Uinta River, Deep Creek and Dry Gulch Creek TMDLs for Total Dissolved Solids

Uinta River Watershed, Utah

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Total Maximum Daily Loads for Total Dissolved Solids in the Uinta River, Deep Creek and Dry Gulch Creek, Duchesne and Uintah Counties, Utah

TMDLs AT A GLANCE:

Water Quality-limited?	Yes
High Priority Watershed?	Yes
Hydrologic Unit Code:	14060003
Standard of Concern:	Total dissolved solids
Designated Use Affected:	Class 4, protection for agricultural uses, irrigation of crops, stock watering
Water Quality Standards:	TDS water quality criterion of 1,200 mg/L (instantaneous maximum). Total dissolved solids (TDS) limits may be adjusted if such adjustment does not impair the designated beneficial use of the receiving water.
TMDL Targets:	Water quality target of 1,140 mg/L TDS load reductions of 15,500 tons/yr at mouth of Uinta River and 18,200 tons/yr at mouth of Dry Gulch Creek
Major Source(s):	Surface runoff, seepage and deep percolation from natural precipitation, canal systems and irrigation water that dissolve salts from local soils and subsurface shales and convey the salts through surface flow or groundwater to receiving streams

Uinta River and Deep Creek:

Current Load:	92,500 tons/yr at the mouth of Uinta River
Loading Capacity:	77,000 tons/yr at the mouth of Uinta River
Wasteload Allocation:	No point sources; wasteload allocation set to zero
Load Allocation:	73,100 tons/yr at the mouth of Uinta River
Margin of Safety (MOS):	Explicit MOS of 5 percent (3900 tons/yr); implicit MOS through conservative assumptions
Load Reduction:	15,500 tons/yr (21%)

Dry Gulch Creek:

Current Load:	59,000 tons/yr at the mouth of Dry Gulch Creek
Loading Capacity:	40,800 tons/yr at the mouth of Dry Gulch Creek
Wasteload Allocation:	No point sources; wasteload allocation set to zero
Load Allocation:	38,800 tons/yr at the mouth of Dry Gulch Creek
Margin of Safety (MOS):	Explicit MOS of 5 percent (2000 tons/yr); implicit MOS through conservative assumptions
Load Reduction:	18,200 tons/yr (34%)

Executive Summary

This report documents the development of three Total Maximum Daily Loads (TMDLs) for total dissolved solids (TDS)—one for the Uinta River, one for Deep Creek, and one for Dry Gulch Creek, all in Utah. These watersheds are located in northeastern Utah with much of their area located on the Uintah and Ouray Indian Reservation. This TMDL was developed for the U.S. Environmental Protection Agency Region 8 by the State of Utah in cooperation with the Ute Indian Tribe and other local stewards in the watershed.

Section 303(d) of the Clean Water Act and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) requires that Total Maximum Daily Loads (TMDLs) be developed for waterbodies that are not meeting water quality standards even after technology-based controls are in place. The TMDL process establishes allowable loadings of pollutants or other quantifiable parameters for a waterbody based on the relationship between pollutant sources and in-stream water quality conditions. It is important to recognize that data collection in support of this TMDL is an ongoing effort and that as new data is collected this TMDL may be revised accordingly.

The Uinta River, Deep Creek and Dry Gulch Creek are included on the state of Utah's 2000 303(d) list as a high priority for TMDL development due to impairments associated with high concentrations of total dissolved solids (TDS). The subsurface bedrock formations in the lower basin are saline and soluble, dissolving easily and contributing TDS to any water that comes into contact with them. The Mancos shale formation in particular is extremely high in salts. Natural background sources of TDS in the watershed include high concentrations of salts that accumulate on the land surface in areas of saline soils or areas of poor drainage where groundwater rises to the surface and evaporates leaving the soluble salts on the surface. This salt efflorescence is then available for washoff and delivery to watershed streams. Natural precipitation that falls in excess of plant uptake potential and soil holding capacity may also percolate into the groundwater where it comes into contact with saline bedrock formations and picks up TDS. The primary source of human-induced TDS loading in the watershed has been attributed to seepage from canals and deep percolation of irrigation water that dissolve salts from soils and subsurface shales and convey the salts through the groundwater which then discharges to surface streams as baseflow. Surface irrigation return flows exist but have been significantly reduced due to the efforts of the Salinity Control Project.

An evaluation of TDS and flow data indicated water quality standards violations at a full range of flows and throughout the year for the Uinta River and Dry Gulch Creek. Flows associated with TDS sampling were used to evaluate the flow regime and to establish representative flow percentiles. The flow percentiles and existing water quality data were used to establish average existing annual TDS loading in the watersheds and to calculate the annual loading capacity for each waterbody. Deep Creek is also listed on the 303d list as impaired for its agricultural beneficial use due to TDS. Since Deep Creek is tributary to the Uinta River and because of the complex and interconnected hydrology of their watersheds it is incorporated into the loading calculations of the Uinta River.

The existing TDS loading in the Uinta River watershed is estimated at 92,500 tons/yr. Using the instantaneous water quality criterion of 1,200 mg/L, the loading capacity is calculated at 77,000 tons/yr. An explicit margin of safety of 5 percent (3,900 tons/yr) was included, corresponding to a resulting TDS concentration of 1,140 mg/L. The remainder of the loading capacity is 73,100 tons/yr. This load is attributed to nonpoint and background sources in the watershed and represents a 21 percent reduction in existing loadings. Therefore the load reduction is set at 15,500 tons/year. Because there are no existing point sources in the watershed, the wasteload allocation is 0 lb/yr.

The existing TDS loading in the Dry Gulch Creek watershed is estimated at 59,000 tons/yr. Using the water quality criterion of 1,200 mg/L, the loading capacity is calculated at 40,800 tons/yr. An explicit margin of safety of 5 percent (2,000 tons/yr) was included, corresponding to a resulting TDS concentration of 1,140 mg/L. The remainder of the loading capacity is 38,800 tons/yr. This load is attributable to nonpoint and background sources in the watershed and represents a 34 percent reduction in existing loadings. Therefore the load reduction is set at 18,200 tons/year. Because there are no existing point sources in the watershed, the wasteload allocation is 0 lb/yr.

It is important to recognize that since all load reductions focus on natural background and nonpoint sources, implementation of best management practices is purely voluntary with no mandatory time-frames instituted. The local committee reviewing this TMDL has expressed concern regarding the feasibility of achieving the 1,200 mg/L standard but is willing to support the implementation of best management practices along with additional monitoring to evaluate progress towards meeting water quality goals. Best management practices will preserve current water rights and needs while optimizing use and minimizing deep percolation of irrigation water. If irrigation water is applied in excess of plant requirements that excess proportion will percolate below the rooting zone of the crop where it picks up TDS and returns to the watershed streams either as surface runoff or groundwater baseflow with elevated TDS concentrations. Because TDS is also washed off watershed surfaces and delivered to receiving streams, potential control options should address surface delivery as well as subsurface delivery of TDS. The key to effectively reducing the man-induced TDS loads delivered to Uinta River and Dry Gulch Creek while maintaining current water rights and use is to improve the efficiency of water use and transport to minimize surface runoff, seepage and deep percolation.

These TMDLs are based on a representative flow regime determined using historical flow records. The allocated loadings and associated load reductions are calculated to meet water quality standards assuming the flow conditions remain similar to those established in the TMDL. However, with the implementation of proposed control options it has been theorized that decreasing TDS loads may actually raise instream TDS concentrations. This could be the result of less dilution water from surface return flows or more concentrated TDS in the groundwater. To address this possibility that implementation may lead to increased instream TDS concentrations and non-attainment of water quality standards this TMDL will utilize an approach that provides for the implementation of load reduction strategies while continuing to collect additional data. If when the load reductions identified in this TMDL are attained or a reasonable effort towards implementation has occurred, and if water quality standards are still violated, site specific water quality standards will be developed based upon the additional data collected. Regardless of the short-term effect on instream flows and concentrations, control efforts will improve irrigation efficiencies and water quality will ultimately benefit.

The reasonable assurance that these implementation activities will occur and attempt to meet load reduction goals is that implementation is currently ongoing under the Salinity Control Program. In fact, approximately 4,400 acres of cropland adjacent to Dry Gulch Creek have already been treated with improved irrigation systems and several projects have been recently funded such as the TN Dodd, K2, and Class C projects. There is a great deal of local interest among watershed stakeholders to participate in the program. Limitations to implementation include the availability of cost-share funding and lack of upstream storage on the Uinta and Whiterocks Rivers that would facilitate the conversion from flood to sprinkler irrigation. It is anticipated that with the establishment of this TMDL for the Uinta River, Deep Creek and Dry Gulch Creek watersheds additional funding will be made available with EPA 319 funding and the priority for funding from other sources provided to watersheds with established TMDLs.

1. Introduction

1.1 Background

Section 303(d) of the Clean Water Act and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) requires that Total Maximum Daily Loads (TMDLs) be developed for waterbodies that are not meeting water quality standards even after technology-based controls are in place. The TMDL process establishes allowable loadings of pollutants or other quantifiable parameters for a waterbody based on the relationship between pollutant sources and in-stream water quality conditions. By following the TMDL process, states can establish water quality-based controls to reduce pollution from both point and nonpoint sources and restore and maintain the quality of their water resources (USEPA, 1991).

Utah's Department of Environmental Quality (DEQ) has assessed the lower 12 miles of the Uinta River (from mouth of the river to the Highway 40 crossing above Fort Duchesne) and its tributaries and has determined that this segment is not supporting its agricultural classifications due to violations of the water quality criterion for total dissolved solids (TDS). TDS was found to exceed Utah's state standards in 8 of the 19 samples collected (UDEQ, 1997). The Uinta River above this point was found to be fully supporting its agricultural beneficial use.

DEQ also assessed Dry Gulch Creek and its tributaries as not supporting their agricultural classification due to high levels of TDS that exceed state standards for agricultural usage in almost 50 percent of the samples (UDEQ, 1997). Irrigation return flows and grazing both impact the streams in this watershed; however, significant natural contributions of TDS to the stream also exist.

Deep Creek (a tributary of the Uinta River) was also assessed as partially supporting its agricultural classification due to high levels of TDS based upon two samples collected during the 1995-1996 intensive monitoring survey. Although Deep Creek is higher in the watershed than the listed segments of the Uinta River and Dry Gulch Creek it flows through an outcrop of Mancos shale which is a natural source of TDS into the creek. Water quality upstream of this outcrop is expected to be good which will be validated with additional monitoring and incorporated into future water quality assessments.

This report presents the background and technical analyses used to develop a TMDL for TDS for the Uinta River, Deep Creek and Dry Gulch Creek. Chapter 1 describes the problem statement, the river segments studied, their location, and the associated impairments. Chapter 2 outlines the relevant water quality standards and TMDL endpoints used. Chapter 3 presents the impairment analysis, including the water quality data sources, the data used, and evaluation of critical conditions. Chapter 4 is the source assessment, which lists the point sources and nonpoint sources in the basin. Chapter 5 describes the methods used to estimate the TDS loading capacity and existing TDS loadings. Chapter 6, the TMDL allocation, describes what a TMDL is, the conditions used in the model, and the resulting allocations required to meet the TMDL endpoints.

1.2 Watershed Characterization

The Uinta River and Dry Gulch Creek watersheds are located in northeastern Utah approximately 140 miles east of Salt Lake City in Uinta and Duchesne counties (Figure 1-1). The Uinta River is approximately 60 miles long and drains the southern slope of King's Peak, Utah's highest point, until it converges with the Duchesne River, a tributary of the Green River. The Uinta River has a large network of tributary streams and mountain lakes that make the river the largest on the southern slope of King's Peak. Deep Creek is a tributary of the Uinta River and drains the area northeast of the Uinta River. Dry Gulch Creek is a tributary of the Uinta River and drains the area west of the Uinta River. After spring runoff, Dry Gulch Creek is typically dry in its upper reaches but receives inflows from Lake Fork River and irrigation return flows throughout its lower reaches. The remainder of this section provides background information on the physical location and environment of the Uinta River and Dry Gulch Creek watersheds.

1.2.1 Land Use

Based on 1985 land use data from USGS's Geographic Information Retrieval Analysis System (GIRAS), the Uinta River watershed is composed primarily of rangeland and agricultural lands in the lower watershed with forest land dominating the upper watershed. The Dry Gulch Creek watershed is also dominated by rangeland, agricultural and forest lands. The 25 GIRAS land uses existing in the watersheds were grouped into 8 general land use categories. Land use distribution in the watersheds based on the general categories is listed in Table 1-1 and shown in Figure 1-3. Appendix A presents the GIRAS land use classes included in each of the eight analysis groupings and the land use distributions based on the original 25 GIRAS land use categories (Table A-1).

Table 1-1. Land use distribution in the Uinta River and Dry Gulch Creek watersheds

	Uinta River watershed			Dry Gulch Creek watershed		
Land use	**Area (acres)**	**Area (square miles)**	**% of total area**	**Area (acres)**	**Area (square miles)**	**% of total area**
Residential/Urban	3,116	4.9	<1%	1,821	2.8	<1%
Agriculture	124,063	193.8	18%	88,663	138.5	29%
Rangeland	231,305	361.4	34%	136,288	212.9	45%
Forest	264,196	412.8	38%	74,923	117.1	25%
Water	2,325	3.6	<1%	356	0.6	<1%
Wetland	5,051	7.9	<1%	74	0.1	<1%
Barren	413	0.6	<1%	42	0.1	<1%
Tundra	58,466	91.4	8%	2,144	3.4	<1%
TOTAL	688,934	1,076.5	100%	304,312	475.5	100%

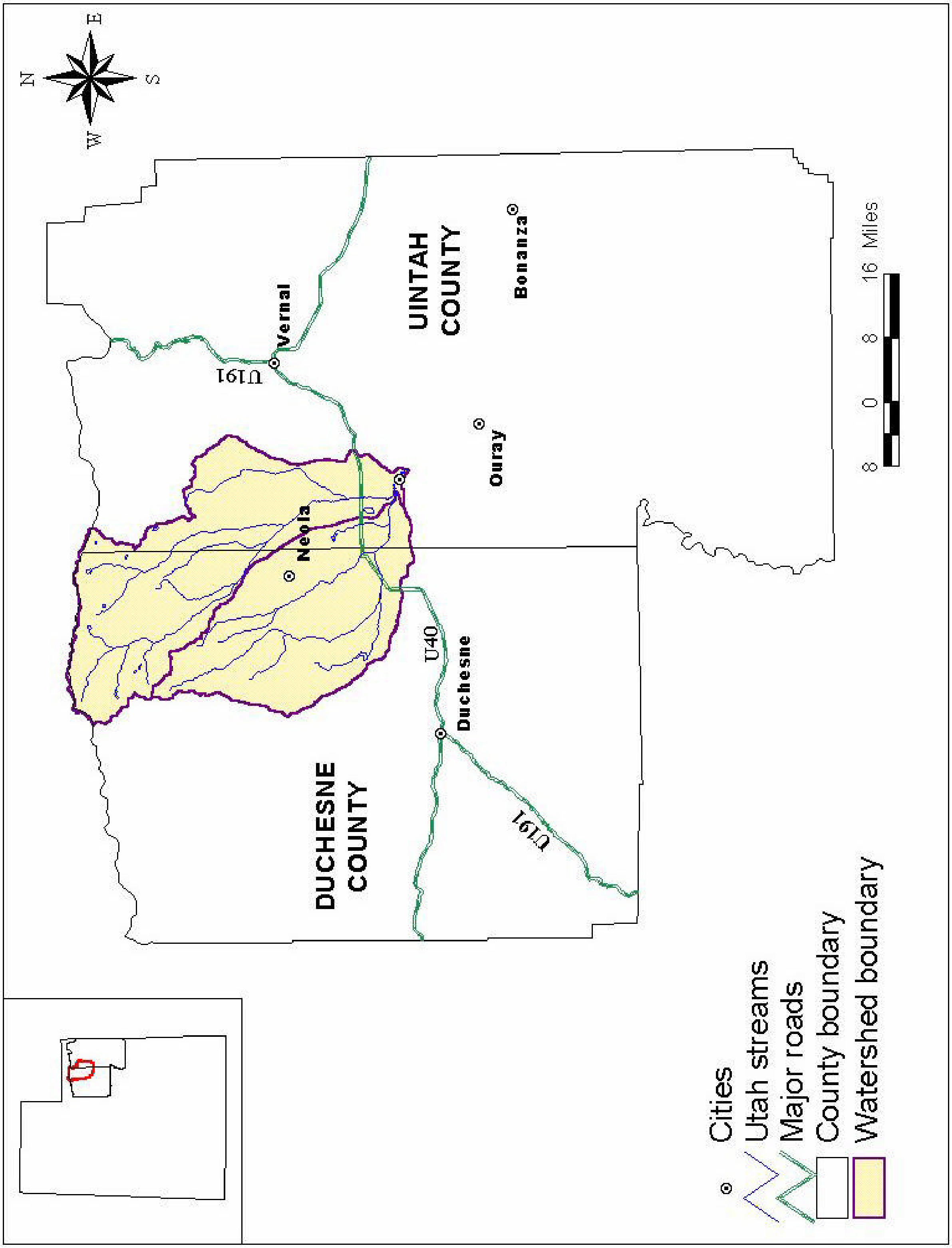

Figure 1-1. Location of Uinta River, Deep Creek and Dry Gulch Creek watershed

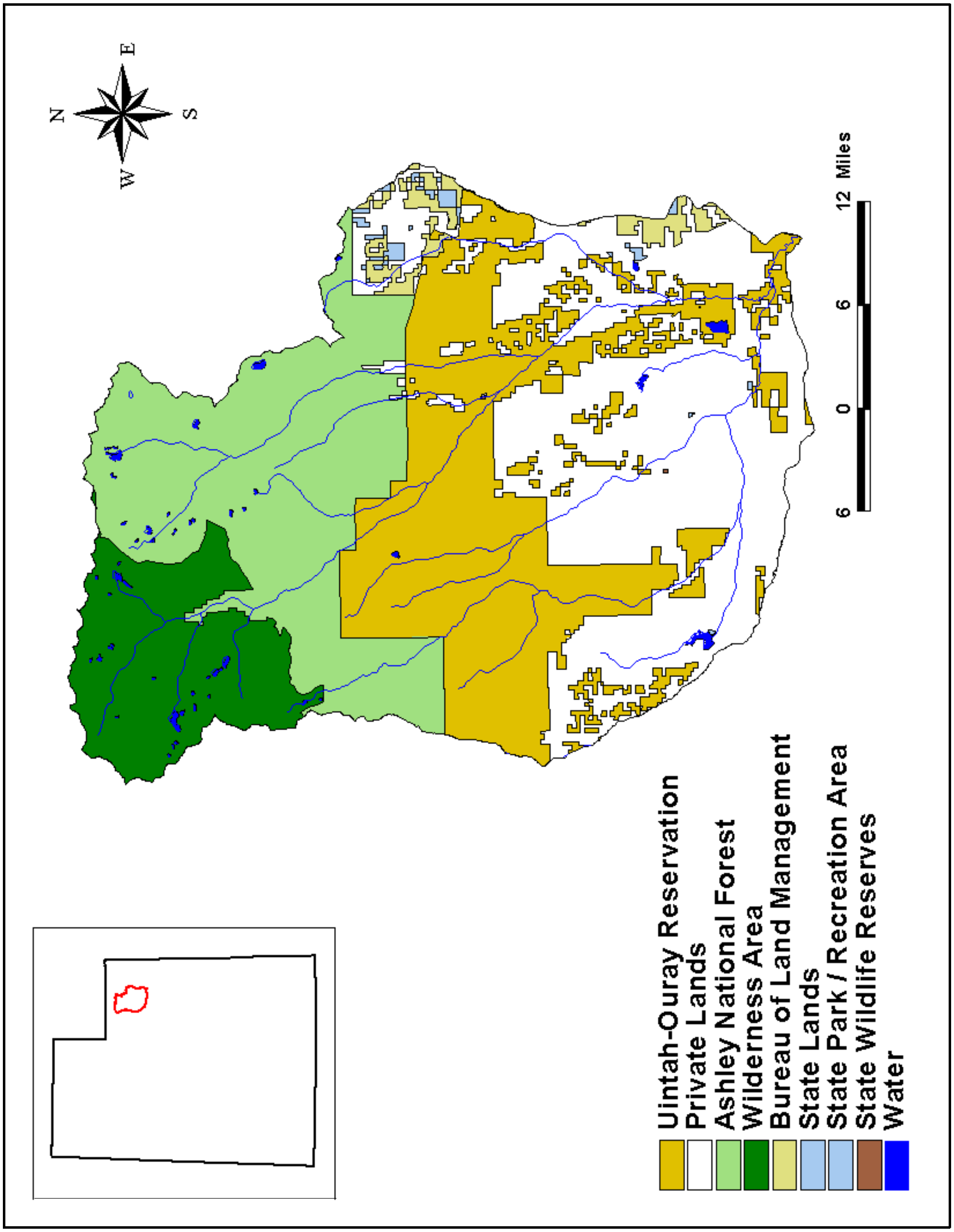

Figure 1-2. Administrative Ownership of Uinta River and Dry Gulch Creek Watershed

