State of Utah Division of Water Quality
in cooperation with
Salt Lake County Department of Public Works Engineering Division
Water Resources Planning & Restoration Program

JORDAN RIVER WATER QUALITY
TOTAL MAXIMUM DAILY LOAD ASSESSMENT

SALT LAKE COUNTY CONTRACT #PV3040C
STATE OF UTAH CONTRACT #040544

SALT LAKE COUNTY DEPARTTMENT OF PUBLIC WORKS ENGINEERING DIVISION
WATER RESOURCES PLANNING & RESTORATION PROGRAM

JORDAN RIVER WATERSHED WATER QUALITY TMDL ASSESSMENT

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Natalie Rees, M.S., Assistant Water Resources Specialist

May, 2005

Partially funded under a Section 319 grant from Region VIII Environmental Protection Agency in co-operation with Salt Lake County, Salt Lake City Public Utilities, Salt Lake valley Health Department, and the Utah Division of Water Quality.

ACKNOWLEDGMENTS

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Natalie Rees	Salt Lake County Engineering	Report Narrative/Edit
Carolyn Marsing	Salt Lake County Operations	Cost Accounting
Steven F. Jensen	Salt Lake County Engineering	Project Management

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EXECUTIVE SUMMARY

Project Title:	Jordan River Water Quality TMDL Assessment
Project Sponsor:	Salt Lake County; Flood Control Engineering Division; Water Resources Planning and Restoration Program
Contact:	Steven F. Jensen, M.P.A., Program Manager Salt Lake County Government Center 2001 South State Street, Suite N3100 Salt Lake City, UT 84190
Watershed:	Jordan River Sub-Basin
Hydrologic Unit Code:	16020204
High Priority Watershed:	Yes
Pollutant Type:	Chemical & Biological
TMDL Development:	Yes
TMDL Implementation:	No

Initiation Date: May 30, 2003

FUNDING:

Total EPA Grant:	$38,000
Local Expenditures:	$25,334
TOTAL EXPENDURES	$63,334

Summary of Accomplishments

Water samples were collected from 9 stations along the Jordan River between June and August of 2004. These samples were analyzed for 8 priority parameters [total and fecal coliform, total suspended solids, total dissolved solids, stream flow, phosphorus, biological oxygen demand, and E Coli bacteria]. The analysis of these samples, presented in this report, will enable the development of a Jordan River Total Maximum Daily Load (TMDL) for class 2B recreation and 3B fishery uses.

Previous data collected by the United States Geological Survey, the Utah Division of Water Quality, and Salt Lake County are included to provide context for this most recent data.

The conclusion of this assessment is that Jordan River violates both total and fecal coliform bacteria and total phosphorus standards and is not meeting protected uses established under the Utah Waste Disposal Code, which places the River on the State 303(d) list for impaired waters and requires the establishment of TMDL requirements and subsequent remediation measures.

INTRODUCTION

The Jordan River is a 4th order stream originating from Utah Lake, a shallow playa formed during the early Cenezoic era from seismic downward block faulting. The resulting water quality conditions in Utah Lake are eutrophic (nutrient rich). Jordan River receives spring discharges from the Wasatch Front canyons, which are generally mesotrophic (moderately nutrient rich) to oligotrophic (nutrient poor). Shallow groundwater discharges to the Jordan during winter months provide minimum, sustained instream flow estimated by the United States Geological Survey (USGS) at approximately 107,000 acre-feet per year. Higher quality flows from the canyons are often diverted for municipal water supply, resulting in lower quality exchange flows from Utah Lake diversions during the summer months.

In 1975, a Section 208 Water Quality Plan was completed, that resulted in regionalization of nine (9) wastewater treatment plants into three new plants. The water quality of the River has generally improved since implementation in 1978, with the River supporting all of its protected beneficial uses with exception of the Class 3B Dissolved Oxygen (DO) standard for aquatic habitat. Illicit discharges and stormwater runoff are the single remaining sources of man-induced contamination. Presently, the causes/sources of the DO problem in the lower Jordan are not understood.

The need for this project is to determine the potential causes and sources of contamination that result in violation of the Class 3B dissolved oxygen standard on the lower Jordan River. The State of Utah conducted an assessment of the Jordan River in 1998, which indicated that DO from North Temple downstream failed the instream standard. Due to holding time limitations, the State did not collect bacteria, BOD, or other pertinent indicator parameters which would suggest causes and sources of violation of Class 2B recreation standards for fecal coliform. However, data collected in 1992-1993 by Salt Lake County indicate the possible causes.

PROJECT GOALS, OBJECTIVES, AND ACTIVITIES

The goal of this project was to determine the causes and sources of low DO levels in the lower Jordan River, which results in the impairment of the Class 3B aquatic habitat standard, to enable potential restoration of the conditions that will sustain higher DO levels. Fecal coliform impacts to Class 2B uses are also likely.

To achieve this goal, the objective was to monitor baseline conditions in the Jordan River from July through September, 2003. Due to delays with funding and seasonal limitations, this data was collected June through August, 2004. Three tasks were identified to meet the baseline monitoring objective:

1. In coordination with the State of Utah, Salt Lake City and Salt Lake County, identify 10 water quality sampling stations along the Jordan River, and collected at least 5 grab sample sets per month for each station (a total of approximately 180 samples).

2. Deliver samples to the Salt Lake City Public Utilities Water Laboratory for analysis of Total Phosphorus, Biochemical Oxygen Demand, Fecal Coliform, Total Coliform, E-Coli, Total Suspended Sediment, and Total Dissolved Solids.

3. Compile water quality data into draft and final interpretive reports to be reviewed by the cooperating agencies and submitted to the State of Utah and Region VIII EPA. In addition, Salt Lake County submitted mid-year and semi-annual reports as necessary for inclusion in EPA's GRTS system. Salt Lake County has electronically transferred data collected during this study to State Water Quality for STORET updating and analysis.

TASK	OUTPUT PLANNED	OUTPUT ACTUAL	QUANTITY PLANNED	QUANTITY ACTUAL	COMPLETION PLANNED	COMPLETION ACTUAL
SAMPLING	Collect grab samples at 9 Jordan River locations	Collected grab samples at 9 JR locations	180 Sample Sets	180 Sample Sets	July – September 2003	June – August 2004
ANALYSES	Perform field and laboratory analyses	Performed field and laboratory analyses	180 Sample Sets	180 Sample Sets	June—August 2004	June—August 2004
REPORTING	Submit mid-year and final project report	Submitted mid-year and final project reports	2 Reports	2 Reports		December 2003 July 2004

The project date was delayed by grant/contract processing time. The County received the grant contract from the State in June of 2003 and signed the agreement in June of 2003. The State of Utah submitted the grant to the Environmental Protection Agency and the agreement was signed in August of 2003.

Evaluation of Goal Achievement and Relationship to the State NPS Management Plan

Despite the delayed project start-up, sufficient samples were collected from June through August which enable the State of Utah to place sections of the Jordan River on the State's 303(d) list, by providing data not previously collected during the statewide 303(d) assessment.

The design of this assessment integrated five sampling locations in downstream proximity to existing watershed development, thus achieving a watershed wide approach. The collection schedule was effective in identifying data spikes useful in further isolating potential nonpoint pollutant discharge locations on the River.

GENERAL WATERSHED INFORMATION

Geography

The Jordan River Watershed is a closed basin that drains a total area of ~805 square miles (515,200 acres). The Watershed is bounded on the east by the Wasatch Mountains, on the west by the Oquirrh Mountains, and on the south by the Traverse Range. The Great Salt Lake is the eventual recipent of water in the north-flowing Jordan River.

The elevation of the Great Salt Lake is approximately 4,200 feet depending on precipitation and water availability. The Wasatch Range to the east of the Jordan River reaches elevations over 11,000 feet and the Oquirrh Mointains to the west of the Jordan River, reach elevations of over 9,000 feet. The land surface between these ranges consists of a series of benches, each of which slope gradually away from the mountains and drop sharply to the next bench.

The Jordan River meanders for approximately 58 river miles flowing from the outlet of Utah Lake north to the Great Salt Lake. Seven major tributary streams (Little Cottonwood Creek, Big Cottonwood Creek, Mill Creek, Parley's Creek, Emigration Creek, Red Butte Creek and City Creek) feed into the River as it flows north to the Great Salt Lake. Notably, each of the Jordan's major tributaries originate in the Wasatch Mountains and flow westward to the Jordan River; no major streams originate from the west side of the valley.

Land Use

Approximately 370 square miles (236,800 acres) of the Jordan River Watershed are in the rugged Wasatch, Oquirrh and Traverse ranges. With the exceptions of limited portions of Emigration, Big Cottonwood and Little Cottonwood canyons, the mountainous areas are almost entirely uninhabited. Most of the lands in the upper watershed are managed by the U.S. Forest Service, which administers 91,933 acres of national forest lands in the Wasatch Range. In addition, the State of Utah has scattered land holdings of 9,778 acres throughout the watershed and owns the beds of all navigable streams and lakes. Valley bottoms are mostly private lands. Industrial lands are fairly well scattered throughout the valley with the most significant cluster in the northwest. Agricultural lands are located in the southern and southwestern portions of the valley with some irrigated acres in the northwest. Conversion of irrigated agricultural land to residential use, primarily in the southern end of the valley, is the current trend.

Demographics

Salt Lake Valley, the major population and employment center in the State, is currently home to over 800,000 residents. The population density for the county grew from 900 people per square mile in 1990 to 1,218 people per square mile in 2000 (SLCO, 2005). Much of the county's rugged terrain, however, cannot be developed. Consequently it may be more appropriate to consider the population density of Salt Lake Valley which is currently approaching 2,000 people per square mile. The rate of growth through the year 2020 is expected to average 1.9 % annually, but should range between 0.5 % and 2.8 % throughout the period. Projected population for the year 2020 is 1,300,100. Employment figures are projected to out-strip population growth at an annual growth rate of 2.31%. The overall pattern is a significant movement away from dependence on the state's traditional goods-producing economic base and toward service-producing industries as the driving sectors in the Utah economy.

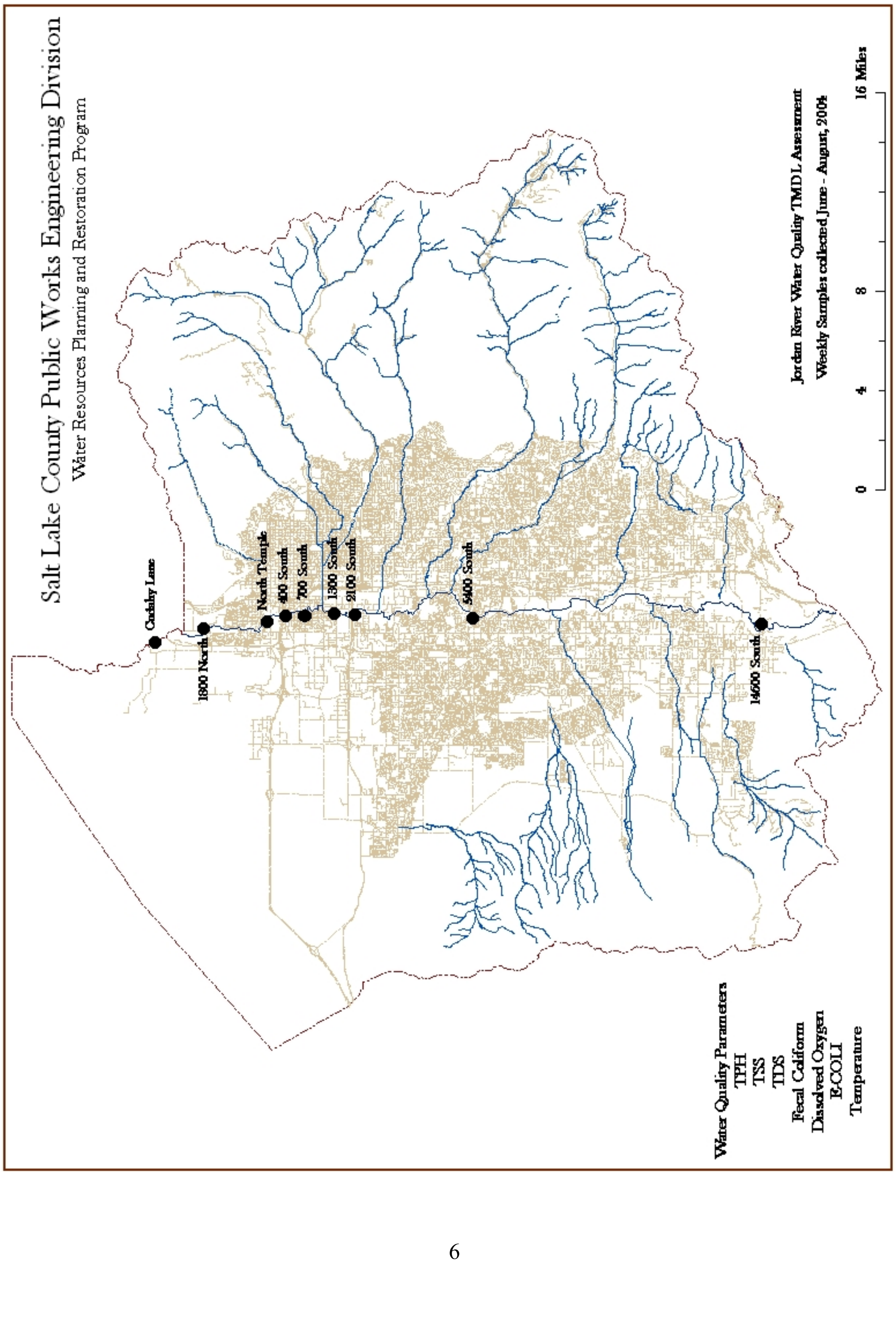
Climate

Seasonal extreme temperatures in the valley range from -30° F in the winter to 110° F in the summer and water surface evaporation in the valley averages 42 inches per year. The average frost-free season for the valley area is approximately 200 days and usually occurs between the middle of April and the end of October. As is the case with many western watersheds, annual precipitation totals vary dramatically. As a result of large differences in elevation, average annual precipitation ranges from 12 inches in the lower valleys to 50+ inches in the highest mountain areas. Snow accumulation and melt is a very significant feature in terms of the annual hydrologic cycle for this watershed.

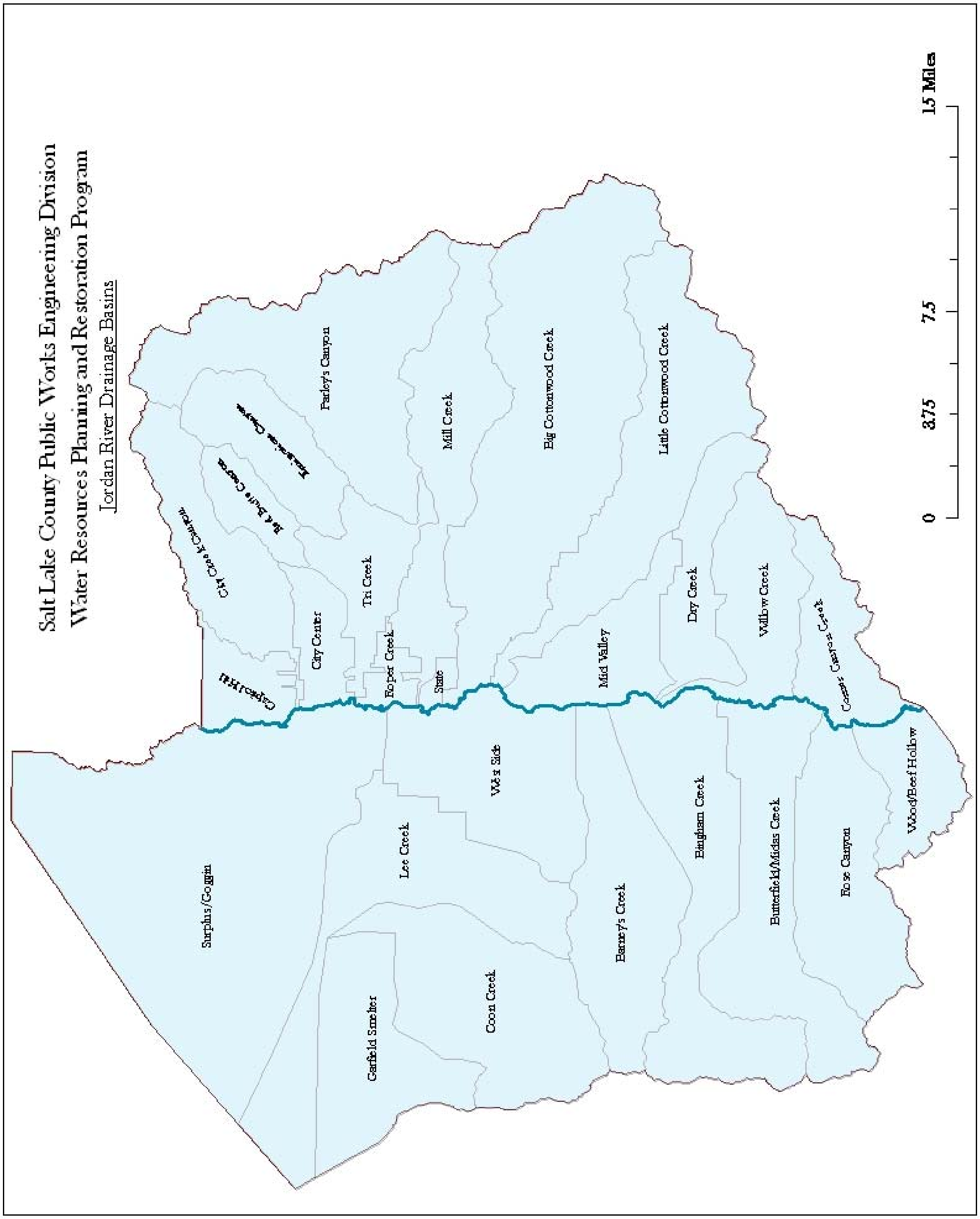
Watershed Mapping

The information mapped on the following pages includes sampling locations, drainage basins within the watershed, property ownership patterns for the watershed, and geological age of bedrock materials.

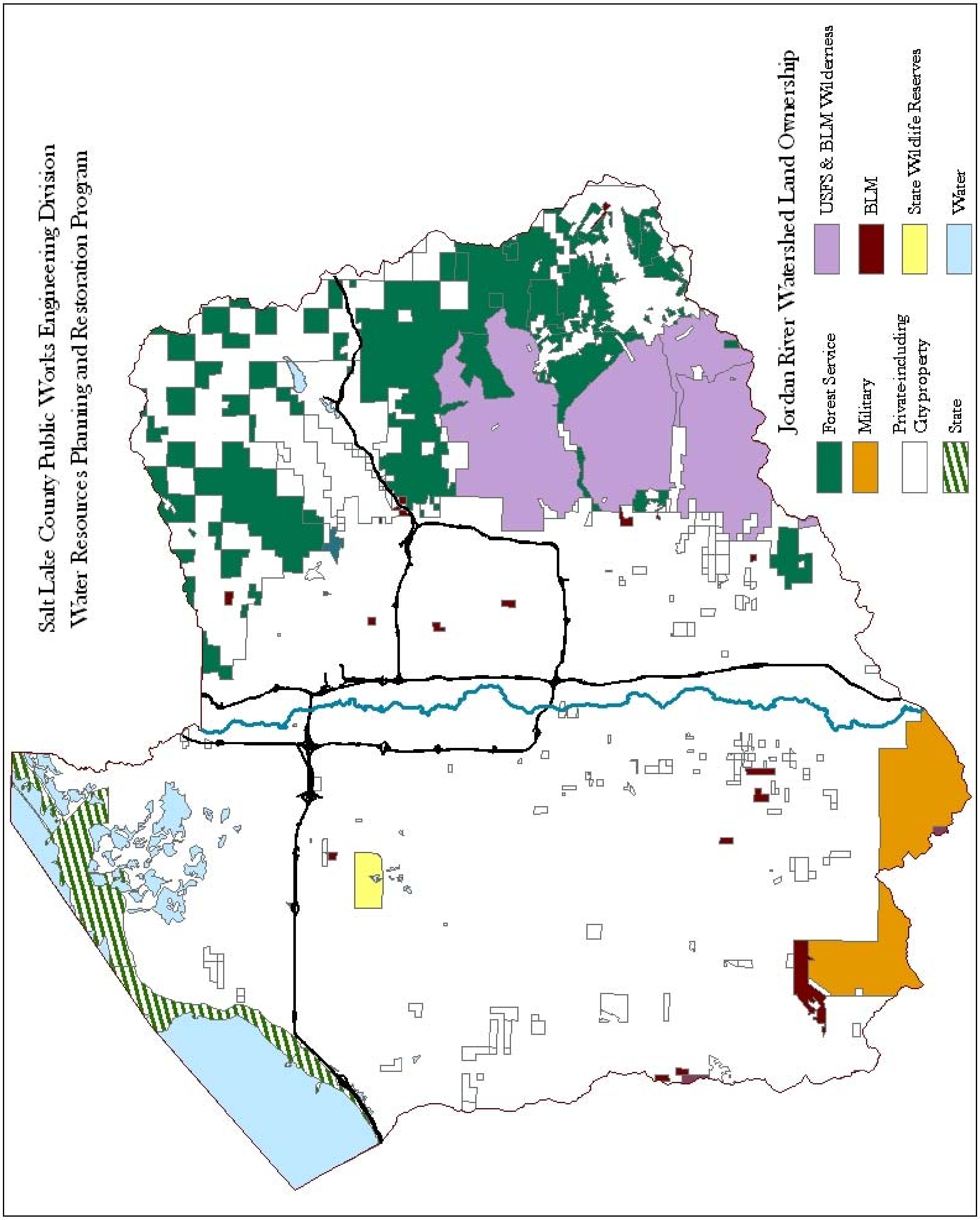
PROJECT LOCATION MAP



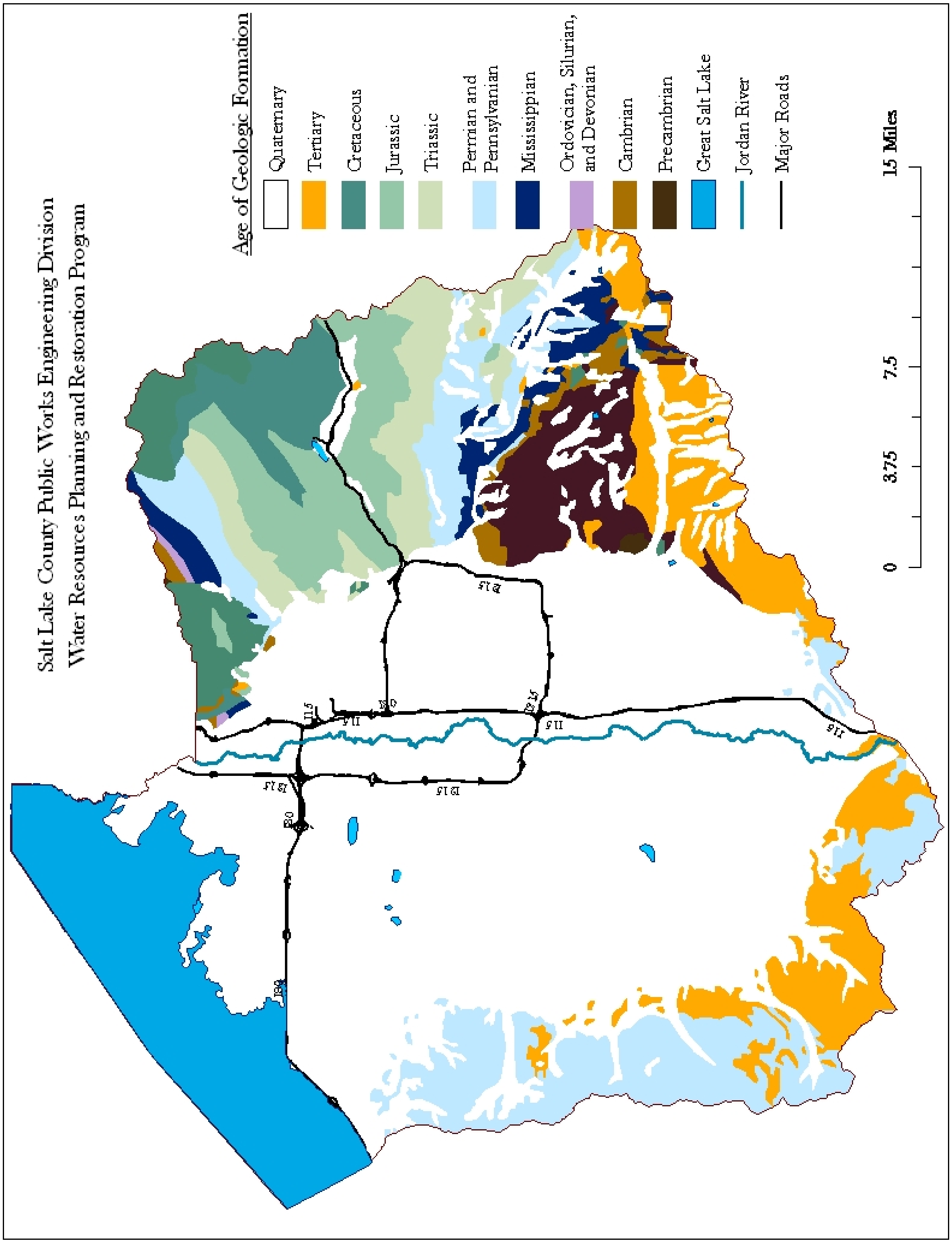
JORDAN RIVER DRAINAGE BASINS



PROPERTY OWNERSHIP MAP



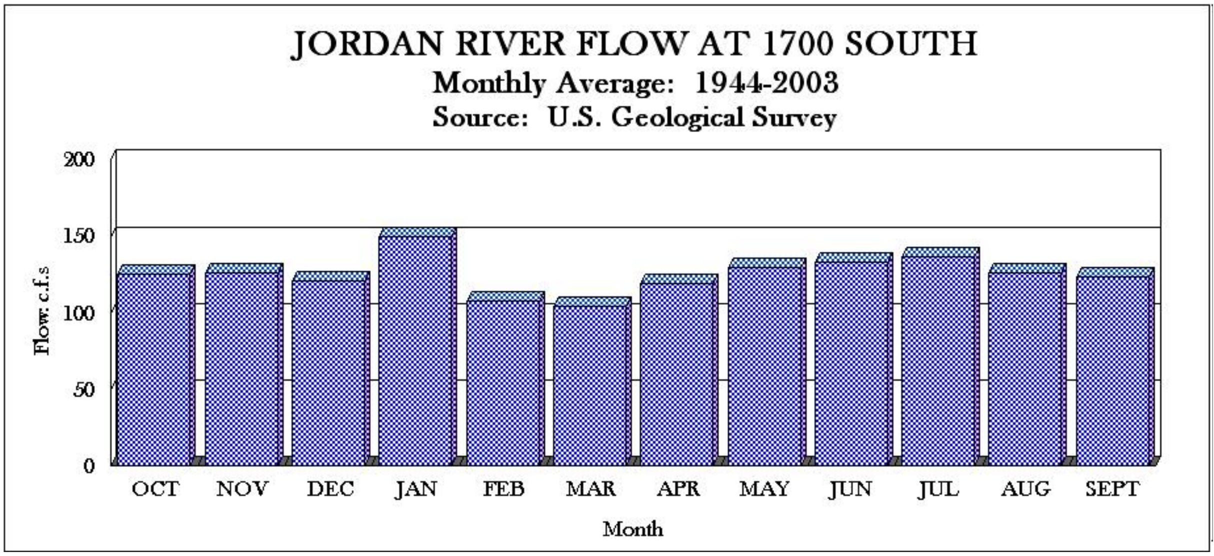
GEOLOGY MAP


Salt Lake County Public Works Engineering Division
Water Resources Planning and Restoration Program
Age of Geologic Formation
Quaternary
Tertiary
Cretaceous
Jurassic
Triassic
Permian and Pennsylvanian
Mississippian
Ordovician, Silurian, and Devonian
Cambrian
Precambrian
Great Salt Lake
Jordan River
Major Roads
0
3.75
7.5
15 Miles

