UTAH LAKE - JORDAN RIVER WATERSHED MANAGEMENT UNIT STREAM ASSESSMENT

UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF WATER QUALITY

UTAH LAKE-JORDAN RIVER WATERSHED MANAGEMENT UNIT STREAM ASSESSMENT

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Division of Water Quality
Department of Environmental Quality

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EXECUTIVE SUMMARY

The Utah Lake-Jordan River Watershed Management Unit lies in north-central Utah and includes those streams that drain into Utah Lake and the Jordan River and its tributaries from Utah Lake to the Great Salt Lake. Samples collected during various periods and various frequencies at eighty monitoring sites from July 1, 1995 to June 30, 2000 within the Utah Lake-Jordan River Watershed Management Unit were used to assess water quality and to determine whether or not rivers and streams were supporting their designated beneficial uses. Samples were collected at different frequencies depending upon the site and whether or not the site was part of the Division of Water Quality's (DWQ) cooperative monitoring program. Salt Lake City, the Central Utah Water Conservancy District, and the Jordanelle Technical Advisory Committee were the cooperating agencies.

Samples collected from July 1, 1999 to June 30, 2000 as part of the DWQ intensive monitoring program were collected twice a month during spring run-off and once a month during the rest of the year. No samples were collected in December. The DWQ long-term monitoring sites were collected at the same frequency during the intensive monitoring period, but were only collected eight times prior to this survey. Samples collected by the cooperating agencies were generally collected on a monthly basis each year.

In addition to the data obtained from the above monitoring, data collected at four of the United States Geological Survey sites, as part of their National Water Quality Assessment Program (NAWQA) in the Jordan River watershed, were used to assess water quality. Bacteriological data collected by Salt Lake City and Salt Lake County in streams along the Wasatch Front were also used to assess water quality. The United State's Forest Service provided data on metals in fish tissue from 5 sample locations on the North Fork of the American Fork River. Benthic macroinvertebrate data and sediment data were obtained from Dr. Lawrence Grey, Utah Valley State College, to assess water quality in the Soldier and Thistle Creek watersheds.

Streams were assessed against State water quality standards and pollution indicators to determine if their designated beneficial uses were being met. The streams in the Utah Lake - Jordan River Watershed Management Unit are classified as one of the following or a combination of the following beneficial use classifications: protected as a source of drinking water (1C), secondary contact recreation (2B), cold water game fish (3A), warm water game fish (3B), non-game fish and other aquatic life (3C), other aquatic wildlife (3D), and agricultural use including irrigation and stock watering (4).

There are an estimated 1,314 perennial stream miles within the Utah Lake - JordanRiver Watershed Management Unit, One-thousand twenty-five (1,025) miles (78.0%) were assessed for support of their designated beneficial uses. Of these, 848.5 (82.7%) miles were determined as fully supporting all their beneficial uses, 108.3 (10.6%) miles were assessed as partially supporting, and 68.4 (6.7%) miles were assessed as not supporting at least one designated beneficial use. The Class 2B, contact recreation, beneficial use assessment was done primarily using physical/chemical data and were not considered fully assessed unless bacteriological data were also collected.

One-thousand twenty-five (1,025) stream miles were assessed for aquatic life use support. This was

81.2% of the estimated stream miles that were classified for this beneficial use. Of the streams assessed for aquatic life, 854 miles (83.3%) were assessed as fully supporting, 102.7 miles (10.0%) partially supporting this beneficial use and 68.4 miles (6.7%) were listed as being non supporting

Of the 923 stream miles assessed for agricultural use, 899 miles (97.4%) were assessed as fully supporting, 24.2 miles (2.6%) were assessed as partially supporting and no stream miles were assessed as not supporting the agricultural beneficial use.

Individual Use Support Summary for the Utah Lake - JordanRiver Watershed Management Unit (Stream Miles).

Goals [a]	Use	Size Assessed	Size Fully Supporting	Size Fully Supporting but Threatened	Size Partially Supporting	Size Not Supporting	Size Not Attainable
Protect & Enhance Ecosystems	Aquatic Life	1,025.2	854.1 (83.3%)	0.0 (0.0%)	108.3. (10.0%)	68.4 (6.7%)	0.0 (0.0%)
Protect & Enhance Public Health	Fish Consumption	5.6	0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)	5.6 (100%)	0.0 (0.0%)
	Swimming [b]	101.3	81.7 (80.7%)	0.0 (0.0%)	29.8 27.3%	0.0 (0.0%)	0.0 (0.0%)
	Secondary Contact	101.3	81.7 (80.7%)	0.0 (0.0%)	29.8 27.3%	0.0 (0.0%)	0.0 (0.0%)
	Drinking Water	402.6	402.6 (100%)	0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)
Social and Economic	Agricultural	923.2	899.0 (897.4%)	0.0 (0.0%)	24.0 (2.6%)	0.0 (0.0%)	0.0 (0.0%)
	Total	1,025.4	848.5 (82.7%)	0.0 (0.0%)	108.3 (10.6%)	68.4 (6.75)	0.0 (0.0%)

a - These goals are part of the national water quality goals adopted by the EPA Office of Water and the ITFM in their Environmental Goals and Indicators effort.

b - Class 2B (secondary contact) streams were evaluated as swimmable for proposes of the CWA goals, therefore the swimming and secondary contact classification categories are the same.

No water quality impairments were found when waters classified as 1C (protected as a source of drinking water) were assessed. Of the streams for which there were fecal coliform data available, only one was impaired for contact recreation (Class 2B) because of high concentrations of fecal coliforms.

Major Causes of Impairment

The major causes of impairment were metals, habitat alterations, flow alterations and pH. The major sources of impairment were resource extraction, habitat modification, hydromodification, and agricultural activities. Urban storm-water runoff is considered a significant source of organic loading that creates a large oxygen demand in the lower parts of the Jordan River that causes the

oxygen level in the stream not to meet State standards.

Waters Not Meeting Standards

The Jordan River from Farmington Bay upstream to North Temple was assessed as impaired because of low dissolved oxygen.

Emigration Creek and its tributaries were found not supporting its secondary contact recreation designation because of high concentrations of fecal coliforms. Potential sources for the fecal coliforms are natural sources and septic tanks. Further work needs to be done in this water shed to determine the sources of the fecal coliforms. Little Cottonwood Creek and its tributaries, upstream from the water treatment plant to its headwaters, were impaired because of potential effects of zinc on aquatic life in the stream. The North Fork of the American Fork River and its tributaries above Tibble Fork Reservoir were impaired because of high levels of arsenic found in fish tissue samples. The Utah Department of Health, Utah Department of Environmental Quality, and the Utah County Health Department have issued a fish consumption advisory for these streams. Historical mining activities, mine drainage and tailings, are the sources of metals in Little Cottonwood Creek and the North Fork of the American Fork River.

Violations of the State's temperature standards for aquatic life occurred in the Jordan River from Bluffdale to the Narrows, and Currant Creek, downstream from Mona Reservoir causing them to be listed as impaired.

Evaluation of water chemistry, sediment, and benthic macroinvertebrate data indicated that Soldier Creek, from its confluence with Thistle Creek, upstream to the point where Starvation Creek enters Soldier Creek, was impaired because of excessive sedimentation and phosphorus. Diamond Fork River and its tributaries from its confluence with the Spanish Fork River were impaired because of flow alterations and habitat degradation. This is caused by the excess amounts of water that are diverted into the stream from Strawberry Reservoir. Sixth Water Creek, a tributary to Diamond Fork River was affected by this also. When Diamond Fork pipeline project is completed, water will be piped downstream to the Spanish Fork River, When this occurs, it is expected that these streams can be rehabilitated and support their aquatic life beneficial use designation.

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Introduction

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This management unit includes all streams located in the U.S.G.S Hydrological Units (HUCs) listed in Table 1 and is located in the north central part of the state (Figure 1).

Table 1. Hydrological Unit Codes and Names

Hydrological Unit Code	Hydrological Unit Name
16020201	Utah Lake
16020202	Spanish Fork
16020203	Provo
16020204	Jordan

Materials and Methods

Field and Laboratory–Eighty stations (Figure 2, Table 2) in the Utah Lake-Jordan River Watershed Management Unit were monitored from July 1, 1995 through June 30, 2000 by the Utah Division of Water Quality and its cooperating agencies. In addition, Salt Lake City monitored stations within the Jordan River watershed for total and fecal coliforms. Salt Lake County monitored sites on Emigration Creek for total and fecal coliforms and the U.S. Forest Service collected fish tissue samples on the North Fork of the American Fork River. Data were also collected by the United States Geological Survey under the Great Salt Lake Basins portion of the National Water Quality Assessment Program (NAWQA).

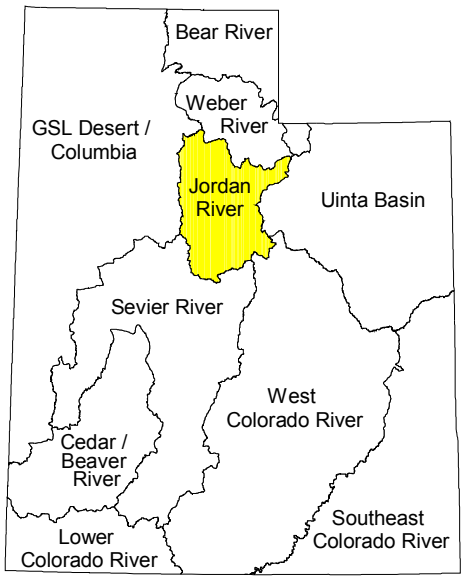

Figure 1. Utah Lake - Jordan River Watershed location.