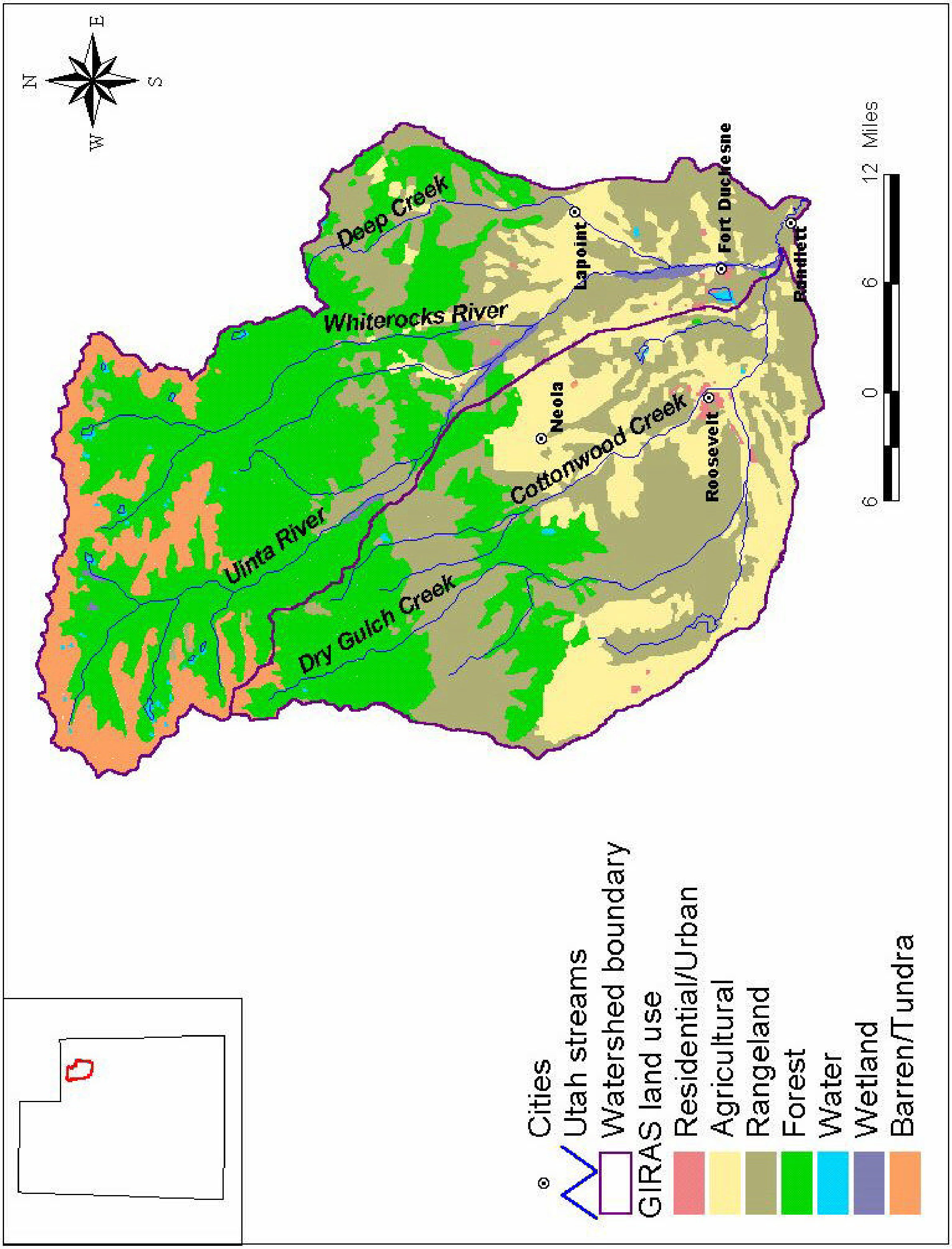

Figure 1-3. Land use distribution in the Uinta River, Deep Creek and Dry Gulch Creek watershed

1.2.2 Geology and Soils

The headwaters of the Uinta River are located in largely undifferentiated glaciated ground and moraines. The soil material located on the low terraces and floodplain of the Uinta River is reworked alluvium that originates on the higher benches, mesas, and fans sloping south from the Uinta Mountains (Mundorff, 1977; USBRc, 1986). The material on these benches and mesas is calcium soil with a zone of lime accumulation above cobble; in some areas there is a distinct creviced lime hardpan. These soils are usually slowly permeable, salic, and sodic where natural drainage is restricted and high water tables have developed (USBRc, 1986).

Upper Dry Gulch Creek begins in mostly glacial outwash, but flows mostly through the Duchesne River Formation (Mundorf, 1977). The Duchesne River formation consists of interbedded red, brown, and vari-colored clay-shales; gray to buff red weathering sandstones; and some conglomerates of fluvial origin derived chiefly from the Uinta Mountains. It is typically not a saline formation and is therefore a low salt producer (Mundorff, 1977; USBRc, 1986). However, the lower reaches of Dry Gulch Creek flow through the Uinta formation that underlies the Duchesne River formation. The Uinta formation is composed mainly of gray or green, saline and gypsiferous clays, shales, sandstones, and marlstone. This formation is the predominant salt producer in the Uintah Basin.

1.2.3 Elevation

The Uinta River/Dry Gulch Creek watershed is located in the Duchesne River Basin, which has an average elevation of 5,520 feet.

1.2.4 Climate

Most of the Uinta Basin Unit is semiarid. Daily temperature extremes can vary as much as 40 degrees. Annual extreme temperatures range from -30 to 105 degrees Fahrenheit (USDA-SCS, 1987; USBRc, 1986). Table 1-2 presents a summary of temperature data for Neola from 1956 through 2000, as reported by the Western Regional Climate Center.

Slightly more precipitation falls in the valleys from April through September; slightly more precipitation falls in the mountains from October through March. Winter precipitation, which falls mostly as snow, is from moist Pacific air associated with frontal systems moving eastward across the basin. Summer precipitation, which results mainly from thunderstorm activity, is associated with the northerly flow of warm, moist air originating in the Gulf of Mexico. These summer thunderstorms are of high intensity, but limited in area. They sometimes cause flash flooding and erosion damage. Rainfall data for Neola from 1956 through 2000 is available from the Western Regional Climate Center and is summarized in Table 1-2 and Figure 1-3. Table 1-2 presents the minimum, mean, and maximum monthly rainfall, and Figure 1-3 presents the monthly average total precipitation.

Table 1-2. Neola temperature and rainfall statistics

Month	Minimum (EF)	Mean (EF)	Maximum (EF)	Minimum (inch/month)	Mean (inch/month)	Maximum (inch/month)
Jan	7.9	19.5	31.0	0.00	0.58	2.16
Feb	12.9	25.3	37.6	0.00	0.52	1.38
Mar	22.9	35.7	48.4	0.00	0.60	2.00
Apr	30.5	44.7	59.0	0.00	0.74	2.64
May	39.6	54.0	68.4	0.00	1.11	3.92
Jun	47.5	62.8	77.9	0.00	0.80	2.88
Jul	53.8	69.1	84.3	0.00	0.59	1.43
Aug	52.4	67.3	82.2	0.02	0.84	2.68
Sep	43.6	58.5	73.4	0.00	0.96	2.63
Oct	32.6	46.8	61.0	0.00	1.04	3.82
Nov	20.8	32.5	44.3	0.00	0.62	2.76
Dec	10.7	21.9	33.2	0.00	0.47	1.61
Annual	31.3	44.8	58.4	4.24	8.86	15.44
Winter	10.5	22.2	33.9	0.09	1.57	3.92
Spring	31.0	44.8	58.6	0.44	2.45	5.45
Summer	51.2	66.4	81.5	0.51	2.22	5.33
Fall	32.4	45.9	59.6	0.36	2.62	5.24

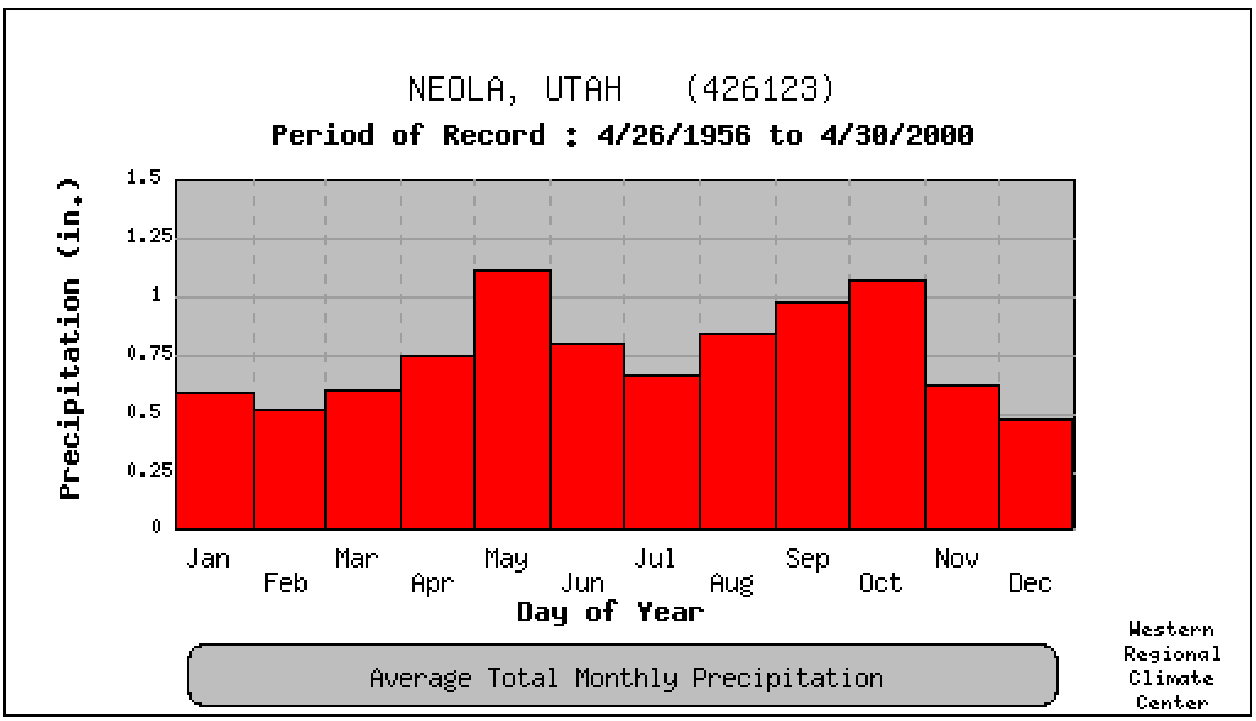

Figure 1-4. Average monthly precipitation at Neola, 1956-2000 (source: Western Regional Climate Center, 2000)

2. Water Quality Criteria and TMDL Endpoint Selection

Because the purpose of the TMDL is to attain and maintain water quality standards, one of the primary components of a TMDL is the establishment of in-stream numeric endpoints to evaluate the attainment of acceptable water quality. In-stream numeric endpoints, therefore, represent the water quality goals to be achieved by implementing the load reductions specified in the TMDL. The endpoints allow for a comparison between observed in-stream conditions and conditions that are expected to restore designated uses. The endpoints are usually based on numeric or narrative criteria from state water quality standards. If applicable numeric water quality standards are available, they can serve as a TMDL endpoint. If only narrative criteria are available, a numeric target needs to be developed to represent conditions resulting in the attainment of designated uses.

2.1 Water Quality Standards

The Uinta River, Deep Creek and Dry Gulch Creek are located in part on the Uintah and Ouray Indian Reservation. There are no tribal standards in place for the waters on the reservation. Because there are no established water quality standards for the Uinta River, Deep Creek and Dry Gulch Creek, the Utah water quality standards were used as the basis for establishing water quality targets and evaluating water quality. This section discusses the relevant Utah water quality standards.

The Uinta River, Deep Creek and Dry Gulch Creek are part of the Colorado River Basin, which provides irrigation water for nearly 4 million acres of land (USBRc, 2000) and municipal and industrial water to more than 23 million people in seven states (Wyoming, Colorado, Utah, Arizona, New Mexico, Nevada, and California). The quality of the water in this basin, particularly the concentration of salinity, is therefore of great concern because of the potentially widespread adverse impact poor water quality would have on water use.

Because of this concern, the Colorado River Basin states established the Colorado River Basin Salinity Control Forum in 1973 to organize interstate cooperation and provide the information needed to comply with Section 303(a) and (b) of the Clean Water Act. Sections 303(a) and (b) of the Clean Water Act sets the requirements for development of water quality standards for interstate and intrastate waters by States and for submission of those standards to EPA for approval. In 1975 the Forum submitted to EPA the report *Water Quality Standards for Salinity Including Numeric Criteria and Plan of Implementation for Salinity Control-Colorado River System*. The numeric criteria and implementation plan contained in the report are reviewed and updated every 3 years to ensure continued compliance with the standards.

The standards themselves require development of a plan to maintain the flow-weighted average annual salinity at or below 1972 levels while the basin states develop their compact-apportioned water supply. The Forum selected below Hoover Dam, below Parker Dam, and at Imperial Dam as stations at which to measure salinity levels in the Colorado River. The salinity standard at Imperial Dam in Yuma, Arizona, is currently 879 mg/L TDS. Salinity control programs must be implemented upstream of the dam in each basin state to meet this standard and improve municipal, industrial, and agricultural water quality.

To facilitate implementation of control projects, Title II of the 1974 Colorado River Basin Salinity Control Act authorized several salinity control units upstream of the Imperial Dam. The Uinta Basin, in which the Uinta River, Deep Creek and Dry Gulch Creek are located, is one of the authorized salinity control units.

As listed in Utah's Classification of Waters of the State (Section R317-2-13 of Standards of Quality for Waters of the State), the Uinta River and tributaries (e.g. Deep Creek and Dry Gulch Creek) are designated for agricultural use. The applicable water quality standard for TDS that is intended to protect this use in the state of Utah is listed in Table 2-1.

Table 2-1. Utah's water quality standards for TDS for relevant designated uses (DEQ, 1997)

Designated Use	Segment	TDS water quality criterion (mg/L)
Agriculture (Class 4, protected for agricultural uses, irrigation of crops, stock watering*)	- Dry Gulch Creek - Deep Creek - Uinta River from confluence with Duchesne River to Highway US-40 crossing	1,200 mg/L

*Total dissolved solids (TDS) limits may be adjusted if such adjustment does not impair the designated beneficial use of the receiving water. The TDS limit for stockwater-only waterbodies is currently being evaluated to determine an appropriate level.

Although Dry Gulch Creek is classified for agricultural uses from the headwaters to its confluence with the Uinta River there is some question regarding the actual agricultural use in the lower reaches. The agricultural uses in this area, whether for irrigation of crops or for stockwater, are currently being investigated.

2.2 TMDL Endpoint

Because there are no established water quality standards for waters within the boundaries of the Uintah and Ouray Indian Reservation, the Utah State water quality standards are used as the basis for establishing an endpoint for the Uinta River, Deep Creek and Dry Gulch Creek TMDL.

The Utah water quality standards include a numeric criterion for TDS, and the impairment in Uinta River, Deep Creek and Dry Gulch Creek is represented by exceedances of that criterion. Therefore, the numeric criterion of 1,200 mg/L for TDS is an appropriate water quality target for this analysis.

Concern was raised at a watershed meeting in April 2000 about the consideration of salinity effects on the watershed's fisheries. The Utah standards have a water quality criterion for TDS for only the agricultural use and not the aquatic life use. However, if salinity effects on aquatic life were to occur at levels below the available numeric criterion, it would be appropriate to set a more stringent TDS target for this TMDL to protect the fisheries use as well as the agricultural use. Research indicates that the levels at which salinity has an effect on freshwater fisheries are typically in the 10,000 to 15,000 mg/L range (Kathy Hernandez, USEPA Region 8, personal communication, April 19, 2000). These levels are significantly higher than the agricultural criterion of 1,200 mg/L. Therefore, the established numeric criterion of 1,200 mg/L will be protective of all designated uses.

As stated earlier, with the implementation of proposed control options it has been theorized that decreasing TDS loads may actually raise instream TDS concentrations. This could be the result of less dilution water from surface return flows or more concentrated TDS in the groundwater. To address this possibility that implementation may lead to increased instream TDS concentrations and non-attainment of water quality standards this TMDL will utilize an approach that provides for the implementation of load reduction strategies while continuing to collect additional data. If when the load reductions identified in this TMDL are attained or a reasonable effort towards implementation has occurred, and if water quality standards are still violated, site specific water quality standards will be developed based upon the additional data collected.

3. Impairment Analysis

3.1 Water Quality and Flow Data Inventory

Monitoring data for this basin are available from a variety of sources, including the U.S. Environmental Protection Agency's STORET database, the Ute Tribe, the U.S. Geological Survey, and U.S. Forest Service. The locations, periods of record, and summary statistics for available flow and water quality data are presented in this section.

3.1.1 USGS Flow Data

Flow records available for USGS flow gages in the Uinta River and Dry Gulch Creek watershed are listed in Table 3-1 with their gage names, station IDs, drainage areas, and periods of record. Only those gages with records of daily flows available for dates since a1970 are shown in Figure 3-1.

3.1.2 Water Quality Data

Monitoring data collected in the Uinta River watershed are available at several locations, with some stations having long-term data records and others providing as few as one sample. Utah DEQ provided TDS data for three stations in the watershed. In addition, all TDS data available in USEPA's STORET for the watershed (after 1980) were retrieved. STORET queries duplicated the data provided by Utah DEQ and also provided data from five additional ambient stations and one well. The Ute Indian Tribe's Fish and Wildlife Department also provided TDS monitoring data for their station located on Uinta River downstream of Dry Gulch Creek. A summary of the data available at all stations is provided in Table 3-2, and station locations are shown in Figure 3-2. (Data retrieved from STORET were for parameter 70300, Dissolved Residue at 180 EC.)