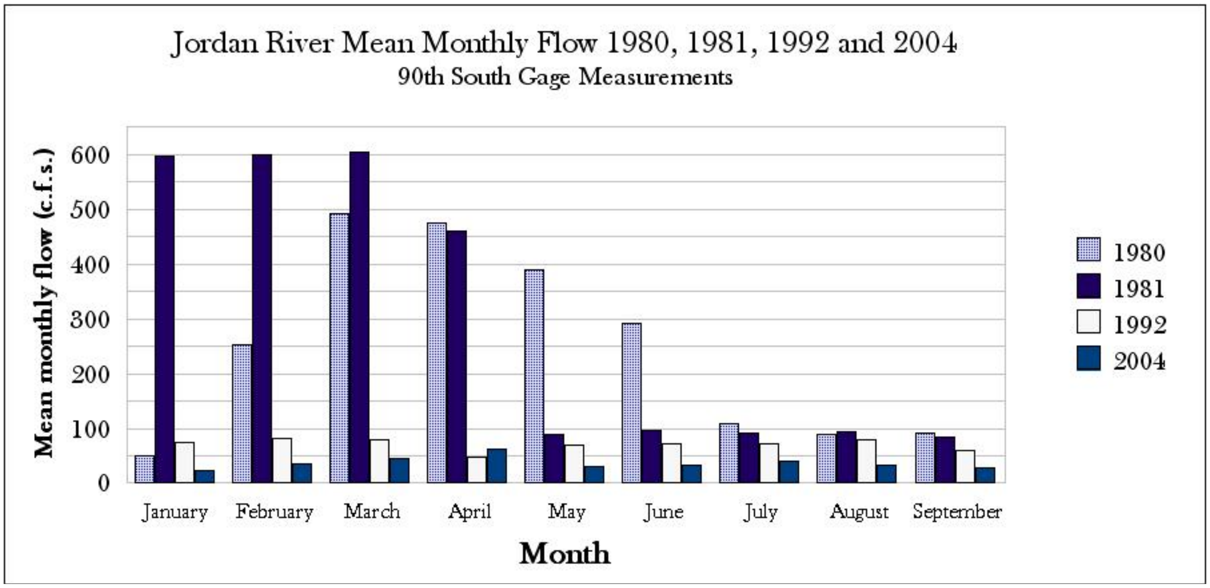
Supplemental Information

USGS Flow Data

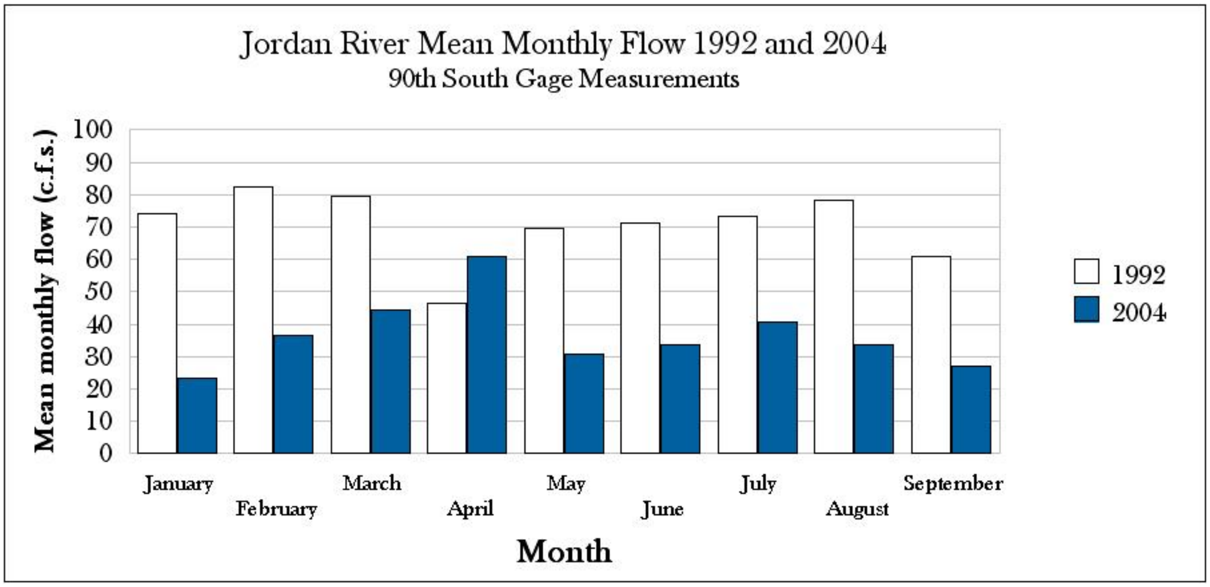
The United States Geological Survey (USGS) has provided flow data at the 1700 South sampling location for nearly 60 years. At this sample location, monthly average flows varied between 104 c.f.s. and 150 c.f.s. (cubic feet per second) over the sampling period (1944-2003). The highest flows appear in the month of January and the lowest flows were observed in March. As would be expected, discharge appears to increase steadily during Spring and early Summer months (March through July) and then remains relatively stable—between 121 c.f.s. and 126 c.f.s.—until peak flows are reached in January.



Salt Lake County Flow Data



In addition to flow data collected by the USGS, the Salt Lake County Flood Control and Engineering Division maintains records of stream flow within the Jordan River watershed. When comparing water quality datasets collected in 1980-1981, 1992, and 2004, it is important to consider the flow regime experienced in each of these years. At the 9000 South gage, flow ranged between 49.6 c.f.s. and 472 c.f.s. in 1980, 83.8 c.f.s. and 606 c.f.s. in 1981, 46.6 c.f.s. and 82.5 c.f.s. in 1992, and 23.4 c.f.s. and 44.6 c.f.s. in 2004. The nearly 25 fold variability in the flow of the Jordan over the last 25 years may have significant impacts on observed concentrations of pollutants throughout the course of the river.

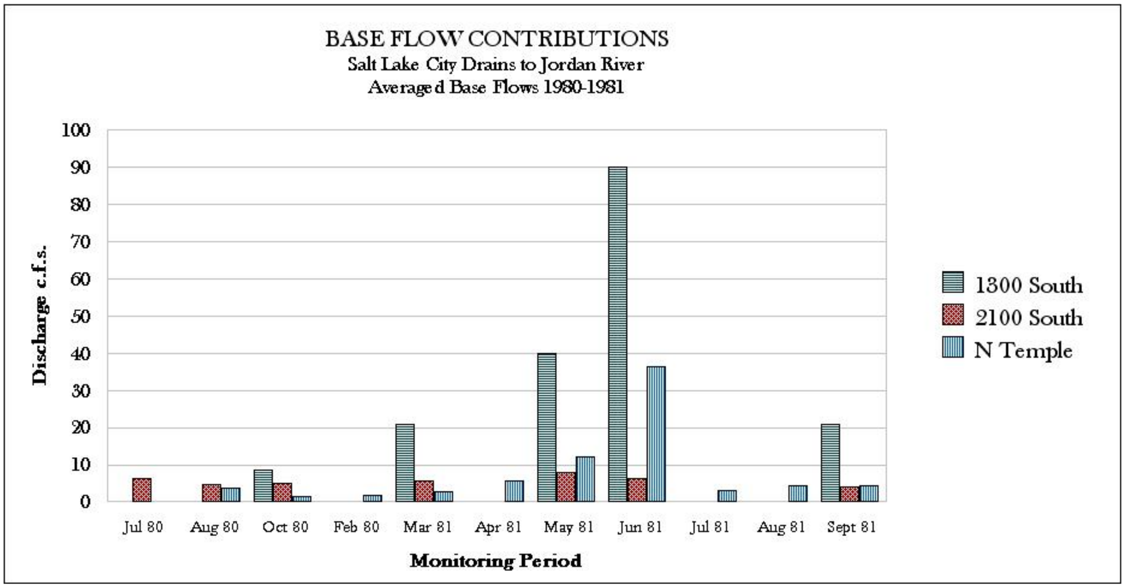


1992 305(b) Data

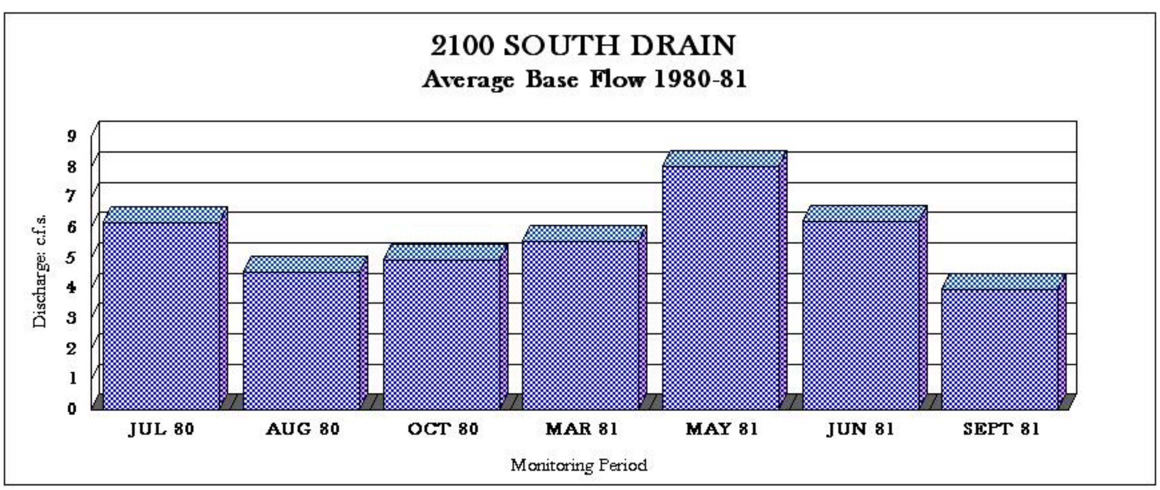
In 1992, Salt Lake County identified priority watersheds concurrent with implementation of section 319 nonpoint source planning programs. In this assessment, numerous parameters were examined for the Jordan River as well as other streams in Salt Lake County. The data for the Jordan River show that the River was in violation of numerous parameters at that time, including: total dissolved and suspended solids, bio-chemical oxygen demand, and dissolved oxygen. The 1992 data is included in Appendix B. Notably, the flow regime experienced in 1992 was substantially higher that the flows for 2004. In 1992, flows varied between 46.6 c.f.s. and 60.9 c.f.s. for the months of April—September. Alternately, 2004 flows varied between 33.6 c.f.s. and 40.7 c.f.s. for the sample period of June—August.

NURP Flow & Water Quality Data

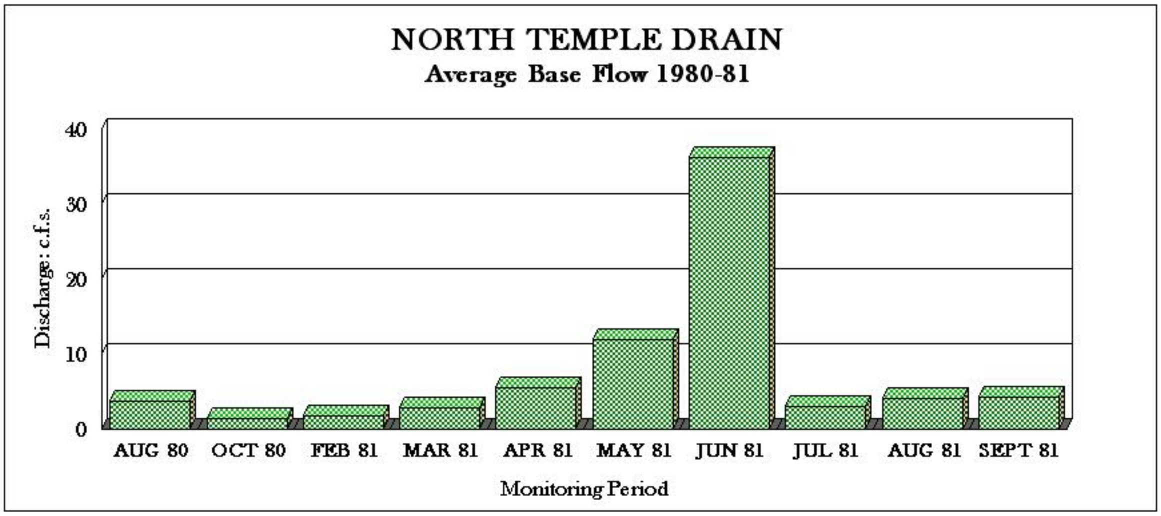
Nationwide Urban Runoff Program (NURP) base flow contribution data was collected at three sampling locations between 1980 and 1981. Discharge rates showed great variability (varying between 4.0 c.f.s. and 90.0 c.f.s.) at these three sample sites. Generally, discharge rates at the 1300 South sample location were higher (varying between 8.7 c.f.s. and 90.0 c.f.s.) than discharge rates at either of the other sampling locations. Additionally, data collected by Salt Lake County showed that flow data for 9000 South was substantially higher (ranging between 83.8 c.f.s. and 606 c.f.s.) for the high flow years of 1980 and 1981. As stated earlier, this variability in flow may have significant effects on the observed concentrations of contaminants and should be considered when comparing datasets.



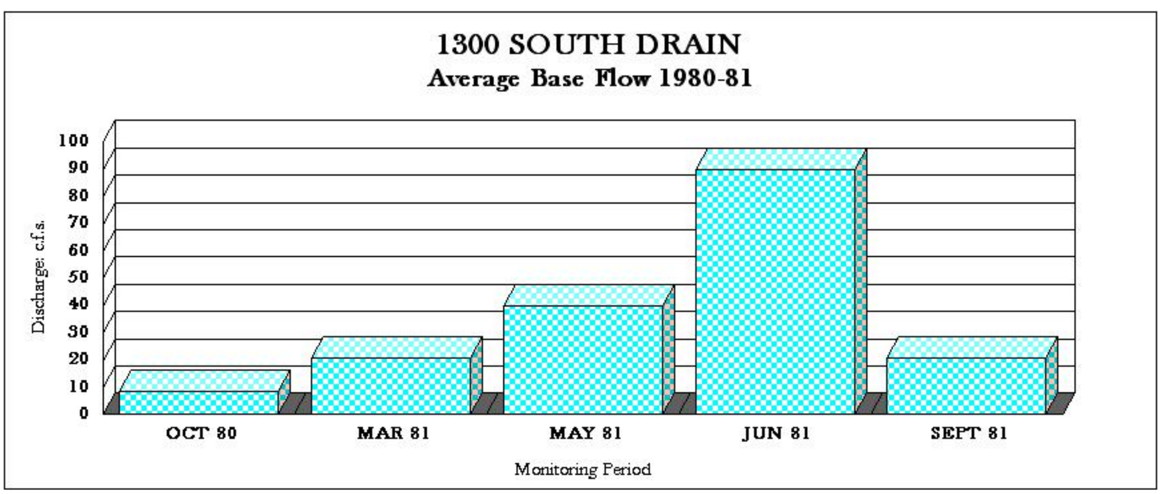
Discharge rates at the 2100 South Drain varied between 4.0 c.f.s. and 8.1 c.f.s. In addition, to the discharge data provided above, data was collected at the 2100 South sample location in July of 1980. With mean discharge of 6.2 c.f.s., July discharge appears similar to June values of 6.3 c.f.s. Notably, the 1980-1981 data suggests that mean flow rates were highest in the month of May (12.1 c.f.s.) and lowest in the month of September (4.0 c.f.s.) at this sample location.



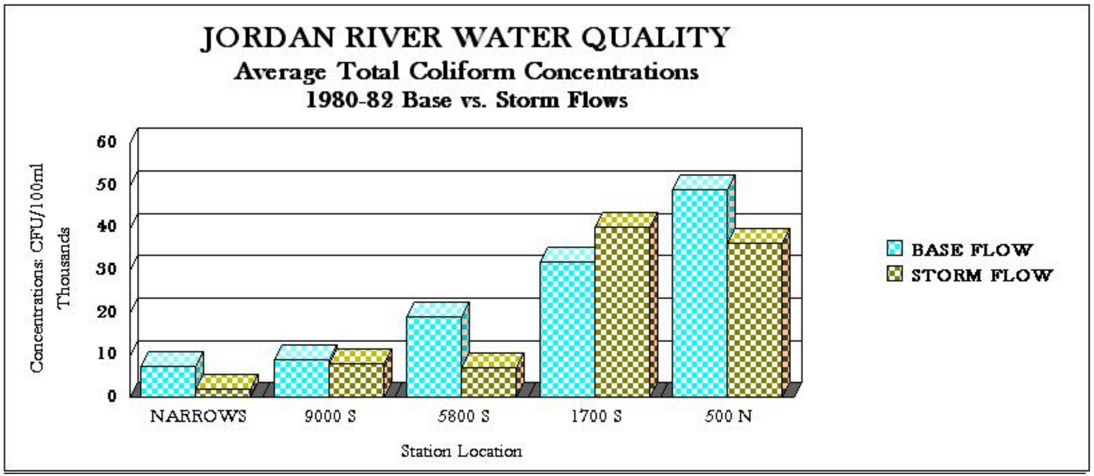
Mean discharge rates for the North Temple sample location varied between 1.6 c.f.s. and 36.3 c.f.s. with highest discharge values observed in June of 1981. April and May mean discharge rates were higher than other months (5.7 c.f.s. and 12.1 c.f.s. respectively) and therefore suggest that spring runoff may have the greatest impact on pollutant concentrations. Notably, discharge rates were generally lower in the months of October, February, and March than they were in July, August, and September of 1981.



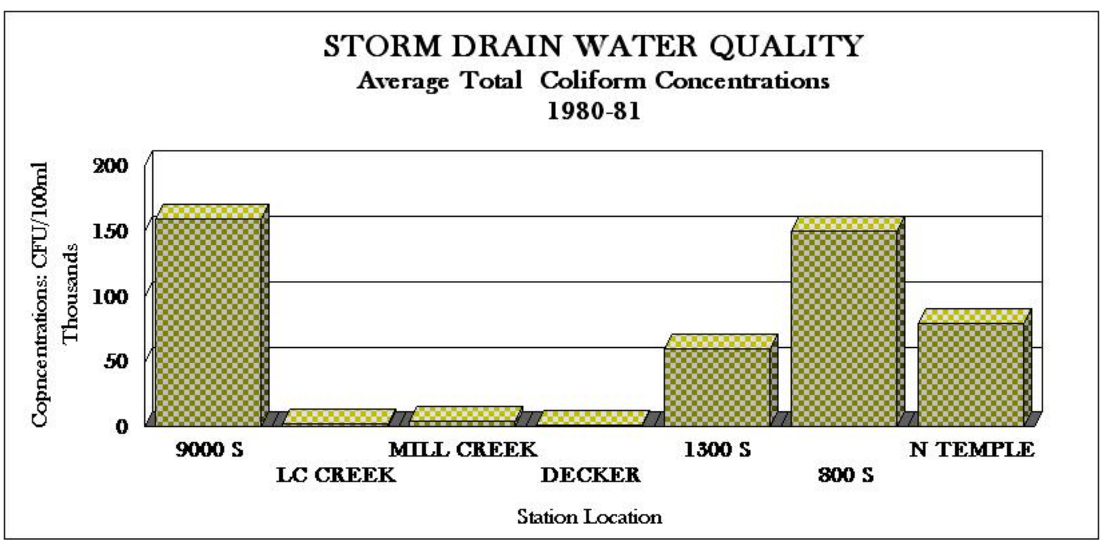
Mean discharge rates at the 1300 South Drain were substantially higher than discharge rates observed at the other two sample locations. Varying between 8.7 c.f.s. and 90.0 c.f.s., this location showed the highest mean discharge rate in the month of June (90.0 c.f.s.) and the lowest rate in October (8.7 c.f.s.). Notably, rates appeared to steadily increase between October and June and then dropped in September. The high discharge rates at this location are most likely due to the confluence of Parley's, Red Butte, and Emigration Creeks with the Jordan River at this sample location.



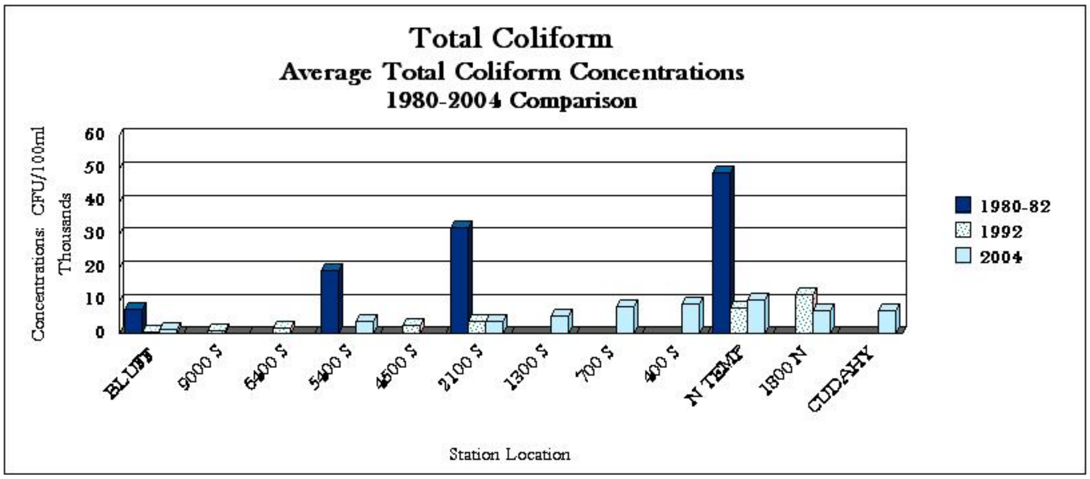
Base flow and storm flow coliform data were also collected between 1980 and 1982 as part of the NURP study. Interestingly, the base flow levels of total coliform CFUs were higher than the storm flow levels at four of the five sample locations. Notably, the difference between base flow and storm flow was upwards of 10,000 CFU/100ml at the 500 North sample location. The only sample location where base flow showed lower concentrations of total CFUs than storm flow was the 1700 South confluence.



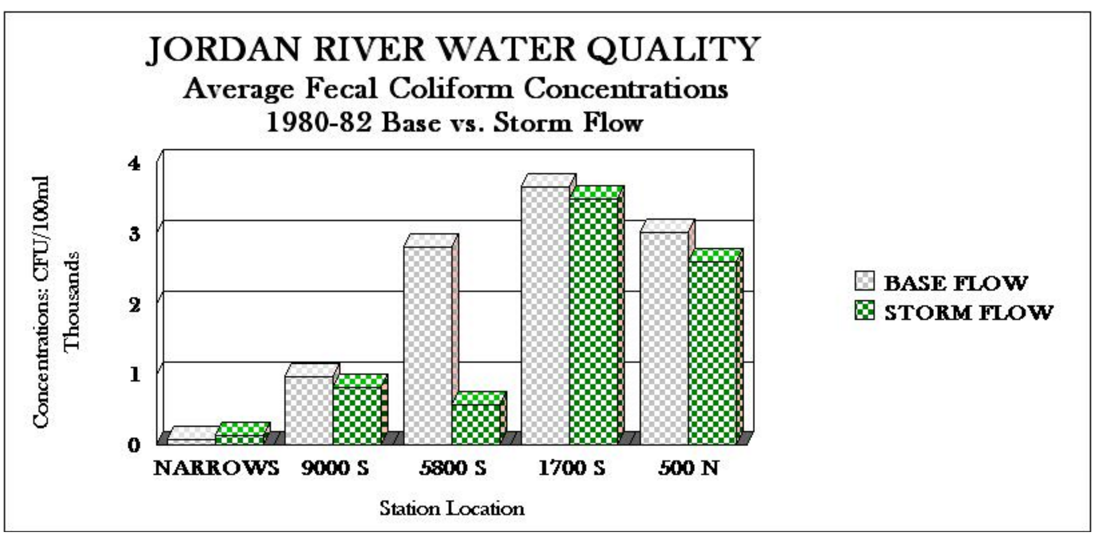
Data collected between 1980 and 1981 showed a high concentration in total coliform CFUs at 9000 South, low counts between the confluence of Little Cottonwood Creek and Decker Street and then an increase at 1300 South. Interestingly, this is the only data that shows high concentrations of total CFUs below 5400 South.