Physical-Chemical Samples-The Division of Water Quality (DWQ) monitored physical and chemical parameters at 48 sites (Table 2) during the July 1, 1999 - June 30, 2000 intensive monitoring survey. These sites were monitored twice monthly during the spring run-off period and once a month during the rest of the period except for December 1999.

Data from six long term sites were also used to assess water quality. They were sampled at the same frequency as intensive sites during the intensive survey but were only sampled eight times a year during the other years. In addition, the DWQ had cooperative agreements with Salt Lake City, the Central Utah Water Conservancy District, and the Jordanelle Technical and Advisory Committee. These cooperative agreements included the collection and processing of samples at the State Health Laboratory. Twenty-six cooperative sties were monitored. They were generally sampled monthly each year.

The following procedures were used by DWQ. Oxygen, pH, water temperature, and conductivity were measured *in situ*. Instantaneous flows were measured using a flow meters during each survey, unless the station was located at or near a U.S. Geological Survey (U.S.G.S.) gaging station. Water quality samples were collected according to standard field procedures defined and adopted by the Division of Water Quality in 1993 (DWQ, 1993). Chemical analysis in the laboratory included ammonia, total phosphorus, dissolved nitrate-nitrite, dissolved total phosphorus, total suspended solids, total dissolved solids, dissolved calcium, dissolved magnesium, dissolved potassium, dissolved sodium chloride concentration, sulfate, alkalinity and hardness. Turbidity was also determined in the laboratory. Concentrations for the following dissolved metals were determined: arsenic, barium, cadmium, chromium, copper, iron, lead, selenium, silver, zinc, and mercury. Field preservation and laboratory analysis of laboratory samples were performed according to standard procedures used by the Division of Health's State Laboratory and are EPA approved. Cooperating agencies followed guidelines in the DWQ's field procedures.

Physical and chemical data obtained from the U.S. Geological Survey were used to assess water quality in Red Butte Creek, Little Cottonwood Creek and a portion of the Jordan River near Salt Lake City. These data were collected for the Great Salt Lake Basins NAWQA Program. Data were collected from October 1998 through June 2001 on a variable basis. Sampling effort ranged from several times each month to monthly.

Benthic Macroinvertebrate Samples-Benthic macroinvertebrate data collected at 11 sites (Figure 2, Table 2) in the Spanish Fork River area and were used to assess several streams. These samples were collected and identified by Dr. Lawrence Gray, Utah Valley State College. Four surber samples (1 square foot each) were taken randomly in a transect across a riffle/run reach. Data provided to the DWQ included identifications, biomass, and graphical presentations of data.

Sediment Samples-Substrate samples were also collected by Dr. Lawrence Gray at the 11 macroinvertebrate sites. Substrates at each site were collected with a corer to a depth of 10 cm. Several cores were taken at each site and combined into one sample. Only materials pebble or smaller in size (<64 mm) were retained. After drying, the sample was sieved through a set of standard sieves into pebble, gravel, sand, and silt+clay fractions. The percent of the weight of the combined sand-silt-clay fraction to total sample weight was calculated for each sample.

Table 2. Benthic Macrointvertebrate Sample Sites.

Station Identification	Station Description
b1	Little Clear Creek

b2	Thistle Ck at Nebo Creek
b3	Thistle Ck at rehab site
b4	Clear Creek
b5	Starvation Creek
b6	Tie Fork Creek
b7	Lake Fork Creek
b8	Solider Ck at Mill Fork Creek
b9	Lower Soldier Creek
b10	Summit Creek
b11	Hobble Creek

Bacteriological Samples-Total and fecal coliform samples were collected from 24 sites located in Little Cottonwood, Big Cottonwood, Mill Creek, Parleys Creek, Lambs Canyon and Emigration Canyon Creeks by the Salt Lake City Public Utilities Department (Figure 2, Table 3). Samples were usually collected weekly from April or May through October, and then monthly during the other months. Data collected in 1998, 1999, and 2000 were used to assess beneficial use for drinking water (Class 1C) and contact recreation (Class 2B) . These data were provided to the DWQ by Florence Reynolds of the Salt Lake City Department of Public Utilities.

Salt Lake County collected bacteriological samples in Emigration Canyon at five locations (Figure 2) from May 23 to November 7, 2001. Samples were collected at each location in the morning, at noon, and in the afternoon on a weekly basis. Steve Jensen of the Salt Lake County Public Works Department provided the data for analysis.

Table 3. Salt Lake City Bacteria Sampling Sites.

Station ID	Canyon	Site Name
MC1	Mill Creek	UB
MC2	Mill Creek	TOLL GATE
MC3	Mill Creek	FSB
CC1	City Creek	ABOVE GATE
CC2	City Creek	BELOW GATE
LB1	Lambs Canyon	LAMBS
PC1	Parley's Canyon	LAMBS WIER
EC1	Emigration Creek	ABOVE ROTARY
LC1	Little Cottonwood	USF BNDRY
LC3	Little Cottonwood	RED PINE
LC6	Little Cottonwood	BL SNOWB
LC8	Little Cottonwood	PERUVIAN
LC9	Little Cottonwood	SUNNYSIDE
BC1	Big Cottonwood	FS BOUNDARY
BC2	Big Cottonwood	STORM MTN
BC4	Big Cottonwood	L BLANCH
BC5	Big Cottonwood	MILL B
BC8	Big Cottonwood	JORDAN PINES
BC10	Big Cottonwood	SILVER FORK
BC12	Big Cottonwood	SOLITUDE
BC13	Big Cottonwood	BRIGHTON LP
BC14	Big Cottonwood	1ST BRDGE
BC15	Big Cottonwood	2ND BRDGE
BC16	Big Cottonwood	LST HOUSE

Fish Tissue- The Uinta National Forest collected fish tissue samples from 5 sites in the North Fork of American Fork Creek in 1999; North Fork below Tibble Fork, North Fork above Tibble Fork, North Fork above confluence with Major Evans Gulch, North Fork between Pacific Mine and Dutchman Flat, and North Fork above Pacific Mine (Figure 2). Four fish were collected at each site. Brown and Cutthroat trout were collected because they are a naturally reproducing species in the creek and would have the highest potential for long term exposure to contaminants. Muscle tissue samples were collected and analyzed for 21 metals by the Utah State University Toxicology Lab.

Stream Miles-Stream mile estimates for beneficial use support and miles of streams classified were calculated using 1:100,000 digital line graph (DLG) traces stored on the State's Automated Geographic Reference Center's computer and ARC/INFO. Calculations for perennial stream miles using the State's file indicated that there are 1,314 perennial stream miles in the Utah Lake-Jordan River Basin.

Data Analysis-All water quality sample data

and field data collected by the DWQ and cooperating agencies were entered into the Division of Water Quality's data base and compared against the State's water quality standards for each of a river or stream's designated beneficial uses (DWQ, 2000). Data from the U.S.G.S. were analyzed using EXCEL spreadsheets and compared against State standards. Bacteriological data were provided to the State in EXCEL spreadsheets and analyses were done using this software.

Specific methods for assessing beneficial use support for the different beneficial use designations assigned to rivers and streams are listed in Chapter VI, Tables VI-1 through VI-4.