Table 3-1. USGS flow gages in the Uinta River Basin

Station ID	Gage name	Drainage area (mi^2)	Start date	End date
9295500	Uinta R below Gilbert Creek near Neola, Utah	33	9/1/50	9/30/55
9296000	Uinta R above Clover Creek near Neola, UT	132	10/1/45	9/30/55
9296500	Clover Creek near Neola, Utah	10	8/21/50	9/30/55
9296800	Uinta R below powerplant diversion near Neola, UT	157	10/1/90	9/30/93
			10/1/94	9/30/98
9297000	Uinta River near Neola, UT	163	10/1/29	9/30/83
9297500	Uinta R near Whiterocks, UT	218	11/5/17	9/30/20
9297600	W. Channel Uinta R below Div Wks near Whiterocks, UT	216	8/26/76	10/5/81
9297800	E. Channel Uinta R at Co Road Bridge near Whiterocks, UT	253	8/25/76	10/2/81
9297900	E. Channel Uinta R at Lapoint Road near Lapoint, UT	382	8/25/76	10/5/81
			10/1/82	10/17/82
9298000	Farm Creek near Whiterocks, UT	15	8/1/49	10/5/81
9298500	Whiterocks R above Paradise Creek near Whiterocks, UT	90	10/1/45	9/30/55
9299000	Paradise Creek near Whiterocks, UT	10	10/1/47	9/30/55
9299400	Whiterocks R below dam site near Whiterocks, UT	110	8/26/76	10/1/81
			10/1/84	9/30/85
			6/4/88	7/19/88
9299500	Whiterocks River near Whiterocks, UT	109	10/1/29	9/30/98
9299600	Whiterocks R below Farm Creek Canal near Whiterocks, UT	120	8/26/76	9/30/81
9299700	Whiterocks R 1 mile east of Whiterocks, UT	124	8/26/76	10/2/81
9299900	Deep Creek at Hwy 246 near Lapoint, UT	72	8/25/76	10/2/79
9300000	Deep Creek near Lapoint, UT	75	10/1/49	9/30/55
9300500	Uinta R at Fort Duchesne, UT	557	9/28/76	10/1/81
9301000	Dry Gulch near Neola, UT	67	10/1/50	9/30/58
9301200	Dry Gulch near Fort Duchesne, UT	469	8/25/76	10/1/81
9301500	Uinta R at Randlett	1,064	9/18/76	10/1/81
			3/25/98	9/30/98

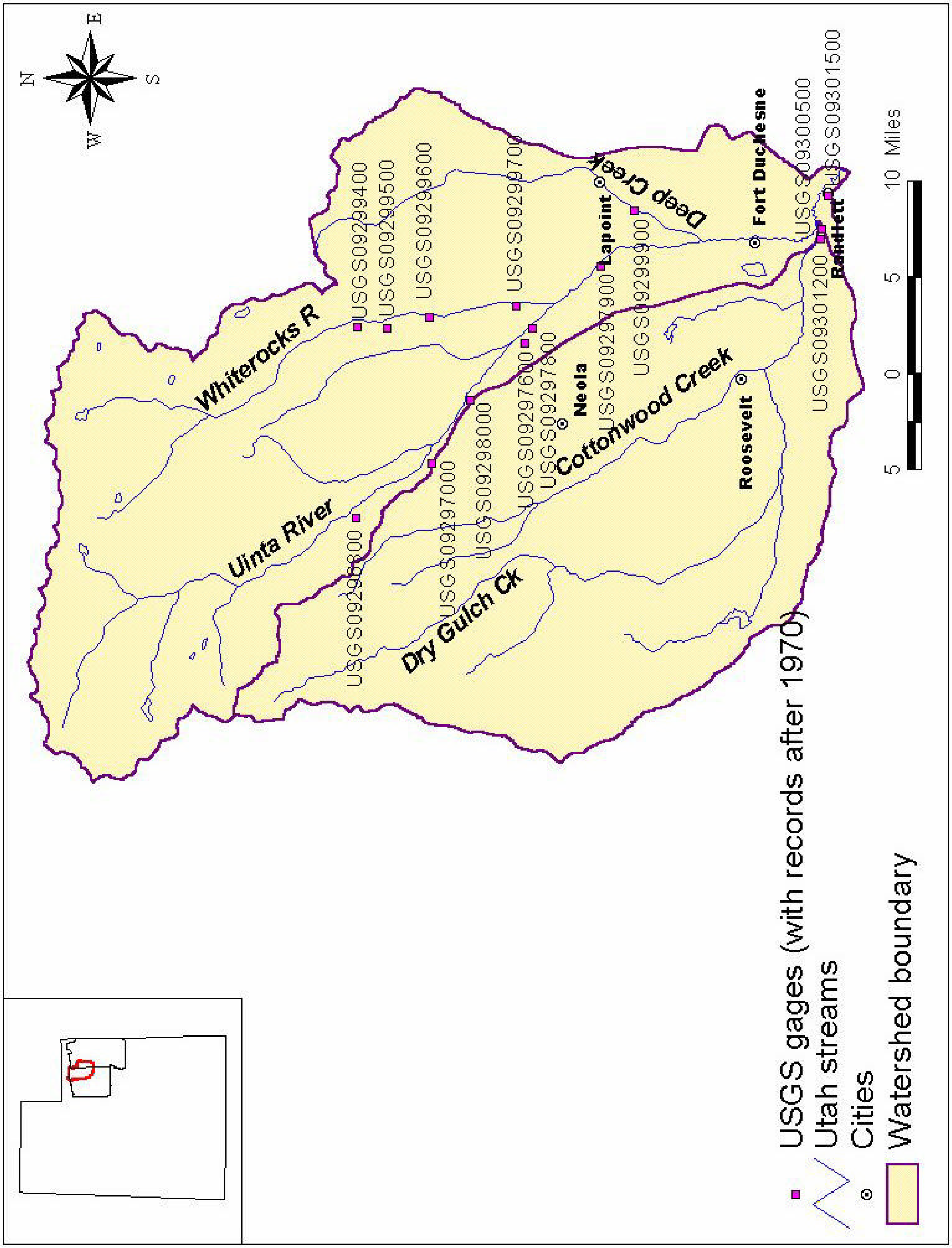

Figure 3-1. USGS gages with flow records available after 1970

Table 3-2. Inventory of available TDS data in Uinta River and Dry Gulch Creek watershed

Station	Location	Type	Start date	End date	Count
Data received from Utah DEQ					
493411	Uinta R at U88 crossing near Randlett	Ambient	1/15/74	6/12/96	110
493414	Dry Gulch Creek at U88 crossing	Ambient	8/1/79	9/14/99	218
493516	Uinta R at NF boundary	Ambient	6/5/85	6/11/96	26
Data received from Ute Indian Tribe, Fish and Wildlife Department					
UFS	Uinta River at USFS Boundary - Lower Uintah Campground	Ambient	12/7/99	7/6/00	3
UBS	Big Springs above ponds / Powerhouse Canal diversion	Ambient	12/7/99	7/6/00	4
UPC	Pole Creek at its confluence with the Uinta River	Ambient	12/7/99	7/6/00	3
UWC	Uinta River below the community of Whiterocks	Ambient	12/8/99	36712	3
UCC	Coltharpe Canal below diversion at Sundance Grounds	Ambient	12/11/99	7/5/00	3
UBN	Bench Canal below its diversion from Uinta River at Leeton	Ambient	12/7/99	36712	3
UFD	Uinta River below east /west channel at US 40 bridge	Ambient	12/7/99	7/5/00	4
TUD	Cottonwood Creek, south of Roosevelt , near housing development and farmland	Ambient	1/12/00	7/12/00	3
MGC	Montes Creek, just north of confluence with Dry Gulch on Bottle Hollow backroad	Ambient	1/12/00	7/12/00	3
G4C	Dry Gulch at the Highway 88 Bridge near four corners	Ambient	1/3/00	7/12/00	3
URN	Uinta River between Randlett and confluence with Duchesne	Ambient	4/12/00	7/5/00	2
Additional data retrieved from STORET[1]					
493430	Uinta R at US 40 crossing	Ambient	10/15/80	1/18/83	13
493462	Dry Gulch Creek-100 ft above Roosevelt Logn	Ambient	8/31/93	8/31/93	1
493473	Dry Gulch Creek at Martin-Hancock Laterals Diversion	Ambient	9/16/80	9/16/80	1
493478	Dry Gulch at USFS boundary	Ambient	6/18/98	9/15/98	4
593018	Well No. 18 in Willows, 50 ft N of Dry Gulch	Well	9/16/80	9/16/80	1
10302017	Uinta River at USGS gaging station	Ambient	4/16/80	11/4/80	3

[1] All STORET data stations are maintained by Utah DEQ except 10302017, which is a USFS station.

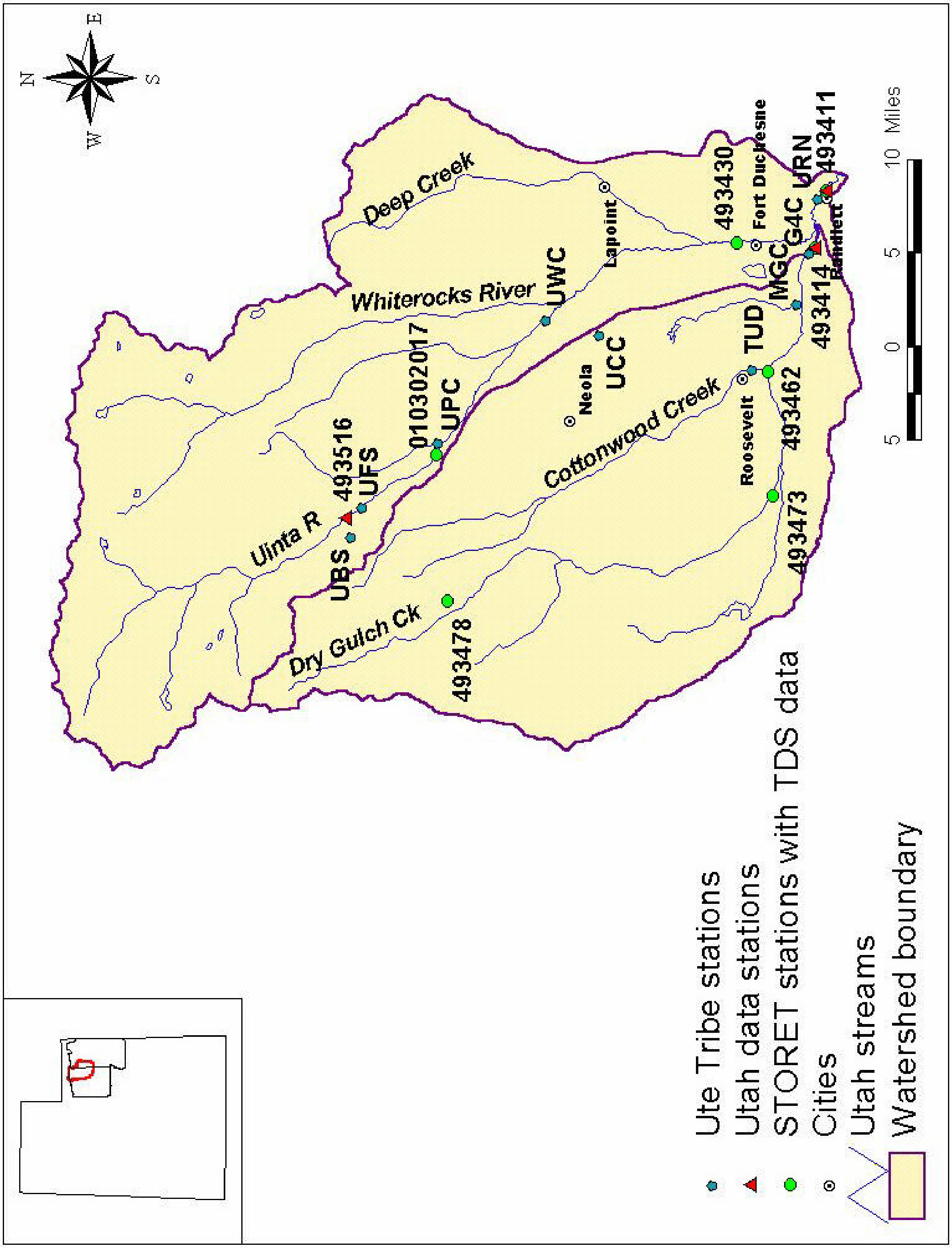

Figure 3-2. Water quality stations with TDS data

3.2 Water Quality Analysis

This section provides a summary of the available TDS data throughout the watershed, as well as discussions on the evaluation of any identifiable spatial or temporal patterns in TDS data. It is important to recognize that data collection in support of this TMDL is an ongoing effort and that as new data is collected this TMDL will be revised accordingly.

This TMDL is based on the best available data. However, because of questions expressed by some stewards in the watershed, water quality and other information pertinent to establishment of background salinity levels will be gathered. New information that has a significant bearing on the current TMDL's established herein may justify amendments to this document that will be submitted to EPA for approval as a new TMDL for these waters.

3.2.1 Summary of TDS Concentrations

Table 3-3 is a summary of the water quality data available in the watershed, including minimum, mean, average, and maximum concentrations, as well as a summary of exceedances of the 1,200 mg/L water quality standard.

Stations where water quality standards violations occur are located in the lower watershed, with the majority of the violations occurring at the two most downstream stations on the Uinta River (see stations 493414 and 493411 on Figure 3-2). Land use in this portion of the watershed is dominated by rangeland and agriculture with significant irrigation, whereas the upper watershed (i.e., above the National Forest boundary) is primarily forest. Higher TDS concentrations in the lower watershed coincide with drainage from areas of irrigation and, likely, TDS loads delivered through irrigation return flows. In addition, sediment deposited in stream channels from streambank erosion also contribute to TDS loading. The concentration patterns also agree with shallow hole and well observations of the Central Utah Water Conservancy District (CUWCD). Map UN-1-4 in the CUWCD's 1996 report is presented as Figure 3-3 and shows four regions in the watershed based on TDS measurements. The maximum concentrations are found near Dry Gulch Creek in the area below Roosevelt, the same region where DEQ stations 493414 and 493411 and the Ute Tribe's station are located.

Table 3-3. Summary of observed TDS concentrations in the Uinta River and Dry Gulch Creek watershed

Station	Location	Count	Min	Average	Median	Max	Violations of WQS
Data received from Utah DEQ							
493411	Uinta R at U88 crossing near Randlett	110	182	1,154	996	3,058	46
493414	Dry Gulch Ck at U88 crossing	218	496	1,463	1,389	3,564	140
493498	Deep Ck @ U121 crossing east of Lapoint	19	124	754	638	1554	4
493516	Uinta R at NF boundary	26	20	35	32	56	0

Station	Location	Count	Min	Average	Median	Max	Violations of WQS
Data received from Ute Indian Tribe, Fish and Wildlife Department							
UFS	Uinta River at USFS Boundary - Lower Uintah Campground	3	20	24	24	28	0
UBS	Big Springs above ponds / Powerhouse Canal diversion	4	76	83	84	88	0
UPC	Pole Creek at its confluence with the Uinta River	3	76	81	76	92	0
UWC	Uinta River below the community of Whiterocks	3	112	153	172	176	0
UCC	Coltharpe Canal below diversion at Sundance Grounds	3	24	33	28	48	0
UBN	Bench Canal below its diversion from Uinta River at Leeton	3	16	43	48	64	0
UFD	Uinta River below east /west channel at US 40 bridge	4	144	413	356	796	0
TUD	Cottonwood Creek, south of Roosevelt , near housing development and farmland	3	700	821	712	1,050	0
MGC	Montes Creek, just north of confluence with Dry Gulch on Bottle Hollow backroad	3	568	883	1,000	1,080	0
G4C	Dry Gulch at the Highway 88 Bridge near four corners	3	1,320	1,407	1,390	1,510	3
URN	Uinta River between Randlett and confluence with Duchesne	2	1,240	1,315	1,315	1,390	2
Additional data retrieved from STORET[1]							
493430	Uinta R at US 40 crossing	13	140	29	364	1,074	0
493462	Dry Gulch Creek-100 ft above Roosevelt Logn	1	1,284	1,284	1,284	1,284	1
493473	Dry Gulch Creek at Martin-Hancock Laterals Diversion	1	886	886	886	886	0
493478	Dry Gulch at USFS boundary	4	40	61	61	80	0
593018	Well No. 18 in Willows, 50 ft N of Dry Gulch	1	932	932	932	932	0
10302017	Uinta River at USGS gaging station	3	10	43	20	100	0

[1] All STORET data stations are maintained by Utah DEQ except 10302017, which is a USFS station.

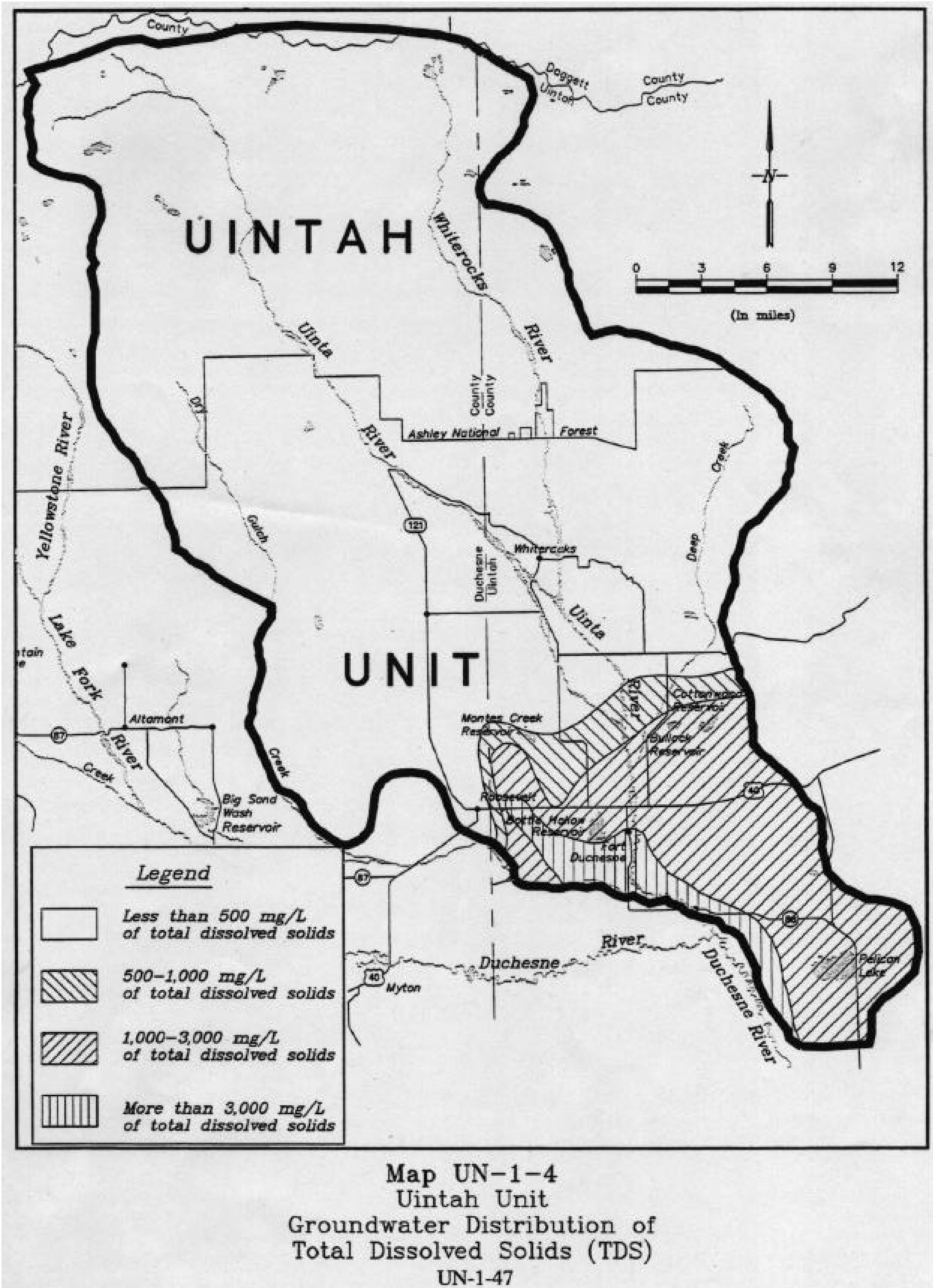

Figure 3-3. Groundwater distribution of TDS (source: CUWCD, 1996)

3.2.2 Seasonal Effects on TDS Concentrations

In Figures 3-4, 3-5 and 3-6, the average monthly TDS values are plotted to show the monthly and seasonal patterns for the Uinta River near Randlett, Dry Gulch Creek and Deep Creek, respectively. Because seasonal effects may be due to the seasonal variations in hydrology, average monthly flows are also included. Generally, the highest average concentrations occur in March, April, October and November. The irrigation season is typically from April through September. These patterns suggest that TDS loading in the Fall may be influenced more by irrigation return flows and TDS loading in the spring is influenced more by natural precipitation and spring runoff. Although not all monthly averages exceed the water quality criterion, all months do have observed TDS concentrations in exceedance of the 1,200 mg/L criterion at stations 493411 and 493414, as discussed in Section 3.3.

3.2.3 Flow Versus TDS Concentrations

Ideally, the water quality analysis should evaluate any identifiable patterns or trends, including any relationships between water quality and flow. This approach provides a better understanding of the hydrologic conditions under which water quality standards violations occur. Although there is limited overlap of the water quality sampling dates and USGS continuous flow records, water quality data provided by Utah DEQ had associated flow measurements for most TDS samples.

Figures 3-7, 3-8 and 3-9 show the relationship between flow and TDS monitoring data in the Uinta River at Randlett (493411), Dry Gulch Creek (493414) and Deep Creek (493498), respectively. The plots of TDS versus flow at Randlett and Deep Creek show a more identifiable trend ($R^2 = 0.7$) than the Dry Gulch Creek data show ($R^2 = 0.4$). However, all plots show the general trend of decreasing TDS concentrations with increased flow. TDS concentrations are likely the highest during baseflow conditions when groundwater with elevated concentrations provides the majority of the streamflow. However, TDS concentrations occur above water quality standards at most flow ranges and in all months. This may illustrate the effect of surface runoff carrying accumulated salts to receiving waters. The consistency in higher concentrations may also be caused by the continual effect of groundwater returns on the receiving waters. Because of the lag time between surface infiltration of irrigation water and precipitation and its return through groundwater, irrigation return flows and precipitation does have an effect on in-stream TDS concentrations over a wide range of flows and times.

