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Utah's Lakes and Reservoirs

An Inventory and Classification of Utah's Priority Lakes and Reservoirs

Utah Department of Environmental Quality
Division of Water Quality

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We anticipate that this will be a dynamic document that will address change and the addition of data as it becomes available. Please fee free to contact the Division of Water Quality with any comments, corrections or data that should be added to the individual synoptic reports.

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EXECUTIVE SUMMARY

Lakes and reservoirs in Utah are an integral part of our way of life. Most Utahns recognize the recreational opportunities that lakes and reservoirs provide. Activities that many of us have engaged in include waterskiing, boating, canoeing, wind surfing, fishing, swimming, scuba diving, or simply appreciating the quiet beauty associated with a lake ecosystem. In addition, the water stored in these systems is essential for municipal, industrial and agricultural usage. Lakes which now offer residents and visitors recreational, aesthetic benefits, and other beneficial uses face an uncertain future. Citizens are becoming increasingly aware of the importance of healthy lakes to the past, present, and future prosperity of the State. No doubt you or your friends have witnessed or discussed the decline of a good fishing lake, the virtual takeover of a lake by aquatic plants, the overdevelopment of a lake's shoreline, or the decreased clarity of a favorite swimming lake.

Unfortunately, some of Utah's lakes may have already passed the point where it is technically or economically feasible to restore them to their natural water quality conditions. Overcrowding, development, watershed impairments, multiple use conflicts, loss of riparian habitat and discharge of pollutants are but a few of the problems causing the decline of our water resources. These problems, which have been building for years, come at a time of increased public awareness of the importance of lakes and also at a time of reduced government resources. Therefore, the degradation of our lakes cannot remain only a concern of government. Lakes can be saved, but the public must accept responsibility for and become part of the solution. One of the major purposes of this publication is to encourage the responsible use of Utah lakes and reservoirs by informing the public and various state and federal agencies of the current state of these vital resources.

Approximately 3000 bodies of water, i.e. lakes, reservoirs, ponds, and wetlands were identified by Utah's initial Clean Lakes Inventory and Classification study conducted from 1980 through 1982. In the report, *State of Utah Clean Lakes Inventory and Classification (1982)*, 127 lakes and reservoirs were identified as "priority lakes or reservoirs". Contained in this report is a new listing of priority lakes and reservoirs based on a reevaluation of Utah's lakes and reservoirs against modified criteria. The original listing and criteria is also present for comparative purposes.

The main body of the report presents a section on each priority waterbody with pertinent information acquired during the study. Reported information includes waterbody location, lake morphometry characteristics, watershed description, biological and chemical data, pollution assessment, use impairment and recommended lake or reservoir restoration measures. The report at this time does not contain all of the acquired data, but additional data is available and will be provided through various mediums to facilitate the understanding of each lake and its watershed.

The intent of this report is not only to update and incorporate information from the original inventory and classification study, but to provide additional basic limnological and recreational data to interested citizens, groups or agencies. Data obtained under the Lake Water Quality Assessment (LWQA) program will provide the basis for evaluation and assessment of long term water quality of major lakes and reservoirs in Utah. This information is the basis for the 305(b) assessment report produced every two years as a requirement under the Clean Water Act. The information contained in the 1996 report is incorporated into this report and future assessment reports will be addendums to this report. Reports will be produced on a biennial basis and will document the changes and trends of water quality associated with Utah's lakes and reservoirs.

Information other than water quality data is present in an effort to facilitate the recreational aspect associated with lakes and reservoirs. This information should be considered to be general in nature and prone to rapid change.

UTAH'S LAKES AND RESERVOIRS

Introduction

Lakes and reservoirs in Utah are an integral part of our way of life. Most Utahns recognize the recreational opportunities that lakes and reservoirs provide. Activities that many of us have engaged in include waterskiing, boating, canoeing, wind surfing, fishing, swimming, scuba diving, or simply appreciating the quiet beauty associated with a lake ecosystem. In addition, the water stored in these systems is essential for municipal, industrial and agricultural usage. Lakes which now offer residents and visitors recreational, aesthetic benefits, and other beneficial uses face an uncertain future. Citizens are becoming increasingly aware of the importance of healthy lakes to the past, present, and future prosperity of the State. No doubt you or your friends have witnessed or discussed the decline of a good fishing lake, the virtual takeover of a lake by aquatic plants, the overdevelopment of a lake's shoreline, or the decreased clarity of a favorite swimming lake.

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Lake Ecology

Ecology is the scientific study of relationships between organisms, and their environment. Lakes are complex and dynamic ecosystems. Lakes are more than standing bodies of water. Their physical and chemical characteristics make them ideal habitats for an immense variety of plants and animals. A lake ecosystem is composed of interacting plant and animal communities and the physical and chemical environments in which they live. All parts of the ecosystem are linked together in an intricate scheme of interdependence as depicted in Figure 1.1. Therefore, if one part of the system is disturbed, other parts may also be affected.

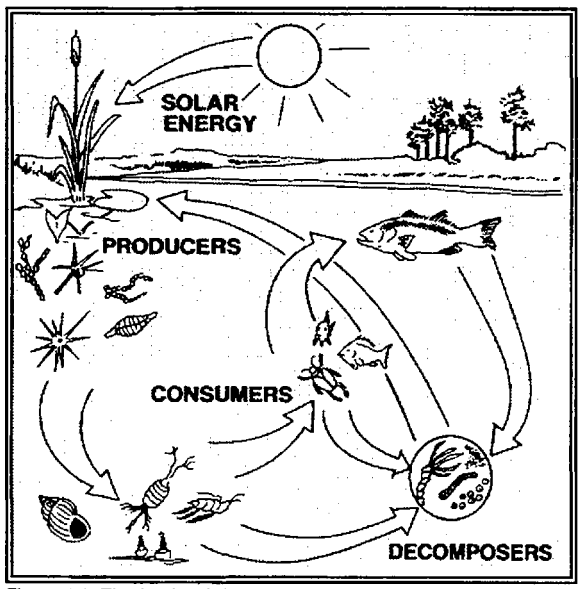

Figure 1.1 The food web is a representation of the transfer of energy through a lake ecosystem.

In lakes, plants use the sunlight, nutrients, and gases to produce living tissue. The plants are eaten by animals which are in turn eaten by other animals. The predator of one species may be the prey of another species. Dead

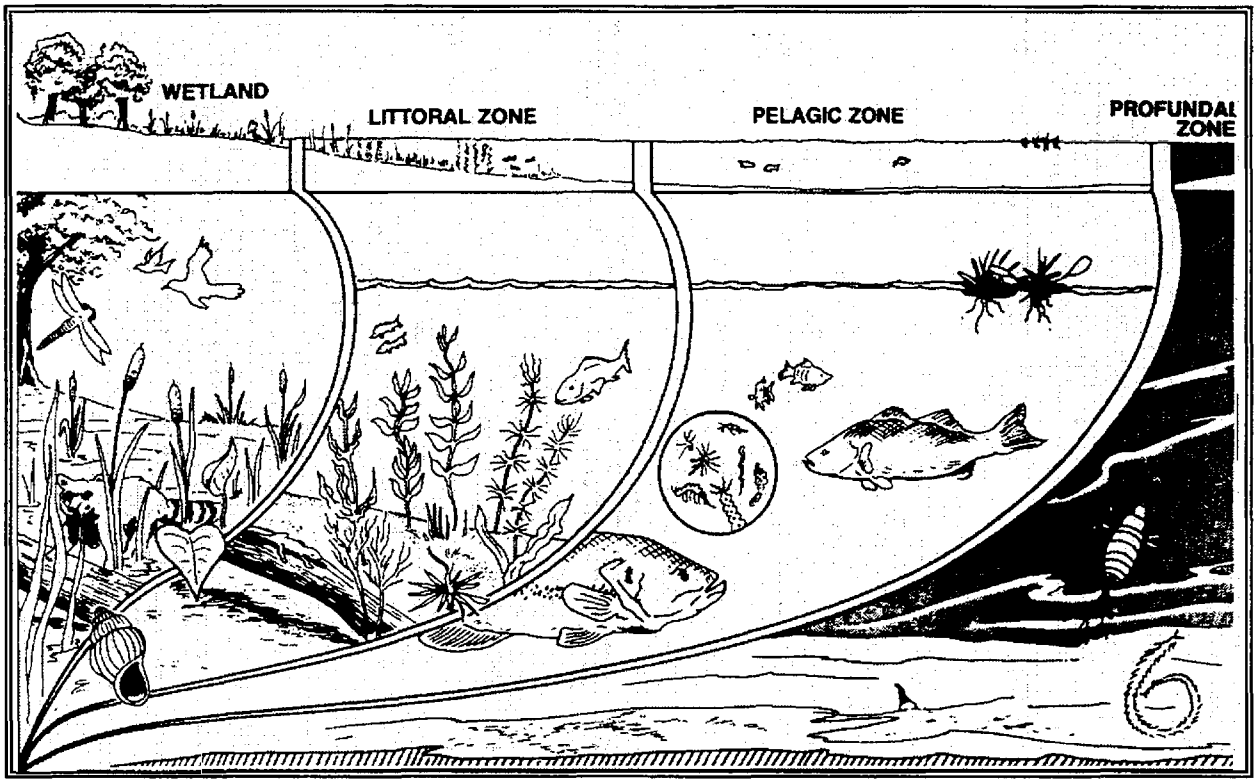

Figure 1.2 Environmental zones in a lake system.

organisms are decomposed by bacteria which recycle nutrients back to the water and sediments. Some bottom dwelling organisms also help to break down organic matter into usable nutrients. This chain of producers, consumers, and decomposers constitutes the food web. Most food webs are complex and involve many different kinds of plants, animals, and bacteria. The abundance and variety of organisms making up a lake's food web is controlled by climate, runoff, watershed characteristics, and the structure and water quality of the lake.

Limnology is the scientific study of freshwater ecosystems: lakes, reservoirs, rivers and streams. The goal of limnology is to improve the understanding of physical, chemical, geological, and biological factors that affect aquatic productivity and water quality. Limnologists have defined certain zones in lakes with differing environments where different organisms live. These areas are depicted in Figure 1.2.

The littoral zone is the shallow-water area around the shore where light usually penetrates to the bottom. Aquatic vegetation, such as emergent and submergent plants, which require a substrate grown in this area. The size of the littoral zone is directly related to the slope of the bottom and water clarity.

The pelagic or open water zone is the area that extends from the surface to the depth where light intensity is reduced to about one percent of surface light. The pelagic and littoral zones are also referred to as the photic zone because below this depth sunlight is too weak for most plants to utilize. Generally, plants found in the pelagic zone are floating plants and microscopic plants called phytoplankton which form the base of lake food webs.

The profundal zone is the lake bottom where organic material from above accumulates and decomposes. It is inhabited mostly by burrowing animals. Other animals such as fish, and swimming microscopic animals, called zooplankton, freely cross all of these zones for purposes of protection, feeding, and reproduction.

Some Utah lakes also have wetlands associated with them. A wetland can be a swamp, marsh, flood plain, or any area of land where water is the dominant factor determining the types of plant and animal communities living there. Wetlands generally represent the transition zone between the lake proper and the adjacent uplands. Wetlands are important habitats for terrestrial and aquatic communities and also may serve as filters for lakes by reducing pollutants, sediments, and nutrients from incoming watershed drainage.

Lake Processes

Interactions between organisms and their environment are critical to the vitality of a lake. Lakes are able to support life and remain healthy, productive bodies of water because of several biological processes.

Photosynthesis, carried out by plants which contain chlorophyll, is an important process in food webs. Using sunlight, plants convert water and carbon dioxide into oxygen and sugars. The sugars are then used by the plants to synthesize other organic compounds needed to sustain them. The productivity of a lake is generally related to the amount of chlorophyll present as plants grow stimulated by the presence of nutrients in the system.

Decomposition of organic matter by bacteria is essential to lake ecosystems. Without decomposition, most material falling to the bottom would remain there and the lake would fill in. Decomposition speeds up the breakdown of matter and helps nutrients recycle back in to the system for reuse. Recycling of nutrients introduced into lakes is an important process. It not only involves the inputs of nutrients into the lake but involves changing the chemical form of nutrients already in the lake so that they may be utilized in the food web again. For example, plants take up inorganic nitrogen which animals cannot use and incorporate it in their tissues as organic nitrogen which animals can use. When animals die, nitrogen must be changed back to the inorganic form for plants or it will be lost to the system as a useful nutrient. This nutrient recycling is accomplished by biological (decomposition), chemical (oxidation), and physical (circulation) processes. Without recycling, many important nutrients such as phosphorus and nitrogen would become depleted and the productivity of many lakes would be drastically reduced.

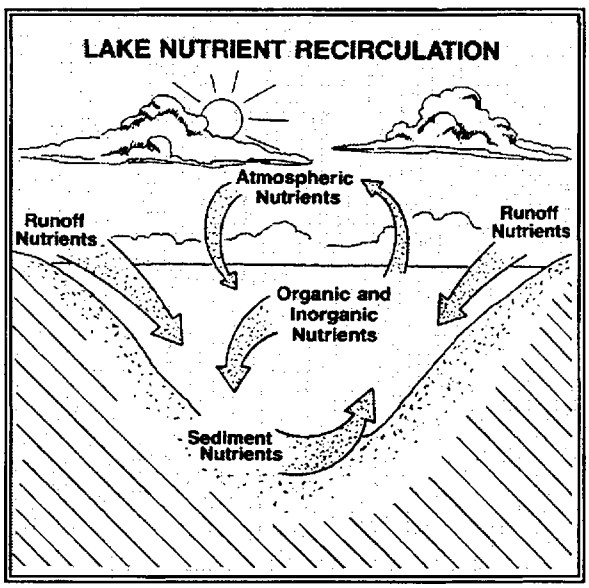

Figure 1.3 Cycling of nutrients in a lake is important factor in lake productivity.

Sedimentation is a process that greatly affects the ecosystem of lakes. The gradual filling-in of a lake is a natural process. Streams, storm water runoff, and other forms of moving water carry sand, silt, clays, organic matter, and other chemicals into the lake from the surrounding watershed. These materials settle out once they reach quieter waters. The rate of settling is dependent on the size of the particles, water velocity, density, and temperature. Not all sediment particles quickly settle to the lake bottom. The lighter, siltier particles often stay suspended in the water column or settle so lightly on the bottom that they can be easily stirred up and re-suspended with even slight water motion. This causes the water to be turbid and brownish in appearance. Sediment blocks light from penetrating into the water column. It also interferes with the gills of fish and the breathing mechanism of other creatures.

The sediment input to a lake can be greatly accelerated by human development in the watershed. In general, the amount of material deposited in the lake is directly related to the use of watershed land. Activities that clear the land and expose soil to winds and rain (e.g., agriculture, logging, and site development) greatly increase the potential for erosion. These activities can significantly contribute to the sediment pollution of a lake unless erosion and runoff is carefully managed. The input of sediments to a lake makes the basin more shallow, with a corresponding loss of water volume. Thus, sedimentation affects navigation and recreational use and also creates more fertile growing space for plants because of increased nutrients and exposure to sunlight.

Sediment material from the watershed tends to fertilize aquatic plants and algae because phosphorus, nitrogen, and other essential nutrients are attached to incoming particles. If a large portion of the material is organic, dissolved oxygen can decrease as a result of respiration of decomposers breaking down the organic matter. Sedimentation also can ruin the lake bottom for aquatic insects, crustaceans, mussels, and other bottom-dwelling creatures. Most important, fish spawning beds are almost always negatively affected.

Thermal stratification is an important process effecting productivity in northern lakes. Stratification causes surface and bottom waters to be separated by a narrow band of water called the metalimnion, characterized by rapidly changing temperature and densities called the thermocline. The density gradient change of the metalimnion acts as a physical barrier to the complete mixing of lake waters. In essence stratification inhibits or prevents the mixing of surface and bottom waters. Stratification occurs because the density (weight) of water changes depending on its temperature. Water is heaviest at about 39.2° F. Above and below this temperature water becomes lighter (less dense). In very shallow lakes, wind and wave forces along the surface are strong enough to mix the water throughout and prevent temperature stratification. In deeper lakes, however, stratification develops because the forces of temperature become greater than those of the wind.

As lakes continue to warm in the late spring, the temperature differences between the surface and deeper waters increase. Most U.S. lakes with a depth of 20 feet or more stratify into three temperature-defined layers during the summer season. The water in the upper layer (epilimnion) is warm, well lit, and circulates easily in response to wind action. In contrast, the deep layer (hypolimnion) is darker, colder, denser, and relatively stagnant. These two layers are separated by a transition zone (metalimnion) where temperatures change rapidly with depth. The metalimnion

as discussed earlier functions as a barrier between the epilimnion and the hypolimnion. The magnitude of the temperature difference between the two layers defines how resistant they are to mixing. A large temperature difference means that the layers are stable and that it would take a great deal of wind energy to break down the stratification and mix the layers.

In the fall, chilly air temperatures cool the lake's surface. As the surface waters nears the temperature of 39.2° F it becomes denser (heavier). This chilled water is heavier than the water below and begins to sink towards the bottom. This process continues until waters in the upper layer have cooled to a point where they become the same temperature (and density) as the lower layer. At this time, the resistance to mixing is removed and the entire lake freely circulates in response to wind action. This action is known as fall overturn.

During winter the lake continues to cool. The colder water (32° F) "floats" on the top, and forms ice. This is why a lake doesn't freeze from the bottom up. The thermal gradient during the winter increases from top to bottom, the opposite of summertime gradients. As the weather moderates in the spring, the ice melts and the surfaces waters begin to warm above 32° F. As water temperatures rise towards 39.2° F, the surface water again becomes more dense and moves downward. The equalization of the temperature gradient throughout the water column is facilitated by wind action. This process is called spring turnover. During this rather brief period of time most of the lake water is at the same temperature and in chemical equilibrium while surface waters mix freely with bottom waters.

The Water Itself

In a lake, water is the medium in which plants and animals live, move, respire, and are nourished. Water's properties of transparency, heat retention, suspension, and dissolution are unique in nature and provide a tempered environment in which extreme fluctuations of climate are reduced. To a great extent, variations in these properties determine the characteristics that a lake or reservoir may develop. Non-biotic factors that regulate lake productivity are water budgets, light penetration, dissolved oxygen content, and nutrient concentration.

Because precipitation and surface water runoff directly influence the nature of lake ecosystems, a good way to begin to learn about lakes is to understand the hydrologic cycle. The circulation of water from atmosphere to Earth and back to the atmosphere is a process that is powered by the sun. About three-fourths of the precipitation that falls on land is returned to the atmosphere as vapor through evaporation and transpiration from terrestrial plants and emergent and floating aquatic plants. The remaining precipitation either is stored in ice caps, or drains directly off the land into surface water systems (such as streams, rivers, lakes, or oceans) from which it eventually evaporates, or infiltrates the soil and underlying rock layers and enters the groundwater system. Groundwater enters lakes and streams through underwater seeps, springs, or surface channels and then evaporates into the atmosphere.

Lakes and reservoirs have a water budget as described in this simple equation: water input = water output +/- the amount of water stored in the lake. Inputs are direct precipitation, groundwater, and surface stream inflow, while outputs include surface discharge (outflow), evaporation, losses to groundwater, and water withdrawn for domestic, agricultural, or industrial purposes. If inputs are greater than outputs, lake levels rise as water is stored. Conversely, when outputs are greater lake levels fall as losses exceed gains.

One important concept affecting water quality is the hydraulic residence time for a specific waterbody. It is defined as the average time required to completely renew a lake's water volume. As depicted in Figure 1.4 this period of time is dependent upon the rate of inflow and the capacity of a waterbody. For instance, it will take 5 minutes to completely fill the bathtub with an inflow of 10 gal/min if the capacity of the tub is 50 gallons (50 gallons/10 gallons per minute = 5 minutes).

These calculations are dependent upon the bathtub being at full capacity. Similarly the hydraulic resident period for the lake in the same figure is 50 days (500 acre-feet/10 acre-feet per day = 50 days). This resident time is important due to its effect on biomass accumulation and the movement of constituents through the lake. If the residence time is relatively short algal cells produced in the water column will be washed out faster than then can grow and accumulate. Residence times in conjunction with nutrient concentrations can produce a variety of effects within a given lake or reservoir.

The transparency of water, or its ability to transmit light, is dependent mainly upon color and turbidity as depicted in figure 1.5. An increase in color or suspended particles will reduce the depth which sunlight can penetrate in a lake and thus reduce clarity. The depth of light penetration in lakes, called the photic zone, is limited by water transparency. This is important because plants can only grow in the photic zone, therefore plant growth in lakes is controlled by the nature of the photic zone.

Temperature is one of the most important factors in an aquatic environment. The specific heat of water is great, thereby allowing a lake to absorb or give off large quantities of heat with only a small increase or decrease in temperature. Water temperature always lags far behind the larger changes in air temperature and only rarely experiences the extreme or rapid changes that occur on land. Thus, organisms living in water only need to adapt to gradual changes in temperature. Lakes also have a modifying influence on the climate of nearby land areas by

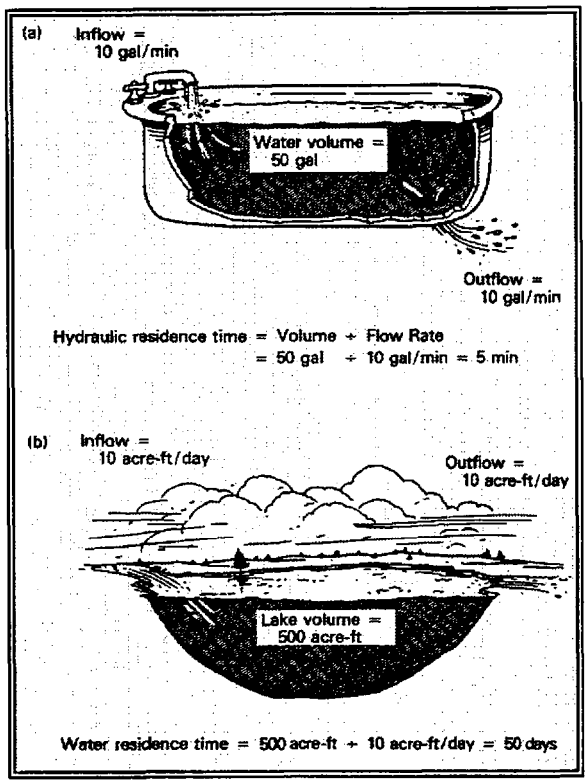

Figure 1.4 Hydraulic residence time is an important factor in lake limnology.

acting as large heat radiators or sinks. Temperature also regulates the amount of dissolved gases (e.g., oxygen) retained in the water column. Warm water holds less dissolved gases than cold water. The relevant concentration of these gases are extremely important in the overall balance of living organism within a given lake or reservoir. Dissolved oxygen (DO) is essential to most aquatic organisms. If dissolved oxygen levels fall to low, many species of sport fish are the first to die.

Water is the medium that contains a variety of dissolved substances required for the growth of many organisms. Two of those substances, nitrogen and phosphorus, are considered the major nutrients necessary for aquatic plant growth. Many other substances are needed but the availability of these nutrients is usually the most important factor controlling plant growth in lakes. Excessive concentrations of nitrogen and phosphorus can cause undesirable algal blooms or aquatic weed problems.

Oxygen is essential for aquatic life. Without oxygen, a lake would be an aquatic desert devoid of fish, plants, and insects. For this reason, many experts consider dissolved oxygen to be the most important parameter used to characterize lake water quality.

The amount of oxygen in the water is an important indicator of overall lake health. In fact, much information can be learned about a lake by examining just this parameter. Oxygen plays a crucial role in determining the type of organisms that live in a lake. Some species, such as trout, need consistently high oxygen concentrations to survive. Other aquatic species are more tolerant of low or fluctuating concentrations of oxygen.

Oxygen is supplied naturally to a lake by: (1) the diffusion of atmospheric oxygen into the water; and (2) the production of oxygen through photosynthesis by aquatic plants and algae. Oxygen is easily dissolved in water. In fact, it is so soluble that water can contain a greater percentage of oxygen than the atmosphere. Because of this phenomenon, oxygen naturally move (diffuses) from the air into the water. Agitation of the water surface by winds and waves enhances this diffusion process.

Vertical mixing of the water, aided by winds, distributes the oxygen within the lake. In this manner, it becomes available to the lake's community of oxygen-breathing organisms. Water temperature affects the capacity of water to retain dissolved oxygen. Cold water can hold more oxygen than warm water. Therefore, a lake will typically have a higher concentration of dissolved oxygen during the winter than the summer.

The following factors may determine the amount of oxygen found in a lake: climate; water temperature and thermal stratification of the water column; wind and waves that create movement on the surface and aid diffusion from the atmosphere; the quantity of respiring life forms including algae, aquatic plants, fish, bacteria, fungi, and protozoans (respiration removes oxygen from the water and produces carbon dioxide); the rate at which organic matter reaches the lake bottom and is decomposed by respiring microorganisms (influenced by growth and death rates of life forms in the lake and the input of organic material from incoming stream and surface runoff); the oxygen content of incoming ground

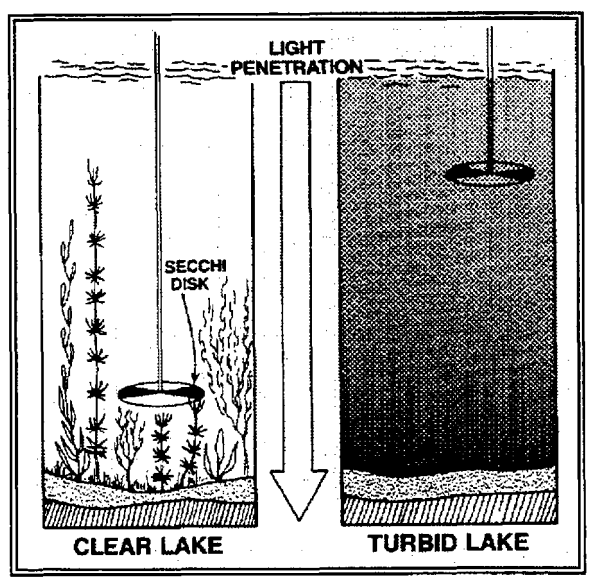

Figure 1.5 Light penetration in a lake.

water and surface streams; and the shape and depth of the lake basin.

Algae and aquatic plants produce oxygen as a by-product of photosynthesis but also require the uptake of oxygen for respiration. Respiration occurs all the time, but photosynthesis occurs only in the presence of light. Consequently, a lake that has a large population of algae or plants can experience a great fluctuation in dissolved oxygen concentration during a 24-hour period due to the timing of various processes within that day. In some lakes dissolved oxygen can be depleted by the plants at a rate faster than it can be diffused into the lake from the atmosphere. In extreme cases, the oxygen in the water can become depleted. This lake of oxygen will cause fish and other aquatic organisms to suffocate.

Extreme fluctuations of dissolved oxygen concentrations place great stress on the oxygen-breathing creatures in the lake. Only tolerant species can survive in this type of environment. Unfortunately, tolerant species are usually the least desirable for recreational purposes. Carp are an example of a tolerant fish. Trout, on the other hand, are highly intolerant of fluctuating oxygen levels.

Another important event relating to the oxygen content in a lake or reservoir takes place at the bottoms of these waterbodies. Bacteria, fungi, and other organisms living on the lake bottom break down organic matter that originates from the watershed and the lake itself. Algae, aquatic plants, and animals all provide food for these decomposers when they excrete, shed, or die. Like higher forms of life, most decomposers need oxygen to live and perform their important function. During summer stratification the lower layer is cut off from the atmosphere. Usually in the lower waters of lakes and reservoirs there is insufficient light to support photosynthesis by algae or aquatic plants. Therefore, without a supply source of oxygen, what oxygen there is in the lower layer can be progressively depleted by an active population of decomposers.

When the dissolved oxygen concentration is severely reduced, the bottom organisms that depend on oxygen either become dormant, move, or die. Fish and other swimming organisms cannot live in the lower layer. As a result, trout, and other game fish that require colder water (usually found in the deeper layers of a lake) and high oxygen levels may be forced into waters that are not optimal for growth and existence or eliminated from the lake altogether.

Oxygen depletion in the lower layer occurs "from the lake bottom up." This is because most decomposers live in or on the lake sediments. Through respiration, they will steadily consume oxygen. When oxygen is reduced to less than one part per million on the lake bottom, several chemical reactions occur within the sediments. Notably, the essential plant nutrient, phosphorus, is released from its association with sediment bound iron and moves freely into the overlying waters. The influx of phosphorus for the sediments under anaerobic conditions is referred to as the internal phosphorus loading. When stratification breaks down if present or as this phosphorus reaches the photic zone, this phosphorus can be used by algae and aquatic plants. This internal pulse of phosphorus can thus accelerate algal and aquatic plant problems associated with cultural eutrophication. Iron and manganese are also released from the sediments during anoxic (no oxygen) periods. These elements can cause taste and odor problems for those who draw water from the lower layer for drinking or domestic purposes.

Lake Productivity

It is important in the overall understanding of the perceived conditions of waterbodies that we understand what constitutes productivity in a waterbody, the components involved, and the effect it has on individual lakes or reservoirs. Primary productivity deals with the rate at which algae and macrophytes fix or convert light, water, and carbon dioxide to sugar in plant cells. In addition the amount of plant material produced and remaining in the system is referred to as the primary production and is analogous to the standing crop or biomass of plants in a farmers's field. Photosynthesis normally is the dominant source of organic matter for the lakes's food web.

It is through the process of photosynthesis that molecular oxygen is produced. This is the primary source of dissolved oxygen in the water and of oxygen in the atmosphere. Oxygen is usually required to completely break down organic matter (molecules) and release their chemical energy. Plants and animals release this energy through a process called respiration. Its end products--energy, carbon dioxide, and water--are produced by the breakdown or organic molecules in the presence of oxygen.

Photosynthesis requires light in the production of organic matter by aquatic plants. It is restricted to the portion of the lake water column that is lighted, the photic zone. The thickness of the photic zone depends upon the transparency of the lake water and corresponds to the depth to which at least 1 percent of the surface light intensity penetrates. Transparency is dependent upon color, and the suspension of particulate matter, organic or inorganic.

When light is adequate for photosynthesis, the availability of nutrients often controls phytoplankton productivity. In the lake, differences between plant requirements for an element and its availability exert the most significant limit on lake productivity. Typically, phosphorus and nitrogen are the least available elements, and therefore they are the most likely to limit lake productivity.

Phosphorus in particular can often severely limit the biological productivity of a lake. The by-products of modern society, however, are rich sources of this element. Waste waters, fertilizers, agricultural drainage, detergents, and municipal sewage contain high concentrations of

phosphorus, and if allowed to enter the lake, they can stimulate algal productivity. Such high productivity, however, may result in nuisance algal blooms, noxious tastes and odors, oxygen depletion in the water column, and undesirable fish kills during winter and summer.

Photosynthetic activity occurs primarily in two groups, algae and macrophytes (aquatic plants). It is essential here that each of these groups be discussed not only to help us in understanding lake productivity but also in understanding problems and solutions associated with these groups.

Algae

Algae are photosynthetic plants that contain chlorophyll and have a simple reproductive structure but do not have tissues that differentiate into true roots, stems, or leaves. They do however, grow in many forms. Some species are microscopic single cells; others grow as mass aggregates of cells (colonies) or in strands (filaments). Some even resemble plants growing on the lake bottom.

The algae are an important living component of lakes. They convert inorganic material to organic matter through photosynthesis; oxygenate the water through photosynthesis; serve as the essential base of the food chain; and affect the amount of light that penetrates into the water column.

Like most plants, algae require light, a supply of inorganic nutrients, and specific temperature ranges to grow and reproduce. Of these factors, it is usually the supply of nutrients that will dictate the amount of algal growth in a lake. In most lakes, increasing the supply of nutrients (especially phosphorus) in the water will usually result in a larger algal population.

There are a number of environmental factors that influence algal growth. The major factors include: (1) the amount of light that penetrates the water (determined by the intensity of sunlight, the amount of suspended material, and water color); (2) the availability of nutrients for algal uptake (determined both by source and removal mechanisms); (3) water temperature (regulated by climate, altitude, et cetera); (4) the physical removal of algae by sinking or flushing through an outflow; (5) grazing on the algal population by microscopic animals, fish, and other organisms; (6) parasitism by bacteria, fungi, and other microorganisms; and (7) competitive pressure from other aquatic plants for nutrients and sunlight.

It is a combination of these and other environmental factors that determines the type and quantity of algae found in lake. It is important to note, however, that these factors are always in a state of flux. This is because a multitude of events, including the change of seasons, development in the watershed, and rainstorms constantly create "new environments" in a lake.

Excessive growth of one or more species of algae is termed a bloom. Algal blooms, usually occurring in response to an increased supply of nutrients, are often a disturbing symptom of cultural eutrophication. A bloom of algae can give the water an unpleasant taste or odor, reduce clarity, and color the lake a vivid green, brown, yellow, or even red, depending on the species. Filamentous and colonial algae are especially troublesome because they can mass together to form scum or mats on the lake surface. These mats can drift and clog water intakes, foul beaches, and ruin many recreational opportunities.

Macrophytes

Aquatic plants have true roots, stems, and leaves. They, too, are a vital part of the biological community of a lake. Unfortunately, like algae, they can overpopulate and interfere with lake uses. Aquatic plants can be grouped into four categories; emergent plants, rooted floating-leaved plants, submergent plants and free-floating plants.

Emergent plants are rooted and have stems or leaves that rise well above the water surface. They grow in shallow water or on the immediate shoreline where water lies just below the land surface. They are generally not found in lake water over two feet deep.

Rooted floating-leaved plants have leaves that rest on, or slightly above, the water surface. These plants, whose leaves are commonly called lily pads or "bonnets," have long stalks that connect them to the lake bottom.

Submergent plants grow with all or most of their leaves and stems below the water surface. They may be rooted in the lake bottom or free-floating in the water. Most have long, thin flexible stems that are supported by the water. Most submergents flower above the surface.

Free-floating plants are found on the lake surface. Their root systems hang freely from the rest of the plant and are not connected to the lake bottom.

Through photosynthesis, aquatic plants convert inorganic material to organic matter and oxygenate the water. They provide food and cover for aquatic insects, crustaceans, snails, and fish. Aquatic plants are also a food source for many animals. In addition, waterfowl, muskrats, and other species use aquatic plants for homes and nests.

Aquatic plants are effective in breaking the force of waves and thus reduce shoreline erosion. Emergents serve to trap sediments, silt, and organic matter flowing off the watershed. Nutrients are also captured and utilized by aquatic plants, thus preventing them from reaching algae in the open portion of a lake.

There are many factors that affect aquatic plant growth including: the amount of light that penetrates into the water; the availability of nutrients in the water (for free-floating plants) and in the bottom sediments (for rooted plants); water and air temperature; the depth, composition, and extent of the bottom sediment; wave action and/or currents; and competition pressure from other aquatic plants for nutrients, sunlight, and growing space.

Excessive growth of aquatic plants is unsightly and can severely limit recreation. Submergents and rooted floating-leaf plants hinder swimmers, tangle fishing lines, and wrap

around boat propellers. Fragments of these plants can break off and wash up on beaches and clog water intakes.

For many species, fragmentation is also a form of reproduction. An overgrowth problem can quickly spread throughout a lake if boat propellers, harvesting operations, or other mechanical actions fragment the plants, allowing them to drift and settle in new areas of the lake.

Free-floating plants can collect in great numbers in bays and coves due to prevailing winds. Emergent plants can also be troublesome if they ruin lake views and make access to open water difficult. In addition, they create areas of quiet water where mosquitoes can reproduce.

Lake Life Cycle

Lake aging is the natural process by which a lake fills in over geologic time with erosional materials carried in by the tributary streams, with materials deposited directly through the air, and with materials produced in the lake itself. Classification schemes are a natural outgrowth of years of scientific study of lakes. As a scientific tool, classification can be a practical method useful in lake management. Scientists have developed lake classification schemes based on origin, shape, thermal range, depth, chemical content, dominant types of organisms, and trophic state. Trophic state is probably the most important factor to use when classifying lakes for lake management decisions.

Trophic state as previously defined can be loosely interpreted as the nutritional status of a lake and can give insight into the productivity and health of a lake. When a lake is formed, the natural process of aging begins. Generally, a geologically "young" lake is usually characterized by low nutrient concentration, low plant biomass, low productivity, very little sedimentation, high clarity, and good water quality. Such lakes are classified as oligotrophic lakes. As a lake continues to age a process known as eutrophication occurs. Newly formed lakes can also be naturally eutrophic due to geological and climatic conditions.

Eutrophication is the natural aging of a lake, characterized by increasing nutrient concentrations and sedimentation rates. Other characteristics include increased productivity, reduced clarity, and reduced water quality. The degree of eutrophication and the lake's intended use will determine whether or not this condition is harmful. Lakes which experience a high degree of eutrophication may experience fish kills, excessive aquatic weed and algal growth, loss of game fish, loss of recreational usage, and other water quality related problems. The final stage in lake aging will be the disappearance of the lake as it becomes a marsh or bog.

he length of time between formation and extinction of a lake depends on climate, watershed characteristics, shape, and many other factors. This natural process usually requires thousands of years to happen. However, man can accelerate the process considerably by drastically altering shoreline vegetation, wetlands, and watersheds, discharging sewage into lakes, and allowing uncontrolled use of water for agricultural and industrial purposes. This condition, known as cultural eutrophication, has created much concern about the effects of man's activities on lakes.

From the time that a lake is created the aging or filling in process begins. Lakes age (i.e., fill in) at different rates because of differences in runoff and watershed characteristics. The natural succession is from lake to pond, pond to marsh, marsh to meadow, and meadow to dry land. Examples of each can be seen today, including areas of dry land where past lake basins can still be identified.

Symptoms of human-induced (or cultural) eutrophication are:

(1) increased algal growth (stimulated by increased supply of nutrients);

(2) increased rooted aquatic plant growth (stimulated by the increased supply of nutrients as well as the creation of additional shallow growing areas via the accumulation of sediments, silt and organic matter); and

(3) lower dissolved oxygen concentrations in all or parts of the lake (as a result of increased plant respiration and the decomposition of organic matter by bacteria and other microorganisms. This lack of oxygen can kill fish and other aquatic life).

Classification of lakes

The trophic state of a lake is a hybrid concept with no precise definition. Originally, trophic referred to nutrient status. Eutrophic water was water high in nutrients and by extension a eutrophic lake was a lake that contained eutrophic water. Later the concept of trophic state was applied to lakes rather than water, and its precise definition was lost. Now trophic state not only refers to the nutrient status of the water, but also to the biological production that occurs in the water and to the morphological characteristics of the lake basin itself. A eutrophic lake may not only be a lake with high levels of nutrients, but also a very shallow pond, full of rooted aquatic plants, that may or may not have high nutrient levels.

Lakes are typically divided into three trophic categories: oligotrophic, mesotrophic, and eutrophic. Other categories have been developed to account for anomalies within the system. In Utah we use the category *hypereutrophic* to describe lakes in the extreme eutrophic range. Lakes and reservoirs are categorized by various characteristics associated with each lake. An oligotrophic lake is typically a large deep lake with low nutrient enrichment, crystal clear waters and a rocky or sandy shoreline. Both planktonic and rooted plant growth are sparse, and the lake can support a cold water fishery. A

eutrophic lake, on the other hand, is usually high in nutrient enrichment and typically shallower with a soft, mucky bottom. Rooted plant growth is abundant along the shores and out into the lake, and algal blooms are not unusual due to nutrient laden waters. Water clarity is poor and the water often has a coloration. If deep enough to thermally stratify, the bottom waters are devoid of oxygen. Mesotrophic is an intermediate trophic state, displaying characteristics between the other two.

The trophic status for Utah lakes and reservoirs was determined utilizing the values in Carlson's Trophic State Index (TSI). Trophic status has been determined using this methodology since the initial classification and inventory project in 1981-82. In order to establish trends, these values were used for comparison. Utilizing the standard Carlson formulas, an annual average TSI Index value was determined for each lake or reservoir. The data obtained is representative of the summer monitoring schedule from late May through early September. These TSI Index values are utilized in determining water quality changes and trends associated with the 305(b) reporting period for incorporation in the 305(b) report.

Beneficial Use Designations

It shall be unlawful and a violation of the State regulations for any person to discharge or place any wastes or other substances in such manner as may interfere with designated uses protected by assigned classes or to cause any of the applicable standards to be violated, except as provided for in Section R317-1-3.1 of the Utah Administrative Code. For a complete discussion of these regulations please refer to the *Standards of Quality for Waters of the State, R317-2, Utah Administrative Code.*

Associated with these defined beneficial uses listed are Figure 1.6 are numerical criteria for various water quality parameters. Water quality standards have been developed for the protection of defined beneficial uses for the waters of the State of Utah. Although there are a number of various standards established there are a few standards that should be discussed to facilitate the understanding of lake water quality and alleviated public concerns associated with certain water quality issues.

Coliform Bacteria

Coliform bacteria are a large group of bacteria that include species found naturally in the intestines of both warm and cold-blooded animals. They also include natural soil bacteria. Because they are easily cultured and are present in sewage in high numbers, they are used as an indicator group. Their presence *seems* to indicate that sewage *may* be present. Their presence may also be due to other sources, including other animals and soils.

Fecal coliform bacteria are a subset of the coliform group. They occur only in warm-blooded animals. They are a better indicator of sewage than total coliforms since they are more specific. But again, their presence may be due to other sources such as beaver, ducks, or sea gulls.

Class 1	*Protected for use as a raw water source for domestic water systems*
Class 1A	*Reserved.*
Class 1B	*Reserved.*
Class 1C	*Protected for domestic purposes with prior treatment by treatment processes as required by the Utah Department of Health.*
Class 2	*Protected for in-stream recreational use and aesthetics*
Class 2A	*Protected for recreational bathing (swimming).*
Class 2B	*Protected for boating, water skiing and similar uses, excluding recreational bathing (swimming).*
Class 3	*Protected for in-stream use by aquatic wildlife.*
Class 3A	*Protected for cold water species of game fish and other cold water aquatic life, including the necessary aquatic organisms in their food chain.*
Class 3B	*Protected for warm water species of game fish and other warm water aquatic life, including the necessary aquatic organisms in their food chain.*
Class 3C	*Protected for nongame fish and other aquatic life, including the necessary aquatic organisms in their food chain.*
Class 3D	*Protected for waterfowl, shore birds and other water-oriented wildlife not included in Classes 3A, 3B, or 3C, including the necessary aquatic organisms in their food chain.*
Class 4	*Protected for agricultural uses including irrigation of crops and stock watering.*
Class 5	*Reserved.*
Class 6	*Waters requiring protection when conventional uses as identified in the previous classes do not apply. Standards for this class are determined based on environmental and human health concerns*

Figure 1.6 Utah's beneficial use classifications

Fecal streptococci are a group of bacteria, separate from the coliform group, that are also associated with the intestines of warm-blooded animals. They include the enterococcus subgroup that occurs exclusively in man and other animals. Fecal strep values are usually used in conjunction with fecal coliform values to help determine the source of the bacteria. A fecal coliform to fecal strep ratio of greater than 2 to 3 indicates a predominance of human waste, whereas a ratio of less than 1 indicates a predominance of animal wastes.

One area of public concern is the concern of water contaminated with bacteria. State criteria have been determined for acceptable levels of coliform bacteria by risk analysis to protect human health. Drinking water should have *no* coliform bacteria. Water quality standards for recreational use (including swimming) state that waters should not exceed 200 fecal coliforms per 100 milliliters of water based on a 30-Day geometric mean. The limit for total coliforms varies according to its classification scheme. For waters defined as swimmable the limit is 1,000, while other

recreation defined uses are limited to 5,000. These levels are generally considered safe unless investigation indicates the source to be sewage.

Because coliform bacteria are ubiquitous in the environment, it is highly unlikely that any untreated lake will have zero coliforms without treatment. Even with no coliforms the lake is still unsafe as a source of drinking water. Without adequate treatment there can be no guarantee concerning the safety of the water.

There are a number of illnesses, particularly related to the eyes, ears, nose, and throat, which may use water as the medium of transmission but in which the disease-causing organism does not necessarily pass through the feces of the infected individual. Just as you may catch a cold by being in the same room as an infected individual, you may catch an ear infection by swimming in a lake with an infected individual. Fortunately, these organisms generally do not survive very long in the water.

Typhoid and cholera epidemics in the mid-19th century led to the discovery that certain gastrointestinal diseases of humans are transmitted via water. The disease causing organisms leave the infected individual via the feces, are discharged into water, and are then consumed by and infect a downstream individual. These water-borne diseases include typhoid, cholera, enteric fevers, and bacterial dysentery.

Coliform bacteria occur naturally in healthy organisms and are essential in the digestion process. Only a few cause diseases. It is not feasible, however, to test only for the disease-causing (pathogenic) bacteria. The coliforms are used to indicate that human waste *may* be present, and if it is present it *may* contain some pathogenic bacteria.

Total Phosphorus

Phosphorus is often the key nutrient in determining the quantity of algae in a lake or reservoir. Phosphorus is typically the least abundant element required for plant growth and commonly limits biological productivity in aquatic ecosystems. For eutrophication studies, total phosphorus is the single most important nutrient to identify in outgoing and incoming streams. Many lake management decisions will be made based on the total phosphorus load coming into a lake or reservoir.

In determining the nutrient limitation association with a specific waterbody it is necessary to determine the nitrogen/phosphorus (N:P) ratio. Specifically, the ratio of inorganic nitrogen (nitrate, nitrite, and ammonia) to total phosphorus needs to be calculated. A ratio value of less than 14 will be defined as nitrogen limited while those values of 14 or greater will be defined as phosphorus limited.

When phosphorus acts as the limiting nutrient, it is readily apparent that increases of phosphorus to the lake may dramatically result in an increase in algal production. It is the magnitude of algal production that has a great impact on lake water quality and the aquatic life within the lake ecosystem. It is imperative to understand the relationship between phosphorus concentrations and water quality. Through the control of phosphorus loading, under this principle, one can influence the quality of water in a majority of waterbodies.

Total phosphorus as it relates to water quality standards is defined as an "indicator of pollution"and not a "standard". The numeric criteria limit associated with lake water quality has been set at 0.025 mg/L (25 micrograms per liter of water). This value is used as a criteria in assessing class 2A, 2B, 3A, and 3B waters.

Dissolved Oxygen

The amount of oxygen in the water is an important indicator of overall lake health. In fact, much information can be learned about a lake by examining just this parameter. Oxygen plays a crucial role in determining the type of organisms that live in a lake. Some species, such as trout, need consistently high oxygen concentrations to survive. Other aquatic species are more tolerant of low or fluctuating concentrations of oxygen. Although dissolved oxygen and its role in the lake ecosystem has already been discussed in greater detail, it is necessary to define the concentration limits as a water quality standard.

The numerical criteria defined for dissolved oxygen varies with the defined beneficial use categories. The most stringent requirement is for class 3A waters where the lower limit is set at 6.5 mg/L. A lower limit of 5.5 mg/L is set for classes 3B, 2A, 2B, and 1C. The least stringent lower limit of 5.0 mg/L is set for class 3C and 3D waters. In the case of Class 3 waters these values are the 30 day average and in all class categories defined the limits are not applicable to lower water levels in deep impoundments. Refer to the *Standards of Quality for Waters of the State, R317-2, Utah Administrative Code* for a complete discussion of various concentrations versus time regimes with respective dissolved oxygen.

Public Conflicts

Recreational uses such as fishing, swimming, boating, skiing, and picnicking as depicted in figure 1.7 can cause conflicts among lake users. Boating and skiing can interfere with fishing and swimming and vice versa. Overuse of a lake's surface area can also damage lake water quality. Examples of problems associated with overuse include: littering; churning up sediments by motorboats in shallow areas; spilling fuel; and emptying boat toilets into the lake.

Conflicts can also occur over the use of lake water for municipal and industrial purposes. There can be a high demand for lake water from many sources. Water uses which affect lakes include: agricultural irrigation; industrial consumption; cooling for electrical generating plants; and municipal water supplies. Some water uses exclude lakes from being used by other potential users.

Lakes used for drinking water may not be allowed to

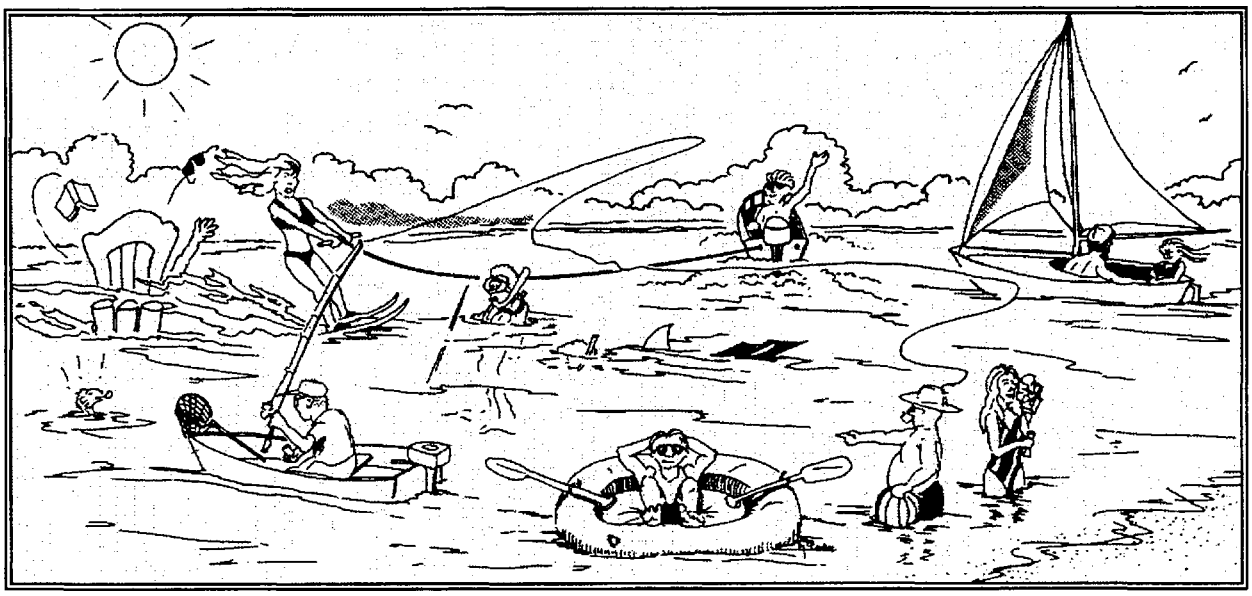

Figure 1.7 Overuse of a lake can cause conflicts.

be degraded or contaminated by industrial and sewage discharges. Likewise, recreational lakes may not be good municipal water supply lakes. The limited supply of water in a lake must be allocated wisely, not only based on user needs but also with regard to assuring the lake's survival as a unique water resource.

Conflicts can occur over development and land uses along lake shorelines. The shorelines and wetlands act as a buffer between water and land as they trap nutrients, filter pollutants, retard erosion, and provide habitats for plants and animals. Shoreline development directly affects lakes in two ways. First, wildlife habitats and buffering capacity are lost through destruction of the natural vegetation around lakes. Second, pollution from septic tanks, increased surface runoff, and nutrient additions from fertilized lawns can affect lake water quality. Sandy soils are especially noted for leaching of nutrients and bacteria from septic tank systems into lakes. Water quality problems caused by shoreline development usually do not appear until after large areas have been altered. By then much damage has already been done.

Sources of Pollution

The causes of cultural eutrophication are varied but are directly related to human activities. The resulting pollution can generally be divided into two categories, point and nonpoint sources.

Point sources are those that are discrete and easily definable, such as sewage or industrial discharges. Point sources are generally thought of as those that empty wastes into waterways through discharge pipes. Point source discharges in Utah that impact lakes include sewage plants, industrial manufacturing, and other dischargers. These discharges may contain high levels of nutrients and organic matter, sediments, high temperature water, toxic metals, harmful chemicals, and disease-producing organisms. Ultimately many of these substances may end up in some Utah lakes. Point source pollution can overwhelm the recycling and self-cleaning capacity of a lake and lead to its rapid decline. However, mechanism are in place to regulate and control the discharge of pollutants from point source dischargers.

In many lakes nonpoint sources are major causes of water quality degradation. Nonpoint sources are those that are dispersed or diffused and released at an unmanaged rate, such as storm water or runoff. Nonpoint sources are subdivided into natural and man-made categories. Only man-made sources will be discussed since they are a major causes of lake water quality problems and are generally the ones man can control.

Development in a lake's watershed can seriously affect water quality due to the increased runoff rates and pollutant loadings that are characteristic of these areas. Surface runoff carries litter, toxic metals, organic materials, potentially harmful bacteria, oil, and grease, and chemicals washed from urban lands and recreational properties within a lake or reservoir watershed. Fertilizers, pesticides, and sediments may be washed from residential lawns and construction sites. In some cases the amount of pollutants from these nonpoint sources can be significantly larger than the amount from domestic waste water or other point sources.

Agricultural and silvicultural areas also contribute significantly to nonpoint source pollutant discharges. Forested areas that have been clear-cut and private or public lands that have poor agricultural or grazing management practices can contribute significant amounts of nutrients and sediments. Pollutants of significance from

these activities include: nitrogen and phosphorus from fertilizers; sediments from unstable stream banks or upland areas; organic materials; animal wastes from public lands or feedlot operations; herbicides/pesticides; potentially harmful bacteria; salts; and a myriad of other pollutants that are typically washed into lakes by overland runoff and irrigation waters.

Other nonpoint sources which can affect lake water quality in Utah include: mining operations; air pollution; construction operations; recreational activities; and septic tank leachate.

Pollution Prevention

Prevention is the best answer for maintaining clean lakes. Protecting our lakes by planning ahead and preventing problems is less expensive and more effective then using structural engineering solutions after problems develop. Preventive methods include land use regulations, zoning laws, and better management practices for reducing runoff from agricultural, forestry, residential, mining, and construction activities. Voluntary measures such as maintaining beneficial shoreline vegetation, eliminating or reducing use of fertilizers, pesticides, and herbicides near lakes, and properly maintaining beneficial shoreline vegetation, eliminating or reducing use of fertilizers, pesticides, and herbicides near lakes, and properly maintaining septic tank drain fields can significantly help. Through good site planning and the incorporation of management practices such as vegetative buffers, grassed waterways, sediment traps, and on-site retention, most nonpoint sources of pollution can be greatly reduced.

Discharges from point sources are usually easier to control because of their definable nature. Despite state and federal programs to control surface water discharges, industrial and municipal dischargers still affect many lakes. Better treatment or diversion of these wastes is necessary to prevent them from degrading lakes. Diversion has been used successfully in some cases by simply discharging wastes away from the affected lake. This has been a very effective means of reducing phosphorus loading in the Deer Creek Reservoir watershed. Historically, all municipal sewage was discharged directly into the tributaries of Deer Creek Reservoir. Currently these nutrient laden waters are now used for agricultural land application. Improved waste treatment, although expensive, is the most effective means of controlling point source pollution and ensuring clean lakes. Runoff (nonpoint source) from streets, parking lots, and other residential and commercial areas can be directed into percolation ponds rather than directly into a lake.

In-Lake Restoration Techniques

In many instances, controlling pollution sources will not improve lake water quality immediately. Years may pass before lakes cleanse themselves of accumulated wastes. For this reason, a number of in-lake restoration techniques have been developed to accelerate recovery. However, the effectiveness of in-lake restoration techniques depends on control of pollution sources to the lake. Most in-lake restoration methods will be short-lived if the causes of the problems are not corrected. Sediment, nutrient, and toxic inputs must first be reduced or eliminated if a lake is expected to improve. Before steps to solve a lake's problems can be identified, extensive studies must often be done. Sources and types of pollutants must be identified and the lake's physical, chemical, and biological processes monitored. In short, lake management requires careful evaluation using the best scientific methods available.

The U.S. Environmental Protection Agency has conducted extensive research on the effectiveness of in-lake restoration techniques, and a brief description of the applicability of these restoration techniques, and a brief description of the applicability of these restoration techniques is given below. The reader is urged to consult scientific papers listed in the References for more details on these techniques if needed.

Dredging

The most frequently prescribed treatment for lakes with excessive shallowness is dredging. This procedure also may be effective in long-term control of nuisance algae by removing nutrient-rich lake sediments and can be beneficial as a means of removing toxic sediments. One of the first steps is the development of a plan to control sediment inflows to the lake. A dredging operation will be short-lived and futile if significant sources of sediment remain after dredging. The availability of a site for disposal of nutrient-rich or contaminated sediments can also be a serious obstacle to the sediment removal option.

Before sediment removal is contemplated as a long-term solution to algal blooms, the significance of the sediments as an internal nutrient source must be determined. The nutrient release potential of the sediment must be analyzed. If the sediments account for only a small percentage of the problem, removing them would not produce the desired results. Good candidates for dredging include lakes for which deepening will immediately restore an impaired benefit, such as boating, and lakes for which sediments are significant nutrient sources. Deepening lakes also discourages the growth of some aquatic plants.

Problems caused by dredging can include nuisance algal blooms, re-suspension of contaminants, and loss of habitat areas. The removal of aquatic plants can also promote algal growth since their shading effect and nutrient uptake are no longer present. Any dredging operation requires a permit from the Corp of Engineers.

Drawdown

Lake level drawdown has been used to control nuisance aquatic plants and to stimulate the growth of beneficial vegetation, to manage fish, to consolidate bottom

sediments, to provide access to shoreline structures for maintenance, and to allow sediment removal using conventional equipment. Drawdown can be effective in nuisance aquatic plant control if the nuisance plants are susceptible to the stressful conditions of the drawdown. The physiology of nuisance plants must be known before attempting to control them by drawdown and exposure. If the nuisance plant survives while beneficial plants die, it will spread rapidly when the lake is refilled and become more of a problem than before the drawdown.

Fishing can be improved by the drawdown technique. Littoral vegetation has a chance to invade the lake bottom during drawdown, and upon refilling can provide cover and food for small fish and invertebrates, which in turn provide food for game fish. Drawdown can also consolidate bottom sediment, thereby increasing potential spawning areas following refilling. Turbidity and internal nutrient cycling, which are partly caused by disturbance of bottom sediments, may be reduced during drawdown and the consolidated sediments may provide habitat for beneficial aquatic plants.

Negative aspects of drawdowns include: unsightliness; loss of use for a long period; nuisance algal blooms; fish kills; spread of nuisance plants; failure to refill; and loss of climate modifying aspect of lakes. These negative effects can be minimized by attempting control of only susceptible nuisance species and by carefully planning the drawdown.

Nutrient Inactivation

Nutrient inactivation and nutrient precipitation can only be successful in lakes from which significant inputs of nutrients have been eliminated. The techniques are used exclusively to control or lower phosphorus concentration in the water column, and therefore, are only effective for algal control and not rooted aquatic plants. Inactivation is an attempt at long-term control by stopping the release of phosphorus from lake sediments, while precipitation is the removal of phosphorus from the water column.

Precipitation of phosphorus is recommended in situations where sediments are not a significant source of phosphorus. Phosphorus inactivation is recommended in most other situations, since eutrophic lake sediments can be a major source of phosphorus for algal growth. Both techniques involve the addition of large amounts of aluminum sulfate to the lake. Negative aspects include low Ph and high dissolved aluminum concentration if incorrect techniques are used.

Aquatic Plant Control

An effective method for controlling excessive aquatic vegetation is herbicide treatment. However, herbicides do not provide a long-term solution for nuisance plants or algal problems. There are no registered herbicides which provide lasting control of plants or algae. Many herbicides are also harmful to non-target species. Herbicide use also leads to the release of nutrients and to dissolved oxygen problems from the decomposing vegetation. Reliance on herbicides requires regular treatment with the possible recurrence of the undesirable side effects. When used correctly, herbicides can be safe and effective. When used correctly, herbicides can be safe and effective. However, if misused, they can be dangerous to fish, wildlife, the applicator, and other water body users. An aquatic plant specialist should be consulted and permits must be obtained before treatment.

Mechanical harvesting is a technique involving the cutting and removal of aquatic plants, thus giving the lake user immediate benefits of improved swimming and boating. Harvesting usually does not constitute a long-term restoration technique since it does not affect external sediment or nutrient inputs or alter conditions for regrowth of the vegetation. In fact harvesting may also stimulate plant growth. Rarely does the amount of nutrients removed with the vegetation exceed the net nutrient inputs to the lake, therefore it is not usually effective as a method of nutrient control and is often prohibitively expensive. Although harvesting is not a long-term restoration method, it is a lake improvement technique that gives the users immediate access to the water without the problems associated with most herbicides. Harvesting does constitute habitat removal, and therefore can result in reduced numbers of animals in the harvested area.

Harvesting has several advantages over herbicide treatment. It is target specific and the site of harvesting is determined by the lake user. The nuisance vegetation is removed from the lake and with it a certain amount of nutrients. The plants do not remain in the lake to decompose, use oxygen, release nutrients, and build up sediments.

Biological control of aquatic plants and algae through the natural grazing of fish or insects is a relatively new experimental approach. However, the introduction of exotic species to combat nuisance vegetation is still in the experimental stage. Caution is being exercised since the introduction of exotic species can sometimes cause more problems than are solved. The grass carp has been successful in vegetation control in Europe and China and is being tested in the United States. Currently sterile grass carp have been introduced into Salem Ponds in an effort to control macrophytes. This project is being monitored to determine the effectiveness and potential for use of grass carp in very selective situations for the control of macrophytes in Utah. However, more research is needed on the role of the grass carp and other herbivorous fish in cycling plant nutrients, interfering with game fish populations, and spreading fish diseases before widespread use is warranted.

Biomanipulation is an experimental technique which alters the food web of a lake to favor the naturally occurring animals which graze on algae. Grazing zooplankton are promoted by reducing fish populations that prey on them.

Biomanipulation is a promising approach that could reduce algal blooms and improve water clarity. At present the use of biological controls on nuisance plants and algae is still largely in the experimental stage.

Aeration and Artificial Circulation

In eutrophic lakes, the bottom sediments contain an excessive amount of organic matter. If the lake is stratified, bacterial decomposition consumes the dissolved oxygen in the bottom waters. The bottom waters then become unfit for fish and benthic animals. Nutrients, methane, and hydrogen sulfide can accumulate in the bottom waters, creating taste and odor problems in lakes used for drinking water.

Aeration introduces oxygen into the bottom waters and induces circulation of water. This circulation may be designed primarily for the bottom waters (hypolimnion) or for the entire water column which mixes the entire water column and breaks up the stratification. These techniques can reduce taste and odor problems, improve the benthic fishery, and prevent fish kills. Control of algal blooms and/or aquatic plants, oxidation of bottom sediments, and reduction of nutrient concentrations have not been sufficiently documented as benefits of aeration or artificial circulation.

Individual Actions

The following is a list of actions that individuals can take to reduce or eliminate unnecessary pollutants into lakes:

1. Those residents in a lake watershed should pump out their septic tank every three to five years, or whenever the sludge level exceeds one-third of the tank capacity. Maintain your septic system properly. Be sure your system is designed to handle the load it receives. A leach field should be increased in size whenever the frequency (seasonal to year-round) or volume (additional people, washing machines, etc.) of use increases. If possible, lake shore owners should connect to a sewage treatment plant. Finally, check your leach field for soft or wet areas or septic smells. Replace faulty systems.

2.. Do not bathe, shampoo, or wash boats, pets, or other objects in the lake with soap or phosphorus-containing detergents. Do not wash automobiles near lakes where the detergent can run into the water.

3. Use low or non-phosphate detergent. Take your clothes to a laundromat located outside the lake's drainage area.

4. Keep land clearing to a minimum. Re-vegetate bare areas to minimize erosion to the lake. Roads and paths leading to the lake should be curved to reduce erosion.

5. Maintain a buffer zone of natural vegetation along the shore to contain erosion and assimilate nutrients before they reach the lake.

6. Do not use fertilizer near the lake shore. Encourage shore fronts with natural vegetation, rather than green, manicured lawns.

7. Do not burn brush or leaves near the shore; the nutrients remain behind to be washed into the lake during the first rain. Do not dump leaves or grass clippings in or near the lake. They also add nutrients to the water.

8. Do not urinate or defecate in the lake, and don't allow pets to do the same. Cows, horses, or other groups of animals should not be housed near the lake where the phosphorus in their manure can be washed into the lake by rain.

9. Do not feed ducks or other aquatic organisms; there is plenty of natural food available. Nutrients in the feed material, which is produced outside the lake's watershed, will be added to the lake through the organism's feces. Also, by discouraging the duck population, you can reduce the risk of swimmer's itch in your area.

10. Do not use powerful outboard motors in shallow areas. The nutrient-laden bottom sediments can be churned into the overlying water to support increased algae growth.

Where To Go For More Information

Organizations

Soil and Water Conservation Districts, located in most counties throughout the State.

U.S. Environmental Protection Agency Region VIII, 999 18th Street Suite 500, Denver CO, 80202-2466. Phone: David Rathke (303) 293-1703.

Utah Division of Water Quality, 288 North 1460 West, PO Box 144870, Salt Lake City UT, 84114-4870. Phone: Harry Judd (801) 538-6146.

North American Lake Management Society, One Progress Blvd., Box 27, Alachua FL, 32615. Phone (904) 462-2554.

Utah Division of Wildlife Resources, 1596 West North Temple, Salt Lake City UT, 84116-3195. Salt Lake, Phone (801) 538-4700; Ogden Regional Office, Phone (801) 479-5143; Provo Regional Office, Phone (801) 489-5678; Cedar

City Regional Office, Phone (801) 586-2445; Price Regional Office, Phone (801) 637-3310; Vernal Regional Office, Phone (801) 789-3103.

Mountainland Association of Governments, 2545 North Canyon Road, Provo UT, 84604-5906. Phone Ray Loveless, (801) 377-2262.

Five County Association of Governments, 906 North 1400 West, St. George UT, 84770. Phone 673-3548

Publications

Carlson, Robert E. 1977. **A Tropic State index for Lakes**. Limnology and Oceanography. 22(2): 361-369

North American Lake Management Society (Lynn Moore and Kent Thornton, editors). **The Lake and Reservoir Restoration Guidance Manual, First edition**. EPA 440/5-88-002, U.S. EPA, Nonpoint Sources Branch, Washington D.C., 1988.

State of Utah Clean Lakes Inventory and Classification. Utah Department of Health, Bureau of Water Pollution Control, Salt Lake City, UT., 1982. 1031 pp.

State of Utah Water Quality of Selected Utah Impoundments. Utah Department of Health, Bureau of Water Pollution Control, Salt Lake City, UT., 1980. 227 pp.

Wetzel, Robert G. and Likens, Gene E., **Limnological Analyses, Second Edition**. Springer-Verlag, New York Inc., New York, NY., 1991. pp 386.

LAKE WATER QUALITY ASSESSMENTS

Lake eutrophication is a naturally occurring phenomenon or aging process that is often accelerated by man's activities. Over time, many lakes will eventually fill up with organic matter and sediment to become a marsh or even dry land. Through a growing public awareness of this problem, Congress passed legislation in 1972 (Section 314 of the Federal Water Pollution Control Act) mandating states to inventory and classify their lakes according to trophic condition. States are to develop a ranking system that is used to prioritize the lakes for potential protective or restorative projects.

Over three thousand bodies of water, i.e. lakes, reservoirs, and wetlands, were identified in Utah's Clean Lakes initial inventory. (*State of Utah Clean Lakes Inventory and Classification, Volumes I & II*, April 1982.) Lakes selected for further study and evaluation were chosen on the following criteria. For the purposed of this assessment a "significant lake", is defined as any publicly owned lake/reservoir/pond with a surface area equal to or greater than 50 acres with the following conditions evident: (1) accessibility to the public is provided; (2) beneficial use status has been defined or is anticipated to protect water quality for public benefit; and (3) the lake provides important recreational benefit to the public. Marshes, springs, waterfowl management areas and intermittent lakes were not considered in the report. Only lakes/reservoirs 50 acres in surface area or larger were addressed. Exceptions in size were made in cases of high recreation use. They also had to be publicly owned. Under these guidelines a final list of 127 lakes and reservoirs was developed.

Table 1 provides a summary of the number of lakes and lake surface area in the State of Utah. Seventy-seven percent of the total surface acres lake in Utah are found in 6 lakes and reservoirs, Bear Lake, Utah Lake, Flaming Gorge Reservoir, Lake Powell, Strawberry Reservoir, and Sevier Bridge Reservoir. The Great Salt Lake is not included in this table.

The State is currently involved in a program assessing 130 lakes and reservoirs. They include most of those previously inventoried, any new waterbodies that have been created since the original assessment in 1981-1982, and other lakes assessed by the State or other agencies on a cooperative basis. Most of the original 127 lakes and reservoirs are included, however, several of the original lakes have been deleted and replaced with additional lakes and reservoirs. This resulted because of a re-evaluation of the lakes and reservoirs in Utah. In addition, the State has been re-evaluating the selection criteria for

Table 1. Utah Freshwater Lakes and Reservoirs by Size Class

Size Class (Surface Acres)	Number of Lakes / Reservoirs	Total Surface Acres
10,000 and greater	6 (0.2%)	370,905 (77.0%)
5,000 - 9,999	2 (0.07%)	15,584 (3.2%)
1,000 - 4,999	18 (0.6%)	34,119 (7.1%)
500 - 999	17 (0.57%)	12,475 (2.6%)
100 - 499	87 (2.9%)	19,890 (4.1%)
50 - 99	68 (2.3%)	4,594 (1.0%)
20 - 49	202 (6.7%)	5,871 (1.2%)
20 or less	2600 (86.7%)	18,200 (3.8%)
Total	3,000	481,638

establishing the priority listing of lakes and reservoirs in the State.

The final priority ranking (1996) contains all of the lakes/reservoirs currently monitored and was developed based upon following three factors: public benefit; the water quality of each impoundment; and the restoration effectiveness. Each category considered several factors in determining an overall group ranking. Public benefit rankings were based on existing beneficial use classification and developed facilities supporting recreation. Water quality rankings included factors for the trophic state index value, dissolved oxygen concentration throughout the water column, phytoplankton species dominance, reported fish kills and water quality trend. Restoration feasibility rankings were developed around criteria associated with lake size, watershed/lake size ratios, average depth, annual drawdown, and economic feasibility in restoring water quality. A listing of the priority lakes and reservoirs for the State of Utah is presented in Table 2.

General ambient water quality conditions of Utah's lakes and reservoirs vary greatly in relation to their respective watersheds and lake morphometry. Nutrient concentrations and trophic states range from the oligotrophic conditions of many high mountain lakes to highly eutrophic downstream lakes and such as Lower Box Reservoir, Rush Lake, Redmond Reservoir, Utah Lake, Kent's Lake and Minersville Reservoir. Other water chemistry characteristics vary from extremely soft water conditions of the high Uinta lakes to high salinity (total dissolved solids - TDS) levels in reservoirs on the lower Sevier drainage such as Gunnison Bend and D.M.A.D. Reservoirs.

Many lakes/reservoirs, both large and small, experience problems relating to thermal stratification and subsequent dissolved oxygen (DO) depletion in the hypolimnion. Several lakes experience fish kills each year due to DO depletion as a result of excessive algal production. Many lakes/reservoirs also have aesthetic and recreational use impairment because of severe annual drawdown leaving expanses of exposed mud flats and often insufficient waters for overwintering fish populations.

During recent years, an EPA assistance grant has been utilized to obtained additional water quality data to assist in the evaluation and assessment of lakes and reservoirs for this report. The initial purpose of this program was to assess newly created reservoirs and to conduct ongoing monitoring programs to reassess the lakes and reservoirs contained in the 1981-1982 Clean Lakes Inventory of the State of Utah. Data is gathered on the States priority lakes and reservoirs for one productivity (May through September) period during the 2 year assessment period. Each lake or reservoir is sampled twice during the period June through September for the year it is scheduled. Occasionally additional data may be obtained as part of cooperative programs with other agencies or during the winter period in an effort to more effectively evaluate annual conditions. Currently, the scope of this program includes the development of a citizen monitoring program to provide additional water quality data, recreational and usage data, related watershed data and to stimulate an awareness of lake water quality and conditions in our State.

Trophic Status

The trophic status for lakes and reservoirs was determined utilizing Carlson's TSI (Trophic State Index) values. Trophic status has been determined using this methodology since the initial classification and inventory project in 1981-82. In order to establish trends, these values were used for comparison. Utilizing the standard Carlson formulas, an annual average TSI Index value was determined for each lake or reservoir. The data obtained is representative of the summer monitoring schedule from late May through early September for the period 1989 through 1991. Data for these 133 waterbodies was acquired during that period by the State or cooperating agencies.

To determine the annual TSI values, the following procedure was used:

1 - An average annual summer TSI Index value for total phosphorus, secchi depth and chlorophyll-a for each lake or reservoir site was determined.
2 - The values from step one were then averaged to determine an overall TSI Index value at each lake or reservoir station.

3 - An average annual summer TSI value for each lake was calculated by averaging all the station TSI Index values for a given lake or reservoir.

4 - TSI Index values utilized in this report were calculated for each lake or reservoir by determining the average TSI value for the period in two year increment periods since 1989 (1989-1990, 1991-92, 1993).

TSI values are compared to the following index values to determine current trophic state condition.

TSI Index value < 40 - Oligotrophic
TSI Index value 40 ↔ 50 - Mesotrophic

Table 2. Utah's Priority Lakes and Reservoirs

	WATER QUALITY FACTORS						PUBLIC BENEFIT				RESTORATION FEASIBILITY							
	3/94 TSI	Dissolved Oxygen	Phyto- -plankton Dominance	WQ Trend	Fishkills	TOTAL	Classification	Facility Support	Annual Usage	TOTAL	Lake Size	Watershed Ratio	Average Depth	Source Delineation	Annual Drawdown	Cost Analysis	TOTAL	TOTAL POINTS
Mantua Reservoir	59.56	10	10	5	10	94.56	7	10		17	6	6	4	5	3	10	34	145.56
Labaron Reservoir	65.47	10	10	10		95.47	7	7		14	8	6	4	3	3	10	34	143.47
Kents Lake	67.12	10	10	5	5	97.12	7	7		14	8	4	4	3	3	10	32	143.12
Minersville Reservoir	66.48	6	10	5	5	92.48	7	9		16	6	4	4	5	3	10	32	140.48
Matt Warner Reservoir	61.26	10	6	10	10	97.26	7	5		12	6	6	3	3	3	10	31	140.26
Lower Box Reservoir	74.28	3	10	5		92.28	7	5		12	8	4	4	5	1	10	32	136.28
Johnson Valley Reservoir	65.18	10	10	5		90.18	7	7		14	6	4	4	5	3	10	32	136.18
East Canyon Reservoir	49.59	10	10	5	10	84.59	8	9		17	6	4	5	5	3	10	33	134.59
Calder Reservoir	59.49	10	6	5	10	90.49	7	6		13	8	4	4	3	1	10	30	133.49
Hoop Lake	59.27	10	10	5		84.27	7	7		14	6	6	4	5	3	10	34	132.27
Newton Reservoir	60.82	10	3	10	5	88.82	7	5		12	6	4	4	5	1	10	30	130.82
Barney Lake	60.70	8	10	5		83.70	7	5		12	8	6	4	3	3	10	34	129.70
Koosharem Reservoir	65.86	6	10	5		86.86	7	5		12	6	4	4	5	1	10	30	128.86
Bridger Lake	51.82	10	3	10		74.82	7	7		14	8	6	4	5	5	10	38	126.82
Navajo Lake	39.71	10	3	10	10	72.71	7	8		15	6	10	4	3	5	10	38	125.71
Scofield Reservoir	53.22	6	6	0	10	75.22	9	9		18	4	6	4	5	3	10	32	125.22
Red Creek Reservoir (Iron)	54.12	10	10	5		79.12	7	5		12	8	4	4	5	3	10	34	125.12
Panguitch Lake	52.67	10	10	5		77.67	7	8		15	4	6	4	5	3	10	32	124.67
Manning Meadow Reservoir	50.17	10	10	5		75.17	7	5		12	8	6	4	5	3	10	36	123.17
Yankee Meadow Reservoir	54.09	0	6	5	10	75.09	7	5		12	8	6	4	5	3	10	36	123.09
Red Creek Reservoir	57.30	10	6	5		78.30	7	5		12	6	4	4	5	3	10	32	122.30
Otter Creek Reservoir	55.23	6	10	5		76.23	7	9		16	4	4	4	5	3	10	30	122.23
Rex's Reservoir	50.21	10	10	5		75.21	7	5		12	8	4	4	5	3	10	34	121.21
Upper Enterprise Reservoir	54.18	10	6	0	5	75.18	7	7		14	4	6	4	5	3	10	32	121.18
Browne Reservoir	47.02	10	6	10		73.02	7	7		14	8	4	4	3	5	10	34	121.02
Utah Lake	67.59	0	10	5	0	82.59	7	9		16	4	6	3	5	3	0	21	119.59
Strawberry Reservoir	48.43	10	6	0	5	69.43	9	8		17	4	6	5	5	3	10	33	119.43
Puffer Lake	38.44	10	6	5	10	69.44	7	8		15	8	6	4	3	3	10	34	118.44

Table 2. Utah's Priority Lakes and Reservoirs

	WATER QUALITY FACTORS						PUBLIC BENEFIT				RESTORATION FEASIBILITY							
	3/94 TSI	Dissolved Oxygen	Phyto-plankton Dominance	WQ Trend	Fishkills	TOTAL	Classification	Facility Support	Annual Usage	TOTAL	Lake Size	Watershed Ratio	Average Depth	Source Delineation	Annual Drawdown	Cost Analysis	TOTAL	TOTAL POINTS
Mill Hollow Reservoir	47.42	10	6	5		68.42	7	7		14	8	4	4	5	5	10	36	118.42
Sheep Creek Reservoir	46.10	10	3	5	5	69.10	7	7		14	8	5	4	3	5	10	35	118.10
Cook Lake	44.42	8	6	5	10	73.42	7	6		13	8	6	1	3	3	10	31	117.42
Rockport Reservoir	41.78	10	6	5		62.78	10	9		19	4	10	5	3	3	10	35	116.78
Rush Lake	72.37	0	3	5	5	85.37	7	5		12	8	4	1	3	3	0	19	116.37
Hyrum Reservoir	44.03	6	6	5	5	66.03	8	10		18	6	4	4	5	3	10	32	116.03
Gunlock Reservoir	47.41	10	3	10		70.41	9	5		14	6	4	5	3	3	10	31	115.41
Three Creeks Reservoir	57.32	0	6	10		73.32	7	5		12	8	4	4	3	1	10	30	115.32
Stansbury Lake	58.31	0	0	5		63.31	7	10		17	6	8	3	3	5	10	35	115.31
Wide Hollow Reservoir	47.59	10	3	5	5	70.59	7	7		14	6	4	4	3	3	10	30	114.59
Pelican Lake	47.06	10	3	5	10	75.06	7	5		12	4	4	3	3	3	10	27	114.06
Forsyth Reservoir	56.87	0	10	5		71.87	7	5		12	6	4	4	5	1	10	30	113.87
Lower Gooseberry Reservoir	40.82	10	6	5	5	66.82	9	7		16	8	4	1	5	3	10	31	113.82
Jordanelle Reservoir	44.82	10	6	5		65.82	7	9		16	4	4	5	5	3	10	31	112.82
Lower Bowns Reservoir	47.18	10	6	5		68.18	7	5		12	8	4	4	3	3	10	32	112.18
Birch Creek Reservoir #2	49.07	10	6	5		70.07	7	5		12	8	4	4	3	1	10	30	112.07
Red Fleet Reservoir	41.02	10	6	5		62.02	10	9		19	6	4	5	3	3	10	31	112.02
Redmond Lake	70.71	0	3	5		78.71	7	5		12	6	8	1	3	3	0	21	111.71
Tony Grove Reservoir	35.26	10	3	5	10	63.26	7	7		14	8	4	4	3	5	10	34	111.26
Electric Lake	43.92	10	3	5		61.92	7	7		14	6	6	5	5	3	10	35	110.92
Newcastle Reservoir	41.78	10	10	5		66.78	7	5		12	6	4	4	5	3	10	32	110.78
Blanding City Reservoir #4	46.74	10	0	5		61.74	9	5		14	8	6	4	3	3	10	34	109.74
Brough Reservoir	44.74	10	6	5		65.74	7	5		12	8	4	4	3	3	10	32	109.74
Big East Lake	41.48	10	6	0		57.48	7	9		16	8	6	4	5	3	10	36	109.48
Spirit Lake	50.21	0	0	10		60.21	7	8		15	8	4	4	3	5	10	34	109.21
Baker Dam Reservoir	46.25	10	6	0		62.25	7	7		14	8	4	4	3	3	10	32	108.25
Sevier Bridge Reservoir	52.19	10	6	5		73.19	7	9		16	4	5	4	3	3	0	19	108.19
Kolob Reservoir	45.06	6	6	5		62.06	7	5		12	6	6	4	5	3	10	34	108.06
Mill Meadow Reservoir	55.75	0	10	0		65.75	7	5		12	6	4	4	5	1	10	30	107.75

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Dark Canyon Lake	40.20	10	0	5		55.20	9	5		14	10	4	4	5	5	10	38	107.20
Lyman Lake	31.21	10	6	0	10	57.21	8	7		15	8	6	4	3	3	10	34	106.21
Lloyds Reservoir	47.02	10	0	5		62.02	9	5		14	6	4	4	3	3	10	30	106.02
Marsh Lake	30.42	10	0	5	10	55.42	7	7		14	8	6	4	3	5	10	36	105.42
Huntington Reservoir	43.78	10	0	5		58.78	7	5		12	6	6	4	5	3	10	34	104.78
Deer Creek Reservoir	42.31	6	6	0		54.31	10	9		19	4	4	5	5	3	10	31	104.31
Nine Mile Reservoir	53.10	3	3	5		64.10	7	5		12	6	4	4	3	1	10	28	104.10
Mona Reservoir	57.58	0	3	5		65.58	7	5		12	4	4	4	3	1	10	26	103.58
Trial Lake	39.51	6	3	5		53.51	9	7		16	8	6	4	3	3	10	34	103.51
Grantsville Reservoir	46.47	3	3	5		57.47	7	5		12	8	4	4	5	3	10	34	103.47
Monticello Lake	45.46	0	3	5	5	58.46	7	5		12	10	6	1	3	3	10	33	103.46
Causey Reservoir	43.41	10	0	5		58.41	7	7		14	6	4	5	3	3	10	31	103.41
Donkey Reservoir	44.16	0	0	5	5	54.16	7	5		12	8	8	3	5	3	10	37	103.16
China Lake	34.87	10	6	0		50.87	7	7		14	8	8	4	5	3	10	38	102.87
Anderson Meadow Rsvr	43.87	0	10	0		53.87	7	7		14	10	4	3	3	5	10	35	102.87
Butterfly Lake	37.79	8	3	5		53.79	7	7		14	10	6	1	3	5	10	35	102.79
Washington Lake	40.73	6	3	5		54.73	7	7		14	8	6	4	3	3	10	34	102.73
Tibble Fork Reservoir	44.39	0	0	10		54.39	7	7		14	8	4	4	3	5	10	34	102.39
Woodruff Creek Reservoir	43.14	10	0	5		58.14	7	5		12	8	4	4	3	3	10	32	102.14
Pineview Reservoir	39.97	10	6	0		55.97	10	8		18	4	4	4	3	3	10	28	101.97
Little Dell Reservoir	36.84	3	10	5		54.84	7	5		12	6	6	5	5	3	10	35	101.84
Settlement Canyon Rsvr	40.84	6	0	5		51.84	7	10		17	8	5	4	3	3	10	33	101.84
Posey Lake	38.82	10	3	0	5	56.82	7	7		14	8	6	1	3	3	10	31	101.82
DMAD Reservoir	60.55	0	6	5		71.55	7	6		13	4	4	3	3	3	0	17	101.55
Recapture Reservoir	44.50	10	0	5		59.50	7	5		12	6	4	4	3	3	10	30	101.50
Fairview Reservoir #2	39.25	0	3	5	10	57.25	9	5		14	6	6	4	3	1	10	30	101.25
Echo Reservoir	41.80	3	3	5		52.80	10	9		19	4	4	5	5	1	10	29	100.80
Little Creek Reservoir	40.41	0	6	5	5	56.41	7	5		12	8	4	4	5	1	10	32	100.41
Tropic Reservoir	39.12	10	0	5	5	59.12	7	7		14	6	4	3	3	1	10	27	100.12

Table 2. Utah's Priority Lakes and Reservoirs

	WATER QUALITY FACTORS						PUBLIC BENEFIT				RESTORATION FEASIBILITY							
	3/94 TSI	Dissolved Oxygen	Phyto-plankton Dominance	WQ Trend	Fishkills	TOTAL	Classification	Facility Support	Annual Usage	TOTAL	Lake Size	Watershed Ratio	Average Depth	Source Delineation	Annual Drawdown	Cost Analysis	TOTAL	TOTAL POINTS
Kens Lake	45.01	3	6	0		54.01	7	5		12	8	6	4	3	3	10	34	100.01
Gunnison Reservoir	56.81	0	10	5		71.81	7	5		12	4	4	4	3	1	0	16	99.81
Wall Lake	39.18		6	5		50.18	7	5		12	8	6	4	3	5	10	36	98.18
Gunnison Bend Reservoir	55.04	0	6	0		61.04	7	7		14	6	10	1	3	3	0	23	98.04
Salem Pond	39.81	3	3	0		45.81	7	10		17	8	4	3	5	5	10	35	97.81
Scout Lake	38.43	0	6	0		44.43	8	8		16	8	6	3	5	5	10	37	97.43
East Park Reservoir	41.41	10	0	0		51.41	7	7		14	6	6	4	3	3	10	32	97.41
Paradise Park Reservoir	36.97	6	3	5		50.97	7	7		14	6	6	4	3	3	10	32	96.97
Marshall Reservoir	31.77	0	10	5		46.77	7	5		12	8	8	4	3	5	10	38	96.77
Steinaker Reservoir	33.72	6	3	5		47.72	10	9		19	6	4	4	3	3	10	30	96.72
Starvation Reservoir	36.66	6	6	0		48.66	10	9		19	4	4	5	3	3	10	29	96.66
Hoover Lake	36.20	0	6	5		47.20	7	5		12	8	6	3	5	5	10	37	96.20
Lost Creek Reservoir	35.17	3	6	5		49.17	9	5		14	6	4	5	5	3	10	33	96.17
Cleveland Reservoir	42.75	3	0	5		50.75	7	6		13	6	6	4	5	1	10	32	95.75
Willard Bay Reservoir	47.68	6	6	0		59.68	9	9		18	4	4	4	3	3	0	18	95.68
Porcupine Reservoir	38.44	6	3	5		52.44	7	5		12	6	4	5	3	3	10	31	95.44
Miller Flat Reservoir	42.35	3	3	5		53.35	7	5		12	6	6	4	3	1	10	30	95.35
Fish Lake	33.59	3	6	0		42.59	7	8		15	4	8	5	5	5	10	37	94.59
Lake Mary	33.50	3		10		46.50	7	5		12	8	6	4	5	3	10	36	94.50
Long Park Reservoir	45.49	0	0	5		50.49	7	7		14	6	4	4	3	3	10	30	94.49
Oak Park Reservoir	42.44	6	0	0		48.44	7	7		14	6	6	4	3	3	10	32	94.44
Whitney Reservoir	37.21	3	3	5		48.21	7	5		12	6	6	4	5	3	10	34	94.21
Ferron Reservoir	35.47	0	0	5		40.47	7	8		15	8	6	4	5	5	10	38	93.47
Joes Valley Reservoir	32.35	3	6	5		46.35	7	8		15	4	4	4	5	5	10	32	93.35
Mirror Lake	31.69	6	3	0		40.69	7	9		16	8	6	4	3	5	10	36	92.69
Ashley Twin Lakes	41.52	0		5		46.52	9	5		14	8	6	4	3	1	10	32	92.52
Currant Creek Reservoir	38.26	0	3	0		41.26	9	7		16	6	4	5	5	5	10	35	92.26
Piute Reservoir	45.54	0	6	0		51.54	7	5		12	4	4	4	3	3	10	28	91.54
Flaming Gorge Reservoir	36.47	0	3	5		44.47	10	10		20	4	10	5	3	5	0	27	91.47

Table 2. Utah's Priority Lakes and Reservoirs

	WATER QUALITY FACTORS						PUBLIC BENEFIT				RESTORATION FEASIBILITY							
	3/94 TSI	Dissolved Oxygen	Phyto-plankton Dominance	WQ Trend	Fishkills	TOTAL	Classification	Facility Support	Annual Usage	TOTAL	Lake Size	Watershed Ratio	Average Depth	Source Delineation	Annual Drawdown	Cost Analysis	TOTAL	TOTAL POINTS
Palisades Lake	39.61	0	0	5		44.61	7	9		16	8	4	4	3	1	10	30	90.61
Stateline Reservoir	41.41	0	0	5		46.41	7	7		14	6	4	4	3	3	10	30	90.41
Millsite Reservoir	35.19	0	0	5		40.19	10	9		19	6	4	4	3	3	10	30	89.19
Huntington Lake North	37.63	0	0	5		42.63	7	9		16	6	4	4	3	3	10	30	88.63
Meeks Cabin Reservoir	40.19	3	0	0		43.19	7	7		14	6	4	5	3	3	10	31	88.19
Duck Fork Reservoir	28.05	10	0	0		38.05	7	5		12	8	6	4	5	5	10	38	88.05
Beaver Meadow Reservoir	45.98	0	0	0		45.98	7	5		12	6	4	4	5	1	10	30	87.98
Big Sand Wash Reservoir	38.97	0	3	0		41.97	9	7		16	6	4	4	3	3	10	30	87.97
Pine Lake	19.66	10	3	0	5	37.66	7	7		14	8	4	4	3	5	10	34	85.66
Moon Lake	37.42	0	0	0		37.42	10	8		18	6	4	4	3	3	10	30	85.42
Quail Creek Reservoir	26.15	6	0	0		32.15	9	9		18	6	4	5	3	5	10	33	83.15
Smith and Morehouse Res	34.39	0	0	0		34.39	7	7		14	8	5	4	3	3	10	33	81.39
Lake Powell	35.13			0		35.13	10	9		19	4	10	5	3	5	0	27	81.13
Bear Lake	32.73	0	0	0		32.73	7	10		17	4	4	5	5	3	10	31	80.73
Upper Stillwater Reservoir	25.21	0	0	0		25.21	10	7		17	6	4	5	3	3	10	31	73.21

Table 3. Trophic Status of Lakes						
Trophic Class	Number/Acreage of Lakes/Reservoirs 1989-90		1991-92		1993-94	
Oligotrophic	17 (18%)	75,103	27 (22%)	239,888	42 (32%)	290,432
Mesotrophic	50 (52%)	220,257	52 (42%)	21,061	51 (39%)	46,678
Eutrophic	17 (18%)	40,939	30 (24%)	31,990	24 (19%)	22,670
Hypereutrophic	13 (13%)	103,032	15 (12%)	122,069	13 (10%)	100,808
TOTALS	97	439,311	124	415,008	130	460,588

TSI Index value 50 ↔ 70 - Eutrophic
TSI Index value > 70 - Hypereutrophic

Table 3 contains a summary of lake trophic status for Utah's lakes and reservoirs by study periods. Lakes that have been determined to be hypereutrophic during the various periods of study include the following waterbodies by periods: (1989-90) Baker Dam Reservoir, DMAD Reservoir, Forsyth Reservoir, Gunnison Bend Reservoir, Johnson Reservoir, Koosharem Reservoir, Mill Meadow Reservoir, Redmond Reservoir, Rush Lake, Scofield Reservoir, Upper Enterprise Reservoir and Utah Lake; (1991-92) Barney Lake, Big Lake, Gunnison Bend Reservoir, Johnson Reservoir, Kents Lake, Lower Box Reservoir, Mill Meadow Reservoir, Mona Reservoir, Newton Reservoir, Redmond Reservoir, Rush Lake, Sevier Bridge Reservoir, Utah Lake and Willard Bay Reservoir; and (1993-94) Lower Bowns Reservoir, Rush Lake, Redmond Lake, Utah Lake, Kent's Lake, LaBaron Reservoir, Minersville Reservoir, Matt Warner Reservoir, Johnson Valley Reservoir, Newton Reservoir, Barney Reservoir and DMAD Reservoir.

Control and Restoration Efforts

The majority of recommended restoration or protective measures relate to Best Management Practices (BMPs) and other land use management practices that could be implemented to control nonpoint sources of pollution in the watershed which would improve or protect water quality. Examples of such BMPs may include eliminating dumping wastes into stream, preventing excessive vegetation removal, controlling grazing and restricting excessive animal stream access, elimination of agricultural practices directly associated with steams, maintaining property tidiness, keeping streets and gutters clean, preserving streambank and slope stability, restricting excessive use of fertilizers and pesticides, and regulating off-road activities.

Best Management Practices are often implemented to control phosphorus loading from barnyard and feed yard surfaces, flush waters from excessive irrigation, top soil erosion, etc. Maintaining riparian vegetation along the river and stream banks is also desirable. In addition it is important that individual sewage disposal systems be properly constructed, used and maintained to avoid the contamination of State waters. Nutrient and bacterial problems in the watershed are sometimes the result of improper waste disposal. Proper design, construction, and maintenance of sewage facilities, solid waste disposal facilities and fish cleaning stations are desired.

Individuals using public lands have a responsibility to understand how they can have an adverse impact water quality and utilize practices to limit or control these negative impacts. Recreationalists such as hikers, campers, and fisherman should develop practices that are environmentally sound. Some of these practices might include but are not restricted to the following: using acceptable sanitation practices with regards to human and animal waste materials, improper use of organic baits while fishing, packing out trash, selection of campsites, preservation of riparian and other vegetative habitats. Some of these things are already encouraged by various public agencies but increased efforts could only be more beneficial. These are just a few of the possible BMPs that could be implemented. Table 4 contains a listing of specific lake rehabilitation techniques that have been used in addressing problems identified in diagnostic/feasibility studies funded under Section 314 of the Clean Water Act.

Specific watershed management plans should be developed based on the unique problems and conditions identified for a particular lake or reservoir. Such management conditions identified for a particular lake or reservoir. Such management plans will be coordinated with the ongoing development and implementation of the 319 Nonpoint Source Management Plan by the Utah Department of Agriculture. In addition, wherever point sources are identified in a watershed that are impacting water quality appropriate steps need to be taken to control the discharge of contaminants under existing water quality standards and guidelines.

Table 4. Lake Rehabilitation Techniques.		
Rehabilitation Technique	Lakes using Technique	Lake Acreage
In-lake Treatments		
1. Phosphorus Precipitation/Inactivation		
2. Sediment Removal/Dredging	1	11
3. Biological controls	1	11
4. Fish Clean Station Installed	2	4,063
Watershed Treatments		
5. Sediment Traps/Detention ponds	1	1,248
6. Erosion control Shoreline/Streambank	3	7,028
7. Diversion of nutrient rich inflows		
8. Animal waste management practices installed	1	2,965
9. Riprap installation	2	4,063
10. Unspecified BMPs installed	1	2,965
11. Riparian Fencing	2	4,063
12. Diversion structures installed	1	2,015
13. Checkdams or stream structures	2	4,063
14. Reseeding areas for erosion control	2	4,063
15. Streambank stabilization using vegetative controls	2	4,063
16. Wetland treatment of inflow waters	1	11
Other Lake Protection/Restoration Efforts		
17. Local Lake Management Program in place	1	2,815
18. Public Information/Education Program	4	4,074
19. Local Ordinance control to protect lakes	3	4,063
20. Point Source Controls	1	2,965
21. Municipal sewer system developed	1	2,815

Phase I and II Clean Lakes Program projects are currently being selected from the State lake/reservoir priority list. Phase I studies have been completed or are near completion on Scofield Reservoir, Panguitch Lake, Deer Creek Reservoir, Bear Lake. Pineview Reservoir, Salem Pond, Minersville Reservoir, Hyrum Reservoir, East Canyon Reservoir and Utah Lake. Phase II lake restoration studies are currently nearing completion, or completed on four of these waterbodies (Panguitch Lake, Scofield Reservoir, Deer Creek Reservoir and Salem Pond). Other Phase I studies currently being conducted include; Otter Creek Reservoir, Navajo Lake, Mantua Reservoir and Pelican Lake.

For specific financial and summary details for Clean Lakes Projects please refer to the summary listed in Table 5.

Table 5. Listing of Clean Lakes Projects					
Name of Project	Date Done	Type	Federal Funding	Problems	Rehabilitation Techniques
Scofield Reservoir	1983	Phase I	$ 73,950	Eutrophication	
Panguitch Lake	1983	Phase I	$ 51,765	Eutrophication	
Deer Creek Reservoir	1984	Phase I	$ 73,590	Eutrophication	
Pineview Reservoir	1992	Phase I	$100,000	Eutrophication	
Salem Pond	1991	Phase I	$ 35,000	Macrophytes	
Minersville Reservoir	1994	Phase I	$ 90,845	Eutrophication	
Hyrum Reservoir	1994	Phase I	$100,000	Eutrophication	
Otter Creek Reservoir		Phase I	$100,000	Eutrophication	
Utah Lake		Phase I	$100,000	Eutrophication	
East Canyon Res		Phase I	$100,000	Eutrophication	
Navajo Lake		Phase I	$ 60,000	Macrophytes	
Mantua Reservoir		Phase I	$ 88,000	Eutrophication Macrophytes	
Scofield Reservoir	1992	Phase II	$120,000	Erosion	16,21,30,32,33,34, 35,36,41,42,44
Panguitch Lake	1989	Phase II	$ 95,925	Erosion	16,20,21,30,32,34,35 36,41,42
Deer Creek Reservoir	1992	Phase II	$328,393	Agricultural Wastes	20,21,25,29,31,40,41 42,43
Salem Pond	1995	Phase II	$ 95,000	Macrophytes, Depth	2,15,37,41,
Statewide Assessment	1993	LWQA	$100,000	305(b) Report	
Statewide Assessment	1994	LWQA	$ 60,000	305(b) Report	
Statewide Assessment		LWQA	$ 50,000	305(b) Report	
Decker Lake		Phase II	$1,000,000	Sedimentation	
Pelican Lake		Phase I	$100,000	Macrophytes Dissolved Oxygen	

Impaired and Threatened Lakes

Several factors were considered in the assessment for beneficial use support. The monitoring program for lakes and reservoirs is designed to determine a basic water quality characterization, and evaluate the productivity during the summer period. Additional winter monitoring is conducted to evaluate dissolved oxygen deficiencies as indicated by the summer monitoring. Water quality standards are evaluated to assess impairment for waters classified in classes 2 (recreation), 3 (aquatic life), and 4 (agriculture).

Three basic areas of data that are compared to standards in addition to other specific parameters include dissolved oxygen, pH, and temperature. These basic parameters are obtained in the field as part of the overall monitoring program for Utah's lakes and reservoirs. The data for these three parameters is analyzed for the entire water column and a percent of the readings in violation of State standards is determined. Exceedence percentages used to assess support status are those identified in the 305(b) guidelines. For any one pollutant or stressor, criteria exceeded in less than or equal to 10 percent of measurements a designation of fully supporting was assigned. For any one pollutant or stressor, criteria exceeded in greater than 10, but less than or equal to 25 percent of measurements a designation of partially supporting was assigned. For any one pollutant or stressor, criteria exceeded in greater than 25 percent of measurements a designation of not supporting was assigned. Having determined support status for individual pollutants or stressors an overall use designation was determined based on a combinations of the individual pollutant or stressor support designations. A `not supportive´ status was assigned to a body of water when at least two of the basic criteria (dissolved oxygen, pH or temperature) were found to be not supportive. A `fully supporting´ status was assigned when all of the criteria were found to be fully supporting. All other waterbodies were assigned a 'partially supporting' status for criteria found is the various remaining combinations. Special considerations were given to waterbodies where there were reported fish kills, extensive winter anoxic conditions or trophic state indexes in excess of the eutrophic state value of 50.00. Fish kills and extensive winter oxygen depletion shifted a classified waterbody down one classification usually from partially supporting to not supporting if they were not already classified as not supporting. High trophic state values would shift a classification into the partial supporting status unless it was already assigned. Where other data was obtained (dissolved metal data or biological data) determinations of exceedence against reported water quality standards were made, but in only one case (Lake Powell) were portions of the waterbody identified as partially supporting.

Table 6. Designated use support summary for Utah's lake waterbodies

	Number		acres
Total Designated:	130	Size:	460,588
Total Assessed:	130		
Total Monitored	130		
Total Evaluated:	0		

Table 6 provides a summary of the number of lake water bodies that were evaluated during this reporting period. Table 7 provides a summary by number and size, the beneficial use support for the lakes and table 8 provides a summary of the overall beneficial use support status for those lakes or reservoirs. Of the 460,588 surface acres evaluated 62% were found to be supporting their designated uses, 36% partially supporting and 2% not supporting.

Tabulation by individual lakes indicates that for the 130 lakes surveyed 25% were fully supporting, 53% partially supporting and 22% not supporting.

Table 9 summarizes the use support by classification, tables 10 and 11 summarize the various cause and source categories for those lakes found not fully supporting their designated uses. The Division of Water Quality will continue to conduct

Table 7. Overall Use Support Summary for Lake / Reservoir Waterbodies (Units in Acres)

Degree of Use Support	Assessed Number Acreage	Monitored Number Acreage	Total
Fully supported	0 0	33 286,695	33 286,695
Threatened	0 0	0 0	0 0
Partially Supporting	1 96,900	68 68,428	69 165,328
Not Supporting	1 173	27 8,392	28 8,565
Total Size Assessed	2 97,073	128 363,515	130 460,588

Figure 8. Overall beneficial use support status for Utah's priority lakes DESCRIPTION	SIZE ACRES	OVERALL SUPPORT STATUS 1994	OVERALL SUPPORT STATUS 1996	FULL SUPPORT 1996	PARTIAL SUPPORT 1996	NOT SUPPORT 1996	MAJOR SOURCE TYPE
Anderson Meadow Reservoir	8	PS	FS	8			NPS
Ashley Twin Lakes	27	FS	FS	27			NPS
Barney Lake	19	PS	PS		19		NPS
Bear Lake	69760	FS	FS	69760			NPS
Beaver Meadow Reservoir	5	FS	FS	5			NPS
Big East Lake	23	NS	NS			23	NPS
Big Lake	35	PS	NOT DONE				
Big Sand Wash Reservoir	390	FS	FS	390			NPS
Birch Creek Reservoir #2	63	PS	PS		63		NPS
Blanding City Reservoir#4	32	PS	NS			32	NPS
Bridger Lake	21	PS	PS		21		NPS
Brough Reservoir	150		NS			150	NPS
Browne Reservoir	54	PS	PS		54		NPS
Butterfly Lake	5	PS	PS		5		NPS
Calder Reservoir	99		PS		99		NPS
Causey Reservoir	142	PS	PS		142		NPS
China Lake	47	PS	NS			47	NPS
Cleveland Reservoir	185	PS	PS		185		NPS
Cook Lake	9	PS	PS		9		NPS
Currant Creek Reservoir	305	PS	FS	305			NPS
Dark Canyon Lake	6		PS		6		NPS
Deer Creek Reservoir	2965	PS	PS		2965		NPS
DMAD Reservoir	1199	PS	PS		1199		NPS
Donkey Reservoir	40	PS	PS		40		NPS
Duck Fork Reservoir	47	FS	PS		47		NPS
East Canyon Reservoir	173	NS	NS			173	PS
East Park Reservoir	684	FS	FS	684			NPS
Echo Reservoir	1394	PS	PS		1394		NPS
Electric Lake	425	PS	PS		425		NPS
Fairview Reservoir #2	105	PS	PS		105		NPS
Ferron Reservoir	55	PS	PS		55		NPS
Fish Lake	2500	PS	PS		2500		NPS
Flaming Gorge Reservoir	42020	FS	FS	42020			NPS
Forsyth Reservoir	158	PS	PS		158		NPS
Grantsville Reservoir	88		FS	88			NPS
Gunlock Reservoir	266	PS	PS		266		NPS
Gunnison Bend Reservoir	706	FS	FS	706			NPS
Gunnison Reservoir	1287	PS	PS		1287		NPS
Hoop Lake	162	PS	PS		162		NPS
Hoover Lake	17	PS	FS	17			NPS
Huntington Lake North	225	PS	FS	225			NPS
Huntington Reservoir	115	PS	PS		115		NPS
Hyrum Reservoir	438	PS	PS		438		NPS
Joes Valley Reservoir	1183	PS	PS		1183		NPS
Johnson Valley Reservoir	285		PS		285		NPS
Jordanelle Reservoir	3068	NS	PS		3068		NPS
Kens Lake	86	PS	PS		86		NPS
Kents Lake	26		NS			26	NPS

Figure 8. Overall beneficial use support status for Utah's priority lakes DESCRIPTION	SIZE ACRES	OVERALL SUPPORT STATUS 1994	OVERALL SUPPORT STATUS 1996	FULL SUPPORT 1996	PARTIAL SUPPORT 1996	NOT SUPPORT 1996	MAJOR SOURCE TYPE
Kolob Reservoir	335	PS	PS		335		NPS
Koosharem Reservoir	310	PS	PS		310		NPS
Labaron Reservoir	24	PS	NS			24	NPS
Lake Mary	23	PS	PS		23		NPS
Lake Powell	162760	FS	FS	162760			NPS
Little Creek Reservoir	65	FS	PS		65		NPS
Little Dell Reservoir	249	FS	PS		249		NPS
Lloyds Reservoir	104	PS	PS		104		NPS
Long Park Reservoir	60	PS	FS	60			NPS
Lost Creek Reservoir	52	PS	PS		52		NPS
Lower Bowns Reservoir	90	PS	PS		90		NPS
Lower Box Reservoir	50	PS	NS			50	NPS
Lower Gooseberry Reservoir	57	PS	NS			57	NPS
Lyman Lake	27	PS	NS			27	NPS
Manning Meadow Reservoir	59	PS	NS			59	NPS
Mantua Reservoir	554	NS	NS			554	NPS
Marsh Lake	38	NS	NS			38	NPS
Marshall Reservoir	18	PS	PS		18		NPS
Matt Warner Reservoir	433		NS			433	NPS
Meeks Cabin Reservoir	477	PS	FS	477			NPS
Mill Hollow Reservoir	15	PS	PS		15		NPS
Mill Meadow Reservoir	156		PS		156		NPS
Miller Flat Reservoir	65	PS	FS	65			NPS
Millsite Reservoir	435	PS	FS	435			NPS
Minersville Reservoir	990	PS	PS		990		NPS
Mirror Lake	50	PS	PS		50		NPS
Mona Reservoir	1110	PS	FS	1110			NPS
Monticello Lake	3	PS	FS	3			NPS
Moon Lake	768	PS	FS	768			NPS
Navajo Lake	714	NS	NS			714	NPS
Newcastle Reservoir	163	PS	NS			163	NPS
Newton Reservoir	350	PS	NS			350	NPS
Nine Mile Reservoir	197	PS	NS			197	NPS
Oak Park Reservoir	382	PS	PS		382		NPS
Otter Creek Reservoir	2520	PS	PS		2520		NPS
Palisades Lake	66	PS	PS		66		NPS
Panguitch Lake	1248	PS	PS		1248		NPS
Paradise Park Reservoir	143	PS	FS	143			NPS
Pelican Lake	1680	NS	NS			1680	NPS
Pine Lake	77	PS	NS			77	NPS
Pineview Reservoir	2874	PS	NS			2874	NPS
Piute Reservoir	2508	PS	FS	2508			NPS
Porcupine Reservoir	190	PS	PS		190		NPS
Posey Lake	20	NS	PS		20		NPS
Puffer Lake	65	NS	PS		65		NPS
Pyramid Lake	14	PS	NOT DONE				
Quail Creek Reservoir	590	PS	PS		590		NPS
Recapture Reservoir	265	NS	NS			265	NPS

Figure 8. Overall beneficial use support status for Utah's priority lakes DESCRIPTION	SIZE ACRES	OVERALL SUPPORT STATUS 1994	OVERALL SUPPORT STATUS 1996	FULL SUPPORT 1996	PARTIAL SUPPORT 1996	NOT SUPPORT 1996	MAJOR SOURCE TYPE
Red Creek Reservoir	142	PS	PS		142		NPS
Red Creek Reservoir (Iron)	39	PS	NS			39	NPS
Red Fleet Reservoir	520	PS	PS		520		NPS
Redmond Lake	160	PS	FS	160			NPS
Rex's Reservoir	46	PS	PS		46		NPS
Rockport Reservoir	1189	PS	PS		1189		NPS
Rush Lake	80	PS	NS			80	NPS
Salem Pond	11	PS	PS		11		NPS
Scofield Reservoir	2815	PS	PS		2815		NPS
Scout Lake	18	PS	FS	18			NPS
Settlement Canyon Reservoir	315	PS	PS		315		NPS
Sevier Bridge Reservoir	10905	PS	PS		10905		NPS
Sheep Creek Reservoir	86	PS	PS		86		NPS
Smith and Morehouse Res	197	PS	FS	197			NPS
Spirit Lake	41	PS	FS	41			NPS
Stansbury Lake	120	FS	FS	120			NPS
Starvation Reservoir	2760	PS	FS	2760			NPS
Stateline Reservoir	288	PS	FS	288			NPS
Steinaker Reservoir	829	PS	PS		829		NPS
Strawberry Reservoir	17160	PS	PS		17160		NPS
Three Creeks Reservoir	57	PS	PS		57		NPS
Tibble Fork Reservoir	13	FS	FS	13			NPS
Tony Grove Reservoir	25	NS	NS			25	NPS
Trial Lake	98	PS	PS		98		NPS
Tropic Reservoir	180	PS	PS		180		NPS
Upper Enterprise Reservoir	200	NS	NS			200	NPS
Upper Stillwater Reservoir	252	PS	FS	252			NPS
Utah Lake	96900	PS	PS		96900		PS
Wall Lake	61	FS	PS		61		NPS
Washington Lake	94	PS	FS	94			NPS
Whitney Reservoir	188	PS	FS	188			NPS
Wide Hollow Reservoir	145	PS	NS			145	NPS
Willard Bay Reservoir	10000	FS	PS		10000		NPS
Woodruff Creek Reservoir	90	PS	PS		90		NPS
Yankee Meadow Reservoir	5	PS	PS		5		NPS
TOTAL ACREAGE	460637			286695	165328	8565	
					460588		

reconnaissance level investigations on several lakes and reservoirs in the future with other agencies including but not limited to the following: Strawberry Reservoir, Lake Powell, and Flaming Gorge Reservoir. However, all of these studies will depend on the available manpower and resources and will be limited by the amount of available State resources.

Acid Effects on Lakes

Since this report came out, the Acid Deposition Technical Advisory Committee has been relatively inactive. In 1986, the Acid Deposition Technical Advisory Committee recommended that reconnaissance surveys be conducted in areas considered potentially sensitive to acid deposition. In response to this recommendation, a cooperative agreement involving private individuals, private industries, and several State and Federal agencies was developed and approved. This agreement organized efforts to sample selected streams and lakes in ten different mountain ranges in Utah during the summer of 1987. The water chemistry data were then used to determine the Acid Neutralizing Capacities

Table 9. Individual Use Support Summary

Units in Acres

Beneficial Use	Supporting	Supporting but Threatened	Partial Supporting	Not Supporting	Not Attainable	Not Assessed
Fish Consumption	460,588	0	0	0	0	21,050
Aquatic Life Support	286,695	0	165,225	8,565	0	21,050
Shellfishing	*	*	*	*	*	481,638
Swimming	161,760	--	--	1,000	0	318,878
Secondary Contact	161,760	--	--	1,000	0	318,878
Drinking Water Supply	252,648	0	0	0	0	228,995
Agriculture	460,588	0	0	0	0	21,040

(ANC) of the sampled lakes and streams and their sensitivities to acid deposition. Generally, it was concluded that several of the high lakes in the State, were susceptible to acid precipitation due to their low buffering capacities but at the moment, none were actually affected by acid deposition.

Table 10. Lake waterbodies not fully supporting uses affected by various cause categories

Lake size units in acres

Cause Categories	IMPACTS Major	Moderate/ Minor	Threat
Cause Unknown	--	--	--
Unknown Toxicity	--	--	--
Pesticides	--	--	--
Priority Organics	--	--	--
Nonpriority Organics	--	--	--
Metals	0	0	0
Ammonia	0	0	0
Chlorine	--	--	--
Other Inorganics	0	0	0
Nutrients	152,726	3,408	0
pH	24075	3,764	0
Siltation	114,500	4,272	0
Organic Enrichment /	34,456	41,024	0
Salinity / TDS /	80	96,900	0
Thermal Modification	0	0	0
Flow Alteration	--	--	--
Habitat Alteration	*	*	*
Pathogen Indicators	--	1000	0
Radiation	--	--	--
Oil and Grease	0	98,478	0
Suspended Solids	1,367	97,929	0
Noxious Aquatic Plants	6,543	--	8,744
Total Toxics	--	--	--
Turbidity	--	--	--
Exotic Species	--	--	--
Filling and Draining	7,305	11,490	0

Toxic Effects on Lakes

Of the 130 lakes/reservoirs that were assessed for toxics this reporting cycle none were found with elevated toxics for those parameters measured. These lakes and reservoirs were monitored for metals only and the resulting data were compared against numeric criteria which have been established or recommended for the protection of existing water quality. It should be noted that these samples were collected near the bottom of a lake or reservoir. Therefore exceedences do not reflect the overall water

Table 11. Lake waterbodies not fully supporting uses affected by various source categories

Lake size units in acres

IMPACTS Cause Category Threat	Major		Minor
Industrial Sources	100,419	13,709	0
Municipal Sources	98,262	6,084	0
Agriculture	93,490	164,175	0
Silviculture	0	1,888	0
Construction	173	8,333	0
Urban Runoff	0	110,049	0
Resource Extract	0	3,761	0
Land Disposal	0	1,189	0
Hydomodification	118,269	3,145	0
Habitat Mod.	--	--	--
Marinas	0	0	0
Atmospheric Dep,	0	0	0
Contaminated Sed.	0	0	0
Unknown Source	--	--	--
Natural Source	--	--	--
Other (specify)	--	--	--

quality throughout the water column. The intent of this monitoring was to evaluate the potential for uptake of toxic metals into the food chain initiated by bottom flora or fauna. The waterbodies that have been identified as being affected by toxics are those where metal concentrations were found to exceed recommend standards. Metal loadings to these waterbodies stem from several sources. These sources are almost exclusively nonpoint in nature and comprised mainly of activities associated with agriculture, construction, mining, silviculture, urban runoff, hydromodification and recreation.

Trends in Lake Water Quality

Table 12 summarizes the trends in water quality of those lakes assessed under the Lake Water Quality Assessment program. The last three columns represent a comparison of lakes and reservoirs present during the last three periods of the study (1989-90, 1991-92, 1993-94). The table has been compiled for both numbers and acreage for lakes and reservoirs in the State.

Table 12. Trends in Water Quality of Lakes and Reservoirs in Utah

Trend Category	Number of Lakes 1989-90	1991-92	1993-94
Improved	27 (30%)	24 (24%)	40 (32%)
Stable	44 (50%)	49 (52%)	70 (56%)
Degraded	18 (20%)	23 (24%)	15 (12%)
Unknown	--	--	5
Total Assessed	89	95	**125**
Trend Category	**Acres 1989-90**	**1991-92**	**1993-94**
Improved	9,087 (5%)	177,785 (45%)	55,302 (13%)
Stable	149,360 (91%)	204,223 (51%)	356,097 (85%)
Degraded	6,609 (4%)	15,251 (4%)	6,759 (2%)
Unknown	--	--	42,430
Total Assessed	165,056	397,259	**418,158**

Carlson TSI values (Table 13) for each waterbody were determined and then compared to values obtained during previous periods of study for comparative lakes or reservoirs. The initial data period contains the information collected for the Clean Lakes Inventory for Utah in 1982. It represents the 1981 period data, which has only eighty-nine lakes and reservoirs where comparable data exists for comparison to the next dataset (1989-90). It should be noted that the 1981 dataset in many cases is limited to total phosphorus and secchi depth data or only one of the two. Chlorophyll-a data is very limited during that study period.

Trends for water quality were then determined from these comparisons. A TSI value comparison yielding a variation of $\pm$ 5 indicated a stable trend. A TSI value

comparison yielding an increase of more than 5 indicated a degrading condition. A TSI value comparison yielding a decrease of more than 5 indicated an improving condition.

As previously discussed this data is summarized in table 12.

Table 13. Utah Reservoir / Lake Monitoring List and TSI Evaluation

Lake / Reservoir	TSI Index 1989-90	TSI Index 1991-92	TSI Index 1993-94	Surface Area (Acres)
Anderson Meadow Reservoir	52.69	50.18	43.87	8
Ashley Twin Reservoir	41.09	44.19	41.52	27
Baker Dam Reservoir	62.33	50.42	46.25	63
Barney Lake		61.46	60.70	19
Bear Lake	37.57	32.36	32.73	69,760
Beaver Dam Meadow Reservoir			45.98	5
Big East Lake	52.42	48.32	41.48	23
Big Lake	40.76	62.47		35
Big Sand Wash Reservoir	46.11	45.28	38.97	390
Birch Creek Reservoir #2	52.35	47.40	49.07	63
Blanding Reservoir #4	48.40		46.74	32
Bridger Lake		46.72	51.82	21
Brough Reservoir			44.74	150
Browne Lake	40.27	45.31	47.02	54
Butterfly Lake	40.71	35.99	77.79	5
Calder Reservoir		54.14	59.49	99
Causey Reservoir	43.23	38.79	43.41	142
China Lake		45.59	34.87	47
Cleveland Reservoir	41.66	51.61	42.75	185
Cook Lake	44.01	48.18	44.42	9
Currant Creek Reservoir	44.15	42.03	38.26	305
Dark Canyon Lake			40.20	6
Deer Creek Reservoir	47.79	47.04	43.14	2,965
DMAD Reservoir	65.29	57.34	60.55	1,199
Donkey Reservoir	48.64	44.57	44.16	40
Duck Fork Reservoir		39.75	28.05	47
East Canyon Reservoir	48.70	52.82	49.59	173

Table 13. Utah Reservoir / Lake Monitoring List and TSI Evaluation				
Lake / Reservoir	TSI Index 1989-90	1991-92	1993-94	Surface Area (Acres)
East Park Reservoir		48.35	41.41	684
Echo Reservoir		39.07	41.80	1,394
Electric Lake Reservoir	39.43	49.74	43.92	425
Fairview Reservoir	52.72	38.92	39.25	105
Ferron Reservoir	43.37	39.86	35.47	55
Fish Lake	41.26	40.26	33.59	2,500
Flaming Gorge Reservoir	42.75		36.47	42,020
Forsyth Reservoir	61.88	52.76	56.87	158
Grantsville Reservoir	43.63	49.09	46.47	88
Gunlock Reservoir	42.47	42.31	47.41	266
Gunnison Bend Reservoir	63.04	62.38	55.04	706
Gunnison Reservoir	61.41	63.96	56.81	1,287
Hoop Lake	57.44	49.80	59.27	162
Hoover Lake	40.22	38.72	36.26	17
Huntington Lake North	37.39	44.81	37.63	225
Huntington Reservoir		46.50	43.78	115
Hyrum Reservoir	45.84	43.07	44.03	438
Joes Valley Reservoir	30.85	34.55	32.35	1,183
Johnson Reservoir	63.77	68.04	65.18	285
Jordanelle Reservoir			44.64	3068
Kens Lake	56.81	44.01	45.01	86
Kents Lake		69.06	67.12	26
Kolob Reservoir	41.53	47.82	45.06	335
Koosharem Reservoir	73.87	55.40	65.86	310
Labaron Reservoir		51.05	65.47	24
Lake Mary	42.18	51.43	33.50	23
Lake Powell	42.47	36.58	35.13	162,760
Little Creek Reservoir	45.14	37.51	40.41	65
Little Dell Reservoir			36.84	249

Table 13. Utah Reservoir / Lake Monitoring List and TSI Evaluation				
Lake / Reservoir	TSI Index 1989-90	1991-92	1993-94	Surface Area (Acres)
Lloyds Reservoir	49.11	42.58	47.02	104
Long Park Reservoir		44.84	45.49	60
Lost Creek Reservoir	39.53	46.18	35.17	52
Lower Bowns Reservoir	50.05	41.31	47.18	90
Lower Box Reservoir		77.07	74.78	50
Lower Gooseberry Reservoir	45.69	44.26	40.82	57
Lyman Lake		37.74	31.21	27
Manning Meadow Reservoir		54.37	50.17	59
Mantua Reservoir	54.93	58.05	59.56	554
Marsh Lake	28.14	34.36	30.42	38
Marshall Lake	36.27	29.51	31.77	18
Matt Warner Reservoir		53.35	61.26	433
Meeks Cabin Reservoir	47.13	42.42	40.19	477
Mill Hollow Reservoir	47.24	47.79	47.42	15
Mill Meadow Reservoir	67.06	69.15	55.75	156
Millers Flat Reservoir		40.84	42.35	65
Millsite Reservoir	35.07	41.46	35.19	435
Minersville Reservoir	59.98	56.23	66.48	990
Mirror Lake	38.23	39.95	31.69	50
Mona Reservoir		66.10	57.58	1110
Moon Lake	46.79	38.08	37.42	768
Monticello Lake		46.71	45.46	3
Navajo Lake	34.03	35.41	39.71	714
New Castle Reservoir	48.12	53.92	41.78	163
Newton Reservoir	53.81	60.67	60.82	350
Nine Mile Reservoir	45.20	59.42	53.10	197
Oak Park Reservoir	48.61	47.89	42.44	382
Otter Creek Reservoir	57.44	43.54	55.23	2,520
Palisade Reservoir	45.73	58.86	39.61	66

Table 13. Utah Reservoir / Lake Monitoring List and TSI Evaluation				
Lake / Reservoir	TSI Index 1989-90	1991-92	1993-94	Surface Area (Acres)
Panguitch Lake	54.25	50.56	52.67	1,248
Paradise Park Lake		40.49	36.97	143
Pelican Lake	44.50	38.71	47.06	1,680
Pine Lake	44.14	34.48	19.66	77
Pineview Reservoir		58.31	39.97	2874
Piute Reservoir	57.18	54.45	45.54	2,508
Porcupine Reservoir	38.05	40.09	38.44	190
Posey Lake	46.29	45.82	38.82	20
Puffer Lake	49.10	36.16	38.44	65
Pyramid Lake	37.37	36.44		14
Quail Creek Reservoir	38.38	40.35	26.15	590
Recapture Creek Reservoir	45.61	49.16	44.50	265
Red Creek Reservoir (Iron)		53.14	57.30	39
Red Creek Reservoir		57.73	54.12	142
Red Fleet Reservoir	42.35	40.47	41.02	520
Redmond Reservoir	68.68	75.03	70.71	160
Rexs Reservoir		45.80	50.21	46
Rockport Reservoir	43.88	42.98	41.78	1189
Rush Lake	60.83	78.55	72.37	80
Salem Pond	45.89	50.00	39.81	11
Scofield Reservoir	62.69	55.77	53.22	2,815
Scout Lake		58.05	38.43	18
Settlement Canyon Reservoir	39.65	47.94	40.84	315
Sevier Bridge Reservoir	54.40	63.95	52.19	10,905
Sheep Creek Reservoir		45.87	46.10	86
Smith and Morehouse Reservoir	44.34	45.96	34.39	197
Spirit Lake	44.43	45.18	50.21	41
Stansbury Lake	55.77	57.22	58.31	120
Starvation Reservoir	54.86	41.45	36.66	2,760

Table 13. Utah Reservoir / Lake Monitoring List and TSI Evaluation				
Lake / Reservoir	TSI Index 1989-90	1991-92	1993-94	Surface Area (Acres)
Stateline Reservoir	46.29	39.66	41.41	288
Steinaker Reservoir	35.01	40.33	33.72	829
Strawberry Reservoir	55.60	53.47	48.43	17,160
Three Creeks Reservoir		50.83	57.32	57
Tibble Fork Reservoir	28.48	42.92	44.39	13
Tony Grove Lake	40.76	33.52	35.26	25
Trial Lake	42.92	37.95	39.51	98
Tropic Reservoir	47.71	36.75	39.12	180
Upper Enterprise Reservoir	73.65	58.37	54.18	200
Upper Stillwater Reservoir	39.21	38.93	25.21	252
Utah Lake	69.35	67.67	67.59	96,900
Wall Lake		31.83	39.18	61
Washington Lake		41.59	40.73	94
Whitney Reservoir	40.11	56.88	37.21	188
Wide Hollow Reservoir	46.33	43.91	47.59	145
Willard Reservoir		62.84	47.68	10,000
Woodruff Creek Reservoir	40.92	48.60	43.14	90
Yankee Meadows Reservoir		50.19	54.09	5

PROJECT METHODOLOGIES

To facilitate the understanding of the information presented in this report requires the understanding of those methods used to acquire information and obtain water quality data. This project is a continuation of the original inventory and classification project undertaken in the early 1980's. Therefore in addition to presenting current methods, it is necessary to review and insert where appropriate those methods utilized to assimilate the original information. Some methods or sources have remained the same and only the data has been updated for incorporation into this report.

Inventory and Information Acquisition

Identification

The original identification of lakes and reservoirs in the State came from three sources: (1) existing USGS maps and Landsat photographs, (2) various governmental agencies, and (3) a listing of lakes established by Plant (1977). From these sources a comprehensive master list of all lakes and reservoirs was developed. The listing included all unnamed waterbodies with a surface acreage equal to or greater than 5 acres and all named waterbodies with a surface acreage equal to or greater than 1 acre. Table 13 summarizes the breakdown of lakes and reservoirs by size class for the 3000 waterbodies identified.

Morphometric and Physical Measurements

Lake or reservoir coordinates and physical measurements were taken from USGS quadrangle maps. Surface area was determined with a planimeter or scaled grid with some information obtained directly from various agencies where information was available. Volumes and depths were acquired from the records of cooperating state and federal agencies; Utah Division of Water Rights, Utah Division of Wildlife Resources, U.S. Forest Service and the Bureau of Reclamation.

Precipitation figures were derived from an isohetal map of Utah prepared by the U.S. Department of Commerce based on 1931-1960 data. Growing seasons were derived from a freeze-free season map of the State prepared jointly by the Utah Agricultural Experiment Station of Utah State University and the Department of Commerce.

Watershed areas were determined with a planimeter and differentiated on the basis of major tributary interruption by an upstream impoundment. Percent land use in each watershed was obtained from land use maps developed under the Section 208 of the Clean Water Act. Soil associations and descriptions are summaries of the information contained in the bulletin, *Soils of Utah*. The soil descriptions and percentages are very general. Any detailed land use limitation recommendations or implementation measures should be based on more detailed soil

Table 14. Utah's Lakes and Reservoirs by Size Class

Size Class in Acres SURFACE	Number/Percent of Lakes	Total Surface Acres
Less than 20	2600 (86.7%)	18,200 (3.8%)
20--49	202 (6.7%)	5,871 (1.2%)
50--99	68 (2.3%)	4,594 (1.0%)
100--499	87 (2.9%)	19,890 (4.1%)
500--999	17 (0.6%)	12,475 (2.6%)
1,000--4,999	18 (0.6%)	34,119 (7.0%)
5,000--9,999	2 (0.1%)	15,584 (3.2%)
Greater than 10,000	6 (0.2%)	370,905 (77.0%)
TOTAL	3000	481,638 (100.0%)

surveys available from the U.S. Soil Conservation Service or Forest Service.

Flow data was obtained when available from cooperating agencies. These agencies included various irrigation companies, water conservancy districts, the U.S. Geological Survey, and the Utah Department of Natural Resources. Retention times were calculated by dividing lake or reservoir capacity by annual inflow.

Biological Information

Biological data was acquired through the cooperation of several State and Federal agencies. The Utah Division of Wildlife Resources provided fishery information for incorporation into this report. In addition they supplied macrophyte, plankton, and invertebrate information when available from their reconnaissance surveys. Also included in the report is phytoplankton data obtained during 1991-92 monitoring season. and other information from other agencies where available. Efforts will continue to monitor the phytoplankton and zooplankton in the future.

Water Chemistry Information

Historical data was acquired form the Utah Division of Water Quality, Eyring Research Institute, Utah State University's Water Research Laboratory and published documents. These documents included theses and dissertation studies and various governmental documents.

The Division of Water Quality in cooperation with the Environmental Protection Agency (EPA) is continuing to obtain and assess water quality data from a network of priority lakes and reservoirs in order to establish water quality changes and trends. The current monitoring program is designed to obtain lake water quality data during the summer productivity season on all accessible priority lakes and reservoirs. Efforts are directed specifically towards those waterbodies identified in this report. Samples are collected twice during the summer (June/August). However, each lake is monitored on alternating years due to limited resources. The following parameters are analyzed from samples collected: total phosphorus, total dissolved phosphorus, nitrate/nitrite, ammonia, sodium, potassium, magnesium, calcium, silica, chloride, sulfate, total suspended solids, total residual solids, total volatile solids, chlorophyll-a, total hardness, total alkalinity, total dissolved solids, and turbidity. In addition dissolved metal samples are collected and analyzed for the following parameters: arsenic, cadmium, copper, lead, mercury, and selenium. These samples are collected near the bottom of the lake/reservoir and total extractable metals (arsenic, cadmium, copper, lead, mercury, selenium) will be obtained from the sediments in the deposition zone and analyzed. Phytoplankton samples are collected during the month of August. In addition field measurements are collected for transparency, pH, dissolved oxygen, specific conductance and temperature.

A non-metallic Kemmerer sampler, or Van Doren sampler were used to collect all subsurface samples for chemical analysis. Samples were transferred into assorted sample containers (polypropylene bottles) with preservatives when required as prescribed under the Divisions of Water Qualities standard operating procedures. Those samples requiring filtration are filtered upon returning to shore.

The location of sampling depths in the water column was determined after conducting a temperature/dissolved oxygen profile. The sample collection depths were identified by following these general rules dependent upon overall lake depth:

1. For primary lake sites five meters deep or less water was collected from two depths: one sample at the one-foot depth interval; and the other sample approximately one meter off the bottom.

2. For primary lake sites greater than five meters deep water was collect at 4 depths dependent upon whether the lake is thermally stratified.

    a. If the lake was not stratified water was collected from the following depths: at the one foot depth; at the ⅓ of total depth; at the ⅔ of total depth and at the one meter above the bottom depth.

    b. If the lake was thermally stratified water was collected from the following depths: at the one-foot depth (epilimion); at one meter above the thermocline; at one meter below the thermocline; and at one meter above the bottom depth (bottom of hypolimnion).

Biological Sampling

Phytoplankton and chlorophyll-a samples were the most important biological parameters measured in a lake. Chlorophyll-a is important because of its close relationship to phytoplankton biomass and is one key indicator of trophic status. In addition the phytoplankton community diversity can be an excellent indicator of water quality. In general, phytoplankton were identified from a water sample representative of the whole water column collected at the primary lake site on the lake from a depth of three times secchi depth to the lake surface. This sample is collected using a tube which is slowly lowered into the water column to obtain a sample representative of this defined range. The water is then brought to the surface and mixed in a plastic bucket and placed into two plastic containers (2L). These samples are placed in ice in a dark ice chest and transported to lab for analysis. The chlorophyll-a sample is collected at approximately 1 foot below the surface into a plastic container (2L) for filtration upon returning to the shore area. Immediately after filtration the filters containing the substrate are place in black plastic containers and frozen in a container with dry ice. They are kept frozen until analysis at the State Health Laboratory.

Sediment Sample Collection

The chemical characterization of lake sediments can be an

important indicator of toxins contamination. Characterization of the top ten centimeters of sediments will be the primary focus of investigation. These samples will be collected and analyzed in 1993-94 study period. Sediments, by their nature can become the repository of years of pollutant accumulations. In general, lake sediment samples may be collected from the deepest area (pelagic zone), the littoral zone, or near each major inlet. During the first period of collect sediment samples will be collected in the embayments near inlet areas. Sediment samples will be analyzed for total extractable metals. Parameters identified for analysis include arsenic, cadmium, copper, lead, mercury, and selenium.

Macrophyte Surveys

While information concerning the aquatic macrophyte community in a lake may not be the most important component of a lake water quality assessment, information on the macrophyte community can provide valuable information concerning the trophic status of a lake as well as impairments to the aesthetic or defined beneficial uses of a lake. In general, a qualitative assessment is made of the areal coverage and dominant species of macrophytes present.

Point Source and Nonpoint Source Information

Files of the Utah Pollution Discharge Elimination Systems (UPDES) permits are maintained by the Utah Division of Water Quality. These files contain the names of dischargers, their location and the effluent limitations on those parameters which have an effect on the water quality of downstream water.

Nonpoint sources and probable pollutants were recorded after reviewing land use activities within a given watershed. Input is also obtained from "on site" observations by staff of the Division of Water Quality.

Current data in the individual reports contains an estimate of the sources of pollutants in a given watershed. It is the intent of DWQ to continue to investigate these sources and to replace the existing estimates with more definitive data as it becomes available. In addition efforts will be made to quantify the sources of pollutants in a given watershed and project controls that may be needed to improve water quality where impairments may exist.

Field Methodology

All methods of collection of water samples and the determination of data in the field by personnel of the Division of Water Quality are documented in operation manuals contained in their offices. For more information regarding these methods please contact staff from the monitoring section of DWQ at 538-6146 in Salt Lake City.

Phytoplankton Data

All phytoplankton identifications and data is obtained under contract with Sam Rushforth, Ph.D. of Brigham Young University (BYU). Samples are collected from the entire water column from a depth of surface to three times the secchi depth reading. These whole water samples are transported to BYU for identification of species composition and relative index of species present. For a complete discussion of the laboratory methodologies, contact Dr. Rushforth at BYU.

Limnological Data Analysis

The data obtained during the course of this study is summarized in the Limnological Data figure box contained within each section on a specific lake or reservoir. In order to enhance the readers understanding of the data a discussion of the methods used to derive those numbers would be useful. The information in the box is divided into three distinct areas: surface data; water column data; and miscellaneous data. The first section dealing with surface water information is further divided into two components, TSI determinations and general water chemistry information. In this section an attempt will be made to describe the procedures and process used to arrive at the endpoint determinations for these various constituents.

TSI Evaluation and Surface Data

The objective of this evaluation is to determine the overall annual TSI value for a given waterbody. The determination of specific TSI values is based on the regression equations developed by Carlson and are commonly referred to as, "Carlson Trophic State Index Values". The actual regression equations that Carlson derived and that are utilized in processing this data are as follows:

Chlorophyll-a TSI Value = 9.81 * (ln CLA conc in ug/L) + 30.6
Secchi Depth TSI Value = 60 - 14.41 (ln Secchi Depth in meters)
Total Phosphorus TSI Value = 14.42 (ln TP conc in ug/L) + 4.15

How the overall determination a waterbody TSI value for a given year is the area that needs further explanation. The number of monitoring sites for each lake varied depending on lake size and morphometry. The overall lake TSI value is an average of all the monitoring site TSI average values. A monitoring site TSI value is determined by averaging the TSI Values for each parameter that has available data for each site.

The TSI values contained in the limnological data figure box do not represent the parameter values for total phosphorus, transparency, or chlorophyll-a as contained in that section of the figure box. The values listed for these parameters are average values for each lake over the two periods of monitoring conducted on an biennial basis.

Determination of those values are based on calculated averages for each parameter at each site for each monitoring event. If more than one site is present on a waterbody then those values are combined for an average lake value for that monitoring period. Finally, the two monitoring period values are averaged to obtain an overall annual average lake concentration for a given parameter. The determination of the average annual value for temperature, pH, total suspended solids, total residual solids, total volatile solids, and conductivity are also calculated by the same procedure. It should also be noted that all of the data presented are based on surface water only for this first section.

Water Column Data

The information presented in this section of the figure box is based on an evaluation of data obtained throughout the water column and not on surface data only. The averaging procedure is the same but additional samples are obtained in the water column (refer to the section on monitoring procedures for the number of samples in the water column and the various parameters obtained at specific depths). Some of these parameters are collected only at the surface while others may be collected at all depths monitored in the water column. It is important to understand the monitoring strategy if one is scrutinizing this data intensely. Under such cases it is recommended that you obtain a complete dataset from the Utah Division of Water Quality.

Miscellaneous Data

To facilitate the understanding of the data in the last section of the limnological figure box the following comments are provided:

The determination of the limiting nutrient is based on the ratio of total inorganic nitrogen (TIN) (ammonia + nitrate + nitrite) and total phosphorus (TP) in the water column for those years after 1981. The 1981 ratio were based on the TIN/Orthophosphorus ratio. The change was mandated due to the fact that monitoring crews could not meet the holding time requirements for orthophosphorus determinations. The threshold ratio values were set at 15 (post 1982) and 11. Ratios determined to be less that these values were indicative of nitrogen limited waters Values equal to or greater were considered to be phosphorus limited It is understood that these values may be dynamic based on biological activity and nutrient loading over time. It should also be understood that in various situations that there may be other factors that are controlling productivity which will overshadow the amount of nutrients present in the system;

The dissolved oxygen concentration at the 75% total depth is used to indicate the potential for oxygen demand in the reservoir. It has been selected to evaluate the impact on defined beneficial uses which may be dependant upon the concentration of dissolved oxygen in the water column. For a more complete understanding review the water column profile contained in the limnological assessment section;

The figures present in this section indicate the depth (in meters) where there is a thermocline present. By definition a thermocline is the area where there is a change of temperature greater than or equal to a one degree Celsius shift per meter of depth;

The depth at the deepest point is representative of the maximum depth of the reservoir during the second period of monitoring, usually in August or September. This may be the replaced with first period of monitoring data if for reason there is no second period data.

Original 1982 Priority Listing

The original determination of the priority lakes and reservoirs contained in the report, *State of Utah Clean Lakes Inventory and Classification (1982)* were derived from three basic areas: (1) **water quality,** (2) **public benefit,** and (3) **restoration effectiveness.** Several criteria were identified in each of these areas so that waterbody rankings could be developed in each area. The original list identified 127 lakes and reservoirs for evaluation and ranking in the final priority listing.

Water Quality

The water quality ranking was derived using four criteria; total phosphorus concentration, total suspended solids concentration, fish kill data where available, and Carlson trophic state indices. Average total phosphorus concentrations (mg/L), indicative of potential problems with planktonic algae and/or macrophyte production, were determined by calculating a mean of all points and depths sampled within the waterbody. Total suspended solids is an important factor in assessing water quality for it represents the amount of organic and inorganic particulate matter found in the water column due to soil erosion, algal production and/or sediments re-suspended from lake bottoms. Where information was available, waterbodies were ranked on the basis of the number or frequency of fish kills for the prior five years. The final criteria used to determine the overall water quality ranking was the Carlson Trophic State Index (TSI) value based on surface total phosphorus concentration, secchi depth readings, and chlorophyll-a concentrations. Overall lake TSI averages were determined for each waterbody, however, data for each of these parameters was not available for each lakes or reservoir. Utilizing each of these criteria waterbodies were ranked numerically with the number 1 indicating "worst" conditions.

Public Benefit

The ranking based on public benefit was derived by combining equally the rankings for the two established criteria; (1) use estimates where available data existed, and (2) U.S. census data for resident population within a 50 mile (80 km) radius of the waterbody. Individual priority lists based on actual use and resident populations were generated and then the ranks combined to yield the final public benefit ranking.

Restoration Effectiveness

The ranking values for lake restoration effectiveness was developed to give the highest priority to those waterbodies where the recommended restoration program would have the greatest effect. The following five subgroups were established to rank lakes or reservoirs:

1. Waterbodies with identifiable point sources or with divertable nonpoint sources of pollution. Priorities within this subgroup were established for waterbodies receiving sewage effluent, septic tank outflow or seepage and/or urban runoff, and divertable nonpoint pollution.

2. Waterbodies that have a watershed area to lake area ratio of less than 100 and whose impairments are related to or complicated by shallowness(10 meters or less). Ordering within this group was on the basis of fish kill frequency.

3. Waterbodies that have a watershed area to lake area ratio of less than 100 and whose watershed demonstrates the greatest need for erosion and soil conservation programs determined by the agricultural nonpoint source (NPS) assessment and approved by the State Soil Conservation Commission. Ordering within this group was by the causes of erosion (induced versus natural) and the availability of best management practices (BMP's) to reduce or eliminate soil erosion.

4. Waterbodies that have a watershed area to lake area ratio greater than 100. Ordering within this group was dependent upon the frequency of fish kills.

5. Waterbodies that have a watershed area to lake area ration greater than 100 with soil erosion or other nonpoint source pollution problems.

The final restoration effectiveness ranking was derived according to the following guidelines with emphasis on those waterbodies which appeared in multiple subgroups indicating waterbodies with multiple problems. Priority ranking groups were established for waterbodies appearing in various combinations of subgroups. Waterbodies listed in the following combinations of subgroups were ranked in the following order: (1) waterbodies listed in subgroups 1-3, (2) waterbodies listed in subgroups 1 and 2, (3) waterbodies listed in subgroups 1 and 3, (4) waterbodies listed in subgroups 1 and 4, (5) waterbodies listed only in subgroup 5, (6) waterbodies listed in subgroups 2 and 3, (7) waterbodies listed only in subgroup 2, (8) waterbodies listed only in subgroup 3, (9) waterbodies listed only in subgroup 4, and (10) waterbodies listed only in subgroup 5. Lakes and reservoirs which appeared in group 10 were those not considered for restoration and were therefore not included in the final ranking. Individual rankings were tabulated for those waterbodies found in various priority groups by tabulating individual rankings within each of the subgroups.

The final statewide restoration priority list for 1982 was derived from the individual rankings described previously for water quality, public benefit, and restoration effectiveness. The individual waterbody rankings for each factor were tabulated for the final ranking. The order of the listing represents those lakes with the highest priority for future investigations and possible restoration. The only exception noted in the original report was for Utah Lake ranked number 1. Original investigators deemed the potential for a Phase I and Phase II 314 project as minimal due to the large surface area of the lake coupled with the shallowness of the lake. These natural conditions of the lake and the number of point and nonpoint sources contributing pollution to the lake made it unrealistic to propose a restoration project on Utah Lake. Table 15 contains a listing of the original 127 lakes and reservoirs priority ranking.

Table 15: 1982 Priority Lakes and Reservoirs

No	Identification	County	No	Identification	County
1	Utah Lake	Utah	36	Posey Lake	Garfield
2	Deer Creek Reservoir	Wasatch	37	Kolob Reservoir	Washington
3	East Canyon Reservoir	Morgan	38	Chicken Creek Reservoir	Juab
4	Echo Reservoir	Summit	39	Ivins Reservoir	Washington
5	Salem Ponds	Utah	40	Flaming Gorge Reservoir	Daggett
6	Willard Bay Reservoir	Box Elder	41	Tibble Fork Reservoir	Utah
7	Hyrum Reservoir	Cache	42	Vernon Reservoir	Tooele
8	Pineview Reservoir	Weber	43	Upper Enterprise Reservoir	Washington
9	Mantua Reservoir	Box Elder	44	Gunnison Reservoir	Sanpete
10	Redmond Lake	Sevier	45	Upper Barker Reservoir	Garfield
11	Strawberry Reservoir	Wasatch	46	Gunnison Bend Reservoir	Millard
12	Johnson Valley Reservoir	Sevier	47	Wide Hollow Reservoir	Garfield
13	Minersville Reservoir	Beaver	48	New Castle Reservoir	Iron
14	Mill Hollow Reservoir	Wasatch	49	Pelican Reservoir	Uintah
15	Newton Reservoir	Cache	50	Steinaker Reservoir	Uintah
16	Bear Lake	Rich	51	Whitney Reservoir	Summit
17	Panguitch Lake	Garfield	52	Huntington Lake North	Emery
18	Scofield Reservoir	Carbon	53	Lower Gooseberry Reservoir	Sanpete
19	Lost Creek Reservoir	Morgan	54	Puffer Lake	Beaver
20	Tony Grove Lake	Cache	55	Causey Reservoir	Weber
21	Koosharem Reservoir	Sevier	56	Settlement Canyon Reservoir	Tooele
22	Marsh Lake	Summit	57	Browne Reservoir	Daggett
23	Gunlock Reservoir	Washington	58	Big Sandwash Reservoir	Duchesne
24	Navajo Lake	Kane	59	Mill Meadow Reservoir	Wayne
25	Decker Lake	Salt Lake	60	Woodruff Creek Reservoir	Rich
26	Sevier Bridge Reservoir	Juab	61	Towave Reservoir	Uintah
27	Otter Creek Reservoir	Piute	62	Lake Powell	Kane
28	Wanship Reservoir	Summit	63	Bottle Hollow Reservoir	Uintah
29	Cutler Reservoir	Cache	64	Pruess Lake	Millard
30	Ninemile Reservoir	Sanpete	65	Tropic Reservoir	Garfield
31	Palisade Lake	Sanpete	66	Piute Reservoir	Piute
32	Fairview Lake #2	Sanpete	67	Porcupine Reservoir	Cache
33	Forsyth Reservoir	Sevier	68	Little Creek Reservoir	Rich
34	Baker Dam Reservoir	Washington	69	D.M.A.D. Reservoir	Millard
35	Big East Lake	Utah	70	Lake Boreham	Duchesne

ANDERSON MEADOW RESERVOIR

Introduction

Anderson Meadow Reservoir is high in the Tushar Mountains east of Beaver. It is a small artificial lake in a high meadow. The reservoir was built by the DWR to create a fishery.

The reservoir shoreline is owned and administered by the Fish Lake National Forest with unrestricted public access. Water is used for coldwater aquatic life and recreation. No changes in water use are anticipated.

Characteristics and Morphometry

Lake elevation (meters / feet)	2,851 / 9,355
Surface area (hectares / acres)	3.2 / 8
Watershed area (hectares / acres)	641 / 1,584
Volume (m^3 / acre-feet)	
capacity	82,645 / 67
conservation pool	none
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	0 / 0
Depth (meters / feet)	
maximum	6.4 / 21
mean	2.7 / 8.7
Length (meters / feet)	425 / 1,395
Width (meters / feet)	242 / 795
Shoreline (meters / feet)	1,100 / 3,600

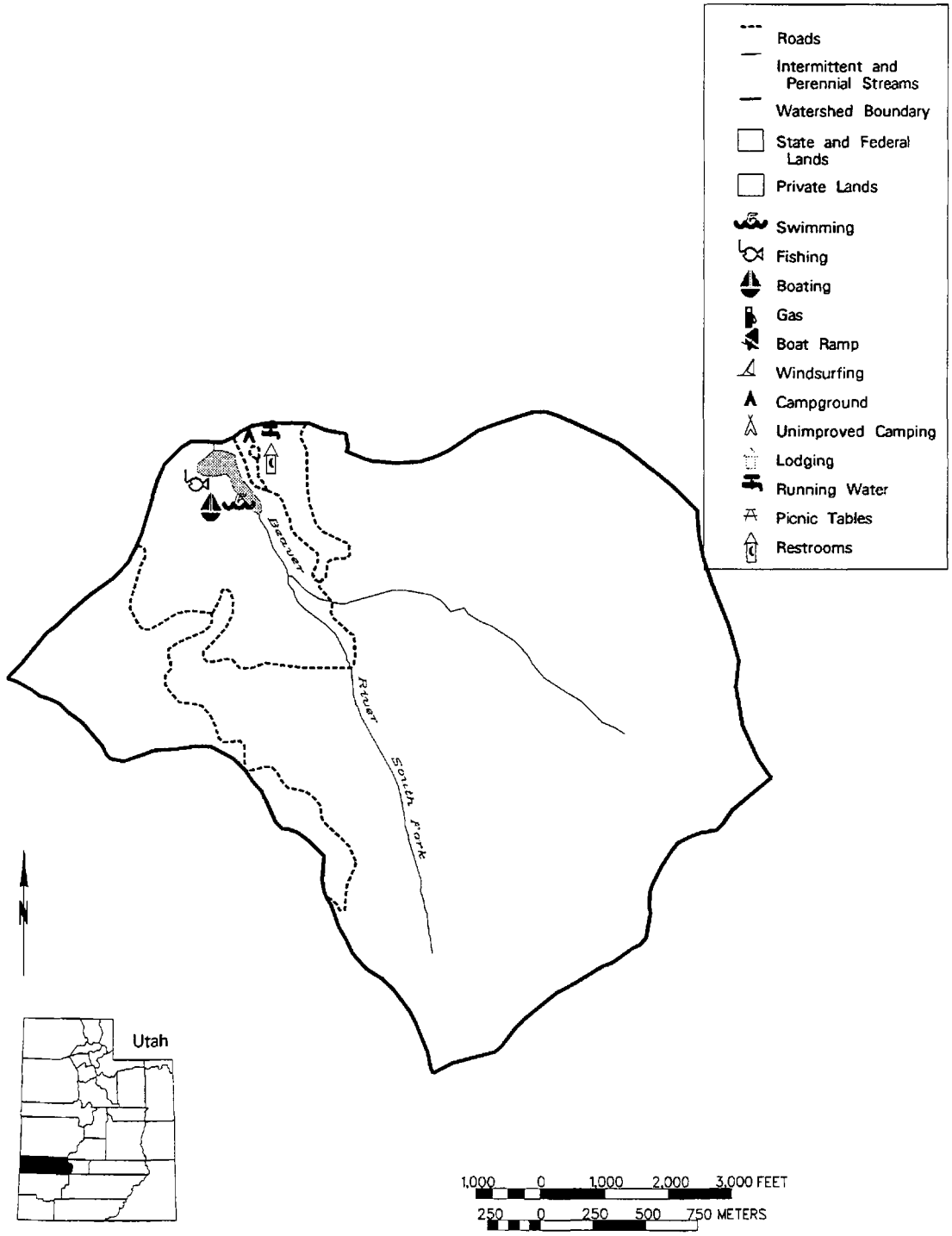
Location

County	Beaver
Longitude / Latitude	112 25 09 / 38 12 09
USGS Map	Circleville Mountain, Utah, 1971
DeLorme's Utah Atlas and Gazetteer™	Page 26, B-2*
Cataloging Unit	Beaver River (16030007)

*not on map, at Anderson Meadow Campground

Recreation

Anderson Meadow Reservoir is accessible from FS-137, a gravel road across the north slope of Circleville Mountain also passing by Kents Lake and LaBaron Lake. FS-137 both originates and terminates at intersections with U-153, the road from Beaver to Junction.



County in which watershed is located.

Anderson Meadow Watershed

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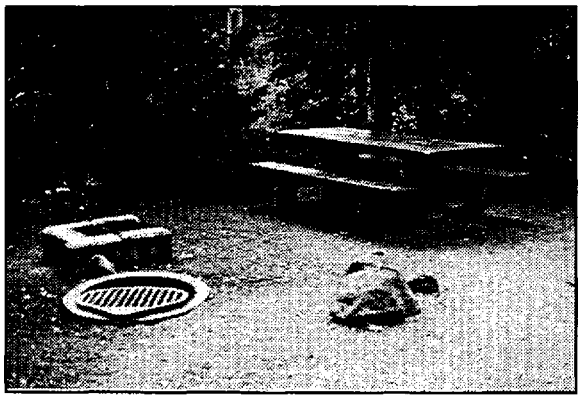
From the west, exit I-15 at Beaver and travel up Beaver Canyon on U-153 for about 12 miles to the FS-137 turnoff, at Little Cottonwood Campground. Travel on FS-137 for another 6 miles to Anderson Meadow Reservoir. From the east, travel up U-153 (this segment is unpaved) from US-89 at Junction for 12 miles to FS-173, and go 7 miles on FS-137 to Anderson Meadow Reservoir.

Fishing, boating, and camping occur in the area. Recreation use of the area is usually heavy. Although there are no developed boat ramps, a small boat can be launched in the reservoir.

Anderson Meadows Campground, maintained by the Forest Service, is adjacent to the reservoir and offers camping at a nominal charge. It has 10 campsites with drinking water, vault toilets, and charges user fees. There are other USFS campgrounds in the vicinity as well as several private campgrounds in Beaver (see info box).



Watershed Description

Anderson Meadow Reservoir is in an area of glaciated draws on the north slope of Circleville Mountain in the Tushar Range. Anderson Meadow itself is mostly inundated by the reservoir, but extends upstream as a grassy, boggy area.

The watershed high point, Circleville Mountain, is 3,362m (11,031 ft) above sea level, thereby developing a complex slope of 21.9% to the reservoir. The inflow and outflow is the South Fork of the Beaver River, and the average stream gradient above the reservoir is 9.5% (500 feet per mile).

The watershed is made up of high mountains. The soil is largely of volcanic origin. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities are comprised of pine, aspen, spruce-fir, oak, maple and alpine. The watershed receives 76 cm (30 inches) of precipitation annually with a frost-free season of 0 - 40 days at the reservoir.

Land use is 100% multiple use and is owned by the Fishlake National Forest.

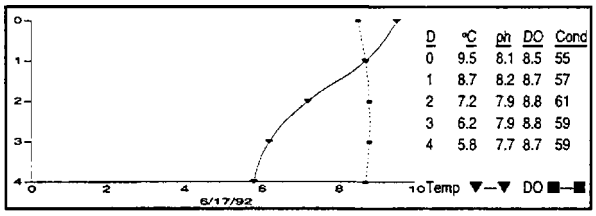
Limnological Assessment

The water quality of Anderson Meadow Reservoir is very good. It is considered very soft water with a hardness generally less than 30 mg/L. The only parameter that exceeds State standards is phosphorus. All other parameters including total metals obtained near the bottom at the deep sites were within State standards for defined beneficial uses. Although the DWQ (1982) reported the lake as phosphorus limited, data from 1989-92 indicates that the lake is nitrogen limited with N/P ratios near 1-2. Although there is a change in temperature gradient inexcess of 1 degree per meter as indicated in the lake profile, no consistent stratification is present due to the shallow nature of the lake and climatic conditions which probably keep the water column fairly well mixed. For all three periods of study the reservoir's trophic status is eutrophic. There has been no significant shift in the trophic status since 1981.

Limnological Data

Data sampled from STORET site: 594115

Surface Data	1981	1990	1992
Trophic Status	E	E	E
Chlorophyll TSI	-	55.14	47.14
Secchi Depth TSI	54.15	46.51	47.38
Phosphorous TSI	53.19	56.41	56.02
Average TSI	53.67	52.67	50.18
Chlorophyll a (ug/L)	-	12.20	5.4
Transparency (m)	-	2.6	2.4
Total Phosphorous (ug/L)	30	38	36
ph	8.4	8.35	7.80
Total Susp. Solids (mg/L)	<5	2.25	<3
Total Volatile Solids (mg/L)	-	-	1
Total Residual Solids (mg/L)	-	-	2
Temperature (°C / °f)	7/45	13/55	12/53
Conductivity (umhos.cm)	45	63	48
Water Column Data			
Ammonia (mg/L)	0.05	0.03	0.03
Nitrate/Nitrite (mg/L)	0.08	-	0.02
Hardness (mg/L)	26	24	23.8
Alkalinity (mg/L)	22	27	28
Silica (mg/L)	-	-	28.5
Total Phosphorous (ug/L)	35	39	47
Miscellaneous Data			
DO (Mg/l) at 75% depth	8.6	9.3	9.3
Stratification (m)	1-2	1-2	1-2
Limiting Nutrient	N	N	N
Depth at Deepest Site (m)	6	4.3	4.3



According to DWR stocking records catchable rainbow trout (*Oncorhynchus mykiss*) and fingerling brook trout (*Salvelinus fontinalis*) have been introduced to Anderson Meadow Reservoir and are stocked annually. In addition the lake has not been treated for control of nongame fish species, therefore native populations could still exist in the lake or it tributaries. Currently the fishery is managed as a put and take fishery. As reported by DWQ (1982) common invertebrate species in the lake include midge and caddisfly larvae and snails. There is a heavy macrophyte growth covering the surface near the inlet but macrophytes are sparse throughout the remainder of the reservoir.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance):

Species	Cell Volume (mm^3/liter)	% Density By Volume
Anabaena spiroides	237.078	74.92
Spirogyra sp.	55.600	17.57
Fragilaria crotonensis	13.744	4.34
Sphaerocystis schroeteri	7.923	2.50
Pandorina morum	2.002	0.63
Pennate diatoms	0.047	0.01
Asterionella formosa	0.028	0.01
Haematococcus lacustris	0.009	0.00
Centric diatoms	0.007	0.00
Total	317.857	
Shannon Weaver [H']	0.79	
Species Evenness	0.36	
Species Richness [d]	0.30	

Phytoplankton data obtained during the 1991-92 monitoring period is dominated by *Anabaena spiroides*, a eutropic blue-green algae. This is indicative of a fairly nutrient rich system and high productivity.

Pollution Assessment

Nonpoint pollution sources include grazing and recreation. The campground and parking areas are above the reservoir. About 520 head of cattle graze in the watershed and around the lake for part of each year.

There are no point pollution sources in the watershed.

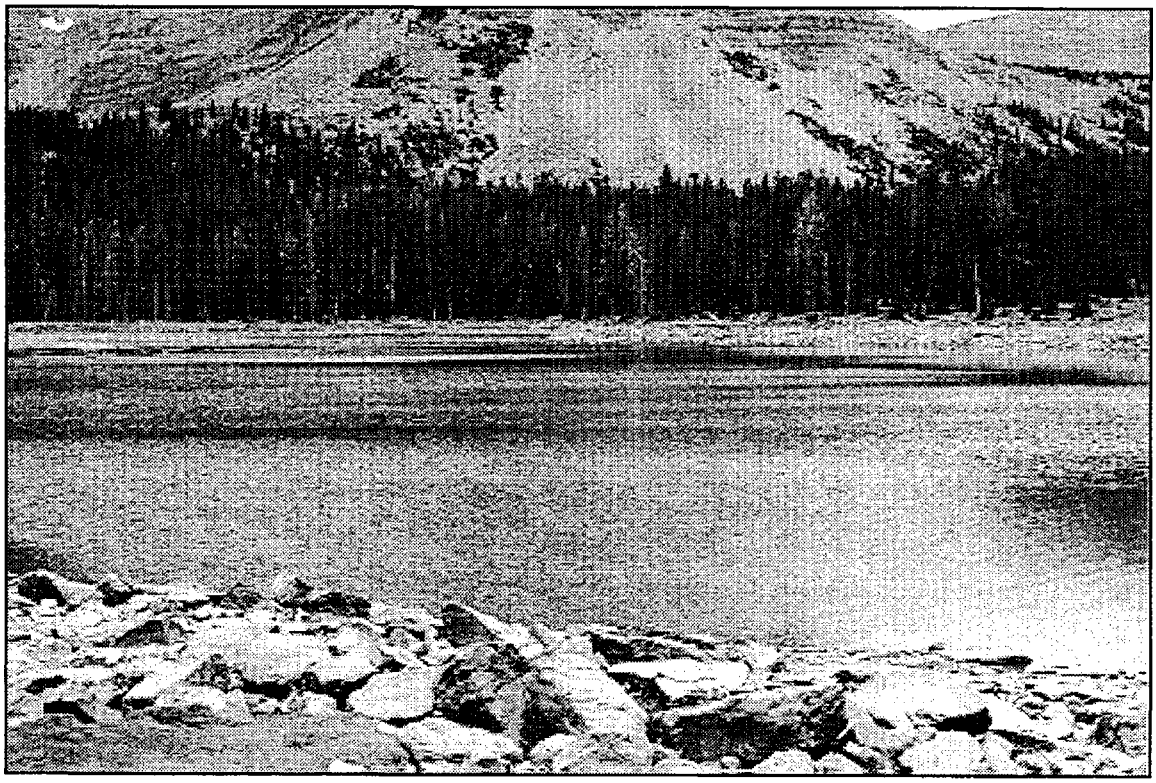
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Fishlake National Forest	896-4491
Beaver Ranger District	438-2436
Five County Association of Governments	673-3548
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Color Country Travel Region (St. George)	
Beaver KOA	438-2924
United Beaver Camperland	438-2808
Beaver Chamber of Commerce	438-2975
Reservoir Administrator	
Division of Wildlife Resources	586-2455

ASHLEY TWIN LAKE



Introduction

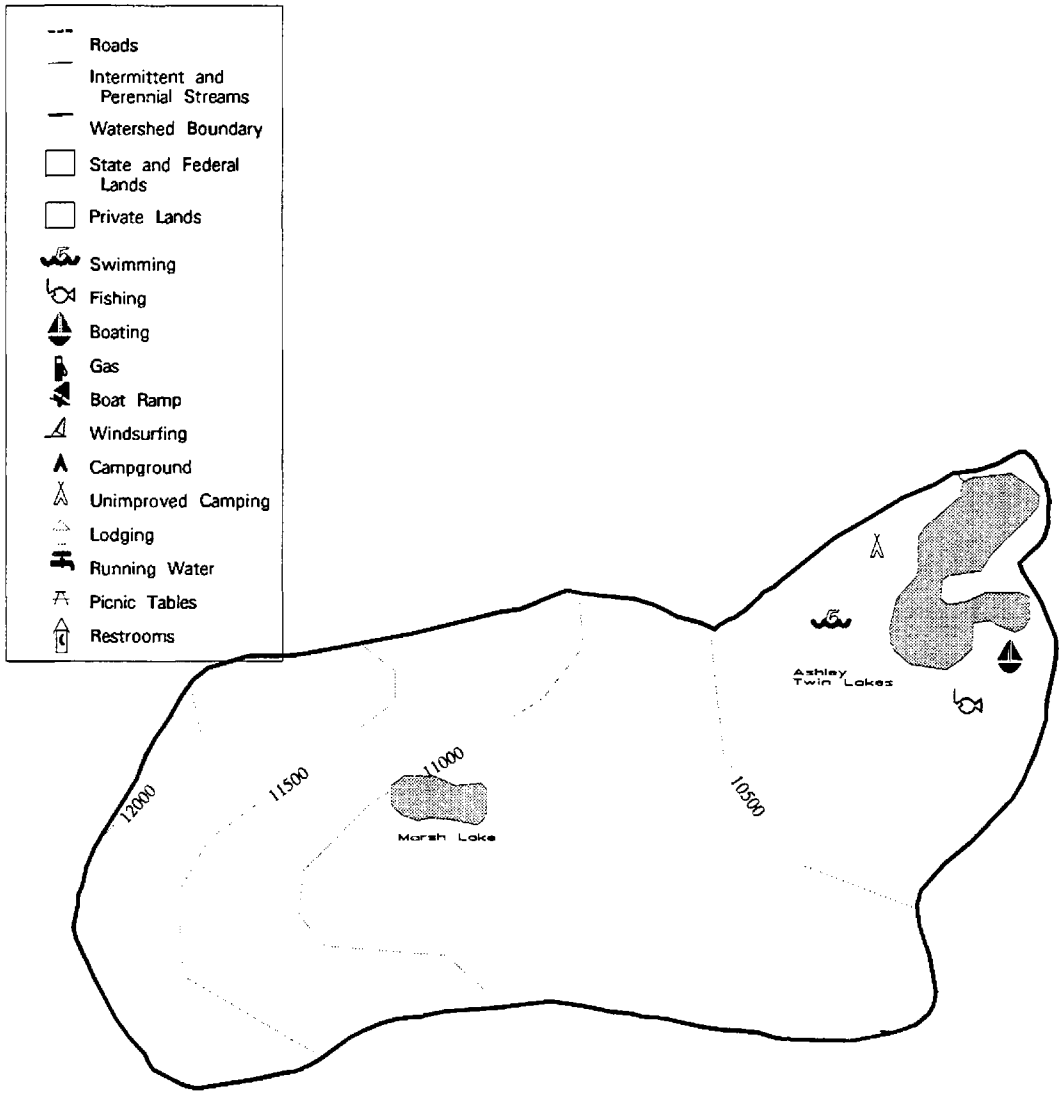
Ashley Twin Lakes is northwest of Vernal in the shadow of Marsh Peak, one of the highest mountains in the southeast Uintas. The area is a moderately popular summer recreation area, being surround by coniferous forests and towering peaks. It is comprised of two natural lakes in the High Uintas that were united when a dam was built to raise the water level. The two larger lakes were formerly Ashley Twin Lakes. The names were not changed to reflect the union, but "they" are collectively referred to as "it". Nevertheless, it appears as two lakes on many maps, and by late summer due to drawdown they once again become separate lakes. Ashley Twin Lakes were united in 1920 by the construction of an earth-fill dam. The reservoir shoreline is owned by the Ashley National Forest and public access is unrestricted. Ninety-five percent of reservoir

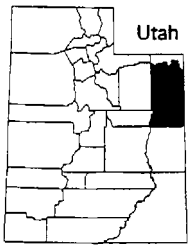
Characteristics and Morphometry

Lake elevation (meters / feet)	3,643 / 9,355
Surface area (hectares / acres)	10.9/27
Watershed area (hectares / acres)	351/868
Volume (m^3 / acre-feet)	
capacity	5,550,000 / 450
conservation pool / acre-feet)	none
Annual Inflow	not measured
Retention time (years)	<1
Drawdown (meters / feet	not measured
Depth (meters/feet)	
maximum	6.10 / 20
mean	3.05 / 10
Length (meters / feet)	607 / 2,200
Width (meters / feet)	244 / 800

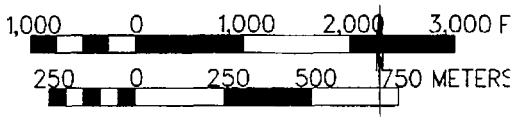
Location

County	Uinta
Longitude / Latitude	109 48 12 / 40 43 24
USGS Map	Marsh Peak, UT, 1965
DeLorme's Utah Atlas & Gazetteer™	Page 56, B-2
(unlabeled. It is directly under the "L" in "NATIONAL FOREST")	
Cataloging Unit	Brush/Ashley Creeks (14060002)





County in which watershed is located.



Ashley Twin Watershed

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water is used for irrigation, and the remaining 5% is treated for culinary water in the Vernal area. Water use is not expected to change in the foreseeable future.

Recreation

Ashley Twin Lakes is accessible from Red Cloud Loop in the Ashley National Forest. The loop begins as 3500 West St. in the Vernal\Maeser area. Travel north on this road as it climbs into the Uintas. At the National Forest Boundary. the road becomes FS-18. About 13 miles after entering the National Forest, turn left on a less traveled road (FS-027). This turn should be signed to the lake and/or to Marsh Peak. Follow this road for 5 miles which terminates at the lake. The last few miles the road is very rough. It is very rocky and not maintained. Driving can be hazardous during inclement weather. The road at one time did continue on past the lake, but this area is now restricted.

Fishing, camping, picnicking, and hiking are all popular uses of the area. The lake is primarily a Brook Trout Fishery, and fish populations have increased in recent years, although seasonal drawdown results in a muddy shoreline that does little to enhance the angling experience. There are no facilites at the lake. All visitors should pack out all waste.

The nearest campground is operated by the USFS at Oaks Park Reservoir, 20 miles north and east on the Red Cloud Loop, which has primitive latrines, picnic areas, and campsites. Primitive camping is available at the lake and there are a significant number of improved campgrounds in the area.

Watershed Description

Ashley Twin Lakes is in a glaciated area at the foot of the tall peaks of the Uinta's. Marsh Peak, 2 miles to the west, rises 2,000 feet over the lake, with vertical slopes. As a result of glaciation, the area around the lake has uneven topography with poor drainage, resulting in many small lakes and wetlands. Open coniferous forests dominate the landscape at eye level, while the peaks rise above the timberline.

The watershed high point, Marsh Peak, is 3,731m (12,240 ft) above sea level, thereby developing a complex slope of 26.4% to the reservoir. There are no perennial inflows, and the outflow is a tributary of South Fork Ashley Creek. Mud Lake and Marsh Lake are other natural lakes in the watershed.

The watershed is made up of high mountains and mountains meadows. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of spruce-fir, alpine and aspen. The watershed receives 76 cm (30 inches) of precipitation annually. The frost-free season around the reservoir is 0 - 20 days per year.

Land use in the watershed is 100% multiple use, with grazing by domestic livestock and human recreation being the primary uses. There are no active or proposed timber sales in the watershed.

Limnological Assessment

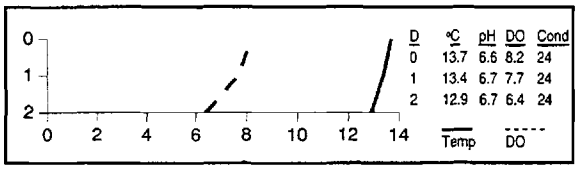
The water quality of Ashley Twin Lakes is high quality. It is very soft water with a hardness generally less than 10 mg/L with very low concentration of anions and cations. No constituents analyzed were found to be in excess of State water quality standards. The nutrient concentrations in the lake are below the pollution indicator level established in the State standards and are characteristic of a low to moderately productive lake. Total inorganic nitrogen values are low, usually below minimum detectable limits in June but rise significantly in late summer to a point where the lake may become phosphorus limited. Although the lake was classified in 1982 as phosphorus limited, a review of the

Limnological Data

Data sampled from STORET site: 493767

Surface Data	1980	1990	1992
Trophic Status	M	M	M
Chlorophyll TSI	-	45.89	38.56
Secchi Depth TSI	44.17	44.17	45.96
Phosphorous TSI	47.35	33.20	48.05
Average TSI	45.76	41.09	44.19
Chlorophyll a (ug/L)	-	4.75	2.25
Transparency (m)	30	3.0	2.65
Total Phosphorous (ug/L)	10	8	21
pH	7.3	6.80	7.45
Total Susp. Solids (mg/L)	<5	<3	<3
Total Volatile Solids (mg/L	-	-	1
Total Residual Solids (mg/L)	-	-	2
Temperature (°C / °f)	14/57	12/54	12/53
Conductivity (umhos.cm)	20	33	24
Water Column Data			
Ammonia (mg/L)	0.15	0.03	0.14
Nitrate/Nitrite (mg/L)	0.38	-	0.05
Hardness (mg/L)	10	9.1	7.6
Alkalinity (mg/L)	6	9	9
Silica (mg/L)	2.0	-	1.4
Total Phosphorous (ug/L)	15	9	20
Miscellaneous Data			
DO (Mg/l) at 75% depth	8.2	7.5	7.1
Stratification (m)	2-4	1-2	NO
Limiting Nutrient	P	N	N
Depth at Deepest Site (m)	5	2.3	2.0

data for that period indicates that it was a nitrogen limited system. The data obtained during the 1990 and 1992 sampling program indicates that the system is usually nitrogen limited except on occasion during late summer when nitrogen concentration increase. Average annual maximum inorganic nitrogen values are 0.13 and 0.19 mg/L for 1990 and 1992. Total epilimnetic phosphorus values for the same periods are 0.015 and .021 mg/L. The ratio of total organic nitrogen to total phosphorus utilizing this data indicate that the system is nitrogen limited. The reservoir is classified as mesotropic. Average TSI values have not shifted significantly since 1982 with an average TSI value of 43.68 for the three periods surveyed. The only period that the reservoir was stratified was in August, 1980. The reservoir had a depth of 5.0 meters with a thermocline



developing from 2-4 meters. During 1990 and 1992 no stratification was present, but the depth of the reservoir during August was insufficient for the development of thermocline. The August, 1993 profile does indicate a drop of dissolved oxygen concentration from 8.2 to 6.2 mg/L in only two meters of water.

The habitat for fish in Ashley Twin Lakes is generally good but late summer drawdowns result in low water conditions which adversely affect the fishery. Brook trout (*Salvelinus fontinalis*), cutthroat trout (*Oncorhynchus clarki*), and rainbow trout (*Oncorhynchus mykiss*) have been stocked at some time in the lake. Recent stocking reports indicate that DWR typically stocks the lake with fingerling brook trout. If natural reproduction of trout takes place, it is of a quantity too small to be of significance in the overall populations. Cutthroat trout are reported as present in the lake. However, it is unclear if these are naturally reproducing or remnants of earlier stocking programs. Because the lake has not been chemically treated by the DWR, populations of native fishes may be present.

The DWQ (1982) reported that significant populations of macrophytes and zooplankton were present in the lake. Species composition mentioned were quillwort (Isotes sp.), peat moss, Cyclops sp. at 1.78/L and Daphnia sp. at 6.67/L. Of the invertebrates surveyed at that time the following organisms were present in order of prevalence: midges (*Chironomidae*), clams (*Pelecypoda*) 11.1%, aquatic earthworms (*Oligochaeta*) 4.4%, larvae (*Tanypodinae*) 2%, pupae 0.7%, leeches (*Hirudinea*) 0.7%, and caddisfly larvae (*Limnephilidae*) 0.7%. (Brady Green, Fisheries Biologist, Ashley National Forest, Vernal, Utah)

Phytoplankton data obtained during the 1991-92 monitoring period is dominated by *Sphaerocystis schroeteri*, a low-productive water algae. Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	47.538	97.24
Pandorina morum	0.444	0.91
Unknown Spherial Chrysophyte (flagellate)	0.434	0.89
Dinobryon divergens	0.147	0.30
Oocystis	0.092	0.19
Euglena sp.	0.082	0.17
Cosmarium sp.	0.078	0.16
Unknown Spherical Green algae	0.025	0.05
Scenedesmus bijuga	0.022	0.05
Asterionella formosa	0.009	0.02
Ankistrodesmus falcatus	0.009	0.02
Pennate diatoms	0.008	0.02
Total	49.630	
Shannon-Weaver [H']	0.17	
Species Evenness	0.07	
Species Richness [d]	0.45	
Number of species	12	

Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Ashley National Forest	789-1181
Vernal Ranger District	789-1181
Recreation	
Dinosaurland Travel Region (Vernal)	789-6932
Vernal Chamber of Commerce	789-1352
Reservoir Administrators	
Ashley Valley Reservoir Company	789-3212
Uinta Water Conservancy District	789-1651

Pollution Assessment

Nonpoint pollution sources include recreation and domestic livestock grazing. 1,250 sheep graze the

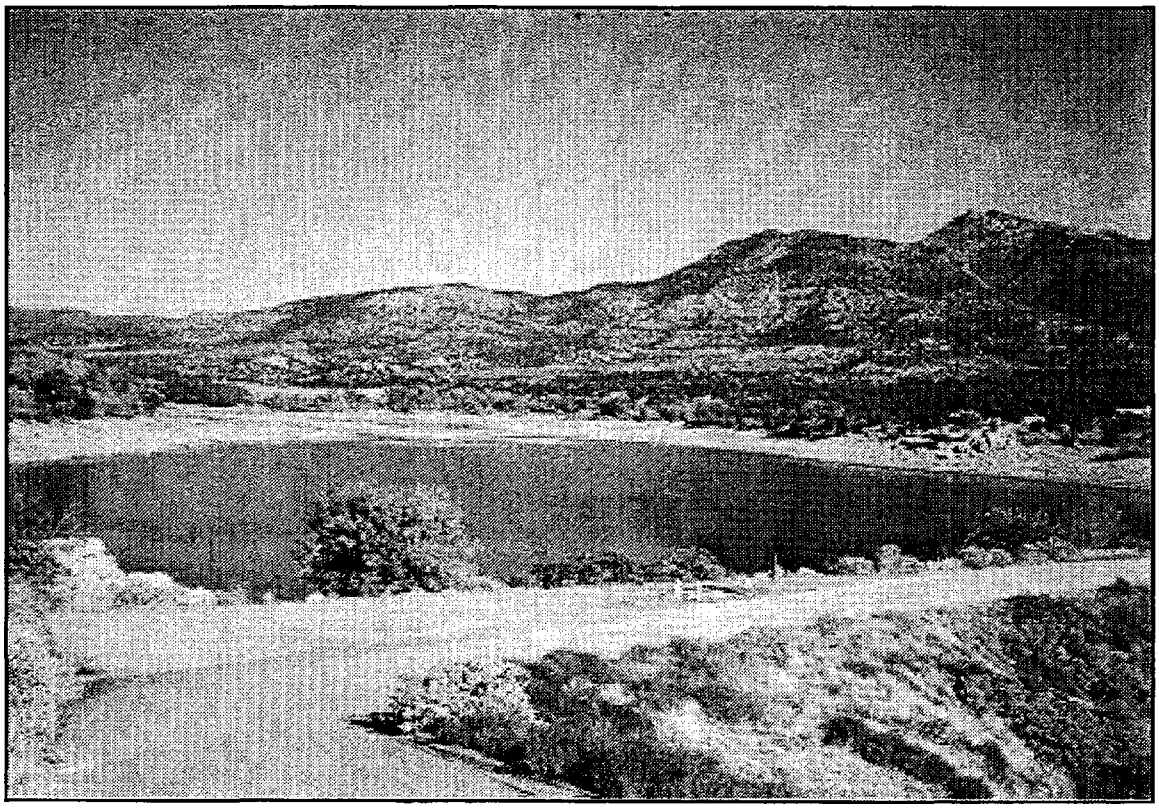
watershed and reservoir shoreline during the summer.

There are no point sources of pollution in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: culinary water (1C), boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

BAKER DAM RESERVOIR



Introduction

Baker Dam Reservoir is a small impoundment on the Santa Clara River in extreme southwestern Utah. At the time of this writing (July 1993) it is leaking and may need to be drained. It is also known as Baker Reservoir.

Characteristics and Morphometry

Lake elevation (meters / feet)	1,484 / 4,869
Surface area (hectares / acres)	25.5 / 63
Watershed area (hectares / acres)	33,232 / 82,115
Volume (m^3 / acre-feet)	
capacity	1,850,253 / 1,500
conservation pool / acre-feet)	none
Annual Inflow	not measured
Retention time (years)	<1
Drawdown (meters / feet)	not measured
Depth (meters/feet)	
maximum	16.7 / 55
mean	5.6 / 18.4
Length (meters / feet)	868.6 / 2,850
Width (maximum)(meters / feet)	274 / 900
Shoreline (km / miles)	1.67 / 1.04

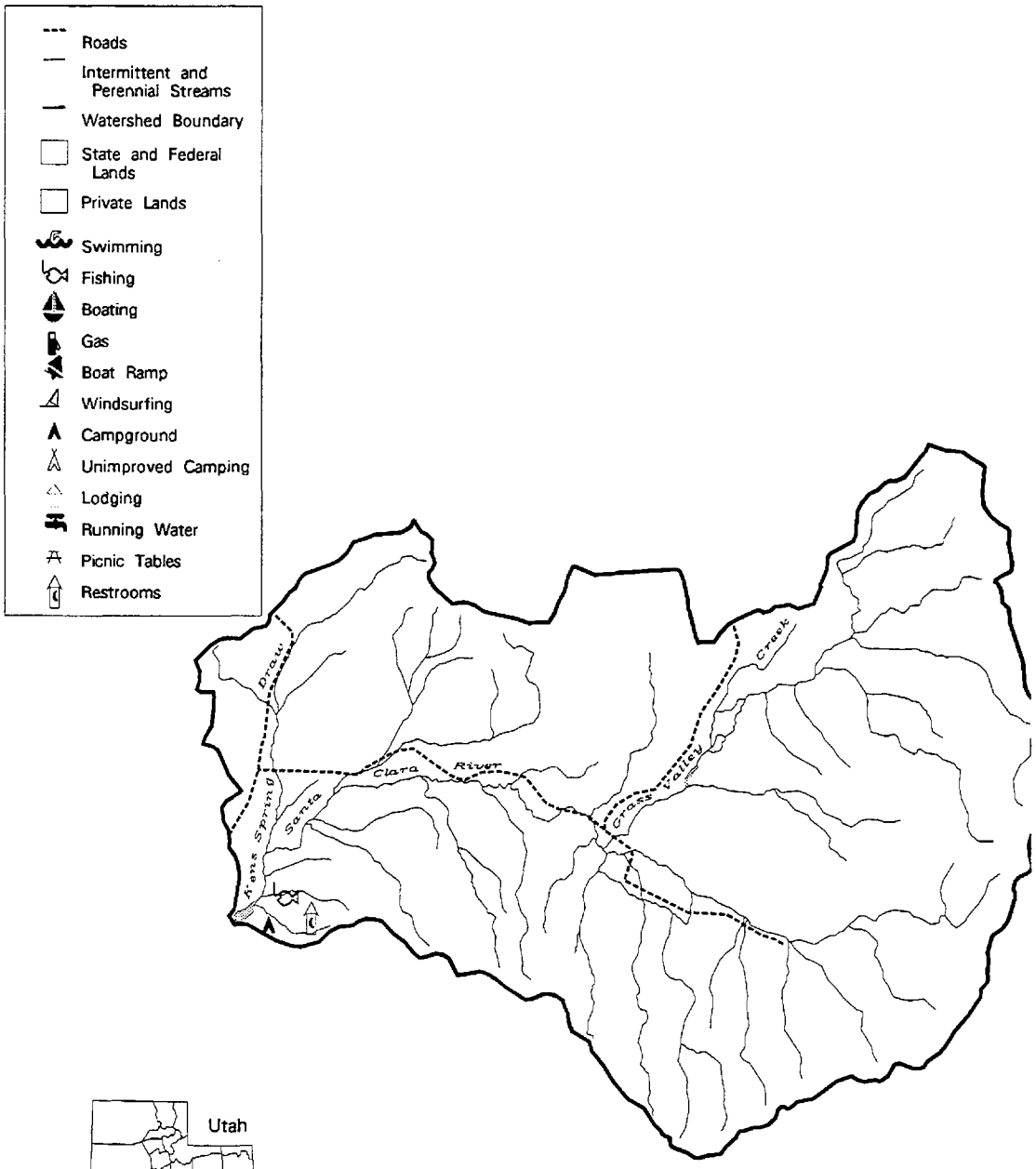
The reservoir shoreline is owned partly by the BLM and partly by the Baker Reservoir Company. Public access is unrestricted. The impoundment, an earth-fill dam, was built in 1950. Reservoir water is consumed for irrigation, coldwater aquatic habitat and recreation. No changes in water use are planned, but St. George is undergoing a growth phase and is in need of more culinary water. Buying out agricultural interests at Baker Dam is a logical choice for St. George to look at to satisfy increasing culinary demand. The other options, implementing a conservation program or building new reservoirs, would not affect water use at Baker Dam.

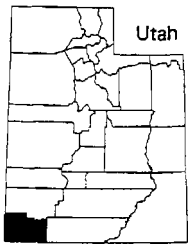
Location

County	Washington
Longitude / Latitude	113 38 06 / 37 22 38
USGS Map	Central West, Utah, 1972
DeLorme's Utah Atlas and Gazetteer™	pg.46,B2
Cataloging Unit	Upper Virgin (15010008)

Recreation

Baker Dam Reservoir is accessible from the U-18 portion of the Legacy Loop Highway between St. George





County in which watershed is located.

Baker Dam Watershed

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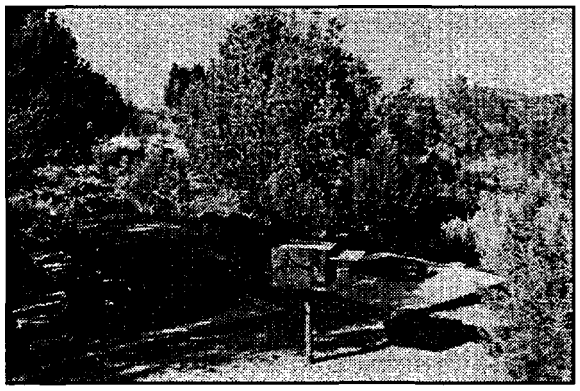
and Enterprise. It is four miles north of Veyo and two miles south of Central. There is an unpaved access road from U-18 that leads east to the reservoir.

Fishing and camping are the primary recreational uses of the area. The BLM's Baker Reservoir campground is adjacent to the reservoir, and has 10 campsites with picnic areas, vault toilets, drinking water, but no boatramp. Usage fees are charged. Cabins and meals may be available in the vicinity.



Watershed Description

Baker Dam Reservoir is the uppermost of the three major reservoirs on the Santa Clara River. It is located in a broad basin between the Pine Valley Mountains to the east and the Bull Valley Mountains to the west. The headwaters are on the northern slope of the Pine Valley Mountains, a federally protected wilderness area. Various tributaries flow down from the mountains into Pine Valley to form the Santa Clara River. There is a transbasin diversion of the upper Grass Creek watershed through a tunnel into North Fork Pinto Creek to Newcastle Reservoir. The Santa Clara River drops into lower elevations with drier climates, where it is impounded at Baker Dam for irrigational usage.

The watershed high point, Signal Peak, is 3,159 m (10,365 ft) above sea level, thereby developing a complex slope of 11.7% to the reservoir. The inflow and outflow is the Santa Clara River. The average stream gradient above the reservoir is 7.2% (379 feet per mile). Pine Valley Reservoir (New Castle Reservoir on some maps) is the sole upstream impoundment.

The watershed is made up of high mountains, mesas, alluvial fans, and floodplains. The soil associations that compose the watershed are found in Appendix III.

The vegetation communities are comprised of sage-grass, pinyon-juniper, bitterbrush-mountain mahogany, pine, aspen, spruce-fir, oak, and maple. The watershed receives 30 - 64 cm (12 - 25 inches) of precipitation annually with a frost-free season of 140 - 160 days at the reservoir.

Land use is multiple use (95%), pasture (5%), and urban (<1%). The major use of the watershed is for livestock grazing.

Limnological Assessment

The water quality of Baker Dam Reservoir is good. It is considered moderately hard to hard with hardness values ranging from 85 (1992) to 214 mg/L (1991). It appears that the hardness tends to increase during drought conditions due to high evaporation and a low inflow of higher quality water. Water quality constituents that have exceeded water quality standards for defined beneficial uses of the reservoir include: phosphorus; pH; dissolved oxygen; and temperature. Although the concentrations of phosphorus in the reservoir exceed the recommended allowances for phosphorus the concentration of nitrogen are usually low approaching the minimum detectable limits much of the time for ammonia and nitrate. The reservoir has a moderate to high biological productivity rate. A review of the data indicates that the reservoir is consistently nitrogen limited.

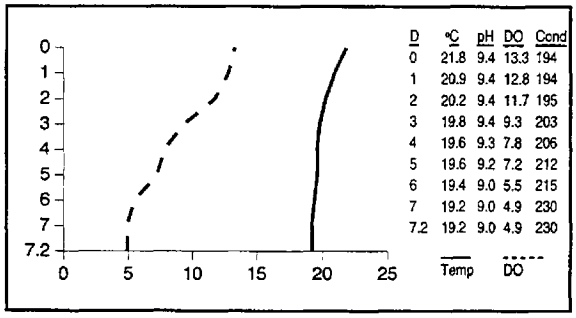
The trophic status of the reservoir ranges from the upper ranges of mesotrophic to hypereutrophic. The reservoir productivity does appear to increase during drought conditions when the reservoir volume is diminished. The

Limnological Data

Data averaged from STORET sites: 595054, 595055

Surface Data	1981	1990	1992
Trophic Status	M	H	E
Chlorophyll TSI	-	78.41	52.94
Secchi Depth TSI	36.72	49.92	48.98
Phosphorous TSI	59.57	70.47	49.35
Average TSI	48.13	66.26	50.42
Chlorophyll a (ug/L)	-	130.8	10.123
Transparency (m)	-	1.8	2.15
Total Phosphorous (ug/L)	45	236	23
pH	8.1	9	9.1
Total Susp. Solids (mg/L)	5	9.3	<3
Total Volatile Solids (mg/L)	-	-	2
Total Residual Solids (mg/L)	-	-	2
Temperature (°C / °f)	17/63	21/70	20/67
Conductivity (umhos.cm)	251	404	174
Water Column Data			
Ammonia (mg/L)	0.05	0.04	0.03
Nitrate/Nitrite (mg/L)	0.05	-	0.03
Hardness (mg/L)	109	214	79
Alkalinity (mg/L)	108	199	83
Silica (mg/L)	-	-	26.5
Total Phosphorous (ug/L)	45	243	41
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	7.4	15	6.5
Stratification (m)	6-7	NO	NO
Depth at Deepest Site (m)	8	1.5	7.2

only stratification that was documented in the reservoir was in June, 1981 between 6 and 7 meters. Although no thermocline was present on September 9, 1992 there was a fairly rapid loss of dissolved oxygen (13.3 to 4.9 mg/L) in the water column. The water temperature through out the water column either exceeds or borders near the maximum allowable value (20 degrees C) for a cold water fishery. It appears that one of the major criteria the affects water quality is the quantity of water stored in the reservoir. According to DWR stocking reports Baker Dam Reservoir is stocked annually with catchable rainbow (*Oncorhynchus mykiss*) and on occasion brown trout (*Salmo trutta*). Other non-game species reported include the redside shiner (*Richardsonius balteatus* hydrophlox), mountain sucker (*Catostomus platyrhynchus*), and green sunfish (*Lepomis cyanellus*). The reservoir was chemically treated in 1959 and 1982 to control rough fish competition, therefore populations of native fish may not be present in the system. In addition an abundant population of crayfish is present. As reported by DWQ (1982) invertebrates were sparse; mostly snails and annelids. Also reported were two types of algae (*Lyngbya aerugineo-caerulea*) and (*Sphaerocystis schroeteri*), and an abundant population of copepods present. In addition it has been reported that a heavy proliferation of macrophytes develop in late summer.



Phytoplankton in the euphotic zone include the following taxa (in order of dominance):

Species	Cell Volume (mm³/liter)	% Density B y Volume
Aphanizomenon flos-aquae		102.471 96.79
Sphaerocystis schroeteri	2.641	2.49
Pediastrum duplex	0.722	0.68
Pennate diatoms	0.022	0.02
Ankistrodesmus falcatus	0.009	0.01
Total	105.864	
Shannon-Weaver [H']	0.16	
Species Evenness	0.10	
Species Richness	0.16	

It appears that the algal community is dominated by *Aphanizomenon flos-aquae* a blue-green species indicative of eutrophic waters.

Pollution Assessment

Nonpoint pollution sources are: sedimentation and nutrient loading from grazing and feed yards, household wastes from urban areas, and litter, toxins, and other human wastes from recreation. Cattle graze in the watershed and around the reservoir.

There are no point pollution sources in the watershed.

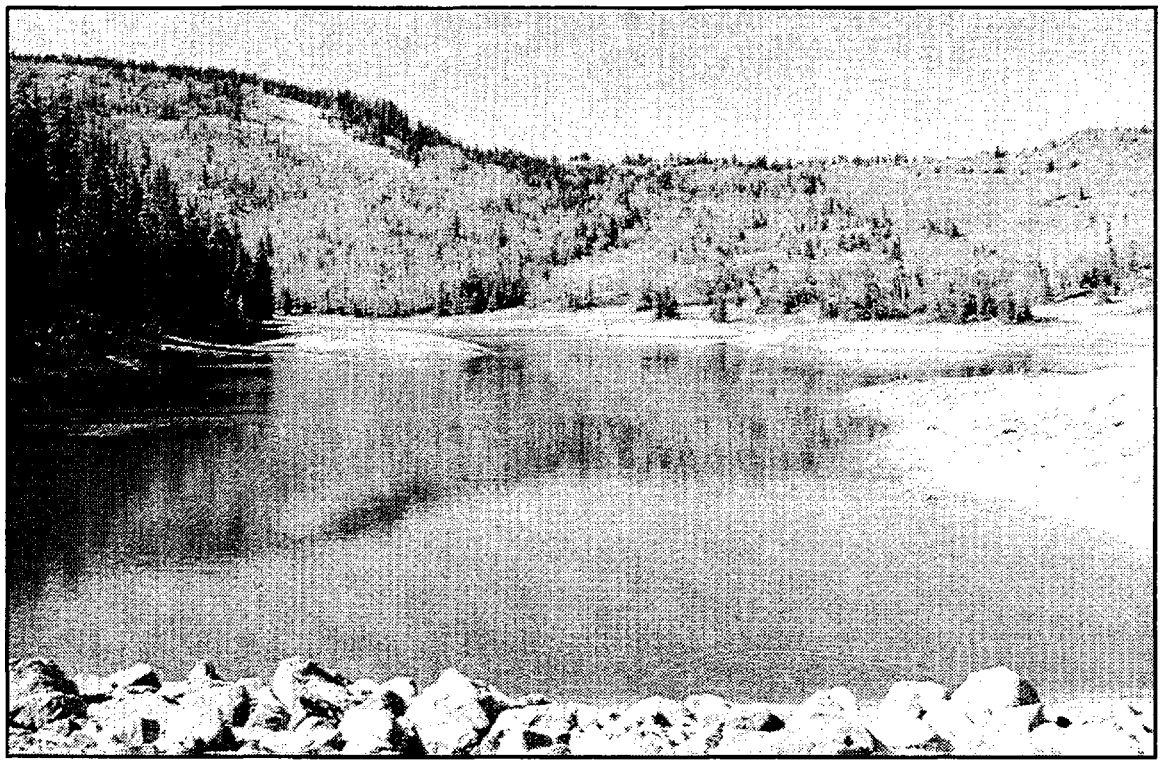
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Bureau of Land Management	539-4001
Dixie Resource Area (St. George)	673-4654
Five County Association of Governments	673-3548
Division of Wildlife Resources	586-2455
Division of Water Quality	538-6146
Recreation	
Color Country Travel Region (St. George)	628-4171
Reservoir Administrators	
Washington County Water Conservation District	673-3617
Baker Dam Reservoir Company	673-2893

BARNEY LAKE



Introduction

Barney Lake is east of Marysvale on the Sevier Plateau. It was acquired by the DWR in 1988 to be managed as a stabilized lake. The dam was rebuilt in 1990,and it now serves as an artificial lake for fishing and other recreation. It is very remote. It should not be confused with like-named Barney Lake on the Aquarius Plateau.

Barney Lake is a small, shallow natural lake that was regulated with a dam in 1914. The reservoir shoreline is publicly owned and administered by the Fish Lake National Forest with unrestricted public access. Reservoir water is used for cold water aquatic habitat and recreation, but is not drained for agricultural purposes. No changes in water use are expected.

Characteristics and Morphometry

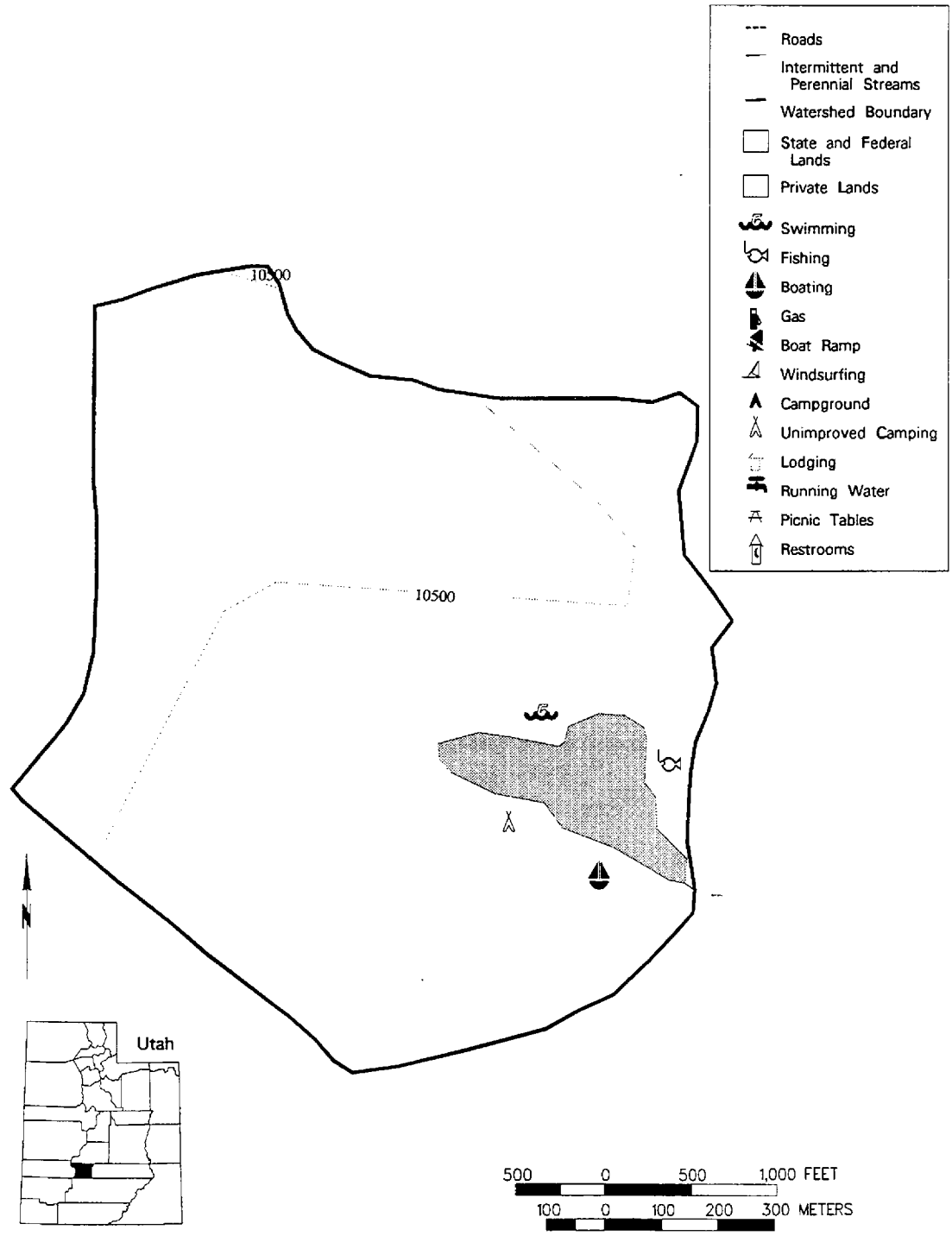
Lake elevation (meters / feet)	3,064 / 10,049
Surface area (hectares / acres)	7.6 / 19
Watershed area (hectares / acres)	119 / 293
Volume (m^3 / acre-feet)	
capacity	247,000 / 200
conservation pool	247,000 / 200
Annual inflow (m^3 / acre-feet)	not measured
Retention time (years)	unknown
Mean annual vertical fluctuation (m^3 / acre-feet)	0 / 0
Depth (meters / feet)*	
maximum	5 / 16.4
mean	3.2 / 10.5
Length (meters / feet)	300 / 1,000
Width (meters / feet)	120 / 400
Shoreline (meters / feet)	850 / 2,800

Location

County	Piute
Longitude / Latitude	112 05 11 / 38 29 04
USGS Map	Marysvale Peak 1981
DeLormes Utah Atlas and Gazetteer™	Page 27, A-4
Cataloging Unit	Richfield (16030002)

Recreation

Barney Lake is not readily accessible. From the west or the north, access is from Monroe via FS-078. Go south, then southeast out of town,



County in which watershed is located.

Barney Watershed

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Park, continue on FS-078 as it turns to gravel and climbs to the top of the plateau. About 7 miles past Monrovian Park, the Paiute ATV trail joins the route, and 12 miles past Monrovian Park the road (FS-083) to Manning Meadows Reservoir and Barney Lake branches to the right.

From the east, take the gravel road 1/2 mile north of the Greenwich church (on U-62 6 miles south of Koosharem) to the west and up onto the Sevier Plateau and becomes FS-069. The Paiute ATV Trail follows this route. Approximately 1 mile past the turn off to Lower Box Creek Reservoir, turn right on FS-078. Proceed to the junction of FS-078 and FS-083, approximately 3-4 miles.

From the FS-078/FS-083 junction, go several miles south on FS-083, past Manning Meadows Reservoir, to the turn off to Barney Lake. The road to the reservoir is approximately 1/2 mile long.

Fishing, backpacking and camping are possible in the area. Usage is light. There are no recreational facilities at the reservoir, although the area offers itself to primitive camping. Please respect this site and carry out all of your trash. Bury human wastes at least 8" deep and at least 300' from the nearest body of water.

There are no improved Forest Service Campgrounds in the area, and the nearest private campgrounds are in Koosharem and Monroe (see info box).

Watershed Description

The reservoir is in an area of high, rolling ridges and valleys characteristic of the top of the Sevier Plateau. The watershed is quite small, and can be seen in its entirety from the reservoir. Vegetation is spruce-fir and aspen down the reservoir shoreline.

The watershed high point, the east shoulder of Marysvale Peak, is 3,330 m (10,925 ft) above sea level, thereby developing a complex slope of 21.4% to the reservoir. There are no perennial inflows to Barney Lake.

The soil is largely of volcanic origin with moderate permeability and moderately slow erosion and runoff.

The vegetation communities are comprised of aspen, spruce-fir and sage-grass. The watershed receives 64 - 76 cm (25 - 30 inches) of precipitation annually with a frost-free season of 20 - 40 days at the reservoir.

Land use is entirely multiple use USFS land.

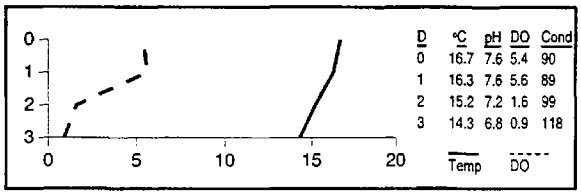
Limnological Assessment

The water quality of Barney Lake appears to be fairly good. The water is considered soft with a hardness concentration of 38 mg/L. Barney Lake is currently not classified, but will be compared to the water quality standards for 2B, 3A and 4 class waters. These are the typical beneficial classifications for most impoundments in the State. A comparison of current lake water quality data against the State standards for these classes of water indicates that there are no exceedences except for phosphorus which exceeds the recommended maximum concentration of 0.25 mg/L. The dam was reconstructed in 1990 and with the impoundment of water, nutrient concentrations are currently moderate to high. This may be a temporary condition due to recent impoundment of water over newly disturbed area or the suspension of nutrients from deposition of waste materials from animals grazing in the area. Currently there is insufficient data available to make a definite categorization of the water quality associated with the productivity for this lake. This relatively high concentration of nutrients provided for a relatively high biological production in the lake during 1992. This is not uncommon for newly impounded waters and may be reduced as the lake reaches a greater state of equilibrium. This will have to be assessed as the program continues. The lake was considered to be a nitrogen limited system in 1992 with an average total phosphorus concentration in the

Limnological Data

Data sampled from STORET site: 594495

Surface Data	1992
Trophic Status	H
Chlorophyll TSI	58.25
Secchi Depth TSI	60.00
Phosphorous TSI	66.12
Average TSI	61.46
Chlorophyll a (ug/L)	16.8
Transparency (m)	1.0
Total Phosphorous (ug/L)	73.5
pH	8
Total Susp. Solids (mg/L)	2.3
Total Volatile Solids (mg/L)	1.0
Total Residual Solids (mg/L)	2.3
Temperature (°C / °f)	16/61
Conductivity (umhos.cm)	87
Water Column Data	
Ammonia (mg/L)	0.08
Nitrate/Nitrite (mg/L)	0.01
Hardness (mg/L)	37.8
Alkalinity (mg/L)	37.0
Silica (mg/L)	11
Total Phosphorus (ug/L)	107
Miscellaneous Data	
DO (Mg/l) at 75% depth	1.4
Stratification (m)	1-2
Limiting Nutrient	N
Depth at Deepest Site (m)	3.0



lake of 0.108 mg/L and the inorganic nitrogen concentration was only 0.09 mg/L.

Although the lake profile indicates that there is by definition, a theoretical stratification between 1 and 2 meters depth, the lake had a maximum depth of 3 meters which is probably well mixed the majority of time and not stratified. The dissolved oxygen concentrations at the time of sampling on August 5, 1992 were fairly low (0.9-5.4 mg/L). The data was collected early in the morning and may reflect the morning sag present due to the respiration requirement from the high algal biomass that may have been present. The current established trophic state for the reservoir is hypereutrophic. It is anticipated that a moderation of this trophic state will occur in the future. Currently DWR stocking records indicate that in 1992 the lake was stocked with fry bonneville cutthroat (*Oncorhynchus clarki utah*) and fingerling tiger trout (*Salvelinus fontinalis X Salvelinus namaycush*) a brook-brown trout cross. In addition brook trout (*Salvelinus fontinalis*) have been stocked at times in the lake. This small lake is noted for its tiger trout fishery, a unique fishing experience in Utah. The DWR has not treated Barney Lake for rough fish control, so native fish populations may still be found.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Aphanocapsa pulchra	55.600	42.84
Volvox areus	44.480	34.28
Aphanizomenon flos-aquae	18.698	14.41
Anabaena spiroides var. crassa	5.782	4.46
Sphaerocystis schroeteri	2.641	2.04
Coelastrum sp.	1.112	0.86
Pennate diatoms	0.475	0.37
Euglena sp.	0.453	0.35
Centric diatoms	0.247	0.19
Haematococcus sp.	0.140	0.11
Unknown flagellate	0.050	0.04
Chlamydomonas globosa	0.046	0.04
Scenedesmus bijuga	0.034	0.03
Oscillatoria sp.	0.012	0.01
Ankistrodesmus falcatus	0.004	0.00
Total	129.774	
Shannon-Weaver [H']	1.34	
Species Evenness	0.49	
Species Richness [d]	0.56	

The phytoplankton community is dominated by the presence of blue-green algae indicative of poorer water quality and high productivity.

Pollution Assessment

Nonpoint solution includes grazing and recreation. Domestic livestock graze in the watershed and in the vicinity of the reservoir.

There are no point pollution sources in the watershed.

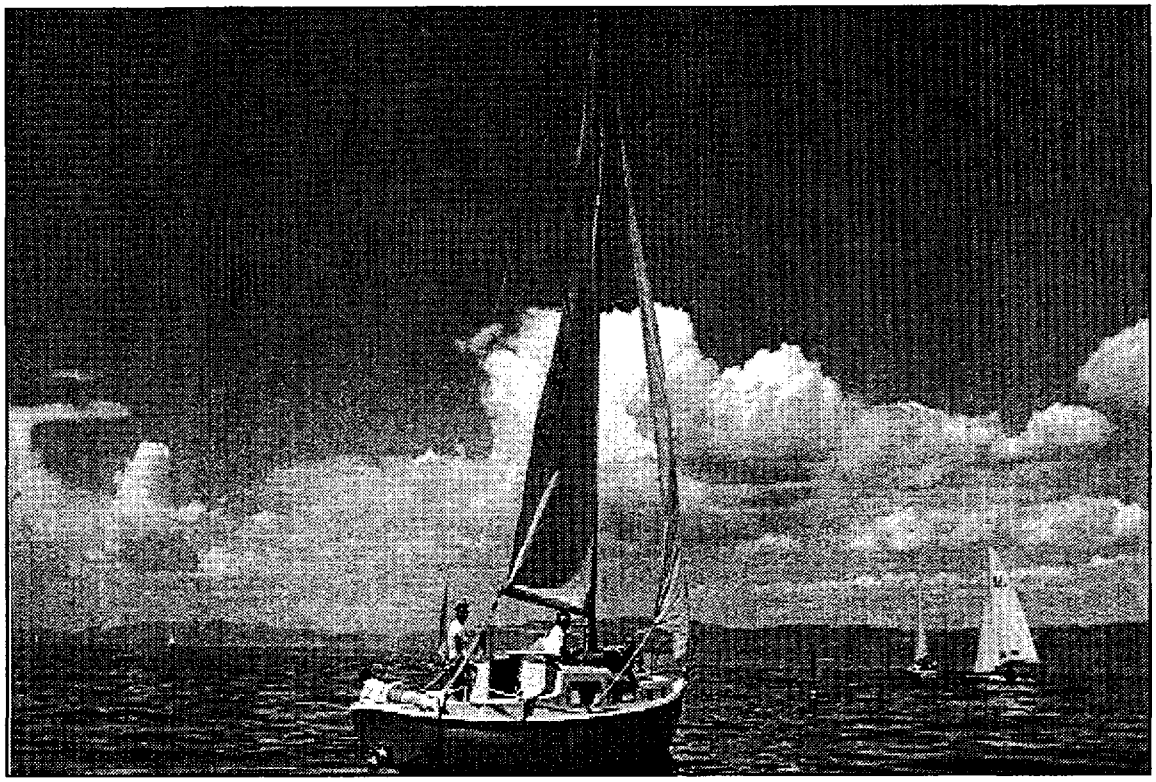
Beneficial Use Classification

This lake currently is not classified but the expected state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Fish Lake National Forest	896-4491
Richfield Ranger District	896-4491
Six-County Commissioners Association	896-9222
Division of Wildlife Resources	586-2455
Division of Water Quality	538-6146
Recreation	
Koosharem Campground, Cafe	638-7310
Monroe Hot Springs Resort	527-4014
Reservoir Administrators	
Division of Wildlife Resources	586-2455

BEAR LAKE



Introduction

Bear Lake is a large natural lake on the Utah/Idaho border. It is a popular place for all forms of water recreation. It has a small natural watershed, but water from the Bear River is diverted into the north end of the lake via a canal system through Dingle Marsh. Historically, Bear River water never entered the lake until a canal was constructed in the early 1900's. As water passes through Dingle Marsh the water quality is improved as the sediment and nutrient loads are reduced through settling and assimilation. The outlet from Bear Lake is regulated to allow for diversion of irrigation water downstream to meet agricultural and electrical generation needs. The west and south shores are primarily privately owned with summer home development, while the east shore is mostly state owned with multiple access points. Impounded water is used for irrigation and power generation, and in dry years the drawdown is such that the shoreline retreats hundreds of meters from the high water line. Water use is not expected to change significantly

Characteristics and Morphometry

Lake elevation (meters /feet)	5,924 / 1,805
Surface area (kilometers^2 / miles^2)	282 / 109
Watershed area (hectares / acres)	2,372,706 / 5,862,957
Volume (m^3 / acre-feet)	
capacity	8.01×10^9 / 6.5×10^6
conservation pool	none
Annual inflow (m^3 / acre-feet)	
tributary	3.5×10^7 / 28,000
Bear River diversion	3.75×10^8 / 304,000
Retention time (years)	19.6
Vertical fluctuation (meters / feet)	3.2 / 10.5
Depth (meters / feet)	
maximum	63 / 208
mean	28.4 / 94
Length (kilometers / miles)	29.5 / 18.3
Width (kilometers / miles)	11.3 / 7.1
Shoreline (kilometers / miles)	77.2 / 48

Location

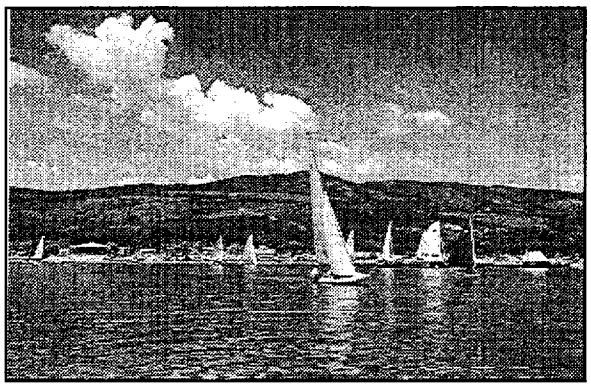
County	Rich
Longitude / Latitude	111 20 20 / 42 00 00
USGS Map	Bear Lake South, Utah 1969
DeLorme's Utah Atlas & Gazetteer™	Page 63, B-5
Cataloging Unit	Bear Lake (16010201)

in the foreseeable future.

Recreation

Bear Lake is accessible from U-30 between Lakeville and Garden City and US-89 from Garden City into Idaho. A gravel road provides access to the east shore from Laketown. The road proceeds north into Idaho and intersects with an asphalt road which circumscribes the remainder of the lake.

"On water recreation" is extensive and diversified. Both Utah and Idaho maintain state parks. Activities include sail and motor boating, water skiing, swimming, and fishing. Sailboat regattas are held periodically, averaging 50 to 100 participants per event, not to mention spectators. Plus, numerous commercial resort developments provide opportunity for "on water recreation" for their patrons. Bear Lake is one of the most attractive water playground in the intermountain area, drawing thousands yearly. In addition camping, picnicking, windsurfing, and winter sports are all popular.



There are three Utah State Parks on the lake. Bear Lake Marina is on US-89 two miles north of Garden City. Bear Lake Rendezvous Beach is on the south shore near Laketown, and Bear Lake Cisco Beach (Eastside) is 10 miles north of Laketown. The Marina is a well developed boating facility with 176 slips that can be rented by day or season, but has only 15 campsites and a small swimming area. Rendezvous Beach has 138 campsites, a mile of beach, concessionaires and small boat rentals. Cisco Beach has primitive camping, swimming, and bathroom facilities. It is much more remote than the other two. Toilets and showers are available at the Marina and Rendezvous only.

Idaho State Park is immediately north of the state line on the east side of the lake. Another Idaho State Park is located on the north end of the lake. Several private recreational areas offer boating, camping, lodging and convenience stores.

Watershed Description

Bear Lake rests in a graben valley between the Bear River Range and Lake Ridge to the west. The graben stretches from Laketown in the south to Soda Springs in the north. The lake has existed for at least 28,000 years, forming as the valley sinks faster than the surrounding hills deposit sediment into the basin.

Bear Lake's natural watershed is entirely visible from the lake. It is made up of relatively low mountains covered with sagebrush at lower elevations and southern exposures and fir-aspen forests at higher elevations and northern exposures. Vacation homes have been built along the shore since the early 1900's, and development is proliferating on hillsides away from the lake. While density is low, the piecemeal patterns of land development make watershed management difficult.

The watershed of the diverted Bear River includes drainage in eastern Utah, western Wyoming, and extreme southeastern Idaho. The headwaters are in the Hayden Peak area of the High Uintas, where barren peaks tower over lush meadows and lakes. The river flows into Wyoming, and maintains a low gradient from there to Bear Lake and eventually the Great Salt Lake. Much of the watershed in Wyoming is low hills with sagebrush vegetation. Soft shales and recent deposits erode easily, and this is compounded by overgrazing. Hence the inflow into Dingle Marsh is rich with nutrients and heavy with sediments.

The watershed high point, Lamotte Peak, is 3,060 m (10,039 ft) above sea level, thereby developing a complex slope of 1.6% to the lake. The average stream gradient of the Bear River is 1.0% (55 feet per mile) The primary inflow to Bear Lake is Bear River water, while other inflows include Big Creek, Fish Haven Creek, Indian Creek, Little Creek, Swan Creek, North Eden Canyon, South Eden Canyon, and Birch Creek. The outflow is a canal through Dingle Marsh and into the Bear River. Woodruff Narrows Reservoir is a major impoundment of the Bear River just downstream from Evanston, and there are small upstream impoundments on

Birch Creek and both Eden Creeks.

The watershed is made up of mountains, plateaus, mountain valleys, and mountain foothills. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of sage-grass, spruce-fir pine, aspen, and alpine. The watershed receives 25 - 102 cm (10 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 80 - 100 days per year.

According to the 1982 Clean Lakes Inventory, land use is as follows (from largest percentage to smallest percentage): Grazing of domestic livestock on public and private lands, multiple use public lands, haylands and irrigated croplands, recreation, and urban. The watershed headwaters are protected as part of the High Uintas Wilderness.

Limnological Assessment

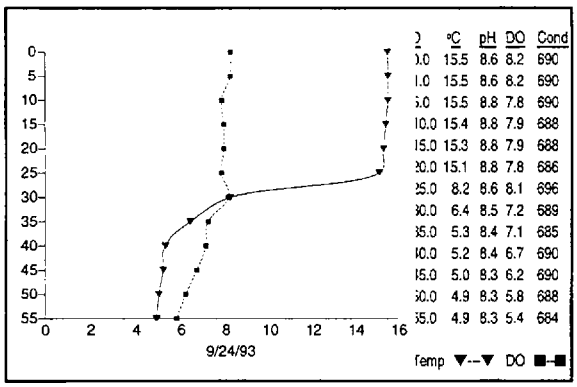
Bear Lake is noted for the very high quality of its water. DWR (1981) reported that the water was considered hard with a concentration of 268 mg/L (CaCO3). In 1975 it was surveyed as part of the USEPA National Eutrophication Survey (NES) and EPA awarded a grant to Idaho to conduct a Phase I, diagnostic/feasibility study in the early 1980's. The study was implemented by the Bear River Regional Commission. The Bear Lake ecosystem has been the focus of numerous studies in recent years. Individuals from governmental agencies, universities (Primarily Utah State University), and the private sector have expended considerable resources in an effort to understand the Bear Lake ecosystem and provide information in the protection of its water quality. The following information will be a summary of some of the data presented by Wurtsbaugh et.al. (1990), the Bear Lake Preservation Project report from Ecosystem Research Institute (ERI) (1993), and DWQ. ERI under contract with BLRC has been conducting studies for a number of years. From water quality monitoring conducted on the lake in 1991-92 they reported the following: (1) Minimum and maximum values for total phosphorus were 12-15 ug/L and 60 ug/L; (2) average values for total phosphorus and orthophosphorus were 30 ug/L and 6 ug/L; (3) average values for total phosphorus have increased from 10 ug/L (1980) to 30 ug/L (1993); (4) secchi disk transparency readings ranged from 1.8 to 12 meters (the deepest secchi disk value since 1975); and (5) the lake has changed from a phosphorus limited system (pre-1983) to a nitrogen limited system (post-1983). The report by Wurtsbaugh et.al. (1990) was based on data obtained during late 1986 and 1987. The following conclusion were extracted from their report: (1) the lake is stratified during the summer with surface temperature reaching 19 degrees C; (2) Chlorophyll-a concentrations were the highest during fall and winter mixing with a mean summer chlorophyll-a concentration of 0.5 mg/m3 indicating that Bear Lake is very oligotrophic; (3) the zooplankton assemblage was dominated by the calonoid copepod *Epischura nevadiensis* and other samll crustaceans and rotifers with a mean annual biomass of 0.42 g dry weight/m2 which is the lowest yet recorded for a temperate zone lake; (4) the benthic invertebrate community was characterized by low densities of small organisms with chironomid larvae and ostracods dominate in the littoral zone and oligochaetes dominant in the profundal areas with a whole-lake mean annual biomass of 0.34 g dry wt/m2; and (5) thirteen species of fish were captured in the lake, four of which are endemic with 99% of the fish captured as natives. As can be assumed due to the limited productivity of the lake, fish production is also limited. The Bonneville cisco (*Prosopium gemmiferum*), Bonneville whitefish (Prosopium spilonotus), Bear Lake whitefish

Limnological Data

Data sampled from STORET site: 490696, 490698, 490700, 490715, 490716, 490717 and 490718

Surface Data	1975*	1981	1993
Trophic Status	O	O	O
Chlorophyll TSI	28.41	28.65	20.86
Secchi Depth TSI	35.70	36.80	37.90
Phosphorous TSI	44.40	47.35	39.44
Average TSI	36.17	37.57	32.73
Chlorophyll a (ug/L)	0.8	-	1.2
Transparency (m)	5.4	-	5.0
Total Phosphorous (ug/L)	16.3	-	26
pH	8.8	-	-
Total Susp. Solids (mg/L)	-	-	-
Total Volatile Solids (mg/L)	-	-	-
Total Residual Solids (mg/L)	-	-	-
Temperature (°C / °f)	14/57	-	-
Conductivity (umhos.cm)	579	-	-
Water Column Data			
Ammonia (mg/L)	0.02	-	-
Nitrate/Nitrite (mg/L)	0.02	-	-
Hardness (mg/L)	-	-	-
Alkalinity (mg/L)	375	-	-
Silica (mg/L)			
Total Phosphorus (ug/L)	16	-	-
Miscellaneous Data			
DO (Mg/l) at 75% depth	-	-	-
Stratification (m)	-	-	-
Limiting Nutrient	-	-	-
Depth at Deepest Site (m)	-	43	-

* Data provided is a summary of 1975 NES.



(*Prosopium abyssicola*), and Bear Lake sculpin (*Cottus extensus*) are endemic to Bear Lake. Bear Lake cutthroat (*Oncorhynchus clarki*) and lake trout (*Salvelinus namaycush*) are managed by the Division of Wildlife Resources through a stocking program. Also found in the lake are rainbow trout (*Oncorhynchus mykiss*), brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), Utah sucker (*Catostomus ardens*), Utah chub (*Gila atraria*), carp (*Cyprinus carpio*), yellow perch (*Perca flavescens*) and redside shiner (*Richardsonius balteatus*), a native forage fish. The lake has not been chemically treated by the DWR, so the populations of endemic fishes are still present in the lake. Macrophytes typically have never been a problem at Bear Lake. However, during late summer as the lake is drawn down bull rushes and cattails can hamper shoreline usage of the lake, especially on the eastern side.

Phytoplankton in the euphotic zone collected on September 24, 1993 include the following taxa (in order of dominance):

Species	Cell Volume (mm^3/liter)	% Density By Volume
Lagerheimia ciliata	0.167	64.40
Oocystis sp.	0.083	32.20
Chlamydomonas sp.	0.004	1.72
Ankistrodesmus falcatus	0.004	1.69
Total Cell Volume	0.258	
Shannon-Weaver Index	0.79	
Evenness	0.57	
Richness	0.16	

The phytoplankton community is dominated by the presence of green algae and flagellates indicative of good water quality and low productivity.

Pollution Assessment

Nonpoint pollution sources include the following: grazing, urban runoff, agricultural runoff, feedlots, and logging (in the Uintas).

Before the Bear River was diverted into the lake, water chemistry was different. The lake was fed by clear mountain streams with a retention time of many years. Currently, large amounts of water from the Bear River are diverted into the lake with large quantities of water drained each summer. During spring runoff as the level of the lake and the water level in Dingle Marsh reach equilibrium, Utah Power and Light pumps additional water into the lake.

As summer irrigation and power demands increase water is released form the lake into the Bear River. Until the lake and canal come to equal elevations the process occurs naturally. After a state of equilibrium is reached Utah Power and Light pumps then pump water from the lake into the Bear River. Because of this type of operation there is a large fluctuation of water levels in the lake on an annual basis. Recreation activities and aesthetics are severely affected. This has become a very controversial issue in recent years. Currently, private land owners, recreationalists and downstream water uses are attempting to resolve the conflict that is present and develop a management policy that is equitable for all parties involved.

This diversion of water into Bear Lake allows for a greater input of sediments and nutrients into the lake and reduces the overall retention period of water in the lake. This has resulted in an increased productivity for the lake and increased the potential for water quality impairments for this system. Natural inflows to the reservoir have also deteriorated since the valley has been used for intensive agriculture. In addition, winter feedlots for livestock have destroyed streams that once spawning grounds for cutthroat trout.

The valley floor is composed of lake deposits in the form of layers of permeable sand and impermeable clay, which drain agricultural runoff directly into the lake rather than allow them to disperse.

There are no discharging point sources of pollution in the immediate watershed. However, there are point source discharges into the Bear River prior to its diversion into the lake. One major discharger is the Evanston Wastewater Treatment Plant in Evanston, Wyoming.

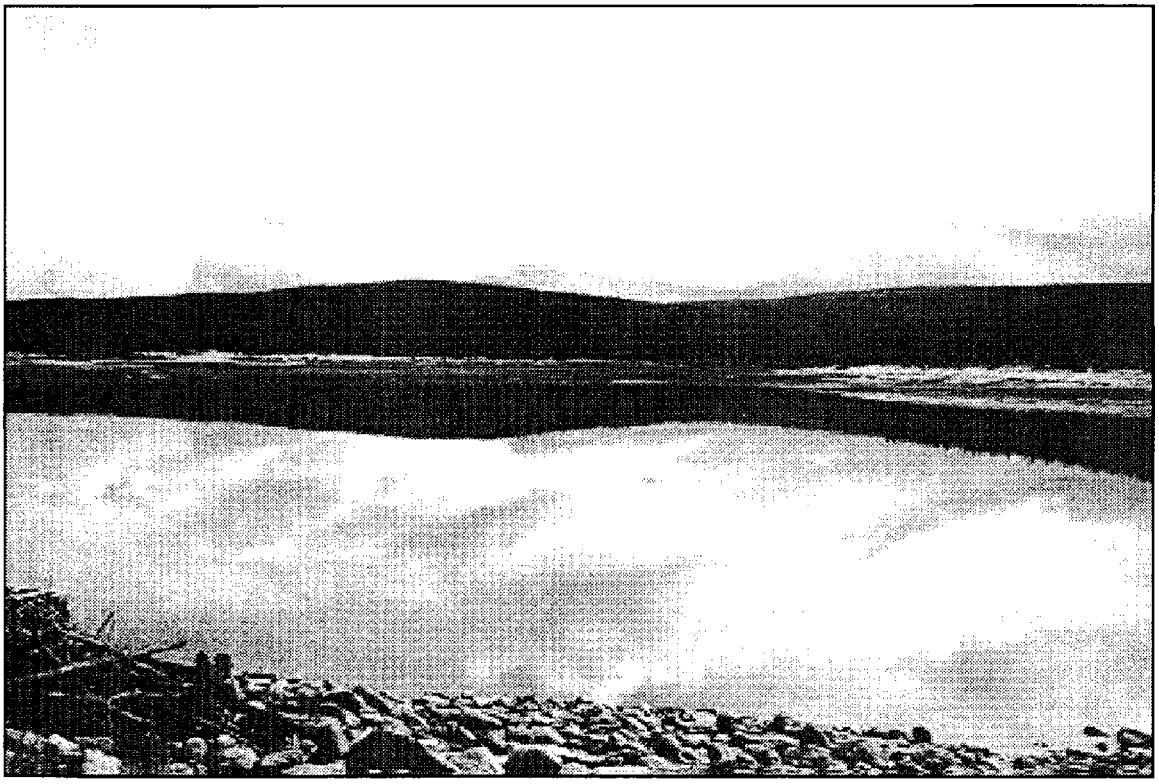
Beneficial Use Classification

The state beneficial use classifications include: swimming and similar recreation (2A), boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Bear River Association of Governments	752-7242
Division of Wildlife Resources	479-5143
Division of Water Quality	538-6146
Recreation	
Bear Lake Regional Commission	(208) 945-2333
Bridgerland Travel Region (Vernal)	752-2161
Garden City Chamber of Commerce	946-2901
Bear Lake State Park	946-3343
Ideal Beach (resort)	946-8735
The East Shore	**946-3208**
Rendezvous Beach	**946-3208**
KOA	**9463454**
Reservoir Administrators	
Bear River Water Conservancy District	723-7034

BEAVER MEADOW RESERVOIR



Introduction

Beaver Meadows Reservoir is an intermediate size reservoir on the north slope of the Uintas. It has a small, natural watershed and provides limited summer recreational opportunities.

Beaver Meadows Reservoir was created in 1949 by the construction of an earth-fill dam. The dam was modified in 1985 to increase storage capacity. The reservoir shoreline is owned by the Wasatch National Forest, and public access is unrestricted. Reservoir water is used primarily for agriculture. Water is used to irrigate approximately 2035 acres of cropland and some stock watering. The reservoir receives water primarily from two perennial springs with a combined flow of approximately 2.5 cfs and spring runoff from the upstream watershed. There is no conservation pool for the reservoir and the water level may be drawn completely down by the end of the irrigation season. Water use is not expected to change in the foreseeable future.

Characteristics and Morphometry

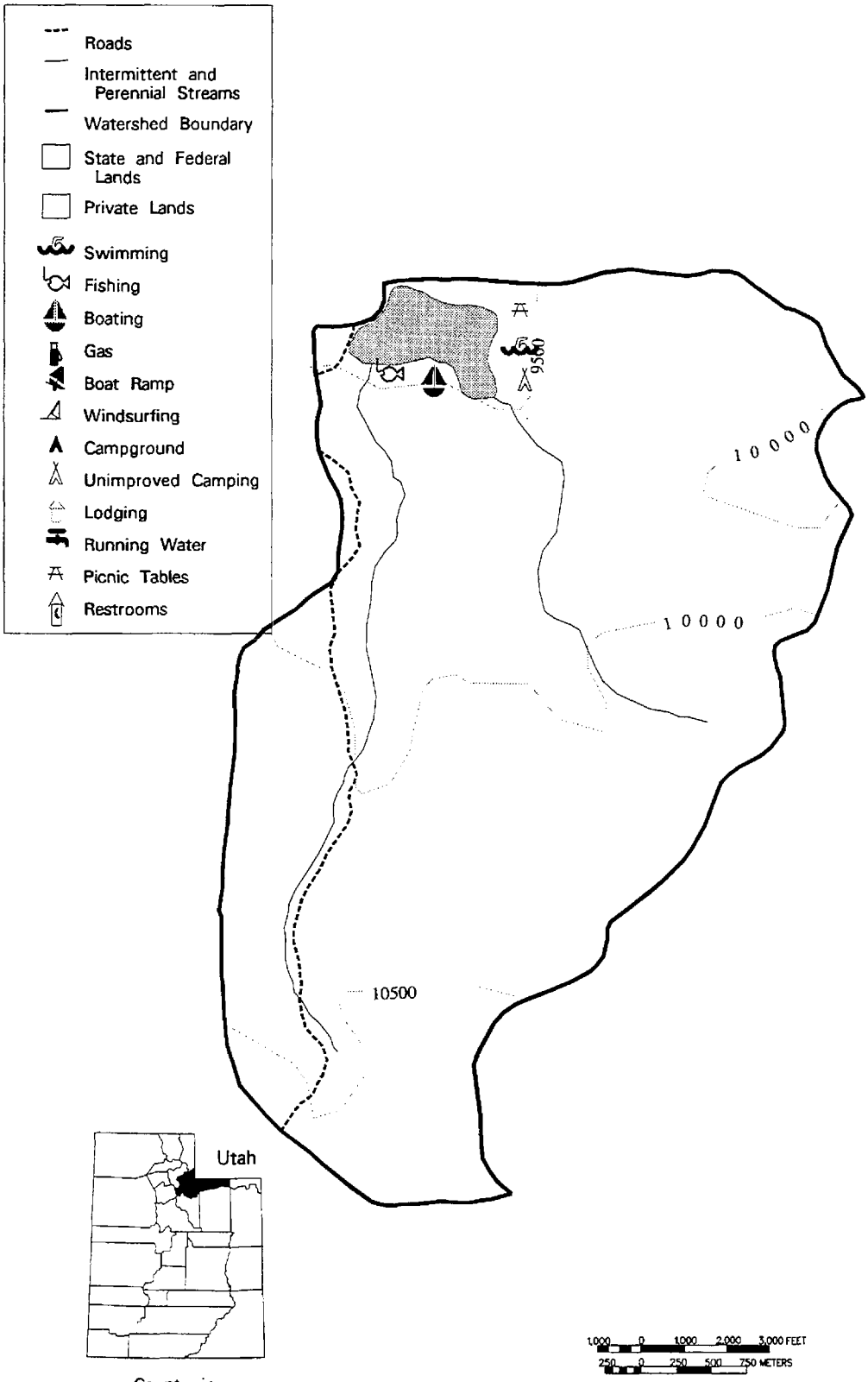
Lake elevation (meters / feet)	2,861 / 9,385
Surface area (hectares / acres)	49.4 / 122
Watershed area (hectares / acres)	2,807 / 6,935
Volume (m^3 / acre-feet)	
capacity	2,657,115 / 2,155
conservation pool	0 / 0
Annual inflow (m^3 / acre-feet)	9,864,000 / 8,000
Retention time (years)	<1
Drawdown (m^3 / acre-feet)	2,657,115 / 2155
Depth (meters / feet)	
maximum	11.1 / 37
mean	5.3 / 17.7
Length (meters / feet)	480 / 1,600
Width (meters / feet)	210 / 700
Shoreline (meters / feet)	1530 / 5100

-Location

County	Summit
Longitude / Latitude	110 03 7 / 40 54 3
USGS Map	Hoop Lake, UT/WY, 1967
DeLorme's Utah Atlas & Gazetteer™	Page 56, A-1
Cataloging Unit	Upper Green-Flaming Gorge (14040106)

Recreation

Beaver Meadow Reservoir is easily accessible from US-43 south via gravel road from McKinnon, Wyoming.



County in which watershed is located.

Beaver Meadows Watershed

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Travel due south on a county road from McKinnon approximately 7 miles to the Wasatch National Forest. This road becomes FS-221. Continue south for 2 more miles and turn right on FS-058. Proceed west for approximately 4.5 miles to the reservoir. An alternate route would be to continue on FS-058 past Hoop Lake to Beaver Meadow Reservoir (approximately 5 miles).

Hunting, boating, swimming, camping, picnicking, and hiking are all popular. Although DWR currently does not manage the reservoir for a fishery, fishing does occur. There are reports that a fishery is present which may consist of native species from limited introductions in the past. While there are no boatramps, it is generally possible to get a small boat on the reservoir.

There are no recreational facilities at the reservoir however, the area is popular for primitive camping around the reservoir. There are improved camping areas in the area.

Watershed Description

Beaver Meadow Reservoir is located on the northern slope of the High Uintas. The watershed consists entirely of alpine meadows, coniferous forests and alpine tundra. The watershed area extends approximately 6 miles to the south up steep and moderately steep terrain climbing nearly 3,000 vertical feet. The slopes surrounding the reservoir are not particularly steep (<15%). The reservoir is an impoundment of a meadow on Lost Creek a tributary to Burnt Fork Creek.

The watershed high point, an unnamed peak six miles south, is 3,672 m (12,240 ft) above sea level, thereby developing a complex slope of 9% to the reservoir. The average stream gradient of Lost Creek is 6.1% (322 feet per mile) The inflow and outflow is Lost Creek. There are also two unnamed streams a two springs flowing into the reservoir. The springs according to the irrigation company, who manages the water, have a combined flow of 2.5 cfs.

The watershed is made up of high mountains and mountains meadows. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of spruce-fir, oak, maple, pine, aspen and grassy meadows. The watershed receives 64 - 76 cm (25 - 30 inches) of precipitation annually. The frost-free season around the reservoir is 0 - 20 days per year.

Land use in the watershed is 100% multiple use, with grazing, timber harvest and recreation being the primary uses. There are active or proposed timber sales in the area.

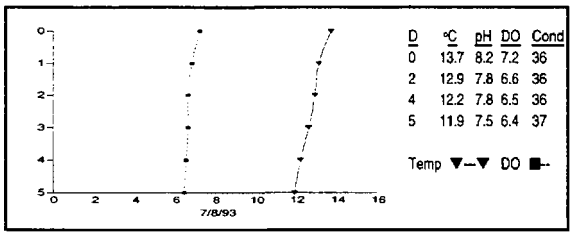
Limnological Assessment

The water quality of Beaver Meadow Reservoir is very good. It is considered to be very soft with a hardness concentration range of 12-16 mg/L ($CaCO_3$). Although the data is limited, currently no none of the parameters monitored have exceeded State water quality standards for defined beneficial uses. The data available indicates that the reservoir is a nitrogen limited system with low productivity. Overall it appears that the reservoir is mesotrophic. It appears that the transparency may be artificially high from turbidity due to the shallow nature of the reservoir. As additional data is obtained, a better understanding of the trophic state of the reservoir will be established. In addition the reservoir because of its shallow

Limnological Data

Data sampled from STORET site: 593833

Surface Data	1981	1993
Trophic Status	-	M
Chlorophyll TSI	-	30.60
Secchi Depth TSI	-	62.34
Phosphorous TSI	-	45.00
Average TSI	-	45.98
Chlorophyll a (ug/L)	-	1
Transparency (m)	-	0.85
Total Phosphorous (ug/L)	-	17
pH	-	8.5
Total Susp. Solids (mg/L)	-	<3
Total Volatile Solids (mg/L)	-	<3
Total Residual Solids (mg/L)	-	<3
Temperature (°C / °f)	-	11/52
Conductivity (umhos.cm)	-	36.5
Water Column Data		
Ammonia (mg/L)	-	0.03
Nitrate/Nitrite (mg/L)	-	0.0186
Hardness (mg/L)	-	12.15
Alkalinity (mg/L)	-	12.0
Silica (mg/L)	-	-
Total Phosphorous (ug/L)	-	23
Miscellaneous Data		
DO (Mg/l) at 75% depth	-	6.5
Stratification (m)	-	N
Limiting Nutrient	-	N
Depth at Deepest Site (m)	-	5



nature probably does not develop a strong thermocline indicative of a stratified reservoir.

Currently DWR maintains no stocked fishery in the reservoir. The reservoir has not been chemically treated by the DWR, so populations of native fishes may be present in the lake. There are reported populations of fish present.

Phytoplankton data obtained on September 16, 1993 include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Quadrigula lacustris	1.112	75.74
Euastrum sp.	0.311	21.21
Pennate diatoms	0.031	2.12
Ankistrodesmus falcatus	0.009	0.59
Ankyra judayi	0.003	0.19
Chlamydomonas sp.	0.002	0.15
Total Cell Volume	1.468	
Shannon-Weaver Index	0.67	
Evenness	0.38	
Richness	0.25	

The phytoplankton community is dominated by the presence of green algae and diatoms indicative of fairly good water quality with low to moderate productivity.

Pollution Assessment

Nonpoint pollution sources include the following: Sedimentation and nutrient loading from grazing and other activities; litter, human waste and chemicals from recreation; and grazing throughout the watershed and in the vicinity of the reservoir.

There are no point sources of pollution in the watershed.

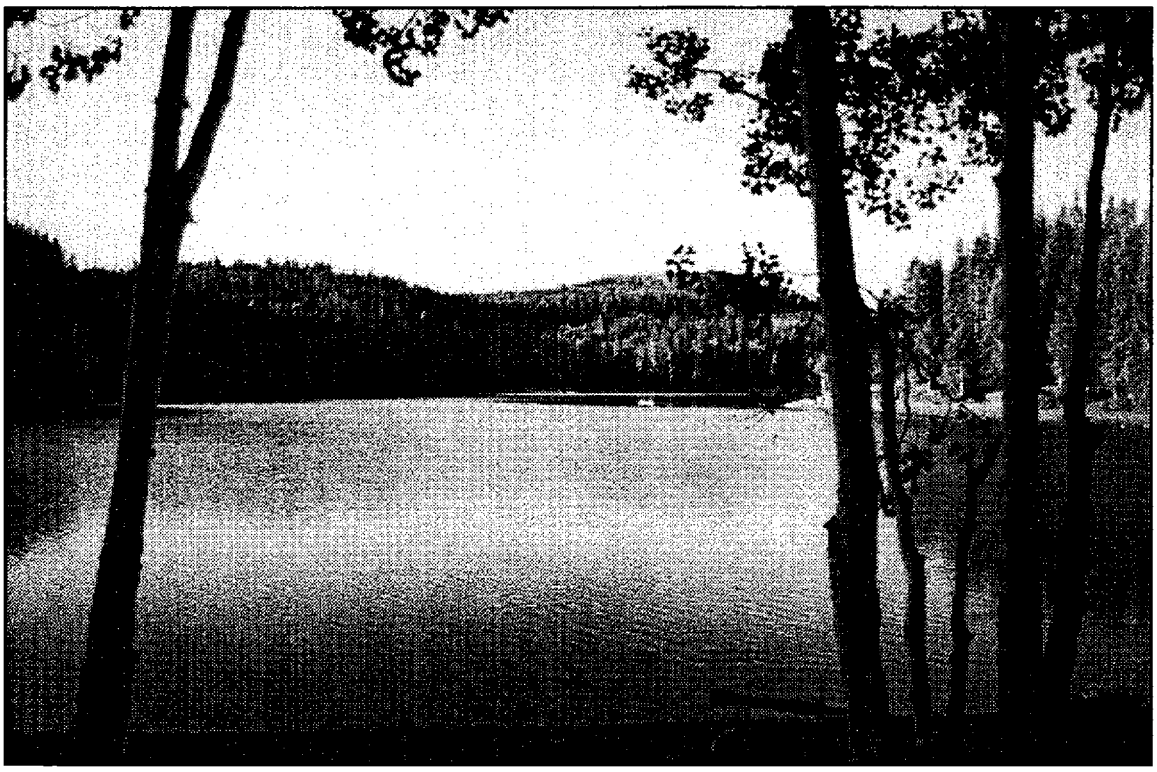
Beneficial Use Assessment

The reservoir is not currently classified by the State but it is being proposed that the following protection classes be implemented: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Wasatch National Forest	524-5030
Mountain View Ranger District	(307) 782-6555
Recreation	
Dinosaurland Travel Region (Vernal)	789-6932
Vernal Chamber of Commerce	789-1352
Reservoir Administrators	
Division of Wildlife Resources	538-4700
Interstate Irrigation and Res Co.	(307) 784-3281

BIG EAST LAKE



Introduction

Big East Lake is south of Utah Valley, between Loafer Mountain and Mount Nebo. It is the largest of the Payson Lakes, a group of about a half-dozen lakes in the Payson Canyon drainage. Some, including Big East, have been regulated with dams so their water can be used for agricultural purposes. The area is a popular summer recreational area for residents of Utah Valley, as it is close to the cities, with a cool, pleasant climate. This particular lake has a large, staffed campground and other developed facilities. The lake was enlarged with the construction of an earth-fill dam in 1898. The shoreline is 100% owned by the Uinta National Forest. Public accessibility is unrestricted. Water is consumed for irrigation, but also used for coldwater aquatic habitat and recreation. No changes in water use are expected.

Characteristics and Morphometry

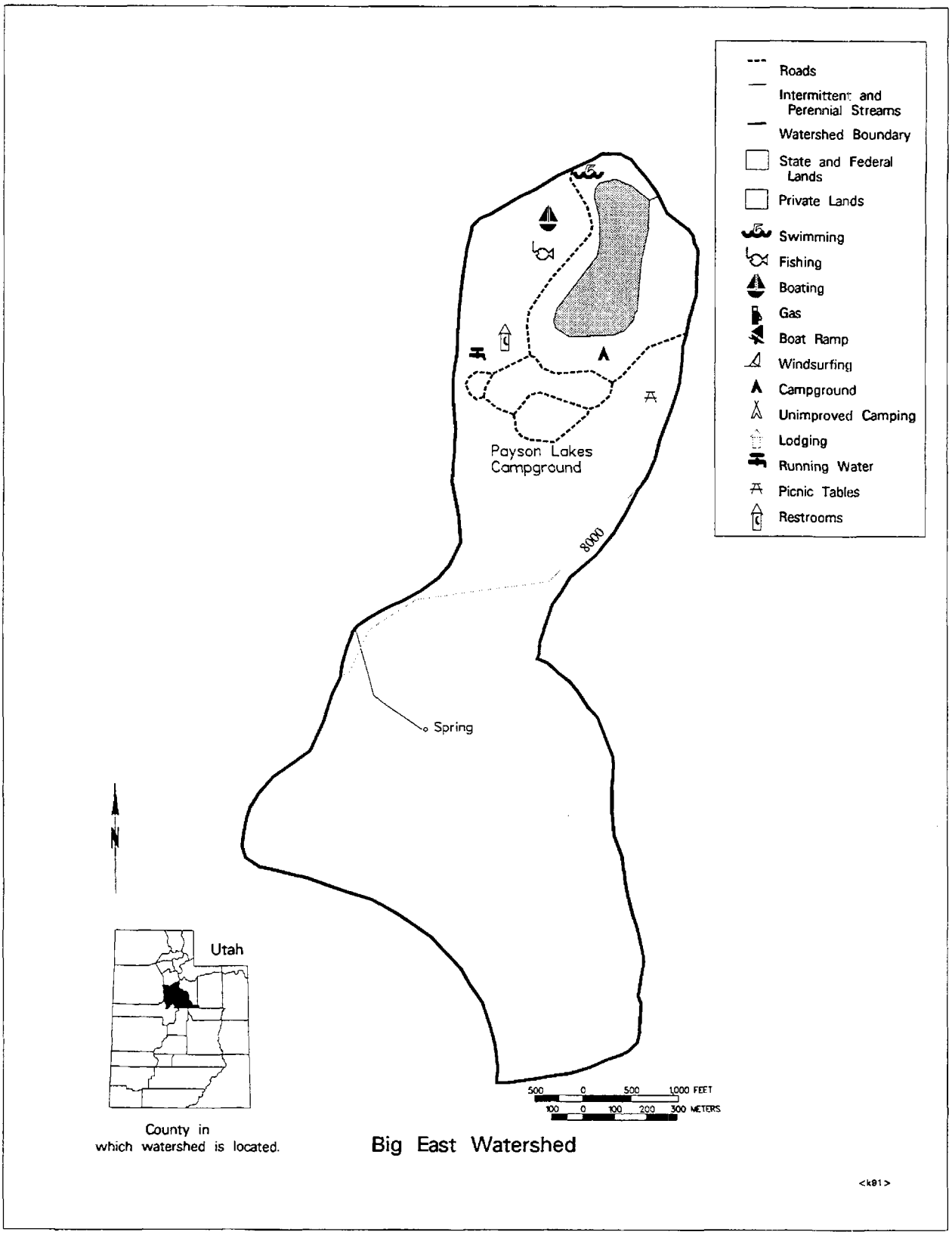
Lake elevation (meters / feet)	2,399 / 7,870
Surface area (hectares / acres)	9.3 / 23
Watershed area (hectares / acres)	
Volume (m^3 / acre-feet)	
capacity	826,446 m^3 / 670
conservation pool	1.604 x 10^6 / 1,300
Annual inflow (m^3 / acre-feet)	not measured
Retention time (years)	<1
Drawdown (m^3 / acre-feet)	not measured
Depth (meters / feet)	
maximum	
mean	8.8 m /29
Length (meters / feet)	515 / 1690
Width (meters / feet)	257 / 845
Shoreline (km / feet)	1.25 / 4,092

Location

County	Utah
Longitude / Latitude	111 38 21 / 39 56 05
USGS Map	Payson Lakes, 1979
DeLorme's Utah Atlas & Gazetteer™	Page 45, B-6
Cataloging Unit	Utah Lake (16020202)

Recreation

Big East Lake is accessible from the Nebo Loop Road,


Roads
Intermittent and Perennial Streams
Watershed Boundary
State and Federal Lands
Private Lands
Swimming
Fishing
Boating
Gas
Boat Ramp
Windsurfing
Campground
Unimproved Camping
Lodging
Running Water
Picnic Tables
Restrooms
Payson Lakes Campground
8000
Spring
N
Utah
County in which watershed is located.
500 0 500 1,000 FEET
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Big East Watershed
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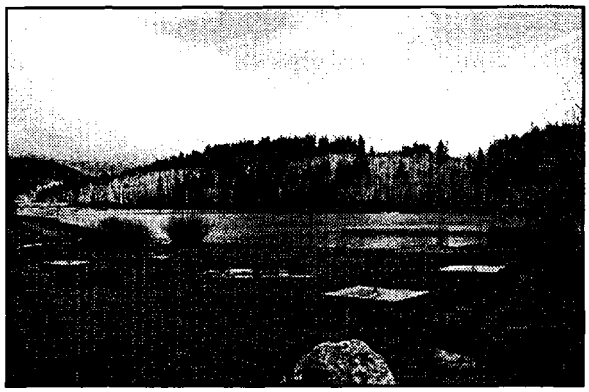


a paved Forest Service road. Exit I-15 in Payson (exit 154), go south to US-6, then east on 6 for about .5 miles to the Nebo Loop Road (there is a small sign). (There is an old brick school on a hill surrounded by large trees at the intersection.) Travel on the Nebo Loop Road for about 10 miles up Payson (Peteetneet) Canyon to the Payson Lakes Campground and Big East Lake. Parking areas are well marked. There is a walking path around the lake with commanding views of the surrounding.

Recreational facilities are well developed at the lake,

and include lawns, flush toilets, and picnic areas. The water is generally cold for swimming. It is possible to get small boats on the lake, but motors are prohibited. Grazing cattle provide some hinderance to recreation, although this area is not nearly as heavily grazed as other areas in the Payson Lakes/Nebo Wilderness area. The road is not plowed during the winter, but is groomed for snowmobiles and cross-country skiers.

The nearby campground has over 70 sites, but it is usually full during summer weekends. Fees are charged ($7) for camping, and the entrance gate is locked at 10:00 pm. Campsites can be reserved through Mistix.

There are complete services and a private campground in Payson (see Info Box), and several other USFS campgrounds in Payson Canyon. Camping outside the lake campgrounds is permitted with several overflow areas close to the area.

Watershed Description

The lake has a very small watershed (500 acres), which, except for the diversion canal, is unmodified by direct human activity, but the vegetation communities have been greatly modified by the grazing of cattle. The watershed is primarily a spruce-fir forest with a few meadows. Bark beetles have killed many individual trees within the watershed.

The watershed high point, a point on the Nebo Loop Road 1.5 miles south of the lake, is 2,566 m (8,420 feet) above mean sea level, creating a complex slope of 6.8% to the lake. The inflow is a spring-fed diversion from Jones Ranch Creek. The outflow is a short, unnamed creek that joins Wimmer Ranch Creek. The average stream gradient above the lake (including the canal) is 3.4% (179 feet per mile).

The watershed is composed of gentle mountains. The soil is derived from fairly soft, recent (Oligocene) strata, leaving few rocky outcroppings. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of aspen, oak, meadow grass and spruce-fir. The watershed receives 51 - 64 cm (20 - 25 inches) of precipitation annually. The frost-free season around the reservoir is 60 - 100 days per year.

Land use in the watershed is 30% intensive recreation and 70% multiple use.

Limnological Assessment

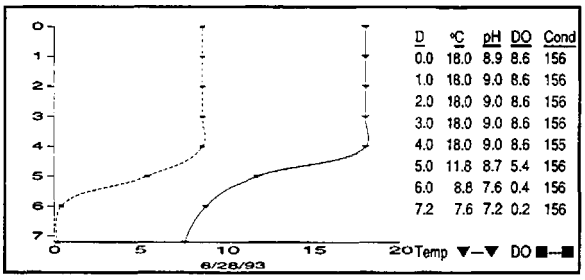
The water quality of Big East Reservoir (Payson Lake) is good. It is considered soft with a hardness concentration of approximately 69 mg/L. The water quality constituents analyzed that exceeded established State water quality standards for the reservoir were phosphorus, temperature, dissolved oxygen, and iron. The average concentration of total phosphorus in the water column during the productivity season exceeded the recommended level of 0.025 mg/L for all three study periods. Although the concentration at the surface 20, 34 and 26 ug/L averages just over the recommended level the concentration throughout the water column was well over the limit with an average of 47 ug/L. Temperature values are within the limits for a cold water fishery early in the year but late in the summer season temperatures throughout the water column rise to near the threshold value of 20 C° in the lake profiles for late summer. Dissolved oxygen concentrations declines in the water column to a point that exerts a stress on the fishery as indicated in the June 28, 1993 profile. The only other

Limnological Data

Data sampled from STORET site: 591791

Surface Data	1980	1989	1991
Trophic Status	E	E	M
Chlorophyll TSI	-	54.17	44.79
Secchi Depth TSI	50.77	48.31	49.31
Phosphorous TSI	59.8	54.79	50.84
Average TSI	55.28	52.42	48.32
Chlorophyll a (ug/L)	-	11.05	4.25
Transparency (m)	1.9	2.25	2.1
Total Phosphorous (ug/L)	20	34	26
pH	8.5	8.8	8.5
Total Susp. Solids (mg/L)	5	-	3
Total Volatile Solids (mg/L)	-	-	4
Total Residual Solids (mg/L)	-	-	1.5
Temperature (°C / °f)	14/58	18/64	19/67
Conductivity (umhos.cm)	150	179	143
Water Column Data			
Ammonia (mg/L)	0.05	0.06	0.28
Nitrate/Nitrite (mg/L)	0.08	-	0.05
Hardness (mg/L)	70	-	67
Alkalinity (mg/L)	75	-	72.5
Silica (mg/L)	-	-	22.3
Total Phosphorus (ug/L)	30	43	69
Miscellaneous Data			
DO (Mg/l) at 75% depth	4.9	8.3	4.8
Stratification (m)	2-4	NO	NO
Limiting Nutrient	N	N	N
Depth at Deepest Site (m)	6	5.0	5.0

constituents that violates standards is iron. Of five samples obtained only once did iron exceed the standard (1000 ug/L). It appears that the major water quality problem is the elevated levels of nutrients which lead to overproduction and a loss of dissolved oxygen due in part to the decomposition of organic matter from the increased algal production. Due to relatively low nitrogen/phosphorus rations the reservoir is classified as a nitrogen limited system. In 1981 and 1989 the reservoir was classified as an eutrophic reservoir. However, the data obtained in 1991 supports a mesotrophic classification. The reservoir has declined from a TSI index value of 55.28 (1981) to 48.41 (1991). This suggest that water quality is improving, but additional monitoring will be need to verify the trend. The reservoir was stratified in 1981 and stratification was evident in 1991 and 1993. Typically, macrophytes have posed no problems at Big East Lake.



The DWR stocks the pond annually with 8,000 catchable rainbow trout (*Oncorhynchus mykiss*) in the spring and 4,000 in the fall. Fingerling brook trout (*Salvelinus fontinalis*) are occasionally planted (5,000 in 1989 and 1991). The lake was chemically treated by the DWR in 1957, so populations of native fishes may not be present.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm³/liter)	% Density By Volume
Gloeotrichia echinulata	889.600	98.30
Sphaerocystis schroeteri	7.923	0.88
Ceratium hirundinella	5.618	0.62
Anabaena flos-aquae	0.845	0.09
Aphanizomenon flos-aquae	0.634	0.07
Pandorina morum	0.222	0.02
Ankistrodesmus falcatus	0.070	0.01
Chroococcus dispersus	0.056	0.01
Asterionella formosa	0.028	0.00
Pennate diatoms	0.013	0.00
Centric diatoms	0.010	0.00
Unknown chrysophyte	0.005	0.00
Melosira granulata angustissima	0.003	0.00
Total	903.497	

Shannon-Weaver [H']	0.11
Species Evenness	0.04
Species Richness	0.44

The phytoplankton is dominated by the blue-green algae, *Gloeotrichia echinulata*. These types of algae are more indicative of eutrophic conditions.

Pollution Assessment

Nonpoint pollution sources include the following: Human waste, litter and chemicals from recreation, and sedimentation, nutrient loading and pathogens from grazing.

There are no point sources of pollution in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

The Payson City Corporation controls the water rights and uses the water for primarily for irrigation purposes.

Information

Management Agencies	
Mountainlands Association of Governments	377-2262
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Payson City Corporation	
Recreation	
Mountainland Travel Region (Vernal)	377-2262
Payson Chamber of Commerce	465-9288
Spanish Fork Chamber of Commerce	798-8352
L&J RV Park (Payson)	465-4761
Mistix	1-800-283-2267

BIG LAKE

Introduction

Big Lake is southeast of Richfield on the Sevier Plateau. It is located in a remote, high elevation forest in a little-known part of the state. The area is popular for camping, hunting hiking and fishing. There are several other small lakes in the area.

Big Lake is a small, shallow natural lake in a high meadow. An earth-fill dam was built in 1979 to control water levels. The reservoir shoreline is publicly owned and administered by the Fish Lake National Forest with unrestricted public access. Defined beneficial uses include: water recreation excluding swimming, propagation of cold water species of game fish and aquatic life, and agricultural needs.

Characteristics and Morphometry

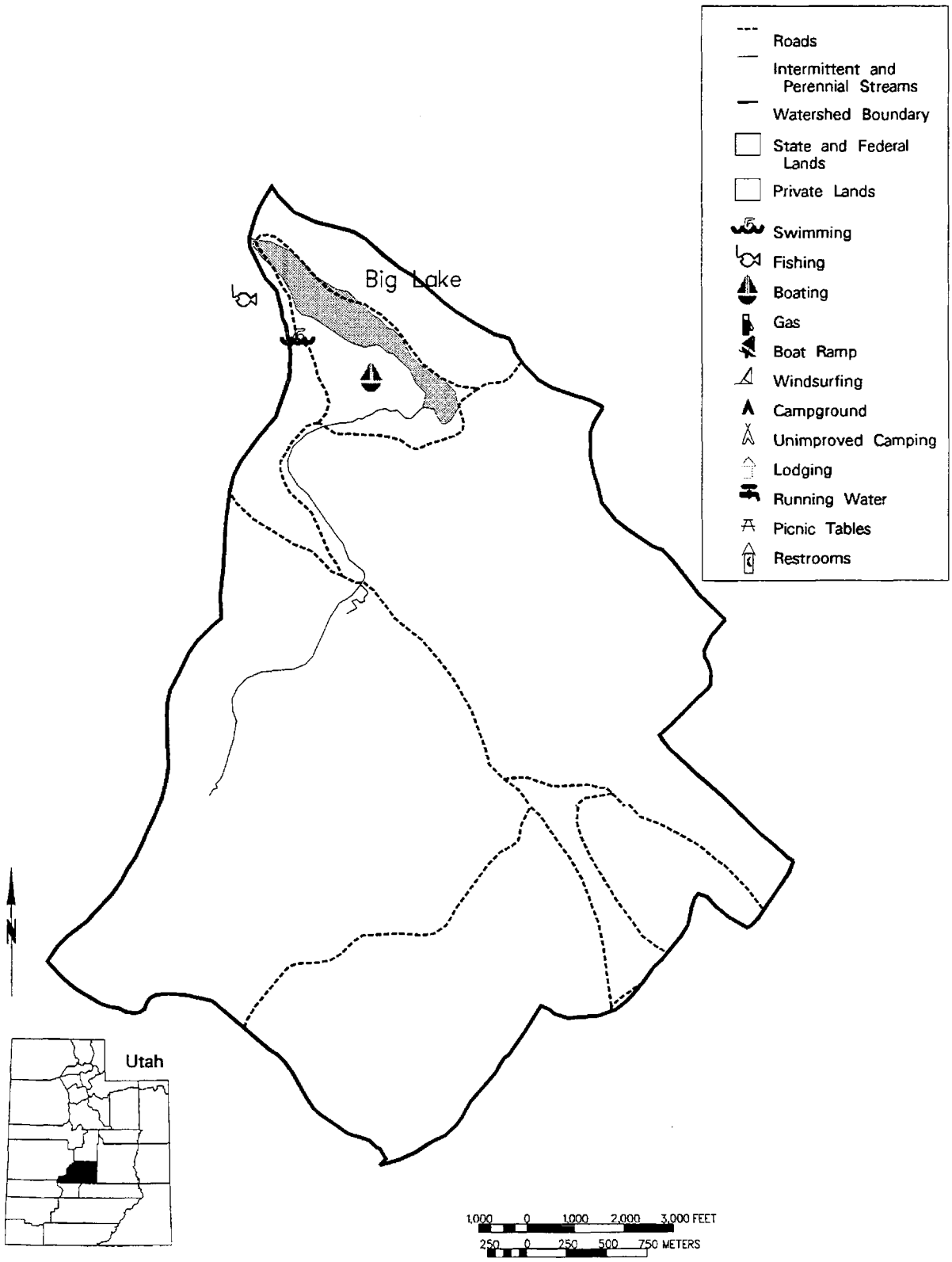
Lake elevation (meters / feet)	2,845 / 9,331
Surface area (hectares / acres)	45 / 123
Watershed area (hectares / acres)	1,334 / 3,296
Volume (m^3 / acre-feet)	
capacity	1.2×10^6 / 950 + cons. pool
conservation pool	65 surface acres
Annual inflow (m^3 / acre-feet)	unknown
Retention time (years)	unknown
Drawdown (m^3 / acre-feet)	3 / 10
Depth (meters / feet)	unknown (10 feet + cons. pool)
Length (meters / feet)	1,650 / 5,400
Width (meters / feet)	470 / 1,530
Shoreline (km / miles)	4.1 / 2.6

Location

County	Sevier
Longitude / Latitude	111 58 00 / 38 39 30
USGS Map	Water Creek Canyon, Utah, 1968
DeLormes Utah Atlas and Gazetteer™	Page 37, D-4 - D-5
Cataloging Unit	Sevier River (16030002)

Recreation

There are several other lakes of this name found in Utah, including one on the Aquarius Plateau one on Thousand Lake Mountain, and at least one in the Uintas, as well as Big East Lake in Payson Canyon. Big Lake is accessible from FS-068, the road between Annabella and Glenwood. From Annabella, head due east out of town (the



County in which watershed is located.

Big Lake Watershed

<k118>

road is unpaved) for 5 miles to a road on the right, which becomes FS-068 and goes to Big Lake. From Glenwood, go east out of downtown on the paved road, which bends south, turns to gravel, and reaches the junction with FS-068 after about 4 miles. Travel on FS-068 for about 9 miles to Big Lake, which is on the north side of the road. Good maps are recommended.

Fishing, boating, and camping are possible in the area. Usage is light.

There are no recreational facilities at the reservoir, although the area offers itself to primitive camping. If you camp, remember to haul out all of your garbage. There are no Forest Service Campgrounds in the area, and the nearest private campground is in Richfield.

Watershed Description

The reservoir is in an area of high, rolling ridges and valleys characteristic of the top of the Sevier Plateau. The area is not densely forested, but has good timber growing on north-facing slopes. The area immediately around the reservoir has sage-grass vegetation with some dense forest nearby. The lake is drawn down in the summer, but a large, shallow pool remains intact.

The watershed high point, Glenwood Mountain, is 3,338 m (10,954 ft) above sea level, thereby developing a complex slope of 11.4% to the reservoir. The inflow and outflow is Water Canyon Creek, and the average stream gradient above the reservoir is 5.5% (290 feet per mile).

The soil is largely of volcanic origin with moderate permeability and moderately slow erosion and runoff.

The vegetation communities are comprised of sage-grass, pine, aspen, spruce-fir, oak and maple. The watershed receives 51 - 76 cm (20 - 30 inches) of precipitation annually with a frost-free season of 60 - 80 days at the reservoir.

Land use in the watershed is almost 100% multiple use on national forest land, with Section 17 north of Red Pine Ridge being privately owned rangeland.

Limnological Assessment

The water quality of Big Lake is good. The water is considered soft with a total hardness concentration of 23 mg/L. The only parameter that exceeds State standards is phosphorus. Total inorganic nitrogen concentration are below the minimum detectable limits giving nitrogen/phosphorus ratios indicative of a nitrogen limited system. The reservoir is classified as hypereutrophic with an average TSI value of 64.03. The TSI evaluation for transparency is misleading since the index is not representative of a true secchi depth, but represents the maximum depth of the reservoir during the sampling period. The reservoir was monitored for the first time in 1992 during drought conditions. Under these circumstances very little water was in the reservoir during the year. For a complete understanding of the reservoir limnology and the water quality conditions of the reservoir addition monitoring will need to be conducted before a proper evaluation can be determined. No profile data is included due to the lack of depth during sampling. According to DWR the reservoir has critical anoxic conditions during the winter due to oxygen demand, low water and an extended winter period.

Limnological Data

Data sampled from STORET site: 594461

Surface Data	1992
Trophic Status	H
Chlorophyll TSI	55.30
Secchi Depth TSI	65.14
Phosphorous TSI	66.97
Average TSI	62.47
Chlorophyll a (ug/L)	12.4
Transparency (m)	0.7
Total Phosphorous (ug/L)	78
pH	8.6
Total Susp. Solids (mg/L)	3.5
Total Volatile Solids (mg/L)	2
Total Residual Solids (mg/L)	2
Temperature (°C / °f)	17/63
Conductivity (umhos.cm)	34
Water Column Data	
Ammonia (mg/L)	0.03
Nitrate/Nitrite (mg/L)	0.01
Hardness (mg/L)	22.6
Alkalinity (mg/L)	25
Silica (mg/L)	0.5
Total Phosphorous (ug/L)	78
Miscellaneous Data	
DO (Mg/l) at 75% depth	8.4
Stratification (m)	NO
Limiting Nutrient	N
Depth at Deepest Site (m)	0.6

It appears that the DWR stock Big Lake with 5000 catchable rainbow trout (*Oncorhynchus mykiss*) annually. The lake has not been treated by the DWR for rough fish control, so native fish populations may still be present.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Aphanocapsa pulchra	500.400	40.25

Anabaena spiroides var. *crassa*	442.353	35.58
Gloeotrichia echinulata	278.000	22.36
Aphanizomenon flos-aquae	12.994	1.05
Sphaerocystis schroeteri	5.282	0.42
Botryococcus braunii	2.224	0.18
Anabaena sp.	0.556	0.04
Coelastrum sp.	0.556	0.04
Staurastrum sp.	0.500	0.04
Cosmarium sp.	0.156	0.01
Euglena sp.	0.041	0.00
Pennate diatoms	0.031	0.00
Ankistrodesmus falcatus	0.013	0.00
Scenedesmus bijuga	0.011	0.00
Oocystis sp.	0.008	0.00
Centric diatoms	0.007	0.00
Oscillatoria sp.	0.006	0.00
Merismopedia tenuissima	0.005	0.00
Ankyra judayi	0.003	0.00
Total	1,242.587	
Shannon-Weaver [H']	1.16	
Species Evenness	0.40	
Species Richness	.65	

It appears that the lake is dominated by blue-green algal species. The four leading species are all blue-greens and comprise 99.2% of the density by volume.

Pollution Assessment

The only nonpoint source of pollution in Big Lake is sedimentation and nutrient loading and potential pathogens from grazing in the watershed and the immediate vicinity of the reservoir.

There are no point pollution sources in the watershed.

Beneficial Use Classification

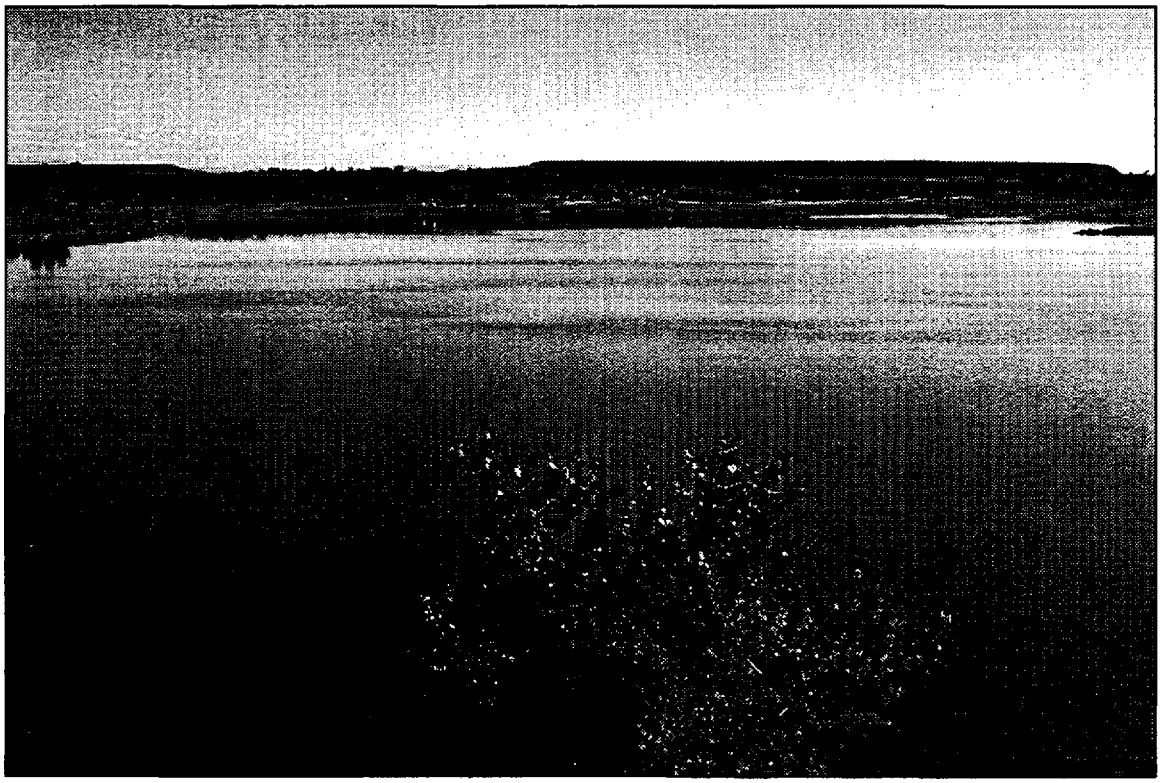
The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Water quality is sufficient to sustain current water use.

Information

Management Agencies	
Fish Lake National Forest	896-4491
Richfield Ranger District	896-4491
Six County AOG	896-9222
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Richfield KOA	896-6674
Reservoir Administrators	
Big Lake Irrigation Company	896-6596

BIG SAND WASH RESERVOIR



Introduction

Big Sand Wash Reservoir is in the Uinta Basin north of Duchesne and Roosevelt. It is a large reservoir and is popular for water recreation. It is located on a terrace along the Lake Fork River, receiving river water via canal.

Big Sand Wash Reservoir was created in 1965 by the construction of an earth-fill dam. The reservoir shoreline is 98% privately owned, with the state owning a small segment of shoreline at the boat ramp. Public access is unrestricted. Water is consumed for irrigation, but also used for recreation and coldwater aquatic habitat. Changes in water use are unlikely. However, some adjustments may be required if the reservoir is enlarged as planned under the Central Utah Project. The reservoir is also noteworthy for a large fleet of inoperative 1957 Chevrolets parked nearby.

Characteristics and Morphometry

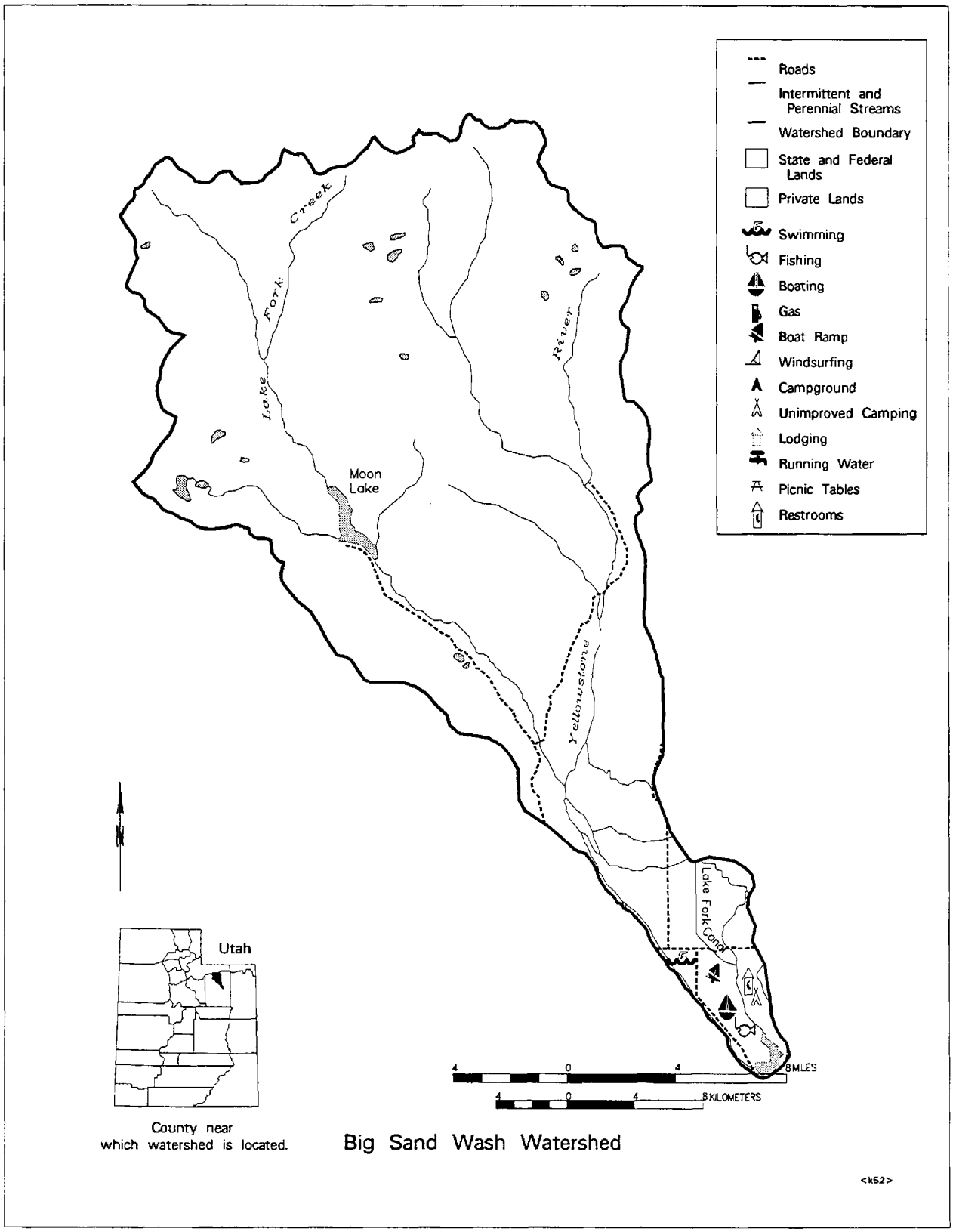
Lake elevation (meters / feet)	1,794 / 5,885
Surface area (hectares / acres	158 / 390
Watershed area (hectares / acres)	34,256 / 83,647
Volume (m^3 / acre-feet)	
capacity	1.49×10^7 / 12,100
conservation pool	1.48×10^6 / 1,200
Annual inflow (m^3 / acre-feet)	11,481,418 / 9,308
Retention time (years)	1.3
Mean annual vertical fluctuation (meters / feet)	14/ 46
Depth (meters / feet)	
maximum	31 / 102
mean	4.6 / 31
Length (meters / feet)	2,900 / 9,500
Width (meters / feet)	1,200 / 3,900
Shoreline (km / miles)	10.4 / 6.5

Location

County	Duchesne
Longitude / Latitude	110 13 17 / 40 18 02
USGS Map	Bluebell, 1965
DeLorme's Utah Atlas & Gazetteer™	Page 55, D-6
Cataloging Unit	Duchesne (4060003)

Recreation

Big Sand Wash Reservoir is located on U-87 one mile


Roads
Intermittent and Perennial Streams
Watershed Boundary
State and Federal Lands
Private Lands
Swimming
Fishing
Boating
Gas
Boat Ramp
Windsurfing
Campground
Unimproved Camping
Lodging
Running Water
Picnic Tables
Restrooms
Lake Fork Creek
Yellowstone River
Moon Lake
Lake Fork Canal
N
Utah
4 0 4 8 MILES
4 0 4 8 KILOMETERS
County near which watershed is located.
Big Sand Wash Watershed
<k52>

north of the village of Upalco in the Uinta Basin. From US-40, turn north at milepost 98.2 (about 9 miles east of Duchesne), northwest on old US-40 towards Bridgerland. Follow this road for a mile, then north-east and north on a paved country road for about 8 miles to U-87. Turn left on U-87 and continue north for 2 miles, through Upalco, to where U-87 bends to the northwest. At the bend, continue due north on an unpaved county road for 0.75 miles to the boat ramp access. Pedestrian access is possible from U-87.

At milepost 105 (16 miles east of Duchesne), there is a sign to a Big Sand Wash Boatramp south of the highway. This is ***not*** Big Sand Wash Reservoir.

Fishing is the primary recreational use of the reservoir. The 1,200 acre-foot conservation pool provides permanent fish habitat. Boating is the only other major recreational use of the reservoir, but swimming and waterskiing are possible.

The boat ramp and some privies are the only recreational facilities at the reservoir. There are numerous USFS campgrounds north of the reservoir along the Lake Fork and Yellowstone Rivers. There is a private campground in Roosevelt (see info box).

Watershed Description

Big Sand Wash Reservoir is located at the north edge of the Uinta Basin, south of the south slope of the Uintas. It has a small, dry (8 - 12 inches/year precipitation) watershed that is supplemented by a diversion from the Lake Fork River. The diversion drains areas of the High Uintas that receive up to 40 inches precipitation annually. The headwaters of the Lake Fork River and its tributary, the Yellowstone River, are in the central High Uintas. Kings Peak, the highest mountain in Utah, is at the headwaters of the Yellowstone. The high mountains are surrounded with glacial valleys, which are filled with forest, meadows, and glacial lakes. Much of this area is protected as federal wilderness.

The rivers cascade out of the Uintas, then turn into slow streams in the Uinta Basin, filling only a fraction of the channel carved by the melting glaciers. Big Sand Wash Reservoir is an impoundment of a shallow channel cut through the soft soil of the Uinta Basin.

The watershed high point, Kings Peak, is 4,123 m (13,528 ft) above sea level, thereby developing a complex slope of 4.4% to the reservoir. The average stream gradient of the canal is 1.4% (71 feet per mile) and the average gradient of the Lake Fork River in the 10 km above the diversion is 1.7% (90 feet per mile). In the upper reaches of the watershed, gradients are considerably greater. The inflows consist of Big Sand Wash (an ephemeral stream) and the Lake Fork Canal from Lake Fork River. The outflows are also Big Sand Wash and Lake Fork Canal. Moon Lake and Twin Pots Reservoir are artificial impoundments upstream on the Lake Fork River. There are many of natural lakes in the watershed, including Kidney Lake, Brown Duck Lake, Island Lake, Crater Lake, Bluebell Lake, Timothy Lakes, Rainbow Lake and Water Lily Lake.

The watershed is made up of high mountains with rock outcroppings, alluvial fans, floodplains, foothills, plateaus, badlands and valleys. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of pine, aspen, spruce-fir, oak-maple, alpine tundra, pinyon-juniper, shadscale, greasewood and sagebrush grass. The watershed receives 20 - 102 cm (8 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 120 - 140 days long.

According to the 1982 Clean Lakes Inventory, land use is multiple use (80% with uses restricted in the wilderness area), private grazing lands (10%), agriculture (6%), and recreation (4%).

Limnological Assessment

The water quality of Big Sand Wash is very good. It considered to be moderately hard with a hardness concentration range of 107-9 mg/L ($CaCO_3$). No parameters monitored have been found exceeding State standards for defined beneficial uses of the reservoir. Nutrient levels are considered low and the phosphorus concentrations are below the recommended pollution indicator value of 0.25 mg/L. The Reservoir is to be nitrogen limited with low nitrogen/phosphorus ratios. The reservoir has been consistently classified as a mesotrophic system. TSI values have remained consistently stable near 45-46.

Although the reservoir probably stratifies during midsummer recent profiles taken either early or later summer do not show the reservoir as stratified. However, in 1981 when the water depth was at 19 meters, a thermocline was developing near the 5 meter depth. Without the presence of a thermocline which would stratify the reservoir, the reservoir maintains a fairly high concentration of dissolved oxygen throughout the water column. It is interesting to note that under the conditions in 1981, dissolved oxygen concentrations declined with increasing depth to a value of 4.0--4.2 mg/L near the bottom of the reservoir. In addition profiles obtained when the reservoir is nearer capacity indicate there is a definite decline in the concentrations of dissolved oxygen throughout the water column.

According to DWR stocking records Big Sand Wash Reservoir is typically stocked with approximately 45,000 fingerling rainbow trout (*Oncorhynchus mykiss*) and on occasion 15,000 fingerling cutthroat trout (*Oncorhynchus clarki*. DWQ records indicate that emergent macrophytes are very limited in the reservoir. Small areas have developed

Limnological Data

Data sampled from STORET site: 593352

Surface Data	1981	1989*	1991
Trophic Status	M	M	M
Chlorophyll TSI	-	45.13	47.59
Secchi Depth TSI	54.1	45.16	53.23
Phosphorous TSI	37.3	48.05	35.01
Average TSI	45.7	46.11	45.28
Chlorophyll a (ug/L)	-	4.4	5.65
Transparency (m)	1.5	2.8	1.6
Total Phosphorous (ug/L)	5	21	9
pH	8.1	8.4	8.4
Total Susp. Solids (mg/L)	<5	-	<3
Total Volatile Solids (mg/L)	-	-	5
Total Residual Solids (mg/L)	-	-	<3
Temperature (°C / °f)	20/69	21/70	19/66
Conductivity (umhos.cm)	163	172	209
Water Column Data			
Ammonia (mg/L)	0.1	<0.01	0.04
Nitrate/Nitrite (mg/L)	.08	-	0.03
Hardness (mg/L)	109	-	99.3
Alkalinity (mg/L)	94	-	84
Silica (mg/L)	-	-	6.8
Total Phosphorus (ug/L)	12.5	19	11
Miscellaneous Data			
DO (Mg/l) at 75% depth	5.8	6.7	9.0
Stratification (m)	5-6	NO	NO
Limiting Nutrient	N	N	N
Depth at Deepest Site (m)	19	8.3	10

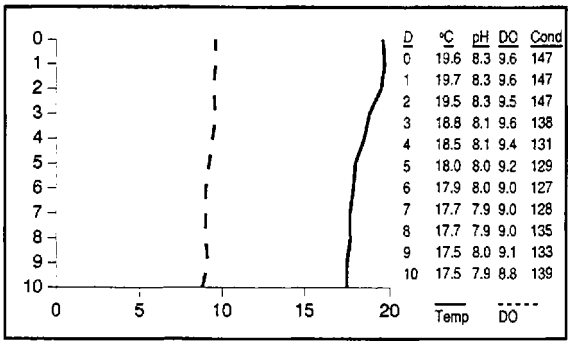
in the areas near the inlet as sediments have accumulated and water levels decreased.

At the present time Big Sand Wash Reservoir is used as an irrigation source and for recreation which includes boating and fishing. This reservoir may later be used as a source for culinary water.

The reservoir has not been chemically treated by the DWR to eliminate rough fish competition, so populations of native fishes may be present in the reservoir.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm³/liter)	% Density By Volume
Ceratium hirundinella	2.809	97.44
Euglena sp.	0.041	1.42
Ankistrodesmus falcatus	0.014	0.45
Microcystis incerta	0.011	0.39
Pennate diatoms	0.003	0.12



Centric diatoms	0.003	0.11
Wislouchiella planktonica	0.002	0.08
Total	2.883	
Shannon-Weaver [H']	0.15	
Species Evenness	0.08	
Species Richness	0.28	

Ceratium sp. are red algae and can be found in both mesotrophic and eutrophic conditions.

Pollution Assessment

Nonpoint pollution source activities include grazing, logging, recreation and agriculture.

Grazing takes place throughout the watershed, and in the vicinity of the reservoir. Logging takes place in the upper parts of the watershed, but any effects are unlikely to affect the reservoir.

There are no point sources of pollution in the watershed.

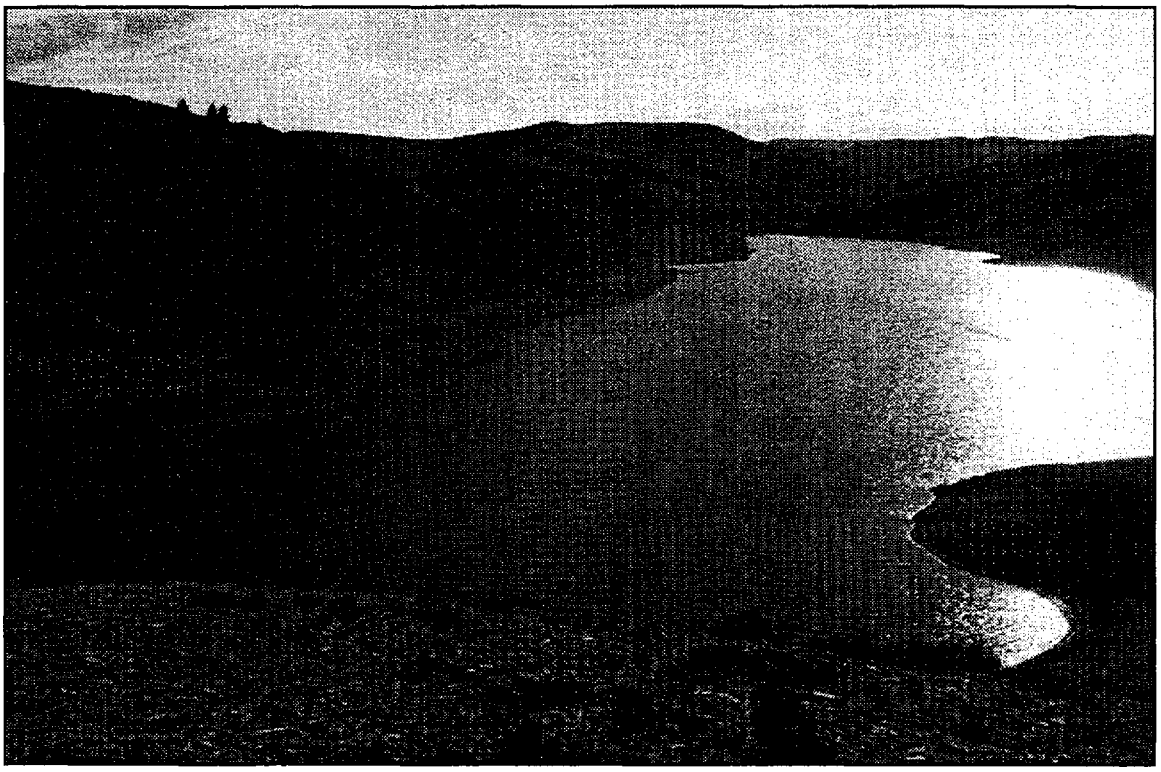
Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	789-3103
Division of Water Quality	538-6146
Ashley National Forest	377-5780
Duchesne Ranger District	738-2482
Recreation	
Dinosaurland Travel Region (Vernal)	789-6932
Duchesne Chamber of Commerce	738-5651/738-2707
Reservoir Administrators	
Moon Lake Water Users Association	722-2002
Division of Wildlife Resources	789-3103

Beneficial Use Classification

The state beneficial use classifications include: culinary water (1C), boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

BIRCH CREEK RESERVOIR #2



Introduction

Birch Creek Reservoir #2 is an intermediate sized reservoir on the east slope of the Monte Cristo Range. It provides some summer recreational opportunities, and has a much smaller sister reservoir, Birch Creek Reservoir #1, about 1/2 mile downstream.

Birch Creek Reservoir #2 was created in 1951 by the construction of an earth-fill dam on Birch Creek. The reservoir shoreline ownership is evenly divided between the BLM and private concerns. Public access is unrestricted. Most of the water is drained for irrigation needs by midsummer, but a 400 acre foot conservation pool ensures that water can be used for recreation and coldwater aquatic habitat as well. There are no foreseeable changes in water usage at this time.

Characteristics and Morphometry

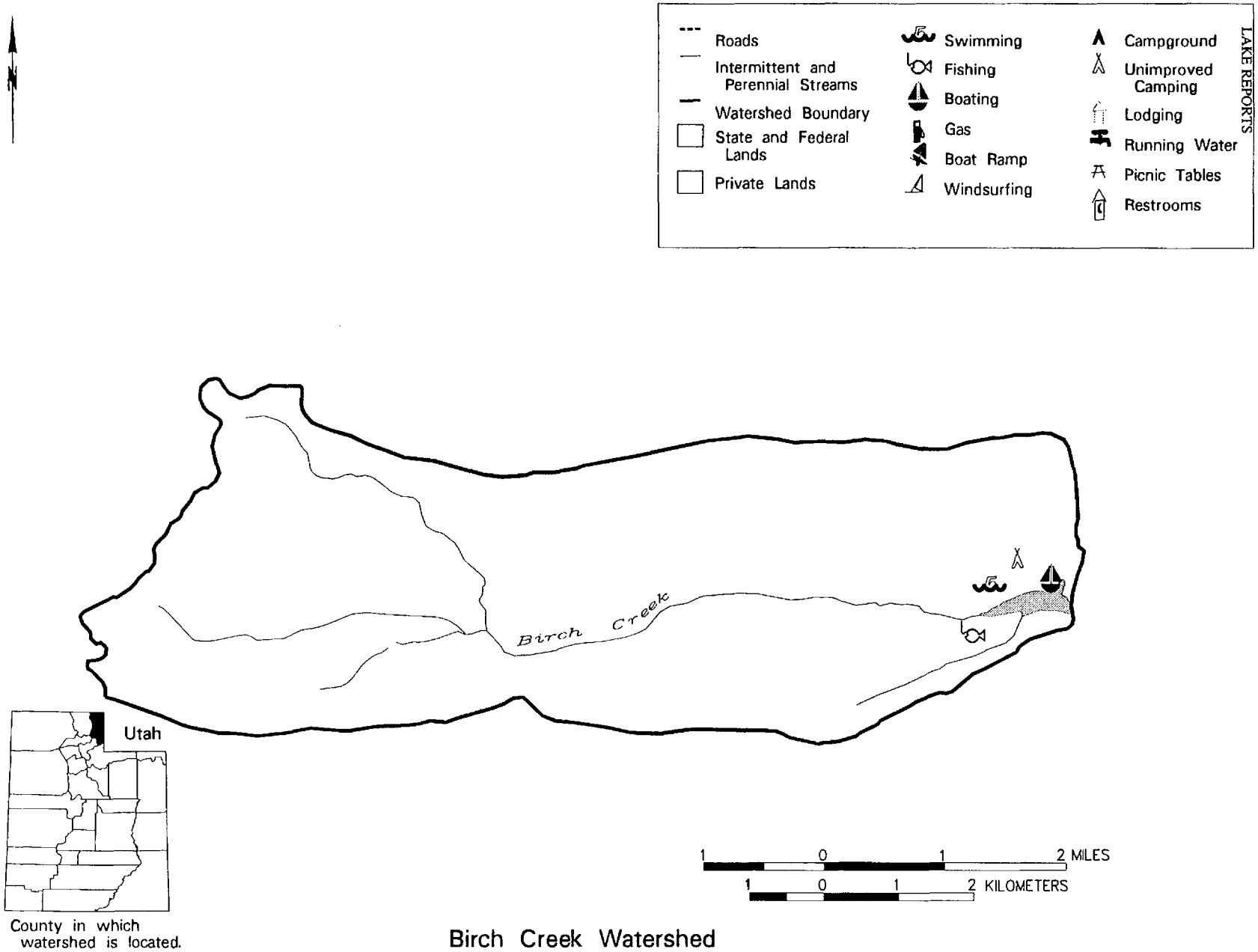
Lake elevation (meters / feet)	2,108 / 6,915
Surface area (hectares / acres)	25 / 63
Watershed area (hectares / acres)	4,406 / 10,880
Volume (m^3 / acre-feet)	
capacity	2.783×10^6 / 2,256
conservation pool	493,400 / 400
Annual inflow (m^3 / acre-feet)	
Retention time (years)	<1
Drawdown (m^3 / acre-feet)	2.259×10^6 / 1831
Depth (meters / feet)	
maximum	25 / 81
mean	11 / 35
Length (meters / feet)	1,263 / 4,137
Width (meters / feet)	262 / 859
Shoreline (km / miles)	3.3 / 2.05

Location

County	Rich
Longitude / Latitude	111° 19' 45" / 41° 30' 23"
USGS Map	Birch Creek Reservoirs, UT 1969
DeLorme's Utah Atlas & Gazetteer™	Page 61, B-5
Cataloging Unit	Bear River (16010101)

Recreation

Birch Creek Reservoir #2 is easily accessible from U-39. The turnoff is about 36 miles east of Huntsville, exactly



Birch Creek Watershed

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two miles west of the Woodruff Creek Reservoirs turnoff, and 8 miles west of Woodruff. Turn north and follow the gravel road to the northwest up Birch Creek about one mile to the reservoirs. Reservoir #2 is upstream from reservoir #1. The turnoff is poorly marked, but with a good map the road is not difficult to find.

Fishing is the primary recreational use of the reservoir. There is a picnic area with primitive toilets between the two reservoirs, and it is possible, but not easy, to get a boat on reservoir #2. By midsummer the reservoir is drained down to the conservation pool (about 25 feet deep) exposing 35 vertical feet of muddy banks.

Monte Cristo Campground, a USFS facility, is about 13 miles west of the Birch Creek turnoff on U-39. It is open from June through September, and has 53 tent sites, picnic areas, and primitive toilets. Fees are charged for campground use.

Watershed Description

The Little Bear River is eroding the west slopes of the Monte Cristo Range at a rate relatively faster than Birch Creek erodes the east slopes. Both sides of the ridge are dissected by deep canyons, but the canyons to the west are much deeper, indicating that their headwaters are slowly capturing drainage from the east side of the ridge. Birch Creek drains the east slopes, and the reservoir is built about halfway from the headwaters to where Birch Creek (after joining Woodruff Creek) joins the Bear River in the town of Woodruff. Slopes surrounding the reservoir are quite steep (60%). The reservoir is an impoundment of the narrow, "V" shaped canyon with sage-grass vegetation.

The watershed high point, Eccles Peak, is 2,768 m (9,062 ft) above sea level, thereby developing a complex slope of 6.1% to the reservoir. The average stream gradient of Little Brush Creek is 2.8% (147 feet per mile) The inflow and outflow is Birch Creek.

The watershed is made up of mountains and terraces. The soil is derived from the Wasatch Formation, the limestone bedrock that underlies much of the watershed. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of sage-grass, spruce-fir and aspen. The watershed receives 41 - 102 cm (16 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 80 - 120 days per year.

Land use in the watershed is 100% multiple use and native grazing. Minor recreational use takes place.

Limnological Assessment

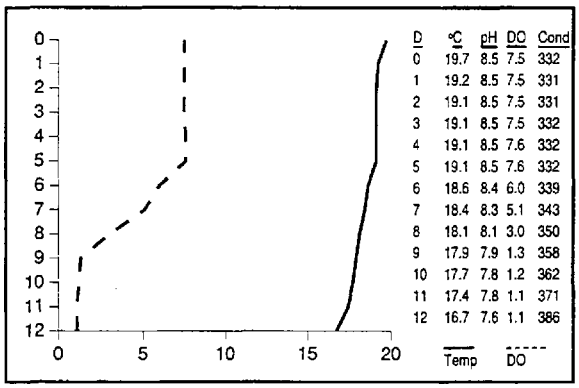
The water quality of Birch Creek Reservoir #2 is to be good. It considered to be hard with a hardness concentration range of 166-183 mg/L ($CaCO_3$). The only parameters monitored exceeding State standards for defined beneficial uses of the reservoir is phosphorus. Nutrient levels are considered low for 1991, however, phosphorus concentrations in 1981 and 1989 both exceeded the recommended pollution indicator value of 0.25 mg/L. The reservoir is considered to be nitrogen limited with low nitrogen/phosphorus ratios. The reservoir in recent years has not been filled to capacity and may be a major factor for elevated phosphorus levels. Although the reservoir had an average TSI value of 70.88 for 1989, the reservoir is classified as a mesotrophic system consistent with data obtained in 1981 and 1991. TSI values for those time periods is relatively stable at approximately 47. Recent conditions show that the reservoir has not stratified. However, if the reservoir was operated nearer capacity the reservoir might be expected to stratify. Even without stratification the reservoir shows a significant loss of

Limnological Data

Data sampled from STORET site: 590713

Surface Data	1981	1989*	1991
Trophic Status	M	H	M
Chlorophyll TSI	-	75.16	51.06
Secchi Depth TSI	-	-	44.17
Phosphorous TSI	47.34	66.59	46.97
Average TSI	47.34	70.88	47.40
Chlorophyll a (ug/L)	-	93.9	8.05
Transparency (m)	-	-	3.0
Total Phosphorous (ug/L)	20	76	20
pH	8.5	8.70	8.50
Total Susp. Solids (mg/L)	5.0	-	<3.0
Total Volatile Solids (mg/L)	-	-	2
Total Residual Solids (mg/L)	-	-	<3
Temperature (°C / °f)	18/64	19/66	18/65
Conductivity (umhos.cm)	388	280	333
Water Column Data			
Ammonia (mg/L)	0.05	<0.05	0.06
Nitrate/Nitrite (mg/L)	0.19	<0.01	0.02
Hardness (mg/L)	172	-	167
Alkalinity (mg/L)	180	-	158
Silica (mg/l)	-	-	5.9
Total Phosphorus (ug/L)	20	76	28.7
Miscellaneous Data			
DO (Mg/l) at 75% depth	-	8.0	1.3
Stratification (m)	-	NO	NO
Limiting Nutrient	P	N	N
Depth at Deepest Site (m)	-	5.7	12

* Period 2 Data Only



D	°C	pH	DO	Cond
0	19.7	8.5	7.5	332
1	19.2	8.5	7.5	331
2	19.1	8.5	7.5	331
3	19.1	8.5	7.5	332
4	19.1	8.5	7.6	332
5	19.1	8.5	7.6	332
6	18.6	8.4	6.0	339
7	18.4	8.3	5.1	343
8	18.1	8.1	3.0	350
9	17.9	7.9	1.3	358
10	17.7	7.8	1.2	362
11	17.4	7.8	1.1	371
12	16.7	7.6	1.1	386

dissolved oxygen downward in the water column. The dissolved oxygen concentration falls below the standard for a cold water fishery (6.5 mg/L) at 6 meters. Below 8 the concentration of dissolved oxygen approaches an anoxic state. According to DWR stocking records Birch Creek Reservoir #2 has been stocked with 30,000 fingerling rainbow trout (*Oncorhynchus mykiss*) annually. In addition some cutthroat trout (*Oncorhynchus clarki*) are present in the reservoir. Emergent macrophytes are very limited in the reservoir.

The reservoir has not been chemically treated by the DWR, so populations of native fishes could still be present in the reservoir

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Aphanizomenon flos-aquae	11.092	80.46
Sphaerocystis schroeteri	2.641	19.16
Oocystis borgei	0.022	0.16
Wislouchiella planktonica	0.020	0.15
Pennate diatoms	0.010	0.07
Total	13.785	
Shannon-Weaver [H']	0.52	
Species Evenness	0.32	
Species Richness	0.17	

As observed, the reservoir is predominately populated by blue-green algae indicative of eutrophic conditions.

Pollution Assessment

Nonpoint pollution sources include the following: Sedimentation and nutrient loading from grazing, and litter, human waste and chemicals from recreation.

Grazing takes place throughout the watershed and along the reservoir shoreline.

There are no point sources of pollution in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Bear River Association of Governments	752-7242
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Bureau of Land Management	539-4001
Bear River Resource Area	977-4300
Recreation	
Bridgerland Travel Region (Logan)	657-5353
Garden City Chamber of Commerce	946-2901
Reservoir Administrators	
Wes Tingey	793-4229
Woodruff Reservoir and Irrigation Company	
PO Box 520, Woodruff, UT 84086	

BLANDING CITY RESERVOIR #4

Introduction

Blanding City Reservoir #4 is an off-stream reservoir on the south slope of the Abajo Mountains. The Mormon pioneers settled the area in the late 1800's, and diverted clear water from the mountain streams for culinary use. Blanding City Reservoir #4 was built in 1965 to retain spring runoff for usage throughout the summer. It is a small reservoir, but larger than nearby Blanding City Reservoir #3, which is larger than either of its predecessors. Reservoir #1 is no longer in service, Reservoir #2 is used entirely for agricultural purposes, #3 is maintained at the conservation pool level. Reservoir #4 the primary source of water for Blanding City.

The reservoir shoreline is owned by Blanding City. Public access is unrestricted. The impoundment, an earth-fill dam, was built in 1965. Present and anticipated future

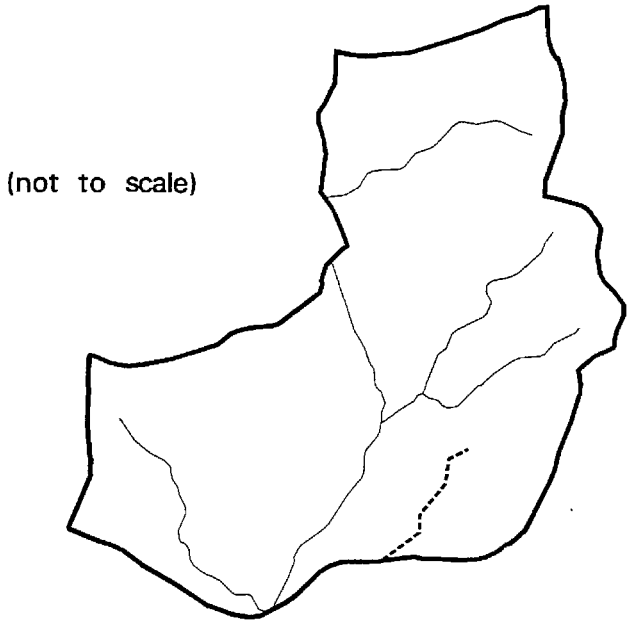
Characteristics and Morphometry

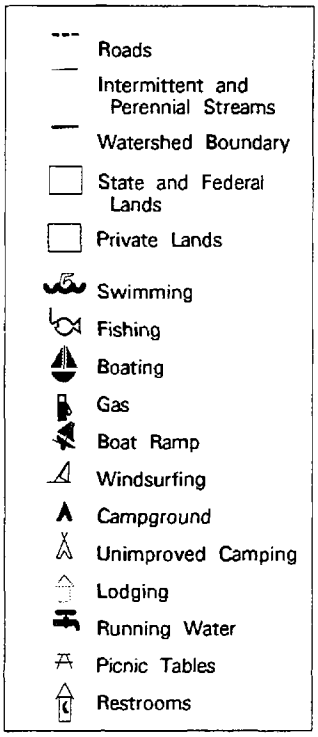
Lake elevation (meters / feet)	2,010 / 6,600
Surface area (hectares / acres)	13 / 32
Watershed area (hectares / acres	
Volume (m^3 / acre-feet)	
capacity	838,781 / 680
conservation pool	270,000 / 219
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	14 / 46
mean	6.5 / 21.3
Length (meters / feet)	790 / 2,600
Width (meters / feet)	640 / 2,100
Shoreline (km / miles)	1.9 / 1.2

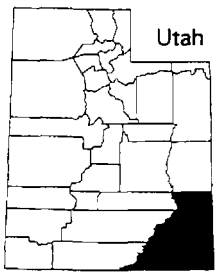
Location

County	San Juan
Longitude / Latitude	109 29 52 / 37 40 06
USGS Map	Blanding North, Utah 1985
DeLorme's Utah Atlas and Gazetteer™	Page 22, A-3*
Cataloging Unit	Lower San Juan (14080201)

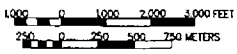
(unlabeled, it is the reservoir at the north end of Reservoir Road.)







County in which watershed is located.



Blanding #4 Watershed

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water use is primarily for culinary and agricultural purposes with recreational use focusing on fishing.

Recreation

Blanding City Reservoir #4 is 4 miles north of Blanding. From downtown Blanding, travel north out of town near 400 West. The asphalt road winds through the desert past Reservoirs #2 and #3 and culminates at reservoir #4.

Aquatic recreation is limited to bankside fishing. Swimming, camping and boating are prohibited. Reservoir #3 has a city park with water and vault toilets. The nearest public campground is Devil's Canyon, a USFS facility 7 miles north of Blanding on US-191 with 32 campsites, drinking water and vault toilets. User fees are charged. There is also a private campground in Blanding (see info box).

Watershed Description

The Abajos are an isolated group of exposed laccoliths mountains that rise high above the redrock deserts. Much of the runoff seeps into the streambed and becomes silt laden as streams cut across various strata of differing erodibility and permeability cutting through the hogback ridges at the base of the mountains. In order to obtain clear water, the city built a 14 km long aqueduct to divert water from Johnson Creek high in the mountains and release it in their reservoir. The Johnson Creek watershed itself is further augmented with a second aqueduct though the Abajo ridgeline, which intercepts the north-flowing waters of Indian Creek and diverts them into the Johnson Creek drainage.

Blanding City Reservoir #4 is on a relatively flat area of the transition zone between the arid lands south the Abajo Mountains. The reservoir has a small natural watershed, but essentially all of the water comes from the mountains.

The watershed high point, the west shoulder of Abajo Peak, is 3443 m (11,295 ft) above sea level, thereby developing a complex slope of 7.5% to the reservoir. The average stream gradient above the reservoir is **?3.0??** (Need Abajo Peak quad)feet per mile).

The watershed is composed of high mountains above the aqueduct and low desert below.

The vegetation communities are comprised of spruce-fir, aspen, pine, alpine, and pinyon-juniper with grasses and forbes near the reservoir. The natural watershed is low desert with sagebrush. The watershed receives 30 - 76 cm (12 - 30 inches) of precipitation annually with a frost-free season of 120 - 140 days at the reservoir.

Land use in the mountains is 100% multiple use, with the exception of a small privately owned parcel around the now inactive Gold Queen Mine on the west face of Abajo Peak. The major use of the watershed is livestock grazing.

Limnological Assessment

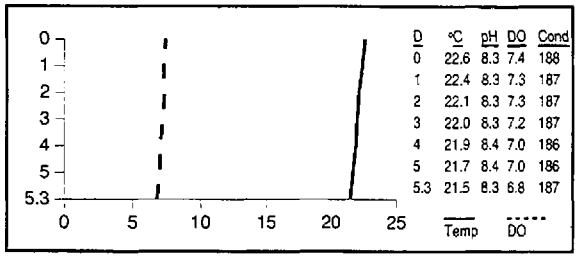
The water quality of Blanding City Reservoir #4 is very good. It is considered to be moderately hard with a range of hardness concentration of 80-92 mg/L ($CaCO_3$). The only parameters that has exceeded State water quality standards for defined beneficial uses are phosphorus and temperature. In May, 1991 the average concentration of total phosphorus in the water column was 0.033 mg/L which is slightly higher than the recommended pollution indicator for phosphorus of 0.025 mg/L. Looking at phosphorus concentrations on an annual basis, they do not exceed pollution indicator exceedence levels. A review of the 1992 profile indicates that temperature exceed the standard established for Class 3A waters (20 degrees C) throughout the water column. No other constituents analyzed indicate any water quality impairments. Although nutrient concentrations are in general considered low, the system has been defined as a nitrogen limited system. TSI values categorize the reservoir as oligotrophic in 1981 and 1992 but mesotrophic in 1991 in

Limnological Data

Data sampled from STORET site: 595209

Surface Data	1981	1991	1992
Trophic Status	O	M	O
Chlorophyll TSI	-	39.19	27.10
Secchi Depth TSI	-	36.81	41.74
Phosphorous TSI	37.35	47.35	38.06
Average TSI	37.35	41.12	35.63
Chlorophyll a (ug/L)	-	2.4	0.7
Transparency (m)	-	5	3.55
Total Phosphorous (ug/L)	5	20	11
pH	8.4	7.9	8.5
Total Susp. Solids (mg/L)	<5	<3	<3
Total Volatile Solids (mg/L)	-	2	-
Total Residual Solids (mg/L)	-	2	3
Temperature (°C / °f)	22/72	21/69	19/67
Conductivity (umhos.cm)	191	224	182
Water Column Data			
Ammonia (mg/L)	0.05	0.03	0.02
Nitrate/Nitrite (mg/L)	0.02	0.03	0.03
Hardness (mg/L)	84	100	81
Alkalinity (mg/L)	63	91	74
Silica (mg/L)	-	7.8	6.3
Total Phosphorus (ug/L)	5	24	9.0
Miscellaneous Data			
DO (Mg/l) at 75% depth	-	6.6	7.0
Stratification (m)	-	NO	NO
Limiting Nutrient	N	N	N
Depth at Deepest Site (m)	-	10.0	5.3

large part due to the increased



D	°C	pH	DO	Cond
0	22.6	8.3	7.4	188
1	22.4	8.3	7.3	187
2	22.1	8.3	7.3	187
3	22.0	8.3	7.2	187
4	21.9	8.4	7.0	186
5	21.7	8.4	7.0	186
5.3	21.5	8.3	6.8	187

concentration of phosphorus in the lake. A difference of 8.46 units in the average trophic state between 1991 and 1992 appears to be significantly different. This may indicate that some event caused a temporary shift in water quality during 1991 but that conditions shifted back to a "state" more equivalent to earlier conditions in 1992. Until more information can be gathered the reservoir will be considered to be oligotrophic. A review of the lake profile of August , 1992 shows no stratification present with fairly consistent water quality throughout the water column.

Wildlife Resources maintains a fishery through annual stockings. The DWR stocks the reservoir annually with 8,000 catchable rainbow trout (*Oncorhynchus mykiss*).

Although macrophytes are present in the lade, their coverage is limited and they are not considered to be a major problem.

While the reservoir has not been chemically treated by the DWR to control rough fish competition, the reservoir was built away from any natural water bodies, so there are no native fish populations.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Ceratium hirundinella	0.936	82.89
Pennate diatoms	0.133	11.81
Centric diatoms	0.035	3.15
Ankistrodesmus falcatus	0.013	1.16
Unknown spherical chrysophyte	0.006	0.59
Oocystis sp.	0.004	0.39
Total	1.127	
Shannon-Weaver [H']	0.62	
Species Evenness	0.32	
Species Richness	0.29	

As observed the algal community is dominated by green algae and diatoms indicative of mesotrophic state water.

Information

Management Agencies	
Southeastern Association of Governments	637-5444
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Canyonlands Travel Region (Monticello)	587-2231
Kampark Campground (Blanding)	678-2770
Reservoir Administrators	
Blanding City	678-2791
San Juan County Water Conservation District	678-2596

Pollution Assessment

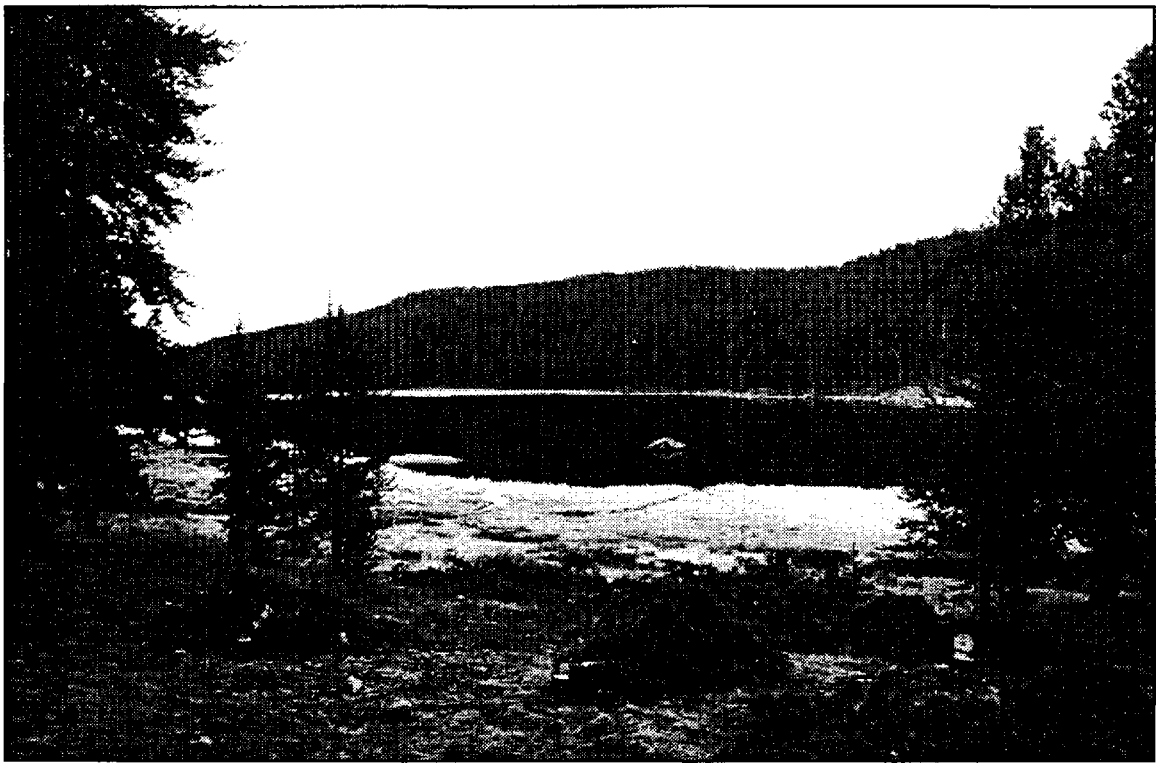
Nonpoint pollution sources include grazing of domestic livestock, and recreation. While the watershed is grazed in summer months, the reservoir area has some fencing to protect water quality.

There are no point pollution sources in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: culinary water (1C), boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

BRIDGER LAKE



Introduction

Bridger Lake sits in a glacial valley on the north slope of the Uinta Mountains. It is a small, natural impoundment, formed by a dam of lateral moraine in the Smith's Fork valley. It is in a cluster of four lakes and reservoirs just south of the Wyoming state line (Bridger Lake, Marsh Lake, and China Lake.)

The reservoir shoreline is 100% publicly owned by the Wasatch-Cache National Forest. Public access is unrestricted. Water is used for recreation and cold water aquatic life. The passage of water through the lake is unregulated by man, but water that flows through it is later stored in Stateline Reservoir and used for agricultural purpose in Wyoming.

Characteristics and Morphometry

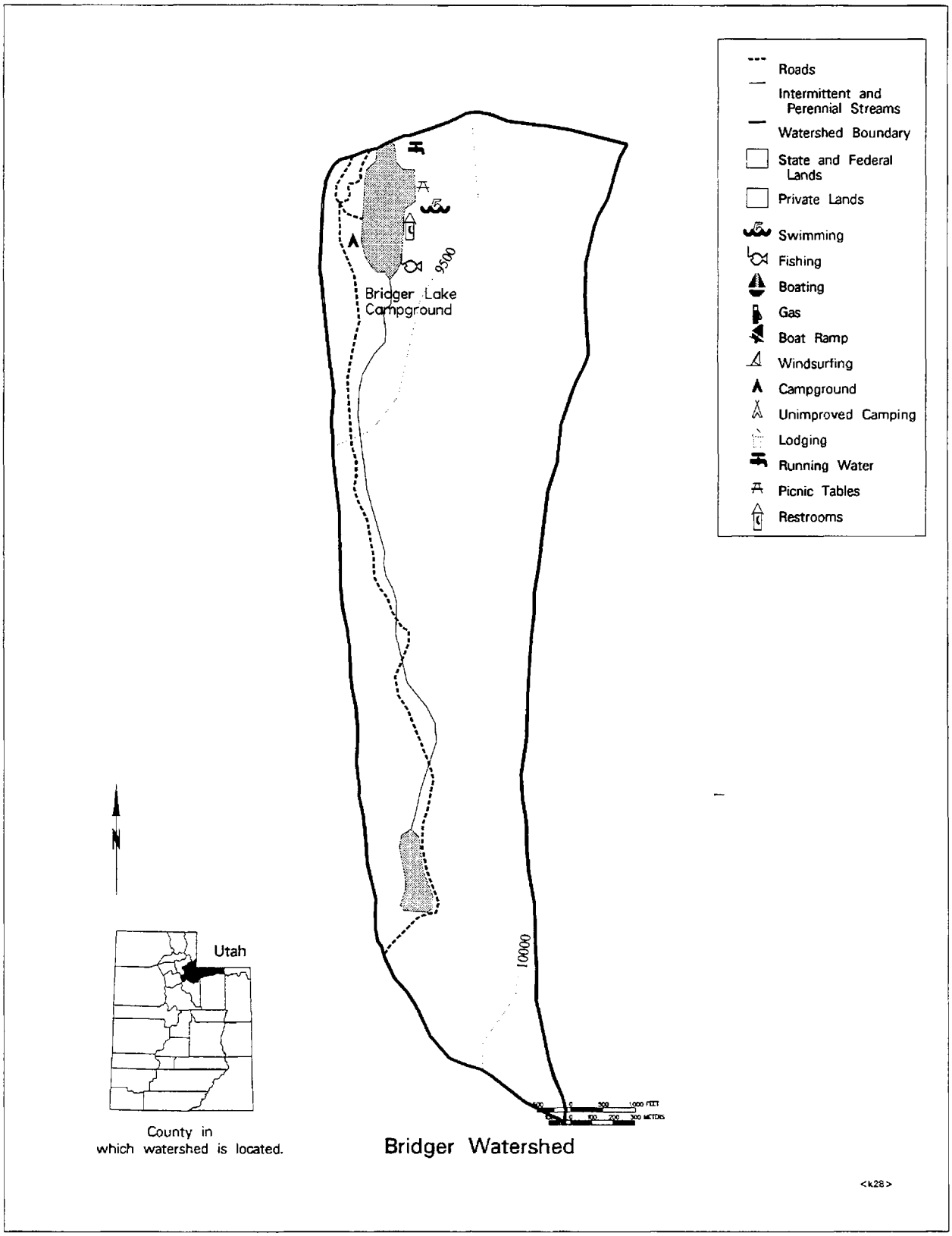
Elevation (meters / feet)	2,854 / 9,364
Surface area (hectares / acres)	8.5 / 21
Watershed area (hectares / acres)	
Volume (m^3 / acre-feet)	
Capacity	337,000/273
Conservation pool	not measured
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Depth (meters / feet)	
maximum	5 / 15
mean	4 / 13
Length (meters / feet)	671 / 2,200
Width (meters / feet)	213 / 700
Shoreline (meters / feet)	1,280 / 4,200

Location

County	Summit
Longitude / Latitude	110 24 15 / 40 56 31
USGS Map	Bridger Lake, UT / WY 1967
DeLorme's Utah Atlas and Gazetteer™	Page 55, A-5
Cataloging Unit	Black's Fork (1404017)

Recreation

Bridger Lake is in the Smith's Fork drainage, 30 miles east of U-150 on the North Slope Road (FS-058). It is also


Roads
Intermittent and Perennial Streams
Watershed Boundary
State and Federal Lands
Private Lands
Swimming
Fishing
Boating
Gas
Boat Ramp
Windsurfing
Campground
Unimproved Camping
Lodging
Running Water
Picnic Tables
Restrooms
Bridger Lake Campground
9500
10000
N
Utah
County in which watershed is located.
Bridger Watershed
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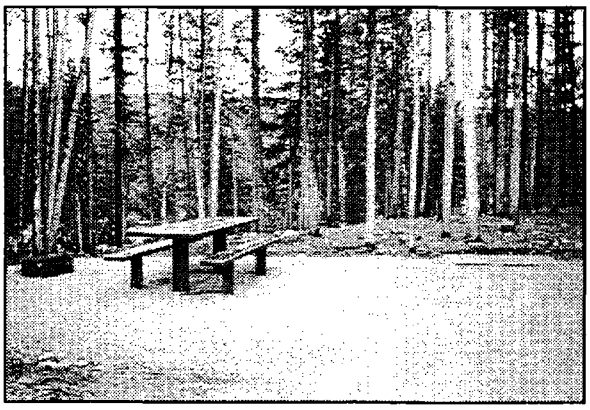
accessible from Mountain View, Wyoming. Go south from Mountain View on the paved road towards Robertson (not towards Lonetree). At the second 90° bend to the west (about 5 miles from Mountain View), leave the highway, continuing south on a gravel road that becomes FS-072.

Bridger Lake is 2 miles south of the Wyoming State Line. The lake is 1/2 mile south of the turnoff to Stateline Reservoir. Located at the lake are the Bridger Lake Guard Station and the Bridger Lake Campground on the west shore. The route to the lake is well marked.

The lake offers fishing, boating and some degree of solitude. The area is noted for good moose habitat with frequent observations noted. The water is too cold for most swimmers. Fishing is popular, and there is a concrete boatramp for launching small boats. It should be noted that there is a 5 hp restriction on motors used on this small lake.

Bridger Lake Campground, administered by the Forest Service, has recently been refurbished (1993). It has 30 campsites, each with a fire pit, barbeque grills, and drinking water. There are two vault toilets, and two of the campsites have been developed with cement pads with a concrete pathway to the restroom facilities for those individuals with special needs. Reservations can be made through Biospherics, the new national reservation system for camping in National Forest camp areas. User fees are charged. There are several other USFS campgrounds in the vicinity, including Stateline, Trail Head, Marsh Lake, China Meadows, and Smiths Fork Trail Head. This area provides access to the popular High Uinta Wilderness, so campgrounds are heavily used in the summer.



Watershed Description

Bridger Lake is on the east side of the valley floor. The valley is about two miles wide and 800' deep. The lake's watershed is a portion of the glacial valley floor, about one mile wide and four miles long, stretching due south from the lake. There is a perennial stream flowing down the watershed, and several smaller glacial lakes near the top. The entire watershed consists of glacial valley floor that has been separated from the river by a long lateral moraine. (The China Lake report has a complete description of the process of glaciation.)

The watershed high point, a point two miles southwest of the lake on the valley wall, is 3,118 m (10,230 feet) above sea level, thereby developing a complex slope of 7.0% to the reservoir. The inflow consists of an unnamed stream that flows north into the lake. The stream gradient is 3.5% (186 feet per mile). The outflow is the continuation of this stream, which flows into Stateline Reservoir (an impoundment of Smiths Fork) about two miles downstream from Bridger Lake.

The soil in the watershed is derived from glacial till, alluvium, and the sedimentary rocks of the east wall of the valley. It is comprised primarily of debris from the scouring of upstream valleys, so the till itself is chemically similar to the Precambrian rocks of the High Uintas. See Appendix III for a complete soil description.

The vegetation community is comprised of lodgepole pine and marshlands. The watershed receives 51 - 64 cm (20 - 25 inches) of precipitation annually with a frost-free season of 20 - 40 days.

Land use is about 75% multiple use and 25% intensive agriculture. The major use of the watershed is sheep grazing, which has increased soil erosion. The campground and ranger station lie within the watershed.

Limnological Assessment

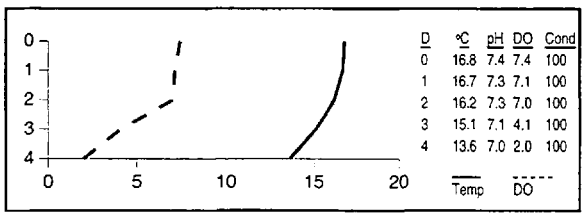
The water quality of Bridger Lake is very good. It is considered to be moderately soft with a hardness concentration near 40 mg/L ($CaCO_3$). The only parameter that has exceeded State water quality standards for defined beneficial uses is phosphorus. The average concentration of total phosphorus in the water column in August, 1992 was 0.045 mg/L which is significantly higher than the recommended pollution indicator for phosphorus of 0.025 mg/L. The phosphorus concentrations on an annual basis was only slightly higher with an average value of 0.033 mg/L. No other constituents analyzed indicate any water quality impairments. In 1981 the system was not characterized for a limiting factor due to nutrient concentrations below detection limits. In 1992 with nutrient concentrations well above detection limits the lake has been classified as a nitrogen limited system. TSI values indicate the lake is mesotrophic. It does appear that there has been a significant rise in the concentrations of nutrients in the lake since it was originally surveyed in 1981. It is very important that these constituents continue to be monitored to see if this is an actual trend or a more consistent evaluation of conditions in the lake. Although the lake has a mean depth of only 4 meters it appears from the profile of August 11,

Limnological Data

Data sampled from STORET site: 593937

Surface Data	1981	1992
Trophic Status	-	M
Chlorophyll TSI	-	41.70
Secchi Depth TSI	-	50.75
Phosphorous TSI	-	47.70
Average TSI	-	46.72
Chlorophyll a (ug/L)	-	3.1
Transparency (m)	-	1.9
Total Phosphorous (ug/L)	30	20
pH	6.7	7.7
Total Susp. Solids (mg/L)	<5	<3
Total Volatile Solids (mg/L)	-	1
Total Residual Solids (mg/L)	-	2
Temperature (°C / °f)	18/64	14/57
Conductivity (umhos.cm)	78	98
Water Column Data		
Ammonia (mg/L)	0.05	0.12
Nitrate/Nitrite (mg/L)	0.1	0.07
Hardness (mg/L)	40	40
Alkalinity (mg/L)	37	46
Silica (mg/L)	-	4.4
Total Phosphorus (ug/L)	40	31
Miscellaneous Data		
DO (Mg/l) at 75% depth	-	4.1
Stratification (m)	-	2-4
Limiting Nutrient	N	N
Depth at Deepest Site (m)	-	4.0

1992 that a mild stratification was present. Consistent with the stratification there is a noticeable decline in the concentration of dissolved oxygen in the water column. Below 2 meters the concentration declines to a low of 2.0 mg/L at the bottom. Due to the shallow nature of the lake the stratification is probable weak and may be broken down by wind and wave action. These conditions are probably critical to the overwintering of fish in the lake and is consistent with the reporting of some fishkills. There are extensive coverage of emergent macrophytes (lily pads) in close proximity to the shoreline.



The DWR stocks the lake annually with 4,000 catchable rainbow trout (*Oncorhynchus mykiss*). In 1992, 2,100 fingerling brook trout (*Salvelinus fontinalis*) were also stocked.

The lake was chemically treated by the DWR to control rough fish competition in 1973, so native fish populations may not be present.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Botryococcus braunii	11.120	46.02
Sphaerocystis schroeteri	10.564	43.72
Dinobryon divergens	1.773	7.34
Peridinium sp.	0.361	1.50
Staurastrum sp.	0.166	0.69
Anabaena sp.	0.111	0.46
Oocystis sp.	0.033	0.14
Ankistrodesmus falcatus	0.013	0.05
Chroococcus sp.	0.011	0.05
Crucigenia sp.	0.006	0.02
Pennate diatoms	0.004	0.02
Total	24.162	
Shannon-Weaver [H']	1.05	
Species Evenness	0.44	
Species Richness	0.42	

As observed the algal community is dominated by two species of green algae indicative of good water usually oligotrophic to mesotrophic conditions.

Information

Management Agencies	
Wasatch-Cache National Forest	524-5030
Mountain View Ranger District	307-782-6555
Mountainland Association of Governments	377-2262
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Mountainland Travel Region (Provo)	377-2262
Biospheric Nat'l Reservation Center	1-800-280-2667

Pollution Assessment

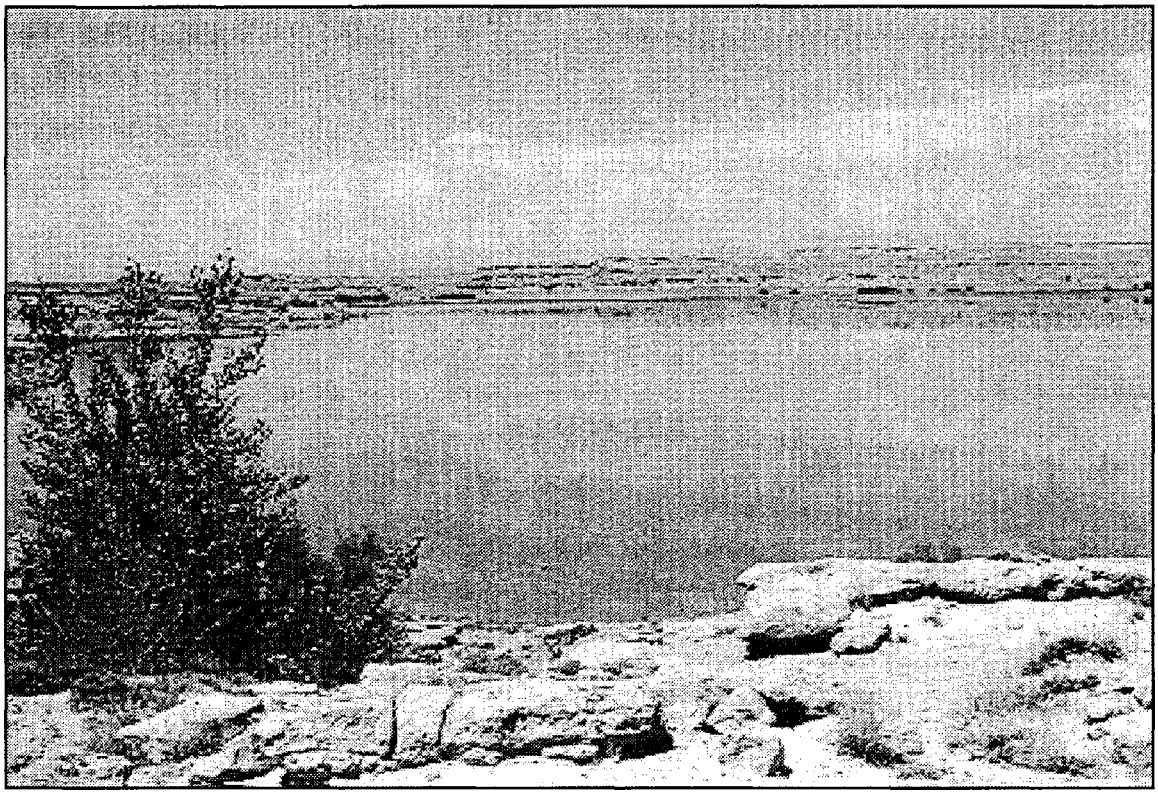
Nonpoint pollution sources include grazing and recreation. In addition to sheep grazing in the area cattle graze in the watershed and around the reservoir. The campground and guard station are on the west shore, where heavy recreational use can degrade the riparian vegetation.

There are no point pollution sources in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

BROUGH RESERVOIR



Introduction

Brough Reservoir is an off stream impoundment located in the Uinta Basin southwest of Vernal. It has been dammed to impound and release water for irrigation, and water is diverted into the lake via the Ouray Valley Canal which originates from the Whiterocks River. The reservoir was created in 1975 with the construction of an earth filled dam. Water is owned by the Ouray Park Irrigation Company and the Division of Wildlife resources for irrigation and recreational useage. In addition to Brough Reservoir there a number of other low elevation, warm water reservoirs in the Uinta Basin. Most noteworthy is Pelican Lake located a few miles due south. Land ownership around the reservoir is primarily privately owned with a small amount of BLM land. However, public access is unrestricted. Consumptive water uses are limited to irrigation, and nonconsumptive uses include warm water aquatic habitats, wetland habitat, and recreational uses. Water use is not expected to change

Characteristics and Morphometry

Lake elevation (meters / feet)	1,527 / 5,010
Surface area (hectares / acres)	52 / 128
Watershed area (hectares / acres)	7,382 / 18,241
Volume (m^3 / acre-feet)	
capacity	4,934,000 / 4,000
conservation pool	1,411,745 / 1,145
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	17 / 55.8
mean	9.5 / 31.2
Length (meters / feet)	1,037 / 3,402
Width (meters / feet)	610 / 2001
Shoreline (meters / feet)	3962 / 12,999

Location

County	Uinta
Longitude / Latitude	109 41 07 / 40 15 03
USGS Map	Vernal, SW, 1964
DeLorme's Utah Atlas & Gazetteer™	Page 56, D-2
Cataloging Unit	Green River (Diamond Mountain Area) (14060001)

in the foreseeable future.

Recreation

Brough Reservoir is accessible from U-88 between Ouray and US-40. The turnoff to U-88 is 15 miles west of Vernal and 15 miles east of Roosevelt on US-40. Approximately 3.7 miles south of US 40, U-88, a gravel road to the west is an access road to the reservoir. The reservoir is about 1 mile to the west and then 1 mile south. Access is possible from U-88 approximately 2 miles further south near a small farming commnunity. Another gravel road leads west and north to the reservoir.

Fishing, boating, and hunting are popular activities at the lake. There is no boat ramp at the reservoir, but small boats can be launched at stategic points.

There are no improved camping areas or facilities located adjacent to the reservoir.

Watershed Description

Brough Reservoir has a small, natural watershed area to the norht and west of the reservoir. The area is bounded by gentle slopes that rise a few hundred feet and become rolling hills. The land is extremely arid desert (6 - 8" annual precipitation).

The Ouray Valley Canal transports water that originates approximately 34 miles northwest from the Whiterocks River. U S Whiterocks canal is the first canal at the point of diversion from Whiterocks River. It late changes to the Whiterocks Ouray Valley Canal at the Merkley Drop approximately 5 miles downstream from the origin. Approximately 12 miles further downstream near LaPoint the canal becomes the Ouray Valley Canal which continues for approximately 17 more miles to the reservoir.

The source of the Whiterocks River is in the upper reaches of the Uinta Mountains. The drainage area widens towards the ridgeline of the Uintas, giving it a large area of very heavy precipitation. The upper portion of the watershed contains hundreds of lake, many square miles of meadows, forests, and barren peaks. The river flows from the mountains directly onto the tertiary deposits of the Uinta Basin, as the hogback-forming intermediate strata are buried here.

The watershed high point, an unnamed peak, is 3,861 m (12,666 ft) above sea level, thereby developing a complex slope of approximately 3.5% to the reservoir. Although the average stream gradient of Whiterocks from Chepeta Lake to the U S Whiterocks Canal is 6.2% (327 feet per mile), the overall gradient for the canal system is 1% (53 feet per mile). The primary inflow is the Ouray ValleyCanal, but natural runoff also flow into the lake.

The natural watershed is made of low terraces, fans, and desert valley plains, while the diverted watershed has high mountains, mountain valleys, terraces, and desert plains. In general the soils in the vicinity of the lake are moderate to strongly alkaline loams from sandy clays to gravelly sand having low to high erodibility and well to somewhat excessive drainage. Permeability is slow to rapid with runoff slow to medium and sediment production moderate to low. Soil composition information for the extended watershed have not been determined by the Division of Water Quality.

The vegetation communities in the natural watershed include shadscale, greasewood, and sage-grass. The diverted watershed includes sage-grass, irrigated farmland, oak-maple, spruce-fir, aspen, pine, and alpine. The watershed receives 15 - 102 cm (6 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 100 - 120 days per year.

Land use in natural watershed is primarily grazing lands. The watershed of the Whiterocks River contains land in the Ashley National Forest, which is managed for multiple use (logging, grazing, recreation, prospecting, hunting, etc.), but the entire upper portion of the watershed is part of the High Uintas Wilderness, where only preexisting consumptive uses are permitted. South of the National Forest boundary, the land is part of the Uinta and Ouray Indian Reservation, with mixed land uses, including agriculture and grazing.

Limnological Assessment

The water quality of Brough Reservoir is good. It is considered to be moderately hard with a hardness concentration value of approximately 105 mg/L ($CaCO3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are total phosphorus, dissolved oxygen and temperature.. The average concentrations of total phosphorus in the water column is 41 ug/L which is over the state pollution indicator value of 25 ug/L. The phosphorus concentration in the hypolimnion on July 26, 1994 under stratified conditions was 136 ug/L. Dissolved oxygen concentrations during late summer substantiate the fact that water quality impairments do exist. There are temperature exceedences above the 20°C standard for a cold water fishery, however, it should be noted that DWR manages the reservoir as a warm water fishery.

The reservoir is characterized as a nitrogen limited system. TSI values indicate the reservoir is mesotrophic. The reservoir does stratify as indicated in the July 26, 1994 profile which result in anoxic conditions developing in the hypolimnion and elevated total phosphorus concentrations which stimulate increased productivity in the resrvoir.

The reservoir supports populations of rainbow trout (*Oncorhynchus mykiss*), cutthroat trout (*Oncorhynchus clarki*), smallmouth bass (*Micropterus dolomieui*), largemouth

Limnological Data

Data averaged from STORET sites: 593243, 593244

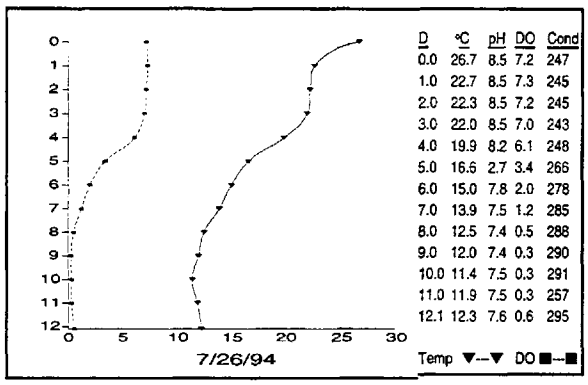
Surface Data	1994
Trophic Status	M
Chlorophyll TSI	38.21
Secchi Depth TSI	48.17
Phosphorous TSI	47.85
Average TSI	44.74
Chlorophyll a (ug/L)	2.0
Transparency (m)	2.3
Total Phosphorous (ug/L)	21
pH	8.7
Total Susp. Solids (mg/L)	1.9
Total Volatile Solids (mg/L)	3
Total Residual Solids (mg/L)	2
Temperature (°C / °f)	22/72
Conductivity (umhos.cm)	232
Water Column Data	
Ammonia (mg/L)	0.03
Nitrate/Nitrite (mg/L)	0.03
Hardness (mg/L)	105
Alkalinity (mg/L)	105
Silica (mg/L)	-
Total Phosphorous (ug/L)	43
Miscellaneous Data	
Limiting Nutrient	N
DO (Mg/l) at 75% depth	8.0
Stratification (m)	NO
Depth at Deepest Site (m)	9

bass (*Micropterus salmoides*), and fathead minnows (*Pimephales promelas*). The lake has not been chemically treated by the DWR, so populations of native fishes are nay be present in the lake. According to DWR stocking reports the reservoir is stocked with approximately 7-10,000 advanced fingerling rainbow trout annually.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm³/liter)	% Density By Volume
Sphaerocystis schroeteri	*0.612*	*70.61*
Coelosphaerium sp.	0.25	28.88
Pennate diatoms	0.004	0.51
Total	0.866	
Shannon-Weaver [H']	0.63	
Species Evenness	0.57	
Species Richness	0.10	

The phytoplankton commnunity is dominated by the presence of green algae and blue-green algae.



Pollution Assessment

Nonpoint pollution sources include the following: agriculture, grazing, logging, and recreation. Grazing takes place throughout the watershed and in the vicinity of the reservoir.

There are no point sources of pollution in the watershed

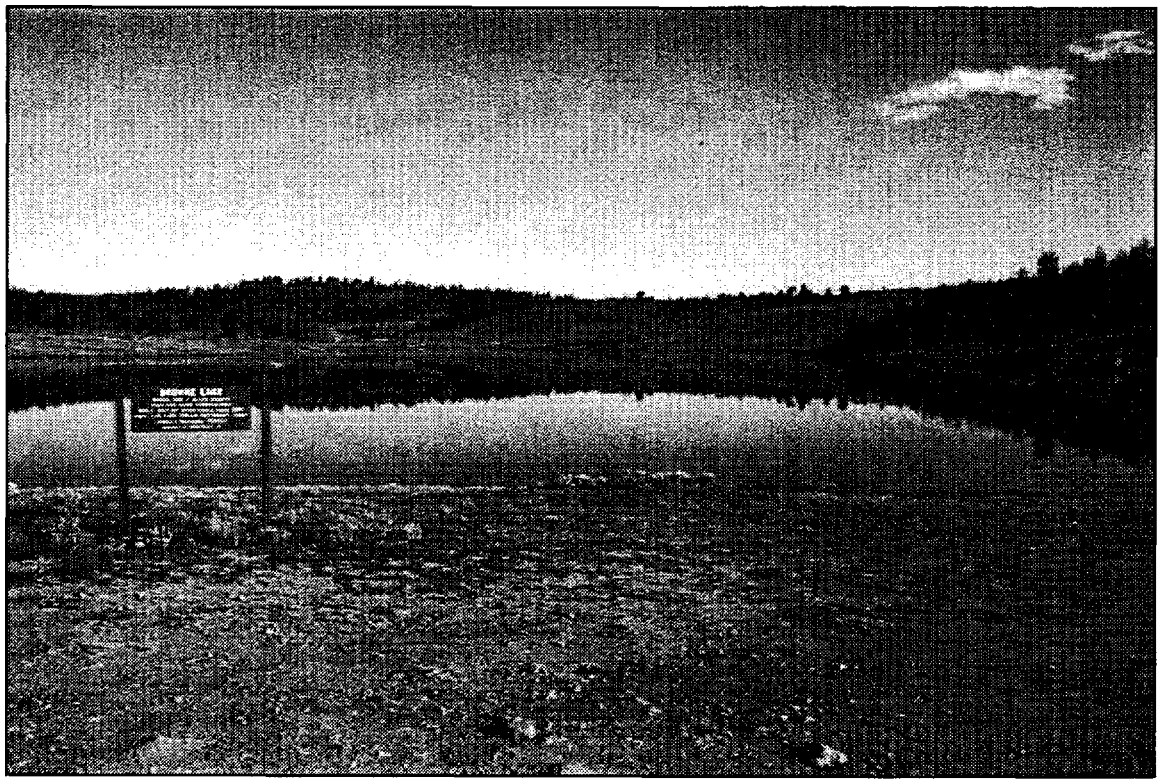
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Bureau of Land Management	
Diamond Mountain Resource Area	789-1362
Recreation	
Dinosaurland Travel Region (Vernal)	789-6932
Vernal Chamber of Commerce	789-1352
Reservoir Administrators	
Ouray Park Irrigation Company	545-2426

BROWNE LAKE



Introduction

Browne Lake (pronounced "Brownie") is a small stabilized lake on the north slope of the eastern High Uintas.

Characteristics and Morphometry

Lake elevation (meters / feet)	2,526 / 8,289
Surface area (hectares / acres)	21.9 / 54
Watershed area (hectares / acres)	7,555 / 18,668
Volume (m^3 / acre-feet)	
capacity	792,000 / 642
conservation pool	none
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	7.6 / 25
mean	3.7 / 12
Length (meters / feet)	914 / 3,000
Width (meters / feet)	244 / 800
Shoreline (km / miles)	2.23 / 1.4

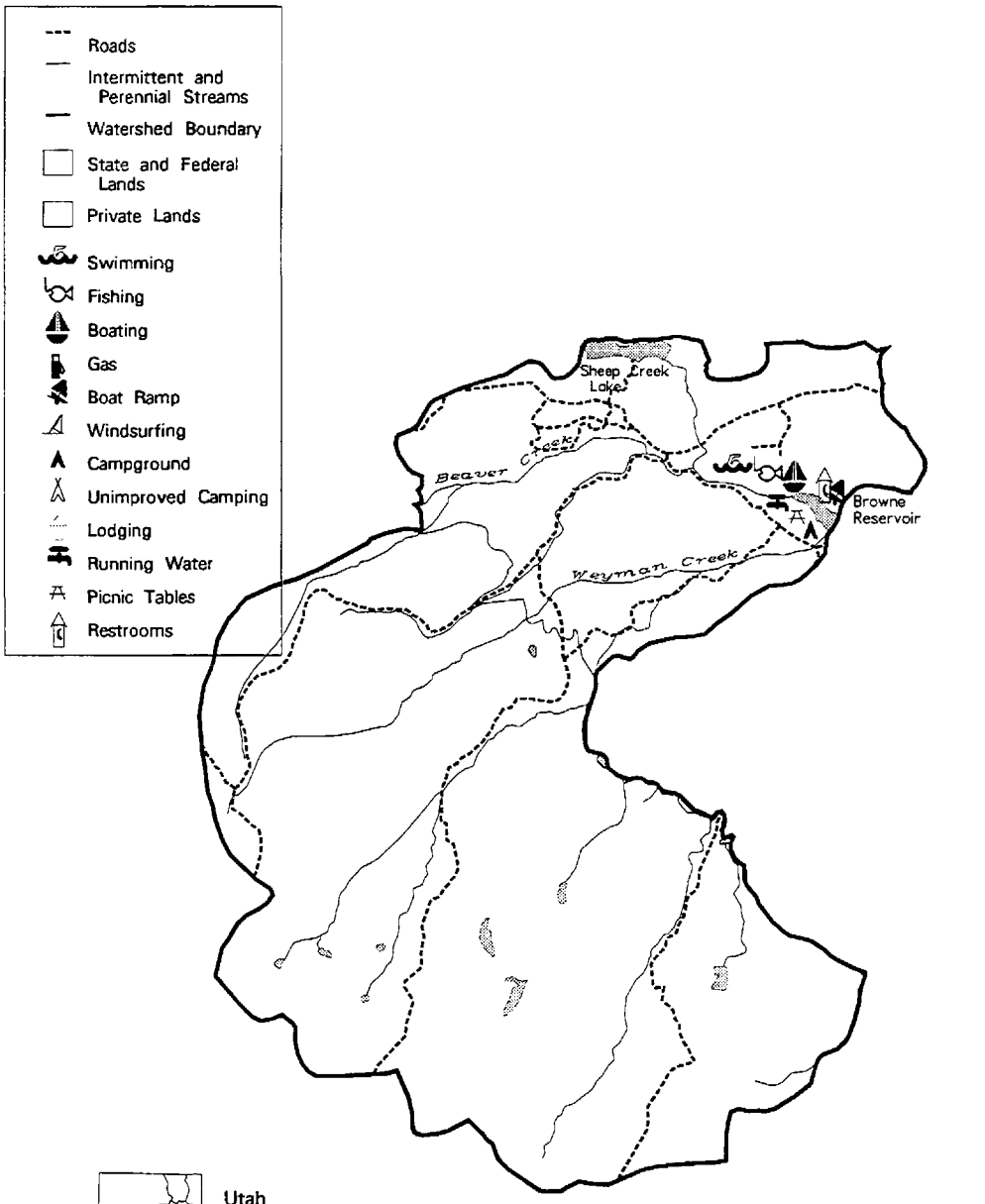
It is owned and maintained by the state of Utah to provide recreational fishing. It is also known as Browne Reservoir or Brownie Lake. It lies at the top of Carter Creek Gorge, one of the tributaries to Flaming Gorge. A Forest Service Campground, good fishing, and a trail head to Leidy Peak make this a popular summer recreation area. It is an artificial lake, impounding Beaver Creek in a mid-elevation meadow. The Lake was created as a reservoir for irrigational use, storing spring runoff for agricultural use in the summer. The Utah DWR acquired the lake in 1958 to provide a permanent stabilized body of water for purely recreational use. The shoreline is owned by the Ashley National Forest, and public access is unrestricted. No changes in water use are foreseen.

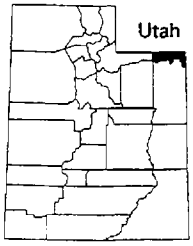
Location

County	Daggett
Longitude / Latitude	109 / 40
USGS Map	Leidy Peak, 1963
DeLorme's Utah Atlas & Gazetteer™	Page 56, B-2
Cataloging Unit	Flaming Gorge (14040106)

Recreation

Browne Lake is on the north slope road of the Uintas, about 10 miles west of U-44. From near milepost 15 on U-





County in which watershed is located.

Browne Watershed

<k38>

44, turn west on the Sheep Creek Geologic Loop. A sign says "Browne Lake 10". Follow the Sheep Creek Road for three miles, then turn west again on a gravel road also signed to Browne Lake. This is the North Slope Road. Follow it for five miles to the turnoff to Browne Lake on the left. The lake is two miles south on this road.

The lake is maintained solely as a fishery. There is no improved boat ramp, but the campground has privies, drinking water, picnic areas and charges user fees. Vehicular access to the lake is possible and smaller boats can be launched from an unimproved dirt boat ramp. It is an excellent trail head for hiking in the eastern Uintas, where glaciers have cut huge cirques out of the ridge line of the Uintas, creating an ice cream scoop effect. Ute Mountain Lookout Tower is off Sheep Creek Road and offers splendid views of the lake and the watershed.

Watershed Description

Browne Lake is an impoundment of a mid-elevation meadow in the north slope of the eastern Uintas. The lake itself lies outside the reach of Pleistocene glaciation, but its watershed includes cirques and dozens of morainal lakes. The area around the lake is a meadow with sage-grass vegetation and a few rock outcroppings, but coniferous forest covers most of the watershed. Much of the forest was burned in 1985, and has been slow to grow back. To the south, barren peaks rise above the forest. The lookout tower offers a good view of the region.

The Sheep Creek Canal diverts much of the runoff out of the Browne Lake watershed into Long Park Reservoir for agricultural use. This canal is at about the 9,100' level and collects much of the runoff from above this elevation.

Beaver Creek, the primary tributary to Browne Lake, enters the Sheep Creek Canal. The same amount of water is released back into the Beaver Creek drainage. Due to mixing, the Browne Lake watershed includes the Sheep Creek Canal watershed upstream from Beaver Creek, with only a small fraction of the water diverted back into the Beaver Creek drainage.

The watershed headwaters are in the eastern Uintas, clearly visible to the south. The high point, an unnamed peak two miles west of Leidy Peak, is 3,680 m (12,074 ft) above sea level, thereby developing a complex slope of 9.6% to the lake. The average stream gradient of Beaver Creek is 5.1% (270 feet per mile) The inflow and outflow are Beaver Creek and Weyman Creek. Weyman Creek has been diverted by the Sheep Creek Canal, but runoff into the lower reaches drains into the lake. Sheep Creek Lake is an upstream impoundment of Sheep Creek Canal water that flows into Beaver Creek. It is also a stabilized lake that is not drawn down for irrigational use.

The watershed is made up of high mountains and mountains meadows. An approximate listing of the soil associations that compose the watershed are found in Appendix III.

The vegetation communities consist of spruce-fir, pine, and aspen. The watershed receives 51 - 76 cm (20 - 30 inches) of precipitation annually. The frost-free season around the reservoir is 40 - 60 days per year.

Land use in the watershed is 100% multiple use, with grazing, logging, and human recreation being the primary uses. Much of the watershed burned in the 1985 Lyman Fire. The area was subsequently logged to salvage the burned timber. Some salvaging operations are still occurring.

Limnological Assessment

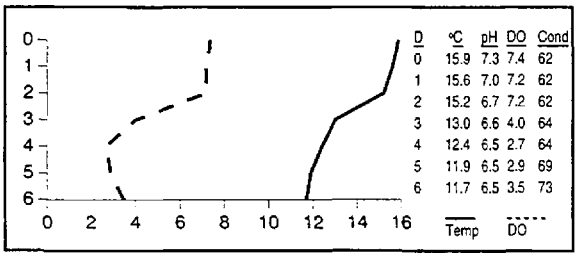
The water quality of Browne Reservoir is very good. It is considered to be soft with a hardness concentration value of approximately 25 mg/L ($CaCO_3$). The only parameter that has exceeded State water quality standards for defined beneficial uses is phosphorus. The average concentration of total phosphorus in the water column in 1981 and 1991 was 32.5 and 31.4 ug/L which exceeds the recommended pollution indicator for phosphorus of 25 ug/L. The phosphorus concentration in the hypolimnion in September, 1991 reached a level of 113 ug/L. This increased concentration occurred when the reservoir was stratified, however anoxic conditions were not present near the bottom. Dissolved oxygen concentrations in late summer substantiate the fact that water quality impairments do exist. Concentrations dropped dramatically below the thermocline to approximately 3.0 mg/L. Although in 1981 the reservoir was characterized as a phosphorus limited system, the 1989-91 data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is mesotrophic. The phosphorus concentrations in 1989 appear to be abnormally low (5.9 ug/L) and have shifted the overall TSI index to the low mesotrophic range. It does not appear that there has been a significant rise in the concentrations of nutrients in the lake since it was originally surveyed in 1981.

Limnological Data

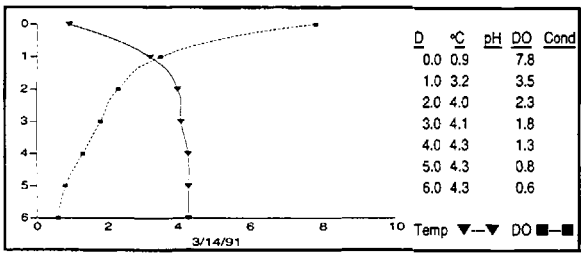
Data sampled from STORET site: 593792

Surface Data	1981	1989	1991
Trophic Status	M	M	M
Chlorophyll TSI	-	48.50	54.39
Secchi Depth TSI	51.9	45.69	42.16
Phosphorous TSI	46.9	26.61	39.37
Average TSI	49.4	40.27	45.31
Chlorophyll a (ug/L)	-	6.2	11.3
Transparency (m)	2.0	2.7	3.45
Total Phosphorous (ug/L)	30	5	12
pH	7.1	8	7.2
Total Susp. Solids (mg/L)	<5		5
Total Volatile Solids (mg/L)	-		3
Total Residual Solids (mg/L)	-		3
Temperature (°C / °f)	16/61	14/57	15/58
Conductivity (umhos.cm)	61	86	66
Water Column Data			
Ammonia (mg/L)	0.05	0.013	0.03
Nitrate/Nitrite (mg/L)	0.2	-	0.01
Hardness (mg/L)	28	-	25
Alkalinity (mg/L)	27	-	26
Silica (mg/L)	-	-	9.2
Total Phosphorus (ug/L)	30	6	31
Miscellaneous Data			
DO (Mg/l) at 75% depth	6.6	1.8	2.8
Stratification (m)	2-4	NO	2-3
Limiting Nutrient	N	N	N
Depth at Deepest Site (m)	6	8.0	6.0

In fact the concentration may have declined specifically the nitrogen species. The reservoir was stratified during a summer monitoring trip was in June, 1981 and September, 1991. Both periods were characterized with a thermocline developed at a depth of 2-3 meters. On the September 5, 1991 profile, consistent with the stratification there was a noticeable decline in the concentration of dissolved oxygen in the water column. These conditions are deleterious to the fishery rendered approximately 1/2 of the water column unsuitable for a fishery. In addition dissolved oxygen concentrations at time have reached a critical state during the winter period for fish. The reservoir was surveyed on



March 13, 1991 and near anoxic conditions were found present in the lower depths of the water column. Concentrations of dissolved oxygen at the surface were 7.8 mg/L but dropped to 3.5 mg/L at 1 meter and reached a low of 0.6 mg/L at the bottom (6 meters). Water temperature at that time was relatively uniform near 4.3 degrees C throughout the water column.



According to DWR no fish kills have been reported in recent years. The reservoir supports populations of brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*), cutthroat trout (*Oncorhynchus clarki*), and sculpins (*Cottus sp.*). Brook trout up to 5 pounds have been reported from Browne Reservoir.

Since the lake was acquired by the DWR and water levels stabilized, the riparian vegetation has become established along the shore, with a thin band of grass and sedges being the colonizing species. Eventually more riparian vegetation may provide significantly improved habitat for aquatic organisms.

The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance):

Species	Cell Volume (mm^3/liter)	% Density By Volume
Anabaena spiroides v. crassa	2.891	32.32
Sphaerocystis schroeteri	2.641	29.53
Fragilaria crotonensis	1.832	20.49
Trachelomonas sp.	1.334	14.92
Cosmarium sp.	0.078	0.88
Chlamydomonas globosa	0.034	0.38
Oocystis sp.	0.033	0.37
Pennate diatoms	0.030	0.34
Asterionella formosa	0.019	0.21
Melosira granulata angustissima	0.016	0.19
Centric diatoms	0.015	0.18
Microcystis incerta	0.011	0.12

Mallamonas sp.	0.007	0.07
Total	8.939	
Shannon-Weaver [H']	1.49	
Species Evenness	0.58	
Species Richness	0.53	

As observed the algal community is dominated by algae and diatom species that are indicative of more eutrophic conditions as supported by the trophic state index.

Pollution Assessment

Nonpoint pollution sources include grazing, recreation, and logging.

Grazing takes place throughout the watershed and in the vicinity of the reservoir.

The fire may have caused some short-term increases in sediment production, but earlier logging operations probably caused more substantial damage. The damage has been largely healed.

There are no point sources of pollution in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	789-3103
Division of Water Quality	538-6146
Ashley National Forest	789-1181
Flaming Gorge Ranger District	784-3445
Recreation	
Dinosauriland Travel Region (Vernal)	789-6932
Manila Chamber of Commerce	784-3395
Reservoir Administrators	
Division of Wildlife Resources, Fisheries Management	538-4812

BUTTERFLY LAKE

Introduction

Butterfly Lake is a small natural lake in the western portion of the High Uintas. Because of close proximity to a paved highway, this lake was chosen as a representative of hundreds of high-elevation lakes of this size. In addition, it receives extensive recreational usage. Its general shape is that of a butterfly.

The shoreline is owned by the Wasatch-Cache National Forest, and public access is unrestricted. The lake may be regulated by its outlet, a culvert beneath U-150.

Characteristics and Morphometry

Lake elevation (meters / feet)	3,151 / 10,340
Surface area (hectares / acres)	2 / 5
Watershed area (hectares / acres)	
Volume (m^3 / acre-feet)	30,838 / 25
Annual inflow (m^3 / acre-feet)	not measured
Retention time (years)	not measured
Drawdown	none
Depth (meters / feet)	
maximum	4 / 13
mean	1.5 / 5
Length (meters / feet)	210 / 700
Width (meters / feet)	150 / 500
Shoreline (meters / feet)	700 / 2,300

Recreation

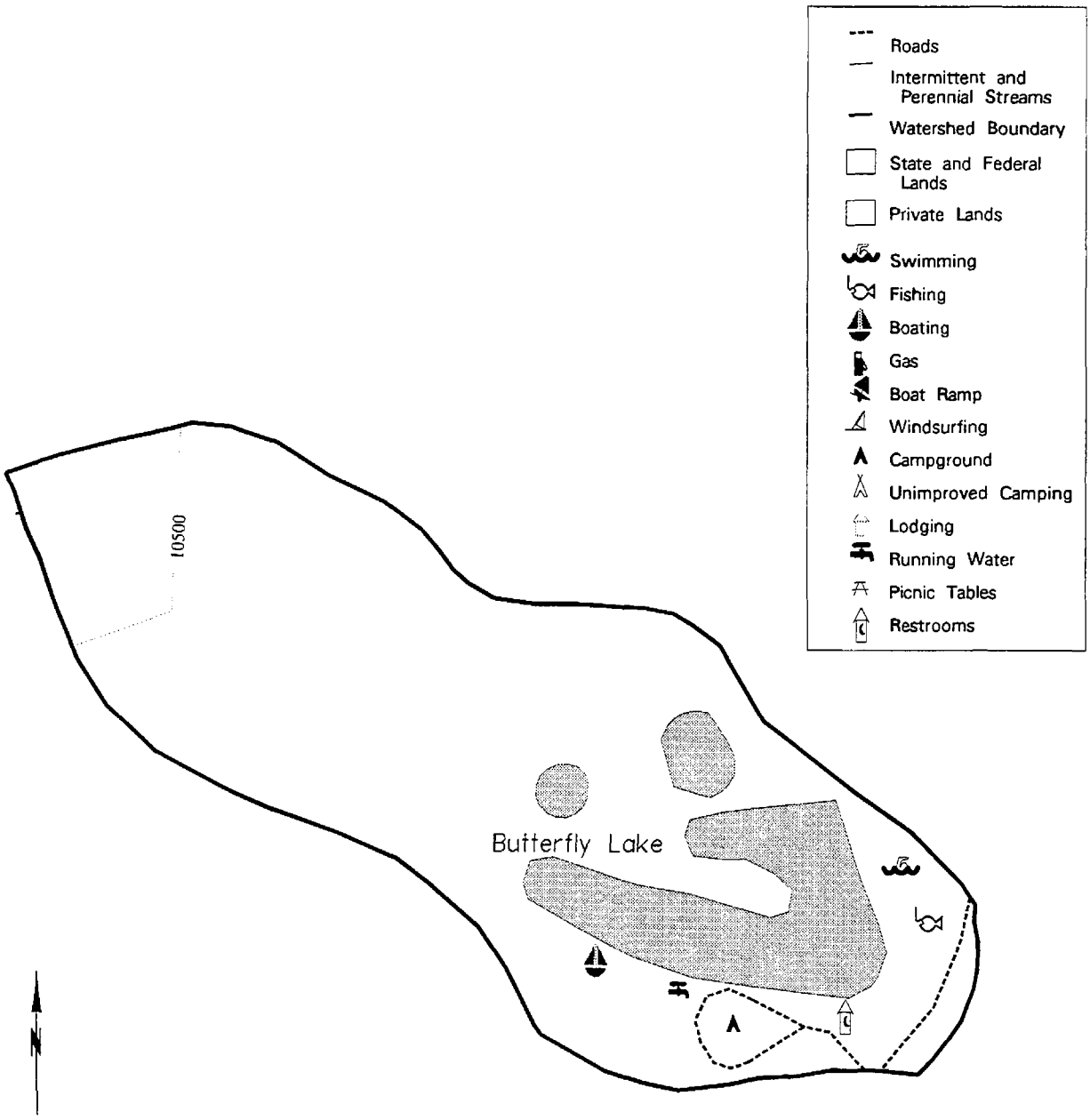
Butterfly Lake is on U-150 (the Mirror Lake Highway) at Hayden Pass (three miles north of Mirror Lake). The lake and adjacent campground are well marked.