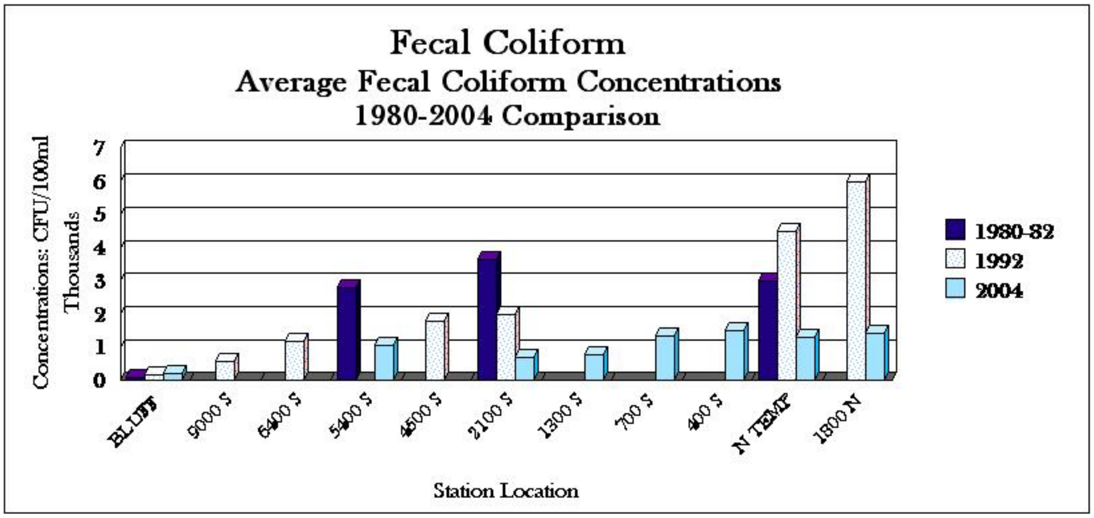
When compared with data collected between 1980 and 1982, and 1992, total coliform counts observed in 2004 are substantially lower. Although comprised of fewer sampling locations, the data collected between 1980 and 1982 by the USGS, show an increase in total coliform counts as the Jordan River moves downstream and show levels nearly five times as great as those observed in both 1992 and 2004. Based on the data collected by Salt Lake County as part of the 305(b) assessment, total coliform counts appear relatively stable between the 1992 and 2004, thus indicating that no substantial alteration has been observed in the last decade.



Base flow and storm flow fecal coliform data were also collected between 1980 and 1982. It is notable that base flow levels of fecal coliform were higher than the storm flow levels at four of the sample locations. This is similar to the pattern observed for total coliforms. The difference between base flow and storm flow fecal coliform counts was greatest at the 5800 South sample location—nearly threefold.

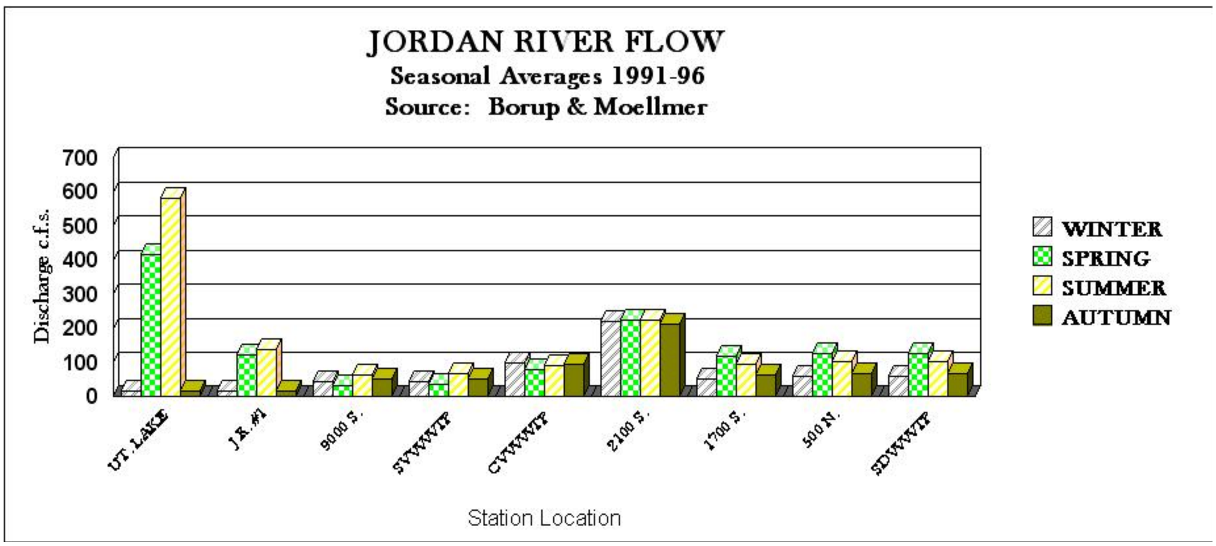


Similar to total coliform counts, when fecal coliform data collected in 1980-1982 and 1992 is compared with fecal coliform counts observed in 2004, 2004 counts are again lower. However, all three datasets show an increase in fecal coliform counts as the Jordan River approaches the Great Salt Lake. In contrast to the total coliform, fecal coliform counts show a drastic decrease between 1992 and 2004 in the upper reaches of the River with the highest fecal coliform counts observed at the 1800 North sample location in 1992 (~6000 CFU/100 ml).



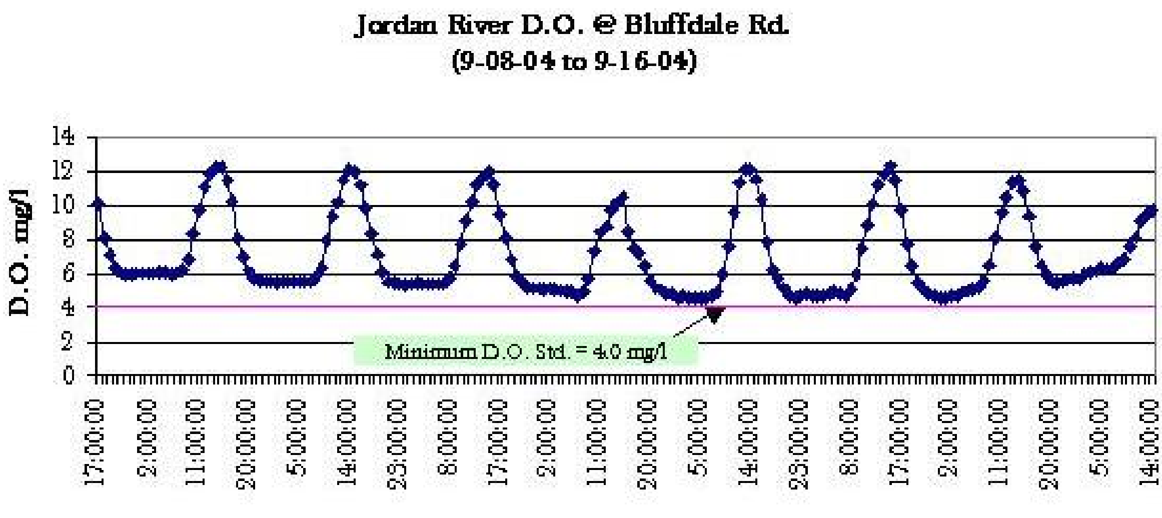
DWQ Flow Data

Additional seasonal discharge data was collected by Borup & Moellmer at nine sample locations between 1991 and 1996. Discharge rates for these sample locations varied between: 16 c.f.s. and 224 c.f.s. in the Winter, 38 c.f.s. and 420 c.f.s. in the Spring, 63 c.f.s. and 584 c.f.s. in the Summer, and 16 c.f.s. and 213 c.f.s. in Autumn. Interestingly, discharge rates for both Spring and Summer were highest at the mouth of the Jordan River adjacent to Utah Lake. Discharge rates for Winter and Autumn were highest at the 2100 South sample location. From the initial peak at the mouth of the Jordan River, discharge rates in Spring and Summer decreased through the Central Valley Waste Water Treatment Plant and showed a second peak at the 2100 South Sample location. Alternately, discharge rates for Winter and Autumn appeared low at the mouth of the River, increased gradually to a peak discharge at 2100 South, and similar to Spring and Summer discharge rates, remained relatively stable throughout the lower reaches of the River.

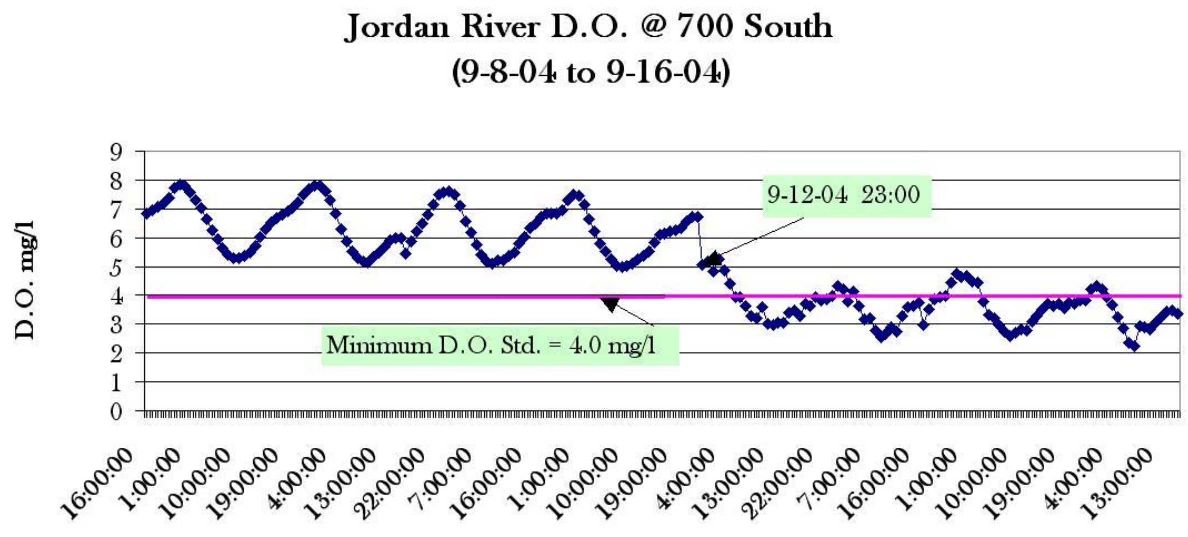


DWQ Diurnal Dissolved Oxygen Data

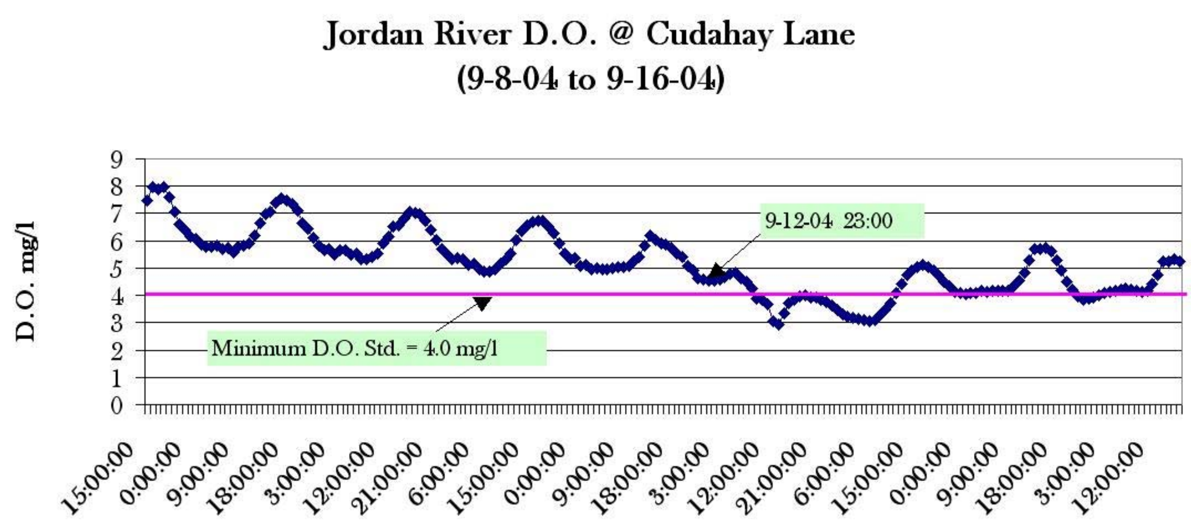
In September of 2004, dissolved oxygen (DO) data was collected at Bluffdale Road, 700 South, and Cudahy Lane by the Utah Division of Water Quality (DWQ). These data, although not corrected for instrument drift, suggest that DO levels fluctuate on a daily cycle with variable temporal peaks. Notably, the range of fluctuation varied slightly between sample locations. Due to the apparent disintegration of recorded information—possibly due to storm events—data from 700 South and Cudahay Lane suggest an instrument drift after 3 or 4 days. DO levels at the Bluffdale Road sample location varied between 5.0 and 12.0 mg/L; whereas, prior to apparent instrument drift, DO levels at the 700 South and Cudahy Lane locations were lower varying between 5.0 and 8.0 mg/L. Notably, DO levels peaked at different times at each of the sample locations. DO levels appeared to peak between 8 am and 2 pm for the Bluffdale Road location, between 1 am and 5 am at the 700 South sample location, and between 6 pm and 10 pm for the Cudahay Road sample location. Due to the instrument failure, further diurnal sampling and monioring are suggested. However, available diurnal DO data are presented on the following pages.



Jordan River D.O. @ Bluffdale Rd.
(9-08-04 to 9-16-04)
D.O. mg/l
Minimum D.O. Std. = 4.0 mg/l

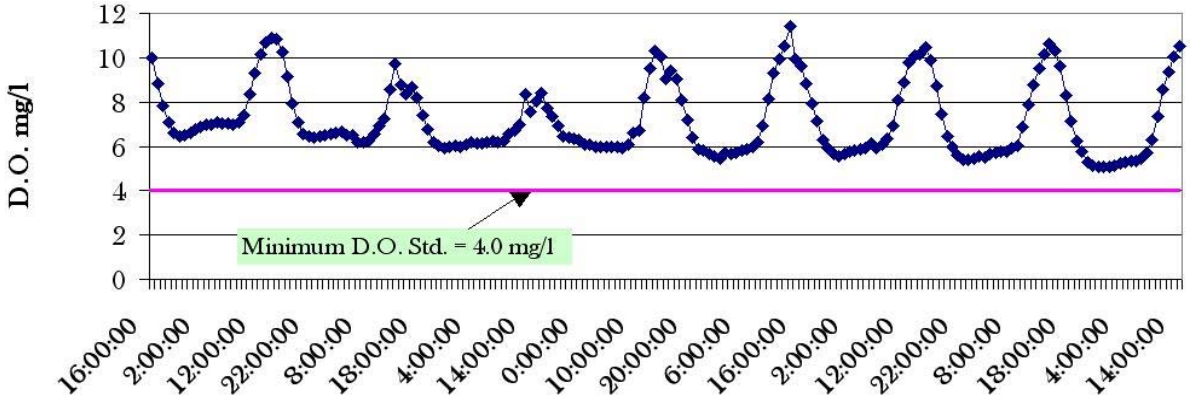


Jordan River D.O. @ 700 South
(9-8-04 to 9-16-04)
D.O. mg/l
9-12-04 23:00
Minimum D.O. Std. = 4.0 mg/l

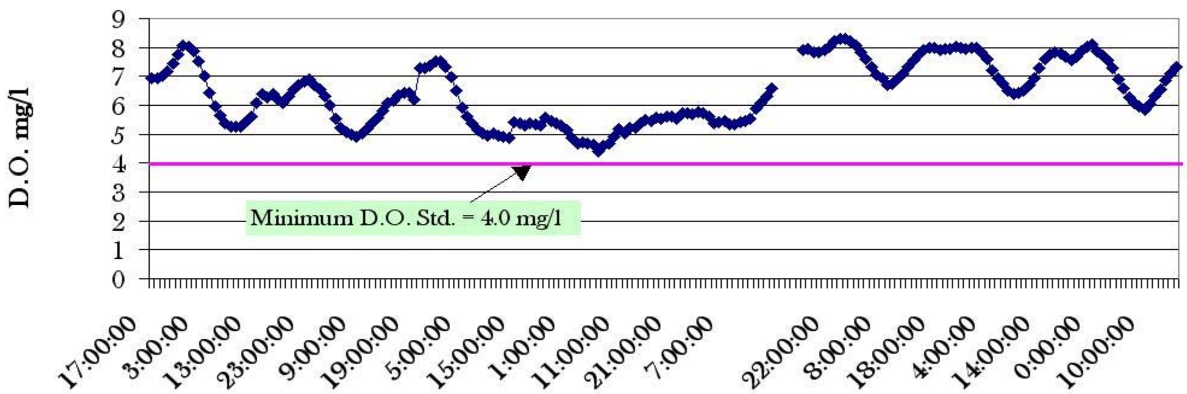


Jordan River D.O. @ Cudahay Lane
(9-8-04 to 9-16-04)
D.O. mg/l
9-12-04 23:00
Minimum D.O. Std. = 4.0 mg/l

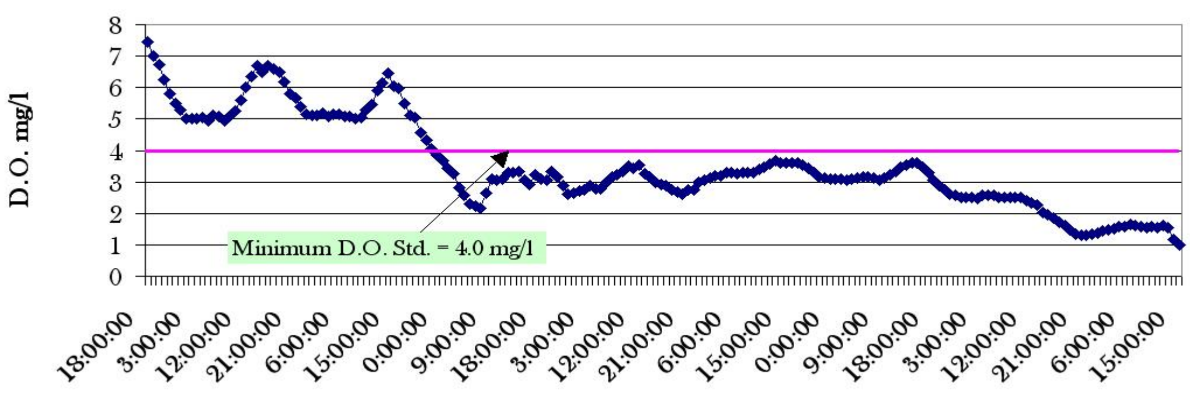
Jordan River @ Bluffdale Rd.
(9-16-04 to 9-24-04)



Jordan River @ 700 South
(9-16-04 to 9-24-04)



Jordan River @ Cudahay Lane
(9-16-04 to 9-24-04)



National Water-Quality Assessment (NAWQA) Data

"The Great Salt Lake Basins NAWQA is one of 59 study units that were part of the U.S. Geological Survey's National Water-Quality Assessment (NAWQA) Program. The long-term goals of NAWQA are to describe the status and trends in the quality of a large, representative part of the Nation's surface- and ground-water resources, and to provide a sound, scientific understanding of the primary factors affecting the quality of these resources. The program will evaluate water quality at a wide range of spatial scales, from local to national, and will employ a multidisciplinary approach using physical, chemical and biological measurements to provide multiple lines of evidence with which to evaluate water quality" (NAWQA, website).

Water Temperature

As part of the Great Salt Lake NAWQA study, water temperature data was collected on a monthly basis at 9400 South, 5800 South, and 1700 South sample locations of the Jordan River. Temperature ranges were similar for all three sample locations (varying between 0.5° C and 26.0° C). Notably, the 5800 South sample location showed the greatest variability; however, the most extensive record exists for the 1700 South location.

Specific Conductivity

Specific conductivity is a measure of the ability of water to carry an electric current. This ability depends on the presence of ions, which are indicative of dissolved solids in the water. Specific conductivity varied between 1,790 and 2,810 us/cm at 9400 South (1965 to 1981), between 1,080 and 2,430 us/cm at 5800 South (1965 to 1984), and between 13 and 2,380 us/cm at 1700 South (1959 to 2003). Interestingly, conductivity rates at the 5800 South sample location have moderately decreased since 1965, and rates at the 1700 South location have also decreased slightly over time.

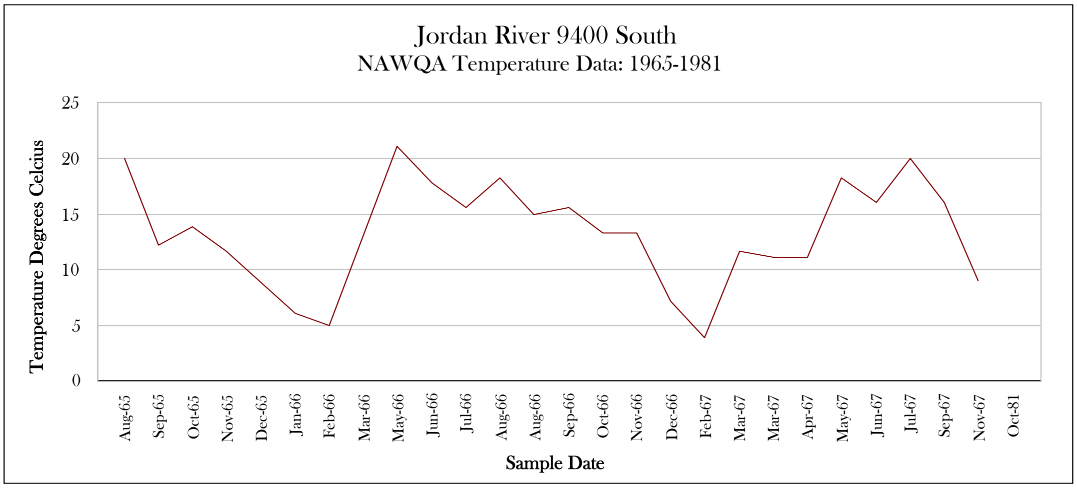
Nitrate

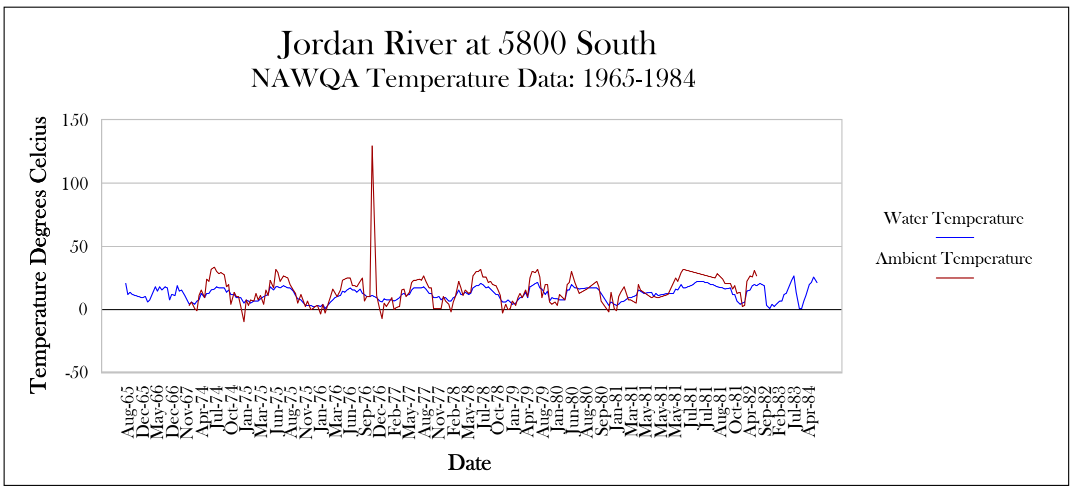
The NAWQA nutrient data is extremely valuable due to the general lack of nutrient information for the Jordan River. Between 1965 and 1981, filtered nitrate levels varied between 1.0 and 7.4 mg/L at the 9400 South sample location. The 5800 South sample location showed less variability (ranging between 1.2 mg/L and 3.0 mg/L) of filtered nitrate. Variability generally decreases as the River moves downstream with samples taken at the 1700 sample site ranging between 0.03 mg/L and 0.439 mg/L of filtered nitrate. Notably, there is little evidence to show a historic increase or decrease of nitrate levels.

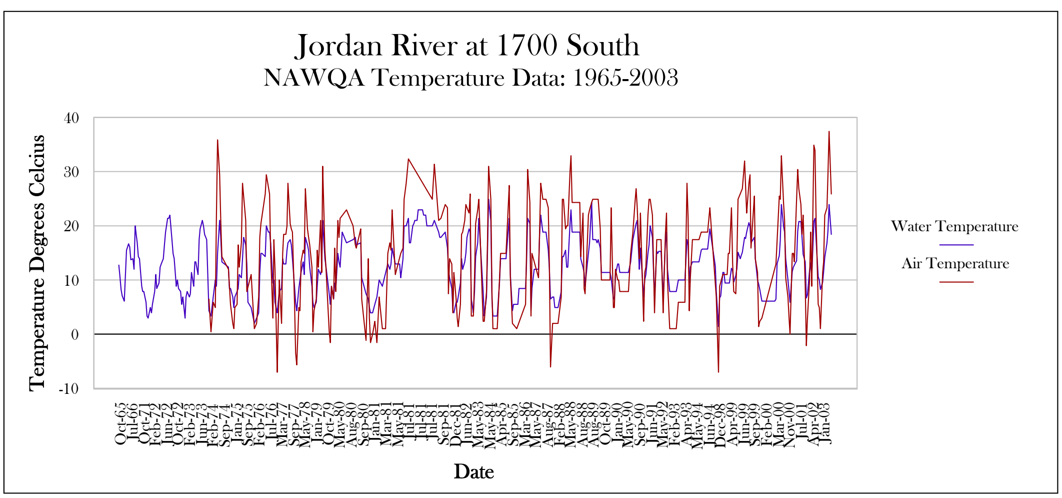
Phosphorus

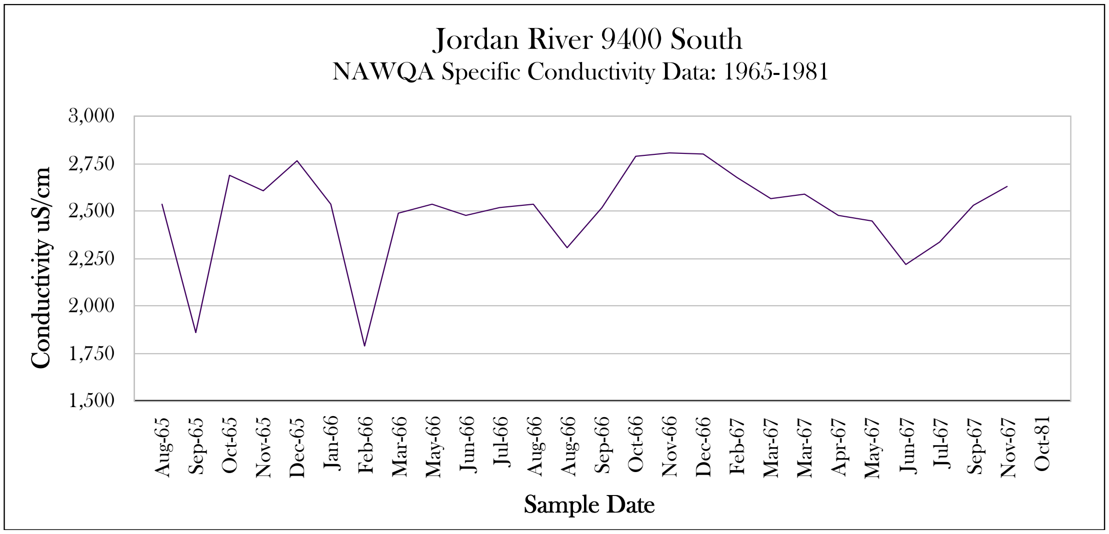
Phosphorus analysis was not conducted for the 9400 South sample location as part of the NAWQA study. However, there is a strong decrease in phosphorus levels between 5800 South and 1700 South. Although a sample analyzed in October of 1977 showed a phosphorus level of 7.8 mg/L, the majority of samples taken at the 1700 South sample location showed a phosphorus level < 3.0 mg/L. Alternately, samples taken at 5800 South varied between 7.4 mg/L and 34.0 mg/L with the majority of samples > 10.0 mg/L. The indicator criteria for the Jordan River is currently 0.05 mg/L.