Table 4. Monitoring Sites and Cooperating Agencies

STORET No.	Site Description	Agency	STORET No.	Site Description	Agency
499569	DIAMOND FORK AB MONKS HOLLOW	cuwcd	499654	MILL RACE CREEK AT I-15 CROSSING (2 MI S PROVO COURTHOUSE)	int
499571	DIAMOND FORK CREEK ABOVE SIXTH WATER CREEK	cuwcd	499686	NORTH FORK PROVO R AB SUNDANCE RESORT	int
499573	SIXTH WATER CREEK AB / DIAMOND FORK CREEK	cuwcd	499707	LAKE CK AB CNFL / TIMBER CREEK	int
499576	DIAMOND FORK AB / HAWTHORNE CAMPGROUND	cuwcd	499767	MCHENRY CREEK	int
499232	JORDAN R 1100 W 2100 S	int	499846	UPPER S FORK PROVO R AB CNFL / PROVO R	int
499254	MILL CK AB CENTRAL VALLEY WWTP AT 300W	int	591045	SNAKE CK ABOVE GOLF COURSE	int
499297	BIG COTTONWOODK CK AB JORDAN RIVER AT 500 W	int	591283	DEER CK ABOVE TIBBLE FORK RESERVOIR	int
499358	LITTLE COTTONWOOD CK AB JORDAN R AT 600 WEST	int	591352	DANIELS CK AB DEER CK RESERVOIR	int
499409	JORDAN RIVER BL 6400 S AT I 215 XING	int	591355	DANIELS CK AB FIRST DIVERSION	int
499417	JORDAN R AT 7800 S XING AB S VALLEY WWTP	int	591363	PROVO R AB CNFL / SNAKE CK AT MCKELLARS BRIDGE	int
499418	BINGHAM CK AB CNFL / JORDAN RIVER AT 1300 WEST XING	int	591976	SPRING CK AB CNFL / BEER CREEK @8400 S	int
499444	BUTTERFIELD CK AT MOUTH OF CANYON	int	591984	BEER CK AB CNFL/ SPRING CREEK @4800 W	int
499472	JORDAN RIVER AT NARROW - PUMP STATION	int	499678	PROVO RIVER AT MURDOCK DIVERSION	jtac
499498	AMERICAN FORK RIVER AT MOUTH OF CANYON	int	499681	PROVO RIVER AT OLMSTEAD DIVERSION	jtac
499512	LINDON DRAIN AT CO RD XING AB UT LAKE	int	499683	LOWER SOUTH FORK PROVO RIVER	jtac
499532	CURRANT CREEK BL MONA RES AT MOUTH OF CANYON	int	499685	N FK PROVO R AB CNFL / PROVO R AT WILDWOOD	jtac
499535	SALT CREEK AT CANYON MOUTH BL QUARRY	int	499687	LITTLE DEER CK AB CNFL / PROVO RIVER	jtac
499536	SALT CK @ USFS BNDY	int	499730	PROVO R AT MIDWAY CUTOFF RD XING N OF HEBER	jtac
499538	SALT CK AB CNFL / RED CREEK	int	499733	PROVO R AT JORDANELLE ON US40 XING	jtac
499539	HOP CREEK AB CNFL / SALT CREEK	int	499813	PROVO RIVER US89 ALT XING	jtac
499551	PETEETNEET CK AB MAPLE DELL CMPGD	int	591016	SNAKE CK AB CNFL / PROVO R @BOR GAGE	jtac
499554	SUMMIT CK (SANTAQUIN CANON AB OLD NFS BNDY	int	591321	PROVO R BL DEER CREEK RES	jtac
499558	SPANISH FORK R AB UTAH L (LAKESHORE)	int	591346	MAIN CK AB DEER CK RES AT US189 XING	jtac
499560	SPANISH FORK R AT MOARK DIVERSION	int	499088	JORDAN R AT STATE CANAL ROAD XING	lt
499564	DIAMOND FK CK AB SPANIS FK R AT US6 89 XING	int	499182	JORDAN R AT CUDAHY LANE AB S DAVIS S WWTP	lt
499580	THISTLE CK AB THISTLE LAKE	int	499460	JORDAN R AT BLUFFDALE ROAD XING	lt
499581	BENNIE CREEK .9 MILE AB / FOREST BNDRY	int	499479	JORDAN RIVER AT UTAH LAKE OUTLET	lt
499582	NEBO CREEK AT / FOREST BNDRY	int	499579	SPANISH FK R AB CNFL / DIAMOND FK CK	lt
499586	THISTLE CK AT NFS BOUNDARY	int	499840	PROVO R AB WOODLAND AT USGS GAGE NO.10154200	lt
499587	LAKE FORK AT NFS BOUNDARY	int	499195	CITY CK AB FILTRATION PLANT	slc
499588	SOLDIER CREEK AB CNFL / LAKE CREEK	int	499210	RB2 RED BUTTE CK AB RES	slc

499590	SHEEP CREEK AB CNFL / SOLDIER CREEK-FLOW ONLY	int	499214	EMIGRATION CANYON CK AT ROTARY GLEN	slc
499591	DAIRY FORK AB CNFL / SOLDIER CREEK-FLOW ONLY	int	499216	EMIGRATION CANYON CK AT SWITCHBACK	slc
499592	TIE FORK AT MOUTH	int	499217	MT DEL CK @ U65 XING BL LIL DEL	slc
499593	CLEAR CK AB CNFL SOLDIER CK	int	499219	LITTLE DEL CK@ U65 XING AB LIL DEL	slc
499594	STARVATION CK AB CNFL SOLDIER CK	int	499220	PARLEYS CANYON CK @ U65 XING AB DEL	slc
499595	SOLDIER CK AB STARVATION CK	int	499221	LAMBS CANYON CREEK BL I-80 AT WEIR	slc
499610	HOBBLE CK AT I-15 BDG 3MI S OF PROVO	int	499264	MILL CK AT USF BOUNDARY	slc
499613	LEFT FK HOBBLE CK AB RIGH FORK	int	499310	BC1 BIG COTTONWOOD CK AT USFS BOUNDARY	slc
499614	RIGHT FK HOBBLE CK @ CHERRY CMPGD	int	499366	LITTLE COTTONWOOD CK AT FORSEST BNDRY	slc
int	Division of Water Quality Intensive Monitoring Site		cuwcd	Central Utah Water Conservancy Cooperative Monitoring Site	
lt	Division of Water Quality Long term Monitoring Site		jtac	Jordannelle Technical Advisory Committee Cooperative Monitoring Ssite	
slc	Salt Lake City Cooperative Monitoring Site				

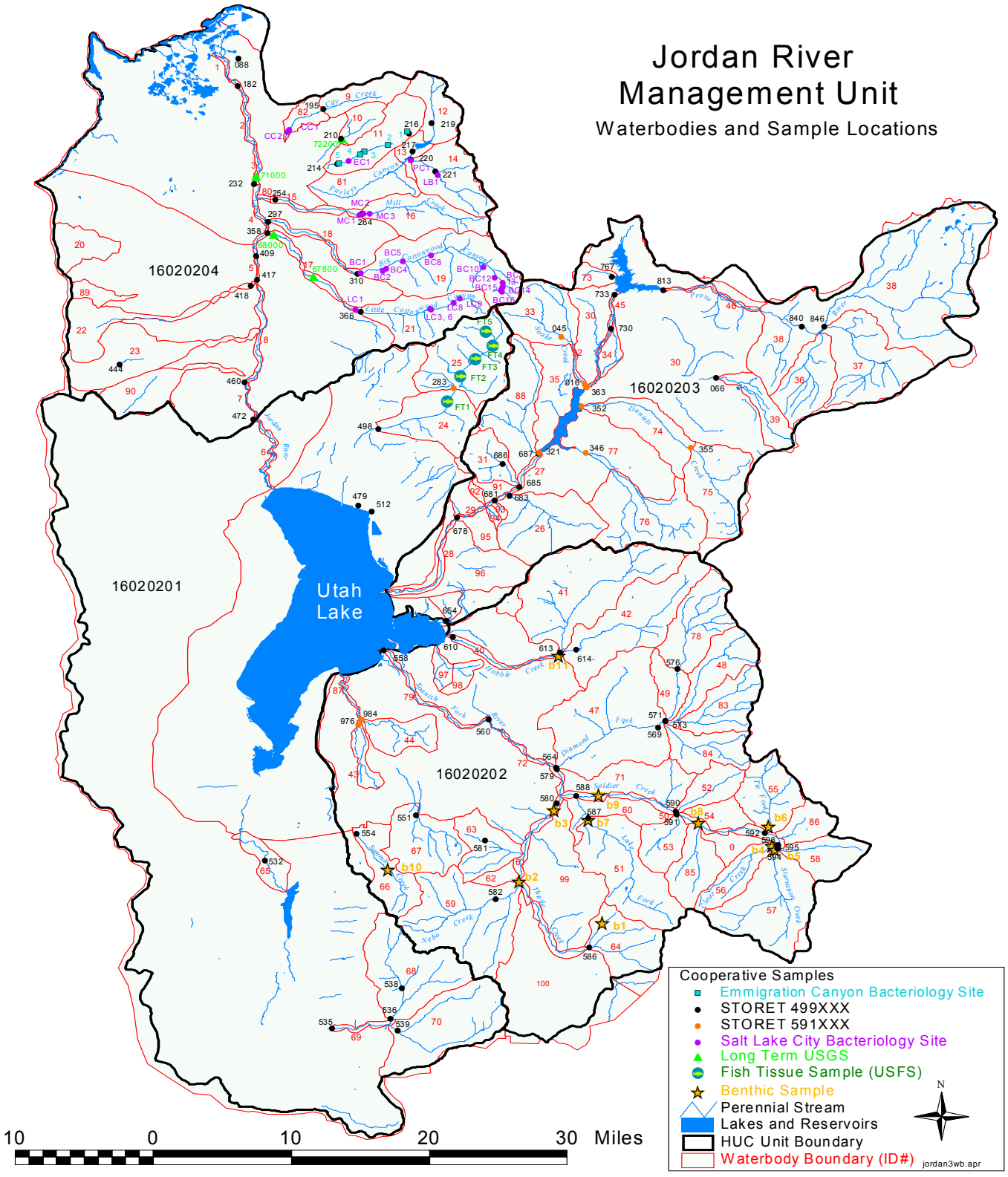

Figure 2. Waterbodies and sampling sites for Utah Lake - Jordan River Watershed water quality assessment.

Results

Beneficial Use Assessment-There are an estimated 1,314 perennial stream miles within the Utah Lake-Jordan River Watershed Management Unit. Some 1,025 miles (78.0%) were assessed for support of their designated beneficial uses. All stream miles designated as Class 2A (contact recreation) waters were assessed using physical/chemical data. Bacteriological data were used to assess 97 miles of streams. Only those segments where bacteriological data were collected are considered fully assessed for Class 2A waters.