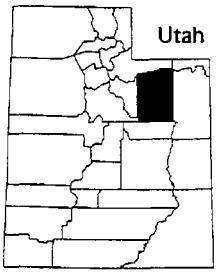
Fishing, camping, picnicking and hiking are all popular. The lake is much to small for boats. There is a backdrop of high, barren peaks. Summer temperatures are cool as a result of the extremely high elevation.

Because the area receives heavy recreational use throughout the summer, visitors should practice low-impact camping so that the area remains relatively pristine. U-150 is closed during the winter and much of the spring, but is groomed for cross country skiers, snowmobilers and hikers.

Location

County	Duchesne
Longitude / Latitude	110 51 59 / 40 43 20
USGS Map	Hayden Peak, UT 1972
DeLorme's Utah Atlas & Gazetteer™	Page 54, B-3
Cataloging Unit	Duchesne (1460003)





County in which watershed is located.

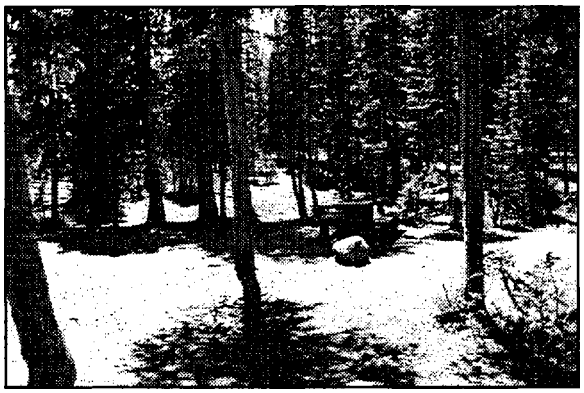
500 0 500 1,000 FEET

100 0 100 200 300 METERS

Butterfly Watershed

<k63>

Recreational facilities at the reservoir include Butterfly Campground, with latrines, day-use areas and 20 campsites. There are numerous other campgrounds along the Mirror Lake Highway, but it is not uncommon for all to be full on summer weekends.



Watershed Description

Butterfly Lake is a few meters south of Hayden Pass, separating the Duchesne River watershed from the Bear River watershed. The lake is of glacial origin. The pass sits at a point where two cirques eroded into each other, resulting in a low pass. Glaciers may have flowed either one way or the other, but it now divides the two river basins. Uneven scouring and deposition of moraine resulted in dozens of basins, which filled with water as the ice melted.

The lake is just below timberline, with spruce-fir and aspen along the shore. The watershed appears to extend to the peak one kilometer west of the lake, although it may only stretch a few hundred meters upwards.

The watershed high point is 3,345 m (10,975 ft) above sea level, thereby developing a complex slope of 17.0% to the reservoir. There are no perennial streams flowing into the lake, but because of the high elevation, snow-melt runoff flows for most of the summer. The outflow is an unnamed tributary to the Duchesne River.

The watershed is made up of high mountains and mountains meadows. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of Pine, oak, maple, spruce-fir, aspen, and alpine. The watershed receives 76 - 102 cm (30 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 0 - 20 days per year.

Land use in the watershed is 100% multiple use, with human recreation being the primary use. Grazing may also occur. No commercial timber harvesting takes place, but the intensity of summer recreation results in some timber being harvested or salvaged for firewood.

Limnological Assessment

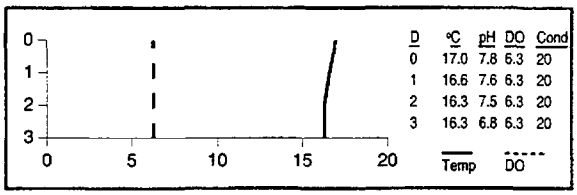
The water quality of Butterfly Lake is very good. It is considered to be very soft with a hardness concentration near 8 mg/L ($CaCO_3$). During 1990 and 1992 no parameters monitored have exceeded State water quality standards for defined beneficial uses. Although the nutrient concentrations within the system are consistently low the data suggest that the system is nitrogen limited. In 1981 the lake was characterized as mesotrophic. No chlorophyll-a data was obtained during that period. Recent data indicates that the lake should be classified as an oligotrophic lake with report average TSI values of 40.71 and 34.04 for 1990 and 1992 respectively. In addition the TSI values for transparency are artificially high because of the shallowness of the lake. Transparency depths are usually indicated as the maximum depth of the reservoir. True depths would even reduce the TSI value more. This would assure that the lake should currently be classified as oligotrophic. The lake was weakly stratified in 1981 at the 2 meter level but no stratification was present during recent monitoring trips as depicted during the August 4, 1992. Due to the shallow nature of the

Limnological Data

Data sampled from STORET site: 593611

Surface Data	1981	1990	1992
Trophic Status	M	M	O
Chlorophyll TSI	-	38.11	32.39
Secchi Depth TSI	44.2	45.96	42.37
Phosphorous TSI	47.3	38.06	33.20
Average TSI	45.8	40.71	35.99
Chlorophyll a (ug/L)	-	2.2	1.2
Transparency (m)	2.8	2.7	3.4
Total Phosphorous (ug/L)	20	10	8
pH	7.1	6.6	7.2
Total Susp. Solids (mg/L)	<5	<3	<3
Total Volatile Solids (mg/L)	-	-	-
Total Residual Solids (mg/L)	-	-	3
Temperature (°C / °f)	17/63	15/60	16/60
Conductivity (umhos.cm)	8	22	21
Water Column Data			
Ammonia (mg/L)	0.05	0.04	0.03
Nitrate/Nitrite (mg/L)	0.13	-	0.01
Hardness (mg/L)	7.5	7	8
Alkalinity (mg/L)	4	3	4
Silica (mg/L)	-	-	0.5
Total Phosphorus (ug/L)	25	15	6.0
Miscellaneous Data			
DO (Mg/l) at 75% depth	7.5	6.3	6.3
Stratification (m)	2.4	1-2	NO
Limiting Nutrient	N	N	N
Depth at Deepest Site (m)	4	2.3	3.0

lake the stratification is probable weak and may be broken down by wind and wave action. Even when the lake was stratified in 1981 there was no major decline in the dissolved oxygen concentration throughout the water column. The shallowness of the lake and the extensive winter season for the lake may make it difficult for the overwintering of fish in the lake.



Because of the shallow nature of the lake and its stable water level, an extensive portion of the surface is covered with macrophytes, predominantly water lilies.

Although the lake has not been chemically treated by the DWR, there were probably no fishes in the lake before early inhabitants stocked trout. The lake is managed as an intensive fishery, and there are no spawning areas in the lake, so all fishes in the lake are hatchery fish. It is stocked annually with approximately 4,000 catchable rainbow and albino trout (*Oncorhynchus mykiss*) and 1,000 fingerling brook trout (*Salvelinus fontinalis*). Fishes are not native to many areas of this region.

On August 4, 1992, phytoplankton in the euphotic zone included the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	13.205	82.86
Botryococcus braunii	2.224	13.95
Pennate diatoms	0.167	1.05
Scenedesmus quadricauda	0.150	0.94
Merismopedia tenuissima	0.058	0.37
Euglena sp.	0.041	0.26
Scenedesmus bijuga	0.033	0.21
Ankistrodesmus falcatus	0.017	0.11
Oocystis sp.	0.008	0.05
Chlamydomonas sp.	0.002	0.01
Total	15.902	
Shannon-Weaver [H']	0.60	
Species Evenness	0.25	
Species Richness	0.46	

As observed the phytoplankton community is dominated by two species of green algae indicative of fairly high quality oligotrophic waters.

Pollution Assessment

Nonpoint pollution sources include the following: Sedimentation and nutrient loading from grazing, and litter, human waste and chemicals from recreation.

There are no point sources of pollution in the watershed.

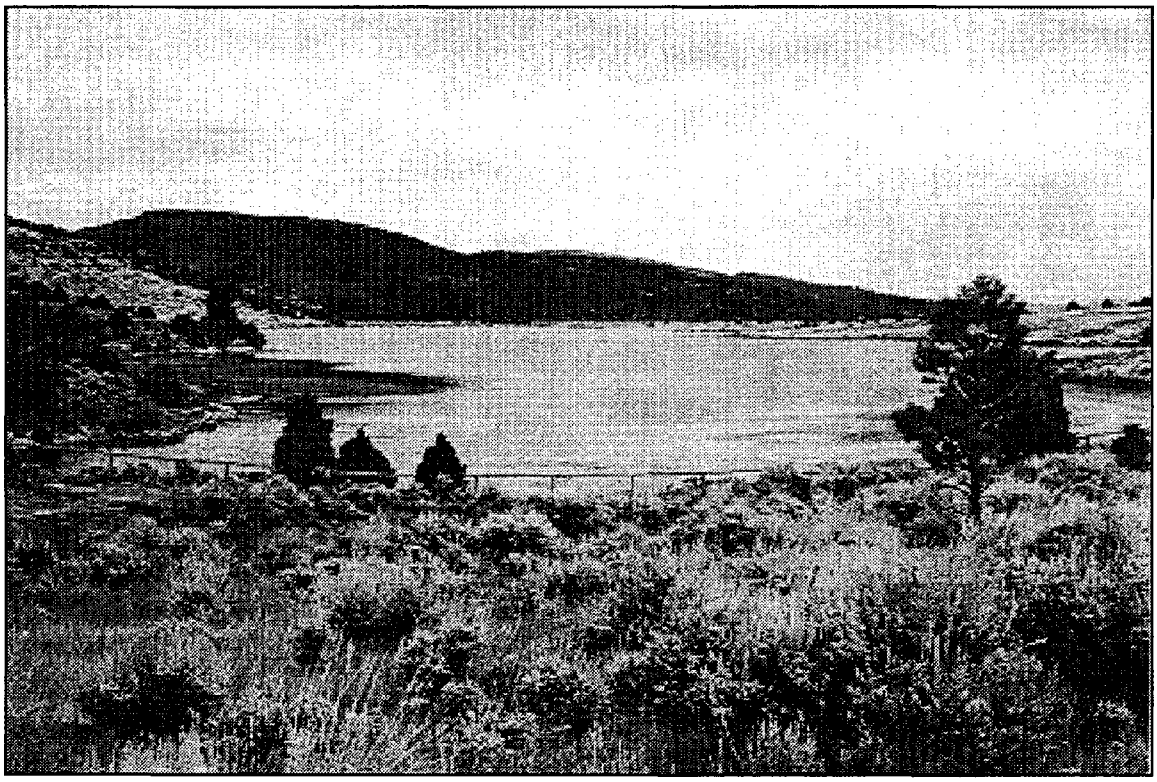
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Wasatch-Cache National Forest	524-5030
Kamas Ranger District	783-4338
Recreation	
Dinosaurland Travel Region (Vernal)	789-6932

CALDER RESERVOIR



Introduction

Calder Reservoir is a small stabilized lake in the Diamond Mountain area northeast of Vernal. It is in the middle of a chain of three stabilized lakes on Pot Creek. Although it is in the Uinta Mountains, elevations are much lower in the eastern end of the range, so the area lacks the continuous coniferous forests of the central portion of the range. It is also known as Calder Pond or Zelph Calder Reservoir. It provides summer recreational opportunities.

Calder Reservoir was created in the 1970's by the construction of an earth-fill dam, and purchased by the DWR in 1978. The reservoir shoreline is mostly privately owned, but the west end and northeast corner are owned by the BLM. Public access is unrestricted. Reservoir water is owned by the DWR for non-consumptive use as cold-water aquatic habitat and a recreation facility, but in drought years the reservoir is drained to meet agricultural needs. There are no foreseeable changes in water use.

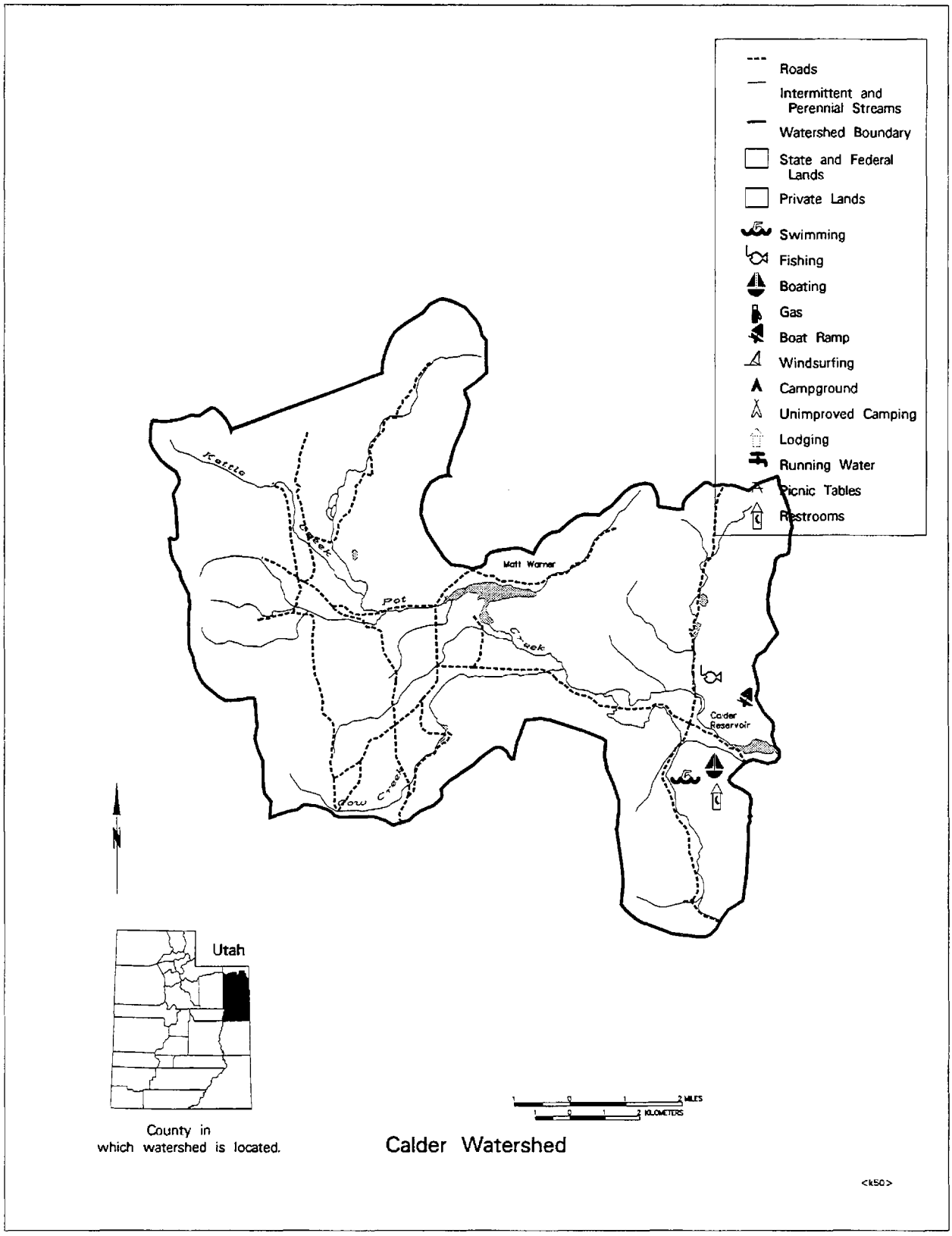
Characteristics and Morphometry

Lake elevation (meters / feet)	2,223 / 7,291
Surface area (hectares / acres)	40 / 99
Watershed area (hectares / acres)	17,220 / 42,551[2]
Volume (m^3 / acre-feet)	
capacity	2,009,790 / 1,630
conservation pool	1,849,500 / 1,500
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Mean annual vertical fluctuation (meters / feet)	0.5 / 1.7
Depth (meters / feet)	
maximum	12 / 38
mean	5 / 17
Length (meters / feet)	1,375 / 4,510
Width (meters / feet)	400 / 1,310
Shoreline (meters / feet)	3,600 / 11,810

Location

County	Uinta
Longitude / Latitude	109 12 02 / 40 43 08
USGS Map*	Crouse Reservoir 1962
DeLorme's Utah Atlas & Gazetteer™	Page 56, B-4 - B-5
Cataloging Unit	(14060001)

* Reservoir not on map. Clearly seen on USGS Dutch John 1:100,000 map


Roads
Intermittent and Perennial Streams
Watershed Boundary
State and Federal Lands
Private Lands
Swimming
Fishing
Boating
Gas
Boat Ramp
Windsurfing
Campground
Unimproved Camping
Lodging
Running Water
Picnic Tables
Restrooms
Kettle
Creek
Pot
Creek
Matt Warner
Calder Reservoir
Utah
County in which watershed is located.
MILES
KILOMETERS
Calder Watershed
<k50>

Recreation

Calder Reservoir is accessible from Jones Hole Road northeast of Vernal. Go east out of Vernal on 500 North, following signs to Jones Hole, Diamond Mountain, and Brown's Park. Two miles west of town, the road bends north and drops into the Brush Creek valley, then climbs for many miles to Diamond Mountain (a plateau). Seven miles after reaching the top of the plateau (and 27 miles out of Vernal), turn left on an unpaved road marked "Crouse Reservoir 5 Browns Park 15". Follow this road for two miles to the crest of a hill, then angle left at a fork in the road to Crouse and Calder reservoirs. After 4 miles or so, Calder Reservoir should be visible on the left and Crouse on the right. It is also possible to remain on the right fork of the road (to Browns Park) to Crouse Reservoir, then go west for one mile to Calder Reservoir.

Fishing is the primary function of the reservoir. It has a boat ramp and latrines, and is well stocked with fish. There are no public or private campgrounds in the area. Campers should pack out *all* refuse. This is private land and being a guest is a privilege.

Watershed Description

Calder Reservoir is on Pot Creek, an east flowing drainage starting from Mount Lena (two miles west of US-191 at the summit) to the Green River in The Canyon of Lodore in Colorado. It is located in an area of rolling hills and flat valley bottoms. The Uintas are lower in this area, and the axis of the anticline is not a watershed boundary, having cut by the Green River and subsequently by tributaries to the river that are capturing the Pot Creek Drainage. On a geologic time scale, Jackson Draw and several other north flowing streams are on the verge of capturing Pot Creek.

Slopes in the Pot Creek drainage are not steep (30% maximum) and very little erosion is occurring. There are some mid-elevation mountains at the headwaters of Pot Creek, but these are small compared to the higher mountains several miles further west.

The watershed high point, the east peak of Mount Lena, is 2,951 m (9,147 ft) above sea level, thereby developing a complex slope of 4.3% to the reservoir. The average stream gradient of Pot Creek is 0.8% (44 feet per mile) The inflow and outflow is Pot Creek. Matt Warner Reservoir, another DWR-owned stabilized lake, is several miles upstream.

The watershed is made up of mountains and mountain valleys. Soil composition information has not been compiled by the Division of Water Quality.

The vegetation communities consist of sage-grass, pinyon-juniper, spruce-fir and aspen. The watershed receives 41 - 51 cm (16 - 20 inches) of precipitation annually. The frost-free season around the reservoir is 60 -80 days per year.

Land use in the watershed rangelands is divided between the privately owned areas (about 50%) and multiple use (rangelands and recreation) in the areas owned by the BLM and the Forest Service (about 25% each).

Limnological Assessment

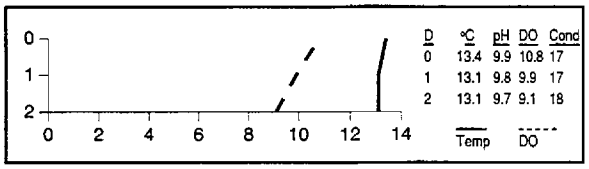
The water quality of Calder Reservoir is good. It is considered moderately hard with a hardness concentration range of 88-123 mg/L ($CaCO_3$). The only water quality parameter that has exceeded water quality standards for defined beneficial uses of the reservoir is phosphorus. The average phosphorus concentration in 1992 in the water column was 0.085 mg/L which is more that three times the recommended pollution indicator value (0.025 mg/L). Although the concentrations of phosphorus in the reservoir is relatively high the concentration of nitrogen are usually low at the minimum detectable limits much of the time for ammonia and nitrate. The reservoir does have a moderate to high biological productivity rate and the data indicates that

Limnological Data

Data sampled from STORET site: 593780

Surface Data	1981	1992
Trophic Status	E	E
Chlorophyll TSI	-	40.52
Secchi Depth TSI	40.02	53.68
Phosphorous TSI	60.56	68.21
Average TSI	50.29	54.14
Chlorophyll a (ug/L)	-	2.8
Transparency (m)	4.0	1.55
Total Phosphorous (ug/L)	50	85
pH	8.6	9.7
Total Susp. Solids (mg/L)	<5	2.75
Total Volatile Solids (mg/L)	-	2
Total Residual Solids (mg/L)	-	2
Temperature (°C / °f)	16/61	14/57
Conductivity (umhos.cm)	251	183
Water Column Data		
Ammonia (mg/L)	0.1	0.03
Nitrate/Nitrite (mg/L)	0.35	0.01
Hardness (mg/L)	123	88
Alkalinity (mg/L)	121	94
Silica (mg/L)	-	1.4
Total Phosphorus (ug/L)	50	85.0
Miscellaneous Data		
DO (Mg/l) at 75% depth	7.1	9.5
Stratification (m)	2-3	NO
Limiting Nutrient	N	N
Depth at Deepest Site (m)	4.0	2.0

the reservoir is consistently nitrogen limited. The trophic status of the reservoir is eutrophic with reported TSI values in excess of 50 for those years monitored. The only stratification that was documented in the reservoir was in June, 1981 between 2 and 3 meters, midway through the water column. No thermocline was present on September 3, 1992 but the depth of the reservoir was only 2 meters. The reservoir has never been near capacity (12 meter depth) during any monitoring periods. Stratification may occur under conditions where more water was stored in the reservoir. It appears that one of the major criteria the affects water quality is the quantity of water stored in the reservoir. In addition to low storage the reservoir is periodically drained. Even if some water is stored in the reservoir during the winter season problems can develop. During a winter survey on March 14, 1991 a profile of the water column was made. The dissolved oxygen concentration ranged from 0.3 mg/L at the surface to 0.1 mg/L at the bottom (3.3 meters). It is evident that under these conditions that survival of fish during the winter season is limited in the reservoir to areas (inlets) where dissolved oxygen concentrations may be sufficient for fishery requirements. According to DWR stocking reports Calder Reservoir is stocked annually with 5,000 catchable and 15,000 fingerling rainbow trout (*Oncorhynchus mykiss*).



The reservoir has not been chemically treated by the DWR, but the periodic draining of the reservoir makes it unlikely that native fishes are present in any significant numbers.

On September 3, 1992, phytoplankton in the euphotic zone was as follows:

Species	Cell Volume (mm^3/liter)	% Density By Volume
Staurastrum sp.	0.333	49.55
Pennate diatoms	0.267	39.64
Scenedesmus quadricauda var. quadrispina	0.044	6.61
Crucigenia rectangularis	0.016	2.48
Oocystis sp.	0.008	1.32
Chlamydomonas sp.	0.002	0.41
Total	0.67	
Shannon-Weaver [H']	1.07	
Species Evenness	0.59	
Species Richness	0.25	

As observed the reservoir is dominated by green algae and diatoms indicative of higher water quality than indicated by the tropic state index.

Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Dinosaurland Travel Region (Vernal)	789-6932
Vernal Chamber of Commerce	789-1352
Reservoir Administrators	
Division of Wildlife Resources	538-4700

Pollution Assessment

Nonpoint pollution sources include the following: Sedimentation and nutrient loading from grazing. Litter, human waste and chemicals from recreation.

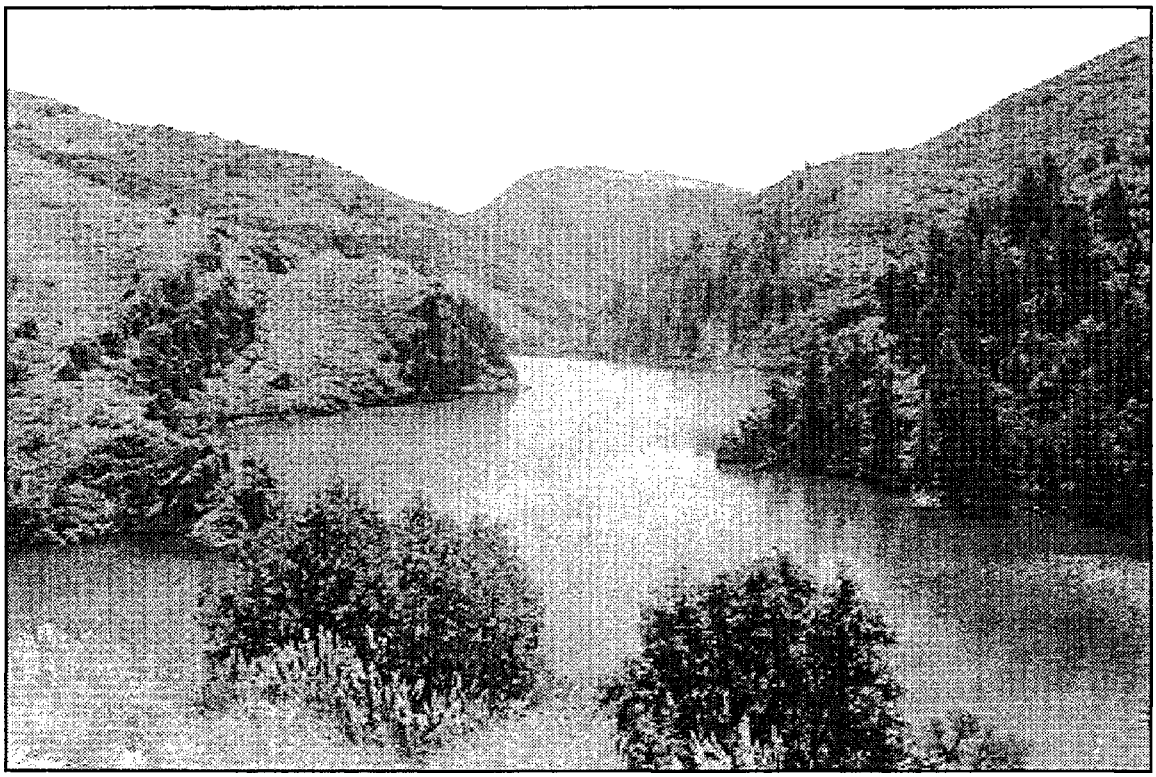
Grazing takes place throughout the watershed, but the reservoir is fenced to protect the riparian areas from domestic livestock.

There are no point sources of pollution in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

CAUSEY RESERVOIR



Introduction

Causey Reservoir is an intermediate-sized reservoir on the South Fork of the Ogden River above Huntsville. It is one of the most scenic and beautiful reservoirs in Utah. The reservoir is nestled in steep valley terrain. The reservoir extends away from the main body into 3 distinct canyons. Travel into these areas is inspiring with shear vertical walls and heavily forested areas. Most of the area has the appearance of remote wilderness. The majority of shoreline is administered by the U.S. forest service, but access is limited due to private ownership at key access areas which restricts access to the area except by existing waterways.

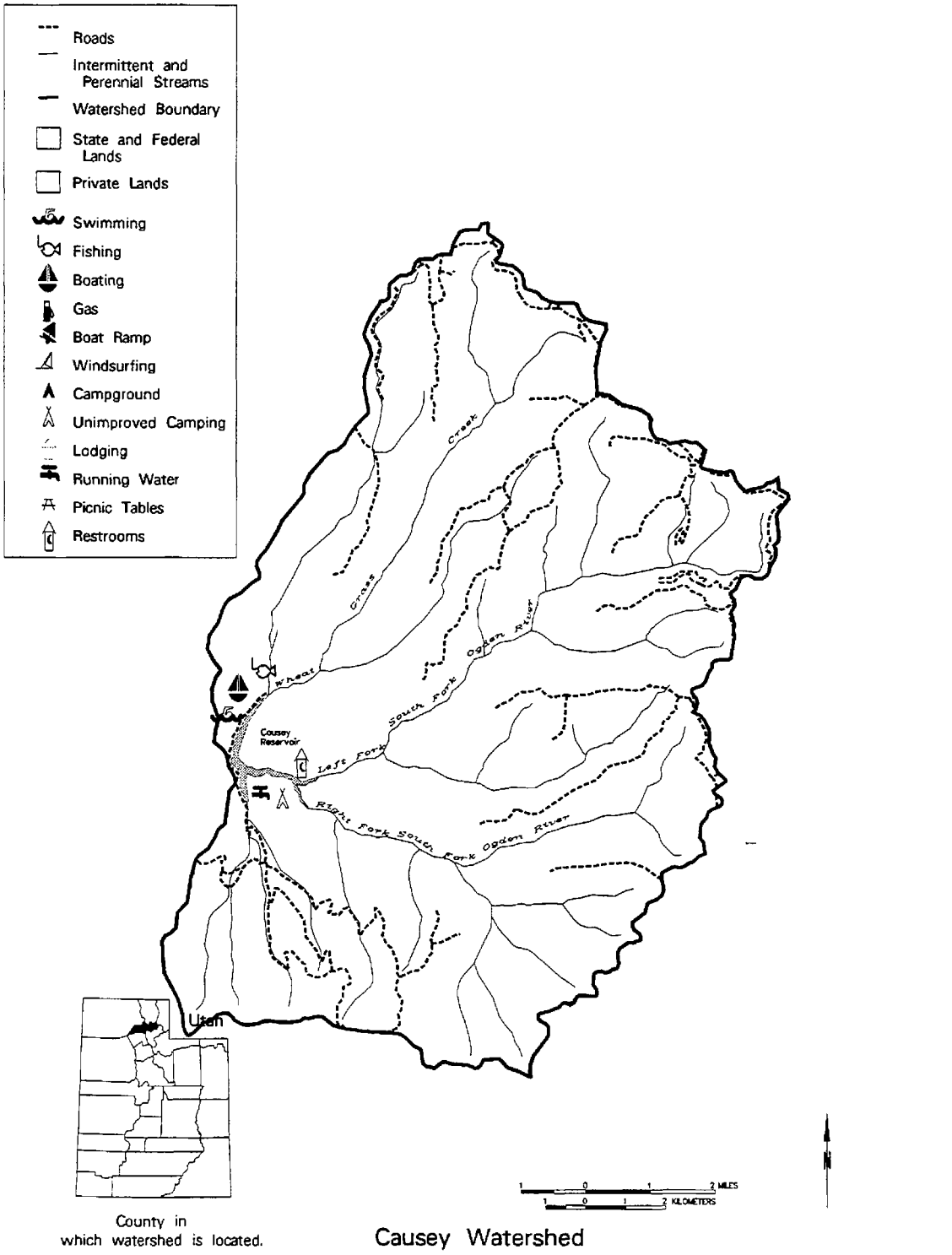
Characteristics and Morphometry

Lake elevation (meters / feet)	1,735 / 5,692
Surface area (hectares / acres)	57 / 142
Watershed area (hectares / acres)	18,648 / 46,080
Volume (m^3 / acre-feet)	
capacity	10,764,0907 / 8,730
conservation pool	none
Annual inflow (m^3 / acre-feet)	
Retention time (years)	1.5
Mean annual vertical fluctuation (meters / feet)	19 / 62
Drawdown (m^3 / acre-feet)	7,274,700 / 5,900
Depth (meters / feet)	
maximum	55 / 182
mean	20 / 65
Length (km / miles)	4.0 / 2.5
Width (meters / feet)	143 / 469
Shoreline (km / miles)	11.8 / 7.3

Location

County	Weber
Longitude / Latitude	111 35 17 / 41 17 55
USGS Map	Causey Dam, 1991
DeLorme's Utah Atlas & Gazetteer™	Page 61, C-4
Cataloging Unit	Lower Weber (16020102)

Use of this reservoir offers a unique experience. It was built by the Bureau of Reclamation, using federal funds to subsidize the cost of providing water to the northern Wasatch Front. Causey Reservoir was created in 1966 by the construction of an earth-fill dam. The reservoir shoreline is almost entirely owned by the Forest Service, but



County in which watershed is located.

Causey Watershed

<k8>

there are several privately-owned key access areas, and the owner does not permit public access to neighboring Forest Service lands. Although water is consumed for agricultural (75%) and culinary (25%) uses, it is used for recreation and cold-water aquatic habitat too. The culinary use will probably increase as suburban sprawl continues to displace local farmland.

Recreation

Causey Reservoir is east of Ogden in Ogden Canyon. Travel on U-39 up Ogden Canyon to Huntsville, and continue for eight more miles to a turnoff on the right. Follow this improved gravel road for two miles to the reservoir. The turnoff should be well marked, as there is a Boy Scout Camp on the north arm of the reservoir.

Access to the reservoir is limited, as some portions of the shore are privately owned, restricting land access to most of the reservoir. Boating is permitted, but there is no boat ramp, and fishing from motorized boats is prohibited.

The Forest Service once maintained latrines at the reservoir, but they have fallen victim to vandals. A Weber County Park is located just below the dam, with drinking water, camping, and latrines. Deep drawdowns by late summer can restrict recreational use. There are USFS campgrounds on U-39 between Huntsville and the reservoir.

Watershed Description

Causey Reservoir is in the southern end of the Monte Cristo Range. These mountains were created by a major twisting of the earth, which then eroded down and was covered with the Tertiary Wasatch Formation, then re-uplifted. Most of the surface is still the Wasatch Formation, but deep canyons expose complex folds of Paleozoic rocks. Causey Reservoir is an impoundment of such a canyon. These rocks are more resistant than the softer Wasatch Formation, resulting in steep canyon walls and rocky outcroppings, providing pockets of sheltered habitat for spruce-fir vegetation. The canyon has several bends and three inundated tributary arms, so the only way to access or even see much of the reservoir is by boat. All of the major tributaries have long, deep, winding canyons cut through the Paleozoic rocks for much of the distance to their sources.

Further away from the reservoir, the land is hilly with sage-grass and oak-maple vegetation. The headwater areas are only moderately high mountains.

The watershed high point, Monte Cristo Peak, is 2,788 m (9,147 ft) above sea level, thereby developing a complex slope of 3.7% to the reservoir. The average stream gradient above the reservoir is 9.4% (494 feet per mile). The major inflows are Dry Bread Creek, Wheat Grass Creek, Left Fork South Ogden River, Right Fork South Ogden River, and Skull Crack Creek. The outflow is the South Fork Ogden River.

The watershed is made up of mountains, mountain valleys, and rolling hills. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of sage-grass, oak, maple, pine, aspen, and spruce-fir. The watershed receives 64 - 76 cm (25 - 30 inches) of precipitation annually. The frost-free season around the reservoir is 100 - 140 days per year.

The reservoir and watershed are within the Wasatch-Cache National Forest, but 66% of the land is privately owned. The area on the north west side of the reservoir is used for intensive recreation, including Camp Keiser, a Boy Scout Camp. The eastern areas of the reservoir are closed to land access by the owner of several parcels of private property around the reservoir. The Weber County line follows the watershed boundary, and all of the area adjacent to Morgan County is privately owned for a width of about three miles. Land use is primarily grazing and dispersed recreation, although logging and small mining operations have taken place in the past. At present, 1% of the watershed contains summer homes, but as population increases on the Wasatch Front, more development will probably occur.

Limnological Assessment

The water quality of Causey Reservoir is very good. It is considered to be hard with a hardness concentration value of approximately 165 mg/L ($CaCO_3$). The only parameters that have exceeded State water quality standards for defined beneficial uses are phosphorus and dissolved oxygen. Although the average concentration of total phosphorus in the water column has generally not exceeded the State pollution indicator for phosphorus of 25 ug/L, in 1989 phosphorus concentration did average 40 ug/L in the water column and in the east arm hypolimnion in August, 1989 reached a level of 152 ug/L. This increased concentration occurred when the reservoir was stratified, and anoxic conditions were present near the bottom. These types of conditions allow for the reintroduction of phosphorus previously stored in the sediments. Dissolved oxygen concentrations in late summer consistently substantiate the fact that water quality impairments do exist. Concentrations dropped dramatically below the thermocline to approximately 3.0 mg/L. It does appear after reviewing the 1991 data that the trophic state of the reservoir is improving and the conditions in 1991 indicate that the reservoir is in an oligotrophic state. All three periods of record indicate that the reservoir is characterized as a phosphorus limited system. TSI values indicate the reservoir has declined from

a mesotrophic state (47.34) to an oligotrophic state (38.79) in 1991. All late season profiles indicate that a thermocline develops at a depth of approximately 18 meters with anoxic conditions developing below the thermocline. These conditions are deleterious to the fishery rendered approximately 1/3 of the water column unsuitable for a fishery. According to DWR no fish kills have been reported in recent years. The reservoir supports populations of rainbow trout (*Oncorhynchus mykiss*), and cutthroat trout (*Oncorhynchus clarki*). DWR typically stocks the reservoir with fingerling trout with some catchable rainbow trout.

Limnological Data

Data averaged from STORET site: 492473, 492474, 492475.

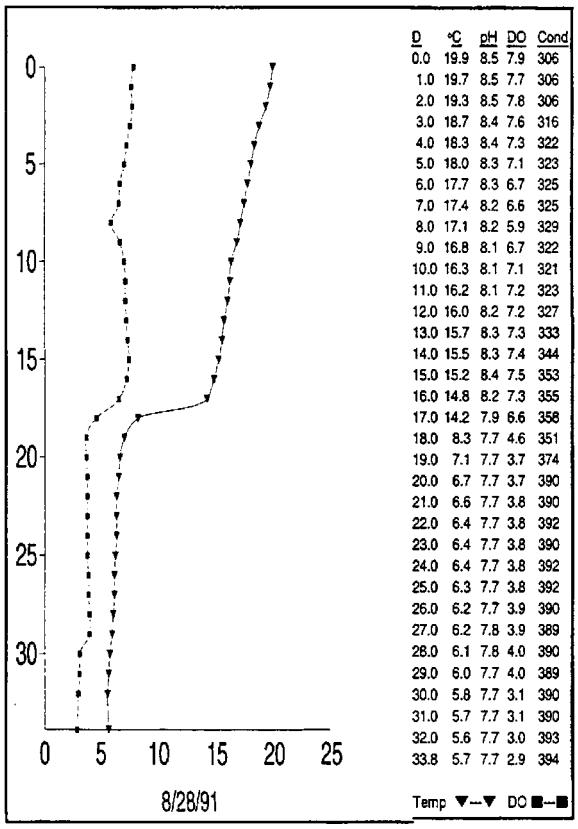
Surface Data	1981	1989	1991
Trophic Status	M	M	O
Chlorophyll TSI	-	42.40	44.40
Secchi Depth TSI	47.38	37.44	42.05
Phosphorous TSI	47.30	49.86	29.90
Average TSI	47.34	43.23	38.79
Chlorophyll a (ug/L)	-	3.35	4.36
Transparency (m)	2.4	4.8	3.8
Total Phosphorous (ug/L)	10	24	6.2
pH	-	8.36	8.86
Total Susp. Solids (mg/L)	<5	-	<3
Total Volatile Solids (mg/L)	-	-	4
Total Residual Solids (mg/L)	-	-	<3
Temperature (°C / °f)	18/64	17/62	18/64
Conductivity (umhos.cm)	280	317	306
Water Column Data			
Ammonia (mg/L)	0.05	0.02	0.03
Nitrate/Nitrite (mg/L)	0.17	-	0.29
Hardness (mg/L)	157	-	173
Alkalinity (mg/L)	157	-	160
Silica (mg/L)	-	-	4.7
Total Phosphorous (ug/L)	10	40	12
Miscellaneous Data			
DO (Mg/l) at 75% depth	7.1	8.3	3.8
Stratification (m)	NO	17-18	17-19
Limiting Nutrient	P	P	P
Depth at Deepest Site (m)	40	38.0	33.0

The reservoir has not been chemically treated by the DWR to eliminate rough fish competition, so populations of native fish may be present. Macrophytes are not typically present and not a problem.

On August 28, 1991, phytoplankton in the euphotic zone were as follows:

Species	Cell Volume (mm³/liter)	% Density By Volume
Sphaerocystis schroeteri	26.410	70.79
Sphaerocystis schroeteri	10.564	28.31
Fragilaria crotonensis	0.229	0.61
Asterionella formosa	0.047	0.13
Pennate diatoms	0.040	0.11
Oocystis sp.	0.017	0.04
Chlamydomonas globosa	0.002	0.01
Total	37.309	
Shannon-Weaver [H']	0.65	
Species Evenness	0.34	
Species Richness	0.26	

As observed the phytoplankton community is dominated by green algae which are indicative of oligotrophic to mesotrophic water. The presence of the diatom Fragilaria crotonensis is more indicative of more eutrophic conditions.



D	°C	pH	DO	Cond
0.0	19.9	8.5	7.9	306
1.0	19.7	8.5	7.7	306
2.0	19.3	8.5	7.8	306
3.0	18.7	8.4	7.6	316
4.0	18.3	8.4	7.3	322
5.0	18.0	8.3	7.1	323
6.0	17.7	8.3	6.7	325
7.0	17.4	8.2	6.6	325
8.0	17.1	8.2	5.9	329
9.0	16.8	8.1	6.7	322
10.0	16.3	8.1	7.1	321
11.0	16.2	8.1	7.2	323
12.0	16.0	8.2	7.2	327
13.0	15.7	8.3	7.3	333
14.0	15.5	8.3	7.4	344
15.0	15.2	8.4	7.5	353
16.0	14.8	8.2	7.3	355
17.0	14.2	7.9	6.6	358
18.0	8.3	7.7	4.6	351
19.0	7.1	7.7	3.7	374
20.0	6.7	7.7	3.7	390
21.0	6.6	7.7	3.8	390
22.0	6.4	7.7	3.8	392
23.0	6.4	7.7	3.8	390
24.0	6.4	7.7	3.8	392
25.0	6.3	7.7	3.8	392
26.0	6.2	7.7	3.9	390
27.0	6.2	7.8	3.9	389
28.0	6.1	7.8	4.0	390
29.0	6.0	7.7	4.0	389
30.0	5.8	7.7	3.1	390
31.0	5.7	7.7	3.1	390
32.0	5.6	7.7	3.0	393
33.8	5.7	7.7	2.9	394

Pollution Assessment

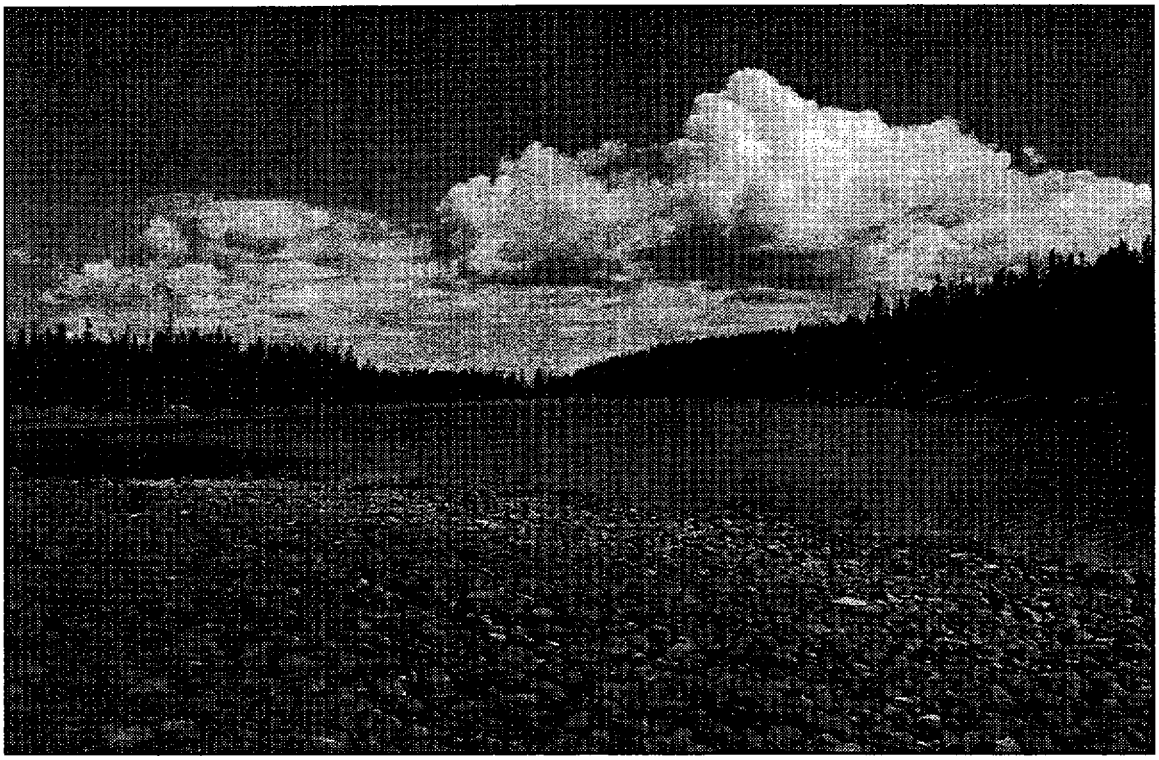
Nonpoint pollution sources include grazing, recreation, summer home areas, and abandoned mining areas.

There are no point sources of pollution in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

CHINA LAKE



Introduction

During ice ages, snow accumulates in the high mountains faster than it melts. After it becomes several hundred feet deep, the weight compresses the lower layers of snow into ice. The increasing pressure of further snowfall eventually becomes so heavy that the lower ice is unable to support the weight, causing the ice to flow downhill--following the paths of streams. These rivers of flowing ice are called glaciers, and move anywhere from one meter to one kilometer annually. Over the course of the millennia, the ice scours away the bedrock and carries away the debris suspended in the ice. The original stream valleys are transformed into deep, wide, flat-bottomed valleys. All of the drainages in the Uintas are such glacial valleys.

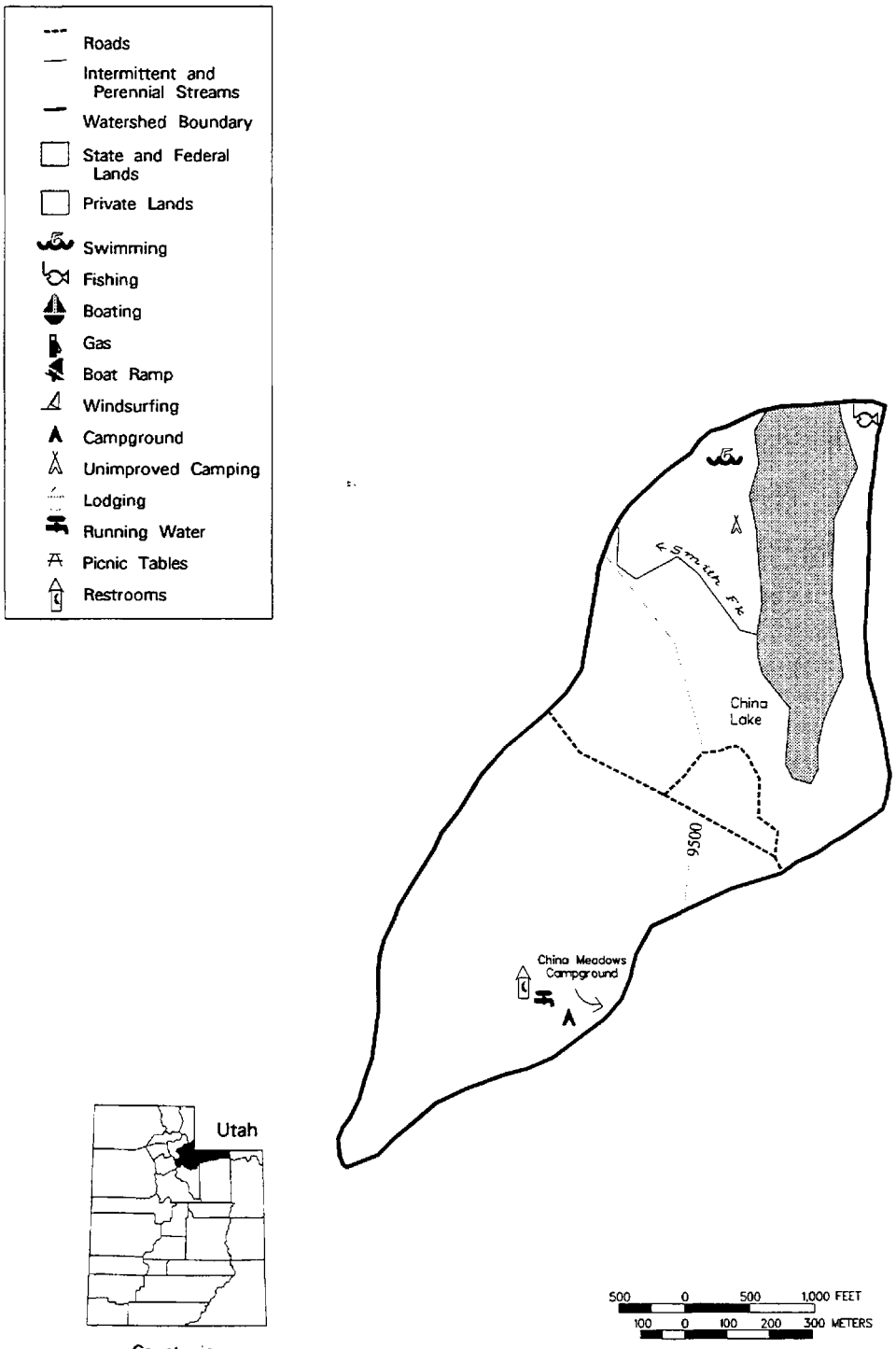
As an ice age ends, glaciers begin to melt faster than they advance. As the toe of the glacier melts, it leaves its load of debris in irregular deposits called moraines. The

Characteristics and Morphometry

Lake elevation (meters / feet)	2,868 / 4,498
Surface area (hectares / acres)	13 / 31
Watershed area (hectares / acres)	935 / 2,311
Volume (m^3 / acre-feet)	
capacity	766,000 / 621
conservation pool(original lake volume) (m^3 / acre-feet)	496,000 / 402
Annual Inflow	not measured
Retention time (years)	unknown
Drawdown (m^3 / acre-feet)	270,000 / 219
Depth (meters/feet)	
maximum	14 / 45
mean	6 / 20
Length (meters / feet)	850 / 2800
Width (meters / feet)	122 / 400
Shoreline (meters / feet)	1,760 / 770

Location

County	Summit
Longitude / Latitude	110 24 15 / 40 56 25
USGS Map	Bridger Lake, UT / WY 1967
DeLorme's Utah Atlas and Gazetteer™	Page 55, A-5
Cataloging Unit	Black's Fork (14040107)



County in which watershed is located.

China Watershed

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bottoms of glacial valleys are partly filled by these morainal deposits, creating areas of irregular, poorly drained topography. China Lake is one of many lake basins created by irregular deposition of glacial deposits. It is notable in that it is impounded by a lateral moraine, rather than the terminal moraine. China Lake is a small lake in the Smiths Fork glacial valley, on the north slope of the Uintas four miles from the Wyoming state line. In 1954, the lake was raised nine feet by the construction of an earth-fill dam. The reservoir shoreline is 100% publicly owned by the Wasatch-Cache National Forest. Public access is unrestricted. Water is consumed for irrigation, but also used for recreation and cold-water aquatic habitat. No changes in water use are expected.

Recreation

China Lake is in the Smith's Fork drainage, 30 miles east of U-150 on the North Slope Road (FS-058). It is also accessible from Mountain View, Wyoming. Go south from Mountain View on U-410, a paved road, towards Robertson (not towards Lonetree). About 5 miles from Mountain View, leave the highway, and continue south on a gravel road that becomes FS-072.

FS-072 and FS-058 join at China Meadows Campground. Access to China Lake is from FS-058, 1/4 mile west of the campground. The lake is 1/4 mile north of the road, accessible by trails and an old jeep road which is closed to motor vehicles. The route to the China Meadows area is well marked, but there are no signs to the lake itself.

The lake offers fishing and solitude. The water is too cold for most swimmers. Fishing is popular, and small boats can be carried in from the road.

The area immediately around the lake offers primitive camping. China Meadows Campground, administered by the Forest Service, has 13 campsites, with latrines. There are several other USFS campgrounds in the vicinity, including Trail Head, Marsh Lake, Bridger Lake, and Smiths Fork Trail Head. This area is a popular access route to the High Uinta Wilderness, so campgrounds are heavily used in the summer.

Watershed Description

China Lake is on the east side of the valley floor in the western area of glacial valley. The valley is about two miles wide and 800' deep. The lake's watershed itself is only a very small portion of the valley floor, extending about one mile to the southwest. The watershed consists entirely of a fairly steep slope draining from the edge of the valley floor into the lake.

The watershed high point, one mile southwest of the lake, is 2,969 m (9,740 ft) above sea level, thereby developing a complex slope of 7.0% to the reservoir. Inflow is from snowmelt and springs, with no perennial streams. While the 1967 USGS map shows a canal capturing water from the valley floor to the north, irrigation company president Claude Walker says "There's no canal a'tall." The outflow is a small stream that joins Smiths Fork 1/2 mile downstream.

The soil in the watershed is entirely glacial till and alluvium. It is comprised primarily of debris from the scouring of upstream valleys, so the till is chemically similar to the Precambrian rocks of the High Uintas. See Appendix III for a complete soil description.

The vegetation community is comprised of lodgepole pine and marshlands. The watershed receives 51 - 64 cm (20 - 25 inches) of precipitation annually with a frost-free season of 20 - 40 days.

Land use is 100% multiple use.

Limnological Assessment

The water quality of China Lake is very good. It is considered to be very soft with a hardness concentration

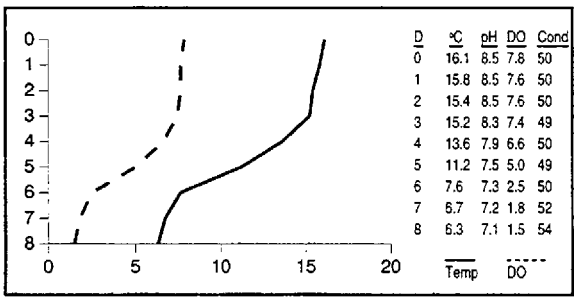
Limnological Data

Data sampled from STORET site: 593945

Surface Data	1981*	1992
Trophic Status	E	M
Chlorophyll TSI	-	44.68
Secchi Depth TSI	-	39.15
Phosphorous TSI	53.20	52.95
Average TSI	53.20	45.59
Chlorophyll a (ug/L)	-	4.2
Transparency (m)	-	4.25
Total Phosphorous (ug/L)	30.0	29.5
pH	7.6	8.2
Total Susp. Solids (mg/L)	<5	<3
Total Volatile Solids (mg/L)	-	0
Total Residual Solids (mg/L)	-	3
Temperature (°C / °f)	20/68	14/57
Conductivity (umhos.cm)	29	52
Water Column Data		
Ammonia (mg/L)	0.10	0.11
Nitrate/Nitrite (mg/L)	0.11	0.01
Hardness (mg/L)	20	15
Alkalinity (mg/L)	19	22
Silica (mg/L)	-	5.6
Total Phosphorus (ug/L)	30.0	28.0
Miscellaneous Data		
DO (Mg/l) at 75% depth	-	2.5
Stratification (m)	-	3-6
Limiting Nutrient	N	N
Depth at Deepest Site (m)	-	8.0

* Period 1 data only

near 15 mg/L (CaCO3). The only parameter that has exceeded State water quality standards for defined beneficial uses is phosphorus. The average concentration of total phosphorus in the water column in 1992 was 0.028 mg/L which is slightly higher than the recommended pollution indicator for phosphorus of 0.025 mg/L. The phosphorus concentrations near the bottom of the lake in August was almost three times the standard at 0.072 mg/L. Dissolved oxygen concentrations in late summer indicate water quality impairments which may be even more limiting during the winter season. In 1981 and 1992 the system was characterized as a phosphorus limited system. Although a TSI value of 53.20 (total phosphorus only) was reported in 1981, current TSI values indicate the lake is mesotrophic. It does not appear that there has been a significant rise in the concentrations of nutrients in the lake since it was originally surveyed in 1981. However, there is insufficient data to determine if the lake is stable or there is a eutrophication trend in the lake. The lake has a maximum depth of 14 meter. The profile of August 11, 1992 shows a thermocline present. The lake was only 8 meters deep but stratification was evident beginning at the 3 meter depth. Consistent with the stratification there was a noticeable decline in the concentration of dissolved oxygen in the water column. Below 4 meters the concentration declines to a low of 1.5 mg/L at the bottom. When shallow conditions are present in the lake, the stratification is probably weak and may be broken down by wind and wave action. These conditions are probably more critical to the overwintering of fish in the lake but according to DWR no fishkills have been reported at the lake. Although macrophyte are present in the upper end of the reservoir their coverage is considered to be minimal.



D	°C	pH	DO	Cond
0	16.1	8.5	7.8	50
1	15.8	8.5	7.6	50
2	15.4	8.5	7.6	50
3	15.2	8.3	7.4	49
4	13.6	7.9	6.6	50
5	11.2	7.5	5.0	49
6	7.6	7.3	2.5	50
7	6.7	7.2	1.8	52
8	6.3	7.1	1.5	54

China Lake is filled by snowmelt runoff in the spring. During the growing season, the irrigation company releases the water for irrigation, draining the lake down to its pre-1954 size. Drawdown typically is about nine feet.

Upon completion of the dam in 1954, the lake was chemically treated by the DWR to control rough fish competition. In the 1980s, the DWR stocked the lake annually with 7,800 fingerling brook trout (*Salvelinus fontinalis*). In 1991, they switched to 7,800 arctic grayling (*Thymallus arcticus*) fry.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Anabaena spiroides var. crassa	20.238	45.49
Sphaerocystis schroeteri	10.564	23.74
Anabaena macrospora v. robusta	7.979	17.93
Botryococcus braunii	2.224	5.00
Staurastrum sp.	1.668	3.75
Quadrigula lacustris	1.112	2.50
Pennate diatoms	0.366	0.82
Haematococcus lacustris	0.262	0.59
Oocystis sp.	0.034	0.07
Centric diatoms	0.023	0.05
Ankistrodesmus falcatus	0.022	0.05
Ankyra judayi	0.003	0.01
Total	44.495	
Shannon Weaver Index [H']	1.46	
Species Evenness	0.59	
Species Richness	0.45	

As observed the phytoplankton community is dominated by the presence of blue-green algal species and a significant portion of the green algae *Sphaerocystis schroeteri*. This population does support the trophic status of mesotrophic to eutrophic conditions that are present.

Pollution Assessment

Nonpoint pollution sources are recreation and domestic livestock grazing. Cattle graze in the watershed and around the reservoir.

Information

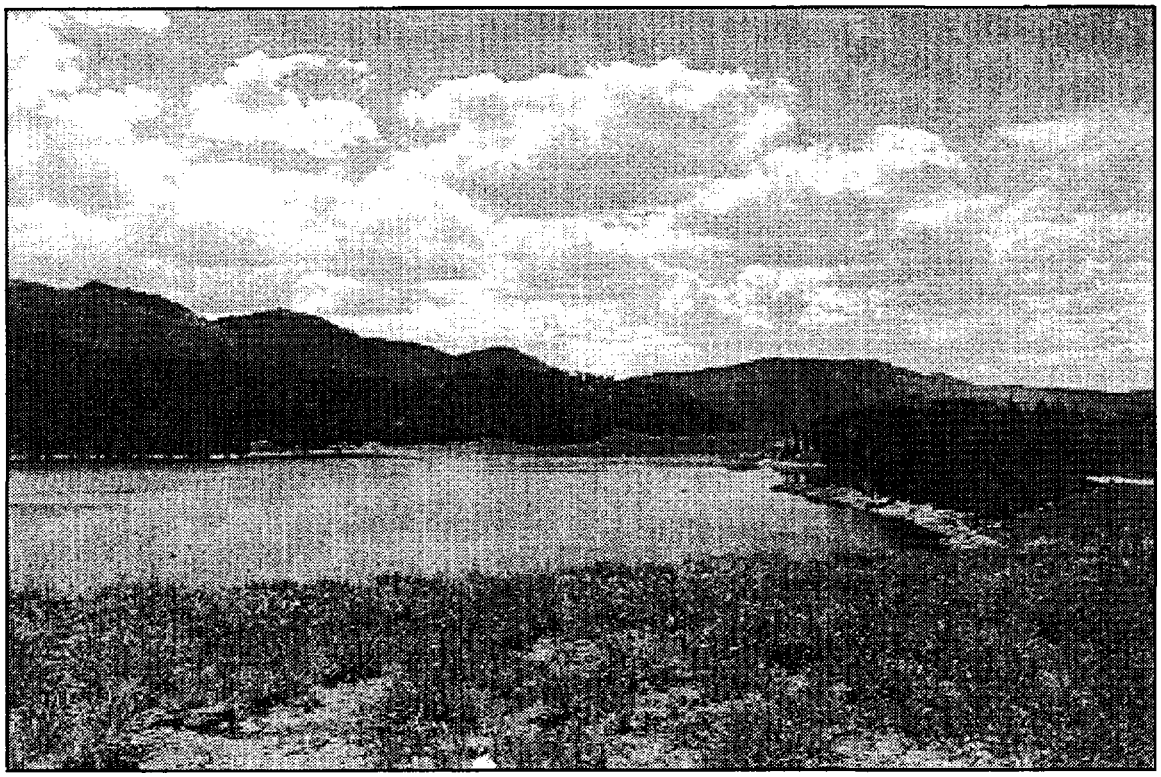
Management Agencies	
Wasatch-Cache National Forest	524-5030
Mountain View Ranger District	307-782-6555
Mountainlands Association of Governments	377-2262
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Mountainland Travel Region (Provo)	377-2262
Reservoir Administrators	
China Lake Reservoir Company	307-782-6793

There are no point pollution sources in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

CLEVELAND LAKE



Introduction

Cleveland Lake is a reservoir in Huntington Canyon high on the east side of the Wasatch Plateau. It is an intermediate-sized impoundment of a meadow in a glaciated graben valley. It receives heavy recreational use and is noteworthy for fishing and scenic beauty, but is drained every summer. The lake is named after the Castle Valley town it serves. It is also known as Cleveland Reservoir, and should not be confused with the two other Cleveland Lakes, both in the Uintas.

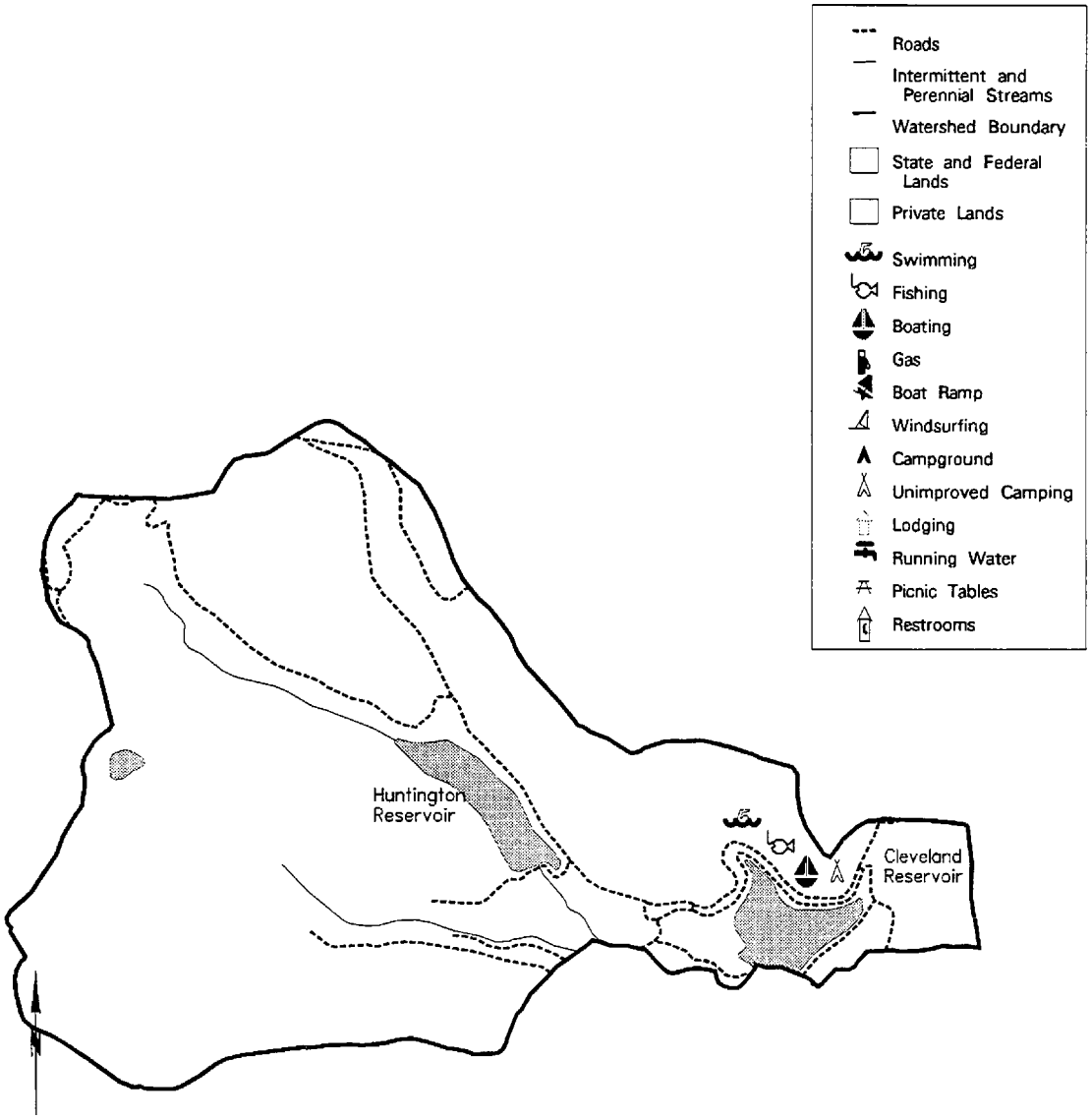
Characteristics and Morphometry

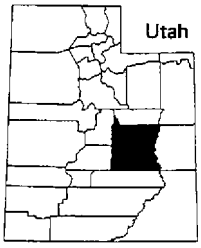
Lake elevation (meters /feet)	2,685 / 8,812
Surface area (hectares / acres)	75 / 185
Watershed area (hectares / acres)	1,531 / 3,785
Volume (m^3 / acre-feet)	
capacity	742,600 / 6,020
conservation pool	none
Annual inflow (m^3 / acre-feet)	not measured
Approximate retention time (years)	1
Drawdown (m^3 / acre-feet)	742,600 / 6,020
Depth (meters / feet)	
maximum	17 / 56
mean	10 / 33
Length (meters / feet)	1,130 / 3,700
Width (meters / feet)	610 / 2,000
Shoreline (kilometers / miles)	4.1 / 2.5

Location

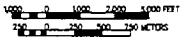
County	Emery
Longitude / Latitude	111 14 28 / 35 34 51
USGS Map	Candland Mtn., UT 1979
DeLorme's Atlas and Gazetteer™	Page 46 D-2
Cataloging Unit	San Rafael (14060009)

The lake was created in 1909 by the construction of a long, low, earth-fill dam at the lower end of a meadow, then diverting water from Left Fork Huntington Creek to fill the lake. The dam failed in the early 1980's, and was rebuilt in 1985. The shoreline is 40% owned by the Manti-La Sal National Forest and 60% owned by the Huntington-Cleveland Irrigation Company. Public access is unrestricted. Water is consumed for irrigation and cooling at the Huntington Power Plant, but also used for recreation and cold-water aquatic habitat. In the future, if additional power plants are constructed in Huntington, more water will be





County in which watershed is located.



Cleveland Watershed

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used for cooling and less for irrigation.

Recreation

Cleveland Reservoir is directly accessible from U-31 which follows the shoreline for about a mile. The lake is 19 miles east of Fairview and 29 miles northwest of Huntington. A sign on the highway identifies the lake.

The area receives heavy recreational use, especially on holiday weekends. Fishing is the primary activity, however, boating, camping, swimming, nordic skiing, sledding, and snowmobiling opportunities are also available. There are many places to launch a boat but no improved boat ramps are available..

There are no recreational facilities at the lake. Visitors are required to pack out their own trash.

Old Folks Flat, a Forest Service campground, is 9 miles southeast on U-31. It has 6 campsites and picnic tables. Usage fees are charged. There are other Forest Service Campgrounds in Huntington Canyon, on U-264, on the road to Joes Valley, and on Skyline Drive north of U-264.

Watershed Description

The reservoir is in an area of rolling ridges and valleys characteristic of the Wasatch Plateau. Water is diverted from Lake Canyon and Spring Canyon into Cleveland Reservoir, augmenting the small natural watershed the reservoir is situated in. The canyons were glaciated during the last ice age, and are now richly covered with coniferous forests.

The watershed high point is 3,149 m (10,340 ft) above sea level, thereby developing a complex slope of 10% to the diversion. The average stream gradient above the diversion is 5% (252 feet per mile). The canal then flows 2.2 km (1.3 miles) to the reservoir. Huntington Reservoir is a large upstream impoundment.

The watershed is situated entirely on the limestone of the Wasatch Formation. The soil associations that compose the watershed are found in Appendix III.

The vegetation communities are comprised of pine, aspen, spruce-fir, oak and maple. The watershed receives 64 - 76 cm (25 - 30 inches) of precipitation annually with a frost-free season of 20 - 60 days at the reservoir.

Land use in the reservoir is 100% multiple use forest lands, used by humans for hunting, recreation and livestock grazing.

Limnological Assessment

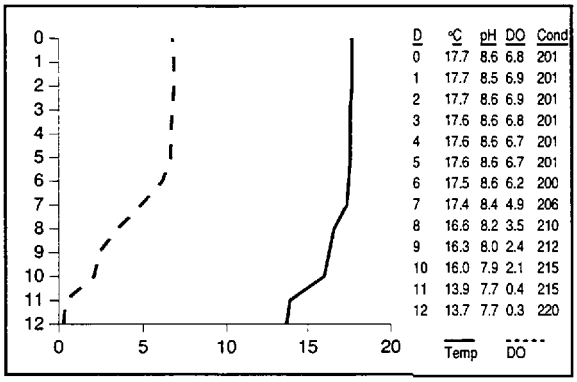
The water quality of Cleveland Reservoir is very good. It is considered to be moderately hard with a hardness concentration range from 111-128 15 mg/L ($CaCO_3$). The only parameter that has exceeded State water quality standards for defined beneficial uses is phosphorus. The average concentration of total phosphorus in the water column in 1989 and 1991 was 7.6 and 20.5 ug/L which is under the recommended pollution indicator for phosphorus of 25 ug/L. The average phosphorus concentration for the water column in June, 1991 and the concentration near the bottom of the lake in August, 1991 did exceed the State standard. Although there was a significant increase in the concentration of total phosphorus from 1989 to 1991 additional data will be needed to evaluate this potential trend for phosphorus concentrations. Dissolved oxygen concentrations in late summer substantiate the fact that water quality impairments do exist. In 1981 the reservoir was characterized as a phosphorus limited system. The 1989-91 data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is eutrophic except for 1989 when the reservoir was classified as mesotrophic. The phosphorus concentrations in 1989 appear to be abnormally low (5.8 ug/L) and have shifted the overall TSI index to the low mesotrophic range. It does not appear that there has been a significant rise in the

Limnological Data

Data sampled from STORET site: 593205

Surface Data	1981	1989	1991
Trophic Status	E	M	E
Chlorophyll TSI	-	47.93	60.01
Secchi Depth TSI	54.16	47.69	53.68
Phosphorous TSI	47.35	29.37	41.14
Average TSI	50.76	41.66	51.61
Chlorophyll a (ug/L)	-	5.85	20.05
Transparency (m)	1.5	2.35	1.55
Total Phosphorous (ug/L)	10	6	13
pH	8.6	8.7	8.7
Total Susp. Solids (mg/L)	5	-	6
Total Volatile Solids (mg/L)	-	-	8
Total Residual Solids (mg/L)	-	-	<3
Temperature (°C / °f)	14/57	15/59	12/53
Conductivity (umhos.cm)	217	230	204
Water Column Data			
Ammonia (mg/L)	0.1	0.03	0.03
Nitrate/Nitrite (mg/L)	0.27	-	0.07
Hardness (mg/L)	128	-	110
Alkalinity (mg/L)	121	-	104
Silica (mg/L)	-	-	1.7
Total Phosphorus (ug/L)	10	8	20
Miscellaneous Data			
DO (Mg/l) at 75% depth	7.7	5.5	2.4
Stratification (m)	3-6	7-9	10-11
Limiting Nutrient	P	N	N
Depth at Deepest Site (m)	13	9.7	12

concentrations of nutrients in the lake since it was originally surveyed in 1981. In fact the concentration may have declined specifically the nitrogen species. However, there is insufficient data to determine if the lake is stable or what is the eutrophication trend in the lake. As additional data is obtained a more substantial determination regarding the trophic status of the reservoir may be obtained. The reservoir has always stratified during the summer. The profile of August 29, 1991 indicates that a thermocline developed at the depth of 10-11 meters. Consistent with the stratification there was a noticeable decline in the concentration of dissolved oxygen in the water column. Below 6 meters the concentration declines to a low of 0.3 mg/L at the bottom. These conditions are deleterious to the fishery rendering approximately 1/3 of the water column unsuitable for a fishery. Dissolved oxygen concentrations may reach a critical state during the winter period for fish. In addition the reservoir may be completely drained prior to winter to meet the irrigation demands downstream.



D	°C	pH	DO	Cond
0	17.7	8.6	6.8	201
1	17.7	8.5	6.9	201
2	17.7	8.6	6.9	201
3	17.6	8.6	6.8	201
4	17.6	8.6	6.7	201
5	17.6	8.6	6.7	201
6	17.5	8.6	6.2	200
7	17.4	8.4	4.9	206
8	16.6	8.2	3.5	210
9	16.3	8.0	2.4	212
10	16.0	7.9	2.1	215
11	13.9	7.7	0.4	215
12	13.7	7.7	0.3	220

The reservoir was treated by the DWR in 1959 for rough fish control, so native fish populations are not present.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	58.102	98.20
Fragilaria crotonensis	0.916	1.55
Dinobryon divergens	0.073	0.12
Oocystis sp.	0.050	0.08
Pennate diatoms	0.027	0.05
Total	59.168	
Shannon-Weaver [H']	0.10	
Species Evenness	0.06	
Species Richness	0.19	

As observed the phytoplankton community is dominated by green algae with a significant amount of the diatom *Fragilaria crotonensis*.

Information

Management Agencies	
Manti-La Sal National Forest and Price Ranger District	637-2817
Six County Commissioners Organization	896-9222
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Castle Country Travel Region (Price)	637-3009
Reservoir Administrators	
Huntington-Cleveland Irrigation Company	687-2505

Pollution Assessment

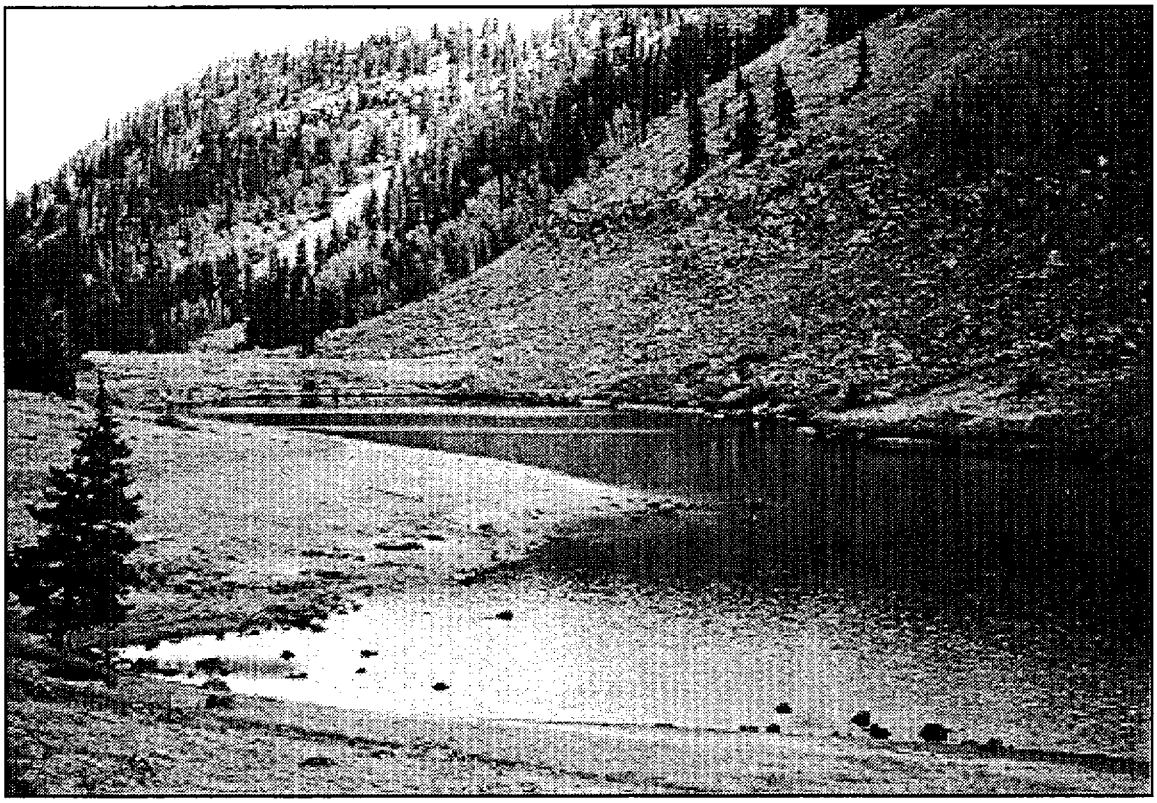
Nonpoint pollution sources include grazing and recreation. About 1,000 sheep graze in the immediate vicinity of the reservoir for two weeks each year. Cattle also graze the area.

There are no point pollution sources in the watershed.

Beneficial Use Classification

The state beneficial use classification for the waters of Cleveland Reservoir include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A), and agricultural uses (4).

COOK LAKE



Introduction

Cook Lake is an small, natural lake on the west slope of Boulder Mountain in south-central Utah. It is one of the hundreds of lakes on the mountain. These lake basins are the result of uneven glacial scouring, and most, including Cook Lake, have not been further modified by people.

The reservoir shoreline is owned and administered by the Dixie National Forest with unrestricted public access. Water is used for recreation and cold-water aquatic habitat. No changes in water use are foreseen.

Characteristics and Morphometry

Lake elevation (meters / feet)	3,225 / 10,580
Surface area (hectares / acres)	4.2 / 10.4
Watershed area (hectares / acres)	
Volume (capacity) (m^3 / acre-feet)	106,200 / 86.1
Annual inflow (m^3 / acre-feet)	not measured
Retention time (years)	unknown
Depth (meters / feet)	
maximum	5.5 / 18
mean	2.5 / 8
Length (meters / feet)	545 / 1,790
Width (meters / feet)	91 / 300
Shoreline (meters / feet)	1,210 / 3,980

Location

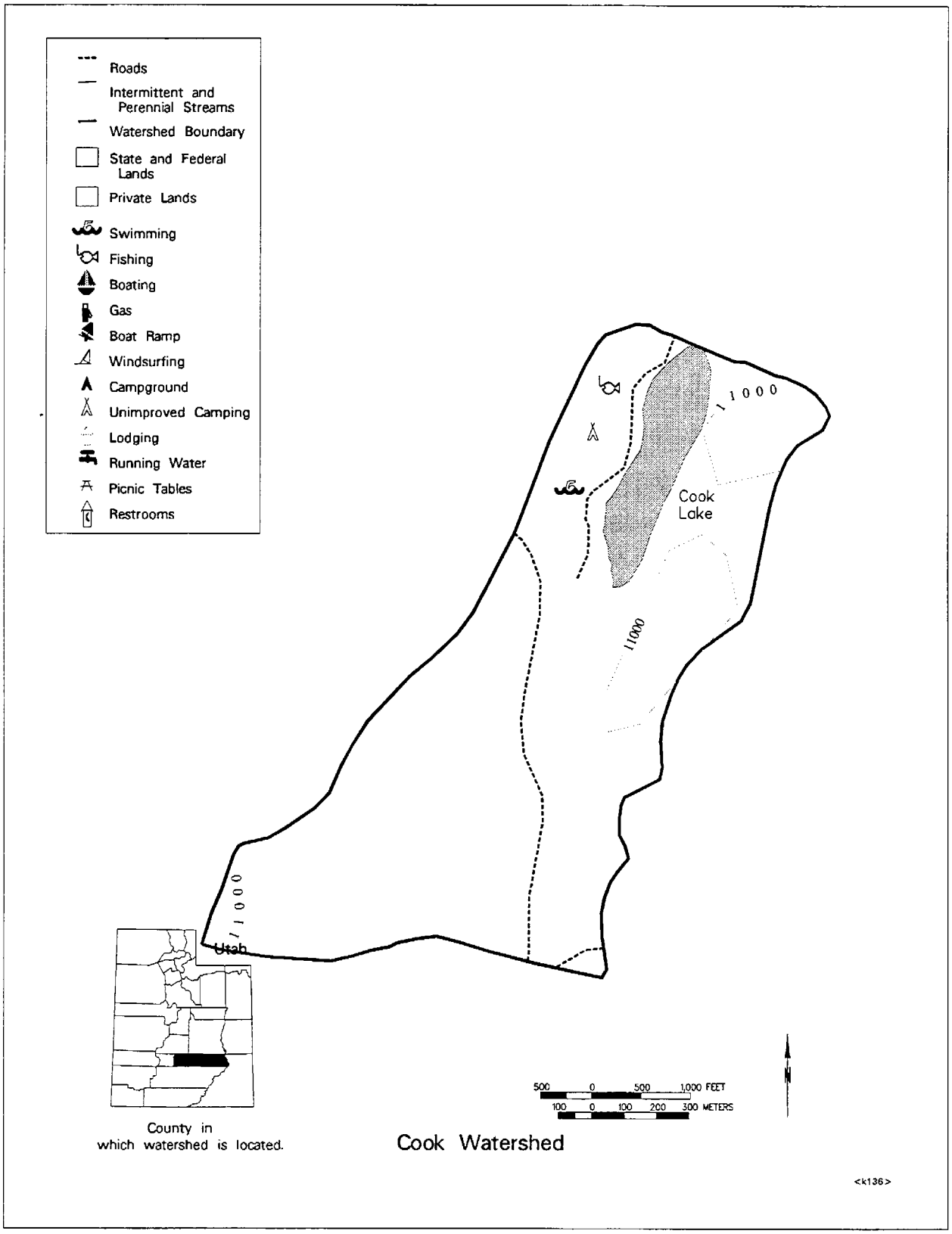
County	Wayne
Longitude / Latitude	111 32 21 / 38 10 41
USGS Map	Government Point 1985
DeLorme's Utah Atlas and Gazetteer™	Page 27, C-6*
Cataloging Unit	Fremont River (14070003)

*Not on map. On Trail 119 just north of its junction with FR-178

Recreation

Most of the lakes on the west slope are near the top of the slope from the Fremont Valley (Loa area) to Boulder Mountain, necessitating long climbs on improved gravel roads and trails. Cook Lake was chosen for the clean lakes study because it is relatively easily accessible, being located just off the road to the top of Boulder Mountain.

Cook Lake is ten miles east of Posey Lake Road on the Boulder Mountain Road (FR-178). The Posey Lake


Roads
Intermittent and Perennial Streams
Watershed Boundary
State and Federal Lands
Private Lands
Swimming
Fishing
Boating
Gas
Boat Ramp
Windsurfing
Campground
Unimproved Camping
Lodging
Running Water
Picnic Tables
Restrooms
Cook Lake
11000
Utah
500 0 500 1,000 FEET
100 0 100 200 300 METERS
N
County in which watershed is located.
Cook Watershed
<k136>

Road runs from Loa to Escalante, and the Boulder Mountain Road turnoff is about 11 miles south of Loa. Cook Lake is on the east side of the road. The existing road bypasses the lake, but the old road goes right past it. Turn on the old road, a sharp left, just before the final incline up the cliff to the top of the mountain. If you get to the top (a flat area of miles and miles rolling meadows interspersed with groves of trees), turn around and go back down the cliff and make a half right (onto the old road) at the bottom (0.5 miles from the beginning of the descent). The lake is 0.5 miles north of the main road on the old road. Access roads are not maintained in the winter, but the lake is easily reached on cross-country skis or by snowmobile.

Fishing and camping are the activities available at the reservoir itself, but the surrounding region is replete with hiking areas. The water is too cold for most swimmers and too small for most boaters.

There are no USFS campgrounds in the vicinity, although primitive camping is possible throughout the area. Heavy recreational use has scarred the west side of the lake. Campers should choose a preexisting campsite and build small fires on preexisting fire sites.

There is an RV park in Bicknell (see info box).

Watershed Description

Cook Lake is at the top of a long, forested slope that begins at the crest of Boulder Mountain. From the plateau top at 3,500 meters, the land drops off down to the Fremont Valley at 2,200 meters. At the top of the slope, an impressive 100 meter cliff completes the gradient to the top of Boulder Mountain. Cook Lake is in a basin immediately below the cliff (which is reduced to a steep slope at that point). Much of the lake shore (40%) is composed of boulders, which provide good aquatic habitat. The remainder is sand, silt and gravel.

The area around the lake is coniferous forest interspersed with meadows. The Dixie National Forest reports that "the riparian area has been impacted by camping and livestock overgrazing and should be protected to prevent [further] erosion." Slopes to the west are gentle, but to the east lies a vertical cliff which rises to the rim of the plateau.

The watershed high point, the north shoulder of Lookout Peak, is 3,379 m (11,085 ft) above sea level, thereby developing a complex slope of 6.9% to the lake. The Forest Service reports no visible inflows the lake, although the USGS 7.5 minute map shows a small stream from the south with an average stream gradient of 0.6% (33 feet per mile). The outflow is to the north, and becomes subterranean in Cook Pasture. It probably reappears in springs downslope in Fremont Valley.

The soil is of volcanic origin. The soil associations that compose the watershed are found in Appendix III.

The vegetation communities are comprised of pine, aspen and spruce-fir. The watershed receives 76 cm (30 inches) of precipitation annually with a frost-free season of 0 - 20 days at the reservoir.

Land use is multiple use and recreation. Dixie National Forest encompasses the entire drainage area.

Limnological Assessment

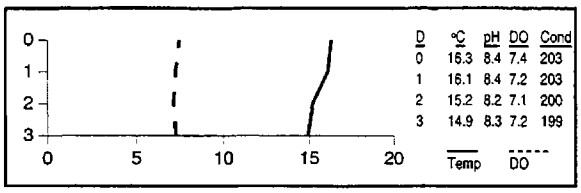
The water quality of Cook Lake is very good. It is considered to be very soft with a hardness concentration value of approximately 10 mg/L ($CaCO_3$). The only parameter that has exceeded State water quality standards for defined beneficial uses is phosphorus. The average concentration of total phosphorus in the water column in 1990 was 36.5 which exceeds the recommended pollution indicator for phosphorus of 25 ug/L. The phosphorus concentration in 1992 did not exceed State standards with

Limnological Data

Data sampled from STORET site: 595562

Surface Data	1981	1990	1992
Trophic Status	M	M	M
Chlorophyll TSI	-	45.68	48.96
Secchi Depth TSI	-	44.66	43.47
Phosphorous TSI	47.35	41.68	51.68
Average TSI	47.35	44.01	48.04
Chlorophyll a (ug/L)	-	4.7	6.5
Transparency (m)	-	2.9	3.15
Total Phosphorous (ug/L)	20.0	14	27.0
pH	7.9	8.3	8.3
Total Susp. Solids (mg/L)	5	<3	3
Total Volatile Solids (mg/L)	-	-	3
Total Residual Solids (mg/L)	-	-	2
Temperature (°C / °f)	17/63	14/58	15/59
Conductivity (umhos.cm)	12	30	108
Water Column Data			
Ammonia (mg/L)	0.1	0.03	0.03
Nitrate/Nitrite (mg/L)	0.08	-	0.02
Hardness (mg/L)	11	9	9
Alkalinity (mg/L)	-	9	9
Silica (mg/L)	-	-	0.5
Total Phosphorus (ug/L)	-	18	24.3
Miscellaneous Data			
DO (Mg/l) at 75% depth	6.8	6.3	7.1
Stratification (m)	NO	NO	NO
Limiting Nutrient	N	N	N
Depth at Deepest Site (m)	4	2.2	3.0

a average concentration of 24.3 ug/L. The lake is characterized as "shallow" and no stratification of the reservoir has been present during scheduled monitoring visits. It appears that there is sufficient concentration of dissolved oxygen throughout the water column and that the temperature regime is supportive for a cold water fishery as depicted in the August 20, 1992 profile. The lake is characterized as a nitrogen limited system. TSI values indicate the reservoir is mesotrophic. It does not appear that there has been a significant rise in the concentrations of nutrients in the lake since it was originally surveyed in 1981. According to DWR it is not uncommon to have annual fish kills during the winter season. This is probably due in fact to the length of the winter, a small storage capacity, and the lack of a perennial stream into the lake. The reservoir has supported populations of brook trout (*Salvelinus fontinalis*), rainbow trout (Oncorhynchus mykiss), and arctic grayling (*Thymallus arcticus*). DWR manages the lake as an intensive yield water stocking fingerling brook trout and antic grayling with catchable size rainbow trout. There is a concern for erosion in the area due to grazing and recreational use. The current depth of the lake will not allow for large accumulation of sediment which could lead to an eventual loss of the fishery.



Cook Lake has not been treated by the DWR for rough fish competition. There is no stream connection to the Fremont River, so there were probably no fishes in the lake before Europeans stocked trout. The lake is managed as an intensive fishery, and there are no spawning areas in the lake, so all fishes in the lake are hatchery fish. Other Boulder Mountain lakes were also without fish before man planted them. Fishes are not native to this region.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Anabaena spiroides var. crassa	23.128	70.55
Sphaerocystis schroeteri	5.282	16.11
Gloeocystis sp.	3.169	9.67
Peridinium sp.	0.722	2.20
Cosmarium sp.	0.234	0.71
Asterionella formosa	0.095	0.29
Pennate diatoms	0.056	0.17
Chlamydomonas sp.	0.033	0.10
Oocystis sp.	0.018	0.05
Staurastrum gracile	0.017	0.05
Dinobryon divergens	0.012	0.04
Centric diatoms	0.009	0.03
Oscillatoria princeps	0.005	0.02
Total	32.780	
Shannon-Weaver [H']	0.93	
Species Evenness	0.36	
Species Richness	0.50	

As observed the phytoplankton community is dominated by blue-green algae which are indicative of eutrophic conditions. There are also significant numbers of green algae present.

Information

Management Agencies	
Dixie National Forest	586-2421
Teasdale Ranger District	425-3435
Six County Commissioners Association	896-9222
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Aquarius Mobile and RV (Bicknell RV Park)	425-3854
Panoramaland Travel Region (Richfield)	896-9222

Pollution Assessment

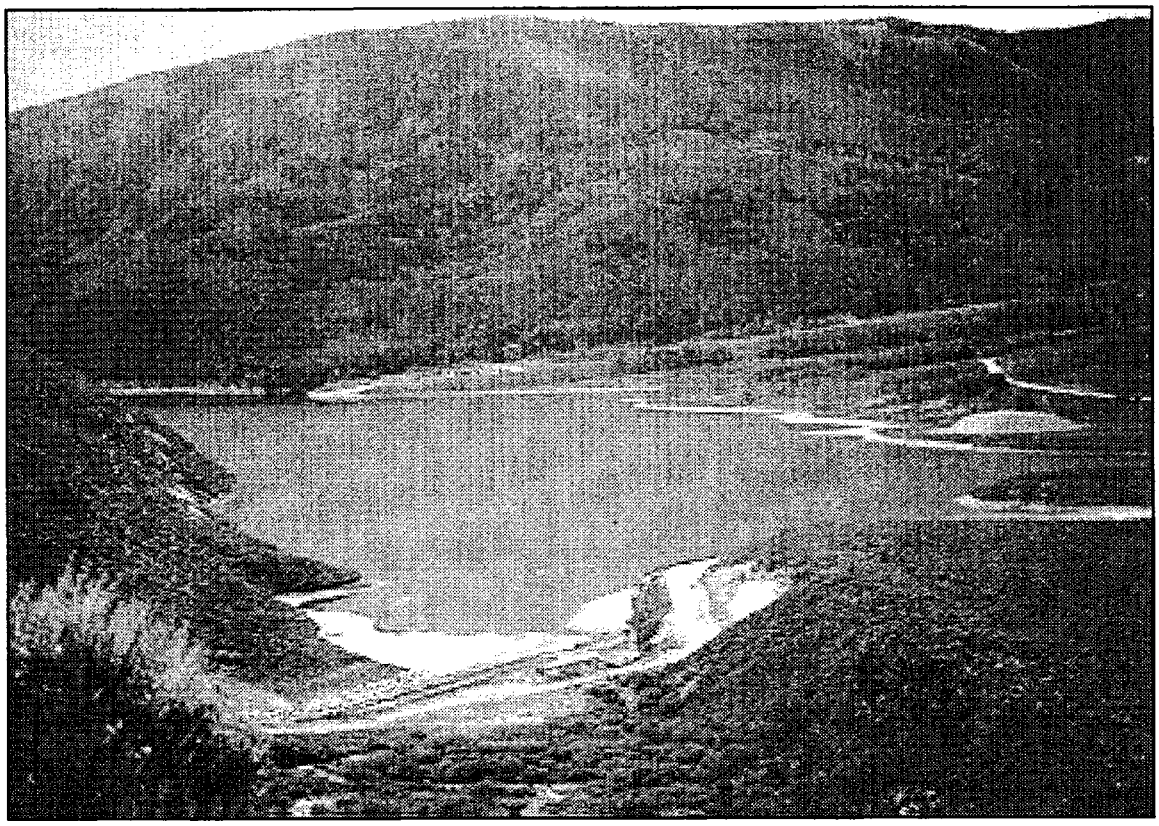
Nonpoint pollution sources are grazing and recreation. As mentioned in the recreation section, the lake suffers abuse from campers as well as overgrazing. Cattle graze in the watershed and around the lake. While the Dixie National Forest hopes to begin harvesting timber on Boulder Mountain by the end of the decade, Cook Lake and its watershed are likely in the "beauty strip" that would not be cut even if sales were approved in the area.

There are no point pollution sources in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

CURRANT CREEK RESERVOIR



Introduction

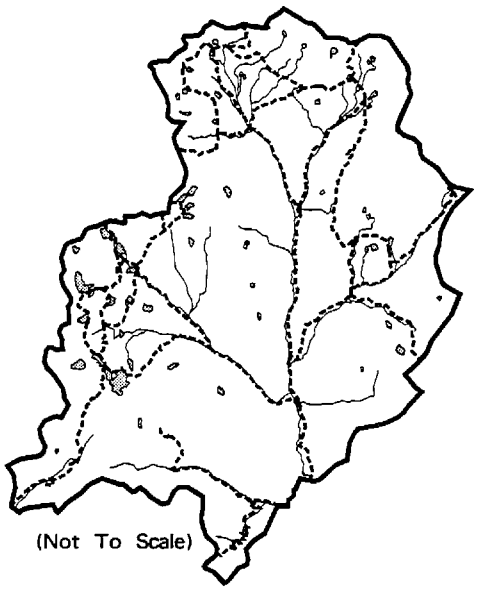
Currant Creek Reservoir is a large reservoir built as part of the Central Utah Project (CUP). It is not very well known as a recreation area, but is relatively close to the Wasatch Front. It supplements Strawberry Reservoir to store spring runoff from the Duchesne River and Rock Creek drainages and releases it to the Wasatch Front over the course of the year. Currant Creek Reservoir was begun in 1977 with the construction of an earth-fill dam, and finished filling in 1982. The reservoir shoreline is 85% owned by the Uinta National Forest. The remaining 15%, in the Coal Mine Hollow Area, is privately owned with restricted access. Reservoir water is used primarily for irrigation on the Wasatch Front, via tunnels to Strawberry Reservoir and Diamond Fork. In addition water is used for recreation and agricultural need downstream from the reservoir. As urbanization replaces agricultural land, it is expected that some water will be used for culinary purposes.

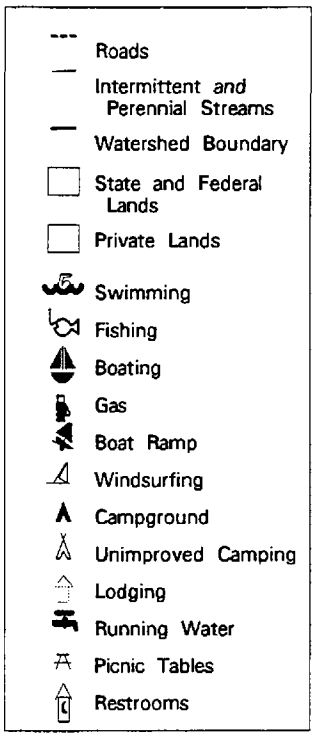
Characteristics and Morphometry

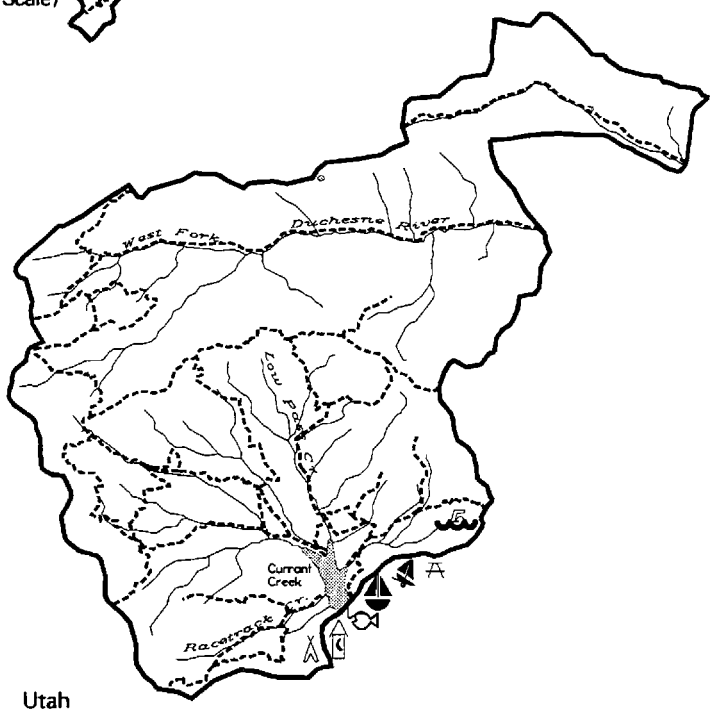
Lake elevation (meters / feet)	2,342 / 7,683
Surface area (hectares / acres)	121 / 300
Watershed area (hectares / acres)	12,225 / 30,208
Volume (m^3 / acre-feet)	
capacity	1.93×10^7 / 15,670
conservation pool	1.38×10^7 / 1,120
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	37.5 / 123
mean	16 / 52.5
Length (meters / feet)	2,499 / 8,200
Width (meters / feet)	686 / 2,250
Shoreline (meters / feet)	7,900 / 25,920

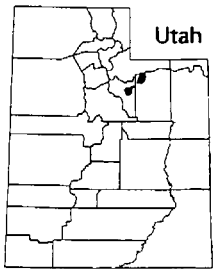
Location

County	Uintah
Longitude / Latitude	109 31 52 / 40 30 58
USGS Map	Steinaker Reservoir, 1965
DeLorme's Utah Atlas & Gazetteer™	Page 54, D-2
Cataloging Unit	Ashley-Brush Creeks (16060002)

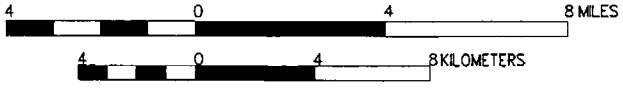








County near which watershed is located.



Currant Creek Watershed

<k176>

Recreation

Currant Creek Reservoir is easily accessible from US-40 between Fruitland and Strawberry Reservoir. At milepost 59.3, the highway is in the bottom of Currant Creek Canyon, with large signs directing traffic to the turnoff in the canyon bottom. The Currant Creek Cafe, at the turnoff, has gas, food, fishing licenses, and other services. Travel up-canyon for about 14 miles on an improved gravel road to the reservoir.

There are no services at the reservoir, but a lodge on US-40 at the turnoff has information, gasoline, groceries and other supplies.

There is a USFS campground at the reservoir, with 49 campsites, tent sites, picnic areas, swimming, toilets, a boat ramp, and handicapped facilities. Winter access is restricted, as the canyon is not plowed.

Watershed Description

Currant Creek has a fairly large natural watershed, and a very large, artificially diverted watershed. The natural watershed consists of gently undulating mountainous terrain with aspen, spruce and sagebrush. The diverted watershed includes much of the south slope of the Uintas, beginning at Upper Stillwater Reservoir.

The natural watershed high point is 3161 m (10,370 ft) above sea level, thereby developing a complex slope of 12.2% to the reservoir. The average stream gradient above the reservoir for Low Pass Creek is 6.5% (343 feet per mile). The inflows are the Left and Right Forks of Currant Creek, Racetrack Creek, Low Pass Creek, Coal Mine Hollow, and the Vat Tunnel. Outflows are Currant Creek and Currant Tunnel. Currant Tunnel eventually drains into Strawberry Reservoir (see the Strawberry Reservoir report for details).

The natural watershed is consists of undulating low mountains, while the diverted watershed is made up of high mountains and glacial valleys.

The vegetation communities consist of pine, spruce-fir, oak-maple, alpine tundra, pinyon-juniper, and sagebrush-grass. The watershed receives 51 - 76 cm (20 - 30 inches) of precipitation annually. The frost-free season around the reservoir is 40 - 80 days per year.

Land use . The watershed above Upper Stillwater Reservoir is entirely federally protected wilderness.

Limnological Assessment

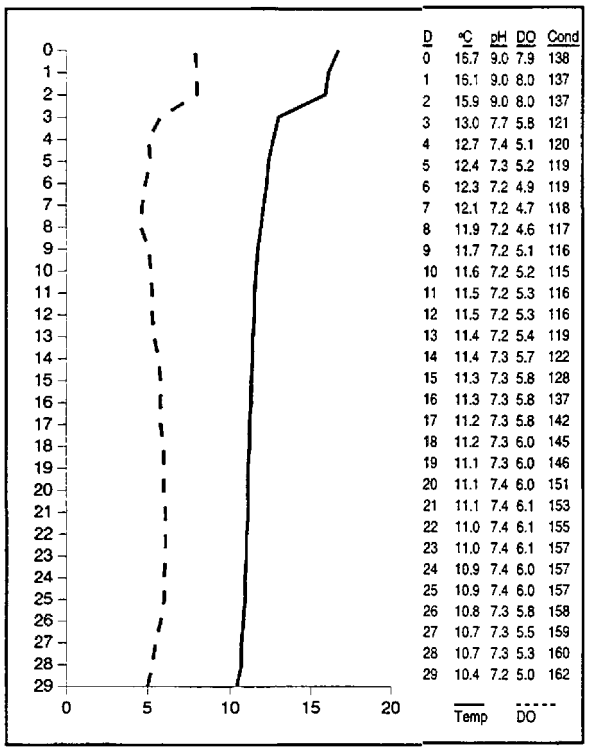
The water quality of Currant Creek Reservoir is very good. It is considered to be soft with a hardness concentration value of approximately 65 mg/L (CaCO3). The only parameters that have exceeded State water quality standards for defined beneficial uses are on occasion total phosphorus and dissolved oxygen. Overall averages for total phosphorus concentrations in the water column have

Limnological Data

Data averaged from STORET sites: 593645, 593646, 593647

Surface Data	1989	1991
Trophic Status	M	M
Chlorophyll TSI	44.38	46.13
Secchi Depth TSI	42.97	46.07
Phosphorous TSI	45.08	33.90
Average TSI	44.15	42.03
Chlorophyll a (ug/L)	4.2	4.9
Transparency (m)	3.3	2.7
Total Phosphorous (ug/L)	17.0	9.0
pH	8.6	8.6
Total Susp. Solids (mg/L)	<3	3.8
Total Volatile Solids (mg/L)	-	6
Total Residual Solids (mg/L)	-	1
Temperature (°C / °f)	18/64	15/60
Conductivity (umhos.cm)	148	135
Water Column Data		
Ammonia (mg/L)	0.03	0.05
Nitrate/Nitrite (mg/L)	-	0.02
Hardness (mg/L)	64	65
Alkalinity (mg/L)	59	62
Silica (mg/L)	-	2.5
Total Phosphorous (ug/L)	18	22
Miscellaneous Data		
DO (Mg/l) at 75% depth	6.2	6.1
Stratification (m)	4-6	2-3
Limiting Nutrient	N	N
Depth at Deepest Site (m)	31.0	29.0

consistently been below the State's pollution indicator (25 ug/L), and only near the bottom of the reservoir has the dissolved oxygen concentrations exceeded minimum dissolved oxygen requirements. Typically these values at the



D	°C	pH	DO	Cond
0	15.7	9.0	7.9	138
1	15.1	9.0	8.0	137
2	15.9	9.0	8.0	137
3	13.0	7.7	5.8	121
4	12.7	7.4	5.1	120
5	12.4	7.3	5.2	119
6	12.3	7.2	4.9	119
7	12.1	7.2	4.7	118
8	11.9	7.2	4.6	117
9	11.7	7.2	5.1	116
10	11.6	7.2	5.2	115
11	11.5	7.2	5.3	116
12	11.5	7.2	5.3	116
13	11.4	7.2	5.4	119
14	11.4	7.3	5.7	122
15	11.3	7.3	5.8	128
16	11.3	7.3	5.8	137
17	11.2	7.3	5.8	142
18	11.2	7.3	6.0	145
19	11.1	7.3	6.0	146
20	11.1	7.4	6.0	151
21	11.1	7.4	6.1	153
22	11.0	7.4	6.1	155
23	11.0	7.4	6.1	157
24	10.9	7.4	6.0	157
25	10.9	7.4	6.0	157
26	10.8	7.3	5.8	158
27	10.7	7.3	5.5	159
28	10.7	7.3	5.3	160
29	10.4	7.2	5.0	162

lower levels of the reservoir are to be expected and are not considered to be in violation of State standards. Although dissolved oxygen concentrations are not considered to have exceeded State standards they do reach low levels near the bottom of the lake. A review of the profile obtained on August, 1991 showed concentrations of 7.9 mg/L at the surface with a slight declining trend to 5.0 mg/L at the bottom (29 meters). The reservoir is defined as a nitrogen limited system with TSI values indicating the reservoir is mesotrophic, with an overall TSI index of 44.15 in 1989 and 42.03 in 1991. There was no TSI evaluation conducted during the initial inventory and classification in 1981 because the construction was underway at that time in building the dam. The phosphorus concentrations in recent years appear stable at approximately 20 ug/L in the water column which is well under the established pollution indicator of 25 ug/L. The profile of September 3, 1991 indicates that the reservoir was stratified with a thermocline developing at 2-3 meters. As indicated previously there was a noticeable decline in the concentration of dissolved oxygen in the water column below the thermocline but not to the point that it effected the fishery and defined beneficial uses. During recent surveys as part of study there have been no problems associated with macrophytes at the reservoir. In some of the bays near inlets some emergent macrophytes are present but not to the extent that there are impairments to the defined beneficial uses.

Fish kills have been reported at Currant Creek Reservoir. The reservoir was chemically treated by the DWR in 1989 to eliminate rough fish competition, so fixed populations of native fishes may not be present in the lake.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	5.282	58.34
Fragilaria crotonensis	3.436	37.95
Melosira granulata	0.108	1.20
Aphanizomenon flos-aquae	0.106	1.17
Peridinium sp.	0.056	0.61
Pennate diatoms	0.023	0.26
Asterionella formosa	0.019	0.21
Ankistrodesmus falcatus	0.013	0.14
Mallamona sp.	0.006	0.07
Centric diatoms	0.003	0.04
Total	9.052	
Shannon-Weaver Index[H']	0.86	
Species Evenness	0.38	
Species Richness	0.41	

As observed the phytoplankton commnunity is dominated by green algae and diatoms. This type of community composition supports the trophic state index for water quality.

Information

Management Agencies	
Mountainlands Association of Governments	377-2262
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Uinta National Forest	377-5780
Recreation	
Mountainlands Travel Region (Provo)	377-2262
Heber Chamber of Commerce	654-3666
Duchesne Chamber of Commerce	738-2707
Reservoir Administrators	
Department of the Interior	538-1467
CUP	226-7100

Pollution Assessment

Nonpoint pollution sources include logging, recreation, and grazing of domestic livestock. Grazing takes place throughout the watershed and along the shores of the reservoir.

In 1993 and 1994, 7.3 million board feet of timber will be logged from the Roundy Basin. Most of this has been killed by bark beetles. By 1996, 2.5 million board feet of timber will be taken from the Smith Basin area. While care is being taken to avoid disturbing riparian areas, these cuts may adversely affect the watershed and reservoir water quality.

There are no point sources of pollution in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

DARK CANYON LAKE

Introduction

Dark Canyon Lake is a small lake on the eastern slope of the La Sal Mountains at the base of Mt Peale. It is located on the boundary between state and private lands. It is located in a heavily forested area at an elevation of 9,940 feet above sea level. Although it appears that it is a natural lake, there is evidence that the natural drainage from the lake has been impounded by man.

The shore line is approximately divided equally between private ownership and State ownership. The south half of the lake is surrounded by public lands. The main access road over the La Sal Mountains via Geyser Pass passes very near the lake. A road lead directly from it to the lake shoreline. The lake is nestled at the base of the ridgeline of the La Sal Mountains in a very scenic area. The primary use of the lake is for recreational fishing, although it is also

Characteristics and Morphometry

Lake elevation (meters / feet)	3,033/9950
Surface area (hectares / acres)	2.4/6
Watershed area (hectares / acres)	591 / 1,461
Volume (m^3 / acre-feet)	
capacity	82,611/67
conservation pool	82,611 / 67
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	0
Depth (meters / feet)	
maximum	9.3 / 30
mean	3.4 / 11.1
Length (meters / feet)	183/600
Width (meters / feet)	152/500
Shoreline (meters / feet)	914 / 3,000

Location

County	San Juan
Longitude/Latitude	109 11 51 / 38 27 24
USGS Map	Mount Peale, Utah 1987
DeLorme's Utah Atlas & Gazetteer™	Page 30, A-4-31
Cataloging Unit	Upper Colorado (14030004)

LAKE REPORTS

classified for culinary, irrigation and recreation.

Recreation

Dark Canyon Lake is approximately 48 miles southeast of Moab or 14 miles north of La Sal.. From mile post 118 on US-191 (about eight miles south of Moab) turn east on Old Airport Road and follow pass the turnoff to Kens Lake, which should be visible about 11 miles south of Moab, to the La Sal Mountain Loop road. There is a junction approximately 3 miles south of the road to Kens Lake, but continue on past the junction, up Brumley Ridge into the La Sal Mountains, to the Geyser Pass Road approximately 8 more miles. The Geyser Pass Road is a well maintained gravel road that leads southeastly to Geyser Pass (approximately 7 miles). After Geyser Pass turn south on FS-129 which follows the ridgeline past Mount Mellenthin and turns eastward, before Mount Peale, to the lake (approximately 5 miles). Travel over the La Sal Mountains via this route produces some of the most spectacular panoramas of this area. Take the time to stop and enjoy some of these views, especially westward towards Moab and Kens Lake. Continuing on past Dark Canyon Lake on FS-129 will eventually lead you to U-46 and to La Sal, Utah. Approximately 6 miles past the lake is the intersection with FS-208. Turn south and travel for approximately 6 more miles to U-46. Two miles further southwest is the town of La Sal.

The lake is primarily for fishing with some private recreation developed in the area on the private lands to the north. It is possible to launch a boat on the lake, but no improved boat ramp is available and the lake is rather small. Camping is permitted, but in a primitive setting, unless use of private facilities are arranged. The lake is nestled in a forested area at the base of Mount Peale and Mount Mellenthin which provide for unsurpassed scenic beauty.

Watershed Description

The lake is approximate 1 mile below the base of very steep colluvial areas above the timberline associated with Mount Mellenthin and Mount Peale. The area around the lake is still fairly steep, but heavily forested. These mountains develop heavy snowpacks in the winter due to their high elevation, and some of the runoff is stored in Dark Canyon Lake. The main tributary for the area, Dark Canyon Creek passes to the south of the lake. It appears from maps that water could be diverted into the lake, but the naturally drainage from the lake is on the north side. In addition there is a minor inflow of water on the northwest side of the lake too.

The watershed high point, Mount Peale Peak, is 3,877 m (12,721 ft) above sea level, thereby developing a complex slope of 25.1% to the reservoir. The sole inflow is the canal from Mill Creek. Although Dark Canyon Creek doesn't flow directly into the lake, it was been used to calculate stream gradients in the area. The average stream gradient from the headwaters to the lake is 12.1% (639 feet per mile).

The watershed is composed of high mountains and moderate to steep canyons. Soil composition is approximately 40% rocky, 30% shallow to very shallow stony soils and 30% quartzite bedrock. Exact soil associations have not been determined by the Division of Water Quality.

The vegetation communities are comprised of sage-grass, oak, maple, aspen-fir, and alpine. The watershed receives approximately 76 cm (30 inches) of precipitation annually with a frost-free season of 40 - 60 days at the lake.

Public land use is 100% multiple use and recreation. The major use of the watershed is livestock grazing and recreation.

Limnological Assessment

The water quality of Dark Canyon Lake is considered very good. It is considered to be soft with a hardness concentration value of approximately 75 mg/L ($CaCO_3$). Although there are no overall water column concentrations

Limnological Data

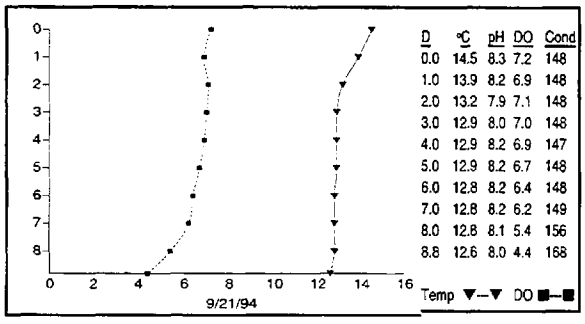
Data sampled from STORET site: 595870

Surface Data	1994
Trophic Status	M
Chlorophyll TSI	44.56
Secchi Depth TSI	36.66
Phosphorous TSI	39.37
Average TSI	40.20
Chlorophyll a (ug/L)	4.2
Transparency (m)	5.0
Total Phosphorous (ug/L)	12.0
pH	7.9
Total Susp. Solids (mg/L)	1.5
Total Volatile Solids (mg/L)	2
Total Residual Solids (mg/L)	2
Temperature (°C / °f)	16/61
Conductivity (umhos.cm)	146
Water Column Data	
Ammonia (mg/L)	0.08
Nitrate/Nitrite (mg/L)	0.01
Hardness (mg/L)	75.2
Alkalinity (mg/L)	75
Silica (mg/L)	-
Total Phosphorus (ug/L)	24
Miscellaneous Data	
Limiting Nutrient	N
DO (Mg/l) at 75% depth	6.4
Stratification (m)	NO
Depth at Deepest Site (m)	8.8

that exceed State water quality standards there are reported violations of parameters near the bottom of the lake. These parameters include phosphorus and dissolved oxygen. At various times of the year the hypolimnion of the lake the oxygen deficiencies develop. It may be that anoxic conditions develop during the winter which are reflective of the higher concentrations near the bottom of the lake during the first period of sampling (53 ug/L). In addition there are also some low dissolved oxygen values in the hypolimnion reported during late summer, but they do not appear to be impairing the fishery. Although these exceedences have occurred, it does not appear that the water quality is significantly impaired. It does indicate that some winter monitoring should be conducted to determine if impairments are present during extended ice coverage conditions during the winter.

Current data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is on the border of oligotrophic to mesotrophic in a state of low productivity. Although the profile of September 24, 1994 does not indicate any stratification, the potential for stratification in the lake does occur. On August 9, 1994 the lake was weakly stratified at a depth of 6 meters when the lake had a maximum depth of 9.3 meters. By September the lake had probably turned over indicative of the uniform conditions. Any stratification present probably is weak due to the size and depth of the lake and the existence of climatic conditions in mixing the lake.

According to DWR no fish kills have been reported in recent years. The reservoir supports a population of brook trout (*Salvelinus fontinalis*), arctic grayling (*Thymallus arcticus*) and rainbow trout (*Oncorhynchus mykiss*). The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake. Current stocking reports indicate that DWR stocks the lake with 3,000 rainbow trout and 500 brook trout fingerlings, 500 arctic grayling fry, and 1,000 catchable rainbow trout annually.



Phytoplankton in the euphotic zone in August, 1994 included the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	9.786	76.27
Quadrigula lacustris	1.112	8.67
Ceratium hirundinella	0.945	7.37
Peridinium sp.	0.361	2.82
Oocystis sp.	0.259	2.02
Dinobryon divergens	0.220	1.72
Unknown spherical chlorophyta	0.139	1.07
Pennate diatoms	0.005	0.03
Centric diatoms	0.004	0.03
Total Cell Volume	12.831	
Shannon-Weaver Index	0.91	
Evenness	0.42	
Richness	0.34	

The flora is dominated by green and red algae indicative of good water quality and low to moderate productivity.

Pollution Assessment

Nonpoint pollution sources are: sedimentation and nutrient loading from grazing, wastes and litter from recreation. Cattle graze in the watershed and around the reservoir.

There are no point pollution sources in the watershed.

Beneficial Use Classification

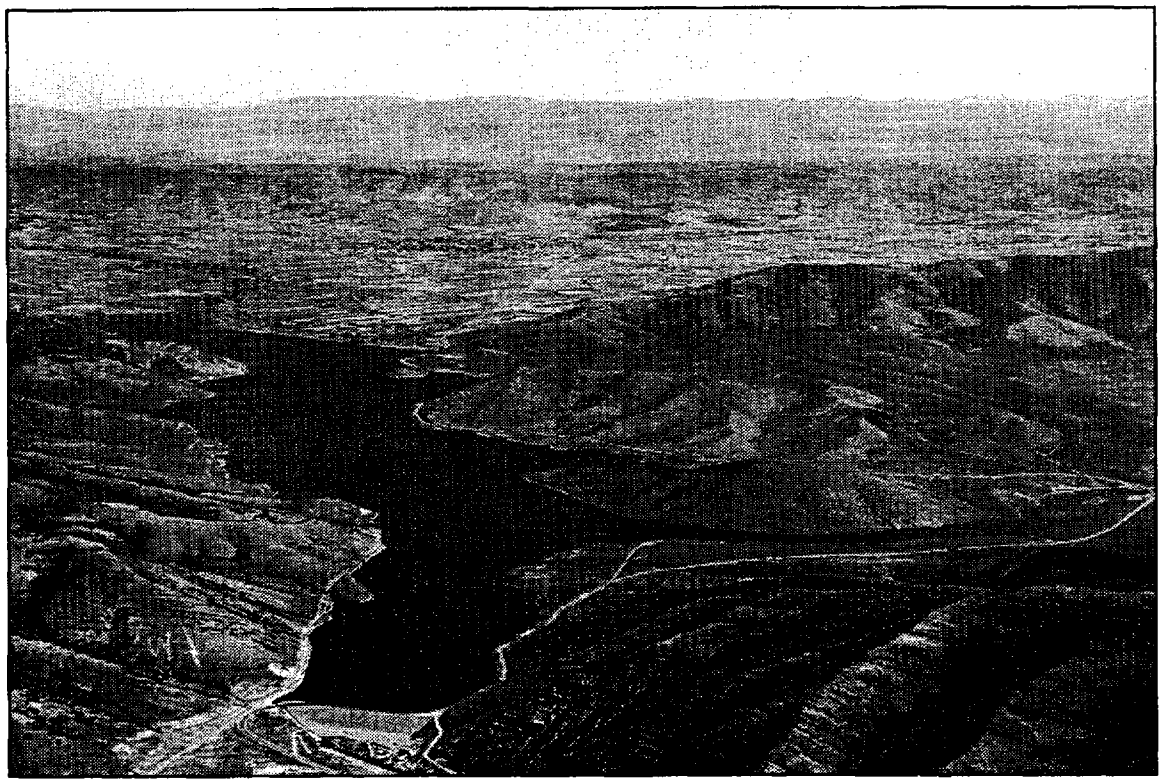
The state beneficial use classifications include: culinary water (1C), boating and similar recreation (excluding

Information

Management Agencies	
Bureau of Land Management	539-4001
Grand Resource Area (Moab)	259-8193
Southeastern Utah Association of Governments	
Division of Wildlife Resources	637-3310
Division of Water Quality	538-6146
Recreation	
Canyonlands Travel Region (Moab)	259-8825
Moab Chamber of Commerce	259-7531
Reservoir Administrators	

swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

DEER CREEK RESERVOIR



Introduction

Deer Creek Reservoir is a large reservoir at the top of Provo Canyon in northern Utah. Much of the Wasatch fronts and Salt Lake City's water comes from this reservoir, and it is a popular destination for year-round recreation. The Heber Creeper, a tourist passenger railroad, follows the reservoir's northern shore, and US-189 follows the southern shore. It impounds spring runoff from the western Uintas, storing it for use throughout the year. Deer Creek Reservoir was created in 1941 by the construction of an earth-fill dam. The reservoir shoreline is publicly owned, and public access is unrestricted. It is named after Deer Creek, which flows into the Provo River immediately downstream from the dam.

Characteristics and Morphometry

Lake elevation (meters / feet)	1,651 /5,417
Surface area (hectares / acres)	1,200 / 2,965
Watershed area (hectares / acres)	187,000 / 462,000
Volume (m^3 / acre-feet)	
capacity	2.38823×10^8 / 193,614
conservation pool	1.850×10^8 / 149,700
Annual inflow (m^3 / acre-feet)	4.930×10^8 / 254,700
Retention time (years)	1.3
Drawdown (m^3 / acre-feet)	8.6854×10^7 / 70,413
Depth (meters / feet)	
maximum	42 / 137
mean	20 / 65
Length (km / miles)	9.2 / 5.7
Width (km / miles)	1.9 / 1.2
Shoreline (km / miles)	29.6 / 18.4

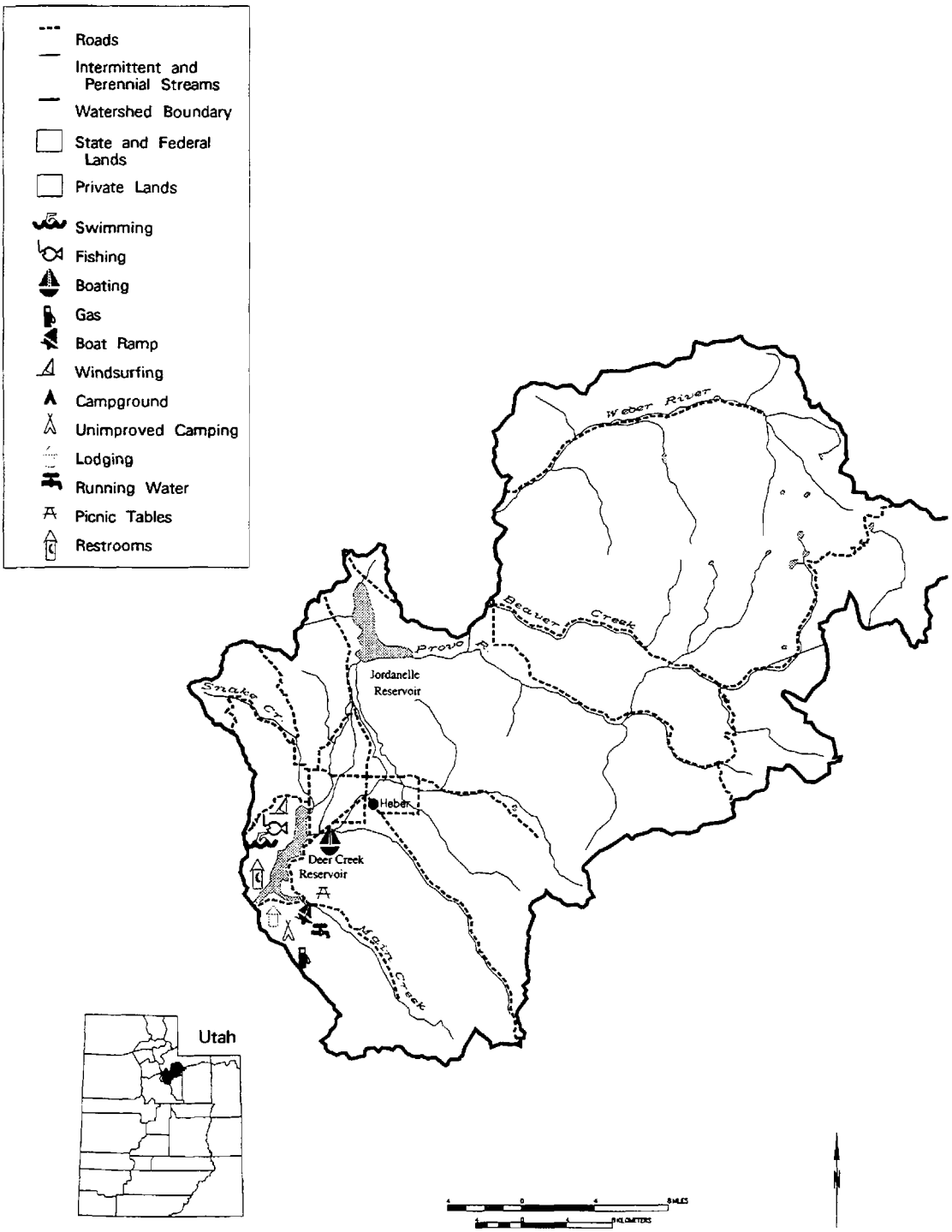
Location

County	Wasatch
Longitude / Latitude	111 32 58 / 40 24 45
USGS Maps	Aspen Grove, 1948, Charleston, 1966
DeLorme's Utah Atlas & Gazetteer™	Page 53 C-6, 54, C-1
Cataloging Unit	Provo River (16020203)

In addition to recreational usage the reservoir water is used for irrigation (38%), and culinary (62%). As urban sprawl continues to cover farmland, the amount consumed for culinary purposes is expected to increase.

Recreation

Deer Creek Reservoir is easily accessible from US-189



County near which watershed is located.

Deer Creek Watershed

<k74>

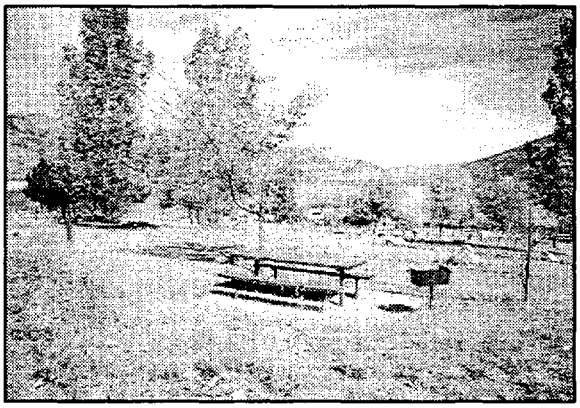
between Provo and Heber. The highway crosses the dam and follows the shore for about five miles. There are several resorts and one state park along the route. The road will be in the process of reconstruction from about 1995 to 2000, rerouting the highway further from the reservoir and providing improved access and parking.

Cross-country skiing, fishing, boating, windsurfing, swimming, camping, picnicking, ice fishing, and water skiing are all popular. Fishing is generally good to excellent, and strong canyon winds create fine sailing conditions. Mount Timpanogos and the rest of the southern Wasatch Front provide a spectacular backdrop. Timpanogos itself is discernable from the north end of the reservoir, with her head and flowing hair at the south end of the mountain.

Recreational facilities at the reservoir include Deer Creek State Park as well as private recreational facilities and marinas. The state park has a concrete boat launch, modern rest rooms with showers, sewage disposal, a 31 unit campground, and fish cleaning stations. The park is located two miles north of the dam on US-189 (milepost 20) with well-marked entrances.

Private facilities include Snow's Marina in Wallsburg Bay (milepost 21), the Deer Creek Island Resort (milepost 24) with a restaurant, boat rentals, boat launch areas, picnic areas, swimming areas, gasoline and sundries. An additional state-owned beach facility with swimming areas and public rest rooms are just north of the resort.

There are numerous USFS campgrounds up the North Fork up Provo Canyon on U-92, and Wasatch State Park in Midway (north of the reservoir and US-189 in the Heber Valley) also offers camping.



Watershed Description

Deer Creek Reservoir an impoundment of the Provo River. The river has a long narrow watershed, from the Trial Lake area in the extreme western Uintas down into the southern end of Kamas (Rhodes) Valley, then down upper Provo Canyon into the Jordanelle Reservoir, across Heber Valley and into Deer Creek Reservoir, which is located where Heber Valley narrows into Provo Canyon.

The area around the reservoir is sage-grass vegetation, with agricultural crops where the reservoir borders Heber Valley.

The inclusion of the western Uintas into the Provo River's watershed is a result of several natural and man-made diversions. In fairly recent geological times, the Provo River only drained the Heber Valley. Upper Provo Canyon was an east-flowing tributary of the Weber River, and what is now the headwaters of the Provo River drained across Kamas Valley and down the Weber. As geologic tilting and faulting occurred, the Heber Valley became topographically lower then Kamas Valley, and tributaries of the Provo River began capturing drainage from the Weber Basin. One of these tributaries began capturing the east flowing, present-day Upper Provo Canyon. It eventually captured that entire canyon (its east flowing tributaries are testament that the stream once flowed east) and reached the southern Kamas Valley and diverted the stream which is now called the Provo River into the Provo River drainage. Presently, the Provo River and Weber River both flow through Kamas Valley. The Provo has cut a narrow channel within the otherwise flat valley, but no further drainage has been captured. It appears that at the moment of human's brief presence in geologic time, the more difficult part of the capture (tough bedrock underlying Upper Provo Canyon) has occurred, but the Provo drainage has not made progress in capturing the remainder of the Weber River tributaries in Kamas Valley (underlaid by soft alluvial deposits), a process that should be nearly instantaneous. It has taken at least 10,000 years, however, because the width of Upper Provo Canyon clearly indicates it has carried glacial runoff.

Since Europeans arrived in the area, they have made two additional diversions to the headwaters of the Provo River. The first was the relatively simple diversion of Weber water across Kamas Valley to the Provo. This approximately doubled the watershed in the Uintas. Only a relatively small fraction of the Weber River is diverted, though. The second diversion involved tunnelling through the mountains between the Duchesne River and the Provo River. This diverts water from the Colorado River watershed to the Wasatch Front.

The natural watershed high point, Bald Mountain, is 3,640 m (11,943 ft) above sea level, thereby developing a complex slope of 3.7% to the reservoir (although higher points exist in the Duchesne River watershed). The average stream gradient above the reservoir is 3.2% (170 feet per mile). The inflows are the Provo River, Main Creek and Daniels Creek. The outflow is the Provo River. Culinary water stored in the reservoir is diverted from the river

several miles downstream at the Olmstead Diversion into the Salt Lake Aqueduct, while irrigation water is diverted near the mouth of the canyon at the Murdock Diversion. The newly completed Jordanelle Reservoir is the only significant upstream impoundment.

The watershed is made up of high mountains, low mountains, and valleys. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of pine, spruce-fir, oak-maple, alpine tundra, and sagebrush-grass. The watershed receives 41 - 102 cm (16 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 80 - 100 days per year.

Land use is primarily multiple use in USFS and BLM owned lands, and grazing of domestic livestock on privately owned lands. Private lands in the Heber Valley, however, are primarily agricultural, suburban, and urban. The headwater area of the Duchesne River is in the High Uintas Wilderness.

Limnological Data

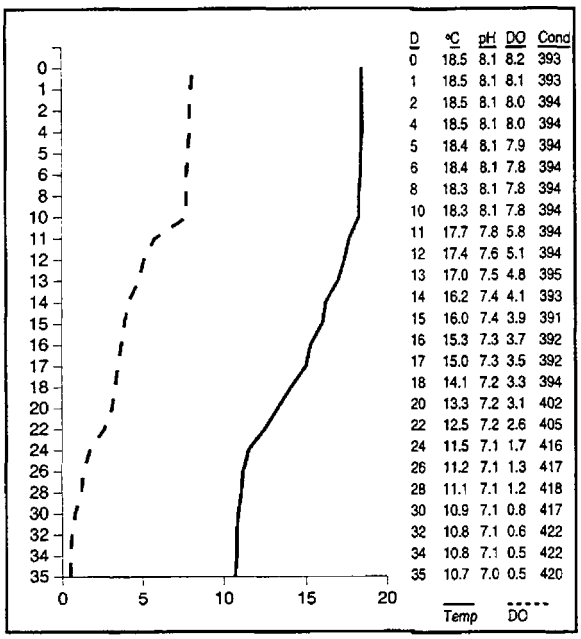
Data sampled and averaged from STORET sites on a year-round schedule: 591322, 591323, 591324, 591343, 591345.

Surface Data	1980	1990	1991*	1992*
Trophic Status	E	M	M	M
Chlorophyll TSI	52.18	48.12	53.92	45.13
Secchi Depth TSI	48.00	41.98	47.15	44.71
Phosphorous TSI	56.72	50.28	47.73	46.48
Average TSI	52.30	46.79	49.60	45.44
Chlorophyll a (ug/L)	-	6.5	14.0	4.2
Transparency (m)	2.57	3.5	2.7	3.1
Total Phosphorous (ug/L)	25	24	20	25
pH	8.2	8.2	8.1	8.4
Total Susp. Solids (mg/L)	<5	2.4	3.4	1.8
Total Volatile Solids (mg/L)	-	-	-	-
Total Residual Solids (mg/L)	-	-	-	-
Temperature (°C / °f)	20/68	19/66	19/68	19/66
Conductivity (umhos.cm)	370	384	321	418
Water Column Data				
Ammonia (mg/L)	0.16	0.06	0.04	0.03
Nitrate/Nitrite (mg/L)	0.23	-	0.15	0.06
Hardness (mg/L)	171	187	181	-
Alkalinity (mg/L)	131	-	-	-
Silica (mg/L)	9.8	-	-	-
Total Phosphorous (ug/L)	28	43	23	36
Miscellaneous Data				
DO (Mg/l) at 75% depth	0.0	1.1	0.5	1.3
Stratification (m)	NO	NO	NO	NO
Limiting Nutrient	N	N	N	N
Depth at Deepest Site (m)	40	35.0	35.0	35.0

* Data from all five sites were used in calculations.

Limnological Assessment

The water quality of Deer Creek Reservoir is good. It is considered to be hard with a hardness concentration value of approximately 180 mg/L ($CaCO_3$). The only parameters that have exceeded State water quality standards for defined beneficial uses are phosphorus, dissolved oxygen and on rare occasion total coliforms. Although the average surface concentrations of total phosphorus have not exceeded the State pollution indicator for phosphorus of 25 ug/L it is not unusual for the concentration throughout the water column to exceed is value several times due in large part to the higher concentrations that develop in the hypolimnion after the reservoirs stratifies and anoxic conditions develop. These types of conditions allow for the reintroduction of phosphorus previously stored in the sediments. Dissolved oxygen concentrations in late summer consistently substantiate the fact that water quality impairments do exist. Concentrations dropped dramatically in the hypolimnion to a low of 0.5 mg/L as depicted by the July 14, 1992 profile. Historically the reservoir has exhibited fairly high eutrophic conditions. During the late 70's and early 80's the reservoir was characterized as a highly eutrophic system with heavy algal blooms and the problems associated with them. The TSI values during that period averaged over 50 with reported values of 53.5, 54.2 and 54.2 in 1975, 1981 and 1982 respectively. This deterioration of water quality became the catalyst for joint activity by several agencies, groups and private land owners to study the problems and find acceptable solutions to alleviate the problems and restore water quality. These efforts have been ongoing since the 1980's. Projects have been implement to control the discharge of point and nonpoint sources of nutrients (primarily phosphorus) throughout the Deer Creek Reservoir watershed. Efforts were primarily focused on municipal wastewater and fish hatchery discharges, dairy operations, erosion control and proper planning with an increase in development in the watershed. Through these combined activities nutrient loadings to the reservoir have been decreased and water quality has improved. Although there is an extensive amount of data that has been collected a review of TSI values and the phytoplankton commnunity support these conclusions. TSI values have steadily declined from the historical values near 54.2 to 49.28, 46.79, 48.41, 45.65 and 43.14 from 1989 through 1993. In addition the phytoplankton community dominance has shifted from a blue-green to a green algae dominance with an increase in diatom diversity. All the periods of record indicate that the reservoir is characterized as a nitrogen limited system. From a complete review of profiles during the summer months it is evident that the reservoir does stratify. These conditions are deleterious to not only to the fishery by rendering some of the water column unsuitable for a fishery,



but water downstream from the reservoir unsuitable for a cold water fishery until the dissolved oxygen concentrations increase to a point when they can sustain a fishery. According to DWR no fish kills have been reported in recent years. The reservoir supports populations of rainbow trout (Oncorhynchus mykiss), cutthroat trout (*Oncorhynchus clarki*), largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieui*), yellow perch (*Perca flavescens*), brown trout (*Salmo trutta*), carp (*Cyprinus carpio*) and chubs (Gila atratia). Walleye (*Stizostedion vitreum*) and crayfish have been illegally introduced into the reservoir. DWR typically stocks the reservoir with fry, fingerling or subcatchable rainbow and cutthroat trout and smallmouth bass.

Macrophytes are not typically present and are not a problem. Traditionally, the DWR has stocked 100,000 fingerling Smallmouth Bass in the spring and nearly 100,000 subcatchable Rainbow Trout in both the spring and the fall. By the early 1990's, the Walleye population (illegally introduced) had become so dominant in the reservoir that it wiped out most of the trout fishery. In 1992, the DWR ceased to stock trout, and now stocks only the 100,000 Smallmouth Bass. Fish populations are very dynamic from year to year, with Walleye being the predominant predator in the early 1990's.

The reservoir has not been chemically treated by the DWR to eliminate rough fish competition, so populations of native Provo River fish may be present. Intensive stocking and angling for over 50 years have probably driven native fish populations to very small numbers.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Aphanizomenon flos-aquae	12.888	68.84
Stephanodiscus niagarae	3.914	20.91
Anabaena spiroides var. crassa	1.557	8.32
Oocystis sp.	.175	0.94
Melosira granulata	.109	0.58
Asterionella formosa	.069	0.37
Pennate diatoms	.004	0.02
Ankistrodesmus falcatus	.004	0.02
Total	154.917	
Shannon-Weaver	0.89	
Species Evenness	0.43	
Species Richness	0.30	

This sampling of the phytoplankton is representative of July 14, 1992 and is not typical of the decreasing trend for dominance by blue-green algae.

According to Rushforth (1992) the algal plankton flora of Deer Creek Reservoir, Wasatch County, Utah was studied throughout the 1991 calendar year. Quantitative net plankton and total plankton samples were examined. A total of 45 taxa was identified in the plankton flora. In addition, the two common categories, centric diatoms and pennate diatoms, each contain many additional taxa.

The most important plankters as determined by calculating Important Species Indices (Isis) from all Deer Creek Reservoir combined net and total plankton samples collected during 1991 were *Fragilaria crotonensis*, *Aphanizomenon flos-aquae*, *Stephanodiscus niagarae*, *Sphaerocystis schroeteri*, *Melosira granulata*, pennate diatoms, *Pandorina morum* and *Ankistrodesmus falcatus*. These taxa all had Isis greater that 1.0. These eight taxa comprised 92.7% of the phytoplankton flora (as determined by calculating sum importance value) of Deer Creek Reservoir for the 1991 year. This measurement is an assessment of algal standing crop and distribution through the year as reflected in our samples.

Algae with ISI's greater that 0.10 included centric diatoms, *Microcystis aeruginosa*, *Staurastrum gracile*, *Anabaena spiroides var. crassa*, *Dinobryon divergens*, Asterionella formosa, Ceratium hirundinella, Chlamydomonas species, and *Pediastrum duplex*.

Bluegreen algae together comprised approximately 17.2% of the flora when measured by summing ISI's. This total represents a significant increase over the past few years. For example, bluegreen algae comprised only 1.5% of the flora for the 1990 year. *Aphanizomenon flos-aquae*

was the most important cyanophyte in the reservoir for 1991 with an important species index of 6.77 (up from an ISI of 1.79 for the 1990 year). A. flos-aquae was also the second most important organism in the reservoir after the diatom *Fragilaria crotonensis*. The increase in abundance of A. flos-aquae continues a trend of rebound of this organism during the past two years.

Deer Creek, historically is a meso-eutrophic to eutrophic ecosystem. The reservoir has responded well to the nutrient limitation program established several years ago. The presence of noxious, poor water quality indicator species continues to be reduced compared to their abundance in the reservoir prior to nutrient limitation although the rebound in *Aphanizomenon flos-aquae* is noteworthy. It will be important to follow the development of this organism in the reservoir system during the 1992 year.

Pollution Assessment

Nonpoint pollution sources include the following: Sedimentation and nutrient loading from grazing. Human wastes, chemicals and nutrients from urban areas. Herbicides and nutrients from cropland. Human wastes, litter and toxins from recreation. Siltation from road construction during the late 1990's.

Point sources of pollution in the watershed include the following:

Midway Fish Hatchery
Kamas Fish Hatchery

Beneficial Use Classification

The state beneficial use classifications include: culinary water (1A), recreational bathing (swimming) (2A), boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Mountainlands Association of Governments	377-2262
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Mountainland Travel Region (Provo)	377-2262
Heber Chamber of Commerce	654-3666
Provo-Orem Chamber of Commerce	224-3636
Deer Creek State Park	654-0171
Concessionaire	--------
Reservoir Administrators	
Department of the Interior	538-1467
Central Utah Water Conservancy District	226-7100

DMAD RESERVOIR

Introduction

DMAD Reservoir is a large reservoir in the eastern Sevier Desert near Delta, UT. It is an impoundment of the lower reaches of the Sevier River. Much of the water has been removed by upstream users, reducing the river to a fraction of its prehistoric size. The reservoir is an impoundment of the river valley, where it has cut through some deposits, forming a serpentine valley about 1 mile wide and 80 feet deep. The reservoir is also called Delta Reservoir, and is referred to as "*The* D.M.A.D.".

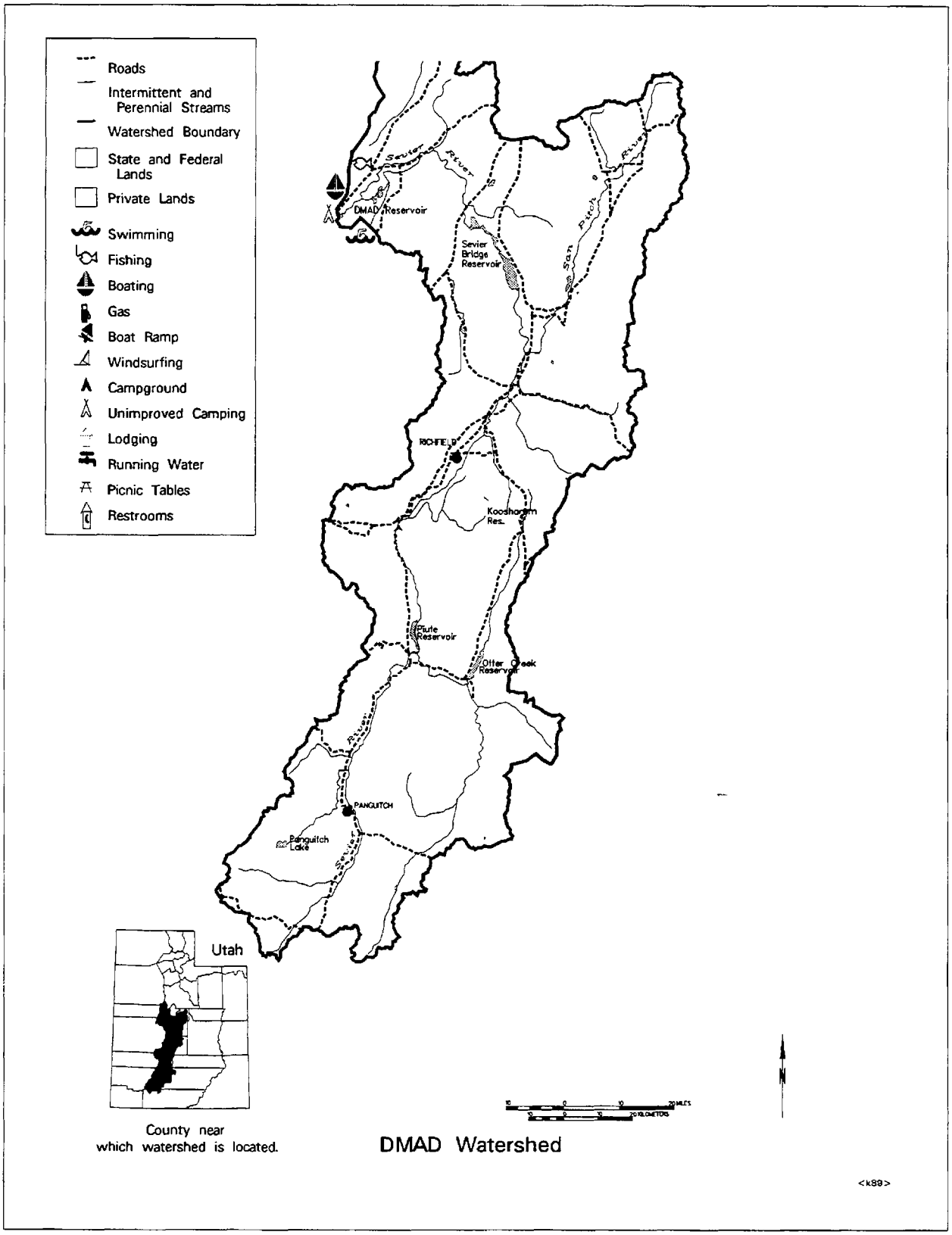
The DMAD is a large reservoir, created in 1959 by the construction of an earth-fill dam and a north dike. The reservoir shoreline is mostly publicly owned by the BLM, but some state and private lands also abut the reservoir. Public access is unrestricted. Current water use is for warm water

Characteristics and Morphometry

Lake elevation (meters / feet)	1,422 / 4,665
Surface area (hectares / acres)	485 / 1,199
Watershed area (km^2 / $miles^2$)	13,803 / 5,364
Volume (m^3 / acre-feet)	
capacity	13,600,000 / 10,990
conservation pool	None
Annual inflow (m^3 / acre-feet)	not measured
Retention time (years)	>1
Drawdown (m^3 / acre-feet)	12,335,019 / 10,000
Depth (meters / feet)	
maximum	7 / 24
mean	3 / 9
Length (km / miles)	2.9 / 1.8
Width (meters / feet)	0.4 / 0.25
Shoreline (km / miles)	10.1 / 6.3

Location

County	Millard
Longitude / Latitude	112 28 22 / 39 23 54
USGS Map	Strong 1985
DeLorme's Utah Atlas & Gazetteer™	Page 36, A-2, 44, D-2
Cataloging Unit	Lower Sevier (16030005)


Roads
Intermittent and Perennial Streams
Watershed Boundary
State and Federal Lands
Private Lands
Swimming
Fishing
Boating
Gas
Boat Ramp
Windsurfing
Campground
Unimproved Camping
Lodging
Running Water
Picnic Tables
Restrooms
DMAD Reservoir
Sevier River
Sevier Bridge Reservoir
San Pitch
RICHFIELD
Koodhorm Res.
Piute Reservoir
Otter Creek Reservoir
PANGUITCH
Panguitch Lake
Utah
County near which watershed is located.
DMAD Watershed
<k89>

aquatic habitat, recreation, and consumed for irrigation and cooling for the two Intermountain Power Project (IPP) coal burning power plants. Although IPP owns significantly more water for future expansion, they currently use an average of 18-20,000 acre-feet per year for cooling and lease their other water for downstream irrigation. The IPP desires to build two additional plants, which would double their water needs.

Recreation

DMAD Reservoir is between Delta and Lynndyl on US-6. Access is several miles south of the airport on US-6. Access to the dam is from a dirt road at the south end of "the river dip"--the 1/2 mile stretch of US-6 that dips into the Sevier River Valley. This road to the reservoir is marked with a small wooden sign. The turnoff, at the south end of the river dip, is 4.5 miles northeast of Delta and 12 miles south west of Lynndyl. Access to the north shore of the reservoir is from several roads leaving US-6 several miles north of the river dip.

The lake is used for fishing and boating. Usage is very low. The land that is now submerged by the reservoir was not cleared of trees and vegetation before flooding, making recreation somewhat hazardous and unappealing. Fish production is low.

The area immediately around the lake offers primitive camping. There are no public campgrounds in the area, but there are several RV Parks in Delta (see info box).

Watershed Description

DMAD Reservoir is an impoundment of the Sevier River Valley, a serpentine channel cut through alluvial deposits on the desert floor. The valley is about 1/2 mile wide and 80' deep. The reservoir impounds a segment of the valley about two miles long. The area around the reservoir is low level desert with grass-sage vegetation.

The watershed covers the entire Sevier River Drainage, from the Paunsaugunt and Markagunt Plateaus in the south, the west face of the Escalante Mountains, the Awapa Plateau, the Sevier Plateau, the east slopes of the Tushars and Pavant Ranges, the San Pitch Mountains, and the east face of the Wasatch Plateau. Everything from Bryce Canyon N.P. to Nephi drains into the DMAD.

The watershed high point, Delano Peak in the Tushar Mountains, is 3,709 m (12,167 ft) above sea level, thereby developing a complex slope of 2.0% to the reservoir. The inflow and outlet is the Sevier River. Some wells also provide water to the reservoir. The average stream gradient above the reservoir is 0.02% (8 feet per mile). Upstream reservoirs, Chicken Creek and Sevier Bridge, protect the DMAD from direct impacts from upstream pollutants.

The watershed contains substantial amounts of all the major soil types found in the state. See Appendix III for soil composition data.

The vegetation communities consist of pine, spruce-fir, aspen, oak-maple, pinyon-juniper, sagebrush-grass, bitterbrush, shadscale, and greasewood. The watershed receives 20 - 102 cm (8 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 140 - 160 days per year.

The largest use of land in the watershed is multiple use land (69.6%). These lands are administered by the BLM, USFS, and the State of Utah. Grazing, recreation, and logging occur on many areas of these lands. Native grazing (mostly cattle and sheep) comprise 18.5% of the watershed. Irrigated cropland (7.2%), pasture and hay fields (4.1%), wildlife (3.5%), urban (0.7%), and recreation (0.05%) make up the remainder of the watershed. The major use of the watershed is livestock grazing, resulting in heavy runoff and substantial soil erosion.

Limnological Assessment

Before the Sevier River was dammed, the river

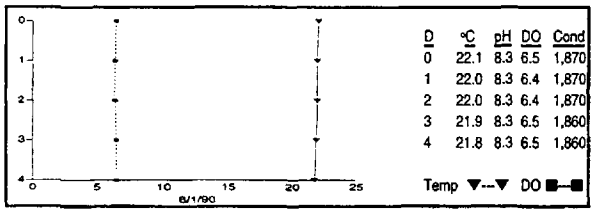
Limnological Data

Data averaged from STORET sites: 494140, 494141, 494142

Surface Data	1979	1990	1992
Trophic Status	E	H	E
Chlorophyll TSI	-	47.12	42.36
Secchi Depth TSI	-	81.93	82.39
Phosphorous TSI	50.00	66.82	47.27
Average TSI	-	65.29	57.34
Chlorophyll a (ug/L)	-	5.4	4.5
Transparency (m)	-	0.2	0.32
Total Phosphorous (ug/L)	40	78	20
pH	8.5	8.2	8.4
Total Susp. Solids (mg/L)	14	38	13
Total Volatile Solids (mg/L)	-	-	5
Total Residual Solids (mg/L)	-	-	8
Temperature (°C / °f)	13/55	19/66	13/55
Conductivity (umhos.cm)	1690	1746	1622
Water Column Data			
Ammonia (mg/L)	.1	0.04	0.03
Nitrate/Nitrite (mg/L)	.6	-	0.30
Hardness (mg/L)	440	417	375
Alkalinity (mg/L)	244	244	218
Silica (mg/L)	-	-	18.9
Total Phosphorous (ug/L)	40	77	27
Miscellaneous Data			
DO (Mg/l) at 75% depth	-	8.5	8.3
Stratification (m)	-	NO	NO
Limiting Nutrient	P	N	N
Depth at Deepest Site (m)	-	4.0	1.5

emptied into Sevier Lake, about 30 miles west of Delta, where all the water evaporated. Because of the high evaporative potential of the river flowing across the desert, all chemicals in the water become increasingly concentrated.

This is not as apparent in the upper reaches of the river, but when water reaches Delta, it is very hard and nutrient-rich. The DMAD is only slightly upstream from Sevier Lake (now dry), and like the lake, it loses much water to evaporation and becomes extremely nutrient rich.



D	°C	pH	DO	Cond
0	22.1	8.3	6.5	1,870
1	22.0	8.3	6.4	1,870
2	22.0	8.3	6.4	1,870
3	21.9	8.3	6.5	1,860
4	21.8	8.3	6.5	1,860

The DMAD is used as a storage reservoir for the Delta area. During the growing season, water is released from the Sevier Bridge Reservoir and stored in the DMAD or other reservoirs in the Delta area. The water level in the DMAD can go up and down several times during the summer, resulting in a short retention time of the water and mitigating the problem of high evaporation rates.

The water quality of DMAD Reservoir fair. It is considered hard with hardness an average concentrations of (235 mg/L (CaCO3). The hardness may tend to increase during drought conditions due to high evaporation and a low inflow of higher quality water.

The DMAD is in compliance with all parameters except total phosphorous. The state pollution indicator is 25 ug/L, and the DMAD averages 48 ug/L. It should be noted that in 1992 the average was only slightly higher at 27 ug/L. This has a negative effect on aquatic life, but does not impair water use for irrigation or industrial cooling. Although this study did not obtain total dissolved solids (TDS) concentrations, it is evident with conductivity values approaching 2000 umhos/cm^2 that the TDS standard of 1200 for irrigation waters is close to being exceeded. In addition the high turbidity associated with shallow reservoirs and the high alkalinity and hardness may inhibit the biological potential for algae growth which will reduce the impact on water quality.

TSI values for the reservoir indicate that the reservoir is a eutrophic to hypereutrophic reservoir. These values are consistently in excess of 50.00. Data also indicates that the system is predominately a nitrogen limited system. Stratification and low dissolved oxygen are typically not problems as depicted in the August 1, 1990 profile. Due to the shallow nature of the reservoir and various climatic factors there is probably continual mixing of the water column.

Because of the vast size of the watershed, it is unlikely that any specific measures can be taken to reduce phosphorous inputs. Upstream reservoirs are also eutrophic. Water quality improvement projects in various portions of the watershed will help, but given the concentrated nature of chemicals in the lower river, it is unlikely the DMAD will come into compliance in the near future.

The DMAD is not stocked with fish by the DWR. It contains populations of catfish (*Ictalurus punctatus*), white bass (*Morone chrysops*), carp (*Cyprinus carpio*), walleye (*Stizostedion vitreum*) and white crappie (*Pomoxis annularis*). It is one of the few waters in the state with populations of white crappie. All fish populations are self-sustaining. The reservoir has not been chemically treated to control rough fish competition, although the DWR would like to treat it when funds become available.

Information

Management Agencies	
Bureau of Land Management	539-4001
House Range Resource Area (Fillmore)	743-6811
Six County Commissioners Association	896-9222
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Panoramaland Travel Region (Richfield)	896-9222
Delta Chamber of Commerce	864-4316
West Delta RV Park	864-2212
B Kitten Clean Trailer Park	864-2614
Reservoir Administrators	
D.M.A.D. Company	864-2494

Pollution Assessment

Nonpoint pollution sources include the following: Sedimentation and nutrient loading from logging, grazing, feedlots and cropland. Human wastes, litter and toxins from recreation. Household wastes and nutrient loading from urban areas. Sedimentation and heavy metal production from active and inactive mines. Essentially, all non-point pollution sources occur in the watershed.

Cattle graze in the watershed and around the reservoir.

Several active mines are located in the immediate watershed, with several others scattered throughout the remainder of the watershed. Included are the Ashgrove Cement Company, which quarries stone at the Neilson Quarry, about 10 miles upstream from Leamington on U-132, and the Leamington Quarry, which mines

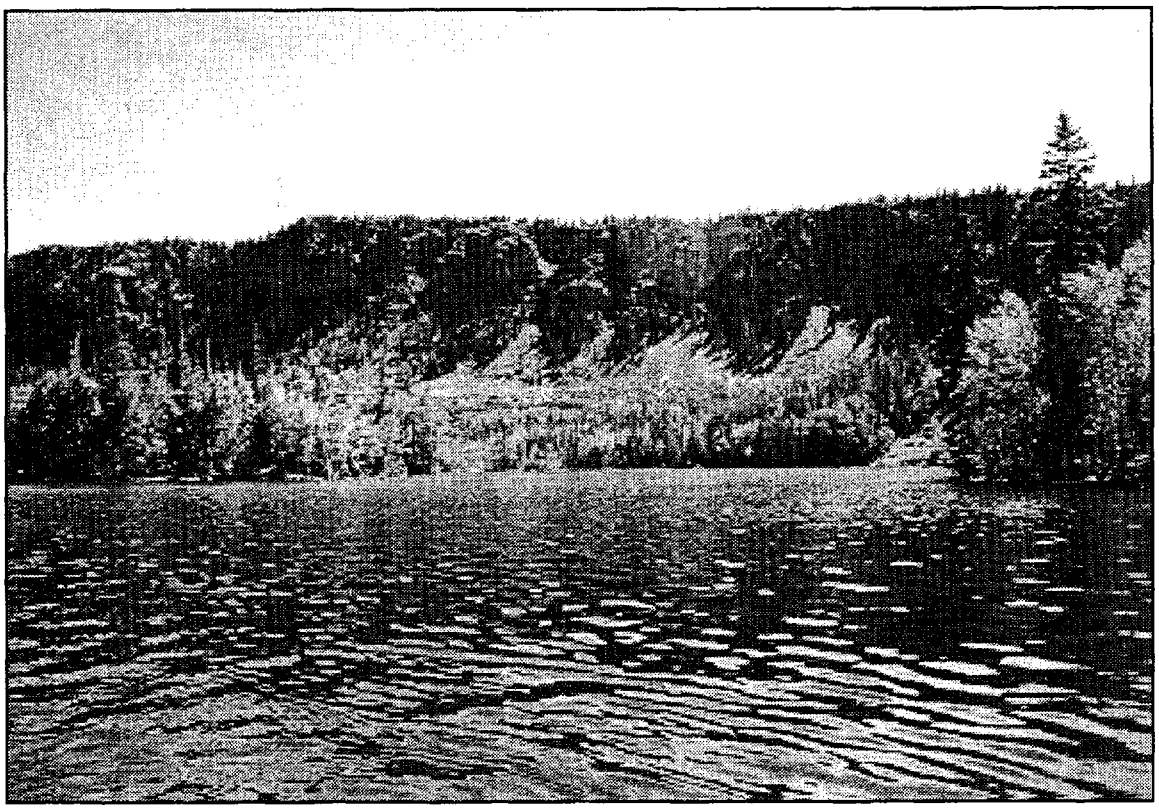
limestone/dolomite for the Ashgrove Cement Company, and discharges 5 miles upstream from Leamington.

All point pollution sources are above the upstream reservoirs and do not have a direct effect on water quality in the DMAD. They are listed with the Sevier Bridge Reservoir information.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), warm water game fish and organisms in their food chain (3B) and agricultural uses (4).

DONKEY RESERVOIR



Introduction

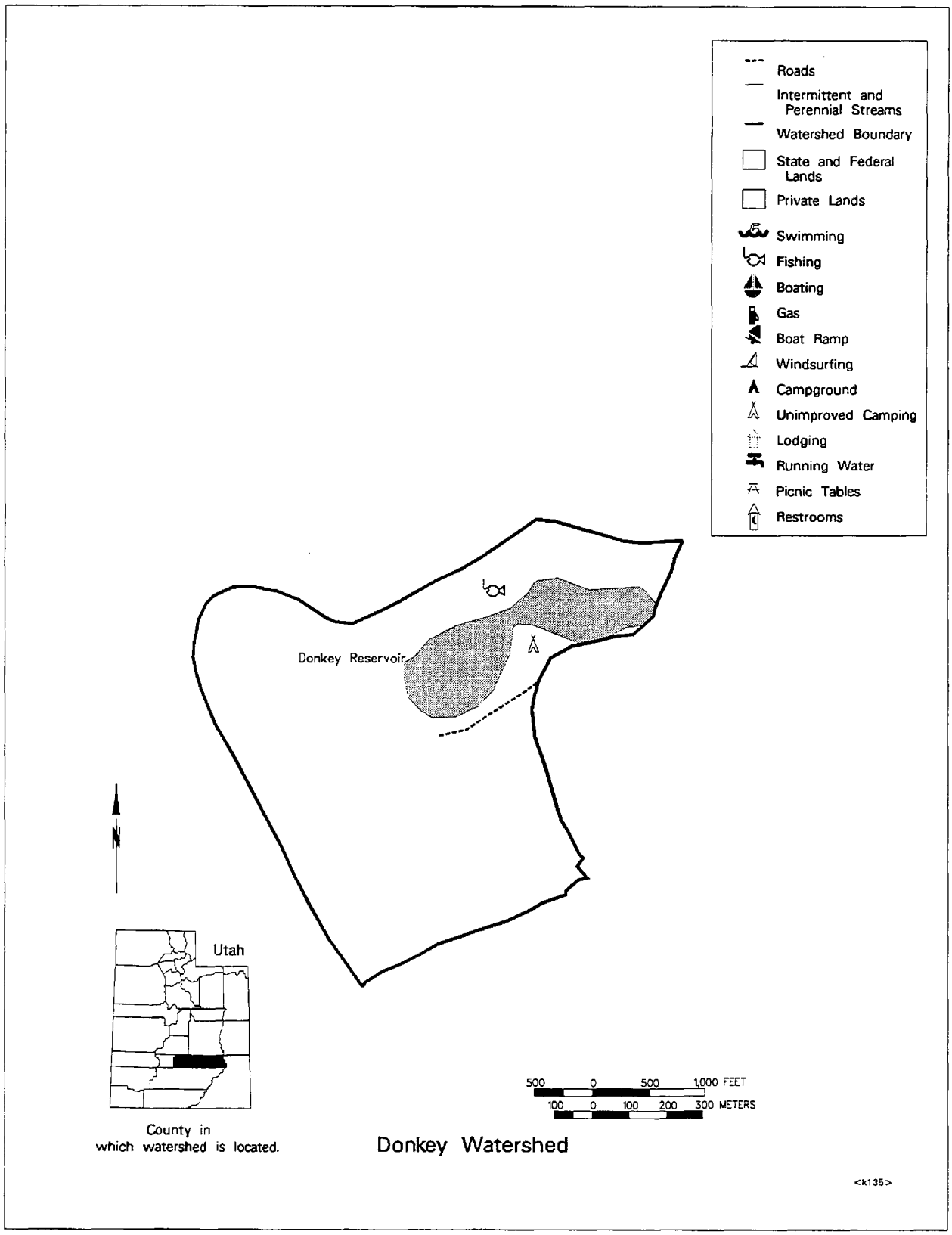
Donkey Reservoir is one of about a dozen lakes and reservoirs on the north slope of Boulder Mountain in south-central Utah. These lake basins are the result of uneven glacial scouring. Donkey Reservoir, like many others, is a small natural lake that has been further impounded to increase its capacity, creating an intermediate-sized reservoir. These lakes are at the base of the 500 foot cliffs at the edge of the top of the plateau. The reservoir was created in 1923 by the construction of an earth-fill dam where the stream flows out from the lake. Depth was doubled from 13 feet to 26 feet. The shoreline is owned and administered by the Dixie National Forest with unrestricted public access. Water is consumed for irrigation, but also used for recreation and coldwater aquatic habitat. No changes in water use are anticipated in the foreseeable

Characteristics and Morphometry

Lake elevation (meters / feet)	3,096 / 10,157
Surface area (hectares / acres)	16 / 40
Watershed area (hectares / acres)	518 / 1,280
Volume (m^3 / acre-feet)	
capacity	4.0×10^5 / 324
conservation pool	0
Annual inflow (m^3 / acre-feet)	not measured
Retention time (years)	<1
Drawdown (m^3 / acre-feet)	up to 23'
Depth (meters / feet)	
maximum	8 / 26.2
mean	2.4 / 8.1
Length (meters / feet)	770 / 2,520
Width (meters / feet)	190 / 630
Shoreline (meters / miles)	1,680 / 5,510

Location

County	Wayne
Longitude / Latitude	111 29 32 / 38 12 10
USGS Map	Blind Lake 1985
DeLorme's Utah Atlas and Gazetteer™	Page 28, B-1
Cataloging Unit	Fremont River (14070003)


Roads
Intermittent and Perennial Streams
Watershed Boundary
State and Federal Lands
Private Lands
Swimming
Fishing
Boating
Gas
Boat Ramp
Windsurfing
Campground
Unimproved Camping
Lodging
Running Water
Picnic Tables
Restrooms
Donkey Reservoir
N
Utah
500 0 500 1,000 FEET
100 0 100 200 300 METERS
County in which watershed is located.
Donkey Watershed
<k135>

future.

Recreation

Donkey Reservoir is at the top of the slope from the Fremont River to Boulder Mountain, necessitating a long climb on primitive roads. Just recently the roads have been improved, but the last mile to the reservoir remains primative and requires a vehicle with high clearance. From downtown Teasdale, go south and east for approximately 1.5 miles. Turn right on a gravel road marked with a sign for Donkey Reservoir and other lakes. Within 2 miles the road begins the ascent on Boulder Mountain. It is a seven mile, fairly continuous climb, to gain 3,000 feet in elevation. Take the left fork at the junction to Coleman Lake. You will pass Bob's Hole, a small lake, on the way and Round Lake near the top. A few hundred yards past Round Lake, an excellent lake for brook trout in the spring, take the right fork which will lead you past a series of impoundments and culminate at Donkey Reservoir at the top. The upper reaches of the road are primitive, suitable only for hikers, horses, mountain bikes, and high clearance vehicles. Good maps, particularly the Teasdale and Blind Lake 7.5' quads, are extremely helpful. The road during inclement weather can become very slick and impassable.

Fishing and primitive camping are the major activities available at the reservoir itself, but the surrounding region is replete with back country hiking areas and additional lakes that are accessible by trail. The water may be considered to cold for most swimmers and the reservoir is noted for the Brook Trout fishery. Although there is no boat ramp small boats can be launched on the reservoir. Access roads are not maintained in the winter. Usage is light to moderate during the spring and summer.

There are no improved USFS campgrounds in the vicinity, although primitive camping is possible throughout the area. There is an RV park in Torrey (see info box).

Watershed Description

Donkey Reservoir at the top of a long, forested slope that begins at the crest of Boulder Mountain. From the plateau top at 3,500 meters, the land drops off down to the Fremont River at 2,100 meters. At the top of the slope, an impressive 200 meter cliff completes the gradient to the top of Boulder Mountain. Donkey Reservoir is in a basin enclosed by the cliff on two sides. Aspens and firs line the lake. Vegetation increases in density near the base of the cliff, and is interspersed with talus slopes.

The surface watershed is very small, extending only a short distance onto the top of the plateau. There are many closed drainages on top of the plateau that have subsurface drainage, appearing as springs on the mountain sides. Such springs are a major source of water for the reservoir, giving it a large subsurface watershed of an unknown location and surface size.

The watershed high point is the top of the plateau above the reservoir at 3,354 m (11,005 ft) above sea level, thereby developing a complex slope of 30.6% to the lake. Inflow is from springs and the outlet is Donkey Creek.

Landforms composing the watershed include a glaciated valley, an escarpment, and a small portion of a high plateau. The soil is of volcanic origin. Soil association types are found in Appendix III.

The vegetation communities are comprised of pine, aspen, spruce-fir and oak, sage-grass, and mountain mahogany. The watershed receives 64 - 76 cm (25 - 30 inches) of precipitation annually with a frost-free season of 0 - 20 days at the reservoir.

Land use is multiple use. The Dixie National Forest encompasses the entire drainage area.

Limnological Assessment

The water quality of Donkey Reservoir is very good. It

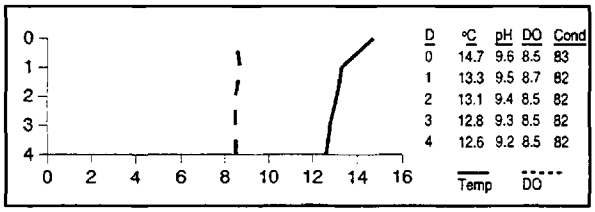
Limnological Data

Data sampled from STORET site: 495462

Surface Data	1979	1989	1991*
Trophic Status	M	M	M
Chlorophyll TSI	-	41.21	43.70
Secchi Depth TSI	38.33	35.05	40.02
Phosphorous TSI	55.4	69.65	49.97
Average TSI	46.8	48.64	44.56
Chlorophyll a (ug/L)	-	2.95	3.8
Transparency (m)	4.5	5.65	4.0
Total Phosphorous (ug/L)	40	94	24
pH	-	9.55	9.6
Total Susp. Solids (mg/L)	5	-	<3
Total Volatile Solids (mg/L)	-	-	2
Total Residual Solids (mg/L)	-	-	<2
Temperature (°C / °f)	-	13/56	15/59
Conductivity (umhos.cm)	-	91	83
Water Column Data			
Ammonia (mg/L)	0.05	<0.01	0.03
Nitrate/Nitrite (mg/L)	0.03	0.03	<0.01
Hardness (mg/L)	41	-	37
Alkalinity (mg/L)	44	-	42
Silica (mg/L)	25	-	20.6
Total Phosphorus (ug/L)	45	91.3	28.0
Miscellaneous Data			
DO (Mg/l) at 75% depth	8.1	-	8.5
Stratification (m)	NO	NO	NO
Limiting Nutrient	N	N	N
Depth at Deepest Site (m)	7	5.8	4.0

* Summer data only

is considered to be soft with a hardness concentration value of approximately 40 mg/L ($CaCO_3$). The only parameter that has exceeded State water quality standards for defined beneficial uses is phosphorus. The average concentration of total phosphorus in the water column in 1979, 1989, and 1991 was 45, 91.3, and 28 ug/L which exceeds the recommended pollution indicator for phosphorus of 25 ug/L. These high concentrations are indicative of eutrophic conditions. Although in late summer the water level is significantly reduced due to heavy drawndown there appears to be no problem with dissolved oxygen concentrations throughout the water column as indicated by the August 21, 1991 profile. The 1989-91 data suggest that the reservoir is currently a nitrogen limited system. Despite the relatively high phosphorus concentrations, TSI values indicate the reservoir is a fairly stable mesotrophic waterbody. With the wide range of phosphorus concentrations, additional monitoring should be conducted to ascertain the probable causes of this kind of variation. In addition investigations of dissolved oxygen concentration during the winter should be conducted to evaluate the effect of lake productivity and the presence of a fairly heavy macrophyte population that develops in the arm above the dam as drawdown during late summer occurs. The reservoir was not stratified during a late summer monitoring trip was in 1989. Concentrations of dissolved oxygen and the temperature regime at that time indicate no apparent problems in the water column. According to DWR no fish kills have been reported in recent years, however, in the early 1960's there were frequent fish kills. One of the problems at that time was a fairly heavy infection rate of trematodes. The reservoir supports populations of brook trout (*Salvelinus fontinalis*) and cutthroat trout (*Oncorhynchus clarki*).



According to existing records, the DWR did not stock Donkey Reservoir in 1991.

Macrophytes can cover about 85% of the surface in late summer if conditions are appropriate.

Phytoplankton in the euphotic zone include the following taxa:

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	2.641	90.70
Fragilaria crotonensis	0.229	7.87
Oocystis sp.	0.042	1.43
Total	2.912	
Shannon-Weaver [H']	0.35	
Species Evenness	0.32	
Species Richness [d]	0.10	

The flora is fairly typical, but not particularly diverse. The dominance of green algae and diatoms indicates that the lake is reasonably healthy.

Information

Management Agencies	
Dixie National Forest	586-2421
Teasdale Ranger District	425-3435
Division of Water Quality	538-6146
Division of Wildlife Resources	538-4700
Six County Commissioners Organization	637-5444
Recreation	
Red Cliff Oasis (Torrey RV Park)	425-3431
Reservoir Administrators	
Teasdale Irrigation Company	425-3546
Division of Water Rights, Richfield Office	896-4429

Pollution Assessment

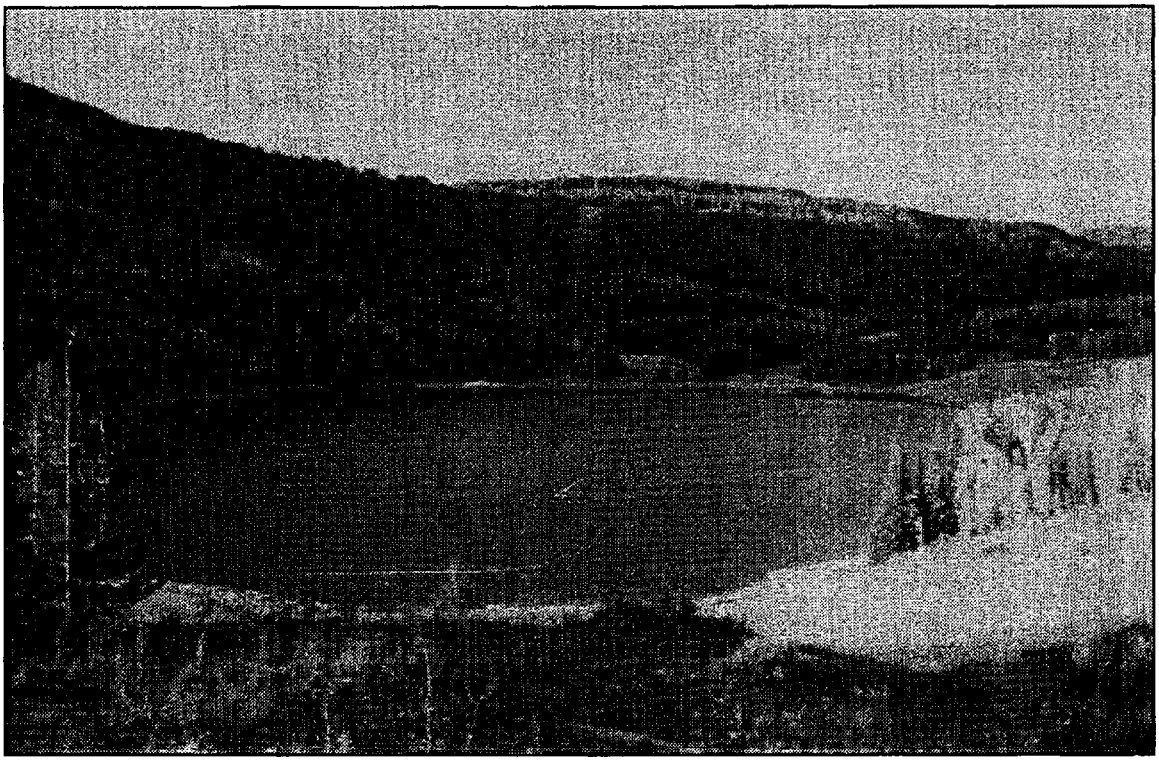
Nonpoint pollution sources are grazing and recreation. Cattle graze in the watershed and probably around the reservoir.

There are no point pollution sources in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

DUCK FORK RESERVOIR



Introduction

Duck Fork Reservoir is an intermediate-sized artificial lake owned by the DWR. It is located in a meadow near the head of a glacial valley in Ferron Canyon, high on the east side of the Wasatch Plateau. It is used as habitat for Bonneville Cutthroat Trout, an endangered species that has been transplanted from the Deep Creek Mountains. It receives little recreational use but is noteworthy for its scenic beauty. The reservoir was created in 1953 by the construction of an earth-fill dam. It was purchased in 1977 by DWR to provide recreational fishing. The shoreline is owned by the Manti-La Sal National Forest with unrestricted public access. Water is used for recreation and coldwater aquatic habitat, but is not stored for irrigation. (Water that flows through the lake is later used for irrigation). no changes in water use are anticipated.

Characteristics and Morphometry

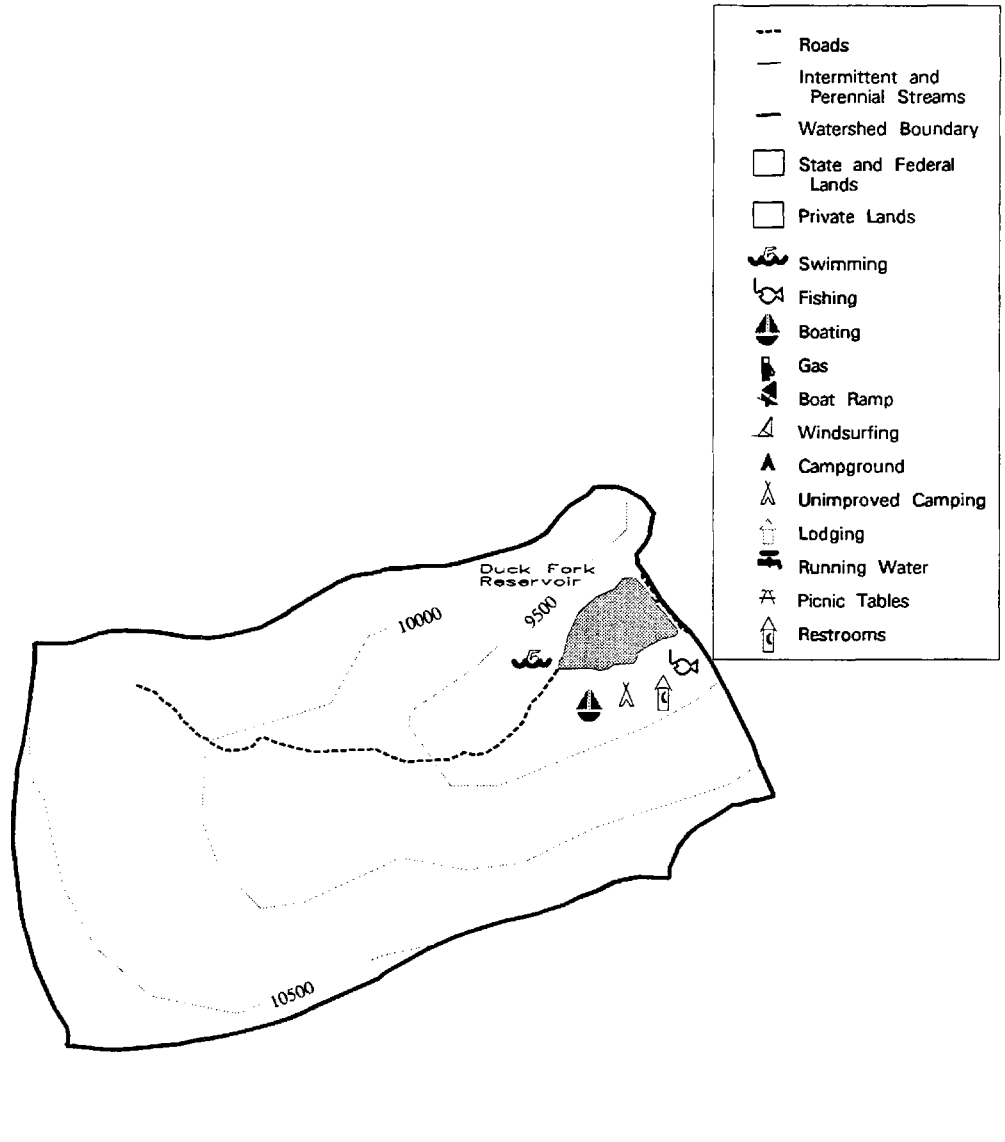
Lake elevation (meters / feet)	2,837 / 9,305
Surface area (hectares / acres)	19.1 / 46.9
Watershed area (hectares / acres)	773 / 1,910
Volume (m^3 / acre-feet)	
capacity	907,000 / 734.6
conservation pool	907,000 / 734.6
Annual inflow (m^3 / acre-feet)	not measured
Retention time (years)	unknown
Drawdown (m^3 / acre-feet)	0 / 0
Depth (meters / feet)	
maximum	10.7 / 35
mean	5.3 / 17.5
Length (meters / feet)	680 / 2,250
Width (meters / feet)	430 / 1,400
Shoreline (km / miles)	2.0 / 1.3

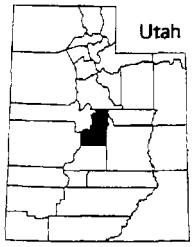
Location

County	Sanpete
Longitude / Latitude	111 26 57 / 39 10 11
USGS Map	Ferron Reservoir 1966
DeLorme's Atlas and Gazetteer™	Page 38, B-1
Cataloging Unit	San Rafael (14060009)

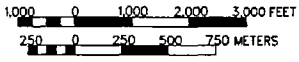
Recreation

Duck Fork Reservoir is accessible on a dirt road from





County in which watershed is located.



Duck Fork Watershed

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Ferron Reservoir. Ferron Reservoir is on the road between Ferron and Mayfield. This road is improved gravel and crosses some of the most rugged terrain on the Wasatch Plateau.

From Ferron, travel east past Millsite Reservoir, and continue on the gravel road as it ascends Ferron Canyon, enters a narrow side canyon and climbs to a high bench area. Ferron Reservoir is 25 miles west of Ferron City. From Mayfield, travel up the canyon, crossing the plateau on Skyline Drive at 10,500', and descend into Ferron Canyon. Ferron Reservoir is 23 miles east of Mayfield. The Ferron Canyon route is likely to be the better maintained road.

From Ferron Reservoir, turn north, below the dam, and follow this road for 5 miles as it goes northeast and then west to Duck Fork Reservoir.

The area around the reservoir receives light recreational usage. Fishing and camping are the primary activities available at Duck Fork Reservoir.

Recreational facilities at the reservoir are limited and primitive. Primitive camping is permitted in the area, and there are latrines at the reservoir. Small boats can be launched from the dam.

Cottage rental and USFS camping are available at Ferron Reservoir.

Watershed Description

The watershed lies in the Manti-La Sal National Forest. The area consists of land extending down from various peaks around the reservoir. It lies on the eastward slope. The land is wooded and very mountainous.

The watershed high point is 3324 meters(10,904 ft.) above sea level, thereby developing a complex slope of 15.1% to the reservoir. The average stream gradient above the reservoir is 9.9% (523 ft. per mile).

Landforms composing the watershed are high plateaus, a valley, and steep escarpments is between. Soil is derived entirely from limestone formations. The soil associations that compose the watershed are found in appendix III.

The vegetation communities are comprised of pine, aspen, spruce-fir, oak and maple. The watershed receives 64 - 76 cm (25 - 30 inches) of precipitation annually with a frost-free season of 20 - 60 days at the reservoir.

Land use in the reservoir is 100% multiple use forest lands, used by humans for hunting, recreation and livestock grazing.

Limnological Assessment

The water quality of Duck Fork Reservoir is excellent. It is considered to be hard with a hardness concentration value of approximately 242 mg/L ($CaCO_3$). Data obtained in 1992 indicates that no parameters exceeded State water quality standards for defined beneficial uses. The average concentration of total phosphorus in the water column in 1992 was 11.2 ug/L which is well under the recommended pollution indicator for phosphorus of 25 ug/L. The 1989-91 data suggest that the reservoir is currently a nitrogen limited system despite the fact that nutrient levels are relatively low. A review of the August, 1992 profile indicates that no conditions exist that would impair the defined beneficial uses of the reservoir. The dissolved oxygen concentration is over 9 mg/L for the majority of the water column and only drops to a low of 7 at the bottom. The reservoir was not stratified during a late summer monitoring trip on August 20, 1992. As mentioned earlier the reservoir is managed by DWR to maintain a population of endangered cutthroat trout (*Oncorhynchus clarki utah*). In addition rainbow trout (*Oncorhynchus mykiss*) can be found in the reservoir.

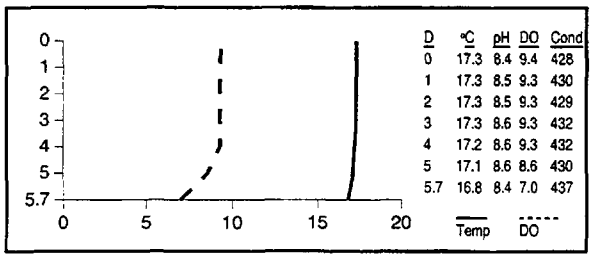
Limnological Data

Data sampled from STORET site: 593186

Surface Data	1992
Trophic Status	O
Chlorophyll TSI	38.77
Secchi Depth TSI	38.81
Phosphorous TSI	41.68
Average TSI	39.75
Chlorophyll a (ug/L)	2.3
Transparency (m)	4.35
Total Phosphorous (ug/L)	14
pH	8.5
Total Susp. Solids (mg/L)	1.5
Total Volatile Solids (mg/L)	1
Total Residual Solids (mg/L)	<3
Temperature (°C / °f)	15/59
Conductivity (umhos.cm)	433
Water Column Data	
Ammonia (mg/L)	0.03
Nitrate/Nitrite (mg/L)	0.05
Hardness (mg/L)	242
Alkalinity (mg/L)	206
Silica (mg/L)	5.1
Total Phosphorus (ug/L)	11
Miscellaneous Data	
DO (Mg/l) at 75% depth	9.1
Stratification (m)	NO
Limiting Nutrient	N
Depth at Deepest Site (m)	5.7

Transparency readings (secchi depth) were at the bottom of the reservoir in August, so the water is clearer that the data indicates.

The lake has not been treated for rough fish competition, so native fishes may still be present.



D	°C	pH	DO	Cond
0	17.3	8.4	9.4	428
1	17.3	8.5	9.3	430
2	17.3	8.5	9.3	429
3	17.3	8.6	9.3	432
4	17.2	8.6	9.3	432
5	17.1	8.6	8.6	430
5.7	16.8	8.4	7.0	437

Phytoplankton in the euphotic zone include the following taxa (in order of dominance).

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	34.333	97.95
Gloeocystis sp.	0.334	0.95
Pennate diatoms	0.156	0.44
Cosmarium sp.	0.078	0.22
Dinobryon divergens	0.061	0.17
Centric diatoms	0.053	0.15
Ankistrodesmus falcatus	0.017	0.05
Oocystis sp.	0.013	0.04
Wislouchiella planktonica	0.007	0.02
Total	35.052	
Shannon-Weaver [H']	0.13	
Species Evenness	0.06	
Species Richness [d]	0.33	

Duck Fork reservoir is a fairly low productive system. The algal community is dominated by green algae indicative of high water quality and low production.

Information

Management Agencies	
Manti-La Sal National Forest	637-2817
Ferron Ranger District	384-2372
Six County Commissioners Organization	896-9222
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Skyhaven Resort (at Ferron Reservoir)	
Castle Dale Chamber of Commerce	381-2547
Panoramaland Travel Region (Richfield)	896-9222
Reservoir Administrators	
Division of Wildlife Resources	538-4700

Pollution Assessment

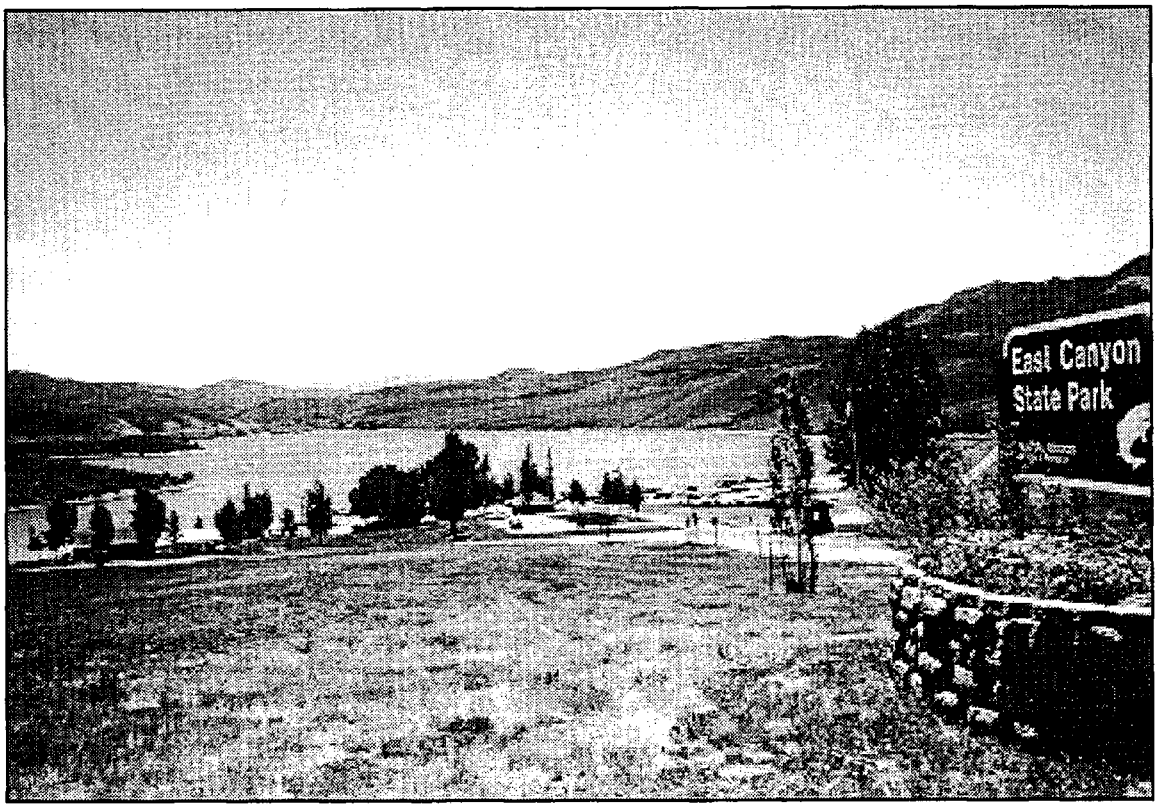
Nonpoint pollution sources include grazing by domestic livestock and recreation. About 1,000 sheep graze in the immediate vicinity of the reservoir for two weeks each year. Cattle also graze the area. No mining or logging takes place in the region.

There are no point pollution sources in the watershed.

Beneficial Use Classification

The state beneficial use classification for the waters of Cleveland Reservoir include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

EAST CANYON RESERVOIR



Introduction

East Canyon Reservoir is a large reservoir behind the northern Wasatch Front. It drains the Snyderville Basin area, including Park West Ski Resort. Close proximity to population centers on the northern Wasatch Front and a well equipped State Park make this a very popular reservoir for year round recreation.

The current dam, a concrete arch, was created in 1966. The spillway is a spectacular waterfall off the west side of the dam. The reservoir shoreline is owned by the State of Utah, and public access is unrestricted. Vehicular access to the west side of the reservoir is restricted. In addition to recreational use the reservoir water is used for irrigation (90%), and culinary (10%). As urban sprawl continues to displace agricultural lands, the fraction consumed for culinary purposes is expected to increase.

Characteristics and Morphometry

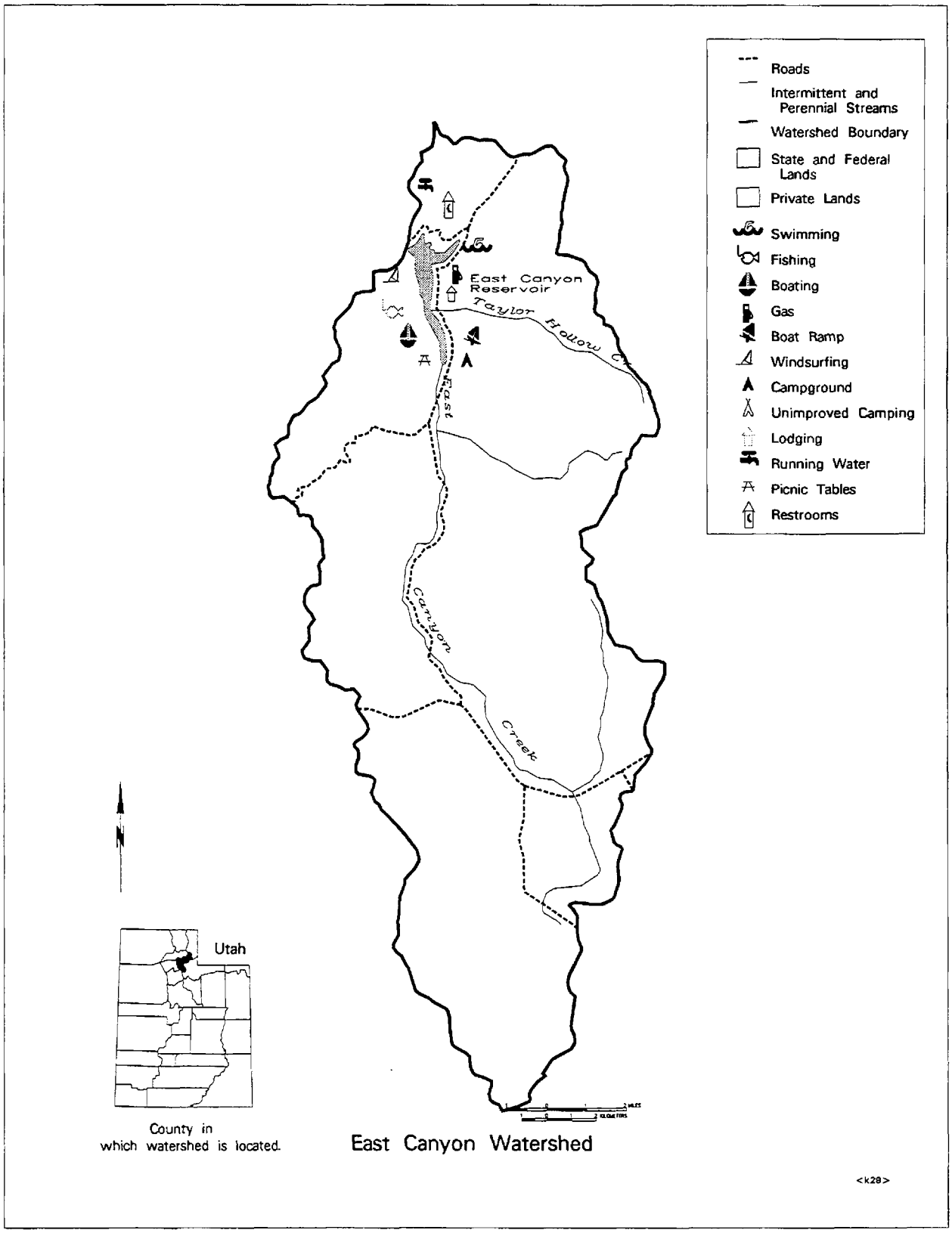
Lake elevation (meters / feet)	1,734 / 5,690
Surface area (hectares / acres)	277 / 684
Watershed area (hectares / acres)	40,146
Volume (m^3 / acre-feet)	
capacity	63,155 / 51
conservation pool	
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	28,701,122 / 23,268
Depth (meters / feet)	
maximum	60 / 197
mean	23 / 75
Length (km / miles)	5.64 / 3.50
Width (km / miles)	2.3 / 1.43
Shoreline (km / miles)	16 / 9.94

Location

County	Morgan
Longitude / Latitude	111 35 20 / 40 54 20
USGS Maps	East Canyon Reservoir -1975
DeLorme's Utah Atlas & Gazetteer™	Page 53, A-6
Cataloging Unit	Lower Weber (16020102)

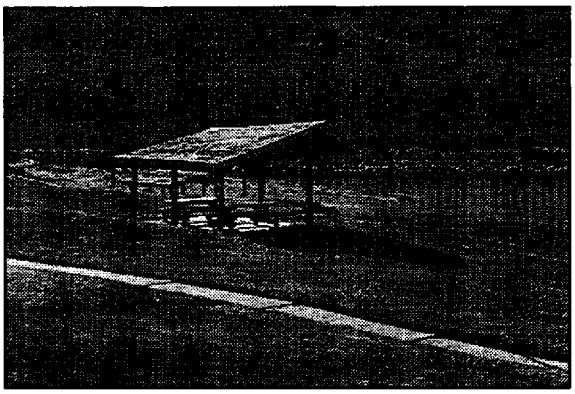
Recreation

East Canyon Reservoir is in East Canyon between I-80 and I-84. The all year access is U-66 from Morgan (Exit 103 off I-84). Alternate routes U-65 from the south (Exit 134 off I-80 in Parley's Canyon) or the north (Exit 115 off I-84 in Henefer). U-66 follows the north shore of the reservoir, while U-65 follows the east shore. There is access to the

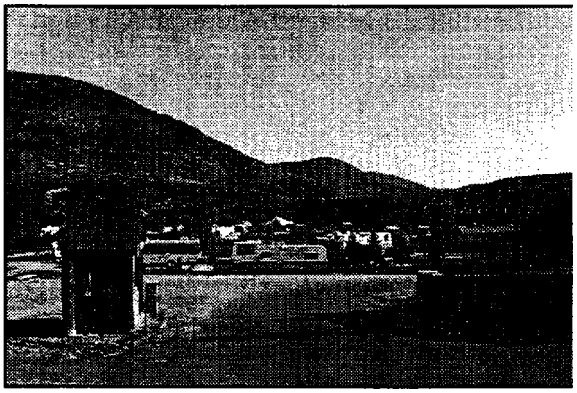

Roads
Intermittent and Perennial Streams
Watershed Boundary
State and Federal Lands
Private Lands
Swimming
Fishing
Boating
Gas
Boat Ramp
Windsurfing
Campground
Unimproved Camping
Lodging
Running Water
Picnic Tables
Restrooms
East Canyon Reservoir
Taylor Hollow Cr.
East
Canyon
Creek
N
Utah
County in which watershed is located.
East Canyon Watershed
<k28>

southern half of the west shore by a gravel road off U-65. Driving time is about 1/2 hour from the mouth of either Parley's or Weber Canyons.

Cross-country skiing, fishing, boating, sailboarding, swimming, camping, picnicking, ice fishing, and water skiing are all popular. In 1992, the state park recorded 108,395 visitors, ranging from 252 visitors in December to 25,716 in June.



Recreational facilities include a wide concrete boat ramp, modern rest rooms with showers, sewage disposal, a 31 unit campground with a large overflow area, and fish cleaning stations. A concessionaire provides a snacks and boat rentals. The park is located on U-66 on the north shore of the reservoir, one mile west of the junction with U-65. Entrances are well marked. There are no other campgrounds in the area, and little public land for dispersed camping. East Canyon Resort is located near the southern end of the reservoir. The resort has a wide range of facilities available to the public.



Watershed Description

East Canyon Reservoir is an impoundment of East Canyon Creek. The watershed drains the back side of the Wasatch Front, from behind Big Cottonwood Canyon to behind Emigration Canyon.

The area around the watershed is relatively dry compared to the areas closer to the Wasatch Front. Vegetation is mostly sage-grass, but there are areas of spruce-fir in sheltered, north facing slopes. Unlike the canyons that drain to the west, the scenery is not the lush forests most recreationalists hope to find in the mountains.

The watershed extends south and west from the reservoir. The highest elevations are along the Wasatch Front itself, with 10,000 foot ridgelines common at the south end of the watershed. The eastern border of the watershed is only slightly higher than the stream elevations in many areas. Like many areas behind the Wasatch Front, the divides between drainages are very low, with Parley's Summit, Snyderville basin to Park City, and Parley's Park all being major divides at low elevations. Silver Creek was once the headwaters of East Canyon Creek, but appears to have been diverted into the Weber Basin in recent geologic history.

The Snyderville Basin is rapidly urbanizing, creating changes in water quality for this watershed. Nutrient and sediment loading within the watershed are major issues at the present time. Pollutant sources include golf courses, dairies and other cattle operations, construction and development sites, erosion and loss of riparian habitat, and discharge from the municipal wastewater treatment facility. These sources are the likely reasons for water quality problems at the reservoir. The East Canyon Technical Advisory Committee is attempting to bring about a coordinated effort to control sources of pollution and restore impaired water quality. Currently there is a spirit of cooperation by all parties associated with these problems.

The watershed high point is 2,753 m (9,034 ft) above sea level, thereby developing a complex slope of 9% to the reservoir. The average stream gradient above the reservoir is 4.2% (220 feet per mile). The inflows are East Canyon Creek, Dixie Hollow, Taylor Hollow, and Sawtooth Creek. The outflow is East Canyon Creek.

The watershed is made up of high mountains, low mountains, and valleys. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of pine, spruce-fir, oak-maple, alpine tundra, and sagebrush-grass. The watershed receives 41 - 102 cm (16 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 80 - 100 days per year.

In 1980, the watershed was zoned as follows: Reserve--no development (57%), multiple use (39%), pioneer trail corridor (3%), and agriculture (1%). Presently, all six square miles of Snyderville Basin, a relatively flat area of the upper part of the watershed, is under heavy development pressure. The watershed is almost entirely privately owned, leaving it vulnerable to development.

Limnological Assessment

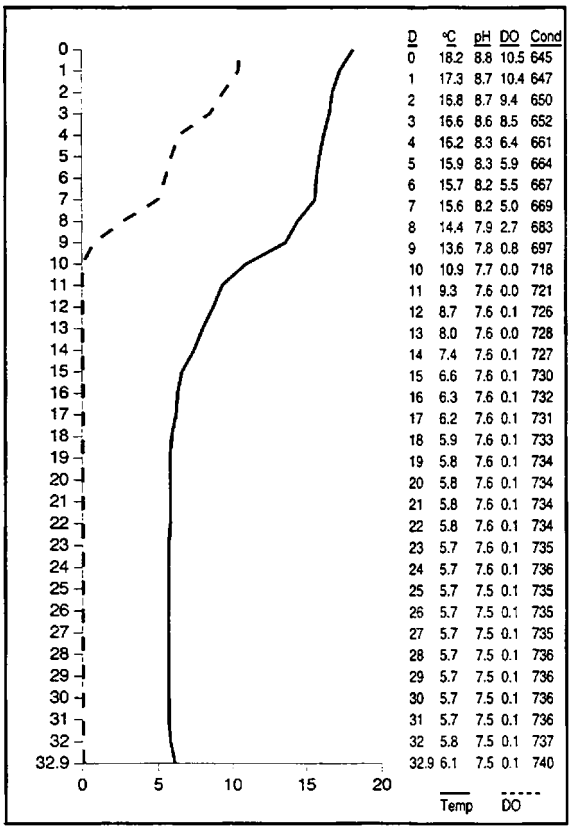
The water quality of East Canyon Reservoir is fair. It is considered to be hard with a hardness concentration value

Limnological Data

Data averaged from STORET sites: 492516, 492517, 492518

Surface Data	1980	1989	1992
Trophic Status	E	M	E
Chlorophyll TSI	-	46.16	45.39
Secchi Depth TSI	46.01	43.10	45.61
Phosphorous TSI	64.59	56.84	67.46
Average TSI	55.30	48.70	52.82
Chlorophyll a (ug/L)	-	5.1	7.4
Transparency (m)	1.5	3.2	2.8
Total Phosphorous (ug/L)	60	39	82
pH	8.3	8.5	8.6
Total Susp. Solids (mg/L)	5	-	4.8
Total Volatile Solids (mg/L)	-	-	5
Total Residual Solids (mg/L)	-	-	2
Temperature (°C / °f)	13/55	20/68	18/64
Conductivity (umhos.cm)	485	609	676
Water Column Data			
Ammonia (mg/L)	0.05	0.02	0.08
Nitrate/Nitrite (mg/L)	0.55	-	0.08
Hardness (mg/L)	241	-	269
Alkalinity (mg/L)	163	-	176
Silica (mg/L)	-	-	1.6
Total Phosphorous (ug/L)	97	84	171
Miscellaneous Data			
DO (Mg/l) at 75% depth	3.1	-	0.1
Stratification (m)	9-14	8-13	7-11
Limiting Nutrient	N	N	N
Depth at Deepest Site (m)	35	44.4	32.9

of approximately 255 mg/L ($CaCO_3$). The parameters that have exceeded State water quality standards for defined beneficial uses are phosphorus, temperature and dissolved oxygen. The average concentration of total phosphorus in the water column has consistently exceeded the State pollution indicator for phosphorus of 25 ug/L. In 1992 phosphorus concentration averaged 171 ug/L in the water column with some individual values approaching 400 ug/L. This high concentration is due in part to high nutrient loadings from the watershed where a major municipal wastewater treatment plant discharges into East Canyon Creek and is increased due to stratified conditions, with anoxic conditions present near the bottom. These types of conditions allow for the reintroduction of phosphorus previously stored in the sediments. High nutrient loadings lead to production of blue-green algal blooms, and excessive production of algae. This high production is responsible for impaired water quality. Dissolved oxygen concentrations in late summer consistently substantiate the fact that water quality impairments do exist. Concentrations dropped dramatically below the thermocline (9-10 meters) to virtually anoxic conditions. In addition surface water temperatures exceed the criteria (20° C) for a cold water fishery. These factors coupled together eliminate a very large portion of the reservoir as fishery habitat. Because of these impairments the reservoir and its watershed have been the focus of a Clean Lakes Phase I study. In addition to the conclusion from that study programs are being implemented to control nutrient loading from the watershed to improve water quality throughout the watershed including the reservoir. TSI values categorize the reservoir as eutrophic. All three periods of record indicate that the reservoir is characterized as a nitrogen limited system. Although the system is nitrogen limited efforts to improve water quality focus on the control of phosphorus into the system. The goal is to reduce the concentration of all nutrients and to push the reservoir towards phosphorus limitation. In addition there are ongoing studies to evaluate the effect of these programs and to track water quality trends in the reservoir. According to DWR fish kills have been reported in recent years. In late summer of 1994 a fish kill was documented in the south arm of the reservoir. It should be noted that in above normal wet years the tendency for a fish kill is reduced. In addition to poor water quality conditions the fish populations is also infected with the parasite, *Lernaea*. *Lernaea* is an anchor



D	°C	pH	DO	Cond
0	18.2	8.8	10.5	645
1	17.3	8.7	10.4	647
2	16.8	8.7	9.4	650
3	16.6	8.6	8.5	652
4	16.2	8.3	6.4	661
5	15.9	8.3	5.9	664
6	15.7	8.2	5.5	667
7	15.6	8.2	5.0	669
8	14.4	7.9	2.7	683
9	13.6	7.8	0.8	697
10	10.9	7.7	0.0	718
11	9.3	7.6	0.0	721
12	8.7	7.6	0.1	726
13	8.0	7.6	0.0	728
14	7.4	7.6	0.1	727
15	6.6	7.6	0.1	730
16	6.3	7.6	0.1	732
17	6.2	7.6	0.1	731
18	5.9	7.6	0.1	733
19	5.8	7.6	0.1	734
20	5.8	7.6	0.1	734
21	5.8	7.6	0.1	734
22	5.8	7.6	0.1	734
23	5.7	7.6	0.1	735
24	5.7	7.6	0.1	736
25	5.7	7.5	0.1	735
26	5.7	7.5	0.1	735
27	5.7	7.5	0.1	735
28	5.7	7.5	0.1	736
29	5.7	7.5	0.1	736
30	5.7	7.5	0.1	736
31	5.7	7.5	0.1	736
32	5.8	7.5	0.1	737
32.9	6.1	7.5	0.1	740

work that causes lesions and sores on the external surface of fish. These conditions and the stress factors associated with water quality are responsible for the loss of fish at the reservoir. The reservoir supports populations of rainbow trout (Oncorhynchus mykiss), cutthroat trout (*Oncorhynchus clarki*) and some brown trout (*Salmo trutta*). DWR typically stocks the reservoir with approximately 300,000 fingerling rainbow. The reservoir has not been chemically treated by the DWR to eliminate rough fish competition, so populations of native fish may be present. Macrophytes are not typically present and are not a problem.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Stephanodiscus niagarae	11.439	68.91
Aphanizomenon flos-aquae	2.430	14.64
Ceratium hirundinella	1.872	11.28
Fragilaria crotonensis	0.458	2.76
Melosira granulata var. angustissima	0.126	0.76
Melosira granulata	0.086	0.52
Cosmarium sp.	0.077	0.47
Oocystis sp.	0.067	0.40
Closteriopsis longissima var. tropica	0.033	0.20
Unknown spherical green alga	0.005	0.03
Ankistrodesmus falcatus	0.004	0.03
Total	16.597	
Shannon-Weaver Index [H']	1.01	
Species Evenness	0.42	
Species Richness [d]	0.42	

As observed the phytoplankton community is dominated by blue-green algae and diatoms that are indicative of eutrophic waters.

Pollution Assessment

Nonpoint pollution sources include grazing, recreation, agricultural runoff, and urban wastes. Urban pollution includes runoff from suburban and commercial development, construction areas, ski slope maintenance activities, and golf course maintenance activities.

The only point source of pollution in the watershed is the East Canyon Wastewater Treatment Plant, located at the top of East Canyon, just north of I-80. It processes sewage from the Snyderville Basin area and discharges it into East Canyon Creek.

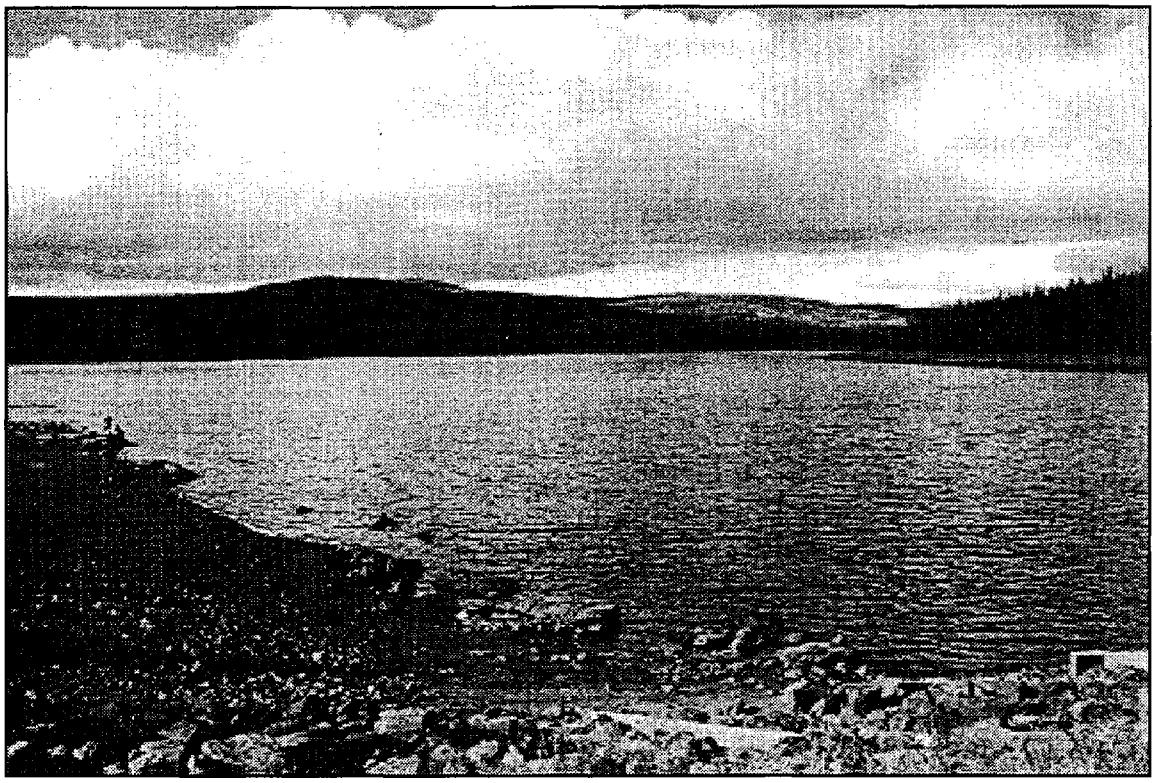
Beneficial Use Classification

The state beneficial use classifications include: recreational bathing (swimming) 2A, boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Wasatch Front Regional Council	292-4469
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Golden Spike Empire Travel Region (Ogden)	627-8288
East Canyon State Park	829-6866
East Canyon Resort	355-3460
Reservoir Administrators	
Department of the Interior	538-1467

EAST PARK RESERVOIR



Introduction

East Park Reservoir is an intermediate-sized reservoir on the south slope of the eastern High Uintas. It is one of the more accessible reservoirs in the High Uintas, being about 8 miles from US-191 by paved forest road. It has a small, natural watershed and provides opportunities for summer recreation. East Park Reservoir was created in 1919 by the construction of an earth-fill dam. The reservoir shoreline is owned by the Ashley National Forest, and public access is unrestricted. Reservoir water is used primarily for irrigation, with 50% of the reservoir's volume drained off before mid-summer for agricultural purposes, while the remainder is retained as a conservation pool. Water use is not expected to change in the foreseeable future. Stored water flows down Little Brush Creek, becomes subterranean just above US-191, and later emerges as springs in the Big Brush Creek drainage.

Characteristics and Morphometry

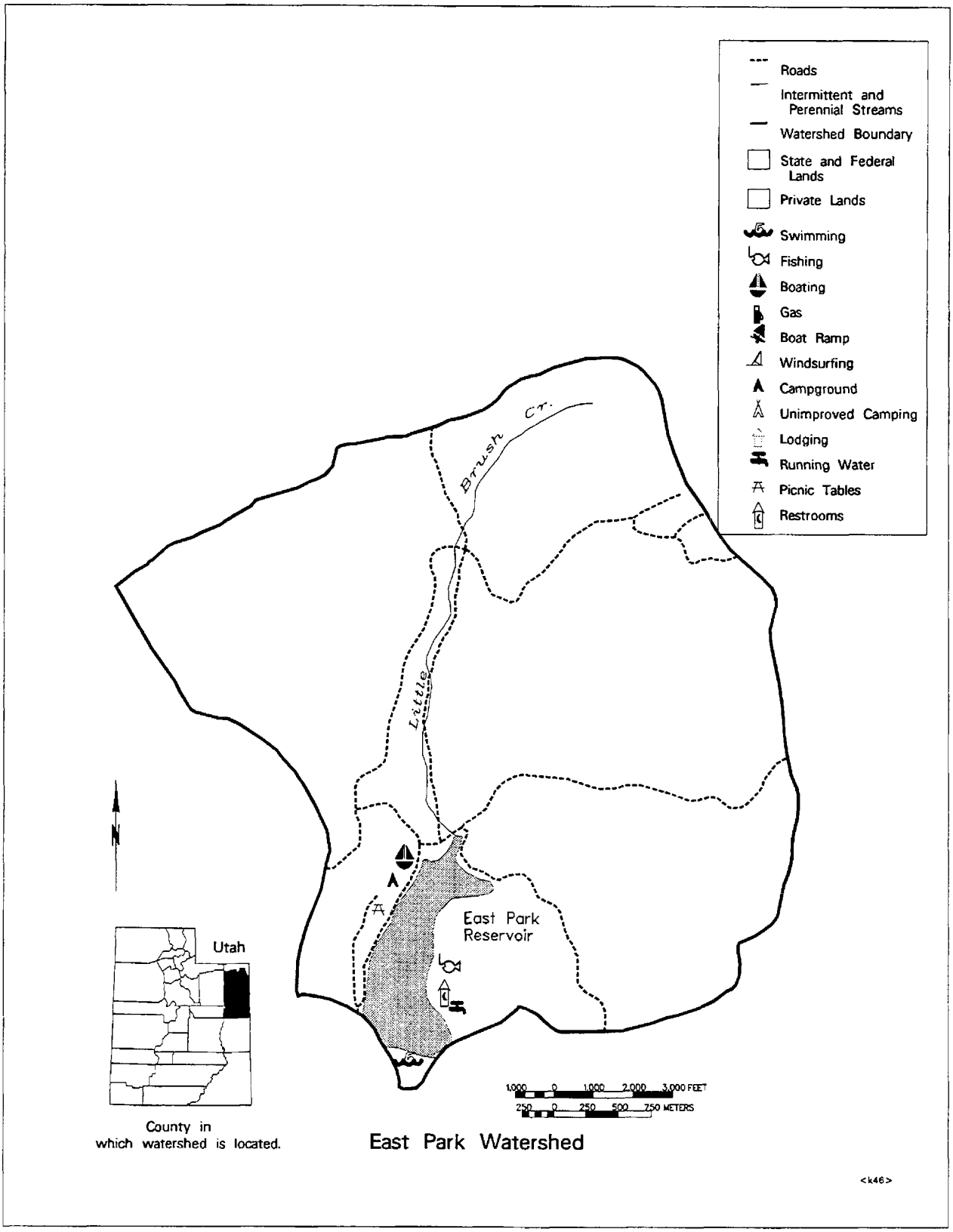
Lake elevation (meters / feet)	2,749 / 9,017
Surface area (hectares / acres)	53.44 / 132
Watershed area (hectares / acres)	2,042 / 5,046
Volume (m^3 / acre-feet)	
capacity	4,660,000 / 3,774
conservation pool	1,603,550 / 1,300
Annual inflow (m^3 / acre-feet)	not measured
Retention time (years)	not measured
Drawdown (m^3 / acre-feet)	not measured
Depth (meters / feet)	
maximum	6.71 / 22
mean	5.79 / 19
Length (km / miles)	1.83 / 1.14
Width (km / miles)	.488 / .3
Shoreline (km / miles)	4.76 / 2.95

Location

County	Uinta
Longitude / Latitude	109 32 53 / 40 47 12
USGS Map	East Park Reservoir, 1963
DeLorme's Utah Atlas & Gazetteer™	Page 56, B-3
Cataloging Unit	(14060002)

Recreation

East Park Reservoir is about thirty miles north of



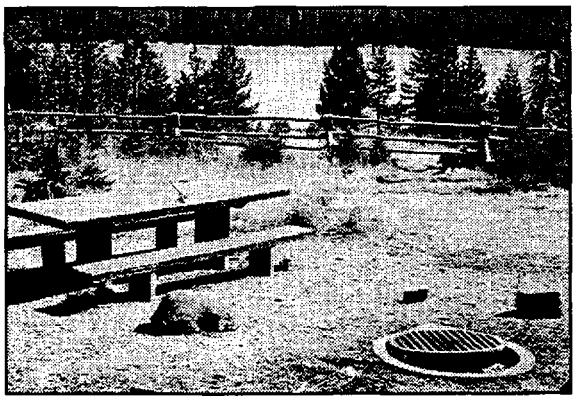
County in which watershed is located.

East Park Watershed

Vernal, easily accessible from US-191. At milepost 220.7 on US-191 (about 22 miles north of Vernal and 15 miles south of the Flaming Gorge Jct (US-191 and U-44)) turn west on FS-018, a paved road, signed to East Park and Red Cloud Loop. Follow this road for about 7 miles, to a fork in the road, and take the right fork for the final mile to the reservoir.

Fishing, boating, swimming, camping, picnicking, and hiking are all popular. While there are no boat ramps, it is generally possible to get a boat on the reservoir.

Recreational facilities at the reservoir include East Park Campground, a USFS facility, which has recently been rebuilt with flush toilets, picnic areas, and campsites. It is said to be "a real nice campground" by Lew Vincent, one of the brothers that owns water rights to the reservoir.



Watershed Description

East Park Reservoir is located in the High Uintas. The watershed consists entirely of alpine meadows, coniferous forests and alpine tundra. Slopes surrounding the reservoir are not particularly steep (<20%). The reservoir is an impoundment of a meadow. In recent years much of the watershed has been turned into crop land for timber, with routine clear-cutting and replanting. Erosion from these operations does not currently appear to have impacted the reservoir.

The watershed high point, an unnamed peak two miles northwest of the reservoir, is 3,060 m (10,039 ft) above sea level, thereby developing a complex slope of 9.6% to the reservoir. The average stream gradient of Little Brush Creek is 3.9% (208 feet per mile). The inflow and outflow is Little Brush Creek. There are also two unnamed tributaries flowing into the reservoir.

The watershed is made up of high mountains and mountains meadows. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of spruce-fir and aspen. The watershed receives 64 - 76 cm (25 - 30 inches) of precipitation annually. The frost-free season around the reservoir is 20 - 40 days per year.

Land use in the watershed is 100% multiple use, with grazing and logging being the primary uses. Much of the watershed has been clear-cut, but there are no active or proposed timber sales in the area.

Limnological Assessment

The water quality of East Park Reservoir is very good. It is considered to be very soft a hardness concentration range from 12-15 mg/L (CaCO3). Currently no parameters that have been sampled have exceeded State water quality standards for defined beneficial. The average concentration of total phosphorus in the water column in 1981 and 1991 was 20 and 19 ug/L which is under the recommended pollution indicator for phosphorus of 25 ug/L. In 1991 the reservoir was characterized as a nitrogen limited system. Although TSI values indicate the reservoir is mesotrophic, it does not appear that there has been a significant rise in the concentrations of nutrients in the lake since it was originally

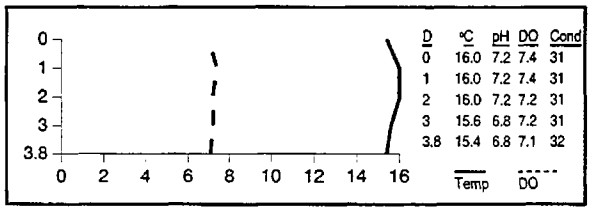
Limnological Data

Data sampled from STORET site: 593775

Surface Data	1981	1991
Trophic Status	M	M
Chlorophyll TSI	-	45.99
Secchi Depth TSI	50.01	52.07
Phosphorous TSI	46.61	46.98
Average TSI	48.31	48.35
Chlorophyll a (ug/L)	-	4.8
Transparency (m)	2.0	1.83
Total Phosphorous (mg/L)	20	20
pH	6.6	7.5
Total Susp. Solids (mg/L)	-	8.5
Total Volatile Solids (mg/L)	-	8
Total Residual Solids (mg/L)	-	6
Temperature (°C / °f)	13/55	15/59
Conductivity (umhos.cm)	24	30
Water Column Data		
Ammonia (mg/L)	0.05	0.03
Nitrate/Nitrite (mg/L)	0.18	0.01
Hardness (mg/L)	15	12
Alkalinity (mg/L)	8	11
Silica (mg/L)	-	2.8
Total Phosphorous (ug/L)	20	19
Miscellaneous Data		
DO (Mg/l) at 75% depth	6.8	7.2
Stratification (m)	NO	NO
Limiting Nutrient	N	N
Depth at Deepest Site (m)	8.1	3.8

surveyed in 1981. In fact the concentration may have declined specifically the nitrogen sp.. The reservoir has not stratified during the summer. This may be due to the limited depth of the lake. A review of the 1981 and September 9, 1991 profiles indicates that there is no thermocline present and that there is sufficient dissolved oxygen throughout the water column and water temperatures do support the criteria for a cold water fishery. It should be noted that in a review of profile data obtained in 1969 that dissolved oxygen depletion was a problem both in February and in August. Although there appear to be no problems association with dissolved oxygen it would be appropriate to determine oxygen concentrations during the winter period to determine if they approach or reach a critical level for fish survival. According to DWR there have been no reported fish kills in the reservoir.

The DWR stocks the reservoir annually with 4,000 catchable Rainbow Trout and 7,000 fingerling Brook Trout. The reservoir has not been chemically treated by the DWR, so populations of native fishes may be present in the lake.



D	°C	pH	DO	Cond
0	16.0	7.2	7.4	31
1	16.0	7.2	7.4	31
2	16.0	7.2	7.2	31
3	15.6	6.8	7.2	31
3.8	15.4	6.8	7.1	32

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Sp.	Cell Volume (mm^3/liter)	%Density By Volume
Botryococcus braunii	20.016	78.31
Sphaerocystis schroeteri	5.282	20.66
Gomphosphaeria lacustris	0.222	0.87
Pennate diatoms	0.023	0.09
Oocystis sp.	0.017	0.07
Total	25.560	
Shannon-Weaver [H']	0.57	
Species Evenness	0.35	
Species Richness [d]	0.17	

As observed the phytoplankton community is dominated by green algae indicative of good water quality with low to moderate production.

Pollution Assessment

Nonpoint pollution sources include the following: Sedimentation and nutrient loading from grazing. Litter, human waste and chemicals from recreation. Sedimentation and increased runoff from logging.

Grazing takes place throughout the watershed and in the vicinity of the reservoir.

Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Ashley National Forest	789-1181
Vernal Ranger District	789-1181
Recreation	
Dinosaurland Travel Region (Vernal)	789-6932
Vernal Chamber of Commerce	789-1352
Reservoir Administrators	
Division of Wildlife Resources	538-4700

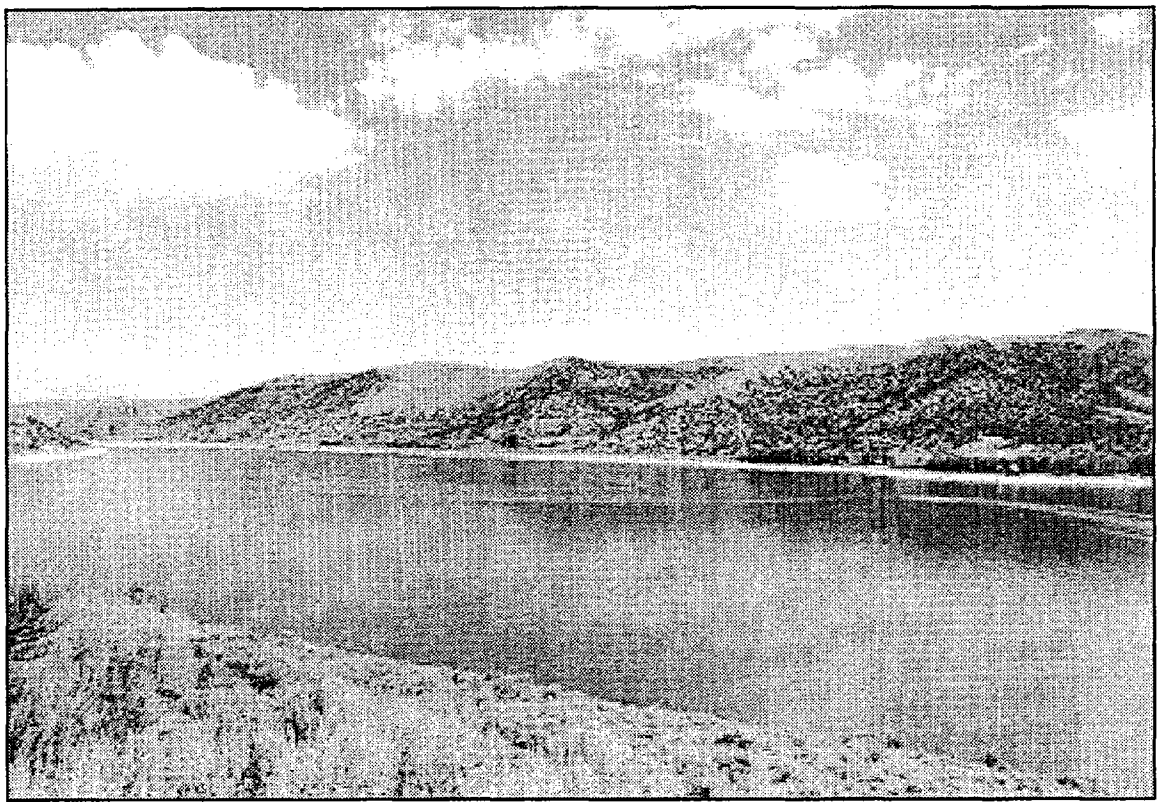
Much of the watershed has been clearcut in fairly recent history, and logging is expected to continue in perpetuity. There are no apparent impacts to reservoir water quality, although long-term changes in vegetation, from a climax community to a community of young trees, may occur.

There are no point sources of pollution in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

ECHO RESERVOIR



Introduction

Echo Reservoir is a large reservoir south of Echo Junction on the Weber River. I-80 hugs its western shore for about three miles, making it one of the most visible reservoirs in the state. One of six reservoirs built by the Bureau of Reclamation in the Weber watershed to provide water to the northern Wasatch Front, it impounds spring runoff from the western Uintas, storing it for use throughout the year. Echo Reservoir and its upstream twin Rockport Lake are popular destinations for year-round recreation.

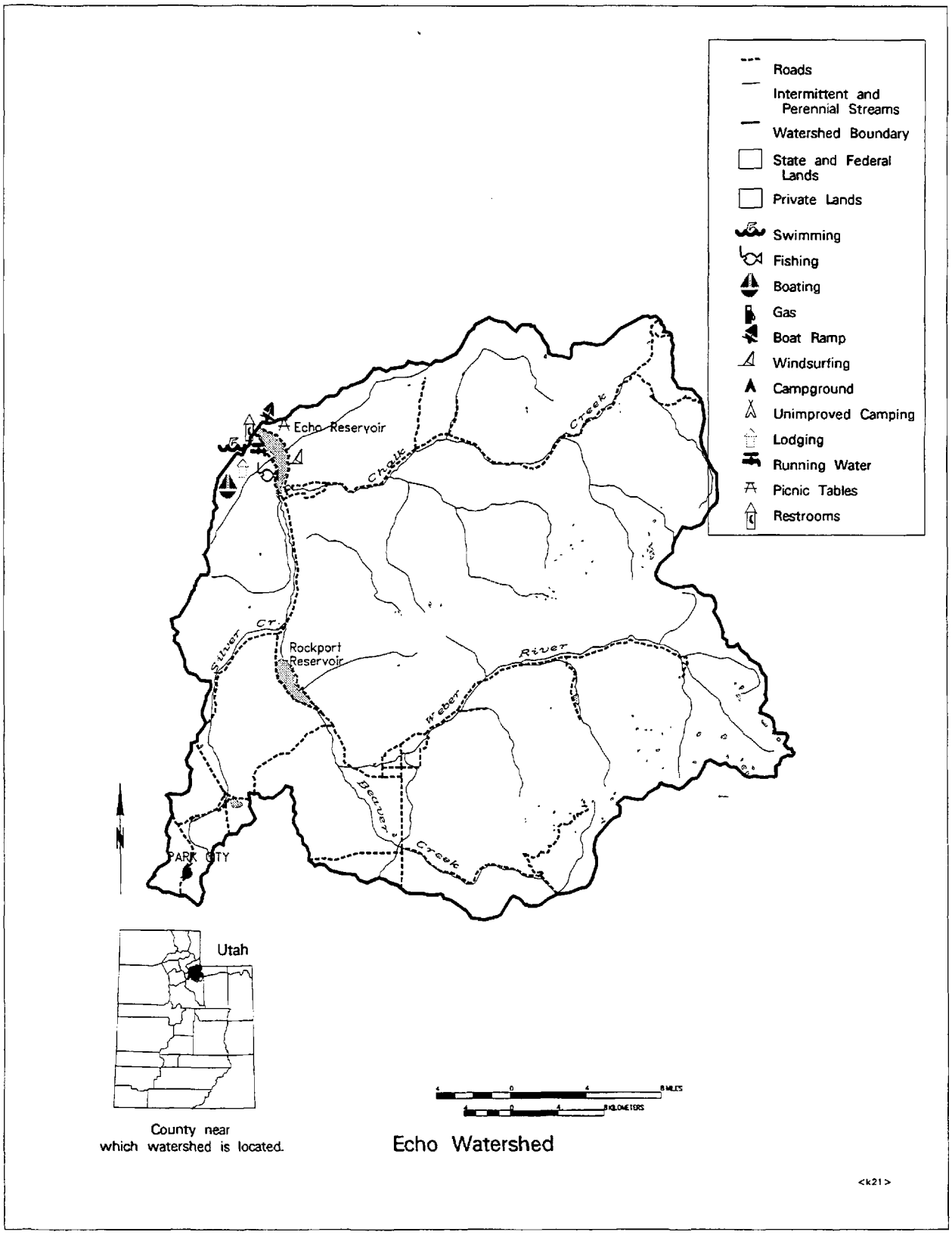
Characteristics and Morphometry

Lake elevation (meters / feet)	1,694 / 5,560
Surface area (hectares / acres)	564 / 1,394
Watershed area (hectares / acres)	189,000 / 468,000
Volume (m^3 / acre-feet)	
capacity	91,156,000
conservation pool	
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (meters / feet)	71,675,000 / 50,000
Depth (meters / feet)	
maximum	33.5 / 110
mean	15.3 / 50.2
Length (km / miles)	6.89 / 4.28
Width (km / miles)	1.219 / .76
Shoreline (km / miles)	16.46 / 10.22

Location

County	Summit
Longitude / Latitude	111 24 19 / 40 57 00
USGS Maps	Coalville, UT - 1967
DeLorme's Utah Atlas & Gazetteer™	Page 54, A-1
Cataloging Unit	Upper Weber (16020101)

Echo Reservoir was created in 1931 by the construction of an earth-fill dam. The reservoir shoreline is 75% owned by the Weber River Water Conservancy District, and public access is restricted in the remaining 25%. The reservoir is named after Echo Creek, which flows into the Weber River immediately downstream from the dam. In addition to recreational usage the reservoir water is used primarily for irrigation. Much is used for residential irrigation


Roads
Intermittent and Perennial Streams
Watershed Boundary
State and Federal Lands
Private Lands
Swimming
Fishing
Boating
Gas
Boat Ramp
Windsurfing
Campground
Unimproved Camping
Lodging
Running Water
Picnic Tables
Restrooms
Echo Reservoir
Chalk Creek
Silver Cr
Rockport Reservoir
Weber River
Beaver Creek
PARK CITY
N
Utah
County near which watershed is located.
Echo Watershed
<k21>

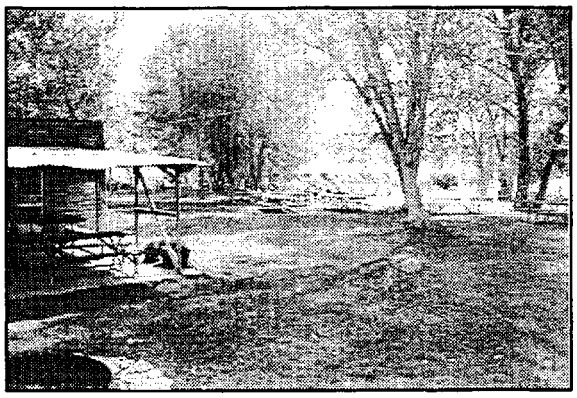
needs, and is known as "Weber Water". As urban sprawl continues to displace farmland along the WasatchFront and in communities along the Weber River, some water is used for culinary purposes.

Recreation

Echo Reservoir is easily accessible from old US-189 on the east side of the reservoir. Take I-80 to either Exit 164, drive into downtown Coalville and go north to the reservoir, or take Exit 169 at Echo and go south. The road follows an abandoned railroad grade that has been converted into a recreation trail. The road and trail hug the base of the canyon wall along the reservoir. There are numerous access points along old US-189. I-80 is on the west side. There is a scenic overlook, but reservoir access is difficult.

Fishing, boating, sailing, swimming, ice fishing, and water skiing are all popular. The reservoir is very large, enabling it to handle heavy recreational use. In late summer, however, severe drawdowns impair recreational use of the reservoir.

There is a public recreation area about two miles north of downtown Coalville on old US-189. It has a boat launching area and latrines. One-half mile north of the public facility is a large private marina and campground. The marina has many large trees, making it one of the more pleasant portions of the shoreline. It has an improved boat ramp, camping, boat rentals, a convenience store, and toilet facilities. This is a privately-owned operation, and fees are charged for all activities.



There are services in Echo and Coalville, and a private campground in Coalville (See info box).

Watershed Description

Echo Reservoir is the second of two large Bureau of Reclamation impoundments on the Weber River. The reservoir is an impoundment of a valley, which displaced agricultural land and a major transportation corridor. The valley is about 0.8 miles wide and up to 800 feet deep. Although the terrain is mountainous, the elevation is relatively low, so the vegetation around the reservoir is mostly sagebrush and grass.

Coalville, the county seat of Summit County, is at the south (upstream) end of the reservoir. Its proximity to Park City and Salt Lake City make it a prime location for development. Although the commute to Salt Lake City is over 50 miles, the rural atmosphere is attracting immigration. Development will probably continue until it has engulfed the entire valley and side canyons, resulting in much-increased nutrient inputs from sewage and lawn fertilizers, but decreased nonpoint pollution from agriculture.

The watershed headwaters are the Weber River in the western Uintas, Chalk Creek in the southwest corner of Wyoming, and Silver Creek flowing out of Park City and joining the Weber in Wanship. The Provo River once flowed through Rhodes Valley and down the Weber, but in fairly recent prehistoric times it was captured by its present drainage. Man has diverted part of the Weber River from one mile east of Oakley south across Rhodes Valley and down the Provo River.

The source of the Weber River lies just west of U-150 at Pass Lake. This is the divide between the Duchesne River and The Weber River. There is no perceptible boundary between the watersheds--the area was leveled by glaciers, possibly reversing their flow as snow deposition patterns changed. Smith and Morehouse Reservoir is an impoundment of a tributary to The upper Weber River. Beaver Creek, the only other large tributary in the Uintas, flows out of the Uintas into Kamas, then north to join the Weber just south of Peoa. All of the headwater areas have many small lakes as a result of glaciation. While none of the watershed is included in the High Uintas Wilderness Area, high elevations have precluded most use of this land by humans, and it remains fairly pristine.

The Chalk Creek drainage is at substantially lower elevation than the Weber River headwaters. The vegetation types are sage-grass with aspen and spruce-fir on the north faces of some ridges. This land is privately owned and public access is restricted. Chalk Creek has captured some of this drainage from Yellow Creek (a tributary of the Bear River) resulting in the unusual pattern of a southwest flowing stream with northeast flowing tributaries.

The headwaters of Silver Creek are in the Deer Valley Ski Resort in Park City. This is the back side of the Wasatch Front, which is somewhat more barren than the canyons to the west. While Park City Ski Resort is in the watershed, Park west lies north of the divide and flows down East Canyon. This watershed suffers from extensive vegetation loss and development which has replaced soils with roads and buildings, creating instant runoff following

storms rather than seepage into groundwater.

The watershed high point, Bald Mountain, is 3,640 m (11,943 ft) above sea level, thereby developing a complex slope of 4.0% to the reservoir. The average stream gradient above the reservoir is 3.7% (200 feet per mile). The inflows are the Weber River, Chalk Creek, Carruth Canyon Creek, Lewis Canyon Creek, and Grass Creek. Rockport Lake, another large reservoir, is about ten miles upstream. The outlet is the Weber River.

The watershed is made up of high mountains, low mountains and valleys. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of alpine, aspen, pine, spruce-fir, oak-maple, and sagebrush-grass. The watershed receives 41 - 102 cm (16 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 60 - 120 days per year.

According to the 1982 Clean Lakes Inventory, land use is as follows: forest and rangelands 85%, irrigated agricultural 12%, non-irrigated agriculture 1% and urban 2%. Since then, extensive urbanization has occurred in Park City, Wanship, and Coalville. Current data is not available at this time. Urban areas include Park City, Silver Creek Junction, Wanship, Peoa, Oakley, Kamas, Francis and Coalville.

Limnological Data

Data averaged from STORET sites: 492613, 492614

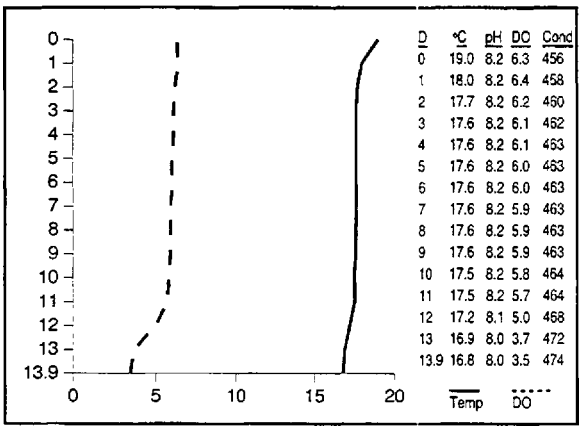
Surface Data	1979	1990	1992
Trophic Status	M	O	M
Chlorophyll TSI	-	40.61	44.226
Secchi Depth TSI	43.47	37.00	40.84
Phosphorous TSI	54.35	39.60	39.25
Average TSI	48.91	39.07	41.45
Chlorophyll a (ug/L)	-	2.8	3.5
Transparency (m)	3.15	5	2.9
Total Phosphorous (ug/L)	32.5	12	14
pH	7.9	8.2	8.4
Total Susp. Solids (mg/L)	-	1.9	<3
Total Volatile Solids (mg/L)	-	0	1
Total Residual Solids (mg/L)	-	-	2
Temperature (°C / °f)	21/70	19/67	18/64
Conductivity (umhos.cm)	290	442	467
Water Column Data			
Ammonia (mg/L)	0.06	0.03	0.03
Nitrate/Nitrite (mg/L)	0.11	-	0.02
Hardness (mg/L)	208	228	208
Alkalinity (mg/L)	191	202	201
Silica (mg/L)	8.5	-	5.2
Total Phosphorous (ug/L)	42.5	23	36
Miscellaneous Data			
DO (Mg/l) at 75% depth	7.2	3.2	5.8
Stratification (m)	3-4	9-10	NO
Limiting Nutrient	N	N	N
Depth at Deepest Site (m)	25	22.2	13.9

Limnological Assessment

The water quality of Echo Reservoir is good. It is considered to be hard with a hardness concentration value of approximately 215 mg/L (CaCO3). The only parameter that has exceeded State water quality standards for defined beneficial uses is phosphorus. The average concentration of total phosphorus in the water column in 1979 and 1992 was 42.5 and 36 ug/L which exceeds the recommended pollution indicator for phosphorus of 25 ug/L. Dissolved oxygen concentrations in late summer substantiate the fact that water quality impairments do exist. Concentrations generally decline downward in the water column to a low of 3.5 mg/L as depicted in the September 2, 1992 profile.

Although the profile from September 2, 1992 does not indicate that the reservoir stratifies, there is evidence from profiles earlier in the summer that stratification does occur. An extended period of stratification is inhibited due to the large irrigation demand downstream. Typically the reservoir capacity quickly diminishes as the irrigation demand increases throughout the summer. The extensive drawdown does impact the recreational use of the reservoir. As the water recedes, it becomes difficult to launch watercraft and it becomes congested as the surface area diminishes. The rapid drawdown of the reservoir may reduce productivity and cause a premature turnover of the reservoir.

TSI values indicate the reservoir is a low level mesotrophic reservoir. The data indicates that it is also a nitrogen limited system. According to DWR no fish kills have been reported in recent years with the exception one summer when the capacity was diminished to 27,000 acre-feet. The reservoir supports populations of rainbow trout (Oncorhynchus mykiss), channel catfish (*Ictalurus punctatus*), utah sucker (*Catostomus ardens*), whitefish (*Prosopium spilonotus*), brown trout (*Salmo trutta*), carp



D	°C	pH	DO	Cond
0	19.0	8.2	6.3	456
1	18.0	8.2	6.4	458
2	17.7	8.2	6.2	460
3	17.6	8.2	6.1	462
4	17.6	8.2	6.1	463
5	17.6	8.2	6.0	463
6	17.6	8.2	6.0	463
7	17.6	8.2	5.9	463
8	17.6	8.2	5.9	463
9	17.6	8.2	5.9	463
10	17.5	8.2	5.8	464
11	17.5	8.2	5.7	464
12	17.2	8.1	5.0	468
13	16.9	8.0	3.7	472
13.9	16.8	8.0	3.5	474

(*Cyprinus carpio*), cutthroat trout (*Oncorhynchus clarki*), and redside shiner (*Richardsonius balteatus*).

According to the Division of Wildlife Resources, the Utah sucker (*Catostomus ardens*) and anchor worm (Lernaea) are populating rapidly. Smallmouth bass are also immigrating from Rockport Reservoir, an upstream impoundment. These together with water quality and temperature are adversely affecting the fish population. The phytoplankton composition during the initial study period (1981) indicated Flagilaria was the most dominant genera in Echo Reservoir at 52%, then, in decreasing importance are the following genera; Chroomonas at 34%, Cryptomonas at 9%, and Aphanizomenon at 2% Chlorophyll-a was found from 2.6 to 8.4 ug/l during Sept. 1975 (NES report).

The reservoir has not been chemically treated by the DWR to eliminate rough fish competition, so populations of native fish may be present, but the long history of heavy stocking with fish monocultures has likely displaced native populations.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Stephanodiscus niagarae	1.407	47.40
Asterionella formosa	0.567	19.09
Coelastrum	0.556	18.72
Melosira granulata	0.144	4.85
Melosira granulata var. angustissima	0.126	4.25
Oocystis sp.	0.071	2.40
Haematococcus planktonica	0.033	1.12
Pennate diatoms	0.022	0.75
Centric diatoms	0.018	0.60
Wislouchiella planktonica	0.016	0.52
Ankistrodesmus falcatus	0.009	0.29
Total	2.970	
Shannon-Weaver [H']	1.52	
Species Evenness	0.63	
Species Richness [d]	0.46	

As observed the phytoplankton community from September 2, 1992 is dominated by diatoms that are indicative of eutrophic waters.

Pollution Assessment

Nonpoint pollution sources include the following: Sedimentation and nutrient loading from grazing. Human wastes, chemicals and nutrients from urban areas. Herbicides and nutrients from cropland. Human wastes, litter and toxins from recreation. Sedimentation from logging. Sedimentation and leachates from mining.

There is at least one active mine in the watershed. Utelite, a clay/shale mine is located immediately upstream from Rockport Lake in Three mile Canyon. Any impact on Echo reservoir from this source is mitigated by Rockport Lake. There are no active mines in the Park City area, but slag piles and other mining byproducts remain exposed and are slowly eroding down into Silver Creek. There is at least one Superfund site in Park City.

Point sources of pollution in the watershed include the following:

Coalville Wastewater Treatment Plant
Kamas Lagoons
Oakley Lagoons

Information

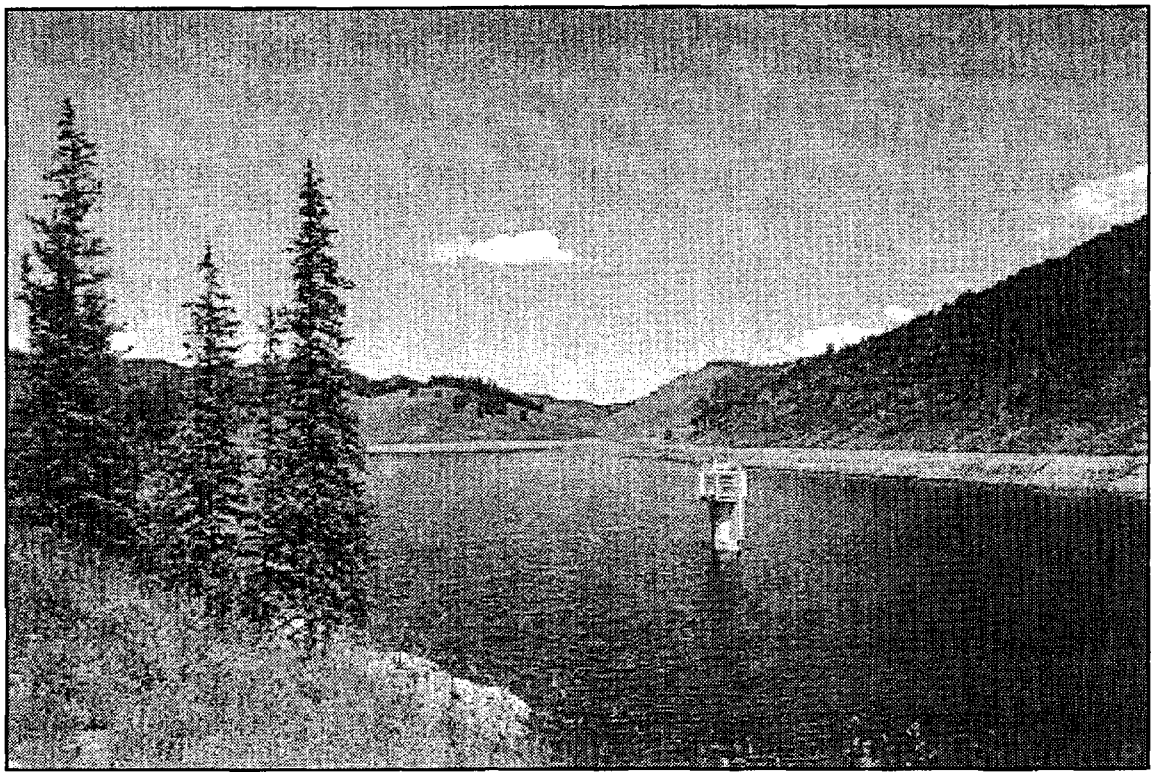
Management Agencies	
Mountainlands Association of Governments	377-2262
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Mountainland Travel Region (Provo)	377-2262
Holiday Hills Campground (Coalville)	336-4210
Camperworld Echo Island Park (Coalville)	336-2100
Echo Resort	336-9894
Reservoir Administrators	
Department of the Interior	538-1467
Central Utah Water Conservancy District	226-7112

Kamas Fish Hatchery
Silver Creek Wastewater Treatment Plant

Beneficial Use Classification

The state beneficial use classifications include: culinary water (1C), recreational bathing (swimming) 2A, boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

ELECTRIC LAKE



Introduction

Electric Lake is a large reservoir on Huntington Creek high on the east slope of the Wasatch Plateau. It is a popular recreation site that is managed as a catch-and-release fishery. The reservoir was created in 1974 by the construction of an earth-fill dam. The shoreline is primarily owned by Utah Power and Light (UP&L) and the Huntington-Cleveland Irrigation Company. Some access points are limited but the northern end of the reservoir is adjacent to the national forest and access is unrestricted to the reservoir at that point. Water is consumed for irrigation and power plant cooling, but also used for recreation and coldwater aquatic habitat. Enough water is stored to provide enough cooling water for a four year drought, so water levels remain deep throughout most summers. This greatly enhances recreational use.

Characteristics and Morphometry

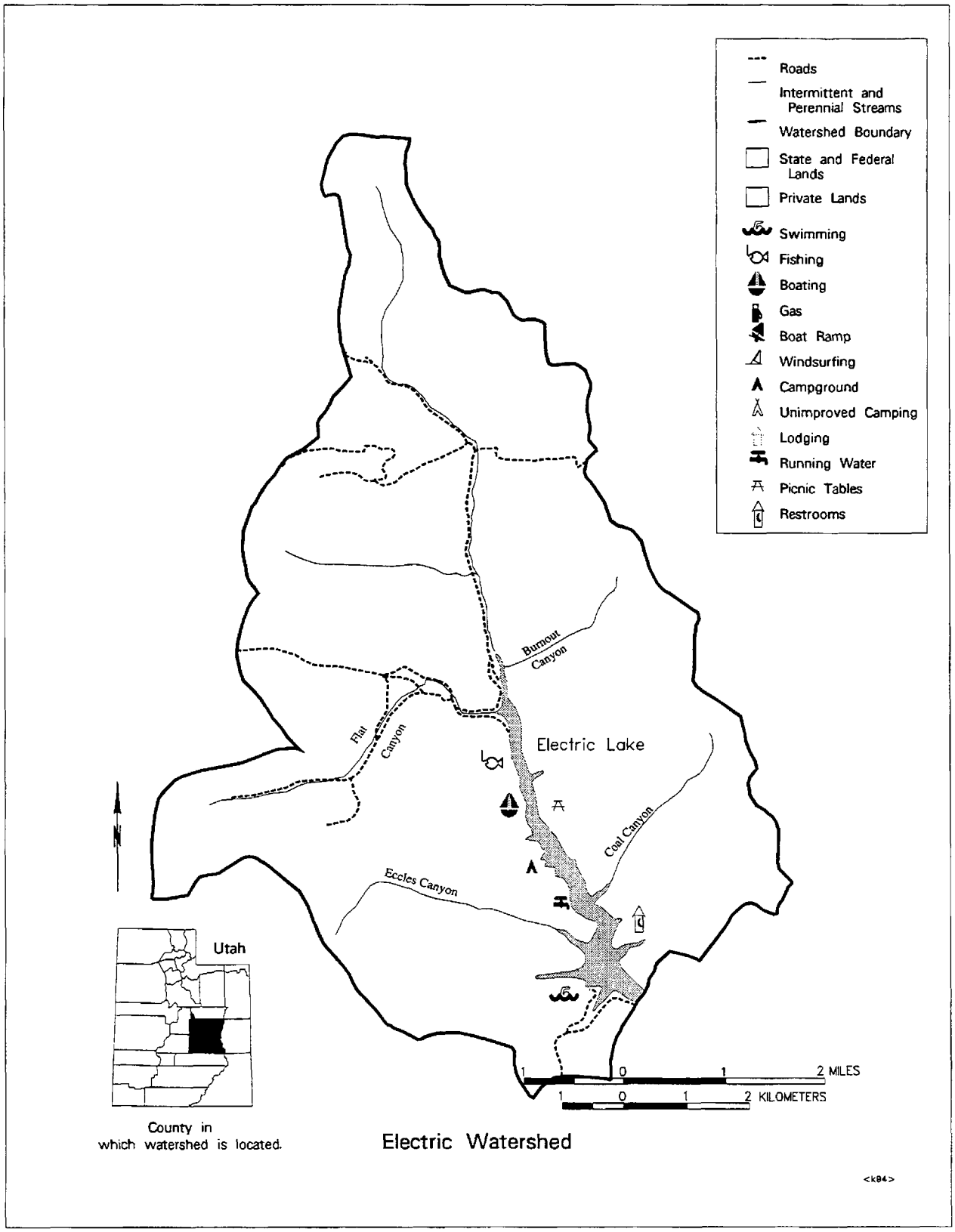
Lake elevation (meters / feet)	2,613.5 / 8,575
Surface area (hectares / acres)	172 / 425
Watershed area (hectares / acres)	7,770 / 19,200
Volume (m^3 / acre-feet)	
capacity	43,771,500 / 35,500
conservation pool	
Annual inflow (m^3 / acre-feet)	24,461,487 / 19,839
Retention time (years)	1.8
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	66 / 217
mean	25 / 84
Length (km / miles)	6.1 / 1.6
Width (km / miles)	0.3 / 0.2
Shoreline (km / miles)	17.1 / 10.6

Location

County	Emery
Longitude / Latitude	111 13 12 / 39 36 26
USGS Map	Scofield 1979, Candland Mountain 1979
DeLorme's Atlas and Gazetteer™	Page 46 C-2
Cataloging Unit	San Rafael (14060009)

Recreation

Electric Lake is accessible from U-31 and U-264. U-31 follows the south shore for about 0.5 miles near the dam (21


Roads
Intermittent and Perennial Streams
Watershed Boundary
State and Federal Lands
Private Lands
Swimming
Fishing
Boating
Gas
Boat Ramp
Windsurfing
Campground
Unimproved Camping
Lodging
Running Water
Picnic Tables
Restrooms
Burnout Canyon
Flat Canyon
Electric Lake
Coal Canyon
Eccles Canyon
N
Utah
County in which watershed is located.
1 0 1 2 MILES
1 0 1 2 KILOMETERS
Electric Watershed
<k84>

miles east of Fairview City and 27 miles northwest of Huntington), but there is no boat ramp at this access. U-264 follows the north shore for 1/2 mile (6 miles east of jct U-31 and 9 miles west of jct U-96). There are latrines and a concrete boat ramp at this site. Visitors are required to pack out their own trash. Both state highways are maintained year-round, making the area popular for winter recreation.

Although the area generally receives moderate recreational use, heavy usage occurs on summer weekends. Fishing is the primary activity, however, boating, camping, swimming, nordic skiing, sledding and snowmobiling are also popular with visitors. The reservoir is large enough for waterskiing, but the water is too cold for most skiers. If you like large, uncrowded lakes and cold water, this is the place for you. Near the northwest tip of the lake there is a smaller impoundment, Boulger Lake, which is an excellent put and take family fishery.

There are two Forest Service campgrounds near the lake: Flat Canyon Campground, 1 mile west on U-264, with 13 campsites and picnic tables, and Old Folks Flat campground, 6 miles southeast on U-31, with 6 campsites and picnic tables. Both campgrounds charge fees.

Watershed Description

The lake is in a narrow stream valley characteristic of the mid-elevations of the Wasatch Plateau. The reservoir is built to store water for up to four years of drought, so the reservoir is large in comparison to the watershed. The canyon walls are steep (30 - 40% slopes). Higher elevations have coniferous forests, while lower elevations and south-facing slopes are vegetated with grass and sagebrush. The watershed has extremely heavy snowfall in the winter.

The watershed high point, the west shoulder of Monument Peak, is 3,079 m (10,100 ft) above sea level, thereby developing a complex slope of 16.7% to the reservoir. The average stream gradient above the reservoir is 2.6% (138 feet per mile). The major inflows are Upper Huntington Creek, Boulger Creek, Coal Creek, and a number of ephemeral tributaries. The outflow is Huntington Creek. The upper slopes of the top of Boulger Canyon are diverted into the Fairview Lakes. Boulger Reservoir, the only upstream impoundment, is a small reservoir on Boulger Creek.

The soil is of limestone origin. Landforms in the watershed are high mountains and valleys. Soil associations are in Appendix III.

The vegetation communities are comprised of bitterbrush, mountain mahogany, pinyon, juniper, sagebrush-grass, pine, aspen, spruce-fir, oak and maple. The watershed receives 76 cm (30 inches) of precipitation annually with a frost-free season of 40 - 60 days at the reservoir.

Land use in the reservoir is 100% multiple use. Primary human uses include hunting, recreation and livestock grazing.

Limnological Assessment

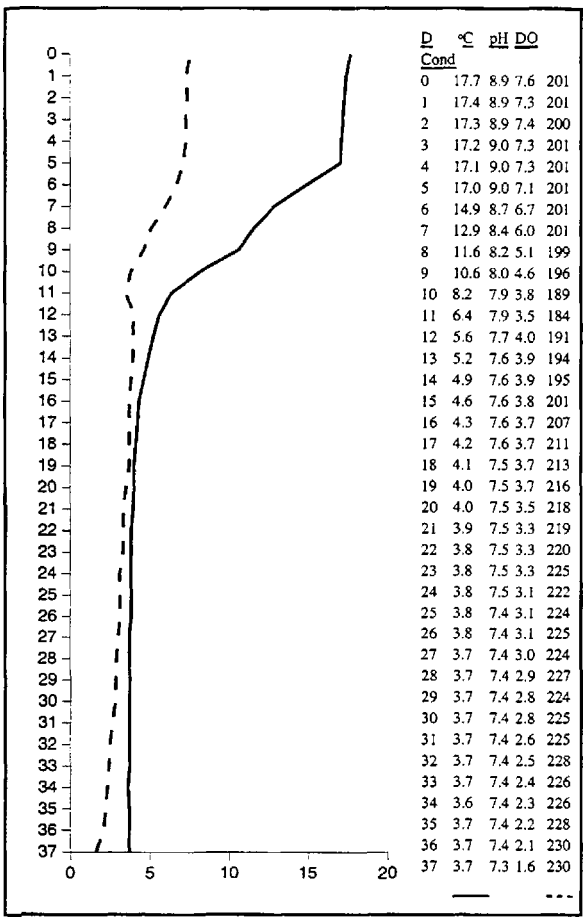
The water quality of Electric Lake is very good. It is considered to be moderately hard with a hardness concentration value of approximately 111 mg/L ($CaCO_3$). The only parameters that have exceeded State water quality standards for defined beneficial uses are pH and dissolved oxygen. It is not atypical for a body of water to exceed the pH standard during periods of high algal production near the surface and during the daylight hours. Average values throughout the water column as in the case of Electric Lake do not exceed the criteria. It is readily apparent from the August 29, 1991 profile that the dissolved oxygen concentrations drop off significantly below the thermocline (6-11 meters) to concentrations near the bottom of 1.6 mg/L. The majority of the water column will not support a viable

Limnological Data

Data averaged from STORET sites: 493119, 493120

Surface Data	1979	1989	1991
Trophic Status	M	O	M
Chlorophyll TSI	-	41.26	45.47
Secchi Depth TSI	-	41.01	61.52
Phosphorous TSI	47.35	36.01	42.21
Average TSI	47.35	39.43	49.74
Chlorophyll a (ug/L)	-	3.0	4.6
Transparency (m)	-	3.8	1.4
Total Phosphorous (ug/L)	20	9	14
pH	8.23	8.8	8.7
Total Susp. Solids (mg/L)	<5	-	<3
Total Volatile Solids (mg/L)	-	-	2
Total Residual Solids (mg/L)	-	-	<3
Temperature (°C / °f)	14/57	15/59	11/52
Conductivity (umhos.cm)	202	199	194
Water Column Data			
Ammonia (mg/L)	0.05	0.02	0.03
Nitrate/Nitrite (mg/L)	0.46	0.15	0.25
Hardness (mg/L)	119	-	103
Alkalinity (mg/L)	112	-	94
Silica (mg/L)	-	-	1.9
Total Phosphorous (ug/L)	19	10	13
Miscellaneous Data			
DO (Mg/l) at 75% depth	1.0	7.3	2.9
Stratification (m)	8-10	5-8	5-11
Limiting Nutrient	P	N	P
Depth at Deepest Site (m)	68	50	37

fishery under these circumstances. The tendency of this deep impoundment to stratify and what appears to be a high oxygen demand in the hypolimnion causes a loss of oxygen in the lower waters of the lake. These conditions, if



D	°C	pH	DO	Cond
0	17.7	8.9	7.6	201
1	17.4	8.9	7.3	201
2	17.3	8.9	7.4	200
3	17.2	9.0	7.3	201
4	17.1	9.0	7.3	201
5	17.0	9.0	7.1	201
6	14.9	8.7	6.7	201
7	12.9	8.4	6.0	201
8	11.6	8.2	5.1	199
9	10.6	8.0	4.6	196
10	8.2	7.9	3.8	189
11	6.4	7.9	3.5	184
12	5.6	7.7	4.0	191
13	5.2	7.6	3.9	194
14	4.9	7.6	3.9	195
15	4.6	7.6	3.8	201
16	4.3	7.6	3.7	207
17	4.2	7.6	3.7	211
18	4.1	7.5	3.7	213
19	4.0	7.5	3.7	216
20	4.0	7.5	3.5	218
21	3.9	7.5	3.3	219
22	3.8	7.5	3.3	220
23	3.8	7.5	3.3	225
24	3.8	7.5	3.1	222
25	3.8	7.4	3.1	224
26	3.8	7.4	3.1	225
27	3.7	7.4	3.0	224
28	3.7	7.4	2.9	227
29	3.7	7.4	2.8	224
30	3.7	7.4	2.8	225
31	3.7	7.4	2.6	225
32	3.7	7.4	2.5	228
33	3.7	7.4	2.4	226
34	3.6	7.4	2.3	226
35	3.7	7.4	2.2	228
36	3.7	7.4	2.1	230
37	3.7	7.3	1.6	230

severe enough will lead to an internal loading of phosphorus from the sediments.

The trophic status for the reservoir appears to be unstable but is probably mesotrophic. I appears that it has moderated over time. Although it was reported as oligotrophic in 1989, it bounced back to a mesotrophic state in 1991. The secchi depth values in 1991 appear a little high but could be the result of a heavy algal bloom at the time of sampling. Additional sampling will need to be done to ascertain a stable trophic state. The data suggest that the reservoir is probably phosphorus limited but it should be noted that in 1989 the data suggest that the system was nitrogen limited. According to DWR no fish kills have been reported in recent years. The reservoir supports a population of cutthroat trout (*Oncorhynchus clarki*). DWR typically stocks the reservoir with fingerling cutthroat trout. The DWR manages the lake as a catch and release fishery.

The reservoir has not been treated to control rough fish competition, so original populations of Huntington Creek fishes may be found in the area. While there is no formal conservation pool, the lake is rarely drained below 80% of capacity, as most of the stored water is insurance for dry years. During the dry years of the late 1980's and early 90's, the reservoir was drawn very low. Macrophytes are typically not present and are not a problem.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Pandorina morum	0.222	64.40
Asterionella formosa	0.066	19.16
Oocystis sp.	0.033	9.66
Centric diatoms	0.009	2.75
Oscillatoria sp.	0.006	1.74
Chlamydomonas globosa	0.005	1.32
Pennate diatoms	0.003	0.97
Total	0.000	
Shannon-Weaver [H']	1.10	
Species Evenness	0.56	
Species Richness [d]	0.31	

As observed the phytoplankton community is dominated by flagellates and diatoms indicative of high quality water with lower productivity.

Information

Management Agencies	
Manti-La Sal National Forest and Price Ranger District	637-2817
Southeastern Association of Governments	637-5444
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Castle Country Travel Region (Price)	637-3009
Castle Dale Chamber of Commerce	381-2547
Reservoir Administrators	
Huntington-Cleveland Irrigation Company	687-2505
Emery County Water Conservancy District	381-2311

Pollution Assessment

Nonpoint pollution sources include grazing, vacation

home activities, and recreation.

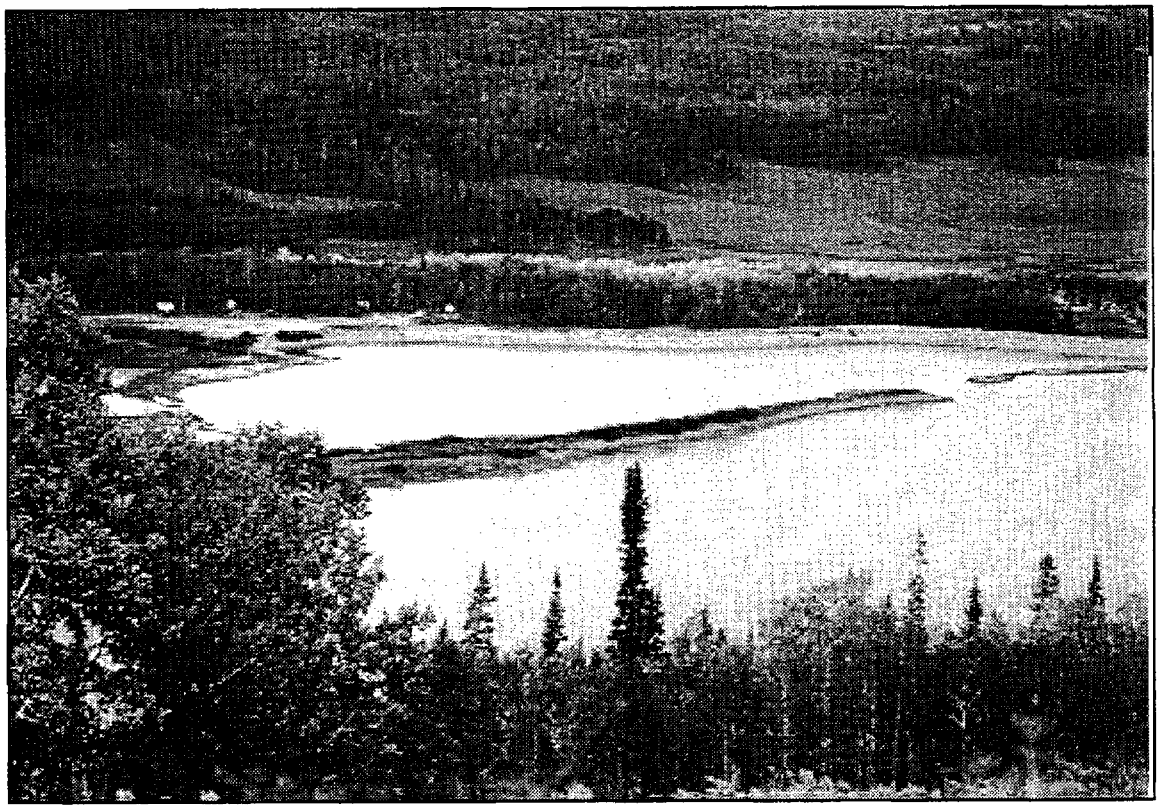
Cattle and cattle graze in the watershed and around the reservoir. Summer homes exist in the Boulger Canyon area.

There are no point pollution sources in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

FAIRVIEW LAKE #2



Introduction

Fairview Lake #2 is the larger of the Fairview Lakes--two adjacent lakes in a wide glaciated graben valley on the north end of the Wasatch Plateau. Lake #2 is intermediate-sized, while Lake #1 is much smaller. The lakes are privately owned and have summer homes on their northeast shore.

Characteristics and Morphometry

Lake elevation (meters / feet)	2,735 / 8,975
Surface area (hectares / acres)	42.5 / 105
Watershed area (hectares / acres)	373 / 922
Volume (m^3 / acre-feet)	
capacity	2,712,600 / 2,200
conservation pool	7 feet minimum depth
Annual inflow (m^3 / acre-feet)	3,329,100 / 2,700
Retention time (years)	0.8
Drawdown (m^3 / acre-feet)	8 / 27
Depth (meters / feet)	
maximum	12 / 40
mean	6.4 / 21
Length (meters / feet)	1,140 / 3,750
Width (meters / feet)	483 / 1,580
Shoreline (km / miles)	2.5 / 1.6

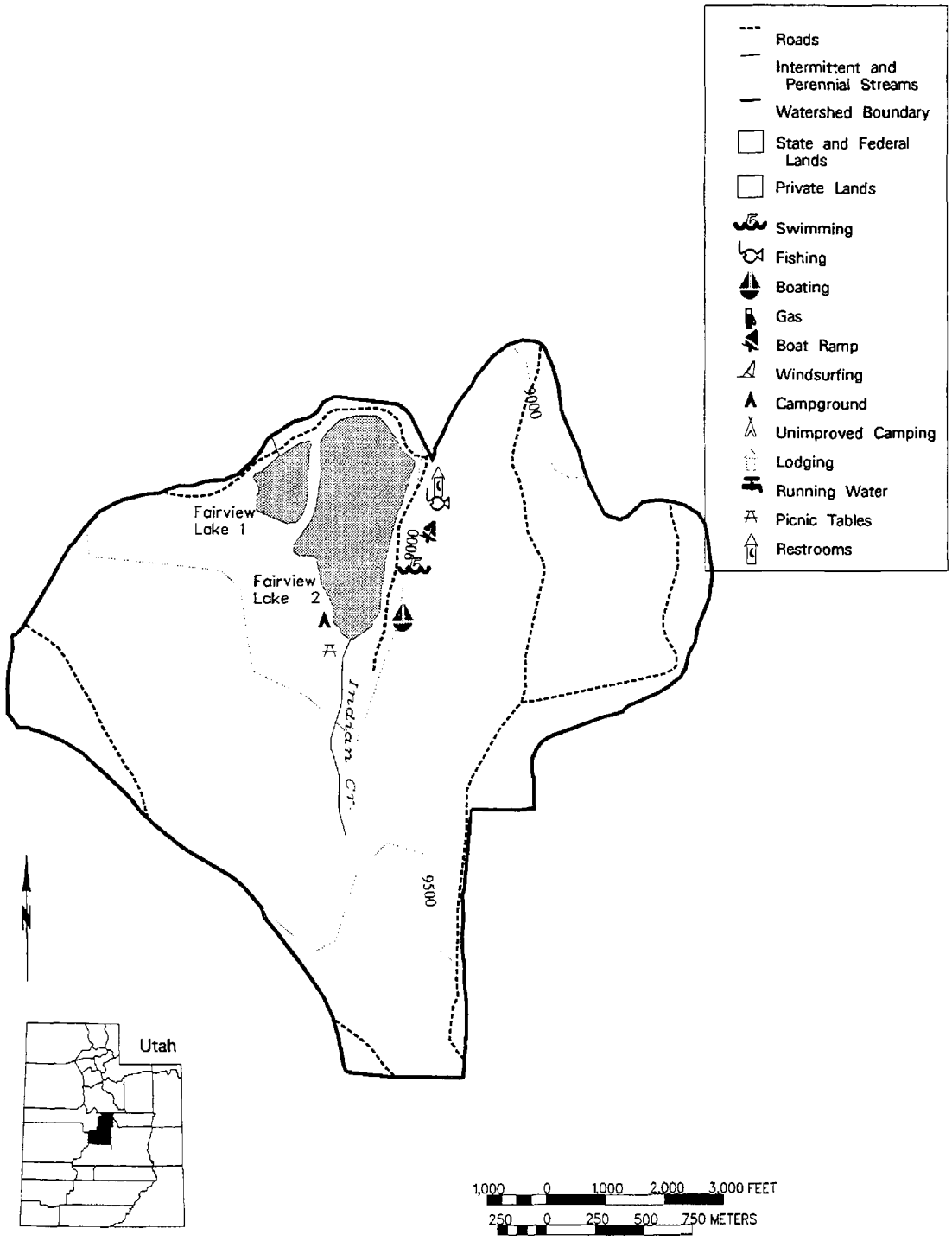
The lakes were created in 1869 by the construction of an earth-fill dam. Water is captured from the headwaters of the Price River and stored for agricultural use in the Sanpete Valley. The reservoir and shoreline are owned by the Cottonwood-Gooseberry Irrigation Company with somewhat restricted public access. Reservoir water is used for irrigation, recreation, and cold water aquatic habitat. No changes are anticipated.

Location

County	Sanpete
Longitude / Latitude	111 18 24 / 39 38 23
USGS Map	Fairview Lakes 1965
DeLorme's Atlas and Gazetteer™	Page 46 C-1
Cataloging Unit	Price (14060007)

Recreation

The Fairview Lakes are located near U-31 between Fairview and Huntington. From Fairview, travel 10 miles up U-31 to U-264. Turn left (east) on U-264, follow it for about



County in which watershed is located.

Fairview Watershed

<k87>

2 miles and turn right (south) on Skyline Drive at Beaver Dam Reservoir. Follow Skyline Drive for 1/2 mile, and turn right (south) on a primitive road for 1 mile to Fairview Lakes.

From Huntington, follow U-31 for about 35 miles, (3 miles north of Huntington Reservoir) to Skyline Drive. Turn right (north) and follow Skyline Drive for about 3 miles to the primitive road, and turn left (south) for one mile.

Huntington Reservoir is directly accessible from U-31 which follows the shoreline for about a mile. The lake is 16 miles east of Fairview City and 32 miles northwest of Huntington City.

The area receives heavy recreational use year round. U-31 is plowed throughout the winter, and this is one of the state's premier winter recreation areas for snowmobiling and cross country skiing. Fishing is the primary summer use of the lake, although boating is also popular.

There is a private campground at the lake managed by the Fairview Lakes Association with campsites, privies, a restaurant, and a gravel boat ramp.

Flat Canyon campground, two miles east of Beaver Dam Reservoir on U-264, has 13 campsites and picnic tables. Usage fees are charged.

Watershed Description

Fairview Lake #2 has a small, natural watershed. The watershed is slightly enlarged by the 2.5 mile long Horseshoe Canal which captures runoff from Beaver Dam Ridge and the headwaters of Boulger Canyon. The watershed extends up the slope for about a mile. U-31 delineates the western and part of the southern boundary of the watershed. The area is at an extremely high elevation and receives very heavy winter snowfall. Some of the watershed is forested, while other areas have sage-grass vegetation.

The watershed high point, a point on U-31, is 2,986 m (9,800 ft) above sea level, thereby developing a complex slope of 13.6% to the reservoir. There are no perennial streams flowing into the lake, but the average gradient of the inflow is 8.3% (436 feet per mile). The outlet is a ditch that drains into White Pine Fork of Cottonwood Canyon.

Land forms composing the watershed are the shallowly dissected highlands of the Wasatch Plateau. Soils are entirely of limestone origin, resulting in the extremely hard, alkaline water found in the reservoir. Soil associations are found in Appendix III.

The vegetation communities are comprised of pine, aspen, spruce-fir, oak, maple and sagebrush-grass. The watershed receives 76 cm (30 inches) of precipitation annually with a frost-free season of 20 - 60 days at the reservoir.

The area around the lake (20% of the watershed)is owned by the irrigation company and/or the lakes association and used for grazing and recreation, while the remaining 80% is multiple use forest lands, for hunting, recreation, and livestock grazing.

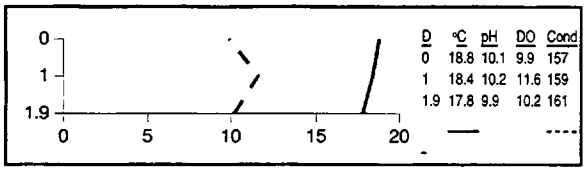
Limnological Assessment

The water quality of Fairview Lake #2 is considered very good. It is considered to be moderately hard with a hardness concentration range from 100-152 mg/L (CaCO3). The only parameters that has exceeded State water quality standards for defined beneficial uses are phosphorus and pH. The average concentration of total phosphorus in the water column in 1990 was 34 ug/L which is higher than the recommended pollution indicator for phosphorus of 25 ug/L. However, in 1992 the average phosphorus concentration for the water column dropped to 14.5 ug/L. As indicated in the August 18, 1990 profile pH values do exceed the maximum of 9.0 criteria established for these waters. It should be noted that elevated pH values often occur with increased algal production during summer months. Although dissolved oxygen concentrations in late summer in 1981 showed a

Limnological Data

Data sampled from STORET site: 593228

Surface Data	1981	1990	1992
Trophic Status	M	E	O
Chlorophyll TSI	-	54.03	27.10
Secchi Depth TSI	46.79	48.31	44.66
Phosphorous TSI	47.43	55.81	45.00
Average TSI	47.11	52.72	38.92
Chlorophyll a (ug/L)	-	10.9	0.7
Transparency (m)	2.5	2.3	2.9
Total Phosphorous (ug/L)	10.0	36.0	17.0
pH	7.8	8.1	9.3
Total Susp. Solids (mg/L)	2.5	4	<3
Total Volatile Solids (mg/L)	-	-	0
Total Residual Solids (mg/L)	-	-	3
Temperature (°C / °f)	15/60	14/57	17/63
Conductivity (umhos.cm)	270	248	204
Water Column Data			
Ammonia (mg/L)	0.05	0.03	0.03
Nitrate/Nitrite (mg/L)	0.45	0.04	0.02
Hardness (mg/L)	152	139	100
Alkalinity (mg/L)	144	133	95
Silica (mg/L)	-	-	1.1
Total Phosphorus (ug/L)	10.0	34.0	15
Miscellaneous Data			
DO (Mg/l) at 75% depth	7.4	7.7	11.0
Stratification (m)	5-6	NO	NO
Limiting Nutrient	P	N	N
Depth at Deepest Site (m)	8	3.7	1.9



decline in concentration downward in the water column, recent data indicate high levels of dissolved oxygen present in the water column. This is indicative of a highly productive system at the time of monitoring. It should also be noted that in recent years only minimal water has been stored in the reservoir which could mask the dissolved oxygen demands at the sediment/water interphase. Reported fish kills during the winter season substantiate the fact that water quality impairments do exist. Low storage volumes and potential oxygen demand may be responsible for this activity. Although the reservoir was characterized as a phosphorus limited system in 1981, recent data suggest that the reservoir is currently a nitrogen limited system. Although the reservoir was classified in 1992 as oligotrophic due to an abnormally low chlorophyll-a value, TSI values indicate the reservoir is mesotrophic except for 1990 when the reservoir was classified as eutrophic. It appears that recent water levels may be influencing the eutrophication status of the reservoir. In 1981 when the reservoir had a maximum depth of 8 meters at the time of monitoring the reservoir was classified as mesotrophic. During recent years with the low water conditions the trophic status shifts frequently due to several factors. Low water levels enhance mixing of the water and induce a more frequent resuspension of the sediments. The resuspension of sediments can increase the concentration of nutrients in the water column or inhibit the productivity of the reservoir during turbid conditions. There may also be high periods of productivity as water clarity increases with the elevated nutrient levels. It is evident that the trophic status is not stable during low water conditions. As more data is obtained under more stable conditions, a more definitive determinations can be made in relation to the reservoirs trophic status. It is evident that current conditions are impairing defined beneficial uses of the reservoir, primarily a sustainable fishery. DWR records indicate that the reservoir is stocked primarily with catchable rainbow trout (*Oncorhynchus mykiss*). Previous reports have indicated that common invertebrates of the lake include the orders Diptera and Trichoptera. In addition there is an abundance of aquatic vegetation (Chara sp.) Although the lake has not been treated to control rough fish competition, it appears that the system has no native fishes present.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance):

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	55.461	68.80
Oedogonium sp.	13.077	16.22
Anabaena sp.	6.116	7.59
Unk. fil. green algae	3.269	4.06
Pennate diatoms	1.078	1.34
Staurastrum sp.	0.667	0.83
Pandorina morum	0.222	0.28
Stephanodiscus niagarae	0.176	0.22
Centric diatoms	0.044	0.06
Cosmarium sp. 2	0.389	0.48
Oocystis sp.	0.022	0.03
Oscillatoria sp.	0.006	0.01
Closterium sp.	0.006	0.01
Chlamydomonas sp.	0.002	0.00
Cosmarium sp.	0.000	0.00
Total	80.535	
Shannon-Weaver [H']	1.05	
Species Evenness	0.38	
Species Richness	0.60	

As observed the phytoplankton community is dominated by green algae which supports the TSI classification during that period. However, we should note that a significant contributor to the community is the blue-green algae Anabaena sp.

The unusually diverse flora is likely the result of macrophyte coverage, which provides many niches for planktonic algae that only grows in close proximity to macrophytes.

Information

Management Agencies	
Manti-La Sal National Forest and Price Ranger District	637-2817
Six County Commissioners Organization	896-9222
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Fairview Lakes Association	
Castle Country Travel Region (Price)	637-3009
Reservoir Administrators	
Cottonwood-Gooseberry Irrigation Company	427-9555

Pollution Assessment

Nonpoint pollution sources include recreation and grazing. Sheep graze in the vicinity of the reservoir in the late fall, contributing coliform bacteria, trampling the soil and denuding the land.

There are no point pollution sources in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

FERRON RESERVOIR

Introduction

Ferron Reservoir is on the east side of the Wasatch Plateau at the headwaters of Ferron Creek. It is an intermediate-sized impoundment of a meadow in a glacial valley. There is a small, private resort on the south shore. It is also called Indian Creek Reservoir.

Characteristics and Morphometry

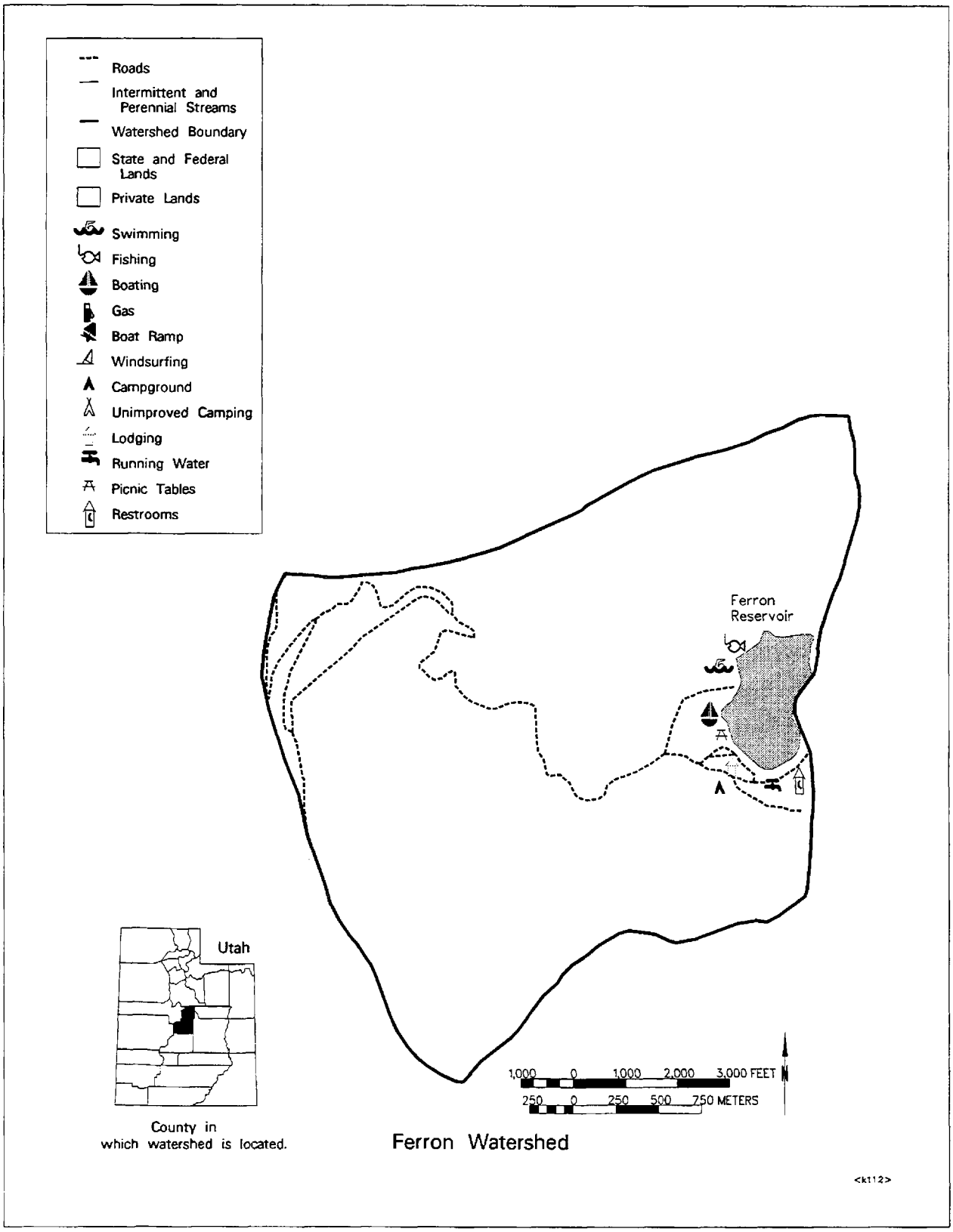
Lake elevation (meters / feet)	2,886 / 9,472
Surface area (hectares / acres)	23.3 / 57.1
Watershed area (hectares / acres)	837 / 2069
Volume (m^3 / acre-feet)	
capacity	1,208,340 / 980
conservation pool	850,770 / 690
Annual inflow (m^3 / acre-feet)	not measured
Retention time (years)	unknown
Mean annual vertical fluctuation (meters / feet)	1.0 / 3.3
Depth (meters / feet)	
maximum	9 / 30
mean	4 / 12
Length (meters / feet)	830 / 2,710
Width (meters / feet)	580 / 1,910
Shoreline (km / miles)	2.6 / 1.6

The reservoir was created in 1939 by the construction of an earth-fill dam. After Millsite Reservoir was built in the early 1970's, local irrigation companies apparently had surplus water storage in Ferron and Duck Fork Reservoirs. They sold this storage to the DWR, which currently maintains them as stabilized water bodies for recreational uses. "Stabilized" refers to the water level, which does not fluctuate. However at Ferron Reservoir, the top meter of water is still drawn off for agricultural uses. In 1992, the reservoir was drained while repairs were made to the dam.

Location

County	Sanpete
Longitude / Latitude	111 27 02 / 39 08 25
USGS Map	Ferron Reservoir 1966
DeLorme's Atlas and Gazetteer™	Page 38, B-1
Cataloging Unit	San Rafael (14060009)

The shoreline is owned by the Manti-La Sal National Forest with unrestricted public access. The top meter of water is consumed for irrigation, with the majority of the water being only for the non-consumptive uses of recreation



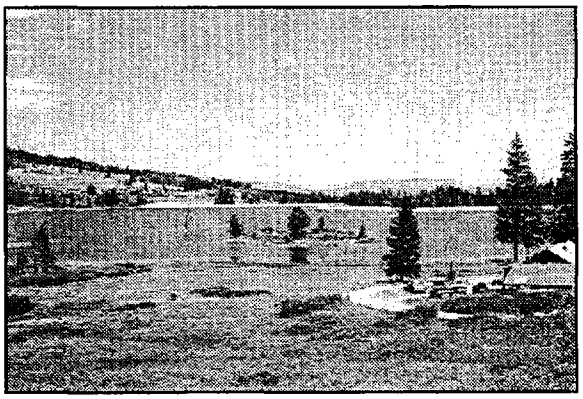
Ferron Watershed

and coldwater aquatic habitat. No changes in water use are foreseen.

Recreation

Ferron Reservoir is directly accessible from the road between Ferron and Mayfield. This is an improved gravel road crossing some of the most rugged terrain on the Wasatch Plateau. From Ferron, travel west past Millsite Reservoir, and continue on the gravel road as it ascends Ferron Canyon, enters a narrow side canyon and climbs to a high bench area. Ferron Reservoir is 25 miles west of Ferron City. From Mayfield, travel up the canyon, crossing the plateau on Skyline Drive at 10,500', and descend into Ferron Canyon. Ferron Reservoir is 23 miles east of Mayfield. The Ferron Canyon route is the better maintained road.

Although the area receives light recreational usage year round, heavy usage occurs on holiday weekends. Fishing is the primary form of recreation, however, boating, camping, swimming, nordic skiing and snowmobiling are also enjoyed. Boats can usually be launched on the reservoir. Ferron Canyon is maintained as a snowmobile route in the winter.



Recreational facilities consist of a Forest Service Campground and a private resort, both are on the shoreline of the reservoir. Ferron Campground has 30 campsites with picnic tables, fire pits, privies, and drinking water. Trash must be carried out, so plan accordingly. Usage fees are charged. Skyhaven Resort has cottage rentals, boat rentals, horse rentals, bicycle rentals, a convenience store, and a cafe.

Watershed Description

The reservoir is in an area of deep glaciated basins characteristic of the southern Wasatch Plateau. Gently rolling meadows of glacial debris are in the area around the reservoir, with abrupt, forested slopes leading to high ridges. Rock outcroppings are common.

The watershed high point, the south shoulder of High Top, is 3,322 m (10,900 ft) above sea level, thereby developing a complex slope of 14.0% to the reservoir. The average stream gradient above the reservoir is 3.6% (189 feet per mile). The inflow and outlet is Indian Creek.

The soil is of limestone origin and has good permeability and moderately slow erosion and runoff. Bedrock is entirely limestone, resulting in hard, alkaline water in the reservoir. Soil associations are listed in Appendix III.

The vegetation communities are comprised of pine, aspen, spruce-fir, and alpine. The watershed receives 64 - 76 cm (25 - 30 inches) of precipitation annually with a frost-free season of 0 - 20 days at the reservoir.

Land use in the reservoir is 100% multiple use forest lands, used by humans for hunting, recreation, logging, and livestock grazing.

Limnological Assessment

The water quality of Ferron Reservoir is excellent. It is considered to be hard with a hardness concentration range from 111-128 15 mg/L ($CaCO_3$). None of the parameters monitored exceeded State water quality standards for defined beneficial uses. Nutrient concentrations in the reservoir are considered low with the average concentration of total phosphorus in the water column in 1989 and 1992 was 6.9 and 8.8 ug/L which is well under the recommended pollution indicator for phosphorus of 25 ug/L. In 1981 the reservoir was characterized as a phosphorus limited system. The 1989-92 data suggest that the reservoir is currently a nitrogen limited system, but the TIN/TP ratio are near the point of transition. TSI values indicate the reservoir is mesotrophic except for 1992 when the reservoir was classified as oligotrophic with an overall TSI value of 39.99 (40.00 is considered mesotrophic) for the lake. TSI values for transparency tend to shift the rating upward, but it should be noted that the reservoir is typically

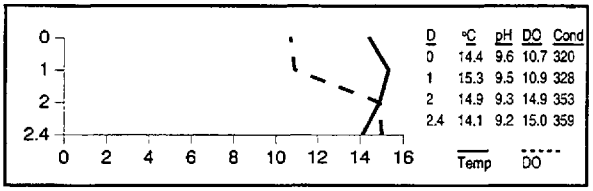
Limnological Data

Data sampled from STORET site: 593180

Surface Data	1981	1989	1992
Trophic Status	M	M	O
Chlorophyll TSI	-	48.34	34.90
Secchi Depth TSI	54.15	55.15	49.66
Phosphorous TSI	37.35	26.61	35.00
Average TSI	45.75	43.37	39.85
Chlorophyll a (ug/L)	-	6.1	1.6
Transparency (m)	1.5	1.4	2.1
Total Phosphorous (mg/L)	10	4.8	8.8
pH	8.3	-	9.0
Total Susp. Solids (mg/L)	<5	-	<3
Total Volatile Solids (mg/L)	-	-	1
Total Residual Solids (mg/L)	-	-	2
Temperature (°C / °f)	13/55	10/50	14/57
Conductivity (umhos.cm)	384	393	358
Water Column Data			
Ammonia (mg/L)	0.05	0.02	0.03
Nitrate/Nitrite (mg/L)	0.20	0.04	0.08
Hardness (mg/L)	220	-	191
Alkalinity (mg/L)	175	-	153
Silica (mg/L)	-	-	3.4
Total phosphorus (ug/L)	10	6.9	8.8
Miscellaneous Data			
DO (Mg/l) at 75% depth	8.6	-	14.1
Stratification (m)	4-7	-	NO
Limiting Nutrient	P	N	N
Depth at Deepest Site (m)	9	8.0	2.4

* First period data only

shallow and turbidity may be effecting that rating. It appears that there has been no significant rise in the concentrations of nutrients in the lake since it was originally surveyed in 1981. It should be noted that the reservoir was drained and repair work done on the dam prior to the 1992 sampling of the reservoir. The reservoir was not stratified during August 19, 1992, but the reservoir lacked sufficient depth to permit the development of a thermocline. In 1981 with an overall depth of 9 meters stratification was present in the reservoir with a weak thermocline developed near the 4-7 meter depth. Even during stratification there has been no apparent decline in the concentration of dissolved oxygen or an increase of epilimnion water temperatures to a point where they have impacted the fishery. Dissolved oxygen concentrations need to be evaluated during the winter to see if they reach a critical state during late ice on conditions due to summer drawdown. The presence of hydrogen sulfide in the outfall during late winter suggest that oxygen deficiencies could be extensive in the reservoir during the winter period. According to DWR no fish kills have been reported at Ferron Reservoir. The reservoir is typically stocked with catchable rainbow trout (*Oncorhynchus mykiss*) and has been stocked with cutthroat trout (*Oncorhynchus clarki*). DWR surveys have indicated numerous invertebrate species present with Diptera and Coleoptera commonly present. The majority of zooplankton populations were comprised of Daphnia with some copepods and those macrophytes present were sparse and submergent, usually Potamogeton, milfoil, and buttercup.



The dataset for 1989 is incomplete due to malfunction of equipment and the loss of the secchi disk.

The reservoir has not been treated for control of rough fish competition, but native fishes may have been displaced by repeated stocking of hatchery fish and periodic draining of the reservoir.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Pennate diatoms	0.334	69.49
Centric diatoms	0.107	22.24
Ankistrodesmus falcatus	0.017	3.64
Scenedesmus bijuga	0.011	2.32
Unknown Spherical green alga	0.011	2.32
Total	0.479	
Shannon-Weaver [H']	0.88	
Species Evenness	0.55	
Species Richness [d]	0.20	

The flora is fairly typical, but not particularly diverse. The dominance of green algae and diatoms indicates that the lake is reasonably healthy.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Pollution Assessment

Nonpoint pollution sources include nutrient loading and sedimentation from grazing and litter and human wastes

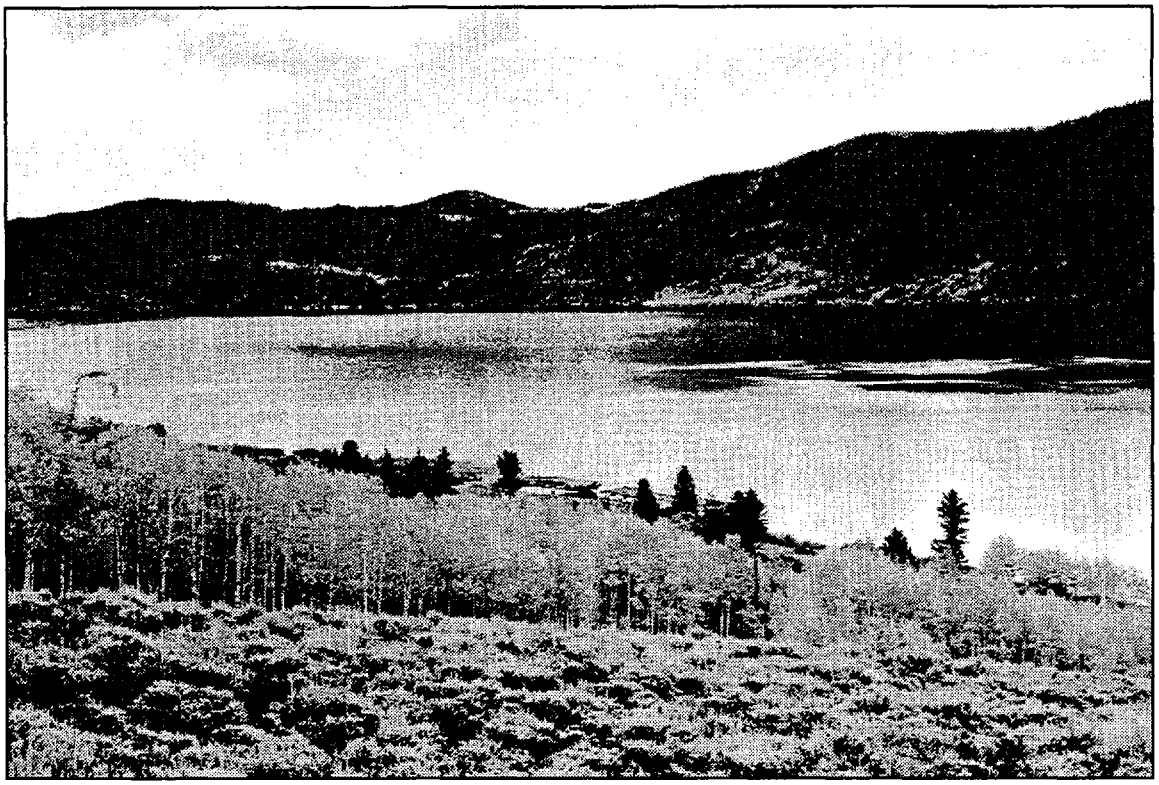
from recreation. About 1,000 sheep graze in the immediate vicinity of the reservoir for two weeks each year. Cattle also graze the area. No mining or logging takes place in the region.

There are no point pollution sources in the watershed.

Information

Management Agencies	
Manti-La Sal National Forest	637-2817
Ferron Ranger District	384-2372
Six County Commissioners Organization	896-9222
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Skyhaven Resort (at Ferron Reservoir)	
Castle Dale Chamber of Commerce	381-2547
Panoramaland Travel Region (Richfield)	896-9222
Reservoir Administrators	
Division of Wildlife Resources	538-4700
Ferron Canal and Irrigation Company	384-2990

FISH LAKE



Introduction

Fish Lake is the largest natural mountain lake in Utah. It is on the Fish Lake Plateau (the sixth highest mountains in the state), in central Utah. It is a natural body of water in a deep, wide graben valley. It is accessible by a paved state highway and has many recreational developments on its north shore. This lake should not be confused with several other lakes of the same name, including one in the Uintas. In 1935 A dam was built to regulate the release of water from the lake. Water level can only be lowered three feet, so the lake remains essentially in its natural state. The reservoir shoreline is publicly owned and administered by the Fish Lake National Forest with unrestricted public access. The top 3' of water is drawn off for agricultural uses. Water is used for coldwater aquatic habitat and recreation. No changes in water use are anticipated.

Characteristics and Morphometry

Lake elevation (meters / feet)	2,695 / 8,843
Surface area (hectares / acres)	1,012 / 2,500
Watershed area (hectares / acres)	4,662 / 11,520
Volume (m^3 / acre-feet)	265,095,000 / 212,500
Annual inflow (m^3 / acre-feet)	
Retention time (years)	58.5
Mean annual vertical fluctuation (meters / feet)	1 / 3
Depth (meters / feet)	
maximum	53.3 / 174.8
mean	25.9 / 84.9
Length (km / miles)	8.6 / 5.3
Width (km / miles)	1.8 / 1.1
Shoreline (km / miles)	19.8 / 12.3

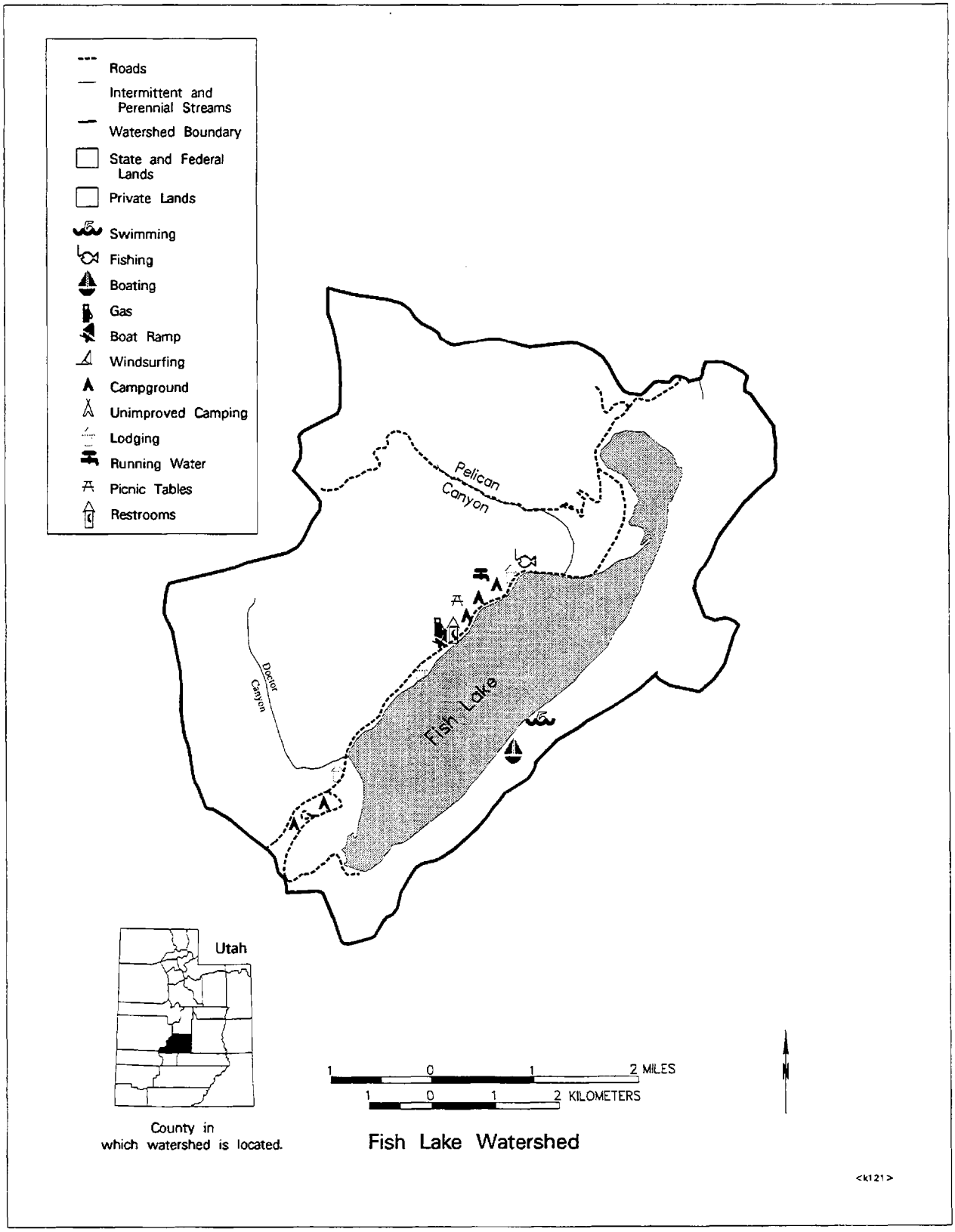
Location

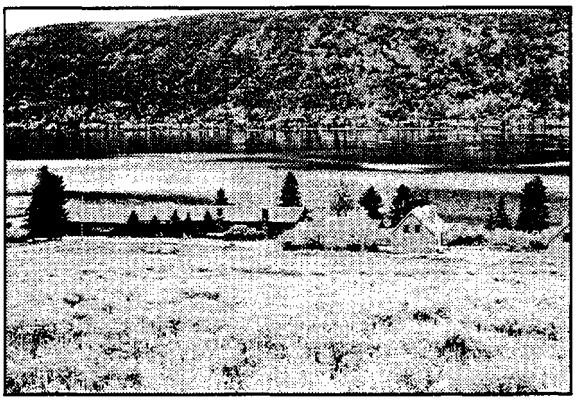
County	Sevier
Longitude / Latitude	111 42 15 / 38 32 45
USGS Map	Fish Lake, Utah, 1968
DeLorme Atlas	Page 27, A-6
Cataloging Unit	Fremont River (14070003)

Recreation

Fish Lake is easily accessed from U-25, which runs from U-24 (between Salina and Loa) to Fish Lake.

Fishing, boating, scuba diving, waterskiing, cross

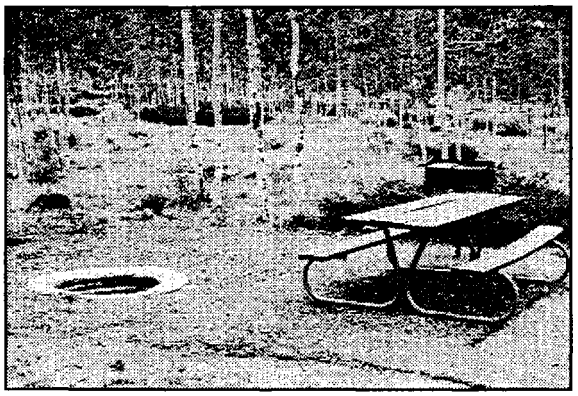

Roads
Intermittent and Perennial Streams
Watershed Boundary
State and Federal Lands
Private Lands
Swimming
Fishing
Boating
Gas
Boat Ramp
Windsurfing
Campground
Unimproved Camping
Lodging
Running Water
Picnic Tables
Restrooms
Pelican Canyon
Doctor Canyon
Fish Lake
Utah
County in which watershed is located.
1 0 1 2 MILES
1 0 1 2 KILOMETERS
N
Fish Lake Watershed
<k121>

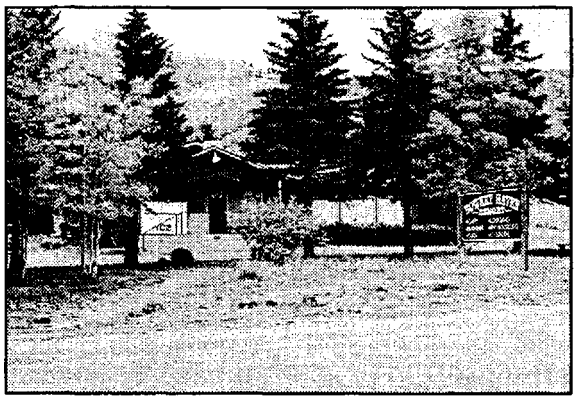


country skiing, and swimming are possible in the area. Usage is heavy, but scenery and recreational opportunities are outstanding.

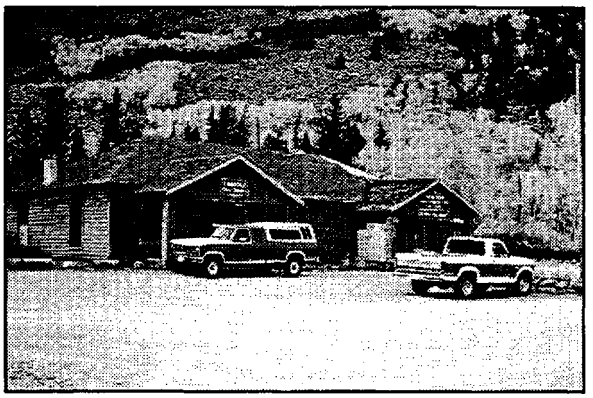
Recreational facilities consist of public and private campgrounds, housekeeping cottages, improved boat ramps, boat rental and picnic grounds.

USFS campgrounds include Doctor Creek (29 family sites and 2 group sites), Mackinaw (53 family sites and 15 group sites) and Bowery (31 family sites and 12 group sites). All have flush toilets and have fees for use.





Private resorts include Bowery Haven and Fish Lake Lodge/Lakeside Resort. Both offer boat rentals, launching ramps, rustic and modern cabins, groceries, gas, RV park facilities, and campgrounds. Bowery Haven also has an eight room motel and a cafe. Nightly rates are about $10 for tent or RV camping, $30 - 60 for housekeeping cabins, and >$100 for large cabins. Reservations should be made several months in advance.



Watershed Description

The lake is in an area of high, rolling ridges and wide valleys characteristic of the top of the Fish Lake Plateau. The lake lies in a graben valley, where the valley floor has sunk beneath the sides. In this instance, the valley is sinking faster than erosion fills it with sediment, resulting in a natural impoundment.

The lake area/watershed area ratio is very high, with the lake occupying about 20% of the watershed. The high ratio results in a long retention time and relatively little deposition of sediments. Other grabens on the Fish Lake/Wasatch Plateaus have been filled with sediments and do not have natural lakes.

One mile east of the lake are Crater Lakes, two natural lakes with no surface drainage. Their origin is similar to Fish Lake's, but they are in small depressions and have no watershed beyond the depressions themselves.

Aspen and coniferous forests cover the mountains around the reservoir. Some of these forests have been cleared for land development and road construction, but they re largely intact. The higher elevations have alpine vegetation.

The Fish Lake Hightop Plateau, immediately north of the lake, is the highest of the high plateaus of southern Utah. A point on the south shoulder, at 3,545 m (11,500 ft) is the watershed high point, thereby developing a complex slope of 12.5% to the reservoir. The average stream gradient above the reservoir is 10.5% (555 feet per mile). The inflows are Jorgenson Creek, Bowery Creek, Twin

Creek, and Doctor Creek. The outlet is Lake Creek, a headwater stream of the Fremont River.

The watershed is composed of high mountains and the graben valley. The soil is largely of volcanic origin with moderate permeability and moderately slow erosion and runoff. Soil associations are listed in Appendix III.

The vegetation communities are comprised of pine, aspen, spruce-fir, oak and maple. The watershed receives 41 - 76 cm (16 - 30 inches) of precipitation annually with a frost-free season of 60 - 80 days at the reservoir.

Limnological Assessment

The water quality of Fish Lake is very good. It is considered soft water with a hardness concentration of approximately 46 mg/L ($CaCO_3$). The only parameter that exceeds State standards is phosphorus. All other parameters including total metals obtained near the bottom at the deep sites were within State standards for defined beneficial uses. Generally total phosphorus levels have not exceeded the State pollution indicator for phosphorus of 25 ug/L. However, in 1989 total phosphorus values exceeded the indicator throughout the water column. Phosphorus concentrations averaged 34.3 ug/L at the surface and a value of 229 ug/L was reported near the bottom. These relatively high values reported near the bottom did skew the data and a typically oligotrophic reservoir was reported as mesotrophic during that period of the study. Nutrients throughout the water column are typically not a problem. However it should be noted that during this period of sampling anoxic conditions were resent near the bottom(August 22, 1989) of the reservoir as again depicted by the August 22, 1991 profile. Anoxic conditions permit the reintroduction of phosphorus stored in the sediments back into the water column. In addition when sampling near the bottom on occasion, the sample may contain suspended bottom materials the give a erroneous high value. As indicated in the profiles for the lake, it does stratify and anoxic conditions do develop near the bottom of the lake. Data throughout the study period indicates that the lake is nitrogen limited with N/P ratios near 1-2. As indicated in the lake profile, stratification does occur at approximated 9-10 meters, but dissolved oxygen concentrations are fairly high throughout the water column. The exceptions ins near the bottom. Although the lake was reported as barely mesotrophic in 1989, it appears that the trophic status for the lake is essentially oligotrophic. According to DWR stocking records subcatchable or advanced rainbow trout (*Oncorhynchus mykiss*), lake trout (*Salvelinus namaycush*),and splake, a cross of brook and lake trout (*Salvelinus fontinalis* X Salvelinus namaycush) and fingerling brook trout (*Salvelinus fontinalis*) have been introduced to Fish Lake.

Limnological Data

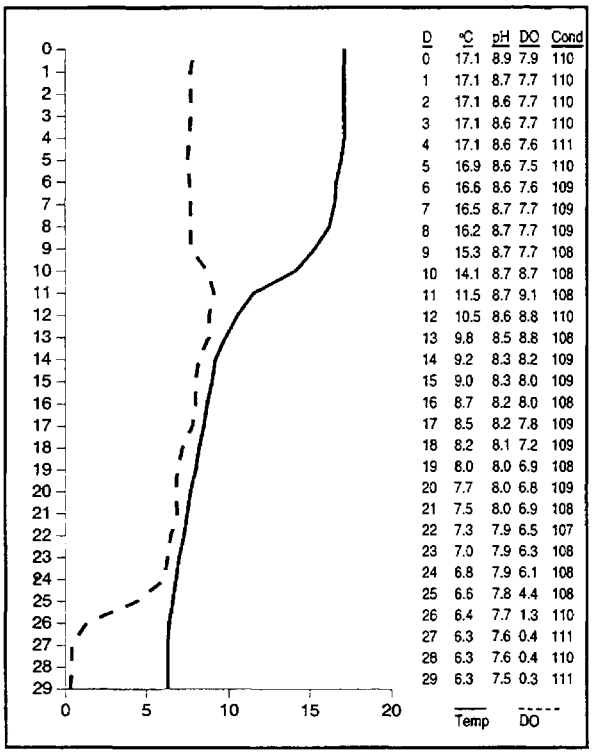
Data averaged from STORET sites: 495485, 495486, 495487

Surface Data	1979*	1989	1991
Trophic Status	O	M	O
Chlorophyll TSI	-	38.54	36.12
Secchi Depth TSI	30.77	26.72	29.51
Phosphorous TSI	47.35	55.10	43.44
Average TSI	39.06	40.12	36.36
Chlorophyll a (ug/L)	-	2.3	2.0
Transparency (m)	-	10.1	8.8
Total Phosphorous (ug/L)	7.6	34.3	15.3
pH	8.6	8.5	8.5
Total Susp. Solids (mg/L)	<5	-	<3
Total Volatile Solids (mg/L)	-	-	5
Total Residual Solids (mg/L)	-	-	<3
Temperature (°C / °f)	17/62	13/55	11/52
Conductivity (umhos.cm)	151	121	113
Water Column Data			
Ammonia (mg/L)	0.17	0.06	0.04
Nitrate/Nitrite (mg/L)	0.03	0.02	0.01
Hardness (mg/L)	49	-	43
Alkalinity (mg/L)	58	-	55
Silica (mg/L)	-	-	1.0
Total Phosphorous (ug/L)	30	72	26.7
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	7.1	2.8	6.6
Stratification (m)	10-13	12-14	9-11
Depth at Deepest Site (m)	30	33.0	29.0

* Data from period 2 only; station 495487.

All but brook trout are typically stocked annually. The lake has not been treated for control of fish species, therefore native populations could still exist in the lake or its tributaries. In addition the following species of fish are present in the lake: yellow perch (*Perca flavescens*), Utah sucker (*Catostomus ardens*), brown trout (*Salmo trutta*) and possible kokanee salmon (*Oncorhynchus nerka*) and mottled sculpin (*Cottus bairdi* semiscuber).

It is important to note that changes in aquatic macrophyte composition have occurred at Fish Lake through the years, thus effecting the production of invertebrate fish foods. The following were reported present in 1972; Emergents, *Myriophyllum*(abundant), *Podomogetara*, *Zanichellia* (both uncommon) and *Elodea* (uncommon); Submergents *Ceratophyllum*, *Lemna*, (both uncommon), *Nostoc*, *Aphanocapsa*. Those listed as uncomm were oncereported to be abundant, and the *Myriophyllum* as at one time only moderately common (Shirley, 1972). Presently there is an abundance of macrophytes growth around the entire shoreline. These macrophytes tend to



D	°C	pH	DO	Cond
0	17.1	8.9	7.9	110
1	17.1	8.7	7.7	110
2	17.1	8.6	7.7	110
3	17.1	8.6	7.7	110
4	17.1	8.6	7.6	111
5	16.9	8.6	7.5	110
6	16.6	8.6	7.6	109
7	16.5	8.7	7.7	109
8	16.2	8.7	7.7	109
9	15.3	8.7	7.7	108
10	14.1	8.7	8.7	108
11	11.5	8.7	9.1	108
12	10.5	8.6	8.8	110
13	9.8	8.5	8.8	108
14	9.2	8.3	8.2	109
15	9.0	8.3	8.0	109
16	8.7	8.2	8.0	108
17	8.5	8.2	7.8	109
18	8.2	8.1	7.2	109
19	8.0	8.0	6.9	108
20	7.7	8.0	6.8	109
21	7.5	8.0	6.9	108
22	7.3	7.9	6.5	107
23	7.0	7.9	6.3	108
24	6.8	7.9	6.1	108
25	6.6	7.8	4.4	108
26	6.4	7.7	1.3	110
27	6.3	7.6	0.4	111
28	6.3	7.6	0.4	110
29	6.3	7.5	0.3	111

inhibit fishing and boating in these areas.

The lake was surveyed during the National Eutrophication Survey in 1975. They determined the reservoir to be mesotrophic. One interesting fact reported was that the retention period for the lake was calculated as 58.5 years. In view of this long retention period loadings to the reservoir should be monitored and not allowed to increase substantially shifting the eutrophic state because of the long term effect due to the long retention period.

Phytoplankton in the euphotic zone on August 22, 1991 include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Stephanodiscus niagarae	0.176	41.65
Merismopedia sp.	0.167	39.48
Peridinium cinctum	0.056	13.16
Microcystis incerta	0.011	2.63
Pennate diatoms	0.007	1.58
Centric diatoms	0.006	1.50
Total	0.423	
Shannon-Weaver [H']	1.22	
Species Evenness	0.68	
Species Richness [d]	0.26	

The flora is fairly typical, but not particularly diverse. The dominance of green algae and diatoms indicates that the lake is reasonably healthy.

Pollution Assessment

Nonpoint pollution sources are grazing, concentrated recreation, construction, and summer home and resort activities. Cattle graze in the watershed and probably around the reservoir.

Concentrated recreation disturbs the shoreline and other areas around the lake, accelerating erosion. Litter can also be a problem.

There are no point pollution sources in the watershed.

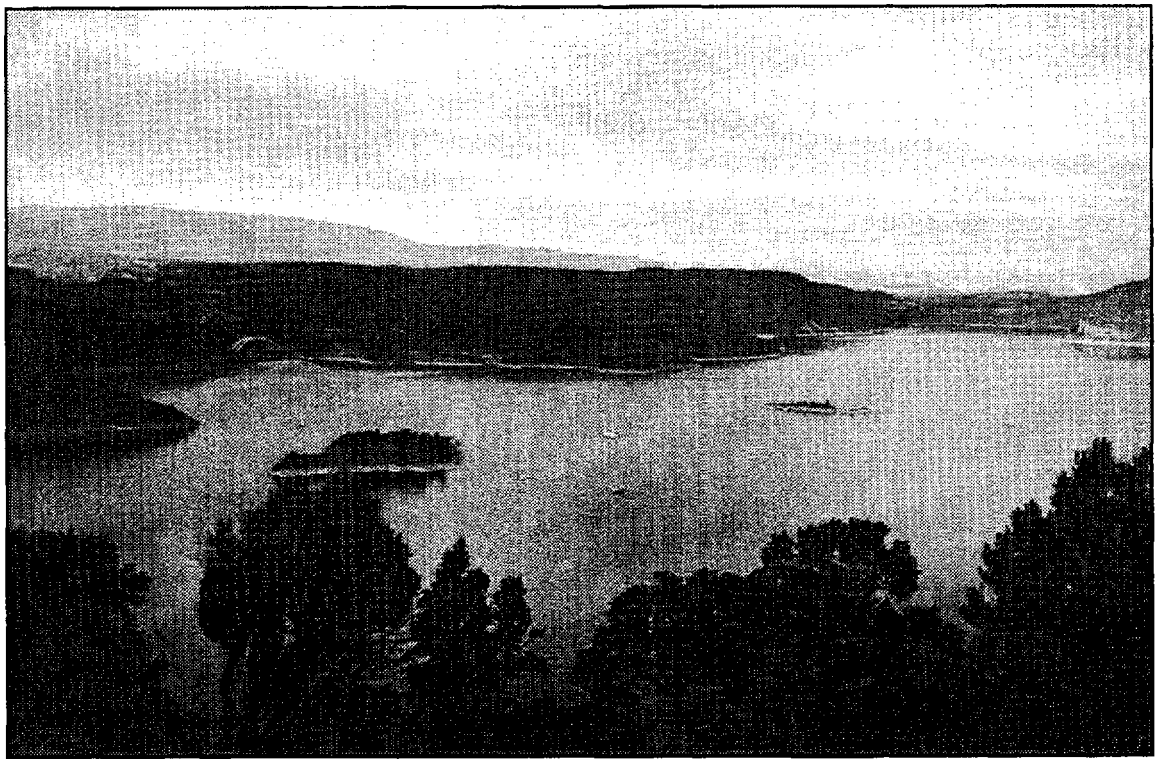
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Fish Lake National Forest & Richfield Ranger District	896-9233
Six County Commissioners Organization	896-9222
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Panoramaland Travel Region (Richfield)	896-9222
Richfield Chamber of Commerce	896-4241
Bowery Haven Resort	
May 21 - Oct. 31	836-2788
Nov. 1 - May 20	782-7378
Fish Lake Lodge/Lakeside Resort	836-2700 or 377-9750
Dam Administrator	
Fremont Irrigation Company	836-2843

FLAMING GORGE RESERVOIR



Introduction

Flaming Gorge Reservoir is one of the largest bodies of water in Utah. It was built to impound spring floods in the Green River and store them for year-round use for Arizona, Nevada, and southern California. The reservoir is second only to Lake Powell in size and recreational popularity. This reservoir holds the state record for several species of trout. The lower end of the reservoir is in Red Canyon and the Flaming Gorge itself, while the upper part spills over the Wyoming deserts. Flaming Gorge and Red Canyon are both several thousand feet deep and with brick-red walls. They were named by John Wesley Powell, the leader of the first intensive exploration of the Green/Colorado Rivers. The dam was built in Red Canyon, the second of five deep canyons the Green River has carved through the Uinta Mountains. A lake, rather than a river, now lies at the bottom of the gorge.

Characteristics and Morphometry

Lake elevation (meters / feet)	1,836 / 6,023
Surface area (hectares / acres)	17,000 / 42,020
Watershed area (hectares / acres)	5,013,765 / 12,384,000
Volume (m^3 / acre-feet)	
capacity	4,673,740,000 / 3,789,000
conservation pool	
Annual inflow (m^3 / acre-feet)	
Retention time (years)	2.3
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	133 / 436
mean	64.5 / 212
Length (km / miles)	68.56 / 42.6
Width (km / miles)	.580 / .3
Shoreline (km / miles)	335 / 208

Location

County	Daggett, UT and Uintah, WY
Longitude / Latitude	109 34 11 / 40 58 42
USGS Map	Flaming Gorge, UT 1966
DeLorme's Utah Atlas & Gazetteer™	Page 56, A-3
Cataloging Unit	Green River/Flaming Gorge Res.(14040106)

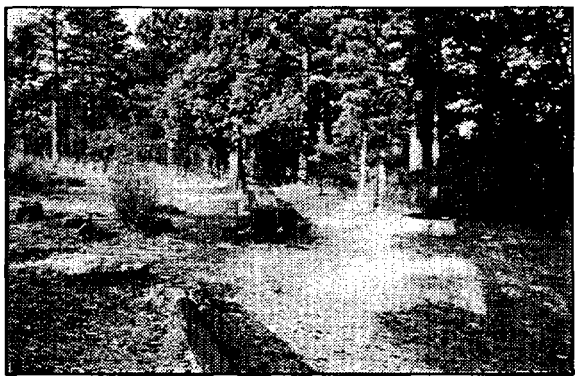
Millions of years ago, drainage in the area was to the east into the Platte River drainage. During the Pliocene, central Wyoming was uplifted and the headwaters of the Green River captured the drainage. Subsequent uplift has taken place in the Uinta Mountains area, and the Green River has essentially maintained its original elevation, carving deep canyons through the mountains.

Damming rivers is easiest in narrow canyons. Dams have been proposed in Lodore, Whirlpool and Split Mountain Canyons, but the dam in Red Canyon is the only one that has ever been built.

Construction was begun in 1958 and completed in 1964. The 502 foot high dam was built out of concrete in an arch shape. Land surrounding the reservoir is managed by the Flaming Gorge National Recreation Area. Public access is unrestricted. Water is used for both culinary and irrigation purposes.

Recreation

Accesses to Flaming Gorge National Recreation Area are on US-191 between Green River, WY and Vernal, UT. Access from the north and west is also possible on Wyoming Highway 414, from I-80 at Fort Bridger, WY to Manilla, UT. Recreational areas are concentrated along the south side of the Flaming Gorge and Red Canyon on U-44, which connects US-191 to W-414. Access areas are well



marked.

Cross-country skiing, fishing, boating, swimming, camping, picnicking, cliff diving, and water skiing are all popular. Although most recreation areas are closed in the winter, there is still opportunity for wintertime activities. Boat ramps are available at Sheep Creek Bay near Manilla and at sites near the dam. There are dozens of campgrounds in the recreation area. For further recreational information, contact the Recreation Area Headquarters (see info box). There is a private campground in Manilla.

There are visitors centers at the dam and on the south shore of the reservoir. Interpretive exhibits, recreational information, and tours of the 50 story tall dam and hydroelectric turbines are available.

Watershed Description

Flaming Gorge Reservoir is located on the Green River as it cuts through the Uintas. The immediate area consists of steep canyon walls and high mountains, with heavy precipitation in the Uintas. Clear mountain streams flow into the south shore of the reservoir, fed by melting winter snowpack. The area is heavily forested, and logging takes place.

In the transition area between the Uintas and the Wyoming desert, the rock strata are sharply tilted to the south, and vegetation communities gradually taper from dense forest to sagebrush. The various strata in close proximity result in variable topography, with steep escarpments, deep canyons, and undulating softer layers. The Sheep Creek Natural Area, west of Flaming Gorge, has a paved road traversing many different strata.

The Wyoming deserts are barren and receive little precipitation. The Green River flows south across them for several hundred miles, from the Wind River Range to the Utah state line.

The source of the Green River is in the Wind River Mountains, the highest range in Wyoming and one of the most remote ranges in the continental United States. The watershed high point, Gannett Peak, is 4,201 m (13,785 ft) above sea level, thereby developing a complex slope of 1.2% to the reservoir. Slopes to the south of the reservoir, however, average 15% to the ridgeline of the Uintas at 10,000'. The average stream gradient of the Green River above the reservoir is 1.2% (64 feet per mile) The major inflows are the Green River, Blacks Fork, and Henrys Fork. Minor inflows include Carter Creek, Sage Creek, Spring Creek, Summers Dry Creek, Currant Creek, Cart Creek, and Birch Spring Draw. There are numerous natural lakes in the Uintas and the Wind Rivers. Many streams have been impounded or diverted for irrigational purposes. Major upstream reservoirs include Fontanelle Dam and Big Sandy Reservoir.

The watershed is made up primarily of high mountains, foothills, high desert plains, and badlands. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities, in order from desert to alpine, include barren areas, grass-sagebrush, agricultural land, giving way to pinyon-juniper, oak, maple, mountain mahogany, which in turn give way to pine, aspen and fir, and finally to alpine. The watershed receives 20 - >102 cm (8 - >40 inches) of precipitation annually. The frost-free season around the reservoir is 80 - 120 days per year.

Land use in the watershed is primarily open range in the high deserts, and multiple use in the mountains. The thick forests on the north slope of the Uintas are intensively logged, including areas less than one mile from the reservoir. Much of both the Uinta and Wind River portions of the watershed are federally protected wilderness areas.

Limnological Assessment

In general, Flaming Gorge Reservoir was found to be of good water quality. The water quality varies in the reservoir because of its exceptional length (69 miles) and variable depth (9-133 meters). In the northern arms of the reservoir eutrophic conditions prevail characterized by silty water, macrophyte growth, algal blooms, depressed dissolved oxygen with depth and higher concentrations of nutrients. These types of conditions lead to higher production and reduced transparency. As one moves downstream towards the dam eutrophic conditions tend to improve. Production tends to fall and water clarity improves. This is a typical type of transition for reservoir as large as Flaming Gorge. As sediments and nutrients drop out of the water column the nutrient base is not available for primary production. It is not uncommon to find embayments along the reservoir with higher states of production as sources of nutrients move into the reservoir through various types of sources.

Limnological Data

Surface Data	1975
Trophic Status	M
Chlorophyll TSI	47.50
Secchi Depth TSI	42.37
Phosphorous TSI	48.05
Average TSI	45.97
Chlorophyll a (ug/L)	5.6
Transparency (m)	3.4
Total Phosphorous (mg/L)	-
pH	8.5
Total Susp. Solids (mg/L)	-
Total Volatile Solids (mg/L)	-
Total Residual Solids (mg/L)	-
Temperature (°C / °f)	13/55
Conductivity (umhos.cm)	532
Water Column Data	
Ammonia (mg/L)	0.03
Nitrate/Nitrite (mg/L)	0.53
Hardness (mg/L)	-
Alkalinity (mg/L)	156
Silica (mg/L)	-
Total Phosphorus (ug/L)	21
Miscellaneous Data	
Limiting Nutrient	P
DO (Mg/l) at 75% depth	6.4
Stratification (m)	15-17
Depth at Deepest Site (m)	125

Data (1975) was summarized from 1975 EPA eutrophication study with the exception of the profile information (April/Oct 1972 by CH_2M Hill).

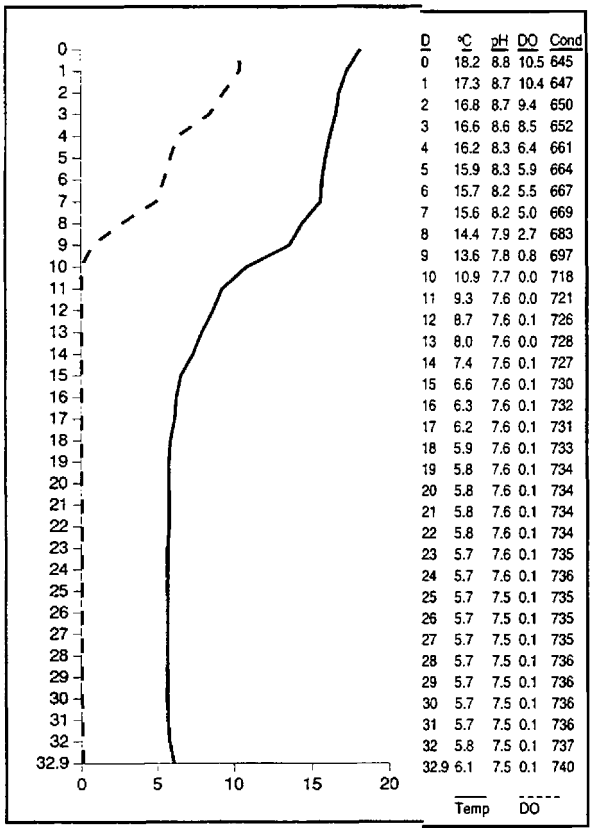
To understand the limnology of the reservoir, historically it has been divided into three zones: (1) riverine, (2) transition, and (3) lacustrine. The riverine zone is described as that area from inflow to Buckboard Marina. It is considered to be the most productive area of the reservoir with nuisance blue-green algae blooms. Although fish kills may occur due to the toxin formed when these blue-green algal (primarily *Aphanazominon* and *Anabaena*) blooms breakdown, they are more likely to result due to the decreased dissolved oxygen content in the water column present in the later part of the summer season under stratified conditions. Another problem that has been documented is the elevated temperatures in the epilimnion late in the summer which forces cold water species down in the water column. Thus fishery habitat area is reduced by low dissolved oxygen in the hypolimnion and elevated temperatures in the epilimnion.

The transition zone is characterized as that area from Buckboard Marina to the Utah/Wyoming stateline. This zone includes water depths from 10 to 50 meters. In this area turbidity from river inflow is significantly decreased, but blue-green algae blooms still occur. This area of the reservoir has relatively high production, but usually more desirable phytoplankton species with higher diversity occur. The cold water fish habitat is generally good throughout the year, as adequate dissolved oxygen is maintained.

The lacustrine zone of the reservoir is characterized as the area from the stateline to the dam. This zone is extremely clear, deep and often cold water. Primary production is usually low except in local embayments.

Flaming Gorge has a distinct temperature stratification which begins in late May and is strongly stratified in early September. The thermocline as reported begins to form at 9 meters and moves deeper to 21 meters in late summer. The fall turnover usually occurs in mid November and produces a largely isothermic situation (CH_2M Hill, 1977). Dissolved oxygen declines below the thermocline to below 2.0 mg/L in late July and continues to degrade through September to anoxic conditions.

Additional data is needed to further characterize the water quality of the reservoir. Currently a program between the Division of Water Quality and the U.S. Forest Service is being developed to assist in the gathering of data to understand the limnology of the reservoir and determine any existing water quality trends that may be developing in the reservoir. Most of the data reported here is reflective of the 1975 National Eutrophication Study.



D	°C	pH	DO	Cond
0	18.2	8.8	10.5	645
1	17.3	8.7	10.4	647
2	16.8	8.7	9.4	650
3	16.6	8.6	8.5	652
4	16.2	8.3	6.4	661
5	15.9	8.3	5.9	664
6	15.7	8.2	5.5	667
7	15.6	8.2	5.0	669
8	14.4	7.9	2.7	683
9	13.6	7.8	0.8	697
10	10.9	7.7	0.0	718
11	9.3	7.6	0.0	721
12	8.7	7.6	0.1	726
13	8.0	7.6	0.0	728
14	7.4	7.6	0.1	727
15	6.6	7.6	0.1	730
16	6.3	7.6	0.1	732
17	6.2	7.6	0.1	731
18	5.9	7.6	0.1	733
19	5.8	7.6	0.1	734
20	5.8	7.6	0.1	734
21	5.8	7.6	0.1	734
22	5.8	7.6	0.1	734
23	5.7	7.6	0.1	735
24	5.7	7.6	0.1	736
25	5.7	7.5	0.1	735
26	5.7	7.5	0.1	735
27	5.7	7.5	0.1	735
28	5.7	7.5	0.1	736
29	5.7	7.5	0.1	736
30	5.7	7.5	0.1	736
31	5.7	7.5	0.1	736
32	5.8	7.5	0.1	737
32.9	6.1	7.5	0.1	740

Recent stocking reports indicate that DWR stocks the

change data in profile chart

reservoir with 200,000 to 500,000 subcatchable rainbow trout (*Oncorhynchus mykiss*). In addition the reservoir contains populations of kokanee (*Oncorhynchus nerka*), lake trout (*Salvelinus namaycush*), smallmouth bass (Micropterus dolomieui), largemouth bass (*Micropterus salmoides*), channel catfish (*Ictalurus punctatus*), brown trout (*Salmo trutta*, whitefish (*Prosopium spilonotus*), Utah chub (*Gila atraria*) brook trout (*Salvelinus fontinalis*) and cutthroat trout (Salmo clarki). According to DWR personnel during the period 1981-88 the reservoir was stocked with rainbow (7,652,286), cutthroat (128,100) and brown trout (1,417,613), kokanee (229,900), smallmouth bass (10,000) and channel catfish (311,294).

The reservoir has not been chemically treated by the DWR, but there are probably limited populations of native fishes present in the reservoir because of temperature problems. The Green River is naturally warm and muddy. Impoundment of the water allows silt to settle to the floor of the reservoir, and only surface water is heated by the sun. This results in cold clear water, which is good for trout, but so different from the original river that the native fish have become regionally extinct. In fact, the reservoir has turned the river below it into a cold, clear trout stream, which has further eliminated natural habitat. Recovery plans for the endangered fishes (Colorado Squawfish, Razorback Sucker, Humpback Chub, Roundtail chub and the Bonytail chub) include releasing only warm water from the surface of the reservoir, and releasing large amounts of water in the spring to restore the natural flow regime of the Green River. This program was completed for the spring of 1993, and resulted in the desired surge of warmer water, mimicking the natural cycle.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance) as summarized in the 1975 EPA National Eutrophication Survey:

Date	Species	Algal Units per ml
05/15/75	*Stephanodiscus sp.*	1,981
	Fragilaria sp.	775
	Diatoma sp.	258
	Chroomonas sp.	258
	Navicula sp.	43
08/07/75	*Chroomonas sp.*	1,331
	Aphanizomenon sp.	951
	Fragilaria sp.	428
	Cryptomonas sp.	333
	Melosira sp.	190
	Other genera	428
09/22/75	*Aphanizomenon sp.*	1,086
	Cryptomonas sp.	827
	Chroomonas sp.	465
	Oscillatoria sp.	103

Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Ashley National Forest	784-3445
Recreation	
Flaming Gorge National Recreation Area	784-3445
Dinosaurland Travel Region (Vernal)	789-6932
concessionaire?	
Flaming Gorge KOA (Manilla)	784-3184
Reservoir Administrators	
Department of the Interior	524-5403

Pollution Assessment

Nonpoint pollution sources include nearly all possible sources, including grazing, logging, mining, heavy industry, irrigated agriculture, urban areas, recreation, summer homes, land development, and others. Most critical to the water quality in the Utah portion of the reservoir are logging, mineral exploration, and recreation.

At the time of this writing (summer 1993), the Wasatch-Cache and Ashley National Forests are proposing to open the entire north slope of the Uintas to logging and oil drilling. This would put the Flaming Gorge Reservoir at some risk, but most areas of the Uintas have long stream distances to mitigate impacts, and exploitation would be carefully mitigated to avoid adverse environmental affects, so impact should be minimal. Watershed damage in streams that flow directly into the reservoir (Spruce Creek, Cart Creek, Skull Creek, Eagle Creek, Cub Creek, Carter Creek, Death Creek and Sheep Creek) would have significant impacts on reservoir water quality because these streams are not long enough to significantly mitigate impacts.

The north slopes of the Uintas are very heavily logged, with many clear-cuts taking place every year. Recovery of the coniferous forest is slow in many places and nonexistent in others, despite planting. While little erosion is apparent, if large areas remain barren it is expected that increased erosion will occur.

There are no active mines in the Utah portion of the watershed, but old sites that have not been reclaimed can leach heavy metals and sediments into waterways.

Cattle graze up to the shoreline of the reservoir. In much of the Utah portion, the shoreline area is too rugged for the animals to reach the shore, and so rocky that they do little damage. The Wyoming portion, however, is more characteristic of desert reservoirs, and cattle have significant adverse riparian impacts.

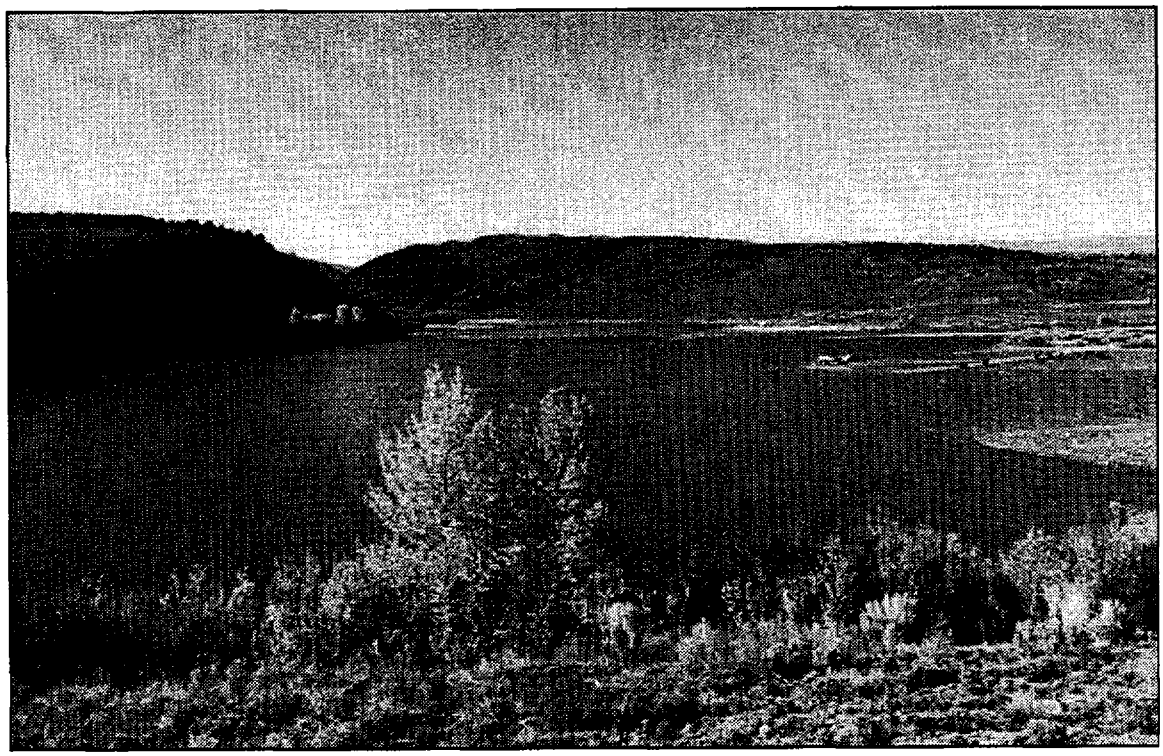
Agricultural areas in Wyoming include Bridger Valley, Bear Valley, Eden Valley, and Star Valley.

Utah point sources of pollution include the Manila Waste water Lagoons and the Flaming Gorge Waste water Treatment Plant. The Manila lagoons have been expanded and currently do not discharge. In Wyoming, Rock Springs and Green River both have sewage Treatment Plants, and there are mining and oil drilling operations throughout the watershed..

Beneficial Use Classification

The state beneficial use classifications include: culinary water (1C), recreational bathing (swimming) (2A), boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

FORSYTH RESERVOIR



Introduction

Forsyth Reservoir is northwest of Loa at the base of the Fish Lake Mountains. It is an intermediate-sized impoundment of a stream valley. In recent years, whirling disease has spread from a fish hatchery into the Fremont River system. Much of the system was treated to exterminate all fishes, and restocked with centrarchids. In several years, the system will be restocked with trout.

The reservoir was created in 1922 by the construction of an earth-fill dam. The reservoir shoreline is 60% owned by the Fish lake National Forest and 40% privately owned (much of the north end of the reservoir). Public access is unrestricted. Water is consumed for agricultural uses, but also used for recreation and coldwater aquatic habitat. Water use is not expected to change in the foreseeable future.

Characteristics and Morphometry

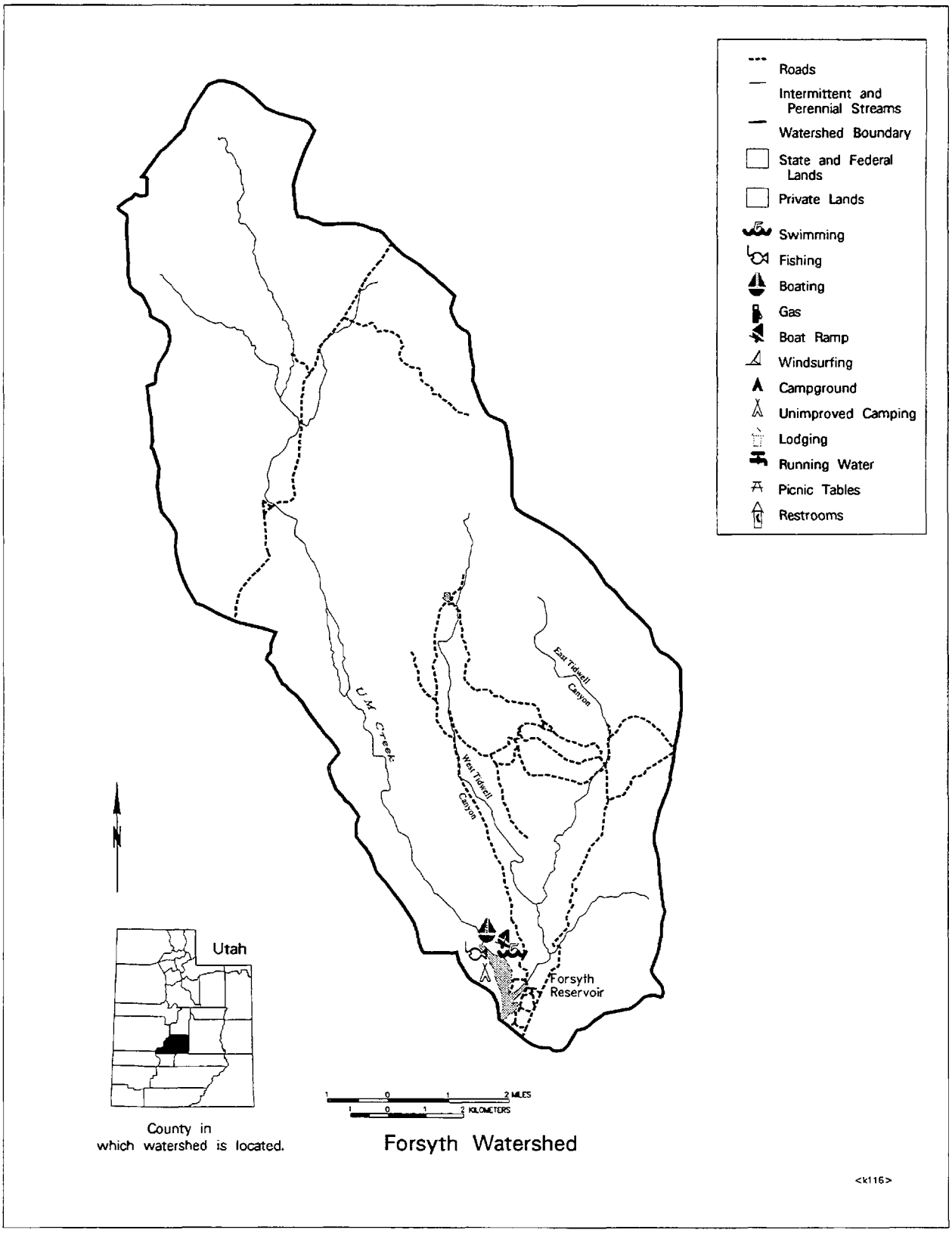
Lake elevation (meters / feet)	2,435 / 7,989
Surface area (hectares / acres)	64 / 158
Watershed area (hectares / acres)	19,374 / 47,872
Volume (m^3 / acre-feet)	
capacity	7,111,139 / 5,765
conservation pool	none
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	24 / 80
mean	8 / 26
Length (km / miles)	2.1 / 1.3
Width (km / miles)	0.5 / 0.3
Shoreline (km / miles)	5.5 / 3.4

Location

County	Sevier
Longitude / Latitude	111 31 53 / 38 31 40
USGS Map	Forsyth Reservoir 1987
DeLorme Atlas	Page 27, A-6
Cataloging Unit	Fremont River (14070003)

Recreation

Forsyth Reservoir is accessible from U-72. From U-24 in the Loa area, go north on U-72 to Fremont Town and


Roads
Intermittent and Perennial Streams
Watershed Boundary
State and Federal Lands
Private Lands
Swimming
Fishing
Boating
Gas
Boat Ramp
Windsurfing
Campground
Unimproved Camping
Lodging
Running Water
Picnic Tables
Restrooms
East Tidwell Canyon
West Tidwell Canyon
Forsyth Reservoir
N
Utah
County in which watershed is located.
1 0 1 2 MILES
1 0 1 2 KILOMETERS
Forsyth Watershed
<k116>

continue north for seven more miles. The reservoir is 1/2 mile west of the highway. The north arm is accessible from FS-018, and the south end from several unpaved roads opposite the FS-206 turnoff. From the north, Forsyth Reservoir is 23 miles south of I-70 on U-72.

The lake offers fishing, boating and primitive camping. Recreational facilities include an unimproved public boat ramp and unimproved campsites. Pack out all of your trash and dispose of human waste in an appropriate manner.

The nearest campground, Elkhorn, is located on the north slope of Thousand Lake Mountain, 7 miles east of Forsyth Reservoir. Go east of FS-206 (the road to Cathedral Valley in Capitol Reef N.P.) from its junction with U-72 for 7 miles, continuing on FS-206 after FS-022 to Cathedral Valley branches to the left. The campground has 6 campsites, vault toilets, and picnic facilities. No fees are charged.

The Inn, an RV park, offers modern facilities in the town of Fremont, 7 miles to the south.

Watershed Description

The reservoir is in an area of rolling ridges and valleys characteristic of the Fish Lake Plateau. U M Creek extends up a long, forested valley to the northwest and East and West Tidwell Canyons to the north. The area around the reservoir is forested with relatively shallow slopes.

The watershed high point, Mount Marvine, is 3,581 m (11,610 ft) above sea level, thereby developing a complex slope of 6.4% to the reservoir. Inflows are Short Creek and U M Creek. The average stream gradient above the reservoir is 2.3% (120 feet per mile). The outflow is U M Creek.

The watershed is composed of high mountains and mountain valleys. The soil is largely of volcanic origin with moderate permeability and moderately slow erosion and runoff. Soil associations are listed in Appendix III.

The vegetation communities are comprised of pine, aspen, mountain mahogany, pinyon-juniper and sage-grass. The watershed receives 41 - 76 cm (16 - 30 inches) of precipitation annually with a frost-free season of 80 - 100 days at the reservoir.

Land use is 95% multiple use land in the Fish lake National Forest, the major use of which is livestock grazing, recreation, and timber harvesting. The remaining 5% is private and State holdings within the forest, which are used primarily for grazing. Land uses have resulted in heavy runoff and substantial soil erosion.

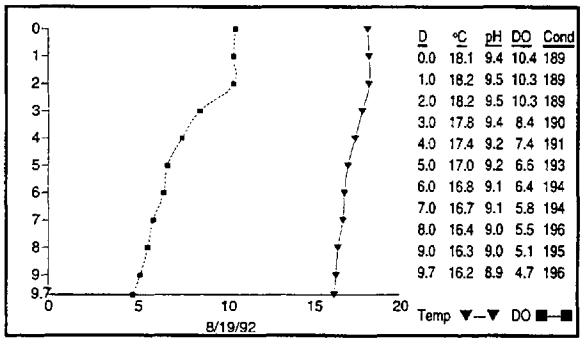
Limnological Assessment

The water quality of Forsyth Reservoir is good. It is considered to be moderately hard with a hardness concentration range from 85-102 mg/L ($CaCO_3$). The only parameter that has exceeded State water quality standards for defined beneficial uses is phosphorus. The average concentration of total phosphorus in the water column in 1980, 1990 and 1992 was 118.5, 87 and 41. All are well over the recommended pollution indicator for phosphorus of 25 ug/L. The phosphorus concentration near the bottom of the lake in July, 1990 exceeded the State pollution indicator with a value of 139 ug/L. Dissolved oxygen concentrations in late summer substantiate with a general decline in dissolved oxygen concentrations the fact that water quality impairments do exist. The reservoir is characterized as a phosphorus limited system. TSI values indicate the reservoir is hypereutrophic except for 1992 when the reservoir was classified as eutrophic. The reservoir typically stratifies if sufficient depth is present. The 1980 summer profile indicates that a thermocline developed at the depth of 2-5 meters with evidence of severe depletions of dissolved oxygen below 5 meters. Although in early summer in 1992 the lake was stratified with a general decline in dissolved oxygen concentrations occurring the profile in August, 1992

Limnological Data

Data averaged from STORET sites: 595595, 595596

Surface Data	1980	1990	1992
Trophic Status	H	H	E
Chlorophyll TSI	-	61.65	59.59
Secchi Depth TSI	61.52	54.16	46.23
Phosphorous TSI	82.57	69.82	52.46
Average TSI	72.04	61.88	52.76
Chlorophyll a (ug/L)	-	23.7	19.2
Transparency (m)	0.9	1.5	2.6
Total Phosphorous (ug/L)	230	95	29
pH	8.1	8.5	9.1
Total Susp. Solids (mg/L)	5	3.9	<3
Total Volatile Solids (mg/L)	-	-	2
Total Residual Solids (mg/L)	-	-	2
Temperature (°C / °f)	19/66	17/63	18/64
Conductivity (umhos.cm)	175	204	179
Water Column Data			
Ammonia (mg/L)	0.48	0.12	<0.05
Nitrate/Nitrite (mg/L)	0.39	0.21	<0.02
Hardness (mg/L)	83	96	89
Alkalinity (mg/L)	85	102	95
Silica (mg/L)	22	-	22.4
Total Phosphorus (ug/L)	118.5	87.0	41.0
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	0.2	3.5	5.7
Stratification (m)	2-5	NO	NO
Depth at Deepest Site (m)	17	5.3	9.7



depicts uniform type conditions typical of a well mixed system. It should be noted at the time there was a maximum depth of under 10 meters.

Historically, the DWR has stocked the reservoir annually with 7,000 fingerling rainbow trout and 3,000 fingerling brook trout. In 1991, the trout became infected with whirling disease, and the reservoir was treated with rotenone in 1992. It has been stocked with wipers, a cross between white bass (*Morone chrysops*) and stripped bass (*Morone saxatilis*) rather than trout until the late 1990's to allow the disease to become extinct.

The reservoir was chemically treated by the DWR to control rough fish competition in 1959 as well as in 1992.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Gloeotrichia echinulata	222.400	94.80
Aphanizomenon flos-aquae	6.127	2.61
Anabaena spiroides var. crassa	5.782	2.46
Stephanodiscus niagarae	0.176	0.08
Pennate diatoms	0.100	0.04
Euglena sp.	0.017	0.01
Total	234.601	
Shannon-Weaver [H']	0.25	
Species Evenness	0.14	
Species Richness [d]	0.19	

As observed the phytoplankton community is dominated by primarily by blue-green algae indicative of fairly poor water quality.

Pollution Assessment

Nonpoint pollution sources are grazing, logging, and recreation.

During the summer, 670 head of cattle graze in the watershed and around the reservoir.

There are several active timber sales in the Sheep Valley area in 1992, with 1,000,000 board feet of aspen being removed from a windstorm area.

There are no point pollution sources in the watershed.

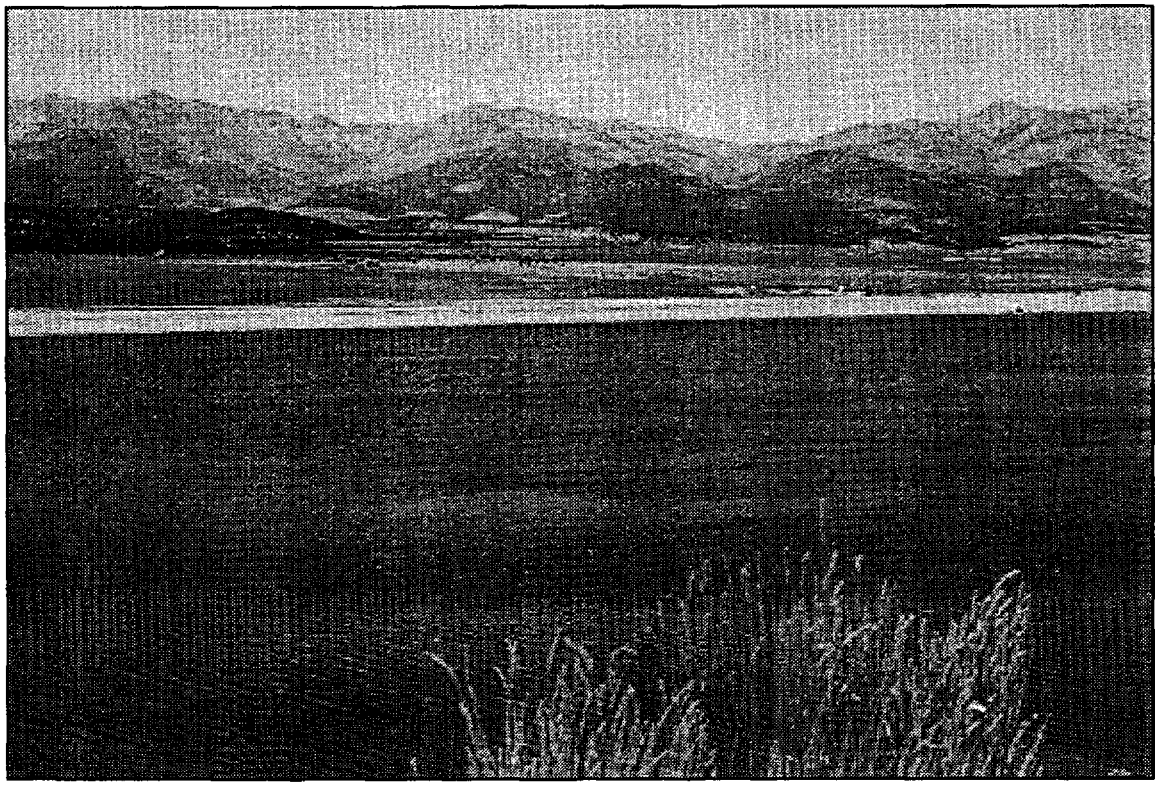
Information

Management Agencies	
Fishlake National Forest	896-9233
Loa Ranger District	836-2811
Six County Government Organization	896-9222
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Panoramaland Travel Region (Richfield)	896-9222
River Inn RV Park (Fremont Town)	836-2715
Reservoir Administrators	
Fremont Irrigation Company	836-2843

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

GRANTSVILLE RESERVOIR



Introduction

Grantsville Reservoir is an intermediate size reservoir at the base of the Stansbury Mountains in western Utah. It is an unusual reservoir in that it is not built in a valley, but is a horseshoe-shaped dam on an alluvial slope. This type of impoundment can be build anywhere, but it requires a tremendous amount of material. Grantsville Reservoir is an off-stream impoundment of several streams on the east slopes of the Stansbury Mountains. It was created in 1984 by the construction of the horseshoe-shaped earth-fill dam. The reservoir shoreline is privately owned, and public access is unrestricted. Reservoir water is used for irrigation, and recreation with no changes foreseen. Water is released from the reservoir into canals for agricultural purposes.