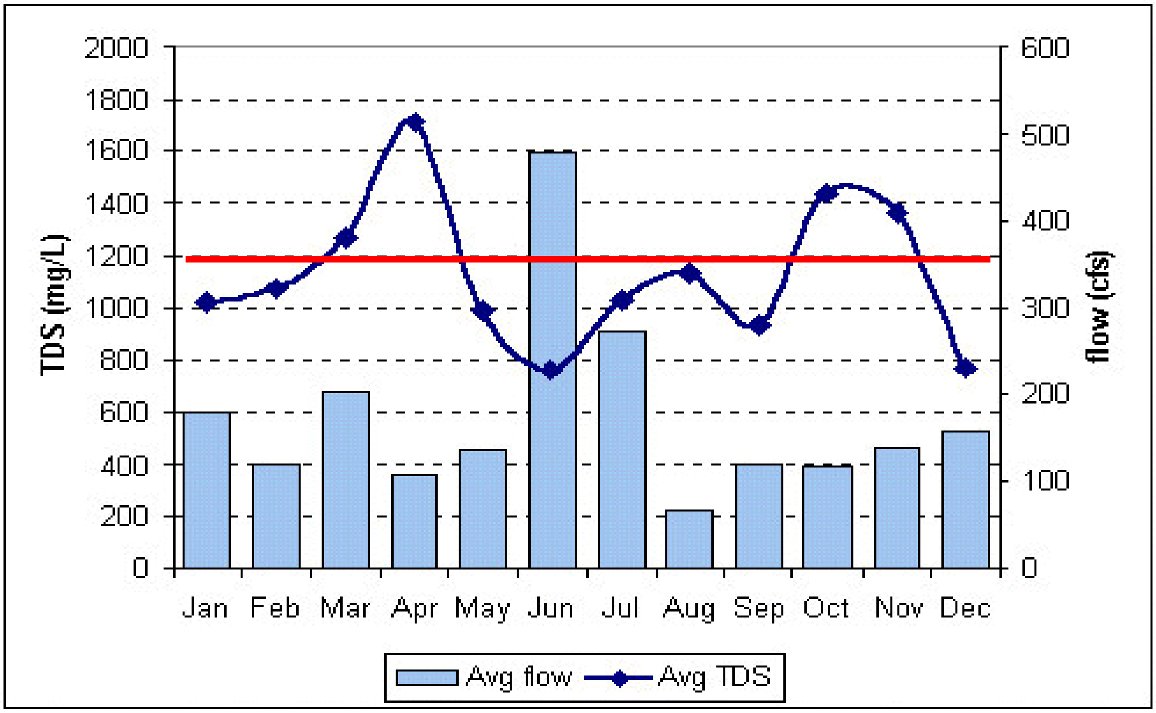

Figure 3-4. TDS versus month on the Uinta River at Randlett (493411)

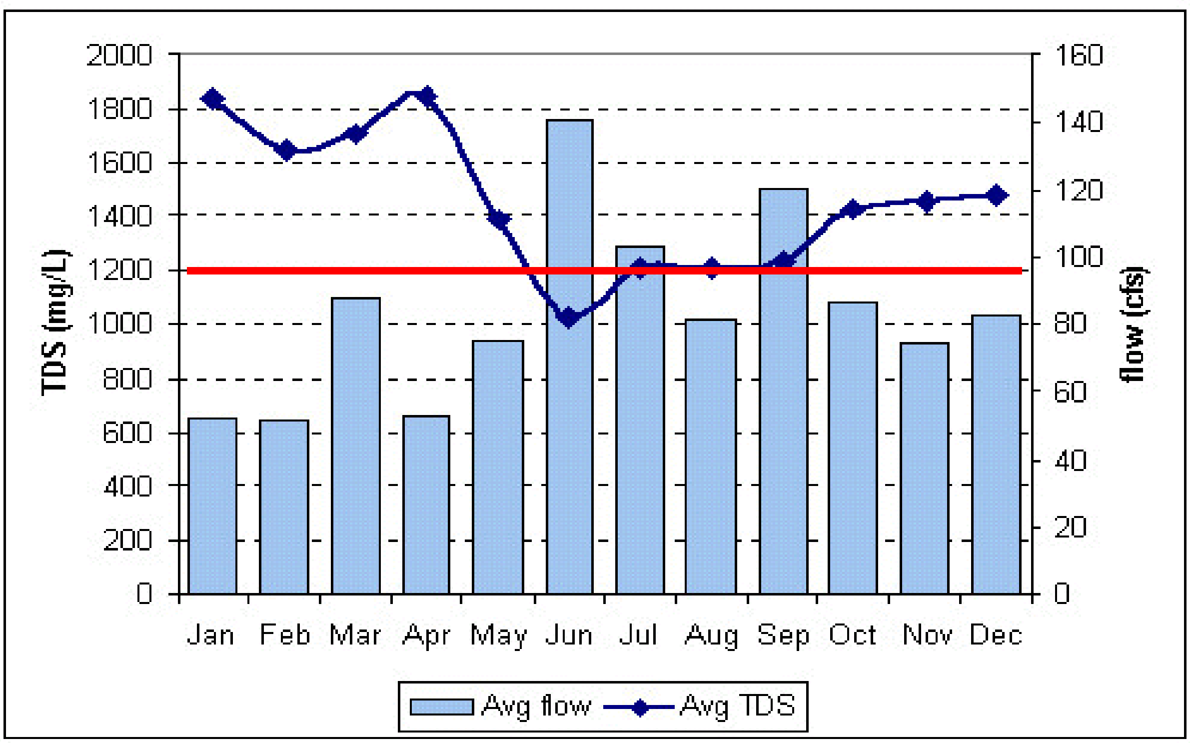

Figure 3-5. TDS versus month on Dry Gulch Creek (493414)

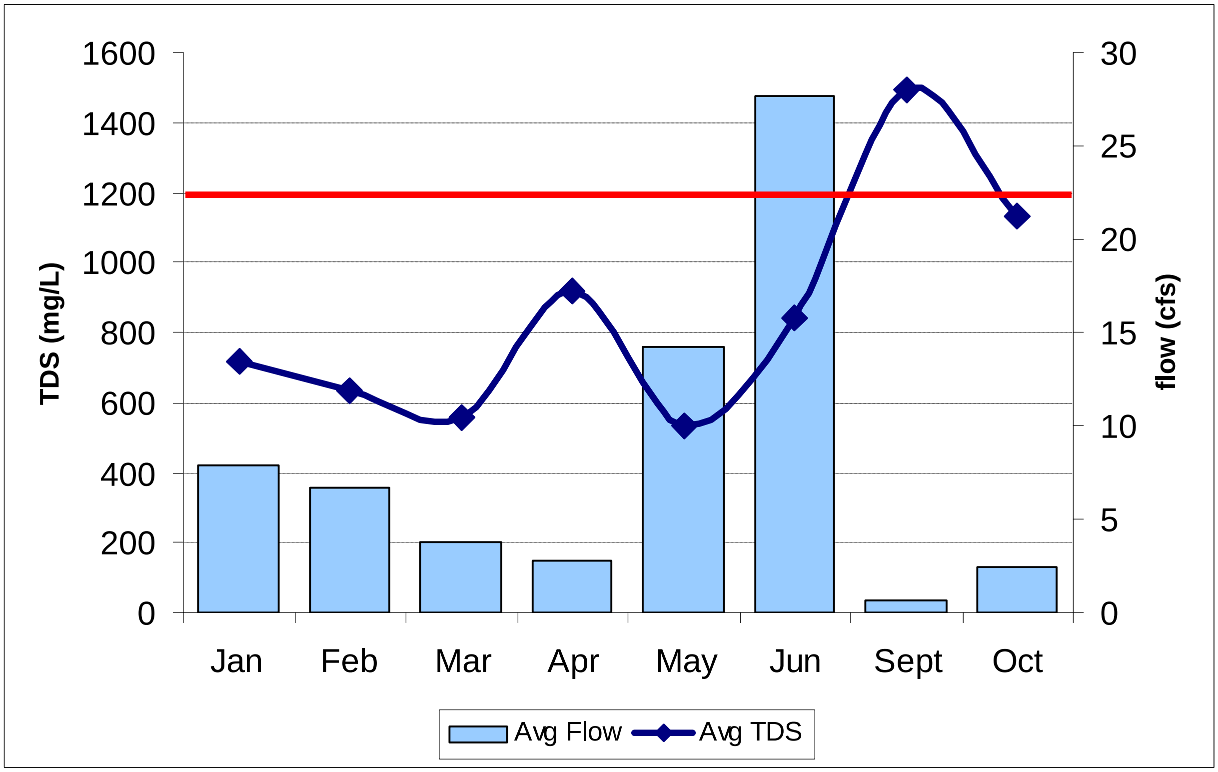

Figure 3-6. TDS versus month on Deep Creek at U121 crossing (493498)

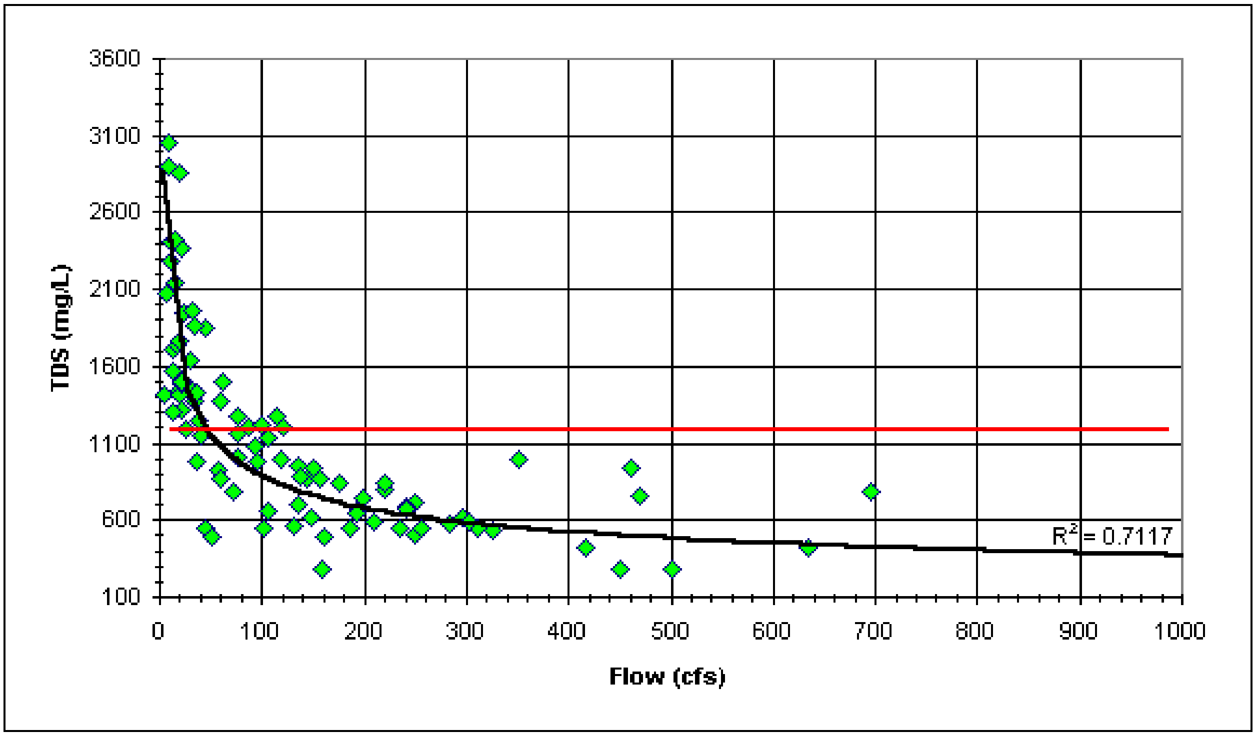

Figure 3-7. TDS versus flow in the Uinta River at Randlett (493411)

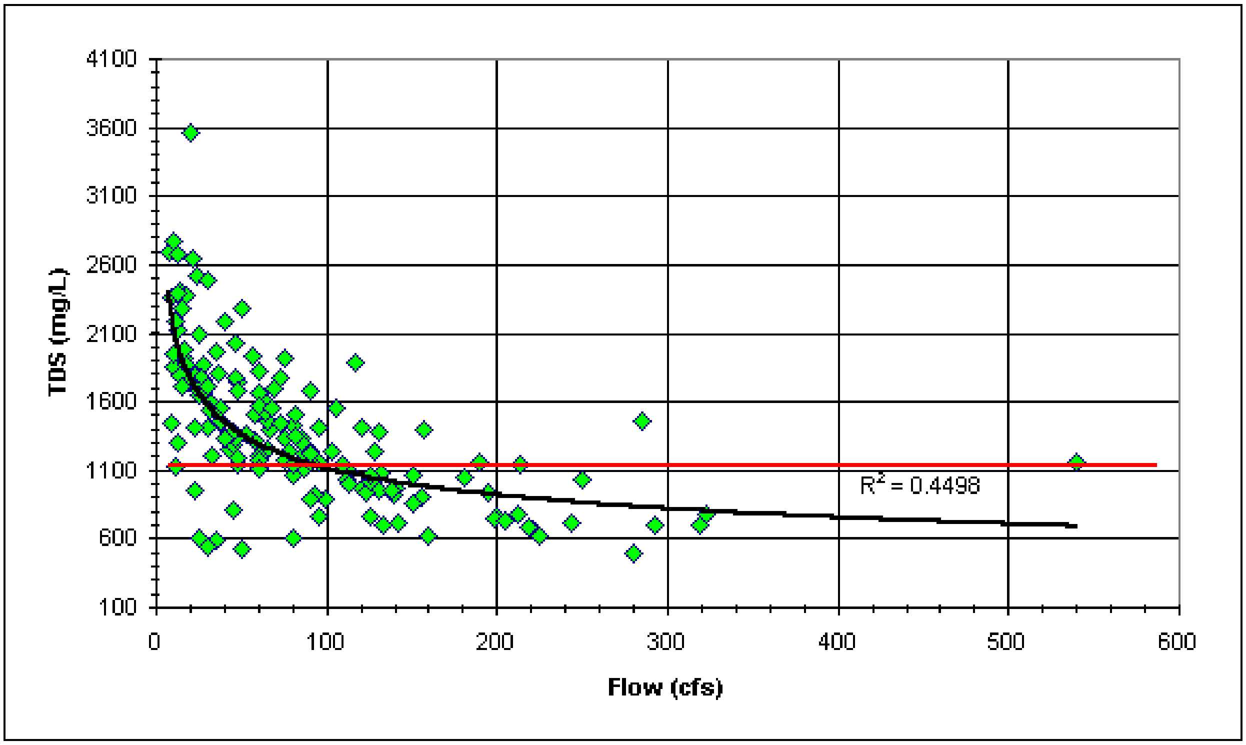

Figure 3-8. TDS versus flow in Dry Gulch Creek (493414)

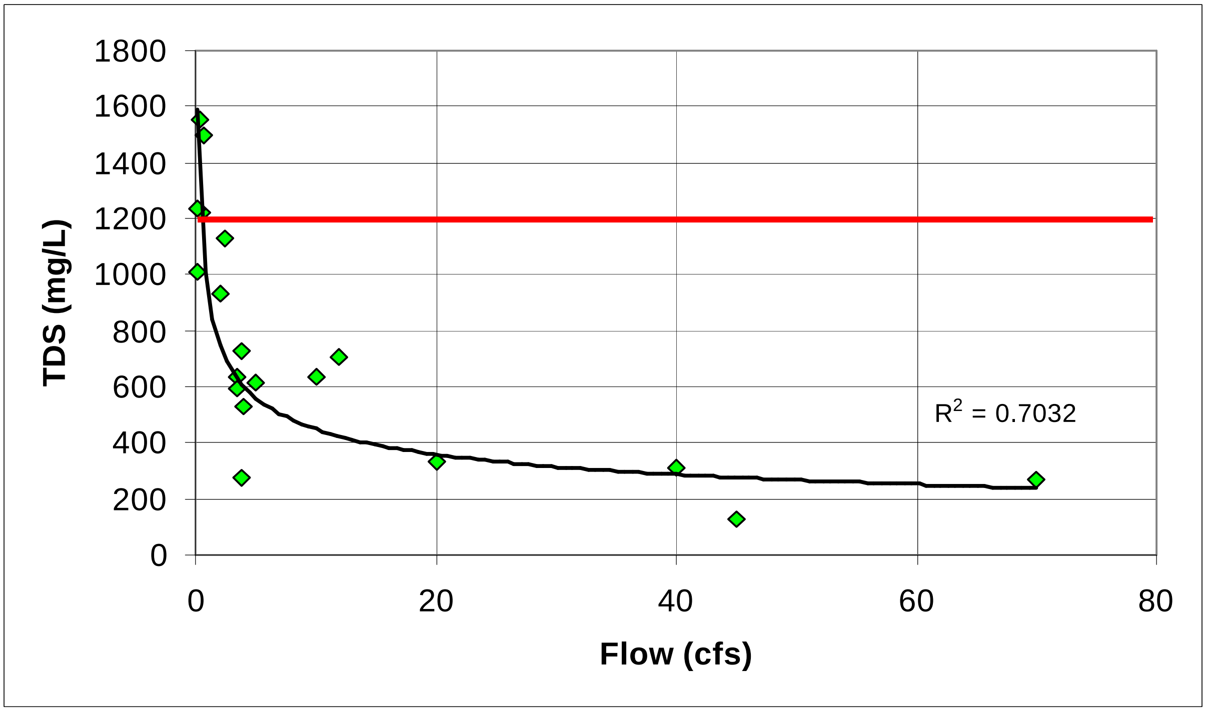

Figure 3-9. TDS versus flow in Deep Creek at U121 crossing (493498)

3.3 Critical Conditions

Critical condition represents the condition or conditions under which impairment (i.e., violations of water quality standards) occurs. Determination of the critical condition and analysis of the TMDL considering the critical condition ensure that water quality standards are met under all conditions. Critical conditions are often difficult to identify because of the combination of hydrologic and loading conditions. When the source of a pollutant is fairly constant in its frequency and magnitude, low flow (i.e., the period of minimum dilution) is typically the critical condition for the receiving water. When pollutant sources are driven by precipitation (e.g., runoff from urban or agricultural land), they affect a receiving water during or just following a storm event, making elevated flows the critical condition. Because the surface and groundwater hydrology of the Uinta River, Dry Gulch Creek and Deep Creek watersheds are interconnected and influence one another, it is difficult to distinguish the loading times that have the greatest impact on instream conditions. Because of lags created by groundwater delivery and surface water diversions, critical loading periods may be a significant amount of time prior to the times of resulting elevated instream concentrations.

Critical conditions also can be dependent on environmental and watershed factors other than rainfall and flow, such as temperature and watershed activities. Precipitation patterns, flow patterns, and TDS concentrations were reviewed to evaluate the critical conditions for the Uinta River, Dry Gulch Creek and Deep Creek. Flows in the Uinta River were sorted by magnitude and divided into percentiles that were matched with the associated TDS data including minimum, average, and maximum TDS concentrations for each flow percentile. This evaluation of the distribution of TDS concentrations and flows indicated that elevated TDS concentrations and violations of water quality standards were not limited to specific flow conditions (e.g., high or low flow). As shown in Table 3-4, maximum TDS concentrations for all percentile groups have exceeded the water quality criterion of 1,200 mg/L. Figures 3-10 through 3-12 presents the TDS data at station 493411 (Uinta at Randlett), station 493414 (Dry Gulch Creek at U88), station 493498 (Deep Creek at U121 crossing) and the water quality criterion of 1,200 mg/L respectively. As discussed in Section 3.2 and shown in Figures 3-10 and 3-11, violations of the TDS water quality standards occur during all months of the year. However, there is not yet enough data on Deep Creek (493498) to reliably discern if water quality violations are related seasonally. With the limited data available it appears that high TDS concentrations are associated with low flow conditions in mid to late summer. But for the watershed in general, based on the preponderance of available monitoring data, water quality standards are violated throughout the year and at all flows; therefore, the critical condition is and the TMDLs will be based on an analysis of all flow conditions and will not isolate specific time periods.