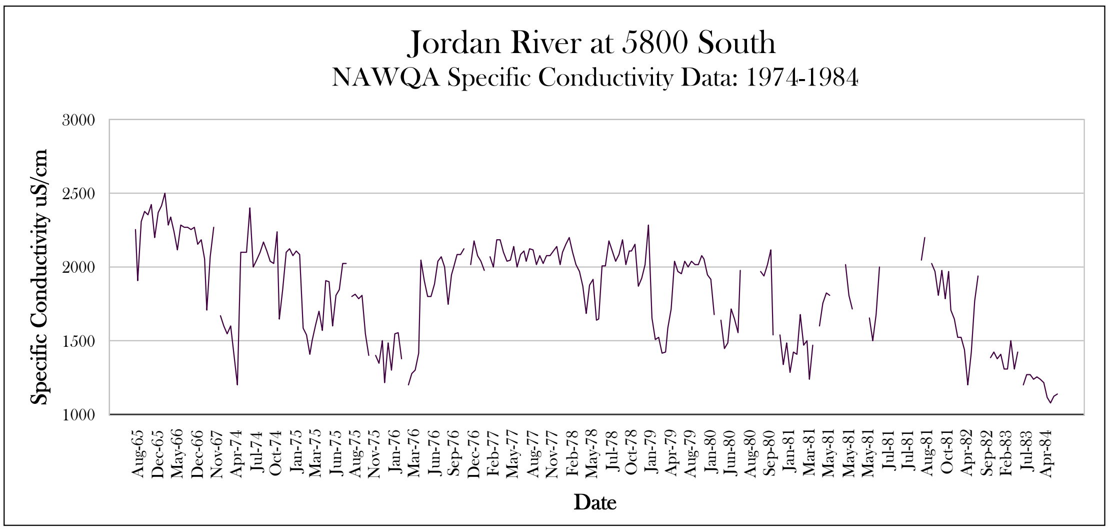
NAWQA Water Quality Data








Jordan River 9400 South
NAWQA Specific Conductivity Data: 1965-1981
Conductivity uS/cm
3,000
2,750
2,500
2,250
2,000
1,750
1,500
Aug-65
Sep-65
Oct-65
Nov-65
Dec-65
Jan-66
Feb-66
Mar-66
May-66
Jun-66
Jul-66
Aug-66
Aug-66
Sep-66
Oct-66
Nov-66
Dec-66
Feb-67
Mar-67
Mar-67
Apr-67
May-67
Jun-67
Jul-67
Sep-67
Nov-67
Oct-81
Sample Date


Jordan River at 5800 South
NAWQA Specific Conductivity Data: 1974-1984
Specific Conductivity uS/cm
3000
2500
2000
1500
1000
Aug-65
Dec-65
May-66
Dec-66
Nov-67
Apr-74
Jul-74
Oct-74
Jan-75
Mar-75
Jun-75
Aug-75
Nov-75
Jan-76
Mar-76
Jun-76
Sep-76
Dec-76
Feb-77
May-77
Aug-77
Nov-77
Feb-78
May-78
Jul-78
Oct-78
Jan-79
Apr-79
Aug-79
Jan-80
Jun-80
Aug-80
Sep-80
Jan-81
Mar-81
May-81
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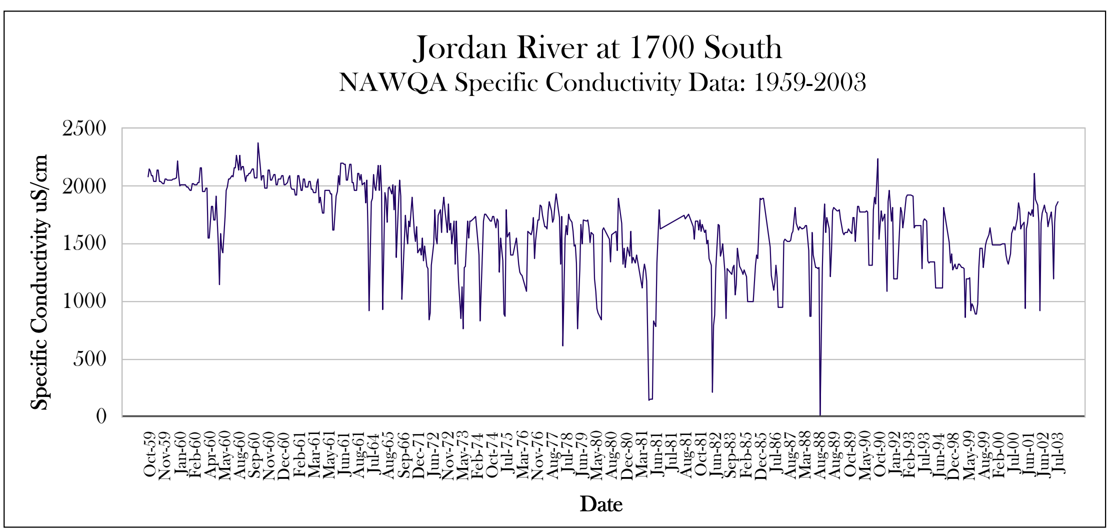
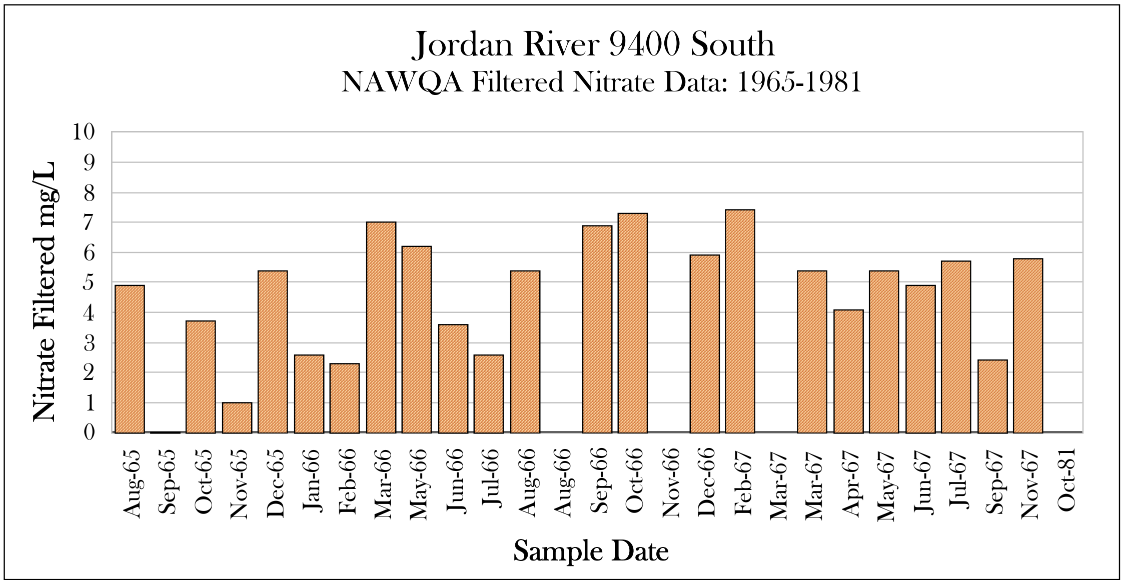
Feb-83
Jul-83
Apr-84
Date


Jordan River at 1700 South
NAWQA Specific Conductivity Data: 1959-2003
Specific Conductivity uS/cm
2500
2000
1500
1000
500
0
Date


Jordan River 9400 South
NAWQA Filtered Nitrate Data: 1965-1981
Nitrate Filtered mg/L
10
9
8
7
6
5
4
3
2
1
0
Aug-65
Sep-65
Oct-65
Nov-65
Dec-65
Jan-66
Feb-66
Mar-66
May-66
Jun-66
Jul-66
Aug-66
Aug-66
Sep-66
Oct-66
Nov-66
Dec-66
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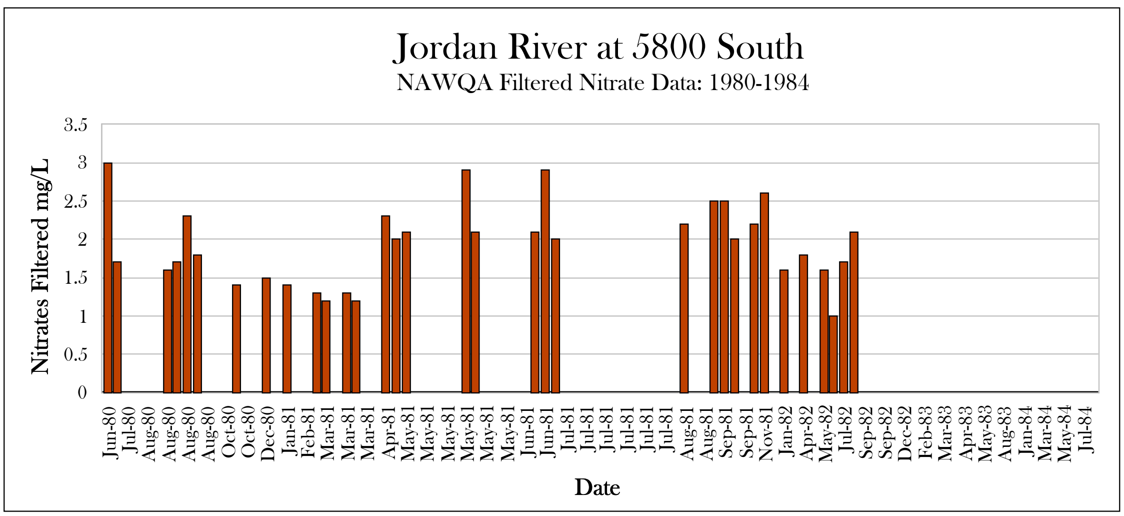
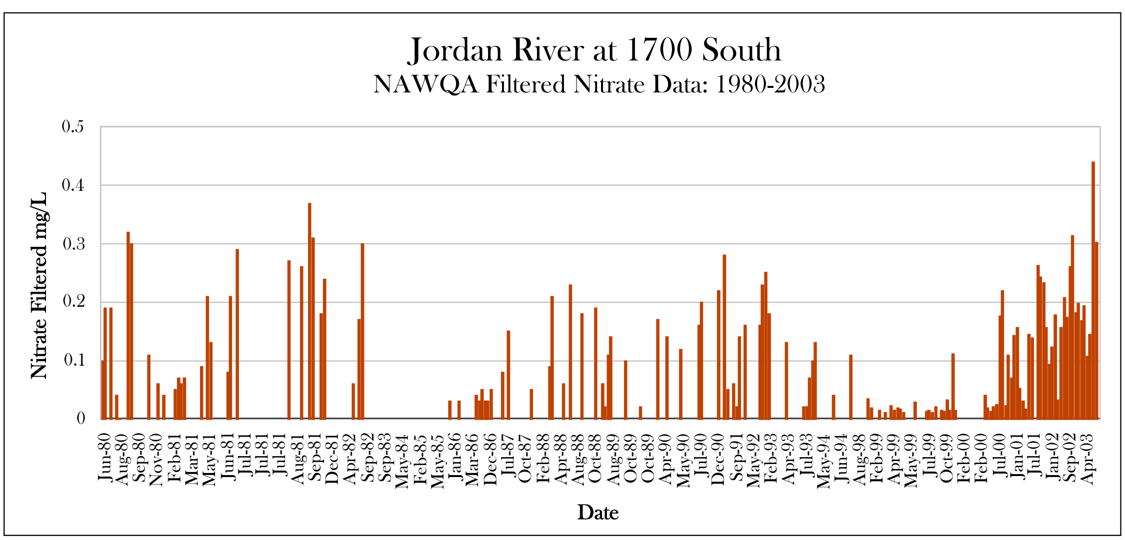
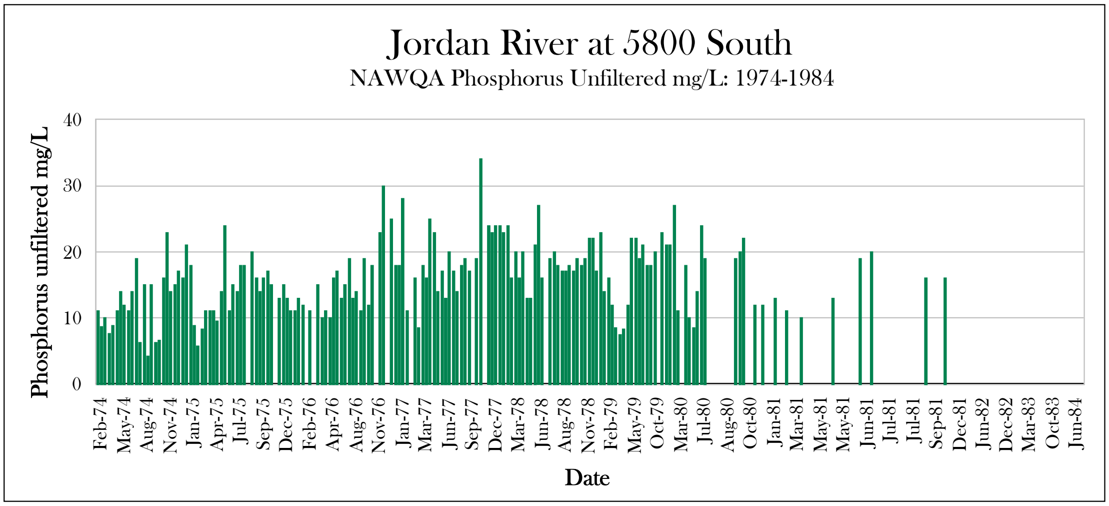
Mar-67
Mar-67
Apr-67
May-67
Jun-67
Jul-67
Sep-67
Nov-67
Oct-81
Sample Date


Jordan River at 5800 South
NAWQA Filtered Nitrate Data: 1980-1984
Nitrates Filtered mg/L
3.5
3
2.5
2
1.5
1
0.5
0
Date


Jordan River at 1700 South
NAWQA Filtered Nitrate Data: 1980-2003
Nitrate Filtered mg/L
0.5
0.4
0.3
0.2
0.1
0
Date


Jordan River at 5800 South
NAWQA Phosphorus Unfiltered mg/L: 1974-1984
Phosphorus unfiltered mg/L
40
30
20
10
0
Feb-74
May-74
Aug-74
Nov-74
Jan-75
Apr-75
Jul-75
Sep-75
Dec-75
Feb-76
Apr-76
Aug-76
Nov-76
Jan-77
Mar-77
Jun-77
Sep-77
Dec-77
Mar-78
Jun-78
Aug-78
Nov-78
Feb-79
May-79
Oct-79
Mar-80
Jul-80
Aug-80
Oct-80
Jan-81
Mar-81
May-81
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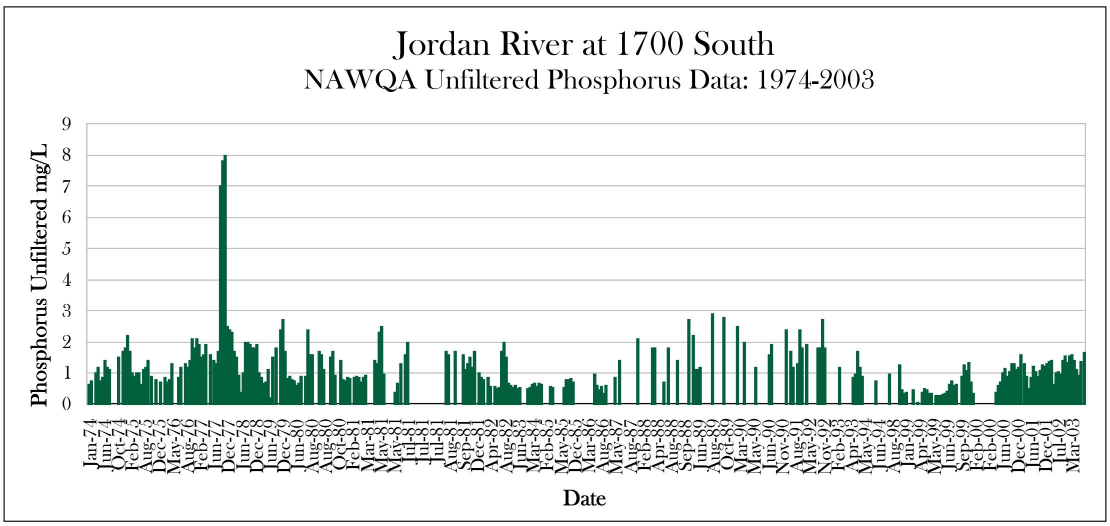
Mar-83
Oct-83
Jun-84
Date

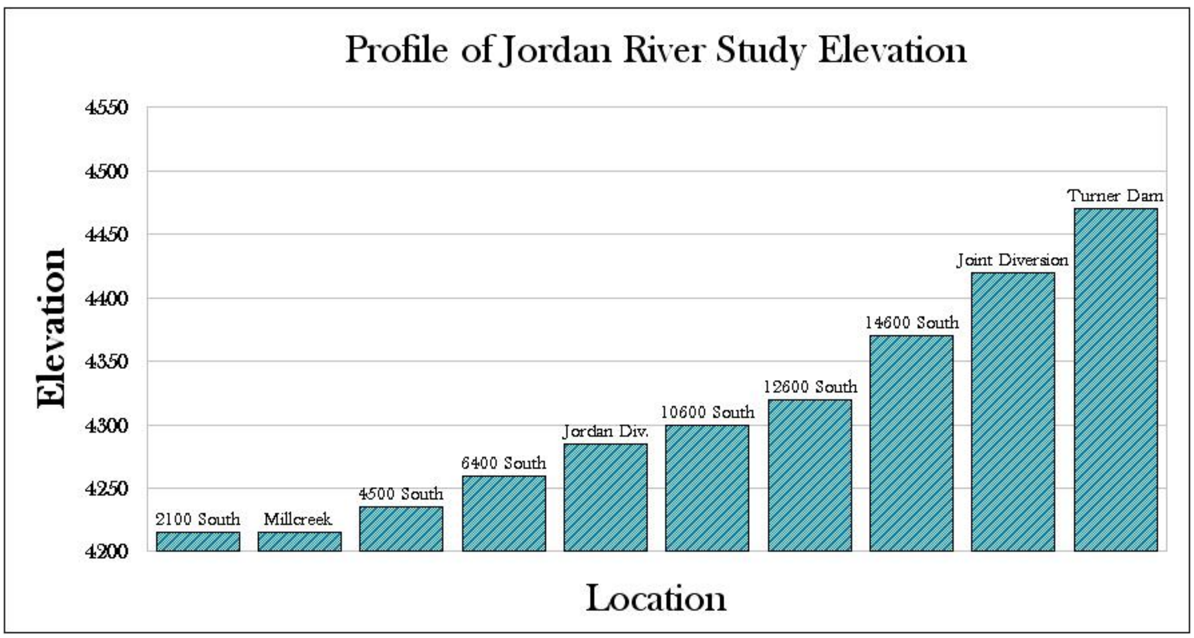

Jordan River at 1700 South
NAWQA Unfiltered Phosphorus Data: 1974-2003
Phosphorus Unfiltered mg/L
9
8
7
6
5
4
3
2
1
0
Date

WATER QUALITY MONITORING RESULTS

Description of Water Quality Sampling Sites

Nine sample locations were used in this study. Stations were located at 146000 South, 5400 South, 2100 South, 1300 South, 700 South, 400 South, North Temple, 1800 North, and Cudahy Lane. Stations in Salt Lake City such as 1300 South, 700 South, and 400 South were sampled to identify the impacts of storm drainage. Upstream samples at 14600 South, 6400 South, and 2100 South were sampled to track possible cumulative impacts of the water quality parameters. The Cudahy Lane site was intended to identify downstream sources outside the Salt Lake City/County jurisdiction.

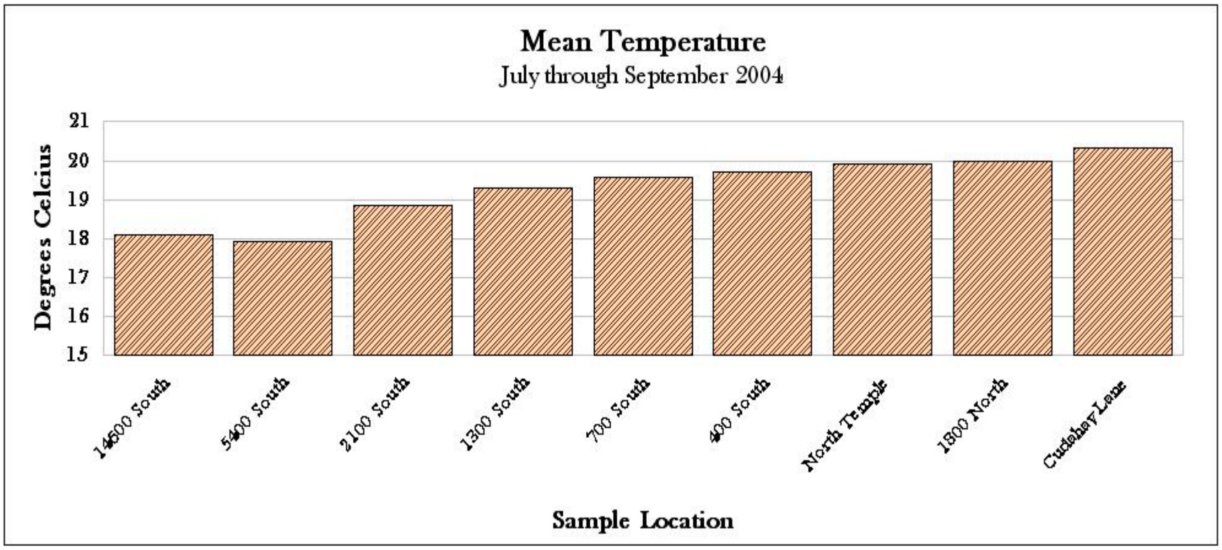
The elevation of the sample points range between approximately 4,480 feet and 4,215 feet, and decrease as the River progresses from Utah Lake to Great Salt Lake. Notably, the gradient of the River decreases drastically around 3300 South and could cause pollutant accumulation due to decreased flow speed.



Results of Laboratory and Field Analysis

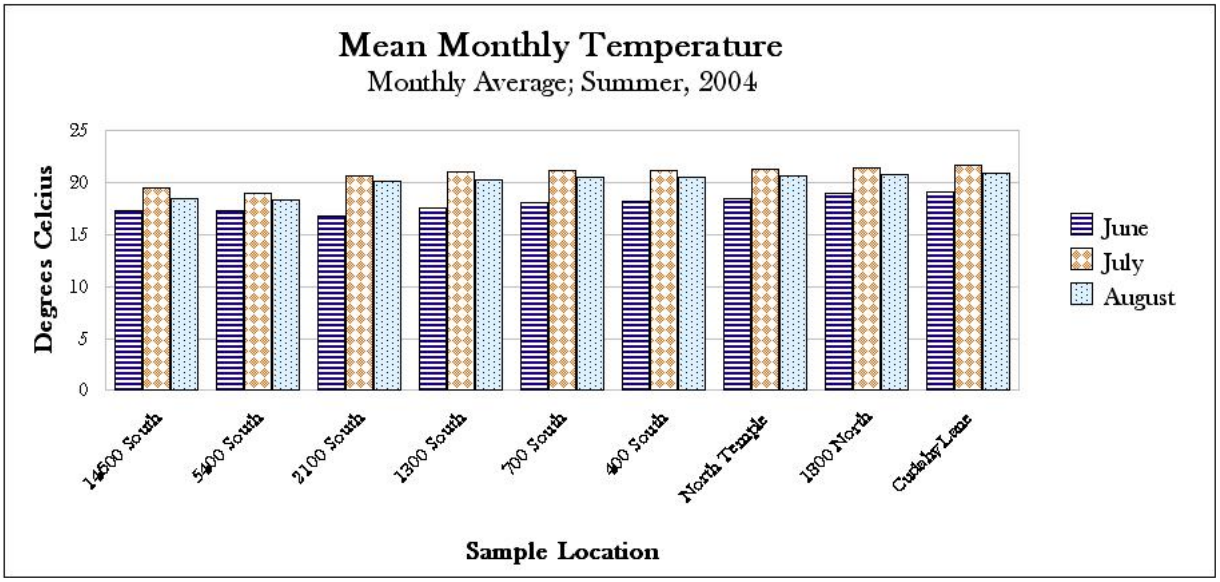
<u>Temperature</u>

Temperature of an aquatic ecosystem can influence: 1) dissolved oxygen (DO) levels; 2) the rate at which algae and aquatic plants photosynthesize; 3) the metabolic rates of aquatic organisms, and 4) how aquatic organisms are affected by different pollutants, parasites and pathogens. Since cold water can hold more dissolved oxygen than warm water, one of the man-made problems associated with water quality is thermal pollution. Thermal pollution is the introduction of warm water or other substrates into an aquatic ecosystem. Sources of thermal pollution include: power plants, also storm-drain runoff, parking lots and sidewalks (NCSU, website).