Characteristics and Morphometry

Lake elevation (meters / feet)	1,532 / 5,026
Surface area (hectares / acres)	35.6 / 88
Watershed area (hectares / acres)	777.3 / 1920
Volume (m^3 / acre-feet)	
capacity	4.157×10^6 / 3,370
conservation pool	617,000 / 500
Annual inflow (m^3 / acre-feet)	3.54×10^6 / 2,870
Retention time (years)	1.2
Drawdown (m^3 / acre-feet)	13 / 43
Depth (meters / feet)	
maximum	19 / 63
mean	15 / 50
Length (meters / feet)	1,000 / 3,300
Width (meters / feet)	550 / 1,800
Shoreline (km / miles)	2.6 / 1.6

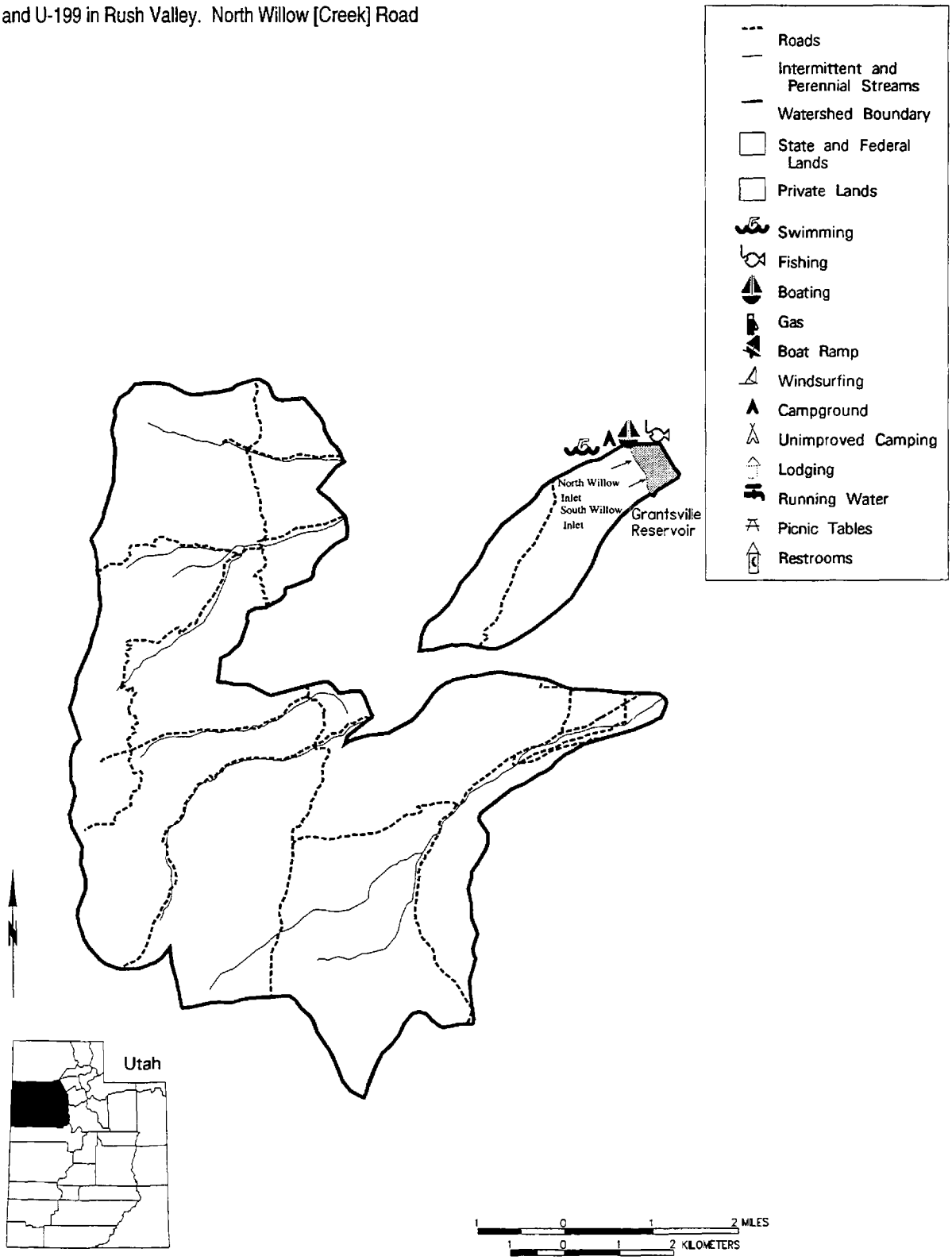
Location

County	Tooele
Longitude / Latitude	112 30 13 / 40 32 32
USGS Map (Reservoir not on map)	North Willow Creek 1985
DeLorme's Utah Atlas & Gazetteer™	Page 52 C-2
Cataloging Unit	Rush/Tooele Valleys (16020304)

Recreation

Grantsville Reservoir is accessible from the Grantsville-Rush Valley Road, a paved road running south from Grantsville along the west side of the Tooele Army to St.

John and U-199 in Rush Valley. North Willow [Creek] Road



County in which watershed is located.

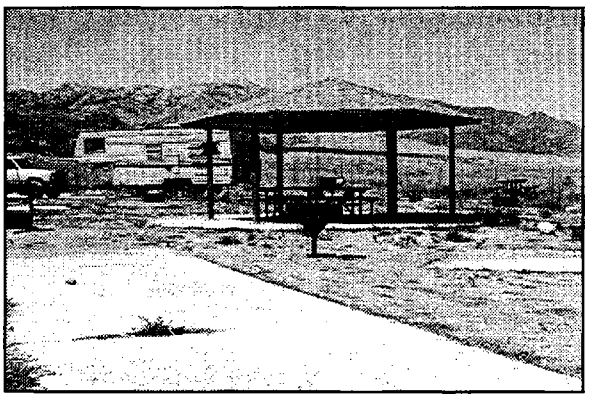
Grantsville Watershed

<k81>

(gravel) runs due west from the Grantsville-RushValley Road, 4 miles south of U-138 in Grantsville and about 1.3 miles north of South Willow [Creek] Road. Grantsville Reservoir is 1/2 miles west of the intersection and 1/4 mile south of North Willow Road.

Fishing is the only recreational use of the reservoir. Although the reservoir has a maximum depth of 19 meters, there is usually a 20 foot deep pool that remains throughout the year, to provide for fish habitat. Gas powered boats are not allowed on the reservoir, but electric boats are permitted. The reservoir has no particular scenic value, although the Stansbury Mountains provide a spectacular backdrop.

Tooele County built a campground immediately west of the reservoir in the summer of 1993. They have 10 acres of land with trees and privies. The campground is accessible from North Willow Road.



There are also some USFS campgrounds in South Willow Creek, including South Willow Campground, Lower Narrows and Upper Narrows and North Willow Canyon.. South Willow Canyon is the primary trailhead for hiking in the Deseret Peak Wilderness Area, part of the Grantsville Reservoir watershed.

Watershed Description

Grantsville Reservoir is an off-stream impoundment on the east face of the Stansbury Mountains. The reservoir is located about a mile east of the base of the mountains on a sloping alluvial plain (made up of sediments carried out of the mountains during heavy rains). The streams begin in high mountains, where the watershed is part of the Deseret Peak Wilderness. The headwaters were glaciated, and now contain several cirque lakes. The natural flow of the streams is to cascade down the mountainsides and out onto the alluvial plains, where they evaporate and are soaked into the ground. Grantsville Reservoir was constructed to capture the stream water before it soaks into the ground, and store it for agricultural uses. The clear mountains streams are piped from the diversions to the reservoir. There is also a small natural watershed of the lower foothills and alluvial slopes, but this watershed only contributes runoff in heavy rains.

The watershed high point, Deseret Peak, is 3,362 m (11,031 ft) above sea level, thereby developing a complex slope of 16.7% to the reservoir. The inflows, from north to south, include Davenport Creek (piped from the National Forest boundary), North Willow Creek (piped from the National Forest Boundary), Left Fork North Willow Creek (piped from about 7,500 elevation), Miners Fork and South Willow Creek (each piped from shortly above their confluence), and Box Elder Creek (piped from the alluvial slopes). The average stream gradient above the pipe intakes is 14% (739 feet per mile). The outlet is an irrigation pipe or canal.

The watershed is made up of high mountains, barren outcroppings and alluvial plains. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities have not been determined, but probably consist of sagebrush-grass, pinyon-juniper, oak-maple, spruce-fir, pine, aspen, and alpine. The watershed receives 30 - 102 cm (12 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 160 -180 days per year.

Land use is native grazing on the private lands (about 15%), and multiple use on the BLM and USFS lands (about 85%). The area above the reservoir is used for intensive recreation, and the high mountains are also used for recreation.

Limnological Assessment

The water quality of Grantsville Reservoir is very good. It is considered to be moderately hard with a hardness concentration value of approximately 109 mg/L ($CaCO_3$). The only parameter that has exceeded State water quality standards for defined beneficial uses is phosphorus. Although the average concentration of total phosphorus in the water column in 1989 and 1991 was 14.1 and 21.5 ug/L which does not exceed the recommended pollution indicator for phosphorus of 25 ug/L, the phosphorus concentration in the epilimnion in August, 1991 reached a level of 35 ug/L. It is apparent that the overall concentration of total phosphorus in the reservoir is having no impact on its defined beneficial uses. Dissolved oxygen concentrations in late summer are relatively good throughout the water column and indicate no water quality impairments exist. The reservoir has been characterized as a nitrogen limited system. The reservoir is currently fairly productive. This is not atypical for newly created reservoirs which usually exhibit a fairly high state of production during the period immediately after impoundment. TSI values indicate the reservoir is mesotrophic. Being a

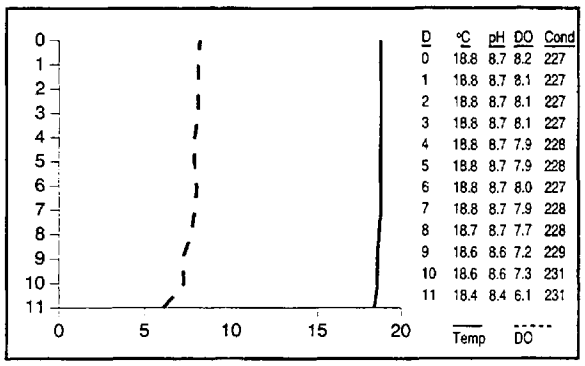
Limnological Data

Data sampled from STORET site: 596087

Surface Data	**1989**	**1991**
Trophic Status	M	M
Chlorophyll TSI	45.57	50.43
Secchi Depth TSI	40.76	45.42
Phosphorous TSI	44.57	51.41
Average TSI	43.63	49.08
Chlorophyll a (ug/L)	4.6	7.5
Transparency (m)	3.8	2.75
Total Phosphorous (ug/L)	17	27
pH	8.4	8.6
Total Susp. Solids (mg/L)	<3*	8.0
Total Volatile Solids (mg/L)	-	8.0
Total Residual Solids (mg/L)	-	7
Temperature (°C / °f)	15/59	16/60
Conductivity (umhos.cm)	295	256
Water Column Data		
Ammonia (mg/L)	0.64	0.03
Nitrate/Nitrite (mg/L)	-	0.24
Hardness (mg/L)	103*	115
Alkalinity (mg/L)	99*	104
Silica (mg/L)	-	7.0
Total Phosphorus (ug/L)	15	22
Miscellaneous Data		
Limiting Nutrient	P	N
DO (Mg/l) at 75% depth	8.3	7.6
Stratification (m)	NO	NO
Depth at Deepest Site (m)	3.5	11.0

* Period 1 Data Only

new reservoir it will be necessary to obtain more data to determine the long term trend information for the reservoir. No stratification was present during regularly scheduled monitoring trips. The August 6, 1991 profile indicate that the temperature of the water column was uniform from top to bottom with an average temperature of 18-19 degrees C and



D	°C	pH	DO	Cond
0	18.8	8.7	8.2	227
1	18.8	8.7	8.1	227
2	18.8	8.7	8.1	227
3	18.8	8.7	8.1	227
4	18.8	8.7	7.9	228
5	18.8	8.7	7.9	228
6	18.8	8.7	8.0	227
7	18.8	8.7	7.9	228
8	18.7	8.7	7.7	228
9	18.6	8.6	7.2	229
10	18.6	8.6	7.3	231
11	18.4	8.4	6.1	231

that an adequate concentration of dissolved oxygen was present to sustain a viable fishery. According to DWR no fish kills have been reported in recent years.

The DWR stocks the reservoir with about 12,000 catchable Rainbow Trout in the spring and 1,000 in the fall. The 20 foot depth (500 acre-feet) conservation pool allows fish to live in the reservoir year round.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Fragilaria crotonensis	115.681	74.67
Sphaerocystis schroeteri	26.410	17.05
Stephanodiscus niagarae	12.671	8.18
Dinobryon divergens	0.125	0.08
Microcystis incerta	0.011	0.01
Ankistrodesmus falcatus	0.009	0.01
Pennate Diatoms	0.007	0.00
Centric Diatoms	0.003	0.00
Total	154.917	
Shannon-Weaver Index [H']	0.73	
Species Evenness	0.35	
Species Richness	0.27	

There is a lot of flora diversity with diatoms and green algae dominating the phytoplankton community. They are also indicative of lower productive waters.

Pollution Assessment

Nonpoint pollution sources include grazing, unreclaimed mines, and recreation.

There is a problem with overgrazing upstream from the Box Elder Creek intake, resulting in silty, turbid water being piped into the reservoir. The irrigation company would like to solve this problem by moving the pipe intake up into the mountains.

Cattle graze heavily on the alluvial slopes, and use the reservoir as a source of drinking water. This results in nutrient loading, soil compaction and increased sedimentation, and is likely a primary cause of eutrophication in the reservoir.

There are no point sources of pollution in the watershed.

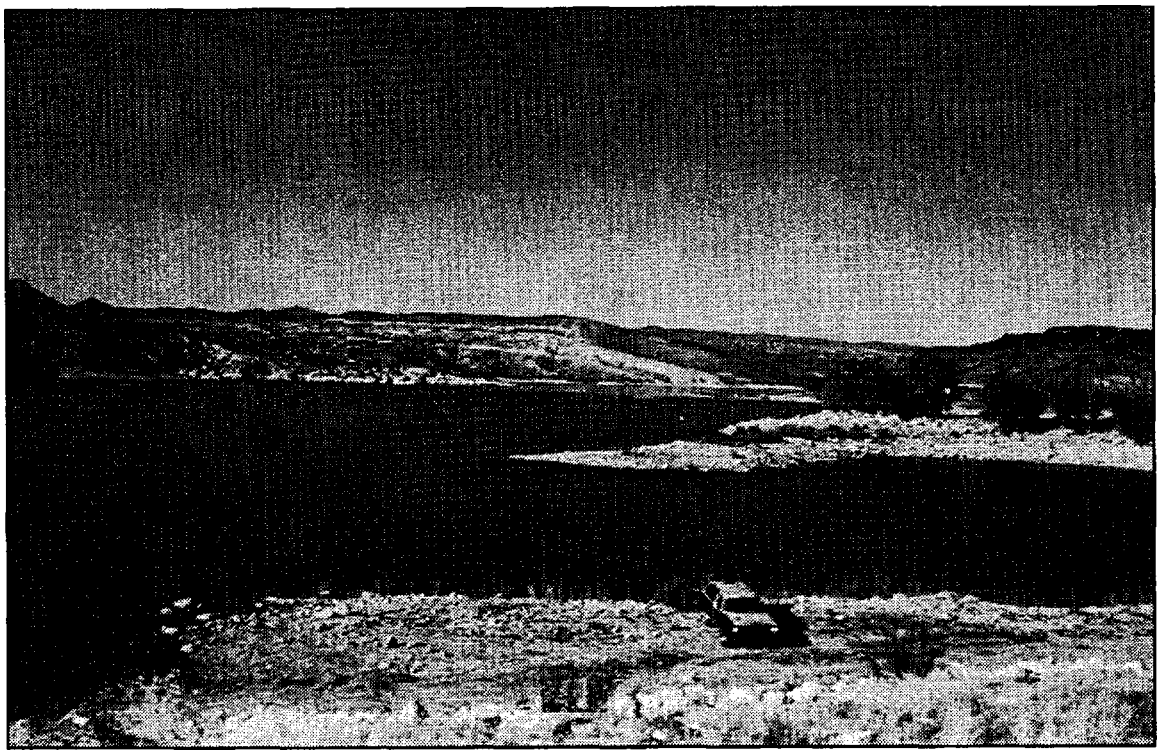
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Wasatch Front Regional Council	292-4469
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Great Salt Lake Country Travel Region (SLC)	896-9222
Tooele Chamber of Commerce	882-0690
Reservoir Administrators	
Grantsville Irrigation Company	884-3451

GUNLOCK RESERVOIR



Introduction

Gunlock Reservoir is an intermediate size impoundment of the Santa Clara River in extreme southwestern Utah. A warm water fishery, it is known for Bass and Crappie fishing. It is the site of an undeveloped state park The reservoir was created in 1970 by the construction of an earth-fill dam.

The shoreline is owned by the State of Utah with unrestricted public access. Water is consumed for agricultural uses, but also used for recreation and warmwater aquatic habitat. Some of the water use may change to culinary if the St. George is unsuccessful in developing other water storage facilities.

Characteristics and Morphometry

Lake elevation (meters / feet)	1,092 / 3,584
Surface area (hectares / acres)	108 / 266
Watershed area (hectares / acres)	76,400 / 189,000
Volume (m^3 / acre-feet)	
capacity	2.5510×10^7 / 20,680
conservation pool	2.837×10^6 / 2,300
Annual inflow (m^3 / acre-feet)	4.9×10^6 / 4,000
Retention time (years)	5
Drawdown (m^3 / acre-feet)	4,934,008 / 4,000
Depth (meters / feet)	
maximum	35 / 115
mean	23 / 77
Length (km / miles)	2.9 / 1.8
Width (km / miles)	1.2 / .7
Shoreline (km / miles)	8.2 / 5.1

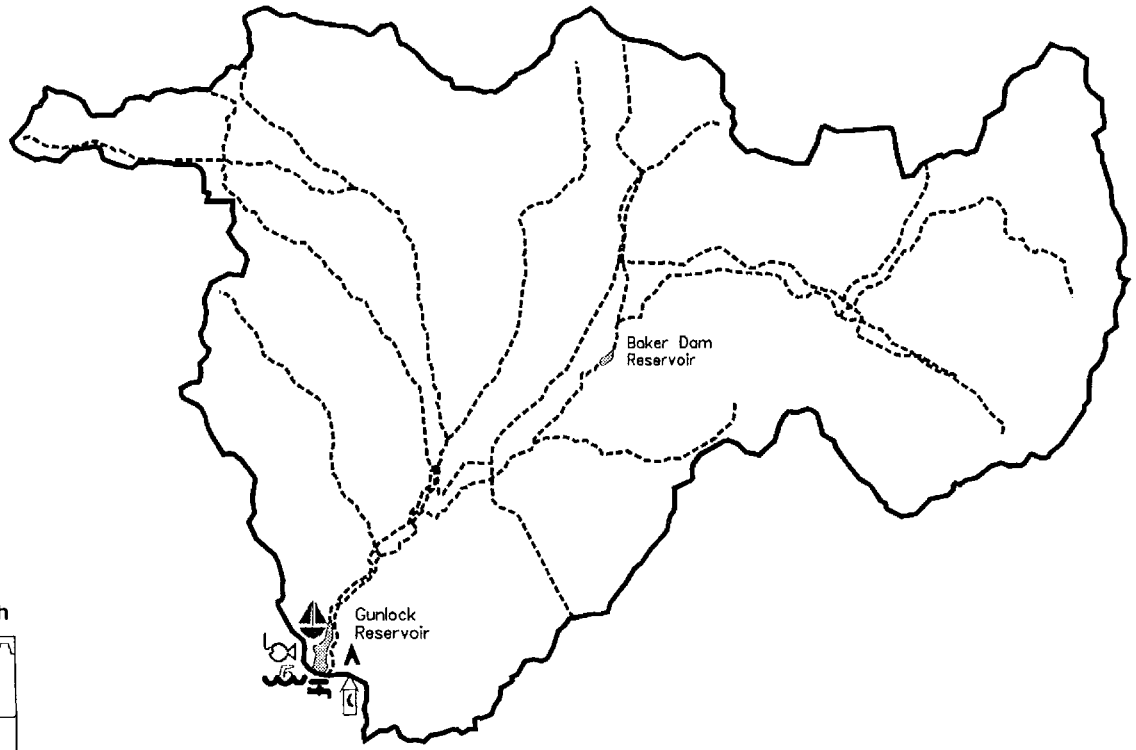
Location

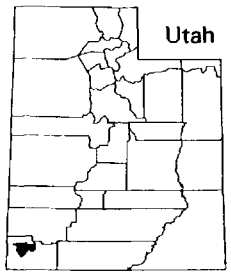
County	Washington
Longitude / Latitude	113 46 28 / 37 15 30
USGS Map	Gunlock 1972
DeLorme's Utah Atlas and Gazetteer	Page 16, C-3
Cataloging Unit	Upper Virgin (15010008)

Recreation

Gunlock Reservoir is located about 20 miles northwest of St. George. Access from the south is via old US-91 to the Paiute Indian Reservation (the town of Shivwits) and north for five miles to Gunlock. From the north, travel south on the Legacy Loop Highway (U-18) to Veyo, then southwest to Gunlock. All access routes are paved.

The area offers many recreational opportunities, including fishing, boating, camping, and swimming. Because of the low elevation and southern location, winter temperatures are mild, extending the water recreation





County in which watershed is located.

Gunlock Watershed

<k151>

season into the spring and fall.

Gunlock State Park encompasses the reservoir. Gunlock Reservoir has high recreational use pressures. Although there is a Utah State Park established at the south end, recreational facilities are limited. There is a boat ramp, parking, picnic tables, campgrounds, and restroom facilities. Boating, fishing, waterskiing, and swimming are all common activities on the reservoir, along with a minimal amount of windsurfing. There is an annual two day speed racing event which draws approximately 1000 visitors.

Watershed Description

Gunlock Reservoir is the second and largest of the three major reservoirs on the Santa Clara River. It is located west of the Red Mountains, which terminate in a spectacular lava-capped Navajo Sandstone cliff.

The watershed high point, Signal Peak, is 3,159 m (10,365 ft) above sea level, thereby developing a complex slope of 7.8% to the reservoir. The inflow and outflow is the Santa Clara River. The average stream gradient above the reservoir is 4.7% (248 feet per mile).

The watershed is made up of alluvial fans, mesas, floodplains, upland plains, terraces, mountains, plateaus, undulating uplands, and rockland. The soil associations that compose the watershed are found in Appendix III.

The vegetation communities are comprised of shadscale, greasewood, saltbrush, sage-grass, bitterbrush-mountain mahogany, pinyon-juniper, mahogany, grass-forbs, pine, aspen, spruce-fir, oak, and maple. The watershed receives 25 - 76 cm (10 - 30 inches) of precipitation annually with a frost-free season of 180 - 200 days at the reservoir.

Land use is multiple use (94%), pasture (3%), cropland (3%) and urban (<1%). The major use of the watershed is livestock grazing.

Limnological Assessment

The water quality of Gunlock Reservoir is very good. It is considered soft water with a hardness concentration of approximately 200 mg/L ($CaCO_3$). The only parameter that exceeds State standards is dissolved oxygen. All other parameters including total metals obtained near the bottom at the deep sites were within State standards for defined beneficial uses. Average total phosphorus levels have not exceeded the State pollution indicator for phosphorus of 25 ug/L. However, on a rare occasion total phosphorus values exceeded the indicator at an individual point in the water column. Phosphorus concentrations averaged 11 and 18 ug/L in 1989 and 1991. These values are well below the state indicator. Nutrients throughout the water column are typically not a problem. However it should be noted that during this period of sampling anoxic conditions were resent near the bottom as depicted by the August 7, 1991 profile. Anoxic conditions permit the reintroduction of phosphorus stored in the sediments back into the water column and

Limnological Data

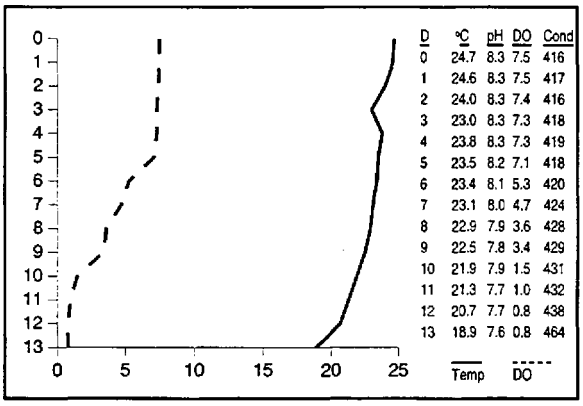
Data averaged from STORET sites: 495051, 495052

Surface Data	1981	1989	1991
Trophic Status	E	M	M
Chlorophyll TSI	-	42.87	37.98
Secchi Depth TSI	-	48.06	41.98
Phosphorous TSI	-	36.48	46.97
Average TSI	51.95	42.47	42.31
Chlorophyll a (ug/L)	-	3.5	2.2
Transparency (m)	.5	2.3	3.1
Total Phosphorous (ug/L)	50	10	15
pH	-	7.9	8.4
Total Susp. Solids (mg/L)	44	-	<3
Total Volatile Solids (mg/L)	-	-	7
Total Residual Solids (mg/L)	-	0	0
Temperature (°C / °f)	21/71	22/71	21/69
Conductivity (umhos.cm)	1500	466	444
Water Column Data			
Ammonia (mg/L)	-	0.04	0.04
Nitrate/Nitrite (mg/L)	0.2	-	<0.01
Hardness (mg/L)	380	-	207
Alkalinity (mg/L)	-	-	182
Silica (mg/L)	-	-	24.8
Total Phosphorous (ug/L)	-	11	18
Miscellaneous Data			
Limiting Nutrient	-	N	N
DO (Mg/l) at 75% depth	6.5	1.1	2.0
Stratification (m)	5-6	8-14	12-13
Depth at Deepest Site (m)	28	14	13

reduce the available habitat for a viable fishery. No stratification was present at that time. Data throughout the study period indicates that the lake is nitrogen limited with N/P ratios usually less that 5. Although the lake was reported as eutrophic in 1981, it appears that it is barely mesotrophic in 1989 and 1991. It appears that the trophic status for the lake has stabilized and is fairly low in productivity. Macrophytes are typically not present and are not a problem.

The types of fish present in Gunlock Reservoir as recorded by the Division of Wildlife Resources in 1973 were Mountain Suckers (Catostomus platyrhynchus), Virgin River Spinedace (*Lepidomeda mollispinis*), Largemouth Bass (*Micropterus salmoides*), Black Crappie (*Pomoxis nigromaculatus*), and Bluegill (*Lepomis macrochirus*). Also noted as present golden shiners (*Notemigonus crysoleucus*), green sunfish (*Lepomis cyanellus*), and carp (*Cyprinus carpio*). There is also an abundant crayfish population present. DWR currently stocks the reservoir with fingerling largemouth bass. No fishkills have been reported according to DWR.

The reservoir has not been chemically treated by the DWR to control rough fish competition, so the reservoir may include original fish populations of the Santa Clara River.



D	°C	pH	DO	Cond
0	24.7	8.3	7.5	416
1	24.6	8.3	7.5	417
2	24.0	8.3	7.4	416
3	23.0	8.3	7.3	418
4	23.8	8.3	7.3	419
5	23.5	8.2	7.1	418
6	23.4	8.1	5.3	420
7	23.1	8.0	4.7	424
8	22.9	7.9	3.6	428
9	22.5	7.8	3.4	429
10	21.9	7.9	1.5	431
11	21.3	7.7	1.0	432
12	20.7	7.7	0.8	438
13	18.9	7.6	0.8	464

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Sp.	Cell Volume% (mm³/liter)	Density By Volume
Sphaerocystis schroeteri	2.641	58.09
Fragilaria crotonensis	0.916	20.15
Dinobryon divergens	0.699	15.38
Chrysocapsa planktonica	0.111	2.45
Ankistrodesmus falcatus	0.074	1.63
Wislouchiella planktonica	0.033	0.73
Oocystis borgei	0.022	0.49
Oocystis sp.	0.016	0.37
Scenedesmus bijuga	0.016	0.34
Pennate diatoms	0.013	0.29
Centric diatoms	0.003	0.07
Total	4.444	
Shannon-Weaver [H']	1.21	
Species Evenness	0.50	
Species Richness [d]	0.45	

The flora is quite diverse, dominated by green algae, diatoms, and gold algae. Such diversity indicates a healthy aquatic ecosystem. Biomass is not great enough to be a problem.

Pollution Assessment

Nonpoint pollution sources are grazing, feed lot runoff and other agricultural activities, recreation, and urban runoff.

Cattle graze in the watershed and around the reservoir. There are no point pollution sources in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: culinary (1A), recreational bathing (swimming) (2A) (proposed), boating and similar recreation (excluding swimming) (2B), warm water game fish and organisms in their food chain (3B) and agricultural uses (4).

Information

Management Agencies	
Bureau of Land Management	539-4001
Dixie Resource Area (St. George)	673-4654
Five County Association of Governments	673-3548
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Color Country Travel Region (St. George)	628-4171
Saint George Area Chamber of Commerce	628-1658
Utah Parks and Recreation	538-7722
Gunlock State Park	No Phone
Reservoir Administrators	
Washington County Water Conservation District	673-3617
Lower Gunlock Reservoir Corporation	673-2566

GUNNISON BEND RESERVOIR

Introduction

Gunnison Bend Reservoir is a moderate sized reservoir in the eastern Sevier Desert immediately downstream from Delta, Utah. The reservoir is an impoundment of a large horseshoe bend in the river valley. It is the last impoundment of the Sevier River. Much of the water has been removed by upstream users, and all of the remaining water is removed for irrigation at Gunnison Bend. The last time water flowed into the river below the reservoir was during the 1983 flood, which also washed out the dam. It was rebuilt in 1984.

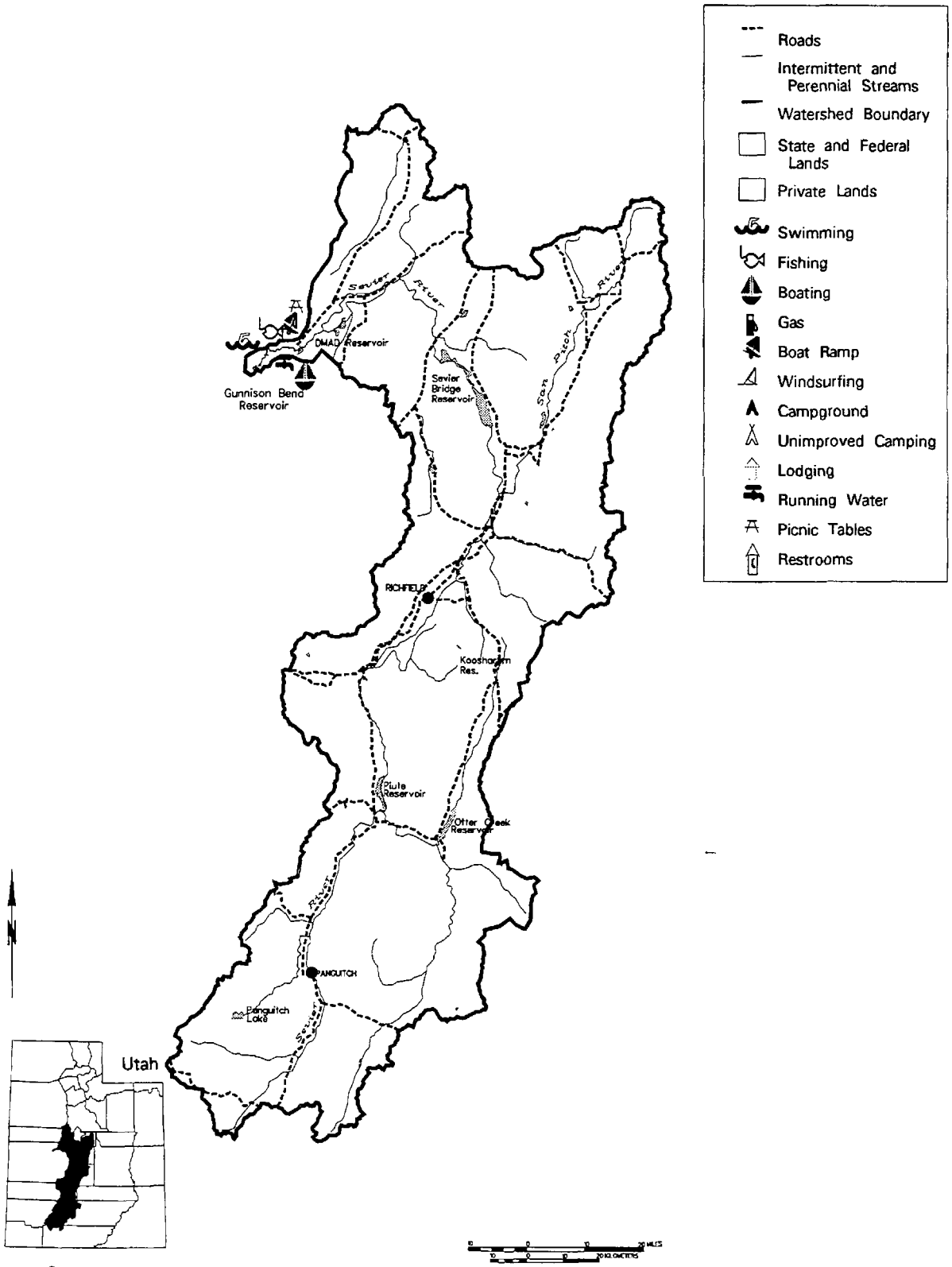
Characteristics and Morphometry

Lake elevation (meters / feet)	1,408 / 4,619
Surface area (hectares / acres)	285 / 706
Watershed area (km^2 / $miles^2$)	13,913 / 5,372
Volume (m^3 / acre-feet)	
capacity	6,170,000 / 5,000
conservation pool	None
Annual inflow (m^3 / acre-feet)	unknown
Retention time	weekly (in summer)
Drawdown (m^3 / acre-feet)	3 / 9
Depth (meters / feet)	
maximum	7 / 24
mean	3 / 9
Length (km / miles)	3.1 / 1.9
Width (km / miles)	0.76 / 0.47
Shoreline (km / miles)	10.3 / 6.4

Location

County	Millard
Longitude / Latitude	112 37 07 / 39 21 03
USGS Map	Delta 1986, Hinckley 1986
DeLorme's Utah Atlas & Gazetteer™	Page 36, A-2
Cataloging Unit	Lower Sevier (16030005)

Gunnison Bend Reservoir was created in 1895 by the construction of an earth-fill dam. The reservoir shoreline is almost entirely privately owned, with BLM land on the western tip of the peninsula and in the northeast corner of the lake. The shore is about 89% privately owned. Public access is restricted to public lands.



County near which watershed is located.

Gunnison Bend Watershed

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Visitors are encouraged to be sensitive to the desires of private landowners.

Recreation

Gunnison Bend Reservoir is west of Delta on US-6. The simplest access is directly west of Delta--cross the railroad tracks on the viaduct, and continue straight ahead (due west) to the reservoir (this requires a right turn, continuing on a county road as US-6 bends south, then a left turn to continue on a smaller road as the county road bends north).

Other access is from the south, on US-6 just west of the Sevier River bridge. This road leads to the peninsula and up the west side of the reservoir to the county park. There is a golf course south of the reservoir.

The lake is used for fishing, swimming, boating, waterskiing and picnicking. Usage is fairly heavy. The county park on the west side of the lake has a sanded beach, a boat ramp, and picnic areas. There are several RV Parks in Delta (see info box).

Watershed Description

Gunnison Bend Reservoir is an impoundment of the Sevier River Valley, a serpentine channel cut through alluvial deposits on the desert floor. The valley is about 1/2 mile wide and 80' deep. The reservoir impounds a segment of the valley about 2.5 miles long, but due to meandering the distance from the top of the reservoir to the dam is only about 1.5 miles.

The watershed covers the entire Sevier River Drainage, from The Paunsaugunt and Markagunt Plateaus in the south, the west face of the Escalante Mountains, the Awapa Plateau, the Sevier Plateau, the east slopes of the Tushars and Pavant Ranges, the San Pitch Mountains, and the east face of the Wasatch Plateau. Everything from Bryce Canyon N.P. to Nephi drains into Gunnison Bend.

The watershed high point, Delano Peak in the Tushar Mountains, is 3,709 m (12,167 ft) above sea level, thereby developing a complex slope of 2.0% to the reservoir. The inflow is the Sevier River. There are several outlets from the reservoir: Abraham Canal, Hinckley High Ditch, Lowline Canal, and occasionally, the Sevier River channel. The average stream gradient above the reservoir is 0.02% (8 feet per mile).

The watershed contains substantial amounts of all the major soil types found in the state. See Appendix III for soil composition data.

The vegetation communities consist of pine, spruce-fir, aspen, oak-maple, pinyon-juniper, sagebrush-grass, bitterbrush, shadscale, and greasewood. The watershed receives 20 - 102 cm (8 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 140 - 160 days per year.

The largest use of land in the watershed is multiple use land (69.6%). These lands are administered by the BLM, USFS, and the State of Utah. Grazing, recreation, and limited logging occur on many areas of these lands. Native grazing (mostly cattle and sheep) comprise 18.5% of the watershed. Irrigated cropland (7.2%), pasture and hayfields (4.1%), wildlife (3.5%), urban (0.7%), and recreation (0.05%) make up the remainder of the watershed. The majority of the watershed is used for livestock grazing.

Limnological Assessment

Before the Sevier River was dammed, the river emptied into Sevier Lake, about 30 miles southwest of Delta, where the water subsequently evaporated. Because of the high evaporative potential of the river flowing across the desert, many constituents in the water become increasingly concentrated. This is not as apparent in the upper reaches of the river, but when water reaches Delta, it is very hard and nutrient-rich. Total dissolved solids are very high. Gunnison Bend Reservoir is only slightly upstream from Sevier Lake, and typically it loses much water to evaporation.

Gunnison Bend Reservoir is used as a storage reservoir for the Delta area. During the growing season, water is released from the Sevier Bridge Reservoir and stored in Gunnison Bend or the DMAD. During the irrigation season, the retention time is only 2-3 days, mitigating the problem of high evaporation rates. The water level can go up and down several times during the summer.

The water quality of Gunnison Bend Reservoir is good It is considered to be very hard with a hardness concentration range in excess of 400 mg/L ($CaCO_3$).

Gunnison Bend Reservoir is in compliance with all parameters except total Phosphorous. The State Pollution Indicator level is 0.025 mg/l, and the reservoir averages 0.063 mg/l. This has a negative effect on aquatic life, but does not impair water use for irrigation or industrial cooling.

The reservoir never stratifies as indicated in the September 8, 1992 profile due to insufficient depth and is a nitrogen limited system. TSI values are consistently over 60 and indicate that the system is hypereutropic. Productivity appears to be reduced which may result from higher turbidity and alkalinity. Macrophytes do not appear to be a problem but they are present in the littoral areas of the reservoir.

Because of the vast size of the watershed, it is unlikely that any specific measures can be done to reduce phosphorous inputs. Upstream reservoirs are also plagued with eutrophism. Water quality improvement projects in various portions of the watershed will help, but given the concentrated nature of chemicals in the lower river, it is unlikely the reservoir will come into compliance in the near

Limnological Data

Data averaged from STORET sites: 494123, 494124, 494125

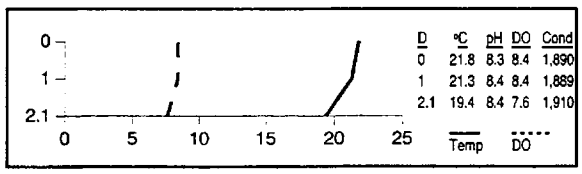
Surface Data	1979	1990	1992
Trophic Status	H	H	H
Chlorophyll TSI	-	45.20	44.55
Secchi Depth TSI	69.99	79.57	80.81
Phosphorous TSI	71.16	67.46	56.65
Average TSI	70.58	64.08	60.68
Chlorophyll a (ug/L)	-	4.8	4.8
Transparency (m)	0.5	0.3	0.2
Total Phosphorous (ug/L)	20	80	42
pH	8.4	8.4	8.3
Total Susp. Solids (mg/L)	-	39	44
Total Volatile Solids (mg/L)	-	-	8
Total Residual Solids (mg/L)	-	-	36
Temperature (°C / °f)	17/63	20/68	20/68
Conductivity (umhos.cm)	1700	1735	1693
Water Column Data			
Ammonia (mg/L)	0.05	0.04	0.05
Nitrate/Nitrite (mg/L)	0.18	-	0.16
Hardness (mg/L)	417	491	425
Alkalinity (mg/L)	226	281	240
Silica (mg/L)	-	-	20.8
Total Phosphorous (ug/L)	55	78	46
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	6	7.0	7.0
Stratification (m)	NO	NO	NO
Depth at Deepest Site (m)	3	2.4	2.1

future.

Gunnison Bend Reservoir is stocked with 20,000 Channel Catfish (*Ictalurus punctatus*) every third year by the DWR. The reservoir is known to contain walleye (*Stizostedion vitreum*), bluegill (*Lepomis macrochirus*), yellow perch (*Perca flavescens*), carp (*Cyprinus carpio*), white bass (*Morone chrysops*) white crappie (*Pomoxis annularis*) and largemouth bass (*Micropterus salmoides*). The reservoir has not been chemically treated to control rough fish competition.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm³/liter)	% Density By Volume
Sphaerocystis schroeteri	10.564	64.07
Pennate diatoms	2.246	13.62
Gomphospheria aponina	1.237	7.50
Cosmarium sp.	0.623	3.78
Coelastrum sp.	0.556	3.37
Scenedesmus quadricauda var. quadrispina	0.489	2.97
Centric diatoms	0.160	0.97
Chlamydomonas sp.	0.158	0.96
Oocystis sp.	0.102	0.62
Unknown Spherical green alga	0.089	0.54
Dinobryon divergens	0.086	0.52
Ankistrodesmus falcatus	0.079	0.48
Closteriopsis longissima var. tropica	0.067	0.40
Scenedesmus bijuga	0.033	0.20
Total	16.487	
Shannon-Weaver [H']	1.33	
Species Evenness	0.50	
Species Richness	0.55	



The phytoplankton community is dominated by green algae and diatoms but there is one species of blue-green algae with some significance. This composition is supportive of fairly good water quality. It should be noted that the high alkalinity and hardness concentrations that productivity may limiting the productivity.

Pollution Assessment

All common sources of nonpoint pollution found in the state are present, including logging, grazing, agricultural operations (feedlots, dairies, and agricultural runoff), urban areas, recreation, mining, and transportation runoff. The effects of most of these are mitigated by long river distances and upstream reservoirs.

The area around the reservoir is comprised of residential and agricultural areas. These land uses impact the reservoir through increased sedimentation, irrigation runoff, dairy operations, feedlot operations, urban runoff, and possibly septic tanks.

The only point source of pollution in the near watershed is the Ash Grove Cement Plant near Leamington which discharges into the Fillmore Canal.

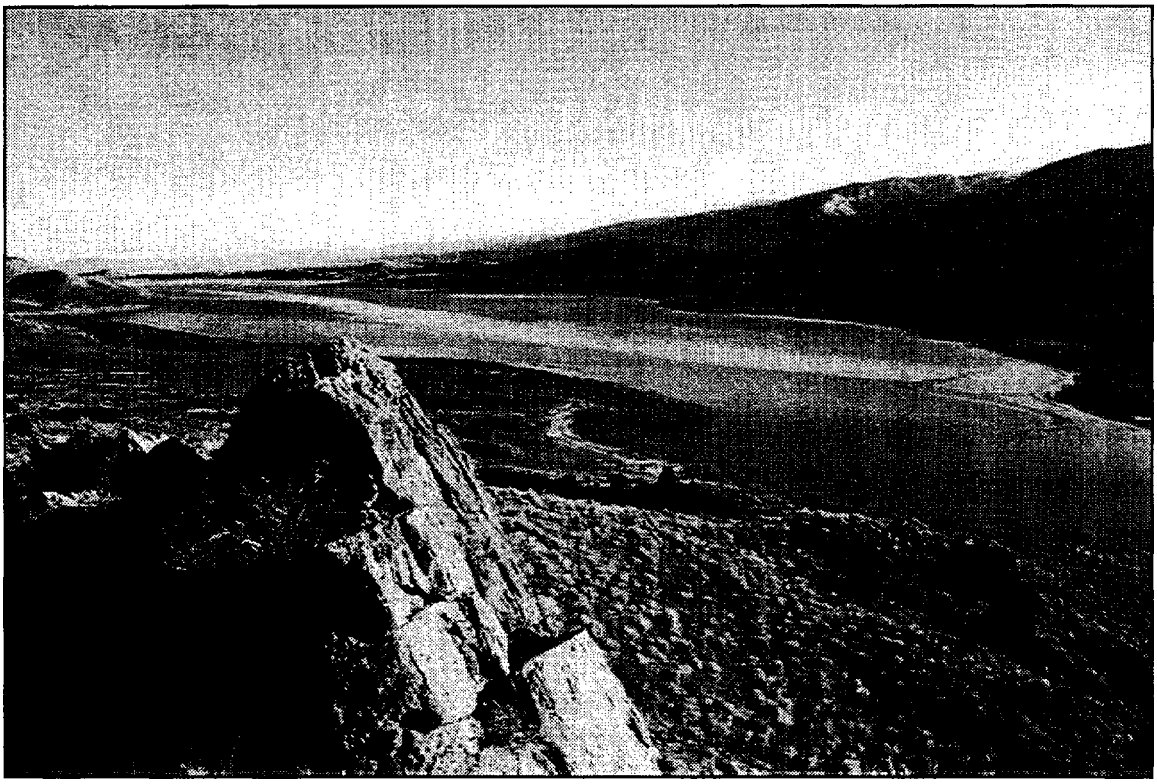
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), warm water game fish and organisms in their food chain (3B) and agricultural uses (4).

Information

Management Agencies	
Bureau of Land Management	539-4001
House Range Resource Area (Fillmore)	743-6811
Six County Commissioners Association	896-9222
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Panoramaland Travel Region (Richfield)	896-9222
Delta Chamber of Commerce	864-4316
Millard County Parks and Recreation	
West Delta RV Park	864-2212
B Kitten Clean Trailer Park	864-2614
Reservoir Administrators	
D.M.A.D. Company	864-2494

GUNNISON RESERVOIR



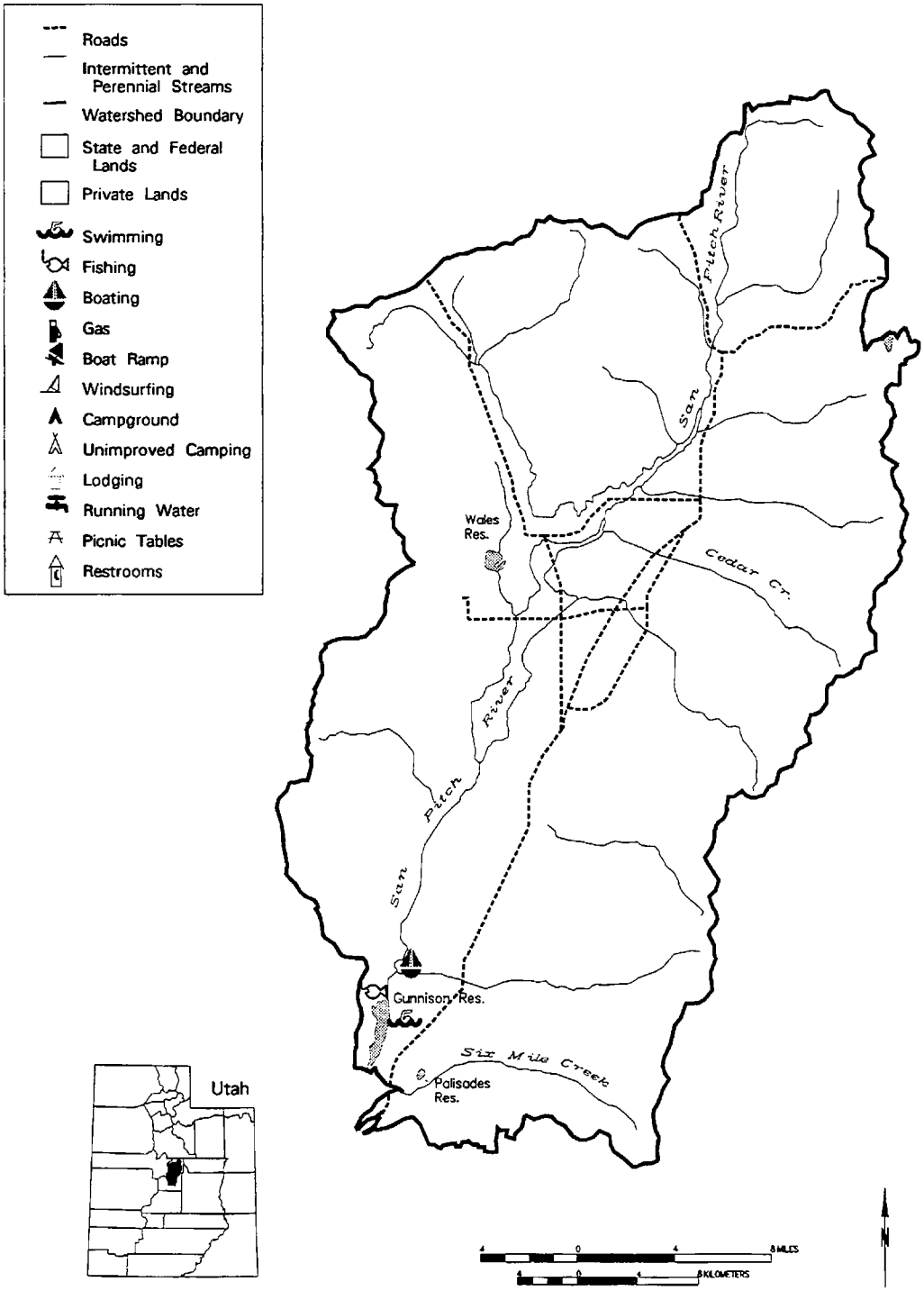
Introduction

Gunnison Reservoir is an large reservoir at the south end of the Sanpete Valley in Central Utah. It is a shallow impoundment of the San Pitch River, upstream from Gunnison and west of Manti, between the Wasatch Plateau and the San Pitch Mountains. In dry years, such as 1992, it is drained. It is also known as Sugar Kids Pond.

Characteristics and Morphometry	
Lake elevation (meters / feet)	1,643 / 5,390
Surface area (hectares / acres)	521 / 1,287
Watershed area (hectares / acres)	174,158 / 430,343
Volume (m^3 / acre-feet)	
capacity	22,470,000 / 18,218
conservation pool	none
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	8.5 / 28
mean	4.8 / 15
Length (meters / miles)	6000 / 19,536
Width (km / miles)	1.600 / 1.03
Shoreline (km / miles)	15.6 / 9.7

Gunnison Reservoir was created in 1889 by the construction of an earth-fill dam. The reservoir shoreline is entirely privately owned, with the exception of two parcels of BLM land on the west shore, and the dam area, which is state-owned. Access is unrestricted. Water is consumed for agricultural uses, but also used for recreation and warmwater aquatic habitat. Irrigation takes precedence over other uses. If the dam is enlarged to store water from the proposed Narrows Reservoir, a conservation pool may be included. Otherwise, water use and management practices are not expected to change.

Location	
County	Sanpete
Longitude / Latitude	111 42 06 / 39 12 03
USGS Maps	Sterling, UT 1966
DeLorme's Utah Atlas & Gazetteer™	Page 37 A-6
Cataloging Unit	San Pitch (16030004)



County near which watershed is located.

Gunnison Watershed

<k83>

Recreation

Gunnison Reservoir is accessible from US-89 immediately north of Sterling via an access road opposite from and immediately south of the road to the Palisade State Park. The road follows Six mile Creek across the valley floor in a northwest direction for about 1.5 miles before crossing the river below the dam and continuing up the west side of the reservoir. The west side of the reservoir is also accessible going west out of Manti. The east side of the reservoir is probably accessible from the abandoned railroad grade for about 1.5 miles.

The lake is used for fishing, boating and waterskiing. Shallow, muddy waters limit recreational demand. There are no recreational facilities at the reservoir.

The nearest campground is Palisade State Park, located east of US-89, across from the access road to Gunnison Reservoir. It has 53 campsites, a sandy beach (on Palisade Reservoir), modern rest rooms with hot showers, a group camping area, a nine-hole golf course and a pavilion. Usage fees are charged.

There are private campgrounds in Gunnison, Sterling and Manti (see info box).

Watershed Description

Gunnison Reservoir is an impoundment of the San Pitch River. The watershed includes the entire Sanpete Valley, from the reservoir north to the divide north of Fairview, and the east face of the San Pitch Mountains, and the west face of the Wasatch Plateau. The valley is relatively flat, being filled with alluvial deposits from the mountain, so the reservoir is consequently shallow.

The land around the reservoir is used for agricultural purposes, including rangelands and irrigated cropland.

The watershed high point, North Tent Mountain, is 3,423 m (11,230 ft) above sea level, thereby developing a complex slope of 5.6% to the reservoir. The average river gradient above the reservoir is 1.3% (67 feet per mile). The inflows are the San Pitch River and a diversion canal from Six mile Creek. The outflow is the San Pitch River, which is subsequently diverted into canals.

The watershed is composed of the deeply dissected west face of the Wasatch Plateau, the foothills and east face of the San Pitch Mountains (also known as the Gunnison Plateau), the foothills at the north end of the watershed, and the alluvial deposits forming the valley itself. Soil associations are listed in Appendix III.

The vegetation communities consist of pine-aspen, spruce-fir, pinyon-juniper, sagebrush-grass, greasewood, cropland, oak, and maple. The watershed receives 25 - 102 cm (10 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 100 -120 days per year.

According to the 1982 Clean Lakes Inventory, land use is as follows: 63% native grazing (mostly cattle and sheep), 23% multiple use, 11% pasture and hayfields, 1% urban, 1% wildlife land, and 1% non-irrigated cropland.

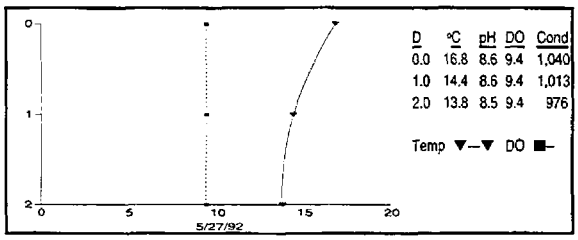
Limnological Assessment

The water quality of Gunnison Reservoir is good, even though it is usually fairly turbid due to the shallow nature of the reservoir. It is considered to be very hard with a hardness concentration range from 380-398 mg/L (CaCO3) in recent years but in 1981 the hardness was reported as 655 mg/L (CaCO3). The only parameter that has exceeded State water quality standards for defined beneficial uses is phosphorus. The average concentration of total phosphorus in the water column in 1990 and 1992 was 69 and 50 ug/L which is over double the recommended pollution indicator for phosphorus of 25 ug/L. Average phosphorus concentration for the water column in June, 1991 and the concentration near the bottom of the lake in August, 1991 did exceed the State standard. Although there was a significant increase in the concentration of total

Limnological Data

Data sampled from STORET site: 594355

Surface Data	1981	1990	1992
Trophic Status	H	H	H
Chlorophyll TSI	-	45.35	
Secchi Depth TSI	-	80.56	77.35
Phosphorous TSI	-	60.84	50.56
Average TSI	60.56	62.25	63.96
Chlorophyll a (ug/L)	-	4.5	-
Transparency (m)	-	0.24	0.3
Total Phosphorous (ug/L)	60	51	25
pH	-	8.5	8.6
Total Susp. Solids (mg/L)	71	43	28
Total Volatile Solids (mg/L)	-	-	6
Total Residual Solids (mg/L)	-	-	22
Temperature (°C / °f)	-	19/66	17/63
Conductivity (umhos.cm)	-	1840	1040
Water Column Data			
Ammonia (mg/L)	0.1	0.04	0.04
Nitrate/Nitrite (mg/L)	0.25	-	0.16
Hardness (mg/L)	655	380	398
Alkalinity (mg/L)	477	276	311
Silica (mg/L)	-	-	10.4
Total Phosphorous (ug/L)	60	69	50
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	-	5.6	9.4
Stratification (m)	-	NO	NO
Depth at Deepest Site (m)	-	2.8	2.0



phosphorus from 1989 to 1991 additional data will be needed to evaluate this potential trend for phosphorus concentrations. Dissolved oxygen concentrations in late summer substantiate the fact that water quality impairments do exist. In 1981 the reservoir was characterized as a phosphorus limited system. The 1989-91 data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is hypereutrophic.

The DWR stocks the reservoir, but stocking information was not available. Historically, there have been naturally reproducing populations of smallmouth bass (*Micropterus dolomieui*), bullhead (Ictalurus sp.), yellow perch (*Perca flavescens*), carp (*Cyprinus carpio*), green sunfish *Lepomis cyanellus*), channel catfish (*Ictalurus punctatus*), largemouth bass (*Micropterus salmoides*) and bluegill (*Lepomis macrochirus*). In some years, bass fishing has been excellent. Currently (1993) the reservoir is almost dry, and some species may have been eliminated. The reservoir has never been chemically treated in by the DWR to control rough fish competition, but a century of water flow manipulation and agricultural runoff make the presence of native fish populations unlikely. In addition DWR has reported that a population of crayfish is present in the reservoir.

Because the reservoir was dry in 1992, there was no phytoplankton to inventory.

Information

Management Agencies	
Six County Commissioners Association	896-9222
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Panoramaland Travel Region (Richfield)	896-9222
Manti Chamber of Commerce	835-6271
Palisade State Park	835-7275
Lund's Campground (Gunnison)	528-3366
Manti Campground	835-7851
Reservoir Administrators	
Gunnison Irrigation Company	528-7961

Pollution Assessment

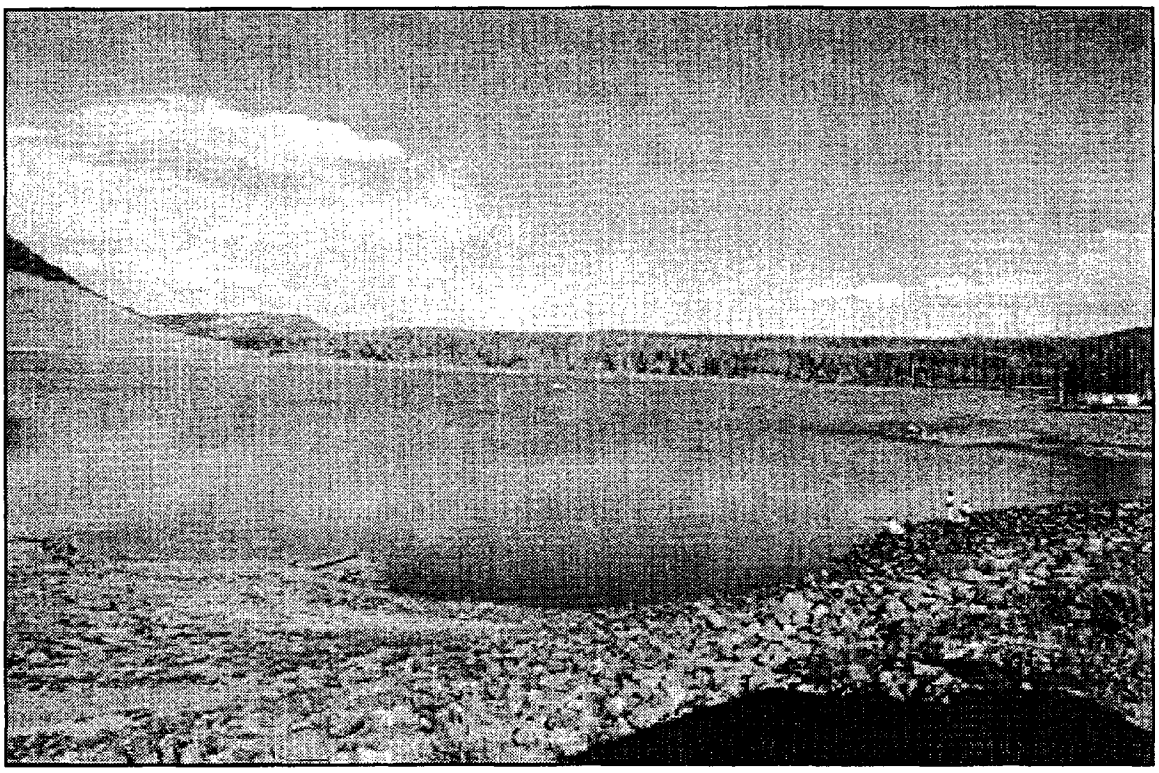
Nonpoint pollution sources include the following: Sedimentation and nutrient loading from grazing. Human wastes, litter and toxins from recreation. Nutrients, cleaning chemicals and human wastes from urban areas. Sediments, pesticides and other toxins from agricultural lands.

Point pollution sources include the following:
Moroni Wastewater Treatment Plant
Moroni Turkey Processing Plant

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), warm water game fish and organisms in their food chain (3B) and agricultural uses (4).

HOOP LAKE



Introduction

Hoop Lake is a natural lake on the north slope of the High Uintas. The lake level has been augmented by construction of a dam, and the watershed has been enlarged by a diversion from Thompson Creek. The lake receives heavy use by anglers.

Characteristics and Morphometry

Lake elevation (meters / feet)	2,802 / 9,194
Surface area (hectares / acres)	74.9 / 185.0
Watershed area (hectares / acres)	2,364 / 5842
Volume (m^3 / acre-feet)	
capacity	6,584,220 / 5,340
conservation pool (original lake)	665,820 / 540
Annual inflow (m^3 / acre-feet)	
Retention time (years)	<1
Drawdown (m^3 / acre-feet)	7.6 / 25
Depth (meters / feet)	
maximum	11 / 36
mean	9 / 29
Length (meters / feet)	1,200 / 4,000
Width (meters / feet)	1,100 / 3,600
Shoreline (meters / feet)	3,700 / 12,000

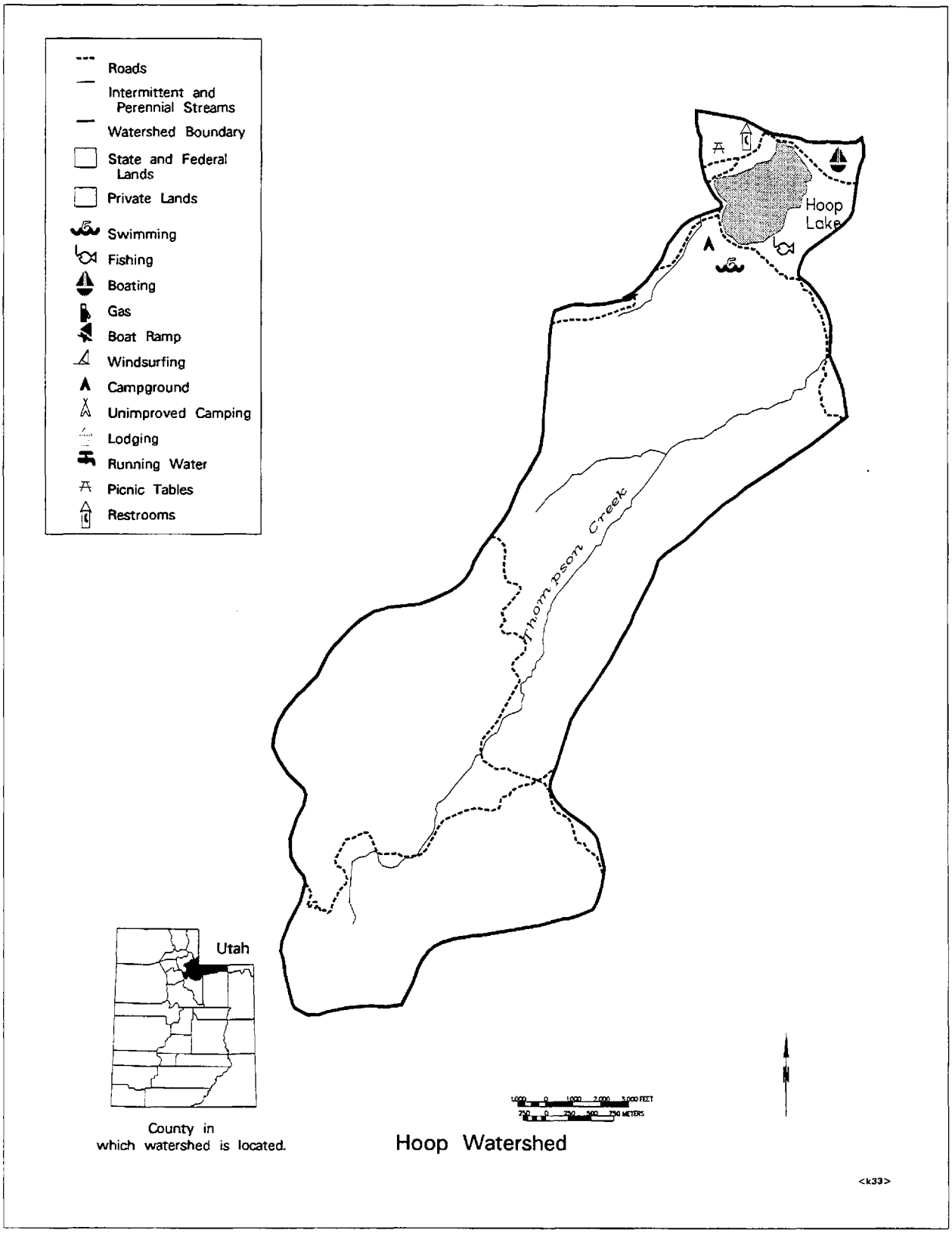
Hoop Lake is a result of glacial moraine impounding the natural drainage of the area. The original lake was 11 feet deep. In 1939, an earth-fill dam was built at the outlet, and in 1948 it was enlarged, raising water level a total of 25 feet. The reservoir shoreline is owned by the Wasatch-Cache National Forest, and public access is unrestricted. Reservoir water is used for irrigation in the McKinnon area of Wyoming (northwest of Manila, UT). The impounded water is drained off before mid-summer for agricultural purposes, but the 11 foot deep original lake remains. Water use is not expected to change in the foreseeable future.

Location

County	Summit
Longitude / Latitude	110 07 02 / 40 55 20
USGS Map	Hoop Lake, UT/WY 1967
DeLorme's Utah Atlas & Gazetteer™	Page 56, A-1
Cataloging Unit	Green River/Flaming Gorge (14040106)

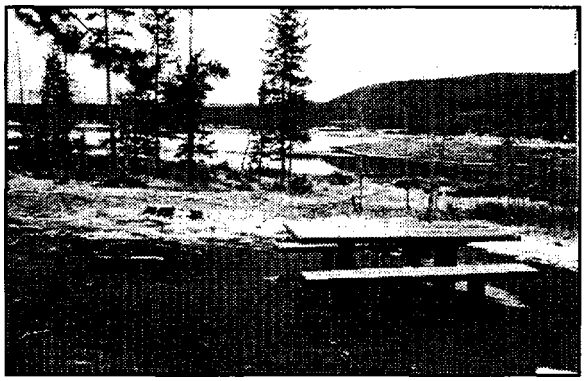
Recreation

Hoop Lake is accessible from Lonetree, Wyoming.


Roads
Intermittent and Perennial Streams
Watershed Boundary
State and Federal Lands
Private Lands
Swimming
Fishing
Boating
Gas
Boat Ramp
Windsurfing
Campground
Unimproved Camping
Lodging
Running Water
Picnic Tables
Restrooms
Hoop Lake
Thompson Creek
Utah
County in which watershed is located.
Hoop Watershed
<k33>

Approximately 1.5 miles east of Lonetree, turn south on the Cedar Basin Road to the national forest. A point of interest along the way is "Hole in the Rock". Travel approximately 7 miles to the intersection of FS-058. Continue southward approximately 3-4 miles past "Hole in the Rock", to the reservoir.

Recreational facilities at Hoop Lake Campground, a USFS facility, include toilet facilities, picnic areas, a swimming area and 44 campsites. Fishing, boating, swimming, camping, picnicking, and hiking are all possible. While there are no launching facilities, it is generally possible to launch a small boat. Angler use is heavy. User fees are charged.



Watershed Description

Hoop Lake is located on the north slope of the High Uintas. The watershed consists primarily of alpine meadows, coniferous forests and alpine tundra.

Slopes vary from 15% to 58%, and average 17%. Thompson Creek is a tributary of Burnt Fork. Numerous small lakes are in the headwaters of Thompson Creek and on top of Burnt Ridge.

The watershed high point, North Burro Peak, is 3,867 m (12,686 ft) above sea level, thereby developing a complex slope of 11.4% to the reservoir. The average stream gradient of Thompson Creek is 7.3% (375 feet per mile) The inflows are the diversion from Thompson Creek, the diversion of the unnamed stream to the west, and an ephemeral stream from Burnt Ridge. Water is transported via a canal from Thompson Creek. The canal has only minimal slope for much of its length, but races down the hillside as it is released into the lake. This has caused substantial erosion over the years, but the hillside has now stabilized itself. The outflow is East Fork Beaver Creek.

The watershed is made up of high mountains, forested valleys, and mountains meadows. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of alpine, spruce-fir, oak, maple, pine, aspen, and grassy meadows. The watershed receives 51 - 102 cm (20 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 20 - 40 days per year.

Land use in the watershed is 100% multiple use, with grazing, logging, and human recreation being the primary uses. Much of the watershed has been harvested for trees, and there are still active timber sales in the area.

Limnological Assessment

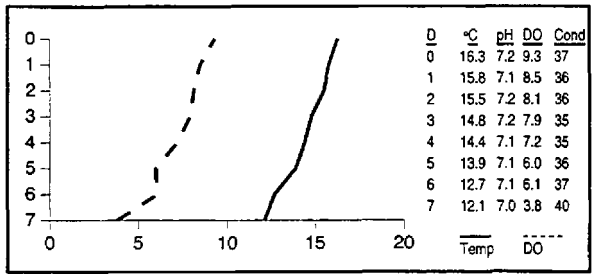
The water quality of Hoop Lake is good. It is considered to be very soft with a hardness concentration range of 12-16 mg/L (CaCO3). The parameters monitored that have exceeded State water quality standards for defined beneficial uses are phosphorus, iron, dissolved oxygen and pH. The reported exceedences for pH and dissolved oxygen occur during periods of high algal production or near the bottom of the lake respectively. This is not atypical and overall do not impact the defined beneficial uses severely. The average concentration of total phosphorus in the water column is usually within defined limits, however in June,

Limnological Data

Data sampled from STORET site: 593837

Surface Data	1981	1989	1991
Trophic Status	E	E	M
Chlorophyll TSI	-	61.69	48.96
Secchi Depth TSI	60	57.08	56.78
Phosphorous TSI	53.2	53.54	43.66
Average TSI	56.6	57.44	49.80
Chlorophyll a (ug/L)	-	23.8	6.5
Transparency (m)	-	1.2	1.3
Total Phosphorous (ug/L)	30	31	16
pH	6.8	8.0	7.3
Total Susp. Solids (mg/L)	<5	-	<3
Total Volatile Solids (mg/L)	-	-	7
Total Residual Solids (mg/L)	-	-	2
Temperature (°C / °f)	16/61	14/57	15/58
Conductivity (umhos.cm)	32	43	34
Water Column Data			
Ammonia (mg/L)	0.05	0.02	0.04
Nitrate/Nitrite (mg/L)	.21	-	0.05
Hardness (mg/L)	16	-	12
Alkalinity (mg/L)	11	-	19
Silica (mg/L)	-	-	6.4
Total Phosphorus (ug/L)	35	22	31
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	6.5	8.8	6.0
Stratification (m)	3-4	NO	5-6
Depth at Deepest Site (m)	5	4.1	7

1989 it averaged 42 ug/L. This is well above the State's pollution indicator of 25 ug/L. Although only half of the samples exceeded the standard, the mean value reported for iron was 1.095 mg/L which is above the established standard for iron of 1.0 mg/L. Metal samples were taken near the bottom of the lake where it is expected to reach a maximum concentration. Concentration may be affected by the concentration of dissolved oxygen, resuspension of materials and turbidity that may be present in the samples. Even though there are reported exceedences it appears that they is no impairment to the defined beneficial uses. A review of the September 4, 1991 profiles indicates there is a weak stratification of the lake with a thermocline developing at the 5-6 meters depth. Although this may present some problems with a decline in the dissolved oxygen concentration near the bottom it is probably short lived due to the shallow nature of the lake and the potential for mixing due to wind and wave action. There have been no reported fish kills at Hoop Lake. No winter sampling has been conducted to evaluate the extent of anoxic conditions that may exist during ice coverage. The lake is a nitrogen limited system with TSI values indicating the lake is a eutrophic lake. According to DWR principle macrophytes present in the lake include: *Sparganium, Carex, Scirpus, Polygonium, Isoetes* (submergent), and *Polygonium* (submergent). The present fishery includes brook trout (*Salvelinus fontinalis*), cutthroat trout (Oncorhynchus clarki), rainbow trout (*Oncorhynchus mykiss*) and suckers (Catastomidae). DWR annually stocks catchable and fingerling rainbow trout. Some years the reservoir does not fill up and an indeterminate amount of water is diverted from Thompson Creek until midsummer.



Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Aphanizomenon flos-aquae	3.697	94.19
Spherical green alga	0.111	2.83
Trachelomonas sp.	0.055	1.42
Oocystis sp.	0.033	0.85
Dinobryon divergens	0.010	0.27
Pennate diatoms	0.007	0.17
Centric diatoms	0.006	0.16
Ankistrodesmus falcatus	0.004	0.11
Total	3.923	
Shannon-Weaver [H']	0.30	
Species Evenness	0.15	
Species Richness [d]	0.32	

The phytoplankton community is dominated by the presence of blue-green algae. This is indicative of water that is eutrophic and nitrogen limited.

Information

Management Agencies	
Mountainlands Association of Governments	377-2262
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Wasatch-Cache National Forest	524-5030
Mountain Home Ranger District	307-782-6555
Recreation	
Mountainlands Travel Region (Provo)	377-2262
Reservoir Administrators	
Hoop Lake Reservoir and Irrigation Company	307-874-6197

Pollution Assessment

Nonpoint pollution sources include logging, recreation and grazing.

Grazing takes place throughout the watershed and in the vicinity of the reservoir.

Much of the watershed has been harvested for trees in recent history, exposing the soil and creating conditions for increased erosion. A timber sale is currently proposed for Kabell Ridge, some of which is probably in the Hoop Lake Watershed.

There are no point sources of pollution in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

HOOVER LAKE

Introduction

Hoover Lake is a small, natural lake in the western High Uintas. Biologically and geologically it is comparable to hundreds of similar lakes in the High Uintas. It is included in this study to assist in the evaluation of other similar types of lakes that are not accessible by vehicle. It is near the Mirror Lake area, but accessible from the Murdock Basin Road. It has two sister lakes, Marshall and Shepherd, of which Marshall is included in this document. The shoreline is owned by the Wasatch-Cache National Forest, and public access is unrestricted. The lake drainage is at the headwaters of the Duchesne River and is not regulated by man. Water is used for recreation and coldwater aquatic habitat.

Characteristics and Morphometry

Lake elevation (meters / feet)	3,017 / 9,900
Surface area (hectares / acres)	7 / 17
Watershed area (hectares / acres)	201 / 497
Volume (m^3 / acre-feet)	209,695 / 170
Annual inflow (m^3 / acre-feet)	not measured
Retention time (years)	unknown
Drawdown (m^3 / acre-feet)	0 / 0
Depth (meters / feet)	
maximum	7.6 / 25
mean	3 / 10
Length (meters / feet)	490 / 1,600
Width (meters / feet)	210 / 700
Shoreline (meters / feet)	1,130 / 3,700

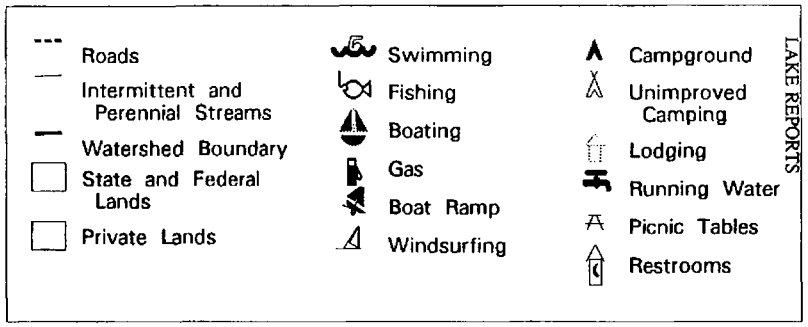
Location

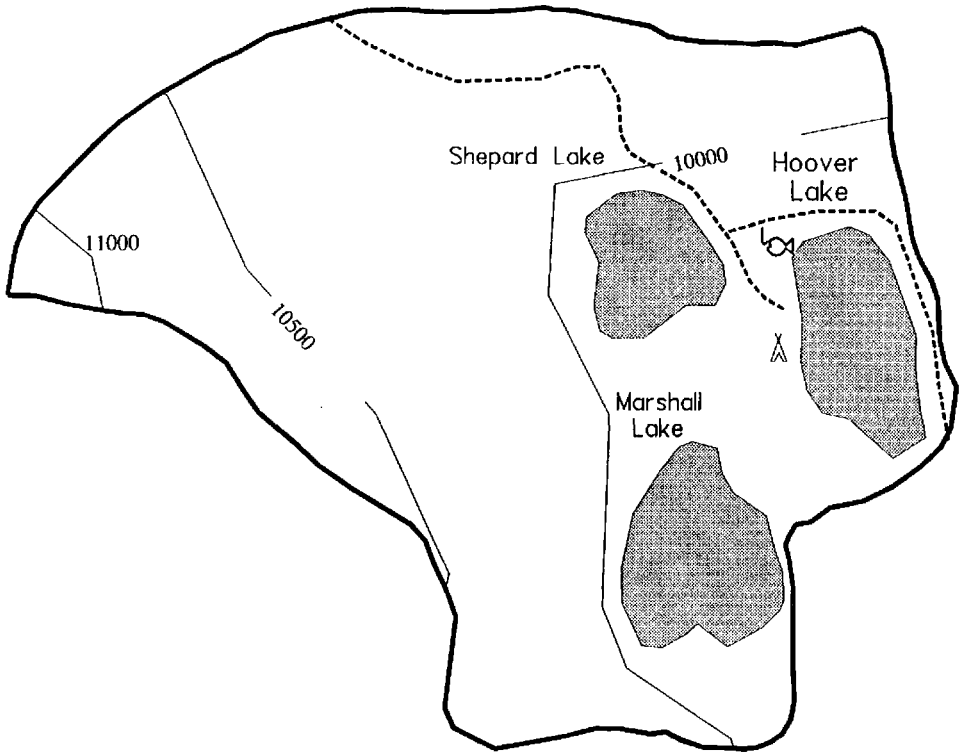
County	Duchesne
Longitude / Latitude	110 52 11 / 40 40 46
USGS Map	Hayden Peak 1972
DeLorme's Utah Atlas & Gazetteer™	Page 54, B-3*
Cataloging Unit	Duchesne (16060003)

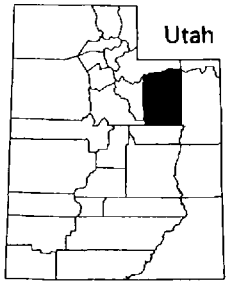
*Not labelled on the map. It is 1 mile NE of Echo Lake.

Recreation

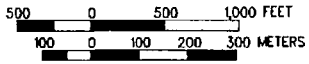
Hoover Lake is a two mile hike from the Moosehorn Campground, just south of Mirror Lake. Follow the trail (beginning across U-150 from the campground) to the east, around Fehr Lake, south to Shepherd Lake, then continue on south for a few hundred meters to Hoover Lake. The trail appears to go directly to Hoover Lake. To drive closer to







County in which watershed is located.



Hoover Watershed

<k70>

the lake, take the Murdock Basin turnoff (about 21 miles east of Kamas and 10 miles southwest from Mirror Lake). Follow FS-027 and then FS-137 (gravel roads) for about 8 miles. At the end of the road, hike due west for a few hundred meters through the forest to the lake.

Fishing, camping, picnicking, scenic beauty and hiking are all popular. The lake is to small for motorized boats, and water temperatures make it to cold for most swimmers. The backdrop of high, barren peaks are reflected in the still water of the lake.

The area receives moderate to heavy recreational use throughout the summer. Please tread lightly so that the area remains relatively pristine. U-150 is closed during the winter and much of the spring, but groomed for cross-country skiers, snowmobilers and hikers.

There are no recreational facilities at the lake, but there are campgrounds on U-150. Campers at the lake should pack out their trash, and properly dispose of any human waste.

Limnological Data

Data sampled from STORET site: 593595

Surface Data	1981	1990	1992
Trophic Status	M	M	O
Chlorophyll TSI	-	33.54	33.17
Secchi Depth TSI	-	44.41	39.32
Phosphorous TSI	-	42.71	43.66
Average TSI	47	40.22	38.72
Chlorophyll a (ug/L)	-	1.4	1.3
Transparency (m)	-	3.0	4.2
Total Phosphorous (ug/L)	20.0	14.5	16
pH	7.7	7.0	6.7
Total Susp. Solids (mg/L)	5	<3	<3
Total Volatile Solids (mg/L)	-	-	0
Total Residual Solids (mg/L)	-	-	3
Temperature (°C / °f)	18/64	17/62	15/60
Conductivity (umhos.cm)	10	20	14
Water Column Data			
Ammonia (mg/L)	0.05	0.03	0.03
Nitrate/Nitrite (mg/L)	.05	-	0.08
Hardness (mg/L)	8	6.8	7.6
Alkalinity (mg/L)	4	4	4
Silica (mg/L)	-	-	0.5
Total Phosphorus (ug/L)	20	18	15
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	-	6.9	7.4
Stratification (m)	-	NO	4-7
Depth at Deepest Site (m)	-	3.5	7.0

Watershed Description

Hoover Lake is located in the western end of the High Uintas. The watershed is very small. The lake is perched on a bench high on the Duchesne River Gorge, and at the foot of Murdock Mountain, a 500' high rocky escarpment. The area is densely forested, interspersed with rocky, barren peaks. In this area of the Uintas, glaciation has removed the majority of the high mountains, leaving only isolated peaks.

The watershed high point, Murdock Mountain, is 3,286 m (11,212 ft) above sea level, thereby developing a complex slope of 24.5% to the reservoir. There are no streams flowing into the lake, but because of the high elevation, snowmelt runoff flows for much of the summer. In addition there are several springs in the area contributing water to the lake.

The watershed is made up of high mountains and rocky outcroppings. The soil associations that compose the watershed are listed in Appendix III.

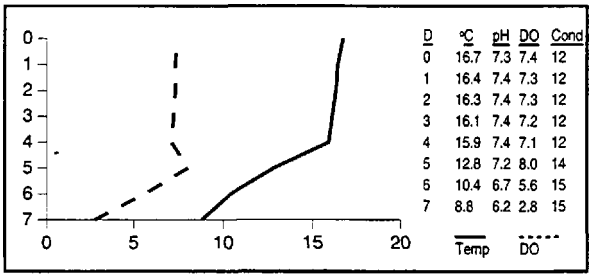
The vegetation communities consist of pine, oak, maple, spruce-fir, aspen, and alpine. The watershed receives 76 - 102 cm (30 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 0 - 20 days per year.

Use of watershed land is primarily recreational. The watershed is too steep and rocky to provide for other uses.

Limnological Assessment

The water quality of Hoover Lake is very good. It is considered to be very soft with a hardness concentration value of 8 mg/L ($CaCO_3$). The only parameter that has exceeded State water quality standards for defined beneficial uses is phosphorus. Although the average concentration of total phosphorus in the water column has never exceeded the State's pollution indicator (25 ug/L), concentrations as high as 35 have been reported as various depths in the water column. Although dissolved oxygen concentrations are not considered to have violated State standards they do reach low levels near the bottom of the lake. A review of the profile obtained on August, 1990 showed concentrations near 7.4 mg/L above the thermocline (4 meters) with a declining trend to 2.8 mg/L at the bottom (7 meters). The lake is defined as a nitrogen limited system with TSI values indicating the lake is a border line oligotrophic/mesotrophic lake with an overall TSI index of 40.22 in 1990 and 38.72 in 1992. The TSI evaluation in 1981 was based totally on phosphorus which had a value near the detection limit at the time. The phosphorus concentrations in recent years appear to be stable at approximately 16 ug/L which is well under the established pollution indicator or 25 ug/L. The profile of August 5, 1992 indicates that the reservoir was stratified with a thermocline developing at 4-5 meters. As indicated previously there was

a noticeable decline in the concentration of dissolved oxygen in the water column below the thermocline. The concentration declines to a low of 2..8 mg/L the bottom. These types of conditions may impact the fishery. Dissolved oxygen concentrations have not been surveyed during the winter and could reach a critical state during the winter period for fish due to the length of the season and the shallow nature of the lake. According to DWR principle invertebrates present in the lake include Amphipoda, Coleopetera, and Zygoptera naiads with Sparganium as the principle aquatic vegetation present during a DWR survey. No fish kills have been reported at Hoover Lake.



D	°C	pH	DO	Cond
0	16.7	7.3	7.4	12
1	16.4	7.4	7.3	12
2	16.3	7.4	7.3	12
3	16.1	7.4	7.2	12
4	15.9	7.4	7.1	12
5	12.8	7.2	8.0	14
6	10.4	6.7	5.6	15
7	8.8	6.2	2.8	15

The DWR has stocked cutthroat trout (*Oncorhynchus clarki*), but currently stocks the lake annually with 2,300 fingerling brook trout (*Salvelinus fontinalis*). In addition arctic grayling (*Thymallus arcticus*) have been stocked. The lake has not been chemically treated by the DWR, so populations of native fishes may be present in the lake.

Macrophytes are prevalent in the lake. Water lilies are very abundant in the shallow literal zone. Coverage is equivalent to approximately 10% of the lake surface area. In addition submergent macrophytes are fairly extensive throughout the lake.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	2.641	65.28
Merismopedia tenuissima	0.600	14.84
Aphanothece nidulans	0.500	12.37
Haematococcus sp.	0.103	2.54
Oocystis sp.	0.042	1.03
Dinobryon divergens	0.037	0.91
Chroococcus sp.	0.033	0.82
Unknown spherical green alga	0.025	0.62
Pennate diatoms	0.023	0.58
Centric diatoms	0.013	0.33
Scenedesmus bijuga	0.011	0.27
Ankistrodesmus falcatus	0.009	0.22
Unknown chrysophyte	0.005	0.12
Tetradesmus sp.	0.003	0.07
Total	4.044	
Shannon-Weaver [H']	1.17	
Species Evenness	0.44	
Species Richness [d]	0.59	

The phytoplankton commnutity is dominated by the presence of green algae, however there is a significant representation of blue-green algae. The species of green algae is typical of fairly good water quality.

Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Wasatch-Cache National Forest	524-5030
Kamas Ranger District	783-4338
Recreation	
Dinosaurland Travel Region (Vernal)	798-6932

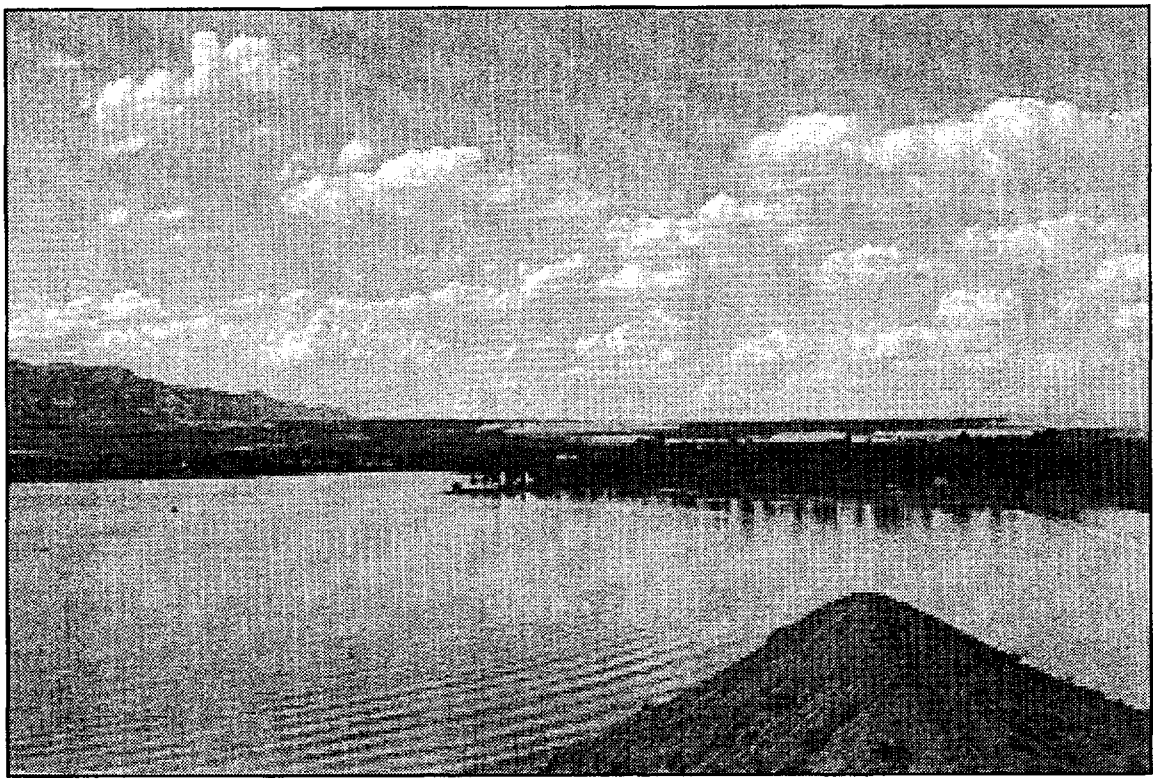
Pollution Assessment

Recreation is the sole source of nonpoint pollution, and there are no point sources of pollution.

Beneficial Use Classification

The state is currently proposing the following beneficial use classifications; boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

HUNTINGTON LAKE NORTH



Introduction

Huntington Lake North is in Castle Valley, one mile north of Huntington City. It is an intermediate-sized impoundment in arid terrain. It was built by the Bureau of Reclamation as part of the Emery Project, using federal funds to subsidize the cost of storing agricultural water in Emery County. Huntington Lake North should not be confused with Huntington Reservoir, 30 miles up Huntington Canyon. Huntington Lake North is also known as Huntington Lake, Huntington North Reservoir, Huntington Reservoir North, and Huntington Reservoir. The reservoir was created in 1966 by the construction of an earth-fill dam. The shoreline is owned by the Emery County Water Conservation District and the State of Utah. Public access is unrestricted, though fees are charged in the State Park. Water is consumed for agricultural uses, but also used for recreation and warmwater aquatic habitat. No changes in use are anticipated.

Characteristics and Morphometry

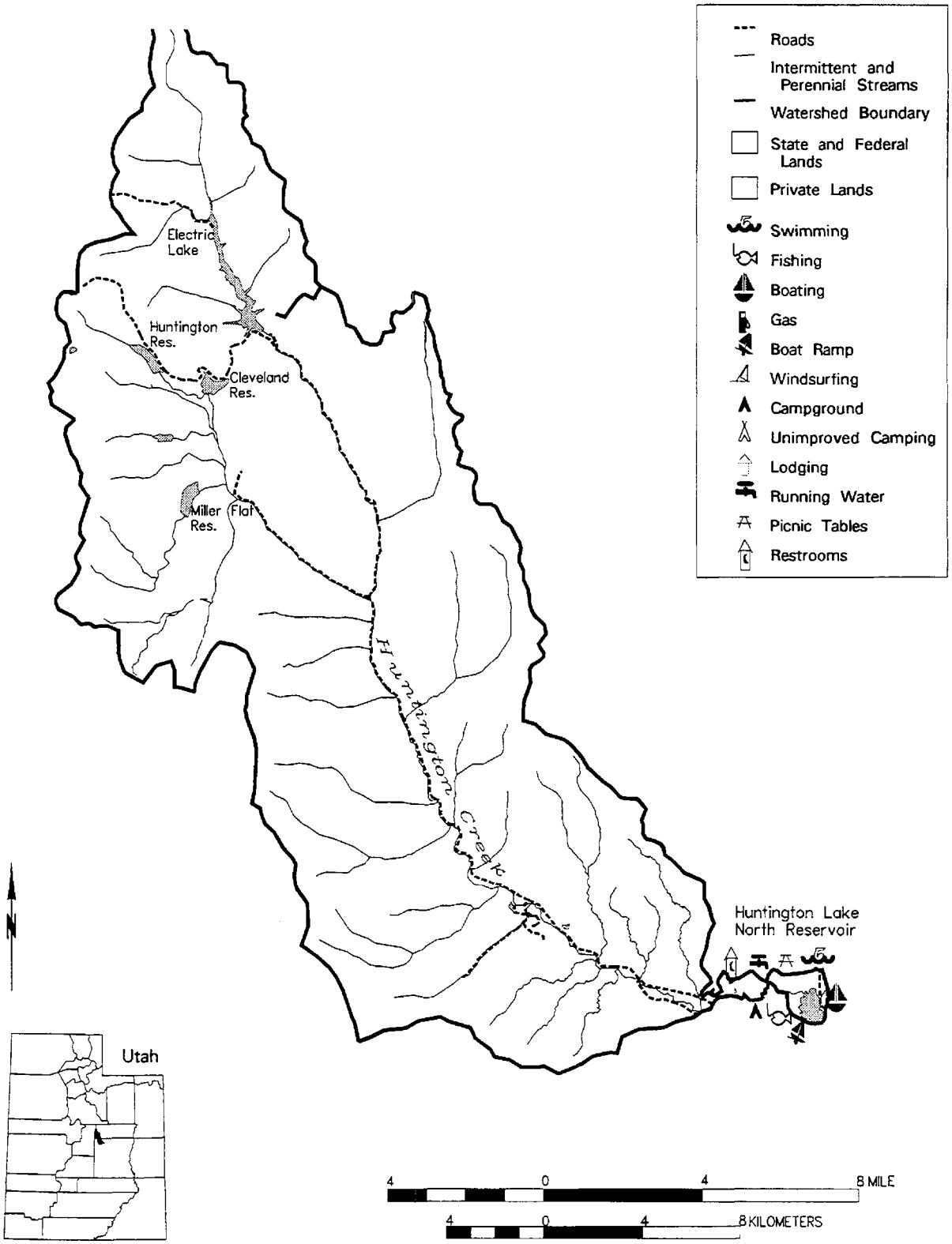
Lake elevation (meters / feet)	1,780 / 5,839
Surface area (hectares / acres)	91.1 / 225
Watershed area (hectares / acres)	64,751 / 160,000
Volume (m^3 / acre-feet)	
capacity	7,018,626 / 5,690
conservation pool	
Annual inflow (m^3 / acre-feet)	9,004,550 / 7,300
Retention time (years)	.8
Drawdown (m^3 / acre-feet)	not measured
Depth (meters / feet)	
maximum	17 / 55.8
mean	7.7 / 25.3
Length (meters / feet)	1,400 / 4,600
Width (meters / feet)	823 / 2,700
Shoreline (km / miles)	4.11 / 2.56

Location

County	Sanpete
Longitude / Latitude	111 16 03 / 39 35 24
USGS Map	Huntington Reservoir 1978
DeLorme's Atlas and Gazetteer™	Page 46 D-2
Cataloging Unit	San Rafael (14060009)

Recreation

Huntington Lake North is accessible via Huntington State Park, one mile north of Huntington City on U-10.



County near which watershed is located.

Huntington Lake North Watershed

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The area receives heavy recreational usage throughout considered very good. It is considered to be very hard with a hardness concentration range of 291-304 mg/L ($CaCO_3$) the summer months. Fishing, boating, camping, swimming, and picnicking are all available at the State Park. Access to the lake is restricted to the park area.

The park charges a $3 fee for day use and $8 for camping (1991). Facilities include a boat launch, picnic pavilions, handicapped-accessible flush toilets, showers, and 30 campsites.

Watershed Description

The lake is in an area of desert badlands characteristic of Castle Valley. Water is from Huntington Creek via a short diversion canal. Old Department of Water Quality records list the inflow as a diversion from Cottonwood Creek near Orangeville. While water can be fed to the lake by this canal, present management practices use only Huntington Creek. ***Most and possibly all the water comes from Cottonwood Creek via the Cottonwood Creek Canal, which flows from Cottonwood Canyon above Castle Dale north to Huntington Lake North. The watershed high point is m (ft) above sea level, thereby developing a complex slope of % to the point of diversion in Cottonwood Canyon. Average stream gradient above the diversion is % (feet per mile). The canal is km (miles) long.

The soil is of limestone origin and has good permeability and moderately slow erosion and runoff. Soil Associations are listed in Appendix III.

The vegetation communities are comprised of shadscale, pinion-juniper, saltbrush, sagebrush-grass, mahogany, mountain mahogany, grass-forbs, greasewood, barren areas, pine, aspen, spruce-fir, oak and maple. The watershed receives 20 - 76 cm (8 - 30 inches) of precipitation annually with a frost-free season of 100 - 120 days each year at the reservoir. The reservoir is in an area of rolling ridges and valleys characteristic of the Wasatch Plateau. It collects water directly from the North Fork of Lake Canyon (the canyon the reservoir is located in), and from the South Fork of Lake Canyon via a short diversion canal. The canyons were likely glaciated during the last ice age.

The watershed high point (the top of the South Fork of Lake Canyon) is 3,152 m (10,340 ft) above sea level, thereby developing a complex slope of 10.3% to the reservoir. The average stream gradient above the reservoir is 4.2% (225 feet per mile).

The soil is of limestone origin and has good permeability and moderately slow erosion and runoff. Soil groupings are found in Appendix III.

The vegetation communities are comprised of pine, aspen, spruce-fir, oak and maple. The watershed receives 64 - 76 cm (25 - 30 inches) of precipitation annually with a frost-free season of 20 - 60 days at the reservoir.

Land use in the reservoir is 100% multiple use forest lands, used by humans for hunting, recreation and livestock grazing.

Limnological Assessment

The water quality of Huntington Lake North is considered very good. It is considered to be very hard with an average hardness concentration of 302 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are phosphorus, temperature and dissolved oxygen. Although the average concentration of total phosphorus in the water column has never exceeded the State's pollution indicator (25 ug/L) in 1991 concentrations of 31 and 51 ug/L were reported at various depths in the water column. The only documented dissolved oxygen exceedences were reported by DEQ (1982). A review of the profile obtained on June 13, 1979 showed concentrations near 5.7 mg/L above the thermocline (6 meters) with a declining trend to 1.5 mg/L at the bottom (12 meters). Recent profiles show a higher concentration throughout the water column, but maximum depths during these monitoring events has not approached the point where stratification could develop. With increased storage or during winter ice coverage anoxic conditions may be present in the lake. The low water levels have caused an increase in the overall temperature throughout the water column. The lake is classified as a cold water fishery which has a maximum temperature of 20 degrees C. The August 28, 1991 profile shows temperature values of greater than 21 degrees C throughout the water column. Currently, these exceedences are not critically impairing the reservoirs defined beneficial uses. The lake is defined as a nitrogen limited system with TSI values indicating the reservoir is mesotrophic except for 1989 when it was ranked as an oligotrophic reservoir. The phosphorus concentrations in 1989 appear to be abnormally low (4.8 ug/L) and have shifted the overall TSI index to the

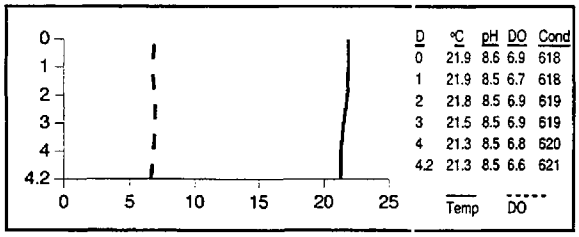
Limnological Data

Data sampled from STORET site: 593197

Surface Data	1979	1989	1991
Trophic Status	M	O	M
Chlorophyll TSI	-	41.38	39.97
Secchi Depth TSI	44.17	44.17*	8.64
Phosphorous TSI	43.20	26.61	45.82
Average TSI	43.69	37.39	44.81
Chlorophyll a (ug/L)	-	3.0	2.6
Transparency (m)	3.0	3.0*	2.2
Total Phosphorous (ug/L)	15	5	18
pH	8.1	8.5*	8.6
Total Susp. Solids (mg/L)	12	-	<3
Total Volatile Solids (mg/L)	-	-	2
Total Residual Solids (mg/L)	-	-	13
Temperature (°C / °f)	19/66	16/61	19/66
Conductivity (umhos.cm)	797	402	640
Water Column Data			
Ammonia (mg/L)	0.06	0.01	0.03
Nitrate/Nitrite (mg/L)	.05	0.05	<0.01
Hardness (mg/L)	306	-	297
Alkalinity (mg/L)	180	-	171
Silica (mg/L)	-	-	3.15
Total Phosphorus (ug/L)	17	9	20
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	2.8	7.1	6.8
Stratification (m)	3-8	NO	NO
Depth at Deepest Site (m)	12	6.5	4.2

* Period 2 Data Only

oligotrophic range. It does not appear that there has been a significant change in the concentrations of nutrients in the lake since it was originally surveyed in 1981. As indicated earlier the reservoir has stratified during the summer (1979) due to an allowable depth. The profile of June, 1979 indicates that a thermocline developed at the depth of 6-8 meters. Consistent with the stratification there was a noticeable decline in the concentration of dissolved oxygen in the water column below the thermocline. Below 6 meters the concentration declines to a low of 1.5 mg/L at the bottom. These types of conditions are deleterious to the fishery. Dissolved oxygen concentrations have not been surveyed during the winter and could reach a critical state during the
winter period for fish. In 1975 this reservoir was included as part of a national eutrophication survey conducted by the USEPA. Their findings substantiated the data presented so far and they reported the presence of submerged



macrophytes at that time.. Fish present in the lake include largemouth bass (*Micropterus salmoides*) and Utah chub (*Gila atraria*). The high abundance of chubs brought about the introduction of largemouth bass. Although the lake was once classified as a cold water fishery it is currently managed and classified as a warm water fishery.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance).

Species	Cell Volume (mm^3/liter)	% Density By Volume
Peridinium sp.	.727	81.82
Closteriopsis long. v. tropica	.059	6.66
Centric diatoms	.038	4.28
Pennate diatoms	.033	3.75
Chlamydomonas sp.	.013	1.50
Chlamydomonas sp.	.009	1.00
Wislouchiella planktonica	.004	0.50
Ankistrodesmus falcatus	.004	0.49
Total	.887	
Shannon-Weaver Index [H']	0.76	
Species Evenness	0.37	
Species Richness [d]	0.34	

The phytoplankton community is dominated by flagellates and diatoms indicative of good water with low productivity. In 1975 as reported in the NES the phytoplankton community was dominated by the following groups: May 13, 1975; *Ankistrodesmus sp., Chroomonas sp., Cryptomonas sp.*, and *Synedra sp.*; August 12, 1975 *Cyclotella sp., Aphanocapsa sp., Achnanthes sp., Crucigenia sp.*; September 24, 1975 *Cryptomonas sp., Chroomonas sp.,Mallomonas sp.*.

Pollution Assessment

Nonpoint pollution sources include nutrient loading and sedimentation from grazing and litter and human wastes from recreation. About 1,000 sheep graze in the immediate vicinity of the reservoir for two weeks each year. Cattle also graze the area. No mining or logging takes place in the

region.

There are no point pollution sources in the watershed.

Beneficial Use Classification

The state beneficial use classification for the waters of Cleveland Reservoir include: recreational bathing (swimming) (2A), boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3B) and agricultural uses (4).

Information

Management Agencies	
Manti-La Sal National Forest	637-2817
Six County Commissioners Organization	896-9222
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Reservoir Administrators	
Huntington-Cleveland Irrigation Company	687-2505

HUNTINGTON RESERVOIR

Introduction

Huntington Reservoir is in Huntington Canyon high on the east side of the Wasatch Plateau. It is an intermediate sized impoundment of a meadow in a glacial valley. Huntington Reservoir should not be confused with Huntington Lake North, a reservoir immediately outside Huntington City. The reservoir became famous in 1988 when the well-preserved, 9,500 year old skeleton of a Columbian Mammoth was uncovered during reconstruction of the dam. The Huntington Mammoth and replicas have been on display at various museums around the state.

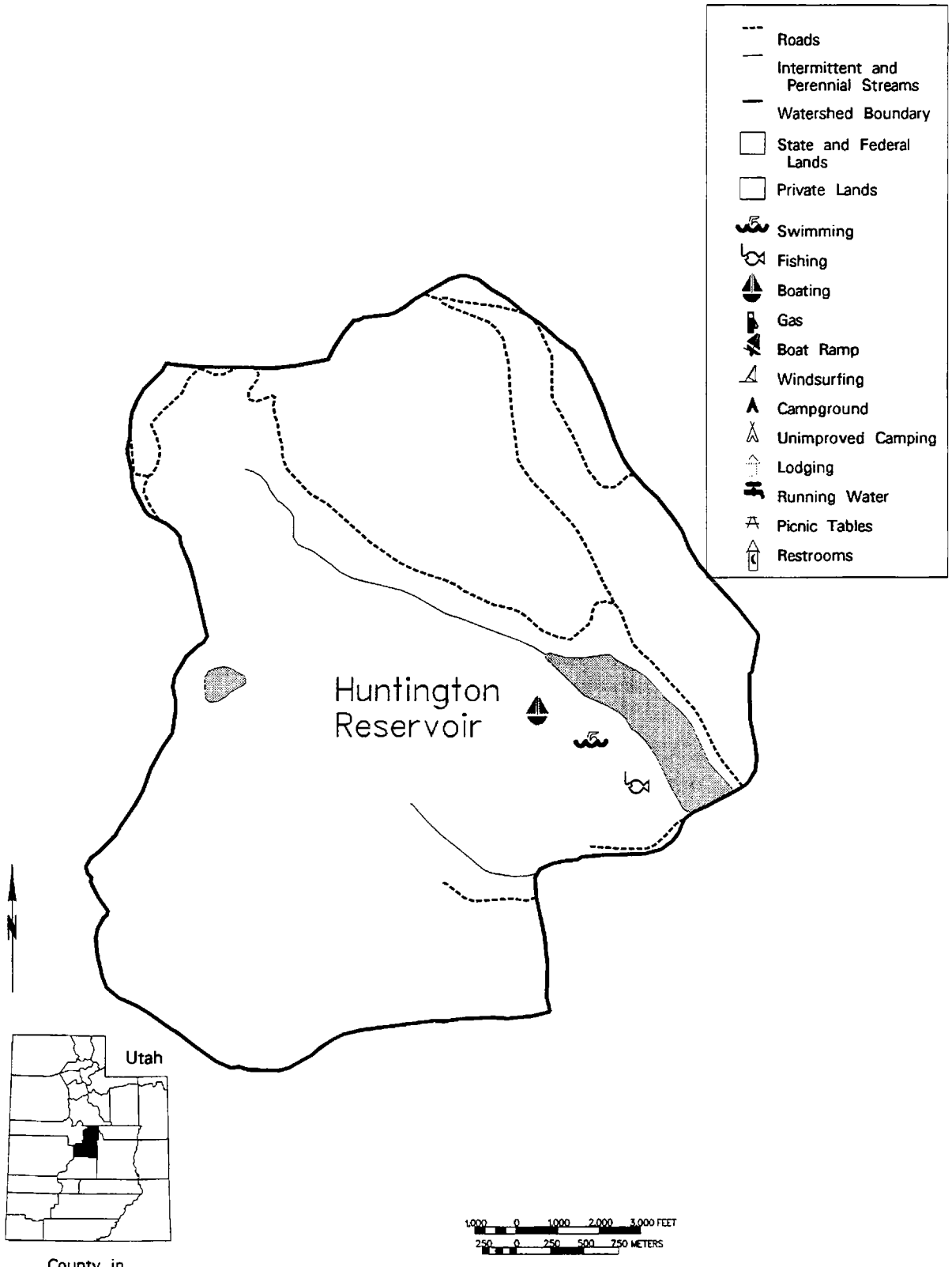
Characteristics and Morphometry

Lake elevation (meters / feet)	2748 / 9014
Surface area (hectares / acres)	47.75 / 118
Watershed area (hectares / acres)	1,155 / 2854
Volume (m^3 / acre-feet)	
capacity	6,907,600 / 5,600
conservation pool	1,110,150 / 900
Annual inflow (m^3 / acre-feet)	5,528,547 / 4482
Retention time (years)	<1
Drawdown (m^3 / acre-feet)	2,691,497 / 2,182
Depth (meters / feet)	
maximum	27.9 / 8.50
mean	6.79 / 22.2
Length (km / miles)	1.89 / 1.2
Width (km / miles)	.35 / .22
Shoreline (km / miles)	4.15 / 2.58

Location

County	Sanpete
Longitude / Latitude	111 16 03 / 39 35 24
USGS Map	Huntington Reservoir 1978
DeLorme's Atlas and Gazetteer™	Page 46 D-2
Cataloging Unit	San Rafael (14060009)

The reservoir was created in 1949 by the construction of an earth-fill dam. It was significantly enlarged in 1991 when the dam was raised 20 feet. The shoreline is owned by the Manti-La Sal National Forest and the Huntington-Cleveland Irrigation Company with unrestricted public access. Reservoir water is used for recreation and irrigation with no changes anticipated. It receives little recreational



County in which watershed is located.

Huntington Reservoir Watershed

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use but is noted for its fishing and scenic beauty.

Recreation

Huntington Reservoir is directly accessible from U-31 which follows the shoreline for about a mile. The lake is 16 miles east of Fairview City and 32 miles northwest of Huntington City.

Although the area generally receives limited recreational usage, heavy use occurs on holiday weekends. Although fishing is the primary activity, boating, camping, swimming, Nordic skiing and snowmobiling are also popular with visitors.

Recreational facilities in the area are primitive. Visitors are required to pack out their own trash. There are Forest Service Campgrounds in lower in Huntington Canyon, on U-264, on the road to Joes Valley, and on Skyline Drive north of U-264. A parking area is provided at the dam site, and toilets are provided at a parking area at the Lake Guard Station (Miller Flat and Joes Valley access road).

Watershed Description

The reservoir is in an area of rolling ridges and valleys characteristic of the Wasatch Plateau. It collects water directly from the North Fork of Lake Canyon (the canyon the reservoir is located in), and from the South Fork of Lake Canyon via a short diversion canal. The canyons were likely glaciated during the last ice age.

The watershed high point (the top of the South Fork of Lake Canyon) is 3,152 m (10,340 ft) above sea level, thereby developing a complex slope of 10.3% to the reservoir. The average stream gradient above the reservoir is 4.2% (225 feet per mile).

The soil is of limestone origin and has good permeability and moderately slow erosion and runoff. Soil groupings are found in Appendix III.

The vegetation communities are comprised of pine, aspen, spruce-fir, oak and maple. The watershed receives 64 - 76 cm (25 - 30 inches) of precipitation annually with a frost-free season of 20 - 60 days at the reservoir.

Land use in the reservoir is designated as 100% multiple use forest lands, and is used for hunting, recreation and livestock grazing.

Limnological Assessment

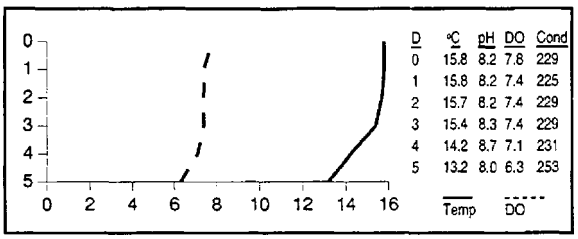
The water quality of Huntington Reservoir is very good. It is considered to be moderately hard with a hardness concentration of 126 mg/L ($CaCO_3$). The only parameter that has exceeded State water quality standards for defined beneficial uses is phosphorus. The average concentration of total phosphorus in the water column in 1992 was 24.3 but during June in the hypolimnion the concentration was 42 ug/L. Currently the only data existing for the lake was obtained in 1992. Additional monitoring will need to be done to effectively describe the conditions of the reservoir. The reservoir has been characterized as a nitrogen limited system. TSI values indicate the reservoir is classified as mesotrophic. The reservoir in August, 1992 was stratified. A thermocline was developing at the 3-4 meter depth. The profile of August 10, 1992 indicates that there were no major concerns with the temperature or dissolved oxygen concentrations throughout the water column.

The DWR began stocking the reservoir after it was

Limnological Data

Data averaged from STORET sites: 593208, 593209

Surface Data	1992
Trophic Status	M
Chlorophyll TSI	40.01
Secchi Depth TSI	53.88
Phosphorous TSI	45.63
Average TSI	46.50
Chlorophyll a (ug/L)	2.6
Transparency (m)	1.6
Total Phosphorous (ug/L)	18.0
pH	8.4
Total Susp. Solids (mg/L)	<3
Total Volatile Solids (mg/L)	1
Total Residual Solids (mg/L)	3
Temperature (°C / °f)	15/60
Conductivity (umhos.cm)	797
Water Column Data	
Ammonia (mg/L)	0.04
Nitrate/Nitrite (mg/L)	0.03
Hardness (mg/L)	126
Alkalinity (mg/L)	123
Silica (mg/L)	1.2
Total Phosphorus (ug/L)	26
Miscellaneous Data	
Limiting Nutrient	N
DO (Mg/l) at 75% depth	7.2
Stratification (m)	3-4
Depth at Deepest Site (m)	5



enlarged, stocking 15,000 fingerling tiger trout (brook trout/ brown trout hybrids) in 1992. The reservoir has not been treated to control rough fish competition, so original populations of Lake Fork fish may be found in the area. Before the dam was reconstructed, however, it was drained annually, so fish populations have never developed in the reservoir. It now has an approximately 20 foot deep conservation pool, which will significantly improve fish habitat.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance).

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	7.923	98.37
Pennate diatoms	.044	0.55
Ankyra judayi	.039	0.49
Unknown spherical green alga	.027	0.35
Chlamydomonas sp.	.011	0.14
Centric diatoms	.009	0.49
Total	8.053	
Shannon-Weaver Index [H']	0.11	
Species Evenness	0.06	
Species Richness	0.22	

The phytoplankton community is dominated by green algae and diatoms. This is indicative of moderate productivity and good water quality.

Pollution Assessment

Nonpoint pollution sources include nutrient loading and sedimentation from grazing and litter and human wastes from recreation. About 1,000 sheep graze in the immediate vicinity of the reservoir for two weeks each year. Cattle also graze the area. No mining or logging takes place in the region.

There are no point pollution sources in the watershed.

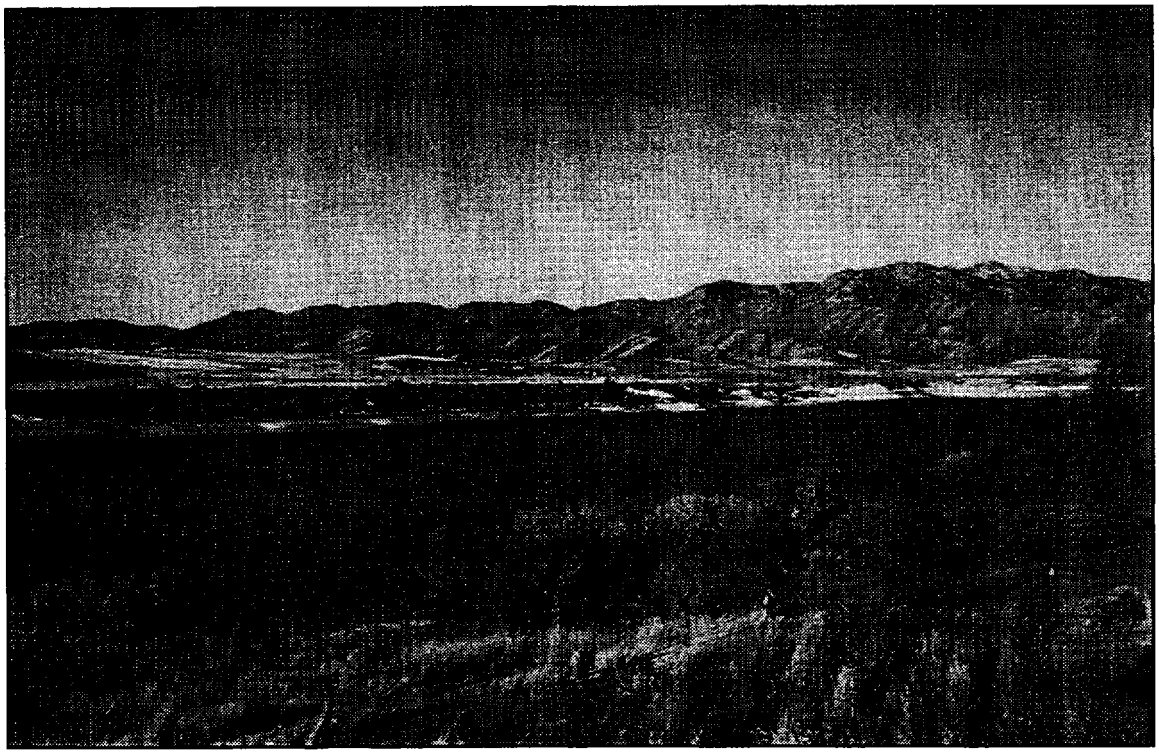
Beneficial Use Classification

The state beneficial use classification for the waters of Cleveland Reservoir include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Manti-La Sal National Forest	637-2817
Six County Commissioners Organization	896-9222
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Reservoir Administrators	
Huntington-Cleveland Irrigation Company	687-2505

HYRUM RESERVOIR



Introduction

Hyrum Reservoir is in Cache Valley, in the city of Hyrum. It is one of the few urban reservoirs in the state. Adjacent to the lake is a heavily used state park. The lake is also the focus of a Clean Lakes Phase I study to improve water quality.

Hyrum Reservoir was created in 1935 by the construction of an earth-fill dam. The reservoir shoreline is owned by the State of Utah with mostly unrestricted public access, although fees are charged in improved recreation areas. The reservoir provides recreation, water storage, wetlands for birds and aquatic life, and waterfowl habitat and refuge. Reservoir water is used for crops, watering stock, and other agricultural needs. Water use is not expected to change in the foreseeable future, however, an expansion to 44,300 acre-feet has been proposed for storage of water from the Bear River drainage.

Characteristics and Morphometry

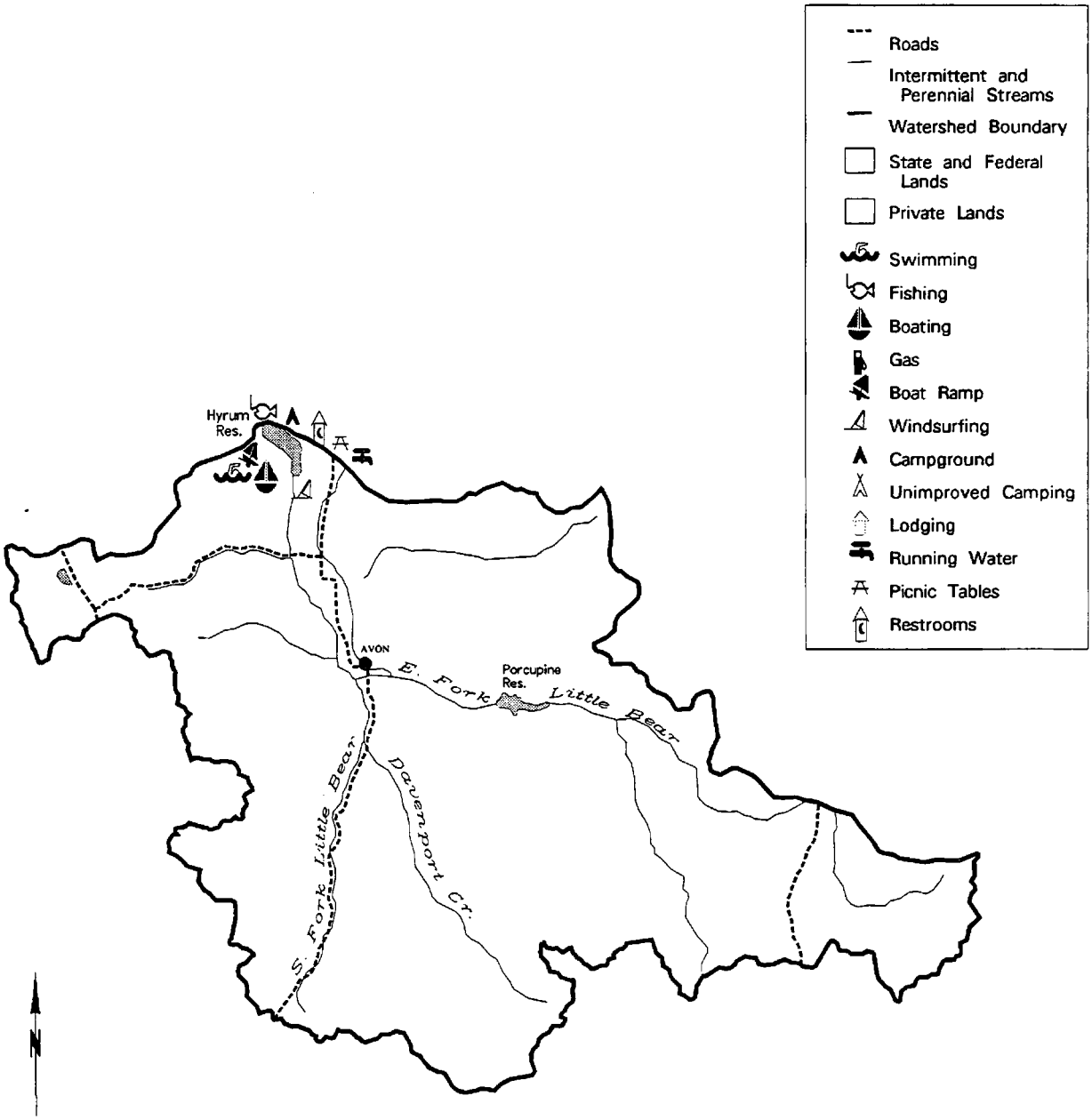
Lake elevation (meters / feet)	1,421 / 4,664
Surface area (hectares / acres)	177 / 438
Watershed area (hectares / acres)	47,139 / 116,480
Volume (m^3 / acre-feet)	
capacity	23,049,217 / 16,290
conservation pool	
Annual inflow (m^3 / acre-feet)	
Retention time (years)	0.30
Drawdown (m^3 / acre-feet)	12,954,237 / 10,502
Depth (meters / feet)	
maximum	25 / 82
mean	12 / 39
Length (km / miles)	2.86 / 1.77
Width (km / miles)	.714 / .44
Shoreline (km / miles)	7.1 / 4.41

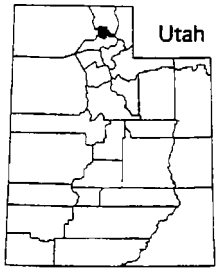
Location

County	Cache
Longitude / Latitude	111 51 28 / 41 37 14
USGS Map	Paradise, 1955
DeLorme's Utah Atlas & Gazetteer™	Page 60, A-3
Cataloging Unit	Little Bear-Logan Rivers (16010203)

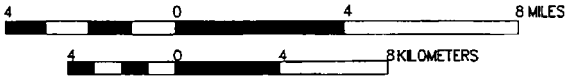
Recreation

Hyrum Reservoir is in the town of Hyrum in Cache Valley. Routes from US-89 to the reservoir are well marked.





County near which watershed is located.



Hyrum Watershed

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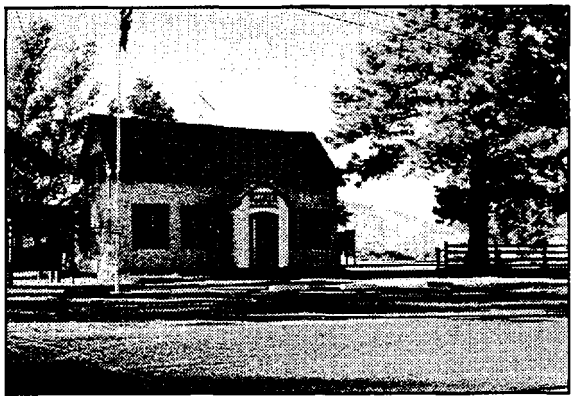
Hyrum Reservoir is a high recreational and agricultural use



facility. Hyrum State Park is located adjacent to the reservoir and has restrooms, drinking water, overnight camping, utility hook-ups a boat ramp and a fish cleaning station. In addition, there is a private development for recreation located in close proximity to the reservoir which is in an urban/agricultural setting.

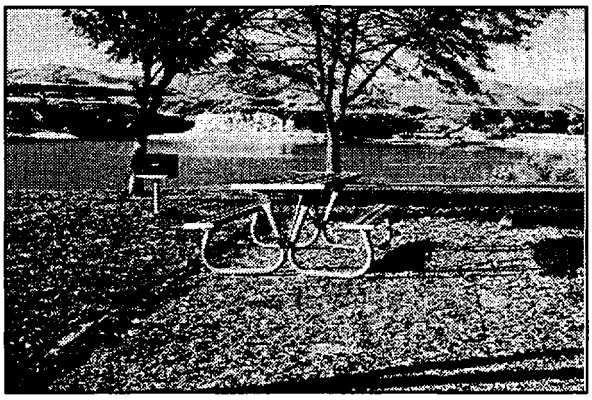
The reservoir receives moderate to heavy use. This area is popular with people throughout the state and is also visited by a significant number of individuals from adjacent States. Year round recreational opportunities are available as ice-fishing becomes a more popular form of recreation in the area. In 1992, the park recorded 168,779 visitors, ranging from 1,261 visitors in January to 52,161 in July.

Watershed Description

The watershed high point is 2,788 m (9,148 ft) above sea level, thereby developing a complex slope of 4% to the reservoir. The inflow and outlet are the Little Bear River, with an average stream gradient of 3.1% (166 feet per mile) Porcupine Reservoir is an impoundment of the Little Bear River several miles upstream from Hyrum.

The watershed is made up of mountains, plateaus, mountain valleys, lake terraces, alluvial fans, and mountain foot-slopes. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of cropland, sage-grass, oak, maple, spruce-fir and aspen. The watershed



receives 41 - 102 cm (16 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 120 - 140 days per year.

Land use in the watershed is as follows: Grazing of domestic livestock on private land (77%), USFS multiple use (16.5%), irrigated pasture and hay fields (3%), dry cropland (3%) and urban (0.5%).

Limnological Assessment

The water quality of Hyrum Reservoir is good, but there have been concerns since the 1950's. According to the Hyrum Reservoir Clean Lakes Phase I study (1994) the issue of degraded water quality conditions are evidenced by extensive late summer blooms of the blue-green *Aphanizomenon flos-aqua*. Phosphorus concentrations frequently exceeded the state indicator value of 25 ug/L during spring runoff. These conditions have resulted in decreased transparency, surface scums and algal mats, noxious odors from these decaying algal mats and changes in food web structure. Low hypolimnetic dissolved oxygen concentrations have occurred in winter and summer. High summer temperatures coupled with low dissolved oxygen have resulted in frequent fish kills. These conditions have compromised beneficial uses of the reservoir.

In a 19971 study, the Little Bear River contributed 97 percent of the phosphorus which entered the reservoir (Luce, 1974). Effluent from a fish hatchery upstream of the reservoir accounted for approximately 40 percent of the inflow total phosphorus and 60 percent of the inflow dissolved total phosphorus. The study also noted significant contributions (50-60 percent) of orthophosphorus and

dissolved total phosphorus from agricultural fields during spring runoff and substantial contributions of all phosphorus fractions in the summer irrigation return flow.

The trout fishery in the reservoir has historically been of variable quality. Prior to 1973, summer fish kills were common in the reservoir. June through early September were identified as a critical period for trout. In addition, numerous fish have been introduced including goldfish (*Carassius autatus*), channel catfish (*Ictalurus punctatus*) and yellow perch (*Perca flavescens*). Yellow perch is now managed as part of the warm water fishery in the reservoir.

Several restoration projects have been implemented to improve water quality in Hyrum Reservoir. An artificial destratification program was conducted during 1973-74 to reduce blue-green algae abundance and improve fish habitat, but was not successful due to insufficient destratification of the water column. A second aeration effort occurred in 1980-81 to improve summer water quality for trout and to improve carryover of stocked trout into the following year., Aeration was successful in 1980, but less successful in 1981. The reservoir was also chemically treated with a piscicide (rotenone) in 1988 to remove non-game fish before restocking efforts were initiated.

As part of the Clean Lake study in 1992-93 water year the reservoir was sampled monthly from October through April and bi-monthly from May through September, the productive season. Four sites on the reservoir and sites throughout the watershed were sampled to obtain a representative view of water quality within the reservoir and its watershed. Various water quality parameters, including nutrients, bacteria, chlorophyll-a dissolved oxygen and river flow, were measured to assess current water quality in the reservoir and inflow waters.

The results from the current study of Hyrum Reservoir showed improvements in several water quality indicators relative to past conditions. Water transparency was good, with a maximum transparency of 4.6 meters in January and midsummer transparencies ranging from 2.2. to 3.2 meters. Although algal concentrations were high in summer, blooms of *Aphanizomenon flos-aqua* were not present, apparently because an increase in the nitrogen to phosphorus ratio in the reservoir eliminated the competitive advantage of this nitrogen-fixing algae. Chlorophyll-a concentrations followed the seasonal phytoplankton abundance pattern throughout most of the 1992-1993 water year, with concentrations low in winter (0.1 ug/L) but immediately increased to a spring maximum of 13.5 ug/L. Improvements could be attributed to a reduction in dissolved total phosphorus output from the fish hatchery above the reservoir.

Surface temperature in the reservoir ranged from 0°C to 20°C. Dissolved oxygen ranged from 7.8 to 9.1 mg/L. This combination of lower temperatures and slightly higher dissolved oxygen concentrations prevented the loss of fish habitat throughout the year.

Limnological Data

Data averaged from STORET sites: 590167, 590168

Surface Data	1981	1989	1991
Trophic Status	E	M	M
Chlorophyll TSI	-	45.37	48.26
Secchi Depth TSI	35.97	40.97	44.66
Phosphorous TSI	47.35	51.17	36.29
Average TSI	41.66	45.84	43.07
Chlorophyll a (ug/L)	-	4.5	6.0
Transparency (m)	5.3	3.8	2.9
Total Phosphorous (ug/L)	20.0	33	10
pH	8.4	8.5	8.5
Total Susp. Solids (mg/L)	-	-	5
Total Volatile Solids (mg/L)	-	-	5
Total Residual Solids (mg/L)	-	-	<2
Temperature (°C / °f)	20/68	19/67	19/67
Conductivity (umhos.cm)	370	389	367
Water Column Data			
Ammonia (mg/L)	0.08	0.083	0.054
Nitrate/Nitrite (mg/L)	0.36	-	0.23
Hardness (mg/L)	207	-	190
Alkalinity (mg/L)	201	-	178
Silica (mg/L)	-	-	10.3
Total Phosphorous (ug/L)	37.5	37	15
Miscellaneous Data			
Limiting Nutrient	N	N	P
DO (Mg/l) at 75% depth	3.4	6.9	2.9
Stratification (m)	6-11	NO	NO
Depth at Deepest Site (m)	18	14.5	15.2

Trophic State indicators (TSI), a measure of lake productivity, were calculated from total phosphorus, chlorophyll-a, and secchi depth. The TSI for the 1992-1993 water year indicate the reservoir is now mesotrophic compared the historic mesotrophic-eutrophic classification. These date further support an improvement in reservoir water quality.

Although an improvement in water quality was observed, problems were evident with some water quality parameters. Hypolimnetic dissolved oxygen concentrations remained below state criteria, ranging from 1.0 to 4.7 mg/L during summer. The volume-weighted mean total phosphorous concentrations were greater than the state pollution indicator level of 0.25 mg/L throughout the winter. Finally, sporadic, high total and fecal coliform counts in the late fall posed a potential public health problem.

During the 1992-1993 monitoring study, the majority of external nutrient and sediment loading to the reservoir

occurred during the runoff. The amount of total phosphorous entering the reservoir, was reduced by 37 percent in 1993 compared to 1971. A reduction in hatchery effluent probably contributed to this observed decrease in dissolved total phosphorous. The relative phosphorous loadings from this source have decreased by almost 90 percent since 1972 as operations at the hatchery were curtailed dudring the study period..

Particulate phosphorous loading increased slightly from 5,380 kg in 1971 to 5,750 kg in 1993. This increase in particulate phosphorous loading suggests that contributions from nonpoint sources may have increased since 1971.

An average of 20,000 kg/day of sediment entered the reservoir (7,200,000 kg/year) during the 1992-1993 water year. More than 60 percent of the inflow sediment was retained in the reservoir. This retention of sediment is consistent with the total phosphorus budget and historical date.

High internal loading of dissolved total phosphorus during the winter and prior to runoff lead to the export of dissolved total phosphorus from the reservoir after the rapid turnover in early spring and export as water is released downstream. As a result there is a net loss of this phosphorus fraction from the reservoir but an increase in dissolved total phosphorus downstream into the Little Bear River. The historic record indicates that Hyrum Reservoir previously acted as a phosphorus sink retaining 60 percent of the total phosphorus and 36 percent of the dissolved total phosphorus entering the reservoir. During the 1992-1993 water year, however, a net export of dissolved total phosphorus occurred. Reservoir outflows in 1993 were 69 percent of 1971 outflows. The observed 1992-1993 seasonal changes in internal dissolved phosphorus loading appear to be related to phosphorus dynamics at the sediment-water interface and macrophyte decay.

Reduced phosphorus loading resulted in higher nitrogen to phosphorus ratios throughout the 1992-1993 water year. As a result, blue-green algae were less competitive, and nuisance blooms of the blue-green *Aphanizomenon flos-aqua* did not occur.

Although an improvement in the biological condition of the reservoir was observed, several of the water quality parameters measured in 1993 were unimproved. From January to September more than 30 percent of the reservoir had dissolved oxygen values below the 30-day average aquatic wildlife criteria of 6.5 mg/L. In addition, 56 percent of total phosphorus values exceeded the state indicator of 0.025 mg/L. Fecal coliform and total coliform also violated state criteria three and six percent of the time, respectively.

Restoration efforts should be directed towards the development and implementation of a water quality management plan which will bring water quality parameters into compliance with state beneficial use criteria. Permanent water quality improvement in Hyrum Reservoir will rely on a long term reduction of nutrient and sediment loading from the watershed. In order to maintain present water quality conditions in Hyrum reservoir, it is imperative that the current phosphorus point source loading to the reservoir not increase. Further improvements in water quality can be expected by reducing the external total phosphorus loading to a total maximum daily load of 6.4 kg/day by watershed and riparian zone improvements.

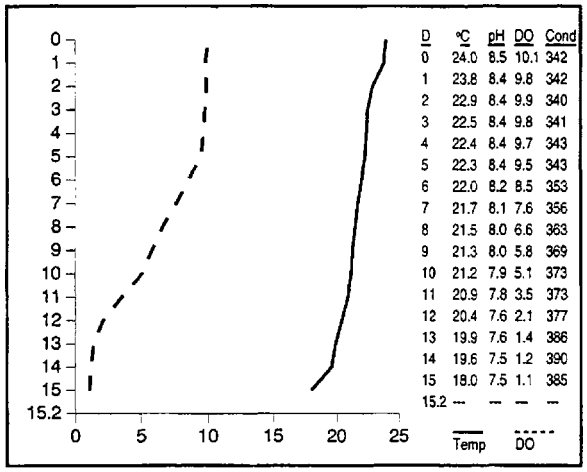
Implementation of best management practices (BMP's) and stabilization of sections of streambanks are required to reduce watershed input of sediments and nutrients from the Little Bear River. A large scale restoration project, the Utah Little Bear Hydrologic Unit Area Plan, was initiated in 1990 to address nonpoint source water pollution associated with agricultural and rangeland practices. The goals of this project are to reduce streambank and rangeland erosion.

While large scale watershed management addresses the primary pollution source, supplementing this management program with other restorative measures may provide temporary and immediate improvement in water quality. Moreover, once external loading is reduced, additional reservoir treatment may be required to offset prolonged eutrophication conditions in the reservoir due to the residual internal phosphorus loading which is the result of historical eutrophication. Several of these treatment options are described in detail in section 5.4 of this document. However, these restoration measures will not be effective unless external, point and nonpoint source loading to the reservoir is reduced.

In 1989 and 1991 samples were collected twice on Hyrum Reservoir. The water is considered to be hard with a hardness concentration of 199 mg/L ($CaCO_3$). Although the profile of August 13, 1991 does not show stratification in the reservoir the reservoir does stratify and as indicated in the profile oxygen depletions downward in the water column do occur. These types of conditions reduce available habitat for a fishery, and increase the internal loading of phosphorus as anoxic conditions develop, especially during the winter season.

The reservoir has been classified as a mesotrophic system during all of our periods of study. Although nitrogen /phosphorus ratios indicate the reservoir was nitrogen limited in 1981 and 1989, recent data (1991) and data from the Phase I study indicate that the reservoir is limited during the productivity season.

The fishery is impaired due to extensive algal blooms and some macrophyte production. The fishery and other recreational components are impacted due to the high enrichment of the waters of the reservoir. These high levels of nutrients lead to high algal production and macrophyte



D	°C	pH	DO	Cond
0	24.0	8.5	10.1	342
1	23.8	8.4	9.8	342
2	22.9	8.4	9.9	340
3	22.5	8.4	9.8	341
4	22.4	8.4	9.7	343
5	22.3	8.4	9.5	343
6	22.0	8.2	8.5	353
7	21.7	8.1	7.6	356
8	21.5	8.0	6.6	363
9	21.3	8.0	5.8	369
10	21.2	7.9	5.1	373
11	20.9	7.8	3.5	373
12	20.4	7.6	2.1	377
13	19.9	7.6	1.4	386
14	19.6	7.5	1.2	390
15	18.0	7.5	1.1	385
15.2	—	—	—	—

phosphorus development. High algal production reduces dissolved oxygen concentrations and creates other problems associated with the fishery.

In addition, the trout population in the reservoir is infested with anchorworm (*Lernaea cyprinacea*) and the downstream fishery conditions are effected due to flow reductions from the reservoir. As reported by DWR the reservoir maintains a population of perch (*Perca flavescens*), rainbow trout (*Oncorhynchus mykiss*), goldfish (*Carassius autatus*, channel catfish (*Ictalurus punctatus*), largemouth bass (*Micropterus salmoides*), smallmouth bass (Micropterus dolomieui), kokanee (*Oncorhynchus nerka*), and splake, a cross between brook trout and lake trout (*Salvelinus fontinalis* X *Salvelinus namaycush*). DWR typically stocks the reservoir with 8,000 fingerling and 1,000 catchable rainbow trout annually. Largemouth bass were stocked in the reservoir in 1990.

Waterskiing and swimming are impaired due to the large amounts of algae present in the summer months. In addition extensive growth of macrophytes in the upper reaches of the reservoir prohibit boating and impair water quality conditions.

For a complete analysis of the limnology refer to the Clean Lakes Phase I Study.

Phytoplankton in the euphotic zone for August 13, 1991 include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	161.101	93.29
Ceratium hirundinella	5.617	3.25
Eudorina elegans	5.560	3.22
Wislouchiella planktonica	0.222	0.13
Dinobryon divergens	0.093	0.05
Pennate diatoms	0.047	0.03
Oocystis sp.	0.033	0.02
Chlamydomonas globosa	0.004	0.00
Total	11.798	
Shannon-Weaver [H']	0.30	
Species Evenness	0.15	
Species Richness	0.27	

The phytoplankton community is dominated by green algae, however historically there has been a dominance by the blue-green algae, *Aphanizomenon flos-aqua.* A similar type of dominance and composition was exhibited during the Phase I study period. However, *Aphanizomenon* colonies were present in August and replaced with colonies of Microcystis in September.

Information

Management Agencies	
Bear River Association of Governments	752-7242
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Bridgerland Travel Region (Logan) / Logan Chamber Of Commerce	752-2161
Hyrum State Park	245-6866
Reservoir Administrators	
DOI	524-5403

Pollution Assessment

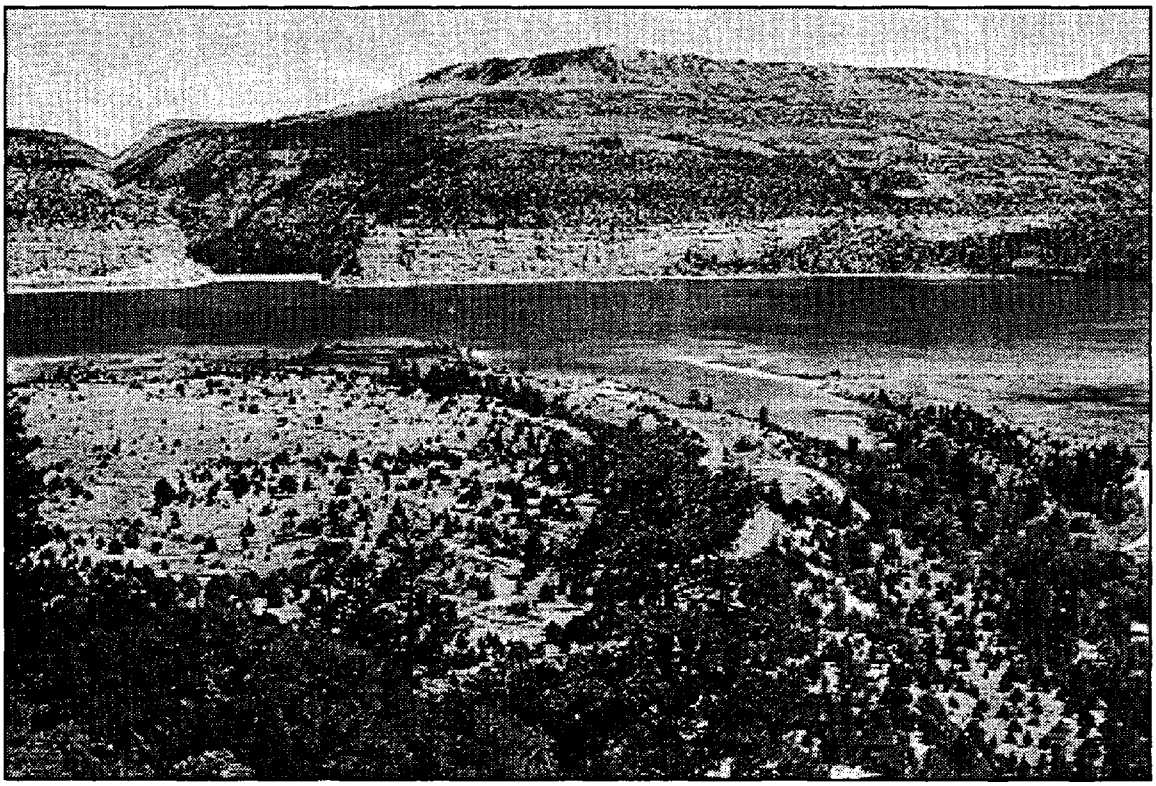
Nonpoint pollution sources include the following: Sedimentation and nutrient loading from grazing. Litter, human waste and chemicals from recreation. Nutrients and sedimentation from agricultural practices in the watershed.

The one major point source of pollution that discharges into tributary waters in the watershed area of Hyrum Reservoir is Whites Trout Farm. It contributes a major nutrient-loading resulting in increased production in the reservoir and degraded lake water quality.

Beneficial Use Classification

The state beneficial use classifications include: recreational bathing (swimming) 2A, boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

JOES VALLEY RESERVOIR



Introduction

Joe's Valley Reservoir is located on the eastern slope of the Wasatch Plateau in the Manti-La Sal Mountains and is a principal component in the Emery County Reclamation Projected constructed by the U.S. Bureau of Reclamation. Storage of irrigation water began on November 3, 1965. It was formed by an impoundment of Cottonwood Creek near the confluence of Lowry Water, Seely Creek, Swasey Creek, and North Dragon Creek by an earth-fill, rockfaced dam. It is located approximately 12 miles west of Orangeville, Utah.

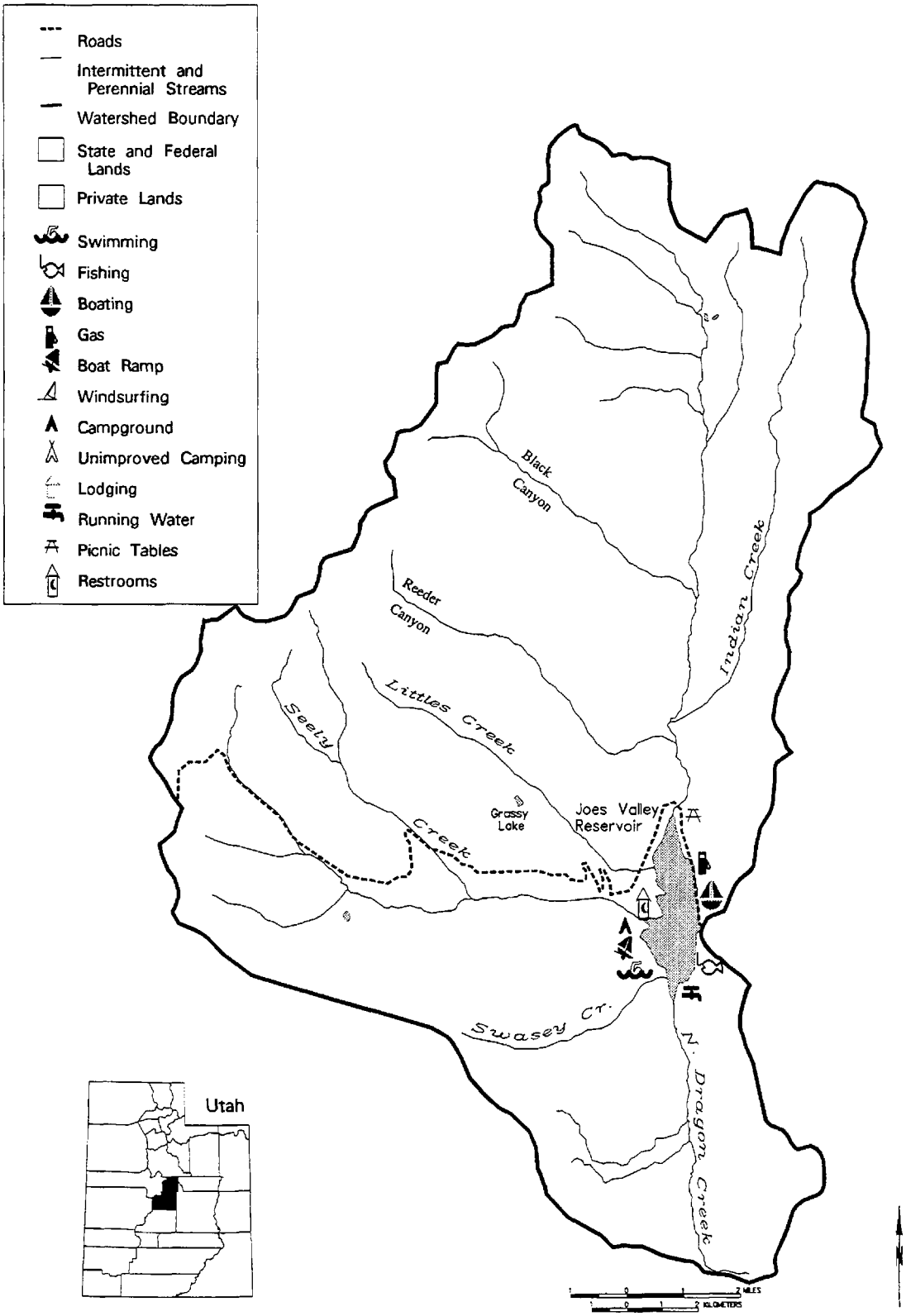
The shoreline is owned primarily by the Manti-La Sal National Forest with some private lands on the southwest shoreline. Reservoir level and downstream releases are controlled by the Emery Water Conservancy District. Public accessibility is basically unrestricted. Reservoir water is currently used for recreation, cold water fishery and

Characteristics and Morphometry

Lake elevation (meters / feet)	2,097 / 6,880
Surface area (hectares / acres)	479 / 1,183
Watershed area (hectares / acres)	35,742 / 88,320
Volume (m^3 / acre-feet)	
capacity	8.869×10^7 / 71,900
conservation pool	none
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	51.4 / 168.7
mean	13 / 44
Length (km / miles)	5.6 / 3.14
Width (km / miles)	1.52 / .95
Shoreline (km / miles)	15.1 / 9.4

Location

County	Emery
Longitude / Latitude	*111 16 47 / 39 17 30*
USGS Map	Joe's Valley Reservoir, 1966
DeLorme's Atlas and Gazetteer™	Page 38, A-1
Cataloging Unit	San Rafael (14060009)



County in which watershed is located.

Joes Valley Watershed

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agriculture. No changes are expected in the future.

Recreation

Joe's Valley Reservoir is directly accessible from U-10 near Castle Dale via U-57 on the south or U-29 on the north. Proceed west for approximately 12 miles from Orangeville through Straight Canyon to the reservoir. The reservoir is nestled in a north/south valley with relatively steep terrain on the east and west slopes. It is a beautiful area and generally receives moderately heavy usage with heavy use on holiday weekends.

Fishing is the primary activity, however, boating, camping, swimming, nordic skiing and snowmobiling are also thoroughly enjoyed. Fishing is generally very good with excellent ice fishing in the winter. The reservoir provides fishing for rainbow, cutthroat, splake, brown and lake trout.

Recreational facilities are fairly extensive and there are some commercial facilities (full service marina, general store and restaurant) located at the reservoir. Commercial services provided include: gas, camping equipment, fishing tackle, boats, groceries, and boat storage.

Two camping areas are located at the reservoir. Near the boat ramp is a trailer camping area with 17 sites available. Fire rings, standing grills, tables and vault rest rooms are located outside the parking area with parking for boat trailers in the area. There are no electrical hookups or dump station present, but dump stations are available at Castle Dale. Two campgrounds (46 site and 18 site) are located in one general area on the west side of the reservoir. Single and multiply family units are provided. Fire rings, standing grills, tables, vault toilets, water and asphalt pads are available. Some of the sites are under the MISTIX Reservation System and reservations are recommended on holidays and weekends.

Several fisherman parking areas and rest room facilities are located at convenient places around the reservoir. In addition there are a significant number of summer homes being developed in the area.

Watershed Description

The reservoir is located in high mountains and plateaus. The reservoir fills the valley floor where the gentle slopes quickly give way to steeper terrain. The reservoir collects water primarily from three major drainage areas into the reservoir.

The watershed high point is 11,282 feet above mean sea level, thereby developing a 30% complex slope to the reservoir. The average decrease in river mile elevation is 5.7% (302 feet per mile).

The soil is of limestone origin and has good permeability and moderately slow erosion and runoff. Soil groupings are found in Appendix III.

The vegetation communities are comprised of pine, aspen, spruce-fir, oak, maple, bitterbrush, mountain mahogany, pinyon-juniper, sage-grass, mahonia and grass-forbes. The watershed receives 20.3 - 63.5 cm (8 - 25 inches) of precipitation annually with a frost-free season of 0 - 100 days at the reservoir.

Land use in the reservoir is primarily multiple use forest lands, used by humans for hunting, recreation and livestock grazing. Summer home development is a major land use of the private areas of the watershed.

Limnological Assessment

The water quality of Joes Valley Reservoir is very good, even though it appears that the reservoir does experience declining dissolved oxygen concentrations in the water column. It is considered to be hard with a hardness concentration of approximately 195 mg/L ($CaCO_3$). The only parameter that has exceeded State water quality standards for defined beneficial uses is dissolved oxygen. The average concentration of total phosphorus in the water column throughout the study period is less than or equal to 10 ug/L. These concentrations are well below the recommended pollution indicator for phosphorus of 25 ug/L. As depicted in the August 28, 1991 profile the dissolved oxygen concentrations in late summer substantiate the fact that water quality impairments do exist. The reservoir does stratify as indicated by the profile and there is a rapid decline in dissolved oxygen concentrations downward in the water column. Below 10 meters conditions do not support a viable fishery. Data from all of the study periods support the fact that the Reservoir is to be an oligotrophic system with low productivity. The system is currently a phosphorus limited system.

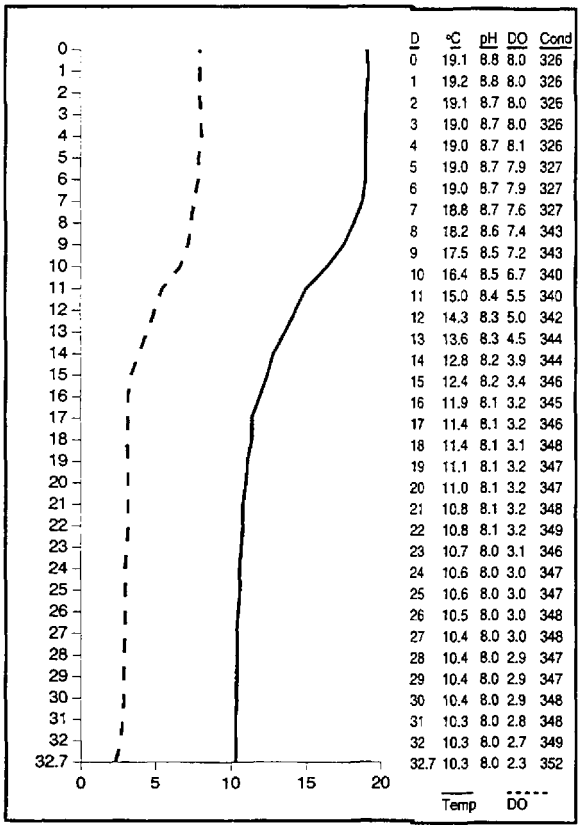
The DWR stocks the reservoir annually with catchable albino trout (*Oncorhynchus mykiss*) and fingerling rainbow (*Oncorhynchus mykiss*) and splake trout (*Salvelinus fontinalis* X *Salvelinus fontinalis*). In addition largemouth

Limnological Data

Data averaged from STORET sites: 493104, 493105, 493106, 493107

Surface Data	1979*	1989	1991
Trophic Status	O	O	O
Chlorophyll TSI	39.43	30.46	27.14
Secchi Depth TSI	22.50	32.20	44.06
Phosphorous TSI	47.35	29.89	32.44
Average TSI	36.43	30.85	34.55
Chlorophyll a (ug/L)	-	1.5	1.05
Transparency (m)	13.5	6.3	3.0
Total Phosphorous (ug/L)	10	5	9
pH	8.3	8.5	8.6
Total Susp. Solids (mg/L)	<5	-	<3
Total Volatile Solids (mg/L)	-	-	1
Total Residual Solids (mg/L)	-	-	<2
Temperature (°C / °f)	15/59	17/63	16/60
Conductivity (umhos.cm)	294	368	365
Water Column Data			
Ammonia (mg/L)	0.05	0.02	0.06
Nitrate/Nitrite (mg/L)	0.14	0.15	0.06
Hardness (mg/L)	191	-	198
Alkalinity (mg/L)	188	-	189
Silica (mg/L)	3.8	-	4.1
Total Phosphorous (ug/L)	10	7	7
Miscellaneous Data			
Limiting Nutrient	P	P	P
DO (Mg/l) at 75% depth	3.9	4.6	3.0
Stratification (m)	16-17	NO	9-11
Depth at Deepest Site (m)	38	34	32.7

* Data summarized from only 2 sites.



bass (*Micropterus salmoides*) were stocked in the reservoir at one time. The reservoir has never been chemically treated in by the DWR to control rough fish competition, so populations of indigenous fish may be present in the reservoir. Data obtained from surveys conducted by DWR in 1976-77 indicate that the principal algal taxa inhabiting the reservoir were *Microcystis, Chroomonas, Carteria, Cryptomonas, Cyclotella,* and *Dinobryon.* The reservoir zooplankton community is composed chiefly of *Daphnia, Bosmina*, Cyclopoid copepods, and rotifers. The principal benthos present are *Chironomidae* larvae, oligochaetes, and ostracods.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm³/liter)	% Density By Volume
Fragilaria crotonensis	0.229	48.81
Aphanizomenon flos-aqua	0.211	45.02
Pennate diatoms	0.010	2.13
Centric diatoms	0.009	2.01
Asterionella formosa	0.009	2.01
Total	.468	

Shannon-Weaver [H']	0.95
Species Evenness	0.59
Species Richness	0.20

The flora is fairly typical, but not particularly diverse. The dominance of diatoms and blue-green algae indicates that the lake is reasonably healthy.

Pollution Assessment

Nonpoint pollution sources are: grazing, recreation and development.

There are no point pollution sources in the watershed.

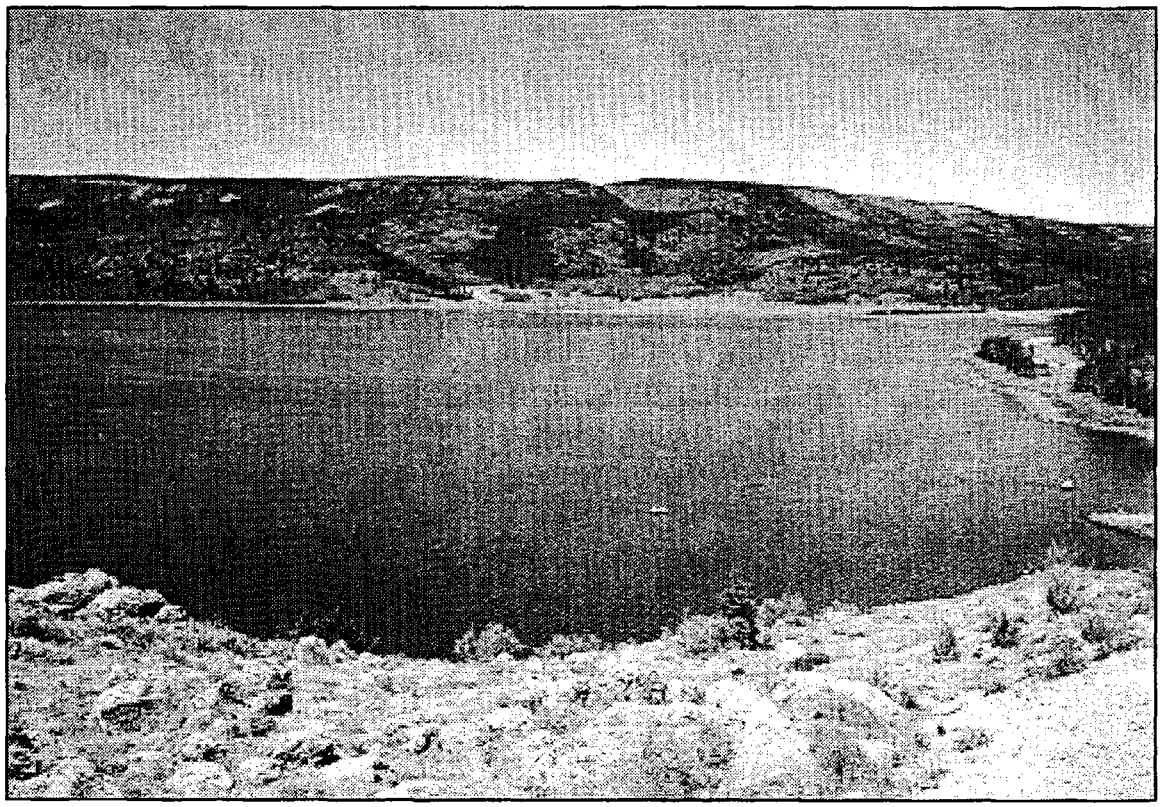
Beneficial Use Classification

The state beneficial use classifications include: recreational bathing (swimming) (2A), boating and similar recreation (excluding swimming) (2B), cold water game fish and aquatic life (3A) and agricultural uses (4).

Information

Management Agencies	
Manti-La Sal National Forest	637-2817
Ferron Ranger District	384-2372
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Castle Dale Chamber of Commerce	381-2547
Six County Commissioners Association	896-9222
Reservoir Administrators	
Emery Water Conservancy District	

JOHNSON VALLEY RESERVOIR



Introduction

Johnson Valley Reservoir is northeast of Fish Lake on the Fish Lake Plateau. It is a shallow, intermediate-sized impoundment of a mountain meadow.

The reservoir shoreline is publicly owned and administered by the Fish Lake National Forest with unrestricted public access. Defined beneficial uses include: water recreation excluding swimming, propagation of cold water species of game fish and aquatic life, and agricultural needs.

Characteristics and Morphometry

Lake elevation (meters / feet)	2,688 / 8,819
Surface area (hectares / acres)	285 / 704
Watershed area (hectares / acres)	14,017 / 34,634
Volume (m^3 / acre-feet)	
capacity	12,331,318 / 9,997
conservation pool	
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	6.4 / 21
mean	4.3 / 14.2
Length (meters / feet)	2.7 / 1.7
Width (km / miles)	1.9 / 1.2
Shoreline (km / miles)	7.9 / 4.9

Location

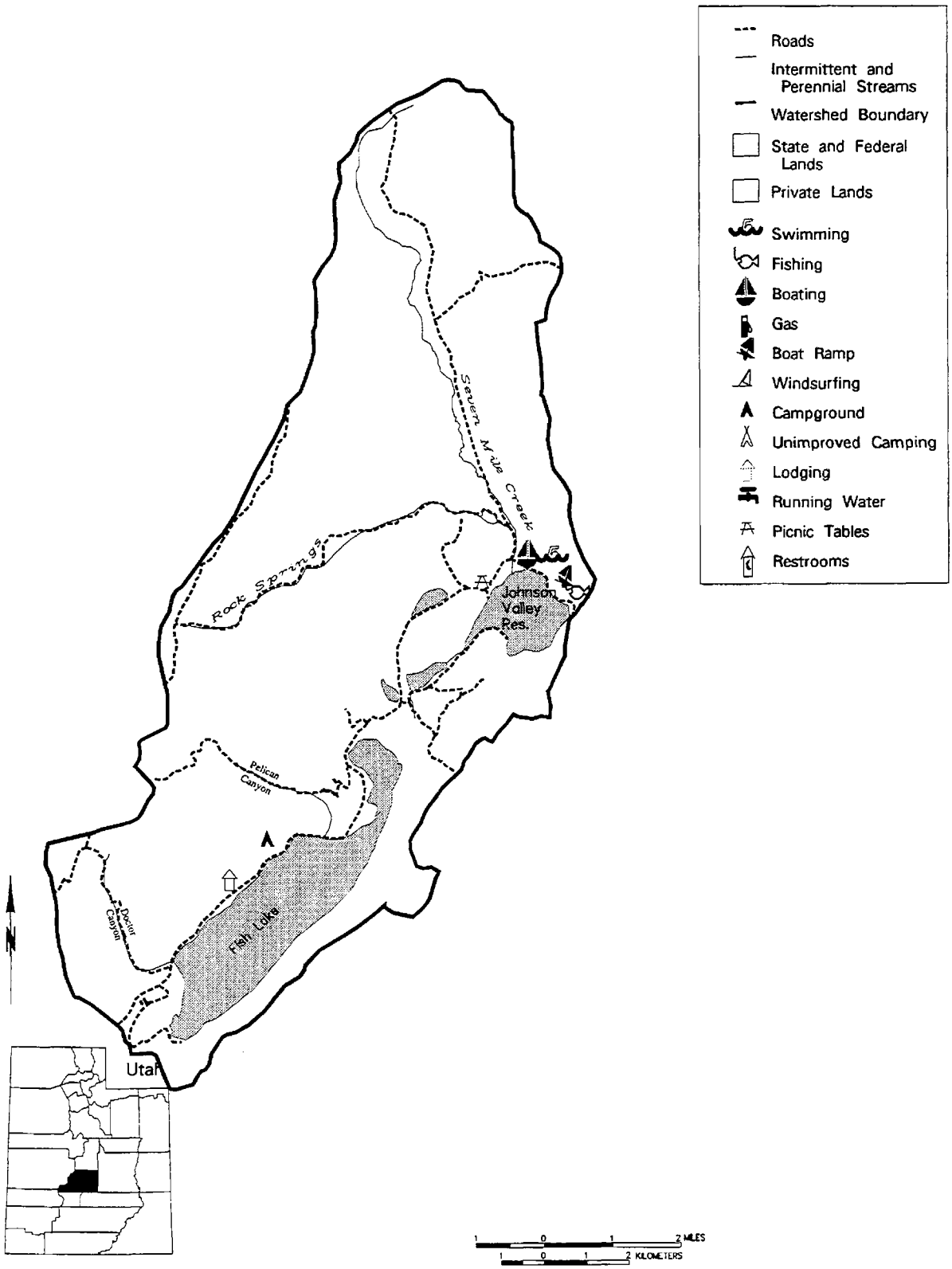
County	Sevier
Longitude / Latitude	111 38 00 / 38 36 05
USGS Map	Fish Lake, Utah, 1968
Cataloging Unit	Fremont River (14070003)

Recreation

Johnson Valley Reservoir is most easily accessed from U-25 at Fish Lake. Continue past Fish Lake on FS-640, which raps around the north shore. An alternate access is on FS-036, a paved road beginning 2 miles north of Fremont on U-72.

Fishing, boating, waterskiing and swimming are possible in the area. Usage is heavy.

Recreational facilities at the reservoir consist of an



County in which watershed is located.

Johnson Valley Watershed

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improved public boat ramp and picnic facilities at Johnson Reservoir Park, on FS-036 1 mile east of the junction with FS-640. The Forest Service maintains a free campground at the junction of FS-036 and FS-640 (Piute Parking Area--48 tent sites but no drinking water), and an improved campground between Fish Lake and Johnson Valley on FS-640 (Frying Pan Flat--11 campsites, fee charged). Housekeeping cabins are available nearby at Fish Lake.

Watershed Description

The reservoir is in an area of high, rolling ridges and wide valleys characteristic of the top of the Fish Lake Plateau. The watershed high point (the Fish Lake Hightop Plateau), is 3,545 m (11,633 ft) above sea level, thereby developing a complex slope of 12.5% to the reservoir. The average stream gradient above the reservoir is 7.3% (386 feet per mile). The soil is largely of volcanic origin with moderate permeability and moderately slow erosion and runoff.

The vegetation communities are comprised of pine, aspen, spruce-fir, oak and maple. The watershed receives 41 - 76 cm (16 - 30 inches) of precipitation annually with a frost-free season of 60 - 80 days at the reservoir.

Limnological Assessment

The water quality of Johnson Valley Reservoir is fair, even though it is usually fairly turbid due to the shallow nature of the reservoir. It is considered to be soft with a hardness concentration of 64 mg/L ($CaCO_3$). The only parameters that have exceeded State water quality standards for defined beneficial uses are phosphorus and dissolved oxygen.. The average concentration of total phosphorus in the water column in 1989 and 1991 was 123 and 97 ug/L which is significantly over the recommended pollution indicator for phosphorus of 25 ug/L. Dissolved oxygen concentrations in late summer as indicated by the August 22, 1991 profile substantiate the fact that water quality impairments do exist. Even with the shallowness of the reservoir dissolved oxygen concentration decline through the water column. Due to the high productivity of the reservoir, it is evident that during the night through the process of respiration carried out by the algal population that severe depletions in the concentration of dissolved oxygen could occur especially with the shallow nature of the reservoir. Although there have not been a recent reports of fish kills in the reservoir, it appears that the possibility of one certainly exists. There are several factors, turbidity, mixing and climatic conditions that could be inhibiting the occurrence of a fish kill. In 1981, 1989 and 1991 the reservoir was characterized as a nitrogen limited system. TSI values indicate the reservoir is hypereutrophic.

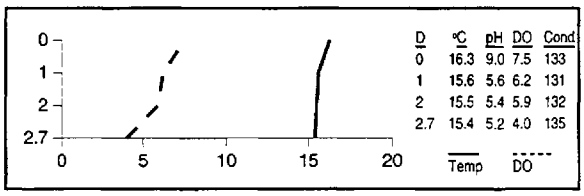
The DWR currently stocks the reservoir with fingerling rainbow (*Oncorhynchus mykiss*) and cutthroat (*Oncorhynchus clarki*) trout.

Johnson Valley Reservoir was treated in 1979 for rough fish control and later restocked with rainbow trout (*Oncorhynchus mykiss*), cutthroat trout (*Oncorhynchus clarki*), and brook trout (S. fontinalis). In 1979 DWR reported: an abundant invertebrates population including snails, Chironomids midges, and mayfly larvae; plankton was evident but not abundant; only submergent macrophytes were found and these were abundant. The two most common types were *Scirpus* and *Potamageton*. DWR recorded the stocking of catchable rainbow trout for 1980.

Limnological Data

Data averaged from STORET sites: 595610, 595611

Surface Data	1981	1989	1991
Trophic Status	E	H	H
Chlorophyll TSI	-	58.22	68.58
Secchi Depth TSI	44.17	61.52	65.44
Phosphorous TSI	57.34	71.54	70.09
Average TSI	50.76	63.77	68.04
Chlorophyll a (ug/L)	-	16.87	50.75
Transparency (m)	3	0.9	0.6
Total Phosphorous (ug/L)	40	107	97
pH	7.6	7.9	8.8
Total Susp. Solids (mg/L)	<5	-	20
Total Volatile Solids (mg/L)	-	-	6
Total Residual Solids (mg/L)	-	-	9
Temperature (°C / °f)	10/50	15/59	14/57
Conductivity (umhos.cm)	121	149	129
Water Column Data			
Ammonia (mg/L)	0.05	0.01	0.04
Nitrate/Nitrite (mg/L)	0.13	-	0.01
Hardness (mg/L)	64	-	63
Alkalinity (mg/L)	66	-	65
Silica (mg/L)	-	-	19.3
Total Phosphorous (ug/L)	37.5	123	97
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	7.2	5.2	5.9
Stratification (m)	NO	1-2	NO
Depth at Deepest Site (m)	6	4.2	2.7



Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Anabaena spiroides var Crassa	323.814	99.00
Stephanodiscus niagarae	2.991	0.91
Pandorina morum	0.222	0.07
Centric diatoms	0.025	0.01
Oocystis sp.	0.016	0.01
Asterionella formosa	0.009	0.00
Pennate diatoms	0.003	0.00
Total	327.080	
Shannon-Weaver [H']	0.06	
Species Evenness	0.03	
Species Richness	0.23	

While there is a fairly high number of taxa found, it is typical of eutrophic reservoirs in that one taxon is extremely dominant. The system is dominated by blue-green algae.

Information

Management Agencies	
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Fish Lake National Forest	896-4491
Loa Ranger District	836-2811,2800
Recreation	
Bowery Haven Resort	836-2788
Fish Lake Resort	836-2700
Panoramaland Travel Region	896-8965
Reservoir Administrators	
Fremont Irrigation Company	

Pollution Assessment

Nonpoint pollution sources grazing and recreation. About 1144 cattle graze in the immediate vicinity of the reservoir part of each year.

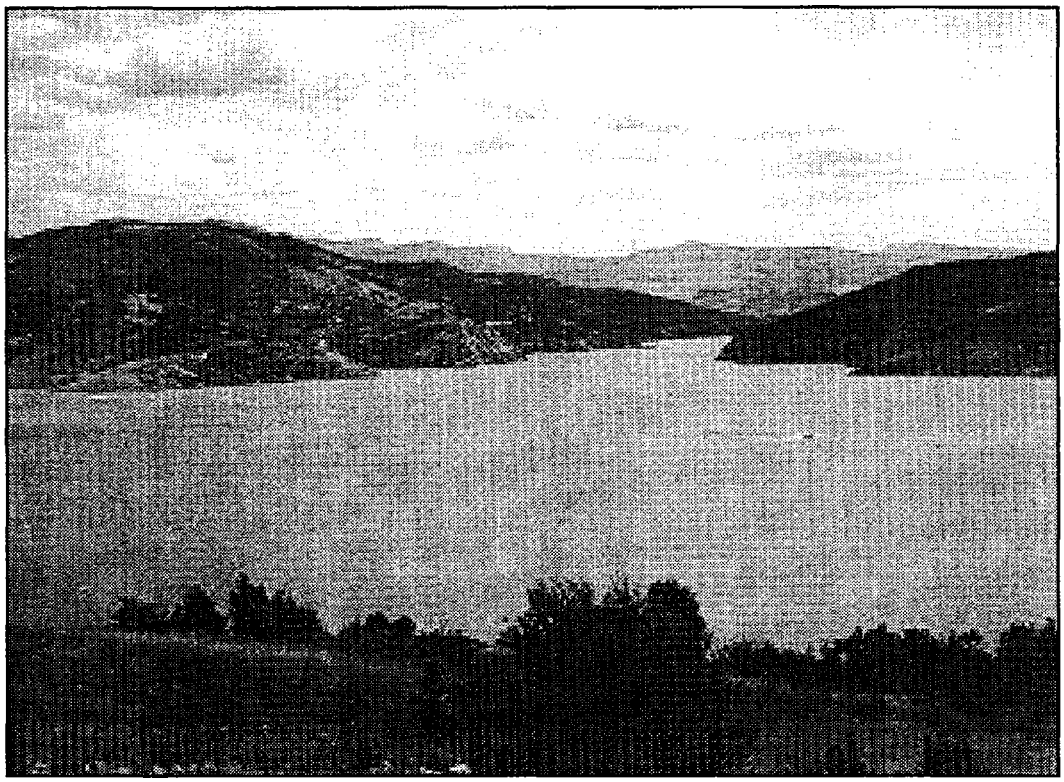
There are no point pollution sources in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Water quality is sufficient to sustain current water use.

JORDANELLE RESERVOIR



Introduction

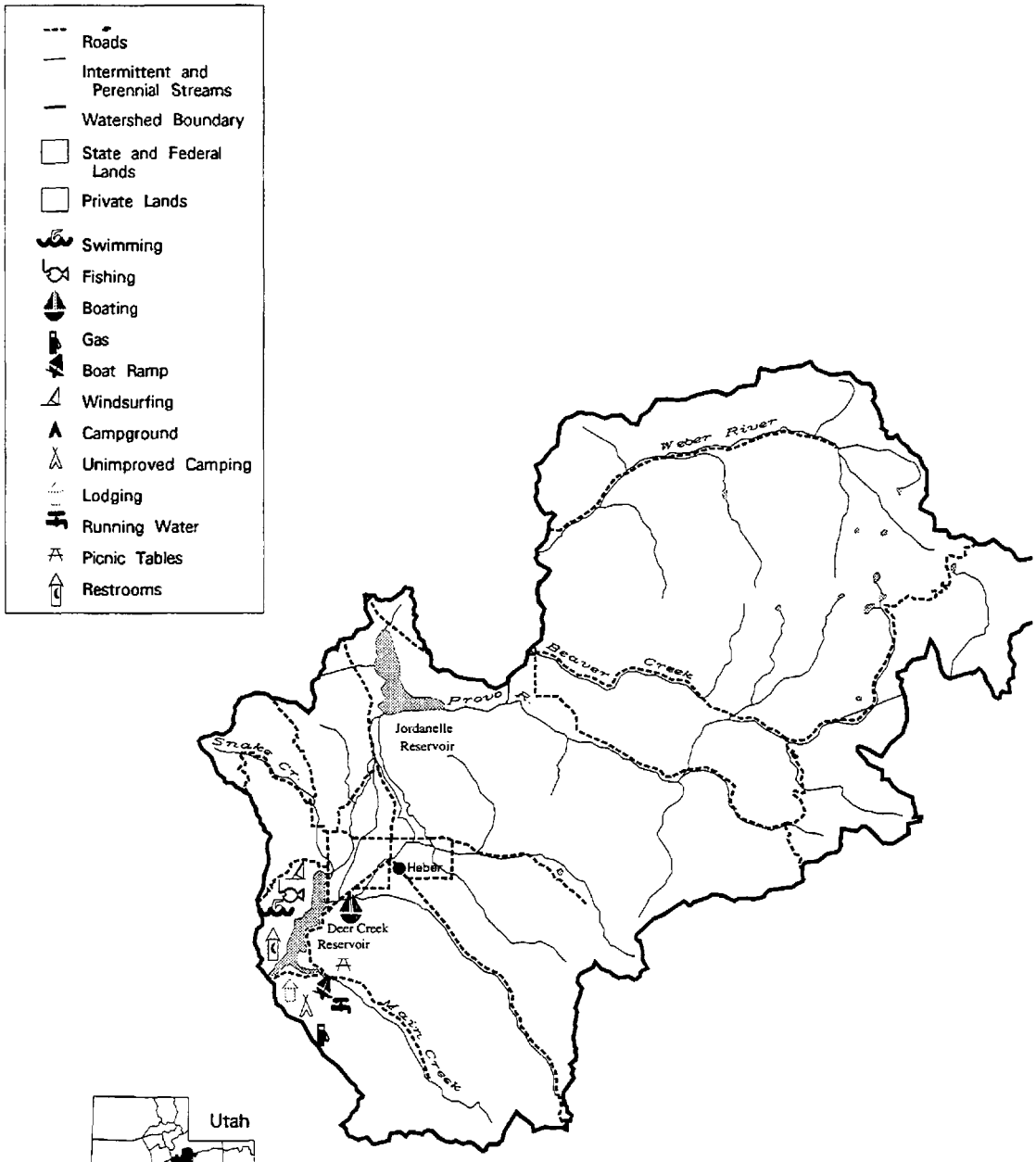
Jordanelle Reservoir is a newly created, large reservoir located on the Provo River about six miles north of Heber City. The reservoir at full capacity could store a total of 360,500 acre-feet of water covering a surface area of 3,300 acres. It was built to provide water storage at an upstream site to exchange for Bonneville Unit water in Utah Lake and Strawberry Reservoir and for most of the water presently regulated in 16 small reservoirs on the headwaters of the Provo River. Most of these reservoirs will be stabilized at or near the original lake levels except for three reservoirs where dams will be reconstructed. Jordanelle Reservoir would function as a long-term holding facility with water levels which fluctuate from year to year, depending on the demands by the water users and the offsetting spring flows. Recreation facilities were completed during the summer of 1995 which are managed as a State Park. Early indications reveal that usage of those facilities is extremely heavy as usage reaches its capacity during weekends. In addition a 10 megawatt powerplant is proposed for consideration at the

Characteristics and Morphometry

Lake elevation (meters / feet)	1,879 /6,166
Surface area (hectares / acres)	1,336 / 3,300
Watershed area (hectares / acres)	137,530 / 339,833
Volume (m^3 / acre-feet)	
capacity	4.445×10^8 / 360,500
conservation pool	
Annual inflow (m^3 / acre-feet)	2.46×10^8 / 199,300
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	89 / 292
mean	33.3 / 109
Length (km / miles)	17.4 / 10.8
Width (km / miles)	1.6 / 1.0
Shoreline (km / miles)	40.2 / 25.0

Location

County	Wasatch
Longitude / Latitude	111 24 54 / 40 36 01
USGS Maps	Heber City, Park City East, Francis, Ut, 1955
DeLorme's Utah Atlas & Gazetteer™	Page 54, B-1
Cataloging Unit	Provo River (16020203)



County near which watershed is located.

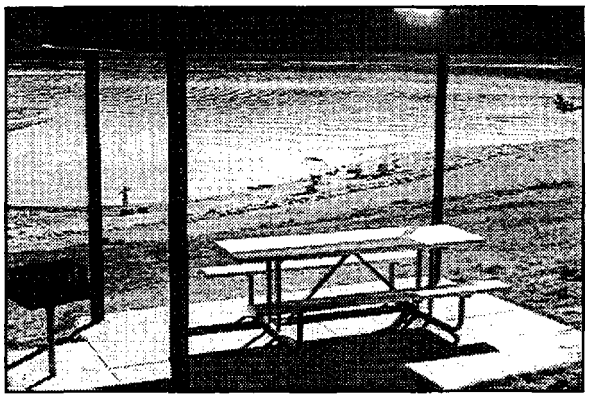
Deer Creek Watershed

<k74>

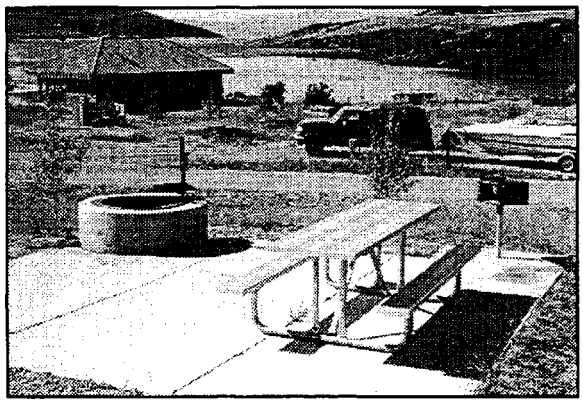
dam. It impounds spring runoff from the western Uintas, storing it for use throughout the year. Construction of the Jordanelle Reservoir dams was initiated on June 27, 1987 and completed on April 12, 1993.The reservoir shoreline is publicly owned, and public access is unrestricted. The benefits of the reservoir include irrigation, municipal and industrial, fish and wildlife, recreation and flood control. The annual monetary benefits have been estimated to be in excess of $100,000,000.00 annually.

Recreation

Jordanelle Reservoir is easily accessible from US-40, US-189 and U-32. Jordanelle State Park has been developed to ensure that the highest level of access is achieved within the park. Jordanelle State Park has been designed so that it's programs and services (including interpretive programs, recreational programs, concession operated activities, and informational services) are accessible to a broad range of visitors, especially those people with disabilities. There are currently two developed components of the park, Rock Cliff and Hailstone sites. The first public facilites opened at the Rock Cliff site during the summer of 1994. Accommodations the public will enjoy include a nature center, elevated boardwalk systems, restrooms with individualized shower rooms, group-use pavilions, 50 walk-in camping sites and limited non-motorized trails. It is located on the Provo River at the east end of the reservoir.



Hailstone, a 200-acre tract of land located on the west shore of the reservoir, was developed as the primary access to the water. It opened during the summer of 1995. This area will function as the park headquarters. Facilities at this site include, camping areas, group pavilions, R.V. camping, marina with 76 slips, general store, restaurant, jet ski dock, two boat ramps, fish cleaning stations and access to several recreational trails.



This state park was developed with the vision that it would function as a year-round facility. During the winter months portions of the trails will be a crosscountry skiing trail complete with warming huts. In combination with a winter ice fishing program, winter concession operations and perhaps even winter camping, Jordanelle State Park will be able to offer the visitors year-round enjoyment.

The Division of Wildlife Resources expects Jordanelle Reservoir to provide an excellent rainbow trout and smallmouth bass sport fishery. The reservoir was initially stocked with 176,000 three inch rainbow trout in 1993 with additional supplemental stockings annually. The DWR also plans to establish a viable smallmouth bass fishery by the year 2000. Their plan is to introduce 250 pre-spawn adults annually (1994-98). If these fish cannot be obtained from Deer Creek Reservoir, then a request for 100,000 northern strain smallmouth fry from the U.S. Fish and Wildlife Service to supplement this introduction will be made. Special regulations may be required to promote and maintain an annual catch rate of 50,000 smallmouth at 12 inches or larger per year.

Watershed Description

Jordanelle Reservoir is an impoundment of the Provo River. The river has a long narrow watershed, from the Trial Lake area in the extreme western Uintas down into the southern end of Kamas (Rhodes) Valley, then down upper Provo Canyon into the Jordanelle Reservoir.

The area around the reservoir is sage-grass, oak, mahogany with aspen and evergreen forests on the mountains to the west of the reservoir.

The inclusion of the western Uintas into the Provo River's watershed is a result of several natural and man-made diversions. In fairly recent geological times, the Provo River only drained the Heber Valley. Upper Provo Canyon was an east-flowing tributary of the Weber River, and what is now the headwaters of the Provo River drained across Kamas Valley and down the Weber. As geologic tilting and

faulting occurred, the Heber Valley became topographically lower then Kamas Valley, and tributaries of the Provo River began capturing drainage from the Weber Basin. One of these tributaries began capturing the east flowing, present-day Upper Provo Canyon. It eventually captured that entire canyon (its east flowing tributaries are testament that the stream once flowed east) and reached the southern Kamas Valley and diverted the stream which is now called the Provo River into the Provo River drainage. Presently, the Provo River and Weber River both flow through Kamas Valley. The Provo has cut a narrow channel within the otherwise flat valley, but no further drainage has been captured. It appears that at the moment of human's brief presence in geologic time, the more difficult part of the capture (tough bedrock underlying Upper Provo Canyon) has occurred, but the Provo drainage has not made progress in capturing the remainder of the Weber River tributaries in Kamas Valley (underlaid by soft alluvial deposits), a process that should be nearly instantaneous. It has taken at least 10,000 years, however, because the width of Upper Provo Canyon clearly indicates it has carried glacial runoff.

Since Europeans arrived in the area, they have made two additional diversions to the headwaters of the Provo River. The first was the relatively simple diversion of Weber water across Kamas Valley to the Provo. This approximately doubled the watershed in the Uintas. Only a relatively small fraction of the Weber River is diverted, though. The second diversion involved tunnelling through the mountains between the Duchesne River and the Provo River. This diverts water from the Colorado River watershed to the Wasatch Front.

The natural watershed high point, Bald Mountain, is 3,640 m (11,943 ft) above sea level, thereby developing a complex slope of 3.7% to the reservoir (although higher points exist in the Duchesne River watershed). The average stream gradient above the reservoir is 3.2% (170 feet per mile). The inflow is primarily the Provo River supplemented with water from Drain Tunnel Creek and McHenry Creek. The outflow is the Provo River.

The watershed is made up of high mountains, low mountains, and valleys. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of pine, spruce-fir, oak-maple, alpine tundra, and sagebrush-grass. The watershed receives 41 - 102 cm (16 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 80 - 100 days per year.

Land use is primarily multiple use in USFS and BLM owned lands, and grazing of domestic livestock on privately owned lands. Private lands in the mid and upper reaches are primarily agricultural, suburban, and urban. The headwater area of the Duchesne River is in the High Uintas Wilderness.

Limnological Assessment

The water quality of Jordanelle Reservoir is very good. It is considered to be moderately hard with a hardness concentration value of approximately 92 mg/L (CaCO3). The only parameters that have exceeded State water quality standards for defined beneficial uses are phosphorus and dissolved oxygen. Although the average water column concentrations of total phosphorus (38 ug/L) exceeds the State pollution indicator for phosphorus of 25 ug/L, it is not unusual to find elevated concentrations of total phosphorus during the early stages of a new reservoir. As soils and other sources of phosphorus are inundated with water concentrations throughout the water column become elevated as phosphorus goes into solution.

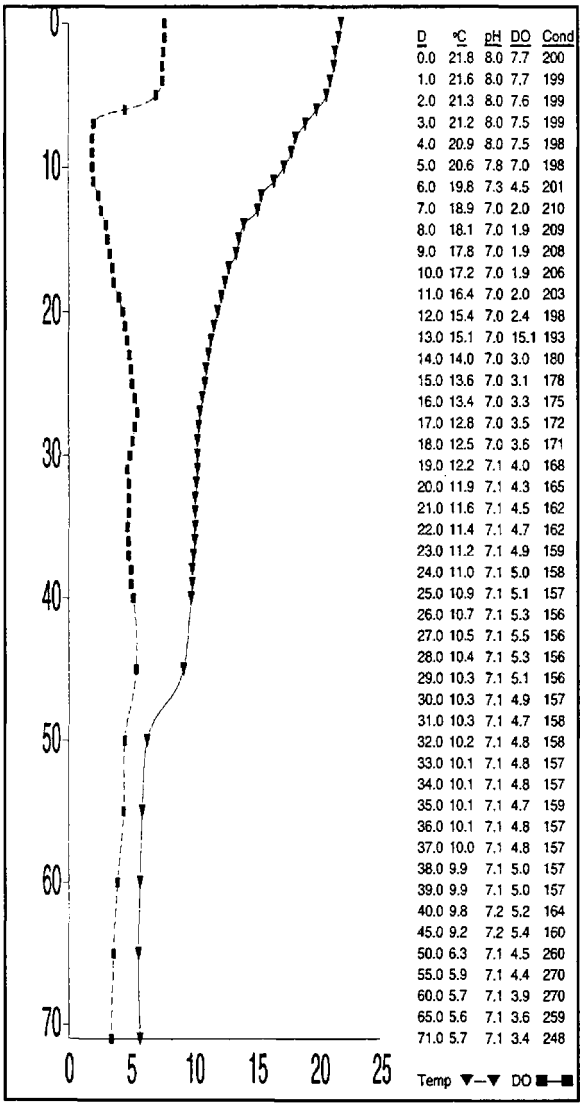
A review of the August 11, 1994 profile gives an indication of the oxygen deficiencies that are present. As the reservoir filled large amounts of organic matter were

Limnological Data

Data sampled and averaged from STORET sites: 591401, 591402, 591403, 591404.

Surface Data	1993*	1994
Trophic Status	M	M
Chlorophyll TSI	42.31	42.93
Secchi Depth TSI	41.15	40.46
Phosphorous TSI	48.19	51.09
Average TSI	43.88	44.82
Chlorophyll a (ug/L)	3.3	4.2
Transparency (m)	3.7	3.8
Total Phosphorous (ug/L)	21.8	29
pH	7.9	8.1
Total Susp. Solids (mg/L)	1.9	1.6
Total Volatile Solids (mg/L)	-	2.0
Total Residual Solids (mg/L)	-	2.0
Temperature (°C / °f)	17/63	20/68
Conductivity (umhos.cm)	162	199
Water Column Data		
Ammonia (mg/L)	0.03	0.03
Nitrate/Nitrite (mg/L)	0.14	0.05
Hardness (mg/L)	153	92.3
Alkalinity (mg/L)	85	92
Silica (mg/L)	-	
Total Phosphorous (ug/L)	30	38
Miscellaneous Data		
DO (Mg/l) at 75% depth	-	4.4
Stratification (m)	-	11
Limiting Nutrient	N	N
Depth at Deepest Site (m)	-	71

*Data summary was not by period, but May through September by site



D	°C	pH	DO	Cond
0.0	21.8	8.0	7.7	200
1.0	21.6	8.0	7.7	199
2.0	21.3	8.0	7.6	199
3.0	21.2	8.0	7.5	199
4.0	20.9	8.0	7.5	198
5.0	20.6	7.8	7.0	198
6.0	19.8	7.3	4.5	201
7.0	18.9	7.0	2.0	210
8.0	18.1	7.0	1.9	209
9.0	17.8	7.0	1.9	208
10.0	17.2	7.0	1.9	206
11.0	16.4	7.0	2.0	203
12.0	15.4	7.0	2.4	198
13.0	15.1	7.0	15.1	193
14.0	14.0	7.0	3.0	180
15.0	13.6	7.0	3.1	178
16.0	13.4	7.0	3.3	175
17.0	12.8	7.0	3.5	172
18.0	12.5	7.0	3.6	171
19.0	12.2	7.1	4.0	168
20.0	11.9	7.1	4.3	165
21.0	11.6	7.1	4.5	162
22.0	11.4	7.1	4.7	162
23.0	11.2	7.1	4.9	159
24.0	11.0	7.1	5.0	158
25.0	10.9	7.1	5.1	157
26.0	10.7	7.1	5.3	156
27.0	10.5	7.1	5.5	156
28.0	10.4	7.1	5.3	156
29.0	10.3	7.1	5.1	156
30.0	10.3	7.1	4.9	157
31.0	10.3	7.1	4.7	158
32.0	10.2	7.1	4.8	158
33.0	10.1	7.1	4.8	157
34.0	10.1	7.1	4.8	157
35.0	10.1	7.1	4.7	159
36.0	10.1	7.1	4.8	157
37.0	10.0	7.1	4.8	157
38.0	9.9	7.1	5.0	157
39.0	9.9	7.1	5.0	157
40.0	9.8	7.2	5.2	164
45.0	9.2	7.2	5.4	160
50.0	6.3	7.1	4.5	260
55.0	5.9	7.1	4.4	270
60.0	5.7	7.1	3.9	270
65.0	5.6	7.1	3.6	259
71.0	5.7	7.1	3.4	248

covered with water. These materials require large amounts of oxygen as they decompose. This exerts a large demand on the dissolved oxygen present in the water column, which leads to a reduction of dissolved oxygen present in the water column. In addition if the hypolimnion becomes anoxic, larger amounts of phosphorus are released into the water column. These conditions may be short lived and as the reservoir ages conditions should stabilize and even improve. Continued monitoring will allow these assessments to be made. It does not appear that the water quality is significantly impaired, at this time. There are indications that winter monitoring should be conducted to determine if impairments are present under extended ice coverage conditions.

Current data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is mesotrophic in a state of moderate productivity. It would not be uncommon for the productivity of the reservoir to increase as addition land is inundated with water until some of the Limnological processes stabilize in the reservoir. Stratification in the lake will occur as conditions permit and the volume of the lake becomes more stable. The profile shown of August 11, 1994 does indicate a weak stratification developing near the 11 meter depth. As stratified conditions develop, dissolved oxygen concentrations and internal phosphorus loading may become more pronounced.

According to DWR no fish kills have been reported to date for the reservoir. The reservoir supports a population of brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*),cutthroat trout (*Oncorhynchus clarki*), rainbow trout (*Oncorhynchus mykiss*) and smallmouth bass (*Micropterus dolomieui*). The lake has not been treated for rough fish competition, so populations of native fishes from the Provo River are probably still be present in the lake. Current stocking reports indicate that DWR stocks the lake with fingerling rainbow trout and smallmouth bass.

Macrophytes are not typically present and are not a problem, however there is a lot of surface debris present which has surfaced as the land was covered with water.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Chrysocapsa planktonica	486.816	97.99
Sphaerocystis schroeteri	2.447	1.29
Fragilaria crotonensis	1.000	0.52
Oocystis sp.	0.133	0.07
Asterionella formosa	0.125	0.07
Ankistrodesmus falcatus	0.061	0.03
Ankyra judayi	0.047	0.02
Pennate diatoms	0.027	0.01
Total	190.656	
Shannon-Weaver	0.12	
Species Evenness	0.06	
Species Richness	0.27	

The phytoplankton community is dominated by the presence of yellow and green algae.

Pollution Assessment

Nonpoint pollution sources include the following: sedimentation and nutrient loading from grazing; urban runoff which may contain chemicals and nutrients from urban areas; herbicides and nutrients from cropland; wastes and litter from recreation; and some siltation from road construction during the late 1990's.

Point sources of pollution in the watershed include the Kamas Fish Hatchery.

Beneficial Use Classification

Jordanelle Reservoir currently is not classified but proposed state beneficial use classifications will probably include: culinary water (1C), recreational bathing (swimming) (2A), boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Mountainlands Association of Governments	377-2262
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Mountainland Travel Region (Provo)	377-2262
Heber Chamber of Commerce	654-3666
Park City Area Chamber of Commerce	64526104
Jordanelle State Park Nature Center	783-3030
Utah Division of State Parks and Recreation	538-7220
Concessionaire Information	538-7320
Reservoir Administrators	
Bureau of Reclamation	379-1000
Central Utah Water Conservancy District	226-7100

KENS LAKE

Introduction

Kens Lake is an off stream reservoir at the foot of the west slopes of the La Sal Mountains in eastern Utah. It is a intermediate-sized reservoir, built on the floor of Spanish Valley near Moab. It is also called Mill Creek Reservoir.

The reservoir shoreline is publicly owned by the BLM and the State of Utah. Public access is unrestricted. The earthen embankment is horseshoe-shaped to create the impoundment, which is on a relatively flat area of the valley floor. The basin was sealed with clay to prevent water from seeping into the porous valley floor. Construction was completed in 1981, but it has been drained and rebuilt several times because of water seepage through the clay. Water is diverted from Mill Creek via a tunnel. It was originally intended as a warm water fishery, but was found to be more suitable for cold water fishes.

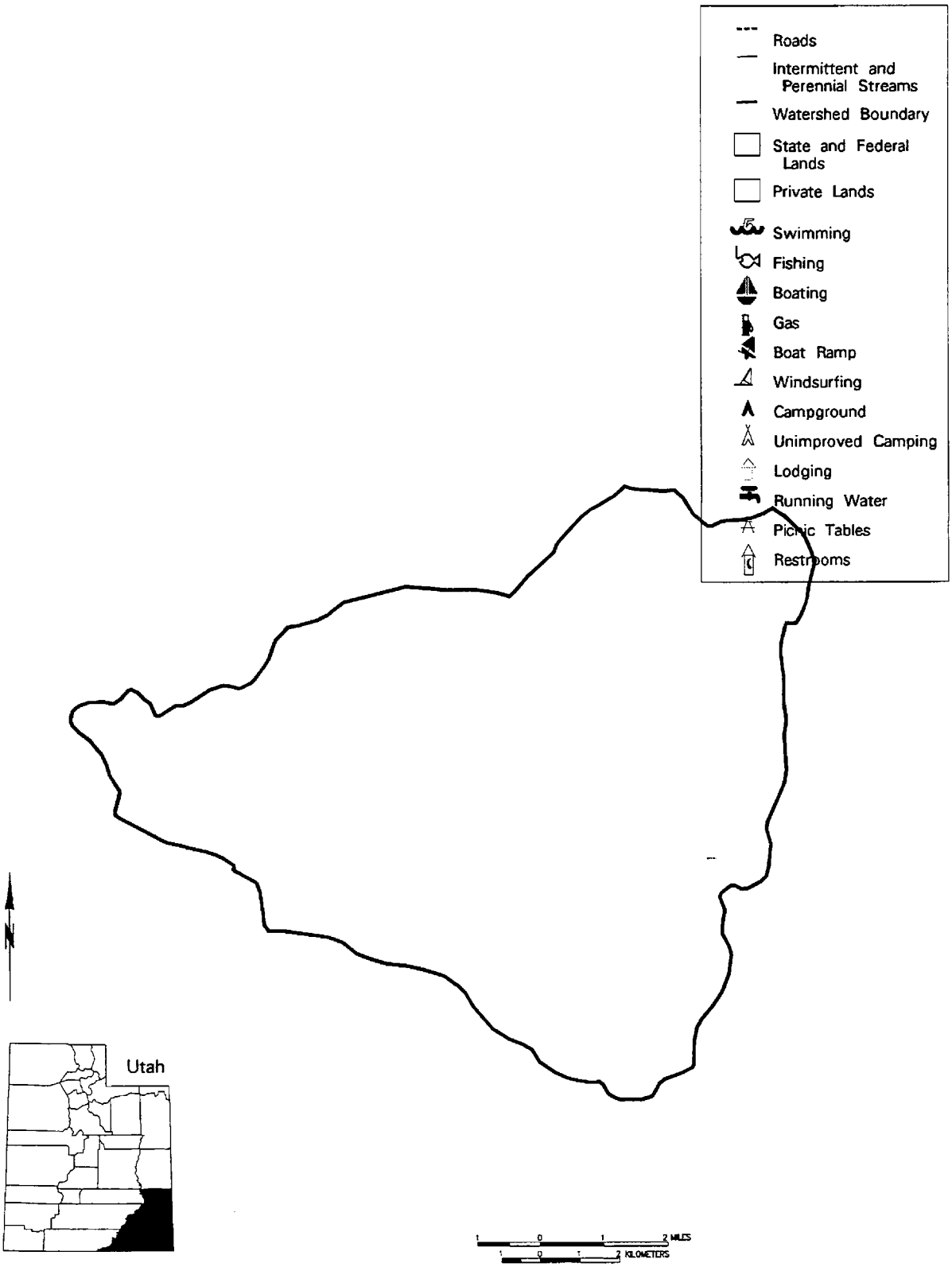
Characteristics and Morphometry

Lake elevation (meters / feet)	1,537/5,048
Surface area (hectares / acres)	35/86
Watershed area (hectares / acres)	777.4 / 1920
Volume (m^3 / acre-feet)	
capacity	3.48 x 10^6/62,820
conservation pool	none
Annual inflow (m^3 / acre-feet)	5.2 x 10^6/4,200
Retention time (years)	0.7
Drawdown (m^3 / acre-feet)	varies
Depth (meters / feet)	
maximum	21/70
mean	10/33
Length (meters / feet)	820/2,690
Width (meters / feet)	440/1,440
Shoreline (meters / feet)	2,140/7,000

Location

County	San Juan
Longitude/Latitude	109 27 46 / 38 29 00
USGS Map	Kane Springs, Utah 1987
DeLorme's Utah Atlas & Gazetteer™	Page 30, A-3-32, A4
Cataloging Unit	Upper Colorado (14030005)

* Not on map. Southwest of airstrip on seam of atlas.



County in which watershed is located.

Kens Lake Watershed

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At present and in the foreseeable future, water is consumed for agricultural purposes, and also used for recreation and cold water aquatic habitat while stored in the reservoir.

Recreation

Kens Lake is 13 miles southeast of Moab. From mile post 118 on US-191 (about eight miles south of Moab) turn east on Old Airport Road and follow the sign to Kens Lake, La Sal Mountain Loop, and Redrock Speedway. After one mile, turn right where Old Airport Road terminates. Go south for 1.5 miles to Flat Pass Road, an unmarked, unpaved road on the left. At this point, the dam should be visible about a mile to the east. Flat Pass Road reaches Kens Lake in about two miles.

The lake offers fishing, swimming and picnicking. Portable privies are provided year-round, and the BLM is considering installing permanent toilet facilities. It is possible to launch a boat on the lake, but boating is restricted to trolling and nonmotorized craft. Motorized vehicles are restricted to designated roads. The lake is close from 11:00 PM to 5:00 AM, but camping is permitted in designated areas. The lake has no riparian habitats or other common lakeside scenery, but the 1,000 feet of slickrock bluffs bordering the Spanish Valley are impressive.

The area immediately around the lake is popular for primitive camping. There are several USFS campgrounds in the La Sal Mountains to the east, and many private campgrounds in Moab.

Watershed Description

The lake is near Moab in Spanish Valley. The valley is a long graben, where the underlying rocks have dropped below the surrounding terrain. It is an arid redrock desert. Water is brought into the lake via the Shelky Diversion Tunnel from Mill Creek, which drains the western face of the La Sal Mountains, the second highest range in Utah. These mountains develop heavy snowpacks in the winter due to their high elevation, and the runoff is stored in Kens Lake for use throughout the summer.

Oowah Lake is tiny upstream impoundment. It was included in the 1982 Clean Lakes Inventory, but has not been included in this document.

The watershed high point, Manns Peak, is 3,741 m (12,272 ft) above sea level, thereby developing a complex slope of 12.2% to the reservoir. The sole inflow is the canal from Mill Creek. Outflow is to Pack Creek in Spanish Valley. The average stream gradient from the headwaters to the diversion (7 km) is 8.3% (437 feet per mile), and the gradient from the diversion to the reservoir (1.5 km) is 3.2% (169 feet per mile).

The watershed is composed of high mountains, canyons, and low deserts. Soil associations have not been determined by the Division of Water Quality.

The vegetation communities are comprised of slickrock, sage-grass, oak, maple, aspen-fir, and alpine. The watershed receives 25-36 cm (6-30 inches) of precipitation annually with a frost-free season of 120 - 160 days at the reservoir.

Land use is 100% multiple use and recreation. The major use of the watershed is livestock grazing and recreation.

Limnological Assessment

The water quality of Kens Lake is considered very good. It is considered to be moderately hard with a hardness concentration range of 101-109 mg/L (CaCO3). The only parameter that has exceeded State water quality standards for defined beneficial uses is phosphorus. The average

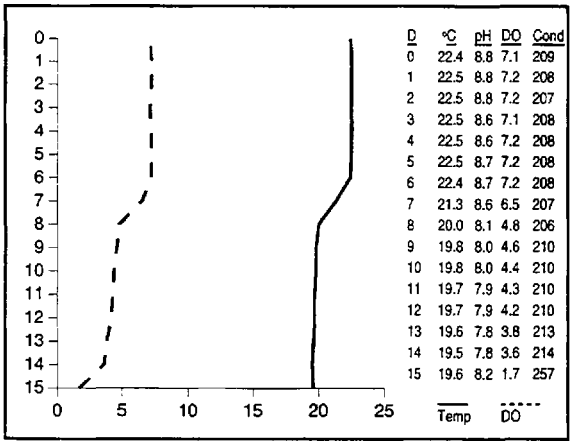
Limnological Data

Data sampled from STORET site: 595850

Surface Data	1989	1990*	1991**
Trophic Status	H	E	M
Chlorophyll TSI	58.57	44.91	37.88
Secchi Depth TSI	65.14	60.59	54.16
Phosphorous TSI	59.97	51.68	39.98
Average TSI	61.23	52.39	44.01
Chlorophyll a (ug/L)	17.3	4.3	2.1
Transparency (m)	0.7	1.0	1.5
Total Phosphorous (ug/L)	48.0	27.0	12.0
pH	8.3	8.6	8.8
Total Susp. Solids (mg/L)	18	-	4
Total Volatile Solids (mg/L)	-	6	2
Total Residual Solids (mg/L)	-	25	2
Temperature (°C / °f)	20/68	16/60	22/72
Conductivity (umhos.cm)	240	212	209
Water Column Data			
Ammonia (mg/L)	0.04	0.03	0.03
Nitrate/Nitrite (mg/L)	-	0.06	0.04
Hardness (mg/L)	109	107	99
Alkalinity (mg/L)	91	87	87
Silica (mg/L)	-	7.2	5.6
Total Phosphorus (ug/L)	41.4	27.8	31.0
Miscellaneous Data			
Limiting Nutrient	N	-	N
DO (Mg/l) at 75% depth	5.6	-	4.3
Stratification (m)	NO	-	6-8
Depth at Deepest Site (m)	5	-	15

* Data from period 1 only
**Data from period 2 only

concentration of total phosphorus in the water column has continually exceeded the State's pollution indicator (25 ug/L). Although in 1989 the reported average was 41.4 ug/L, in 1990 and 1991 the average concentrations were reduced significantly to 27.8 and 31.0 ug/L. It appears that the reservoir may be decreasing in productivity as the newly created reservoir is aging. Additional monitoring will allow a determination to be made regarding the stability of the reservoir. A review of the profile obtained on August 6, 1991 showed dissolved oxygen concentrations near 7.2 mg/L above the thermocline (6-7 meters) with a declining trend to 1.7 mg/L at the bottom (15 meters). It appears that there is sufficient oxygen demand in the hypolimnion which is beginning to impact the fishery. The lake is defined as a nitrogen limited system with TSI values indicating the lake has shifted from a hypereutrophic to a mesotrophic lake with an overall TSI index shift of 17.22 units from 61.23 to 44.01. Although the lake is managed as a cold water fishery, it is marginal during the summer due to the elevated water temperatures and the low concentrations of dissolved oxygen in the hypolimnion. There have been no reported fish kills in the lake.



The DWR stocks the reservoir twice annually with catchable rainbow trout (*Oncorhynchus mykiss*); 4,000 in the spring and 7,000 in the summer. Some brown trout (*Salmo trutta*) from Mill Creek have migrated down to the reservoir.

The reservoir was chemically treated by the DWR to control rough fish competition in 1984 and 1988.

Phytoplankton in the euphotic zone in August, 1991 included the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Chrysocapsa planktonica	326.150	94.92
Ceratium hirundinella	10.299	3.00
Sphaerocystis schroeteri	5.282	1.54
Peridinium sp.	1.091	0.32
Asterionella formosa	0.397	0.12
Microcystis incerta	0.334	0.10
Oocystis sp.	0.025	0.01
Chroococcus dispersus	0.013	0.00
Centric diatoms	0.009	0.00
Ankistrodesmus falcatus	0.009	0.00
Pennate diatoms	0.007	0.00
Wislouchiella planktonica	0.004	0.00
Total	343.620	
Shannon-Weaver Index[H']	0.25	
Species Evenness	0.10	
Species Richness	0.41	

The flora is dominated by golden algae with Dinoflagellates and green algae also present in significant quantities. Algal biomass is very high and could lead to water quality problems. However the low elevation of this lake probably results in a short freeze-over period, mitigating this problem. No macrophytes have been observed.

Information

Management Agencies	
Bureau of Land Management	539-4001
Grand Resource Area (Moab)	259-8193
Southeastern Utah Association of Governments	637-5444
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Canyonlands Travel Region (Moab)	259-8825
Moab Chamber of Commerce	259-7531
Reservoir Administrators	
Grand County Water Conservation District	259-8121

Pollution Assessment

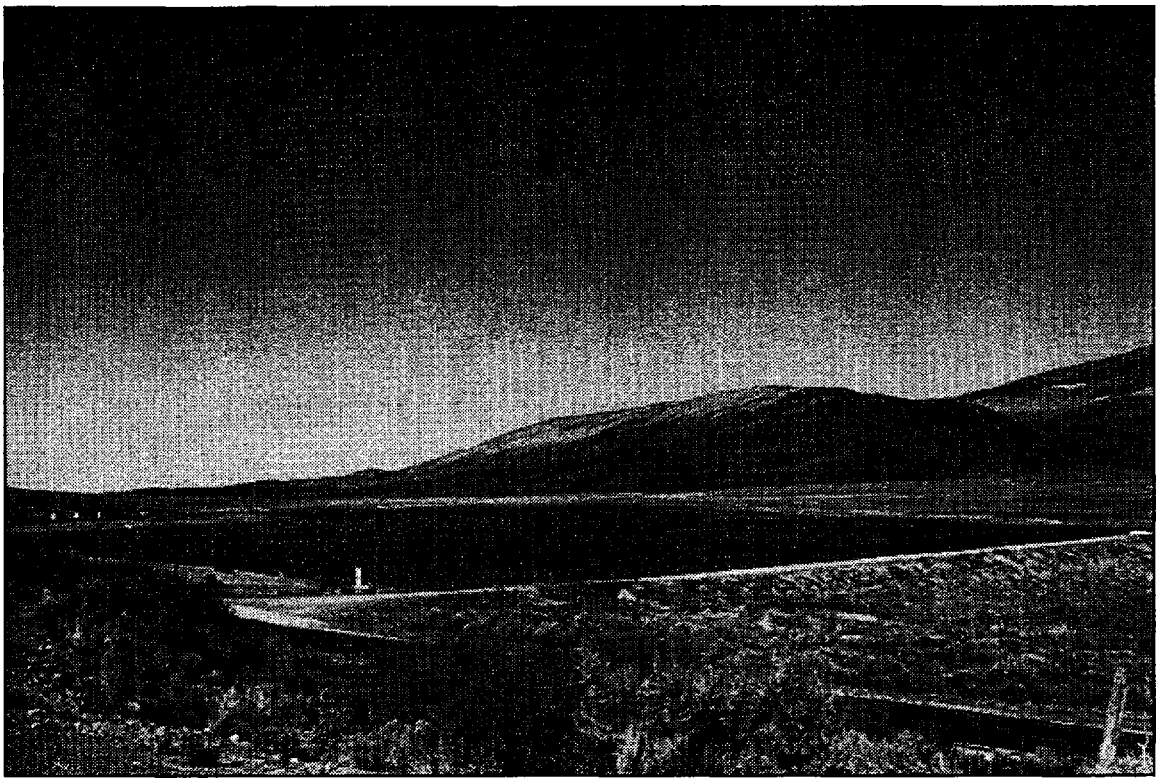
Nonpoint pollution sources are: sedimentation and nutrient loading from grazing, and human wastes, litter and toxins from recreation. Cattle graze in the watershed and around the reservoir.

There are no point pollution sources in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

KOOSHAREM RESERVOIR



Introduction

Koosharem Reservoir is at the north end of Grass Valley, south of Salina and north of Koosharem. It is an intermediate-sized, shallow impoundment of a low elevation valley. The reservoir was created in 1919 by the construction of an earth-fill dam.

Characteristics and Morphometry

Lake elevation (meters / feet)	2,132 / 6,995
Surface area (hectares / acres)	125 / 310
Watershed area (hectares / acres)	14,930 / 36,894
Volume (m^3 / acre-feet)	
capacity	9,214,260 / 7,470
conservation pool	
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	6 / 20
mean	3.6 / 12
Length (meters / feet)	2.2 / 13.6
Width (meters / feet)	1.2 / .77
Shoreline (km / miles)	2.4 / 1.5

The reservoir shoreline is privately/publicly owned and administered by the BLM and the Koosharem Irrigation Company with unrestricted public access. Current water use if for agriculture and a cold water fishery. The reservoir and watershed lie within the boundaries of the Otter Creek Reservoir watershed which is currently under study to investigate the feasibility of improving water quality.

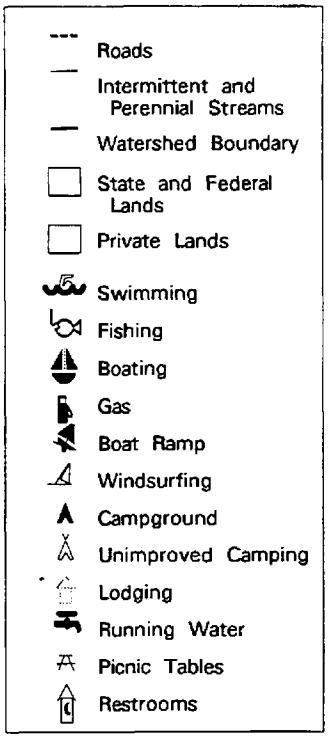
Location

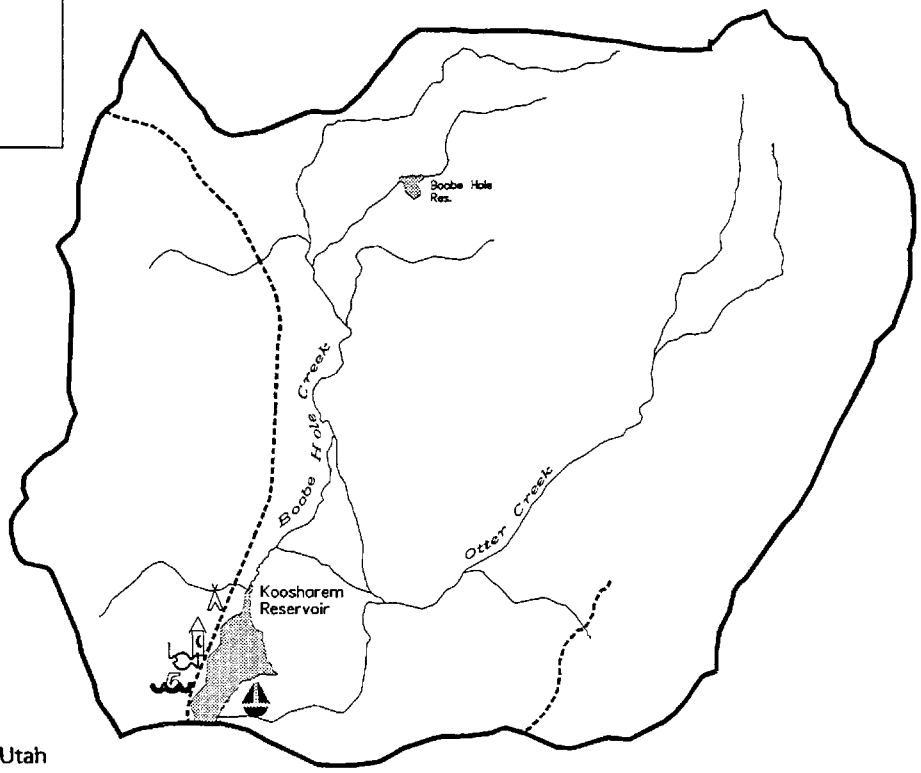
County	Sevier
Longitude / Latitude	111 50 08 / 38 35 05
USGS Map	Burrville, Utah, 1968
DeLorme's Atlas & Gazetter™	Page 27, A-5 & 37, D-5
Cataloging Unit	East Fork Sevier (16030002)

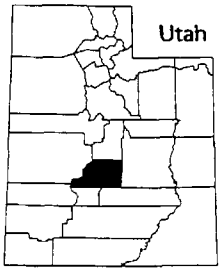
Recreation

Koosharem Reservoir is directly accessible from U-24 between Salina and Loa near milepost 38. The reservoir is 2 miles north of the U-24/U-62 junction near Koosharem and 13 miles south of the U-119/U-24 junction.

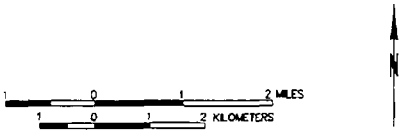
The reservoir is highly productive due to a high input of nutrients into the system. The reservoir is popular with







County in which watershed is located.



Koosharem Watershed

<k117>

perennial fisherman. Fishing is good with larger fish taken later in the year. Water levels are greatly reduced late in the year and the reservoir may be drained some years. Other types of recreational usage is limited.

There are limited recreational facilities at the reservoir. Vault toilets are provided. It is possible to launch a boat in the reservoir, and primative camping is possible along the shore. No fees are charged for use. There are no Forest Service Campgrounds in the area, and the nearest private campground is in Koosharem.

Limnological Data

Data averaged from STORET sites: 594577, 594578

Surface Data	1981	1990	1992
Trophic Status	H	H	E
Chlorophyll TSI	-	60.38	44.08
Secchi Depth TSI	-	80.27	51.14
Phosphorous TSI	65.41	80.95	70.97
Average TSI	65.41	73.87	55.40
Chlorophyll a (ug/L)	-	21.2	3.95
Transparency (m)	-	0.25	1.85
Total Phosphorous (ug/L)	93	211	103
pH	-	8.4	8.9
Total Susp. Solids (mg/L)	43	40.5	<3
Total Volatile Solids (mg/L)	-	-	-
Total Residual Solids (mg/L)	-	-	3
Temperature (°C / °f)	-	22/71	8/47
Conductivity (umhos.cm)	-	292	279
Water Column Data			
Ammonia (mg/L)	0.07	0.08	0.03
Nitrate/Nitrite (mg/L)	0.24	0.11	0.04
Hardness (mg/L)	130	132	123
Alkalinity (mg/L)	141	136	130
Silica (mg/L)	-	-	32.3
Total Phosphorous (ug/L)	93	211	107
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	-	6.7	6.6
Stratification (m)	-	NO	NO
Depth at Deepest Site (m)	-	1.0	2.6

Watershed Description

The reservoir is in the north end of Grass Valley, between the Fish Lake Plateau and the Sevier Plateau. It is an impoundment of a flat valley resulting in a fairly shallow body of water. Heavy agricultural use of the watershed has resulted in a long history of water quality problems. The headwaters of Otter Creek reservoir are in the Fish Lake mountains where snowpack provides inflow to the reservoir throughout the summer. The mountains have beautiful meadows and coniferous forests in stark contrast to the valley below.

The watershed high point, The Fish Lake Hightop Plateau, is 3,546m (11,633 ft) above sea level, thereby developing a complex slope of 18.3% to the reservoir. The inflows are Otter Creek and Boobe Hole Creek. Boobe Hole Reservoir, the only upstream impoundment, is in the headwaters of Boobe Hole Creek. The outflow is Otter Creek. The average stream gradient above the reservoir is 5.9% (309 feet per mile).

The soil in the surrounding high country is derived from the underlying volcanic rocks, and the soil in the vicinity of the reservoir is made up of alluvial deposits from the high country. Soil Associations are listed in Appendix III.

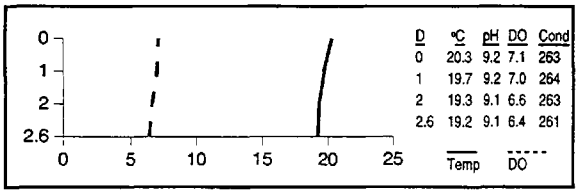
The vegetation communities are comprised of bitterbrush-mountain mahogany, pinion-juniper, sage-grass, pine, aspen, spruce-fir, oak and maple. The watershed receives 30 - 75 cm (12 - 30 inches) of precipitation annually with a frost-free season of 80 - 100 days at the reservoir.

Land use in the watershed is 48% multiple use, 48% private grazing land and 4% pasture and hayland. The shoreline is mostly privately owned, the remainder being controlled by the BLM. Public accessibility is unrestricted.

Limnological Assessment

The water quality of Koosharem Reservoir is fair. It is considered to be moderately hard with a hardness concentration value of approximately 128 mg/L ($CaCO_3$). The only parameters that have exceeded State water quality standards for defined beneficial uses are phosphorus and temperature. The average concentration of total phosphorus in the water column in 1990 and 1992 was 211 and 107 ug/L which significantly exceeds the recommended pollution indicator for phosphorus of 25 ug/L. The reservoir is a highly nutrient rich system with high production. This production is dominated by extensive blue-green algal blooms and leads to impaired water quality conditions. Is is not uncommon for the temperature regime of the reservoir to exceed the standard of 20°C for a cold water fishery. High productivity and the shallow nature of the reservoir leads to elevated temperature during the summer season. It is apparent that the entire water column approaches the limit at this time as evidenced by the profile of August 19, 1992. The reservoir is characterized as a nitrogen limited system. Excessive levels of phosphorus push the levels downward. TSI values indicate the reservoir is usually hypereutrophic. The phosphorus concentrations are excessively high. The reservoir does not typically stratify due to its shallow nature. Although conditions are present that are conducive for a potentioal fish kill, according to DWR no fish kills have been reported in recent years. Rainbow trout (*Oncorhynchus mykiss*) and Utah chub (*Gila atraria*) are the dominant fish of Koosharem Reservoir. Approximately 20,000 fingerling

rainbow trout are stocked annually by DWR as part of their put and take management of the reservoir. DWR reports that caddisflies and midges are common invertebrates. Macrophytes are present but with a rapidly receding reservoir during irrigation season it is difficult for the macrophytes to become established.



D	°C	pH	DO	Cond
0	20.3	9.2	7.1	263
1	19.7	9.2	7.0	264
2	19.3	9.1	6.6	263
2.6	19.2	9.1	6.4	261

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Anabaena sp.	2.224	90.73
Aphanizomenon flos-aquae	0.106	4.31
Oocystis sp.	0.044	1.81
Centric diatoms	0.027	1.09
Pennate diatoms	0.022	0.91
Ankyra judayi	0.017	0.68
Ankistrodesmus falcatus	0.009	0.36
Chlamydomonas sp.	0.003	0.11
Total	2.447	
Shannon-Weaver [H']	0.45	
Species Evenness	0.22	
Species Richness	0.32	

The phtoplankton commnunity as can be expected is dominated by blue-green algae which is indicative of poorer water quality.

Pollution Assessment

Nonpoint sources of pollution are grazing, irrigated agriculture, and recreation. Cattle graze throughout the watershed. Very heavy grazing takes place around the reservoir and cattle follow the exposed reservoir bottom as water levels recede late in the year.

There are no point pollution sources in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Bureau of Land Management	
Sevier River Resource Area (Richfield Office)	896-8228
Six County Comissioners Association	896-9222
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Reservoir Administrator	
Koosharem Irrigation Company	
Recreation	
Koosharem Campground and Cafe	638-7310

KOLOB RESERVOIR

Introduction

Kolob Reservoir is on the Upper Kolob Plateau upstream from the Zion Narrows in Zion National Park (ZNP). It is an intermediate size reservoir of a stream valley fed by a small watershed and many springs. Much of the surrounding highland is deeply dissected by canyons, resulting in the reservoir seeming unusually large for its location. It is also known as Kolob Creek Reservoir or Big Creek Reservoir. The reservoir was created by the construction of an earth-fill dam in 1956.

Although the reservoir shoreline is privately owned public access is virtually unrestricted. Water is consumed for agricultural use and used for recreation and cold water aquatic habitat while stored in the reservoir.

Characteristics and Morphometry

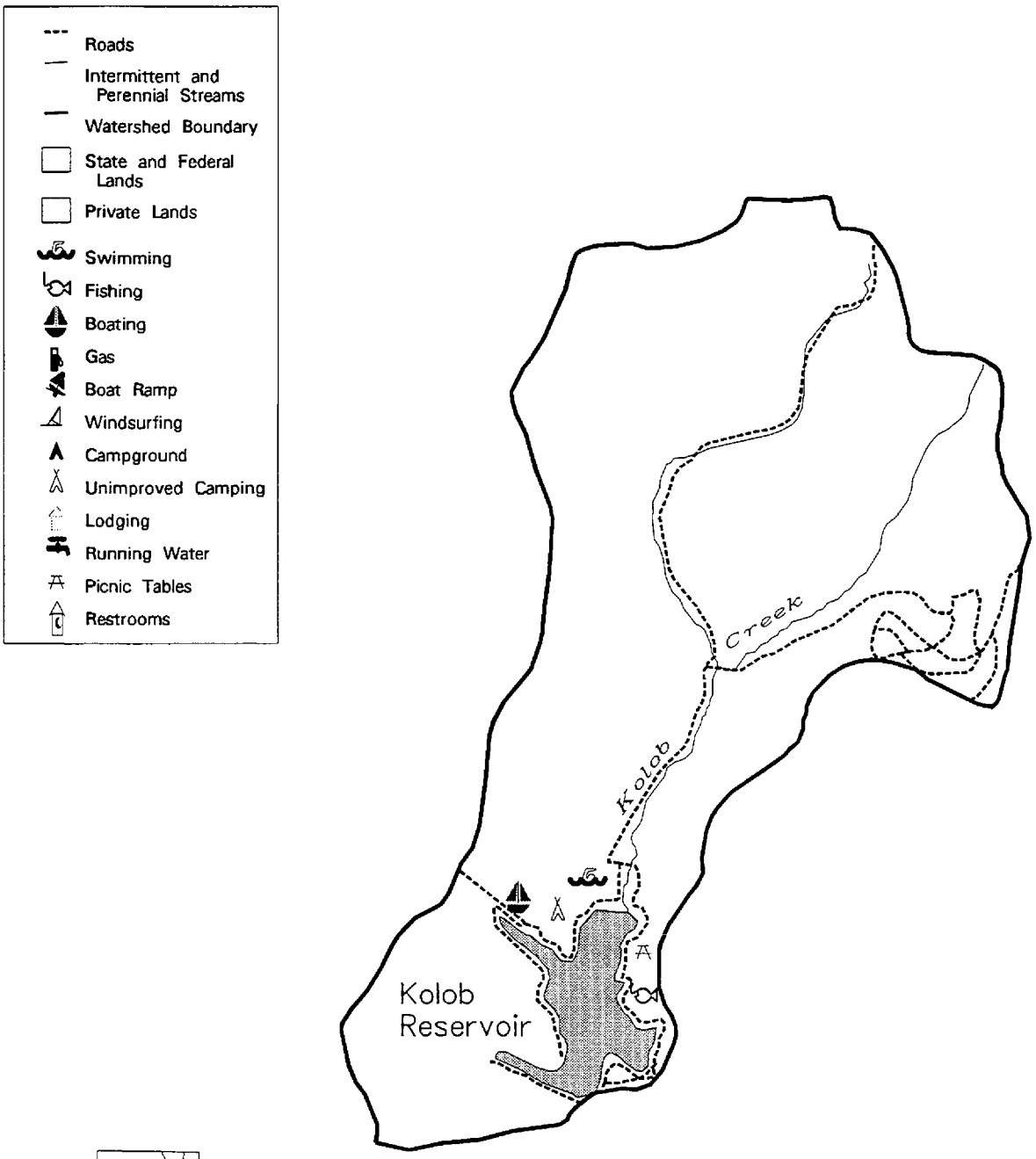
Lake elevation (meters / feet)	2,474 / 8,118
Surface area (hectares / acres)	136 / 249
Watershed area (hectares / acres)	1605 / 3965
Volume (m^3 / acre-feet)	
capacity	8,528 / 6,914
conservation pool	
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	15.5 / 51
mean	6.3 / 20.6
Length (km / miles)	1.74 / 1.08
Width (km / miles)	1.81 / 11.3
Shoreline (km / miles)	7.01 / 4.35

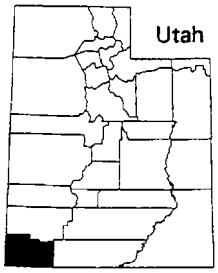
Location

County	Washington
Longitude / Latitude	113 02 09 / 37 26 00
USGS Map	Kolob Reservoir, Utah, 1980
DeLorme's Atlas & Gazetteer™	Page 17, B-6
Cataloging Unit	Upper Virgin (15010008)

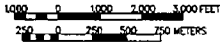
Recreation

Kolob Reservoir is on the road that follows North Creek and continues to Cedar City. It begins as a paved road at





County in which watershed is located.



Kolob Watershed

<k154>

U-9 in Virgin, UT (between I-15 and Zion National Park). It goes north, skirting the west boundary of ZNP and finally crossing to the east side of the Kolob section of the park. As it leaves the park, about 15 miles north of Virgin, it becomes gravel. Kolob Reservoir is about 20 miles north of Virgin on this road.

Access from the north is more complicated, with access to this road possible from a gravel road following Murie Creek (three miles north of Kanarraville at Exit 57) or from U-14 (approximately six miles east of Cedar City) in Cedar Canyon. The later road is paved for the ascent to the summit. As you travel up this road the panorama's that unfold are unsurpassed in the State. Good maps or detailed directions are recommended if using these routes.

Fishing, boating, picnicking, cross country skiing and snowmobiling are popular around the lake. The water is too cold for most swimmers and waterskiers. The road is not maintained in the winter, and access is often impossible. Usage is heavy. The reservoir can have extensive drawdown by September.

There are no public campgrounds in the vicinity, although primitive camping is available in the area. RV parks are available in Springdale and Hurricane.

Watershed Description

Kolob Reservoir is located in the Carmel Formation, which is immediately above the Navajo Sandstone which form the canyons of Zion. The drainage basin is relatively unspectacular topographically. The drainage basin is also quite small for a reservoir of this size, but precipitation is supplemented by a number of springs.

The watershed high point, a few miles north of the reservoir, is 2,874 m (9,432 ft) above sea level, thereby developing a complex slope of 7.5% to the reservoir. The inflow and outflow is Kolob Creek. The average stream gradient above the reservoir is 6.6% (348 feet per mile).

Soil associations are listed in Appendix III.

The vegetation communities are comprised of pine, aspen, spruce-fir, oak, and maple. The watershed receives 51 - 64 cm (20 - 25 inches) of precipitation annually with a frost-free season of 40 - 80 days at the reservoir.

Land use is multiple use recreation and livestock grazing. Much of the watershed is heavily grazed, resulting in increased runoff and soil erosion.

Limnological Assessment

The water quality of Kolob Reservoir is good. It is considered to be hard with a hardness concentration value of approximately 156 mg/L ($CaCO_3$). The only parameter that has exceeded State water quality standards for defined beneficial uses is phosphorus. The average concentration of total phosphorus in the water column in 1989 and 1991 was 29 and 12 ug/L. The only time values exceeded the recommended pollution indicator for phosphorus of 25 ug/L was on August 3, 1989 at the deep site where values averaged 84 ug/L. Peak phosphorus concentration in the hypolimnion near the bottom reached a level of 143 ug/L. In general it appears that phosphorus has not been a problem in recent years. As indicated in the profile of August 14, 1991 there is a gradual decline in dissolved oxygen concentrations in late summer indicating that water quality impairments do exist. Concentrations generally decline throughout the water column to approximately 1.7 mg/L near the bottom of the reservoir. It appears that the reservoir could in fact develop anoxic problems during the winter and the reservoir should be surveyed to determine the extent of oxygen depletion during the winter season. Throughout the study period the reservoir has been characterized as a nitrogen limited system. The nitrogen/phosphorus ratios have generally increased during the study period and is approaching a phosphorus limited situation. TSI values indicate the reservoir is mesotrophic. It does not appear that there has been a significant rise in the concentrations of

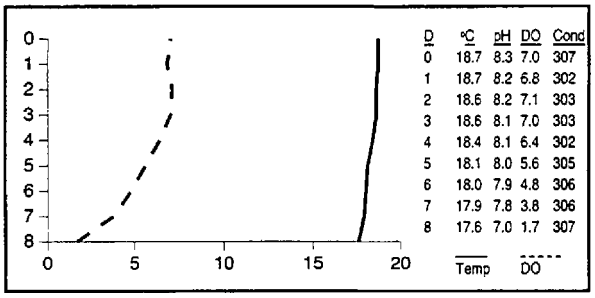
Limnological Data

Data averaged from STORET sites: 495132, 495133

Surface Data	1979	1989	1991
Trophic Status	M	M	M
Chlorophyll TSI	-	40.52	52.95
Secchi Depth TSI	33.00	39.17	49.48
Phosphorous TSI	55.45	44.87	41.01
Average TSI	44.23	41.52	47.82
Chlorophyll a (ug/L)	-	2.8	9.8
Transparency (m)	6.5	4.3	2.08
Total Phosphorous (ug/L)	33	17	14
pH	8.3	8.4	8.5
Total Susp. Solids (mg/L)	-	-	1.5
Total Volatile Solids (mg/L)	-	-	5
Total Residual Solids (mg/L)	-	-	<2
Temperature (°C / °f)	13/55	16/61	16/60
Conductivity (umhos.cm)	207	251	302
Water Column Data			
Ammonia (mg/L)	0.13	0.03	0.05
Nitrate/Nitrite (mg/L)	<.1	0.02	0.06
Hardness (mg/L)	152	-	160
Alkalinity (mg/L)	140	-	134
Silica (mg/L)	4.0	-	1.9
Total Phosphorous (ug/L)	52.5	29	12
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	1.2	3.5	4.8
Stratification (m)	12-14	NO	NO
Depth at Deepest Site (m)	17	10.4	8.0

nutrients in the lake since it was originally surveyed in 1981. In fact the concentration appear to be declining. The reservoir was stratified during 1979, but recent summer monitoring has not shown that the reservoir has been stratified. Stratification is inhibited due to the high elevation which precludes excessive warming of the reservoir and recent levels of water have been abnormally low. The reservoir could stratify when the depths of the reservoir are deeper earlier in the season if warmer climatic conditions prevailed.

According to DWR no fish kills have been reported in recent years. The reservoir supports populations of brook trout (*Salvelinus fontinalis*), rainbow trout (Oncorhynchus mykiss), and cutthroat trout (*Oncorhynchus clarki*). The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake.



D	°C	pH	DO	Cond
0	18.7	8.3	7.0	307
1	18.7	8.2	6.8	302
2	18.6	8.2	7.1	303
3	18.6	8.1	7.0	303
4	18.4	8.1	6.4	302
5	18.1	8.0	5.6	305
6	18.0	7.9	4.8	306
7	17.9	7.8	3.8	306
8	17.6	7.0	1.7	307

The DWR typically stocks the reservoir with 5,000 catchable and 15,000 fingerling Rainbow Trout, 5,000 fingerling Cutthroat Trout and 5,000 fingerling Brook Trout on an annual basis. DWR reports an abundant invertebrate population. Organisms observed were midge larva (*Tendipes sp.*) and snails (*Gyrauluas sp.*), both of which were abundant. The plankton present, all of which were sparse, were Cladoceins (*Daphina sp.*), Diatoms (*Fragilaris sp.*) and Desmids (*Closterium sp.*). The reservoir does have some marginal macrophyte growth and a population of crayfish have been noted in recent years.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	21.128	73.10
Ceratium hirundinella	7.490	25.92
Dinobryon divergens	0.146	0.51
Oocystis sp.	0.100	0.35
Pennate diatoms	0.013	0.05
Microcystis incerta	0.011	0.04
Asterionella formosa	0.009	0.03
Ankistrodesmus falcatus	0.004	0.02
Total	28.901	

Shannon-Weaver [H']	0.64
Species Evenness	0.31
Species Richness	0.31

While the flora is quite diverse, it is heavily dominated by two groups. The dominant colonies are green algae and flagellates. These are indicative of fairly good water quality.

Pollution Assessment

Nonpoint pollution sources are grazing and recreation. Cattle graze in the watershed and around the reservoir.

There are no point pollution sources in the watershed.

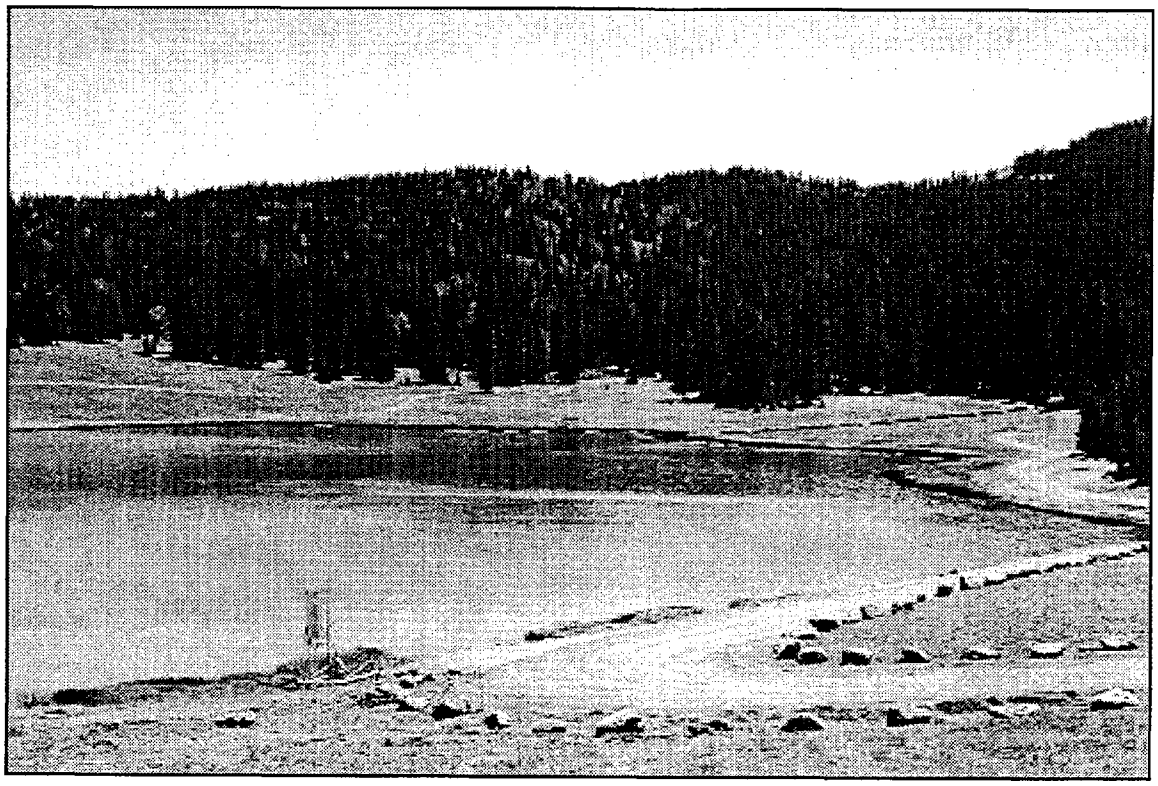
Information

Washington County Water Conservation District	673-3617
Five County Association of Governments	673-3548
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

LABARON



Introduction

LaBaron Lake is high in the Tushar Mountains east of Beaver. It is a small, shallow natural lake in a high meadow. It was originally either a small natural lake or a small reservoir that was enlarged by the Division of Wildlife Resources as a stabilized lake for recreational fishing in 1966. Water levels are controlled by a dam. It is also known as Laron Reservoir, Blainey Reservoir and LaBaron Lake Reservoir.

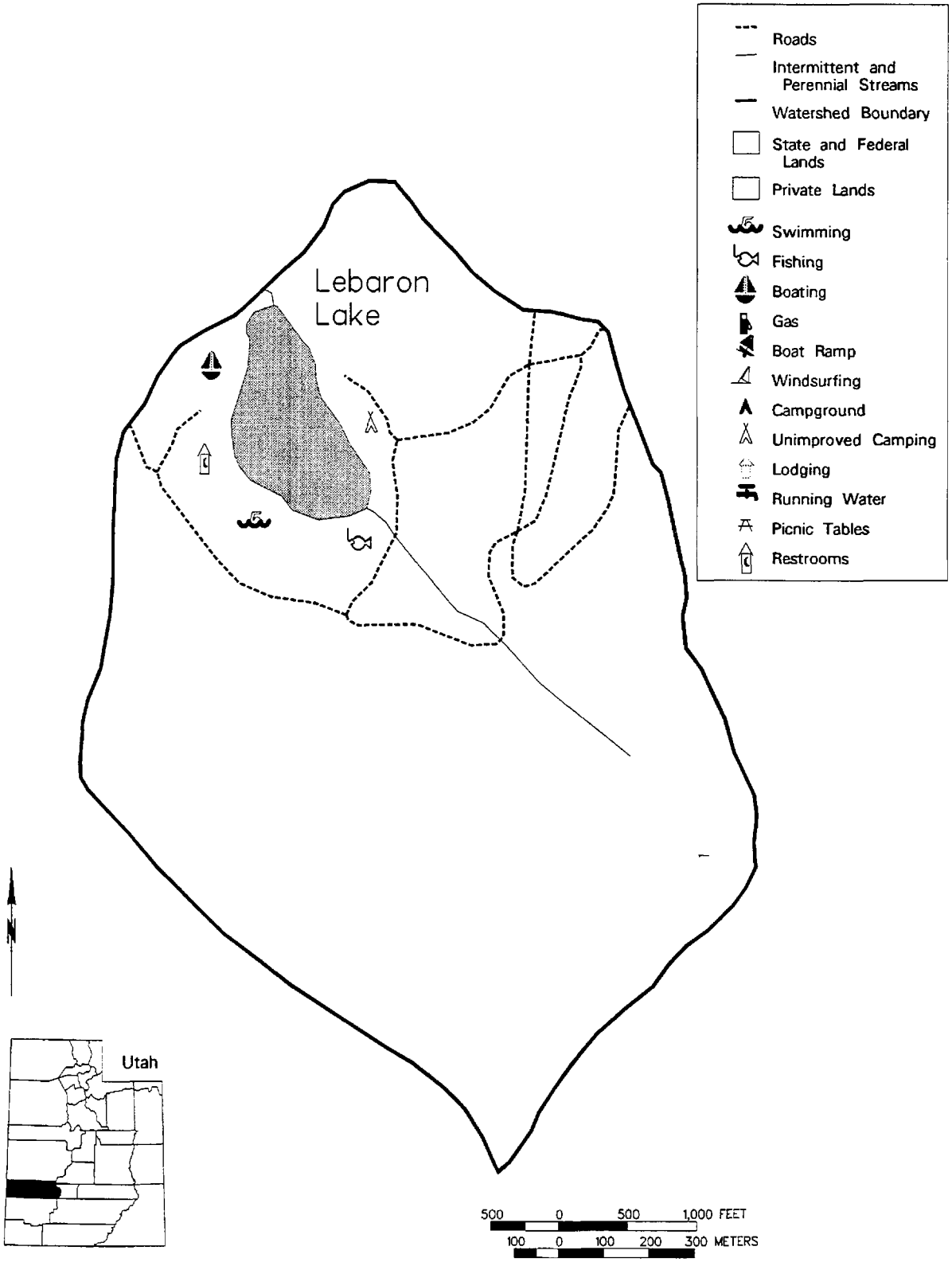
The reservoir shoreline is 80% publicly owned and administered by the Fish Lake National Forest with unrestricted public access. The remaining 20%, on the east side, is privately owned and is being developed into recreational homes. Although the defined beneficial uses include: water recreation excluding swimming, propagation of cold water species of game fish and aquatic life, and agricultural needs, it is currently used solely for recreation and cold water aquatic habitat. No changes are foreseen in water use in the future.

Characteristics and Morphometry

Lake elevation (meters / feet)	3018 / 9900
Surface area (hectares / acres)	9.47 / 23
Watershed area (hectares / acres)	317 / 768
Volume (m^3 / acre-feet)	
capacity	317,300 / 257
conservation pool	317,300 / 257
Annual inflow (m^3 / acre-feet)	Unknown
Retention time (years)	Unknown
Drawdown (m^3 / acre-feet)	0 / 0
Depth (meters / feet)	
maximum	6.5 / 21.3
mean	3.23 / 10.6
Length (meters / feet)	547 / 1,795
Width (meters / feet)	277 / 910
Shoreline (meters / feet)	1,219 / 4,000

Location

County	Beaver
Longitude / Latitude	112 23 50 / 38 13 30
USGS Map	Circleville Mountain, Utah, 1971
DeLorme's Utah Atlas and Gazetteer™	Page 26, B-3
Cataloging Unit	Beaver River (16030007)



County in which watershed is located.

Labaron Watershed

<k133>

Recreation

LaBaron Lake is accessible from FS-137, a gravel road across the north slope of Circleville Mountain also passing by Kents Lake and Anderson Meadow Reservoir. FS-137 originates and terminates at separate junctions with U-153.

From the west, exit I-15 at Beaver and travel up Beaver Canyon on U-153 for about 10 miles to the FS-137 turnoff, at Little Cottonwood Campground. Travel on FS-137 for another 10 miles to LaBaron Lake. From the east, travel up U-153 (this segment is unpaved) from US-89 at Junction for 12 miles to FS-173, and go three miles on FS-173 to LaBaron Lake.

Fishing, boating, swimming, and camping are possible in the area. Usage is fairly heavy.

Recreational facilities at the reservoir consist of one vault toilet, and the area offers itself to primitive camping. There are Forest Service Campgrounds at Anderson Meadows and Kents Lake, 4 and 8 miles west of LaBaron Lake on FS-173. Both charge fees and have about 10 campsites, drinking water and vault toilets. City Creek Campground is on U-153 8 miles east of the Lake. There are also several private campgrounds in Beaver.

Watershed Description

The reservoir is in an area of glaciated draws on the north slope of Circleville Mountain in the Tushar Range. The watershed high point, the northeast shoulder of Circleville Mountain, is 3,362 m (11,031 ft) above sea level, thereby developing a complex slope of 32.1% to the reservoir. The inflow and outflow is LaBaron Creek, and the average stream gradient above the reservoir is 7.3% (386 feet per mile).

The soil is largely of volcanic origin with moderate permeability and moderately slow erosion and runoff.

The vegetation communities are comprised of pine, aspen, spruce-fir, oak and maple. The watershed receives 51 - 64 cm (20 - 25 inches) of precipitation annually with a frost-free season of 0 - 20 days at the reservoir.

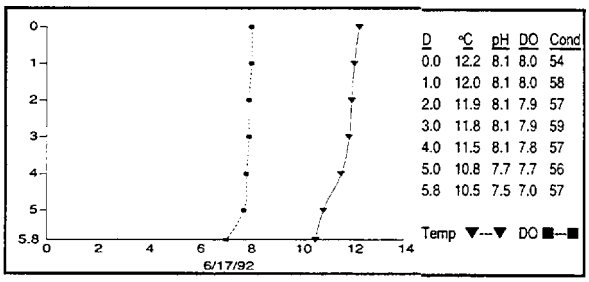
Limnological Assessment

The water quality of LaBaron Reservoir is good. It is considered to be soft with a hardness concentration value of approximately 23 mg/L ($CaCO_3$). The only parameters that have exceeded State water quality standards for defined beneficial uses are phosphorus and dissolved oxygen. The average concentration of total phosphorus in the water column in 1992 was 68 ug/L which exceeds the recommended pollution indicator for phosphorus of 25 ug/L. The phosphorus concentration in the hypolimnion on August 12, 1992 reached a level of 226 ug/L with a depth of only 5.8 meters, but anoxic conditions were present near the bottom. Dissolved oxygen concentrations in late summer substantiate the fact that water quality impairments do exist. Concentrations dropped dramatically downward in the water column reaching a level of 0.1 mg/L near the bottom as compared to the June 17, 1992 profile depicted. The oxygen deficiency is evidenced by the presence of two wind driven aerators on the lake. It is likely that conditions during the winter may pose a treat to the overwintering of fish due to potential anoxic conditions which need to be evaluated. It is evident that insufficient data exist to characterize the limnology of the reservoir. TSI values indicate the reservoir

Limnological Data

Data sampled from STORET site: 594128

Surface Data	1992
Trophic Status	E
Chlorophyll TSI	55.06
Secchi Depth TSI	44.41
Phosphorous TSI	53.67
Average TSI	51.05
Chlorophyll a (ug/L)	12.1
Transparency (m)	2.95
Total Phosphorous (ug/L)	31
pH	9.1
Total Susp. Solids (mg/L)	<3
Total Volatile Solids (mg/L)	1
Total Residual Solids (mg/L)	2
Temperature (°C / °f)	15/59
Conductivity (umhos.cm)	61
Water Column Data	
Ammonia (mg/L)	0.03
Nitrate/Nitrite (mg/L)	0.02
Hardness (mg/L)	23.3
Alkalinity (mg/L)	29
Silica (mg/L)	8.4
Total Phosphorous (ug/L)	68
Miscellaneous Data	
Limiting Nutrient	N
DO (Mg/l) at 75% depth	7.8
Stratification (m)	NO
Depth at Deepest Site (m)	5.8



is eutrophic. Both profiles indicate that no thermocline develops due to the shallow nature of the reservoir. According to DWR no fish kills have been reported in recent years. DWR reports indicate the reservoir supports populations of brook trout (*Salvelinus fontinalis*), rainbow trout (Oncorhynchus mykiss), and arctic grayling (*Thymallus arcticus*). Recent stocking reports indicate that the DWR stocks the lake annually with 4,000 catchable rainbow trout. The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Anabaena spiroides var. crassa	531.981	83.47
Gloeotrichia echinulata	55.600	8.72
Staurastrum gracile	33.249	5.22
Sphaerocystis schroeteri	7.923	1.24
Volvox areus	5.560	0.87
Gloeocystis sp.	0.834	0.13
Microcystis aeruginosa	0.734	0.12
Haematococcus lacustris	0.609	0.10
Pandorina morum	0.445	0.07
Coelosphaerium sp.	0.250	0.04
Pennate diatoms	0.050	0.01
Characiopsis sp.	0.037	0.01
Centric diatoms	0.033	0.01
Ankistrodesmus falcatus	0.004	0.00
Total	637.268	
Shannon-Weaver [H']	0.65	
Species Evenness	0.25	
Species Richness	0.48	

The phytoplankton community is dominated by blue-green algae indicative of eutrophic conditions and lower water quality.

Pollution Assessment

Nonpoint pollution sources include: grazing, silviculture, construction and recreational development. The LaBaron II timber sale (1993) is the most recent silviculture. It involved group selection of timber in areas 0.5 acres or smaller. Private logging takes place to the east of the lake. About 520 head of cattle graze in the watershed and around the reservoir for part of the summer period.

There are no point pollution sources in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Fishlake National Forest	896-4491
Beaver Ranger District	438-2436
Five County Association of Governments	673-3548
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Color Country Travel Region (St. George)	628-4171
Beaver KOA	438-2924
United Beaver Camperland	438-2808
Beaver Chamber of Commerce	438-2975
Reservoir Administrator	
DWR	538-4700

LAKE MARY

Introduction

Lake Mary is a high elevation glacial lake in Big Cottonwood Canyon east of Salt Lake City. It has been augmented with a dam and retains winter snowmelt until summer for culinary use in the Salt Lake Valley. It is within the Brighton Ski Resort, and also receives heavy summer recreational use.

Lake Mary was deepened and enlarged in 1915 by construction of a 72' concrete dam. The reservoir shoreline is 95% publicly owned by the Wasatch-Cache National Forest. Public access is unrestricted. Current water use is for culinary purposes and some recreation with no changes expected.

Characteristics and Morphometry

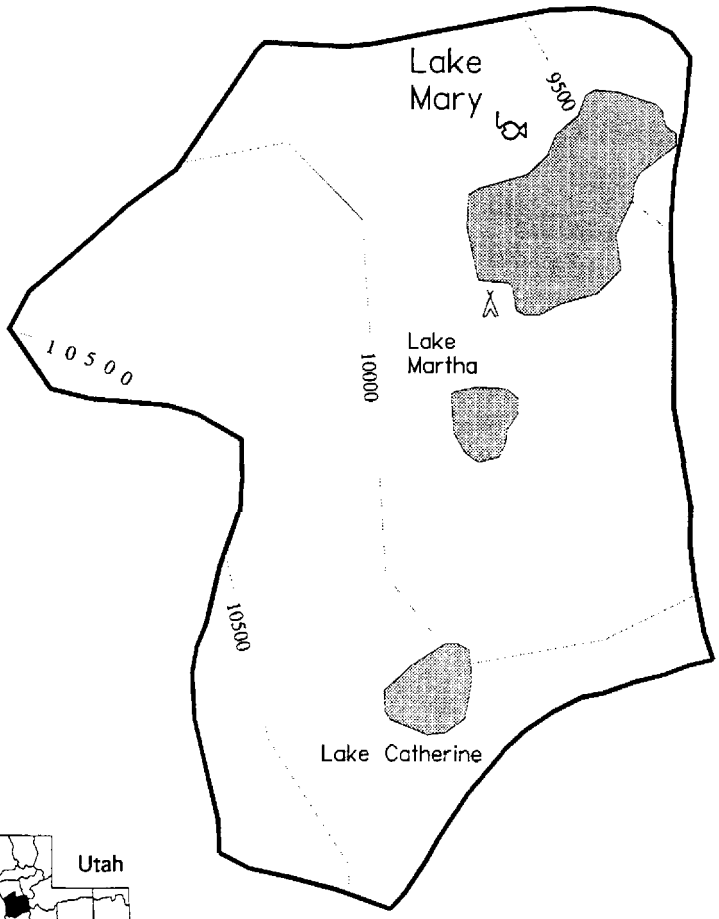
Lake elevation (meters / feet)	2,903 / 9,528
Surface area (hectares / acres)	9.3 / 23
Watershed area (hectares / acres)	103 / 339
Volume (m^3 / acre-feet)	
capacity	740,101 / 600
conservation pool	
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (meters / feet)	
Depth (meters / feet)	
maximum	27.4 / 90
mean	9.1 / 30
Length (meters / feet)	483 / 1,584
Width (meters / feet)	274 / 898
Shoreline (meters / feet)	1,247 / 4,092

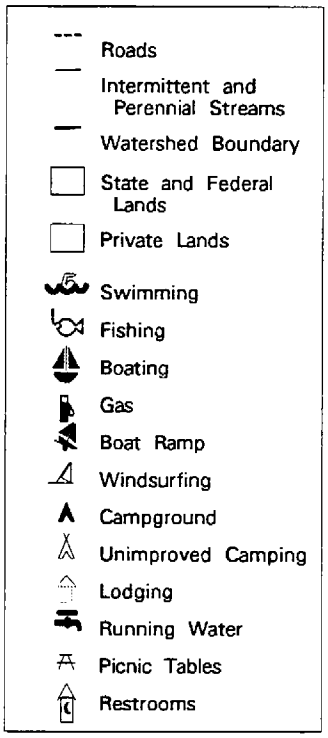
Location

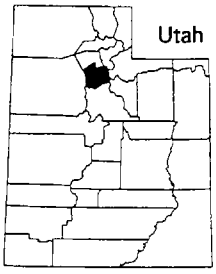
County	Salt Lake
Longitude / Latitude	111 35 17 / 40 35 17
USGS Map	Brighton 1955
DeLorme's Utah Atlas and Gazetteer™	Page 53 C-6
(Not labeled on map, one mile southeast of Twin Lakes Res)	
Cataloging Unit	Jordan (16020204)

Recreation

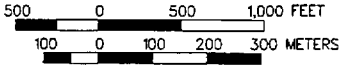
Lake Mary is on the hiking route from Brighton to Alta. Access is easiest from the top of Big Cottonwood Canyon. Exit I-215 at Exit 7 (South of I-80 and east of I-15) and follow signs to Big Cottonwood Canyon and Brighton Ski Resort. At the top of the canyon, locate the Sunset Peak Trailhead and follow the trail about 0.75 miles to the lake. Although Big Cottonwood Canyon is plowed throughout the







County in which watershed is located.



Lake Mary Watershed

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inter, the lake is most easily accessed between Memorial

Day and before the first heavy snowfall of the autumn. Summer access to Big Cottonwood Canyon is also possible via improved gravel road from Park City or Midway.

The lake offers fishing and solitude. Because the lake is a culinary water source, swimming is not permitted. Most visitors do not have this lake as a destination, but are enjoying the experience of hiking around under high mountain peaks and glacial lakes.

The lake is in a popular hiking area. Sunset Peak, Lake Martha, and Lake Catherine are all renowned for their scenic beauty. While such high elevation lakes are common below the ridgeline from Park City to Lone Peak, this area is popular because of easy automobile access.

Redman Campground, administered by the USFS, is between Brighton and Solitude Ski Resorts, and has 37 campsites, drinking water, toilets and picnic sites. Spruces Recreation Area is several miles down canyon and has 90 campsites.

Watershed Description

Lake Mary is a cirque lake just under the peaks of the Wasatch Mountains. The lake lies just above the timberline, with barren peaks rising 1,200 feet above the lake and slopes up to 100%. The watershed is very small, There are no ski runs in the watershed, but adjacent basins to the northeast and southwest are routinely devegetated to maintain ski runs.

The watershed high point, Mount Wolverine, is 3,290 m (10,795 ft) above sea level, thereby developing a complex slope of 40.3% to the reservoir. Inflow is from snowmelt, with no perennial streams. The outflow is a small stream that joins Big Cottonwood Creek in Brighton. Lake Catherine and Lake Martha are two smaller lakes within the watershed.

The soil in the watershed is entirely glacial till and barren rock. See Appendix III for a complete soil description.

The vegetation communities are composed of aspen, pine, spruce-fir and alpine. The watershed receives 127 cm (50 inches) of precipitation annually with a frost-free season of 20 - 40 days.

Land use is 100% recreation. There is no grazing in the watershed, and dogs are prohibited.

Limnological Assessment

The water quality of Lake Mary is considered very good. It is considered to be soft with a hardness concentration value of approximately 23 mg/L ($CaCO_3$). The only parameter that has exceeded State water quality standards for defined beneficial uses is phosphorus. Prior to 1992 total phosphorus concentration were well below the pollution indicator. In 1992 the average concentration of total phosphorus in the water column was 55 ug/L which exceeds the recommended pollution indicator for phosphorus of 25 ug/L. The phosphorus concentration in the hypolimnion on September 3, 1991 reached a level of 143 ug/L. The average concentration in the water column on that date was 103 ug/L. This increased concentration occurred even though the depth of the lake was 10 meters with aerobic conditions present throughout the water column (3.1 ug/L near the bottom). This is not consistent with previous data and additional data will need to be obtained to confirm these increases in nutrient concentrations. A review of the September 3, 1992 profile indicates a sharp decline in temperatures near the bottom with no stratification present. It should be noted that this profile was obtain immediately adjacent to the dam by lowering the field instrumentation from the crest of the dam. Although in 1981 the reservoir was characterized as a phosphorus limited system, the 1990-92 data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is

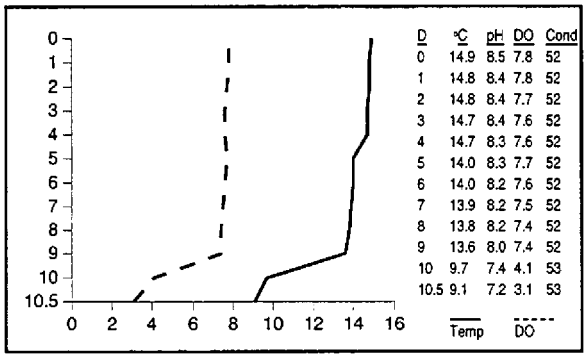
Limnological Data

Data sampled from STORET site: 591168

Surface Data	1981	1990	1992
Trophic Status	M	M	E
Chlorophyll TSI	-	39.19	51.59
Secchi Depth TSI	-	57.37	47.05
Phosphorous TSI	42.50	29.98	55.62
Average TSI	42.50	42.18	51.53
Chlorophyll a (ug/L)	-	2.4	8.5
Transparency (m)	-	1.2	2.45
Total Phosphorous (mg/L)	5	6	36
pH	6.6	8.6	7.8
Total Susp. Solids (mg/L)	<5	<3	4.3
Total Volatile Solids (mg/L)	-	-	2
Total Residual Solids (mg/L)	-	-	3
Temperature (°C / °f)	18/64	15/59	14/57
Conductivity (umhos.cm)	27	62	55
Water Column Data			
Ammonia (mg/L)	0.05	0.03	0.03
Nitrate/Nitrite (mg/L)	.17	0.09	0.04
Hardness (mg/L)	25	23.2	20.2
Alkalinity (mg/L)	19	21	21
Silica (mg/L)	-	-	1.7
Total Phosphorus (ug/L)	5	8	55
Miscellaneous Data			
Limiting Nutrient	P	N	N
DO (Mg/l) at 75% depth	-	6.9	7.4
Stratification (m)	-	NO	9-10
Depth at Deepest Site (m)	-	8	10.5

mesotrophic with the exception of 1992 when high phosphorus and chlorophyll-a values late in the season shifted the status to eutrophic. The eutrophic status in 1992 appears abnormal but additional data will need to be collected to verify this trend. According to DWR no fish kills have been reported in recent years. The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake. The DWR reports that the only fish Lake Mary is presently stocked with is brook trout (*Salvelinus fontinalis*) fingerlings. A few lake trout (S. namaycush) have survived from an initial plant made in the 60's and 70's. Redside shiner (*Richardsonius balteatus*) is also found in the reservoir. Fishing is allowed from the shore only and swimming and wading in the lake are prohibited.

No phytoplankton samples have been taken during our study period.



D	°C	pH	DO	Cond
0	14.9	8.5	7.8	52
1	14.8	8.4	7.8	52
2	14.8	8.4	7.7	52
3	14.7	8.4	7.6	52
4	14.7	8.3	7.6	52
5	14.0	8.3	7.7	52
6	14.0	8.2	7.6	52
7	13.9	8.2	7.5	52
8	13.8	8.2	7.4	52
9	13.6	8.0	7.4	52
10	9.7	7.4	4.1	53
10.5	9.1	7.2	3.1	53

Pollution Assessment

Nonpoint pollution sources include: human wastes and litter from recreation. There are no domestic animals permitted in the watershed.

There are no point pollution sources in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: culinary (1C), boating and similar recreation (excluding swimming) (2B), and cold water game fish and organisms in their foodchain (3A).

Information

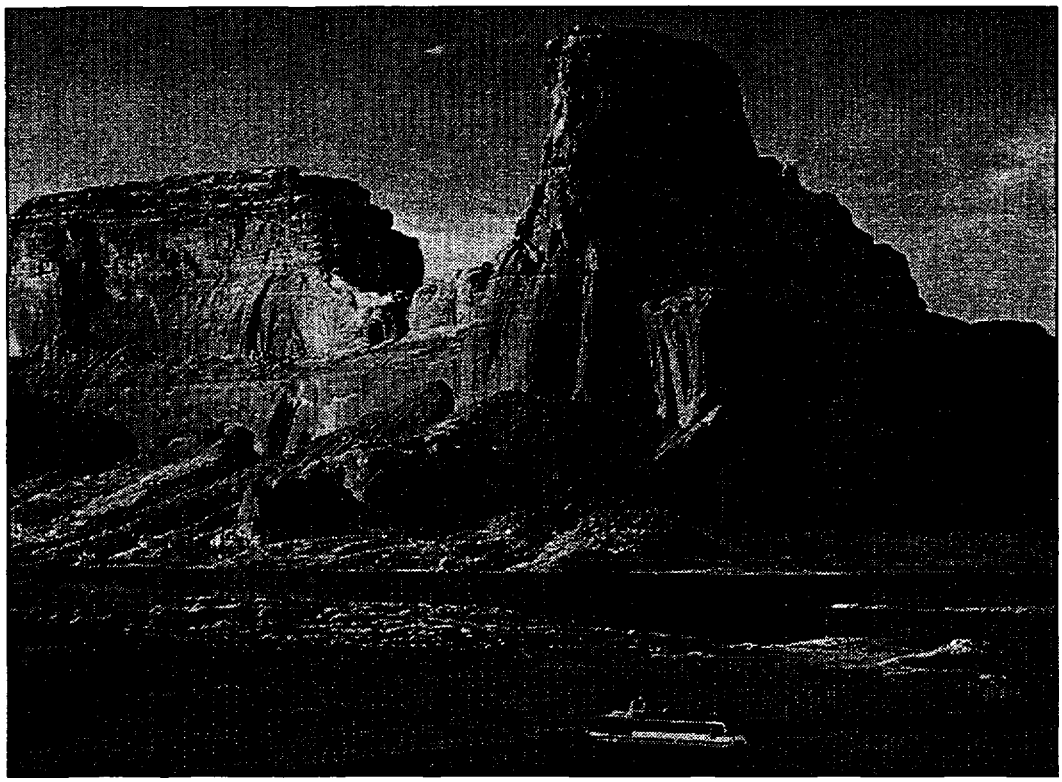
Management Agencies

Salt Lake County Commission	468-3610
Wasatch National Forest	524-5030
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	

Reservoir Administrators

Salt Lake City Corporation	535-7880

LAKE POWELL



Introduction

Lake Powell is the largest reservoir in Utah. It stretches from two miles south of the state line in Arizona upstream approximately 186 miles to Canyonlands National Park in Utah. It is known as an aquatic playground in the desert. It is named after John Wesley Powell, who led the first exploration of the Colorado River.

Not long after Powell's voyage, permanent settlements were established at the easiest and most reliable river crossings. An early proponent of the need for reclamation activities in this arid country, Powell eventually was honored by having the lake named for him. The dam was born amid great controversy and compromise., It fulfills its goals of water storage and power generation and also provides major recreational opportunities. The resulting lake makes it possible for many people to view natural marvels and cultural features that once were accessible to only a determined few. Construction of the concrete arch dam began in 1956, and the final two generating units began

Characteristics and Morphometry

Lake elevation (meters / feet)	1,127 / 3,700
Surface area (hectares / acres)	65,843 / 162,700
Watershed area (hectares / acres)	26,700,000 / 65,800,000
Volume (m^3 / acre-feet)	
capacity	2.6526×10^{10} / 2.1505×10^7
conservation pool	none specified
Annual inflow (m^3 / acre-feet)	3.7×10^9 / 3.0×10^6
Retention time (years)	7.2
Drawdown (m^3 / acre-feet)	3.7×10^9 / 3.0×10^6
Vertical fluctuation (meters / feet)	6 / 18
Depth (meters / feet)	
maximum	170 / 560
mean	40 / 132
Length (kilometers / miles)	299 / 186
Width (kilometers / miles)	40 / 25
Shoreline (kilometers / miles)	3,057 / 1,900

Location

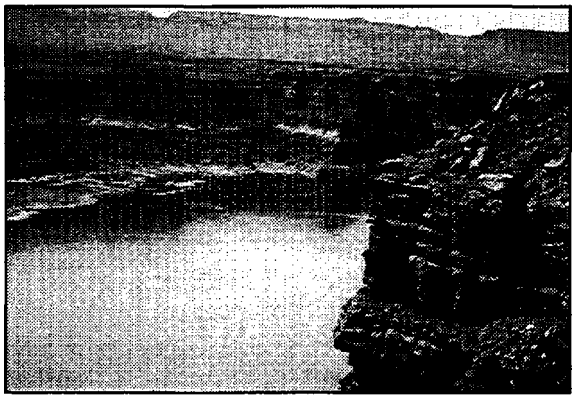
County	San Juan, Garfield, Kane
Longitude / Latitude	111 00 00 / 37 15 00
USGS Map	
DeLorme's Utah Atlas & Gazetteer™	Pages 20, 21, 29
Cataloging Unit	Upper Colorado

LAKE REPORTS

providing power in 1966.

The concrete arch dam and powerplant together required 5.1 million cubic yards of concrete-poured round the clock for more than three years. The dam's crest is 1,560 feet long. It lies 710 feet above bedrock and 583 feet above the original river channel. At its full pool elevation of 3,700 feet Lake Powell holds 27 million acre-feet of water, 560 feet deep at the dam.

The lake reached full pool level in 1980. The spillways were used in that year and again in 1983 to handle the rising lake level caused by flood waters. In 1983, there was concern the dam might fail, when water ripped huge chunks of sandstone from the spillways. After lake elevations receded the spillways were repaired and management plans changed to fill the lake more slowly in the spring. Lake level dropped continually throughout the remainder of the 80's and early 90's, and at the present (June 1993), it is filling again.

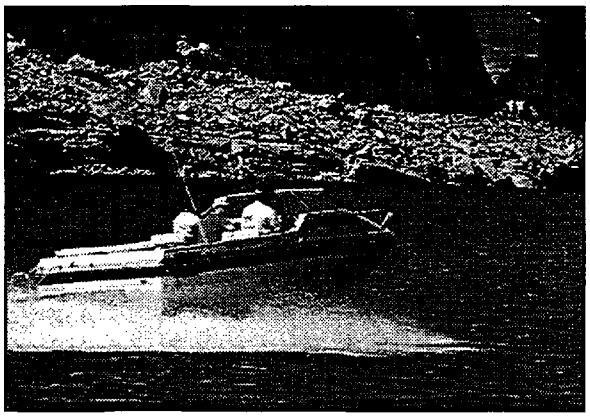


It is an impoundment of Glen Canyon, and the sculpted Navajo Sandstone walls create almost 2,000 miles of shoreline. The Glen Canyon National Recreation Area encloses most of the reservoir, with the Navaho Indian Reservation on the south shore from the dam eastward on the San Juan River arm. Public access is unrestricted in the NRA, but there is no public access on the reservation. Reservoir water is not used in Utah, but in Arizona, Nevada, California, and Mexico. Water is used for agriculture, culinary, recreation, aquatic life, recreation, and hydropower. Water use is not expected to change in the foreseeable future.

Recreation

Lake Powell is accessible from U-95 near Hite, U-276 at Hall's Crossing and Bullfrog Bay, and US-89 just north of the Arizona Border.

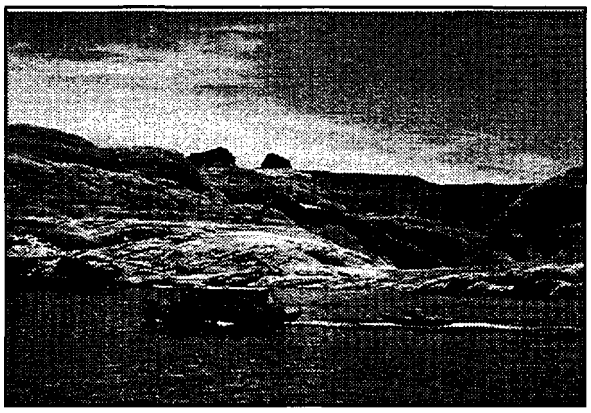
Water sports dominate recreation activities at Glen Canyon National Recreation Area. Concessioners offer boat



tours that last from an hour to all day and provide boat rentals at developed areas. Houseboats provide comfort at a relaxed pace, as well as a chance to sightsee beyond developed areas. Sailing is best at Wahweap, Padre, and Bullfrog Bays. Canoes and kayaks provide access to secluded areas in small canyons. Lake waters are relatively warm from June through September making swimming, snorkeling, SCUBA diving and water skiing enjoyable.

Fishing is rewarding all year. Primary game species are largemouth (*Micropterus salmoides*) and striped bass (*Morone saxatilis*), black crappie (*Pomoxis nigromaculatus*), catfish (*Ictalurus punctatus*), bluegill (*Lepomis macrochirus*), rainbow trout (*Oncorhynchus mykiss*), and walleye (*Stizostedion vitreum*). The cold waters of the Colorado River below the dam provide excellent trophy trout habitat. Fishermen frequently catch very large rainbow trout upstream from Lees Ferry.

There is excellent camping on flat sites along the lakeshore. You can supplement your water sports with a hike in desert side canyons on trails of your own choosing Please exercise reasonable caution. Backcountry hiking in the canyon country requires planning and stamina. However, the rewards can far outweigh the efforts of preparation and the exertion of the experience itself.



Mountain biking is becoming a popular activity within the recreation area. Routes in the park provide various levels of difficulty and maps are available. For more information about facilities, activities, and regulations write to the Superintendent, Glen Canyon National Recreation Area, P.O. Box 1507, Page, AZ 86040.

Watershed Description

Lake Powell is an impoundment of the Colorado River at the Utah/Arizona state line. It drains the deserts of eastern Utah with plateaus to the west, the Uinta Mountains, the high plains of southwestern Wyoming where the Green River has its source. All of western Colorado, northwestern New Mexico, and northeastern Arizona drain into Lake Powell.

The area around the reservoir is mostly Navaho Sandstone, the same strata that the canyons of Zions National Park are carved in, as well as the Slickrock Trail in Moab. The spectacular landscape dominating this canyon country is the product of eons of geologic activity: shifting of continents, global rising and falling of sea levels, and creation of highlands now worn and redeposited. At times, desert dominated the landscape; sometimes, freshwater or saltwater seas invaded, leaving rivers to erode the most recently deposited layers. The process was assisted by prevailing winds. These periods of erosion account for missing rock strata--layers that appear elsewhere in sequence. The last uplift of the Colorado Plateau began about 60 million years ago. Uplift made meandering streams of the Colorado River run faster and cut the canyons that are Lake Powell's basin. Navajo sandstone, the dominant formation, is made of sand dunes hardened by pressure from deposits above them. The deposits eventually wore away and exposed today's sandstone. Other layers contain sea-deposited sediments; still others hold fossils of land or marine organisms that lived millions of years ago. Petrified wood and fossils of dinosaur bones, sea shell, and small sea creatures are found in several rock strata in this area.

Most plants and animals found here are typical of desert species. Cactus, yucca, blackbrush, rabbitbrush, and grasses dominate desert plant communities. Spring or summer precipitation prompts sand lilies, fleabane, evening primrose, lupine, Indian paintbrush, and globe mallow to bloom. Pinyon and juniper trees grow at higher elevations. Common animal inhabitants include coyotes, foxes, rats, mice, lizards, and insects. In startling contrast, shady springfed alcoves in side canyons provide suitable habitat for deer and beaver, ferns and sedges, reeds and cattails, cottonwoods and willows. Ravens, eagles, hawks, owls, sparrows, and swallows are regular residents of the canyon country, where canyon wrens sing their unforgettable song.

The watershed high point is 4,400 m (14,433 ft) above sea level, thereby developing a complex slope of 0.6% to the reservoir. The average stream gradient of the Colorado River is 0.7% (36 feet per mile) Major inflows include the Escalante River, the Dirty Devil River, the Colorado River and the San Juan River. There are thousands of ephemeral streams with flow after heavy rains and during snowmelt. The outlet is the Colorado River. Major upstream reservoirs are the Flaming Gorge Reservoir on the Green River and the Blue Mesa Reservoir on the Gunnison River. The soil associations that compose the watershed are listed in Appendix III.

The watershed receives 15 - 127 cm (6 - 50 inches) of precipitation annually. The frost-free season around the reservoir is 200 - 220 days per year.

Land use in the watershed includes: livestock grazing on private, state, and BLM land (53.7%), forest and woodland (27.2%), multiple use (14.6%), cropland (2.9%), and urban (0.1%).

Limnological Assessment

Lake Powell is one of the largest man-made reservoirs

Limnological Data

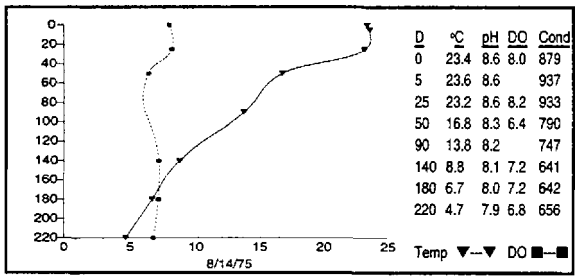
Surface Data	1981	1990	1993
Trophic Status	M		O
Chlorophyll TSI	-		27.66
Secchi Depth TSI	38.48		44.53
Phosphorous TSI	51.13		41.29
Average TSI	44.80		37.83
Chlorophyll a (ug/L)	-		
Transparency (m)	-		
Total Phosphorous (mg/L)	20		
pH	8.5		
Total Susp. Solids (mg/L)	<5		
Total Volatile Solids (mg/L)	-		
Total Residual Solids (mg/L)	-		
Temperature (°C / °f)	13/55	/	/
Conductivity (umhos.cm)	-		
Water Column Data			
Ammonia (mg/L)	-		
Nitrate/Nitrite (mg/L)	.61		
Hardness (mg/L)	286		
Alkalinity (mg/L)	-		
Silica (mg/L)	-		
Miscellaneous Data			
Limiting Nutrient	-		
DO (Mg/l) at 75% depth	5.6		
Stratification (m)	YES		
Depth at Deepest Site (m)	509		

in the United States. Due to its vast size and the complexity of the hydrology and limnology associated with the reservoir only a general characterization of the water will be presented. For further information contact those agencies with oversight jurisdiction over the reservoir. Most of the information here is summarized from the National Eutrophication Survey or from papers produced under the oversight of the Glen Canyon National Recreation Area (GCNRA).

The water quality of Lake Powell is considered very good. It is considered to be moderately hard and saline with a total dissolved solids concentration of approximately 500 mg/L. The only parameters that has exceeded State water quality standards for defined beneficial uses are coliform counts used to assess primary and secondary contact recreation. These exceedences are usually in localized areas receiving heavy recreational use in undeveloped recreational areas. The exceedences occur for only short periods and the GCNRA has a program to monitor and post areas that are in violation. For the period of record (1991--1995 documented incidents occurred in 1991, 1992 and 1995. The lake acts as a sink for nutrients and heavy metals from natural erosion. Currently there are ongoing monitoring efforts by federal and state agencies to document and evaluate the effect of heavy metals in the food chain within the reservoir. Part of these efforts will be to ascertain any potential risks to the public by uptake by fish and their consumption by humans.

The rapid depletion of nutrients available for primary productivity is well documented. With the exception of certain areas near the inflow of tributaries or isolated areas of high recreation use, nutrient concentrations are low. Total phosphorus concentration rage from 8-10 ug/L, well below the state indication for pollution of 25 ug/L. Mean soluble reactive phosphorus values range from 2-3 ug/L (USEPA NES, 1977). All studies substantiate the fact that in general the reservoir is a phosphorus limited system.

The NES reported the reservoir as borderline between oligotrophic and mesotrophic. Data obtained in 1993 indicates that the reservoir is oligotrophic. It is evident that trophic status varies spatially throughout the reservoir, but the generally accepted conclusion is that the reservoir is oligotrophic overall. Profiles obtained on the reservoir indicate that a relatively deep thermocline does develop and that the reservoir is stratified. It appears that dissolved oxygen concentrations may develop sags in late summer or winter but they remain at fairly high levels. Included for reference is a profile taken upstream from the dam on August 14, 1975 as part of the NES.



The Division of Wildlife Resources reports that there are 17 different species of fish in the reservoir. Important game fish present are the rainbow trout (Oncorhynchus mykiss), striped bass (*Morone saxatilis*), largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieui*) bluegill (*Lepomis macrochirus*), walleye (*Stizostedion vitreum*), the channel and black bull head catfish (*Ictalurus punctatus*), and (I. melas), green sunfish (*Lepomis cyanellus*), and the black crappie (*Pomoxis nigromaculatus*). Other species present include the flannelmouth, and humpback suckers (*Catostomus latipinnis*) and redside shiner (*Richardsonius balteatus*), Colorado squawfish (*Ptychocheilus lucius*), speckled dace (Rhinichthys osculus), flathead minnow (*Pimephales promelas*), and threadfin shad (*Dorosoma petenense*). Crayfish are found commonly in Lake Powell.

Lake Powell is also a large and important recreational area administered by the GCNRA. Known to be one of the most appealing vacation spot in the west, Lake Powell furnishes activities from fishing to all kinds of water activities to camping, hiking, and backpacking.

The reservoir has not been chemically treated by the DWR

Phytoplankton in the euphotic zone include the following taxa (in order of dominance) as reported by NES (1977):

Sampling Date	Dominant Genera	Algal Units Per ml
4/16/75	*Chroomonas*	513
	Fragilaria	438
	Cryptomonas	257
	Glenodinium	29
	Other genera	
Total		1,227
8/14/75	*Fragilaria*	816
	Chroomonas	371
	Centric diatom	185
	Navicula	148
	Skeletonema	148
	Other genera	279
Total		1,947

12/01/75	*Chroomonas*	486
	Fragilaria	333
	Cryptomonas	26
	Tetraedron	26
	Scenedesmus	26
	Other genera	
Total		897

Pollution Assessment

Nonpoint pollution sources include: Grazing, recreation, agriculture, urban runoff, silviculture, and hydrological modification. Erosion of soils is one activity with a great impact to the reservoir. The movement of sediments and associated constituents downstream to the reservoir effect water quality and the longevity of the reservoir. An area of concern that impairs water quality at least in a localized manner is recreation. Recreationist contribute to bacterial exceedences in swimming areas due in part to unsanitary practices and the discharge of sewage from mobile housing facilities. In addition an area of concern is the discharge of "gray waters" from watercraft on the reservoir. Gray water is defined as non-sewage wastewaters that can be discharged from a watercraft or other vehicle. These issues are those that receive the most focus and attention in an attempt to control nonpoint sources of pollution.

There are numerous point sources of pollution in the watershed, but most are far enough upstream that they are of no consequence.

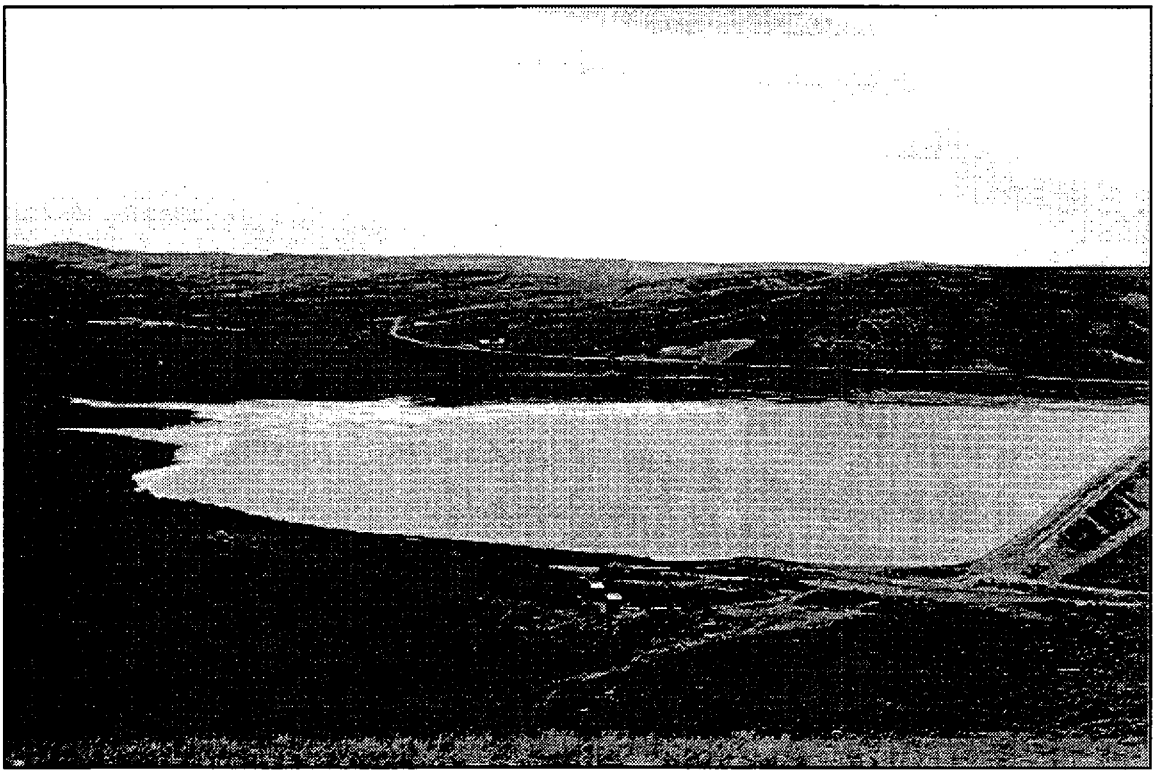
Beneficial Use Classification

The state beneficial use classifications include: culinary (1C), recreational bathing (swimming) (2A), boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Southeastern Association of Governments	637-5444
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Glen Canyon National Recreation Area	**(602)645-2471**
Recreation	
Canyonlands Travel Region (Monticello)	587-3235
Color Country Travel Region (St. George)	628-4171
Glen Canyon National Recreation Area	(602)645-2471
ARA Leisure Services	1-800-528-6154
Wahweap	(602)645-2433
Bullfrog	(801)684-2233
Halls Crossing	(801)684-2261
Hite	(801)684-2278
Reservoir Administrators	
Bureau of Reclamation	524-5436

LITTLE CREEK RESERVOIR



Introduction

Little Creek Reservoir is an intermediate size reservoir on the east slopes of the Monte Cristo Range south of Bear Lake. It was created in 1929 by the construction of an earth-fill dam on Little Creek. The reservoir shoreline is mostly privately owned. However, the first 1/4 mile of shoreline to the right of the dam (looking upstream) and the first 1/8 mile to the left are owned by the BLM. Public access is unrestricted. Reservoir water is used primarily for irrigation, and the reservoir is typically drained every summer. There are no foreseeable changes in water usage at this time.

Characteristics and Morphometry

Lake elevation (meters / feet)	1,948 / 6,393
Surface area (hectares / acres)	26.3 / 65
Watershed area (hectares / acres)	8,288 / 20,480
Volume (m^3 / acre-feet)	
capacity	1,366,720 / 1,108
conservation pool	
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	1,366,720 / 1,108
Depth (meters / feet)	
maximum	5.18 / 17
mean	3.05 / 10
Length (meters / feet)	643 / 2,109
Width (meters / feet)	571.4 / 1,875
Shoreline (km / miles)	2.3 / 1.43

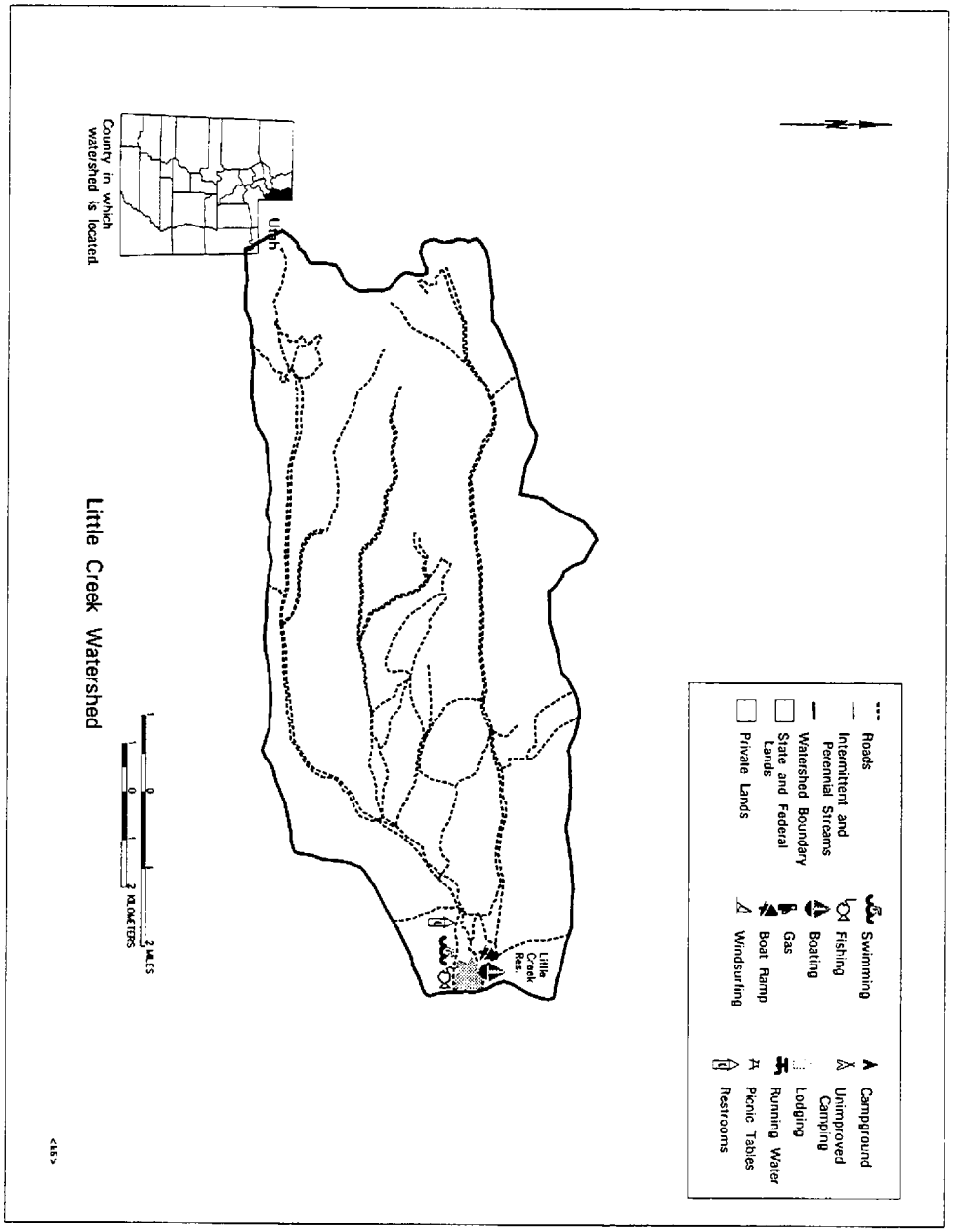
Location

County	Rich
Longitude / Latitude	111 13 48 / 41 41 34
USGS Map	Randolph 1968
DeLorme's Utah Atlas & Gazetteer™	Page 61,A-6
Cataloging Unit	Upper Bear (16010101)

Recreation

Little Creek Reservoir is easily accessible from the town of Randolph. From downtown, go west up the canyon for about two miles.

Due to the annual draining of the reservoir, it only receives recreational use in the spring and early summer. Fishing is the primary recreational use of the reservoir, as it is stocked with catchable rainbow trout every spring.


Roads
Intermittent and Perennial Streams
Watershed Boundary
State and Federal Lands
Private Lands
Swimming
Fishing
Boating
Gas
Boat Ramp
Windsurfing
Campground
Unimproved Camping
Lodging
Running Water
Picnic Tables
Restrooms
Little Creek Res.
Utah
County in which watershed is located
Little Creek Watershed
1 0 1 2 MILES
1 0 1 2 KILOMETERS

There are privies at the south end of the dam, but no other recreational facilities are available. Although, there is no improved boat ramp, it is possible to launch small boats on the south shore near the dam. It should be noted that by late summer the reservoir is usually completely dry and the area is not notably scenic.

The nearest campground is at Rendezvous Beach on the south shore of Bear Lake.

Watershed Description

The two primary tributary drainages, Old Canyon and New Canyon reach to the ridgeline of the Monte Cristo Range, defining a rectangular watershed between the ridgeline and the reservoir. The underlying bedrock is recent (Tertiary) deposits. The area is forested at upper elevations and on north facing slopes, with sage-grass areas at lower elevations and on south facing slopes. The area around the reservoir is rolling hills of sagebrush.

The watershed high point is 2,542 m (8,340 ft) above sea level, thereby developing a complex slope of 4% to the reservoir. The average stream gradient of Little Creek is 4% (216 feet per mile) The inflow and outflow is Little Creek.

The watershed is made up of gentle mountains. The soil is derived from the Wasatch Formation, the limestone bedrock that underlies much of the watershed. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of spruce-fir, pine, aspen, oak-maple, and sagebrush-grass. The watershed receives 30-64 cm (12-25 inches) of precipitation annually. The frost-free season around the reservoir is 80 - 100 days per year.

Land use in the watershed is multiple use (81%), native grazing (16%), and irrigated pasture/haylands (3%). Minor recreational use takes place.

Limnological Assessment

The water quality of Little Creek Reservoir is very good. It is considered to be hard with a hardness concentration value of approximately 224 mg/L ($CaCO_3$). The only parameter that has exceeded State water quality standards for defined beneficial uses is phosphorus. The average concentration of total phosphorus in the water column only exceeded the criteria in 1989 with a concentration of 27.0 ug/L which slightly exceeds the recommended pollution indicator for phosphorus of 25 ug/L. The phosphorus concentration on August 16, 1989 averaged 51.5 ug/L. This increased concentration occurred late in the summer under low volume conditions. The reservoir is characterized as a nitrogen phosphorus limited system with TSI values indicating the reservoir is mesotrophic. The reservoir does not stratify due to the shallow conditions.

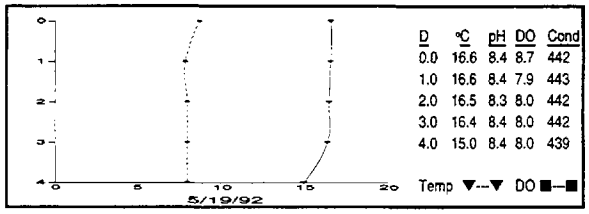
According to DWR no fish kills have been reported in recent years but problems may arise due to the shallowness of the reservoir late in the summer. The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake. The reservoir is primarily managed for rainbow trout (*Oncorhynchus mykiss*). This reservoir is managed as a put and take fishery and DWR typically stocks the reservoir with 10,000 catchable rainbow trout each year. No agreement exists between the irrigation company and the Division of Wildlife Resources concerning a conservation pool and the reservoir is drained annually. Fishing is supported primarily by local residents.

Limnological Data

Data sampled from STORET site: 590651

Surface Data	1981*	1989	1991*	1992*
Trophic Status	M	M	O	M
Chlorophyll TSI	-	39.39	33.90	37.88
Secchi Depth TSI	44.7	43.70	38.65	44.17
Phosphorous TSI	47.3	52.32	39.97	47.34
Average TSI	46	45.14	37.51	43.13
Chlorophyll a (ug/L)	-	2.5	1.4	2.1
Transparency (m)	2.9	3.1	4.4	3.0
Total Phosphorous (mg/L)	10.0	28.0	12.0	20.0
pH	8.5	9.2	8.5	8.4
Total Susp. Solids (mg/L)	<5	-	-	<3
Total Volatile Solids (mg/L)	-	-	6	2
Total Residual Solids (mg/L)	-	-	<0.1	<3
Temperature (°C / °f)	19/66	18/64	19/65	17/62
Conductivity (umhos.cm)	410	329	460	442
Water Column Data				
Ammonia (mg/L)	0.05	0.03	0.03	0.03
Nitrate/Nitrite (mg/L)	0.10	0.01	0.01	0.01
Hardness (mg/L)	212	-	236	224
Alkalinity (mg/L)	209	-	220	214
Silica (mg/L)	-	-	9.0	9.0
Total Phosphorus (ug/L)	10.0	27.0	13.0	21.0
Miscellaneous Data				
Limiting Nutrient	P	N	N	N
DO (Mg/l) at 75% depth	8.2	9.0	12.0	8.2
Stratification (m)	NO	NO	NO	NO
Depth at Deepest Site (m)	5	2.0	4.4	4.0

* Period 1 Data Only



DWR reported in 1980 that invertebrates present included gammarus and leeches and the zooplankton community included *Daphnia, Cyclops, Nauplii, and Turbellarianii.* The reservoir has extensive macrophyte coverage with pondweed as the dominant macrophyte.

Phytoplankton in the euphotic zone from August 3, 1994 include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Pennate diatoms	0.552	44.14
Fragilaria crotonensis	0.334	26.69
Anabaena sp.	0.278	22.24
Centric diatoms	0.078	6.23
Ankistrodesmus falcatus	0.009	0.70
Total	1.251	
Shannon-Weaver [H']	1.26	
Species Evenness	0.78	
Species Richness	0.20	

The phytoplankton community is dominated by the presence of diatoms and blue-green algae .

Pollution Assessment

Nonpoint pollution sources include the following: grazing, recreation, and agriculture.

There are no point sources of pollution in the watershed.

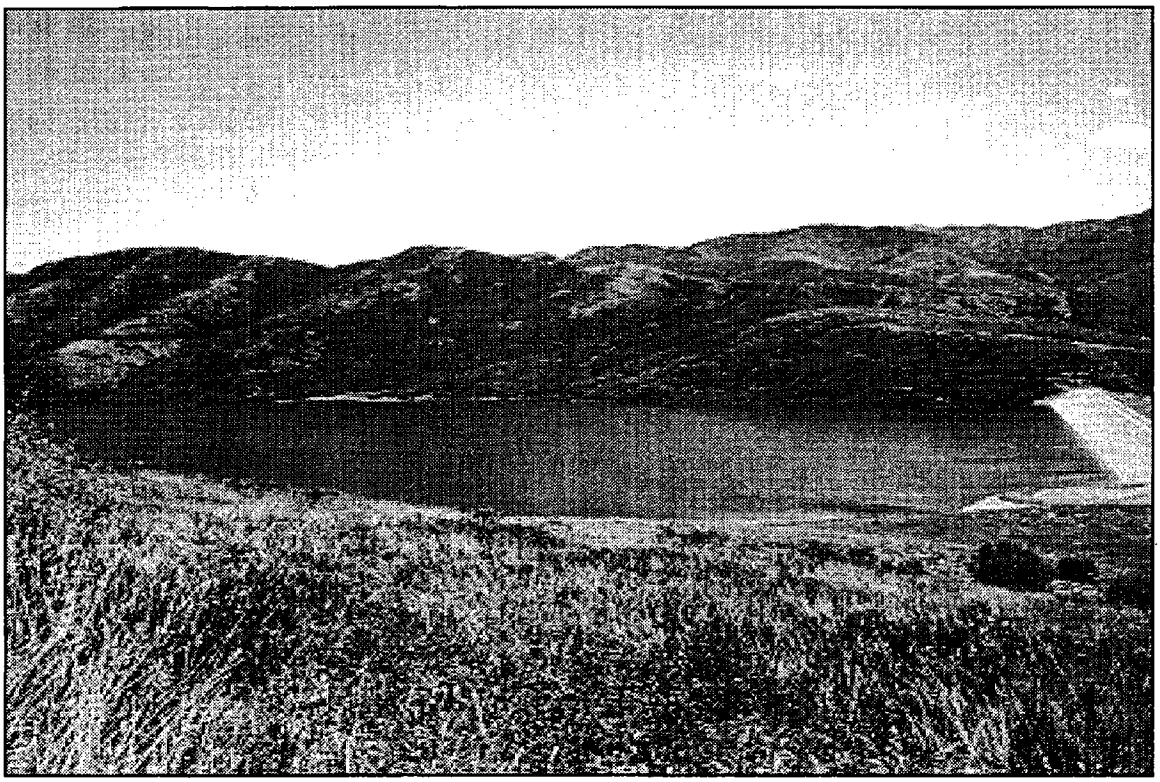
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Bear River Association of Governments	752-7242
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Bureau of Land Management	539-4001
Bear River Resource Area	977-4300
Recreation	
Bridgerland Travel Region (Logan)	657-5353
Garden City Chamber of Commerce	946-2901
Reservoir Administrators	
Little Creek Irrigation Company	793-6655

LITTLE DELL RESERVOIR



Introduction

Little Dell Reservoir, an impoundment on Dell Creek stores water not only from Dell Creek but diverted water from Parleys Creek located immediately downstream. It is operated in conjunction with Mountain Dell Reservoir for flood control and water supply. Although initially no recreational component was planned, recent interest by area residents has brought about the preliminary development of a recreation plan associated with the reservoir.

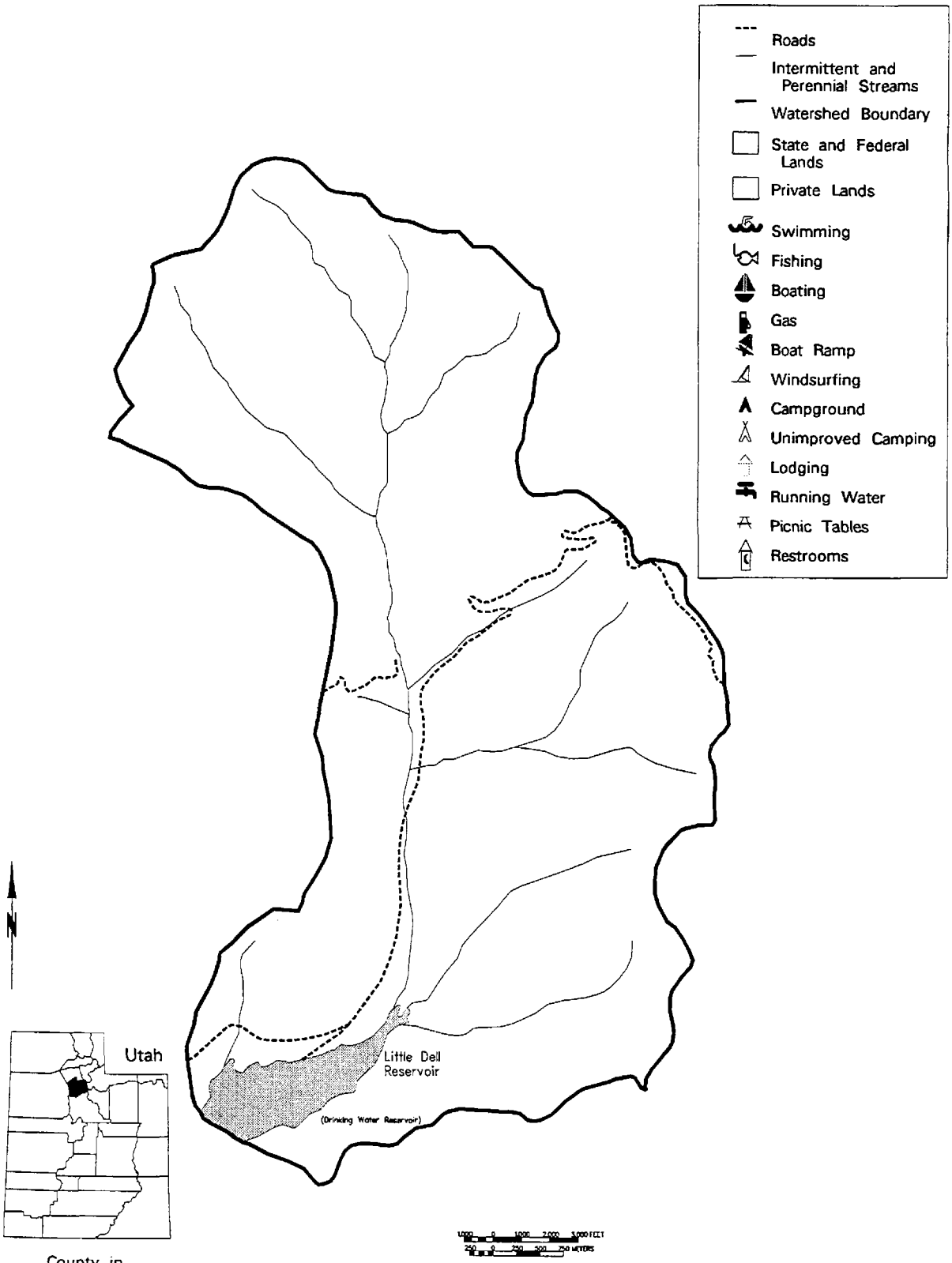
Characteristics and Morphometry

Lake elevation (meters / feet)	1,767 / 5,798
Surface area (hectares / acres)	101 / 249
Watershed area (hectares / acres)	7,641 / 18,880
Volume (m^3 / acre-feet)	
capacity	2,528,000 / 20,500
conservation pool	
Annual inflow (m^3 / acre-feet)	11,300
Retention time (years)	1.8
Drawdown (meters / feet)	
Depth (meters / feet)	
maximum	61 / 200.1
mean	25.1 / 82.4
Length (meters / feet)	2,006 / 6,582
Width (meters / feet)	546 / 1,791
Shoreline (meters / feet)	4,907 / 16,100

Location

County	Salt Lake
Longitude / Latitude	111 41 55 / 40 46 25
USGS Map	Mountain Dell, Utah 1961
DeLorme's Utah Atlas and Gazetteer™	Page 53 B-6
(Not labeled on map, just east of Mountain Dell Reservoir)	
Cataloging Unit	16020204

The dam is a rolled earthfill structure. It has a maximum height of 224 feet above the streambed and is 1,700 feet in length. When full the reservoir impounds 20,500 acre-feet of water. The project was build through the cooperation of the Metropolitan Water District of Salt Lake City, Salt Lake County and the US Army Corp of Engineers. Construction was essentially completed in 1993. Little Dell Reservoir is maintained at gross pool throughout much of the year. The reservoir is periodically drawn down for



County in which watershed is located.

Little Dell Watershed

<k40>

municipal and industrial water supply and irrigation. In the spring the reservoir is drawn down to control possible flooding from snowmelt. Information shows that a water surface area of 140 acres is provided 90 percent of the time during the recreational season.

Recreation

Little Dell Reservoir is located in Salt Lake County about 13 miles east of Salt Lake City in the western Wasatch Mountains. It is located adjacent to State Highway 65 approximately 1 mile northeast of I-80.

Although a recreation component was not developed as part of original plan for the reservoir, plans are proceeding forward to develop a recreational plan associated with the reservoir. Recreational opportunities would be developed that are compatible with dam operations and project purposes. There are certain constraints mandated by a Salt Lake City Watershed Ordinance. These include: no potable water services directly from the lake, no swimming, bathing or washing within the lake, picnicking limited to restricted areas, no operations of motorized boats and limited day-use only. In addition there are other physical and environmental constraints that could influence full development of a recreational project. Given these constraints there are still about eight potential recreational opportunities being defined for consideration. They include hiking, fishing with flies and artificial lures only, boating, picnicking, sightseeing, wind surfing, camping, and fishing. Furthermore, incidental winter use including cross-country skiing will be an opportunity considered.

There is no plan to allow camping within the project lands but camping facilites are located at Affleck Park, 3 miles north of the reservoir. Facilities at Affleck Park include picnic tables, open play and camping areas and trails in the canyon areas.

Watershed Description

Little Dell Reservoir is an impoundment of Dell Creek, a tributary to Parleys Creek. Water entering the reservoir would be comprised of water from Dell Creek and diverted water from Parleys Creek. The north side of the reservoir is gently rolling terrain with several small knolls which slightly extend into the waters edge. Much of the terrain is very steep. A relatively small flat area exists northwest of the reservoir and south of State Highway 65.

The watershed high point, Murdock Peak, is 2,927 m (9,602 ft) above sea level, thereby developing a complex slope of 14% to the reservoir. Inflow is from Dell Creek and Parleys Creek. The outflow is a Dell Creek a tributary of Parleys Creek that enters into Mountain Dell Reservoir a short distance downstream.

The geology of the project area is made up of rocks which range in age from Jurassic to Quaternary. The soil in the watershed are residual clay or silty-clay soil derived from bedrock of shales, shaley sandstone, and lime shales. The soils surrounding the reservoir are a mix of reddish clay and rock.

The vegetation communities are composed of low-growing plant associations. The north facing hillside is dominated by scrub oak interspersed with rabbit brush, sagebrush, and snowberry. The south facing slope is primarily a sagebrush and bitterbrush association with an undergrowth of brome grass and other grasses and herbs. The upper watershed is composed primarily of aspen, pine, spruce-fir and alpine. The watershed receives 64 cm (25 inches) of precipitation annually with a frost-free season of 80 - 120 days.

Land use is multiple use with restrictions to protect the watershed for a municipal water supply.

Limnological Assessment

According to the 1994 data, water quality of Little Dell Reservoir is considered excellent. It is considered to be hard with a hardness concentration value of approximately 176

Limnological Data

Data sampled from STORET site: 591168

Surface Data	1992	1994
Trophic Status	E	O
Chlorophyll TSI	57.86	28.41
Secchi Depth TSI	48.64	31.26
Phosphorous TSI	56.60	50.85
Average TSI	54.37	36.84
Chlorophyll a (ug/L)	16.1	0.8
Transparency (m)	2.2	7.3
Total Phosphorous (mg/L)	38	25
pH	8.7	8.3
Total Susp. Solids (mg/L)	3	3.7
Total Volatile Solids (mg/L)	1	2
Total Residual Solids (mg/L)	2	2
Temperature (°C / °f)	16/61	20/68
Conductivity (umhos.cm)	41	340
Water Column Data		
Ammonia (mg/L)	0.12	0.03
Nitrate/Nitrite (mg/L)	0.06	.10
Hardness (mg/L)	31	176
Alkalinity (mg/L)	33	176
Silica (mg/L)	7.2	-
Total Phosphorus (ug/L)	113	24
Miscellaneous Data		
Limiting Nutrient		P
DO (Mg/l) at 75% depth		5.5
Stratification (m)		14
Depth at Deepest Site (m)		26.9

mg/L ($CaCO_3$). There are no parameters monitored that have exceeded State water quality standards for defined beneficial uses is phosphorus. In 1994 the average concentration of total phosphorus in the water column was 24 ug/L which is below the recommended pollution indicator for phosphorus of 25 ug/L. A review of the September 9, 1994 profile indicates that generally dissolved oxygen is fairly stable throughout the water column and that the reservoir is stratified at a depth of 14 meters. The existing data suggest that the reservoir is currently a phosphorus limited system. TSI values indicate the reservoir is oligotrophic.

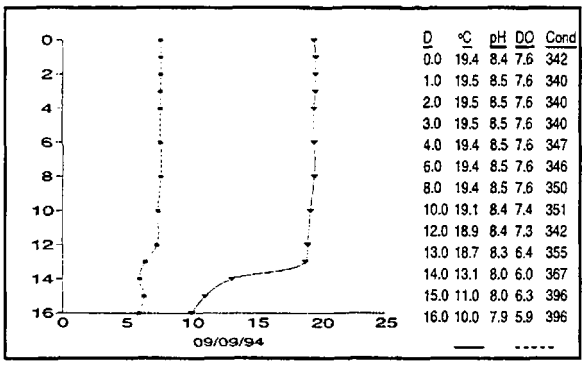
It should be noted that the water quality data from 1992 is significantly different from 1994. This data was not used in the overall projections for the reservoir because the data was collected shortly after the reservoir was filled. It is not uncommon for newly impounded waters to be more productive, higher in nutrients, than a stabilized reservoir. It is apparent from the 1994 data is more indicative of the long term water quality for the reservoir.

According to DWR no fish kills have been reported in recent years. Although the DWR stocking reports at this time indicate that the reservoir has not been stocked with game fish, Dell Creek and Parleys Creek contain populations of brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), and native cutthroat trout (*Oncorhynchus clarki*).

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Microcystis incerta	0.167	84.27
Centric diatoms	0.012	5.90
Pennate diatoms	0.009	4.49
Oocystis sp.	0.008	4.21
Chlamydomonas sp.	0.002	1.12
Total	0.198	
Shannon-Weaver [H']	0.63	
Species Evenness	0.39	
Species Richness	0.21	

As observed, although the reservoir is predominately populated by blue-green algae indicative of eutrophic conditions, the amount of production is fairly low.



D	°C	pH	DO	Cond
0.0	19.4	8.4	7.6	342
1.0	19.5	8.5	7.6	340
2.0	19.5	8.5	7.6	340
3.0	19.5	8.5	7.6	340
4.0	19.4	8.5	7.6	347
6.0	19.4	8.5	7.6	346
8.0	19.4	8.5	7.6	350
10.0	19.1	8.4	7.4	351
12.0	18.9	8.4	7.3	342
13.0	18.7	8.3	6.4	355
14.0	13.1	8.0	6.0	367
15.0	11.0	8.0	6.3	396
16.0	10.0	7.9	5.9	396

Pollution Assessment

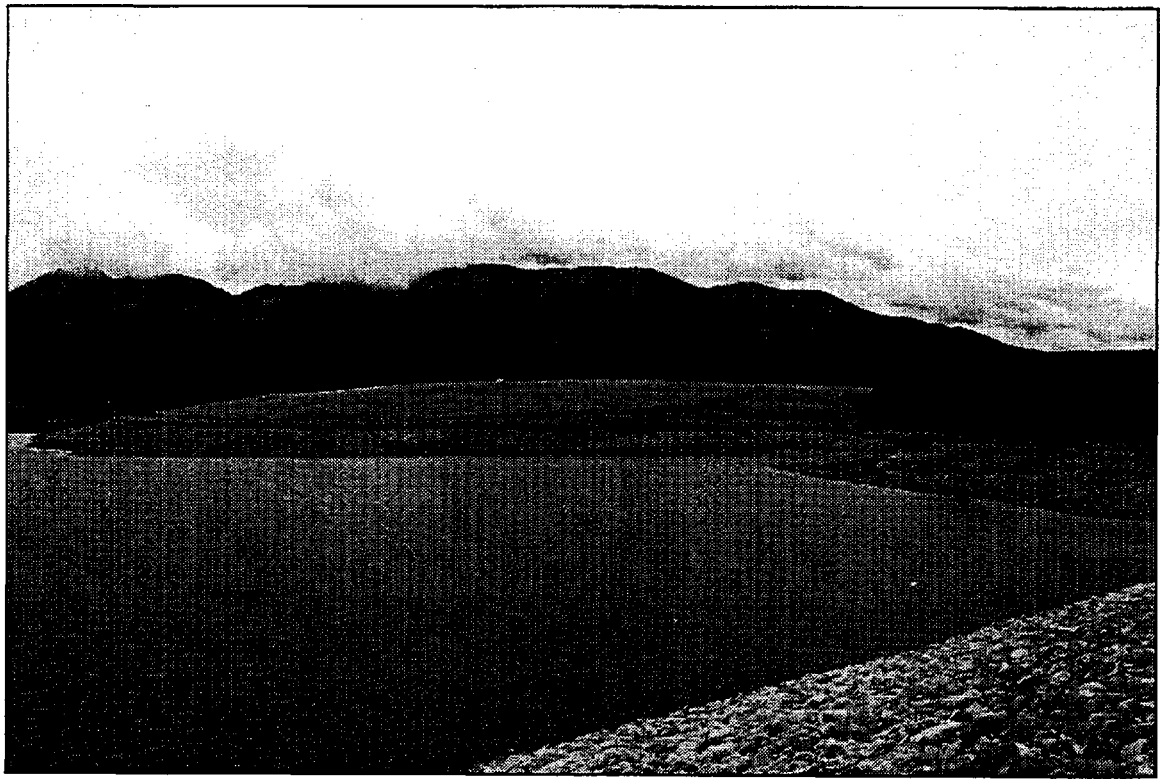
Nonpoint pollution sources include: human wastes and litter from recreation. There are no domestic animals permitted in the watershed.

There are no point pollution sources in the watershed.

Beneficial Use Classification

Although the reservoir has not yet been classified proposed state beneficial use classifications include: culinary (1C), boating and similar recreation (excluding swimming) (2B), and cold water game fish and organisms in their foodchain (3A).

LLOYDS RESERVOIR



Introduction

Lloyds Lake is an impoundment on the east slope of the Abajo Mountains. Twenty-eight million years ago, molten rock pushed up through the horizontal strata of this area of what is now the Colorado Plateau. The lava blistered the horizontal rock strata, and eventually burst through the surface. The area has since been uplifted and eroded, leaving a rugged mountain range. The runoff from the high mountains where the majority of precipitation occurs has cut stream valleys through the lowland area at the base of the mountains.

The Mormon pioneers settled the area in the late 1800's, and diverted water from the mountain streams for irrigation. South Creek was impounded to form Lloyds Lake in the early 1980's to retain spring runoff for culinary and agricultural purposes during the summer. It is a intermediate size reservoir, also known as Loyds Lake or Monticello Reservoir.

The reservoir shoreline is privately owned. Currently public access is unrestricted. The impoundment, an earth-fill dam, was built in 1984 at a cost of $3,588,000.

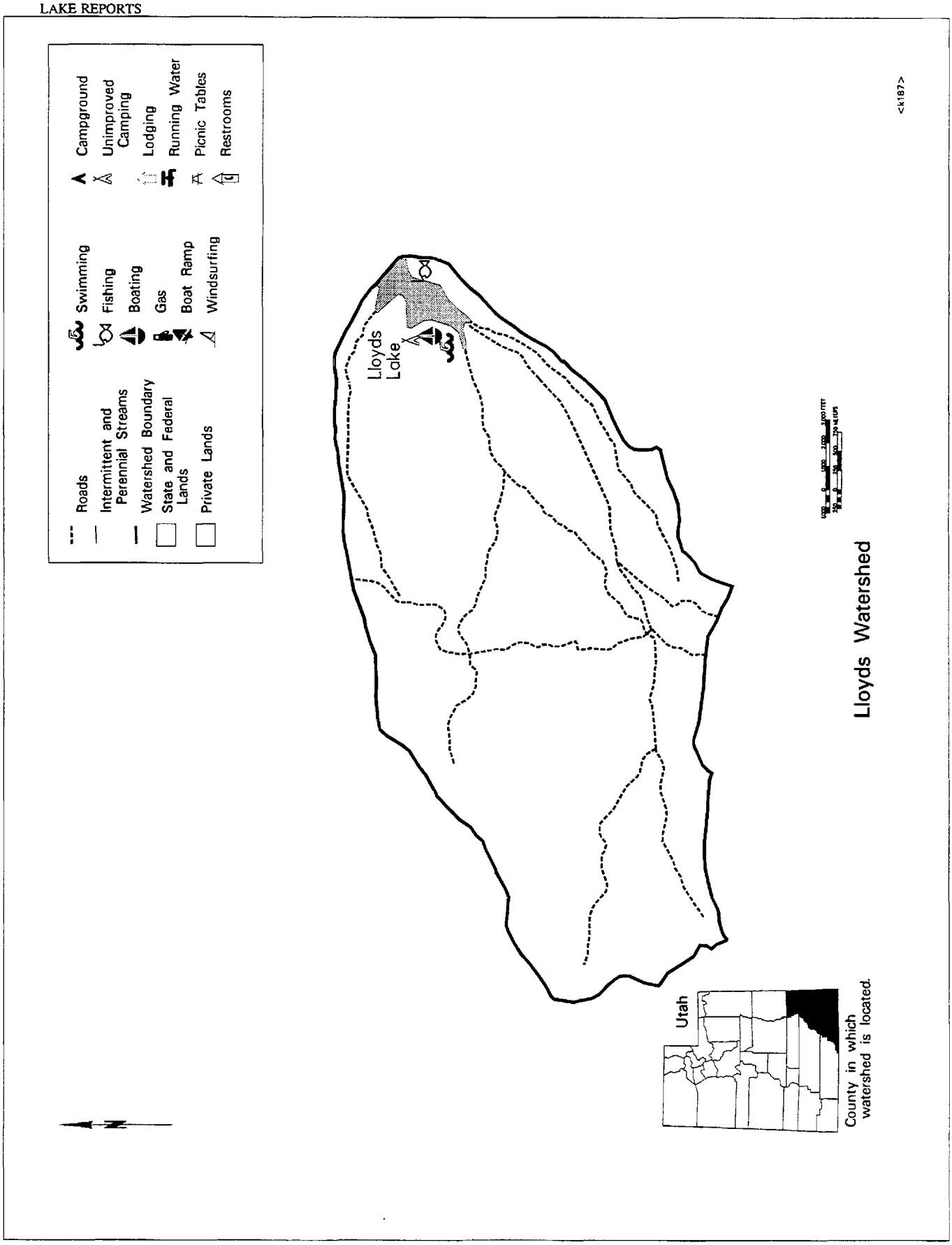
Water use priorities are 1) supplemental culinary water for Monticello City, 2) agricultural uses, and 3) water-based recreation.

Characteristics and Morphometry

Lake elevation (meters / feet)	2,151 / 7,055
Surface area (hectares / acres)	42.08 / 104
Watershed area (hectares / acres)	4,040 / 9,984
Volume (m^3 / acre-feet)	4,316,700 / 3,500
capacity	
conservation pool	
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	20.2 / 66.3
mean	10.3 / 33.8
Length (meters / feet)	1,685 / 5,527
Width (meters / feet)	532 / 1,742
Shoreline (meters / feet)	6,096 / 20,000

Location

County	San Juan
Longitude / Latitude	109 23 13 / 37 49 44
USGS Map	Monticello South, Utah (not on map) 1985
Atlas	pg.46,B2
Cataloging Unit	Montezuma Creek (14080203)


Roads
Intermittent and Perennial Streams
Watershed Boundary
State and Federal Lands
Private Lands
Swimming
Fishing
Boating
Gas
Boat Ramp
Windsurfing
Campground
Unimproved Camping
Lodging
Running Water
Picnic Tables
Restrooms
Lloyds Lake
Utah
County in which watershed is located.
Lloyds Watershed

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Recreation

Lloyds Lake is two miles southwest of Monticello. Travel west from downtown on Blue Mountain North Creek Road (FS-105) which goes high in the Abajos. One half mile past a secondary school on the right (at 200 W in Monticello), turn left on a gravel road and go one mile to the reservoir.

The lake offers primarily fishing and boating. The area immediately around the lake offers primitive camping. There are two USFS campgrounds several miles west on FS-105. Dalton Springs is 4 miles west and has 16 campsites, picnic areas, drinking water, and vault toilets. User fees are charged. Buckboard, 5 miles west, is more primitive and has 13 campsites. There are several private campgrounds in Monticello.

Watershed Description

Lloyds Lake is in a shallow canyon in the transition zone between the arid plains east of Monticello and the Abajo Mountains. During periods of high erosion in the last ice age, alluvial fans accumulated in these zones. In the 10,000 years since, streams have cut shallow canyons through the alluvium. Lloyds Lake is an impoundment of one such canyon.

The watershed high point, Abajo Peak, is 3,463 m (11,360 ft) above sea level, thereby developing a complex slope of 16.6% to the reservoir. The inflows are South Creek, Pole Creek and Shingle Mill Draw. South Creek is the only perennial inflow. The outflow is also South Creek, but immediately downstream North and South Creeks conflue to become Montezuma Creek. The average stream gradient above the reservoir is 6.1% (322 feet per mile).

The soil is of limestone origin with rapid permeability and erosion is rapid. See appendix III for a complete soil description.

The vegetation communities are comprised of spruce-fir, aspen, pine, alpine, and pinyon-juniper with grasses and forbes near the reservoir. The watershed receives 30 - 51 cm (12 - 20 inches) of precipitation annually with a frost-free season of 100 - 120 days at the reservoir.

Land use is 100% multiple use. The major use of the watershed is livestock grazing.

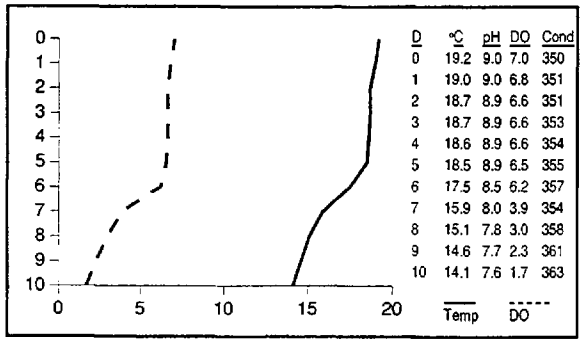
Limnological Assessment

The water quality of Lloyds Reservoir is good. It is considered to be moderately hard with a hardness concentration value of approximately 115 mg/L ($CaCO_3$). The only parameters that has exceeded State water quality standards for defined beneficial uses are phosphorus and dissolved oxygen. The concentrations in May and August of 1990 at the deep site were 48 and 133.3 ug/L for an average of 90.6 which exceeds the recommended pollution indicator for phosphorus of 25 ug/L. The phosphorus concentration during 1990 appears to be atypical. A complete profile of the reservoir is not available for 1990 to determine if anoxic conditions were present thereby giving rise to the high total phosphorus concentrations. A review of the profile for August 7, 1991 does indicate that the reservoir can stratify and anoxic conditions could develop inducing the movement of phosphorus from the sediments. Dissolved oxygen concentrations in late summer (1991) substantiate the fact that water quality impairments do exist. Concentrations decline gradually throughout the water column to a low of 1.7 mg/L. It is evident that additional data will need to be obtained to establish actual limnological

Limnological Data

Data averaged from STORET sites: 595825, 595826

Surface Data	1989	1990	1991
Trophic Status	M	E	M
Chlorophyll TSI	41.69	43.89	35.36
Secchi Depth TSI	61.54	55.93	64.99
Phosphorous TSI	37.69	53.86	27.35
Average TSI	46.98	51.23	42.57
Chlorophyll a (ug/L)	3.1	3.1	1.7
Transparency (m)	0.9	1.6	0.75
Total Phosphorous (ug/L)	10	24	5
pH	8.3	8.3	8.6
Total Susp. Solids (mg/L)	9.6	3	6
Total Volatile Solids (mg/L)	-	7	2
Total Residual Solids (mg/L)	-	25	4
Temperature (°C / °f)	16/61	15/59	18/65
Conductivity (umhos.cm)	327	301	359
Water Column Data			
Ammonia (mg/L)	0.02	0.06	0.03
Nitrate/Nitrite (mg/L)	-	0.01	0.01
Hardness (mg/L)	148	143	168
Alkalinity (mg/L)	121	107	117
Silica (mg/L)	-	9.3	7.6
Total Phosphorous (ug/L)	13	89	9
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	0.7	-	3.7
Stratification (m)	9-11	NO	6-7
Depth at Deepest Site (m)	24.0	14.0	9.7



D	°C	pH	DO	Cond
0	19.2	9.0	7.0	350
1	19.0	9.0	6.8	351
2	18.7	8.9	6.6	351
3	18.7	8.9	6.6	353
4	18.6	8.9	6.6	354
5	18.5	8.9	6.5	355
6	17.5	8.5	6.2	357
7	15.9	8.0	3.9	354
8	15.1	7.8	3.0	358
9	14.6	7.7	2.3	361
10	14.1	7.6	1.7	363

conditions. The reservoir is characterized as a nitrogen limited system. TSI values indicate the reservoir is mesotrophic but eutrophic conditions do exist as indicated in 1990.

According to DWR no fish kills have been reported in recent years. The DWR stocks the reservoir annually with about 7,000 advanced fingerling rainbow trout (*Oncorhynchus mykiss*). The reservoir has not been chemically treated by the DWR to control rough fish competition, so native populations from South Creek may be present in the reservoir.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Dinobryon divergens	0.365	50.0
Scenedesmus bijuga	0.171	23.5
Pennate Diatoms	0.137	18.7
Unknown Chrysophyte	0.038	5.2
Asterionella formosa	0.009	1.2
Unknown Green Flagellate	0.004	0.6
Ankistrodesmus falcatus	0.004	0.6
Total	0.728	
Shannon-Weaver Index [H']	1.27	
Species Evenness	0.65	
Species Richness [d]	0.29	

The flora dominated by golden algae, green algae and diatoms, is more diverse than most Utah lakes. Algal biomass is low and not a problem indicative of good water quality.

Pollution Assessment

Nonpoint pollution sources are: sedimentation and nutrient loading from grazing, human wastes and litter from recreation. Cattle graze in the watershed and around the reservoir.

There are no point pollution sources in the watershed.

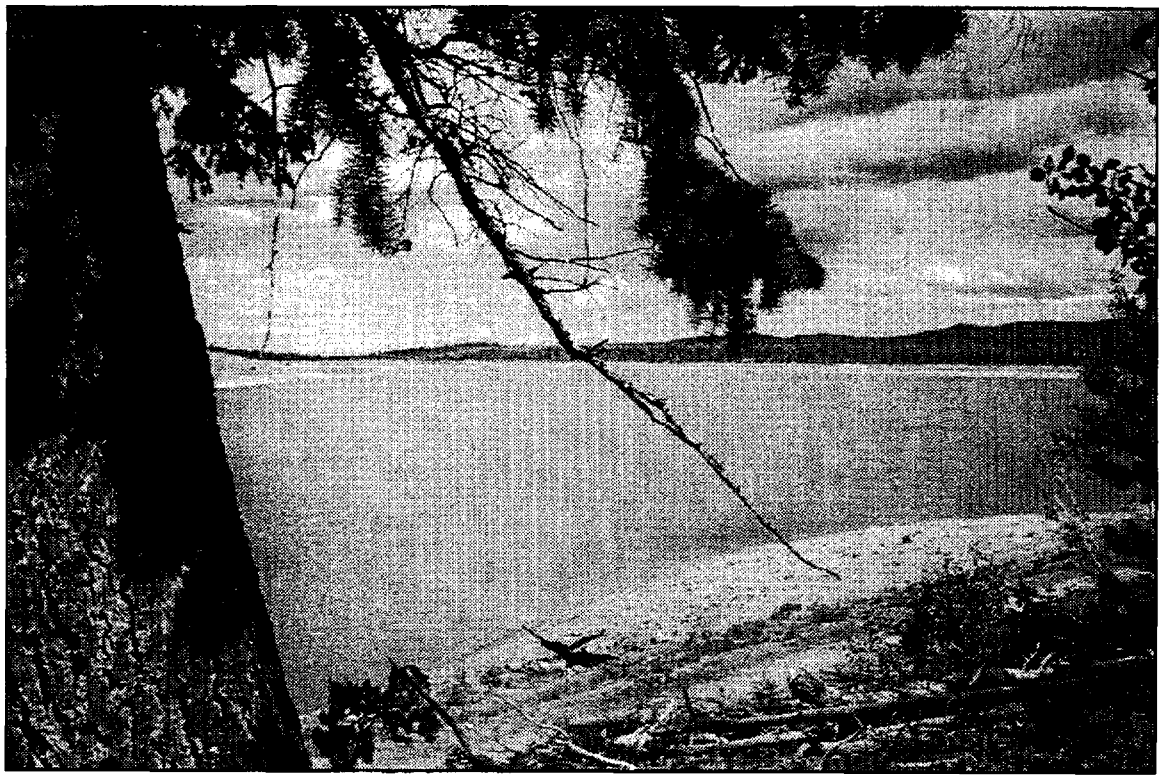
Beneficial Use Classification

The state beneficial use classifications include: culinary water (1C), boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Bureau of Land Management	539-4001
San Juan Resource Area (Monticello)	587-2141
Southeastern Utah Association of Governments	637-5444
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Canyonlands Travel Region (Monticello)	587-2231
Reservoir Administrators	
San Juan County Water Conservation District	678-2596

LONG PARK RESERVOIR



Introduction

Long Park Reservoir is a large reservoir on the north slopes of the Uintas. Its primary purpose is storage of agricultural water. It has a large conservation pool, but drawdown reduces the fish habitat area and may result in an impairment to the fishery.

Long Park Reservoir was created in the late 1970's by the construction of an earth-fill dam. The reservoir shoreline is owned by the Ashley National Forest, and public access is unrestricted. Reservoir water is used entirely for irrigation, and 75% of the volume of the reservoir is drained by mid-summer for agricultural purposes in the Lucerne Valley, but the remaining 25% is retained as a conservation pool. Water use is not expected to change in the foreseeable future.

Characteristics and Morphometry

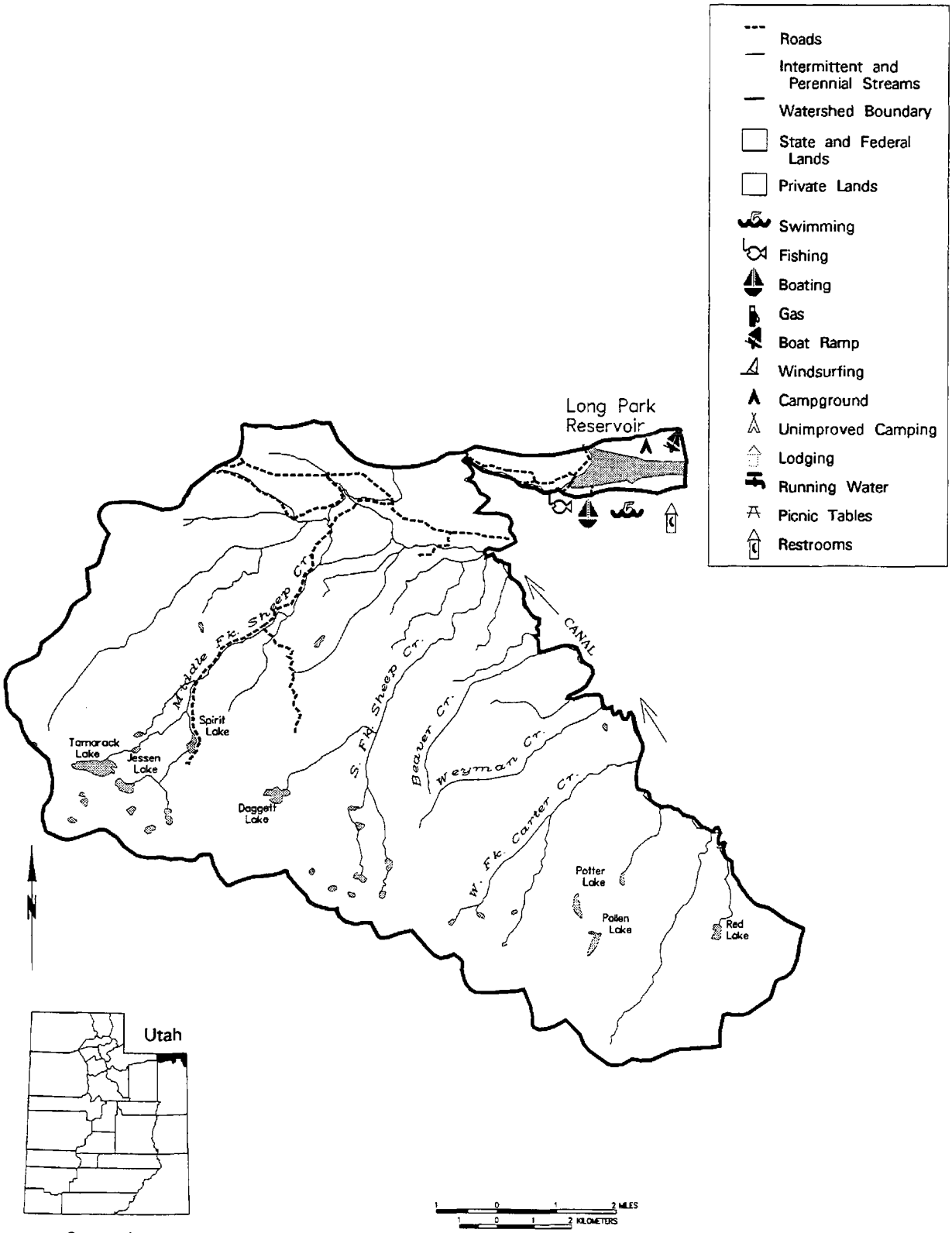
Lake elevation (meters / feet)	2,635 / 8,646
Surface area (hectares / acres)	1,200 / 300
Watershed area (hectares / acres)	1,347 / 3,328
Volume (m^3 / acre-feet)	
capacity	16,900,000 / 13,700
conservation pool	3,700,500 / 3000
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	10,700
Depth (meters / feet)	
maximum	29.3 / 96
mean	14 / 45.9
Length (meters / feet)	2,765 / 9,070
Width (meters / feet)	1,138 / 3,735
Shoreline (meters / feet)	7,478 / 24,533

Location

County	Daggett
Longitude / Latitude	109
USGS Map	UT/WY 1963, Phil Pico Mtn, UT/WY 1963
(Not on map, but in area marked Long Park to 8,648' elevation)	
DeLorme's Utah Atlas & Gazetteer™	Page 56, A-2
Cataloging Unit	Flaming Gorge (14040106)

Recreation

Long Park Reservoir is off the north slope road of the Uintas, 14 miles west of U-44. From near milepost 15 on U-44, turn west on the Sheep Creek Geologic Loop. A sign



County in which watershed is located.

Long Park Watershed

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says "Long Park Reservoir 14". Follow the Sheep Creek Road for three miles, then turn west again on a gravel road also signed to Long Park Reservoir. This is the North Slope Road. Follow it for nine miles to the turnoff to Long Park Reservoir on the right. The lake is two miles north on this road.

It is also accessible from the west by turning south near milepost 28 east of Burntfork, Wyoming on W-414. Follow this gravel road up Birch Creek and across the north slope for 16 miles to the Long Park turnoff.

Fishing, waterskiing, swimming, and boating are the recreational uses of the reservoir, but primary emphasis is on fishing. The water is very clear and the bottom firm, making ideal swimming conditions. Boating is best in the spring before the water is drained down to the conservation pool. A long, wide, concrete boatramp extends deep into the reservoir for easy launching of boats regardless of drawdowns. Improved privies are located at the top of the boatramp, and primitive camping is possible throughout the area.

The nearest campground is at Browne Lake, about 8 miles southeast on Sheep Creek Road, with toilet facilities, campsites, and picnic areas.

Watershed Description

Long Park Reservoir is located in the High Uintas. The reservoir is situated in a strike valley. The valley has periodic notches cut in it by streams that predated the exposure of the limestone. Long Park Reservoir is built in such a valley.

The natural watershed consists solely of the area immediately around the lake. It was once forested, but selective cuts have removed almost all of the timber, and little has grown back. South facing slopes have sage-grass vegetation.

The reservoir has a small natural watershed, but is fed primarily by the Sheep Creek Canal, which collects the runoff from Carter Creek, Weyman Creek, Beaver Creek and Sheep Creek into Long Park Reservoir. This effectively captures the drainage from a 12 mile stretch of the north slope of the Uintas.

The top of the watershed is the ridgeline of the Uintas, which has been effectively carved out by glaciers. This galaciation has created a line of cirques with wooded meadows, lakes and marshes at their base. The watershed boundary follows the top of the cirques, with snow on the tops of the mountains themselves draining to the south. Slopes greater than 100% are the norm in cirques. These high peaks are visible from the reservoir.

The watershed high point, Mount Chepeta, is 3,742 m (12,276 ft) above sea level, thereby developing a complex slope of 9.9% to the reservoir. The average stream gradient is variable. The average stream gradient of the diverted streams is 5.1% (270 feet per mile). The canal which transports water from these streams is relatively level, but yields to a fairly steep gradient for about 0.5 miles above the reservoir. The inflow and outflow is referred to as Sheep Creek Canal, although the canal follows Sols Canyon (a natural watercourse) for the two miles after it leaves the reservoir.

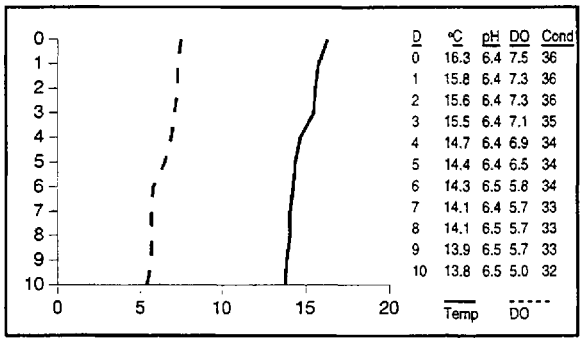
The watershed is made up of high mountains and mountains meadows. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of sage-grass, oak, maple, pine, alpine, spruce-fir and aspen. The watershed receives 51 - 76 cm (20 - 30 inches) of precipitation annually. The frost-free season around the reservoir is 20 - 40 days per year.

Land use in the watershed is 100% multiple use, with grazing and human recreation being the primary activities. Much of the watershed has been logged, and there are several active or proposed sales.

Limnological Assessment

The water quality of Long Park Reservoir is very good to excellent. It is considered to be very soft with a hardness concentration value of approximately 13.4 mg/L ($CaCO_3$). There are no violation of State water quality standards for the entire water column of the reservoir but pH and dissolved oxygen values have been reported outside of the existing criteria at places in the water column. On the average for the water column these values are within the limitations. Dissolved oxygen does show a decline as depicted in the profile form September 5, 1991 and pH values have reached 6.3 (6.5 is the low range point). This



D	°C	pH	DO	Cond
0	16.3	6.4	7.5	36
1	15.8	6.4	7.3	36
2	15.6	6.4	7.3	36
3	15.5	6.4	7.1	35
4	14.7	6.4	6.9	34
5	14.4	6.4	6.5	34
6	14.3	6.5	5.8	34
7	14.1	6.4	5.7	33
8	14.1	6.5	5.7	33
9	13.9	6.5	5.7	33
10	13.8	6.5	5.0	32

body of water is susceptible to acidification with the low buffering capacity as are a lot of the higher Uinta lakes. The reservoir did not show stratification during our monitoring, but it has the attributes necessary for stratification. The reservoir was surveyed on March 14, 1991 to determine if dissolved oxygen deficiencies were

Limnological Data

Data averaged from STORET sites: 593810, 593811

Surface Data	1991
Trophic Status	M
Chlorophyll TSI	48.85
Secchi Depth TSI	53.31
Phosphorous TSI	32.35
Average TSI	44.84
Chlorophyll a (ug/L)	6.5
Transparency (m)	2.3
Total Phosphorous (ug/L)	8
pH	6.65
Total Susp. Solids (mg/L)	9
Total Volatile Solids (mg/L)	7
Total Residual Solids (mg/L)	2
Temperature (°C / °f)	15/59
Conductivity (umhos.cm)	29
Water Column Data	
Ammonia (mg/L)	0.04
Nitrate/Nitrite (mg/L)	0.01
Hardness (mg/L)	13.4
Alkalinity (mg/L)	13.5
Silica (mg/L)	3.6
Total Phosphorous (ug/L)	8
Miscellaneous Data	
Limiting Nutrient	N
DO (Mg/l) at 75% depth	5.7
Stratification (m)	NO
Depth at Deepest Site (m)	10

present under the ice. The profile indicated that there was a substantial oxygen demand in the hypolimnion as depicted in the profile. The dissolved oxygen concentration decreases to a low of 2.0 mg/L near the bottom of the reservoir.

The reservoir level has a large fluctuation due to the primary use of the reservoir as a storage facility for irrigation needs. There has been a leakage problem associated with the reservoir in recent years but efforts have been taken to correct the problem. The limited data available on the reservoir indicates that it is a nitrogen limited system. TSI values indicate the reservoir is mesotrophic with low to moderate productivity.

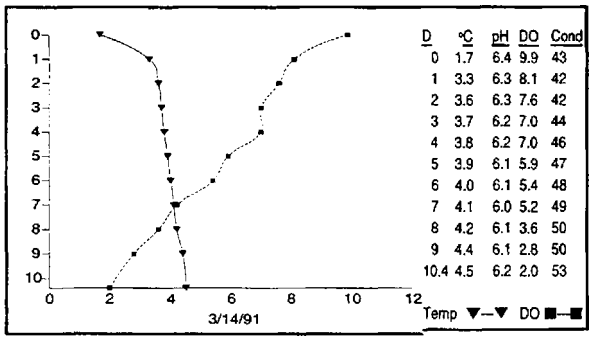
The reservoir has not been treated by the DWR for rough fish competition, therefore there may be native populations of fishes in the reservoir. DWR typically stocks the reservoir with 30,000 fingerling rainbow trout (*Oncorhynchus mykiss*). In 1992 they used advanced fingerlings, a little larger fish.

In recent years as indicated earlier the reservoir has not been operated at capacity due to a leakage problem. Limnological conditions may change as operational situations change. Further monitoring will allow a better interpretation of the system.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Tabellaria sp.	0.836	70.48
Dinobryon divergens	0.195	16.48
Centric diatoms	0.063	5.34
Oocystis sp.	0.050	4.21
Pennate diatoms	0.010	0.84
Asterionella formosa	0.009	0.80
Ankistrodesmus falcatus	0.009	0.74
Chlamydomonas sp.	0.006	0.56
Mallamonas sp.	0.006	0.55
Total	1.183	
Shannon-Weaver [H']	1.01	
Species Evenness	0.46	
Species Richness	0.41	

The flora is fairly typical, but not particularly diverse. The dominance of green algae and diatoms indicates that the lake is reasonably healthy and is indicative of good water quality.



Pollution Assessment

Nonpoint pollution sources include the following: sedimentation and nutrient loading from grazing, litter from recreation, and sedimentation and increased runoff from logging.

Grazing takes place throughout the watershed and in the vicinity of the reservoir.

Much of the watershed has been cut in fairly recent history, and a large timber sale is proposed in the Bear Park area. Unlike much of the central and western areas of the Uintas, none of this area is protected as a wilderness area.

Much of it, however, retains its wilderness quality. While the ruggedness and severe climate of the Uintas have given them natural protection from human degradation, only careful management will protect them in the future.

There are no point sources of pollution in the watershed.

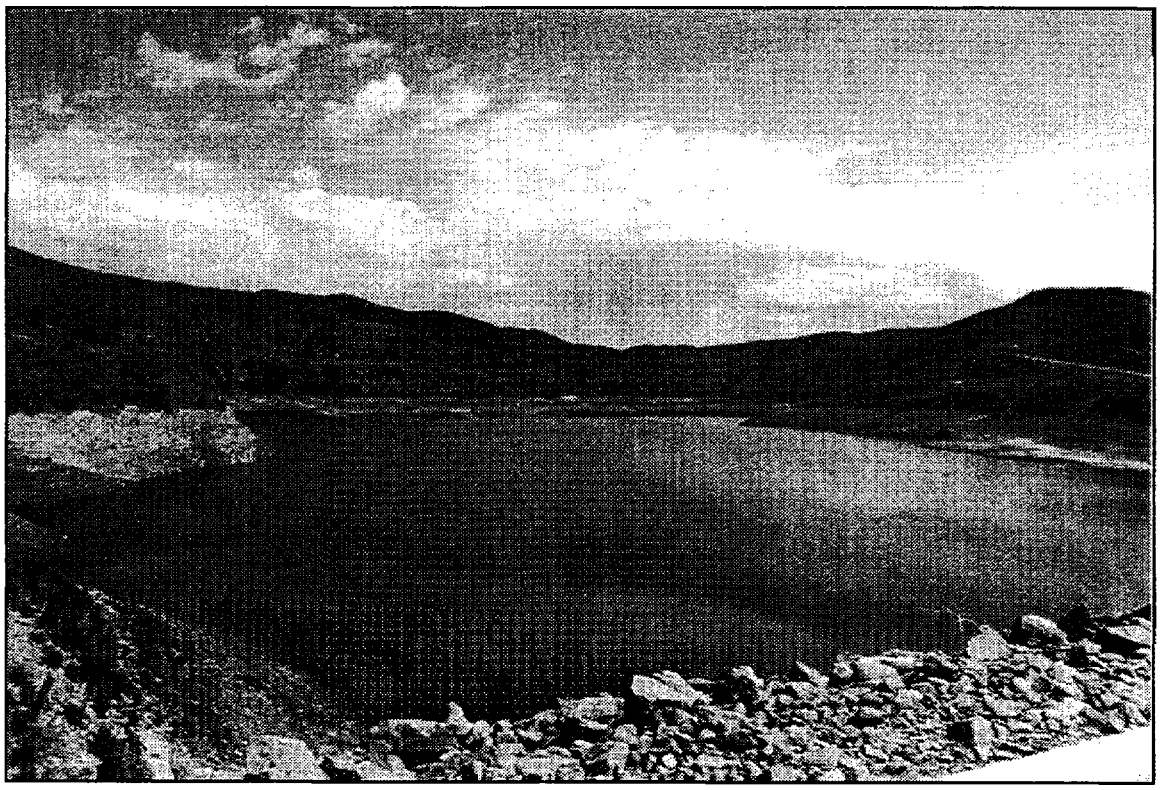
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Ashley National Forest	789-1181
Flaming Gorge Ranger District	784-3445
Recreation	
Dinosaurland Travel Region (Vernal)	789-6932
Manila Chamber of Commerce	784-3395
Reservoir Administrators	
Sheep Creek Irrigation Company	784-3412

LOST CREEK RESERVOIR



Introduction

Lost Creek Reservoir is a large reservoir in Lost Creek Canyon, a southwest flowing tributary to the Weber River in northeastern Utah, about ten miles upstream from the Devils Slide area. The reservoir is in a deep, V-shaped canyon, and provides good fishing and waterskiing.

Lost Creek Reservoir was created in 1966 by the construction of an earth-fill dam. It is a Bureau of Reclamation dam, built with federal funds to provide subsidized water to the northern Wasatch Front. The reservoir shoreline is 100% owned by the Bureau of Reclamation and the Utah Division of Parks and Recreation. Public access is unrestricted. Reservoir water is used for irrigation (75%), and culinary (25%). As urban sprawl continues to cover farmland, the fraction consumed for culinary purposes is expected to increase.

Characteristics and Morphometry

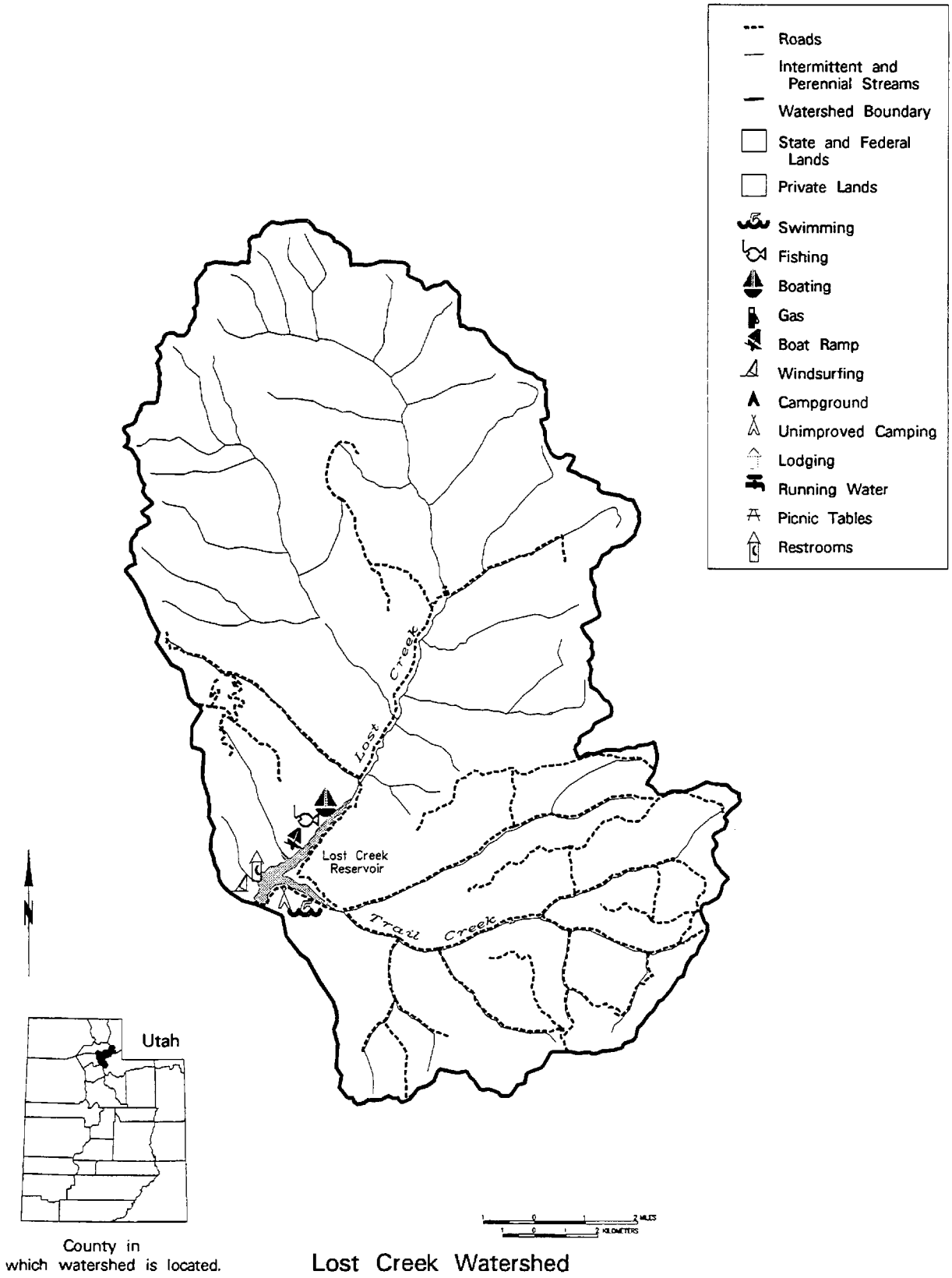
Lake elevation (meters / feet)	1,830 / 6,005
Surface area (hectares / acres)	168 / 415
Watershed area (hectares / acres)	31,870 / 78,720
Volume (m^3 / acre-feet)	
capacity	25,681,509 / 20,820
conservation pool	2,500
Annual inflow (m^3 / acre-feet)	20,000
Retention time (years)	0.69
Drawdown (meters / feet)	11,542,465 / 9,359
Depth (meters / feet)	
maximum	54.86 / 180
mean	19.51 / 64
Length (meters / feet)	4.3 / 2.7
Width (km / miles)	2.020 / 1.25
Shoreline (km / miles)	13 / 8.07

Location

County	Morgan
Longitude / Latitude	111 22 58 / 41 11 50
USGS Maps	Lost Creek Dam 1991, Francis Canyon 1991
DeLorme's Utah Atlas & Gazetteer™	Page 61, C-5 to D-5
Cataloging Unit	Weber River (16020101)

Recreation

Lost Creek Reservoir is easily accessible from a paved and improved gravel road from Devils Slide. Exit I-84 at Exit



Lost Creek Watershed

111 in Weber Canyon, go north, past the cement plant to the village of Croyden, and turn left and continue to Lost Creek Reservoir. The small valley narrows into a canyon, and pavement ends about four miles from the reservoir. The road is plowed throughout the winter.

Cross country skiing, fishing, boating, sailing, swimming, camping, picnicing, snowmobiling, ice fishing, and water skiing are all popular. Lost Creek State Park is an unimproved non-fee state recreation area, with an improved boatramp, 200 campsites, pit privies, and a swimming beach. There are no concessionaires or other commercial facilities. In 1992, there were 40,165 visitors, ranging from 25,716 in June to 206 in December.

Watershed Description

The north canyon wall is composed of Nugget Sandstone, a variety of Navajo Sandstone. There is more precipitation here than in the deserts, so soil is better developed over the rock, but on the canyon wall there are small cliffs, crags, caves, and other redrock outcroppings.

The watershed high point, Bald Mountain, is 2,595 m (8,514 ft) above sea level, thereby developing a complex slope of 7.3% to the reservoir. The average stream gradient above the reservoir is 3.6% (192 feet per mile). The inflows are Lost Creek, Spring Hollow, Little Deer Hollow, Belnap Creek and Trail Creek. The outflow is Lost Creek.

The watershed is made up of high mountains, mountain valleys and plateaus. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of pine, aspen, spruce-fir, oak-maple, and sagebrush-grass. The watershed receives 41 - 76 cm (16 - 30 inches) of precipitation annually. The frost-free season around the reservoir is 80 - 120 days per year.

According to the 1982 Clean Lakes Inventory, land use is as follows: 3% is zoned for multiple use corridor, 97% is zoned for reserve (no development). The land in the watershed is entirely privately owned and used for grazing livestock.

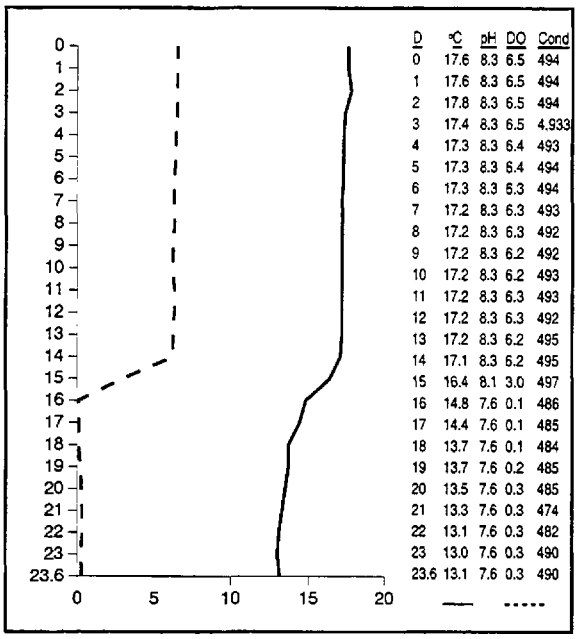
Limnological Assessment

The water quality of Lost Creek Reservoir is very good. It is considered to be hard with a hardness concentration value of approximately 197 mg/L ($CaCO_3$). The only parameters that has exceeded State water quality standards for defined beneficial uses are phosphorus and dissolved oxygen. A review of the limnological data shows that average total phosphorus concentrations in the water column to be in violation of the recommended pollution indicator for phosphorus of 25 ug/L. In 1992 the phosphorus concentration in the water column was 42.9 ug/L. The average phosphorus concentration was elevated due to exceptionally high concentrations in the north arm in late summer. Concentrations averaged 236.5 ug/L on September 1, 1992. The depth at the site was 11 meters and it appears that an algal bloom was in progress with a chlorophyll-a level of 9.3 ug/L. A review of the stream flow data at that time indicates that concentrations for total suspended solids and total phosphorus were elevated with values of 4,167 mg/L and 165 ug/L respectively. It appears that there may have been an episodic event that moved large concentrations of nutrients into the reservoir inducing an algal bloom. However anoxic conditions present substantiate the fact that water quality impairments do exist. A review of the September 1, 1992 profile indicate that the dissolved oxygen concentrations dropped dramatically below the thermocline to near anoxic conditions. All of the available data suggest that the reservoir is currently a nitrogen limited system. Recent TSI values indicate the reservoir is mesotrophic. The reservoir does stratified during the summer as indicated by the September 1, 1992 profile. The anoxic conditions present are deleterious to the fishery

Limnological Data

Data averaged from STORET sites: 492591, 492592,492594

Surface Data	1979	1989	1991	1992
Trophic Status	E	O	M	M
Chlorophyll TSI	-	37.73	53.88	41.21
Secchi Depth TSI	44.17	41.44	49.55	43.00
Phosphorous TSI	56.10	39.47	33.96	55.48
Average TSI	50.14	39.53	45.80	46.56
Chlorophyll a (ug/L)	-	2.03	13.1	3.3
Transparency (m)	3	3.65	2.1	3.3
Total Phosphorous (mg/L)	36.7	16.9	8	72.7
pH	8.0	8.6	8.3	8.3
Total Susp. Solids (mg/L)	<5	-	<3	<3
Total Volatile Solids (mg/L)	-	-	5	1
Total Residual Solids (mg/L)	-	-	<3	<3
Temperature (°C / °f)	15/59	19/67	17/62	16/61
Conductivity (umhos.cm)	304	430	365	477
Water Column Data				
Ammonia (mg/L)	0.08	0.01	0.04	0.08
Nitrate/Nitrite (mg/L)	0.22	-	0.07	0.02
Hardness (mg/L)	183	-	192	216
Alkalinity (mg/L)	150	-	140	166
Silica (mg/L)	4.7	-	1.7	2.6
Total phosphorus (ug/L)	36.7	23.4	9.5	42.9
Miscellaneous Data				
Limiting Nutrient	N	N	N	N
DO (Mg/l) at 75% depth	4.4	3.3	4.7	0.1
Stratification (m)	6-10	15-18	8-13	15-16
Depth at Deepest Site (m)	25	36.8	19.5	23.6



D	°C	pH	DO	Cond
0	17.6	8.3	6.5	494
1	17.6	8.3	6.5	494
2	17.8	8.3	6.5	494
3	17.4	8.3	6.5	4,933
4	17.3	8.3	6.4	493
5	17.3	8.3	6.4	494
6	17.3	8.3	6.3	494
7	17.2	8.3	6.3	493
8	17.2	8.3	6.3	492
9	17.2	8.3	6.2	492
10	17.2	8.3	6.2	493
11	17.2	8.3	6.3	493
12	17.2	8.3	6.3	492
13	17.2	8.3	6.2	495
14	17.1	8.3	6.2	495
15	16.4	8.1	3.0	497
16	14.8	7.6	0.1	486
17	14.4	7.6	0.1	485
18	13.7	7.6	0.1	484
19	13.7	7.6	0.2	485
20	13.5	7.6	0.3	485
21	13.3	7.6	0.3	474
22	13.1	7.6	0.3	482
23	13.0	7.6	0.3	490
23.6	13.1	7.6	0.3	490

r endered approximately 1/3 of the water column unsuitable for a fishery. It appears that there is a high oxygen demand in the hypolimnion and could cause problems during the winter if extended ice conditions persist. No winter sampling has been done at this point but will be considered to evaluate these conditions.