Of the1,025 miles assessed, 848 (82.7%) miles were assessed as fully supporting their beneficial uses, 108 (10.6%) miles were assessed as partially supporting, and 68 (6.7%) miles were assessed as not supporting at least one designated beneficial use (Figure 3).

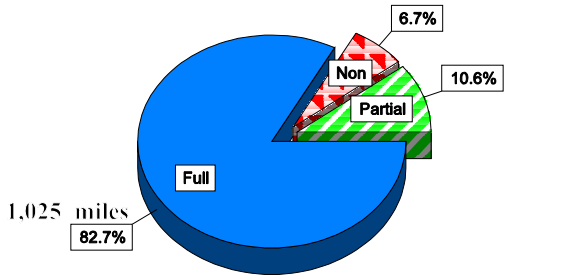

Figure 3. Overall use support for rivers and streams-Jordan River.

Individual beneficial use support is listed in Table 5.

One-thousand twenty-five (1,025) stream miles were assessed for aquatic life use support. This was 81.2% of the estimated stream miles that were classified for this beneficial use.

Of the streams assessed for aquatic life, 854 miles (83.3%) were assessed as fully supporting, 103 miles (10.0%) partially supporting this beneficial use and 68 miles (6.7%) were listed as being non supporting.

Of the 923 stream miles assessed for agricultural use, 899 miles (97.4%) were assessed as fully supporting, 24.2 miles (2.6%) were assessed as partially supporting and no stream miles were assessed as not supporting their agricultural beneficial use classification.

Those stream segments that were determined not to be supporting at least one of their designated beneficial uses are called 'water quality limited segments' and can be placed on a list called the '303(d) list of impaired waters'. This list is submitted to EPA every two years and identifies those waters that are not meeting water quality standards or are assessed as not fully supporting one or more of their designated beneficial uses.

Beneficial use designations for streams are shown in Figure 4 and the overall beneficial use support is shown in Figure 5.

The causes and sources of impairment are listed in Table 6 and Table 7 respectively. The major causes of impairment were metals, habitat alterations, flow alterations and pH. The percent of miles impacted were 5.0, 4.3, 3.2, and 2.4 percent respectively (Figure 6). The relative contribution of each cause to water quality impairment is shown in Figure 7.

The major sources of impairment were resource extraction, habitat modification, hydromodification, and agricultural activities as shown in Figure 8. They affected 5.0, 4.3, 3.8, and 3.8 percent respectively of the stream miles assessed. The relative percent impairment by sources

is illustrated in Figure 9.

A description of the impaired segments and the causes and sources of impairments are listed in Table 8. Figure 6 identifies segments that have elevated levels of total phosphorus.

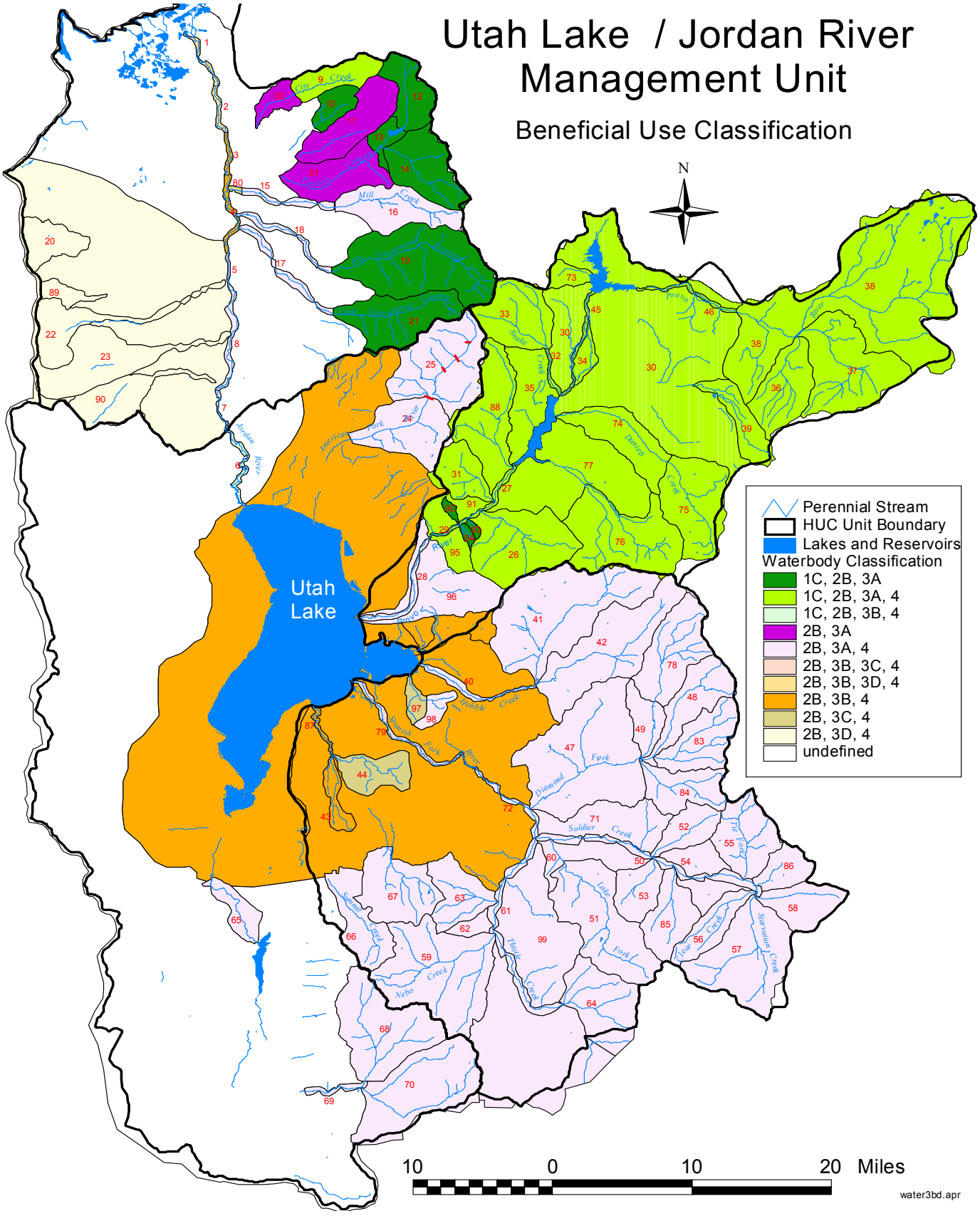

Figure 4. Beneficial use classification designations in the Utah Lake-Jordan River Watershed Management Unit.