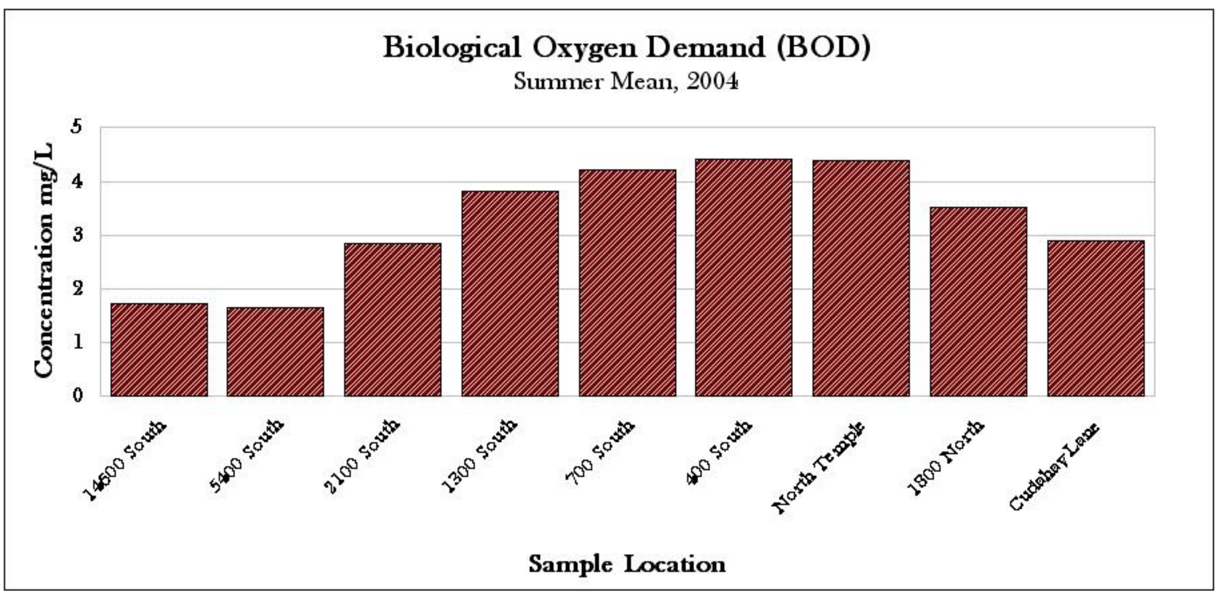
Mean temperature in the Jordan River varied between 17.94 °C and 20.34 °C for the ten sample locations utilized in this study. Ambient temperature for Salt Lake City varied between 11 °C and 37 °C for this same time period (NOAA, website). Our data suggests that the River's temperature increases as it progresses downstream. Notably, the highest mean temperature was observed at the Cudahy Lane sample location (20.34 °C) and the lowest mean temperature was observed at the 6400 South sample location (17.94 °C). Increases in temperature may be due to decreased vegetation coverage, increased sediment load, and/or confluence with contributing streams.

As with mean summer temperature, 30 day average water temperatures increased as the River progresses downstream. Overall, temperatures were highest in the month of July (varying between 19.57 °C and 21.7 °C) and lowest in the month of June (varying between 17.31 °C and 19.15 °C). August temperatures were slightly lower than July temperatures but remained above the values observed for June (varying between 18.48 °C and 21.0 °C).

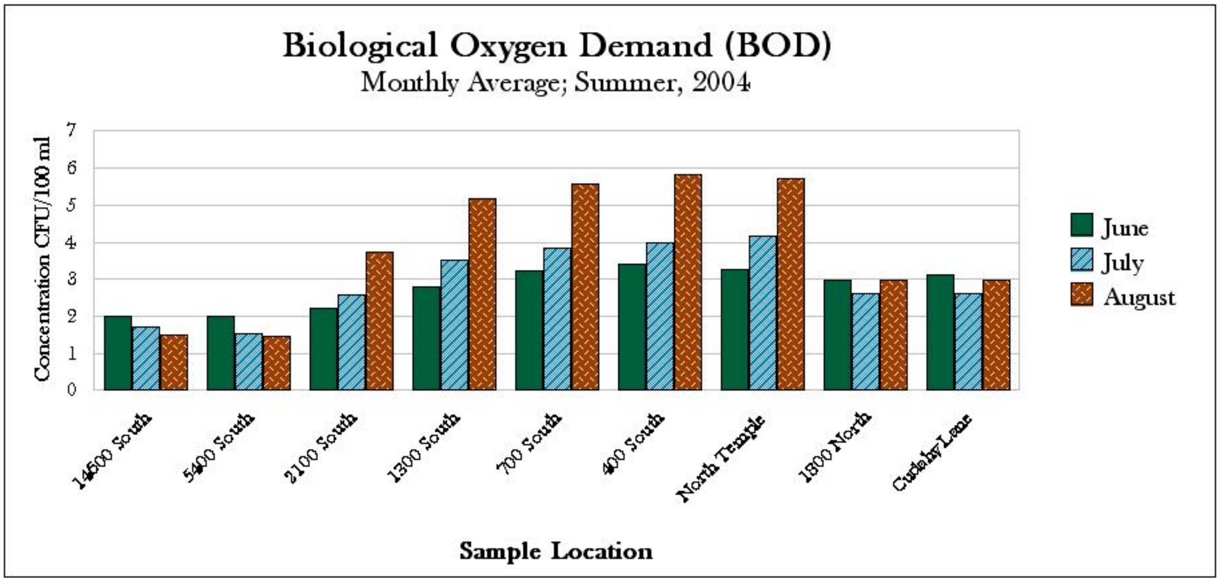


Biological Oxygen Demand (BOD)

Organic matter in water—such as dead organisms, leaves, sewage, or other carbon based materials—is decomposed by microorganisms such as water-borne bacteria. Bacteria decompose this material using Dissolved Oxygen (DO) found in the water column and thereby decreasing DO availability for fish and other aquatic species. Therefore, Biological Oxygen Demand (BOD) is a measure of the amount of DO that bacteria will use in decomposing material found in a water sample. The amount of oxygen consumed is directly correlated with the amount of organic matter that is present.



Mean BOD levels in the Jordan River ranged between 1.72 and 4.42 mg/L for the months of June, July and August. The highest level was observed at the 400 South location and the lowest level was observed at 14600 South. Notably, a general trend was observed that shows an increase in BOD level as the River progresses downstream and then a decreases above North Temple. No mean BOD levels were above the state standard of 5.0 mg/L.

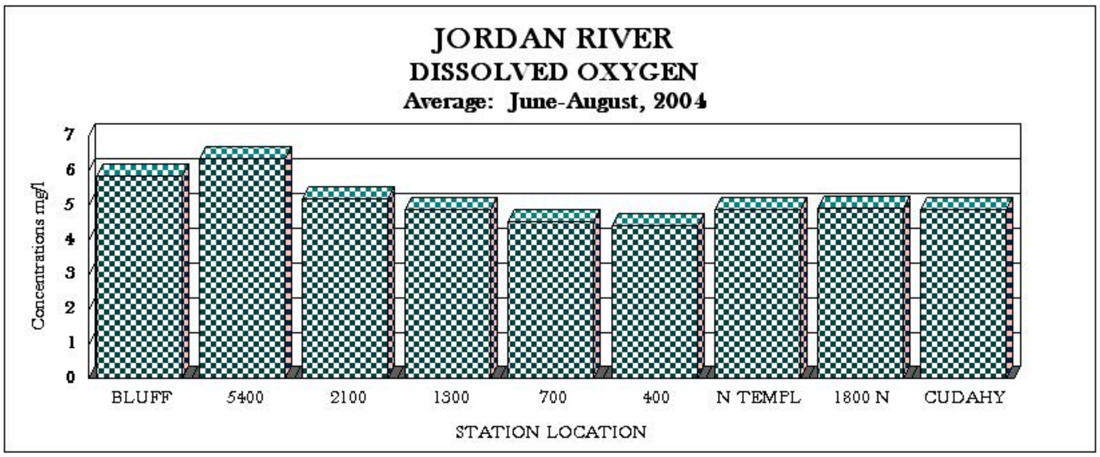


When mean BOD levels are examined by month, it is apparent that the downstream trend is consistent across months; however, BOD levels in August (1.45 mg/L to 5.83 mg/L) are generally higher than those observed in either June (2.0 mg/L to 3.42 mg/L) or July (1.52 mg/L to 4.15 mg/L). Possible explanations for this monthly trend include: increased vegetation in late summer, reduced flow that correlate with increased organic load per volume, and increased bacterial counts. BOD levels exceeded the state standard of 5.0 mg/L at 1300 South, 2100 South, 400 South, and North Temple for the month of August.

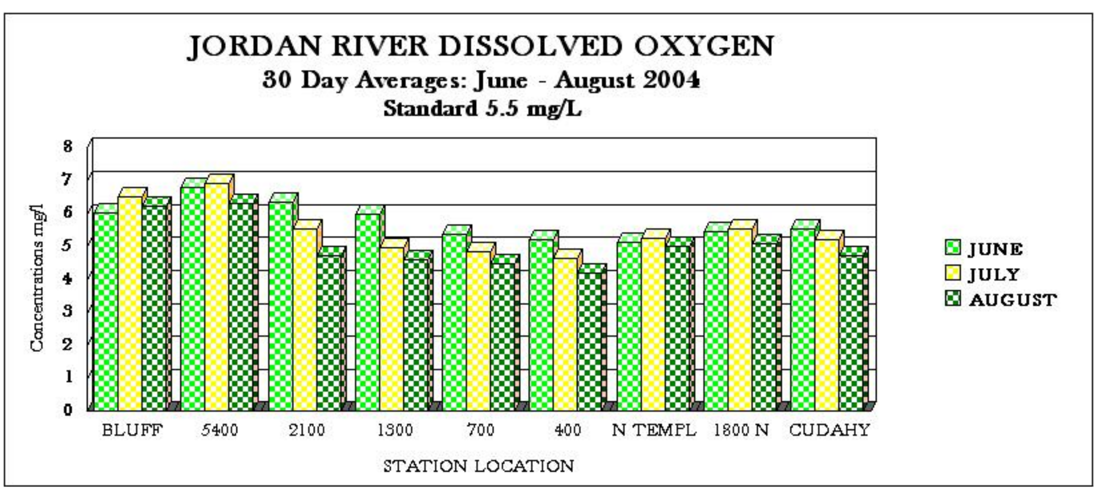
Dissolved Oxygen

Dissolved oxygen (DO) is a measure of the amount of gaseous oxygen (O_2) dissolved in an aqueous solution. Oxygen is infused into the water column by: diffusion from surrounding air, aeration (rapid movement), and as a waste product of photosynthesis. Adequate DO is essential to aerobic life forms which contribute to stream purification processes. In general, when DO levels in water drop below 5.0 mg/L, aquatic life is put under stress. Notably, oxygen levels that remain below 1-2 mg/L for a few hours can result in large fish kills.

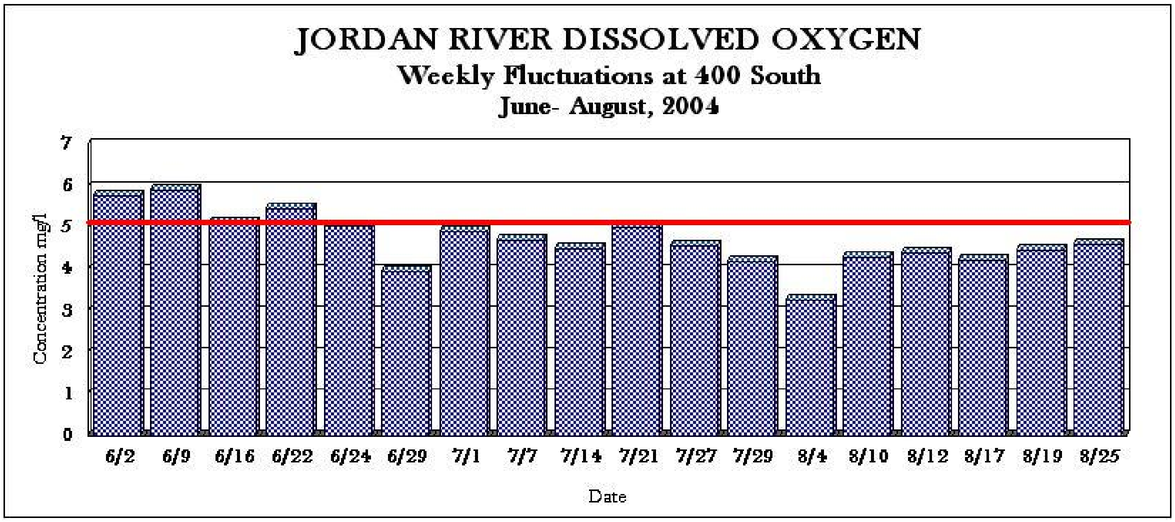
Arithmetic means of DO levels in the Jordan River varied between 4.4 mg/L and 6.4 mg/L throughout the course of this study. DO levels were above 5.0 mg/L upstream of 5400 South and subsequently dropped downstream. Notably, a low mean of 4.4 mg/L was observed at the 400 North sampling location. DO levels did increase slightly downstream from the 400 South sample site location; however, the increased levels do not exceed the 5.0 mg/L standard.



When mean DO levels recorded in this study are examined by month, June levels were highest (ranging from 5.1 mg/L to 6.8 mg/L). DO levels in August were low (ranging from 4.2 mg/L to 6.3 mg/L), and DO levels for July were moderate (ranging from 4.7 mg/L to 6.9 mg/L). The general geographic trend of decreasing DO levels as the stream moves downstream is consistent for all month where data was collected.



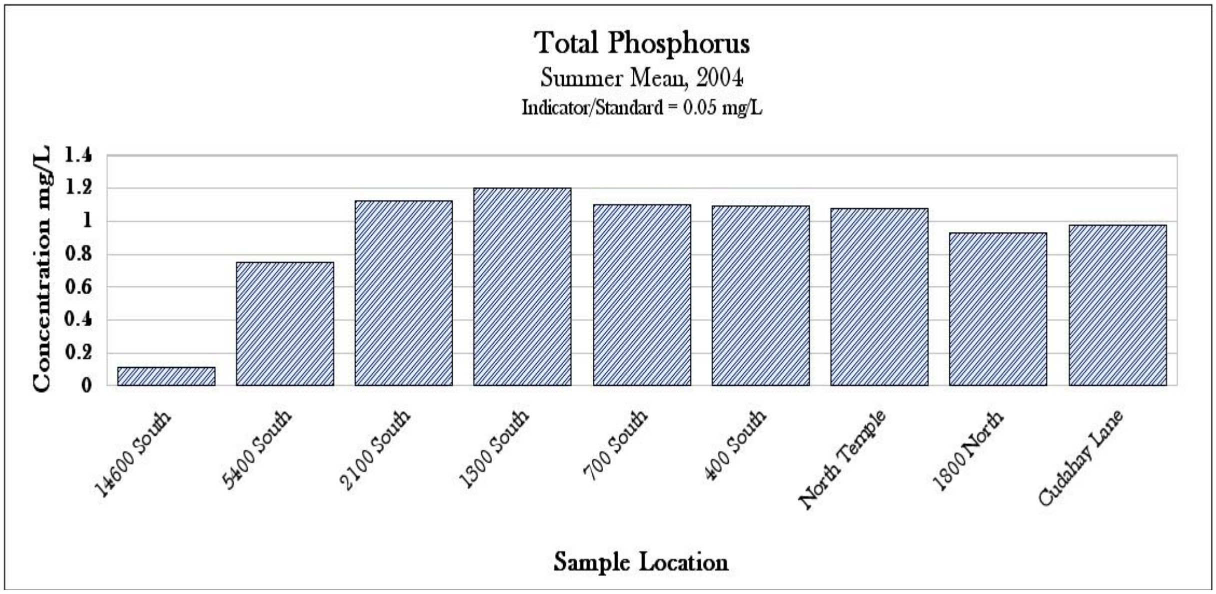
When DO levels are examined by week, additional trends are detected. For example, at the 400 South sample location—the location with the lowest DO levels—the majority of exceedences occurred within the month of June. However, certain weeks within the month of June had DO levels below the 5.0 mg/l standard. The weeks of 6/29 and 8/4 showed DO levels of 4.0 mg/L and 3.3 mg/L respectively, well below the 5.0 mg/L standard.



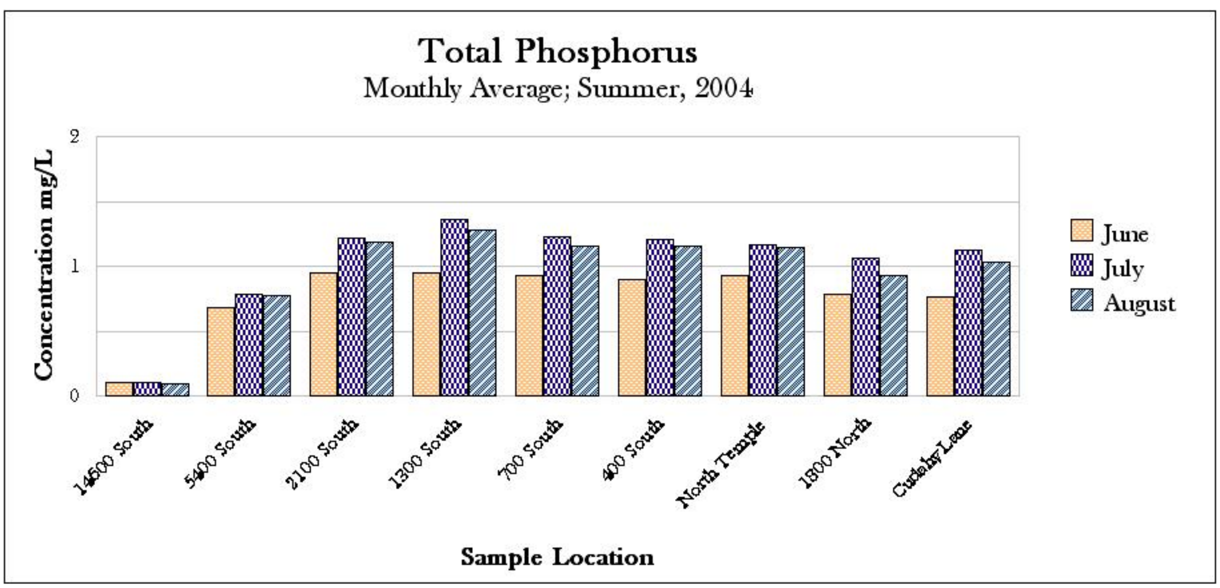
Total Phosphorus

Phosphorus is usually present in natural waters as phosphates (orthophospates, polyphosphates, and organically bound phosphates) and is an essential element for plant life. However, when there is too much of it in water, it can speed up eutrophication (a reduction in dissolved oxygen in water bodies caused by an increase of mineral and organic nutrients) of rivers and lakes. Sources of phosphorus in natural waterways include: human and animal wastes (i.e., sewage), industrial wastes, soil erosion, and fertilizers. All of these sources may contribute to elevated phosphorus levels in the Jordan River.

According to the data collected between June and August of 2004, mean total phosphorus levels varied between 0.11 mg/L and 1.09 mg/L in the Jordan River. The highest concentration was observed at the 400 South sample location and the lowest concentration was observed at the 14600 South sample location. Although phosphorus concentration were very low at the 14600 South sample location, the majority of sample locations had mean phosphorus levels > 0.75 mg/L, which is substantially higher than the 0.05 mg/L indicator level.



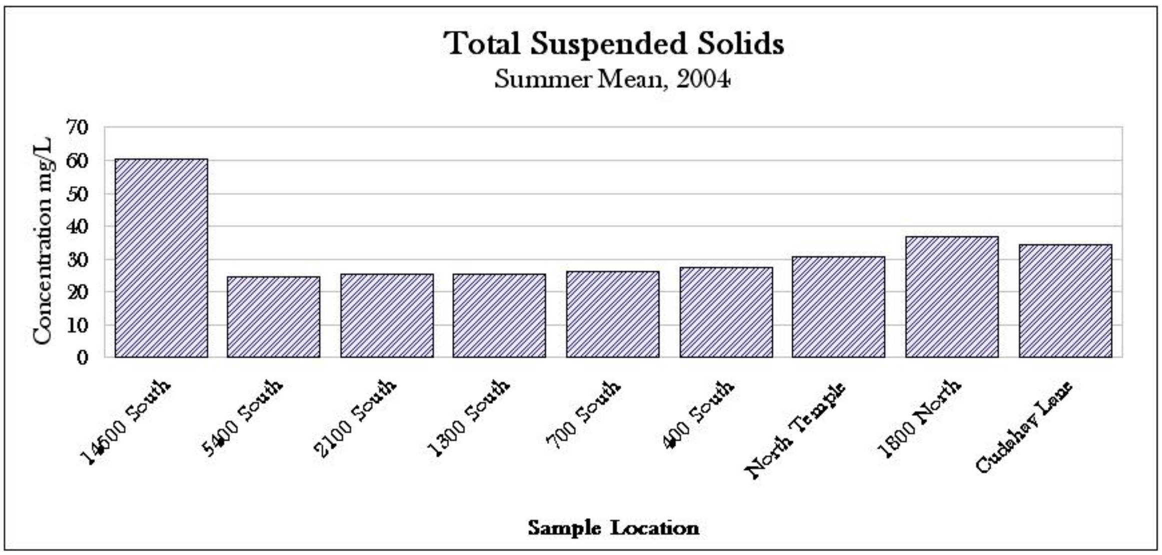
As with mean total phosphorus, 30 day average phosphorus concentrations increase between 14600 South and 1300 South and then declined slightly as the River progressed downstream. Overall, total phosphorus concentrations were highest in the month of July (varying between 0.11 mg/L and 1.37 mg/L) and lowest in the month of June (varying between 0.11 mg/L and 0.95 mg/L). August phosphorus concentrations were slightly lower than July concentrations (varying between 0.1 mg/L and 1.28 mg/L), but remained above the values observed for June.



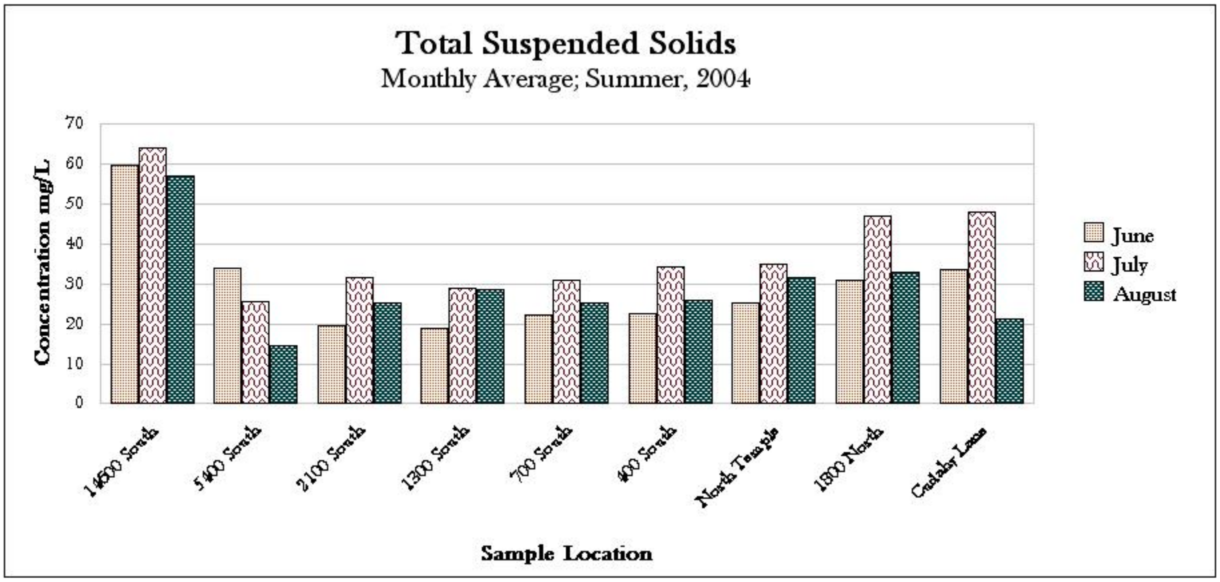
Total Suspended Solids

Total Suspended Solids (TSS) is a common water quality measure of the amount of small particulate matter suspended in a water column (EPA, website). High TSSs can clog fish gills, reduce light penetration, and potentially reduce the photosynthetic capacity of algae. Indirectly, the suspended solids may affect other parameters such as temperature and dissolved oxygen (DO).

Mean Total Suspended Solids (TSS) levels for June through August of 2004 varied between 24.71 mg/L and 60.36 mg/L at nine sample locations. Notably, the highest levels were observed at the 14600 South sample location and the lowest level was observed at the 6400 South sample location. TSS levels generally increased downstream from the 6400 South sample site and showed a second, low peak at the 1800 North sample location.



As with mean summer TSS, 30 day average TSS concentrations were highest at the mouth of the Jordan River—near Utah Lake, decreased at 5400 South, and gradually increased as the River progressed downstream. Similar to temperature and total phosphorus data, TSS concentrations were highest in the month of July (varying between 25.53 mg/L and 64.0 mg/L) and were lowest in the month of June (varying between 18.93 mg/L and 59.93 mg/L). August TSS concentrations were slightly lower than July concentrations, but remained above the values observed for June (varying between 14.53 mg/L and 57.13 mg/L). Although the general trend of high concentrations in July and low concentrations in June was found for TSS, it is notable that the lowest 30 day average concentration was observed at the 5400 South sample location in the month of August. These low TSS levels could be indicative of dilution from South Valley Water Reclamation Facility (SVWRF) effluent whose TSS ranged from approximately 2 to 16 mg/L in the months of July and August of 2004. Notably, the total effluent discharge for the SVWRF ranged between 26 and 30 million gallons per day (MGD) for the months of July and August.