Present fish populations in the reservoir include rainbow trout (*Oncorhynchus mykiss*), cutthroat trout (*Oncorhynchus clarki*), mountain suckers (Catostomus platyrhinchus), and the Utah chub (*Gila atraria*). In 1977, the reservoir was treated with rotenone to eradicate the Utah chub population. After treatment the reservoir was managed primarily as a trout fishery with some supplemental stocking of cutthroat trout. Recent surveys indicate that anglers are disappointed with harvest success and catch size. The DWR are looking ar various management alternatives to improve conditions. Current stocking reports indicate that DWR stocks the reservoir annually with 10,000 advanced cutthroat trout and 75,000 fingerling rainbow trout. The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm³/liter)	% Density By Volume
Ceratium hirundinella	1.873	49.53
Dinobryon divergens	0.624	16.50
Anabaena sp.	0.556	14.71
Peridinium sp.	0.361	9.56
Microcystis aeruginosa	0.122	3.24
Asterionella formosa	0.095	2.50
Melosira granulata	0.087	2.29
Melosira granulata var. angustissima	0.050	1.34
Ankistrodesmus falcatus	0.008	0.23
Oocystis sp.	0.009	0.12
Total	3.776	
Shannon-Weaver [H']	1.52	
Species Evenness	0.66	
Species Richness	0.41	

The phytoplankton communities is dominated by the presence of flagellates and blue-green algae. This is indicative of fairly good water but the blue-green presence is significant and may indicate a trend towards more eutrophic conditions or dominance later in the productivity season with a nitrogen limited system where blue-greens are capable of existence.

Pollution Assessment

Nonpoint pollution sources are: sedimentation and nutrient loading from grazing, and human wastes and litter from recreation. Cattle graze in the watershed and around the reservoir.

There are no point pollution sources in the watershed.

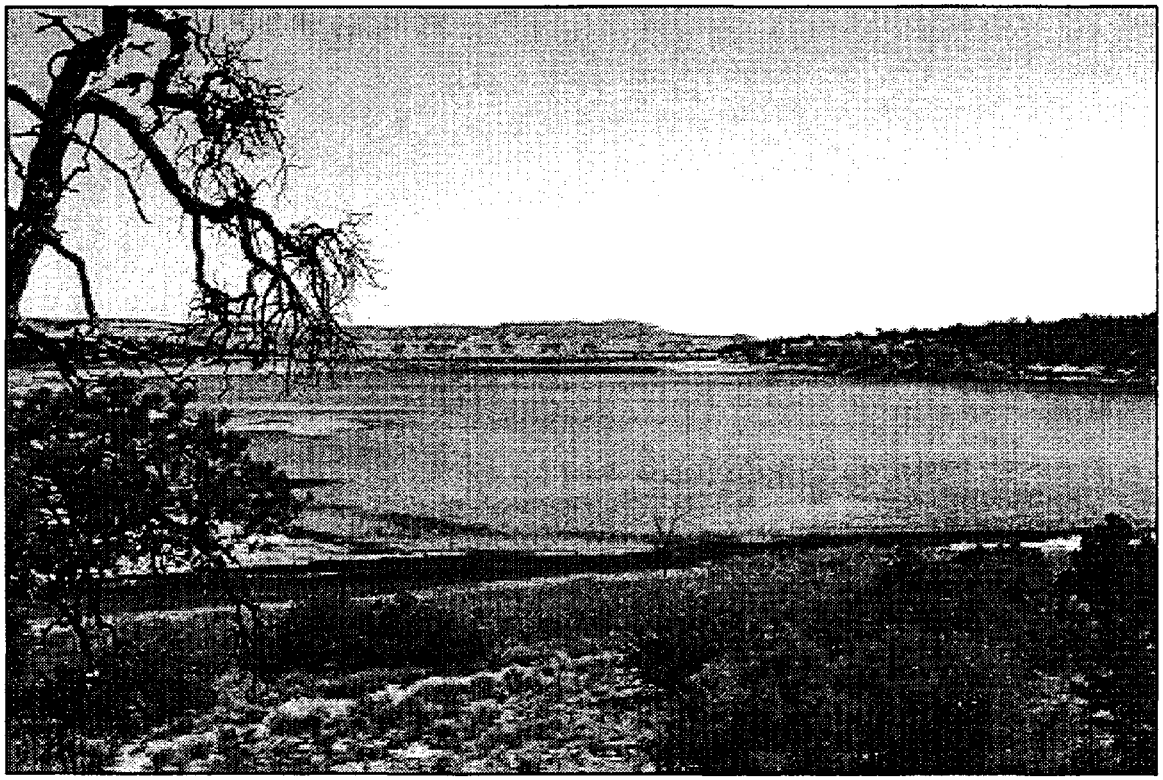
Beneficial Use Classification

The state beneficial use classifications include: culinary purposes (1C), boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Wasatch Front Regional Council	292-4469
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Golden Spike Empire Travel Region (Ogden)	627-8288
Lost Creek State Park	829-6866
Dearden Bed and Breakfast Inn (Henefer)	336-5698
Reservoir Administrators	
Department of the Interior	538-1467
Weber River Water Conservancy District	771-1677

LOWER BOWNS RESERVOIR



Introduction

Lower Bowns Reservoir is an intermediate-sized reservoir on the east slopes of the Boulder Mountain in south-central Utah. It is sometimes spelled Lower Browns Reservoir, Lower Bounds Reservoir, or simply referred to as Bowns Reservoir (Lower). Upper Bowns reservoir is usually known as Oak Creek Reservoir.

Characteristics and Morphometry

Lake elevation (meters / feet)	2270.1 / 7450
Surface area (hectares / acres)	36.4 / 90
Watershed area (hectares / acres)	7284.5 / 18,000
Volume (m^3 / acre-feet)	
capacity	1,665,227.5 / 1350
conservation pool	725
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	13.7 / 45
mean	4.6 / 15
Length (meters / feet)	792 / 2,600
Width (meters / feet)	381 / 1,250
Shoreline (km / miles)	2.133 / 1.33

The reservoir shoreline is owned and administered by the Dixie National Forest with unrestricted public access. Defined beneficial uses include: water recreation excluding swimming, propagation of cold water species of game fish and aquatic life, and agricultural needs.

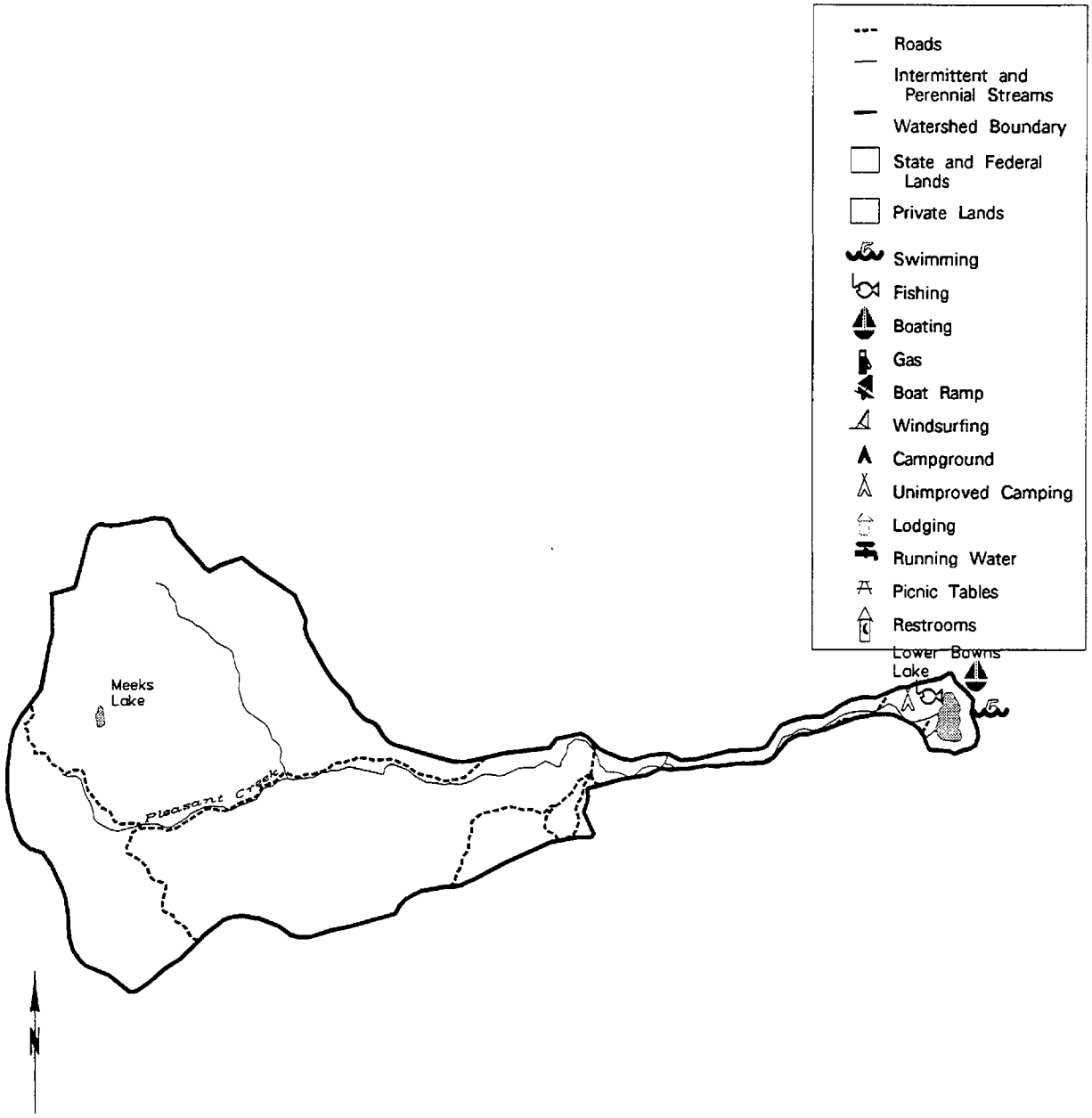
Location

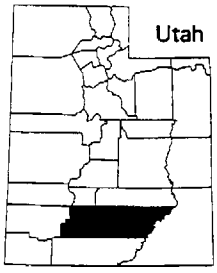
County	Garfield
Longitude / Latitude	111 16 12 / 38 06 35
USGS Map	Lower Bowns Reservoir, Utah 1985
Cataloging Unit	Fremont River (14070003)

Recreation

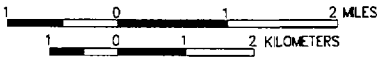
Lower Bowns Reservoir is accessible FS-181, a gravel road intersecting the Boulder Mountain Highway (U-12) 1.5 miles south of the Wildcat Ranger Station. The intersection is 19 miles north of Boulder Town and 15 miles south of Torrey.

Fishing, picnicking and boating are possible at the reservoir. There is no boat ramp, however, and the





County in which watershed is located.



zip

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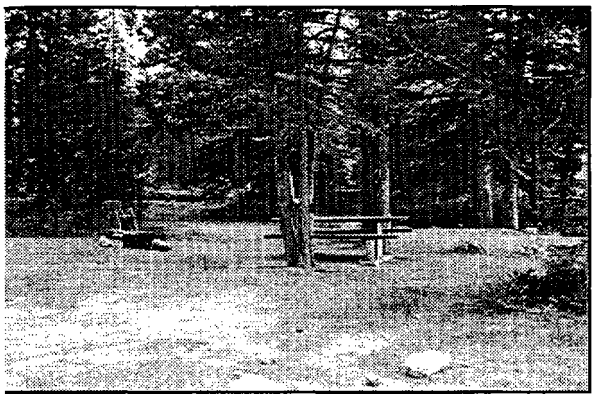
reservoir is too small for waterskiing. The road is probably not maintained in the winter. Usage is moderately heavy.

Lower Bowns Reservoir Campground is adjacent to the lake and maintained by the Forest Service. primitive campsites, vault toilets and picnic areas. There are more developed USFS campgrounds along U-12, and an RV Park in Torrey. It can be seen from the overlook between mileposts 109 and 110.



Watershed Description

Lower Bowns Reservoir is on a long, forested slope that begins at over 11,000 feet elevation at the crest of the Boulder Mountain. From the plateau top at 3,300 meters, the land drops off down to the Waterpocket Fold in Capitol Reef National Park at 1,600 meters. Lower Bowns Reservoir is near the bottom of the slope, and is only a short distance from U-12. While the immediate watershed is still forest, it is in the transition to arid desert, and Capitol Reef National Park can be viewed from several nearby knolls.

The watershed high point, a knoll above Stink Flats, is 3,402 m (11,162 ft) above sea level, thereby developing a complex slope of 7.6% to the lake. Although Lower Bowns Reservoir is an off-stream reservoir, it has a small natural watershed. Most of the water, however, comes from a diversion canal drawing water from Pleasant Creek, an adjacent stream, into the natural watershed. The outflow is in the Oak Creek Drainage. A substantial portion of the Pleasant Creek (and therefore Lower Bowns) drainage area is on the top of Boulder Mountain. The average stream gradient above the reservoir (including the short canals) is 6.7% (353 feet per mile).

The soil is largely of volcanic origin. Soil Associations that compose the watershed are found in Appendix III.

The vegetation communities are comprised of aspen, pine, spruce-fir, oak, alpine, maple, bitterbrush, mountain mahogany, pinyon-juniper and sage-grass. The watershed receives 31 - 102 cm (12 - 40 inches) of precipitation annually with a frost-free season of 100 - 120 days at the reservoir.

Land use is multiple. The entire drainage area is on the Dixie National Reservoir and Forest.

Limnological Assessment

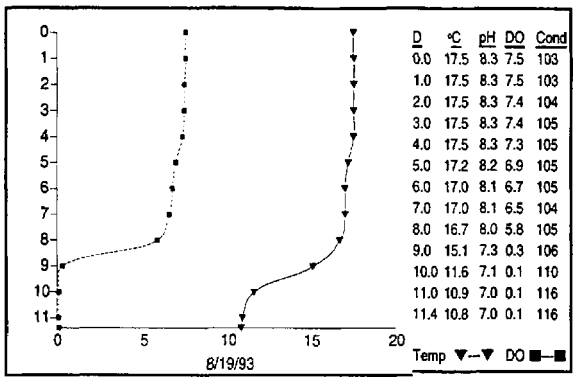
The water quality of Lower Bowns Reservoir is good. It is considered to be soft with a hardness concentration value of approximately 58 mg/L (CaCO3). The parameters that have exceeded State water quality standards for defined beneficial uses are phosphorus, pH and dissolved oxygen. The average concentration of total phosphorus in the water column in 1979 and 1989 was 50 and 47 ug/L which exceeds the recommended pollution indicator for phosphorus of 25 ug/L, but in 1991 the concentration was only 10 ug/L. Dissolved oxygen concentrations due decline downward in the water column and below the thermocline go anoxic. This is not unusually for deeper impoundments but is evident that there is a large demand for oxygen in the hypolimnion and is impairing water quality conditions especially for a viable

Limnological Data

Data sampled from STORET site: 595452

Surface Data	1979	1989	1991
Trophic Status	E	E	M
Chlorophyll TSI	-	47.84	45.78
Secchi Depth TSI	41.95	42.80	41.54
Phosphorous TSI	60.55	59.50	36.60
Average TSI	51.25	50.05	41.31
Chlorophyll a (ug/L)	-	5.8	4.7
Transparency (m)	3.5	3.3	3.6
Total Phosphorous (ug/L)	50	47	10
pH	8.8	9.3	9.5
Total Susp. Solids (mg/L)	-	-	1.5
Total Volatile Solids (mg/L)	-	-	5
Total Residual Solids (mg/L)	-	-	13
Temperature (°C / °f)	21/70	17/63	17/63
Conductivity (umhos.cm)	110	125	125
Water Column Data			
Ammonia (mg/L)	0.03	0.01	0.03
Nitrate/Nitrite (mg/L)	.28	-	0.05
Hardness (mg/L)	55.3	-	60
Alkalinity (mg/L)	56	-	65
Silica (mg/L)	17.7	-	19
Total Phosphorous (ug/L)	100	57	12
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	0.4	7	5.6
Stratification (m)	4-7	NO	NO
Depth at Deepest Site (m)	14	8.0	4.0

fishery. The pH values have historically been elevated and continue to range above the state standard of 9.0. This is not an atypical situation with algal blooms but in this reservoir elevated pH values extend throughout the water column. Due to a low alkalinity or buffering capacity the effects produced from algal activity may be extended for a longer period of time and more extensive in the water column. The reservoir appears to have a sharp thermocline near the 8 meter level. This stratification has a dramatic effect on water quality as is evidenced by the anoxic conditions. Current data indicates that the system is nitrogen limited. TSI values indicate the reservoir has shifted from an eutrophic system to a mesotrophic state. Additional data will need to be



D	°C	pH	DO	Cond
0.0	17.5	8.3	7.5	103
1.0	17.5	8.3	7.5	103
2.0	17.5	8.3	7.4	104
3.0	17.5	8.3	7.4	105
4.0	17.5	8.3	7.3	105
5.0	17.2	8.2	6.9	105
6.0	17.0	8.1	6.7	105
7.0	17.0	8.1	6.5	104
8.0	16.7	8.0	5.8	105
9.0	15.1	7.3	0.3	106
10.0	11.6	7.1	0.1	110
11.0	10.9	7.0	0.1	116
11.4	10.8	7.0	0.1	116

obtained to determine if this is trend.

According to DWR no fish kills have been reported in recent years. The reservoir supports a populations of rainbow trout (*Oncorhynchus mykiss*). The lake has been treated for rough fish competition in 1954 and 1963. Populations of native fishes may still be present in the lake. The DWR stocks Lower Bowns Reservoir with 12,500 fingerling rainbow trout annually.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	5.282	98.40
Staurastrum gracile	0.085	1.60
Total	5.367	
Shannon-Weaver [H']	0.08	
Species Evenness	0.12	
Species Richness	0.04	

The flora is fairly typical, but not particularly diverse. The dominance of green algae and diatoms indicates that the lake is reasonably healthy and has generally good water quality.

Information

Management Agencies	
Dixie National Forest	586-2421
Teasdale Ranger District	425-3435
Recreation	
Red Cliff Oasis (Torrey RV Park)	425-3431
Six County Commissioners Association	896-9222
Reservoir Administrators	
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146

Pollution Assessment

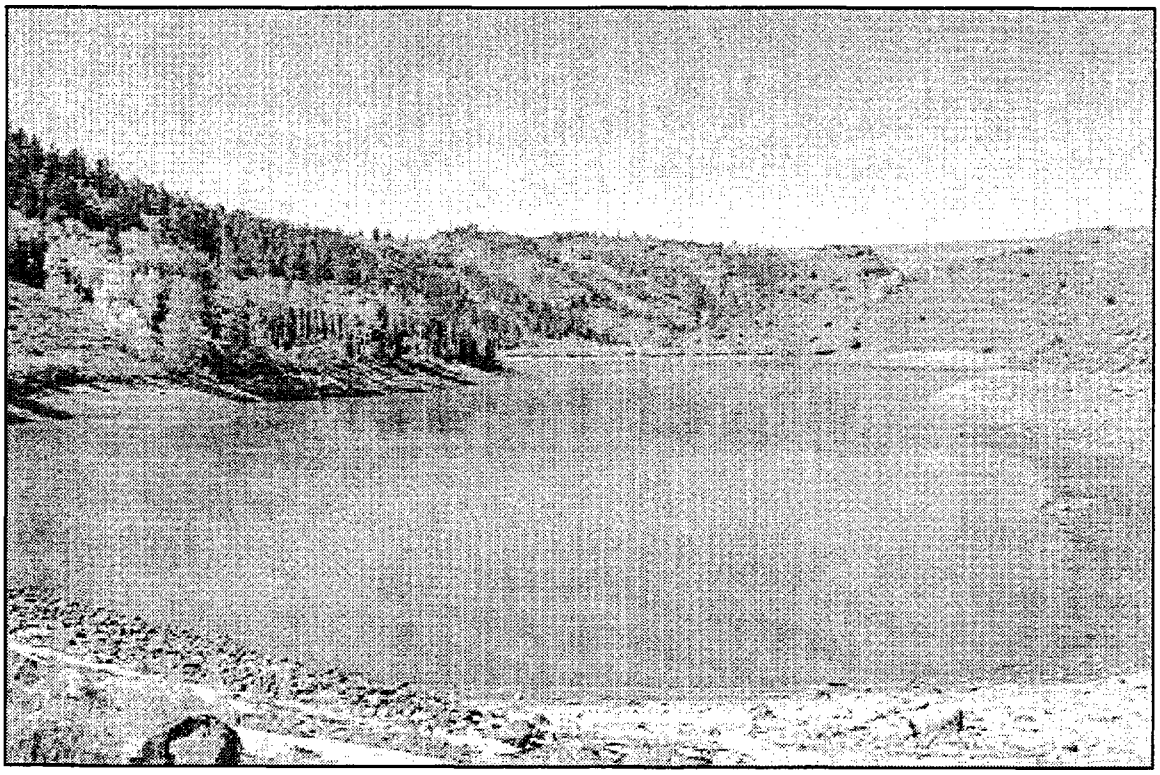
Nonpoint pollution sources are: recreation, grazing, sedimentation and nutrient loading from grazing, and human wastes and litter from recreation. Cattle graze in the watershed and around the reservoir.

There are no point pollution sources in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

LOWER BOX CREEK RESERVOIR



Introduction

Lower Box Creek Reservoir is west of Greenwich on the Sevier Plateau. It is a small, shallow impoundment of a stream valley. It lies just downstream of Upper Box Creek Reservoir, 1/2 mile upstream, and they are often labeled as "Box Creek Reservoirs" on maps. An alternate name is "Box Creek Reservoir (Lower)".

The reservoir shoreline is publicly owned and administered by the Fish Lake National Forest with unrestricted public access. Defined beneficial uses include: water recreation excluding swimming, propagation of cold water game fish and aquatic life, and agricultural needs.

Characteristics and Morphometry

Lake elevation (meters / feet)	2,581 / 8,466
Surface area (hectares / acres)	20.2 / 50
Watershed area (hectares / acres)	190 / 469
Volume (m^3 / acre-feet)	
capacity	
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	7.02 / 23
mean	
Length (meters / feet)	610 / 2,000
Width (meters / feet)	183 / 600
Shoreline (meters / feet)	1,402 / 4,600

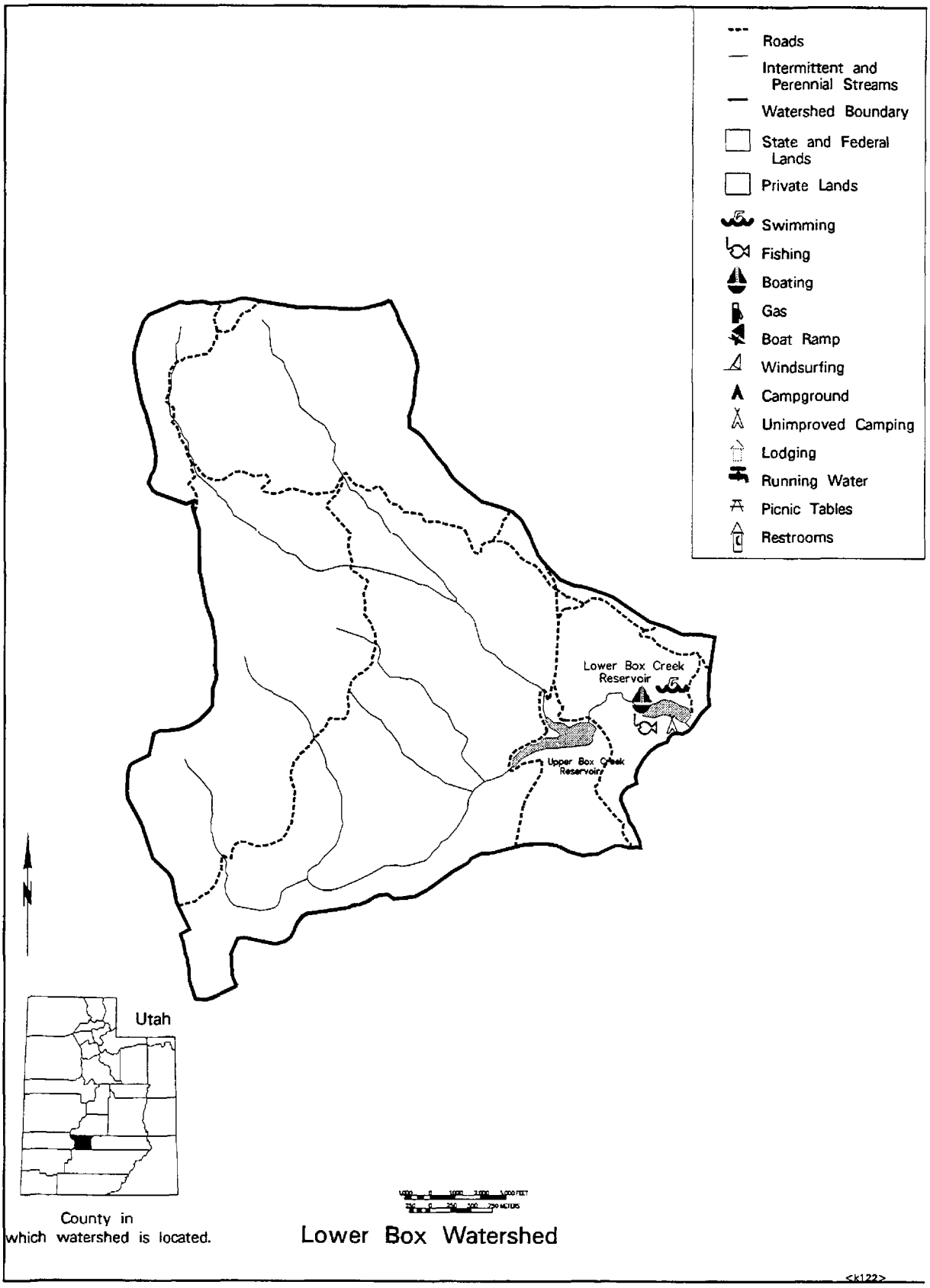
Location

County	Piute
Longitude / Latitude	111 59 10 / 38 28 42
USGS Map	Greenwich, Utah 1969
Cataloging Unit	Otter Creek (16030002)

Recreation

Lower Box Creek Reservoir is most easily accessed from Greenwich. If you are coming from the north or west, however, it is also accessible from Monroe.

Take the gravel road 1/2 mile north of the Greenwich church (on U-62, 6 miles south of Koosharem) to the west. This road climbs up onto the Sevier Plateau and becomes FS-069. After about 9 miles a primitive road leads south to


Roads
Intermittent and Perennial Streams
Watershed Boundary
State and Federal Lands
Private Lands
Swimming
Fishing
Boating
Gas
Boat Ramp
Windsurfing
Campground
Unimproved Camping
Lodging
Running Water
Picnic Tables
Restrooms
Lower Box Creek Reservoir
Upper Box Creek Reservoir
N
Utah
County in which watershed is located.
Lower Box Watershed
<k122>

Lower Box Creek Reservoir.

Access is from Monroe via FS-078. From downtown Monroe, go south, then southeast out of town, following signs to Monrovian Park. At Monrovian Park, continue on FS-078 as it turns to gravel and climbs to the top of the plateau. About 16 miles past Monrovian Park and .5 miles beyond the 23nd FS-068 junction, the road to Lower Box Creek Reservoir branches to the right.

Fishing, backpacking and camping are possible in the area. Usage is light. There are no recreational facilities at the reservoir, although there are pleasant groves of aspen for primitive camping. There are no Forest Service Campgrounds in the area, and the nearest private campgrounds are in Koosharem and Monroe.

Limnological Data

Data sampled from STORET site: 594562

Surface Data	1992
Trophic Status	H
Chlorophyll TSI	85.76
Secchi Depth TSI	67.36
Phosphorous TSI	78.08
Average TSI	77.07
Chlorophyll a (ug/L)	276.7
Transparency (m)	0.6
Total Phosphorous (ug/L)	169
pH	10
Total Susp. Solids (mg/L)	14
Total Volatile Solids (mg/L)	13
Total Residual Solids (mg/L)	<3
Temperature (°C / °f)	17/63
Conductivity (umhos.cm)	141
Water Column Data	
Ammonia (mg/L)	0.05
Nitrate/Nitrite (mg/L)	0.10
Hardness (mg/L)	65.4
Alkalinity (mg/L)	75
Silica (mg/L)	22.2
Total Phosphorous (ug/L)	128
Miscellaneous Data	
Limiting Nutrient	N
DO (Mg/l) at 75% depth	7.1
Stratification (m)	0-2
Depth at Deepest Site (m)	5.0

Watershed Description

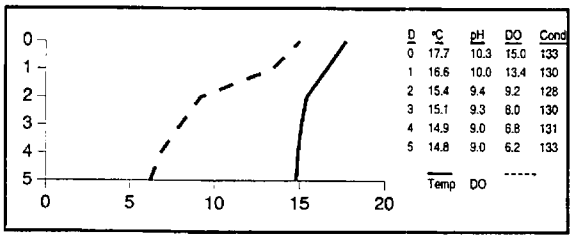
The reservoir is in an area of high, rolling ridges and valleys characteristic of the Sevier Plateau. The watershed high point, Monkey Flat Ridge, is 2,695 m (8,844 ft) above sea level, thereby developing a complex slope of 9.0% to the reservoir. Box Creek is the inflow and outlet for the reservoir. Upper Box Creek Reservoir, an upstream impoundment, is 0.5 miles up Box Creek from Lower Box Creek Reservoir. Above the reservoirs the average stream gradient is 8.4% (447 feet per mile).

The soil is largely of volcanic origin with moderate permeability and moderately slow erosion and runoff.

The vegetation communities are comprised of aspen, spruce-fir and sage-grass. The watershed receives 51 - 76 cm (20 - 30 inches) of precipitation annually with a frost-free season of 60 - 80 days at the reservoir.

Limnological Assessment

The water quality of Lower Box Reservoir is fair. It is considered to be soft with a hardness concentration value of approximately 65 mg/L ($CaCO_3$). The parameters that have exceeded State water quality standards for defined beneficial uses are phosphorus and pH. The average concentration of total phosphorus in the water column in 1992 was 128 ug/L which exceeds the recommended pollution indicator for phosphorus of 25 ug/L. The phosphorus concentration in the water column on August 5, 1992 reached a level of 191 ug/L. With these high concentrations of nutrients the reservoir develops extensive blue-green algal blooms indicative of poorer water quality. As indicated in the August 5 profile the pH concentration throughout the water column either is equal to or exceeds the criteria of 9.0. These high values are indicative of conditions that result from the high production of algae. During photosynthetic activity during the daytime pH values become elevated. The lakes shallow nature usually does not allow for stratification. This condition is also a result of late summer drawdown of the reservoir to meet downstream irrigation needs. Current data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is highly eutrophic. It is one of the most eutrophic reservoirs in the State. The phosphorus concentrations are relatively high and are due in part to the grazing that occurs in the vicinity of the reservoir itself during summer and late fall. The waste products deposited on the shoreline when it is drawn down are readily incorporated into the water column through spring runoff and other episodic events. These nutrients are readily available for primary production. In addition dissolved oxygen concentrations may reach critical levels



during the winter as the high amount of organic matter deposited on the bottom of the reservoir from high production of algae during the summer. Macrophytes are typically not a problem, but they do develop in the western end of the lake in the inlet area later in the summer.
According to DWR no fish kills have been reported in recent years. It should be noted that the reservoir can be drained late in the fall. The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake. The DWR typically stocks Lower Box Creek Reservoir with 2,000 catchable rainbow trout (*Oncorhynchus mykiss*) and 1,500 fingerling brook trout (*Salvelinus fontinalis*).

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Aphanizomenon flos-aquae	116.204	99.79
Microcystis aeruginosa	.244	0.21
Total	116.448	
Shannon-Weaver [H']	0.02	
Species Evenness	0.02	
Species Richness	0.04	

The phytoplankton community is dominated by the presence of blue-green algae, indicative of highly eutrophic conditions and poorer water quality.

Information

Fish Lake National Forest (owners)	896-4491
Richfield Ranger District	896-4491
Koosharem Campground, Cafe	638-7310
Monroe Hot Springs Resort	527-4014
Six County Commissioners Association	896-9222
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146

Pollution Assessment

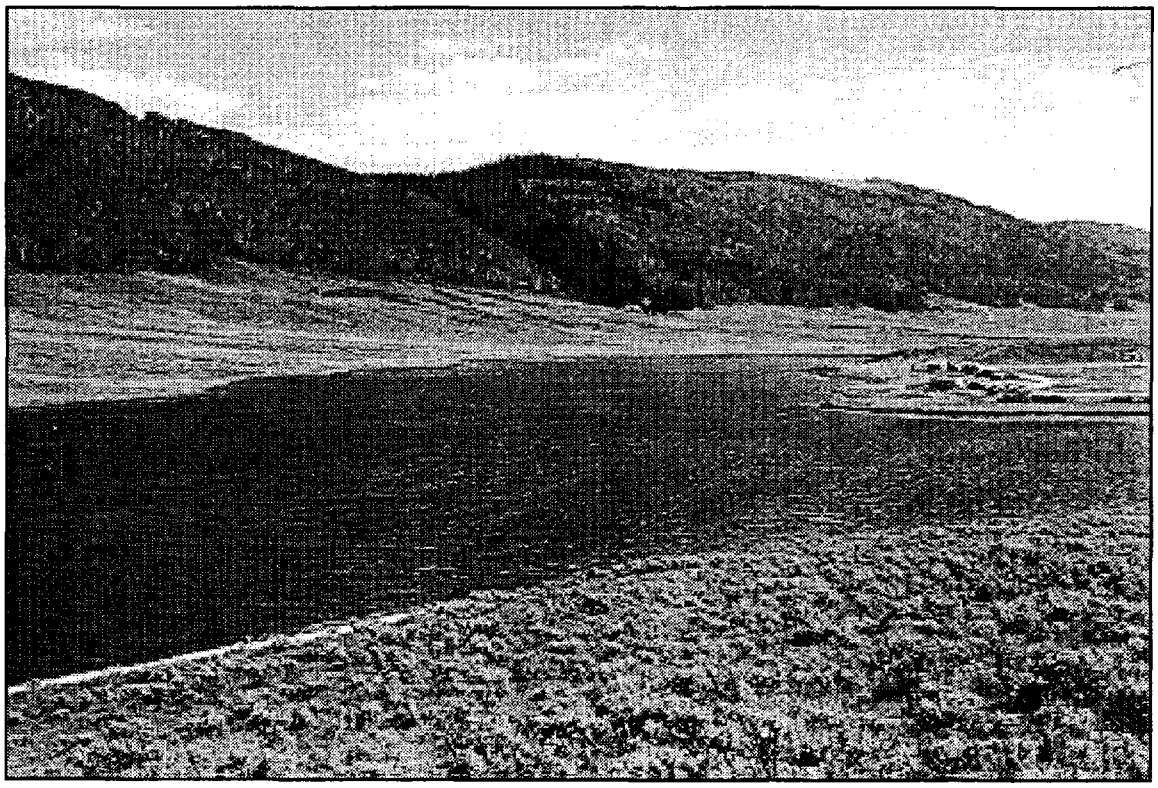
The only nonpoint source of pollution in Lower Box Creek Reservoir is sedimentation and nutrient loading from grazing in the watershed and in the vicinity of the reservoir. High numbers of cattle graze in the vicinity of the reservoir for part of the summer and fall.

There are no point pollution sources in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and aquatic life (3A) and agriculture (4).

LOWER GOOSEBERRY RESERVOIR



Introduction

Lower Gooseberry Reservoir is located in a sage-grass meadow on the north side of the Wasatch Plateau. It is an intermediate sized impoundment of a meadow high in the Price River watershed. It is located within the boundaries of land administered by the Bureau of Reclamation. The reservoir was first impounded in 1939 by construction of an earth-fill dam on Gooseberry Creek. In 1990 the dam was reconstructed. Although the immediate vicinity of the reservoir is primary a sage-grass community, it is nestled in the high mountains with aspen and conifer forests in the immediate vicinity. There are a number of summer recreational homes in the area with plans for continued development in the area. The shoreline is owned and managed by the Bureau of Reclamation with unrestricted public access. Reservoir water is used primarily for downstream irrigation and public recreation.

Characteristics and Morphometry

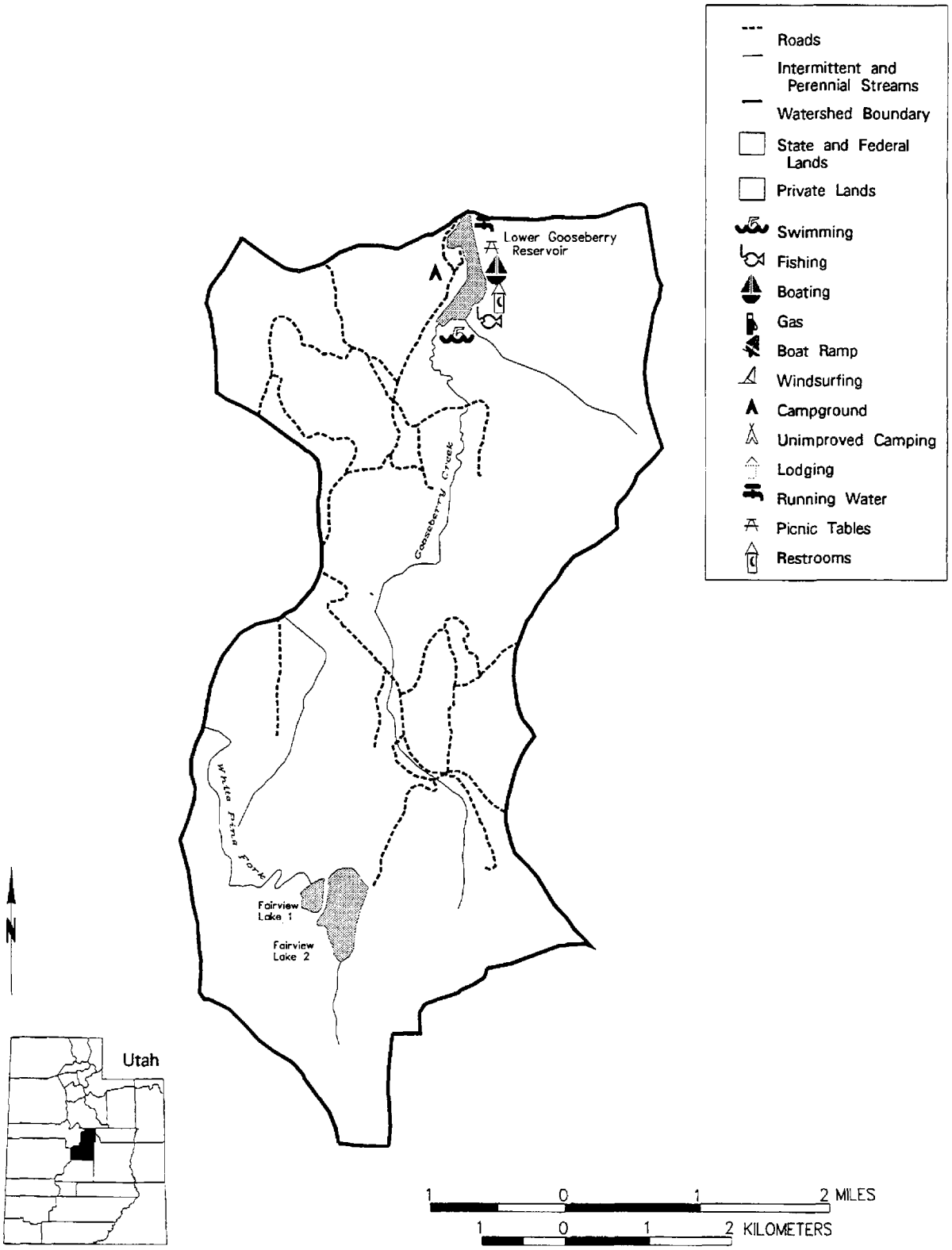
Lake elevation (meters / feet)	2,568 / 8,424
Surface area (hectares / acres)	23.4 / 57.3
Watershed area (hectares / acres)	3301 / 8329
Volume (m^3 / acre-feet)	
capacity	261,502 / 212
conservation pool	
Annual inflow (m^3 / acre-feet)	See Narrows Dam
Retention time (years)	unknown
Mean annual vertical fluctuation (meters / feet)	1.2 / 4.0
Depth (meters / feet)	
maximum	5 / 16.4
mean	1.1 / 3.7
Length (meters / feet)	1,370 / 4,488
Width (meters / feet)	258 / 845
Shoreline (km / miles)	3 / 1.8

Location

County	Sanpete
Longitude / Latitude	111 16 03 / 39 35 24
USGS Map	Huntington Reservoir 1978
DeLorme's Atlas and Gazetteer™	Page 46 D-2
Cataloging Unit	San Rafael (14060009)

Recreation

Lower Gooseberry Reservoir is directly accessible from



County in which watershed is located.

Lower Gooseberry Watershed

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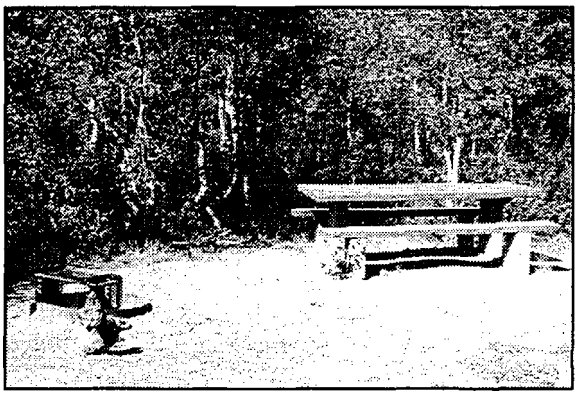
state highway 31 between Fairview and Huntington. From Fairview, travel 10 miles east on U-31. Take highway U-264 near the top of the mountain. Shortly after leaving U-31 as U-264 turns eastward towards Electric Lake , a gravel road goes north to the reservoir. It is well marked and proceeds past a forest service campground and ranger station to the reservoir (3-4 miles).

Although the area generally receives moderate recreational usage, heavy usage occurs on holiday weekends. Fishing is the primary activity, however, boating, camping, swimming, nordic skiing and snowmobiling are also thoroughly enjoyed.

Recreational facilities are limited and primitive in the area. Visitors are required to pack out their own trash. There is a Forest Service Campgrounds located in the forested area prior to the reservoir. The camping area provides 10 camping units with vault toilets, fire pits, tables, and drinking water.



Watershed Description

The reservoir is in an area of rolling ridges and valleys characteristic of the Wasatch Plateau. Inflows to the reservoir consist primarily of Gooseberry Creek, Japanese Creek and Brooks Canyon Creek. Water leaves the reservoir via Gooseberry Creek, a tributary to Fish Creek, a major source of water for Scofield Reservoir.

The watershed high point is 3,184 m (9,706 ft) above sea level, thereby developing a complex slope of 11% to the reservoir. The average stream gradient above the reservoir is 3.0% (156 feet per mile).

The soil is of limestone origin and has good permeability and moderately slow erosion and runoff. Soil groupings are found in Appendix III.

The vegetation communities are comprised of sage-grass, pine, aspen, spruce-fir, oak and maple. The watershed receives 76-102 cm (30-40 inches) of precipitation annually with a frost-free season of 40 - 60 days at the reservoir.

Land use in the reservoir is 100% multiple use forest lands, used for hunting, recreation, livestock grazing and privately developed recreational property.

Limnological Assessment

The water quality of Lower Gooseberry Reservoir is good. It is considered to be moderately hard with a hardness concentration value of approximately 144 mg/L (CaCO3). The only parameters that have exceeded State water quality standards for defined beneficial uses are phosphorus, pH, and dissolved oxygen. The average concentration of total phosphorus in the water column has not exceeded the recommended pollution indicator for phosphorus of 25 ug/L, but on occasion values are reported at various depths in the water column. On occasion dissolved oxygen levels (2.3 mg/L)and pH values(10.2) have violated state standards near the bottom of the reservoir. The factor in the reservoir responsible for this phenomenon is the extensive macrophyte coverage of the bottom of the reservoir. The reservoir is shallow with good light penetration throughout the water column. Although the submerged plant material

Limnological Data

Data sampled from STORET site: 593224

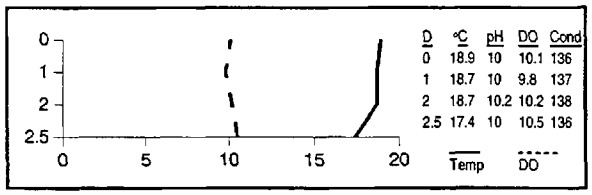
Surface Data	1981	1990	1991
Trophic Status	M	M	M
Chlorophyll TSI	-	39.39	29.57
Secchi Depth TSI	50.01	48.64	50.75
Phosphorous TSI	37.35	49.04	52.45
Average TSI	43.68	45.69	44.26
Chlorophyll a (ug/L)	-	2.5	0.9
Transparency (m)	2	2.2	1.9
Total Phosphorous (ug/L)	10	22.5	28.5
pH	7.9	8.6	9.1
Total Susp. Solids (mg/L)	5	<3	5
Total Volatile Solids (mg/L)	-	-	5
Total Residual Solids (mg/L)	-	-	<1
Temperature (°C / °f)	18/64	14/56	15/58
Conductivity (umhos.cm)	325	235	233
Water Column Data			
Ammonia (mg/L)	-	0.03	0.03
Nitrate/Nitrite (mg/L)	-	0.04	0.06
Hardness (mg/L)	179	140.3	113.3
Alkalinity (mg/L)	-	120	119
Total Phosphorus (ug/L)		24	24.8
Silica (mg/L)	-	-	4.0
Miscellaneous Data			
Limiting Nutrient	P		
DO (Mg/l) at 75% depth	8.4	-	10.2
Stratification (m)	4	NO	NO
Depth at Deepest Site (m)	5	3.7	2.5

produces oxygen during the day, it elevates the pH concentration during the day and reduces the dissolved oxygen concentration during the night. It is evident from the August 29, 1991 profile that the reservoir is to shallow to produce stratification. Although the reservoir was reported in 1981 to be phosphorus limited, current data suggest that the reservoir is in fact a nitrogen limited system. TSI values indicate the reservoir is a fairly stable mesotrophic system.

According to DWR fish kills have been reported during severe winter conditions. This is to be expected with the large amounts of organic material that accumulate form summer macrophyte growth. As this organic material decays and is decomposed oxygen is consumed. Because the reservoir is shallow and oxygen production is largely inhibited during the period of ice coverage the reservoir's dissolved oxygen content is reduced to the point that it cannot sustain a viable fishery. A profile conducted on March 5, 1992 indicates the severity of the depletion. At the surface the dissolved oxygen concentration was 1.1 mg/L, but quickly dropped to 0.4 mg/L throughout the majority of the water column.

The reservoir supports populations of rainbow trout (Oncorhynchus mykiss), and cutthroat trout (*Oncorhynchus clarki*). The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake. According to a recent stocking records Lower Gooseberry Reservoir is stocked with 12,000 catchable rainbow trout.

A 1978 USFS limnological survey noted the existence of rainbow and cutthroat trout. Many species of macroinvertebrates were observed including Odonata, Hemiptera, Tricoptera, Coleoptera, Diptera, Amphipoda, Mollusca and Leeches. Zooplankton in the reservoir was composed almost entirely of Daphnia. In addition the reservoir had large amounts of submerged macrophyte growth which reached the surface in about 40% of the reservoirs total area.



D	°C	pH	DO	Cond
0	18.9	10	10.1	136
1	18.7	10	9.8	137
2	18.7	10.2	10.2	138
2.5	17.4	10	10.5	136

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm³/liter)	% Density By Volume
Dictyosphaerium pulchellum	96.738	83.4
Gomphosphaeria lacustris	5.615	4.85
Sphaerocystis schroeteri	5.282	4.56
Anabaena sp.	3.892	3.36
Anabaena sp. 2	1.112	0.96
Staurastrum gracile	0.722	0.62
Fragilaria crotonensis	0.687	0.59
Staurastrum sp.	0.667	0.58
Staurastrum sp.	0.500	0.43
Pennate diatoms	0.183	0.16
Cosmarium sp.	0.157	0.14
Oocystis sp.	0.108	0.09
Spirulina sp.	0.056	0.05
Cylindrospermum stagnale	0.056	0.05
Stichococcus bacillaris	0.028	0.02
Tetraedrom minimum	0.021	0.02
Oscillatoria sp.	0.018	0.02
Scenedesmus bijuga	0.015	0.01
Microcystis incerta	0.011	0.01
Gomphosphaeria sp.	0.006	0.01
Merisniopekia tennuissima	0.003	0.00
Chlamydomonas sp.	0.002	0.00
Total	115.876	
Shannon-Weaver [H']	0.75	
Species Evenness	0.24	
Species Richness	0.82	

The flora is fairly typical, but not particularly diverse. The dominance of green algae and diatoms indicates that the lake is reasonably healthy.

Pollution Assessment

Nonpoint pollution sources include nutrient loading and sedimentation from grazing and litter and human wastes from recreation. About 1,000 sheep graze in the immediate vicinity of the reservoir for two weeks each year. Cattle also graze the area. No mining or logging takes place in the region.

Information

Management Agencies	
Dixie National Forest	586-2421
Teasdale Ranger District	425-3435
Recreation	
Red Cliff Oasis (Torrey RV Park)	425-3431
Six County Commissioners Association	896-9222
Reservoir Administrators	
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146

There are no point pollution sources in the watershed.

Beneficial Use Classification

The state beneficial use classification for the waters of Lower Gooseberry Reservoir include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

LYMAN LAKE

Introduction

Lyman Lake is a small lake in the Blacks Fork drainage on the north slope of the High Uintas. It is a natural impoundment, formed by a dam of terminal moraine--glacial rubble. (The China Lake report has a complete description of the process of glaciation.) It is easily accessible by passenger car, and has a youth camp on it. Little Lyman Lake, 100 meters downstream, is much smaller and has a USFS campground on the south shore.

Lyman Lake has a low dam that has artificially raised the water level. This extra water is drawn off in the summer for agricultural use. Because the watershed is so small, natural filling and downcutting have yet to obliterate this lake. The shoreline is owned by the Wasatch-Cache National Forest. Public access is unrestricted, but camping is not permitted outside the campground.

Characteristics and Morphometry

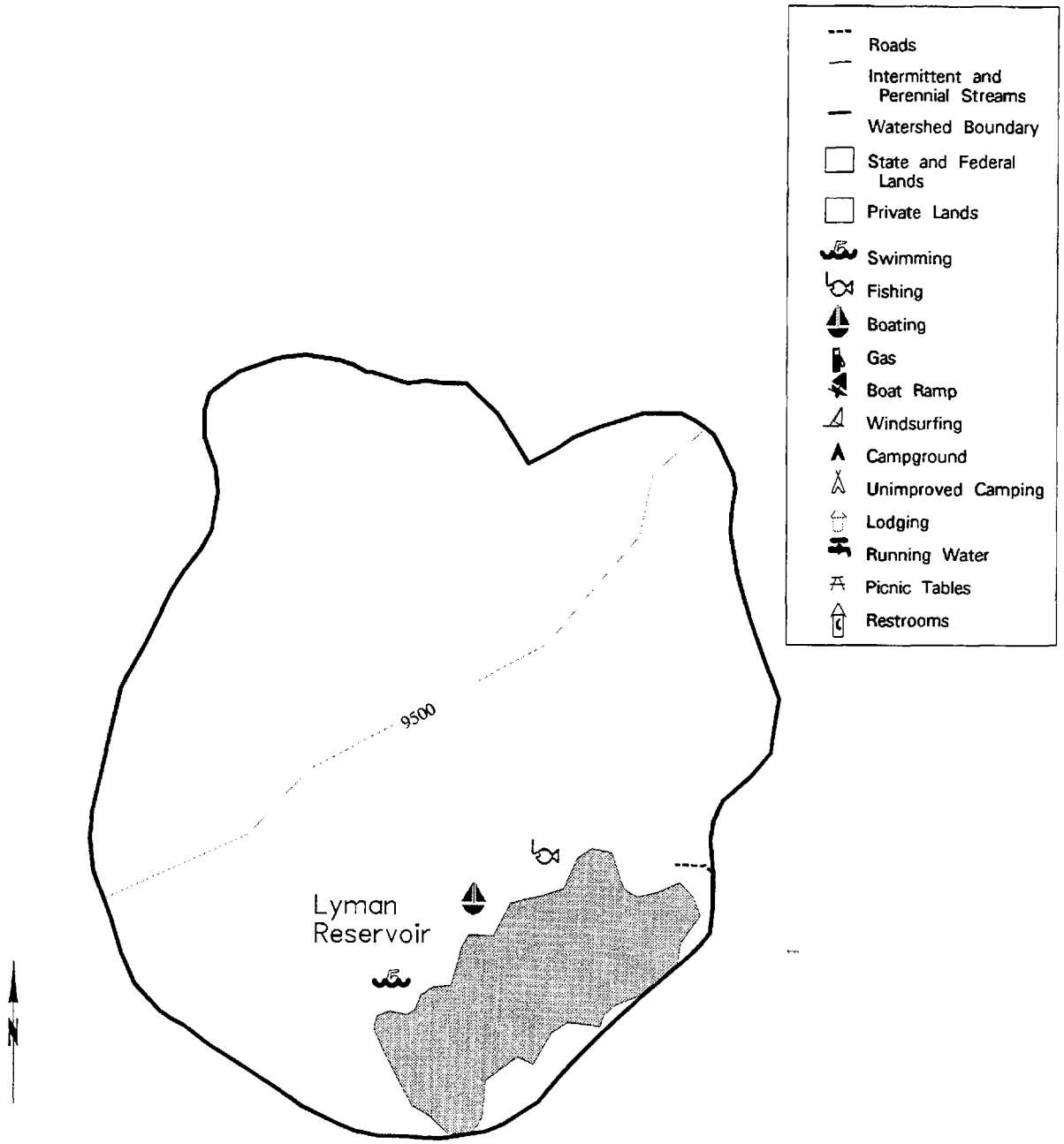
Lake elevation (meters / feet)	2,839 / 9,311
Surface area (hectares / acres)	11 / 27
Watershed area (hectares / acres)	156 / 386
Volume (m^3 / acre-feet)	
capacity	128,000 / 104
conservation pool	
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	7.01 / 23
mean	3.05 / 10
Length (meters / feet)	732 / 2,400
Width (meters / feet)	244 / 800
Shoreline (km / miles)	1.6 / 1.02

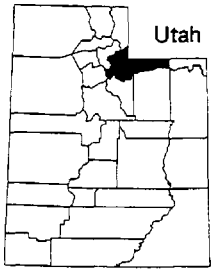
Location

County	Summit
Longitude / Latitude	110 36 44 / 40 56 20
USGS Map	Lyman Lake, UT / WY 1967
DeLorme's Utah Atlas and Gazetteer™	Page 55, A-4
Cataloging Unit	Black's Fork (1404017)

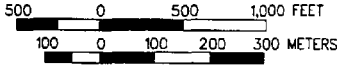
Recreation

Lyman Lake is about 17 miles east of U-150 on the North Slope Road (FS-058) of the Uintas. The route from





County in which watershed is located.



Lyman Watershed

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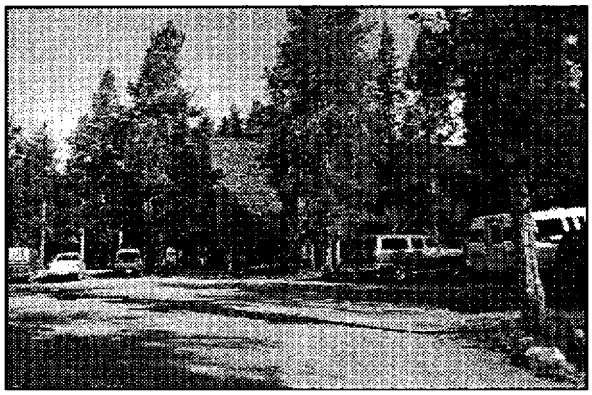
U-150 is well signed.

The lake offers fishing and boating. The water is to cold for most swimmers, but a there is a young womens summer camp located on the northeastern end of the lake.



Little Lyman Lake Campground, on Little Lyman Lake, is administered by the Forest Service, and has 10 campsites, running water, and primitive latrines.

Watershed Description

Lyman Lake is in an area of moraine from the Right Fork Backs Fork glaciers. Melting of debris-lain glaciers created this lake basin. The watershed is very small. The watershed drains to the south, contrary to the regional slope.

The area around the lake has high elevation coniferous forests on the rolling hills of the moraine. Slopes average 9%. There are two small tributary streams (2.8% gradient, or 147 feet per mile), several springs, and three small ponds. The watershed high point, a point 1 mile north of the lake, is 2,926 m (9,600 ft) above sea level, thereby developing a complex slope of 6.5% to the reservoir. The outflow is a small stream that joins Blacks Fork 1/2 mile below Little Lyman Lake.

The soil in the watershed is entirely glacial till and alluvium. It is comprised not only of debris from the scouring of Precambrian rock of upstream valleys, but also a variety of strata in the transition zone to the Tertiary strata in the Lyman Lake area. Therefore the till is chemically erratic. See Appendix III for a complete soil description.

The vegetation community is comprised of coniferous forest and marshland. The watershed receives 51 - 64 cm (20 - 25 inches) of precipitation annually with a frost-free season of 20 - 40 days.

Land use is multiple use in the all areas except the youth camp.

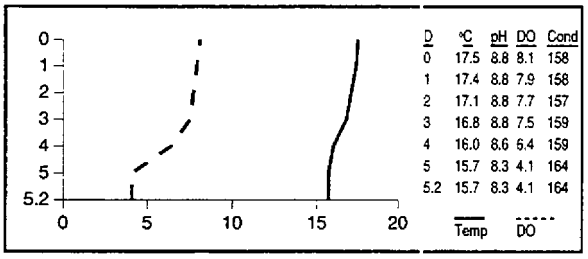
Limnological Assessment

The water quality of Lyman Lake is considered very good. It is considered to be moderately hard with a hardness concentration value of approximately 94 mg/L ($CaCO_3$). There are no parameters that have exceeded State water quality standards for defined beneficial uses. The average concentration of total phosphorus in the water column in 1992 was 18 ug/L. Although no exceedences of the water quality standards is noted, there are water quality

Limnological Data

Data sampled from STORET site: 593986

Surface Data	1992
Trophic Status	O
Chlorophyll TSI	29.57
Secchi Depth TSI	36.66
Phosphorous TSI	46.98
Average TSI	37.74
Chlorophyll a (ug/L)	0.9
Transparency (m)	5.1
Total Phosphorous (ug/L)	20
pH	8.8
Total Susp. Solids (mg/L)	<3
Total Volatile Solids (mg/L)	1
Total Residual Solids (mg/L)	2
Temperature (°C / °f)	15/59
Conductivity (umhos.cm)	173
Water Column Data	
Ammonia (mg/L)	0.07
Nitrate/Nitrite (mg/L)	0.01
Hardness (mg/L)	95
Alkalinity (mg/L)	94
Silica (mg/L)	2.0
Total Phosphorous (ug/L)	18
Miscellaneous Data	
Limiting Nutrient	N
DO (Mg/l) at 75% depth	6.5
Stratification (m)	NO
Depth at Deepest Site (m)	5.2



D	°C	pH	DO	Cond
0	17.5	8.8	8.1	158
1	17.4	8.8	7.9	158
2	17.1	8.8	7.7	157
3	16.8	8.8	7.5	159
4	16.0	8.6	6.4	159
5	15.7	8.3	4.1	164
5.2	15.7	8.3	4.1	164

impairments in Lyman Lake. The lake has an extensive growth of macrophytes present, primarily submerged in the water column. The lake by nature is to shallow to permit stratification of the lake. However, it should be noted that dissolved oxygen concentration decline near the bottom of the lake which is indicative of the large amount of macrophytes present. Although the macrophytes produce oxygen during the day through the process of photosynthesis, during the night they consume oxygen in respiration. These large masses of macrophytes produce anoxic conditions during extended ice coverage during the winter. As winter sets in the macrophytes die off and settle in the bottom of the lake and begin to decompose. This decomposition process utilizes the dissolved oxygen present in the water column. As the dissolved oxygen is diminished, anoxic conditions develop and the potential for fish kills exists. DWR has reported winter fish kills during recent years due to lack of oxygen. Current data suggest that the reservoir is nitrogen limited system. TSI values indicate the reservoir is oligotrophic, but water quality impairments do exist.

According to DWR stocking reports the reservoir is stocked with 1,000 fingerling brook trout (*Salvelinus fontinalis*), 1-2000 catchable rainbow trout (*Oncorhynchus mykiss*), and 1,000 albino rainbow trout. The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Oocystis sp.	0.100	43.90
Dinobryon divergens	0.049	21.46
Pennate diatoms	0.039	17.07
Centric diatoms	0.023	10.24
Scenedesmus bijuga	0.011	4.88
Total	0.222	
Shannon-Weaver [H']	1.46	
Species Evenness	0.82	
Species Richness	0.26	

The flora is fairly typical, but not particularly diverse. The dominance of green algae and diatoms indicates that the lake is reasonably healthy.

Pollution Assessment

Nonpoint pollution sources are sedimentation and nutrient loading from grazing, and wastes or litter from recreation. Cattle graze in the watershed and probably around the reservoir.

There are no point pollution sources in the watershed.

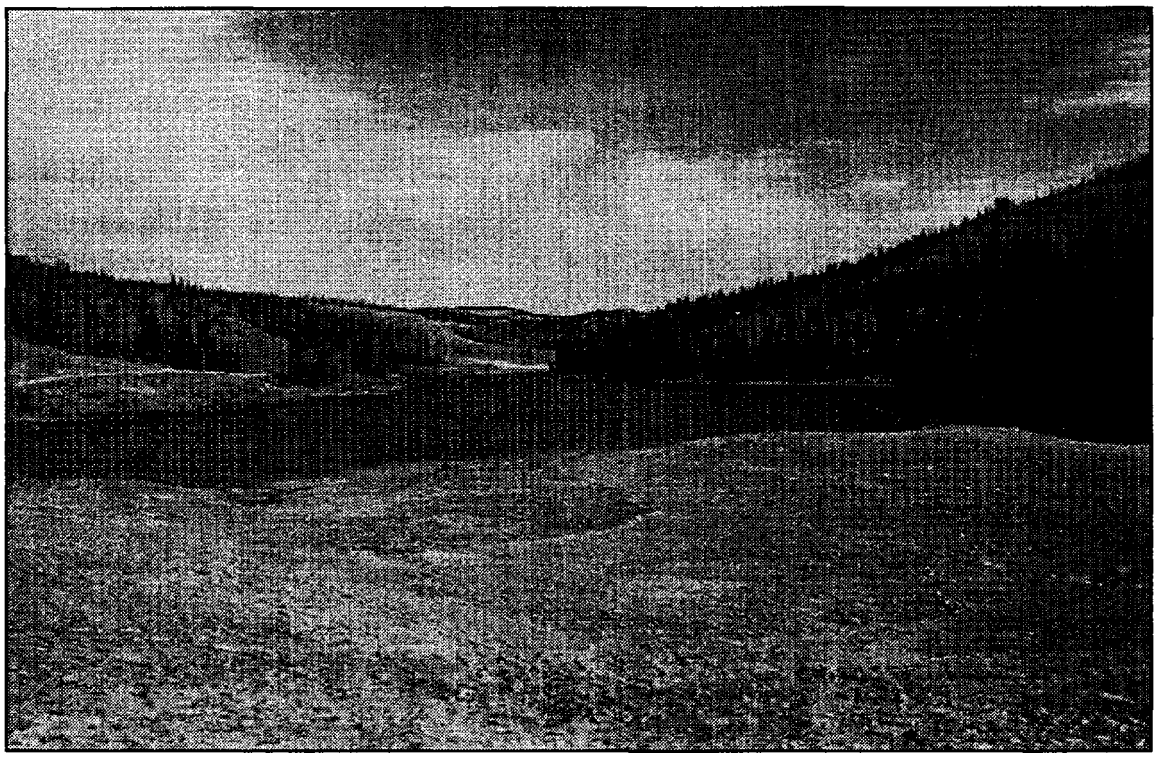
Beneficial Use Classification

The state beneficial use classifications include: recreational bathing (swimming) 2A, boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Wasatch-Cache National Forest	524-5030
Evanston Ranger District	307-789-3194
Mountainlands Association of Governments	377-2262
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Mountainland Travel Region (Provo)	377-2262
Reservoir Administrators	
Lyman Reservoir and Irrigation Company	

MANNING MEADOW RESERVOIR



Introduction

Manning Meadow Reservoir is east of Marysvale on the Sevier Plateau. It is a medium sized impoundment of Manning Meadow, a high mountain meadow. Some maps list it as Manning Meadows Reservoir. It is somewhat remote.

The reservoir shoreline is publicly owned and administered by the Fish Lake National Forest with unrestricted public access. Defined beneficial uses include: water recreation excluding swimming, cold water species of game fish and aquatic life, and agriculture. The DWR has recently acquired the total water right for the reservoir.

Characteristics and Morphometry

Lake elevation (meters / feet)	2,973 / 9,750
Surface area (hectares / acres)	23.8 / 59
Watershed area (hectares / acres)	480 / 1,186
Volume (m^3 / acre-feet)	
capacity	1,230,000 / 996.3
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	19.93 / 49
mean	5.52 / 18.1
Length (meters / feet)	
Width (meters / feet)	
Shoreline (km / miles)	2.1 / 1.32

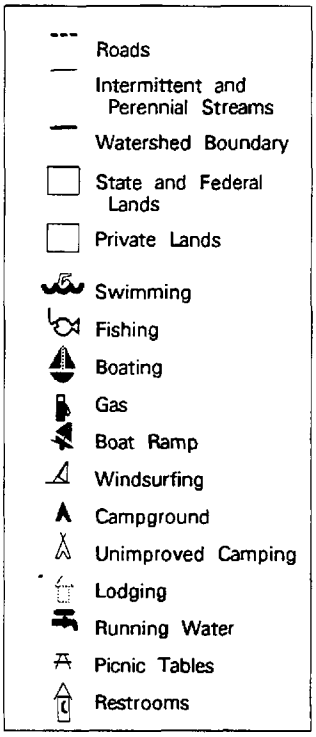
Location

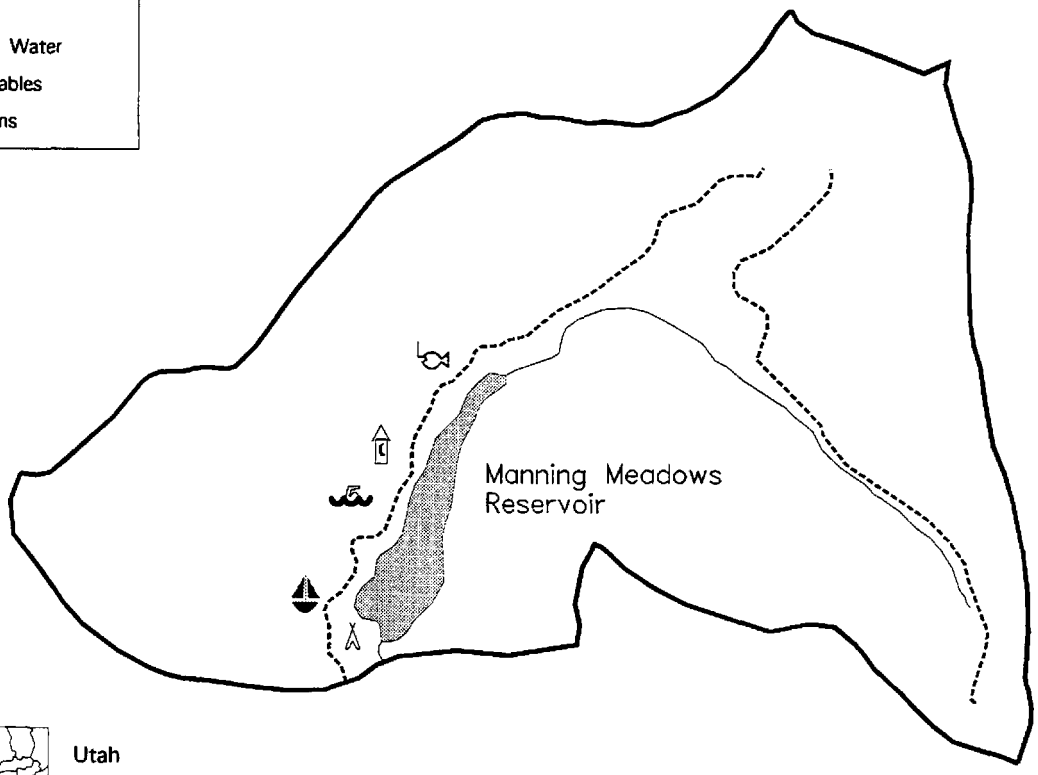
County	Piute
Longitude / Latitude	112 04 00 / 38 29 38
USGS Map	Marysvale Peak, Utah, 1981
Cataloging Unit	Richfield (16030003)

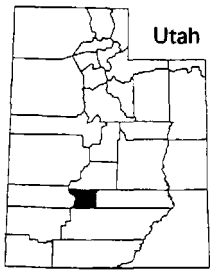
Currently they use the reservoir to provide habitat for brood stock of cutthroat trout. The fishing regulations are restricted.

Recreation

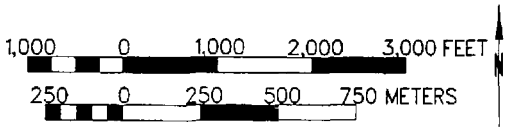
Manning Meadow Reservoir is not very easily accessed. From the west or the north, access is from Monroe via FS-078. Go south, then southeast out of town, following signs to Monrovian Park. At Monrovian Park,







County in which watershed is located.



Manning Meadows Watershed

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continue on FS-078 as it turns to gravel and climbs to the top of the plateau. About 12 miles past Monrovian Park, the road (FS-083) to Manning Meadows Reservoir and Barney Lake branches to the right.

From the south or east, take the gravel road 1/2 mile north of the Greenwich church (on U-62 6 miles south of Koosharem) to the west and up onto the Sevier Plateau and becomes FS-069. After about 10 miles (near the Box Creek Reservoirs) turn left on FS-078 and continue about 5 miles to the road to FS-083.

From the FS-078/FS-083 junction, go several miles south on FS-083 to Manning Meadow Reservoir, which is on the east (left) side of the road.

Fishing, backpacking and camping are possible in the area. Usage is light. There are no recreational facilities at the reservoir, although the area offers itself to primitive camping. There are no Forest Service Campgrounds in the area, and the nearest private campgrounds are in Koosharem and Monroe.

Watershed Description

The reservoir is in an area of high, rolling ridges and valleys characteristic of the top of the Sevier Plateau. The meadow extends upstream from the reservoir in a small valley, filled with sedges and bog grasses. The creek flows through the meadow and is neither aggrading nor degrading. The dam itself is built on the site of a mudslide which had also impounded the meadow.

The watershed high point, one kilometer west of the lake, is 3,237 m (10,621 ft) above sea level, thereby developing a complex slope of 28.4% to the reservoir. Manning Creek is the inflow and outlet for the reservoir. Above the reservoir the average stream gradient is 1.9% (98 feet per mile).

The soil is largely of volcanic origin with moderate permeability and moderately slow erosion and runoff.

The vegetation communities are comprised of aspen, spruce-fir and sage-grass. The watershed receives 64 - 76 cm (25 - 30 inches) of precipitation annually with a frost-free season of 20 - 40 days at the reservoir.

Limnological Assessment

The water quality of Manning Meadow Reservoir is good. It is considered to be soft with a hardness concentration value of approximately 31 mg/L ($CaCO_3$). The only parameters that have exceeded State water quality standards for defined beneficial uses are phosphorus and dissolved oxygen. The average concentration of total phosphorus in the water column in 1992 was 113 ug/L which exceeds the recommended pollution indicator for phosphorus of 25 ug/L. Phosphorus concentration in the hypolimnion have been as high as 396 ug/L and during August 5, 1992 averaged 163 ug/L. These high concentrations of nutrients lead to the production of algal blooms. Such a high amount of production can lead to anoxic problems in the water column. As depicted in the August 5, 1992 profile these types of conditions manifest themselves. The reservoir is stratified at the 4 meter depth and below that the dissolved oxygen concentrations decline rapidly to a low of 0.5 ug/L near the bottom of the reservoir. Dissolved oxygen concentrations in late summer and winter substantiate the fact that water quality impairments do exist. These conditions are deleterious to the fishery rendered large portions of the water column unsuitable for a fishery. In addition dissolved oxygen concentrations may reach critical state during the winter period for fish.

Limnological Data

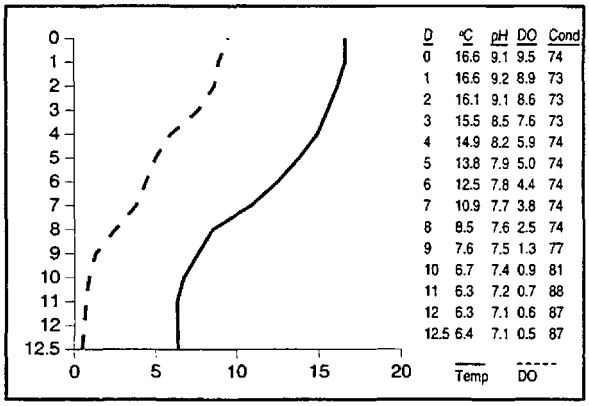
Data sampled from STORET site: 594504

Surface Data	1992
Trophic Status	E
Chlorophyll TSI	57.86
Secchi Depth TSI	48.64
Phosphorous TSI	56.60
Average TSI	54.37
Chlorophyll a (ug/L)	16.1
Transparency (m)	2.2
Total Phosphorous (ug/L)	38
pH	8.7
Total Susp. Solids (mg/L)	<3
Total Volatile Solids (mg/L)	1
Total Residual Solids (mg/L)	2
Temperature (°C / °f)	16/60
Conductivity (umhos.cm)	41
Water Column Data	
Ammonia (mg/L)	0.12
Nitrate/Nitrite (mg/L)	0.06
Hardness (mg/L)	31
Alkalinity (mg/L)	33
Silica (mg/L)	7.15
Total Phosphorous (ug/L)	113
Miscellaneous Data	
Limiting Nutrient	N
DO (Mg/l) at 75% depth	1.1
Stratification (m)	4-8
Depth at Deepest Site (m)	12.5

Current data suggest that the reservoir is a nitrogen limited system. TSI values indicate that the reservoir is highly productive and classified as a eutrophic system.

According to DWR no fish kills have been reported in recent years. The reservoir supports populations of splake,

a cross of brook trout (*Salvelinus fontinalis*) with lake trout (*Salvelinus namaycush*), and Bonneville cutthroat trout (*Oncorhynchus clarki utah*). DWR maintains a breeding population of these cutthroat trout in the reservoir. The lake was treated for rough fish competition in 1989 so that management of the fishery for these fish could occur. According to recent stocking records, advanced fingerling Bonneville cutthroat trout and Splake (male brook trout X female lake trout) (*Salvelinus fontinalis* male X *Salvelinus namaycush* female) continue to be stocked in the reservoir.



D	°C	pH	DO	Cond
0	16.6	9.1	9.5	74
1	16.6	9.2	8.9	73
2	16.1	9.1	8.6	73
3	15.5	8.5	7.6	73
4	14.9	8.2	5.9	74
5	13.8	7.9	5.0	74
6	12.5	7.8	4.4	74
7	10.9	7.7	3.8	74
8	8.5	7.6	2.5	74
9	7.6	7.5	1.3	77
10	6.7	7.4	0.9	81
11	6.3	7.2	0.7	88
12	6.3	7.1	0.6	87
12.5	6.4	7.1	0.5	87

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Gloeotrichia echinulata	111.200	92.44
Anabaena spiroides var. crassa	8.674	7.21
Aphanizomenon flos-aquae	0.317	0.26
Haematococcus sp.	0.067	0.06
Ankistrodesmus falcatus	0.031	0.03
Pennate diatoms	0.008	0.01
Total	120.292	
Shannon-Weaver [H']	0.28	
Species Evenness	0.16	
Species Richness	0.20	

The flora is fairly typical, but not particularly diverse. The dominance of blue- green algae and diatoms indicates that the lake has fairly good water quality with eutrophic conditions present in the reservoir.

Pollution Assessment

The only nonpoint source of pollution in Manning Meadow Reservoir is sedimentation and nutrient loading from grazing in the watershed and in the vicinity of the reservoir. This type of activity is fairly extensive and is contributing to the nutrient load as indicated by the reservoir response in recent years.

There are no point pollution sources in the watershed.

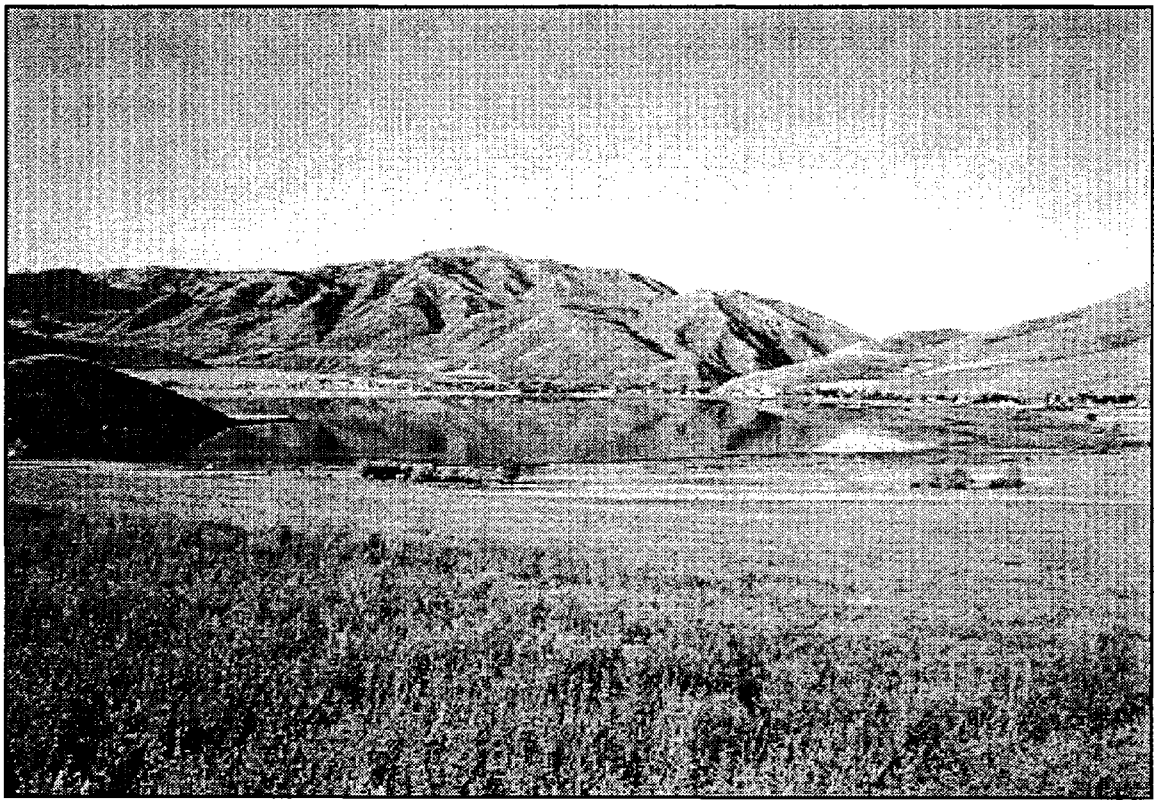
Information

Fish Lake National Forest	896-4491
Richfield Ranger District	896-4491
Henrie Brothers (Reservoir Managers)	
Koosharem Campground, Cafe	638-7310
Monroe Hot Springs Resort	527-4014
Six County Commissioners Association	896-9222
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agriculture (4).

MANTUA RESERVOIR



Introduction

Mantua Reservoir is a moderate impoundment at the top of Box Elder Canyon East of Brigham City. Close proximity to urban areas make this large reservoir a popular location for all season water recreation. It is prounounced "man' a way", and is also known as Brigham City Reservoir.

Mantua Reservoir was created in 1961 by the construction of an earth-fill dam. The reservoir shoreline is 100% publicly owned and administered by Brigham City. Public acessibility is 100% open, but access by vehicle is limited. Water is used for recreation, boating, water skiing, fishing, swimming, water storage for irrigation use, wetlands for birds and aquatic animals, waterfowl habitat and refuge, and hydroelectic generation. Water use is not expected to change in the forseeable future.

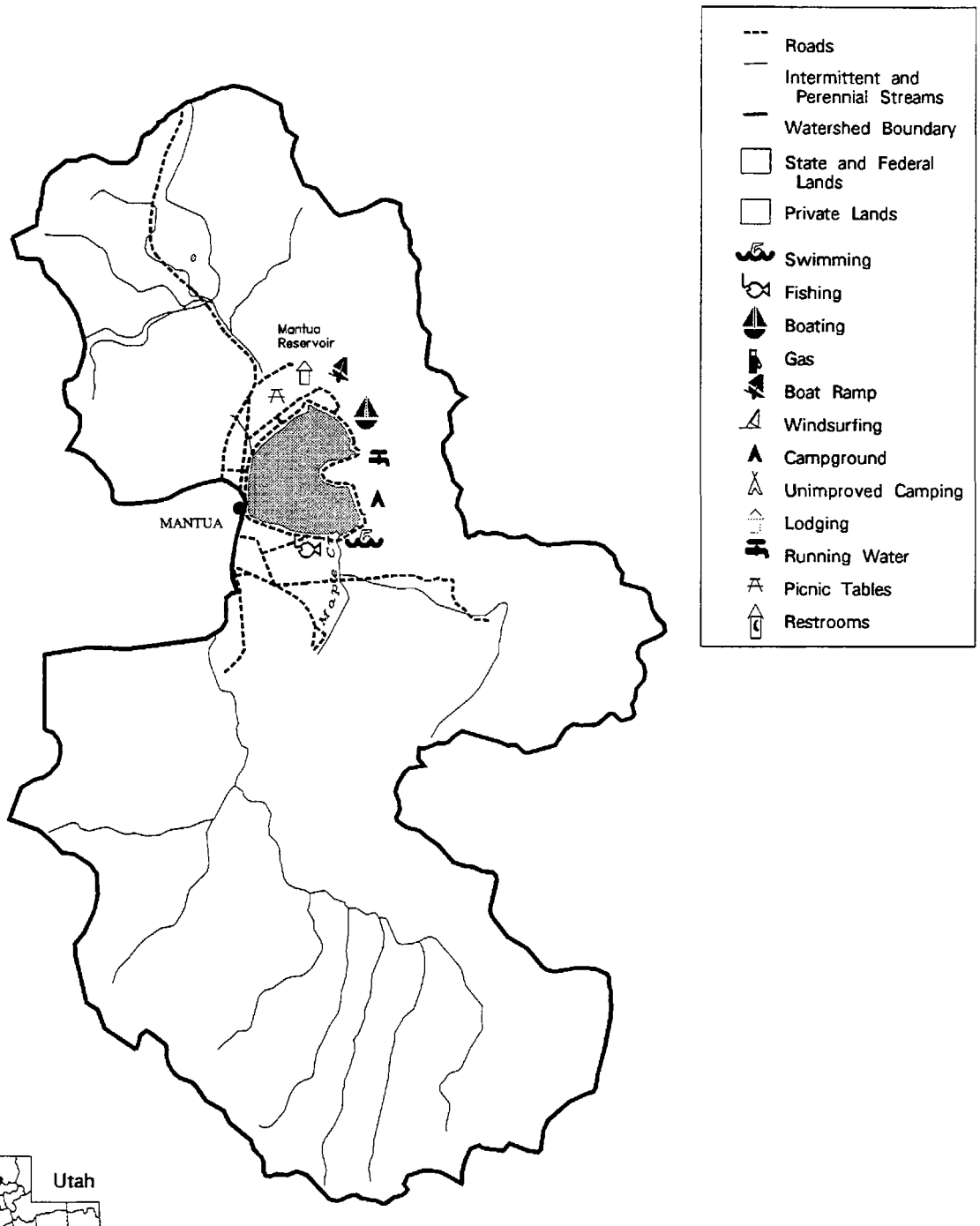
An EPA Section 314 CLean Lakes project was started in 1992 at a cost of $143,000 to assess the water quality and trophic state of Mantua Reservoir. It will identify the

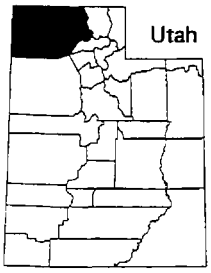
Characteristics and Morphometry

Lake elevation (meters / feet)	1,572 / 5,159
Surface area (hectares / acres)	224.19 / 554
Watershed area (hectares / acres)	2250 / 5559
Volume (m^3 / acre-feet)	
capacity	12,887,997 / 10,450
conservation pool	
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	3,700,506 / 3,000
Depth (meters / feet)	
maximum	6.09 / 20
mean	4.27 / 14
Length (km / miles)	1.809 / 1.12
Width (km / miles)	1.64 / 1.02
Shoreline (km / miles)	3.4 / 2.1

Location

County	Box Elder
Longitude / Latitude	111 55 57 / 41 30 12
USGS Map	Mantua, 1991, Mount Pisgah, 1955
DeLorme's Utah Atlas & Gazetteer™	Page 60, B-3
Cataloging Unit	Lower Bear-Malad (16010204)





County in which watershed is located.

1 0 1 2 MILES

1 0 1 2 KILOMETERS

Mantua Watershed

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causes of the existing decline in water quality, evaluate possible solutions to existing or potential pollution problems, recommend the most feasible cost effective alternatives to restore or preserve the quality of the reservoir, and maximize the public benefits associated with water quality and restore the beneficial uses of the water. The project will be completed in 1995, and a report should be published in early 1996.

Recreation

Mantua Reservoir is accessible from US 89 between Brigham City and Logan. It is on the Brigham City side of Sardine Summit at the top of Box Elder Canyon, east of Brigham City. It is only about two miles long and the reservoir is very visable from the the highway. At the top of the canyon, turn off the highway into the community of Mantua, (if you miss this turn, go another mile and make a hard right at the north end of town) turn left at a "T" intersection, and the reservoir is on the right.

There are presently no facilities at the reservoir, but there is a wide, gravely area that is used as a boat ramp. Fishing, boating, sailing, sailboarding, swimming, camping, picnicing, ice fishing, and water skiing are all possible. It is a popular place, with ice fishing contributing to increased usage during the winter.

Watershed Description

Mantua Reservoir is in a small valley that drains out through a small gap in the Wasatch Front. The watershed is entirely visible from the reservoir. While the valley floor is very flat (and the reservoir correspondingly shallow), the valley walls rise with slopes in excess of 50% in most directions.

The watershed high point, Perry Peak, located southwest of the reservoir, is 2,501 m (8,207 ft) above sea level, thereby developing a complex slope of 17.9 % to the reservor. The average stream gradient for Maple Creek above the reservoir is less than 1% (37 feet per mile). Inflows include an unnamed stream to the northeast, groundwater pump discharge, Dam Creek, Spring #1, Spring #2, Spring #3, Rock Spring, Maple Creek, and an unnamed stream above Maple Creek. It appears that water may also be diverted from Box Elder Creek through Mantua Reservoir. There are no upstream impoundments.

The watershed is made up of mountains and mountain valleys. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of sagebrush-grass, cottonwoods, willows, and scattered conifers. The watershed receives 64 cm (25 inches) of precipitation annually. The frost-free season around the reservoir is 120 - 140 days per year.

Estimated land uses within the watershed as percent or relative composition are: Grazing - 86%; irrigated agricultural - 13%; and dairy operations and barnyards - 1%.

Limnological Assessment

The water quality of Mantua Reservoir is poor with significant water quality impairments present. It is considered

Limnological Data

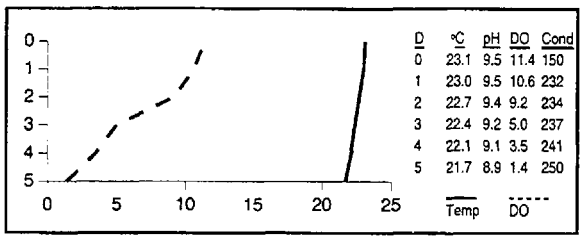
Data averaged from STORET sites: 490044, 490045, 490046

Surface Data	1980	1990	1991
Trophic Status	H	E	E
Chlorophyll TSI	-	58.37	61.04
Secchi Depth TSI	73.20	45.38	45.38
Phosphorous TSI	57.34	61.02	68.04
Average TSI	65.27	54.93	58.05
Chlorophyll a (ug/L)	-	17.6	65.4
Transparency (m)	0.29	2.8	2.4
Total Phosphorous (ug/L)	33.4	52	95
pH	-	9.7	9.1
Total Susp. Solids (mg/L)	23	<3	<3
Total Volatile Solids (mg/L)	-	-	7
Total Residual Solids (mg/L)	-	-	13
Temperature (°C / °f)	17/63	23/74	19/67
Conductivity (umhos.cm)	312	252	244
Water Column Data			
Ammonia (mg/L)	0.08	0.04	0.09
Nitrate/Nitrite (mg/L)	0.47	0.03	0.02
Hardness (mg/L)	146	141	141
Alkalinity (mg/L)	139	133	131
Silica (mg/L)	4.0	-	8.0
Total Phosphorous (ug/L)	42	57	100
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	8	6.5	3.9
Stratification (m)	NO	NO	NO
Depth at Deepest Site (m)	7	5	5.0

to be moderately hard with a hardness concentration value of approximately 143 mg/L (CaCO3). Those parameters that have exceeded State water quality standards for defined beneficial uses are phosphorus, dissolved oxygen, temperature and pH. The average concentration of total phosphorus in the water column increased from 42 ug/L (1981) to 100 ug/L (1991). These concentrations have consistantly exceeded the recommended pollution indicator for phosphorus of 25 ug/L. The excessive nutrient loading to the reservoir has increased the productivity to a point that water quality is impaired in the reservoir. As a result a Clean Lakes Phase I study is currently underway to assess impairments and to develop a feasibility plan to control sources of nutrients in the watershed. The high level of nutrients not only drives the production of large blue-green algal blooms but supports the production of extensive macrophytes in the reservoir. They are so abundant that it restricts boating and impairs the fishery. This high state of productivity and the reservoirs shallow nature are responsible for depletion of dissolved oxygen in the water column as indicated in the August 13, 1991 profile. There is a significant loss of dissolved oxygen in the summer and winter. Loss of oxygen results from respiration during the nocturnal period and the decompositon of organic matter(algae and macrophytes) during winter under ice coverage. These conditions are detrimental to the fishery. In addition the temperature regime exceeds the state standard of 20°C for a cold water fishery. The other violation of state standards is excessive pH concentrations which are indicative of high production of algae and the increase associated due to the process of photosynthesis.

Typically the reservoir does not stratify due to the shallow nature of the reservoir. Current data indicates that the reservoir is a nitrogen limited system and in a state of eutrophic to hypereutrophic conditions. Although the data isn't totally conclusive it appears that the nutrient loading to the reservoir have gradually increased in recent years.

According to DWR there were frequent trout fish kills during the 1960's and partial winter kills still occurring. Carp (*Cyprinus carpio*) and other fish were chemically removed in 1983. Largemouth bass (*Micropterus salmoides*), bluegil (*Lepomis macrochirus*)l, and Utah chub (*Gila atraria*) were re-introduced in addition to trout to develop a warm water fishery. According to DWR since 1987 avion predators displaced by the flooding on the Great Salt Lake have had a detrimental effect on the bass and bluegill population. Until the birds return to the recovering marshes they may continue to have a detrimental impact on the fishery in Mantua. Recent stocking reports also indicate that the reservoir is stocked annual with 1,000 catchable rainbow trout (*Oncorhynchus mykiss*).



Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm³/liter)	% Density By Volume
Aphanizomenon flos-aquae	191.208	99.76
Fragilaria crotonensis	0.458	0.24
Total	191.658	
Shannon-Weaver [H']	0.02	
Species Evenness	0.02	
Species Richness	0.04	

The phytoplankton commnunity is dominated primariy by blue-green algael indicative of the highly eutrophic conditions and the impaired water quality.

Pollution Assessment

Nonpoint pollution sources include grazing, recreation, construction activities, and agricultural runoff. Agricultural land is predominant in the watershed with some small feedlots and dairies within the watershed area. Agricultural activities contribute to the nutrient loading by movement of soils from erosion and animal waste materials in the reservoir.

There is one point source of pollution, Mantua Fish Hatchery, that discharges into Maple Creek, a tributary of Mantua Reservoir. An additional discharge to the reservoir is a pump station on the northern end of the reservoir. Preliminary indication show the water is high in nutrient concentrations. It results from Brigham City pumping agricultural runoff into the reservoir. This source of nutrients is receiving further attention. The cessation of this practice should result in improving water quality of Mantua Reservoir

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Beneficial Use Classification

The state beneficial use classifications include: culinary water (1A), boating and similar recreation (excluding swimming) (2B), cold water game fish and aquatic life (3A) and agricultural uses (4).

The fishery and other recreation uses are considered moderately impaired with occasional severe acute impacts evident. The fishery is impaired due to extensive algal blooms and macrophyte production. The fishery and other recreational components are impacted due to the high enrichment of the waters of the reservoir. These high levels of nutrients lead to high algal production and macrophye development. High algal production reduced dissolved oxygen concentrations and create other problems associated with the fishery. Lake summer and fall macrophyte conditions inhibit recreational uses, not only as a fishery but other recreational uses typically supported at the reservoir.

If restoration is to be effective, a watershed management program should address primary pollutants currently or potentially affecting the ecosystem, mass loads of the selected contaminant(s), and the sources of these loads. Some idea of the amount of load reduction possible through available control methods is also necessary. Control efforts should be directed at those sources which are most significant and cost effective.

Information

Management Agencies	
Wasatch Front Regional Council	292-4469
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Golden Spike Empire Travel Region (Ogden)	627-8288
Brigham City Chamber of Commerce	723-3931
Reservoir Administrators	
Brigham City	723-3146

MARSH LAKE

Introduction

Marsh Lake is in a glacial valley on the north slope of the Uinta Mountains. It is a natural impoundment, formed by a dam of lateral moraine--glacial rubble. (The China Lake report has a complete description of the process of glaciation.) Marsh Lake is a small lake in the Smiths Fork valley, four miles from the Wyoming state line. It is in a cluster of four lakes and reservoirs, also including Stateline Reservoir, Bridger Lake, and China Lake. The reservoir shoreline is 100% publicly owned by the Wasatch-Cache National Forest. Public access is unrestricted. The passage of water through the lake is unregulated by man.

Characteristics and Morphometry

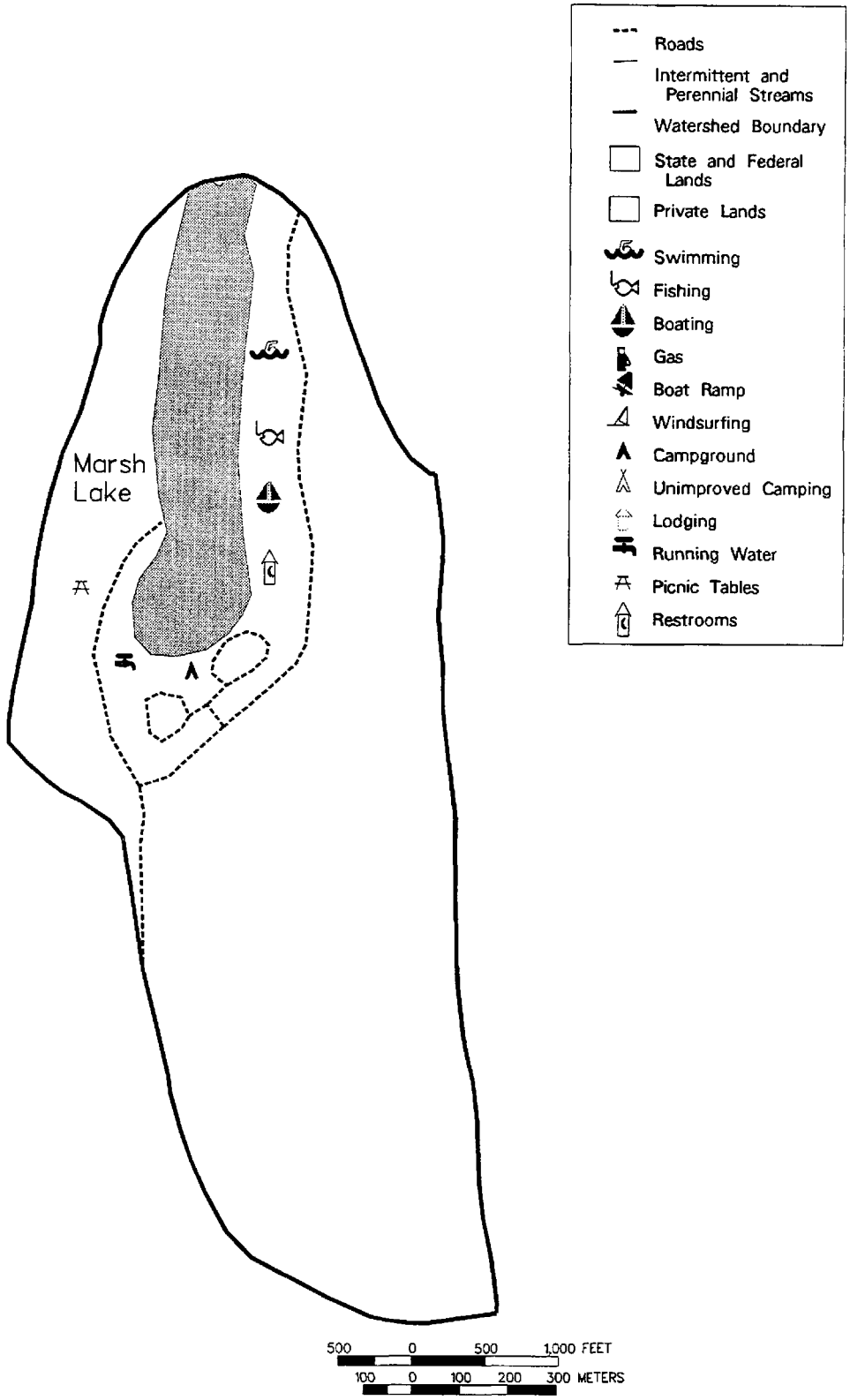
Lake elevation (meters / feet)	2,845 / 9,335
Surface area (hectares / acres)	15.38 / 38
Watershed area (hectares / acres)	67 / 166
Volume (m^3 / acre-feet)	
capacity	246,700 / 200
conservation pool	
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	82,600 / 67
Depth (meters / feet)	
maximum	10.67 / 35
mean	4.57 / 15
Length (meters / feet)	975 / 3,200
Width (meters / feet)	183 / 600
Shoreline (km / miles)	2.13 / 1.3

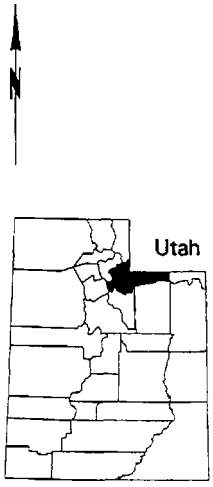
Location

County	Summit
Longitude / Latitude	110 23 42 / 40 57 29
USGS Map	Bridger Lake, UT / WY 1967
DeLorme's Utah Atlas and Gazetteer™	Page 55, A-5
Cataloging Unit	Black's Fork (1404017)

Recreation

Bridger Lake in the Smiths Fork drainage, 30 miles east of U-150 on the North Slope Road (FS-058). It is also accessible from Mountain View, Wyoming. Go south from Mountain View on the paved road towards Robertson (not towards Lonetree). At the second 90° bend to the west(about 5 miles from Mountain View), leave the highway,





County in which watershed is located.

Marsh Watershed

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continuing south on a gravel road that becomes FS-072.

FS-072 and FS-058 join at China Meadows Campground. Marsh Lake is 2 miles north of the campground on FS-072 (and 4 miles south of the Wyoming State Line). The route to the China Meadows is well marked.

The lake offers fishing, boating and some degree of solitude. The water is too cold for most swimmers. Fishing is popular, and small boats can be carried in from the road.

Marsh Lake Campground, administered by the Forest Service, has 32 campsites, drinking water, and primitive latrines. There are several other USFS campgrounds in the vicinity, including Stateline, Trail Head, Bridger Lake, China Meadows, and Smiths Fork Trail Head. This area is a popular access to the High Uinta Wilderness, so campgrounds are heavily used in the summer.

Watershed Description

It might seem odd that the watershed area is so small in comparison to the lake. This is because the lake is the result of variations in the amount of rubble that different parts of the glacier carried. A natural dam was deposited and a lake formed when the glaciers retreated. The basin has probably never been dry, and the retention time is fairly long.

Marsh Lake is in the middle of the valley floor. The valley is about two miles wide and 800' deep. The lake's watershed itself is a tiny, relatively flat portion of the valley floor. There are no perennial inflows.

The watershed high point, the lateral moraine 300m east of the lake, is 2,886 m (9,470 feet) above sea level, thereby developing a complex slope of 3.1% to the reservoir. The outflow joins the outflow from Bridger Lake and joins the East Fork Smiths Fork at Stateline Reservoir (an impoundment of Smiths Fork).

The soil in the watershed is derived from glacial till, and alluvium. It is comprised primarily of debris from the scouring upstream valleys. The till and alluvium is chemically similar to the Precambrian rocks of the High Uintas. See Appendix III for a complete soil description.

The vegetation community is comprised of lodgepole pine and marshlands. The watershed receives 51 - 64cm (20 - 25 inches) of precipitation annually with a frost-free season of 20 - 40 days.

Land use is 100% multiple use. The major use of the watershed is sheep grazing and recreation.

Limnological Assessment

The water quality of Marsh Lake is very good. It is considered to be moderately hard with a hardness concentration value of approximately 120 mg/L ($CaCO_3$). The only parameter that has exceeded State water quality standards for defined beneficial in recent years is dissolved oxygen. Marsh lake is an isolated body of water without a perennial inflow or out flow of water. Historically this lake due to a lack of circulation and exchange of water has stratified in early summer and produced winter fish kills due to anoxic conditions. Although the Lake is oligotrophic with low algal production, anoxic conditions develop which are

Limnological Data

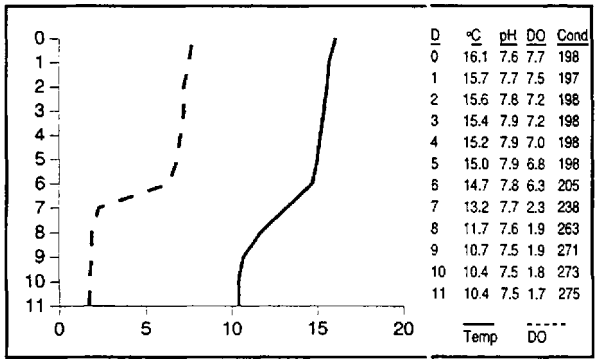
Data sampled from STORET site: 593940

Surface Data	1981	1989	1991
Trophic Status	E	O	O
Chlorophyll TSI	-	32.58	37.40
Secchi Depth TSI	-	32.48	38.33
Phosphorous TSI	53.2	17.35	27.35
Average TSI	53.2	28.14	34.36
Chlorophyll a (ug/L)	-	1.5	2
Transparency (m)	-	7	4.5
Total Phosphorous (ug/L)	30	3	5
pH	8.0	8.2	7.9
Total Susp. Solids (mg/L)	<5	-	<3
Total Volatile Solids (mg/L)	-	-	3.5
Total Residual Solids (mg/L)	-	-	1
Temperature (°C / °f)	18/64	14/57	15/59
Conductivity (umhos.cm)	239	224	204
Water Column Data			
Ammonia (mg/L)	0.3	0.03	0.03
Nitrate/Nitrite (mg/L)	0.48	-	0.01
Hardness (mg/L)	128	-	112
Alkalinity (mg/L)	124	-	109
Silica (mg/L)	-	-	7.2
Total Phosphorous (ug/L)	30	8	7
Miscellaneous Data			
Limiting Nutrient	P	N	N
DO (Mg/l) at 75% depth	4.4	5	2.1
Stratification (m)	2-8	NO	6-8
Depth at Deepest Site (m)	8	10.1	10.1

detrimental to the overwintering of fish. The lake is approximately 10 meters in depth but light penetration occurs to the bottom of the reservoir due to its high clarity. As a result extensive beds of macrophytes develop in the sediments of the lake. The decomposition of these plants and other organic materials provide for extensive oxygen depletion during the winter. This leads to the development of anoxic conditions and fish kills. It is also in an area that has a prolonged and severe winter causing persistant ice coverage. Dissolved oxygen depletions were evident in the September 4, 1991 profile. Below the thermocline concentrations quickly drop to 1.7 mg/L near the bottom. A review of a profile obtained on April 10, 1990 shows a concentration of 3.0 mg/L at 1 meter and virtually 1.2 mg/L from 2 to 10.5 meters. In an effort to offset the high oxygen demand during the winter the USFS had installed a circulator. They have only achieved marginal success due to vandalism and problems associated with it. Even though the lake still winter kills most winters, it has very productive water during the summer.

Although in 1981 the reservoir was characterized as a phosphorus limited system, the 1989-91 data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is oligotrophic in recent years.

According to DWR fish kills occur annually with a total loss evident most years. The DWR typically stocks the reservoir annually with 4,000 catchable rainbow trout (Oncorhunchus mykiss), and 1,500 catchable albino rainbow trout (*Oncorhynchus mykiss*). The lake was treated for rough fish competition in 1954, so populations of native fishes may not be present in the lake as indicated when DWR staff found brook trout (*Salvelinus fontinalis*) in 1980. Marsh Lake is maintained for recreation and fishery purposes. This popularity is due in part to its easy access and close proximity to the High Uintas Primitive Area.



D	°C	pH	DO	Cond
0	16.1	7.6	7.7	198
1	15.7	7.7	7.5	197
2	15.6	7.8	7.2	198
3	15.4	7.9	7.2	198
4	15.2	7.9	7.0	198
5	15.0	7.9	6.8	198
6	14.7	7.8	6.3	205
7	13.2	7.7	2.3	238
8	11.7	7.6	1.9	263
9	10.7	7.5	1.9	271
10	10.4	7.5	1.8	273
11	10.4	7.5	1.7	275

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm³/liter)	% Density By Volume
Sphaerocystis schroeteri	18.487	98.91
Melosira granulata	0.054	0.29
Centric diatoms	0.050	0.27
Oocystis sp.	0.041	0.22
Euglena sp.	0.040	0.22
Pennate diatoms	0.016	0.09
Total	18.688	
Shannon-Weaver [H']	0.08	
Species Evenness	0.04	
Species Richness	0.26	

Information

Management Agencies	
Wasatch-Cache National Forest	524-5030
Mountain View Ranger District	307-782-6555
Mountainlands Association of Governments	377-2262 / 534-0772
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Mountainland Travel Region (Provo)	377-2262
Reservoir Administrators	
Division of Wildlife Resources	538-4700

The phytoplankton commnunity is dominated by the presence of green algae which is indicative of its trophic status and its good water quality.

Pollution Assessment

Nonpoint pollution sources include sedimentation and nutrient loading from grazing, and wastes or litter from recreation. Cattle graze in the watershed and around the reservoir.

There are no point pollution sources in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

MARSHALL LAKE

Introduction

Marshall Lake is a small, natural lake in the western High Uintas. Biologically and geologically it is comparable to hundreds of similar lakes in the High Uintas. It is included in this report for that reason and because it is accessible by vehicle. It is near the Mirror Lake area, but accessible from the Murdock Basin Road. It has two sister lakes, Shepherd and Hoover. Hoover is also included in this report.

The lake shoreline is owned by the Wasatch-Cache National Forest, and public access is unrestricted. The lake drainage is part of the headwaters of the Duchesne River.

Characteristics and Morphometry

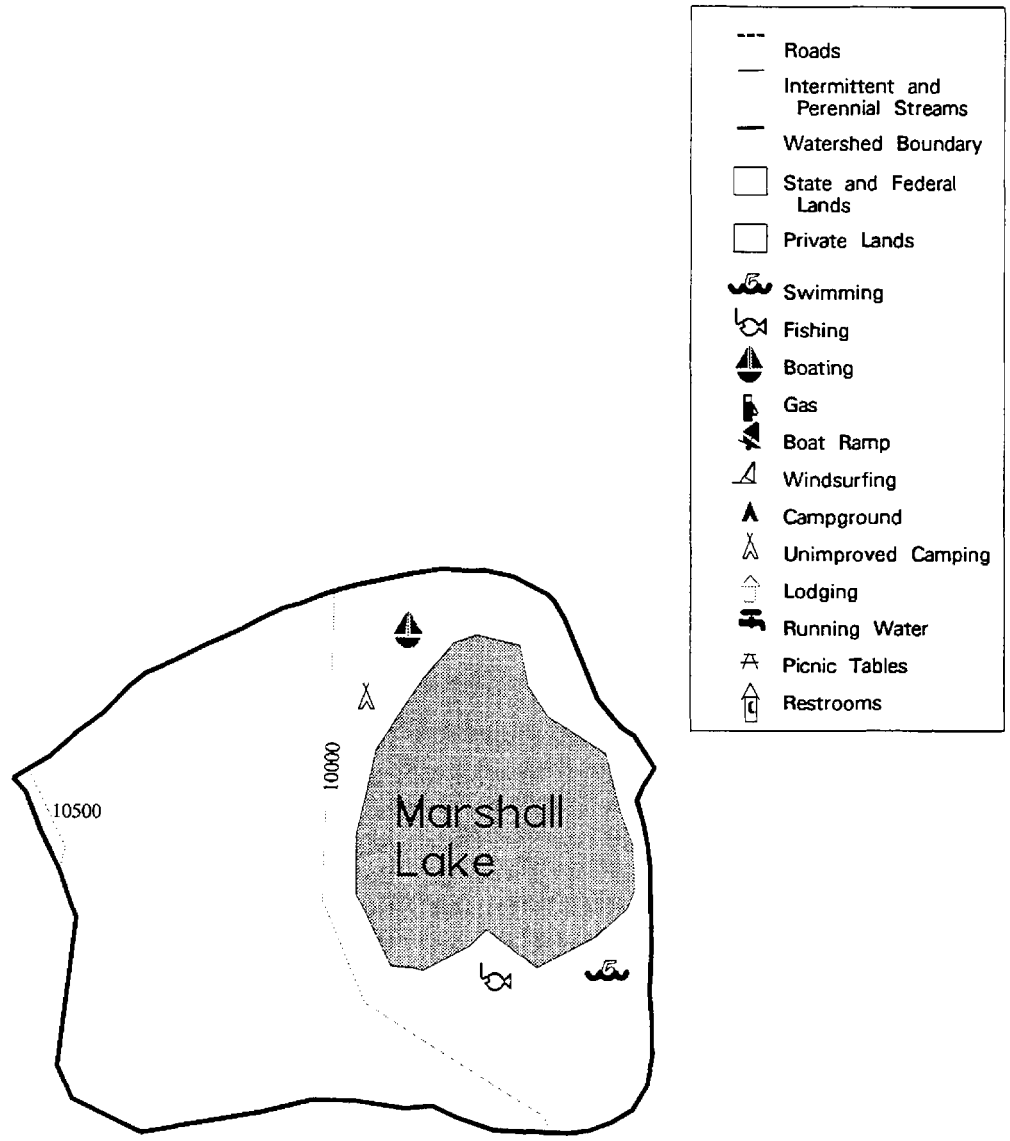
Lake elevation (meters / feet)	3,045 / 9,990
Surface area (hectares / acres)	7 / 18
Watershed area (hectares / acres)	43 / 106
Volume (m^3 / acre-feet)	
capacity	310,842 / 252
conservation pool	
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	11 / 36
mean	4.3 / 14
Length (meters / feet)	35 / 1,150
Width (meters / feet)	305 / 1,000
Shoreline (meters / feet)	1,189 / 3,900

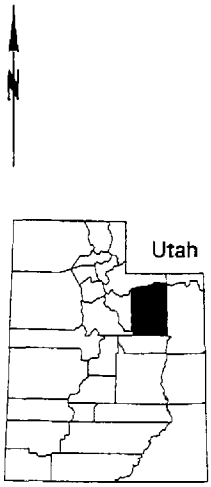
Location

County	Duchesne
Longitude / Latitude	110 52 25 / 40 40 32
USGS Map	Hayden Peak, UT 1972
DeLorme's Utah Atlas & Gazetteer™	Page 54, B-3
Cataloging Unit	Duchesne (16060003)

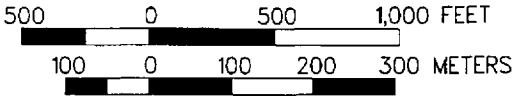
Recreation

Marshall Lake is accessible by a two mile hike from the Moosehorn Campground, just south of Mirror Lake. Follow the trail to the east and south to Shepherd Lake, then go due south along the base of the escarpment (a good map and a compass are helpful) for several hundred meters to Marshall Lake. To get there by vehicle take the Murdock Basin turnoff (about 21 miles east of Kamas or 10 miles southwest from Mirror Lake). Follow FS-027 and then FS-





County in which watershed is located.



Marshall Lake Watershed

<k71>

137 (gravel roads) for about 8 miles. About 1/2 mile before the end of the road, (there are probably no signs) there is a turnoff which leads due west for about 1/4 mile to the lake. The lake is approximately 100 yards to the northwest..

Fishing, camping, picnicking, scenic beauty and hiking are all popular. The lake is too small for motorized boats. Air and water temperatures are too cold for most swimmers. The backdrop of high, barren peaks are reflected in the still water of the lake.

The area receives heavy recreational use throughout the summer. Tread lightly so that the area remains relatively pristine. U-150 is closed during the winter and much of the spring, but groomed for cross country skiers and snowmobilers.

There are no recreational facilities at the lake, but there are campgrounds on U-150. If you camp in the area, pack out your trash.

Watershed Description

Marshall Lake is located in the western end of the High Uintas. The watershed is very small. The lake is perched on a bench high on the Duchesne River Gorge, and at the foot of Murdock Mountain, a 500' high rocky escarpment. The area is densely forested, interspersed with rocky peaks and barren peaks. In this area of the Uintas, glaciation has removed the majority of the high mountains, with isolated peaks remaining.

The watershed high point, the south arm of Murdock Mountain, is 3,286 m (10,780 ft) above sea level, thereby developing a complex slope of 55.8% to the reservoir. There are no streams flowing into the lake, but because of the high elevation, snowmelt runoff flows into the summer period. There is no surface outflow.

The watershed is made up of high mountains and rocky outcroppings. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of pine, oak, maple, spruce-fir, aspen, and alpine. The watershed receives 76 - 102 cm (30 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 0 - 20 days per year.

The watershed is 100% recreation. The watershed is too high and rocky to be of any other use.

Limnological Assessment

The water quality of Marshall Reservoir is very good. It is considered to be very soft with a hardness concentration value of approximately 8.5 mg/L ($CaCO_3$). Although there are no average water column concentrations that exceed State water quality standards, there are violations of parameters near the bottom of the lake. These parameters include phosphorus, dissolved oxygen and pH. At various times of the year, the hypolimnion of the lake develops oxygen deficiencies. Most of the occurrence are noted during the first monitoring trip usually in June. It may be that anoxic conditions developed during the winter are still exerting an influence in lower depths of the reservoir. There are also some low dissolved oxygen values reported during late summer. These values typically are in the 2-3 mg/L range. Total phosphorus values reported in the hypolimnion are slightly higher than the recommended pollution indicator value of 25 ug/L with values reported in the range of 40 ug/L. The pH values have dipped to a low of 5.2 on one occasion. Although these exceedences have occurred, it does not appear that the water quality is significantly impaired. It does indicate that some winter monitoring should be conducted to determine the extent of impairment present during extended ice coverage.

Stratification in the lake does occur. Although the profile shown of August 5, 1992 does not show it, stratification has been evident during other years. As stratified conditions develop they will contribute to the process of oxygen loss as previously discussed. Current data suggest that the

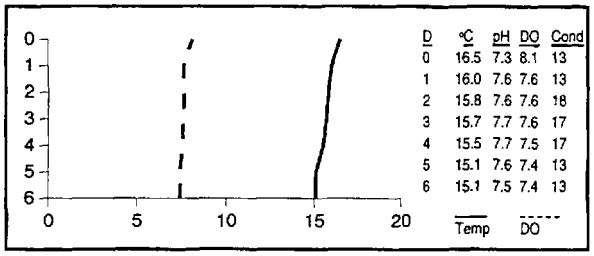
Limnological Data

Data sampled from STORET site: 593592

Surface Data	1981	1990	1992
Trophic Status	M	O	O
Chlorophyll TSI	-	34.90	26.37
Secchi Depth TSI	38	39.32	34.79
Phosphorous TSI	47	34.57	27.35
Average TSI	42.5	36.26	29.50
Chlorophyll a (ug/L)	-	1.6	0.6
Transparency (m)	4.5	4.2	5.8
Total Phosphorous (ug/L)	20	8	5
pH	8.1	7.1	6.7
Total Susp. Solids (mg/L)	<5	<3	<3
Total Volatile Solids (mg/L)	-	-	0
Total Residual Solids (mg/L)	-	-	3
Temperature (°C / °f)	16/61	16/60	15/58
Conductivity (umhos.cm)	11	9	15
Water Column Data			
Ammonia (mg/L)	0.05	0.03	0.03
Nitrate/Nitrite (mg/L)	0.06	-	0.03
Hardness (mg/L)	10	7.9	7.6
Alkalinity (mg/L)	6	23	5
Silica (mg/L)	-	-	0.5
Total Phosphorous (ug/L)	20	17	12
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	6.6	5.1	7.5
Stratification (m)	2-6	5-7	NO
Depth at Deepest Site (m)	9	10	5.5

reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is oligotrophic in a state of low productivity.

According to DWR no fish kills have been reported in recent years. The reservoir supports a population of brook trout (*Salvelinus fontinalis*) The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake.



D	°C	pH	DO	Cond
0	16.5	7.3	8.1	13
1	16.0	7.6	7.6	13
2	15.8	7.6	7.6	18
3	15.7	7.7	7.6	17
4	15.5	7.7	7.5	17
5	15.1	7.6	7.4	13
6	15.1	7.5	7.4	13

The DWR stocked the lake most recently in 1990 with 1,800 fingerling brook trout.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Bluegreen unicell	0.193	32.25
Chroococcus sp.	0.161	26.88
Anabaena sp.	0.111	18.54
Oocystis sp.	0.075	12.51
Chroococcus limneticus	0.028	4.63
Centric diatoms	0.023	3.89
Pennate diatoms	0.008	1.30
Total	0.597	
Shannon-Weaver [H']	1.62	
Species Evenness	0.78	
Species Richness	0.35	

The phytoplankton community is dominated by the presence of blue-green algae and flagellates. This is due to the fact that the system is nitrogen limited and although low in productivity, blue-greens are able to fix atmospheric nitrogen as required.

Pollution Assessment

Nonpoint pollution sources is primarily associated with recreation.

There are no point sources of pollution in the watershed.

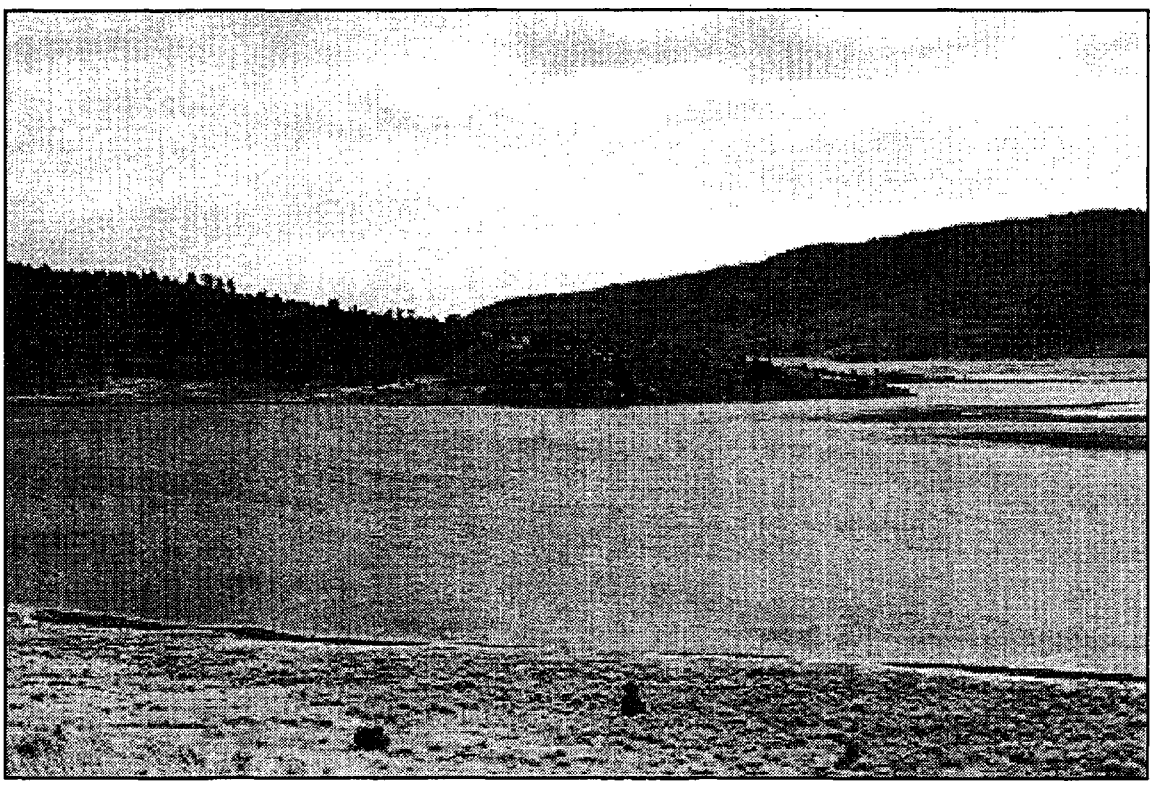
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Uinta Basin Association of Govemments	722-4518
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Wasatch-Cache National Forest	524-5030
Kamas Ranger District	783-4338
Recreation	
Dinosaurland Travel Region (Vernal)	798-6932

MATT WARNER RESERVOIR



Introduction

Matt Warner Reservoir is a medium sized stabilized lake on Pot Creek in extreme northeastern Utah. It was built for agricultural purposes, but was purchased by the DWR to provide a fishery for the public. Although it is far removed from any metropolitan areas, it is near Flaming Gorge National Recreational Area and is a popular fishing spot. This area is also prime elk habitat. Elk herds are commonly seen while driving around the area. Crouse and Calder Reservoirs are also stabilized lakes owned by the DWR in the same drainage.

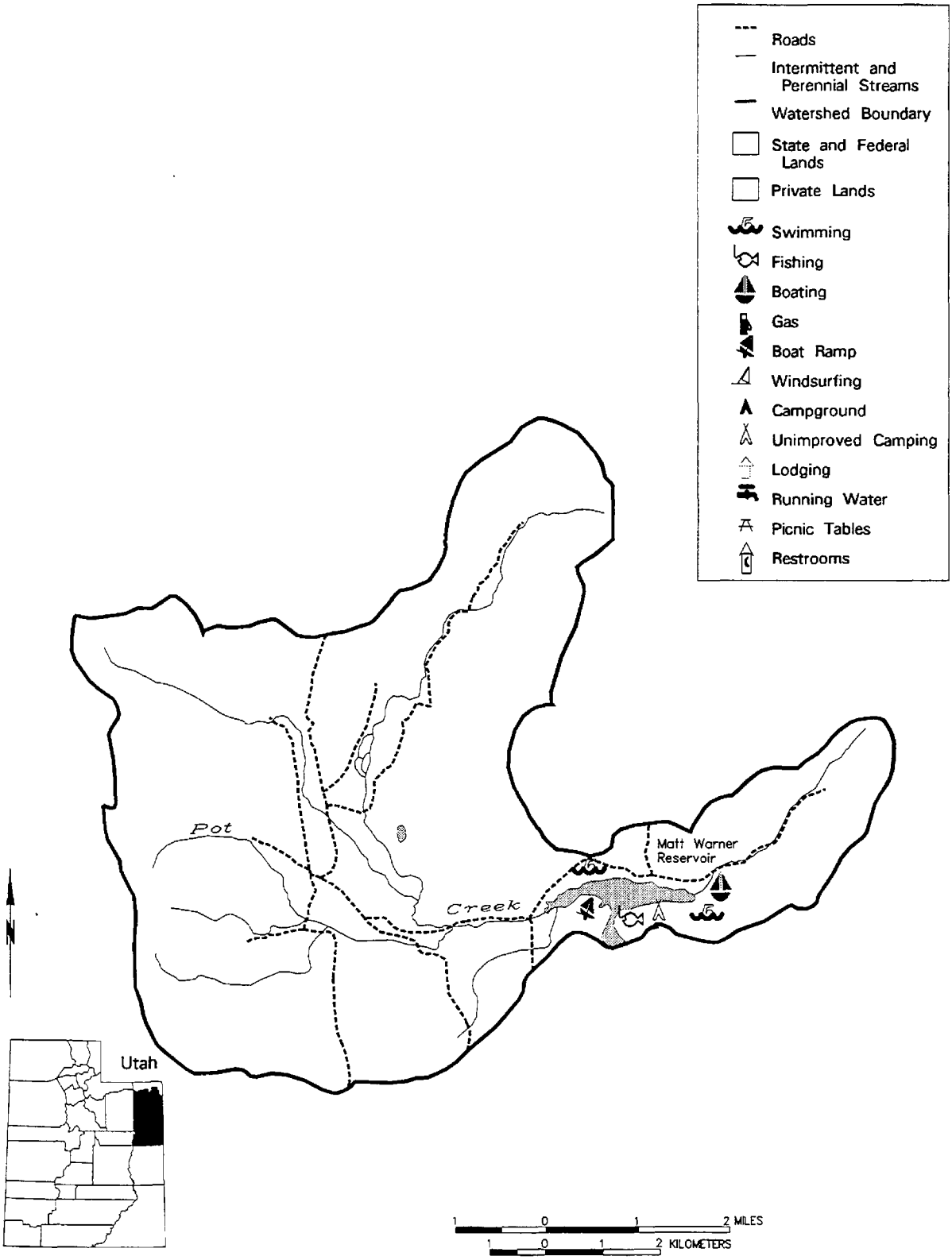
Matt Warner Reservoir was created in 1938 and modified in 1986 by the construction of an earth-fill dam. The reservoir shoreline is primarily privately owned, but public access is unrestricted. The DWR purchased the reservoir in 1978 for use as a fishing lake. It no longer functions as a reservoir, but as a lake. It is now held at full pool thus enhancing the fishery.

Characteristics and Morphometry

Lake elevation (meters / feet)	2,298 / 7,540
Surface area (hectares / acres)	120 / 297
Watershed area (hectares / acres)	2,334 / 5,767
Volume (m^3 / acre-feet)	
capacity	3,447,468 / 2,796
conservation pool	3,447,468 / 2,796
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	7.0 / 23
mean	2.9 / 9.4
Length (meters / feet)	2,578 / 8,458
Width (meters / feet)	854 / 530
Shoreline (km / miles)	8.17 / 5.07

Location

County	Uinta
Longitude / Latitude	109 17 49 40 46 24
USGS Map	Jackson Draw, 1967
DeLorme's Utah Atlas & Gazetteer™	Page 57, B-4
Cataloging Unit	(16060001)



County in which watershed is located.

Matt Warner Watershed

<k41>

Recreation

Matt Warner Reservoir is accessible from US 191 between Vernal and Dutch John. From an intersection between mileposts 224 and 225 (10.5 miles south of the U-44/US-191 intersection and 4 miles north of the Red Cloud Loop turnoff), turn east on an improved gravel road (FS-048, signed to Diamond Mountain) and follow it for about 8 miles to where the main road turns right. Go straight, follow the road as it makes a sharp bend to the left, then bears due north for 0.5 miles and another road branches off to the right. Take this right fork for just over three miles, and turn north on an unimproved dirt road for one mile to the reservoir.

Another route is on the Jones Hole Road from Vernal. Travel west on 500 N in Vernal as it goes out of town and winds up Diamond Mountain. Twenty-two miles from Vernal, turn left on a gravel road marked Highway 44 9, Little Hole. (US-191 was originally U-44, and the BLM has not updated the sign). Follow this road for five miles, then turn north on another gravel road where the main road forks to the west. (If in doubt, use a compass). This road joins the above mentioned right fork after two miles, (turn right) and turn left in 2.5 miles to the reservoir.

Because of the lack of signs, a compass and the USGS 1:100,000 Dutch John map are highly recommended. The DeLorme's Utah Atlas and Gazetteer is a reasonable substitute.

Fishing is the primary use of the reservoir. It is well stocked, and the DWR maintains a boat ramp.

Recreational facilities at the reservoir include latrines and a boat ramp. There are no private or public campgrounds nearby.

Watershed Description

Matt Warner Reservoir is located in an area of rolling hills and flat valley bottoms. The Uintas are lower in this area

Slopes in the Pot Creek drainage are not steep (30% maximum) and very little erosion is occurring. There are some mid-elevation mountains at the headwaters of Pot Creek, but these are small compared to the higher mountains several miles further west.

The watershed high point, the east shoulder of Mount Lena, is 2,832 m (9,292 ft) above sea level, thereby developing a complex slope of 5.5% to the reservoir. The average stream gradient of Pot Creek is 0.9% (48 feet per mile) The inflow and outflow is Pot Creek.

The watershed is made up of mountains and mountains meadows. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of spruce-fir, aspen and grasslands. The watershed receives 41 - 51 cm (16 - 20 inches) of precipitation annually. The frost-free season around the reservoir is 60 - 80 days per year.

Land use in the watershed is rangeland on the privately owned areas (about 50%) and multiple use (rangeland and recreation) in the areas owned by the BLM and the Forest Service (about 25% each).

Limnological Assessment

The water quality of Matt Warner Reservoir is fairly good. It is considered to be moderately hard with a hardness concentration value of approximately 82 mg/L ($CaCO_3$). The only parameters that have exceeded State water quality standards for defined beneficial uses are phosphorus. The average concentration of total phosphorus in the water column in 1992 was 86 ug/L which exceeds the recommended pollution indicator for phosphorus of 25 ug/L. The phosphorus concentration in the hypolimnion was 98 ug/L in late summer, but has reached a level of 138 ug/L during March, 1991 under the ice. This increased

Limnological Data

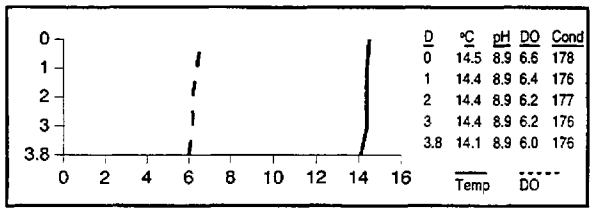
Data sampled from STORET sites:
593785, 593786

Surface Data	1992
Trophic Status	E
Chlorophyll TSI	45.76
Secchi Depth TSI	46.27
Phosphorous TSI	68
Average TSI	53.35
Chlorophyll a (ug/L)	4.7
Transparency (m)	2.83
Total Phosphorous (ug/L)	84
pH	8.3
Total Susp. Solids (mg/L)	3.3
Total Volatile Solids (mg/L)	1
Total Residual Solids (mg/L)	3
Temperature (°C / °f)	15/59
Conductivity (umhos.cm)	179
Water Column Data	
Ammonia (mg/L)	0.12
Nitrate/Nitrite (mg/L)	0.02
Hardness (mg/L)	82
Alkalinity (mg/L)	86
Silica (mg/L)	7.7
Total Phosphorous (ug/L)	86
Miscellaneous Data	
Limiting Nutrient	N
DO (Mg/l) at 75% depth	6.2
Stratification (m)	NO
Depth at Deepest Site (m)	3.8

concentration occurred due to anoxic conditions at the time. A review of a March 14, 1991 profile indicates that the dissolved oxygen concentration throughout the water column was near the 0.2 m/L except at the 1 meter depth where it was 1.6 mg/L. These conditions may be detrimental to an overwintering fish population.

The natural shallowness of the reservoir limits the opportunity for stratification to develop. Current data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is eutrophic with fairly high productivity.

According to DWR frequent fish kills have been reported in recent years during the winter period. Recent



stocking reports indicate that the reservoir is stocked annually with a combination of fingerling and catchable rainbow trout (*Oncorhynchus mykiss*). The last report indicated 50,000 fingerling and 5,000 catchable were placed in the reservoir. The reservoir has not been chemically treated by the DWR , so populations of native fishes may still be present in the lake.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	7.923	93.96
Microcystis aeruginosa	0.245	2.90
Stephanodiscus niagarae	0.176	2.09
Pennate diatoms	0.067	0.79
Centric diatoms	0.018	0.21
Oocystis sp.	0.004	0.05
Total	8.429	
Shannon-Weaver [H']	0.30	
Species Evenness	0.17	
Species Richness	0.22	

The phytoplankton community is dominated by green algae but there are blue-green algae present. This indicates that the water quality of the reservoir is fairly good.

Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Dinosaurland Travel Region (Vernal)	789-6932
Vernal Chamber of Commerce	789-1352
Reservoir Administrators	
Division of Wildlife Resources	538-4700

Pollution Assessment

Nonpoint pollution sources include sedimentation and nutrient loading from grazing and litter or wastes from recreation.

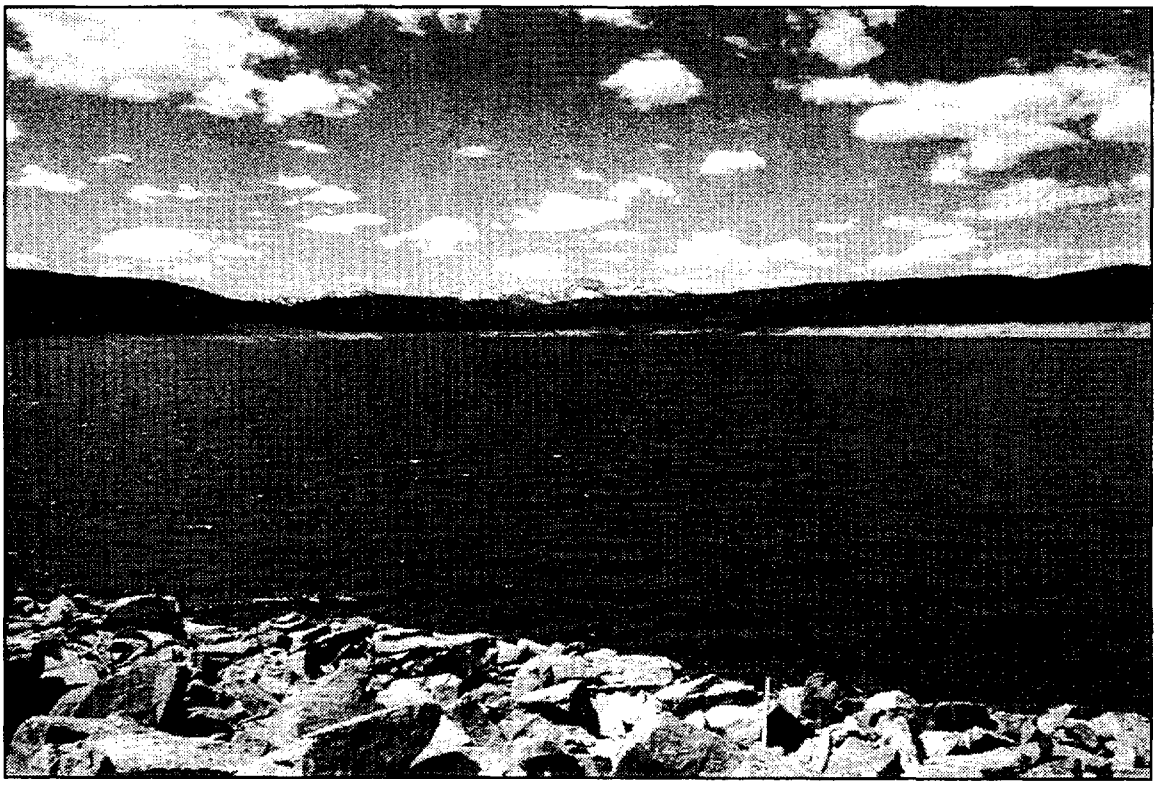
Grazing takes place throughout the watershed and in the vicinity of the reservoir, however the area immediately adjacent to the reservoir is fenced.

There are no point sources of pollution in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

MEEKS CABIN RESERVOIR



Introduction

Meeks Cabin Reservoir is a large reservoir built by the Bureau of Reclamation in the late 1970's to provide agricultural water to southwestern Wyoming. Only the extreme upstream end of the reservoir is in Utah, but because is on the north slope of the Uinta Mountains and receives heavy recreational use by Utahns, it is included in this report.

It was created by the construction of an earth-fill dam, impounding the Blacks Fork River. The shoreline is owned by the Bureau of Reclamation and the Ashley National Forest.

Characteristics and Morphometry

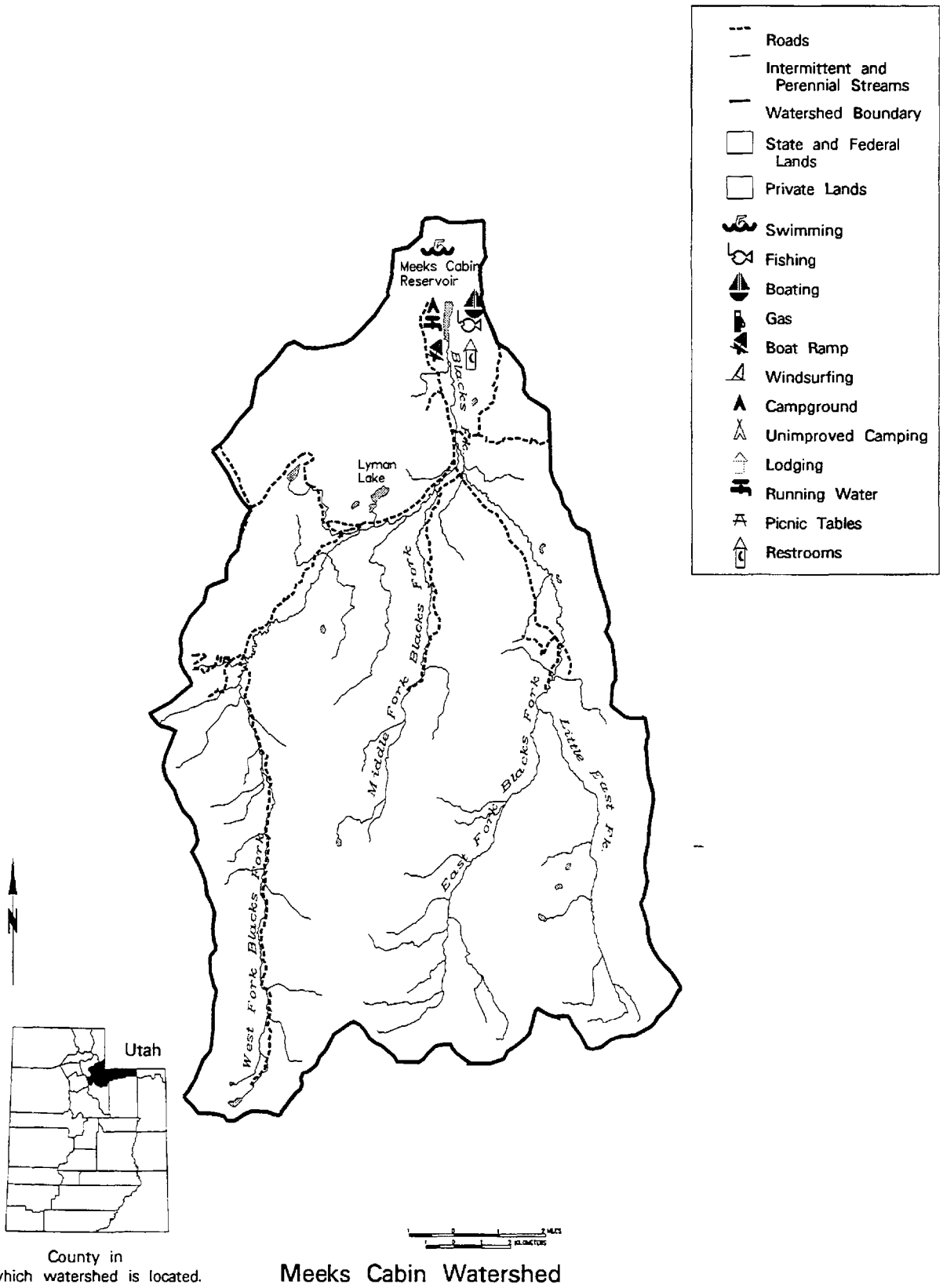
Lake elevation (meters / feet)	2,658 / 8,720
Surface area (hectares / acres)	193 / 477
Watershed area (hectares / acres)	32,842 / 81,152
Volume (m^3 / acre-feet)	
capacity	40,051,807 / 32,470
conservation pool	
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	
mean	20.7 / 68
Length (meters / feet)	4,020 / 13,190
Width (meters / feet)	805 / 2,641
Shoreline (meters / feet)	

Location

County	Summit (UT), Uinta (WY)
Longitude / Latitude	
USGS Map Lyman Lk, UT/WY,1967; Meeks Cabin Res, WY 1965	
DeLorme's Utah Atlas and Gazetteer™	Page 55, A-4
(Not in atlas, but located where Blacks Fork crosses into Wyoming)	
Cataloging Unit	Black's Fork (14040107)

Recreation

Meeks Cabin Reservoir is in the Blacks Fork drainage, 21 miles east of U-150 on the North Slope Road (FS-058). The road bends north at Blacks Fork. Continue north rather than turning right to continue on the north slope road. The reservoir is about 3 miles north of the north slope road turnoff.



County in which watershed is located.

Meeks Cabin Watershed

It is also accessible from Robertson, Wyoming. From Robertson, go west for 4.5 miles to where the pavement ends. The road forks into three gravel roads. Take the left fork, which is likely the most heavily traveled. The reservoir is 13 miles south on this road.

The reservoir offers fishing, boating and solitude. The water is too cold for most swimmers. Fishing is popular, and there is an improved boat ramp.

Meeks Cabin Campground, administered by the Forest Service, is on the west sine of the lake in Wyoming with 25 campsites, running water, and toilet facilities.

Watershed Description

Meeks Cabin Reservoir is at the northernmost reach of the glaciers that flowed down Blacks Fork. The valley is relatively shallow (500' deep), but quite wide (2 miles). The valley bottom is composed of terminal, medial and lateral moraines, resulting in uneven topography. The dam is built where the river cut a notch through the terminal moraine. The valley is forested, with numerous lakes and marshes impounded by moraines. Lyman Lake, also included in this report, is south of the Right Fork.

Midway from the dam to the headwaters, the streams cut across a series of hogback ridges exposed at the margins of the Precambrian rocks that compose the High Uintas. These narrow bands of other strata offer geologic and topographic diversity not found in the Tertiary sediments to the north or the Uintas themselves. This is the approximate delineation of the wilderness area, although in this watershed the boundary is several miles south of the hogbacks.

The southern half of the watershed is in the High Uintas. Four large valleys converge to form Blacks Fork--Little Left Fork, Left Fork, Middle Fork, and Right Fork. These occupy deep, wide glaciated valleys with many cirques cut into the interdigitating ridges. Most of the ridges exceed 12,000' elevation. Much of this area is part of the High Uintas Wilderness Area, protected from nonsustainable abuse by the Wilderness Act of 1964.

The watershed high point, Mount Lovenia, is 4,012 m (13,219 ft) above sea level, thereby developing a complex slope of 5.4% to the reservoir. The inflow and outflow is the Blacks Fork River. The average stream gradient above the reservoir 1.2% (61 feet per mile).

The soil in the watershed is derived from Tertiary sediments in the northern half and Precambrian rock in the Uintas, with small amounts of others at the interface between the two. Much of the area is covered with sediments processed by glaciers. See Appendix III for a complete soil description.

The vegetation community is comprised of alpine, pine, aspen, spruce-fir, oak, maple and marshland. The watershed receives 51 - 102 (20 - 40 inches) of precipitation annually with a frost-free season of 20 - 40 days.

Land use is 100% multiple use. The major use of the watershed is livestock grazing, recreation, and logging. Most of the watershed is in the Wasatch-Cache National Forest, but there is some private land in the northwest part of the watershed and in the area immediately east and west

Limnological Data

Data averaged from STORET sites: 593977, 593978

Surface Data	1981	1989*	1991
Trophic Status	E	M	M
Chlorophyll TSI	-	40.70	44.90
Secchi Depth TSI	60	43.70	51.58
Phosphorous TSI	47.3	56.97	30.74
Average TSI	53.7	47.12	42.41
Chlorophyll a (ug/L)	-	2.8	4.3
Transparency (m)	1	3.1	1.8
Total Phosphorous (ug/L)	20	39	7
pH	7.5	7.1	7.7
Total Susp. Solids (mg/L)	<5	-	5.5
Total Volatile Solids (mg/L)	-	-	5
Total Residual Solids (mg/L)	-	-	2.0
Temperature (°C / °f)	14/57	11/52	13/56
Conductivity (umhos.cm)	45	69	61
Water Column Data			
Ammonia (mg/L)	0.08	<0.01	0.03
Nitrate/Nitrite (mg/L)	0.10	-	0.17
Hardness (mg/L)	38	-	26.8
Alkalinity (mg/L)	34	-	37.5
Silica (mg/L)	-	-	3.1
Total Phosphorous (ug/L)	20	20	6
Miscellaneous Data			
Limiting Nutrient	N	N	P
DO (Mg/l) at 75% depth	7.4	-	5.2
Stratification (m)	2-3	-	20-21
Depth at Deepest Site (m)	26	-	31

* Data from period 1 only.

of the reservoir.

Limnological Assessment

The water quality of Meeks Cabin Reservoir is very good. It is considered to be very soft with a hardness concentration value of approximately 32 mg/L (CaCO3). Although there are no overall water column concentrations that exceed State water quality standards there are reported violations of dissolved oxygen criteria in the deeper regions of the reservoir which aren't technically included in the standards. As noted in the September 3, 1991 profile there is a general decline in the concentration of dissolved oxygen below the thermocline near the 20 meter depth. It does not appear that this is detrimental to the system but it does indicate an area of concern that needs to be monitored. Data suggest that the reservoir is reservoir has been phosphorus limited but that a shift may be occurring to a nitrogen limited system. TSI values indicate that the reservoir is becoming less productive than in years past and is currently a mesotrophic system.

According to DWR reports the reservoir supports populations of brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*), and cutthroat trout (*Oncorhynchus clarki*). All of these species are know to reproduce naturally within the reservoir and its tributary streams. Rainbow and brook trout are also stocked.

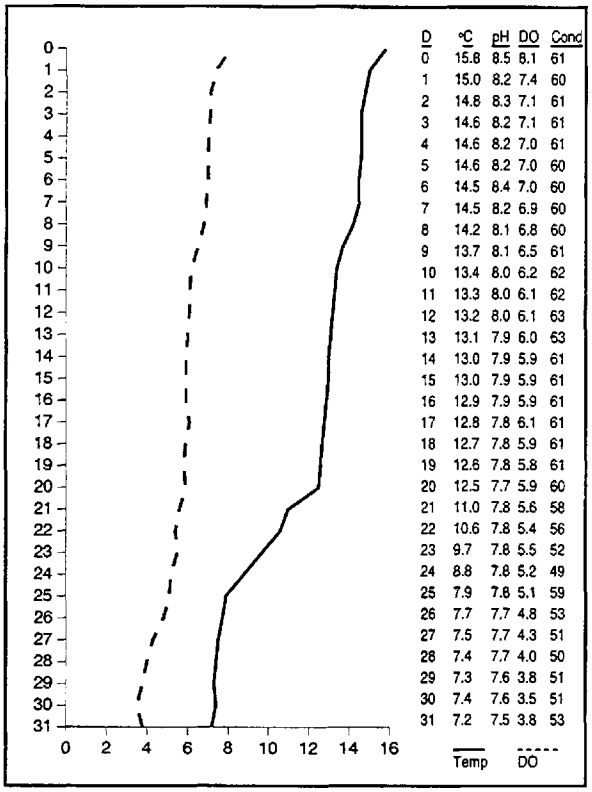
Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Centric diatoms	0.386	95.08
Pennate diatoms	0.020	4.92
Total	0.406	
Shannon-Weaver [H']	0.20	
Species Evenness	0.28	
Species Richness	0.05	

The phytoplankton community is dominated by diatoms which is indicative of good water quality and low productivity.

Pollution Assessment

Nonpoint pollution sources are: sedimentation and nutrient loading from grazing, and human wastes, litter and toxins from recreation. Cattle graze in the watershed and around the reservoir. Currently the Wasatch-Cache and Ashley National Forests are proposing to open the entire north slope of the Uintas to logging and oil drilling. This could put this area at some risk, but most areas of the



Uintas have long stream distances to mitigate impacts, and exploitation would be carefully mitigated to avoid adverse environmental affects, so impact should be minimal.

There are no point pollution sources in the watershed.

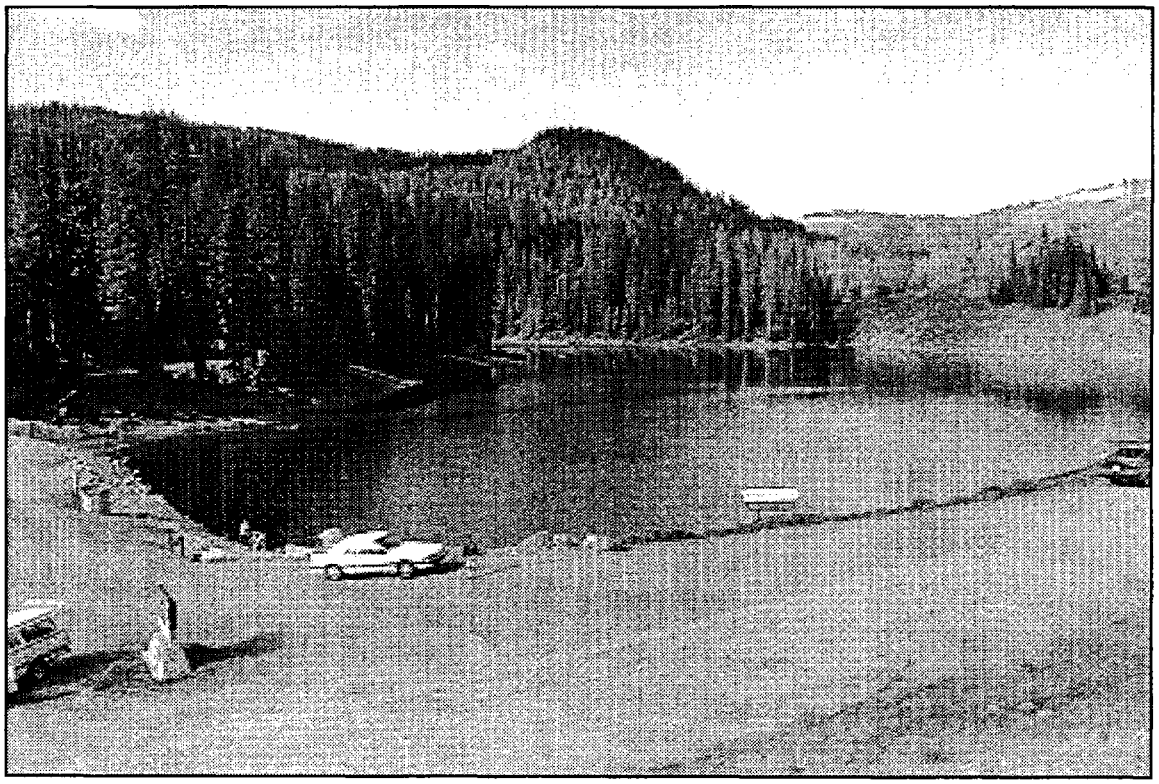
Beneficial Use Classification

Because the dam and outflow are in Wyoming, Utah does not classify the waters of Meeks Cabin Reservoir.

Information

Management Agencies	
Wasatch-Cache National Forest	524-5030
Evanston Ranger District	307-789-3194
Mountainlands Association of Governments	377-2262
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Mountainland Travel Region (Provo)	377-2262
Reservoir Administrators	
DOI	

MILL HOLLOW RESERVOIR



Introduction

Mill Hollow Reservoir is in the Provo River drainage south of the Uinta Mountains. It is a small artificial, stabilized lake maintained by the DWR to provide angling opportunities for Utahns. It is an isolated recreation area.

Mill Hollow Reservoir was created in 1962 by the construction of an earth-fill dam. The shoreline is owned by the Uinta National Forest and public access is unrestricted. Water use is for recreation and habitat for aquatic life. Water is never drained from the lake for agricultural use. Water use is not expected to change in the foreseeable future.

Characteristics and Morphometry

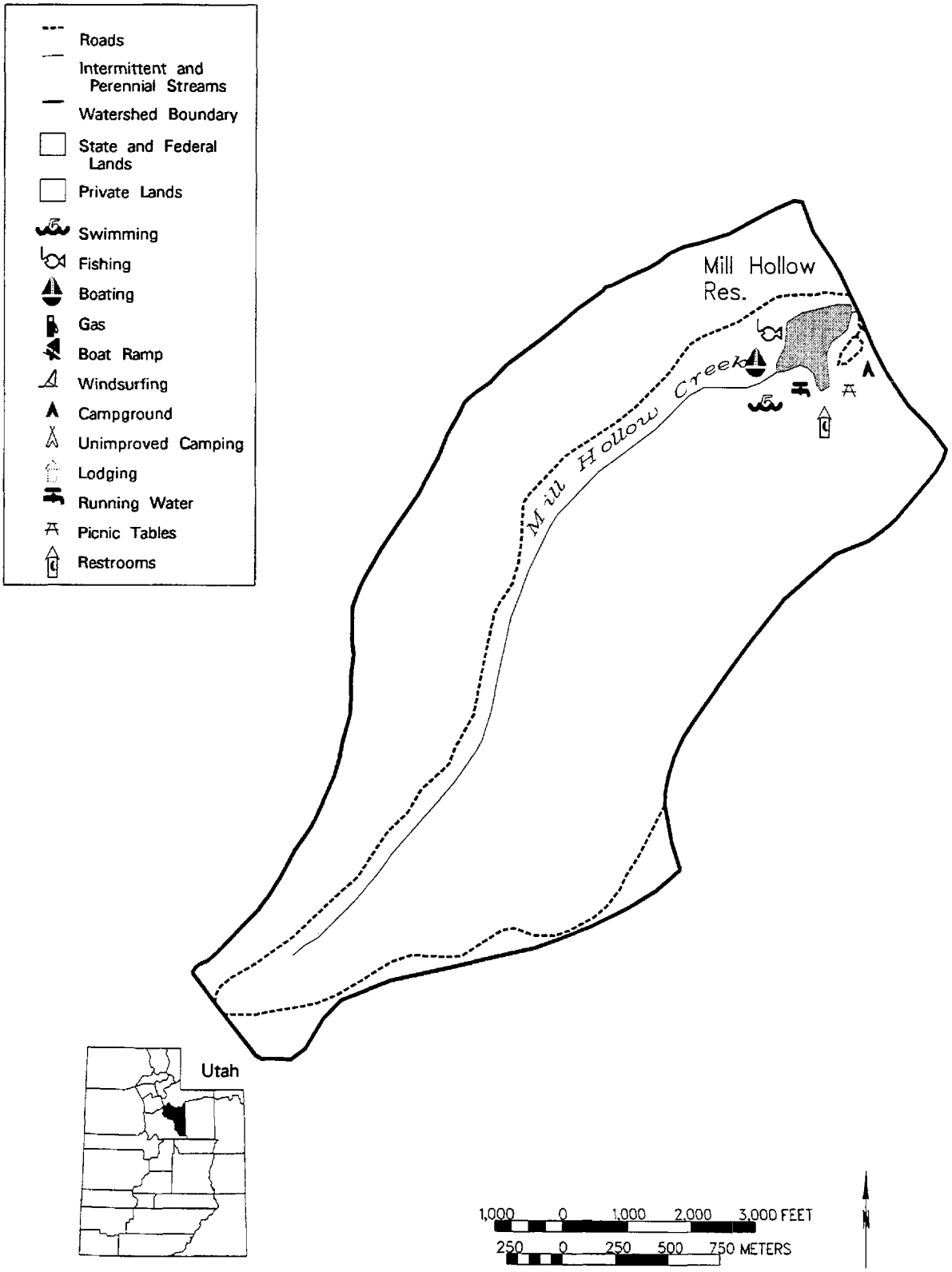
Lake elevation (meters / feet)	2,695 / 8,843
Surface area (hectares / acres)	6 / 15
Watershed area (hectares / acres)	65 / 168
Volume (m^3 / acre-feet)	
capacity	338,553 / 315
conservation pool	
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	11 / 36
mean	5.4 / 18
Length (meters / feet)	435 / 1,426
Width (meters / feet)	354 / 1,162
Shoreline (meters / feet)	1,158 / 3,800

Location

County	Wasatch
Longitude / Latitude	110 53 56 / 40 39 22
USGS Map	Wolf Creek Summit 1967
DeLorme's Utah Atlas & Gazetteer™	Page 54, C-2
Cataloging Unit	Provo (16020203)

Recreation

Mill Hollow Reservoir is south of U-35 between Woodland and Tabiona. 11 miles east of Woodland or five miles west of Wolf Creek Summit, turn south off U-35 onto an improved gravel road to Mill Hollow Reservoir, campground, and guard station. The reservoir is 3.5 miles south on this road. The route is well marked from U-35.



County in which watershed is located.

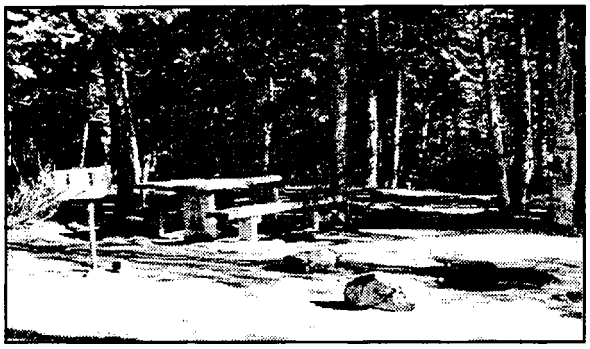
Mill Hollow Watershed

<k175>

Fishing, camping, picnicking, swimming, scenic beauty and hiking are all popular. There is no boat ramp at the reservoir but the launching of small boats and watercraft is possible.

The area receives moderate to heavy recreational use throughout the summer. The road is not maintained in the winter.

There is a USFS campground at the lake which has 46 camping units, fishing areas, a swimming area, drinking water, and privies.



Watershed Description

Mill Hollow Reservoir has a small, natural watershed. It is on the north slope of Duchesne Ridge, which divides the Strawberry Basin from the Provo River drainage. The elevation is high, so the watershed is primarily spruce forest.

The watershed high point is 3,089 m (10,133 ft) above sea level, thereby developing a complex slope of 15.8% to the reservoir. The major perennial stream entering the lake is Mill Hollow Creek with an average gradient of 6.9% (363 feet per mile). The inflow and outlet is Mill Hollow Creek.

The watershed is made up of high mountains with abundant rock outcroppings and meadows. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of aspen, spruce-fir, and subalpine meadows. The watershed receives 76 cm (30 inches) of precipitation annually. The frost-free season around the reservoir is 20 - 40 days per year.

Use of the watershed is 100% multiple use with grazing and recreation the dominant uses.

Limnological Assessment

The water quality of Mill Hollow Reservoir is good. It is considered to be soft with a recent hardness concentration value of approximately 68 mg/L ($CaCO_3$). The only parameters that have exceeded State water quality standards for defined beneficial uses are phosphorus and dissolved oxygen. On occasion pH values will exceed the criteria of 9.0 when a heavy algal bloom is in progress. The average concentration of total phosphorus in the water column in 1981 and 1991 was 135 and 43 ug/L which exceeds the recommended pollution indicator for phosphorus of 25 ug/L. The phosphorus concentration in the hypolimnion in September, 1991 reached a level of 118 ug/L. This increased concentration occurred when the reservoir was stratified, and low dissolved oxygen was present near the bottom. Dissolved oxygen concentrations in late summer substantiate the fact that water quality impairments do exist. Concentrations dropped dramatically below the thermocline to approximately 1.4 mg/L during the summer. A review of a reservoir profile obtained on March 28, 1990 indicates that anoxic conditions are prevalent throughout the winter. Concentrations of dissolved oxygen were 1.8 mg/L at 1 meter, 1.2 mg/L at 2 meters and virtually 0.0 down to a depth of 9 meters. These conditions are deleterious to the fishery rendered approximately the entire reservoir unsuitable for a fishery. It is apparent that the only carryover of fish would be in the inlet area where oxygen supplies are sufficient to maintain a limited fishery. Current data suggest that the reservoir is currently a nitrogen limited system. TSI

Limnological Data

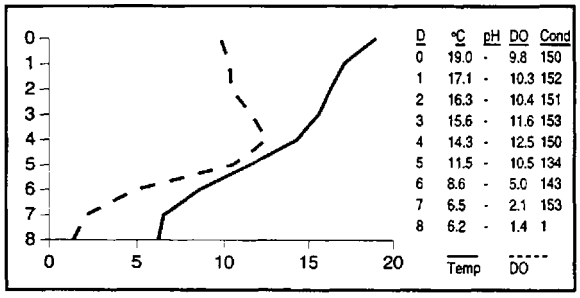
Data sampled from STORET site: 591455

Surface Data	1981	1989	1991
Trophic Status	H	M	M
Chlorophyll TSI	-	46.87	41.54
Secchi Depth TSI	54.2	45.96	48.64
Phosphorous TSI	66.1	48.88	53.19
Average TSI	60.15	47.24	47.79
Chlorophyll a (ug/L)	-	5.3	3.1
Transparency (m)	1.5	2.7	2.2
Total Phosphorous (ug/L)	30	22	30
pH	8.9	9	6.9
Total Susp. Solids (mg/L)	<5	-	<3
Total Volatile Solids (mg/L)	-	-	2
Total Residual Solids (mg/L)	-	-	<2
Temperature (°C / °f)	13/55	14/58	15/58
Conductivity (umhos.cm)	106	148	136
Water Column Data			
Ammonia (mg/L)	0.18	0.01	0.05
Nitrate/Nitrite (mg/L)	0.39	-	0.12
Hardness (mg/L)	90.5	-	67
Alkalinity (mg/L)	87	-	68
Silica (mg/L)	-	-	16.7
Total Phosphorous (ug/L)	135	21	43
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	1.5	2.6	5.0
Stratification (m)	2	6-8	3-7
Depth at Deepest Site (m)	9	9.7	8.0

values indicate the reservoir is mesotrophic approaching the eutrophic range with fairly high productivity.

The reservoir was stratified during a summer monitoring trip was on August 21, 1991. The profile indicates that a thermocline developed at a depth of 3-7 meters. This is consistent with a noticeable decline in the concentration of dissolved oxygen in the water column.

According to DWR no fish kills have been reported in recent years, however it is evident that some winter kills may occur. The reservoir supports populations of brook trout (*Salvelinus fontinalis*), rainbow trout and albino rainbow trout (*Oncorhynchus mykiss*). The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake. According to the Utah State Division of Wildlife Resources, Mill Hollow Reservoir is regularly stocked with 8,000 catchable rainbow trout, 4,200 catchable albino rainbow trout, and 7,500 fingerling brook trout. DWR also reports that the water flea, *Daphnia* is also present in the reservoir.



D	°C	pH	DO	Cond
0	19.0	-	9.8	150
1	17.1	-	10.3	152
2	16.3	-	10.4	151
3	15.6	-	11.6	153
4	14.3	-	12.5	150
5	11.5	-	10.5	134
6	8.6	-	5.0	143
7	6.5	-	2.1	153
8	6.2	-	1.4	1

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Eudorina elegans	2.780	41.63
Pandorina morum	1.334	19.98
Fragilaria crotonensis	1.145	17.15
Microcystis incerta	0.767	11.49
Aphanizomenon flos-aquae	0.422	6.33
Ankistrodesmus falcatus	0.139	2.09
Wislouchiella planktonica	0.029	0.43
Centric diatoms	0.029	0.43
Asterionella formosa	0.028	0.42
Pennate diatoms	0.003	0.05
Total	6.675	
Shannon-Weaver [H']	1.57	
Species Evenness	0.68	
Species Richness	0.40	

The phytoplankton community is dominated by flagellates, diatoms and blue-green algae. This supports the water quality analysis of the reservoir with moderate productivity and generally good water quality.

Pollution Assessment

Nonpoint pollution sources include the following: sedimentation and nutrient loading from grazing and litter or waste from recreation. Grazing takes place and throughout the watershed.

There are no point sources of pollution in the watershed.

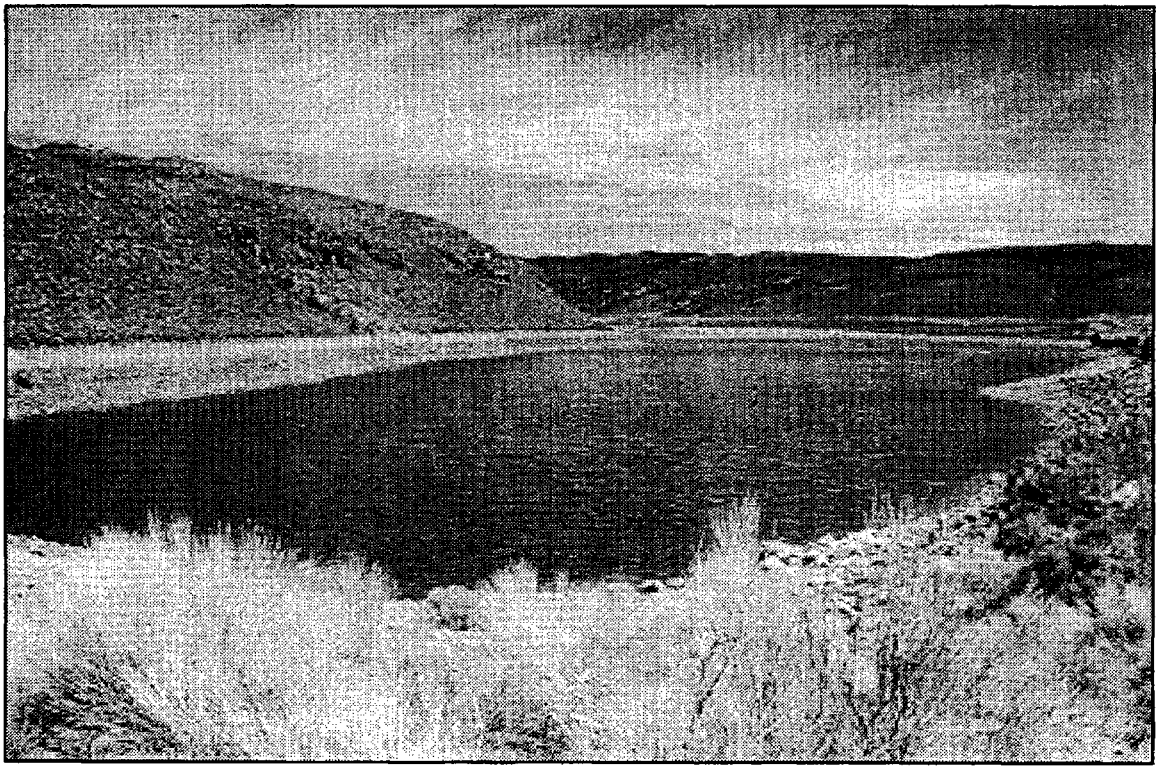
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Mountainland Association of Governments	377-2262
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Uinta National Forest	377-5780
Heber Ranger District	654-0470
Recreation	
Mountainland Travel Region (Provo)	377-2262
Reservoir Administrator	
Division of Wildlife Resources	

MILL MEADOW RESERVOIR



Introduction

Mill Meadow Reservoir is northwest of Loa at the base of the Fish Lake Mountains. It is an intermediate impoundment of a stream valley just below the confluence of the Fremont River and U M Creek.

The reservoir shoreline is administered by the Fishlake National Forest and publicly/privately owned. Public access is unrestricted. The shore within 1/4 mile of the dam is on BLM land, and the shore near the center of the reservoir is privately owned. The impoundment, an earth-fill dam, was built in 1954.

Water is used primarily for irrigation and other agricultural purposes.

Characteristics and Morphometry

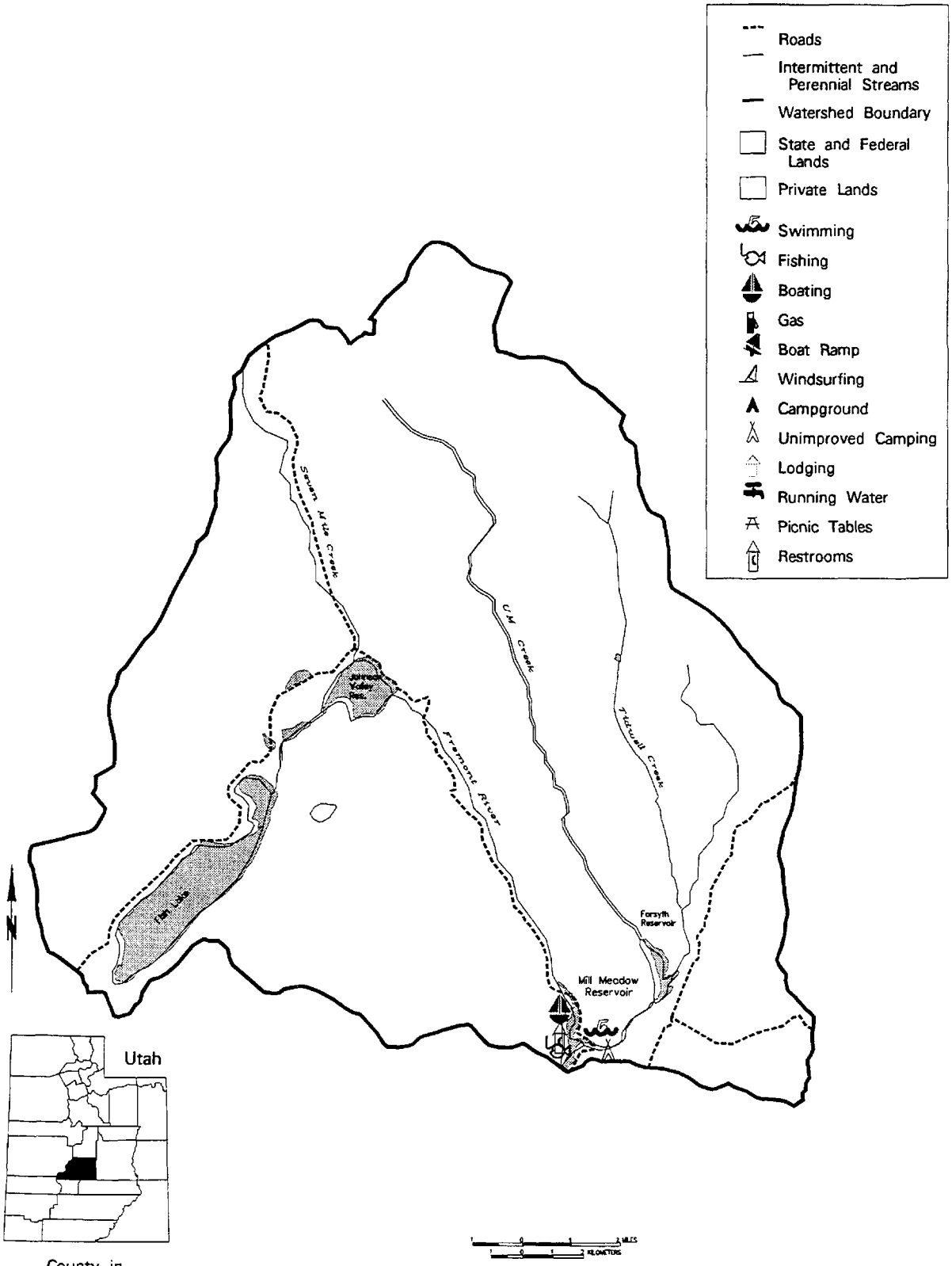
Lake elevation (meters / feet)	2,341 / 7,681
Surface area (hectares / acres)	63 / 156
Watershed area (hectares / acres)	
Volume (m^3 / acre-feet)	
capacity	6,453,682 / 5,232
conservation pool	
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	20 / 66
mean	10.2 / 33.5
Length (meters / feet)	2,600 / 8,531
Width (meters / feet)	457 / 1,499
Shoreline (km / miles)	7.62 / 4.73

Location

County	Sevier, Wayne
Longitude / Latitude	111 33 53 / 38 30 24
USGS Map	Forsyth Reservoir, Utah, 1968, Lyman, Utah 1985
DeLorme Atlas	pg.46,B2
Cataloging Unit	Fremont River (14070003)

Recreation

Mill Meadow Reservoir is accessible from U-72. From U-24 in the Loa area, go north on U-72 to Fremont Town and continue north for 2.5 miles to FS-036, a paved road to Johnson Valley Reservoir. Mill Meadow Reservoir is 2 miles up this road. From the north, travel 27 miles south on U-72 from Fremont Junction to FS-036.



County in which watershed is located.

Mill Meadow Watershed

<k120>

The lake offers fishing, boating and primitive camping. Recreational facilities are limited at the reservoir with only restrooms and unimproved campsites. The nearest USFS campgrounds are near Johnson Valley Reservoir on FS-036. The Inn, an RV park, offers modern facilities in Fremont Town, 7 miles to the south.

Watershed Description

The reservoir is in an area of rolling ridges and valleys characteristic of the Fishlake Plateau. The watershed High point, the Fish Lake Hightop Plateau, is 3,945 m (11,633 ft) above sea level, thereby developing a complex slope of 6.9% to the reservoir. Inflows are the Fremont River and U M Creek. The average stream gradient above the reservoir is 4.0% (209 feet per mile). Upstream imp[oundments include Forsyth Reservoir (3 miles up U M Creek) and Johnson Valley Reservoir (about 13 miles up the Fremont River). The outflow is the Fremont River.

The soil is of limestone origin with rapid permeability and erosion is rapid. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities are comprised of pine, aspen, bitterbrush, mountain mahogany, pinyon-juniper and sage-grass. The watershed receives 51 - 102 cm (20 - 40 inches) of precipitation annually with a frost-free season of 80 - 100 days at the reservoir.

Land use is 98% multiple use and recreation, the major use of the watershed is livestock grazing and timber harvesting. The remaining 2% is private land used primarily for grazing. The land uses result in heavy runoff and substantial soil erosion.

Limnological Assessment

The water quality of ill Meadow Reservoir is fair. It is considered to be moderately hard with a hardness concentration value of approximately 92 mg/L ($CaCO_3$). The only parameterd that have exceeded State water quality standards for defined beneficial uses are phosphorus adn dissolved oxygen on occasion. The average concentration of total phosphorus in the water column in 1981, 1989, and 1991 was 57.7, 169, and 77 ug/L which consistantly exceeds the recommended pollution indicator for phosphorus of 25 ug/L. It is not uncommon to see values in excess of 100 ug/L. This reservoir has exhibited some of the highest productiviy in the State. Dissolved oxygen concentrations in the hypolimnion have reached a low of 0.8 mg/L. As indicated by the profile of August 21, 1991 dissolved oxygen levels do decline downward in the water column but typically do not reach levels that impair the fishery during productivity season. In recent years the reservoir has been draw down extensively so that late summer substantiate the fact that water quality impairments do exist. Concentrations dropped dramatically below the thermocline to approximately 3.0 mg/L. Although in 1981 the reservoir was characterized as a phosphorus limited system, the 1989-91 data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is mesotrophic. The phosphorus concentrations in 1989 appear to be abnormally low (5.9 ug/L) and have shifted the overall TSI index to the low mesotrophic range. It does not appear that there has been a significant rise in the concentrations of nutrients in the lake since it was orginally surveyed in 1981. In fact the concentration may have declined specifically the nitrogen species. The reservoir was stratified during a summer monitoring trip was in June, 1981 and September, 1991. Both profiles indicate that a thermocline developed at a depth of 2-3 meters. On September 5, 1991, consistant with the stratification there was a noticable decline in the concentration of dissolved oxygen in the water column. These conditions are deleterious to the fishery rendered approximately 1/2 of the water column unsuitable for a

Limnological Data

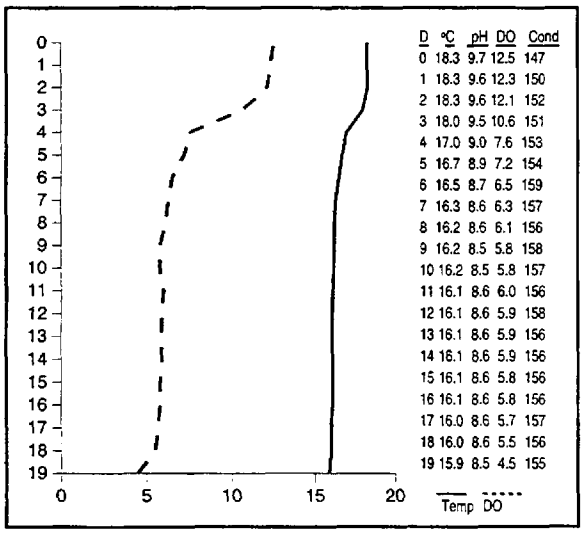
Data averaged from STORET sites: 595588, 595589

Surface Data	1981	1989	1991
Trophic Status	E	H	H
Chlorophyll TSI	-	70.28	79.62
Secchi Depth TSI	48.86	46.51	58.34
Phosphorous TSI	73.48	84.39	69.48
Average TSI	61.17	67.06	69.15
Chlorophyll a (ug/L)	-	57	160
Transparency (m)	3	2.6	0.9
Total Phosphorous (ug/L)	55	316	89
pH	8.0	8.6	9.2
Total Susp. Solids (mg/L)	<5	-	19
Total Volatile Solids (mg/L)	-	-	13
Total Residual Solids (mg/L)	-	-	14
Temperature (°C / °f)	12/54	17/62	16/60
Conductivity (umhos.cm)	207	177	285
Water Column Data			
Ammonia (mg/L)	0.05	0.07	0.07
Nitrate/Nitrite (mg/L)	0.15	-	.02
Hardness (mg/L)	100	-	84.3
Alkalinity (mg/L)	92	-	92
Silica (mg/L)	-	-	24.5
Total Phosphorous (ug/L)	57.5	169	77
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	6.1	6.3	5.8
Stratification (m)	NO	NO	3-4
Depth at Deepest Site (m)	19	19.2	19.2

fishery. In addition dissolved oxygen concentrations at time have reached a critical state during the winter period for fish. The reservoir was surveyed on March 13, 1991 and near anoxic conditions were found present in the lower depths of the water column. Concentrations of dissolved oxygen at the surface were 7.8 mg/L but dropped to 3.5 mg/L at 1 meter and reached a low of 0.6 mg/L at the bottom (6 meters). Water temperature at that time was relatively uniform near 4.3 degrees C throughout the water column. According to DWR no fish kills have been reported in recent years. The reservoir supports populations of brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*), cutthroat trout (*Oncorhynchus clarki*), and sculpins (Cottus spp.). Brook trout up to 5 pounds have been reported from Browne Reservoir.

Since the lake was acquired by the DWR and water levels stabilized, the riparian vegetation has become established along the shore, with a thin band of grass and sedges being the colonizing species. Eventually more riparian vegetation may provide significantly improved habitat for aquatic organisms.

The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake. The reservoir is stocked annually with rainbow (*Oncorhynchus mykiss*) and cutthroat trout (*Oncorhynchus clarki*). Gill net surveys show that the Utah chub (*Gila atraria*), the redside shiner (Gila balteata), and the Utah sucker (*Catostomus ardens*) are also present. Invertebrates, primarily midges were found. Plankton consisted of Copepods, Cladocerins, rotifers, and algae.



D	°C	pH	DO	Cond
0	18.3	9.7	12.5	147
1	18.3	9.6	12.3	150
2	18.3	9.6	12.1	152
3	18.0	9.5	10.6	151
4	17.0	9.0	7.6	153
5	16.7	8.9	7.2	154
6	16.5	8.7	6.5	159
7	16.3	8.6	6.3	157
8	16.2	8.6	6.1	156
9	16.2	8.5	5.8	158
10	16.2	8.5	5.8	157
11	16.1	8.6	6.0	156
12	16.1	8.6	5.9	158
13	16.1	8.6	5.9	156
14	16.1	8.6	5.9	156
15	16.1	8.6	5.8	156
16	16.1	8.6	5.8	156
17	16.0	8.6	5.7	157
18	16.0	8.6	5.5	156
19	15.9	8.5	4.5	155

Historically, the DWR has stocked the reservoir annually with 10,000 - 20,000 fingerling rainbow trout. In 1991, the trout became infected with whirling disease, and the reservoir was treated with rotenone in 1992. It will be stocked with centrarchids rather than trout for until the late 1990s in order to allow the disease to become eradicated.

The reservoir was chemically treated by the DWR to control rough fish competition in 1966, 1978 and 1986 as well as in 1992.

Phytoplankton in the euphotic zone in August, 1991 included the following taxa:

Species	Cell Volume (mm^3/liter)	% Density By Volume
Aphanizomenon flos-aquae	236.634	100.00
Ankistrodesmus falcatus	0.009	0.00
Total	236.643	
Shannon-Weaver Index[H']	0.00	
Species Evenness	0.00	
Species Richness	0.06	

The flora indicates a very unhealthy reservoir. Cell biomass is very high and there is no diversity. *Aphanizomenon*, a blue-green alga, is an indicator of poor water quality.

Pollution Assessment

Nonpoint pollution sources include sedimentation and nutrient loading from grazing, and wastes or litter from recreation.

During the summer, 670 head of cattle graze in the watershed and around the reservoir. In 1992, there are several active timber sales in the Sheep Valley area of the U M Creek drainage, with 1,000,000 board feet of aspen being removed from a windstorm area. In the summer of 1992, FS-036 was widened and paved.

There are no point pollution sources in the watershed.

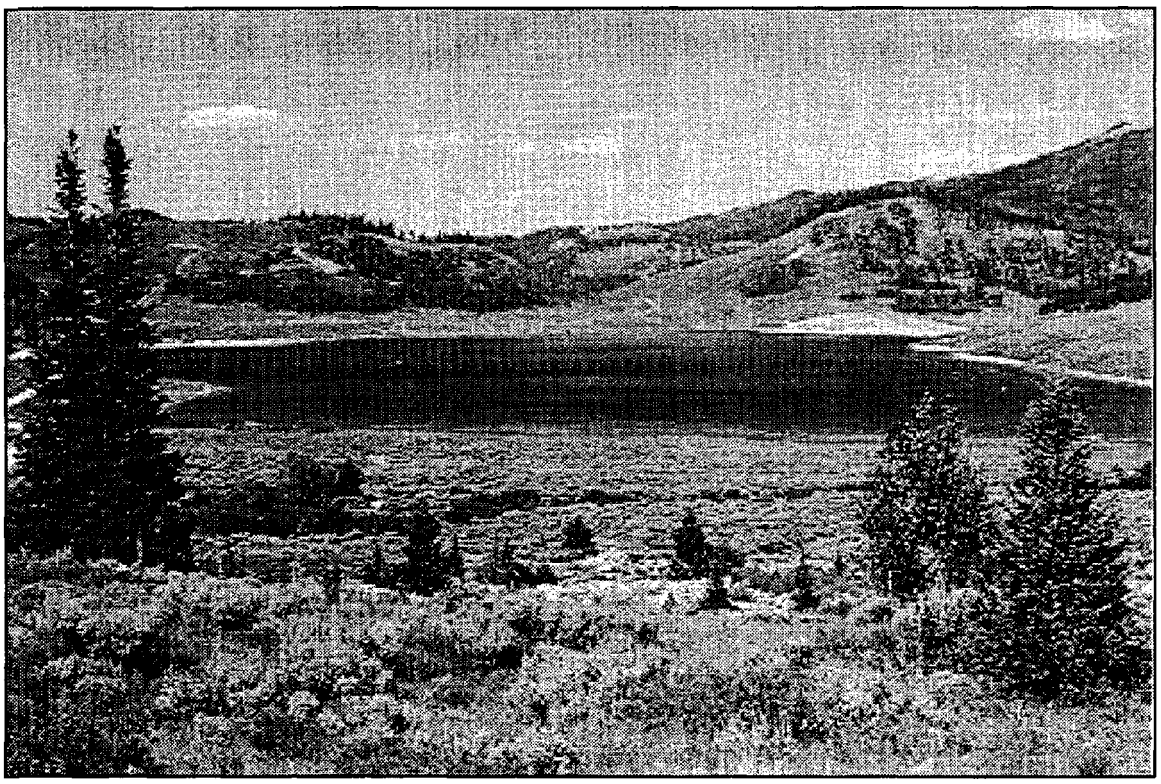
Information

Management Agencies	
Fishlake National Forest	896-9233
Loa Ranger District	836-2811
Six County Government Association	
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Panoramaland Travel Region (Richfield)	896-9222
The Inn RV Park, Fremont	836-2715
Reservoir Administrators	
Fremont Irrigation Company	

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

MILLER FLAT RESERVOIR



Introduction

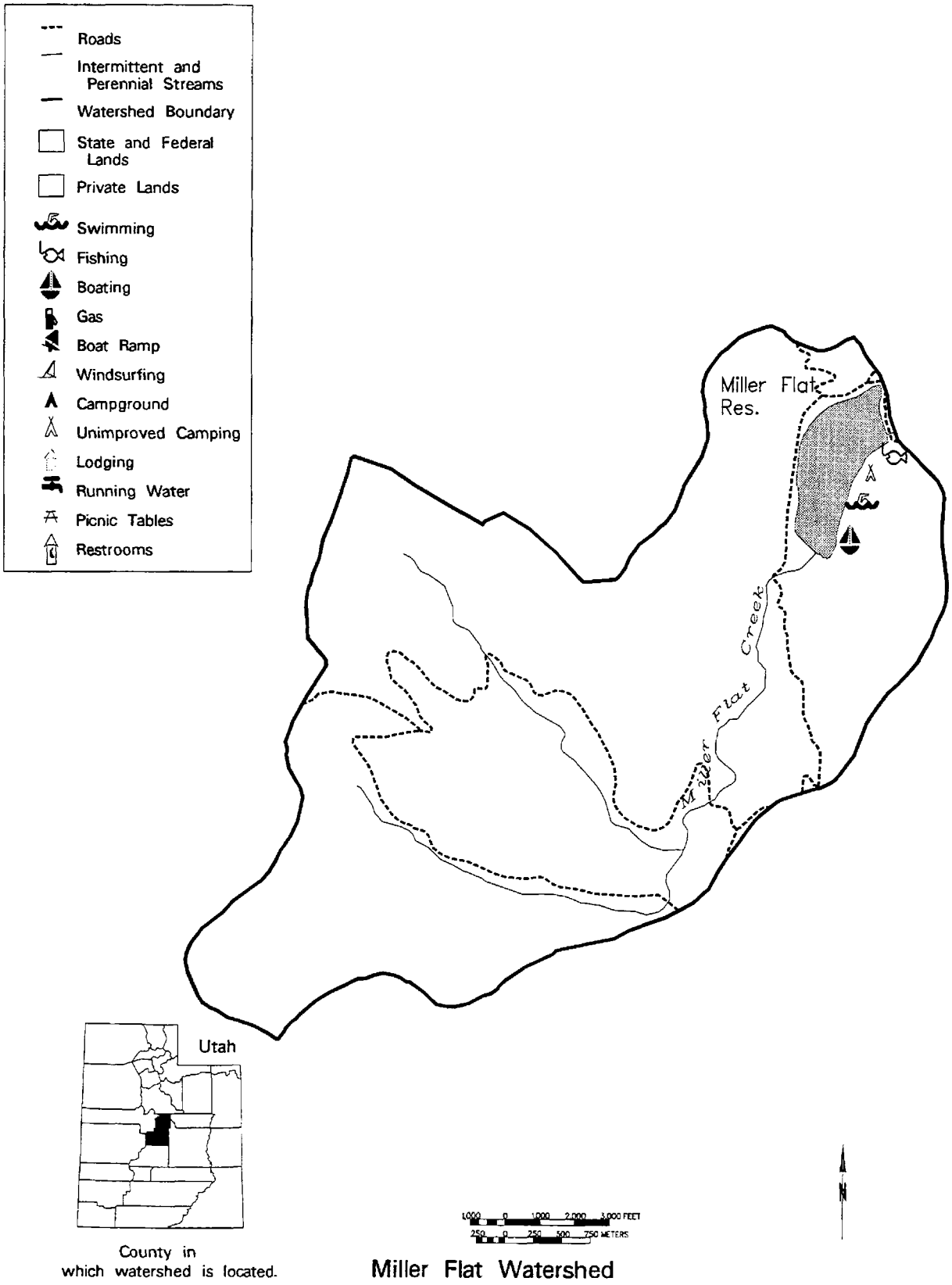
Miller Flat Reservoir is located in on the east side of the Wasatch Plateau at the base of Bald Mountain. It situated in a meadow area of grass and sage surrounded by aspen and conifer forests. It is a intermediate sized impoundment. The original plan developed on August 10, 1940 called for the construction of an earth dam with a maximum height of 132 feet at a site 2,000 feet downstream for the present dam area. The original site was abandoned after initial excavation work had begun. Initial construction was completed in 1949 at the present site. The dam was modified in 1953 and again in 1985 to its present condition. The primary purpose of the building the impoundment was to provide storage water for irrigation and later cooling water for a nearby electrical generation plant. The reservoir is owned and operated by the Huntington-Cleveland Irrigation Company. Of the water stored in the reservoir 75% is used for irrigation and 25% for cooling water. The shoreline is owned primarily by the irrigation company but there are certain areas owned by the USFS. Public accessibility is currently unrestricted.

Characteristics and Morphometry

Lake elevation (meters / feet)	2,579 / 8,462
Surface area (hectares / acres)	65 / 160
Watershed area (hectares / acres)	2,065 / 4,955
Volume (m^3 / acre-feet)	
capacity	7,885,778 / 6,393
conservation pool	
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	19.5 / 64
mean	12.2 / 39.9
Length (meters / feet)	1,520 / 4,987
Width (meters / feet)	610 / 2,001
Shoreline (km / miles)	6.7 / 4.1

Location

County	Sanpete
Longitude / Latitude	111 16 03 / 39 35 24
USGS Map	Huntington Reservoir 1978
DeLorme's Atlas and Gazetteer™	Page 46 D-2
Cataloging Unit	San Rafael (14060009)



County in which watershed is located.

Miller Flat Watershed

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Recreation

Miller Flat Reservoir is accessible from U-31 between Fairview and Huntington. A gravel road located between Huntington and Cleveland reservoirs is the turnoff point from U-31. It is approximately 16 miles east of Fairview City and 32 miles northwest of Huntington City. The road is well marked and Miller Flat Reservoir is approximately 3-4 miles south. This road continues past the reservoir and terminates at Joes Valley Reservoir.

Although the area generally receives moderate recreational usage, heavy usage occurs on holiday weekends. Fishing is the primary activity, however, boating, camping, swimming, nordic skiing and snowmobiling are also thoroughly enjoyed.

Recreational facilities are limited and primitive in the area. Visitors are required to pack out their own trash. There are Forest Service Campgrounds in the area but not in close proximity to the reservoir.

Watershed Description

The reservoir is located on the eastern slope of the Wasatch Plateau. It lies at the base of the slope in a narrow valley adjacent to several high peaks. High mountains make up the watershed. The reservoir is filled by flow from two springs and snowmelt. The primary tributary to the reservoir is Miller Flat Creek.

The watershed high point is 3,288 m (10,789 ft) above sea level, thereby developing a complex slope of 14% to the reservoir. The average stream gradient above the reservoir is 5.8% (308 feet per mile).

The soil is of limestone origin and has good permeability and moderately slow erosion and runoff. Soil groupings are found in Appendix III.

The vegetation communities are comprised of pine, aspen, spruce-fir, sagebrush, oak and maple. The watershed receives 76 - 102 cm (30 - 40 inches) of precipitation annually with a frost-free season of 40 - 60 days at the reservoir.

Land use in the reservoir watershed is primarily multiple use forest lands for hunting, recreation and livestock grazing with some private lands for recreational development.

Limnological Assessment

The water quality of Miller Flat Reservoir is very good. It is considered to be hard with a hardness concentration value of approximately 152 mg/L ($CaCO_3$). The only parameter that has exceeded State water quality standards for defined beneficial uses is phosphorus. The average concentration of total phosphorus in the water column in 1981 and 1992 was 10 and 23 ug/L. Neither exceeds the recommended pollution indicator for phosphorus of 25 ug/L, but the average phosphorus concentration on August 19,1992 was approximately 40 ug/L. This increased concentration occurred when the reservoir was drawndown and in a state where resuspension of sediments with phosphorus could have occurred due to mixing from winds. These conditions probably do not indicate impaired water quality conditions. Although in 1981 the reservoir was characterized as a phosphorus limited system, the 1992 data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is mesotrophic.

The reservoir has the potential to stratify, but under normal management of the reservoir is likely not to occur due to the rapid drawdown for downstream water needs. There is no conservation pool requirement and the release of water begins in July with the reservoir emptied in October.

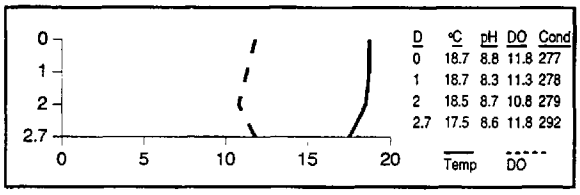
According to DWR no fish kills have been reported in recent years and no problems are exhibited except for the draining of the reservoir. DWR manages the reservoir primarily as a put and take fishery. Typically, they stock the reservoir with 20,000 fingerling and 5,000 catchable rainbow trout

Limnological Data

Data sampled from STORET site: 593201

Surface Data	1981	1992
Trophic Status	M	M
Chlorophyll TSI	-	32.79
Secchi Depth TSI	50.01	41.34
Phosphorous TSI	47.34	48.39
Average TSI	48.67	40.84
Chlorophyll a (ug/L)	-	1.3
Transparency (m)	2.0	3.7
Total Phosphorous (ug/L)20	10.0	21.0
pH	8.5	8.9
Total Susp. Solids (mg/L)	100	<3
Total Volatile Solids (mg/L)	-	1
Total Residual Solids (mg/L)	-	2
Temperature (°C / °f)	16/61	17/63
Conductivity (umhos.cm)	263	274
Water Column Data		
Ammonia (mg/L)	0.08	0.04
Nitrate/Nitrite (mg/L)	0.27	0.04
Hardness (mg/L)	145	158
Alkalinity (mg/L)	153	155
Silica (mg/L)	-	3.3
Total Phosphorus (ug/L)	10	23
Miscellaneous Data		
Limiting Nutrient	P	N
DO (Mg/l) at 75% depth	6	10.8
Stratification (m)	3-6	NO
Depth at Deepest Site (m)	13	2.7

(Oncorhynchus mykiss). According to a 1978 U.S.F.S. limnological inventory and 1980 DWR files, stocked rainbow trout (*Oncorhynchus mykiss*) compose 100% of the total fish population. Common invertebrates found were Hemiptera, Coleoptera, Ephemeroptera, Odonata, Diptera, and Mollusca. Other invertebrates were also found in lesser numbers. Zooplankton was mainly Daphnia, Copepods, Asterionella, and Rotifers. Potamogeton, Milfoil, and Buttercup were the dominant submergent macrophytes.



D	°C	pH	DO	Cond
0	18.7	8.8	11.8	277
1	18.7	8.3	11.3	278
2	18.5	8.7	10.8	279
2.7	17.5	8.6	11.8	292

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	121.486	99.68
Aphanizomenon flos-aquae	0.317	0.26
Unknown spherical green alga	0.033	0.03
Wislouchiella planktonica	0.013	0.01
Pennate diatoms	0.011	0.01
Haematococcus lacustris	0.006	0.00
Oscillatoria sp.	0.006	0.00
Total	121.779	
Shannon-Weaver [H']	0.02	
Species Evenness	0.01	
Species Richness	0.24	

The phytoplankton community is dominated by the presence of green algae indicative of good water quality and mesotrophic conditions.

Pollution Assessment

Nonpoint pollution sources include nutrient loading and sedimentation from grazing and litter or wastes from recreation. About 1,000 sheep graze in the immediate vicinity of the reservoir for two weeks each year. Cattle also graze the area. No mining or logging takes place in the region.

There are no point pollution sources in the watershed.

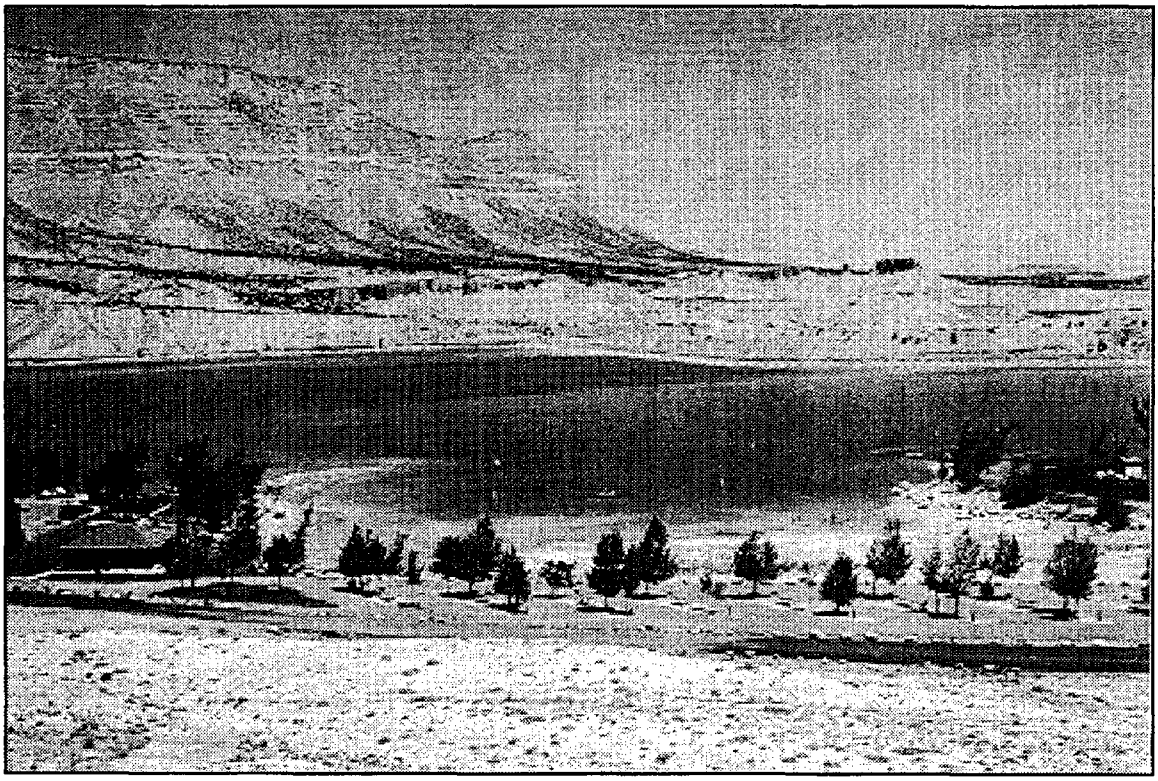
Beneficial Use Classification

The state beneficial use classification for the waters of Miller Flat Reservoir include boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Manti-La Sal National Forest	637-2817
Six County Commissioners Organization	896-9222
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Reservoir Administrators	
Huntington-Cleveland Irrigation Company	687-2505

MILLSITE RESERVOIR



Introduction

Millsite Reservoir is in Castle Valley at the mouth of Ferron Canyon. It is a large impoundment of a mid-elevation desert at its interface with high, mountainous plateaus. It is one of several large reservoirs on the east slopes of the high plateaus of central Utah, so it does not receive a great deal of recreational use, although there is a state park at the facility. High bluffs at the mouth of Ferron Canyon provide a spectacular backdrop to the reservoir.

The reservoir was created in 1974 by the construction of an earth-fill dam. The shoreline is owned by a number of different agencies, including the BLM, the State of Utah, the Ferron Canal and Reservoir Company, and possibly some private individuals. Public access is somewhat restricted. Water is consumed for irrigation, but also used for recreation and coldwater aquatic habitat. No changes are foreseen in water use.

Characteristics and Morphometry

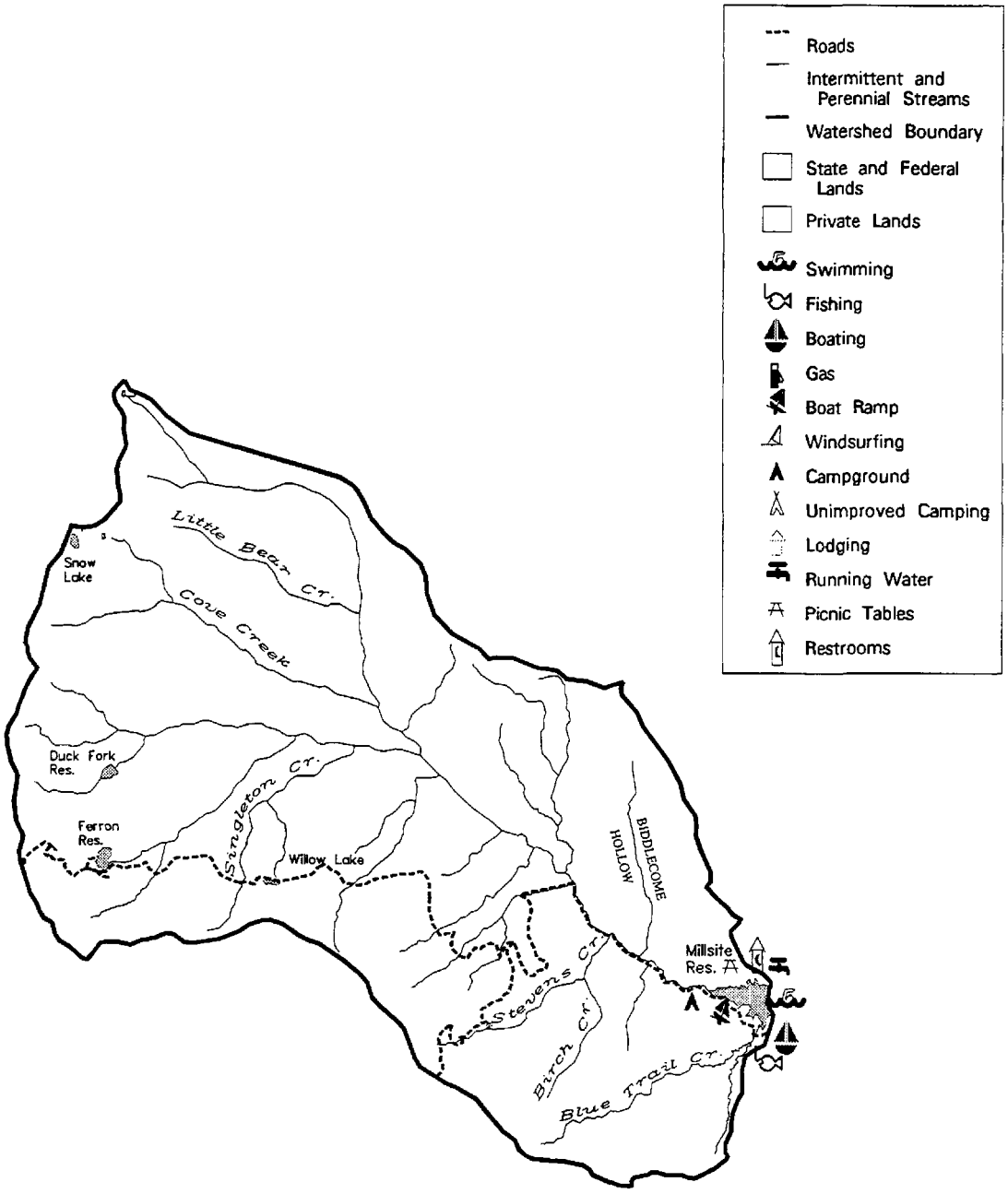
Lake elevation (meters / feet)	1,893 / 6,211
Surface area (hectares / acres)	176 / 435
Watershed area (hectares / acres)	40,146 / 99,200
Volume (m^3 / acre-feet)	
capacity	22,194,000 / 18,000
conservation pool	2,466,000 / 2,000
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	31 / 102
mean	14 / 46
Length (meters / feet)	2,220 / 7,284
Width (meters / feet)	1,066 / 3,498
Shoreline (km / miles)	10.36 / 36.43

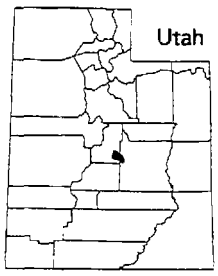
Location

County	Emery
Longitude / Latitude	111 12 01 / 39 06 00
USGS Map	Ferron 1979
DeLorme's Atlas and Gazetteer™	Page 38, D-2
Cataloging Unit	San Rafael (14060009)

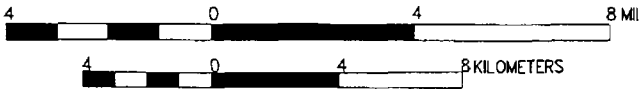
Recreation

Millsite Reservoir is within Millsite State Park, 2 miles





County near which watershed is located.



Millsite Watershed

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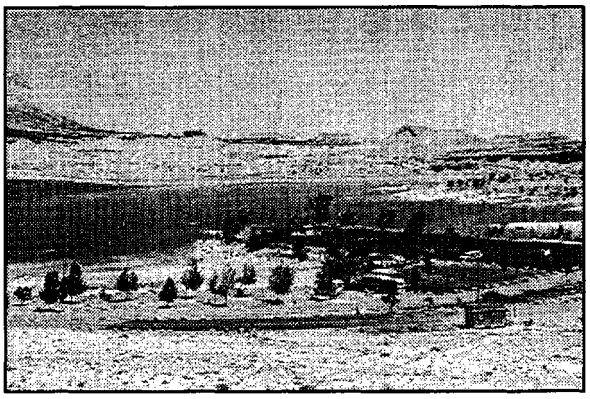
west of U-10 in Ferron City on Canyon Road (100 S).

The area is a four season recreational area. Fishing, boating, camping, swimming, and picnicking facilities are all popular. It is also a good area for watching eagles.

The park charges a $3 fee for day use and $9 for



camping (1991). Facilities include a boat launch, picnic pavilions, showers, flush toilets, drinking water, a sandy beach, and 20 campsites. An intriguing nine hole golf course is adjacent to the park.

Watershed Description

The reservoir is situated where Ferron Canyon emerges from the Wasatch Plateau into Castle Valley. Bluffs rising 2,000' surround the reservoir three sides, and the fourth side opens to the desert badlands of Castle Valley.

Ferron Canyon has a large drainage area that consists of a large portion of the southeastern Wasatch Plateau. At the headwaters, small streams arise from glaciated valleys, winter snowpacks remain late in the season, and domestic livestock graze in the area. Duck Fork and Ferron Reservoirs are stabilized lakes near the headwaters of Ferron Creek. The creek cuts a deep gorge through the eastern plateau, then emerges as the canyon walls flare outward into the edge of the plateau. Downstream from the reservoir, flat, irrigated desert extends for a few miles beyond the cliffs, then canyons and reefs delineate the western edge of the San Rafael Swell.

The reservoir is located in the mouth of the canyon, where vegetation and weather is typical of the desert. Irrigation water from the reservoir allows the lands to the east to be irrigated for crops. Little if any of the canyon is irrigated.

The watershed high point, Heliotrope Mountain, is 3,392 m (11,130 ft) above sea level, thereby developing a complex slope of 7% to the reservoir. The average stream gradient above the reservoir is 4.7 % (249 feet per mile).

The soil is of limestone origin and has good permeability and moderately slow erosion and runoff. Soil Associations are listed in Appendix III.

The vegetation communities are comprised of shadscale, pinion-juniper, saltbrush, sagebrush-grass, mahonia, mountain mahogany, grass-forbs, greasewood, pine, aspen, spruce-fir, oak and maple. The watershed receives 25 - 102 cm (10 - 40 inches) of precipitation annually with a frost-free season of 120 - 140 days each year at the reservoir.

The soil is of limestone origin and has good permeability and moderately slow erosion and runoff. Soil groupings are found in Appendix III.

The watershed is 90% owned by the Forest Service. While grazing is not permitted in the immediate vicinity of the reservoir, heavy grazing takes place throughout the watershed. The forest is used for hunting, recreation and livestock grazing.

Limnological Assessment

The water quality of Millsite Reservoir is very good. It

Limnological Data

Data averaged from STORET sites: 593174, 593175

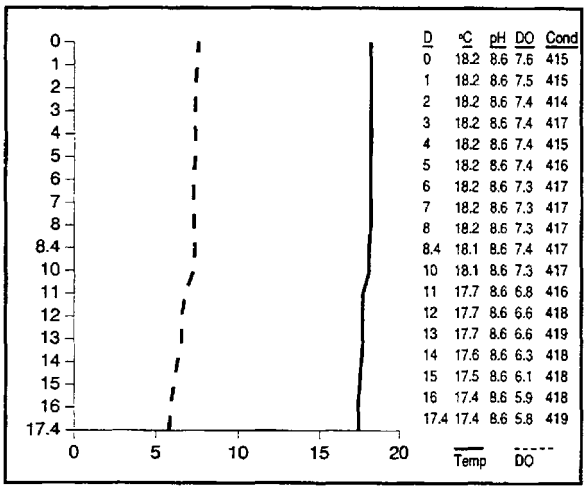
Surface Data	1981*	1989	1991
Trophic Status	M	O	M
Chlorophyll TSI	-	36.64	41.59
Secchi Depth TSI	46.80	44.60	51.18
Phosphorous TSI	37.35	23.96	31.58
Average TSI	42.08	35.07	41.46
Chlorophyll a (ug/L)	-	1.9	3.1
Transparency (m)	2.5	2.9	1.9
Total Phosphorous (ug/L)	5	4	7
pH	8.1	8	8.4
Total Susp. Solids (mg/L)	<5	-	<3
Total Volatile Solids (mg/L)	-	-	1
Total Residual Solids (mg/L)	-	-	3
Temperature (°C / °f)	16/61	17/63	16/61
Conductivity (umhos.cm)	477	472	441
Water Column Data			
Ammonia (mg/L)	0.05	0.03	0.03
Nitrate/Nitrite (mg/L)	0.16	-	0.08
Hardness (mg/L)	234	-	231
Alkalinity (mg/L)	193	-	189
Silica (mg/L)	-	-	3
Total Phosphorous (ug/L)	5	6	8
Miscellaneous Data			
Limiting Nutrient	P	N	N
DO (Mg/l) at 75% depth	7.4	5.9	6.6
Stratification (m)	7-8	NO	NO
Depth at Deepest Site (m)	21	19.0	17.4

* One site only (593174)

is considered to be hard with a hardness concentration value of approximately 233 mg/L ($CaCO_3$). There are no overall water column concentrations that have exceeded State water quality standards.

The potential for stratification in the reservoir does occur when there is sufficient depth and holding period. Although the profile shown of August 5, 1992 does not show it, stratification has been evident during other years. Current data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is oligotrophic or low mesotrophic in a state of low productivity.

According to DWR no fish kills have been reported in recent years. The State Division of Wildlife typically stocks 20,000 advanced fingerling rainbow trout (*Oncorhynchus mykiss*). In addition, cutthroat trout (*Oncorhynchus clarki*) and bluehead sucker (Pantosteus clarki) are present in the reservoir.



D	°C	pH	DO	Cond
0	18.2	8.6	7.6	415
1	18.2	8.6	7.5	415
2	18.2	8.6	7.4	414
3	18.2	8.6	7.4	417
4	18.2	8.6	7.4	415
5	18.2	8.6	7.4	416
6	18.2	8.6	7.3	417
7	18.2	8.6	7.3	417
8	18.2	8.6	7.3	417
8.4	18.1	8.6	7.4	417
10	18.1	8.6	7.3	417
11	17.7	8.6	6.8	416
12	17.7	8.6	6.6	418
13	17.7	8.6	6.6	419
14	17.6	8.6	6.3	418
15	17.5	8.6	6.1	418
16	17.4	8.6	5.9	418
17.4	17.4	8.6	5.8	419

The reservoir has not been treated to control rough fish competition, so native fish populations could be present. Stocking of hatchery fish and heavy fishing pressures, however, may have displaced all native fishes from the reservoir. It has a 2,000 acre-foot conservation pool, which guarantees adequate fish habitat throughout the year.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Fragilaria crotonensis	2.290	90.56
Dinobryon divergens	0.146	5.78
Oocystis sp.	0.050	1.98
Pennate diatoms	0.020	0.79
Centric diatoms	0.012	0.50
Unknown Chrysophyte	0.010	0.40
Total	2.528	
Shannon-Weaver [H']	0.42	
Species Evenness	0.23	
Species Richness [d]	0.23	

The phytoplankton community is dominated by diatoms and is indicative of good water quality in a state of low productivity.

Pollution Assessment

Nonpoint pollution sources include grazing, summer home development, and recreation. Grazing is not permitted in the vicinity of the reservoir. There are no active mines or timber sales, but areas scarred in past projects may still impact water quality. All residential developments are several miles upstream from the reservoir.

There are no point pollution sources in the watershed.

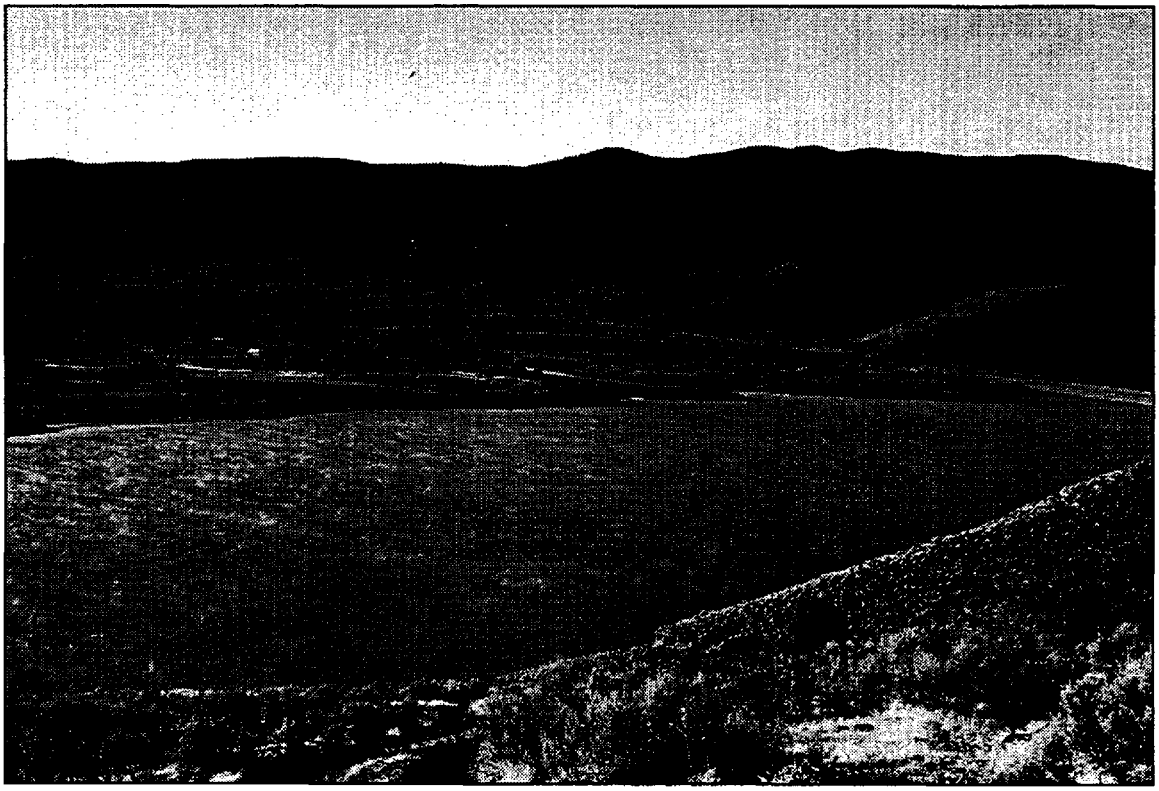
Beneficial Use Classification

The state beneficial use classification for the waters of Millsite Reservoir include: culinary water (1A), recreational bathing (swimming) (2A), boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Bureau of Land Management	539-4001
San Rafael Resource Area	637-4584
Southeastern Association of Governments	637-5444
Recreation	
Millsite State Park	687-2491
Castle Dale Chamber of Commerce	381-2547
Castle Country Travel Region (Price)	637-3009
Reservoir Administrators	
Ferron Canal and Reservoir Company	384-2990

MINERSVILLE RESERVOIR



Introduction

Minersville Reservoir is a large reservoir in the desert west of Beaver and east of Minersville. It is one of the larger reservoirs in western Utah, and has a State Park providing aquatic recreational in an area where there are few such facilities. It impounds winter runoff from the Tushar Mountains for agricultural use in the Minersville area. It is also known as Rocky Ford Reservoir

Minersville Reservoir was created in 1914 by the construction of an earth-fill dam. The reservoir shoreline is private and public lands, but public access is unlimited.

Characteristics and Morphometry

Lake elevation (meters / feet)	1,677 / 5,503
Surface area (hectares / acres)	400.6 / 990
Watershed area (hectares / acres)	137,587 / 339,840
Volume (m^3 / acre-feet)	
capacity	32,687,800 / 26,500
conservation pool	2,467,000 / 2,000
Annual inflow (m^3 / acre-feet)	37,091,345 / 30,070
Retention time (years)	.88
Drawdown (m^3 / acre-feet)	14,216,109 / 11,525
Depth (meters / feet)	
maximum	13.4 / 44
mean	8.1 / 26.7
Length (km / miles)	5.4 / 3.4
Width (meters / feet)	1.15 / .7
Shoreline (km / miles)	1.28 / 7.9

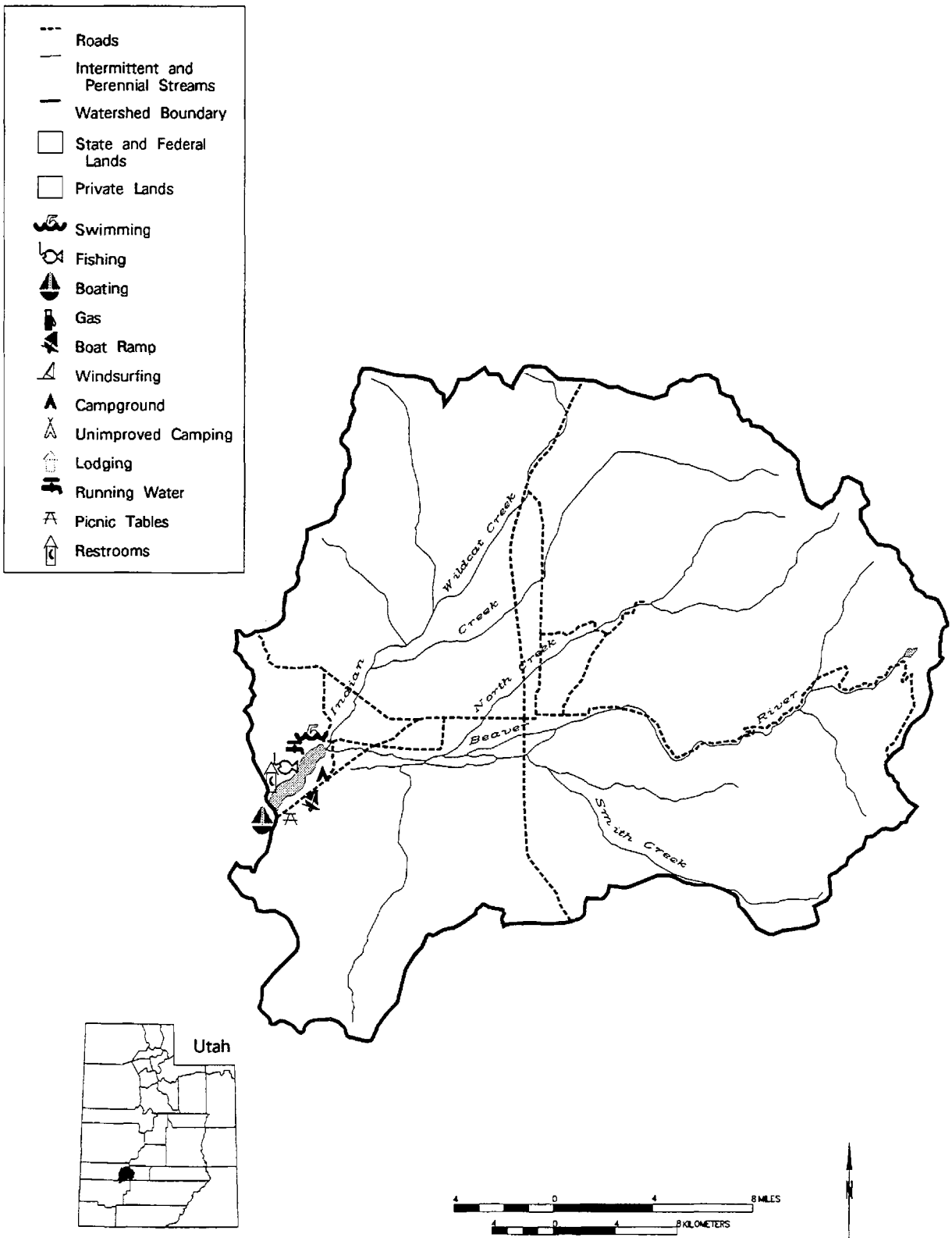
Location

County	Beaver
Longitude / Latitude	112 48 48 / 38 14 08
USGS Maps	Minersville Reservoir, Adamsville
DeLorme's Utah Atlas & Gazetteer™	Page 26, B-1
Cataloging Unit	Beaver (16030007)

Current water use is for irrigation, and no changes are anticipated.

Recreation

Minersville Reservoir is 12 miles west of Beaver (I-15 Exit 109 or 112) on U-21. From Minersville, the reservoir is six miles east on U-21. Access to the north shore of the reservoir is a dirt road from Adamsville to its junction with U-



County near which watershed is located.

Minersville Watershed

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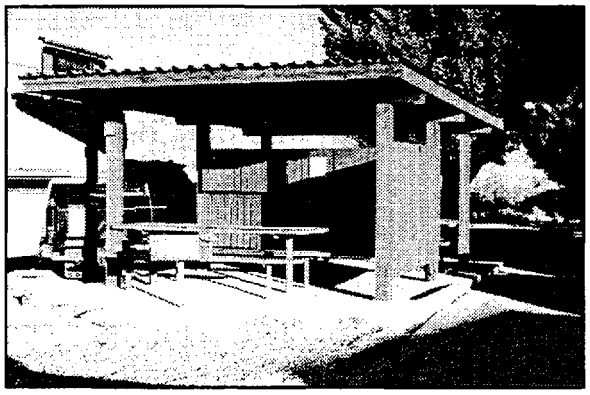
21, the junction being 2 miles west of the dam and 3.5 miles east of Minersville.

The reservoir is used for fishing, swimming, boating, and waterskiing. Usage is fairly heavy in wet years, but light in dry years. Recreation is concentrated to the reservoir itself, as the surrounding area is low desert. Minersville State Park has a sanded beach, a concrete public boat ramp, a 29 unit campground, flush toilets, hot showers, and picnic areas. The reservoir has also proven to be a valuable and popular fishery, which is operated and maintained by the DWR, who own a 2,000 acre-feet. conservation pool. The State Park is located along the southeastern shore of the reservoir with associated boating, swimming, fishing, and waterskiing. There is a private campground in Beaver (see info box).



During recent years with the adoption of the reservoir as a "trophy fishery" there has been a substantial decline in recreational use at the State Park. The facilities at the park are some of the best in the State, but park staff are concerned with the decline.

Watershed Description

Minersville Reservoir is an impoundment of the Beaver River at the west end of Beaver Valley, where the river passes through a gap between the Black Mountains to the south and the Mineral Mountains to the north, flowing out into the eastern Escalante Desert. This area is a desert valley with desert mountains to the north, south and west. The area around the reservoir is arid and relatively flat.

The river originates in the Tushar Mountains, with elevations of over 12,000 feet, making them the third highest range in the state. The headwaters are in wide, glaciated valleys surrounded by jagged peaks. The mountains are richly forested. Numerous smaller rivers join the Beaver River as it flows down a long, deep, narrow canyon. The mountains are used for logging, grazing and recreation. Mount Holly Ski Resort is here, as well as several summer camps and resorts, such as Puffer Lake. The bulk of the range is owned by the USFS, but there are some private lands with summer home development interspersed. In recent years, many of these private lands have been sites of timber harvest. These timber harvests have presented some concerns with regards to erosion control. The mountains are known for fishing, hunting, hiking, and general scenic beauty. There are a number of points that provide vistas of natural beauty unsurpassed in the State.

The city of Beaver was built where the river flows out into the valley. The low elevation provides a long growing season and the river ensures a steady supply of water. From the city to the reservoir, the river flows across the valley, acquiring several major tributaries from the Tushars (South Creek, North Creek, and Indian Creek) and several ephemeral streams from the Mineral and Black Mountains.

The watershed high point, Delano Peak, is 3,709 m (12,167 ft) above sea level, thereby developing a complex slope of 5.2% to the reservoir. The inflows are the Beaver River, Indian Creek, and Chalk Hollow Creek. The outlet is the Beaver River. The average stream gradient above the reservoir is 4.6% (245 feet per mile). The gradient is much lower in Beaver Valley and much higher in the Tushars. There are many upstream reservoirs in the Tushars, which are used for fishing, irrigation water storage, and hydroelectric power. The river and other streams are usually completely dewatered in Beaver Valley, with agricultural return flows returning to Minersville Reservoir. There are a number of upstream lakes and reservoirs in the Tushars, including Little Creek Reservoir, Kents Lake, Anderson Meadows Reservoir, LaBaron Lake, Three Creeks Reservoir, and Puffer Lake.

The watershed is made up of foothills, terraces, alluvial fans, high mountains, desert mountains, mountain valleys and foothills. See Appendix III for soil composition data.

The vegetation communities consist of urban, cropland (irrigated and nonirrigated), sagebruch-grass, bitterbrush, pinyon-juniper, oak, maple, aspen, pine, spruce-fir, and alpine. The watershed receives 25 - 102 cm (10 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 120 - 140 days per year.

According to the 1992 Upper Beaver River Watershed Project, the DWQ estimates that the watershed contains: 9,000 acres of irrigated pastureland, 13,000 acres of irrigated croplands, 9,000 acres of state woodland and grazing land, 142,000 acres of BLM grazing land, 3,200 acres of urban land, 121,000 acres of USFS multiple use land (including 1,280 acres of ski resort).

D	°C	pH	DO	Cond
0	16.6	8.4	7.0	658
1	16.6	8.4	6.8	658
2	16.6	8.4	6.7	658
3	16.6	8.4	6.7	659
3.8	16.6	8.4	6.7	659

Temp ▼--▼ DO ■--■

Limnological Assessment

The water quality of Minersville Reservoir is fair. It is considered to be hard with a hardness concentration value

of approximately 170 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are phosphorus, dissolved oxygen and some heavy metals.

The average concentration of total phosphorus in the water column in 1989 and 1992 was 137 and 113 ug/L which exceeds the recommended pollution indicator for phosphorus of 25 ug/L. Peak phosphorus concentrations, at various stages in the water column have reached as high as 270 ug/L. Dissolved oxygen concentrations in the water column substantiate the fact that water quality impairments do exist. Concentrations periodically drop below the criteria established for a cold water fishery. These conditions could also be compounded under extended ice coverage or development of a thermocline if sufficient depths were allowed to develop. However as indicated in the 1992 profile, current conditions due not allow sufficient depth in the reservoir for stratification.

Limnological Data

Data averaged from STORET sites: 594011, 594012, 594013

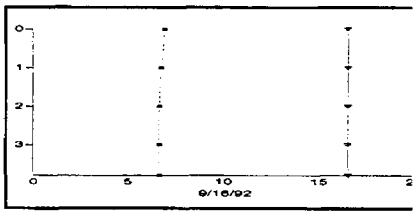
Surface Data	1980*	1989	1992
Trophic Status	E	E	E
Chlorophyll TSI	-	52.05	51.90
Secchi Depth TSI	46.796	51.96	46.34
Phosphorous TSI	72.255	75.90	69.56
Average TSI	59.52	59.97	55.94
Chlorophyll a (ug/L)	-	9.0	14.9
Transparency (m)	2.5	1.8	2.5
Total Phosphorous (ug/L)	110	146	113
pH	87.9	8.6	8.8
Total Susp. Solids (mg/L)	28	-	8.26
Total Volatile Solids (mg/L)	-	-	3
Total Residual Solids (mg/L)	-	-	6
Temperature (°C / °f)	17/63	19/66	18/65
Conductivity (umhos.cm)	414	560	599
Water Column Data			
Ammonia (mg/L)	0.09	0.01	0.03
Nitrate/Nitrite (mg/L)	.24	-	0.01
Hardness (mg/L)	150	-	189
Alkalinity (mg/L)	155	-	190
Silica (mg/L)	27.8	-	29.1
Total Phosphorous (ug/L)	107.5	137	113
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	8.7	6.8	6.6
Stratification (m)	NO	NO	NO
Depth at Deepest Site (m)	13	7.3	2.6

* Data from only 2 sites, 594011 and 594012

Some metal concentrations were found to exceed state standards during the Clean Lakes Phase I study period (1992). The standards used were based on a 200 mg/L total hardness concentration. The average cadmium concentration did not exceed the 4 day standard of 2.0 ug/L, but a maximum value of 4.0 was reported. The average concentration for lead of 10.4 ug/L exceeded the 4 day standard of 7.7 ug/L. An average value of 0.19 ug/L was reported for mercury which has a 4 day standard of 0.12 ug/L. Finally silver had a reported mean value of 3.29 ug/L with a 4 day standard established at 0.12 ug/L. It should be noted that although violations of the standard for cadmium, lead, mercury and silver were observed, some clarifications of the data need to be presented. The data obtained was from samples near the bottom of the reservoir only. This is an area where higher concentrations are found due to the decomposition and resuspension of metals. Historical data throughout the water column has not show any significant elevated concentrations of metals. For a more complete discussion of these violations refer to the Minersville Reservoir Clean Lakes Phase I Study (1995).

Minersville Reservoir is a eutrophic reservoir that is subject to considerable variation in excessive algae growth, turbid waters, heavy water plant growth at times, low dissolved oxygen concentrations and occasional fish kills. As a result a Clean Lakes study was undertaken on the reservoir in 1991. The intent of that study was to quantify nutrient loadings to the reservoir and determine what alternatives were available to reduce or eliminate nutrient loadings into the reservoir. Although data suggest that the reservoir is a nitrogen limited system, targeted nutrients included nitrogen and phosphorus. Those sources identified as most like controllable were farm and ranch operations. TSI values indicate the reservoir is eutrophic. It does appear that there has been a significant reduction in the loadings to the reservoir in recent years. In 1975 EPA NES survey the reservoir was characterized as hypereutrophic. Since that time nutrient loadings from the following sources have been eliminated or diverted to a nondischarging lagoon system: Beaver Fish Hatchery; Cache Valley Creamery; Valley Packing Company and Beaver City sewage.

According to DWR no fish kills have been reported in recent years. However, during the late summer of 1994, there was a documented fish fill at the reservoir. A review



of the data indicates that it was probably due to a combination of factors; a heavy blue-green algal bloom (*Anabaena spiroides var. crassa*), high temperatures, and low dissolved oxygen. The reservoir supports populations of rainbow trout (*Oncorhynchus mykiss*), cutthroat trout (*Oncorhynchus clarki*), Utah chub (*Gila atraria*), and smallmouth bass (*Micropterus dolomieui*). In addition brown trout (*Salmo trutta*), which are planted annually in the drainage above the reservoir may be in the reservoir. Over the years Minersville Reservoir has provided an exceptional trout fishery. Repeated chemical treatments (1958, 1961, 1967, 1972, 1977, 1984, and 1991) have failed to completely eradicate the competing chub populations. Since these treatments have not been able to effectively control the populations of these rough fish a study was done to determine and formulate a new management program. As a result the basic management concept at the reservoir has been changed from a "Basic Yield Water" to a "Trophy Water"

To accomplish their goals after the last treatment the reservoir was stocked with 7-inch rainbow and cutthroat trout instead of the customary 3-inch trout. Stocking was done in June when most of the predacious birds had migrated north which would allow the fish to reach approximately 15 inches by the following March when the bird populations peak. In addition smallmouth bass were planted to provide more fishing variety and biological control of chubs. Finally, special fishing regulations are used to reduce harvest and maintain a large population of trout in the reservoir. The currently reported fish population (trout) has attained the size necessary to be harvested under existing regulations.

Reported types of plankton present historically in the reservoir include *Daphnia spp.*, *Ceratium sp.*, *Fragillaria sp.*, and *Nostoc sp.*. The Daphnia occurring in the reservoir is the larger type, and serves as the main food source. Plankton is abundant in the reservoir. The bottom fauna is reported to be relatively sparse except for *Chironomidae*. Phytoplankton present in the euphotic zone by sampling period include the following taxa (in order of dominance):

Samples from October 1, 1991.

Species	Cell Volume (mm^3/liter)	% Density By Volume
Ukn. fil. green algae	6.539	51.11
Melosira granulata	2.556	19.99
Pediastrum duplex	1.334	10.44
Pennate diatoms	0.937	7.33
Stephanodiscus niagarae	0.352	2.75
Anabaena spp.	0.278	2.17
Closteriopsis long. v. tropica	0.296	2.30
Coelastrum microporum	0.215	1.68
Oscillatoria spp.	0.072	0.56
Chlorococcum spp.	0.056	0.43
Meloisra. granulata angustissima	0.050	0.39
Centric diatoms	0.044	0.35
Ankistrodesmus falcatus	0.034	0.27
Oscillatoria amphibia	0.014	0.11
Scenedesmus bijuga	0.008	0.06
Total		

Shannon-Weaver Index[H']	1.55
Species Evenness	0.57
Species Richness[d]	0.62

Samples from August 13, 1992.

Species	Cell Volume (mm^3\Liter)	% Density by volume
Stephanodiscus niagarae	7.294	53.36
Sphaerocystis schroeteri	2.641	19.32
Melosira granulata	1.745	12.75
Staurastrum gracile	0.723	5.29
Centric diatoms	0.420	3.07
Pennate diatoms	0.362	2.65
Fragilaria crotonensis	0.229	1.68
Oscillatoria spp.	0.091	0.67
Euglena spp.	0.066	0.60
Asterionella formosa	0.066	0.48
Oocystis spp.	0.017	0.12
Totals		

Shannon-Weaver Index[H']	1.44
Species Evenness	0.60
Species Richness[d]	0.44

Samples from August 17, 1994.

Species	Cell Volume (mm^3\Liter)	% Density by volume
Anabaena spiroides var. crassa	96.13	378.69
Pleromonas spp.	1.85	7.28
Trachellomnonas spp.	1.84	7.25
Sphaerocystis schroeteri	0.16	0.61
Dysmorphococcus spp.	0.01	0.04
Unknown sperical chlorophyta	0.01	0.03

Ankistrodesmus falcatus	0.00	0.02
Oocystis spp.	0.00	0.01
Chlamydomonas spp.	0.00	0.00
Totals	100.00	393.93

Shannon-Weaver Index[H']	0.20
Species Evenness	0.09
Species Richness[d]	0.30

The phytoplankton community dominance changes according to existing water quality conditions. However, the most recent community is dominated by the presence of noxious blue-green algae, *Anabaena*. This composition is indicative of relatively poor water quality, and highly eutrophic conditions.

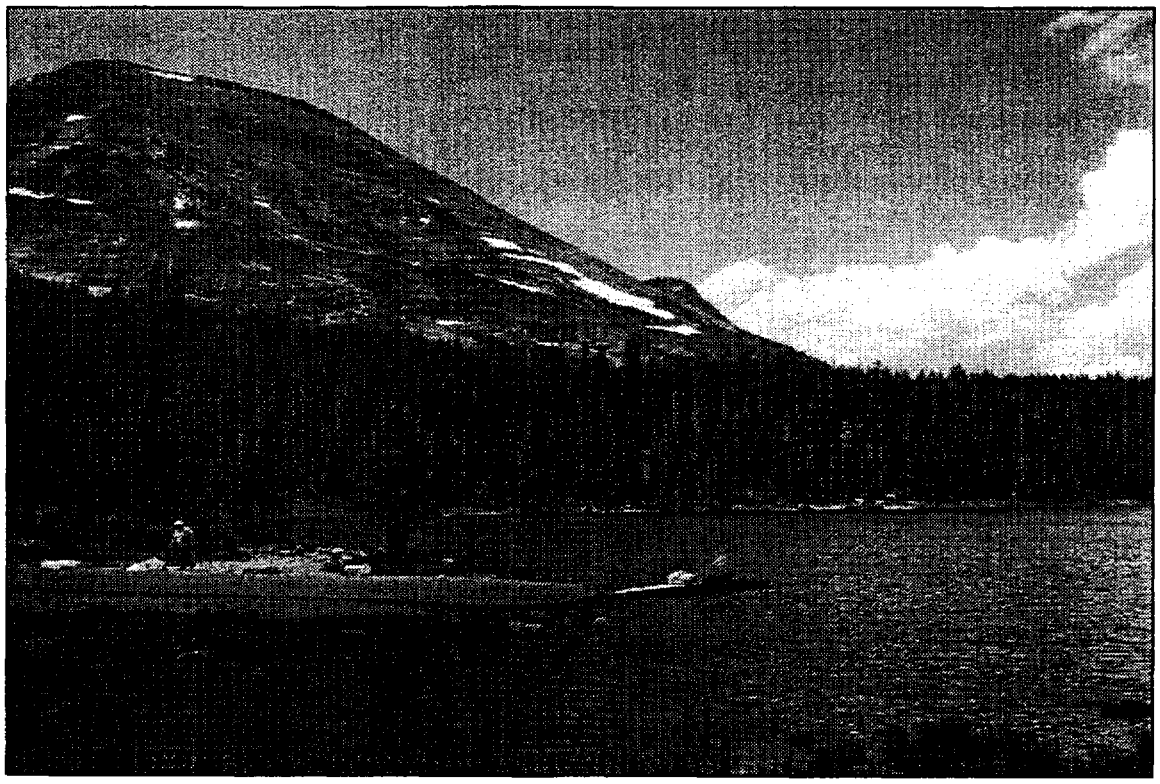
Pollution Assessment

Nonpoint sources of pollution in Minersville Reservoir include: sedimentation, and nutrient loading from grazing in the watershed and in the vicinity of the reservoir, pesticides and fertilizers from cultivated cropland, human wastes and litter from recreation, and urban runoff. These sources currently exhibit a significant impact on reservoir water quality.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), warm water game fish and organisms in their food chain (3B), wildfowl and associated organisms (3D), and agricultural uses (4).

MIRROR LAKE



Introduction

Mirror Lake is an intermediate-sized natural lake in the western High Uintas. Biologically and geologically it is comparable to numerous other glacial lakes in the High Uintas. It is unique in the fact that a paved road has been built to it, therefore it receives extensive recreational use. Consequently, Utahns are more familiar with Mirror Lake than perhaps any other natural mountain lake in the state. Due to the accessibility, the Forest Service has extensively developed the area for recreational uses. The shoreline is owned by the Wasatch-Cache National Forest, and public access is unrestricted. The lake drainage is the extreme headwaters of the Duchesne River and is not regulated by man.

Characteristics and Morphometry

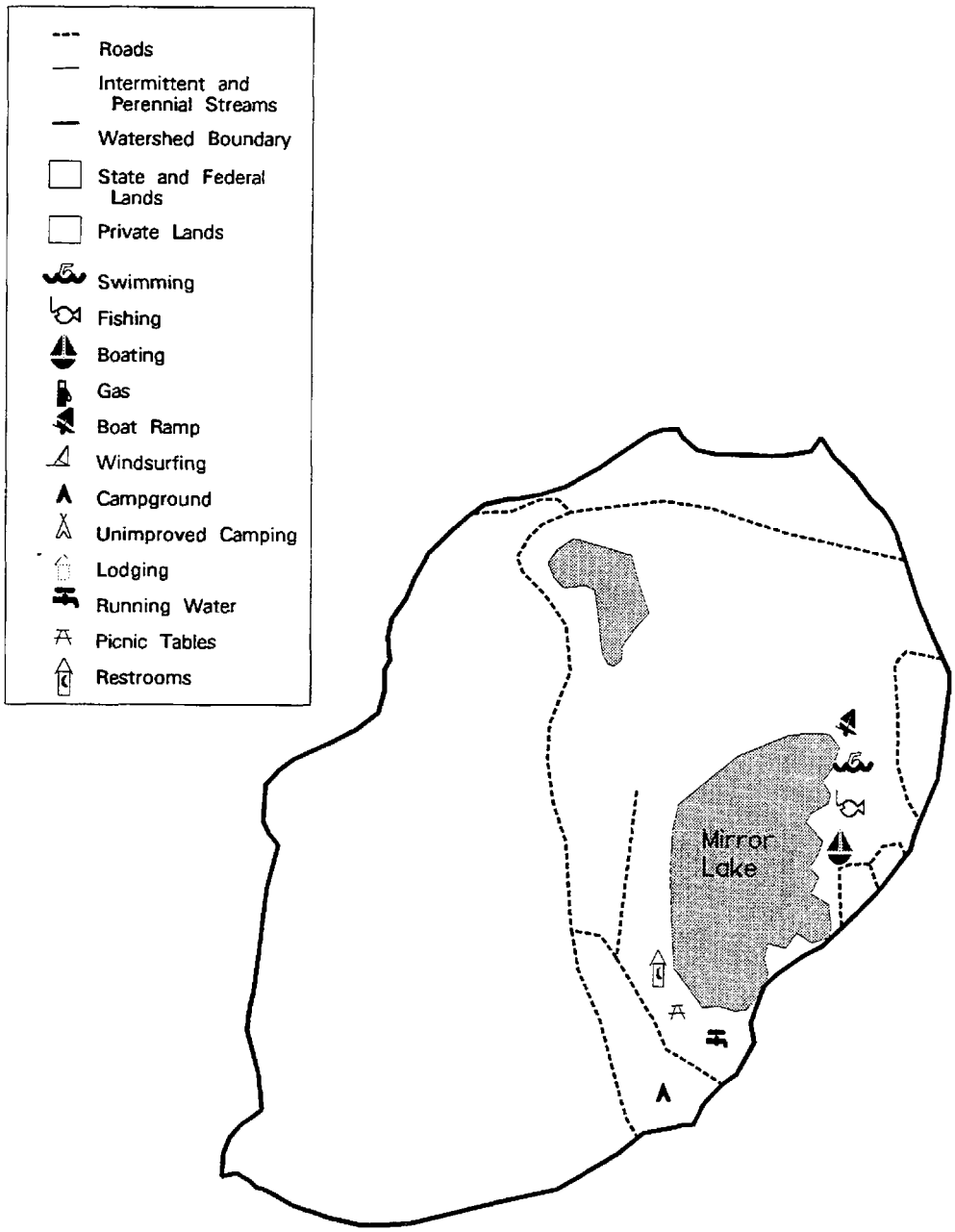
Lake elevation (meters / feet)	3,045 / 10,020
Surface area (hectares / acres)	20 / 50
Watershed area (hectares / acres)	203 / 502
Volume (m^3 / acre-feet)	
capacity	863,451 / 700
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	12.5 / 41
mean	4.3 / 14
Length (meters / feet)	777 / 2,550
Width (meters / feet)	389 / 1,275
Shoreline (km / miles)	2.12 / 1.32

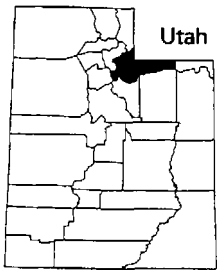
Location

County	Duchesne
Longitude / Latitude	110 53 13 / 40 42 18
USGS Map	Mirror Lake, UT 1972
DeLorme's Utah Atlas & Gazetteer™	Page 54, B-3
Cataloging Unit	Duchesne (16060003)

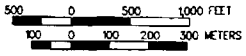
Recreation

Mirror Lake is easily accessible from U-150 about 31 miles east of Kamas. The highway passes very near the lake, and is often referred to as "The Mirror Lake Highway". There is a USFS campground directly on the lake, and many





County in which watershed is located.



Mirror Lake Watershed

others in the vicinity. Large signs on U-150 direct travelers to the lake.

Fishing, boating, swimming, camping, picnicking, scenic beauty and hiking are all popular. Motorized boats are prohibited. Except for a few warm days in the late summer, air and water are too cold for swimming. The backdrop of high, barren peaks are reflected in the still water of the lake, hence its name.

The area receives heavy recreational use throughout the summer, so please tread lightly to ensure that the area remains relatively pristine. U-150 is closed during the winter and much of the spring, but groomed for use by cross country skiers, snowmobilers and hikers.

Recreational facilities at the lake include Mirror Lake Campground, with latrines, day-use areas and 94 campsites.

Watershed Description

Mirror Lake is located in the western end of the High Uintas. The watershed is quite small, and consists of dense forest, smaller lakes, boggy meadows, and barren, rugged mountain peaks. U-150 passes through the watershed, but water chemistry does not seem to be significantly effected by transportation activity.

The watershed high point, Bald Mountain, 3,640 m (11,943 ft) above sea level is directly to the west of the lake, thereby developing a complex slope of 49.1% to the reservoir. There are no perennial streams flowing into the lake, but because of the high elevation, snowmelt runoff flows for most of the summer. The water that enters the lake is overflow from Pass Lake located just above Mirror Lake. The outflow is the headwaters of the Duchesne River.

The watershed is made up of high mountains and mountains meadows. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of Pine, oak, maple, spruce-fir and aspen. The watershed receives 76 - 102 cm (30 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 0 - 20 days per year.

Land use in the watershed is 100% multiple use, with grazing, and recreation being the primary uses. No commercial timber harvesting takes place, but the intensity of summer recreation has some impact on the water quality. This may become a significant problem as usage increases.

Limnological Assessment

The water quality of Mirror Lake is very good. It is considered to be very soft with a hardness concentration value of approximately 7 mg/L ($CaCO_3$). Although there are no overall water column concentrations that exceed State water quality standards there are reported violations of parameters near the bottom of the lake or sporadically through the water column on occasion. These parameters include phosphorus, dissolved oxygen and pH. At various times of the year the hypolimnion of the lake the oxygen deficiencies develop. These occurrences as indicated during the September 15, 1993 profile show anoxic conditions near the bottom of the lake later in the year. Total phosphorus values reported on a rare occasion exceed the pollution indicator of 25 ug/L. However, as a general rule the overall concentration of phosphorus is rather low in the lake. The pH values have dipped to a low of 5.8 on occasion which is only a little under the limit of 6.5 established for a cold water fishery. Although these exceedences have occurred, it does not appear that the water quality is significantly impaired. It does indicate that some winter monitoring should be conducted to determine if impairments are present during extended ice coverage conditions during the winter. The potential for stratification in the lake does occur when there is sufficient depth in the lake. Although the profile shown of September 15, 1993 does show some limited stratification near the bottom of the lake, thermoclines higher in the water column have been documented earlier in the year at other times. As stratified conditions develop they will contribute to the process of oxygen loss as previously discussed. Current data suggest

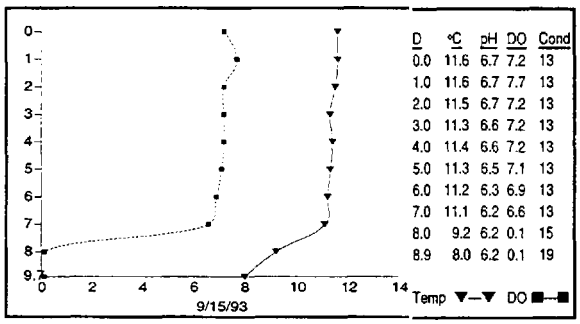
Limnological Data

Data sampled from STORET site: 593605

Surface Data	1981	1989	1991
Trophic Status	M	O	O
Chlorophyll TSI	-	37.64	38.33
Secchi Depth TSI	41.8	38.01	44.91
Phosphorous TSI	47.3	39.04	36.60
Average TSI	44.5	38.23	39.95
Chlorophyll a (ug/L)	-	2.1	2.2
Transparency (m)	2.5	4.6	2.9
Total Phosphorous (ug/L)	20	11	10
pH	6.2	6.3	7.8
Total Susp. Solids (mg/L)	<5	-	<3
Total Volatile Solids (mg/L)	-	-	4
Total Residual Solids (mg/L)	-	-	1
Temperature (°C / °f)	15/59	12/53	14/56
Conductivity (umhos.cm)	11	21	11
Water Column Data			
Ammonia (mg/L)	0.05	<0.05	0.03
Nitrate/Nitrite (mg/L)	0.07	-	0.01
Hardness (mg/L)	7	-	7.5
Alkalinity (mg/L)	2	-	5
Silica (mg/L)	-	-	1.0
Total Phosphorous (ug/L)	20	12	14
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	7.2	4.7	4.4
Stratification (m)	2	7-9	NO
Depth at Deepest Site (m)	9	10.1	8.6

that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is oligotrophic in a state of low productivity.

According to DWR no fish kills have been reported in recent years. The reservoir supports a population of brook trout (*Salvelinus fontinalis*), rainbow and albino rainbow trout (*Oncorhynchus mykiss*). The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake The DWR stocks the lake annually with 7,000 catchable rainbow trout, 4,200 albino rainbow trout and 7,500 fingerling brook trout.



D	°C	pH	DO	Cond
0.0	11.6	6.7	7.2	13
1.0	11.6	6.7	7.7	13
2.0	11.5	6.7	7.2	13
3.0	11.3	6.6	7.2	13
4.0	11.4	6.6	7.2	13
5.0	11.3	6.5	7.1	13
6.0	11.2	6.3	6.9	13
7.0	11.1	6.2	6.6	13
8.0	9.2	6.2	0.1	15
8.9	8.0	6.2	0.1	19

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm³/liter)	% Density By Volume
Peridinium sp.	0.727	43.61
Pennate diatoms	0.683	41.01
Dinobryon sp.	0.085	5.14
Centric diatoms	0.063	3.80
Oocystis sp.	0.058	3.50
Merismopedia sp.	0.044	2.67
Chlamydomonas sp.	0.004	0.27
Total	1.664	
Shannon-Weaver [H']	1.23	
Species Evenness	0.63	
Species Richness	0.29	

The phytoplankton community is dominated by the presence of flagellates and diatoms indicative of good water quality and fairly low productivity.

Pollution Assessment

Nonpoint pollution sources include sedimentation and nutrient loading from grazing, and litter or waste from recreation.

There are no point sources of pollution in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Wasatch-Cache National Forest	524-5030
Kamas Ranger District	783-4338
Recreation	
Dinosaurland Travel Region (Vernal)	789-6932

MONA RESERVOIR

Introduction

Mona Reservoir is a large reservoir at the north end of Juab Valley in Central Utah, located near I-15 between Santaquin and Nephi and west of Mount Nebo. It is typical of Great Basin reservoirs, being in a flat valley of alluvial deposits surrounded by mountains. It is also known as Mount Nebo Reservoir.

Characteristics and Morphometry

Lake elevation (meters / feet)	1,488 / 4,882
Surface area (hectares / acres)	4,490 / 1,110
Watershed area (hectares / acres)	20,760 / 51,273
Volume (m^3 / acre-feet)	
capacity	33,300,000 / 26,973
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	7.01 / 23
mean	5.18 / 17
Length (km / miles)	7.49 / 4.65
Width (km / miles)	1.58 / .97
Shoreline (km / miles)	17.5 / 10.9

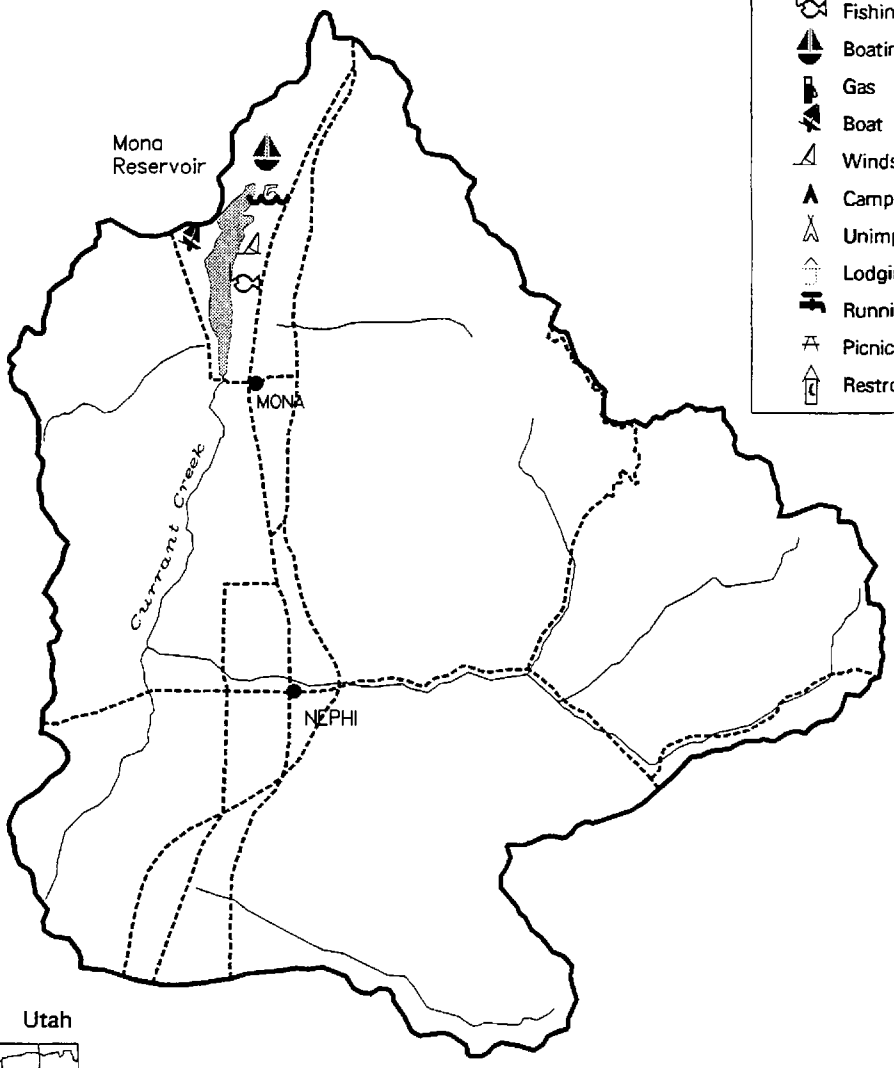
Mona Reservoir was created in 1895 by the construction of an earth-fill dam. The reservoir is privately owned, and access is restricted. Water use is primarily for irrigation, and recreation with no changes are foreseen in the future. It is anticipated that the Central Utah Project will bring water from the Spanish Fork River to Mona Reservoir, but the details have not yet been determined (Dec. 1992).

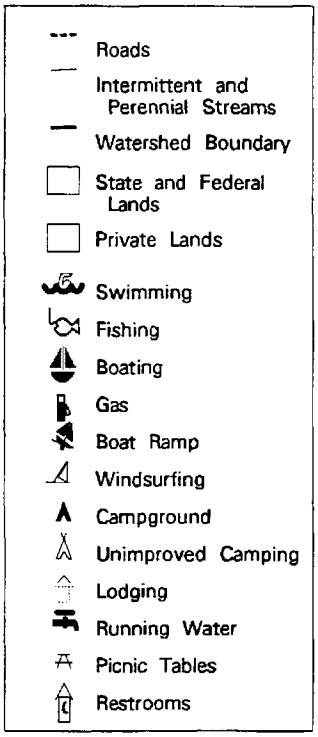
Location

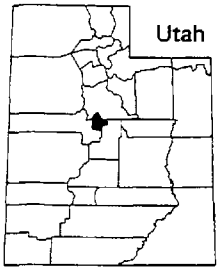
County	Juab
Longitude / Latitude	111 52 53 / 39 52 24
USGS Maps	Mona, UT 1979, Santaquin, UT 1979
DeLorme's Utah Atlas & Gazetteer™	Page 45, B-5
Cataloging Unit	Utah Lake (16020201)

Recreation

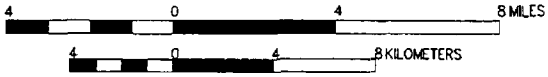
Mona Reservoir is accessible from the Mona-Goshen Road. This is a paved road running from I-15 (Exit #236) east to Mona, across Currant Creek, then bending north towards Goshen, following Currant Creek's canyon through







County near which watershed is located.



Mona Watershed

<k90>

Long Ridge and arriving at US-6 in downtown Goshen. The turnoff to Mona Reservoir is 7 km northwest from Mona and 10 km south from Goshen. The dam is 2 km east on a dirt road. Boats can be launched at the dam, and vehicles can travel north or south along the reservoir.

The lake is used for fishing, boating and waterskiing. Usage is light. There are no facilities located at the reservoir. This is a private reservoir and was once closed to public use, so please be considerate and pick up litter, etc.

There is are private campgrounds in Nephi (see info box), but no public camping in the area.

Watershed Description

The centerpiece of the watershed, geographically and in runoff production, is Mount Nebo. Although the valley floor itself is not particularly scenic, Mount Nebo rises over 7,000 feet above the valley, with no foothills to obscure the view of the jagged peaks, and nearly 40 inches of precipitation fall on its summit. Much of the high area is federally protected wilderness.

Mona Reservoir is an impoundment of Currant Creek, (this is a different Currant Creek than the reservoir of that name in Wasatch County) which drains the east slopes of Mount Nebo, flows around to the front and up the valley to the impoundment. The streams on the west face of Nebo historically drained into Currant Creek, but are now diverted for irrigation. The watershed also drains Long Ridge to the west, the northern San Pitch mountains, and much of the mountainous region east of Mount Nebo.

The watershed high point, Mount Nebo, is 3,636 m (11,959 ft) above sea level, thereby developing a complex slope of 24.1% to the reservoir. The inflow and outlet is Currant Creek. Inflow also includes some springs on the east side of the reservoir. The average stream gradient in the valley upstream from the reservoir is about 10% (53 feet per mile), with much higher gradients in the mountains.

The watershed is comprised of alluvial plains, alluvial fans, low mountains and high mountains. See Appendix III for soil composition data.

The vegetation communities consist of alpine, pinyon-juniper, spruce-fir, aspen, oak-maple, sagebrush-grass, bitterbrush, shadscale, and greasewood. The watershed receives 30 - 76 cm (12 - 30 inches) of precipitation annually. The frost-free season around the reservoir is 140 -160 days per year.

According to the 1982 Clean Lakes Inventory, land use is as follows. The largest use is native grazing (mostly cattle and sheep) which comprises 36% of the watershed. Other uses are multiple use 25%, pasture, hay, and croplands 15%, non-irrigated cropland 15%, wildlife 7%, urban 1% and recreation 1%.

Limnological Assessment

The water quality of Mona Reservoir is moderately good. It is considered to be very hard with a hardness concentration value of approximately 315 mg/L ($CaCO_3$). The only parameter that has exceeded State water quality standards for defined beneficial uses is phosphorus. The average concentration of total phosphorus in the water column in 1981 and 1992 was 48.3 and 217 ug/L which exceeds the recommended pollution indicator for phosphorus of 25 ug/L. The phosphorus concentration in the hypolimnion in September, 1992 reached a level of 391 ug/L. This increased concentration occurred when the reservoir was very shallow and resuspension of bottom sediments occurred.

Limnological Data

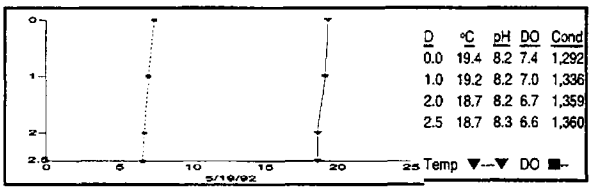
Data sampled from STORET site: 491298, 491299, 491307

Surface Data	1981	1992
Trophic Status	E	E
Chlorophyll TSI		41.38
Secchi Depth TSI	54.75	77.35
Phosphorous TSI	60.06	81.46
Average TSI	57.40	66.73
Chlorophyll a (ug/L)		3.0
Transparency (m)	1.4	0.3
Total Phosphorous (ug/L)	41.5	213
pH	8.3	8.1
Total Susp. Solids (mg/L)	38	168.50
Total Volatile Solids (mg/L)		5
Total Residual Solids (mg/L)		164
Temperature (°C / °f)	18/64	20/68
Conductivity (umhos.cm)	1,658	1,086
Water Column Data		
Ammonia (mg/L)	0.09	0.03
Nitrate/Nitrite (mg/L)	0.20	0.09
Hardness (mg/L)	421	315
Alkalinity (mg/L)	242	212
Silica (mg/L)		-
Total Phosphorous (ug/L)	48.3	217
Miscellaneous Data		
Limiting Nutrient	P	N
DO (Mg/l) at 75% depth	7.6	8.1
Stratification (m)	NO	NO
Depth at Deepest Site (m)	4.0	0.2

Although in 1981 the reservoir was characterized as a phosphorus limited system, the 1992 data suggest that the reservoir is currently a nitrogen limited system. TSI values

indicate the reservoir is hypereutrophic, but shallow condition during the last sampling trip aren't indicative of the overall trophic state due to the shallow nature of the reservoir at that time. The reservoir is probably still eutrophic as was indicated in 1981. The reservoir does not stratify due to its shallow nature.

Because of high evaporation rates and high nutrient input, most valley reservoirs in the Great Basin suffer from eutrophication, and this is no exception. It is unusual, though in that the majority of the water comes from mountains in close proximity to the reservoir, resulting in short stream lengths and consequently cleaner water. The reservoir is rarely drained, but in 1992 it was completely emptied. During the last decade, floods have washed over 4' of silt into the reservoir, significantly reducing depth and capacity, and increasing the likelihood of the need for all of the stored water in the future.



While Great Basin reservoirs are characteristically nutrient rich, corrective measures could be taken to improve water quality, including careful monitoring and control of nonpoint sources of pollution within a the watershed.

According to DWR no fish kills have been reported in recent years. It is occasionally stocked with fish by the DWR, the most recent stocking being 10,000 fingerling smallmouth bass (*Micropterus dolomieui*)in 1990. Burraston Ponds, one mile upstream from the reservoir, are stocked twice annually with catchable rainbow trout (*Oncorhynchus mykiss*), and some of these may reach Mona Reservoir. The reservoir contains self-sustaining populations walleye (*Stizostedion vitreum*), yellow perch (*Perca flavescens*), smallmouth bass, carp (*Cyprinus carpio*), utah chub (*Gila atraria*), black bullhead (*Ictalurus melas*), and other non-game fish. Zebra killifish and rainwater killifish (*Lucania parva*) live in Currant Creek above and below the reservoir. The reservoir was chemically treated by the DWR to control rough fish competition in 1960. The DWR plans to retreat the lake if funds become available, then restock with smallmouth bass and yellow perch, but no walleye.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Pennate diatoms	7.395	90.37
Melosira granulata	0.433	5.29
Centric diatoms	0.356	4.35
Total	8.181	
Shannon-Weaver [H']	0.38	
Species Evenness	0.35	
Species Richness	0.10	

The phytoplankton community is dominated by the presence of diatoms. It should be noted that under such low water conditions that the limiting factor associated with productivity is probably turbidity.

Information

Management Agencies	
Six County Commissioners Association	896-9222
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Panoramaland Travel Region (Richfield)	896-9222
Nephi Chamber of Commerce	623-2411
High Mountain Campground (Nephi)	623-0550
Mountain View RV Park (Nephi)	623-0218
Reservoir Administrators	
Currant Creek Irrigation Company	667-3203

Pollution Assessment

Nonpoint pollution sources include the following: sedimentation and nutrient loading from grazing, feedlots and cropland; wastes and litter from recreation; household wastes and nutrient loading from urban areas; and sedimentation and heavy metal production from active and inactive mines. The major use of the watershed is livestock grazing and agriculture which may increase soil erosion. There is an active gypsum mine on the east side of Nephi, but runoff is said to be well contained. Another gypsum mine is proposed for a steep, narrow canyon in the Nebo Wilderness Area, which could increase erosion problems and may impact water quality in the reservoir.

The area around the reservoir is rangeland and cropland. These land uses have impact on the reservoir, including sediment production and contamination from agricultural chemicals.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), warm water game fish and organisms in their food chain (3B) and agricultural uses (4).

MONTICELLO LAKE

Introduction

Monticello Lake is a tiny reservoir in the lower Abajo Mountains. The reservoir shoreline is publicly owned by the Manti-La Sal National Forest. Public access is unrestricted. The impoundment, an earth-fill dam, was built in 1954. Water use priorities are primarily recreation and fishing.

Characteristics and Morphometry

Lake elevation (meters / feet)	2,621 / 8,600
Surface area (hectares / acres)	1.2 / 3
Watershed area (hectares / acres)	155 / 382
Volume (m^3 / acre-feet)	
capacity	75,000 / 15
conservation pool	
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	5.5 / 18
mean	1.5 / 5
Length (meters / feet)	482 / 1,584
Width (meters / feet)	161 / 528
Shoreline (meters / feet)	644 / 2,112

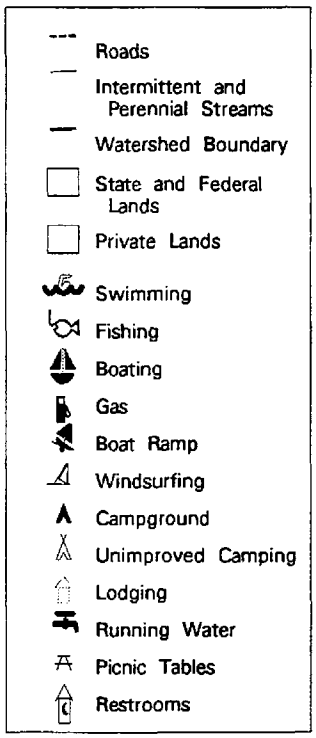
Recreation

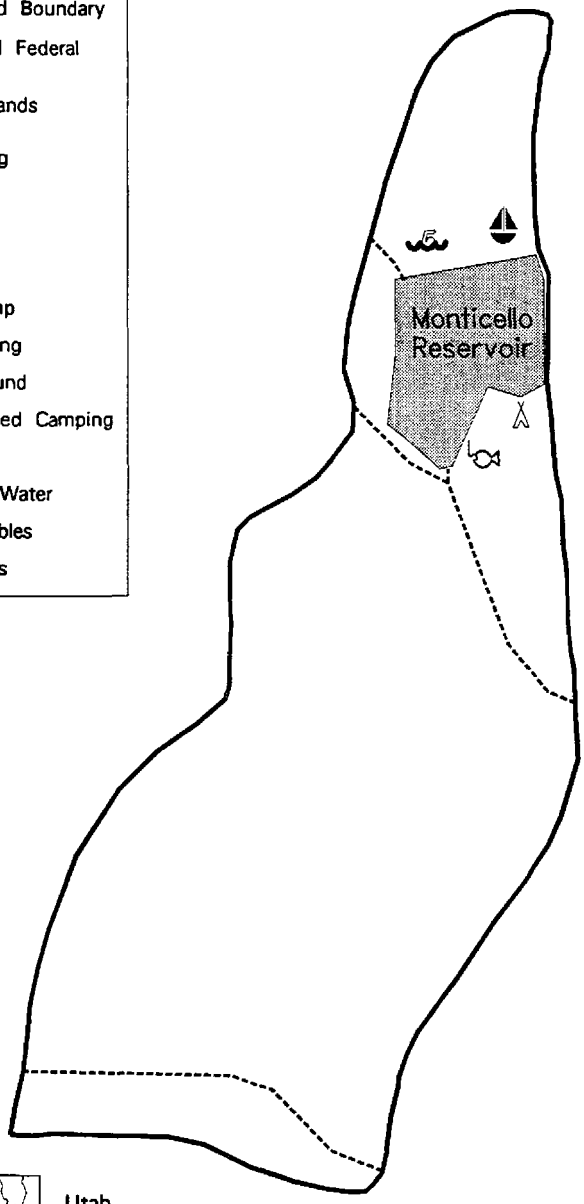
Monticello Lake is 8 miles west of Monticello. Travel west from downtown onto the Blue Mountain North Creek Road (FS-105) and goes high in the Abajos. Monticello Lake is on the right side of the road, one mile past Buckboard Campground.

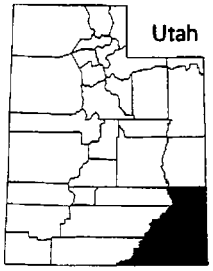
Location

County	San Juan
Longitude / Latitude	109 28 00 / 37 53 40
USGS Map	Abajo Peak, Utah, 1985
Atlas	pg.46,B2
Cataloging Unit	Montezuma Creek (14080203)

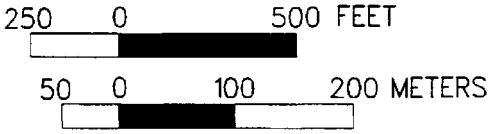
The lake was once one of the only lake fisheries in southwestern Utah. In the 1980s, three large reservoirs were constructed in the regoin: Ken's Lake in Moab, Lloyds Lake near Monticello, and Recapture Reservoir near Blanding. These three reservoirs are much larger than Monticello Lake and offer more fishing opportunities.







County in which watershed is located.



Monticello Watershed

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In addition to Monticello Lake , approximately 2 miles to the west is Race Track Reservoir. Monticello Lake is still popular, and its high elevation offers respite from the desert summers.

The area immediately around the lake offers primitive camping. There are two USFS campgrounds east on FS-105. Dalton Springs is 2 miles east and has 16 campsites, picnic areas, drinking water, and vault toilets. User fees are charged. Buckboard, 1 miles east, is more primitive and has 13 campsites. There are several private campgrounds in Monticello.

Watershed Description

Monticello Lake is in the Abajo Mountains. The range is an exposed laccolith, but the lake is in the area of uplifted sedimentary rocks rather than exposed igneous rocks. The watershed high point, Abajo Peak, is 3,463 m (11,360 ft) above sea level, thereby developing a complex slope of 16.6% to the reservoir. The inflows are South Creek, Pole Creek and Shingle Mill Draw. South Creek is the only perennial inflow. The outflow is also South Creek, but immediately downstream North and South Creeks conflue to become Montezuma Creek.

The soil is of limestone origin with rapid permeability and erosion is rapid (Dakota Sandstone).

The vegetation communities are comprised of spruce-fir, pine-aspen and land grass communities. The watershed receives 51 - 76 cm (20 - 30 inches) of precipitation annually with a frost-free season of 60 - 80 days at the reservoir.

Land use is 100% multiple use. The major use of the watershed is livestock grazing, which contributes to heavy runoff and soil erosion. The watershed was trenched in 1963 in an effort to reduce and control erosion. The area around the lake is used for recreation, and since the watershed is so small, this is a large fraction of the watershed area. Recreational use does impact the lake with heavy human usage and disposal of litter.

Limnological Assessment

The water quality of Monticello Lake is good. It is considered to be moderately hard with a hardness concentration value of approximately 132 mg/L ($CaCO_3$). The only parameter that has exceeded State water quality standards for defined beneficial uses is phosphorus. The average concentration of total phosphorus in the water column in 1992 was 42 which exceeds the recommended pollution indicator for phosphorus of 25 ug/L. The decline in dissolved oxygen concentrations in late summer indicate that water quality impairments do exist due to a demand for oxygen in the water column. These conditions maybe more pronounced during the winter and probably should be surveyed.

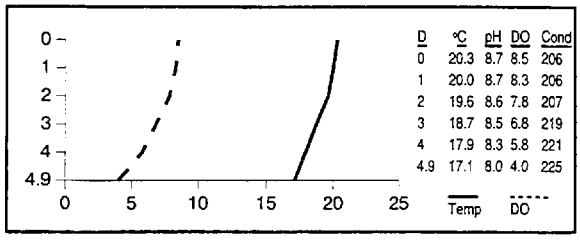
Limnological Data

Data sampled from STORET site: 595221

Surface Data	1981	1992
Trophic Status	O	M
Chlorophyll TSI	-	39.97
Secchi Depth TSI	-	43.93
Phosphorous TSI	37.35	56.22
Average TSI	37.35	46.71
Chlorophyll a (ug/L)	-	2.6
Transparency (m)	-	3.1
Total Phosphorous (ug/L)	5	37
pH	7.9	8.6
Total Susp. Solids (mg/L)	<5	82.5
Total Volatile Solids (mg/L)	-	2
Total Residual Solids (mg/L)	-	81
Temperature (°C / °f)	18/64	17/63
Conductivity (umhos.cm)	328	242
Water Column Data		
Ammonia (mg/L)	0.05	0.03
Nitrate/Nitrite (mg/L)	0.3	0.02
Hardness (mg/L)	151	112
Alkalinity (mg/L)	125	98
Silica (mg/L)	-	13.4
Total Phosphorous	5	42
Miscellaneous Data		
Limiting Nutrient	P	N
DO (Mg/l) at 75% depth	-	6.12
Stratification (m)	-	NO
Depth at Deepest Site (m)	-	4.9

Although in 1981 the reservoir was characterized as a phosphorus limited system, the 1989-91 data suggest that the reservoir is currently a nitrogen limited system. This appears due to the shift of nitrate concentrations to a significantly lower concentration. Verification of this data will need to be obtained as monitoring continues. TSI values indicate the reservoir is mesotrophic and the reservoir doesn't stratify due to its shallow nature

According to DWR no fish kills have been reported in recent years, they indicate that problems can develop during low water years with some pH problems developing in late summer. These elevated pH values are probably associated



D	°C	pH	DO	Cond
0	20.3	8.7	8.5	206
1	20.0	8.7	8.3	206
2	19.6	8.6	7.8	207
3	18.7	8.5	6.8	219
4	17.9	8.3	5.8	221
4.9	17.1	8.0	4.0	225

with the development of an extensive algae bloom or productivity associated with extensive macrophytes which do develop in the lake. The reservoir supports populations of brook trout (*Salvelinus fontinalis*), and rainbow trout (*Oncorhynchus mykiss*). The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake. Recent stocking reports indicate that the DWR annually stocks the lake with 6,000 catchable rainbow trout and 1,000 fingerling brook trout.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	2.641	89.00
Staurastrum gracile	0.120	4.04
Anabaena macrospora	0.078	2.62
Pennate diatoms	0.067	2.25
Ankistrodesmus falcatus	0.026	0.88
Unknown spherical green alga	0.022	0.75
Centric diatoms	0.009	0.30
Oocystis sp.	0.004	0.15
Total	2.965	
Shannon-Weaver [H']	0.52	
Species Evenness	0.25	
Species Richness	0.32	

The phytoplankton commnunity is dominated by the presence of green algae and diatoms. These are indicative of fairly good water quality and modereate productivity.

Pollution Assessment

Nonpoint pollution sources are sedimentation and nutrient loading from grazing, and wastes or litter from recreation. Cattle graze in the watershed and around the reservoir. There are no point pollution sources in the watershed.

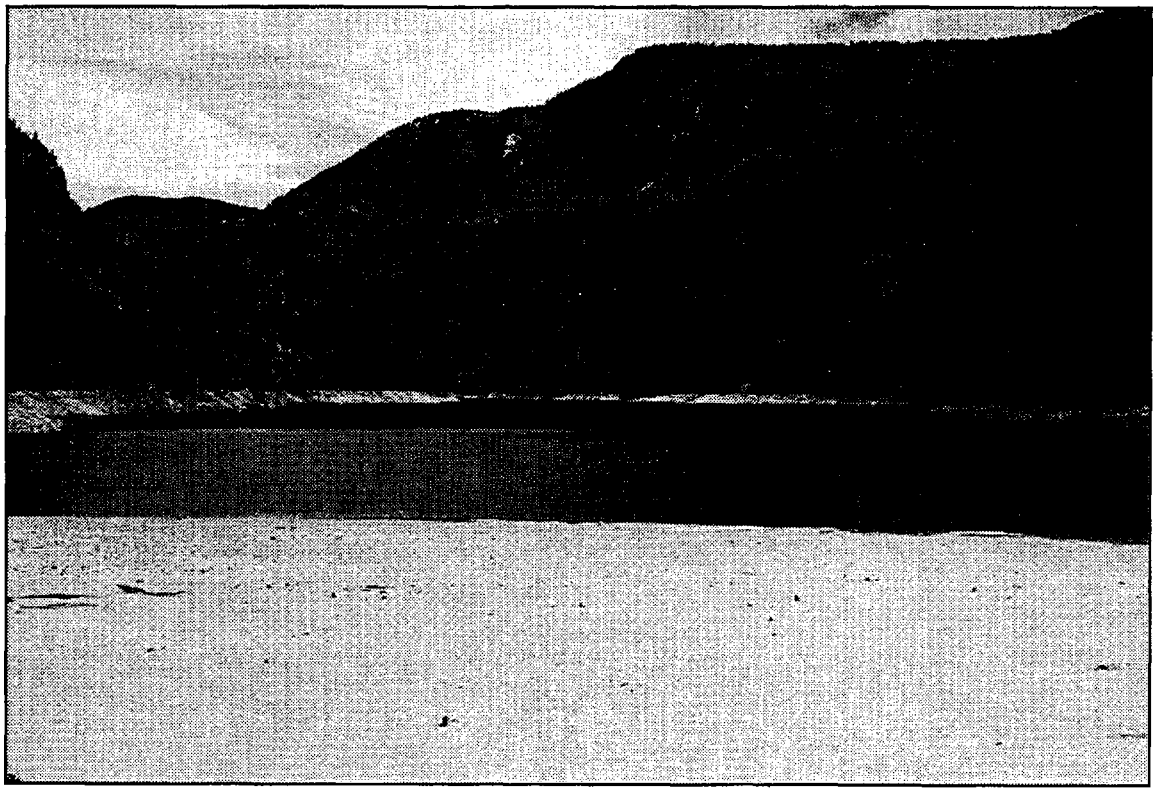
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Manti - La Sal Nationjal Forest	637-2817
Monticello Ranger District	587-2237
Southeastern Utah Association of Governments	
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Canyonlands Travel Region (Monticello)	587-2231
Reservoir Administrators	
San Juan County Water Conservation District	678-2596

MOON LAKE



Introduction

Moon Lake is a large natural lake which was enlarged by an earth filled dam in 1938. It is located on the south slope of the Uintas. It is an impoundment of the Lake Fork Creek and Brown Duck Creek which are typical of many rivers that drain the south slopes in valleys carved by glacial meltwaters.

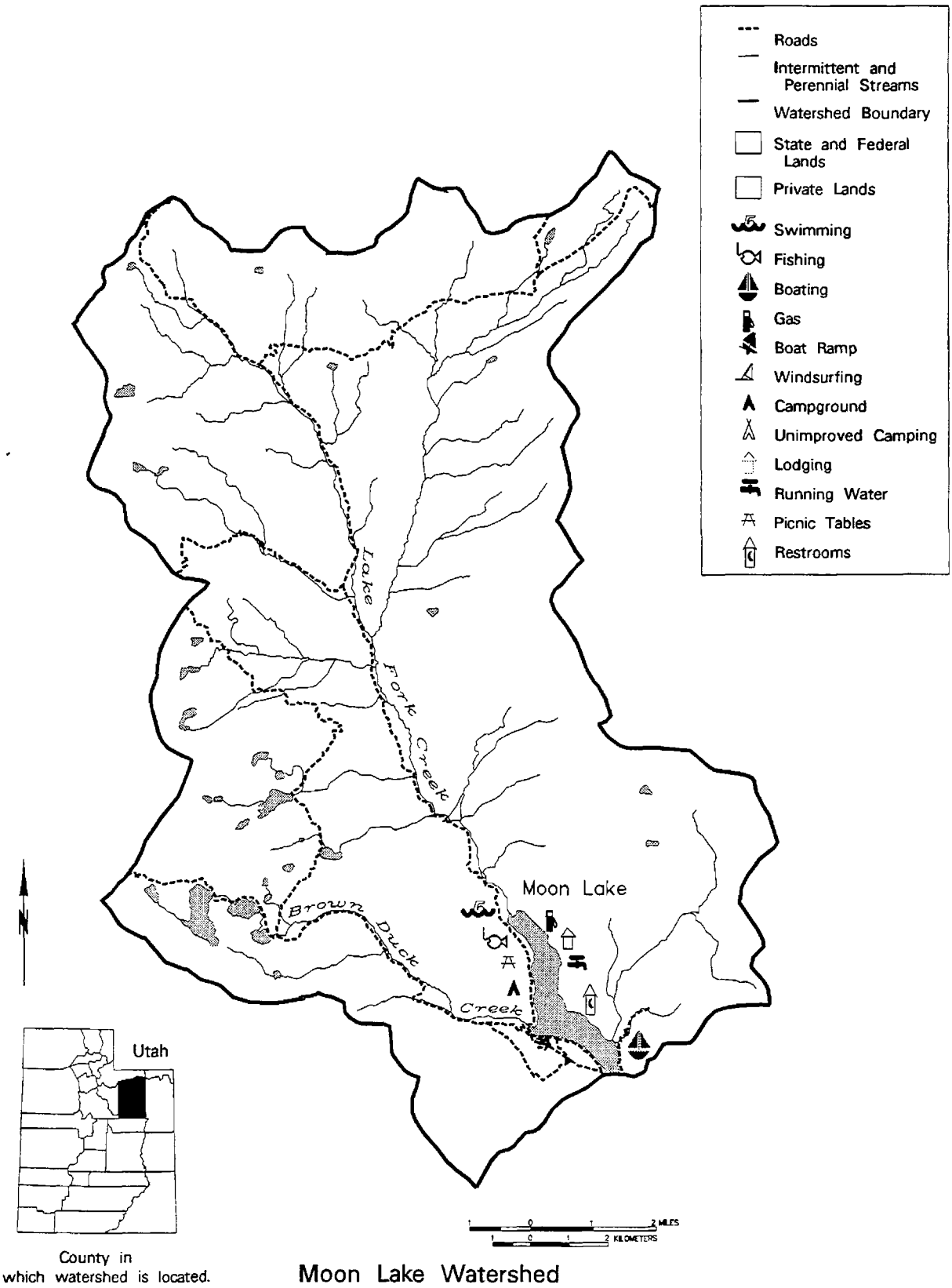
The dam was built by the Bureau of Reclamation, using federal funds to subsidize agriculture in the Uinta Basin. The reservoir is a popular access to the High Uintas Wilderness Area, which surrounds the northern half of the lake and encompasses much of the watershed. The reservoir shoreline is entirely publicly owned, and public access is unrestricted. Water is used primarily for irrigation and recreation, but a small hydroelectric generating plant owned by the Moon Lake Water Users Association utilized the discharge water to generate electricity. Currently with stable human populations in the Uinta Basin, water is unlikely to be used for culinary purposes.

Characteristics and Morphometry

Lake elevation (meters / feet)	2,463 / 8.083
Surface area (hectares / acres)	311 / 768
Watershed area (hectares / acres)	27,984 / 69,120
Volume (m^3 / acre-feet)	
capacity	44,110,028 / 35,760
conservation pool	0
Annual inflow (m^3 / acre-feet)	21,549,245 / 17,470
Retention time (years)	2
Drawdown (m^3 / acre-feet)	19,254,964 / 15,610
Depth (meters / feet)	
maximum	22.2 / 72.8
mean	14.1 / 46.3
Length (meters / feet)	5,880 / 19,292
Width (meters / feet)	1,200 / 3,937
Shoreline (km / miles)	12.55 / 7.8

Location

County	Duchesne
Longitude / Latitude	110 30 21 / 40 34 46
USGS Map	Kidney Lake, 1967, Lake Fork Mtn, 1967
DeLorme's Utah Atlas & Gazetteer™	Page 55, C-5
Cataloging Unit	Duchesne (14060003)



County in which watershed is located.

Moon Lake Watershed

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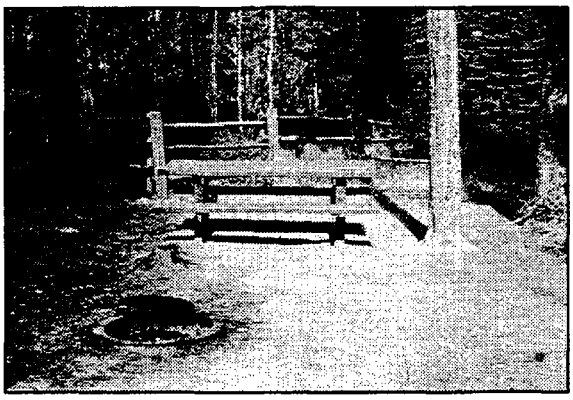
Recreation

Moon Lake is accessible from Mountain Home in the Uinta Basin (north of Duchesne). Go north out of Mountain Home across the Indian Reservation. The road turns to gravel just past Mountain Home, but is paved after it enters the National Forest. This road leads directly to the reservoir, which is about 15 miles northwest of Mountain Home.

Fishing, boating, swimming, camping, picnicking, and water skiing are all popular. There is an unimproved public boat ramp at the lake. Care must be taken when attempting to launch a boat because of the sandy nature of the beach area. Vehicles can quickly sink into the sandy base so exercise caution and utilized metal ramp pads if they available.

Moon Lake Campground, a USFS facility, has 57 campsites, toilets, and picnic areas.



Moon Lake Resort has lodging, a convenience store, boat rentals, and a volleyball court (see info box).

Watershed Description

Moon Lake is an located on the Lake Fork River in its deep glacial valley on the south slope of the High Uintas. The valley is 0.5 miles wide and up to 2,000 feet deep, with slopes of 50 - 100%. It is narrow and deep, the result of tens of square miles of glaciers all flowing out the Lake Fork. This valley is morphologically similar to many others along the south slope, including the Duchesne River, Rock Creek, the Yellowstone River and the Uinta River. The valley walls are thickly forested, and beyond the midway point of the lake are permanently protected as part of the High Uintas Wilderness.

The watershed includes about 80 square miles of the Uintas, stretching from the reservoir to the ridgeline. Much of the area is made up of forested areas interspersed with lakes and meadows. These areas are where glaciers left uneven terrain as they flowed, and deposited piles of moraine when they melted. The glaciated area is interdigitated with the barren ridges that were not scoured by glaciers. The Lake Fork valley is at 8,000 feet elevation at Moon Lake, while the forests are at 9,000 to 11,000 feet in elevation, and the mountains are up to 13,000 feet elevation.

The watershed high point, Mt. Lovenia, is 4,029 m (13,219 ft) above sea level, thereby developing a complex slope of 8% to the reservoir. The average stream gradient is 5% (265 feet per mile).

The watershed is made up of high mountains with abundant rock outcroppings. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of pine, aspen, spruce-fir, and alpine tundra. The watershed receives 51 - 64 cm (20 - 25 inches) of precipitation annually. The frost-free season around the reservoir is 0 - 20 days per year.

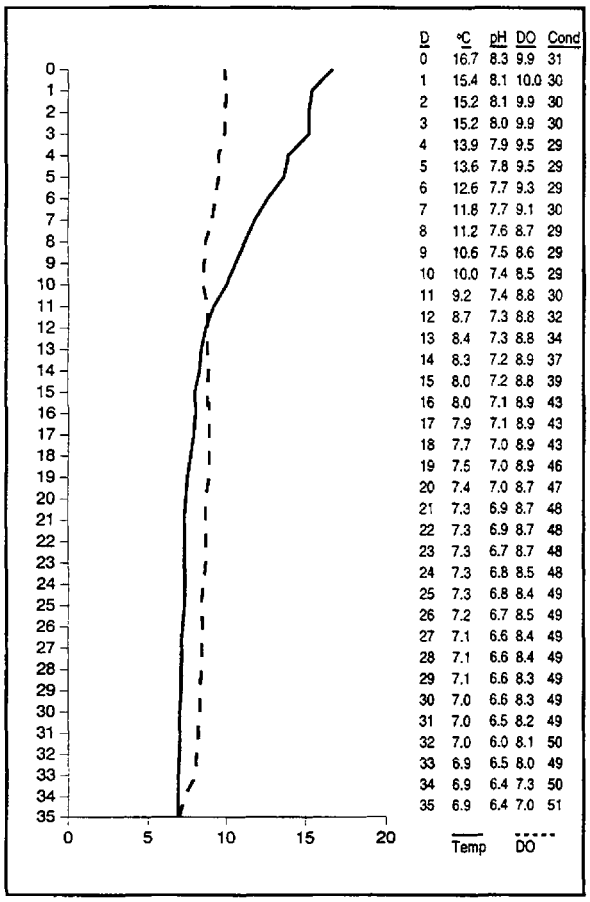
Land use is as follows 95% wilderness, which includes recreation and allotment grazing by sheep and cattle. Of the remaining 5%, 3% is multiple use and 2% is concentrated recreation.

Limnological Assessment

The water quality of Moon Lake is very good. It is considered to be very soft with a hardness concentration value of approximately 10.1 mg/L ($CaCO3$). Although there are no overall water column concentrations that exceed State water quality standards, there are reported exceedences on a rare occasion at specific points in the lake. These include occasion elevations of pH or total phosphorus concentrations.

The lake does stratify but it appears to be a weak stratification with a general decline in temperatures throughout the water column as depicted in the August 21, 1991 profile.. Stratification may be stronger and more pronounced at other times during the season, however, data is not available during those times to document it. Current data suggest that the reservoir is currently a nitrogen limited system with fairly low concentration of nutrients present. TSI values indicate the reservoir is oligotrophic in a state of low productivity. During 1989 productivity data indicates that the reservoir was in a state of mesotrophy. The parameter that has skewed the data is the transparency which appears abnormally low. It appears that in August of 1991 there was a significant algal bloom which effected the evaluation. It is therefore apparent that overall the reservoir is probably oligotrophic, it is capable of moderate productivity on a limited basis.

According to DWR no fish kills have been reported in recent years. Historical fishery data (1980 Division of Wildlife Resources) shows Moon Lake to contain both brown (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*) and mountain whitefish (*Prosopium williamsoni*). Moon Lake is



D	°C	pH	DO	Cond
0	16.7	8.3	9.9	31
1	15.4	8.1	10.0	30
2	15.2	8.1	9.9	30
3	15.2	8.0	9.9	30
4	13.9	7.9	9.5	29
5	13.6	7.8	9.5	29
6	12.6	7.7	9.3	29
7	11.8	7.7	9.1	30
8	11.2	7.6	8.7	29
9	10.6	7.5	8.6	29
10	10.0	7.4	8.5	29
11	9.2	7.4	8.8	30
12	8.7	7.3	8.8	32
13	8.4	7.3	8.8	34
14	8.3	7.2	8.9	37
15	8.0	7.2	8.8	39
16	8.0	7.1	8.9	43
17	7.9	7.1	8.9	43
18	7.7	7.0	8.9	43
19	7.5	7.0	8.9	46
20	7.4	7.0	8.7	47
21	7.3	6.9	8.7	48
22	7.3	6.9	8.7	48
23	7.3	6.7	8.7	48
24	7.3	6.8	8.5	48
25	7.3	6.8	8.4	49
26	7.2	6.7	8.5	49
27	7.1	6.6	8.4	49
28	7.1	6.6	8.4	49
29	7.1	6.6	8.3	49
30	7.0	6.6	8.3	49
31	7.0	6.5	8.2	49
32	7.0	6.0	8.1	50
33	6.9	6.5	8.0	49
34	6.9	6.4	7.3	50
35	6.9	6.4	7.0	51

managed as a rainbow trout fishery. If browns are still present in Moon Lake they are not abundant.

The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake. Recent stocking reports indicate that DWR stocks the lake with approximately 12,500 catchable rainbows annually.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm³/liter)	% Density By Volume
Pennate diatoms	0.410	51.57
Asterionella formosa	0.179	22.57
Dinobryon divergens	0.073	9.22
Microspora sp.	0.066	8.39
Lagerheimia ciliata	0.022	2.80
Scenedesmus incrassulatus	0.017	2.17
Oocystis sp.	0.016	2.10
Centric diatoms	0.009	1.19
Total	0.792	

Shannon-Weaver [H']	1.42
Species Evenness	0.68
Species Richness	0.34

The phytoplankton community is dominated with the presence of diatoms, flagellates and green algae. This community supports the water quality assessment of good water quality with low productivity.

Pollution Assessment

Nonpoint pollution sources include grazing, and recreation.

The High Uintas Wilderness is a popular recreational destination for backpackers and mountain climbers. The area immediately around the lake is utilized heavily.

Grazing is permitted throughout the watershed.

There are no active mines within the watershed, but old sites do exist that may leach materials into waterways. Data suggest that they do not pose a treat to water quality.

There are no point sources of pollution in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: culinary water (1C), recreation bathing (swimming) (2A), boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Ashley National Forest	377-5780
Duchesne Ranger District	738-2482
Recreation	
Dinosaurland Travel Region (Vernal)	789-6932
Duchesne Chamber of Commerce	738-5651/738-2707
Moon Lake Resort	454-3142
Reservoir Administrators	
Department of the Interior	-------
Central Utah Water Conservancy District	226-7112

NAVAJO LAKE

Introduction

Navajo Lake is south edge of the Markagunt Plateau at the top of the Grand Staircase. It is an intermediate-sized natural lake that has been modified with a dam. It is easily viewed from an overlook near Cedar Breaks National Monument on U-14 (between Cedar City and Long Valley Junction).

The reservoir shoreline is owned and administered by the Dixie National Forest with unrestricted public access. Defined beneficial uses include: water recreation excluding swimming, propagation of cold water species of game fish and aquatic life, and agricultural needs.

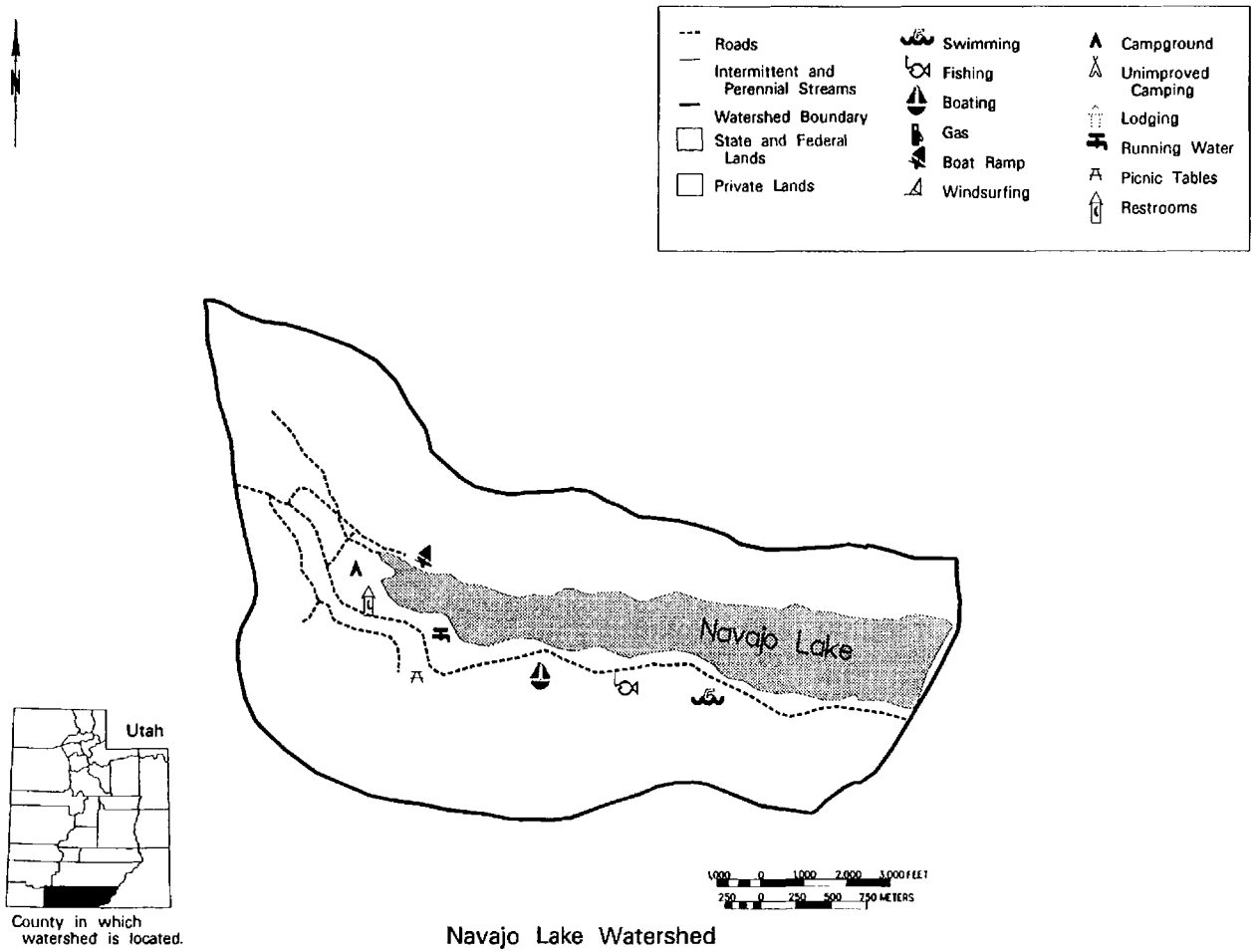
The lake is rather unique in the fact that it relies primarily on subterranean water movement for both inflow and outflow. Sinkholes in the east end of the lake drained the lake completely in low water years before the construction of a dike on the east end of the lake. This north-south dike now exists just west of major sinkholes. The dike has been raised in stages beginning in about 1933. It was last raised to 5.2 meters (17 feet) in 1945. The dike allows for impoundment of the lake at more controlled levels;

Characteristics and Morphometry

Lake elevation (meters / feet)	2,753 / 9,035
Surface area (hectares / acres)	289 / 714
Watershed area (hectares / acres)	1,355 / 3,348
Volume (m^3 / acre-feet)	
capacity	1,037,147 / 8,700
conservation pool	3,700,500 / 3,000
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	7.3 / 23.9
mean	3.7 / 12.1
Length (meters / feet)	5,000 / 16,405
Width (meters / feet)	600 / 1,969
Shoreline (km / miles)	11 / 6.8

Location

County	Kane
Longitude / Latitude	112 45 36 / 37 31 18
USGS Map	Navajo Lake, Utah, 1985
Cataloging Unit	Upper Sevier (16030001)



Navajo Lake Watershed

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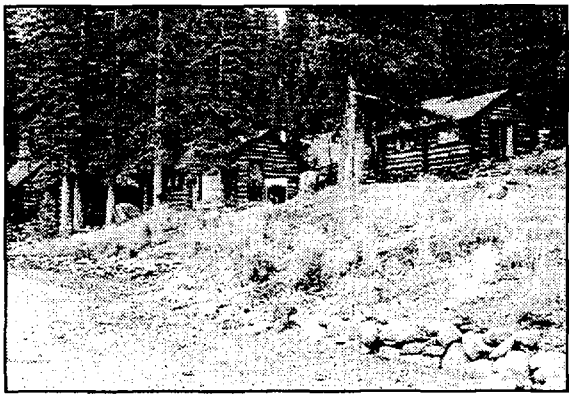
however evaporation and seepage, or release of water via a pipe outlet, still drop the water level a few feet below the dike spillway by the late summer in most years.

Recreation

Navajo Lake is only a few hundred feet from U-14, but steep cliffs make it necessary to use FS-053, 1 mile east of the lake, for access. Navajo Lake is 25 miles east of Cedar City and 15 miles west of Long Valley Junction (US-89).

Fishing, boating, picnicking, cross country skiing and snowmobiling are popular around the lake. There is a gravel boatramp at the west end of the lake. The water is too cold for most swimmers and waterskiiers. Usage is heavy. There are two USFS campgrounds in the vicinity of the lake, Navajo Lake and Spruces. Both are accessed off FS-053. Both have swimming areas, picnic areas and drinking water. Navajo Lake Campground is much larger, having 28 campsites. Spruces has only 4 campsites, but has flush toilets. Fees are charged at both sites.

There is also a resort, Belmer's Lodge and Landing, which rents boats and cabins. It also has a gravel boat ramp and a campground with flush toilets.



Watershed Description

Navajo Lake is located in the Kaiparowits Formation--the same formation the spires of Cedar Breaks and Bryce Canyon are formed from. While still a high elevation lake, it is south of the lava-capped portion of the Markagunt Plateau. The watershed is very small, and the lake is fed by a number of springs.

The watershed high point, the plateau top one mile northwest of the lake, is 3,078 m (10,100 ft) above sea level, thereby developing a complex slope of 12.9% to the lake. The inflows are several springs at the west end of the lake, and the outflow is through subterranean potholes.

The watershed is made up of rocky mountainous terrain with a small meadow. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities are comprised of pine, aspen, spruce-fir, oak, maple and alpine. The watershed receives 76 - 102 cm (30 - 40 inches) of precipitation annually with a frost-free season of 40 - 60 days at the reservoir.

Land use is multiple use and recreation. There are perhaps 50 recreation homes in the immediate vicinity of the lake.

Limnological Assessment

The water quality of Navajo Lake is good. It is considered to be moderately hard with a hardness concentration value of approximately 80 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are phosphorus, pH, dissolved oxygen, and hydrogen sulfide. The average concentration of total phosphorus in the water column typically does not exceed the recommended pollution indicator for phosphorus of 25 ug/L. On occasion individual values in the water column can exceed the indicator. As indicated in the August 13, 1991 profile pH concentrations do exceed the criteria of 9.0. This is due largely to the biological activity associated with the photosynthetic activity of aquatic plants and algae during the productivity season. The pH concentrations will fluctuated depending on the seasonality and the time of day. The lake is a natural, shallow lake with penetration of light to the bottom due to the clarity of the water. These conditions facilitate the extensive growth of macrophytes form the sediments of the lake. It is these large mats of organic material that are responsible for the water quality problems associated with the lake. During the summer they are responsible for high pH values and reduction of dissolved oxygen during the nocturnal period and during the winter of the extensive depletion of dissolved oxygen in the water column that

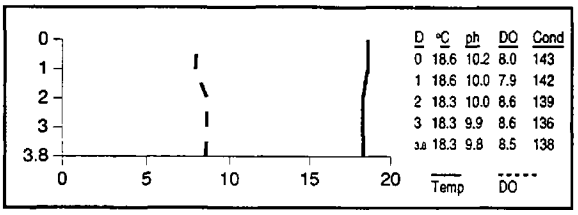
Limnological Data

Data sampled from STORET site: 594681, 594682, 594683.

Surface Data	1981	1990	1991
Trophic Status	M	O	O
Chlorophyll TSI	37.39	-	36.42
Secchi Depth TSI	36.77	45.78	42.46
Phosphorous TSI	54.34	41.51	27.35
Average TSI	42.83	29.10	35.41
Chlorophyll a (ug/L)	-	0	1.9
Transparency (m)	-	2.8	3.4
Total Phosphorous (ug/L)	20	17	5
pH	7.9	9.3	9.2
Total Susp. Solids (mg/L)	<5	<3	<3
Total Volatile Solids (mg/L)	-	-	4
Total Residual Solids (mg/L)	-	-	1
Temperature (°C / °f)	11/52	15/60	17/62
Conductivity (umhos.cm)	158	119	154
Water Column Data			
Ammonia (mg/L)	0.05	0.03	0.04
Nitrate/Nitrite (mg/L)	0.07	-	0.03
Hardness (mg/L)	90	65	84
Alkalinity (mg/L)	87	64	83
Silica (mg/L)	-	-	1.4
Total Phosphorous (ug/L)	15	14	5
Miscellaneous Data			
DO (Mg/l) at 75% depth	11	8.7	9.9
Stratification (m)	NO	NO	NO
Limiting Nutrient	N	N	N
Depth at Deepest Site (m)	4	2.8	3.8

* 1 Site Only (594681)

results in anoxic conditions and associated fish kills. Concentrations of hydrogen sulfide also develop during the winter period as these materials decompose and anoxic conditions develop. These impaired conditions have resulted in concern for the cold water fishery and the implementation of a Clean Lakes Phase I study. This study which is currently ongoing will attempt to assess the extent of those problems and propose solutions to improve conditions in the lake. During recent years efforts have been implemented by the DWR and others to divert spring waters through an underground pipeline out into the reservoir to maintain an open water condition on to facilitate the exchange of oxygen into the water column. This has proven somewhat successful but mechanical difficulties with the line and other conditions have limited the effectiveness of this project. If a viable year around fishery is to be maintained something will have to be put into place to supplement the oxygen demand within the lake or to eliminate the problem associated with the production of excessive macrophytes. Although dissolved oxygen concentrations during the open water period are sufficient as indicated in the August 13, 1991 profile profiles during late winter under ice coverage conditions show anoxic conditions prevalent throughout most of the water column.



The current data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is oligotrophic with fairly low concentrations of nutrients present in the water column. The reservoir does not typically stratify due to the shallow nature of the lake during the summer season.

According to DWR, at least a partial fish kill can be expected annually. As discussed previously efforts to reduce these losses have been partially successful. The lake is managed as a brook trout (*Salvelinus fontinalis*) and rainbow trout (*Oncorhynchus mykiss*) fishery. Past surveys also reported the presence of Utah chub (Gila atraria), smallmouth bass (*Micropterus dolomieui*) and redside shiners (*Richardsonius balteatus*). The redside shiners have not been reported in recent years. The lake has been chemically treated in 1954 and 1988 for the removal of the existing fishery. Recent stocking reports indicate that the DWR stocked Navajo Lake with 27,000 catchable rainbow trout and 30,000 fingerling brook trout.

A field survey by the DWR in 1968 reported the following invertebrates were observed; midge larvae, snails, and caddisflies. In the same survey there was abundant aquatic vegetation observed, primarily *Myriophyllum sp.* and *Chara sp.* The 1975 NES study obtained the following information concerning phytoplankton: The dominant genera of phytoplankton found during the two sampling dates include Flagellates, *Kirchneriella sp.* and *Tetraedron sp.*

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	15.84	96.76
Chroococcus minor	0.166	1.02
Aphanizomenon flos-aquae	0.105	0.65
Oocystis sp.	0.066	0.41
Chroococcus limneticus	0.055	0.34
Ankistrodesmus falcatus	0.030	0.19

Pennate diatoms	0.026	0.16
Crucigenia irregularis	0.026	0.16
Microcystis incerta	0.022	0.14
Tetraedron minimum	0.021	0.13
Oscillatoria sp.	0.006	0.04
Unknown *Chrysophyte*	0.003	0.02
Total	16.366	
Shannon-Weaver [H']	0.21	
Species Evenness	0.08	
Species Richness	0.47	

While the flora is quite diverse, it is heavily dominated by a single species of green algae. This data is supportive that the lake is oligotrophic with low phytoplankton productivity.

Pollution Assessment

Nonpoint pollution sources include: sedimentation and nutrient loading from grazing and wastes or litter from recreation. Cattle graze in the watershed and probably around the reservoir.

There are no point pollution sources in the watershed.

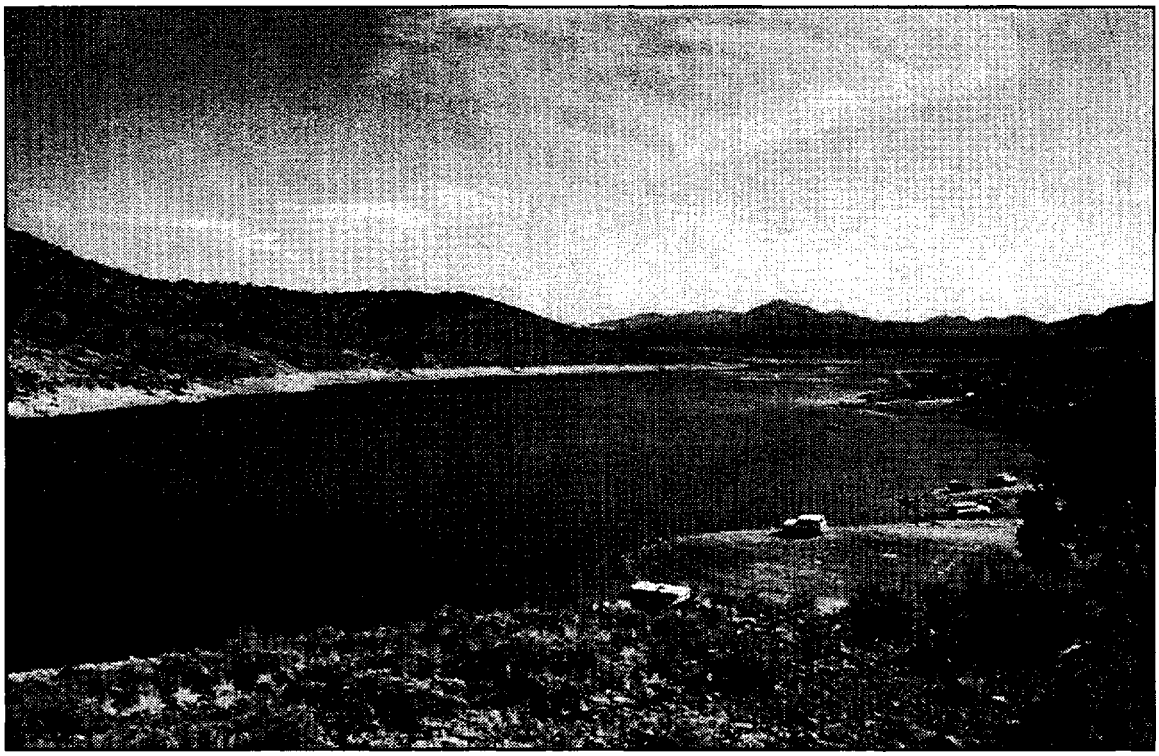
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Dixie National Forest Ranger District	586-2421
Belners Lodge and Landing	
Five County Association of Governments	
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146

NEWCASTLE RESERVOIR



Introduction

Newcastle Reservoir in located in the northern foothills of the Pine Valley Mountains in southwestern Utah. It is a moderate size impoundment of a wide stream valley. This reservoir should not be confused with Grass Valley Reservoir, a small reservoir high in the Pine Valley Mountains, listed on some maps as New Castle Reservoir.

The reservoir shoreline is privately owned by the Newcastle Irrigation Company with unrestricted public access. Land outside the immediate reservoir area is owned by the BLM. The dam, an earth-fill, was built in 1956. Water is used primarily for irrigation and recreation. Defined beneficial uses include: water recreation excluding swimming; propagation of cold water species of game fish and aquatic life; and agricultural needs.

Characteristics and Morphometry

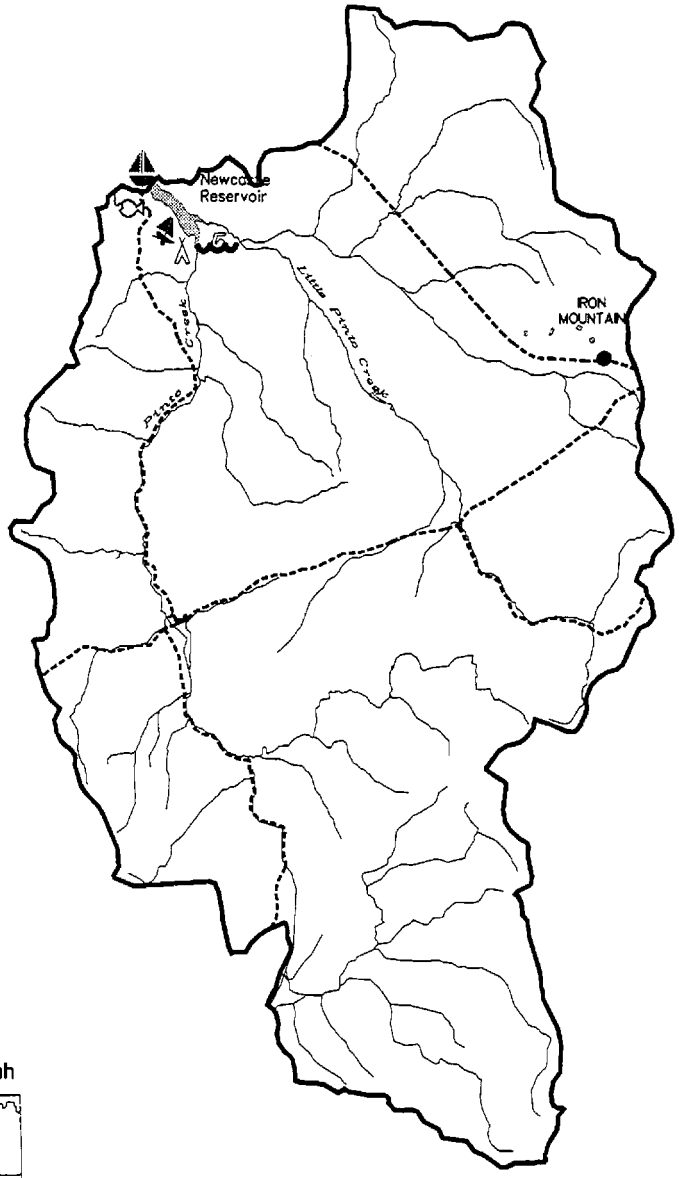
Lake elevation (meters / feet)	1,659 / 5,443
Surface area (hectares / acres)	66 / 163
Watershed area (hectares / acres)	32,113 / 73,319
Volume (m^3 / acre-feet)	
capacity	4,735,414 / 3,839
conservation pool	616,750 / 500
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	23.5 / 77.5
mean	7.2 / 23.6
Length (meters / feet)	2,010 / 6,595
Width (meters / feet)	450 / 1,476
Shoreline (km / miles)	4.8 / 3

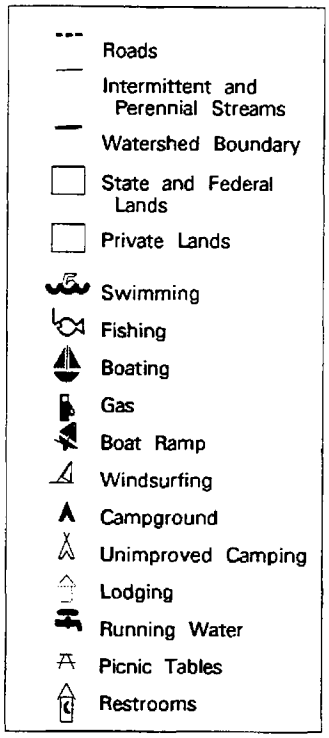
Location

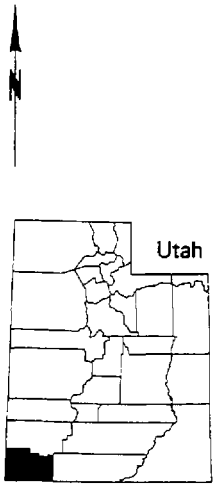
County	Washington
Longitude / Latitude	113 31 15 / 37 38 58
USGS Map	Newcastle, Utah 1972
Cataloging Unit	Southern Escalante Desert (16030006)

Recreation

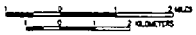
Newcastle Reservoir is on an improved secondary road between the communities of Newcastle and Pinto. Access is easiest from Newcastle. From U-56, travel 5 blocks south in Newcastle and turn east (left). The road winds up a wide canyon for about 1.5 miles, then climbs the canyon wall at the dam. Access to the reservoir is possible on primitive







County in which watershed is located.



Newcastle Watershed

roads past the dam on the left.

Fishing, is the primary recreational activity on the lake. Boating, picnicking, and primitive camping, are also possible. The reservoir is accessible year round. On a per acre basis usage of the reservoir is high, comparable to Otter Creek or Minersville reservoirs.

Recreational facilities are primitive, although it is possible to launch a boat in the reservoir. There are no public or private campgrounds in the area. Cedar City is 30 miles east and has all services.

Watershed Description

Newcastle Reservoir in the lower slopes of the Pine Valley Mountains, where Pinto Creek emerges from the mountains into the Escalante Desert through an unusual short, deep, U-shaped stream valley. It has a large natural drainage basin that has been enlarged by a tunnel through the ridge at the headwaters of South Fork Pinto Creek to divert water from the upper Santa Clara River drainage. This area is a substantial part of the highest portion of the Pine Valley Mountains, and greatly increases the water entering Newcastle Reservoir.

The watershed high point (in the upper Santa Clara drainage) the west shoulder of Big Point, is 3,018 (9,900 ft) above sea level, thereby developing a complex slope of 4.8% to the reservoir. The inflows are Pinto Creek and Little Pinto Creek. The outflow is Pinto Creek, but water is primarily diverted into a pipeline for sprinkler irrigation.

The vegetation communities are comprised of pinyon-juniper, sage-grass, shadscale, bitterroot-mahogany, spruce-fir, pine, aspen and associated grasses and forbes. The immediate watershed receives 30 - 41 cm (12 - 16 inches) of precipitation annually with a frost-free season of 120 - 140 days at the reservoir.

The soil is of limestone origin with rapid permeability and erosion. The soil associations that compose the watershed are listed in Appendix III.

Land use is multiple use and recreation, the major use being livestock grazing. Much of the watershed has received heavy historical grazing which may be contributing to runoff and soil erosion. The strip mine at Iron Mountain composes 2% of the watershed, and 1% each is used for cropland and pasture.

Limnological Assessment

The water quality of Newcastle Reservoir is good. It is considered to be hard with a hardness concentration value of approximately 190 mg/L ($CaCO_3$). Those parameters that has exceeded State water quality standards for defined beneficial uses are total phosphorus, dissolved oxygen and temperature. The average concentration of total phosphorus in the water column during the three periods of study were 70, 37 and 96 ug/L which all exceed the recommended pollution indicator for phosphorus of 25 ug/L. The maximum temperature standard for a cold water fishery is 20°C. Temperature exceedences occur primarily later in the summer when the reservoir when the reservoir is drawn down due to meet irrigation needs downstream. As was the case on August 2, 1990 temperatures in the reservoir ranged from 24.1°C at the surface to 21.7°C at the bottom.

In addition as is evident from the 9/9/92 profile dissolved oxygen concentrations do decline in the hypolimnion. This suggest that there is a large demand for dissolved oxygen at the sediment-water interface. Although anoxic conditions are not present during late summer if extended ice conditions exist during the winter anoxic conditions may develop. A profile taken during May, 1992 had levels as low as 1.6 mg/L dissolved oxygen near the bottom with a substantial amount of the water column below the standard of 6.5 for a cold water fishery. This data substantiate the fact that water quality impairments do occur in the reservoir and that some winter time monitoring should be conducted to assess the extent of oxygen depletion in the

Limnological Data

Data averaged from STORET sites: 494061, 494062

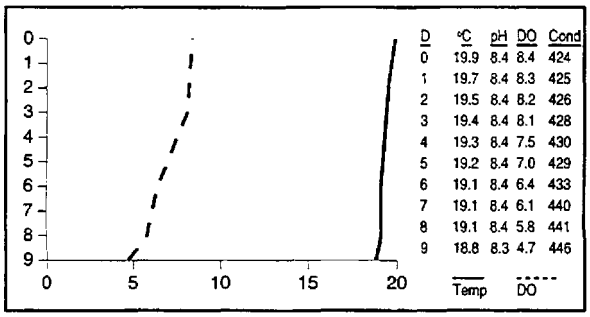
Surface Data	1979	1990	1992
Trophic Status	E	M	E
Chlorophyll TSI	-	47.36	46.57
Secchi Depth TSI	50.01	46.09	46.94
Phosphorous TSI	63.19	50.90	68.25
Average TSI	56.6	48.12	53.92
Chlorophyll a (ug/L)	-	4.8	5.2
Transparency (m)	2	2.6	2.5
Total Phosphorous (ug/L)	60	26	85
pH	8.5	8.5	8.3
Total Susp. Solids (mg/L)	-	2.8	<3
Total Volatile Solids (mg/L)	-	0	1
Total Residual Solids (mg/L)	-	-	2
Temperature (°C / °f)	20/68	20/69	19/66
Conductivity (umhos.cm)	399	809	382
Water Column Data			
Ammonia (mg/L)	0.15	0.03	0.03
Nitrate/Nitrite (mg/L)	0.42	0.03	0.01
Hardness (mg/L)	171	301	166
Alkalinity (mg/L)	155	246	169
Silica (mg/L)	29	-	31.9
Total Phosphorous (ug/L)	70	37	96
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	6.2	6.9	6.2
Stratification (m)	1-2	NO	NO
Depth at Deepest Site (m)	16	4.6	9.0

water column.

Current data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is upper mesotrophic to eutrophic. The reservoir does not typically stratify due to rapid drawdown, and mixing associated with the shallow nature of the reservoir later in the summer.

According to DWR no fish kills have been reported in recent years. The reservoir supports a population of smallmouth bass (*Micropterus dolomieui*) and rainbow trout (*Oncorhynchus mykiss*). Recent stocking reports indicate that DWR stocked Newcastle Reservoir with 25,000 advanced fingerling (6") and 6,500 catchable rainbow trout in 1991. DWR currently owns a 500 acre-feet conservation pool.

It was reported by the DWR that the bottom fauna observed in the reservoir were chironomids of which were sparse. Crayfish are reported to be abundant in the reservoir and smallmouth bass have also been introduced. In 1979 limited macrophytes and algal blooms were observed by DWQ staff. The NES reported the following dominant plankton present in 1975: *Stephanodiscus sp., Nitzschia sp., Elakatothrix sp., Asterionella sp.*, and *Oocystis sp.*



D	°C	pH	DO	Cond
0	19.9	8.4	8.4	424
1	19.7	8.4	8.3	425
2	19.5	8.4	8.2	426
3	19.4	8.4	8.1	428
4	19.3	8.4	7.5	430
5	19.2	8.4	7.0	429
6	19.1	8.4	6.4	433
7	19.1	8.4	6.1	440
8	19.1	8.4	5.8	441
9	18.8	8.3	4.7	446

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Coelosphaerium sp.	0.250	47.19
Ankyra judayi	0.122	23.05
Euglena sp.	0.075	14.16
Ankistrodesmus falcatus	0.035	6.59
Pennate diatoms	0.022	4.19
Unknown spherical green alga	0.017	3.15
Total	0.519	

Shannon-Weaver [H']	1.46
Species Evenness	0.75
Species Richness	0.30

The phytoplankton community is dominated by blue-green algae and flagellates indicative of more productive waters with limited water quality.

Pollution Assessment

Nonpoint pollution sources include: sedimentation and nutrient loading from grazing; sedimentation and heavy medal loading from mining; and wastes or litter from recreation. Cattle graze in the watershed and around the reservoir.

There are no point pollution sources in the watershed.

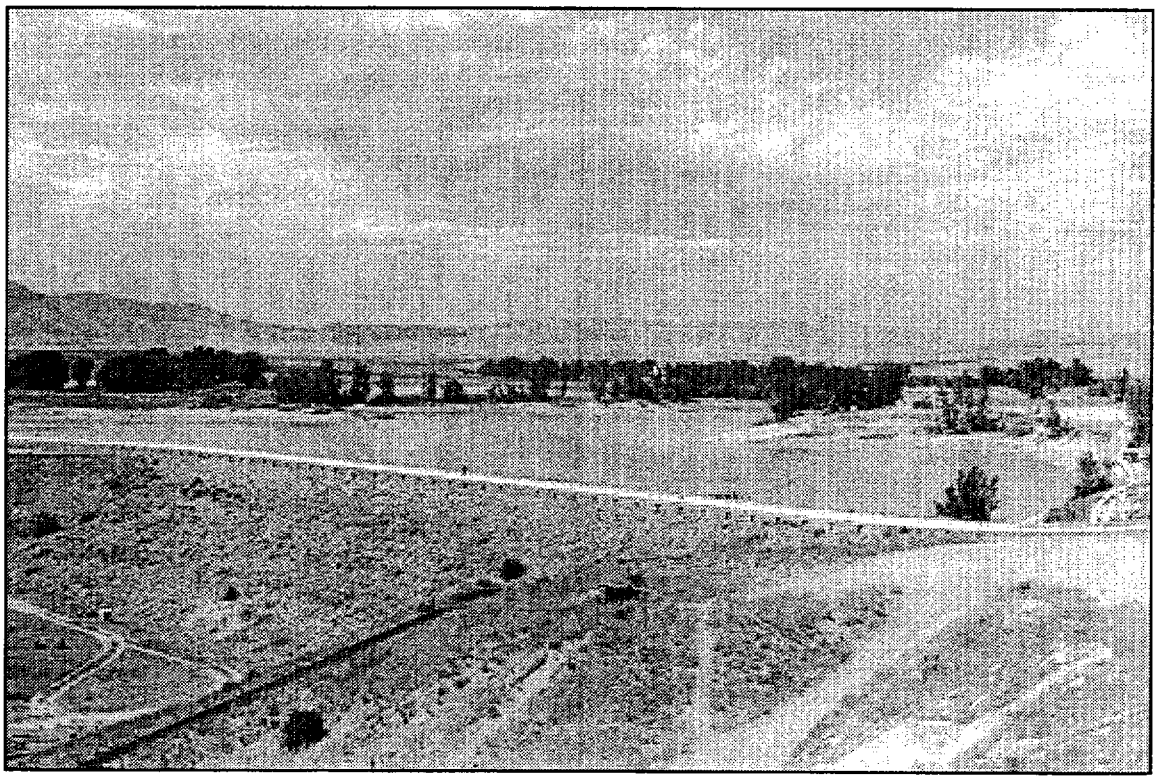
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Newcastle Reservoir Company	439-5300
Five County Association of Governments	
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146

NEWTON RESERVOIR



Introduction

Newton Reservoir is located in Cache Valley in extreme northern Utah. It is an intermediate size impoundment of Clarkston Creek on the valley floor.

Newton Reservoir was the first water storage reservoir built by white settlers in Utah. It was created in 1871 by the construction of an earth-fill dam. The reservoir shoreline is 66% owned by the Bureau of Reclamation. Public access is unrestricted. Reservoir water is released entirely for irrigation, but enough water is left in the reservoir that it serves well as aquatic habitat and as a recreation facility. Water use is not expected to change in the foreseeable future.

Characteristics and Morphometry

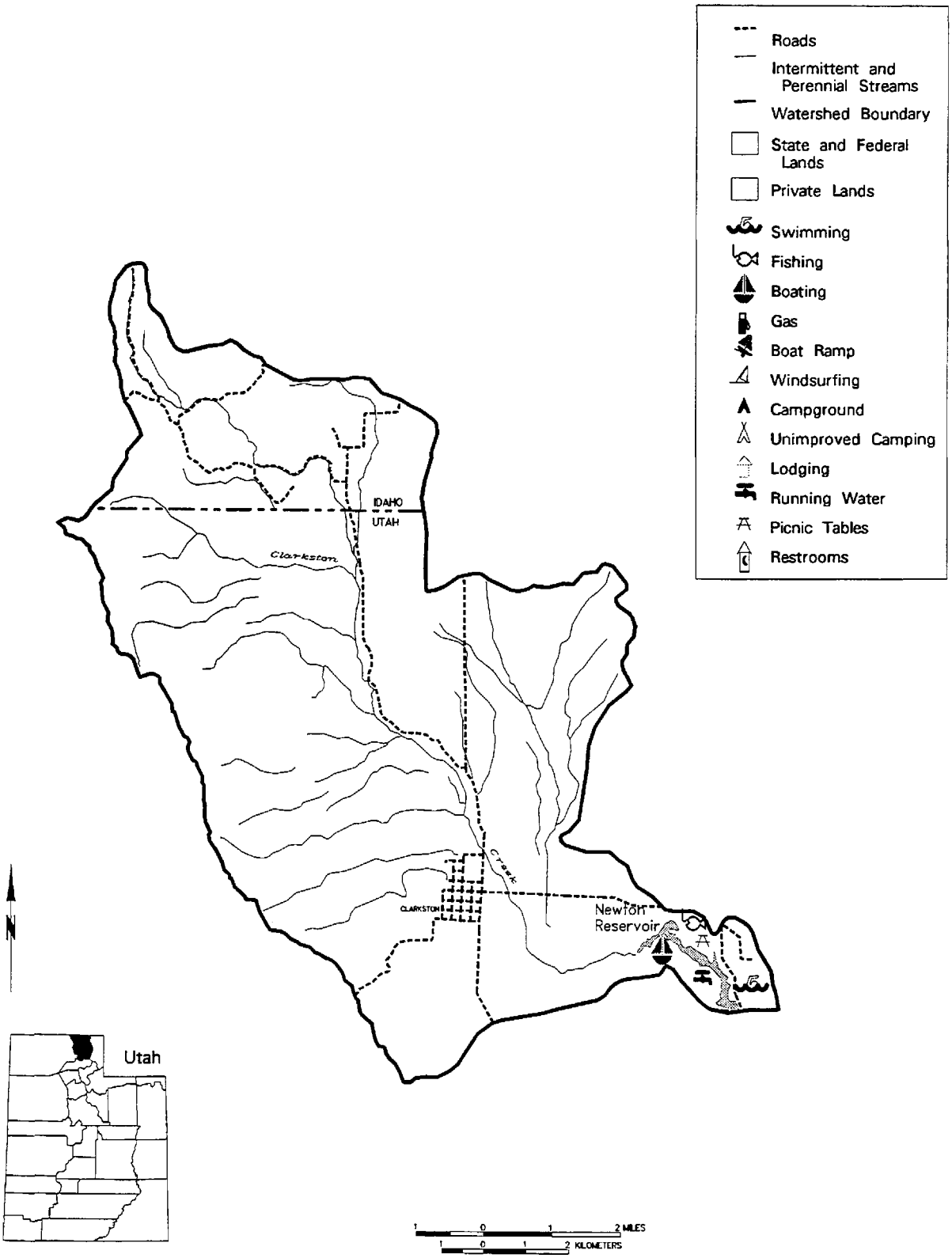
Lake elevation (meters / feet)	1,456 / 4,778
Surface area (hectares / acres)	141.64 / 350
Watershed area (hectares / acres)	6,035 / 14,912
Volume (m^3 / acre-feet)	
capacity	6,896,509 / 5,591
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	3,750,468.9 / 3,041
Depth (meters / feet)	
maximum	22.55 / 74
mean	5.49 / 18
Length (meters / feet)	3,450 / 11,319
Width (meters / feet)	357 / 1,171
Shoreline (km / miles)	9.2 / 5.7

Location

County	Cache
Longitude / Latitude	111 58 53 / 41 54 14
USGS Map	Trenton, UT/ID 1964, Clarkston UT/ID 1964
DeLorme's Utah Atlas & Gazetteer™	Page 62, B-3
Cataloging Unit	Middle Bear River (16010202)

Recreation

Newton Reservoir, north of Newton [Town] is accessible from the south on U-23 from US-89 in Wellsville. Go two miles north of Newton on 6400 West St., follow the main road as it makes a 90° bend to the right, and arrives at the reservoir in one more mile. Access is also possible from U-142 between Richmond and Clarkston. The turnoff is to



County in which watershed is located.

Newton Watershed

<k1>

the south, 1.25 miles west of U-123 and 3.5 miles east of Clarkston. Follow the road south for about one mile to the reservoir, eventually arriving at the boatramp and dam.

Fishing and boating are the primary recreational uses of the reservoir. Facilities include a parking area, a picnic area, an improved public boatramp. and privies. The nearest public campground is Hyrum State Park, and the nearest private campgrounds are in Logan (See info box).

Watershed Description

The reservoir is located on the rolling floor of the great basin. The area is a desert, with some hills and mountains. Little Mountain rises immediately east of the dam, and can be seen as a landmark when driving to the reservoir. While slopes on this mountain are steep (up to 50%), the mountain is only 5,700 feet in elevation. Clarkston Mountain forms the western boundary of the watershed, 8,000 feet in elevation, and owned by the Caribou National Forest. These mountains have heavy snowfall and support coniferous forests. Slopes are up to 70%. The areas between these mountains are gently undulating crop and pastureland. The City of Clarkston is in the watershed, and there are feedlots and dairies which create nutrient loading problems for the reservoir.

The watershed high point; Clarkston Mountain(?), is 2,469 m (8,101 ft) above sea level, thereby developing a complex slope of 12% to the reservoir. The average stream gradient above the reservoir is 1.4% (235 feet per mile) The inflow Clarkston Creek and the outflow is Newton Creek.

The watershed is made up of low mountains, alluvial fans, and desert valleys. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of cropland, urban, willows and cottonwoods, sage-grass, oak, maple, and spruce-fir. The watershed receives 41 - 76 cm (16 - 30 inches) of precipitation annually. The frost-free season around the reservoir is 100 - 120 days per year.

Land use in the watershed is as follows: dry agriculture (57%), grazing lands (27%), USFS multiple use (8%), irrigated pasture and hayland (6%), and urban (2%).

Limnological Assessment

The water quality of Newton Reservoir is fair. It is considered to be hard with a hardness concentration value of approximately 272 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are total phosphorus and dissolved oxygen. The average concentrations of total phosphorus in the water column for the three study periods were 153.4, 77 and 152 ug/L which all exceed the recommended pollution indicator for phosphorus of 25 ug/L. The phosphorus concentration in the hypolimnion in late summer regularly is near 300 ug/L. This increased concentration usually occurs when near anoxic conditions were present near the bottom. Dissolved oxygen concentrations in late summer and late winter substantiate the fact that water quality impairments do exist. Even as early as depicted in the May 20, 1992 profile dissolved oxygen concentrations decline dramatically below the thermocline to 0.8 mg/L.

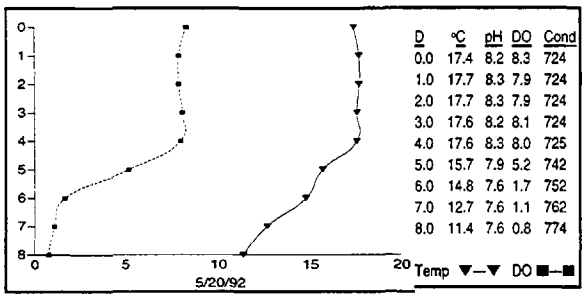
Data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is eutrophic to hypereutrophic with high levels of nutrients available for productivity. The reservoir has sufficient depth to stratify and early in the year does stratify as indicated by the May 20, 1992 profile. However fairly rapid drawdown due to irrigation needs allows for the breaking down of stratification later in the summer. Consistent with the stratification there was a noticeable decline in the concentration of dissolved oxygen in the water column. These conditions are deleterious to the fishery rendering a significant portion of the water column unsuitable for a fishery. In addition it is apparent that dissolved oxygen concentrations probably reach a critical state during the winter period for fish.

Limnological Data

Data averaged from STORET sites: 490313, 490314, 490315

Surface Data	1980	1990	1992
Trophic Status	H	E	H
Chlorophyll TSI	-	50.15	60.18
Secchi Depth TSI	57.37	54.01	54.23
Phosphorous TSI	78.03	57.27	67.62
Average TSI	67.7	53.81	60.67
Chlorophyll a (ug/L)	-	7.0	26.4
Transparency (m)	0.9	1.5	1.3
Total Phosphorous (ug/L)	161.7	38	118
pH	8.2	8.6	8.3
Total Susp. Solids (mg/L)	116	6.4	6
Total Volatile Solids (mg/L)	-	-	4
Total Residual Solids (mg/L)	-	-	2
Temperature (°C / °f)	18/64	25/77	18/64
Conductivity (umhos.cm)	664	679	800
Water Column Data			
Ammonia (mg/L)	0.12	0.19	0.14
Nitrate/Nitrite (mg/L)	1.26	-	0.03
Hardness (mg/L)	241	273	302
Alkalinity (mg/L)	292	184	222
Silica (mg/L)	19.2	-	27
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	0	0.2	10.6
Stratification (m)	9-11	3-9	NO
Depth at Deepest Site (m)	13	10.0	3.2

According to DWR no fish kills have been reported in recent years but conditions are marginal for a trout fishery during the summer as substantiated by water quality data.. Fisheries at times have included yellow perch (*Perca flavescens*), large-mouth bass (*Micropterus salmoides*), black crappie (*Promoxis nigromaculatus*), brown trout (*Salmo trutta*), bluegill (*Lepomis macrochirus*), Utah sucker (Castostomus ardens), channel catfish (*Ictalurus punctatus*) and rainbow trout (*Oncorhynchus mykiss*). The lake has been treated for rough fish competition in 1981 and 1987, so populations of native fishes may not be present in the reservoir. Current stocking reports indicate that DWR stocks the reservoir with 30,000 fingerling channel catfish and 5,000 catchable rainbow trout. In addition in 1989 5,000 largemouth bass fry were stocked in the reservoir.



D	°C	pH	DO	Cond
0.0	17.4	8.2	8.3	724
1.0	17.7	8.3	7.9	724
2.0	17.7	8.3	7.9	724
3.0	17.6	8.2	8.1	724
4.0	17.6	8.3	8.0	725
5.0	15.7	7.9	5.2	742
6.0	14.8	7.6	1.7	752
7.0	12.7	7.6	1.1	762
8.0	11.4	7.6	0.8	774

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Pandorina morum	19.126	49.46
Sphaerocystis schroeteri	13.205	34.15
Fragilaria crotonensis	2.062	5.33
Melosira granulata	1.903	4.92
Pediastrum duplex	1.444	3.73
Unknown spherical green alga	0.434	1.12
Oocystis sp.	0.156	0.40
Asterionella formosa	0.095	0.24
Oscillatoria agardhii	0.056	0.14
Phacus sp.	0.056	0.14
Oscillatoria sp.	0.048	0.12
Centric diatoms	0.036	0.09
Pennate diatoms	0.033	0.09
Ankistrodesmus falcatus	0.017	0.05
Oscillatoria amphibia	0.003	0.01
Total	38.665	
Shannon-Weaver [H']	1.27	
Species Evenness	0.46	
Species Richness	0.62	

The phytoplankton community is dominated by the presence of flagellates and green algae. Historically DWR has reported a dominance of blue-green algae, Ceratium and Aphanizomenon.

Pollution Assessment

Nonpoint pollution sources include the following: grazing by domestic livestock, recreation, and urban.

Cattle graze intensively throughout the watershed, and routinely on the shores of the upper portion of the reservoir. In addition it is common practice to cultivate crops to the edge of the reservoir where farmland is adjacent to the reservoir. The area within about a mile of the dam is owned by the Bureau of Reclamation and is not grazed.

There are no point sources of pollution in the watershed.

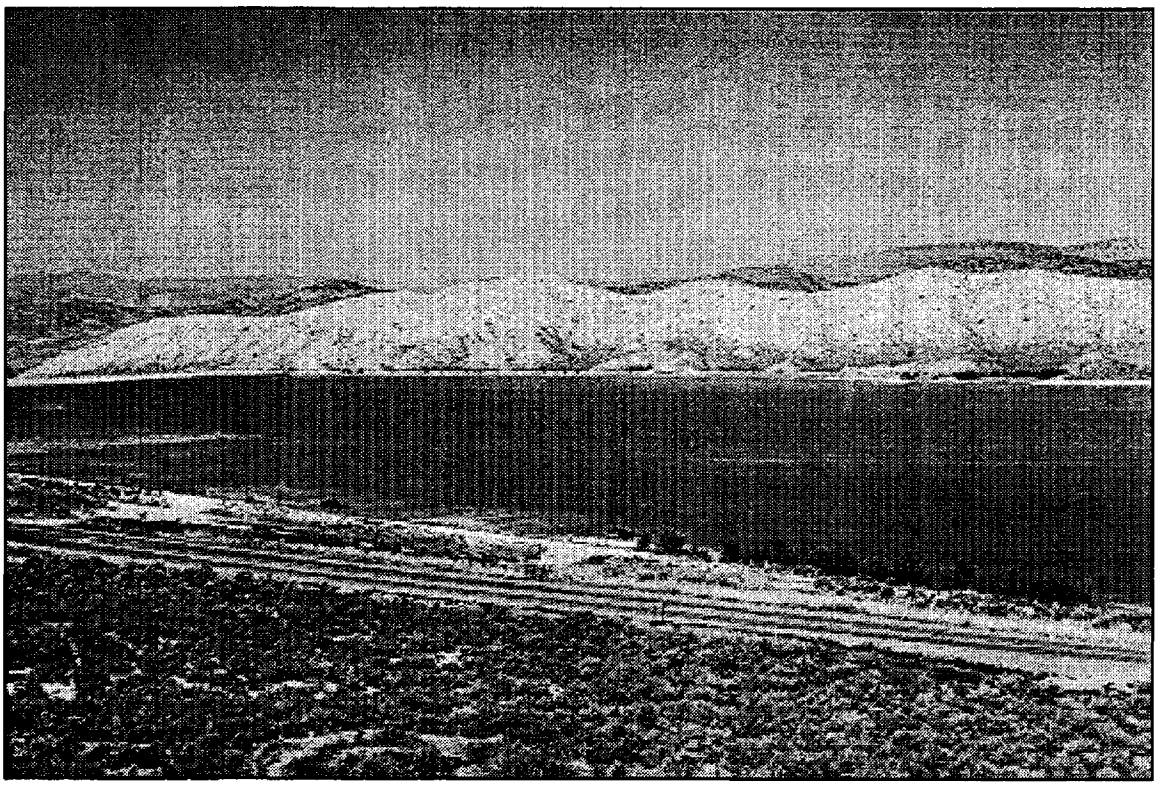
Information

Management Agencies	
Bear River Association of Governments	752-7242
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Bridgerland Travel Region (Logan) / Logan Chamber Of Commerce	752-2161
Reservoir Administrators	
DOI	
Bear River	

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

NINEMILE RESERVOIR



Introduction

Ninemile Reservoir is an intermediate sized reservoir at the south end of the Sanpete Valley in Central Utah. It is located alongside US-89 between Manti and Gunnison, at the western base of the Wasatch Plateau. It is also known as Highland Reservoir.

Ninemile Reservoir was created in 1900 by the construction of an earth-fill dam. In 1982 the dam was raised, increasing the capacity from from 3,015 acre feet to 3,500 acre feet. The reservoir is privately owned, but access is unrestricted. Water use is for primarily for irrigation and recreation with no changes foreseen in the future.

Characteristics and Morphometry

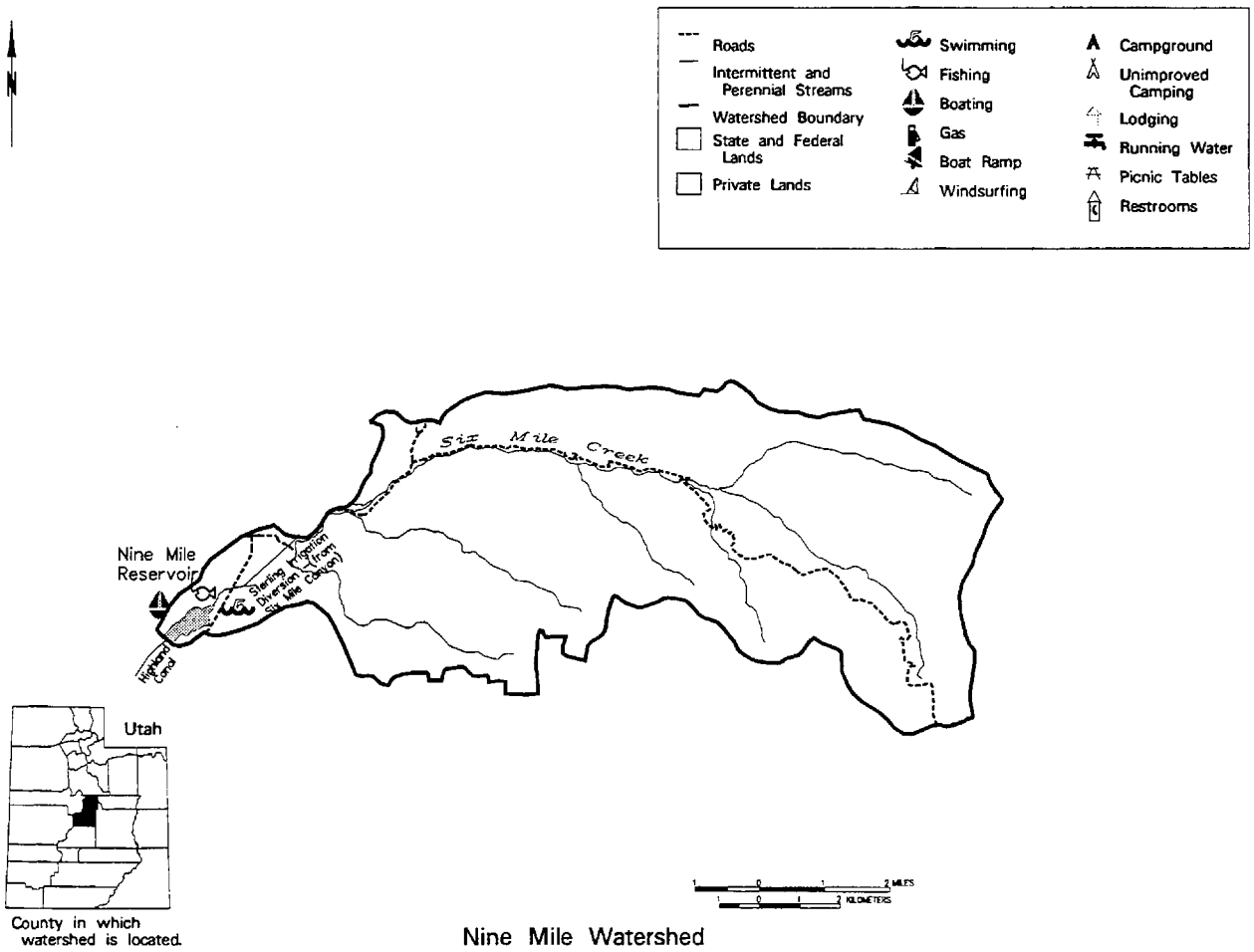
Lake elevation (meters / feet)	1,649 / 5,402
Surface area (hectares / acres)	86 / 213
Watershed area (hectares / acres)	732 / 1810
Volume (m^3 / acre-feet)	
capacity	4,320,000 / 3,500
conservation pool	0
Annual inflow (m^3 / acre-feet)	4,317,250 / 3,500
Retention time (years)	1
Drawdown (m^3 / acre-feet)	18,502 / 15
Depth (meters / feet)	
maximum	11 / 36
mean	4.6 / 15
Length (meters / feet)	1,750 / 5,742
Width (meters / feet)	816 / 2,677
Shoreline (meters / feet)	4,320 / 14,174

Location

County	Sanpete
Longitude / Latitude	111 42 30 / 39 10 30
USGS Maps	Sterling, UT 1966
DeLorme's Utah Atlas & Gazetteer™	Page 37 B-6
Cataloging Unit	San Pitch (16030004)

Recreation

Ninemile Reservoir is accessible from the US-89 south of Sterling at the junction with U-137 (see map). It is six miles east of Gunnison and six miles south of Manti. Access to the dam is via an unimproved road west of the US-89 immediately west of the U-137 junction.



Nine Mile Watershed

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The primary recreational use of the reservoir is fishing. Usage is light, and there are no facilities of any sort.

Palisade State Park is one mile east of Sterling. It has 53 campsites, a sandy beach, modern rest rooms with hot showers, a group camping area, a nine-hole golf course and a pavilion. Usage fees are charged. There is also a USFS campground seven miles up Manti Canyon.

There are private campgrounds in Gunnison and Manti (see info box).

Watershed Description

Ninemile Reservoir is used to store springwater throughout the winter for irrigational use during the growing season. The only inflowing perennial stream originates from a spring about one mile northeast of the reservoir. Additional water is diverted to the reservoir via the Sterling Irrigation Diversion from Six Mile Creek. The small watershed also provides some runoff during snowmelt.

The watershed high point, 1.5 miles east of the reservoir, is 2,036 m (6,680 ft) above sea level, thereby developing a complex slope of 19.8% to the reservoir. The outlet is the Highland Canal, with any overflow water draining into the San Pitch River. The average stream gradient between the principle spring and the reservoir is 5.6% (295 feet per mile).

The watershed is comprised of alluvial plains, alluvial fans, and low mountains. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of pinyon-juniper, sagebrush-grass, and bitterbrush. The watershed receives 30 cm (12 inches) of precipitation annually. The frost-free season around the reservoir is 100 -140 days per year.

According to the 1982 Clean Lakes Inventory, land use is as follows. Native grazing (mostly cattle and sheep) and wildlife land (the Ninemile State Wildlife Area is managed as winter range for wildlife) comprise 42% each, while 10% is pasture and hayland and 6% is urban.

Limnological Assessment

The water quality of Ninemile Reservoir is good. It is considered to be very hard with a hardness concentration value of approximately 302 mg/L ($CaCO_3$). The only parameter that has exceeded State water quality standards for defined beneficial uses is total phosphorus. The average concentrations of total phosphorus in the water column typically does not violate the criteria but on September 9, 1992 with only 2.3 meters of water in the reservoir, the average concentration was 260 ug/L. This increase of nutrients late in the year leads to an increased productivity at the reservoir. Large mats of algae are present on the reservoir during this period of the year.

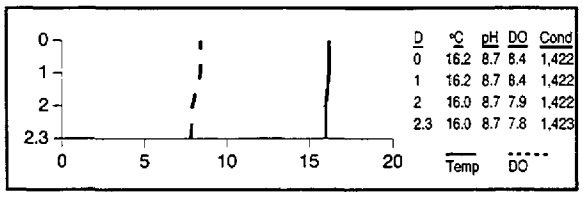
Current data indicates that the reservoir is a nitrogen limited system. TSI values indicate the reservoir is mesotrophic to eutrophic with seasonal variability. The high alkalinity associated with the reservoir may be limiting productivity too. The reservoir does not stratify due to its shallow nature and fairly rapid drawdown as indicated by the September 9, 1992 profile. Macrophytes are present and are fairly extensive during late summer.

Limnological Data

Data averaged from STORET sites: 594324, 594325

Surface Data	1981	1990	1992
Trophic Status	E	M	E
Chlorophyll TSI	-	45.79	49.69
Secchi Depth TSI	-	47.84	54.65
Phosphorous TSI	61.94	41.93	73.9
Average TSI	61.94	45.19	59.42
Chlorophyll a (ug/L)	-	4.7	7.1
Transparency (m)	-	2.3	2.1
Total Phosphorous (ug/L)	55	14	127
pH	-	8.8	8.9
Total Susp. Solids (mg/L)	17	6	5
Total Volatile Solids (mg/L)	-	-	4
Total Residual Solids (mg/L)	-	-	2
Temperature (°C / °f)	-	22/71	17/63
Conductivity (umhos.cm)	-	829	901
Water Column Data			
Ammonia (mg/L)	0.1	0.14	0.03
Nitrate/Nitrite (mg/L)	0.53	0.23	0.17
Hardness (mg/L)	290	272	326
Alkalinity (mg/L)	308	276	325
Silica (mg/L)	-	-	3.9
Total Phosphorous (ug/L)	40	15	133
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	-	12.6	8.0
Stratification (m)	-	NO	NO
Depth at Deepest Site (m)	-	1.7	2.3

According to DWR no fish kills have been reported in recent years. The DWR stocks the reservoir annually with either 15,000 catchable Rainbow Trout or 3,000 catchable and 25,000 advanced fingerling Rainbow Trout. Historical DWR records show the reservoir once had cutthroat, brown and brook trout. Also present were, fathead minnow (*Pimephales promelas*), and green sunfish (*Lepomis cyanellus*). It was drained in 1981 to raise the dam. In addition the reservoir was chemically treated in 1959 and 1970 by the DWR to control rough fish competition.



D	°C	pH	DO	Cond
0	16.2	8.7	8.4	1,422
1	16.2	8.7	8.4	1,422
2	16.0	8.7	7.9	1,422
2.3	16.0	8.7	7.8	1,423

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Peridinium sp.	8.312	43.861
Tetraedron minimum	5.747	30.32
Pennate diatoms	3.2912	17.37
Pandorina morum	0.667	3.52
Scenedesmus quadricauda var. quadrispina	0.578	3.05
Centric diatoms	0.142	0.75
Unknown spherical green alga	0.072	0.38
Scenedesmus sp.	0.033	0.18
Oocystis sp.	0.031	0.16
Euglena sp.	0.025	0.13
Ankistrodesmus falcatus	0.022	0.12
Chlamydomonas sp.	0.019	0.10
Merismopedia sp.	0.011	0.06
Total	18.948	
Shannon-Weaver [H']	1.36	
Species Evenness	0.53	
Species Richness	0.51	

The phytoplankton community is dominated by flagellates and green algae indicative of moderate productivity and good water quality.

Pollution Assessment

Nonpoint pollution sources include the following: sedimentation and nutrient loading from grazing, and cropland; and wastes and litter from recreation

One major use of the watershed is livestock grazing, resulting in increased runoff and soil erosion. The area around the reservoir is rangeland and cropland with animals grazing in direct proximity to the water. These land uses can impact the reservoir through increased sediment production, higher nutrient loadings and contamination from agricultural chemicals when utilized.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2A), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Six County Commissioners Association	896-9222
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Panoramaland Travel Region (Richfield)	896-9222
Manti Chamber of Commerce	835-6271
Palisade State Park	835-7275
Lund's Campground (Gunnison)	528-3366
Manti Campground	835-7851
Reservoir Administrators	
Gunnison Irrigation Company	528-7961

OAKS PARK RESERVOIR

Introduction

Oaks Park Reservoir is a moderate sized reservoir on the south slope of the eastern High Uintas. It has a small, natural watershed and provides summer recreational opportunities. It is also known as Oak Park Reservoir.

Oaks Park Reservoir was created in 1924 by the construction of an earth-fill dam. The reservoir shoreline is owned by the Ashley National Forest, and public access is unrestricted. Reservoir water is consumed for irrigation, but used for coldwater aquatic habitat and recreation. Water use is not expected to change in the foreseeable future.

Characteristics and Morphometry

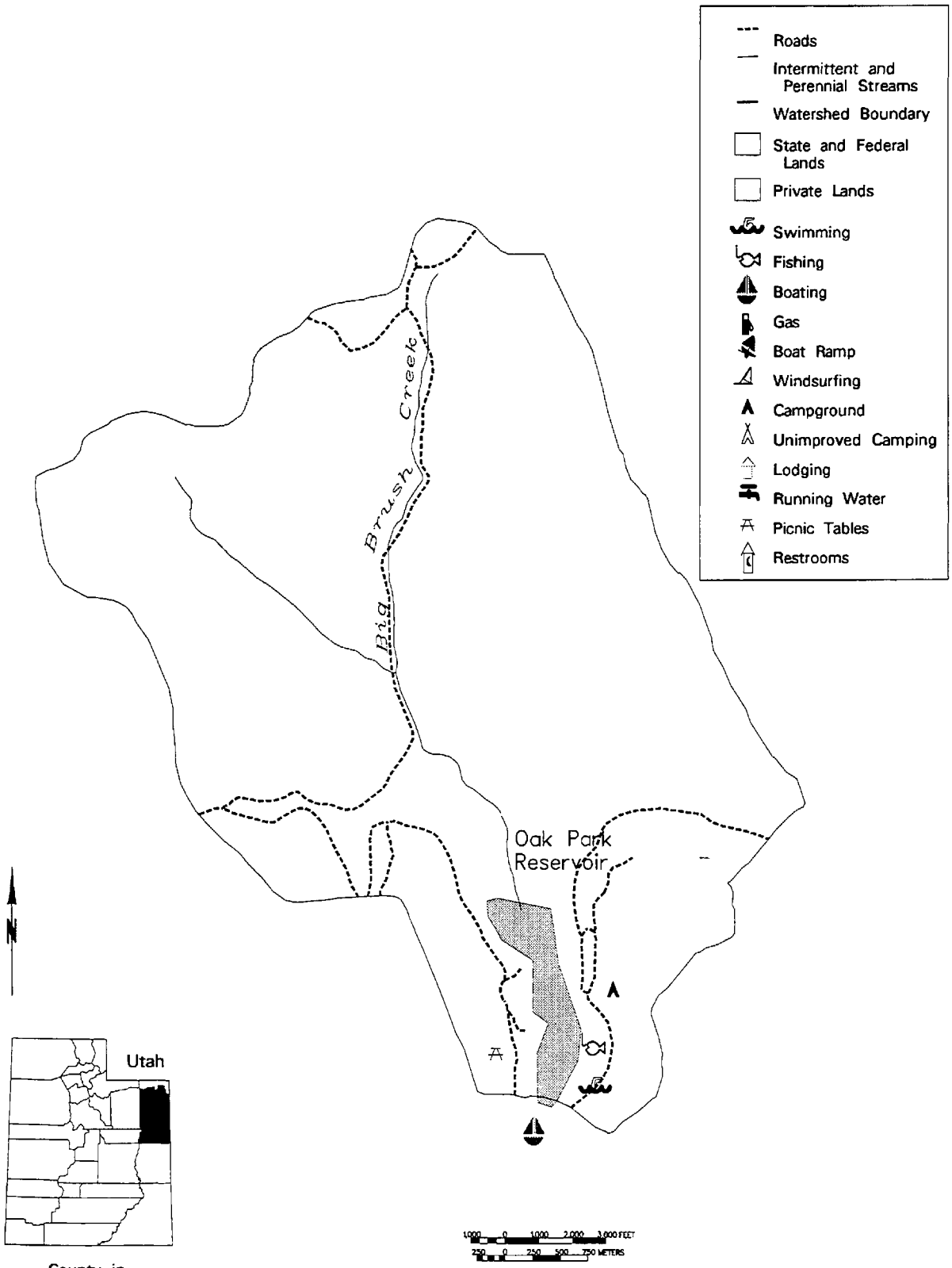
Lake elevation (meters / feet)	2,828 / 9,280
Surface area (hectares / acres)	155 / 382
Watershed area (hectares / acres)	2,626 / 6,488
Volume (m^3 / acre-feet)	
capacity	8,297,800 / 6,727
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	12.8 / 42
mean	5.4 / 17.6
Length (meters / feet)	610 / 2,001
Width (meters / feet)	366 / 1,201
Shoreline (km / miles)	6.6 / 4.1

Location

County	Uintah
Longitude / Latitude	109 44 52 / 40 37 05
USGS Map	Elk Park & East Park Resr, 1963, Dyer Mtn, 1950
DeLorme's Utah Atlas & Gazetteer™	Page 56, B-2
Cataloging Unit	Ashley-Brush Creeks (16060002)

Recreation

Oaks Park Reservoir is accessible from the Red Cloud Loop road north of Vernal. Turn west on FS-018--The Red Cloud Loop--from between mileposts 220 and 221 on US-191 (about 22 miles north of Vernal and 15 miles south of the Flaming Gorge Jct (US-191 and U-44). The route is signed East Park, Red Cloud Loop. The road is paved for



County in which watershed is located.

Oak Park Watershed

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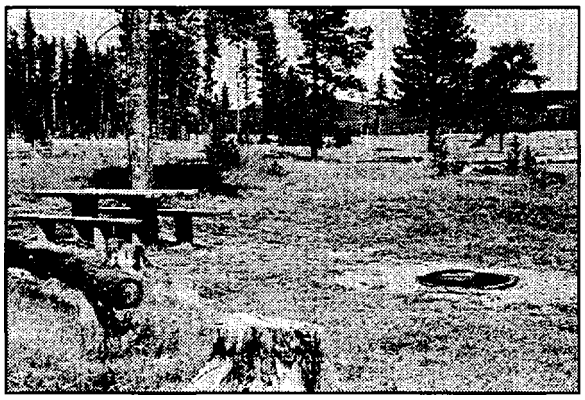
about three miles, after which the Red Cloud Loop branches to the left. Continue on the Red CLoud Loop, now gravel, for about ten miles, to where the road to Oaks Park Reservoir branches off to the right. It is well marked. The reservoir is about 1.5 miles off the loop on this side road.