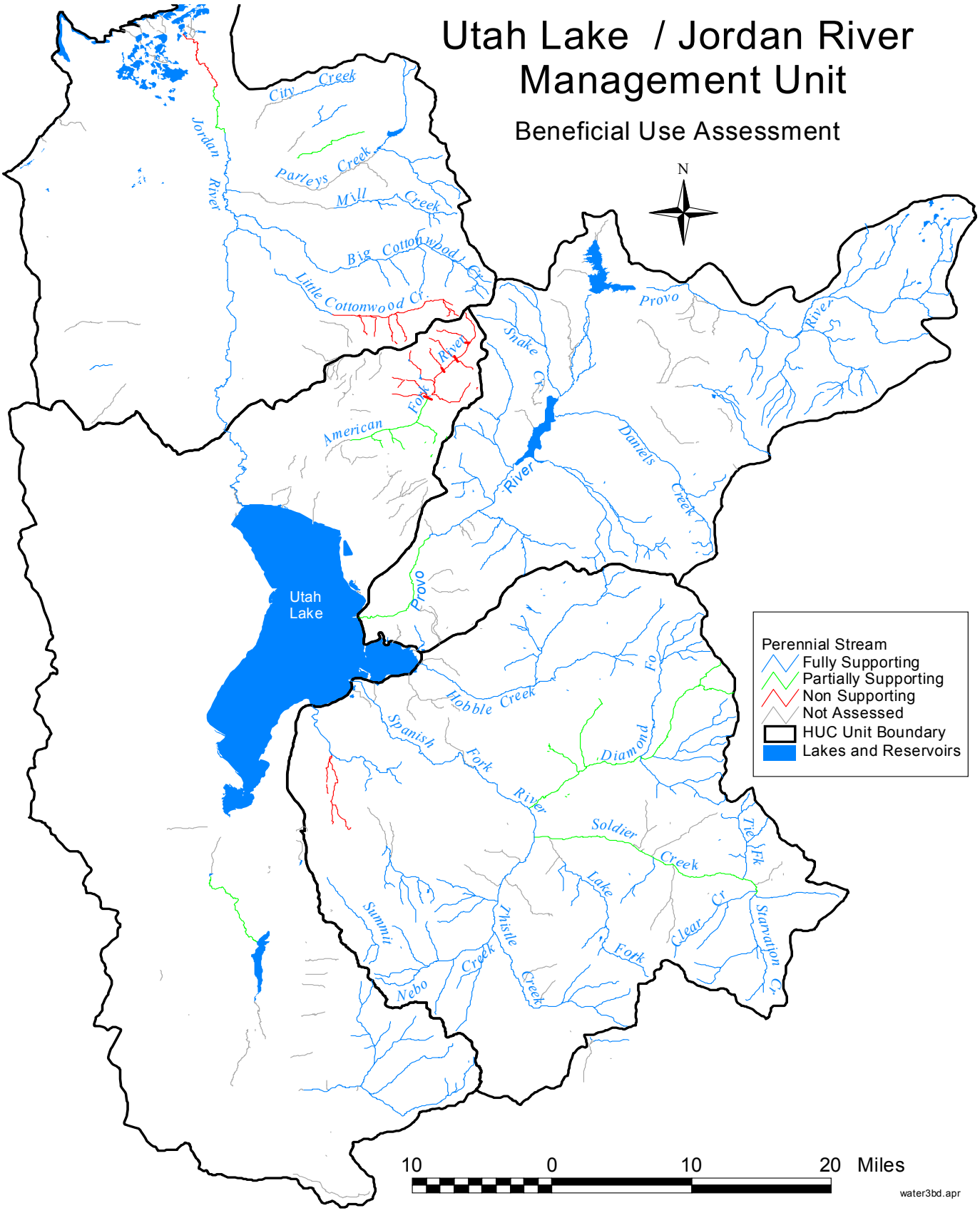

Figure 5. Overall beneficial use support in the Utah Lake-Jordan River Watershed Management Unit.

Jordan River - Three segments of the Jordan were assessed as not supporting at their aquatic life beneficial use support designation. Low dissolved oxygen concentration in two stream segments from Farmington Bay upstream to North Temple violated the dissolved oxygen standards for the aquatic life beneficial use and the Jordan River from Bluffdale to the Narrows exceeded the temperature standard for a Class 3A water (cold water game fish).

Urban storm-water runoff is considered a significant source of organic loading that creates a large oxygen demand in the lower parts of the Jordan River that causes the oxygen level in the stream not to meet State standards. A proposed Nonpoint Source Project, if approved, will evaluate the BOD demand from Farmington Bay upstream to Utah Lake to determine what inputs are occurring that could be causing the low dissolved oxygen concentrations in the lower portion of the river.

Emigration Creek - Emigration Creek was assessed as partially supporting its contact recreation beneficial use designation (Class 2B) after evaluating the bacteriological data provided by Salt Lake County.

Parleys Canyon Creek - Parleys Canyon Creek from 1300 East to Mountain Dell Reservoir has been assessed as not supporting its Class 3A designation because of hydromodification caused by the interstate highway. This segment is a candidate for being assigned a new beneficial use classification because of the road and the inability to correct this situation.

Mill Creek - The upper portion of Mill Creek was assessed as supporting its Class 3A beneficial use and a request to remove it was made in the 2002 303(d) list submission.

Little Cottonwood Creek - Little Cottonwood and its tributaries were assessed as being impaired by zinc in a portion of Little Cottonwood Creek upstream from the Metropolitan Waste Water Treatment Plant to headwaters. A TMDL, addressing the zinc problem, was submitted to EPA on April 1, 2002. If it is approved, this stream segment will be removed from the 303(d) list.

Big Cottonwood Creek - All segments of Big Cottonwood Creek and its tributaries were assessed as meeting their beneficial uses.

American Fork River - Based upon the fish tissue data collected by the U.S.F.S., a fish consumption advisory for arsenic was issued by the State Department of Environmental Quality, the Department of Health and the Utah County Health Department for the North Fork American Fork River upstream from Tibble Fork Reservoir (Appendix VI-2, Figure VI-1). This health advisory resulted in that portion of the river being listed as impaired. The lower portion of the American Fork River exceeded the State Standard of 9.0 for pH.

Provo River - All segments of the Provo River, with the exception of the river from Utah Lake to the Murdock Diversion, were assessed as meeting their beneficial uses. The lower segment was in violation of the pH standard. The source of this violation is unknown, but is thought to be related to algal growth in this section of the river.

Diamond Fork River - Diamond Fork River and its tributary Sixth Water Creek were determined to be impaired by flow alterations and habitat alterations. The source of these impairments is caused by hydromodification when the water is

discharged from the tunnel from Strawberry Reservoir. The project to divert this water down the canyon via a pipeline to the Spanish Fork River should help alleviate these problems.

Soldier Creek - The only other segment in the Spanish Fork drainage that was assessed as impaired was Soldier Creek from its confluence with Thistle Creek to its confluence with Starvation Creek. The impairment was caused by sediment and total phosphorus. Water chemistry data, sediment data, and benthic macroinvertebrate data collected by Dr. Lawrence Gray, was used to make this assessment. Benthic macroinvertebrate data were compared with sites on Hobble Creek, Summit Creek, and Thistle Creek to help make this determination. Graphical plots of number of taxa versus sediment particle size were also used. In addition, field surveys were made by DWQ, Natural Resource Conservation Service, and the Utah Division of Wildlife Resources to evaluate the percent of cut banks and sediment deposition. This segment was then listed under the narrative standard based upon weight of evidence.

Currant Creek - Current Creek, downstream from Mona Reservoir to the mouth of Goshen Canyon was listed as impaired because of temperature violations. The reason for these violations is not known.

All other stream segments assessed in the Utah Lake-Jordan River Watershed Management
Unit were meeting the criteria for their beneficial use designations. Table VI-9 list those segments that were meeting their beneficial use standards, but because of elevated levels of phosphorus, these segments will need to be evaluated further. Through this evaluation, those needing additional work such as diurnal dissolved oxygen data, benthic macroinvertebrate data, and periphyton data will be identified.

Table 5. Individual Use Support Summary for the Utah Lake - Jordan River Watershed Management Unit (Stream Miles).

Goals [a]	Use	Size Assessed	Size Fully Supporting	Size Fully Supporting but Threatened	Size Partially Supporting	Size Not Supporting	Size Not Attainable
Protect & Enhance Ecosystems	Aquatic Life	1,025.2	854.1 (83.3%)	0.0 (0.0%)	108.3. (10.0%)	68.4 (6.7%)	0.0 (0.0%)
Protect & Enhance Public Health	Fish Consumption	5.6	0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)	5.6 (100%)	0.0 (0.0%)
	Swimming [b]	111.5	81.7 (73.3%)	0.0 (0.0%)	29.8 (26.7%)	0.0 (0.0%)	0.0 (0.0%)
	Secondary Contact	111.5	81.7 (73.3%)	0.0 (0.0%)	29.8 (26.7%)	0.0 (0.0%)	0.0 (0.0%)

	Drinking Water	402.6	402.6 (100%)	0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)
Social and Economic	Agricultural	923.2	899.0 (97.4%)	0.0 (0.0%)	24.0 (2.6%)	0.0 (0.0%)	0.0 (0.0%)
	Total	1,025.4	848.5 (82.7%)	0.0 (0.0%)	108.3 (10.6%)	68.4 (6.7%)	0.0 (0.0%)

a - These goals are part of the national water quality goals adopted by the EPA Office of Water and the ITFM in their Environmental Goals and Indicators effort.

b - Class 2B (secondary contact) streams were evaluated as swimmable for proposes of the CWA goals, therefore the swimming and secondary contact classification categories are the same.

Table 6. Stream Miles Impaired by Various Causes within the Utah Lake - Jordan River Water Quality Management Unit.

Cause Category	Contribution to Impairments	
	Major	Moderate/Minor
Cause unknown	0.0	0.0
Unknown toxicity	0.0	0.0
Pesticides	-	-
Priority organics	-	-
Nonpriority organics	-	-
Metals	50.9	0.0
Ammonia	0.0	0.0
Chlorine	0.0	0.0
Other inorganics	0.0	0.0
Nutrients	0.0	18.5
pH	0.0	24.2
Siltation/Sediments	0.0	18.5
Organic Enrichment/low DO	6.1	4.5
Salinity/TDS/Chlorides	0.0	0.0
Thermal modifications	11.4	11.7
Flow alterations	0.0	32.4
Other habitat alterations	0.0	43.7
Pathogen Indicators	0.0	5.6
Radiation	-	-
Oil and grease	0.0	0.0
Taste and odor	-	-
Noxious aquatic plants	-	-
Total toxics	0.0	0.0
Turbidity	0.0	0.0
Exotic species	-	-
Other (specify)	0.0	0.0

* = Category not applicable.
- = Category applicable, no data available.
0 = Category applicable, but size of waters in the category is zero.

Table 7. Stream Miles Impaired by Various Source Categories in the Utah Lake-Jordan River Watershed Management Unit

Source Category	Contribution to Impairments	
	Major	Moderate/Minor
Industrial Point Sources	0.0	10.6
Municipal Point Sources	0.0	10.6
Combined Sewer Overflow	-	-

Table 7. Stream Miles Impaired by Various Source Categories in the Utah Lake-Jordan River Watershed Management Unit		
Source Category	**Contribution to Impairments**	
	Major	**Moderate/Minor**
Agriculture	0.0	38.5
Silviculture	0.0	0.0
Construction	0.0	0.0
Urban Runoff/Storm Sewers	0.0	5.6
Resource Extraction	50.9	0.0
Land Disposal	0.0	0.0
Hydromodification	0.0	38.5
Habitat Modification	0.0	43.7
Marinas	-	-
Atmospheric Deposition	-	-
Contaminated Sediments	-	-
Unknown Source	11.4	35.9
Natural Sources	5.6	5.6
Reservoir Releases	0.0	0.0
Recreation	0.0	0.0

* = Category not applicable.
- = Category applicable, no data available.
0 = Category applicable, but size of waters in the category is zero.
Note: Major category is now used only for waters found not supporting.