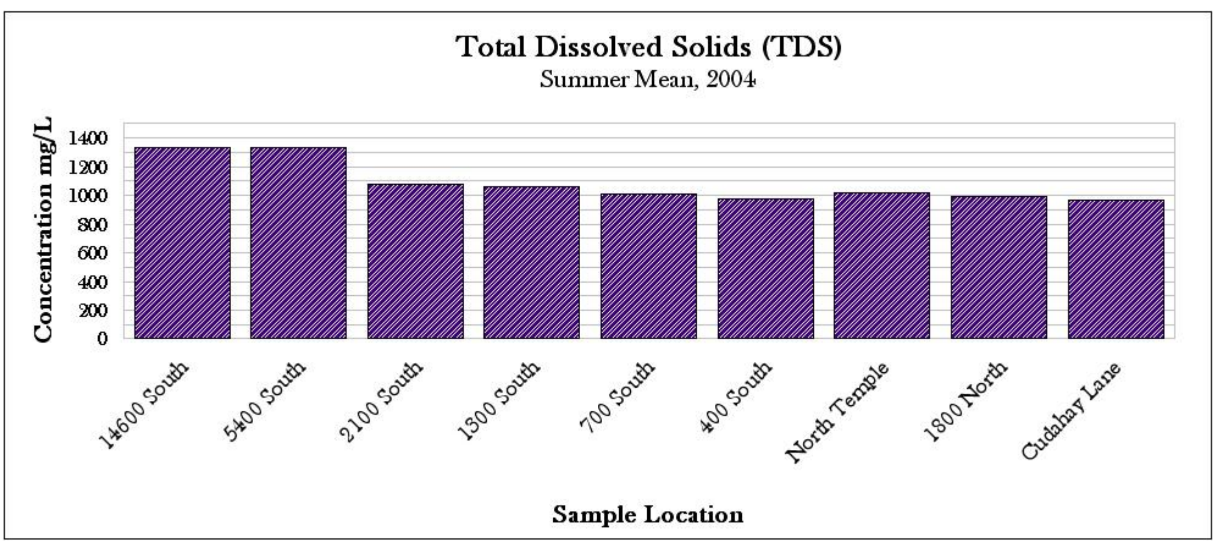


Total Dissolved Solids

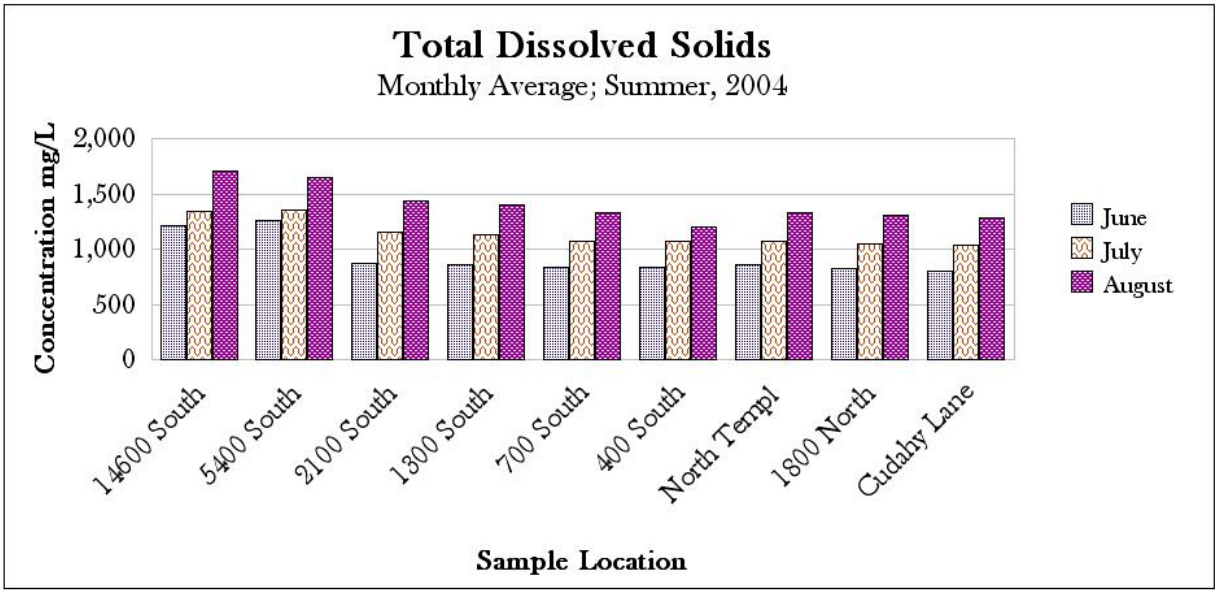
"Dissolved solids and total dissolved solids are terms generally associated with freshwater systems and consist of inorganic salts, small amounts of organic matter, and dissolved materials. The principal inorganic anions dissolved in water include the carbonates, chlorides, sulfates, and nitrates (principally in groundwater); the principle cations are sodium, potassium, and magnesium" (EPA, 1987).

Total dissolved solids (TDS) refers to minerals, salts, metals, cations and/or anions that are dissolved within the water column. TDS includes all material that is neither H_20 or particles that are suspended in the water column.

The irrigation standard for TDS along the Jordan River is 1200 mg/L. As can be seen in the figure below, this standard was violated at the Bluffdale sample location (1330.56 mg/L) and the 5400 South sampling location (1332.44 mg/L). In general, TDS levels appeared to decrease as the river progressed downstream with a low of 970.56 mg/L observed at the Cudahy Lane sample location.

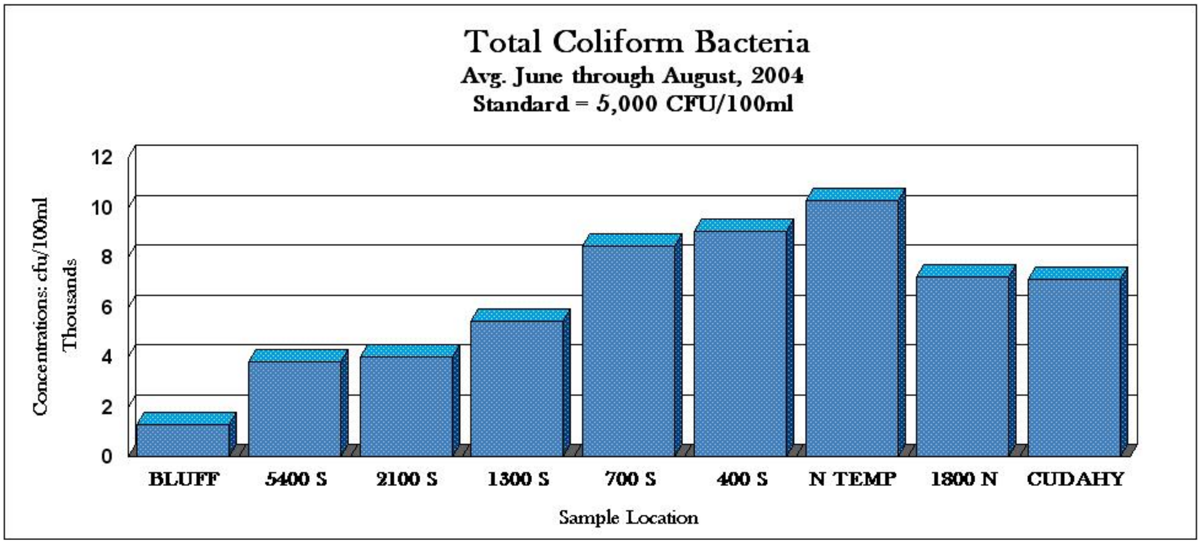


As with mean summer TDS, 30 day average TDS concentrations were highest at the Jordan Narrows, and gradually decreased as the River progressed downstream. In contrast to patterns observed with temperature, total phosphorus, and TSS data, TDS concentrations were highest in the month of August (varying between 1,208.8 mg/L and 1,708.0 mg/L) and lowest in the month of June (varying between 803.67 mg/L and 1,267.67 mg/L). July TDS concentrations were between August and June concentrations (varying between 1,038.0 mg/L and 1,348.0 mg/L). Notably, 30 day average TDS values exceeded the 1,200 mg/L standard for the Bluffdale and 6400 South sample site for all three months of this study. Although samples taken at 2100 South and 1300 South nearly exceed this level in July and August (values ranged between 1,134 mg/L and 1,199 mg/L), violations were only observed upstream of 2100 South.

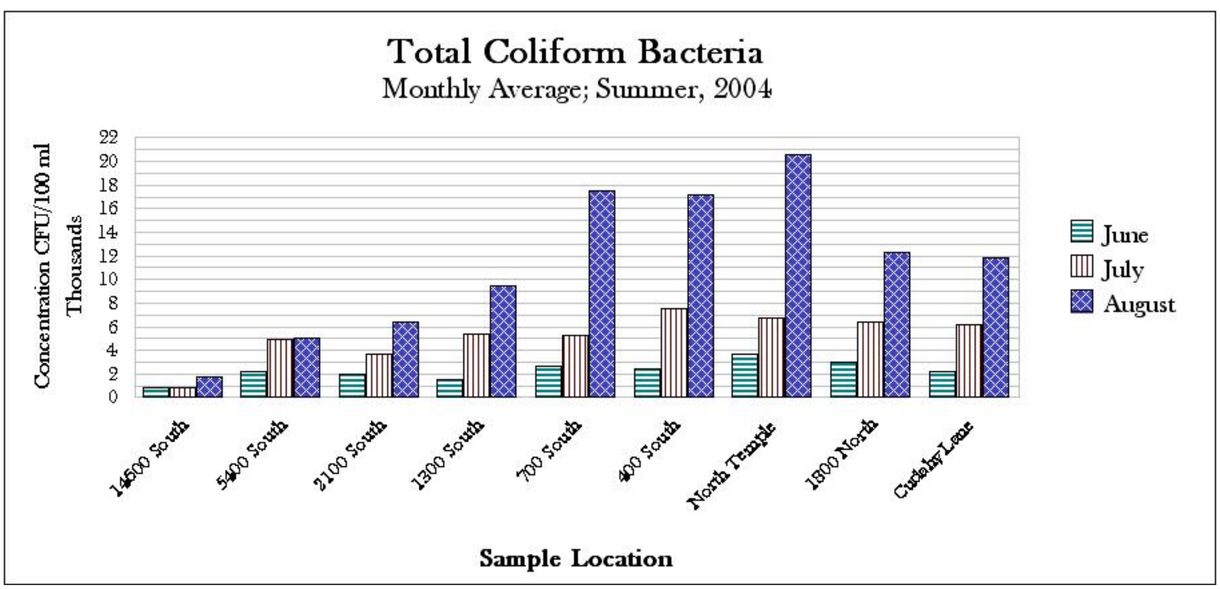


<u>Total Coliform</u>

Total coliform bacteria in water is an indicator of pathogen presence and is therefore a public health concern. This bacteria is present in suspended solids from erosional runoff water, storm water runoff, animal waste and septic tank systems-including gray water. The standard for coliform forming units (CFUs) in the Jordan River is 5,000 CFU/100 mL. Upstream of 1300 South, total CFUs are below the standard limit of 5,000 CFU/100mL. However, a sharp increase in total CFUs was found to occur between 1300 and 700 South. Notably, the total CFUs at 700 South exceed the standard by nearly 3,000 CFU/100 mL. Between 700 South and North Temple, total CFUs increase; whereas, a slight decrease in CFUs was observed at 1800 North and Cudahy Drive. Although the cause of increase in CFU at 1300 South is undetermined, possible causes include: I&I from municipal infrastructure, increase from Red Butte, Emigration and Parleys Creek inflow, and urban runoff.

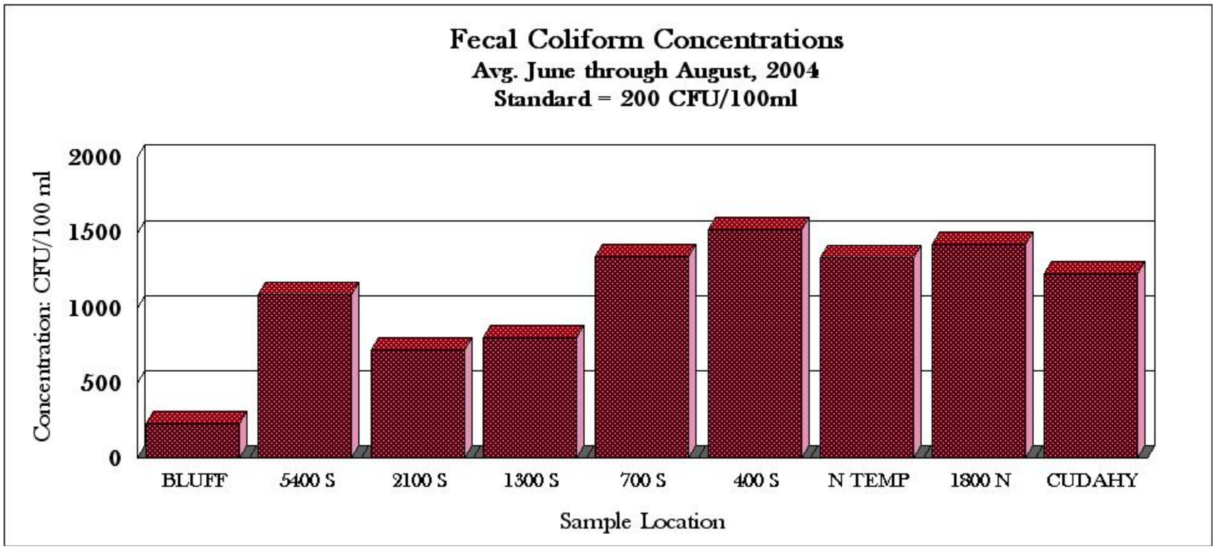


When total coliform is examined by 30 day average, it is apparent that August values (ranging between 1,767 CFU/100 mL and 17,467 CFU/100 mL) far exceed those of either June (ranging between 817 CFU/100 mL and 3,251 CFU/100 mL) or July (ranging between 800 CFU/100 mL and 7567 CFU/100 mL). When all samples were combined CFU's appeared to increase as the Jordan River progressed downstream from Utah Lake and peaked between 700 South and North Temple, it appears that August is the only month where this trend exists. Therefore, the pattern observed overall is most likely due to the strong influence of August values.

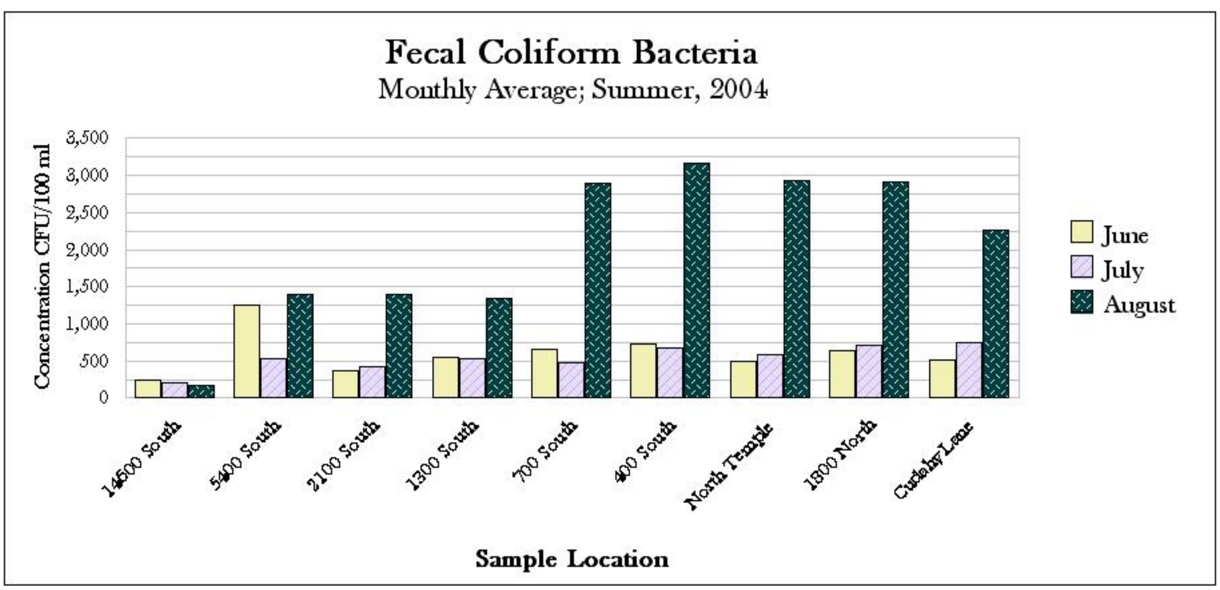


Fecal Coliform

Fecal coliform bacteria is generally indicative of animal or human waste sources in a stream. Notably, this parameter is likely to originate from wastewater treatment plants, septic tanks and/or graywater facilities, seepage pits, and animal waste. The 2004 data for the Jordan River indicate that, similar to total coliform, an increase in fecal coliform CFUs occured between 1300 South and 700 South; however, a slightly higher concentration of CFUs was also observed at the 6400 South sample location. Notably, only the Bluffdale sampling location was even moderately close to the 200 CFU/100 mL limit. The most egregious fecal coliform level was observed at 400 South sample location (1,522 CFU/100 mL) and the lowest concentration was again found at the Bluffdale sample location (233 CFU/100 mL). As with total coliforms, the reason for such violations is yet to be determined.

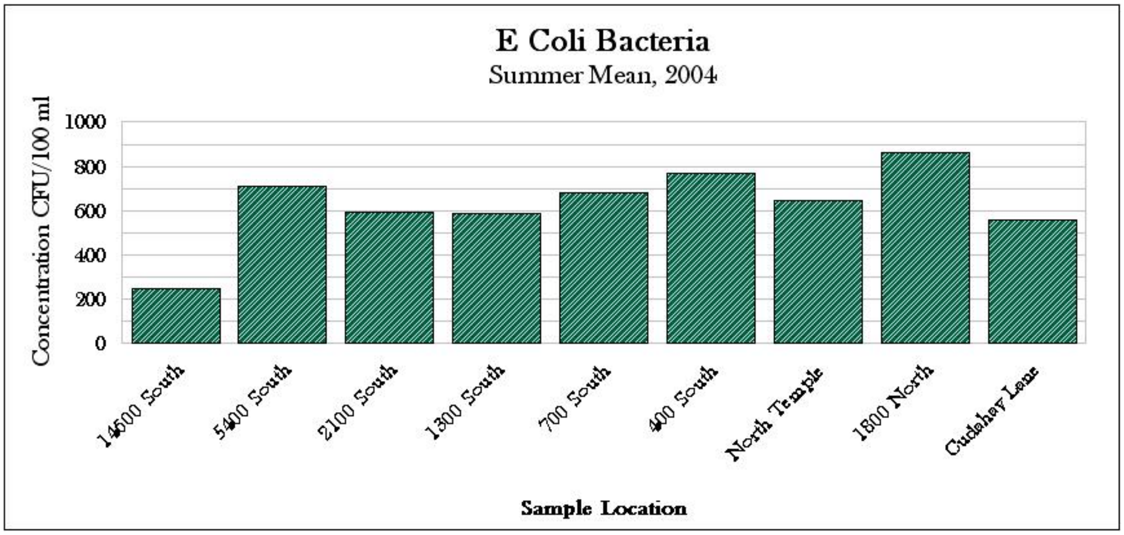


Similar to total coliform, our data suggests that the overall trend in fecal coliform concentrations is derived from extremely high CFU counts in August. August fecal coliform counts (ranging from 167 CFU/100 mL to 3,160 CFU/100 mL) far exceed those observed in either June (ranging from 245 CFU/100 mL to 733 CFU/100 mL) or July (ranging from 200 CFU/100 mL to 673 CFU/100 mL).

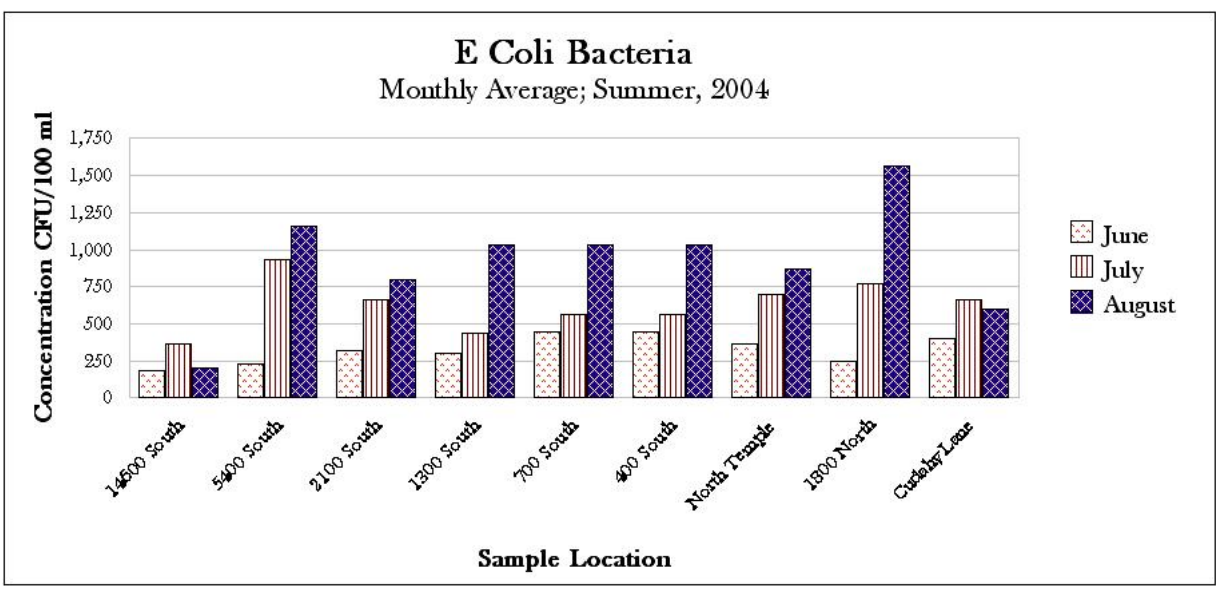


E. Coli Bacteria

Currently, the Utah Division of Water Quality is proposing to replace Total and Fecal Coliform standards with E. Coli. The standard that is being proposed is 126 org/100 mL. Throughout the course of the Jordan River, E. Coli measurements were substantially higher than the proposed standard. Similar to Total and Fecal Coliform, E. Coli bacteria were lowest (250 org/100 mL) at the 14600 South sample location. However, in contrast to the coliform data, this parameter showed much less variability throughout the course of the River and had no strong downstream pattern. The highest E. Coli count was observed at 1800 North (861 org/100 mL) and was nearly seven times the proposed standard.



As with total and fecal coliform concentrations, E. Coli bacteria counts were highest in the month of August (ranging from 201 org/100 mL to 1,567 org/100 mL) and lowest in the month of June (ranging from 184 org/100 mL to 450 org/100 mL). July levels were again moderate (ranging from 367 org/100 mL to 767 org/100 mL). Although variability did exist between months, none of the 30 day averages showed a strong downstream trend. Similar to the overall average, the highest 30 day average was observed at the 1800 North Sample location.



PUBLIC INVOLVEMENT AND COORDINATION

The purpose of this project was primarily to determine the potential causes and sources of contamination that result in violation of the Class 3B dissolved oxygen standard on the lower Jordan River. Extensive coordination with federal, state and local agencies was included, while public involvement has been limited pending determination of potential causes and sources of contamination in the River. Expanded stakeholder groups are anticipated to become part of the TMDL process.

- Salt Lake City Corporation

The principal local partner for the project was the Salt Lake City Department of Public Utilities Laboratory. Salt Lake County has a long, successful history of coordination with Salt Lake City on numerous watershed projects, including the 208 Area-Wide Water Quality management Plan, Salt Lake City Watershed Management Plan, Wasatch Canyon Master Plan, Stormwater Monitoring Projects, Wetland Assessments for Albion and Brighton Basins, the Alta Fen abandoned Mine Pilot Project, and annual water quality and flow monitoring at numerous stations within Wasatch Front Canyons.

Salt Lake City provided the use of its water quality laboratory, located at the Water Reclamation Facility, for chemical analyses and reporting of the bacterial water quality samples. The City coordinated closely with County monitoring staff on all aspects including sample chain of custody, documentation of receipt, use of alternate dilutions, additional laboratory time and preparation, and reporting.

- Utah Division of Water Quality

The Utah Division of Water Quality (DWQ) administers all Section 319 grants which are based on annual federal budget allocations from Region VIII of the Environmental Protection Agency (EPA). The Utah Nonpoint Task Force identified the Jordan River Assessment as a high priority and funded the project. Salt Lake County coordinated with DWQ from project design to final report completion, with particular attention to statistical requirements for documenting arithmetic and geometric means for fecal coliform data.

ASPECTS OF THE PROJECT THAT DID NOT WORK WELL

1. The Jordan River water quality assessment was delayed an entire sampling season due to the length of time required for the grant award, inter-agency contract processing, and contract execution. However, the grant agreement was written to allow enough time to shift the project forward to 2004 without sacrificing critical timetables or requiring contract extensions.

2. The project sampling design was first conceived to utilize equal-width integrated sampling, with USGS DH 48 sediment samplers as the principal collection vehicle. After a training run or two, it became evident that sample personnel could not manage the weight requirements of the equipment, so the project resorted to grab sampling instead.

3. Another factor which led to this grab sampling decision was the flow of the Jordan River, which has been abnormally low for the last 5-6 years. For example, flows at the 9000 South gaging station, operated and maintained by Salt Lake County, were commonly between 100-200 c.f.s. historically. Flows over the last five years have been consistently below 100 c.f.s., and during 2003-2004 more commonly between 20-50 c.f.s. The low flows extended downstream to the Jordan River in Salt Lake City, and it became apparent that flows were concentrated within narrow channel width profiles instead of evenly distributed along the entire channel cross section. Therefore, it was determined that adequate mixing existed under the low flow regime to merit grab sampling and yield accurate results.

4. The low flow regime of the Jordan River may in part be responsible for the abnormally high concentrations of various pollutants which had previously been documented in the River in the 1994 Jordan River 305(b) assessment (Salt Lake County, 1994). Notably, annual mean flow of the Jordan River was 126 c.f.s. in 1994 and ~37 c.f.s. in 2004. Lower flows usually result in higher concentrations, but high flows can also mask concentrations. The priority should continue to identify sources of contaminants and lead to development of control programs.

5. Salt Lake County was not able to acquire the equipment necessary to conduct “Colilert” coliform bacteria sampling methodology as described in the approved work plan. This is due in part to complications associated with purchasing rules against “sole source” products or vendors. By the time the issues were resolved with purchasing agents, the project was well into its third summer month. However, substantial data was collected and laboratory analyzed, so the overall objectives were not defeated. Although “Colilert” coliform bacteria sampling methodology provides the most probable coliform numbers, membrane filtration gives actual counts.

6. Some problems were encountered with the field instruments. They were generally associated with operator error and maintenance neglect, and the instruments performed most of the time to enable validation. The County requested the State Division of Water Quality to perform diurnal dissolved oxygen sampling to further validate observations recorded by County sampling personnel. The diurnal D.O. data provide an interesting comparison to day time measurements. It is noted that diurnal fluctuations have been documented by the U.S. Geological Survey in other western streams for heavy metals and nutrients. Such an approach should be considered for the Jordan River.

VII. CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE ACTIVITIES

This section describes general conclusions and results of the project, and makes recommendations for possible future water quality monitoring activities as part of the Jordan River TMDL project.

1. HISTORIC FLOW CONDITIONS

The Jordan River has experienced extraordinarily low flows over the past 5-6 years. While undoubtedly due to extended drought conditions, the current flow scenario nonetheless needs to be included in a statistical examination of the historic record. The same applies to the exceedingly high flows experienced during the extended flood conditions which occurred during 1983-84.

Much has been said about the "managed" flow conditions of the Jordan River, and how the River no longer displays attributes associated with natural stream processes. The Jordan is still subject to beneficial snow melt contributions in the Spring, particularly downstream of 4800 South (the confluence with Little Cottonwood Creek). It also experiences un-natural flooding conditions created by management of the Utah Lake "Compromise Elevation," which dictates that the Lake gates be opened and drained when this level is reached. These practices often result in temporary scouring flows between 1,500-2,300 c.f.s. Finally, regardless of Utah Lake influences, there is ample sediment supply to the Jordan River from tributaries and non-point sources, which continues to make fluvial sediment dynamics (scouring/deposition) an issue in long-term River maintenance and restoration activities.