Fishing, boating, swimming, camping, and picnicking are all popular.

Recreational facilities at the reservoir include a Oaks Park Campground, a USFS facility, which has primitive latrines, picnic areas, and campsites, but no drinking water. There is no boatramp, but it is possible to launch a small boat near the dam.



Watershed Description

Oaks Park Reservoir is located in the High Uintas. The watershed consists entirely of alpine meadows, coniferous forests and alpine tundra. Slopes surrounding the reservoir are not particularly steep (<25%). The reservoir is an impoundment of what was Oaks Park, a meadow that Big Brush Creek flowed through.

The watershed high point, an unnamed peak four miles northwest, is 3,240 m (10,629 ft) above sea level, thereby developing a complex slope of 7.9% to the reservoir. The average stream gradient of Big Brush Creek is 3.3% (179 feet per mile). The inflows are Big Brush Creek and an unnamed tributary from Windy Park. The outflow is a canal that flows across Government Park and into Ashley Creek. Excess water flows down Big Brush Creek several miles to where the stream becomes subterranean.

The watershed is made up of high mountains and mountains meadows. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of spruce-fir, meadow and aspen. The watershed receives 64 - 76 cm (25 - 30 inches) of precipitation annually. The frost-free season around the reservoir is 0 - 20 days per year.

Land use in the watershed is 100% multiple use, with logging, grazing and human recreation being the primary uses. A large portion of the forest has been clearcut in the past decade, which may have contributed to current water quality degradation. The forest and soil are healing, but very slowly, given the high altitude and short growing season. Current logging operations leave a 200 foot buffer around the reservoir.

Limnological Assessment

The water quality of Oak Park Reservoir is very good. It is considered to be very soft with a hardness concentration value of approximately 14.6 mg/L ($CaCO_3$). The parameters that have exceeded State water quality standards for defined beneficial uses are total phosphorus, pH, and dissolved oxygen. The average concentrations of total phosphorus in the water column for the three study periods has not exceeded the recommended pollution indicator for phosphorus of 25 ug/L, but an occasional value is reported slightly in excess of the indicator. Although these occasional exceedences do not impair water quality as such, dissolved oxygen concentrations in late summer substantiate the fact

Limnological Data

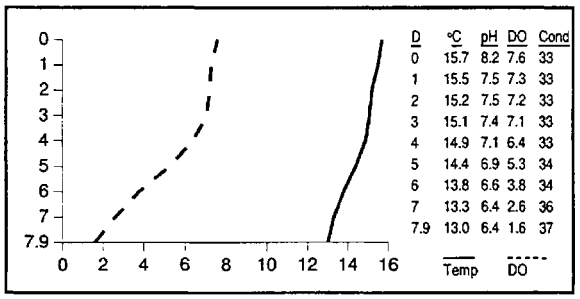
Data averaged from STORET sites: 593770, 593771

Surface Data	1981	1989	1991
Trophic Status	M	M	M
Chlorophyll TSI	-	50.84	43.60
Secchi Depth TSI	60.00	56.26	58.11
Phosphorous TSI	39.3	38.71	41.96
Average TSI	49.65	48.61	47.89
Chlorophyll a (ug/L)	-	7.9	3.8
Transparency (m)	1	1.3	1.1
Total Phosphorous (ug/L)	20	14	14
pH	8.5	7.2	7.8
Total Susp. Solids (mg/L)	<5	-	5
Total Volatile Solids (mg/L)	-	-	4
Total Residual Solids (mg/L)	-	-	2
Temperature (°C / °f)	12/54	13/55	13/56
Conductivity (umhos.cm)	20	36	28
Water Column Data			
Ammonia (mg/L)	0.05	0.01	0.04
Nitrate/Nitrite (mg/L)	0.12	-	0.03
Hardness (mg/L)	17.5	-	11.7
Alkalinity (mg/L)	7	-	9.5
Silica (mg/L)	-	-	3.6
Total Phosphorous (ug/L)	23	19	17
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	6.7	6.8	3.8
Stratification (m)	NO	NO	NO
Depth at Deepest Site (m)	10	4.2	7.9

that water quality impairments do exist. As observed in the September 5, 1991 profile there is moderate decline in the concentrations in the lower regions of the reservoir. It is also in the hypolimnion that low pH values appear.

The reservoir does not typically stratify as indicated by the profile. This is due in part to a fairly rapid drawdown to shallower conditions, which are not conducive for stratification. Current data indicates that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is mesotrophic. The reservoir has not been surveyed during the winter but near anoxic conditions late in the summer indicate that there may be severe conditions present with ice coverage. The Ashley National Forest and the Utah Division of Wildlife Resources are working with the Ashley Valley Reservoir Company to determine how a fishery conservation pool can be created to enhance the overwintering of fish.

According to DWR no fish kills have been reported in recent years. The reservoir supports populations of brook trout (*Salvelinus fontinalis*), and rainbow trout (*Oncorhynchus mykiss*). The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake. Current stocking reports indicate that DWR stocks the reservoir with 2,500 catchable rainbow trout annually.



D	°C	pH	DO	Cond
0	15.7	8.2	7.6	33
1	15.5	7.5	7.3	33
2	15.2	7.5	7.2	33
3	15.1	7.4	7.1	33
4	14.9	7.1	6.4	33
5	14.4	6.9	5.3	34
6	13.8	6.6	3.8	34
7	13.3	6.4	2.6	36
7.9	13.0	6.4	1.6	37

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Asterionella formosa	0.567	60.57
Oocystis sp.	0.241	25.83
Dinobryon divergens	0.104	11.15
Scenedesmus quadricauda	0.013	1.43
Centric diatoms	0.006	0.68
Pennate diatoms	0.003	0.36
Total	0.934	
Shannon-Weaver [H']	1.01	
Species Evenness	0.57	
Species Richness [d]	0.24	

The phytoplankton community is dominated by the presence of diatoms and green algae support of the water quality assessment.

Pollution Assessment

Nonpoint pollution sources include grazing, concentrated and dispersed recreation, and logging.

Grazing takes place throughout the watershed and in the vicinity of the reservoir.

Although much of the watershed has been clearcut in fairly recent history, shallow slopes in the watershed have prevented substantial watershed damage from taking place.

There are no point sources of pollution in the watershed.

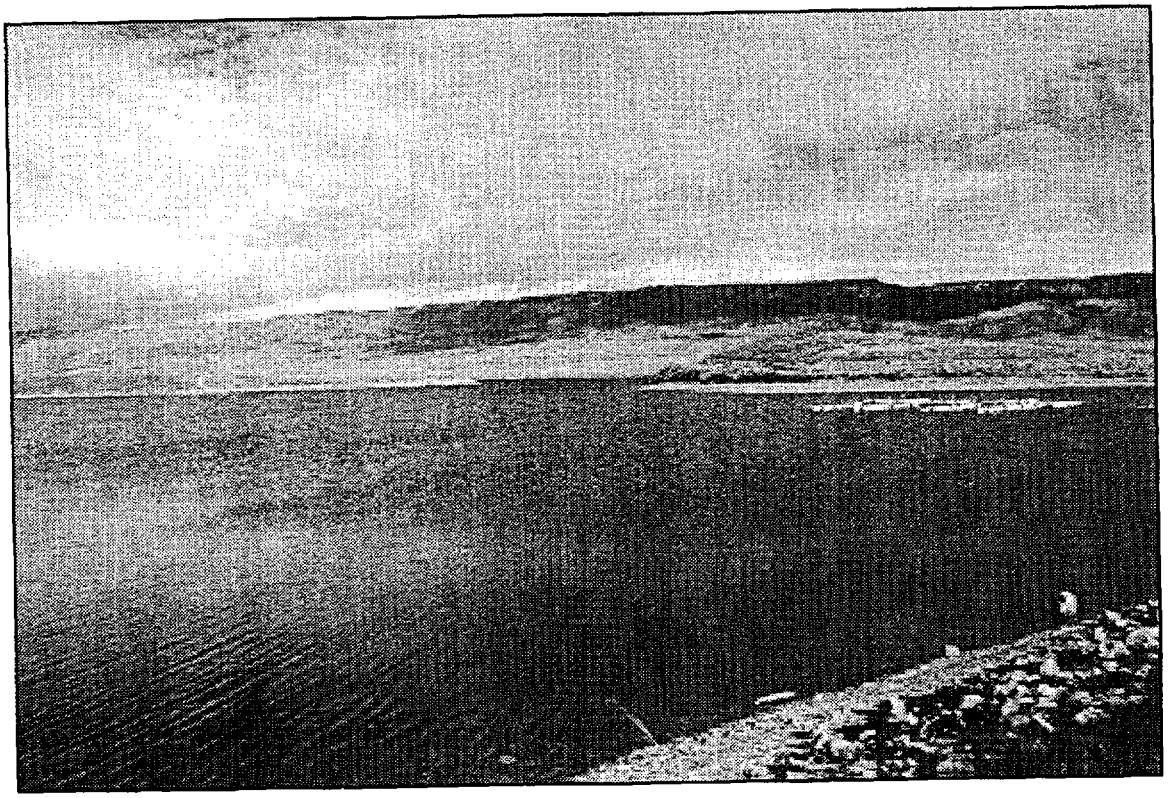
Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Ashley National Forest	789-1181
Vernal Ranger District	789-1181
Recreation	
Dinosaurland Travel Region (Vernal)	789-6932
Vernal Chamber of Commerce	789-1352
Reservoir Administrators	
Whiterocks Irrigation Company, LaPoint	247-2327

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

OTTER CREEK RESERVOIR



Introduction

Otter Creek Reservoir is at the south end of Grass Valley, east of Circleville and south of Koosharem. It is a large, shallow impoundment of a low elevation valley.

The reservoir shoreline is publicly and privately owned. The public portion is administered by the Bureau of Land Management and Utah State Parks and Recreation.

Characteristics and Morphometry

Lake elevation (meters / feet)	1,942 / 6,372
Surface area (hectares / acres)	1,020 / 2,520
Watershed area (hectares / acres)	281,000 / 694,000
Volume (m^3 / acre-feet)	
capacity	64,752,682 / 52,495
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	41,434,562 / 33,591
Depth (meters / feet)	
maximum	11.3 / 37
mean	6.3 / 20.6
Length (km / miles)	10.5 / 6.55
Width (meters / feet)	1,170 / 3,854
Shoreline (km / miles)	27.3 / 16.9

Public access is restricted to the south and west sides. Defined beneficial uses include: water recreation excluding swimming, propagation of cold water fish and aquatic life, and agricultural needs.

Recreation

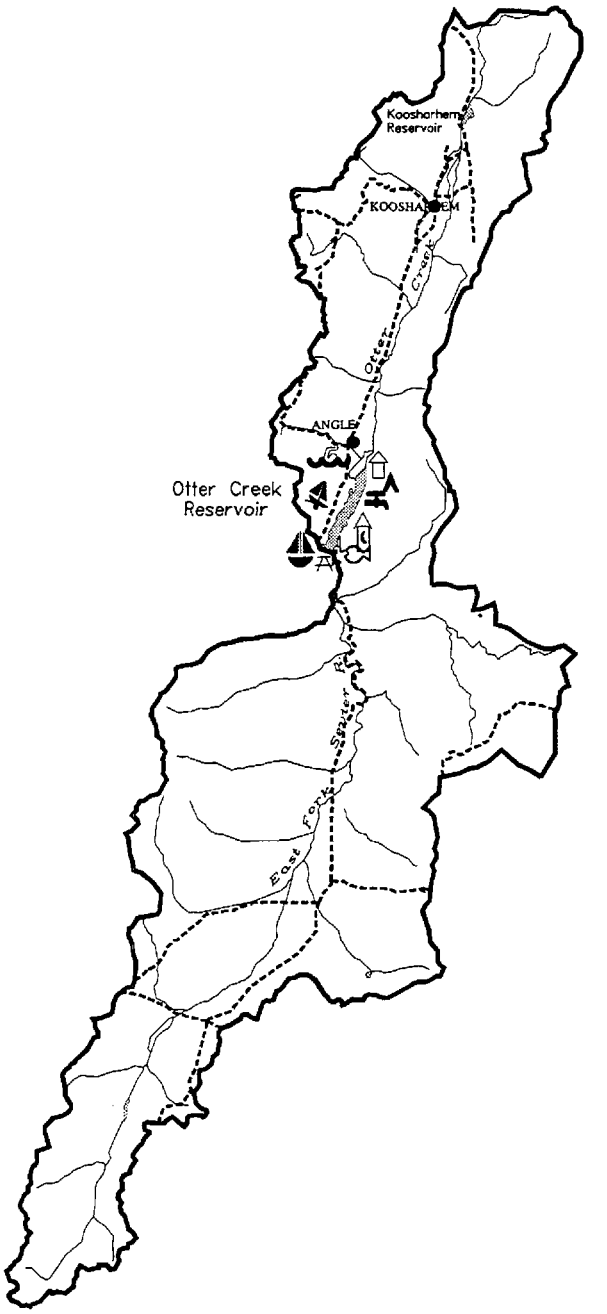
Otter Creek Reservoir is directly accessible from U-62 between Koosharem and Junction. The reservoir is 31 miles south of the U-24/U-62 junction near Koosharem and 12 miles east of the US-89/U-62 junction near Junction, Utah.

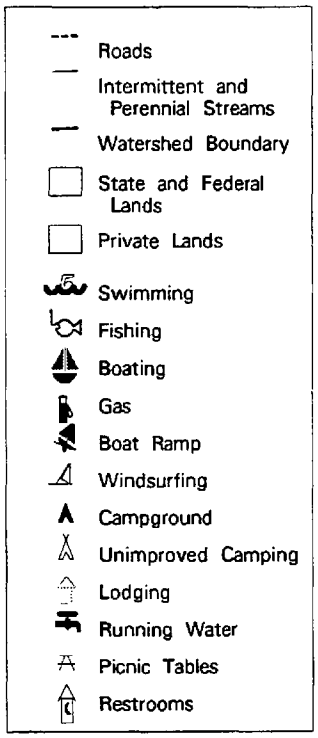
Fishing is excellent for rainbow trout. Waterskiing, swimming, picnicking and camping are also possible. Usage is moderate.

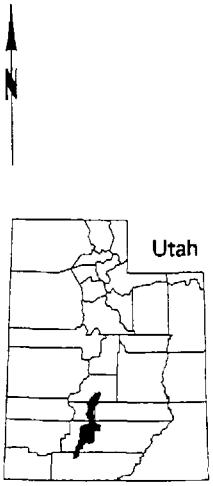
Otter Creek State Park, located at the south end of the lake, has complete recreational facilities, including 24

Location

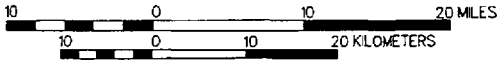
County	Piute
Longitude / Latitude	111 59 17 / 38 12 52
USGS Maps	Angle, Utah 1970, Phenolite Hill, Utah 1971
DeLorme's Utah Atlas & Gazetteer™	Page 27, B-4
Cataloging Unit	Otter Creek (16030002)







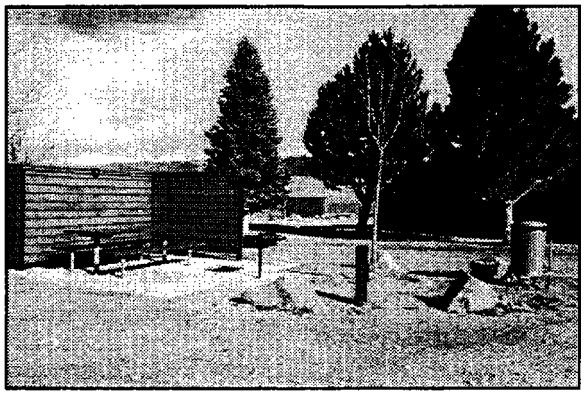
County near which watershed is located.



Otter Creek Watershed

<k119>

campsites with flush toilets, showers, an improved public boat ramp, picnic areas and a swimming area. The State Park is open year around. In addition there are private facilites in the area. The low elevation and consequent sagebrush vegetation, however, result in a lack of traditional scenic beauty. There are no other public campgrounds in the area.



Otter Creek R.V. Park and Marina, a private resort has full hookup RV sites, cabins, boat launching facilities and non-motorized boats for rent, a laundromat, showers, and flush toilets.

Watershed Description

The reservoir is in the south end of Grass Valley, between the Fish Lake Plateau and the Sevier Plateau. Otter Creek Reservoir impounds Otter Creek and receives supplementary water from the East Fork Sevier River via the East Fork Canal.

Grass Valley is a long, broad valley between the Awapa Plateau and the Sevier Plateau. Parker Mountain, the 20 mile long uninterrupted 3,000' tall face of the Awapa Plateau, provides a stunning backdrop for Otter Creek Reservoir. The area immediately surrounding the reservoir is lacking in traditional scenic beauty, being a sagebrush rangeland.

The watershed high point, The Fish Lake Hightop Plateau, is 3,546 m (11,633 ft) above sea level, thereby developing a complex slope of 3.6% to the reservoir. The inflows are Otter Creek and East Fork Canal. Koosharem Reservoir is an upstream impoundment on Otter Creek and Tropic Reservoir is an upstream impoundment on the East Fork Sevier River. The outflow is a canal that drains into the East Fork Sevier River. The average stream gradient in the Otter Creek Drainage is 2.1% (109 feet per mile) and 0.8% (45 feet per mile) in the East Fork Sevier drainage.

The soil in the surrounding high country is derived from the underlying volcanic rocks. The soil in the vicinity of the reservoir is made up of alluvial deposits from the high country. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities are comprised of bitterbrush, mountain mahogany, pinion-juniper, sage-grass, pine, aspen, spruce-fir, oak and maple. The watershed receives 25 - 64 cm (10 - 25 inches) of precipitation annually with a frost-free season of 80 - 100 days at the reservoir.

Land use in the Otter Creek and in the East Fork Sevier River watershed is 97.2% and 96% multiple use respectively. The primary use is grazing with approximately 2% in each watershed for pasture and hayland. There is about 2% in the Otter Creek drainage in crop production. The shoreline is 50% privately owned and 50% BLM owned. Public accessibility is restricted to the south and west shores.

Limnological Assessment

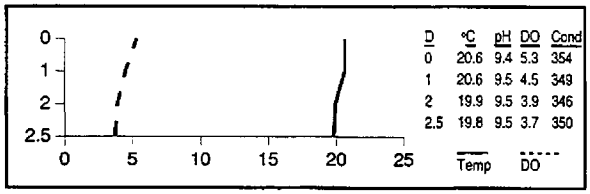
The water quality of Otter Creek Reservoir is fair to good. It is considered to be moderately hard with a hardness

Limnological Data

Data averaged from STORET sites: 494922, 494923, 494929

Surface Data	1979**	1990***	1992
Trophic Status	E	E	M
Chlorophyll TSI	54.72	39.97	30.21
Secchi Depth TSI	44.17	57.37	45.99
Phosphorous TSI	66.88	74.98	54.41
Average TSI	55.29	57.44	43.53
Chlorophyll a (ug/L)	11.7*	2.7	0.9
Transparency (m)	3	1	2.7
Total Phosphorous (ug/L)	77.5	136	45
pH	8.6	8.5	9.3
Total Susp. Solids (mg/L)	-	6.5	<3
Total Volatile Solids (mg/L)	-	-	0
Total Residual Solids (mg/L)	-	-	3
Temperature (°C / °f)	15/59	21/71	19/67
Conductivity (umhos.cm)	373	435	338
Water Column Data			
Ammonia (mg/L)	0.07	0.03	0.03
Nitrate/Nitrite (mg/L)	0.16	-	0.01
Hardness (mg/L)	172	185	139
Alkalinity (mg/L)	175	176	139
Silica (mg/L)	26.2	-	20.4
Total Phosphorous (ug/L)	81	149	56
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	5.9	6	3.9
Stratification (m)	NO	1-2	NO
Depth at Deepest Site (m)	10	3.0	2.5

* NES data.
** Data from 2 sites only (494922, 4949000.
*** Data is from period two only.



concentration value of approximately 163 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are total phosphorus, pH and dissolved oxygen. The average concentration of total phosphorus in the water column for the three study periods was 81, 149 and 56 ug/L. All values exceed the recommended pollution indicator for phosphorus of 25 ug/L. The phosphorus concentration appears to be declining which may be due to environmental remediation programs that have been implemented in recent years. Excessive pH values greater than 9.0 are probably due to the high production of algae and macrophytes in the system. During the photosynthetic process pH values are naturally elevated. Low dissolved oxygen conditions develop due to the increased demand for oxygen in decomposition of organic materials at the bottom of the reservoir and the consumption of oxygen by plants during respiration.

The reservoir does not usually stratify because of summer drawdown which leads to shallow conditions not conducive for stratification as indicated in the August 19, 1992 profile. Dissolved oxygen concentrations in late summer do substantiate the fact that water quality impairments do exist. Concentrations can drop dramatically during the nocturnal period due to the high demand from plant respiration. These types of conditions can lead to fish kills when shallow conditions and high productivity are combined.

Current data suggest that the reservoir is currently a nitrogen limited system and TSI values indicate the reservoir is usually eutrophic but in 1992 was mesotrophic. The productivity appears to be abnormally low in 1992. Low water years may be masking the productivity by limiting nutrient loadings.

Due to the impaired water quality of the reservoir in recent years, a Clean Lakes Phase I study was initiated. The purpose of the study is to assess impairments and to develop a feasibility plan to control sources of nutrients in the watershed. In recent years the high level of nutrients not only drives the production of large blue-green algal blooms but the production of macrophytes in the reservoir. Macrophyte production is so extensive that it restricts boating and impairs the fishery. This high state of production and the reservoirs shallow nature are responsible for depletion of dissolved oxygen in the water column. This depletion results from the loss of dissolved oxygen in the summer due to the heavy needs by the algal community involved in respiration during the nocturnal period and the loss experienced to the decomposition of organic matter(algae and macrophytes). These conditions can be become more severe during the winter under ice coverage. These conditions reduce the viability of the fishery by reducing the available habitat for fish. A report from that study is currently being drafted and review by agencies and individuals involved in the study area. The report will be available through the DWQ.

According to DWR no fish kills have been reported in recent years, but there are document limited fish kills historically. The reservoir supports populations of rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), cutthroat trout (*Oncorhynchus clarki*), Utah chub (*Gila atraria*), and Utah sucker (*Catostomus ardens*). Current stocking reports indicate that DWR stocked the reservoir with with 200,000 6-8" rainbow trout and 25,000 fingerling cutthroat trout in 1991.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Ceratium hirundinella	0.936	73.86
Pennate diatoms	0.289	22.81
Centric diatoms	0.027	2.11
Oscillatoria princeps	0.006	0.44
Unknown spherical green alga	0.006	0.44
Ankyra judayi	0.004	0.34

Information

Management Agencies	
Utah Parks and Recreation	538-7221
Otter Creek State Park	624-3268
Bureau of Land Management	539-4001
Sevier River Resource Area (Richfield Office)	896-8228
Six County Commissioners Association	
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Otter Creek R.V. Park and Marina	624-3292
Panoramaland Travel Region (Richfield)	896-9222
Reservoir Administrators	
Otter Creek Reservoir Company	896-5217

Total	0.000
Shannon-Weaver [H']	0.71
Species Evenness	0.40
Species Richness	0.24

The phytoplankton community is dominated by the presence of flagellates and diatoms indicative of fairly good water and moderate productivity as was the case in 1992.

Pollution Assessment

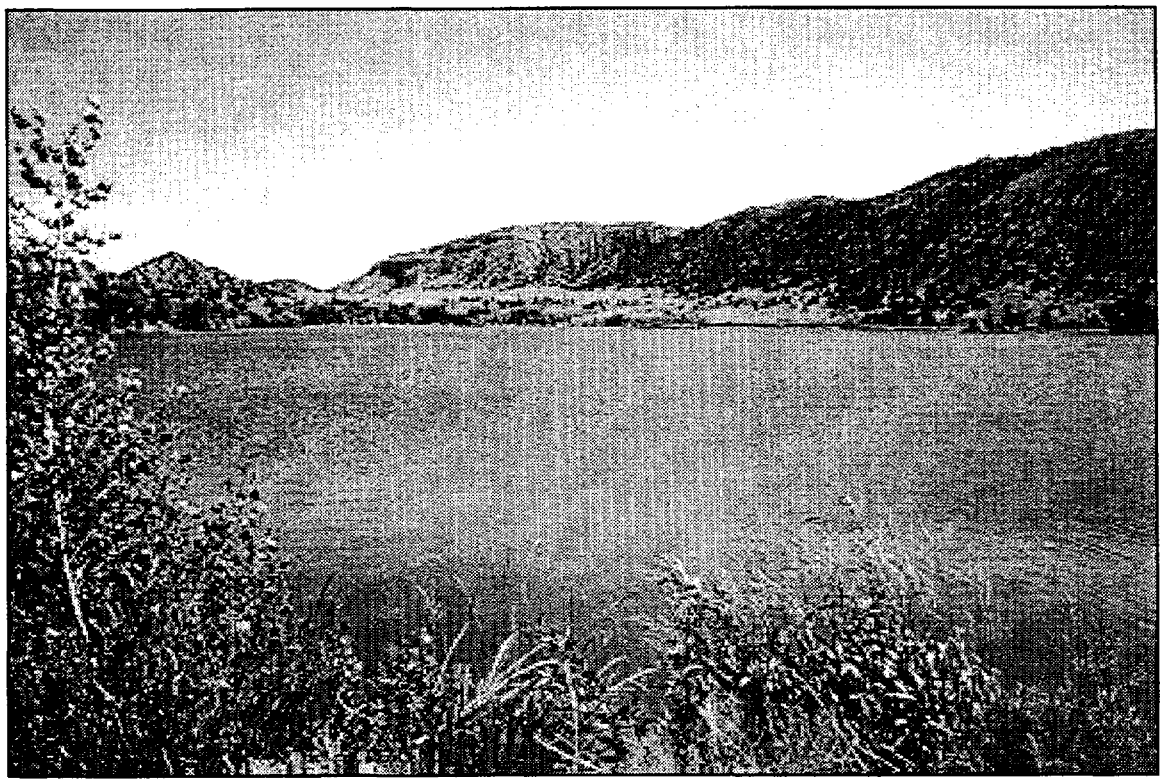
Nonpoint sources of pollution in the reservoir include: sedimentation and nutrient loading from grazing in the watershed and in the vicinity of the reservoir; pesticides and fertilizers from cultivated cropland; and wastes or litter from recreation.

There are two point pollution sources in the watershed, Burrville and Deans Fish Hatcheries..

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

PALISADES LAKE



Introduction

Palisade Lake is an intermediate sized off stream reservoir at the south end of the Sanpete Valley in Central Utah. The original dam was constructed in 1899 by Mormon Pioneers, who hauled dirt in in buckboards without the benefit of power equipment. The lake has been used for recreation since it was first constructed. It is nestled behind a hogback arm of the Wasatch Plateau at the edge the Sanpete Valley. It is located five miles south of Manti, and is the site of a State Park and a golf course. It is also known as Funk's Lake or Palisade Reservoir.

The reservoir shoreline is 50% privately owned and 50% State Park property. Access is unrestricted, but fees are charged for use of State Park property. Water use is primarily for irrigation. By late summer water storage in the reservoir is very low and recreation opportunities are limited. There are no changes foreseen in the future.

Characteristics and Morphometry

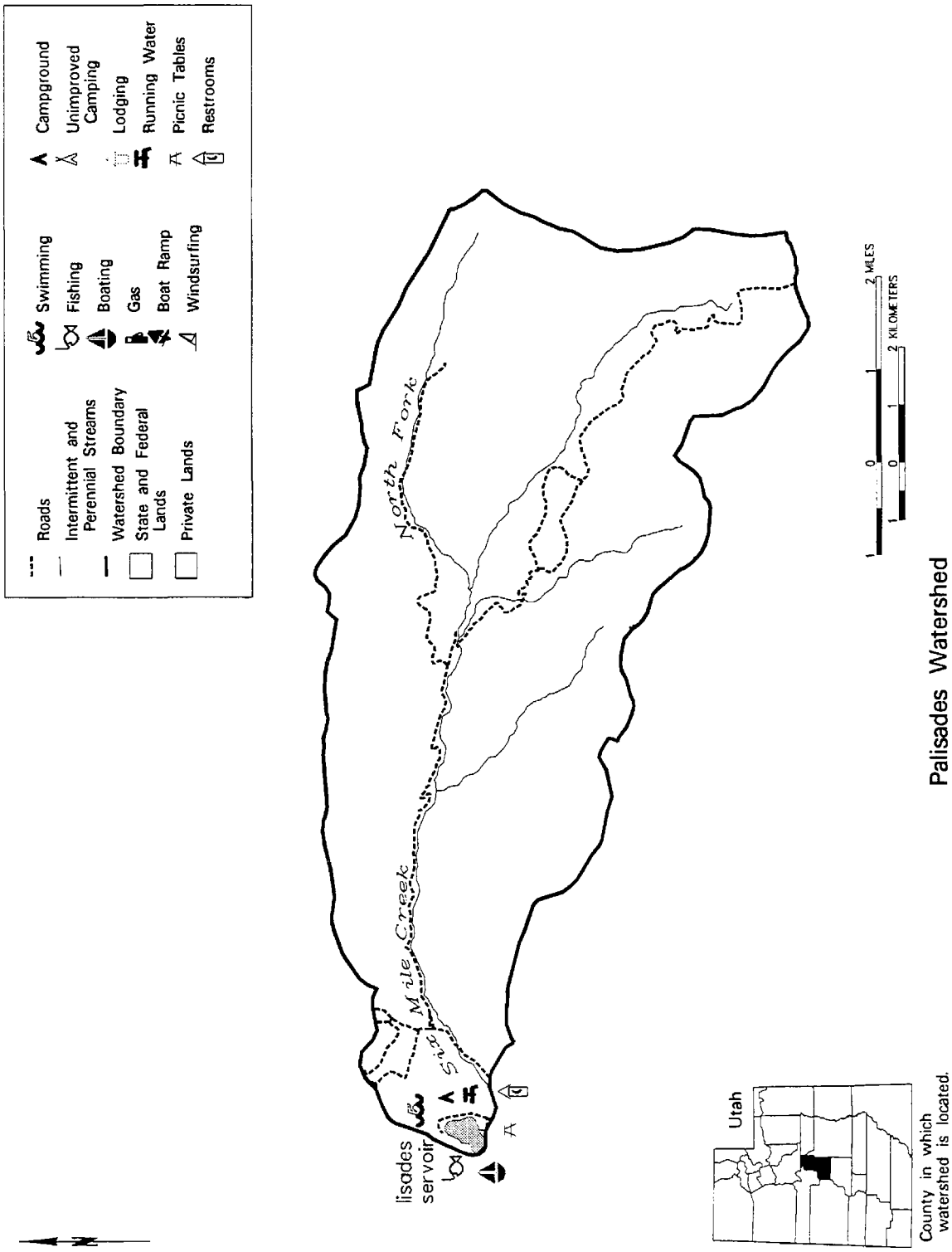
Lake elevation (meters / feet)	1,788 / 5,868
Surface area (hectares / acres)	28 / 66
Watershed area (hectares / acres)	6,941 / 17,152
Volume (m^3 / acre-feet)	
capacity	2,131,491 / 1,728
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	9.5 / 31
mean	5.5 / 18
Length (meters / feet)	792 / 2,600
Width (meters / feet)	488 / 1,600
Shoreline (meters / feet)	2,100 / 6,890

Recreation

Palisade Lake is accessible from US-89 immediately north of Sterling via an access road to the state park, which winds east for about 1.5 miles to the lake. Sterling is

Location

County	Sanpete
Longitude / Latitude	111 40 00 / 39 12 00
USGS Maps	Sterling, UT 1966
DeLorme's Utah Atlas & Gazetteer™	Page 37 A-6
Cataloging Unit	San Pitch (16030004)

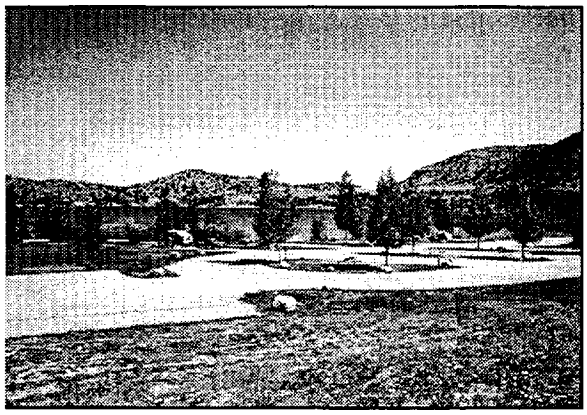


Palisades Watershed

<k108>

between Manti and Gunnison

The lake is used for fishing, non-motorized boating and swimming. The state park has 53 campsites, a sandy beach, modern rest rooms with hot showers, a group camping area, a nine-hole golf course and a pavilion. Usage fees are charged.



There is are private campgrounds in Gunnison and Manti (see info box).

Watershed Description

Palisade Lake an off-stream impoundment of Six Mile Creek. Water is diverted by a short (0.7 mile). The natural watershed is a small valley extending one mile north of the reservoir. The valley, which is carved out of the base of the Wasatch Plateau, is several hundred feet higher than Sanpete Valley.

The drainage basin of Six Mile Creek extends to the ridgeline of the Wasatch Plateau. The watershed high point, found at two locations--Black Mountain and the north shoulder of High Top, is 3,316 m (10,880 ft) above sea level, thereby developing a complex slope of 9.4% to the reservoir (from High Top). The average stream gradient on Six Mile Creek is 8.4% (443 feet per mile) and the gradient of the canal is 2.8% (147 feet per mile).

The watershed is entirely composed of the deeply dissected west face of the Wasatch Plateau. See Appendix III for soil composition data.

The vegetation communities consist of pinyon-juniper, pine-aspen, spruce-fir, sagebrush-grass, oak, and maple. The watershed receives 30 - 76 cm (12 - 30 inches) of precipitation annually. The frost-free season around the reservoir is 120 -140 days per year.

According to the 1982 Clean Lakes Inventory, land use is as follows: 90% is multiple use; 5% is recreation, 3% is wildlife land (the Manti State Wildlife Area is managed as winter range for wildlife) and 2% native grazing (mostly cattle and sheep).

Limnological Assessment

The water quality of Palisades Lake is good. It is considered to be hard with a hardness concentration value of approximately 204 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are total phosphorus and temperature. The average concentrations of total phosphorus in the water column rose dramatically in 1992 to a level of 181 ug/L which exceed the recommended pollution indicator for phosphorus of 25 ug/L. Prior to that year average concentrations in the water column were near or below the indicator value. This increased concentration elevated the productivity of the lake to a point that may impair water quality. These impairments may not be readily apparent because the lake is usually drawndown extensively in late summer because there is no conservation pool allocated in the lake. It is not uncommon for surface temperatures to exceed the criteria of 20°C established for a cold water fishery. This enhances the use of the lake for recreation but places stress on cold water trout species.

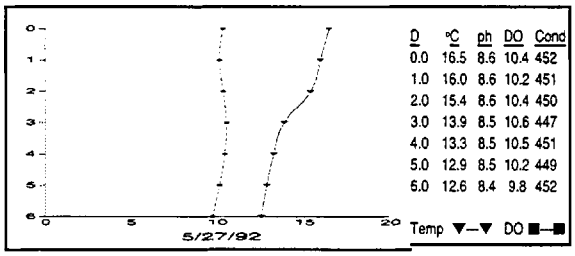
Limnological Data

Data sampled from STORET site: 494628

Surface Data	1981	1990	1992
Trophic Status	M	M	E
Chlorophyll TSI	-	41.54	44.44
Secchi Depth TSI	45.59	51.53	53.23
Phosphorous TSI	53.19	44.12	78.90
Average TSI	49.39	45.73	58.86
Chlorophyll a (ug/L)	-	3.1	4.1
Transparency (m)	1	1.8	1.6
Total Phosphorous (ug/L)	30	16	178
pH	8.2	8.6	8.7
Total Susp. Solids (mg/L)	15	5	17
Total Volatile Solids (mg/L)	-	-	3
Total Residual Solids (mg/L)	-	-	13
Temperature (°C / °f)	7/45	19/66	19/65
Conductivity (umhos.cm)	435	398	452
Water Column Data			
Ammonia (mg/L)	0.05	0.03	0.03
Nitrate/Nitrite (mg/L)	0.14	0.02	0.04
Hardness (mg/L)	202	210	201
Alkalinity (mg/L)	210	205	218
Silica (mg/L)	-	-	6.9
Total Phosphorous (ug/L)	30	17	181
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	10	6.6	10.3
Stratification (m)	6-7	NO	NO
Depth at Deepest Site (m)	7	5	6

1992 Miscellaneous data represents period 1.

The lake due to its shallow nature and summer drawdown does not stratify as indicated in the May 27, 1992 profile. The reservoir exhibits nitrogen limitation and has TSI values indicative of a moderately productive system with a mesotrophic status. However, in 1992 the lake exhibited highly eutrophic conditions with elevated levels of nutrients in the lake. There is an extensive macrophyte coverage later in the year as the lake is drawndown.



According to DWR no fish kills have been reported in recent years. The DWR stocks the reservoir annually with 3,000 catchable and 10,000 advanced fingerling rainbow trout. Historical DWR files record carp and bluegill may also be present. The reservoir was chemically treated in 1959 and 1980 by the DWR to control rough fish competition.

Due to the extensive drawdown in recent years phytoplankton in the euphotic zone was not been collected until 1994.

Phytoplankton in the euphotic zone from August 9, 1994 include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Centric diatoms	0.012	1.12
Dinobryon divergens	0.330	31.55
Euglena sp.	0.041	3.93
Pennate diatoms	0.031	2.97
Sphaerocystis schroeteri	0.612	58.42
Tetraedron minimum	0.021	2.01
Total	1.047	
Shannon-Weaver Index	1.04	
Evenness	0.58	
Richness	0.24	

The phytoplankton community is dominated by the presence of green algae and flagellates indicative of good water quality.

Pollution Assessment

Nonpoint pollution sources include the following: sedimentation and nutrient loading from grazing, chemicals and nutrients from the golf course, and wastes or litter from recreation.

The major use of the watershed is livestock grazing. Heavy runoff and substantial soil erosion contribute to water quality impairments.. The golf course in the immediate vicinity of the lake has immediate impacts on the reservoir.

The lake has a documented history of swimmer's itch, a protozoan which causes sevier itching. The protozoan is sustained due to warm summer water, warm water fish and snail hosts. After swimming in the reservoir, individuals should shower using soap and dry off to avoid the problems associated with this protozoan.

Beneficial Use Classification

The state beneficial use classifications include: recreational bathing (swimming) (2A), boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3B) and agricultural uses (4).

Information

Management Agencies	
Six County Commissioners Association	896-9222
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Panoramaland Travel Region (Richfield)	896-9222
Manti Chamber of Commerce	835-6271
Palisade State Park	835-7275
Lund's Campground (Gunnison)	528-3366
Manti Campground	835-7851
Reservoir Administrators	
Manti Irrigation and Reservoir Company	528-5671

PANGUITCH LAKE

Introduction

Panguitch Lake was a natural lake encompassing 777 acres until it was enlarged by a 22 foot dam to become a reservoir with a maximum surface area of 1,248 acres. It is a large midelevation lake on the Markagunt Plateau, between Panguitch and Cedar Breaks National Monument. The lake is located in the Dixie National Forest in a high tourist use area near three national parks and one national monument. In recent year there has been a significant number of summer homes built in the area by residents from neighboring states in addition to Utah residents.

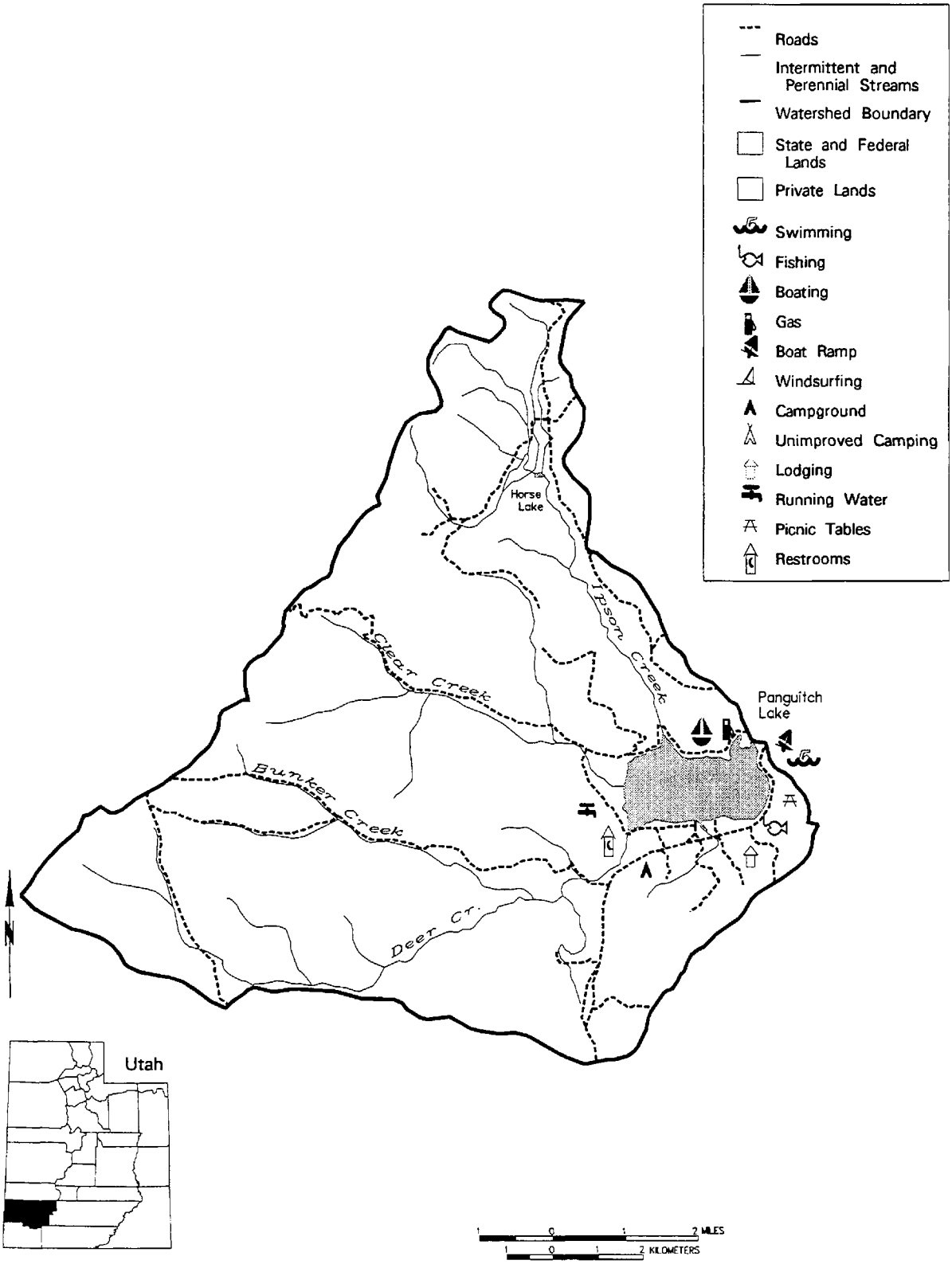
Characteristics and Morphometry

Lake elevation (meters / feet)	2,502 / 8,208
Surface area (hectares / acres)	505 / 1,248
Watershed area (hectares / acres)	9,583 / 23,680
Volume (m^3 / acre-feet)	
capacity	29,271,000 / 23,730
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	20 / 66
mean	5.8 / 19
Length (km / miles)	3.22 / 2
Width (km / miles)	1.77 / 1.1
Shoreline (km / miles)	8.8 / 5.5

Location

County	Garfield
Longitude / Latitude	112 38 34 / 37 42 50
USGS Maps	Panguitch Lake 1958
Cataloging Unit	Upper Sevier River (16030001)

The earliest know human use of the lake was as a fishery by the Piute Indians before the advent of the Caucasians into the area. The name Panguitch means "big fish" in the Piute language. The earliest record of Caucasians visiting the lake was in early June of 1852 when the old Indian chief, Quinarra (Kanara), requested the Mormon leaders at Parowan to visit a group of about 100 Piutes who were camped at the lake, catching fish and drying them for their winter supply of food (Woodbury, 1950).



County in which watershed is located.

Panguitch Watershed

<k143>

The original dam was of rock masonry and was constructed to a height of 12 feet. A 6 foot high masonry extension was added in 1912 and an additional 2 feet in 1921. In 1942 a concrete cap, 2 feet wide and 2 feet high, was place on the top of the existing dam raising the dam height to a total of 22 feet. Due to seepage problems the dam was grouted and a concrete layer was placed on the backside of the dam in the mid 1970's. Historically Panguitch Lake has been a very popular fishery not only for residents of Utah but those states adjoining or in close proximity to the area.

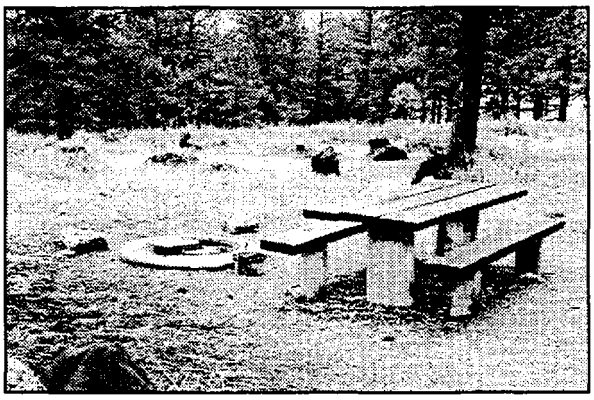
The reservoir shoreline is 45% owned by the Dixie National Forest, the remainder being privately owned. Public access is unrestricted. Defined beneficial uses include: water recreation excluding swimming, propagation of cold water species of game fish and aquatic life, and agricultural needs.

Recreation

Panguitch Lake is directly accessible from U-143, 17 miles southwest of Panguitch and 16 miles east of Cedar Breaks National Monument. U-143 follows the shoreline for several miles. Campgrounds and resorts are well marked.

Panguitch Lake is an excellent location for recreation year around, including waterskiing, picnicking, camping, cross country skiing and snowmobiling. Usage is heavy from Memorial Day to Labor Day. It has also become a popular site for ice fishing during the winter months.

There are two USFS campgrounds south of the lake, Panguitch Lake North and Panguitch Lake South. Both have flush toilets, electrical hookups, picnic areas, family and multi-family units with tables, water, fire pits, and asphalt roadways. The south campground has mainly tent sites, while the north campground has R.V. trailer sites. Fees are charged for use.



There are four private resorts on Panguitch Lake, each with many services, including gasoline and groceries. Their names and telephone numbers are listed in the Information box.

Watershed Description

Panguitch Lake is a natural body of water that was augmented with a series of dams culminating in the late 1970's. Construction of the dam has changed the original depth from 35 feet to 57 feet and the surface area from 777 acres to 1,248 acres.

The watershed high point, Sidney Peaks, is 3,371 meters (11,060 ft) above sea level, thereby developing a complex slope of 7.4% to the reservoir. There are three tributary streams, Ipson Creek, Clear Creek and Blue Spring Creek, whose headwaters originate at the brink of the Markagunt Plateau and flow south and east to Panguitch Lake. Deer Creek in the Blue Spring Creek drainage is actively pirating drainage area from the Mammoth Creek Basin. Panguitch Lake drains into Panguitch Creek, which joins the Sevier River in Panguitch. There are no upstream impoundments. The average stream gradient above the Lake is 4.4% (234 feet per mile).

The soil in the area is derived from the underlying volcanic rocks. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities are comprised of pine, aspen, spruce-fir, oak and maple. The watershed receives 25 - 51 cm (10 - 20 inches) of precipitation annually with a frost-free season of 60 - 80 days at the reservoir.

Land use in the watershed is mostly multiple use but with substantial vacation home development. Overgrazing has resulted in severe stream bank erosion in the tributaries, which was addressed in Panguitch Lake Restoration, a document published by the DWQ and EPA. In a project area on Blue Springs Creek, grazing was eliminated and stream restoration projects implemented. This resulted in substantial improvements to the riparian corridor for those streams involved and to an extent, the water quality of Panguitch Lake. In addition the overall restoration project consisted of construction of a fish cleaning station and increased public awareness of the aspects of water pollution. If improved management practices are implemented throughout the watershed, both with development and ranching, the water quality is expected to continue to recover.

Limnological Assessment

The water quality of Panguitch Lake is fair. It is considered to be moderately hard with a hardness concentration value of approximately 84 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are total phosphorus and dissolved oxygen. The average concentrations of total

phosphorus in the water column in recent years has usually always exceeded the recommended pollution indicator for phosphorus of 25 ug/L. Those problems relating to the excessive enrichment of Panguitch Lake has been documented in several reports. In the 1975 NES report it was ranked as 25th in water quality of the 27 lakes surveyed in Utah. It was judged to eutrophic, nitrogen limited, and receiving a eutrophic loading of 0.36 gm/m²/yr (1,815 Kg/m²/yr) of phosphorus. Historically the data documents summer blue-green algal blooms, winter and summer hypolimnetic oxygen deficits and fish kills have been problems associated with the lake.

In 1980 a Clean lakes 314 Phase I water quality study was initiated on the lake. A summary of that study (Panguitch Lake Phase I Study, 1983) indicate that the lake

Limnological Data

Data averaged from STORET sites: 594948, 594949

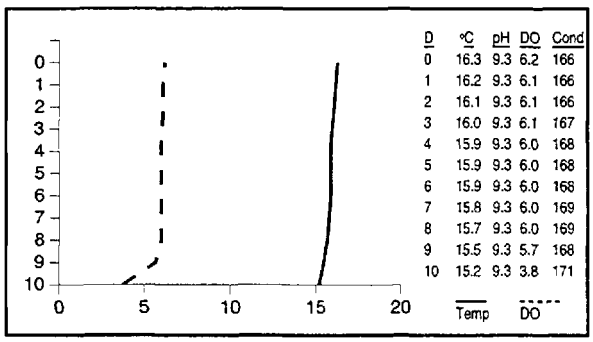
Surface Data	1981	1989	1990	1991
Trophic Status	E	E	E	E
Chlorophyll TSI	57.17	58.36	55.60	43.43
Secchi Depth TSI	46.23	45.70	49.31	49.41
Phosphorous TSI	59.67	57.29	55.42	58.75
Average TSI	54.36	53.78	54.72	50.56
Chlorophyll a (ug/L)	15	23	13	3.2
Transparency (m)	2.6	2.3	2.1	3.9
Total Phosphorous (ug/L)	47	38	25	72
ph	8.7	8.6	9.0	8.8
Total Susp. Solids (mg/L)	2.9	3.1	2.8	1.5
Total Volatile Solids (mg/L)	-	-	-	8
Total Residual Solids (mg/L)	-	-	-	25
Temperature (°C / °f)	16/61	15/58	15/59	16/60
Conductivity (umhos.cm)	170	218	163	176
Water Column Data				
Ammonia (mg/L)	0.21	0.10	0.03	0.13
Nitrate/Nitrite (mg/L)	0.57	-	-	0.02
Hardness (mg/L)	87	-	82	84
Alkalinity (mg/L)	89	108	84	90
Silica (mg/L)	-	-	-	8.6
Total Phosphorous (ug/L)	56	60	25	84
Miscellaneous Data				
Limiting Nutrient	N	N	N	N
DO (Mg/l) at 75% depth	6.8	6.7	0.8	6.0
Stratification (m)	11-12	NO	NO	NO
Depth at Deepest Site (m)	19	6.0	9.5	10.0

has good water quality as measured by most parameters. The lake is moderately low in alkalinity and hardness (80 mg/L). Secchi depth readings for the study period during the summer months range from 1 to 7 meters which is typical for slightly eutrophic systems. Nutrient levels in the epilimnion are relatively high but drop during the summer as nutrients are depleted by phytoplankton growth. Total phosphorus levels were commonly reported at 20 to 100 ug/L and inorganic nitrogen at 0.10 to 0.50 mg/L.

As expected, dissolved oxygen was low in the hypolimnion with temperature and dissolved oxygen profiles typical when compared to other mesotrophic to slightly eutrophic lakes in Utah. However, severe oxygen depletions were found near the lake bottom during late summer and again during the winter.

Panguitch Lake was determined to be eutrophic in both 1981 and 1982 based on overall trophic state indexes (TSI's). As part of the study Dr. Samuel R. Rushforth (1982) algal studies substantiated these trophic state determinations. He concluded that Panguitch Lake is a eutrophic system dominated by noxious species of blue-green algae (Anabaena, Aphanizomenon, and Microcystis) during the summer and fall months. It was also determined that exchangeable phosphorous values in the sediments were relatively small and that internal phosphorus loadings should be minimal, if the hypolimnion can be kept aerobic.

Current data still indicates that the lake is nitrogen limited with TSI values still in the eutrophic range. It appears that there has been a slight improvement of conditions since the implementation of some restoration



work in the watershed on Deer Creek and Bunker Creek, tributaries of Blue Spring Creek.

Although the profile of September 9, 1991 doesn't indicate the presence of a thermocline, the reservoir does stratify during the summer. There are also still problems with the depletion of dissolved oxygen in the water column due to the high demand for oxygen in decomposition and respiration carried on by extensive beds of macrophytes and algae during later summer and throughout the winter.

An ever increasing problems is the massive beds of macrophytes that limit accessibility to large portions of the lake during late summer. It is estimated at times that approximately 1/3 of the lakes surface area is affected with

emergent vegetation or submergent macrophytes near the surface. These large mats of algae and macrophytes impact the fishery and as they die off exert a large demand on the dissolved oxygen in the water column during decomposition. Five species of rooted aquatic macrophytes were found in Panguitch Lake during the Phase I study. Small beds of Polygonum coccineum and Ranunculus aquatilis occurred in shallow areas on the north, east and southeast shores of the lake with extensive beds of the two species occurring the shallow western shoreline of the lake. In places the two species occur up to 600 feet from the shoreline. Two species of *Potamogeton, P. filiformis and P. pectinatus* occurred throughout the macrophyte beds with *P. coccineum* and *R. aquatilis* extending 100 to 200 feet farther out into deeper water beyond the beds of *Polygonum* and *Ranunculus. Myriophyllum spicatum* was found in the boar dock areas and along steeper shorelines as well as the deep water border of the macrophyte beds.

According to DWR no fish kills have been reported in recent years. The lake supports populations of rainbow trout (*Oncorhynchus mykiss*), cutthroat trout (*Oncorhynchus clarki*), brown trout (*Salmo trutta*), and brook trout (*Salvelinus fontinalis*). Observed benthos includes mayflies, midges, copepods, and *Daphnia*. The DWR treated Panguitch Lake with rotenone in 1973 and again in September, 1991, in an attempt to eliminate nongame species. It was then restocked with 250,000 fingerling and 10,000 catchable rainbow trout and 20,000 fingerling each of brown trout and brook trout.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Anabaena spiroides v. crassa	40.476	76.41
Sphaerocystis schroeteri	7.923	14.96
Stephanodiscus niagarae	2.815	5.32
Pediastrum duplex	0.667	1.26
Pennate diatoms	0.107	0.20
Asterionella formosa	0.075	0.14
Melosira granulata	0.054	0.10
Centric diatoms	0.044	0.08
Oocystis sp.	0.025	0.05
Gomphosphaeria aponina	0.018	0.03
Staurastrum gracile	0.017	0.03
Ankistrodesmus falcatus	0.008	0.02
Chlamydomonas globosa	0.004	0.01
Total	52.900	

Shannon-Weaver [H']	0.81
Species Evenness	0.31
Species Richness	0.53

Although this is an unusually diverse flora a Utah lake, it is dominated by the presence of blue-green algae indicative of impaired water quality from excessive productivity. The extensive diversity may be a result of heavy macrophyte growth providing a increased diversity of algal habitats.

Pollution Assessment

Nonpoint sources of pollution in Panguitch Lake include: recreational wastes such as litter, and human wastes; silviculture activities which increase the potential for sedimentation from denuded land; grazing which tends to increase sedimentation from devegetation and nutrient loading and pathogen introduction from excrement.

The documentation of water quality problems and recommendations to control sources are contained in the study, *Panguitch Lake Phase I Clean Lakes Study (1983).* The goal of the restoration effort is to control those sources of phosphorus within the watershed. This would reduce nutrient loading to the lake and reduce the productivity associated with the lake. Primary areas focused on include control of sewage disposal, grazing activities not only in the watershed but in direct proximity of the lake, erosion and sediment control, and education. It is also evident that with the increasing macrophyte problems that efforts will need to be implemented to reduce the effect they are exhibiting on water quality in the lake. Increased vacation home development and recreational use and the need for more timber harvest due to losses associated with beetle infestations, unless carefully managed, may contribute to the already stressed water quality problems associated with Panguitch Lake.

Information

Dixie National Forest	
Ranger District	
Deer Creek Lodge	
Beaver Dam Lodge	
Panguitch Lake Resort	676-2657
Lake View Resort	676-2650
Rustic Lodge	676-2639
Five County Association of Governments	
West Panguitch Irrigation Company	
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146

There are no point pollution sources currently known in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

PARADISE PARK RESERVOIR

Introduction

Paradise Park Reservoir is an intermediate size reservoir on the south slope of the High Uintas. It is at the terminus of a well maintained gravel road with a campground by the reservoir. It has a small, natural watershed and provides hiking opportunities. Paradise Park Reservoir was created in 1924 by the construction of an earth-fill dam. The reservoir shoreline is owned by the Ashley National Forest, and public access is unrestricted. Reservoir water is consumed entirely for irrigation. Fifty percent of the volume of the reservoir is drained off before mid-summer for agricultural purposes and the remaining 50% is retained as a conservation pool. Water use is not expected to change in the foreseeable future.

Characteristics and Morphometry

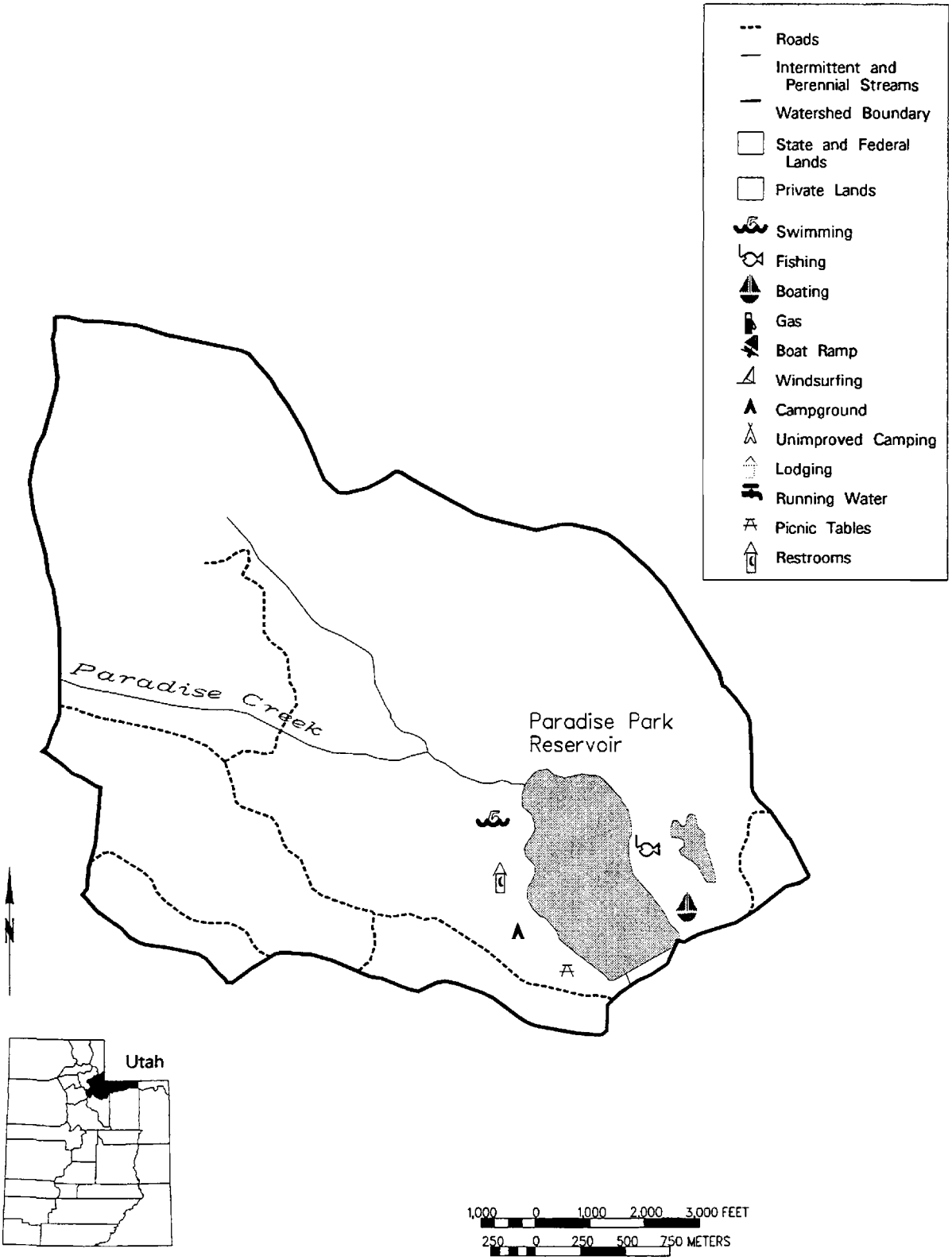
Lake elevation (meters / feet)	3,036 / 9,958
Surface area (hectares / acres)	57.8 / 143
Watershed area (hectares / acres)	996 / 2,461
Volume (m^3 / acre-feet)	
capacity	3,870,000 / 3,135
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	11.28 / 37
mean	6.09 / 20
Length (meters / feet)	1,220 / 4,000
Width (meters / feet)	610 / 2,000
Shoreline (km / miles)	2.97 / 1.8

Location

County	Uinta
Longitude / Latitude	109 54 56 / 40 40 04
USGS Map	Paradise Park 1965
DeLorme's Utah Atlas & Gazetteer™	Page 56, B-1
Cataloging Unit	Duchesne River (14060003)

Recreation

Paradise Park Reservoir is north of LaPoint in the Uinta Basin. From U-121 in LaPoint, go north on a paved road for about seven miles to a fork, take the left fork. As the pavement ends and leaves the Uinta and Ouray Indian Reservation it enters the National Forest, becoming FS-104. The reservoir is about 16 miles into the National Forest. The route is well marked, but the road at times is very rough



County in which watershed is located.

Paradise Park Watershed

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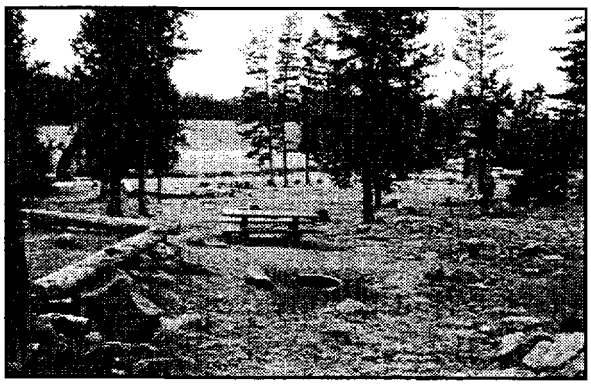
due to washboard development in the road.

Fishing, boating, swimming, camping, picnicking, and hiking are all popular. While there are no boat ramps, it is generally possible to get a boat on the reservoir. The USFS recommends that boats be less than 14' long.

Recreational facilities at the reservoir include a Paradise Park Campground, a USFS facility, which has primitive latrines, picnic areas, and 15 campsites. Usage fees are not charged.



Watershed Description

Paradise Park Reservoir is located in the High Uintas. It is an impoundment of Paradise Creek, a tributary to the Whiterocks River. The watershed consists entirely of alpine meadows and coniferous forests. Slopes surrounding the reservoir are not particularly steep (<20%). The reservoir is an impoundment of a meadow. The watershed lies slightly south of the high peaks along the ridgeline.

The watershed high point, the shoulder of an unnamed ridge northwest of the reservoir, is 3,392 m (11,130 ft) above sea level, thereby developing a complex slope of 9.0% to the reservoir. The average stream gradient of Paradise Creek is 7.0% (403 feet per mile) The inflow and outflow is Paradise Creek. It may be intermittent by the end of the summer.

The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of spruce-fir, meadows and aspen. The watershed receives 76 - 102 cm (30 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 0 - 20 days per year.

Land use in the watershed is 100% multiple use, with grazing and human recreation being the primary uses. Some of the watershed has been logged in the past, but there are no active or proposed timber sales in the area.

Limnological Assessment

The water quality of Paradise Park Reservoir is very good. It is considered to be very soft with a hardness concentration value of approximately 7 mg/L ($CaCO_3$). The parameters that have exceeded State water quality standards for defined beneficial uses are dissolved oxygen and pH. Dissolved oxygen concentrations in late summer substantiate the fact that water quality impairments do exist. Concentrations dropped dramatically in the hypolimnion. The profile of September 4, 1991 indicates that stratified conditions may have existed earlier in the summer when the depth of the reservoir was greater. These low levels of dissolved oxygen indicate that there is a substantial demand for oxygen at the sediment-water interface. Although this may not create a problem for the fishery during the productivity season, depletion of the dissolved oxygen during winter months may be extensive enough to impair the fishery.

Current data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is

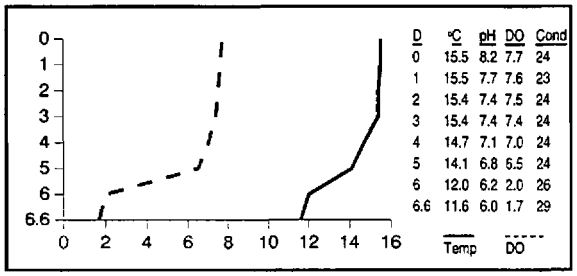
Limnological Data

Data sampled from STORET site: 593262

Surface Data	1991
Trophic Status	M
Chlorophyll TSI	38.33
Secchi Depth TSI	50.25
Phosphorous TSI	32.88
Average TSI	40.49
Chlorophyll a (ug/L)	2.2
Transparency (m)	2.1
Total Phosphorous (ug/L)	7
pH	7.9
Total Susp. Solids (mg/L)	3.5
Total Volatile Solids (mg/L)	4
Total Residual Solids (mg/L)	1
Temperature (°C / °f)	14/58
Conductivity (umhos.cm)	23
Water Column Data	
Ammonia (mg/L)	0.03
Nitrate/Nitrite (mg/L)	0.03
Hardness (mg/L)	9.5
Alkalinity (mg/L)	7
Silica (mg/L)	2.7
Total Phosphorous (ug/L)	5
Miscellaneous Data	
Limiting Nutrient	N
DO (Mg/l) at 75% depth	6.5
Stratification (m)	5
Depth at Deepest Site (m)	6.6

mesotrophic but this may be skewed higher than it really is due to the elevated transparency TSI value. The phosphorus and chlorophyll-a concentrations are relatively low at 5 and 2.2 ug/L respectively. The high transparency TSI value may be due to increased turbidity from the shallowness of the reservoir. The reservoir is probably upper oligotrophic to low mesotrophic.

According to DWR no fish kills have been reported in recent years. The reservoir supports populations of brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*), and cutthroat trout (*Oncorhynchus clarki*). The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake. Current stocking reports indicate that DWR stocks the reservoir with 5,000 catchable rainbow trout and 7,000 fingerling brook trout.



D	°C	pH	DO	Cond
0	15.5	8.2	7.7	24
1	15.5	7.7	7.6	23
2	15.4	7.4	7.5	24
3	15.4	7.4	7.4	24
4	14.7	7.1	7.0	24
5	14.1	6.8	6.5	24
6	12.0	6.2	2.0	26
6.6	11.6	6.0	1.7	29

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Spherical green alga	0.008	37.47
Oocystis sp.	0.008	35.13
Pennate diatoms	0.003	14.05
Centric diatoms	0.003	13.35
Total	0.022	
Shannon-Weaver [H']	1.28	
Species Evenness	0.92	
Species Richness	0.18	

The phytoplankton community is dominated by green algae and diatoms indicative of low productivity and good water quality.

Pollution Assessment

Nonpoint pollution sources include gazing and recreation. Each summer, 400 cattle gaze in the area and on the shore line of the reservoir.

There are no point sources of pollution in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Ashley National Forest	789-1181
Vernal Ranger District	789-1181
Recreation	
Dinosaurland Travel Region (Vernal)	789-6932
Vernal Chamber of Commerce	789-1352
Reservoir Administrators	
Whiterocks Irrigation Company	247-2327

PELICAN LAKE

Introduction

Pelican Lake is a natural lake in the Uinta Basin southwest of Vernal. Historically, it is noted as a world class bluegill fishery. In 1983 it produced the state record, a two pound, three ounce bluegill. Old timers claim that it was one of the "little ones". Recently, there has been a decline of the bluegill fishery. Currently a Clean Lakes Phase I study is underway to investigate the water quality of the lake. A major focus of the study is to ascertain the cause of the bluegill fishery decline and determine what can be done to restore the world class fishery.

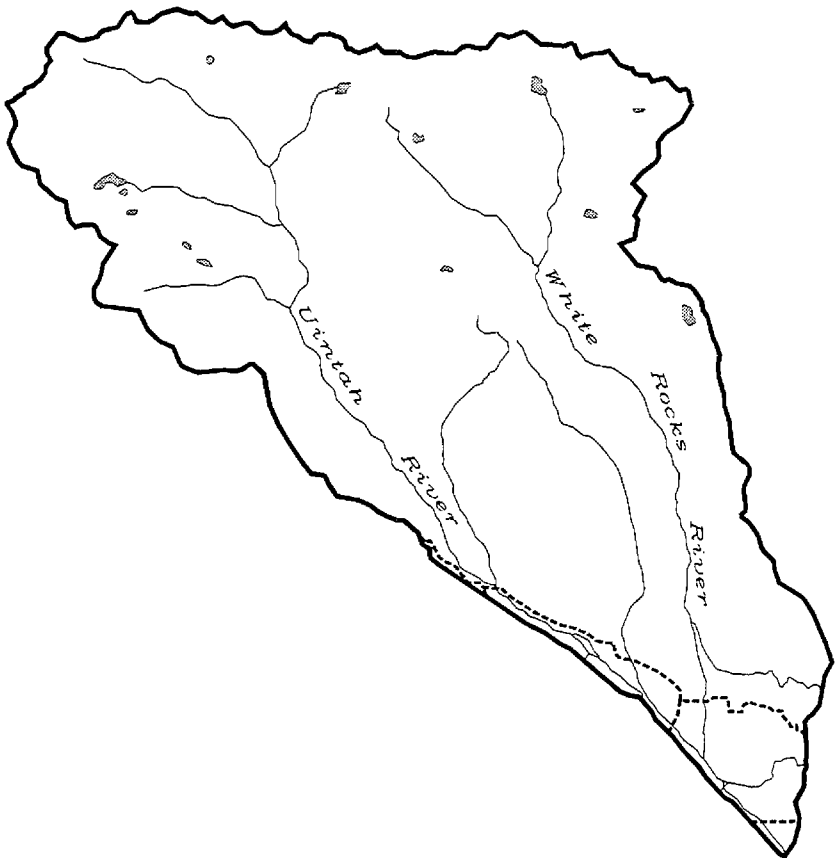
Characteristics and Morphometry

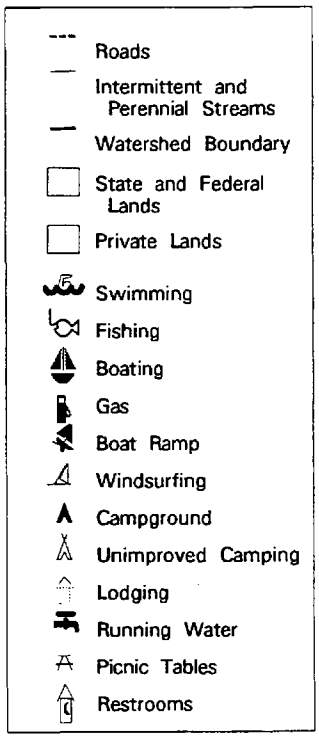
Lake elevation (meters / feet)	1,462 / 4,797
Surface area (hectares / acres)	680 / 1,680
Watershed area (hectares / acres)	7,382 / 18,240
Volume (m^3 / acre-feet)	
capacity	20,895,000 / 17,071
conservation pool	5,550,750 / 4,500
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	5.5 / 18.05
mean	3 / 9.84
Length (km / miles)	3.17/ 1.96
Width (km / miles)	1.83 / 1.13
Shoreline (km / miles)	1.2 / 7.4

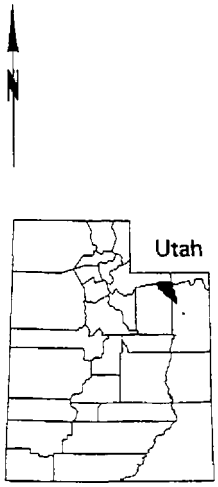
Location

County	Uinta
Longitude / Latitude	109 40 52 / 40 11 42
USGS Map	Pelican Lake 1964
DeLorme's Utah Atlas & Gazetteer™	Page 48, A-2
Cataloging Unit	Green River, Diamond Mountain Area 14060001

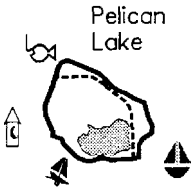
It has been dammed to impound and release water for irrigation, and water is diverted into the lake via the Ouray Park Canal from the Uinta River. The existing concrete dam was built in 1967, but the lake has been in use as a water storage facility for decades. Half of the shoreline is owned by the BLM and half is privately owned. Public access is unrestricted. Consumptive water use is limited to irrigation,







County near which watershed is located.



Pelican Watershed

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and nonconsumptive uses include warm water aquatic habitats, wetland habitat, and recreational uses. Water use is not expected to change in the foreseeable future.

Recreation

Pelican Lake is accessible from U-88 between Ouray and US-40. The turnoff to U-88 is 15 miles west of Vernal and 15 miles east of Roosevelt on US-40. 15 miles south of US 40, U-88 drops down a steep hill and Pelican Lake is clearly visible. Access is possible from U-88 itself to the east shore of the lake. Various farm roads provide access to other parts of the lake.

Fishing, boating, and hunting are popular activities at the lake. There is a BLM camping area on the south side of the lake which will accommodate approximately 18 units and provides a concrete boatramp. Facilities are limited at the lake but the lake is in close proximity to Roosevelt and Vernal. In addition there is a convenience store and cafe located on the highway just to the northeast of the lake.

Watershed Description

Pelican Lake has a small, natural watershed consisting of Ouray Park, an flat agricultural area north of the lake. The park is bounded by gentle slopes that rise several hundred feet and become rolling hills. The land was originally extremely arid desert (6 - 8" annual precipitation), but diversion of water form the High Uintas have transformed the area into productive agricultural land.

The Ouray Park Canal begins five miles north of US-40, where it diverts water from the East Channel of the Uinta River. The canal flows into Bullock Reservoir, then into Cottonwood Reservoir. Water returns to the Ouray Park Canal and is transported to Pelican Lake. A secondary source of water is diverted from the Whiterock River via a network of canals into Brough Reservoir. Water can then be released into the Ouray Park Canal if needed to supplement water into Pelican Lake.

The source of the Uinta River is at the foot of King's Peak, the highest mountain in Utah. The drainage area widens towards the ridgeline of the Uintas, giving it a large area of very heavy precipitation. The upper portion of the watershed contains hundreds of lake, many square miles of meadows, forests, and barren peaks. The river flows from the mountains directly onto the tertiary deposits of the Uinta Basin.

The watershed high point, King's Peak, is 4,123 m (13,528 ft) above sea level, thereby developing a complex slope of 3.1% to the reservoir. The primary inflow is the Ouray Park Canal, but irrigation runoff, springs, and natural runoff also flow into the lake. The natural outflow was a wash into the Ouray National Wildlife Refuge and eventually into the Green River. Currently, no water is released into the wash, but it is removed by pumping at various locations for sprinkler irrigation.

The natural watershed is made of low terraces, fans, and desert valley plains, while the diverted watershed has high mountains, mountain valleys, terraces, and desert plains. In general the soils in the vicinity of the lake are moderate to strongly alkaline loams from sandy clays to gravelly sand having low to high erodibility and well to somewhat excessive drainage. Permeability is slow to rapid with runoff slow to medium and sediment production moderate to low. Soil composition information for the extended watershed have not been determined by the Division of Water Quality.

The vegetation communities in the natural watershed include irrigated farmland, shadscale, greasewood, and sage-grass. The diverted watershed includes sage-grass, irrigated farmland, oak-maple, spruce-fir, aspen, pine, and alpine. The watershed receives 15 - 102 cm (6 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 100 - 120 days per year.

Land use in the natural watershed is primarily irrigated agriculture, with some grazing lands. The watershed of the Uinta River contains land in the Ashley National Forest. It is managed as multiple use (logging, grazing, recreation, etc.). The entire upper portion of the watershed is part of the High Uintas Wilderness, where only preexisting consumptive uses are permitted. South of the National Forest boundary, the land is part of the Uinta and Ouray Indian Reservation, with mixed land uses, including agriculture and grazing.

Limnological Assessment

The water quality of Pelican Lake is fair. It is considered to be hard with a hardness concentration value of approximately 216 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are total phosphorus, dissolved oxygen and pH. The average concentrations of total phosphorus in the water column has gradually increased since 1980. In 1992 the average concentration was 35 ug/L with greater concentrations in the western area of the lake. The phosphorus concentration in western portion of the lake have reached levels in excess of 70 ug/L. Dissolved oxygen concentrations during the winter substantiate the fact that water quality impairments do exist. In late winter anoxic conditions have been documented in recent years. In addition the pH values as shown in the profile from September 3, 1992 exceed the criteria value of 9 established for the lake. These elevated values are typical of lakes that exhibit heavy macrophyte growth or phytoplankton production. The Utah State Division of Wildlife Resources reports that the bottom of Pelican Lake is covered with rooted aquatic vegetation, mostly *Potamogeton* and *Scirpus*,

Limnological Data

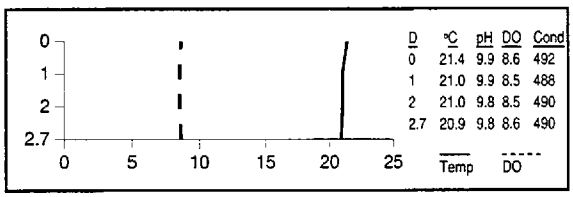
Data averaged from STORET sites: 493713, 493714

Surface Data	1980	1990	1992
Trophic Status	M	M	O
Chlorophyll TSI	-	38.19	20.95
Secchi Depth TSI	41.95	46.52	40.97
Phosphorous TSI	37.35	48.76	54.18
Average TSI	39.65	44.50	38.70
Chlorophyll a (ug/L)	-	2.3	0.38
Transparency (m)	3.5	2.6	3.8
Total Phosphorous (ug/L)	10	25	32
pH	7.9	9.0	9.4
Total Susp. Solids (mg/L)	<5	1.9	1.5
Total Volatile Solids (mg/L)	-	-	1
Total Residual Solids (mg/L)	-	-	2
Temperature (°C / °f)	23/73	22/71	21/70
Conductivity (umhos.cm)	555	693	504
Water Column Data			
Ammonia (mg/L)	0.07	0.03	0.03
Nitrate/Nitrite (mg/L)	0.26	-	0.04
Hardness (mg/L)	196	261	190
Alkalinity (mg/L)	141	193	143
Silica (mg/L)	3	-	8.6
Total Phosphorous (ug/L)	10	22	35
Miscellaneous Data			
Limiting Nutrient	P	N	N
DO (Mg/l) at 75% depth	6.9	8.6	8.5
Stratification (m)	N	NO	NO
Depth at Deepest Site (m)	5	2.6	2.7

and the perimeter of the lake has mostly cattails and *Typha*, along the shore area.

Although in 1981 the reservoir was characterized as a phosphorus limited system, the 1990-92 data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is oligotrophic to mesotrophic.

Pelican Lake has one perennial inflow, an unnamed canal and several intermittent streams. The outlet of the Reservoir is into the Lake Canal. During recent years flow regimes into the reservoir have changed and may be responsible for the conditions which have lead to the decline of the world class bluegill fishery. Other alternatives may be



implemented in the near future that will alter the flow regime from the reservoir due to selenium problems in an associated bird refuge, the Ouray National Waterfowl Refuge, located downstream from the reservoir which is dependant upon water from this watershed. A Clean Lakes Phase I study is currently underway to evaluate water management and other alternatives to determine what is causing the impairments to the water quality of the lake. Other alternatives are reduced dissolved oxygen concentrations, nutrient enrichment, reduction of macrophyte coverage and potential contamination of return irrigation waters with pesticides or other toxics.

The fishery is impaired due to high pH values and dissolved oxygen depletions. Wildlife Resources has reported pH values as high as 9.8 which can create a stressful situation for bluegill and some fish kills may result. In addition low dissolved oxygen concentrations have been reported and anoxic conditions do occur. During recent years the bluegill fishery has severely been impaired and is a major concern of the State Division of Wildlife Resources. DWR officials in their assessment of the lake have said, "Historically, the lake supported a world class bluegill fishery; it also contains largemouth bass. The lake provides a productive warm water fishery (estimated Class II), rare in the Uintah Basin. The bluegill population of trophy-sized fish steadily declined, then disappeared. The cause of this problem is unknown".

In addition waterskiing and swimming are impaired due to the large amounts of algae and macrophytes present in the summer months.

In 1975 the National Eutrophication Study included an assessment of Pelican Lake. Their survey indicated Pelican Lake was eutrophic. It ranked twelfth in overall trophic quality when the 27 Utah lakes and reservoirs were compared. Survey limnologists observed extensive growths of submerged macrophytes with a phytoplankton bloom present during their September survey. The phosphorus loading at that time was calculated at 0.13 g/m^2/year. Mean chlorophyll-a concentrations were reported at 6.33 mg/l with a mean secchi reading of 1.55 meters.

Data obtained during surveys in 1979 and 1980 by the Utah Division of Water Quality indicated the values for arsenic (1-3 ug/L), copper (5-11 ug/L) and lead (5-6 ug/L) exceeded state standards.

The reservoir does not typically stratify. As indicated in the profile, the temperature is rather uniform throughout the water column. This is due in part to the shallow nature of the lake and climatic conditions which provide for circulation of water in the lake.

According to DWR fish kills have been reported in recent years during the winter. The reservoir supports populations of black bass (*Micropterus salmoides*), and

bluegill (*Lepomis macrochirus*). Those fish kills that do occur, DWR contributes mostly to dissolved oxygen depletion and high hydrogen sulfide concentrations.

The lake has not been chemically treated by the DWR, so populations of native fishes are may be present in the lake.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Gomphospheria aponina	4.946	38.49
Ceratium hirundinella	2.809	21.86
Sphaerocystis schroeteri	2.641	20.55
Pennate diatoms	0.756	5.89
Pediastrum duplex	0.722	5.62
Anabaena sp.	0.556	4.33
Cosmarium sp.	0.156	1.21
Centric diatoms	0.053	0.42
Crucigenia rectangularis	0.050	0.39
Oocystis sp.	0.044	0.35
Unknown spherical green alga	0.028	0.22
Chroococcus sp.	0.022	0.17
Aphanocapsa sp.	0.017	0.13
Scenedesmus sp.	0.017	0.13
Oscillatoria sp.	0.012	0.09
Scenedesmus bijuga	0.011	0.09
Ankistrodesmus falcatus	0.009	0.07
Total	12.841	
Shannon-Weaver [H']	1.67	
Species Evenness	0.59	
Species Richness	0.69	

The phytoplankton community is dominated by the presence of blue-green algae, flagellates and green algae, but a fairly diverse composition is present.

Pollution Assessment

Nonpoint pollution sources include the following: agriculture, grazing, logging, and recreation. Grazing takes place throughout the watershed and in the vicinity of the reservoir.

There are no point sources of pollution in the watershed

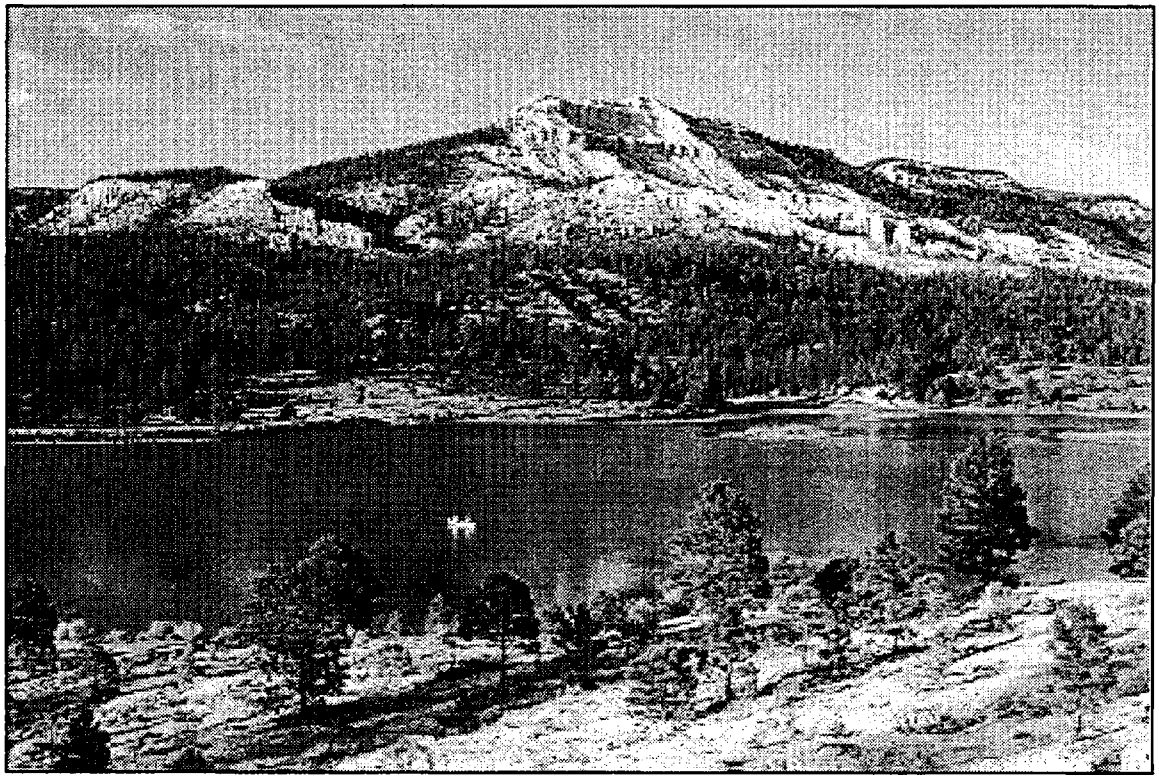
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), warm water game fish and organisms in their food chain (3B) and agricultural uses (4).

Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Bureau of Land Management	
Diamond Mountain Resource Area	789-1362
Recreation	
Dinosaurland Travel Region (Vernal)	789-6932
Vernal Chamber of Commerce	789-1352
Reservoir Administrators	
Ouray Park Irrigation Company	545-2426

PINE LAKE



Introduction

Pine Lake is an intermediate-sized off stream reservoir on the west slopes of the Table Cliff Plateau in south-central Utah. The reservoir shoreline is owned and administered by the Dixie National Forest with unrestricted public access. The dam was rebuilt in 1988 by the Utah Division of Wildlife Resouces.

Characteristics and Morphometry

Lake elevation (meters / feet)	2,496 / 8,192
Surface area (hectares / acres)	31.2 / 77
Watershed area (hectares / acres)	1,784 / 4,409
Volume (m^3 / acre-feet)	
capacity	1,356,852 / 1,100
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	6 / 20
mean	4.36 / 14.29
Length (meters / feet)	823 / 2,700
Width (meters / feet)	610 / 2,000
Shoreline (km / miles)	2.07 / 1.28

Recreation

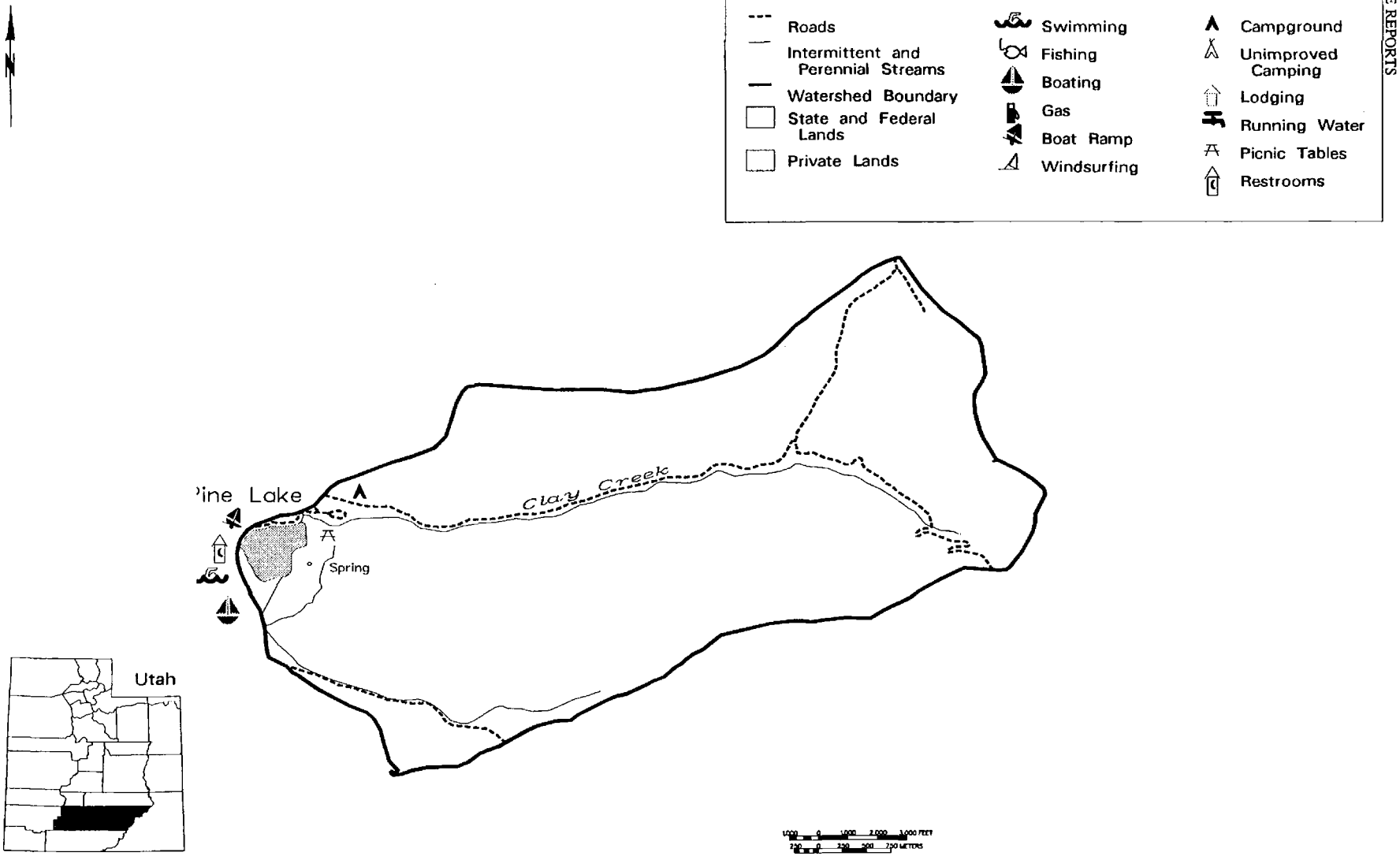
Pine Lake is accessible on FS-132, which intersects the road from Bryce Canyon to Antimony (formerly U-22) 11 miles north of U-12 and 25 miles south of Antimony. Pine Lake is 6 miles east of U-12 on FS-132.

Fishing, boating, picnicing, cross country skiing and snowmobiling are popular around the lake. There is a boat ramp, but the lake can only accomodate small boats. The water is too cold for most swimmers and waterskiiers, and the road is not maintained in the winter. Usage is usually fairly light, but high during the summer.

Location

County	Garfield
Longitude / Latitude	111 57 20 / 37 44 26
USGS Map	Pine Lake, Utah 1964
Cataloging Unit	East Fork Sevier/Otter Creek?? (16030002)

Pine Lake Campground is adjacent to the lake and maintained by the Foerst Service. It has 33 campsites and 2 group sites. Facilities include vault toilets, water, and



County in which watershed is located.

Pine Lake Watershed

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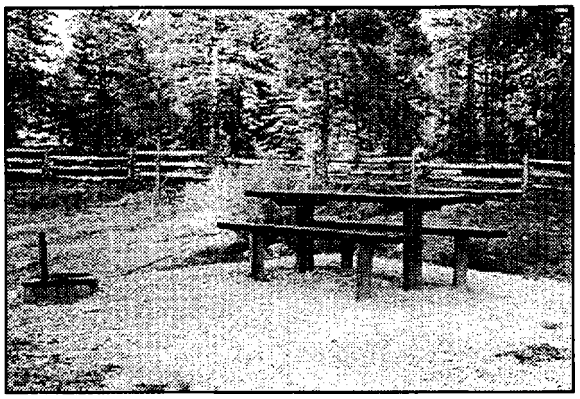
cemented fire pits. Usage fees are collected.



Limnological Data

Data sampled from STORET site: 594609

Surface Data	1981	1989	1991
Trophic Status	H	M	O
Chlorophyll TSI	-	39.59	22.77
Secchi Depth TSI	-	49.31	41.95
Phosphorous TSI	64.34	43.52	38.72
Average TSI	64.34	44.14	34.48
Chlorophyll a (ug/L)	-	2.5	0.5
Transparency (m)	-	2.1	3.5
Total Phosphorous (ug/L)	20	19	11
pH	-	9.7	10.1
Total Susp. Solids (mg/L)	<5	<3	<3
Total Volatile Solids (mg/L)	-	-	2
Total Residual Solids (mg/L)	-	-	<2
Temperature (°C / °f)	-	17/62	17/62
Conductivity (umhos.cm)	-	356	297
Water Column Data			
Ammonia (mg/L)	0.05	0.02	0.04
Nitrate/Nitrite (mg/L)	0.11	0.01	0.05
Hardness (mg/L)	175	-	183
Alkalinity (mg/L)	170	241	176
Silica (mg/L)	-	-	2.35
Total Phosphorous (ug/L)	25	15	8
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	-	10.9	8.9
Stratification (m)	-	NO	NO
Depth at Deepest Site (m)	-	2.0	4.2

Watershed Description

Pine Lake is located on the deeply dissected, forested terrain between Barney Top and John's Valley. Historically inflow water was a diversion canal from Clay Creek and Pole Canyon Creek. The primary source of water was Clay Creek but due to heavy sedimentation and high turbidity water is typically not diverted into the reservoir. Inflow water consists primarily of mininal watershed runoff from precipitation and a spring developed by DWR near Clay Creek and piped to the reservoir. Excess water from the reservoir is discharged to a wash which eventually returns to Clay Creek.

The watershed high point, the south end of Barney Top, is 3,231m (10,600 ft) above sea level, thereby developing a complex slope of 10.5% to the lake. The average stream gradient above the reservoir is 3.7% (195 feet per mile).

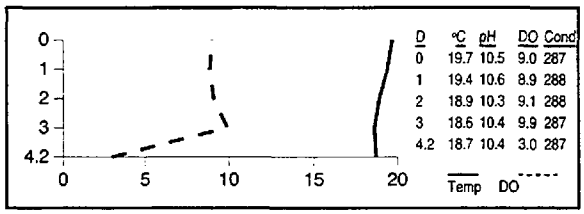
The soil is of limestone origin with rapid permiability and erosion is rapid. The soil associations taht compose the watershed are listed in Appendix III.

The vegetation communities are comprised of shadscale, greasewood, saltbrush, grass-forbs, pinyon-juniper, pine, aspen, spruce-fir, oak, and maple. The watershed receives 41 - 51 cm (16 - 20 inches) of precipitation annually with a frost-free season of 80 - 100 days at the reservoir.

Land use is multiple use and recreation. Dixie National Forest encompasses the entire drainage area.

Limnological Assessment

The water quality of Pine Lakeis considered very good. It is considered to be hard with a hardness concentration value of approximately 179 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards are pH and dissolved oxygen.It appears that both of these exceedences are due in part to the biological production ocurring in the reservoir. It is not uncommon for high pH values to be reported during periods of high production of macrophytes of algae. The major influence appear to be associated with macrophytes in the lake. It has been reported by DWQ staff that at times the entire bottom of the lake where light penetration occurs is covered by macrophytes. During daylight hours phototsynthetic activity increase pH values in the water column and during night time hours plant respiration reduces the concentration of dissolved oxygen near the bottom of the lake. Although these exceedences have occurred, it does not appear that the water quality is significantly impaired during the summer period. Some winter monitoring should be conducted to determine if impairments are present due to dissolved



D	°C	pH	DO	Cond
0	19.7	10.5	9.0	287
1	19.4	10.6	8.9	288
2	18.9	10.3	9.1	288
3	18.6	10.4	9.9	287
4.2	18.7	10.4	3.0	287

oxygen depletion during extended ice coverage conditions during the winter.

Current data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is oligotrophic or low mesotrophic in a state of low productivity. Phytoplanton productivity may be offset due to the large production of macrophytes which compete for the available nutrients. The potential for stratification in the lake is greatly reduced due to the shallow nature of the lake. The profile shown of August 20, 19912 does not show stratification.

According to DWR fish kills have been reported in recent years but efforts have been taken to enhance winter dissolved oxygen concentration by increasing aeration from the delivery of the spring water into the lake. The reservoir supports a population of brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*) and cutthroat trout (*Oncorhynchus clarki*). The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake. Current stocking reports indicate that DWR stocks the lake with with 8-10,000 catchable rainbow trout and 3,000 fingerling brook and cutthroat trout. Macrophytes reported as present in the lake include *Myriophyllum* and *Potamogeton*.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	10.564	97.89
Oocystis sp.	0.066	0.62
Merismopedia sp.	0.055	0.52
Pennate diatoms	0.040	0.37
Ankistrodesmus falcatus	0.035	0.32
Merismopedia sp.	0.011	0.10
Centric diatoms	0.009	0.09
Scenedesmus bijuga	0.007	0.07
Wislouchiella planktonica	0.002	0.02
Total	10.788	
Shannon-Weaver [H']	0.14	
Species Evenness	0.06	
Species Richness	0.35	

The phytoplankton commnunity is dominated by the presence of green algae indicative of good water quality and lower productivity.

Pollution Assessment

Nonpoint pollution sources include: sedimentation and nutrient loading from grazing, and wastes or litter from recreation. Cattle graze in the watershed and around the reservoir.

There are no point pollution sources in the watershed.

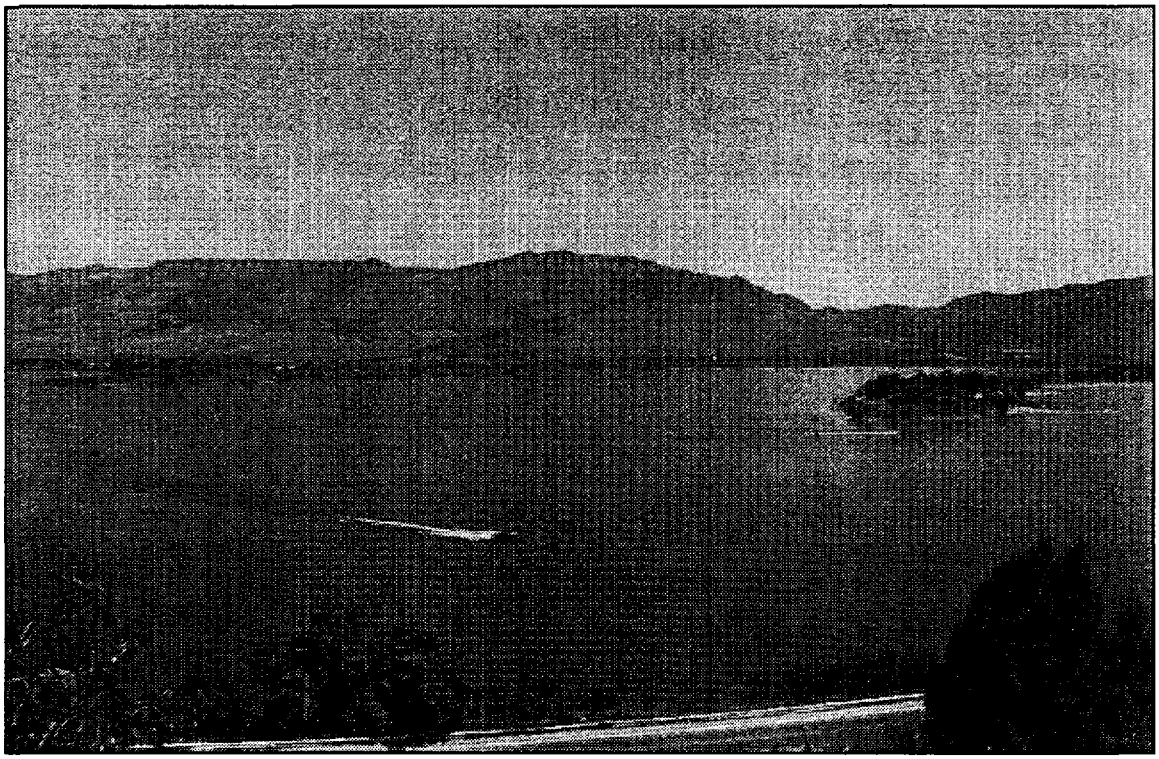
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Dixie National Forest	586-2421
Escalante Ranger District	826-4221
Five County Association of Governments	
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146

PINEVIEW RESERVOIR



Introduction

Pineview Reservoir is a large impoundment of the to Ogden River at the top of Ogden Canyon. Close proximity urban areas make this large reservoir a popular location for four season water recreation. The dam was built by the Bureau of Reclamation with federal funds to relieve Wasatch Front communities of the cost of storing their own water. There are several boating and swimming areas on this popular reservoir. Huntsville is a small community on the lower of two peninsulas on the reservoir. It was partially inundated when the impoundment was created, and the cemetery eventually had to be moved from the tip of the peninsula when wave action began unearthing coffins.

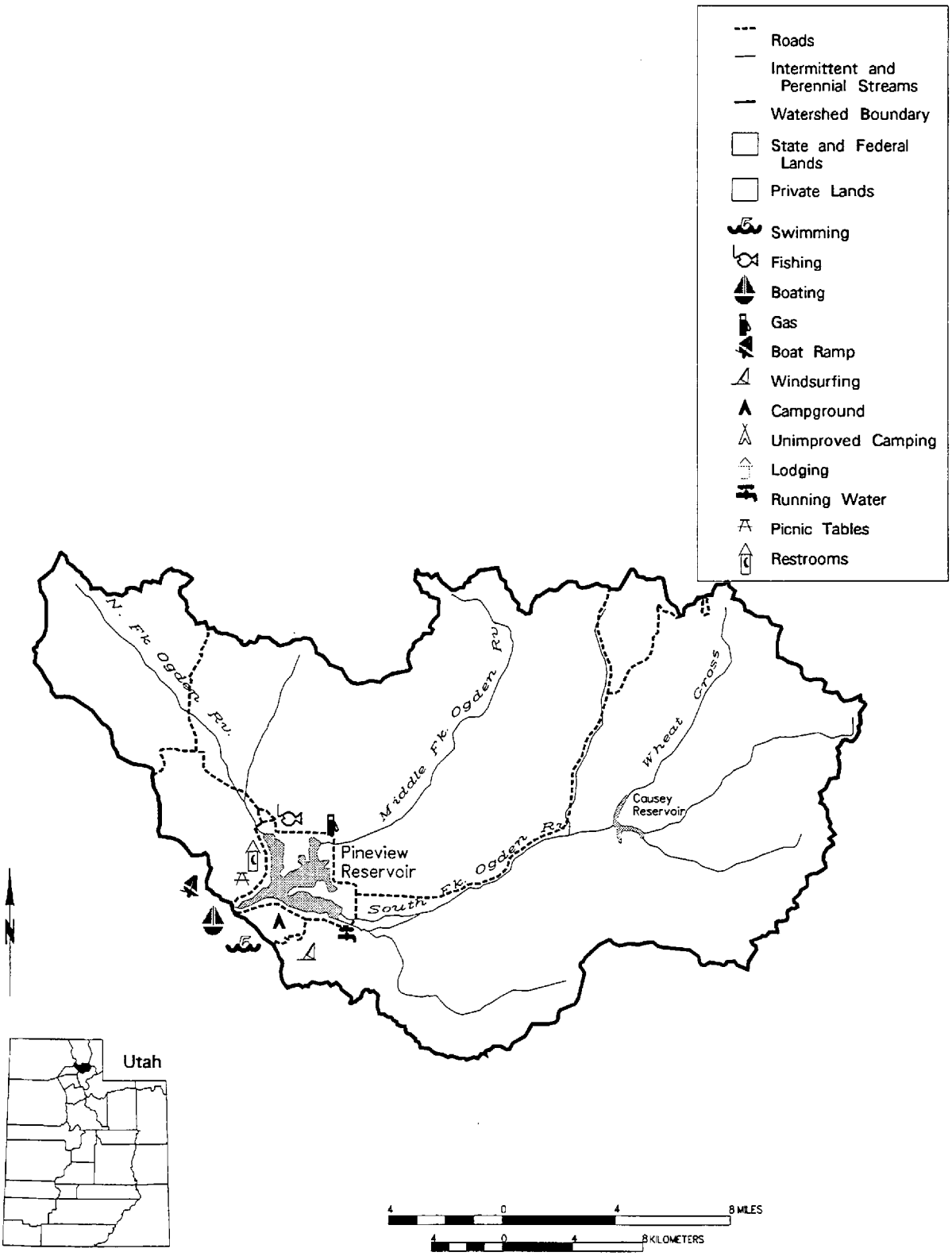
Characteristics and Morphometry

Lake elevation (meters / feet)	1,493 / 4,900
Surface area (hectares / acres)	1,163 / 2,874
Watershed area (hectares / acres)	54,100 / 153,000
Volume (m^3 / acre-feet)	
capacity	135,684,000 / 109,999
conservation pool	none
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	32,330,085 / 26,210
Depth (meters / feet)	
maximum	25 / 81
mean	13.4 / 43.97
Length (km / miles)	7.1 / 4.4
Width (km / miles)	5.8 / 3.6
Shoreline (km / miles)	39 / 24.2

Location

County	Weber
Longitude / Latitude	111 48 28 / 41 16 00
USGS Map	Huntsville, 1991
DeLorme's Utah Atlas & Gazetteer™	Page 60, C-3
Cataloging Unit	Lower Weber (16020102)

Pineview Reservoir was created in 1937 by the construction of an earth-fill dam. The shoreline is 98% owned by the Wasatch-Cache National Forest, and public access is 100% open. Water is used for culinary purposes (15%), irrigation (85%), as well as recreation, fish habitat, and hydroelectric generation. A greater proportion of water



County near which watershed is located.

Pineview Watershed

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is expected to be used for culinary purposes as suburban development continues to displace agricultural land.

Recreation

Paved roads encircle the reservoir, but because of the undulating shoreline, the roads are set back a significant distance in most areas. The south shore is accessible from U-39 between the Pineview Dam and Huntsville, the lower peninsula from West Baseline Street in Huntsville, the east and north shores from U-166 between Huntsville and Eden, and the west shore from U-162 between Eden and the Pineview Dam.

The two USFS campsites are on the south shore, Anderson Cove and Jefferson Hunt. Both have picnic areas, swimming areas, boat ramps, toilets, and campsites (29 at Jefferson, 96 at Anderson). Other swimming areas are on the lower peninsula (Bluffs Recreation Area) and the east shore just north of Huntsville (Middle Inlet Swim Area). Additional boatramps (Port Recreation Area) and a private marina are on the west shore. Camping is only permitted in designated areas. Maps are available at the Ogden Ranger District offices in Ogden.

Fishing, boating, sailing, sailboarding, swimming, camping, picnicking, ice fishing, and water skiing are all popular.

Watershed Description

Pineview Reservoir is an impoundment of the Ogden River at the top of Ogden Canyon. The Ogden River flows through the Wasatch Front, and the dam impounds the reservoir in Ogden Valley, which is behind the Wasatch Front. The reservoir has three major arms with two peninsulas separating them. The area to the north, east, and south is relatively flat, while the back of the Wasatch Front bounds the west shore. Huntsville and Eden are two small communities along the shore, with the remainder of the area being agricultural. Summer home development has and will continue to take place on the lower slopes of the mountains west of the reservoir.

The Wasatch Mountains uplifted slowly as a block fault, so streams were able to cut their canyons as the mountains uplifted. The softer strata behind the mountains has been eroded away to form the valley. The north end of the valley drained out North Ogden Canyon until fairly recent past (in geologic time), but has now been captured by the Ogden River, and the canyon is dry.

The major portion of the snowpack falls in the south end of the Monte Cristo Range, to the east of Huntsville. Large areas of these mountains collect in excess of 25 inches precipitation annually. The range is of ancient origin, and has been more recently exposed by uplift (more details are in the Causey Reservoir report).

The watershed high point, Willard Peak, is 2,976 m (9,764 ft) above sea level, thereby developing a complex slope of 9.3% to the reservoir. The average stream gradient above the reservoir is 5.92% (310 feet per mile). The inflows are the South Branch South Fork [Ogden River], North Branch South Fork [Ogden River], Spring Creek, Middle Fork [Ogden River], and the North Fork [Ogden River]. There are also a number of ephemeral streams and agricultural runoff ditches. The outlet is the Ogden River and the Ogden Canyon Conduit. Causey Reservoir is an upstream impoundment of the South Fork. It is also a Bureau of Reclamation facility.

The watershed is made up of high mountains, foothills, terraces, and mountain valleys. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of urban, cropland and grazing lands, sage-grass, oak, maple, pine, aspen, and spruce-fir. The watershed receives 51 - 102 cm (20 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 80 - 140 days per year.

Estimated land use is as follows (largest to smallest): domestic grazing on private lands; multiple use (grazing, wildlife habitat, recreation, and watershed recharge) on National Forest Lands, agriculture, urban and summer home areas, and recreation.

Limnological Assessment

The water quality of Pineview Reservoir is good. It is considered to be moderately hard with a hardness concentration value of approximately 119 mg/L ($CaCO_3$). The parameters that have exceeded State water quality standards for defined beneficial uses are total phosphorus, temperature and dissolved oxygen. Dissolved oxygen depletion usually occurs after the lake stratifies and the demand in the hypolimnion exceeds the exchange in the lower levels of the reservoir. A review of the phosphorus data shows that it is well below the State pollution indicator value of 25 ug/L during the first period of monitoring for 1992

(average 15.5 ug/L). However under management operations of the reservoir, a premature overturn of the reservoir is induced by the early seasonal release of appropriated irrigation water for downstream needs. The average concentration rises to 55.3 ug/L which not only exceeds the indicator level but provides the stimulus for algal blooms on the reservoir. In addition with the lower volumes of water present in the reservoir the temperature regime increases and exceedences of the criteria (20°C) for a cold water fishery occur.

Although in 1981 the reservoir was characterized as a phosphorus limited system, the 1990-92 data suggest that the reservoir is currently a nitrogen limited system. The NES determined that the reservoir was phosphorus limited on September 23, 1975.

From 1988-90 a Clean Lakes Phase I Study was conducted on the reservoir with Weber Basin Water Quality Management Council. The study reports that the reservoir hydrology exhibits a controlling influence on the limnology of the reservoir. Pineview Reservoir has a capacity of 110,000 acre-feet with an allotment of 44,000 acre-feet to meet downstream irrigation requirements. It normally begins to stratify in early June becoming strongly stratified by late June or early July. Due to the morphology of the reservoir and early withdrawals to meet irrigation requirements downstream, stratification breaks down and reservoir mixes (turnover). This is evidenced by the uniformity of the water as depicted in the August 24, 1992 profile. This early mixing results in an increase of nutrients in the photic zone (epilimnion) causing an algae bloom in mid to late August. As indicated earlier during early summer, the upper water in the reservoir is fairly low in nutrients but the lower levels have higher concentration of phosphorus and nitrogen. Data from the report indicates that the high nitrate inflow during April is primarily doe to runoff from frozen pasture lands where waste management practice could improve. It should also be noted that approximately 20,000 acre-feet of groundwater with nitrate concentrations averaging approximately 2.0 mg/L enters the reservoir during the summer. Most of this water probably enters the hypolimnion due to the density of the water and the point of discharge which adds to the nitrate loading in the lower waters of the reservoir. As the reservoir overturns and this nutrient rich water becomes available for production algal blooms intensify and cause concerns and impacts to the reservoir.

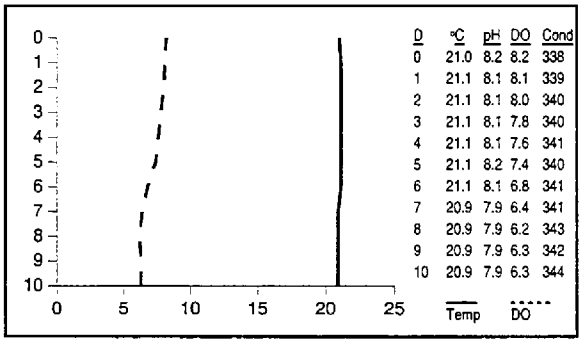
TSI values indicate that the reservoir is in fact an eutrophic reservoir. The higher rate of productivity is definitely pronounced during the later part of summer.

According to DWR no fish kills have been reported in recent years. However from early July through fall the waters of Pineview Reservoir are mostly unsuitable for trout due to temperature increases and the dissolved oxygen decreases. The fish attempt to find more optimum habitat by migrating to the inflows, or downlake where the dam impedes their search for cooler water. At the inlets they find somewhat cooler temperatures due to the inflowing water. This tributary flow, however, is extremely low due to upstream irrigation needs. Near the dam the temperature of the water

Limnological Data

Data averaged from STORET sites: 49281, 49282, 49283, 49284

Surface Data	1980	1992
Trophic Status	E	E
Chlorophyll TSI		61.40
Secchi Depth TSI	52.96	57.49
Phosphorous TSI	47.77	56.05
Average TSI	50.37	58.31
Chlorophyll a (ug/L)	-	23.2
Transparency (m)	1.6	1.12
Total Phosphorous (ug/L)	20.6	37
pH	8.1	7.4
Total Susp. Solids (mg/L)	7.9	9
Total Volatile Solids (mg/L)	-	5
Total Residual Solids (mg/L)	-	3
Temperature (°C / °f)	20/68	20/68
Conductivity (umhos.cm)	243	315
Water Column Data		
Ammonia (mg/L)	0.07	0.05
Nitrate/Nitrite (mg/L)	0.38	0.05
Hardness (mg/L)	98	149
Alkalinity (mg/L)	100	138
Silica (mg/L)	7.6	0.5
Total phosphorous (ug/L)	23.5	42
Miscellaneous Data		
Limiting Nutrient	N	N
DO (Mg/l) at 75% depth	0.3	6.3
Stratification (m)	11-12	NO
Depth at Deepest Site (m)	16	10



D	°C	pH	DO	Cond
0	21.0	8.2	8.2	338
1	21.1	8.1	8.1	339
2	21.1	8.1	8.0	340
3	21.1	8.1	7.8	340
4	21.1	8.1	7.6	341
5	21.1	8.2	7.4	340
6	21.1	8.1	6.8	341
7	20.9	7.9	6.4	341
8	20.9	7.9	6.2	343
9	20.9	7.9	6.3	342
10	20.9	7.9	6.3	344

increases. As the cooler hypolimnetic waters are discharged, the higher temperature regime is drawn down in the water column. In addition dissolved oxygen is depleted from the hypolimnion. The fish become stressed and are preyed upon by anchorworm (*Lernea sp.*) and secondary bacterial infections. Fish mortality is considerable. In 1987 Utah Wildlife Resources stopped stocking trout in Pineview Reservoir because of poor survival related to poor water quality. In 1988 they stocked 6,000 tiger musky and introduced small bass. Those fisheries present in order of relative abundance include; yellow perch (*Perca flavescens*), black crappie (*Pomoxis nigromaculatus*), black bullhead (Ictalurus melas), carp (*Cyprinus carpio*), bluegill (*Lepomis macro*, largemouth bass (*Micropterus salmoides*), smallmouth bass, and tiger musky (*Esox lucius* crossed with *Esox masquinongy*). DWR is continuing to stock fingerling tiger muskies and smallmouth bass in the reservoir. The reservoir was been chemically treated by the DWR in 1959 and 1970 to eliminate rough fish competition, so populations of native Ogden River fish are probably not present.

Phytoplankton identified in 1975 by the EPA NES, in order of relative abundance included *Chroomonas sp., Cryptomonas sp., Fragilaria sp., Chlamydomonas sp., Cryptomonas sp., Fragilaria sp., Chlamydomonas sp., Schroderia sp., Aphanizomenon sp., and Stephanodiscus sp..*

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Stephanodiscus niagarae	22.175	42.31
Gomphospheria aponina	21.021	40.11
Microcystis aeruginosa	4.893	9.34
Fragilaria crotonensis	0.687	1.31
Coelastrum sp.	0.556	1.06
Asterionella formosa	0.473	0.90
Pandorina morum	0.222	0.42
Melosira granulata	0.173	0.33
Botryococcus sudeticus	0.150	0.29
Centric diatoms	0.107	0.20
Trachelomonas sp.	0.089	0.17
Cosmarium sp.	0.077	0.15
Oocystis sp.	0.071	0.14
Pennate diatoms	0.033	0.06
Unknown spherical green alga	0.033	0.06
Euglena sp.	0.008	0.02
Scenedesmus sp.	0.008	0.02
Total	50.804	

Shannon-Weaver [H']	1.32
Species Evenness	0.46
Species Richness	0.69

The phytoplankton community is dominated by the presence of diatoms and blue-green algae which are indicative of eutrophic conditions.

Information

Management Agencies	
Wasatch Front Regional Council	292-4469
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Wasatch-Cache National Forest	524-5030
Ogden Ranger District	625-5112
Recreation	
Golden Spike Empire Travel Region (Ogden)	627-8288
Ogden Chamber of Commerce	621-8300
Reservoir Administrators	
DOI	

Pollution Assessment

Nonpoint pollution sources include the following: agriculture return flows; grazing; recreation; construction; and urban activities.

Currently there are no point sources of pollution in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: culinary water (1A), recreational bathing (swimming) (2A), boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

LAKE REPORTS

PIUTE RESERVOIR

Introduction

Piute Reservoir is at the north end of Circle Valley, north of Circleville and south of Marysvale. It is a large, shallow impoundment of a low elevation valley.

The reservoir shoreline is publicly/privately owned and administered by the BLM and the Piute Reservoir and Irrigation Company with unrestricted public access. Defined beneficial uses include: water recreation excluding swimming; propagation of cold water species of game fish and aquatic life; and agricultural needs.

Characteristics and Morphometry

Lake elevation (meters / feet)	1,828 / 5,996
Surface area (hectares / acres)	1,015 / 2,508
Watershed area (hectares / acres)	558,000
Volume (m^3 / acre-feet)	
capacity	88,957,508 / 71,826
conservation pool	none
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	68,248,797 / 55,329
Depth (meters / feet)	
maximum	20 / 66
mean	10 / 33
Length (km / miles)	11.1 / 6.9
Width (km / miles)	1.4 / .9
Shoreline (km / miles)	28.6 / 17.8

Location

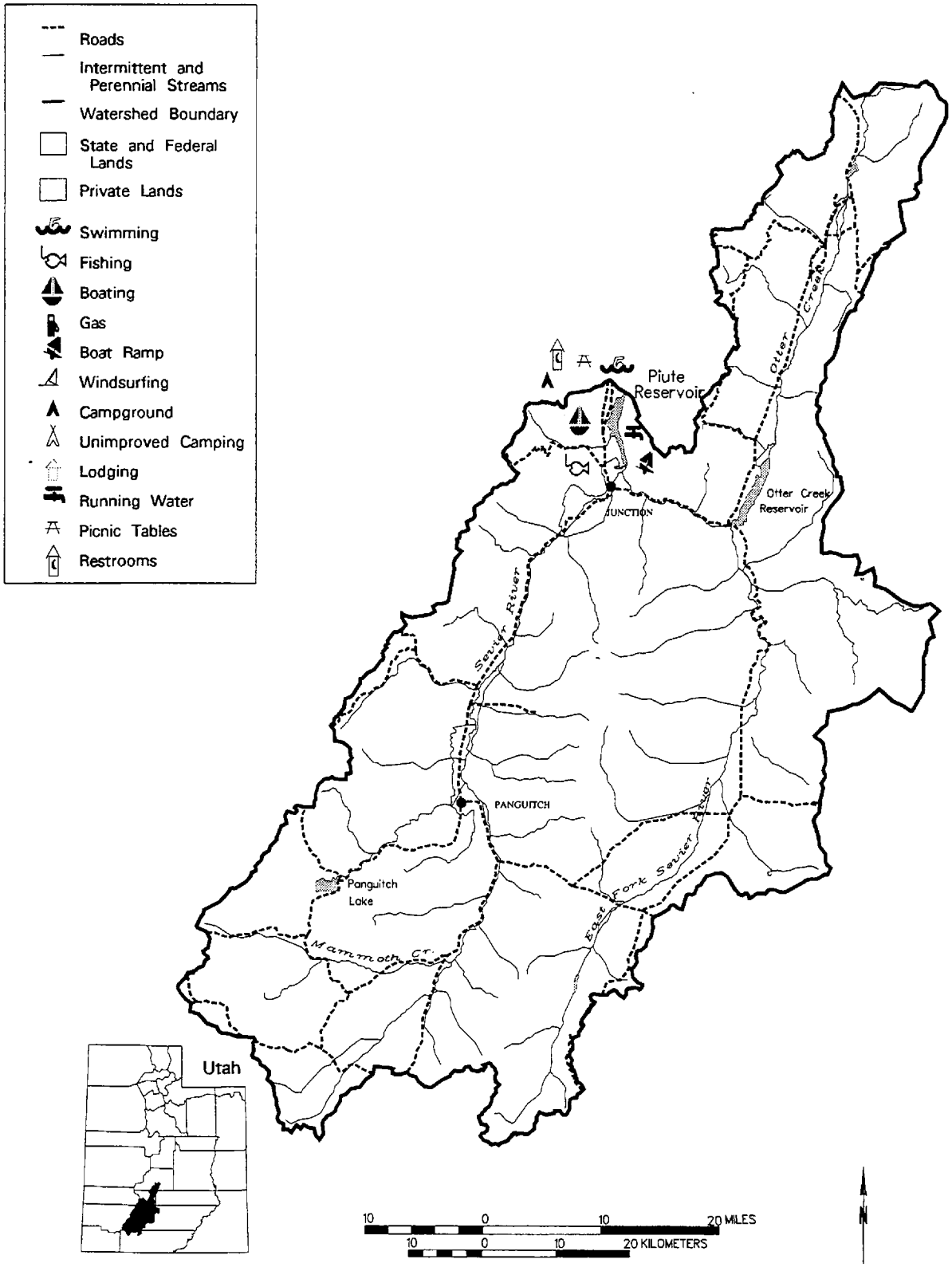
County	Piute
Longitude / Latitude	112 12 26 / 38 17 22
USGS Maps	Piute Reservoir, Utah 1981
Cataloging Unit	Upper Sevier (16030001)

Recreation

Piute Reservoir is directly accessible from Piute Reservoir State Park located on US-89 between Marysvale and Junction.

Fishing is the primary activity but waterskiing, swimming, boating, waterfowl hunting, picnicking and camping are also possible. Usage is moderate.

Piute Reservoir State Park, located at the north end of the lake, has limited recreational facilities. The low precipitation and consequent sagebrush vegetation is not noted for its scenic beauty. Primitive camping on BLM land



County near which watershed is located.

Piute Watershed

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is the only camping available at the reservoir. There are private campgrounds available in Junction, Circleville and at the Big Rock Candy Mountain, about 12 miles north on US-89. There is a public campground at the Otter Creek State Park a few miles to the east.

Watershed Description

The reservoir is in the north end of Circle Valley, between the Tushar Mountains and the Sevier Plateau. It is located where the Sevier River from the south and the East Fork of the Sevier River from the east converge.

Circle Valley is a bowl-shaped valley with a lobed extension to the north, in which the reservoir is located. The Tushar Mountains, over 12,000' tall, provide a stunning backdrop for Piute Reservoir. The area immediately surrounding the reservoir is lacking in traditional scenic beauty, being a sagebrush rangeland.

The watershed high point, The Fish Lake Hightop Plateau, is 3,546 m (11,633 ft) above sea level, thereby developing a complex slope of 3.6% to the reservoir. Panguitch Lake is an upstream impoundment on the Sevier River, and Otter Creek Reservoir is an upstream impoundment on the East Fork Sevier River. The outflow is the Sevier River. The average stream gradient is 1.3 (69 feet per mile) for both watersheds. In the Otter Creek Drainage the average slope is 2.1% (109 feet per mile) and in the East Fork Sevier drainage it is 0.8% (45 feet per mile).

The soil in the surrounding high country is derived from the underlying volcanic rocks, and the soil in the vicinity of the reservoir is made up of alluvial deposits from the high country.

The vegetation communities are comprised of bitterbrush-mountain mahogany, pinion-juniper, sage-grass, pine, aspen, spruce-fir, oak and maple. The watershed receives 20 - 102 cm (8 - 40 inches) of precipitation annually with a frost-free season of 100 - 1400 days at the reservoir.

Land use in the watershed is 92.3% multiple use, 6.2% pasture and hayland, 1.3% cropland, and the remainder urban and recreation. Although some of the shoreline is privately owned, public accessibility is unrestricted.

Limnological Assessment

The water quality of Piute Reservoir is good. It is considered to be hard with a hardness concentration value of approximately 198 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are total phosphorus and dissolved oxygen. The average concentration of total phosphorus in the water column for the three study periods was 38, 41 and 64 ug/L which all exceed the recommended pollution indicator for phosphorus of 25 ug/L. The phosphorus concentration in the second period of sampling are usually higher as the level of the reservoir diminishes and resuspension of nutrients from the sediments occurs due to mixing by wave action and wind. Dissolved oxygen concentrations decrease in late summer due to the shallow nature of the reservoir and production of algae.

Although in 1981 the reservoir was characterized as a phosphorus limited system, the 1989-91 data suggest that the reservoir is currently a nitrogen limited system. In the 1975 NES report the reservoir was characterized as phosphorus limited in May, but shifting to nitrogen limitation later in the year. TSI values indicate the reservoir is eutrophic. The reservoir does have sufficient depth to stratify as indicated in the August 13, 1991 profile, but in recent years due to lower storage and early drawdown, the reservoir did not stratify.

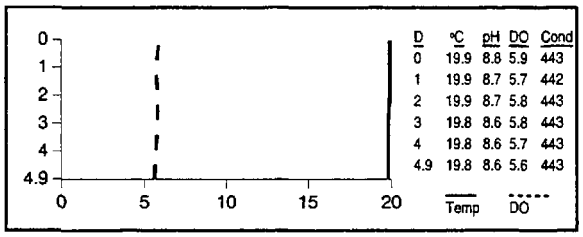
According to DWR reports no fish kills have been reported in recent years. In a 1975, DWR reported that the composition of the fishery in the reservoir was rainbow trout (*Oncorhynchus mykiss*) (0.8%), brown trout (*Salmo trutta*)

Limnological Data

Data averaged from STORET sites: 494916, 494917, 494918

Surface Data	1979	1989	1991
Trophic Status	E	E	E
Chlorophyll TSI	62.29	53.74	41.10
Secchi Depth TSI	50.00	58.89	58.76
Phosphorous TSI	57.40	58.91	63.48
Average TSI	56.56	57.18	54.45
Chlorophyll a (ug/L)	-	9.0	3.3
Transparency (m)	2.0	1.98	1.1
Total Phosphorous (mg/L)	34.8	39	63
pH	8.6	8.5	8.6
Total Susp. Solids (mg/L)	2	-	22
Total Volatile Solids (mg/L)	-	-	6
Total Residual Solids (mg/L)	-	-	21
Temperature (°C / °f)	12/54	19/65	18/64
Conductivity (umhos.cm)	363	494	449
Water Column Data			
Ammonia (mg/L)	0.06	0.03	0.04
Nitrate/Nitrite (mg/L)	0.13	-	0.08
Hardness (mg/L)	194	-	201
Alkalinity (mg/L)	211	-	206
Silica (mg/L)	24	-	33
Total Phosphorous (ug/L)	38	41	64
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	6.5	6.8	5.7
Stratification (m)	NO	NO	NO
Depth at Deepest Site (m)	10	7.0	4.9

(0.2%), Utah chub (*Gila atraria*) (80%), Utah sucker (*Catostomus ardens*) (14%), carp (*Cyprinus carpio*) (3%), redside shiner (*Richardsonius balteatus*) (1.2%), and cutthroat trout (*Oncorhynchus clarki*) (0.8%). In the same survey it was reported that both invertebrates and macrophytes were almost absent. In order for DWR to manage the fishery more effectively they treated the reservoir in 1985 and again in 1991 for the remove of rough fish. They have introduced smallmouth bass (*Micropterus dolomieui*), brown trout, and rainbow trout back into the reservoir. Information from annual stocking reports indicates that the reservoir is stocked annually with substantial amounts of fingerling and catchable rainbow trout.



In 1975 the phytoplankton community composition in the reservoir by period of sampling was reported by the EPA included:

May 5,1975		Algal Units per ml
	Diatoma sp.	10,007
	Dinobryon sp.	1,943
	Cyclotella sp.	426
	Cryptomonas sp.	80
	Gymnodinium sp.	80
August 13, 1975		Algal Units per ml
	Mallomonas sp.	489
	Cryptomonas sp.	383
	Chroomonas sp.	349
	Staurastrum sp.	70
	Oocystis sp.	70
September 24, 1975		Algal Units per ml
	Cyclotella sp.	1,635
	Mallomonas sp.	1,372
	Cryptomonas sp.	739
	Euglena sp.	369
	Schroederia sp.	369

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Unknown filamentous green alga	1.634	76.89
Stephanodiscus niagarae	0.175	8.28
Pennate diatoms	0.140	6.59
Ankyra judayi	0.055	2.62
M. granulata angustissima	0.027	1.31
Asterionella formosa	0.019	0.89
Oocystis sp.	0.016	0.78
Ankistrodesmus falcatus	0.008	0.41
Total	2.073	
Shannon-Weaver [H']	0.93	
Species Evenness	0.42	
Species Richness	0.40	

Piute Reservoir has a relatively diverse phytoplankton community for a low-elevation reservoir, but is dominated by green algae and diatoms indicative of fairly good water quality

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Pollution Assessment

Nonpoint sources of pollution in the reservoir include: sedimentation, and nutrient loading from grazing in the watershed and in the vicinity of the reservoir; pesticides and fertilizers from cultivated cropland; and wastes and litter from recreation.

There are three point pollution sources in the watershed. All of these are fish hatcheries.

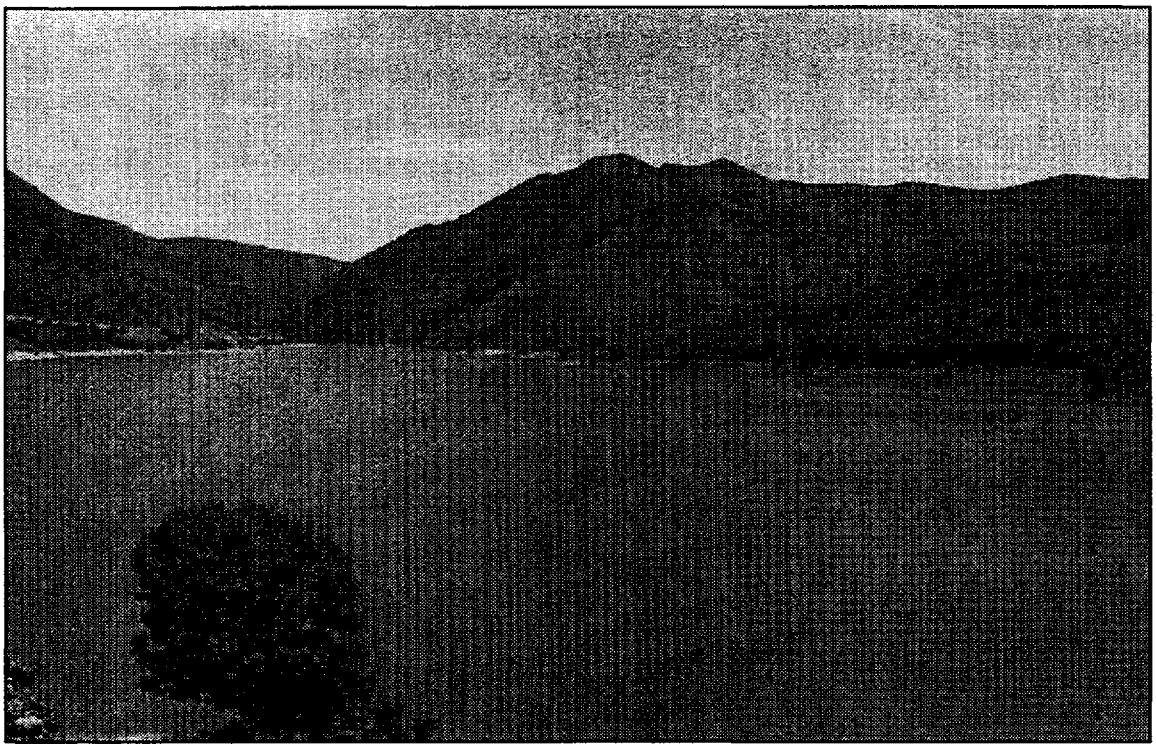
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Bureau of Land Management	
Sevier River Resource Area (Richfield Office)	896-8228
Piute Reservoir and Irrigation Company	
Big Rock Candy Mountain Campground	
Five County Association of Governments???	
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146

PORCUPINE RESERVOIR



Introduction

Porcupine Reservoir is an intermediate reservoir on the Little Bear River above Avon in Cache Valley. It is located in a steep narrow canyon on the East Fork of Little Bear River. The reservoir supplies primarily agricultural water for areas of Cache Valley. It is located in a very scenic area and is picturesque in the spring and early summer.

Porcupine Reservoir was created in 1964 by the construction of an earth-fill dam. The reservoir shoreline is privately owned, but public access is unrestricted. It is named after Porcupine Creek, which joins the East Fork of the Little Bear River at the reservoir. Although the water from the reservoir is consumed entirely for irrigation in Cache Valley, it provides a valuable recreation area and fishery.

Characteristics and Morphometry

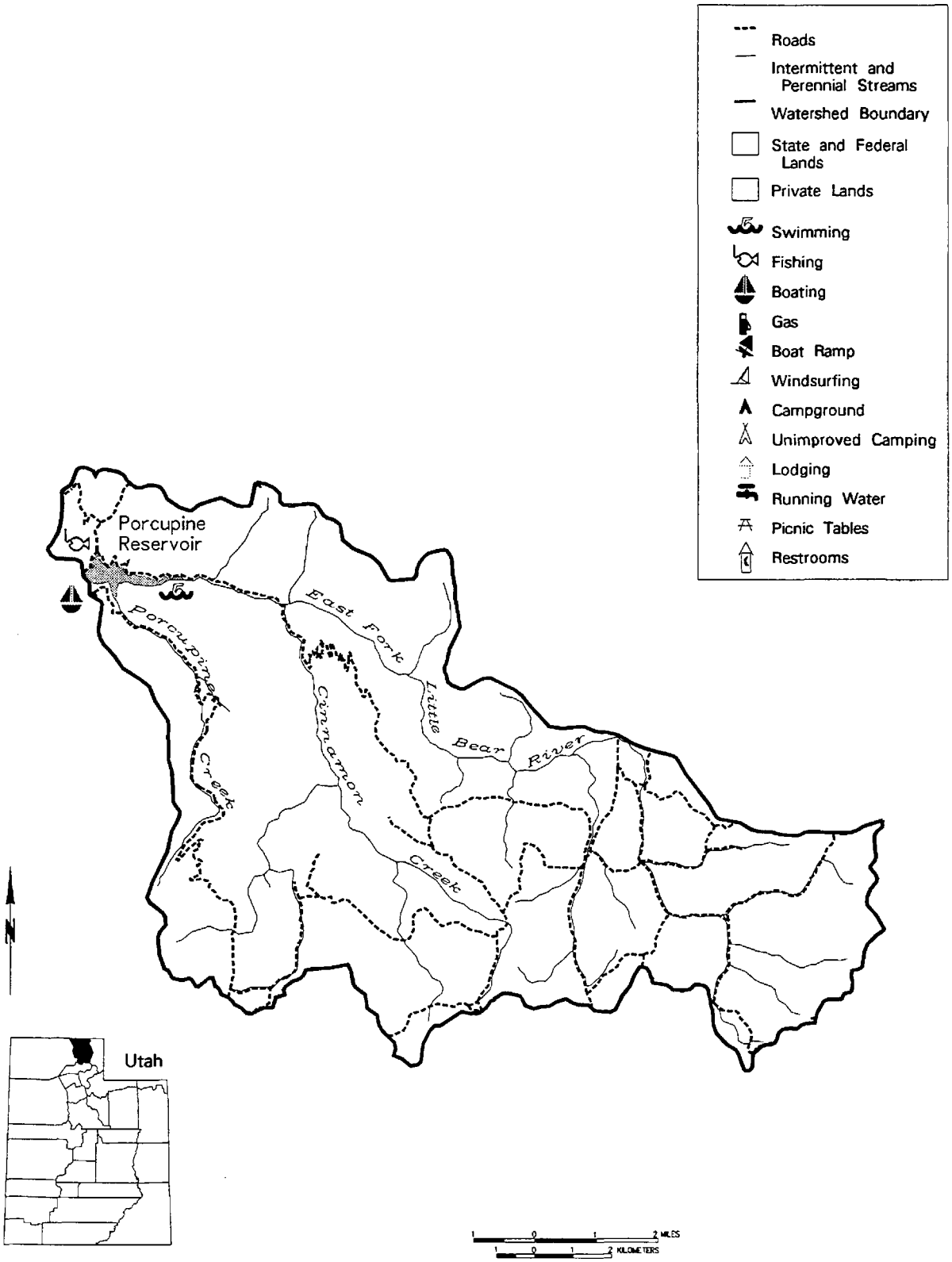
Lake elevation (meters / feet)	1,640 / 5,381
Surface area (hectares / acres)	77 / 190.27
Watershed area (hectares / acres)	15,799 / 39,040
Volume (m^3 / acre-feet)	
capacity	15,419,000 / 12,500
conservation pool	1,850,250 / 1,500
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	14,185,271 / 11,500
Depth (meters / feet)	
maximum	42.4 / 139.1
mean	20.1 / 65.9
Length (km / miles)	2.74 / 1.70
Width (km / miles)	1.07 / .66
Shoreline (km / miles)	6.8 / 4.2

Location

County	Cache
Longitude / Latitude	111 44 08 / 41 31 10
USGS Map	Porcupine Reservoir, 1969
DeLorme's Utah Atlas & Gazetteer™	Page 61, B-4
Cataloging Unit	Little Bear-Logan Rivers (16010203)

Recreation

Porcupine Reservoir is east of Paradise (in southern Cache Valley) in the Bear River Range. From Paradise, go south thorough Avon until you cross the East Fork of Little Bear River. Turn east on a well traveled road up the canyon. The road turns to gravel, but the reservoir is only



County in which watershed is located.

Porcupine Watershed

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about two miles up the canyon.

Fishing, boating, camping, and picnicking are all popular. Deep drawdowns by late summer restrict recreational use. Boats can be launched on the eastern end of the reservoir, but extra care should be taken as the reservoir draws down to avoid the soft areas near the shoreline that develop.

There are no recreational facilities at the reservoir and only primitive camping is available at the reservoir. Most areas for camping are located below the dam in the canyon.

The watershed is primarily privately owned, with the land adjacent to the reservoir privately owned. Therefore there are no USFS facilities in direct proximity to the reservoir. The nearest public campgrounds are Hyrum State Park in Hyrum. There are USFS campgrounds up Blacksmith Fork east of Hyrum on U-242. Private campgrounds are available in Logan.

Watershed Description

The watershed high point is 2788 m (9,148 ft) above sea level, thereby developing a complex slope of 5% to the reservoir. The major inflows are the East Fork Little Bear River and Porcupine Creek. The outflow is the East Fork Little Bear River. There are no upstream impoundments.

The watershed is made up of high mountains, plateaus and mountain valleys. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of pine, spruce-fir, oak-maple, aspen, and sagebrush-grass. The watershed receives 51 - 102 cm (20 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 120 - 160 days per year.

While the reservoir and watershed are within the Wasatch-Cache National Forest, nearly all the land is privately owned. Land use is primarily grazing and dispersed recreation, although logging and small mining operations have taken place in the past.

Limnological Assessment

The water quality of Porcupine Reservoir is very good. It is considered to be hard with a hardness concentration value of approximately 161 mg/L ($CaCO_3$). Although there are no overall water column concentrations that exceed State water quality standards, there are reported depressions of dissolved oxygen near the bottom of the reservoir. As indicated in the August 14, 1991 profile the dissolved oxygen declines steadily downward in the water column. Although these values are indicative of later summer conditions it would not be surprising to see anoxic conditions develop later in the winter. It appears that since 1979 nutrient concentrations have decline. Currently total phosphorus concentrations appear to be very low.

The reservoir is currently classified as a phosphorus limited system. With nutrient concentrations as low as current data indicates and the nitrogen/phosphorus ratios near the threshold point, the reservoir does shift with regards to the limiting nutrient. TSI values indicate the reservoir is oligotrophic in a state of low productivity. Although the profile shown of August 14, 1991 does not show strong stratification, it has stratified during other years. The stratification depicted may get stronger as the season progresses. As stratified conditions develop they will contribute to the process of oxygen loss as previously discussed.

According to DWR no fish kills have been reported in recent years. Brown trout (*Salmo trutta*), rainbow trout (*Oncorhynchus mykiss*), cutthroat trout (*Oncorhynchus clarki*), brook trout (*Salvelinus fontinalis*), splake trout (brook trout cross with lake trout (*Salvelinus namaycush*) and kokanee salmon (*Oncorhynchus nerka*) are the dominant fisheries. According to DWR stocking reports DWR stocks the reservoir with 17,000 cutthroat and 500 brook trout fingerling and 8,000 advance fingerling splake. The

Limnological Data

Data averaged from STORET sites: 490579, 490580

Surface Data	1979	1989	1991
Trophic Status	M	O	M
Chlorophyll TSI	50.83	45.84	44.77
Secchi Depth TSI	50.01	50.96	41.25
Phosphorous TSI	47.40	17.35	34.25
Average TSI	49.41	38.05	40.09
Chlorophyll a (ug/L)	-	6.7	4.2
Transparency (m)	2	1.95	3.9
Total Phosphorous (ug/L)	20	3	9
pH	8.4	8.5	8.3
Total Susp. Solids (mg/L)	-	-	11
Total Volatile Solids (mg/L)	-	-	4
Total Residual Solids (mg/L)	-	-	13
Temperature (°C / °f)	20/68	19/67	17/63
Conductivity (umhos.cm)	360	300	253
Water Column Data			
Ammonia (mg/L)	0.06	0.01	0.03
Nitrate/Nitrite (mg/L)	0.19	0.05	0.09
Hardness (mg/L)	168	-	167
Alkalinity (mg/L)	164	-	157
Silica (mg/L)	7.7	-	4.5
Total Phosphorous (ug/L)	20	3	8
Miscellaneous Data			
Limiting Nutrient	N	P	P
DO (Mg/l) at 75% depth	5.9	5.9	5.0
Stratification (m)	5-10	NO	NO
Depth at Deepest Site (m)	25	13.7	27.3

reservoir has not been chemically treated for the removal of rough fish.

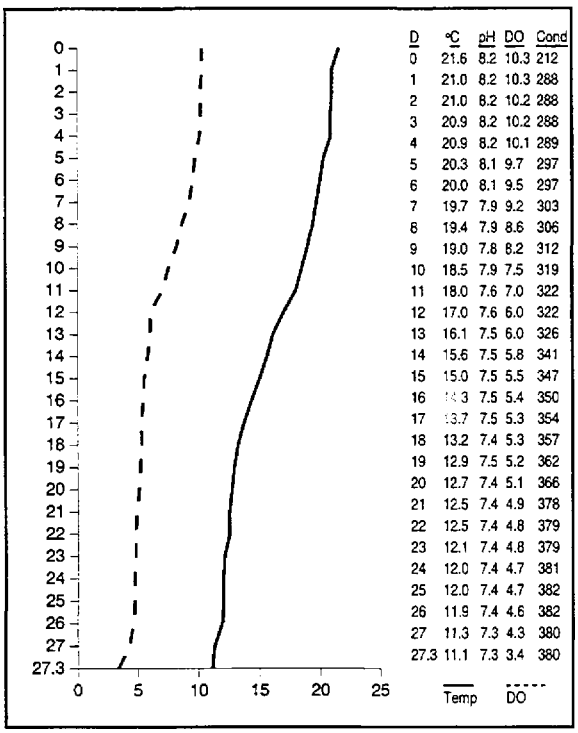
The EPA 1975 NES identified the following phytoplankton by period of sampling:

May 14,1975		Algal Units per ml
	Chroomonas sp.	3,196
	Dinobryon sp.	761
	Cryptomonas sp.	203

August 6, 1975		Algal Units per ml
	Dinobryon sp.	1,147
	Cyclotella sp.	688
	Cryptomonas sp.	191349
	Oocystis sp.	76
	Peridinium sp.	38

September 23, 1975		Algal Units per ml
	Cyclotella sp.	887
	Melosira sp.	242
	Dinobryon sp.	202
	Asterionella sp.	161
	Cryptomonas sp.	121

No macrophytic growth was observed during the survey.



D	°C	pH	DO	Cond
0	21.6	8.2	10.3	212
1	21.0	8.2	10.3	288
2	21.0	8.2	10.2	288
3	20.9	8.2	10.2	288
4	20.9	8.2	10.1	289
5	20.3	8.1	9.7	297
6	20.0	8.1	9.5	297
7	19.7	7.9	9.2	303
8	19.4	7.9	8.6	306
9	19.0	7.8	8.2	312
10	18.5	7.9	7.5	319
11	18.0	7.6	7.0	322
12	17.0	7.6	6.0	322
13	16.1	7.5	6.0	326
14	15.6	7.5	5.8	341
15	15.0	7.5	5.5	347
16	[illegible]	7.5	5.4	350
17	13.7	7.5	5.3	354
18	13.2	7.4	5.3	357
19	12.9	7.5	5.2	362
20	12.7	7.4	5.1	366
21	12.5	7.4	4.9	378
22	12.5	7.4	4.8	379
23	12.1	7.4	4.8	379
24	12.0	7.4	4.7	381
25	12.0	7.4	4.7	382
26	11.9	7.4	4.6	382
27	11.3	7.3	4.3	380
27.3	11.1	7.3	3.4	380

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	322.202	99.62
Ceratium hirundinella	0.936	0.29
Oocystis sp.	0.142	0.04
Dinobryon divergens	0.104	0.03
Pennate diatoms	0.020	0.01
Asterionella formosa	0.009	0.00
Centric diatoms	0.003	0.00
Chlamydomonas globosa	0.002	0.00
Total	323.417	
Shannon-Weaver [H']	0.03	
Species Evenness	0.01	
Species Richness	0.33	

The phytoplankton commnunity is dominated by the presence of green algae and diatoms associated with fairly good water quality.

Information

Management Agencies	
Bear River Association of Governments	752-7242
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Wasatch-Cache National Forest	524-5030
Logan Ranger District	753-2772
Recreation	
Bridgerland Travel Region (Logan) / Logan Chamber Of Commerce	752-2161
Reservoir Administrators	
Porcupine Reservoir Company	245-3309

Pollution Assessment

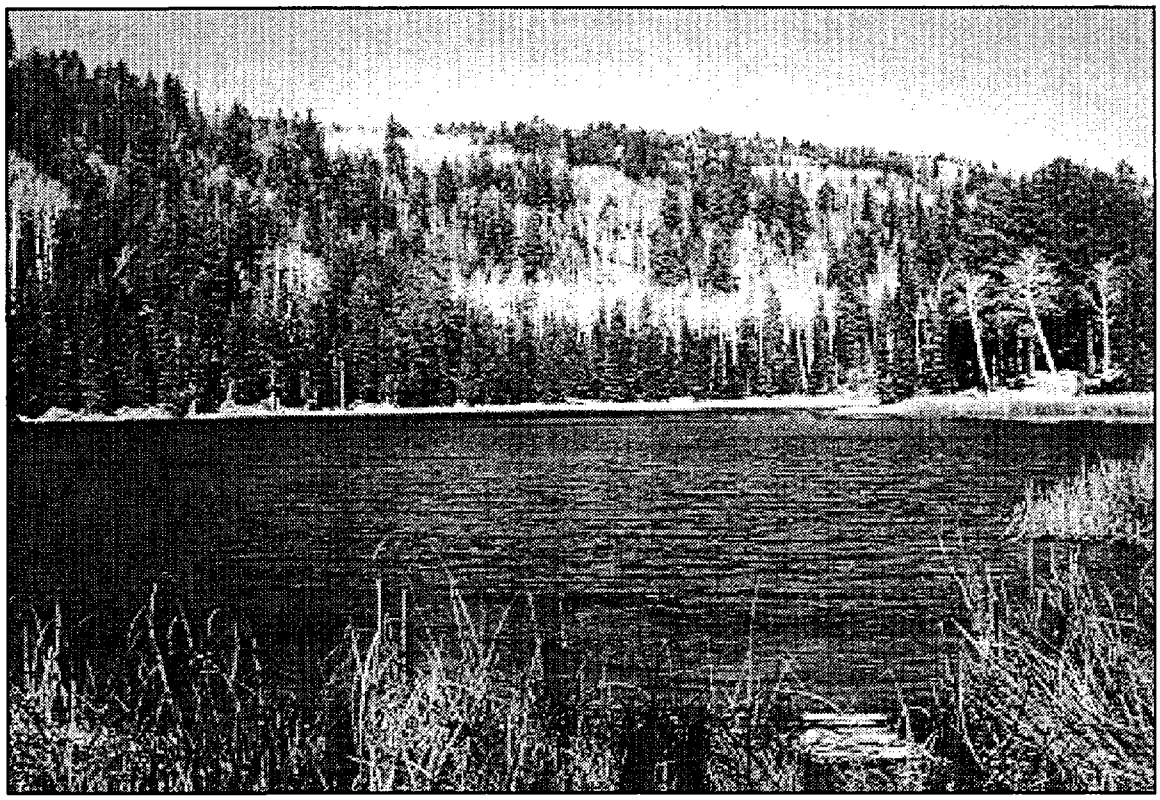
Nonpoint pollution sources include the following: sedimentation and nutrient loading from grazing; wastes and litter from recreation; and potential contaminants from old mining areas.

There are no point sources of pollution in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

POSEY LAKE



Introduction

Posey Lake is a very small reservoir on the south slopes of the the Aquarius Plateau in south-central Utah. It is nestled in tall spruces, firs and quaking aspen. It is a beautiful little lake abounding with solitude.

The reservoir shoreline is owned and administered by the Dixie National Forest with unrestricted public access. Defined beneficial uses include: water recreation excluding swimming; propagation of cold water species of game fish and aquatic life; and agricultural needs.

Characteristics and Morphometry

Lake elevation (meters / feet)	2,644 / 8,676
Surface area (hectares / acres)	8 / 20
Watershed area (hectares / acres)	111 / 275
Volume (m^3 / acre-feet)	
capacity	123,350 / 100
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	6 / 19.7
mean	1.5 / 5
Length (meters / feet)	335 / 1,100
Width (meters / feet)	183 / 600
Shoreline (meters / feet)	975 / 3,200

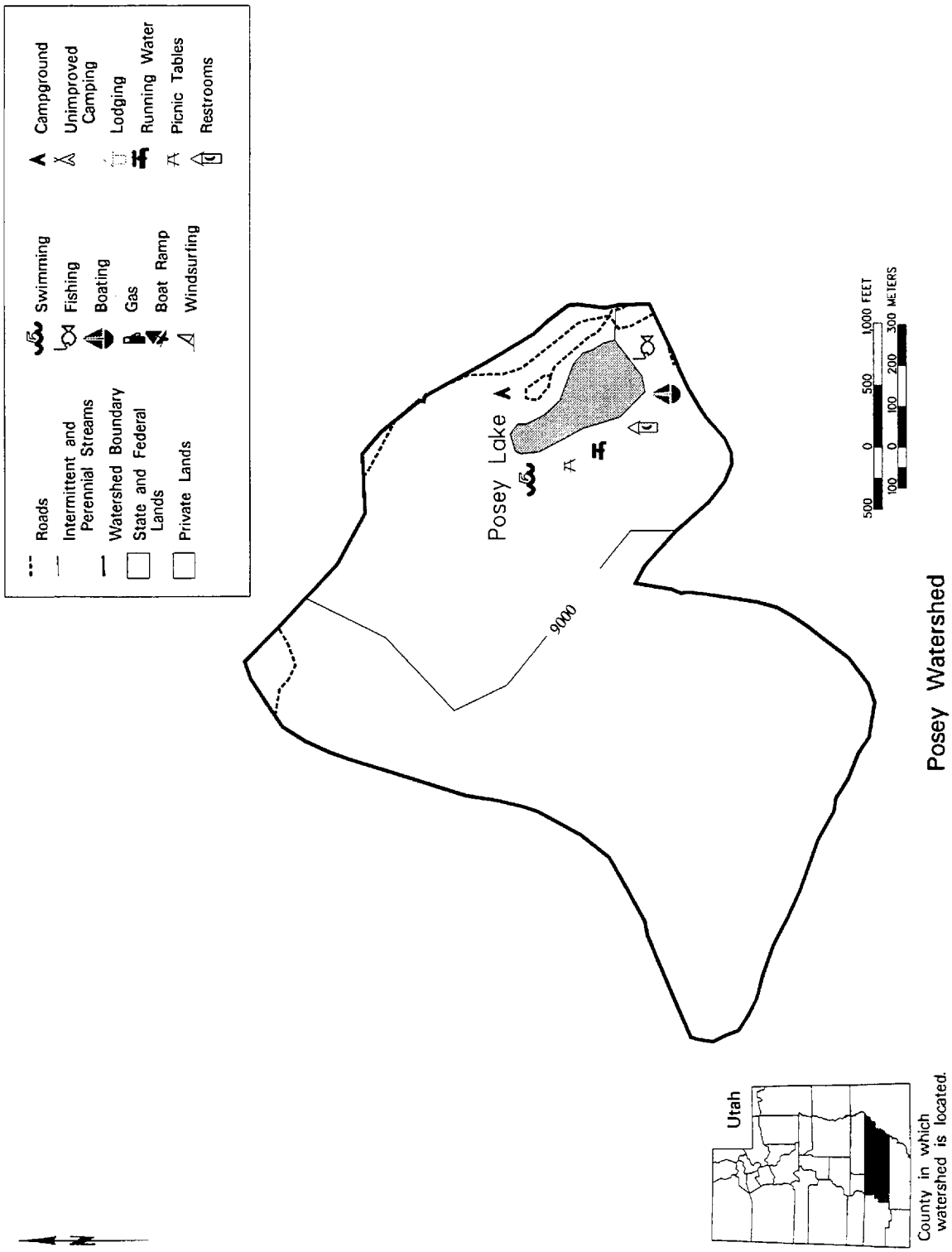
Recreation

Posey Lake is accessible via several different forest service roads from the Escalante, Boulder and Loa areas. The easiest route is probably FS-153 from downtown Escalante. Follow this gravel road northward for 20 miles to FS-154, which passes Posey Lake. Continuing on northward this road will lead you to Loa and other surrounding communities in Wayne county. Other access routes can be determined from a Dixie National Forest map.

Fishing is the only recreational activity available at the

Location

County	Garfield
Longitude / Latitude	111 41 43 / 37 56 14
USGS Map	Posey Lake, Utah 1964
Cataloging Unit	Escalante River (14070005)



Posey Watershed

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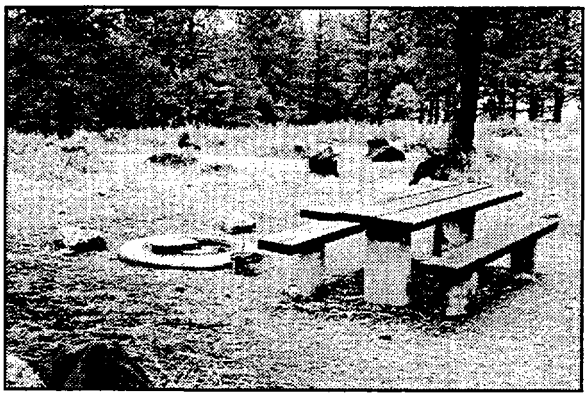
reservoir itself, but the surrounding region is replete with hiking areas, including the Phipps-Death Hollow Wilderness. The lake water is too cold for most swimmers and the lake is to small for larger boating. Smaller boats are allowed on the lake and a boatramp is located on the eastern end of the lake. The road is not maintained in the winter. Usage is moderate.

Posy Lake Campground is adjacent to the lake and maintained by the Forest Service. It has 23 campsites, vault toilets and picnic areas. Usage fees are collected.



Limnological Data

Data sampled from STORET site: 595376

Surface Data	1979	1989	1991
Trophic Status	M	M	M
Chlorophyll TSI	-	42.75	45.25
Secchi Depth TSI	36.10	37.40	46.80
Phosphorous TSI	55.40	58.71	45.41
Average TSI	45.75	46.29	45.82
Chlorophyll a (ug/L)	-	3.5	4.5
Transparency (m)	4.5	4.8	2.5
Total Phosphorous (ug/L)	50	44	18
pH	8.5	9.2	8.2
Total Susp. Solids (mg/L)	-	<3	<3
Total Volatile Solids (mg/L)	-	-	5
Total Residual Solids (mg/L)	-	-	<2
Temperature (°C / °f)	19/66	16/60	16/61
Conductivity (umhos.cm)	210	192	219
Water Column Data			
Ammonia (mg/L)	0.13	0.01	0.06
Nitrate/Nitrite (mg/L)	0.27	0.04	0.01
Hardness (mg/L)	110	-	117
Alkalinity (mg/L)	118	-	120
Silica (mg/L)	14	-	18.7
Total Phosphorous (ug/L)	75	48	38
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	5.4	5	3.1
Stratification (m)	NO	NO	NO
Depth at Deepest Site (m)	6	5.6	4.7

Watershed Description

Posy Lake is on a long, forested slope that begins at at the crest of the Aquarius Plateau. From the plateau top at 3,200 meters, the land drops off down to the Escalante River at 1,800 meters. Posy Lake is near the top of the slope, and requires a substantial climb on primitive roads through the forest. The inflow is the drainage from Tule Lakes, which are 0.5 miles upstream, and the outflow is Hungary Creek.

The watershed high point is 2,865 m (9,400 ft) above sea level, thereby developing a complex slope of 8% to the lake. The average stream gradient above the reservoir is 6.6% (349 feet per mile).

The soil is of volcanic origin. For a complete listing of soil type composition refer to Appendix III.

The vegetation communities are comprised of pine, aspen, spruce-fir and oak. The watershed receives 51 cm (20 inches) of precipitation annually with a frost-free season of 60 - 100 days at the reservoir.

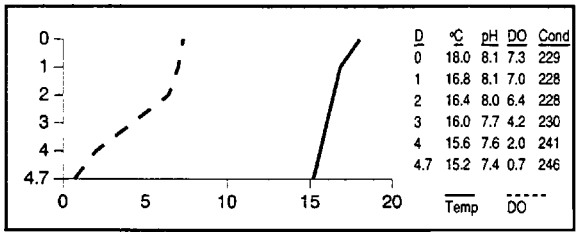
Land use is multiple use and recreation. Dixie National Forest encompasses the entire drainage area.

Limnological Assessment

The water quality of Posey Lake is considered good. It is considered to be moderately hard with a hardness concentration value of approximately 119 mg/L ($CaCO_3$). Those parameters that have exceeded state water quality standards include phosphorus, dissolved oxygen and pH. Annual phosphorus values continually exceed the pollution indicator value of 25 ug/L. Averages for the three study periods are 75, 48 and 38 ug/L. These elevated nutrient levels induce algal blooms and coupled with the extensive growth of macrophytes (large leaf varieties and *Potamogeton*) in the lake are responsible for the exceedences related to dissolved oxygen and pH. Ph values are elevated naturally due to photosynthetic activity during the day and depletion of dissolved oxygen occurs during the night as plants shift to respiration processes to obtain energy requirements. In addition anoxic conditions may become more critical during the winter due to the decomposition of all the plant material produced during the summer productivity period. This indicates that some winter monitoring should be conducted to determine if impairments are present during extended ice coverage conditions during the winter.

Current data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is mesotrophic in a state of moderately high productivity. One

of the major problems is the excessive amount of macrophytes produced which physically restrict movement on or in the reservoir and contribute to loss of oxygen when they decompose. There is no real potential for stratification in the lake due to insufficient depth in the lake. The profile on August 8, 1990 is evident of the shallow nature of the lake and the decline of dissolved oxygen in the water as previously described.



D	°C	pH	DO	Cond
0	18.0	8.1	7.3	229
1	16.8	8.1	7.0	228
2	16.4	8.0	6.4	228
3	16.0	7.7	4.2	230
4	15.6	7.6	2.0	241
4.7	15.2	7.4	0.7	246

According to DWR it is not uncommon to have at least a partial fishkill due to loss of oxygen during the winter period. Due to the problem in maintaining a fishery, the U.S. Forest Service is presently studying ways of increasing the lakes water volume. Rainbow (*Oncorhynchus mykiss*) and brook (*Salvelinus fontinalis*) trout are stocked annually by DWR. The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake.

The DWR stocked Posy Lake with 4,500 catchable rainbow trout and 2,500 fingerling brook trout in 1991.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	301.074	92.54
Anabaena spiroides v. crassa	23.129	7.11
Quadrigula lacustris	1.112	0.34
Staurastrum gracile	0.017	0.01
Ankistrodesmus falcatus	0.013	0.00
Pennate diatoms	0.006	0.00
Oscillatoria sp.	0.006	0.00
Total	325.357	
Shannon-Weaver [H']	0.28	
Species Evenness	0.14	
Species Richness	0.23	

The phytoplankton community is dominated by the presence of green algae with a significant quantify of blue-green algae. This is indicative of fairly good water quality and moderate eutrophic conditions.

Pollution Assessment

Nonpoint pollution sources include: sedimentation and nutrient loading from grazing, and human wastes and litter from recreation. Cattle graze in the watershed and around the reservoir.

There are no point pollution sources in the watershed.

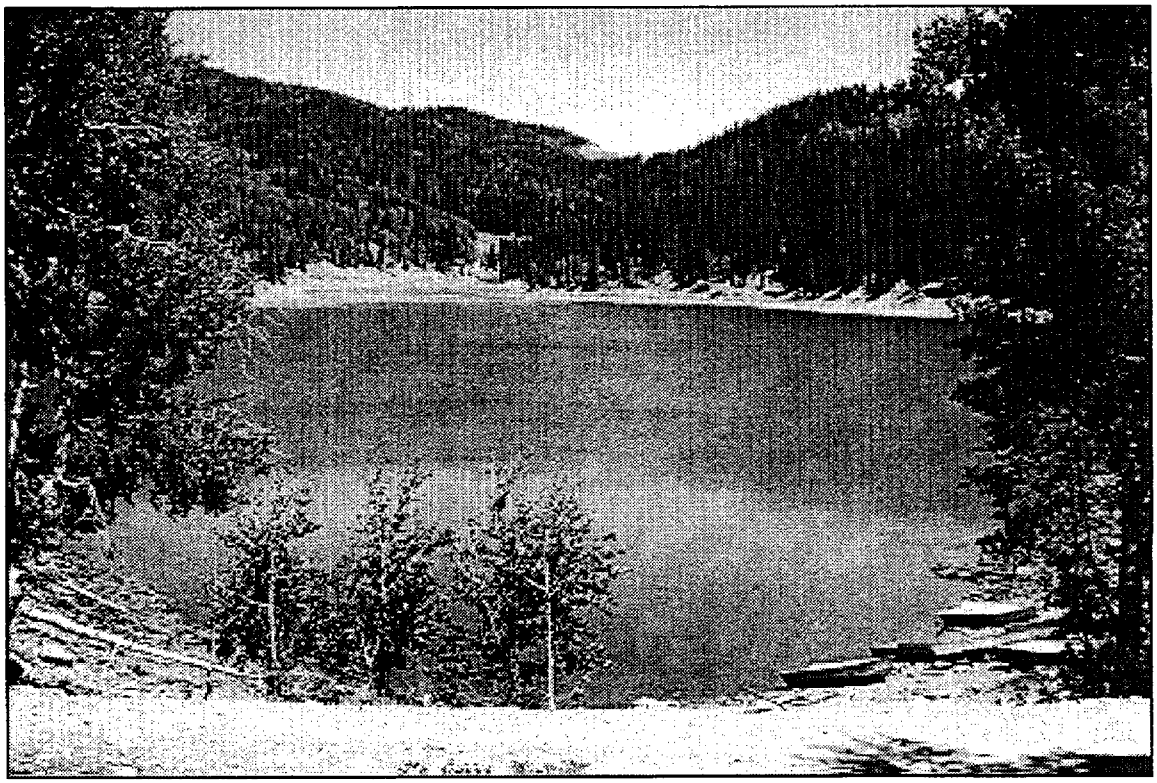
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Dixie National Forest	586-2421
Escalante Ranger District	826-4221
Five County Association of Governments	
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146

PUFFER LAKE



Introduction

Puffer Lake is high in the Tushar Mountains east of Beaver. While it is not particularly large, it is the largest natural lake found in the Tushars.

The area around the reservoir is privately owned but access is unrestricted. Defined beneficial uses include: water recreation excluding swimming; propagation of cold water species of game fish and aquatic life; and agricultural needs.

Characteristics and Morphometry

Lake elevation (meters / feet)	2,948 / 9,672
Surface area (hectares / acres)	26.3 / 65
Watershed area (hectares / acres)	706 / 1,744
Volume (m^3 / acre-feet)	
capacity	1,106,451 / 897
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	552,603 / 448
Depth (meters / feet)	
maximum	15.2 / 50
mean	4.5 / 14.8
Length (meters / feet)	1,010 / 3,609
Width (meters / feet)	500 / 1,640
Shoreline (km / miles)	2.5 / 1.5

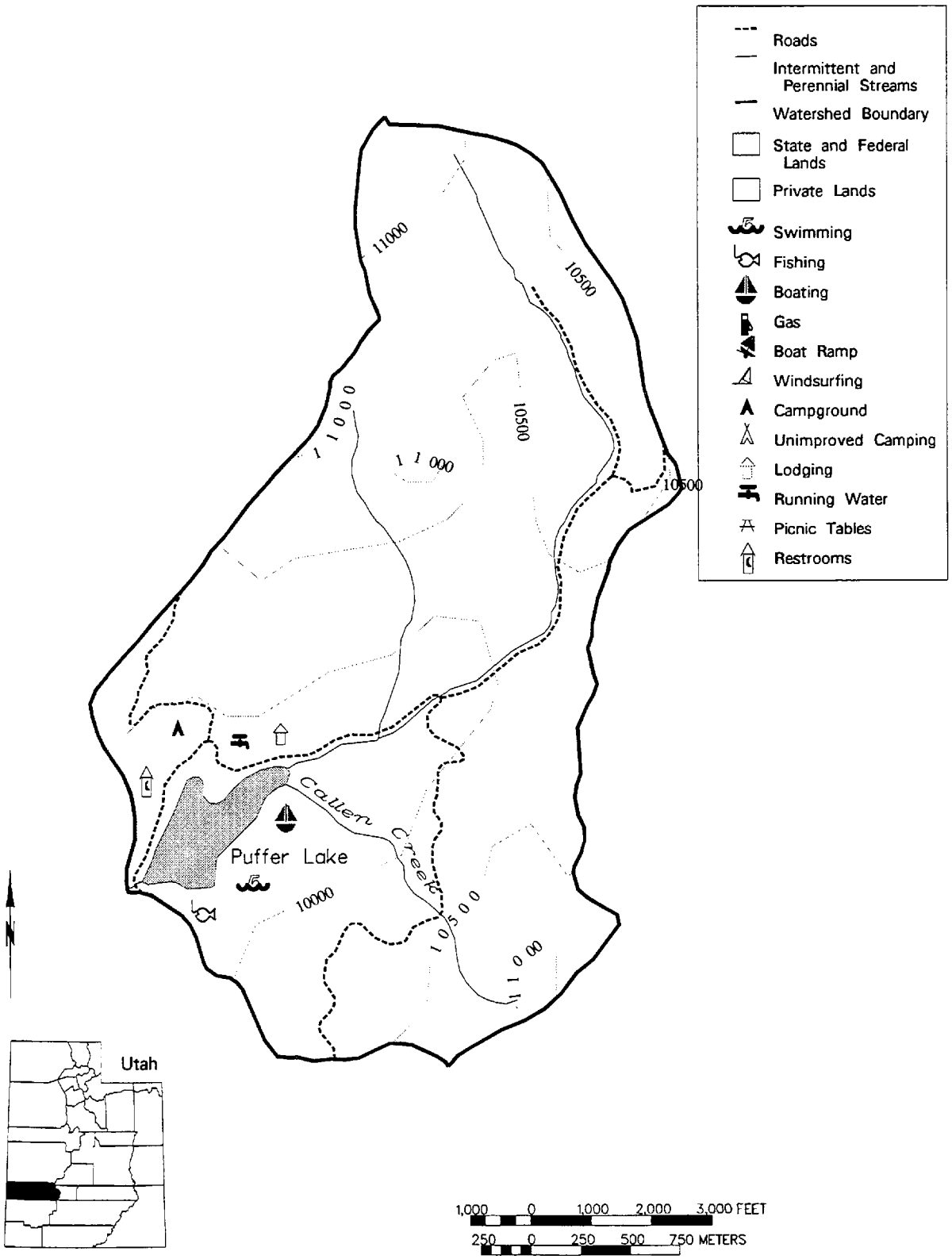
Location

County	Beaver
Longitude / Latitude	111 22 00 / 38 18 09
USGS Map	Delano Peak, Utah, 1981
Cataloging Unit	Beaver River (16030007)

Recreation

Puffer Lake is 18 miles east of Beaver and 16 miles west of Junction on U-153. The highway from Beaver is paved, while the highway from Junction, although steep, is gravel and maintained in good condition. Currently efforts are underway to widen and improve the road from the reservoir towards the east.

Puffer Lake and the surrounding area is entirely privately owned by the Puffer Lake Resort, but public access is permitted through agreements with DWR that allow for fishery access to the lake. Facilities at the resort include: camping, cottage rental, boat rental, boat launching, fishing,



County in which watershed is located.

Puffer Lake Watershed

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picnicking, showers, horseback riding, and a convenience store. Puffer Lake receives heavy fishing pressure during the summer season.

The nearest USFS campground, Mahogany Cove, has 7 campsites, vault toilets, and picnic facilities. Fees are charged. It is 7 miles west of Puffer Lake on U-153. There are also several private campgrounds in Beaver.

Watershed Description

The reservoir is in a deep glaciated valley south of Mount Holly in the Tushar Range. The watershed high point, the south shoulder of Mount Holly, is 3,597 m (11,800 ft) above sea level, thereby developing a complex slope of 19.8% to the reservoir. The inflow and outflow is Lake Stream, and the average stream gradient above the reservoir is 8.8% (647 feet per mile). Cullen Creek also flows into the reservoir.

The soil is largely of volcanic origin with moderate permeability and moderately slow erosion and runoff.

The vegetation communities are comprised of pine, aspen, spruce-fir, oak, maple and alpine vegetation. The watershed receives 76 - 102 cm (30 - 40 inches) f precipitation annually with a frost-free season of 0 - 20 days at the reservoir.

Limnological Assessment

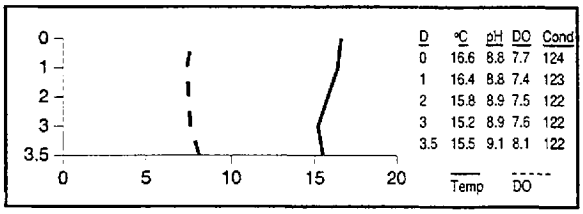
The water quality of Puffer Lake is good. It is considered to be soft with a hardness concentration value of approximately 54 mg/L (CaCO3). Those parameters that have exceeded State water quality standards for defined beneficial uses are total phosphorus, pH and dissolved oxygen. Although the average total phosphorus concentration in the water column was above the state pollution indicator (25 ug/L) in 1981 and 1989, it was well under in 1991 with a concentration of only 7 ug/L, which appears to be abnormally low. Elevated pH values develop as algal bloom develop later in the year and are associated with photosynthesis. With the drawdown of the lake macrophytes become more predominate with the increased algal blooms. This high production of organic matter poses a concern for the overwintering of fish in the lake due to the large demand for oxygen required in the decomposition process of this material. On March 22, 1990 a survey of the lake was conducted to ascertain the effect of decomposition during the winter on the lake. Data obtained indicated that the reservoir was anoxic and the average concentration of total phosphorus in the water column was 381 ug/L. This data substantiates the fact that the oxygen is consumed and phosphorus is released back into the water column from sediments and organic decomposition. These conditions make it difficult to overwinter fish in the lake without the input of fresh oxygenated water into the lake.

Limnological Data

Data sampled from STORET site: 594145

Surface Data	1981	1989	1991
Trophic Status	M	M	O
Chlorophyll TSI	-	49.11	37.88
Secchi Depth TSI	44.16	42.37	43.24
Phosphorous TSI	55.41	55.81	27.35
Average TSI	49.7	49.10	36.16
Chlorophyll a (ug/L)	-	6.6	2.1
Transparency (m)	-	3.4	3.2
Total Phosphorous (ug/L)	35	36	5
pH	9	9.1	8.6
Total Susp. Solids (mg/L)	<5	-	<3
Total Volatile Solids (mg/L)	-	-	2
Total Residual Solids (mg/L)	-	-	<2
Temperature (°C / °f)	10/50	14/56	15/58
Conductivity (umhos.cm)	107	129	117
Water Column Data			
Ammonia (mg/L)	0.05	0.014	0.03
Nitrate/Nitrite (mg/L)	0.06	-	0.017
Hardness (mg/L)	56	-	51
Alkalinity (mg/L)	54	-	53
Silica (mg/L)	-	-	9.8
Total Phosphorous (ug/L)	35	42	7
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	4.4	12.7	7.6
Stratification (m)	5-7	NO	NO
Depth at Deepest Site (m)	8	3.6	3.5

The reservoir is characterized as a nitrogen limited system. TSI values indicate the reservoir is mesotrophic except in 1991 when abnormally low phosphorus concentration skewed the data into the oligotrophic state. The reservoir was not stratified during a summer monitoring trip was on August 14, 1992 but when sufficient depth has been present (1981) the lake did show a week stratification later in the year.



D	°C	pH	DO	Cond
0	16.6	8.8	7.7	124
1	16.4	8.8	7.4	123
2	15.8	8.9	7.5	122
3	15.2	8.9	7.6	122
3.5	15.5	9.1	8.1	122

According to DWR frequent partial winter fish kills have occurred in recent years. The reservoir supports population of rainbow trout (*Oncorhynchus mykiss*), brook trout (*Salvelinus fontinalis*), and cutthroat trout (*Oncorhynchus*

clarki). The lake was treated for rough fish competition in 1957, so populations of native fishes may not be present in the lake.

DWR stocked Puffer Lake with 6,000 catchable rainbow trout and 2,500 fingerling brook trout in 1991.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	13.205	50.22
Aphanizomenon flos-aquae	11.620	44.19
Quadrigula lacustris	1.112	4.23
Fragilaria crotonensis	0.229	0.87
Pennate diatoms	0.073	0.28
Centric diatoms	0.051	0.19
Ankistrodesmus falcatus	0.004	0.02
Total	26.293	
Shannon-Weaver [H']	0.91	
Species Evenness	0.47	
Species Richness	0.26	

The phytoplankton community is dominated by the presence of green and blue-green algae indicative of fair water quality with tendencies toward eutrophic conditions.
Macrophyte growth is entirely submergent and fairly heavy.

Pollution Assessment

Nonpoint pollution sources include: sedimentation and nutrient loading from grazing; and wastes and litter from recreation. Because the immediate area around the lake is privately owned, grazing has been limited near the lake but many cattle do graze throughout the watershed.

There are no point pollution sources in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Fish Lake National Forest	896-4491
Beaver Ranger District	438-2436
Puffer Lake Resort (reservations)	864-2751
Five County Association of Governments	
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146

PYRAMID RESERVOIR

Introduction

Pyramid Lake is located on the eastern edge of Murdock Basin a thousand feet below the peak rising quickly to the west. It is located in an area of solitude and beauty with several other small lakes in the area at the base of Murdock Mountain. The reservoir shoreline is owned and administered by the Wasatch National Forest. with unrestricted public access. Water is used for coldwater aquatic life and recreation. No changes in water use are anticipated.

Characteristics and Morphometry

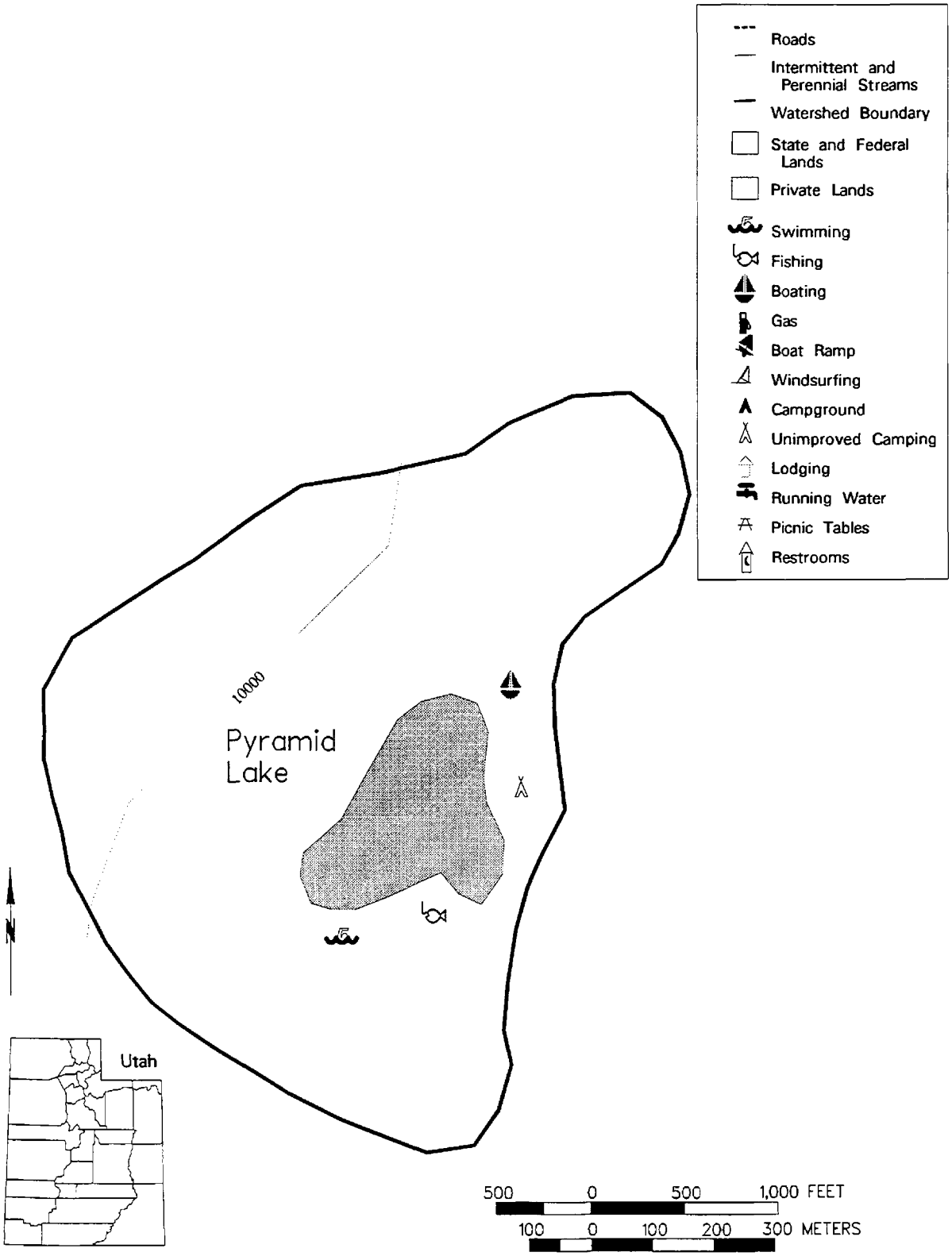
Lake elevation (meters / feet)	2,956 / 9,700
Surface area (hectares / acres)	4.7 / 14
Watershed area (hectares / acres)	77 / 190
Volume (m^3 / acre-feet)	
capacity	189,959 / 154
conservation pool	189,959 / 154
Annual inflow (m^3 / acre-feet)	Unknown
Retention time (years)	Unknown
Drawdown (m^3 / acre-feet)	0 / 0
Depth (meters / feet)	
maximum	34 / 10.4
mean	11 / 3.4
Length (meters / feet)	366 / 1,200
Width (meters / feet)	244 / 800
Shoreline (meters / feet)	975 / 3,200

Location

County	Duchesne
Longitude / Latitude	110 53 56 / 40 39 11
USGS Map	Mirror Lake, Utah, 1972
DeLorme's Utah Atlas and Gazetteer™	Page 54, B-3
Cataloging Unit	Duchesne (14060003)

Recreation

Pyramid Lake is accessible via State Highway 150 east out of Kamas, Utah. Approximately 22 miles east of Kamas take the Murdock Basin Road, a gravel road. This a relatively good road to Murdock Basin but the road past Pyramid Lake becomes very rocky and a high clearance vehicle should be utilized. Travel on this road for approximately 5.0 miles. This should bring you into Murdock Basin and near a junction in the road. To reach the lake turn left and travel about 0.2 miles to a trailhead area. The



County in which watershed is located.

Pyramid Watershed

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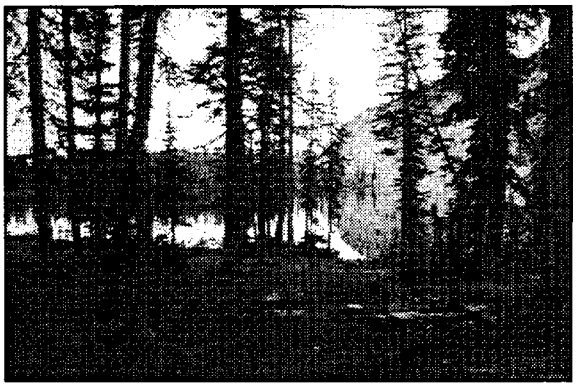
lake is a few hundred yards up the slope to the west. You can continue past the junction for about 0.3 miles to another junction. The road to the left goes to Pyramid Lake (turn left shortly after the junction for approximately 0.4 miles) or Echo Lake (continue straight ahead for approximately 0.6 miles).

Fishing, boating, and camping occur in the area. Watercraft will need to be carried a minimum of a few hundred feet to the lake and camping is strictly primitive. Recreation use of the area is usually light but can get heavier around holidays. Although there are no improved campgrounds in the immediate area, there are several campgrounds within a short driving distance of the basin.



Limnological Data

Data sampled from STORET site: 593564

Surface Data	1981	1990	1992
Trophic Status	M	O	O
Chlorophyll TSI	-	30.60	34.58
Secchi Depth TSI	-	37.85	47.38
Phosphorous TSI	47.30	43.67	27.36
Average TSI	47.30	37.37	36.44
Chlorophyll a (ug/L)	-	1.0	1.5
Transparency (m)	-	4.65	2.40
Total Phosphorous (ug/L)	20	16	5
pH	7.8	7.35	7.60
Total Susp. Solids (mg/L)	5	1.5	1.5
Total Volatile Solids (mg/L)	-	-	-
Total Residual Solids (mg/L)	-	-	3
Temperature (°C / °f)	18/64	17/62	18/64
Conductivity (umhos.cm)	10	9	14
Water Column Data			
Ammonia (mg/L)	0.1	0.03	0.03
Nitrate/Nitrite (mg/L)	0.06	-	0.01
Hardness (mg/L)	-	6.6	8.4
Alkalinity (mg/L)	-	4	6
Silica (mg/L)	-	-	0.5
Total Phosphorous (ug/L)	20	18	8
Miscellaneous Data			
DO (Mg/l) at 75% depth	-	0.7	7.6
Stratification (m)	-	4-6	1-2
Limiting Nutrient	N	N	N
Depth at Deepest Site (m)	-	8.5	3

Watershed Description

Pyramid Lake is located in the western end of the High Uintas. The watershed is very small. The lake is perched on a bench high on the Duchesne River Gorge, and at the foot of an unnamed peak, a 1,000' high rocky escarpment rising westward above the lake.. The area is densely forested, interspersed with rocky peaks and barren peaks. In this area of the Uintas, glaciation has removed the majority of the high mountains, with isolated peaks remaining.

The watershed high point, the south arm of Murdock Mountain, is 3,243 m (10,640 ft) above sea level, thereby developing a complex slope of 47% to the reservoir. There are no streams flowing into the lake, but because of the high elevation, snowmelt runoff flows for much of the summer. There is no surface outflow.

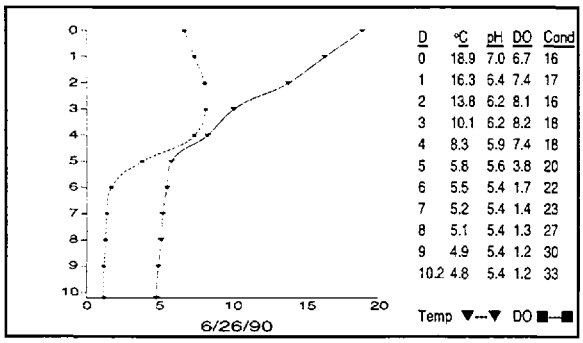
The watershed is made up of high mountains and rocky outcroppings. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of pine, oak, maple, spruce-fir, aspen, and alpine. The watershed receives 76 - 102 cm (30 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 0 - 20 days per year.

The use of watershed land is 100% recreation. The watershed is too high and rocky for many other uses.

Limnological Assessment

The water quality of Pyramid Lake is considered very good. It is considered to be very soft with a hardness concentration value of approximately 7.5 mg/L ($CaCO_3$). Although there are no overall water column concentrations that exceed State water quality standards there are reported violations of parameters near the bottom or surface of the



lake. These parameters include dissolved oxygen and pH. At various times of the year oxygen deficiencies develop in the hypolimnion as indicated by the profile on June 26, 1990. It may be that anoxic conditions developed during the winter are still exerting an influence in the lower depths of the lake. There are anoxic conditions values reported during late summer. In August of 1990 there was no dissolved oxygen below the 8 meter depth. The pH values have dipped below criteria established for a cold water fishery as indicated in the profile.

Stratification is evident also but may be limited due to climatic conditions and the short duration of the summer period. Current data suggest that the reservoir is a nitrogen limited system. TSI values indicate the reservoir is oligotrophic in a state of low productivity.

According to DWR no fish kills have been reported in recent years. The reservoir supports a population of brook trout (*Salvelinus fontinalis*). The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake. The lake has not been treated for rough fish competition, so native fishes could still exist in the lake.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Gomphosphaeria lacustris	3.339	71.15
Quadrigula lacustris	1.112	23.69
Botryococcus sudeticus	.150	3.20
Merismopedia tenuissima	.025	1.18
Oocystis sp.	.025	0.53
Chroococcus sp.	.011	0.24
Total	4.662	
Shannon Weaver [H']	0.79	
Species Evenness	0.44	
Species Richness [d]	0.23	

The phytoplankton community is dominated by the presence of blue-green and green algae.

Pollution Assessment

Nonpoint pollution sources include the following: sedimentation and nutrient loading from grazing, and litter or wastes from recreation.

There are no point sources of pollution in the watershed.

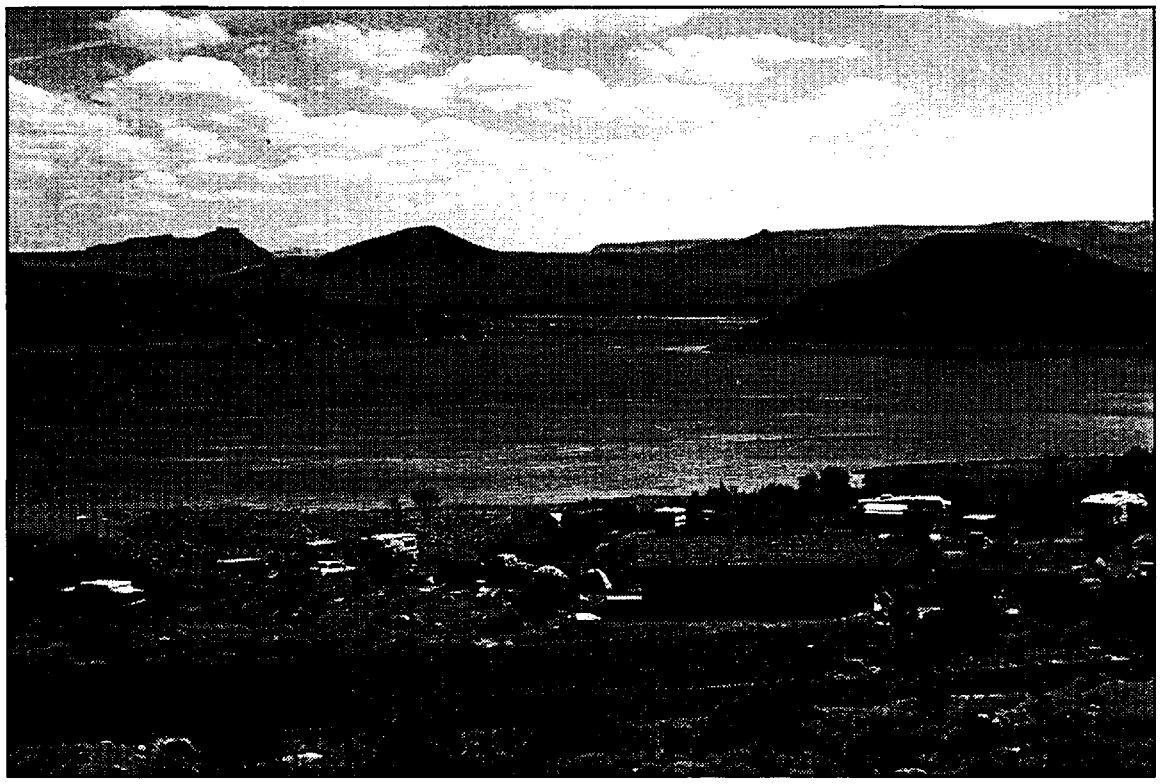
Beneficial Use Classification

This lake currently is not classified for state beneficial use classifications.

Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Wasatch-Cache National Forest	524-5030
Kamas Ranger District	783-4338
Recreation	
Dinosaurland Travel Region (Vernal)	798-6932

QUAIL CREEK RESERVOIR



Introduction

Quail Creek Reservoir is a large impoundment of Quail Creek and several tributaries in extreme southwestern Utah. This reservoir provides drinking water to St. George and offers many recreational opportunities. At 12:08 a.m. on January 1, 1989 the southwest dike finally failed and unleashed a wall of water, forty feet in height, downstream. The torrent of water, estimated at 25,000 acre-feet, forced the evacuation of some downstream residents, and caused fairly extensive property damage. The dike had been plagued by leakage since its completion in 1985, but was considered safe until shortly before the flows began to increase prior to its collapse. The leakage was due in large part to the solubility of gypsum found in the soil which dissolved and produced conduits for the transmission of water in the area. Several attempts were made to reduce and control the flow past the dike but new leaks continued

Characteristics and Morphometry

Lake elevation (meters / feet)	910 / 2,985
Surface area (hectares / acres)	239 / 590
Watershed area (hectares / acres)	239,816 / 592,577
Volume (m^3 / acre-feet)	
capacity	238.7 / 40,325
conservation pool	370,000 / 300
Annual inflow (m^3 / acre-feet)	2.71×10^8 / 22,000
Retention time (years)	1.84
Drawdown (m^3 / acre-feet)	4.5 / 15
Depth (meters / feet)	
maximum	58 / 190
mean	20.8 / 68.3
Length (meters / feet)	2,476 / 8,125
Width (meters / feet)	1,485 / 4,872
Shoreline (meters / feet)	12,214 / 40,071

Location

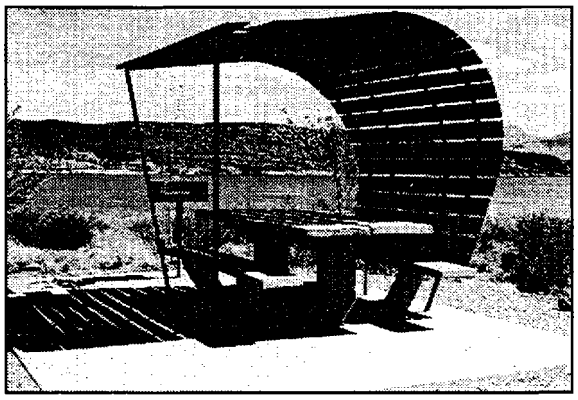
County	Washington
Longitude / Latitude	113 22 49 / 37 10 51
USGS Map	Harrisburg Junction, UT (not on map) 1986
DeLorme's Utah Atlas and Gazetteer™	Page 17, D-4
Cataloging Unit	Upper Virgin (15010008)

to appear. The leakage increased significantly on Saturday prior to the failure. Work crews battled for 14 hours to seal the leak in the earthen dike including efforts to pump concrete grouting into the toe of the dike. Despite efforts the situation got progressively worse. By 10:00 p.m. on New Years Eve, it was apparent that failure of the dike was eminent. Although New Years Eve celebrations caused some difficulties efforts to warn residents and conduct needed evacuations worked well and ran smoothly which prevented injury and the loss of life. Some livestock was lost in addition to property damage as water sweep into fields in the Washington area.

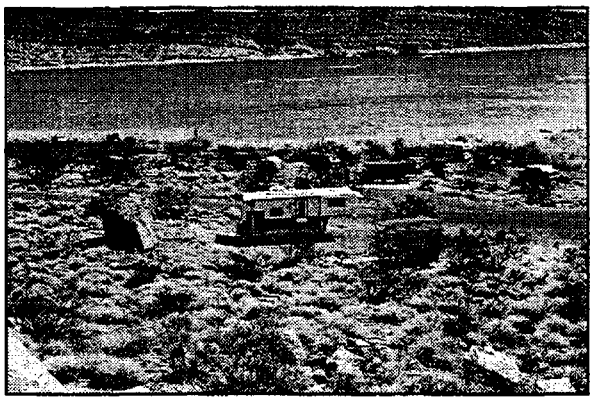
The reservoir shoreline is publicly owned and public access is unrestricted. The reservoir is built between two hogbacks of the Harrisburg Dome. Quail Creek has cut a notch, Harrisburg Gap, in the more prominent hogback. The reservoir was created by building earth-fill dams were constructed in the strike valley to the southwest and in Harrisburg Gap itself. Construction was initially completed in 1984. However, after the collapse in 1989 the southwest dike was reconstructed utilizing a design strategy more conductive to the geological conditions and soils in the area. Currently, water is used for both municipal/industrial purposes and irrigation, but as growth in the St. George area continues without water conservation measures, all of the water will be required for municipal/industrial purposes.

Recreation

Quail Creek Reservoir is on U-9 about 3 miles east of I-15 (at exit 16) and 4 miles west of Hurricane. The reservoir offers many recreational opportunities, including fishing, boating, camping, and swimming. Because of the low elevation and southern location, winter temperatures are mild and the recreation season extends from early spring to late fall.



Quail Creek State Park is on the south side of the reservoir and is accessible from U-9. Facilities include 23 campsites, an improved boat ramp, modern toilets, a fish cleaning station and two covered picnic areas. Usage fees are charged in all areas of the park.



Watershed Description

Quail Creek Reservoir is located on the desert floor between two hogback ridges. The ridges trend north-east/south-west, with Quail Creek cutting through them. To the northwest, the topography rises steeply into the Pine Valley Mountains. The outlet is immediately upstream from the confluence of Quail Creek and the Virgin River.

The watershed rises steeply to the west into the lava-capped Pine Valley Mountains (technically a plateau). Streams carry runoff from snowmelt down the mountainside and immediately into the reservoir. Most valley reservoirs are eutrophic; Quail Creek, owing to its close proximity to the stream sources, is not. It is also a relatively new reservoir, so nutrient-rich sediments have not yet accumulated in quantity.

The watershed high point, Signal Peak, is 3,159 m (10,365 ft) above sea level, thereby developing a complex slope of 14.9% to the reservoir. The inflows are Quail Creek and Cottonwood Creek and the outflow immediately enters the Virgin River. The average stream gradient above the reservoir is 8% (422 feet per mile) for Quail Creek and 1.3% (68 feet per mile) for the East Fork of the Virgin River. Upstream impoundments include Kolob Creek Reservoir and Blue Springs Reservoir.

The area surrounding the reservoir is mostly bare rock and desert soils, while much of the watershed is comprised of soils typical of steep, vegetated slopes at low to high elevations.

The vegetation communities are comprised of shadscale, greasewood, saltbrush, sage-grass, bitterbrush-mountain mahogany, pinyon-juniper, mahonia, grass-forbes, pine, aspen, spruce-fir, oak, and maple. The watershed receives 25 - 76 cm (10 - 30 inches) of precipitation annually with a frost-free season of 180 - 200 days at the reservoir.

Land use is nearly 100% multiple use, with some urban and agricultural development in Leeds. Much of the watershed is in the Dixie National Forest. The major use of the watershed is livestock grazing, much of which is overgrazed, resulting in heavy runoff and substantial soil erosion. The highest areas of the watershed are a federally protected wilderness area.

Limnological Assessment

The water in Quail Creek Reservoir is of fairly good quality. The water is considered very hard with a hardness concentration of 415 mg/L ($CaCO^3$). The alkalinity and conductivity, as is expected are also relatively high. These values increase in the reservoir as naturally occurring gypsum (Ca_2SO_4) in the sediments dissolves. Although there are no overall water column concentrations that exceed State water quality standards dissolved oxygen concentrations do decline through the water column and reach low concentrations that are an impairment to the fishery at times. In May of 1991 total phosphorus values averaged 41 ug/L near the dam site which exceed the state pollution indicator value of 25 ug/L. Typically total phosphorus concentration are well below the indicator value as summarized in the limnological data table. Although phosphorus concentration is relatively low nitrate/nitrite concentrations appear fairly stable at concentrations near 0.2 mg/L.

Current data suggest that the reservoir is currently a phosphorus limited system. TSI values indicate the reservoir is oligotrophic to low mesotrophic in a state of low productivity. The reservoir does stratify as indicated by the profile from August 8, 1991. Below the thermocline there is a marked decline in the concentration of dissolved oxygen.

Limnological Data

Data averaged from STORET sites: 494035, 494036, 494037

Surface Data	1989*	1990**	1991
Trophic Status	O	M	M
Chlorophyll TSI	34.58	36.75	35.78
Secchi Depth TSI	47.09	46.53	42.01
Phosphorous TSI	17.35	48.38	43.28
Average TSI	33.00	43.89	40.35
Chlorophyll a (ug/L)	1.5	1.9	1.7
Transparency (m)	2.5	2.6	3.5
Total Phosphorous (ug/L)	3	21	16
pH	7.7	8.1	8.1
Total Susp. Solids (mg/L)	-	6.5	<3
Total Volatile Solids (mg/L)	-	-	8
Total Residual Solids (mg/L)	-	-	13
Temperature (°C / °f)	19/65	26/80	20/66
Conductivity (umhos.cm)	1110	1003	930
Water Column Data			
Ammonia (mg/L)	0.04	0.03	0.03
Nitrate/Nitrite (mg/L)	-	-	0.23
Hardness (mg/L)	-	422	408
Alkalinity (mg/L)	-	125	136
Silica (mg/L)	-	-	9.1
Total Phosphorous (ug/L)	3	13	17
Miscellaneous Data			
Limiting Nutrient	N	N	P
DO (Mg/l) at 75% depth	-	0.6	4.0
Stratification (m)	-	10-12	8-12
Depth at Deepest Site (m)	-	23.6	42.0

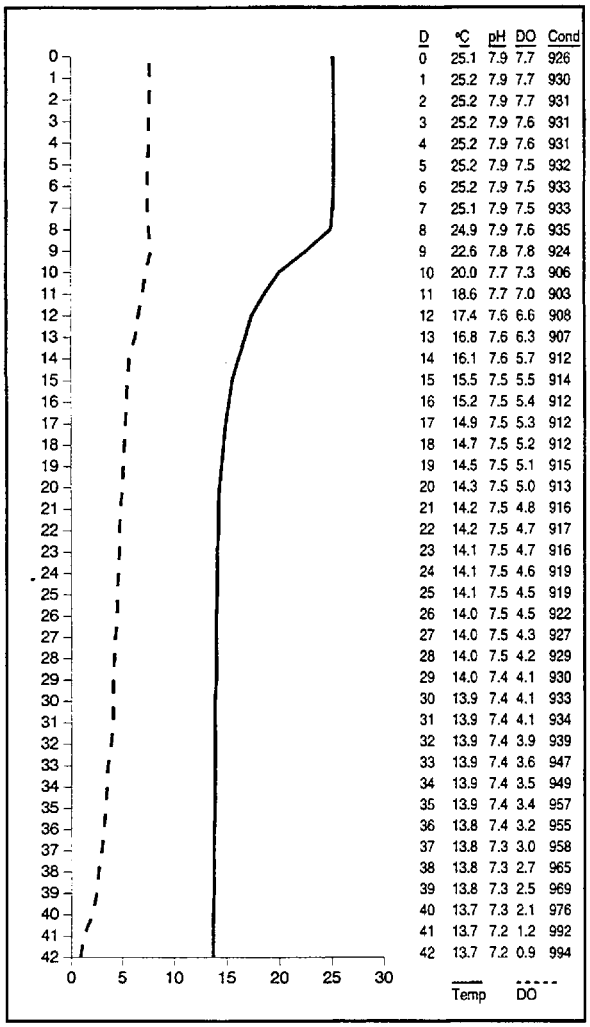
* Spring data only ** Summer data only

There are profiles documenting fairly extensive anoxic conditions present in the hypolimnion. The extensive loss of dissolved oxygen in the water column may be due in part to the oxidation of nitrogen in the system.

According to DWR no fish kills have been reported in recent years. The reservoir supports a population of rainbow trout (*Oncorhynchus mykiss*), largemouth bass (Microptereus salmoides), bluegill (*Lepomis macrochirus*), and Threadfin shad (*Dorosoma petenense*). Current stocking reports indicate that DWR stocks the lake with 25-50,000 subcatchable rainbow trout. The reservoir has not been chemically treated by the DWR to control rough fish competition, so the reservoir could contain some of the original fish populations of Quail Creek and the Virgin River.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume	% Density



D	°C	pH	DO	Cond
0	25.1	7.9	7.7	926
1	25.2	7.9	7.7	930
2	25.2	7.9	7.7	931
3	25.2	7.9	7.6	931
4	25.2	7.9	7.6	931
5	25.2	7.9	7.5	932
6	25.2	7.9	7.5	933
7	25.1	7.9	7.5	933
8	24.9	7.9	7.6	935
9	22.6	7.8	7.8	924
10	20.0	7.7	7.3	906
11	18.6	7.7	7.0	903
12	17.4	7.6	6.6	908
13	16.8	7.6	6.3	907
14	16.1	7.6	5.7	912
15	15.5	7.5	5.5	914
16	15.2	7.5	5.4	912
17	14.9	7.5	5.3	912
18	14.7	7.5	5.2	912
19	14.5	7.5	5.1	915
20	14.3	7.5	5.0	913
21	14.2	7.5	4.8	916
22	14.2	7.5	4.7	917
23	14.1	7.5	4.7	916
24	14.1	7.5	4.6	919
25	14.1	7.5	4.5	919
26	14.0	7.5	4.5	922
27	14.0	7.5	4.3	927
28	14.0	7.5	4.2	929
29	14.0	7.4	4.1	930
30	13.9	7.4	4.1	933
31	13.9	7.4	4.1	934
32	13.9	7.4	3.9	939
33	13.9	7.4	3.6	947
34	13.9	7.4	3.5	949
35	13.9	7.4	3.4	957
36	13.8	7.4	3.2	955
37	13.8	7.3	3.0	958
38	13.8	7.3	2.7	965
39	13.8	7.3	2.5	969
40	13.7	7.3	2.1	976
41	13.7	7.2	1.2	992
42	13.7	7.2	0.9	994

	(mm^3/liter)	By Volume
Sphaerocystis schroeteri	2.641	93.22
Dinobryon divergens	0.104	3.68
Oocystis sp.	0.050	1.77
Pennate diatoms	0.017	0.59
Scenedesmus bijuga	0.016	0.55
Centric diatoms	0.003	0.11
Chlamydomonas globosa	0.002	0.08
Total	2.831	
Shannon-Weaver [H']	0.33	
Species Evenness	0.17	
Species Richness	0.31	

The flora dominated by green algae, which indicates a fairly healthy aquatic ecosystem. Algal biomass is not great enough to be a problem.

Pollution Assessment

Nonpoint pollution sources include: sedimentation and nutrient loading from grazing and feed yards, potential mine wastes from abandoned mines and wastes or litter from recreation. Cattle graze in the watershed.

There are point pollution sources in the watershed. They are located primarily in the upper watershed of the Virgin River.

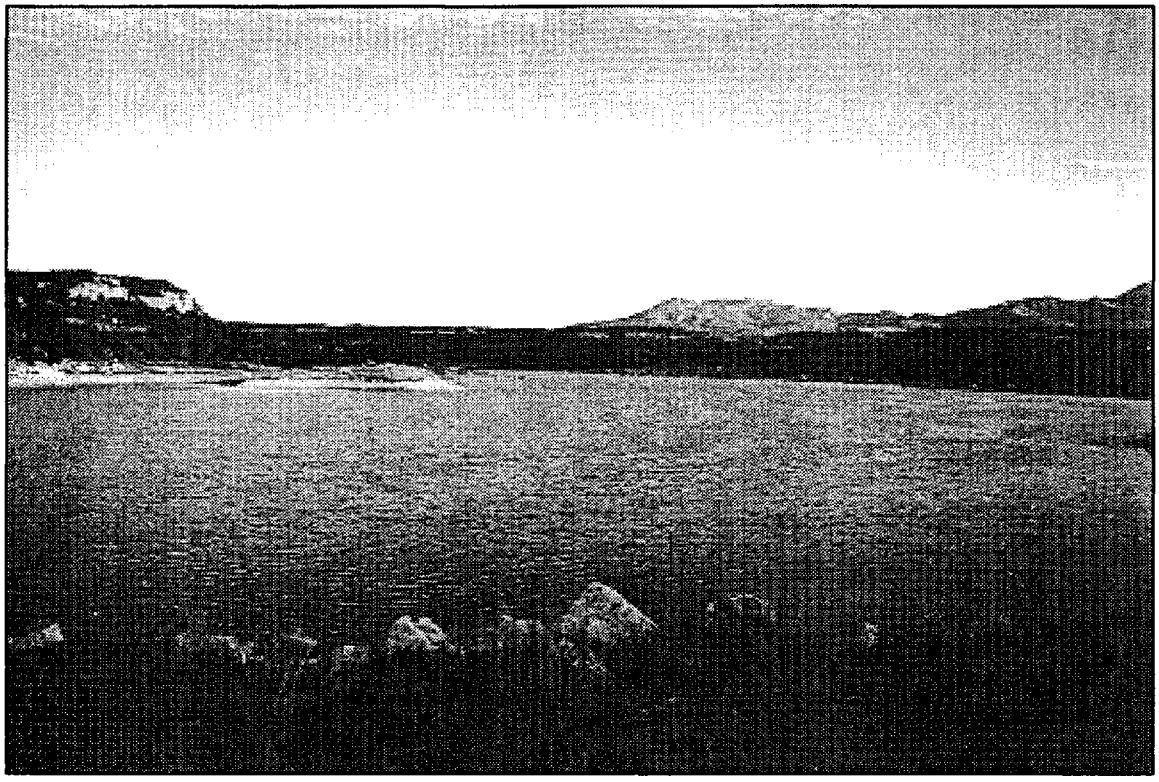
Beneficial Use Classification

The state beneficial use classifications include: culinary water (1C), recreational bathing (swimming) 2A, boating and similar recreation (excluding swimming) (2B), warm water game fish and organisms in their food chain (3B) and agricultural uses (4).

Information

Management Agencies	
Utah Parks and Recreation	538-7722
Quail Creek State Park	879-2378
Bureau of Land Management	539-4001
Dixie Resource Area (St. George)	673-4654
Five County Association of Governments	673-3548
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Color Country Travel Region (St. George)	628-4171
Saint George Area Chamber of Commerce	628-1658
Reservoir Administrators	
Washington County Water Conservation District	673-3617

RECAPTURE LAKE



Introduction

Recapture Reservoir is an impoundment of an ephemeral stream on the south slope of the Abajo Mountains. Twenty-eight million years ago, molten rock pushed up through the horizontal strata of this area of what is now the Colorado Plateau. The lava blistered the horizontal rock strata, and eventually burst through the surface. The area has since been been uplifted and eroded, leaving a rugged mountain range. The high elevations collect much more precipitation than the surrounding lowlands, and the runoff eroded deep stream valleys through the area surrounding the mountains.

Characteristics and Morphometry

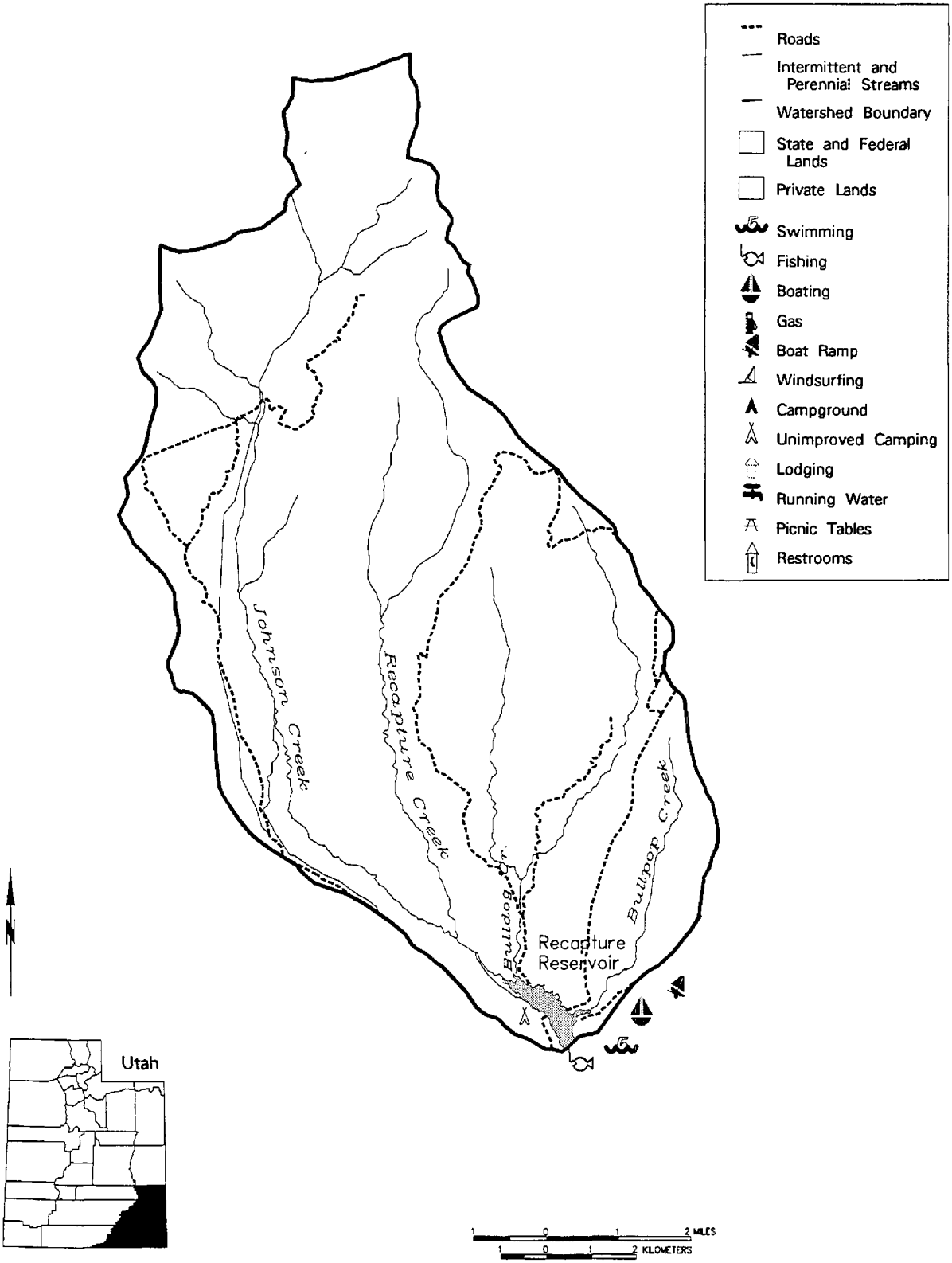
Lake elevation (meters / feet)	1850 / 6068
Surface area (hectares / acres)	107.3 / 265
Watershed area (hectares / acres)	48,155,840 / 39,040
Volume (m^3 / acre-feet)	
capacity	11,494,986 / 9319
conservation pool	0
Annual inflow (m^3 / acre-feet)	8,400,429 / 6,813
Retention time (years)	1.37
Drawdown (m^3 / acre-feet)	8,317,818 / 6,746
Depth (meters / feet)	
maximum	34.4 / 113
mean	10.7 / 35.2
Length (meters / feet)	1,981 / 6,500
Width (meters / feet)	427 / 1,400
Shoreline (meters / feet)	4,328 / 14,200

Location

County	San Juan
Longitude / Latitude	109 26 26 / 37 40 05
USGS Map	Blanding North, Utah (not on map) 1985
Atlas	pg.46,B2
Cataloging Unit	Lower San Juan (14080201)

The Mormon pioneers settled the area in the late 1800's, and diverted water from the mountain streams for irrigation. Recapture Creek was impounded in the early 1980's to retain spring runoff for irrigation during the summer. It is a large reservoir, also known as Recapture Lake.

The reservoir shoreline is 80% publicly owned by the BLM. The west end of the reservoir is on private land. Public access is unrestricted. The impoundment, an earth-



County in which watershed is located.

Recapture Watershed

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fill dam, was built in 1983. Currently, water is consumed entirely for agriculture.

Recreation

Recapture Reservoir is on US-191 about 3 miles north of Blanding and 17 miles South of Monticello. Highway 191 crosses the dam, and unimproved roads lead down to the reservoir.

The reservoir offers swimming, waterskiing, boating, fishing and other forms of water recreation.

The area immediately around the reservoir offers primitive camping. About 4.5 miles north off US-191 is Devil's Canyon Campground, a USFS facility with 32 campsites, drinking water and vault toilets. User fees are charged. There is one private campground in Blanding and several in Monticello.

Watershed Description

Recapture Reservoir is in a wide canyon in the transition zone between the arid lands west of Blanding and the Abajo Mountains, an isolated group of exposed laccoliths. Water from the headwaters of Indian Creek is diverted via a tunnel through the ridgeline of the Abajos into Johnson Creek, a tributary of Recapture Creek.

The watershed high point, the west shoulder of Abajo Peak, is 3443 m (11,295 ft) above sea level, thereby developing a complex slope of 8.6% to the reservoir. The inflows are Recapture Creek, Bulldog Creek and Bullpup Creek. All inflows are ephemeral--flowing only during spring runoff. The outflow is Recapture Creek, but water is only released in wet years when the reservoir reaches capacity. The average stream gradient above the reservoir is 6.7 % (353 feet per mile).

The vegetation communities are comprised of . The watershed receives 30 - 51 cm (12 - 20 inches) of precipitation annually with a frost-free season of 120 - 140 days at the reservoir.

Aside from at least one ranch in the drainage basin, land use is 100% multiple use. The major use of the watershed is livestock grazing.

Limnological Assessment

The water quality of Recapture Reservoir is good. It is considered to be moderately hard with a hardness concentration value of approximately 148 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are total phosphorus and dissolved oxygen. The average concentrations of total phosphorus in the water column only exceeded the recommended pollution indicator for phosphorus of 25 ug/L slightly in 1991. Anoxic conditions have been reported as indicated in the August 7, 1991 profile. Dissolved oxygen concentrations in late summer substantiate the fact that water quality impairments do exist. Concentrations dropped dramatically below the thermocline from a concentration of only approximately 6.0 mg/L to values less than 1 for the majority of the water column. These low concentrations have a definite impact on the fishery present in the reservoir.

The reservoir is characterized as a nitrogen limited system. TSI values indicate the reservoir is mesotrophic. The reservoir was stratified during August, 1991 as indicated in the profile. Stratification usually begins in early June , intensifies in August and turnover sometime in September. The profile indicates that a thermocline developed at a depth of 5 meters. There was a noticeable decline in the concentration of dissolved oxygen in the water column. These conditions are deleterious to the fishery rendered approximately 2/3 of the water column unsuitable for a fishery. Water temperatures during late summer to exceed the indicator for a cold water fishery but only by a degree near the surface for a short period of time.

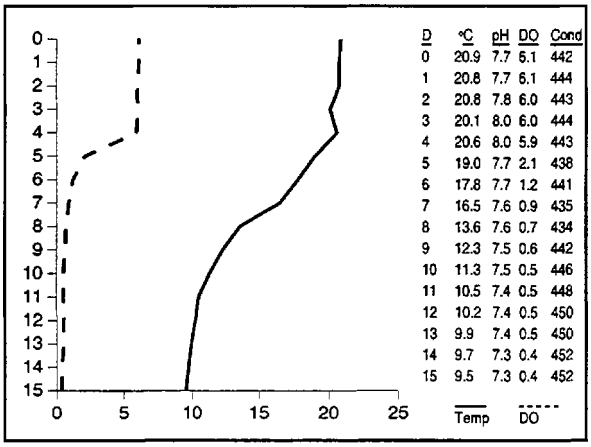
According to DWR no fish kills have been reported in

Limnological Data

Data averaged from STORET sites: 595801, 595802, 595803

Surface Data	1989	1991
Trophic Status	M	M
Chlorophyll TSI	38.83	40.33
Secchi Depth TSI	57.62	58.02
Phosphorous TSI	40.36	49.12
Average TSI	45.60	49.16
Chlorophyll a (ug/L)	2.4	2.9
Transparency (m)	1.3	1.2
Total Phosphorous (ug/L)	13	24
pH	8.1	8.2
Total Susp. Solids (mg/L)	1.5	10
Total Volatile Solids (mg/L)	-	5
Total Residual Solids (mg/L)	-	16
Temperature (°C / °f)	20/67	18/64
Conductivity (umhos.cm)	390	418
Water Column Data		
Ammonia (mg/L)	0.05	0.04
Nitrate/Nitrite (mg/L)	-	0.01
Hardness (mg/L)	140	156
Alkalinity (mg/L)	152	167
Silica (mg/L)	-	6.5
Total Phosphorous (ug/L)	18	27
Miscellaneous Data		
Limiting Nutrient	N	N
DO (Mg/l) at 75% depth	1.3	0.5
Stratification (m)	5-14	4-9
Depth at Deepest Site (m)	24	15

recent years. The reservoir supports populations of brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus* mykiss), and bullheads (*Ictalurus sp.*). The lake was treated for elimination of rough fish in September, 1983 prior to completion of the dam and filling of the impoundment. From careful consideration of limnological conditions recommended a fishery management plan focusing on the establishment of a rainbow trout fishery. Concerns were expressed over the potential for illegal introduction of bass into the reservoir with a plan to educate the public on the benefits of their management plan strategy.



D	°C	pH	DO	Cond
0	20.9	7.7	6.1	442
1	20.8	7.7	6.1	444
2	20.8	7.8	6.0	443
3	20.1	8.0	6.0	444
4	20.6	8.0	5.9	443
5	19.0	7.7	2.1	438
6	17.8	7.7	1.2	441
7	16.5	7.6	0.9	435
8	13.6	7.6	0.7	434
9	12.3	7.5	0.6	442
10	11.3	7.5	0.5	446
11	10.5	7.4	0.5	448
12	10.2	7.4	0.5	450
13	9.9	7.4	0.5	450
14	9.7	7.3	0.4	452
15	9.5	7.3	0.4	452

The DWR stocks the reservoir annually with about 9,000 advanced fingerling rainbow trout. Fingerling brook trout have been stocked in the past.

The reservoir and tributaries were chemically treated by the DWR to control rough fish competition, therefore endemic fish populations of Recapture Creek may not be present.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Sp.	Cell Volume (mm^3/liter)	
Sphaerocystis schroeteri	2.641	97.94
Wislouchiella planktonica	0.022	0.82
Chlamydomonas globosa	0.016	0.56
Ankistrodesmus falcatus	0.013	0.49
Unknown green flagellate	0.004	0.16
Total Algal Cell Volume	2.696	99.99
Shannon-Weaver Index[H']	0.13	
Species Evenness	0.07	
Species Richness	0.23	

The flora dominated by green algae, which indicates a fairly healthy aquatic ecosystem. Algal biomass is not great enough to be a problem.

Pollution Assessment

Nonpoint pollution sources include: sedimentation and nutrient loading from grazing and feed yards; and wastes or litter from recreation. Cattle graze in the watershed and around the reservoir.

There are no point pollution sources in the watershed.

Beneficial Use Classification

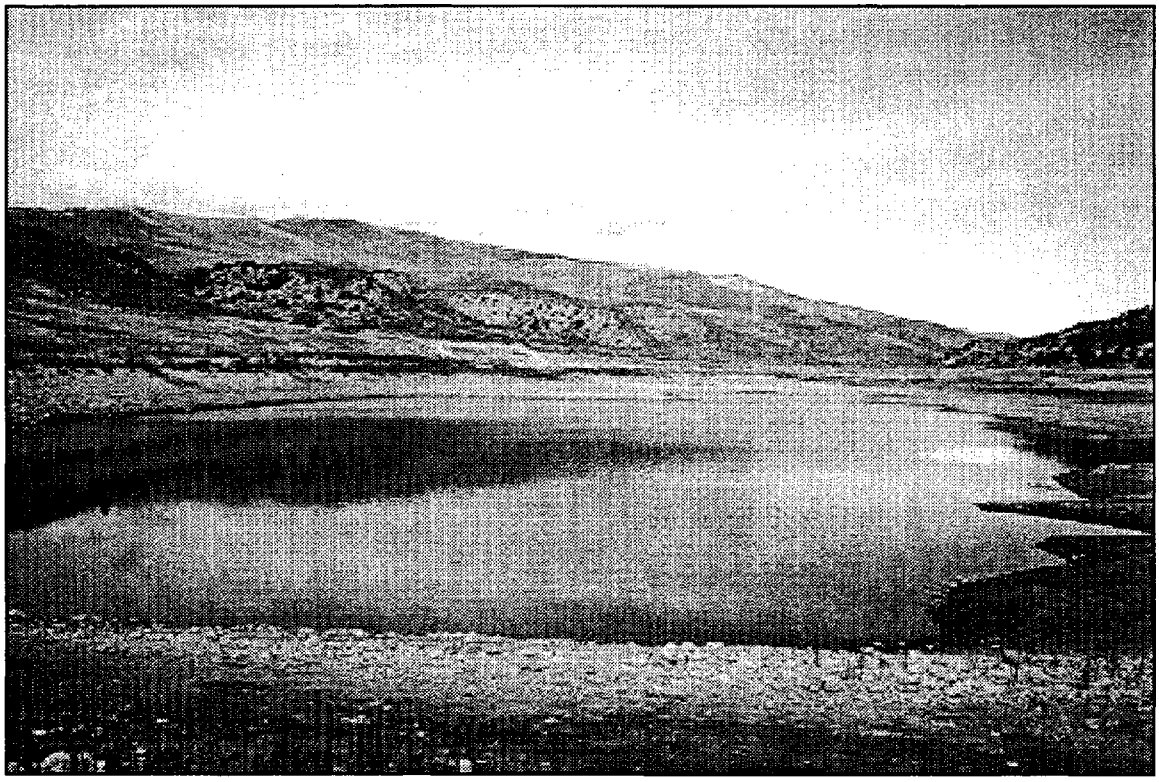
The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Water quality is sufficient to sustain current water use.

Information

Management Agencies	
Bureau of Land Management	539-4001
San Juan Resource Area (Monticello)	587-2141
Southeastern Utah Association of Governments	
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Canyonlands Travel Region (Monticello)	587-2231
Reservoir Administrators	
San Juan County Water Conservation District	678-2596

RED CREEK RESERVOIR (Duchesne County)



Introduction

Red Creek Reservoir is a medium sized reservoir north of Fruitland in the Uinta Basin. It is an impoundment of Red Creek, a tributary to the Strawberry River. It is relatively close to the Wasatch Front and offers summer recreation. Although it is in the heart of the area served by the CUP, it is not part of the project. It should not be confused with another Red Creek Reservoir above Paragonah in Iron County, which is also included in these lake reports. It was created in 1960 by the construction of an earth-fill dam. The dam leaked, so a grout curtain was installed in 1964. The reservoir shoreline is 100% privately owned. In addition to recreation usage, reservoir water is consumed entirely for irrigation No changes are anticipated in the foreseeable future.

Characteristics and Morphometry

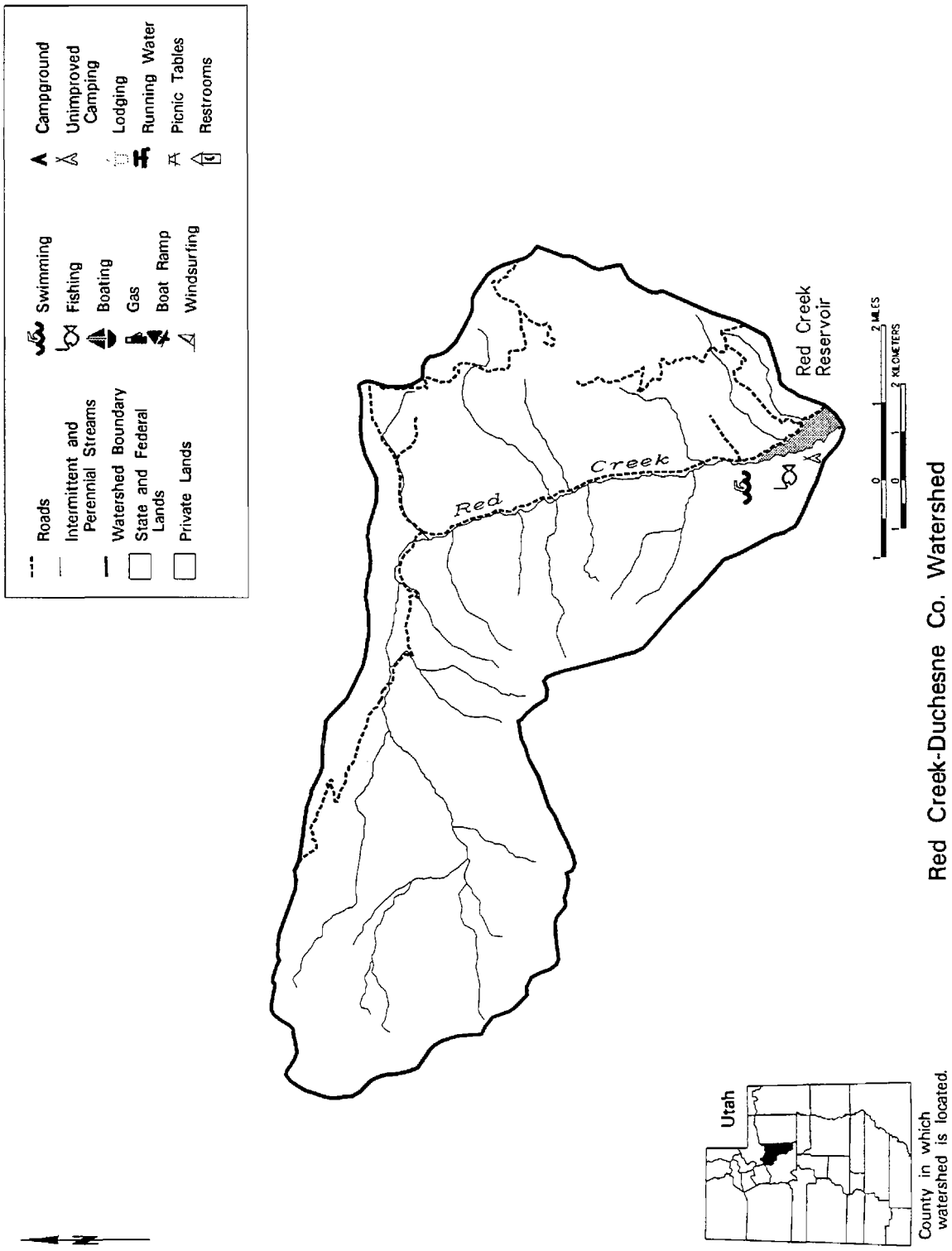
Lake elevation (meters / feet)	2,202 / 7,224
Surface area (hectares / acres)	57.46 / 142
Watershed area (hectares / acres)	10,252 / 25,333
Volume (m^3 / acre-feet)	
capacity	7,030,000 / 5,694
conservation pool	157,888 / 128
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	29 / 95
mean	12.2 / 40.1
Length (meters / feet)	187 / 614
Width (meters / feet)	564 / 1,850
Shoreline (km / miles)	4.66 / 2.89

Location

County	Duchesne
Longitude / Latitude	109 31 52 / 40 30 58
USGS Map	Tabby Mountain, UT 1962
DeLorme's Utah Atlas & Gazetteer™	Page 54, D-3
Cataloging Unit	Strawberry River (14060004)

Recreation

Red Creek Reservoir is easily accessible from US-40 in Fruitland. Turn north on the road across the street from the Fruitland store/gas station and continue for about seven



Red Creek-Duchesne Co. Watershed

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miles. The road essentially terminates at the reservoir.

There are no services at the reservoir, but gas and supplies are available in Fruitland.

The area is entirely private land. You are a guest here, so treat the area with due respect. Any camping should be done such that there is minimal impact to the area.

Watershed Description

Red Creek Reservoir has a moderate size natural watershed. The reservoir is in the rolling hills of the Uinta Basin, but the headwaters of the watershed are in the foothills surrounding the Uinta Mountains. The foothills are hogbacks--ridges formed by inclined strata surrounding the large dome of the Uintas.

The watershed high point is Red Creek Mountain at an elevation of 3,229 meters (10,595 ft) above sea level, thereby developing a complex slope of 6.6% to the reservoir. The average stream gradient for Red Creek is 3.9% (206 feet per mile). The inflows are the Red Creek and Kersha Creek (ephemeral). The outlet is Red Creek. Two miles downstream much of the creek is diverted into an irrigation canal to irrigate crops in Fruitland.

The natural watershed is consists of undulating low mountains, while the diverted watershed is made up of high mountains and glacial valleys.

The vegetation communities consist of spruce-fir, oak-maple, pinyon-juniper, and sagebrush-grass. The watershed receives 41 - 76 cm (16 - 30 inches) of precipitation annually. The frost-free season around the reservoir is 40 - 80 days per year.

Land use is essentially 100% private grazing land and recreation. Summer home development is taking place in the watershed, resulting in increased pollution. This watershed is excluded from the Uinta National Forest, but the boundary is a series of north-south and east-west lines, so some of the forest is in the watershed. This forest land is multiple use.

Limnological Assessment

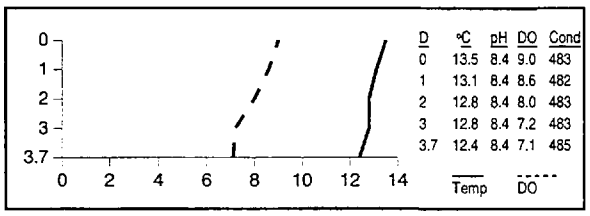
The water quality of Red Creek Reservoir is good. It is considered to be hard with a hardness concentration value of approximately 248 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are total phosphorus and dissolved oxygen. The average concentrations of total phosphorus in the water column for 1992 was 138 ug/L which exceeds the recommended pollution indicator for phosphorus of 25 ug/L. The phosphorus concentration in the hypolimnion averaged 219 ug/L for the same period.

Dissolved oxygen concentrations in late summer substantiate the fact that water quality impairments do exist. As depicted in the September 2, 1992 profile, concentrations ranged from 7.5 to 4.3 mg/L downward in the water column. The reservoir was monitored on March 15, 1991 to determine if anoxic conditions were present under ice coverage. The profile at that time indicates that anoxic conditions were present in the lower portions of the reservoir. With a maximum depth of 11 meters the dissolved oxygen was 3.4 mg/L at a depth of 5 meters with near zero conditions from 8-11 meters. These conditions support the fact that there is a large demand in the hypolimnion at the sediment interface for oxygen indicative of large accumulation of organic material usually from high productivity over an extended period of time.

Limnological Data

Data averaged from STORET site: 593621

Surface Data	1992
Trophic Status	E
Chlorophyll TSI	52.84
Secchi Depth TSI	49.66
Phosphorous TSI	70.70
Average TSI	57.33
Chlorophyll a (ug/L)	9.7
Transparency (m)	2.1
Total Phosphorous (ug/L)	101
pH	8.4
Total Susp. Solids (mg/L)	20.5
Total Volatile Solids (mg/L)	4
Total Residual Solids (mg/L)	17
Temperature (°C / °f)	14/57
Conductivity (umhos.cm)	492
Water Column Data	
Ammonia (mg/L)	0.03
Nitrate/Nitrite (mg/L)	0.07
Hardness (mg/L)	248
Alkalinity (mg/L)	254
Silica (mg/L)	8.9
Total Phosphorous (ug/L)	138
Miscellaneous Data	
Limiting Nutrient	N
DO (Mg/l) at 75% depth	7.4
Stratification (m)	NO
Depth at Deepest Site (m)	3.7



D	°C	pH	DO	Cond
0	13.5	8.4	9.0	483
1	13.1	8.4	8.6	482
2	12.8	8.4	8.0	483
3	12.8	8.4	7.2	483
3.7	12.4	8.4	7.1	485

The 1992 data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is highly eutrophic with relatively high concentrations of phosphorus present. The reservoir has not been stratified during any recent monitoring trips. Even though sufficient depth is available in the reservoir, recent drought conditions and early drawdown due to irrigation requirements has not allowed a thermocline to develop.

According to DWR no fish kills have been reported in recent years. The reservoir supports a populations of rainbow trout (*Oncorhynchus mykiss*). The DWR stocks the reservoir annually with 15,000 fingerling rainbow trout. The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Anabaena spiroides var. Crassa	11.564	92.79
Aphanizomenon flos-aquae	.528	4.24
Pennate Diatoms	.048	0.89
Asterionella formosa	.095	0.76
Oocystis sp.	.053	0.43
Oscillatoria sp.	.048	0.39
Centric diatoms	.036	0.29
Unknown spherical green alga	.028	0.22
Total	87.028	
Shannon-Weaver [H']	0.36	
Species Evenness	0.17	
Species Richness	0.30	

The phytoplankton community is dominated by the presence of blue-green algae species indicative of eutrophic conditions and limited water quality.

Pollution Assessment

Nonpoint pollution sources include the following: sedimentation and nutrient loading from grazing; wastes or litter and from recreation; and sediments from construction associated with the development of summer homes.

Grazing takes place throughout the watershed and along the shores of the reservoir.

There are no point sources of pollution in the watershed.

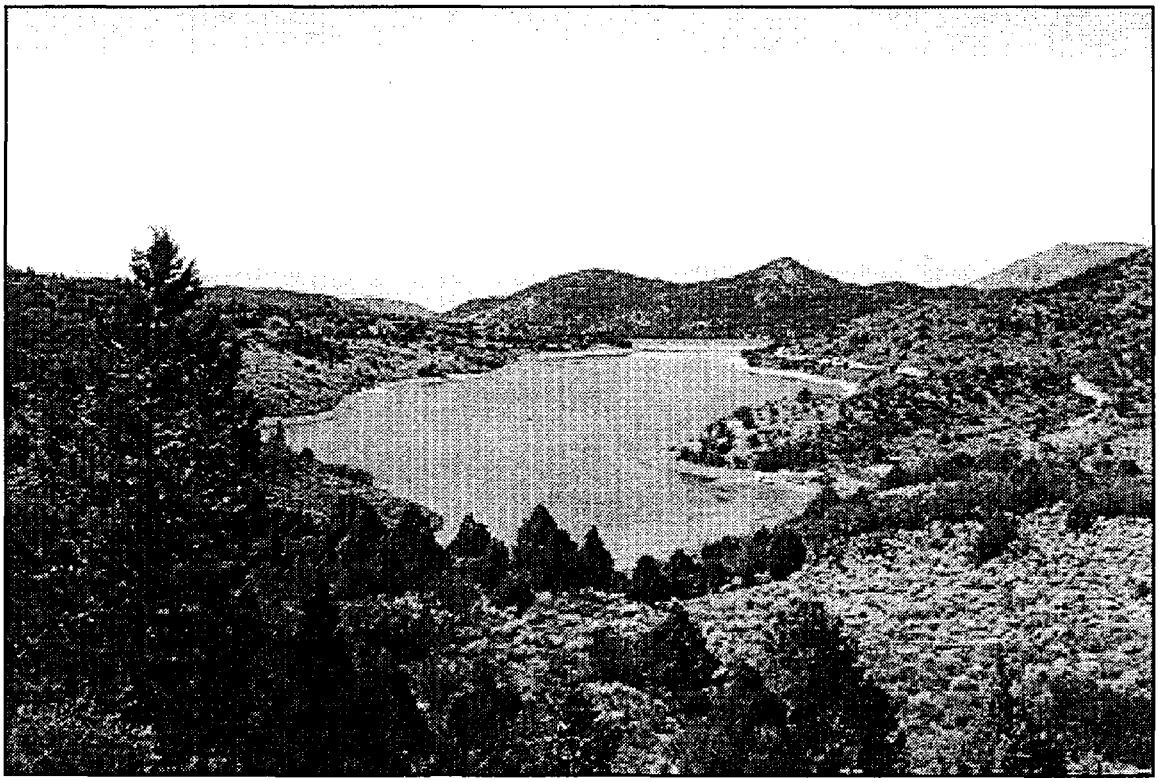
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Dinosaurland Travel Region (Vernal)	789-6932
Fruitland Store	548-2214
Reservoir Administrators	
Red Creek Irrigation Company	548-2317

RED CREEK RESERVOIR (Iron County)



Introduction

Red Creek Reservoir is on the face of the Markagunt Plateau as it drops into Paragonah. It is a small impoundment in a high meadow. There is another reservoir of this name in north of Fruitland in Duchesne County, hence (Iron County) or (Paragonah) is often added as a suffix to the name.

The reservoir shoreline is owned and administered by the Dixie National Forest with unrestricted public access. Defined beneficial uses include: water recreation excluding swimming, propagation of cold water species of game fish and aquatic life, and agricultural needs.

Characteristics and Morphometry

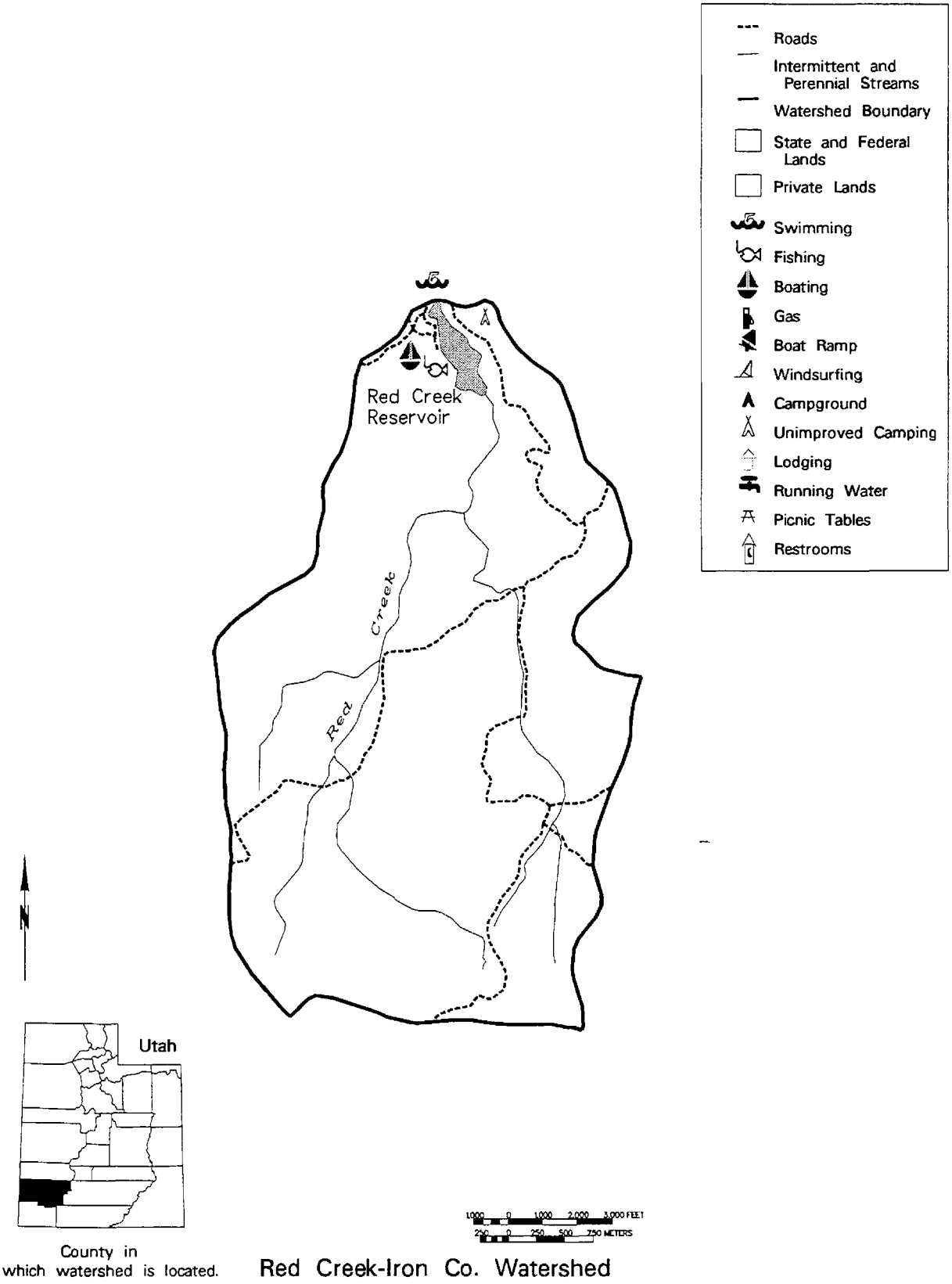
Lake elevation (meters / feet)	2,376 / 7,794
Surface area (hectares / acres)	25 / 62
Watershed area (hectares / acres)	2,074 / 5,120
Volume (m^3 / acre-feet)	
capacity	1,677,880 / 1,360
conservation pool	431,550 / 350
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	1,245,330 / 1,010
Depth (meters / feet)	
maximum	9.5 / 31
mean	6.7 / 22
Length (meters / feet)	1,300 / 4,265
Width (meters / feet)	300 / 984
Shoreline (meters / feet)	3,058 / 10,033

Location

County	Iron
Longitude / Latitude	110 51 13 / 40 18 33
USGS Map	Red Creek Reservoir, Utah, 1971
Cataloging Unit	Cedar City (14060004)

Recreation

Red Creek Reservoir is accessible from FS-078, a gravel road leading up the face of the Markagunt Plateau. Access is easiest from downtown Paragonah, where FS-078 begins, bearing due east. Red Creek Reservoir is 8 miles up Red Creek Canyon from Paragonah. Access is also possible from the north shore of Panguitch Lake, where FS-076 begins and eventually meets the other terminus of FS-



County in which watershed is located.

Red Creek-Iron Co. Watershed

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078. This is a 12 mile route on graded dirt road.

Fishing, boating, and camping are possible in the area. Usage is light.

There are no improved recreational facilities at the reservoir except for restroom facilities. The nearest private or Forest Service campgrounds are at Panguitch Lake. There are no public or private campgrounds in the Paragonah/Parowan area.

Watershed Description

The reservoir is on the Markagunt Platueau, but is several miles north of the steep northwest face, which dwindles into a range of hills. Red Creek Reservoir is an impoundment of a midelevation meadow in mountainous terrain. uplifted by repeated movements of the Hurricane Fault below. Yankee Meadow is on a bench area, above the Pink Cliff formation but below the steep upper face of volcanic rock that caps the plateau.

The watershed high point, is 3,064 m (10,054 ft) above sea level, thereby developing a complex slope of 12.7% to the reservoir. The inflow and outflow is Red Creek, and the average stream gradient above the reservoir is 8.7% (457 feet per mile).

The soil is of volcanic origin with moderate permeability and moderately slow erosion and runoff. A listing of the soil types is in Apprendix III.

The vegetation communities are comprised of pine, aspen, spruce-fir, oak, and maple. The watershed receives 41 - 51 cm (16 - 20 inches) of precipitation annually with a frost-free season of 40 - 60 days at the reservoir.

Limnological Assessment

The water quality of Red Creek Reservoir is fairly good. It is considered to be moderately hard with a hardness concentration value of approximately 181 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are total phosphorus and dissolved oxygen. The average concentrations of total phosphorus in the water column for 1992 was 132 ug/L which exceeds the recommended pollution indicator for phosphorus of 25 ug/L. The phosphorus concentration in the hypolimnion averaged 305 ug/L for the same period. Dissolved oxygen concentrations in early summer substantiate the fact that water quality impairments do exist. Concentrations on June 16, 1992 ranged from 7.2 to 1.7 mg/L downward in the water column. These conditions support the fact that there is a large demand in the hypolimnion at the sediment interface for oxygen indicative of large accumulation of organic material usually from high productiviy over an extended period of time.

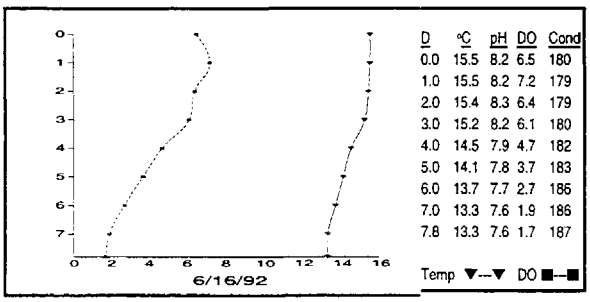
The 1992 data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is moderately eutrophic with relatively high concentrations of phosphorus present. The reservoir has not been stratified during any recent monitoring trips which is indicative of the limited depth and early drawdown due to downstream irrigation needs.

According to DWR no fish kills have been reported in recent years. The reservoir supports a populations of rainbow trout (*Oncorhynchus mykiss*). The DWR stocks the reservoir annually with 2,000 fingerling rainbow trout. The

Limnological Data

Data averaged from STORET site: 594180

Surface Data	1992
Trophic Status	E
Chlorophyll TSI	51.18
Secchi Depth TSI	47.69
Phosphorous TSI	60.56
Average TSI	53.14
Chlorophyll a (ug/L)	8.2
Transparency (m)	2.4
Total Phosphorous (ug/L)	50
pH	8.9
Total Susp. Solids (mg/L)	<5.5
Total Volatile Solids (mg/L)	2
Total Residual Solids (mg/L)	4
Temperature (°C / °f)	18/64
Conductivity (umhos.cm)	169
Water Column Data	
Ammonia (mg/L)	.24
Nitrate/Nitrite (mg/L)	0.038
Hardness (mg/L)	81.1
Alkalinity (mg/L)	84
Silica (mg/L)	22.8
Total Phosphorous (ug/L)	132
Miscellaneous Data	
Limiting Nutrient	N
DO (Mg/l) at 75% depth	7.4
Stratification (m)	NO
Depth at Deepest Site (m)	3.7



lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Gloetrichia echinulata	55.600	63.88
Stephanodiscus niagarae	23.663	27.19
Anabaena spiroides var. crassa	2.891	3.32
Sphaerocystis schroeteri	2.641	3.03
Microcystis aeruginosa	1.101	1.26
Melosira granulata	1.090	1.25
Oocystis sp.	0.025	0.03
Pennate diatoms	0.012	0.01
Centric diatoms	0.007	0.01
Haematococcus sp.	0.003	0.00
Total	87.026	
Shannon-Weaver [H']	0.97	
Species Evenness	0.42	
Species Richness	0.36	

The phytoplankton commnunity is dominated by the presence of blue-green algae and diatoms indicative of eutrophic conditions and limited water quality.

Pollution Assessment

Nonpoint pollution sources include: sedimentation and nutrient loading from grazing and wastes or litter from recreation. Cattle graze in the watershed, around the reservoir and even in the reservoir in late summer when the macrophytes emerge near the shoreline..

There are no point pollution sources in the watershed.

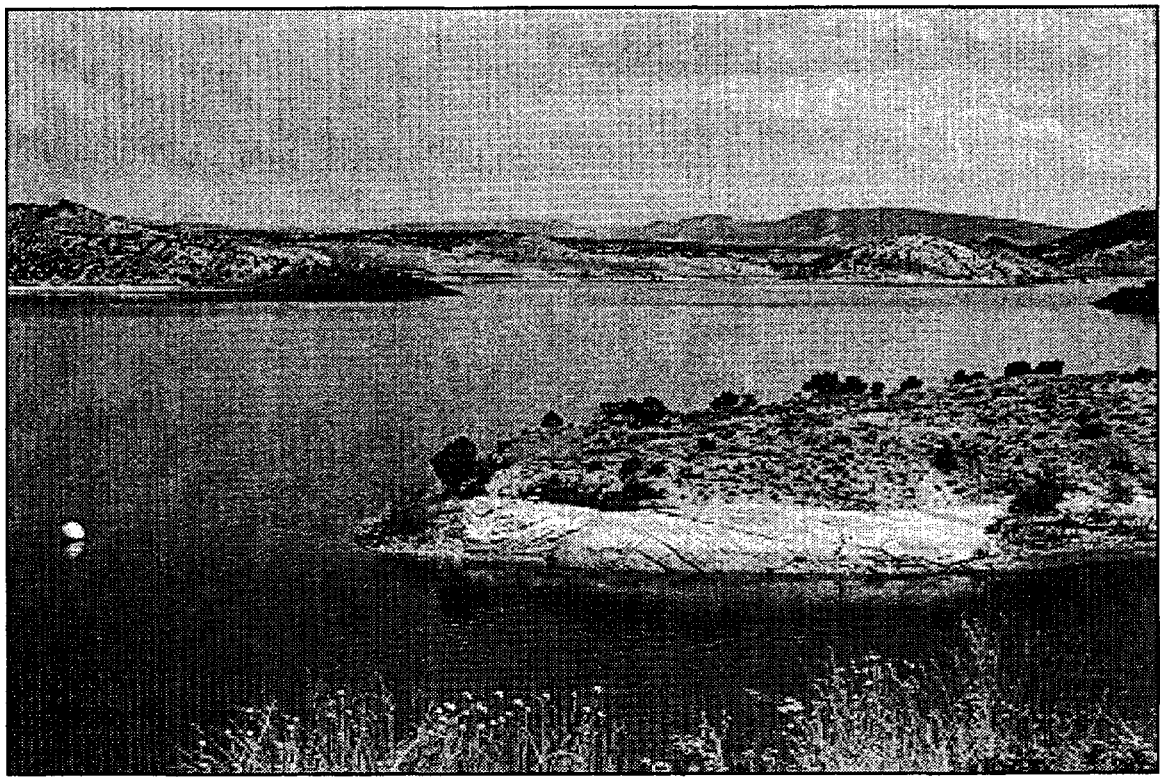
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Dixie National Forest Ranger District	586-2421
Five County Association of Governments	
Division of Wildlife Resources	896-6666
Division of Water Quality	538-6146

RED FLEET RESERVOIR



Introduction

Red Fleet Reservoir is a large reservoir at the base of the Uinta Mountains in Eastern Utah. It was built in the early 1980's with federal funds to relieve the residents of Ashley Valley of the cost of storing their own water. It has a state park with full recreational facilities. The reservoir is named for the Navajo Sandstone buttes surrounding the reservoir that look like a fleet of ships. It is also called Tyzack Reservoir. Red Fleet Reservoir was created in 1980 by the construction of an earth-fill dam. It reached full capacity for the first time in 1983. The shoreline is owned by the State of Utah, and public access is unrestricted. Consumptive water uses are irrigation (70%) and culinary (30%). Nonconsumptive uses are recreation and habitat for both aquatic and riparian life. Water use is not expected to change in the foreseeable future.

Characteristics and Morphometry

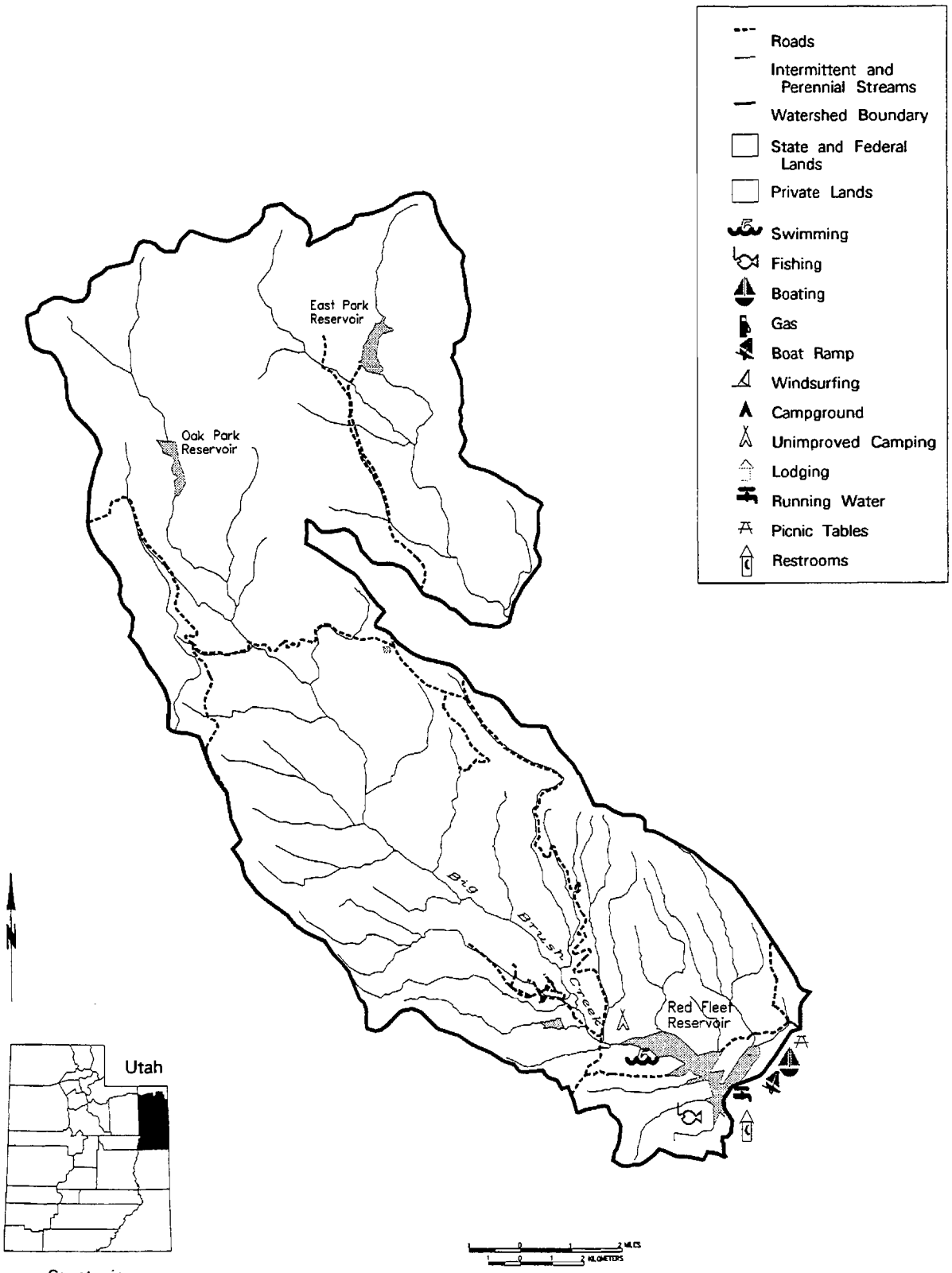
Lake elevation (meters / feet)	1,710 / 5,608
Surface area (hectares / acres)	2,100 / 520
Watershed area (hectares / acres)	32,552 / 80,434
Volume (m^3 / acre-feet)	
capacity	32,082,660 / 26,020
conservation pool	4,932,000 / 4,000
Annual inflow (m^3 / acre-feet)	3.29×10^7 / 26,670
Retention time (years)	1
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	44 / 145
mean	15 / 50
Length (kilometers/ miles)	2.7 / 1.7
Width (kilometers / miles)	1.0 / 0.6
Shoreline (kilometers / miles)	24.7 / 15.4

Location

County	Uinta
Longitude / Latitude	109 25 19 / 40 34 31
USGS Map	Donkey Flat 1965
DeLorme's Utah Atlas & Gazetteer™	Pg 56, C-3, Pg 57, C-4
Cataloging Unit	Ashley-Brush Creeks (16060002)

Recreation

Red Fleet Reservoir is accessible from US-191 (formerly U-44) between Flaming Gorge and Vernal. Travel



Red Fleet Watershed

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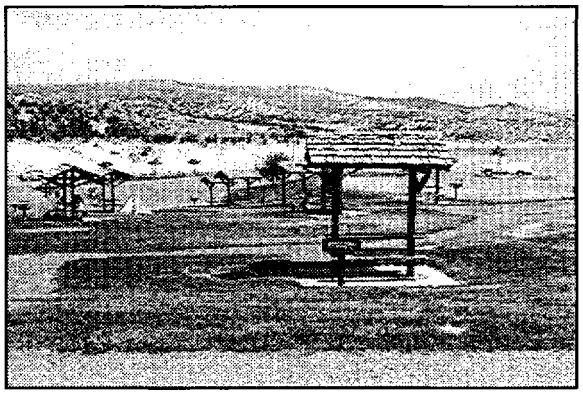
north of Vernal for about nine miles to the road to the reservoir, and go west on this road for about two miles. A boat launch area is on the right on a gravel road shortly after turning off US-191, but the main park facility is further east. Usage fees are charged for use of all park facilities. The route to the park is well marked.

Fishing, boating, swimming, camping, jet skiing, picnicking, hiking, and water skiing are all popular. The fleet of sandstone buttes provide a beautiful backdrop to the blue water of the reservoir.

Recreational facilities are well developed at Red Fleet State Park. There are 29 campsites, a swimming beach, a picnic table, a concrete boat ramp, modern rest rooms, sewage disposal, and a fish cleaning station. Because the reservoir and park are relatively new, relatively few recreationalists are familiar with it. In 1992, 30,238 people visited the park, ranging from 342 in February to 6,286 in July. At present, the park receives considerably less use than nearby Steinaker State Park, but attendance figures are expected to equilibrate as recreationalists become better acquainted with this park.



There is another state park at Steinaker Reservoir, USFS campgrounds north of the Steinaker along US-191, and private campgrounds nearby in Vernal (see info box).

Watershed Description

Red Fleet Reservoir is an impoundment of Big Brush Creek at the edge of the Uinta Mountains. The dam was built where Big Brush Creek cuts through hogback ridges of the sedimentary strata that were steeply uplifted as the Uinta Mountains bulged upwards. The resistant strata are ideal for dam construction, because only a small notch needs to be filled to flood a large area. Red Fleet Dam as well as Steinaker Dam are built in such notches. Navajo Sandstone is the layer exposed at the upstream half of the reservoir resulting in lakeside topography that is similar to Lake Powell. The reservoir is in dry, relatively low elevation desert. Sagebrush and other desert vegetation surround the reservoir, while just a few miles away (but 4,000 feet higher) the coniferous forests of the Uintas begin.

The large, natural watershed originates above Oak Park Reservoir in the Uinta Mountains. This is an area of heavily forested mountains, with the Precambrian rocks underlying the soil. As Big Brush Creek flows down from Oak Park, it reaches younger softer sedimentary rocks, into which it has eroded a deep gorge. The creek disappears into the bedrock at one point, reappearing as numerous springs lower in the watershed. Little Brush Creek also flows into Big Brush Gorge by the same means.

The deepest portion of the gorge is the near vertical-walled section in Weber Sandstone. The gorge ends at the Potash mile at the US-191 crossing, then slices through the strike valleys where Red Fleet Reservoir has impounds the stream. The drainage also includes segments of the strike valleys east and west of the reservoir.

The watershed high point, Trout Peak, two miles east of Trout Creek Peak, is 3,240 m (10,629 ft) above sea level, thereby developing a complex slope of 4.8% to the reservoir. The average stream gradient in the Big Brush Creek is 3.8% (201 feet per mile). The outflow is Big Brush Creek, but a pumping station immediately below the dam transfers water into a pipeline to Ashley Creek, providing irrigation and culinary water to Ashley Valley.

The watershed is made up of high mountains, foothills, plateaus, badlands and valleys. The soil associations that compose the watershed have not been determined by the Division of Water Quality.

The vegetation communities consist of pine, spruce-fir, oak-maple, pinyon-juniper, saltbrush, shadscale, greasewood and sagebrush-grass. The watershed receives 25 - 64 cm (10 - 25 inches) of precipitation annually. The frost-free season around the reservoir is 120 - 140 days per year.

Land use is private grazing land at lower elevations, multiple use on USFS and BLM land, and intensive recreation in the area immediately around the reservoir and at Oaks Park Reservoir. The Potash mine occupies several square miles immediately above the reservoir.

Limnological Assessment

The water quality of Red Fleet Reservoir is very good. It is considered to be moderately hard with a hardness concentration value of approximately 128 mg/L ($CaCO_3$). Although there are no overall water column concentrations that exceed State water quality standards there are reported violations of parameters near the bottom of the lake. These parameters include phosphorus, dissolved oxygen and temperature. Although it is evident that the average water column concentration of total phosphorus has never

Limnological Data

Data sampled from STORET site: 593766, 593773, 593765.

Surface Data	1989	1990	1991	1992
Trophic Status	M	M	M	O
Chlorophyll TSI	38.95	-	40.16	33.52
Secchi Depth TSI	48.14	45.69	49.16	51.77
Phosphorous TSI	40.62	38.73	39.16	27.36
Average TSI	42.57	42.21	42.83	37.55
Chlorophyll a (ug/L)	2.2	-	2.9	1.6
Transparency (m)	2.2	2.7	2.5	1.9
Total Phosphorous (ug/L)	13	11	11	6
pH	8.7	8.3	8.3	8.4
Total Susp. Solids (mg/L)	1.5	1.5	3	3
Total Volatile Solids (mg/L)	-	-	3	-
Total Residual Solids (mg/L)	-	-	13	-
Temperature (°C / °f)	20/69	20/68	20/68	20/68
Conductivity (umhos.cm)	309	311	257	223
Water Column Data				
Ammonia (mg/L)	.02	.03	.04	.03
Nitrate/Nitrite (mg/L)	-	0.11	.04	.06
Hardness (mg/L)	146	-	134	105
Alkalinity (mg/L)	101	95	87	79
Silica (mg/L)	-	-	2.9	-
Total Phosphorous (ug/L)	15	14	16	12
Miscellaneous Data				
Limiting Nutrient	N	N	P	P
DO (Mg/l) at 75% depth	2.5	1.6	3.4	4.6
Stratification (m)	10-12	NO	6-7	4-6
Depth at Deepest Site (m)	22.2	16	26	8

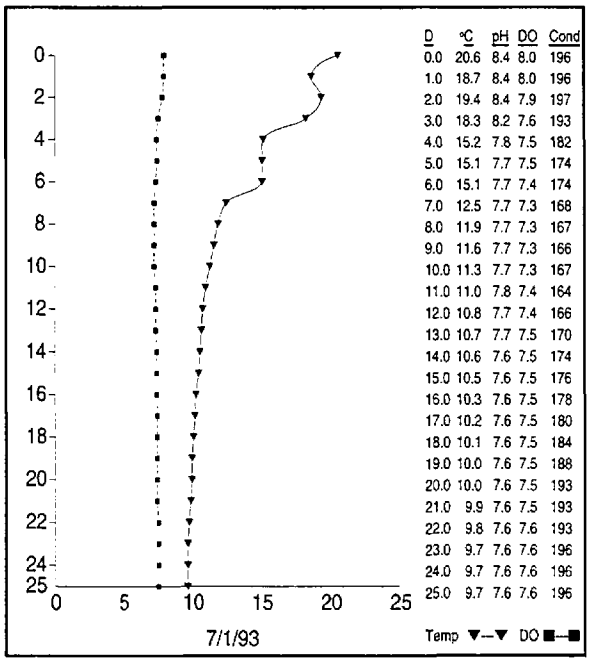
exceeded the State pollution indicator criteria of 25 ug/L, on occasion values have been reported in excess at various depths in the water column. There are no indications that nutrient concentrations are a problem in the reservoir. Dissolved oxygen deficiencies occur later in the year after the reservoir has stratified. It is not uncommon to oxygen limited condition in the bottom 7 meters of the water column. On occasion dissolved oxygen depletions have been more extensive but not as a regular occurrence. Late in the summer it is common for the temperature in the epilimnion to exceed the criteria for a cold-water fishery. The increase in water temperatures near the surface and the decrease in dissolved oxygen in the lower depths of the reservoir can lead to a situation where the fish are squeezed into a region in the middle of the reservoir. This area may become reduced enough to impact the current fishery present in the reservoir.

Current data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is borderline oligotrophic-mesotrophic in a state of low productivity. The reservoir does stratify as indicated in the July 1, 1993 profile. As the season progresses the stratification becomes stronger and more pronounced.

According to DWR no fish kills have been reported in recent years. The reservoir supports a population of rainbow trout (*Oncorhynchus mykiss*), largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), brown trout (*Salmo trutta*), flannelmouth sucker (*Catostomus latipinnis*) and mountain sucker (*Catostomus platyrhinchus*). The largemouth bass and bluegill were illegally stocked soon after the reservoir was built, and have caused a substantial decline in trout populations. The DWR has considered treating the reservoir to eliminate the bass, but apparently has not done it yet. In addition to other native populations of Brush Creek, brook trout are occasionally found in the reservoir.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm³/liter)	% Density By Volume
Desmidium sp.	0.278	50.56
Dinobryon divergens	0.146	26.70
Aphanizomenon flos-aquae	0.105	19.21
Harpochytrium sp.	0.008	1.52
Pennate diatoms	0.007	1.21
Ankistrodesmus falcatus	0.004	0.79
Total	00.548	
Shannon-Weaver [H']	1.17	



Species Evenness	0.65
Species Richness	0.25

The phytoplankton commnunity is dominated by the presence of desmids and flagellates and some blue-green algae that are capable of fixing nitrogen in a nutrient limited system.

Pollution Assessment

Nonpoint pollution sources include grazing, logging, recreation, and mining.

Grazing takes place throughout the watershed, but not in the vicinity of the reservoir.

Some of the heaviest logging in Utah takes place in this watershed, with large timber sales in the Oaks Park and East Park areas. Much of the watershed has been logged in fairly recent history, and the forest has only begun to recover. Large meadows have replaced thick forests.

Vernal Phosphate is a large mining operation along Big Brush Creek west of US-191. It practices careful revegetation of disturbed areas and has a large settling pond to remove solids from runoff. Nonetheless, heavy rains can wash substantial amounts of sediment from the watershed into the reservoir.

There are no point sources of pollution in the watershed.

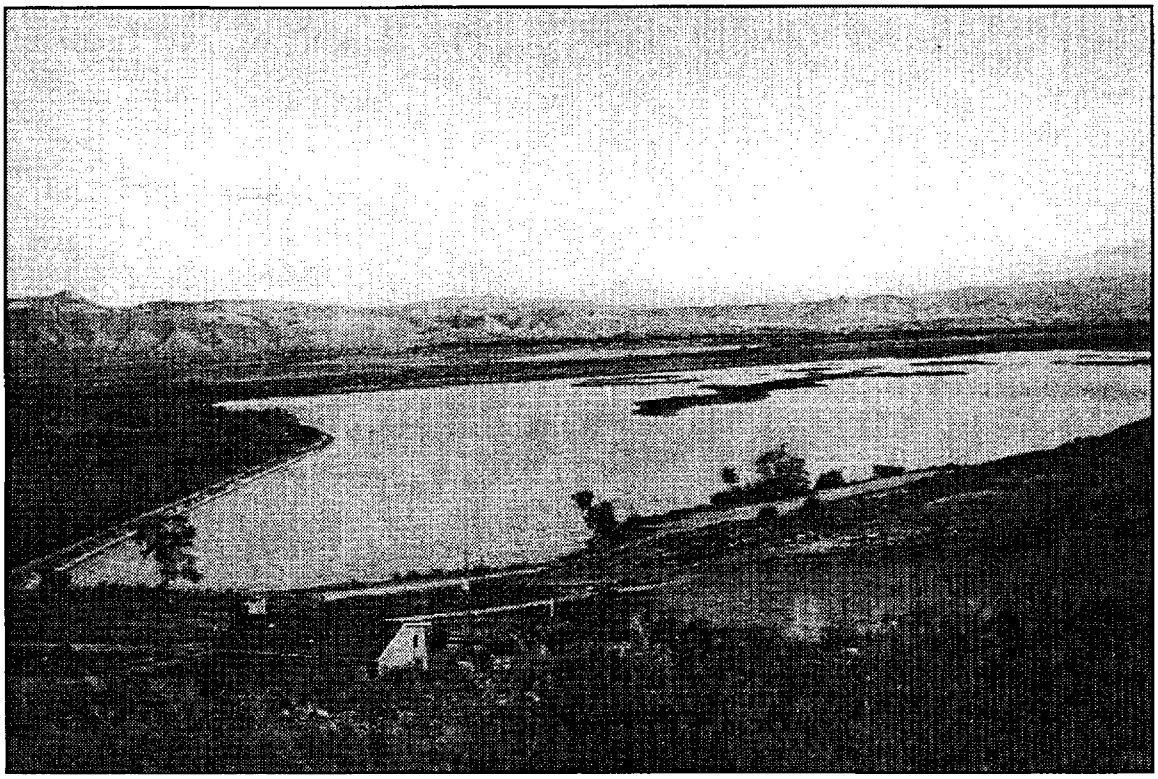
Beneficial Use Classification

The state beneficial use classifications include: culinary water (1C), recreation bathing (swimming) 2A, boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Dinosaurland Travel Region (Vernal)	789-6932
Vernal Chamber of Commerce	789-1352
Red Fleet State Park	789-4432
Mammoth R.V. Park (Vernal)	789-9309
Campground Dina (Vernal)	789-2148
Reservoir Administrators	
Department of the Interior	524-5436
CUP	226-7100

REDMOND LAKE



Introduction

Redmond Lake is a moderately large, spring-fed reservoir in the town of Redmond. Beyond being a warm water fishery, its shallow, turbid water does not support extensive recreational use.

Redmond Lake was created by the development of an earth-fill dam. The reservoir shoreline is privately owned by the Redmond Irrigation Company, but public access is unrestricted. Water use is for irrigation and recreation. Water use is not expected to change in the foreseeable future.

Characteristics and Morphometry

Lake elevation (meters / feet)	1,557 / 5,110
Surface area (hectares / acres)	65 / 160
Watershed area (hectares / acres)	388 / 959
Volume (m^3 / acre-feet)	
capacity	1,480,202 / 1,200
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	3 / 10
mean	1.5 / 5
Length (meters / feet)	1,540 / 5,053
Width (meters / feet)	772 / 2,533
Shoreline (km / miles)	4.5 / 2.8

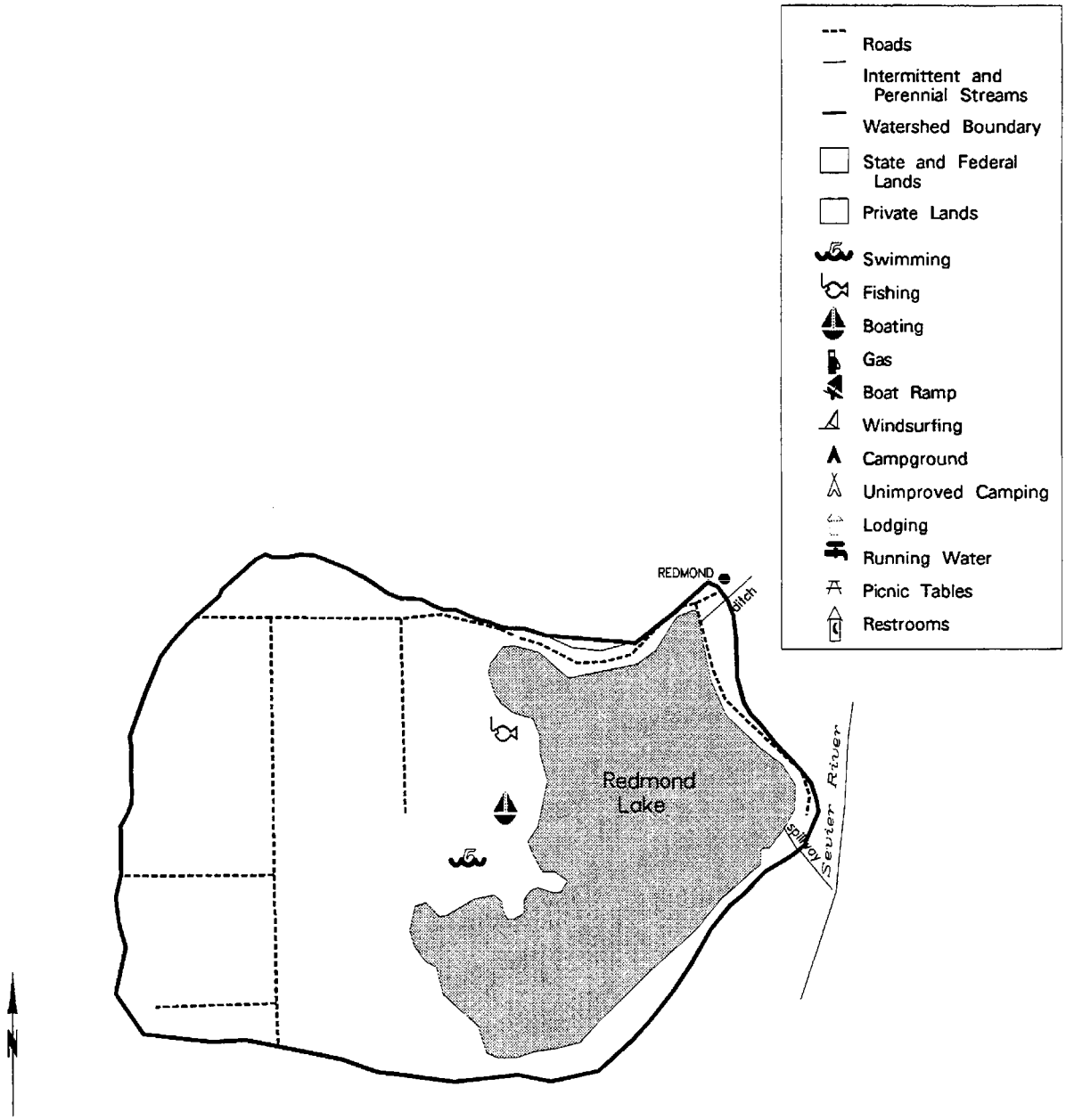
Location

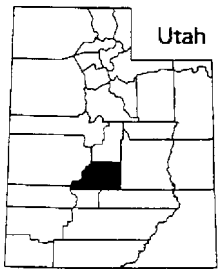
County	Sevier
Longitude / Latitude	111 52 01 / 38 59 09
USGS Maps	Salina 1966 and others
DeLorme's Utah Atlas & Gazetteer™	Page 37, C-5
Cataloging Unit	Middle Sevier (16030003)

Recreation

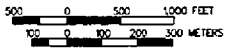
Redmond Lake is accessible from U-256 (Old US-89) in Redmond. The current US-89 route bypasses Redmond, so several miles north or south of town, turn onto U-256 leading to Redmond. The lake is about a quarter mile southwest of town.

There are no recreational facilities at the lake but it is feasible to launch a small boat on the northern side.





County in which watershed is located.



Redmond Watershed

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Watershed Description

Redmond Lake is fed by springs. Water is impounded throughout the year for irrigational use in the summer. No water comes from the Sevier River or any other stream. The reservoir does have a small watershed, however, which is relatively flat and serves as an intensive agricultural area.

The vegetation communities consist of Sage-grass and cropland. The watershed receives 25 cm (10 inches) of precipitation annually. The frost-free season around the reservoir is 100 - 120 days per year.

Land use is 100% intensive agriculture.

Limnological Assessment

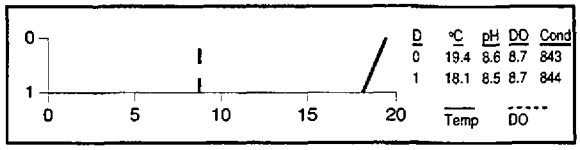
The water quality of Redmond Reservoir is fair. It is considered to be hard with a hardness concentration value of approximately 264 mg/L ($CaCO_3$). The parameter that has exceeded State water quality standards for defined beneficial uses is primarily total phosphorus. The average concentrations of total phosphorus in the water column for the three study periods were 60, 111 and 209 ug/L which all exceed the recommended pollution indicator for phosphorus of 25 ug/L. The phosphorus concentration near the surface on September 8, 1992 reached a level of 322 ug/L. It appears from a review of the data that the concentration of nutrients in the reservoir is increasing over time. This increased concentration may be due to an increase in agricultural activities in direct proximity to the reservoir.

The existing data suggest that the reservoir is currently a nitrogen limited system. There is a relatively high abundance of nutrients and the limiting factor is probably turbidity due to the shallow nature of the lake. Transparency is extremely low and in large part due to the resuspension of sediments which inhibit the transmission of light essential for plant growth. TSI values indicate the reservoir is in a state of hypereutrophism. The reservoir does not stratify due to its shallow nature as indicated in the September 8, 1992 profile..

Limnological Data

Data sampled from STORET site: 594395

Surface Data	1981	1990	1992
Trophic Status	E	H	H
Chlorophyll TSI	-	55.38	53.94
Secchi Depth TSI	51.57	77.35	89.96
Phosphorous TSI	60.56	73.31	81.19
Average TSI	56.06	68.68	75.03
Chlorophyll a (ug/L)	-	12.5	10.8
Transparency (m)	-	0.3	0.1
Total Phosphorous (ug/L)	50	121	209
pH	-	8.5	8.4
Total Susp. Solids (mg/L)	60	83.5	162.5
Total Volatile Solids (mg/L)	-	-	18
Total Residual Solids (mg/L)	-	-	144
Temperature (°C / °f)	-	23/73	18/64
Conductivity (umhos.cm)	-	888	901
Water Column Data			
Ammonia (mg/L)	0.05	0.06	0.07
Nitrate/Nitrite (mg/L)	0.60	-	0.34
Hardness (mg/L)	288	249.6	245
Alkalinity (mg/L)	200	193	197
Silica (mg/L)	-	-	37.9
Total Phosphorous (ug/L)	60	111	209
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	-	7.3	8.7
Stratification (m)	-	NO	NO
Depth at Deepest Site (m)	-	1	1



According to DWR no fish kills have been reported in recent years. The lake was treated for rough fish competition in 1968, so populations of native fishes may not be present in the lake. According to DWR records, Redmond Lake has been stocked with northern pike (*Esox lucius*), largemouth bass (*Micropterus salmoides*), centrarchids, and channel catfish (*Ictalurus punctatus*). Populations of black bullhead (*Ictalurus melas*), carp (*Cyprinus carpio*), and yellow perch (*Perca flavescens*) also occur. Lake invertebrates are numerous and varied. Dragonflies (*Anax libellula*), snails (*Physa*), leeches (*Hirudinea*) and many other insects larva are present. Macrophyte growth is moderate and composed mainly of emergent tamaracks, bulrushes, and cattails.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Pennate diatoms	14.078	97.04
Centric diatoms	0.249	1.72
Phacus sp.	0.056	0.38
Oocystis sp.	0.053	0.37
Unknown spherical green alga	0.033	0.23
Scenedesmus sp.	0.017	0.11
Chlamydomonas sp.	0.017	0.11
Wislouchiella planktonica	0.004	0.03

Total	14.507
Shannon-Weaver [H']	0.17
Species Evenness	0.08
Species Richness	0.30

Pollution Assessment

Nonpoint pollution sources are primarily associated with intensive agriculture in direct proximity to the reservoir. There is grazing of cattle in direct proximity to the reservoir in addition to feedlots which drain downhill to the reservoir.

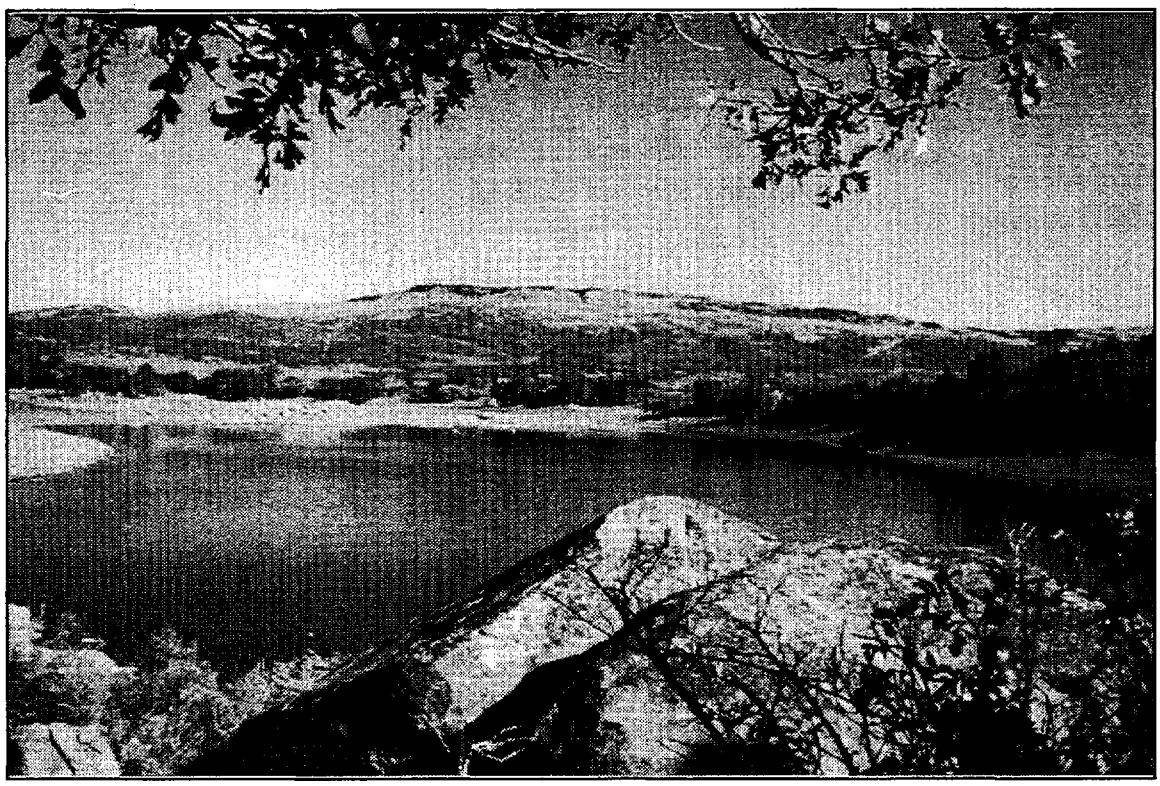
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), warm water game fish and organisms in their food chain (3B) and agricultural uses (4).

Information

Management Agencies	
Six County Commissioners Association	896-9222
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Panoramaland Travel Region (Richfield)	896-9222
Reservoir Administrators	
Redmond Irrigation Company	

REX RESERVOIR



Introduction

Rex Reservoir is southeast of Salina on the Fishlake Plateau. It is a small, moderate depth impoundment in a mid-elevation meadow. It is nestled in an area of low rolling hills amidst the oak, pinyon, and juniper trees.

The reservoir shoreline is publicly owned and administered by the Fish Lake National Forest with unrestricted public access. Defined beneficial uses include: water recreation excluding swimming, propagation of cold water species of game fish and aquatic life, and agricultural needs.

Characteristics and Morphometry

Lake elevation (meters / feet)	2,210 / 7,250
Surface area (hectares / acres)	18.6 / 46
Watershed area (hectares / acres)	8,185 / 20,224
Volume (m^3 / acre-feet)	
capacity	1,202,663 / 975
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	11.6 / 38
mean	6.4 / 21
Length (meters / feet)	628 / 2,059
Width (meters / feet)	209 / 686
Shoreline (meters / feet)	1,703 / 5,590

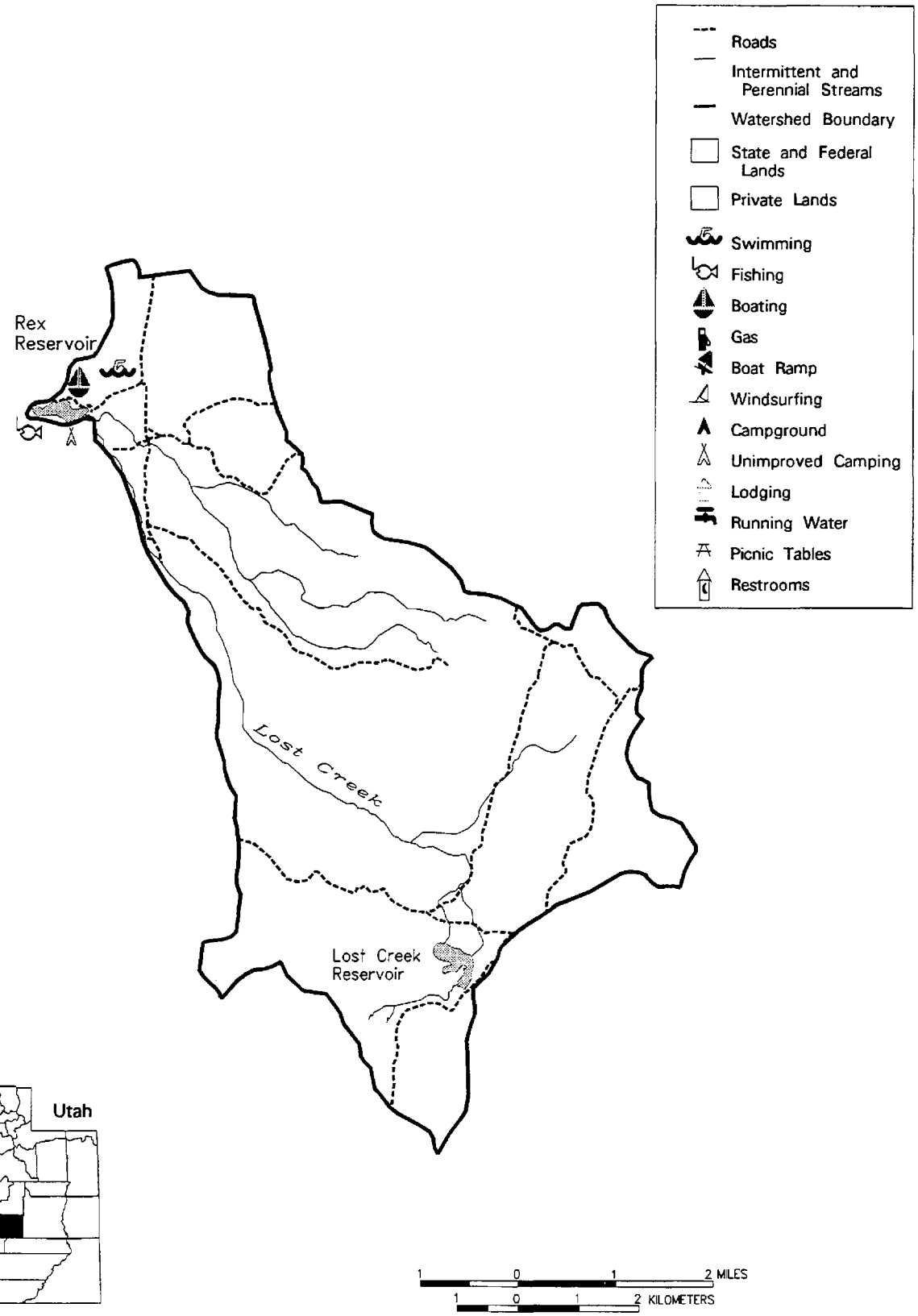
Recreation

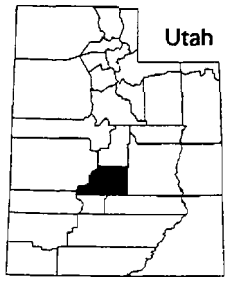
Rex Reservoir is on FS-050 and FS-053, accessible from I-70 in Salina Canyon and U-24 south of Sigurd. Exit I-70 at Gooseberry Valley (Exit 81, 7 miles east of Salina) and travel south on FS-640, a paved road. About 4 miles south of I-70, leave the paved road, turning right on FS-037 .5 miles later, turn left on FS-050 and follow it for 8 miles to Rex Reservoir.

From U-24, travel south from Sigurd past the junction with U-119. Approximately 9 miles further south is the first of two exits to the east that will lead to FS-053. Travel north and east for about 1 mile where the road forks. Take the north fork, FS-056, and travel another 2 miles. There is a sign directing your travel to the reservoir from this point.

Location

County	Sevier
Longitude / Latitude	111 46 30 / 38 47 04
USGS Map	Rex Reservoir, Utah, 1966
DeLorme's Utah Atlas and Gazetteer™	Page 37, D-5
Cataloging Unit	Sevier River (16030003)





County in which watershed is located.

Rex Watershed

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The road proceeds to the north and unites again with FS-053. The distance to the reservoir is approximately 5 miles. Fishing, boating, and camping are possible in the area. Usage is light.

There are no recreational facilities at the reservoir, although the area offers itself to primitive camping. There are no Forest Service Campgrounds in the area, and the nearest private campgrounds are in Salina.

Watershed Description

The reservoir is in an area of rolling ridges and valleys characteristic of west Fishlake Plateau. The watershed high point, the northwest shoulder of Mount Terrill, is 3,476 m (11,404 ft) above sea level, thereby developing a complex slope of 10.3% to the reservoir. The reservoir is adjacent to and receives water from, but does not impound Lost Creek. The average stream gradient above the reservoir is 4.9% (259 feet per mile). Lost Creek Reservoir is 9.5 miles upstream on Lost Creek.

The soil is largely of volcanic origin with moderate permeability and moderately slow erosion and runoff.

The vegetation communities are comprised of pine, aspen, spruce-fir, sage-grass, pinion juniper, oak and maple. The watershed receives 38 - 51 cm (15 - 20 inches) of precipitation annually with a frost-free season of 80 - 100 days at the reservoir.

Limnological Assessment

The water quality of Browne Reservoir is good. It is considered to be moderately hard with a hardness concentration value of approximately 123 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are total phosphorus, dissolved oxygen and temperature. The average concentrations of total phosphorus in the water column for 1992 was 56 ug/L which exceeds the recommended pollution indicator for phosphorus of 25 ug/L. This occurred primarily because in late summer anoxic conditions developed in the bottom of the reservoir and the total phosphorus concentration jumped to 262 ug/L. The remainder of the water column readings were well below the indicator value. It does appear that sufficient organic matter has accumulated in the sediments and is exerting a demand on the dissolved oxygen present in the system. These conditions are evident from the August 4, 1992 profile. Loss of dissolved oxygen can be a late season problem as the reservoir is drawn down and a heavy algal bloom were to develop. A large bloom of algae would require the consumption of dissolved oxygen which could leave the water column in a critical state for the existing fishery. Temperatures are only beginning to exceed the criteria (20°C) near the surface as indicated in the profile.

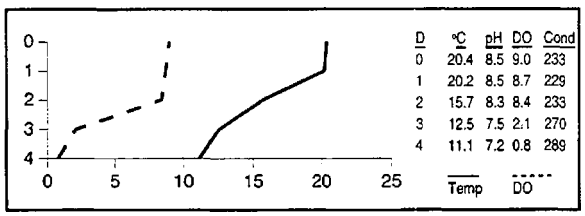
It is apparent that the reservoir does not stratify due to the shallow conditions and early withdrawal to meet irrigations needs downstream. The reservoir is characterized as a nitrogen limited system with TSI values indicating that the reservoir is mesotrophic.

According to DWR no fish kills have been reported in recent years. The reservoir has been treated for the control of rough fish in 1957, 1970 and 1978. It is managed primarily as a rainbow trout (*Oncorhynchus mykiss*) fishery with the DWR stocking 4,000 fingerling trout each year.

Limnological Data

Data sampled from STORET site: 594410

Surface Data	1992
Trophic Status	M
Chlorophyll TSI	46.09
Secchi Depth TSI	50.75
Phosphorous TSI	40.57
Average TSI	45.80
Chlorophyll a (ug/L)	4.9
Transparency (m)	1.9
Total Phosphorous (ug/L)	13
pH	8.6
Total Susp. Solids (mg/L)	2.25
Total Volatile Solids (mg/L)	1
Total Residual Solids (mg/L)	2
Temperature (°C / °f)	20/68
Conductivity (umhos.cm)	255
Water Column Data	
Ammonia (mg/L)	0.03
Nitrate/Nitrite (mg/L)	0.04
Hardness (mg/L)	123
Alkalinity (mg/L)	121
Silica (mg/L)	18.9
Total Phosphorous (ug/L)	56
Miscellaneous Data	
Limiting Nutrient	N
DO (Mg/l) at 75% depth	2.1
Stratification (m)	1-4
Depth at Deepest Site (m)	4



Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Anabaena spiroides		

var. crassa	286.229	99.40
Pennate diatoms	0.479	0.17
Centric diatoms	0.337	0.12
Ankistrodesmus formosa	0.038	0.01
Fragilaria crotonensis	0.229	0.08
Melosira granulata	0.218	0.08
Euglena sp.	0.165	0.06
Asterionella formosa	0.038	0.01
Mallomonas sp.	0.013	0.00
Haematococcus sp.	0.007	0.00
Chlamydomonas sp.	0.002	0.00
Total	287.748	
Shannon-Weaver [H']	0.05	
Species Evenness	0.02	
Species Richness	0.38	

The phytoplankton community is dominated by the presence of *Anabaena spiroides*, a blue-green algae indicative of eutrophic conditions and poorer water quality.

Pollution Assessment

The only nonpoint source of pollution in Rex Reservoir is sedimentation and nutrient loading from agriculture and grazing in the watershed and in the vicinity of the reservoir.

There are no point pollution sources in the watershed.

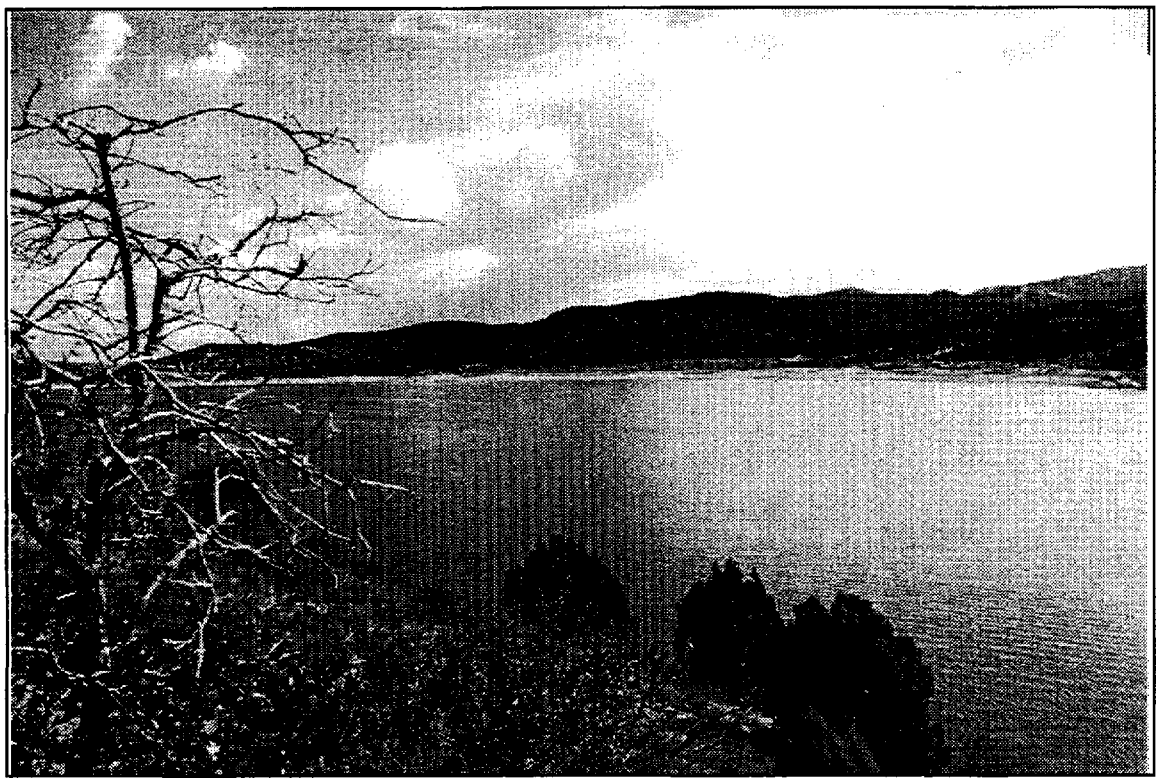
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Fish Lake National Forest	896-4491
Richfield Ranger District	896-4491
Lost Creek Irrigation Company	529-3549
Salina Chamber of Commerce	
Six County Commissioners Association	
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146

ROCKPORT RESERVOIR



Introduction

Rockport Lake, also called Wanship Reservoir, is a large reservoir on the Weber River midway between Kamas and Coalville. It is easily accessible from the Wasatch Front and has a state park that is open year round. It is one of six reservoirs built by the Bureau of Reclamation in the Weber watershed to provide subsidized water to the northern Wasatch Front. It impounds spring runoff from the western Uintas, storing it for use throughout the year.

Rockport Lake is the first of two large Bureau of Reclamation impoundments on the Weber River. The reservoir is an impoundment of a valley, which displaced agricultural land and a small community.

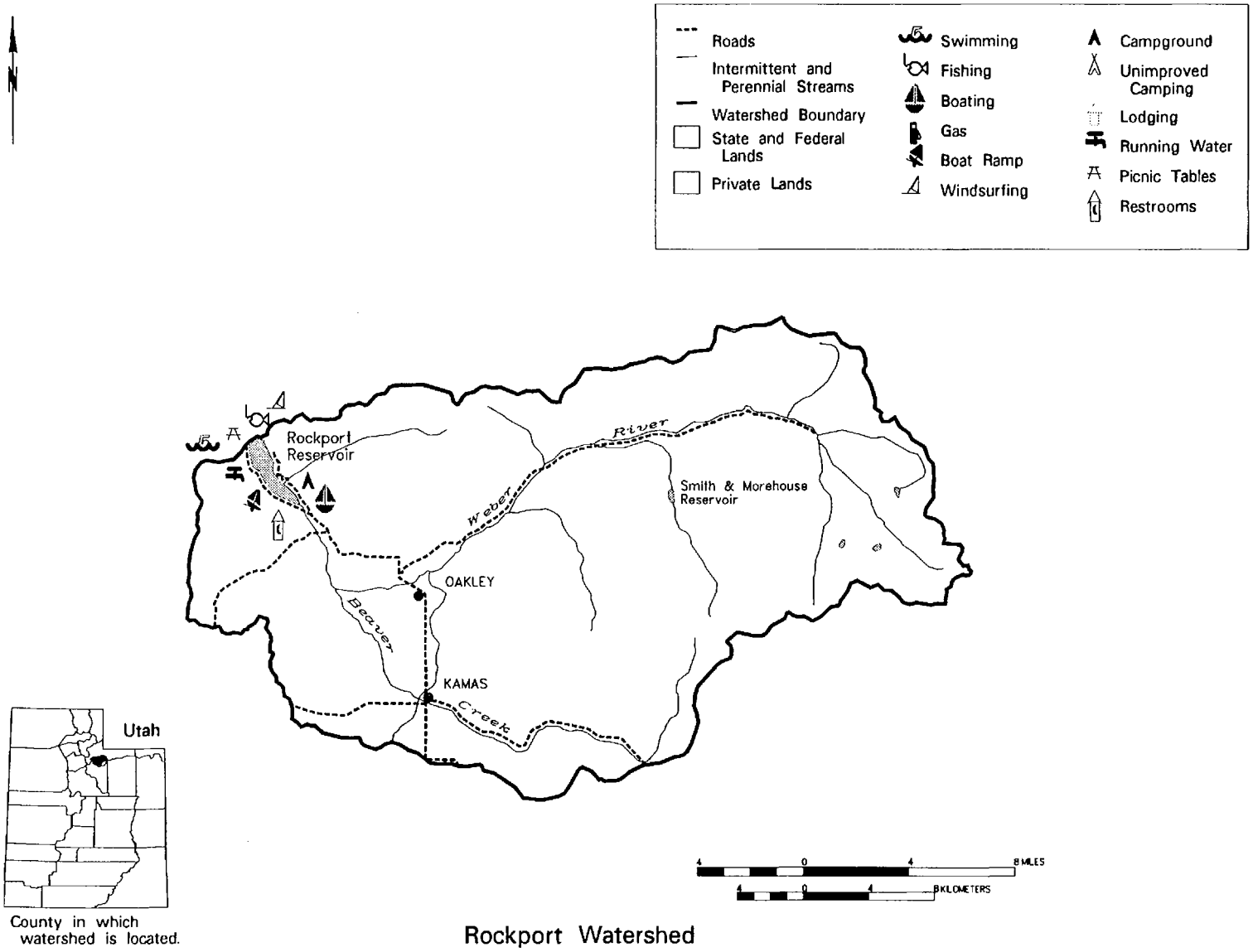
Rockport Lake was created in 1957 by the construction of an earth-fill dam. The reservoir shoreline is owned entirely by the state of Utah. Public access is unrestricted, but fees are charged to use park facilities. The reservoir is named after the town of Rockport, which was inundated by the reservoir. Reservoir water is consumed for irrigation (75%) and culinary (25). Of the irrigation component much

Characteristics and Morphometry

Lake elevation (meters / feet)	1,840 / 6,038
Surface area (hectares / acres)	481.2 / 1,189
Watershed area (hectares / acres)	82,800 / 205,000
Volume (m^3 / acre-feet)	
capacity	93,410,000 / 75,730
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (meters / feet)	
Depth (meters / feet)	
maximum	45.7 / 150
mean	19.4 / 63.7
Length (meters / feet)	4,998 / 16,368
Width (meters / feet)	1,219 / 4,000
Shoreline (meters / feet)	11,300 / 37,065

Location

County	Summit
Longitude / Latitude	111 23 43 / 40 46 34
USGS Maps	Wanship, Utah , 1967
DeLorme's Utah Atlas & Gazetteer™	Page 54, 1-B
Cataloging Unit	Upper Weber 16020101



Rockport Watershed

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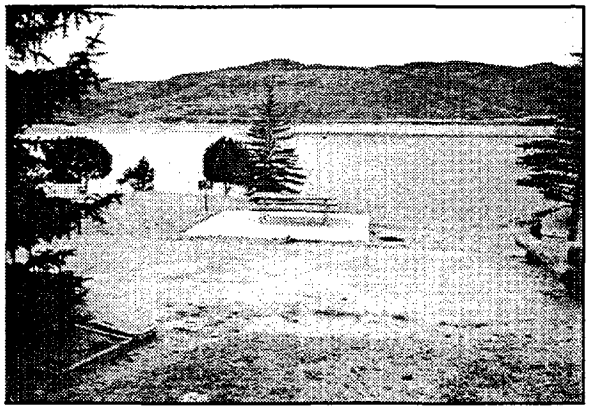
is used for residential irrigation needs, and is known as "Weber Water" by downstream users. As urban sprawl continues to displace farmland along the Wasatch Front and in communities along the Weber River, more water will probably be used for culinary purposes.

Recreation

Rockport Lake is located just south of I-80 at Wanship (Exit 156), 40 miles east of Salt Lake City. The dam is about 1.5 miles south of the junction. This road was once US-189, but UDOT has recently renumbered it as state highway U-32. It is also accessible from the Kamas area, to the south. The campground area is reached by driving to the south end of the reservoir, then returning north on the east shore on U-32. The route is well marked, paved, and open all winter. These two roads provide access to 85% of the shoreline.

The park receives moderate to heavy use. An example of the use of State Park facilities includes the following activities followed by 1990 user day data: cross-country skiing (148), fishing from bank or ice (22,670), boating (32,406), sailing and windsurfing (6,792), swimming (5,956), picnicking (20,176), snowmobiling (26), camping (33,870) and water skiing (12,704). Snowfall in 1990 was low, resulting in unusually little winter recreational use. The reservoir is very large, enabling it to handle heavy recreational use.

Recreational facilities at the reservoir include an improved boat ramp, 200 campsites, toilets, and a swimming area. Silver Sails, a concessionaire, offers boat rentals, recreational equipment and miscellaneous supplies.



There are services in Oakley and a private campground in Coalville.

Watershed Description

Although the terrain is mountainous, the elevation is relatively low, so the vegetation around the reservoir is mostly sagebrush and grass. Although the commute from Kamas to Salt Lake City is 45, the rural setting and clean air is rapidly transforming the area into suburbia. This is resulting in much-increased nutrient inputs from sewage and lawn fertilizers, but decreased nonpoint pollution from agriculture.

The watershed headwaters are the Weber River in the western Uintas. The Provo River once flowed through Rhodes Valley and down the Weber, but in fairly recent prehistoric times it was captured by its present drainage. Man has diverted part of the Weber River from one mile east of Oakley south across Rhodes Valley and down the Provo River.

The source of the Weber River lies just west of U-150 at Pass Lake. This is the divide between the Duchesne River and The Weber River. There is no perceptible boundary between the watersheds--the area was leveled by glaciers, possibly reversing their flow as snow deposition patterns changed. The glaciers left behind dozens of naturally impounded lakes. While none of the watershed is included in the High Uintas Wilderness Area, high elevations have precluded most use of this land by humans, and it remains fairly pristine.

Two major tributaries enter the Weber River above Rockport Lake. The first is Smith and Morehouse Creek, which enters midway between the headwaters and Rhodes Valley. Smith and Morehouse Reservoir is a large impoundment of this stream, and the only significant impoundment anywhere in the watershed. Beaver Creek is a tributary to the Weber River, flowing out of the Uintas into Kamas, then north to join the Weber just south of Peoa.

The watershed high point, Bald Mountain, is 3,640 m (11,943 ft) above sea level, thereby developing a complex slope of 4.5% to the reservoir. The average stream gradient above the reservoir is 2.3% (122 feet per mile). The inflows are the Weber River, Lost Creek, Threemile Canyon Creek, Kent Canyon Creek, Pine Creek, Crandall Canyon Creek, and an unnamed creek at the state campground. The creeks may dry up during the summer.

The watershed is made up of high mountains, low mountains and valleys. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of alpine, aspen, pine, spruce-fir, oak-maple, and sagebrush-grass. The watershed receives 41 - 102 cm (16 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 60 - 100 days per year.

Land use statistics are not available, but most of the watershed is managed as multiple use by the Wasatch-Cache National Forest, or maintained as private grazing lands. Rhodes Valley is mostly irrigated agriculture, but is expected to become more urban in the next 20 years.

Limnological Assessment

The water quality of Rockport Reservoir is very good. It is considered to be moderately hard with a hardness concentration value of approximately 181 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are total phosphorus and dissolved oxygen. The average concentrations of total phosphorus in the water column for 1990-92 were 30 and 36 ug/L which exceed the recommended pollution indicator for phosphorus of 25 ug/L. It is interesting to note that the concentration of total phosphorus in the hypolimnion dramatically rises as the reservoir develops anoxic conditions late in the season. On September 2, 1992, it reached a level of 309 ug/L.

Limnological Data

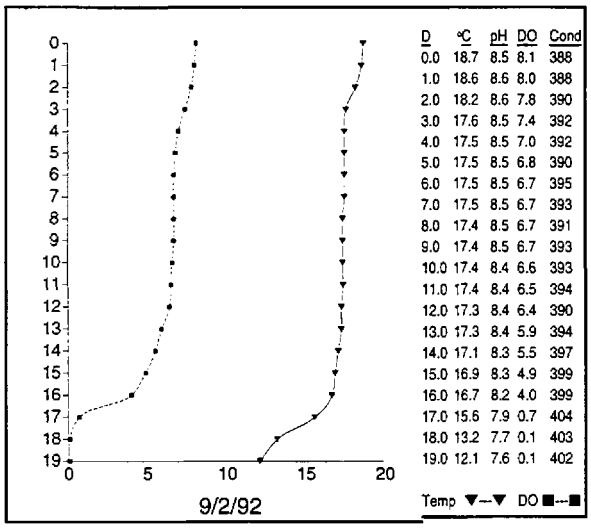
Data averaged from STORET sites: 592331, 592332

Surface Data	**1981**	**1990**	**1992**
Trophic Status	M	M	M
Chlorophyll TSI	-	42.67	48.13
Secchi Depth TSI	50.00	45.78	44.05
Phosphorous TSI	47.34	43.20	36.76
Average TSI	48.70	43.80	42.98
Chlorophyll a (ug/L)	-	3.45	6.3
Transparency (m)	2.0-	2.7	3.03
Total Phosphorous (ug/L)	18	15	10
pH	8.4	7.8	8.48
Total Susp. Solids (mg/L)	-	3	<3
Total Volatile Solids (mg/L)	-	-	-
Total Residual Solids (mg/L)	-		3
Temperature (°C / °f)	12/54	18/65	18/65
Conductivity (umhos.cm)	199	314	369
Water Column Data			
Ammonia (mg/L)	0.07	0.04	0.06
Nitrate/Nitrite (mg/L)	0.19	-	0.02
Hardness (mg/L)	104	175	187
Alkalinity (mg/L)	98	163	178
Silica (mg/L)	6.3		6.95
Total Phosphorus (ug/L)	-	30	36
Miscellaneous Data			
Limiting Nutrient	P	N	N
DO (Mg/l) at 75% depth	8.1	5.1	5.4
Stratification (m)	NO	NO	16
Depth at Deepest Site (m)	33	32	19

Although not indicated in the September 2, 1992 profile, the reservoir does stratify when sufficient depth is present. The profile also shows the anoxic conditions near the bottom of the reservoir. It appears that if these conditions were to intensify and be present for longer periods of time they could have more detrimental effects upon the reservoir water quality. It appears that the internal phosphorus loading from the sediments could become fairly substantial leading to greater productivity and eutrophication.

Although the reservoir was classified as a phosphorus limited system in 1981, the 1990-92 data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is mesotrophic. The phosphorus concentrations throughout the water column are moderately low. Because the system is nitrogen limited the phytoplankton community appears to be dominated by species that are capable of fixing nitrogen for their needs.

According to DWR no fish kills have been reported in recent years. The reservoir is stocked each year with rainbow trout (*Oncorhynchus mykiss*). The management strategy has been to stock with approximately 100-200,000 fingerling trout, however in recent years DWR has stock some subcatchables and even catchables. In addition from 1985 through 1987 30,000 smallmouth bass (*Micropterus dolomieui*) fingerlings were stocked which appear to be



reproducing in the reservoir.

The reservoir has not been chemically treated by the DWR to eliminate rough fish competition, so populations of native fish may be present.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Aphanizomenon flos-aquae	8.557	60.61
Anabaena spiroides var. crassa	2.891	20.48
Stephanodiscus niagarae	1.232	8.73
Anabaena sp.	1.112	7.88

Trachelomonas sp.	.133	0.95
Ankyra judayi	.052	0.37
Ankistrodesmus falcatus	.052	0.37
Pennate diatoms	.022	0.16
Centric diatoms	.018	0.13
Wislouchiella planktonica	.016	0.11
Dinobryon divergens	.012	0.09
Crucigenia rectangularis	.011	0.08
Oocystis sp.	.009	0.06
Total	2.970	
Shannon-Weaver [H']	1.17	
Species Evenness	0.46	
Species Richness [d]	0.51	

The phytoplankton community is dominated by the presence of blue-green algae species. This is probably due to nitrogen limitation.

Pollution Assessment

Nonpoint pollution sources include the following: sedimentation and nutrient loading from grazing; wastes or chemicals and nutrients from urban areas; herbicides and nutrients from croplands; recreation; leachates from mines and sedimentation from logging.

In addition, there are other abandoned mine sites in the watershed, which may not have been reclaimed upon abandonment. These sites can have large piles of tailings and due to a lack of vegetated cover can produce pollutants from as water leaches through them and is transported into waterways.

Point sources of pollution in the watershed also include municipal wastewater treatment lagoons at Oakley and Kamas, the Kamas Fish Hatchery and two active mines in the watershed. Bear Hole Gold Mines are in the South Fork drainage, just north of Hoyt Peak in section 29 and Utelite, a clay/shale mine immediately upstream from the reservoir in Threemile Canyon.

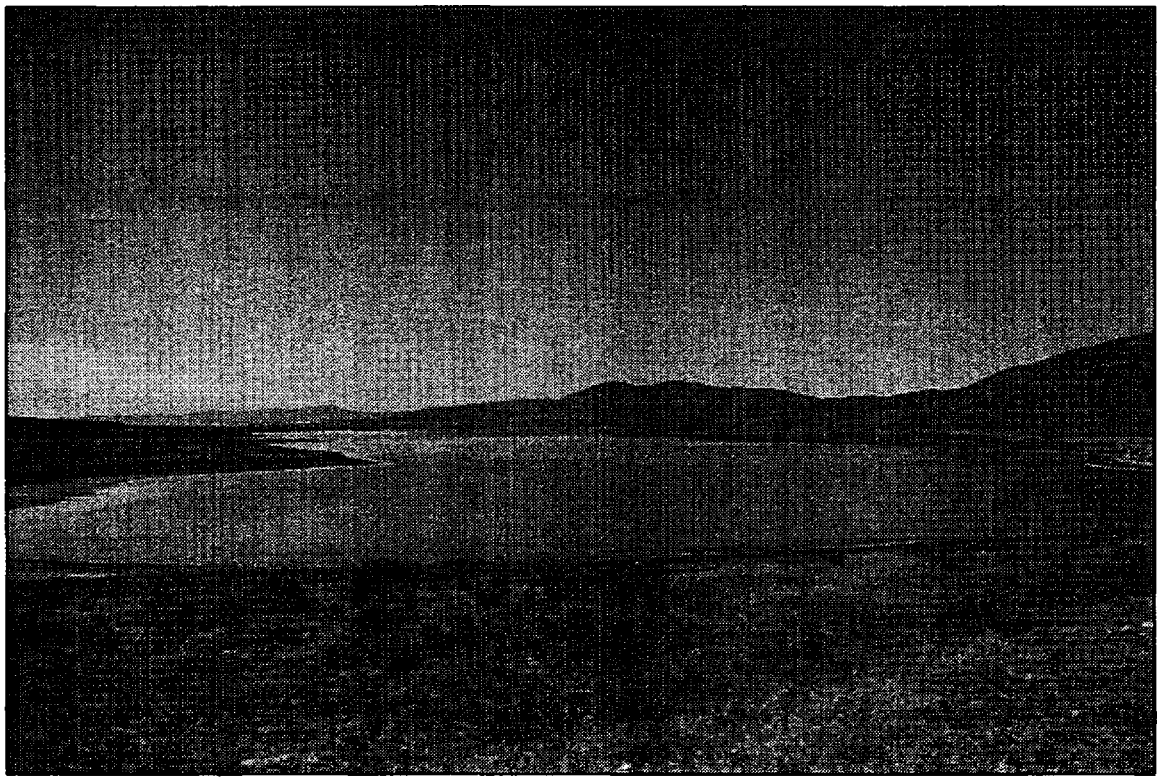
Beneficial Use Classification

The state beneficial use classifications include: culinary water (1A), recreational bathing (swimming) (2A), boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Mountainlands Association of Governments	377-2262
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Mountainland Travel Region (Provo)	377-2262
Rockport Lake State Park	336-2241
Reservoir Administrators	
Department of the Interior	524-5436
Central Utah Water Conservancy District	226-7100

RUSH LAKE



Introduction

Rush Lake is a natural impoundment of a southern tributary to the Great Salt Lake. The lake is at the northern end of Rush Valley near Stockton, where the formation of a sandbar on Lake Bonneville has blocked drainage further north. Rush Lake is several miles south of Tooele. It is also known as Rush Reservoir. The lake area is about 50% BLM owned and 50% privately owned. Public access is unrestricted. Water is not taken from the lake for human use, but the lake is used for windsurfing, other summer recreation and commercial fish production on occasion.

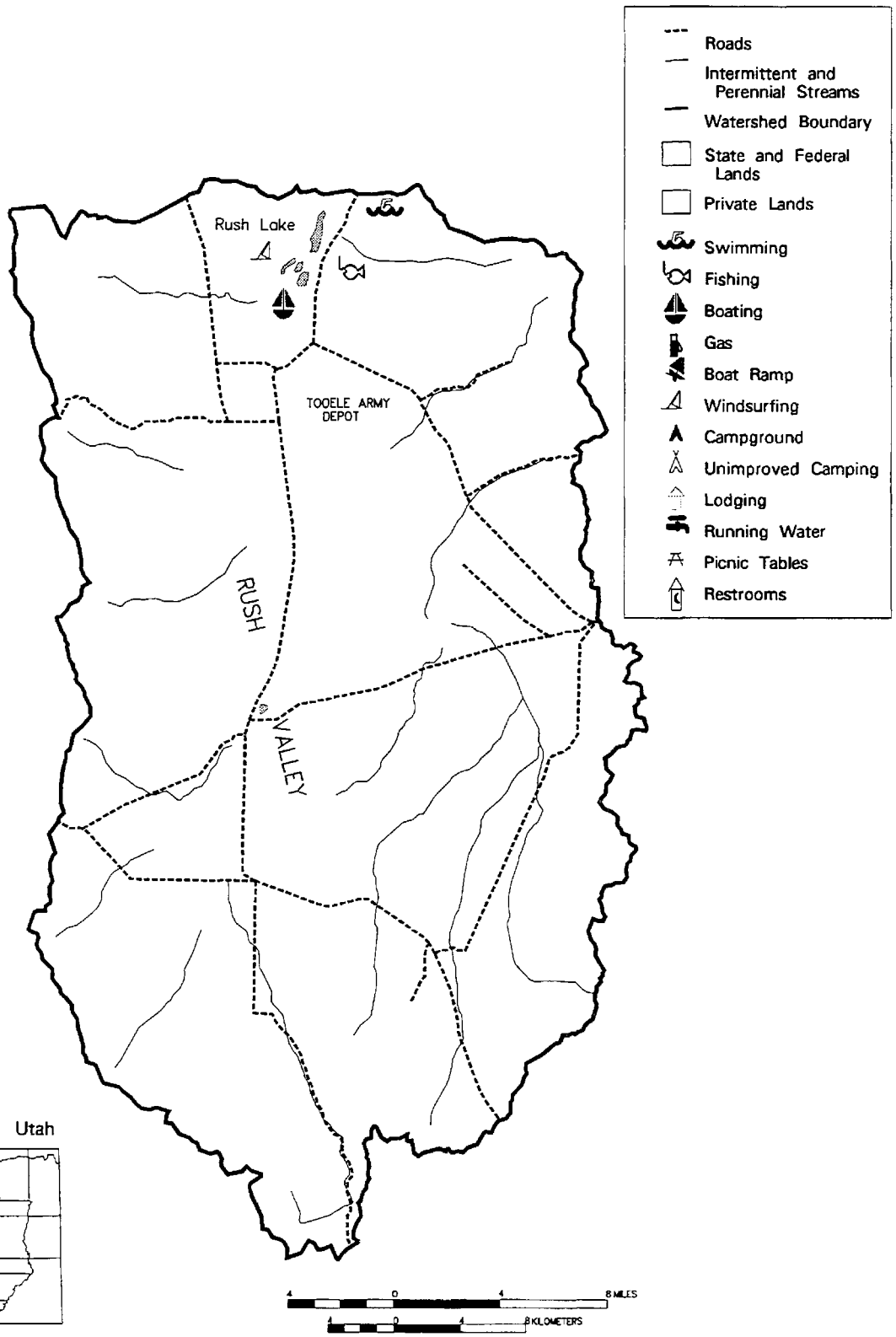
Rush Lake was created when shore currents on Lake Bonneville deposited a spit, which extended across the gap between the Oquirrh Mountains and South Mountain, eventually sealing off the Rush Valley portion of Lake Bonneville from the main body of the lake. Decreasing precipitation ended the glacial epoch, and Lake Bonneville evaporated down to its present elevation (the Great Salt Lake). Rush Valley, which drained directly into the Great Salt Lake in preglacial times, was impounded by the

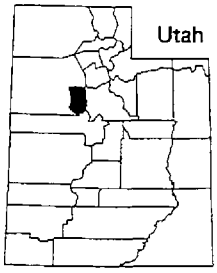
Characteristics and Morphometry

Lake elevation (meters / feet)	1,524 / 5,000
Surface area (hectares / acres)	32.4 / 80
Watershed area (hectares / acres)	689 / 1,701
Volume (m^3 / acre-feet)	
capacity	300,000 / 243
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	1.7 / 5.6
mean	0.9 / 3
Length (meters / feet)	595 / 1,953
Width (meters / feet)	119 / 390
Shoreline (meters / feet)	1,358 / 4,453

Location

County	Tooele
Longitude / Latitude	112 23 00 / 40 26 40
USGS Maps	South Mountain, UT 1980
DeLorme's Utah Atlas & Gazetteer™	Page 52 C-3
Cataloging Unit	Tooele/Rush Valleys (16020304)





County near which watershed is located.

Rush Watershed

<k84>

developed sandbar. Because of the extremely low precipitation (less than 10 inches per year in the valley) and high evapo-transpiration rates, Rush Valley does not produce enough runoff to fill the impoundment and cut a gap in it. In wet years, however, enough runoff occurs to back water up behind the impoundment, creating Rush Lake. Just prior to the 83-84 floods, Rush Lake was not a lake, but a wetland. The floods inundated an area of approximately five square miles forming the lake. Since then the lake has generally been decreasing in size except during periods of high precipitation. Currently the lake fairly shallow and much smaller in size. Undrained lakes in the Great Basin usually become extremely saline. This is happening to Rush Lake as it decreases in volume. The increased salinity and other factors have impacted the fishery causing fishkills at times. The lake will continue to evaporate at about 2 feet per year, and unless another wet year happens before the end of the decade, Rush Lake will probably shrink back into a wetland.

Recreation

Rush Lake is accessible from U-36 from the town of Stockton (5 miles south of Tooele and 5 miles north of the U-73 jct). From downtown Stockton, go west on an improved gravel road towards a small mountain (South Mountain) This road crosses the sandbar and provides access to various points along Rush Lake.

Fishing and windsurfing are the primary recreational uses of the lake. As lake depth fluctuates throughout the seasons and from year to year, recreational potential also fluctuates. During wet years, the lake has been used for waterskiing.

There are no permanent recreational facilities at the lake. The BLM has had portable latrines on the site for several years. It is possible to launch a boat on the lake during wet years. There are no private campgrounds in the area, but there are USFS campgrounds up South Willow Creek in the Stansbury Mountains. From Rush Lake, follow the gravel road to the west, after five miles it intersects the St. John-Grantsville Road (paved). Go north on this road for about three miles, and South Willow Canyon is to the west (left). The campgrounds are several miles up the canyon on the gravel road.

Watershed Description

Rush Valley is bounded by the Sheeprock Mountains in the south, the Tintic Mountains to the southeast, the Oquirrh Mountains to the east, South Mountain to the north, the Stansbury Mountains to the northwest, and the Onaqui Mountains to the west. This diverse assemblage of mountain ranges produces runoff, but the valley is wide and dry that streams disappear shortly after they enter the valley and do not provide water to Rush Lake by subterranean flow. Any outflow is also subsurface, through the above-mentioned Lake Bonneville sandbar.

The watershed high point, Lowe Peak, is 3,228 m (10,590 ft) above sea level, thereby developing a complex slope of 11.9% to the reservoir. (Lowe Peak is in relatively close proximity to the lake. Other mountain ranges form much shallower slopes to the lake.) There are no perennial streams flowing into the lake.

Soil associations are unknown, but the watershed is composed of soils formed from a vast array of different geologic formations in the various mountain ranges, in addition to alluvial fans and lake bottom.

The vegetation communities consist of sagebrush-grass and pinyon-juniper. Spruce-fir and alpine vegetation communities are probably found at higher elevations. The watershed receives 25 - 102 cm (10 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 100 -140 days per year.

Land use is mostly native grazing of cattle and sheep. The South Area of the Tooele Army Depot occupies 30 square miles of the watershed. Some other land uses, including cropland, urban, and recreation occupy small areas of the watershed.

Limnological Assessment

The water quality of Rush Lake is marginal. It is considered to be extremely hard with a hardness concentration value of approximately 2,076 mg/L ($CaCO_3$) and a increasing trend exists as evapo-transpiration reduces the volume of the lake. The only parameter that has exceeded State water quality standards for defined beneficial uses is total phosphorus. The average concentrations of total phosphorus in the water column consistently exceeds the recommended pollution indicator for phosphorus of 25 ug/L. The phosphorus concentration in 1991 was 225 ug/L.

Current data suggest that the reservoir is a nitrogen limited system. However, due to the shallow nature of the lake, the wind keeps the lake fairly turbid. This restricts the production of algae throughout the water column and alleviates some of the problems that would be associated with consistently large algal blooms. Despite these conditions, TSI values indicate the reservoir is still hypereutrophic. As noted in the August 29, 1991 profile the lake is shallow and does not stratify.

According to DWR fish kills have been reported in recent years due to a decline in water quality as saline conditions have increased. Maintenance of the warm water fishery have become increasingly difficult without sufficient quantities of freshwater feeding the lake to reduce salt concentrations.

The DWR has not stocked Rush Lake since 1988,

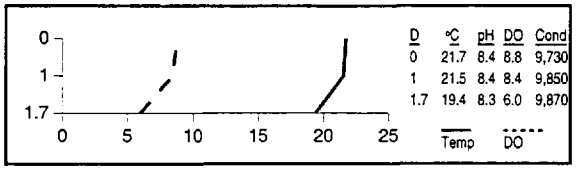
Limnological Data

Data averaged from STORET site: 596081, 596082.

Surface Data	1989	1991
Trophic Status	H	H
Chlorophyll TSI	56.93	65.25
Secchi Depth TSI	52.35	88.33
Phosphorous TSI	73.19	82.06
Average TSI	60.83	78.55
Chlorophyll a (ug/L)	14.78	34.20
Transparency (m)	1.7	0.14
Total Phosphorous (ug/L)	121	228
pH	8.1	8.4
Total Susp. Solids (mg/L)	94	140
Total Volatile Solids (mg/L)	-	36
Total Residual Solids (mg/L)	-	60
Temperature (°C / °f)	16/61	19/66
Conductivity (umhos.cm)	3980	9165
Water Column Data		
Ammonia (mg/L)	0.18	0.09
Nitrate/Nitrite (mg/L)	-	0.01
Hardness (mg/L)	1634	2519
Alkalinity (mg/L)	250	264
Silica (mg/L)	-	17.25
Total Phosphorous (ug/L)	120	225
Miscellaneous Data		
Limiting Nutrient	N	N
DO (Mg/l) at 75% depth	7.1	7.7
Stratification (m)	NO	NO
Depth at Deepest Site (m)	3.5	1.7

when it released 71,000 largemouth bass fry in the lake. The lake was over 4 miles long and nearly 20 feet deep after the floods of 83-84, but since then it has consistently decreased in size and depth, while nutrients and chemicals have become more concentrated. Given the natural fluctuations in precipitation, the lake is always in a state of flux. It will become larger only after very wet winters. Fish populations will rise after wet winters, but diminish throughout the year and after average to dry winters.

In 1986, when the lake was still large and water quality was good, fish populations included (in order of abundance) Utah chub (*Gila atraria*), carp (*Cyprinus carpio*), green sunfish (*Lepomis cyanellus*), bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), channel catfish



(Ictalurus punctatus), yellow perch (*Perca flavescens*), black crappie (*Pomoxis nigromaculatus*), and black bullhead (*Ictalurus melas*). The reservoir has never been chemically treated in by the DWR to control rough fish competition, so native fish populations may be present in the lake.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Centric Diatoms	0.228	31.81
Pennate Diatoms	0.220	30.69
Ankistrodesmus falcatus	0.157	21.90
Merismopedia glauca	0.040	5.58
Scenedesmus quadricauda	0.040	5.58
Oocystis sp.	0.025	3.49
Chlamydomonas globosa	0.007	0.95
Total	0.717	
Shannon-Weaver Index [H']	1.54	
Species Evenness	0.79	
Species Richness [d]	0.30	

The phytoplankton community is dominated by the presence of diatoms and green algae.

Pollution Assessment

Nonpoint pollution sources include the following: sedimentation and nutrient loading from grazing; wastes and litter from recreation; nutrients, cleaning chemicals and human wastes from urban areas; sediments, pesticides and other pollutants from agricultural lands; and sediments and chemicals from mines.

There are a large number of inactive miles in the watershed, with unvegetated slag piles and other relics left from prior operation that could contribute pollutants as water leaches through tailings or other areas carrying pollutants

Information

Management Agencies	
Bureau of Land Management	539-4001
Pony Express Resource Area	977-4300
Wasatch Front Regional Council	292-4469
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Great Salt Lake Travel Region (SLC)	521-2882
Tooele Chamber of Commerce	882-0690
Springville Fish Hatchery (DWR)	489-4567

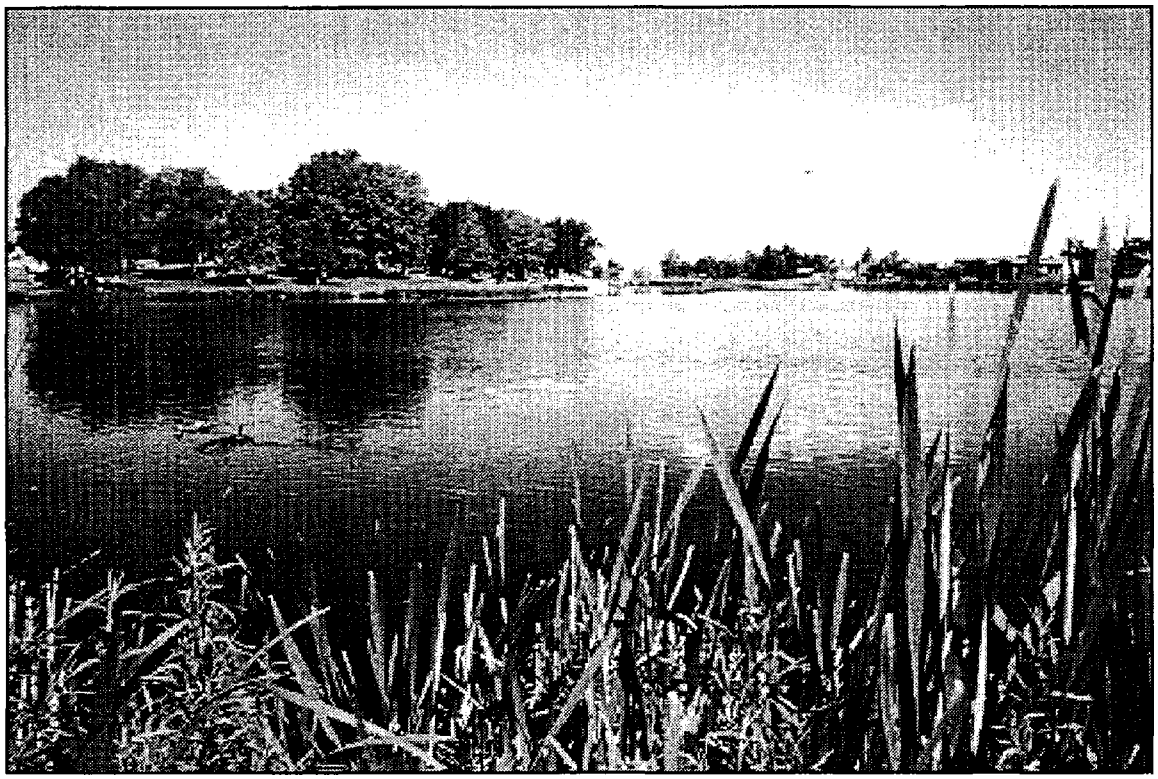
into waterways.

There are two active mines, the Ophir Gold Mine in Ophir Canyon in the Oquirrh Mountains, and Roudabush #1, a stone mine on Hickman Creek. These active mines are managed and operated under discharge permits from the UPDES program and will probably not have substantial effects on Rush Lake.

Beneficial Use Classification

The state beneficial use classifications include boating and similar recreation (excluding swimming) (2B) and warm water game fish and organisms in their food chain (3B).

SALEM POND



Introduction

Salem Pond is one of many natural ponds in the south end of Utah Valley. These are small, spring-fed bodies of water at the base of the mountains. Salem Pond is noteworthy because the town of Salem was built around the pond, making it one of the few natural lakes in the state that has been surrounded by a residential area. City parks surround the pond, and pedestrian bridges cross it.

The pond was created by construction of an earth-fill dam in 1851. Inflow is from clear flowing springs. The shoreline is 80% owned by Salem City and 20% by individual homeowners. Public accessibility is unrestricted. The water is used for irrigating 900 acres of land lower in the valley. No changes in water use are planned.

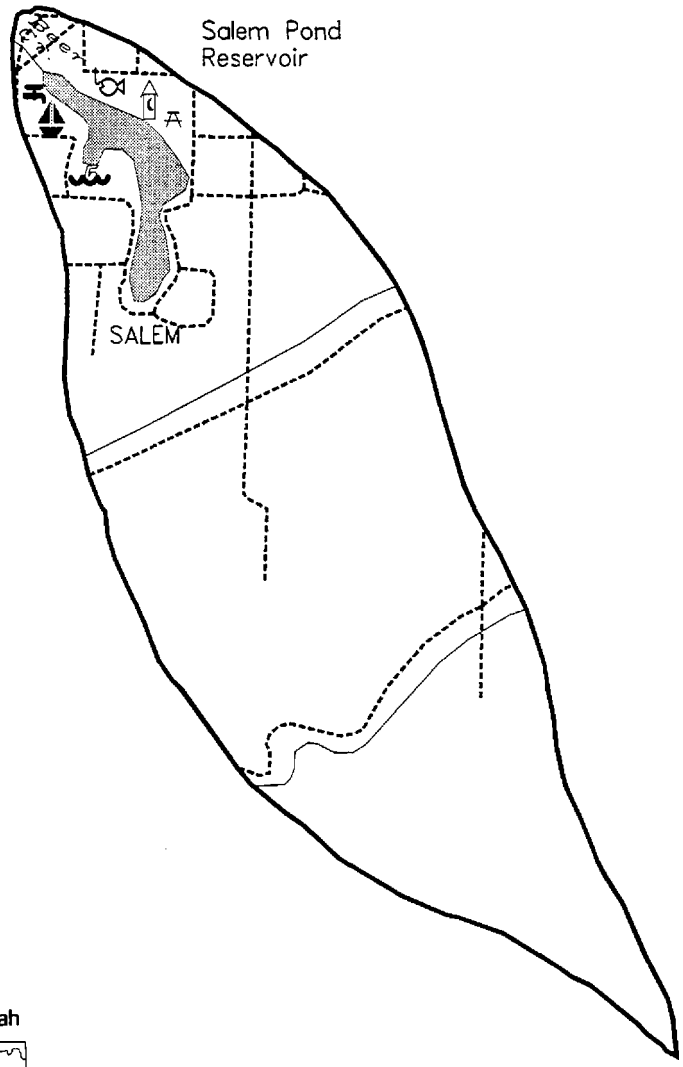
After 135 years of sediment accumulation, the once clear pond had become murky and chocked with aquatic vegetation and algae. The average depth of the lake had been reduced to only 7 feet. A joint project with Salem City, Mountainlands Association of Governments, the Utah Division of Water Quality, and the federal EPA was instituted to revitalize the pond. Between 1988 and 1993, it was

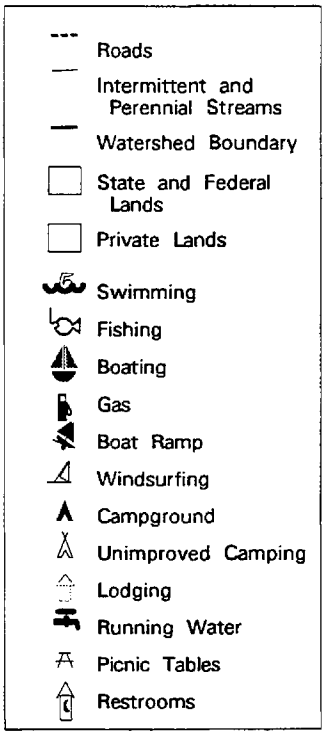
Characteristics and Morphometry

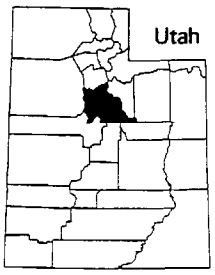
Lake elevation (meters / feet)	1,399 / 4,590
Surface area (hectares / acres)	4.45 / 11
Watershed area (hectares / acres)	192 / 474
Volume (m^3 / acre-feet)	
capacity	195,000 / 158
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	7 / 23
mean	4.4 / 14.4
Length (meters / feet)	579 / 1,900
Width (meters / feet)	209 / 686
Shoreline (meters / feet)	1,462 / 4,800

Location

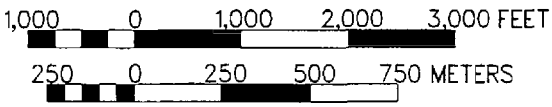
County	Utah
Longitude / Latitude	111 40 26 / 40 03 06
USGS Map	Spanish Fork, 1979
DeLorme's Utah Atlas & Gazetteer™	Page 45, A-6
Cataloging Unit	Utah Lake (16020202)







County in which watershed is located.



Salem Pond Watershed

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drained, the fish were killed, a new drain was built at the bottom of the dam, 135 years of sediments were dredged, the storm sewer was diverted onto an adjacent wetland, and the duck population was brought under control. This involved expenditure of $100,000 each in federal EPA funds and the State of Utah, and $150,000 by Salem City.

Recreation

Salem Pond is easily accessible from US-6 in Salem, which is between Spanish Fork and Payson. There is a historical marker at the pond, so drive through town and stop at the sign for the historical marker. Most of the pond is south of the highway, so one can turn south into town anywhere. It is not difficult to find, as most streets in town terminate at the pond.

Most of the pond is surrounded by park areas, with playgrounds and picnic areas. Since the cleanup, children enjoy swimming in the pond, small boats can be floated in the pond and even jetskiing is popular. The park can be used for cross-country skiing in the winter and fishing is sometimes good with hopes that it will improve as conditions allow.

There is a private campground in Payson (see info box), and several USFS campgrounds in Payson Canyon. Camping at the pond is discouraged.

Watershed Description

The pond is primarily spring fed. It also receives water from a small natural watershed, which has been modified by urbanization and truncated by an irrigation canal. Surface inflows to the pond are largely from storm sewers, and are often contaminated with fertilizers, sediments, oils, and garbage.

Part of the foothills drained into Salem Pond, but the construction of a canal upslope from the pond has cut off foothill runoff. The watershed high point is the canal (about 100' higher then the pond), below which water drains to the pond. Slopes surrounding the reservoir are not particularly steep (up to 20% at the south end). There are two storm sewers that feed into the reservoir, and several springs. The springs provide the majority of the water to the pond. The outlet is Beer Creek.

The watershed is made up of alluvial deposits that have been stabilized by urbanization. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of disturbed sagebrush-grass, and urban vegetation. The watershed receives 30 - 41 cm (12 - 16 inches) of precipitation annually. The frost-free season around the reservoir is 120 - 140 days per year.

Land use in the watershed is 100% urban.

Limnological Assessment

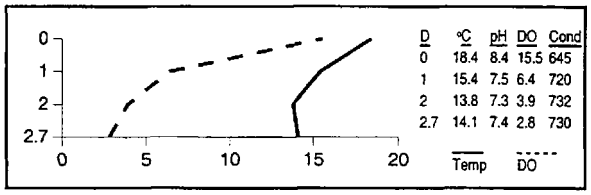
The water quality of Salem Pond is considered very good. It is considered to be hard with a hardness concentration value of approximately 261 mg/L ($CaCO_3$). The parameters that have exceeded water quality standards for defined beneficial uses include total phosphorus, and dissolved oxygen. Although the overall concentration of total phosphorus in the water column exceeds the pollution indicator the data is skewed due to higher concentration in August and September which may result as the over abundance of macrophytes die off and decomposition reintroduces nutrients into the water column. Low dissolved oxygen concentrations as indicated in the September 3, 1992 profile are due in large part to the biological activity of the plants at night through the process of respiration consume dissolved oxygen. The greatest impairment todefined beneficial uses is due to the extensive development of macrophytes in the lake. Because of this a

Limnological Data

Data sampled and averaged from STORET site: 591761, 591762, 591770.

Surface Data	1981*	1989	1990	1992
Trophic Status	E	M	M	E
Chlorophyll TSI	-	36.84	43.48	45.50
Secchi Depth TSI	59.26	44.98	46.95	52.77
Phosphorous TSI	50.35	46.63	56.47	51.72
Average TSI	54.8	42.82	48.96	50.00
Chlorophyll a (ug/L)	-	1.8	4.3	9.1
Transparency (m)	0.8	2.6	2.3	2.0
Total Phosphorous (ug/L)	30	21	49	26
pH	9.5	7.8	7.9	8.1
Total Susp. Solids (mg/L)	9	-	4.9	<3
Total Volatile Solids (mg/L)	-	-	-	1
Total Residual Solids (mg/L)	-	-	-	2
Temperature (°C / °f)	18/64	19/67	16/61	16/61
Conductivity (umhos.cm)	760	727	629	676
Water Column Data				
Ammonia (mg/L)	0.08	0.10	0.04	0.05
Nitrate/Nitrite (mg/L)	2.79	1.54	1.72	1.61
Hardness (mg/L)	235	-	294	254
Alkalinity (mg/L)	244	-	269	253
Silica (mg/L)	-	-	-	5.6
Total Phosphorous (ug/L)	30	25	39	28
Miscellaneous Data				
Limiting Nutrient	P	N	N	P
DO (Mg/l) at 75% depth	7.3	14	3.0	3.9
Stratification (m)	NO	NO	NO	NO
Depth at Deepest Site (m)	4	1.7	2.4	2.7

* One site only (591761)



Clean Lakes Phase I study was undertaken to study the problems contributing to the problem and develop alternatives to address the defined problems. The study was completed in 1991.

Recommendations from the Clean Lakes Phase I study included the following: dredging the lake; diversion of nutrient rich urban waters into wetlands for uptake of nutrients and sediments; reduction of an existing duck population, and the introduction of grass carp to control macrophyte densities. A complete discussion of the study is included in the report, *"Diagnostic and Feasibility Report on Salem Lake (1991)"* available from Mountainland Association of Governments or Utah Division of Water Quality.

In 1992 Clean Lakes funding was obtained from EPA to address the concerns with Salem Pond. In addition state funds and local funding from Salem City was provided to assist in the implementation of the recommendations of the Phase I study. The major components including removal of 100,000 cubic yards of nutrient rich sediments, control of an existing duck population, introduction of grass carp for control of persistent macrophytes, diversion of urban runoff into an enhanced wetland, and providing an educational tool for instruction on water quality and wetlands.

Implementation of these Clean Lakes Phase II elements indicates that water quality has improved. A review of the data presented in the report, *"Salem Lake Restoration (1995)"* available from Mountainland Association of Governments or Utah Division of Water Quality substantiates this fact. Water was sampled during 1993, the year after implementation . The average total phosphorus concentration in the pond was 23 ug/L which is below the pollution indicator and less than previous annual concentrations. During that year the average dissolved oxygen concentration was 9.1 mg/L with the lowest recorded value of 4.2 mg/L. Although improving, it still appears that the existing macrophyte community is still exerting an influence on dissolved oxygen concentrations. It is anticipated as the grass carp develop the macrophytes will be controlled or reduced to the point that their influence will be minimal. A determination of TSI values for 1993 (40.00) indicates that the water quality has improved and production has been reduced . It should be noted that the time since implementation is relatively short and the pond should continue to be monitored to better evaluate the effectiveness of the Phase II implementation project.

Although the depth of the pond has been increased, it is still to shallow to permit stratification. In 1981 the pond was classified as a nitrogen limited system but current data suggest that it is nitrogen limited.

The Division of Wildlife Resources treated the pond prior to dredging in 1988 for the removal of rough fish and currently stocks the pond with 5,000 catchable rainbow trout (*Oncorhynchus mykiss*) annually. In addition triploid (sterile) grass carp (*Ctenopharyngodon idella*) are present in the pond.

Macrophytes document in the Phase I study include water milfoil (*Myriophyllum verticillatum*), duck weed (*Lemma gibba*), glaborous monkey-flower (*Mimulus glabrata*), water cress (*Nasturtium officinale*), and spirodela (*Spirodela polyrhiza*). The largest part of the biomass consists of water milfoil. It is associated wherever it grows with the algal genus *Chara*. The floating mat of algae is partially comprised of *Cladophora sp.*).

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Pennate diatoms	5.771	41.92
Scenesdesmus quadricauda var. quadrispina	2.179	15.83
Peridinium sp.	1.446	10.50
Cosmarium sp.	1.089	7.92
Staurastrum sp.	1.001	7.27
Unknown filamentous green alga	0.817	5.94
Mougeotia sp.	0.612	4.44
Coelastrum sp.	0.556	4.04
Tetraedron sp.	0.083	0.61
Dinobryon divergens	0.049	0.36
Scenedesmus bijuga	0.044	0.32
Oocystis sp.	0.036	0.26
Centric diatoms	0.018	0.13
Ankistrodesmus falcatus	0.017	0.13
Euglena sp.	0.017	0.12
Oscillatoria sp.	0.012	0.09
Chroococcus sp.	0.011	0.08
Chlamydomonas sp.	0.006	0.04
Unknown spherical chlorophyta	0.003	0.02
Total	13.759	
Shannon-Weaver [H']	1.85	
Species Evenness	0.63	
Species Richness	0.77	

The phytoplankton community is fairly diverse due in part to the over abundance of macrophytes present in the system. It is dominated by green algae, flagellates and desmids. It is indicative of fairly good water quality.

Pollution Assessment

Nonpoint pollution sources include the following: sedimentation, nutrient loading and household chemicals from urban areas; and litter or wastes from recreation.

There are no point sources of pollution in the watershed.

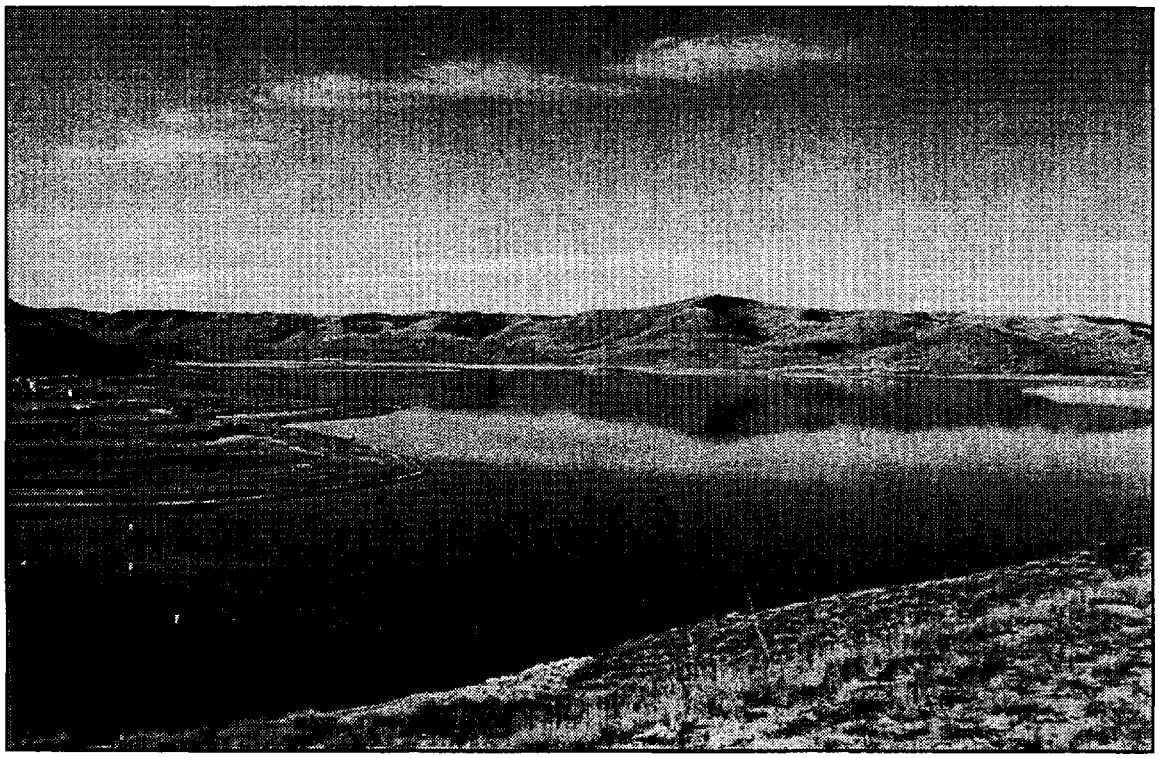
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Mountainlands Association of Governments	377-2262
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Salem City Corporation	
Recreation	
Mountainland Travel Region (Vernal)	377-2262
Payson Chamber of Commerce	465-9288
Spanish Fork Chamber of Commerce	798-8352
L&J RV Park (Payson)	465-4761

SCOFIELD RESERVOIR



Introduction

Scofield Reservoir a 2,815 acre body of water, is located in Carbon County in Central Utah. The reservoir was originally impounded in 1926 and enlarged in 1946. The replacement of the original dam was expedited during World War II because a potential failure of the existing dam posed a threat to the war effort. The project began in 1943 but was not completed until 1946. As part of the authorization for the project was a provision for an 8,000 acre-feet conservation pool. Uses of Scofield Reservoir and its watershed include coal mining, agriculture, residential, fishing, hunting, snowmobiling, camping, and a variety of other types of summer and winter recreations.

Characteristics and Morphometry

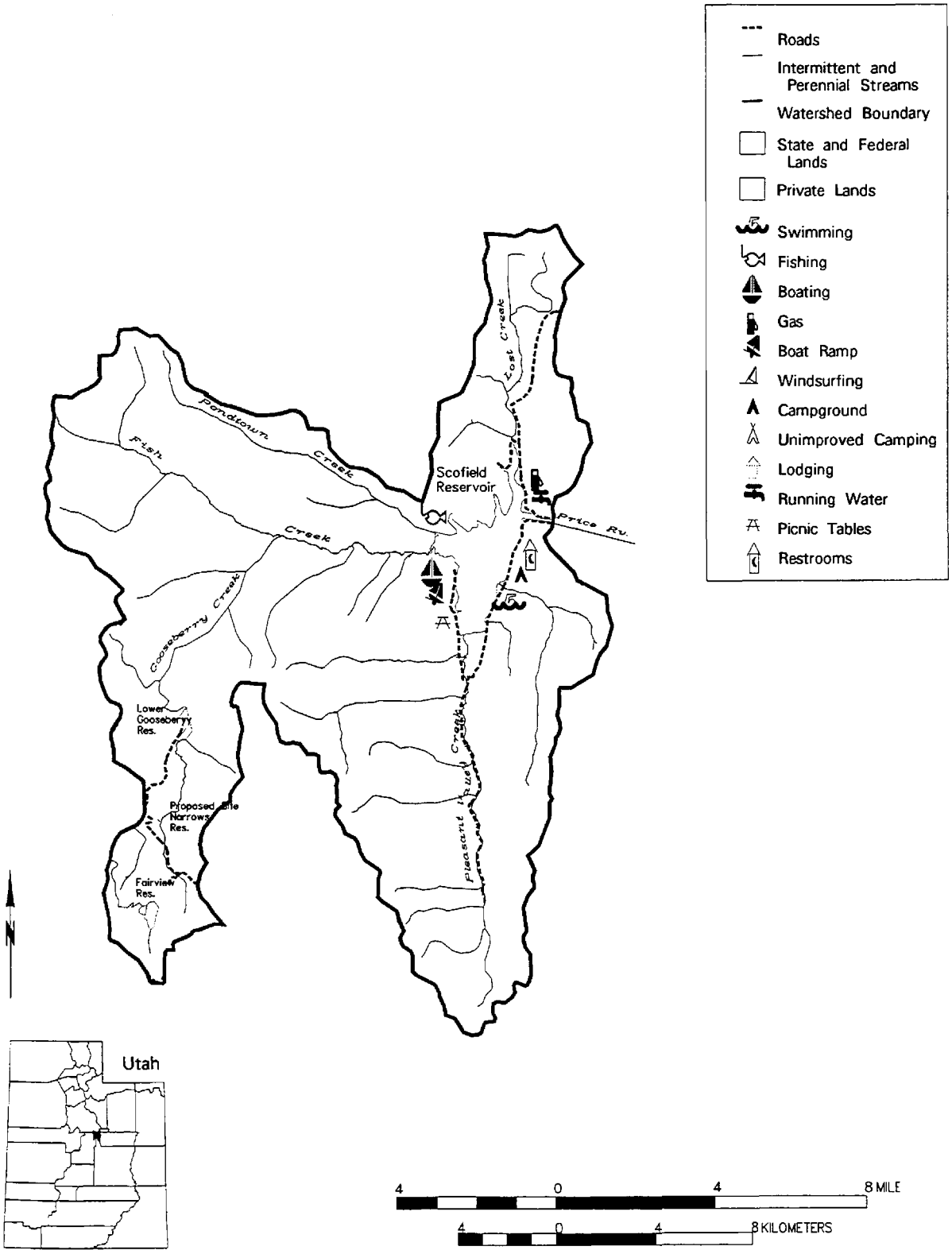
Lake elevation (meter / feet)	2,321 / 7,618
Surface area (hectares / acres)	1,139 / 2,815
Watershed area (hectares / acres)	3,990,000 / 4,350,000
Volume (m^3 / acre-feet)	
capacity	90,285,740 / 73,600
conservation pool	9,868,000 / 8,000
Annual inflow (m^3 / acre-feet)	105,716,000 / 52,000
Retention time (years)	1.42
Drawdown (m^3 / acre-feet)	38,073,270 / 30,866
Depth (meters / feet)	
maximum	20.1 / 66
mean	7.9 / 26
Length (km / miles)	7.9 / 4.9
Width (km / miles)	3.3 / 2.1
Shoreline (km / miles)	24.9 / 15.5

Recreation

Scofield Reservoir is accessible from US-6 between Spanish Fork and Price via U-96 or from U-31 between Fairview and Huntington via U-264. The route is well marked on a State highway map and it is accessible year-round. Occasionally during heavy snow conditions travel via U-31 may be restricted. Scofield has traditionally been one of Utah's top fisheries. Besides producing desirable size

Location

County	Sanpete
Longitude / Latitude	111 16 03 / 39 35 24
USGS Map	Huntington Reservoir 1978
DeLorme's Atlas and Gazetteer™	Page 46 D-2
Cataloging Unit	San Rafael (14060009)



County near which watershed is located.

Scofield Watershed

<k92>

via U-31 may be restricted. Scofield has traditionally been one of Utah's top fisheries. Besides producing desirable size and quantities of trout, it is unique in that it is an outstanding shore fishery. It is also popular during the winter as an ice fishery. In recent years the fishery and its management have been impacted due to water quality impairments.

Scofield Reservoir is the site of a State Park. The park provides for camping (both trailers and tents), garbage disposal, water, barbeque pits, flush toilets, hot showers, a fish cleaning station and boat ramps at both camping areas. There are two sites that comprise the park, the Madsen BAy Unit and the Mountain View Unit. In addition a sanitary dump site is available with a convenience store and other support services available in Scofield on the south shore of the reservoir. Facilities are available at the State Park from May through November. Snowmobiling and ice fishing are popular winter sports at Scofield Reservoir too. In additon to all of the public recreation opportunities there is a Boy Scout Camp on the northwest tip of the reservoir.

This area is a very popular recreational site and camping areas are limited. Overflow camping is not allowed in direct proximity to the reservoir, however, there is primative camping available on forest service lands up the Fish Creek drainage.

Limnological Assessment

The water quality ofScofiled Reservoir is considered fair. It is considered to be hard with a hardness concentration value of approximately 187 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are total phosphorus and dissolved oxygen. The average concentrations of total phosphorus in the water column in recent years has usually always exceeded the recommended pollution indicator for phosphorus of 25 ug/L. The problems relating to the excessive enrichment of Scofield Reservoir have been documented in several reports. Historically the data documents summer blue-green algal blooms, winter and summer hypolimnetic oxygen deficits and fish kills as problems associated with the lake.

In 1983 a Clean lakes 314 Phase I water quality study was completed on the reservoir. A summary of that study (Scofield Reservoir Phase I Clean Lakes Study, 1983) indicate that the reservoir has good water quality as measured by most parameters. The reservoir was moderately high in alkalinity (155 mg/L) and hardness (170 mg/L). Secchi depth readings for the study period during the summer months range from 2 to 5 meters which is typical for mesotropic systems. Nutrient levels are relatively high but drop during the summer as nutrients are depleted by phytoplankton growth. Total phosphorus levels were commonly reported at 10 to 50 ug/L and inorganic nitrogen at 0.10 to 0.30 mg/L.

As expected, dissolved oxygen was low in the hypolimnion. The temperature and dissolved oxygen profiles were similar with other mesotrophic to slightly eutrophic reservoirs in Utah. However it should be noted, anoxic conditions were found near the reservoir bottom during late summer and again during the winter. The report indicated that this only affected a small portion of the water column and for only a short duration.