Table 3-4. TDS data results by flow percentile group

Flow		TDS						
Percentile	Flow (cfs)	Maximum (mg/L)	Mean (mg/L)	Minimum (mg/L)	Standard Deviation	Mean + Deviation	Mean - Deviation	# of Obs.
0-10%	14	3,058	2,082	1,306	633	2,715	1,448	9
10-20%	18	2,418	2,100	1,738	342	2,442	1,758	3
20-30%	22	2,855	1,800	1,312	541	2,341	1,260	8
30-40%	26	1,946	1,549	1,196	377	1,926	1,172	3
40-50%	30	1,636	1,552	1,468	119	1,671	1,433	2
50-60%	36	1,962	1,655	1,372	299	1,954	1,356	4
60-70%	46	1,854	1,153	542	475	1,628	678	5
70-80%	63	1,506	1,034	494	408	1,441	626	5
80-90%	98	1,280	1,073	792	164	1,237	910	7
90-100%	2640	1,272	691	182	257	948	435	46

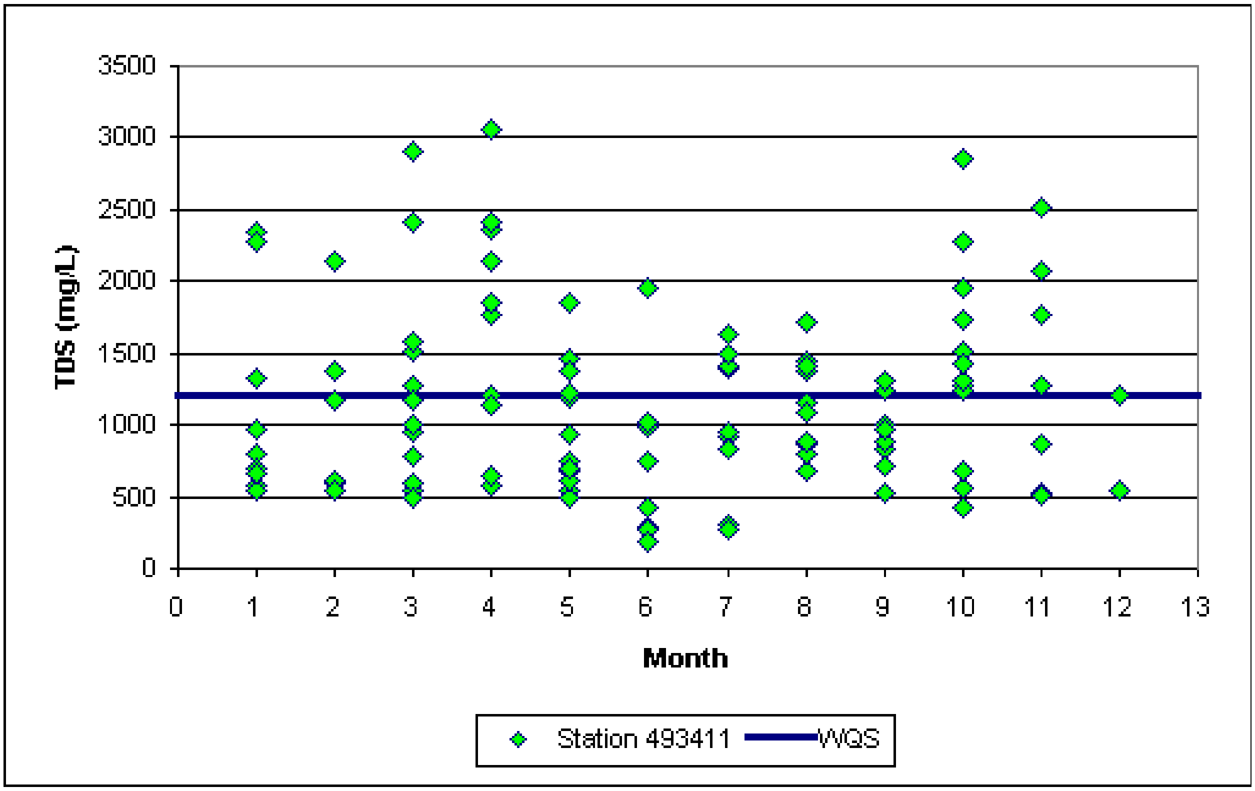

Figure 3-10. Monthly distribution of TDS concentrations at station 493411 (Uinta at Randlett)

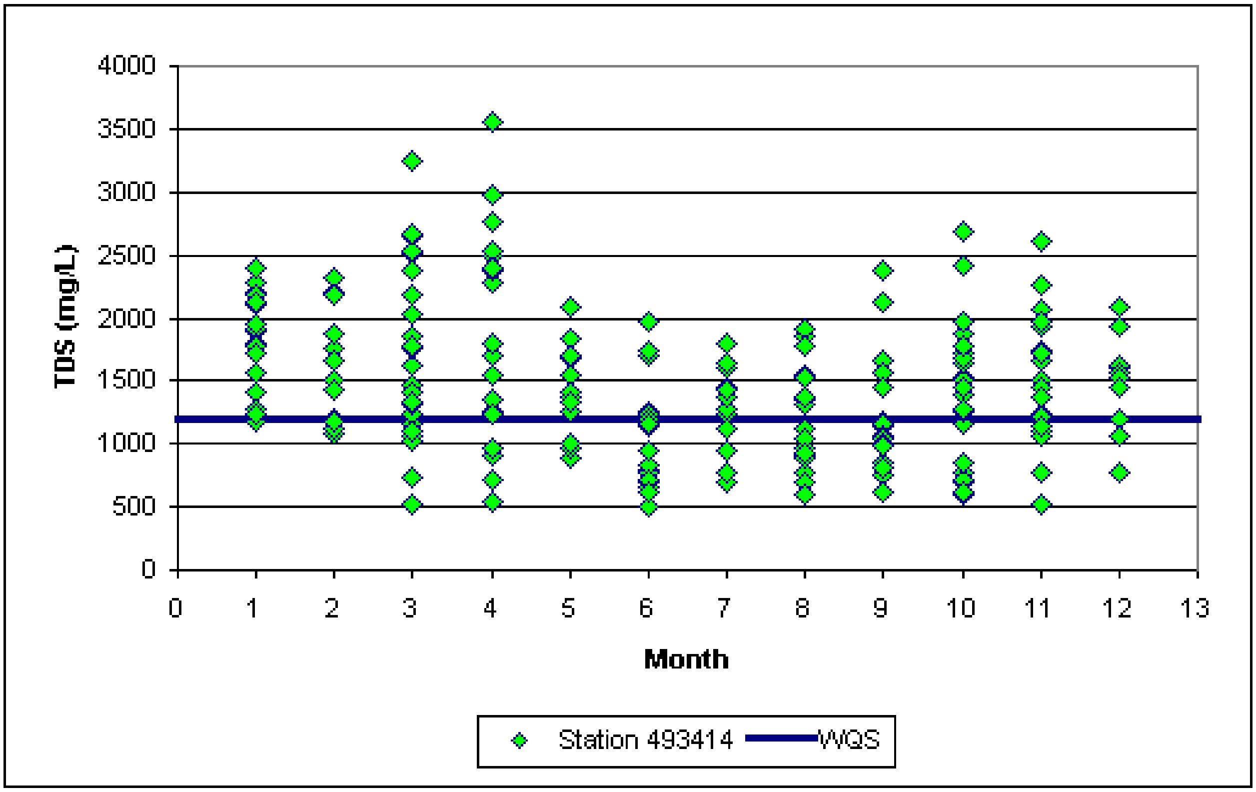

Figure 3-11. Monthly distribution of TDS concentrations at station 493414 (Dry Gulch Creek at U88 crossing)

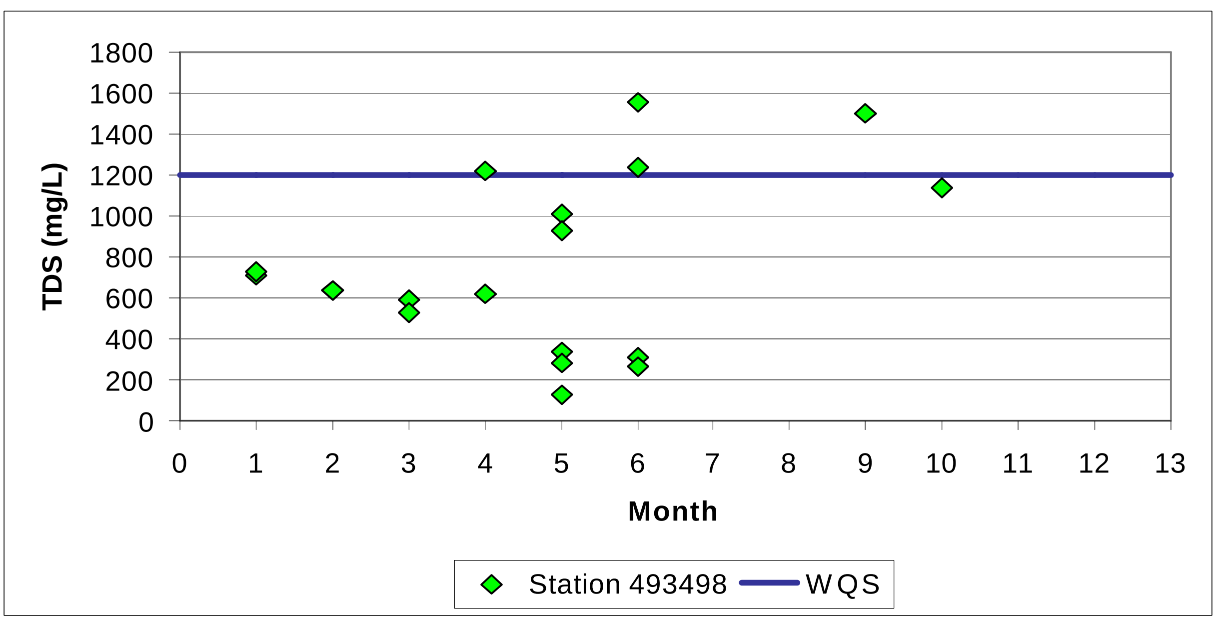

Figure 3-12. Monthly distribution of TDS concentrations at station 493498 (Deep Creek at U121 crossing)

4. Source Assessment

The evaluation of TDS sources in the Uinta River and Dry Gulch Creek watershed included point and nonpoint sources.

4.1 Assessment of Point Sources

Data retrieved from EPA's Permit Compliance System show no permitted facilities in the Uinta River and Dry Gulch Creek watershed.

4.2 Assessment of Nonpoint Sources

Significant natural and man-induced sources of TDS exist in the watershed. Because the area is naturally saline, there are background contributions of TDS resulting in elevated concentrations in watershed streams. The geology of the lower portion of the basin is dominated by the slightly-to-moderately saline Uinta and Duchesne River Formations **and the highly saline Mancos shale formation** (USBRc, 1986; CUWCD, 1996). However, because the hydrology of the watershed has been so modified from its natural state, with canals and diversions throughout the watershed, and groundwater is interconnected to surface water, it is impossible to distinguish "natural" conditions of the watershed.

Surface and sub-surface irrigation return flows that dissolve and transport TDS to receiving streams have been identified as a significant source of TDS in the watershed (USDA-SCS, 1987; USBRc, 1986; CUWCD; 1996; UDEQ, 1997). Approximately 78 percent of the water in the Uinta Unit is diverted for irrigation (CUWCD, 1996a). The lower watershed (below the National Forest boundary) is dominated by irrigated agricultural land and rangeland. Irrigation water and natural precipitation that is not transpired by vegetation, evaporated into the atmosphere, or held in the soil, percolates through the soil and enters the groundwater, eventually returning to watershed streams as baseflow. The subsurface bedrock formations in the lower basin are saline and soluble **(Mancos shale)**, dissolving easily and contributing TDS to the groundwater passing through them. Water quality is degraded by agricultural return flows high in salt entering the Uinta River as nonpoint source additions through the lower reaches (CUWCD, 1996; USBRc, 1986). As water moves down through the basin and is used and reused for irrigation, it picks up increasing amounts of salt. CUWCD (1996) indicates that the largest single source of irrigation return flow enters the lower Uinta River from Dry Gulch Creek, an intermittent stream that primarily carries agricultural return flows. Salt also can accumulate on the land surface in areas of saline soils or areas of poor drainage where groundwater rises to the surface and evaporates, leaving the soluble salts on the surface. When salts accumulate on the surface, they are available for runoff and delivery to watershed streams.

Observed TDS concentrations support the conclusion that irrigation return flows are the major source of man-induced TDS in the watershed. Elevated concentrations of TDS occur in the lower portion of the watershed where irrigated agricultural land and rangeland are the dominant land uses and the geology is more saline. Although data are limited in the middle and upper portions of the watershed, lower TDS concentrations occur in those portions of the watershed where forest is the primary land use and the geology consists of less-saline parent material and surface substrate.

"Natural condition" implies the absence of human manipulation, e.g. snowmelt and storm runoff. The hydrology of the watershed currently and historically has been extensively manipulated and altered for irrigation. Without a reference condition it is impossible to determine what effect that alteration and use has had on water quality and to what degree natural and irrigation sources influence TDS. It is assumed that irrigation return flows are the primary man-induced source of TDS loading and, most likely, the only controllable source of TDS loading in the watershed. Because of the interconnectedness of the surface and groundwater hydrology, the naturally saline soils, and the complexities in water diversions, use and pathways, it is impossible to distinguish the natural contributions of TDS in these watersheds. The concentrations during irrigation season (times of higher flow and dilution) are, on average, lower than during non-irrigation season, but are still in exceedance of water quality standards.

The watershed characteristics that make it difficult to identify natural conditions also make it difficult to isolate specific areas or sources of TDS loading. The landscape of the lower watershed, and the surrounding areas, is characterized by an extensive network of diversion canals and irrigation ditches (Figure 4-1), that divert and transport water within the watershed as well as into and out of the watershed. It would be impossible to appropriately establish representative conditions and evaluate loadings and responses at specific points in the complex stream network of the Uinta River, Deep Creek and Dry Gulch Creek watersheds. Therefore, the TMDL analyses will focus on the watersheds as a whole, not isolating TDS loadings from specific subwatersheds, areas or sources. The TMDL analyses are based on data collected at the mouths of the watersheds and establish gross loadings for the entire watershed.

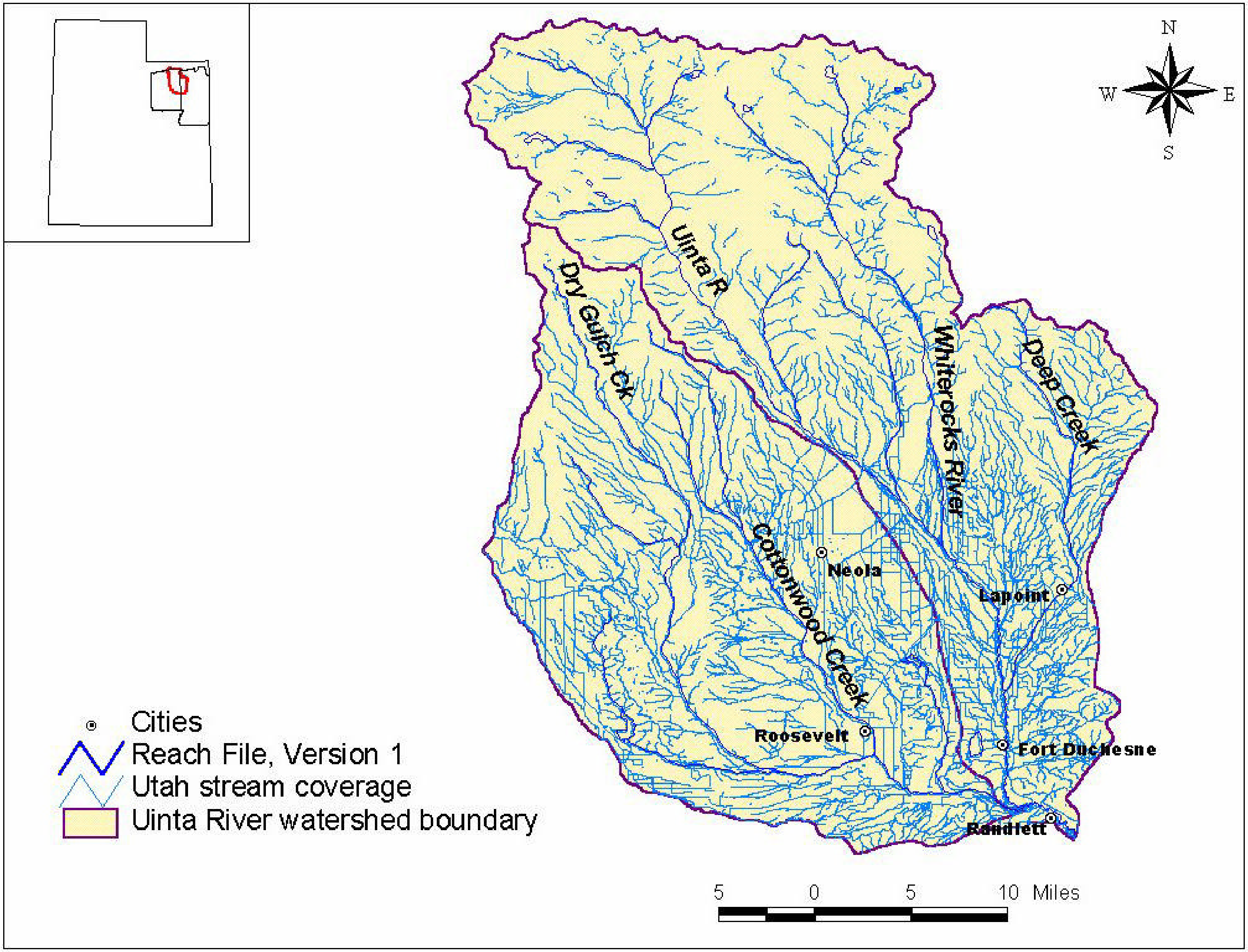

Figure 4-1. Waterways in the Uinta River, Deep Creek and Dry Gulch Creek watershed

5. Identification of Loading Capacity

Establishing a relationship between the in-stream water quality target and source loading is a critical component of TMDL development. Identifying the cause-and-effect relationship between pollutant loads and the water quality response is necessary to evaluate the loading capacity of the receiving waterbodies. The loading capacity is the amount of pollutant that can be assimilated by the waterbody while still attaining and maintaining water quality standards. This section discusses the estimation of the loading capacity and existing TDS loadings in the Uinta River and Dry Gulch Creek watersheds.

Together with historical flow records, the water quality target for TDS was used to establish loading capacities for all flows expected to occur in the Uinta River and Dry Gulch Creek in a typical year. Existing loads also were estimated for comparison to loading capacities and evaluation of necessary load reductions. Existing loads were calculated based on available monitoring data for TDS and flow. The following sections discuss the approaches used to estimate loading capacity and existing TDS loadings for the two waterbodies.

5.1 Estimation of TDS Loading Capacity

A statistical model based on flow can be used to establish associated TDS loads if the flow record is of sufficient length and representative of long term conditions. The available flow record at the Randlett USGS gage (9301500) is 5 years, and the available flow record at the Neola gage (9297000) is 54 years. Although 5 years in length, the flow record and percentiles for the Randlett gage would be sufficiently accurate to represent Uinta River flow and to be used in the statistical model if two criterion were met: (1) the flow percentiles for Neola during the time period of available flows at Randlett (10/76 to 9/81) are similar to the full record and (2) the Randlett flow percentiles follow a pattern similar to the Neola flow percentiles. Table 5-1 shows the comparisons of the flow percentiles at Neola for the entire period of record, at Neola for Randlett's period of record, and at Randlett. The impact of diversions and evaporation on the Uinta River flows is shown in Table 5-1: all flows at Randlett except the highest flows are less than the Neola flows. However, the ratio of the flows at Neola and Randlett for each percentile ranking is sufficient to assume a similar flow pattern between the two gages. Further, flows at Neola during the 5-year period also are not significantly different from flows during the 54-year period. For these reasons, the flow duration curve developed for Randlett data was used in the loading analysis for the TMDLs.

5.1.1 Uinta River

The observed daily USGS flows (10/76 to 9/81) were arranged in order of magnitude and each flow was assigned a percent that reflects the chance of a flow less than or equal to it. To evaluate the allowable TDS loading for the watershed, each flow was then multiplied by the 1,200 mg/L criterion to calculate a corresponding maximum loading limit for each flow. The individual lines were plotted to present a loading capacity line by flow percentile, as shown in Figure 5-1.