Jordan River flows recorded in the early 1990's may be closer to historic averages, and during this period, equal-width integrated sample data were collected along the River and reported in the 1992 305(b) Water Quality Assessment (See Appendix B). The extent of water quality standard exceedences during this period were significantly lower than those documented in 2004. This does not necessarily imply that conditions in the Jordan River have degraded in the last decade, because the flows have been lower, resulting in less dilution. But the drought conditions also serve to reveal ambient water quality conditions that may be masked by a higher flow regime. Additionally, in drought years the amount of canyon stream water that reaches the Jordan may be reduced due to diversions to meet drinking water demands.

2. BASE FLOW CONTRIBUTIONS

A review of historic tributary flow data, and that collected during the Nationwide Urban Runoff Project (NURP), provide important clues to the source of pollutant concentrations. For example, many of the water quality problems in the Jordan appear to magnify below the 1300 South Drain confluence, which includes the combined flow of Parleys, Red Butte, and Emigration Creeks. Emigration Creek has been listed as impaired [303(d)) for total and fecal coliform bacteria]. Of the three principal perennial flow sources to the Jordan (2100 South, 1300 South, and North Temple), the 1300 South combined flow is by far the greatest. Any future sampling and load allocation should incorporate individual drainage system (subwatershed) water quality data and monitoring, together with close examination of wastewater treatment plant contributions, industrial permitted and illicit discharges.

3. DISSOLVED OXYGEN

The Jordan River is experiencing minimal daily dissolved oxygen conditions during summer months between 2100 South and 400 South, and significant diurnal “crashes” from 700 South downstream to Cudahy Lane. Low nightly and early morning summer dissolved oxygen concentrations in this reach are likely having significant impact on aquatic biota, when photosynthesis slows (or ceases) and oxygen is consumed below standards levels for 6-8 hours.

Because this reach of the Jordan River is among the most densely vegetated, with large stands of riparian overstory species (large trees and shrubs), it is rather curious that lowest dissolved oxygen levels would occur here, rather than along some of the more exposed stream segments. Although the opportunity for cooling from riparian shade is highest along this reach, mean water temperatures gradually increase to well beyond 20° C. in July and August.

In hydro-geomorphic terms, velocity and gradient of the Jordan River flatten significantly downstream of 3300 South, and oxygen infusion into the water column gradually becomes limited, particularly below the 2100 South diversion. Conversely, the bio-chemical oxygen demanding load of water born constituents (coliform bacteria) increases to significant levels within this reach. The symbiotic relationship of high coliform concentrations and low dissolved oxygen levels seems apparent, although other factors may contribute (chemical or carbonaceous oxygen demand). However, it is apparent that further diurnal DO data is required before substantial conclusions can be made.

4. BIOLOGICAL OXYGEN DEMAND

Biological Oxygen Demand (BOD) is a function of aerobic metabolic processes associated with the decomposition of organic matter in water. The decomposition of dead organisms, leaves, sewage, or other carbon based materials is conducted by microorganisms such as bacteria. Therefore, BOD is essentially a measure of the amount of oxygen required for microorganisms to decompose the organic matter found in a stream, river or lake and is correlated with nutrient availability and bacterial composition. Because the decomposition of organic matter requires the consumption of Dissolved Oxygen (DO), DO levels tend to decrease as decomposition occurs and thereby reduces the oxygen availability for fish and other aquatic species. The State standard for BOD is 5.0 mg/L.

In association with bacteria and phosphorus data, the Jordan River shows an increase in Biological Oxygen Demand (BOD) below 2100 South and a slight decrease in BOD in the northern reaches of the River above 1800 North. Mean BOD levels remained below the 5.0 mg/L standard for the summer. However, when BOD levels were examined by month it was reveled that this standard was exceeded between 2100 South and North Temple for the month of August. Since BOD is a function of nutrient availability and microorganisms, the correlation with phosphorus and coliform counts is predictable. Therefore, the reduction of coliform pollutants and phosphorus levels in the Jordan River would decrease DO depletion that results from the decomposition of organic matter.

5. TOTAL PHOSPHORUS

The indicator criteria for total phosphorus in the Jordan River Water Quality Standards is 0.05 mg/L. The data collected from eight (8) stations along the Jordan River during the summer of 2004 show that average phosphorus concentrations are extremely high, averaging between 0.11 to 1.37 mg/L between June and August, from 5400 South downstream.

Total Phosphorus stimulates excessive algal growth, leading to eutrophication, which creates an on-going source of oxygen-demanding biota. Algae, periphyton, and other aquatic plant growth in Utah Lake are transmitted downstream to the Jordan River. During this journey, these plants receive nourishment from wastewater effluent (estimated at >95%), surface runoff, stormwater runoff, effluent from groundwater tile drains, return flow from irrigation, cattle feedlots, concentrations of domestic or wild duck populations, tree leaves, and atmospheric deposition. "The human body excretes about one pound per year of phosphorus expressed as P. The use of phosphate detergents and other domestic phosphates increases the per capita contribution to about 3.5 pounds per year." (EPA Quality Criteria for Water, 1996).

Phosphorus sources/loads can be more specifically defined through intensive monitoring design, compilation of effluent discharge data, and implementation of comprehensive algae and periphyton assessments. The Salt Lake City Public Utilities Laboratory uses methods to determine phosphorus "speciation" or origin, together with identifying bio-available phosphorus types. In summary, phosphorus may be the most critical, yet easily identifiable and manageable, of the Jordan River contaminant family. It can also be effectively treated and removed from the aquatic ecosystem with use of passive bio-systems such as constructed wetlands, as well as addition of chemical treatment processes to wastewater plants.

6. TOTAL SUSPENDED SOLIDS (TSS).

Concentrations of total suspended solids (TSS) in the Jordan River are not extraordinary. The highest levels occur in the steeper, upstream monitoring station at Bluffdale (the 14600 South bridge). At this location, TSS concentrations are 2-3 times those of downstream sites. The River geomorphology in this steeper Bluffdale reach is much more incised or down-cut, and would be classified as an "F" or "G" type river than a typical "C" type. The F and G types are characterized by greater levels of entrenchment, smaller width/depth ratios, less sinuosity, and greater channel slope.

7. TOTAL DISSOLVED SOLIDS (TDS).

As discussed in the "flow" paragraph headings, the Jordan River inherits its base flow and water quality from Utah Lake. Hydro-geomorphic and geo-antiquity studies conducted by the University of Utah (Curry, 2001), suggest that Utah Lake was formed when upward tilting of the valley floor in Utah County occurred during pleistocene orogeny and other earthquake events. This interrupted flow of the Jordan River (the antiquity heir to the Spanish Fork River), and created a 12-20 ft. deep shallow "playa" lake. The Lake rose to the level of the present Jordan Narrows, cut down and through the elevated landscape and resumed flow into the receding Great Salt Lake.

Since then, Utah Lake has maintained its shallow, wind swept presence in the landscape, receiving more and more nutrients from agricultural inflow, urban runoff, wastewater discharges, and feedlot runoff as the area developed. Increased nitrate and phosphorus inputs have aggravated the problems of eutrophication, creating algal growth continually churned by wind and wave. The result of this mix is high TDS, which is imported into the Jordan River from Utah Lake.

The Jordan River TDS standard levels of 1200 mg/l limit is used for irrigation, which at these levels will result in the bio-accumulation of salts, calcium carbonate, and other minerals. Inflow to the Jordan from high quality tributaries of the Wasatch mountains may seasonally dilute the high TDS inflows from Utah Lake (May-June). However, after spring runoff has passed, the return flow of Utah Lake water from numerous irrigation canals finds its way back into the Jordan River (April-September). During winter months, after irrigation canal diversions close (October-April), the base flow of the Jordan River is regenerated by generally high quality discharge (average of 107,000 acre feet) from the shallow unconfined aquifer.

The most effective management approach to reducing TDS in the Jordan River is to implement practices around Utah Lake that intercept, trap, and remove nitrates and phosphorus. This would reduce eutrophication, but not eliminate TDS generated by wave action that will continue to entrain the fine silt and clay particles present in the Lake bottom. The TDS levels in the Jordan River, despite reducing aesthetics, do not preclude fishery success.

8. TOTAL COLIFORM BACTERIA

The Jordan River "2B" water quality classification for "non-contact" recreation typically applies to boating, floating, canoeing, and kayaking activities. The standard of 5,000 CFUs/100mL is intended to alert River recreationists of potentially unhealthy conditions when the River is unsafe to float or otherwise come in contact with. Unhealthy conditions are apparent during the months of July and August, from 2100 South downstream. The July concentrations are somewhat marginal, while August concentrations are twice the water quality standard levels from 700 South downstream.

The summer pattern of total coliform standard violations may be associated with monthly temperature, avian use, illicit discharge, seasonal accumulation, or seasonal flushing. Notably, June levels were the lowest, progressing to the highest levels in August. Upstream summer concentrations are within standard range from Bluffdale downstream to 5400 South, where water temperatures are 16-19° C. By the time the River flow reaches 1300 South, water temperatures have increased to above 20° C. This suggests a pattern of River heating from 2100 South downstream to Cudahy Lane. The total coliform concentration pattern also fits with the downstream pattern increases in total phosphorus, which can indirectly cause growth of total coliform bacteria.

9. FECAL COLIFORM BACTERIA

The Jordan River "2B" water quality standard for fecal coliform is 200 CFUs/100 ml, and represents a higher level of concern for pathogenic interactions with human use on the River. The sources of fecal coliform include mainly human and animal fecal waste, and are generally attributed to discharges from municipal wastewater treatment facilities, and animal concentrations (both wild and domestic) on or near the water. Since Jordan River sub-watersheds have few domestic animal concentrations (i.e. feedlots, dairy operations, turkey farms, horse pastures, etc.), it is likely that non-domestic waterfowl may contribute significantly to non-point source fecal coliform load. In addition to treated municipal wastewater and non-domestic animal concentrations, illicit discharges from numerous pipes, point sources, or stormwater containing feces of domestic animals should not be overlooked.

The concentrations and pattern of fecal coliform contamination along the Jordan River are significant, with all sample stations (excluding Bluffdale) exhibiting violations well in excess of 200 CFU's/100 mL. That fecal coliform pattern is manifest at 5400 South, and remains static downstream to Cudahy Lane, with June and July concentrations ranging from 500-750 CFU/100 mL. The pattern drastically shifts upward in August, with the highest concentrations exceeding 3,000 CFU/100 mL occurring at 700 South downstream to Cudahy Lane. These levels are several orders of magnitude above the Class 2B standard for "non-contact" recreation (boating, floating, kayaking).

Although fecal coliform patterns and levels appear to closely correlate with those of total coliform, growth of fecal coliform is not believed to occur, which suggests a somewhat consistent or static point source discharge. Static levels would suggest continuously flowing discharge source or consistent populations of non-domestic animal populations, but the drastic August increases may suggest more dynamic loading rates during this time period.

10. E. COLI

The Utah Division of Water Quality (DWQ) will propose rule changes in 2005 to adopt a standard for E. Coli, considered to be more indicative of human health impairment potential than the current Fecal and Total coliform regulations. Marine studies have concluded that "[E. Coli] were the most predictive indicator for enteric disease symptoms." Conclusions from fresh water studies suggest that "the strongest correlations occurred between incidence rates of gastrointestinal disease and fecal streptococci densities". The authors indicated that their definition of fecal streptococci essentially included what the EPA studies call "enterococci." However, there appears to be some discrepancy in the studies, some of which differentiate E. Coli from enterococci. For fresh water conditions, "a statistically sufficient number of samples (generally not less that 5 samples equally spaced over a 30-day period) the geometric mean of E. Coli densities should not exceed 126 org/100ml."

The summer monthly averages of E. Coli in the Jordan River appear to regularly exceed the 126 org/100 mL guidelines, and the concentrations follow a static pattern during this time period, similar to that of fecal coliform.

RECOMMENDATIONS FOR FUTURE ACTIVITIES

The table below summarizes recommended follow up studies or activities to further define point or non-point sources of the targeted water quality parameters of the Jordan River.

Parameter	Source	Studies/Activities
Flow Fluctuations	Utah Lake Management; Groundwater Diversions;	Identify new freshwater sources; Flood water storage; Continue secondary effluent water discharges; Secure instream flows; Stormwater storage & wetlands recharge.
Base Flow Contributions	Wastewater Effluent; Storm drains; Shallow Aquifer	Compile UPDES data; Monitor subwatershed stream contributions & water quality
Groundwater	Shallow capture projects	Evaluate impacts on the Jordan River flow from shallow groundwater capture projects.
Dissolved Oxygen	Coliform, BOD, COD, Temperature, Phosphorus	Establish correlations between oxygen demanding sources & D.O. fluctuations
Total Phosphorus	Wastewater Treatment Plants; Urban Runoff; Animal concentrations; Natural	Compile UPDES data for POTW's & establish TMDL; Compile NURP & storm data
Total Suspended Sediment	Natural; Urban Runoff	Implement Construction BMP's
Total Dissolved Solids	Utah Lake	Implement inflow nutrient reduction programs
Coliform Bacteria	Wastewater Treatment Plants; Animal Concentrations; Illicit discharges.	Compile UPDES data for POTW's; Control total phosphorus; Restrict River use during critical periods. Conduct Ribotyping analysis.
Selenium	Natural, Urban Runoff	Evaluate Selenium contributions to the Jordan River.

In addition, Salt Lake County recommends that quarterly studies of water quality be conducted of the Jordan River and that intermediate sample stations between Bluffdale and 5400 South be added. Although numerous patterns were determined using summer data, the water quality information collected in 1992, as part of a 305(d) study, showed high contamination levels in winter months as well as those observed in summer months. It is therefore the County's recommendation that future analysis include all seasons. Additional sample stations between Bluffdale and 5400 South would provide a more complete understanding of potential contamination sources in the upper reaches of the River.

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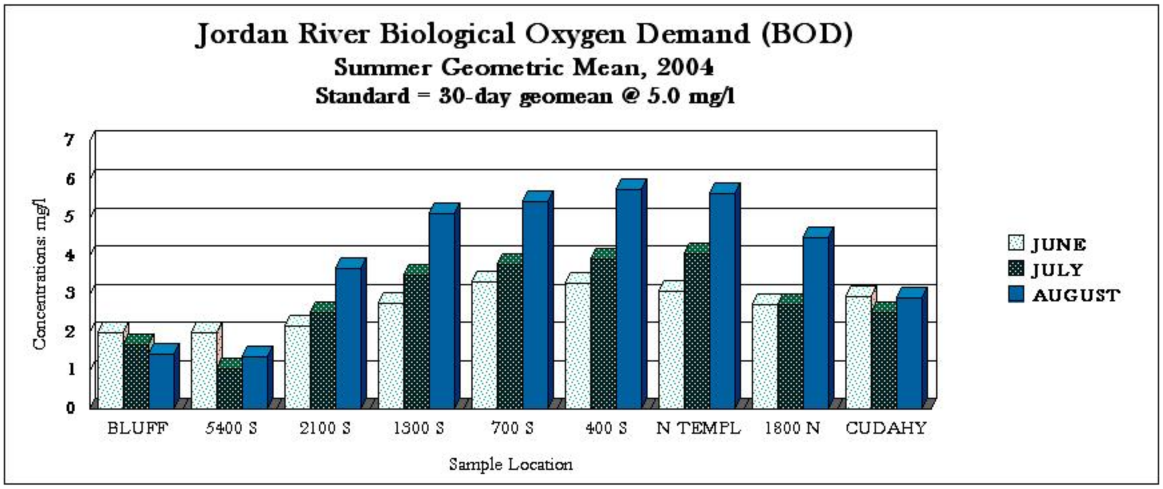
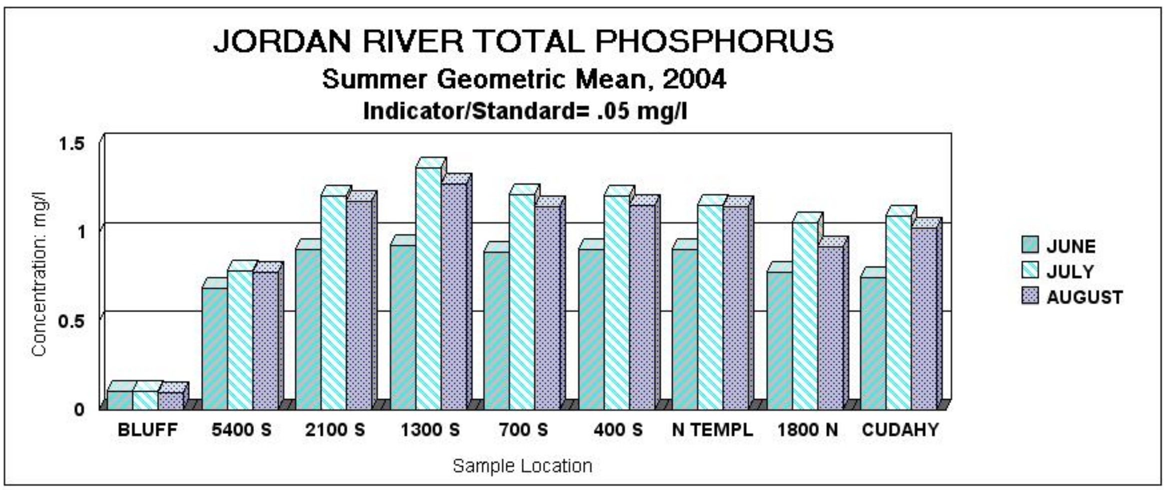
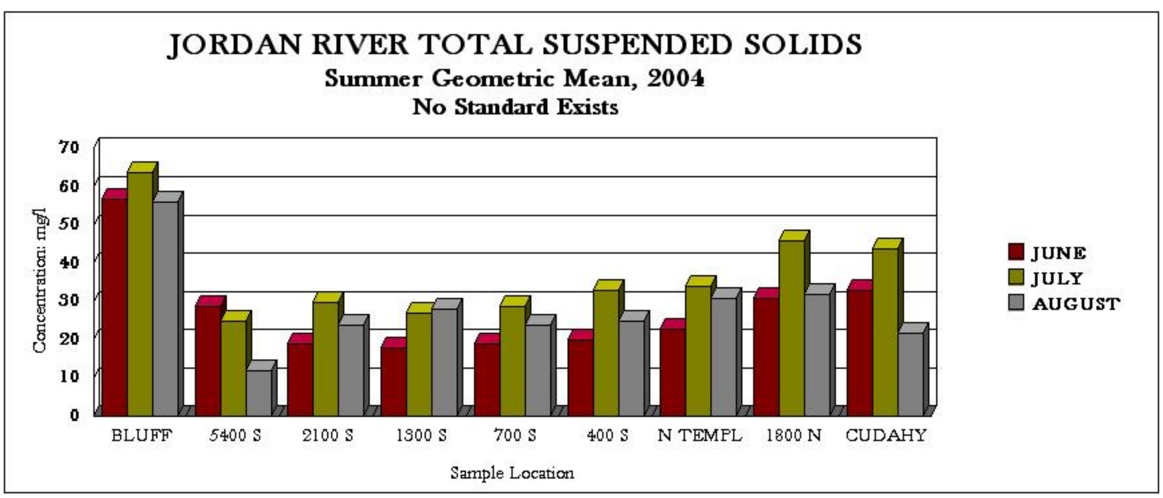
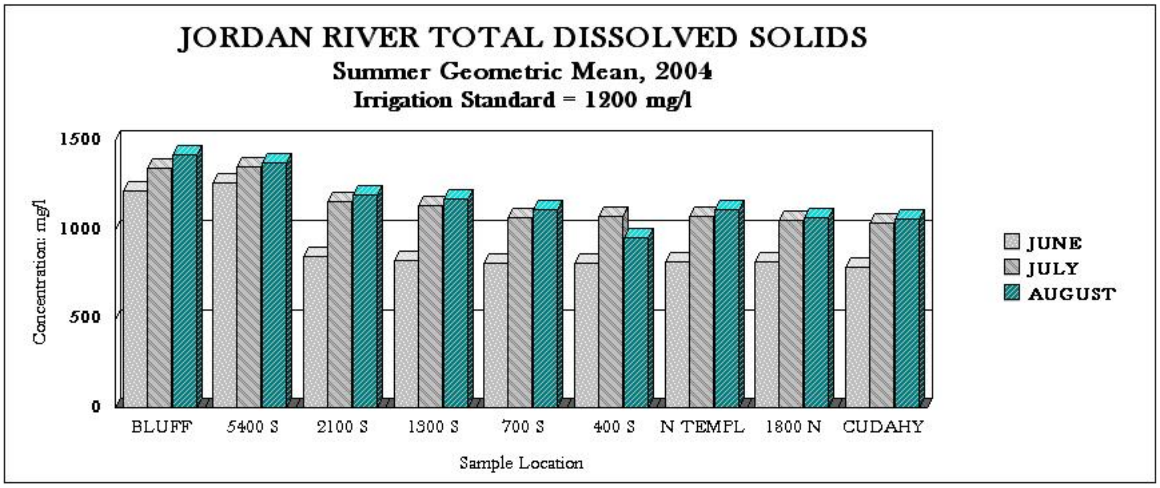
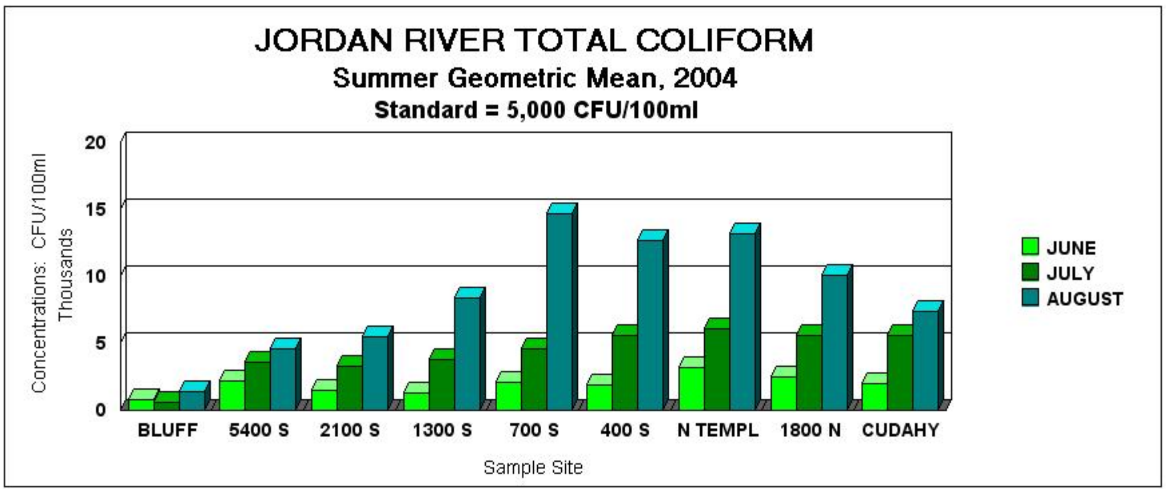
APPENDIX A: Geometric Mean Graphs

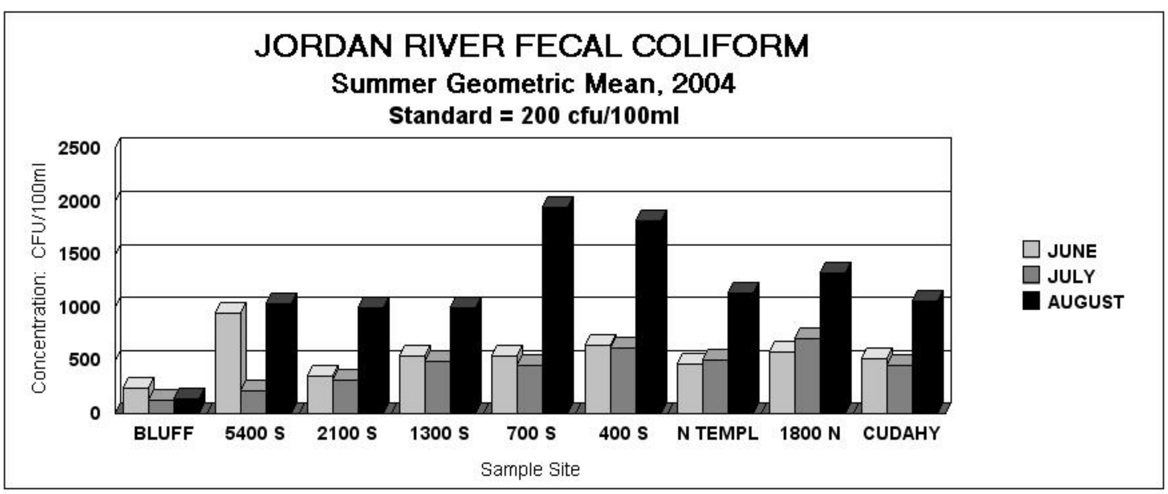


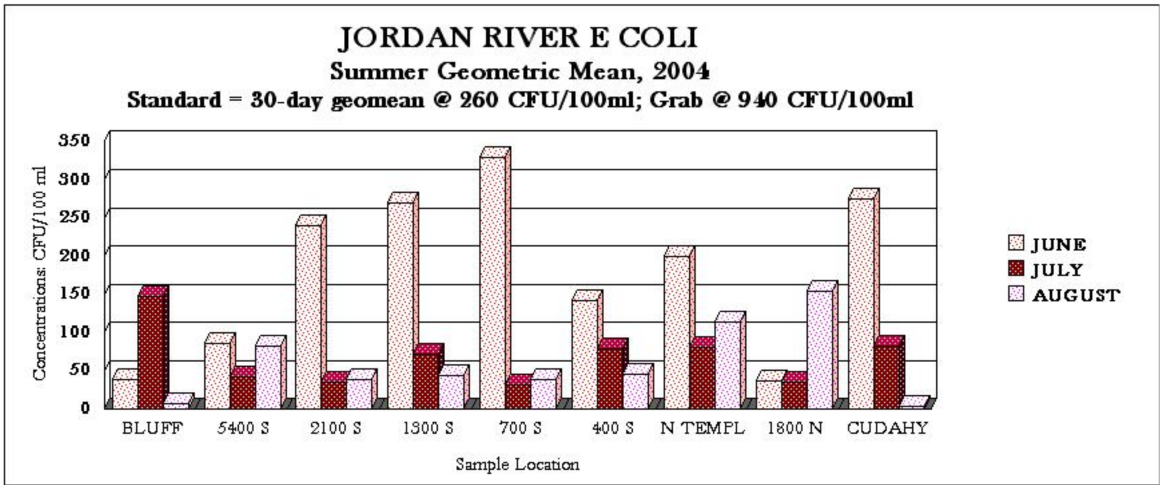




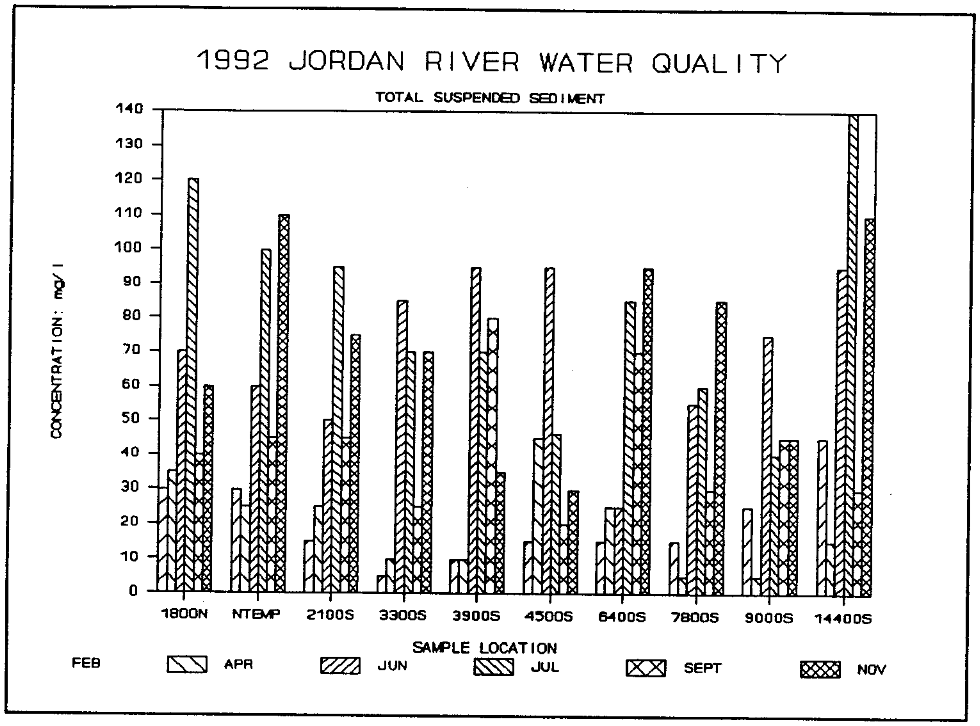

JORDAN RIVER TOTAL DISSOLVED SOLIDS
Summer Geometric Mean, 2004
Irrigation Standard = 1200 mg/l
Concentration: mg/l
1500
1000
500
0
BLUFF
5400 S
2100 S
1300 S
700 S
400 S
N TEMPL
1800 N
CUDAHY
Sample Location
JUNE
JULY
AUGUST