Scofield Reservoir was determined to be meso-eutrophic in 1981 and 1982 based on overall trophic state indexes (TSI's) of 49.00 and 53.00 respectively. Phytoplankton analyses indicated that the reservoir was meso-eutrophic with the presence of a significant number of blue-green algae species and some diatoms indicative of eutrophic conditions. As part of the study Dr. Samuel R. Rushforth's (1982) algal studies substantiated these trophic state determinations. He concluded that Scofield Reservoir

Limnological Data

Data averaged from STORET sites: 593097, 593098, 593099, 593100, 593101, 593107, 593127

Surface Data	1979*	1990	1991	1992
Trophic Status	M	H	H	M
Chlorophyll TSI	-	67.88	65.64	35.62
Secchi Depth TSI	36.10	65.42	65.15	57.82
Phosphorous TSI	53.30	55.41	59.85	53.61
Average TSI	44.70	62.90	63.55	49.02
Chlorophyll a (ug/L)	-	73.7	47.1	2.9
Transparency (m)	2.3	0.6	0.6	2.0
Total Phosphorous (ug/L)	28	33	50	54
pH	9.0	8.4	8.6	8.3
Total Susp. Solids (mg/L)	-	17.2	8	<3
Total Volatile Solids (mg/L)	-	-	6	1
Total Residual Solids (mg/L)	-	-	27	2
Temperature (°C / °f)	15/59	14/57	12/53	17/63
Conductivity (umhos.cm)	218	375	376	328
Water Column Data				
Ammonia (mg/L)	0.10	0.27	0.11	0.2
Nitrate/Nitrite (mg/L)	0.10	-	0.34	0.03
Hardness (mg/L)	-	203	202	156
Alkalinity (mg/L)	-	18	17.3	13
Silica (mg/L)	-	-	6	6.5
Total Phosphorous (ug/L)	28	43	51	60
Miscellaneous Data				
Limiting Nutrient	N	N	N	N
DO (Mg/l) at 75% depth	6.7	4.8	6.7	6.6
Stratification (m)	NO	1-2	NO	NO
Depth at Deepest Site (m)	11	4	5	5

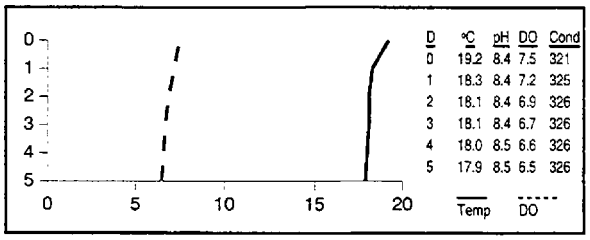
* Data averaged from only 2 sites (593098, 593099)

is a meso-eutrophic to eutrophic system dominated by noxious species of blue-green algae (Anabaena and Aphanizomenon) during the summer and fall months. Although there was a limited diversity during the early part of the year, diatom diversity peaked during the spring with a continued dominance by *Dinobryon divergens* and an increase in green algal production during early summer. By mid August blue-green algal dominance began to evolve and continued into late fall with continued representation of *Dinobryon divergens*. One additonal factor in the diatom analysis was the high production of *Stephanodiscus minutula* which is indicative of eutrophic waters when present in the quantities found in the reservoir. It was reported in the Phase I study that the exchangeable phosphorous values in the sediments could become moderate if anoxic conditions were present.

The coverage of macrophytes, almost entirely of *Elodea canadensis*, was extensive throughout all areas of the reservoir in both 1981 and 1982. Although the macrophytes were submergent in most cases, they were present in almost all areas of less than 15 feet of water. During 1982 beds of *Ranunculis aquatilis* and *Polygonum coccineum* occupied the shallow areas at the south end of the reservoir with small areas of *Potamogeton pectinatus* and *Potamogeton filiformis*.

The study suggested four options as the most feasible and beneficial for solving the pollution problems. They were; 1) creation of a south shore wetland to trap nutrients before they can enter the reservoir; 2) increase public awareness and generate support for reduced human impacts; 3) alter the outlet to allow more hypolimnetic discharge; 4) continue to monitor projects through SEUALG (Pleasant Valley Committee).

Data prior to 1992 indicates that the reservoir is a nitrogen limited with consistantly high productivity. TSI values in 1990-91 depict the reservoir as hypereutrophic with values in excess of 60.00. These poor water quality conditions were responsible for a decline in the cold water fishery. Christopherson and Judd (1991) linked the overall effect of water quality on the fishery. High algal production, primarily blue-greens, and severe dissolved oxygen depletions were contributing factors to the decline. On April 4, 1990 dissolved oxygen concentrations were documented



D	°C	pH	DO	Cond
0	19.2	8.4	7.5	321
1	18.3	8.4	7.2	325
2	18.1	8.4	6.9	326
3	18.1	8.4	6.7	326
4	18.0	8.5	6.6	326
5	17.9	8.5	6.5	326

at a maximum of 4.1 mg/L near the surface, 1.5 mg/L at 2.5 meters and no oxygen below the 5 meter depth. This excessive depletion of dissolved oxygen is indicative of the excessive demand for oxygen in the hypolimnion due to accumulations of organic matter due to the high productivity of the reservoir during recent years. These conditions are critical to the overwintering of fish in the reservoir. DWR reports substantiate the loss of fish during this period of time in the reservoir.

In 1992 an overall TSI value for the reservoir was 49.02 which was significantly lower. It is noteworty that in the fall of 1991 the reservoir was treated for the removal of rough fish. With the treatment it appears that there has been a improvement of conditions. Prior to treatment one factor attributing to the increased eutrophication of the reservoir was the increase in the internal phosphorus loading to the reservoir. One factor contributing to this increase was the resuspension of sediments by non-game fish. With the elimination of those species during treatment a reduction in the internal loading appears to have occurred. In addition the amount of internal phosphorus loading due to anoxic conditions may have been reduced due to greater mixing of the water column due to lower levels of water in recent years. Additional data will be need to ascertain the validity of this phenomenon.

As indicated in the profile of August 8, 1991 the reservoir typically does not stratify during the summer due to insufficient depth.

According to DWR no fish kills have been reported since the last treatment, but prior to treatment fish kills were common. A major contributing factor prior to the treatment in 1991 were anoxic conditions from dissolved oxygen depletions during late summer and winte. Dissolved oxygen concentrations were determined to be well below the treshold established for a viable cold water fishery. This was having a dramatic effect on the fingerling stocked during the fall resulting in very little carryover of these fish. It has also been reported that dry years increased the chances of fish kills.

The reservoir supports populations of rainbow trout (Oncorhynchus mykiss), cutthroat trout (Oncorhynchus clarki), an probably some brown trout (Salmo trutta) from tributaries.

Phytoplankton in the euphotic zone on August 8, 1991 include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Aphanizomenon flos-aquae	1×10^{17}	100.00
Stephanodiscus niagarae	.175	0.00

Pennate diatoms	.040	0.00
Centric diatoms	.009	0.00
Chlamydomonas globosa	.002	0.00
Total	210.050	
Shannon-Weaver [H']	0.00	
Species Evenness	0.00	
Species Richness	0.11	

Samples from August 18, 1992 include

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	208.639	99.33
Ceratium hirundinella	.936	0.45
Pennate diatoms	.145	0.07
Aphanizomenon flos-aquae	.105	0.05
Asterionella formosa	.095	0.04
Centric diatoms	.062	0.03
Melosira granulata	.056	0.03
Oocystis species	.013	0.01
Totals		
Shannon-Weaver Index[H']	0.05	
Species Evenness	0.02	
Species Richness[d]	0.33	

The phytoplankton commnunity was dominated by the presence of blue-green alae and diatoms indicative of poorer water quality and eutrophic conditions in 1991 but in 1992 dominance shifted to green algae and diatoms with some eutrophic species still present in the commnunity.

Pollution Assessment

The Utah Division of Water Quality completed a Phase I - 314 Clean Lake Study at Scofield Reservoir (Denton etd, 1983). This study identified the sources of pollution. Phosphate and nitrate were responsible for the increased eutrophication, with phosphorus identified as the limiting nutrient. For this reason phosphorus was identified as the target parameter for nutrient reduction efforts.

The blue-green algae blooms are linked to high phosphorus concentration in the reservoir. Internal loading of phosphorus involves chemical interactions within the reservoir. With the impoundment of the reservoir in 1946, sediments have been deposited in the reservoir. These sediments contain phosphorus that has been stored in different chemical forms. The phosphorus is bound to other elements (iron and calcium) to form phosphate salts. In summer and winter the lake thermally stratifies so that the hypolimnion (bottom) can not mix with the surface. As the organic material decomposes, free oxygen in the water is utilized causing a reduction in the concentration of dissolved oxygen in the water column. Eventually the hypolimnion becomes anoxic. Under these conditions phosphate salts are changed and bound phosphorus is released into the water (Figure 5). This phosphorus is readily available for biological production. When this phosphorus enters the epilimnion it stimulates algal production. Recently these summer algal blooms are dominated by blue-green algae, which produce large amounts of organic material that sink to the bottom. This deteriorating cycle occurs in Scofield Reservoir. In addition fish species like carp (*Cyprinus carpio*) may add to the problem of internal loading by resuspending phosphorus laden sediments into the water column, and releasing nutrients into the water.

External loading consists of phosphorus bound to sediments, and dissolved bioavailable phosphorus entering the reservoir from the watershed. The Phase i study reported that approximately 52% of all external loading comes from Fish Creek (3,508 Kg), and Mud Creek (1,943 Kg) annually. The remaining tributaries contribute approximately 18%, and the remaining 5% comes from shoreline erosion.

The external sources of phosphorus include sediment, culinary waste and livestock sewage. Much has been done since 1983 to reduce culinary waste. A more adequate sewage system has been installed in the Scofield area. Erosion and livestock continue to be a problem.

Information

Management Agencies

Manti-La Sal National Forest	637-2817
Six County Commissioners Organization	896-9222
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146

Erosion in the watershed leads directly to sediment release, and the external loading of phosphorus and nitrates into the reservoir. Intensive livestock grazing in the watershed, particularly in riparian zones (stream banks), greatly increases the natural erosion in the area. Combined with road construction, recreational home construction and mining activities the damage to the watershed is considerable.

The Manti LaSal National Forest has completed a

Water Resource Inventory for the Price River watershed (G. Dennis Kelly Manti-LaSal National Forest). Computer models (SEDROUT) were used to predict sedimentaton. The models were run, and data were compiled on 72,359 acres, in and around the National Forest. Sediment yields were estimated and water shed improvement needs were identified.

Of the land surveyed, 7257 acres or 10.1 percent of the Price watershed was classified as having high to extreme erosion potential. Water quality based on suspended sediments was, estimated to range up to 276 mg/L in Mud Creek.

The effects of the sediment loading and eutrophication can be summarized as follows.

Problems of poor water quality

1. Major algae blooms, leading to loss of the zooplankton an important food for trout.
2. Oxygen depletion which threatens fish populations.
3. Excessive sedimentation into the reservoir.

Effects on Reservoir

1. Visual impacts and offensive odors.
2. Boater and swimmer safety.
3. Low fish survival.
4. Water more costly to treat for Culinary use.
5. Loss of water storage.

Sources of Sedimentation

1. Grazing and resulting loss of vegetation leading to eroding stream banks.
2. Road and vacation home construction.
3. Mining activities.
4. Poor pasture management.
5. Damaged riparian areas.

Effects on the Drainage

1. Threaten cold water fish in streams.
2. Enhance production of non-game fish.
3. Reduce or inhibit trout spawning.
4. Reduced wildlife habitat.
5. Visual impacts.
6. Loss of top soil.
7. Erosion damage to roads.

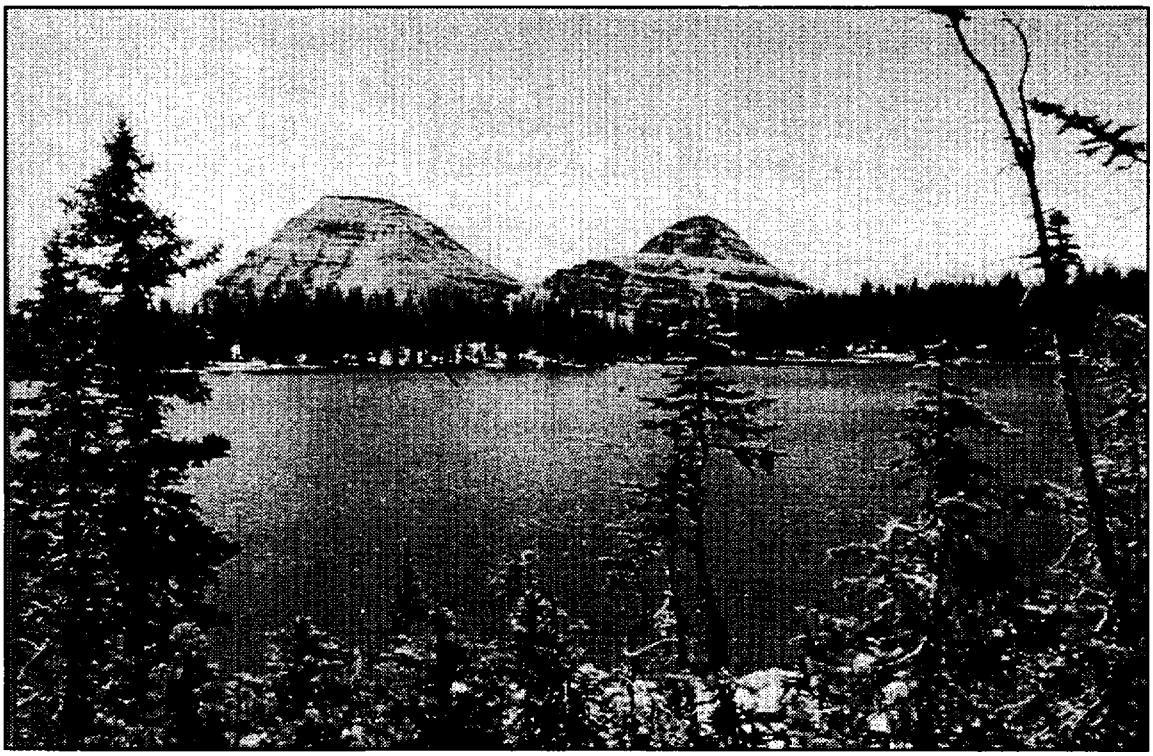
The following is a list of recommendations that could prove beneficial in the improvement of water quality in this watershed:

1. The Price River/Scofield Reservoir watershed is vital to the area, and the Manti LaSal National Forest should evaluate managing the drainage specifically for water shed protection.
2. Stream bank stabilization and riparian enhancement should continue at an accelerated pace.
3. Wetlands should be created to trap sediments before they enter the reservoir.
4. A project to chemically remove the carp should be undertaken.
5. New fisheries management techniques need to be developed and evaluated. A study should be conducted to evaluate the survival of different sizes of stocked rainbow trout. Other species such as Bear Lake cutthroat trout should be evaluated to determine their survival and potential for natural recruitment.
6. Efforts should continue to inform the public about the importance of our watersheds and how to protect them.
7. Sources of funding must be located. These might include:
   a. Special Agriculture Conservation Program (ACP)
   b. National Forest Service
   c. Wallop-Breau fisheries enhancement
   d. Water Quality Act, Section 319 (Riparian)
   e. Water Quality Act, Section 314 (Clean Lakes)
   f. Bureau of Reclamation
   g. Flat Water Fisheries Enhancement.
   h. Watershed Protection and Flood Prevention Act (PL-83-566) USDA SCS
   i. Special Appropriation from Utah State Legislature.

Beneficial Use Classification

Use designation for the waters of Scofield Reservoir have been established as: (1C) protected for domestic purposes with prior treatment by standard complete treatment processes as required by the Utah Department of Environmental Quality; (2B) protected for boating, water skiing, and similar uses, excluding recreational bathing (swimming), (3A) protected for cold water species of game fish and other cold water aquatic life, including the necessary aquatic organisms in their food chain; and (4) protected for agricultural uses including irrigation of crops and stock watering.

SCOUT LAKE



Introduction

Scout Lake is an intermediate-sized natural lake in the western High Uintas. Biologically and geologically it is comparable to numerous other glacial lakes in the High Uintas. It is located with the boundaries of Camp Steiner, a Boy Scouts of America camp. Consequently, it receives a substantial impact from recreational use during the entire summer period. It is nestled on the southern face of the divide with three major peaks on the north and west sides that ascend quickly an additional 600 feet above the lake. The shoreline is owned by the Wasatch-Cache National Forest, and public access is unrestricted. The lake drainage is the extreme headwaters of the Duchesne River and is not regulated in any way by man.

Characteristics and Morphometry

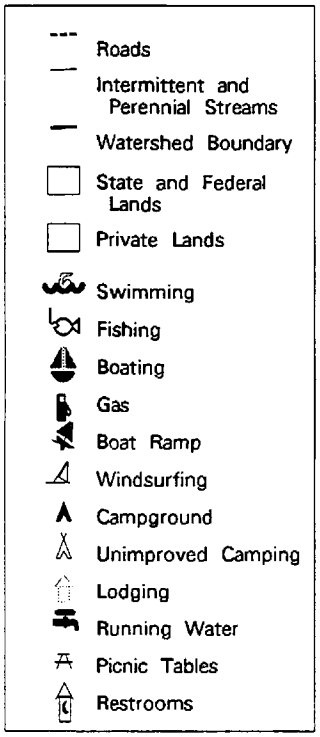
Lake elevation (meters / feet)	3,164 / 10,380
Surface area (hectares / acres)	7.3 / 18
Watershed area (hectares / acres)	85.8 / 212
Volume (m^3 / acre-feet)	
capacity	222,030 / 180
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	0
Depth (meters / feet)	
maximum	5.2 / 17
mean	3.0 / 10
Length (meters / feet)	442 / 1,450
Width (meters / feet)	351 / 1,150
Shoreline (meters / feet)	1,158 / 3,800

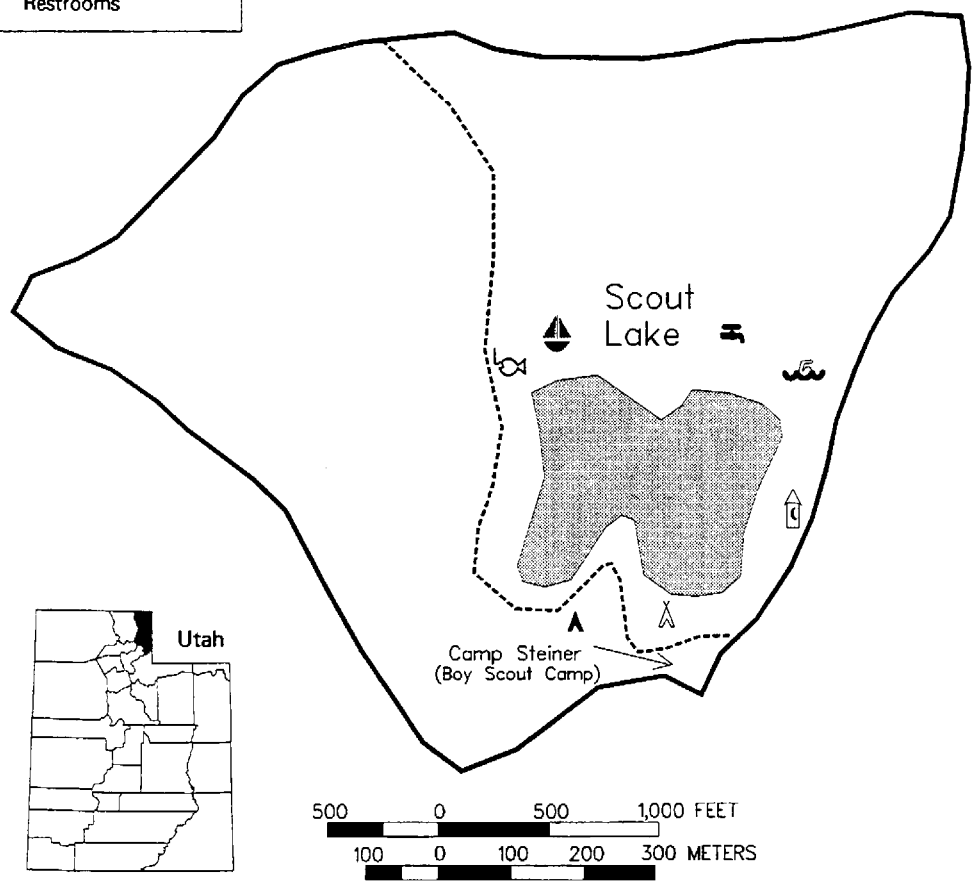
Location

County	Duchesne
Longitude / Latitude	110 53 03 / 40 43 19
USGS Map	Mirror Lake, UT 1972
DeLorme's Utah Atlas & Gazetteer™	Page 54, B-3
Cataloging Unit	Duchesne (16060003)

Recreation

Scout Lake is easily accessible from U-150 about 33 miles east of Kamas. There is a roadway entrance through the Camp Steiner entrance which is clearly marked, but the preferred access route for the public is from the trailhead





County in which watershed is located.

Scout Lake Watershed

<k2>

north of Camp Steiner. Although Camp Steiner is within the jurisdiction of the U.S. forest service, public use of the lake is permitted through their lease agreement.

Fishing, boating, swimming, camping, picnicking, scenic beauty and hiking are all popular. During the summer period the lake is heavily used by the Boy Scouts of America for fishing, boating, and swimming. Motorized boats are prohibited. Except for a few warm days in the late summer, air and water are too cold for swimming. The lake is surrounded by peaks to the north and west in a fairly heavy forested area.

There are no public recreational facilities at the lake, only those provided by and for Camp Steiner. There are numerous campgrounds in the area for use by the public.

Limnological Data

Data sampled from STORET site: 593605

Surface Data	1994
Trophic Status	O
Chlorophyll TSI	35.81
Secchi Depth TSI	39.49
Phosphorous TSI	39.98
Average TSI	38.43
Chlorophyll a (ug/L)	1.7
Transparency (m)	4.2
Total Phosphorous (ug/L)	12
pH	6.8
Total Susp. Solids (mg/L)	1.5
Total Volatile Solids (mg/L)	2
Total Residual Solids (mg/L)	2
Temperature (°C / °f)	13/55
Conductivity (umhos.cm)	17
Water Column Data	
Ammonia (mg/L)	0.03
Nitrate/Nitrite (mg/L)	0.01
Hardness (mg/L)	6.8
Alkalinity (mg/L)	7
Silica (mg/L)	-
Total Phosphorous (ug/L)	10
Miscellaneous Data	
Limiting Nutrient	N
DO (Mg/l) at 75% depth	6.5
Stratification (m)	NO
Depth at Deepest Site (m)	4.3

Watershed Description

Scout Lake is located in the western end of the High Uintas. The watershed is quite small, and consists of dense forest, smaller lakes, boggy meadows, and barren, rugged mountain peaks.

The watershed high point, an unnamed peak just west of the lake, is 3,387 m (11,113 ft) above sea level, thereby developing a complex slope of 28.8% to the reservoir. Slopes are very steep in the area, at times near 80%. Around the lake slopes moderate, with a buffer area somewhat flat near the lake. There are no perennial streams flowing into the lake, but because of the high elevation, snowmelt can flow into the lake for most of the summer. There is also no perennial outflow from the lake.

The watershed is made up primarily of high mountains and rolling mountainous area with some meadows near and around the lake. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of Pine, oak, maple, spruce-fir and aspen. The watershed receives 76 - 102 cm (30 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 0 - 20 days per year.

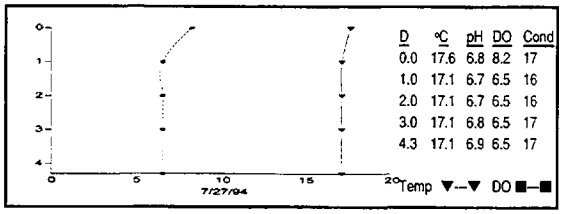
Land use in the watershed is 100% multiple use, with grazing and human recreation, primarily a boy scout camp, being the primary uses.

Limnological Assessment

The water quality of Scout Lake is very good. It is considered to be very soft with a hardness concentration value of approximately 6.8 mg/L ($CaCO_3$). Currently there are no parameters with overall water column concentrations that exceed State water quality standards. However it should be noted that data has only been obtained for one summer period and additional data will need to be obtained to verify this status. There are indications that some winter monitoring needs to be conducted due to extensive mats of submerged macrophytes to determine if winter anoxic conditions exist.

Current data indicates that this a nitrogen limited lake. TSI values define it in an oligotrophic state with low production. The potential for stratification in the lake does not exist due to the shallow nature of the lake, the short summer period and other climatic conditions. This is also indicated by the July 27, 1994 profile.

According to DWR no fish kills have been reported in recent years. The reservoir supports a population of rainbow trout (*Oncorhynchus mykiss*), but other species may still be present because the lake has not been treated for rough fish



D	°C	pH	DO	Cond
0.0	17.6	6.8	8.2	17
1.0	17.1	6.7	6.5	16
2.0	17.1	6.7	6.5	16
3.0	17.1	6.8	6.5	17
4.3	17.1	6.9	6.5	17

competition. The DWR stocks the lake annually with 1,000 catchable rainbow trout.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Merismopedia glauca	1.526	46.84
Gloeocystis sp.	1.000	30.71
Mougeotia sp.	0.556	17.06
Oocystis sp.	0.067	2.05
Pennate diatoms	0.076	2.32
Crucigenia sp.	0.022	0.68
Unknown spherical chlorophyta	0.011	0.34
Total	3.258	
Shannon-Weaver [H']	1.24	
Species Evenness	0.64	
Species Richness	0.27	

The phytoplankton community is dominated by the presence of blue-green and green algae indicative of good water quality that is nitrogen limited.

Pollution Assessment

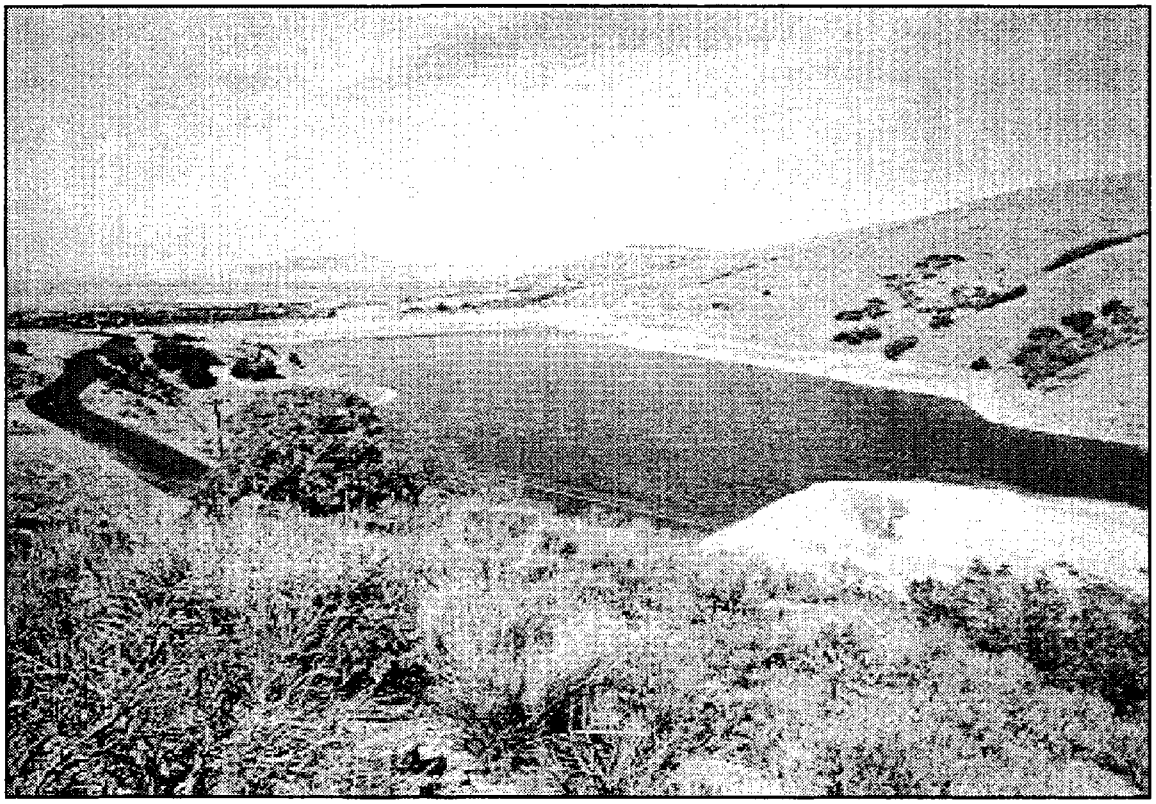
Nonpoint pollution sources include the following: sedimentation and nutrient loading from grazing; and litter or waste associated with recreation.

There are no point sources of pollution in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: recreational bathing (swimming) (2A), boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

SETTLEMENT CANYON RESERVOIR



Introduction

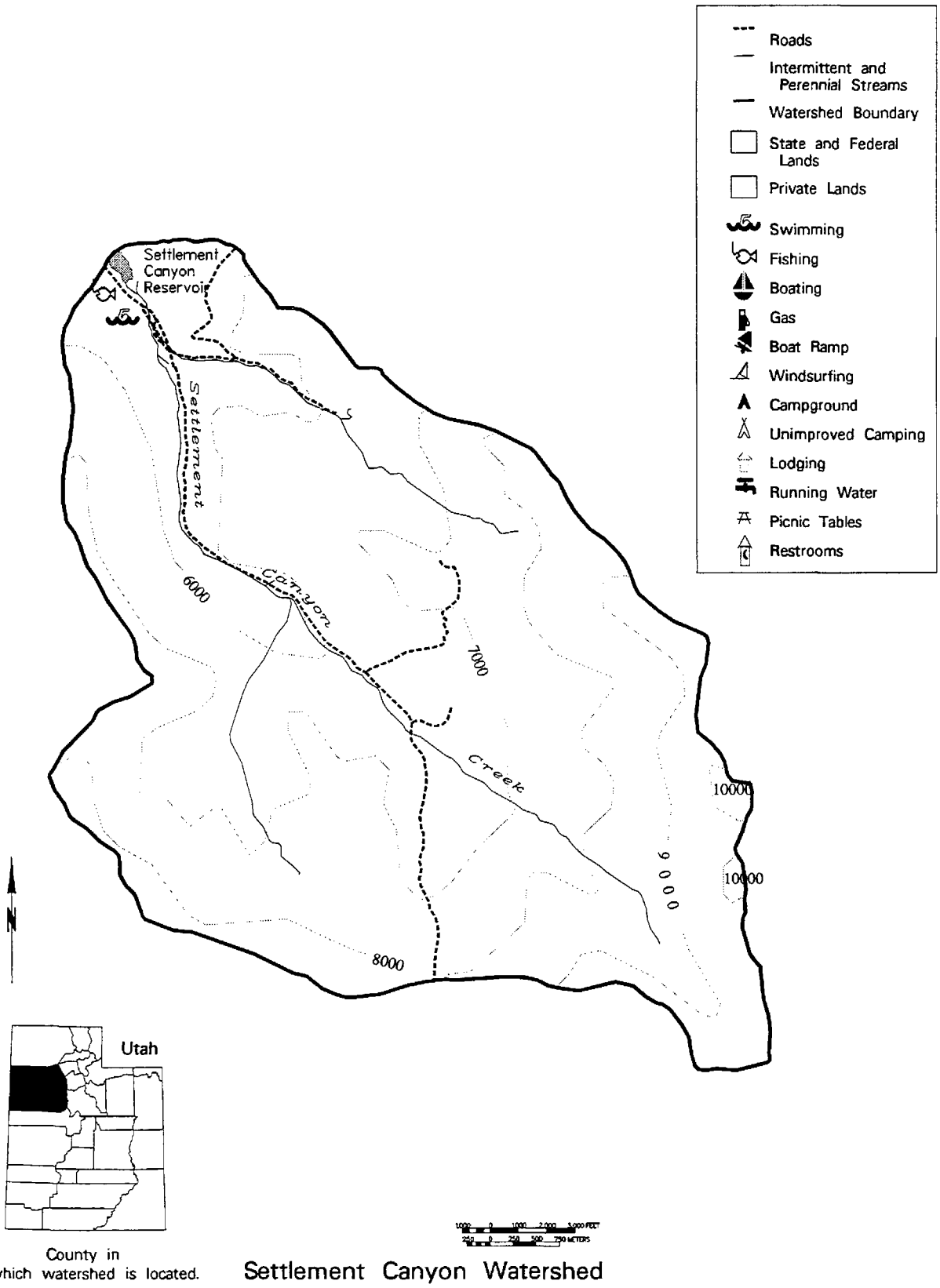
Settlement Canyon Reservoir is an small reservoir at the base of the Oquirrh Mountains. It is at the foot of Settlement Canyon, a narrow, steep canyon immediately south of Tooele. Settlement Canyon Reservoir was created in 1966 by the construction of an earth-fill dam. The reservoir shoreline is privately owned, but public access is unrestricted. Water use of reservoir water is primarily for irrigation in addition to the recreational values. Water is released into canals for agricultural purposes, and into Tooele City's municipal irrigation system for pressurized use in residential areas. Some springs above the reservoir are piped and the water is bought by Tooele City for culinary purposes. It is anticipated that unless water conservation measures are implemented, population growth will force the city to purchase increasing quantities of water from the reservoir.

Characteristics and Morphometry

Lake elevation (meters / feet)	1,627 / 5,340
Surface area (hectares / acres)	12.75 / 315
Watershed area (hectares / acres)	3,626 / 8,960
Volume (m^3 / acre-feet)	
capacity	1,440,989 / 1,168
conservation pool	0
Annual inflow (m^3 / acre-feet)	4,934,000 / 4,000
Retention time (years)	0.3
Drawdown (m^3 / acre-feet)	1,356,850 / 1,100
Depth (meters / feet)	
maximum	20 / 65.6
mean	7.6 / 25
Length (meters / feet)	357 / 1,172
Width (meters / feet)	191 / 625
Shoreline (meters / feet)	1,261 / 4,140

Location

County	Sanpete
Longitude / Latitude	111 42 06 / 39 12 03
USGS Maps	Sterling, UT 1966
DeLorme's Utah Atlas & Gazetteer™	Page 37 A-6
Cataloging Unit	San Pitch (16030004)



Settlement Canyon Watershed

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Recreation

Settlement Canyon Reservoir is accessible from U-36 just south of Tooele. From downtown, go south on Main Street. At the south end of town the road meets the Oquirrh Mountains and bends towards the west, the residential area ends, and there is a white, windowless Masonic Lodge on the left. Turn left at the lodge, and go up the canyon for about 1/2 mile to the reservoir. The reservoir is close enough to the city that Howard Clegg, former president of the Settlement Canyon Irrigation Company, said "any kid in town could go up there and fish if he had a little ambition"

Fishing is the only recreational use permitted on the reservoir. The reservoir and surrounding area are privately owned, and public use is a privilege. Remember you are a guest.

The county constructed some toilet facilities near the reservoir, but they have been heavily vandalized. Legion Park Campground is located one mile up the canyon from the reservoir. There are no other private or public campgrounds in the area.

Watershed Description

Settlement Canyon Reservoir an impoundment of Settlement Creek in the Oquirrh Mountains. The canyon is steep and narrow, resulting in a small, deep reservoir. The entire watershed is homogenous, consisting of deeply dissected mountains. Slopes are very steep (>40%) throughout the watershed. There is some evidence of glaciation at the head of Settlement Canyon.

The watershed high point, a peak on the ridge at the headwaters of Settlement Creek, is 3,162 m (10,373 ft) above sea level, thereby developing a complex slope of 16.7% to the reservoir. The average stream gradient above the reservoir is 9.7% (514 feet per mile). The inflow is Settlement Canyon Creek, which is fed by snowmelt from the high Oquirrh Mountains and several springs immediately upstream from the reservoir (some of these are piped). The outlet is Settlement Canyon Creek.

The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of sagebrush-grass and pinyon-juniper. Spruce-fir and alpine vegetation commuties are probably found at higher elevations. The watershed receives 41 - 102 cm (16 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 140 -160 days per year.

According to the 1982 Clean Lakes Inventory, land use is entirely native grazing of mostly cattle and possibly sheep with some recreational use.

Limnological Assessment

The water quality of Settlement Canyon Reservoir is very good. It is considered to be hard with a hardness concentration value of approximately 192 mg/L ($CaCO_3$). Although there are no overall water column concentrations that exceed State water quality standards there are reported violations of parameters near the bottom of the lake or on occasion at a specific depth in the water column. These parameters include phosphorus and dissolved oxygen. Neither of these exceedences appears to be effecting the defined beneficial uses established for the reservoir and have little effect on the overall water quality of the reservoir.

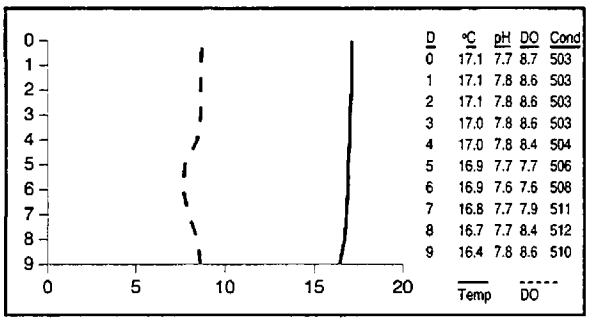
Current data suggest that the reservoir is currently a phosphorus limited system. TSI values indicate the reservoir is oligotrophic to mesotrophic system in a state of low productivity. Although the profile shown of August 24, 1992 does not show it, stratification has been evident during other years.

According to DWR no fish kills have been reported in recent years. The reservoir supports a population of brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*). The lake has not

Limnological Data

Data sampled from STORET site: 596020

Surface Data	1981	1990	1992
Trophic Status	M	O	M
Chlorophyll TSI	-	48.81	49.62
Secchi Depth TSI	40.02	52.78	43.93
Phosphorous TSI	43.2	17.35	50.26
Average TSI	41.61	39.65	47.94
Chlorophyll a (ug/L)	-	6.4	6.9
Transparency (m)	4.1	1.7	3.1
Total Phosphorous (ug/L)	10	3	25
pH	8.3	8.2	7.9
Total Susp. Solids (mg/L)	<5	4.8	2.8
Total Volatile Solids (mg/L)	-	-	2
Total Residual Solids (mg/L)	-	-	2
Temperature (°C / °f)	16/61	20/68	16/61
Conductivity (umhos.cm)	360	678	487
Water Column Data			
Ammonia (mg/L)	0.08	0.04	0.03
Nitrate/Nitrite (mg/L)	0.08	0.36	0.32
Hardness (mg/L)	188	203	185
Alkalinity (mg/L)	181	188	197
Silica (mg/L)	-	-	9.0
Total Phosphorous (ug/L)	10	2	15
Miscellaneous Data			
Limiting Nutrient	P	P	P
DO (Mg/l) at 75% depth	11.2	5.2	7.9
Stratification (m)	4-6	NO	NO
Depth at Deepest Site (m)	20	12.7	9.0



D	°C	pH	DO	Cond
0	17.1	7.7	8.7	503
1	17.1	7.8	8.6	503
2	17.1	7.8	8.6	503
3	17.0	7.8	8.6	503
4	17.0	7.8	8.4	504
5	16.9	7.7	7.7	506
6	16.9	7.6	7.6	508
7	16.8	7.7	7.9	511
8	16.7	7.7	8.4	512
9	16.4	7.8	8.6	510

been treated for rough fish competition, so populations of native fishes may still be present in the lake. Current stocking reports indicate that DWR stocks the lake in excess of 15,00 0 catchable rainbow trout annually.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	7.923	57.82
Dinobryon divergens	4.208	30.71
Ceratium hirundinella	0.936	6.83
Gloeocystis sp.	0.334	2.43
Pennate diatoms	0.189	1.38
Oocystis sp.	0.044	0.32
Ankistrodesmus falcatus	0.035	0.25
Centric diatoms	0.018	0.13
Unknown spherical green alga	0.017	0.12
Total	13.700	
Shannon-Weaver [H']	1.06	
Species Evenness	0.48	
Species Richness [d]	0.34	

The phytoplankton community is dominated by the presence of green algae and flagellates indicative of fairly good water quality.

Pollution Assessment

Nonpoint pollution sources include the following: sedimentation and nutrient loading from grazing; and wastes or litter from recreation.

Point pollution sources include the following:

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Wasatch Front Regional Council	292-4469
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Great Salt Lake Country Travel Region (SLC)	896-9222
Tooele Chamber of Commerce	882-0690
Reservoir Administrators	
Settlement Canyon Irrigation Company	882-0257

SEVIER BRIDGE RESERVOIR (YUBA LAKE)

Introduction

Measured by surface area, the Sevier Bridge Reservoir is the fourth largest artificial body of water in the state. It is located in a long, narrow valley between the Valley Mountains and the San Pitch Mountains, between Gunnison and I-15. It is also known as Yuba Lake. The Sevier Bridge Reservoir was created in 1914 by the construction of an earth-fill dam. The reservoir shoreline is about 50% privately owned, with BLM comprising the remaining 50%. Public access is unrestricted. Current water use is for irrigation, cooling water for the Intermountain Power Project (IPP) coal burning power plants and recreation. The potential exists for the construction of two additional plants, which would double their water needs.

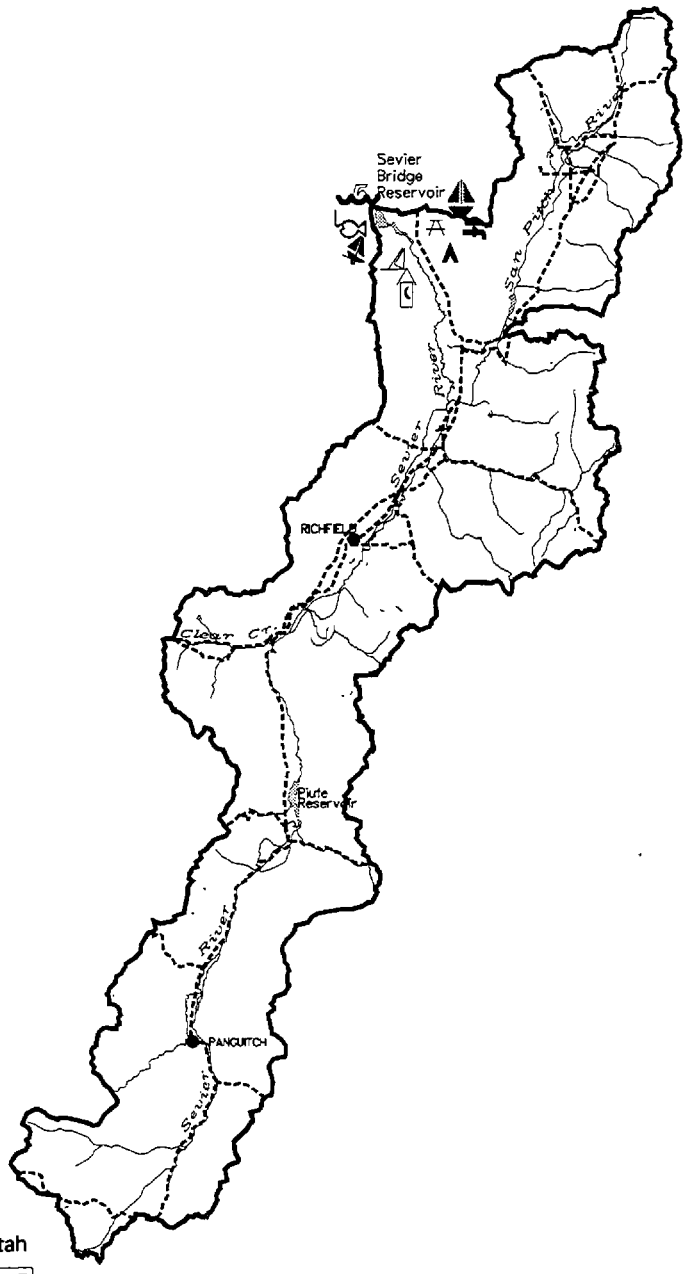
The Sevier River is an exotic stream, meaning it carries water originating in a moist climate (in this case the mountains) across the deserts. Before the river was dammed, it emptied into Sevier Lake (about 60 miles west of the Sevier Bridge Reservoir) where all the water

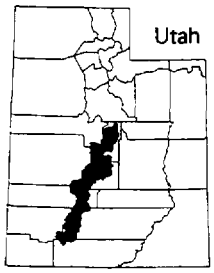
Characteristics and Morphometry

Lake elevation (meters / feet)	1,517 / 4,978
Surface area (hectares / acres)	4,413 / 10,905
Watershed area (hectares / acres)	511,000 / 1,260,000
Volume (m^3 / acre-feet)	
capacity	201,302,930 / 236,145
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	1.6
Drawdown (m^3 / acre-feet)	125,364,900 / 101,633
Depth (meters / feet)	
maximum	22.6 / 74
mean	6.5 / 21.3
Length (km / miles)	5.8 / 19
Width (km / miles)	4.99 / 3.1
Shoreline (km / miles)	56.32 / 34.8

Location

County	Juab / Sanpete
Longitude / Latitude	111 58 10 / 39 21 39
USGS Maps	Mills, UT 1985, Skinner Peaks, UT 1966, Hell's Kitchen Canyon, UT 1965, Hayes Canyon, UT 1966, Gunnison, UT 1966.
DeLorme's Utah Atlas & Gazetteer™	Page 37, A-4, A-5
Cataloging Unit	Middle Sevier (16030003)





County near which watershed is located.

Sevier Bridge Watershed

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evaporated. Because of the high evaporative potential of the river flowing across the desert, all chemicals in the water become increasingly concentrated. The Sevier Bridge Reservoir loses much water to evaporation.

Recreation

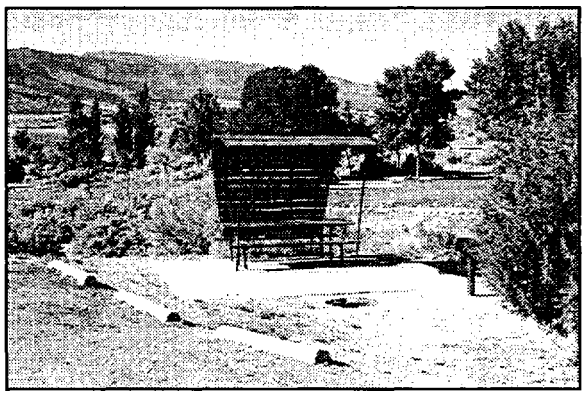
Sevier Bridge Reservoir is accessible from many points on U-28 north of Gunnison, as well as from old US-91 north of Scipio. Northern accesses are favored because the south end of the reservoir is often shallow or dry.

Old US-91 passes by Yuba Lake State Park, near the dam. Exit I-15 at exit #202 and go south, or exit at #188 (Scipio), and take the frontage road on the west side of the freeway which intersects old US-91 via an underpass a few miles north of Scipio.

There are numerous accesses along U-28 from about 15 miles south of Levan (Painted Rocks access) to near Fayette. Access is also possible from a network of unpaved roads on the west side of the reservoir.

The lake is used for fishing, swimming, boating, waterskiing and picnicking. Usage is fairly heavy throughout the year with excessively large crowds around Memorial Day weekend.

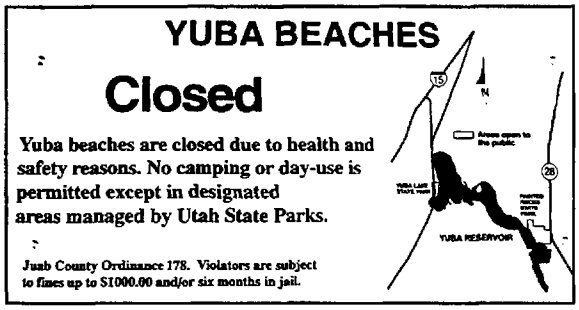
Yuba Lake State Park has a sanded beach, a boat



ramp, a 27 unit campground, flush toilets, hot showers, and picnic areas. Painted Rocks State Access (midway between Gunnison and Levan on U-28) has a primitive campground and a boat ramp. Primitive camping has been allowed north of the state park, but recent abuse of the area is forcing the evaluation of current policies. In addition there is a private campground in Gunnison (see info box).

Watershed Description

Sevier Bridge Reservoir is an impoundment of the Sevier River. The reservoir occupies a long, narrow valley between the San Pitch Mountains and the Valley Mountains. The valley is filled with alluvial deposits from the mountains.



The valley is so flat the a change of several vertical feet of reservoir water level will expose large areas of mud.

The watershed covers the upper Sevier River Drainage, from The Paunsaugunt and Markagunt Plateaus in the south, the west face of the Escalante Mountains, the Awapa Plateau, the Sevier Plateau, the east slopes of the Tushars and Pavant Ranges, the San Pitch Mountains, and the east face of the Wasatch Plateau. Everything from Panguitch to Manti drains into the Sevier Bridge Reservoir.

The watershed high point, Delano Peak in the Tushar Mountains, is 3,709 m (12,167 ft) above sea level, thereby developing a complex slope of 2.1% to the reservoir. The inflow and outlet is the Sevier River. The average stream gradient above the reservoir is 0.32% (16.9 feet per mile). There are several upstream reservoirs in the Sevier River and its tributaries. Gunnison Reservoir dams the Sanpete River not far above its confluence with the Sevier, which is not far from the upstream end of Sevier Bridge Reservoir. On the Sevier River itself, the nearest upstream reservoir is Piute, more than 60 highway miles upstream and probably double that in river miles. Hence, there are few buffers to protect the reservoir water from upstream mismanagement.

The watershed contains substantial amounts of all the major soil types found in the state. See Appendix III for soil composition data.

The vegetation communities consist of pine, spruce-fir, aspen, oak-maple, sagebrush-grass, bitterbrush, pinyon-juniper, shadscale, and greasewood. The watershed receives 20 - 102 cm (8 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 80 - 120 days per year.

According to the 1982 Clean Lakes Inventory, land use is as follows. The largest use is multiple use land (39%). These lands are administered by the BLM, USFS, and the State of Utah. Grazing, recreation, and limited logging occur on many areas of these lands. Pasture, hay, and croplands make up 35%, native grazing (mostly cattle and sheep) comprise 17% of the watershed. Irrigated cropland (6%), wildlife (3%), urban (0.7%), and recreation (0.05%) make up the remainder of the watershed.

Limnological Assessment

The water quality of Sevier Bridge Reservoir is fairly good. It is considered to be very hard with a hardness concentration value of approximately 425 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are total phosphorus and dissolved oxygen. Although data hasn't been collect for total dissolved solids conductivity values as depicted in the September 8, 1992 profile, indicate that exceedences could be occurring later in the summer season. The average concentrations of total phosphorus in the water column for the three study periods were 40, 44 and 110 ug/L which all exceed the recommended pollution indicator for phosphorus of 25 ug/L. The phosphorus concentration in the hypolimnion near the dam reached a level of 190 ug/L. This increased concentration occurred when the reservoir was also exhibiting a decline in dissolved oxygen concentrations in the lower levels of the reservoir as indicated in the profile. This substantiates the fact that water quality impairments do exist. Concentrations drop to a low of 4.0 mg/L. The loss of dissolved oxygen could be more extensive during ice coverage and result in a greater impairment to the existing fishery. Although the profile does not indicate that the reservoir was stratified in September there is data that shows that the reservoir does stratify earlier in the year when conditions are appropriate. The reservoir was stratified during May , 1980 with a thermocline present at 10-11 meters.

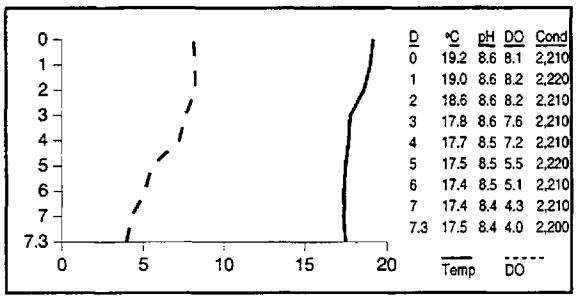
Current data suggest that the reservoir is currently a phosphorus limited system. This conclusion is substantiated by the 1975 NES survey. TSI values indicate the reservoir is eutrophic with hypereutrophic conditions present in 1992. It appears that there was a significant increase in the overall concentrations of phosphorus in the lake in 1992 compared to the other survey years.

According to DWR no fish kills have been reported in recent years. However, it should be noted that DWR staff reported that the perch fishery crashed with an increasing walleye population and low water conditions. With the loss of the perch as a stable fishery the walleye populations have diminished significantly too. The reservoir supports populations of channel catfish (*Ictalurus punctatus*) stocked in 1978 and 1983-84, yellow perch (*Perca flavescens*), walleye (*Stizostedion vitreum*) stocked in 1978, northern pike (*Esox lucius*), carp (*Cyprinus carpio*) and Utah sucker (*Catostomus ardens*). The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake. DWR has not stocked the reservoir in recent years with fish.

Limnological Data

Data averaged from STORET sites: 494230, 494231, 494232

Surface Data	1980	1990	1992
Trophic Status	E	E	H
Chlorophyll TSI	-	46.14	48.76
Secchi Depth TSI	46.85	63.54	80.27
Phosphorous TSI	59.67	53.51	62.81
Average TSI	53.26	54.40	63.95
Chlorophyll a (ug/L)	-	5.0	6.9
Transparency (m)	-	0.9	0.6
Total Phosphorous (ug/L)	41.4	32	90
pH	8.2	8.4	8.5
Total Susp. Solids (mg/L)	14.8	13	6
Total Volatile Solids (mg/L)	-	-	2
Total Residual Solids (mg/L)	-	-	3
Temperature (°C / °f)	18/65	20/67	18/64
Conductivity (umhos.cm)	1564	2007	2140
Water Column Data			
Ammonia (mg/L)	0.17	0.06	0.09
Nitrate/Nitrite (mg/L)	0.70	0.40	0.31
Hardness (mg/L)	405	441	428
Alkalinity (mg/L)	279	259	250
Silica (mg/L)	14	-	21.6
Total Phosphorous (ug/L)	40	44	110
Miscellaneous Data			
Limiting Nutrient	P	P	P
DO (Mg/l) at 75% depth	8.1	5.9	5.3
Stratification (m)	9-10	NO	NO
Depth at Deepest Site (m)	20	14.0	7.3



The DWR would like to chemically treat the lake if funds become available and water storage conditions are favorable, then restock with Smallmouth Bass and Yellow Perch, but no Walleye.

According to the 1975 NES survey, there were thirteen genera of phytoplankton found in the reservoir. Of those found, five of the genera were diatoms (*Synedra, Diatoma, Fragilaria, Cyclotella, and Nitzschia*), and one species of blue-green algae, *Aphanizomenon*.

Phytoplankton in the euphotic zone for the last study period include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Anabaena spiroides var. crassa	89.623	94.13
Sphaerocystis schroeteri	2.641	2.77
Ceratium hirundinella	0.936	0.98
Coelastrum sp.	0.556	0.58
Ankistrodesmus falcatus	0.432	0.45
Staurastrum sp.	0.334	0.35
Pennate diatoms	0.267	0.28
Asterionella formosa	0.189	0.20
Centric diatoms	0.062	0.07
Unknown spherical green alga	0.038	0.04
Closteriopsis longissima var. tropica	0.033	0.04
Crucigenia sp.	0.033	0.04
Scenedesmus bijuga	0.022	0.02
Microcystis incerta	0.022	0.02
Scenedesmus sp.	0.008	0.01
Euglena sp.	0.008	0.01
Oocystis sp.	0.004	0.00
Chlamydomonas sp.	0.003	0.00
Total	95.208	
Shannon-Weaver [H']	0.32	
Species Evenness	0.11	
Species Richness	0.67	

The phytoplankton community is currently dominated by the presence of blue-green algae indicative of the eutrophic state of the reservoir.

Pollution Assessment

Nonpoint pollution sources include the following: sedimentation and nutrient loading from logging, grazing, feedlots and croplands; wastes and litter from recreation; household wastes and nutrient loading from urban areas; and sedimentation and heavy metal production from active and inactive mines. The major use of the watershed is livestock grazing, which may contribute to heavy runoff and substantial soil erosion. There are several industrial mineral (sand, gravel, clay) mines in the watershed, further information is available from the Utah Geologic Survey. There are many active timber sales, none of which are near enough to be of any significance. Further information on logging is available from the Fishlake, Dixie, and Manti-La Sal National Forests.

Essentially, all types of non-point pollution sources occur in the watershed, but the impacts are somewhat mitigated by the long river distances and upstream reservoirs.

The area around the reservoir is rangeland and cropland. These land uses have impact on the reservoir, including sediment and nutrient production associated with grazing and land use practices.

There are a number of point sources throughout the watershed area of various types. These would include fish hatcheries, municipal and industrial discharges.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), warm water game fish and organisms in their food chain (3B) and agricultural uses (4).

Information

Management Agencies	
Bureau of Land Management	539-4001
House Range Resource Area (Fillmore)	743-6811
Sevier River Resource Area (Richfield)	896-8228
Six County Commissioners Association	896-9222
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Panoramaland Travel Region (Richfield)	896-9222
Delta Chamber of Commerce	864-4316
Nephi Chamber of Commerce	623-2411
Lund's Campground (Gunnison)	528-3366
Reservoir Administrators	
Consolidated Sevier Bridge Company	864-2494

SHEEP CREEK LAKE

Introduction

Sheep Creek Lake, perched on the bluff above Sheep Creek Canyon, is actually in the Beaver Creek Watershed. These creeks flow north out of the the Uintas, then west into the Flaming Gorge. Sheep Creek Lake is a stabilized off stream impoundment that is maintained as a recreational fishery. A campground is on the south shore of the lake.

It is an artificial, off stream lake, receiving water from a diversion of Beaver Creek and other creeks via the Sheep Creek Canal. The lake was created as a reservoir for agricultural use. The Utah DWR purchased the lake in 1959 to provide a permanent stabilized body of water for wildlife habitat and recreation. The shoreline is owned by the Ashley National Forest, and public access is unrestricted. No changes in water use are anticipated.

Characteristics and Morphometry

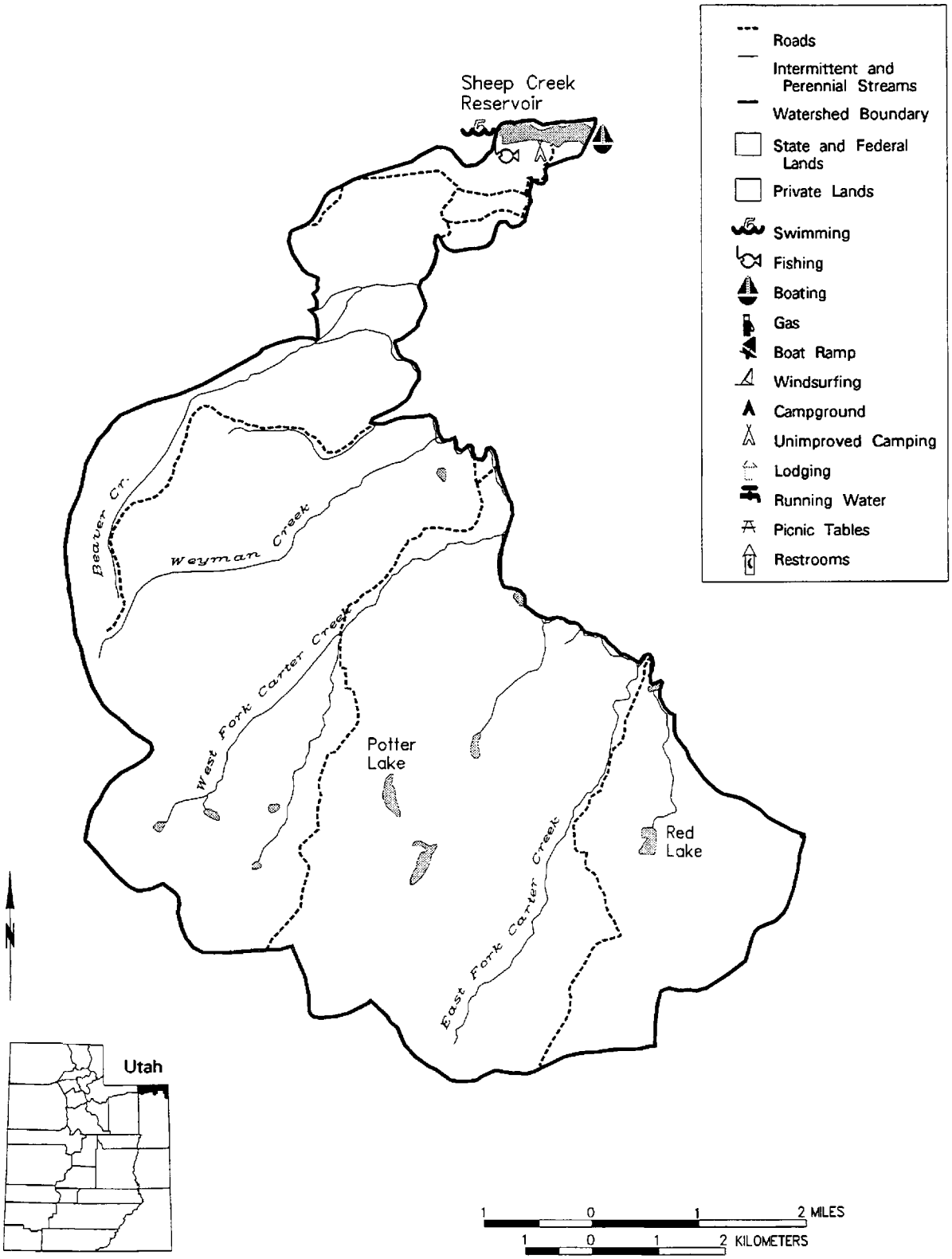
Lake elevation (meters / feet)	2,261 / 8,600
Surface area (hectares / acres)	34.8 / 86
Watershed area (hectares / acres)	898 / 2,218
Volume (m^3 / acre-feet)	
capacity	1,130,000 / 915
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	5.18 / 17
mean	3.05 / 10
Length (meters / feet)	1,400 / 4,593
Width (meters / feet)	244 / 801
Shoreline (km / miles)	3.11 / 1.9

Location

County	Daggett
Longitude / Latitude	109 50 34 / 40 53 20
USGS Map	Leidy Peak 1963
DeLorme's Utah Atlas & Gazetteer™	Page 56, B-2
Cataloging Unit	Flaming Gorge (14040106)

Recreation

Sheep Creek Lake is on the north slope road of the Uintas, about 10 miles west of U-44. From near milepost 15



County in which watershed is located.

Sheep Creek Watershed

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on U-44, turn west on the Sheep Creek Geologic Loop. A sign says Sheep Creek Lake 10. Follow the Sheep Creek Road for three miles, then turn west again on a gravel road also signed to Sheep Creek Lake. This is the Spirit Lake Road. It begins at the southwest corner of the loop. Go west on Sheep Creek Road (FS-221) for about 6 miles to the turnoff for Browne Lake. Continue on the gravel road on the right, which should be marked to the Sheep Creek Lake. The turnoff to Sheep Creek Lake is about 1.5 miles past the turnoff. Follow this road about one mile to the lake.

It is also accessible from the north and west via the state highway from Manila to Mountain View, Wyoming. Access points to forest service lands include roads from Lonetree, Burnt Fork and west of Manila at Antelope Junction. These roads will eventually combine with FS-221 which will lead to the lake. Please refer to a variety of maps for specific direction to the lake.

The lake is maintained solely as a fishery. There is no boat ramp and limited other facilities. Browne Lake Campground has privies, campsites, picnic areas and drinking water.

Watershed Description

Sheep Creek Lake is located on the north slopes of the High Uintas. The natural watershed is extremely small, consisting of a few small hills south of the reservoir. The canal from Beaver Creek carries water in from an area of meadows and coniferous forests. Slopes surrounding the reservoir are nearly level (<5%), but immediately to the north, the land drops down into Sheep Creek Gorge.

The watershed high point, Wayman Park, is 3,250 m (10,660 ft) above sea level, thereby developing a complex slope of 6.6% to the reservoir. The average stream gradient of Beaver Creek is 5.1% (270 feet per mile). The diversion canal is nearly level. The outflow drains down the slope and returns to Beaver Creek.

The watershed is made up of high mountains and mountains meadows. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of spruce-fir, pine and aspen. The watershed receives 51 - 76 cm (20 - 30 inches) of precipitation annually. The frost-free season around the reservoir is 20 - 40 days per year.

Land use in the watershed is 100% multiple use, with grazing, logging and human recreation being the primary uses. A timber sale is projected for 1993.

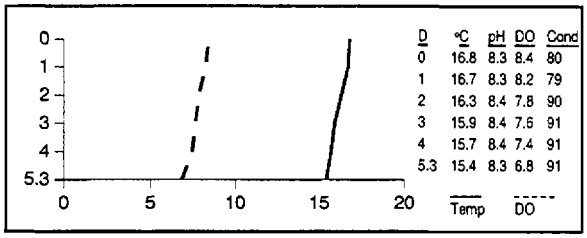
Limnological Assessment

The water quality of Sheep Creek Reservoir is fairly good. It is considered to be soft with a hardness concentration value of approximately 41 mg/L ($CaCO_3$). Although there are no overall water column concentrations that exceed State water quality standards throughout the year dissolved oxygen concentrations during the winterconducted on March 14, 1991 indicates that the dissolved oxygen concentrations ranges from 1.5 mg/L at the surface to 0.5 mg/L from 1-4 meters at the bottom.

Limnological Data

Data sampled and averaged from STORET site: 593806.

Surface Data	1992
Trophic Status	M
Chlorophyll TSI	44.91
Secchi Depth TSI	40.76
Phosphorous TSI	51.94
Average TSI	45.87
Chlorophyll a (ug/L)	4.3
Transparency (m)	3.8
Total Phosphorous (ug/L)	28
pH	8.2
Total Susp. Solids (mg/L)	<3
Total Volatile Solids (mg/L)	1
Total Residual Solids (mg/L)	2
Temperature (°C / °f)	16/61
Conductivity (umhos.cm)	57
Water Column Data	
Ammonia (mg/L)	0.13
Nitrate/Nitrite (mg/L)	0.01
Hardness (mg/L)	40.7
Alkalinity (mg/L)	44
Silica (mg/L)	10.0
Total Phosphorous (ug/L)	25
Miscellaneous Data	
Limiting Nutrient	N
DO (Mg/l) at 75% depth	7.4
Stratification (m)	NO
Depth at Deepest Site (m)	5.3



D	°C	pH	DO	Cond
0	16.8	8.3	8.4	80
1	16.7	8.3	8.2	79
2	16.3	8.4	7.8	90
3	15.9	8.4	7.6	91
4	15.7	8.4	7.4	91
5.3	15.4	8.3	6.8	91

approaches anoxic conditions. Data from a survey

Current data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is mesotrophic in a state of moderate productivity. The lake lacks sufficient depth to permit stratification as indicated in the August 12, 1992 profile.

According to DWR no fish kills have been reported in recent years, but partial winter kills have been known to occur. The lake supports a population of brook trout (*Salvelinus fontinalis*), cutthroat trout (*Oncorhynchus clarki*), and rainbow trout (*Oncorhynchus mykiss*). The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake. Current stocking reports indicate that DWR stocks the lake with 4,000 catchable rainbow trout and 7,000 fingerling brook trout annually.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	5.282	69.03
Pediastrum duplex	1.334	17.44
Microcystis aeruginosa	0.734	9.59
Pennate diatoms	0.202	2.64
Centric diatoms	0.080	1.05
Asterionella formosa	0.019	0.25
Total	7.650	
Shannon-Weaver [H']	0.94	
Species Evenness	0.53	
Species Richness	0.23	

The phytoplankton community is dominated by the presence of green algae which is indicative of relatively good water with moderate production.

Pollution Assessment

Nonpoint pollution sources include the following: sedimentation and nutrient loading from grazing; litter and waste from recreation; and sedimentation and increased runoff from logging.

Grazing takes place throughout the watershed and in the vicinity of the reservoir.

There are no point sources of pollution in the watershed.

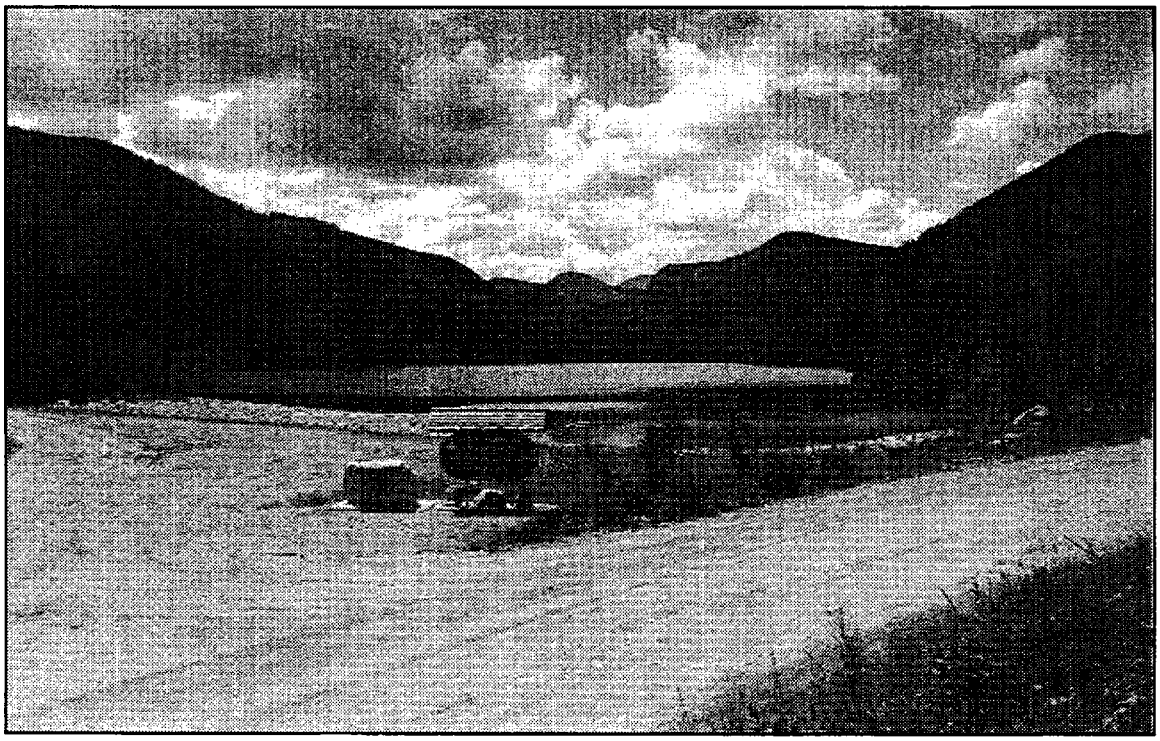
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Ashley National Forest	789-1181
Flaming Gorge Ranger District	784-3445
Recreation	
Dinosaurland Travel Region (Vernal)	789-6932
Manila Chamber of Commerce	784-3395
Reservoir Administrators	
Division of Wildlife Resources, Fisheries Management	538-4812

SMITH AND MOREHOUSE RESERVOIR



Introduction

Smith and Morehouse Reservoir is in the upper reaches of the Weber River drainage in the western High Uintas. This area of the Uintas is popular during the summer, as it is relatively close to population centers on the Wasatch Front. It is in a narrow, north-facing canyon that stays cooler and moister than other areas. The reservoir was enlarged in 1987, quintupling its capacity.

Characteristics and Morphometry

Lake elevation (meters / feet)	2,426 / 7,960
Surface area (hectares / acres)	17.8 / 44
Watershed area (hectares / acres)	8,314 / 20,545
Volume (m^3 / acre-feet)	
capacity	1,667,600 / 1,360
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	1,667,600 / 1,360
Depth (meters / feet)	
maximum	9.23 / 30.3
mean	
Length (meters / feet)	975 / 3,199
Width (meters / feet)	244 / 801
Shoreline (meters / feet)	2,130 / 6,989

The shoreline is owned by the Wasatch-Cache National Forest, and public access is unrestricted. In addition to recreation water use is for both irrigation and culinary purposes, with a greater fraction being used for culinary as population increases along the Wasatch Front.

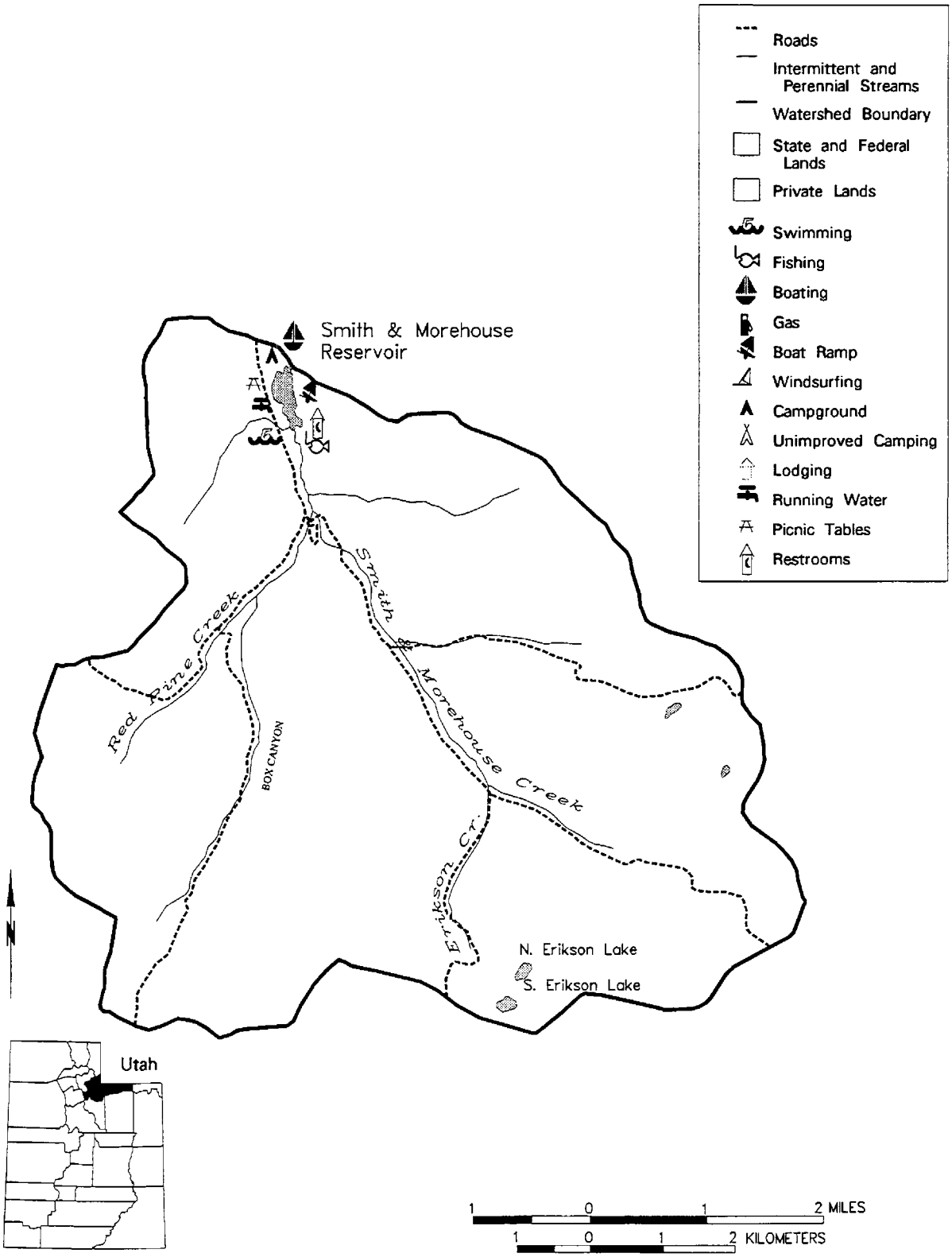
Location

County	Summit
Longitude / Latitude	110 06 09 / 40 45 31
USGS Map	Erickson Basin, UT , Slader Basin, UT 1972
DeLorme's Utah Atlas & Gazetteer™	Page 54, B-2
Cataloging Unit	Upper Weber (16020101)

Recreation

Smith and Morehouse Reservoir is east of Oakley on the paved road that follows the Weber River. The route is well marked from Oakley.

Fishing, camping, picnicking, scenic beauty and hiking are all popular. There is a boat ramp, and the reservoir is popular for water recreation, although it is quite cold for swimming.



County in which watershed is located.

Smith & Morehouse Watershed

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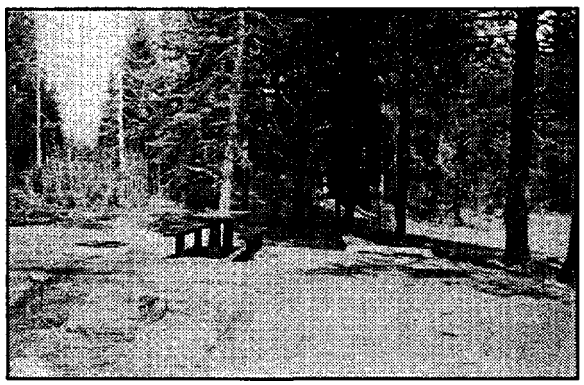
The area receives heavy recreational use throughout the summer. The paved road up the Weber River is plowed during the winter, and the reservoir is accessible by cross-country ski, snowshoe, or snowmobile from the paved road approximately 2 miles south on FR-33.

The campground at the lake was inundated when the dam was raised, but campgrounds are currently available both above and below the reservoir. They provide campsites, with picnic areas, drinking water, and restrooms.



Limnological Data

Data sampled from STORET site: 592396

Surface Data	1981	1989	1991
Trophic Status	M	M	M
Chlorophyll TSI	-	45.25	44.68
Secchi Depth TSI	50	48.09	57.37
Phosphorous TSI	37	39.67	35.82
Average TSI	43.5	44.34	45.96
Chlorophyll a (ug/L)	-	4.5	4.2
Transparency (m)	1.8	2.3	1.2
Total Phosphorous (ug/L)	5	12	9
pH	8.4	8.1	7.4
Total Susp. Solids (mg/L)	<5	-	5
Total Volatile Solids (mg/L)	-	-	4
Total Residual Solids (mg/L)	-	-	<2
Temperature (°C / °f)	8/46	14/58	13/56
Conductivity (umhos.cm)	28	48	47
Water Column Data			
Ammonia (mg/L)	0.1	0.01	0.03
Nitrate/Nitrite (mg/L)	0.18	-	0.02
Hardness (mg/L)	16	-	24
Alkalinity (mg/L)	13	-	18
Silica (mg/L)	-	-	2.4
Total Phosphorous (ug/L)	7.5	15	6
Miscellaneous Data			
Limiting Nutrient	P	N	N
DO (Mg/l) at 75% depth	8.3	6.9	5.2
Stratification (m)	1-2	10-12	5-10
Depth at Deepest Site (m)	7	13.5	11

Watershed Description

The watershed is quite small, almost visible in its entirety from the reservoir. The watershed high point, Moffit Peak, is 3,354 m (11,003 ft) above sea level, thereby developing a complex slope of 18.9% to the reservoir. There are at least four small, perennial streams entering the lake, the average gradient being 4.0% (210 feet per mile). The inflows drain small natural lakes in the watershed, many of which are beaver ponds rather than glacial lakes. Beaver activity probably modifies the drainage such that water flows in these streams year round, rather than only during spring and summer runoff. There are 4 major upstream lakes in the watershed.

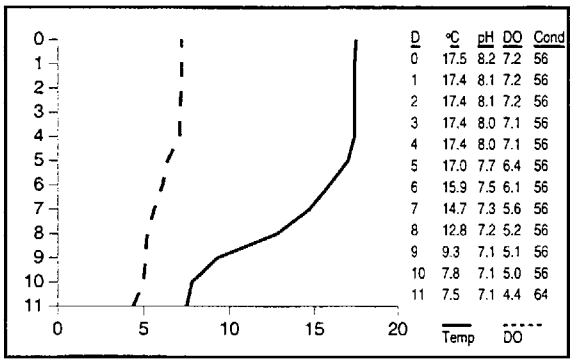
The watershed is made up of high mountains, lakes, meadows, and rocky outcroppings. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of marshes, pine, spruce-fir, aspen, oak, maple, and alpine. The watershed receives 64 - 102 m (25 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 0 - 40 days per year.

Use of the watershed is 100% multiple use with grazing and recreation the dominant uses.

Limnological Assessment

The water quality of Smith and Morehouse Reservoir is very good. It is considered to be very soft with a hardness concentration value of approximately 20 mg/L ($CaCO_3$). Although there are no overall water column concentrations that exceed State water quality standards occasional low dissolved oxygen concentrations are observed as indicated in the August 27, 1991 profile. Although these conditions do not indicate a sever impact to water quality, investigations are needed to determine the severity of dissolved oxygen depletion during winter ice coverage conditions. is not there are reported violations of parameters near the bottom of the lake. These parameters include phosphorus, dissolved oxygen and pH. At various times of the year the



D	°C	pH	DO	Cond
0	17.5	8.2	7.2	56
1	17.4	8.1	7.2	56
2	17.4	8.1	7.2	56
3	17.4	8.0	7.1	56
4	17.4	8.0	7.1	56
5	17.0	7.7	6.4	56
6	15.9	7.5	6.1	56
7	14.7	7.3	5.6	56
8	12.8	7.2	5.2	56
9	9.3	7.1	5.1	56
10	7.8	7.1	5.0	56
11	7.5	7.1	4.4	64

hypolimnion of the lake the oxygen deficiencies develop. Most of the occurrence are noted during the first monitoring trip usually in June. It may be that anoxic conditions developed during the winter are still exerting an influence in lower depths of the reservoir. There are also some low values reported during late summer. These values typically are in the 2-3 mg/L range. Total phosphorus values reported in the hypolimnion are slightly higher than the recommended pollution indicator value of 25 ug/L with values reported in the range of 40 ug/L. The pH values have dipped to a low of 5.2 on one occasion. Although these exceedences have occurred, it does not appear that the water quality is significantly impaired. It does indicate that some winter monitoring should be conducted to determine if impairments are present during extended ice coverage conditions during the winter.

Although the reservoir was classified as a phosphorus limited system in 1981, current data suggest that the reservoir is nitrogen limited. TSI values indicate the reservoir is mesotrophic in a state of moderate productivity. The reservoir does stratify as indicated in the profile.

According to DWR no fish kills have been reported in recent years. DWR stocks the lake annually with 10,000 catchable and 30,000 fingerling rainbow trout (*Oncorhynchus mykiss*). In 1992, the fingerlings were not stocked. The lake has not been chemically treated by the DWR, so populations of native fishes are likely present in the lake.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Asterionella formosa	5.397	90.71
Euglena sp.	0.245	4.12
Oocystis sp.	0.208	3.50
Staurastrum gracile	0.086	1.44
Pennate diatoms	0.010	0.17
Centric diatoms	0.003	0.05
Total	5.706	
Shannon-Weaver [H']	0.41	
Species Evenness	0.23	
Species Richness	0.22	

The phytoplankton community is dominated by the presence of diatoms, flagellates and some green algae. This is indicative of fairly good water quality and low to moderate productivity.

Pollution Assessment

Nonpoint pollution sources include the following: sedimentation and nutrient loading from grazing; and wastes and litter from recreation. Grazing takes place around the reservoir and throughout the watershed.

There are no point sources of pollution in the watershed.

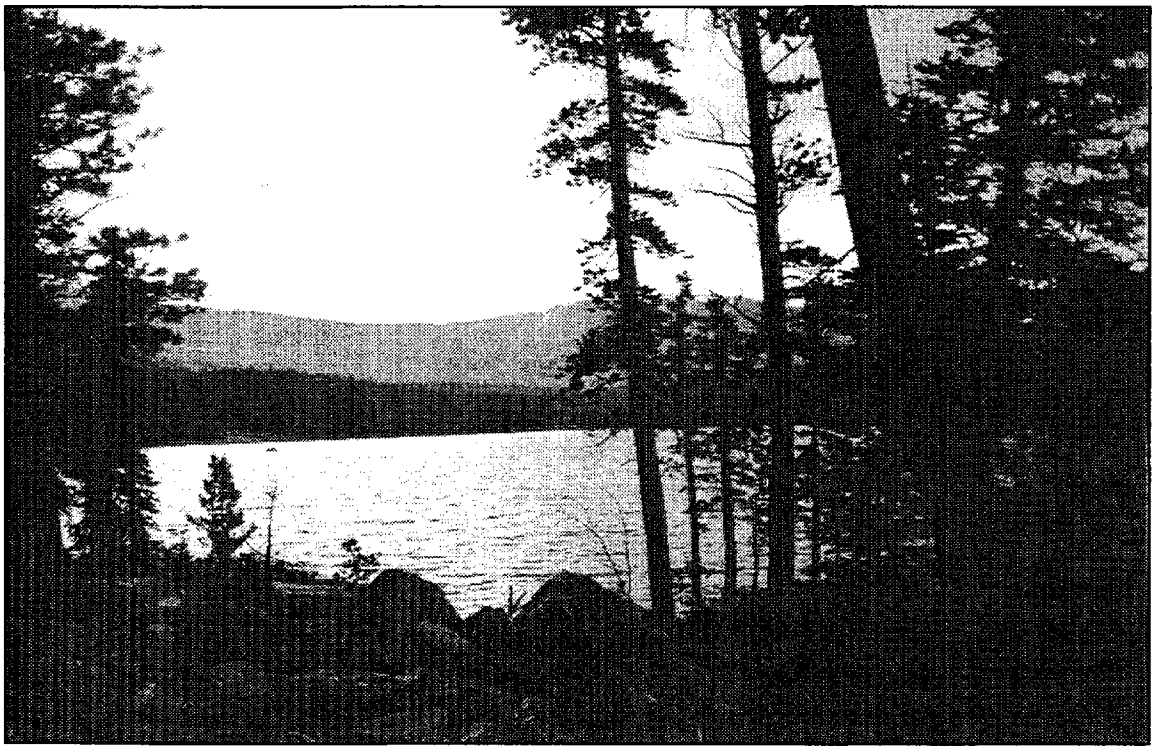
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Mountainland Association of Governments	377-2262
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Wasatch-Cache National Forest	524-5030
Kamas Ranger District	783-4338
Recreation	
Mountainland Travel Region (Provo)	377-2262
Reservoir Administrator	
Weber River Water Conservation District	771-1677

SPIRIT LAKE



Introduction

Spirit Lake is a small augmented lake in the High Uintas. It is one of the few lakes in the vicinity of the ridgeline that is accessible by road. Because of easy access, the area has heavy recreational pressure. A lodge and campground border the lake, and concessionaires offer horseback rides, etc.

Characteristics and Morphometry

Lake elevation (meters / feet)	3,103 / 10,180
Surface area (hectares / acres)	16.6 / 41
Watershed area (hectares / acres)	823 / 2,033
Volume (m^3 / acre-feet)	
capacity	678,426 / 550
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	5.5 / 18
mean	4 / 13
Length (meters / feet)	731 / 2,398
Width (meters / feet)	244 / 801
Shoreline (meters / feet)	1,700 / 5,578

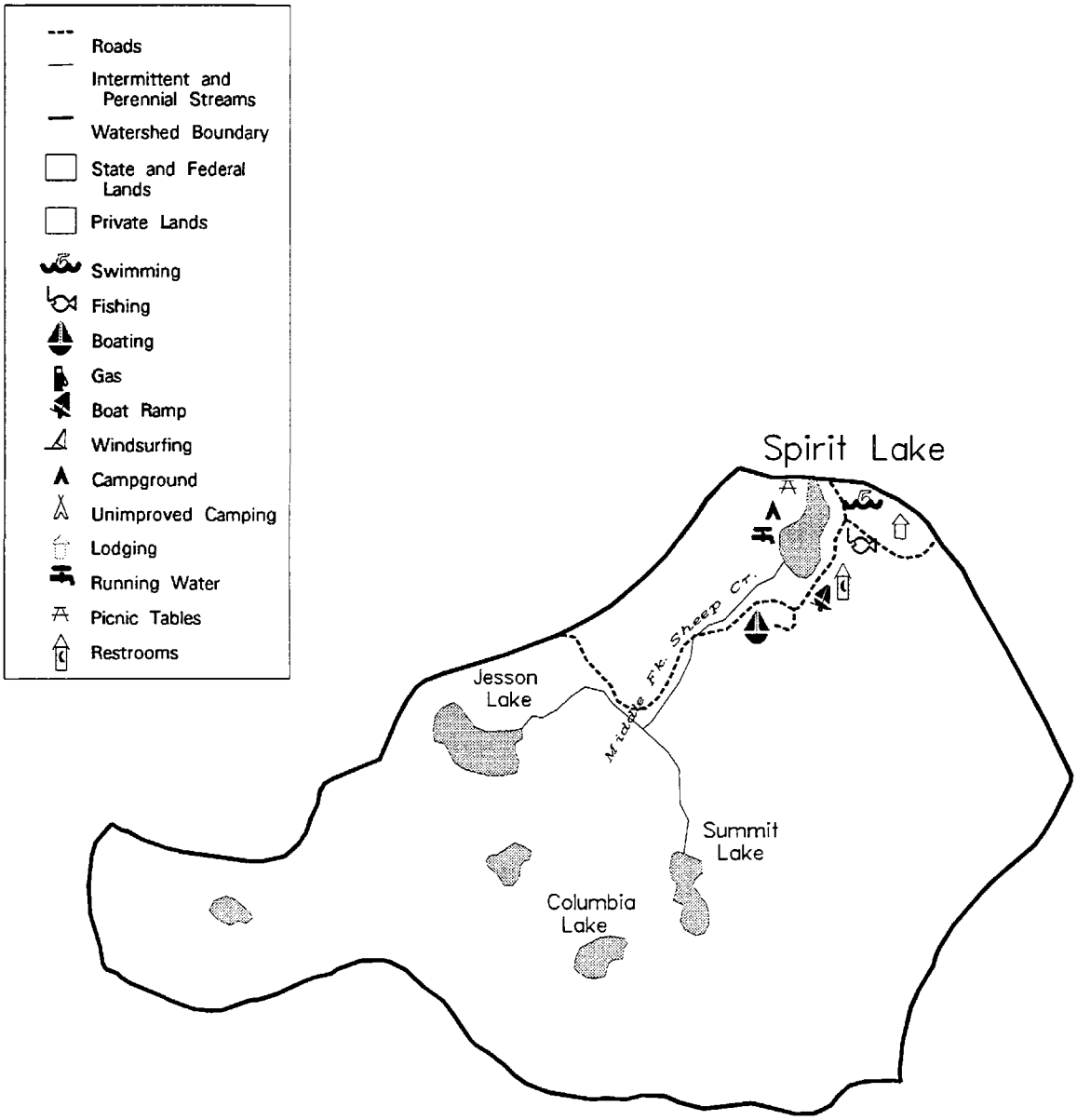
Spirit Lake is a natural cirque lake that was augmented by construction of an small earth-fill dam. The shoreline is owned by the Ashley National Forest, and public access is unrestricted. Reservoir water is used for irrigation, but the lake can only be drained six feet below original lake level. The dam raised water level five feet, and a trench to the dam allows the irrigation company to lower water level six feet below the original lake. The remaining water is never drained, functioning like a natural lake. The lake is 11' deep when it is drawn down to this level. Water use is not expected to change in the foreseeable future.

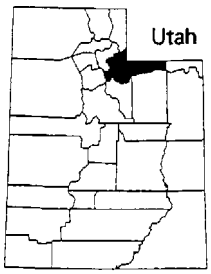
Location

County	Daggett
Longitude / Latitude	109 59 50 / 40 50 30
USGS Map	Whiterocks Lake, 1963
DeLorme's Utah Atlas & Gazetteer™	Page 56, A-1
Cataloging Unit	Flaming Gorge (14040106)

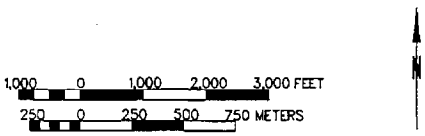
Recreation

Spirit Lake is accessible from the Sheep Creek Road southwest of Manilla. Sheep Creek Road (Also called Spirit





County in which watershed is located.



Spirit Watershed

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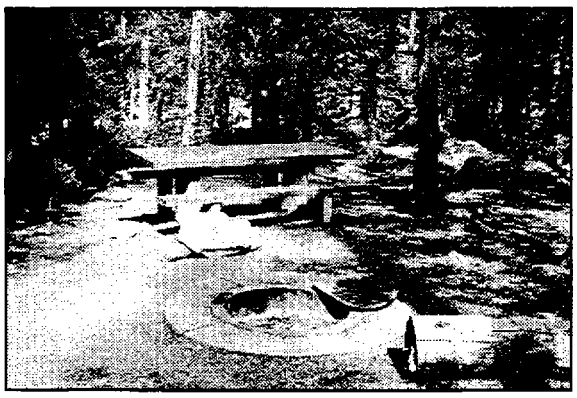
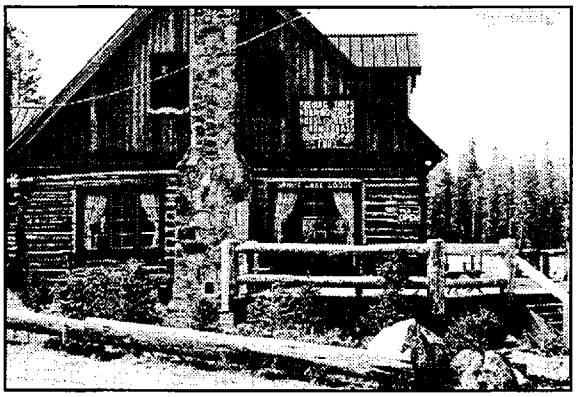
Lake Road) originates at the southwest corner of the Sheep Creek Geological Loop, and becomes the North Slope Road of the Uintas. Follow this road for about 11 miles to where Spirit Lake Road bends to the south. It is also possible to begin on U-150 in the Bear River area and take the North Slope Road to this intersection. The lake is about 8 miles south on this road. The route is well marked.

Fishing, boating, swimming, camping, horseback riding, picnicking, and hiking are all popular.

Recreational facilities at the reservoir include Spirit Lake Campground, a USFS facility with toilet facilities, picnic areas, and 24 campsites. It has no drinking water.



Spirit Lake Lodge is located on the western shores of the lake. It has a variety of facilities including a convenience store with lodging and horseback rides.



Nearby Tamarack Lake, slightly larger than Spirit Lake, was also augmented as a reservoir, but has been purchased by the state to be maintained as a natural lake.

The boundary of the High Uintas Wilderness Area is the western boundary of the cirque, and the Spirit Lake area is a popular trail head for wilderness users.

Watershed Description

Spirit Lake is in the High Uintas. The watershed consists of one large cirque with several subcirques in it. Upstream lakes include Jesson Lake, Columbia Lake, Summit Lake and Lily Pad Lake. The meadow/forest/marsh areas of the cirque bottom are surrounded by the barren, boulder covered slopes of the Uinta ridgeline, which towers over 1,000 feet over the lakes. Slopes often exceed 120%.

The watershed high point, an unnamed peak two miles south of the lake, is 3,679 m (12,070 ft) above sea level, thereby developing a complex slope of 22% to the lake. The average stream gradient above the lake is 3.9% (218 feet per mile) The inflow and outflow is Middle Fork Sheep Creek. Snowmelt continues throughout much of the summer, the snow acting as a natural reservoir to provide a constant supply of water to the lake.

The watershed is made up of high mountains and mountains meadows. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of alpine, pine, spruce-fir and aspen. The watershed receives 76 - 102 cm (30 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 0 - 20 days per year.

Land use in the watershed is mostly recreation, although some grazing and logging takes place. At present, no timber sales are planned for the watershed.

Limnological Assessment

The water quality of Spirit Lake is very good. It is considered to be very soft with a hardness concentration value of approximately 9 mg/L ($CaCO_3$). There are no overall water column concentrations that exceed State water quality standards

Current data suggest that the reservoir is nitrogen limited. TSI values indicate the reservoir is mesotrophic in a state of moderate productivity. The reservoir does not stratify as indicated in the August 12, 1992 profile due to the shallow nature of the lake. DWQ monitoring crews reported a maximum depth of 1.6 meters (5 feet) at the time. This was probably a result of further removal of water by the irrigation company, evaporation, or the measurement not at the deepest point.

According to DWR no fish kills have been reported in recent years. DWR stocks the lake annually with approximately 7,000 catchable rainbow trout (*Oncorhynchus mykiss*). The lake has not been chemically treated by the DWR, so populations of native fishes are likely present in the lake. The DWR has not treated the lake for rough fish competition, so populations of native fishes may be present in the lake.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance):

Limnological Data

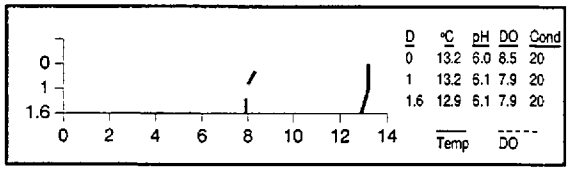
Data sampled from STORET site: 593825

Surface Data	1981	1990	1992
Trophic Status	O	M	M
Chlorophyll TSI	-	45.25	41.70
Secchi Depth TSI	48.40	49.31	51.14
Phosphorous TSI	25.80	38.72	42.70
Average TSI	37.10	44.43	45.18
Chlorophyll a (ug/L)	-	4.45	3.1
Transparency (m)	2.0	2.1	1.85
Total Phosphorous (ug/L)	20	11	15
pH	6.3	7.3	6.9
Total Susp. Solids (mg/L)	<5	3.75	<3
Total Volatile Solids (mg/L)	-	-	1
Total Residual Solids (mg/L)	-	-	2
Temperature (°C / °f)	10/50	14/57	12/54
Conductivity (umhos.cm)	14	24	21
Water Column Data			
Ammonia (mg/L)	0.05	0.03	0.12
Nitrate/Nitrite (mg/L)	0.08	-	0.01
Hardness (mg/L)	9.5	9.1	8.3
Alkalinity (mg/L)	5	12	7
Silica (mg/L)	-	-	2.5
Total Phosphorous (ug/L)	20	18	15
Miscellaneous Data			
Limiting Nutrient	N*	N	N
DO (Mg/l) at 75% depth	8.4*	7.3	7.9
Stratification (m)	6-7*	NO	NO
Depth at Deepest Site (m)	7*	1.5	1.6

* Second period 1980

Species	Cell Volume (mm³/liter)	% Density By Volume
Sphaerocystis schroeteri	2.641	72.28
Peridinium sp.	0.361	9.89
Staurastrum sp.	0.167	4.56
Dinobryon divergens	0.147	4.02
Pennate diatoms	0.140	3.83
Mallomonas sp.	0.127	3.47
Asterionella formosa	0.028	0.78
Oocystis sp.	0.025	0.68
Centric diatoms	0.013	0.37
Ankistrodesmus falcatus	0.004	0.12
Total	3.650	
Shannon-Weaver [H']	1.08	
Species Evenness	0.47	
Species Richness [d]	0.41	

The phytoplankton community is dominated by the presence of green algae, flagellates, desmids and diatoms. This is



indicative of good water quality and low productivity.

Pollution Assessment

Nonpoint pollution sources include the following: sedimentation and nutrient loading from grazing; and litter and wastes from recreation.

There are no point sources of pollution in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Ashley National Forest	789-1181
Flaming Gorge Ranger District	784-3445
Recreation	
Dinosaurland Travel Region (Vernal)	789-6932
Manila Chamber of Commerce	784-3395
Reservoir Administrators	
Sheep Creek Irrigation Company	784-3412

STANSBURY LAKE

Introduction

Stansbury Lake is an intermediate-sized, artificial lake between Tooele and the Great Salt Lake. It is was created as part of the landscape of Stansbury Park, a residential community. The shores are undulating, so as to provide maximum shoreline length, thereby maximizing the number of residential lots with shoreline. Over 250 lots have lake frontage. The lake is spring fed, and has no active inlet. Due to the continual evaporation of water, the lake is somewhat saline.

Stansbury Lake was created in about 1970 by the excavation of the lake basin. The lake was allowed to fill with spring water. The shoreline is 100% privately owned, with public access restricted to a boat launch near the clubhouse. Reservoir water is for irrigating the adjacent golf course, but runoff returns to the lake via ponds in the golf course. No changes in water use are foreseen.

Characteristics and Morphometry

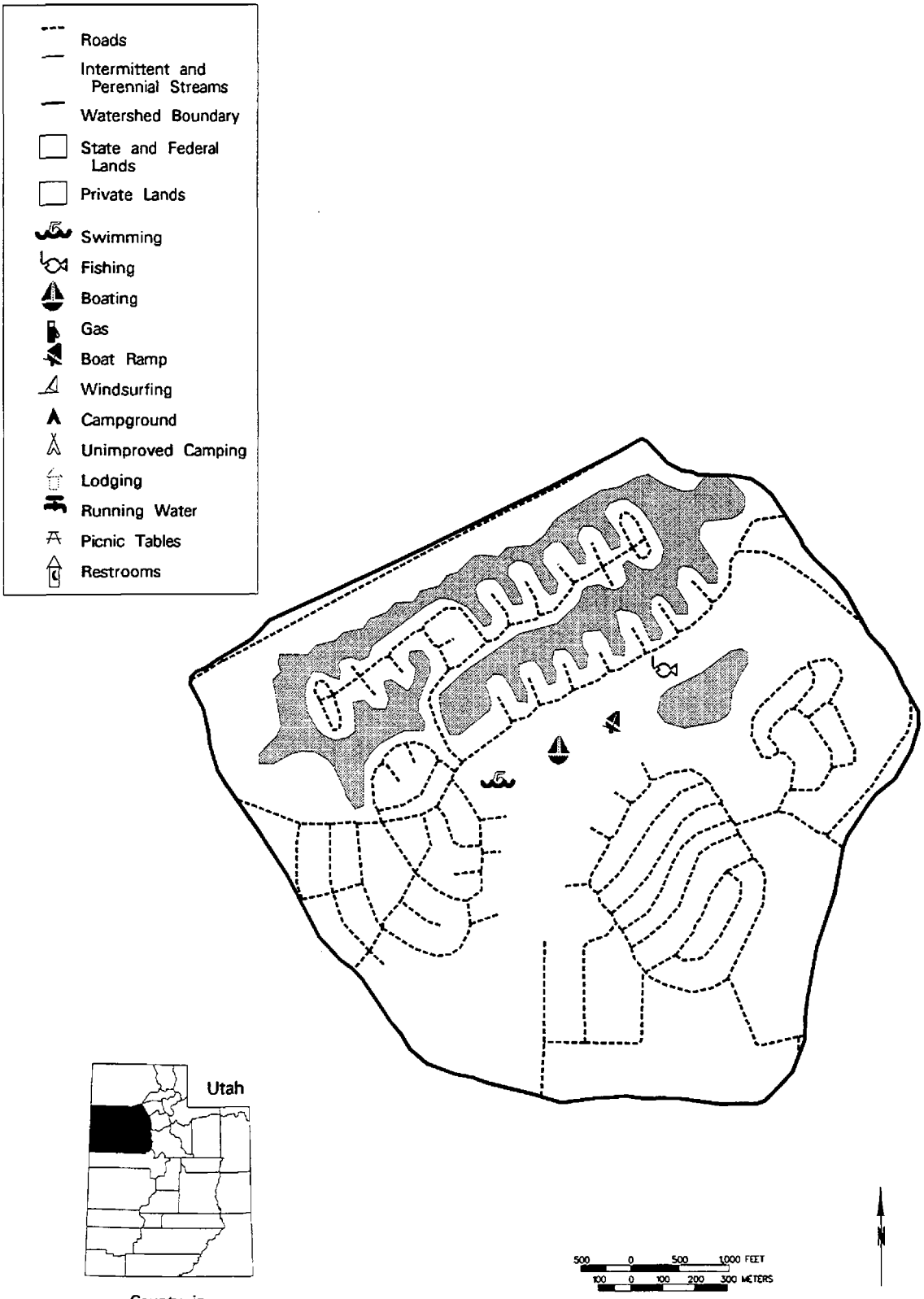
Lake elevation (meters / feet)	1,299 / 4,263
Surface area (hectares / acres)	48.6 / 120
Watershed area (hectares / acres)	313 / 773
Volume (m^3 / acre-feet)	
capacity	888,121 / 720
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	296,040 / 240
Depth (meters / feet)	
maximum	1.8 / 6
mean	1.8 / 6
Length (meters / feet)	1,800 / 5,706
Width (meters / feet)	500 / 1,641
Shoreline (km / miles)	10.2 / 6.3

Location

County	Tooele
Longitude / Latitude	112 18 17 / 40 38 40
USGS Maps	Mills Junction, UT 1972
DeLorme's Utah Atlas & Gazetteer™	Page 52 B-3
Cataloging Unit	Rush/Tooele Valleys (16020304)

Recreation

Stansbury Lake is accessible from U-36 between



County in which watershed is located.

Stansbury Watershed

Tooele and I-80. Signs direct visitors from U-36 to the clubhouse, which is on the lake. From U-36, turn west on Stansbury Parkway (1/2 mile south of the U-138 jct), and immediately south on Country Club Drive, a frontage road to U-36. 1/3 miles south, turn west (left) on Club House Drive, which passes the Club House in 1/2 mile.

Fishing, swimming and nonmotorized boating are permitted on the lake. A launching fee is charged for visitors. Remember you are a guest at this facility.

There are no public or private campgrounds in the area.

Watershed Description

Stansbury Lake is artificial lake. The basin was excavated from the alluvial plain at the northwest edge of the Oquirrh Mountains. The lake has a very small watershed, consisting solely of the golf course to the south and neighboring residential areas. The lake is spring-fed. Because the watershed consists entirely of land in an unnatural state, impacts from storm and irrigation runoff is the major factor in watershed integrity.

Because the watershed is so flat, the high point is not significant. There are no perennial surface inlets, although water from neighboring Mill Pond can be released into the lake. Runoff from the Oquirrh Mountains does not enter the lake.

The soil in the watershed is desert alluvial deposits that have been disturbed, covered with a layer of topsoil, and turned into irrigated lawns and gardens.

The vegetation communities consist of sagebrush-grass and noxious weeds in undeveloped sites, and irrigated lawns and gardens in the remainder of the watershed. The lake receives 25 - 30 cm (10 - 12 inches) of precipitation annually. The frost-free season around the reservoir is 160 -200 days per year.

Land use is urban and recreational. The remaining undeveloped land in the project is sitting idle.

Limnological Assessment

The water quality of Stansbury Lake is considered good. It is considered to be extremely had with a hardness concentration value of approximately 617 mg/L ($CaCO_3$). The only parameter that has exceeded State water quality standards for defined beneficial uses is total phosphorus. The average concentrations of total phosphorus in the water column was highest in 1981 at 50 mg/L. Recent data indicates that the average water column concentration is only slightly over the recommended pollution indicator for phosphorus of 25 ug/L at 29 mg/L. The phosphorus concentration will probably remain relatively constant due to the nature of the watershed, but could rise significantly without proper fertilizer management by property owners.

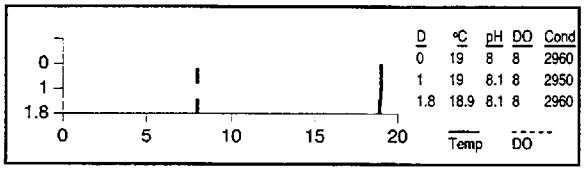
Limnological Data

Data sampled from STORET site: 596015

Surface Data	1981	1990	1992
Trophic Status	H	E	E
Chlorophyll TSI	-	49.48	42.89
Secchi Depth TSI	61.52	75.13	77.35
Phosphorous TSI	63.19	42.70	51.40
Average TSI	62.36	55.77	57.21
Chlorophyll a (ug/L)	-	6.9	3.5
Transparency (m)	0.9	0.4	0.3
Total Phosphorous (ug/L)	60	15	27
pH	8.2	8.6	8.2
Total Susp. Solids (mg/L)	31	24	28
Total Volatile Solids (mg/L)	-	-	5
Total Residual Solids (mg/L)	-	-	23
Temperature (°C / °f)	20/68	23/74	18/64
Conductivity (umhos.cm)	2300	2620	2775
Water Column Data			
Ammonia (mg/L)	0.2	0.15	0.03
Nitrate/Nitrite (mg/L)	0.08	-	0.02
Hardness (mg/L)	557	648	645
Alkalinity (mg/L)	157	143	145
Silica (mg/L)	-	-	11.1
Total Phosphorous (ug/L)	50	14	29
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	7.2	7.1	8.0
Stratification (m)	NO	NO	NO
Depth at Deepest Site (m)	1.5	2.2	1.8

Current data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is eutrophic, but transparency values tend to be lower than probably could be expected due to the resuspension of sediments in this shallow system. The lake does not stratify due to its shallow nature.

According to DWR no fish kills have been reported in recent years. The reservoir supports a limited warm water fishery with populations of carp (*Cyprinus carpio*), bluegill (*Lepomis macrochirus*), and some largemouth bass (*Micropterus salmoides*). DWR currently does not stock the reservoir with fish. Old DWR files record naturally reproducing populations of Brown Trout and Black Bullheads.



D	°C	pH	DO	Cond
0	19	8	8	2960
1	19	8.1	8	2950
1.8	18.9	8.1	8	2960

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Gloeocystis sp.	17.180	47.88
Unknown filamentous green alga	17.164	47.84
Cosmarium sp.	0.545	1.52
Peridinium sp.	0.361	1.01
Pennate diatoms	0.311	0.87
Centric diatoms	0.142	0.40
Oocystis sp.	0.098	0.27
Ankistrodesmus falcatus	0.052	0.15
Euglena sp.	0.017	0.05
Scenedesmus sp.	0.008	0.02
Total	35.874	
Shannon-Weaver [H']	0.91	
Species Evenness	0.40	
Species Richness	0.38	

The phytoplankton community is dominated by the presence of green algae indicative of more mesotrophic conditions.

Pollution Assessment

Nonpoint pollution sources may include the following: urban wastes from streets and residential areas directly adjacent to the lake, and herbicides, pesticides or nutrients from the golf course.

There are no point sources of pollution in the watershed.

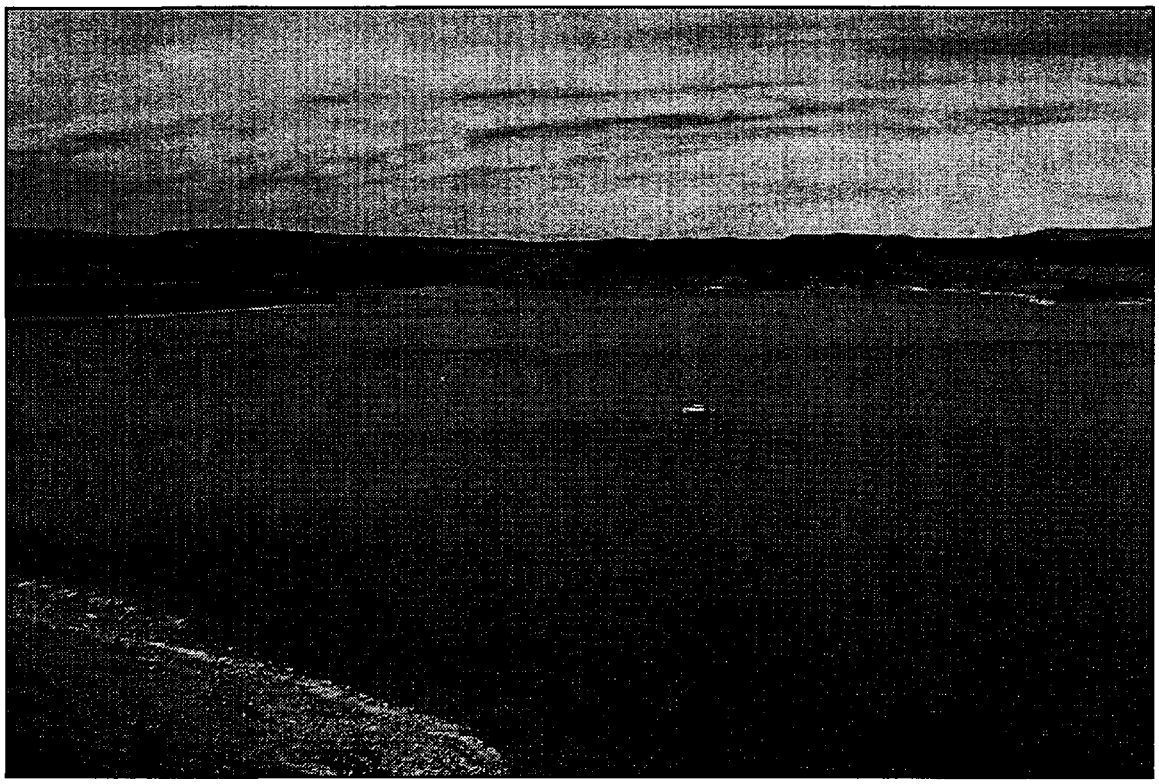
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), warm water game fish and organisms in their food chain (3B) and agricultural uses (4).

Information

Management Agencies	
Wasatch Front Regional Council	292-4469
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Great Salt Lake Country Travel Region (SLC)	896-9222
Tooele Chamber of Commerce	882-0690
Lake Administrators	
Stansbury Park Homeowners Association	882-7447

STARVATION RESERVOIR



Introduction

Starvation Reservoir is a large Bureau of Reclamation Reservoir of the Strawberry River in the Uinta Basin. It is large enough for all water sports and has a state park with a campground. Good fishing and a two hour drive from the southern Wasatch Front make it a popular recreational destination. It should not be confused with a Starvation Reservoir north of Blanding. The earth-fill dam was built in 1970 to supply irrigation water for agriculture along the Duchesne River. It is unlikely that the 2% of water presently used by Duchesne for culinary purposes will increase. The shoreline is 100% publicly owned. Access is unrestricted. The reservoir is located immediately upstream from the city of Duchesne, where the Duchesne and Strawberry Rivers conflue.

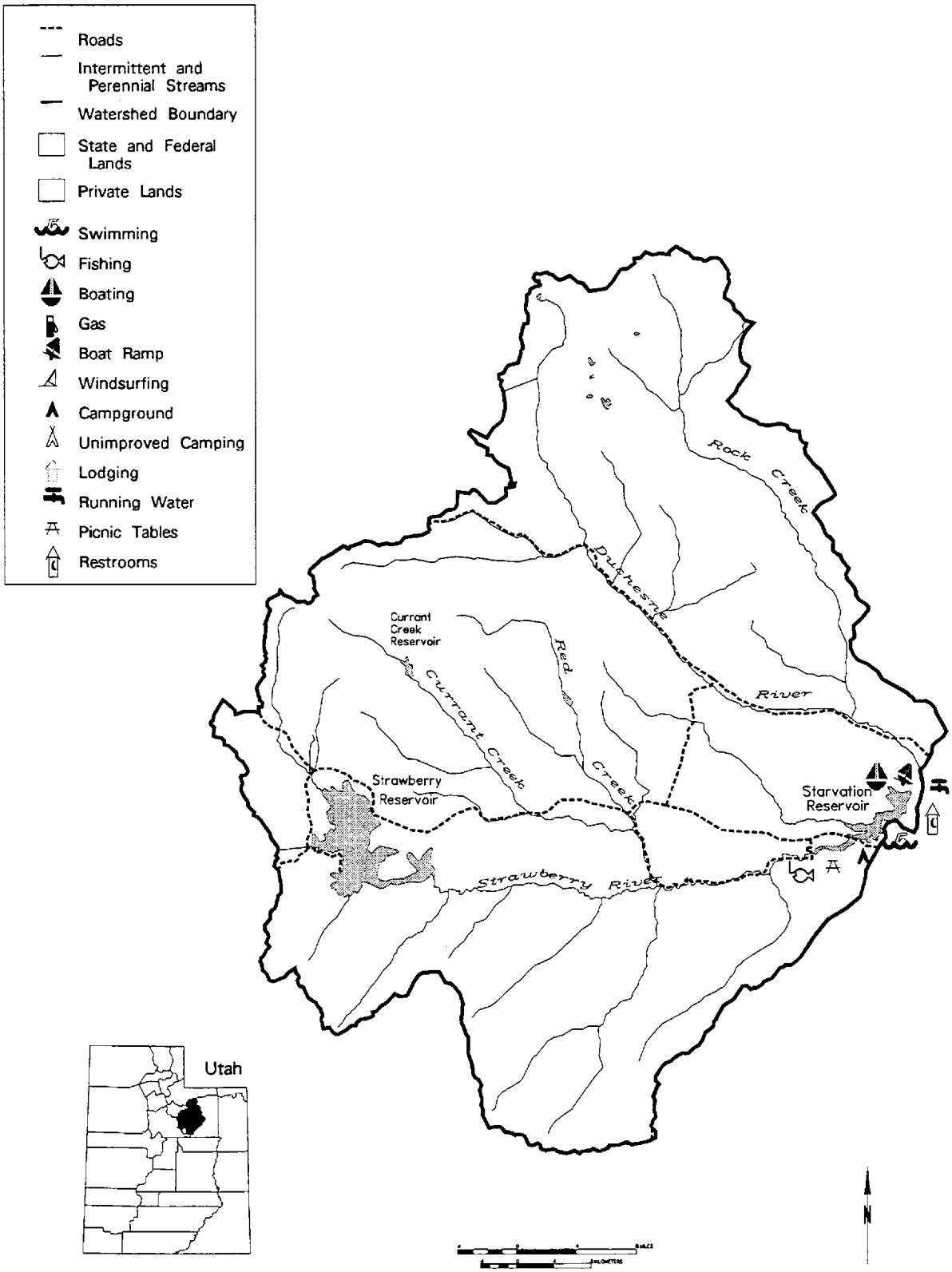
The reservoir was so named because a rancher once attempted to graze stock in the area, and they all starved to death. Bureau of Reclamation projects such as this one use federal funds to pay the cost of providing water for agricultural uses, enabling crops to be grown and cattle to

Characteristics and Morphometry

Lake elevation (meters / feet)	1,741 / 5,712
Surface area (hectares / acres)	1,117 / 2,760
Watershed area (hectares / acres)	484,000 / 1,190,000
Volume (m^3 / acre-feet)	
capacity	2.008×10^8 / 162,798
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	varies
Drawdown (m^3 / acre-feet)	$1.894 \times 10^{8\ (1072)}$ / 153,562
Depth (meters / feet)	
maximum	47.2 / 154.9
mean	19.9 / 65.3
Length (km / miles)	12.4 / 7.7
Width (km / miles)	3.2 / 2.0
Shoreline (km / miles)	37 / 23

Location

County	Duchesne
Longitude / Latitude	110 28 00 / 40 11 00
USGS Map	Duchesne, UT 1982 (1:100,000)
DeLorme's Utah Atlas & Gazetteer™	Page 47, A-5, Page 55, D-5
Cataloging Unit	Strawberry (14060004)



County near which watershed is located.

Starvation Watershed

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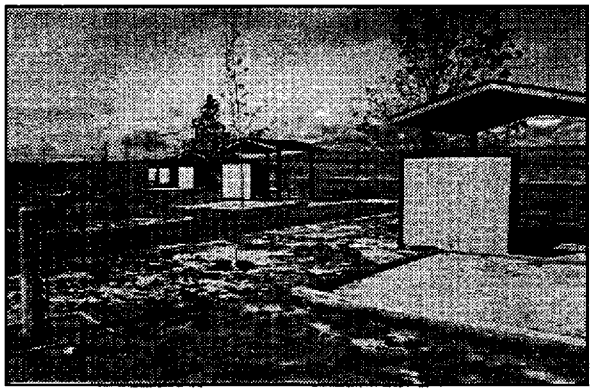
be grazed at less expense to farmers.

Recreation

Starvation Reservoir is crossed by US 40 about 3 miles west of Duchesne. Access to the State Park is from US 40 at the west end of Duchesne (one block west of the Conoco station). Other parts of the shore are accessible from various unpaved roads or the view area at milepost 83 (just east of the US 40 bridge).

The reservoir is popular for swimming, waterskiing, sailing, and fishing. It is a popular reservoir for walleye and smallmouth bass. The scenery from the reservoir is a partially submerged, steep-walled desolate canyon.

Starvation State Park has 35 campsites, flush toilets, a fish cleaning station, a sandy beach, group use areas, and showers. Primitive camping is permitted at various sites around the lake.



Watershed Description

Starvation Reservoir has a large natural watershed that includes most of the western Uinta Basin, and includes the eastern Uintas via the Knight Diversion from the Duchesne River. The natural watershed is still quite large, including many very remote areas along Reservation Ridge and west to Strawberry Ridge north of Soldier Summit.

As with most reservoirs with fluctuating water levels, the shoreline of the lake is barren of riparian vegetation. Sagebrush prairies surround the high water line of the reservoir, but when water is low, the area above shoreline is exposed mud flats. The vertical nature of the some parts of the shoreline make fluctuations somewhat inconsequential.

The watershed high point, Ostler Peak , is 3,876 m (12,717 feet) above mean sea level, creating a complex slope of 3.5 % to the reservoir. The principle inflows are the Strawberry River, Saleratus Wash, Rabbit Gulch, and the Duchesne River via the Knight Diversion. The outlet is the Strawberry River. The average stream gradient above the lake is 1.2% (65 feet per mile).

This diverse watershed contains soils of many different types. A partial listing (omitting all of the artificially diverted watersheds) of the soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist bitterbrush-mountain mahogany, pinyon-juniper, ponderosa pine, shadscale, greasewood, saltbrush, pine, aspen, spruce-fir, oak, and sage-grass. The diverted watersheds also include mountain meadow and alpine vegetation. The watershed receives 25 - 102 cm (10 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 120 -140 days per year.

Limnological Data

Data averaged from STORET sites: 493605, 493606, 493607, 494608, 494609

Surface Data	1981	1989	1991	1992
Trophic Status	M	E	M	M
Chlorophyll TSI	-	-	41.25	36.33
Secchi Depth TSI	41.95	55.11	45.16	47.54
Phosphorous TSI	49.98	60.27	36.02	42.40
Average TSI	45.96	57.69	40.81	42.10
Chlorophyll a (ug/L)	-	-	3.2	1.8
Transparency (m)	3.5	1.6	3.1	2.1
Total Phosphorous (ug/L)	24	48	10	23
pH	8.5	8.4	8.3	8.4
Total Susp. Solids (mg/L)	-	5.6	2.7	2.1
Total Volatile Solids (mg/L)	-	-	-	2
Total Residual Solids (mg/L)	-	-	-	2
Temperature (°C / °f)	17/63	17/62	17/63	17/63
Conductivity	595	675	561	608
Water Column Data				
Ammonia (mg/L)	0.08	0.04	0.04	0.03
Nitrate/Nitrite (mg/L)	0.30	-	0.01	0.02
Hardness (mg/L)	263	232	223	214
Alkalinity (mg/L)	259	241	212	247
Silica (mg/L)	-	-	-	9
Total Phosphorous (ug/L)	30	42	14	22
Miscellaneous Data				
Limiting Nutrient	N	N	N	N
DO (Mg/l) at 75% depth	5.9	0.6	2.0	6.4
Stratification (m)	6	NO	NO	NO
Depth at Deepest Site (m)	35	31.0	32.0	25.1

Land use in the natural watershed is 85% multiple use (logging, mining, grazing and recreation on BLM, State, and USFS lands), 10% private grazing lands and 5% agriculture.

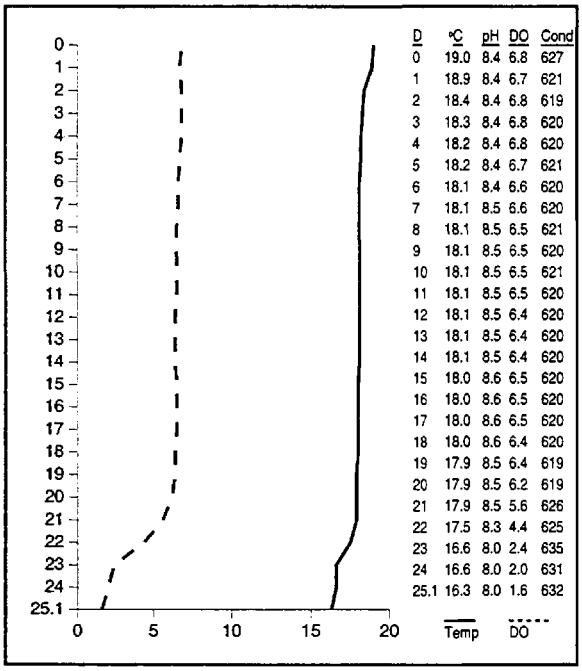
Limnological Assessment

The water quality of Starvation Reservoir is very good. It is considered to be hard with a hardness concentration value of approximately 233 mg/L (CaCO3). Those parameters that have exceeded State water quality standards for defined beneficial uses are total phosphorus and dissolved oxygen. Although the average concentrations of total phosphorus in the water column since 1991 have not exceeded the recommended pollution indicator for phosphorus of 25 ug/L, there have been an occasional value in the water column that has exceeded the indicator. It does not appear that the nutrient concentrations is exhibiting an impact on water quality at this point in time. Nutrient concentrations have declined since the reservoir was created as is indicated in the decline of average water column concentrations from the study periods since 1981. It is not uncommon to see depletion of the dissolved oxygen concentrations in the hypolimnion later in the productivity season, but not to the extent that a severe impact to the fishery occurs.

Existing data suggest that the reservoir is a nitrogen limited system. TSI values indicate the reservoir is mesotrophic except for 1989 when elevated nutrient concentrations increased production. The reservoir in general exhibits low to moderate production. Although the profile of September 2, 1992 does not exhibit stratification , the reservoir does stratify during the summer usually near the 10 meter depth. When it is stratified dissolved oxygen depletions are more extreme with concentrations document as low as 4.0 mg/L at a depth of 12 meters. This depletion is of concern and needs to continue to be monitored, with some winter monitoring conducted.

In 1975 Starvation Reservoir was one of the reservoirs evaluated under the NES survey. The survey indicated that the reservoir was mesotrophic with nitrogen limitation for all periods of sampling. The loading rates was 2.70 g/m^2 for phosphorus and 34.0 g/m^2 for total nitrogen. It should be noted that these rates are relatively high but that the sampling occurred during a period in which the reservoir was initially filling. The dominate phytoplankton populations included: for the May sampling period *Stephanodiscus sp., Fragilaria sp., and Asterionella sp.* (44, 35, and 19% respectively); for the August period *Oocystis sp., Chroomonas sp., and Dinobryon sp.* (40, 27, and 20% respectively); and for the September period *Chroomonas sp. and Cryptomonas* (33 and 25% respectively).

According to DWR no fish kills have been reported in recent years. The reservoir supports populations of naturally reproducing walleye (*Stizostedion vitreum*) and smallmouth bass (*Micropterus dolomieui*) with the potential of some brook trout (*Salvelinus fontinalis*) and rainbow trout (*Oncorhynchus mykiss*) which were stocked in 1978. The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake. Current stocking reports indicate that DWR does not stock the reservoir but relies on the natural reproduction of the predominant warm water species.



D	°C	pH	DO	Cond
0	19.0	8.4	6.8	627
1	18.9	8.4	6.7	621
2	18.4	8.4	6.8	619
3	18.3	8.4	6.8	620
4	18.2	8.4	6.8	620
5	18.2	8.4	6.7	621
6	18.1	8.4	6.6	620
7	18.1	8.5	6.6	620
8	18.1	8.5	6.5	621
9	18.1	8.5	6.5	620
10	18.1	8.5	6.5	621
11	18.1	8.5	6.5	620
12	18.1	8.5	6.4	620
13	18.1	8.5	6.4	620
14	18.1	8.5	6.4	620
15	18.0	8.6	6.5	620
16	18.0	8.6	6.5	620
17	18.0	8.6	6.5	620
18	18.0	8.6	6.4	620
19	17.9	8.5	6.4	619
20	17.9	8.5	6.2	619
21	17.9	8.5	5.6	626
22	17.5	8.3	4.4	625
23	16.6	8.0	2.4	635
24	16.6	8.0	2.0	631
25.1	16.3	8.0	1.6	632

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Asterionella formosa –	6.711	68.67
Gomphospheria aponina	1.237	12.65
Ceratium hirundinella	0.936	9.58
Coelastrum sp.	0.556	5.69
Fragilaria crotonensis	0.229	2.34
Staurastrum gracile	0.034	0.35
Oocystis sp.	0.031	0.32
Dinobryon divergens	0.012	0.13
Pennate diatoms	0.011	0.11
Crucigenia rectangularis	0.011	0.11
Ankistrodesmus falcatus	0.004	0.04
Total	9.770	
Shannon-Weaver [H']	1.06	
Species Evenness	0.44	
Species Richness	0.43	

The phytoplankton community is dominated by the presence

of diatoms, blue-green algae, flagellates and some green algae species.

Pollution Assessment

Nonpoint pollution sources include the following: waste and litter from recreation; and sedimentation, and nutrient loading from grazing. Cattle graze in the watershed, but the shoreline is fenced off in certain areas around the reservoir. Logging has taken place in watershed, but there are no active or proposed timber sales.

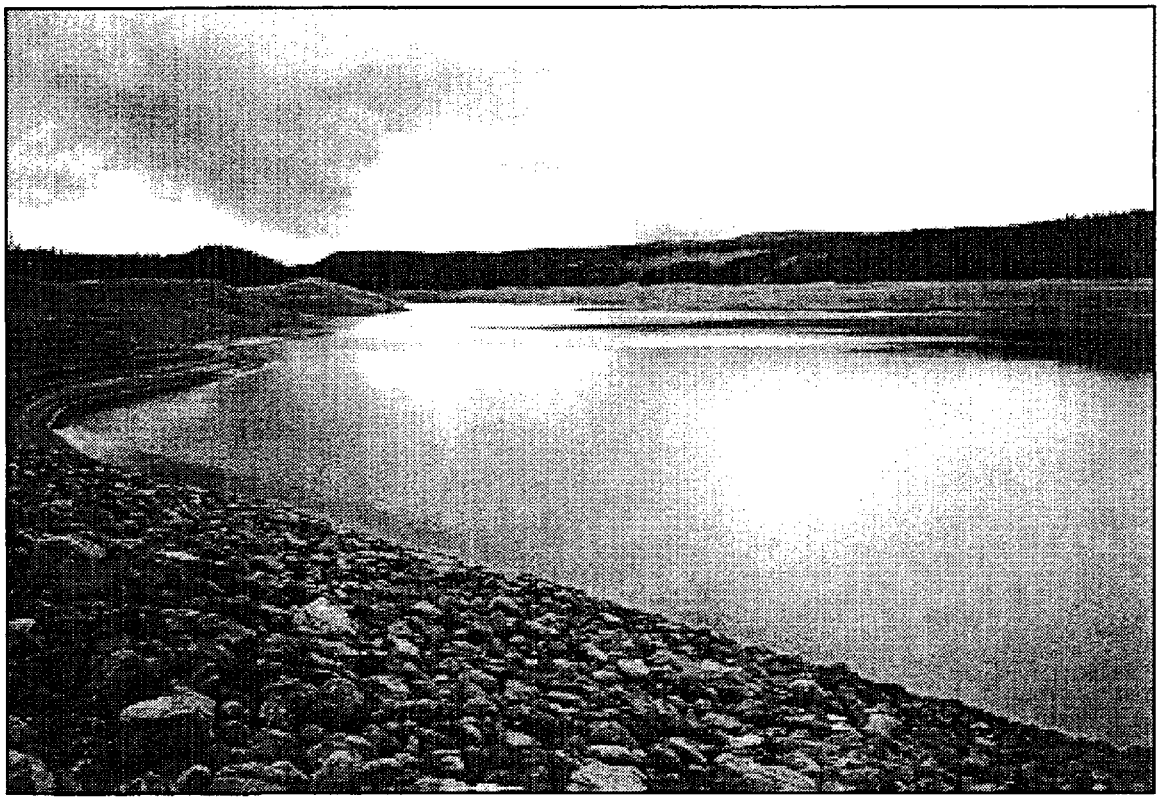
Beneficial Use Classification

The state beneficial use classifications include: culinary (1C), recreational bathing (swimming) 2A, boating and similar recreation (excluding swimming) (2B), warm water game fish and organisms in their food chain (3B) and agricultural uses (4).

Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Dinosaurland Travel Region (Vernal)	789-6932
Duchesne Chamber of Commerce	738-5651
Starvation State Park	738-2326
Reservoir Administrators	
DOI	6

STATELINE RESERVOIR



Introduction

Stateline Reservoir is a large reservoir in a glacial valley north of the Uinta Mountains. It is 1/4 mile south of the Wyoming state line, in the China Meadows area, in close proximity to three natural, moraine lakes--Bridger, China and Marsh.

Stateline Reservoir was created in 1979 with the construction of an earth-fill dam, impounding the East Fork Smith's Fork River. The reservoir shoreline is 100% publicly owned by the Bureau of Reclamation and the Bridger Valley Conservancy District. Public access is unrestricted. Current water use is primarily for irrigation with no changes expected.

Characteristics and Morphometry

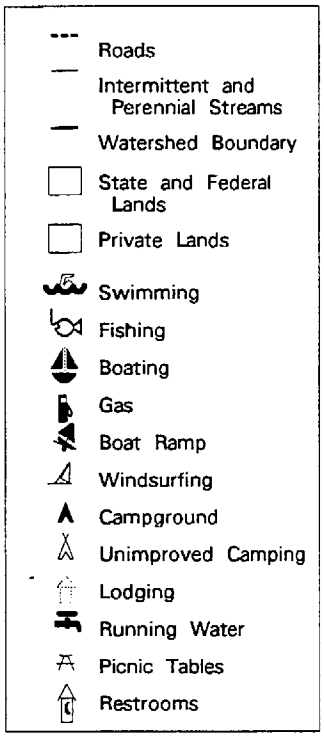
Lake elevation (meters / feet)	2,793 / 9,163
Surface area (hectares / acres)	116.6 / 288
Watershed area (hectares / acres)	10,831 / 26,752
Volume (m^3 / acre-feet)	
capacity	17,300,000 / 14,000
conservation pool	2,000
Annual inflow (m^3 / acre-feet)	352,781,000 / 286,000
Retention time (years)	<1
Drawdown (m^3 / acre-feet)	148,000,000 / 12,000
Depth (meters / feet)	
maximum	39 / 128
mean	14.8 / 48.6
Length (km / miles)	2.9 / 1.8
Width (km / miles)	0.762 / 0.47
Shoreline (km / miles)	6.44 / 4

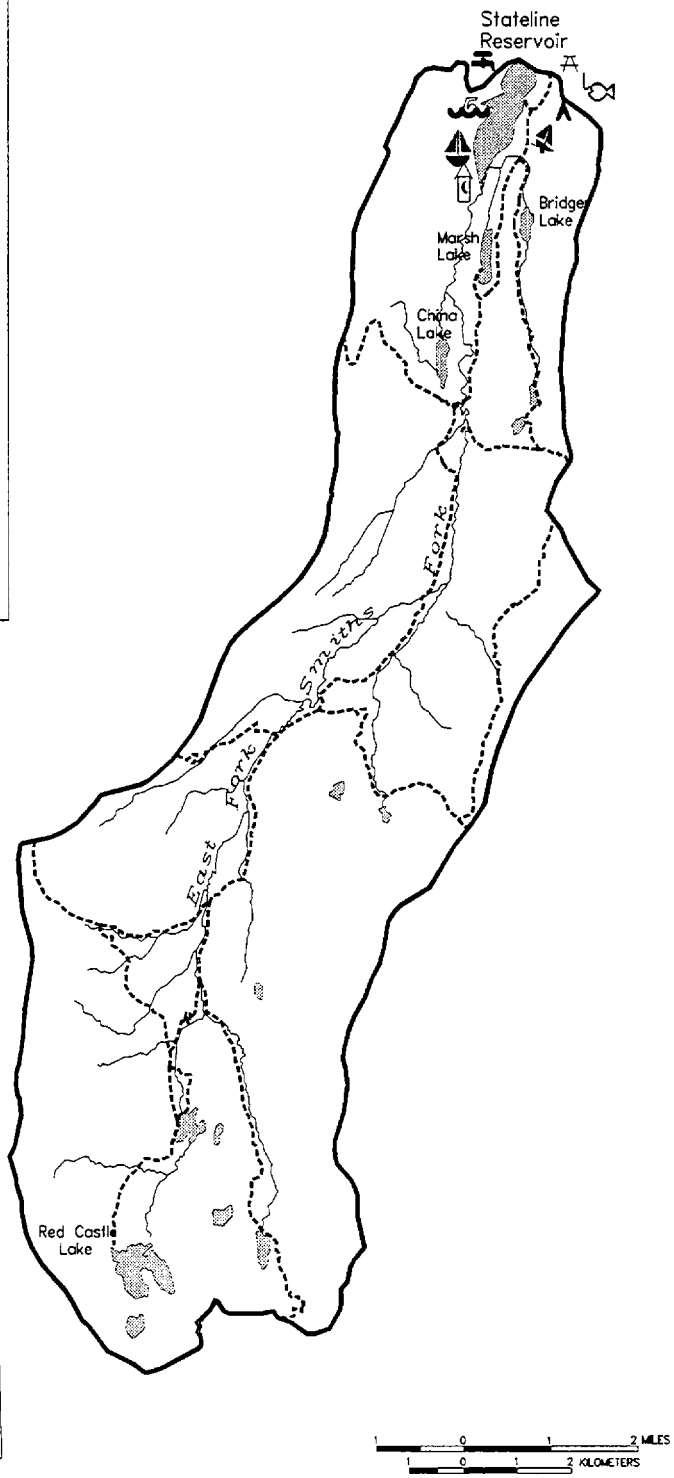
Location

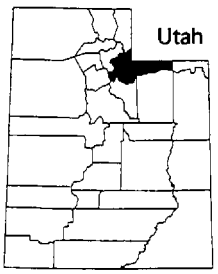
County	Summit
Longitude / Latitude	110 23 07 / 40 58 42
USGS Map	Bridger Lake, UT / WY 1967
DeLorme's Utah Atlas and Gazetteer™	Page 55, A-5
Cataloging Unit	Black's Fork (1404017)

Recreation

Stateline reservoir in the Smith's Fork drainage, 30 miles east of U-150 on the North Slope Road (FS-058). FS-072 and FS-058 join at China Meadows Campground. Stateline Reservoir is 4 miles north of the campground on FS-058.







County in which watershed is located.

Stateline Watershed

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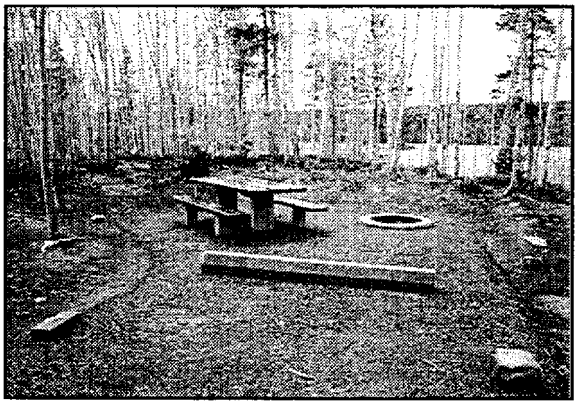
It is also accessible from Mountain View, Wyoming. Go south from Mountain View on the paved road towards Robertson (not towards Lonetree). At the second 90° bend to the west (about 5 miles from Mountain View), leave the highway, continuing south on a gravel road that becomes FS-072. The reservoir is just across the Utah state line.

The lake offers fishing, boating and hiking. The water is too cold for most swimmers. There is a unimproved boat ramp adjacent to the campground and fishing is popular.

Stateline Reservoir Campground, administered by the Forest Service, has 41 campsites, running water, and primitive latrines. There are several other USFS campgrounds in the vicinity, as this area is a popular access to the High Uinta Wilderness. Campgrounds are heavily used in the summer.



Watershed Description

Stateline Reservoir is an impoundment of the East Fork Smith's Fork River. The watershed consists of a long (15 miles), narrow (3 miles) drainage on the north slope of the Uintas. Valley glaciers extended from the cirques in the Uinta ridgeline all the way north to the state line, so the river flows down the wide, relatively flat, valley. At the reservoir, the valley is about two miles wide and 800' deep. China Lake, Marsh Lake and Bridger Lake are all natural lakes in the immediate area, created by the damming of side drainages by glacial moraines. The Stateline Dam is built at a point where the river has cut through a moraine. The Red Castle Lakes, Lake Hessie, and Smiths Fork Pass Lake are cirque lakes at the heads of tributaries to the river.

The watershed high point, Red Castle Peak, is 4,006 m (13,142 ft) above sea level, thereby developing a complex slope of 5.0% to the reservoir. Inflow is from East Fork Smiths Fork and an unnamed stream that drains Bridger and marsh Lakes. The outflow is East Fork Smiths Fork.

The soil in the lower areas of the watershed is glacial till and alluvium. It is comprised primarily of debris from the scouring up upstream valleys, so the till is chemically similar to the Precambrian rocks of the High Uintas, which compose the remainder of the watershed. See Appendix III for a complete soil description.

The vegetation community is comprised of alpine, pine, aspen, spruce-fir, oak, maple and marshlands. The watershed receives 51 - 102 cm (20 - 40 inches) of precipitation annually with a frost-free season of 20 - 40 days.

Land use is 100% multiple use. Both livestock (predominantly sheep) and recreation exert very heavy pressure on the watershed. Commercial horseback tours keep the meadow vegetation closely cropped in the Red Castle area, and large herds of sheep are rotated throughout the area over the course of the summer.

Limnological Assessment

The water quality of Stateline Reservoir is to be excellent. It is considered to be very soft with a hardness concentration value of approximately 16 mg/L ($CaCO_3$).

Limnological Data

Data averaged from STORET sites: 593932, 593934

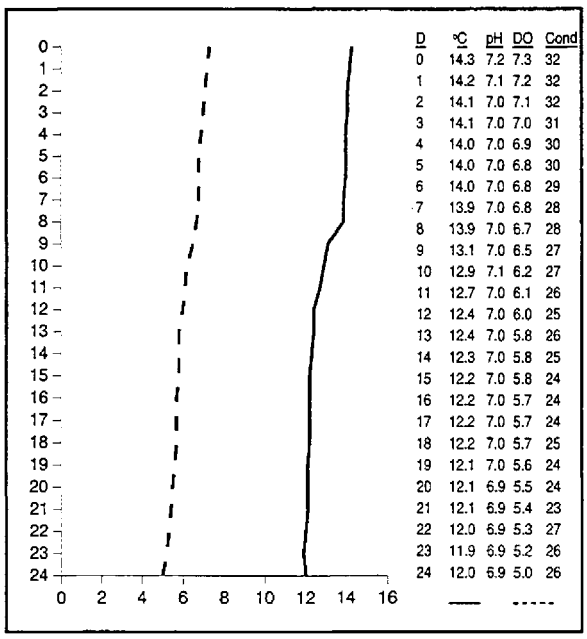
Surface Data	1981*	1989	1991
Trophic Status	E	M	O
Chlorophyll TSI	-	43.03	38.61
Secchi Depth TSI	54.20	51.94	53.00
Phosphorous TSI	53.20	43.89	27.35
Average TSI	53.70	46.29	39.66
Chlorophyll a (ug/L)	-	3.6	2.3
Transparency (m)	1.5	1.8	1.7
Total Phosphorous (ug/L)	30	16	5
pH	6.9	7.2	7.1
Total Susp. Solids (mg/L)	<5	-	6
Total Volatile Solids (mg/L)	-	-	5
Total Residual Solids (mg/L)	-	-	1
Temperature (°C / °f)	13/55	13/55	11/52
Conductivity (umhos.cm)	26	41	36
Water Column Data			
Ammonia (mg/L)	0.05	0.01	0.03
Nitrate/Nitrite (mg/L)	0.05	0.01	0.01
Hardness (mg/L)	18	-	13
Alkalinity (mg/L)	12	-	12
Silica (mg/L)	-	-	3.5
Total Phosphorous (ug/L)	25	15	7
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	7.3	6.5	5.7
Stratification (m)	4-7	NO	NO
Depth at Deepest Site (m)	27	14.0	24.0

* One site only (593954)

There are no overall water column concentrations that exceed State water quality standards for defined beneficial uses for parameters analyzed.

Data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is currently a oligotrophic reservoir in a state of low productivity. It should be noted that the trophic status has continually declined since it was originally impounded. There will need to be additional data collected to see if the reservoir maintains its oligotrophic state. The reservoir has sufficient depth for stratification but due to the early withdrawal for downstream irrigation needs and the elevation of the reservoir stratification has not been evident during our monitoring periods as indicated in the September 3, 1991 profile.

According to DWR no fish kills have been reported in recent years. The DWR stocked the reservoir with 10,000 advanced fingerling rainbow trout (*Oncorhynchus mykiss*) and 10,000 fingerling kokanee (*Oncorhynchus nerka*) in 1992. In addition the reservoir probably supports a population of brook trout (*Salvelinus fontinalis*)(previously stocked), cutthroat trout (*Oncorhynchus clarki*), mountain whitefish (*Prosopium williamsoni*), mountain sucker (Catostomus platyrhinchus), and sculpins (Cottus sp.) which are present in the tributaries to the reservoir. DWR has not treated the reservoir for the remove of nongame species so populations of native species will probably be present in the reservoir.



D	°C	pH	DO	Cond
0	14.3	7.2	7.3	32
1	14.2	7.1	7.2	32
2	14.1	7.0	7.1	32
3	14.1	7.0	7.0	31
4	14.0	7.0	6.9	30
5	14.0	7.0	6.8	30
6	14.0	7.0	6.8	29
7	13.9	7.0	6.8	28
8	13.9	7.0	6.7	28
9	13.1	7.0	6.5	27
10	12.9	7.1	6.2	27
11	12.7	7.0	6.1	26
12	12.4	7.0	6.0	25
13	12.4	7.0	5.8	26
14	12.3	7.0	5.8	25
15	12.2	7.0	5.8	24
16	12.2	7.0	5.7	24
17	12.2	7.0	5.7	24
18	12.2	7.0	5.7	25
19	12.1	7.0	5.6	24
20	12.1	6.9	5.5	24
21	12.1	6.9	5.4	23
22	12.0	6.9	5.3	27
23	11.9	6.9	5.2	26
24	12.0	6.9	5.0	26

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Pennate diatoms	0.140	66.90
Asterionella formosa	0.066	31.59
Centric diatoms	0.003	1.51
Total	00.209	
Shannon-Weaver [H']	0.70	
Species Evenness	0.63	
Species Richness	0.11	

The phytoplankton community is dominated exclusively by diatoms and is indicative of good water quality and low production.

Pollution Assessment

Nonpoint pollution sources include: sedimentation and nutrient loading from grazing; and wastes and litter associated with recreation. Cattle graze in the watershed and around the reservoir.

There are no point pollution sources in the watershed.

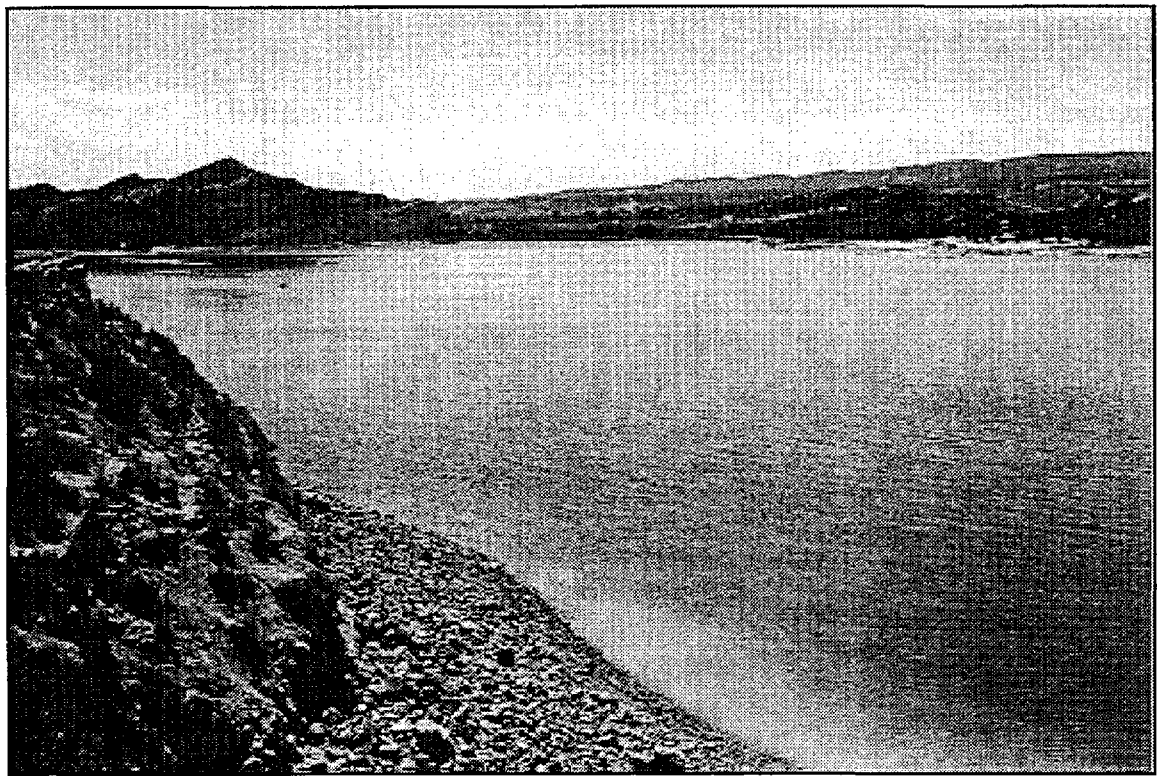
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Wasatch-Cache National Forest	524-5030
Mountain View Ranger District	307-782-6555
Mountainlands Association of Governments	377-2262
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Mountainland Travel Region (Provo)	377-2262
Reservoir Administrators	
Bureau of Reclamation	524-5436

STEINAKER RESERVOIR



Introduction

Steinaker Reservoir is a large reservoir immediately north of Vernal in northeastern Utah. It is an off-stream impoundment of Ashley Creek, which drains the eastern High Uintas. The reservoir is built in a strike valley that has formed behind the resistant Dakota Sandstone. A state park at the reservoir provides year-round recreational opportunities.

Steinaker Reservoir was created in 1961 by the construction of an earth-fill dam. The reservoir shoreline is entirely state owned, and public access is unrestricted. Reservoir water is used for irrigation (91%), and culinary (9%). If the urban growth takes place in Ashley Valley, the proportion used for culinary purposes is expected to increase.

Characteristics and Morphometry

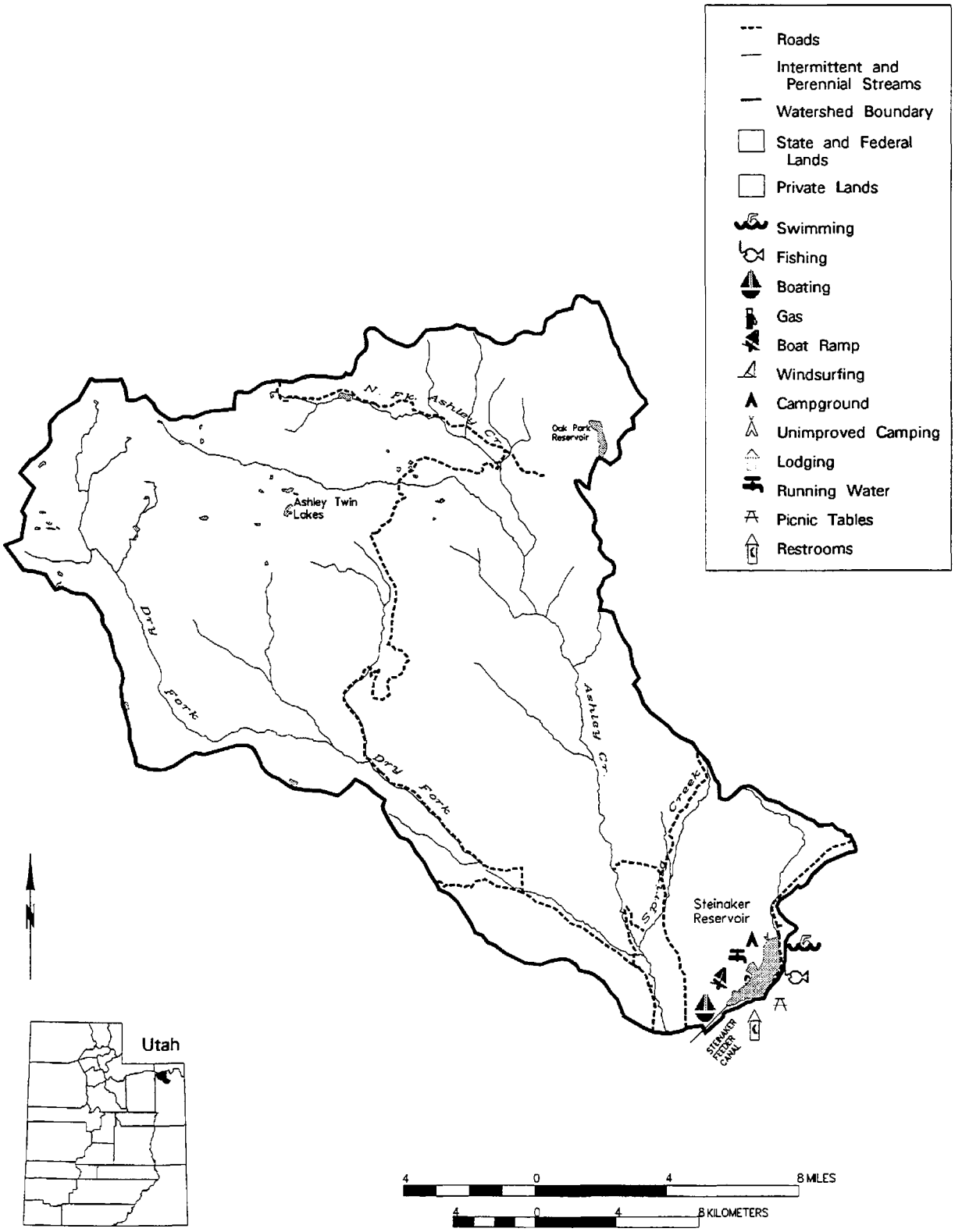
Lake elevation (meters / feet)	1,682 / 5,520
Surface area (hectares / acres)	335.5 / 829
Watershed area (hectares / acres)	67,200 / 166,000
Volume (m^3 / acre-feet)	
capacity	49,833,000 / 40,400
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	14,262,000 / 11,562
Depth (meters / feet)	
maximum	39.6 / 129.9
mean	14 / 45.9
Length (km / miles)	4.2 / 2.61
Width (km / miles)	.914 / .56
Shoreline (km / miles)	.885 / 5.5

Location

County	Uinta
Longitude / Latitude	109 31 52 / 40 30 58
USGS Map	Steinaker Reservoir, 1965
DeLorme's Utah Atlas & Gazetteer™	Page 56, C-3
Cataloging Unit	Ashley-Brush Creeks (16060002)

Recreation

Steinaker Reservoir is easily accessible from US-191 about four miles north of Vernal. The highway follows the east shore for about a mile. An access road leads across the north end of the reservoir to the state park, which is on



County near which watershed is located.

Steinaker Watershed

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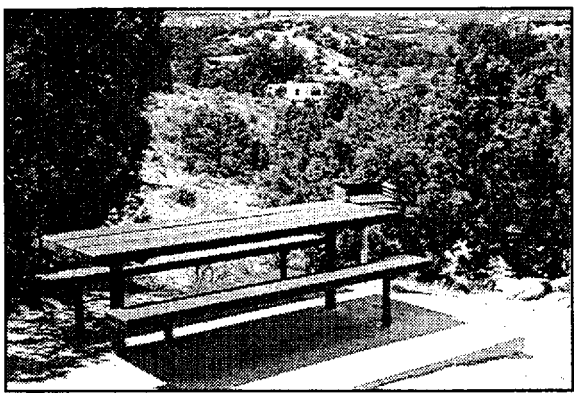
the west side of the lake.

Cross-country skiing, fishing, boating, swimming, camping, picnicking, ice fishing, and water skiing are all popular. Red Mountain and other foothill to the Uintas provide a backdrop.

Recreational facilities at the reservoir include Steinaker State Park. The state park has a concrete boat launch, modern rest rooms with showers, sewage disposal, sandy beaches, a 31 unit campground, and fish cleaning stations. Entrances are well marked.



There are numerous USFS campgrounds north of the reservoir along US-191. There are several private campgrounds nearby in Vernal (see info box).

Watershed Description

Steinaker Reservoir is located at the edge of the Uinta Mountains, where the Precambrian granite that makes the Uintas is still buried by younger strata. The younger strata is tilted upwards towards the Uintas, and the harder layers have eroded to form cliffs (hogbacks) facing the mountains. Steinaker Reservoir is an impoundment of the strike valley behind the a hogback of Dakota Sandstone. The dam is at a point where a stream cut through the cliffs, allowing a large body of water to be impounded behind a small dam.

The natural watershed consists of the strike valley and drainage from Red Mountain. Ashley Creek, which also drains Dry Fork and Black Canyon Creek in the eastern High Uintas, is diverted into the reservoir via the Steinaker Feeder Canal.

The watershed high point, Marsh Peak, is 3,731 m (12,240 ft) above sea level, thereby developing a complex slope of 6.5% to the reservoir. The average stream gradient in the lower reaches of Ashley Creek is 2.3% (121 feet per mile), but is much steeper in the upper reaches of Ashley Creek and lower in the Steinaker Feeder Canal. The inflows are the Steinaker Feeder Canal and various washes along the west side and north end of the reservoir. The outflow is the Steinaker Service Canal, which provides irrigation water to Ashley Valley.

The watershed is made up of high mountains, foothills, plateaus, badlands and valleys. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of pine, spruce-fir, oak-maple, alpine tundra, pinyon-juniper, saltbrush, shadscale, greasewood and sagebrush-grass. The watershed receives 25 - 76 cm (10 - 30 inches) of precipitation annually. The frost-free season around the reservoir is 120 - 140 days per year.

According to the 1982 Clean Lakes Inventory, land use is as follows: multiple use--87% (grazing, recreation, and limited logging on National Forest lands, Agriculture--6.5% and private grazing and mining--6.5%.

Limnological Assessment

The water quality of Steinaker Reservoir is very good. It is considered to be moderately hard with a hardness concentration value of approximately 142 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality

Limnological Data

Data averaged from STORET sites: 493755, 493756, 493757

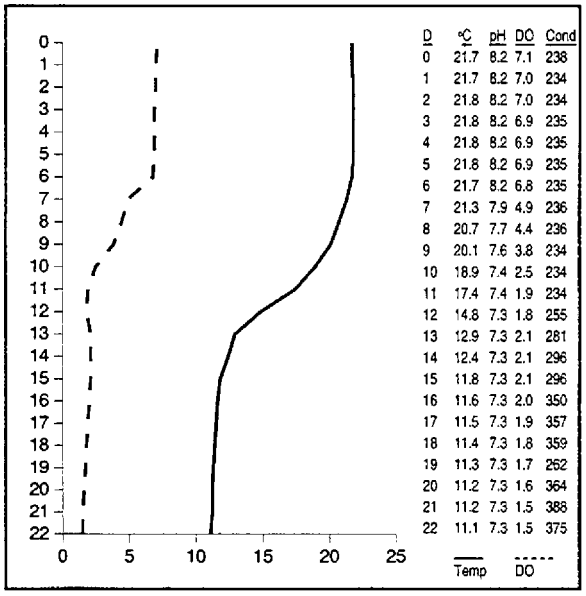
Surface Data	1979	1989	1991
Trophic Status	M	O	M
Chlorophyll TSI	36.53	34.45	39.72
Secchi Depth TSI	37.50	43.34	47.26
Phosphorous TSI	53.20	27.23	34.01
Average TSI	42.41	35.01	40.33
Chlorophyll a (ug/L)	-	2.3	2.8
Transparency (m)	5	3.6	2.5
Total Phosphorous (mg/L)	17	10	11
pH	8.3	8.6	8.1
Total Susp. Solids (mg/L)	-	-	3
Total Volatile Solids (mg/L)	-	-	3
Total Residual Solids (mg/L)	-	-	1
Temperature (°C / °f)	20/68	20/68	21/70
Conductivity (umhos.cm)	190	359	197
Water Column Data			
Ammonia (mg/L)	0.07	0.11	0.04
Nitrate/Nitrite (mg/L)	0.09	-	0.02
Hardness (mg/L)	157	-	126
Alkalinity (mg/L)	105	-	82
Silica (mg/L)	4.5	-	4.3
Total Phosphorous (ug/L)	24	40	18
Miscellaneous Data			
Limiting Nutrient	N	P	N
DO (Mg/l) at 75% depth	0.3	0.2	1.9
Stratification (m)	11-15	5-7	9-13
Depth at Deepest Site (m)	22	14.5	22.0

standards for defined beneficial uses are total phosphorus and dissolved oxygen. Although the average concentrations of total phosphorus in the water column only exceeded the recommended pollution indicator for phosphorus of 25 ug/L in 1989 with a concentration of 40 mg/L, there were reported values much higher in the water column. The phosphorus concentration in the hypolimnion on August 15, 1991 reached a level of 137 ug/L. This increased concentration occurred when the reservoir was stratified and anoxic conditions were present near the bottom as indicated in the August 15, 1991 profile. Dissolved oxygen concentrations in late summer substantiate the fact that water quality impairments do exist. Concentrations dropped dramatically below the thermocline to approximately 1.5 mg/L. It is apparent that there is a high demand for oxygen at the sediment interface probably due to an accumulations of organic material.

The nitrogen/phosphorus data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is mesotrophic even though it dropped into the oligotrophic range during 1989. The reservoir was stratified during a summer monitoring trip was on September 5, 1991 as indicated in the profile. The profile indicates that a thermocline developed at a depth of 10-12 meters. Consistent with the stratification was a noticeable decline in the concentration of dissolved oxygen in the water column. These conditions are deleterious to the fishery rendering approximately 1/2 of the water column unsuitable for a fishery. Winter data is not available to determine the extent of depletion, but should be obtained to evaluate impairments to the overwintering of fish.

In 1975 Steinaker Reservoir was one of the reservoirs evaluated under the NES survey. The survey indicated that the reservoir was mesotrophic with a lower than expected nutrient loading. The loading rates was 0.11 g/m^2 for phosphorus and 5.5 g/m^2 for total nitrogen. It was noted in the report that insufficient tributary and outlet sampling was conducted in relationship to these calculations. During the May sampling period *Chroomonas sp.* (52%) was the dominate phytoplankton populations while in August and September it was *Aphanocapsa sp.* (67% and 53% respectively).

According to DWR no fish kills have been reported in recent years. The reservoir supports populations of brown trout (*Salmo trutta*), rainbow trout (*Oncorhynchus mykiss*), and largemouth bass (*Micropterus salmoides.*). The reservoir was treated for rough fish competition in 1989, so populations of native fishes may not be present in the reservoir.



The DWR stocks the reservoir with 50,000 - 75,000 fingerling rainbow trout annually. In 1990, 20,000 sub-catchable rainbow trout and 50,000 largemouth bass fry were also stocked.

Phytoplankton in the euphotic zone during the last study period include in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	2.641	89.24
Cosmarium sp.	0.236	7.96
Staurastrum gracile	0.034	1.16
Ankistrodesmus falcatus	0.017	0.59
Pennate Diatoms	0.010	0.34
Asterionella formosa	0.009	0.32
Oocystis sp.	0.008	0.28
Centric Diatoms	0.003	0.11
Total	2.958	
Shannon-Weaver [H']	0.45	
Species Evenness	0.21	
Species Richness	0.32	

The phytoplankton community is dominated by the presence of green algae and desmids. This is indicative of good water quality and moderate production.

Pollution Assessment

Nonpoint pollution sources include the following: sedimentation and nutrient loading from grazing; leachates,

nutrients and sediments from mine sites that have not been reclaimed; sedimentation and increased runoff from logging activities; and wastes and litter from recreation.

Grazing takes place throughout the watershed, but not in direct proximity of the reservoir.

Some of the heaviest logging in the Uinta Mountains takes place in this watershed, with large timber sales in the Oaks Park area. Much of the watershed has been logged in fairly recent history. Current logging practices leave buffer zones around riparian areas to mitigate impacts to water quality.

There are no active mines within the watershed, but old sites that have not been reclaimed likely leach some heavy metals and sediments into waterways, but water quality analysis in the reservoir has not documented any impairments from heavy metals.

There are no point sources of pollution in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: culinary water (1A), recreational bathing (swimming) 2A, boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Uinta National Forest	377-5780
Recreation	
Dinosaurland Travel Region (Vernal)	789-6932
Vernal Chamber of Commerce	789-1352
Steinaker State Park	789-4432
Mammoth R.V. Park (Vernal)	789-9309
Campground Dina (Vernal)	789-2148
Reservoir Administrators	
Department of the Interior	-------
CUP	--------

STRAWBERRY RESERVOIR

Introduction

Strawberry Reservoir is the 5th largest body of fresh water in the state. It is located in a high mountain valley at an elevation of 7,600 feet above sea level in Wasatch County. It collects water from the south slope of the Uintas through a network of streams, canals and tunnels in its natural watershed area and transbasin diversions from other watershed areas... It stores water for use on the Wasatch Front in addition to providing a primary recreation area for people of Utah. The Strawberry Tunnel, a 3.8 mile long hand dug tunnel, drains the reservoir into Sixth Water Creek, a tributary of the Diamond Fork drainage, a tributary of the Spanish Fork River, which flows into Utah Lake. Approximately 60,000 acre-feet of water is supplied annually.

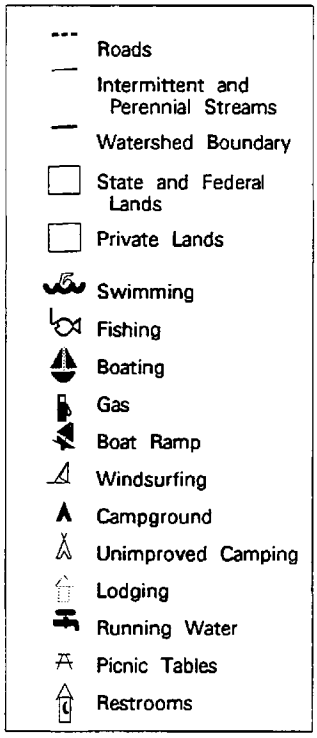
It is located at the extreme west end of the Uinta Basin, near the continental divide between the Great Basin and the Colorado drainage (The tunnel carries water through the divide). It is southeast of Heber City and west of Duchesne--less than an hour drive from the southern Wasatch Front. The high elevation and good to excellent fishing make it a

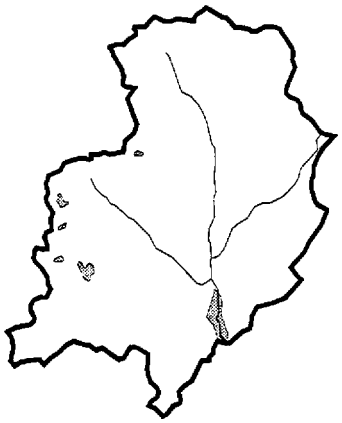
Characteristics and Morphometry

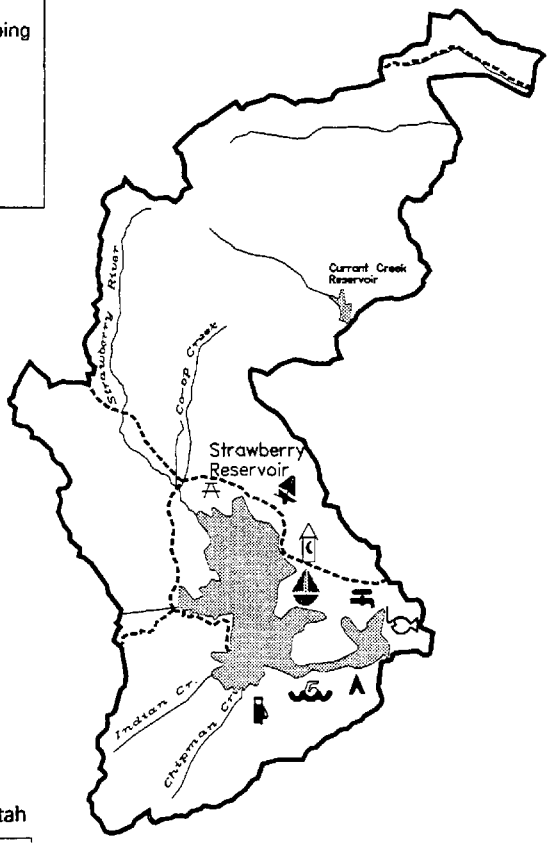
Lake elevation (meters / feet)	2,317 / 7,602
Surface area (hectares / acres)	3,994 / 17,000
Watershed area (km^2 / $miles^2$	616 / 238
Volume (m^3 / acre-feet)	
capacity	1,364,314,500 / 1,106,500
conservation pool	0
Annual inflow (m^3 / acre-feet)	277,425 / 225,000
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	74 / 243
mean	19.8 / 65
Length (km / miles)	13 / 8.1
Width (km / miles)	5.8 / 3.6
Shoreline (km / miles)	102 / 63.3

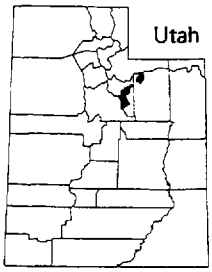
Location

County	Duchesne
Longitude / Latitude	110 08 40 / 40 11 12
USGS Map	Provo, UT (1980)
DeLorme's Utah Atlas & Gazetteer™	Page 46, A-2, Page 54, D-2
Cataloging Unit	Strawberry (14060004)

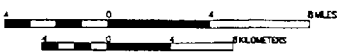








County near which watershed is located.



Strawberry Watershed

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popular summer recreational area. Strawberry Reservoir had a fraternal twin, Soldier Creek Reservoir, which was about five miles downstream and backed water up to the Strawberry Dam. In the late 1980's, Soldier Creek Dam was raised above the Strawberry Reservoir Dam, creating one larger, deeper reservoir. The reservoir retains the Strawberry name, and the dam retains the Soldier Creek name.

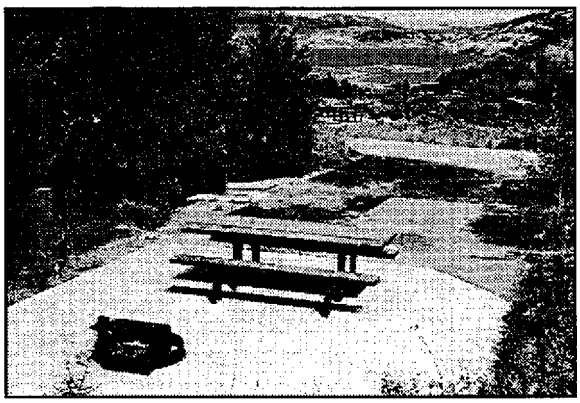
The shoreline, administered by the Uinta National Forest, is 100% publicly owned with unlimited public access. The first dam was completed in 1906 as the first Bureau of Reclamation project in Utah. The Strawberry Tunnel was completed in 1912 for delivery of water for agricultural needs in Utah County. In addition to recreation water is currently used entirely for irrigation, but as residential development continues to obliterate farmland, water will probably be used for culinary purposes and in the generation of power as well.

Since 1906, the Bureau of Reclamation has used federal funds to construct over two dozen other projects in Utah. These projects collect spring runoff for utilization by Utah farmers and ranchers to enhance agricultural productivity in the arid west.

Recreation

Strawberry Reservoir is accessible from several areas along US-40 between Heber and Duchesne. The eastern access is Soldier Creek Dam, and the western access is the road to the main campground and tunnel, with several access points in between. Paved roads almost circumscribe the lake, but the steep hills to the south prevent complete encircling.

The reservoir is also accessible by unpaved roads from the right fork of Hobble Creek Canyon, Diamond Fork, and the Sheep Creek road midway up US-6 in Spanish Fork Canyon.



The lake is popular for fishing, boating, sailing, swimming, and waterskiing. It has long been recognized as one of the best trout-producing waters in the state. Historically non-game fish have flourish in the reservoir, so it was necessary to periodically treat the reservoir by the DWR to control non-game species to reduce competition and enhance the trout fishery.

Recreational facilities are well developed. Strawberry Bay and Soldier Creek campgrounds have 200 and 108 sites respectively, picnic areas, boat ramps, and toilets. Strawberry Bay also has a marina. Chicken Creek and Soldier Creek Dam are day use areas, and Aspen Grove campground (south of the dam) is a slightly more rustic area with 23 campsites.

Watershed Description

Strawberry Reservoir has a large natural watershed (approximately 238 square miles), bounded by Strawberry Ridge to the west, and stretching about the some distance to the north and south. This area has no high mountains, but still collects 20 - 25 inches of precipitation annually. There is a large area that is artificially added to the watershed by a series of tunnels, which divert water from Rock Creek (30 miles northeast) and all the drainages in between. Upper Stillwater Reservoir on Rock Creek and Current Creek Reservoir on Currant Creek also impound water that is later drained into Strawberry. These creeks and rivers have their headwaters in the High Uintas, receiving over 40 inches of precipitation annually. This diversion adds considerable diversity to the watershed.

As with most reservoirs with fluctuating water levels, the shoreline of the lake is barren of riparian vegetation. Sagebrush prairies surround the high water line of the reservoir, but when water is low, the shoreline is mud flats.

The natural watershed high point , is 3,226 m (10,584 feet) above mean sea level, creating a complex slope of 4.7 % to the reservoir.

The principle inflows are the (clockwise from the Strawberry River) the Strawberry River, Chicken Creek, Trout Creek, Cow Hollow Creek, Water Hollow Tunnel, Coal Canyon, Sage Creek, Badger Hollow Creek, Road Hollow Creek, Soldier Creek, Pine Hollow Creek, Chipman Creek, Indian Creek, Squaw Creek, Horse Creek, Bryants Fork, and Mud Creek. The inflows to Water Hollow Tunnel are Water Hollow Creek, Layout Canyon Creek, Currant Creek, West Fork Duchesne River, Wolf Creek, Hades Creek and Rock Creek. The outlets are the Strawberry River and the Strawberry Tunnel. A very rough approximation of the average stream gradient above the lake is 2.4% (130 feet per mile).

This diverse watershed contains soils of many different types. A partial listing (omitting all of the artificially diverted watersheds) of the soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist pine, aspen,

spruce-fir, oak, and sage-grass. The diverted watersheds also include mountain meadow and alpine vegetation. The watershed receives 64 - 102 cm (25 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 40 - 80 days per year.

Land use in the natural watershed is 73% multiple use (logging, mining, grazing and recreation on BLM, State, and USFS lands), 16% private grazing lands and 11% Strictly recreation.

Limnological Assessment

The water quality of Strawberry Reservoir is good. It is considered to be moderately hard with a hardness concentration value of approximately 130 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are total phosphorus and dissolved oxygen. The average concentrations of total phosphorus in the water column for the four study periods were 72, 77, 76 and 63 ug/L which all exceed the recommended pollution indicator for phosphorus of 25 ug/L.

Limnological Data

Data sampled from STORET sites: 493632, 493633, 493642, 593676, 593677

Surface Data	1989	1990	19910	1992
Trophic Status	E	E	E	E
Chlorophyll TSI	60.28	62.03	62.19	57.75
Secchi Depth TSI	45.33	47.87	43.26	41.35
Phosphorous TSI	59.59	59.59	57.95	57.27
Average TSI	54.70	56.50	54.47	52.46
Chlorophyll a (ug/L)	21.7	24.8	23.2	29.4
Transparency (m)	2.6	2.8	3.4	4.1
Total Phosphorous (ug/L)	46	47	43	42
pH	8.1	8.7	8.4	8.6
Total Susp. Solids (mg/L)	1.7	<3.0	-	<3.0
Total Volatile Solids (mg/L)	-	-	-	1
Total Residual Solids (mg/L)	-	-	-	2
Temperature (°C / °f)	13/55	14/58	13/55	16/61
Conductivity (umhos.cm)	274	266	262	266
Water Column Data				
Ammonia (mg/L)	0.10	0.13	0.13	0.09
Nitrate/Nitrite (mg/L)		-	0.18	0.06
Hardness (mg/L)	153	143	-	125
Alkalinity (mg/L)	142	131	-	114
Silica (mg/L)	-	-	-	0.5
Total Phosphorus (ug/L)	72	77	76	63
Miscellaneous Data				
Limiting Nutrient	N	N	N	N
DO (Mg/l) at 75% depth	1.2	1.8	1.1	0.1
Stratification (m)	7-12	8-10	6-12	-
Depth at Deepest Site (m)	55	56	45	53

These phosphorus concentration values represent the data obtained during the productivity season. It is not uncommon for total phosphorus concentrations to reach levels in excess of 200 ug/L in the hypolimnion during late summer when anoxic conditions are present and levels in excess of 500 ug/L have been documented during winter months after anoxic conditions are present for longer periods of time. These dissolved oxygen concentrations substantiate the fact that water quality impairments do exist. Concentrations dropped dramatically below the thermocline and remain depressed for nearly 35 meters at the deep station above Soldier Creek Dam as depicted in the August 20, 1991 profile.. Anoxic conditions have been documented in all major areas of the reservoir, although at stations with limited depths the proportion of the water column affected is not as dramatic.

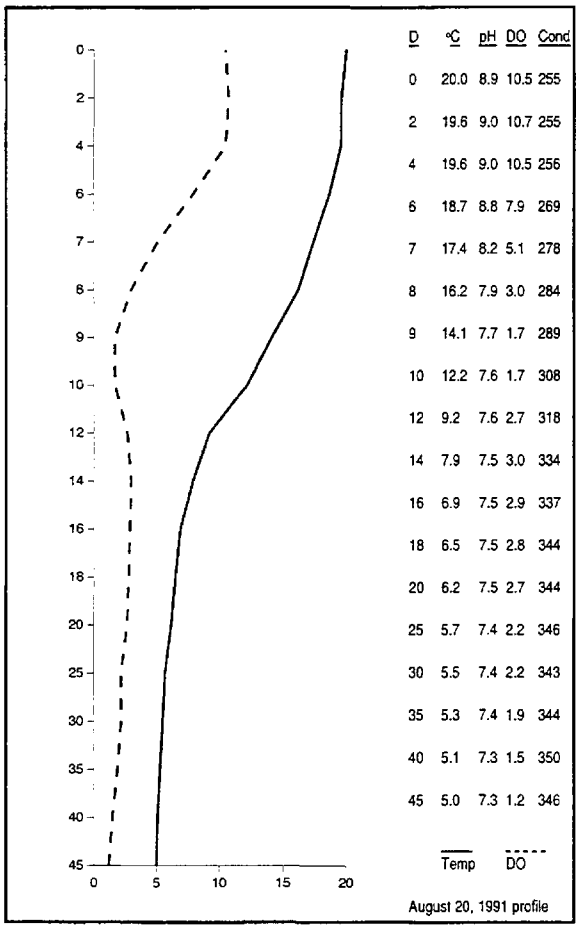
Data suggest that the reservoir is currently a nitrogen limited system with TSI values indicating that the reservoir is eutrophic. The reservoir typically stratifies later in the summer at a depth near 10 meters. Consistent with the stratification there is a noticeable decline in the concentration of dissolved oxygen in the water column. These conditions are deleterious to the fishery rendered significant portions of the water column unsuitable for a fishery. Although this limits the habitat area for the reservoir, it should be noted that this a large reservoir in which recruitment of new fish occurs in the tributaries of the reservoir.

As previously mention Strawberry Reservoir has always been one of Utah's prime trout fisheries. It has continually been plagued with recurring populations of non-game species of fish that overtake and predominate over trout species. The basic strategy was to treat the reservoir for the eliminations of non-game species, restock with trout species, and then monitor the fishery until they would be forced to start the cycle over due to over infestation of non-game species. In an effort to establish a permanent viable trout fishery, it was necessary for the DWR to look at a new trout management strategy . It was estimated by DWR staff in 1987 that the population of trout species had diminished to approximately 10%. Another problem in the watershed related to the fishery was the loss of suitable stream spawning habitat for the natural recruitment of reservoir species of fish. The loss of spawning habitat was brought about due to dewatering for irrigation, spraying with herbicides to eliminate willows in hopes of increasing forage yields, and overgrazing in the watershed and on streambanks. Threatened with the loss of this prime trout fishery a coordinated effort of citizens and governmental agencies began to focus on watershed and fishery problems with the intent of restoring this once renowned trout fishery. A comprehensive plan was developed to not only establish

a viable fishery for the existing conditions but to implement necessary work in the watershed to restore spawning habitat for the establishment of a self sustaining population of game fish. Stream restoration in the watershed was facilitated with the acquisition of project lands and and control of grazing within the immediate watershed area.

Watershed implementation goals consisted of the following:

1. Improve water quality by reducing total phosphorus loading to the reservoir by 4-5,000 Kg/year;
2. A return of stream conditions to be able to support trout reproduction;
3. To reduce turbidity in the streams to the extent practical;
4. To reduce erosion and sediment loading to the streams to the extent practical;



5. To reduce ambient maximum stream temperatures to conform to State standards for a cold-water fishery;
6. To eliminate fish kills in the reservoir;
7. To maintain dissolved oxygen at or above 5 mg/L in the reservoir; and
8. To maintain average summer chlorophyll at or below 8-10 ug/L in the reservoir.

In order for the complete restoration of the trout fishery would also require the establishment of a perpetual trout fishery capable of control of non-game fish to the extent possible. With this as a goal DWR staff developed a management strategy based on control of non-game fish through natural predation by game species. This biological control focused on the establishment of a viable breeding population of Bear Lake (Bonneville) cutthroat (*Oncorhynchus clarki utah*) and kokanee salmon (*Oncorhynchus nerka*), both considered to be predacious in nature. In addition the stocking of sterile rainbow trout would be maintained to provide alternative sportfishery.

In order to establish the new fishery, it would be advantageous to treat the reservoir for the removal of non-game species. With the enlargement of the reservoir capacity and the nearing of the completion of the transbasin collection system which would bring new water to the reservoir, it was eminent that treatment of the reservoir would have to occur as soon as possible. Even with careful planning, it was necessary to delay the treatment of the reservoir in order to acquire an adequate amount of rotenone to chemically treat such a large reservoir. The treatment focused on treating only that portion of the water column suitable as fishery habitat. The amount of the column was determined by the extent of the oxygen depletion at the time of treatment. Here was one time that poorer water quality in the lower levels of the reservoir allowed for the treatment of the reservoir from an economical perspective.

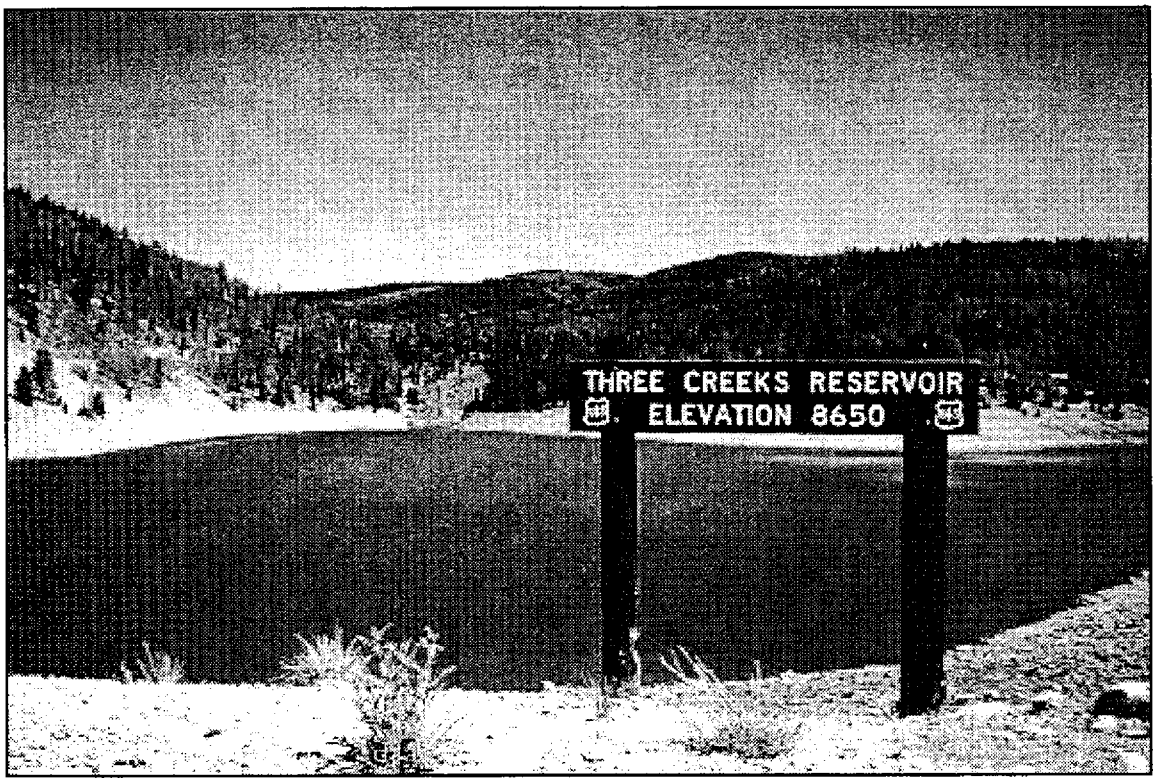
The treatment of the reservoir was a successful operation and considerable efforts have been expended in the watershed to restore stream habitat suitable for spawning. Current conditions are pointing towards the success of this overall project to improve water quality and restore a primary trout fishery in our state.

According to DWR no fish kills have been reported in recent years. The reservoir supports populations of rainbow trout (*Oncorhynchus mykiss*), cutthroat trout (*Oncorhynchus clarki utah*), and kokanee (*Oncorhynchus nerka*). Current stocking reports indicate that DWR stocks the reservoir with

Phytoplankton in the euphotic zone during the last study period included the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Ceratium hirundinella	13.108	99.85
Microcystis incerta	0.011	0.08
Ankistrodesmus falcatus	0.008	0.07
Total	13.127	

THREE CREEKS RESERVOIR



Introduction

Three Creeks Reservoir is located in the upper reaches of the Beaver River drainage in the Tushar Mountains. It is a small artificial impoundment in a high meadow at the confluence of the north and south forks of Three Creeks and Lake Stream.

The Tushar Mountains on the Beaver Ranger District of the Fishlake National Forest offers a unique experience. It is one of the most beautiful and scenic areas of our State. Evidence still remains of the Tushar Caldera that exploded thousands of years ago throwing rocks and boulders hundreds of miles. In exploring the area one can find igneous , sedimentary, and metamorphic rocks. The volcanic activity of the Tushar's is responsible for the highly mineralized rocks which can be found in the area. Minerals which occur are gold, silver, pyrite and uranium.

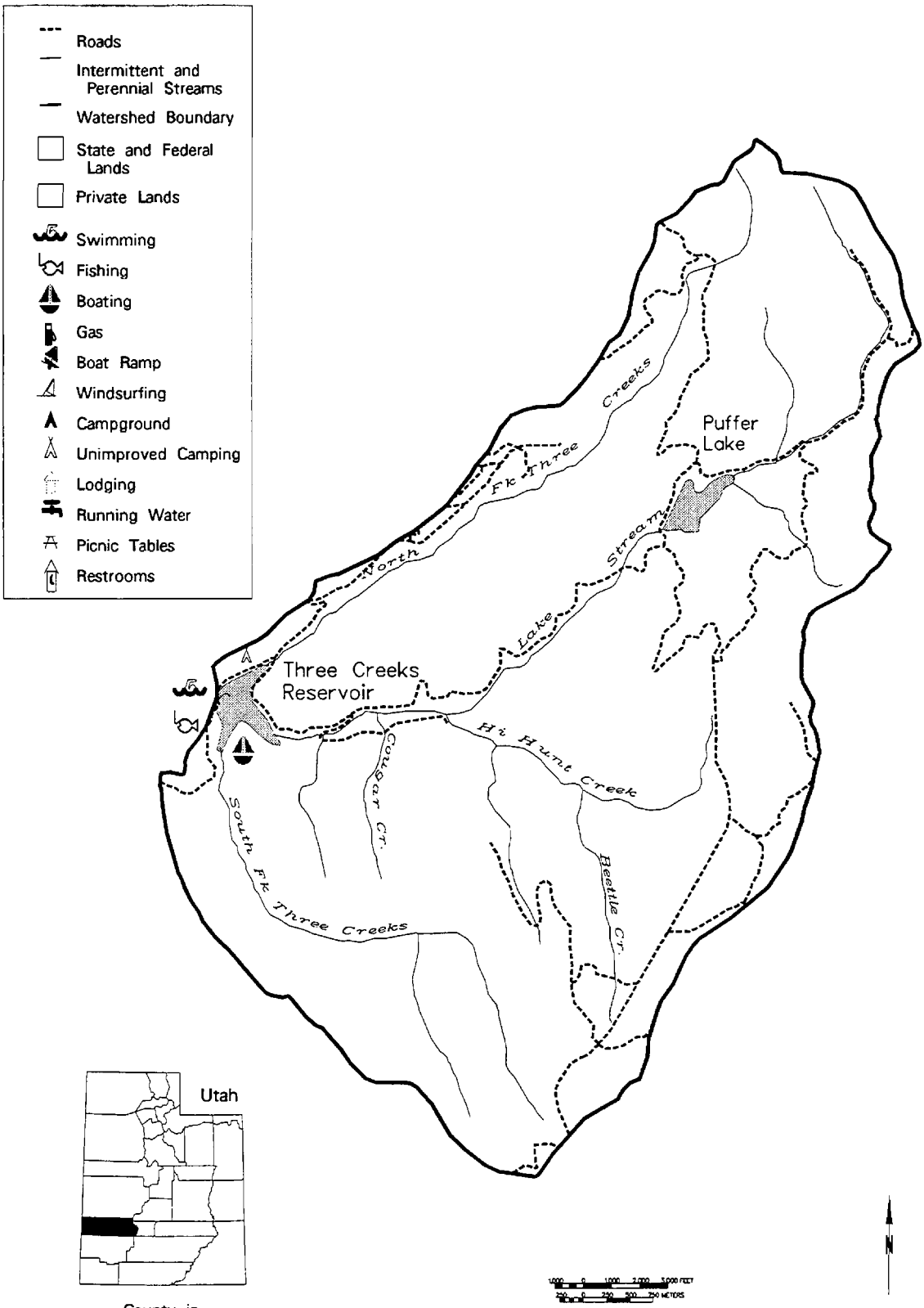
The reservoir shoreline is 70% owned and administered by the Fish Lake National Forest with unrestricted public access. The south lobe of the lake falls on a school section which was sold into private ownership. Defined beneficial uses include: water recreation excluding swimming,

Characteristics and Morphometry

Lake elevation (meters / feet)	2,625 / 8,613
Surface area (hectares / acres)	23.1 / 57
Watershed area (hectares / acres)	4,845 / 11,972
Volume (m^3 / acre-feet)	
capacity	2,502,200 / 2,029
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	25.7 / 84.3
mean	10.8 / 35.4
Length (meters / feet)	900 / 2,953
Width (meters / feet)	450 / 1,476
Shoreline (meters / feet)	3,500 / 11,483

Location

County	Beaver
Longitude / Latitude	112 25 15 / 38 17 45
USGS Map	Shelly Baldy Peak, Utah, 1981
Cataloging Unit	Beaver River (16030007)



County in which watershed is located.

Three Creeks Watershed

<k127>

propagation of cold water species of game fish and aquatic life, and agricultural needs.

Recreation

Three Creeks Reservoir is accessible via U-153, 17 miles east of Beaver or 18 miles west of Junction. The highway from Beaver is paved, while the highway from Junction is gravel, but a fairly good road.

Fishing, boating, hiking, skiing, packing and camping are possible in the area. Usage is moderate and it is usually possible to launch a boat in the reservoir.

The nearest USFS campground, Mahogany Cove, is 7 miles west on U-153, and offers camping at a nominal charge. It has 7 campsites, drinking water and vault toilets. There are also several private campgrounds in Beaver. There are also some private lodge areas associated with Elk Meadows Ski Resort or Puffer Lake that provide lodging and recreational activities. Other points of interest in the area are the old mining areas of Frisco and Kimberly besides several other lakes and reservoirs for fishing and camping.

Watershed Description

The reservoir is in a small meadow at the top of the Beaver River gorge some distance below the tall peaks of the Tushars. The watershed high point, Delano Peak, is 3,708 m (12,169 ft) above sea level, thereby developing a complex slope of 11.7% to the reservoir. The inflows are North Fork Three Creeks, South Fork Three Creeks and Lake Stream and the outflow is Three Creeks (only one stream). The average stream gradient above the reservoir is 6.2% (327 feet per mile).

The soil is largely of volcanic origin with moderate permeability and moderately slow erosion and runoff. A complete listing of soils compositions that compose the watershed are listed in Appendix III.

The vegetation communities are comprised of pine, aspen, spruce-fir, oak, maple and alpine. The watershed receives 64 - 102 cm (25 - 40 inches) of precipitation annually with a frost-free season of 40 - 60 days at the reservoir.

Limnological Assessment

The water quality of Three Creeks Reservoir is good. It is considered to be soft with a hardness concentration value of approximately 45 mg/L ($CaCO_3$). The parameter that has exceeded State water quality standards for defined beneficial uses is total phosphorus. The average concentrations of total phosphorus in the water column for 1992 was 49 ug/L which exceeds the recommended pollution indicator for phosphorus of 25 ug/L. The phosphorus concentration in the hypolimnion in August, 1992 was 72 ug/L. The amount of data available at this time is insufficient to determine impairments conclusively. Additional data will need to be obtained for proper evaluation.

Data suggest that the reservoir is currently a phosphorus limited system. A more accurate descriptions would indicate that the reservoir was phosphorus limited during early summer and in late summer with limited water in the reservoir, it was nitrogen limited. This conclusion is based on the fact that the inorganic nitrogen concentration was below detectable limits in June (< 0.02 mg/L) while in August it rose to 1.9 mg/L. TSI values indicate the reservoir is eutrophic, primarily due to elevated levels of total phosphorus in the water column. The reservoir was weakly stratified during June, 1992 with a thermocline at mid-level in the water column. Early withdrawal probably does not allow for the stratification to become fairly strong, but if water was stored for a significant period of time , it probably would occur.

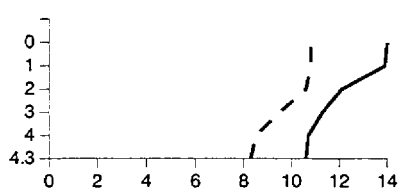
According to DWR no fish kills have been reported in

Limnological Data

Data sampled from STORET site: 594110

Surface Data	1992
Trophic Status	E
Chlorophyll TSI	47.23
Secchi Depth TSI	46.23
Phosphorous TSI	59.04
Average TSI	50.83
Chlorophyll a (ug/L)	5.5
Transparency (m)	2.6
Total Phosphorous (ug/L)	45
pH	8.3
Total Susp. Solids (mg/L)	<3
Total Volatile Solids (mg/L)	0
Total Residual Solids (mg/L)	3
Temperature (°C / °f)	15/59
Conductivity (umhos.cm)	103
Water Column Data	
Ammonia (mg/L)	0.03
Nitrate/Nitrite (mg/L)	0.96
Hardness (mg/L)	45
Alkalinity (mg/L)	50
Silica (mg/L)	18.6
Total Phosphorous (ug/L)	49
Miscellaneous Data	
Limiting Nutrient	P
DO (Mg/l) at 75% depth	7.8
Stratification (m)	4-5
Depth at Deepest Site (m)	11

recent years, but it was noted that the reservoir could be drained for irrigation requirements if needed. The reservoir is stocked with approximately 2,000 catchable rainbow trout (*Oncorhynchus mykiss*) but because the lake has not been treated for rough fish competition populations of native fishes may still be present in the lake.



D	°C	pH	DO	Cond
0	13.5	8.1	7.8	87
1	13.0	8.1	7.8	87
2	12.8	8.1	7.8	86
3	12.5	8.1	7.8	86
4	12.0	8.1	7.9	87
5	10.8	8.1	8.0	85
6	10.6	7.8	7.9	87
7	10.4	7.8	7.9	86

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Pennate diatoms	0.973	66.51
Pandorina morum	0.222	15.20
Centric diatoms	0.127	8.67
Anabaena sp.	0.111	7.60
Haematococcus lacustris	0.013	0.91
Asterionella formosa	0.009	0.65
Chlamydomonas sp.	0.007	0.46
Total	1.46	
Shannon-Weaver [H']	1.07	
Species Evenness	0.55	
Species Richness	0.30	

The phytoplankton community is dominated by the presence of diatoms, flagellates and some blue-green algae.

Pollution Assessment

Nonpoint pollution sources are: sedimentation and nutrient loading from grazing and recreational development; and wastes and litter from recreation. Cattle graze around the USFS portion of the reservoir and throughout the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Fishlake National Forest	896-4491
Beaver Ranger District	438-2436
Five County Association of Governments	673-3548
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Beaver County Travel Council	438-2975
Beaver KOA	438-2924
United Beaver Camperland	438-2808
Beaver Chamber of Commerce	438-2975
Elk Meadows Ski and Summer Resort	**438-5433**
Puffer Lake Resort	**864-2751**
Reservoir Administrator	
Kents Lake Irrigation Company	438-2275

TIBBLE FORK RESERVOIR

Introduction

Tibble Fork Reservoir is a small reservoir north of Mount Timpanogos in the Wasatch Front. It is located at the point where glaciers extended furthest south in American Fork Canyon. At this point the wide canyon cut by glaciers narrows to a steep "V" profile. The view from the reservoir of the north end of Mount Timpanogos is quite spectacular, and Tibble Fork is a popular trailhead for climbing Box Elder Peak, and winter recreation in the winter.

Tibble Fork Reservoir was created in 1966 by the construction of an earth-fill dam. The reservoir shoreline is owned by the Uinta National Forest, and public access is unrestricted. Reservoir water is used primarily for irrigation, but a 166 acre-foot conservation pool is maintained throughout the year. Water use is not expected to change in the foreseeable future.

Characteristics and Morphometry

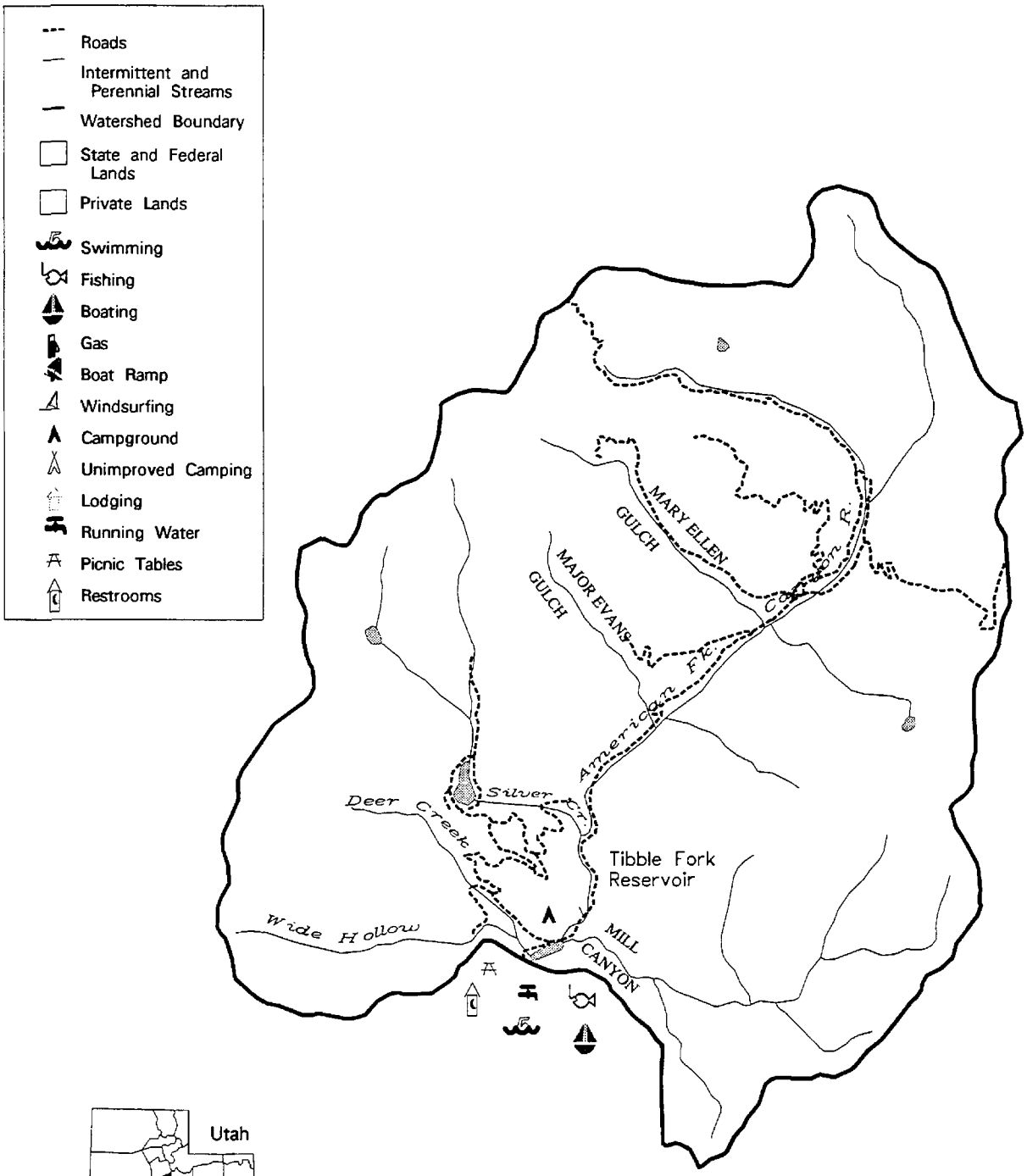
Lake elevation (meters / feet)	1,948 / 6392
Surface area (hectares / acres)	5.2 / 13
Watershed area (hectares / acres)	9,139 / 22,582
Volume (m^3 / acre-feet)	
capacity	319,477 / 259
conservation pool	207,461 / 166
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	10.9 / 36
mean	3.6 / 12
Length (meters / feet)	634 / 2,086
Width (meters / feet)	110 / 360
Shoreline (meters / feet)	1,536 / 5,040

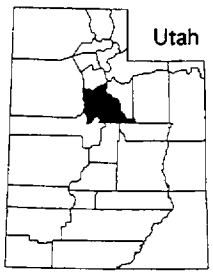
Location

County	Utah
Longitude / Latitude	111 38 35 / 40 28 57
USGS Map	Timpanogos Cave, UT 1948
DeLorme's Utah Atlas & Gazetteer™	Page 53, C-3
Cataloging Unit	Utah Lake (16020201)

Recreation

Tibble Fork Reservoir is about eight miles up American Fork Canyon. From the north, exit I-15 at U-92 (Exit 287), and follow it east across the north end of Utah Valley and up





County in which watershed is located.

1 0 1 2 MILES
1 0 1 2 KILOMETERS

Tibble Fork Watershed

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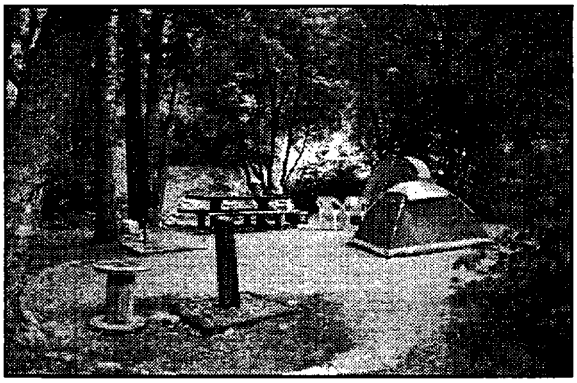
American Fork Canyon.

From the south, go north on US-89 (State St.) to Pleasant Grove (Exit I-15 in Lindon and go east to State St.). Turn north on U-146. The intersection is poorly marked, but it has a small sign directing you to Timpanogos Cave National Monument. The Purple Turtle and Daylight Doughnuts are located on this corner. Follow U-146 to U-92 and go up the canyon.

About 3 miles past Timpanogos Cave, turn left on U-144 and go two more miles to the reservoir. All routes to the reservoir are paved, and plowed year round.

Fishing, boating, snowmobiling, cross-country skiing, swimming, camping, picnicking, and hiking are all popular. The reservoir is small for boating, but it is generally possible to get a boat on the reservoir for fishing.

Recreational facilities at the reservoir include parking areas and latrines. There are numerous USFS campgrounds in the vicinity, including Granite Flat (above Tibble Fork towards Silver Lake Flat Reservoir) and Mile Rock, Warnick, and Martin, which are along U-144 below the reservoir.



Watershed Description

Tibble Fork Reservoir is located halfway from the headwaters of American Fork Canyon to Utah Valley. The reservoir is situated at the lowest reach of the glaciers that flowed down the canyon during the last ice age. Consequently, the drive up the canyon from the valley is in the very steep, very narrow canyon that was cut by glacial runoff, and the canyon above the reservoir is broader, cut by flowing ice, and partially filled with moraines.

The north facing slopes to the south are covered with coniferous forest, while the south facing slopes have scrub oak and meadows. The forest service has attempted to plant the slopes north of the reservoir with Ponderosa Pine, a non-native tree that does well in slightly dryer areas. Abandoned mines pockmark the canyon walls for many miles above the reservoir, but the Forest Service is in the process of reclaiming them.

The watershed high point, Twin Peaks, is 3,485 m (11,433 ft) above sea level, thereby developing a complex slope of 18.4% to the reservoir. The average stream gradient above the reservoir is 7.6% (402 feet per mile) The inflow and outflow is the American Fork River. Mill Canyon Creek is also a tributary. Silver Lake Flat Reservoir is an upstream impoundment (named after Silver Lake flat, the name of the meadow it impounded), and Silver Lake is a natural lake upstream from the meadow.

The watershed is made up of high mountains, mountains meadows, and mountain valleys. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of spruce-fir, oak, subalpine meadows, alpine and aspen. The watershed receives 76 - 152 cm (30 - 60 inches) of precipitation annually, more than any other reservoir in this study. The frost-free season around the reservoir is 80 - 100 days per year, but on the mountainsides it is only 20 - 40 days per year.

Land use in the watershed is 100% multiple use, with grazing and human recreation being the primary uses. Much of the watershed lies in the Lone Peak Wilderness Area. The area has been logged and mined in the past, but such activities are not presently taking place and are unlikely to resume in the foreseeable future.

Limnological Assessment

The water quality of Tibble Fork Reservoir is excellent. It is considered to be hard with a hardness concentration value of approximately 165 mg/L ($CaCO_3$). There are no overall water column concentrations that exceed State waterquality standards for parameters tested.

Data from 1991 suggest that the reservoir is currently a nitrogen limited system but the two previous periods suggest that it was phosphorus limited. A more complete review of the data shows that the system is phosphorus limited after turnover early in the productivity season and then as the nitrogen is consumed it readily becomes nitrogen limited. TSI values indicate the reservoir is oligotrophic to low mesotrophic in a state of low productivity. The 1981 data suggested that the reservoir was eutrophic, but it appears from reviewing the data that index values were skewed toward the eutrophic range due to an abnormally low level of transparency. This could be due to turbid conditions or an erroneous data point.

The reservoir does not typically stratify due to its shallow nature as depicted in the August 8, 1991 profile.

According to DWR no fish kills have been reported in recent years, but the reservoir has been accidentally drained on occasion. The reservoir supports a population of brook

Limnological Data

Data sampled from STORET site: 591282

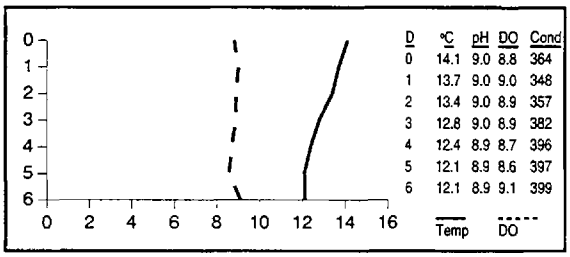
Surface Data	1981	1989	1991
Trophic Status	E	O	M
Chlorophyll TSI	-	31.97	41.86
Secchi Depth TSI	56.25	36.10	43.24
Phosphorous TSI	44.52	17.35	43.66
Average TSI	50.38	28.48	42.92
Chlorophyll a (ug/L)	-	1.2	2.1
Transparency (m)	1.3	5.3	3.2
Total Phosphorous (ug/L)	20	3	16
pH	8.1	8.3	8.6
Total Susp. Solids (mg/L)	<5	-	<3
Total Volatile Solids (mg/L)	-	-	7
Total Residual Solids (mg/L)	-	-	0
Temperature (°C / °f)	10/50	13/55	11/52
Conductivity (umhos.cm)	230	432	339
Water Column Data			
Ammonia (mg/L)	0.05	<.05	0.03
Nitrate/Nitrite (mg/L)	0.25	0.19	0.06
Hardness (mg/L)	128	-	201
Alkalinity (mg/L)	102	-	137
Silica (mg/L)	-	-	7.0
Total Phosphorous (ug/L)	20	3	17
Miscellaneous Data			
Limiting Nutrient	P	P	N
DO (Mg/l) at 75% depth	10.2	9.0	8.7
Stratification (m)	NO	NO	NO
Depth at Deepest Site (m)	7	8.4	6.0

trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*). The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake. Current stocking reports indicate that DWR stocks the lake with approximately 14,000 catchable rainbow trout annually. In 1991, it also stocked 300 albino rainbow trout.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Pennate diatoms	0.090	61.42
Euglena sp.	0.040	27.87
Centric diatoms	0.006	4.32
Unknown chrysophyte	0.005	3.41
Ankistrodesmus falcatus	0.004	2.98
Total	00.145	
Shannon-Weaver [H']	1.01	
Species Evenness	0.63	
Species Richness	0.21	

The phytoplankton community is dominated by the presence of diatoms, flagellates and green algae indicative of good water quality and low production.



D	°C	pH	DO	Cond
0	14.1	9.0	8.8	364
1	13.7	9.0	9.0	348
2	13.4	9.0	8.9	357
3	12.8	9.0	8.9	382
4	12.4	8.9	8.7	396
5	12.1	8.9	8.6	397
6	12.1	8.9	9.1	399

Pollution Assessment

Nonpoint pollution sources include the following: sedimentation and nutrient loading from grazing; litter and wastes wastes from recreation; sedimentation and increased runoff from logging; and potential contaminates and increased sedimentation from abandoned mines. Grazing takes place throughout the watershed and in the vicinity of the reservoir.

There are no point sources of pollution in the watershed.

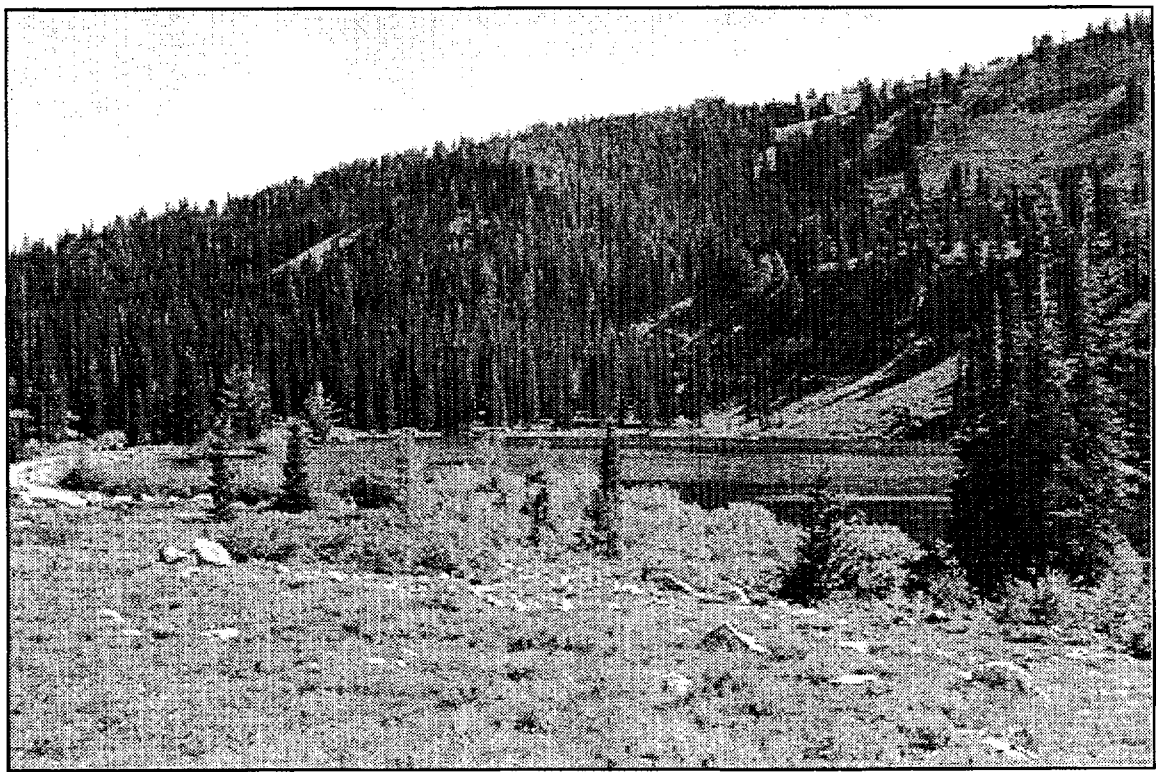
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Mountainlands Association of Governments	377-2262
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Uinta National Forest	789-1181
Pleasant Grove Ranger District	785-3563
Recreation	
Mountainlands Travel Region (Provo)	377-2262
Provo/Orem Chamber of Commerce	224-3636
American Fork Chamber of Commerce	756-5110
Reservoir Administrators	
North Utah County Water Conservation District	756-4268

TONY GROVE LAKE



Introduction

Tony Grove Lake is a small, glacial lake in the Bear River Range in extreme northern Utah. Although it has been enlarged by the construction of a dam, water storage rights are owned by the Forest Service, so there is no vertical fluctuation. The Forest Service maintains a campground, and the area is a trailhead for the Naomi Peak Wilderness Area. Utah State University Limnology Students have studied this lake for a number of years.

Tony Grove Lake is a natural lake that was enlarged in 1939 by the construction of an earth-fill dam. The reservoir shoreline is 100% publicly owned by the Wasatch-Cache National Forest. Public access is unrestricted. The lake is not used for water storage, and this is not expected to change in the foreseeable future.

Characteristics and Morphometry

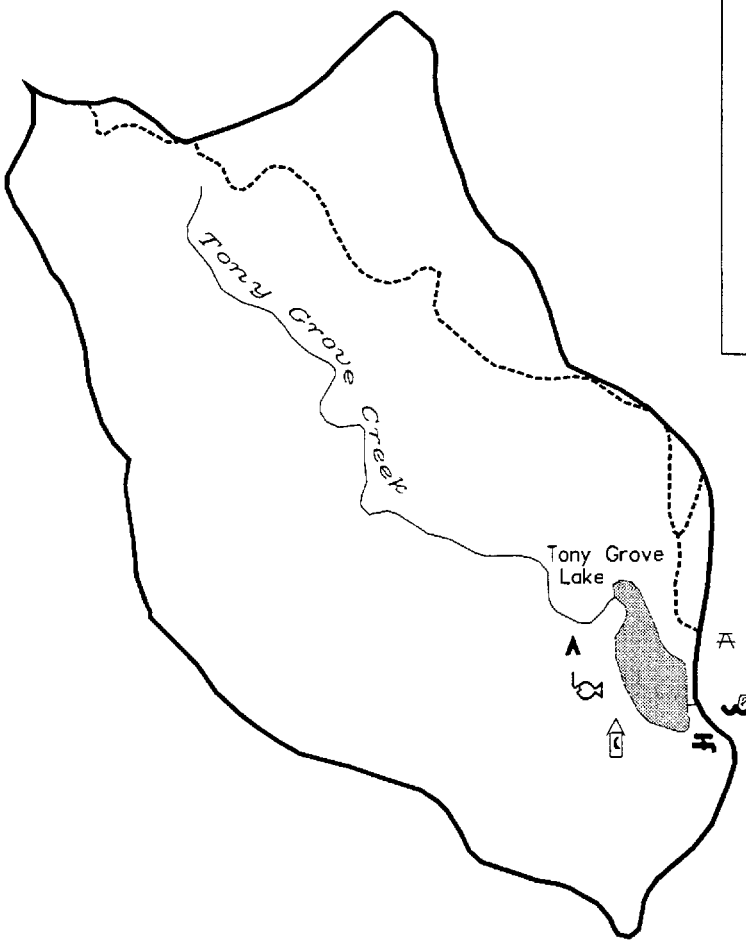
Lake elevation (meters / feet)	2,451 / 8,043
Surface area (hectares / acres)	10 / 25
Watershed area (hectares / acres)	538 / 1,330
Volume (m^3 / acre-feet)	
capacity	400,888 / 325
conservation pool	400,888 / 325
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (meters / feet)	0 / 0
Depth (meters / feet)	
maximum	11 / 36
mean	4 / 13
Length (meters / feet)	667 / 2,187
Width (meters / feet)	238 / 781
Shoreline (meters / feet)	1,633 / 5,360

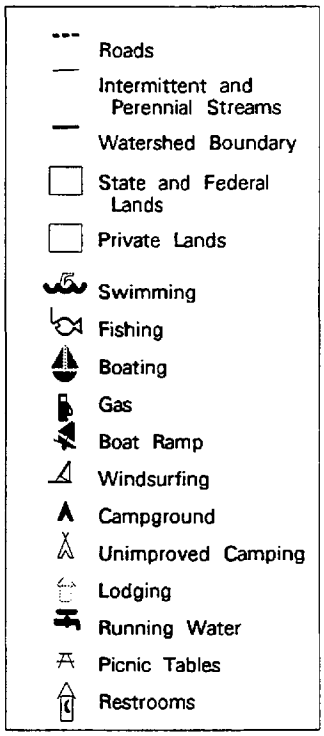
Location

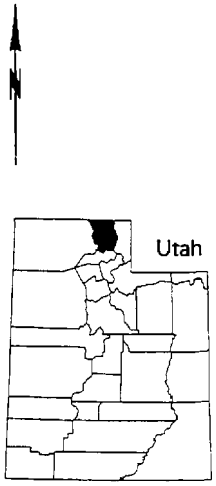
County	Cache
Longitude / Latitude	111 38 25 / 41 53 25
USGS Map	Naomi Peak 1969
DeLorme's Utah Atlas and Gazetteer™	Page 63, B-4
Cataloging Unit	Little Bear-Logan Rivers (16010203)

Recreation

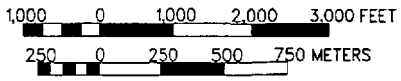
Tony Grove Lake is accessible from US-89 in Logan Canyon. The turnoff is at the Tony Grove Guard Station, 22 miles northeast of downtown Logan and 17 miles west of Garden City. Follow a gravel road (FS-003) for about eight







County in which watershed is located.

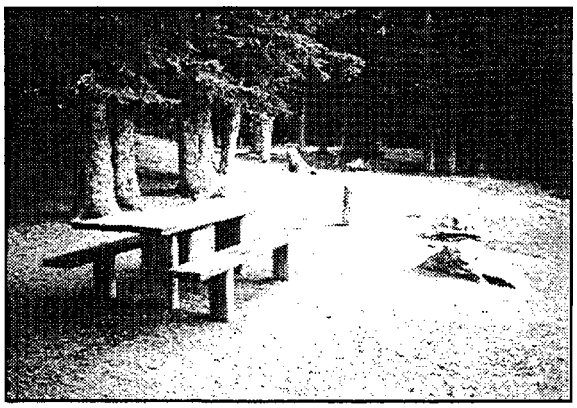


Tony Grove Watershed

<k3>

miles to the lake. The route is well marked, as it is also the primary trailhead to the Naomi Peak Wilderness.

The lake offers fishing, boating, hiking, swimming, and solitude. Fishing is not particularly good, as the lake has a winter fish kill problem. Tony Grove Campground, administered by the Forest Service, has 37 campsites, a swimming area, running water, and primitive latrines.



Watershed Description

Tony Grove Lake is a cirque lake, a water-filled depression created by a glacier pushing downward at its base in the middle of the cirque. The 300' vertical wall behind the lake is the edge of a small cirque.

The entire watershed has been glaciated, leaving rugged cliffs and chaotic mounds of moraine. Slopes of >100% are common. Much of the land is bare rock without vegetation. Forest growth is limited to the more sheltered areas. Boggy meadows occur in many areas which are not very steep.

The watershed high point is Naomi Peak, the highest peak in the Bear River Range, 3,042 m (9,979 ft) above sea level, thereby developing a complex slope of 20.0% to the reservoir. Inflow is from a ephemeral stream fed by snowmelt (stream gradient 10.1% (534 feet per mile), as well as many other flows during peak snowmelt. The outflow is Tony Grove Creek, a tributary of the Logan River.

The soil in the watershed is entirely glacial till and alluvium. A complete listing of the soil composition in contained in Appendix III.

The vegetation communities are comprised of spruce-fir, aspen, and alpine. The watershed receives 127 cm (50 inches) of precipitation annually with a frost-free season of 40 - 80 days.

Land use is 100% multiple use. The major use of the watershed is sheep grazing, resulting in devegetation and increased soil erosion.

Limnological Assessment

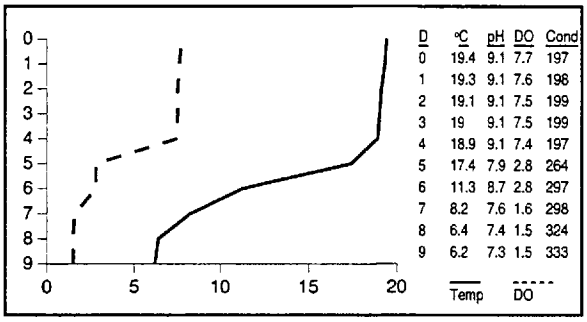
The water quality of Browne Reservoir is fairly good. It is considered to be moderately hard with a hardness concentration value of approximately 136 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are total phosphorus and dissolved oxygen. Although the average concentrations of total phosphorus in the water column for the last two study periods were only slightly over the recommended pollution indicator for phosphorus of 25 ug/L levels of 149 ug/L have been reported in the hypolimnion. These elevated concentrations of phosphorus occurred when the reservoir

Limnological Data

Data sampled from STORET site: 590275

Surface Data	1981	1989	1991
Trophic Status	O	M	O
Chlorophyll TSI	-	39.19	36.09
Secchi Depth TSI	31.90	36.66	37.10
Phosphorous TSI	43.20	46.42	27.36
Average TSI	37.60	40.76	33.52
Chlorophyll a (ug/L)	-	2.4	1.8
Transparency (m)	6.3	5.1	4.9
Total Phosphorous (ug/L)	5	19	5
pH	8.3	8.9	8.0
Total Susp. Solids (mg/L)	<5	-	<3
Total Volatile Solids (mg/L)	-	-	5
Total Residual Solids (mg/L)	-	-	13
Temperature (°C / °f)	20/68	16/61	16/61
Conductivity (umhos.cm)	242	213	188
Water Column Data			
Ammonia (mg/L)	0.13	0.15	0.26
Nitrate/Nitrite (mg/L)	0.32	0.02	0.01
Hardness (mg/L)	164	-	107
Alkalinity (mg/L)	157	-	106
Silica (mg/L)	-	-	1.15
Total Phosphorous (ug/L)	12.5	29	27
Miscellaneous Data			
Limiting Nutrient	P	N	N
DO (Mg/l) at 75% depth	0.1	0.7	1.9
Stratification (m)	5-8	7-9	4-8
Depth at Deepest Site (m)	11	11	9

was stratified and anoxic conditions were present near the bottom as indicated in the August 28, 1991 profile.. Dissolved oxygen concentrations in late summer substantiate the fact that water quality impairments do exist. Concentrations dropped dramatically below the thermocline to approximately 2.8 mg/L and continue to decline 10 1.5 mg/L. It is not uncommon to see concentrations near zero



D	°C	pH	DO	Cond
0	19.4	9.1	7.7	197
1	19.3	9.1	7.6	198
2	19.1	9.1	7.5	199
3	19	9.1	7.5	199
4	18.9	9.1	7.4	197
5	17.4	7.9	2.8	264
6	11.3	8.7	2.8	297
7	8.2	7.6	1.6	298
8	6.4	7.4	1.5	324
9	6.2	7.3	1.5	333

throughout the water column by the end of winter ice coverage. Profiles have been taken that document these conditions and as early as June, it is not uncommon to see near anoxic conditions (0.7 mg/L) at a depth beginning at 2 meters. These conditions are deleterious to the fishery rendered essentially the entire water column unsuitable for a fishery during late winter.

With the exception of 1981, data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is oligotrophic except in 1989 when it was slightly higher than the upper TSI limit of 40.00.

According to DWR there are annual partial or complete fish kills. The reservoir is stocked annually with 2,500 catchable albino rainbow trout and 5,000 catchable rainbow trout (*Oncorhynchus mykiss*). The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake.

The lake has not been chemically treated by the DWR to control rough fish competition, so it could contain original fish populations.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm³/liter)	% Density By Volume
Sphaerocystis schroeteri	10.564	70.05
Ceratium hirundinella	3.745	24.83
Fragilaria crotonensis	.458	3.04
Oocystis sp.	.142	0.94
Chlorococcum sp.	.111	0.74
Asterionella formosa	.019	0.13
Merismopedia glauca	.013	0.09
Pennate diatoms	.013	0.09
Ankistrodesmus falcatus	.013	0.09
Chlamydomonas globosa	.002	0.02
Total	0.728	
Shannon-Weaver Index[H']	0.81	
Species Evenness	0.35	
Species Richness [d]	0.40	

The phytoplankton commnunity is dominated by the presence of green algae, diatoms and flagellates.

Pollution Assessment

Nonpoint pollution sources are: sedimentation and nutrient loading from grazing, and wastes and litter from recreation. Sheep graze in the watershed and around the reservoir.

There are no point pollution sources in the watershed.

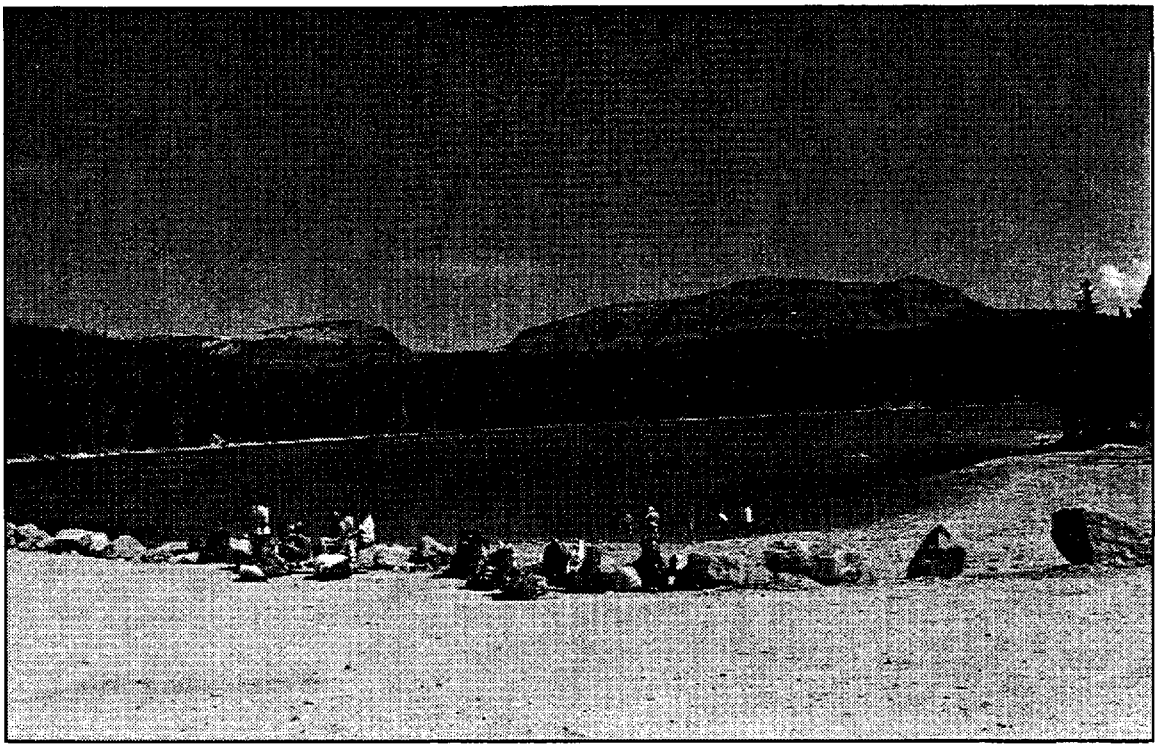
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Wasatch-Cache National Forest	524-5030
Logan Ranger District	753-2772
Bear River Association of Governments	752-7242
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Bridgerland Travel Region (Logan) / Logan Chamber of Commerce	752-2161

TRIAL LAKE



Introduction

Trial Lake was a small natural lake, but it was enlarged by construction of an earth-fill dam to create an intermediate-sized artificial impoundment. This has been a common practice in the Uintas. Many such lakes have been similarly augmented, including Wall and Washington Lakes, both near Trial Lake and both included in this inventory.

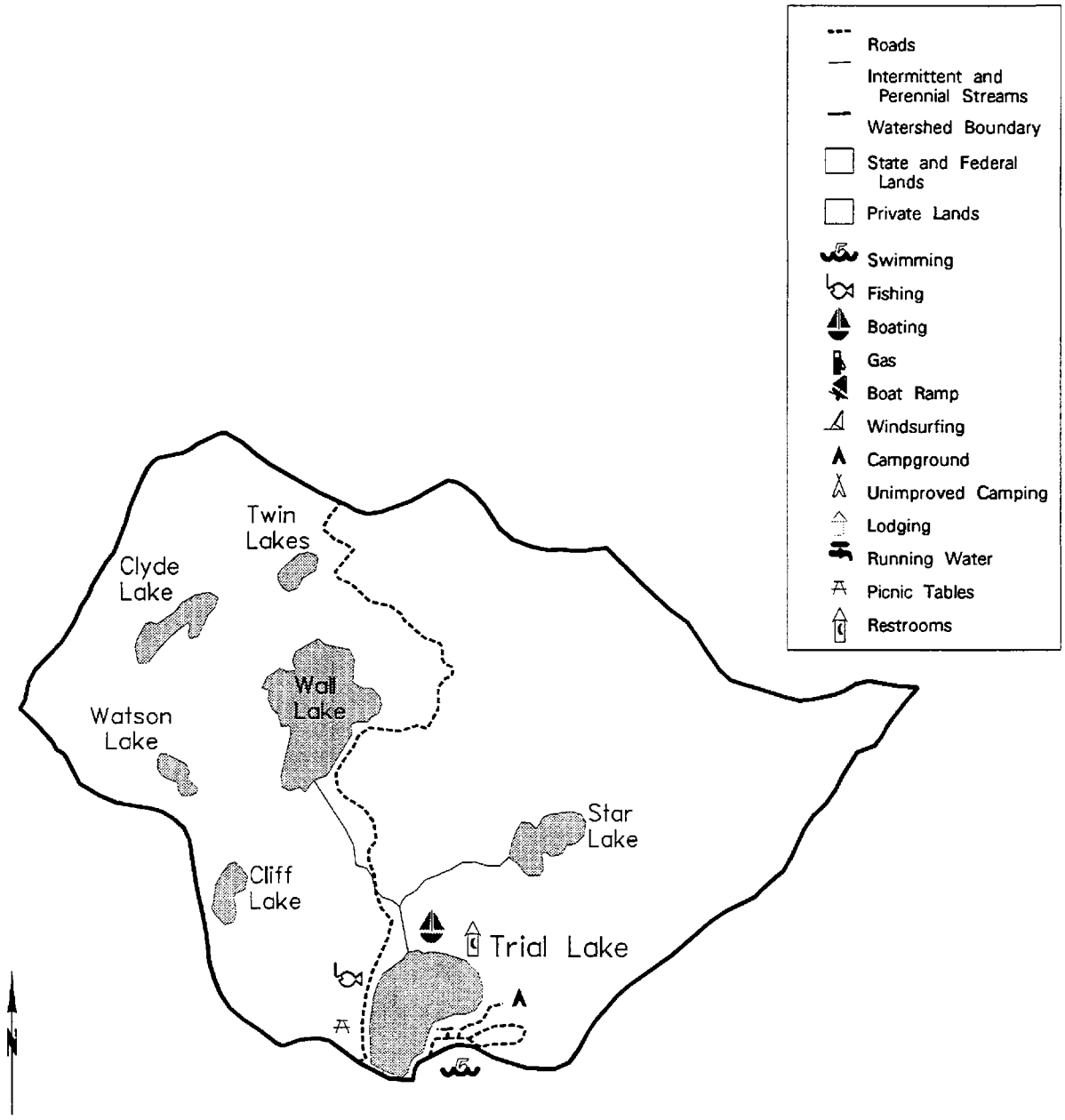
Characteristics and Morphometry

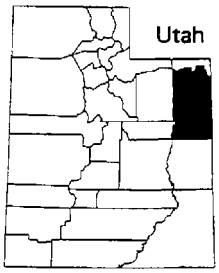
Lake elevation (meters / feet)	2,999 / 9,840
Surface area (hectares / acres)	39.7 / 98
Watershed area (hectares / acres)	891 / 2,202
Volume (m^3 / acre-feet)	
capacity	3,022,075 / 2,450
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	18.3 / 60
mean	8 / 26.5
Length (meters / feet)	731 / 2,378.45
Width (meters / feet)	366 / 1,201.22
Shoreline (meters / feet)	1.950 / 6,398

Trial Lake is at the headwaters of the Provo River, in the Mirror Lake area of the Uintas. The shoreline is owned by the Wasatch-Cache National Forest, and public access is unrestricted. The dam and dike were built in 1914, but the dike failed in the late 1980's, and both were rebuilt in 1990. Water use is primarily for irrigation, but can be used as supplementary culinary water. Completion of the CUP will probably include water level stabilization of several of the lakes in this area but Trial Lake will continue to be operated as an irrigation reservoir. This lake stabilization program should improving the scenic and recreational value, but

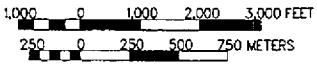
Location

County	Summit / Wasatch
Longitude / Latitude	110 57 15 / 40 41 00
USGS Map	Mirror Lake, UT 1967
DeLorme's Utah Atlas & Gazetteer™	Page 54, B-3
Cataloging Unit	Provo (16020203)





County in which watershed is located.



Trial Watershed

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eliminate some of the lakes' ability to function as a reservoirs.

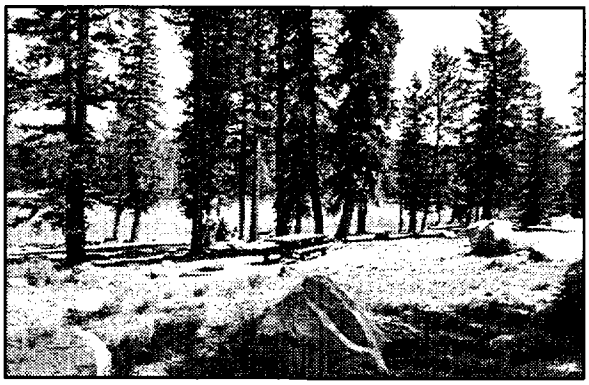
Recreation

Trial Lake is accessible from U-150 about four miles east of Mirror Lake and 32 miles west of Kamas. The lake is about 1/4 mile from the paved highway, and is marked.

Fishing, camping, picnicking, scenic beauty and hiking are all popular. This is one lake that has a perennial stream of significant size to support a fishery of natural reproducing brook trout (*Salvelinus fontinalis*). This stream leads to Wall Lake, which will be stabilized as a nonirrigation reservoir. Air and water temperatures are too cold for most swimmers. The backdrop of high, barren peaks are reflected in the still water of the lake.

The area receives heavy recreational use throughout the summer. Please tread lightly so that the area remains relatively pristine. U-150 is closed during the winter and much of the spring, but groomed for cross country skiers, snowmobilers and hikers. The low water level from late summer to the following spring leaves some areas of mud exposed. As with most mountains reservoirs, recreation is hindered not by water *quality* but by water *quantity*. Before the lake was enlarged, the surrounding area was forested. Now the forest extends down to the high water line.

Trial Lake Campground is on the east shore of the lake, with 60 campsites, picnic areas, and primitive toilets. There are several other USFS campgrounds along U-150 throughout the area.



Watershed Description

Trial Lake is in a large area of lakes and meadows interspersed with high, alpine peaks. In this area of the Uintas, most of the high peaks have been scoured away, leaving isolated peaks, rather than the ridgelines characteristic of the central part of the range. Defining the north and west edge of the watershed are Notch Mountain and Mount Watson, respectively. The remainder of the watershed area is difficult to determine, as the area is covered with uneven glacial moraine, leaving many lakes, most of which have no surface drainage. Wall Lake, another enlarged natural lake and numerous other unmodified lakes are in the watershed.

The watershed high point, Mount Watson, is 3,509 m (11,512 ft) above sea level, thereby developing a complex slope of 21.1% to the reservoir. There are several perennial streams flowing into the lake, the largest of which is from Wall Lake. The outflow is, in its infancy, the Provo River.

The watershed is made up of high mountains and rocky outcroppings. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of pine, oak, maple, spruce-fir, aspen, and alpine. The watershed receives 76 - 102 cm (30 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 0 - 20 days per year.

Use of watershed land is 100% recreation.

Limnological Assessment

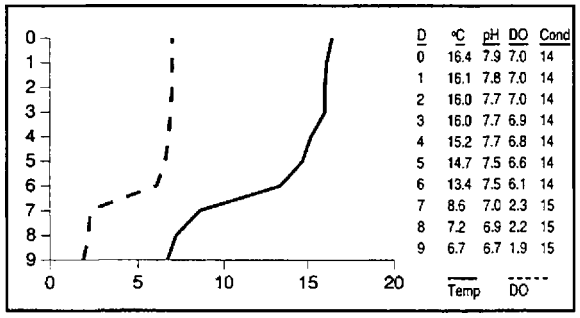
The water quality of Trial Lake is very good. It is

Limnological Data

Data sampled from STORET site: 591646

Surface Data	1981	1990	1992
Trophic Status	O	M	O
Chlorophyll TSI	-	32.39	37.64
Secchi Depth TSI	46.8	44.17	43.02
Phosphorous TSI	20.8	52.20	33.20
Average TSI	33.8	42.92	37.95
Chlorophyll a (ug/L)	-	1.2	2.1
Transparency (m)	2.5	3.0	3.3
Total Phosphorous (ug/L)	5	28	8
pH	8.2	6.5	7.0
Total Susp. Solids (mg/L)	5	<3	<3
Total Volatile Solids (mg/L)	-	-	0
Total Residual Solids (mg/L)	-	-	3
Temperature (°C / °f)	6/43	15/58	15/58
Conductivity (umhos.cm)	11	20	16
Water Column Data			
Ammonia (mg/L)	0.05	0.03	0.03
Nitrate/Nitrite (mg/L)	0.09	0.03	0.02
Hardness (mg/L)	10	8	8.5
Alkalinity (mg/L)	4	5	7
Silica (mg/L)	-	-	2.2
Total Phosphorous (ug/L)	5	28	10
Miscellaneous Data			
Limiting Nutrient	P	N	N
DO (Mg/l) at 75% depth	7.3	3.9	3.3
Stratification (m)	NO	5-6	5-8
Depth at Deepest Site (m)	10	9.0	9.0

considered to be very soft with a hardness concentration value of approximately 9 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are pH, total phosphorus and dissolved oxygen. Trial Lake has extremely soft water with very low alkalinities. As a result it is very sensitive to shifts in pH. On June 27, 1990 the profile taken showed pH values throughout the water column below 6, with a low value of 5.2 reported near the bottom of the lake. All of the other profiles that have been obtained during our surveys indicate that the pH values are normal. It should be emphasized that this is



one of those lakes in this area that is sensitive to acid deposition and should continue to be monitored to assess any affects related to this phenomenon. The average concentration of total phosphorus in the water column was only elevated for one period, 1990, above the recommended pollution indicator for phosphorus of 25 ug/L at 28 ug/L. Elevations of phosphorus concentration in the hypolimnion can occur, but it does not appear that nutrients are causing a problem in the lake at this time. Dissolved oxygen values decline in the water column but not to the point that a significant impairment is occurring. Additional winter monitoring needs to be done to determine dissolved oxygen impacts under ice coverage conditions.

Current data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is probably oligotrophic. The lake was mesotrophic in 1990 due in large part to the elevated phosphorus levels that year which appears to be atypical for the lake. The reservoir was stratified during on August 4, 1992 as the profile indicates. A thermocline developed at a depth of 5-7 meters.

According to DWR no fish kills have been reported in recent years. The reservoir supports populations of brook trout (*Salvelinus fontinalis*), albino rainbow and rainbow trout (*Oncorhynchus mykiss*). The Division of Wildlife Resources introduced grayling (*Thymallus arcticus*) into the reservoir some years ago. The grayling have established a stable population there, which is periodically stocked. Also present are mountain suckers (*Catostomus platyrhinchus*) which are indigenous to the lake. The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake.

The DWR stocks the lake annually with 6,500 catchable rainbow trout and 2,600 catchable albino rainbow trout. In 1992, 8,000 fingerling brook trout were also stocked.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Quadrigula lacustris	2.224	39.82
Gloeocystis sp.	1.168	20.90
Coelastrum sp.	1.112	19.91
Peridinium sp.	0.723	12.94
Merismopedia glauca	0.250	4.48
Dinobryon divergens	0.037	0.66
Ankistrodesmus falcatus	0.031	0.55
Pennate diatoms	0.027	0.48
Scenedesmus bijuga	0.011	0.20
Centric diatoms	0.004	0.07
Total	5.585	
Shannon-Weaver [H']	1.52	
Species Evenness	0.66	
Species Richness	0.40	

The phytoplankton commnunity is dominated by the presence of green algae indicative of lower productivity and good water quality.

Pollution Assessment

Nonpoint pollution sources include the following: sedimentation and nutrient loading from grazing, and litter and wastes from recreation.

Grazing takes place around the reservoir and

Information

Management Agencies	
Mountainland Association of Governments	377-2262
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Wasatch-Cache National Forest	524-5030
Kamas Ranger District	783-4338
Recreation	
Mountainland Travel Region (Provo)	377-2262
Reservoir Administrator	
Timpanogas Canal Company	654-1346

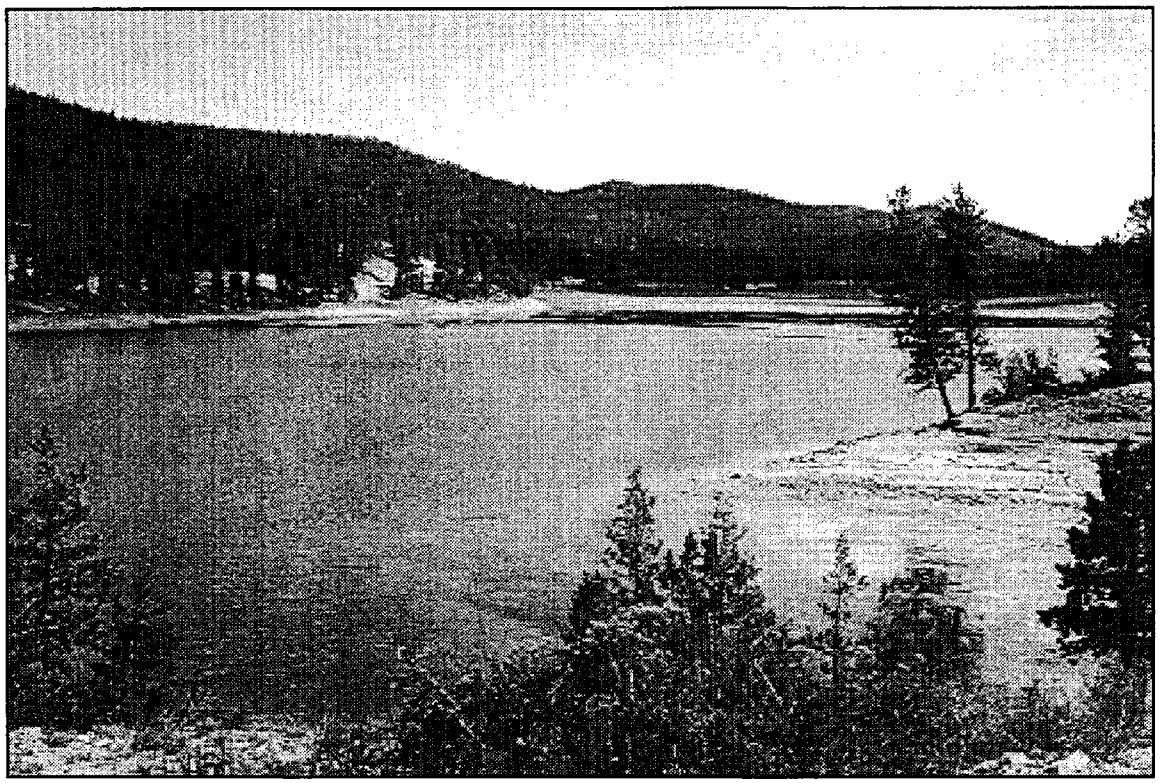
throughout the watershed.

There are no point sources of pollution in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

TROPIC RESERVOIR



Introduction

The origins of Tropic Reservoir began ten million years ago as the entire area now known as the Colorado Plateau (an area roughly centered at the Four Corners area) began to uplift. The flow of streams in central Utah was generally south to north, as exhibited by the Sevier River. As uplift took place, large rivers, such as the Colorado and the Green, were able to maintain their elevation by cutting into the land as fast as it uplifted. Smaller rivers, such as the Sevier, were not able to maintain their elevation.

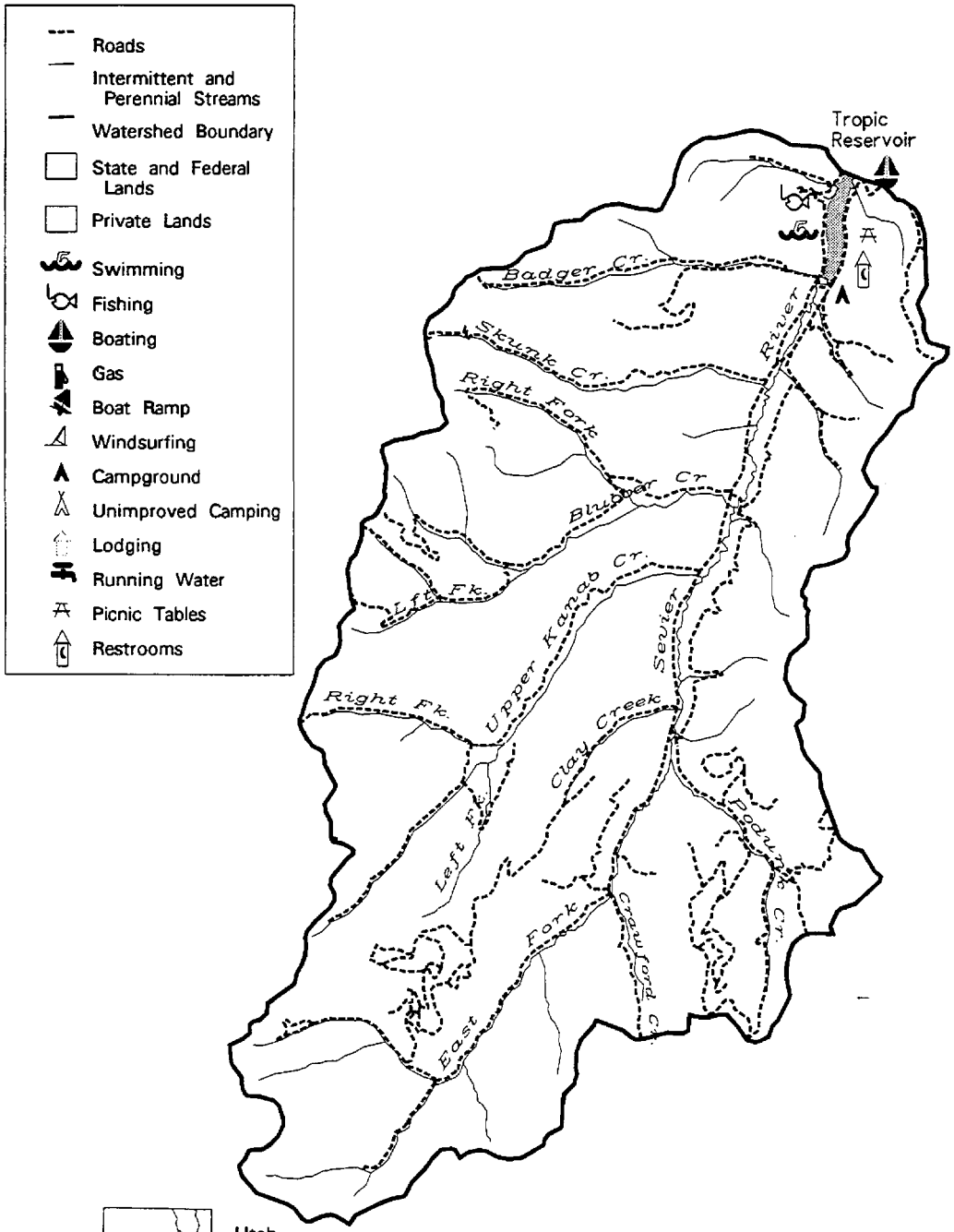
Characteristics and Morphometry

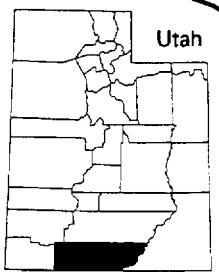
Lake elevation (meters / feet)	2,388 / 7,835
Surface area (hectares / acres)	73 / 180
Watershed area (hectares / acres)	22,300 / 54,104
Volume (m^3 / acre-feet)	
capacity	4,440,607 / 3,600
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	9 / 29.9
mean	3 / 9.9
Length (meters / feet)	2,380 / 7,809
Width (meters / feet)	366 / 1,201
Shoreline (km / miles)	4.8 / 3

Location

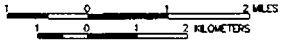
County	Garfield
Longitude / Latitude	112 15 23 / 37 36 10
USGS Map	Tropic Reservoir, Utah 1966
DeLorme's Utah Atlas & Gazetteer™	Page 18, B-3
Cataloging Unit	Otter Creek?? (16030002)

Tributaries of deep canyons began to extend themselves at their headwaters, pirating drainage area once held by the Sevier. Headward extension eventually created what is now known as the Grand Staircase, as layers of rock were stripped away, leaving a series of step-like cliffs. The Paunsaugunt Plateau is a remnant of the Sevier drainage with nearly all of its tributaries captured by surrounding watersheds. The headwaters of the East Fork Sevier River are now a shallow elevated basin dropping off at cliffs on three sides, but still draining placidly to the north,





County in which watershed is located.



Tropic Watershed

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meandering for hundreds of miles before coming to rest in Sevier Lake.

Settlers in Tropic realized that the much precipitation fell on the high Paunsaugunt Plateau, and given the very gentle gradient from the river to the edge of the plateau, were able to neatly divert water from its meandering course over to the edge of the plateau, where it cascaded down Water Canyon (now in Bryce Canyon National Park) to their settlement in Tropic. Tropic Reservoir, an intermediate-sized impoundment of the gentle river valley, retains the winter snowmelt for use throughout the summer.

The reservoir shoreline is owned and administered by the Dixie National Forest with unrestricted public access. Defined beneficial uses include: water recreation excluding swimming, propagation of cold water species of game fish and aquatic life, and agricultural needs.

Recreation

Tropic Reservoir is accessible on FS-087, which intersects U-12 11 miles east of US-89 and 3 miles wast of the Bryce Canyon entrance. Tropic Reservoir is 8 miles south of U-12 on FS-087.

Fishing, boating, picnicking, cross country skiing and snowmobiling are popular around the lake. The reservoir has a concrete boat ramp. Recreation use is fairly heavy.

King Creek, a Forest Service campground at the reservoir, has 34 campsites and picnic areas. Facilities include tables, fire pits, toilets, water and a sanitary dump station for recreational vehicles. Fees are charged for use. The reservoir and campground are nestled in groves of tall pines and unsurpassed scenic beauty.

Watershed Description

Tropic Reservoir is on the extreme headwaters of the East Fork Sevier River, on the Paunsaugunt Plateau, perched as if on a platform between the Pink Cliffs to the east and south, and the Sunset Cliffs to the west. The area surrounding the reservoir is gently rolling hills covered with Ponderosa Pine.

The watershed high point, Black Butte, is 2,914 m (9,560 ft) above sea level, thereby developing a complex slope of 6.0% to the lake. The inflows Badger Creek and the East Fork Sevier River. The average stream gradient above the reservoir is 1.8% (97 feet per mile). The sole outflow is the East Fork Sevier River, part of which is diverted into the Tropic Canal some distance downstream.

The soil is of limestone origin with rapid permeability and erosion is fairly rapid. A complete listing of soil compositions that compose the watershed are listed in Appendix III.

The vegetation communities are comprised of bitterbrush-mountain mahogany, mahonia, grass-forbes, pinion-juniper, pine, aspen, spruce-fir, oak, and maple. The watershed receives 30 - 40 cm (12 - 16 inches) of precipitation annually with a frost-free season of 80 - 100 days at the reservoir.

Land use is multiple use and recreation. Much of the watershed is in Bryce Canyon National Park, where lands are protected from the problems associated with grazing, but suffer from recreational development and human use.

Limnological Assessment

The water quality of Tropic Reservoir is good. It is considered to be hard with a hardness concentration value of approximately 196 mg/L ($CaCO_3$). Although there are no overall water column concentrations that exceed State water quality standards there are reported violations of parameters at various depths in the lake. These parameters include pH and dissolved oxygen. At various times of the year the hypolimnion of the lake the oxygen deficiencies develop. These anoxic conditions develop primarily during the winter due to the decomposition of large amounts of organic material from macrophytes and algae that are deposited in the bottom of the reservoir. As these material decompose they require large amounts of oxygen which is removed from the water column. Due to the extensive winter period in this area, it is not uncommon to see extensive anoxic conditions develop in the reservoir. On February 14, 1989 the reservoir was surveyed and the dissolved oxygen concentration was 7.3 mg/L at 1.0 meter which dropped dramatically to 0.3 mg/L at 4 meters and 0.0 mg/L at the bottom(6.5 meters). Surveys have not been conducted in recent years during the winter, but conditions are expected to remain the same.

Current data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is oligotrophic in a state of low productivity. The reservoir typically does not stratify due to its shallow nature and early withdrawal of water for irrigation needs downstream. Extensive growth of macrophytes occurs in the reservoir. It is not uncommon for them to reach the surface later in the

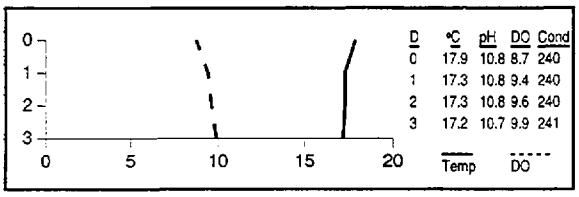
Limnological Data

Data averaged from STORET sites: 494934, 494935

Surface Data	1979	1990	1991
Trophic Status	M	O	O
Chlorophyll TSI	50.97	-	36.37
Secchi Depth TSI	43.85	52.38	46.51
Phosphorous TSI	47.35	43.04	27.35
Average TSI	47.39	31.80	36.75
Chlorophyll a (ug/L)	-	0	1.8
Transparency (m)	1.9	2.0	2.6
Total Phosphorous (ug/L)	15	20	5
pH	8.6	9.2	9.6
Total Susp. Solids (mg/L)	-	<3	<3
Total Volatile Solids (mg/L)	-	-	2
Total Residual Solids (mg/L)	-	-	<3
Temperature (°C / °f)	15/59	16/61	15/59
Conductivity (umhos.cm)	408	270	325
Water Column Data			
Ammonia (mg/L)	0.05	0.03	0.03
Nitrate/Nitrite (mg/L)	0.07	-	0.02
Hardness (mg/L)	226	168	195
Alkalinity (mg/L)	226	163	188
Silica (mg/L)	-	-	3.6
Total Phosphorous (ug/L)	16	20	5
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	7.5	8.3	9.7
Stratification (m)	6	NO	NO
Depth at Deepest Site (m)	8	1.8	3

year as the water level is drawn down and they do inhibit travel on the reservoir.

According to DWR no fish kills have been reported in recent years, but they recognize the potential for fish leaving the reservoir during the winter due to anoxic conditions. The reservoir supports a population of rainbow trout (*Oncorhynchus mykiss*) and cutthroat trout (*Oncorhynchus clarki*). The lake has been treated for rough fish competition in 1955, 1959., 1966, 1971 and 1979 so populations of native fishes may not be present in the lake. Brook trout (*Salvelinus fontinalis*) have been stocked in the upper tributaries and could appear in the reservoir. Current stocking reports indicate that DWR stocks the lake annually with approximately 6,000 catchable rainbow trout.



D	°C	pH	DO	Cond
0	17.9	10.8	8.7	240
1	17.3	10.8	9.4	240
2	17.3	10.8	9.6	240
3	17.2	10.7	9.9	241

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm³/liter)	% Density By Volume
Fragilaria crotonensis	0.229	45.75
Pennate diatoms	0.223	44.64
Scenedesmus bijuga	0.031	6.22
Oocystis sp.	0.008	1.67
Centric diatoms	0.006	1.27
Chlamydomonas globosa	0.002	0.45
Total	0.499	
Shannon-Weaver [H']	1.04	
Species Evenness	0.58	
Species Richness	0.25	

The flora of Tropic Reservoir is quite healthy, as indicated by the almost complete dominance of diatoms.

Pollution Assessment

Nonpoint pollution sources include: sedimentation and nutrient loading from grazing, and waste material and litter from recreation. Cattle graze in the watershed and around the reservoir.

There are no point pollution sources in the watershed.

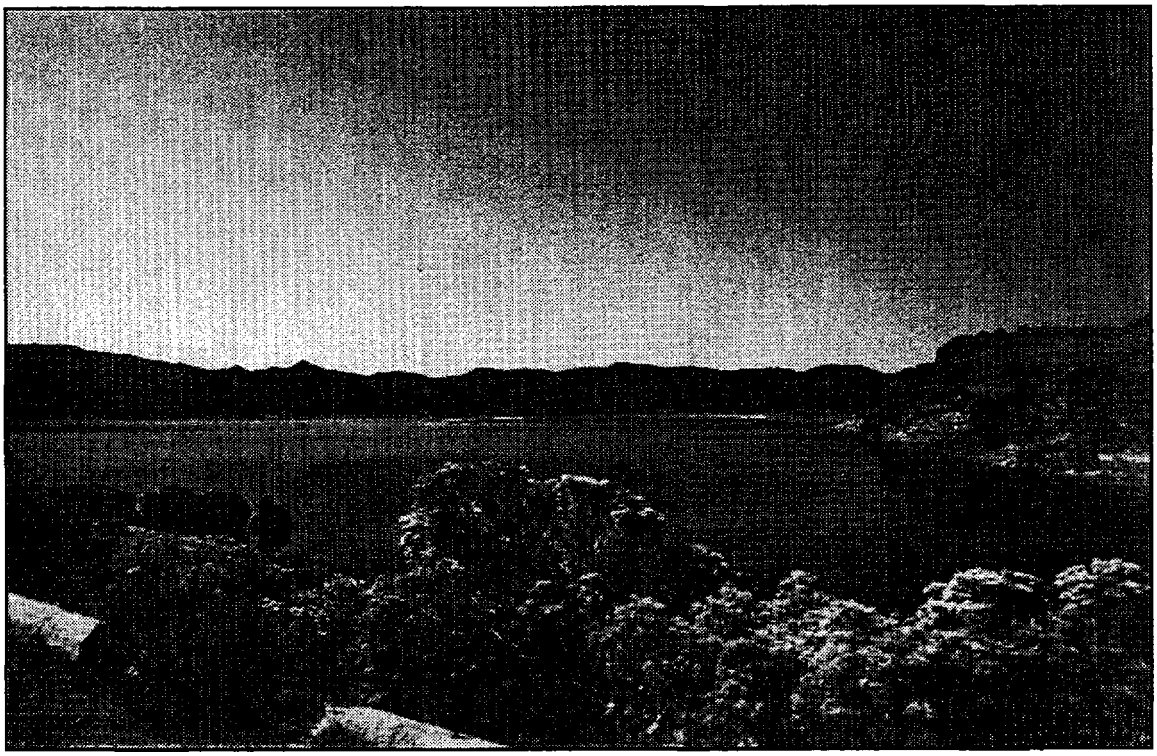
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Dixie National Forest	586-2421
Powell Ranger District	676-8815
Tropic and East Fork Irrigation Company	679-8746
Ruby's Inn	
Five County Association of Governments	
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146

UPPER ENTERPRISE RESERVOIR



Introduction

Upper Enterprise Reservoir is in the Bull Valley Mountains in extreme southwestern Utah. It is a large impoundment of a stream valley. Lower Enterprise Reservoir is immediately downstream and is a moderate-sized body of water (79 acres) in its own right. Some maps and agencies refer to the larger reservoir as only Enterprise Reservoir.

The reservoir shoreline is owned by the Dixie National Forest with unrestricted public access. The dam, an earth-fill, was built in 1912. Water is used primarily for irrigation, however, DWR does own a conservation pool of 200 acre-feet for maintenance of a fishery. Defined beneficial uses include: water recreation excluding swimming, propagation of cold water species of game fish and aquatic life, and agricultural needs.

Characteristics and Morphometry

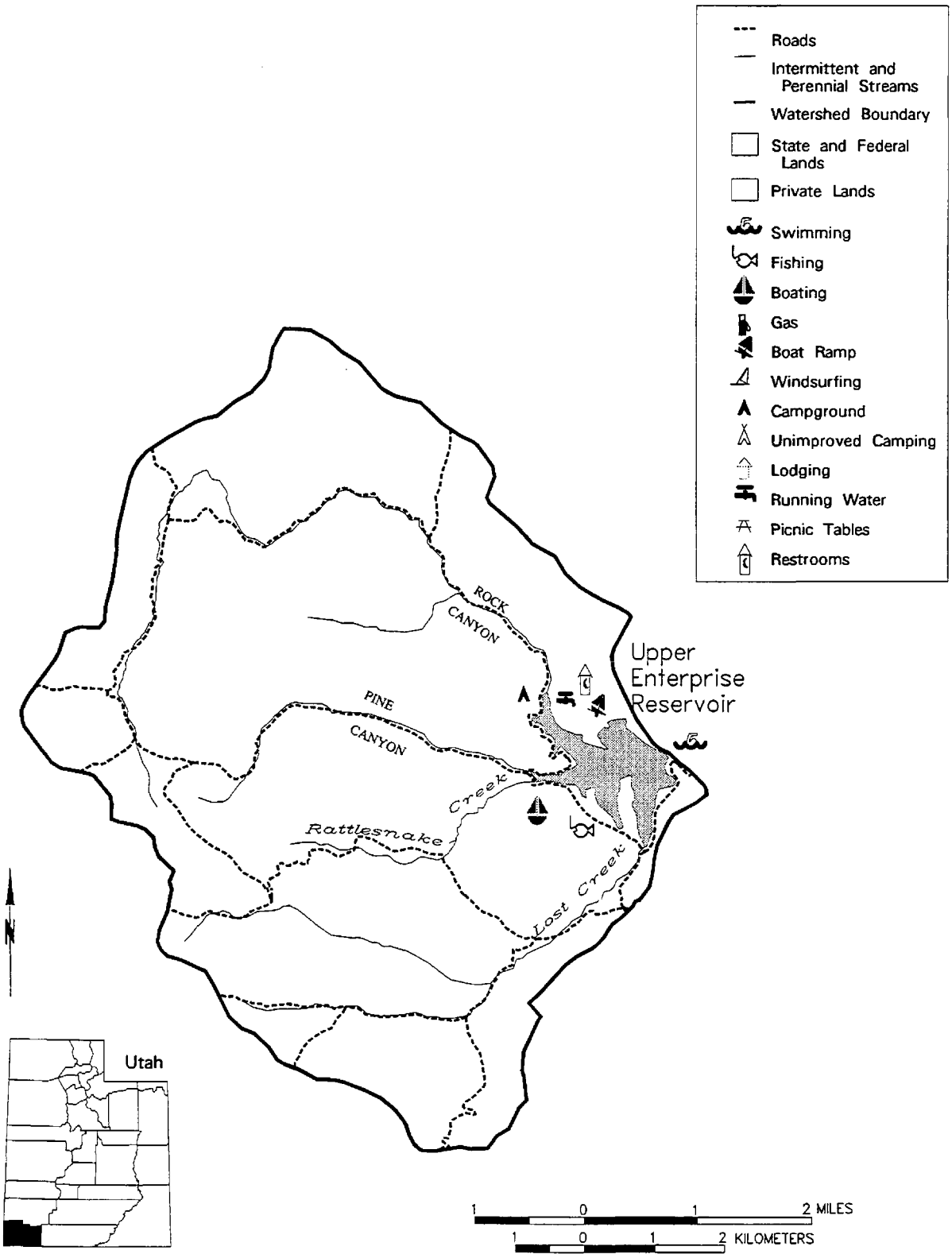
Lake elevation (meters / feet)	1,755 / 5,761
Surface area (hectares / acres)	107 / 265
Watershed area (hectares / acres)	7,537 / 18,700
Volume (m^3 / acre-feet)	
capacity	12,088,318 / 9,800
conservation pool	246,700 / 200
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	18.2 / 60
mean	14.0 / 49
Length (km / miles)	1.92 / 1.18
Width (km / miles)	1.68 / 1.03
Shoreline (km / miles)	11.27 / 7

Location

County	Washington
Longitude / Latitude	113 52 20 / 37 31 05
USGS Map	Hebron, UT 1972, Water Canyon Peak, UT, 1972
Cataloging Unit	Southern Escalante Desert (16030006)

Recreation

Upper Enterprise Reservoir is on a paved secondary road west of the town of Enterprise. Travel west out of town for six miles to a place called Hebron. At Hebron, turn south



County in which watershed is located.

Upper Enterprise Watershed

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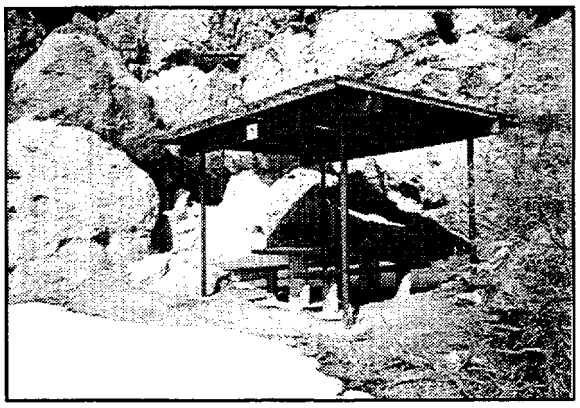
(left) on another paved road and continue for five miles to the Honeycomb Rocks Campground, from which both reservoirs are accessible.

Fishing, boating, picnicking, camping, and hiking are popular around the lake. The road is well maintained year round. Usage is heavy.

Honeycomb Rocks Campground is on a peninsula bordered by the lower reservoir to the east and the upper reservoir to the west. It has flush toilets, 21 campsites, drinking water, a boat ramp, and fishing areas. Usage fees are charged. This is one of the most distinctive campgrounds in the State. It is nestled in an area of unique rock formations that provide a nonstop recreational resource for children. There are no private campgrounds in the area.



Watershed Description

Upper Enterprise Reservoir is located in the lower slopes of the Bull Valley Mountains. Rock Creek, a tributary, has recently pirated drainage in the Water Hole Peak area, indicating that the drainage basin is adapting to recurring tectonic activity.

The watershed high point, Lost Peak, is 2,291 m (7,516 ft) above sea level, thereby developing a complex slope of 10.3% to the reservoir. The inflows are Rock Creek, Pine Creek, Rattlesnake Creek, and Lost Creek. The outflow is Little Pine Creek.

The soil is of limestone origin with rapid permeability and erosion. A complete listing of the soil compositions in the watershed are listed in Appendix III.

The vegetation communities are comprised of pinyon-juniper, sage-grass, and bitterroot-mahogany. The watershed receives 30 - 41 cm (12 - 16 inches) of precipitation annually with a frost-free season of 120 - 140 days at the reservoir.

Land use is multiple use and recreation, the major use being livestock grazing. Much of the watershed is overgrazed, resulting in heavy runoff and substantial soil erosion.

Limnological Assessment

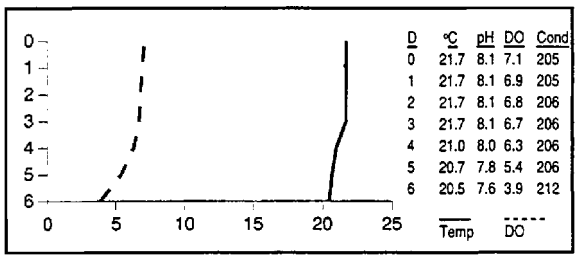
The water quality of Upper Enterprise Reservoir is fairly good. It is considered to be soft with a hardness concentration value of approximately 74 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are total phosphorus, dissolved oxygen, temperature and pH. The average concentration of total phosphorus in the water column for the three study periods was 36, 221 and 37 ug/L which all exceed the recommended pollution indicator for phosphorus of 25 ug/L. The phosphorus concentration in the hypolimnion in August, 1989 average 336 ug/L. This increased concentration occurred when the reservoir was shallow and it appears that resuspension of bottom sediments rich in nutrients were resuspended in the water column. This was also the period when biological productivity was very high which resulted in elevated pH values in excess of 9.0 and water temperatures higher than the recommended level of 20°C. The reservoir was

Limnological Data

Data averaged from STORET sites: 494072, 494073

Surface Data	1979	1989	1991
Trophic Status	E	H	E
Chlorophyll TSI	-	76.60	58.51
Secchi Depth TSI	48.64	60.00	58.97
Phosphorous TSI	51.51	84.33	57.61
Average TSI	50.6	73.64	58.36
Chlorophyll a (ug/L)	-	96.75	17.25
Transparency (m)	2.2	0.9	1.1
Total Phosphorous (ug/L)	20	214	41
pH	8.4	9.4	8.6
Total Susp. Solids (mg/L)	<5	-	10
Total Volatile Solids (mg/L)	-	-	9
Total Residual Solids (mg/L)	-	-	16
Temperature (°C / °f)	19/66	18/65	17/63
Conductivity (umhos.cm)	145	225	188
Water Column Data			
Ammonia (mg/L)	0.05	0.08	0.05
Nitrate/Nitrite (mg/L)	0.14	-	0.02
Hardness (mg/L)	62	-	85
Alkalinity (mg/L)	68	-	88
Silica (mg/L)	20	-	3.7
Total Phosphorous	36	221	37
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	0.5	7.9	5.9
Stratification (m)	10-13	NO	N
Depth at Deepest Site (m)	17	4.0	6.0

*Spring data limited to surface readings



D	°C	pH	DO	Cond
0	21.7	8.1	7.1	205
1	21.7	8.1	6.9	205
2	21.7	8.1	6.8	206
3	21.7	8.1	6.7	206
4	21.0	8.0	6.3	206
5	20.7	7.8	5.4	206
6	20.5	7.6	3.9	212

characterized as a hypereutropic system with an average chlorophyll-a concentration of 96.75 ug/L. It is apparent that the during low water conditions, the reservoir is impacted as algal production reaches extreme conditions. Although dissolved oxygen concentrations are not consistently low throughout the water column, investigations should be conducted during winter to observe conditions at that time.

Data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is typically eutrophic, but can become hypereutrophic as conditions permit. These types of conditions are probably more frequent due to the high demand for irrigation water downstream and the potential for low precipitation in the area on an annual basis. The reservoir has not stratified during recent summers due to low volumes, but when sufficient depths are present the reservoir does stratify as observed during the initial study period (1979).

According to DWR no fish kills have been reported in recent years, but the recognize the problems associated with high pH and low water levels during the summer. Elevated water temperatures and high algal blooms which deplete dissolved oxygen concentrations during night time hours can result in fish mortalities. The reservoir is managed primarily as a rainbow trout (*Oncorhynchus mykiss*) fishery. The lake has been treated for rough fish competition in 1956, 1976 and 1987, so populations of native fishes may not be present in the lake, but the presence of non-game species appears to be a continual problem. Current stocking reports indicate that DWR stocks the reservoir with approximately 30,000 fingerling rainbow trout annually.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Gloeotrichia echinulata	55.600	74.52
Aphanizomenon flos-aquae	13.839	18.55
Sphaerocystis schroeteri	2.641	3.54
Stephanodiscus niagarae	1.232	1.65
Ceratium hirundinella	0.936	1.25
Oocystis sp.	0.209	0.28
Cosmarium sp.	0.079	0.11
Pennate diatoms	0.040	0.05
Oocystis borgei	0.022	0.03
Ankistrodesmus falcatus	0.009	0.01
Total	74.602	
Shannon-Weaver [H']	0.80	
Species Evenness	0.35	
Species Richness	0.36	

The phytoplankton community is dominated by the presence of blue-green algal species which is indicative of poorer water quality and eutrophic conditions

Pollution Assessment

Nonpoint pollution sources are: sedimentation and nutrient loading from grazing and waste materials and litter from recreation. Cattle graze in the watershed and in direct proximity to the reservoir.

There are no point pollution sources in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Merrill Staley	878-2472
Enterprise Reservoir and Canal Company	878-2331
Five County Association of Governments	
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Sherwood Braken	878-2331

UPPER STILLWATER RESERVOIR

Introduction

Upper Stillwater Reservoir is a large reservoir on the south slope of the High Uintas. It is the uppermost reservoir in a chain of impoundments, diversions and tunnels that stores and divert Uinta water to Wasatch Front irrigational interests. Currant Creek and Strawberry Reservoirs are also facilities that are involved in this process that are linked together via diversion structures. The system was built by the Bureau of Reclamation as part of the Central Utah Project (CUP). Access is fairly easy, and the rolled concrete dam is an attraction for engineers. Rock Creek Campground at the reservoir is a popular trailhead into the High Uintas Wilderness, with the boundary only a mile north of the dam near the high water line for the reservoir.

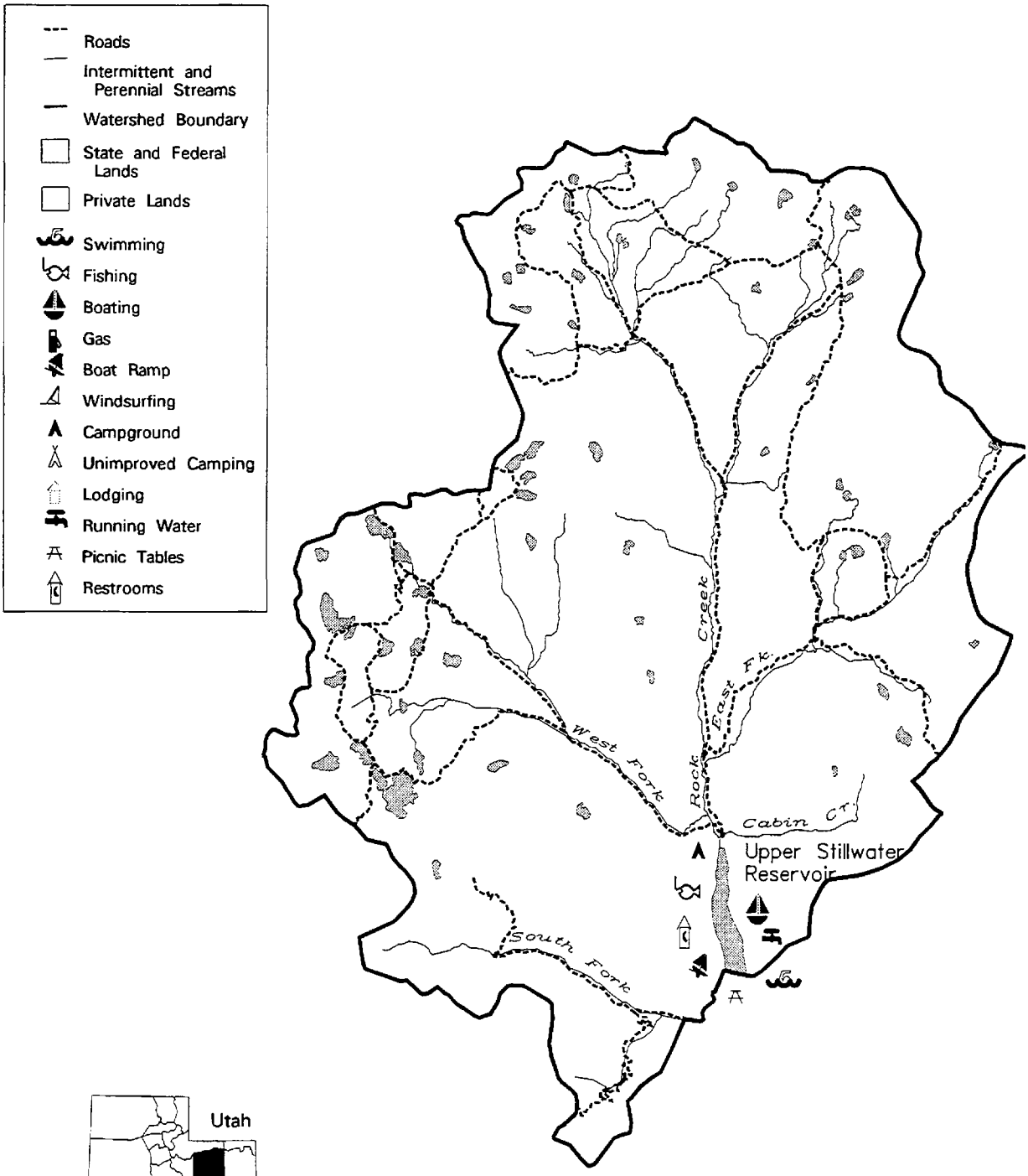
Upper Stillwater Reservoir was created in 1987 by the construction of a concrete gravity dam. The reservoir shoreline is owned by the Bureau of Reclamation and the Ashley National Forest. Public access is unrestricted. Reservoir water is used primarily for recreation during the summer but it is diverted into the collection system for use

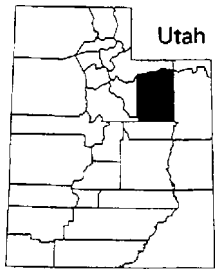
Characteristics and Morphometry

Lake elevation (meters / feet)	2,492 / 8,176
Surface area (hectares / acres)	130 / 320
Watershed area (hectares / acres)	29,012 / 71,688
Volume (m^3 / acre-feet)	
capacity	40,857,000 / 33,123
conservation pool	
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	51 / 167
mean	31.6 / 103.5
Length (m / feet)	2,134 / 7,000
Width (m / feet)	610 / 2,000
Shoreline (m / feet)	5,486 / 18,000

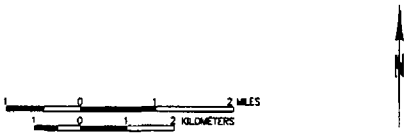
Location

County	*Duchesne*
Longitude / Latitude	110 41 57 / 40 33 43
USGS Map	Tworoose Pass, Ut 1967
DeLorme's Utah Atlas & Gazetteer™	Page 55, C-4
Cataloging Unit	Duchesne 14060003





County in which watershed is located.



Upper Stillwater Watershed

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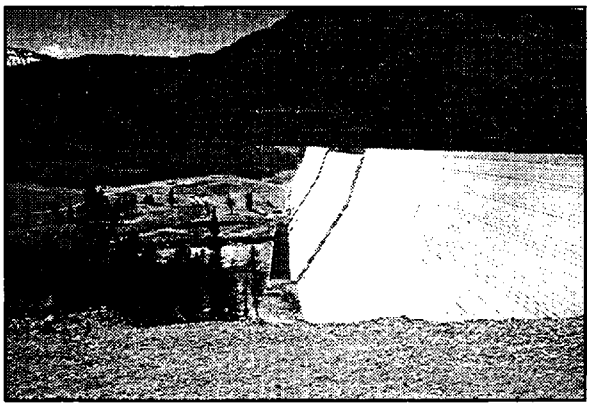
downstream later in the year. It is estimated that at least twice the storage capacity of the reservoir will be diverted towards the Wasatch Front annually.



Although the primary use on the wasatch front is for irrigation, water will be used for power production and consumption as facilities are constructed and the demand for culinary water increases.

Recreation

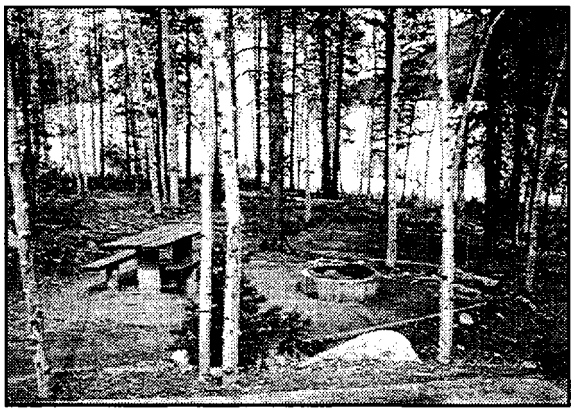
Upper Stillwater Reservoir is easily accessible from U-87 near Mountain Home. From Mountain Home take FR-134, an asphalt surface road, proceeds west from the city. Travel for approximately 22 miles in a northwest direction to reach the reservoir. FR-134 continues past the reservoir to U-35 just north of Hanna, a distance of approximately 12 miles on a gravel road. At the reservoir an access road leads across Rock Creek below the dam and up the east slope to the boat launching area at the reservoir. A trailhead into the wilderness area north of the reservoir is on the western side of the reservoir.

Fishing, boating, swimming, camping, picnicking, and hiking are all popular activities. The area is directly adjacent to the wilderness area and offers a unique experience for those recreating in the area.

Recreational facilities near the reservoir include public campgrounds and some private recreational opportunities. There are numerous USFS campgrounds in route to the reservoir in addition to the one located adjacent to the reservoir.

Watershed Description

Upper Stillwater Reservoir is located at the edge of the Uinta Mountains on the edge of the wilderness area. It is an impoundment of Rock Creek which originates near the summit to the Uinta Mountains. It is an impoundment of a deep glacial valley on the south slope of the High Uintas.



The valley is about 0.5 miles wide and up to 2,300 feet deep, with slopes of 50 - 100%. It is narrow and deep, the result of tens of square miles of glaciers all flowing out the Rock Creek. This valley is morphologically similar to many others along the south slope, including the Duchesne River, Lake Fork, Yellowstone River and Uinta River. The valley walls are thickly forested, and beyond the reservoir are permanently protected as part of the High Uintas Wilderness.

The watershed high point, Ostler Peak , is 3,876 m (12,717 feet) above mean sea level, creating a complex slope of 7.2% to the reservoir. The principle inflow and outflow is Rock Creek, however, water from the south fork of Rock Creek can be diverted into the reservoir. The average stream gradient above the lake is 4.4% (232 feet per mile).

The watershed is primarily the Uinta Mountains, stretching from the reservoir to the ridgeline. Much of the area is made up of relatively flat, forested areas interspersed with lakes and meadows. These areas are where glaciers left uneven terrain as they flowed, and deposited piles of moraine when they melted. The glaciated area is interdigitated with the barren ridges that were not scoured by glaciers. The Rock Creek valley is near 8,600 feet elevation at the base of the reservoir, while the forests are at 9,000 to 11,000 feet in elevation, and the mountains are up to 13,000 feet elevation.

The watershed is made up of high mountains with abundant rock outcroppings. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of pine, aspen, spruce-fir, and alpine tundra. The watershed receives 52 - 102 cm (20 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 40 - 60 days per year.

Land use is approximately 90% wilderness, which includes recreational use by humans, grazing by animals used by recreational users, and allotment grazing by sheep

and cattle. That portion of the watershed that is not wilderness is in direct proximity to the reservoir and the tributaries of the south fork of Rock Creek which can be diverted into the reservoir.

Limnological Assessment

The water quality of Upper Stillwater Reservoir is considered excellent. It is considered to be very soft with a hardness concentration value of approximately 9.3 mg/L ($CaCO_3$). There are no overall water column concentrations that exceed State water quality standards for those parameters analyzed.

Current data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is oligotrophic in a state of low productivity. The reservoir does stratify at a depth of 8-10 meters as summer progresses as is indicated in the August 21, 1991 profile.

According to DWR no fish kills have been reported in recent years. The reservoir is stocked with 10,000 catchable rainbow trout (*Oncorhynchus mykiss*) but because it has not been chemically treated for rough fish competition, populations of native fishes may still be present in the lake. These could be populations of brook trout (*Salvelinus fontinalis*) and cutthroat trout (*Oncorhynchus clarki*).

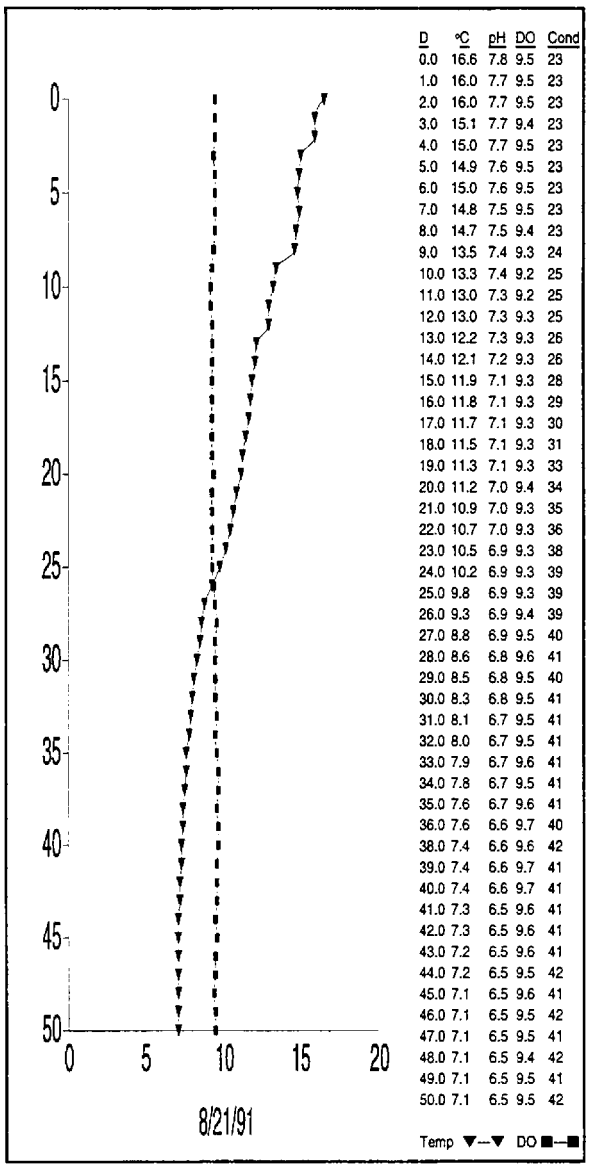
Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm³/liter)	% Density By Volume
Sphaerocystis schroeteri	7.923	77.29
Quadrigula lacustris	2.224	21.70
Dinobryon divergens	.083	0.81
Oocystis sp.	.017	0.16
Pennate diatoms	.003	0.03

Limnological Data

Data averaged from STORET sites: 493550, 493551, 493552

Surface Data	1989	1991
Trophic Status	O	O
Chlorophyll TSI	41.18	34.96
Secchi Depth TSI	45.92	44.88
Phosphorous TSI	31.03	36.95
Average TSI	39.38	38.93
Chlorophyll a (ug/L)	3	1.7
Transparency (m)	2.75	3.1
Total Phosphorous (ug/L)	7	9
pH	7.2	7.2
Total Susp. Solids (mg/L)	<3	<3
Total Volatile Solids (mg/L)	-	2
Total Residual Solids (mg/L)	-	7
Temperature (°C / °f)	12/54	13/56
Conductivity (umhos.cm)	22	25
Water Column Data		
Ammonia (mg/L)	0.03	0.03
Nitrate/Nitrite (mg/L)	-	0.02
Hardness (mg/L)	10.4	8.2
Alkalinity (mg/L)	6.5	6.5
Silica (mg/L)	-	2.3
Total Phosphorous (ug/L)	9	10
Miscellaneous Data		
Limiting Nutrient	N	N
DO (Mg/l) at 75% depth	7.1	9.7
Stratification (m)	NO	NO
Depth at Deepest Site (m)	52	50



D	°C	pH	DO	Cond
0.0	16.6	7.8	9.5	23
1.0	16.0	7.7	9.5	23
2.0	16.0	7.7	9.5	23
3.0	15.1	7.7	9.4	23
4.0	15.0	7.7	9.5	23
5.0	14.9	7.6	9.5	23
6.0	15.0	7.6	9.5	23
7.0	14.8	7.5	9.5	23
8.0	14.7	7.5	9.4	23
9.0	13.5	7.4	9.3	24
10.0	13.3	7.4	9.2	25
11.0	13.0	7.3	9.2	25
12.0	13.0	7.3	9.3	25
13.0	12.2	7.3	9.3	26
14.0	12.1	7.2	9.3	26
15.0	11.9	7.1	9.3	28
16.0	11.8	7.1	9.3	29
17.0	11.7	7.1	9.3	30
18.0	11.5	7.1	9.3	31
19.0	11.3	7.1	9.3	33
20.0	11.2	7.0	9.4	34
21.0	10.9	7.0	9.3	35
22.0	10.7	7.0	9.3	36
23.0	10.5	6.9	9.3	38
24.0	10.2	6.9	9.3	39
25.0	9.8	6.9	9.3	39
26.0	9.3	6.9	9.4	39
27.0	8.8	6.9	9.5	40
28.0	8.6	6.8	9.6	41
29.0	8.5	6.8	9.5	40
30.0	8.3	6.8	9.5	41
31.0	8.1	6.7	9.5	41
32.0	8.0	6.7	9.5	41
33.0	7.9	6.7	9.6	41
34.0	7.8	6.7	9.5	41
35.0	7.6	6.7	9.6	41
36.0	7.6	6.6	9.7	40
38.0	7.4	6.6	9.6	42
39.0	7.4	6.6	9.7	41
40.0	7.4	6.6	9.7	41
41.0	7.3	6.5	9.6	41
42.0	7.3	6.5	9.6	41
43.0	7.2	6.5	9.6	41
44.0	7.2	6.5	9.5	42
45.0	7.1	6.5	9.6	41
46.0	7.1	6.5	9.5	42
47.0	7.1	6.5	9.5	41
48.0	7.1	6.5	9.4	42
49.0	7.1	6.5	9.5	41
50.0	7.1	6.5	9.5	42

Total	2.958
Shannon-Weaver [H']	0.58
Species Evenness	0.36
Species Richness	0.19

The phytoplankton community is dominated by the presence of green algae and diatoms indicative of good water quality and low production.

Pollution Assessment

Nonpoint pollution sources include the following: sedimentation and nutrient loading from grazing; and wastes and litter from recreational activities.

There are no point sources of pollution in the watershed.

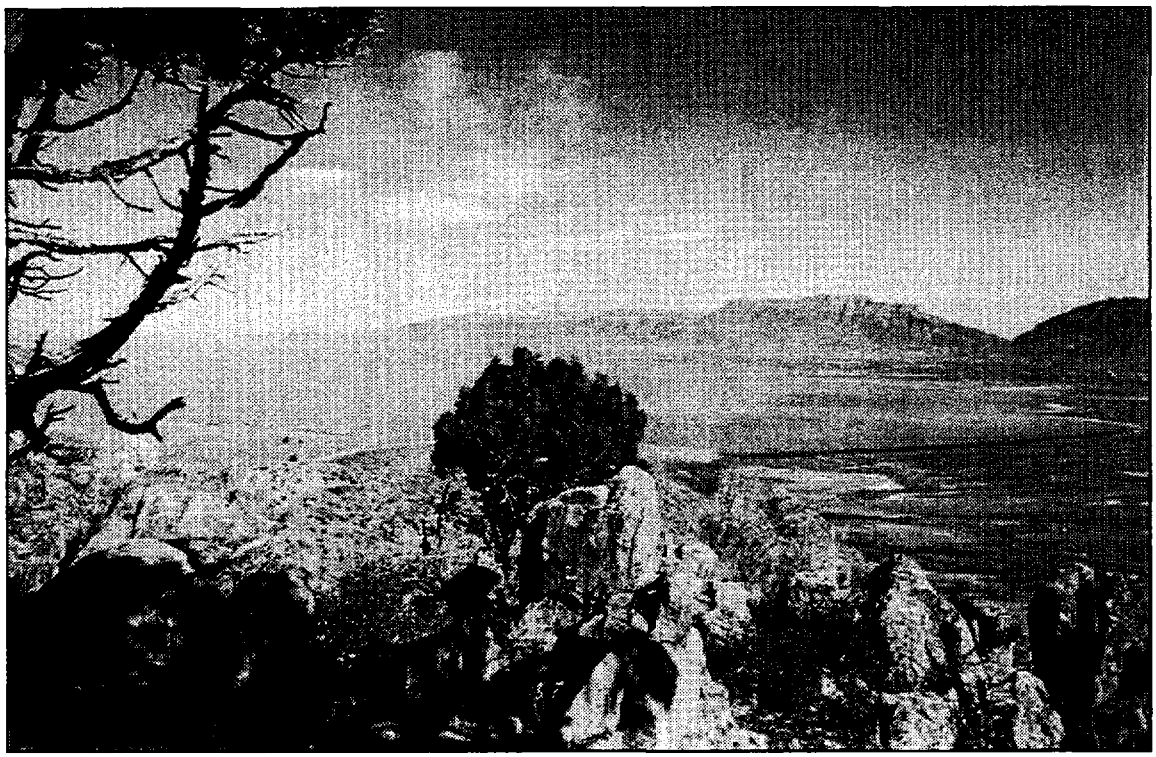
Beneficial Use Classification

The state beneficial use classifications include: culinary water (1C), boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Uinta Basin Association of Governments	722-4518
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Uinta National Forest	377-5780
Recreation	
Dinosaurland Travel Region (Vernal)	789-6932
Vernal Chamber of Commerce	789-1352
Steinaker State Park	789-4432
Mammoth R.V. Park (Vernal)	789-9309
Campground Dina (Vernal)	789-2148
Reservoir Administrators	
Department of the Interior	524-5403
CUP	226-7100

UTAH LAKE



Introduction

Utah Lake is one of the largest natural freshwater lakes in the western United States. It occupies much of Utah Valley, and is used by Salt Lake Valley as a water source. The Provo, Spanish Fork and American Fork Rivers are primary inflows, and the Jordan River drains the lake north to the Great Salt Lake. While it is large in surface area, the average depth is only about 10 feet. This allows winds to constantly stir up bottom sediments, resulting in turbid water. The lake is commonly perceived as being polluted and undesirable for water recreation. This is in part because of human-caused pollutants, such as agricultural uses around the lake, steel mill effluent, nutrients from sewage treatment facilities and overgrazing in the watershed, but because of its shallowness, the lake has always been somewhat turbid.

Characteristics and Morphometry

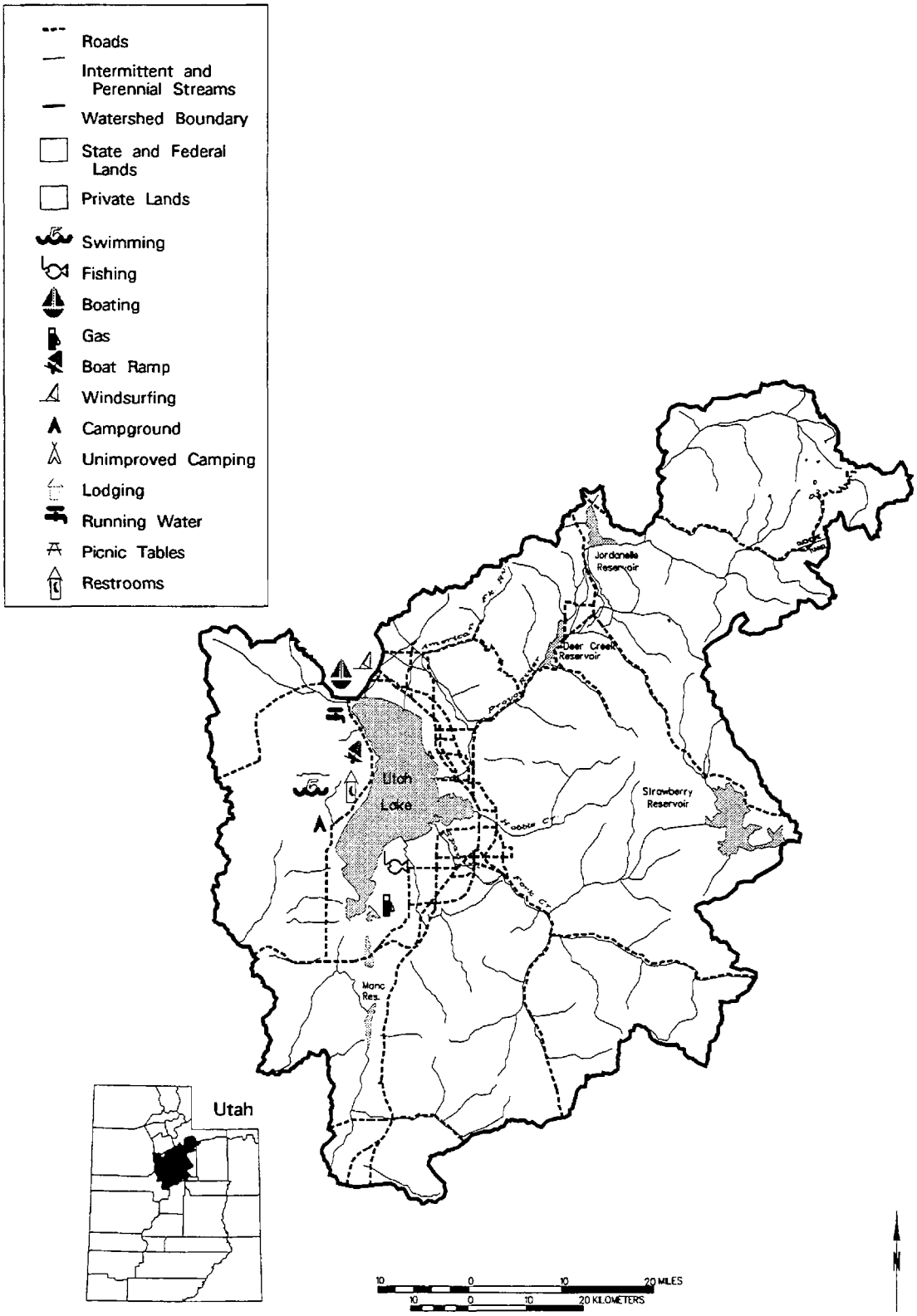
Lake elevation (meters / feet)	1,368 / 4,489
Surface area (hectares / acres)	39,214 / 96,900
Watershed area (km^2 / $miles^2$	8,920 / 3,444
Volume (m^3 / acre-feet)	
capacity	1,113,112,125 / 902,400
conservation pool	0
Annual inflow (m^3 / acre-feet)	754,313,643 / 611,771
Retention time (years)	1.5
Drawdown (m^3 / acre-feet)	750,552,993 / 608,721
Depth (meters / feet)	
maximum	4.27 / 14
mean	2.74 / 9.4
Length (km / miles)	38.3 / 23.8
Width (km / miles)	20.4 / 12.7
Shoreline (km / miles)	122.3 / 76

Location

County	Utah
Longitude / Latitude	111 47 33 / 40 11 45
USGS Map	
DeLorme's Utah Atlas & Gazetteer™	Page 45, A-5, 53, D-5
Cataloging Unit	Utah Lake (16020202)

The turbidity of the lake exerts a controlling influence on the productivity as it controls the photosynthetic activity by limiting light penetration throughout the water column. Although the appearance of the lake may tend to be offensive and initiates concern water quality data does not substantiate the fact that there are significant health risks exist and that water quality is highly impaired.

The area between the Wasatch Front and the Sierra



County near which watershed is located.

Utah Lake Watershed

<k173>

Nevada Mountains is stretching and collapsing, leaving the area topographically lower than the mountains to the east and west, forming what is geologically referred to as "the Basin and Range Province. Hydrological, much of the area does not have a route to the ocean for precipitation. (hydrological, the "Great Basin" includes the entire Wasatch Range and the western Uintas.) In moister eras, such as the cold periods of the ice ages, the great basin has filled with water, creating Lake Bonneville, and eventually flooding to the north into the Snake River and to the Pacific Ocean. The drainage was not able to maintain itself as decreased precipitation lowered the lake level of Lake Bonneville, and the remnants are Utah Lake and the Great Salt Lake. Utah Lake remained intact due to its mountainous watershed which contributes a significant amount of water to the area.

Utah Lake currently is controlled by man influence. Without this influence Utah Lake through natural processes could have essentially drained itself The Traverse Mountains originally separated Utah Valley from the Salt Lake Valley, has been removed many years ago. An isthmus formed across the Point of the Mountain during the Lake Bonneville period (much like the isthmus impounding Rush Lake in the next valley to the west) has been downcut by the Jordan River through a natural chain of events. Utah Lake regularly overflowed the isthmus, and has cut it 600' below its original height about 300' above the I-15 level down to the Jordan Narrows. If outlet structures were not in place and the river cut itself 15' deeper, Utah Lake would cease to exist. The hydrology of the river under mans influence has a developed a dynamic meander pattern, indicating that it is at equilibrium and energy is not being spent to further cut the channel. Although, the lake is now controlled by people, which has temporarily halted downcutting of the river, on occasion efforts are expended to deepened the channel to secure the release of more water than would naturally drain. Currently water level are managed to regulate water for Salt Lake County. A dam, at the source of the Jordan River as it leaves the lake, was built in the 1800's to facilitate the management of the waters of Utah Lake.

Over the years, many proposals have been made to artificially raise or control the water level to allow for the development associated with the lands adjacent or even in the lake proper. Proposals have been initiated to drain the lake, to drain Provo and Goshen Bays, to create an island in the lake for recreation or residential development, to construct a causeway across the lake to open development on the western shores, to enhance wetlands associated with the lake proper or other things that creative minds can imagine, but currently none of these ideas have ever left the planning stages. Other plans include the protection of the south half of Provo Bay for wildlife refuge status and the extension of the Provo Airport into Provo Bay

As the Central Utah Project comes to completion and various alternatives for development are evaluated and implemented Utah Lake proper will become more stable, but future appearance may differ dramatically from its current state. Many of the issues associated with development and use are clearly not defined or resolved.

Two important concepts have evolved that will directly influence and perhaps control activities associated with Utah Lake. In 1988 a "Compromise Elevation" which governs the maximum level of the lake as a result of a lawsuit between Salt Lake and Utah counties was established at a level of 4489.045 feet above sea level. When the water level in Utah Lake exceeds this level the Jordan River gates controlling the outflow from the lake are to be "left wide open". The other decision that exerts an influence is a decision by the Unites States Supreme Court which in June, 1987 confirmed title of the bed of Utah Lake to the State of Utah. The court ruled that since the lake was not reserved by the federal government prior to statehood, Utah acquired the lands under navigable waters (called "sovereign" lands) by virtue of its sovereignty and admittance into the union "on an equal footing with the original states" (Utah Enabling Act Ch. 138, 28 Statutes At Large 107. July 16, 1894). The Utah Legislature has provided statutory authority and direction for the management of the State's sovereign lands through the Board and Division of State Lands and Forestry. A general management plan has been developed through that office in conjunction with other interested parties and is available for review through their agency.

Although the shoreline is mostly privately owned with little of it developed, access is usually unrestricted. The water is used for irrigation and culinary water, but due to its high mineral content it must be mixed with water from other sources for satisfactory culinary use.

Recreation

Utah Lake is easily accessible from various points around the lake. Utah Lake State Park is at the west end of Provo's Center Street. From Exit 258 off I-15, a road follows the shore behind the steel mill, from 2000 North in Orem, or northwest from Geneva Road at about 400 S in Orem. American Fork has a marina, access to which is signed from downtown. West of Lehi is Saratoga Springs resort with waterslides and pools and U-68 (Redwood Road) follows the west shore fairly closely for about 22 miles. The road around the west side of West Mountain, from Genola to the Benjamin area, follows the shore closely for about 11 miles, offering easy access to rocky beaches. The lake is accessible by all of these sites, as well as Hobble Creek from the overpass on the west frontage road of I-15 between Exits 265 and 263 (the two Springville exits).

The lake is popular for fishing, boating, sailing, and waterskiing. There are abundant supplies of fish including carp and bullhead in the lake. Anyone fishing should carefully acquaint themselves with drawings of the June Sucker, a endangered fish whose natural range is limited to the lake and the Provo River. Care should be taken to protect these endangered species to assure their propagation and survival

Recreational facilities are fairly well developed at some sites. The State Park has 70 campsites, a marina, boat ramps, flush toilets, a handicap fishing area and an ice rink. The American Fork Marina and Saratoga Springs are also developed. At most access sites, however, visitors may simply walk from the road to the lake. The lake is visible from most areas of the valley, and clearly visible from roads following its perimeter.

In addition to Saratoga Resort, Lakeside Campground is 0.5 miles east of the state park on Center Street in Provo. Camping at the lake itself is allowed in most areas.

Watershed Description

Utah Lake's watershed includes areas east and west of the Wasatch Fault, in both (geologically speaking) the Basin and Range province and the Rocky Mountains. The lake itself, and Utah Valley itself, are part of the Basin and Range province, while the mountains bordering the valley to the east are part of the Rocky Mountains.

The Basin and Range area is generally very flat, with small mountains ranges jutting above it. The climate is clearly arid. West Mountain, the Tintics, and the Lake Mountains are classic ranges.

The Rocky Mountains are much higher, and consequently have more precipitation and large areas of lush vegetation. Continual uplift (as much as 10'/1,000 yrs) results in rocky outcrops wherever soil building processes are outstripped by erosion. In the high elevations, glaciers turned narrow canyons into broad valleys, and the quantity of rock removed is evidenced by the massive Provo bench, the Provo River delta in Lake Bonneville.

Among the tributaries, the Provo River is the largest. It flows through the Wasatch Range in an ancient canyon, which has carried rivers in the past from west to east. The present Provo River has captured drainage in fairly recent history that has added a portion on the Uintas to the watershed. (Details of this process are in the Deer Creek Reservoir report.) Man has further augmented the watershed with diversions from the Duchesne River and the Weber River. The Spanish Fork River has been similarly augmented, receiving water carried from the south face of the Uintas, from Upper Stillwater Reservoir in the Rock Creek Drainage to Strawberry Reservoir, including the Duchesne River, Currant Creek, Layout Creek and Water Hollow Creek. All of this water is drained through the Strawberry Tunnel into the Diamond Fork Drainage, which is a tributary of the Spanish Fork River.

The shoreline of the lake is surprisingly devoid of riparian vegetation. There are few cottonwoods or other common trees and shrubs of desert riparian areas. There are multiple beach lines from fluctuating lake levels, and that may cause enough variability in groundwater levels to preclude cottonwood growth. The flat nature of the valley makes Utah Lake similar to other Basin and Range water bodies, such as Mona Reservoir and Sevier Bridge Reservoir, where fluctuations of one or two vertical feet expose or drown several hundred feet of beach.

The watershed high point, Bald Mountain in the High Uintas, is 3,641 m (11,947 feet) above mean sea level, creating a complex slope of 2.7% to the lake. Mount Nebo is a mere 5 m shorter (3,636 m / 11,929 feet), but is 50 km closer, resulting in an 8.7% slope. Slopes of 100% are not uncommon along the Wasatch Front with some areas in excess of 100%.

The principle inflows are the American Fork River, the Provo River, Mill Race Creek, Hobble Creek, the Spanish Fork River, and Currant Creek. The American Fork River and Currant Creek are entirely diverted for much of the year. Many other tributaries once flowed into the lake during the spring floods, but have since been diverted for culinary or agricultural uses, a partial listing of which includes (clockwise from the Jordan River): Dry Creek (Alpine), Grove Creek, Battle Creek, Slate Canyon Creek (ephemeral), Dry Creek (Mapleton), Benjamin Slough (Beer Creek, Peteetneet (Payson) Creek and Spring Creek), Santaquin Canyon Creek (all from the Wasatch Range) and West Canyon Wash (from the Oquirrh Mountains). A very rough approximation of the average stream gradient above the lake is 2.3% (124 feet per mile).

Most tributaries are impounded to divert water into culinary systems or onto agricultural lands, or to regulate the

flow of water into the lake. Tibble Fork Reservoir and Silver Lake Flats Reservoir are impoundments in the American Fork River Drainage. Deer Creek Reservoir and the Jordanelle Reservoir are impoundments of the Provo River. Hobble Creek and the Spanish Fork River have no reservoirs, but both like other tributaries have diversions to shunt water into culinary or irrigation systems. Salem Pond is an impoundment of the source of Beer Creek. The Payson Lakes are augmented natural impoundments in the Peteetneet Creek (Payson Canyon) drainage. Mona Reservoir is an impoundment of Currant Creek.

This diverse watershed contains soils of many different types. A partial listing (omitting all of the artificially diverted watersheds) of the soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of all types found in the state. The watershed receives 25 - 152 cm (10 - 60 inches) of precipitation annually. The frost-free season around the reservoir is 120 - 160 days per year.

Land use in the natural watershed is 53% multiple use (logging, mining, grazing and recreation on BLM, State, and USFS lands), 31% agricultural, and 16% Urban which includes industrial areas around the lake.

Perhaps the greatest impact that humans have had on Utah Lake has not been changing the biota, dumping sewage and industrial wastes, logging the watershed, grazing the watershed, agricultural runoff or paving the watershed, but has been the elimination of most of the natural inflow to the lake. Before settlement by Europeans, there were no dams, no irrigation systems, and no household use of water.

Limnological Assessment

The historical information contained in this summary of Utah Lake water quality conditions was derived from several reports prepared for the Bureau of Reclamation by Erying Research Institute and Brigham Young University in 1981 and 1982. These studies were conducted to determine the affects of the proposed Central Utah Project on the Utah Lake ecosystem. The water quality data for these studies was collected mainly since 1970 with more than half collected specifically for the BOR studies from 1977 through 1981. Data for Utah Lake and its tributaries are almost nonexistent prior to 1960. Additional data has been collected by the Utah Division of Water Quality (DWQ) within the Department of Environmental Quality and by Mountainlands Association of Governments under contract with DWQ to complete a Clean Lakes Phase I diagnostic/feasibility study study. A final report of their findings is expected by the end of 1995.

Utah Lake's water quality history has fluctuated with the overall Northern Utah climate. Notable rises in total dissolved solids have occurred during the drought period of 1933-34 and during 1977. The hydrologic cycle has an important impact on water quality in Utah Lake. During drought periods, salinity increases as the inflow to the lake is reduced. Evaporation from the lake, can exceed 300,000 acre feet per year. The agricultural water quality standard set by the state for total dissolved solids (TDS) is 1200 mg/L, and Utah Lake's TDS has ranged from a low of 300 to a high of over 4000 during the 1933 drought. Major tributaries such as the Provo, American Fork, and Spanish Fork rivers whose waters are primarily snowmelt produced and have a diluting effect on the lake.

It is known that springs feeding the Northeast side of the lake have a TDS concentration 400 mg/L, while saline springs exist at Lincoln Point with TDS concentrations as high as 6,150 mg/L. The fresh springs are not controlled by faults in the area, but are controlled by depositional deposits associated with the Spanish Fork, Provo, and American Fork rivers entering the lake. The lake model developed by Merritt(1982) predicted that as much as 15 to 20 percent of the inflow to the lake is spring water.

Data from the Provo airport on Utah Lake has provided 5600 daily readings over a four year period on wind speed and direction. Twenty-five percent of the time, wind comes from the Northwest, 10% from the South, and 18% from the Southeast. Only very rarely do winds occur from East to West. Given the physical configuration of Utah Lake, wind is a powerful influence on water quality and mixing in the shallow lake.

Winter ice flows are the most notable physical feature of Utah Lake. Some with walls as high as 10 feet have destroyed most of the old buildings along the shores of the Utah Lake. With some 13 to 20 miles of unobstructed opportunity for prevailing winds to move the ice, and the relatively flat terrain in the vicinity of the lake, surprising distances of shorelines have been covered by ice flows in the winter. Ice as thick as three feet has been measured at some locations in recent years. Recently, sheets of ice as high as 10 feet have damaged facilities at Utah Lake State Park.

Transparency is generally poor due to the shallow nature of the lake and wind action. Measurements made during May, August and September 1975 showed that the transparency averaged ten inches.

Historical water quality data for Utah Lake and its tributaries are almost nonexistent prior to 1960. Most of the date have been collected since 1970 and the majority since 1977 as a result of studies at the Erying Research Institute, Inc. The available water quality date have been tabulated in the report, "Utah Lake Phase I Report #20, by Merritt and Wood. The quality of lake and tributary water ranges from poor to good when compared when compared to the Utah

water quality standards prior to the recent revision. A discussion by Merritt and Wood concerning existing water quality versus existing state standards at the time shows few violations in free-flowing streams and natural drainage flows except when those waters receive effluent from wastewater treatment plants (WWTP). The majority of violations were associated with ammonia (NH3), orthophosphorus (OP), biochemical oxygen demand (BOD) with some violations associated with dissolved oxygen (DO), total dissolved solids (TDS), and heavy metals.

The heavy metal violations were usually associated with WWTP effluent, but were relatively infrequent with limited duration. It was concluded that heavy metal violations were of little concern because of infrequent incidents, their minor nature, and their occurrence in relatively alkaline waters which tends to reduce toxicity.

TDS violations are largely due to natural conditions and nonpoint source return flow and seepage from irrigated lands. In addition, the TDS concentrations within the lake vary markedly over time. These variations consist of not only seasonal cycles buy cycles over extended periods of time. These changes are due largely to climatic conditions associated with wet and dry climatic cycles.

The EPA National Eutrophication Survey Program conducted in 1973-74 reported Utah Lake to be the most eutrophic lake of the 27 lakes survey in Utah. Furriman (1981) reported the lake to be hypereutrophic with a mean in-flow of phosphorus concentration of 0.218 mg/l and inorganic nitrogen concentration of 2.065 mg/l. Merritt and Wood reported mean phosphorus concentration of 0.3 mg/l and nitrogen concentration of 1.56 mg/l.

Pollution indicators have been established as part of the Standards of Water Quality for waters of the state for phosphate as P at 50 ug/L in streams and 25 ug/L in lakes; and nitrate as N at 4.0 mg/l. Applying these indicator values, it is evident that there is a very large nutrient loading into the lake to sustain algae growth. However, the dominant limiting factor associated with algal growth in the lake is the presence of high turbidity. High turbidity limits light penetration and hence limits algal growth.

An associated problem which may develop with the production of algae and aquatic plants due to high availability of nutrients is oxygen loss during the decomposition phase of the plant growth cycle. These appear to be only a minor problem due to the lake of thermal-density stratification of the lake and the high frequency of wave action which aids in the oxygenation of the water during spring, summer and fall. During the winter, lack of decomposing organic matter under the winter ice which forms on a limited basis precludes serious oxygen depletion.

Although oxygen depletion has not been extensively documented under winter ice there is some evidence (odor's, visual evidence, and low oxidation reduction potential measure shortly after off-ice in the spring) of anoxic conditions in some areas of the lake. These areas are usually confined to the margins and bay areas.

The turbidity which limits algal productions is the source of the public perception that the lake is polluted. The lake's relative shallowness and flocculent calcite bottom sediments, couples with climatic conditions producing frequent wave action, allows for the continual resuspension of bottom sediments into the water column. These resuspended calcium carbonate calcite crystals and algae account for the gray-green turbidity associated with the lake. Merritt and Word reported that water in the bay areas and near tributaries is relatively clear. It was estimated that about 50 percent of the total sediments and 65 percent of the calcite appear to be originating in the lake itself via mineral precipitation.

Other pollutants which need consideration which need consideration are pathogenic microbes, organic materials, pesticides, and heavy metals. Merritt and Wood felt at the time of their work that there were no significant concerns for these pollutants. They concluded:

1) Pathogenic microbes die off rapidly in open-water environment,

2) organic debris degrades quite rapidly over time, and

3) pesticides, herbicides and other relatively non-biodegradable compounds may cause long-term pollution problems.

However, pesticides and herbicide tests on tributary water, lake water and sediments, generally show concentrations to be one of three orders of magnitude lower than state standards required. In addition, they cited reports indicating low concentration of pesticides and heavy metals in fish tissue analyses.

Utah Lake is a highly productive ecosystem with the majority of production occurring as massive bluegreen algal "blooms" late in the summer and fall. The dominant planktonic bluegreen algae present in the lake are *Aphanizomenon flos-aquae*, *Anabaena spiroides var. crassa* and species of *Microcystis*. All of these species are nuisance algae which cause various water quality problems in eutrophic systems throughout temperate regions.

The diversity of diatoms in Utah Lake is high. The planktonic diatoms are mostly centric species typical of eutrophic systems. The dominant diatoms in the littoral regions are mostly pennate diatoms. The majority of the dominant species in the littoral are also typical of eutrophic systems.

The soft bottom benthos community of Utah Lake makes up 93 to 99% of the total area depending on the level of lake drawdown. Chironomid larvae (blood worms or

midge flies) and oligochaetes (fresh water worms) are the dominant benthic community members. Studies determined that Provo Bay supports lower densities of oligochaetes and chironomids than Goshen Bay and the Main Lake. Both Goshen Bay and the Main Lake are more similar to each other than to Provo Bay.

The highest zooplankton numbers were found in summer and late fall while the lowest numbers were present during the winter, when the lake was iced over and immediately after the ice melt in April. The Provo Bay area of Utah Lake had the highest concentrations of zooplankton.

Goshen Bay and the main lake were more similar to each other than either were to Provo Bay, in terms of seasonal density trends and seasonal changes in the zooplankton community composition. During summer and fall zooplankton composition underwent distinct change. The major component change was a dramatic increase in cladocerans in all lake areas. The summer and fall zooplankton community in Provo Bay underwent a similar change in that a cladoceran became the dominant organism, but there was no shift in species as *Ceriodaphnia* was the dominant organism during the summer (59%) and fall (44%).

Two other significant trends are: first, the general increase of *Cyclops* into the fall and the fact that they made up 15 to 20% of the total community year round in Provo Bay; and second, the area Main Lake North -- the northern end of Utah Lake -- had very high numbers of *Daphnia* and *Diaptomus*.

A fresh water sponge, *Ephydatia fluviatilis*, present in the littoral habitat of Utah Lake have the greatest percent cover in water greater than one meter deep with a hardpan matrix and a small amount of silt deposition. Acceptable substrate were readily colonized by new sponge colonies.

Mosquito production is high around Utah Lake from early spring to late fall during most years. Production is related to water depth and level fluctuations and vegetation type and cover. The higher production occurs in areas of saltgrass mixed with willows, sedge or other emergent vegetation types and where water depth is less than 12 inches and water level frequently changes. Approximately 80% of the mosquito producing areas around Utah Lake area presently under a regular mosquito control program.

Deerflies and horseflies are a serious nuisance in many areas around Utah Lake from mid-summer through late fall. They are commonly found in areas of shallow marshlands, associated with low ground gradients and slowly receding waters. In Utah County there is no control program for deer and horse flies.

The fish life inhabiting the Utah Lake has changed since the valley was first permanently settled. Trout and suckers were highly visible during early years, but wasteful fishing practices and the introduction of new species such as the carp have all but wiped out those populations. Utah Lake presently supports a population of channel catfish(*Ictalurus punctatus*), black bullhead (Ictalurus melas), walleye (*Stizostedion vitreum*), large mouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), black crappie (*Pomoxis nigromaculatus*), yellow perch (*Perca flavescens*) and white bass (*Morone chrysops*). Non-game species such as carp (*Cyprinus carpio*), Utah suckers (*Catostomus ardens*), fathead minnows (*Pimephales promelas*), and spottail shiner (*Notropis hudsonius*) also inhabit the lake and comprise approximately 66% of the total fish population.

The fish concentration in Provo Bay represents the younger fish spawned that year. The adult fish move out into the main body of the Lake and into Goshen Bay.

A commercial fish operation works from Utah Lake on a year-round basis. The operator harvests the carp to meet large orders from outside the Utah area.

A nearly extinct species known as the June Sucker (*Chasmistes liorus*) also lives in the waters of Utah Lake near the Provo River. This is the only known spawning found in the world for the fish and it appears from more recent studies that populations are dying out with few new generations being produced. As a consequence, the June Sucker is listed as and endangered species and is protected by law. Any actions which could conceivably be detrimental to the survival or recovery of the June Sucker is protected under the Threatened and Endangered Species Act.

Critical spawning habitat for the June Sucker has been identified on the lower Provo River from Columbia Lane to Utah Lake.

Birds are abundant with the passerine or similar small bird comprising 43% of the avifauna. Twenty-seven percent are shore or other aquatic species, 15% are waterfowl, 12% are raptures, and 3% are of the upland game varieties. Utah Lake is an important habitat for the mallard, pintail, redhead, and canvasback ducks. Canadian geese are also highly visible during certain times of the year.

Five migratory bird species nest and/or feed in the marshes and bays. These include the white pelicans, great blue herons, black-crowned night heron, double crested cormorants, and the western grebes.

An evaluation of current data obtained by the DWQ indicates the water quality of Utah Lake is fairly good. It is considered to be very hard with a hardness concentration value of approximately 399 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses continue to be total dissolved solids, total phosphorus and on occasion dissolved oxygen sporadically in the water column. The average

Limnological Data

Data averaged from STORET sites*: 491731, 491737, 491739, 491750, 491752

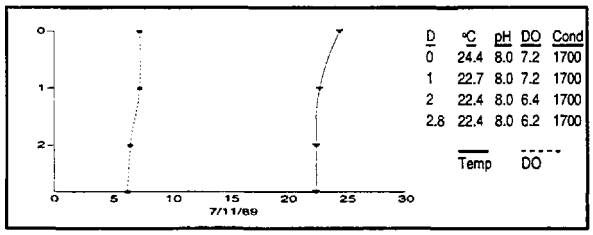
Surface Data	1981	1989	1991
Trophic Status	H	E	H
Chlorophyll TSI	72.3	70.07	65.77
Secchi Depth TSI	80.89	57.22	66.25
Phosphorous TSI	78.70	49.95	71.41
Average TSI	77.29	59.08	67.81
Chlorophyll a (ug/L)	-	69.4	50.0
Transparency (m)	-	2.2	0.5
Total Phosphorous (ug/L)	40	122	79
pH	8.6	8.1	8.4
Total Susp. Solids (mg/L)	-	97	106
Total Volatile Solids (mg/L)	-	-	135
Total Residual Solids (mg/L)	-	-	89
Temperature (°C / °f)	15/59	25/77	21/70
Conductivity (umhos.cm)	1392	1712	1914
Water Column Data			
Ammonia (mg/L)	0.07	0.02	0.05
Nitrate/Nitrite (mg/L)	0.19	-	0.05
Hardness (mg/L)	369	390	437
Alkalinity (mg/L)	-	206	198
Silica (mg/L)	-	-	-
Total Phosphorous (ug/L)	40	127	82
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	-		
Stratification (m)	-		
Depth at Deepest Site (m)	-		

* There were a significant larger amount of stations during the 1991 Clean Lake study period.

concentration of total phosphorus in the water column for the last two study periods was 127, and 82 ug/L both of which exceed the recommended pollution indicator for phosphorus of 25 ug/L. The state standard for total dissolved solids (TDS) for Class 4 waters is 1,200 mg/L. This is a measurement in general of dissolved inorganic salts, somewhat equivalent to salinity. A general rule of thumb to evaluate TDS from the conductivity for a given water is approximately 60% of the known conductivity is equivalent to the TDS concentration (1,000 conductivity = approximately 600 mg/L TDS). The conductivity of Utah Lake has show a gradual increase in recent years. Although not included in the limnological data, in 1990 the average conductivity was over 2,000 indicating that the state standard had been exceeded at some point in time. Actual TDS data obtained in the Clean Lakes Phase I study conducted via a contract with Mountainland Association of Governments for the period 1990-91 substantiated the exceedences with an average value of 1,187 mg/L in the lake with a maximum value of 1,330 mg/L reported and average annual values over 1,200 mg/L at several of the seventeen stations identified for monitoring.

Data suggest that the reservoir is currently a nitrogen limited system, however, turbidity in the water column form the resuspension of sediments is probably control the productivity of the lake by limiting the penetration of light in the water column and therefore controlling the algal production. TSI values indicate the reservoir is hypereutrophic. The reservoir does not stratify due to its shallow nature and climatic conditions which continually mix the water column as indicated in the profile of July 11, 1989.

According to DWR no lakewide fish kills have been reported in recent years, but some localized fish kills occur periodically due to discharges from point sources. The lake has not been chemically treated by the DWR, so populations of native fishes are present in the lake. Lake Trout in excess of 50 pounds once inhabited the lake, but were finally fished to extinction in the 1940's. The June Sucker still holds a tenuous grip on existence, with the tremendous populations of non-native bass and carp resulting in very low reproductive rates for these fishes.



Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm³/liter)	% Density By Volume
Aphanizomenon flos-aquae	158.460	85.20
Euglena species	12.343	6.64
Pennate diatoms	11.565	6.22
Centric diatoms	1.168	0.63
Ankistrodesmus falcatus	.873	0.47
Mallomonas sp.	.667	0.36
Unknown spherical chrysophyte	.667	0.36
Total	2.958	
Shannon-Weaver [H']	0.60	
Species Evenness	0.29	
Species Richness	0.27	

The phytoplankton community is presently dominated by the presence of noxious blue-green algae. This is indicative of a system rich in nutrients with fairly high production.

Pollution Assessment

Nonpoint pollution sources include the following: waste and litter from recreation; treated sewage, household chemicals, and oils from urban areas; toxins, nutrients, and heavy metals from industry; pathogens, sediments, nutrients, chemicals from agriculture; and sedimentation and nutrient loading from grazing, construction or development.

Gravel pits and constant construction in Utah Valley result in a continuous influx of sediments. All commercial mines and timber sales are buffered by one or more reservoirs. Agricultural use of lands occur in direct proximity to the lake shore in many areas.

Point sources of pollution in the watershed include municipal and industrial discharges directly into the lake or in tributaries that are in close proximity to the lake itself.

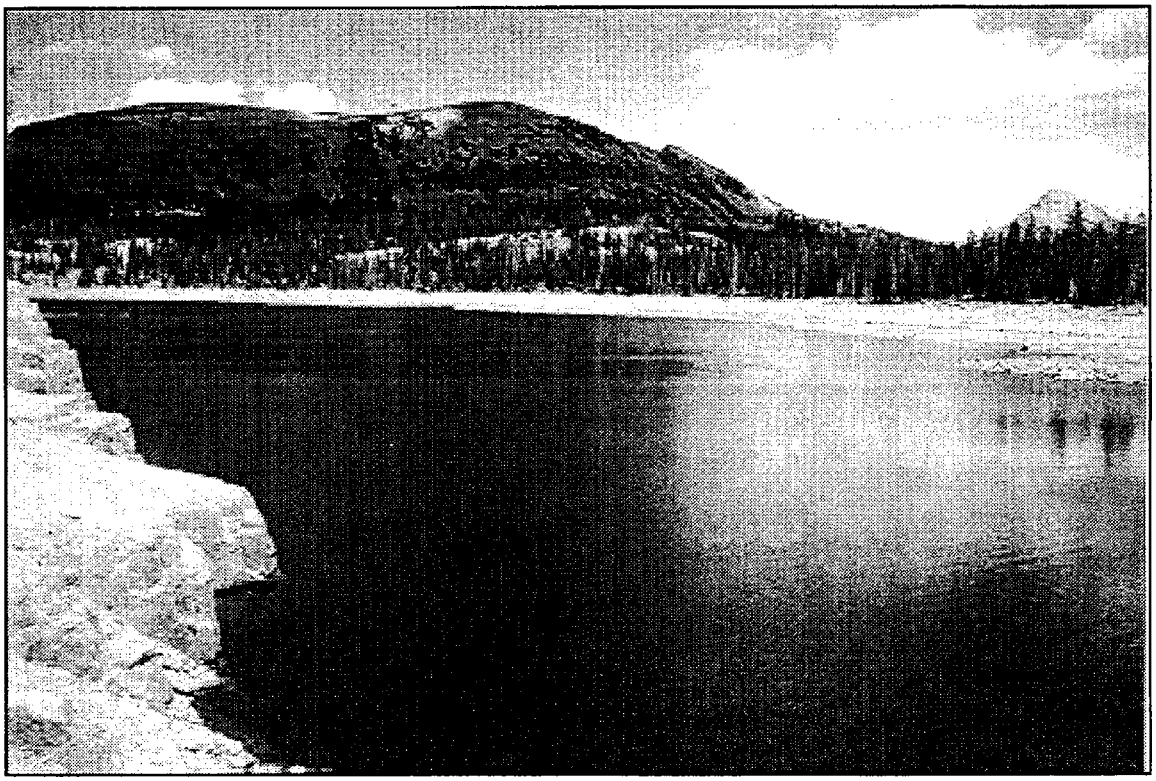
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), warm water game fish and organisms in their food chain (3B), wildfowl and associated organisms (3D), and agricultural uses (4).

Information

Management Agencies	
Mountainlands Association of Governments	377-2262
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Mountainland Travel Region (Vernal)	377-2262
Provo/Orem Chamber of Commerce	224-3636
Lakeside Campground (Provo)	373-5267
Saratoga Springs Resort (Lehi)	768-8206
Utah Lake State Park	375-0731
American Fork Marina	
Reservoir Administrators	
C.U.P.	226-7100

WALL LAKE



Introduction

Wall Lake is at the base of Mount Watson and Notch Mountain, both of which rise over 1,000 feet above the lake in nearly sheer walls. This area is the extreme headwaters of the Provo River. The stream flowing into Wall Lake from Clyde Lake and several smaller lakes is the actual source of the Provo River, but it is not named such until it is downstream from Trial Lake. Wall Lake was a small natural lake, but it was enlarged by construction of an earth-fill dam to create an intermediate-sized artificial impoundment. The lake is known for its deep, clear waters.

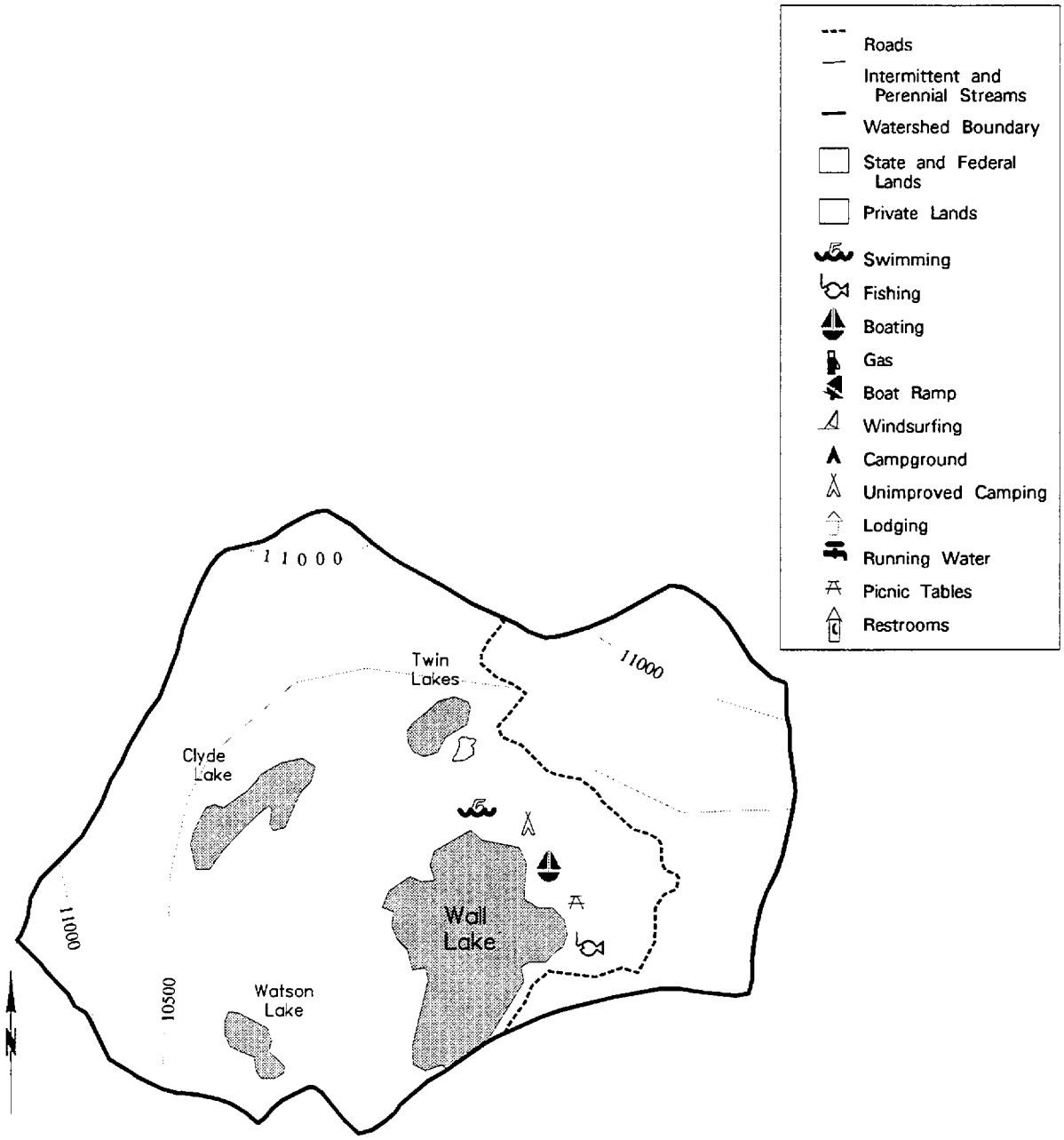
The shoreline is owned by the Wasatch-Cache National Forest, and public access is unrestricted. The dam was built in 1914. Since then water use is primarily for irrigation, but can be used as supplementary culinary water. Currently, the lake is being stabilized as part of the Central Utah Project. The original dam will be removed and the area restored to its former mountain lake status. The primary function of the lake will resort to recreational purposes.

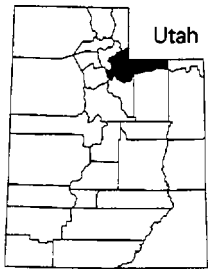
Characteristics and Morphometry

Lake elevation (meters / feet)	3097 / 10,160
Surface area (hectares / acres)	24.7 / 61
Watershed area (hectares / acres)	320 / 791
Volume (m^3 / acre-feet)	
capacity	4,250,000 / 3,442
conservation pool	0
Annual inflow (m^3 / acre-feet)	2,502,772 / 2,029
Retention time (years)	
Drawdown (m^3 / acre-feet)	0
Depth (meters / feet)	
maximum	39 / 128
mean	9.5 / 31
Length (meters / feet)	793 / 2,600
Width (meters / feet)	488 / 1,600
Shoreline (km / miles)	2.1 / 1.32

Location

County	Summit
Longitude / Latitude	110 57 34 / 40 41 54
USGS Map	Mirror Lake, UT 1967
DeLorme's Utah Atlas & Gazetteer™	Page 54, B-3
Cataloging Unit	Provo (16020203)





County in which watershed is located.

1,000 0 1,000 2,000 3,000 FEET

250 0 250 500 750 METERS

Wall Watershed

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Recreation

Wall Lake is not accessible by motor vehicle, but is only a short hike in from the Trial Lake area (on U-150 about four miles east of Mirror Lake and 32 miles west of Kamas) or the Crystal Lake Trailhead (above Washington Lake adjacent to Trial Lake). From the Trial Lake dam, hike for 1.5 miles on the Notch Mountain Trail, which follows the west side of Trial Lake and follows the stream to Wall Lake. There is a shorter route (approximately 1 mile) from the Crystal Lake Trailhead. It is located by continuing past Trial Lake and turning right as the road divides at Washington Lake. Proceed northward for approximately another mile to the parking area. The trail to Wall Lake leaves the parking lot on the eastern side in a northern direction.

Fishing, camping, picnicking, scenic beauty and hiking are all popular. Wall is the largest of perhaps a dozen lakes in the immediate vicinity, all of which are remote and pristine, but still only a short hike from the parking area. Air and water temperatures are too cold for most swimmers. The backdrop of high, barren peaks are reflected in the still water of the lake.

The area receives moderate recreational use throughout the summer. U-150 is closed during the winter and much of the spring, but groomed for cross country skiers, snowmobilers and hikers. The low water level from early summer to the following spring leaves large areas of mud exposed.

Primitive camping is available anywhere in the area, but be sure to camp an appropriate distance from the nearest waterbody and carry out all waste. Call the Kamas Ranger District for complete backcountry camping information and regulations.

Trial Lake Campground is on the east shore of Trial Lake, with 60 campsites, picnic areas, and primitive toilets. There are several other USFS campgrounds along U-150 throughout the area in addition to primitive camping allowed in the Washington Lake area..

Watershed Description

Wall Lake is in an area of numerous lakes and meadows interspersed with high, alpine peaks. In this area of the Uintas, most of the high peaks have been scoured away, leaving isolated peaks, rather than the ridgelines characteristic of the central part of the range. Because of the heavy glacial scouring, divides between major watersheds are often low, poorly drained passes. For instance the pass between Notch Mountain and Mount Watson has three lakes on it, and it is unclear whether they drain into Wall Lake and the Provo River or into Hidden Lake and the Weber River. Stream erosion has yet to make significant changes on this landscape, where glaciers melted only several thousand years ago.

Defining the north and west edge of the watershed are Notch Mountain and Mount Watson, respectively. Mount Watson is the watershed high point, is 3,512 m (11,521 ft) above sea level, thereby developing a complex slope of 33.3% to the lake. There are several extremely small streams entering the lake, the largest of which is from Clyde Lake. Its gradient is 10.6% (559 feet per mile). This inflow, and the outflow to Trial Lake, are the infant Provo River.

The watershed is made up of high mountains and rocky outcroppings. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of marshes, pine, spruce-fir, aspen, and alpine. The watershed receives 76 - 102 cm (30 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 0 - 20 days per year.

What use of watershed land takes place is 100% recreation.

Limnological Assessment

The water quality of Wall Lake is excellent. It is considered to be very soft with a hardness concentration value of approximately 7.5 mg/L ($CaCO3$). There are no overall water column concentrations that exceed State water quality standards for those parameters analyzed. Monitoring of the lake was restricted to near shore surface monitoring because of its location. Current water quality conditions do not indicate that any impairments with the lake occur. However, to assure that these conditions are correct winter monitoring should be conducted to investigate potential dissolved oxygen depletions and to obtain water quality data form the entire water column.

Current data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is oligotrophic in a state of low productivity. The potential for stratification in the lake does but profile data has not been obtained to verify stratification due to the location of the lake.

According to DWR no fish kills have been reported in recent years. The reservoir has been stocked with rainbow trout (*Oncorhynchus mykiss*) and Yellowstone cutthroat trout (*Oncorhynchus clarki* bouvieri). Brook trout (*Salvelinus fontinalis*) are present in the lake too. The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake. The DWR stocks the lake in most years, with 17,000 Yellowstone Cutthroat fry.

Phytoplankton samples have not been obtained for Wall Lake. It is the intent to obtain samples as soon as the logistics can be met to conduct investigations on the lake.

Pollution Assessment

Nonpoint pollution sources include the following: sedimentation and nutrient loading from grazing, and litter or

Limnological Data

Data sampled from STORET site: 591657

Surface Data	1992
Trophic Status	O
Chlorophyll TSI	25.59
Secchi Depth TSI	-
Phosphorous TSI	38.06
Average TSI	31.83
Chlorophyll a (ug/L)	0.6
Transparency (m)	-
Total Phosphorous (ug/L)	11
pH	7.1
Total Susp. Solids (mg/L)	<3
Total Volatile Solids (mg/L)	-
Total Residual Solids (mg/L)	3
Temperature (°C / °f)	17/63
Conductivity (umhos.cm)	11
Water Column Data	
Ammonia (mg/L)	0.03
Nitrate/Nitrite (mg/L)	0.01
Hardness (mg/L)	7.5
Alkalinity (mg/L)	5
Silica (mg/L)	1.7
Total Phosphorous (ug/L)	11
Miscellaneous Data	
Limiting Nutrient	N
DO (Mg/l) at 75% depth	-
Stratification (m)	-
Depth at Deepest Site (m)	-

Information

Management Agencies	
Mountainland Association of Governments	377-2262
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Wasatch-Cache National Forest	524-5030
Kamas Ranger District	783-4338
Recreation	
Mountainland Travel Region (Provo)	377-2262
Reservoir Administrator	
Timpanogas Canal Company	654-1346

wastes from recreation.

Grazing takes place around the reservoir and throughout the watershed.

There are no point sources of pollution in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

WASHINGTON LAKE

Introduction

Washington Lake is just west of Trial Lake in the Mirror Lake area of the High Uintas. It is an intermediate size natural lake that was enlarged with an earth-fill dam, a commonly practice to store spring snowmelt for use in summer irrigation. The original dam was completed in 1914, although plans were developed in 1910 for construction. The Union Reservoir Company manages the release of water from the lake to shareholders of the Timpanogos Canal Company or Provo City. The original construction of these primitive rock and dirt dams required a lot of manual labor. It has been reported that as many as 600 men with 300 teams of horses were required to construct more than a dozen of these facilities over a period of twenty-plus years. Most of the work occurred between June 10 and Labor Day each year. As primitive as these dams may have been only once did one of the barriers fail. In 1986 Trial Lake dam broke, but has since been reconstructed too. As the impounded water is drawndown for irrigation needs a barren lake bed between the undrainable original lake and the dam's high water line develops.

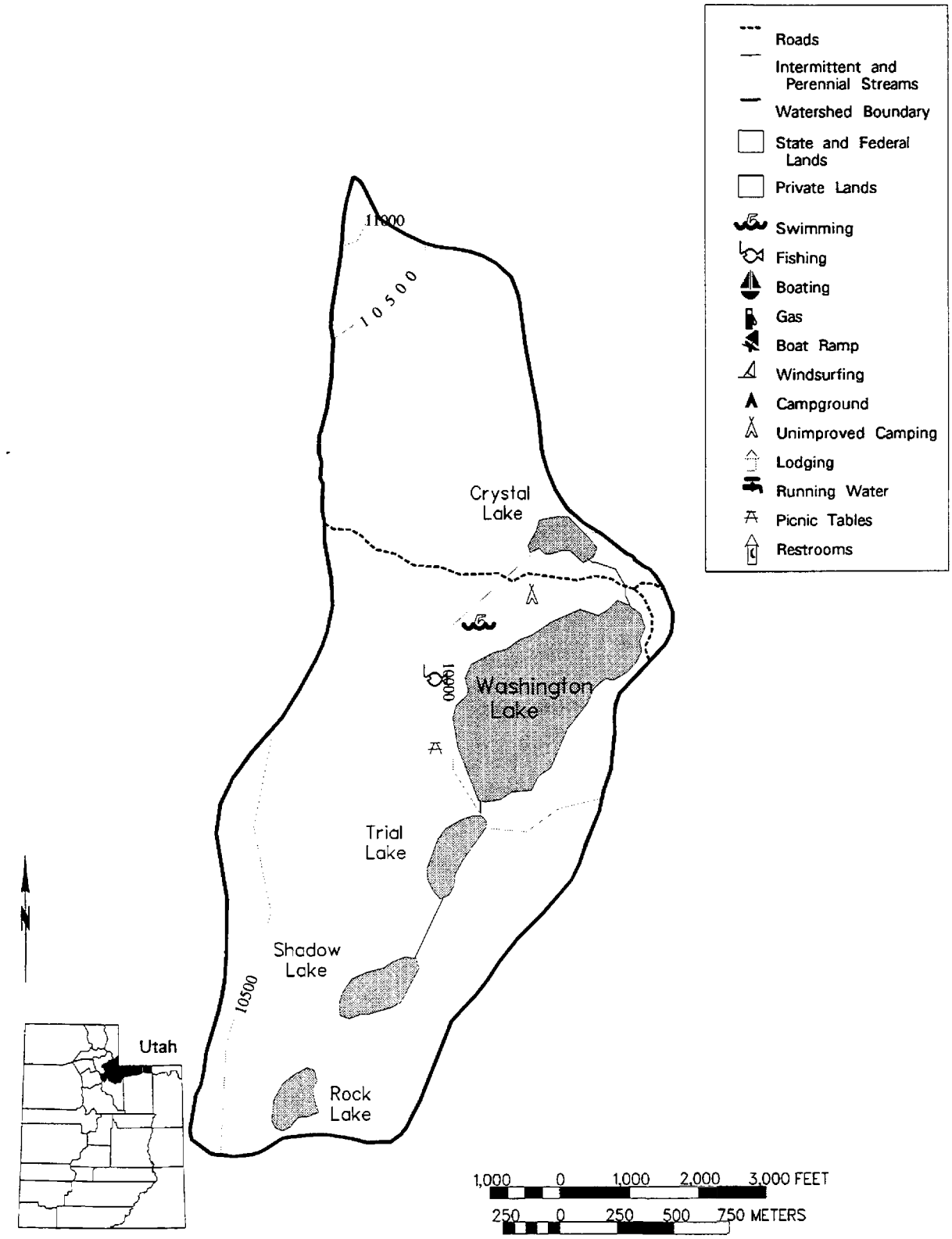
The shoreline is owned by the Wasatch-Cache National

Characteristics and Morphometry

Lake elevation (meters / feet)	3,049 / 10,000
Surface area (hectares / acres)	38.1 / 94
Watershed area (hectares / acres)	577 / 1,426
Volume (m^3 / acre-feet)	
capacity	5,180,000 / 4,195
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	16.2 / 53
mean	6.1 / 20
Length (meters / feet)	110 / 3,600
Width (meters / feet)	427 / 1,400
Shoreline (km / miles)	2.56 / 1.59

Location

County	Summit
Longitude / Latitude	110 58 01 / 40 40 32
USGS Map	Mirror Lake, UT 1967
DeLorme's Utah Atlas & Gazetteer™	Page 54, B-3
Cataloging Unit	Provo (16020203)



County in which watershed is located.

Washington Watershed

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Forest, and public access is unrestricted. Water use is primarily for irrigation, but can be used as supplementary culinary water. As part of the CUP, Washington Lake was stabilized in the fall of 1994 with the reconstruction of the dam. This lake will continue to act as a reservoir to provide downstream irrigation water. Other stabilized lakes will include Trial Lake and Lost Lake. Other lakes in the area, will be stabilized as lakes to improve the scenic and recreational value, but eliminating the lakes' ability to function as a reservoir.

Recreation

Washington Lake is in the Trial Lake area located on U-150 about four miles east of Mirror Lake or 32 miles east of Kamas. Turn left at the Trial Lake turnoff and turn left again after about 0.25 miles, follow the road for about 0.5 miles. The lake is northwest of the junction near Washington Lake. It is possible to drive a vehicle to the lake, but unless the road has been improved, high clearance vehicles are recommended.

Fishing, camping, picnicking, scenic beauty and hiking are all popular. Even though the watershed is fairly small, there are a number of upstream natural lakes. Air and water temperatures are too cold for most swimmers. The backdrop of high, barren peaks are reflected in the still water of the lake.

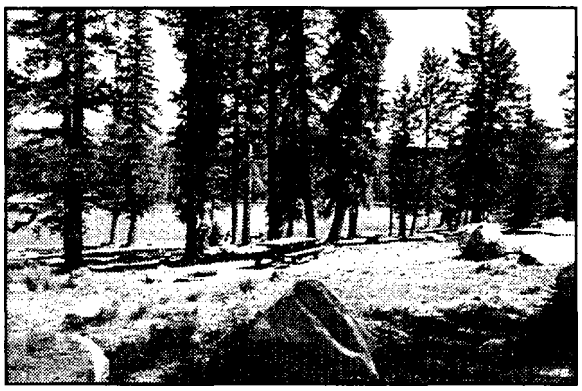
The area receives moderate recreational use throughout the summer. U-150 is closed during the winter and much of the spring, but groomed for cross country skiers, snowmobilers and hikers. The low water level from early summer to the following spring leaves large areas of mud exposed.

Although primitive camping is allowed in the area of Washington Lake, Trial Lake Campground is on the east shore of Trial Lake, with 60 campsites, picnic areas, and primitive toilets. There are several other USFS campgrounds along U-150 throughout the area. Call the Kamas Ranger District for complete backcountry camping information and regulations.

Watershed Description

Washington Lake is in an area of numerous lakes and meadows interspersed with high, alpine peaks. In this area of the Uintas, most of the high peaks have been scoured away, leaving isolated peaks, rather than the ridgelines characteristic of the central part of the range.

Defining the west edge of the watershed are Haystack Mountain and Mount Watson. Mount Watson is the



watershed high point, is 3,512 m (11,521 ft) above sea level, thereby developing a complex slope of 18.9% to the lake. There are two small streams entering the lake, the average gradient being 2.5% (130 feet per mile). The inflows drain small natural lakes in the watershed, including Azure Lake, Shadow Lake, Tail Lake, and Crystal Lake.

The watershed is made up of high mountains, lakes, and rocky outcroppings. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of marshes, pine, spruce-fir, aspen, and alpine. The watershed receives 76 - 102 cm (30 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 0 - 20 days per year.

What use of watershed land takes place is 100% recreation. The pristine nature of the area is a result of its unsuitability to other forms of exploitation by humans.

Limnological Assessment

The water quality of Washington Lake is very good. It is considered to be very soft with a hardness concentration value of approximately 8.1 mg/L ($CaCO_3$). Although there are no overall water column concentrations that exceed State water quality standards there are reported violations of parameters near the bottom of the lake. These parameters include phosphorus, dissolved oxygen and pH. At various times of the year in the hypolimnion of the lake oxygen deficiencies develop. As is apparent in the August 4, 1992 profile dissolved oxygen quickly diminishes below the thermocline. Below the 5 meter depth dissolved oxygen is well below the concentration needed to support a viable fishery. In addition these oxygen deficiencies allow for the introduction back into the water column of phosphorus bound up in the sediments. This is evident that the only values to exceed the state pollution indicator of 25 ug/L wasobtained near the bottom of the reservoir at 40 ug/L. In addition pH values tend to decline downward in the water column. It is apparent that some impairments do occur due

Limnological Data

Data sampled from STORET site: 591626

Surface Data	1992
Trophic Status	M
Chlorophyll TSI	35.81
Secchi Depth TSI	48.97
Phosphorous TSI	39.97
Average TSI	41.59
Chlorophyll a (ug/L)	1.7
Transparency (m)	2.2
Total Phosphorous (ug/L)	12
pH	6.5
Total Susp. Solids (mg/L)	<3
Total Volatile Solids (mg/L)	-
Total Residual Solids (mg/L)	3
Temperature (°C / °f)	14/57
Conductivity (umhos.cm)	14
Water Column Data	
Ammonia (mg/L)	0.04
Nitrate/Nitrite (mg/L)	0.01
Hardness (mg/L)	8.1
Alkalinity (mg/L)	5
Silica (mg/L)	1.4
Total Phosphorous (ug/L)	20
Miscellaneous Data	
Limiting Nutrient	N
DO (Mg/l) at 75% depth	1.9
Stratification (m)	3-8
Depth at Deepest Site (m)	15.0

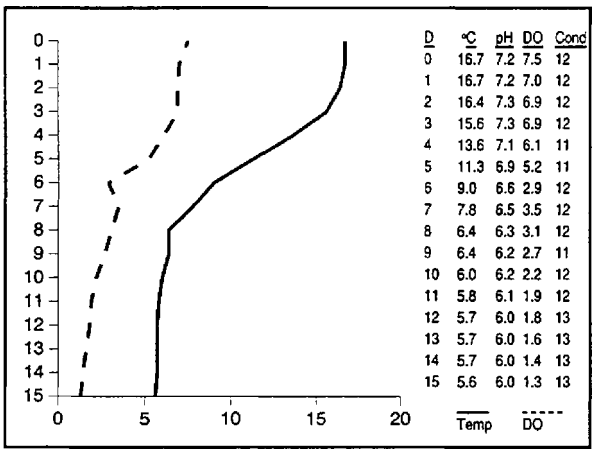
to the low dissolved oxygen concentration in the water column. The extent of impairment cannot be completely ascertained without conduction additional winter monitoring when dissolved oxygen levels can be more extensive and become more critical.

Current data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is mesotrophic in a state of moderate productivity. The lake does stratify as indicated in the included profile.

According to DWR no fish kills have been reported in recent years. The reservoir supports a population of brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*), cutthroat trout (*Oncorhynchus clarki*) redside shiners (*Richardsonius balteatus*), and Utah chub (*Gila atraria*). The lake was treated in 1970 for rough fish competition, so populations of native fishes may not be present in the lake.

The DWR stocks the lake annually with 5,000 catchable rainbow trout and in 1992, 8,000 fingerling brook trout were introduced.

Phytoplankton in the euphotic zone include the



D	°C	pH	DO	Conc
0	16.7	7.2	7.5	12
1	16.7	7.2	7.0	12
2	16.4	7.3	6.9	12
3	15.6	7.3	6.9	12
4	13.6	7.1	6.1	11
5	11.3	6.9	5.2	11
6	9.0	6.6	2.9	12
7	7.8	6.5	3.5	12
8	6.4	6.3	3.1	12
9	6.4	6.2	2.7	11
10	6.0	6.2	2.2	12
11	5.8	6.1	1.9	12
12	5.7	6.0	1.8	13
13	5.7	6.0	1.6	13
14	5.7	6.0	1.4	13
15	5.6	6.0	1.3	13

following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Botrydiopsis sp.	0.093	30.62
Haematococcus sp.	0.089	29.16
Pediastrum tetras	0.030	9.84
Scenedesmus bijuga	0.022	7.29
Gloeocystis vesiculosa	0.017	5.47
Gomphosphaeria lacustris	0.014	4.56
Pennate diatoms	0.012	3.83
Chroococcus sp.	0.011	3.64
Ankistrodesmus falcatus	0.009	2.86
Oocystis sp.	0.008	2.73
Total	00.808	
Shannon-Weaver [H']	1.89	
Species Evenness	0.82	
Species Richness	0.46	

The phytoplankton community is dominated by the presence of green algae.

Pollution Assessment

Nonpoint pollution sources include the following: sedimentation and nutrient loading from grazing, and litter or wastes from recreation.

Grazing takes place around the reservoir and throughout the watershed.

There are no point sources of pollution in the watershed.

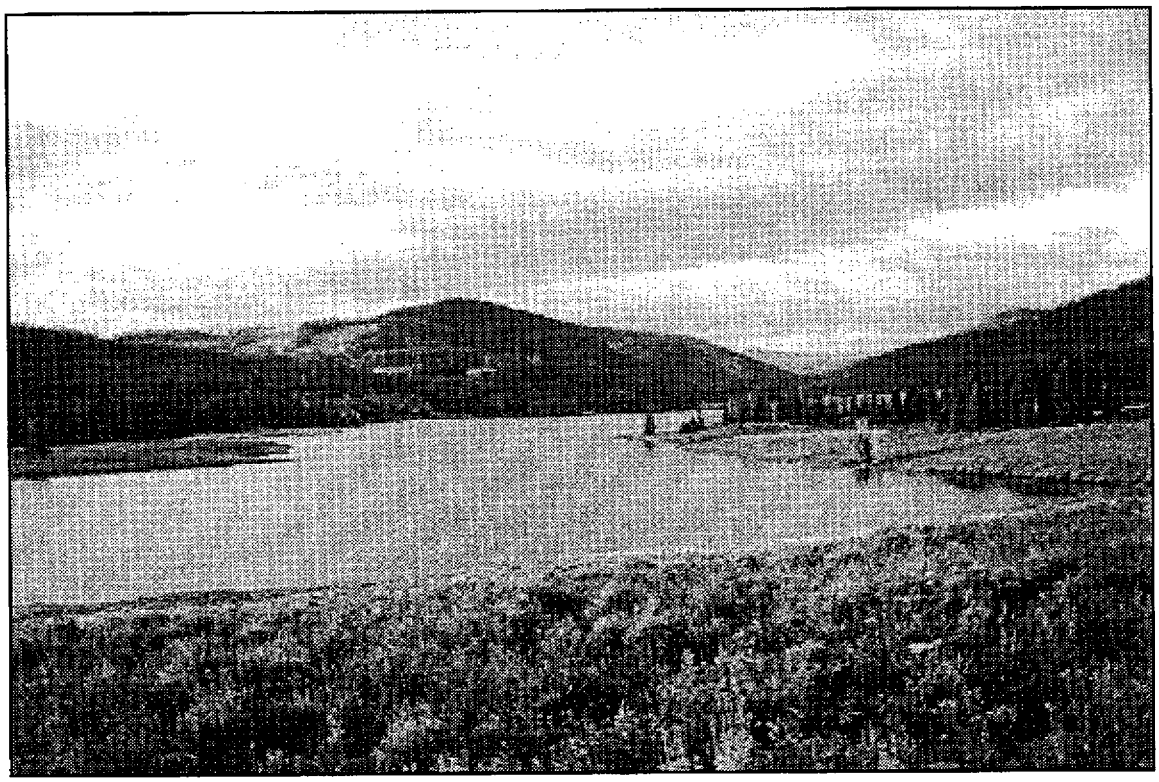
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Mountainland Association of Governments	377-2262
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Wasatch-Cache National Forest	524-5030
Kamas Ranger District	783-4338
Recreation	
Mountainland Travel Region (Provo)	377-2262
Reservoir Administrator	
Timpanogos Canal Company	654-1346

WHITNEY RESERVOIR



Introduction

Whitney Reservoir is in the headwaters of the West Fork of the Bear River in the western High Uintas. It is located at the base of Moffit Peak, nestled at the base of several ridges that climb rapidly above the reservoir. During early spring and summer this area displays great scenic beauty. Snow drifts that have accumulated near the upper ridges is usually present late into summer. From here, the Bear flows north to Wyoming. The river crosses the 111th meridian several times as it meanders through Utah and Wyoming before it enters into Idaho. It eventually turns south and works it way back through Utah and into the Great Salt Lake.