Table 5-1. Flow comparison by percentile

Percentile	Flow (ft^3/s)			Ratio of flows at Neola to flows at Randlett
	Neola 10/29–9/83	Neola 10/76–9/81	Randlett 10/76–9/81	
0%-10%	52	51	14	3.6
10%-20%	59	54	18	3.0
20%-30%	65	59	22	2.7
30%-40%	75	68	26	2.6
40%-50%	93	82	30	2.7
50%-60%	124	105	36	2.9
60%-70%	173	135	46	2.9
70%-80%	244	177	63	2.8
80%-90%	398	275	98	2.8
90%-100%	2,900	1,960	2,640	0.7

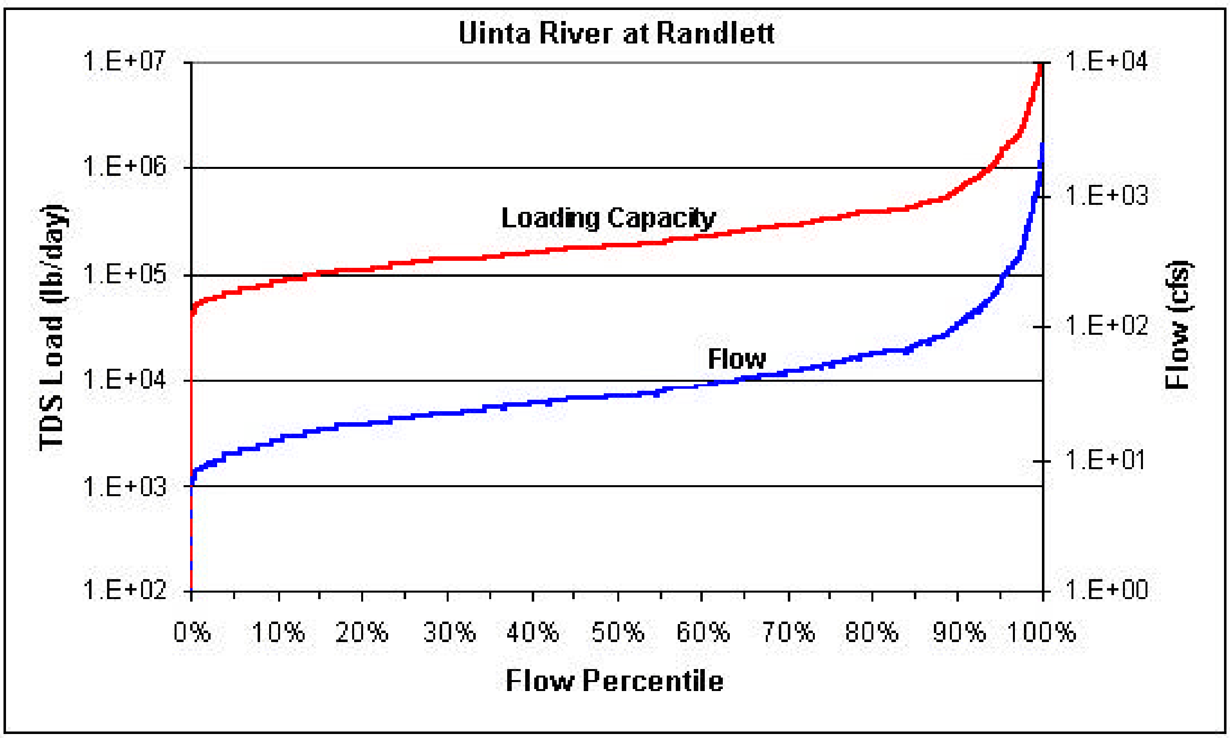

Figure 5-1. Loading capacity for all observed flows in the Uinta River

5.1.2 Dry Gulch Creek

As for the Uinta River, the available USGS flows for Dry Gulch near Fort Duchesne (9301200) were used with the 1,200-mg/L TDS limit to estimate the loading capacity by flow for the Dry Gulch Creek watershed. The estimated loading capacity is presented in Figure 5-2.

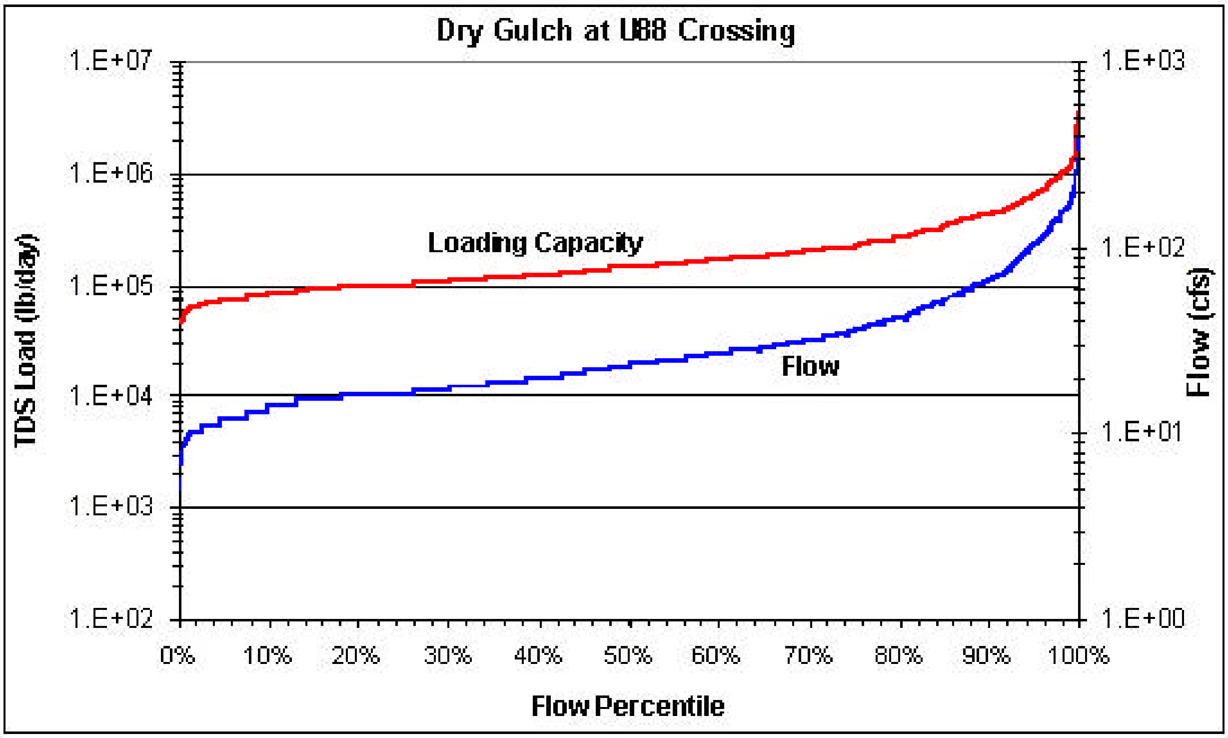

Figure 5-2. Loading capacity for all flows in Dry Gulch Creek

5.2 Estimation of Existing Loading

Existing TDS loadings for the Uinta River watershed and the Dry Gulch Creek watershed were calculated using observed instream TDS concentrations and associated flows. This section presents the methods and results of the analysis of existing TDS loadings in the two watersheds.

5.2.1 Uinta River Watershed

Existing loadings for the Uinta River were calculated using monitoring data provided by Utah DEQ for station 493411 (Uinta River at Randlett), which included measured TDS concentrations with associated flow for most days of sampling. Daily TDS loads for the Uinta River were calculated for the days with both flow and TDS measurements by multiplying the flow by the associated TDS concentration (Figure 5-1). The calculated existing loads were then grouped based on the 10 flow percentile groupings from Table 5-1. Table 5-2 summarizes the maximum, minimum, average, and standard deviation existing loads for each of the 10 percentile groups for the Uinta River.

Maximum individual loads were used to establish a line representing existing loading for all flows for the Uinta River. Figure 5-3 presents all individual existing loadings for the Uinta River and the representative loading line arranged by flow percentile.

Table 5-2. Loading statistics for the Uinta River and Deep Creek watershed

Flow Percentile	Flow (cfs)	No. of Loads[1]	Violations	Existing load summary: Max (lb/day)	Mean+Std (lb/day)	Mean (lb/day)	Mean-Std (lb/day)	Min (lb/day)	Load Limit[2] (lb/day)
0%-10%	14	9	9	149,703	140,523	104,815	69,107	34,130	90,425
10%-20%	18	3	3	181,578	184,471	167,746	151,021	149,159	116,261
20%-30%	22	8	8	290,963	248,920	192,923	136,926	142,387	142,097
30%-40%	26	3	2	235,901	230,891	191,332	151,773	160,380	167,933
40%-50%	30	2	2	262,381	270,897	241,823	212,748	221,264	193,769
50%-60%	36	4	4	340,975	346,915	299,528	252,140	250,214	232,523
60%-70%	46	5	2	447,508	372,565	253,282	133,998	130,825	297,112
70%-80%	63	5	2	488,718	464,783	324,541	184,299	135,137	406,915
80%-90%	98	7	2	561,855	563,903	476,175	388,447	308,418	632,978
90%-100%	2640	46	3	2,934,338	1,498,468	925,177	351,886	240,840	17,051,655

[1]Number of loads calculated using flows within the specified percentile range. This number reflects the number of available paired TDS and flow measurements available within the specific flow range.
[2]Based on water quality criterion of 1,200 mg/L.

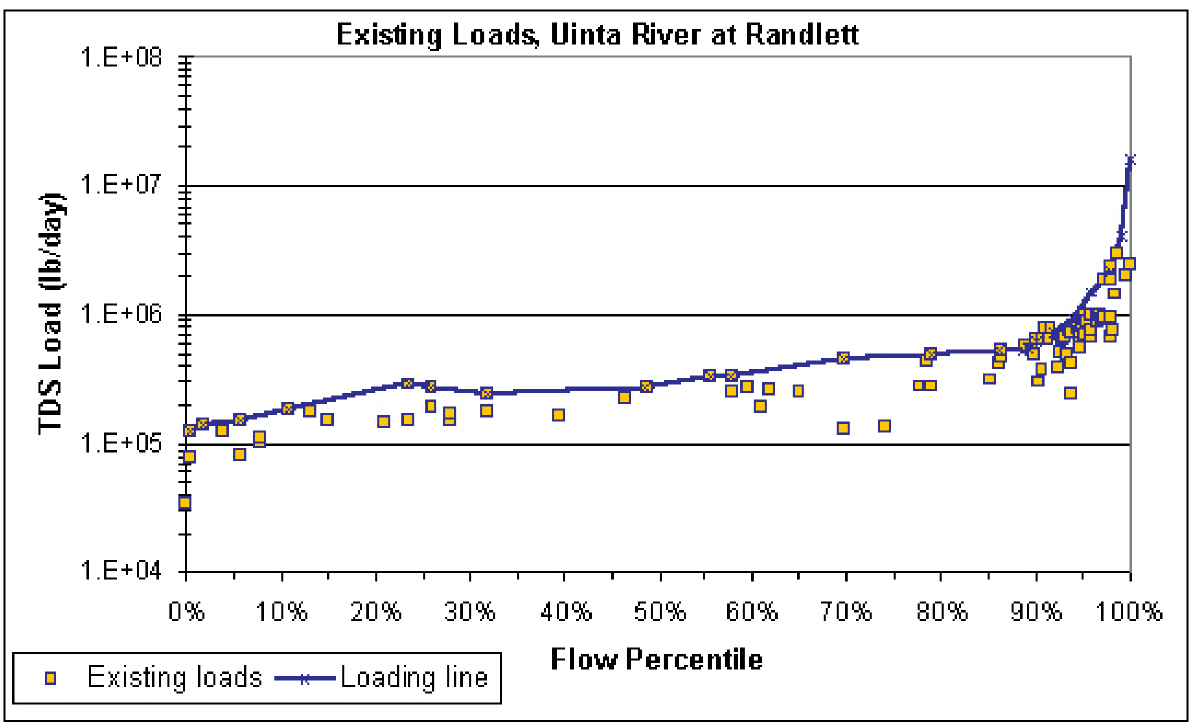

Figure 5-3. Existing TDS loading by flow for Uinta River

5.2.2 Dry Gulch Creek Watershed

Existing loadings for Dry Gulch Creek were calculated using monitoring data provided by Utah DEQ for station 493414 (Dry Gulch Creek at U88 crossing), which included measured TDS concentrations with associated flow for most days of sampling. Daily TDS loads for Dry Gulch Creek were calculated for the days with both flow and TDS measurements by multiplying the flow by the associated TDS concentration (Figure 5-2). The calculated existing loads were then grouped based on the 10 flow percentile groupings from Table 5-1. Table 5-3 summarizes the maximum, minimum, average, and standard deviation existing TDS loads for each of the 10 percentile groups for Dry Gulch Creek.

Existing loads estimated for Dry Gulch Creek contained several extreme outlier loads much higher than other loads calculated in the flow range. Using the maximum estimated existing loads to establish the existing load line (as was done in the Uinta River) could result in significantly overestimated loads and infeasible load reductions to meet the TMDL. Several options concerning the use of TDS concentrations and flows were considered to remove that effect of extreme outliers and still produce a representative existing loading line. Some of the options considered were using the 70^{th}, 75^{th}, or 80^{th} percentile TDS concentration with discrete flow groups of 10 or 20 (e.g., 0 to 20 percent, 20 to 40 percent, etc.) or with cumulative flow groupings of 10 or 20 (e.g., 0 to 20 percent, 0 to 40 percent, 0 to 60 percent, etc.). Using the 75th percentile concentration with discrete 20 percent flow ranges (e.g., 0 to 20 percent, 20 to 40 percent, etc.) produced an existing load line that was most representative of observed instream TDS concentrations, without overestimating or underestimating the loadings. Therefore, the 75^{th} percentile TDS concentration for each 20 percent flow range (i.e., 0 to 20 percent, 20 to 40 percent, etc.) was identified and that concentration was then multiplied by the flows in its associated flow range to establish an existing TDS loading line for Dry Gulch Creek.

Figure 5-4 presents all individual existing loadings for Dry Gulch Creek and the representative loading line arranged by flow percentile.

Table 5-3. Loading statistics for the Dry Gulch Creek watershed

Flow Percentile	Flow (cfs)	No. of Loads[1]	Violations	Existing load summary Max (lb/day)	Mean+Std (lb/day)	Mean (lb/day)	Mean-Std (lb/day)	Min (lb/day)	Load Limit[2] (lb/day)
0%-10%	14	13	12	186,825	153,051	117,873	82,696	66,312	90,425
10%-20%	16	3	3	184,565	194,343	168,281	142,219	138,222	103,343
20%-30%	17	2	2	176,911	179,305	171,130	162,955	165,349	109,802
30%-40%	20	4	4	230,197	228,593	202,435	176,277	178,353	129,179
40%-50%	23	5	4	383,662	346,369	244,092	141,815	112,020	148,556
50%-60%	27	7	6	324,498	303,594	225,228	146,861	82,352	174,392
60%-70%	32	9	8	402,070	335,349	255,199	175,050	88,165	206,687
70%-80%	42	11	10	470,212	388,026	297,291	206,556	111,525	271,276
80%-90%	67	30	23	615,754	526,968	411,889	296,811	142,097	432,750
90%-100%	432	75	26	3,348,325	1,199,867	782,458	365,049	258,358	2,790,271

[1]Number of loads calculated using flows within the specified percentile range. This number reflects the number of available paired TDS and flow measurements available within the specific flow range.
[2]Based on water quality criterion of 1,200 mg/L.

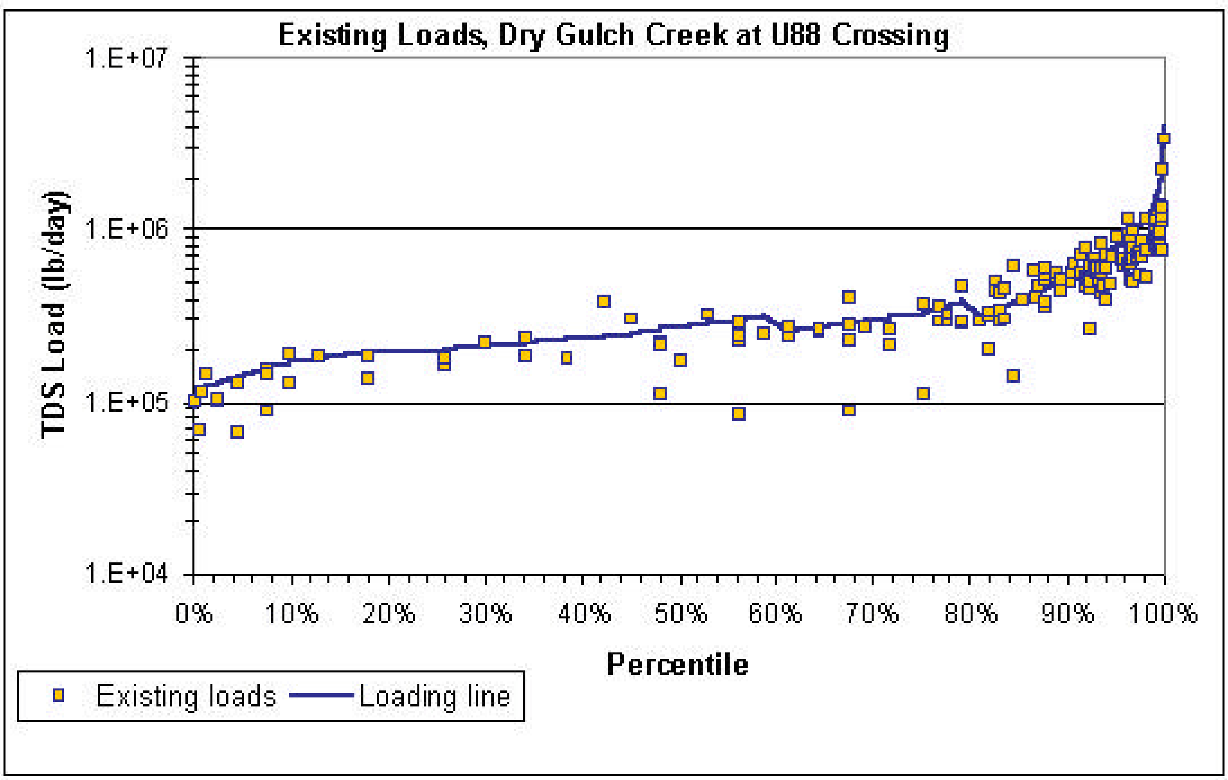

Figure 5-4. Existing TDS loading by flow in Dry Gulch Creek

5.3 Comparison of Existing Loading and Loading Capacity

To evaluate the load reductions and controls necessary to maintain water quality standards in Uinta River and Dry Gulch Creek, the existing TDS loadings were compared to the loading capacity. Figures 5-5 and 5-6 present the estimated loading capacity curve and existing loadings based on monitoring data, arranged by flow percentile, for the Uinta River and Dry Gulch Creek, respectively. Table 5-2 presents the existing loadings for the Uinta River, grouped into the 10 percentile ranges, and the discrete loading capacity based on the 1,200 mg/L target and maximum flow for the percentile grouping (e.g., 14 ft^3/s multiplied by 1,200 mg/L multiplied by conversion factors equals 90,425 lb/d). Table 5-3 presents the existing loadings and loading capacity for Dry Gulch Creek for each flow range. In general, most percentile groups have a maximum load above the loading capacity limit, indicating the need for reductions of TDS loads at most flows for both the Uinta River and Dry Gulch Creek.

By plotting the loading capacities and individual existing loads by flow percentile, the specific dates of flows and loads are removed and the curve can be applied to different time periods. The curve illustrates a representative or statistically average year, with all flows and associated loadings expected to occur during a typical year. Therefore, Figure 5-5 presents the estimated annual existing loadings and loading capacity of the Uinta River watershed, and Figure 5-6 presents the estimated annual existing loadings and loading capacity of the Dry Gulch Creek watershed.