Table 8. Impaired Stream Segments in the Utah Lake - Jordan River Watershed										
					Beneficial	Beneficial		Impact		Impact
Polygon	Waterbody			Stream	Use	Use		of		of
No	ID	Name	Description	Miles	Class	Support	Cause	Cause	Source	Source
24	UT16020201-001	American Fork River-1	American Fork River and tributaries from Diversion at mouth of Canyon to Tibble Fork Res	14.0	2B	PS	pH	Moderate	Unknown	Moderate
24	UT16020201-001	American Fork River-1	American Fork River and tributaries from Diversion at mouth of Canyon to Tibble Fork Res	14.0	3A	PS	pH	Moderate	Unknown	Moderate
24	UT16020201-001	American Fork River-1	American Fork River and tributaries from Diversion at mouth of Canyon to Tibble Fork Res	14.0	4	PS	pH	Moderate	Unknown	Moderate
25	UT16020201-002	American Fork River-2	American Fork River and other tributaries above Tibble Fork Dam	30.8	3A	NS	Arsenic	Moderate	Resource Extraction	Major
65	UT16020201-003	Currant Creek	Current Creek from mouth of Gohsen Canyon to Mona Reservoir	7.6	3A	PS	Temperature	Moderate	Unknown	Moderate
47	UT16020202-006	Diamond Fork-1	Diamond Fork Creek from confluence w/ Spanish Fork River to Sixth Water confluence-tribs	20.0	3A	PS	Riparian Habitat Alteration	Moderate	Hydromodification	Moderate
47	UT16020202-006	Diamond Fork-1	Diamond Fork Creek from confluence w/ Spanish Fork River to Sixth Water confluence-tribs	20.0	3A	PS	Riparian Habitat Alteration	Moderate	Habitat Modification	Low
47	UT16020202-006	Diamond Fork-1	Diamond Fork Creek from confluence w/ Spanish Fork River to Sixth Water confluence-tribs	20.0	3A	PS	Riparian Habitat Alteration	Moderate	Agriculture	Low
47	UT16020202-006	Diamond Fork-1	Diamond Fork Creek from confluence w/ Spanish Fork River to Sixth Water confluence-tribs	20.0	3A	PS	Flow Alteration	Moderate	Hydromodification	Moderate
47	UT16020202-006	Diamond Fork-1	Diamond Fork Creek from confluence w/ Spanish Fork River to Sixth Water confluence-tribs	20.0	3A	PS	Stream Habitat Alteration	Moderate	Hydromodification	Moderate
48	UT16020202-009	Sixth Water Creek	Sixth Water Creek and tributaries from confluence w/ Diamond Fork Creek to headwaters	13.4	3A	PS	Habitat Alteration	Moderate	Habitat Modification	Moderate
48	UT16020202-009	Sixth Water Creek	Sixth Water Creek and tributaries from confluence w/ Diamond Fork Creek to headwaters	13.4	3A	PS	Habitat Alteration	Moderate	Hydromodification	Moderate
48	UT16020202-009	Sixth Water Creek	Sixth Water Creek and tributaries from confluence w/ Diamond Fork Creek to headwaters	13.4	3A	PS	Flow Alteration	Moderate	Hydromodification	Moderate
50	UT16020202-012	Soldier Creek-1	Soldier Creek from confluence with Thistle Creek to confluence of Starvation Creek	18.5	3A	PS	Sediment	Moderate	Agriculture	Moderate
50	UT16020202-012	Soldier Creek-1	Soldier Creek from confluence with Thistle Creek to confluence of Starvation Creek	18.5	3A	PS	Sediment	Moderate	Hydromodification	Moderate

Table 8. Impaired Stream Segments in the Utah Lake - Jordan River Watershed										
Polygon No	Waterbody ID	Name	Description	Stream Miles	Beneficial Use Class	Beneficial Use Support	Cause	Impact of Cause	Source	Impact of Source
50	UT16020202-012	Soldier Creek-1	Soldier Creek from confluence with Thistle Creek to confluence of Starvation Creek	18.5	3A	PS	Total Phosphorus	Moderate	Agriculture	Moderate
50	UT16020202-012	Soldier Creek-1	Soldier Creek from confluence with Thistle Creek to confluence of Starvation Creek	18.5	3A	PS	Total Phosphorus	Moderate	Hydromodification	Moderate
43	UT16020202-026	Spring Creek	Spring Creek and tributaries from confluence w/ Beer Creek to headwaters	11.4	3A	NS	Temperature	Major	Unknown	Major
28	UT16020203-001	Provo River-1	Provo River from Utah Lake to Murdock Diversion	10.2	2B	PS	pH	Moderate	Unknown	Moderate
28	UT16020203-001	Provo River-1	Provo River from Utah Lake to Murdock Diversion	10.2	3A	PS	pH	Moderate	Unknown	Moderate
28	UT16020203-001	Provo River-1	Provo River from Utah Lake to Murdock Diversion	10.2	4	PS	pH	Moderate	Unknown	Moderate
1	UT16020204-001	Jordan River-1	Jordan River from Farmington Bay upstsream 6.3 miles	6.1	3C	NS	Dissolved Oxygen	Major	Municipal Discharge	Moderate
1	UT16020204-001	Jordan River-1	Jordan River from Farmington Bay upstsream 6.3 miles	6.1	3C	NS	Dissolved Oxygen	Major	Urban Runoff	Moderate
1	UT16020204-001	Jordan River-1	Jordan River from Farmington Bay upstsream 6.3 miles	6.1	3C	NS	Dissolved Oxygen	Major	Industrial Discharge	Moderate
2	UT16020204-002	Jordan River-2	Jordan River from 6.3 miles upstream to North Temple	4.5	3B	PS	Dissolved Oxygen	Moderate	Municipal Discharge	Moderate
2	UT16020204-002	Jordan River-2	Jordan River from 6.3 miles upstream to North Temple	4.5	3B	PS	Dissolved Oxygen	Moderate	Urban Runoff	Moderate
2	UT16020204-002	Jordan River-2	Jordan River from 6.3 miles upstream to North Temple	4.5	3B	PS	Dissolved Oxygen	Moderate	Industrial Discharge	Moderate
7	UT16020204-007	Jordan River-7	Jordan River from Bluffdale to Narrows	4.1	3A	PS	Temperature	Moderate	Unknown	Moderate
11	UT16020204-012	Emigration Creek	Emigration Creek and tributaries from Foothill BLVD to headwaters	5.6	2B	PS	Fecal Coliforms	Major	Septic Systems	Moderate
11	UT16020204-012	Emigration Creek	Emigration Creek and tributaries from Foothill BLVD to headwaters	5.6	2B	PS	Fecal Coliforms	Major	Wildlife	Moderate
21	UT16020204-022	Little Cottonwood Creek-2	Little Cottonwood Creek and tributaries form Metropolitan WTP to headwaters	20.1	3A	NS	Zinc	Major	Resource Extraction	Major
81	UT16020204-025	Parley Canyon Creek-1	Parley's Canyon Creek and tributaries from 1300 East to Mountain Dell Reservoir	11.4	3C	PS	Habitat Alteration	Moderate	Habitat Modification	Habitat Modification