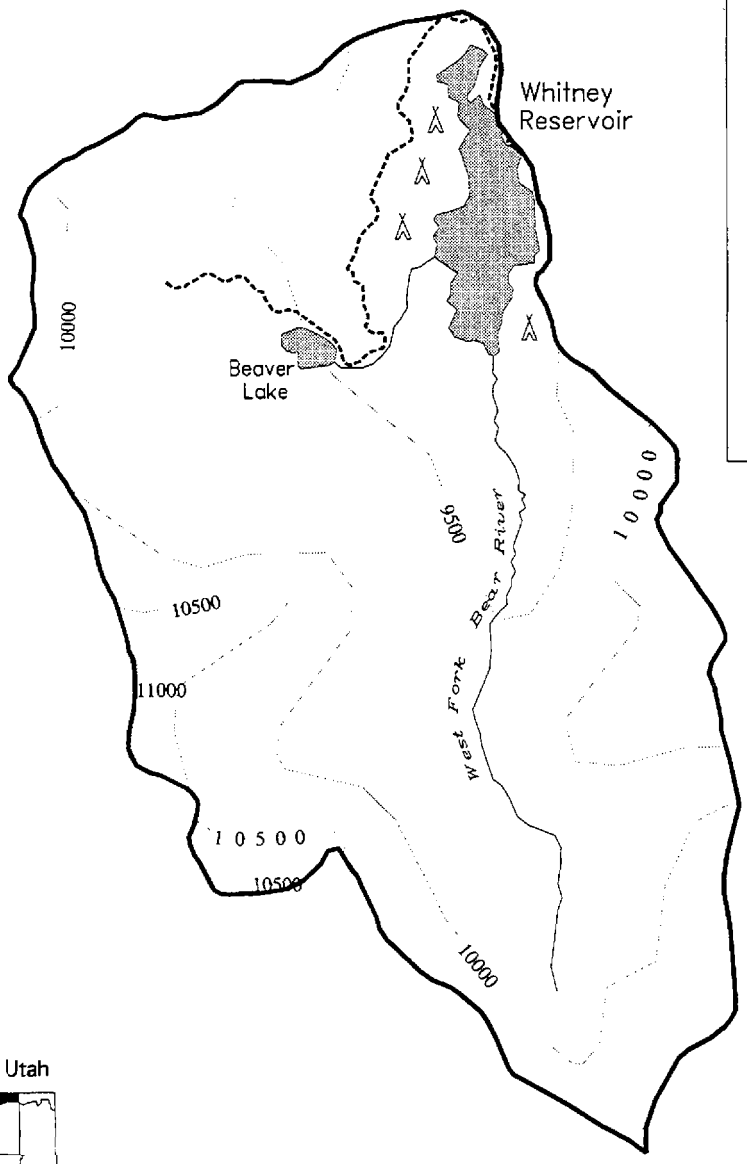
Characteristics and Morphometry

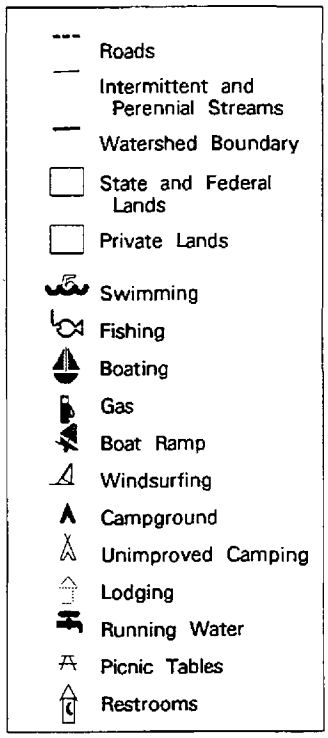
Lake elevation (meters / feet)	2,822 / 9,260
Surface area (hectares / acres)	76 / 188
Watershed area (hectares / acres)	1,620 / 4,002
Volume (m^3 / acre-feet)	
capacity	7,180,000 / 5,820
conservation pool	616,500 / 500
Annual inflow (m^3 / acre-feet)	40,070,0000 / 33,000
Retention time (years)	5.7
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	21 / 70
mean	9.4 / 31
Length (km / miles)	1,829 / 6001
Width (km / miles)	488 / 1601
Shoreline (km / miles)	4.2 / 2.6

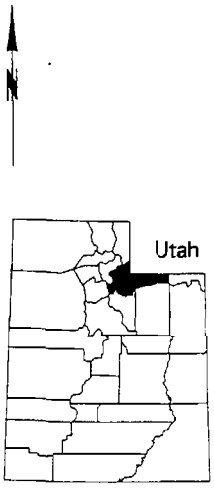
Location

County	Summit
Longitude / Latitude	110 55 44 / 40 50 06
USGS Map	Whitney Reservoir, UT 1972
DeLorme's Utah Atlas & Gazetteer™	Page 54, A-3
Cataloging Unit	Upper Bear (16010101)

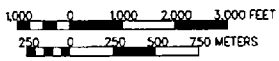
The shoreline is owned by the Wasatch-Cache National Forest, and public access is unrestricted. Water use in addition to recreation is used primarily for irrigation in Wyoming for the Upper Bear River and Mill Creek Water Users Association.. The reservoir was created in 1966 by construction of an earth-fill dam and several dikes. Water may be drained each year down to the 500 acre-foot







County in which watershed is located.



Whitney Watershed

conservation pool each summer.

Recreation

Whitney Reservoir is west of the Mirror Lake Highway, U-150, after it drops down from Hayden Pass and follows the Middle Fork Bear River towards the Wyoming State Line. Whitney Road, FS-032, a gravel road running from U-150 to and beyond Whitney Reservoir, is found about 1.5 miles north of Hayden Fork Campground and 1.5 miles south of Stillwater campground. It climbs the valley wall with a several switchbacks to the plateau. Continue on this fairly good gravel base road for approximately five miles to the West Fork of the Bear River. Shortly after crossing the river take FS-069 which leads south to the reservoir. This road will pass the Whitney Guard Station which is viable from the junction (about 0.5 miles in) and and continues about two miles further to Whitney Reservoir. The route around the reservoir is not maintained as well and travel can be difficult to Beaver Lake or the south end of the reservoir.

Fishing, camping, picnicking, scenic beauty and hiking are all popular. There are relatively few other lakes in the area, and all are much smaller than the reservoir. Most are beaver ponds rather than glacial lakes, and all are strikingly beautiful. The low water level from early summer to the following spring leaves large areas of mud exposed in the reservoir.

The area receives moderate recreational use throughout the summer. U-150 is closed during the winter and much of the spring, but groomed for cross country skiers, snowmobilers and hikers. Whitney Reservoir is extremely remote in the winter.

There are no campgrounds at the lake, but primitive camping is permitted. Register with the Kamas Ranger Station and familiarize yourself with the backcountry use regulations and follow them. This will preserve the quality of the reservoir and watershed.

There are numerous USFS campgrounds along U-150, both north and south of the Whitney Road turnoff.

Watershed Description

Whitney Reservoir is in a basin covered with marshes and beaver ponds and surrounded by high peaks. The area is in the extreme western Uintas, where elevations are lower and glaciation did not produce the striking valleys and peaks characteristic of the central part of the range. Construction of the reservoir destroyed some of the wetland area, but ponds and marshes are still intact above the high water line of the reservoir, as is easily seen on the USGS 7.5' map.

The watershed is bounded to the south by the hogback ridges surrounding the uplifted precambrian rock of the Uinta Mountains. The mountains are chemically and physically different than the peaks further south composed of the actual Uinta Mountain Group. Moffit Peak and Gold Hill are high outcroppings of Weber Sandstone. The Uinta Mountain Group (rock formation) is chemically inert, which is why lakes in the Uintas have soft water. Whitney Reservoir is chemically similar to reservoirs in other mountains ranges, but not other lakes in the Uintas.

The watershed is quite small, almost visible in its entirety from the reservoir. The watershed high point, Moffit Peak, is 3,354 m (11,003 ft) above sea level, thereby developing a complex slope of 18.9% to the reservoir. There are at least four small, perennial streams entering the lake, the average gradient being 4.0% (210 feet per mile). The inflows drain small natural lakes in the watershed, many of which are beaver ponds rather than glacial lakes. Beaver activity probably modifies the drainage such that water flows in these streams year round, rather than only during spring and summer runoff.

The watershed is made up of high mountains, lakes, meadows, and rocky outcroppings. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of marshes, pine, spruce-fir, aspen, and alpine. The watershed receives 76 cm (30 inches) of precipitation annually. The frost-free season around the reservoir is 0 - 40 days per year.

What use of watershed land takes place is 100% recreation. The pristine nature of the area is a result of its unsuitability to other forms of exploitation by humans.

Limnological Assessment

The water quality of Whitney Reservoir is very good. It is considered to be moderately hard with a hardness concentration value of approximately 109 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are total phosphorus and dissolved oxygen. Although the average concentration of total phosphorus in the water column has not exceeded the recommended pollution indicator for phosphorus of 25 ug/L, concentrations from samples in the hypolimnion were 45 ug/L and 59 ug/L in 1989 and 1991 respectively. This increased concentration are enhanced when anoxic conditions are present near the bottom. Dissolved oxygen concentrations in late summer substantiate the fact that water quality impairments do exist. Although the profile from September 3, 1991 does not indicated a substantial decline in the dissolved oxygen at the time of sampling evidence has been obtained that extensive dissolved oxygen depletions do occur in the reservoir prior to turnover in late summer. In August of 1989 there was essentially no dissolved oxygen below the thermocline and the profile from June, 1991 indicates the development of anoxic conditions in the hypolimnion after the reservoir

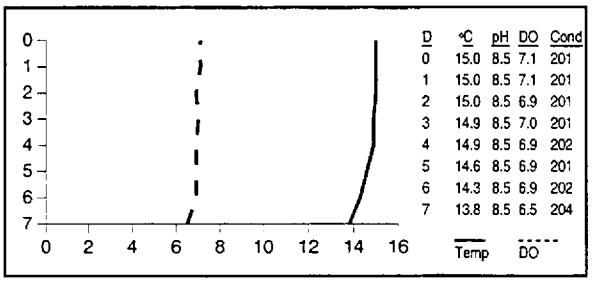
Limnological Data

Data sampled from STORET site: 590778

Surface Data	1981	1989	1991
Trophic Status	-	M	M
Chlorophyll TSI	-	49.11	41.38
Secchi Depth TSI	-	48.00	44.91
Phosphorous TSI	-	23.20	46.22
Average TSI	-	40.10	44.13
Chlorophyll a (ug/L)	-	6.6	3.0
Transparency (m)	-	2.3	2.9
Total Phosphorous (ug/L)	20	4	13
pH	8.3	8.8	8.4
Total Susp. Solids (mg/L)	<5	-	4
Total Volatile Solids (mg/L)	-	-	4
Total Residual Solids (mg/L)	-	-	2
Temperature (°C / °f)	15/59	13/55	13/55
Conductivity (umhos.cm)	169	221	189
Water Column Data			
Ammonia (mg/L)	0.05	<0.05	0.03
Nitrate/Nitrite (mg/L)	0.37	0.15	.18
Hardness (mg/L)	112	-	105
Alkalinity (mg/L)	105	-	107
Silica (mg/L)	-	-	1.25
Total Phosphorous (ug/L)	40	13	19
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	8	0.3	6.9
Stratification (m)	3-8	6-7	NO
Depth at Deepest Site (m)	14	11.0	7.0

becomes stratified.

Data suggest that the reservoir is a nitrogen limited system with TSI values indicating the reservoir is mesotrophic. The reservoir was stratified during a summer monitoring trip was in June, 1991 at a depth of 4-6 meters, but that by September 3, the reservoir had turned over due to drawdown which left the lake with a maximum depth of only 7 meters. These conditions are deleterious to the fishery during the summer period and may be even more sever during later winter. This period needs to be evaluated



D	°C	pH	DO	Cond
0	15.0	8.5	7.1	201
1	15.0	8.5	7.1	201
2	15.0	8.5	6.9	201
3	14.9	8.5	7.0	201
4	14.9	8.5	6.9	202
5	14.6	8.5	6.9	201
6	14.3	8.5	6.9	202
7	13.8	8.5	6.5	204

to determine the extent of impairment to the fishery.

According to DWR no fish kills have been reported in recent years. The reservoir supports populations of brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*), and cutthroat trout (*Oncorhynchus clarki*). The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake. Current stocking reports indicate that DWR stocks the reservoir annually with approximately 4,000 catchable rainbow trout, although historically they have stocked the reservoir with fingerling of all species present.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	5.282	88.01
Dinobryon divergens	0.330	5.50
Pandorina morum	0.222	3.71
Asterionella formosa	0.057	0.94
Tolypothrix sp.	0.055	0.93
Pennate diatoms	0.030	0.50
Ankistrodesmus falcatus	0.013	0.22
Oocystis sp.	0.008	0.14
Centric diatoms	0.003	0.05
Total	6.000	
Shannon-Weaver [H']	0.53	
Species Evenness	0.24	
Species Richness	0.36	

The phytoplankton community is dominated by the presence of green algae and flagellates indicative of fairly good water quality and moderate productivity.

Pollution Assessment

Nonpoint pollution sources include the following: sedimentation and nutrient loading from grazing; litter and wastes from recreation.

Grazing takes place around the reservoir and throughout the watershed. Two sheep allotments are grazed in the watershed and it is not uncommon for the unloading of sheep to occur in direct proximity to the reservoir.

There are no point sources of pollution in the watershed.

Beneficial Use Classification

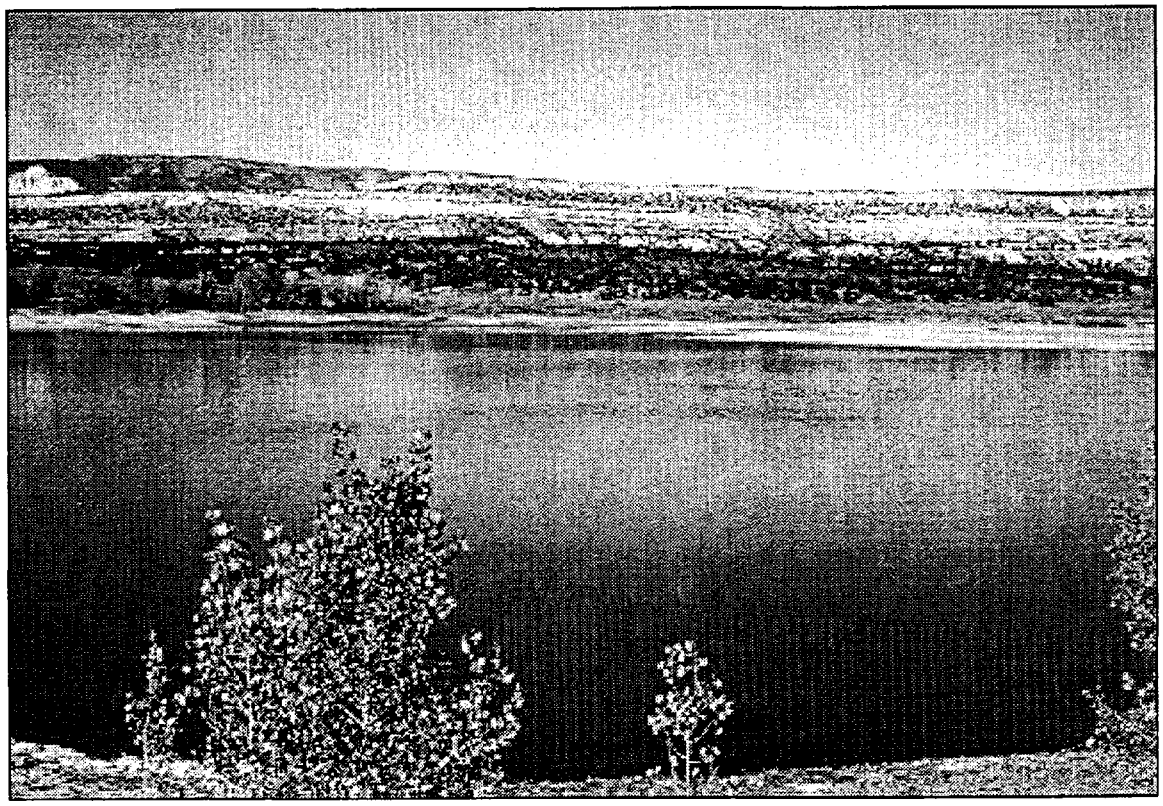
The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and

agricultural uses (4).

Information

Management Agencies	
Mountainland Association of Governments	377-2262
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Wasatch-Cache National Forest	524-5030
Kamas Ranger District	783-4338
Recreation	
Mountainland Travel Region (Provo)	377-2262
Reservoir Administrator	
Upper Bear River and Mill Creek [Irrigation Co.]	307-789-2596

WIDE HOLLOW RESERVOIR



Introduction

Wide Hollow Reservoir is an intermediate-sized off-stream reservoir of the Escalante RIver in southern Utah. The reservoir shoreline is primarily privately owned with a State Park located on the southeastern corner. The Escalante State Park is noted for colorful deposits of mineralized wood and dinosaur bones. Currently there are no restriction on public access.

Defined beneficial uses include: water recreation excluding swimming, propagation of cold water species of game fish and aquatic life, and agricultural needs.

Characteristics and Morphometry

Lake elevation (meters / feet)	1,807.7 / 5,931
Surface area (hectares / acres)	58.7 / 145
Watershed area (hectares / acres)	70,822 / 175,000
Volume (m^3 / acre-feet)	
capacity	2,866,658 / 2,324
conservation pool	0
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	7 / 23
mean	4.9 / 16
Length (meters / feet)	975.3 / 3,200
Width (meters / feet)	671 / 2,200
Shoreline (km / miles)	2.59 / 1.6

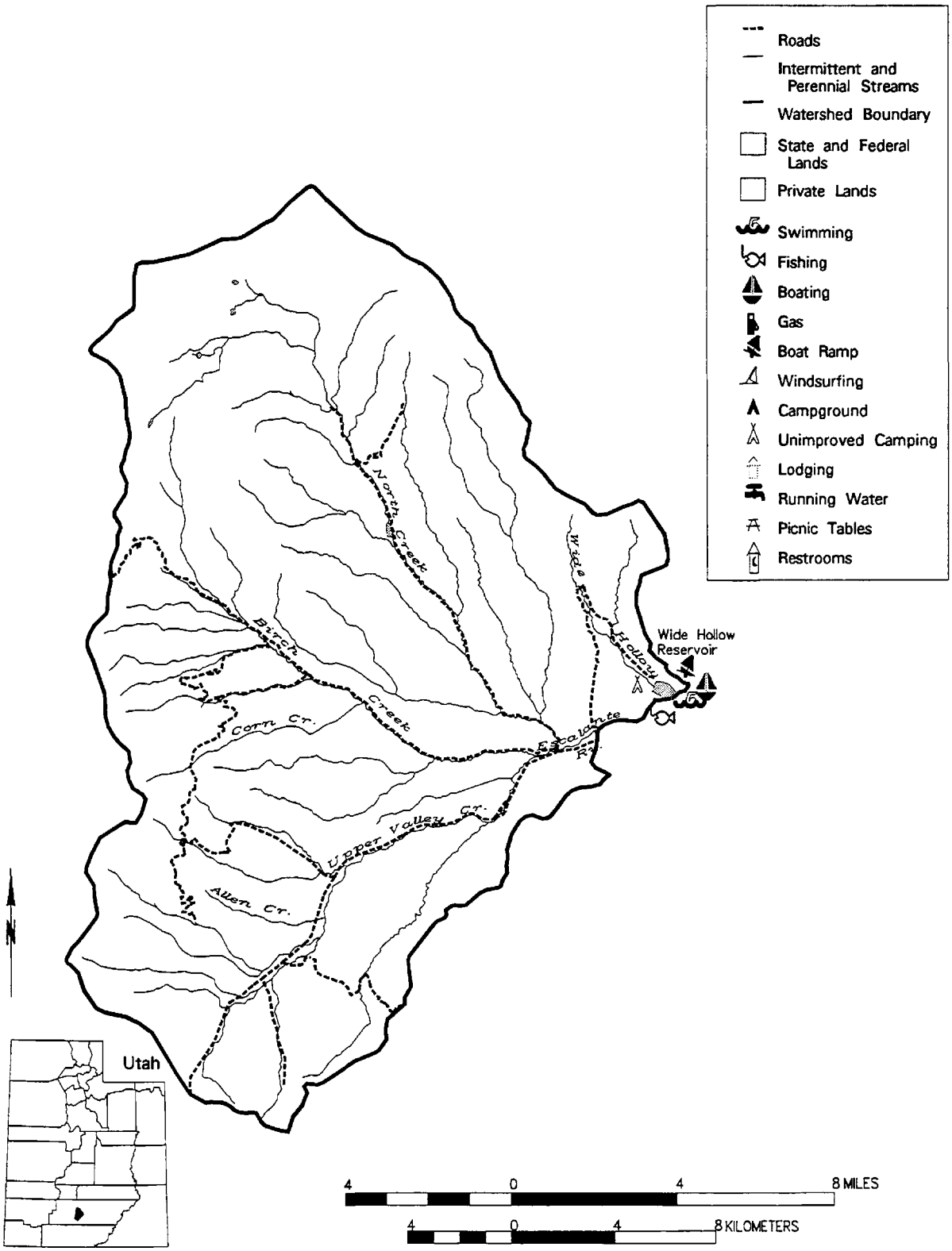
Recreation

Location

County	Garfield
Longitude / Latitude	111 38 13 / 37 47 14
USGS Map	Wide Hollow Reservoir, Utah 1964
DeLorme's Utah Atlas and Gazetteer™	Page 19, A-6
Cataloging Unit	Escalante River (14070005)

Wide Hollow Reservoir is a short distance from U-12 and is accessible via a gravel road. From downtown Escalante, travel 1.5 miles west and turn north. The reservoir is 3/4 miles north of U-12.

Fishing, waterskiing, boating and swimming are the primary



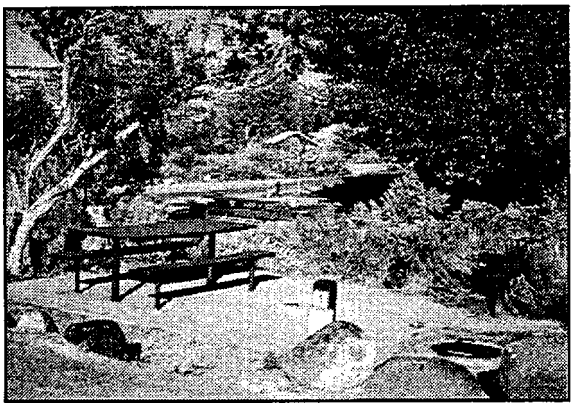
County near which watershed is located.

Wide Hollow Watershed

<k140>

uses of the reservoir. There is an improved public boat ramp at the reservoir. Usage is fairly heavy.

Escalante Petrified Forest State Park is the only public camping facility in the area. Access is from U-12 between downtown Escalante and Wide Hollow Reservoir. It has 24 campsites, vault toilets and picnic areas. Usage fees are collected.



Limnological Data

Data sampled from STORET site: 595386

Surface Data	1981	1990	1992
Trophic Status	E	M	M
Chlorophyll TSI	-	35.51	39.59
Secchi Depth TSI	50.01	51.94	45.16
Phosphorous TSI	64.35	51.53	46.97
Average TSI	57.18	46.33	43.91
Chlorophyll a (ug/L)	-	1.7	2.5
Transparency (m)	-	1.8	2.8
Total Phosphorous (ug/L)	30	27	20
pH	-	9.3	8.8
Total Susp. Solids (mg/L)	<5	4	<3
Total Volatile Solids (mg/L)	-	-	1
Total Residual Solids (mg/L)	-	-	2
Temperature (°C / °f)	-	21/69	21/69
Conductivity (umhos.cm)	-	528	433
Water Column Data			
Ammonia (mg/L)	0.05	0.03	0.03
Nitrate/Nitrite (mg/L)	0.12	0.04	0.15
Hardness (mg/L)	206	207	174
Alkalinity (mg/L)	188	173	157
Silica (mg/L)	-	-	10.5
Total Phosphorous (ug/L)	35	27	16
Miscellaneous Data			
Limiting Nutrient	N	N	N
DO (Mg/l) at 75% depth	10.2	4.4	8.4
Stratification (m)	NO	NO	NO
Depth at Deepest Site (m)	5	1.0	4.0

Watershed Description

Wide Hollow Reservoir is in Wide Hollow, a small valley north of the Escalante River. The area is arid desert on the east side of the Escalante Mountains and south of the Aquarius Plateau. Steep, forested slopes rise from Wide Hollow for 5-10 miles up to these high plateaus.

While the reservoir is located 1/2 mile north of the Escalante River, it receives most of its water from the river via a short canal. The natural watershed of Wide Hollow composes only 7% of the total watershed area.

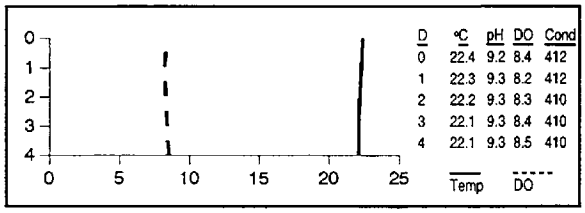
The watershed high point, Mud Springs Point, is 3,283 m (10,770 ft) above sea level, thereby developing a complex slope of 5.8% to the lake. The average stream gradient above the reservoir is 5.6% (298 feet per mile).

The vegetation communities are comprised of pinyon-juniper, grass-sage, saltbrush, shadscale-greasewood, mahonia, mountain mahogany, grass-forbes, pine, aspen, spruce-fir and oak. The watershed receives 31 - 51 cm (12 - 20 inches) of precipitation annually with a frost-free season of 100 - 120 days at the reservoir.

Land use is multiple use and recreation. WHile the upper watershed is in Dixie National Forest, low elevation areas surrounding the reservoir is privately owned, and the region between the lowlands and the national forest boundary is BLM land.

Limnological Assessment

The water quality of Wide Hollow Reservoir is good. It is considered to be hard with a hardness concentration value of approximately 196 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are temperature, pH, total phosphorus and dissolved oxygen. All of these exceedences are sporadic at various times of the year and are not present on a regular basis. Temperatures increase in late summer and exceed the standard established for a cold water fishery (20°C). These elevated values throughout the water column due to the shallowness later in the year could be responsible for some fish kills that are observed. On August 20, 1992 the maximum depth of the reservoir was 4 meters with temperatures in excess of 22° C throughout the water



D	°C	pH	DO	Cond
0	22.4	9.2	8.4	412
1	22.3	9.3	8.2	412
2	22.2	9.3	8.3	410
3	22.1	9.3	8.4	410
4	22.1	9.3	8.5	410

column. The rise in pH values is in part due to photosynthetic activity and elevated total phosphorus concentrations and reduced dissolved oxygen levels are only sporadic in the water column and do not appear to impair those beneficial uses defined for the reservoir.

Data suggest that the reservoir is currently a nitrogen limited system with TSI values indicating that the reservoir is mesotrophic. The reservoir does not typically stratify due to the shallow nature of the reservoir.

According to DWR an occasional summer fish kill does occur probably due to elevations in water temperatures. The reservoir was treated for the removal of nongame fish in 1981 and 1989. The reservoir is managed to support a population of rainbow trout (*Oncorhynchus mykiss*). Current stocking reports indicate that DWR stocks the reservoir with 5,000 catchable rainbow trout annually.

Heavy macrophytes have been documented to be present in the shallow areas of the reservoir.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Unknown spherical green alga	0.685	29.26
Ceratium hirundinella	0.936	16.26
Trachelomonas sp.	0.889	15.45
Tetraedron minimum	0.528	9.17
Pennate diatoms	0.456	7.92
Dinobryon divergens	0.086	1.49
Centric diatoms	0.062	1.08
Scenedesmus quadricauda	0.050	0.87
Euglena sp.	0.033	0.58
Scenedesmus bijuga	0.033	0.58
Oscillatoria sp.	0.030	0.52
Staurastrum gracile	0.017	0.30
Oocystis sp.	0.009	0.15
Mougeotia sp.	0.006	0.10
Total	4.785	
Shannon-Weaver [H']	1.93	
Species Evenness	0.71	
Species Richness	0.63	

The phytoplankton community is dominated by the presence of green algae and flagellates.

Pollution Assessment

Nonpoint pollution sources are: sedimentation and nutrient loading from grazing, and wastes or litter from recreation. Cattle graze in the watershed and in the vicinity of the reservoir.

There are no point pollution sources in the watershed.

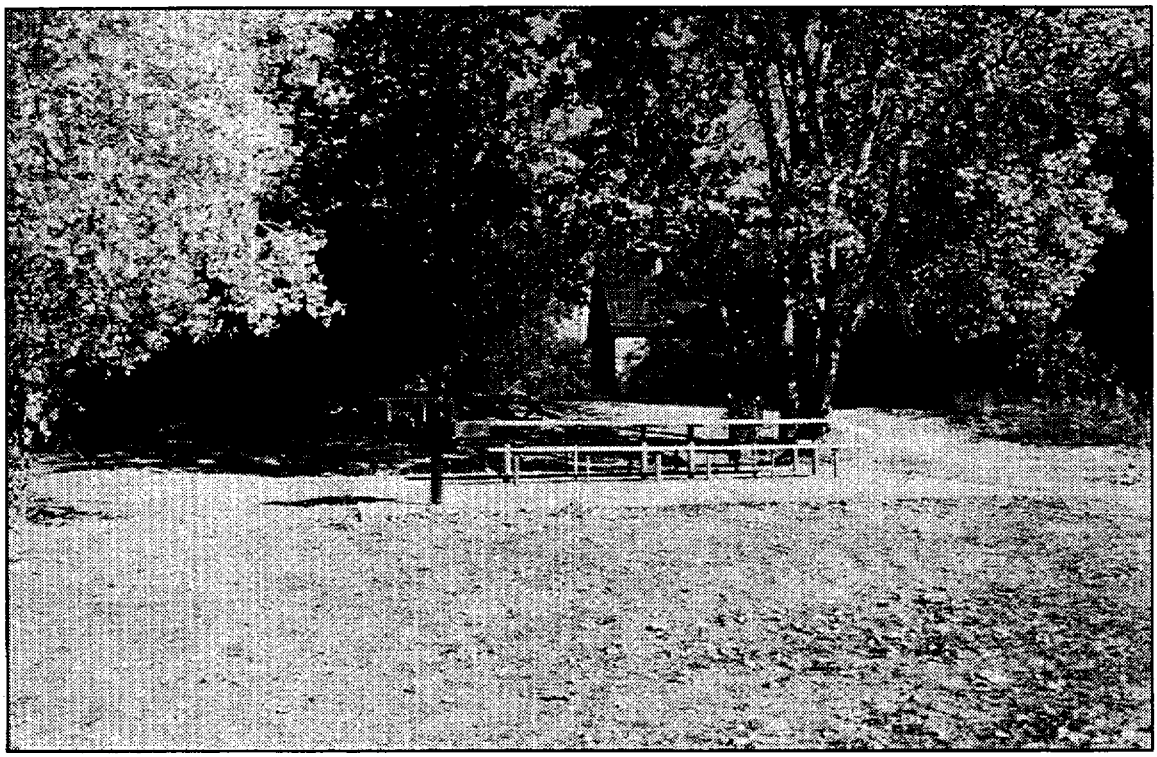
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Bureau of Land Management, Escalante Office	826-4291
New Escalante Irrigation Company	
Five County Association of Governments	
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146

WILLARD BAY RESERVOIR



Introduction

Willard Reservoir is a portion of the Great Salt Lake that was diked off and dewatered. It was then filled with water from the Weber River that would otherwise have flowed into the Great Salt Lake, and stored for irrigation and other uses as may be needed on the northern Wasatch Front. It is located west of Willard and Willard Peak, and is bounded by I-15 on its extreme eastern end. It is readily viable from I-15 and is directly adjacent to the Great Salt Lake. At 10,000 surface acres, this is by far the largest reservoir in the most northern part of Utah. A state park with full facilities is on the northeastern shore. It is also known as Willard Bay Reservoir or Arthur V. Watkins Reservoir.

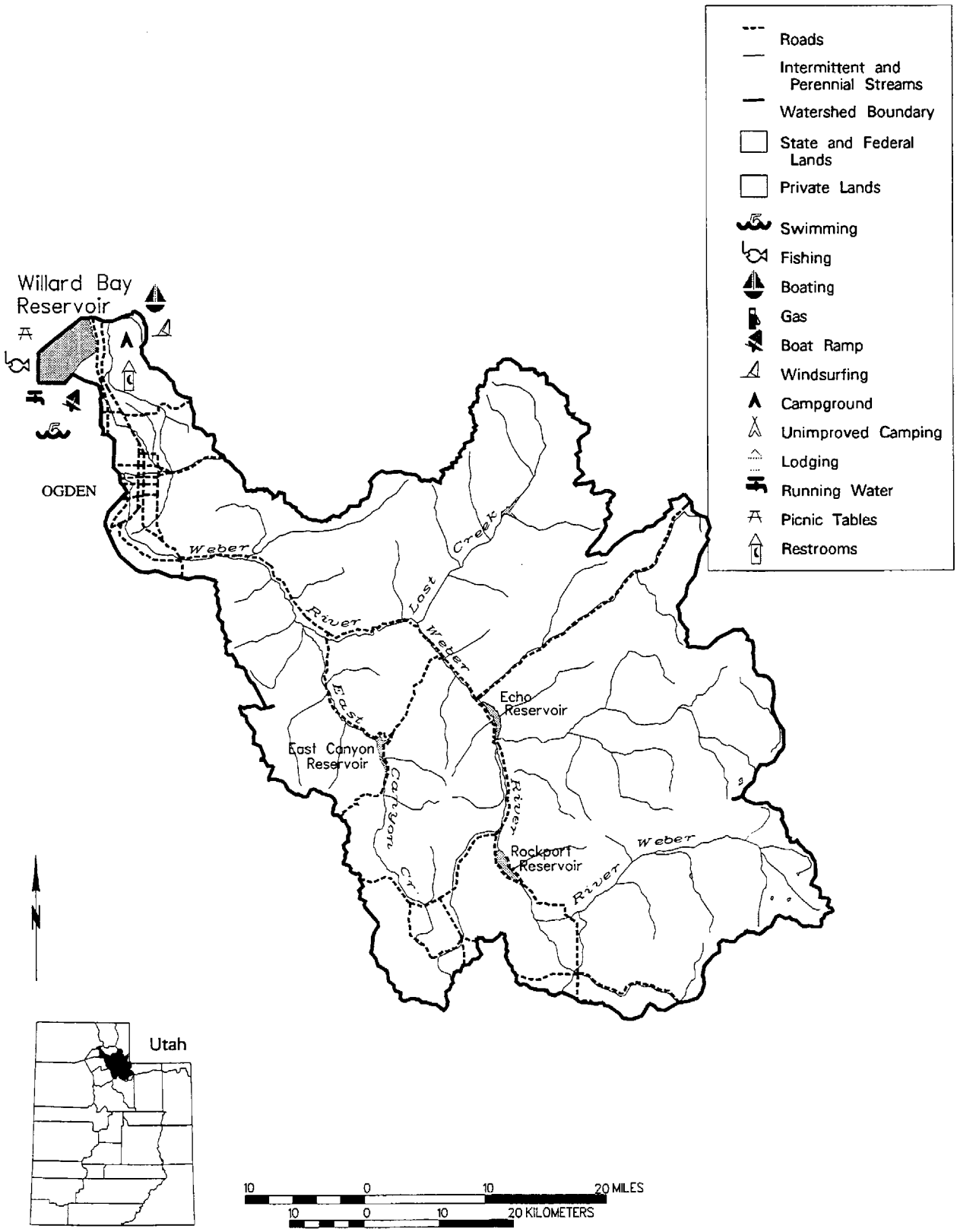
Characteristics and Morphometry

Lake elevation (meters / feet)	1,287 / 4,223
Surface area (hectares / acres)	4,047 / 10,000
Watershed area (hectares / acres)	485,830 / 1,200,000
Volume (m^3 / acre-feet)	
capacity	238,435,910 / 193,300
conservation pool	0
Annual inflow (m^3 / acre-feet)	188,108,750 / 152,500
Retention time (years)	1.4
Drawdown (m^3 / acre-feet)	62,754,409 / 50,875
Depth (meters / feet)	
maximum	11 / 36.1
mean	5.9 / 19.4
Length (km / miles)	9.2 / 5.7
Width (km / miles)	7.4 / 4.6
Shoreline (km / miles)	25.2 / 15.6

Location

County	Box Elder
Longitude / Latitude	112 05 27 / 41 22 32
USGS Maps	Willard 1955, Plain City 1955, Plain City SW 1972
DeLorme's Utah Atlas & Gazetteer™	Page 60, B-2 - C-2
Cataloging Unit	Great Salt Lake (16020310)

Willard Reservoir was created in 1964 by the construction of 14 mile long rectangular earthen dike, enabling the reservoir to be filled 20 feet above the elevation of the Great Salt Lake. Reservoir shoreline is owned by the Department of the Interior and the State of Utah. Public access is unrestricted, but usage fees are charged in the state park areas. Reservoir water is used for irrigation (both



County near which watershed is located.

Willard Bay Watershed

<k168>

suburban and agricultural) (85%) and culinary (15%). The Weber River Water Conservancy District administers the water use. Water is pumped in and out as it is available or needed elsewhere in the district. The fraction allotted to culinary use will probably increase as suburban growth continues to displace agricultural land. This reservoir may also play a vital part in the development of Bear River water for use on the Wasatch Front.

Recreation

Willard Reservoir is accessible from I-15 between Ogden and Brigham City. The primary recreation area is at the Willard Exit (Exit 360). It is only a short distance west of the freeway to the recreation area. A recreational area on the southern part of the reservoir is just three miles west of I-15 at Exit 354. Both locations are well marked and easily accessed on paved roads.

Fishing, boating, sailing, swimming, picnicking, camping, and water skiing are all popular. This is the largest body of fresh water in the Salt Lake Valley. The low elevation results in warmer air and water temperatures than in mountain reservoirs, making water recreation a prime importance earlier in the spring and later in the fall.

Recreational facilities at the reservoir include marinas for either daily or seasonal slip rental, campsites (62 in the north, 30 in the south), modern rest rooms, hot showers, fish cleaning stations, picnic areas, swimming areas, and concessionaires with gas, refreshments, groceries, and sundries. The south site also has boat rentals. The north area is open all year, while the south area is closed during the winter. In 1992, the park recorded 270,791 visitors, ranging from 1,103 in January to 59,022 in July.

There is a private campground in Willard Town (See info box).

Watershed Description

Willard Reservoir's natural watershed consists of Willard Peak and the narrow strip of valley floor between the mountain and the reservoir. This is the area that has always drained into Willard Bay of the Great Salt Lake. Willard Peak, one of the highest and most spectacular parts of the northern Wasatch Front, rises a mile feet above the reservoir to 2,976 m (9,764 feet), forming a complex slope of 29.2% to the reservoir. The entire face of the mountain is almost entirely exposed rock with slopes of 100%. Jagged teeth rise hundreds of feet above narrow draws.

Only a small percentage of the inflow comes from the natural watershed, though, and much of it is diverted for agricultural use south of Willard. Most of the inflow comes in through the Willard Canal, which is a diversion of the Weber River in Ogden. The Weber River watershed covers much of the back side of the Wasatch Front, the land east of the Wasatch Front, and a small portion of the eastern Uintas. The mountainous areas have heavy precipitation and are forested, while the other areas, including the watersheds of Cottonwood Canyon, much of East Canyon Creek, Lost Creek, Echo Canyon, Chalk Creek, and all areas along the Weber River, have rolling hills with predominantly sage-grass vegetation interspersed with aspen and spruce-fir in higher elevations and north facing slopes.

The Weber River watershed high point, Bald Mountain in the Uintas, is m (11,947 ft) above sea level, thereby developing a complex slope of 2.8% to the reservoir. Because there is no gradient to the Willard Canal, water can be transported in either direction depending upon the need. The average stream gradient of the lower Weber River is about 0.5% (25 feet per mile). The inflow and outflow is the Willard Canal depending upon which way the water is pumped into the canal. Several streams flow in from the natural watershed, including Willard Creek, Cold Springs Creek, and First Salt Creek. Upstream impoundments include East Canyon Reservoir, Lost Creek Reservoir, Echo Reservoir, Rockport Lake, and Smith and Morehouse Reservoir.

The watershed is made up of high mountains, mountains valleys, plateaus, lake terraces, alluvial fans, valley bottoms, and playas. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of alpine, pine, aspen, spruce-fir, oak-maple, sage-grass, shadscale and greasewood. The watershed receives 30 - 102 cm (12 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 140 - 160 days per year.

Land use in the watershed has not been quantified. The area along the Wasatch Front is urban, and upstream urban areas include Morgan, Henefer, Coalville, Kamas, the Snyderville Basin, and Park City. Mountain valleys are used for agriculture, with the exception of the Snyderville Basin, which is suburban. National Forest and BLM lands are

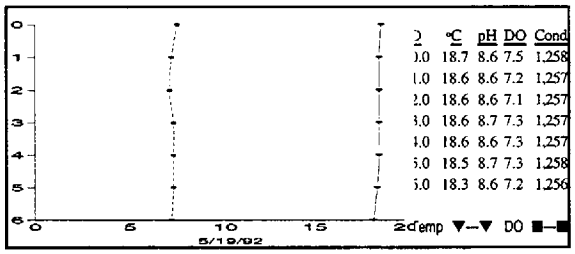
predominantly multiple use, with some logging taking place at the headwaters of the Weber and a few mining operations scattered throughout the watershed. Much of the watershed (probably well over 50%) is private grazing land, including almost all of every major tributary watershed to the Weber River. Private lands are subject to various types of development.

Limnological Assessment

The water quality of Willard Bay Reservoir is fairly good. It is considered to be hard with a hardness concentration value of approximately 223 mg/L ($CaCO_3$). The one parameters that has exceeded State water quality standards for defined beneficial uses is total phosphorus. The average concentration of total phosphorus in the water column for the two study periods is 67.5 and 75 ug/L which both exceed the recommended pollution indicator for phosphorus of 25 ug/L.

Data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is very productive in a state of eutrophic to hypereutrophic conditions. The reservoir typically does not stratify due to the shallow nature of the reservoir. The profile from May 19,1992 although early in the year, substantiates the uniform conditions typically found in the water column.

According to DWR no fish kills have been reported in recent years. The reservoir supports populations of black crappie (*Pomoxis nigromaculatus*), channel catfish (*Ictalurus punctatus*), black bullhead (*Ictalurus melas*), bluegill (*Lepomis macrochirus*), walleye (*Stizostedion vitreum*), spot tailed shiner (*Notropis hudsonius*), sand shiner (*Notropis stramineus*), and white ass (*Morone chrysops*). *Potamogeton* is the dominant submergent macrophyte. Bottom fauna are primarily chironomids and oligochaete. Zooplankton include *Daphnia*, *Diaptomus*, *Nauplius*, and *Rotifers*. The lake has



not been treated for rough fish competition, but there are no native fishes in the reservoir. DWR does not conduct an annual stocking program but relies upon the perpetuation of those species present in the reservoir.

The reservoir has not been treated by the DWR to control rough fish competition, but there are no fishes native to Willard Bay, as it was originally part of the Great Salt Lake.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Centric diatoms	4.226	41.41
Pennate diatoms	4.048	39.67
Unknown spherical green alga	0.545	5.34
Staurastrum sp.	0.500	4.90
Melosira granulata	0.375	3.67
Ankistrodesmus falcatus	0.201	1.97
Trachelomonas sp.	0.178	1.74
Euglena sp.	0.033	0.33
Chlamydomonas sp.	0.033	0.33
Phacus sp.	0.028	0.27
Scenedesmus sp.	0.025	0.25
Oscillatoria sp.	0.012	0.12
Total	1.925	
Shannon-Weaver [H']	1.38	

Limnological Data

Data averaged from STORET sites: 492044, 492045, 492046, 492047

Surface Data	1979	1992
Trophic Status	E	H
Chlorophyll TSI	50.46	50.73
Secchi Depth TSI	60.43	71.93
Phosphorous TSI	63.31	65.85
Average TSI	58.07	62.84
Chlorophyll a (ug/L)	-	8
Transparency (m)	1.1	0.43
Total Phosphorous (ug/L)	67.5	73
pH	8.6	8.4
Total Susp. Solids (mg/L)	-	18
Total Volatile Solids (mg/L)	-	4
Total Residual Solids (mg/L)	-	14
Temperature (°C / °f)	19/67	20/68
Conductivity (umhos.cm)	800	1346
Water Column Data		
Ammonia (mg/L)	0.07	0.03
Nitrate/Nitrite (mg/L)	0.12	0.02
Hardness (mg/L)	210	235
Alkalinity (mg/L)	175	177
Silica (mg/L)	2.5	11.6
Total Phosphorous (ug/L)	67.5	75
Miscellaneous Data		
Limiting Nutrient	N	N
DO (Mg/l) at 75% depth	6.9	8.4
Stratification (m)	NO	NO
Depth at Deepest Site (m)	4	3.0

Species Evenness	0.56
Species Richness	0.48

The phytoplankton community is dominated by the presence of diatoms, green algae and desmids. This is indicative of fairly good water quality

Pollution Assessment

Nonpoint pollution sources include the following: urban runoff; wastes and litter from recreation; sedimentation and nutrients from agricultural runoff and grazing; mining and logging. The areas of greatest impact are urban storm water runoff and grazing lands. Stormwater runoff can produce a variety of pollutants washed from streets and 7

areas associated from urban communities. Grazing activities have contributed to the movement of sediments and waste material from the watershed into the reservoir. There are several significant point sources in the watershed that contribute a variety of potential pollutants. These sources include municipal and industrial dischargers.

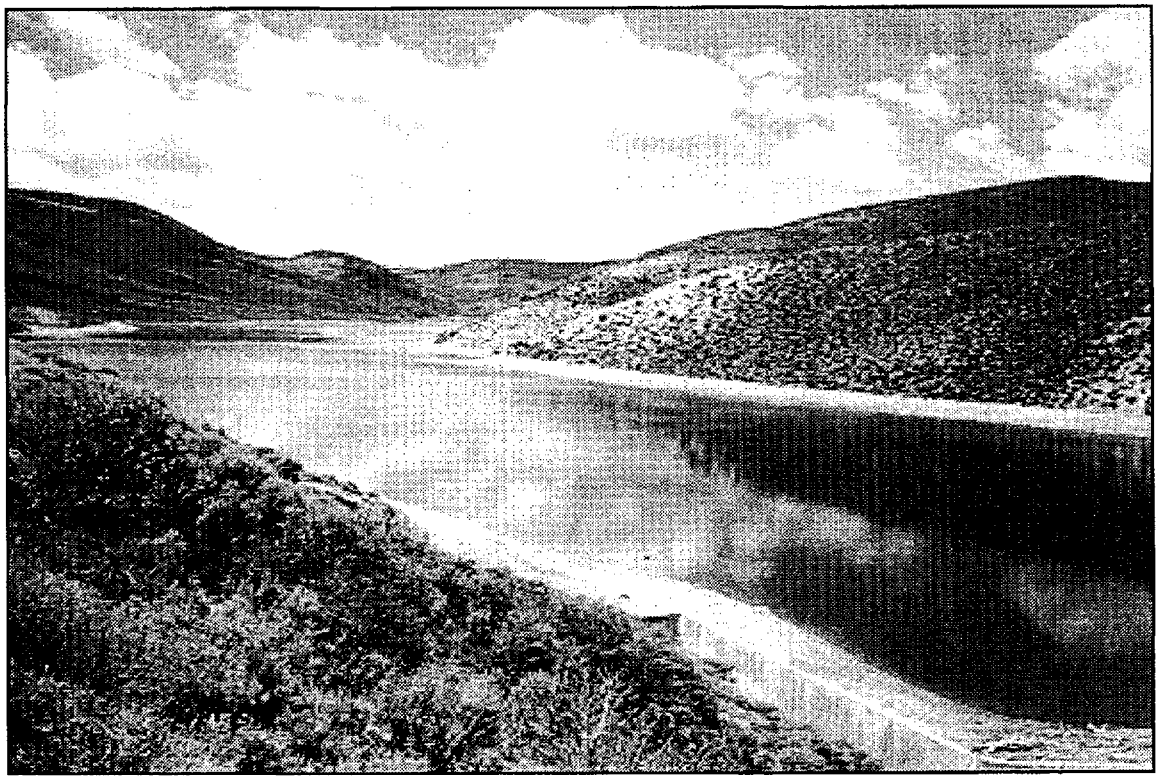
Beneficial Use Classification

The state beneficial use classifications include: culinary (1C), boating and similar recreation (excluding swimming) (2B), warm water game fish and organisms in their food chain (3B), wildfowl and associated organisms (3D), and agricultural uses (4).

Information

Management Agencies	
Bear River Association of Governments	752-7242
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Recreation	
Golden Spike Empire Travel Region (Ogden)	627-8288
Brigham City Chamber of Commerce	723-3931
Willard Bay State Park	734-9494
RV Acres (Willard)	723-7000
Reservoir Administrators	
Weber River Water Conservancy District	
DOI	
Grant Salter	771-1677

WOODRUFF CREEK RESERVOIR



Introduction

Woodruff Creek Reservoir is an intermediate size reservoir on the east slope of the Monte Cristo Range. It provides some summer recreational opportunities. It should not be confused with Woodruff Narrows Reservoir, an impoundment of the Bear River in Wyoming, just over the state line from the town of Woodruff. Woodruff Creek Reservoir was created in 1970 by the construction of an earth-fill dam on Woodfuff Creek. The reservoir shoreline is owned by the BLM with a few small parcels of private land.

Characteristics and Morphometry

Lake elevation (meters / feet)	2,088 / 6,852
Surface area (hectares / acres)	36.42 / 90
Watershed area (hectares / acres)	11,655 / 28,800
Volume (m^3 / acre-feet)	
capacity	4,195,140 / 3,401
conservation pool	555,075 / 450
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	28.4 / 93
mean	10.1 / 33
Length (meters / feet)	2,450 / 8,038
Width (meters / feet)	238 / 781
Shoreline (km / miles)	7.24 / 4.5

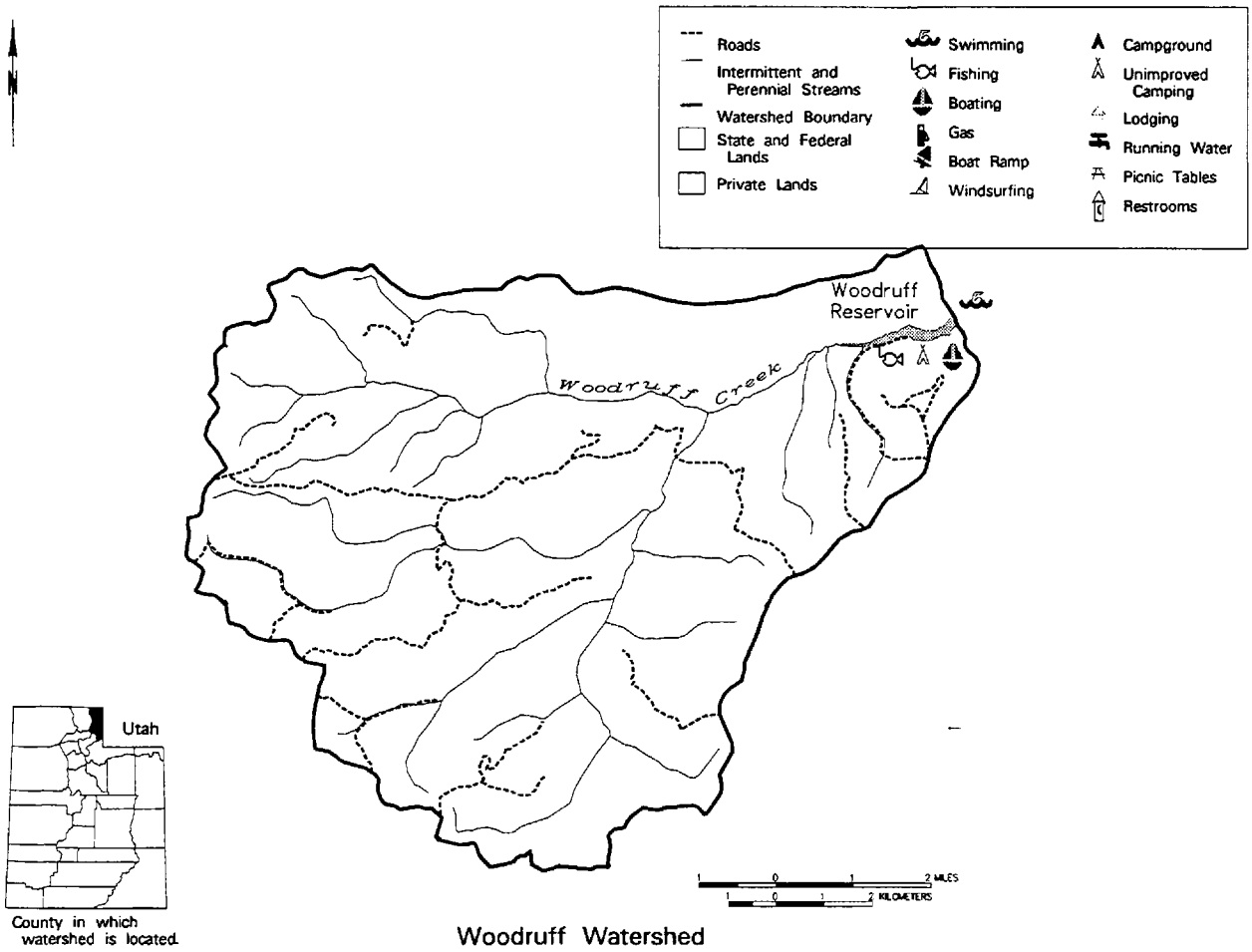
Location

County	Rich
Longitude / Latitude	111 19 54 / 41 27 50
USGS Map	Meachum Ridge, UT 1968
DeLorme's Utah Atlas & Gazetteer™	Page 61, B-5
Cataloging Unit	Upper Bear (16010101)

Public access is unrestricted. Reservoir water is used entirely for irrigation, and most of the water is drained for irrigational use, with the conservation pool being about 15% of total capacity. There are no foreseeable changes in water usage at this time.

Recreation

Woodruff Creek Reservoir is easily accessible from U-39. The turnoff is about 38 miles east of Huntsville, exactly two miles east of the Birch Creek Reservoirs turnoff, and 6 miles west of Woodruff. Turn south and follow this gravel



Woodruff Watershed

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road to the southwest up Woodruff Creek for about four miles to the reservoir. The turnoff is poorly marked, but the road is not hard to find.

Fishing is the primary recreational use of the reservoir and there are no developed recreational facilities. It is possible to launch a boat in the reservoir but access points are limited. By midsummer the reservoir is drained down to the conservation pool (about 25 feet deep) leaving 25 vertical feet of muddy banks exposed. Monte Cristo Campground, a USFS facility, is about 15 miles west of the Woodruff Creek Reservoir turnoff on U-39. It is open from June through September, and has 53 tent sites, picnic areas, and primitive toilets. Fees are charged for use.

Limnological Data

Data averaged from STORET sites: 590686, 590687

Surface Data	1981*	1989	1991
Trophic Status	E	M	M
Chlorophyll TSI	-	44.97	53.35
Secchi Depth TSI	45.16	44.38	52.52
Phosphorous TSI	63.2	33.43	39.93
Average TSI	54.18	40.92	48.60
Chlorophyll a (ug/L)	-	4.4	9.3
Transparency (m)	2.8	2.5	1.7
Total Phosphorous (ug/L)	100	23	12
pH	8.4	8.5	8.5
Total Susp. Solids (mg/L)	<5	-	5
Total Volatile Solids (mg/L)	-	-	4
Total Residual Solids (mg/L)	-	-	3
Temperature (°C / °f)	17/63	17/63	15/60
Conductivity (umhos.cm)	260	343	336
Water Column Data			
Ammonia (mg/L)	0.13	0.01	0.08
Nitrate/Nitrite (mg/L)	0.27	0.59	0.55
Hardness (mg/L)	174	-	173
Alkalinity (mg/L)	171	-	158
Silica (mg/L)	-	-	4.8
Total Phosphorous (ug/L)	55	11.5	19
Miscellaneous Data			
Limiting Nutrient	N	P	P
DO (Mg/l) at 75% depth	3.35	2.5	1.1
Stratification (m)	14-16	NO	6-13
Depth at Deepest Site (m)	21	23.0	16.0

* One site only (590686)

Watershed Description

The Little Bear River is eroding the west slopes of the Monte Cristo Range at a rate relatively faster than Woodruff Creek erodes the east slopes. Both sides of the ridge are dissected by deep canyons, but the canyons to the west are much deeper, indicating that the their headwaters are slowly capturing drainage from the east side of the ridge. Woodruff Creek drains the east slopes, and the reservoir is built about halfway from the headwaters to where the creek joins the Bear River in the town of Woodruff. Slopes surrounding the reservoir are quite steep (60%). The reservoir is an impoundment of the narrow, "V" shaped canyon.

The watershed high point, Monte Cristo Peak, is 2,788 m (9,148 ft) above sea level, thereby developing a complex slope of 4.7% to the reservoir. The average stream gradient of Little Brush Creek is 2.5% (131 feet per mile) The inflow and outflow is Woodruff Creek. There is also an unnamed tributary flowing from the south into the reservoir.

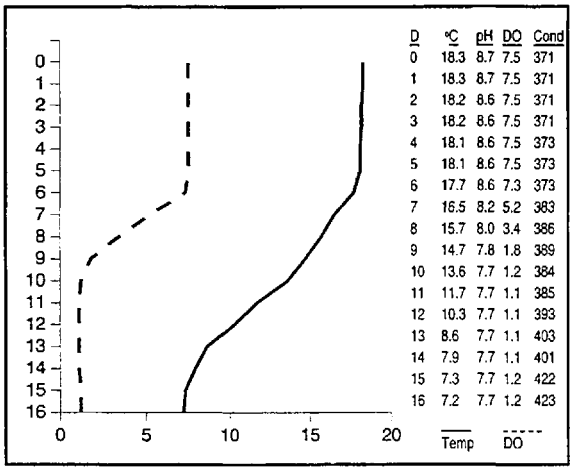
The watershed is made up of mountains. The soil is derived from the Wasatch Formation, the limestone bedrock that underlies much of the watershed. The soil associations that compose the watershed are listed in Appendix III.

The vegetation communities consist of spruce-fir and aspen. The watershed receives 41 - 102 cm (16 - 40 inches) of precipitation annually. The frost-free season around the reservoir is 80 - 120 days per year.

Land use in the watershed is 100% multiple use and native grazing. Minor recreational use takes place.

Limnological Assessment

The water quality of Woodruff Creek Reservoir is good. It is considered to be hard with a hardness concentration value of approximately 174 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are total phosphorus and dissolved oxygen. The average concentration of total phosphorus in the water column for the three study periods only exceeded the recommended pollution indicator for phosphorus of 25 ug/L in 1981 with an overall concentration of 55 ug/L. In recent years concentration have averaged below the indicator, but elevated values have been reported later in the year with shallow conditions present. However, dissolved oxygen concentrations in late summer substantiate



D	°C	pH	DO	Cond
0	18.3	8.7	7.5	371
1	18.3	8.7	7.5	371
2	18.2	8.6	7.5	371
3	18.2	8.6	7.5	371
4	18.1	8.6	7.5	373
5	18.1	8.6	7.5	373
6	17.7	8.6	7.3	373
7	16.5	8.2	5.2	383
8	15.7	8.0	3.4	386
9	14.7	7.8	1.8	389
10	13.6	7.7	1.2	384
11	11.7	7.7	1.1	385
12	10.3	7.7	1.1	393
13	8.6	7.7	1.1	403
14	7.9	7.7	1.1	401
15	7.3	7.7	1.2	422
16	7.2	7.7	1.2	423

the fact that water quality impairments do exist. Concentrations dropped dramatically below the thermocline to approximately 1.0 mg/L. The demand exerted in the lower portion of the water column may be due in fact to larger productions of organic matter during the early history of the reservoir when it was more productive. Winter monitoring will need to be conducted to determine the extent of impairment to the fishery. The data does indicate an impairment later in the summer as oxygen levels fall below those necessary to maintain a viable fishery.

Data suggest that the reservoir is currently a phosphorus limited system. TSI values indicate the reservoir is mesotrophic. The reservoir does stratify as indicated in the August 27, 1991 profile.

According to DWR no fish kills have been reported in recent years. The reservoir supports populations of rainbow trout (Oncorhynchus mykiss), cutthroat trout (*Oncorhynchus clarki*), whitefish (*Prosopium williamsoni*), and mountain sucker (*Pantosteus platyrhychus*). The lake has not been treated for rough fish competition, so populations of native fishes may still be present in the lake.

The DWR has typically stocked the reservoir annually with 100,000 yellowstone cutthroat fry. In 1992, however, the reservoir was not stocked, and the DWR's future plans are unknown.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	15.846	98.60
Asterionella formosa	0.094	0.59
Euglena sp.	0.081	0.51
Pennate diatoms	0.020	0.12
Wislouchiella planktonica	0.015	0.10
Oocystis sp.	0.008	0.05
Ankistrodesmus falcatus	0.004	0.03
Total	16.068	
Shannon-Weaver [H']	0.09	
Species Evenness	0.05	
Species Richness	0.26	

The phytoplankton community is dominated by the presence of green algae and diatoms.

Pollution Assessment

Nonpoint pollution sources include the following: sedimentation and nutrient loading from grazing, and litter or wastes from recreation.

Grazing takes place throughout the watershed and along the reservoir shoreline.

There are no point sources of pollution in the watershed.

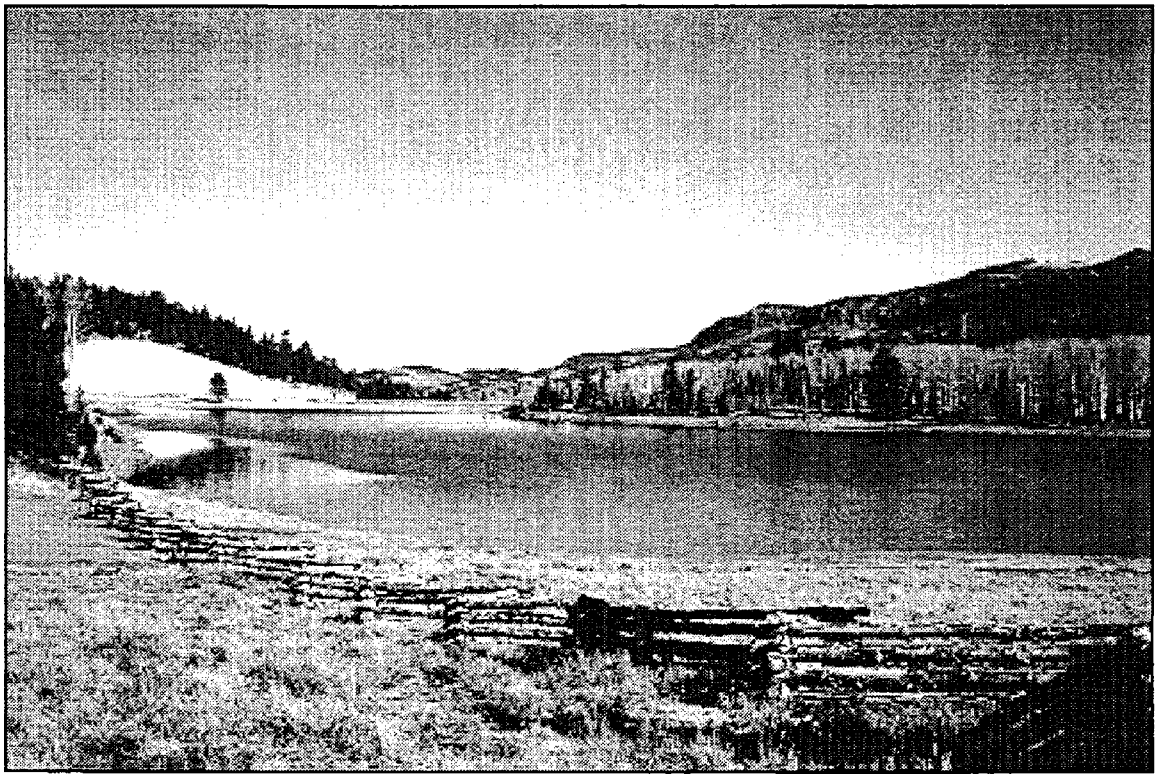
Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Bear River Association of Governments	752-7242
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Bureau of Land Management	539-4001
Bear River Resource Area	977-4300
Recreation	
Bridgerland Travel Region (Logan)	657-5353
Garden City Chamber of Commerce	946-2901
Reservoir Administrators	
Woodruff Reservoir and Irrigation Company	
PO Box 520, Woodruff, UT 84086	

YANKEE MEADOW RESERVOIR



Introduction

Yankee Meadow Reservoir is north of Brian Head on the face of the Markagunt Plateau as it drops into Parowan. It is a small impoundment in a high meadow surrounded by coniferous and aspen forests.

The reservoir shoreline is owned and administered by the Utah Division of Wildlife Resources while the water ownership and management is controlled by the Parowan Reservoir Company. Public access to the reservoir is unrestricted, but camping and grazing is restricted in direct proximity to the reservoir by fencing. Defined beneficial uses include: water recreation excluding swimming, propagation of cold water species of game fish and aquatic life, and agricultural needs.

Characteristics and Morphometry

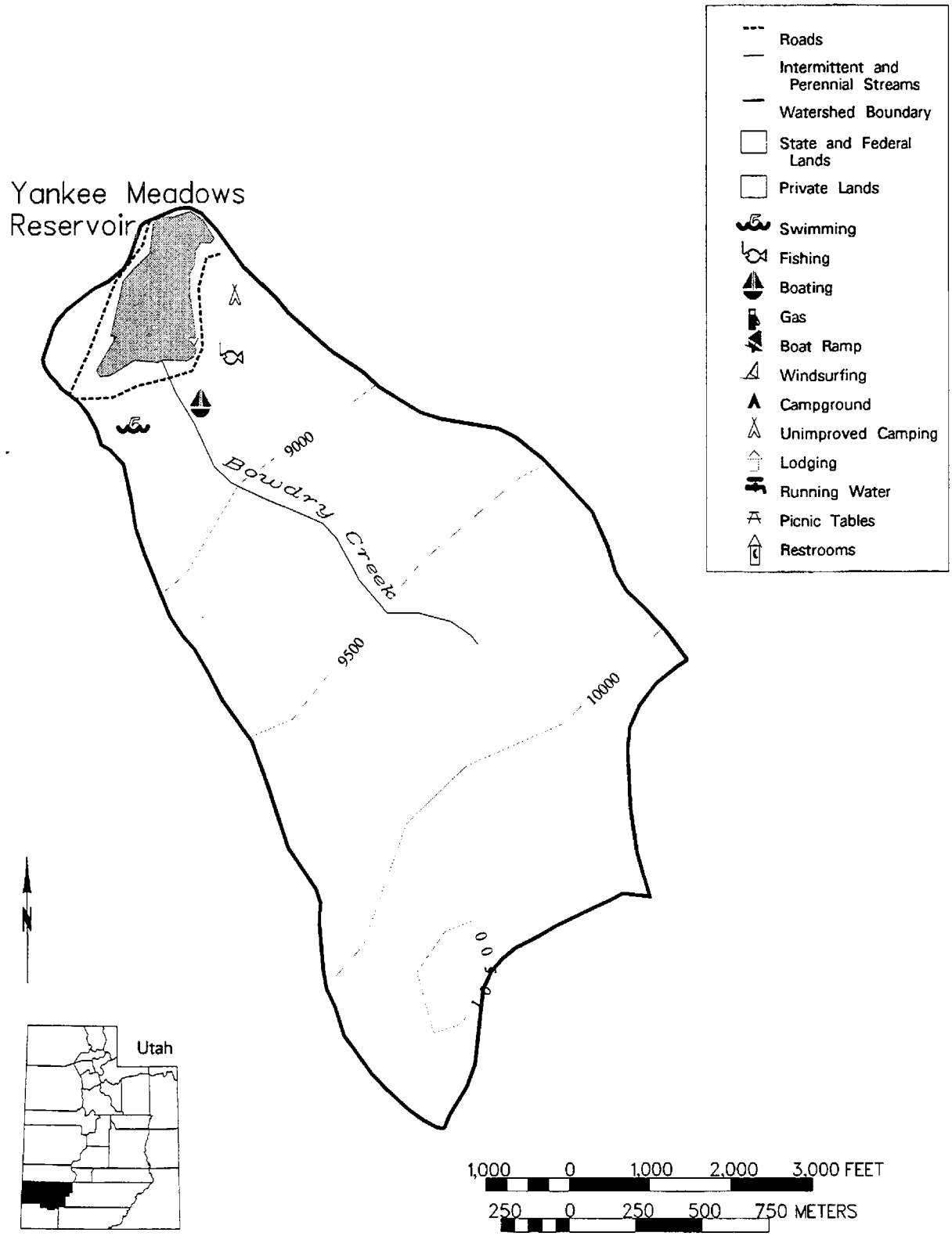
Lake elevation (meters / feet)	2,639 / 8,656
Surface area (hectares / acres)	21.4 / 53
Watershed area (hectares / acres)	658 / 1,625
Volume (m^3 / acre-feet)	
capacity	1,270,000 / 1,028
conservation pool	1,603,550 / 1,300
Annual inflow (m^3 / acre-feet)	
Retention time (years)	
Drawdown (m^3 / acre-feet)	
Depth (meters / feet)	
maximum	7.9 / 26
mean	4.8 / 15.7
Length (meters / feet)	640 / 2,100
Width (meters / feet)	343 / 1,125
Shoreline (meters / feet)	1,460 / 4,790

Location

County	Iron
Longitude / Latitude	112 46 01 / 37 45 03
USGS Map	Yankee Meadows, Utah, 1971
Cataloging Unit	Cedar City (16030006)

Recreation

Yankee Meadow Reservoir is accessible from FS-049, a gravel road leading up the face of the Markagunt Plateau. Access is easiest from Parowan on U-143. Approximately 3.5 miles south of Parowan, turn left on a paved road up First Left Hand Canyon to Vermillion Castle Campground



County in which watershed is located.

Yankee Meadows Watershed

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and Yankee Meadow Reservoir. At the campground, the road turns to gravel. Yankee Meadow is about 8 miles from U-143. Access is also possible from FS-048, up Second Left Hand Canyon (1/4 mile further south on U-143) and FS-048 from the top of the Markagunt Plateau, from 5 miles east of Cedar Breaks and 11 miles west of Panguitch Lake. The latter route may be snow covered until early summer in years of heavy snow accumulation. FS-047 is better maintained than FS-048. It should be noted that one of the most scenic drives in Utah is from U-143 north on FS-048, the Sidney Valley Road. Just before the road begins its decent off the Markagunt Plateau at an elevation of just over 11,000 feet above sea level, the road passes adjacent to an area that looks over the Escalante Desert. The first few hundred yards down the dugway, from the plateau top, may appear challenging but is passable.

Fishing, boating, and camping are possible in the area. Usage is fairly heavy.

There are no improved recreational facilities at the reservoir. The nearest USFS campground, Vermillion Castle, is 6 miles down canyon. It has 10 campsites, lacks drinking water and has vault toilets. There are no private campgrounds in the area, but primitive camping is allowed in the area.

Watershed Description

The reservoir is on the steep northwest face of the Markagunt Plateau uplifted by repeated movements of the Hurricane Fault below. Yankee Meadow is on a bench area, above the Pink Cliff formation (of which the remarkable formations of Noah's Ark and the Vermillion Castle are carved from) but below the steep upper face of volcanic rock that caps the plateau.

The watershed high point, the crest of the Markagunt Plateau, is 3,207 (10,520 ft) above sea level, thereby developing a complex slope of 21.9% to the reservoir. The inflow and outflow is Bowery Creek, and the average stream gradient above the reservoir is 15.6% (825 feet per mile).

The soil is entirely of volcanic origin with moderate permeability and moderately slow erosion and runoff.

The vegetation communities are comprised of pine, aspen, spruce-fir, oak, maple and alpine. The watershed receives 41 - 51 cm (16 - 20 inches) of precipitation annually with a frost-free season of 40 - 60 days at the reservoir.

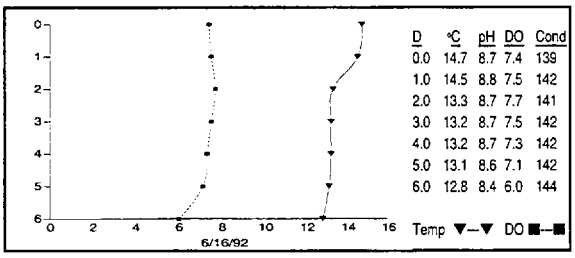
Limnological Assessment

The water quality of Yankee Meadow Reservoir is fairly good. It is considered to be soft with a hardness concentration value of approximately 67 mg/L ($CaCO_3$). Those parameters that have exceeded State water quality standards for defined beneficial uses are total phosphorus and dissolved oxygen. The average concentration of total phosphorus in the water column for 1992 was 41 ug/L which exceeds the recommended pollution indicator for phosphorus of 25 ug/L. Dissolved oxygen concentrations in early summer begin to decline below a weak thermocline. It appears the thermocline breaks down later in the summer as drawdown of the reservoir creates shallow conditions. This is only slightly indicated in the June 16, 1992 profile, but it is evident in data collected in subsequent years. Winter monitoring needs to be conducted to determine the extent of dissolved oxygen depletion and its effect on the fishery. There are large accumulations of macrophytes and algae later in the season which could exhibit a substantial demand

Limnological Data

Data sampled from STORET site: 594190

Surface Data	1992
Trophic Status	E
Chlorophyll TSI	43.95
Secchi Depth TSI	50.01
Phosphorous TSI	56.60
Average TSI	50.19
Chlorophyll a (ug/L)	3.9
Transparency (m)	2.0
Total Phosphorous (ug/L)	38
pH	9.0
Total Susp. Solids (mg/L)	<3
Total Volatile Solids (mg/L)	-
Total Residual Solids (mg/L)	3
Temperature (°C / °f)	16/61
Conductivity (umhos.cm)	143
Water Column Data	
Ammonia (mg/L)	0.03
Nitrate/Nitrite (mg/L)	0.06
Hardness (mg/L)	67
Alkalinity (mg/L)	76
Silica (mg/L)	19.7
Total Phosphorous (ug/L)	41
Miscellaneous Data	
Limiting Nutrient	N
DO (Mg/l) at 75% depth	7.5
Stratification (m)	1-2
Depth at Deepest Site (m)	3.8



on dissolved oxygen during the winter as this organic material decomposes under ice coverage.

Data suggest that the reservoir is currently a nitrogen limited system. TSI values indicate the reservoir is eutrophic. The reservoir does stratify, but it is weak and not for an extended period of time due to early withdrawal of water for downstream irrigation needs.

According to DWR a fish kill has been reported in recent years, and they have concerns about potential winter mortality.. The reservoir supports populations of brook trout (*Salvelinus fontinalis*), and rainbow trout (*Oncorhynchus mykiss*). It appears that DWR stocks Yankee Meadow Reservoir with 2,500 catchable and 2,500 fingerling rainbow trout and 2,000 fingerling brook trout annually.

Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume (mm^3/liter)	% Density By Volume
Sphaerocystis schroeteri	150.537	96.53
Ceratium hirundinella	4.726	3.03
Planktospheria gelatinosa	0.612	0.39
Pennate diatoms	0.051	0.03
Centric diatoms	0.010	0.01
Oocystis sp.	0.008	0.01
Mallomonas sp.	0.007	0.00
Total	155.948	
Shannon-Weaver [H']	0.17	
Species Evenness	0.09	
Species Richness	0.27	

The phytoplankton community is dominated by the presence of green algae and diatoms with a fairly high rate of productivity.

Pollution Assessment

Nonpoint pollution sources are: sedimentation and nutrient loading from grazing and wastes or litter from recreation. Cattle graze in the watershed and until recent construction of fence in direct proximity to the reservoir. They are allowed in the area adjacent to the reservoir, but not direct access to the reservoir.

There are no point pollution sources in the watershed.

Beneficial Use Classification

The state beneficial use classifications include: boating and similar recreation (excluding swimming) (2B), cold water game fish and organisms in their food chain (3A) and agricultural uses (4).

Information

Management Agencies	
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146
Dixie National Forest	865-3700
Recreation	
Reservoir Administrators	
Parowan Reservoir Company	477-3422

APPENDIX I

WATER COLUMN PROFILES

Column Sequence: Depth (meters), Temperature (C), pH, Dissolved oxygen (mg/L), and Conductivity (umhos)

ANDERSON MEADOW RESERVOIR 07/06/94

0.015.7	9.1	10.4	68
1.013.8	9.1	11.7	72
2.012.7	9.1	12.0	70
3.011.3	9.0	11.9	73
4.011.0	9.0	11.9	77

ANDERSON MEADOW RESERVOIR 08/17/94

0.015.9	8.9	10.4	71
1.015.0	8.9	10.9	71
2.012.3	8.8	11.5	71
3.011.1	8.3	10.0	72
4.010.6	8.0	10.0	73

ANDERSON MEADOW RESERVOIR 03/07/95

0.0 0.2	7.7	6.2	86
1.0 1.2	7.7	5.2	80
2.0 1.6	7.6	4.0	81
3.0 1.7	7.5	3.6	81
4.0 1.7	7.5	3.3	82

ANDERSON MEADOW RESERVOIR 07/01/96

0.016.2	9.1	8.6	72
1.014.2	9.1	8.9	72
2.112.0	9.0	9.7	74
3.010.2	8.9	9.7	75
4.0 9.5	8.8	9.7	75
4.1 9.5	8.8	9.4	75

ANDERSON MEADOW RESERVOIR 08/13/96

-0.413.9	8.1	8.5	72

ANDERSON MEADOW RESERVOIR 08/31/96

0.015.4	9.5	12.3	74
1.014.1	9.5	12.8	74
2.012.2	9.3	13.1	74
3.011.0	9.3	13.0	74
3.910.6	9.3	13.0	74

BAKER DAM RESERVOIR 06/15/94

0.019.6		8.0	261
1.019.5		8.0	259
2.019.4		7.9	259
3.019.4		7.8	258
4.019.2		7.8	259
5.019.0		7.4	258
6.018.0		6.7	262
7.015.2		4.5	264
8.013.9		2.2	262
9.013.3		0.5	262
10.012.8		0.2	274
11.012.4		0.1	288
12.011.8		0.1	302

BAKER DAM RESERVOIR 08/16/94

0.025.9	9.0	9.4	275
1.025.5	9.0	9.4	276
2.024.7	8.9	9.3	277
3.023.8	8.8	8.9	282
4.023.2	8.6	8.7	281
5.022.8	8.4	5.6	280
5.622.6	8.2	3.8	291

BAKER DAM RESERVOIR 06/12/96

0.022.5	8.9	9.3	358
1.122.5	8.9	9.2	359
2.022.4	8.9	9.1	358
3.022.4	8.9	9.1	358
4.019.2	8.6	9.3	366
5.017.6	8.5	7.8	364
5.317.3	8.4	7.2	365

BAKER DAM RESERVOIR 06/12/96

0.022.4	8.8	8.3	360
1.022.4	8.8	8.6	359
2.022.4	8.8	9.0	360
3.021.2	8.7	9.0	365
4.019.0	8.5	8.2	361
5.017.7	8.8	7.3	363
6.017.0	8.3	6.2	362
7.016.6	8.1	4.8	367
8.016.2	8.0	4.2	366
8.915.7	7.9	2.7	374
9.615.3	7.7	1.3	372

BAKER DAM RESERVOIR 07/31/96

0.026.5	8.8	9.6	368
1.026.0	8.8	9.4	369
2.024.4	8.8	10.9	370
2.423.9	8.8	11.2	373

BAKER DAM RESERVOIR 07/31/96

0.025.1	8.7	8.8	371
1.025.0	8.7	8.8	372
2.024.2	8.7	9.0	371
3.024.0	8.6	8.2	374
4.024.8	8.6	7.8	375
5.023.5	8.3	4.9	382
6.023.1	8.1	2.1	386
7.022.4	7.9	0.2	390
7.222.1	7.9	0.1	394

BARNEY LAKE 07/06/94

0.017.6	7.8	6.6	84
1.017.6	7.7	6.6	84
2.017.5	6.7	7.4	84
3.014.1	6.8	7.6	100
3.411.2	6.8	2.0	117

BARNEY LAKE 08/20/96

0.116.0	9.4	8.5	91
1.015.1	9.3	7.8	91
1.914.8	9.2	7.5	90
3.014.5	8.5	5.5	93
3.914.4	8.0	3.1	96

BEAR LAKE 09/24/93

0.015.5	8.6	8.2	690
1.015.5	8.6	8.2	690
5.015.5	8.8	7.8	690
10.015.4	8.8	7.9	688
15.015.3	8.8	7.9	688
20.015.1	8.8	7.8	686
25.0 8.2	8.6	8.1	696
30.0 6.4	8.5	7.2	689
35.0 5.3	8.4	7.1	685
40.0 5.2	8.4	6.7	690
45.0 5.0	8.3	6.2	690
50.0 4.9	8.3	5.8	688
55.0 4.9	8.3	5.4	684

BEAVER MEADOW RESERVOIR 07/08/93

0.013.7	8.2	7.2	36
1.013.1	7.9	6.8	36
2.012.9	7.8	6.6	36
3.012.6	7.8	6.6	37
4.012.2	7.8	6.5	36
5.011.9	7.5	6.4	37

BEAVER MEADOW RESERVOIR 09/26/95

0.0 9.3	8.8	8.1	43
1.0 9.1	8.4	7.7	41
2.0 8.9	8.2	7.6	40
3.0 8.8	8.1	7.5	40

BIG EAST LAKE 06/28/93

0.018.0	8.9	8.6	156
1.018.0	9.0	8.6	156
2.018.0	9.0	8.6	156
3.018.0	9.0	8.6	156
4.018.0	9.0	8.6	155
5.011.8	8.7	5.4	156
6.0 8.8	7.6	0.4	217
7.2 7.6	7.2	0.2	215

BIG EAST LAKE 06/20/95

0.015.5	8.8	10.2	161
1.015.2	8.8	10.2	162
2.013.8	8.8	10.7	162
3.011.3	8.9	15.7	166
4.0 9.1	8.7	14.0	184
5.0 7.0	8.1	4.8	199
6.0 6.0	7.5	0.4	202
6.7 5.9	7.4	0.2	204

BIG EAST LAKE 08/09/95

0.020.5	8.8	7.4	216
1.020.3	8.8	7.2	213
2.020.0	8.8	7.2	213
3.019.9	8.8	7.2	211
4.018.6	8.4	6.4	217
5.016.0	8.2	4.9	224
6.013.2	8.0	1.8	237
7.012.6	8.0	1.2	243

BIG SAND WASH RESERVOIR 07/15/93

0.019.4	8.4	7.7	142
1.018.8	8.4	7.7	142
2.018.7	8.4	7.6	142
3.018.1	8.2	7.1	139
4.017.7	8.1	7.1	142
5.017.5	8.0	6.8	139
6.017.3	7.9	6.6	138
7.017.2	7.9	6.6	137
8.016.9	7.8	6.4	138
9.016.5	7.8	6.3	138
10.016.4	7.8	6.3	137
11.016.3	7.7	6.2	137
12.016.3	7.7	6.1	138
13.016.1	7.7	6.1	140
14.015.9	7.7	6.1	139
15.015.7	7.7	6.1	137
16.015.6	7.7	6.1	136
17.015.5	7.7	6.2	136
18.015.5	7.7	6.0	137
19.015.4	7.7	5.9	142
20.015.3	7.7	5.8	142
21.015.2	7.7	5.5	143
22.015.2	7.7	5.4	143
22.215.2	7.7	5.4	142

BIG SAND WASH RESERVOIR 09/06/95

0.021.4	8.4	7.1	192
1.020.8	8.4	7.1	193
2.020.5	8.3	6.9	193
3.020.4	8.3	6.8	193
4.020.2	8.2	6.6	196
5.020.1	8.2	6.5	196
6.019.8	7.9	5.6	187
7.019.6	7.9	5.3	189
8.019.2	7.8	5.1	189
9.018.4	7.6	4.6	178
10.018.3	7.6	4.6	170
11.018.4	7.6	4.6	169

12.018.0	7.5	4.9	174
13.018.0	7.5	4.9	174
14.018.0	7.6	5.2	178
15.018.0	7.6	5.0	168
16.017.9	7.5	4.3	188
18.017.9	7.4	3.8	218
19.1 7.9	7.4	3.5	220

BIRCH CREEK RESERVOIR #2
08/25/93

0.017.7	8.7	8.8	286
1.017.6	8.7	8.9	287
2.017.5	8.7	9.0	289
3.017.4	8.7	8.9	289
4.017.4	8.7	8.6	286
5.017.4	8.7	8.4	291
6.016.9	8.2	5.6	302
7.016.9	8.2	4.1	311
8.016.4	8.0	3.7	319
9.016.2	7.9	1.7	331
10.015.5	7.8	0.4	340
11.015.0	7.8	0.3	351
12.015.0	7.2	0.1	350
13.015.0	7.7	0.1	350
14.514.8	7.7	0.1	350

BIRCH CREEK RESERVOIR #2
09/07/95

0.019.5	9.1	6.2	331
1.018.8	9.1	6.2	335
2.018.6	9.0	5.6	333
3.018.5	9.0	5.4	333
4.018.4	9.0	5.5	333
5.018.4	9.0	5.7	333
6.018.4	8.9	5.7	333
7.018.3	8.9	4.9	336
8.018.3	8.8	4.4	339
9.018.1	8.8	3.8	342
10.0 7.8	8.7	3.2	345
11.016.7	8.6	1.5	358
12.015.4	8.5	0.2	367
13.013.6	8.4	0.1	372
14.012.6	8.4	0.1	373
15.012.2	8.3	0.1	376
16.012.0	8.3	0.1	375
17.011.7	8.3	0.1	374
17.911.5	8.3	0.1	377

BLANDING CITY RESERVOIR 04
07/06/94

0.021.2	8.4	7.2	222
1.021.3	8.4	7.2	221
2.021.4	8.4	7.2	221
3.021.3	8.4	7.1	222
4.021.3	8.4	7.1	222
5.018.9	8.2	6.2	218
6.018.0	7.8	3.8	217
7.016.6	7.8	3.2	220
8.813.6	7.6	1.0	221

BLANDING CITY RESERVOIR 04
08/09/94

0.022.8	7.5	6.7	235
1.022.8	7.5	6.7	235
2.022.8	7.5	6.7	236
3.022.2	7.5	6.7	234
4.021.9	7.5	6.6	239
5.021.5	7.2	5.1	236
6.019.3	6.7	0.1	245
7.015.8	6.7	0.1	247
8.014.7	6.6	0.1	241
9.014.5	6.6	0.1	240
10.214.4	6.6	0.1	245

BLUE LAKE
08/17/93

0.015.7	8.1	7.9	242
0.515.6	8.2	8.0	242
1.015.5	8.2	7.4	241
1.515.2	8.3	7.8	240
2.015.0	8.3	8.4	240
2.514.8	8.3	8.6	240
3.014.6	8.3	8.3	241
3.514.5	8.3	8.0	241
4.014.3	8.3	7.9	241
4.514.3	8.3	7.9	241
5.014.2	8.3	7.8	242
5.514.1	8.3	8.0	241
6.014.0	8.4	8.1	240
6.314.0	8.4	8.5	238

BLUE LAKE
03/01/94

0.015.7	7.9	8.1	242
0.515.6	8.0	8.2	242
1.015.5	7.4	8.2	241
1.515.2	7.8	8.3	240
2.015.0	8.4	8.3	240
2.514.8	8.6	8.3	240
3.014.6	8.3	8.3	241
3.514.5	8.0	8.3	241
4.014.3	7.9	8.3	241
4.514.3	7.9	8.3	241
5.014.2	7.8	8.3	242
5.514.1	8.0	8.3	241
6.014.0	8.1	8.4	240
6.214.0	8.5	8.4	238

BOULGER RESERVOIR
07/13/93

0.014.5	7.9	8.0	291
0.514.1	8.0	7.8	291
1.013.9	8.0	7.5	292
1.513.4	8.0	7.7	293
2.011.9	8.0	8.0	299
2.511.0	8.1	8.5	300
3.010.8	8.1	7.9	301
3.510.5	8.1	8.2	302

BRIDGER LAKE
07/27/94

0.017.5	8.0	7.4	123
1.017.5	8.0	7.2	123
2.016.8	7.7	6.1	124
3.016.0	7.4	3.7	125
4.015.4	9.2	1.2	125

BRIDGER LAKE
03/13/95

0.0 1.2	7.3	0.0	140
1.0 2.0	7.4	0.0	144
2.0 3.1	7.3	0.0	151
3.0 4.0	7.1	0.0	137

BRIDGER LAKE
07/17/96

0.017.8	8.0	6.1	89
1.016.9	7.9	6.1	88
2.015.7	7.5	4.3	89
3.013.5	7.1	0.3	88
3.810.8	6.8	0.2	115

BROUGH RESERVOIR
07/26/94

0.026.7	8.5	7.2	247
1.022.7	8.5	7.3	245
2.022.3	8.5	7.2	245
3.022.0	8.5	7.0	243
4.019.9	8.2	6.1	248
5.016.6	2.7	3.4	266
6.015.0	7.8	2.0	278
7.013.9	7.5	1.2	285
8.012.5	7.4	0.5	288
9.012.0	7.4	0.3	290
10.011.4	7.5	0.3	291
11.011.9	7.5	0.3	257
12.112.3	7.6	0.6	295

BROUGH RESERVOIR
09/15/94

0.018.6	8.8	8.4	214
1.018.5	8.9	8.2	213
2.018.3	8.9	8.2	215
3.018.2	8.9	8.0	216
4.018.1	8.9	8.0	215
5.018.0	8.9	8.0	217
6.018.0	9.0	8.0	218
7.017.6	8.9	7.6	220
8.015.8	8.1	2.6	234
9.014.1	7.9	1.3	242

BROUGH RESERVOIR
09/06/95

0.022.1	8.6	7.0	197
1.022.1	8.6	6.9	200
2.022.0	8.6	6.9	201
3.022.0	8.6	6.8	200
4.021.9	8.5	6.4	203
5.019.3	7.9	2.4	215
6.016.0	7.7	1.3	233
7.014.9	7.6	1.0	243
8.014.5	7.6	1.0	244
9.014.1	7.5	0.9	247
10.013.6	7.5	0.8	247
11.013.6	7.4	0.5	250
12.013.6	7.4	0.4	260
13.013.6	7.4	0.3	245
14.013.4	7.4	0.3	244

BROUGH RESERVOIR
09/06/95

0.022.1	8.6	7.2	203
1.022.1	8.6	7.1	195
2.022.0	8.6	7.0	205
3.021.9	8.6	6.9	194
4.020.8	8.3	5.0	199
5.019.2	8.0	2.3	209
6.016.6	7.7	1.0	219
7.015.0	7.6	0.8	229
7.514.7	7.6	0.6	249

BROUGH RESERVOIR
07/10/96

0.023.2	8.5	7.2	263
1.022.1	8.6	7.5	263
2.021.8	8.6	7.4	263
3.020.7	8.5	6.9	265
4.017.4	8.1	5.4	273
5.014.4	7.8	4.1	282
6.013.5	7.8	3.7	289
7.012.9	7.7	3.7	293
8.012.8	7.7	3.5	295
9.012.5	7.7	3.4	299
10.012.4	3.3	3.3	300
11.012.3	7.7	3.1	301
12.012.3	7.7	3.1	302
12.612.2	7.8	3.0	302

BROUGH RESERVOIR
07/10/96

6.024.0	8.6	7.1	263
1.022.5	8.6	7.2	264
2.021.8	8.6	7.2	264
3.020.3	8.4	6.3	267
4.018.0	9.1	4.9	274
5.015.0	7.9	4.0	283
6.013.8	7.8	3.4	290
7.012.9	7.9	3.3	290
8.012.5	7.7	3.0	298
9.012.3	7.7	2.9	301
9.012.4	7.7	2.9	301
9.512.3	7.7	9.5	302

BROUGH RESERVOIR
08/28/96

0.022.1	8.6	7.8	183
1.022.0	8.6	7.5	184
1.921.8	8.6	7.5	184
3.021.6	8.5	7.4	184
4.019.4	7.9	4.8	206
5.017.5	7.7	2.9	241
6.015.3	7.4	1.3	283
7.014.1	7.4	1.0	293
8.013.5	7.4	0.8	296
9.013.2	7.3	0.9	297
10.013.1	7.3	0.6	297
11.013.0	7.3	0.6	298

BROUGH RESERVOIR
08/28/96

0.022.1	8.7	7.4	183
1.022.0	8.6	6.9	183
2.022.0	8.6	6.8	183
3.021.6	8.6	7.0	185
4.020.6	8.4	6.0	195
5.017.8	7.8	2.3	237
6.015.3	7.6	1.1	280
6.914.7	7.5	0.7	287

BULLOCK DRAW RESERVOIR
09/05/95

0.022.8	8.9	8.0	380
1.022.8	8.9	8.0	380
2.022.2	8.8	7.8	380
3.021.6	8.6	5.6	399
4.021.3	8.4	3.6	415
5.019.6	7.7	0.2	408

BUTTERFLY LAKE

07/27/94

0.013.7	6.5	7.6	9
1.016.9	6.4	6.3	28
2.016.7	6.4	5.9	30
3.016.6	6.3	0.0	30

BUTTERFLY LAKE
07/17/96

0.015.3	7.7	5.8	18
1.015.4	7.2	5.5	18
2.015.1	7.1	5.3	18
3.010.0	6.5	6.0	50

CABIN RESERVOIR
09/27/95

0.012.0	7.6	7.1	66
1.011.9	7.6	7.2	66
2.011.9	7.6	7.1	65
3.011.9	7.5	7.0	66
4.011.9	7.5	6.9	65
5.011.8	7.5	7.0	66
6.011.8	7.5	6.9	66
7.011.7	7.5	6.8	66
8.011.7	7.4	6.7	65
9.011.6	7.4	7.0	67
10.011.6	7.4	7.0	67
11.011.5	7.4	7.1	66
12.011.5	7.4	7.1	66
13.011.5	7.4	7.1	66
14.011.5	7.4	7.1	66
15.011.5	7.4	7.1	66
16.011.5	7.4	7.0	63
17.011.5	7.3	6.9	68
18.011.5	7.3	6.9	68
20.011.1	7.2	6.7	68
22.010.7	7.2	6.5	71
24.010.3	7.2	6.3	75
26.0 9.0	7.1	4.9	53
28.0 8.0	7.0	4.5	54
31.0 7.6	6.9	3.9	61
33.0 7.3	6.8	2.8	55

CALDER RESERVOIR (ZELPH)
07/27/94

0.019.7	8.6	7.0	296
1.018.9	8.5	6.4	299
2.018.5	8.4	5.9	293
3.018.3	8.3	4.9	303
4.017.9	8.1	3.2	303
5.017.3	7.8	1.1	302
6.016.6	7.7	0.2	304
6.516.7	7.8	0.2	314

CALDER RESERVOIR (ZELPH)
09/15/94

0.014.2	9.3	10.0	230
1.014.3	9.3	9.2	239
2.014.3	9.3	9.2	238
3.014.3	9.3	9.2	239
4.014.3	9.3	9.2	236
5.014.3	9.3	9.0	241
6.014.2	9.3	9.0	240
7.014.0	9.3	8.0	245

CALDER RESERVOIR (ZELPH)
07/11/96

0.119.7	9.0	10.6	276
1.019.7	9.0	10.6	277
2.019.6	9.0	10.4	277
3.019.5	9.0	10.0	277
4.019.4	8.9	9.7	278
5.018.5	8.6	4.5	282
6.016.4	7.8	0.3	297
6.915.8	7.8	0.2	300
8.015.5	7.8	0.1	303

CALDER RESERVOIR (ZELPH)
08/27/96

0.118.6	9.2	8.1	257
1.018.5	9.2	8.2	257
2.018.3	9.2	8.8	257
3.017.3	9.1	6.8	259
4.016.7	8.9	5.1	264
5.016.5	8.7	4.6	266
6.016.5	8.7	4.2	267
7.016.3	8.6	3.9	268
7.916.3	8.4	1.5	271

CAUSEY RESERVOIR
08/24/93

0.017.7	8.3	9.3	302
1.017.7	8.3	9.4	303
2.017.6	8.3	9.4	303
3.017.6	8.4	9.4	303
4.017.0	8.3	11.4	316
5.016.2	8.3	11.1	325
6.015.7	8.3	11.4	316
7.015.2	8.3	10.6	327
8.015.2	8.3	10.5	322
9.014.6	8.2	9.4	318
10.014.3	8.2	8.9	329
11.014.2	8.2	8.9	328
12.014.1	8.2	8.9	228
13.014.1	8.1	8.8	328
14.014.0	8.1	8.2	329
16.013.6	8.1	8.2	325
18.013.4	8.1	8.5	331
20.013.0	8.0	8.5	322
22.012.8	8.0	7.9	332
23.011.4	7.7	5.0	334
24.0 8.8	7.7	5.3	312
25.0 8.6	7.6	3.6	311
26.0 8.3	7.5	2.7	286
28.0 8.1	7.5	2.6	284
30.0 7.8	7.5	2.4	297
32.0 7.5	7.4	2.1	296
34.0 6.9	7.4	1.0	325
36.0 6.8	7.3	0.5	318
40.0 6.0	7.4	0.1	350
42.0 5.9	7.4	0.1	354
44.0 5.9	7.4	0.1	354

CAUSEY RESERVOIR
08/24/93

0.017.3	8.4	9.2	307
1.017.5	8.4	9.1	307
2.017.6	8.4	9.0	307
3.017.4	8.4	9.1	318
4.016.5	8.4	9.4	328
5.016.1	8.4	8.9	329
6.015.8	8.4	9.1	329
7.015.6	8.3	8.7	337
8.015.2	8.3	8.2	339
9.015.0	8.3	7.9	338
10.014.0	8.2	7.9	346
11.014.4	8.1	7.1	346
12.014.4	8.1	6.5	350
13.014.3	8.0	6.1	352

CAUSEY RESERVOIR
08/30/93

0.017.7	8.3	9.3	302
1.017.7	8.3	9.4	303
2.017.6	8.3	9.4	303
3.017.6	8.4	9.4	303
4.017.0	8.3	11.4	316
5.016.2	8.3	11.1	325
6.015.7	8.3	11.4	316
7.015.2	8.3	10.6	327
8.015.2	8.3	10.5	322
9.014.6	8.2	9.4	318
10.014.3	8.2	8.9	329
11.014.2	8.2	8.9	328
12.014.1	8.2	8.9	228
13.014.1	8.1	8.8	328
14.014.0	8.1	8.2	329
16.013.6	8.1	8.2	325
18.013.4	8.1	8.3	331
20.013.0	8.0	8.5	322
22.012.8	8.0	7.9	332
23.011.4	7.7	5.0	334
24.0 8.8	7.7	5.3	312
25.0 8.6	7.6	3.6	311
26.0 8.3	7.5	2.7	286
28.0 8.1	7.5	2.6	284
30.0 7.8	7.5	2.4	297
32.0 7.5	7.4	2.1	296
34.0 6.9	7.4	1.0	325
36.0 6.8	7.3	0.5	318
40.0 6.0	7.4	0.1	350
42.0 5.9	7.4	0.1	354
44.0 5.9	7.4	0.1	354

CAUSEY RESERVOIR
09/07/95

0.018.7	8.9	8.0	326
1.018.7	8.9	7.7	326
2.018.4	8.9	7.9	326
3.017.7	8.8	9.4	326
4.017.1	8.8	9.2	339
5.016.5	8.8	8.5	350
6.016.2	8.7	7.7	352
7.015.8	8.7	7.6	343
8.015.6	8.6	7.1	356
9.015.4	8.6	7.1	356
10.015.2	8.6	6.8	354
11.015.0	8.6	0.8	358
12.014.9	8.7	6.8	365
13.014.8	8.7	7.1	357
14.014.7	8.7	7.3	369
15.014.5	8.7	7.4	348
15.914.2	8.7	7.3	369

CAUSEY RESERVOIR
09/07/95

0.018.7	8.9	8.0	324
1.018.7	8.9	7.9	325
2.018.5	8.9	8.2	326
3.018.5	8.9	7.8	320
4.016.9	8.8	7.6	353
5.016.5	8.8	6.6	357
6.016.0	8.7	6.7	366
7.015.7	8.7	6.3	370
8.015.5	8.6	6.5	357
9.015.3	8.6	6.4	347
10.015.1	8.6	6.4	348
11.015.0	8.6	6.5	359
12.014.9	8.6	6.5	351
13.014.8	8.6	6.5	370
14.014.7	8.6	6.3	362
15.014.6	8.6	6.4	369
16.014.4	8.6	6.4	368
17.014.1	8.6	6.6	370
18.013.8	8.6	6.4	371
19.013.8	8.6	6.2	369
20.010.3	8.4	2.3	360
21.0 8.4	8.4	2.2	342
22.0 8.1	8.4	2.2	300
23.0 7.8	8.3	2.2	334
24.0 7.7	8.3	2.2	299
25.0 7.5	8.3	1.9	325
26.0 7.4	8.3	1.8	334
26.6 6.6	8.3	1.6	341

CAUSEY RESERVOIR
09/07/95

0.018.5	8.9	7.1	335
1.018.3	8.9	6.9	336
2.018.2	8.9	7.1	341
3.017.5	8.9	7.0	349
4.017.0	8.8	6.1	356
5.016.5	8.8	6.3	364
6.016.1	8.7	6.4	368
7.015.8	8.7	6.5	375
8.015.5	8.7	6.0	365
9.015.4	8.7	5.8	360

CENTER CREEK RESERVOIR #1
07/02/96

0.016.3	7.9	6.7	80
1.015.0	7.9	6.4	82
2.013.9	7.8	6.0	82
3.012.8	7.7	4.6	82
3.512.4	7.7	3.8	83

CHINA LAKE
07/27/94

0.017.4	9.1	6.7	64
1.017.0	9.0	6.6	64
2.016.6	9.0	6.3	64
3.014.4	8.2	3.7	61
4.011.3	7.4	3.5	62
5.0 8.0	7.3	2.9	62
6.0 6.9	7.2	1.8	62
7.4 6.5	7.0	0.7	65

CHINA LAKE
03/13/95

0.0 1.1	7.5	6.3	66
1.0 2.1	7.4	5.8	62
2.0 3.5	7.2	4.9	63
3.0 3.8	7.1	4.6	62
4.0 3.9	7.1	4.6	62
5.0 3.9	7.0	4.4	62
6.0 4.0	7.0	4.1	62
7.0 4.0	6.9	3.8	60
8.0 3.9	6.8	2.1	62
9.0 3.9	6.0	1.4	64

CHINA LAKE
07/01/96

0.017.5	9.4	7.4	54
1.017.5	9.4	7.7	54
2.016.8	9.4	7.4	54
3.016.0	9.3	6.9	53
4.013.7	7.7	3.1	55
5.0 8.9	7.2	3.0	53
6.0 6.6	7.0	2.2	54
7.0 6.2	6.9	1.8	54
8.0 6.0	6.8	1.4	54
8.4 6.7	6.7	1.2	54

CLEVELAND LAKE
08/30/95

0.018.6	9.1	6.6	233
1.018.5	9.1	7.2	234
2.018.3	9.1	7.3	233
3.018.1	9.1	7.3	233
4.017.9	9.1	7.3	233
5.017.7	9.1	7.2	234
6.016.7	8.9	8.2	235
7.012.3	8.9	10.8	237
8.010.3	8.9	10.4	241
9.0 9.2	8.7	9.0	246
10.0 8.2	8.4	6.1	252
11.0 7.1	8.1	1.8	257
12.0 6.4	8.0	0.3	271
13.0 6.2	7.8	0.2	274
13.4 6.3	7.8	0.2	274

CLEVELAND RESERVOIR
07/19/93

0.017.1	6.6	8.1	226
0.517.0	6.6	8.1	228
1.016.9	6.6	8.1	228
1.516.8	6.6	8.1	228
2.016.7	6.8	8.1	228
2.516.7	6.6	8.1	228
3.016.6	6.7	8.0	228
3.516.6	6.8	8.0	228
4.016.5	6.9	8.0	228
4.516.4	6.8	8.0	229
5.016.1	6.7	8.0	230
5.515.9	6.7	8.0	231
6.015.6	6.7	8.0	232
6.515.2	6.9	8.0	236
7.014.8	7.0	8.1	239
7.514.4	7.4	8.1	241
8.013.7	7.7	8.1	241
8.513.0	8.0	8.1	245
9.011.9	8.4	8.1	241
9.511.5	8.6	8.1	241
10.0 9.3	8.0	8.2	242
11.0 7.6	4.5	8.0	244
11.5 7.3	3.4	7.9	248
12.0 7.2	2.6	7.8	249
12.5 6.9	1.7	7.7	254
13.0 6.7	1.3	7.6	255

CLEVELAND RESERVOIR
08/11/93

0.017.2	8.6	8.3	200
1.017.2	8.6	8.2	200
2.017.0	8.6	8.1	201
3.017.0	8.6	8.0	201
4.016.7	8.6	7.7	202
5.016.4	8.6	7.7	206
6.016.2	8.6	7.5	207
7.015.9	8.5	7.0	216
8.014.9	8.1	6.2	216
9.012.7	7.9	5.8	219
9.412.3	7.6	4.3	219

CLEVELAND RESERVOIR
02/28/94

0.017.1	6.6	8.1	226
0.517.0	6.6	8.1	228
1.016.9	6.6	8.1	228
1.516.8	6.6	8.1	228
2.016.7	6.8	8.1	228
2.516.7	6.6	8.1	228
3.016.6	6.7	8.0	228
3.516.6	6.8	8.0	228
4.016.5	6.9	8.0	228
4.516.4	6.8	8.0	229
5.016.1	6.7	8.0	230
5.515.9	6.8	8.0	231
6.015.6	6.7	8.0	232
6.515.2	6.9	8.0	236
7.014.8	7.0	8.1	239
7.514.4	7.4	8.1	241
8.013.7	7.7	8.1	241
8.513.0	8.0	8.1	245
9.011.9	8.4	8.1	241
9.511.5	8.6	8.1	241
10.0 9.3	8.0	8.2	242
11.0 7.6	4.5	8.0	244
11.5 7.3	3.4	7.9	248
12.0 7.2	2.6	7.8	249
12.5 6.9	1.7	7.7	254
13.0 6.7	1.3	7.6	255

COOK LAKE
07/13/94

0.014.9	8.7	6.2	25
1.014.9	8.6	6.2	26
2.014.8	8.7	6.1	26
3.014.6	5.2	1.7	26

COOK LAKE
06/26/96

0.013.1	8.3	7.1	21
1.013.1	8.2	7.2	21
2.013.1	8.1	7.3	21
3.013.2	8.1	7.1	21
3.213.2	8.2	6.5	21

CRESCENT LAKE
07/13/94

0.015.1	7.2	6.3	16
1.015.1	7.2	6.2	17
2.014.9	7.2	6.2	17
3.014.8	7.2	6.2	15
4.014.8	6.8	6.0	18
5.014.8	8.7	6.2	17
6.014.7	6.8	6.2	17
7.014.7	6.4	6.1	16
8.013.4	6.1	0.2	30

CRESCENT LAKE
09/06/94

0.013.5	8.8	6.7	17
1.013.4	8.6	6.7	16
2.013.4	8.6	6.7	16
3.013.4	8.5	6.6	16
4.013.3	8.5	6.6	16
5.013.3	8.4	6.5	16
6.013.2	8.4	6.4	16
7.013.1	8.3	6.2	17
7.213.1	8.3	6.0	16

CRESCENT LAKE
06/26/96

0.012.9	7.9	7.3	13
1.012.9	7.8	7.1	13
2.012.9	7.6	6.9	13
3.012.9	7.6	6.8	13
4.012.9	7.5	6.6	13
5.012.9	7.5	6.8	13
6.012.9	7.5	6.6	13
7.012.9	7.5	6.3	13
7.812.9	7.3	1.9	15

CURRANT CREEK RESERVOIR
06/23/93

0.012.3	8.8	10.3	150
1.012.2	8.5	9.9	150
2.012.2	8.3	9.9	150
3.012.2	8.1	9.9	151
4.012.1	8.0	9.8	150
5.012.1	8.0	9.9	151
6.012.1	8.0	9.9	151
7.011.1	7.9	10.0	151
8.0 9.3	8.0	10.0	151
9.0 8.8	7.9	10.2	149
10.0 8.5	7.8	10.2	145
11.0 8.5	7.8	10.2	145
12.0 8.4	7.8	10.2	147
13.0 8.2	7.7	10.1	147
14.0 8.3	7.7	10.1	146
15.0 8.2	7.7	10.0	146
16.0 8.1	7.7	10.0	146
17.0 8.1	7.7	10.0	146
18.0 8.0	7.8	10.0	145
19.0 8.0	7.7	10.0	146
20.0 7.9	7.7	10.0	146
21.0 7.8	7.7	10.0	148
22.0 7.8	7.8	10.0	148
23.0 7.6	7.7	10.0	145
24.0 7.6	7.7	9.9	150
25.0 7.5	7.7	9.8	152
26.0 7.4	7.7	9.7	152
27.0 7.3	7.7	9.6	153
28.0 7.2	7.8	9.5	154
30.0 7.3	7.8	9.1	152
32.0 7.2	7.8	9.1	153

CURRANT CREEK RESERVOIR
09/07/95

0.015.9	8.3	8.0	104
1.015.8	8.4	8.0	104
2.015.8	8.4	8.0	104
3.015.8	8.4	8.0	104
4.014.7	8.4	8.8	104
5.011.8	8.3	9.0	84
6.011.0	8.0	8.3	87
7.010.8	7.8	8.1	85
8.010.7	7.8	8.1	81
9.010.6	7.6	8.1	80
10.010.5	7.6	8.1	82
11.010.5	7.6	8.2	87
12.010.4	7.5	8.2	84
13.010.4	7.5	8.1	84
14.010.4	7.5	8.1	83
15.010.3	7.4	8.1	92
16.010.3	7.4	8.1	96
17.010.2	7.4	8.0	101
18.010.3	7.4	8.0	98
19.010.2	7.4	7.9	91
20.010.2	7.4	7.9	94
21.010.1	7.4	7.8	98
22.010.0	7.4	7.7	98
23.010.0	7.3	7.6	113
24.0 9.9	7.3	7.3	97

CURRANT CREEK RESERVOIR
09/07/95

0.015.5	8.3	8.1	109
1.015.4	8.5	8.1	109
2.014.3	8.4	8.7	108
3.012.5	8.3	8.9	104
4.012.0	8.2	8.7	104
5.011.6	8.0	8.5	111
6.011.2	7.9	8.2	102
7.011.0	7.8	8.0	93
8.011.0	7.7	7.9	735
9.010.9	7.7	7.8	132
10.010.6	7.7	7.8	110
11.010.6	7.6	7.8	106

D.M.A.D. RESERVOIR
06/11/96

0.022.7	8.4	7.3	1,543
1.022.3	8.4	7.1	1,527
1.921.1	8.4	6.1	1,552

D.M.A.D. RESERVOIR
06/11/96

0.023.1	8.5	7.2	1,572
1.022.7	8.5	6.9	1,574
2.021.7	8.4	6.5	1,559
3.021.6	8.4	5.6	1,564
4.021.4	8.3	5.3	1,562
4.321.3	8.3	4.9	1,558

D.M.A.D. RESERVOIR
06/11/96

0.021.7	8.4	7.0	1,538
1.020.7	8.4	7.0	1,556

DARK CANYON LAKE
08/09/94

0.017.8	7.4	7.4	143
1.017.7	7.3	7.2	143
2.017.6	7.3	7.1	144
3.017.5	7.2	7.1	140
4.017.5	7.1	7.1	152
5.017.3	6.8	6.4	160
6.017.1	6.5	4.0	207
7.014.8	6.3	0.1	235
8.012.1	6.2	0.1	235
9.311.6	6.3	0.1	258

DARK CANYON LAKE
09/21/94

0.014.5	8.3	7.2	148
1.013.9	8.2	6.9	148
2.013.2	7.9	7.1	148
3.012.9	8.0	7.0	148
4.012.9	8.2	6.9	147
5.012.9	8.2	6.7	148
6.012.8	8.2	6.4	148

7.012.8	8.2	6.2	149
8.012.8	8.1	5.4	156
8.812.6	8.0	4.4	168

DEEP CREEK LAKE
07/12/94

0.016.2	8.3	7.5	61
1.015.6	8.5	7.5	61
2.015.5	7.0	7.4	61
3.015.1	7.8	7.1	61
3.515.1	7.7	6.3	64

DEEP CREEK LAKE
06/25/96

0.014.8	8.1	7.8	61
1.014.9	8.1	7.6	61
2.014.0	8.2	7.7	61
3.013.7	8.6	8.1	61

DEEP CREEK LAKE
09/04/96

0.014.6	8.9	9.1	67
1.014.6	8.9	8.7	66
2.014.0	8.9	8.6	66
3.013.8	9.2	10.4	67
3.813.8	7.0	3.2	69

DEER CREEK RESERVOIR
07/13/93

0.018.3	8.6	8.3	249
1.018.2	8.7	8.3	250
2.018.2	8.7	8.3	250
3.018.0	8.7	8.3	250
4.017.8	8.7	8.2	252
5.017.7	8.6	8.2	251
6.017.4	8.6	8.2	250
7.017.3	8.6	8.1	252
8.017.3	8.6	8.1	248
9.016.7	8.5	7.2	252
10.015.5	8.1	6.5	248
11.015.0	8.0	6.3	250
12.014.5	7.9	6.2	246
13.014.0	7.9	6.1	254
14.013.6	7.8	6.0	257
15.013.0	7.8	5.8	260
16.012.3	7.8	5.7	280
17.012.0	7.7	5.5	285
18.011.8	7.8	5.4	292
19.011.3	7.8	5.2	311
20.011.1	7.7	4.9	317
21.010.9	7.7	4.7	322
22.010.9	7.7	4.7	328
23.010.8	7.7	4.6	347
24.010.6	7.6	4.3	341
25.010.5	7.6	4.1	345
26.010.3	7.6	4.1	347
27.010.4	7.7	4.0	353
28.010.4	7.7	4.0	362
29.010.4	7.7	3.9	362
30.010.3	7.6	3.9	360
32.010.2	7.6	3.7	358
34.010.1	7.6	3.5	364
36.010.1	7.6	3.6	371
38.010.1	7.6	3.6	369
39.210.2	7.6	3.5	363

DEER CREEK RESERVOIR
08/31/93

0.218.8	8.0	7.0	312
1.018.8	8.0	6.9	312
2.018.8	8.0	6.9	312
4.018.8	8.0	6.9	313
6.018.8	8.0	6.9	311
7.918.8	8.0	6.9	315
10.018.8	8.0	6.7	311
11.018.5	7.9	6.1	310
12.018.1	7.6	4.7	310
13.017.3	7.5	3.4	313
14.017.0	7.4	3.3	306
15.016.5	7.4	3.0	300
16.016.3	7.4	2.8	296
18.015.7	7.3	2.6	294
20.015.4	7.3	2.6	286
22.014.9	7.3	2.3	284
24.014.2	7.3	2.4	275
26.013.5	7.3	1.9	271
28.013.1	7.2	1.3	271
30.012.7	7.2	0.8	262
32.012.5	7.2	0.3	276
34.012.5	7.2	0.1	277
36.012.4	7.2	0.1	277
37.012.3	7.2	0.1	273

DEER CREEK RESERVOIR
08/31/93

0.219.9	8.2	8.2	336
1.019.9	8.2	8.2	337
2.019.8	8.2	8.0	337
3.019.8	8.2	8.0	342
4.019.8	8.2	8.0	343
5.019.8	8.2	7.9	345
6.019.0	7.8	5.9	341
7.018.5	7.6	4.5	339

DEER CREEK RESERVOIR
08/31/93

0.219.3	8.1	7.1	319
1.019.3	8.1	7.0	320
1.919.3	8.1	7.0	320
4.019.3	8.1	7.0	321
6.019.3	8.1	7.0	321
8.019.3	8.1	7.0	321
9.019.3	8.1	7.0	322
10.018.3	7.6	4.5	319
11.018.1	7.5	4.2	318
12.017.8	7.4	3.2	341
14.017.1	7.3	2.9	325
15.016.5	7.3	2.3	310
16.015.8	7.2	1.8	302
17.015.4	7.2	1.7	289
18.014.8	7.2	1.5	283
20.014.0	7.2	1.1	282
22.013.4	7.2	0.7	271

DONKEY RESERVOIR
09/14/93

0.011.6	9.2	8.8	84
1.011.5	9.2	8.7	83
2.010.7	9.2	8.7	83
3.010.5	9.2	8.6	83
4.010.4	9.2	8.6	83
4.510.4	9.2	7.8	83

DONKEY RESERVOIR
09/12/95

0.011.2	8.8	8.0	78
1.011.4	8.9	8.0	78
2.011.4	8.9	7.7	79
3.011.3	9.0	8.4	78
4.011.1	8.9	8.2	78
4.811.0	8.9	7.6	78

DUCK FORK RESERVOIR
09/07/93

0.014.8	8.0	8.4	401
0.514.9	8.1	8.2	401
1.014.9	8.1	8.2	406
1.514.7	8.1	7.9	405
2.014.7	8.1	7.8	406
2.514.6	8.1	8.0	406
3.014.6	8.2	8.2	407
3.514.6	8.2	8.1	407
4.014.6	8.2	8.2	407
4.514.6	8.2	8.0	407
5.014.5	8.2	8.2	406
5.514.2	8.2	8.0	407
6.014.0	8.2	7.8	407
6.514.0	8.2	7.7	410
7.013.9	8.2	7.6	409
7.313.8	7.2	7.8	411

DUCK FORK RESERVOIR
07/19/94

0.018.1	8.7	8.3	458
1.018.1	8.7	8.3	458
2.017.8	8.8	9.3	459
3.017.1	8.7	8.4	464
4.016.9	8.7	8.9	459
5.016.6	8.7	8.6	459
6.016.3	8.6	8.5	468
6.915.9	8.5	7.8	480

DUCK FORK RESERVOIR
08/31/94

0.016.6	8.7	8.1	370
1.016.7	8.7	7.8	370
2.016.6	8.8	7.8	371
3.016.6	8.8	7.8	374
4.016.6	8.8	7.8	374
5.016.6	8.8	7.9	368
6.016.6	8.8	7.9	373
7.016.5	8.8	8.0	373

DUCK FORK RESERVOIR
03/07/95

0.0 3.4	8.0	0.0	401
1.0 3.6	7.8	0.0	442
2.0 3.8	7.9	0.0	458
3.0 3.9	7.7	0.0	491
4.0 4.4	7.7	0.0	502
5.0 4.5	7.7	0.0	502
6.3 4.5	7.7	0.0	502

DUCK FORK RESERVOIR
06/25/96

0.213.0	8.6	9.6	419
1.013.1	8.6	9.8	419
1.913.1	8.6	9.9	418
3.113.0	8.6	9.8	419
3.9 9.5	8.5	11.0	425
4.9 7.9	8.2	8.8	430
6.0 7.4	8.0	7.0	432
6.6 7.3	7.9	6.6	431

DUCK FORK RESERVOIR
08/20/96

0.016.9	8.7	10.0	405
1.016.8	8.7	9.9	406
2.116.5	8.7	10.0	407
2.916.4	8.7	10.0	408
4.115.6	8.8	10.5	408
4.915.4	8.7	9.9	410
5.915.2	8.7	9.7	411
7.014.8	8.8	8.8	424
7.314.7	8.5	8.6	424

EAST CANYON RESERVOIR
07/12/93

0.019.1	8.5	7.8	531
1.019.0	8.5	7.8	535
2.018.6	8.5	7.7	536
3.018.3	8.5	7.5	536
4.017.5	8.5	7.0	541
5.016.8	8.4	6.5	546
6.015.9	8.3	6.0	549
7.015.2	8.3	5.6	554
8.013.0	8.1	4.7	559
9.011.1	8.0	4.5	578
10.010.4	7.9	4.6	583
11.0 9.8	7.9	4.8	596
12.0 9.1	7.9	4.8	618
13.0 8.6	7.8	4.8	636
14.0 8.2	7.8	4.6	643
15.0 7.6	7.7	4.4	658
16.0 7.0	7.6	3.8	685
17.0 6.6	7.6	3.5	694
18.0 6.3	7.5	3.2	702
19.0 6.1	7.5	3.1	710
20.0 6.0	7.5	2.9	708
21.0 5.9	7.5	2.8	720
22.0 5.6	7.4	2.5	736
23.0 5.5	7.4	2.3	726
24.0 5.4	7.4	2.2	744
25.0 5.3	7.4	2.2	831
26.0 5.3	7.4	2.1	732
27.0 5.2	7.4	2.1	730
28.0 5.1	7.4	2.1	760
29.0 5.0	7.4	1.9	750
30.0 4.9	7.4	1.9	753
31.0 4.8	7.4	1.9	753
32.0 4.8	7.4	1.8	753
34.0 4.5	7.3	0.8	765
36.0 4.3	7.3	0.8	782
38.0 4.2	7.3	0.4	780
40.0 4.1	7.3	0.2	777
45.0 4.0	7.3	0.1	780
50.0 4.0	7.3	0.1	780
52.0 4.0	7.3	0.0	793

EAST CANYON RESERVOIR
06/28/94

0.020.6	8.5	8.5	620
1.020.1	8.6	8.5	622
2.019.8	8.6	8.4	621
3.019.6	8.6	8.3	624
4.019.3	8.6	8.1	623
5.019.0	8.6	7.5	626
6.015.9	8.5	5.4	648
7.015.5	8.4	5.1	647
8.014.5	8.3	4.6	657
9.013.2	8.2	4.2	650
10.011.9	8.2	4.1	659
11.010.6	8.1	3.9	660

12.0	9.3	8.0	3.5	667
13.0	7.6	7.9	2.9	686
14.0	7.2	7.8	2.6	697
15.0	6.5	7.8	2.3	703
16.0	6.2	7.7	2.2	707
17.0	6.0	7.7	2.1	710
18.0	5.9	7.7	1.9	712
19.0	5.8	7.7	1.7	715
20.0	5.7	7.7	1.7	719
21.0	5.7	7.7	1.7	723
22.0	5.6	7.7	1.6	720
23.0	5.5	7.7	1.6	716
24.0	5.5	7.7	1.6	715
25.0	5.4	7.6	1.5	715
26.0	5.3	7.6	1.5	716
27.0	5.3	7.6	1.4	719
28.0	5.2	7.6	1.4	722
29.0	5.2	7.6	1.2	724
30.0	5.1	7.3	1.0	726
31.0	5.0	7.6	0.8	722
32.0	5.0	7.7	0.6	729
33.0	4.9	7.5	0.4	731
34.0	4.2	7.5	0.2	733
35.0	4.7	7.5	0.1	734
36.0	4.7	7.5	0.1	734
37.0	4.6	7.5	0.1	735
38.0	4.6	7.5	0.1	735
39.0	4.5	7.5	0.1	736
40.0	4.5	7.5	0.1	736
41.0	4.5	7.5	0.1	738
42.0	4.5	7.5	0.1	740
43.0	4.4	7.5	0.1	742
44.0	4.4	7.5	0.1	744
45.0	4.4	7.5	0.1	745
46.0	4.4	7.5	0.1	745
49.0	4.3	7.5	0.1	747
50.0	4.3	7.5	0.1	748
50.2	4.3	7.5	0.1	749

EAST CANYON RESERVOIR
06/28/94

EAST CANYON RESERVOIR
07/26/94

0.0	20.9	8.6	8.3	633
1.0	20.8	8.6	7.6	635
2.0	20.8	8.6	7.6	634
3.0	20.8	8.6	7.6	637
4.0	20.8	8.6	7.6	632
5.0	20.8	8.6	7.4	633
6.0	20.8	8.6	7.6	632
7.0	20.8	8.6	7.6	637
8.0	19.0	8.3	4.0	647
9.0	15.8	8.0	2.7	657
10.0	13.1	7.9	1.8	675
11.0	10.1	7.8	1.8	701
12.0	8.1	7.8	1.5	712
13.0	6.8	7.7	1.5	121
14.0	6.3	7.7	1.4	731
16.0	6.0	7.6	0.9	732
18.0	5.7	7.6	1.4	731
20.0	5.6	7.6	0.8	736
24.0	5.4	7.6	3.9	736
28.0	5.3	7.5	4.0	747
32.0	5.0	7.5	4.5	739
36.0	4.8	7.6	0.6	766
38.7	4.7	7.5	0.3	764

EAST CANYON RESERVOIR
08/11/94

0.0	20.1	8.3	7.8	616
1.0	20.1	8.3	7.8	614
2.0	20.9	8.3	7.8	616
3.0	20.8	8.3	7.8	608
4.0	20.8	8.3	7.8	614
5.0	20.8	8.3	7.8	614
6.0	20.8	8.4	7.8	616
7.0	20.8	8.3	7.8	620
8.0	18.1	7.7	1.2	630
9.0	15.0	7.6	0.4	640
10.0	12.0	7.6	0.3	649
11.0	11.0	7.6	0.3	660
12.0	8.3	7.5	0.3	662
13.0	7.0	7.5	0.3	672
14.0	6.6	7.4	0.4	670
15.0	6.3	7.4	0.4	676
16.0	6.1	7.4	0.3	672
17.0	6.1	7.4	0.2	672
18.0	6.0	7.4	0.1	673
19.0	5.9	7.4	0.1	674
20.0	5.7	7.4	0.2	673
22.0	5.7	7.4	0.2	675
24.0	5.5	7.4	0.1	677
26.0	5.2	7.4	0.1	651
28.0	5.2	7.4	0.1	681
30.0	5.0	7.4	0.1	685
32.0	4.9	7.4	0.1	687
34.0	4.8	7.4	0.1	689
36.0	4.8	7.4	0.0	691
38.0	4.7	7.4	0.0	691
40.0	4.7	7.4	0.0	693
42.0	4.6	7.3	0.0	694
44.0	4.6	7.3	0.0	694
46.0	4.6	7.3	0.0	695
47.0	4.6	7.3	0.0	695

EAST CANYON RESERVOIR
09/13/94

0.0	17.3	9.0	7.5	617
1.0	17.3	9.0	7.4	621
2.0	17.3	9.0	7.3	619
3.0	17.3	9.0	7.3	619
4.0	17.3	9.0	7.3	621
6.0	17.3	9.0	7.2	622
7.0	17.3	8.9	6.2	630
8.0	13.8	8.3	1.0	642
9.0	11.3	8.2	0.7	646
10.0	9.9	8.2	0.4	647
11.0	8.7	8.2	0.4	660
12.0	8.2	8.2	0.4	660
13.0	7.6	8.2	0.3	665
14.0	7.4	8.2	0.3	661
16.0	7.1	8.2	0.3	666
18.0	6.6	8.2	0.3	669
20.0	6.2	8.2	0.3	665
24.0	5.7	8.2	0.3	672
28.0	5.4	8.2	0.3	673
32.0	5.2	8.1	0.3	677
36.0	5.1	8.1	0.2	670
40.0	5.0	8.1	0.3	680
41.5	5.1	8.1	0.2	686

EAST CANYON RESERVOIR
11/08/94

0.0	7.3	8.1	7.5	656
2.0	7.3	8.1	7.4	657
4.0	7.3	8.2	7.5	656
6.0	7.3	8.2	7.5	656
8.0	7.3	8.2	7.5	656
10.0	7.3	8.1	7.3	659
12.0	7.3	8.1	6.7	659
14.0	7.2	8.0	5.8	662
16.0	7.1	7.9	4.2	672
20.0	6.9	7.8	2.3	674
24.0	6.8	7.7	0.9	672
28.0	6.7	7.6	0.4	674
32.0	6.6	7.6	0.4	678
36.0	6.2	7.6	0.4	678

EAST CANYON RESERVOIR
11/22/94

0.0	5.1	7.8	7.2	685
1.0	5.1	7.8	7.2	683
2.0	5.1	7.8	7.2	685
4.0	5.1	7.8	7.4	680
6.0	5.1	7.8	7.4	686
8.0	5.1	7.8	7.4	687
10.0	5.1	7.8	7.4	689
12.0	5.1	7.8	7.4	689
14.0	5.1	7.8	7.4	692
16.0	5.1	7.8	7.4	682
18.0	5.1	7.8	7.7	698
20.0	5.1	7.8	7.9	700
22.0	5.0	7.9	8.0	687
24.0	5.1	7.9	8.1	689
26.0	5.0	7.9	8.2	666
28.0	5.0	7.9	8.1	687
30.0	5.0	7.9	8.2	680
34.0	5.0	7.9	8.2	672
38.0	5.0	7.8	7.5	692
41.3	4.8	7.9	8.5	690

EAST CANYON RESERVOIR
04/04/95

0.0	5.1	7.6	9.6	728
1.0	5.1	8.1	9.4	726
2.0	5.1	8.1	9.4	726
3.0	5.1	8.1	9.4	727
4.0	5.1	8.1	9.4	727
5.0	5.0	8.1	9.4	728
6.0	5.0	8.1	9.4	727
7.0	5.0	8.1	9.3	728
8.0	5.0	8.1	9.3	727
9.0	5.0	8.1	9.3	727
10.0	4.9	8.1	9.2	728
11.0	4.9	8.1	9.2	727
12.0	4.9	8.1	9.1	727
13.0	4.9	8.1	9.0	727
14.0	4.9	8.1	9.0	726
15.0	4.8	8.1	9.0	727
16.0	4.8	8.1	8.8	728
17.0	4.8	8.1	8.7	727
18.0	4.6	8.0	8.5	727
19.0	4.4	7.9	8.0	733
20.0	4.4	7.9	7.8	740
21.0	4.3	7.8	7.4	744
22.0	4.3	7.8	7.3	744
23.0	4.3	7.8	7.2	746
24.0	4.3	7.8	7.2	744
25.0	4.2	7.8	7.1	748
26.0	4.2	7.8	7.0	752
27.0	4.1	7.8	6.8	752
28.0	4.1	7.7	6.7	752
29.0	4.0	7.7	6.6	758
30.0	4.0	7.7	6.5	761
31.0	3.9	7.7	6.3	772
32.0	3.8	7.7	6.0	776
33.0	3.7	7.7	5.9	781
34.0	3.6	7.6	5.7	786
35.0	3.6	7.6	5.6	789
36.0	3.6	7.6	5.5	789
37.0	3.6	7.6	5.4	790
38.0	3.5	7.6	5.3	791
39.0	3.5	7.6	5.3	791
40.0	3.5	7.6	5.2	793
41.0	3.5	7.6	5.2	795
42.0	3.5	7.6	5.1	793
43.0	3.5	7.6	5.0	795
44.0	3.5	7.6	5.0	794
45.0	3.5	7.6	5.0	795

EAST CANYON RESERVOIR
04/04/95

0.0	6.7	8.5	10.6	741
1.0	6.7	8.5	10.3	741
2.0	6.4	8.5	10.3	738
3.0	6.4	8.5	10.2	737
4.0	5.8	8.5	10.2	735
5.0	5.8	8.4	10.1	733
6.0	5.9	8.4	10.0	731
7.0	5.9	8.4	10.0	731
8.0	5.8	8.4	10.0	732
9.0	5.5	8.3	9.6	737
10.0	4.9	8.2	8.9	739
11.0	5.0	8.2	8.8	739
12.0	4.8	8.2	8.6	747
13.0	4.5	8.1	8.4	747
14.0	4.4	8.1	8.0	751
15.0	4.3	8.0	7.8	752
16.0	4.3	8.0	7.6	754
17.0	4.2	8.0	7.5	753
18.0	4.1	7.9	7.3	756
19.0	4.0	7.9	7.0	758
20.0	4.0	7.9	6.9	762
21.0	4.0	7.9	6.8	763
22.0	4.0	7.9	6.8	762
23.0	4.0	7.9	6.7	763

EAST CANYON RESERVOIR
04/04/95

0.0	5.8	8.2	10.8	719
1.0	5.8	8.3	10.6	724
2.0	5.8	8.2	10.5	726
3.0	3.7	8.2	10.5	726
4.0	5.7	8.2	10.2	726
5.0	5.4	8.2	10.1	725
6.0	5.4	8.2	9.9	727
7.0	5.2	8.2	9.8	726
8.0	5.2	8.2	9.6	727
9.0	5.1	8.2	9.5	727
10.0	5.0	8.1	9.4	726
11.0	5.0	8.1	9.3	728
12.0	4.9	8.1	9.2	728
13.0	4.9	8.1	9.2	729
14.0	4.8	8.1	8.9	729
15.0	4.9	8.1	8.8	728
16.0	4.6	8.0	8.7	731
17.0	4.6	8.0	8.4	739
18.0	4.4	8.0	8.0	740
19.0	4.4	7.9	7.9	740
20.0	4.4	7.9	7.6	743

EAST CANYON RESERVOIR
05/18/95

0.0	11.4	8.6	9.8	675
1.0	11.2	8.6	9.4	676
2.0	11.1	8.6	9.2	673
3.0	11.1	8.6	9.0	676
4.0	11.0	8.6	9.1	673

5.011.0	8.6	9.3	673
6.011.0	8.6	9.0	673
7.011.0	8.6	8.9	672
8.011.0	8.6	9.1	670
9.010.8	8.6	8.9	673
10.010.7	8.6	8.7	678
11.010.6	8.6	8.7	675
12.0 9.0	8.5	8.0	683
13.0 8.5	8.5	8.0	692
14.0 7.9	8.4	7.7	709
15.0 7.4	8.4	7.6	720
16.0 6.9	8.3	7.6	725
17.0 6.5	8.3	7.2	732
18.0 6.1	8.2	6.9	736
19.0 5.9	8.2	6.8	745
20.0 5.7	8.2	6.6	745
21.0 5.7	8.2	6.4	745
22.0 5.6	8.1	6.4	735
23.0 5.4	8.1	6.2	745
24.0 5.3	8.1	6.1	735
25.0 5.3	8.1	5.9	746
26.0 5.3	8.1	5.9	735
27.0 5.1	8.1	5.9	742
28.0 5.1	8.0	5.7	744
29.0 5.0	8.0	5.6	750
30.0 4.9	8.0	5.1	749
31.0 4.8	7.9	4.9	750
32.0 4.8	7.9	4.8	759
33.0 4.7	7.9	4.7	759
34.0 4.7	7.9	4.6	758
35.0 4.7	7.9	4.4	764
36.0 4.7	7.9	4.3	761
37.0 4.6	7.9	4.2	761
38.0 4.6	7.9	4.1	759
39.0 4.6	7.9	4.0	758
40.0 4.6	7.9	4.0	759
41.0 4.6	7.9	4.0	760
42.0 4.6	7.9	4.0	760
43.0 4.6	7.9	4.0	761
44.0 4.5	7.9	3.9	761
45.0 4.5	7.9	3.9	761
46.0 4.5	7.9	3.8	761
47.0 4.5	7.8	3.7	762
49.0 4.5	7.8	3.6	762
50.4 4.5	7.8	2.8	764

EAST CANYON RESERVOIR
05/18/95

0.010.5	8.5	9.0	626
1.010.5	8.5	9.0	623
2.010.4	8.5	9.0	620
3.010.4	8.5	9.0	613
4.010.3	8.5	9.0	615
5.010.0	8.5	8.8	629
6.0 9.6	8.5	8.8	668
7.0 9.0	8.5	8.6	638
8.0 8.7	8.4	8.4	638
9.0 8.6	8.4	8.2	658
10.0 8.1	8.4	7.9	673
11.0 8.0	8.3	7.7	675
12.0 7.9	8.3	7.6	675
13.0 7.7	8.3	7.1	677
14.0 7.5	8.2	6.8	690
14.5 7.3	8.2	6.3	695

EAST CANYON RESERVOIR
05/18/95

0.011.6	8.6	9.1	667
1.011.4	8.6	9.1	669
2.011.3	8.6	8.8	672
3.011.3	8.6	9.1	669
4.011.3	8.6	8.9	669
5.011.2	8.6	8.9	669
6.011.0	8.6	8.9	666
7.010.8	8.6	8.8	673
8.010.6	8.8	8.9	672
9.010.3	8.6	8.7	680
10.010.1	8.5	8.7	676
11.0 9.7	8.5	8.3	681
12.0 9.0	8.5	8.1	683
13.0 8.7	8.4	7.8	685
14.0 8.3	8.4	7.7	691
15.0 8.1	8.4	7.5	692
16.0 7.7	8.3	7.1	708
17.0 7.5	8.3	7.0	711
18.0 7.3	8.2	6.9	711
19.0 7.0	8.2	6.6	717
20.0 6.6	8.2	6.4	727
21.0 6.5	8.1	6.3	728
22.0 6.2	8.1	6.1	734
22.2 6.0	8.1	5.3	740

EAST CANYON RESERVOIR
05/30/95

0.012.9	8.3	8.8	592
1.012.8	8.4	8.6	588
2.012.5	8.4	8.7	586
3.012.3	8.4	8.6	587
4.012.2	8.4	8.6	593
5.012.1	8.4	8.8	594
6.011.2	8.3	8.9	565
7.010.9	8.3	8.6	580
8.010.2	8.2	8.4	557
9.0 9.9	8.2	8.6	567
10.0 9.7	8.2	8.8	569
11.0 9.6	8.2	9.3	574
12.0 9.3	8.2	8.3	572
14.0 8.5	8.1	8.0	607
16.0 7.7	8.0	7.6	650
18.0 6.9	7.9	6.7	675
20.0 6.6	7.9	6.4	679
22.0 6.1	7.8	6.2	699
24.0 5.6	7.8	5.7	706

EAST CANYON RESERVOIR
05/30/95

0.013.0	8.4	9.5	612
1.012.7	8.4	9.1	612
2.012.4	8.4	9.0	615
3.012.1	8.4	9.1	617
4.011.9	8.4	9.2	616
5.011.8	8.4	9.2	616
6.011.7	8.4	9.0	615
7.011.7	8.4	8.9	616
8.011.6	8.4	8.9	617
9.011.5	8.4	8.9	619
10.011.3	8.3	8.7	616
11.010.5	8.2	8.8	604
12.0 9.6	8.2	7.9	619
13.0 8.8	8.2	7.5	656
14.0 7.5	8.1	6.8	684
15.0 7.1	8.0	6.7	690
16.0 7.1	8.0	6.7	690
17.0 6.5	7.9	6.4	694
18.2 6.3	7.9	6.3	700

EAST CANYON RESERVOIR
05/30/95

0.013.6	8.8	8.8	625
1.012.7	8.7	8.8	621
2.012.3	8.6	8.8	622
3.012.2	8.6	8.8	621
4.012.2	8.6	8.7	618
5.012.0	8.5	8.7	616
6.012.0	8.5	8.7	619
7.012.0	8.5	8.7	622
8.011.9	8.5	8.7	622
9.011.8	8.5	8.6	627
10.011.5	8.5	8.4	632
11.010.7	8.4	8.0	618
12.0 9.9	8.3	8.0	622
13.0 9.0	8.3	8.0	648
14.0 8.6	8.3	7.8	653
15.0 7.8	8.2	7.7	679
16.0 7.6	8.1	7.4	681
17.0 7.2	8.1	7.4	690
18.0 6.9	8.1	7.2	694
19.0 6.7	8.0	7.3	699
20.0 6.6	8.0	7.1	698
21.0 6.4	8.0	7.1	701
22.0 6.3	8.0	7.5	700
23.0 6.1	7.9	7.5	701
24.0 6.0	7.9	6.9	704
25.0 5.9	7.9	6.7	707
26.0 5.6	7.8	6.6	708
27.0 5.4	7.8	6.3	709
28.0 5.4	7.8	6.3	709
29.0 5.3	7.7	5.7	710
30.0 5.0	7.7	5.7	710
31.0 5.2	7.7	5.5	709
32.0 5.2	7.7	5.5	709
33.0 5.1	7.7	5.5	713
34.0 5.1	7.7	5.5	713
35.0 5.0	7.7	5.2	713
36.0 5.0	7.7	5.2	713
37.0 5.0	7.6	5.0	713
38.0 5.0	7.6	5.0	713
39.0 5.0	7.6	4.8	713
40.0 5.0	7.6	4.8	713
41.0 4.9	7.6	4.8	713
42.0 4.9	7.6	4.8	713
43.0 4.9	7.6	4.6	714
44.0 4.9	7.6	4.6	714
45.0 4.9	7.6	4.5	712
46.0 4.9	7.6	4.5	712
49.0 4.8	7.6	4.0	714
51.0 4.8	7.6	4.0	713
52.0 4.8	7.6	3.8	710

EAST CANYON RESERVOIR
08/22/95

0.019.7	8.2	9.7	583
1.019.7	8.2	9.7	585
2.019.7	8.2	9.9	585
3.019.7	8.2	9.6	587
4.019.7	8.2	9.3	585
5.019.7	8.2	9.4	589
6.019.2	8.2	8.9	590
7.018.9	8.1	8.4	599
8.017.9	8.1	7.2	601
9.016.9	8.1	6.4	609
10.015.0	8.0	5.5	608
11.013.8	7.9	4.8	609
12.011.0	8.0	4.7	630
13.0 9.3	7.9	4.6	680
14.0 8.8	7.7	4.4	682
15.0 8.4	7.7	4.2	694
16.0 8.0	7.6	4.1	703
17.0 8.0	7.6	4.0	711
18.0 7.7	7.5	4.0	711
19.0 7.7	7.5	4.0	715
20.0 7.4	7.5	3.9	722
21.0 7.3	7.5	4.0	725
22.0 7.1	7.5	4.0	727
23.0 7.0	7.5	4.0	727

EAST CANYON RESERVOIR
08/22/95

0.020.6	8.3	8.8	575
1.020.6	8.3	8.8	575
2.020.6	8.3	8.8	575
3.020.3	8.4	8.7	575
4.020.9	8.4	8.7	576
5.020.1	8.3	8.0	580
6.019.7	8.3	7.6	583
7.019.5	8.3	7.0	583
8.017.8	8.0	4.6	600
9.016.3	7.8	3.5	596
10.014.6	7.7	2.9	591
11.012.9	7.7	2.7	593
12.011.6	7.6	2.7	605
13.010.4	7.6	3.0	634
14.0 9.5	7.6	3.1	655
15.0 9.3	7.5	3.1	666
16.0 8.9	7.5	3.1	674
17.0 8.5	7.5	3.1	695
18.0 8.0	7.5	3.1	695
19.0 7.9	7.4	3.0	700
20.0 7.8	7.4	3.0	703
21.0 7.5	7.4	2.9	708
22.0 7.5	7.4	2.8	710
23.0 7.5	7.4	2.8	713
24.0 7.4	7.4	2.7	716
25.0 7.3	7.4	2.6	715
26.0 7.3	7.4	2.5	718
27.0 7.0	7.3	2.4	723
28.0 6.9	7.3	2.4	723
29.0 6.9	7.3	2.3	725
30.0 6.7	7.3	2.0	730
31.0 6.5	7.3	1.9	736
32.0 6.4	7.3	1.9	740
33.0 6.3	7.2	1.2	743
34.0 6.2	7.2	1.2	746
35.0 6.0	7.2	1.0	747
36.0 6.0	7.2	1.0	749
37.0 6.0	7.2	1.0	750
38.0 6.0	7.2	1.0	750
40.0 5.9	7.0	0.8	752
41.0 5.9	7.0	0.8	752
42.0 5.9	7.0	0.8	752
43.0 5.8	7.0	0.8	751
44.0 5.8	7.0	0.8	749
45.0 5.8	7.0	0.8	753
46.0 5.8	7.0	0.8	755
47.0 5.8	7.0	0.8	754
48.0 5.8	7.0	0.8	754
49.0 5.8	7.0	0.8	753
50.5 5.8	7.0	0.8	753

EAST CANYON RESERVOIR
08/22/95

0.020.6	8.1	10.5	578
1.020.6	8.1	10.5	578
2.020.6	8.2	10.5	580
3.020.5	8.2	10.5	583
4.020.4	8.2	10.2	588
5.019.9	8.1	9.6	589
6.019.6	8.2	9.3	592
7.019.1	8.1	8.7	599
8.018.6	8.1	7.7	603

9.0	16.0	8.1	6.3	604
10.0	14.6	8.0	5.2	601
11.0	13.7	7.9	5.0	601
12.0	12.0	7.9	4.9	619
13.0	11.2	7.8	4.8	625
14.0	11.2	7.7	4.6	624

EAST CANYON RESERVOIR
10/26/95

0.0	9.8	8.6	13.6	615
1.0	9.9	8.6	12.3	629
2.0	9.9	8.7	12.2	630
3.0	9.9	8.7	12.5	629
4.0	9.8	8.7	12.6	618
5.0	9.8	8.7	12.6	619
6.0	9.8	8.7	12.1	630
7.0	9.8	8.7	12.1	630
8.0	9.8	8.7	12.1	630
9.0	9.8	8.7	12.1	629
10.0	9.8	8.7	12.4	618
11.0	9.8	8.7	12.6	617
12.0	9.5	8.8	8.7	635
13.0	9.0	8.8	8.7	635
14.0	8.8	8.7	8.7	684
15.0	8.5	8.2	8.4	700
16.0	7.9	8.2	8.1	710
17.4	7.9	8.2	7.8	728

EAST CANYON RESERVOIR
10/26/95

0.0	9.8	8.6	14.0	625
1.0	9.8	8.7	14.8	618
2.0	9.8	8.7	14.1	632
3.0	9.8	8.7	14.1	630
4.0	9.8	8.7	14.0	630
5.0	9.8	8.7	14.4	630
6.0	9.8	8.7	13.7	632
7.0	9.8	8.7	13.7	632
8.0	9.7	8.7	13.6	632
9.0	9.7	8.7	13.6	632
10.9	0.7	8.7	13.2	632
11.0	9.7	8.7	13.1	632
12.0	9.6	8.7	13.5	632
13.0	9.4	8.6	13.4	632
14.0	9.0	8.5	12.9	645
15.0	8.8	8.4	11.5	663
16.0	8.4	8.0	11.3	677
17.0	8.1	8.1	10.9	677
19.3	7.8	8.1	9.8	730

EAST CANYON RESERVOIR
10/26/95

0.0	10.2	8.6	12.9	658
1.0	10.1	8.6	12.6	644
2.0	10.0	8.6	12.0	642
3.0	10.0	8.6	12.0	635
4.0	9.9	8.6	12.0	635
5.0	9.9	8.0	13.2	648
6.0	9.9	8.6	13.2	646
7.0	9.8	8.6	13.2	646
8.0	9.9	8.6	13.3	647
9.0	9.8	8.6	13.1	647
10.0	9.8	8.6	13.0	640
11.0	9.8	8.6	13.2	648
12.0	9.8	8.6	13.2	648
13.0	9.8	8.6	13.1	646
14.0	9.7	8.4	13.2	652
15.0	9.6	8.3	13.2	666
16.0	9.0	8.0	10.5	715
17.0	8.1	7.8	9.2	739
18.0	7.9	7.8	8.9	737
19.0	7.7	7.8	9.2	737
20.0	7.6	7.7	9.4	736
21.0	7.5	7.7	9.4	736
22.0	7.4	7.7	9.4	741
23.0	7.4	7.7	9.4	741
24.0	7.2	7.7	9.3	746
25.0	7.2	7.6	9.3	741
26.0	7.0	7.6	9.3	746
27.0	7.0	7.6	9.4	750
28.0	6.8	7.6	9.5	760
29.0	6.7	7.6	9.7	768
30.0	6.4	7.6	9.7	768
31.0	6.4	7.6	9.7	768
32.0	6.4	7.6	9.7	768
33.0	6.4	7.5	9.7	768
34.0	6.2	7.6	10.0	770
35.0	6.0	7.6	9.9	777
36.0	6.0	7.6	9.9	771
37.0	5.9	7.6	9.7	772
38.0	5.9	7.6	9.7	772
39.0	5.9	7.6	9.7	772
40.0	5.9	7.5	10.0	772
41.0	5.9	7.5	10.0	771
42.0	5.9	7.5	10.1	770
43.0	5.9	7.5	10.2	769
44.0	5.9	7.5	10.5	768
45.0	5.9	7.5	10.5	769
46.0	5.9	7.5	10.5	770
47.0	5.9	7.5	10.5	771

EAST CANYON RESERVOIR
04/30/96

0.0	8.1	8.7	13.0	657
1.0	7.8	8.7	12.2	657
2.0	7.8	8.7	12.1	658
3.0	7.8	8.7	11.9	659
4.0	7.8	8.7	11.8	658
5.0	7.8	8.7	11.7	659
6.0	7.7	8.7	11.6	659
7.0	7.7	8.7	11.6	659
8.0	7.7	8.7	11.6	659
9.0	7.6	8.7	11.5	661
10.0	7.2	8.6	11.2	668
11.0	6.4	8.5	9.7	686
12.0	5.5	8.4	8.9	701
13.0	5.4	8.3	8.0	704
14.0	5.1	8.3	8.0	704
15.0	5.0	8.2	7.5	712
16.0	5.0	8.2	7.4	712
17.0	4.9	8.2	7.4	715
18.0	4.8	8.2	7.3	718
19.0	4.8	8.2	7.1	721
20.0	4.8	8.2	7.0	723
22.0	4.6	8.1	6.8	728
24.0	4.5	8.1	6.6	732
26.0	4.4	8.1	6.4	739
28.0	4.3	8.1	6.1	742
30.0	4.1	8.0	5.8	751
35.0	4.0	8.0	5.3	758
40.0	3.9	8.0	5.1	762
41.0	3.8	8.0	4.9	768
42.0	3.8	8.0	4.8	767
43.0	3.8	8.0	4.8	765
44.0	3.8	8.0	4.8	767
45.0	3.8	8.0	4.8	768
46.0	3.8	8.0	4.8	768
46.2	3.8	7.9	4.6	768

EAST CANYON RESERVOIR
04/30/96

0.0	9.2	8.8	12.7	605
1.0	9.1	8.8	12.1	607
2.0	8.8	8.8	11.7	615
3.0	8.4	8.8	11.7	632
4.0	8.3	8.8	11.5	640
6.0	8.1	8.8	11.5	649
7.0	7.8	8.8	11.3	654
8.0	7.6	8.8	11.1	652
10.0	6.2	8.8	10.7	682
11.0	5.3	8.7	9.1	713
12.0	5.0	8.7	8.1	721
13.0	4.6	8.7	7.4	737
15.0	4.5	8.6	6.9	737
16.0	4.4	8.6	6.6	748
17.0	4.3	8.5	6.3	747
21.1	4.2	8.3	5.5	751

EAST CANYON RESERVOIR
04/30/96

0.0	9.2	8.8	12.5	640
1.0	8.8	8.8	12.5	647
2.0	8.4	8.8	12.5	649
3.0	8.3	8.8	12.4	650
5.0	8.1	8.5	12.1	652
6.0	8.0	8.8	11.9	655
7.0	7.7	8.8	11.6	659
9.0	7.1	8.7	11.2	672
10.0	6.8	8.7	10.5	674
11.0	6.3	8.7	9.9	687
13.0	5.8	8.7	7.3	701
14.0	5.5	8.6	8.6	707
15.0	5.4	8.6	8.1	709
17.0	4.6	8.5	7.4	736
19.4	4.3	8.5	6.3	746

EAST CANYON RESERVOIR
04/30/96

0.0	9.2	8.8	12.5	640
1.0	8.8	8.8	12.5	647
2.0	8.4	8.8	12.5	649
3.0	8.3	8.8	12.4	650
5.0	8.1	8.5	12.1	652
6.0	8.0	8.8	11.9	655
7.0	7.7	8.8	11.6	659
9.0	7.1	8.7	11.2	672
10.0	6.8	8.7	10.5	674
11.0	6.3	8.7	9.9	687
13.0	5.8	8.7	7.3	701
147.0	5.5	8.6	8.6	707
15.0	5.4	8.6	8.1	709
17.0	4.6	8.5	7.4	736
19.4	4.3	8.5	6.3	746

EAST CANYON RESERVOIR
06/12/96

0.0	20.2	8.8	9.7	534
1.0	19.3	8.8	9.8	536
2.1	19.0	8.8	9.8	533
3.1	18.5	8.8	9.9	536
4.0	17.9	8.9	10.2	537
5.0	15.2	8.9	10.9	545
6.0	14.5	9.0	11.6	556
7.1	13.7	8.9	10.6	562
7.9	13.0	8.9	10.0	568
9.0	12.4	8.8	8.7	574
10.0	12.0	8.7	7.8	576
11.1	11.5	8.6	7.2	580
12.1	10.7	8.5	6.6	589
13.0	10.5	8.5	6.4	591
14.0	10.2	8.5	6.3	598
15.0	6.5	8.4	5.3	711
16.1	6.4	8.4	5.2	717
17.0	6.5	8.3	5.1	712
18.0	6.2	8.3	5.0	721
19.0	6.1	8.3	4.9	722
20.2	5.8	8.3	4.9	729
21.0	5.8	8.2	4.9	729
22.0	5.6	8.2	4.9	735
23.1	5.5	8.2	4.9	738
24.0	5.5	8.2	4.9	739
24.9	5.3	8.2	4.9	744
25.7	5.0	8.2	4.9	752

EAST CANYON RESERVOIR
06/12/96

0.1	21.2	8.8	9.2	539
1.1	20.4	8.8	9.3	539
2.0	20.0	8.8	9.4	539
1.8	19.8	8.8	9.3	540
4.0	17.3	8.9	12.2	538
5.0	15.2	9.1	13.1	551
6.2	14.0	9.1	12.9	563
7.0	12.8	9.0	11.4	576
8.0	12.3	8.8	8.1	579
9.0	12.0	8.7	7.6	579
10.0	11.6	8.6	7.1	581
11.0	11.3	8.5	6.7	581
12.1	10.9	8.5	6.6	585
13.0	10.6	8.5	6.4	590
14.1	10.3	8.5	6.5	592
15.0	10.1	8.4	6.4	599
16.1	9.6	8.4	6.1	613
17.0	8.2	8.3	5.6	659
17.9	7.2	8.3	5.5	696
19.0	6.4	8.3	5.3	718
20.0	6.1	8.3	5.2	726
21.0	6.1	8.3	5.1	725
22.1	5.9	8.2	5.1	730
23.0	5.8	8.2	5.0	733
24.0	5.7	8.2	5.0	734
25.0	5.6	8.2	4.9	737
26.1	5.5	8.2	4.9	737
26.8	5.5	8.2	4.8	739

EAST CANYON RESERVOIR
06/12/96

0.1	20.5	9.0	10.1	535
1.0	19.5	9.0	10.3	536
1.9	19.3	9.0	10.2	538
3.0	19.2	9.0	10.2	538
4.0	15.7	9.2	12.6	552
5.1	13.7	9.3	12.8	569
6.0	13.0	9.1	10.0	573
7.1	12.3	8.9	8.1	576
8.1	12.1	8.8	7.7	579
9.1	11.7	8.7	7.2	579
10.0	10.4	8.6	6.9	580
11.1	10.5	8.6	6.7	589
12.2	10.4	8.6	6.7	591
13.0	10.2	8.6	6.7	595
14.0	9.7	8.6	6.7	607
15.0	9.1	8.6	6.7	629
16.0	8.7	8.6	6.6	643
17.0	8.4	8.5	6.6	656
18.0	7.8	8.5	6.6	678
19.0	7.1	8.5	6.6	702
20.0	6.6	8.5	6.5	713

21.0	6.2	8.5	6.4	721
21.9	6.3	8.5	6.6	724
23.1	6.0	8.5	6.5	727
24.0	5.9	8.5	6.4	728
25.0	5.8	8.5	6.3	729
26.0	5.7	8.4	6.2	733
27.1	5.6	8.4	6.0	734
28.1	5.5	8.4	6.0	735
29.4	5.4	8.4	6.1	737
29.9	5.3	8.4	6.0	740
32.1	5.2	8.3	5.7	746
34.1	5.0	8.3	5.4	751
36.0	4.8	8.2	5.0	761
38.2	4.6	8.2	4.5	767
40.1	8.2	8.2	4.2	768
42.1	8.2	8.2	4.1	768
43.8	4.6	8.3	4.2	770
46.0	4.5	8.2	4.0	770
48.0	4.4	8.2	4.0	771
49.9	4.4	8.1	3.8	771
51.9	4.4	8.1	3.6	773
52.4	4.4	8.1	3.0	774

EAST CANYON RESERVOIR
06/27/96

0.018.4		8.8	8.7	526
1.018.4		8.8	8.6	526
2.118.3		8.8	8.6	527
2.118.3		8.8	8.6	525
3.018.2		8.8	8.5	526
4.018.2		8.8	8.4	527
5.118.1		8.8	8.3	526
6.017.7		8.8	8.0	536
7.015.6		8.6	7.5	574
8.013.4		8.5	5.9	572
9.112.1		8.3	5.2	564
10.011.1		8.2	4.4	572
11.010.4		8.1	4.2	584
11.210.5		8.1	4.1	584

EAST CANYON RESERVOIR
06/27/96

0.019.1		8.7	8.4	522
1.019.1		8.7	8.3	523
2.119.1		8.7	8.2	523
3.019.0		8.8	8.2	523
4.018.9		8.8	8.2	524
5.018.7		8.8	8.2	525
6.117.8		8.7	8.1	530
7.015.5		8.7	8.2	545
8.014.2		8.6	8.1	547
8.913.4		8.5	7.8	551
10.012.5		8.4	7.4	558
11.011.9		8.3	5.9	559
12.011.1		8.2	4.9	566
13.110.4		8.1	4.5	574
14.010.0		8.1	4.4	591
15.0	9.5	8.1	4.5	592
16.0	9.3	8.0	4.3	600
17.0	8.5	8.0	4.1	622
18.0	7.5	7.9	4.0	654
19.0	6.8	7.9	3.9	675
20.1	6.6	7.9	3.8	679
21.0	6.4	7.8	3.8	683
22.0	6.3	7.8	3.7	686
23.0	6.2	7.8	3.7	688
23.9	6.1	7.8	3.7	690
25.0	5.8	7.8	3.6	698

EAST CANYON RESERVOIR
06/27/96

0.019.3		8.3	8.3	526
1.019.3		8.6	8.1	524
2.019.3		8.6	8.2	523
3.019.2		8.7	8.1	523
4.019.2		8.7	8.1	523
5.019.0		8.7	8.1	524
5.917.7		8.7	8.1	530
7.014.5		8.6	8.8	548
7.014.3		8.5	8.9	547
8.013.2		8.4	7.5	550
9.012.7		8.3	7.1	553
10.012.4		8.3	6.2	554
11.011.9		8.2	5.1	555
13.011.0		8.0	4.6	557
14.010.0		8.0	4.5	578
15.0	9.4	7.9	4.6	599
16.0	8.8	7.9	4.7	618
17.0	8.2	7.9	4.7	641
18.0	7.6	7.9	4.8	656
19.0	7.2	7.8	4.8	668
20.0	6.8	7.8	4.7	678
21.0	6.5	7.8	4.5	683
22.0	6.3	7.8	4.4	687
23.1	6.2	7.7	4.3	689
24.0	6.2	7.7	4.3	691
25.0	6.0	7.7	4.5	694
26.0	5.7	7.7	4.6	702
27.0	5.5	7.7	4.7	706
28.0	5.3	7.7	4.5	710
29.1	5.3	7.7	4.2	712
30.0	5.2	7.6	3.9	715
31.0	5.1	7.6	3.8	717
32.0	5.0	7.6	3.6	721
33.0	4.9	7.6	3.3	722
34.0	4.9	7.6	3.2	724
35.0	4.8	7.6	3.0	724
36.0	4.8	7.5	2.8	727
37.0	4.8	7.5	2.7	728
38.0	4.7	7.5	2.7	728
39.0	4.7	7.5	2.6	730
40.0	4.7	7.5	2.4	729
41.0	4.7	7.5	2.4	730
42.0	4.7	7.5	2.2	731
43.0	4.7	7.5	2.1	730
44.0	4.7	7.5	2.1	731
45.0	4.7	7.5	2.0	731
46.1	4.7	7.5	1.9	731
48.0	4.6	7.5	1.8	732
51.0	4.6	7.5	1.3	732
52.7	4.6	7.5	0.9	735

EAST CANYON RESERVOIR
07/09/96

0.022.6		8.8	7.3	554
1.122.4		8.7	7.3	556
2.022.1		8.7	7.3	556
3.021.9		8.7	7.4	557
4.020.7		8.7	7.5	560
5.018.9		8.6	7.6	572
6.018.1		8.6	7.3	574
7.016.1		8.4	7.1	585
8.014.4		8.3	6.6	591
10.012.6		8.1	5.4	596
11.011.9		8.0	4.7	599
12.011.1		7.9	4.4	604
13.010.8		7.9	4.3	609
14.0	9.9	7.8	4.1	625
17.0	9.6	7.8	4.0	678
19.0	7.3	7.8	3.9	719
23.1	6.4	7.7	3.9	732

EAST CANYON RESERVOIR
07/09/96

0.022.0		8.6	7.2	555
1.021.9		8.6	7.1	555
2.021.9		8.6	6.9	555
3.021.8		8.6	7.0	555
4.021.8		8.6	6.9	555
5.020.0		8.6	6.7	561
6.017.2		8.4	6.4	581
7.015.9		8.3	6.1	582
8.114.7		8.2	5.6	589
9.013.7		8.1	5.0	587
10.012.1		7.9	3.6	594
11.011.4		7.8	3.2	596
12.010.7		7.8	3.2	605
13.010.3		7.7	3.3	615
14.0	9.5	7.7	3.4	634
15.0	8.8	7.7	3.4	655
16.0	8.1	7.7	3.5	681
17.0	7.7	7.7	3.5	693
18.0	7.2	7.7	3.4	710
19.0	7.0	7.6	3.4	714
20.0	6.8	7.6	3.4	721
21.0	6.7	7.6	3.3	722
22.0	6.5	7.6	3.3	726
23.0	6.4	7.6	3.3	728
24.0	6.2	7.6	3.2	731
25.0	6.2	7.6	3.2	733
26.0	6.1	7.6	3.2	735
27.0	6.0	7.6	3.3	738
28.1	5.9	7.6	3.3	740
29.0	5.8	7.6	3.2	743
29.9	5.7	7.6	3.2	744
31.0	5.7	7.6	3.2	745
32.0	5.7	7.6	3.0	746
33.0	5.7	7.6	3.0	747
34.0	5.6	7.6	3.0	748
35.0	5.5	7.6	2.8	753
36.0	5.3	7.5	2.8	757
37.0	5.2	7.5	2.5	753
38.0	5.2	7.5	2.5	762
39.1	5.0	7.5	2.3	766
41.0	5.0	7.5	2.8	767
42.0	4.9	7.5	2.4	769
42.9	4.8	7.5	1.8	773

EAST CANYON RESERVOIR
08/08/96

0.613.9		8.6	651

EAST CANYON RESERVOIR
08/08/96

0.020.3		8.5	572
1.020.3		8.6	575
1.920.3		8.6	577
3.020.1		8.6	578
4.020.1		8.6	577
5.020.1		8.6	577
6.019.9		8.6	577
7.019.6		8.6	586
7.918.2		8.4	603
9.017.0		8.2	611
10.015.8		8.2	606
11.114.2		8.2	605
12.012.3		8.2	621
13.011.2		8.2	627
14.110.0		8.2	645
14.8	9.4	8.1	650
15.9	7.8	8.1	691
17.2	7.2	8.1	705
18.2	7.1	8.0	704
19.1	6.9	8.0	710
20.0	6.6	8.0	716

EAST CANYON RESERVOIR
08/08/96

0.120.0		8.6	7.3	574
1.019.9		8.7	7.3	575
2.019.9		8.7	7.3	576
3.019.9		8.7	7.0	574
4.019.9		8.7	7.1	574
5.019.9		8.7	7.1	575
6.119.8		8.7	7.1	575
7.019.8		8.7	7.2	575
8.219.8		8.7	7.3	575
9.019.7		8.6	7.3	575
10.015.8		8.2	3.6	611
11.013.3		8.2	2.7	604
12.010.7		8.4	2.3	620
13.0	9.7	8.3	2.3	640
14.0	8.4	8.3	2.4	669
15.0	8.0	8.2	2.5	682
16.0	7.6	8.2	2.5	692
17.1	7.2	8.2	2.6	702
18.0	7.1	8.2	2.6	706
19.1	6.9	8.1	2.5	709
20.0	6.8	8.2	2.5	711
21.0	6.8	8.1	2.4	714
22.1	6.6	8.1	2.5	712
23.0	6.6	8.1	2.5	713
24.0	6.5	8.1	2.3	716
25.1	6.4	8.0	2.3	719
26.1	6.3	8.0	2.3	721
27.0	6.2	8.0	2.3	724
28.0	6.2	8.0	2.2	724
29.0	6.1	8.0	2.2	728
30.0	6.0	8.0	2.2	729
30.9	5.8	8.0	2.0	735
32.1	5.7	8.0	1.9	738
33.0	5.6	8.0	1.7	741
34.1	5.5	8.0	1.5	741
35.0	5.5	8.0	1.4	745
36.0	5.3	7.9	1.1	749
37.0	5.3	7.9	0.8	750
38.1	5.2	7.9	0.6	751
39.0	5.2	7.9	0.5	752
40.1	5.2	7.9	0.4	753
41.0	5.1	7.9	0.4	756
42.1	5.0	7.9	0.3	760
42.9	5.0	7.9	0.3	760
44.0	5.0	7.9	0.3	760
44.9	5.0	7.9	0.3	761
45.8	5.0	7.9	0.3	762

EAST CANYON RESERVOIR
08/08/96

0.020.3		8.5	7.5	572
1.020.3				

EAST CANYON RESERVOIR
08/08/96

0.020.4		8.7	571
1.220.4		8.6	573
2.020.2		8.6	574
3.020.1		8.6	575
4.120.1		8.6	575

5.020.1	8.6		576
6.020.0	8.6		576
7.119.9	8.5		579
8.019.8	8.5		578
9.019.1	8.3		588
10.015.7	8.1		596
11.012.0	8.2		608
12.110.7	8.4		618
13.0 9.8	8.4		634
14.2 9.0	8.3		649
14.9 8.2	8.3		673
15.5 8.1	8.2		680

EAST CANYON RESERVOIR
08/23/96

0.019.7	8.7	7.9	556
1.019.6	8.6	7.9	555
2.019.5	8.6	7.9	555
3.019.5	8.6	7.9	558
4.019.4	8.6	7.9	562
5.019.4	8.6	7.9	553
6.019.4	8.6	7.9	553
7.019.3	8.6	7.9	554
8.019.3	8.6	7.9	557
9.017.2	8.1	2.7	575
10.015.5	8.0	1.2	583
11.012.1	7.9	0.8	592
12.010.2	7.9	1.2	612
13.0 8.4	7.8	1.7	652
14.0 8.0	7.8	1.8	647
15.0 7.5	7.7	1.8	668
16.0 7.2	7.7	1.7	682
17.0 7.0	7.7	1.7	680
18.0 6.8	7.7	1.8	675
19.0 6.7	7.7	1.6	690
20.0 6.6	7.6	1.5	699
21.0 6.6	7.6	1.6	693
22.0 6.5	7.6	1.7	696
23.0 6.5	7.6	1.6	698
24.0 6.4	7.6	1.6	698
25.0 6.2	7.6	1.5	683
30.0 5.8	7.5	1.1	688
35.0 5.3	7.5	0.1	732
40.0 5.0	7.5	0.1	746
45.0 4.9	7.5	0.1	722
47.4 4.8	7.4	0.1	737

EAST CANYON RESERVOIR
08/23/96

0.019.9	8.6	7.8	558
1.019.9	8.5	7.8	561
2.019.7	8.5	7.6	563
3.019.5	8.5	7.6	565
4.019.5	8.5	7.5	557
5.019.5	8.5	7.5	566
6.019.4	8.5	7.3	560
7.119.3	8.5	7.1	558
8.019.2	8.5	6.9	564
9.018.9	8.4	5.1	575
10.014.6	8.1	1.2	606
10.911.8	7.9	0.4	607
12.0 9.9	7.8	0.6	618
13.0 9.2	7.7	0.7	620
14.0 8.5	7.6	0.9	647
15.0 8.2	7.6	0.7	656
17.9 7.3	7.6	3.8	669

EAST CANYON RESERVOIR
08/23/96

0.020.0	8.6	8.0	550
1.019.9	8.5	8.0	552
2.019.8	8.5	7.9	554
3.019.5	8.5	7.8	557
3.919.5	8.5	7.7	558
5.119.4	8.5	7.6	559
6.019.4	8.5	7.3	559
7.019.1	8.5	6.5	564
8.018.5	8.3	4.8	574
9.017.1	8.1	3.2	580
10.015.5	7.9	1.6	583
11.013.1	7.8	0.6	596
12.011.5	7.7	0.4	623
12.910.2	7.7	0.3	617
14.0 9.2	7.6	0.5	652
15.0 8.8	7.6	0.4	635
20.0 6.7	7.5	0.1	677
22.0 3.4	7.5	0.2	676

EAST CANYON RESERVOIR
08/28/96

0.122.0	8.8	8.2	562
1.021.8	8.7	7.9	561
2.021.6	8.7	8.3	560
3.021.5	8.7	8.4	560
3.921.3	8.7	8.6	559
5.020.0	8.7	8.7	564
5.220.0	8.7	8.6	564
6.118.5	8.5	8.4	593
7.017.3	8.3	7.9	601
8.016.0	8.3	7.6	599
9.013.9	8.2	7.1	600
10.012.5	8.0	6.0	602
11.011.6	8.0	5.9	605
12.011.1	8.0	5.2	611
13.110.4	7.9	4.6	623
14.0 9.5	7.8	4.3	644
15.0 9.0	7.8	4.0	657
16.1 8.0	7.8	3.7	683
17.0 7.6	7.8	3.5	690
18.0 7.2	7.7	3.3	709
23.0 7.1	7.7	3.1	717
27.1 5.9	7.7	2.6	747

EAST PARK RESERVOIR
07/08/93

0.015.3	7.5	8.4	29
1.013.2	7.3	7.4	29
2.013.1	7.3	7.1	29
3.013.0	7.3	7.1	29
4.012.9	7.2	7.0	29
5.012.6	7.1	6.9	29
6.012.6	7.1	6.9	29

EAST PARK RESERVOIR
03/14/95

0.0 0.8	7.0	4.4	34
1.0 3.8	7.0	2.5	34
2.0 4.1	7.0	2.2	34
3.0 4.3	7.4	1.8	34

ECHO RESERVOIR
06/28/94

0.019.6	8.4	7.3	471
1.019.3	8.5	7.2	472
2.019.3	8.5	7.2	473
3.019.2	8.5	7.2	472
4.019.1	8.5	7.2	473
5.018.9	8.5	7.2	472
6.018.9	8.5	7.1	474
7.018.7	8.5	7.1	475
8.017.3	8.4	6.3	480
9.016.5	8.3	5.8	482
10.016.1	8.3	5.4	481
11.015.7	8.2	5.3	480
12.015.3	8.2	5.1	481
13.014.8	8.2	4.9	481
14.014.4	8.1	4.7	481
15.014.2	8.1	4.7	481
16.013.8	8.1	4.6	483
17.013.7	8.1	4.5	486
18.013.6	8.1	4.4	489
19.013.2	8.1	4.3	484
20.013.1	8.1	4.3	486
21.013.1	8.0	4.3	488
22.012.9	8.0	4.0	488
23.012.7	8.0	4.0	484
24.012.6	8.0	3.8	487
24.912.1	7.9	2.7	486

ECHO RESERVOIR
08/02/94

0.022.7	8.6	7.4	460
1.022.3	8.6	7.4	461
2.022.2	8.6	7.5	463
3.022.1	8.6	7.4	461
4.021.9	8.5	7.1	461
5.020.1	8.3	5.9	460
6.019.7	8.2	5.1	451
7.019.5	8.2	4.8	465
8.019.3	8.2	4.8	464
9.019.2	8.1	4.6	482
10.019.0	8.1	4.5	454
11.018.9	8.1	4.4	458
12.018.7	8.0	4.3	465
13.018.4	8.0	3.9	454
14.018.3	8.0	3.7	469
15.018.2	7.9	3.1	451
16.018.1	7.9	3.4	466
17.018.1	7.9	2.9	464
18.017.9	7.9	2.3	454
19.017.8	7.9	1.8	470

ECHO RESERVOIR
08/06/96

0.220.5	8.4	7.4	391
1.120.4	8.5	7.4	392
2.020.4	8.4	7.4	392
3.020.3	8.4	7.4	393
4.020.3	8.4	7.3	393
5.020.3	8.4	7.3	393
5.920.3	8.4	7.3	393
7.020.3	8.4	7.2	393
8.018.9	8.2	6.2	392
9.218.5	8.1	5.1	393
10.018.2	8.0	4.8	392
10.917.8	8.0	4.8	390
12.017.5	8.0	4.6	392
13.217.3	8.0	4.0	395
14.017.0	7.9	4.3	388
15.016.9	8.0	4.3	388
15.516.8	8.0	4.8	387

ECHO RESERVOIR
08/06/96

0.120.1	8.3	7.2	394
1.020.1	8.3	7.1	394
2.020.1	8.3	7.1	395
3.020.1	8.3	7.1	394
3.920.1	8.3	7.1	395
5.020.1	8.3	7.1	395
5.920.0	8.3	7.1	394
7.220.0	8.3	7.1	395
8.219.2	8.1	5.9	399
9.018.7	8.0	4.6	399
10.118.3	7.9	4.1	400
11.117.9	7.9	3.8	400
12.017.7	7.8	3.5	399
13.017.6	7.8	3.6	399
14.017.4	7.8	3.6	400
15.017.3	7.8	3.6	400
16.017.2	7.8	3.5	400
16.917.1	7.8	3.5	400
18.216.8	7.8	3.4	399
18.916.7	7.8	3.3	400
20.516.6	7.7	3.1	400
20.916.5	7.7	2.9	400
21.916.4	7.7	2.7	400
23.016.3	7.7	2.6	402
24.016.2	7.7	2.2	402
24.416.1	7.7	1.6	403

ELECTRIC LAKE
06/16/93

0.015.0	9.2	12.3	181
1.015.0	9.2	12.5	181
2.015.0	9.2	12.6	181
3.014.9	9.2	12.6	182
4.0 9.6	8.6	12.1	183
5.0 8.3	8.1	10.9	183
6.0 8.0	8.0	10.5	187
7.0 7.7	7.9	10.2	185
8.0 7.4	7.9	9.8	184
9.0 7.1	7.9	9.8	186
10.0 6.9	7.9	9.9	188
11.0 6.5	7.9	9.5	190
12.0 6.3	7.8	9.2	191
13.0 6.2	7.8	9.0	192
14.0 5.7	7.8	9.4	193
15.0 5.4	7.7	9.2	194
16.0 4.8	7.7	7.8	205
17.0 4.4	7.7	7.5	215
18.0 4.1	7.7	7.3	223
19.0 3.9	7.6	7.1	231
20.0 3.7	7.6	6.8	243
21.0 3.5	7.6	6.4	252
22.0 3.5	7.6	6.1	258
23.0 3.4	7.5	5.8	259
24.0 3.4	7.5	5.6	264
25.0 3.4	7.5	5.4	267
27.0 3.4	7.5	5.2	269
29.0 3.4	7.5	4.9	274
31.0 3.4	7.5	4.6	274
33.0 3.4	7.4	4.2	279
35.0 3.2	7.4	4.0	281
37.0 3.3	7.4	3.8	286
39.0 3.3	7.3	3.4	288
41.0 3.3	7.3	3.3	288
45.0 3.3	7.3	3.0	290
50.0 3.2	7.3	2.8	290
51.1 3.3	7.3	2.7	295

ELECTRIC LAKE
08/11/93

0.016.9	8.8	7.7	183
1.016.8	8.8	7.7	184
2.016.6	8.8	7.6	184

3.016.4	8.8	7.6	184
4.016.4	8.8	7.5	184
5.016.0	8.7	7.3	191
6.013.5	8.4	7.2	190
7.011.7	8.2	7.0	190
8.0 9.3	8.0	6.7	190
9.0 8.6	7.8	6.3	188
10.0 7.7	7.7	6.0	180
11.0 7.3	7.6	5.7	180
12.0 6.8	7.6	5.6	178
13.0 6.4	7.6	5.7	175
14.0 5.9	7.6	5.7	180
15.0 5.5	7.6	5.7	184
16.0 5.2	7.6	5.7	190
17.0 4.5	7.5	5.4	213
18.0 4.3	7.5	4.9	206
19.0 4.2	7.5	4.7	210
20.0 4.0	7.5	4.5	216
21.0 3.9	7.4	4.3	223
23.0 3.8	7.4	4.0	227
25.0 3.6	7.4	3.7	231
28.0 3.6	7.4	3.1	237
30.0 3.5	7.4	2.9	237
35.0 3.5	7.3	2.9	246
40.0 3.4	7.3	1.9	241
45.0 3.4	7.3	1.4	244
50.0 3.4	7.3	1.1	252
52.6 3.4	7.3	1.0	253

ELECTRIC LAKE
08/30/95

0.018.6	8.8	6.7	228
1.018.4	8.8	6.6	231
2.018.3	8.8	6.6	228
3.018.1	8.8	6.6	228
4.0 7.8	8.8	6.6	235
5.017.6	8.8	6.5	228
6.016.6	8.6	6.1	239
7.014.0	8.5	7.2	231
8.011.0	8.3	6.0	223
9.0 9.0	8.2	4.3	221
10.0 8.1	8.1	4.3	224
11.0 7.5	8.0	4.6	223
12.0 6.8	8.0	4.9	226
13.0 6.6	8.0	5.0	224
14.0 6.3	8.9	5.1	226
15.0 6.1	7.9	5.2	227
16.0 5.7	7.9	5.2	228
17.0 5.5	7.8	5.3	230
18.0 5.3	7.8	5.3	232
19.015.2	7.8	5.2	233
20.0 5.1	7.8	5.1	234
25.0 4.6	7.8	5.0	242
30.0 4.3	7.7	4.5	248
35.0 4.1	7.7	4.0	253
40.0 4.0	7.7	3.7	257
45.0 3.9	7.6	3.1	259
50.0 3.9	7.6	2.6	262
51.0 3.9	7.6	2.3	262
52.0 3.8	7.6	2.2	263
53.0 3.8	7.6	2.1	263
54.0 3.8	7.6	1.9	264
54.8 3.8	7.6	1.8	264

ELECTRIC LAKE
08/30/95

0.018.6	8.8	6.8	228
1.018.3	8.8	6.8	230
2.018.2	8.9	6.7	228
3.017.6	8.7	6.7	233
4.017.5	8.9	6.7	233
5.017.4	8.8	6.6	232
6.015.3	8.6	6.3	246
7.012.9	8.4	7.0	217
8.010.8	8.3	5.5	230
9.0 9.5	8.2	4.8	220
10.0 8.3	8.1	4.4	218
11.0 7.4	8.1	4.5	231
12.0 7.2	8.1	4.1	229
13.0 6.7	8.0	4.8	220
14.0 6.4	8.0	4.9	217
15.0 6.1	8.0	5.0	225
16.0 5.8	8.0	5.1	222
17.0 5.6	7.9	5.2	229
18.0 5.4	7.9	5.2	235
19.0 5.2	7.9	5.2	235
20.0 5.0	7.9	5.1	218
21.0 4.9	7.9	5.0	240
22.0 4.8	7.9	4.9	245
23.0 4.7	7.9	4.9	250
24.0 4.6	7.9	4.7	260
25.0 4.5	7.8	4.6	262
26.0 4.4	7.8	4.5	265
27.0 4.4	7.8	4.4	266
28.0 4.4	7.8	4.3	270
29.0 4.4	7.8	4.0	275
30.0 4.4	7.8	3.8	279
31.0 4.4	7.8	3.8	280
32.0 4.3	7.8	3.8	282
33.0 4.2	7.8	3.8	286
34.0 4.2	7.8	3.8	288
35.0 4.1	7.7	3.8	291

EMERALD LAKE
08/17/93

0.016.4	7.6	9.2	152
0.515.8	7.7	8.5	151
1.015.6	7.4	8.5	152
1.515.6	7.2	8.6	152
2.015.4	7.4	8.6	153
2.515.1	7.1	8.5	153
3.015.0	7.0	8.5	154
3.514.9	7.2	8.6	154
4.014.9	6.8	8.6	154
4.514.8	7.1	8.5	154
5.014.7	7.2	8.6	155
5.514.7	7.0	8.5	156
6.014.6	7.3	8.6	154
6.514.5	7.0	8.6	154
7.014.4	6.1	8.5	159
7.514.1	3.5	8.2	166
8.013.8	1.4	7.9	193
8.313.6	1.1	7.7	195

EMERALD LAKE
11/16/93

0.016.4	7.6	9.2	152
0.515.8	7.7	8.5	151
1.015.6	7.4	8.5	152
1.515.6	7.2	8.6	152
2.015.4	7.4	8.6	153
2.515.1	7.1	8.5	153
3.015.0	7.0	8.5	154
3.514.9	7.2	8.6	154
4.014.9	6.8	8.6	154
4.514.8	7.1	8.5	154
5.014.7	7.2	8.6	155
5.514.7	7.0	8.5	156
6.014.6	7.3	8.6	154
6.514.5	7.0	8.6	154
7.014.4	6.1	8.5	159
7.514.1	3.5	8.2	166
8.013.8	1.4	7.9	193
8.213.6	1.1	7.7	195

FAIRVIEW LAKE #2
07/19/94

0.019.0	8.6	7.8	291
1.018.8	8.6	7.7	296
2.018.7	8.6	7.9	295
3.018.4	8.5	8.5	290
4.318.1	8.2	7.6	296

FAIRVIEW LAKE #2
08/30/94

0.017.5	9.3	9.7	149
1.017.4	9.4	9.5	149
2.017.2	9.5	10.0	149

FAIRVIEW LAKE #2
06/25/96

0.214.7	8.4	7.9	280
1.014.7	8.4	7.9	279
2.014.7	8.4	7.8	280
3.014.7	8.4	7.8	279
4.014.7	8.4	7.8	278
4.913.0	8.3	9.6	284
6.0 8.7	8.1	7.8	293
7.0 7.3	7.8	7.8	293
7.9 6.8	7.6	3.1	314

FAIRVIEW LAKE #2
08/20/96

0.017.4	8.3	9.2	236
1.017.5	8.3	9.0	237
2.017.0	8.3	9.3	236
2.917.0	8.3	9.5	236
4.016.8	8.4	10.7	231
4.316.8	8.4	10.5	232

FERRON RESERVOIR
06/15/93

0.010.9	8.7	10.1	383
1.010.7	8.7	10.2	383
2.010.5	8.7	10.2	384
3.010.4	8.7	10.2	383
4.0 8.1	8.6	10.4	386
5.0 7.7	8.6	10.2	385
6.0 7.5	8.5	10.0	386
7.0 7.2	8.5	9.7	387
8.0 6.9	8.4	9.5	388
9.0 6.4	8.2	8.4	394
10.2 6.3	8.1	7.8	397

FERRON RESERVOIR
08/10/93

0.015.5	8.3	8.9	356
1.015.3	8.3	9.0	356
2.015.2	8.3	9.0	356
3.015.0	8.4	9.0	357
4.014.8	8.4	8.9	357
5.014.3	8.3	8.7	357
6.013.9	8.3	8.4	357

FERRON RESERVOIR
07/19/94

0.017.4	9.7	11.4	327
1.017.3	11.4	9.7	332
2.015.6	9.8	16.9	341

FERRON RESERVOIR
08/31/94

0.014.9	10.0	10.5	293
1.014.8	10.0	10.3	294
2.314.7	10.0	11.5	305

FERRON RESERVOIR
06/25/96

0.213.3	8.5	8.3	385
1.013.2	8.5	8.4	385
2.012.4	8.5	8.5	385
3.012.1	8.5	8.6	387
4.010.3	8.4	8.6	397
5.0 8.7	8.3	8.6	386
6.1 7.5	7.9	7.9	394
7.0 7.2	7.7	6.9	395
8.2 6.9	7.6	5.0	402
8.4 6.8	6.9	2.2	628

FERRON RESERVOIR
08/20/96

0.115.7	8.3	8.4	418
0.915.7	8.3	8.2	418
2.115.7	8.3	8.1	417
3.015.6	8.3	8.1	418
4.015.6	8.3	8.0	418
4.914.8	8.3	7.9	417
6.114.5	8.2	7.6	418
7.014.1	7.9	5.3	419
8.112.8	7.5	1.5	431

FISH LAKE
08/18/93

0.014.9	8.7	8.0	109
1.014.9	8.7	7.7	108
2.014.9	8.7	7.7	108
3.014.9	8.7	7.6	109
4.014.9	8.7	7.6	108
5.014.9	8.7	7.6	107
6.014.9	8.7	7.6	107
7.014.9	8.7	7.5	103
8.014.7	8.8	7.6	108
9.014.7	8.8	7.7	108
10.014.6	8.8	7.7	108
11.014.6	8.8	7.7	108
12.014.5	8.8	7.6	108
13.013.5	8.6	7.7	109
14.017.7	8.3	7.9	109
15.010.6	8.0	7.7	108
16.0 9.9	8.0	7.8	108
17.0 9.5	7.9	7.7	109
18.0 9.3	7.8	7.5	109
19.0 9.1	7.8	7.2	109
20.0 8.8	7.7	6.9	109
21.0 8.6	7.7	6.7	109
22.0 8.3	7.6	6.4	108
23.0 8.0	7.5	5.5	109
24.0 7.8	7.5	4.7	108
26.0 7.4	7.3	2.4	111
28.0 7.4	7.3	2.3	111

FISH LAKE
09/12/95

0.016.5	8.8	7.3	117
1.016.5	8.8	7.6	117
2.016.5	8.8	7.6	117
3.016.5	8.9	7.7	117
4.016.5	8.9	8.2	117
5.016.5	8.9	8.3	117
6.016.4	8.9	8.3	117
7.016.4	8.9	8.3	117
8.016.4	8.9	8.3	116
9.016.3	8.9	8.4	117
10.015.9	8.9	8.6	117
11.015.1	8.8	8.6	117
12.012.9	8.8	10.0	115
13.011.5	8.7	10.0	115
14.010.0	8.6	9.0	114
15.0 9.3	8.4	8.6	115
16.0 8.5	8.3	7.7	114
17.0 8.0	8.1	7.0	113
18.0 7.7	8.0	6.2	115
19.0 7.4	8.0	6.0	114
20.0 7.1	7.9	5.3	114
21.0 6.9	7.9	4.8	114
22.0 6.7	7.8	4.8	114
23.0 6.6	7.8	4.1	114
24.0 6.5	7.7	3.3	114
25.0 6.3	7.7	3.0	115
26.0 6.0	7.6	1.0	116
27.0 5.9	7.5	0.1	116
28.0 5.9	7.4	0.0	116
29.0 5.8	7.4	0.0	116
30.0 5.8	7.4	0.0	117
31.0 5.8	7.4	0.0	139

FISH LAKE
09/12/95

0.016.7	8.8	7.3	117
1.016.7	8.8	7.2	117
2.016.6	8.8	7.3	117
3.016.6	8.8	7.3	117
4.016.5	8.8	7.3	117
5.016.5	8.8	7.3	117
6.016.5	8.9	7.3	117
7.016.5	8.8	7.3	117
8.016.5	8.8	7.5	117
9.016.5	8.8	7.5	117
10.016.4	8.9	7.4	116
11.015.9	8.8	7.5	117
12.011.3	8.8	8.5	115
13.012.5	8.9	9.0	114
14.011.5	8.8	9.0	114
15.0 9.9	8.7	8.5	115
16.0 9.8	8.6	8.3	115
17.0 8.6	8.4	7.9	113
18.0 8.0	8.3	7.5	113
19.0 7.8	8.2	6.8	113
20.0 7.5	8.2	6.4	115
21.0 7.3	8.1	5.8	114
22.0 7.0	8.1	5.5	112
23.0 6.7	8.0	4.4	114
24.0 6.6	7.9	4.0	114
25.0 6.4	4.9	3.8	113
26.0 6.7	7.9	3.2	115
27.0 6.0	7.8	2.0	115
28.0 5.8	7.8	0.2	116
29.0 5.8	7.7	0.1	116
30.0 5.7	7.6	0.0	120
31.0 5.8	7.6	0.0	115
32.0 5.7	7.5	0.0	115
33.0 5.7	7.5	0.0	120

FLAMING GORGE RESERVOIR
07/11/95

0.019.7	8.3	7.6	600
1.019.7	8.3	7.6	600
3.019.7	8.3	7.6	600
4.017.6	8.4	7.9	590
5.017.2	8.5	7.9	591
6.016.7	8.4	7.9	587
7.015.8	8.4	7.9	616
8.015.4	8.4	8.0	625
9.015.0	8.3	7.9	623
10.014.6	8.3	7.9	612
11.013.5	8.3	8.0	616
12.013.1	8.3	8.1	646
13.012.7	8.3	8.1	660
14.012.0	8.3	8.3	646
15.011.6	8.3	8.4	656
16.011.6	8.3	8.4	682
18.010.6	8.3	8.7	724
20.010.0	8.3	9.4	748
22.0 9.3	8.3	9.2	757
24.0 8.6	8.3	9.2	755
26.0 8.1	8.3	9.3	751
30.0 7.1	8.2	9.3	742
35.0 6.4	8.2	9.3	746
40.0 5.6	8.1	9.0	750
45.0 5.0	8.0	9.0	755
50.0 4.6	8.0	8.9	760
55.0 4.5	8.0	8.2	762
60.0 4.3	7.8	8.1	764
65.0 4.3	7.7	7.3	770
70.0 4.2	7.6	6.8	770
75.0 4.2	7.5	6.1	777
80.0 4.2	7.5	5.6	781
85.0 4.2	7.4	5.2	785
90.0 4.2	7.4	5.0	778
95.0 4.2	7.4	5.0	780
100.0 4.2	7.4	5.0	780

FLAMING GORGE RESERVOIR
07/11/95

0.019.5	8.4	8.1	740
1.019.3	8.4	8.1	738
2.018.9	8.4	8.2	739
3.018.8	8.4	8.2	738
4.018.7	8.4	8.2	737
5.018.6	8.3	8.3	736
6.018.5	8.3	8.2	737
7.017.4	8.4	8.5	737
8.016.9	8.4	8.6	735
9.016.3	8.4	8.7	743
10.015.7	8.4	8.5	746
11.015.5	8.3	8.5	742
12.015.4	8.2	8.2	742
13.014.7	8.1	8.0	730
14.013.9	8.1	8.2	739
15.013.2	8.1	8.0	751
16.012.6	8.1	8.3	788
18.011.5	8.1	8.0	763
20.011.0	8.1	8.3	763
25.0 9.2	8.1	8.6	772
30.0 7.8	8.2	9.0	774
35.0 7.0	8.2	8.9	778
40.0 6.7	8.1	8.8	775
45.0 6.3	8.1	8.7	776
50.0 6.0	8.0	8.4	775
53.0 5.9	8.0	8.4	780

FLAMING GORGE RESERVOIR
08/16/95

0.020.2	8.4	7.9	742
1.019.9	8.4	8.1	743
2.019.2	8.4	8.3	739
4.017.8	8.4	8.3	739
6.016.9	8.4	8.6	730
9.015.2	8.3	8.5	725
11.014.3	8.3	8.3	724
13.013.1	8.2	8.3	755
15.012.4	8.1	8.4	757
20.0 9.9	8.2	8.7	782
25.0 8.1	8.2	9.2	789
30.0 7.0	8.2	9.3	781
35.0 6.4	8.2	9.4	782
40.0 5.8	8.1	9.2	777
45.0 5.4	8.0	9.0	777
50.0 5.1	8.0	8.8	770
55.0 4.9	7.9	8.5	770
60.0 4.7	8.0	8.2	773
63.0 4.8	7.8	8.0	771

FLAMING GORGE RESERVOIR
08/16/95

0.021.5	8.5	7.5	730
1.021.5	8.5	7.7	729
3.021.0	8.5	7.2	725
5.020.5	8.5	7.1	730
7.020.2	8.5	7.1	732
9.019.8	8.5	7.0	737
10.019.6	8.5	7.0	731
11.019.4	8.4	6.7	735
12.019.2	8.4	6.4	739
13.018.5	8.3	6.2	732
14.017.2	8.2	6.0	731
15.016.2	8.2	5.9	721
16.015.4	8.2	5.9	742
17.014.9	8.2	5.9	743
18.014.9	8.2	6.0	740
19.013.9	8.2	6.0	750
20.012.4	8.1	6.2	756
21.012.0	8.1	6.2	760
22.011.6	8.1	6.2	771
25.0 9.7	8.1	6.7	810
30.0 8.1	8.1	7.2	801
35.0 7.4	8.1	7.3	822
40.0 6.7	8.0	7.3	810
45.0 6.2	8.0	7.3	808
50.0 5.6	7.9	7.1	823
55.0 5.2	7.9	6.8	802
60.0 5.0	7.8	6.6	808

FLAMING GORGE RESERVOIR
08/16/95

0.019.5	8.6	7.0	700
1.019.5	8.6	7.0	700
3.019.5	8.6	6.9	700
5.019.5	8.6	7.5	703
7.019.4	8.6	6.9	703
9.019.3	8.6	6.9	709
11.018.5	8.4	6.1	704
12.017.8	8.3	5.6	744
13.016.5	8.2	5.3	768
14.015.8	8.2	5.5	740
15.015.1	8.2	5.7	770
16.014.1	8.2	5.8	770
17.013.8	8.2	5.9	776
18.012.6	8.2	5.9	776
19.011.8	8.2	5.9	782
20.011.3	8.2	6.1	790
22.010.2	8.2	6.3	800
25.0 9.4	8.2	6.4	801
30.0 8.1	8.1	6.6	806
35.0 7.4	8.1	6.7	804
40.0 6.9	8.1	6.8	826
45.0 6.6	8.0	6.8	814
50.0 6.2	7.9	6.5	850
54.0 6.2	7.9	6.2	866

FLAMING GORGE RESERVOIR
08/16/95

1.020.8	8.7	7.7	631
2.020.8	8.6	7.6	632
3.020.7	8.6	7.5	635
5.020.3	8.6	7.5	631
7.020.2	8.6	7.4	632
9.019.7	8.5	7.3	632
10.018.0	8.4	6.8	631
11.018.6	8.4	6.8	642
12.017.6	8.4	6.6	621
13.016.8	8.3	6.6	613
14.016.0	8.3	6.4	638
15.015.2	8.3	6.4	638
16.014.8	8.2	6.3	636
17.014.2	8.2	6.1	650
18.013.1	8.2	6.4	709
20.012.1	8.2	6.6	723
25.0 9.4	8.3	7.2	775
30.0 8.0	8.2	7.9	798
35.0 7.3	8.2	8.1	768
40.0 6.4	8.2	8.1	800

FLAMING GORGE RESERVOIR
08/16/95

0.020.0	8.4	6.6	350
1.020.0	8.4	6.5	350
3.019.4	8.4	6.5	350
5.019.4	8.4	6.5	350
7.019.4	8.4	6.3	349
9.019.4	8.3	6.2	357
11.019.2	8.3	6.0	390
12.018.9	8.1	5.3	429
13.018.0	8.0	4.2	478
14.017.0	7.9	3.3	518
15.015.3	7.8	2.7	587
16.014.0	7.7	2.3	649
17.012.9	7.6	1.9	701
18.012.2	7.6	1.7	730
19.012.0	7.6	1.6	720
20.011.8	7.6	1.6	744
21.011.6	7.6	1.5	751
23.011.0	7.5	1.5	758

FLAMING GORGE RESERVOIR
08/16/95

0.019.8	8.5	7.7	470
1.019.8	8.4	7.2	473
3.019.6	8.4	7.1	477
5.019.5	8.4	7.0	475
7.019.4	8.4	7.0	474
9.019.7	8.4	6.9	472
11.019.2	8.4	6.7	465
12.019.0	8.3	6.5	458
13.018.9	8.3	6.4	450
14.018.8	8.3	6.3	447
15.016.2	8.0	4.4	594
16.013.6	7.9	3.9	677
17.012.6	7.8	3.7	698
18.012.0	7.8	3.6	740
19.011.8	7.8	3.7	745
20.011.5	7.8	3.7	750

22.011.0	7.8	3.6	750
25.010.0	7.7	3.3	752
28.0 9.4	7.7	3.3	765
30.0 8.8	7.7	3.2	786

FLAMING GORGE RESERVOIR
08/16/95

0.020.7	8.5	7.1	381
1.020.7	8.5	7.1	380
3.019.8	8.5	7.1	383
5.019.7	8.4	7.0	387
7.019.6	8.4	6.9	391
9.019.4	8.3	6.5	412
11.019.3	8.3	6.2	460
12.019.3	8.3	6.1	490
13.019.3	8.3	6.1	510
14.018.2	8.0	4.2	654
15.016.8	7.8	2.6	659
16.014.4	7.6	1.6	701
17.013.6	7.6	1.5	702
18.012.5	7.6	1.4	730
19.011.5	7.5	1.3	750
20.011.2	7.5	1.1	761

FLAMING GORGE RESERVOIR
08/16/95

0.019.3	8.5	7.1	580
1.019.3	8.5	7.0	581
3.019.5	8.5	7.0	582
5.019.2	8.5	7.0	582
7.019.1	8.5	6.8	581
9.019.0	8.5	6.7	579
11.019.0	8.5	6.7	593
12.018.9	8.5	6.6	593
13.018.8	8.4	6.4	595
14.017.8	8.3	5.9	620
15.016.6	8.2	5.9	658
16.014.8	8.4	5.2	723
17.014.3	8.1	5.2	732
18.013.9	8.1	5.2	740
19.012.8	8.1	5.3	760
20.012.0	8.1	5.4	777
22.010.8	8.0	5.4	781
25.0 9.5	8.0	5.5	800
30.0 8.3	8.0	5.4	810
35.0 7.6	7.9	5.4	812
40.0 7.4	7.9	5.1	815

FLAMING GORGE RESERVOIR
07/10/96

0.021.0	8.6	8.3	651
1.021.0	8.6	8.2	646
2.021.0	8.6	8.1	648
4.020.9	8.6	8.1	651
5.020.9	8.6	8.0	651
6.018.8	8.6	8.6	658
7.017.9	8.6	9.3	641
8.217.1	8.6	9.0	642
9.216.8	8.6	9.1	646
10.116.3	8.5	8.7	650
11.015.9	8.5	8.6	666
11.814.8	8.4	8.6	670
12.914.0	8.4	8.2	672
14.113.1	8.4	8.7	680
16.011.8	8.3	8.8	703
17.111.0	8.3	8.8	714
18.810.1	8.3	8.9	707
20.3 8.5	8.3	8.9	
21.0 9.2	8.3	8.9	714
22.0 8.7	8.3	9.0	717
22.9 8.4	8.3	9.1	718
24.0 7.9	8.3	9.2	718
25.0 7.7	8.3	9.2	718
26.3 7.4	8.3	9.3	715
28.0 7.0	8.3	9.5	708
30.0 6.5	8.3	8.6	737
30.8 6.4	8.3	9.6	740
31.8 6.3	8.3	9.7	730
33.5 6.2	8.3	8.8	755
34.1 6.1	8.3	9.8	740
36.0 6.0	8.3	8.8	743
37.0 5.8	8.3	9.8	712
38.1 5.8	8.2	8.8	740
39.1 5.7	8.2	9.8	734
40.0 5.7	8.3	8.8	748
45.0 5.2	8.3	8.9	753
50.1 4.9	8.2	9.8	722
55.1 4.7	8.2	9.5	758
59.8 4.3	8.1	8.8	761
64.8 4.1	8.0	8.0	787
68.8 4.0	7.9	6.8	761
74.9 3.9	7.8	5.9	777
80.1 3.9	7.7	5.1	805
84.8 3.9	7.6	4.7	784
89.9 3.9	7.6	4.2	773
95.1 3.9	7.6	4.0	808

FORSYTH RESERVOIR
07/12/94

0.018.9	8.1	7.4	211
1.018.0	8.5	7.4	210
2.018.4	8.5	7.5	211
3.018.3	8.5	7.1	211
4.017.9	8.4	6.6	211
5.017.7	8.4	6.4	212
6.017.5	8.3	6.0	212
7.017.2	8.3	6.0	209
8.017.4	8.3	5.8	206
8.317.5	8.2	5.6	211

FORSYTH RESERVOIR
06/26/96

0.015.5	8.5	7.8	189
1.015.5	8.5	7.4	189
2.015.5	8.5	7.1	190
3.015.5	8.5	7.2	190
4.015.3	8.4	6.8	190
5.014.9	8.2	5.9	191
6.014.0	8.0	5.2	190
7.013.8	7.9	5.0	190
8.013.3	7.8	4.4	190
9.013.0	7.7	4.0	190
10.012.5	7.7	3.5	190
10.911.5	7.6	3.1	190
12.011.3	7.5	2.8	190
13.011.0	7.5	2.4	190
14.111.0	7.5	1.8	191
14.410.9	7.4	1.2	191

FORSYTH RESERVOIR
06/26/96

0.010.8	8.4	8.6	207

FORSYTH RESERVOIR
09/04/96

0.016.3	7.9	5.2	211
1.016.3	7.9	5.0	211
2.016.2	7.9	4.9	211
3.015.5	8.2	4.7	211
4.014.5	8.0	4.5	212
4.914.4	8.0	4.3	211
5.514.3	8.0	3.9	211

FORSYTH RESERVOIR
09/04/96

-0.817.1	8.5	6.0	116

GRANTSVILLE RESERVOIR
06/28/93

0.017.2	8.5	8.9	194
1.017.2	8.5	8.9	194
2.017.2	8.5	8.9	193
3.017.2	8.5	8.9	193
4.017.1	8.5	8.9	194
5.017.1	8.5	8.9	194
6.016.6	8.5	9.1	192
7.015.3	8.4	9.1	190
8.014.9	8.3	8.6	193
9.014.5	8.2	8.5	193
10.014.2	8.2	8.2	196
11.013.8	8.1	8.0	198
12.013.3	7.9	7.7	201
13.013.0	7.9	7.5	203
14.012.9	7.8	7.2	203
15.012.9	7.8	7.2	203
16.012.9	7.8	6.6	205
17.012.7	7.7	4.6	205
18.112.6	7.7	2.6	209

GRANTSVILLE RESERVOIR
06/20/95

0.013.8	8.4	8.6	250
1.013.8	8.4	8.6	252
2.013.8	8.4	8.6	252
3.013.8	8.4	8.6	252
4.013.7	8.4	8.5	252
5.013.3	8.4	8.3	252
6.013.2	8.4	8.3	253
7.013.1	8.4	8.2	252
8.013.1	8.4	8.2	254
9.013.1	8.4	8.1	253
10.013.0	8.4	8.1	253
11.013.0	8.4	8.0	252
12.012.9	8.4	7.9	253
13.012.8	8.4	7.9	256
14.012.6	8.3	7.5	255
15.012.6	8.3	7.3	254
16.012.3	8.2	6.6	261
17.011.9	8.1	5.5	266
17.911.6	8.0	4.5	268

GRANTSVILLE RESERVOIR
08/09/95

0.018.1	8.7	8.6	288
1.018.1	8.0	8.4	288
2.018.2	8.9	8.3	288
3.018.2	8.9	8.3	288
4.018.2	8.9	8.3	288
5.018.2	8.9	8.3	288
6.018.0	8.9	8.3	288
7.017.9	8.9	8.9	288
8.017.8	8.9	8.0	291
9.017.6	8.7	8.0	291
10.017.6	8.7	7.8	286
11.017.4	8.7	7.6	284
12.017.1	8.6	7.6	284
13.016.5	8.3	6.1	272
14.016.2	8.2	6.0	268
15.015.9	8.0	5.1	268
16.015.6	7.3	3.5	268

GRASSY LAKE
07/22/93

0.016.9	9.3	7.8	302
0.516.7	9.2	7.9	302
1.016.4	9.1	7.9	304
1.516.3	9.0	8.0	303
2.016.2	9.3	8.0	305
2.516.1	9.4	8.0	306
3.016.0	9.2	8.0	307
3.515.9	9.2	8.0	307
4.015.7	9.3	8.0	309
4.515.6	8.8	8.0	309
5.015.5	8.7	8.0	309
5.515.5	8.6	8.0	309
6.015.3	8.6	8.0	308

GRASSY LAKE
02/23/94

0.016.9	9.3	7.8	302
0.516.7	9.2	7.9	302
1.016.4	9.1	7.9	304
1.516.3	9.0	8.0	303
2.016.2	9.3	8.0	305
2.516.1	9.4	8.0	306
3.016.0	9.2	8.0	307
3.515.9	9.2	8.0	307
4.015.7	9.3	8.0	309
4.515.6	8.8	8.0	309
5.015.5	8.7	8.0	309
5.515.5	8.6	8.0	309
6.015.3	8.6	8.0	308

GRASSY TRAIL CREEK
RESERVOIR 09/04/93

0.016.6	8.1	8.1	540
0.516.4	7.7	8.2	541
1.016.3	8.0	8.2	540
1.516.1	8.5	8.2	540
2.016.1	8.3	8.2	541
2.516.0	8.5	8.2	540
3.016.0	8.3	8.2	541
3.515.9	8.7	8.2	540
4.015.9	8.7	8.2	541
4.515.8	8.9	8.2	541
5.015.8	9.1	8.2	542
5.515.8	8.9	8.2	541
6.015.8	8.8	8.2	542
6.515.8	9.4	8.2	542
7.015.7	9.4	8.2	542
7.515.7	8.8	8.2	543
8.015.4	8.5	8.1	554
8.515.3	8.4	8.1	558
9.014.9	8.2	8.1	557
10.013.0	8.3	8.1	538
10.512.0	7.0	8.0	523
11.010.8	7.4	8.1	519
12.0 9.8	6.5	8.0	520
13.0 9.3	6.3	8.0	515
14.0 8.4	3.6	8.0	522
15.0 7.9	1.6	7.7	524
15.5 7.7	1.0	7.7	524

GUNLOCK RESERVOIR

06/02/93

0.019.4	8.7	9.3	243
1.019.3	8.7	9.2	243
2.019.1	8.7	9.0	244
3.019.1	8.6	8.9	244
4.019.0	8.4	8.7	244
5.018.9	8.2	8.7	244
6.018.1	8.0	8.5	245
7.017.7	7.9	8.4	247
8.017.1	7.9	8.2	252
9.016.8	7.9	8.2	262
10.016.4	7.9	7.9	275
11.017.9	8.0	7.5	283
12.017.4	8.0	7.3	286
13.016.6	8.0	6.9	291
14.016.3	8.1	6.5	298
15.015.2	8.1	6.3	298
16.014.8	8.1	6.3	300
17.013.8	8.0	6.1	301
18.013.6	8.0	5.8	301
19.013.6	8.0	5.6	301
20.013.4	8.0	5.4	301
21.013.1	7.9	4.9	302
22.012.9	7.8	4.0	304
23.012.9	7.8	3.4	307
24.412.8	7.8	2.9	309

GUNLOCK RESERVOIR
08/04/93

0.024.0	8.6	7.8	295
1.023.8	8.7	7.8	296
2.023.6	8.7	7.8	295
3.023.5	8.7	7.6	295
4.023.5	8.6	6.4	297
5.022.6	8.4	8.5	307
6.022.4	8.3	4.9	301
7.021.9	8.1	3.2	303
8.021.5	7.9	1.9	303
9.021.3	7.8	1.5	301
10.021.1	7.8	1.2	301
11.020.9	7.8	0.9	297
12.020.5	7.7	0.6	297
13.020.0	7.7	0.2	296
14.019.5	7.7	0.1	291
15.018.7	7.6	0.1	285
16.018.6	7.6	0.1	290
17.018.2	7.0	0.1	282
18.018.1	7.6	0.0	281
19.017.8	7.5	0.1	288
20.017.4	7.5	0.0	285
21.017.0	7.5	0.1	294
22.415.8	7.5	0.0	303

GUNLOCK RESERVOIR
08/09/95

0.023.2	8.3	7.1	295
1.023.3	8.3	7.1	295
2.023.2	8.3	7.0	294
3.023.2	8.3	7.0	294
4.022.9	8.3	7.0	294
5.022.6	8.1	5.8	299
6.022.5	8.0	5.6	297
7.022.5	8.0	5.1	298
8.022.4	7.9	4.7	298
10.022.2	7.8	4.5	302
11.021.8	7.7	3.1	300
12.021.6	7.7	2.4	301

GUNLOCK RESERVOIR
08/09/95

0.024.5	8.5	7.6	290
1.024.3	8.5	7.6	292
2.024.2	8.4	7.6	293
3.024.0	8.4	7.5	293
4.023.8	8.4	7.4	294
5.023.5	8.3	7.0	295
6.023.1	8.3	6.7	295
7.023.0	8.2	6.5	300
8.022.6	8.2	5.9	300
9.021.9	7.8	4.1	302
10.021.3	7.7	3.1	298
11.020.9	7.6	2.7	293
12.020.9	7.6	2.7	295
13.020.2	7.6	2.1	288

GUNNISON BEND RESERVOIR
08/02/94

0.028.5	8.4	6.5	1,485
1.027.6	8.5	6.5	1,453
2.024.5	8.4	6.2	1,452
2.324.4	8.4	6.1	1,452

GUNNISON BEND RESERVOIR
06/11/96

0.025.5	8.4	6.5	1,809
1.023.3	8.4	6.1	1,843
2.022.4	8.2	4.8	1,850
2.422.0	8.0	3.7	1,839

GUNNISON BEND RESERVOIR
06/11/96

0.025.5	8.4	6.2	1,840
1.024.1	8.4	6.1	1,817
1.922.5	8.3	6.0	1,850

GUNNISON BEND RESERVOIR
06/11/96

0.027.4	8.4	6.2	1,668
0.823.0	8.4	6.7	1,894

GUNNISON BEND RESERVOIR
07/30/96

0.023.5	8.5	7.8	1,804
1.023.5	8.5	7.8	1,804

GUNNISON BEND RESERVOIR
07/30/96

0.025.1	8.5	7.7	1,917
1.025.1	8.5	7.7	1,936
2.023.8	8.5	6.9	1,918
2.423.5	8.4	6.5	1,925

GUNNISON BEND RESERVOIR
07/30/96

0.025.4	8.5	7.4	1,864
1.025.4	8.5	7.5	1,873
1.625.5	8.5	7.5	1,864

GUNNISON BEND RESERVOIR
09/03/96

0.022.5	8.7	8.4	1,574
1.020.0	8.7	8.1	1,581
2.019.9	8.7	7.2	1,577
3.019.8	8.7	7.2	1,583
3.819.7	8.7	7.1	1,583

GUNNISON RESERVOIR
06/28/94

0.023.8	8.6	6.0	1,359
1.023.2	8.6	5.8	1,358
2.022.4	8.6	5.5	1,357
3.022.1	8.6	5.5	1,354
4.021.2	8.6	5.0	1,358
5.021.2	8.6	4.9	1,357
6.021.0	8.6	4.9	1,356

GUNNISON RESERVOIR
08/09/94

0.021.7	8.0	7.1	1,459
1.021.8	8.3	6.5	1,459
2.021.8	8.4	6.4	1,460
3.021.8	8.4	6.4	1,460
3.221.8	8.4	6.1	1,461

GUNNISON RESERVOIR
06/19/96

0.020.5	8.6	5.6	1,477
1.120.0	8.6	5.5	1,479
2.019.9	8.6	5.4	1,480
3.019.8	8.6	5.3	1,475
3.019.8	8.6	5.3	1,476
4.019.5	8.6	5.4	1,483
5.119.2	8.6	5.2	1,488
6.017.7	8.6	4.1	1,483
6.916.4	8.6	3.2	1,495
8.015.0	8.6	2.5	1,394

GUNNISON RESERVOIR
06/19/96

0.019.8	8.5	6.0	1,480
1.019.4	8.6	5.9	1,483
2.019.2	8.6	5.8	1,481
3.019.2	8.6	5.8	1,484
4.019.1	8.6	5.5	1,482
5.018.0	8.6	4.1	1,482
6.017.3	8.6	3.7	1,495
6.917.1	8.6	3.4	1,484

HOOP LAKE
07/08/93

0.013.1	7.9	7.0	40
1.013.1	7.7	6.9	39
2.013.1	7.7	6.9	38
3.013.0	7.7	7.0	38
4.012.7	7.5	6.9	38
5.012.4	7.5	6.9	38
6.012.2	7.4	6.7	39
7.010.1	7.4	6.3	38
8.0 8.7	7.3	5.9	38
9.4 8.4	7.3	3.9	40

HOOP LAKE
07/27/94

0.019.1	8.8	8.3	39
1.018.3	8.7	8.2	40
2.016.0	8.0	7.1	40
3.013.1	7.2	3.8	40
4.011.7	6.8	0.7	49

HOOP LAKE
09/26/95

0.011.5	7.6	7.0	34
1.011.4	7.6	7.0	34
2.011.3	7.6	6.4	35
3.511.2	7.5	6.2	35
4.011.1	7.4	6.1	35
5.011.1	7.4	6.0	34
6.811.1	7.3	5.9	34
7.011.0	7.2	5.8	34

HOOVER LAKE
07/26/94

0.018.4	7.6	6.9	20
1.018.4	7.4	6.8	20
2.018.1	7.4	6.9	20
3.018.0	7.7	7.4	20

HOOVER LAKE
07/16/96

0.017.6	8.1	6.1	15
1.017.4	8.0	6.1	16
2.016.6	7.9	6.2	15
3.013.1	8.0	8.0	15
3.910.0	7.9	7.4	17

HUNTINGTON LAKE NORTH
06/17/93

0.017.7	8.5	7.4	684
1.017.7	8.5	7.4	684
2.017.7	8.5	7.3	685
3.017.7	8.4	7.3	685
4.017.7	8.4	7.3	685
5.017.7	8.4	7.3	685
5.717.3	8.2	7.3	686

HUNTINGTON LAKE NORTH
08/12/93

0.020.8	8.4	7.8	596
1.020.8	8.4	7.6	598
2.020.8	8.4	7.3	599
3.020.8	8.5	7.2	600
4.020.8	8.5	7.1	600
5.020.7	8.5	7.1	600
5.320.7	8.5	7.1	600

HUNTINGTON LAKE NORTH
08/31/95

0.011.8	9.1	6.1	515
1.022.8	8.9	6.0	517
2.022.4	9.0	6.1	516
3.022.3	9.0	5.5	520
4.022.1	9.0	6.0	518
5.022.0	8.9	6.0	516
6.021.7	8.9	5.6	530
7.018.4	8.5	3.0	571
8.016.6	8.4	1.5	593
9.015.6	8.3	0.7	596
10.014.9	8.2	0.4	610

HUNTINGTON LAKE NORTH
06/25/96

0.114.6	8.7	8.4	204
1.014.6	8.8	8.5	204
2.014.4	8.8	8.5	204

3.014.3	8.8	8.8	205
3.912.4	8.8	9.8	206
5.010.8	8.7	10.7	207
6.0 8.6	8.7	11.5	206
7.1 8.6	11.1	7.1	208
8.0 6.0	8.4	11.8	208
9.0 5.6	8.2	10.1	209
10.0 5.1	8.1	9.5	211
11.1 4.7	8.0	9.1	212
12.1 4.8	7.9	8.6	213
12.9 4.5	7.8	8.1	213

HUNTINGTON LAKE NORTH
06/25/96

0.214.9	8.8	8.4	204
1.014.8	8.8	8.4	204
2.014.7	8.8	8.5	204
3.012.7	8.8	9.3	207
4.011.4	8.8	10.6	208
5.0 8.6	8.6	11.1	210
6.0 6.5	8.5	11.3	208
6.9 5.7	8.3	10.6	209
8.0 5.2	8.2	9.8	211
8.9 4.9	8.0	9.2	211
10.0 4.8	8.0	8.9	211
11.0 4.5	7.9	8.6	212
12.0 4.5	7.9	8.4	212
13.0 4.4	7.9	8.2	212
14.0 4.3	7.8	7.7	213
14.9 4.2	7.8	7.3	215

HUNTINGTON RESERVOIR
07/19/94

0.017.7	8:4	6.7	249
1.017.6	8.5	6.1	247
2.017.6	8.5	6.1	245
3.017.6	8.5	6.1	250
4.017.5	8.5	6.4	250
5.017.5	8.5	6.6	248
6.015.3	8.4	6.5	245
7.017.0	8.2	7.2	260
8.0 8.4	8.0	6.5	260
9.0 7.8	7.8	6.0	267
10.0 7.1	7.6	3.9	267
11.0 6.8	7.5	3.3	274

HUNTINGTON RESERVOIR
08/30/94

0.018.5	8.4	7.5	212
1.018.4	8.5	7.4	212
2.018.3	8.5	7.4	212
3.018.3	8.5	7.3	212
4.017.7	8.5	6.9	212
5.017.4	8.4	6.8	213
6.017.3	8.4	6.6	212
7.017.2	8.3	6.2	212
7.617.0	8.3	5.8	215

HUNTINGTON RESERVOIR
08/31/94

0.022.3	8.5	7.2	608
1.022.3	8.5	7.1	608
2.022.3	8.5	7.2	608
3.022.3	8.5	7.2	608
4.022.2	8.5	7.1	608
5.022.7	8.5	7.0	610
6.021.9	8.4	6.4	613
6.521.6	8.2	5.4	611

HUNTINGTON RESERVOIR
08/20/96

0.018.8	8.6	7.9	224
1.018.4	8.6	7.7	224
2.118.3	8.6	7.6	224
3.017.9	8.6	7.6	224
4.117.4	8.6	7.6	223
5.017.1	8.6	7.5	224
6.016.9	8.6	7.5	224
6.916.4	8.5	7.6	225
7.914.6	8.4	7.8	224
8.414.1	8.4	8.0	226

HUNTINGTON RESERVOIR
08/20/96

0.017.6	8.6	7.3	224
0.917.6	8.6	7.3	224
2.117.5	8.6	7.3	224
3.017.5	8.6	7.3	224
3.917.4	8.6	7.3	223
5.017.2	8.6	7.3	223
6.016.5	8.6	7.2	226
6.916.0	8.5	7.2	227
7.715.8	8.5	7.5	227

HYRUM RESERVOIR
06/22/95

0.015.3	8.8	10.4	433
1.015.3	8.7	10.1	434
2.015.1	8.7	10.3	435
3.014.3	8.5	9.4	435
4.013.0	8.3	8.7	458
5.012.0	7.9	6.6	448
6.011.8	7.8	6.0	449

HYRUM RESERVOIR
06/22/95

0.015.3	8.8	11.0	428
1.015.3	8.8	10.9	425
2.015.3	8.8	10.7	425
3.015.2	8.8	10.8	425
4.015.2	8.8	10.8	425
5.015.2	8.8	10.8	425
6.011.2	7.9	5.7	447
7.010.5	7.8	5.3	449
8.010.0	7.8	4.9	451
9.0 9.8	7.7	4.7	451
10.0 9.7	7.7	4.4	454
11.0 9.6	7.7	4.2	456
12.0 9.6	7.6	4.0	454
13.0 9.5	7.6	3.9	457
14.0 9.5	7.6	3.7	458
15.0 9.4	7.6	3.6	458
16.0 9.4	7.6	3.5	458
17.0 9.3	7.6	3.4	459
18.0 9.3	7.6	3.3	462
19.0 9.2	7.6	3.2	461
20.0 9.2	7.5	3.1	461
21.0 9.2	7.5	2.9	464

HYRUM RESERVOIR
06/22/95

0.015.9	8.8	10.5	430
1.015.7	8.8	10.6	429
2.015.5	8.8	10.6	429
3.015.4	8.7	10.5	428
4.015.4	8.7	10.5	428

5.013.1	8.3	8.0	444
6.011.7	7.9	6.4	443
7.011.3	7.9	6.1	446
8.010.9	7.8	5.7	448
9.010.6	7.8	5.5	448
10.010.4	7.8	5.3	448
11.010.2	7.7	5.1	448
12.010.1	7.7	4.8	450
13.0 9.6	7.6	4.0	453
14.0 9.4	7.6	3.5	459
15.0 9.2	7.6	3.2	461
15.8 9.2	7.5	2.7	465

HYRUM RESERVOIR
09/06/95

0.022.3	8.8	6.1	367
1.021.9	8.8	6.0	368
2.021.4	8.9	5.8	369
3.021.3	8.8	5.5	373
4.021.2	8.8	5.4	373
5.021.1	8.8	5.4	376
6.020.5	8.6	3.4	385
7.020.4	8.6	3.4	386
8.020.4	8.5	3.1	381
9.020.3	8.5	3.0	385
10.020.3	8.4	2.5	391
11.020.2	8.4	2.2	385
12.020.1	8.3	1.8	391
13.020.8	8.3	1.3	399
13.419.8	8.3	0.4	397

HYRUM RESERVOIR
09/06/95

0.022.3	8.8	6.0	371
1.021.7	8.9	5.9	371
2.021.4	8.9	5.9	371
3.021.2	8.9	5.7	372
4.021.1	8.8	5.4	372
5.021.0	8.8	5.4	374
6.020.8	8.8	5.1	375
7.020.8	8.7	5.0	370
8.020.5	8.6	3.9	383
9.020.4	8.6	3.2	380
10.020.7	8.5	2.4	386
11.020.0	8.4	1.0	398
1.919.8	8.3	0.3	391

HYRUM RESERVOIR
09/06/95

0.022.2	8.8	5.6	372
1.021.8	8.8	5.4	372
2.021.6	8.8	5.4	374
3.021.5	8.8	5.5	376
4.021.3	8.8	5.8	382
4.220.7	8.8	6.8	408

JOE'S VALLEY RESERVOIR
06/16/93

0.014.5	8.5	8.6	377
1.014.4	8.5	8.4	378
2.014.2	8.5	8.3	378
3.013.5	8.5	8.4	375
4.012.8	8.5	8.3	376
5.011.7	8.5	8.4	375
6.011.5	8.4	8.4	373
7.010.7	8.4	8.4	377
8.010.4	8.4	8.4	377
9.010.2	8.4	8.2	376

10.010.0	8.4	8.1	377
11.0 9.8	8.4	8.0	378
12.0 9.7	8.4	8.0	377
13.0 9.5	8.3	8.5	378
14.0 9.3	8.3	8.2	377
15.0 9.1	8.3	8.1	379
16.0 9.1	8.3	8.1	379
17.0 9.1	8.3	8.1	379
18.0 9.0	8.3	8.1	377
19.0 9.0	8.3	8.1	379
20.0 8.9	8.3	8.3	379
21.0 8.9	8.3	8.2	377
22.0 8.8	8.3	8.2	379
23.0 8.8	8.3	8.2	379
24.0 8.7	8.3	8.2	380
25.0 8.6	8.3	8.2	381
26.0 8.6	8.3	8.1	380
27.0 8.6	8.3	8.1	380
28.0 8.6	8.3	8.1	379
29.0 8.5	8.3	8.1	380
30.0 8.5	8.3	8.1	380
32.0 8.5	8.3	8.1	380
34.0 8.5	8.3	8.1	380
34.5 8.5	8.3	8.0	380

JOE'S VALLEY RESERVOIR
08/11/93

0.018.5	8.5	7.5	319
1.018.5	8.5	7.3	318
2.018.0	8.6	7.3	319
3.018.0	8.6	7.3	319
4.017.8	8.6	7.3	319
5.017.5	8.6	7.3	320
6.017.0	8.6	7.3	320
7.017.0	8.6	7.2	322
8.016.8	8.5	7.1	330
9.016.4	8.5	7.1	333
10.014.8	8.4	7.1	334
11.013.4	8.4	6.6	334
12.011.7	8.2	5.3	333
13.011.6	8.1	4.9	331
14.011.1	8.1	4.6	332
15.011.1	8.1	4.4	331
16.010.9	8.1	4.3	331
17.010.6	8.0	4.2	331
18.010.5	8.0	4.2	333
19.010.5	8.0	4.2	334
20.010.3	8.0	4.2	334
21.010.3	8.0	4.2	334
22.010.3	8.0	4.2	331
23.010.2	8.0	4.1	338
24.010.2	8.0	4.1	338
25.010.1	8.0	4.0	338
25.610.1	8.0	3.9	342

JOE'S VALLEY RESERVOIR
08/31/95

0.019.4	8.7	6.7	360
1.019.5	8.8	5.9	364
2.019.5	8.8	5.5	360
3.019.5	8.9	5.8	362
4.019.5	8.9	6.0	360
5.019.4	8.8	5.9	364
6.018.0	8.8	6.4	375
7.017.0	8.7	6.4	375
8.015.5	8.7	6.5	370
9.014.2	8.6	6.3	365
10.013.0	8.6	5.8	364
11.011.9	8.5	5.2	369
12.011.5	8.5	4.9	369

13.011.0	8.4	4.6	353
14.010.6	8.3	4.6	372
15.010.4	8.3	4.2	371
16.010.2	8.3	4.0	356
17.010.0	8.3	4.0	386

JOE'S VALLEY RESERVOIR
08/31/95

0.019.4	8.9	6.7	359
1.019.4	8.9	6.6	358
2.019.4	8.9	6.5	362
3.019.4	8.9	6.5	361
4.019.4	8.9	6.5	362
5.019.1	8.9	6.4	362
6.017.7	8.8	6.4	380
7.016.5	8.8	6.4	380
8.015.3	8.7	6.2	374
9.013.9	8.7	6.2	365
9.713.2	8.6	5.8	361

JOE'S VALLEY RESERVOIR
08/31/95

0.019.5	8.8	6.7	330
1.019.6	8.8	6.6	358
2.019.6	8.8	6.6	359
3.019.6	8.8	6.5	362
4.019.6	8.7	6.5	358
5.019.6	8.7	6.5	360
6.018.6	8.6	6.6	377
7.016.7	8.6	6.8	377
8.015.3	8.6	6.8	367
9.014.2	8.5	6.1	370
10.013.2	8.5	6.2	369
11.012.2	8.4	5.9	357
12.011.5	8.4	5.4	363
13.010.9	8.4	5.0	360
14.010.4	8.3	4.5	360
15.010.1	8.3	4.3	357
16.010.0	8.2	4.3	352
17.0 9.8	8.2	4.4	366
18.0 9.8	8.2	4.4	376
19.0 9.7	8.2	4.4	368
20.0 9.7	8.2	4.3	359
21.0 9.6	8.2	4.3	368
22.0 9.6	8.2	4.3	370
23.0 9.5	8.2	4.2	381
24.0 9.5	8.2	4.1	374
25.0 9.5	8.2	4.1	374
26.0 9.5	8.2	4.3	368
27.0 9.5	8.2	4.2	359
28.0 9.4	8.2	4.2	359
29.0 9.4	8.2	4.2	388
30.0 9.4	8.2	4.2	347
31.0 9.4	8.2	4.2	360
33.0 9.4	8.2	4.2	368
36.0 9.4	8.2	4.2	368
38.0 9.4	8.2	4.2	371

JOHNSON LAKE
09/12/95

0.016.2	8.4	5.6	116
1.016.3	8.5	5.4	116
2.016.1	8.5	5.2	116
3.016.0	8.5	5.0	116
4.015.8	8.5	4.7	116
4.615.7	8.4	4.3	117

JOHNSON VALLEY RESERVOIR
06/17/93

0.017.6	9.0	8.8	128
1.017.7	9.0	8.6	127
2.017.6	8.9	8.3	127
3.017.4	8.9	8.0	129
4.616.1	8.3	4.0	132

JOHNSON VALLEY RESERVOIR
08/17/93

0.017.6	9.0	8.8	128
1.017.7	9.0	8.6	127
2.017.6	8.9	8.3	127
3.017.4	8.9	8.0	129
4.616.1	8.3	4.0	132

JORDANELLE RESERVOIR
06/29/94

0.020.7	8.0	6.8	180
1.020.6	8.0	7.0	180
2.020.0	8.0	7.0	179
3.019.8	8.0	7.0	180
4.019.8	8.0	6.9	179
5.019.2	7.9	6.9	179
6.018.4	7.8	6.8	180
7.017.2	7.7	6.4	180
8.016.1	7.7	6.2	173
9.015.5	7.6	6.2	173
10.015.3	7.6	6.2	175
11.015.1	7.6	6.2	173
12.014.8	7.6	6.0	171
13.014.6	7.6	6.0	171
14.014.1	7.6	6.0	170
15.013.5	7.6	5.9	167
16.013.0	7.5	5.9	162
17.012.7	7.5	5.9	158
18.012.2	7.5	6.0	154
19.011.8	7.5	6.1	153
20.011.6	7.5	6.1	154
22.011.2	7.5	6.1	155
24.010.9	7.5	6.0	154
26.010.6	7.5	6.0	154
28.010.5	7.6	6.0	154
30.010.2	7.6	6.0	154
32.010.1	7.6	6.0	154
34.010.0	7.5	5.9	158
36.0 9.9	7.5	5.9	158
38.0 9.8	7.5	5.9	158
40.0 9.8	7.5	5.9	159
44.0 9.5	7.5	5.8	164
48.0 8.3	7.5	5.8	198
50.5 6.0	7.5	5.3	275

JORDANELLE RESERVOIR
08/11/94

0.021.8	8.0	7.7	200
1.021.6	8.0	7.7	199
2.021.3	8.0	7.6	199
3.021.2	8.0	7.5	199
4.020.9	8.0	7.5	198
5.020.6	7.8	7.0	198
6.019.8	7.3	4.5	201
7.018.9	7.0	2.0	210
8.018.1	7.0	1.9	209
9.017.8	7.0	1.9	208
10.017.2	7.0	1.9	206
11.016.4	7.0	2.0	203
12.015.4	7.0	2.4	198
13.015.1	7.0	2.6	193
14.014.0	7.0	3.0	180
15.013.6	7.0	3.1	178
16.013.4	7.0	3.3	175
17.012.8	7.0	3.5	172
18.012.5	7.0	3.6	171
19.012.2	7.1	4.0	168
20.011.9	7.1	4.3	165
21.011.6	7.1	4.5	162
22.011.4	7.1	4.7	162
23.011.2	7.1	4.9	159
24.011.0	7.1	5.0	158
25.010.9	7.1	5.1	157
26.010.7	7.1	5.3	156
27.010.5	7.1	5.5	156
28.010.4	7.1	5.3	156
29.010.3	7.1	5.1	156
30.010.3	7.1	4.9	157
31.010.3	7.1	4.7	158
32.010.2	7.1	4.8	158
33.010.1	7.1	4.8	157
34.010.1	7.1	4.8	157
35.010.1	7.1	4.7	159
36.010.1	7.1	4.8	157
37.010.0	7.1	4.8	157
38.0 9.9	7.1	5.0	157
39.0 9.9	7.1	5.0	157
40.0 9.8	7.2	5.2	164
45.0 9.2	7.2	5.4	160
50.0 6.3	7.1	4.5	260
55.0 5.9	7.1	4.4	270
60.0 5.7	7.1	3.9	270
65.0 5.6	7.1	3.6	259
71.0 5.7	7.1	3.4	248

JORDANELLE RESERVOIR
09/13/94

0.018.2	7.9	6.0	218
1.018.2	7.9	6.0	218
2.018.2	7.8	5.9	217
4.018.1	7.8	5.8	218
6.018.1	7.8	5.8	218
8.018.1	7.8	5.8	218
10.018.1	7.8	5.8	218
12.017.8	7.6	3.8	219
13.016.0	7.3	0.2	213
14.015.2	7.2	0.4	198
16.014.2	7.2	0.8	190
18.013.5	7.2	1.6	177
20.013.0	7.2	1.6	174
22.012.4	7.1	2.0	166
24.011.7	7.2	2.8	160
26.011.4	7.2	3.0	158
28.011.1	7.2	3.4	156
30.010.9	7.2	3.4	156
32.010.8	7.2	2.8	157
34.010.7	7.2	2.8	156
36.010.6	7.1	2.8	157
38.010.5	7.1	2.9	157
40.010.4	7.1	2.8	157
42.010.3	7.1	2.8	157
44.010.2	7.1	2.4	161
46.010.0	7.1	2.7	160

JORDANELLE RESERVOIR
10/12/94

0.013.7	7.6	6.6	235
1.013.8	7.6	6.5	237
2.013.8	7.6	6.5	235
4.013.7	7.6	6.4	235
6.013.8	7.6	6.4	236
8.013.8	7.6	6.4	233
10.013.8	7.6	6.4	233
12.013.8	7.6	6.4	235
14.013.8	7.6	6.4	236
16.013.7	7.6	6.0	230
18.013.6	7.5	5.8	238
20.013.1	7.3	4.1	201
22.012.6	7.2	1.9	178
24.011.8	7.2	1.7	187
26.011.7	7.1	2.1	176
28.011.3	7.1	1.6	173
30.011.1	7.0	2.0	161
32.010.9	7.0	1.5	162
34.010.7	7.0	1.4	160
36.010.6	7.0	1.6	169
38.010.5	7.0	1.8	159
42.010.4	7.0	1.6	162
45.010.0	7.0	1.7	165

JORDANELLE RESERVOIR
07/03/96

0.120.4	7.9	7.4	160
1.120.3	7.9	7.3	171
2.020.2	7.9	7.3	163
3.119.7	7.9	7.2	174
4.018.1	7.8	7.0	159
5.017.8	7.8	5.0	171
6.117.0	7.7	6.1	172
6.816.8	7.6	6.2	155
8.116.2	7.6	8.1	158
9.014.6	7.6	6.2	140
10.014.1	7.5	6.2	137
11.113.1	7.5	6.2	147
12.112.4	7.4	6.2	156
13.012.0	7.4	6.1	184
14.110.9	7.4	6.2	172
15.010.3	7.4	6.3	183
16.010.1	7.4	6.2	166
17.0 9.8	7.4	6.2	185
18.0 9.6	7.4	6.4	187
19.1 9.3	7.4	6.4	171
20.0 9.2	7.4	6.4	196
21.0 9.0	7.4	6.4	177
22.0 8.8	7.3	6.4	181
23.1 8.5	7.3	6.3	190
24.1 8.4	7.3	6.3	172
25.0 8.3	7.3	6.3	178
26.0 8.2	7.3	6.3	174
27.2 8.1	7.3	6.2	172
28.0 8.0	7.3	6.2	187
29.0 7.9	7.3	6.2	171
30.0 7.9	7.3	6.1	169
32.0 7.7	7.3	5.9	212
34.0 7.5	7.3	5.9	184
36.0 7.2	7.3	5.9	188
37.9 7.2	7.2	5.9	181
40.1 7.2	7.3	6.0	182
42.0 7.1	7.3	6.1	213
43.1 7.0	7.3	6.2	183

JORDANELLE RESERVOIR
07/03/96

2.019.5	7.9	7.4	159
1.019.5	7.9	7.4	159
2.019.4	7.9	7.4	159
3.018.3	7.8	7.1	163
4.017.7	7.8	7.2	161
5.117.1	7.7	5.1	159
6.016.9	7.7	6.7	159
7.016.7	7.7	6.6	159
8.016.3	7.6	6.4	148
9.014.8	7.6	6.5	147

9.014.8	7.5	6.5	133
10.013.9	7.5	6.6	134
11.013.0	7.5	6.6	126
12.012.0	7.4	6.7	131
13.011.3	7.4	6.7	149
14.010.6	7.4	6.9	157
15.010.2	7.4	7.0	171
16.0 7.4	7.0	7.0	181
17.0 9.6	7.4	7.2	151
18.0 9.3	7.4	7.2	155
19.0 9.1	7.4	7.2	176
20.0 8.7	7.5	7.4	148
21.1 8.5	7.4	7.2	152
22.0 8.3	7.4	7.4	171
23.0 8.2	7.4	7.3	161
24.0 8.0	7.4	7.4	160
25.0 7.9	7.5	7.5	159
25.9 7.9	7.5	7.6	158
27.0 7.7	7.5	7.6	177
28.0 7.7	7.5	7.5	151
29.0 7.6	7.5	7.5	168
30.0 7.4	7.5	7.5	180
31.0 7.4	7.5	7.6	172
32.0 7.4	7.5	7.4	168
33.0 7.4	7.4	7.0	202
34.1 7.4	7.4	6.8	171
35.0 7.3	7.4	6.9	181
36.0 7.4	7.4	6.9	201
37.0 7.2	7.4	6.9	195
37.9 7.1	7.4	6.9	181
39.0 7.1	7.4	6.9	190
40.0 7.0	7.4	6.9	202
42.0 6.9	7.4	7.3	205
46.1 6.8	7.4	7.2	195
50.1 6.8	7.4	7.1	211
56.0 6.6	7.4	7.1	179
66.0 6.4	7.4	7.0	224
70.0 6.4	7.4	7.0	224
75.9 6.0	7.4	6.9	223
80.2 5.9	7.4	6.5	224

JORDANELLE RESERVOIR
07/03/96

0.020.3	7.9	7.2	142
1.020.3	7.9	7.2	148
2.019.0	7.9	7.1	156
3.117.7	7.8	3.1	158
4.017.4	7.8	6.9	154
5.017.0	7.7	6.7	147
5.916.8	7.6	6.5	141
7.216.2	7.6	6.7	139
8.115.4	7.6	8.1	150
9.014.9	7.6	6.9	141
10.013.8	7.6	7.0	130
11.013.0	7.6	7.0	131
12.112.2	7.6	7.0	131
13.111.6	7.6	6.9	124
14.011.0	7.5	6.7	112
15.010.3	7.5	6.3	125
16.110.0	7.4	6.3	116
17.0 9.7	7.4	6.2	123
18.0 9.4	7.4	6.2	137
19.0 9.3	7.4	6.1	142
19.8 9.0	7.0	7.3	138
21.0 8.7	7.3	6.1	127
22.0 8.4	7.3	6.1	152
23.1 8.3	7.3	6.3	142
24.1 8.1	7.3	6.5	137
25.1 8.0	7.3	6.6	146
26.0 7.9	7.3	6.5	137
27.0 7.6	7.3	6.4	157
27.9 7.5	7.3	6.5	151
28.5 7.5	7.3	6.5	148

JORDANELLE RESERVOIR
08/05/96

0.120.0	7.8	7.0	176
1.120.0	7.8	6.9	176
2.020.0	7.8	6.9	176
3.019.9	7.8	6.9	176
3.819.9	7.8	6.8	177
4.219.9	7.8	6.8	177
4.919.9	7.8	6.8	177
6.519.8	7.8	6.8	177
7.419.7	7.8	6.7	178
8.119.7	7.8	6.6	178
9.216.7	7.7	5.7	182
10.115.4	7.7	4.3	181
11.014.9	7.7	4.0	194
11.014.1	7.7	4.0	194
12.014.1	7.6	3.7	187
13.112.8	7.6	3.8	182
15.910.5	7.5	4.9	182
17.110.2	7.5	4.9	181
18.310.0	7.5	5.0	180
19.0 9.6	7.5	5.1	183
20.4 9.4	7.4	5.1	184
21.2 9.2	7.4	4.9	184
22.0 8.9	7.4	5.0	185
23.1 8.7	7.4	5.2	185
24.2 8.4	7.4	5.0	188
25.3 8.3	7.4	4.9	189
26.4 8.2	7.4	4.9	190
27.3 8.1	7.4	5.0	190
28.2 8.0	7.4	5.0	191
29.2 7.9	7.4	5.1	192
30.1 7.8	7.4	5.2	192
31.2 7.8	7.4	5.2	192
32.2 7.7	7.4	5.2	194
33.3 7.7	7.4	5.3	194
34.1 7.6	7.4	5.3	195
34.8 7.6	7.4	5.3	195

JORDANELLE RESERVOIR
08/05/96

0.020.0	8.1	6.9	175
1.020.0	8.0	6.7	175
1.919.9	8.0	6.6	176
3.019.9	8.0	6.6	176
4.019.8	7.9	6.6	176
5.019.8	7.9	6.5	175
6.119.8	7.9	6.5	175
7.019.8	7.9	6.4	175
8.120.0	7.8	5.7	176
9.016.8	7.9	5.1	169
9.915.5	7.9	4.4	164
11.113.9	8.0	4.2	157
12.012.6	8.1	4.7	151
13.011.7	8.0	5.2	150
13.911.2	8.0	5.5	153
15.010.9	8.0	5.8	158
16.010.5	7.9	6.0	160
16.910.1	7.9	6.2	161
17.9 9.8	7.9	6.3	163
18.9 9.4	7.9	6.5	164
20.2 8.9	7.9	6.5	165
21.2 8.6	7.9	6.7	168
22.0 8.5	7.8	6.7	168
23.2 8.3	7.8	6.7	169
24.1 8.2	7.8	6.8	168
25.0 8.0	7.8	6.9	169
26.2 7.9	7.8	7.1	170
26.9 7.9	7.8	7.1	171
28.3 7.9	7.8	7.1	177
29.0 7.8	7.8	6.9	180
30.0 7.7	7.8	6.8	185
31.1 7.6	7.8	6.7	188
32.1 7.6	7.8	6.6	189
33.1 7.9	7.7	6.6	189
34.3 7.5	7.7	6.5	191
35.0 7.5	7.7	6.4	191
37.1 7.5	7.7	6.3	193
39.4 7.4	7.7	6.4	194
41.9 7.2	7.7	6.4	195
44.3 7.0	7.7	7.0	197
48.1 7.0	7.7	7.0	199
52.1 7.0	7.7	6.9	200
56.1 7.0	7.7	6.9	200
60.3 6.9	7.7	6.9	202
63.7 6.7	7.7	6.8	204
67.9 6.7	7.7	6.7	206
69.9 6.7	7.7	6.6	206
71.9 6.7	7.7	6.6	206
74.1 6.7	7.6	6.6	206
74.7 6.7	7.6	6.5	206

JORDANELLE RESERVOIR
08/05/96

0.021.0	8.0	7.0	181
0.921.0	8.0	7.0	182
2.021.0	8.0	7.0	182
3.320.8	7.9	6.9	182
4.020.8	7.9	6.8	180
5.120.7	7.9	6.7	182
5.919.9	7.9	6.4	179
6.819.5	7.8	4.9	182
8.218.3	7.7	4.3	193
9.018.0	7.7	3.8	189
10.117.2	7.7	3.8	189
11.216.0	7.7	3.1	174
12.015.2	7.8	2.6	166
13.114.0	7.8	2.5	160
14.012.8	7.6	2.2	154
15.311.9	11.9	7.6	149
16.211.1	7.6	2.9	153
17.210.3	7.7	2.3	155
18.0 9.6	7.6	2.4	158
19.0 9.9	7.8	3.5	153
20.1 9.5	7.7	3.4	155
21.0 9.2	7.7	3.6	159
22.0 9.1	7.6	3.5	161
22.8 9.1	7.6	3.5	160
24.0 8.8	7.6	3.6	164
25.1 8.5	7.6	4.0	170
25.8 8.2	7.6	4.4	173
27.2 8.0	7.6	4.6	176
28.2 7.8	7.6	4.7	182
28.3 7.8	7.6	4.8	180

KENS LAKE
06/09/93

0.016.0	8.6	8.8	200
1.015.4	8.7	8.6	201
2.015.0	8.7	8.4	201
3.014.6	8.7	8.3	201
4.014.4	8.6	7.8	201
5.014.4	8.6	7.8	200
6.014.3	8.6	7.7	201
7.014.1	8.6	7.7	201
8.013.7	8.6	7.6	199
9.013.4	8.5	7.6	199
10.013.1	8.5	7.5	197
11.012.6	8.5	7.3	198
12.012.3	8.4	7.3	201
13.011.9	8.4	7.0	206
14.011.2	6.7	8.3	219
15.011.1	8.2	6.0	222
16.011.0	8.2	5.6	226
17.010.8	8.1	5.2	228
18.010.6	8.1	4.9	230
18.910.6	8.1	4.4	231

KENS LAKE
08/11/93

0.023.1	8.5	7.1	193
1.022.8	8.5	7.1	193
2.022.6	8.5	7.0	194
3.022.5	8.5	7.0	194
4.022.1	8.5	6.6	194
5.021.7	8.4	6.6	193
6.021.0	8.3	6.3	193
7.020.3	8.3	6.3	192
8.019.5	8.2	5.9	194
9.018.7	8.1	5.8	193
10.017.8	8.1	5.2	193
11.017.5	7.9	4.5	194
12.017.5	7.9	4.4	195
13.017.4	7.8	4.3	197
14.017.4	7.9	4.1	197

KENS LAKE
08/31/94

0.023.7	8.3	7.8	250
1.022.0	8.1	7.5	253
2.021.0	7.9	5.8	254
3.019.8	7.7	5.7	250
4.019.2	7.7	5.6	243
5.019.1	7.7	5.5	242

KENS LAKE
08/22/95

0.023.5	9.0	7.5	197
1.023.5	9.1	7.5	196
2.023.0	9.0	7.5	197
3.022.8	9.1	7.5	197
4.022.5	9.2	7.5	197
5.022.0	9.2	7.5	199
6.021.2	9.2	7.2	198
7.020.9	9.2	7.1	199
8.020.3	9.2	7.0	199
9.019.6	9.1	6.7	197
10.018.8	9.0	6.1	196
11.017.9	9.0	6.0	197
12.117.9	8.9	5.3	197

KENTS LAKE (LOWER) #2
08/13/96

0.017.9	9.6	7.8	73
1.017.1	9.4	5.9	72
2.016.7	9.2	4.7	73
3.016.4	8.9	1.5	74
3.815.6	8.1	0.3	91

KENTS LAKE (MIDDLE)
07/06/94

0.018.1	7.5	7.2	69
1.017.7	7.3	5.6	69
2.017.5	7.3	5.3	69

3.017.4	7.3	5.1	69

KENTS LAKE (MIDDLE)
08/17/94

0.017.6	9.5	11.1	138
1.115.8	9.6	10.4	125
1.015.6	9.2	8.5	102
2.014.7	8.6	7.0	82
3.013.7	7.6	3.7	43
3.313.8	7.3	2.6	30

KENTS LAKE (MIDDLE)
03/07/95

0.0 0.1	7.5	3.9	78
1.0 2.4	7.3	1.5	79
2.0 3.1	7.2	0.3	84
3.0 3.5	7.0	0.3	86

KENTS LAKE (UPPER) #1
07/01/96

0.017.6	9.5	11.1	138
1.115.8	9.3	10.4	125
1.015.6	9.2	8.5	102
2.014.7	8.6	7.0	82
3.013.7	7.6	3.7	43
3.313.8	7.3	2.6	30

KOLOB RESERVOIR
06/02/93

0.013.7	8.8	10.3	270
1.013.6	8.8	10.2	272
2.012.3	8.8 -	10.6	271
3.010.5	8.8	10.5	281
4.0 9.2	8.6	9.6	281
5.0 7.6	8.2	6.4	281
6.0 6.7	8.2	5.3	285
7.0 6.3	8.2	5.0	285
8.0 5.8	8.2	4.8	283
9.0 5.6	8.2	4.6	285
10.0 5.4	8.2	4.4	287
11.0 5.2	8.2	4.1	292
12.0 5.1	8.2	3.9	296
13.0 5.0	8.1	3.5	296
14.0 5.0	8.1	3.3	299
14.1 5.0	8.1	3.0	300

KOLOB RESERVOIR
08/31/94

0.019.4	8.4	6.6	242
1.019.4	8.4	6.6	242
2.019.4	8.4	6.6	242
3.019.4	8.4	6.6	242
4.019.4	8.4	6.6	242
5.019.4	8.4	6.4	243
6.019.3	8.3	6.0	243
7.018.9	7.9	4.1	247
8.018.8	7.7	3.3	246
9.018.4	7.5	1.3	251
10.416.8	7.4	0.2	267

KOLOB RESERVOIR
08/09/95

0.020.1	8.3	6.9	319
1.020.1	8.3	6.8	318
2.019.9	8.3	6.9	321
3.019.7	8.3	6.9	315
4.019.3	8.3	6.8	325
5.019.2	8.3	6.7	326
6.018.6	8.2	6.0	319
7.013.3	7.6	3.8	330
8.011.3	7.5	1.7	358

KOLOB RESERVOIR
08/09/95

0.019.9	8.3	6.9	321
1.019.8	8.3	6.9	321
2.019.5	8.3	6.9	320
3.019.3	8.3	6.9	319
4.019.2	8.3	6.8	321
5.018.9	8.2	6.4	313
6.017.8	8.0	5.2	329
7.014.7	7.8	5.3	328
8.012.2	7.6	2.9	349
9.010.7	7.4	1.1	347
10.0 9.8	7.3	0.5	351
11.0 9.2	7.2	0.1	337
12.0 8.7	7.3	0.1	360
13.0 8.3	7.2	0.1	363
14.0 8.1	7.2	0.1	363

KOOSHAREM RESERVOIR
07/14/94

0.020.2	8.8	6.6	283
1.020.1	8.9	6.5	283
2.019.7	8.8	5.9	283
3.019.5	8.8	5.0	284
4.019.0	8.7	3.7	284

KOOSHAREM RESERVOIR
06/25/96

0.017.7	8.7	7.5	286
1.117.7	8.7	6.9	286
2.017.7	8.7	6.8	286
3.017.7	8.7	6.8	286
4.017.5	8.7	6.4	284
5.016.5	8.6	5.9	264

KOOSHAREM RESERVOIR
06/25/96

0.016.0	8.1	8.6	149

KOOSHAREM RESERVOIR
06/25/96

0.012.6	8.0	8.6	104

KOOSHAREM RESERVOIR
09/05/96

0.117.7	8.5	7.3	267
1.017.7	8.5	7.0	268
2.017.8	8.5	7.0	268
2.817.7	8.5	6.8	268

LABARON LAKE RESERVOIR
08/17/94

0.018.3	9.3	12.9	87
1.018.0	9.2	12.9	86
2.017.2	9.1	12.9	86
3.015.4	7.6	1.5	81
4.014.0	7.2	1.4	102
5.012.0	7.0	1.2	114
6.011.4	6.8	0.6	144

LABARON RESERVOIR
08/03/94

0.021.3	9.9	9.5	80
1.018.2	10.0	10.8	77
2.017.0	9.6	9.3	78
3.016.3	8.0	4.4	78
4.013.9	7.0	0.2	78
5.011.5	6.7	0.1	175
5.910.7	6.6	0.1	150

LABARON RESERVOIR
08/20/94

0.021.3	9.9	9.5	80
1.018.2	10.0	10.8	77
2.017.0	9.6	9.3	78
3.016.3	8.0	4.4	78
2.013.9	7.0	0.2	98
5.011.5	6.7	0.1	175
5.910.7	6.6	0.1	150

LABARON RESERVOIR
03/17/95

0.0 0.3	7.4	0.3	93
1.0 3.2	7.4	0.0	96
2.0 3.6	7.3	0.0	102
3.0 3.8	7.3	0.0	108
4.0 4.1	7.1	0.0	118
4.5 4.1	7.1	0.0	153

LABARON RESERVOIR
07/01/96

0.016.6	9.3	9.0	83
0.916.0	9.3	8.7	83
2.015.3	9.3	8.9	83
3.014.4	8.8	7.9	84
4.013.1	8.3	8.2	86
5.110.8	7.4	2.5	103
6.0 9.2	6.9	2.3	132

LABARON RESERVOIR
08/13/96

0.016.7	10.2	12.0	87
0.916.4	10.1	11.6	86
2.015.9	9.8	8.7	83
3.015.4	9.2	3.9	80
4.012.4	7.6	0.3	116
5.011.4	7.2	0.2	128
5.411.4	7.1	0.2	130

LAKE BOREHAM
09/06/95

0.021.6	8.6	8.3	664
1.021.5	8.4	7.5	664
2.021.1	8.6	7.4	664
3.021.0	8.5	7.0	665
4.020.8	8.5	7.0	662
5.020.6	8.2	6.7	668

LAKE MARY
07/29/94

0.018.3	7.3	7.4	60
1.018.2	7.0	7.4	60
2.017.9	7.0	7.2	61
3.017.5	6.8	6.9	61
4.017.1	6.8	6.5	61
5.016.6	6.7	5.6	61
6.016.3	6.6	5.2	63
7.016.2	6.6	4.9	59
8.015.8	6.7	2.6	39

LAKE MARY
07/03/96

0.015.5	8.9	7.2	49
1.015.3	9.0	4.0	46
2.012.8	9.1	7.4	47
3.011.5	9.0	9.2	45
4.0 9.8	9.0	10.1	45
5.0 8.3	9.0	10.6	45
6.0 7.0	8.8	11.3	45
7.0 6.1	8.8	11.2	46
8.0 5.6	8.7	10.9	44
9.1 5.1	8.6	10.6	44
10.0 4.9	8.5	10.6	44
11.0 4.9	8.5	8.1	44
11.1 4.8	8.5	7.7	44

LITTLE CREEK RESERVOIR
06/29/94

0.020.3	8.9	10.3	315
1.020.4	9.0	10.2	380
2.020.4	9.0	10.2	380
2.820.3	9.0	10.5	380

LITTLE CREEK RESERVOIR
08/03/94

0.017.7	9.3	11.8	287
1.016.9	8.3	7.8	334

LITTLE CREEK RESERVOIR
06/20/96

0.019.0	8.8	9.1	432
4.019.0	8.8	8.9	432
2.019.0	8.8	9.1	433
3.019.0	8.8	9.5	433
4.016.4	8.7	9.1	429

LITTLE DELL RESERVOIR
07/19/94

0.0 0.0	0.0	0.0	0
1.020.9	8.2	7.5	338
2.020.8	8.2	7.5	337
3.020.8	8.2	7.5	338
4.020.8	8.2	7.5	337
5.020.8	8.2	7.5	337
6.020.6	8.2	7.4	337
7.019.7	8.1	7.7	341
8.019.6	8.1	7.7	341
9.019.4	8.1	7.7	342
10.018.9	8.1	7.8	343
11.016.6	8.1	8.6	347
12.012.7	8.1	8.2	360
13.010.9	8.1	7.6	368
14.010.0	8.1	7.6	372
15.0 9.4	8.0	7.2	374
16.0 8.0	7.9	7.2	383
17.0 7.6	7.9	7.0	384
18.0 7.2	7.9	6.9	390
19.0 6.9	7.9	6.7	394
20.0 6.9	7.9	6.7	395
21.0 6.8	7.9	6.6	396
22.0 6.8	7.9	6.6	398
23.0 6.8	7.9	6.5	399

24.0	6.8	7.9	6.5	400
25.0	6.7	7.9	6.4	400
26.0	6.7	7.9	6.4	401
27.0	6.6	7.9	6.4	401
28.0	6.6	7.9	6.3	402
29.0	6.6	7.9	6.3	404
30.0	6.6	7.9	6.3	405

LITTLE DELL RESERVOIR
09/09/94

0.0	19.4	8.4	7.6	342
1.0	19.5	8.5	7.6	340
2.0	19.5	8.5	7.6	340
3.0	19.5	8.5	7.6	340
4.0	19.4	8.5	7.6	347
6.0	19.4	8.5	7.6	346
8.0	19.4	8.5	7.6	350
10.0	19.1	8.4	7.4	351
12.0	18.9	8.4	7.3	342
13.0	18.7	8.3	6.4	355
14.0	13.1	8.0	6.0	367
15.0	11.0	8.0	6.3	396
16.0	10.0	7.9	5.9	396
17.0	9.4	7.9	5.7	403
18.0	8.9	7.9	5.6	397
19.0	8.5	7.9	5.7	407
20.0	8.3	7.8	5.5	392
21.0	8.2	7.8	5.5	401
22.0	7.9	7.8	5.6	405
24.0	7.6	7.8	5.4	408
26.9	7.1	7.8	5.0	405

LITTLE DELL RESERVOIR
07/03/96

0.1	21.5	8.5	7.4	416
1.0	20.6	8.5	7.5	418
2.0	20.4	8.5	7.5	418
3.1	20.4	8.5	7.5	417
4.0	19.2	8.5	7.8	415
5.0	18.8	8.5	7.8	419
6.1	18.5	8.5	7.9	418
7.0	18.0	8.5	7.9	424
8.0	14.6	8.4	9.0	412
9.1	12.8	8.3	9.1	418
10.0	11.8	8.3	9.0	422
10.9	10.8	8.2	8.6	441
12.1	9.9	8.1	8.2	456
13.0	9.0	8.1	7.9	483
14.0	8.2	8.0	7.7	497
15.0	8.0	8.0	7.6	498
16.0	7.8	8.0	7.6	494
17.0	7.7	8.0	7.6	499
18.0	7.6	8.0	7.5	500
19.0	7.5	8.0	7.5	511
20.0	7.4	8.0	7.5	511
22.1	7.3	8.0	7.3	511
24.1	7.2	8.0	7.3	526
26.0	7.1	8.0	7.2	530
28.2	7.1	8.0	7.3	508
30.1	7.0	7.9	7.1	521
32.1	6.9	7.9	7.0	534
34.0	6.9	7.9	7.8	525
36.0	6.9	7.9	6.7	524
38.0	6.9	7.9	6.6	514

LLOYDS RESERVOIR
06/09/93

0.0	13.5	8.5	8.4	192
1.0	13.4	8.5	8.3	194
2.0	13.3	8.4	8.1	195
3.0	13.0	8.5	8.1	195
4.0	13.0	8.4	8.0	195
5.0	17.9	8.4	8.0	194
6.0	12.8	8.4	7.7	196
7.0	11.8	8.3	7.5	193
8.0	11.0	8.7	7.6	192
9.0	10.2	8.2	7.7	191
10.0	9.5	8.1	7.2	196
11.0	9.0	8.1	7.0	201
12.0	8.5	8.0	6.8	206
13.0	8.4	8.0	6.8	204
14.0	8.2	8.0	6.8	204
15.0	8.2	8.0	6.8	204
16.0	8.0	8.0	6.7	212
17.0	7.8	8.0	6.7	211
18.0	7.7	8.0	6.6	215
19.0	7.8	8.0	6.6	210
19.7	7.8	8.0	6.4	210

LLOYDS RESERVOIR
08/11/93

0.0	18.9	8.3	6.7	274
1.0	18.9	8.3	6.7	223
2.0	18.9	8.3	6.7	223
3.0	18.9	8.3	6.6	223
4.0	18.9	8.3	6.6	223
5.0	18.9	8.3	6.6	222
6.0	18.9	8.3	6.6	223
7.0	18.2	7.9	4.7	228
8.0	17.8	7.8	4.2	226
9.0	15.8	7.7	2.9	225
10.0	13.2	7.7	3.0	222
11.0	12.4	7.6	3.3	220
12.0	11.3	7.6	3.4	218
13.0	9.9	7.6	2.9	224
14.0	9.5	7.6	2.7	224
15.0	9.4	7.5	2.5	226
16.0	9.2	7.5	7.4	227
17.0	9.3	7.5	2.4	238
18.0	9.1	7.5	2.3	230
19.0	9.1	7.5	2.3	230
20.0	9.9	7.6	2.6	234
21.2	10.3	7.7	2.6	230

LLOYDS RESERVOIR
08/31/94

0.0	19.8	8.3	7.0	339
1.0	19.8	8.3	6.9	339
2.0	19.7	8.3	6.9	340
3.0	19.7	8.3	6.7	340
4.0	19.7	8.3	6.7	340
5.0	19.6	8.3	6.8	341
6.0	19.6	8.3	6.7	341
7.0	19.6	8.3	6.8	341
8.0	19.5	8.3	6.8	340
9.0	17.8	8.0	6.0	339
10.0	15.6	7.8	3.8	337
11.0	14.6	7.7	3.0	340
12.0	13.8	7.6	2.0	342
13.0	12.9	7.5	1.1	340
14.0	12.6	7.4	0.8	343
15.0	12.5	7.4	0.5	344
16.0	12.5	7.4	0.4	344
17.0	12.5	7.4	0.4	345
18.0	12.5	7.4	0.4	344
19.0	12.6	7.4	0.4	344
20.0	12.7	7.4	0.4	344
21.0	12.7	7.4	0.4	343
22.0	12.7	7.4	0.4	343
23.0	12.7	7.4	0.4	344
24.0	12.8	7.4	0.4	344

LLOYDS RESERVOIR
08/23/95

0.0	19.8	9.0	7.6	275
1.0	19.9	9.0	7.4	273
2.0	19.8	9.0	7.3	277
3.0	19.8	9.0	7.2	279
4.0	19.8	9.0	7.2	274
5.0	19.8	9.0	7.1	281
6.0	19.8	9.0	7.1	281
7.0	16.2	8.8	5.5	258
8.0	14.5	8.7	5.3	253
9.0	13.4	8.6	4.6	274
10.0	13.1	8.5	4.0	249
11.0	12.2	8.5	3.8	251
12.0	11.3	8.5	3.0	259
13.0	11.2	8.4	2.5	274
14.0	11.1	8.4	2.0	261

LLOYDS RESERVOIR
08/23/95

0.0	19.6	8.8	7.2	274
1.0	19.6	8.8	7.1	274
2.0	19.6	8.8	7.1	276
3.0	19.6	8.9	7.1	271
4.0	19.5	8.9	7.0	273
5.0	19.3	8.9	7.0	271
6.0	18.7	8.8	6.5	279
7.0	16.3	8.8	5.8	273
8.0	14.2	8.6	4.7	262
9.0	13.5	8.6	4.6	260
10.0	12.7	8.5	3.8	269
11.0	12.7	8.5	3.7	264
12.0	12.3	8.4	3.5	266
13.0	11.7	8.3	3.2	273
14.0	11.7	8.3	3.2	273
15.0	11.4	8.3	2.4	272

LONG PARK RESERVOIR
07/01/93

0.0	18.3	7.5	7.8	34
1.0	17.5	7.4	7.6	33
2.0	15.5	7.5	7.5	32
3.0	14.4	7.5	7.6	32
4.0	13.8	7.4	7.6	32
5.0	12.5	7.4	7.5	33
6.0	11.6	7.3	7.5	32
7.0	11.3	7.2	7.5	32
8.0	11.0	7.2	7.5	32
9.0	10.9	7.2	7.5	32
10.0	10.8	7.2	7.5	32
11.0	10.8	7.2	7.5	32
12.0	10.7	7.1	7.5	32
13.0	10.6	7.1	7.5	33
14.0	10.5	7.1	7.5	33
15.0	10.5	7.1	7.4	33
16.0	10.5	7.1	7.4	33
17.0	10.4	7.1	7.4	33
18.0	10.3	7.1	7.3	33
18.4	10.3	7.1	7.2	33

LOST CREEK RESERVOIR
06/29/94

0.0	19.2	8.6	7.5	392
1.0	19.2	8.6	7.4	392
2.0	19.1	8.7	7.4	391
3.0	19.0	8.7	7.3	391
4.0	18.7	8.7	7.4	392
5.0	18.6	8.7	7.4	391
6.0	16.2	8.4	6.3	396
7.0	15.7	8.4	6.3	397
8.0	15.0	8.4	6.0	397
9.0	14.5	8.3	5.8	398
10.0	14.0	8.3	5.6	397
11.0	12.4	8.2	5.3	396
12.0	11.4	8.1	5.4	398
13.0	10.5	8.1	5.5	396
14.0	9.0	8.1	5.6	401
15.0	8.6	8.1	5.7	402
16.0	8.2	8.1	5.9	404
17.0	7.7	8.2	6.0	405
18.0	7.4	8.1	6.1	412
19.0	7.0	8.1	6.2	414
20.0	6.7	8.1	6.1	415
21.0	6.5	8.1	6.1	415
22.0	6.4	8.1	5.9	413
23.0	6.3	8.0	5.9	415
24.0	6.3	8.1	5.9	415
25.0	6.2	8.0	5.9	416
26.0	6.2	8.0	5.9	418
27.0	6.2	8.0	5.8	418
28.0	6.2	8.0	5.8	418
29.0	6.2	8.0	5.8	418
30.0	6.2	8.0	5.8	422
31.0	6.2	8.0	5.8	425
32.0	6.2	8.0	5.8	425
33.4	6.2	8.0	5.7	428

LOST CREEK RESERVOIR
07/13/94

0.0	22.5	8.7	7.2	416
1.0	22.5	8.7	7.2	416
2.0	21.7	8.7	7.2	416
3.0	21.5	8.7	7.2	468
4.0	21.4	8.6	7.2	405
5.0	20.8	8.6	7.2	413
6.0	19.8	8.6	6.8	416
7.0	18.9	8.5	6.3	416
8.0	17.9	8.4	5.6	413
9.0	17.2	8.3	5.2	419
10.0	16.8	8.2	4.8	422
11.0	15.5	8.1	4.4	410
12.0	14.5	8.0	4.0	405
13.0	13.1	7.9	4.8	410
14.0	12.0	7.9	4.8	408
15.0	11.6	7.9	4.8	398
16.0	10.9	7.9	4.8	400
17.0	10.1	7.9	5.1	418
18.0	9.3	7.9	5.2	414
19.0	8.4	8.0	5.4	419
20.0	7.9	8.0	5.5	417
21.0	7.7	8.0	5.6	429
22.0	7.5	8.0	5.6	430
23.0	7.7	8.1	5.6	415

LOST CREEK RESERVOIR
08/02/94

LOST CREEK RESERVOIR
08/02/94

0.0	22.5	8.7	7.2	416
1.0	22.5	8.7	7.2	416
2.0	21.7	8.7	7.2	416
3.0	21.5	8.7	7.2	468
4.0	21.4	8.6	7.2	405

5.020.8	8.6	7.2	413
6.019.8	8.6	6.8	416
7.018.9	8.5	6.3	416
8.017.9	8.4	5.6	413
9.017.2	8.3	5.2	419
10.016.8	8.2	4.8	422
11.015.5	8.1	4.4	410
12.014.5	8.0	4.0	405
13.013.1	7.9	4.8	410
14.012.0	7.9	4.8	408
15.011.6	7.9	4.8	398
16.010.9	7.9	4.8	400
17.010.1	7.9	5.1	418
18.0 9.3	7.9	5.2	414
19.0 8.4	8.0	5.4	419
20.0 7.9	8.0	5.5	417
21.0 7.7	8.0	5.6	429
22.0 7.5	8.0	5.6	430
23.0 7.7	8.1	5.6	415

LOST CREEK RESERVOIR
06/18/96

0.019.0	8.7	8.1	368
1.019.0	8.7	8.1	369
2.019.0	8.7	8.1	369
3.019.0	8.7	7.9	369
4.019.0	8.7	8.0	369
5.018.9	8.7	8.1	369
6.018.3	8.7	8.3	370
7.016.9	8.7	9.0	371
8.011.9	8.4	8.0	372
9.010.7	8.3	9.0	371

LOST CREEK RESERVOIR
06/18/96

0.018.2	8.7	8.4	366
1.018.0	8.7	8.4	367
2.017.6	8.7	8.7	367
3.016.2	8.7	10.2	367
4.014.2	8.7	11.9	371
5.013.3	8.7	12.0	368
6.012.7	8.7	12.1	370
7.011.8	8.6	12.0	365
8.010.7	8.2	10.1	368
9.010.0	8.1	8.7	370
10.0 9.7	8.1	8.6	371
11.0 9.4	8.1	8.6	373
12.0 9.1	8.1	8.8	376
12.9 8.9	8.1	9.0	378
14.0 8.6	8.1	9.0	380
15.0 8.4	8.1	9.0	384
16.0 8.2	8.1	9.1	387
17.0 8.0	8.1	9.3	391
18.0 7.8	8.1	9.3	395
18.9 7.7	8.1	9.3	398
20.0 7.5	8.1	9.9	402
22.1 7.2	8.1	9.9	408
23.0 7.2	8.1	9.0	408
23.9 7.2	8.1	9.2	409
26.1 7.1	8.1	9.2	410
30.1 7.1	8.1	9.5	411
34.9 7.1	8.1	9.7	412
36.6 7.1	8.1	9.6	412

LOST CREEK RESERVOIR
06/18/96

0.014.0	7.8	7.8	597

LOST CREEK RESERVOIR
06/18/96

0.019.5	8.7	8.2	367
1.019.5	8.7	8.0	367
2.019.1	8.7	8.4	368
3.018.6	8.7	8.9	368
4.017.9	8.7	9.2	369
5.017.2	8.8	9.5	369
6.013.4	8.7	11.0	385
7.011.0	8.6	10.5	375
8.110.2	8.2	7.8	375
9.0 9.9	8.2	7.6	376
10.0 9.3	8.1	7.1	378
11.0 9.2	8.1	7.0	379
12.0 9.0	8.1	6.9	381
13.0 8.7	8.1	6.9	383
15.0 8.4	8.1	6.9	389
17.0 8.2	8.0	6.9	393
19.0 7.7	8.0	6.9	401
21.0 8.0	8.0	6.9	406
22.8 8.0	8.0	6.7	410

LOST CREEK RESERVOIR
08/06/96

-0.120.2	8.5	7.7	393
1.120.1	8.5	7.5	392
2.020.1	8.5	7.4	392
3.120.0	8.5	7.4	393
4.120.0	8.5	7.4	393
5.019.9	8.5	7.5	395
6.319.9	8.5	7.5	397
7.419.1	8.5	7.3	411
8.018.6	8.5	6.9	423
8.917.8	8.5	5.9	414
9.915.4	8.5	4.8	406
11.014.4	8.4	4.5	399
12.314.0	8.4	4.0	404

LOST CREEK RESERVOIR
08/06/96

0.020.0	8.4	7.9	386
1.020.0	8.4	7.7	386
2.020.0	8.4	7.7	386
3.119.7	8.4	7.7	386
4.019.6	8.4	7.7	386
5.019.5	8.4	7.6	387
6.019.4	8.4	7.5	393
7.019.1	8.4	7.3	393
8.018.7	8.3	7.0	397
9.117.8	8.2	6.4	403
10.114.7	8.3	6.1	392
11.013.0	8.5	5.8	385
11.912.4	8.5	5.6	383
13.211.7	8.4	5.5	380
13.811.6	8.4	5.3	380
14.911.3	8.3	5.2	381

LOST CREEK RESERVOIR
08/06/96

0.019.4	8.5	7.5	387
1.019.4	8.5	7.5	388
2.019.4	8.5	7.5	388
2.919.3	8.5	7.4	388
4.019.3	8.5	7.5	388
5.019.2	8.5	7.5	389
6.019.2	8.5	7.4	389
7.019.2	8.5	7.3	389
8.018.5	8.4	5.9	397
9.017.0	8.2	5.8	403
10.015.6	8.2	5.6	396
11.014.0	8.3	5.6	391
12.012.8	8.4	5.6	383
12.911.6	8.4	5.6	378
14.010.6	8.4	5.5	374
15.0 9.9	8.4	5.6	374
16.1 9.5	8.3	5.6	375
17.0 9.3	8.3	5.7	375
18.0 9.0	8.3	5.8	376
19.0 8.8	8.3	6.0	378
20.1 8.6	8.3	6.2	379
21.0 8.5	8.3	6.2	380
22.1 8.4	8.3	6.3	383
23.1 8.3	6.4	6.4	384
24.0 8.2	8.3	6.4	384
24.8 8.3	8.3	6.3	385

LOST CREEK RESERVOIR
08/06/96

1.415.6	8.3	8.0	526

LOST CREEK RESERVOIR
08/06/96

0.316.7	8.6	7.7	477

LOWER BOWNS RESERVOIR
08/19/93

0.017.5	8.3	7.5	103
1.017.5	8.3	7.5	103
2.017.5	8.3	7.4	104
3.017.5	8.3	7.4	105
4.017.5	8.3	7.3	105
5.017.2	8.2	6.9	105
6.017.0	8.1	6.7	105
7.017.0	8.1	6.5	104
8.016.7	8.0	5.8	105
9.015.1	7.3	0.3	106
10.011.6	7.1	0.1	110
11.010.9	7.0	0.1	116
11.410.8	7.0	0.1	116

LOWER BOWNS RESERVOIR
09/13/95

0.017.8	8.6	6.9	104
1.017.6	8.6	6.8	104
2.017.4	8.6	6.2	104
3.017.4	8.7	6.5	105
4.017.3	8.7	7.3	104
5.017.1	8.7	6.7	105
6.016.6	8.6	5.0	104
7.013.3	8.1	0.5	100
8.011.5	7.9	0.2	105
9.011.0	7.6	0.2	105
10.010.7	7.4	0.1	109
11.010.3	7.3	0.1	110

LOWER BOX CREEK
RESERVOIR 07/06/94

0.017.9	9.5	10.1	133
1.017.9	9.5	10.0	132
2.017.9	9.4	10.0	133
3.017.6	9.3	9.8	133
4.015.9	8.5	6.3	135
5.015.7	8.5	6.2	136

LOWER BOX CREEK
RESERVOIR 07/02/96

0.016.1	9.1	8.6	135
1.015.7	9.0	8.6	135
2.014.4	8.7	7.8	137
3.013.8	8.4	7.2	135
4.013.5	8.2	6.5	141
4.413.3	8.2	6.6	139

LOWER BOX CREEK
RESERVOIR 08/21/96

0.016.2	10.3	13.7	148
1.116.2	10.3	13.4	148
2.015.5	10.0	12.2	141
3.015.0	9.8	8.3	139
3.914.8	9.6	6.9	141
4.614.7	9.5	5.3	143

LOWER GOOSEBERRY
RESERVOIR 06/21/93

0.014.9	8.1	7.2	350
1.014.8	8.1	7.2	350
2.014.8	8.1	7.2	351
2.814.8	8.1	7.2	353
3.214.4	8.4	7.2	352

LOWER GOOSEBERRY
RESERVOIR 08/11/93

0.017.4	8.8	9.6	159
1.017.4	8.8	9.6	159
2.017.4	8.8	9.6	159
3.017.3	8.8	9.6	159
3.817.1	8.8	9.5	160

LYMAN LAKE (RES.)
07/27/94

0.018.4	9.4	7.8	166
1.017.9	9.4	8.3	166
2.017.6	9.4	7.6	166
3.017.1	9.1	5.8	180
4.016.5	8.3	2.0	212
5.015.6	7.6	0.3	269

LYMAN LAKE (RES.)
02/28/95

0.0 0.3	7.7	1.5	202
1.0 3.4	7.6	0.6	215
2.0 4.0	7.6	0.4	221
3.0 4.1	7.6	0.3	230
4.0 4.1	7.5	0.2	233
5.0 4.1	7.5	0.2	250
6.0 4.1	7.4	0.2	260
6.7 4.0	7.4	0.2	278

LYMAN LAKE (RES.)
09/22/95

0.010.6	8.4	8.1	193
1.010.5	8.4	7.9	193
2.010.4	8.4	7.8	193
3.010.3	8.4	7.8	193
4.010.3	8.4	7.8	193
5.010.2	8.4	7.6	194
6.0 9.5	8.0	4.4	212
7.0 9.4	7.6	3.8	217

LYMAN LAKE (RES.)
07/17/96

0.017.6	9.0	6.9	170
1.017.6	9.0	6.8	170
2.017.3	9.0	6.6	169
3.017.1	8.8	6.0	178
3.916.3	8.2	4.2	199
4.912.9	7.6	0.6	237
6.0 8.8	7.5	0.3	277
7.0 7.6	7.3	0.1	299
7.9 7.4	7.2	0.1	306

MANNING MEADOW
07/06/94

0.017.2	9.0	6.6	77
1.017.2	8.6	6.6	77
2.017.1	8.8	6.6	77
3.016.9	8.8	6.6	78
4.015.7	8.1	5.5	78
5.012.3	7.1	4.1	76
6.010.2	7.1	2.0	73
7.0 6.9	7.0	0.3	83
8.0 6.0	7.0	0.3	88
9.0 5.2	7.0	0.3	100
10.0 4.9	7.0	0.3	99
11.0 4.6	7.0	0.3	110
12.0 4.5	7.0	0.3	114
13.0 4.5	7.0	0.3	124

MANNING MEADOW
07/10/94

0.017.2	9.0	6.6	77
1.017.2	8.6	6.6	77
2.017.1	8.8	6.6	77
3.016.9	8.8	6.6	78
4.015.7	8.1	5.5	78
5.012.3	7.1	4.1	76
6.010.2	7.1	2.0	73
7.0 6.9	7.0	0.3	83
8.0 6.0	7.0	0.3	88
9.0 5.2	7.0	0.3	100
10.0 4.9	7.0	0.3	99
11.0 4.6	7.0	0.3	110
12.0 4.5	7.0	0.3	114
13.0 4.5	7.0	0.3	124

MANNING MEADOW
03/07/95

0.0 0.2	7.5	5.3	82
1.0 2.3	7.4	4.9	82
2.0 2.7	7.4	4.3	82
3.0 2.8	7.3	3.8	82
5.0 2.9	7.2	3.1	83
6.0 2.6	7.2	2.9	83
7.0 3.0	7.1	1.6	85
8.0 3.0	7.0	0.3	90
9.0 3.0	7.0	0.3	90
10.0 3.0	6.7	0.3	114
11.0 3.0	6.7	0.3	114
12.0 3.1	6.7	0.3	131

MANNING MEADOW
07/02/96

0.015.5	8.2	7.3	79
1.015.1	8.1	7.3	80
2.013.3	8.0	7.0	79
3.012.8	8.0	6.8	80
4.012.2	7.9	6.5	80
5.011.8	7.9	6.2	82
6.010.2	7.8	5.8	87
6.9 7.3	7.7	5.5	84
8.0 6.3	7.7	5.0	85
9.0 5.8	7.6	3.6	83
10.0 5.6	7.5	2.3	81
11.0 5.5	7.4	0.8	92
12.1 5.3	7.4	0.7	95
12.9 8.2	7.2	0.2	98

MANNING MEADOW
08/21/96

0.015.2	7.9	6.8	84
1.115.2	7.9	6.7	84
2.014.9	7.8	6.7	84
2.914.9	7.8	6.7	84
4.014.8	7.8	6.5	84
5.014.2	7.7	5.2	85
6.012.6	7.6	3.2	86
6.9 9.4	7.5	1.4	86
8.1 8.2	7.4	1.0	86
9.1 7.2	7.3	0.4	87
10.0 7.0	7.2	0.2	89
10.4 6.7	7.2	0.1	91

MANTUA RESERVOIR
08/24/93

0.020.7	9.3	8.6	229
1.020.6	9.3	8.3	229
2.020.5	9.3	7.6	231
3.019.8	9.0	4.4	235
4.019.7	9.0	3.0	241
5.019.0	8.8	0.3	247
6.018.9	8.7	0.1	248

MANTUA RESERVOIR
11/09/94

0.0 5.4	8.3	8.7	377
1.0 5.3	8.3	8.6	378
2.0 5.4	8.3	8.7	378
3.0 5.3	8.3	8.7	379
3.8 5.4	8.3	8.9	379

MANTUA RESERVOIR
11/21/94

0.0 5.4	8.3	9.0	380
1.0 5.4	8.3	9.0	380
2.0 5.4	8.3	9.0	380
3.4 5.4	8.3	9.4	380

MANTUA RESERVOIR
01/24/95

0.0 3.1	8.2	8.6	392
1.0 4.5	7.9	6.5	409
2.0 4.6	7.9	5.3	411
3.0 4.8	7.8	4.8	414
4.0 4.7	7.9	4.8	414

MANTUA RESERVOIR
01/24/95

0.0 0.7	7.8	6.9	440
1.0 4.6	7.6	4.6	420
2.0 4.8	7.6	4.6	424
3.0 4.9	7.5	4.0	430
4.0 5.1	7.4	3.4	432
5.0 5.2	7.4	3.1	440
5.5 4.9	7.4	3.2	446

MANTUA RESERVOIR
01/24/95

0.0 2.5	8.1	8.4	400
1.0 4.6	7.9	6.6	411
2.0 4.6	7.8	5.4	411
3.0 4.7	7.8	4.8	419
4.0 4.8	7.8	4.5	420

MANTUA RESERVOIR
04/26/95

0.010.1	8.0	7.8	370
1.010.0	8.0	7.8	370
2.010.0	8.0	7.8	370
3.0 9.9	8.0	7.8	370
4.2 9.8	7.9	7.7	370

MANTUA RESERVOIR
04/26/95

0.0 9.6	8.0	7.9	369
1.0 9.6	7.9	7.9	369
2.0 9.6	7.9	7.9	370
3.0 9.6	7.9	7.9	370
4.0 9.5	7.9	7.8	370
5.0 9.5	7.9	7.8	370
6.3 9.4	7.9	7.9	370

MANTUA RESERVOIR
04/26/95

0.010.0	8.0	8.1	369
1.010.0	8.0	8.1	370
2.010.0	8.0	8.0	370
3.0 9.9	8.0	8.0	366
4.3 9.9	8.0	7.9	370

MANTUA RESERVOIR
05/11/95

0.012.8	8.1	8.6	372
1.012.8	8.1	8.6	371
2.012.7	8.1	8.6	370
3.012.7	8.1	8.6	374
4.012.7	8.1	8.6	370
5.012.3	8.0	7.7	370
6.311.6	7.7	5.9	377

MANTUA RESERVOIR
05/11/95

0.012.8	8.0	8.4	373
1.012.7	8.0	8.4	372
2.012.7	8.1	8.4	373
3.012.5	8.1	8.4	371
4.012.5	8.0	8.5	377

MANTUA RESERVOIR
05/11/95

0.013.1	8.2	9.5	366
1.013.0	8.2	9.5	365
2.013.0	8.2	9.5	366
3.013.0	8.2	9.3	365
4.0 9.8	8.0	9.3	300

MANTUA RESERVOIR
09/06/95

0.020.1	9.5	4.6	242
1.021.7	9.5	4.6	243
2.021.3	9.5	4.4	248
3.021.1	9.4	2.3	247
4.020.7	9.3	1.9	250
4.620.6	9.3	1.8	252

MANTUA RESERVOIR
09/06/95

0.021.8	9.4	4.4	244
1.021.8	9.5	4.4	246
3.021.1	9.5	4.1	247
4.020.7	9.3	2.6	276

MANTUA RESERVOIR
09/06/95

0.021.7	9.4	4.6	254
1.021.0	9.5	4.3	244
2.020.9	9.4	3.4	246
3.020.8	9.4	3.6	246
4.020.7	9.4	3.0	241
5.020.6	9.3	2.7	246

MARSH LAKE
09/16/93

0.011.6	8.4	5.9	208
1.011.9	8.3	5.9	209
2.011.9	8.3	5.9	208
3.011.9	8.3	5.9	209
4.011.9	8.3	5.9	209
5.011.9	8.3	5.9	209
6.011.8	8.3	6.1	208
7.411.8	8.6	6.2	208

MARSH LAKE
07/22/94

0.017.9	8.8	8.3	209
1.017.9	8.8	8.1	210
2.017.8	8.9	7.9	212
3.017.5	8.8	7.7	214
4.017.1	8.8	7.3	214
5.016.8	8.7	6.4	217
6.016.1	8.3	4.2	223
7.014.2	7.7	0.5	260
8.013.0	7.6	0.3	270
9.011.7	7.5	0.1	277
10.011.6	7.5	0.1	282

MARSH LAKE
07/27/94

0.017.9	8.8	8.3	209
1.017.9	8.8	8.1	210
2.017.8	8.9	7.9	212
3.017.5	8.8	7.7	214
4.017.1	8.8	7.3	214
5.016.8	8.7	6.4	217
6.016.1	8.3	4.2	223
7.014.2	7.7	0.5	260
8.013.0	7.6	0.3	270
9.011.7	7.5	0.1	277
10.011.6	7.5	0.1	282

MARSH LAKE
03/13/95

0.0 1.1	7.8	0.6	240
1.0 3.2	7.8	0.0	242
2.0 3.8	7.8	0.0	243
3.0 4.0	7.8	0.0	244

4.0 4.1	7.8	0.0	245
6.0 4.3	7.7	0.0	256
8.0 4.3	7.7	0.0	275
10.0 4.9	7.5	0.0	313

MARSH LAKE
09/27/95

0.010.6	7.5	6.0	227
1.010.7	7.6	6.0	226
2.010.6	7.6	5.6	227
3.010.6	7.6	5.6	227
4.010.6	7.6	5.6	227
5.010.6	7.6	5.5	227
6.010.5	7.6	5.3	228
7.010.4	7.6	5.1	229
8.010.4	7.6	5.2	228
9.010.3	7.6	4.9	228
10.010.3	7.6	4.9	228

MARSHALL LAKE
07/26/94

0.017.8	7.4	7.1	21
1.017.7	7.2	7.0	20
2.017.6	7.2	7.0	20
3.016.6	7.3	6.9	21
4.016.4	7.4	6.0	20
5.016.3	7.5	4.3	22

MATT WARNER RESERVOIR
07/27/94

0.022.3	9.2	10.5	244
1.021.4	9.2	9.5	245
2.019.2	8.9	7.4	249
3.018.4	8.8	6.7	248
4.018.0	8.7	5.7	250
5.017.1	8.2	2.7	255
6.016.4	7.8	1.3	260
7.216.5	8.0	0.2	268

MATT WARNER RESERVOIR
09/15/94

0.014.2	8.7	7.9	222
1.014.2	8.8	7.6	222
2.014.2	8.8	7.3	222
3.014.2	8.8	7.2	222
4.014.1	8.8	7.1	222
5.014.1	8.8	7.1	222
6.014.1	8.8	7.0	222
7.014.1	8.7	6.2	222

MATT WARNER RESERVOIR
07/11/96

0.019.6	8.8	8.1	246
1.019.6	8.8	7.9	246
2.019.5	8.8	7.9	246
3.019.5	8.8	7.4	247
4.018.5	8.5	4.5	252
5.017.2	7.7	0.5	263
5.317.0	7.7	0.4	264

MATT WARNER RESERVOIR
07/11/96

0.019.2	8.8	7.0	248
1.019.2	8.7	6.9	249
2.019.2	8.7	6.9	248
3.019.1	8.7	7.0	250
4.019.0	8.8	7.1	250
5.019.0	8.7	4.8	247
6.016.1	7.7	0.3	266
7.015.5	7.6	0.2	271
7.115.3	7.5	0.2	275

MATT WARNER RESERVOIR
08/27/96

0.118.6	8.6	6.4	236
1.018.3	8.6	6.3	237
2.018.2	8.6	6.1	237
3.018.1	8.5	5.3	238
4.018.0	8.2	4.0	239
4.718.0	8.3	4.3	238

MATT WARNER RESERVOIR
08/27/96

0.118.1	8.7	7.5	236
1.017.9	8.7	7.5	236
2.017.8	8.6	7.4	237
3.017.7	8.5	7.2	238
4.017.6	8.5	7.4	238
5.017.6	8.5	7.8	238
6.017.4	8.3	7.4	239
6.917.2	7.9	6.0	242

MEEKS CABIN RESERVOIR
09/16/93

0.012.2	8.3	7.4	58
1.012.2	8.1	7.3	58
3.012.1	8.0	7.3	58
4.012.1	8.0	7.3	58
5.012.1	8.0	7.3	58
6.012.1	8.0	7.3	58
7.012.1	8.0	7.3	58
8.012.1	8.0	7.3	58
9.012.1	7.9	7.3	58
10.012.1	7.9	7.3	58
11.012.1	7.9	7.3	58
12.012.1	7.9	7.3	58
13.012.1	7.9	7.3	58
14.013.1	7.9	7.3	58
15.012.0	7.9	7.3	59
16.012.0	7.8	7.2	59
17.011.9	7.9	7.2	59
18.011.8	7.8	7.1	60
19.011.4	7.7	7.0	62
20.011.0	7.7	6.8	62
21.010.6	7.6	6.4	61
22.010.3	7.6	6.4	62
23.010.2	7.6	6.1	60
23.610.1	7.5	5.7	58

MEEKS CABIN RESERVOIR
09/27/95

0.012.0	8.0	7.2	67
1.012.0	7.9	7.1	67
2.012.0	7.8	7.1	67
3.012.0	7.8	7.2	67
4.011.9	7.7	7.2	67
5.011.9	7.7	7.2	67
6.011.9	7.7	7.2	66
7.011.6	7.6	7.1	67
8.011.5	7.6	7.1	66
9.011.4	7.6	7.1	67
10.011.3	7.6	7.1	66
11.011.4	7.5	7.1	66
12.011.4	7.5	7.1	66
13.011.3	7.5	7.1	70

MIDWAY RESERVOIR
07/30/96

-0.125.5	8.6	6.3	1,704

MIDWAY RESERVOIR
07/30/96

0.025.9	8.6	8.6	1,750
0.325.3	8.6	8.6	1,749

MIDWAY RESERVOIR
07/30/96

0.025.2	8.6	8.0	1,843
1.025.6	8.5	6.6	1,851

MILL HOLLOW RESERVOIR
06/12/94

0.010.3	6.9	9.3	122
1.0 9.5	7.1	8.9	121
2.0 8.9	7.2	8.5	119
3.0 5.2	7.2	8.1	118
4.0 5.0	7.1	8.0	120
5.0 5.0	7.1	7.8	126
6.0 3.3	7.0	2.0	206
6.8 3.1	6.8	1.6	212

MILL MEADOW RESERVOIR
08/17/93

0.015.9	8.9	9.0	161
1.015.9	8.9	8.8	162
2.015.6	8.9	8.2	164
3.015.5	8.8	7.9	163
4.015.5	8.8	7.9	164
5.015.5	8.8	7.8	163
6.015.5	8.8	7.8	163
7.015.4	8.8	7.8	165
8.015.4	8.8	7.8	162
9.015.4	8.8	7.8	162
10.015.3	8.8	7.7	163
11.015.2	8.8	7.6	162
12.015.1	8.8	7.4	161
13.014.9	8.8	7.3	159
14.014.8	8.7	7.4	157
15.014.7	8.7	7.3	152
16.014.6	8.7	7.4	153
16.514.5	8.7	7.3	150

MILL MEADOW RESERVOIR
09/12/95

0.016.9	8.7	8.5	154
1.016.9	8.7	8.1	154
2.016.9	8.7	8.5	159
3.016.9	8.7	8.5	147
4.016.9	8.6	8.4	155
5.016.3	8.4	6.2	155
6.016.1	8.3	6.2	151
7.016.0	8.3	6.1	164
8.016.0	8.3	6.1	162
9.015.9	8.4	6.4	150
10.015.9	8.5	6.9	160
11.015.7	8.5	6.5	168

MILL MEADOW RESERVOIR
09/12/95

0.017.5	8.9	10.1	147
1.017.5	8.9	10.3	147
2.017.4	9.0	10.3	149
3.017.2	8.9	9.7	155
4.017.1	8.9	9.3	153
5.017.1	8.9	9.1	148
6.017.0	8.8	8.9	147
7.016.9	8.8	7.9	150
8.016.6	8.6	6.5	150
9.015.9	8.3	5.5	163
10.1 5.8	8.3	5.6	154
11.015.7	8.3	6.3	151
12.015.5	8.2	5.5	145
13.015.5	8.2	6.1	145
14.015.3	8.2	6.1	145
15.015.2	8.2	6.2	149
16.015.1	8.2	6.0	146
17.014.9	8.2	6.0	148

MILLER FLAT RESERVOIR
07/19/94

0.019.6	8.5	7.7	289
1.019.4	8.6	7.7	290
2.019.2	8.6	7.5	290
3.018.9	8.6	7.5	291
4.018.8	8.6	7.8	290
5.018.5	8.6	7.8	293
6.018.4	8.6	7.4	292
7.018.1	8.5	7.1	298
8.017.8	8.4	6.6	304
9.016.0	7.9	3.8	320

MILLER FLAT RESERVOIR
08/31/94

0.015.7	8.4	8.1	292
1.015.7	8.4	8.0	294
2.315.4	8.3	7.6	305

MILLER FLAT RESERVOIR
06/25/96

0.215.4	8.6	8.3	270
1.015.4	8.6	8.4	271
3.014.2	8.6	8.8	274
4.012.1	8.5	8.7	269
5.110.2	8.4	9.0	268
6.0 8.9	8.3	8.9	269
7.0 8.2	8.6	8.9	278
8.0 7.7	8.2	8.9	275
9.0 7.2	8.2	8.8	287
10.0 6.7	8.4	8.4	292
11.0 6.2	8.1	8.0	291
12.0 6.0	8.0	8.0	290
13.0 5.7	7.9	7.1	292
14.1 5.6	7.9	6.9	293
15.0 5.5	7.8	6.3	300
15.9 5.7	7.8	6.2	295

MILLER FLAT RESERVOIR
08/02/96

0.018.5	8.4	8.1	166
1.118.6	8.5	8.0	268
2.018.6	8.5	8.0	268
2.918.6	8.5	8.0	268
3.918.5	8.5	8.0	268
5.018.4	8.5	8.0	269
6.018.1	8.5	8.1	268
7.017.0	8.4	8.9	276
7.916.0	8.4	9.7	277

9.013.2	8.4	9.6	280
10.010.3	8.2	8.9	287
11.0 9.9	8.1	8.4	289
12.0 9.0	8.0	6.8	293
12.8 8.6	7.8	4.5	297

MILLSITE RESERVOIR
06/15/93

0.014.8	8.6	8.8	423
1.014.8	8.6	8.5	422
2.014.7	8.3	8.4	423
3.014.6	8.5	8.3	421
4.014.5	8.5	8.3	422
5.014.4	8.5	8.2	422
6.012.2	8.5	8.5	417
7.011.6	8.5	8.5	417
8.011.1	8.5	8.4	412
9.010.9	8.5	8.4	414
10.010.7	8.5	8.4	411
11.010.5	8.5	8.4	411
12.010.4	8.5	8.4	113
13.010.2	8.5	8.2	417
14.0 9.9	8.4	8.2	419
15.0 9.8	8.4	8.2	420
16.0 9.8	8.4	8.2	420
17.0 9.7	8.4	8.2	420
18.0 9.5	8.4	7.9	422
18.4 9.5	8.4	7.7	423

MILLSITE RESERVOIR
07/14/93

0.018.9	7.3	8.2	422
0.518.8	7.0	8.2	421
1.018.7	6.8	8.2	423
1.518.5	7.0	8.2	422
2.018.3	6.4	8.2	423
2.517.9	6.7	8.2	424
3.017.8	6.8	8.2	424
3.517.6	6.9	8.2	424
4.017.1	6.4	8.3	425
4.517.0	6.4	8.3	425
5.016.8	6.4	8.3	425
5.516.7	6.7	8.3	425
6.016.6	6.9	8.3	424
6.516.5	6.8	8.3	425
7.016.4	6.9	8.3	425
7.516.4	7.0	8.3	425
8.016.4	7.1	8.3	425
8.516.4	7.0	8.3	425
9.016.2	7.1	8.3	425
9.515.6	6.7	8.3	426
10.015.3	6.9	8.3	426
10.515.1	6.8	8.3	427
11.014.9	6.8	8.3	426
12.014.6	6.5	8.3	425
13.013.5	6.5	8.2	423
14.013.1	6.2	8.2	422
15.012.9	6.1	8.2	421
16.012.7	6.0	8.2	421
17.012.6	6.1	8.2	420
18.012.4	6.1	8.2	420
19.012.1	5.9	8.2	418
20.011.9	5.7	8.2	418

MILLSITE RESERVOIR
08/10/93

0.019.4	8.5	7.8	377
1.018.8	8.5	7.7	377
2.018.8	8.5	7.6	378
3.018.6	8.5	7.5	378
4.018.5	8.5	7.5	378
5.018.4	8.5	7.5	380
6.018.3	8.5	7.5	381
7.018.1	8.5	7.3	381
8.017.8	8.5	7.3	382
9.017.4	8.5	6.9	381
10.017.1	8.5	6.8	381
11.016.8	8.5	6.7	382
12.016.7	8.5	6.6	382
13.016.5	8.5	6.5	381
14.016.5	8.5	6.4	381
15.016.1	8.5	6.2	382
16.016.0	8.5	6.1	382
17.015.9	8.5	6.0	382
18.015.7	8.5	5.9	382

MILLSITE RESERVOIR
08/30/93

0.017.9	7.3	7.1	448
0.517.8	7.8	6.8	450
1.017.8	7.8	6.6	450
1.517.7	7.9	6.8	450
2.017.7	7.9	6.7	450
2.517.7	7.9	6.7	450
3.017.7	7.9	6.5	450
3.517.7	8.0	6.6	450
4.017.7	8.0	6.6	450
4.517.6	8.0	6.6	450
5.017.6	8.0	6.6	450
5.517.6	8.0	6.8	450
6.017.6	8.0	6.6	450
6.517.5	8.0	6.7	450
7.017.5	8.0	6.7	450
7.517.5	8.0	6.6	450
8.017.5	8.0	6.4	450
8.517.5	8.0	6.8	450
9.017.4	8.0	6.5	451
9.517.3	8.0	6.4	451
10.017.3	8.0	6.1	451
10.517.3	8.0	6.2	451
11.017.3	8.0	6.3	451
12.017.1	8.0	6.0	450
13.017.1	8.0	6.0	450
14.016.9	8.0	6.0	450
15.016.7	8.0	5.3	449
16.016.6	7.9	5.0	448
17.016.6	7.9	4.8	448

MILLSITE RESERVOIR
08/31/94

0.019.3	8.5	6.8	470
1.019.1	8.6	6.8	471
2.018.9	8.5	6.7	471
3.018.7	8.5	6.8	472
4.018.4	8.5	6.7	472
5.018.3	8.5	6.6	472
6.018.2	8.5	6.6	472
7.018.2	8.5	6.5	472
8.018.1	8.5	6.3	471
9.018.0	8.4	6.1	472
10.018.0	8.4	6.1	472
11.017.9	8.4	6.1	473
12.017.9	8.4	6.1	473
13.017.9	8.4	6.0	473
14.017.8	8.4	5.9	475
15.017.7	8.4	5.9	475
16.017.6	8.4	5.9	474
17.017.6	8.4	5.5	474
18.017.5	8.4	5.3	474
19.017.6	8.4	4.8	475

MILLSITE RESERVOIR
08/31/95

0.019.0	9.1	6.0	442
1.018.5	9.1	6.0	445
2.018.1	9.1	6.1	444
3.018.0	9.1	6.0	450
4.018.0	9.1	6.0	449
5.018.0	9.1	6.0	443
6.018.0	9.0	6.0	440
7.017.9	9.0	6.0	438
8.017.8	9.0	5.9	458
9.017.7	8.9	5.9	457
9.817.7	8.9	5.9	444

MILLSITE RESERVOIR
08/31/95

0.019.3	9.1	6.4	443
1.018.9	9.1	6.4	443
2.018.8	9.1	6.2	443
3.018.7	9.1	5.5	445
4.018.6	9.1	5.7	444
5.018.6	9.1	5.8	443
6.018.0	9.0	5.7	447
7.018.0	9.0	5.4	445
8.017.7	8.9	5.5	451
9.017.6	8.9	5.3	446
10.017.6	8.8	4.9	469
11.017.2	8.7	4.1	461
12.017.0	8.7	4.1	475
13.016.9	8.6	4.0	469
14.016.8	8.6	4.0	512
15.016.8	8.6	3.9	480
16.016.8	8.6	4.0	489
17.016.8	8.6	3.9	516
18.016.7	8.6	3.9	482
19.016.7	8.5	3.8	511
20.016.7	8.5	3.8	495
21.016.7	8.5	3.7	479
21.816.6	8.5	3.6	513

MINERSVILLE RESERVOIR
05/20/93

0.017.8	8.8	9.8	550
1.017.4	8.8	9.8	549
2.016.5	8.8	9.6	550
3.016.2	8.8	9.2	552
4.015.7	8.7	8.6	556
5.014.4	8.6	7.6	555
6.014.0	8.5	7.3	551
7.013.5	8.5	6.8	555
8.013.0	8.4	6.4	552
9.013.1	8.4	6.0	547
10.012.8	8.3	4.4	551

MINERSVILLE RESERVOIR
06/29/93

0.019.4	8.5	7.0	395
1.019.4	8.5	7.0	395
2.018.8	8.5	7.5	395
3.018.5	8.5	6.9	395
4.018.2	8.5	6.5	395
5.018.0	8.4	6.1	395
6.017.8	8.4	6.0	395
7.017.8	8.4	5.9	395
8.017.8	8.4	5.8	395
9.017.7	8.3	5.7	395
10.017.4	8.3	5.0	395
11.017.0	8.1	4.2	397
12.016.4	7.9	2.3	396
12.716.0	7.8	1.0	395

MINERSVILLE RESERVOIR
07/14/93

0.019.7	8.3	6.3	411
1.019.7	8.3	6.3	411
2.019.7	8.3	6.3	411
4.019.7	8.3	6.1	412
5.019.6	8.3	6.1	410
6.019.6	8.3	6.1	412
7.019.6	8.3	6.0	412
8.019.6	8.3	5.9	410
9.019.5	8.3	5.7	416
10.019.3	8.2	5.5	412
10.919.0	8.2	4.8	412

MINERSVILLE RESERVOIR
08/03/93

0.021.5	8.4	7.4	436
1.021.5	8.5	7.2	437
2.021.4	8.5	7.1	436
3.021.4	8.5	7.1	438
4.021.3	8.5	6.9	435
5.020.5	8.3	5.9	435
6.019.8	8.3	4.6	437
7.019.5	8.1	3.6	435
8.019.4	8.1	3.3	439
9.019.2	8.0	2.1	446
9.818.9	7.8	0.2	444

MINERSVILLE RESERVOIR
07/06/94

0.020.0	8.6	7.7	571
1.019.9	8.6	7.4	570
2.019.8	8.6	7.2	576
3.019.8	8.6	7.0	578
4.019.8	8.6	6.9	579
5.019.8	8.6	6.7	571
6.019.7	8.6	6.4	567

MINERSVILLE RESERVOIR
08/17/94

0.025.0	9.2	15.7	456
1.023.1	9.2	12.7	457
2.022.5	9.1	10.1	455
3.022.1	8.6	7.8	456
4.022.0	8.5	6.4	459

MINERSVILLE RESERVOIR
08/10/95

0.021.4	9.1	9.5	310
1.021.4	9.1	9.2	310
2.021.3	9.0	7.8	334
4.019.8	8.6	3.3	332
5.019.2	8.0	3.3	334
5.819.0	7.9	2.8	336

MINERSVILLE RESERVOIR
08/10/95

0.020.8	8.8	7.3	332
1.020.7	8.7	7.2	330
2.020.6	8.7	7.0	335
3.020.4	8.6	6.5	332

5.020.4	8.6	6.4	328
6.020.2	8.6	6.2	336
7.020.2	8.6	6.0	332
8.018.8	7.9	3.0	325
9.018.0	7.7	2.6	327
10.017.4	7.4	0.2	323
11.017.2	7.4	0.2	323
11.916.5	7.4	0.1	333

MINERSVILLE RESERVOIR
08/10/95

0.020.9	8.9	8.3	333
1.020.9	8.9	7.9	333
2.020.9	8.9	7.9	331
3.020.9	8.9	7.9	332
4.020.9	8.9	7.9	332
5.020.3	8.3	6.1	331
6.019.4	8.3	5.2	333
7.019.0	8.0	3.4	329
8.018.6	7.8	2.9	329
9.017.9	7.6	1.2	326
9.817.7	7.5	0.8	326

MINERSVILLE RESERVOIR
06/13/96

0.019.3	8.6	7.0	546
1.019.3	8.6	6.9	546
2.019.3	8.6	6.9	545
3.019.1	8.6	6.7	545
4.018.6	8.6	6.6	548
5.018.5	8.5	6.3	548
5.718.5	8.5	6.0	543

MINERSVILLE RESERVOIR
06/13/96

0.019.0	8.6	7.3	545
0.919.0	8.6	7.1	545
3.018.9	8.6	7.3	546
4.018.9	8.6	6.4	546
5.018.9	8.6	6.2	546
6.018.8	8.6	6.2	545
7.018.7	8.6	6.3	546
8.018.4	8.6	6.6	546
9.017.1	8.3	3.6	548
10.015.9	8.0	1.2	550
10.415.6	7.9	0.7	554

MINERSVILLE RESERVOIR
06/13/96

0.020.1	8.6	7.0	549
1.020.1	8.6	6.9	552
2.020.1	8.6	6.8	548
3.019.4	8.5	5.8	547
4.018.3	8.4	4.7	551
4.518.1	8.3	4.0	548

MINERSVILLE RESERVOIR
07/31/96

0.021.4	8.8	7.5	596
1.021.4	8.8	7.4	600
2.021.4	8.8	7.4	601
3.021.4	8.8	7.4	602

MINERSVILLE RESERVOIR
07/31/96

0.021.8	8.9	8.1	591
1.021.8	8.9	8.0	593
2.121.8	8.9	8.0	593
3.021.8	8.9	8.0	593
4.021.8	8.9	8.0	593
5.021.8	8.9	8.0	594
6.021.2	8.6	3.9	602
6.921.8	8.3	0.5	610

MINERSVILLE RESERVOIR
07/31/96

0.022.0	8.9	8.7	588
1.022.1	8.9	8.6	588
2.022.0	8.9	8.5	590
3.022.0	8.9	8.6	590
4.122.0	8.9	8.4	591
5.021.5	8.6	3.9	599
6.021.1	8.4	2.7	605
7.020.8	8.3	0.2	609
7.520.7	8.3	0.1	611

MIRROR LAKE
07/22/93

0.014.3	6.6	7.6	22
1.014.3	6.3	7.3	22
2.014.2	6.0	7.3	22
3.014.2	5.8	7.2	22
4.014.1	5.6	7.4	22
5.012.2	5.6	7.3	23
6.0 8.4	5.6	6.8	25
7.0 7.3	5.6	5.9	25
8.0 7.0	5.9	5.5	26

MIRROR LAKE
09/15/93

0.011.6	6.7	7.2	13
1.011.6	6.7	7.7	13
2.011.5	6.7	7.2	13
3.011.3	6.6	7.2	13
4.011.4	6.6	7.2	13
5.011.3	6.5	7.1	13
6.011.2	6.3	6.9	13
7.011.1	6.2	6.6	13
8.0 9.2	6.2	0.1	15
8.9 8.0	6.2	0.1	19

MIRROR LAKE
02/24/95

0.0 1.1	7.4	6.6	39
1.0 2.9	2.1	5.1	34
2.0 4.0	2.0	2.9	33
3.0 4.1	6.8	2.1	31
4.0 4.2	6.7	1.7	31
5.0 4.2	6.6	1.4	31

MIRROR LAKE
09/28/95

0.0 9.9	8.4	6.8	19
1.0 9.9	8.2	6.7	18
2.0 9.9	8.1	6.6	18
3.0 9.9	8.1	6.6	18
4.0 9.9	8.0	6.5	18
5.0 9.9	8.0	6.5	19
6.0 9.8	7.9	6.2	19
7.0 9.7	7.8	6.0	19
8.0 9.2	7.4	3.5	20
9.0 7.8	7.1	0.4	22

MONA RESERVOIR
06/22/94

0.023.5	8.7	7.1	1,630
1.020.6	8.7	7.0	1,630
2.020.5	8.7	7.0	1,620
3.020.5	8.7	6.9	1,610

MONA RESERVOIR
08/03/94

0.022.7	8.8	6.2	1,457
1.022.5	8.8	6.2	1,457
1.822.4	8.8	6.1	1,457

MONA RESERVOIR
06/11/96

0.022.0	8.4	8.2	1,824
1.022.0	8.4	7.9	1,833
2.022.0	8.4	7.8	1,835
3.021.8	8.4	7.5	1,838
4.021.3	8.4	7.5	1,833
5.020.7	8.3	8.6	1,827
5.519.2	8.4	9.4	1,829

MONA RESERVOIR
06/11/96

0.122.3	8.4	7.6	1,823
1.022.3	8.5	7.6	1,831
2.022.3	8.5	7.7	1,823
3.122.0	8.5	7.9	1,860
4.120.2	8.4	10.5	1,807
4.419.4	8.4	10.7	1,859

MONA RESERVOIR
08/01/96

0.023.4	8.4	6.7	1,887
1.023.2	8.4	6.7	1,886
2.023.0	8.4	6.7	1,885
3.022.9	8.4	6.5	1,885
3.922.8	8.4	6.2	1,893
4.622.8	8.4	6.1	1,884

MONA RESERVOIR
08/01/96

0.023.5	8.4	6.4	1,869
1.023.3	8.4	6.4	1,878
2.023.3	8.4	6.4	1,877
3.022.7	8.3	5.5	1,874
3.722.4	8.3	4.2	1,892

MONTICELLO LAKE
08/11/93

0.019.8	6.5	8.0	344
0.519.7	6.1	8.0	345
1.018.9	6.3	8.1	344
1.518.7	6.4	8.1	344
2.018.4	6.1	8.0	344
2.518.3	5.6	8.1	344
3.018.1	5.5	8.0	344
3.518.0	5.7	8.0	345
4.017.9	5.4	8.0	345
4.317.9	4.7	7.9	346

MONTICELLO LAKE
07/06/94

0.019.2	8.5	8.4	432
1.019.1	8.5	8.3	435
2.018.3	8.5	8.2	435
3.017.7	8.5	8.0	435
4.017.4	8.4	7.3	437
4.717.2	8.3	6.5	437

MONTICELLO LAKE
08/09/94

0.018.6	7.7	8.4	399
1.018.2	7.7	7.2	403
2.017.5	7.7	6.9	402
3.017.0	7.7	6.8	402
4.116.9	7.7	5.6	401

MOON LAKE
06/24/93

0.011.4	7.7	8.4	22
1.011.3	7.4	8.4	22
2.011.0	7.3	8.4	22
3.010.6	7.2	8.4	21
4.010.2	7.2	8.4	21
5.010.0	7.7	8.4	21
6.0 9.8	7.1	8.4	21
7.0 9.8	7.1	8.4	21
8.0 8.4	7.0	8.3	21
9.0 8.7	7.0	8.4	20
10.0 8.3	7.0	8.3	20
11.0 7.9	7.0	8.3	20
12.0 7.8	6.9	8.3	20
13.0 7.6	6.9	8.3	20
14.0 7.5	6.9	8.3	20
15.0 7.4	6.8	8.4	20
16.0 7.4	6.8	8.3	20
17.0 6.8	6.8	8.3	20
17.6 6.4	6.8	8.4	19

MOON LAKE
09/06/95

0.016.7	7.5	7.1	23
1.016.7	7.4	7.1	23
2.016.6	7.4	7.1	24
3.016.5	7.4	7.1	24
4.016.4	7.4	7.1	23
5.016.2	7.4	7.2	24
6.016.1	7.3	7.0	24
7.016.0	7.3	7.0	24
8.015.9	7.3	7.0	24
9.015.8	7.3	7.0	24

MOON LAKE
09/06/95

0.016.9	7.7	7.2	24
1.016.8	7.7	7.1	24
2.016.6	7.7	7.1	24
3.016.6	7.7	7.1	24
4.016.5	7.7	7.1	24
5.016.0	7.7	7.1	24
6.015.7	7.4	7.0	23
7.014.0	7.4	7.0	31
8.012.2	7.3	6.8	18
9.011.0	7.3	6.8	20
10.0 8.9	7.2	6.6	16
11.0 8.4	7.1	6.6	18
12.0 8.1	7.0	6.6	25
13.0 7.7	6.9	6.7	26
14.0 7.5	6.9	6.8	27
15.0 7.2	6.8	6.8	23

16.0 7.1	6.8	6.8	24
17.0 6.9	6.7	6.9	26
18.0 6.9	6.7	6.9	28

NAVAJO LAKE
05/08/95

0.018.4	8.4	8.9	220
1.018.4	8.4	8.8	218
2.018.3	8.4	8.9	220
3.017.9	8.5	9.9	218
4.017.9	8.5	11.0	214
5.017.6	8.4	10.0	216

NAVAJO LAKE
05/08/95

0.018.2	8.5	8.1	222
1.018.3	8.5	8.0	226
2.018.3	8.5	7.9	225
3.018.3	8.5	8.0	224
4.018.2	8.5	8.2	226
5.018.2	8.5	8.3	222

NAVAJO LAKE
08/08/95

0.018.3	8.5	7.8	227
1.018.4	8.5	7.6	228
2.018.4	8.5	7.6	225
3.018.4	8.5	7.6	228
4.018.1	8.5	8.1	224
5.018.1	8.5	8.4	222
6.018.0	8.5	8.7	221
7.018.0	8.5	8.6	222

NEW CASTLE RESERVOIR
06/12/96

0.022.3	8.5	7.9	841
1.022.2	8.6	7.4	840
2.022.1	8.6	7.5	840
3.022.0	8.6	7.1	840
4.020.3	8.5	6.9	845
5.018.1	8.3	4.9	841
6.016.9	8.3	4.1	835
7.016.4	8.2	3.1	837
8.016.0	8.1	1.9	837
9.015.7	8.1	1.5	839
10.015.1	8.0	0.4	853

NEW CASTLE RESERVOIR
06/12/96

0.021.7	8.6	4.4	352
1.021.8	8.6	7.2	842
2.021.8	8.6	7.0	840
3.021.7	8.6	7.0	839
4.020.4	8.5	1.9	848
5.018.6	8.4	6.2	838
6.018.3	8.4	4.8	839
7.016.6	8.2	2.5	840
7.616.2	8.1	1.5	846

NEWCASTLE RESERVOIR
06/15/94

0.020.6		8.7	642
1.020.6		8.6	643
2.020.4		8.6	644
3.020.5		8.5	644
4.020.4		8.5	644
5.020.4		8.5	644
6.020.2		8.4	645
7.019.7		8.4	645
8.018.5		8.4	649
9.016.8		7.6	650
10.015.8		7.1	653
11.015.3		6.4	655
12.015.0		5.8	657
13.014.9		5.5	657
14.014.7		4.3	660
15.013.9		0.5	672

NEWCASTLE RESERVOIR
08/06/94

0.025.2	8.9	7.3	620
1.025.1	8.8	7.4	618
2.024.3	8.8	7.2	616
3.023.7	8.7	6.0	627
4.023.5	8.6	5.0	623
5.023.3	8.5	4.0	624
6.023.0	8.4	2.9	623
7.022.6	8.2	0.9	623
8.022.2	8.2	0.4	620

NEWCASTLE RESERVOIR
07/31/96

0.023.5	8.4	7.1	922
1.023.5	8.4	7.1	925
2.023.2	8.4	6.9	924
3.023.0	8.4	6.4	929
4.022.8	8.4	6.4	927
5.021.8	8.2	2.3	933
6.020.9	8.0	0.3	931
7.020.3	8.0	0.1	924
7.919.1	7.9	0.1	935

NEWCASTLE RESERVOIR
07/31/96

0.024.1	8.5	7.3	917
1.024.0	8.5	7.3	923
2.023.8	8.5	7.3	924
3.023.6	8.5	7.2	925
4.022.5	8.4	5.2	935
5.021.5	8.2	2.7	935
6.020.4	5.0	0.1	930
6.219.9	8.0	0.1	926

NEWTON RESERVOIR
06/30/94

0.022.1	8.3	7.5	657
1.022.1	8.4	7.4	657
2.022.1	8.4	7.4	657
3.022.1	8.5	7.4	656
4.021.3	8.4	4.6	658
5.019.7	8.1	1.1	664
6.018.6	8.0	5.3	664
7.017.4	7.9	0.2	664
8.014.8	7.9	0.2	651
9.313.2	7.7	0.2	637

NEWTON RESERVOIR
08/03/94

0.026.1	8.7	7.0	610
1.024.5	8.7	7.0	611
2.023.5	8.7	6.7	610
3.023.3	8.7	6.0	610
4.019.9	7.5	0.1	646
5.015.4	7.3	0.2	681
6.014.1	7.2	0.2	693

NEWTON RESERVOIR
06/19/96

0.022.7	8.7	7.2	859
1.022.7	8.7	6.9	861
2.021.8	8.7	7.6	864
3.021.5	8.7	7.5	863
4.019.3	8.5	7.0	872
5.116.2	8.1	3.0	918
6.013.5	7.9	1.3	927
7.012.4	7.9	1.2	928
8.011.0	7.8	1.0	916
9.010.5	7.7	1.0	904
10.010.2	7.7	0.8	902
11.1 9.9	7.6	0.7	896

NEWTON RESERVOIR
06/19/96

0.023.1	8.8	7.9	859
1.022.7	8.7	7.8	866
2.022.3	8.8	8.2	867
3.021.6	8.8	8.2	877
4.020.2	8.7	7.2	889
5.015.3	8.0	3.6	961
6.014.0	7.8	2.9	982
6.713.0	7.8	3.0	984

NEWTON RESERVOIR
06/19/96

0.023.3	8.6	7.3	858
1.022.5	8.6	7.0	859
2.021.8	8.6	7.3	860
3.021.6	8.6	7.1	860
4.019.3	8.4	4.9	866
5.015.5	8.1	2.6	882
6.013.6	8.0	1.4	883
7.012.3	8.0	0.9	885
8.011.4	7.8	0.8	883
9.010.7	7.8	0.7	881
10.010.3	7.8	0.8	884
11.022.7	8.7	7.2	886
12.022.7	8.7	6.9	884
12.221.8	8.7	7.6	886

NEWTON RESERVOIR
08/07/96

1.022.1	8.4	6.1	872
2.121.9	8.4	6.0	872
3.021.8	8.7	5.9	872
3.921.7	8.4	5.9	871
5.021.7	8.4	5.8	870
6.021.6	8.4	5.8	872
7.120.5	8.1	3.4	882
7.817.3	8.1	1.0	920

NEWTON RESERVOIR
08/07/96

0.022.8	8.5	6.7	864
1.022.2	8.5	6.7	869
2.021.9	8.5	6.6	870
3.121.8	8.5	6.5	871
4.021.7	8.5	6.4	871
5.121.6	8.5	6.4	872
5.821.6	8.4	5.9	873

NINE MILE RESERVOIR
06/28/94

0.022.3	9.4	7.1	1,000
1.022.3	9.4	7.2	1,000
2.022.1	9.4	7.6	1,002
3.021.7	9.4	7.6	1,002
4.021.7	9.4	6.8	1,010
5.021.1	9.2	4.8	1,013
5.621.0	9.0	3.9	1,020

NINE MILE RESERVOIR
08/09/94

0.023.4	9.6	8.5	1,090
1.023.1	9.6	8.5	1,088
2.023.0	9.6	8.5	1,090
3.022.8	9.6	8.5	1,088
4.022.8	9.6	8.5	1,090

NINEMILE RESERVOIR
06/19/96

0.020.5	8.9	7.9	868
1.120.6	8.9	7.9	869
2.020.5	8.9	7.9	870
2.920.5	8.9	7.8	870
4.120.5	8.9	7.7	869
5.019.7	8.8	7.2	875
6.018.4	8.7	3.8	895

NINEMILE RESERVOIR
09/03/96

0.021.3	9.1	8.6	981
1.020.7	9.1	8.6	981
2.020.5	9.1	8.2	982
3.020.2	9.0	6.8	984
4.019.9	9.0	4.9	996
4.619.7	8.8	3.5	1,007

NINEMILE RESERVOIR
09/03/96

0.121.5	9.1	8.3	976
1.021.4	9.1	8.0	980
2.020.5	9.1	7.8	985
3.020.3	9.1	7.7	985
4.020.0	8.9	5.0	1,005
5.019.5	8.9	5.1	1,005
5.519.5	8.9	4.9	1,007

OAK PARK RESERVOIR
07/01/93

0.012.6	7.4	7.7	30
1.012.6	7.4	7.6	30
2.012.5	7.3	7.5	30
3.012.3	7.2	7.5	30
4.012.2	7.1	7.5	30
5.012.0	7.1	7.5	30
6.011.9	7.0	7.5	29
7.011.9	7.0	7.5	30
8.011.8	6.9	7.5	30
9.011.6	6.8	7.4	29
10.010.9	6.8	7.3	30
11.110.8	6.6	7.2	30

OAK PARK RESERVOIR
03/15/95

0.0 0.6	6.5	7.9	

1.0 1.7	6.5	8.0	
2.0 3.1	6.4	5.1	
3.0 3.5	6.4	4.1	
4.0 3.9	6.3	2.3	
5.0 3.9	6.3	1.5	

OOWAH LAKE
08/31/94

0.011.0	7.3	8.3	119
1.010.1	7.4	8.0	117
2.0 9.9	7.3	4.6	133

OTTER CREEK RESERVOIR
06/02/94

0.018.8	9.1	7.2	332
1.018.1	9.0	7.8	333
2.017.5	9.0	8.1	333
3.017.4	9.0	8.1	335
4.016.7	9.0	8.2	337
5.015.9	9.0	8.2	344
6.015.4	8.7	7.1	352
7.014.4	8.3	5.0	376
8.013.8	8.1	4.0	391
9.013.6	8.1	3.6	410

OTTER CREEK RESERVOIR
07/14/94

0.020.1	8.7	6.8	385
1.020.2	8.7	6.8	387
2.020.1	8.7	6.8	385
3.020.1	8.7	6.8	385
4.020.1	8.6	6.8	385
5.020.1	8.6	6.7	385
6.020.1	8.6	6.7	385
7.019.9	8.5	5.6	388
8.019.6	8.4	4.6	389

OTTER CREEK RESERVOIR
06/25/96

0.017.7	8.5	7.2	434
1.017.7	8.5	7.4	437
2.017.7	8.8	6.8	437
2.917.7	8.5	6.8	437
4.017.7	8.5	6.8	437
5.117.7	8.5	6.6	437
6.017.7	8.5	6.8	437
7.017.7	8.5	6.7	437
8.117.3	8.4	4.7	440

OTTER CREEK RESERVOIR
06/25/96

0.017.8	8.5	6.8	436
1.017.8	8.5	6.6	437
2.017.8	8.5	6.3	437
3.017.7	8.5	6.4	437
4.017.7	8.5	6.3	437
5.017.7	8.5	6.2	437
6.017.7	8.5	6.3	437
7.017.7	8.5	6.2	437

OTTER CREEK RESERVOIR
09/05/96

0.017.9	8.3	5.7	213
1.017.7	8.1	5.5	417
1.917.6	8.1	5.4	417
3.017.6	8.1	5.4	418
3.917.5	8.1	5.3	418

PALISADE LAKE
06/28/94

0.020.5	8.6	6.2	419
1.020.4	8.6	6.3	419
2.020.1	8.6	6.2	420
3.019.9	8.6	6.2	421
4.019.1	8.6	6.1	422
5.018.4	8.6	6.2	422
6.317.4	8.6	7.5	416

PALISADE LAKE
08/09/94

0.021.1	8.6	9.3	387
1.021.1	8.6	9.3	386
2.021.1	8.7	9.6	385
2.221.1	8.7	9.6	386

PALISADE LAKE
06/19/96

0.018.5	8.6	7.0	409
1.018.6	8.6	7.0	410
2.018.5	8.6	7.1	411
3.017.0	8.6	7.2	412
4.015.9	8.7	6.8	414
5.015.0	8.0	6.9	415
6.013.8	8.6	5.0	424
6.512.5	8.3	3.3	429

PALISADE LAKE
09/03/96

0.020.7	9.0	10.7	395
1.020.7	9.0	11.0	396
2.019.8	8.8	9.9	424
2.518.5	8.8	10.6	431

PANGUITCH LAKE
06/03/93

0.014.0	8.0	7.4	167
1.014.0	8.0	7.1	162
2.014.0	7.9	7.1	163
3.014.0	7.9	7.1	163
4.014.0	7.9	7.0	163
5.013.8	7.9	7.0	162
6.013.5	7.9	7.0	163
7.013.3	7.9	6.9	163
8.013.2	7.9	6.8	162
9.013.1	7.8	6.6	162
10.012.9	7.8	6.5	163
11.0 8.6	7.7	6.1	164
12.0 7.9	7.7	4.9	166
13.0 7.5	7.5	4.1	182
14.0 7.5	7.5	3.3	190
15.0 7.5	7.5	2.1	194
15.7 7.5	7.4	0.3	196

PANGUITCH LAKE
07/06/94

0.017.9	8.6	6.3	217
1.017.9	8.6	6.1	216
2.017.9	8.6	6.1	218
3.017.9	8.5	6.1	217
4.017.9	8.5	6.1	218
5.017.9	8.5	6.1	216
6.017.9	8.5	6.0	216
7.017.5	8.3	5.2	221
8.017.2	8.3	4.8	219
9.017.0	8.2	4.6	219
10.016.8	8.0	3.8	222
11.015.4	7.5	0.9	225
12.013.9	7.4	0.1	228
13.012.9	7.3	0.1	235
14.012.0	7.3	0.0	247

PANGUITCH LAKE
08/08/95

0.019.5	8.6	7.1	184
1.019.4	8.6	7.1	184
2.019.3	8.6	7.1	185
3.019.2	8.6	7.1	182
4.018.9	8.6	6.9	188
5.018.7	8.6	6.9	186
6.018.7	8.6	6.8	185
7.017.1	7.9	3.2	181
8.014.3	7.5	0.3	190
9.012.7	7.4	0.1	188
10.011.8	7.3	0.1	179
11.011.3	7.1	0.1	191
12.011.2	7.1	0.1	198
13.010.9	7.0	0.1	192
14.010.8	7.0	0.1	190
15.010.0	7.0	0.1	193

PANGUITCH LAKE
08/08/95

0.018.8	8.7	7.1	183
1.018.8	8.7	7.0	184
2.018.6	8.6	6.9	184
3.018.3	8.5	6.4	184
4.018.2	8.5	6.4	184
5.017.7	8.1	4.0	188

PANGUITCH LAKE
07/02/96

0.016.2	9.3	8.6	202
1.016.2	9.3	8.2	202
2.016.1	9.2	7.8	202
3.015.6	9.2	7.0	202
4.015.2	8.9	5.2	208
5.015.3	8.9	4.8	208

PANGUITCH LAKE
07/02/96

0.017.1	9.5	10.2	199
1.117.1	9.4	10.3	199
2.017.1	9.4	10.1	200
3.016.9	9.4	9.9	200
4.016.5	9.4	9.9	200
5.015.2	8.9	5.6	208
5.915.0	8.8	5.4	209
7.015.0	8.9	5.5	208
8.015.0	8.8	5.3	208
9.114.9	8.8	5.1	208
10.014.8	8.9	4.8	209
11.014.7	8.8	5.0	209
12.014.7	8.8	4.2	210
13.014.4	8.3	2.4	215
13.314.2	8.1	1.4	217

PANGUITCH LAKE
08/14/96

0.017.8	9.2	6.5	171
1.017.6	9.2	6.3	170
2.017.5	9.2	6.4	170
3.017.4	9.2	6.4	170
4.017.4	9.2	6.4	170
5.017.4	9.2	6.4	170
6.017.4	9.2	6.3	170
7.017.4	9.2	6.2	170
8.017.3	9.2	6.2	170
9.017.1	9.0	5.1	173
10.017.0	9.0	4.7	175
11.017.0	9.0	4.4	175
11.516.9	8.9	3.7	177
0.017.9	9.2	6.2	170
1.017.7	9.1	5.9	170
2.017.6	9.1	5.9	171
3.017.4	9.2	6.1	170
4.017.1	9.0	4.6	172
4.716.9	8.9	3.3	175

PARADISE PARK RESERVOIR
07/02/93

0.015.0	7.0	8.1	23
1.015.0	6.9	7.9	23
2.014.9	6.9	7.7	23
3.014.7	6.8	7.6	24
4.011.3	6.6	7.7	23
5.0 9.7	6.4	7.3	23
6.0 8.8	6.3	7.2	23
7.0 8.2	6.2	6.2	24
8.0 8.0	6.0	6.2	24
9.0 7.7	5.8	5.9	24
9.4 7.7	5.7	5.9	24

PELICAN LAKE
07/20/94

0.022.9	10.1	8.5	562
1.022.8	10.1	8.6	561
2.022.7	10.0	9.4	561

PELICAN LAKE
09/06/94

0.021.9	9.4	7.5	611
1.021.4	9.5	8.4	612
2.121.4	9.6	9.4	611

PELICAN LAKE
08/15/95

0.222.9	9.6	8.7	481
0.522.8	9.6	8.5	482
1.022.7	9.6	8.6	480
1.522.6	9.6	8.7	476
2.022.6	9.6	8.7	479
2.522.6	9.6	8.8	481
3.022.6	9.6	8.9	479
3.522.6	9.3	7.7	478

PELICAN LAKE
08/15/95

0.223.5	9.6	6.7	488
0.523.4	9.6	6.7	488
1.023.5	9.6	6.8	488
1.523.2	9.6	6.6	488
2.023.2	9.6	6.6	488
2.523.1	9.6	6.8	489
3.023.1	9.6	6.9	487
3.523.1	9.6	6.9	490
4.023.1	9.6	6.8	488

PELICAN LAKE
08/15/95

0.223.2	9.6	8.2	487
0.523.1	9.6	8.3	488
1.023.0	9.6	8.4	487
1.523.0	9.6	8.4	487
2.022.9	9.6	8.4	488
2.522.9	9.6	8.4	488
3.022.9	9.6	8.5	488
3.522.9	9.6	8.6	488
4.022.9	9.7	9.0	487

PELICAN LAKE
08/24/95

0.224.5	9.6	9.4	481
0.524.5	9.6	9.4	483
1.024.5	9.6	9.5	483
1.524.5	9.6	9.6	483
2.024.4	9.6	9.7	484

PELICAN LAKE
08/24/95

0.224.3	9.7	10.4	483
0.524.3	9.7	10.4	482
1.024.3	9.7	10.4	482
1.524.3	9.7	10.5	482
2.024.3	9.7	10.6	483
2.524.3	9.7	10.7	487
3.024.3	9.7	10.6	487
3.524.0	9.5	7.2	491

PELICAN LAKE
08/24/95

0.224.3	9.6	8.6	481
0.524.3	9.6	8.7	482
1.024.5	9.7	8.7	482
1.524.5	9.7	8.7	482
2.024.3	9.6	8.7	482
2.524.3	9.6	8.6	482
3.024.2	9.7	8.6	482
3.524.2	9.6	8.6	482
4.024.3	9.6	8.5	482

PELICAN LAKE
08/24/95

0.224.2	9.7	10.2	479
0.524.2	9.7	10.1	477
1.024.2	9.7	10.1	480
1.524.2	9.7	10.1	479
2.024.2	9.7	10.1	480
2.524.2	9.7	10.0	477
3.024.2	9.7	10.1	482
3.524.2	9.7	10.1	478
4.024.2	9.7	9.4	484

PELICAN LAKE
09/06/95

0.223.1	9.6	8.4	486
0.523.2	9.6	7.7	488
1.023.2	9.6	7.7	488
1.523.2	9.6	7.7	489
2.023.2	9.6	7.6	489
2.523.2	9.6	7.6	490
3.023.3	9.6	7.6	490
3.523.2	9.6	7.5	489

PELICAN LAKE
09/06/95

0.223.5	9.6	7.8	482
0.523.5	9.6	7.7	483
1.023.5	9.6	7.7	485
1.523.5	9.6	7.7	484
2.023.5	9.6	7.7	483
2.523.5	9.6	7.7	484
3.023.6	9.6	7.7	483
3.523.5	9.6	7.6	483

PELICAN LAKE
09/06/95

0.222.8	9.0	9.4	479
0.522.9	9.4	8.2	476
1.022.9	9.4	8.2	480
1.522.9	9.4	8.2	474
2.022.9	9.4	8.2	480
2.522.9	9.4	8.1	481
3.022.8	9.1	6.8	482
3.521.6	9.0	5.9	501

PELICAN LAKE
09/06/95

0.223.2	9.5	7.2	485
0.523.3	9.5	7.1	483
1.023.3	9.5	7.1	483
1.523.3	9.5	7.1	484
2.023.3	9.5	7.2	483

PELICAN LAKE
10/25/95

0.0	8.2	9.0	8.8	466
0.5	8.3	9.0	8.1	468
1.0	8.1	9.0	8.2	463
1.5	8.0	9.0	8.2	456
2.0	8.0	8.9	8.2	454
2.5	8.0	9.0	8.2	458
3.0	8.1	9.0	8.2	452
3.6	8.0	8.9	8.1	449

PELICAN LAKE
10/25/95

0.0	9.5	9.2	8.3	495
0.5	9.5	9.1	7.6	497
1.0	9.5	9.2	7.4	497
1.5	9.5	9.2	7.3	497
2.0	9.5	9.2	7.6	499

PELICAN LAKE
10/25/95

0.0	9.6	9.2	7.4	493
0.5	9.6	9.2	7.3	495
1.0	9.6	9.2	7.3	496
1.5	9.6	9.2	7.3	498
2.0	9.6	9.2	7.3	496
2.5	9.6	9.2	7.3	493
3.0	9.6	9.2	7.1	491
3.5	9.6	9.2	7.1	500
3.7	9.6	9.2	7.0	494

PELICAN LAKE
10/25/95

0.0	9.4	9.2	7.4	489
0.5	9.4	9.2	7.3	488
1.0	9.4	9.2	7.3	492
1.5	9.4	9.2	7.2	489
2.0	9.4	9.2	7.3	493
2.5	9.5	9.3	7.4	493
3.0	9.4	9.2	7.2	493
3.5	9.4	9.2	7.2	492
3.8	9.5	9.2	7.1	488

PELICAN LAKE
08/06/96

0.022.4	10.1	9.0	585
0.522.4	10.0	8.9	585
1.022.4	10.1	9.1	585
1.522.4	10.1	9.2	586
2.022.4	10.1	9.6	585
2.422.4	10.1	9.4	585

PELICAN LAKE
08/06/96

-0.122.5	10.1	9.8	574
0.622.5	10.1	9.7	574
1.022.5	10.1	9.9	575
1.122.5	10.1	10.1	575

PELICAN LAKE
08/06/96

0.022.4	10.1	9.4	596
0.522.4	10.1	9.3	595
1.022.4	10.1	9.2	594
1.522.4	10.1	9.3	595
2.022.4	10.1	10.1	596
2.622.4	10.1	10.1	596
2.622.4	10.1	10.7	595

PELICAN LAKE
08/06/96

0.022.6	9.9	7.7	577
0.422.6	9.9	7.7	577
1.022.6	9.9	7.7	576
1.422.6	9.9	7.7	576
1.922.6	9.9	8.0	577
2.522.5	9.9	8.0	577

PETES HOLE RESERVOIR
07/22/93

0.016.0	7.9	9.4	414
0.515.9	8.0	9.1	417
1.015.9	8.1	9.1	418
1.515.8	8.1	9.3	417
2.015.8	8.1	9.3	418
2.515.7	8.2	9.7	417
3.015.7	8.2	9.9	416
3.515.6	8.2	10.0	416
4.015.6	8.1	9.4	422
4.515.5	8.1	9.5	424
4.815.5	8.1	9.5	425

PINE LAKE
09/14/93

0.016.0	9.8	9.1	247
1.016.0	9.8	8.8	247
2.016.0	9.8	9.0	247
3.016.0	9.7	9.1	247
4.016.0	9.7	9.1	246
5.015.9	9.8	9.0	247
6.015.8	9.8	9.1	746
7.015.8	9.8	9.1	245
7.815.5	9.8	9.2	250

PINE LAKE
06/29/94

0.020.5	8.6	7.4	263
1.020.5	8.5	7.3	264
2.020.5	8.5	7.3	264
3.020.5	8.5	7.2	264
4.020.5	8.5	7.2	264
5.020.5	8.5	7.2	264
6.020.1	8.5	7.0	264
7.019.3	8.5	6.7	264
8.017.6	8.0	4.8	265
9.017.0	7.9	4.1	265
10.015.7	7.7	3.0	264
11.015.2	7.7	2.6	264
12.014.6	7.6	2.3	263
13.013.7	7.6	1.7	262
14.012.3	7.5	1.2	263
15.011.6	7.5	1.1	263
16.011.3	7.5	0.8	263
17.011.1	7.5	0.6	264
18.010.9	7.5	0.4	264
19.010.7	7.4	0.3	265
20.010.6	7.4	0.2	266
21.010.6	7.4	0.1	266
21.510.6	7.4	0.1	266

PINE LAKE
09/14/95

0.017.0	9.2	4.0	281
1.017.2	9.2	8.8	280
2.017.2	9.2	8.8	287
3.017.2	9.2	8.8	280
4.017.2	9.3	8.9	282
5.017.2	9.3	8.9	285
6.017.1	9.4	9.3	282
7.017.0	9.4	9.1	277
8.016.8	9.2	3.8	287
9.016.8	9.1	3.5	290

PINEVIEW RESERVOIR
06/29/94

0.0	0.0	0.0	0.0	0

PINEVIEW RESERVOIR
06/29/94

0.020.5	8.6	7.4	263
1.020.5	8.5	7.3	264
2.020.5	8.5	7.3	264
3.020.5	8.5	7.2	264
4.020.5	8.5	7.2	264
5.020.5	8.5	7.2	264
6.020.1	8.5	7.0	264
7.019.3	8.5	6.7	264
8.017.6	8.0	4.8	265
9.017.0	7.9	4.1	265
10.015.7	7.7	3.0	264
11.015.2	7.7	2.6	264
12.014.6	7.6	2.3	263
13.013.7	7.6	1.7	262
14.012.3	7.5	1.2	263
15.011.6	7.5	1.1	263
16.011.3	7.5	0.8	263
17.011.1	7.5	0.6	264
18.010.9	7.5	0.4	264
19.010.7	7.4	0.3	265

20.010.6	7.4	0.2	266
21.010.6	7.4	0.1	266
21.510.6	7.4	0.1	266

PINEVIEW RESERVOIR
08/04/94

0.024.4	8.2	6.6	278
1.024.0	8.2	6.6	276
2.023.9	8.1	6.5	279
3.023.8	8.1	6.5	278
4.023.7	8.1	6.5	280
5.023.6	7.7	4.1	284
6.023.6	7.7	4.0	284

PINEVIEW RESERVOIR
08/04/94

0.023.0	8.3	6.4	274
1.023.0	8.3	6.3	278
2.023.0	8.3	6.3	275
3.023.0	8.3	6.2	275
4.023.0	8.3	6.3	271
5.023.0	8.3	6.2	276
6.023.0	8.3	6.4	276
7.022.9	8.3	6.0	273
8.022.9	8.2	5.9	278
9.022.8	7.9	5.6	275
10.020.7	7.5	1.8	273
11.018.7	7.4	0.4	267
12.017.7	7.4	0.1	273
13.017.0	7.4	0.1	277
14.016.2	7.4	0.1	275
15.015.8	7.4	0.1	285
16.015.2	7.4	0.2	280
17.014.9	7.4	0.2	263
18.014.5	7.4	0.2	268
19.014.3	7.4	0.2	284
20.014.3	7.5	0.3	287

PINEVIEW RESERVOIR
06/19/96

0.020.2	8.6	7.7	248
1.020.4	8.6	7.5	248
2.020.2	8.5	7.3	249
3.019.7	8.5	7.3	245
4.019.5	8.5	7.3	244
5.019.4	8.5	7.3	244
6.018.4	8.3	7.0	246
7.018.0	8.3	6.9	246
8.015.7	8.0	5.6	252
9.013.8	7.9	5.5	248
10.012.5	7.8	5.3	242
11.011.9	7.8	5.2	242
12.011.6	7.8	4.7	243
13.011.3	7.7	4.3	242
14.011.3	7.7	4.2	241
15.011.2	9.0	4.0	241

PINEVIEW RESERVOIR
06/19/96

0.018.1	8.4	7.6	239
1.018.2	8.4	7.5	239
2.018.2	8.4	7.5	240
3.018.2	8.4	7.5	240
4.018.2	8.4	7.5	240
5.018.2	8.4	7.5	239
6.018.1	8.4	7.5	239
7.018.1	8.3	7.5	239
8.018.1	8.4	7.5	239
9.018.1	8.4	7.5	239
10.018.1	8.4	7.4	239
11.018.0	8.4	7.4	239
12.017.9	8.3	6.7	239
13.016.0	8.0	5.8	237
14.013.5	7.8	5.5	235
15.013.1	7.7	5.6	235
16.012.5	7.7	5.4	234
16.912.2	7.7	5.3	234
18.011.9	7.7	5.0	235
19.011.8	7.7	4.9	236
20.011.5	7.6	4.1	237
21.111.2	7.6	3.6	239

PINEVIEW RESERVOIR
06/19/96

0.021.6	8.4	7.3	239
1.021.8	8.4	6.8	239
2.020.2	8.3	7.0	238
3.019.7	8.3	6.7	240
4.018.9	8.2	6.7	239
5.018.6	8.2	6.7	241
6.017.8	8.1	6.4	239
7.016.3	7.9	6.1	237
8.014.4	7.7	5.1	234
9.012.7	7.6	4.4	232
10.012.5	7.6	4.5	230
11.012.2	7.6	4.2	231
12.011.8	7.6	4.1	232
13.011.6	7.5	3.8	234
14.011.5	7.5	3.6	235
15.011.2	7.5	3.6	236
16.011.1	7.5	3.4	236
16.811.5	7.5	2.8	238

PINEVIEW RESERVOIR
06/19/96

0.019.9	8.2	7.4	242
1.019.5	8.2	7.2	243
2.018.5	8.1	7.0	240
3.018.3	8.1	6.7	240
4.018.0	8.1	6.6	239
5.016.7	7.9	6.3	237
6.015.9	7.9	6.0	237
7.013.9	7.7	6.0	234
8.013.9	7.7	5.8	231
9.013.8	7.7	5.7	234
10.013.2	5.7	5.7	231
11.012.9	7.6	5.5	231
12.012.6	7.7	5.4	232
13.012.1	7.6	4.9	232
14.011.7	7.6	4.5	235
15.011.6	7.6	4.3	235

PINEVIEW RESERVOIR
08/06/96

0.021.1	8.3	6.3	265
1.121.2	8.3	6.3	265
2.121.1	8.3	6.1	265
3.021.1	8.3	6.1	265
4.121.1	8.3	6.0	265
5.121.0	8.3	5.9	265
6.020.4	8.0	3.9	266
7.019.9	7.9	3.3	265
8.019.4	7.9	1.9	265
9.018.3	7.9	0.6	262
10.018.1	7.9	0.4	262
11.017.3	7.9	0.3	260
12.017.0	7.8	0.3	259
13.216.6	7.8	0.2	257
14.116.3	7.8	0.2	256
15.115.6	7.8	0.3	256
16.014.8	7.8	0.2	254
17.114.8	7.8	0.2	254
18.114.5	7.8	0.2	254
18.514.5	7.8	0.3	255

PINEVIEW RESERVOIR
08/06/96

0.121.9	8.4	6.9	269
1.022.0	8.4	6.8	270
2.021.9	8.4	6.9	270
3.021.9	8.4	6.8	270
4.021.9	8.4	6.8	270
5.121.9	8.4	6.7	270
6.021.9	8.4	6.7	270
7.121.9	8.4	6.6	271
8.121.9	8.4	6.7	270
9.021.8	8.4	6.6	271
10.220.0	8.2	6.0	272
10.518.1	8.1	2.0	273

PINEVIEW RESERVOIR
08/06/96

-0.121.9	8.4	7.4	269
1.021.9	8.3	6.8	269
2.021.9	8.3	6.7	169
3.021.9	8.3	6.6	269
4.021.8	8.3	6.4	270
5.121.8	8.2	6.3	270
6.021.6	8.2	6.2	271
7.021.5	8.2	6.0	269
8.121.4	8.1	5.8	269
9.121.3	8.1	5.4	269
10.021.3	8.1	5.3	269
11.020.9	8.0	4.5	269
12.020.4	7.9	3.7	268
13.218.3	7.8	1.6	263

PINEVIEW RESERVOIR
08/06/96

0.021.4	8.1	6.3	267
1.021.4	8.1	6.3	267
2.021.4	8.1	6.4	266
3.021.4	8.1	6.3	267
4.021.4	8.2	6.2	266
5.021.4	8.2	6.2	267
6.021.4	8.2	6.4	267
7.021.4	8.1	6.0	267
8.820.7	8.0	5.2	267
10.019.9	7.8	3.7	267
10.918.7	7.7	2.0	263
11.318.5	7.7	0.7	263

PIUTE RESERVOIR
06/04/93

0.015.4	7.8	7.5	356
1.015.4	8.0	7.5	356
2.015.4	8.1	7.4	356
3.015.5	8.1	7.3	356
4.015.5	8.1	7.2	356
5.015.5	8.2	7.1	356
6.015.5	8.2	7.1	355
7.015.5	8.2	7.1	355
8.015.5	8.2	7.1	356
9.015.4	8.2	7.1	356
10.015.4	8.2	7.1	356
11.015.4	8.2	7.0	357
12.015.4	8.3	7.1	357
13.015.4	8.4	7.0	357
14.015.3	8.3	7.0	358
15.015.3	8.3	6.9	358
16.015.3	8.3	6.8	359
17.015.3	8.3	6.8	359
17.315.3	8.3	6.8	360

PIUTE RESERVOIR
08/08/95

0.021.2	8.5	7.5	406
1.021.1	8.5	7.4	408
2.021.0	8.5	7.3	408
3.020.9	8.5	7.1	406
4.020.0	8.4	6.8	414
5.020.4	8.4	6.6	411
6.020.2	8.4	6.6	412
7.020.2	8.4	6.6	415
8.020.1	8.4	6.4	413
9.019.9	8.3	5.8	421
10.019.8	8.3	5.5	417
11.619.6	8.2	4.8	421
12.019.2	8.1	3.8	420
13.019.2	8.1	1.8	415
14.018.2	7.8	0.7	410
15.018.0	7.7	0.3	409
16.017.9	7.7	0.1	420

PIUTE RESERVOIR
08/08/95

0.019.9	8.5	6.9	418
1.019.9	8.5	6.7	419
2.019.9	8.5	6.6	416
3.019.8	8.5	6.5	418
4.019.8	8.5	6.5	418
5.019.8	8.5	6.5	418
6.019.7	8.4	6.3	416
7.019.6	8.4	6.1	422
8.019.5	8.4	6.0	416
9.019.3	8.3	5.0	422
10.019.0	8.2	3.3	420

PIUTE RESERVOIR
08/08/95

0.019.7	8.4	6.5	483
1.019.7	8.4	6.5	485
2.019.7	8.4	6.5	488
3.019.7	8.4	6.5	488
4.019.6	8.4	6.5	498
5.019.3	8.8	5.9	522

PORCUPINE RESERVOIR
08/24/93

0.019.8	8.2	8.8	310
1.019.8	8.2	8.8	311
2.019.7	8.7	8.7	311
3.019.7	8.7	8.7	311
4.019.6	8.7	8.7	310
5.019.5	8.2	8.8	311
6.019.0	8.2	8.7	317
7.018.4	8.2	8.5	323
8.016.6	8.0	7.1	338
9.016.2	7.9	6.9	350
10.016.0	7.9	6.8	342
11.015.9	7.8	6.4	349
12.015.8	7.8	6.1	359
13.015.8	7.8	5.9	359

PORCUPINE RESERVOIR
08/30/93

0.019.6	8.2	9.1	306
1.019.6	8.7	9.0	300
2.019.4	8.2	9.0	307
3.019.1	8.2	9.0	308
4.018.9	8.2	9.0	305
5.018.9	8.2	9.0	305
6.018.2	8.2	8.7	319
7.018.1	8.1	8.3	328
8.017.8	8.0	7.8	330
9.017.0	7.9	6.9	341
10.016.3	7.8	6.0	340
11.016.2	7.8	6.0	346
12.015.7	7.8	5.4	347
14.014.8	7.7	5.5	358
16.013.9	7.7	5.8	356
17.013.4	7.7	5.8	355
18.012.8	7.7	5.8	355
20.011.8	7.7	3.3	345
22.010.9	7.6	5.0	352
24.010.6	7.6	4.3	347
26.010.3	7.6	4.2	343
28.0 9.9	7.5	3.7	340
30.0 9.8	7.5	3.3	350
32.0 9.7	7.4	2.9	343
34.0 9.5	7.4	2.6	350

PORCUPINE RESERVOIR
09/06/95

0.020.4	8.8	7.2	342
1.020.4	8.9	7.1	343
2.020.4	8.9	7.1	343
3.020.1	8.8	6.6	346
4.019.6	8.8	6.9	353
5.019.5	8.8	6.9	353
6.019.4	8.7	6.8	360
7.019.9	8.7	6.7	362
8.019.1	8.6	6.6	362
9.018.8	8.6	6.4	370
10.018.3	8.5	6.0	377
11.017.8	8.5	5.8	375
12.017.4	8.5	6.0	382
13.017.0	8.4	5.9	383
14.016.4	8.4	6.3	384
15.015.7	8.4	6.9	382
16.014.8	8.4	7.6	322
17.014.0	8.4	7.8	369
18.013.3	8.4	8.0	386
19.012.9	8.4	7.8	381
20.012.3	8.4	6.9	380
21.012.0	8.3	6.9	380
22.012.0	8.3	6.4	383
23.011.4	8.3	5.8	383
24.011.0	8.8	5.1	383
25.010.7	8.3	4.6	383
26.010.4	8.2	4.2	383
27.010.3	8.2	3.8	391
28.010.3	8.2	3.6	391
29.010.1	8.2	3.2	391
30.010.0	8.2	2.9	393
31.0 9.7	8.2	2.3	396
32.0 9.5	8.1	1.8	399
33.0 9.3	8.1	1.1	400
34.0 9.0	8.1	1.0	400
35.0 8.8	8.1	0.2	304

PORCUPINE RESERVOIR
09/06/95

0.020.7	8.8	6.6	343
1.020.7	8.9	6.4	342
2.020.7	8.9	6.5	343
4.020.6	8.9	6.7	345
3.020.5	8.9	6.4	348
4.020.4	8.8	6.7	349
5.020.4	8.8	6.7	349
6.020.3	8.8	6.7	349
7.020.2	8.8	6.5	349
8.019.0	8.8	6.1	359
9.018.3	8.7	6.0	362
10.018.1	8.6	5.7	376
11.017.7	8.6	5.4	370
12.017.2	8.5	5.5	373
13.016.6	8.5	5.5	375
14.016.3	8.5	5.5	375
15.015.9	8.5	5.5	395
16.015.3	8.4	5.9	381

POSEY LAKE
09/14/93

0.013.1	8.7	8.5	166
1.012.6	8.7	8.5	173
2.012.4	8.7	8.5	173
3.011.8	8.7	8.3	172
4.011.6	8.8	8.6	171
5.211.5	8.8	7.5	173

POSEY LAKE
09/13/95

0.015.5	8.9	8.3	150
1.014.2	8.9	8.0	152
2.013.8	8.9	7.0	151
3.013.4	8.8	7.1	154
4.013.0	8.8	7.8	160
5.012.5	8.8	7.9	151
6.011.7	8.8	8.1	148

POTTERS NO.1
07/21/93

0.019.1	8.6	10.4	157
0.519.0	8.7	10.1	158
1.019.0	8.7	10.5	158
1.519.0	8.7	10.4	160
2.018.9	8.7	10.5	161
2.518.8	8.8	11.1	160
3.018.8	8.7	10.9	159
3.518.6	8.7	10.0	160

POTTERS POND NO.2
07/21/93

0.018.5	9.1	8.2	143
0.518.4	9.1	9.5	143
1.018.3	9.1	9.4	143
1.518.2	9.2	9.6	143
2.018.1	9.2	9.3	143
2.518.1	9.2	9.3	143
3.018.0	9.2	9.2	143
3.318.0	9.2	9.2	143

PUFFER LAKE
08/16/93

0.012.4	8.2	7.7	103
1.012.4	8.2	7.7	104
2.012.1	8.1	7.6	102
3.011.9	8.1	7.7	103
4.011.4	8.1	7.7	103
5.0 9.9	8.1	8.0	107
6.0 8.7	8.0	8.0	105
7.0 7.4	7.9	2.9	105
8.0 6.1	7.6	1.9	109
9.0 5.8	7.4	0.3	113
9.5 5.8	7.3	0.1	120

PUFFER LAKE
08/30/95

0.014.6	8.6	7.6	119
1.014.7	8.6	7.3	121
2.014.7	8.6	7.2	123
3.014.0	8.5	7.6	124
4.0 9.1	8.1	6.1	112
5.0 7.2	7.7	3.2	115
6.0 5.5	7.3	0.7	128

QUAIL CREEK RESERVOIR
06/03/93

0.020.8	7.9	8.2	772
1.020.9	8.0	8.1	773
2.020.9	8.0	8.1	773
3.020.8	8.0	8.1	773
4.020.8	8.0	8.1	773
5.020.7	8.1	8.2	773
5.020.3	8.0	8.2	771
7.018.0	8.0	10.4	779
8.015.8	8.1	10.5	790
9.014.6	8.1	10.2	785
10.013.5	8.1	9.6	790
11.012.8	8.1	8.8	793
12.012.0	8.1	8.3	790
13.011.2	8.1	7.9	775
14.010.9	8.0	7.7	776
15.010.7	8.0	7.6	776
16.010.6	7.9	7.6	773
17.010.5	7.9	7.5	772
18.010.3	7.9	7.5	771
19.010.3	7.9	7.5	771
20.010.3	7.8	7.5	
21.010.2	7.8	7.5	
22.010.1	7.8	7.5	
23.010.1	7.8	7.5	
24.010.1	7.8	7.5	
25.010.0	7.8	7.5	
26.010.0	7.8	7.5	
27.0 9.9	7.8	7.4	
28.0 9.9	7.8	7.4	
29.0 9.8	7.8	7.4	
30.0 9.8	7.8	7.4	
31.0 9.8	7.7	7.4	
32.0 9.7	7.7	7.4	
33.0 9.7	7.7	7.4	
34.0 9.7	7.7	7.4	
35.0 9.7	7.7	7.3	
36.0 9.6	7.7	7.2	
37.0 9.6	7.7	7.2	
38.0 9.6	7.7	7.1	
39.0 9.6	7.7	6.9	
40.0 9.5	7.7	6.8	811
41.0 9.5	7.6	6.7	823
42.0 9.5	7.6	6.6	827
43.0 9.5	7.6	6.4	834
44.0 9.5	7.6	6.1	860
45.0 9.5	7.6	5.8	862

QUAIL CREEK RESERVOIR
08/04/93

0.025.2	8.2	7.9	873
1.025.4	8.2	7.7	874
2.025.4	8.7	7.6	873
3.025.3	8.2	7.6	873
4.025.3	8.2	2.6	874
5.025.2	8.2	7.7	874
6.024.8	8.3	7.7	877
7.024.4	8.3	7.8	873
8.024.1	8.3	7.8	872
9.023.3	8.7	7.7	867
10.021.9	8.1	7.6	870
11.019.4	8.0	7.2	881
12.016.4	7.9	6.7	892
13.014.6	7.8	6.1	902
14.013.4	7.7	5.6	900
15.017.5	7.8	5.5	902
16.012.3	7.7	4.8	897
17.012.1	7.6	4.8	895
18.011.7	7.6	4.4	895
20.011.5	7.6	4.7	899
25.011.2	7.6	4.6	895
30.011.0	7.0	4.5	909
35.010.9	7.5	3.9	929
40.010.8	7.4	3.1	965
42.810.7	7.3	1.2	994

QUAIL CREEK RESERVOIR
08/09/95

0.024.9	8.1	7.4	866
1.024.9	8.1	7.4	873
2.024.9	8.1	7.4	872
3.024.9	8.1	7.4	877
4.024.9	8.1	7.4	864
5.024.9	8.1	7.4	862
6.024.9	8.1	7.4	864
7.024.9	8.1	7.4	871
8.024.8	8.1	7.4	871
9.023.6	8.1	7.9	847
10.022.5	8.1	8.0	850
11.021.3	8.0	8.0	857
12.019.5	8.0	7.8	857
13.018.7	7.9	7.1	886
14.016.9	7.8	7.8	884
15.015.2	7.7	4.8	883
16.013.8	7.6	4.2	881
17.013.4	7.5	4.0	887
18.013.1	7.5	4.1	869
19.012.6	7.5	3.7	853
20.012.4	7.5	3.6	861
21.012.1	7.5	3.6	861
22.012.0	7.5	3.9	860
23.011.8	7.5	3.9	896
24.011.7	7.5	3.7	882
25.011.7	7.5	3.6	912
26.011.6	7.5	3.7	905
27.011.5	7.5	3.7	897
28.011.5	7.5	3.7	835
29.011.5	7.5	3.6	858
30.011.4	7.5	3.6	878
31.011.4	7.5	3.6	884
32.011.4	7.4	3.5	847
33.011.4	7.4	3.4	861
34.011.4	7.4	3.3	915
35.011.3	7.4	3.3	918
36.011.3	7.4	3.2	881
37.011.3	7.4	3.2	906
38.011.3	7.4	3.0	875
39.011.3	7.4	2.8	891
40.011.3	7.4	2.2	882
41.011.3	7.3	2.5	952
42.011.3	7.3	2.4	904
43.011.2	7.3	2.0	914

44.0	11.3	7.3	2.0 1,030

QUAIL CREEK RESERVOIR
08/09/95

0.0	25.3	8.2	7.4 864
1.0	25.3	8.2	7.4 864
2.0	25.3	8.2	7.4 864
3.0	25.2	8.2	7.4 866
4.0	25.1	8.2	7.4 868
5.0	24.8	8.1	7.5 863
6.0	24.8	8.1	7.6 866
7.0	24.7	8.1	7.5 860
8.0	24.5	8.1	7.6 881
9.0	24.3	8.1	7.6 368
10.0	23.5	8.1	7.6 832
11.0	23.1	8.1	7.6 844
12.0	20.9	8.0	7.4 862
13.0	18.0	7.9	5.7 876
14.0	15.5	7.7	5.0 885
15.0	15.5	7.7	4.7 885
16.0	14.9	7.6	4.4 888
17.0	14.0	7.6	3.6 876

QUAIL CREEK RESERVOIR
08/09/95

0.0	25.1	8.2	7.3 874
1.0	25.1	8.2	7.3 874
2.0	25.1	8.2	7.3 874
3.0	25.0	8.2	7.3 872
4.0	25.0	8.2	7.3 874
5.0	25.0	8.2	7.3 873
6.0	25.0	8.2	7.3 874
7.0	25.0	8.2	7.3 872
8.0	25.0	8.2	7.3 875
9.0	24.7	8.2	7.3 870

RAFT LAKE
07/13/94

0.0	12.9	7.9	6.6 17
1.0	12.9	7.8	6.6 18
2.3	12.9	7.5	6.7 18

RAFT LAKE
06/27/96

0.0	8.8	7.8	7.8 16
1.0	8.8	7.7	7.9 16
2.0	8.7	7.6	8.1 16
3.0	8.8	7.6	8.2 16
3.3	8.7	7.5	8.2 16

RECAPTURE RESERVOIR
06/14/93

0.0	15.3	8.2	8.0 190
1.0	14.7	8.3	8.0 192
2.0	14.5	8.3	7.9 191
3.0	14.1	8.3	7.5 192
4.0	12.7	8.1	6.8 195
5.0	11.5	8.0	6.6 195
6.0	10.7	7.9	6.5 191
7.0	10.0	7.9	6.3 196
8.0	9.1	7.9	6.1 202
9.0	8.4	7.9	6.0 205
10.0	8.2	7.9	6.0 208
11.0	8.1	7.9	6.1 209
12.0	7.9	7.9	6.1 208
13.0	7.7	7.9	6.2 205
14.0	7.6	7.9	6.3 205
15.0	7.5	7.9	6.3 213
16.0	7.5	7.9	6.3 213
17.0	7.5	7.9	6.3 214
18.0	7.5	7.9	6.3 205
19.0	7.4	8.0	6.3 206
20.0	7.3	8.0	6.3 210
21.0	7.4	8.0	6.3 210
22.0	7.4	8.0	6.3 209
23.0	7.4	8.0	6.3 212
24.0	7.4	8.4	6.3 212
25.0	7.3	8.0	6.2 208