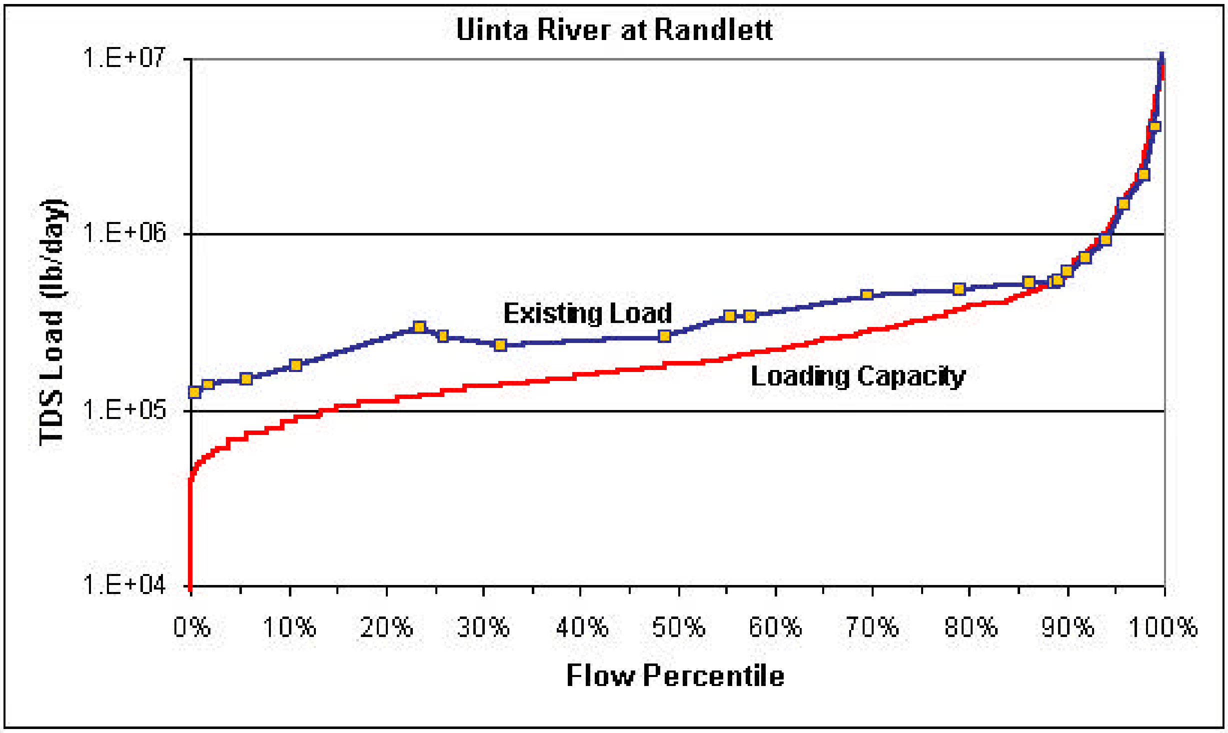

Figure 5-5. Estimated existing TDS loading and loading capacity for the Uinta River and Deep Creek watershed

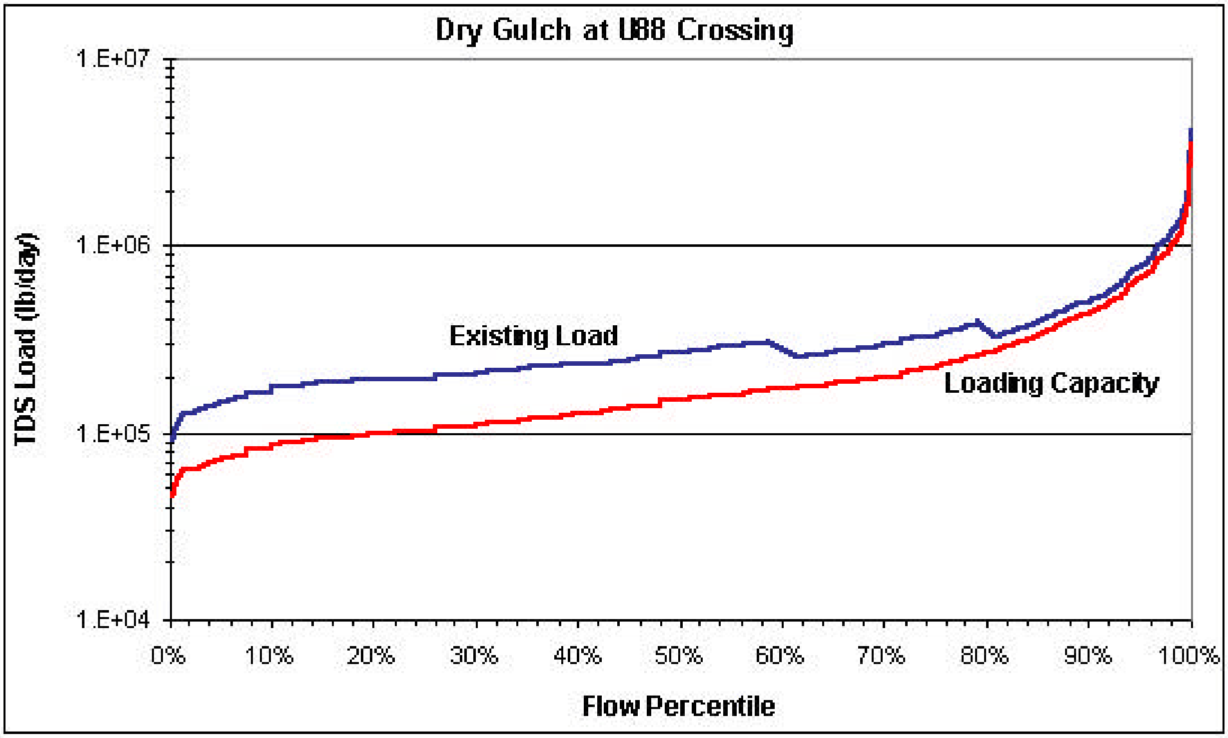

Figure 5-6. Estimated existing TDS loading and loading capacity for the Dry Gulch Creek watershed

6. TMDL Allocation

6.1 Description of TMDL Allocation

A TMDL is composed of the sum of individual waste load allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. Conceptually, this definition is denoted by the equation

$$TMDL = S\ WLAs + S\ LAs + MOS$$

The TMDL is the total amount of a pollutant that can be assimilated by the receiving water while still achieving water quality standards.

For some pollutants, TMDLs are expressed on a mass loading basis (e.g., pounds or kilograms per day). In some cases a TMDL is expressed as another appropriate measure that is the relevant expression for the reduction of loadings of the specific pollutant needed to meet water quality standards or goals. The TMDLs for TDS for the Uinta River , Deep Creek and Dry Gulch Creek are expressed on a mass loading basis.

6.2 Selecting a Margin of Safety

The MOS is a required part of the TMDL development process. There are two basic methods for incorporating the MOS (USEPA, 1991):

- Implicitly incorporate the MOS using conservative model assumptions to develop allocations.
- Explicitly specify a portion of the total TMDL as the MOS, allocating the remainder to sources.

For the Uinta River, Deep Creek and Dry Gulch TMDLs, the MOS was included explicitly by allocating 5 percent of the loading capacity to the MOS. The loading capacity minus the MOS results in meeting a TDS concentration of 1,140 mg/L.

6.3 Allocation Summary

The TMDLs for Uinta River and Deep Creek have been developed for the range of flows measured from October 1976 to September 1981 at the USGS Randlett gage. Using the 54-year record at the Neola gage as the basis, this 5-year flow record is considered representative of long-term conditions. Using the observed flows and a target of 1,200 mg/L TDS, an average annual loading capacity was calculated. Maximum existing TDS loadings were developed using observed water quality data and flows at the Randlett monitoring station (493411). Using these loadings, area-weighted loads were developed to calculate an annual existing load. This existing load was compared to the loading capacity, and a necessary reduction was calculated. The same analysis was performed to establish the Dry Gulch TMDL using data from monitoring station 493414. Tables 6-1 and 6-2 provide summaries of the TDS TMDLs for the Uinta River, Deep Creek and Dry Gulch Creek, respectively. It should be noted that because the TMDLs for Uinta River and Deep Creek were based on flows and concentrations measured at the Randlett monitoring station, the TMDL inherently includes contributions of TDS from Dry Gulch Creek. The three TMDLs are not additive—the Dry Gulch TMDL represents the TMDL and necessary load reductions from the watershed draining to the mouth of Dry Gulch Creek and the Uinta River and Deep Creek TMDLs represent the TMDLs and necessary load reductions for the entire watershed draining to the mouth of the Uinta River (including the Dry Gulch watershed). Because the Dry Gulch TMDL is the more stringent of the two and there isn't likely a significant source of TDS to Uinta after its confluence with Dry Gulch, it can be assumed that meeting the TMDL for Dry Gulch Creek would result in attainment of the TMDL for the Uinta River and Deep Creek.

Section 6.4 provides more detail on the calculation of the loading capacity and determination of the allocations.

Table 6-1. Summary of TDS TMDL for Uinta River and Deep Creek watershed

Source	Annual existing TDS load	Estimated percent reduction	Annual allocated TDS load
Nonpoint Sources:			
Uinta River watershed (incl. Deep Creek)	92,500 tons/yr	21 %	73,100 tons/yr
Point Sources:			
None	0 ton/yr	0 %	0 ton/yr
Total Existing Load	**92,500 tons/yr**	**Load Allocation**	**73,100 tons/yr**
Total Annual Load Reduction = 21 %		**Wasteload Allocation**	**0 ton/yr**
		Margin of Safety[1]	**3,900 tons/yr**
		TMDL = Loading Capacity =	**77,000 tons/yr**

[1] **Margin of safety.** The MOS was included in the analysis explicitly by allocating 5 percent of the loading capacity to the MOS, corresponding to a resulting TDS concentration of 1,140 mg/L.

Table 6-2. Summary of TDS TMDL for Dry Gulch Creek watershed

Source	Annual existing TDS load	Estimated percent reduction	Annual allocated TDS load
Nonpoint Sources:			
Dry Gulch Creek watershed	59,000 tons/yr	34 %	38,800 tons/yr
Point Sources:			
None	0 ton/yr	0 %	0 ton/yr
Total Existing Load	**59,000 tons/yr**	**Load Allocation**	**38,800 tons/yr**
Total Annual Load Reduction = 34 %		**Wasteload Allocation**	**0 ton/yr**
		Margin of Safety[1]	**2,000 tons/yr**
		TMDL = Loading Capacity =	**40,800 tons/yr**

[1] **Margin of safety.** The MOS was included in the analysis explicitly by allocating 5 percent of the loading capacity to the MOS, corresponding to a resulting TDS concentration of 1,140 mg/L.

6.4 Pollutant Loading Scenarios

The TMDL process is designed to establish the total loading a stream can assimilate without causing violation of the water quality standards. Because of the complex hydrology, the interconnectedness of the sources, and the location and temporal record of the monitoring data, the TMDLs do not distinguish between the contribution of TDS from the various tributaries and canals. Therefore, the TMDL analyses focus on and establish the TMDLs for the entire watersheds of the Uinta River and Dry Gulch Creek based on flow. The TMDL analyses are calculated on a yearly basis to account for complex and varying hydrology and critical conditions in the watersheds and consistent year-round violations of TDS water quality standards.

6.4.1 Existing Conditions

The existing conditions represent TDS loadings in the Uinta River and Dry Gulch Creek watersheds calculated using existing monitoring data. As discussed in Section 5.3, existing loads were calculated for days that had recorded TDS concentrations. These individual daily loadings were calculated by multiplying the observed TDS concentrations by the flow for that day and were used to establish an existing loading curve at each station (Figures 5-3 and 5-4). This curve represents the estimated existing TDS loads at all flows occurring over the 5-year analysis period. The calculated area under the existing loading curve represents the total loading over the analysis period. With that total loading, an annual average loading can be calculated. As summarized in Table 6-3, the average annual existing TDS loading in the Uinta River watershed is 92,500 tons/yr and 59,000 tons/yr in the Dry Gulch Creek watershed.

6.4.2 TDS Load Allocation

As discussed in Section 5.1, USGS observed flow at Randlett was used with the 1,200 mg/L target to establish a TDS loading capacity curve for the 5-year period of observed flows (as shown in Figure 5-2). This results in a 385,500-ton loading capacity over the 5 years, with an average annual loading capacity of 77,000 tons/yr of TDS for the Uinta River (Table 6-3). Because 5 percent of the TMDL loading capacity is allocated to margin of safety (corresponding to a resulting TDS concentration of 1,140 mg/L), the allocatable portion of the loading capacity is 73,000 tons/yr.

Likewise, USGS observed flow at Dry Gulch near Fort Duchesne was used with the 1,200 mg/L target to establish the loading capacity for Dry Gulch Creek (Figure 5-3). The analysis resulted in a 204,000-ton loading capacity over the 5 years and an average annual loading capacity of 40,800 tons/yr of TDS for Dry Gulch Creek, as summarized in Table 6-3. After the 5 percent allocation to margin of safety, the allocatable portion of the loading capacity for Dry Gulch Creek is 38,750 tons/yr.

To illustrate the range of reductions needed at various flow and loading conditions for the TMDLs, Table 6-4 presents the loading capacity and existing loads associated with several existing daily loadings used to develop the existing loading curve (and, therefore, the annual existing loads) in the Uinta River. These existing loads represent occurrences of maximum existing loading and maximum exceedances of water quality standards.

6.4.3 Waste Load Allocation

Because there are no identified point sources for TDS in the watershed, the wasteload allocation (WLA) is set equal to zero in both the Uinta River watershed and the Dry Gulch Creek watershed.

Table 6-3. Existing TDS loadings in the Uinta River, Deep Creek and Dry Gulch Creek watershed

Uinta River watershed	
Annual average existing loading	92,500 tons/yr
Dry Gulch Creek watershed	
Annual average existing loading	59,000 tons/yr)

Table 6-4. TDS loading capacity in the Uinta River, Deep Creek and Dry Gulch Creek watershed

Uinta River watershed	
5-year total loading capacity	385,500 tons
Annual average loading capacity	77,000 tons/yr
Dry Gulch Creek watershed	
5-year total loading capacity	204,000 tons
Annual average loading capacity	40,800 tons/yr

Table 6-5. TDS load allocation, existing load, and necessary reduction at various flows

Appropriate flow range	Flow percentile	Flow (cfs)	Existing load (lb/d)	Load allocation (lb/d)	Percent reduction
0%-10%	0.54%	7.60	1.25×10^5	4.66×10^4	63%
0%-10%	1.75%	9.00	1.40×10^5	5.52×10^4	61%
10%-20%	10.73%	14.00	1.82×10^5	8.59×10^4	53%
20%-30%	25.90%	20.39	2.60×10^5	1.25×10^5	52%
30%-40%	31.82%	22.60	2.37×10^5	1.39×10^5	41%
40%-50%	48.57%	29.90	2.63×10^5	1.83×10^5	30%
50%-60%	55.47%	32.40	3.42×10^5	1.99×10^5	42%
60%-70%	69.60%	45.00	4.49×10^5	2.76×10^5	39%
70%-80%	79.03%	60.50	4.90×10^5	3.71×10^5	24%
80%-90%	86.19%	77.00	5.30×10^5	4.72×10^5	11%
90%-100%	90.00%	100.00	6.14×10^5	6.14×10^5	0%
90%-100%	100.00%	2640.00	1.62×10^5	1.62×10^5	0%

7. Potential Control Options

It is important to recognize that since all load reductions are associated with natural background and nonpoint sources, implementation of best management practices to control these sources is purely voluntary with no mandatory time-frames instituted. The local committee reviewing this TMDL has expressed concern regarding the feasibility of achieving the 1,200 mg/L standard but is willing to support the implementation of best management practices along with additional monitoring to evaluate progress towards meeting water quality goals.

Control options will preserve current water rights and needs while optimizing use and minimizing deep percolation of irrigation water. If excess irrigation water is applied to cropland and pastureland, the excess proportion percolates below the rooting zone of the crop where it picks up TDS and returns to the watershed streams either as surface runoff or groundwater baseflow with elevated TDS concentrations. Because TDS also is washed off watershed surfaces and delivered to receiving streams, potential control options should address surface delivery as well as subsurface delivery of TDS. The key to effectively reducing the TDS loads delivered to Uinta River and Dry Gulch Creek while maintaining current water rights and use is to control the TDS concentration in the water moving through the watershed.

Activities to reduce TDS loading throughout the watershed will be a highly localized effort. This report does not specifically propose management activities but rather provides examples of options to control TDS loading to watershed streams. UBAG (1977) and USDA-SCS (1987) discuss potential options for reducing TDS loads in the Uinta River watershed. Those options include the following:

- Increase irrigation efficiency by providing sprinkler irrigation, properly scheduling irrigation turns, reducing flood length and leveling land.
- Line canals and ditches with open concrete lining or replace them with pipe. Seepage losses in canals and ditches can result in mineral pickup and flow return to streams through springs and drains.
- Construct weirs at turnouts to ensure that proper amounts of water are applied.
- Maintain grassed waterways and construct check dams on return flows.
- Maintain uncultivated buffer strips along streams and channels.

An estimated 2.92 and 3.19 tons of salt loading can be attributed to each acre foot of deep percolation within the Dry Gulch and Whiterocks-East Uinta River areas respectively. Following implementation of improved irrigation techniques deep percolation has been found to be reduced by approximately 1 acre foot per acre. Areas identified for implementation of improved irrigation systems are included within the USDA Salinity Report, Uinta Basin Unit, Utah (USDA-SCS, 1987).

In addition to reducing deep percolation of irrigation water it is anticipated that controlling soil erosion from uplands and streambanks will also reduce TDS loading since soils in the lower watershed are slightly to highly saline. Potential control options for reducing soil and streambank erosion include:

- Promoting proper grazing management on uplands and riparian areas to maintain sufficient plant cover to protect the soil.
- Improve condition of riparian areas through plantings, temporary grazing exclusion and development of alternate watering sites.
- Stabilize streambanks through planting deep rooted plant species, placement of rock barbs and revetment to deflect flow away from erosive banks and sloping vertical streambanks to allow vegetation to establish.

These TMDLs are based on a representative flow regime that is determined using historical flow records. Therefore the allocated loadings and associated load reductions are calculated to meet water quality standards assuming the flow conditions remain similar to those established in the TMDL. However, it is possible with salinity control efforts focusing on decreasing TDS loads that instream TDS concentrations may increase. This could be the result of less dilution water available from flood irrigation return flows or higher TDS concentrations of groundwater baseflow. To offset this, the control options for the Uinta River and Dry Gulch Creek watersheds should focus on minimizing deep percolation of irrigation water through improving the efficiency of irrigation practices and conveyances. In order to facilitate the implementation of improved irrigation techniques additional upstream storage options must be pursued. The development of new irrigation water storage would lead to better water management and encourage the conversion from flood to sprinkler irrigation techniques. To address the possibility that implementation may lead to increased instream TDS concentrations and non-attainment of water quality standards this TMDL will utilize an approach that provides for the implementation of load reduction strategies while continuing to collect additional data. If when the load reductions identified in this TMDL are attained or a reasonable effort towards implementation has occurred, and water quality standards are still violated, site specific water quality standards will be developed based upon the additional data collected. Regardless of the short-term effect on instream flows and concentrations, the available and recommended control efforts should improve irrigation efficiencies and water quality will ultimately benefit.

The reasonable assurance that these implementation activities will occur and attempt to meet the load reduction goals is that implementation is currently ongoing under the cooperative efforts of local agricultural producers and the USDI/USDA Salinity Control Program. In fact, approximately 4,400 acres of cropland immediately adjacent to Dry Gulch Creek have already been treated . There is a great deal of local interest among watershed stakeholders to participate in the salinity control program. Limitations to implementation include the availability of cost-share funding and lack of upstream storage on the Uinta and Whiterocks Rivers that would facilitate the conversion from flood to sprinkler irrigation. It is anticipated that with the establishment of this TMDL for the Uinta River, Deep Creek and Dry Gulch Creek watersheds some of the funding shortfalls will be alleviated with 319 funding along with the priority status of other sources of funding associated with approved TMDL watersheds.

8. Future Monitoring

Continued water quality monitoring is essential to evaluate the effects of best management practices as well as progress towards meeting water quality goals and beneficial use support. In addition to the regular and intensive monitoring already conducted by the state and Ute Tribe additional monitoring of springs and shallow wells is recommended to determine the influence of groundwater and deep aquifers on surface water TDS concentrations. Concerns have also been raised regarding the water quality of Dry Gulch Creek above the Hancock Cove and Martin Lateral diversions which corresponds to STORET site 493473 (DRY GULCH AT DIVERSION TO HANCOCK LATERAL). This site should be added to the monitoring schedule to evaluate the quality of water used for irrigation.

Additional water quality information is also needed upstream of the Mancos shale outcrop on Deep Creek to determine whether TDS loading is primarily attributable to this natural geologic formation.

In addition to regular water quality monitoring, upland and riparian areas should be monitored periodically. The purpose for monitoring these areas is to identify where significant sources of sediment and salt originate from. This monitoring will be conducted through the cooperative efforts of the Uinta River Watershed Steering Committee and the specific protocols will be included in the Uinta River Watershed Management Plan.

9. Public Participation

Public participation for this TMDL was accomplished through a series of public meetings with the local Watershed Steering Committee from its inception to its completion. The Committee is comprised of individuals representing key interests within the watershed including the Ute Tribe.

A public hearing on the TMDLs was held on March 18, 2002 with notification of the hearing published in the local newspapers on February 19, 2002 (Uintah Basin Standard). The comment period was opened on February 18 and closed on March 18, 2002. Formal Comments and responses are included in Appendix B.