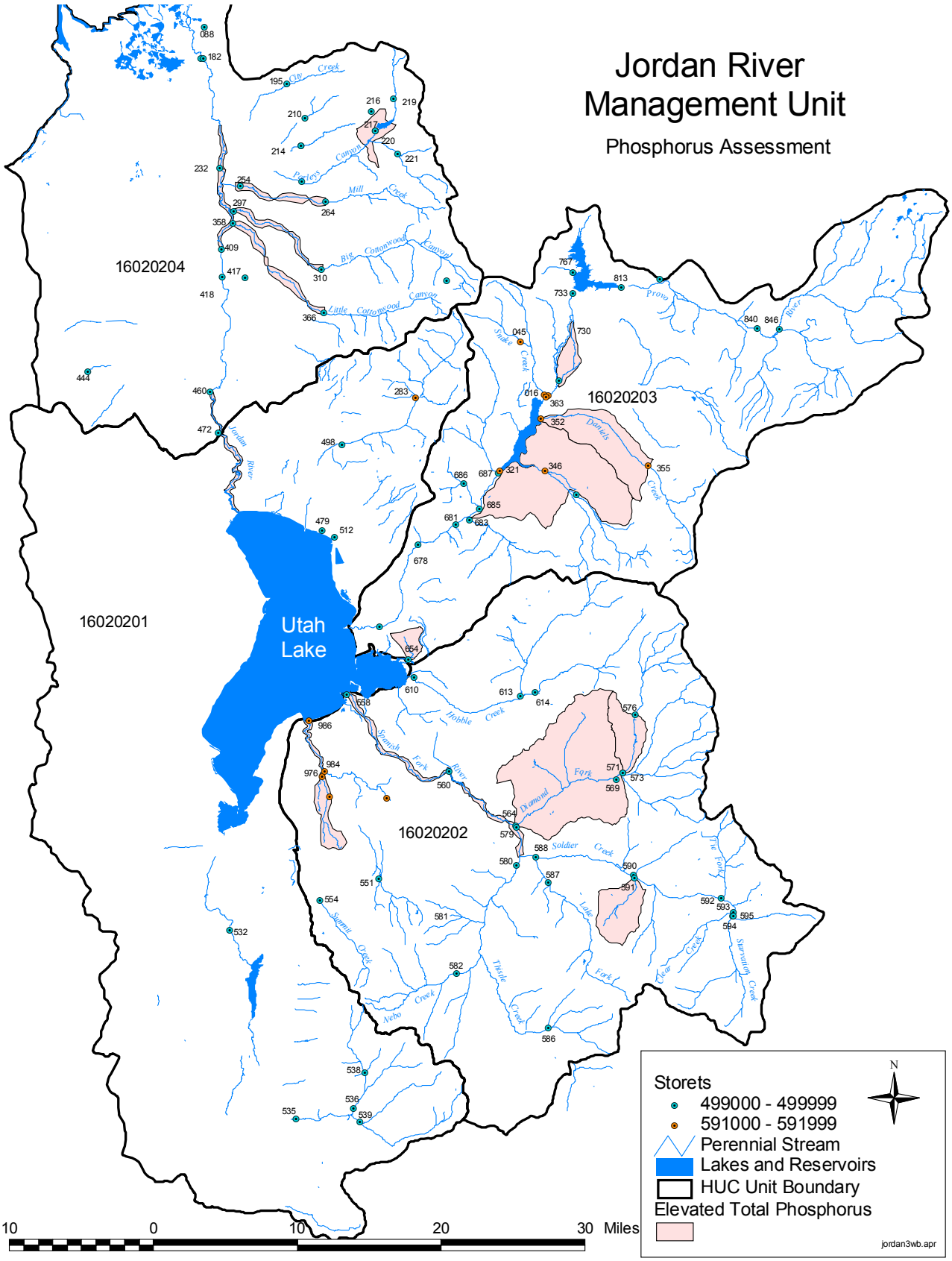

Figure 6. Waterbodies with elevated total phosphorus-Utah Lake Jordan River.

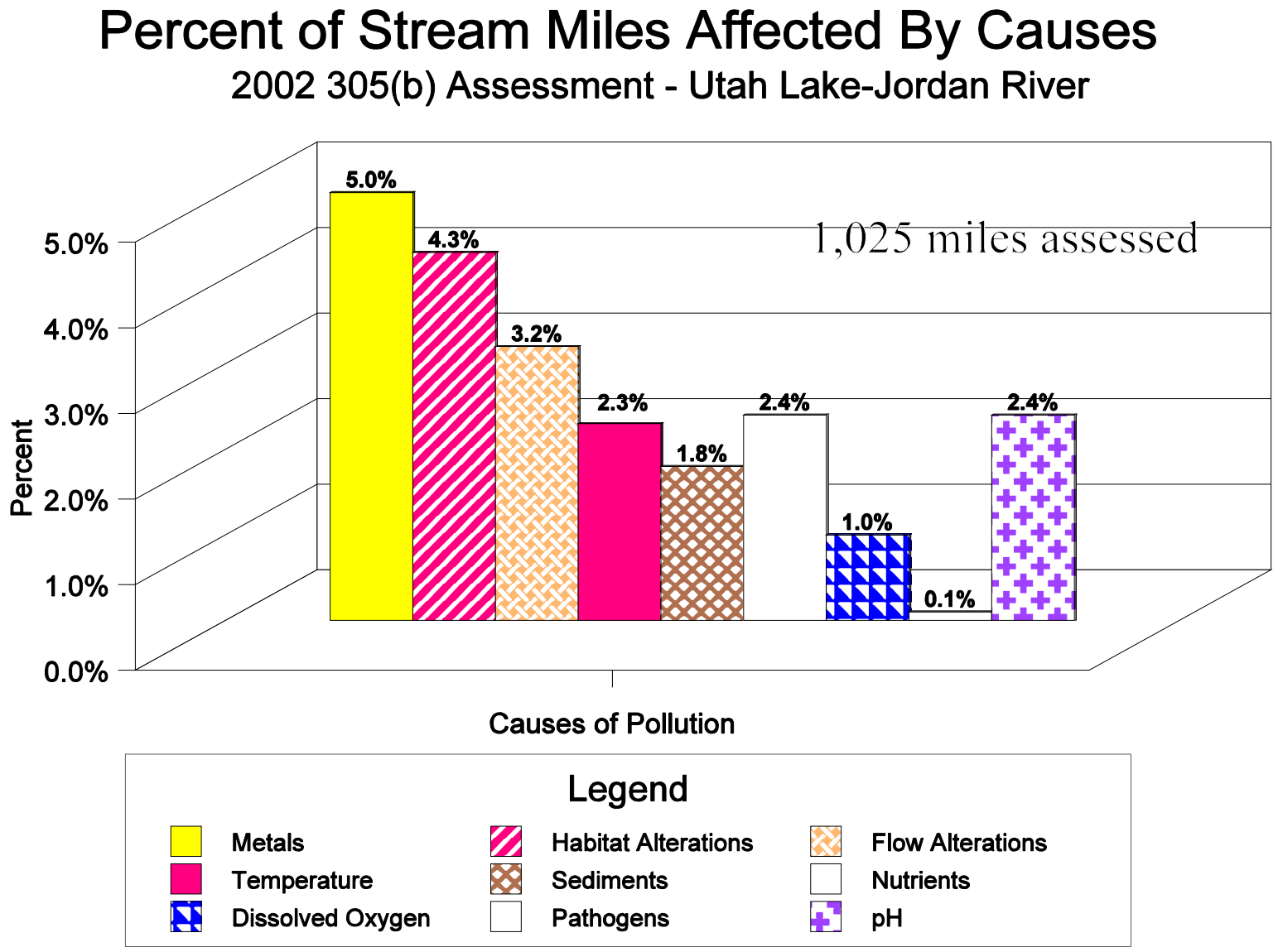

Figure 7. Percent of assessed miles impacted by causes - Utah Lake-Jordan River Watershed Management Unit.

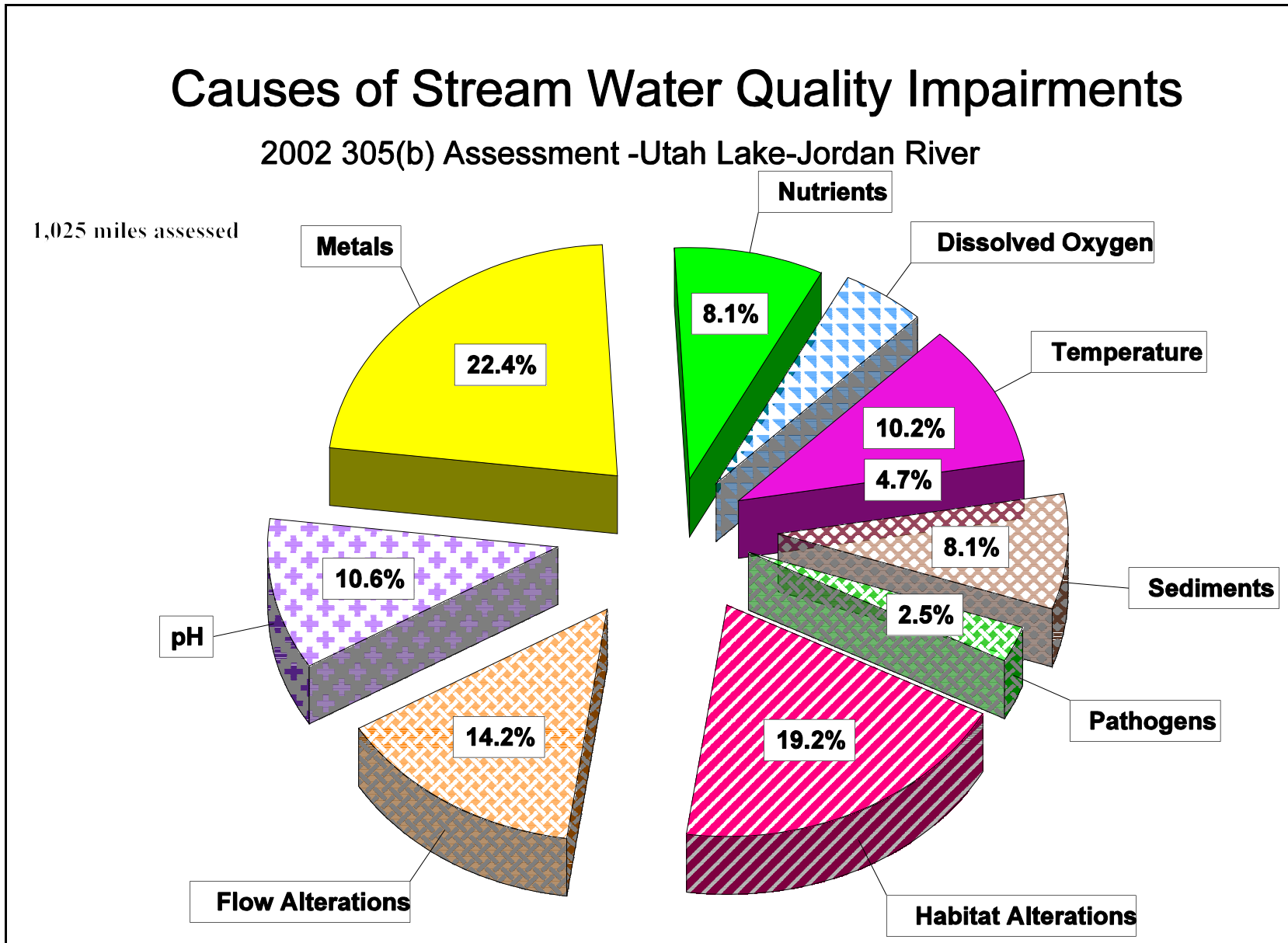

Figure 8. Relative percent contribution by cause to impairment of stream water quality -Utah Lake-Jordan River watershed.