RECAPTURE RESERVOIR
08/10/93

0.0	23.2	8.4	7.0 239
1.0	22.7	8.5	7.1 240
2.0	22.2	8.3	7.0 239
3.0	21.7	8.4	6.6 240
4.0	20.7	8.1	5.3 240
5.0	20.5	8.0	4.9 240
6.0	19.9	7.8	3.8 237
7.0	18.4	7.6	2.5 235
8.0	12.6	7.4	2.8 224
9.0	11.0	7.4	1.5 219
10.0	9.5	7.3	2.0 218
11.0	9.3	7.3	2.3 218
12.0	8.9	7.3	2.3 219
13.0	8.6	7.3	2.4 220
14.0	8.3	7.3	2.6 221
15.0	8.3	7.3	2.5 221
16.0	8.2	7.3	2.5 222
17.0	8.1	7.3	2.5 221
18.0	8.0	7.3	2.6 221
19.0	8.0	7.3	2.6 222

RECAPTURE RESERVOIR
08/11/93

0.0	23.0	6.8	7.9 247
0.5	22.9	6.8	7.9 247
1.0	22.8	6.8	7.9 248
1.5	22.4	6.9	7.9 248
2.0	22.3	7.1	7.9 248
2.5	22.2	7.2	7.9 248
3.0	22.0	7.2	7.9 248
3.5	21.9	7.4	7.9 248
4.0	21.8	7.4	7.9 248
4.5	20.7	7.0	7.7 248
5.0	20.5	6.5	7.7 248
5.5	20.2	6.3	7.6 247
6.0	19.0	5.7	7.5 244
6.5	18.4	5.5	7.4 241
7.0	17.5	4.9	7.3 239
7.5	16.3	4.6	7.2 235
8.0	14.5	4.3	7.2 229
8.5	12.9	4.4	7.2 226
9.0	12.1	4.4	7.2 224
9.5	10.7	4.3	7.2 224
10.0	10.0	4.8	7.2 222
10.5	9.4	4.8	7.2 221
11.0	9.2	4.8	7.2 221
16.0	8.4	4.5	7.2 221
21.0	7.9	4.8	7.2 220
26.0	7.7	4.6	7.2 218
27.5	7.6	3.7	7.2 217

RECAPTURE RESERVOIR
08/23/95

0.0	23.0	8.9	7.0 324
1.0	23.0	8.9	7.0 325
2.0	23.0	9.0	7.0 325
3.0	22.7	9.0	7.0 325
4.0	22.6	9.1	6.9 325
5.0	22.3	9.0	6.4 326
6.0	21.7	9.0	5.5 329
7.0	21.3	8.8	4.3 329
8.0	19.3	8.7	2.7 328
9.0	17.4	8.6	0.6 323
10.0	15.5	8.6	0.2 320
11.0	14.4	8.5	0.2 322
12.0	13.6	8.4	0.1 321
13.0	12.9	8.4	0.1 320
14.0	12.5	8.3	0.2 319
15.0	11.8	8.3	0.2 320
16.0	11.3	8.2	0.2 324
17.0	10.6	8.2	0.2 324
18.0	10.3	8.2	0.2 324

RECAPTURE RESERVOIR
08/23/95

0.0	22.9	8.7	7.4 323
1.0	22.9	8.8	7.1 327
2.0	22.9	8.8	7.1 326
3.0	22.8	8.9	7.0 328
4.0	22.7	9.0	7.0 327
5.0	22.2	9.1	6.6 325
6.0	22.0	9.0	6.3 326
7.0	22.0	9.0	6.1 326
8.0	20.9	9.0	5.5 330
9.0	19.3	8.9	3.1 327
10.0	17.4	8.8	0.8 327
11.0	16.9	8.7	0.4 325

RECAPTURE RESERVOIR
08/23/95

0.0	22.7	9.3	7.2 339
1.0	22.6	9.3	7.1 328
2.0	22.5	9.2	7.1 327
3.0	22.5	9.2	7.1 327
4.0	22.4	9.2	7.0 326
5.0	22.4	9.2	7.0 326
6.0	21.7	9.1	5.4 327
7.0	20.1	8.8	2.1 325
8.0	19.6	8.7	1.3 324
9.0	18.4	8.6	0.6 325
10.0	14.9	8.6	0.2 322
11.0	13.9	8.6	0.2 321
12.0	13.3	8.5	0.1 321
13.0	12.9	8.5	0.1 318
14.0	12.4	8.5	0.1 321
15.0	11.9	8.4	0.1 320
16.0	11.4	8.4	0.1 320
17.0	10.4	8.4	0.1 321
18.0	10.2	8.3	0.1 321

RED CREEK RESERVOIR
07/19/94

0.0	17.5	8.5	8.9 409
1.0	17.5	8.9	8.9 410
2.0	17.5	8.5	8.9 410
3.0	17.5	8.5	8.8 410
4.0	17.5	8.5	8.6 410
5.0	15.8	8.3	5.8 420
6.0	13.2	8.1	3.3 424
7.0	14.1	7.8	0.5 430
8.0	13.8	7.8	0.5 433

RED CREEK RESERVOIR
09/06/94

1.0	15.0	8.7	9.4 435
1.0	13.8	8.7	8.9 431
2.0	13.7	8.7	7.9 431
3.0	13.5	8.7	7.9 431
3.7	12.8	8.6	7.9 428

RED CREEK RESERVOIR
(DUCHESNE) 08/28/96

0.0	17.1	8.6	9.6 418
1.0	17.0	8.6	8.0 418
2.0	17.0	8.6	7.8 418
3.0	17.0	8.6	7.9 418
4.0	16.9	8.6	7.6 419
5.0	16.6	8.5	7.3 421
6.0	16.3	8.5	7.1 422
6.9	16.1	8.5	6.8 422
7.9	16.1	8.4	6.8 423
9.0	16.1	8.4	6.2 423
10.0	16.0	8.4	6.1 425
11.0	15.9	8.3	5.7 426
11.9	15.0	8.0	2.9 435
12.7	14.6	7.9	2.3 438

RED CREEK RESERVOIR
(DUCHESNE) 09/04/96

0.0	20.4	8.9	8.2 1,021
1.1	20.3	8.9	8.0 1,022

RED CREEK RESERVOIR (IRON)
07/26/94

0.0	19.2	9.2	7.9 171
1.0	19.2	9.2	8.1 171
2.0	19.2	9.2	8.4 173
3.0	19.1	9.2	8.2 174
4.0	18.0	8.7	5.2 178
5.0	16.7	8.2	2.3 189
6.0	14.7	7.7	0.5 197
7.0	11.8	7.4	0.3 214
8.0	11.3	7.3	0.2 212

RED CREEK RESERVOIR (IRON)
08/16/94

0.0	20.0	9.1	13.1 132
1.0	19.9	9.1	12.9 133
2.0	19.8	9.1	12.6 134
3.0	18.3	8.4	8.0 150
4.0	18.0	8.2	8.2 158
5.0	17.3	7.6	1.0 175
6.0	15.8	7.4	0.4 203
6.7	14.4	6.6	0.1 230

RED CREEK RESERVOIR
(PARAGONAH) 07/02/96

0.0	17.9	9.3	8.5 195
1.0	17.8	9.2	7.8 196
2.0	17.8	9.2	7.5 196
3.0	17.6	9.2	7.5 197
4.0	16.5	9.0	6.9 199
5.0	16.3	8.9	6.6 199
6.0	15.9	8.8	6.0 199
7.0	14.0	8.2	1.9 205
8.0	12.8	8.0	1.4 209
9.0	11.8	7.8	1.4 213
9.7	11.5	7.8	1.6 215

RED CREEK RESERVOIR
(PARAGONAH) 07/09/96

0.018.5	8.5	8.9	404
1.018.5	8.5	8.8	406
2.018.4	8.5	8.7	406
3.018.2	8.5	8.7	407
4.018.0	8.5	8.6	409
5.016.6	8.4	8.6	415
6.015.9	8.4	7.8	422
7.015.5	8.4	7.3	425
8.015.0	8.3	6.3	429
9.014.5	8.2	5.2	438
10.0 1.9	8.1	4.8	438
11.013.1	8.0	4.4	435
12.011.0	8.0	5.0	440
13.010.3	8.0	5.0	438
14.0 9.8	8.0	4.9	439
15.0 9.3	7.9	4.8	452
16.0 9.1	7.9	4.5	442
17.0 9.0	7.9	4.3	445
17.7 8.7	7.8	3.9	453

RED CREEK RESERVOIR
(PARAGONAH) 08/14/96

0.018.6	8.8	8.1	169
1.018.4	8.8	7.8	168
2.018.3	8.8	7.5	168
3.018.3	8.8	7.5	169
4.017.7	8.3	3.2	172
5.017.1	7.8	0.4	178
6.015.7	7.5	0.2	200
7.014.9	7.3	0.2	211
8.014.2	7.2	0.2	220
8.314.1	7.2	0.1	223

RED FLEET RESERVOIR
07/01/93

0.020.6	8.4	8.0	196
1.018.7	8.4	8.0	196
2.019.4	8.4	7.9	197
3.018.3	8.2	7.6	193
4.015.2	7.8	7.5	182
5.015.1	7.7	7.5	174
6.015.1	7.7	7.4	174
7.012.5	7.7	7.3	168
8.011.9	7.7	7.3	167
9.011.6	7.7	7.3	166
10.011.3	7.7	7.3	167
11.011.0	7.8	7.4	164
12.010.8	7.7	7.4	166
13.010.7	7.7	7.5	170
14.010.6	7.6	7.5	174
15.010.5	7.6	7.5	176
16.010.3	7.6	7.5	178
17.010.2	7.6	7.5	180
18.010.1	7.6	7.5	184
19.010.0	7.6	7.5	188
20.010.0	7.6	7.5	193
21.0 9.9	7.6	7.5	193
22.0 9.8	7.6	7.6	193
23.0 9.7	7.6	7.6	196
24.0 9.7	7.6	7.6	196
25.0 9.7	7.6	7.6	196

REDMOND LAKE
06/28/94

0.025.4	8.5	6.2	938
1.225.4	8.8	6.1	980

REDMOND LAKE
08/10/94

0.020.7	8.5	6.4	913
0.820.8	8.5	6.2	913

REDMOND LAKE
06/18/96

0.023.6	9.1	8.0	1,010
1.023.6	8.8	8.0	1,009
1.423.3	8.8	7.6	1,016

REX RESERVOIR
07/07/94

0.018.8	8.6	6.7	314
1.018.8	8.6	6.7	312
2.018.7	8.6	6.2	311
3.017.5	8.5	6.4	307

REX RESERVOIR
08/24/94

0.017.7	8.2	7.5	224
1.017.5	8.2	7.5	223
2.016.4	8.0	6.8	225
3.014.6	7.3	1.3	252
4.011.3	7.1	0.0	283
4.310.2	6.9	0.0	308

REX RESERVOIR
07/01/96

0.019.2	8.6	8.1	264
1.019.0	8.6	8.0	264
2.017.7	8.6	7.9	268
3.016.6	8.5	7.4	274
4.015.6	8.3	6.9	275
5.013.4	8.0	5.2	272
6.0 9.6	7.7	2.3	264
7.0 8.1	7.5	1.1	268
8.0 7.7	7.4	0.2	275
9.0 7.6	7.4	0.1	278

REX RESERVOIR
08/20/96

0.018.4	8.5	7.6	221
1.018.3	8.5	8.0	224
2.017.3	8.5	7.8	226
3.013.7	8.0	2.7	257

ROCKPORT LAKE (WANSHIP
RESERVOIR) 06/13/94

0.018.4	8.3	7.2	342
1.018.5	8.4	6.9	343
2.018.5	8.4	6.9	344
3.018.5	8.4	6.9	344
4.018.5	8.4	6.8	343
5.018.4	8.4	6.8	345
6.018.4	8.4	6.8	343
7.018.3	8.5	6.8	344
8.017.1	8.3	6.1	345
9.016.4	8.3	5.8	346
10.015.8	8.3	5.7	345
11.015.2	8.2	5.4	348
12.014.8	8.2	5.4	348
13.014.2	8.2	5.3	343
14.013.1	8.1	5.4	333
15.012.6	8.1	5.4	332
16.012.4	8.1	5.3	335
17.012.2	8.1	5.1	335
18.011.9	8.1	5.2	337
19.011.8	8.1	5.3	337
20.011.6	8.1	5.2	342
21.011.3	8.0	5.0	350
22.011.1	8.0	4.9	355
23.010.9	8.0	4.7	359
24.010.8	8.0	4.4	361
25.010.4	7.9	4.1	367
26.010.0	7.9	3.7	373
28.0 9.8	7.8	3.3	376
30.0 9.4	7.8	2.8	381
32.0 9.2	7.8	2.4	385
34.0 9.2	7.8	2.0	386
36.0 9.1	7.7	1.7	387

ROCKPORT LAKE (WANSHIP
RESERVOIR) 08/02/94

0.021.5	8.6	6.5	362
1.021.5	8.6	6.4	365
2.021.5	8.6	6.4	364
3.021.5	8.6	6.4	367
4.021.5	8.6	6.4	367
5.021.4	8.6	6.0	365
6.020.7	8.4	5.2	366
7.019.7	8.3	4.2	375
8.019.1	8.3	4.1	374
9.018.6	8.2	3.9	375
10.018.2	8.2	3.7	379
11.018.0	8.2	3.7	370
12.017.7	8.1	3.5	366
13.017.5	8.0	3.2	358
14.017.2	8.0	3.0	357
15.016.8	8.0	3.1	375
16.016.2	7.9	3.0	
17.015.8	7.9	2.7	357
18.015.5	7.9	2.6	
19.015.3	7.9	2.6	357
20.015.0	7.8	2.5	357
21.014.5	7.8	7.4	360
22.014.2	7.7	2.3	350
23.013.8	7.7	2.2	341
24.013.5	7.7	1.9	355
25.012.5	7.7	1.8	358
26.011.8	7.6	1.0	358
27.011.3	7.6	0.4	359
28.011.2	7.6	0.5	362
29.010.6	7.6	0.5	387
30.010.4	7.6	0.5	381

ROCKPORT RESERVOIR
06/18/96

0.017.0	8.3	7.0	244
1.016.8	8.3	7.6	244
2.015.6	8.3	7.8	230
2.915.0	8.1	8.0	229
4.014.5	8.1	8.0	227
5.013.7	8.0	7.5	230
6.013.1	8.0	7.5	244
7.012.9	8.0	7.5	251
8.012.2	8.0	7.4	254
9.012.5	8.0	7.4	252
10.012.2	8.0	7.1	255
11.011.9	8.0	7.6	248
12.011.8	8.0	7.4	239
13.011.7	8.0	7.9	238
14.011.7	8.0	7.6	238
15.011.6	8.0	7.5	247
16.011.6	8.0	7.4	263
18.011.4	8.0	7.3	253
20.011.2	8.0	7.2	265
22.011.0	8.0	7.5	266
24.010.8	8.0	7.2	294
26.010.3	8.0	6.5	321
28.010.0	7.8	5.9	325
30.0 9.8	7.8	5.7	331
32.0 9.7	7.8	5.6	336
34.0 9.5	7.8	5.3	341
36.0 9.4	7.7	4.9	343

ROCKPORT RESERVOIR
06/18/96

0.016.6	8.4	7.9	240
1.016.6	8.4	7.9	241
2.016.4	8.3	7.9	240
3.016.0	9.3	7.9	237
4.015.5	8.2	7.1	232
5.014.3	8.1	7.1	217
6.013.9	8.1	7.3	214
7.013.5	8.1	7.2	219
8.012.8	8.0	7.2	224
9.012.4	8.0	7.3	218
10.012.0	8.0	7.2	222
11.011.8	8.0	7.3	222
12.011.4	8.0	7.3	222
14.011.3	8.0	7.2	244
16.011.1	8.0	7.1	243
18.010.8	8.0	7.2	241
20.010.8	8.0	6.8	263
22.010.7	8.0	6.6	287
22.510.7	8.0	6.2	289

ROCKPORT RESERVOIR
08/06/96

0.018.9	8.2	7.2	297
1.018.9	8.3	7.1	298
2.018.9	8.3	7.1	298
3.018.9	8.3	7.0	298
4.018.9	8.3	7.0	298
5.018.9	8.3	7.0	298
6.018.9	8.3	7.0	298
7.019.0	8.3	7.0	298
8.018.9	8.3	6.9	300
9.018.6	8.2	6.5	306
9.917.2	8.1	6.1	326
11.016.2	8.0	5.3	305
12.015.8	7.9	4.8	305
13.114.7	7.9	4.6	286
14.114.0	7.9	4.7	266
15.213.5	7.9	4.8	261
16.013.3	7.9	4.9	259
17.013.1	7.9	4.9	258
18.013.0	7.8	4.8	258
19.112.8	7.8	4.9	256
19.412.7	7.8	4.9	256

ROCKPORT RESERVOIR
08/06/96

0.119.3	8.5	7.3	295
1.019.3	8.4	7.2	296
2.119.3	8.4	7.2	296
3.019.3	8.4	7.1	296
4.019.3	8.4	7.1	296
5.119.3	8.4	7.1	296
6.019.3	8.4	7.2	297
7.019.3	8.4	7.1	297
8.119.2	8.4	6.9	298
9.016.8	8.1	5.0	302
10.016.3	8.0	4.6	304
11.015.9	8.0	4.6	300
12.015.7	7.9	4.6	297

13.015.2	7.9	4.5	286
14.014.2	8.0	4.7	262
15.013.8	7.9	5.0	261
16.013.3	7.9	5.1	256
17.113.0	7.9	5.1	256
18.012.8	7.9	5.2	253
19.012.7	7.9	5.2	254
19.912.5	7.9	5.2	252
21.012.3	7.9	5.2	252
22.012.2	7.9	5.2	251
22.812.0	7.9	5.2	252
23.911.8	7.8	5.1	251
24.911.6	7.8	5.1	253
26.011.4	7.8	5.0	254
27.211.3	7.8	4.8	255
28.111.3	7.8	4.7	256
29.311.2	7.8	4.3	257
30.111.2	7.7	4.2	257
31.011.2	7.7	4.1	257
31.911.1	7.7	4.1	258
32.211.2	7.7	3.9	258

ROCKPORT RESERVOIR
08/06/96

0.018.9	8.2	7.2	297
1.018.9	8.3	7.1	298
2.018.9	8.3	7.1	298
3.018.9	8.3	7.0	298
4.018.9	8.3	7.0	298
5.018.9	8.3	7.0	298
6.018.9	8.3	7.0	298
7.019.0	8.3	7.0	298
8.018.9	8.3	6.9	300
9.018.6	8.2	6.5	306
9.917.2	8.1	6.1	326
11.016.2	8.0	5.3	305
12.015.8	7.9	4.8	305
13.114.7	7.9	4.6	286
14.114.0	7.9	4.7	266
15.213.5	7.9	4.8	261
16.013.3	7.9	4.9	259

ROCKPORT RESERVOIR
08/06/96

0.313.4	8.2	8.5	423

RUSH LAKE
06/28/93

0.019.4	8.0	6.9	1,213
1.019.3	8.1	6.9	1,213
2.319.2	8.1	6.9	1,222

RUSH LAKE
06/20/95

0.014.7	8.4	7.7	1,870
0.714.7	8.4	7.7	1,870

RUSH LAKE
08/09/95

0.017.2	8.2	8.0	231
1.017.2	8.2	7.4	230
2.017.0	8.2	6.2	320

SALEM POND
06/01/93

0.021.2	7.6	9.5	737
1.020.1	7.5	9.8	742
2.017.7	7.2	12.8	738
3.014.8	7.1	13.2	741
3.814.3	7.1	11.3	757

SALEM POND
06/28/93

0.022.3	8.0	8.3	715
1.022.2	8.0	8.3	714
2.021.6	7.9	7.6	721
3.018.5	7.3	5.1	737
4.015.6	7.3	5.7	727
4.515.6	7.4	5.7	729

SALEM POND
07/13/93

0.023.6	8.1	9.7	695
1.022.0	8.0	9.9	701
2.015.5	7.4	9.3	736
3.015.8	7.4	9.5	742
3.715.8	7.4	8.6	759

SALEM POND
07/28/93

0.021.0	8.1	11.0	698
1.020.1	8.1	10.9	698
2.017.6	7.8	10.8	773
3.116.0	7.6	10.7	728

SALEM POND
08/05/93

0.021.2	7.9	12.2	701
1.020.1	7.8	11.2	708
2.017.6	7.5	14.9	719
3.015.6	7.4	12.2	729
4.114.5	7.2	7.4	747

SALEM POND
08/16/93

0.022.5	8.2	7.4	655
1.022.2	7.9	7.5	655
2.020.3	7.8	7.6	672
3.017.8	7.6	7.6	686
4.015.6	7.5	7.6	690

SALEM POND
09/16/93

0.015.7	8.1	12.2	683
1.015.6	8.1	12.5	685
2.015.1	7.8	11.8	685
3.014.8	7.4	10.3	707
3.614.6	7.4	6.5	706

SALEM POND
08/31/94

0.019.8	8.1	11.8	702
1.019.1	8.0	13.7	713
2.016.0	7.9	11.0	742
3.014.4	2.8	8.9	747
3.814.2	7.8	6.9	775

SALEM POND
06/19/96

0.019.7	8.1	11.8	702
1.018.8	8.0	13.7	713
2.016.0	7.9	11.0	742
2.914.4	7.8	8.9	747
3.514.2	7.8	6.9	733

SALEM POND
08/15/96

1.020.8	7.9	10.5	636
2.017.2	7.6	11.4	682
3.013.3	7.2	5.3	696
4.013.0	7.2	4.9	688
4.413.0	7.2	4.5	687

SALEM POND
08/15/96

0.921.0	7.9	11.2	631
1.917.1	7.7	13.5	674
3.014.2	7.2	3.2	668
3.913.4	7.2	3.7	677
4.913.3	7.2	4.3	679

SCOFIELD RESERVOIR
06/08/93

0.012.1	8.4	7.8	374
1.012.2	8.4	7.6	374
2.012.2	8.5	7.6	377
3.012.1	8.5	7.2	375
4.012.1	8.5	7.1	376
5.012.1	8.5	7.0	374
6.012.0	8.5	7.5	373
7.011.9	8.4	7.1	373
8.011.8	8.4	6.8	372
9.011.6	8.4	6.7	372
10.011.5	8.3	6.4	376

SCOFIELD RESERVOIR
08/12/93

0.017.6	8.3	5.8	397
1.012.7	8.3	5.7	397
2.017.6	8.3	5.6	398
3.017.7	8.3	5.6	399
4.017.7	8.3	5.6	399
5.017.7	8.3	5.6	396
6.017.7	8.3	5.6	398
7.017.7	8.3	5.6	399
8.017.7	8.3	5.5	402
9.017.6	8.3	4.9	406
9.417.5	8.2	4.4	402

SCOFIELD RESERVOIR
07/12/94

0.019.2	8.6	8.3	381
1.019.2	8.6	8.3	381
2.019.3	8.6	8.7	380
3.019.3	8.6	8.2	389
1.019.3	8.6	8.2	381
5.019.3	8.6	8.2	388
6.019.1	8.6	7.8	390
7.018.5	8.4	5.7	384
8.218.4	8.2	3.1	388

SCOFIELD RESERVOIR
08/30/94

0.018.3	8.8	8.2	301
1.018.3	8.8	7.6	301
2.018.3	8.8	7.1	301
3.018.3	8.8	7.1	301
4.018.3	8.8	7.1	300
5.018.2	8.8	6.8	302
5.518.2	8.7	5.7	303

SCOFIELD RESERVOIR
08/30/95

0.019.1	8.8	7.7	363
1.018.7	8.8	7.4	314
2.018.4	8.7	6.8	365
3.018.2	8.7	6.6	365
4.018.2	8.6	6.6	365

SCOFIELD RESERVOIR
08/30/95

0.018.9	8.7	7.7	362
1.018.5	8.8	8.0	359
2.018.4	8.8	8.0	358
3.018.3	8.8	8.0	360
4.018.3	8.8	8.0	361
5.018.3	8.8	7.7	362

SCOFIELD RESERVOIR
08/30/95

0.019.6	8.7	8.5	360
1.019.5	8.8	8.5	360
2.019.4	8.8	8.3	362
3.019.3	8.8	8.0	361
4.019.1	8.8	8.0	361
5.018.8	8.8	7.3	364
6.018.6	8.7	6.4	370
7.018.1	8.5	4.7	370
8.017.2	8.3	1.2	399
9.016.6	8.0	0.3	397

SCOFIELD RESERVOIR
06/25/96

0.217.3	8.4	7.8	348
1.017.3	8.4	7.8	346
2.017.3	8.4	7.8	350
3.017.3	8.5	7.7	350
4.017.3	8.4	7.7	348
5.017.3	8.4	7.6	353
6.015.7	8.3	6.6	355
6.915.3	8.2	5.5	364
8.013.9	8.0	2.5	370
9.012.9	7.8	7.7	373
9.412.9	7.7	9.4	376

SCOFIELD RESERVOIR
06/25/96

0.215.9	8.4	8.2	352
1.016.0	8.5	8.1	349
2.016.0	8.5	8.2	350
3.015.8	8.5	8.3	351
4.115.8	8.5	8.4	353
5.015.8	8.5	8.5	351
5.715.8	8.5	8.5	352

SCOFIELD RESERVOIR
06/25/96

0.216.7	8.4	8.4	349
1.016.7	8.5	8.2	349
2.016.7	8.5	8.3	351
3.016.7	8.5	8.2	353
4.016.5	8.5	8.3	354

5.015.8	8.4	6.7	356
5.815.6	8.3	6.0	360

SCOFIELD RESERVOIR
08/20/96

0.018.3	9.3	11.2	330
1.018.3	9.3	11.1	325
1.918.0	9.3	11.2	325
3.318.1	8.2	3.2	511

SCOFIELD RESERVOIR
08/20/96

0.017.6	9.0	13.1	259
0.817.6	9.0	13.6	273
1.017.6	8.9	13.6	274
2.017.1	8.9	13.4	268
2.616.5	8.9	12.4	248

SCOFIELD RESERVOIR
08/20/96

0.018.9	8.8	10.8	291
1.018.7	8.8	11.0	291
1.918.6	8.8	10.8	291
3.018.6	8.8	10.3	292
3.918.5	8.7	10.1	293
5.018.3	8.6	9.0	297
6.018.0	8.4	6.3	304
6.817.8	8.2	4.9	311

SCOUT LAKE
07/27/94

0.012.6	6.8	8.2	17
1.017.1	6.7	6.5	16
2.017.1	6.7	6.5	16
3.017.1	6.8	6.5	17
4.317.1	6.9	6.5	17

SCOUT LAKE
07/17/96

0.015.4	7.4	6.3	13
1.015.3	7.1	6.1	13
2.015.2	7.0	6.2	13
3.014.9	6.7	6.5	13
4.212.0	6.5	7.0	13
4.511.7	6.5	5.8	13

SETTLEMENT CANYON
RESERVOIR 08/02/94

0.020.3	8.2	8.3	416
1.020.2	8.2	8.4	416
2.019.5	8.2	8.9	424
3.018.8	8.1	9.1	430
4.018.4	8.1	8.8	432
5.018.0	8.0	8.1	433
6.017.8	7.7	7.6	432
7.017.4	7.8	6.8	430
8.017.1	7.7	5.2	427
9.016.7	7.5	3.3	433
10.016.4	7.5	1.6	430
11.016.2	7.4	0.2	438
11.516.3	7.5	0.3	430

SETTLEMENT CANYON
RESERVOIR 07/05/96

0.020.5	8.4	8.4	431
1.019.3	8.3	9.2	439
2.017.5	8.3	11.2	456
3.017.0	8.2	10.8	465
4.016.6	8.2	11.4	461
5.016.3	8.2	11.4	457
6.016.1	8.1	11.0	461
7.015.8	8.1	10.5	464
8.015.8	8.0	10.0	460
9.015.5	8.0	10.0	461
10.015.2	8.0	9.7	460
11.015.1	7.9	9.4	459
12.014.9	7.9	9.4	461
13.014.4	7.8	8.8	465

SETTLEMENT CANYON
RESERVOIR 07/30/96

0.019.3	8.3	9.5	499
1.019.2	8.3	9.6	500
2.018.1	8.3	11.6	508
3.017.8	8.3	12.0	510
3.917.4	8.3	11.4	512
5.017.1	8.3	12.3	506
6.016.9	8.2	11.0	510
7.016.6	8.2	10.9	507
8.016.3	8.1	10.1	502
9.016.1	8.0	9.3	502
10.016.0	8.0	8.6	500
11.015.8	7.9	7.8	498
12.015.7	7.9	7.2	498
13.015.4	7.8	5.4	498
14.015.1	7.7	2.6	500
14.415.0	7.6	1.6	501

SEVIER BRIDGE (YUBA)
RESERVOIR 06/28/94

0.021.0	8.4	5.9	1,680
1.021.0	8.4	5.8	1,680
2.020.8	8.4	5.7	1,670
3.020.0	8.4	5.6	1,690
4.019.6	8.4	5.5	1,680
5.019.1	8.4	5.2	1,690
6.019.1	8.4	5.1	1,670
7.018.8	8.3	5.0	1,690
8.018.6	8.3	4.9	1,690
9.018.6	8.3	4.7	1,680
10.018.5	8.3	4.7	1,680
11.018.4	8.3	4.5	1,680
12.018.0	8.3	4.4	1,680
13.017.4	8.2	3.6	1,670
14.017.0	8.2	3.2	1,650
16.016.8	8.1	2.9	1,670

SEVIER BRIDGE (YUBA)
RESERVOIR 08/10/94

0.022.7	8.0	7.2	1,850
1.022.3	8.2	7.3	1,850
2.022.1	8.2	7.0	1,840
3.022.0	8.2	7.1	1,830
4.021.9	8.2	6.6	1,830
5.021.8	8.2	6.4	1,840
6.021.8	8.2	6.4	1,840
7.021.8	8.2	6.3	1,830
8.021.8	8.2	6.3	1,840
9.021.6	8.2	5.7	1,850
10.021.5	8.2	5.5	1,840
11.021.4	8.2	5.4	1,840
11.721.3	8.1	4.6	1,840

SEVIER BRIDGE (YUBA)
RESERVOIR 08/18/94

0.022.7	8.4	7.9	1,670
1.022.7	8.4	8.0	1,660
2.022.7	8.5	7.8	1,660
3.022.7	8.5	7.7	1,660
4.022.6	8.5	7.6	1,660
5.022.6	8.5	7.6	1,660
6.022.6	8.5	7.6	1,660
7.022.4	8.5	7.8	1,660
8.021.9	8.4	6.5	1,650
9.021.8	8.4	6.2	1,660
10.021.7	8.4	5.7	1,660
11.021.6	8.3	5.1	1,660
12.021.5	8.2	4.0	1,660

SEVIER BRIDGE RESERVOIR
06/18/96

0.020.9	8.7	7.3	1,552
1.020.8	8.6	7.2	1,533
1.920.6	8.6	7.1	1,532
3.020.6	8.5	7.0	1,598
4.020.5	8.5	7.0	1,532
5.020.5	8.5	7.0	1,598
6.020.2	8.5	6.9	1,578
7.020.0	8.5	6.8	1,540
8.019.5	8.5	6.7	1,662
9.019.3	8.5	6.6	1,587
10.018.6	8.5	6.2	1,633
11.017.7	8.6	5.9	1,493
12.016.1	8.6	5.0	1,552
13.015.2	8.7	4.1	1,639
14.014.9	8.6	3.9	1,499
15.114.6	8.6	3.8	1,566
15.614.2	8.6	3.7	1,521

SEVIER BRIDGE RESERVOIR
06/18/96

0.019.6	8.5	7.2	1,559
1.019.6	8.5	7.1	1,569
2.019.6	8.5	7.0	1,578
3.119.6	8.5	7.0	1,587
3.919.3	8.5	6.9	1,549
5.019.1	8.5	6.8	1,549
5.919.1	8.5	6.8	1,568
7.119.0	8.5	6.7	1,577
8.118.8	8.5	6.7	1,577
9.018.8	8.5	6.7	1,539
10.118.8	8.5	6.7	1,539
11.018.0	8.5	5.9	1,409
12.014.9	8.7	5.5	1,593
13.114.7	8.6	5.4	1,396
13.914.2	8.6	5.1	1,682
15.013.7	8.6	4.7	1,539
16.013.4	8.6	4.6	1,449
16.913.0	8.6	4.0	1,553
18.112.6	8.5	3.7	1,552
18.212.5	8.5	3.3	1,445

SEVIER BRIDGE RESERVOIR
06/18/96

0.020.8	8.6	7.2	1,608
1.020.7	8.6	7.1	1,626
1.920.6	8.6	7.1	1,626
3.120.5	8.6	7.0	1,645
4.020.4	8.6	6.9	1,654
5.020.3	8.6	6.9	1,673
6.120.3	8.6	6.8	1,682
7.020.2	8.6	6.7	1,682
8.020.1	8.6	6.6	1,700
9.019.4	8.6	6.1	1,737
9.619.4	8.6	6.1	1,737

SEVIER BRIDGE RESERVOIR
09/05/96

0.020.1	8.6	7.9	1,981
1.020.1	8.6	7.7	1,983
2.121.1	8.6	7.6	1,983
3.020.1	8.6	7.5	1,983
4.020.1	8.6	7.5	1,983
5.020.1	8.6	7.3	1,992
6.120.1	8.6	7.1	2,011
7.120.1	8.6	6.9	2,020
7.320.1	8.6	6.7	2,031

SEVIER BRIDGE RESERVOIR
09/06/96

0.019.5	8.6	6.5	1,813
1.119.5	8.6	6.3	1,823
2.019.5	8.6	6.3	1,823
3.019.5	8.6	6.2	1,825
4.019.5	8.6	6.2	1,834
5.019.5	8.5	6.1	1,826
6.019.5	8.6	6.1	1,832
7.019.5	8.6	6.1	1,832
8.019.5	8.6	6.1	1,828
9.019.5	8.6	6.1	1,832
10.019.5	8.5	6.0	1,832
11.019.5	8.5	6.0	1,832
12.019.5	8.5	6.0	1,832
13.019.5	8.5	6.0	1,832
14.019.5	8.5	6.0	1,832
15.019.5	8.5	5.9	1,832
15.319.5	8.5	5.9	1,832

SEVIER BRIDGE RESERVOIR
09/06/96

0.019.1	8.5	6.9	623
1.019.5	8.6	6.6	1,832
2.019.5	8.6	6.6	1,832
3.019.5	8.6	6.6	1,832
4.019.5	8.6	6.6	1,832
5.019.5	8.6	6.6	1,832
6.119.5	8.6	6.5	1,832
7.019.5	8.6	6.5	1,832
8.019.5	8.6	6.5	1,832
9.019.5	8.6	6.5	1,832
10.019.5	8.6	6.5	1,832
11.019.5	8.6	6.5	1,832
12.019.5	8.5	6.4	1,832
13.119.4	8.5	5.8	1,832

SHEEP CREEK LAKE
07/27/94

0.018.2	9.0	8.4	126
1.018.2	9.0	8.4	131
2.018.1	9.0	8.5	123
3.017.3	9.0	8.6	122
3.917.1	9.0	8.6	133

SHEEP CREEK LAKE
09/15/94

0.014.3	9.1	8.1	106
1.014.3	9.1	8.1	109
2.014.3	9.1	8.1	106
3.013.8	9.1	8.1	106

4.013.6	9.1	8.1	104
5.013.1	9.1	7.9	110
5.413.0	9.1	7.7	109

SHEEP CREEK LAKE
07/11/96

0.017.7	8.8	8.1	100
1.017.7	8.8	8.0	101
2.017.7	8.8	8.0	2
3.017.7	8.8	7.9	101
4.017.5	8.7	7.5	103

SMITH AND MOREHOUSE
RESERVOIR 08/26/93

0.016.4	7.9	8.0	43
1.016.3	7.8	7.4	44
2.016.1	7.8	7.4	44
3.016.0	7.8	7.4	44
4.016.0	7.8	7.3	43
6.015.4	7.8	7.7	46
6.013.9	7.8	7.3	46
7.012.0	7.6	6.6	41
8.0 9.8	7.5	6.8	43
9.0 8.8	7.5	6.7	45
10.0 8.4	7.5	6.6	43
11.0 8.0	7.4	6.5	44
12.0 8.0	7.4	6.5	43
13.0 7.5	7.3	6.2	46
14.0 7.3	7.3	6.1	49
15.0 7.2	7.4	6.0	49
16.0 7.1	7.3	5.9	48
17.0 7.2	7.3	5.8	49
18.0 7.1	7.3	5.8	49
19.0 7.1	7.3	5.7	48
20.4 7.1	7.3	5.7	50

SMITH AND MOREHOUSE
RESERVOIR 09/08/95

0.017.5	9.2	6.1	52
1.017.5	9.3	6.0	53
2.017.5	9.3	6.0	53
3.017.5	9.3	6.0	53
4.017.5	9.2	6.0	55
5.017.5	9.2	5.8	53
6.016.0	9.1	5.2	53
7.014.7	9.0	4.8	52
8.012.4	9.0	4.7	50
9.011.4	9.0	5.0	44
10.010.5	8.9	5.1	41
11.010.0	8.9	5.1	39
12.0 9.5	8.9	4.8	43
13.0 8.9	8.8	4.5	50
14.0 8.6	8.8	4.4	53
14.4 8.6	8.8	4.4	56

SOUP BOWL RESERVOIR
07/22/93

0.017.0	8.5	8.3	407
0.517.0	8.3	8.8	406
1.017.0	8.3	9.1	406
1.517.0	8.3	9.0	406
2.017.0	8.3	9.0	406
2.516.9	8.2	9.0	407
3.016.9	8.2	9.4	407
3.516.9	8.2	9.4	406
4.016.8	8.2	9.3	406
4.516.8	8.2	9.3	407
5.016.8	8.2	9.6	407
5.516.7	8.2	9.6	407
6.016.7	8.2	9.3	407
6.516.5	8.0	7.8	411

SOUTH CREEK RESERVOIR
06/15/94

0.022.4		8.2	545
1.022.4		8.2	534
2.022.4		8.2	533
3.015.6		9.7	518
4.014.8		9.7	507
5.012.5		8.9	516
6.010.2		8.2	619
7.0 9.5		7.4	521
8.0 9.4		7.1	521
9.0 9.1		6.9	524
10.0 8.9		6.3	524
11.0 8.8		5.9	526
12.0 8.7		5.4	527

SOUTH CREEK RESERVOIR
06/12/96

0.024.0	8.6	8.1	646
1.024.0	8.7	7.9	646
2.023.6	8.7	7.8	644
3.023.4	8.7	7.8	646
4.022.5	8.6	8.2	640
5.021.6	8.6	8.1	638
6.019.6	8.5	7.6	628
7.017.5	8.4	7.1	609
8.014.2	8.0	7.0	599
9.012.2	6.3	6.3	601
10.010.9	7.8	6.0	590
11.0 9.8	7.7	5.0	590
12.0 9.4	7.6	4.5	596
13.0 9.2	7.6	4.0	584
14.0 9.0	7.5	3.2	599
14.9 9.0	7.4	2.4	595

SPIRIT LAKE
07/28/94

0.013.8	7.2	8.0	26
1.113.9	7.2	8.0	29

SPIRIT LAKE
09/15/94

0.0 8.1	7.9	9.1	26
1.0 7.9	7.7	9.1	24
1.5 7.8	7.8	9.1	22

SPIRIT LAKE
03/15/95

0.0 1.2	6.7	7.6	33
1.0 3.5	6.6	4.9	33
2.0 4.1	6.6	3.4	36
3.0 4.5	6.5	1.0	39
4.0 4.8	6.4	0.8	48

SPIRIT LAKE
07/11/96

0.013.4	8.0	8.0	24
1.013.0	7.9	8.0	25
2.012.2	7.9	7.9	27
3.010.8	7.7	7.2	22
4.110.1	7.6	5.6	23
4.3 9.6	7.5	7.3	23

SPIRIT LAKE
08/27/96

0.013.3	7.6	7.6	23
1.013.3	7.5	7.3	23
2.013.2	7.5	7.1	23
3.013.1	7.4	7.0	23
4.012.9	7.3	6.6	24
5.012.5	7.2	5.7	24
5.612.2	7.0	4.5	24

STANSBURY LAKE
08/02/94

0.024.0	8.4	6.2	2,300
1.024.0	8.3	6.1	2,290
2.024.0	8.3	6.1	2,290
3.524.0	8.3	6.1	2,280

STANSBURY LAKE
06/11/96

0.023.4	8.5	7.2	2,979
1.023.3	8.6	7.2	2,974
2.023.1	8.5	6.4	2,981
2.223.1	8.5	6.3	2,981

STANSBURY LAKE
07/03/96

0.024.3	8.5	7.0	3,224
1.023.7	8.5	6.8	3,236
1.323.6	8.6	6.8	3,244

STARVATION RESERVOIR
07/19/94

0.019.6	8.5	7.6	545
1.019.6	8.5	7.6	545
2.019.6	8.5	7.6	545
3.019.6	8.5	7.6	545
4.017.6	8.5	7.6	544
5.019.6	8.5	7.5	544
6.019.5	8.5	7.5	540
7.019.5	8.5	7.5	544
8.019.5	8.5	7.5	544
9.019.4	8.5	7.5	544
10.019.4	8.5	7.5	544
11.019.3	8.5	7.5	545
12.019.3	8.4	7.3	545
13.019.3	8.5	7.4	543
14.018.2	8.3	5.9	548
15.018.1	8.3	5.9	550
16.017.7	8.2	5.2	551
17.017.5	8.2	5.0	550
18.016.9	8.2	4.9	552
19.016.1	8.2	4.7	554
20.015.8	8.1	4.5	554
21.015.0	8.1	4.5	554
22.014.7	8.1	4.5	554
23.014.1	8.1	4.5	534
24.014.0	8.1	4.4	554
25.013.9	8.1	4.5	553
26.013.6	5.1	4.4	552
27.012.2	8.1	4.4	552
28.012.0	8.1	4.3	552
29.011.9	8.1	4.3	553
30.011.4	8.1	4.2	553
31.011.4	8.1	4.1	554
32.011.3	8.1	4.0	555
33.011.0	8.1	4.0	555
34.010.9	8.1	3.9	556

STARVATION RESERVOIR
07/09/96

0.020.8	8.6	8.9	568
1.020.8	8.6	8.9	562
2.020.5	8.6	8.9	557
3.020.4	8.6	8.9	556
4.020.4	8.6	8.8	560
5.020.3	8.6	8.8	562
6.019.6	8.6	8.5	572
7.018.9	8.6	8.0	564
8.018.2	8.5	7.4	565
9.017.3	8.5	6.7	574
10.015.9	8.3	4.7	599
11.015.5	8.3	4.6	610
12.015.0	8.3	4.4	597
13.014.3	8.3	4.6	597
14.013.9	8.3	4.6	625
14.613.0	8.3	5.1	613

STARVATION RESERVOIR
07/09/96

0.021.5	8.7	8.7	530
1.021.4	8.7	8.7	531
2.021.0	8.7	8.8	535
3.021.0	8.7	8.7	535
4.020.7	8.6	8.7	536
5.020.5	8.6	8.7	547
6.019.7	8.6	8.3	545
7.019.2	8.6	8.0	536
8.018.3	8.6	7.7	527
8.016.3	8.4	6.4	541
10.015.1	8.3	5.8	556
11.014.5	8.4	5.8	568
12.014.1	8.3	5.8	573
13.013.4	8.4	5.9	581
14.013.1	8.4	6.1	594
15.012.7	8.4	6.2	602
16.012.6	8.4	6.3	603
17.012.3	8.4	6.1	610
18.012.2	8.4	6.1	611
19.011.8	8.4	6.2	619
20.011.7	8.4	6.3	623
21.011.6	8.4	6.3	625
22.011.5	8.4	6.3	627
24.011.4	8.4	6.3	627
26.011.2	8.3	6.2	631
28.010.9	8.3	5.9	634
30.010.8	8.3	5.7	636
32.010.8	8.3	5.6	635
34.010.7	8.3	5.6	636
36.010.7	8.2	5.5	637
37.110.7	8.3	5.5	637

STARVATION RESERVOIR
07/09/96

0.021.7	8.7	8.6	521
1.021.5	8.7	8.6	532
2.021.4	8.7	8.6	514
3.021.4	8.7	8.5	520
4.020.8	8.7	8.4	510
5.020.7	8.6	8.6	540
6.019.3	8.6	8.2	517
7.017.9	8.5	7.0	507
8.016.9	8.5	6.5	508
9.016.1	8.3	5.5	508
10.015.1	8.3	5.3	527
11.014.9	8.3	5.3	524
12.014.2	8.3	5.3	551
13.013.8	8.3	4.9	547

14.013.6	8.3	5.3	552
15.013.5	8.3	5.3	574
16.013.1	8.3	5.4	594
16.912.9	8.3	5.4	581
18.012.2	8.3	5.6	620
19.011.9	8.3	5.7	615
20.011.7	8.3	5.9	615
21.011.6	8.3	6.0	614
21.811.6	8.3	6.0	617

STARVATION RESERVOIR
08/28/96

0.020.1	8.6	8.1	561
1.020.0	8.6	7.9	562
2.020.0	8.5	7.8	561
3.020.0	8.5	7.5	561
4.020.0	8.5	7.6	563
5.020.0	8.5	7.7	565
5.920.0	8.5	7.5	561
7.020.0	8.5	7.6	560
8.020.0	8.5	7.6	559
9.020.0	8.5	7.6	560
10.019.9	8.5	7.4	563
10.919.2	8.4	7.1	570
12.119.1	8.4	6.5	575
13.018.8	8.3	5.2	580
14.118.2	8.1	3.5	583
15.017.4	8.0	2.8	592
16.116.9	7.9	2.1	588
17.115.9	7.9	1.6	593
18.015.1	7.9	1.5	591
19.014.3	7.9	1.7	595
20.114.2	7.9	1.9	601
21.013.9	7.9	2.1	599
22.013.5	7.9	2.3	609
23.013.4	7.9	2.3	603
24.013.3	7.9	2.4	617
25.013.2	7.9	2.4	613
28.412.9	7.9	2.7	620

STARVATION RESERVOIR
08/28/96

0.019.6	8.8	8.9	581
1.019.7	8.7	7.7	576
2.019.6	8.7	7.4	579
3.019.6	8.7	7.3	578
4.019.6	8.7	7.4	576
5.019.5	8.7	7.3	578
6.019.5	8.7	7.3	577
7.019.0	8.6	6.7	580
8.018.9	8.6	6.2	590
9.018.8	8.5	5.8	590
10.018.7	8.5	5.6	596
11.118.7	8.5	5.5	599
12.018.2	8.4	7.0	603
13.117.8	8.3	3.2	606
14.117.1	8.2	2.4	608

STARVATION RESERVOIR
08/28/96

0.020.4	8.7	9.2	551
1.020.4	8.7	8.1	551
2.020.4	8.7	8.0	553
3.020.4	8.7	7.9	553
3.920.3	8.7	7.9	555
5.120.2	8.7	7.9	556
6.020.1	8.7	7.7	558
7.020.1	8.7	7.5	560
8.019.7	8.7	7.6	556
9.019.6	8.6	7.6	560
10.119.6	8.6	7.5	559
10.019.6	8.6	7.3	560
10.919.4	8.6	7.4	563
11.919.1	8.5	6.1	569
12.919.0	8.4	4.8	577
14.118.3	8.3	4.0	580
15.017.9	8.2	2.9	584
15.917.0	8.1	2.1	590
17.116.2	8.0	1.6	591
18.015.5	8.0	1.4	590
19.015.0	8.0	1.4	598
20.114.5	8.0	1.4	599
23.113.7	7.9	1.5	593

STATELINE RESERVOIR
07/12/93

0.011.8	8.6	8.0	34
1.011.8	8.4	7.7	34
2.011.8	8.3	7.6	34
3.011.8	8.2	7.5	34
4.011.8	8.1	7.4	34
5.011.5	8.1	7.3	34
6.011.4	8.0	7.3	34
7.011.4	7.9	7.3	34
8.011.2	7.9	7.3	34
9.011.1	7.8	7.3	34
10.010.8	7.8	7.2	34
12.010.2	7.8	7.2	34
14.0 9.8	7.6	7.4	33
16.0 8.9	7.7	7.6	33
18.0 8.1	7.6	7.5	34
20.0 7.6	7.6	7.3	35

STATELINE RESERVOIR
09/16/93

0.011.7	8.4	7.3	25
1.011.8	8.2	7.3	25
3.011.7	8.0	7.2	25
4.011.8	8.0	7.2	25
4.011.8	8.0	7.2	25
5.011.8	7.9	7.2	25
6.011.8	7.9	7.2	25
0.011.8	7.9	7.7	25
8.011.9	7.8	7.2	25
9.011.8	7.8	7.2	25
10.011.8	7.8	7.2	25
12.011.7	7.7	7.2	25
14.011.7	7.7	7.3	25
16.011.7	7.7	7.1	25
18.011.6	7.7	7.1	25
20.011.6	7.5	7.1	25
21.411.6	7.6	7.1	25

STATELINE RESERVOIR
03/14/95

0.0 0.9	7.5	0.3	57
1.0 0.8	7.5	8.9	51
3.0 1.7	7.4	8.2	49
5.0 2.2	7.3	7.6	49
7.0 2.5	7.3	7.3	50
8.0 2.6	7.3	7.2	50
9.0 2.7	7.3	7.0	49
11.0 2.8	7.3	6.5	50
13.0 3.0	7.2	5.9	50
15.0 3.4	7.2	2.8	62
17.0 4.0	7.2	0.0	78

STATELINE RESERVOIR
09/26/95

0.011.4	7.1	7.7	29
1.011.4	7.0	7.3	29
2.011.3	7.0	7.1	29
3.011.2	7.0	6.9	29
4.011.2	7.0	6.8	28
5.011.1	7.0	6.8	29
6.011.1	7.0	6.8	30
7.011.1	7.0	6.8	30
8.011.1	6.9	6.8	28
9.011.1	6.9	6.8	29
10.011.1	6.9	6.8	28
11.011.1	6.9	6.7	29
12.011.0	6.9	6.7	29
13.011.0	6.9	6.7	29
14.011.0	6.9	6.7	29
15.011.0	6.9	6.7	30
16.010.9	6.8	6.6	30
17.010.7	6.8	6.6	28
17.610.7	6.8	6.7	31

STATELINE RESERVOIR
09/26/95

0.011.6	7.5	7.4	29
1.011.6	7.5	7.2	28
2.011.3	7.3	7.2	28
3.011.2	7.3	7.0	28
4.011.2	7.2	7.0	28
5.011.0	7.2	7.0	29
6.011.2	7.1	7.0	29
7.011.2	7.1	6.9	28
8.011.2	7.1	6.9	28
9.011.2	7.0	6.9	29
10.011.1	7.0	6.9	28
11.011.1	7.0	6.9	28
12.011.1	7.0	6.9	29
13.011.1	7.0	6.9	30
14.011.1	6.9	6.6	32
15.011.1	6.9	6.9	29
16.011.1	7.0	6.8	30
17.011.1	6.9	6.8	29
18.011.1	6.9	6.8	30
19.011.1	6.9	6.8	27
20.011.1	6.9	6.8	28
21.011.0	6.9	6.8	29
22.011.0	6.9	6.8	30

STEINAKER RESERVOIR
07/02/93

0.019.6	8.1	7.5	245
1.019.5	8.0	7.5	244
2.019.5	8.0	7.5	244
3.019.4	8.0	7.6	244
4.019.4	8.0	7.7	244
5.019.1	8.0	7.7	244
6.017.5	7.8	7.4	243
7.016.6	7.7	7.2	244
8.015.0	7.6	7.1	244
9.014.5	7.6	6.9	247
10.014.3	7.6	6.8	249
11.013.6	7.5	6.7	250
12.011.1	7.5	6.6	256
13.010.9	7.5	6.5	271
14.010.7	7.5	6.4	271
15.010.4	7.5	6.3	274
16.010.3	7.5	6.2	277
17.0 9.7	7.5	6.2	282
18.0 9.6	7.5	6.0	287
18.5 9.6	7.5	6.0	280

STRAWBERRY RESERVOIR
06/11/93

0.012.6	8.1	8.6	263
1.012.0	8.0	7.7	267
2.011.9	8.1	7.6	267
3.011.7	8.1	7.5	264
4.011.6	8.1	7.5	264
5.011.6	8.1	7.4	261
6.011.3	8.1	7.2	269
7.010.7	8.1	7.0	268
8.010.5	8.1	6.7	269
9.0 9.6	8.0	5.5	266
10.0 8.6	7.9	3.9	267
11.0 7.7	7.8	2.3	269

STRAWBERRY RESERVOIR
06/11/93

0.013.0	8.1	7.6	253
1.012.9	8.2	7.6	252
2.012.8	8.3	7.6	253
3.012.8	8.3	7.6	253
4.012.8	8.2	7.5	253
5.012.7	8.3	7.4	252
6.011.9	8.2	7.4	253
7.011.5	8.3	7.3	253
8.011.4	8.3	7.2	253
9.011.1	8.2	7.1	254
10.010.8	8.2	6.9	254
11.010.4	8.2	6.7	255
12.010.2	8.1	6.6	256
13.0 9.5	8.1	6.1	257
14.0 7.5	7.9	5.4	258
15.0 6.6	7.9	5.1	257
16.0 6.2	7.8	4.6	259
17.0 5.8	7.7	4.6	259
18.0 5.5	7.6	4.5	258
19.0 5.4	7.6	4.5	258
20.0 5.4	7.6	4.5	258
25.0 5.0	7.5	3.8	260
30.0 4.7	7.5	3.5	262
35.0 4.5	7.5	2.9	260
40.0 4.3	7.4	1.6	270
45.0 4.2	7.4	1.6	272
50.0 4.2	7.3	0.3	271
55.0 4.2	7.3	0.2	275
57.0 4.2	7.3	0.2	272

STRAWBERRY RESERVOIR
06/11/93

0.012.4	8.1	9.4	218
1.012.1	8.1	7.5	220
2.011.6	8.1	7.3	218
3.011.4	8.1	7.3	219
4.011.2	8.1	7.3	216
5.011.0	8.1	7.3	215
6.010.9	8.1	7.1	215
7.010.8	8.1	6.8	217
8.010.6	8.1	6.6	221
9.010.4	8.0	6.1	223

STRAWBERRY RESERVOIR
06/11/93

0.013.1	8.6	8.0	215
1.013.1	8.4	7.7	216
2.013.0	8.3	7.6	216
3.012.9	8.3	7.6	216
4.011.8	8.3	7.5	215
5.011.0	8.2	7.1	220

6.0	10.8	8.2	6.8	218
7.0	10.6	8.2	6.8	220
8.0	10.6	8.2	6.9	221
9.0	10.5	8.1	7.0	222
10.0	10.5	8.1	6.8	225
11.0	10.4	8.1	6.5	230
12.0	10.4	8.1	6.3	229
13.0	10.3	8.0	6.1	231
14.0	9.8	8.0	5.4	237
15.0	9.3	7.9	4.1	243
16.0	8.9	7.8	2.3	244

STRAWBERRY RESERVOIR
06/11/93

0.0	12.2	8.2	10.0	204
1.0	12.0	8.2	8.0	203
2.0	11.8	8.2	7.8	205
3.0	11.4	8.1	7.5	212
4.0	11.2	8.2	7.3	213
5.0	11.2	8.1	7.3	213
6.0	11.2	8.1	7.2	213
7.0	11.1	8.1	7.1	215
8.0	10.9	8.1	6.8	213
9.0	10.8	8.1	6.6	213
10.0	10.7	8.1	6.5	213
11.0	10.6	8.1	6.4	214
12.0	10.6	8.0	6.0	215

STRAWBERRY RESERVOIR
06/11/93

0.0	11.9	8.1	7.9	253
1.0	12.0	8.1	7.6	252
2.0	11.7	8.1	7.5	252
3.0	11.7	8.1	7.5	253
4.0	11.7	8.2	7.5	252
5.0	11.6	8.1	7.5	253
6.0	11.6	8.2	7.4	252
7.0	11.5	8.2	7.5	253
8.0	11.4	8.2	7.4	253
9.0	11.0	8.2	7.3	253
10.0	10.9	8.2	7.2	254
11.0	10.8	8.2	7.2	255
12.0	10.7	8.2	7.2	256
13.0	10.1	8.1	6.8	256
14.0	9.6	8.1	6.4	255
15.0	8.4	8.0	5.6	256
16.0	7.3	7.9	4.7	257
17.0	6.1	7.8	4.0	260
18.0	6.0	7.7	3.8	260
19.0	5.8	7.7	3.7	259
20.0	5.7	7.7	3.6	260
25.0	5.3	7.6	3.4	262
30.0	5.0	7.5	2.9	265
35.0	4.9	7.5	2.3	263
38.0	4.8	7.5	1.7	266

STRAWBERRY RESERVOIR
11/18/93

0.0	5.9	7.7	5.9	283
2.0	5.9	7.7	5.9	283
4.0	5.9	7.7	5.9	283
6.0	5.9	7.7	5.9	284
8.0	5.9	7.7	5.8	284
10.0	5.9	7.7	5.8	285
12.0	5.9	7.7	5.8	285
14.0	5.9	7.7	5.7	285
16.0	5.9	7.7	5.6	285
18.0	5.9	7.6	5.3	285
20.0	5.9	7.6	5.3	284
25.0	5.9	7.5	5.1	283
30.0	5.9	7.4	4.6	285
35.0	5.9	7.3	0.2	291
40.0	5.7	7.3	0.2	297
45.0	5.5	7.3	0.2	301
50.0	5.4	7.2	0.2	300
55.0	5.3	7.3	0.7	305

STRAWBERRY RESERVOIR
06/03/94

0.0	15.1	8.5	9.0	245
1.0	14.5	8.6	9.7	244
2.0	13.9	8.6	9.7	244
3.0	13.5	8.6	9.7	242
4.0	13.3	8.5	9.6	245
5.0	13.1	8.5	9.5	247
6.0	12.8	8.5	9.3	249
7.0	11.9	8.5	9.2	249
8.0	10.3	8.4	7.6	249
9.0	9.7	8.0	7.4	251
10.0	9.4	8.2	7.3	252
11.0	9.2	8.2	7.2	250
12.0	9.1	8.2	7.0	254
13.0	8.9	8.2	6.8	256
14.0	8.7	8.2	6.7	255
15.0	8.6	8.2	6.7	260
16.0	8.5	8.2	6.9	260
17.0	8.3	8.2	6.6	260

STRAWBERRY RESERVOIR
06/03/94

0.0	15.3	8.2	9.3	267
1.0	14.8	8.4	9.5	264
2.0	14.6	8.5		
3.0	14.3	8.5		
4.0	13.6		9.8	262
5.0	13.2	8.6		
6.0	13.0			261
7.0	12.7		9.6	262
8.0	12.2	8.5	9.0	263
9.0	10.6			
10.0	9.4		8.9	260
11.0	8.4		8.5	266
12.0	8.0	8.4	8.1	269
13.0	7.9	8.3	7.8	
14.0	7.6	8.2	7.3	270
15.0	7.4	8.1	7.2	
16.0	7.2	8.1	7.0	268
17.0	7.1	8.0	6.9	270
18.0	7.0	8.0	6.7	270
19.0	6.5	7.9	6.5	270
20.0	6.3	7.9	6.0	271
21.0	6.1	7.9	5.9	273
22.0	6.0	7.8	5.6	272
23.0	5.8	7.9	5.6	272
24.0	5.8	7.8	5.6	273
25.0	5.7	7.7	5.5	274
26.0	5.4	7.7	5.3	274
28.0	5.3	7.7	5.1	278
30.0	5.1	7.6	4.9	278
32.0	5.1	7.6	4.8	274
34.0	5.0	7.6	4.6	277
36.0	5.0	7.6	4.4	286
38.0	4.8	7.6	4.2	281
40.0	4.8	7.6	3.9	284
42.0	4.6	7.6	3.6	278
44.0	4.6	7.6	3.5	278
46.0	4.6	7.6	3.5	282
48.0	4.6	7.6	3.5	282
50.0	4.6	7.6	3.3	282
52.0	4.5	7.6	3.2	282
54.0	4.6	7.7	3.3	282
56.0	4.6	7.7	3.3	282

STRAWBERRY RESERVOIR
07/21/94

0.0	19.5	8.5	7.4	234
1.0	19.4	8.6	7.5	233
2.0	19.3	8.6	7.4	232
3.0	19.0		7.4	232
4.0	19.0	8.5	7.4	233
5.0	18.4	8.5	7.2	234
6.0	18.8	8.5	6.9	234
7.0	18.8	8.5	6.7	233
8.0	18.1	8.3	5.6	235
9.0	16.9	8.0	4.2	235
10.0	13.4	7.7	2.7	241
11.0	11.2		2.6	237
12.0	9.0		2.5	242
13.0	8.1		2.3	242
14.0	7.7		2.5	242
15.0	7.0		2.3	240
16.0	6.8		2.4	242
18.0	6.5	7.2	2.1	241
20.0	6.2	7.2	2.0	243
24.0	5.8	7.2	1.8	242
28.0	5.5	7.2	1.5	242
32.0	5.3	7.2	1.2	243
36.0	5.2	7.2	1.0	245
40.0	5.1	7.2	0.8	243
44.0	5.0	7.2	0.7	246
48.0	4.9	7.2	0.7	247
52.0	4.9	7.2	0.7	249
54.0	4.8	7.3	0.7	249
56.0	4.9	7.3	0.7	249
57.0	5.0	7.3	0.7	250

STRAWBERRY RESERVOIR
07/21/94

0.0	19.6	8.5	6.9	218
2.0	19.3		7.1	218
4.0	19.1		7.1	217
5.0	19.1		7.0	219
6.0	19.0		7.0	218
7.0	18.9		6.9	218
8.0	18.2		5.8	218
9.0	16.1		3.4	222
10.0	15.1		2.5	221
11.0	13.8		2.0	223
12.0	12.8		1.2	224
14.0	11.1		0.8	226

STRAWBERRY RESERVOIR
08/01/94

0.0	19.2	8.4	6.7	219
1.0	19.1		6.8	220
3.0	18.7		6.6	220
5.0	18.1		5.7	220
6.0	17.6		5.2	220
7.0	17.4		5.1	219
8.0	16.5		4.1	221
9.0	14.4		2.2	228
10.0	13.6		7.4	226
11.0	12.6		0.5	228
12.0	11.9		0.6	228
13.0	11.4			
14.0	10.6		0.5	230
15.0	10.6		0.5	230
16.0	10.7		0.8	232

STRAWBERRY RESERVOIR
09/15/94

0.0	16.1	8.8	7.0	255
2.0	16.2	8.7	6.8	254
4.0	16.2	8.7	6.6	256
6.0	16.2	8.7	6.3	256
8.0	16.2	8.6	6.2	256
9.0	16.0	8.6	5.1	256
10.0	16.2	7.9	2.4	265
11.0	13.5	7.7	0.8	268
12.0	10.5	7.6	0.5	274
13.0	9.1	7.6	0.5	273
14.0	8.4	7.5	0.5	273
15.0	7.7	7.5	0.4	270
16.0	7.5	7.5	0.4	269
17.0	7.3	7.5	0.3	270
18.0	6.9	7.5	0.4	270
20.0	6.6	7.5	0.4	270
22.0	6.2	7.5	0.4	270
26.0	5.9	7.5	0.4	266
30.0	5.8	7.5	0.3	268
34.0	5.6	7.5	0.3	268
38.0	5.3	7.5	0.3	267
42.0	5.2	7.5	0.3	265
46.0	5.0	7.5	0.3	270
50.0	4.9	7.5	0.3	270
54.0	4.9	7.5	0.3	276

STRAWBERRY RESERVOIR
09/15/94

0.0	15.2	8.8	5.5	227
1.0	15.2	8.8	5.5	228
2.0	15.2	8.7	5.3	229
3.0	15.2	8.7	5.2	230
4.0	15.1	8.7	5.2	230
5.0	15.1	8.7	5.1	232
6.0	15.1	8.7	5.1	232
7.0	15.1	8.7	5.1	231
8.0	15.1	8.7	5.2	231
9.0	15.1	8.7	5.2	234
10.0	15.1	8.7	5.2	232
11.0	15.0	8.6	4.4	232
12.0	14.4	7.7	0.5	251
13.0	12.7	7.6	0.3	257
14.0	12.6	7.5	0.2	261
14.5	12.6	7.5	0.2	261

STRAWBERRY RESERVOIR
08/22/95

0.2	18.7	8.5	7.5	278
1.0	18.4	8.5	7.4	278
2.0	18.2	8.5	7.4	284
3.0	18.2	8.5	7.2	279
4.0	18.1	8.4	7.1	278
5.0	18.0	8.4	6.8	282
6.0	18.0	8.3	6.7	281
7.0	17.8	8.3	6.5	289
8.0	17.1	8.1	4.7	291
9.0	16.0	7.8	3.4	304
10.0	14.5	7.7	1.9	296
11.0	13.4	7.6	0.8	200
12.0	12.3	7.5	0.3	284
13.0	11.0	7.4	0.1	290
14.0	10.1	7.4	0.1	313
15.0	9.8	7.4	0.1	303
16.0	9.0	7.3	0.1	322

STRAWBERRY RESERVOIR
08/22/95

0.0	18.8	8.5	7.6	256
1.0	18.8	8.5	7.6	256
2.0	18.8	8.5	7.6	256
3.0	18.8	8.5	7.5	254
4.0	18.7	8.5	7.5	254
5.0	18.7	8.5	7.4	257
6.0	18.4	8.4	7.0	258
7.0	18.2	8.3	6.5	257
8.0	17.8	8.2	6.4	257
9.0	17.2	8.4	6.0	259
10.0	16.1	7.8	3.8	258
11.0	14.8	7.6	2.0	260
12.0	12.8	7.5	0.4	262
13.0	12.0	7.4	0.1	247
14.0	11.3	7.3	0.1	272
15.0	10.9	7.3	0.1	270

STRAWBERRY RESERVOIR
08/22/95

0.0	19.2	8.8	7.9	286
1.0	19.2	8.8	7.8	284
2.0	18.8	8.8	7.8	285
3.0	18.7	8.8	7.6	285
4.0	18.7	8.8	7.5	284
5.0	18.7	8.8	7.4	285
6.0	18.6	8.8	7.4	287
7.0	18.6	8.7	6.9	288
8.0	18.2	8.6	5.1	288
9.0	15.9	7.8	1.6	293
10.0	13.5	7.6	0.8	294
11.0	11.9	7.5	0.9	294
12.0	10.8	7.5	1.1	294
13.0	10.3	7.5	1.3	295
14.0	10.0	7.4	1.4	294
15.0	9.7	7.4	1.4	294
16.0	9.2	7.4	1.4	293
17.0	8.7	7.4	1.4	292
18.0	8.2	7.4	1.4	293
19.0	7.5	7.4	1.1	293
20.0	7.1	7.3	1.0	294
21.0	6.8	7.3	0.8	293
22.0	6.6	7.3	0.8	294
23.0	6.5	7.3	0.9	293
24.0	6.3	7.3	1.0	294
25.0	6.3	4.3	1.0	294
26.0	6.1	7.2	0.9	293
27.0	6.0	7.2	0.9	294
28.0	5.9	7.2	0.9	294
29.0	5.8	7.2	0.7	294
30.0	5.7	7.2	0.1	294
31.0	5.7	7.2	0.7	295
34.0	5.5	7.2	0.4	295
37.0	5.3	7.2	0.5	297
40.0	5.2	7.2	0.1	299
45.0	5.0	7.2	0.1	311
50.0	4.9	7.2	0.1	324
54.0	5.0	7.2	0.1	348
55.0	4.9	7.2	0.1	351

STRAWBERRY RESERVOIR
08/22/95

0.2	18.7	8.4	7.4	261
1.0	18.5	8.4	7.2	261
2.0	18.4	8.4	7.2	255
3.0	18.3	8.4	7.2	257
4.0	18.2	8.4	6.9	257
5.0	18.2	8.4	6.8	258
6.0	18.1	8.4	6.7	262
7.0	17.9	8.3	6.3	255
8.0	17.5	8.1	5.3	261
9.0	15.5	7.8	2.7	276
10.0	13.9	7.6	1.7	286
11.0	12.7	7.5	0.4	260
12.0	11.7	7.4	0.2	269
13.0	11.3	7.4	0.1	279
14.0	11.0	7.3	0.1	282
15.0	10.8	7.3	0.1	277
16.0	10.2	7.3	0.1	304
17.0	9.9	7.3	0.1	306
18.0	9.8	7.3	0.1	302
19.0	9.6	7.3	0.1	308
20.0	9.6	7.3	0.1	301
21.0	9.3	7.3	0.1	296

STRAWBERRY RESERVOIR
08/22/95

0.0	19.3	8.8	7.9	280
1.0	19.0	8.8	7.9	281
2.0	18.9	8.8	7.7	288
3.0	18.8	8.8	7.6	287
4.0	8.7	7.4	7.4	279
5.0	18.8	8.7	7.4	287
6.0	18.7	8.6	7.0	279
7.0	18.1	8.4	5.9	292
8.0	17.4	8.1	4.7	290
9.0	15.8	7.8	2.7	285
10.0	14.1	7.6	1.2	291
11.0	12.4	7.5	0.2	287
12.0	11.4	7.5	0.1	300
13.0	10.8	7.4	0.1	296
14.0	10.1	7.4	0.1	310
15.0	9.7	7.4	0.2	298
16.0	9.0	7.4	0.3	299
17.0	8.7	7.4	0.5	308
18.0	8.1	7.4	0.6	298
19.0	7.8	7.3	0.6	304
20.0	7.4	7.3	0.5	313
21.0	7.2	7.3	0.4	302
22.0	7.0	7.3	0.2	316
23.0	6.7	7.2	0.2	316
24.0	6.6	7.2	0.2	292
25.0	6.5	7.2	0.2	289
26.0	6.3	7.2	0.2	318
27.0	6.3	7.2	0.2	320
28.0	6.2	7.2	0.2	287
29.0	6.2	7.2	0.3	316
30.0	6.1	7.2	0.2	306
31.0	6.1	7.2	0.2	292
32.0	6.0	7.2	0.7	318
33.0	5.8	7.2	0.2	287
34.0	5.8	7.2	0.1	284
35.0	5.8	7.2	0.1	307
36.0	5.8	7.2	0.1	340

STRAWBERRY RESERVOIR
07/09/96

0.0	19.6	8.3	7.5	262
1.0	18.9	8.3	7.6	260
2.0	18.8	8.3	7.6	270
3.0	18.7	8.3	7.7	270
4.0	18.7	8.3	7.7	257
5.0	18.3	8.3	7.6	258
6.0	17.6	8.3	7.5	264
7.0	16.0	8.2	7.2	264
8.0	14.4	8.1	6.8	271
9.0	14.0	8.0	6.5	278
10.0	12.8	7.9	5.9	272
11.0	12.8	7.9	5.9	278
12.0	12.6	7.8	5.7	279
13.0	11.5	7.8	5.2	275
14.0	10.3	7.7	4.5	281
15.0	9.8	7.6	4.2	280
15.9	9.4	7.6	4.0	283
17.0	8.6	7.6	3.6	282
18.0	8.3	7.5	3.2	282
19.0	8.2	7.5	3.2	286
20.1	8.2	7.5	2.9	285
21.0	8.1	7.4	2.7	285
22.1	8.1	7.4	2.7	285
23.1	7.9	7.4	2.4	285
23.0	7.8	7.4	2.3	287

STRAWBERRY RESERVOIR
07/09/96

0.0	18.8	8.7	9.2	283
1.0	19.8	8.7	8.2	285
2.0	18.8	8.7	8.2	286
3.0	18.8	8.7	8.1	287
4.0	18.2	8.6	8.7	281
5.0	18.0	8.5	8.3	289
5.8	16.5	8.4	8.4	294
7.0	15.8	8.4	8.1	293
8.0	15.1	8.3	7.6	290
9.0	14.3	8.1	9.0	285
10.0	13.1	8.0	6.6	289
11.1	11.4	7.9	6.5	299
12.0	10.5	7.8	6.5	294
13.0	9.7	7.8	6.3	298
14.0	9.1	7.8	6.5	299
15.0	8.8	7.8	6.4	296
16.0	8.2	7.7	6.3	295
17.0	8.0	7.7	6.2	291
18.0	7.7	7.7	6.1	291
19.0	7.5	7.7	6.0	285
21.0	7.0	7.6	5.8	288
22.0	6.8	7.6	5.6	298
23.0	6.6	7.6	5.4	287
24.1	6.4	7.6	5.1	298
25.0	6.1	7.5	4.6	302
26.0	6.0	7.5	4.6	303
27.0	5.9	7.5	4.5	305
28.0	5.8	7.5	4.5	301
29.0	5.7	7.5	4.2	289
30.0	5.6	7.4	4.2	302
31.0	5.5	7.4	3.9	297
32.0	5.4	7.4	3.8	301
34.0	5.3	7.4	3.8	309
36.0	5.2	7.4	3.6	309
38.0	5.1	7.4	3.3	309
40.0	5.0	7.4	3.0	323
42.0	4.9	7.3	2.7	313
45.0	4.8	7.3	2.3	299
48.0	4.7	7.3	2.1	322
50.0	4.5	7.3	0.8	297
55.0	4.4	7.2	0.2	311
58.6	4.4	7.2	0.1	331

STRAWBERRY RESERVOIR
08/29/96

0.0	14.9	9.5	9.6	40
0.1	18.5	9.1	7.9	266
1.0	18.4	9.1	8.1	266
2.0	18.2	9.1	8.0	268
3.0	18.1	9.1	7.9	269
4.0	18.1	9.0	7.7	265
5.0	18.1	9.0	7.6	268
6.0	18.0	9.0	7.3	270
7.0	17.6	8.5	4.2	275
8.0	16.9	8.0	2.7	274
8.9	16.2	7.8	1.4	282
10.0	14.6	7.6	4.7	285
11.0	12.8	7.5	0.1	287
12.0	11.8	7.4	0.1	289
13.0	10.8	7.4	0.1	282
14.0	10.3	7.4	0.1	290
15.1	9.7	7.4	0.3	281
16.0	9.4	7.4	0.2	290
17.0	8.8	7.4	1.3	290
18.0	8.3	7.4	1.8	290
19.0	7.9	7.4	2.0	293
20.0	7.4	7.4	2.1	298
21.0	7.3	7.4	1.9	292
22.0	7.2	7.4	1.4	295
22.9	6.9	7.3	1.0	305
24.0	6.7	7.3	0.9	309
25.0	6.6	7.3	0.9	307
26.0	6.5	7.3	0.7	302
27.0	6.4	7.3	0.6	298
28.0	6.3	7.2	0.5	306
29.0	6.2	7.2	0.5	306
29.9	6.1	7.2	0.4	311
32.0	6.0	7.2	0.2	301
33.6	6.0	7.2	0.2	319

STRAWBERRY RESERVOIR
08/29/96

0.1	19.8	9.0	8.0	268
1.0	18.6	9.1	8.6	265
2.0	18.3	9.1	9.1	265
3.0	18.2	9.1	9.0	266
4.0	18.1	9.0	9.0	267
5.0	17.7	8.8	8.2	271
6.0	17.4	8.7	8.1	270
7.0	17.2	8.6	7.5	277
8.0	16.7	8.2	3.7	284
9.0	14.8	7.6	0.2	291
10.0	13.7	7.5	0.1	289
11.0	12.4	7.5	0.1	287
12.0	11.4	7.4	0.1	285
13.0	10.5	7.4	0.1	287
13.9	10.3	7.3	0.1	284
15.0	10.0	7.3	0.1	287
16.0	9.5	7.3	0.1	290
17.1	8.9	7.3	0.1	297
18.0	8.2	7.2	0.1	299
19.0	7.9	7.2	0.1	303
19.7	7.8	7.3	0.1	300

STRAWBERRY RESERVOIR
08/29/96

0.0	18.8	9.2	8.2	263
1.0	18.7	9.2	8.1	263
2.0	18.6	9.2	7.9	263
2.9	18.5	9.1	8.0	293
4.0	18.5	9.1	8.1	264
5.0	18.4	9.1	7.9	264
6.0	18.2	9.0	7.3	266
7.0	18.1	8.9	6.8	267
8.0	17.3	8.2	2.4	279
9.0	15.4	7.7	0.7	287
10.0	14.3	7.6	0.5	290
12.0	12.2	7.6	0.8	292
13.0	11.7	7.5	0.8	291
14.0	10.8	7.5	1.1	290
15.0	10.2	7.5	1.8	291
16.0	9.4	7.5	2.2	293
17.0	8.8	7.5	2.5	294
18.0	8.4	7.5	2.5	293
19.0	8.0	7.5	2.5	294
20.0	7.5	7.5	2.5	296

21.0	7.1	7.4	2.3	297
22.0	6.8	7.4	2.0	297
23.0	6.7	7.4	4.5	298
24.0	6.4	7.4	1.5	298
25.0	6.3	7.3	1.3	299
26.0	6.2	7.3	1.1	298
27.0	6.2	7.3	1.1	299
28.0	6.1	7.3	1.2	299
29.0	6.0	7.3	1.0	299
30.0	5.9	7.3	0.1	299
32.0	5.8	7.3	9.8	300
34.0	5.6	7.3	1.1	300
36.0	5.5	7.3	0.1	301
38.0	5.5	7.2	0.5	302
40.0	5.4	7.2	0.3	302
42.0	5.3	7.2	0.1	304
44.0	5.2	7.3	0.2	302
46.0	5.2	7.3	0.2	294
48.0	5.1	7.2	0.1	336
50.0	5.0	7.2	0.1	326
55.0	5.0	7.2	0.1	334
57.8	5.0	7.2	0.7	346

STRAWBERRY RESERVOIR
08/29/96

0.019.5	9.1	8.9	259
1.018.6	9.1	8.8	261
2.018.3	9.1	8.4	264
2.918.2	9.0	7.6	262
4.018.1	9.0	7.2	261
5.018.0	8.9	6.9	261
6.017.8	8.8	6.4	264
7.017.2	8.5	5.0	268
8.017.0	8.4	4.5	268
9.016.8	8.3	3.7	271
10.014.7	7.7	1.3	273
11.012.9	7.5	0.3	284
12.011.9	7.5	0.1	286
13.011.4	7.4	0.1	275
14.010.6	7.3	0.1	273
15.010.4	7.3	0.1	276
16.010.0	7.3	0.1	277
17.0 9.9	7.3	0.1	279
18.0 9.5	7.3	0.1	285
19.0 9.1	7.3	0.1	293
20.0 8.9	7.3	0.1	289
20.9 8.7	7.3	0.1	290

STRAWBERRY RESERVOIR
08/29/96

0.119.0	9.1	0.9	4,255
1.019.0	9.1	9.2	255
2.018.1	9.1	9.1	252
3.117.8	9.0	8.3	257
4.017.8	9.0	7.9	260
4.017.8	9.0	7.9	256
5.017.7	8.9	7.7	260
6.017.6	8.9	7.7	259
7.017.6	8.9	7.6	255
8.016.7	8.4	5.0	259
9.015.6	7.8	2.5	261
10.114.5	7.5	1.1	270
11.012.9	7.5	0.5	274
12.012.1	7.4	0.5	271
13.011.4	7.3	0.3	275
13.910.7	7.3	0.3	270
15.110.0	7.3	0.2	275
16.0 9.4	7.3	0.1	276
17.0 9.1	7.2	0.1	279
18.0 8.8	7.2	0.1	278
19.0 8.5	7.2	0.1	280
20.1 8.3	7.2	0.0	287
20.5 8.3	7.2	0.1	293

STRAWBERRY RESERVOIR
08/29/96

0.018.5	9.1	8.6	258
1.018.5	9.1	8.7	258
2.118.4	9.1	8.6	258
3.017.9	9.1	8.5	258
4.017.8	9.1	8.1	258
5.017.7	9.0	7.9	259
6.017.7	9.0	7.6	259
7.017.6	9.0	7.5	259
8.017.5	9.0	7.1	259
9.017.3	8.8	6.6	261
10.115.6	8.0	2.7	269
11.012.8	7.6	0.6	272
12.011.3	7.4	0.2	273
13.010.3	7.4	0.1	276
14.0 9.9	7.4	0.1	276
15.0 9.6	7.3	0.1	277
16.0 9.5	7.3	0.1	277
16.9 9.2	7.3	0.1	278
18.0 8.9	7.3	0.1	279
18.7 8.8	7.3	0.1	276

THREE CREEK RESERVOIR
08/13/96

0.017.8	8.4	7.6	112
1.016.2	8.4	7.2	113
2.014.6	8.3	6.9	115
2.314.0	8.2	6.5	117

THREE CREEKS RESERVOIR
08/04/94

0.016.2	9.0	7.6	106
1.016.4	9.0	7.3	106
2.014.5	8.7	7.2	106
2.314.1	8.6	7.2	106

TIBBLE FORK RESERVOIR
06/10/93

0.0	7.8	8.3	10.1	323
1.0	7.3	8.4	9.4	323
2.0	7.2	8.4	9.4	323
3.0	7.1	8.4	9.3	323
4.0	6.9	8.4	9.3	322
5.0	6.9	8.4	9.3	322
6.0	6.8	8.4	9.3	322
7.0	6.7	8.4	9.2	322
6.0	6.6	8.5	9.2	321

TIBBLE FORK RESERVOIR
08/12/93

0.013.5	8.2	8.2	374
1.017.0	8.5	8.3	359
2.010.7	8.2	8.2	359
3.010.5	8.1	8.1	375
4.010.4	8.1	8.0	380
5.010.4	8.1	8.0	379
6.210.3	8.1	8.0	379

TIBBLE FORK RESERVOIR
06/20/95

0.0	9.2	8.2	9.5	267
1.0	9.0	8.2	9.4	265
2.0	8.9	8.2	9.3	269
3.0	8.2	8.1	9.2	269
4.0	7.1	8.1	9.3	257
5.0	7.0	8.1	9.3	287
6.0	7.0	8.1	9.3	257
6.8	7.0	8.1	9.3	257

TIBBLE FORK RESERVOIR
08/09/95

0.012.7	8.7	9.4	355
1.012.4	8.6	9.4	348
2.011.4	8.6	9.2	348
3.010.9	8.6	9.2	348
4.010.4	8.6	9.3	340
5.010.0	8.6	9.4	326
6.0 9.7	8.6	9.5	322
7.0 9.6	8.6	9.5	323
8.0 9.6	8.6	9.4	323

TONY GROVE LAKE
08/25/93

0.017.0	8.9	9.0	203
1.017.2	9.0	9.0	204
2.017.2	9.0	9.1	206
3.017.2	9.0	9.2	203
4.016.6	8.9	9.2	205
5.015.6	8.9	6.4	202
6.012.0	7.7	2.8	283
7.0 9.6	7.5	0.8	304
8.0 6.8	7.3	0.5	324
9.0 5.6	7.2	0.3	330
10.0 5.4	7.1	0.3	336
11.0 5.1	7.0	0.2	370

TONY GROVE LAKE
08/08/95

0.019.6	6.9	9.3	243
1.019.6	6.9	9.2	243
2.019.6	6.9	9.2	245
3.019.2	6.9	9.3	245
4.017.6	8.5	5.9	281
5.013.8	8.1	2.8	332
6.0 8.9	8.0	1.6	345
7.0 7.5	7.7	1.2	235

TRIAL LAKE
07/26/94

0.018.4	6.6	6.7	20
1.018.4	6.6	6.7	21
2.018.3	6.6	6.7	19
3.017.2	6.6	6.7	21
4.016.7	6.6	6.6	19
5.516.7	6.6	6.6	20

TRIAL LAKE
02/24/95

0.0	0.3	7.6	7.4	36
1.0	0.5	7.3	6.9	30
2.0	0.4	7.2	5.9	30

TRIAL LAKE
07/16/96

0.016.9	8.0	6.5	15
1.016.7	7.6	6.5	15
2.115.9	7.5	6.9	15
3.015.5	7.6	7.1	15
4.013.8	7.5	8.0	15
4.810.4	7.5	8.1	15

TROPIC RESERVOIR
06/03/93

0.014.5	8.1	7.3	404
1.014.5	8.0	7.0	404
2.014.1	8.0	6.9	404
3.013.7	8.0	7.0	404
4.013.6	8.0	7.0	405
5.013.4	8.0	6.8	404
6.013.2	8.0	6.7	405
7.013.2	7.8	3.7	407

TROPIC RESERVOIR
09/13/95

0.016.8	8.9	9.1	305
1.016.8	8.9	8.9	305
2.015.9	9.0	9.3	303
3.015.6	9.0	9.3	302
4.015.4	9.0	10.2	299
4.715.4	9.1	10.5	304

UPPER ENTERPRISE
RESERVOIR 06/02/93

0.018.1	9.6	11.9	123
1.018.1	9.5	11.8	123
2.018.1	9.4	11.8	122
3.018.0	9.3	11.7	123
4.018.1	9.3	11.7	123
5.018.1	9.4	11.6	123
6.015.2	9.1	11.2	122
7.013.6	8.8	6.5	118
8.012.1	8.4	6.2	118
9.011.7	8.4	6.0	116
10.011.6	8.4	5.7	117
11.011.5	8.3	5.6	117
12.011.5	8.4	5.1	116
13.011.4	8.4	4.8	118
14.011.4	8.3	4.6	118
15.011.3	8.3	4.2	119
16.011.2	8.2	4.0	122
16.611.2	8.1	3.7	122

UPPER ENTERPRISE
RESERVOIR 08/04/93

0.021.2	9.1	8.5	143
1.021.2	9.1	8.4	143
2.021.2	9.1	8.4	145
3.021.2	9.1	8.3	144
4.021.2	9.1	8.3	144
5.021.2	8.9	6.7	144
6.019.3	8.5	4.6	144
7.018.9	8.1	4.0	145
8.018.3	7.9	2.7	145
9.016.6	7.5	0.4	144
10.015.3	7.4	0.2	143
11.013.7	7.2	0.2	140
12.013.0	7.1	0.1	139
13.012.8	7.0	0.1	138
14.012.4	7.0	0.1	138
15.212.1	7.0	0.1	139

UPPER ENTERPRISE
RESERVOIR 08/10/95

0.021.8	8.7	6.7	166

1.021.8	8.8	6.7	167
2.021.8	8.8	6.7	167
3.021.8	8.8	6.7	167
4.021.7	8.7	6.3	167
5.021.4	8.6	5.7	167
6.020.5	8.2	3.8	164
7.017.0	7.4	0.1	165
8.015.0	7.2	0.1	165
9.014.1	7.2	0.1	156
10.013.6	7.1	0.1	156
11.013.5	7.1	0.1	159
12.013.4	7.1	0.1	155
13.013.0	7.0	0.1	173

UPPER ENTERPRISE RESERVOIR 08/10/95

0.022.0	8.8	7.0	168
1.022.0	8.8	6.8	165
2.022.0	8.5	6.8	168
3.022.0	8.8	6.8	168
4.022.0	8.7	6.3	167
5.020.6	8.1	4.5	169
5.720.3	7.9	2.7	171

UPPER STILLWATER RESERVOIR 06/24/93

0.0	9.1	6.9	8.5	17
1.0	9.0	6.7	8.6	16
2.0	9.0	6.6	8.2	16
3.0	9.0	6.6	8.4	16
4.0	8.9	6.6	8.5	16
5.0	8.9	6.5	8.4	16
6.0	8.9	6.5	8.3	16
7.0	8.9	6.5	8.3	16
8.0	8.9	6.5	8.4	16
9.0	8.9	6.4	8.4	16
10.0	8.8	6.4	8.4	17
11.0	8.8	6.4	8.5	16
12.0	8.5	6.5	8.8	18
13.0	8.3	6.4	8.6	17
14.0	8.0	6.4	8.6	17
15.0	7.9	6.3	8.7	17
16.0	7.8	6.3	8.6	17
17.0	7.7	6.3	8.6	17
18.0	7.6	6.3	8.5	17
19.0	7.4	6.3	8.4	17
20.0	7.0	6.3	8.6	17
21.0	6.9	6.3	8.6	17
22.0	6.8	6.3	8.7	17
24.0	6.5	6.3	8.7	17
26.0	6.3	6.3	8.8	17
28.0	6.2	6.3	8.8	17
30.0	6.2	6.3	8.8	17
32.0	6.1	6.3	8.8	17
34.0	6.0	6.2	8.8	18
36.0	6.0	6.2	8.8	18
38.0	5.9	6.2	8.8	18
40.0	5.9	6.2	8.8	18
42.0	5.8	6.2	8.8	18
44.0	5.8	6.2	8.7	18
46.0	5.7	6.2	8.7	18
48.0	5.7	6.2	8.7	18
50.0	5.7	6.0	8.7	18
54.0	5.6	6.2	8.6	18

VALLEY RESERVOIR 08/31/95

0.019.3	8.8	6.8	358
1.019.4	8.8	6.6	361
2.019.4	8.9	6.6	361
3.019.4	8.9	6.6	362
4.019.4	8.9	6.6	361
5.019.3	8.9	6.6	362
6.018.4	8.8	6.9	375
7.017.3	8.8	6.3	377
8.016.0	8.6	4.9	389
9.013.6	8.6	5.6	367
10.012.1	8.6	5.3	363
11.011.5	8.5	5.1	363
12.011.1	8.5	4.7	363
13.010.6	8.4	4.4	365
14.010.3	8.4	4.3	364
15.010.1	8.4	4.3	365
16.010.0	8.3	4.3	365
17.0 9.9	8.3	4.3	365

WASHINGTON LAKE 07/26/94

0.018.1	7.5	6.7	19
1.018.1	7.0	6.7	19
2.016.5	6.4	6.9	19
3.011.0	6.6	7.0	18
4.0 8.3	6.4	6.6	18
5.0 7.4	6.2	5.6	17
6.0 7.0	6.1	5.6	16
7.0 6.3	5.9	4.2	16
8.0 6.1	5.8	4.0	15

WASHINGTON LAKE 02/24/95

0.0	0.5	7.6	8.9	32
1.0	2.0	7.3	7.0	27
2.0	3.1	7.1	6.2	23
3.0	3.6	7.0	5.9	22
4.0	3.7	7.0	5.5	22
5.0	3.8	6.9	4.8	22
6.0	3.9	6.8	4.1	22
7.0	4.0	6.7	3.0	22
8.1	4.2	6.5	1.3	32

WHITNEY RESERVOIR 09/15/93

0.012.8	8.3	8.0	200
1.012.8	8.7	7.8	200
2.012.6	8.7	7.9	200
3.012.5	8.7	7.8	200
4.012.5	8.7	7.8	200
5.012.5	8.7	7.8	199
5.712.5	8.8	7.8	202

WHITNEY RESERVOIR 09/28/95

0.010.2	7.6	7.2	205
1.010.2	7.8	7.3	210
2.010.2	7.9	7.4	210
3.010.2	7.9	7.4	210
4.010.2	7.9	7.6	210
5.010.1	8.0	7.6	211
6.010.1	8.0	7.8	211

WIDE HOLLOW RESERVOIR 07/13/94

0.022.7	10.2	10.2	385
1.022.8	10.2	10.1	384
1.922.7	8.8	0.7	387

WIDE HOLLOW RESERVOIR 06/27/96

0.021.0	10.5	10.6	405
1.020.9	10.5	10.9	406
2.020.8	10.5	10.9	407
3.020.8	10.5	11.6	407
3.620.7	9.9	9.8	416

WIDE HOLLOW RESERVOIR 09/05/96

0.019.7	9.0	6.8	474
1.019.7	9.1	6.9	474
1.619.7	9.2	6.9	475

WILLARD BAY RESERVOIR 06/13/94

0.026.1	8.7	7.0	938
1.024.7	8.7	7.1	943
2.024.3	8.7	7.2	943
3.023.7	8.7	7.1	943
4.023.1	8.7	7.0	943
5.022.3	8.6	5.9	949
6.020.6	8.2	1.4	962

WILLARD BAY RESERVOIR 06/19/96

0.022.3	8.6	7.4	707
1.021.9	8.6	7.2	707
2.021.3	8.6	7.1	709
3.121.1	8.6	6.9	709
4.021.0	8.6	6.7	709
5.021.0	8.6	6.6	709
6.021.0	8.6	6.7	710
7.020.7	8.5	6.3	711
7.420.6	8.4	5.1	714

WILLARD BAY RESERVOIR 06/19/96

0.022.2	8.6	7.2	708
1.122.1	8.6	7.1	708
2.021.2	8.6	6.9	711
3.020.6	8.6	7.0	711
4.020.6	8.6	6.9	711
5.020.5	8.6	7.0	711
5.920.2	8.6	6.7	713

WILLARD BAY RESERVOIR 06/19/96

0.021.6	8.6	7.5	711
1.021.4	8.6	7.6	711
2.021.1	8.6	7.9	712
3.020.7	8.6	8.3	712
4.020.6	8.5	8.2	710
7.620.0	8.3	8.1	711

WILLARD BAY RESERVOIR 06/19/96

0.021.6	8.6	6.9	712
1.021.0	8.5	6.8	713
2.020.4	8.5	6.4	714
3.020.3	8.5	6.4	713
4.020.3	8.5	6.5	713
5.020.3	8.5	6.5	713
5.220.3	8.5	6.5	713

WILLARD BAY RESERVOIR 08/07/96

0.022.7	8.4	6.9	725
1.022.7	8.4	7.0	727
2.022.7	8.4	6.9	729
3.022.7	8.4	6.9	729
4.122.7	8.4	6.9	729
5.122.7	8.4	6.9	729
5.922.4	8.2	5.9	735
6.422.4	8.1	4.8	737

WILLARD BAY RESERVOIR 08/07/96

0.022.4	8.3	6.9	728
0.922.5	8.4	7.0	730
2.022.5	8.4	7.0	730
3.122.5	8.4	7.0	730
4.122.5	8.4	6.9	730
5.022.5	8.3	6.9	730
6.022.4	8.3	6.0	724

WILLARD BAY RESERVOIR 08/07/96

0.022.3	8.4	7.1	729
1.122.3	8.5	7.1	730
2.022.3	8.5	7.1	730
3.022.3	8.5	7.0	730
4.122.3	8.5	7.0	730
5.022.3	8.5	7.0	730
5.522.3	8.5	6.9	730

WILLARD BAY RESERVOIR 08/07/96

0.022.2	8.4	6.7	725
1.022.1	8.4	6.6	728
2.022.1	8.4	6.6	728
3.022.1	8.4	6.5	730
4.022.1	8.4	6.5	729
5.022.1	8.4	6.5	730
5.922.1	8.4	6.4	730
6.922.1	8.4	6.4	730

WOODRUFF CREEK RESERVOIR 08/25/93

0.016.9	8.5	8.8	334
1.016.6	8.5	8.5	335
2.016.6	8.4	8.5	336
3.016.4	8.5	8.3	337
4.016.4	8.5	8.2	339
5.015.1	8.2	5.7	349
6.014.5	8.1	4.9	352
7.014.4	7.9	3.5	354
8.013.4	7.7	1.3	352
9.011.0	7.6	1.1	345
10.0 9.1	7.5	0.1	325
11.0 8.1	7.5	0.1	318
12.0 7.3	7.5	0.1	322
13.0 7.2	7.5	0.1	325
14.0 7.0	7.5	0.1	328
15.0 6.9	7.4	0.1	330

WOODRUFF CREEK RESERVOIR 08/30/93

0.016.9	8.5	8.8	334
1.016.6	8.6	8.5	335
2.016.6	8.4	8.5	336

3.016.4	8.5	8.3	337
4.016.4	8.5	8.2	339
5.015.1	8.2	5.7	349
6.014.5	8.1	4.9	352
7.014.4	7.9	3.5	354
8.013.4	7.7	1.3	352
9.011.0	7.6	1.1	345
10.0 9.1	7.5	0.1	325
11.0 8.1	7.5	0.1	318
12.0 7.3	7.5	0.1	322
13.0 7.2	7.5	0.1	325
14.0 7.0	7.5	0.1	328
15.0 6.9	7.4	0.1	330

WOODRUFF CREEK RESERVOIR
09/07/95

0.018.1	9.2	7.5	334
1.017.9	9.2	7.2	334
2.017.4	9.2	6.9	338
3.016.7	9.2	6.7	343
4.016.4	9.1	5.9	348
5.016.9	9.0	5.9	353
6.015.8	9.0	5.5	354
7.015.6	8.9	5.1	360
8.015.5	8.9	4.9	358
8.715.3	8.8	4.5	358

YANKEE MEADOWS
RESERVOIR 07/05/94

0.019.2	8.6	8.0	157
1.019.2	8.6	8.1	156
2.019.1	8.6	8.1	157
3.018.9	8.6	8.1	154
4.016.3	8.4	7.5	156
5.015.5	8.1	6.1	164
6.015.3	7.8	5.1	163
7.014.9	7.6	4.4	166

YANKEE MEADOWS
RESERVOIR 08/16/94

0.021.1	8.9	10.1	140
1.021.0	8.8	10.3	140
2.018.8	9.1	9.2	142
3.018.3	9.1	8.7	140
4.017.7	9.1	7.7	139
5.017.4	9.0	7.7	140

YANKEE MEADOWS
RESERVOIR 07/02/96

0.017.1	8.7	6.8	163
1.016.6	8.7	6.6	163
2.016.5	8.7	6.7	163
3.016.0	8.7	6.7	163
4.015.6	8.6	6.7	163
5.015.4	8.6	6.6	163
6.015.1	8.5	6.0	164
7.014.8	8.2	5.2	166

YANKEE MEADOWS
RESERVOIR 08/14/96

0.018.3	9.5	10.5	141
1.017.9	9.5	10.1	142
2.017.7	9.4	9.6	142
3.017.5	9.4	8.9	143
4.016.8	9.3	8.5	143
4.316.6	9.3	8.3	143

APPENDIX II

BATHYMETRIC MAPPING

APPENDIX III

SOIL ASSOCIATIONS DATA

Soil Associations for Utah Lakes and Reservoirs Watersheds										
Lake / Reservoir	Soil Type/Percent Relative									
Anderson Meadow Reservoir	1 (100%)									
Ashley Twin Reservoir	4 (50%)	70 (50%)								
Baker Dam Reservoir	38 (24%)	3 (24%)	5 (18%)	8 (15%)	41 (12%)	18 (6%)	1 (100%)			
Barney Lake	1 (90%)	22 (10%)								
Bear Lake	44 (28%)	31 (24%)	25 (15%)	4 (11%)	1 (10%)	43 (5%)	29 (3%)	70 (3%)	21 (1%)	
Beaver Dam Meadow Reservoir	4 (100%)									
Big East Lake	1 (86%)	22 (14%)								
Big Lake	1 (90%)	22								
Big Sand Wash Reservoir	4 (62%)	9 (15%)	38 (9%)	17 (9%)	70 (4%)	63 (1%)				
Birch Creek Reservoir #2	25 (70%)	1 (20%)	31 (10%)							
Blanding Reservoir #4	68 (90%)	18 (10%)								
Bridger Lake	4 (100%)									
Brough Reservoir	63	51	17	4	70					
Browne Lake	4 (89%)	70 (11%)								
Butterfly Lake	4 (92%)	70 (8%)								
Calder Reservoir	5 (90%)	4 (10%)								
Causey Reservoir	24 (41%)	25 (37%)	1 (22%)							
China Lake	4 (100%)									

Soil Associations for Utah Lakes and Reservoirs Watersheds

Lake / Reservoir	Soil Type/Percent Relative									
Cleveland Reservoir	1 (100%)									
Cook Lake	1 (25%)	3 (75%)								
Currant Creek Reservoir	1 (90%)	5								
Dark Canyon Lake	1 (100%)									
Deer Creek Reservoir	25 (35%)	24 (33%)	1 (30%)	21 (22%)	4 (3%)	70 (3%)				
DMAD Reservoir	47 (11.2%)	1 (11%)	3 (10%)	22 (10%)	2 (10%)	49 (9.2%)	48 (8.3%)	50 (7.2%)	5 (4%)	69 (.4%)
	13 (4%)	61 (3%)	30 (2.5%)	9 (2%)	51 (1.4%)	65 (1.3%)	52 (1.2%)	12 (1%)	35 (1%)	8 (.9%)
	10 (.9%)									
Donkey Reservoir	1 (50%)	5 (50%)								
Duck Fork Reservoir	1 (100%)									
East Canyon Reservoir	1 (52%)	22 (19%)	25 (19%)	26 (6%)	21 (3%)					
East Park Reservoir	4 (100%)									
Echo Reservoir	4 (43%)	25 (39%)	21 (11%)	24 (7%)						
Electric Lake Reservoir	1 (85%)	69 (15%)								
Fairview Reservoir	1 (60%)	22 (40%)								
Ferron Reservoir	1 (100%)									
Fish Lake	3 (100%)									
Flaming Gorge Reservoir	BF-10 (48%)	MC-8 (23%)	BF-5 (8.6%)	MC-7 (6.8%)	MC-10 (5.7%)	BF-6 (2.5%)	MF-3 (2%)	MC-9 (2%)	BX-1 (.3%)	BF-1 (.3%)
	MX-1 (.3%)									
Forsyth Reservoir	1 (98%)	5 (2%)								

Soil Associations for Utah Lakes and Reservoirs Watersheds

Lake / Reservoir	Soil Type/Percent Relative									
Grantsville Reservoir	47 (20%)	39 (20%)	50 (20%)	22 (20%)	1 (20%)					
Gunlock Reservoir	38 (39.4%)	41 (17.0%)	18 (15.9%)	8 (8.5%)	5 (6.4%)	3 (4.3%)	36 (4.3%)	68 (3.1%)	63 (1.1%)	
Gunnison Bend Reservoir	52 (11.9%)	47 (11.0%)	1 (10.%5)	3 (9.9%)	22 (9.9%)	49 (9.0%)	48 (8.2%)	50 (7.1%)	5 (3.9%)	10 (.8%)
	13 (3.9%)	65 (3.2%)	61 (2.9%)	30 (2.4%)	51 (2.0%)	9 (1.8%)	12 (.9%)	35 (.9%)	8 (.8%)	69 (.3%)
Gunnison Reservoir	22 (48%)	49 (14%)	33 (13%)	1 (10%)	61 (4%)	50 (4%)	48 (2%)	25 (2%)	26 (2%)	60 (1%)
Hoop Lake	4 (86%)	70 (14%)								
Hoover Lake	4 (100%)									
Huntington Lake North	1 (70%)	69 (15%)	68 (6%)	63 (3%)						
Huntington Reservoir	1 (100%)									
Hyrum Reservoir	24 (65%)	28 (18%)	26 (17%)							
Joes Valley Reservoir	1 (70%)	5 (20%)	69 (10%)							
Johnson Reservoir	3 (100%)									
Jordanelle Reservoir	1	70	4	25	24	21				
Kens Lake	68	51	41	7	5	19				
Kents Lake	1 (100%)									
Kolob Reservoir	1 (100%)									
Koosharem Reservoir	1 (18%)	9 (53%)	10 (29%)							
Labaron Reservoir	1 (100%)									
Lake Mary	1 (100%)									
Lake Powell	68 (7.25%)	1 (6.15%)	4 (1.6%)	5 (1.6%)	63 (1.6%)	69 (1.6%)	41 (1.7%)	3 (1.05%)	17 (.95%)	42 (.06%)
	55 (.945%)	65 (.75%)	18 (.7%)	22 (.65%)	52 (.65%)	70 (.65%)	16 (.6%)	64 (.5%)	2 (.38%)	6 (.01%)

Soil Associations for Utah Lakes and Reservoirs Watersheds

Lake / Reservoir	Soil Type/Percent Relative									
	9 (.375%)	14 (.27%)	39 (.195%)	38 (.17%)	51 (.17%)	35 (.13%)	36 (.12-24%)	61 (.12%)	15 (.11%)	67 (.05%)
	19 (.1%)	60 (.085%)	11 (.065%)	40 (.065%)	20 (.055%)	54 (.07%)	A-5-B (.51%)	A-4-C (1.8%)	A-5-A (.9%)	A-4-B (.71%)
	C-23 (.43%)	C-9 (.57%)	C-6 (.51%)	C-62 (.41%)	C-1 (7.19%)	C-42 (3.19%)	C-58 (2.89%)	C-35 (2.39%	C-56 (2.1%)	C-18 (.38%)
	C-47 (1.99%)	C-57 (1.39%)	C-3 (1.29%)	C-24 (1.29%)	C-34 (1.29%)	C-60 (1.26)	C-59 (1.12%)	C-10 (1.11%)	C-12 (.99%)	C-54 (.35%)
	C-33 (.93%)	C-2 (.86%)	C-13 (.80%)	C-21 (.78%)	C-41 (.73%)	C-55 (.70%)	C-52 (.68%)	C-28 (.66%)	C-30 (.62%)	C-49 (.37%)
	C-72 (.38%)	C-53 (.38%)	C-16 (.45%)	NM-1 (.68)	NM-3 (.905)	NM-4 (.12)	NM-5 (.68)	NM-7 (.98%)	NM-8 (.62%)	MX-1 (.05%)
	MC-8 (4.3%)	MC-7 (1.2%)	MC-10 (1%)	MF-3 (.3%)	MC-9 (.3%)	BX-1 (.05%)	BF-6 (.4%)	\BF-5 (1.6%)	BF-10 (9%)	BF-1 (.05%)
Little Creek Reservoir	25 (40%)	1 (30%)	31 (30%)							
Little Dell Reservoir	1	24								
Lloyds Reservoir	7	1								
Long Park Reservoir	4 (100%)									
Lost Creek Reservoir	22 (84%)	1 (16%)								
Lower Bowns Reservoir	11	1								
Lower Box Reservoir	1									
Lower Gooseberry Reservoir	1 (100%)									
Lyman Lake	4 (100%)									
Manning Meadow Reservoir	1 (100%)									
Mantua Reservoir	28 (50%)	23 (40%)	26 (10%)							
Marsh Lake	4 (80%)	70 (20%)								
Marshall Lake	4 (57%)	70 (43%)								
Matt Warner Reservoir	4	5								
Meeks Cabin Reservoir	4 (81%)	70 (19%)								

Soil Associations for Utah Lakes and Reservoirs Watersheds

Lake / Reservoir	Soil Type/Percent Relative									
Mill Hollow Reservoir	1 (100%)									
Mill Meadow Reservoir	1 (65%)	5 (25%)	3 (10%)							
Millers Flat Reservoir	1 (100%)									
Millsite Reservoir	1 (50%)	5 (25%)	68 (15%)	69 (10%)						
Minersville Reservoir	34 (26%)	1 (24%)	22 (16%)	29 (10%)	49 (9%)	30 (7%)	28 (4%)	31 (2%)	50 (2%)	70 (1%)
Mirror Lake	4 (70%)	70 (30%)								
Mona Reservoir	34 (40%)	47 (10%)	50 (20%)	62 (30%)						
Moon Lake	70 (74%)	4 (26%)								
Monticello Lake	7 (100%)									
Navajo Lake	1 (90%)	70 (10%)								
New Castle Reservoir	45 (31%)	5 (26%)	8 (24%)	50 (14%)	49 (5%)					
Newton Reservoir	22 (42%)	26 (29%)	62 (29%)							
Nine Mile Reservoir	48 (69%)	50 (13%)	33 (18%)							
Oak Park Reservoir	4 (100%)									
Otter Creek Reservoir	1 (30%)	9 (25%)	10 (25%)	35 (20%)						
Palisade Reservoir	1 (85%)	22 (15%)								
Panguitch Lake	1 (96%)	70 (4%)								
Paradise Park Lake	4 (100%)									
Pelican Lake	4	63	55	42	17					
Pine Lake	64 (80%)	1 (20%)								
Pineview Reservoir	24 (34%)	22 (27%)	26 (14%)	1 (13%)	25 (12%)					

Soil Associations for Utah Lakes and Reservoirs Watersheds

Lake / Reservoir	Soil Type/Percent Relative									
Piute Reservoir	1 (38%)	9 (16%)	35 (11%)	8 (8%)	10 (7.6%)	30 (5.8%)	12 (3%)	48 (3%)	49 (2.3%)	22 (0.4%)
	5 (1.4%)	3 (0.9%)	61 (0.6%)							
Porcupine Reservoir	24 (72%)	1 (19%)	25 (9%)							
Posey Lake	1 (80%)	3 (20%)								
Puffer Lake	1 (95%)	70 (5%)								
Pyramid Lake	4 (57%)	70 (43%)								
Quail Creek Reservoir										
Recapture Creek Reservoir	68	1	7							
Red Creek Reservoir (Iron)	1 (100%)									
Red Creek Reservoir	1 (100%)									
Red Fleet Reservoir	63	17	4	5						
Redmond Reservoir	48 (100%)									
Rexs Reservoir	1 (50%)	22 (50%)								
Rockport Reservoir	4 (51%)	25 (30%)	21 (13%)	70 (8%)	24 (7.6%)					
Rush Lake	60	61	34	22	1					
Salem Pond	28 (100%)									
Scofield Reservoir	1 (75%)	5 (25%)								
Scout Lake	4 (70%)	70 (30%)								
Settlement Canyon Reservoir	22 (45%)	27 (35%)	34 (20%)							
Sevier Bridge Reservoir	1 (40%)	9 (10%)	35 (7.0%)	8 (6%)	2 (6%)	10 (5.3%)	48 (3.7%)	12 (3.6%)	30 (3.6%)	22 (0.1%)
	69 (3%)	52 (2.2%)	51 (2%)	49 (2.0%)	13 (2.0%)	5 (1.0%)	47 (0.9%)	3 (0.7%)	50 (0.6%)	65 (0.1%)
	60 (0.2%)									

Soil Associations for Utah Lakes and Reservoirs Watersheds										
Lake / Reservoir	**Soil Type/Percent Relative**									
Sheep Creek Reservoir	4 (100%)									
Smith and Morehouse Reservoir	4 (80%)	70 (20%)								
Spirit Lake	70 (52%)	4 (48%)								
Stansbury Lake	2									
Starvation Reservoir	1 (40%)	5 (39%)	17 (12%)	63 (6%)	51 (3%)					
Stateline Reservoir	4 (91%)	70 (9%)								
Steinaker Reservoir	4 (55%)	9 (13%)	63 (11%)	17 (10%)	70 (6%)	51 (3%)	42 (2%)			
Strawberry Reservoir	5 (67%)	1 (33%)								
Three Creeks Reservoir	1									
Tibble Fork Reservoir	1 (92%)	25 (8%)								
Tony Grove Lake	1 (100%)									
Trial Lake	4 (56%)	70 (44%)								
Tropic Reservoir	1 (40%)	10 (35%)	69 (25%)							
Upper Enterprise Reservoir	32 (50%)	8 (50%)								
Upper Stillwater Reservoir	4	70								
Utah Lake	22 (17.7%)	1 (17.5%)	48 (15.6%)	49 (15.2%)	27 (6.7%)	50 (6.3%)	26 (4.0%)	61 (3.9%)	28 (3.5%)	34 (.8%)
	62 (2.8%)	25 (1.4%)	47 (1.3%)	33 (1.1%)	71 (1.1%)	21 (.9%)				
Wall Lake	4	70								
Washington Lake	4	70								
Whitney Reservoir	4 (83%)	70 (17%)								
Wide Hollow Reservoir	64 (80%)	69 (20%)								
Willard Reservoir	25 (29%)	1 (25%)	4 (8%)	28 (6%)	27 (5%)	22 (3%)	24 (3%)	26 (3%)	62 (1%)	21 (17%)

Soil Associations for Utah Lakes and Reservoirs Watersheds										
Lake / Reservoir	Soil Type/Percent Relative									
	70 (1%)	71 (1%)								
Woodruff Creek Reservoir	1 (60%)	25 (40%)								
Yankee Meadows Reservoir	3									

Association	Description
1.	Argic Cryoboborolls-Pachic Cryoborolls-Cryic Paleborolls Association contains mildly alkaline to strongly acid, silt loams to clay loams which have low to moderately high erodibility (K + .17 to .28) and moderately well to somewhat excessive drainage. Permeability is slow to rapid. Runoff is medium to slow and sediment production is moderately low - The hydrologist groups are mainly B and C.
3.	Lithic Cryoborolls-Mollic Cryoboralfs-Rock Outcrop Association contains mildly to strongly acid, loams to cobbly loams which have low to moderately high erodibility (K = .17 to .28) and well to excessive drainage. Permeability above the bedrock is slow to moderate. Runoff is medium and sediment production is low. The hydrologic groups are mainly C and D.
4.	Typic Cryorthents-Typic Cryochrepts-Mollic Cryoboralfs association contains medium to extremely acid, silty loam to loamy sand soil (gravelly to stony sub-soils) which have low to moderately high erodibility (K + .17 to .28) and well to excessive drainage. Permeability above the bedrock is very slow to rapid. Runoff is slow to medium and sediment production is low. The hydrologic groups are mainly B and C.
5.	Aridic Argiustolls-Typid Agriustolls Association contains neutral to moderately alkaline soils. The surface layers are dark reddish-brown very fine sandy loams. The subsoils are reddish brown fine-silty. The soils in this association are well-drained and permeability is moderate. Runoff is medium to rapid and sediment production is moderate. The hydrologic groups are mainly B and C. Wind erosion is a problem on these soils when vegetation is removed. K value = .43.
8.	Lithic Argiborolls-Typic Argiborolls Association contains neutral to moderately alkaline soils. The surface layers are dark brown and dark grayish-brown cobbly and very gravelly loams and fine sandy loams. The subsoils are loamy-skeletal and clayey-skeletal. The soils in this association are well-drained. Permeability is slow and moderately slow. Runoff is medium to slow and sediment production is low. The hydrologic groups are mainly C for the Typic Argiborolls and D for the Lithic Argiborolls. K value = .17 to .24.
9.	Lithic Argiborolls-Rock Outcrop-Typic Argiborolls Association contains neutral to moderately alkaline soils. The surface layers are dark brown and brown gravelly and cobbly loams. The subsoils are loamy skeletal underlain by sandstone and shale bedrock. Soils in this association are well-drained. Permeability is moderate to slow. Runoff is medium and sediment production is moderate. The hydrologic groups C & D indicate a moderately-high to high runoff potential. The rock outcrop is exposure to bare sandstone.
10.	Typic Haploborolls-Typic Argiborolls-Typic Calciborolls Association contains neutral to moderately alkaline, gravelly, silt, and sandy loams which have low to moderately high erodibility (K = .17 to .24) and are well drained. Permeability is medium to low, and sediment production is medium to low. The hydrologic groups are mainly B and C.
11.	Lithic Haploborolls-Lithic Argiborolls Typic Haploborolls Association contains neutral to moderately alkaline soils. The surface layers are brown and grayish-brown gravelly and cobbly loams and sandy loams. The subsoils are brown loamy-skeletal underlain by bedrock. The soils in this association are well and somewhat excessively drained. Permeability is slow to moderately rapid about the bedrock. Runoff is slow to rapid and sediment production is moderate to low. The hydrologic group is mainly D for the Lithic Haploborolls and Lithic Argiborolls and C for the Typic Haplohorolls. Alkalinity is neutral - moderate (K value = .24)
12.	Lithic Haploborolls-Lithic Calciborolls Association contains neutral to moderately alkaline soils. The surface layers are brown and grayish-brown gravelly and cobbly loams and sandy loams. Erodibility is moderately high (K + .24) and the soils are well and somewhat excessively drained. Permeability is moderate above the bedrock, runoff is rapid, and sediment production is moderate. The hydrologic group is mainly D.
13.	Typic Ustochrepts-Cumulic Haploborolls Association contains neutral to moderately alkaline, gravelly, light clay, and silt loams which have low to moderately high erodibility (K = .15 to .32) and are well drained. Permeability is moderate and moderately slow. Runoff is slow to medium and sediment production is slow to moderate. The hydrologic groups are mainly B and D.
14.	Lithic Argiborolls Association contains neutral to moderately alkaline soils. The surface layers are dark brown and brown gravelly and cobbly loams. The subsoils are loamy skeletal and clayey-skeletal underlain by bedrock. The soils in this association are well drained; permeability is slow and moderately slow. Runoff is medium to slow and sediment production is low. The hydrologic groups are mainly C and D.
15.	Lithic Haploborolls-Aridic Cakiborolls-Borollic Calciorthid Association contains mildly to moderately alkaline soils 10-20 inches deep over bedrock. The surface layers are brown gravelly loams, loams and silt loams. The soils are well and somewhat excessively drained. Permeability is moderate to moderately rapid. Runoff is medium to rapid and sediment production is moderate. The hydrologic groups are B, C and D.
16.	Lithic Haploborolls-Rockland-Aridic Argiborolls Association contains mildly to moderately alkaline soils. The surface layers are brown and grayish brown gravelly and cobbly loams and sandy loams. The rockland is a very shallow mantle of soil and colluvial material over bedrock The subsoils are brown fine-loamy and loamy skeletal. The soils in this association are well-drained. Permeability is moderate to very slow. Runoff is slow to medium and sediment production is moderate. The hydrologic groups are mainly C and D.
17.	Petrocalcic Calciboralls-Aridic Calciboralls Association contains mildly to moderately alkaline, gravelly and cobbly loams underlain with bedrock and lime hardpan. These soils are well drained and have moderate to moderately rapid permeability, slow to medium runoff, moderate sediment

production and a k-value of .28. The hydrologic soil groups are C and D.

18. Aridic argiustolls-Typid Agriustolls Association contains neutral to moderately alkaline soils. The surface layers are dark reddish-brown very fine sandy loams. The subsoils are reddish brown fine-silty. The soils in this association are well drained and permeability is moderate. Runoff is medium to rapid an sediment production is moderate. The hydrologic groups are mainly B and C. Wind erosion is a problem on these soils when vegetation is removed. K value = .43.

19. Lithic Argiustolls-Aridic Argiustolls-Lithic Calciustolls Association are shallow to deep, neutral to moderately alkaline soils. The surface layers are dark reddish-brown fine-silty. The substrata are reddish-brown fine-silty. The soils in this association are well drained. Permeability is moderate. Runoff is medium to rapid and sediment production is moderate. The hydrologic group is mainly B and D.

20. Typic Ustorthents-Typic Calciustolls Association contains mildly to moderately alkaline soils. The surface layers are brown clay loams. The subsoils are brown clay loams. The subsoils are brown fine-loamy. The soils in this association are well and moderately well drained. Permeability is slow and very slow. Runoff is medium to rapid and sediment production is moderate to high. The hydrologic group is mainly C for the moderately deep soils an D for the shallow soils. K value = .23 to .49.

21. Typic Argixerolls-Cumulic Haplaquolls Association contains slightly acid to mildly alkaline loams to gravelly, gravelly clay, sandy clay loams, and silty clays which have low to moderately high erodibility (K = .17 to .32) and well to poor drainage. Permeability is moderate to very slow. Runoff is medium to slow and sediment production is low. The hydrologic groups are mainly B, C and D.

22. Typic Argixerolls-Typic Haploxerolls Association contains medium acid to mildly alkaline, coarse sandy loams to gravelly, very cobbly, very fine sandy and stony silt loams which have low to moderately high erodibility (K = .15 to .28) and well to somewhat excessive drainage. Permeability is moderately rapid to slow. Runoff is slow to rapid and sediment production is moderate. The hydrologic groups are mainly B and C.

23. Calcic Haploxerolls-Calcic Argixerolls Association contains neutral to strongly alkaline, cobbly silt loams and very cobbly loams which have moderate to low erodibility (K = .24 to .28) and are well drained. Permeability is moderate to moderately rapid. Runoff is medium to rapid. and sediment production is moderate to low. The hydrologic groups are mainly B and C.

24. Lithic Haploxerolls-Typic Haploxerolls Association contains slightly acid to mildly alkaline, cobbly coarse sandy loams to gravelly, very cobbly, very fine sandy, cobbly silt, and sandy clay loams which have low to moderately high erodibility (K = .15 to .28) and well to somewhat excessive drainage. Permeability is moderate to moderately rapid. Runoff is medium to rapid and sediment production is moderate. The hydrologic groups are mainly B, C and D.

25. Pachic Argixerolls-Typic Argixerolls-Calci Argixerolls Association contains slightly acid to moderately alkaline, loams to silt, and very cobbly sandy clay loams which have very low to moderately excessive drainage. Permeability is slow to moderately rapid. Runoff is slow to medium and sediment production is low. The hydrologic groups are mainly B and C.

26. Calcic Argixerolls-Calcic Haploxerolls Association contains neutral to strongly alkaline, silty sand loams to silty clay loams with low to moderately high erodibility (K = .17 to .37) and well to moderately well drainage. Permeability is slow to rapid. Runoff is slow to rapid and sediment production is moderate to low. The hydrologic groups are mainly B and C.

27. Typic Calcixerolls-Calcic Argixerolls Association contains mildly to strongly alkaline, silt loams and gravelly or cobbly to fine sandy loams which have low to high erodibility (K - .17 to .43) and well to somewhat excessive drainage. Permeability is rapid to moderately slow. Runoff is slow to rapid and sediment production is moderate to low. The hydrologic group is mainly B.

28. Aquic Calciustoll-Typic Calciaquolls-Fluvaquentic Haplustolls Association contains mildly to strongly alkaline, silty clay loams which have low to moderately high erodibility (K = .15 to .28) and very poor to moderately well drainage. Permeability is moderate to very slow. Runoff is medium to ponded and sediment production is low. The hydrologic groups are mainly C and D.

29. Aridic Calcic Argixerolls-Aridic Haploxerolls Association contains mildly to strongly alkaline, silt, gravelly and cobbly loams which have low erodibility (k = .15) and somewhat excessive drainage. Permeability is moderate and moderately rapid. Runoff is medium to slow and sediment production is moderate to low. The hydrologic group is B.

30. Lithic Argixerolls-Aridid Haploxerolls-Aridic Calcixerolls Association contains slightly acid to moderately alkaline, brown, sandy, gravelly and cobbly loams. The soils in this association are well and somewhat excessively drained. Permeability is moderately rapid to rapid. Runoff is medium to rapid and sediment production is moderate to low. The hydrologic groups are mainly B for the Aridic Calcixerolls and Aridid Haploxerolls and D for the Lithic Argixerolls. (K value = .10 to .15.)

31. Aridic Calcixerolls-Xerollic Calciorthids Association contains moderately deep and deep soils which are moderately and strongly alkaline. Surface is loam to cobbly loam. Hydrologic soil groups are B and C. Drainage is good to somewhat excessive, permeability moderate to rapid, runoff potential is medium sediment production is moderate to low, K value = .15.

32. Aridic Argixerolls-Xerollic Haplargids Association are deep, mildly to moderately alkaline soils consisting of cobbly and stony loams. They are well drained and permeability is slow. Runoff is medium and sediment production is moderate to low. The hydrologic group mainly C.

33. Aridic Calcic Argixerolls- Aridic Petrocalcic Palexerolls Association contains mildly to strongly alkaline, gravelly and cobbly loams which have low to moderate erodibility (K = .10 to .28) and well to somewhat excessive drainage. Permeability is moderately slow to moderately rapid. Runoff is medium and sediment production is moderate to low. The hydrologic groups are mainly C and D.

34. Aridic Calcixerolls-Xerollic Calciorthids Association contains moderately to strongly alkaline, gravelly and cobbly loams which have low erodibility (K = .20) and somewhat excessive drainage. Permeability is moderate to rapid. Runoff is slow to medium and sediment production is moderate to low. The hydrologic group is mainly B.

35. Ustic Torrifluvents-Borollic Calciorthids Association contains mildly to strongly alkaline, gravelly and sandy loams, and are well drained. Permeability is moderate to moderately rapid. Runoff is medium to slow and sediment production is moderate to low. The hydrologic groups are mainly B and C.

36. Ustic Torrifluvents - Ustic Torriorthents Association contains mildly and moderately alkaline fine sandy loams, loams, silt loams, and silty clay loams, loams, silt loams, and silty clay loams. The soils in this association are well and moderately well drained. Permeability is slow to moderately rapid, runoff is slow to medium, and sediment production is moderate to high. The hydrologic groups are mainly B and C.

38. Ustollic Palerothids-Ustollic Calciorthids Association contains moderately to strongly alkaline, gravelly loams to loams with calcium carbonate underlayers and hardpan. They are well drained and have rapid permeability. Hydrologic soil groups B and D. K value = .32.

39. Ustollic Haplargids-Ustollic Calciorthids Association - Soils are deep and moderately deep, mildly to moderately alkaline soils. The surface layers are reddish-brown and very fine sandy loams. The subsoils are yellowish-red fine-silty and fine-loamy. The substrata are yellowish-red fine-silty and fine-loamy. The soils in this association are well drained. Permeability is moderately slow to moderately rapid. Runoff is slow to rapid and sediment production is moderate. The hydrologic groups are mainly B and C.

40. Ustollic Palerothids-Ustollic Calciorthids Association contains moderately to strongly alkaline, gravelly loams to loams with calcium carbonate underlayers and hardpan. They are well drained and have rapid permeability. Hydrologic soil groups B and C. K value = .32.

41. Lithic Ustollic Calcirothids-Lithic Ustic Torriorthents Association contains mildly to strongly alkaline, brown, cobbly, gravelly and sandy loams. The soils in the association are well-drained. Permeability is moderate to rapid. Runoff is medium to rapid and sediment production is low. Hydrologic groups are C and D, K value = .10 to .17.

42. Ustic Torriorthents-Ustic Torrifluvents Association contains mildly to strongly alkaline, brown, sandy and cobbly loams. The soils in this association are well to somewhat poorly drained. Areas adjacent to the drainages have seasonal high water tables. Permeability is very rapid to moderate. Runoff is slow to medium and sediment production is low to moderate. The hydrologic groups A and B indicate low to moderately low runoff potential. (K = .15)

43. Aquic Calciorthids-Aquic Ustifluvents Association contains mildly to strongly alkaline loams and silty clay loams. The soils are poorly and somewhat poorly drained. Permeability is moderately slow to slow. Runoff is slow and sediment production is low. The hydrologic groups are mainly C and D.

44. Xerollic Calciorthids-Xeric Torriorthents Association contains moderately to strongly alkaline loams, silt loams, gravelly loams, and fine sandy loams. The soils are well drained. Permeability is moderately slow to rapid. Runoff is medium and sediment production is moderate to low. The hydrologic groups are mainly B and C.

45. Xerollic Calciorthids-Xerollic Paleorthids Association contains moderately to strongly alkaline, loams, sandy loams to gravelly or cobbly sandy loams. The soils in this association are well drained. Permeability is moderate to moderately rapid. Runoff is slow to medium and sediment production is moderate to low;. The hydrologic groups are mainly B and D.

46. Lithic Xeric Torriorthents-Xerollic Calciorthids Association contains neutral to strongly alkaline, loams to cobbly silt and gravelly loams which have moderately high erodibility (K + .24) and somewhat excessive drainage. Permeability is moderate to moderately rapid. Runoff is medium to rapid and sediment production is moderate to low;. The hydrologic group is mainly B.

47. Xerollic Haplargid-Xerollic Calciorthids Association contains neutral to strongly alkaline, loams to silt and fine sandy loams which have moderately high erodibility (K = .32 to .27) and are well drained. Permeability is moderately slow to moderately rapid. Runoff is slow to medium and sediment production is moderate to low. The hydrologic groups are mainly B and C.

48. Xeric Torrifluvents-Xerollic Calciorthids Association contains mildly to strongly alkaline, silt loams, loams, and fine sandy loams which have moderately high to erodibility (K = .32 to .43) and are well drained. Permeability is moderately slow to moderately rapid. Runoff is slow to medium and sediment production is moderate to low. The hydrologic groups are mainly B and C.

49. Xerollic Calciorthids-Xeric Torrifluvents Association contains mildly to strongly alkaline, loams, sandy to very gravelly sandy loams which have low erodibility (K = .15 to .20) and somewhat excessive drainage. Permeability is moderately rapid to rapid. Runoff is medium and sediment production is moderate to low. The hydrologic group is mainly B.

50. Lithic Xerollic Calcirothids-Xerollic Calciorthids Association contains mildly to strongly alkaline, stony, gravelly, flaggy, sandy, or very gravelly sand

loams which have low erodibility (K = .15 to .20) and well to somewhat excessive drainage. Permeability is moderately rapid and rapid. Runoff is medium to very rapid and sediment production is moderate. The hydrologic groups are mainly B and D.

51. Aquic Xerofluvents-Aquic Ustifluvents-Typic Torrifuluvents Association contains mildly to strongly alkaline, silty clay loams to very fine sandy loams which have moderately high to high erodibility (K = .24 50 .43) and somewhat poor to moderately well drained. Permeability is slow to moderately rapid. Runoff is slow to rapid and sediment production is high mainly because of bankcutting. They hydrologic group is mainly B.

52. Typic Torrifluvents-Typic Torriorthents Association contains mildly to strongly alkaline, silt loams and silty clay loams to sandy loams and sandy clay loams which have high erodibility (I = .37 to .43) and well to somewhat excessive drainage. Permeability is slow to rapid. runoff is slow to rapid and sediment production is moderate. The hydrologic groups are mainly A, B and C.

54. Lithic Calciorthids-Typic Calciorthids Association contains moderately to strongly alkaline soils with fine sands to very fine sandy loams. Erodibility is low to moderate (K = .10 and .37). The soils in this association are well drained. Permeability is moderate to rapid. Runoff is medium to rapid and sediment production is moderate. The hydrologic groups are mainly B and D.

55. Typic Calciorthids-Typic Torriorthents Association contains moderately to strongly alkaline, silt loams, sandy clay loams, loamy fine sands, very fine sandy loams, and gravelly sand loams which have low to high erodibility (K = .17 to .49) and well to somewhat excessive drainage. Permeability is slow to rapid. Runoff is slow to medium and sediment production is moderate to low. The hydrologic groups are mainly B, C and D.

60. Typic Natrargids-Xerollic Natrargids-Typic Calcirorthids Association contains moderately to very strongly alkaline, silt loams to silty clay loams which have high erodibility (K = .27 to .49) and moderately well to well drainage. Permeability is moderately slow to very slow. Runoff is medium to slow and sediment production is moderate. The hydrologic groups are mainly C and D.

61. Typic Fluvaquents-Typic Salorthids Association contains neutral to very strongly alkaline, loams, silt loams, silty clay loams which have moderately high to high erodibility (K = .32 to .49) and poor to very poor drainage. Permeability is moderate to very slow. Runoff is slow to ponded and sediment production is low. The hydrologic group is mainly D.

62. Typic Ustochrepts-Cumulic Haploborolls Association contains neutral to moderately alkaline, gravelly, light clay, and silt loams which have low to moderately high erodibility (K = .15 to .32) and are well drained. Permeability is moderate and moderately slow. Runoff is slow to medium and sediment production is slow to moderate. The hydrologic groups are mainly B and D.

63. Typic Torriorthents (Shallow)-Lithic Calciothids-Lithic Natrargids Association contains mildly to strongly alkaline, silty, silty clay, and sandy loams which have a high erodibility (K = .37 to .47) and are well drained. Permeability is moderate to slow. Runoff is rapid and sediment production is high. The hydrologic group is mainly D.

64. Ustic Torriorthents (Shallow)-Rock Outcrop Association contains mildly to moderately alkaline, silt and silty clay loams which are well drained. Permeability is moderate to very slow. Runoff is moderate to high an sediment production is high. The hydrologic group is mainly D.

65. Typic Torripsamments-Typic Torriorthents Association contains mildly to strongly alkaline, loamy fine sands which have moderately high erodibility (K = .24 to .37) and somewhat excessive drainage. Permeability is rapid. Runoff is slow to medium and sediment production is low. The hydrologic group is mainly A.

67. Ustic Torripsamments Association are deep, mildly alkaline soils. The surface layers are reddish-yellow fine sands. The subsoils and substrata are reddish-yellow fine sands. The soils in this association are excessively and somewhat excessively drained. Permeability is very rapid to rapid. Runoff is slow and very slow and sediment production is moderate to low. The hydrologic group is mainly A.

68. Rock Land Association contains bare rock and shallow soils over sandstone bedrock.

69. Badland-Rock land Association contains barren shale or interbedded sandstone and shale. Runoff is rapid to very rapid and sediment production is very high.

70. Rockland of the High Mountains - Very steep colluvial areas above the timber line. 40% is rocky, 30% is shallow to very shallow, stony soils. Major importance is as a snow field watershed.

71. Playas are nearly flat areas with light colored, deep and clayey deposits with very strong accumulations of salt, mostly devoid of vegetation, any plants found are extremely salt tolerant.

Soils of Arizona

A-4-B Palma-Clouis association soils are reddish brown sandy soils with loamy to fine sandy loam subsoils. Slopes range from O to 15 per cent and permeability is moderate. The major hydrologic group is A.

A-4-C Shepard-Rock outcrop association soils are reddish brown to reddish yellow in color with loamy fine sand to sand textures. Slopes

range from 2-15 percent. Permeability is rapid and these soils usually have a very high erosion rate (by wind). The main hydrologic group is A.

A-5-A Sedimentary-Rock outcrop association consists of vertical cliffs belonging to the major hydrologic groups.

A-5-B Rough broken land association consists of semi-consolidated sandstone and shale with sand to clay loams. The major hydrologic group is D.

BF-l Torripsamments-Slopes varied from 4% to 20%. The soil surface texture is coarse and permeability is rapid. The erodibility "K" factor is .15 or low. Wind Erosion Group 2 indicates high erodibility and Hydrologic Group A indicates a low runoff potential.

BF-5 Torrifluvents-Fluvaguents-Halaqvepts Association-Slopes range from 0% to 6%. The soil surface texture is medium to course and the permeability is moderate to rapid. Soil Erodibility "K" factor is .27 or medium. The Wind Erosion Group ranges from 3 to 5 (moderate)and the Hydrologic Group is LC, or moderately high runoff potential.

BF-6 Torriorthents Alkali Association-Slopes rangefrom 0% to 6%. The surface texture is fine andpermeability is slow. The soil erodibility or"K" factor value is .32 or moderate. The WEG(Wind Erosion Group) is 4 and the Hydrologic Group D indicates a high runoff potential.

BF-109 Torriorthents-Haplarqids Association-These are gently sloping to steep soils, 3% to 20% slope. Surface texture is coarse to medium; permeability is slow to rapid. Soil Erodibility or "K" factorvalue is .27. Soils in this group range from somewhat severe #3 to more moderate #6 Wind Erosion Group. This soil association also belongs to all four Hydrologic Groups ratingrunoff potential from low to high.

BX-l Calciorthids-Ustifluvents Association-Slopes varyfrom 0% to 3% surface texture is medium andpermeability is moderate. The soil erodibility"K" factor is .32 o~ medium. The Wind Erosiongroup is 5 or just about moderate and theHydrologic Group is C or moderately high runoffpotential.

Colorado Soils

C-l7 Typic Cryoboralfs are moderately deep to deep, light colored, well-drained soils that contain gravel, cobble and stones in most layers. Texture ranges from clayey to sandy. They are on moderately sloping to very steep mountainsides. Slopes range from 5 to greater than 50 percent. Depth to bedrock ranges from 20 to more than 60 inches. Rock fragments generally increase with depth and comprise more than 35 percent of the soil volume in many locations. Permeability, shrink-swell and frost action potential are highly variable because of the wide range in textures, but most commonly they are moderately permeable, and have a mode rage to low shrink-swell potential and moderate frost action potential. They are typically neutral to medium acid in reaction, but in some places the lower part is calcareous.

C-2 Typic Cryoboralfs are moderately deep to deep, light colored, well-drained soils having loamy textures and containing up to 35 percent rock fragments. They are on gently sloping to steep mountainsides and alluvial fans at high elevations. Slope gradients range from 2 to 50 percent. Depth to bedrock ranges from 20 to more than 60 inches but is typically less than 40 inches. Permeability is moderate, and the shrink-swell potential is low to moderate. They are typically slightly acid in the upper layers and neutral in the lower part, but in some soils the lower part is moderately alkaline.

C-3 Typic Eutroboralfs are moderately deep to deep, light-colored, well-drained soils have clayey textures. Rock fragments generally increase with depth and typically compose less than 35 percent of the soil volume but may be more than 35 percent in places. They are most commonly on steep mountainsides, and slopes normally range from 30 to 50 percent or more, but lesser slopes also occur in some areas. Depth to bedrock ranges from 20 to more than 60 inches. Permeability is moderate to slow, and shrink-swell potential is moderate to high. The frost action potential is moderate. The soils are typically slightly acid to neutral throughout but may become calcareous in the lower layers of some soils.

C-6 Typic Haplargids are deep, light-colored, well-drained soils have loamy textures and contain less than 35 percent rock fragments. These soils are on nearly level to gently sloping high terraces and mesa tops; and slopes range from O to about 5 percent, except at the edge of terrace breaks where slopes may be steep. Depth to bedrock is more than 60 inches. Permeability is moderate, shrink-swell potential is low to moderate, and frost action potential is low. Reaction ranges from mildly to moderately alkaline.

C-9 Borollic Haplargids are deep, light-colored, well-drained soils have loamy textures and contain less than 35 percent rock fragments. They are on nearly level to moderately steep alluvial fans and valley side slopes and have slopes of O to 30 percent. Depth to bedrock is 60 or more inches. Permeability is moderate and shrink-swell and frost action potentials are low to moderate. They are typically neutral to mildly alkaline in the upper layer and calcareousin the lower part.

C-10 Ustollic Haplargids are deep, light-colored, well-drained soils have loamy textures and contain less than 35 percent rock fragments. These soils are on nearly level to gently sloping uplands and high terraces, and slopes range from O to 5 percent. Depth to bedrock is more than 60 inches. Permeability is moderate to rapid, with a low shrink-swell and frost action potential. They are typically neutral in upper layers and moderately alkaline and calcareous in the lower part.

C-12 Ustollic Haplargids are moderately deep and deep, light-colored, well-drained soils have loamy textures and usually contain less than 35 percent rock fragments. These soils are on gently sloping to steep valley side slopes, dissected plateaus, and mesas ranging from 20 to 50 percent slopes. Depth to bedrock is 20 to more than 60 inches. Permeability is moderate to rapid with a low shrink-swell and frost action potential. They are typically neutral in the upper layers and calcareous in the lower part of the soil.

C-13 Ustollic Haplargids, Ustollic Haplargids-Ustic Torriorthents are deep to moderately deep, light-colored, well-drained soils have loamy textures which are generally high in silt content and contain very few rock fragments, usually less than 5 percent. These soils are on nearly level to strongly sloping hills, ridges, side slopes, and alluvial fans. Slopes range from O to about 15 or more percent. Depth to bedrock ranges from 20 to more than 60 inches. Permeability is moderate to moderately slow. The shrink-swell potential is low to moderate, and the frost action potential is low. These soils are typically moderately alkaline throughout.

C-16 Esoteric Camborthids-Ustollic Haplargids aremoderately deep and deep, light-colored, well-drained soils have clayey or loamy subsoils. Rock fragments range from O to 25 percent but are usually less than 15 percent. Some soils have contrasting layers of gravel, cobble, and sand below a depth of 30 inches. These soils are on gently sloping, high terraces or old alluvial fans, and on gently to strongly sloping upland hills and ridges. Slopes range from 2 to 15 percent or more. Depth to bedrock ranges from 20 to more than 60 inches. Permeability is slow to moderate, shrink-swell potential ranges from low to high, and frost action potential is low. They are typically neutral or mildly alkaline in the surface layers and moderately or strongly alkaline and calcareous in the lower ~art.

C-18 Ustollic Natrargids are deep, light-colored, well-drained soils dominantly have loamy textures but some are clayey. They usually contain less than 15 percent rock fragments, mainly of gravel size. These soils are on nearly level to gently sloping uplands and have slopes of O to 5 percent. Depth to bedrock is greater than 60 inches. Permeability is moderate in the loamy soils and moderately slow in the clayey soils. The shrink-swell potential is low to moderate and frost action potential is low. They are typically neutral to mildly alkaline in the upper part and moderately to strongly alkaline in the lower part of the soil.

C-21 Borollic Camborthids-Aridic Argiborolls are deep, light-dark-colored, well-drained soils dominantly have loamy subsoils but some are clayey. Rock fragments are less than 35 percent above a depth of 20 inches but may be higher than 35 percent below this depth. These soils are on gently sloping to moderately steep alluvial fans, old high terraces, or valley side slopes. Slopes range from 2 to about 20 percent. Depth to bedrock is more than 60 inches. Permeability is moderate where the subsoil is loamy and moderately slow where clayey. The shrink-swell potential ranges from low to high but is more commonly moderate. The frost action potential is low or moderate. These soils are typically neutral to mildly alkaline in the surface layers and mildly alkaline to strongly alkaline in the lower part.

C-23 Borollic Vertic Camborthids are moderately deep, light-colored, well-drained soils have clayey textures and contain very few rock fragments. They are on gently sloping to moderately steep uplands having slopes of 2 to about 25 percent. These soils formed in materials weathered from shale and sandstone. Depth to the bedrock ranges from 20 to 40 inches. Permeability is slow or very slow. The shrink-swell potential is high. Cracks one to three inches wide extend from the surface downward through the subsoil when the soils are dry. Frost action potential is low. Typically, these soils are mildly alkaline in the upper part and grade to strongly alkaline with depth. They are usually calcareous throughout.

C-24 Lithic Ustic Torriorthents-Lithic Camborthids are shallow, light-colored, well-drained soils have loamy textures. Rock fragments are variable and increase with depth. They are on steep uplands with slopes ranging from 20 to 50 percent. Depth to bedrock ranges from 20 to more than 60 inches. Permeability is moderate to slow, and shrink-swell and frost action potentials are low. Typically, they are mildly alkaline in the upper layers and strongly alkaline in the lower part. to bedrock is less than 20 inches. Permeability is moderate to slow and the shrink-swell and frost action potentials are low. Typically, they are mildly alkaline in the upper layers and strongly alkaline in the lower part.

C-28 Typic Torrifluvents are deep, light-colored, well-drained soils have loamy textures and contain very few rock fragments. These soils are on nearly level alluvial fans, flood plains, and narrow alluvial valleys and have slopes of O to 2 percent. Depth to bedrock is greater than 60 inches. Permeability is slow to moderate, the shrink-swell potential is moderate, and the frost action potential is high. Flooding is rare. It is only for brief periods. They are typically moderately or mildly alkaline and calcareous throughout.

C-29 Typic Fluvaguents-Ustic Torrifluvents are deep, light-colored, well-drained soils have loamy textures and contain less than 35 percent rock fragments. These soils are on nearly level to gently sloping alluvial valleys and have slopes of 0 to 5 percent. Depth to bedrock is over 60 inches. Flooding is rare and is only for brief periods. Permeability is moderate, and the shrink-swell and frost action potentials are low to moderate. Typically, these soils-are mildly to moderately alkaline.

C-30 Ustic Torrifluvents are deep, well-drained, light-colored soils have loamy textures and contain less than 35 percent rock fragments. These soils are on nearly level and gently sloping alluvial fans and alluvial valleys. Slopes range from O to 5 percent. Depth to bedrock ranges from 40 to over 60 inches. Flooding is rare and is only for brief periods. Permeability is moderate, and the shrink-swell and frost action potentials are low to moderate. Typically these soils are mildly to moderately alkaline.

C-33 Typic Torriorthents are shallow, light-colored, well-drained soils have clayey textures and contain very few rock fragments. These soils are on gently sloping to steep uplands and have slopes ranging from 2 to 45 percent or more. Depth to repayable bedrock is less than 20 inches. Permeability is slow; the shrink-swell potential is moderate and frost action potential low. Typically, these soils are mildly or moderately alkaline and calcareous throughout.

C-34 Borollic Camborthids-Ustic Torriorthents are moderately deep and deep, light-colored, well-drained soils have loamy textures and contain less than 35 percent rock fragments. These soils are on gently sloping to moderately steep uplands and alluvial fans and have slopes ranging from 2 to 30 percent. Depth to bedrock ranges from 20 to over 60 inches. Permeability is moderate to moderately rapid, and the shrink-swell and frost action potentials are low. Typically, these soils are mildly or moderately alkaline in the upper part and moderately alkaline in the lower layers. They are commonly calcareous throughout.

C-35 Aridic Agrgiborolls, Ustic Torriorthents are moderately deep to shallow, dark-light-colored, well-drained soils. About two-thirds have loamy textures

and one-third have clayey textures. Rock fragments generally comprise less than 35 percent of the soil volume. They are on nearly level to sloping uplands and valley side-slopes. Slopes range from O to about 15 percent. Depth to bedrock ranges from 10 to 40 inches. Permeability is moderate on the loamy soils and slow on the clayey soils. The shrink-swell potential is low on the loamy soils and moderate to high on the clayey soils. The frost action potential is low. Typically, these soils have mildly alkaline surface layers and mildly to moderately alkaline lower layers.

C-41 Ustic Torriorthents-Lithic Ustic Torriorthents are shallow, light-colored, well-drained soil shave loamy textures and usually contain less than 35 percent rock fragments, but some contain up to 85 percent. These soils are on sloping to steep uplands and mesas. Slopes range from about 5 to 50 percent. Depth to bedrock is less than 20 inches. Permeability is moderate, and the shrink-swell and frost action potentials are low. Typically, they have neutral to mildly alkaline surface layers and are moderately alkaline in the lower part.

C-42 Lithic Ustic Torriorthents are shallow, light-colored, well-drained, loamy soils usually contain less than 35 percent rock fragments. The rock fragments which are present are mainly channery or flaggy. These gently sloping to steep soils are on bedrock-controlled uplands and have slopes of 2 to over 30 percent. Depth to hard bedrock is less than 20 inches. Permeability in the soil is moderate, and the shrink-swell potential is low. The frost action potential is low. Typically, these soils are mildly alkaline in the surface and moderately alkaline in the lower part. They may be calcareous throughout.

C-47 Pergelic Cryochrepts-Pergelic Cryumbrepts are shallow to moderately deep, light-dark-colored, well-drained, loamy soils usually contain 35 to 85 percent rock fragments, most of which are angular and greater than 3 inches in diameter. These are the soils of the high mountains above timberline. Slopes range from about 10 to greater than 50 percent but include small areas of lesser slopes. Depth to bedrock ranges from less than 20 to over 40 inches. Permeability is generally moderate to moderately rapid. The shrink-swell potential is low to moderate, and the frost action potential is moderate to high. Typically these soils are strongly or very strongly acid throughout.

C-49 Typic Cryaquolls are deep, dark-colored, cold, poorly drained, loamy soils contain less than 35 percent rock fragments. They are nearly level to gently sloping soils on flood plains and alluvial fans and have slopes of O to 5 percent. Depth to bedrock is greater than 60 inches, and depth to the seasonal high water table is O to1.5 feet. These soils are commonly subject to flooding over brief periods. Permeability is moderately slow, shrink-swell potential is moderate, and the frost action potential is high. Typically, these soils are medium acid in the upper layers and slightly acid in the lower part.

C-52 Antic Haploborolls-Aridic Argiborolls aremoderately deep to deep, dark-colored, well-drained, clayey soils usually contain less than 35 percent rock fragments. They are gently sloping to steep soils on mesas, valleyside-slopes, alluvial fans, and old terraces and have slopes ranging from 2 to 40 percent armaria. Depth to bedrock ranges from 20 to 60 inches or more. Permeability is slow, the shrink-swell potential is high, and the frost action potential is moderate. Typically, these soils are neutral to mildly alkaline in the upper layers and mildly or moderately alkaline in the lower part.

C-53 Antic Calciborolls are moderately deep and deep, dark-colored soils have loamy textures. About one-half contain more than 35 percent rock fragments, and half contain less than 35 percent. They are on gently sloping to steep uplands and alluvial fans and have slopes ranging from 2 to over 30 percent. Depth to bedrock ranges from 20 to over 60 inches. Permeability is moderate to rapid, and the shrink-swell and frost action potentials are low. Typically, these soils are moderately alkaline and calcareous throughout and have a calcic horizon(a horizon at least 6 inches thick which contains more than 15 percent calcium carbonate equivalent).

C-54 Typic Cryoborolls are deep, dark-colored, well-drained, cold, loamy and sandy soils contain from 35 to 85 percent rock fragments. They are on nearly level to strongly sloping alluvial fans, terraces, outwash plains, glacial moraines, eskers and gently rolling to moderately steep upland hills and ridges. Slopes range from O to about 30 percent. Depth to bedrock ranges from 40 to over 60 inches. Permeability is moderate to rapid, and the shrink-swell and frost action potentials are low. Typically, they are neutral or mildly alkaline in reaction.

C-55 Typic Cryoborolls are moderately deep and deep, dark-colored, well-drained, loamy soils usually contain less than 35 percent rock fragments, but some areas contain a higher percentage. They are on sloping to steep upland hills, ridges, mountain slopes, and on alluvial fans and high terraces, or glacial outwash areas. Slopes range from about 2 to more than 30 percent. Depth to bedrock ranges from 20 to 60 or more inches. Permeability, shrink-swell potential, and frost action potential are usually moderate. Typically, they are neutral to moderately alkaline in reaction.

C-56 Typic Cryorthents-Typic Cryoborolls are moderately deep and deep, light-dark-colored, well-drained, clayey soils usually contain less than 35 percent rock fragments but moderately steep to steep soils on mountainsides, hills, and crests, and have slopes of 15 to 50 percent. Depth to bedrock is usually over 40 inches but ranges from 20 to over 60 inches. Permeability is slow or moderately slow, shrink-swell potential is high or moderate, and the frost action potential is moderate. Typically, these soils are neutral or mildly alkaline in the surface layers and mildly or moderately alkaline in the lower part.

C-57 Typic Cryorthents-Typic Cryoborolls are moderately deep and deep, dark-colored, clayey soils usually contain less than 35 percent rock fragments but sometimes contain as much as 85 percent. They are gently sloping to steep soils on mountainsides, hills and crests, valleyside-slopes and alluvial fans and have slopes of 3 to 50 percent. Depth to bedrock is usually over 40 inches but ranges from 20 to over 60 inches. Permeability is slow or moderately slow, shrink-swell potential is high or moderate, and the frost action potential is moderate. Typically, these soils are neutral or mildly alkaline in the surface layers and mildly or moderately alkaline in the lower part.

C-58 Typic Cryoborolls, Argic Cryoborolls are deep and moderately deep, dark-colored, well-drained soil shave loamy or clayey over loamy textures, and much of the area contains a high percentage of rock fragments in the lower layers. They are on gently sloping to steep mountainsides and

ridgesand have slopes of 2 to 50 percent. Depth to bedrock ranges from 20 to more than 60 inches. Permeability ranges from moderately slow to moderately rapid. They have a moderate to low shrink-swell potential, and frost action potential is dominantly moderate but ranges from low to high. They are typically neutral in the upper part and calcareous in the lower part but may remain neutral throughout.

C-59 Cryic Paleborolls-Argic Cryoborolls aremoderately deep to deep, well-drained, dark-colored, loamy soils usually contain less than 35 percent rock fragments but sometimes will contain up to 85 percent. They are nearly level to moderately steep soils of the high mountains and occur on valley side slopes, ridge crests, and alluvial fans. They have slopes of O to 30 percent or more. Depth to bedrock is usually between 20 and 60 inches but is deeper than this in some areas. Permeability and the shrink-swell and frost action potentials generally are moderate. Typically, these soils have neutral surface layers grading to moderately alkaline in the lower part.

C-60 Aridic Haploborolls, Torriorthentic Haploborolls, Aridic Argiborolls are deep and moderately deep, dark-colored, well-drained, loamy soils usually contain less than 35 percent rock fragments, but areas having a higher percentage are included. They are on gently sloping to steep uplands, old alluvial fans, and terraces, and have slopes ranging from 2 to 30 or more percent. Depth to bedrock ranges from 20 to more than 60 inches. Permeability is moderate, and the shrink-swell and frost action potentials are low to moderate. Typically, these soils are neutral to mildly alkaline in the surface layers and mildly or moderately alkaline in the lower part.

C-62 Typic Paleborolls-Borollic Camborthids aremoderately deep to deep, light-colored, well-drained, clayey soils usually contain less than 35 percent rock fragments. They are on gently sloping to moderately steep uplands dominated by the underlying soft sedimentary bedrock. They have slopes of 2 to about 30 percent. Depth to repayable bedrock ranges from 20 to 40 or more inches. Permeability is slow, shrink-swell potential is high, and the frost action potential is moderate. Typically, these soils are mildly alkaline in the upper layers and moderately or strongly alkaline in the lower part.

C-72 Antic Argiustolls are moderately deep and deep, dark-colored, well-drained, clayey soils usually contain less than 35 percent rock fragments. They are on moderately sloping to steep uplands, alluvial fans and valley side slopes and have slopes of 5 to about 50 percent. Depth to bedrock ranges from 20 to over 40 inches. Permeability is slow, the shrink-swell potential is high, and the frost action potential is low. Typically, these soils are neutral in the surface layers and moderately alkaline and calcareous in the lower part.

Soils of New Mexico

MF-3 Haploborolls-Arqiborolls Rock Outcrop Association-Slopes range from 5% to 40%. Thesurface texture is mostly medium and permeabilityis slow to moderate. The soil erodibility "K"factor averaged .28 or moderate. WEG ranges from5 to 8 or somewhat low wind erosion potential andHydrologic Groups B through D indicate moderatelylow to high runoff potential.

MC-7 Cryoboralfs-Cryoborolls-Rock Outcrop Association-Slopes range from 20% to 60-. The surface texture is mostly medium and permeability is slow to rapid. The average soil erodibility or "K" factor is .29 or medium, the Wind Erosion Group ranges from 3 to 8 or moderate and the Hydrologic Group ranges from moderately low to high runoff potential.

MC-8 Cryoborolls-Crygrthents Association-Slopes range from 2% to 60%. The surface texture is fine to medium and permeability is slow to moderate. The average soil erodibility or "K" factor value is.32-medium erodibility. The soil series belongs in a Wind Erosion Group between #4 to #8, #8 not being subject to wind erosion. Hydrologic Group associations are B through D (moderately low to high, runoff potential).

MC-9 Cryoboralfs Stony Cryoborolls, StonyAssociation-Slopes vary from 5% to 60%. Surfacetexture is coarse to medium and permeability ismoderate to rapid. The "K" factor averages .19for these soils indicating low soil erodibility.Wind Erosion Groups 3 to 8 and Hydrologic GroupsA and B indicate low to moderately low runoffpotential.

MC-10 Cryoborolls-Cryaguents Association-Slopes varyfrom 0% to 16%. The soil surface texture ismostly medium and permeability is moderate torapid. The soil erodibility or "K" factoraverages .24 or medium. The WEG (Wind ErosionGroup) ranges from 3 to 8 or moderate and theHydroloaic Group includes a through C or low tomoderately-high runoff potential.

MX-I. Calcixerolls-Calciorthids Association-Slopes varyfrom 5% to 65%. The surface texture is mediumand permeability is moderate. The averageerodibility or "K" factor is .34 or moderate.The WEG group varied from 5 to 6 and theHydrologic Group B indicates moderately lowrunoff potential.

NM-I Typic Torriorthents association contains clay loam, silty clay loam, light brown gray to light olive brown soils. Permeability is low and the erodibility is moderately high (K=.24-.32). The major hydrologic group is B.

NM-3 Typic Haplargids association contains fine sandy loam, sandy loam pale brown, dark grayish brown soils. Permeability is slow to moderate and erodibility is moderate to moderately high(K=.15-.28). The major hydrologic group is B.

NM-4 Haplargids-Typic Calciorthids-Terriorthentsassociation contains cobbly sandy loams, loamylight brown to dark brown soils. Erodibility ismoderate (K=.15-.17) and permeability is moderateto highly rapid. The major hydrologic group is B.

NM-5 Typic Haplargids-Typic Camborthids association contains silty clay loam, loam dark-yellowish brown, pale brown, brown soils. Permeability is slow and erodibility is moderately high(K=.28-.32). The major hydrologic group is B.

NM-6 Typic Torriosamments association soils have light brown loamy fine sand, which have a moderate to moderately high erodibility (K=.15-.48).Permeability is slow to moderate and the major hydrologic group is A.

NM-7 Lithic-Ustic-Torriorthents association contains loamy, sandy loam dark brown soils. Erodibility is low to moderately high (K=.15-.38) and permeability is slow. The major hydrologic group is D.

NM-8 Bad land rock outcrop association contains clay loam to fine sandy loam soils. Permeability is slow to rapid and erodibility is moderately high(K=.24-.37). The major hydrologic groups are A, B and D.

APPENDIX IV

WATER QUALITY DATA

ANDERSON MEADOW RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.30	
Transparency (meters)	3.3	
Total Phosphorus (ug/L)	25.0	39.0
pH	9.0	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	15.8	
Conductivity (umhos)	70	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.58
Total Hardness (mg/L)		26.3
Total Alkalinity (mg/L)		26.0
Silica (mg/L)		

BAKER DAM RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	4.20	
Transparency (meters)	2.8	
Total Phosphorus (ug/L)	22.0	54.0
pH	9.0	
Total suspended solids (mg/L)	0.9	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	22.8	
Conductivity (umhos)	275	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		126.9
Total Alkalinity (mg/L)		127.0
Silica (mg/L)		

BARNEY LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	19.60	
Transparency (meters)	1.5	
Total Phosphorus (ug/L)	85.0	93.0
pH	8.5	
Total suspended solids (mg/L)	7.0	
Volatile suspended solids (mg/L)	7.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	18.8	
Conductivity (umhos)	87	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		34.8
Total Alkalinity (mg/L)		35.0
Silica (mg/L)		

BEAR LAKE 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.40	
Transparency (meters)	4.7	
Total Phosphorus (ug/L)	20.0	18.0
pH	8.5	
Total suspended solids (mg/L)	1.7	
Volatile suspended solids (mg/L)	1.0	
Residual suspended solids (mg/L)	2.3	
Temperature (C)	16.0	
Conductivity (umhos)	681	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		289.0
Total Alkalinity (mg/L)		247.0
Silica (mg/L)		

BEAR LAKE 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.40	
Transparency (meters)	4.5	
Total Phosphorus (ug/L)	5.0	6.0
pH	8.7	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	1.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	19.3	
Conductivity (umhos)	718	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		294.0
Total Alkalinity (mg/L)		241.0
Silica (mg/L)		

BEAVER MEADOW RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.00	
Transparency (meters)	0.9	
Total Phosphorus (ug/L)	17.0	21.0
pH	8.5	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	1.5	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	10.0	
Conductivity (umhos)	37	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		12.0
Total Alkalinity (mg/L)		12.0
Silica (mg/L)		

BEAVER MEADOW RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	3.90	
Transparency (meters)	1.4	
Total Phosphorus (ug/L)	5.0	16.0
pH	8.2	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	4.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	12.5	
Conductivity (umhos)	34	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		14.0
Total Alkalinity (mg/L)		13.0
Silica (mg/L)		

BIG EAST LAKE 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.30	
Transparency (meters)	3.2	
Total Phosphorus (ug/L)	14.0	42.0
pH	8.7	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	1.5	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	18.0	
Conductivity (umhos)	162	
Ammonia (mg/L)		0.12
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		68.0
Total Alkalinity (mg/L)		77.0
Silica (mg/L)		

BIG EAST LAKE 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	3.20	
Transparency (meters)	3.4	
Total Phosphorus (ug/L)	5.0	16.0
pH	8.8	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	18.0	
Conductivity (umhos)	189	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.10
Total Hardness (mg/L)		70.0
Total Alkalinity (mg/L)		82.0
Silica (mg/L)		

BIG SAND WASH RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	3.40	
Transparency (meters)	2.5	
Total Phosphorus (ug/L)	5.0	6.0
pH	8.2	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.5	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	18.0	
Conductivity (umhos)	167	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		81.0
Total Alkalinity (mg/L)		72.0
Silica (mg/L)		

BIG SAND WASH RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	3.40	
Transparency (meters)	2.5	
Total Phosphorus (ug/L)	5.0	6.0
pH	7.6	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	19.6	
Conductivity (umhos)	183	
Ammonia (mg/L)		0.02
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		88.0
Total Alkalinity (mg/L)		80.0
Silica (mg/L)		

BIRCH CREEK RESERVOIR #2 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	7.40	
Transparency (meters)	2.0	
Total Phosphorus (ug/L)	20.0	62.0
pH	8.4	
Total suspended solids (mg/L)	3.5	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	0.8	
Temperature (C)	11.0	
Conductivity (umhos)	286	
Ammonia (mg/L)		0.12
Nitrate/Nitrite (mg/L)		0.04
Total Hardness (mg/L)		162.0
Total Alkalinity (mg/L)		154.0
Silica (mg/L)		

BIRCH CREEK RESERVOIR #2 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.70	
Transparency (meters)	3.8	
Total Phosphorus (ug/L)	5.0	76.0
pH	8.9	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	19.5	
Conductivity (umhos)	329	
Ammonia (mg/L)		0.06
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		166.0
Total Alkalinity (mg/L)		160.0
Silica (mg/L)		

BLANDING CITY RESERVOIR 04 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	5.20	
Transparency (meters)	1.6	
Total Phosphorus (ug/L)	13.0	16.0
pH	8.0	
Total suspended solids (mg/L)	5.0	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	3.0	
Temperature (C)	22.0	
Conductivity (umhos)	230	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		104.5
Total Alkalinity (mg/L)		105.0
Silica (mg/L)		

BLUE LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)		
Transparency (meters)		
Total Phosphorus (ug/L)	15.0	15.0
pH	7.4	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)		
Residual suspended solids (mg/L)		
Temperature (C)	27.1	
Conductivity (umhos)	8,840	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.45
Total Hardness (mg/L)		633.7
Total Alkalinity (mg/L)		634.0
Silica (mg/L)		

BLUEBELL LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	4.40	
Transparency (meters)		
Total Phosphorus (ug/L)	29.0	73.0
pH	6.4	
Total suspended solids (mg/L)	29.0	
Volatile suspended solids (mg/L)	7.0	
Residual suspended solids (mg/L)	22.0	
Temperature (C)	9.3	
Conductivity (umhos)	10	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.04
Total Hardness (mg/L)		7.2
Total Alkalinity (mg/L)		7.0
Silica (mg/L)		

BRIDGER LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	14.50	
Transparency (meters)	2.2	
Total Phosphorus (ug/L)	24.0	26.0
pH	8.0	
Total suspended solids (mg/L)	2.7	
Volatile suspended solids (mg/L)	4.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	17.5	
Conductivity (umhos)	723	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.10
Total Hardness (mg/L)		48.8
Total Alkalinity (mg/L)		49.0
Silica (mg/L)		

BRIDGER LAKE 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	4.60	
Transparency (meters)	2.4	
Total Phosphorus (ug/L)	18.0	79.0
pH	6.5	
Total suspended solids (mg/L)	14.0	
Volatile suspended solids (mg/L)	8.0	
Residual suspended solids (mg/L)	14.0	
Temperature (C)	10.4	
Conductivity (umhos)	83	
Ammonia (mg/L)		0.10
Nitrate/Nitrite (mg/L)		0.03
Total Hardness (mg/L)		47.0
Total Alkalinity (mg/L)		54.0
Silica (mg/L)		

BROUGH RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.00	
Transparency (meters)	2.3	
Total Phosphorus (ug/L)	21.0	43.0
pH	8.7	
Total suspended solids (mg/L)	1.9	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	22.2	
Conductivity (umhos)	232	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.03
Total Hardness (mg/L)		105.0
Total Alkalinity (mg/L)		105.0
Silica (mg/L)		

BROUGH RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	4.90	
Transparency (meters)	1.8	
Total Phosphorus (ug/L)	13.0	18.0
pH	8.1	
Total suspended solids (mg/L)	3.0	
Volatile suspended solids (mg/L)	1.0	
Residual suspended solids (mg/L)	3.0	
Temperature (C)	22.4	
Conductivity (umhos)	176	
Ammonia (mg/L)		0.06
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		77.0
Total Alkalinity (mg/L)		64.0
Silica (mg/L)		

BROWNE RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.00	
Transparency (meters)	1.3	
Total Phosphorus (ug/L)	21.0	28.0
pH	7.8	
Total suspended solids (mg/L)	3.5	
Volatile suspended solids (mg/L)	1.5	
Residual suspended solids (mg/L)	2.3	
Temperature (C)	12.0	
Conductivity (umhos)	61	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		21.0
Total Alkalinity (mg/L)		26.0
Silica (mg/L)		

BROWNE RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	6.00	
Transparency (meters)	1.4	
Total Phosphorus (ug/L)	10.0	23.0
pH	8.0	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	4.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	12.6	
Conductivity (umhos)	66	
Ammonia (mg/L)		0.05
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		24.0
Total Alkalinity (mg/L)		26.0
Silica (mg/L)		

BUTTERFLY LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.60	
Transparency (meters)	2.9	
Total Phosphorus (ug/L)	8.0	6.0
pH	6.5	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	13.7	
Conductivity (umhos)		
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		7.4
Total Alkalinity (mg/L)		7.0
Silica (mg/L)		

CALDER RESERVOIR (ZELPH) 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	21.50	
Transparency (meters)	3.2	
Total Phosphorus (ug/L)	132.0	157.0
pH	9.0	
Total suspended solids (mg/L)	3.7	
Volatile suspended solids (mg/L)	4.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	17.0	
Conductivity (umhos)	264	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		131.8
Total Alkalinity (mg/L)		132.0
Silica (mg/L)		

CAUSEY RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	8.00	
Transparency (meters)	3.2	
Total Phosphorus (ug/L)	9.0	15.0
pH	8.4	
Total suspended solids (mg/L)	2.3	
Volatile suspended solids (mg/L)	3.8	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	16.0	
Conductivity (umhos)	239	
Ammonia (mg/L)		0.06
Nitrate/Nitrite (mg/L)		0.23
Total Hardness (mg/L)		156.0
Total Alkalinity (mg/L)		145.0
Silica (mg/L)		

CAUSEY RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	4.70	
Transparency (meters)	3.7	
Total Phosphorus (ug/L)	6.0	15.0
pH	8.7	
Total suspended solids (mg/L)	2.3	
Volatile suspended solids (mg/L)	1.0	
Residual suspended solids (mg/L)	2.3	
Temperature (C)	17.5	
Conductivity (umhos)	323	
Ammonia (mg/L)		0.08
Nitrate/Nitrite (mg/L)		0.23
Total Hardness (mg/L)		165.0
Total Alkalinity (mg/L)		158.0
Silica (mg/L)		

CHINA LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.10	
Transparency (meters)	4.8	
Total Phosphorus (ug/L)	9.0	14.0
pH	9.1	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	17.4	
Conductivity (umhos)	64	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		17.5
Total Alkalinity (mg/L)		17.0
Silica (mg/L)		

CLEVELAND RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.90	
Transparency (meters)	2.2	
Total Phosphorus (ug/L)	11.0	15.0
pH	8.8	
Total suspended solids (mg/L)	2.3	
Volatile suspended solids (mg/L)	1.5	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	15.0	
Conductivity (umhos)	213	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.06
Total Hardness (mg/L)		114.0
Total Alkalinity (mg/L)		114.0
Silica (mg/L)		

CLEVELAND RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.00	
Transparency (meters)	3.5	
Total Phosphorus (ug/L)	5.0	17.0
pH	8.9	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	16.3	
Conductivity (umhos)	219	
Ammonia (mg/L)		0.09
Nitrate/Nitrite (mg/L)		0.10
Total Hardness (mg/L)		118.0
Total Alkalinity (mg/L)		116.0
Silica (mg/L)		

COOK LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.30	
Transparency (meters)	2.8	
Total Phosphorus (ug/L)	23.0	76.0
pH	8.6	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	15.6	
Conductivity (umhos)	98	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		8.1
Total Alkalinity (mg/L)		8.0
Silica (mg/L)		

CRESCENT LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.40	
Transparency (meters)	5.3	
Total Phosphorus (ug/L)	5.0	16.0
pH	8.1	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	15.5	
Conductivity (umhos)	59	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		6.6
Total Alkalinity (mg/L)		7.0
Silica (mg/L)		

CURRANT CREEK RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.90	
Transparency (meters)	3.8	
Total Phosphorus (ug/L)	10.0	30.0
pH	8.1	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	1.3	
Residual suspended solids (mg/L)	1.8	
Temperature (C)	13.0	
Conductivity (umhos)	120	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.03
Total Hardness (mg/L)		59.0
Total Alkalinity (mg/L)		60.0
Silica (mg/L)		

CURRANT CREEK RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	4.90	
Transparency (meters)	2.9	
Total Phosphorus (ug/L)	5.0	16.0
pH	8.2	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	14.6	
Conductivity (umhos)	136	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		63.0
Total Alkalinity (mg/L)		63.0
Silica (mg/L)		

DARK CANYON LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	4.20	
Transparency (meters)	5.0	
Total Phosphorus (ug/L)	12.0	24.0
pH	7.9	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	16.1	
Conductivity (umhos)	146	
Ammonia (mg/L)		0.08
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		75.2
Total Alkalinity (mg/L)		75.0
Silica (mg/L)		

DEEP CREEK RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.70	
Transparency (meters)	3.3	
Total Phosphorus (ug/L)	76.0	66.0
pH	8.2	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	16.0	
Conductivity (umhos)	285	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		21.8
Total Alkalinity (mg/L)		22.0
Silica (mg/L)		

DEER CREEK RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	3.90	
Transparency (meters)	3.5	
Total Phosphorus (ug/L)	18.0	28.0
pH	8.2	
Total suspended solids (mg/L)	1.7	
Volatile suspended solids (mg/L)	1.8	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	17.0	
Conductivity (umhos)	312	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.28
Total Hardness (mg/L)		109.0
Total Alkalinity (mg/L)		92.0
Silica (mg/L)		

DEER CREEK RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.70	
Transparency (meters)	3.3	
Total Phosphorus (ug/L)	0.1	0.1
pH	8.2	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	16.0	
Conductivity (umhos)	285	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		21.8
Total Alkalinity (mg/L)		22.0
Silica (mg/L)		

DEER CREEK RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	4.50	
Transparency (meters)	3.4	
Total Phosphorus (ug/L)	8.0	22.0
pH	8.1	
Total suspended solids (mg/L)	2.2	
Volatile suspended solids (mg/L)	0.0	
Residual suspended solids (mg/L)	2.2	
Temperature (C)	17.0	
Conductivity (umhos)	367	
Ammonia (mg/L)		0.05
Nitrate/Nitrite (mg/L)		0.12
Total Hardness (mg/L)		
Total Alkalinity (mg/L)		
Silica (mg/L)		

DONKEY RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.30	
Transparency (meters)	3.3	
Total Phosphorus (ug/L)	26.0	32.0
pH	8.8	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	1.0	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	11.0	
Conductivity (umhos)	378	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.04
Total Hardness (mg/L)		33.0
Total Alkalinity (mg/L)		42.0
Silica (mg/L)		

DONKEY RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.90	
Transparency (meters)	4.9	
Total Phosphorus (ug/L)	10.0	65.0
pH	8.7	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	11.7	
Conductivity (umhos)	41	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		33.0
Total Alkalinity (mg/L)		4.0
Silica (mg/L)		

DUCK FORK RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.60	
Transparency (meters)	7.0	
Total Phosphorus (ug/L)	5.0	11.0
pH	8.7	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	17.4	
Conductivity (umhos)	414	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		230.0
Total Alkalinity (mg/L)		230.0
Silica (mg/L)		

EAST CANYON RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	3.00	
Transparency (meters)	3.2	
Total Phosphorus (ug/L)	23.0	114.0
pH	8.5	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.3	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	19.0	
Conductivity (umhos)	530	
Ammonia (mg/L)		0.05
Nitrate/Nitrite (mg/L)		0.31
Total Hardness (mg/L)		236.0
Total Alkalinity (mg/L)		153.0
Silica (mg/L)		

EAST CANYON RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)		
Transparency (meters)		
Total Phosphorus (ug/L)		
pH		
Total suspended solids (mg/L)		
Volatile suspended solids (mg/L)		
Residual suspended solids (mg/L)		
Temperature (C)		
Conductivity (umhos)		
Ammonia (mg/L)		
Nitrate/Nitrite (mg/L)		
Total Hardness (mg/L)		
Total Alkalinity (mg/L)		
Silica (mg/L)		

EAST CANYON RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)		
Transparency (meters)		
Total Phosphorus (ug/L)		
pH		
Total suspended solids (mg/L)		
Volatile suspended solids (mg/L)		
Residual suspended solids (mg/L)		
Temperature (C)		
Conductivity (umhos)		
Ammonia (mg/L)		
Nitrate/Nitrite (mg/L)		
Total Hardness (mg/L)		
Total Alkalinity (mg/L)		
Silica (mg/L)		

EAST CANYON RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)		
Transparency (meters)		
Total Phosphorus (ug/L)		
pH		
Total suspended solids (mg/L)		
Volatile suspended solids (mg/L)		
Residual suspended solids (mg/L)		
Temperature (C)		
Conductivity (umhos)		
Ammonia (mg/L)		
Nitrate/Nitrite (mg/L)		
Total Hardness (mg/L)		
Total Alkalinity (mg/L)		
Silica (mg/L)		

EAST CANYON RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	5.20	
Transparency (meters)	2.3	
Total Phosphorus (ug/L)	30.0	137.0
pH	8.4	
Total suspended solids (mg/L)	2.6	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	19.6	
Conductivity (umhos)	614	
Ammonia (mg/L)		0.05
Nitrate/Nitrite (mg/L)		0.11
Total Hardness (mg/L)		248.2
Total Alkalinity (mg/L)		248.0
Silica (mg/L)		

EAST CANYON RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	7.30	
Transparency (meters)	3.4	
Total Phosphorus (ug/L)	20.0	99.0
pH	8.6	
Total suspended solids (mg/L)	2.8	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.8	
Temperature (C)	17.3	
Conductivity (umhos)	589	
Ammonia (mg/L)		0.06
Nitrate/Nitrite (mg/L)		0.03
Total Hardness (mg/L)		241.0
Total Alkalinity (mg/L)		165.0
Silica (mg/L)		

EAST PARK RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.90	
Transparency (meters)	1.5	
Total Phosphorus (ug/L)	13.0	17.0
pH	7.7	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	0.5	
Residual suspended solids (mg/L)	2.3	
Temperature (C)	13.0	
Conductivity (umhos)	29	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		10.0
Total Alkalinity (mg/L)		10.0
Silica (mg/L)		

EAST PARK RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	3.00	
Transparency (meters)	1.4	
Total Phosphorus (ug/L)	8.0	18.0
pH	7.5	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	4.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	14.1	
Conductivity (umhos)	29	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		11.0
Total Alkalinity (mg/L)		1.0
Silica (mg/L)		

ECHO LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.90	
Transparency (meters)	1.3	
Total Phosphorus (ug/L)	18.0	24.0
pH	8.5	
Total suspended solids (mg/L)	1.9	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	21.5	
Conductivity (umhos)	464	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.03
Total Hardness (mg/L)		215.5
Total Alkalinity (mg/L)		216.0
Silica (mg/L)		

ECHO RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)		
Transparency (meters)		
Total Phosphorus (ug/L)		
pH		
Total suspended solids (mg/L)		
Volatile suspended solids (mg/L)		
Residual suspended solids (mg/L)		
Temperature (C)		
Conductivity (umhos)		
Ammonia (mg/L)		
Nitrate/Nitrite (mg/L)		
Total Hardness (mg/L)		
Total Alkalinity (mg/L)		
Silica (mg/L)		

ELECTRIC LAKE 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	3.10	
Transparency (meters)	2.9	
Total Phosphorus (ug/L)	18.0	21.0
pH	9.0	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	1.5	
Residual suspended solids (mg/L)	1.9	
Temperature (C)	16.0	
Conductivity (umhos)	183	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.22
Total Hardness (mg/L)		95.0
Total Alkalinity (mg/L)		92.0
Silica (mg/L)		

ELECTRIC LAKE 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.50	
Transparency (meters)	2.3	
Total Phosphorus (ug/L)	5.0	9.0
pH	8.9	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	17.7	
Conductivity (umhos)	204	
Ammonia (mg/L)		0.09
Nitrate/Nitrite (mg/L)		0.13
Total Hardness (mg/L)		104.0
Total Alkalinity (mg/L)		99.0
Silica (mg/L)		

ENTERPRISE RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	18.30	
Transparency (meters)	1.6	
Total Phosphorus (ug/L)	28.0	45.0
pH	9.1	
Total suspended solids (mg/L)	2.8	
Volatile suspended solids (mg/L)	3.5	
Residual suspended solids (mg/L)	1.1	
Temperature (C)	19.0	
Conductivity (umhos)	108	
Ammonia (mg/L)		0.07
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		57.0
Total Alkalinity (mg/L)		67.0
Silica (mg/L)		

FAIRVIEW LAKE #2 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.70	
Transparency (meters)	3.0	
Total Phosphorus (ug/L)	20.0	20.0
pH	9.0	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	18.3	
Conductivity (umhos)	220	
Ammonia (mg/L)		0.15
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		109.1
Total Alkalinity (mg/L)		109.0
Silica (mg/L)		

FERRON RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	5.80	
Transparency (meters)	2.3	
Total Phosphorus (ug/L)	14.0	13.0
pH	8.5	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	1.0	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	13.0	
Conductivity (umhos)	374	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.03
Total Hardness (mg/L)		213.0
Total Alkalinity (mg/L)		185.0
Silica (mg/L)		

FERRON RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.40	
Transparency (meters)	2.1	
Total Phosphorus (ug/L)	9.0	7.0
pH	9.9	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	16.1	
Conductivity (umhos)	310	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.09
Total Hardness (mg/L)		165.0
Total Alkalinity (mg/L)		165.0
Silica (mg/L)		

FISH LAKE 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.60	
Transparency (meters)	6.9	
Total Phosphorus (ug/L)	16.0	26.0
pH	8.4	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.3	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	12.0	
Conductivity (umhos)	601	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.03
Total Hardness (mg/L)		39.0
Total Alkalinity (mg/L)		55.0
Silica (mg/L)		

FISH LAKE 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.20	
Transparency (meters)	6.2	
Total Phosphorus (ug/L)	5.0	20.0
pH	8.5	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	1.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	14.6	
Conductivity (umhos)	113	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		40.0
Total Alkalinity (mg/L)		56.0
Silica (mg/L)		

FLAMING GORGE RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.50	
Transparency (meters)	5.2	
Total Phosphorus (ug/L)	16.0	16.0
pH	8.6	
Total suspended solids (mg/L)	1.7	
Volatile suspended solids (mg/L)	0.9	
Residual suspended solids (mg/L)	1.9	
Temperature (C)	17.0	
Conductivity (umhos)	627	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		224.0
Total Alkalinity (mg/L)		145.0
Silica (mg/L)		

FLAMING GORGE RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	3.00	
Transparency (meters)	4.5	
Total Phosphorus (ug/L)	8.0	15.0
pH	8.4	
Total suspended solids (mg/L)	2.1	
Volatile suspended solids (mg/L)	1.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	20.0	
Conductivity (umhos)	621	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		229.0
Total Alkalinity (mg/L)		137.0
Silica (mg/L)		

FORSYTH RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	12.00	
Transparency (meters)	2.0	
Total Phosphorus (ug/L)	71.0	74.0
pH	8.5	
Total suspended solids (mg/L)	12.3	
Volatile suspended solids (mg/L)	5.0	
Residual suspended solids (mg/L)	9.0	
Temperature (C)	17.9	
Conductivity (umhos)	202	
Ammonia (mg/L)		0.05
Nitrate/Nitrite (mg/L)		0.09
Total Hardness (mg/L)		95.0
Total Alkalinity (mg/L)		95.0
Silica (mg/L)		

GRANTSVILLE RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	4.70	
Transparency (meters)	2.3	
Total Phosphorus (ug/L)	18.0	15.0
pH	8.6	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	17.0	
Conductivity (umhos)	216	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.07
Total Hardness (mg/L)		95.0
Total Alkalinity (mg/L)		96.0
Silica (mg/L)		

GRANTSVILLE RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	4.60	
Transparency (meters)	2.9	
Total Phosphorus (ug/L)	8.0	6.0
pH	8.5	
Total suspended solids (mg/L)	3.0	
Volatile suspended solids (mg/L)	1.0	
Residual suspended solids (mg/L)	3.0	
Temperature (C)	16.0	
Conductivity (umhos)	140	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.03
Total Hardness (mg/L)		109.0
Total Alkalinity (mg/L)		110.0
Silica (mg/L)		

GUNLOCK RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	5.60	
Transparency (meters)	1.9	
Total Phosphorus (ug/L)	17.0	32.0
pH	8.6	
Total suspended solids (mg/L)	2.5	
Volatile suspended solids (mg/L)	1.3	
Residual suspended solids (mg/L)	1.9	
Temperature (C)	21.0	
Conductivity (umhos)	270	
Ammonia (mg/L)		0.07
Nitrate/Nitrite (mg/L)		0.04
Total Hardness (mg/L)		123.0
Total Alkalinity (mg/L)		115.0
Silica (mg/L)		

GUNLOCK RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	5.50	
Transparency (meters)	2.8	
Total Phosphorus (ug/L)	6.0	18.0
pH	8.5	
Total suspended solids (mg/L)	2.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.5	
Temperature (C)	22.5	
Conductivity (umhos)	280	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		123.0
Total Alkalinity (mg/L)		118.0
Silica (mg/L)		

GUNNISON BEND RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.30	
Transparency (meters)	0.3	
Total Phosphorus (ug/L)	26.0	30.0
pH	8.4	
Total suspended solids (mg/L)	26.3	
Volatile suspended solids (mg/L)	8.0	
Residual suspended solids (mg/L)	18.0	
Temperature (C)	25.1	
Conductivity (umhos)	1,598	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.34
Total Hardness (mg/L)		394.8
Total Alkalinity (mg/L)		395.0
Silica (mg/L)		

GUNNISON RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	4.40	
Transparency (meters)	0.5	
Total Phosphorus (ug/L)	38.0	39.0
pH	8.4	
Total suspended solids (mg/L)	12.1	
Volatile suspended solids (mg/L)	4.0	
Residual suspended solids (mg/L)	9.0	
Temperature (C)	22.5	
Conductivity (umhos)	1,407	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.11
Total Hardness (mg/L)		559.3
Total Alkalinity (mg/L)		559.0
Silica (mg/L)		

HOOP LAKE 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	4.90	
Transparency (meters)	1.0	
Total Phosphorus (ug/L)	41.0	33.0
pH	7.7	
Total suspended solids (mg/L)	5.8	
Volatile suspended solids (mg/L)	3.5	
Residual suspended solids (mg/L)	2.8	
Temperature (C)	12.0	
Conductivity (umhos)	34	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		10.0
Total Alkalinity (mg/L)		11.0
Silica (mg/L)		

HOOP LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	13.40	
Transparency (meters)	0.7	
Total Phosphorus (ug/L)	38.0	36.0
pH	8.8	
Total suspended solids (mg/L)	9.0	
Volatile suspended solids (mg/L)	4.0	
Residual suspended solids (mg/L)	3.0	
Temperature (C)	19.1	
Conductivity (umhos)	39	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		13.7
Total Alkalinity (mg/L)		14.0
Silica (mg/L)		

HOOP LAKE 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	3.70	
Transparency (meters)	1.4	
Total Phosphorus (ug/L)	13.0	15.0
pH	7.0	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	4.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	14.3	
Conductivity (umhos)	30	
Ammonia (mg/L)		0.11
Nitrate/Nitrite (mg/L)		0.04
Total Hardness (mg/L)		12.0
Total Alkalinity (mg/L)		12.0
Silica (mg/L)		

HOOVER LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	3.00	
Transparency (meters)	4.0	
Total Phosphorus (ug/L)	5.0	5.0
pH	7.6	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	18.4	
Conductivity (umhos)	20	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		7.7
Total Alkalinity (mg/L)		8.0
Silica (mg/L)		

HUNTINGTON LAKE NORTH 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.30	
Transparency (meters)	1.7	
Total Phosphorus (ug/L)	5.0	5.0
pH	8.5	
Total suspended solids (mg/L)	2.3	
Volatile suspended solids (mg/L)	1.5	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	19.0	
Conductivity (umhos)	640	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		292.0
Total Alkalinity (mg/L)		174.0
Silica (mg/L)		

HUNTINGTON LAKE NORTH 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.90	
Transparency (meters)	3.2	
Total Phosphorus (ug/L)	5.0	6.0
pH	8.9	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	5.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	21.7	
Conductivity (umhos)	499	
Ammonia (mg/L)		0.05
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		243.0
Total Alkalinity (mg/L)		162.0
Silica (mg/L)		

HUNTINGTON RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.10	
Transparency (meters)	6.7	
Total Phosphorus (ug/L)	407.0	236.0
pH	8.6	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	18.1	
Conductivity (umhos)	230	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		119.1
Total Alkalinity (mg/L)		119.0
Silica (mg/L)		

HYRUM RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	7.90	
Transparency (meters)	2.7	
Total Phosphorus (ug/L)	8.0	12.0
pH	8.8	
Total suspended solids (mg/L)	4.0	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	4.0	
Temperature (C)	18.9	
Conductivity (umhos)	400	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		173.0
Total Alkalinity (mg/L)		166.0
Silica (mg/L)		

JOE'S VALLEY RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.70	
Transparency (meters)	3.8	
Total Phosphorus (ug/L)	6.0	11.0
pH	8.5	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	1.3	
Residual suspended solids (mg/L)	1.7	
Temperature (C)	16.0	
Conductivity (umhos)	347	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.05
Total Hardness (mg/L)		190.0
Total Alkalinity (mg/L)		188.0
Silica (mg/L)		

JOE'S VALLEY RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.40	
Transparency (meters)	2.5	
Total Phosphorus (ug/L)	6.0	7.0
pH	8.7	
Total suspended solids (mg/L)	2.4	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.4	
Temperature (C)	16.6	
Conductivity (umhos)	340	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.07
Total Hardness (mg/L)		190.0
Total Alkalinity (mg/L)		180.0
Silica (mg/L)		

JOHNSON LAKE 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	26.50	
Transparency (meters)	1.1	
Total Phosphorus (ug/L)	88.0	94.0
pH	8.5	
Total suspended solids (mg/L)	10.5	
Volatile suspended solids (mg/L)	4.0	
Residual suspended solids (mg/L)	10.5	
Temperature (C)	16.6	
Conductivity (umhos)	108	
Ammonia (mg/L)		0.06
Nitrate/Nitrite (mg/L)		0.09
Total Hardness (mg/L)		49.0
Total Alkalinity (mg/L)		57.0
Silica (mg/L)		

JOHNSON VALLEY RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	50.40	
Transparency (meters)	1.4	
Total Phosphorus (ug/L)	6.0	93.0
pH	8.7	
Total suspended solids (mg/L)	4.3	
Volatile suspended solids (mg/L)	3.5	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	16.0	
Conductivity (umhos)	642	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		56.0
Total Alkalinity (mg/L)		68.0
Silica (mg/L)		

JORDANELLE RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	3.30	
Transparency (meters)	3.6	
Total Phosphorus (ug/L)	27.0	30.0
pH	7.8	
Total suspended solids (mg/L)	2.1	
Volatile suspended solids (mg/L)	0.0	
Residual suspended solids (mg/L)	0.0	
Temperature (C)	16.0	
Conductivity (umhos)	162	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.13
Total Hardness (mg/L)		133.0
Total Alkalinity (mg/L)		84.0
Silica (mg/L)		

JORDANELLE RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	4.20	
Transparency (meters)	3.8	
Total Phosphorus (ug/L)	29.0	38.0
pH	8.1	
Total suspended solids (mg/L)	1.6	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	20.0	
Conductivity (umhos)	199	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.05
Total Hardness (mg/L)		92.3
Total Alkalinity (mg/L)		92.0
Silica (mg/L)		

JORDANELLE RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	5.40	
Transparency (meters)	2.8	
Total Phosphorus (ug/L)	7.0	24.0
pH	7.8	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	0.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	16.9	
Conductivity (umhos)	182	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		
Total Alkalinity (mg/L)		
Silica (mg/L)		

KENS LAKE 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	3.10	
Transparency (meters)	1.7	
Total Phosphorus (ug/L)	13.0	21.0
pH	8.6	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.5	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	19.0	
Conductivity (umhos)	197	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		93.0
Total Alkalinity (mg/L)		84.0
Silica (mg/L)		

KENS LAKE 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.00	
Transparency (meters)	3.1	
Total Phosphorus (ug/L)	5.0	5.0
pH	8.8	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	21.8	
Conductivity (umhos)	148	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.06
Total Hardness (mg/L)		89.0
Total Alkalinity (mg/L)		96.0
Silica (mg/L)		

KENTS LAKE (LOWER) #2 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	71.30	
Transparency (meters)	1.1	
Total Phosphorus (ug/L)	94.0	84.0
pH	8.4	
Total suspended solids (mg/L)	7.5	
Volatile suspended solids (mg/L)	6.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	18.6	
Conductivity (umhos)	69	
Ammonia (mg/L)		0.07
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		24.6
Total Alkalinity (mg/L)		25.0
Silica (mg/L)		

KOLOB RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	3.50	
Transparency (meters)	2.0	
Total Phosphorus (ug/L)	15.0	33.0
pH	8.5	
Total suspended solids (mg/L)	2.8	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	1.9	
Temperature (C)	15.0	
Conductivity (umhos)	303	
Ammonia (mg/L)		0.05
Nitrate/Nitrite (mg/L)		0.05
Total Hardness (mg/L)		164.0
Total Alkalinity (mg/L)		164.0
Silica (mg/L)		

KOLOB RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	7.80	
Transparency (meters)	2.5	
Total Phosphorus (ug/L)	8.0	24.0
pH	8.4	
Total suspended solids (mg/L)	3.0	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	3.0	
Temperature (C)	17.9	
Conductivity (umhos)	311	
Ammonia (mg/L)		0.15
Nitrate/Nitrite (mg/L)		0.03
Total Hardness (mg/L)		166.0
Total Alkalinity (mg/L)		154.0
Silica (mg/L)		

KOOSHAREM RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	18.50	
Transparency (meters)	1.1	
Total Phosphorus (ug/L)	198.0	206.0
pH	8.7	
Total suspended solids (mg/L)	6.2	
Volatile suspended solids (mg/L)	6.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	19.6	
Conductivity (umhos)	83	
Ammonia (mg/L)		0.05
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		133.6
Total Alkalinity (mg/L)		134.0
Silica (mg/L)		

LABARON RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	49.30	
Transparency (meters)	0.7	
Total Phosphorus (ug/L)	59.0	86.0
pH	9.6	
Total suspended solids (mg/L)	8.0	
Volatile suspended solids (mg/L)	10.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	19.8	
Conductivity (umhos)	84	
Ammonia (mg/L)		0.15
Nitrate/Nitrite (mg/L)		0.36
Total Hardness (mg/L)		32.2
Total Alkalinity (mg/L)		32.0
Silica (mg/L)		

LAKE BOREHAM 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)		
Transparency (meters)		
Total Phosphorus (ug/L)		
pH		
Total suspended solids (mg/L)		
Volatile suspended solids (mg/L)		
Residual suspended solids (mg/L)		
Temperature (C)		
Conductivity (umhos)		
Ammonia (mg/L)		
Nitrate/Nitrite (mg/L)		
Total Hardness (mg/L)		
Total Alkalinity (mg/L)		
Silica (mg/L)		

LAKE MARY 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.50	
Transparency (meters)		
Total Phosphorus (ug/L)	15.0	17.0
pH	7.3	
Total suspended solids (mg/L)	3.0	
Volatile suspended solids (mg/L)	4.0	
Residual suspended solids (mg/L)	3.0	
Temperature (C)	18.3	
Conductivity (umhos)	60	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		21.0
Total Alkalinity (mg/L)		25.0
Silica (mg/L)		

LAKE POWELL 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.74	
Transparency (meters)	2.9	
Total Phosphorus (ug/L)	13.1	27.0
pH	8.3	
Total suspended solids (mg/L)	33.2	
Volatile suspended solids (mg/L)		
Residual suspended solids (mg/L)	0.0	
Temperature (C)	24.0	
Conductivity (umhos)	722	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.24
Total Hardness (mg/L)		140.0
Total Alkalinity (mg/L)		90.0
Silica (mg/L)		

LAKE POWELL 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)		
Transparency (meters)		
Total Phosphorus (ug/L)	23.0	23.0
pH	9.4	
Total suspended solids (mg/L)	6.0	
Volatile suspended solids (mg/L)		
Residual suspended solids (mg/L)		
Temperature (C)	29.1	
Conductivity (umhos)	885	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.16
Total Hardness (mg/L)		280.9
Total Alkalinity (mg/L)		281.0
Silica (mg/L)		

LAKE POWELL 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.90	
Transparency (meters)	4.2	
Total Phosphorus (ug/L)	11.0	7.0
pH	8.5	
Total suspended solids (mg/L)	4.0	
Volatile suspended solids (mg/L)	0.0	
Residual suspended solids (mg/L)	4.0	
Temperature (C)	25.0	
Conductivity (umhos)	788	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.06
Total Hardness (mg/L)		182.0
Total Alkalinity (mg/L)		98.0
Silica (mg/L)		

LITTLE CREEK RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.80	
Transparency (meters)	1.9	
Total Phosphorus (ug/L)	14.0	14.0
pH	9.1	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	1.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	19.0	
Conductivity (umhos)	301	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		173.5
Total Alkalinity (mg/L)		174.0
Silica (mg/L)		

LITTLE DELL RES 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.80	
Transparency (meters)	7.3	
Total Phosphorus (ug/L)	25.0	24.0
pH	8.3	
Total suspended solids (mg/L)	3.7	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	20.1	
Conductivity (umhos)	340	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		176.3
Total Alkalinity (mg/L)		176.0
Silica (mg/L)		

LLOYDS RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.20	
Transparency (meters)	1.4	
Total Phosphorus (ug/L)	19.0	41.0
pH	7.9	
Total suspended solids (mg/L)	11.3	
Volatile suspended solids (mg/L)	3.5	
Residual suspended solids (mg/L)	8.6	
Temperature (C)	13.0	
Conductivity (umhos)	209	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		93.0
Total Alkalinity (mg/L)		80.0
Silica (mg/L)		

LLOYDS RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.00	
Transparency (meters)	2.9	
Total Phosphorus (ug/L)	5.0	12.0
pH	8.7	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	18.7	
Conductivity (umhos)	259	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		114.0
Total Alkalinity (mg/L)		95.0
Silica (mg/L)		

LONG PARK RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.40	
Transparency (meters)	1.2	
Total Phosphorus (ug/L)	17.0	13.0
pH	7.6	
Total suspended solids (mg/L)	3.0	
Volatile suspended solids (mg/L)	2.5	
Residual suspended solids (mg/L)	0.8	
Temperature (C)	14.0	
Conductivity (umhos)	56	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.04
Total Hardness (mg/L)		10.0
Total Alkalinity (mg/L)		11.0
Silica (mg/L)		

LONG PARK RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.00	
Transparency (meters)	1.9	
Total Phosphorus (ug/L)	5.0	9.0
pH	7.5	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	4.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	14.6	
Conductivity (umhos)	36	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		13.0
Total Alkalinity (mg/L)		13.0
Silica (mg/L)		

LOST CREEK RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.70	
Transparency (meters)	3.0	
Total Phosphorus (ug/L)	8.0	14.0
pH	8.6	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	1.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	21.3	
Conductivity (umhos)	402	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.04
Total Hardness (mg/L)		192.0
Total Alkalinity (mg/L)		192.0
Silica (mg/L)		

LOWER BOWNS RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	7.50	
Transparency (meters)	2.2	
Total Phosphorus (ug/L)	14.0	44.0
pH	8.3	
Total suspended solids (mg/L)	2.8	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	16.0	
Conductivity (umhos)	563	
Ammonia (mg/L)		0.06
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		48.0
Total Alkalinity (mg/L)		56.0
Silica (mg/L)		

LOWER BOWNS RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	11.40	
Transparency (meters)	2.4	
Total Phosphorus (ug/L)	8.0	39.0
pH	8.5	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	17.8	
Conductivity (umhos)	99	
Ammonia (mg/L)		0.10
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		46.0
Total Alkalinity (mg/L)		5.0
Silica (mg/L)		

LOWER BOX CREEK RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	133.70	
Transparency (meters)	0.7	
Total Phosphorus (ug/L)	180.0	149.0
pH	9.8	
Total suspended solids (mg/L)	14.5	
Volatile suspended solids (mg/L)	10.0	
Residual suspended solids (mg/L)	5.0	
Temperature (C)	17.3	
Conductivity (umhos)	133	
Ammonia (mg/L)		0.09
Nitrate/Nitrite (mg/L)		0.03
Total Hardness (mg/L)		59.0
Total Alkalinity (mg/L)		59.0
Silica (mg/L)		

LOWER GOOSEBERRY RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.90	
Transparency (meters)	2.3	
Total Phosphorus (ug/L)	17.0	14.0
pH	8.5	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	16.0	
Conductivity (umhos)	255	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		129.0
Total Alkalinity (mg/L)		137.0
Silica (mg/L)		

LOWER GOOSEBERRY RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.80	
Transparency (meters)	1.4	
Total Phosphorus (ug/L)	10.0	10.0
pH	8.0	
Total suspended solids (mg/L)	4.0	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	4.0	
Temperature (C)	16.1	
Conductivity (umhos)	309	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.03
Total Hardness (mg/L)		187.0
Total Alkalinity (mg/L)		175.0
Silica (mg/L)		

LYMAN LAKE (RES.) 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.80	
Transparency (meters)	4.7	
Total Phosphorus (ug/L)	5.0	9.0
pH	9.4	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	18.4	
Conductivity (umhos)	166	
Ammonia (mg/L)		0.06
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		91.6
Total Alkalinity (mg/L)		92.0
Silica (mg/L)		

LYMAN LAKE (RES.) 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.70	
Transparency (meters)	3.7	
Total Phosphorus (ug/L)	8.0	10.0
pH	7.9	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	4.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	14.2	
Conductivity (umhos)	178	
Ammonia (mg/L)		0.09
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		90.0
Total Alkalinity (mg/L)		96.0
Silica (mg/L)		

LYNN RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.80	
Transparency (meters)	4.7	
Total Phosphorus (ug/L)	5.0	9.0
pH	9.4	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	18.4	
Conductivity (umhos)	166	
Ammonia (mg/L)		0.06
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		91.6
Total Alkalinity (mg/L)		92.0
Silica (mg/L)		

MANNING MEADOW 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	7.50	
Transparency (meters)	2.9	
Total Phosphorus (ug/L)	35.0	81.0
pH	8.8	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	16.8	
Conductivity (umhos)	42	
Ammonia (mg/L)		0.08
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		33.3
Total Alkalinity (mg/L)		33.0
Silica (mg/L)		

MANTUA RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	31.60	
Transparency (meters)	2.5	
Total Phosphorus (ug/L)	111.0	124.0
pH	9.2	
Total suspended solids (mg/L)	2.2	
Volatile suspended solids (mg/L)	0.2	
Residual suspended solids (mg/L)	2.9	
Temperature (C)	20.0	
Conductivity (umhos)	230	
Ammonia (mg/L)		0.06
Nitrate/Nitrite (mg/L)		0.10
Total Hardness (mg/L)		122.0
Total Alkalinity (mg/L)		124.0
Silica (mg/L)		

MANTUA RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	31.20	
Transparency (meters)	1.7	
Total Phosphorus (ug/L)	83.0	90.0
pH	8.9	
Total suspended solids (mg/L)	7.8	
Volatile suspended solids (mg/L)	6.0	
Residual suspended solids (mg/L)	3.0	
Temperature (C)	20.2	
Conductivity (umhos)	293	
Ammonia (mg/L)		0.05
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		130.3
Total Alkalinity (mg/L)		130.0
Silica (mg/L)		

MANTUA RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	13.60	
Transparency (meters)	3.3	
Total Phosphorus (ug/L)	49.0	102.0
pH	8.8	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	1.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	17.0	
Conductivity (umhos)	309	
Ammonia (mg/L)		0.12
Nitrate/Nitrite (mg/L)		0.03
Total Hardness (mg/L)		142.0
Total Alkalinity (mg/L)		13.0
Silica (mg/L)		

MARSH LAKE 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.00	
Transparency (meters)	6.4	
Total Phosphorus (ug/L)	5.0	19.0
pH	8.4	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	1.5	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	13.0	
Conductivity (umhos)	199	
Ammonia (mg/L)		0.06
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		105.0
Total Alkalinity (mg/L)		111.0
Silica (mg/L)		

MARSH LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.70	
Transparency (meters)	5.0	
Total Phosphorus (ug/L)	5.0	11.0
pH	8.8	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	17.9	
Conductivity (umhos)	209	
Ammonia (mg/L)		0.05
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		103.4
Total Alkalinity (mg/L)		103.0
Silica (mg/L)		

MARSH LAKE 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.00	
Transparency (meters)	6.2	
Total Phosphorus (ug/L)	5.0	6.0
pH	7.4	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	13.4	
Conductivity (umhos)	216	
Ammonia (mg/L)		0.06
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		110.0
Total Alkalinity (mg/L)		112.0
Silica (mg/L)		

MARSHALL LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.30	
Transparency (meters)	5.7	
Total Phosphorus (ug/L)	5.0	9.0
pH	7.4	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	17.8	
Conductivity (umhos)	21	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		8.0
Total Alkalinity (mg/L)		8.0
Silica (mg/L)		

MATT WARNER RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	28.90	
Transparency (meters)	1.4	
Total Phosphorus (ug/L)	80.0	61.0
pH	8.9	
Total suspended solids (mg/L)	5.6	
Volatile suspended solids (mg/L)	6.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	17.8	
Conductivity (umhos)	234	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.04
Total Hardness (mg/L)		116.0
Total Alkalinity (mg/L)		116.0
Silica (mg/L)		

MATT WARNER RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	32.90	
Transparency (meters)	2.6	
Total Phosphorus (ug/L)	45.0	80.0
pH	8.8	
Total suspended solids (mg/L)	3.0	
Volatile suspended solids (mg/L)	5.0	
Residual suspended solids (mg/L)	3.0	
Temperature (C)	18.1	
Conductivity (umhos)	220	
Ammonia (mg/L)		0.08
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		98.0
Total Alkalinity (mg/L)		100.0
Silica (mg/L)		

MEEKS CABIN RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	3.20	
Transparency (meters)	2.2	
Total Phosphorus (ug/L)	7.0	8.0
pH	8.2	
Total suspended solids (mg/L)	1.9	
Volatile suspended solids (mg/L)	1.8	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	12.0	
Conductivity (umhos)	56	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.04
Total Hardness (mg/L)		24.0
Total Alkalinity (mg/L)		26.0
Silica (mg/L)		

MEEKS CABIN RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.40	
Transparency (meters)	2.6	
Total Phosphorus (ug/L)	6.0	9.0
pH	7.9	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	13.2	
Conductivity (umhos)	53	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		24.0
Total Alkalinity (mg/L)		25.0
Silica (mg/L)		

MILL HOLLOW RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	4.80	
Transparency (meters)	1.5	
Total Phosphorus (ug/L)	14.0	50.0
pH		
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.5	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	14.0	
Conductivity (umhos)	118	
Ammonia (mg/L)		0.09
Nitrate/Nitrite (mg/L)		0.03
Total Hardness (mg/L)		67.0
Total Alkalinity (mg/L)		76.0
Silica (mg/L)		

MILL HOLLOW RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	8.00	
Transparency (meters)	3.6	
Total Phosphorus (ug/L)	10.0	37.0
pH	8.4	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	12.4	
Conductivity (umhos)	167	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		77.0
Total Alkalinity (mg/L)		85.0
Silica (mg/L)		

MILL MEADOW RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	14.10	
Transparency (meters)	2.0	
Total Phosphorus (ug/L)	61.0	67.0
pH	8.6	
Total suspended solids (mg/L)	1.9	
Volatile suspended solids (mg/L)	2.3	
Residual suspended solids (mg/L)	1.1	
Temperature (C)	15.0	
Conductivity (umhos)	125	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		77.0
Total Alkalinity (mg/L)		85.0
Silica (mg/L)		

MILL MEADOW RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	45.30	
Transparency (meters)	2.5	
Total Phosphorus (ug/L)	75.0	66.0
pH	8.5	
Total suspended solids (mg/L)	4.0	
Volatile suspended solids (mg/L)	5.0	
Residual suspended solids (mg/L)	4.0	
Temperature (C)	17.1	
Conductivity (umhos)	152	
Ammonia (mg/L)		0.09
Nitrate/Nitrite (mg/L)		0.06
Total Hardness (mg/L)		71.0
Total Alkalinity (mg/L)		78.0
Silica (mg/L)		

MILLER FLAT RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	3.00	
Transparency (meters)	2.7	
Total Phosphorus (ug/L)	12.0	18.0
pH	8.5	
Total suspended solids (mg/L)	2.7	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	17.6	
Conductivity (umhos)	291	
Ammonia (mg/L)		0.39
Nitrate/Nitrite (mg/L)		0.06
Total Hardness (mg/L)		163.9
Total Alkalinity (mg/L)		164.0
Silica (mg/L)		

MILLSITE RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.10	
Transparency (meters)	2.3	
Total Phosphorus (ug/L)	5.0	10.0
pH	8.6	
Total suspended solids (mg/L)	1.9	
Volatile suspended solids (mg/L)	0.5	
Residual suspended solids (mg/L)	2.2	
Temperature (C)	17.0	
Conductivity (umhos)	399	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.13
Total Hardness (mg/L)		215.0
Total Alkalinity (mg/L)		193.0
Silica (mg/L)		

MILLSITE RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.30	
Transparency (meters)	2.6	
Total Phosphorus (ug/L)	6.0	5.0
pH	8.9	
Total suspended solids (mg/L)	2.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.5	
Temperature (C)	16.5	
Conductivity (umhos)	469	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.17
Total Hardness (mg/L)		221.0
Total Alkalinity (mg/L)		180.0
Silica (mg/L)		

MINERSVILLE RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	5.30	
Transparency (meters)	1.8	
Total Phosphorus (ug/L)	75.0	84.0
pH	8.4	
Total suspended solids (mg/L)	6.4	
Volatile suspended solids (mg/L)	2.8	
Residual suspended solids (mg/L)	4.4	
Temperature (C)	18.0	
Conductivity (umhos)	460	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		172.0
Total Alkalinity (mg/L)		173.0
Silica (mg/L)		

MINERSVILLE RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	54.20	
Transparency (meters)	1.0	
Total Phosphorus (ug/L)	151.0	153.0
pH	8.9	
Total suspended solids (mg/L)	12.3	
Volatile suspended solids (mg/L)	7.0	
Residual suspended solids (mg/L)	6.0	
Temperature (C)	22.9	
Conductivity (umhos)	519	
Ammonia (mg/L)		0.10
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		183.1
Total Alkalinity (mg/L)		183.0
Silica (mg/L)		

MINERSVILLE RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	10.40	
Transparency (meters)	2.0	
Total Phosphorus (ug/L)	29.0	67.0
pH	8.6	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	19.5	
Conductivity (umhos)	340	
Ammonia (mg/L)		0.10
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		128.0
Total Alkalinity (mg/L)		127.0
Silica (mg/L)		

MIRROR LAKE 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.30	
Transparency (meters)	4.1	
Total Phosphorus (ug/L)	10.0	10.0
pH	6.7	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	13.0	
Conductivity (umhos)	18	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		7.0
Total Alkalinity (mg/L)		5.0
Silica (mg/L)		

MIRROR LAKE 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.40	
Transparency (meters)	3.6	
Total Phosphorus (ug/L)	5.0	7.0
pH	7.9	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	12.8	
Conductivity (umhos)	20	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		7.0
Total Alkalinity (mg/L)		6.0
Silica (mg/L)		

MONA RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.70	
Transparency (meters)	0.6	
Total Phosphorus (ug/L)	75.0	58.0
pH	8.9	
Total suspended solids (mg/L)	13.4	
Volatile suspended solids (mg/L)	6.0	
Residual suspended solids (mg/L)	9.0	
Temperature (C)	22.0	
Conductivity (umhos)	1,234	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.04
Total Hardness (mg/L)		374.8
Total Alkalinity (mg/L)		375.0
Silica (mg/L)		

MONTICELLO LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.50	
Transparency (meters)	2.5	
Total Phosphorus (ug/L)	25.0	30.0
pH	8.1	
Total suspended solids (mg/L)	3.5	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	18.9	
Conductivity (umhos)	416	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		178.6
Total Alkalinity (mg/L)		179.0
Silica (mg/L)		

MOON LAKE 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.90	
Transparency (meters)	2.3	
Total Phosphorus (ug/L)	5.0	5.0
pH	7.8	
Total suspended solids (mg/L)	18.4	
Volatile suspended solids (mg/L)	1.5	
Residual suspended solids (mg/L)	18.1	
Temperature (C)	12.0	
Conductivity (umhos)	23	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.04
Total Hardness (mg/L)		7.0
Total Alkalinity (mg/L)		7.0
Silica (mg/L)		

MOON LAKE 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.20	
Transparency (meters)	2.2	
Total Phosphorus (ug/L)	8.0	7.0
pH	7.2	
Total suspended solids (mg/L)	2.5	
Volatile suspended solids (mg/L)	1.0	
Residual suspended solids (mg/L)	2.5	
Temperature (C)	15.0	
Conductivity (umhos)	19	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.03
Total Hardness (mg/L)		8.0
Total Alkalinity (mg/L)		8.0
Silica (mg/L)		

NAVAJO LAKE 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.40	
Transparency (meters)	4.0	
Total Phosphorus (ug/L)	9.0	11.0
pH	8.3	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	1.4	
Residual suspended solids (mg/L)	1.7	
Temperature (C)	14.0	
Conductivity (umhos)	233	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.03
Total Hardness (mg/L)		118.0
Total Alkalinity (mg/L)		118.0
Silica (mg/L)		

NAVAJO LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.00	
Transparency (meters)	3.0	
Total Phosphorus (ug/L)	15.0	16.0
pH	9.2	
Total suspended solids (mg/L)	2.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	13.2	
Conductivity (umhos)	150	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		83.1
Total Alkalinity (mg/L)		83.0
Silica (mg/L)		

NAVAJO LAKE 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.30	
Transparency (meters)	3.9	
Total Phosphorus (ug/L)	5.0	6.0
pH	8.4	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	1.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	15.3	
Conductivity (umhos)	222	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		115.0
Total Alkalinity (mg/L)		109.0
Silica (mg/L)		

NEWCASTLE RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.00	
Transparency (meters)	3.0	
Total Phosphorus (ug/L)	16.0	28.0
pH	8.9	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	22.8	
Conductivity (umhos)	631	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		245.1
Total Alkalinity (mg/L)		245.0
Silica (mg/L)		

NEWTON RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	10.70	
Transparency (meters)	1.0	
Total Phosphorus (ug/L)	90.0	115.0
pH	8.7	
Total suspended solids (mg/L)	12.0	
Volatile suspended solids (mg/L)	5.0	
Residual suspended solids (mg/L)	7.0	
Temperature (C)	24.2	
Conductivity (umhos)	640	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		269.3
Total Alkalinity (mg/L)		269.0
Silica (mg/L)		

NINEMILE RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	19.40	
Transparency (meters)	2.0	
Total Phosphorus (ug/L)	24.0	27.0
pH	9.5	
Total suspended solids (mg/L)	5.7	
Volatile suspended solids (mg/L)	5.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	23.1	
Conductivity (umhos)	1,046	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		284.3
Total Alkalinity (mg/L)		284.0
Silica (mg/L)		

OAK PARK RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.80	
Transparency (meters)	1.1	
Total Phosphorus (ug/L)	13.0	23.0
pH	7.3	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	1.3	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	13.0	
Conductivity (umhos)	29	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.12
Total Hardness (mg/L)		10.0
Total Alkalinity (mg/L)		9.0
Silica (mg/L)		

OAK PARK RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.90	
Transparency (meters)	1.3	
Total Phosphorus (ug/L)	6.0	11.0
pH	7.4	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	4.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	14.3	
Conductivity (umhos)	28	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		11.0
Total Alkalinity (mg/L)		1.0
Silica (mg/L)		

OTTER CREEK RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	8.00	
Transparency (meters)	2.6	
Total Phosphorus (ug/L)	98.0	105.0
pH	8.6	
Total suspended solids (mg/L)	2.7	
Volatile suspended solids (mg/L)	2.8	
Residual suspended solids (mg/L)	1.6	
Temperature (C)	18.0	
Conductivity (umhos)	398	
Ammonia (mg/L)		0.06
Nitrate/Nitrite (mg/L)		0.05
Total Hardness (mg/L)		176.0
Total Alkalinity (mg/L)		185.0
Silica (mg/L)		

OTTER CREEK RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)		
Transparency (meters)		
Total Phosphorus (ug/L)		
pH		
Total suspended solids (mg/L)		
Volatile suspended solids (mg/L)		
Residual suspended solids (mg/L)		
Temperature (C)		
Conductivity (umhos)		
Ammonia (mg/L)		
Nitrate/Nitrite (mg/L)		
Total Hardness (mg/L)		
Total Alkalinity (mg/L)		
Silica (mg/L)		

OTTER CREEK RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	28.10	
Transparency (meters)	2.2	
Total Phosphorus (ug/L)	71.0	93.0
pH	9.0	
Total suspended solids (mg/L)	10.3	
Volatile suspended solids (mg/L)	5.0	
Residual suspended solids (mg/L)	6.0	
Temperature (C)	17.7	
Conductivity (umhos)	383	
Ammonia (mg/L)		0.09
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		174.0
Total Alkalinity (mg/L)		174.0
Silica (mg/L)		

PALISADE LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.80	
Transparency (meters)	2.2	
Total Phosphorus (ug/L)	8.0	8.0
pH	8.6	
Total suspended solids (mg/L)	3.7	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	20.8	
Conductivity (umhos)	403	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		198.5
Total Alkalinity (mg/L)		199.0
Silica (mg/L)		

PANGUITCH LAKE 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	15.00	
Transparency (meters)	7.1	
Total Phosphorus (ug/L)	314.0	271.0
pH	8.4	
Total suspended solids (mg/L)	40.4	
Volatile suspended solids (mg/L)	44.0	
Residual suspended solids (mg/L)	0.4	
Temperature (C)	15.0	
Conductivity (umhos)	177	
Ammonia (mg/L)		0.19
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		85.0
Total Alkalinity (mg/L)		94.0
Silica (mg/L)		

PANGUITCH LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	7.90	
Transparency (meters)	3.4	
Total Phosphorus (ug/L)	69.0	90.0
pH	8.9	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	17.8	
Conductivity (umhos)	203	
Ammonia (mg/L)		0.11
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		101.8
Total Alkalinity (mg/L)		102.0
Silica (mg/L)		

PANGUITCH LAKE 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	4.30	
Transparency (meters)	2.6	
Total Phosphorus (ug/L)	10.0	23.0
pH	8.8	
Total suspended solids (mg/L)	3.8	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	3.8	
Temperature (C)	16.6	
Conductivity (umhos)	177	
Ammonia (mg/L)		0.06
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		79.0
Total Alkalinity (mg/L)		14.0
Silica (mg/L)		

PARADISE PARK RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.30	
Transparency (meters)	1.9	
Total Phosphorus (ug/L)	5.0	6.0
pH	7.2	
Total suspended solids (mg/L)	2.3	
Volatile suspended solids (mg/L)	1.5	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	14.0	
Conductivity (umhos)	23	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		8.0
Total Alkalinity (mg/L)		7.0
Silica (mg/L)		

PARADISE PARK RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.00	
Transparency (meters)	2.9	
Total Phosphorus (ug/L)	5.0	9.0
pH	8.0	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	14.4	
Conductivity (umhos)	23	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		9.0
Total Alkalinity (mg/L)		8.0
Silica (mg/L)		

PELICAN LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	4.50	
Transparency (meters)	2.4	
Total Phosphorus (ug/L)	23.0	22.0
pH	9.8	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	22.3	
Conductivity (umhos)	585	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		217.7
Total Alkalinity (mg/L)		218.0
Silica (mg/L)		

PELICAN LAKE 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.20	
Transparency (meters)	3.3	
Total Phosphorus (ug/L)	6.0	11.0
pH	9.0	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	20.8	
Conductivity (umhos)	492	
Ammonia (mg/L)		0.05
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		193.0
Total Alkalinity (mg/L)		144.0
Silica (mg/L)		

PINE LAKE 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.10	
Transparency (meters)	7.8	
Total Phosphorus (ug/L)	5.0	7.0
pH	9.5	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	1.0	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	16.0	
Conductivity (umhos)	266	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		155.0
Total Alkalinity (mg/L)		157.0
Silica (mg/L)		

PINE LAKE 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.90	
Transparency (meters)	8.5	
Total Phosphorus (ug/L)	5.0	6.0
pH	9.1	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	17.3	
Conductivity (umhos)	298	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		178.0
Total Alkalinity (mg/L)		178.0
Silica (mg/L)		

PINEVIEW RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.20	
Transparency (meters)	3.6	
Total Phosphorus (ug/L)	12.0	26.0
pH	8.4	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	22.7	
Conductivity (umhos)	270	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.04
Total Hardness (mg/L)		128.2
Total Alkalinity (mg/L)		128.0
Silica (mg/L)		

PIUTE RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.70	
Transparency (meters)	1.6	
Total Phosphorus (ug/L)	22.0	26.0
pH	8.2	
Total suspended solids (mg/L)	2.1	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	17.0	
Conductivity (umhos)	401	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.08
Total Hardness (mg/L)		191.0
Total Alkalinity (mg/L)		216.0
Silica (mg/L)		

PIUTE RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	5.70	
Transparency (meters)	1.9	
Total Phosphorus (ug/L)	19.0	26.0
pH	8.6	
Total suspended solids (mg/L)	6.2	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	6.2	
Temperature (C)	18.9	
Conductivity (umhos)	405	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		184.0
Total Alkalinity (mg/L)		197.0
Silica (mg/L)		

PORCUPINE RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	4.70	
Transparency (meters)	2.9	
Total Phosphorus (ug/L)	5.0	9.0
pH	8.4	
Total suspended solids (mg/L)	1.9	
Volatile suspended solids (mg/L)	2.8	
Residual suspended solids (mg/L)	0.8	
Temperature (C)	18.0	
Conductivity (umhos)	303	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.10
Total Hardness (mg/L)		180.0
Total Alkalinity (mg/L)		171.0
Silica (mg/L)		

PORCUPINE RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.90	
Transparency (meters)	3.2	
Total Phosphorus (ug/L)	6.0	10.0
pH	8.7	
Total suspended solids (mg/L)	2.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.5	
Temperature (C)	19.5	
Conductivity (umhos)	336	
Ammonia (mg/L)		0.05
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		178.0
Total Alkalinity (mg/L)		173.0
Silica (mg/L)		

POSEY LAKE 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.20	
Transparency (meters)	5.2	
Total Phosphorus (ug/L)	21.0	22.0
pH	8.6	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	1.0	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	15.0	
Conductivity (umhos)	180	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		92.0
Total Alkalinity (mg/L)		101.0
Silica (mg/L)		

POSEY LAKE 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.50	
Transparency (meters)	5.9	
Total Phosphorus (ug/L)	8.0	16.0
pH	8.9	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	16.1	
Conductivity (umhos)	159	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		77.0
Total Alkalinity (mg/L)		86.0
Silica (mg/L)		

PUFFER LAKE 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.30	
Transparency (meters)	3.5	
Total Phosphorus (ug/L)	13.0	37.0
pH	8.6	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	13.0	
Conductivity (umhos)	109	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		49.0
Total Alkalinity (mg/L)		54.0
Silica (mg/L)		

PUFFER LAKE 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.90	
Transparency (meters)	3.5	
Total Phosphorus (ug/L)	5.0	15.0
pH	8.4	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	4.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	14.9	
Conductivity (umhos)	115	
Ammonia (mg/L)		0.05
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		47.0
Total Alkalinity (mg/L)		51.0
Silica (mg/L)		

QUAIL CREEK RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.20	
Transparency (meters)	4.2	
Total Phosphorus (ug/L)	5.0	6.0
pH	8.1	
Total suspended solids (mg/L)	2.4	
Volatile suspended solids (mg/L)	1.5	
Residual suspended solids (mg/L)	2.1	
Temperature (C)	23.0	
Conductivity (umhos)	824	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.07
Total Hardness (mg/L)		394.0
Total Alkalinity (mg/L)		134.0
Silica (mg/L)		

QUAIL CREEK RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.50	
Transparency (meters)	4.9	
Total Phosphorus (ug/L)	5.0	5.0
pH	8.2	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	24.0	
Conductivity (umhos)	855	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		374.0
Total Alkalinity (mg/L)		136.0
Silica (mg/L)		

RAFT LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.80	
Transparency (meters)	2.6	
Total Phosphorus (ug/L)	18.0	20.0
pH	8.0	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	13.0	
Conductivity (umhos)	52	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		6.8
Total Alkalinity (mg/L)		7.0
Silica (mg/L)		

RECAPTURE RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.60	
Transparency (meters)	1.3	
Total Phosphorus (ug/L)	14.0	24.0
pH	8.4	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	1.7	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	19.0	
Conductivity (umhos)	215	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		90.0
Total Alkalinity (mg/L)		88.0
Silica (mg/L)		

RECAPTURE RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.20	
Transparency (meters)	2.8	
Total Phosphorus (ug/L)	5.0	12.0
pH	8.8	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	21.7	
Conductivity (umhos)	305	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		118.0
Total Alkalinity (mg/L)		112.0
Silica (mg/L)		

RED CREEK RESERVOIR (DUCHESNE) 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	15.30	
Transparency (meters)	1.2	
Total Phosphorus (ug/L)	40.0	82.0
pH	8.6	
Total suspended solids (mg/L)	7.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	6.0	
Temperature (C)	16.3	
Conductivity (umhos)	422	
Ammonia (mg/L)		0.07
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		250.0
Total Alkalinity (mg/L)		250.0
Silica (mg/L)		

RED CREEK RESERVOIR (IRON) 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	7.40	
Transparency (meters)	0.7	
Total Phosphorus (ug/L)	20.0	64.0
pH	9.1	
Total suspended solids (mg/L)	10.5	
Volatile suspended solids (mg/L)	7.0	
Residual suspended solids (mg/L)	4.0	
Temperature (C)	19.6	
Conductivity (umhos)	152	
Ammonia (mg/L)		0.12
Nitrate/Nitrite (mg/L)		0.05
Total Hardness (mg/L)		71.2
Total Alkalinity (mg/L)		71.0
Silica (mg/L)		

RED FLEET RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.50	
Transparency (meters)	1.5	
Total Phosphorus (ug/L)	9.0	17.0
pH	8.4	
Total suspended solids (mg/L)	3.1	
Volatile suspended solids (mg/L)	1.5	
Residual suspended solids (mg/L)	2.2	
Temperature (C)	19.0	
Conductivity (umhos)	205	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.06
Total Hardness (mg/L)		90.0
Total Alkalinity (mg/L)		75.0
Silica (mg/L)		

RED FLEET RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.20	
Transparency (meters)	3.1	
Total Phosphorus (ug/L)	70.0	33.0
pH	8.3	
Total suspended solids (mg/L)	2.8	
Volatile suspended solids (mg/L)		
Residual suspended solids (mg/L)	2.8	
Temperature (C)	20.5	
Conductivity (umhos)	230	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.07
Total Hardness (mg/L)		127.0
Total Alkalinity (mg/L)		95.0
Silica (mg/L)		

REDMOND LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	18.80	
Transparency (meters)	0.2	
Total Phosphorus (ug/L)	105.0	105.0
pH	8.5	
Total suspended solids (mg/L)	79.0	
Volatile suspended solids (mg/L)	11.0	
Residual suspended solids (mg/L)	68.0	
Temperature (C)	23.0	
Conductivity (umhos)	926	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.41
Total Hardness (mg/L)		244.6
Total Alkalinity (mg/L)		245.0
Silica (mg/L)		

REX RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	4.20	
Transparency (meters)	2.0	
Total Phosphorus (ug/L)	36.0	136.0
pH	8.4	
Total suspended solids (mg/L)	3.5	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	18.3	
Conductivity (umhos)	519	
Ammonia (mg/L)		0.11
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		138.0
Total Alkalinity (mg/L)		138.0
Silica (mg/L)		

ROCKPORT RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.20	
Transparency (meters)	2.5	
Total Phosphorus (ug/L)	12.0	29.0
pH	8.5	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	4.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	20.3	
Conductivity (umhos)	352	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.08
Total Hardness (mg/L)		177.0
Total Alkalinity (mg/L)		177.0
Silica (mg/L)		

RUSH LAKE 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	27.40	
Transparency (meters)	0.2	
Total Phosphorus (ug/L)	115.0	144.0
pH	8.2	
Total suspended solids (mg/L)	84.0	
Volatile suspended solids (mg/L)	21.0	
Residual suspended solids (mg/L)	63.5	
Temperature (C)	18.0	
Conductivity (umhos)	8,283	
Ammonia (mg/L)		0.23
Nitrate/Nitrite (mg/L)		0.07
Total Hardness (mg/L)		3,747.0
Total Alkalinity (mg/L)		316.0
Silica (mg/L)		

RUSH LAKE 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	3.50	
Transparency (meters)	0.8	
Total Phosphorus (ug/L)	135.0	143.0
pH	8.3	
Total suspended solids (mg/L)	22.0	
Volatile suspended solids (mg/L)	8.0	
Residual suspended solids (mg/L)	22.0	
Temperature (C)	16.0	
Conductivity (umhos)	1,845	
Ammonia (mg/L)		0.15
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		6,341.0
Total Alkalinity (mg/L)		265.0
Silica (mg/L)		

SALEM POND 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.70	
Transparency (meters)	3.5	
Total Phosphorus (ug/L)	14.0	19.0
pH	8.0	
Total suspended solids (mg/L)	1.6	
Volatile suspended solids (mg/L)	1.1	
Residual suspended solids (mg/L)	1.9	
Temperature (C)	20.0	
Conductivity (umhos)	679	
Ammonia (mg/L)		0.06
Nitrate/Nitrite (mg/L)		1.52
Total Hardness (mg/L)		295.0
Total Alkalinity (mg/L)		291.0
Silica (mg/L)		

SCOFIELD RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.50	
Transparency (meters)	2.8	
Total Phosphorus (ug/L)	33.0	34.0
pH	8.3	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	0.0	
Residual suspended solids (mg/L)	3.0	
Temperature (C)	14.0	
Conductivity (umhos)	385	
Ammonia (mg/L)		0.06
Nitrate/Nitrite (mg/L)		0.03
Total Hardness (mg/L)		166.0
Total Alkalinity (mg/L)		197.0
Silica (mg/L)		

SCOFIELD RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	3.40	
Transparency (meters)	2.8	
Total Phosphorus (ug/L)	142.0	104.0
pH	9.1	
Total suspended solids (mg/L)	1.9	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	18.3	
Conductivity (umhos)	316	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		178.5
Total Alkalinity (mg/L)		179.0
Silica (mg/L)		

SCOFIELD RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	3.20	
Transparency (meters)	5.0	
Total Phosphorus (ug/L)	9.0	25.0
pH	8.7	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	17.5	
Conductivity (umhos)	351	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		187.0
Total Alkalinity (mg/L)		165.0
Silica (mg/L)		

SCOUT LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.70	
Transparency (meters)	4.2	
Total Phosphorus (ug/L)	12.0	10.0
pH	6.8	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	12.6	
Conductivity (umhos)		
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		6.8
Total Alkalinity (mg/L)		7.0
Silica (mg/L)		

SETTLEMENT CANYON RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.50	
Transparency (meters)	2.5	
Total Phosphorus (ug/L)	10.0	12.0
pH	8.3	
Total suspended solids (mg/L)	3.5	
Volatile suspended solids (mg/L)	4.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	19.5	
Conductivity (umhos)	434	
Ammonia (mg/L)		0.05
Nitrate/Nitrite (mg/L)		0.26
Total Hardness (mg/L)		207.1
Total Alkalinity (mg/L)		207.0
Silica (mg/L)		

SEVIER BRIDGE (YUBA) RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	6.90	
Transparency (meters)	1.2	
Total Phosphorus (ug/L)	30.0	32.0
pH	8.3	
Total suspended solids (mg/L)	11.3	
Volatile suspended solids (mg/L)	4.0	
Residual suspended solids (mg/L)	7.0	
Temperature (C)	21.5	
Conductivity (umhos)	1,820	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.39
Total Hardness (mg/L)		406.5
Total Alkalinity (mg/L)		407.0
Silica (mg/L)		

SHEEP CREEK LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	3.20	
Transparency (meters)	3.1	
Total Phosphorus (ug/L)	29.0	24.0
pH	9.1	
Total suspended solids (mg/L)	2.2	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	16.3	
Conductivity (umhos)	120	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		47.5
Total Alkalinity (mg/L)		48.0
Silica (mg/L)		

SHEEP CREEK LAKE 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	3.50	
Transparency (meters)	2.8	
Total Phosphorus (ug/L)	8.0	14.0
pH	7.6	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	15.4	
Conductivity (umhos)	60	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		36.0
Total Alkalinity (mg/L)		4.0
Silica (mg/L)		

SMITH AND MOREHOUSE RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.90	
Transparency (meters)	2.5	
Total Phosphorus (ug/L)	5.0	6.0
pH	7.8	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	1.0	
Residual suspended solids (mg/L)	2.3	
Temperature (C)	12.0	
Conductivity (umhos)	41	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.03
Total Hardness (mg/L)		14.0
Total Alkalinity (mg/L)		19.0
Silica (mg/L)		

SMITH AND MOREHOUSE RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	3.40	
Transparency (meters)	3.5	
Total Phosphorus (ug/L)	5.0	6.0
pH	8.6	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	13.7	
Conductivity (umhos)	33	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		17.0
Total Alkalinity (mg/L)		16.0
Silica (mg/L)		

SOUTH CREEK RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.70	
Transparency (meters)		
Total Phosphorus (ug/L)	5.0	5.0
pH		
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)		
Residual suspended solids (mg/L)		
Temperature (C)		
Conductivity (umhos)		
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		125.1
Total Alkalinity (mg/L)		125.0
Silica (mg/L)		

SPIRIT LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	4.50	
Transparency (meters)	1.3	
Total Phosphorus (ug/L)	22.0	22.0
pH	7.6	
Total suspended solids (mg/L)	5.5	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	3.0	
Temperature (C)	11.0	
Conductivity (umhos)	14	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		9.8
Total Alkalinity (mg/L)		10.0
Silica (mg/L)		

STANSBURY LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.80	
Transparency (meters)	0.4	
Total Phosphorus (ug/L)	69.0	53.0
pH	8.5	
Total suspended solids (mg/L)	18.0	
Volatile suspended solids (mg/L)	8.0	
Residual suspended solids (mg/L)	11.0	
Temperature (C)	22.7	
Conductivity (umhos)	1,271	
Ammonia (mg/L)		0.05
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		576.0
Total Alkalinity (mg/L)		576.0
Silica (mg/L)		

STARVATION RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.70	
Transparency (meters)	3.8	
Total Phosphorus (ug/L)	8.0	11.0
pH	8.6	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	19.7	
Conductivity (umhos)	558	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		230.3
Total Alkalinity (mg/L)		230.0
Silica (mg/L)		

STATELINE RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.00	
Transparency (meters)	1.7	
Total Phosphorus (ug/L)	9.0	12.0
pH	8.2	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	1.5	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	12.0	
Conductivity (umhos)	31	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		9.0
Total Alkalinity (mg/L)		11.0
Silica (mg/L)		

STATELINE RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	3.30	
Transparency (meters)	2.0	
Total Phosphorus (ug/L)	5.0	7.0
pH	7.0	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	12.2	
Conductivity (umhos)	23	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		10.0
Total Alkalinity (mg/L)		1.0
Silica (mg/L)		

STEINAKER RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.50	
Transparency (meters)	2.7	
Total Phosphorus (ug/L)	5.0	24.0
pH	8.3	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	1.5	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	18.0	
Conductivity (umhos)	288	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.09
Total Hardness (mg/L)		128.0
Total Alkalinity (mg/L)		99.0
Silica (mg/L)		

STEINAKER RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.80	
Transparency (meters)	4.6	
Total Phosphorus (ug/L)	5.0	16.0
pH	7.9	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	21.2	
Conductivity (umhos)	221	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		94.0
Total Alkalinity (mg/L)		75.0
Silica (mg/L)		

STRAWBERRY RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	12.90	
Transparency (meters)	3.9	
Total Phosphorus (ug/L)	61.0	57.0
pH	8.7	
Total suspended solids (mg/L)	10.3	
Volatile suspended solids (mg/L)	7.2	
Residual suspended solids (mg/L)	5.4	
Temperature (C)	14.0	
Conductivity (umhos)	234	
Ammonia (mg/L)		0.11
Nitrate/Nitrite (mg/L)		0.03
Total Hardness (mg/L)		127.0
Total Alkalinity (mg/L)		119.0
Silica (mg/L)		

STRAWBERRY RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	16.80	
Transparency (meters)	4.0	
Total Phosphorus (ug/L)	40.0	61.0
pH	8.7	
Total suspended solids (mg/L)	3.7	
Volatile suspended solids (mg/L)	5.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	16.6	
Conductivity (umhos)	235	
Ammonia (mg/L)		0.07
Nitrate/Nitrite (mg/L)		0.07
Total Hardness (mg/L)		132.0
Total Alkalinity (mg/L)		132.0
Silica (mg/L)		

STRAWBERRY RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	12.50	
Transparency (meters)	3.6	
Total Phosphorus (ug/L)	15.0	80.0
pH	8.7	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	12.1	
Conductivity (umhos)	264	
Ammonia (mg/L)		0.17
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		135.0
Total Alkalinity (mg/L)		122.0
Silica (mg/L)		

STRAWBERRY RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)		
Transparency (meters)		
Total Phosphorus (ug/L)		
pH		
Total suspended solids (mg/L)		
Volatile suspended solids (mg/L)		
Residual suspended solids (mg/L)		
Temperature (C)		
Conductivity (umhos)		
Ammonia (mg/L)		
Nitrate/Nitrite (mg/L)		
Total Hardness (mg/L)		
Total Alkalinity (mg/L)		
Silica (mg/L)		

THREE CREEK RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	8.60	
Transparency (meters)	1.1	
Total Phosphorus (ug/L)	57.0	55.0
pH	8.6	
Total suspended solids (mg/L)	15.0	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	12.0	
Temperature (C)	13.4	
Conductivity (umhos)	108	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.06
Total Hardness (mg/L)		50.6
Total Alkalinity (mg/L)		51.0
Silica (mg/L)		

TIBBLE FORK RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.00	
Transparency (meters)	1.2	
Total Phosphorus (ug/L)	17.0	13.0
pH	8.3	
Total suspended solids (mg/L)	3.3	
Volatile suspended solids (mg/L)	0.5	
Residual suspended solids (mg/L)	3.5	
Temperature (C)	10.0	
Conductivity (umhos)	349	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.09
Total Hardness (mg/L)		179.0
Total Alkalinity (mg/L)		136.0
Silica (mg/L)		

TIBBLE FORK RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.20	
Transparency (meters)	1.7	
Total Phosphorus (ug/L)	13.0	13.0
pH	8.5	
Total suspended solids (mg/L)	10.0	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	10.0	
Temperature (C)	11.0	
Conductivity (umhos)	282	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.12
Total Hardness (mg/L)		158.0
Total Alkalinity (mg/L)		126.0
Silica (mg/L)		

TONY GROVE LAKE 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.00	
Transparency (meters)	3.6	
Total Phosphorus (ug/L)	8.0	30.0
pH	8.5	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.5	
Residual suspended solids (mg/L)	0.8	
Temperature (C)	14.0	
Conductivity (umhos)	196	
Ammonia (mg/L)		0.33
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		131.0
Total Alkalinity (mg/L)		118.0
Silica (mg/L)		

TONY GROVE LAKE 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.70	
Transparency (meters)	4.5	
Total Phosphorus (ug/L)	5.0	32.0
pH	8.4	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	1.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	18.8	
Conductivity (umhos)	260	
Ammonia (mg/L)		0.22
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		129.0
Total Alkalinity (mg/L)		128.0
Silica (mg/L)		

TRIAL LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.00	
Transparency (meters)	3.9	
Total Phosphorus (ug/L)	21.0	11.0
pH	6.6	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	18.4	
Conductivity (umhos)	20	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		7.9
Total Alkalinity (mg/L)		8.0
Silica (mg/L)		

TROPIC RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.00	
Transparency (meters)	3.5	
Total Phosphorus (ug/L)	5.0	5.0
pH	8.5	
Total suspended solids (mg/L)	1.9	
Volatile suspended solids (mg/L)	1.0	
Residual suspended solids (mg/L)	2.3	
Temperature (C)	15.0	
Conductivity (umhos)	365	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		216.0
Total Alkalinity (mg/L)		226.0
Silica (mg/L)		

TROPIC RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.50	
Transparency (meters)	4.9	
Total Phosphorus (ug/L)	5.0	5.0
pH	8.6	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	17.0	
Conductivity (umhos)	341	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		207.0
Total Alkalinity (mg/L)		196.0
Silica (mg/L)		

UPPER ENTERPRISE RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	9.30	
Transparency (meters)	1.5	
Total Phosphorus (ug/L)	26.0	49.0
pH	8.8	
Total suspended solids (mg/L)	2.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.5	
Temperature (C)	20.6	
Conductivity (umhos)	159	
Ammonia (mg/L)		0.10
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		67.0
Total Alkalinity (mg/L)		77.0
Silica (mg/L)		

UPPER STILLWATER RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.10	
Transparency (meters)	3.6	
Total Phosphorus (ug/L)	5.0	6.0
pH	7.2	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	1.5	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	11.0	
Conductivity (umhos)	19	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.04
Total Hardness (mg/L)		7.0
Total Alkalinity (mg/L)		5.0
Silica (mg/L)		

UPPER STILLWATER RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.00	
Transparency (meters)	3.8	
Total Phosphorus (ug/L)	5.0	5.0
pH	7.5	
Total suspended solids (mg/L)	2.0	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	12.8	
Conductivity (umhos)	17	
Ammonia (mg/L)		0.04
Nitrate/Nitrite (mg/L)		0.02
Total Hardness (mg/L)		8.0
Total Alkalinity (mg/L)		8.0
Silica (mg/L)		

UTAH LAKE 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)		
Transparency (meters)	0.2	
Total Phosphorus (ug/L)	99.0	101.0
pH	8.5	
Total suspended solids (mg/L)	35.8	
Volatile suspended solids (mg/L)	6.6	
Residual suspended solids (mg/L)	24.5	
Temperature (C)	22.0	
Conductivity (umhos)	1,464	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.15
Total Hardness (mg/L)		316.0
Total Alkalinity (mg/L)		187.0
Silica (mg/L)		

UTAH LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	52.60	
Transparency (meters)		
Total Phosphorus (ug/L)	71.0	71.0
pH		
Total suspended solids (mg/L)	47.5	
Volatile suspended solids (mg/L)		
Residual suspended solids (mg/L)		
Temperature (C)		
Conductivity (umhos)		
Ammonia (mg/L)		0.08
Nitrate/Nitrite (mg/L)		0.55
Total Hardness (mg/L)		384.7
Total Alkalinity (mg/L)		385.0
Silica (mg/L)		

UTAH LAKE 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	15.90	
Transparency (meters)	0.4	
Total Phosphorus (ug/L)	60.0	66.0
pH	8.7	
Total suspended solids (mg/L)	29.8	
Volatile suspended solids (mg/L)	10.0	
Residual suspended solids (mg/L)	29.8	
Temperature (C)	19.3	
Conductivity (umhos)	1,576	
Ammonia (mg/L)		0.13
Nitrate/Nitrite (mg/L)		0.08
Total Hardness (mg/L)		349.0
Total Alkalinity (mg/L)		185.0
Silica (mg/L)		

WALL LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.80	
Transparency (meters)	4.0	
Total Phosphorus (ug/L)	13.0	13.0
pH		
Total suspended solids (mg/L)	29.3	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	27.0	
Temperature (C)		
Conductivity (umhos)		
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		7.0
Total Alkalinity (mg/L)		7.0
Silica (mg/L)		

WASHINGTON LAKE 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	1.70	
Transparency (meters)	2.2	
Total Phosphorus (ug/L)	11.0	19.0
pH	7.5	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	18.1	
Conductivity (umhos)	19	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		7.5
Total Alkalinity (mg/L)		7.0
Silica (mg/L)		

WHITNEY RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	0.08	
Transparency (meters)	3.6	
Total Phosphorus (ug/L)	14.0	55.0
pH	8.4	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	0.5	
Residual suspended solids (mg/L)	2.3	
Temperature (C)	12.0	
Conductivity (umhos)	174	
Ammonia (mg/L)		0.08
Nitrate/Nitrite (mg/L)		0.05
Total Hardness (mg/L)		104.0
Total Alkalinity (mg/L)		105.0
Silica (mg/L)		

WHITNEY RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	4.60	
Transparency (meters)	3.2	
Total Phosphorus (ug/L)	8.0	8.0
pH	7.9	
Total suspended solids (mg/L)	5.0	
Volatile suspended solids (mg/L)	5.0	
Residual suspended solids (mg/L)	5.0	
Temperature (C)	11.3	
Conductivity (umhos)	109	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		117.0
Total Alkalinity (mg/L)		118.0
Silica (mg/L)		

WIDE HOLLOW RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	2.10	
Transparency (meters)	1.8	
Total Phosphorus (ug/L)	29.0	28.0
pH	9.6	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	22.8	
Conductivity (umhos)	540	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		164.2
Total Alkalinity (mg/L)		164.0
Silica (mg/L)		

WILLARD BAY RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	3.30	
Transparency (meters)	1.7	
Total Phosphorus (ug/L)	25.0	29.0
pH	8.6	
Total suspended solids (mg/L)	3.7	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	26.8	
Conductivity (umhos)	935	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.04
Total Hardness (mg/L)		215.2
Total Alkalinity (mg/L)		215.0
Silica (mg/L)		

WITTS LAKE 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)		
Transparency (meters)		
Total Phosphorus (ug/L)		
pH		
Total suspended solids (mg/L)		
Volatile suspended solids (mg/L)		
Residual suspended solids (mg/L)		
Temperature (C)		
Conductivity (umhos)		
Ammonia (mg/L)		
Nitrate/Nitrite (mg/L)		
Total Hardness (mg/L)		
Total Alkalinity (mg/L)		
Silica (mg/L)		

WOODRUFF CREEK RESERVOIR 1993

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	5.00	
Transparency (meters)	2.2	
Total Phosphorus (ug/L)	8.0	20.0
pH	8.4	
Total suspended solids (mg/L)	1.5	
Volatile suspended solids (mg/L)	2.3	
Residual suspended solids (mg/L)	1.5	
Temperature (C)	14.0	
Conductivity (umhos)	299	
Ammonia (mg/L)		0.08
Nitrate/Nitrite (mg/L)		0.42
Total Hardness (mg/L)		162.0
Total Alkalinity (mg/L)		155.0
Silica (mg/L)		

WOODRUFF CREEK RESERVOIR 1995

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	6.20	
Transparency (meters)	3.1	
Total Phosphorus (ug/L)	8.0	11.0
pH	8.5	
Total suspended solids (mg/L)	4.3	
Volatile suspended solids (mg/L)	2.0	
Residual suspended solids (mg/L)	4.3	
Temperature (C)	18.0	
Conductivity (umhos)	318	
Ammonia (mg/L)		0.05
Nitrate/Nitrite (mg/L)		0.20
Total Hardness (mg/L)		165.0
Total Alkalinity (mg/L)		154.0
Silica (mg/L)		

YANKEE MEADOWS RESERVOIR 1994

Parameter	Sur.	Col.
Chlorophyll-a (ug/L)	18.70	
Transparency (meters)	2.1	
Total Phosphorus (ug/L)	31.0	40.0
pH	8.8	
Total suspended solids (mg/L)	4.0	
Volatile suspended solids (mg/L)	3.0	
Residual suspended solids (mg/L)	2.0	
Temperature (C)	20.1	
Conductivity (umhos)	149	
Ammonia (mg/L)		0.03
Nitrate/Nitrite (mg/L)		0.01
Total Hardness (mg/L)		69.7
Total Alkalinity (mg/L)		70.0
Silica (mg/L)		

APPENDIX V

PHYTOPLANKTON DATA

ANDERSON MEADOW RESERVOIR DATE 08/17/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena spiroides var. crassa	19.071	52.92
Ankistrodesmus falcatus	0.004	0.01
Asterionella formosa	0.014	0.04
Centric diatoms	0.276	0.77
Fragilaria crotonensis	14.011	38.88
Mallomonas sp.	0.040	0.11
Pandorina morum	1.334	3.70
Pennate diatoms	1.108	3.07
Stephanodiscus niagarae	0.178	0.50

BAKER DAM RESERVOIR DATE 08/16/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena spiroides var. crassa	3.114	16.50
Centric diatoms	3.822	20.26
Ceratium hirundinella	0.945	5.01
Euglena sp.	0.041	0.22
Fragilaria crotonensis	0.667	3.54
Melosira granulata var. angustissima	0.051	0.27
Mougeotia sp.	1.112	5.89
Pandorina morum	0.222	1.18
Pennate diatoms	2.713	14.38
Sphaerocystis schroeteri	0.612	3.24
Volvox areus	5.560	29.47
Wislouchiella planktonica	0.007	0.04

BARNEY LAKE DATE 08/23/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena sp.	0.558	0.02
Anabaena spiroides var. crassa	1,249.920	49.94
Sphaerocystis schroeteri	2.455	0.10
Volvox aereus	1,249.920	49.94

BEAR LAKE DATE 09/27/93

Species	Cell Volume (mm3/liter)	% Density by volume
Akistrodesmus flacatas	0.004	1.69
Chlamydomonas sp.	0.004	1.72
Lagerheimia ciliata	0.167	64.40
Oocystis sp.	0.083	32.20

BEAR LAKE DATE 08/08/95

Species	Cell Volume (mm3/liter)	% Density by volume
Spirulina species	0.884	81.93
Ankinstrodesmus falcatus	0.183	16.99
Oocystis species	0.008	0.77
Chlorophyta	0.003	0.31

BEAVER MEADOW RESERVOIR DATE 09/16/93

Species	Cell Volume (mm3/liter)	% Density by volume
Quadrigula lacustris	1.112	75.74
Euastrum species	0.311	21.21
Pennate diatoms	0.031	2.12
Ankistrodesmus falcatus	0.003	0.59
Ankyra judayi	0.003	0.19
Chlamydomonas species	0.002	0.15

BEAVER MEADOW RESERVOIR DATE 09/16/95

Species	Cell Volume (mm3/liter)	% Density by volume
Staurastrum sp.	8.840	69.23
Sphaerocystis schroeteri	2.641	20.68
Ankistrodesmus falcatus	0.951	7.45
Chroococcus sp.	0.272	2.13
Pennate diatoms	0.031	0.24
Oocystis sp.	0.016	0.13
Chlorophyta	0.016	0.13

BIG EAST LAKE DATE 08/17/93

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.125	0.90
Centric diatoms	0.035	0.25
Chlamydomonas sp.	0.002	0.02
Fragilaria crotonensis	3.336	24.09
Melosira granulata var. angustissima	0.051	0.37
Microcystis incerta	7.339	52.99
Oscillatoria sp.	0.006	0.04
Pennate diatoms	0.302	2.18
Sphaerocystis schroeteri	2.446	17.66
Trachellomonas sp.	0.178	1.28
Unknown spherical chlorophyte	0.028	0.20

BIG EAST LAKE DATE 08/10/95

Species	Cell Volume (mm3/liter)	% Density by volume
Trachellomonas sp.	0.890	46.54
Microcystis incerta	0.334	17.45
Fragilaria crotonensis	0.229	11.98
Oocystis gigas	0.167	8.73
Dinobryon divergens	0.122	6.40
Aphanizomenon flos-aquae	0.106	5.53
Pennate diatoms	0.035	1.83
Centric diatoms	0.010	0.52
Unk. spherical chlorophyta	0.010	0.52
Asterionella formosa	0.009	0.49

BIG SAND WASH RESERVOIR DATE 09/03/93

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.042	1.10
Centric diatoms	0.004	0.10
Ceratium hirundinella	0.945	24.93
Cosmarium sp.	0.078	2.05
Dinobryon divergens	0.086	2.26
Fragilaria crotonensis	1.000	26.40
Melosira granulata	0.055	1.44
Oocystis sp.	0.025	0.66
Pennate diatoms	0.022	0.59
Peridinium sp.	0.361	9.53
Scenedesmus bijuga	0.022	0.59
Sphaerocystis schroeteri	0.612	16.13
Staurastrum gracile	0.361	9.53
Stephanodiscus niagarae	0.178	4.69

BIG SAND WASH RESERVOIR DATE 09/06/95

Species	Cell Volume (mm3/liter)	% Density by volume
Fragilaria crotonensis	0.458	25.25
Melosira granulata	0.381	21.02
Staurastrum gracile	0.361	19.92
Asterionella formosa	0.217	11.98
Cosmarium sp.	0.156	8.58
Oocystis sp.	0.075	4.14
Gomphosphaeria lacustris	0.056	3.06
Pennate diatoms	0.047	2.57
M. granulata var. angustissima	0.026	1.41
Ankistrodesmus falcatus	0.017	0.96
Unk. spherical chlorophyta	0.017	0.92
Centric diatoms	0.003	0.18

BIRCH CREEK RESERVOIR #2 DATE 08/25/93

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.014	0.07
Ceratium hirundinella	17.014	85.54
Fragilaria crontonensis	0.333	1.68
Mallomonas sp.	0.007	0.03
Melosira granulata	0.109	0.55
Oocystis sp.	0.008	0.04
Pennate diatoms	0.058	0.29
Quadrigula lacustris	1.112	5.59
Sphaerocystis schroeteri	1.223	6.15
Unknown spherical chrysophyte	0.002	0.01
Wislouchiella planktonica	0.009	0.04

BIRCH CREEK RESERVOIR #2 DATE 09/07/95

Species	Cell Volume (mm3/liter)	% Density by volume
Phacus sp.	0.083	33.65
Trachellomonas sp.	0.044	17.95
Euglena sp.	0.041	16.60

Asterionella formosa	0.028	11.44
Dinobryon divergens	0.012	4.94
Microcystis incerta	0.011	4.49
Unk. spherical chlorophyta	0.010	4.04
Ankistrodesmus falcatus	0.009	3.52
Oocystis sp.	0.008	3.37

BLANDING CITY RESERVOIR 04 DATE 08/09/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ceratium hirundinella	0.945	17.85
Dinobryon divergens	0.795	15.02
Gloeocystis vesiculosa	0.017	0.32
Oocystis sp.	0.017	0.32
Pandorina morum	0.445	8.40
Pennate diatoms	0.018	0.34
Sphaerocystis schroeteri	3.058	57.75

BRIDGER LAKE DATE 09/08/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.009	0.05
Botryococcus braunii	2.224	11.56
Chlamydomonas sp.	0.004	0.02
Gloeocystis sp.	12.176	63.30
Pennate diatoms	0.018	0.09
Phacotus sp.	0.167	0.87
Scenedesmus bijuga	0.022	0.12
Sphaerocystis schroeteri	1.835	9.54
Trachellomonas sp.	2.669	13.87
Unknown spherical chlorophyta	0.111	0.58

BROUGH RESERVOIR DATE 09/17/94

Species	Cell Volume (mm3/liter)	% Density by volume
Coelosphaerium sp.	0.250	28.88
Pennate diatoms	0.004	0.51
Sphaerocystis schroeteri	0.612	70.61

BROUGH RESERVOIR DATE 09/06/95

Species	Cell Volume (mm3/liter)	% Density by volume
Aphanizomenon flos-aquae	5.176	93.41
Peridinium sp.	0.361	6.52
Pennate diatoms	0.004	0.07

BROWNE RESERVOIR DATE 09/16/93

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena sp.	1.390	4.61
Asterionella formosa	1.000	3.32
Centric diatoms	0.008	0.03
Closteriopsis longissima var. tropica	0.012	0.04
Eudorina elegans	22.240	73.80
Fragilaria crotonensis	2.669	8.86
Melosira granulata var. angustissima	0.384	1.27
Oocystis sp.	0.042	0.14
Pennate diatoms	0.089	0.30
Quadrigula lacustris	1.112	3.69
Sphaerocystis schroeteri	0.612	2.03
Trachellomonas sp.	0.578	1.92

BROWNE RESERVOIR DATE 09/19/95

Species	Cell Volume (mm3/liter)	% Density by volume
Sphaerocystis schroeteri	7.923	73.20
Var angustissima	2.148	19.85
Trachellomonas sp.	0.444	4.11
Fragilaria crotonensis	0.229	2.12
Asterionella formosa	0.028	0.26
Chlorophyta	0.020	0.18
Pennate diatoms	0.019	0.18
Centric diatoms	0.010	0.09

BUTTERFLY LAKE DATE 08/07/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.022	0.59
Aphanizomenon flos-aquae	0.317	8.61
Cosmarium sp.	0.078	2.12
Dinobryon divergens	0.416	11.30
Merismopedia glauca	0.200	5.44
Oocystis sp.	0.025	0.68
Pediastrum tetras	0.015	0.41
Pennate diatoms	0.022	0.60
Quadrigula lacustris	2.224	60.43
Staurastrum sp.	0.167	4.53
Unknown spherical chlorophyta	0.195	5.29

CALDER RESERVOIR (ZELPH) DATE 09/15/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena spiroides var. crassa	1.557	12.16
Aphanizomenon flos-aquae	4.754	37.14
Coelosphaerium sp.	0.250	1.95
Eudorina elegans	5.560	43.43
Microcystis aeruginosa	0.122	0.96
Pandorina morum	0.222	1.74
Pennate diatoms	0.036	0.28
Trachellomonas sp.	0.267	2.08
Unknown spherical chlorophyta	0.033	0.26

CAUSEY RESERVOIR DATE 08/25/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.009	0.16
Asterionella formosa	0.083	1.54
Chlamydomonas sp.	0.004	0.08
Dinobryon divergens	2.141	39.62
Fragilaria crotonensis	1.000	18.52
Mallomonas sp.	0.007	0.12
Oocystis sp.	0.042	0.77
Pennate diatoms	0.031	0.58
Peridinium sp.	0.361	6.69
Quadrigula lacustris	1.112	20.58
Sphaerocystis schroeteri	0.612	11.32

CAUSEY RESERVOIR DATE 09/07/95

Species	Cell Volume (mm3/liter)	% Density by volume
Sphaerocystis schroeteri	34.333	79.01
Dinobryons divergens	5.822	13.40
Peridinium sp.	1.084	2.50
Crucigenia rectangularis	1.001	2.30
Oocystis sp.	0.676	1.55
Phacus sp.	0.278	0.64
Centric diatoms	0.110	0.25
Asterionella formosa	0.085	0.20
Chlamydomonas sp.	0.033	0.08
Pennate diatoms	0.019	0.04
Microcystis incerta	0.011	0.03

CHINA LAKE DATE 09/08/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.013	0.06
Centric diatoms	0.004	0.02
Gloeocystis sp.	6.672	29.53
Microcystis incerta	0.445	1.97
Oocystis sp.	0.017	0.07
Pennate diatoms	0.022	0.10
Quadrigula lacustris	13.344	59.07
Sphaerocystis schroeteri	1.835	8.12
Trachellomonas sp.	0.222	0.98
Unknown spherical chlorophyta	0.017	0.08

CLEVELAND RESERVOIR DATE 08/11/93

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.014	0.04
Centric diatoms	0.004	0.01
Ceratium hirundinella	0.945	2.43
Pennate diatoms	0.004	0.01
Sphaerocystis schroeteri	37.919	97.50
Wislouchiella planktonica	0.004	0.01

CLEVELAND RESERVOIR DATE 08/30/95

Species	Cell Volume (mm3/liter)	% Density by volume
Sphaerocystis schroeteri	23.769	94.50
Dinobryon divergens	1.015	4.04
Oocystis sp.	0.291	1.16
Microcystis incerta	0.033	0.13
Phacus sp.	0.027	0.11
Pennate diatoms	0.007	0.03
Mallomonas sp.	0.006	0.03

COOK LAKE DATE 08/24/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena sp.	0.278	2.95
Cosmarium sp.	7.862	83.37

Gloeocystis vesiculosa	0.117	1.24
Micrasterias sp.	0.361	3.83
Oocystis sp.	0.033	0.35
Peridinium sp.	0.361	3.83
Sphaerozoma sp.	0.056	0.59
Staurastrum gracile	0.361	3.84

CRESCENT LAKE DATE 08/24/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.004	0.01
Crucigenia sp.	0.017	0.03
Gloeocystis sp.	58.880	99.82
Oscillatoria sp.	0.006	0.01
Xanthidium sp.	0.078	0.13

CURRANT CREEK RESERVOIR DATE 09/07/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankyra judayi	0.008	0.73
Oocystis sp.	0.008	0.73
Pennate diatoms	0.018	1.55
Quadrigula lacustris	1.112	96.99

CURRANT CREEK RESERVOIR DATE 09/07/95

Species	Cell Volume (mm3/liter)	% Density by volume
Fragilaria crotonensis	5.498	91.10
Aphanizomenon flos-aquae	0.423	7.00
Pennate diatoms	0.074	1.23
Asterionella formosa	0.028	0.47
Ankistrodesmus falcatus	0.009	0.14
Centric diatoms	0.003	0.06

DARK CANYON LAKE DATE 08/09/94

Species	Cell Volume (mm3/liter)	% Density by volume
Centric diatoms	0.004	0.03
Ceratium hirundinella	0.945	7.37
Dinobryon divergens	0.220	1.72
Oocystis sp.	0.259	2.02
Pennate diatoms	0.005	0.03
Peridinium sp.	0.361	2.82
Quadrigula lacustris	1.112	8.67
Sphaerocystis schroeteri	9.786	76.27
Unknown spherical chlorophyta	0.139	1.07

DEEP CREEK LAKE DATE 08/25/94

Species	Cell Volume (mm3/liter)	% Density by volume
Gloeocystis vesiculosa	0.011	1.06
Melosira granulata var. angustissima	0.026	2.44
Oscillatoria sp.	0.006	0.58
Pennate diatoms	0.031	2.97
Sphaerocystis schroeteri	0.612	58.42
Staurastrum gracile	0.361	34.53

DEER CREEK RESERVOIR DATE 07/27/93

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena spiroides var. crassa	1.557	8.32
Ankistrodesmus falcatus	0.004	0.02
Aphanizomenon flos-aquae	12.888	68.84
Asterionella formosa	0.071	0.37
Melosira granulata	0.109	0.58
Oocystis sp.	0.175	0.94
Pennate diatoms	0.004	0.02
Stephanodiscus niagarae	3.914	20.91

DEER CREEK RESERVOIR DATE 09/01/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.009	0.33
Asterionella formosa	0.083	3.15
Fragilaria crotonensis	0.667	25.19
Gomphosphaeria lacustris	0.111	4.20
Microcystis aeruginosa	0.367	13.85
Oocystis sp.	0.033	1.26
Pandorina morum	0.222	8.40
Pennate diatoms	0.004	0.17
Sphaerocystis schroeteri	0.612	23.09
Staurastrum gracile	0.361	13.64
Stephanodiscus niagarae	0.178	6.72

DEER CREEK RESERVOIR DATE 03/22/94

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.000	0.57
Fragilaria crotonensis	0.010	55.45
Pennate diatoms	0.000	0.24
Staurastrum gracile	0.008	43.74

DEER CREEK RESERVOIR DATE 03/22/94

Species	Cell Volume (mm3/liter)	% Density by volume
Pennate diatoms	0.000	1.07
Staurastrum gracile	0.005	98.93

DEER CREEK RESERVOIR DATE 03/22/94

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.000	0.27
Fragilaria crotonensis	0.036	77.87
Melosira granulata	0.001	1.54
Staurastrum gracile	0.005	10.24
Stephanodiscus niagarae	0.005	10.08

DEER CREEK RESERVOIR DATE 03/22/94

Species	Cell Volume (mm3/liter)	% Density by volume
Fragilaria crotonensis	0.006	28.57
Pennate diatoms	0.001	4.85
Stephanodiscus niagarae	0.015	66.58

DEER CREEK RESERVOIR DATE 06/01/94

Species	Cell Volume (mm3/liter)	% Density by volume
Fragilaria crotonensis	0.002	14.32
Pennate diatoms	0.001	6.81
Staurastrum gracile	0.009	67.76
Stephanodiscus niagarae	0.001	11.11

DEER CREEK RESERVOIR DATE 06/01/94

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.001	3.35
Fragilaria crotonensis	0.008	46.45
Pennate diatoms	0.001	4.54
Staurastrum gracile	0.006	36.64
Stephanodiscus niagarae	0.002	9.02

DEER CREEK RESERVOIR DATE 06/01/94

Species	Cell Volume (mm3/liter)	% Density by volume
Fragilaria crotonensis	0.005	27.38
Pennate diatoms	0.000	1.09
Staurastrum gracile	0.008	43.19
Stephanodiscus niagarae	0.005	28.34

DEER CREEK RESERVOIR DATE 06/01/94

Species	Cell Volume (mm3/liter)	% Density by volume
Botryococcus species	0.035	74.69
Fragilaria crotonensis	0.002	3.85
Pennate diatoms	0.000	0.46
Staurastrum gracile	0.003	6.07
Stephanodiscus niagarae	0.007	14.93

DEER CREEK RESERVOIR DATE 06/21/94

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.003	1.22
Botryococcus sudeticus	0.013	5.79
Ceratium hirundinella	0.014	6.08
Fragilaria crotonensis	0.020	8.84
Oocystis borgei	0.003	1.14
Pediastrum duplex	0.010	4.29
Pennate diatoms	0.000	0.03
Sphaerocystis schroeteri	0.156	67.91
Staurastrum gracile	0.005	2.32
Stephanodiscus niagarae	0.005	2.29
Unknown spherical chlorophyta	0.000	0.09

DEER CREEK RESERVOIR DATE 06/21/94

Cell Volume % Density

Species	(mm3/liter)	by volume
Asterionella formosa	0.000	0.13
Fragilaria crotonensis	0.003	6.06
Pennate diatoms	0.000	0.05
Sphaerocystis schroeteri	0.033	69.91
Staurastrum gracile	0.002	4.78
Stephanodiscus niagarae	0.009	18.84
Unknown spherical chlorophyta	0.000	0.23

DEER CREEK RESERVOIR DATE 06/21/94

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.000	0.10
Fragilaria crotonensis	0.002	1.27
Oocystis borgei	0.000	0.12
Pediastrum duplex	0.006	3.69
Pennate diatoms	0.000	0.04
Sphaerocystis schroeteri	0.119	73.01
Staurastrum gracile	0.013	7.99
Stephanodiscus niagarae	0.022	13.78

DEER CREEK RESERVOIR DATE 06/21/94

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.001	0.70
Botryococcus sudeticus	0.006	3.33
Ceratium hirundinella	0.026	13.98
Fragilaria crotonensis	0.016	8.47
Oocystis borgei	0.001	0.33
Pennate diatoms	0.000	0.03
Sphaerocystis schroeteri	0.110	58.60
Staurastrum gracile	0.010	5.35
Stephanodiscus niagarae	0.017	9.21

DEER CREEK RESERVOIR DATE 07/19/94

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.007	0.56
Ceratium hirundinella	0.085	6.41
Eudorina elegans	0.025	1.89
Fragilaria crotonensis	0.847	63.89
Microcystis incerta	0.001	0.10
Oocystis species	0.000	0.01
Pediastrum duplex	0.006	0.45
Staurastrum gracile	0.010	0.74
Stephanodiscus niagarae	0.344	25.95

DEER CREEK RESERVOIR DATE 07/19/94

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.011	1.00
Ceratium hirundinella	0.390	35.40
Eudorina elegans	0.041	3.72
Fragilaria crotonensis	0.443	40.14
Melosira granulata	0.001	0.07
Microcystis aeruginosa	0.002	0.16
Microcystis incerta	0.005	0.42
Sphaerocystis schroeteri	0.039	3.53
Staurastrum gracile	0.016	1.45
Stephanodiscus niagarae	0.073	6.66
Volvox areus	0.082	7.45

DEER CREEK RESERVOIR DATE 07/19/94

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.004	0.98
Ceratium hirundinella	0.051	12.19
Fragilaria crotonensis	0.243	58.10
Microcystis incerta	0.001	0.24
Pediastrum duplex	0.012	2.87
Sphaerocystis schroeteri	0.024	5.68
Staurastrum gracile	0.016	3.88
Stephanodiscus niagarae	0.067	16.06

DEER CREEK RESERVOIR DATE 07/19/94

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.022	0.30
Ceratium hirundinella	0.121	1.66
Eudorina elegans	3.035	41.51
Fragilaria crotonensis	2.824	38.63
Microcystis aeruginosa	0.039	0.54
Pediastrum duplex	0.043	0.59
Pennate diatoms	0.000	0.00
Staurastrum gracile	0.016	0.21
Stephanodiscus niagarae	1.211	16.56

DEER CREEK RESERVOIR DATE 08/17/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena species	0.064	7.28
Anabaena spiroides var. crassa	0.213	24.28
Asterionella formosa	0.002	0.22
Ceratium hirundinella	0.021	2.38
Dinobryon divergens	0.060	6.88
Eudorina elegans	0.062	7.00
Fragilaria crotonensis	0.105	11.93
Melosira granulata	0.004	0.46
Melosira granulata var. angustissima	0.010	1.14
Microcystis aeruginosa	0.014	1.64
Pediastrum duplex	0.010	1.12
Staurastrum gracile	0.149	16.99
Stephanodiscus niagarae	0.164	18.68

DEER CREEK RESERVOIR DATE 08/17/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena species	0.005	1.19
Anabaena spiroides var. crassa	0.034	7.73
Asterionella formosa	0.001	0.20
Ceratium hirundinella	0.006	1.26
Dinobryon divergens	0.012	2.71
Euglena species	0.000	0.05
Fragilaria crotonensis	0.046	10.41
Gomphosphaeria lacustris	0.000	0.07
Melosira granulata	0.014	3.06
Melosira granulata var. angustissima	0.009	2.02
Microcystis aeruginosa	0.004	0.82
Oscillatoria limnetica	0.000	0.01
Pediastrum duplex	0.004	0.89
Pennate diatoms	0.000	0.02
Staurastrum gracile	0.167	37.68
Stephanodiscus niagarae	0.142	31.88

DEER CREEK RESERVOIR DATE 08/17/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena species	0.022	1.13
Anabaena spiroides var. crassa	1.139	58.84
Aphanizomenon flos-aquae	0.008	0.43
Asterionella formosa	0.000	0.02
Dinobryon divergens	0.072	3.71
Fragilaria crotonensis	0.271	13.99
Melosira granulata	0.017	0.89
Melosira granulata var. angustissima	0.010	0.47
Microcystis aeruginosa	0.029	1.49
Oocystis species	0.000	0.02
Pandorina morum	0.009	0.45
Staurastrum gracile	0.114	5.88
Stephanodiscus niagarae	0.245	12.68
Wislouchiella planktonica	0.000	0.00

DEER CREEK RESERVOIR DATE 08/17/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena species	0.011	1.06
Anabaena spiroides var. crassa	0.057	5.49
Asterionella formosa	0.007	0.70
Ceratium hirundinella	0.130	12.57
Dinobryon divergens	0.053	5.18
Fragilaria crotonensis	0.220	21.32
Melosira granulata	0.002	0.21
Melosira granulata var. angustissima	0.041	3.98
Microcystis aeruginosa	0.019	1.86
Pandorina morum	0.026	2.53
Staurastrum gracile	0.319	30.90
Stephanodiscus niagarae	0.146	14.20

DEER CREEK RESERVOIR DATE 09/13/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena spiroides var. crassa	0.981	72.21
Aphanizomenon flos-aquae	0.083	6.08
Asterionella formosa	0.001	0.09
Ceratium hirundinella	0.028	2.05
Euglena species	0.001	0.04
Fragilaria crotonensis	0.020	1.49
Melosira granulata	0.145	10.65
Melosira granulata var. angustissima	0.036	2.64
Microcystis aeruginosa	0.004	0.27
Staurastrum gracile	0.021	1.57

Stephanodiscus niagarae	0.039	2.91

DEER CREEK RESERVOIR DATE 09/13/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena spiroides var. crassa	0.359	20.99
Aphanizomenon flos-aquae	0.098	5.75
Asterionella formosa	0.004	0.21
Ceratium hirundinella	0.078	4.57
Fragilaria crotonensis	0.090	5.27
Melosira granulata	0.446	26.11
Melosira granulata var. angustissima	0.229	13.37
Microcystis aeruginosa	0.033	1.92
Phacus species	0.001	0.03
Staurastrum gracile	0.030	1.75
Stephanodiscus niagarae	0.342	20.03

DEER CREEK RESERVOIR DATE 09/13/94

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.004	0.07
Ceratium hirundinella	0.093	1.63
Cosmarium species	0.015	0.27
Fragilaria crotonensis	0.607	10.68
Melosira granulata	1.734	30.48
Melosira granulata var. angustissima	1.251	21.99
Microcystis aeruginosa	0.228	4.01
Staurastrum gracile	0.568	9.98
Stephanodiscus niagarae	1.188	20.89

DEER CREEK RESERVOIR DATE 09/13/94

Species	Cell Volume (mm3/liter)	% Density by volume
Aphanizomenon flos-aquae	0.150	8.75
Asterionella formosa	0.006	0.33
Ceratium hirundinella	0.060	3.26
Cosmarium species	0.005	0.27
Eudorina elegans	0.082	4.80
Fragilaria crotonensis	0.041	2.37
Melosira granulata	1.013	59.26
Melosira granulata var. angustissima	0.122	7.15
Microcystis aeruginosa	0.029	1.69
Pandorina morum	0.007	0.38
Staurastrum gracile	0.064	3.74
Stephanodiscus niagarae	0.136	8.00

DEER CREEK RESERVOIR DATE 10/12/94

Species	Cell Volume (mm3/liter)	% Density by volume
Fragilaria crotonensis	0.016	11.31
Melosira granulata	0.019	13.46
Melosira granulata var. angustissima	0.008	5.47
Pediastrum duplex	0.016	10.98
Staurastrum gracile	0.017	11.90
Stephanodiscus niagarae	0.067	46.88

DEER CREEK RESERVOIR DATE 10/12/94

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.000	0.39
Fragilaria crotonensis	0.005	9.45
Melosira granulata	0.024	42.72
Melosira granulata var. angustissima	0.002	3.17
Staurastrum gracile	0.009	14.91
Stephanodiscus niagarae	0.017	29.36

DEER CREEK RESERVOIR DATE 10/12/94

Species	Cell Volume (mm3/liter)	% Density by volume
Aphanizomenon flos-aquae	0.007	5.84
Fragilaria crotonensis	0.015	12.67
Melosira granulata	0.029	24.11
Melosira granulata var. angustissima	0.002	1.41
Microcystis aeruginosa	0.008	6.77
Stephanodiscus niagarae	0.058	49.20

DEER CREEK RESERVOIR DATE 10/12/94

Species	Cell Volume (mm3/liter)	% Density by volume
Melosira granulata	0.021	53.50
Melosira granulata var. angustissima	0.007	16.74
Pennate diatoms	0.000	0.64
Stephanodiscus niagarae	0.012	29.12

DEER CREEK RESERVOIR DATE 07/20/95

Species	Cell Volume (mm3/liter)	% Density by volume
Chrysocapsa planktonica	116.760	87.25
Sphaerocystis schroeteri	13.205	9.87
Fragilaria crotonensis	1.833	1.37
Anabaena flos-aquae	1.268	0.95
Centric diatoms	0.274	0.20
Oocystis borgei	0.222	0.17
Dinobryon divergens	0.122	0.09
Oocystis sp.	0.075	0.06
Microcystis incerta	0.044	0.03
Pennate diatoms	0.012	0.01

DONKEY RESERVOIR DATE 08/14/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.009	1.31
Centric diatoms	0.004	0.58
Pennate diatoms	0.044	6.65
Sphaerocystis schroeteri	0.612	91.46

DONKEY RESERVOIR DATE 09/13/95

Species	Cell Volume (mm3/liter)	% Density by volume
Fragilaria crotonensis	4.352	66.01
Fragilaria virescens	1.526	23.14
Pennate diatoms	0.506	7.67
Aphanizomenon flos-aquae	0.106	1.60
Oocystis sp.	0.083	1.26
Ankistrodesmus falcatus	0.017	0.26
Centric diatoms	0.003	0.05

DUCK FORK RESERVOIR DATE 08/31/94

Species	Cell Volume (mm3/liter)	% Density by volume
Centric diatoms	0.200	6.34
Ceratium hirundinella	1.890	59.91
Dinobryon divergens	0.306	9.69
Gloeobotrys sp.	0.334	10.58
Oocystis sp.	0.042	1.32
Scenedesmus bijuga	0.022	0.70
Staurastrum gracile	0.361	11.46

EAST CANYON RESERVOIR DATE 09/01/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.009	0.05
Aphanizomenon flos-aquae	10.141	61.41
Asterionella formosa	0.014	0.08
Centric diatoms	0.004	0.02
Microcystis incerta	5.282	31.98
Oocystis sp.	0.008	0.05
Sphaerocystis schroeteri	0.612	3.70
Stephanodiscus niagarae	0.356	2.15
Unknown spherical chrysophyte	0.009	0.05
Wislouchiella planktonica	0.080	0.48

EAST CANYON RESERVOIR DATE 06/28/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena sp.	12.788	59.12
Ankistyrodesmus falcatus	0.004	0.02
Ankyra judayi	0.003	0.01
Chlamydomonas sp.	0.002	0.01
Dinobryon divergens	0.697	3.22
Microcystis incerta	0.834	3.86
Pandorina morum	0.222	1.03
Pennate diatoms	0.013	0.06
Sphaerocystis schroeteri	6.728	31.10
Stephanodiscus niagarae	0.178	0.82
Unknown spherical chrysophyta	0.003	0.02
Wislouchiella planktonica	0.156	0.72

EAST CANYON RESERVOIR DATE 07/14/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena sp.	4.448	36.65
Ceratium hirundinella	0.945	7.79
Chlamydomonas sp.	0.002	0.02
Dinobryon divergens	0.049	0.40
Oocystis sp.	0.200	1.65
Pennate diatoms	0.009	0.07

Sphaerocystis schroeteri	6.116	50.39
Stephanodiscus niagarae	0.356	2.93
Unknown spherical chlorophyta	0.011	0.10

EAST CANYON RESERVOIR DATE 07/26/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena sp.	3.614	27.31
Aphanizomenon flos-aquae	0.211	1.60
Asterionella formosa	0.167	1.26
Ceratium hirundinella	2.836	21.43
Dinobryon divergens	0.245	1.85
Fragilaria crotonensis	1.000	7.56
Oocystis sp.	0.250	1.89
Pennate diatoms	0.009	0.07
Sphaerocystis schroeteri	4.893	36.97
Wislouchiella planktonica	0.009	0.06

EAST CANYON RESERVOIR DATE 08/11/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.009	0.10
Aphanizomenon flos-aquae	1.585	18.99
Centric diatoms	0.007	0.08
Ceratium hirundinella	0.946	11.33
Fragilaria crotonensis	0.458	5.49
Gloeocystis vesiculosa	0.011	0.13
Merismopedia glauca	0.050	0.60
Microcystis aeruginosa	0.245	2.93
Microcystis incerta	0.267	3.20
Oocystis sp.	0.259	3.10
Pandorina morum	1.557	18.65
Pennate diatoms	0.004	0.05
Sphaerocystis schroeteri	2.641	31.65
Wislouchiella planktonica	0.309	3.70

EAST CANYON RESERVOIR DATE 08/25/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.004	0.04
Asterionella formosa	0.042	0.40
Centric diatoms	0.023	0.23
Ceratium hirundinella	0.945	9.16
Dinobryon divergens	0.012	0.12
Fragilaria crotonensis	0.333	3.23
Gloeocystis vesiculosa	0.011	0.11
Microcystis incerta	6.950	67.32
Oocystis sp.	0.150	1.45
Pandorina morum	0.445	4.31
Pennate diatoms	0.018	0.17
Phacotus sp.	1.390	13.46

EAST CANYON RESERVOIR DATE 07/11/95

Species	Cell Volume (mm3/liter)	% Density by volume
Stephanodiscus niagarae	0.538	44.82
Melosira granulataa	0.163	13.73
Chlorophyta	0.163	13.73
Aphanizomenon flos-aquae	0.015	8.87
Oocystis species	0.100	8.40
Euglena species	0.041	3.45
Asterionella formosa	0.028	2.38
Phacus species	0.028	2.33
Pennate diatoms	0.027	2.29

EAST CANYON RESERVOIR DATE 07/27/95

Species	Cell Volume (mm3/liter)	% Density by volume
Sphaerocystis schroeteri	5.282	68.93
Stephanodiscus niagarae	1.245	16.25
Staurastrum gracile	0.364	4.72
Phacus species	0.250	3.26
Pandorina morum	0.222	2.90
Melorisa granulata	0.163	2.13
Var angustissima	0.077	1.00
Oocystis species	0.058	0.76
Unknown spherical chlorophyta	0.003	0.04

EAST CANYON RESERVOIR DATE 08/01/95

Species	Cell Volume (mm3/liter)	% Density by volume
Aphanizomenon flos-aquae	4.859	28.21
Fragilaria crotonensise	3.894	22.65
Ceratium Hirundinella	3.780	21.95
Sphaerocystis schroeteri	26.410	15.33
Stephanodiscus niagarae	12.454	7.23
Phacus Species	0.417	2.42
Pandorina Morum	0.222	1.29
Oocystis species	0.583	0.34
Melosira granulata	0.058	0.32
Var angustissima	0.051	0.30
Chlorophyta	0.033	0.02

EAST PARK RESERVOIR DATE 09/07/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.013	1.39
Centric diatoms	0.004	0.41
Dinobryon divergens	0.110	11.71
Oocystis sp.	0.042	4.43
Pennate diatoms	0.036	3.78
Scenedesmus quadricauda	0.450	47.89
Scenedesmus sp.	0.017	1.77
Unknown spherical chlorophyte	0.267	28.38
Unknown spherical chrysophyte	0.002	0.24

EAST PARK RESERVOIR DATE 09/20/95

Species	Cell Volume (mm3/liter)	% Density by volume
Botryococcus baunii	2.224	78.67
Oocystis species	0.350	12.39
Chlorophyta	0.067	2.36
Pennate diatoms	0.066	2.34
Chroococcus species	0.044	1.57
Mallomonas species	0.027	0.94
Centric diatoms	0.023	0.83
Scenedesmus Bijuga	0.011	0.39
Selanastrum species	0.010	0.35
Ankistrodesmus falcatus	0.004	0.15

ECHO RESERVOIR DATE 08/02/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ceratium hirundinella	0.945	29.10
Dinobryon divergens	0.012	0.38
Fragilaria crotonensis	0.334	10.27
Melosira granulata var. angustissima	0.026	0.79
Oocystis sp.	0.167	5.14
Oscillatoria amphibia	0.003	0.09
Pennate diatoms	0.004	0.14
Scenedesmus bijuga	0.022	0.68
Sphaerocystis schroeteri	1.223	37.66
Staurastrum gracile	0.361	11.13
Unknown spherical chlorophyta	0.006	0.17
Wislouchiella plantonica	0.145	4.45

ELECTRIC LAKE DATE 08/11/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus flacatus	0.022	0.64
Mallomonas caudata	0.013	0.39
Microcystis incerta	0.111	3.28
Oocystis sp.	0.142	4.18
Sphaerocystis schroeteri	3.058	90.19
Trachellomonas sp.	0.045	1.31

ELECTRIC LAKE DATE 08/30/95

Species	Cell Volume (mm3/liter)	% Density by volume
Sphaerocystis schroeteri	76.589	97.82
Ceratium hirundinella	0.945	1.21
Pandorina morum	0.667	0.85
Euglena species	0.041	0.05
Asterionella formosa	0.028	0.04
Centric diatoms	0.016	0.02
Chlorophyta	0.007	0.01
Ankistrodesmus falcataus	0.004	0.01

ENTERPRISE RESERVOIR DATE 08/03/93

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena spiroides var crassa	1.557	2.70
Asterionella formosa	0.014	0.02
Botryococcus braunii	2.224	3.86
Centric diatoms	0.008	0.01
Cosmarium sp.	0.156	0.27
Fragilaria crotonensis	4.670	8.11
Melosira granulata	0.055	0.09
Oocystis sp.	0.033	0.06
Pennate diatoms	0.036	0.06
Staurastrum gracile	48.789	84.72
Trachellomonas sp.	0.044	0.08

FAIRVIEW LAKE #2 DATE 08/30/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.004	0.17

Botryococcus sudeticus	0.150	5.77
Mougeotia sp.	1.668	64.09
Oscillatoria sp.	0.006	0.24
Pennate diatoms	0.018	0.68
Sphaerocystis schroeteri	0.612	23.50
Spirogyra sp.	0.139	5.34
Unknown spherical chlorophyta	0.006	0.21

FERRON RESERVOIR DATE 08/10/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus flacatus	0.009	0.80
Centric diatoms	0.023	2.14
Dinobryon divergens	0.612	56.10
Fragilaria crotonensis	0.334	30.60
Mallomonas sp.	0.027	2.45
Melosira granulata var. angustissima	0.026	2.35
Oocystis sp.	0.025	2.30
Pennate diatoms	0.031	2.86
Wislouchiella planktonica	0.004	0.41

FERRON RESERVOIR DATE 08/31/94

Species	Cell Volume (mm3/liter)	% Density by volume
Centric diatoms	0.004	0.14
Fragilaria crotonensis	0.334	11.91
Pennate diatoms	0.018	0.64
Sphaerocystis schroeteri	2.446	87.31

FISH LAKE DATE 08/18/93

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.056	1.79
Centric diatoms	0.019	0.63
Dinobryon divergens	0.184	5.90
Melosira granulata var. angustissima	0.486	15.64
Microcystis incerta	1.056	34.00
Oocystis sp.	0.067	2.15
Peroniella sp.	0.015	0.48
Rhizochrysis sp.	0.002	0.05
Sphaerocystis schroeteri	1.223	39.36

FISH LAKE DATE 09/12/95

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena flos-aquae	2.535	40.73
Mougeotia species	2.224	35.73
Microcystis incerta	1.245	20.01
Stephanodiscus niagarae	0.178	2.86
Oocystis species	0.033	0.54
Ankistrodesmus falcatus	0.004	0.07
Pennate diatoms	0.004	0.06

FLAMING GORGE RESERVOIR DATE 08/16/95

Species	Cell Volume (mm3/liter)	% Density by volume
Aphanizomenon flos-aquae	1.056	44.22
Var angustissima	1.023	42.82
Pandorina morum	0.222	9.31
Dinobryon divergens	0.049	2.05
Pennate diatoms	0.027	1.14
Centric Diatoms	0.007	0.28
Ankistrodesmus falcatus	0.004	0.18

FLAMING GORGE RESERVOIR DATE 08/16/95

Species	Cell Volume (mm3/liter)	% Density by volume
Ceratium hirundinella	1.890	95.59
Melosira granulata	0.057	2.76
Centric diatoms	0.013	0.67
Microcystis incerta	0.011	0.56
Oocystis species	0.008	0.42

FLAMING GORGE RESERVOIR DATE 08/16/95

Species	Cell Volume (mm3/liter)	% Density by volume
Microcystis incerta	0.144	78.08
Oocystis species	0.017	9.01
Unknown spherical chlorophyta	0.067	9.01
Pennate diatoms	0.004	2.10
Centric diatoms	0.003	1.80

FLAMING GORGE RESERVOIR DATE 08/16/95

Species	Cell Volume (mm3/liter)	% Density by volume
Ceratium Hirundinella	0.945	73.98
Fragilaria crotonensis	0.229	17.93
Melosira granulata	0.054	4.26
Var angustissima	0.026	2.00
Centric diatoms	0.010	0.78
Asterionella formosa	0.009	0.74
Pennate diatoms	0.004	0.30

FLAMING GORGE RESERVOIR DATE 08/16/95

Species	Cell Volume (mm3/liter)	% Density by volume
Var angustissima	1.534	54.68
Fragilaria crotonensis	0.458	16.32
Melosira granulata	0.272	9.71
Pandorina morum	0.222	7.92
Stephanodiscus niagarae	0.178	6.34
Aphanizomenon flos-aquae	0.106	3.76
Pennate diatoms	0.012	0.42
Asterionella formosa	0.009	0.34
Centric diatoms	0.007	0.24
Ankistrodesmus falcatus	0.004	0.06
Unknown spherical chlorophyta	0.003	0.12

FLAMING GORGE RESERVOIR DATE 08/16/95

Species	Cell Volume (mm3/liter)	% Density by volume
Ceratium hirundinella	1.890	80.02
Var angustissima	0.179	7.58
Melosira	0.163	6.92
Aphanizomenon flos-aquae	0.106	4.47
Dinobryon divergens	0.012	0.52
Oocystis species	0.008	0.35
Centric diatoms	0.003	0.14

FLAMING GORGE RESERVOIR DATE 08/16/95

Species	Cell Volume (mm3/liter)	% Density by volume
Var angustissima	0.167	51.15
Dinobryon divergens	0.024	24.46
Oocystis species	0.017	16.68
Ankistrodesmus faalcaatus	0.004	4.36
Centric diatoms	0.003	3.34

FORSYTH RESERVOIR DATE 08/25/94

Species	Cell Volume (mm3/liter)	% Density by volume
Aphanizomenon flos-aquae	2.324	1.91
Asterionella formosa	0.028	0.02
Centric diatoms	2.078	1.71
Fragilaria crotonensis	0.667	0.55
Gloeotrichia echinulata	111.200	91.27
Melosira granulata var. angustissima	0.563	0.46
Oocystis sp.	0.008	0.01
Oscillatoria sp.	0.006	0.01
Pediastrum duplex	0.667	0.55
Pennate diatoms	2.518	2.07
Stephanodiscus niagarae	1.779	1.44

GRANTSVILLE RESERVOIR DATE 08/17/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.009	0.03
Asterionella formosa	0.042	0.12
Ceratium hirundinella	0.945	2.80
Dinobryon divergens	0.587	1.74
Fragilaria crotonensis	32.026	94.86
Microcystis incerta	0.111	0.33
Pennate diatoms	0.040	0.12

GRANTSVILLE RESERVOIR DATE 08/09/95

Species	Cell Volume (mm3/liter)	% Density by volume
fragilaria crotonensis	0.916	56.79
Centric diatoms	0.594	36.80
Pennate diatoms	0.054	3.38
Oocystis species	0.025	1.55
Chrysophyta	0.010	0.62
Asterionella formosa	0.009	0.59
Ankistrodesmus falcatus	0.004	0.27

GUNLOCK RESERVOIR DATE 08/04/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus flacatus	0.018	0.28

Centric diatoms	0.027	0.43
Chroococcus sp.	0.006	0.09
Fragilaria crotonensis	4.003	63.63
Mallomonas sp.	0.007	0.11
Melosira granulata	0.055	0.87
Pennate diatoms	0.062	0.99
Scenedesmus sp.	0.008	0.13
Sphaerocystis schroeteri	0.612	9.72
Staurastrum gracile	1.446	22.98
Unknown spherical chrysophyte	0.047	0.74
Wislouchiella planktonica	0.002	0.04

GUNLOCK RESERVOIR DATE 08/09/95

Species	Cell Volume (mm3/liter)	% Density by volume
Fragilaria crotonensis	0.916	56.79
Centric diatoms	0.593	36.80
Pennate diatoms	0.054	3.38
Oocystis species	0.025	1.55
Chlorophyta	0.010	0.62
Asterionella formosa	0.009	0.59
Ankistrodesmus	0.004	0.27

GUNNISON BEND RESERVOIR DATE 08/02/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena sp.	1.668	24.16
Arthrodesmus sp.	0.078	1.13
Botryococcus sudeticus	0.150	2.17
Centric diatoms	0.008	0.11
Chlamydomonas sp.	0.004	0.06
Closteriopsis longissima var. tropica	0.025	0.35
Cosmarium sp.	0.156	2.25
Dinobryon divergens	0.012	0.18
Euglena sp.	0.123	1.79
Oocystis sp.	0.417	6.04
Pediastrum sp.	0.334	4.83
Pennate diatoms	0.062	0.90
Phacus sp.	0.028	0.40
Scenedesmus quadricauda var. quadrispina	0.020	0.29
Scenedesmus bijuga	0.008	0.12
Sphaerocystis schroeteri	2.446	35.44
Stichococcus bacillaris	1.351	19.57
Tetraedron sp.	0.013	0.21

GUNNISON RESERVOIR DATE 08/09/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.061	0.38
Ankyra judayi	0.003	0.02
Closteriopsis longissima var. tropica	0.049	0.30
Gomphosphaeria lacustris	0.334	2.08
Microcystis aeruginosa	13.700	85.29
Pennate diatoms	0.120	0.75
Phacus sp.	0.028	0.17
Quadrigula lacustris	1.112	6.92
Scenedesmus quadricauda var. quadrispina	0.007	0.04
Sphaerocystis schroeteri	0.612	3.81
Wislouchiella planktonica	0.038	0.24

HOOP LAKE DATE 09/16/93

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena sp.	0.278	0.74
Aphanizomenon flos-aquae	36.657	97.24
Centric diatoms	0.008	0.02
Closteriopsis longissima var. tropica	0.012	0.03
Cosmarium sp.	0.078	0.21
Pennate diatoms	0.053	0.14
Sphaerocystis schroeteri	0.612	1.62

HOOP LAKE DATE 09/26/95

Species	Cell Volume (mm3/liter)	% Density by volume
Sphaerocystis schroeteri	7.923	88.19
Aphanizomenon flos-aquae	0.845	9.41
Trachellomonas species	0.178	1.98
Chlorophyta	0.020	0.22
Microcystis incerta	0.011	0.12
Centric diatoams	0.007	0.07

HOOVER LAKE DATE 09/07/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.026	0.67
Asterionella formosa	0.028	0.71
Centric diatoms	0.020	0.50
Chroococcus sp.	0.011	0.28
Crucigenia sp.	0.006	0.14
Dinobryon divergens	0.061	1.57
Gloeobotrys sp.	0.556	14.24
Microcystis incerta	1.557	39.89
Oocystis sp.	0.100	2.56
Pennate diatoms	0.138	3.53
Quadrigula lacustris	1.112	28.49
Spondylosium sp.	0.111	2.85
Unknown spherical chrysophyta	0.100	2.56
Xanthidium sp.	0.078	2.01

HUNTINGTON LAKE NORTH DATE 08/12/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.009	0.38
Ankyra judayi	0.003	0.12
Centric diatoms	0.008	0.34
Ceratium hirundinella	0.945	40.86
Dinobryon divergens	0.037	1.59
Mallomonas sp.	0.007	0.29
Oocystis sp.	0.067	2.88
Pennate diatoms	0.013	0.58
Sphaerocystis schroeteri	1.223	52.88
Wislouchiella planktonica	0.002	0.10

HUNTINGTON LAKE NORTH DATE 08/31/95

Species	Cell Volume (mm3/liter)	% Density by volume
Certium hirundinella	1.890	97.49
Dino divergens	0.037	1.89
Ankistrodesmus falcataus	0.009	0.45
Chlorophyta	0.003	0.17

HUNTINGTON RESERVOIR DATE 08/30/94

Species	Cell Volume (mm3/liter)	% Density by volume
Mougeotia sp.	1.112	53.01
Oocystis sp.	0.008	0.40
Pennate diatoms	0.004	0.21
Sphaerocystis schroeteri	0.612	29.15
Staurastrum gracile	0.361	17.23

HYRUM RESERVOIR DATE 09/06/95

Species	Cell Volume (mm3/liter)	% Density by volume
Sphaerocystis schroeteri	132.050	93.01
Fragilaria crotonensis	8.934	6.29
Oocystis species	0.659	0.46
Cosmarium species	0.156	0.11
Asterionella formosa	0.067	0.05
Centric diatoms	0.047	0.03
Pennate diatoms	0.027	0.02
Dinobryon divergens	0.012	0.01
Oocystis species 2	0.008	0.01
Chloeophyta	0.007	0.00
Chlamydomonas species	0.002	0.00
Ankistrodesmus falcatus	0.000	0.00

JOE'S VALLEY RESERVOIR DATE 08/11/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.013	4.11
Ankyra judayi	0.006	1.75
Asterionella formosa	0.028	8.73
Centric diatoms	0.027	8.56
Dinobryon divergens	0.245	76.85

JOE'S VALLEY RESERVOIR DATE 08/31/95

Species	Cell Volume (mm3/liter)	% Density by volume
Sphaerocystis schroeteri	5.282	92.09
Centric diatoms	0.380	6.63
Pennate Diatoms	0.094	0.34
Oocystis species	0.017	0.29
Dinobryon divergens	0.012	0.21
Asterionella formosa	0.009	0.16
Ankistrodesmus falcatus	0.009	0.15

JOHNSON LAKE DATE 09/12/95

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena circinalis	147.340	95.80
Aphanizomenon flos-aquae	3.908	2.54
Stephanodiscus niagarae	1.245	0.81
Fragilaria crotonensis	1.145	0.74

Pennate diatoms	0.089	0.06
Centric diatoms	0.070	0.05

JOHNSON VALLEY RESERVOIR DATE 08/17/93

Species	Cell Volume (mm3/liter)	% Density by volume
Aphanizomenon flos-aquae	82.399	99.64
Centric diatoms	0.012	0.01
Euglena sp.	0.041	0.05
Oscillatoria sp.	0.006	0.01
Pennate diatoms	0.058	0.07
Stephanodiscus niagarae	0.178	0.22

JORDANELLE RESERVOIR DATE 06/01/94

Species	Cell Volume (mm3/liter)	% Density by volume
Pennate diatoms	0.000	0.22
Sphaerocystis schroeteri	0.063	99.78

JORDANELLE RESERVOIR DATE 06/01/94

Species	Cell Volume (mm3/liter)	% Density by volume
Pennate diatoms	0.000	0.15
Sphaerocystis schroeteri	0.094	99.71
Unknown Spherical chlorophyta	0.000	0.14

JORDANELLE RESERVOIR DATE 06/01/94

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.002	1.25
Botryococcus sudeticus	0.002	1.66
Pennate diatoms	0.000	0.04
Sphaerocystis schroeteri	0.104	87.63
Unknown filamentous chlorophyta	0.011	9.04
Unknown spherical chlorophyta	0.000	0.12
Unknown spherical chlorophyta	0.000	0.26

JORDANELLE RESERVOIR DATE 06/21/94

Species	Cell Volume (mm3/liter)	% Density by volume
Pennate diatoms	0.000	0.04
Sphaerocystis schroeteri	0.095	99.96

JORDANELLE RESERVOIR DATE 06/21/94

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.001	10.39
Botryococcus sudeticus	0.002	13.75
Unknown filamentous chlorophyta	0.010	74.85
Unknown spherical chlorophyta	0.000	1.01

JORDANELLE RESERVOIR DATE 06/21/94

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.001	2.55
Botryococcus sudeticus	0.001	4.05
Sphaerocystis schroeteri	0.020	71.32
Unknown filamentous chlorophyta	0.006	22.08

JORDANELLE RESERVOIR DATE 07/19/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena flos-aquae	0.930	98.36
Asterionella formosa	0.004	0.46
Melosira granulata	0.006	0.63
Oocystis species	0.000	0.01
Pennate diatoms	0.000	0.00
Zygnema species	0.005	0.54

JORDANELLE RESERVOIR DATE 07/19/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena flos-aquae	3.384	98.37
Asterionella formosa	0.001	0.04
Ceratium hirundinella	0.025	0.72
Fragilaria crotonensis	0.009	0.26
Melosira granulata	0.006	0.17
Stephanodiscus niagarae	0.005	0.14
Unknown filamentous chlorophyta	0.011	0.30

JORDANELLE RESERVOIR DATE 07/19/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.086	64.67
Asterionella formosa	0.009	6.82
Ceratium hirundinella	0.012	9.34
Melosira granulata	0.021	15.61
Staurastrum gracile	0.005	3.56

JORDANELLE RESERVOIR DATE 08/11/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.061	0.03
Ankyra judayi	0.047	0.02
Asterionella formosa	0.125	0.07
Chrysocapsa planktonica	186.816	97.99
Fragilaria crotonensis	1.000	0.52
Oocystis sp.	0.133	0.07
Pennate diatoms	0.027	0.01
Sphaerocystis schroeteri	2.447	1.29

JORDANELLE RESERVOIR DATE 08/17/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankyra judayi	0.000	0.01
Asterionella formosa	0.007	0.83
Euglena species	0.002	0.19
Fragilaria crotonensis	0.406	46.64
Gloeobotrys limnetica	0.004	0.44
Melosira granulata	0.002	0.25
Microcystis incerta	0.000	0.03
Oocystis species	0.000	0.01
Pennate diatoms	0.000	0.04
Sphaerocystis schroeteri	0.209	24.03
Staurastrum gracile	0.240	27.53

JORDANELLE RESERVOIR DATE 08/17/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.035	0.30
Ankyra judayi	0.019	0.17
Euglena species	0.041	0.36
Fragilaria crotonensis	6.672	57.66
Gloeobotrys limneticus	0.389	3.36
Oocystis species	0.108	0.94
Pennate diatoms	0.009	0.08
Quadrigula lacustris	1.112	9.61
Sphaerocystis schroeteri	2.446	21.14
Staurastrum gracile	0.723	6.25
Unknown spherical chlorophyta	0.017	0.13

JORDANELLE RESERVOIR DATE 08/17/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.039	0.22
Ankyra judayi	0.100	0.57
Asterionella formosa	0.028	0.16
Euglena species	0.123	0.70
Fragilaria crotonensis	9.007	50.98
Gloeobotrys limneticus	2.836	16.05
Oocystis species	0.259	1.46
Pennate diatoms	0.022	0.13
Quadrigula lacustris	1.112	6.29
Sphaerocystis schroeteri	1.223	6.92
Staurastrum gracile	2.891	16.36
Unknown spherical chlorophyta	0.028	0.16

JORDANELLE RESERVOIR DATE 08/17/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankyra judayi	0.000	0.00
Aphanizomenon flos-aquae	0.003	0.13
Asterionella formosa	0.026	1.31
Dinobryon divergens	0.001	0.05
Euglena speciesq	0.002	0.13
Fragilaria crotonensis	1.150	59.02
Gloeobotrys limnetica	0.008	0.41
Melosira granulata	0.002	0.07
Pandorina morum	0.003	0.14
Pennate diatoms	0.001	0.06
Sphaerocystis schroeteri	0.282	14.48
Staurastrum gracile	0.472	24.20

JORDANELLE RESERVOIR DATE 09/13/94

Species	Cell Volume (mm3/liter)	% Density by volume
Aphanizomenon flos-aquae	0.410	47.89
Asterionella formosa	0.007	0.71
Dinobryon divergens	0.001	0.13
Euglena species	0.001	0.12
Fragilaria crotonensis	0.421	49.23
Gloeobotrys limnetica	0.001	0.16
Microcystis incerta	0.001	0.16
Staurastrum gracile	0.014	1.60

JORDANELLE RESERVOIR DATE 09/13/94

Species	Cell Volume (mm3/liter)	% Density by volume
Aphanizomenon flos-aquae	0.349	37.33
Asterionella formosa	0.003	0.28
Chlamydomonas species	0.000	0.01
Dinobryon divergens	0.001	0.14
Fragilaria crotonensis	0.530	56.73
Gloeobotrys species	0.004	0.43
Melosira granulata	0.001	0.07
Microcystis incerta	0.003	0.32
Oocystis species	0.000	0.03
Staurastrum gracile	0.044	4.66

JORDANELLE RESERVOIR DATE 09/13/94

Species	Cell Volume (mm3/liter)	% Density by volume
Aphanizomenon flos-aquae	0.028	19.30
Asterionella formosa	0.001	0.62
Ceratium hirundinella	0.010	6.91
Cosmarium species	0.001	0.57
Dinobryon divergens	0.001	0.36
Fragilaria crotonensis	0.077	53.56
Gloeobotrys species	0.006	4.06
Melosira granulata	0.005	3.58
Microcystis incerta	0.001	0.49
Staurastrum gracile	0.015	10.55

JORDANELLE RESERVOIR DATE 10/12/94

Species	Cell Volume (mm3/liter)	% Density by volume
Aphanizomenon flos-aquae	0.001	0.59
Asterionella formosa	0.066	49.85
Ceratium hirundinella	0.007	5.28
Dinobryon divergens	0.005	3.89
Fragilaria crotonensis	0.010	7.67
Melosira granulata	0.024	17.94
Melosira granulata var. angustissima	0.005	3.71
Microcystis incerta	0.000	0.19
Oocystis species	0.001	0.42
Quadrigula lacustris	0.008	6.21
Staurastrum gracile	0.005	4.03
Unknown Spherical chlorophyta	0.000	0.22

JORDANELLE RESERVOIR DATE 10/12/94

Species	Cell Volume (mm3/liter)	% Density by volume
Aphanizomenon flos-aquae	0.005	1.70
Asterionella formosa	0.098	37.50
Centric diatoms	0.000	0.02
Coelastrum species	0.009	3.59
Dinobryon divergens	0.007	2.52
Fragilaria crotonensis	0.025	9.60
Gloeobotrys species	0.000	0.18
Melosira granulata	0.075	28.47
Melosira granulata var. angustissima	0.009	3.38
Microcystis incerta	0.001	0.32
Mougeotia species	0.005	1.79
Oocystis species	0.001	0.19
Pediastrum duplex	0.006	2.15
Quadrigula lacustris	0.009	3.59
Staurastrum gracile	0.006	2.33
Stephanodiscus niagarae	0.003	1.15
Unknown spherical chlorophyta	0.001	1.52

JORDANELLE RESERVOIR DATE 10/12/94

Species	Cell Volume (mm3/liter)	% Density by volume
Aphanizomenon flos-aquae	0.002	1.10
Asterionella formosa	0.065	34.37
Dinobryon divergens	0.003	1.53
Fragilaria crotonensis	0.018	9.58
Gloeobotrys species	0.002	0.87
Melosira granulata	0.065	34.17
Melosira granulata var. angustissima	0.005	2.67
Microcystis incerta	0.001	0.29
Oocystis species	0.001	0.31
Pediastrum duplex	0.007	3.49
Quadrigula lacustris	0.011	5.81
Staurastrum gracile	0.011	5.67
Unknown spherical chlorophyta	0.000	0.14

KENS LAKE DATE 08/11/93

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.014	0.45
Centric diatoms	0.035	1.13
Ceratium hirundinella	1.890	60.89
Dinobryon divergens	0.012	0.39
Fragilaria crotonensis	1.000	32.23
Mallomonas sp.	0.060	1.93
Oocystis sp.	0.017	0.54
Pennate diatoms	0.076	2.44

KENS LAKE DATE 08/17/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena sp.	0.278	0.22
Aphanizomenon flos-aquae	12.254	9.90
Centric diatoms	0.008	0.01
Gloeotrichia echinulata	111.200	89.86
Pennate diatoms	0.004	0.01

KENS LAKE DATE 08/22/95

Species	Cell Volume (mm3/liter)	% Density by volume
Microcystis incerta	1.334	96.82
Pennate diatoms	0.031	2.26
Oocystis species	0.008	0.61
Ankistrodesmus falcatus	0.004	0.32

KOLOB RESERVOIR DATE 08/31/93

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena sp.	0.278	6.13
Ankistrodesmus flacatus	0.004	0.10
Centric diatoms	0.035	0.77
Ceratium hirundinella	1.890	41.66
Dinobryon divergens	0.037	0.81
Fragilaria crotonensis	1.000	22.06
Melosira granulata var. angustissima	0.026	0.56
Microcystis incerta	0.111	2.45
Oocystis sp.	0.050	1.10
Pandorina morum	0.445	9.80
Pennate diatoms	0.004	0.10
Sphaerocystis schroeteri	0.612	13.48
Wislouchiella planktonica	0.044	0.98

KOLOB RESERVOIR DATE 08/09/95

Species	Cell Volume (mm3/liter)	% Density by volume
Sphaerocystis schroeteri	44.897	96.72
Staurastrum gracile	0.723	1.26
Pandorina morum	0.667	1.44
Gloeobotrys species	0.056	0.12
Phacus species	0.028	0.06
Pennate diatoms	0.016	0.03
Ankistrodesmus falcataus	0.013	0.03
Dinobryon divergens	0.012	0.03
Oocystis species	0.008	0.02

KOOSHAREM RESERVOIR DATE 08/24/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena sp.	0.278	0.23
Ankistrodesmus falcatus	0.004	0.00
Gloeocystis vesiculosa	0.006	0.00
Gloeotrichia echinulata	111.200	93.97
Microcystis aeruginosa	6.605	5.58
Oscillatoria sp.	0.055	0.05
Pennate diatoms	0.013	0.01
Stephanodiscus niagarae	0.178	0.16

LABARON RESERVOIR DATE 08/17/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena spiroides var. crassa	159.572	97.24
Aphanizomenon flos-aquae	0.211	0.13
Botryococcus sudeticus	0.150	0.09
Ceratium hirundinella	1.890	1.15

Dysmorphococcus sp.	0.006	0.00
Gloeocystis sp.	1.000	0.61
Sphaerocystis schroeteri	1.223	0.75
Unknown spherical chlorophyta	0.050	0.03

LAKE BOREHAM DATE 09/06/95

Species	Cell Volume (mm3/liter)	% Density by volume
Sphaerocystis schroeteri	0.016	78.70
Fragilaria crotonensis	2.978	14.79
Dinobryon divergens	0.428	2.13
Oocystis gigaas	0.367	1.82
Staurastrum gracile	0.361	1.80
Pennate diatoms	0.078	0.39
Var angustissima	0.026	0.13
Asterionella formosa	0.019	0.09
Ankistrodesmus falcatus	0.017	0.09
Mallomonas species	0.007	0.03
Centric diatoms	0.003	0.02
Unknown spherical chlorophyta	0.003	0.02

LITTLE CREEK RESERVOIR DATE 08/03/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena sp	0.278	22.24
Ankistrodesmus falcatus	0.009	0.70
Centric diatoms	0.078	6.23
Fragilaria crotonensis	0.334	26.69
Pennate diatoms	0.552	44.14

LITTLE DELL RES DATE 09/07/94

Species	Cell Volume (mm3/liter)	% Density by volume
Centric diatoms	0.012	5.90
Chlamydomonas sp.	0.002	1.12
Microcystis incerta	0.167	84.27
Oocystis sp.	0.008	4.21
Pennate diatoms	0.009	4.49

LLOYDS RESERVOIR DATE 08/11/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus flacatus	0.013	3.39
Ankyra judayi	0.003	0.72
Centric diatoms	0.019	5.04
Dinobryon divergens	0.171	44.35
Oocystis sp.	0.075	19.44
Pennate diatoms	0.102	26.49
Unknown spherical chrysophyte	0.002	0.58

LLOYDS RESERVOIR DATE 08/23/95

Species	Cell Volume (mm3/liter)	% Density by volume
Peridinium species	1.446	39.75
Staurastrum gracile	0.723	19.87
Fragilaria crotonensis	0.458	12.60
chlorophyta	0.409	11.24
Cosmarium species	0.233	6.42
Dinobryon divergens	0.147	4.04
Oocystis species	0.917	2.52
Ankistrodesmus falcatus	0.052	1.44
Euglena species	0.041	1.13
Microcystis incerta	0.222	0.61
Chlorophyta	0.010	0.28
Pennate diatoms	0.004	0.11

LONG PARK RESERVOIR DATE 09/17/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus flacatus	0.004	0.27
Asterionella formosa	0.139	8.50
Centric diatoms	0.012	0.71
Dinobryon divergens	0.685	41.91
Melosira granulata	0.055	3.33
Onychonema sp.	0.195	11.91
Oocystis sp.	0.025	1.53
Pennate diatoms	0.520	31.84

LONG PARK RESERVOIR DATE 09/19/95

Species	Cell Volume (mm3/liter)	% Density by volume
Aphaerocystis schroeteri	2.641	66.13
Pediastrum duplex	1.334	33.41
Asterionella formosa	0.009	0.24
Ankistrodesmus falcatus	0.009	0.22

LOST CREEK RESERVOIR DATE 08/02/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.004	0.22
Asterionella formosa	0.125	6.16
Centric diatoms	0.020	0.96
Chlamydomonas sp.	0.002	0.11
Dinobryon divergens	0.232	11.45
Fragilaria crotonensis	1.334	65.76
Microcystis incerta	0.278	13.70
Oocystis sp.	0.033	1.64

LOWER BOWNS RESERVOIR DATE 08/19/93

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena sp.	1.390	11.76
Anabaena spiroides var. crassa	0.778	6.59
Aphanizomenon flos-aquae	0.106	0.89
Asterionella formosa	0.014	0.12
Centric diatoms	0.004	0.03
Ceratium hirundinella	0.945	8.00
Dictyosphaerium sp.	0.500	4.24
Dinobryon divergens	1.064	9.01
Fragilaria crotonensis	5.671	48.00
Melosira granulata	0.055	0.46
Oocystis sp.	0.058	0.49
Pandorina morum	0.222	1.88
Pennate diatoms	0.018	0.15
Scenedesmus sp.	0.017	0.14
Sphaerocystis schroeteri	0.612	5.18
Staurastrum gracile	0.361	3.06

LOWER BOWNS RESERVOIR DATE 09/13/95

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena flos-aquae	4.014	46.40
Staurastrum gracile	0.144	16.71
Fragilaria crotonensis	1.374	15.89
Mougeotia species	0.556	6.43
Gloeobotrys species	0.556	6.43
Trachellomonas species	0.444	5.14
Pennate diatoms	0.109	1.26
Phacus species	0.056	0.64
Microcystis incerta	0.044	0.51
Oocystis species	0.025	0.29
Chlorophyta	0.010	0.12
Asterionella formosa	0.009	0.11
Centric diatoms	0.006	0.08

LOWER BOX CREEK RESERVOIR DATE 08/24/94

Species	Cell Volume (mm3/liter)	% Density by volume
Aphanizomenon flos-aquae	70.145	82.66
Haematococcus sp.	0.007	0.01
Merismopedia glauca	0.025	0.03
Microcystis aeruginosa	14.678	17.30

LOWER GOOSEBERRY RESERVOIR DATE 08/11/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.013	0.65
Microcystis incerta	0.056	2.75
Oocystis sp.	0.008	0.41
Pennate diatoms	0.098	4.84
Scenedesmus bijuga	0.011	0.55
Sphaerocystis schroeteri	1.835	90.80

LOWER GOOSEBERRY RESERVOIR DATE 10/03/95

Species	Cell Volume (mm3/liter)	% Density by volume
Pennate diatoms	0.023	62.69
Oocystis species	0.008	22.39
Spherical chlorophyta	0.005	14.93

LYMAN LAKE (RES.) DATE 09/07/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.035	2.17
Botryococcus sudeticus	0.300	18.68
Centric diatoms	0.031	1.94
Cosmarium sp.	0.156	9.69
Crucigenia sp.	0.006	0.35
Fragilaria crotonensis	0.334	20.76
Microcystis incerta	0.445	27.67
Oocystis sp.	0.234	14.53
Oscillatoria sp.	0.012	0.76
Pennate diatoms	0.045	2.77
Scenedesmus bijuga	0.011	0.69

LYMAN LAKE (RES.) DATE 09/27/95

Species	Cell Volume (mm3/liter)	% Density by volume
Quadrigula lacustris	1.112	78.46
Oocystis species	0.067	4.71
Gomphosphaeria lacustris	0.056	3.92
Scenedesmus	0.051	3.65
Euglena species	0.041	2.90
Microcystis incerta	0.033	2.35
Pennate diatoms	0.023	1.65
Chroococcus species	0.017	1.18
Centric diatoms	0.017	1.18

MANNING MEADOW DATE 08/23/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.026	0.04
Asterionella formosa	0.042	0.07
Centric diatoms	0.004	0.01
Ceratium hirundinella	0.945	1.49
Cosmarium sp.	0.078	0.12
Fragilaria crotonensis	5.338	8.41
Gloeocystis vesiculosa	0.017	0.03
Gloeotrichia echinulata	55.600	87.58
Haematococcus sp.	0.007	0.01
Oocystis sp.	0.025	0.04
Pennate diatoms	0.009	0.01
Staurastrum gracile	0.361	0.57
Unknown spherical chlorophyta	1.034	1.63

MANTUA RESERVOIR DATE 08/24/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankyra judayi	0.003	0.47
Aphanizomenon flos-aquae	0.423	71.97
Centric diatoms	0.004	0.66
Mallomonas sp.	0.013	2.27
Oocystis sp.	0.100	17.05
Pennate diatoms	0.040	6.82
Unknown spherical chrysophyte	0.004	0.76

MANTUA RESERVOIR DATE 09/06/95

Species	Cell Volume (mm3/liter)	% Density by volume
Aphanizomenon flos-squae	52.397	99.88
Phacus species	0.028	0.05
Chlorophyta	0.016	0.03
Microcystis incerta	0.011	0.02
Pennate diataoams	0.008	0.01

MARSH LAKE DATE 09/16/93

Species	Cell Volume (mm3/liter)	% Density by volume
Centric diatoms	0.070	1.14
Oocystis sp.	0.008	0.14
Pediastrun duplex	0.667	10.86
Pennate diatoms	0.004	0.07
Quadrigula lacustris	1.112	18.10
Sphaerocystis schroeteri	4.281	69.69

MARSH LAKE DATE 09/27/95

Species	Cell Volume (mm3/liter)	% Density by volume
Centric diatoms	0.023	51.22
Microcystis incerta	0.011	24.39
Pennate diatoms	0.008	17.07
Unknown spherical chlorophyta	0.003	7.32

MARSHALL LAKE DATE 09/07/94

Species	Cell Volume (mm3/liter)	% Density by volume
Botryococcus sudeticus	0.150	3.28
Chlamydomonas sp.	0.013	3.29
Chroococcus sp.	0.039	0.85
Euglena sp.	0.041	0.90
Mallomonas sp.	0.040	0.88
Microcystis incerta	1.890	41.32
Oocystis sp.	0.033	0.73
Pennate diatoms	0.004	0.10
Peridinium sp.	1.084	23.70
Quadrigula lacustris	1.112	24.31
Unknown filamentous chlorophyta	0.006	0.12
Unknown spherical chlorophyta	0.161	3.52

MATT WARNER RESERVOIR DATE 09/15/94

Species	Cell Volume (mm3/liter)	% Density by volume
Aphanizomenon flos-aquae	0.106	0.58
Coelosphaerium sp.	2.252	12.38
Microcystis aeruginosa	1.223	6.73
Pennate diatoms	0.013	0.07
Stephanodiscus niagarae	14.589	80.23

MATT WARNER RESERVOIR DATE 09/19/95

Species	Cell Volume (mm3/liter)	% Density by volume
Sphaerocystis schroeteri	13.205	29.57
Pandorina morum	11.120	24.90
Eudorina elegans	11.120	24.90
Stephanodiscus niagarae	9.073	20.32
Microsystis aeruginosa	0.122	0.27
Pennate diatoms	0.008	0.02
Chlamydomonas species	0.004	0.01
Ankistrodesmus falcaatus	0.004	0.01
Unknown spherical chlorophyta	0.003	0.01

MEEKS CABIN RESERVOIR DATE 09/16/93

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.028	0.65
Centric diatoms	0.405	9.52
Chlamydomonas sp.	0.002	0.05
Dinobryon divergens	0.061	1.44
Oocystis sp.	0.017	0.39
Pennate diatoms	0.071	1.67
Sphaerocystis schroeteri	3.670	86.27

MEEKS CABIN RESERVOIR DATE 09/27/95

Species	Cell Volume (mm3/liter)	% Density by volume
Centric diatoms	0.207	84.74
Mallomonas species	0.020	8.20
Asterionella formosa	0.009	3.87
Pennate diatoms	0.008	3.19

MILL HOLLOW RESERVOIR DATE 09/07/93

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	4.754	67.21
Centric diatoms	0.012	0.17
Fragilaria crotonensis	1.334	18.87
Microcystis incerta	0.389	5.50
Pandorina morum	0.222	3.14
Peridinium sp.	0.361	5.11

MILL HOLLOW RESERVOIR DATE 09/21/95

Species	Cell Volume (mm3/liter)	% Density by volume
Aphanizomenon flos-aquae	5.493	49.34
Sphaerozystis schroeteri	5.282	47.44
Pandorina morum	0.222	2.00
Asterionella formosa	0.113	1.02
Pennate diatoms	0.016	0.14
Ankistrodesmus falcataus	0.004	0.04
Unknown spherical chlorophyta	0.003	0.03

MILL MEADOW RESERVOIR DATE 08/17/93

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena sp.	0.278	2.22
Ankyra judayi	0.064	0.51
Aphanizomenon flos-aquae	2.113	16.86
Asterionella flormosa	0.014	0.11
Centric diatoms	8.457	67.51
Coelastrum microporum	0.217	1.73
Melosira granulata var. angustissima	0.051	0.41
Pennate diatoms	0.053	0.43
Scenedesmus dimorphus	0.008	0.06
Scenedesmus quadricauda	0.050	0.40
Sphaerocystis schroeteri	1.223	9.76

MILL MEADOW RESERVOIR DATE 09/12/95

Species	Cell Volume (mm3/liter)	% Density by volume
Aphanizomenon flos-aquae	66.130	91.16
Var. crassa	5.782	7.97
Microsystis aeruginosa	0.612	0.84
Gomphosphaeria aponina	0.022	0.03

MILLER FLAT RESERVOIR DATE 08/31/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.009	0.06
Asterionella formosa	0.778	5.11
Fragilaria crotonensis	5.338	35.05
Mallomonas sp.	0.007	0.04
Oocystis sp.	0.017	0.11
Oscillatoria agardhii	0.028	0.18
Pennate diatoms	0.036	0.23
Phacotus sp.	2.280	14.97
Sphaerocystis schroeteri	6.728	44.17
Unknown spherical chlorophyta	0.011	0.07

MILLSITE RESERVOIR DATE 08/09/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.009	0.24
Asterionella formosa	0.028	0.75
Centric diatoms	0.090	2.41
Fragilaria crotonensis	0.334	8.98
Oocystis sp.	0.175	4.72
Pennate diatoms	0.013	0.36
Sphaerocystis schroeteri	3.058	82.34
Unknown spherical chlorophyte	0.006	0.15
Unknown sperical chrysophyte	0.002	0.06

MILLSITE RESERVOIR DATE 08/31/95

Species	Cell Volume (mm3/liter)	% Density by volume
Sphaerocystis schroeteri	5.282	99.62
Centric diataoms	0.013	0.25
Unknown spherical chlorophyta	0.007	0.13
Oocystis species	0.000	0.01

MINERSVILLE RESERVOIR DATE 08/03/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus flacatus	0.009	0.20
Botryoccoccus braunii	2.224	51.05
Centric diatoms	0.016	0.36
Ceratium hirundinella	0.945	21.70
Fragilaria crotonensis	0.667	15.31
Melosira granulata	0.109	2.50
Pennate diatoms	0.165	3.78
Pleodorina illinoisense	0.222	5.10

MINERSVILLE RESERVOIR DATE 08/18/93

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena sp.	5.282	13.41
Ankyra judayi	0.003	0.01
Aphanizomenon flos-aquae	9.296	23.61
Centric diatoms	0.012	0.03
Ceratium hirundinella	14.178	36.01
Euglena sp.	0.041	0.10
Fragilaria crotonensis	2.002	5.08
Melosira granulata	0.218	0.55
Oocystis sp.	0.025	0.06
Pandorina morum	0.222	0.56
Pennate diatoms	0.013	0.03
Sphaerocystis schroeteri	0.612	1.55
Stephanodiscus niagarae	7.473	18.98

MINERSVILLE RESERVOIR DATE 09/01/93

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena sp.	3.892	14.05
Ankistrodesmus falcatus	0.009	0.03
Aphanizomenon flos-aquae	1.268	4.58
Asterionella formosa	0.348	1.25
Centric diatoms	0.004	0.01
Fragilaria crotonensis	0.667	2.41
Melosira granulata	0.109	0.39
Oocystis sp.	0.008	0.03
Pennate diatoms	0.040	0.14
Stephanodiscus niagarae	21.350	77.08
Wislouchiella planktonica	0.004	0.02

MINERSVILLE RESERVOIR DATE 09/14/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus flacatus	0.004	0.02
Asterionella formosa	0.125	0.59
Centric diatoms	0.020	0.09
Fragilaria crotonensis	1.000	4.69
Melosira granulata	0.055	0.26
Oocystis sp.	0.025	0.12
Pennate diatoms	0.040	0.19
Sphaerocystis schroeteri	0.612	2.87
Stephanodiscus niagarae	19.393	90.95
Wislouchiella planktonica	0.049	0.23

MINERSVILLE RESERVOIR DATE 09/16/93

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.459	4.72
Centric diatoms	0.027	0.28
Closteriopsis longissima var. tropica	0.012	0.13
Euglena sp.	0.041	0.42
Fragilaria crotonensis	3.002	30.91
Melosira granulata	0.327	3.37
Oocystis sp.	0.033	0.34
Oscillatoria agardhii	0.139	1.43
Pennate diatoms	0.205	2.11
Scenedesmus dimorphus	0.008	0.08
Sphaerocystis schroeteri	0.612	6.30
Stephanodiscus niagarae	4.804	49.46
Wislouchiella planktonica	0.045	0.46

MINERSVILLE RESERVOIR DATE 08/05/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena spiroides var. crassa	3,463.880	99.99
Pennate diatoms	0.445	0.01

MINERSVILLE RESERVOIR DATE 08/17/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena spiroides	378.692	96.13
Ankistrodesmus falcatus	0.018	0.00
Chlamydomonas sp.	0.007	0.00
Dysmorphococcus sp.	0.042	0.00
Oocystis sp.	0.008	0.00
Pteromonas sp.	7.284	1.85
Sphaerocystis schroeteri	0.612	0.16
Trachelomonas sp.	7.250	1.84
Unknown spherical chlorophyta	0.028	0.01

MINERSVILLE RESERVOIR DATE 10/10/95

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena circinalis	17.792	63.05
Anabaena flos-aqua	6.338	22.46
Ceratium hirundinella	3.780	13.40
Stephanodiscus niagarae	0.178	0.63
Ankistrodesmus falcatus	0.057	0.20
Melosira granulata	0.054	0.09
Pennate diatoms	0.008	0.03
Centric diatoms	0.007	0.02
Ankyra judayi	0.002	0.01

MIRROR LAKE DATE 09/15/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.009	0.31
Ankyra judayi	0.003	0.10
Centric diatoms	0.199	7.14
Dinobryon divergens	0.049	1.76
Pennate diatoms	0.142	5.12
Quadrigula lacustris	1.112	39.99
Sphaerocystis schroeteri	1.223	43.99
Trachellomonas sp.	0.044	1.60

MIRROR LAKE DATE 09/01/95

Species	Cell Volume (mm3/liter)	% Density by volume
Sphaerocystis schroeteri	2.641	75.92
Merismopedia glauca	0.450	12.95
Microcystis incerta	0.278	7.90
Pennate diatoms	0.047	1.34
Phacus species	0.028	0.80
Dinobryon divergens	0.012	0.35
Unknown spherical chlorophyta	0.010	0.29
Oocystis species	0.008	0.24
Ankistrodesmus falcatus	0.004	0.13

MONA RESERVOIR DATE 08/03/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.004	0.31
Centric diatoms	0.148	10.46

Chlamydomonas sp.	0.002	0.16
Euglena sp.	0.041	2.91
Melosira granulata	1.090	77.11
Oscillatoria sp.	0.006	0.43
Pennate diatoms	0.089	6.29
Unknown flagellate	0.005	0.35
Unknown spherical Chlorophyta	0.028	1.97

MONTICELLO LAKE DATE 08/09/94

Species	Cell Volume (mm3/liter)	% Density by volume
Centric diatoms	0.012	0.54
Dinobryon divergens	1.028	46.42
Euglena sp.	0.041	1.86
Merismopedia glauca	0.075	3.39
Mougeotia sp.	0.556	25.12
Oocystis sp.	0.025	1.13
Pennate diatoms	0.116	5.22
Staurastrum gracile	0.361	16.33

MOON LAKE DATE 09/06/93

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.070	21.40
Centric diatoms	0.023	7.19
Chlamydomonas sp.	0.013	4.11
Cosmarium sp.	0.078	23.97
Dinobryon divergens	0.012	3.77
Pennate diatoms	0.120	36.99
Scenedesmus sp.	0.008	2.57

MOON LAKE DATE 09/06/95

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.075	47.22
Pennate diatoms	0.067	41.32
Unknown spherical chlorophyta	0.010	6.25
Oocystis species	0.008	5.21

NAVAJO LAKE DATE 08/08/95

Species	Cell Volume (mm3/liter)	% Density by volume
Ceratium hirundinella	0.945	61.89
Dinobryon divergens	0.464	30.43
Cosmarium species	0.078	5.10
Pennate diatoms	0.161	0.02
Tetraedron species	0.009	0.58
Oocystis species	0.008	0.55
Unknown spherical chrysophyta	0.007	0.44

NEWCASTLE RESERVOIR DATE 08/16/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.004	0.01
Centric diatoms	0.031	0.04
Dinobryon divergens	0.037	0.05
Euglena sp.	0.041	0.06
Fragilaria crotonensis	12.010	16.61
Gloeothrichia echinulata	55.600	76.88
Melosira granulata var. angustissima	0.051	0.07
Oocystis sp.	0.017	0.02
Pandorina morum	0.222	0.31
Pennate diatoms	0.227	0.31
Sphaerocystis schroeteri	0.612	0.85
Staurastrum gracile	2.530	3.50
Stephanodiscus niagarae	0.890	1.23
Wislouchiella planktonica	0.053	0.07

NEWTON RESERVOIR DATE 08/03/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.004	0.04
Centric diatoms	0.008	0.08
Ceratium hirundinella	1.890	18.70
Chlamydomonas sp.	0.009	0.09
Closteriopsis longissima var. tropica	0.012	0.12
Mallomonas sp.	0.007	0.07
Melosira granulata	1.743	17.25
Melosira granulata var. angustissima	0.512	5.06
Oocystis sp.	0.192	1.90
Pediastrum duplex	0.667	6.60
Pennate diatoms	1.753	17.34
Quadrigula lacustris	1.112	11.00
Sphaerocystis schroeteri	1.223	12.10
Unknown spherical chlorophyta	0.083	0.83
Wislouchiella planktonica	0.892	8.82

NINEMILE RESERVOIR DATE 08/09/94

Species	Cell Volume (mm3/liter)	% Density by volume
Actinastrum sp.	0.004	0.00
Cosmarium sp.	0.156	0.14
Dinobryon divergens	0.049	0.05
Mallomonas sp.	0.007	0.01
Oscillatoria sp.	0.006	0.01
Pennate diatoms	0.423	0.39
Peridinium sp.	102.638	94.51
Phacus sp.	0.028	0.03
Scenedesmus bijuga	0.478	0.44
Scenedesmus quadricauda var. quadrispina	0.013	0.01
Tetraedron minimum	2.578	2.37
Unknown spherical chlorophyta	2.224	2.04

OAK PARK RESERVOIR DATE 09/08/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.004	0.19
Asterionella formosa	0.042	1.84
Centric diatoms	0.020	0.86
Chlamydomonas sp.	0.007	0.29
Dinobryon divergens	0.942	41.46
Pennate diatoms	0.018	0.78
Scenedesmus sp.	0.017	0.73
Sphaerocystis schroeteri	1.223	53.84

OAK PARK RESERVOIR DATE 09/19/95

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.879	68.29
Unknown spherical chlorophyta	0.227	17.62
Pennate diatoms	0.070	5.44
Dinobryon divergens	0.061	4.75
Oocystis species	0.033	2.59
Chroococcus species	0.017	1.30

OTTER CREEK RESERVOIR DATE 08/25/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankyra judayi	0.006	0.08
Aphanizomenon flos-aquae	2.535	34.51
Centric diatoms	0.016	0.21
Ceratium hirundinella	0.945	12.87
Crucigenia sp.	0.011	0.15
Euglena sp.	0.041	0.56
Gloeocystis sp.	1.501	20.43
Melosira granulata var. angustissima	0.077	1.04
Oocystis sp.	0.008	0.11
Pennate diatoms	0.071	0.97
Stephanodiscus niagarae	2.135	29.07

OTTER CREEK RESERVOIR DATE 09/09/94

Species	Cell Volume (mm3/liter)	% Density by volume
Aphanizomenon flos-aquae	0.528	1.98
Centric diatoms	0.066	0.25
Chlamydomonas sp.	0.004	0.02
Euglena sp.	0.041	0.15
Fragilaria crotonensis	0.667	2.50
Franceia sp.	0.008	0.03
Lyngbya sp.	0.006	0.02
Melosira granulata	0.109	0.41
Melosira granulata var. angustissima	0.154	0.57
Oocystis sp.	0.017	0.06
Pennate diatoms	0.347	1.30
Phacotus sp.	0.222	0.83
Stephanodiscus niagarae	24.553	91.84
Unknown spherical chlorophyta	0.011	0.04

PALISADE LAKE DATE 08/09/94

Species	Cell Volume (mm3/liter)	% Density by volume
Centric diatoms	0.012	1.12
Dinobryon divergens	0.330	31.55
Euglena sp.	0.041	3.93
Pennate diatoms	0.031	2.97
Sphaerocystis schroeteri	0.612	58.42
Tetraedron minimum	0.021	2.01

PANGUITCH LAKE DATE 08/31/93

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena sp.	0.834	8.61
Ankistrodesmus falcatus	0.013	0.14
Ankyra judayi	0.003	0.03
Aphanizomenon flos-aquae	2.852	29.46
Ceratium hirundinella	3.781	39.05
Fragilaria crotonensis	0.334	3.45
Oocystis sp.	0.008	0.09
Sphaerocystis schroeteri	0.612	6.32
Stephanodiscus niagarae	1.245	12.86

PANGUITCH LAKE DATE 08/23/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.031	0.05
Ankyra judayi	0.003	0.00
Centric diatoms	0.004	0.01
Gloeotrichia echinulata	55.600	99.37
Microcystis aeruginosa	0.122	0.22
Oocystis sp.	0.008	0.01
Pennate diatoms	0.004	0.01
Stêphanodiscus niagarae	0.178	0.33

PANGUITCH LAKE DATE 08/08/95

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena spiroides	453.918	99.15
Ceratium hirundinella	2.835	0.62
Microcystis incerta	0.411	0.09
Stephanodiscus niagarae	0.356	0.08
Fragilaria crotonensis	0.229	0.05
Asterionella formosa	0.028	0.01
Oocystis species	0.025	0.01
Pennate diatoms	0.012	0.00

PARADISE PARK RESERVOIR DATE 09/08/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.004	0.01
Ankyra judayi	0.003	0.00
Centric diatoms	0.023	0.03
Chrysocapsa planktonica	70.056	92.12
Microcystis incerta	0.389	0.51
Oocystis sp.	0.067	0.09
Pennate diatoms	0.098	0.13
Quadrigula chodatii	3.336	4.39
Sphaerocystis schroeteri	1.835	2.41
Unknown spherical chlorophyte	0.184	0.24
Unknown spherical chrysophyte	0.051	0.07

PARADISE PARK RESERVOIR DATE 09/20/95

Species	Cell Volume (mm3/liter)	% Density by volume
Sphaerocystis schroeteri	2.641	68.08
Dinobryon divergens	0.844	21.76
Gloeobotrys species	0.167	4.30
Microcystis incerta	0.156	4.01
Chlorophyta	0.047	1.20
Oocystis species	0.025	0.64

PELICAN LAKE DATE 09/06/94

Species	Cell Volume (mm3/liter)	% Density by volume
Botryococcus sudeticus	0.150	2.59
Centric diatoms	0.008	0.13
Ceratium hirundinella	0.945	16.31
Chroococcus sp.	0.006	0.10
Cosmarium sp.	0.078	1.34
Crucigenia sp.	0.022	0.38
Lyngbya sp.	0.006	0.11
Merishopedia glauca	0.025	0.43
Oocystis sp.	4.404	76.00
Pennate diatoms	0.004	0.08
Scendesmus arcuatus	0.008	0.14
Scenedesmus bijuga	0.011	0.19
Tetraedron minimum	0.042	0.73
Unknown spherical chlorophyta	0.044	0.77
Unknown spherical chrysophyta	0.040	0.70

PELICAN LAKE DATE 10/06/95

Species	Cell Volume (mm3/liter)	% Density by volume
Staurastrum gracile	11.926	60.83
Fragilaria crotonensis	2.978	15.19
Ceratium hirundinella	1.890	9.64
Pennate diatoms	1.502	7.66
Pediastrum duplex	0.667	3.40
Botryococcus sudeticus	0.300	1.53
Cosmarium species	0.156	0.79
Gomphosphaeria lacustris	0.111	0.57
Scebedesnys bijuga	0.044	0.23
Oocystis species	0.008	0.04
Scenedesmus dimorphus	0.008	0.04
Centric diatoms	0.006	0.03
Oscillatoria species	0.667	0.03

PELICAN LAKE DATE 10/06/95

Species	Cell Volume (mm3/liter)	% Density by volume
Ceratium hirundinella	0.945	73.69
Fragilaria crotonensis	0.229	17.86
Oocystis species	0.083	6.50
Pennate diatoms	0.019	1.52
Unknown spherical chlorophyta	0.006	0.43

PINE LAKE DATE 09/14/93

Species	Cell Volume (mm3/liter)	% Density by volume
Gomphosphaeria lacustris	0.056	13.30
Merismopedia sp.	0.011	2.66
Oocystis sp.	0.250	59.84
Oocystis sp. 2	0.083	19.95
Pennate diatoms	0.018	4.26

PINE LAKE DATE 09/14/95

Species	Cell Volume (mm3/liter)	% Density by volume
Quadrigula lacustris	10.008	61.31
Sphaerocystis schroeteri	5.282	32.36
Oocystis species	0.925	5.67
Gomphosphaeria lacustris	0.056	0.34
Chroococcus species	0.027	0.17
Pennate diatoms	0.023	0.14

PINEVIEW RESERVOIR DATE 08/04/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.009	0.22
Asterionella formosa	0.070	1.78
Ceratium hirundinella	0.945	24.16
Dinobryon divergens	0.281	7.19
Euglena sp.	0.041	1.05
Fragilaria crotonensis	1.000	25.58
Melosira granulata var. angustissima	0.128	3.27
Microcystis aeruginosa	0.122	3.13
Oocystis sp.	0.025	0.64
Quadrigula lacustris	1.112	28.43
Stephanodiscus niagarae	0.178	4.55

PIUTE RESERVOIR DATE 08/31/93

Species	Cell Volume (mm3/liter)	% Density by volume
Aphanizomenon flos-aquae	0.106	1.09
Asterionella formosa	0.083	0.86
Centric diatoms	0.016	0.16
Melosira granulata	0.055	0.56
Pediastrum duplex	1.334	13.76
Pennate diatoms	0.013	0.14
Sphaerocystis schroeteri	0.612	6.31
Stephanodiscus niagarae	7.473	77.04
Wislouchiella planktonica	0.009	0.09

PIUTE RESERVOIR DATE 08/08/95

Species	Cell Volume (mm3/liter)	% Density by volume
Fragilaria crotonensis	26.801	85.42
Anabaena circinalis	1.668	5.32
Anabaena flos-aquae	0.845	2.69
Stephanodiscus niagarae	0.712	2.27
Pandorina morum	0.667	2.13
Aphanizomenon flos-aquae	0.317	1.01
Phacus species	0.167	0.53
Pennate diatoms	0.136	0.43
Asterionella formosa	0.047	0.15
Ankistrodesmus falcatus	0.008	0.03
Oocystis species	0.083	0.03

PORCUPINE RESERVOIR DATE 08/24/93

Species	Cell Volume (mm3/liter)	% Density by volume
Aphanizomenon flos-aquae	0.317	3.17
Centric diatoms	0.786	7.85
Ceratium hirundinella	2.836	28.33

Dinobryon divergens	0.367	3.67
Fragilaria crotonensis	0.667	6.67
Oocystis sp.	0.167	1.67
Pennate diatoms	0.004	0.04
Peridinium sp.	1.807	18.05
Sjphaerocystis schroeteri	3.058	30.55

PORCUPINE RESERVOIR DATE 09/06/95

Species	Cell Volume (mm3/liter)	% Density by volume
Microcystis incerta	4.000	47.69
Sphaerocystis schroeteri	2.641	31.46
Oocystis parava	1.378	16.43
Peridinium species	0.361	4.31
Unknown spherical chlorophyta	0.010	0.12

POSEY LAKE DATE 09/14/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankyra judayi	0.003	0.88
Centric diatoms	0.004	1.23
Pennate diatoms	0.053	16.90
Staurastrum sp.	0.167	52.82
Trachellomonas sp.	0.089	28.17

POSEY LAKE DATE 09/01/95

Species	Cell Volume (mm3/liter)	% Density by volume
Staurastrum gracile	0.361	95.87
Oocystis species	0.008	2.21
Pennate diatoms	0.003	1.03
Centric diatoms	0.003	0.88

PUFFER LAKE DATE 08/18/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.009	0.09
Asterionella formosa	0.167	1.77
Centric diatoms	0.023	0.25
Ceratium hirundinella	0.945	10.05
Fragilaria crotonensis	3.002	31.94
Melosira granulata	0.055	0.58
Oocystis sp.	0.058	0.62
Pennate diatoms	0.080	0.85
Quadrigula lacustris	4.448	47.31
Sphaerocystis schroeteri	0.612	6.51
Wislouchiella planktonica	0.002	0.02

PUFFER LAKE DATE 08/30/95

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	3.639	52.75
Sphaerocystis schroeteri	2.641	38.28
Pandorina morum	0.444	6.45
Centric diatoms	0.093	1.35
Oocystis species	0.041	0.60
Pennate diatoms	0.025	0.51
Unknown spherical chlorophyta	0.033	0.05

QUAIL CREEK RESERVOIR DATE 08/04/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.004	0.10
Centric diatoms	0.016	0.35
Ceratium hirundinella	2.836	63.89
Dinobryon divergens	0.012	0.28
Pennate diatoms	0.013	0.30
Unknown filamentous green alga	1.557	35.08

QUAIL CREEK RESERVOIR DATE 08/09/95

Species	Cell Volume (mm3/liter)	% Density by volume
Dinobryon divergens	0.146	73.57
Scenedesmus bijuga	0.022	11.15
Unknown spherical chrysophyta	0.010	5.02
Oocystis sp.	0.008	4.18
Pennate diatoms	0.007	3.90
Ankistrodesmus falcatus	0.004	2.19

RAFT LAKE DATE 08/24/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena sp.	3.058	52.32
Centric diatoms	0.016	0.27
Chroococcus sp.	0.017	0.29
Coelastrum sp.	0.556	9.51
Gloeocystis vesiculosa	0.061	1.05
Melosira granulata var. angustissima	0.077	1.31
Micrasterias sp.	0.361	6.18
Mougeotia sp.	1.668	28.54
Pennate diatoms	0.031	0.53

RECAPTURE RESERVOIR DATE 08/10/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.013	1.02
Asterionella formosa	0.028	2.16
Centric diatoms	0.101	7.86
Dinobryon divergens	0.012	0.95
Fragilaria crotonensis	0.333	25.90
Oocystis sp.	0.042	3.24
Pennate diatoms	0.138	10.71
Planktospheria gelantinosa	0.612	47.48
Wislouchiella planktonica	0.009	0.69

RECAPTURE RESERVOIR DATE 08/23/95

Species	Cell Volume (mm3/liter)	% Density by volume
Sphaerocystis schroeteri	5.282	97.89
Melosira granulata	0.054	1.01
Phacus sp.	0.027	0.52
Oocystis sp.	0.025	0.46
Centric diatoms	0.003	0.06
Unknown spherical chlorophyta	0.003	0.06

RED CREEK RESERVOIR (DUCHESNE) DATE 09/06/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankyra judayi	0.003	0.33
Dinobryon divergens	0.025	2.93
Melosira granulata	0.055	6.52
Oocystis sp.	0.159	18.95
Pennate diatoms	0.040	4.79
Phacotus sp.	0.556	66.48

RED CREEK RESERVOIR (IRON) DATE 08/16/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena spiroides var. crassa	62.661	98.20
Ankistrodemus falcatus	0.017	0.03
Dysmorphococcus sp.	0.028	0.04
Microcystis incerta	0.834	1.31
Oocystis sp.	0.025	0.04
Pennate diatoms	0.022	0.03
Pteromonas sp.	0.222	0.35

RED FLEET RESERVOIR DATE 09/07/93

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.014	1.20
Dinobryon divergens	1.125	96.80
Mallomonas sp.	0.007	0.57
Oocystis sp.	0.017	1.43

RED FLEET RESERVOIR DATE 09/20/95

Species	Cell Volume (mm3/liter)	% Density by volume
Dinobryon divergens	0.012	34.92
Asterionella formosa	0.009	26.98
Unknown spherical chlorophyta	0.006	19.05
Centric diatoms	0.006	19.05

REDMOND LAKE DATE 08/10/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.004	0.03
Centric diatoms	0.420	3.29
Chlamydomonas sp.	0.007	0.05
Chroococcus turgidus	1.068	8.34
Cosmarium sp.	0.467	3.65
Crucigenia sp.	1.379	10.78
Gomphosphaeria lacustris	0.612	4.78
Mallomonas sp.	0.027	0.21
Merismopedia glauca	0.200	1.56
Oscillatoria sp.	0.012	0.10
Pediastrum duplex	4.003	31.29
Pediastrum sp.	0.667	5.22
Pennate diatoms	0.979	7.65
Scendesmus bijuga		

var. alternans	0.445	3.48
Scenedesmus bijuga	0.956	7.48
Scenedesmus dimorphus	0.016	0.12
Scenedesmus quadricauda var. quadrisphina	0.053	0.42
Stichococcus bacillaris	1.118	8.74
Tetraedron sp.	0.027	0.21
Unknown spherical chlorophyta	0.334	2.60

REX RESERVOIR DATE 08/24/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena sp.	0.278	51.31
Ankistrodesmus falcatus	0.018	3.22
Ankyra judayi	0.017	3.08
Centric diatoms	0.016	2.87
Euglena sp.	0.082	15.19
Melosira granulata var. angustissima	0.026	4.72
Oocystis sp.	0.008	1.54
Pennate diatoms	0.053	9.85
Phacus sp.	0.028	5.13
Unknown spherical chlorophyta	0.017	3.09

ROCKPORT RESERVOIR DATE 08/02/94

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.014	1.02
Ceratium hirundinella	0.945	69.08
Microcystis aeruginosa	0.122	8.94
Stephanodiscus niagarae	0.178	13.00
Wislouchiella planktonica	0.109	7.96

RUSH LAKE DATE 08/17/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.087	1.29
Centric diatoms	3.051	45.18
Gomphosphaeria sp.	1.112	16.46
Merismopedia tenuissima	0.056	0.82
Oocystis sp.	0.784	11.61
Pennate diatoms	1.664	24.63

RUSH LAKE DATE 09/09/95

Species	Cell Volume (mm3/liter)	% Density by volume
Pennate diatoms	1.517	91.37
Centric diatoms	0.076	4.62
Oocystis sp.	0.033	2.01
Unknown sperical chrysophyta	0.333	2.01

SCOFIELD RESERVOIR DATE 08/12/93

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena sp.	1.112	58.51
Asterionella formosa	0.014	0.73
Centric diatoms	0.047	2.46
Mougeotia sp.	0.006	0.29
Oocystis sp.	0.042	2.19
Pennate diatoms	0.142	7.49
Stephanodiscus niagarae	0.534	28.09
Unknown spherical chrysophyte	0.002	0.12
Wislouchiella planktonica	0.002	0.12

SCOFIELD RESERVOIR DATE 08/30/94

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.014	0.04
Botryococcus sudeticus	0.150	0.45
Eudorina elegans	11.123	3.14
Fragilaria crotonensis	19.682	58.66
Melosira granulata var. angustissima	0.026	0.08
Microcystis incerta	0.278	0.83
Oocystis sp.	0.008	0.02
Pandorina morum	0.445	1.33
Phacotus sp.	0.500	1.49
Sphaerocystis schroeteri	0.612	1.82
Stephanodiscus niagarae	0.712	2.12
Tetraedron sp.	0.007	0.02

SCOFIELD RESERVOIR DATE 08/30/95

Species	Cell Volume (mm3/liter)	% Density by volume
Eudorina elegans	13.900	57.83
Sphaerocystis schroeteri	5.282	21.97
Aphanizomenon flos-aquae	3.380	14.06
Fragilaria crotonensis	0.916	3.81
Pandorina morum	0.222	0.93
Phacus sp.	0.139	0.58
Microcystis incerta	0.100	0.42
Euglena sp.	0.082	0.34
Pennate diatoms	0.007	0.03
Unknown spherical chlorophyta	0.006	0.03

SCOUT LAKE DATE 09/06/94

Species	Cell Volume (mm3/liter)	% Density by volume
Crucigenia sp.	0.022	0.68
Gloeocystis sp.	1.000	30.71
Merismopedia glauca	1.526	46.84
Mougeotia sp.	0.556	17.06
Oocystis sp.	0.067	2.05
Pennate diatoms	0.076	2.32
Unknown spherical chlorophyta	0.011	0.34

SETTLEMENT CANYON RESERVOIR DATE 08/02/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	2.571	34.34
Asterionella formosa	0.083	1.11
Centric diatoms	0.058	0.78
Crucigenia quadrata	2.563	34.24
Dinobryon divergens	1.419	18.95
Oocystis sp.	0.125	1.67
Pennate diatoms	0.031	0.42
Sphaerocystis schroeteri	0.612	8.17
Tetraedron sp.	0.007	0.09
Unknown spherical chlorophyta	0.017	0.23

SEVIER BRIDGE (YUBA) RESERVOIR DATE 08/18/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.004	0.06
Asterionella formosa	0.083	1.10
Centric diatoms	0.012	0.15
Ceratium hirundinella	6.616	87.09
Closteriopsis longissima var. tropica	0.025	0.32
Gloeocystis vesiculosa	0.011	0.15
Gomphosphaeria lacustris	0.007	0.09
Microcystis incerta	0.056	0.73
Oocystis sp.	0.075	0.99
Pennate diatoms	0.080	1.05
Sphaerocystis schroeteri	0.612	8.05
Unknown spherical chlorophyta	0.017	0.22

SHEEP CREEK LAKE DATE 09/15/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.004	0.11
Centric diatoms	0.047	1.12
Pediastrum duplex	2.669	64.24
Pennate diatoms	0.054	1.28
Scenedesmus bijuga	0.011	0.27
Sphaerocystis schroeteri	1.223	29.44
Tetraedron minimum	0.042	1.02
Tetraedron sp.	0.007	0.16
Trachellomonas sp.	0.089	2.14
Unknown flagellate	0.003	0.08
Unknown shperical chlorophyta	0.006	0.14

SHEEP CREEK LAKE DATE 09/19/95

Species	Cell Volume (mm3/liter)	% Density by volume
Sphaerocystis schroeteri	2.641	40.14
Botryococcus species	2.224	33.80
Pediastrum duplex	1.334	20.28
Trachellomonas species	0.222	3.38
Scenedesmus quadricauda	0.050	0.76
Unknown sperical chlorophyta	0.050	0.76
Microcystis incerta	0.033	0.51
Centric diatoms	0.010	0.15
Centric diatoms	0.010	0.15
Chlamydomonas species	0.007	0.01
Akistrodesmus falcatus	0.004	0.07
Pennate diatoms	0.004	0.06

SMITH AND MOREHOUSE RESERVOIR DATE 08/26/93

Species	Cell Volume (mm3/liter)	% Density by volume

Scenedesmus bijuga	0.033	0.78
Staurastrum gracile	0.361	8.48
Staurastrum sp.	2.836	66.54
Tetraedron minimum	0.021	0.52

WILLARD BAY RESERVOIR DATE 08/03/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena sp.	12.232	55.88
Ankistrodesmus falcatus	0.052	0.24
Centric diatoms	2.538	11.59
Dinobryon sp.	0.073	0.34
Euglena sp.	0.041	0.19
Oocystis sp.	0.025	0.11
Oscillatoria sp.	0.012	0.06
Pennate diatoms	0.156	0.71
Phacus sp.	0.028	0.13
Scenedesmus bijuga	0.011	0.05
Scenedesmus quadricauda	0.150	0.69
Staurastrum sp.	0.334	1.52
Stephanodiscus niagarae	0.356	1.63
Tetraedron minimum	0.021	0.10
Trachelomonas sp.	5.693	26.01
Wislouchiella planktonica	0.169	0.75

WITTS LAKE DATE 09/04/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.004	0.01
Aphanizomenon flos-aquate	73.948	98.58
Centric diatoms	0.016	0.02
Melosira granulata	0.164	0.22
Oscillatoria sp.	0.006	0.01
Pennate diatoms	0.009	0.01
Sphaerocystis schroeteri	0.612	0.82
Unknown spherical chrysophyta	0.002	0.00
Wislouchiella planktonica	0.256	0.34

WOODRUFF CREEK RESERVOIR DATE 08/25/93

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.014	0.39
Centric diatoms	0.008	0.22
Ceratium hirundinella	0.945	26.68
Melosira granulata var. angustissima	0.026	0.72
Oocystis sp.	0.008	0.24
Pennate diatoms	0.027	0.75
Sphaerocystis schroeteri	2.446	69.05
Wislouchiella planktonica	0.069	1.95

WOODRUFF CREEK RESERVOIR DATE 09/07/95

Species	Cell Volume (mm3/liter)	% Density by volume
Sphaerocystis schroeteri	396.150	72.30
Dinobryon divergens	7.608	13.89
Phacus species	7.367	13.44
Asterionella formosa	0.076	0.01
Oocystis species	0.067	0.12
Chlamydomonas species	0.053	0.10
Pennate diatoms	0.007	0.01

YANKEE MEADOWS RESERVOIR DATE 08/16/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.096	0.04
Ankyra judayi	0.006	0.00
Asterionella formosa	0.014	0.01
Centric diatoms	0.016	0.01
Fragilaria crotonensis	12.343	5.22
Gloeotrichia echinulata	222.400	94.14
Melosira granulata	0.109	0.05
Pennate diatoms	0.071	0.03
Stephanodiscus niagarae	1.069	0.45
Trachelomonas sp.	0.089	0.04
Wislouchiella planktonica	0.033	0.01

TIBBLE FORK RESERVOIR DATE 08/09/95

Species	Cell Volume (mm3/liter)	% Density by volume
Pennate diatoms	0.027	89.09
Centric diatoms	0.003	10.91

TONY GROVE LAKE DATE 08/25/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ceratium hirundinella	9.452	65.97
Dinobryon divergens	0.073	0.51
Melosira granulata var. angustissima	0.051	0.36
Oocystis sp.	0.042	0.29
Pennate diatoms	0.018	0.12
Quadrigula lacustris	3.336	23.28
Sphaerocystis schroeteri	1.223	8.54
Trachellomonas sp.	0.133	0.93

TONY GROVE LAKE DATE 08/08/95

Species	Cell Volume (mm3/liter)	% Density by volume
Quadrigula lacustris	1.112	55.68
Phymatodocis sp.	0.556	27.84
Pennate diatoms	0.085	4.29
Gomphosphaeria lacustris	0.055	2.78
Unknown spherical chlorophyta	0.050	2.51
Trachellomonas sp.	0.044	2.23
Oocystis sp.	0.041	2.09
Dinobryon divergens	0.036	1.84
Ankistrodesmus falcatus	0.008	0.44
Oscillatoria sp.	0.006	0.31

TRIAL LAKE DATE 09/06/94

Species	Cell Volume (mm3/liter)	% Density by volume
Quadrigula lacustris	2.224	39.82
Gloeocystis sp.	1.168	20.90
Coelastrum sp.	1.112	19.91
Peridinium sp.	0.723	12.94
Merismopedia glauca	0.250	4.48
Dinobryon divergens	0.037	0.66
Ankistrodesmus falcatus	0.031	0.55
Pennate diatoms	0.027	0.48
Scenedesmus bijuga	0.011	0.20
Centric diatoms	0.004	0.07

TROPIC RESERVOIR DATE 08/31/93

Species	Cell Volume (mm3/liter)	% Density by volume
Dinobryon divergens	0.037	5.34
Mougeotia sp.	0.006	0.81
Oscillatoria amphibia	0.003	0.40
Pennate diatoms	0.031	4.53
Sphaerocystis schroeteri	0.612	88.92

TROPIC RESERVOIR DATE 09/13/95

Species	Cell Volume (mm3/liter)	% Density by volume
Ceratium hirundinella	1.890	74.86
Mougeotia species	0.556	22.02
Oocystis species	0.007	2.64
Pennate diatoms	0.008	0.31
Ankistrodesmus falcatus	0.004	0.17

UPPER ENTERPRISE RESERVOIR DATE 08/09/95

Species	Cell Volume (mm3/liter)	% Density by volume
Botryococcus braunii	2.224	47.02
Ceratium hirundinella	0.945	19.98
Microcystis incerta	0.723	15.28
Pediastrum duplex	0.667	14.10
Oocystis species	0.100	2.12
Pennate diatoms	0.311	0.66
Var angustissima	0.026	0.54
Ankistrodesmus falcatus	0.009	0.18
Unknown spherical chlorophyta	0.003	0.07
Chlamydomonas species	0.022	0.05

UPPER STILLWATER RESERVOIR DATE 09/06/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.004	0.25
Centric diatoms	0.008	0.45
Chlamydomonas sp.	0.004	0.26
Quadrigula lacustris	1.112	63.90
Sphaerocystis schroeteri	0.612	35.15

UPPER STILLWATER RESERVOIR DATE 09/21/95

Species	Cell Volume (mm3/liter)	% Density by volume
Pennate diatoms	0.019	81.68
Ankistrodesmus falcatus	0.004	18.32

UTAH LAKE DATE 09/27/95

Species	Cell Volume (mm3/liter)	% Density by volume
Aphanaizomenon flos-aquae	0.074	83.84
Var crassa	11.564	13.15
Anabaena flos-aquae	1.690	1.92
Microcystis incerta	0.911	1.04
Scenesesmus bijuga	0.022	0.03
Ankistrodesmus falcatus	0.017	0.02
Unknown spherical chlorophyta	0.006	0.01
Centric diatoms	0.003	0.00
Chlamydomonas species	0.002	0.00

WALL LAKE DATE 09/07/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.009	2.17
Chroococcus sp.	0.011	2.76
Dinobryon bavaricum	0.025	6.07
Dinobryon divergens	0.061	15.18
Microcystis incerta	0.167	41.40
Oocystis sp.	0.009	2.07
Pennate diatoms	0.044	11.04
Unknown spherical chlorophyta	0.011	2.76
Unknown spherical chrysophyta	0.067	16.55

WASHINGTON LAKE DATE 09/06/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus flacatus	0.004	0.14
Ankyra judayi	0.003	0.09
Centric diatoms	0.020	0.63
Coelastrum sp.	0.556	17.97
Dinobryon divergens	0.049	1.58
Merismopedia glauca	0.025	0.81
Oocystis sp.	0.008	0.27
Pennate diatoms	0.022	0.72
Quadrigula lacustris	2.224	71.87
Scenedesmus bijuga	0.011	0.36
Staurastrum sp.	0.167	5.39
Unknown spherical chlorophyta	0.006	0.17

WHITNEY RESERVOIR DATE 09/15/93

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.042	0.06
Ceratium hirundinella	3.781	5.66
Chroococcus sp.	0.006	0.01
Dinobryon divergens	0.208	0.31
Fragilaria crotonensis	1.334	2.00
Oocystis sp.	0.150	0.22
Pennate diatoms	0.125	0.19
Sphaerocystis schroeteri	61.160	91.55

WHITNEY RESERVOIR DATE 09/28/95

Species	Cell Volume (mm3/liter)	% Density by volume
Fragilaria acrotonensis	1.145	80.92
Dinobryon divergens	0.122	8.64
Pennate diatoms	0.078	5.50
Centric diatoms	0.040	2.83
Asterionella formosa	0.009	0.67
Ankistrodesmus falcatus	0.009	0.62
Oocystis species	0.008	0.59
Unknown spherical chrysophyta	0.003	0.24

WIDE HOLLOW RESERVOIR DATE 08/24/94

Species	Cell Volume (mm3/liter)	% Density by volume
Closterium sp.	0.056	1.30
Cosmarium sp.	0.389	9.13
Euglena sp.	0.082	1.93
Oocystis sp.	0.050	1.17
Pennate diatoms	0.071	1.67
Peridinium sp.	0.361	8.48

Scenedesmus bijuga	0.033	0.78
Staurastrum gracile	0.361	8.48
Staurastrum sp.	2.836	66.54
Tetraedron minimum	0.021	0.52

WILLARD BAY RESERVOIR DATE 08/03/94

Species	Cell Volume (mm3/liter)	% Density by volume
Anabaena sp.	12.232	55.88
Ankistrodesmus falcatus	0.052	0.24
Centric diatoms	2.538	11.59
Dinobryon sp.	0.073	0.34
Euglena sp.	0.041	0.19
Oocystis sp.	0.025	0.11
Oscillatoria sp.	0.012	0.06
Pennate diatoms	0.156	0.71
Phacus sp.	0.028	0.13
Scenedesmus bijuga	0.011	0.05
Scenedesmus quadricauda	0.150	0.69
Staurastrum sp.	0.334	1.52
Stephanodiscus niagarae	0.356	1.63
Tetraedron minimum	0.021	0.10
Trachelomonas sp.	5.693	26.01
Wislouchiella planktonica	0.169	0.75

WITTS LAKE DATE 09/04/93

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.004	0.01
Aphanizomenon flos-aquate	73.948	98.58
Centric diatoms	0.016	0.02
Melosira granulata	0.164	0.22
Oscillatoria sp.	0.006	0.01
Pennate diatoms	0.009	0.01
Sphaerocystis schroeteri	0.612	0.82
Unknown spherical chrysophyta	0.002	0.00
Wislouchiella planktonica	0.256	0.34

WOODRUFF CREEK RESERVOIR DATE 08/25/93

Species	Cell Volume (mm3/liter)	% Density by volume
Asterionella formosa	0.014	0.39
Centric diatoms	0.008	0.22
Ceratium hirundinella	0.945	26.68
Melosira granulata var. angustissima	0.026	0.72
Oocystis sp.	0.008	0.24
Pennate diatoms	0.027	0.75
Sphaerocystis schroeteri	2.446	69.05
Wislouchiella planktonica	0.069	1.95

WOODRUFF CREEK RESERVOIR DATE 09/07/95

Species	Cell Volume (mm3/liter)	% Density by volume
Sphaerocystis schroeteri	396.150	72.30
Dinobryon divergens	7.608	13.89
Phacus species	7.367	13.44
Asterionella formosa	0.076	0.01
Oocystis species	0.067	0.12
Chlamydomonas species	0.053	0.10
Pennate diatoms	0.007	0.01

YANKEE MEADOWS RESERVOIR DATE 08/16/94

Species	Cell Volume (mm3/liter)	% Density by volume
Ankistrodesmus falcatus	0.096	0.04
Ankyra judayi	0.006	0.00
Asterionella formosa	0.014	0.01
Centric diatoms	0.016	0.01
Fragilaria crotonensis	12.343	5.22
Gloeotrichia echinulata	222.400	94.14
Melosira granulata	0.109	0.05
Pennate diatoms	0.071	0.03
Stephanodiscus niagarae	1.068	0.45
Trachelomonas sp.	0.089	0.04
Wislouchiella planktonica	0.033	0.01