In addition, the TMDL and dates for public comment were posted on the Division of Water Quality's website at (www.deq.state.ut.us/EQWQ/TMDL/TMDL_WEB.HTM).

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Appendix A

Table A-1. Land use distribution in the Uinta River watershed

Analysis land use	GIRAS land use	GIRAS code	Area (acres)	Area (mi^2)	% of total area
Residential/Urban	Residential	11	1,272	2.0	0.2%
	Commercial And Services	12	755	1.2	0.1%
	Industrial	13	252	0.4	0.0%
	Trans, Comm, Util	14	201	0.3	0.0%
	Mxd Urban Or Built-Up	16	381	0.6	0.1%
	Other Urban Or Built-Up	17	255	0.4	0.0%
Agriculture	Cropland And Pasture	21	123,681	193.3	18.0%
	Confined Feeding Ops	23	40	0.1	0.0%
	Other Agricultural Land	24	342	0.5	0.0%
Rangeland	Herbaceous Rangeland	31	1,496	2.3	0.2%
	Shrub & Brush Rangeland	32	190,205	297.2	27.6%
	Mixed Rangeland	33	39,604	61.9	5.7%
Forest	Deciduous Forest Land	41	6,188	9.7	0.9%
	Evergreen Forest Land	42	213,251	333.2	31.0%
	Mixed Forest Land	43	44,758	69.9	6.5%
Water	Lakes	52	1,290	2.0	0.2%
	Reservoirs	53	1,035	1.6	0.2%
Wetland	Forested Wetland	61	3,833	6.0	0.6%
	Nonforested Wetland	62	1,218	1.9	0.2%
Barren	Bare Exposed Rock	74	332	0.5	0.0%
	Strip Mines	75	81	0.1	0.0%
Tundra	Shrub And Brush Tundra	81	3,972	6.2	0.6%
	Herbaceous Tundra	82	43,709	68.3	6.3%
	Bare Ground	83	4,935	7.7	0.7%
	Mixed Tundra	85	5,849	9.1	0.8%
TOTAL			688,934	1,076.5	100.0%

Table A-2. Land use distribution in the Dry Gulch Creek watershed

Analysis land use	GIRAS land use	GIRAS code	Area (acres)	Area (mi^2)	% of total area
Residential/Urban	Residential	11	800	1.2	0.3%
	Commercial And Services	12	554	0.9	0.2%
	Industrial	13	160	0.3	0.1%
	Trans, Comm, Util	14	128	0.2	0.0%
	Mxd Urban Or Built-Up	16	32	0.1	0.0%
	Other Urban Or Built-Up	17	148	0.2	0.0%
Agriculture	Cropland And Pasture	21	88,553	138.4	29.1%
	Confined Feeding Ops	23	40	0.1	0.0%
	Other Agricultural Land	24	71	0.1	0.0%
Rangeland	Herbaceous Rangeland	31	592	0.9	0.2%
	Shrub & Brush Rangeland	32	108,386	169.4	35.6%
	Mixed Rangeland	33	27,311	42.7	9.0%
Forest	Deciduous Forest Land	41	92	0.1	0.0%
	Evergreen Forest Land	42	52,260	81.7	17.2%
	Mixed Forest Land	43	22,571	35.3	7.4%
Water	Lakes	52	27	0.0	0.0%
	Reservoirs	53	329	0.5	0.1%
Wetland	Forested Wetland	61	74	0.1	0.0%
Barren	Strip Mines	75	42	0.1	0.0%
Tundra	Herbaceous Tundra	82	2,143	3.3	0.7%
	Bare Ground	83	1	0.0	0.0%
Total			304,312	475.5	100.0%

Appendix B

Harry J
JMI

United States Department of the Interior

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DIVISION OF
WATER QUALITY

Mr. Jay B. Pitkin, Branch Manager
Utah Division of Water Quality
Department of Environmental Quality
P.O. Box 144870
Salt Lake City UT 84114-4870

Subject: Attainability of Total Maximum Daily Loads (TMDL's) for Salinity

Dear Mr. Pitkin:

For many years now Utah has had a salinity standard of 1,200 mg/L on streams running thru the Dirty Devil, San Rafael, Price, and Uinta drainages. I understand that Utah is now in the process of developing Total Maximum Daily Loads (TMDL's) for salinity. This letter is intended to provide some insights into geochemical processes effecting attainment of these standards.

As you know, the geohydrology of the Upper Colorado River Basin is somewhat unique. The underlying geologic formation (mancos shale) in the basin is naturally very saline. Groundwater sources typically have fairly constant salinity (2,000 to 3,500 mg/L depending upon their native geochemical makeup). We use this equilibrium to our advantage in the CRBSC Program to reduce salt loading. The program's goal is to improve irrigation efficiency to reduce the groundwater outflow volume. Since the outflow concentration remains relatively constant, the reduced outflow volume translates into reduced salt loads to the mainstem river system.

However, salinity control of the big river system does not translate into salinity control on its smaller, near-ephemeral tributaries. The lower portions of these tributary drainages (even under completely natural conditions) are often dominated by very saline groundwater outflows during all but spring runoff. Groundwater concentrations can be expected to remain fairly constant (2,000 to 3,500 mg/L) under any management scheme due to chemical equilibrium with the mancos shale. Therefore, we would not expect irrigation Best Management Practices to be effective in attaining the present 1,200-mg/L targets in these small tributaries.

Sincerely,

D.P. Trueman

David P. Trueman
CRB Salinity Control Program Manager

cc: Jack Barnett
CRBSC
106 West 500 South
Bountiful UT 84010

Upper Chain Lake

Duchesne County Water Conservancy District

855 East 200 North (112-10)
Roosevelt, Utah 84066
Office: (435) 722-4977
Cellular: (435) 823-5726
Fax: (435) 722-4827

General Manager: Randy Crozier

Board Members:
Keith Mortensen, Chairman
Art Taylor, Vice Chairman
Adrienne S. Marett, Admin. Asst.
Ed Bench, Member
Lynn Burton, Member
D. Brad Hancock, Member
Kent Peatross, Member
Max Warren, Member

Sent to Harry J. Carl

March 6, 2002

RECEIVED
MAR 08 2002
DIVISION OF WATER QUALITY

Mr. Don Ostler
Utah DEQ/Division of Water Quality
P.O. Box 144870
Salt Lake City, Utah 84114-4870

Dear Mr. Ostler:

We are writing to express our concerns regarding the Dry Gulch-Uinta River TMDL process that your agency is leading in Duchesne County.

We started meeting on the Uinta River and Dry Gulch TMDL's in 1997. Jim Christensen was your representative at the time. We have continued meeting with your representatives since that time. Unfortunately, the TMDL plan is proposed for completion of public comment on March 18, 2002 containing what we view as serious technical and political problems. We feel that many of the comments we have made since 1997 have not been addressed.

Some of the issues are:

- Salinity related issues regarding measurement processes (TDS vs. Salt Load), natural salinity vs. man caused, and unachievable TDS goals.

- Stream Classification. The local work group was told in 1997 that the stream classification process was dynamic and the original classifications would be adjusted as data and information was gathered (i.e. temperature and agricultural TDS limits).

- The final draft contains a new stream (Deep Creek) that has never been discussed or addressed in any of the meetings. In fact, the local work group feels that the commitment was made to separate Uinta River from Dry Gulch (instead of adding a stream).

We are requesting that the TMDL process be extended to allow for our concerns to be addressed. We cannot support it in its current form. We would appreciate your personal involvement in this matter to help us reach a solution and we look forward to meeting with you.

If you have any questions or need clarification as to our concerns, please feel free to contact me at the DCWCD office at (435) 722-4977 or on my cellular phone (435) 823-5726.

Sincerely,

Randy Crozier
General Manager

addressed w/ Randy at Water Users Mtg w/Don on 3-12-02

RC:asm

Public Meeting
Uinta River, Dry Gulch Creek and Deep Creek TNML
March 6, 2002

Name Brett Prevedel

Address USDA NRCS
240 W. Hwy 40 (333-4)
Roosevelt, UT 84066

Phone: (435)722-4621 x111
E-mail: Brett.Prevedel@ut.usda.gov

Representing: Individual [ ]
Agency [X]
Group [ ]
Other [ ]

FORMAL COMMENT:

The salinity reduction goals of the TMDL will likely not be met for the following reasons:

- The annual salt load reduction goal is for a percentage of all salt loading (natural and man caused). The goal of a 34% reduction in the total salt load of Dry Gulch would require over 6500 acres of irrigation systems according to USDA salt loading factors. If the land was available to treat, this would cost approximately six million dollars. The TMDL contains data reflecting that the majority of the salt loading is occurring during non-irrigation season so the goals may be impossible to achieve(even if the land was available). This is why the USDA and USDI salinity control efforts concentrate on removing tons of salt based on economics of doing so (instead of using a designated concentration to calculate load reduction).

- The accuracy of stream beneficial use classifications is questionable on many of the designated sections.

- The assumption that USDA salinity control programs will be utilized to achieve the TMDL goals may be inaccurate. Current USDA priorities do not coincide with DEQ priorities.

- Deep Creek is included in the final draft yet no discussion has taken place over the last two years during work group meetings. It needs to be addressed as an individual stream. The local work group feels that DEQ made the commitment to develop separate TMDL documents for the Uinta River and Dry Gulch.

Harry J.

Public Meeting
Uintah River, Dry Gulch Creek and Deep Creek TMDL
March 6, 2002

RECEIVED
MAR 1 2 2002
DIVISION OF WATER QUALITY

Name Moon Lake Water Users Association
Address P. O. Box 235
Roosevelt, Utah 84066
Phone: 435-722-2002
E-mail: drymoon@ubtanet.com

Representing: Individual [ ]
Agency [ ]
Group [X] Moon Lake Water Users Association, Board of Directors representing 72,000 acres of irrigated lands located in the Uintah Basin area of Dry Gulch Creek and Uintah River
Other [ ]

FORMAL COMMENT: The Moon Lake Water Users Association board of directors have directed me to write comments in regard to their concerns related to the February 12, 2002, Draft Statement titled "Total Dissolved Solids TMDL Development for Uintah River, Deep Creek and Dry Gulch Creek, Utah".

1. This Association finds it difficult to understand how we can list the "(instantaneous maximum) Water Quality Standard" of 1,200 mg/L with the data that has been provided. We understand that this is the goal but the wording in this document seems to make it a fixed level that we will achieve. We worry that future employees of the United States Environmental Projection Agency, Utah State Department of Environmental Quality, the Ute Indian Tribe and others will assume that the local water users have agreed to this document and we want to go on record that we do not as it is written.

2. We wonder how you can designate the TMDL levels on estimates, and not wait for the final input of the actual tests that are being collected.

3. This document states very clearly many times that the "major source is seepage from conveyance systems and deep percolation resulting from irrigation ..... We strongly feel that there are other major sources. This document seems to close the door to the fact that stockholders of this Association are working diligently with the Department of Interior and the Department of Agriculture by piping delivery systems and changing to sprinkling systems to reduce the salt load of the irrigation systems on the Uintah River, Dry Gulch Creek.

4. We actually wonder why representatives of our organization were invited to be involved in the local work group if conclusions were made before we became involved. This document has drawn the same conclusions, based on intermittent samples and estimates, as the initial information that we started with. It appears now that this Association can be credited with helping and assisting in these results with no recognition of their representatives past input. The Moon Lake Water Users Association believes the TMDL process could be adjusted so that actual data can be studied. We realize that you have a deadline and need to meet a schedule but we feel that the wording in this document could be carefully adjusted to show that the goals are based on estimates only and can be changed depending on results learned from the final data. It could acknowledge that local agriculture is working to reduce irrigation affects.

The Moon Lake Water Users Association wants to go on record that they do not support the "Total Dissolved Solids TMDL..... February 13, 2002 Draft document as prepared by Tetra Tech, Inc.

Lynn R Winterton, Secretary - Manager

Harry J.

Public Meeting
Uintah River, Dry Gulch Creek and Deep Creek TMDL
March 6, 2002

RECEIVED
MAR 12 2002
DIVISION OF WATER QUALITY

Name Dry Gulch Irrigation Company
Address P. O. Box 265
Roosevelt, Utah 84066
Phone: 435-722-2204
E-mail: drymoon@ubtanet.com

Representing: Individual [ ]
Agency [ ]
Group [X] Dry Gulch Irrigation Company, Board of Directors
Other [ ] representing water users irrigating lands located in the Uintah Basin area of Dry Gulch Creek and Uintah River

FORMAL COMMENT: The Dry Gulch Irrigation Company board of directors held their regular board meeting on March 6, 2002. One of the main items of discussion was the February 12, 2002, Draft Statement titled "Total Dissolved Solids TMDL Development for Uintah River, Deep Creek and Dry Gulch Creek, Utah" prepared by Tetra Tech, Inc. After considerable discussion, they directed me to write their comments and concerns and submit them to this office.

1. The Dry Gulch Irrigation Company does not agree with listing the "(instantaneous maximum) Water Quality Standard" of 1,200 mg/L. The TMDL levels are based on "estimates" and do not have data from the actual tests or final input that is in the process of being collected. The draft TMDL document gives the impression that the 1,200 mg/L level is the answer and that it is the goal of all water users in that area. The Dry Gulch Irrigation Company does not support any document that can be misunderstood by future employees of the Federal Agencies and other organizations that may or may not be involved now.

2. This Association feels that no decision can be made without having sufficient numbers of actual data that will provide reliable and credible background material to make a decision that is accurate.

3. The February 12, 2002 document concerning the TMDL levels in this area seem to point to seepage and deep percolation resulting from irrigation as the major source of problems. Any other source is not mentioned or discussed. The Dry Gulch Irrigation Company feels very strongly that other sources must be considered at the same time. We also want to point out that the agriculture water users in the subject area are attempting to make changes at this time to reduce runoff and seepage using Federal assistance.

4. It appears that the February 12, 2002 document is the same as the original information that we were provided when invited to participate in the "local work group", and we now wonder what the reasons were for us to be involved. The Dry Gulch Irrigation Company does not want to be listed as a supporting party to the document as written.

Please record that the Dry Gulch Irrigation Company does not support the "Total Dissolved Solids TMDL..., February 13, 2002 Draft document as prepared by Tetra Tech, Inc.

Carolyn W. Winterton

Carolyn W. Winterton, Secretary

Public Meeting
Uinta River, Dry Gulch Creek and Deep Creek TMDL
March 6, 2002

Name Mike Montoya
Address 333 So. State St.
Roosevelt, UT
84066
Phone: (435) 722-0805
Email:

Representing: Individual [X]
Agency [ ]
Group [ ]
Other [ ]

FORMAL COMMENT:
Although cognizant of the threat of ~~meeting~~ suit (Commitment) for not submitting a TMDL for Uinta River and Dry Gulch in a timely fashion, I ~~wiser~~ believe it is still far more benefical to spend the time and effort to build a community base of support for this process. The risks involved in alienating the community and the Tribe by persuing this timetable is, in my opinion, reckless.
A realistic achievable target should be the goal of a TMDL, not a ~~[illegible]~~ process to ~~[illegible]~~ obtain an information base which end result is to admend the TMDL, which was set originally without sufficient data.
For the record, I am submitting my comments only as an interested community member and not as a representative of any organization.
(over)

I am opposed to making a TMDL (which is a regulatory mechanism) that is not based on the best available science. I am confident that the best available science (i.e. data collection) has not yet been applied or achieved in this case to date.

Public Meeting
Uinta River, Dry Gulch Creek and Deep Creek TMDL
March 6, 2002

Name Sue
Address
Phone:
Email:

Representing: Individual [ ]
Agency [✓] RC&D
Group [ ]
Other [ ]

FORMAL COMMENT:

Non-point source, non-regulatory, voluntary without mandatory timeframes

Purpose ~~of this~~ document is to Implement & monitor TMDL to verify or change standard to make it more reflective of reality

Does the plan state that the watershed plan will be completed?

Natural vs man-induced is not well defined

1200ppm is not achieveable but the Basin is willing to implement BMP, move forward & make a recommendation for a better number.

Can the deadline be extended?

Can the public comments be included & shown how they were considered. Saying comments were discarded for specific reason is acceptable. →

How will data be collected? Who? When?
The document can not be revisited without good data.
Was this a locally-led group? Some say no. Should that wording be taken out?
Document is not concrete. Document needs to be revised + revisited.

Response to Comments received on Draft Uinta River Watershed TMDL

David P. Trueman, USDI Bureau of Reclamation

Response:

The Division of Water Quality appreciates the information and insight the Bureau of Reclamation is able to provide from many years of addressing salinity within the State of Utah through the Colorado River Salinity Control Program. We recognize the potential conflict in attempting to meet water quality standards for Total Dissolved Solids through measures intended to reduce salt loading. These very same concerns have been expressed by the Uinta River Watershed Steering Committee. The following language was added to the TMDL to address this issue. "If when the load reductions identified in this TMDL are attained or a reasonable effort towards implementation has occurred, and water quality standards are still violated, site specific water quality standards will be developed based upon the additional data collected. Regardless of the short-term effect on instream flows and concentrations, the available and recommended control efforts should improve irrigation efficiencies and water quality will ultimately benefit."

Randy Crozier, Duchesne County Water Conservancy District

Response:

Issues addressed with Mr. Crozier and Don Ostler, Director of the Division of Water Quality at Water Users Meeting on March 12, 2002.

Item #1: See response to Mr. Trueman's comments above.

Item #2: It is outside the purview of TMDL establishment for 303d listed waters to review beneficial use classifications for the listed waterbodies. The process for initiating a review of beneficial use classifications was discussed with Mr. Crozier in the March 12th meeting.

Item #3: Deep Creek is tributary to the Uinta River and as such was included within the purview of the original discussions as were other tributaries such as Montes Creek and Cottonwood Creek. It was not until Deep Creek was recognized as a 303d listed waterbody that it was specifically mentioned within the TMDL.

Brett Prevedel, Natural Resources Conservation Service

Response:

Items #1-4: Concerns raised by Mr. Prevedel are similar to those raised by Mr. Crozier and Mr. Trueman. Please refer to responses to comments above.

Lynn Winterton, Moon Lake Water Users Association

Response:

Item #1: Comment noted

Item #2: The TMDL is based on water quality samples collected by the Division of Water Quality over a period of several years. Due to the lack of instantaneous flow data, modeling of stream flows was required to develop meaningful load estimates. Continued monitoring in cooperation with the Ute Tribe is a critical element of this TMDL. The results of this monitoring will be used to evaluate progress towards achieving water quality goals and determine whether the water quality standard for TDS is achievable.

Item #3: The TMDL has been revised to reflect other significant sources of TDS within the watershed, particularly natural contributions.

Item #4: The TMDL has been revised to address the potential that meeting the load reduction goals through the Salinity Control Program may not lead to attainment of the water quality standard for TDS.

Item #5: The TMDL has been revised to acknowledge the efforts of local agricultural producers in reducing the effects of irrigation.

Carolyn Winterton, Dry Gulch Irrigation Company

Item #1: The 1,200 mg/L water quality standard for Total Dissolved Solids has been established by the State of Utah, Water Quality Board for protection of agricultural beneficial uses including irrigation of crops and stockwatering. Comment noted.

Item #2: See Response to Item #2 of Lynn Winterton's comment above.

Item #3: See Response to Item #3 of Lynn Winterton's comment above.

Item #4: The TMDL has been revised to address specific issues that were raised on the meetings held on March 12^{th} and 18^{th}, 2002.

Mike Montoya, Community Member

Additional monitoring and information gathering is an important element of all TMDLs in Utah. The purpose of continued monitoring is to provide direction and evaluate progress toward meeting water quality goals. The Division of Water Quality looks forward to working with the Ute Tribe and all partner agencies and organizations in moving forward to address water quality concerns within the watershed.

Sue Wight, Dinosaurland RC&D

Item #1: Comments noted and incorporated.

Item #2: Comment noted.

Item #3: Watershed planning efforts within the Uinta River Watershed will continue along with continued monitoring and evaluation.

Item #4: Comment noted.

Item #5: Comment noted.

Item #6: It is the intention of the Division of Water Quality to move forward in a timely fashion and fulfill its obligations to the Clean Water Act and the citizens of the Uinta River Watershed and the State of Utah.

Item #7: Comment noted.

Item #8: The monitoring plan for the Uinta River Watershed in coordination with the Ute Tribe, Division of Water Quality, and the Uinta River Watershed Steering Committee has yet to be completed. It is the intention of the Division of Water Quality to address this issue within the context of continued watershed planning efforts.

Item #9: No wording regarding a "locally-led group" is contained within the TMDL. However local input and review throughout the development of the TMDL has been critical in identifying concerns of watershed stakeholders.

Item #10: Comment noted.