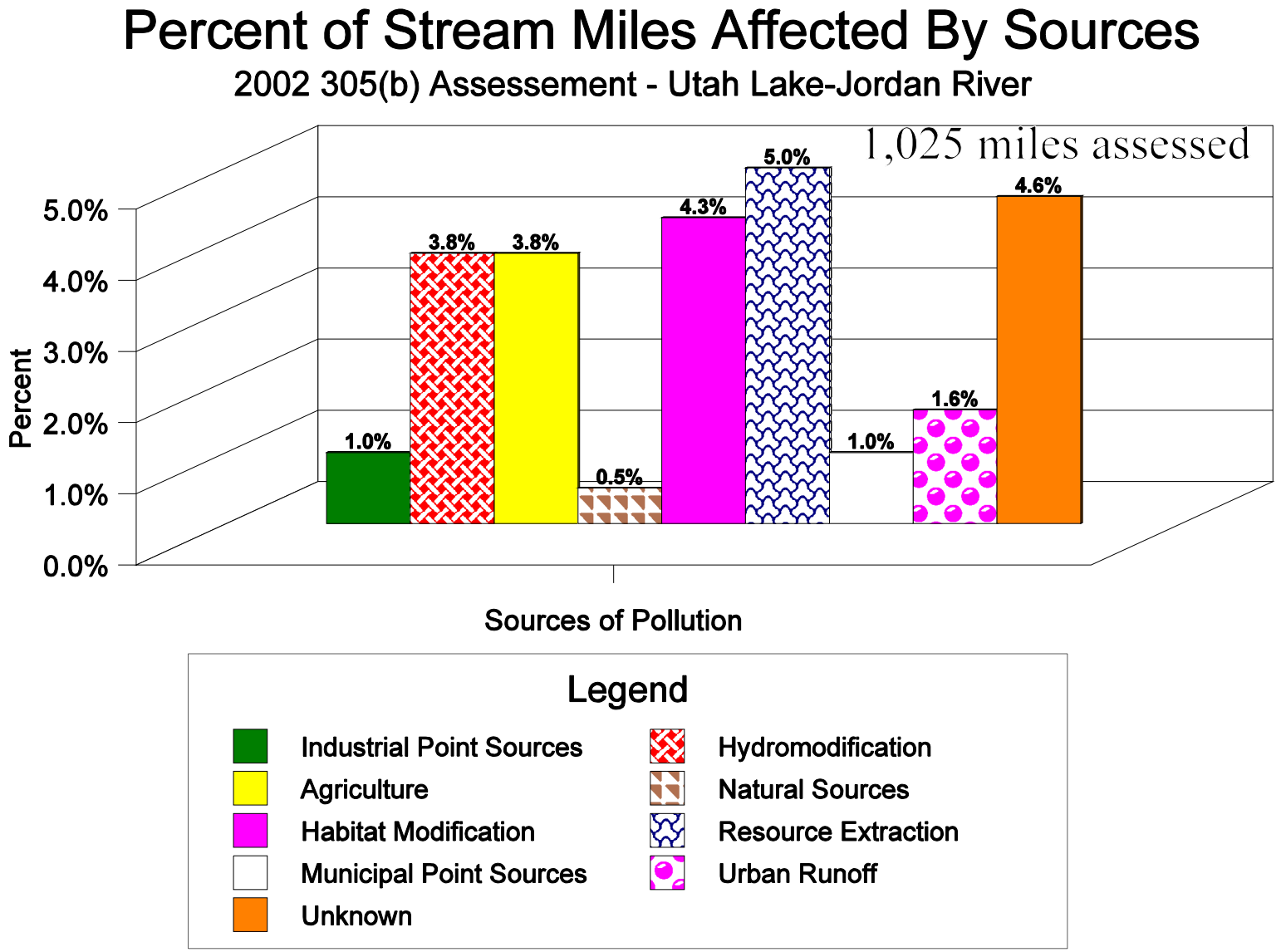

Figure 9. Percent of assessed stream miles impacted by sources - Utah Lake - Jordan River Watershed Management Unit.

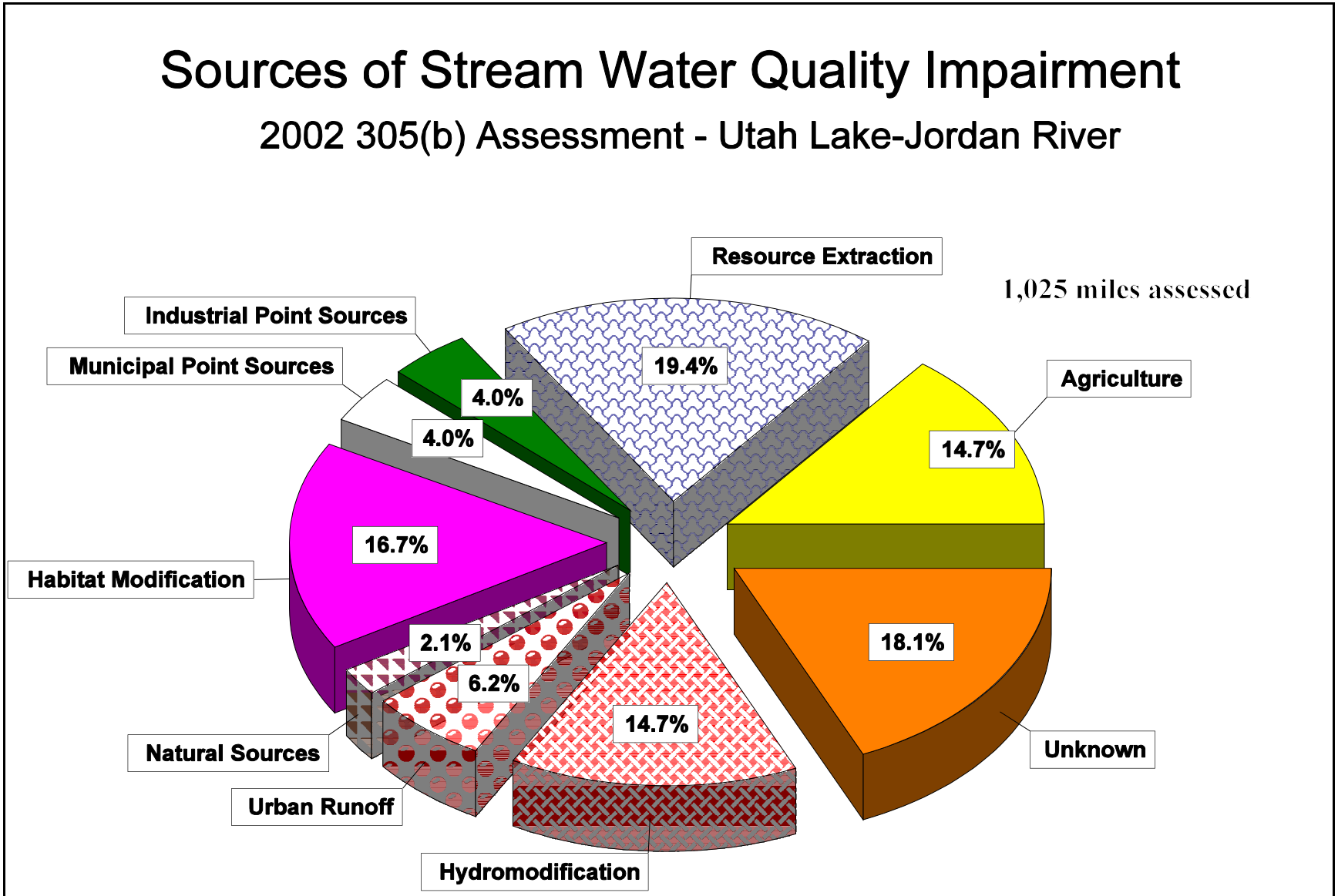

Figure 10. Relative percent contribution of sources to the impairment of stream water quality-Utah Lake-Jordan River watershed.