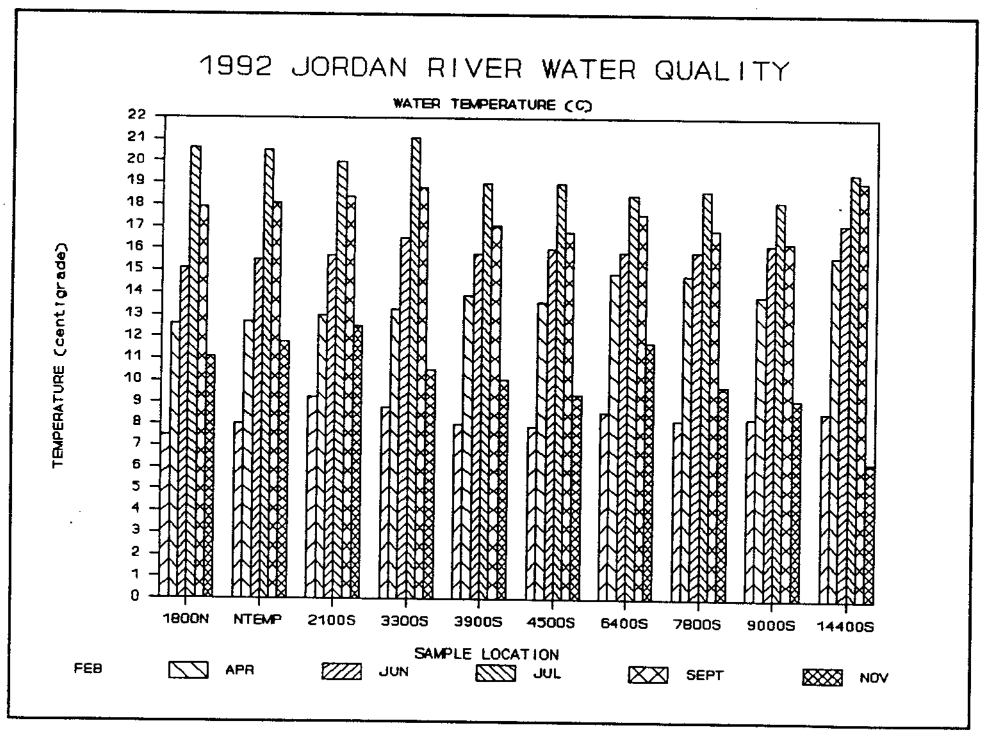

JORDAN RIVER TOTAL COLIFORM
Summer Geometric Mean, 2004
Standard = 5,000 CFU/100ml
Concentrations: CFU/100ml
Thousands
20
15
10
5
0
BLUFF
5400 S
2100 S
1300 S
700 S
400 S
N TEMPL
1800 N
CUDAHY
Sample Site
JUNE
JULY
AUGUST

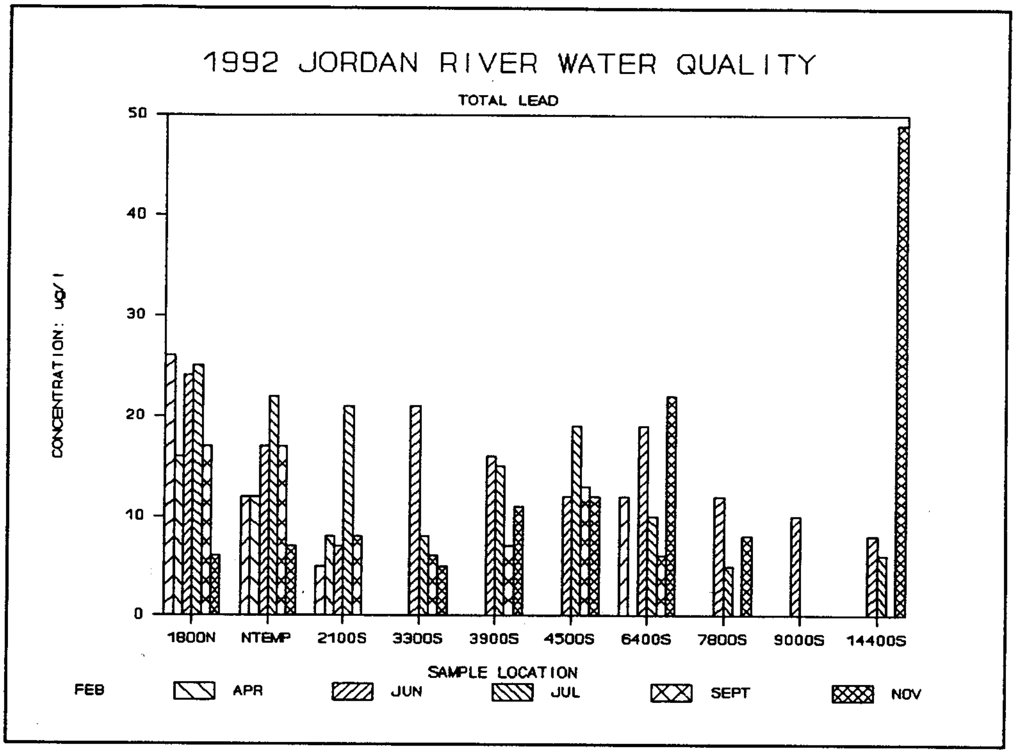

JORDAN RIVER FECAL COLIFORM
Summer Geometric Mean, 2004
Standard = 200 cfu/100ml
Concentration: CFU/100ml
2500
2000
1500
1000
500
0
BLUFF
5400 S
2100 S
1300 S
700 S
400 S
N TEMPL
1800 N
CUDAHY
Sample Site
JUNE
JULY
AUGUST

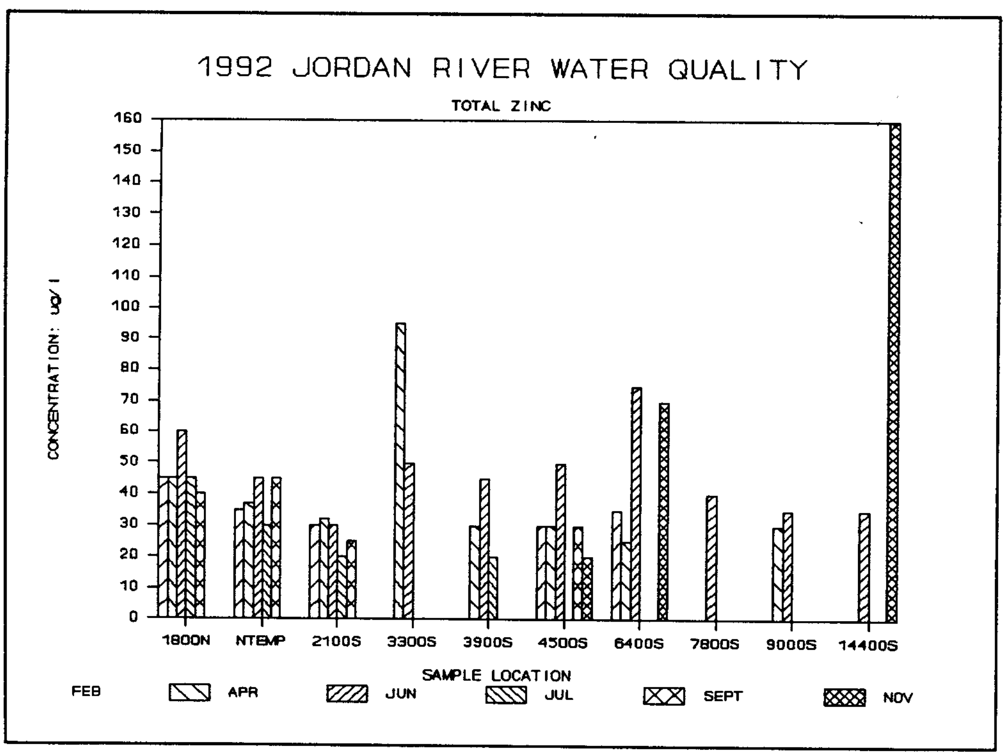

JORDAN RIVER E COLI
Summer Geometric Mean, 2004
Standard = 30-day geomean @ 260 CFU/100ml; Grab @ 940 CFU/100ml
Concentrations: CFU/100 ml
350
300
250
200
150
100
50
0
BLUFF
5400 S
2100 S
1300 S
700 S
400 S
N TEMPL
1800 N
CUDAHY
Sample Location
JUNE
JULY
AUGUST

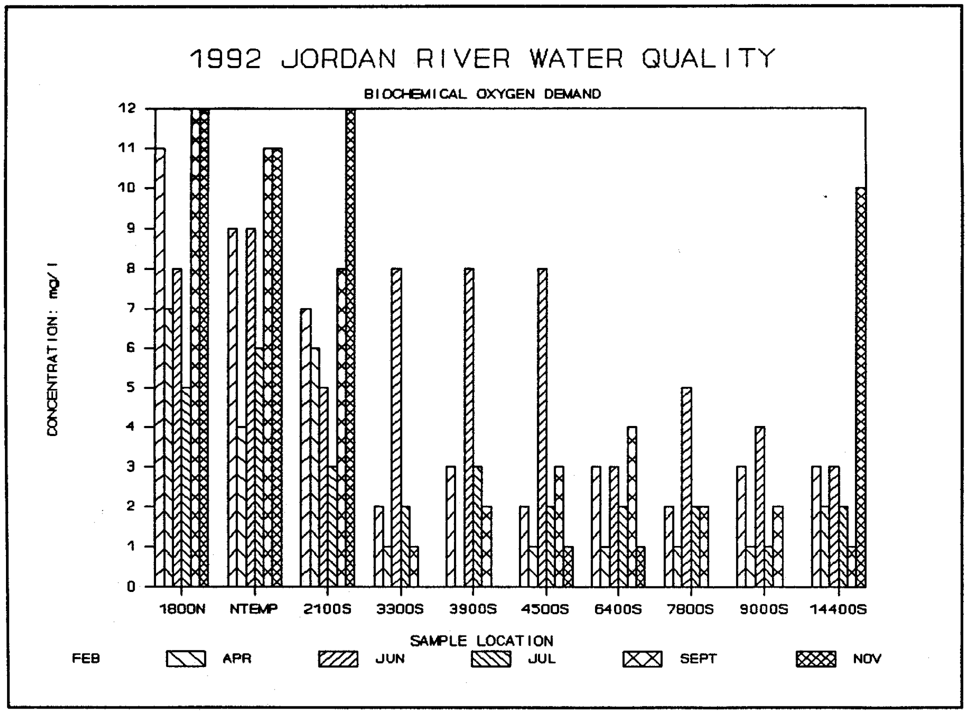
APPENDIX B: 305(b) Data

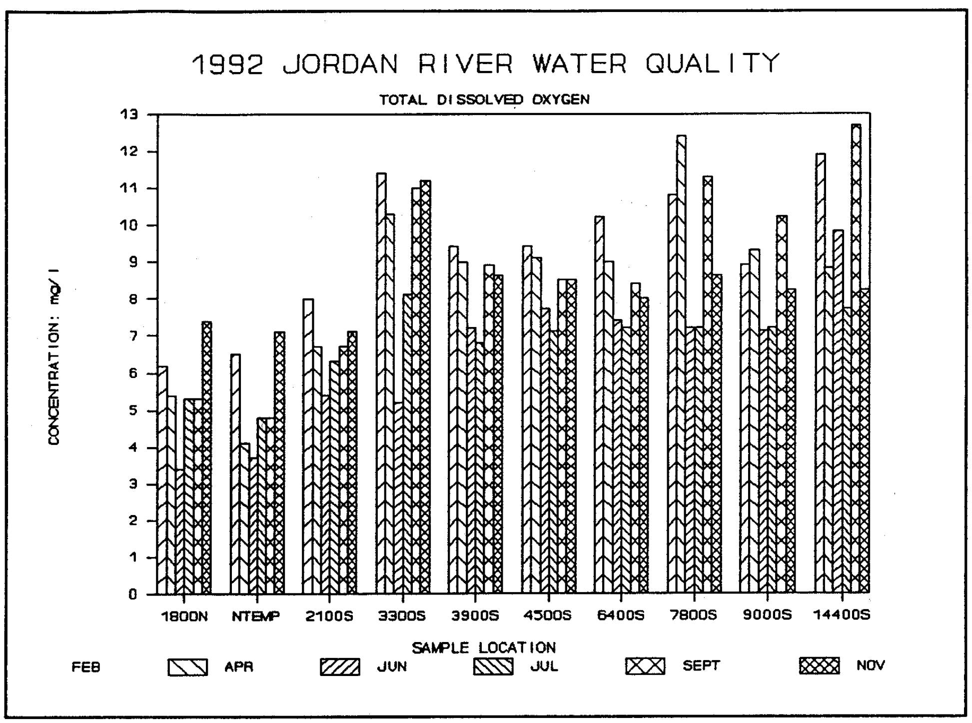


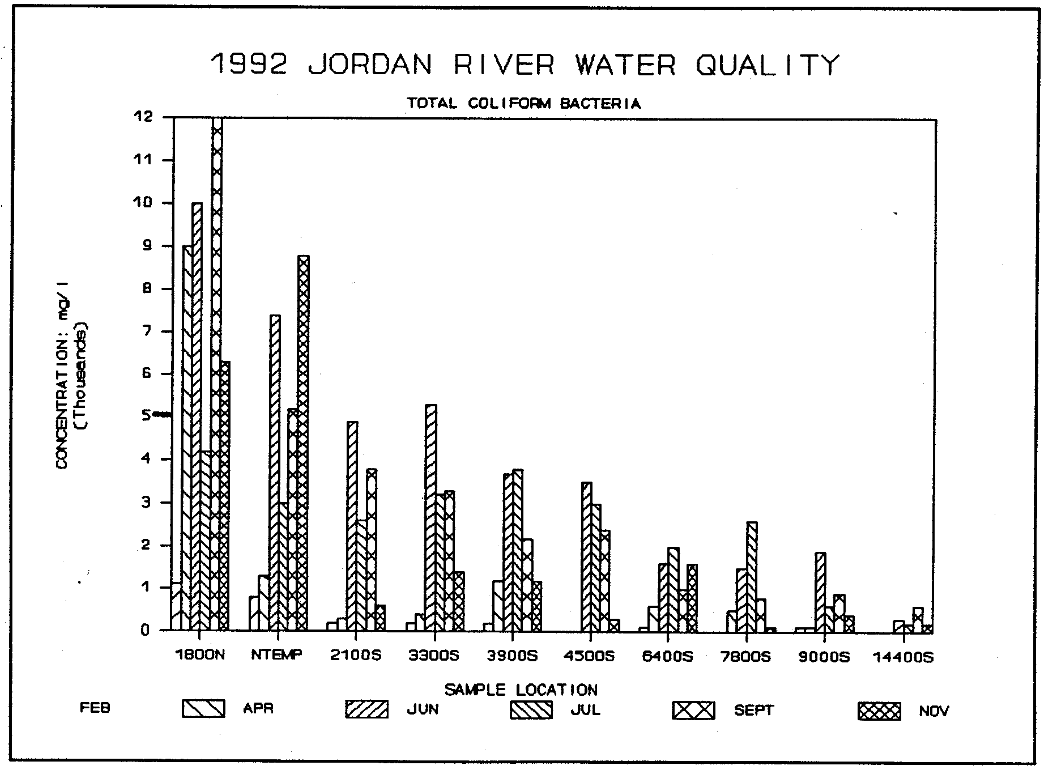


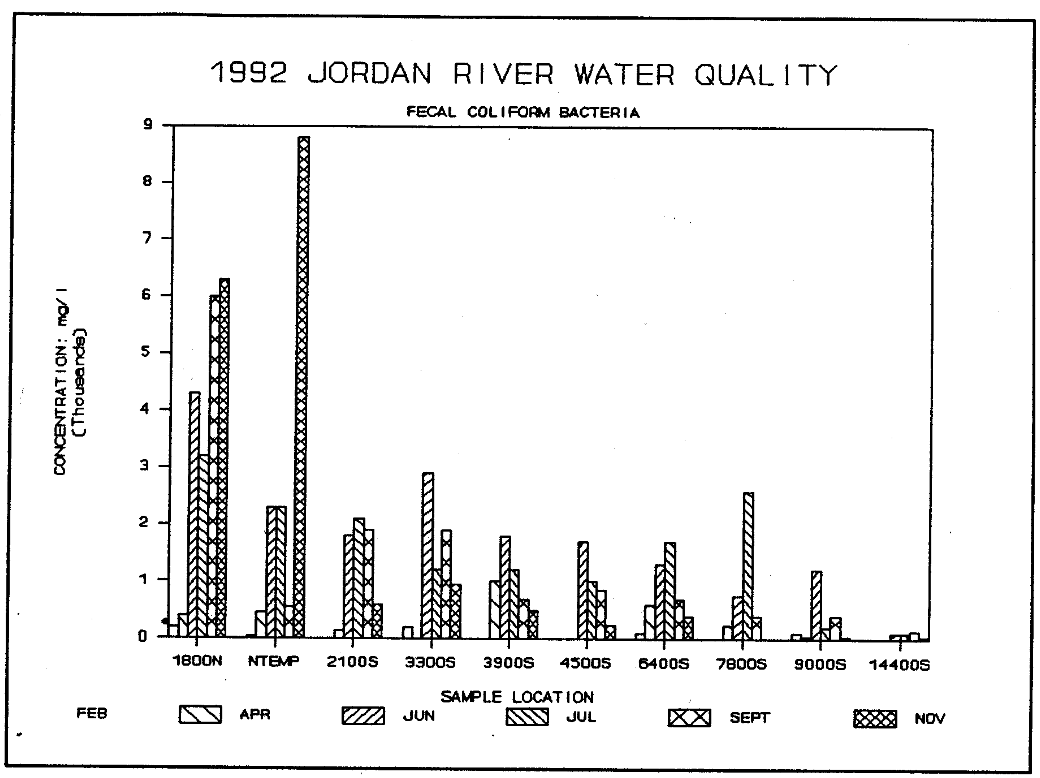

1992 JORDAN RIVER WATER QUALITY
TOTAL LEAD
CONCENTRATION: ug/l
0
10
20
30
40
50
1800N
NTEMP
2100S
3300S
3900S
4500S
6400S
7800S
9000S
14400S
SAMPLE LOCATION
FEB
APR
JUN
JUL
SEPT
NOV

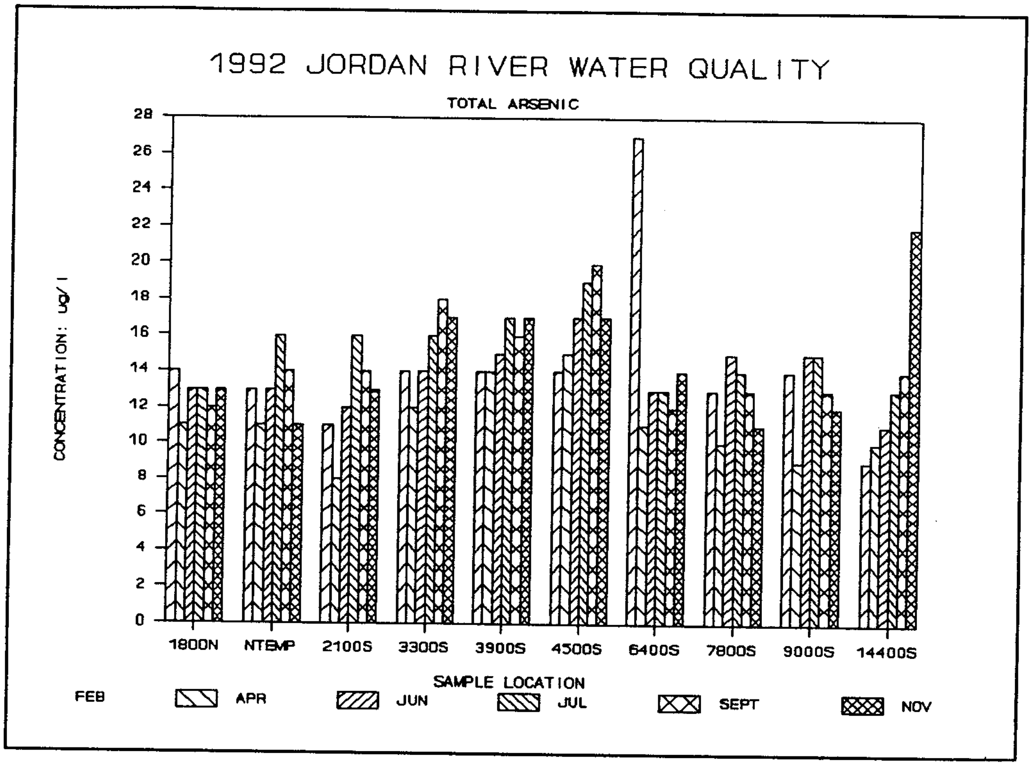

1992 JORDAN RIVER WATER QUALITY
TOTAL ZINC
CONCENTRATION: ug/l
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
1800N
NTEMP
2100S
3300S
3900S
4500S
6400S
7800S
9000S
14400S
SAMPLE LOCATION
FEB
APR
JUN
JUL
SEPT
NOV

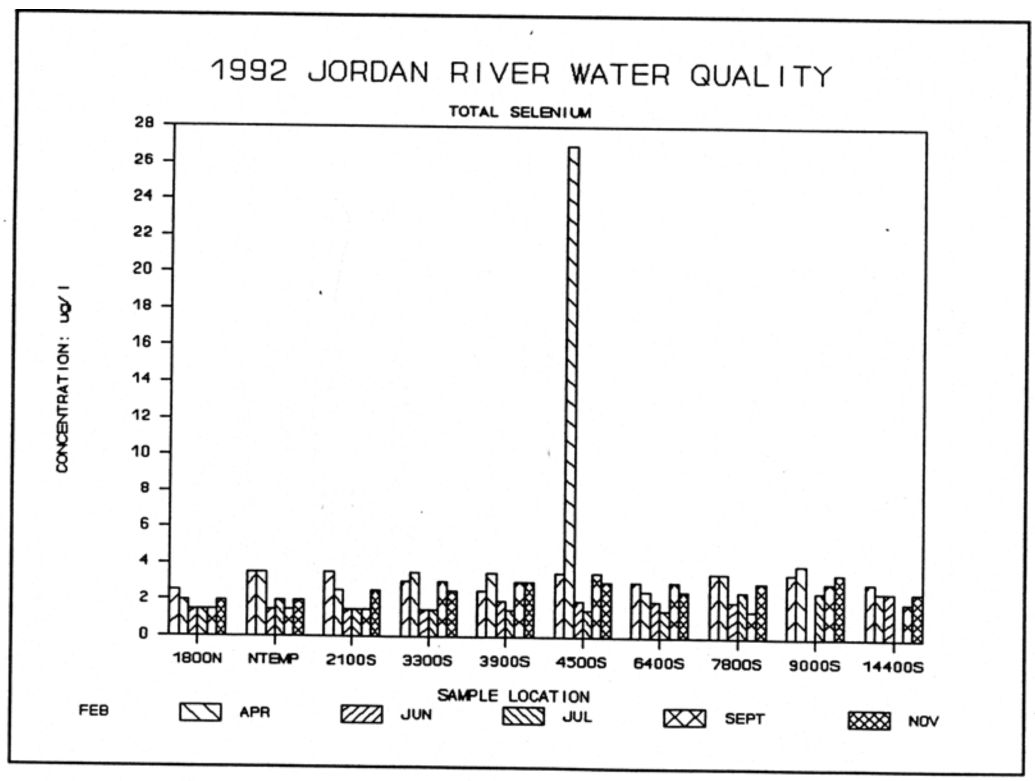

1992 JORDAN RIVER WATER QUALITY
BIOCHEMICAL OXYGEN DEMAND
CONCENTRATION: mg/l
1800N NTEMP 2100S 3300S 3900S 4500S 6400S 7800S 9000S 14400S
SAMPLE LOCATION
FEB APR JUN JUL SEPT NOV

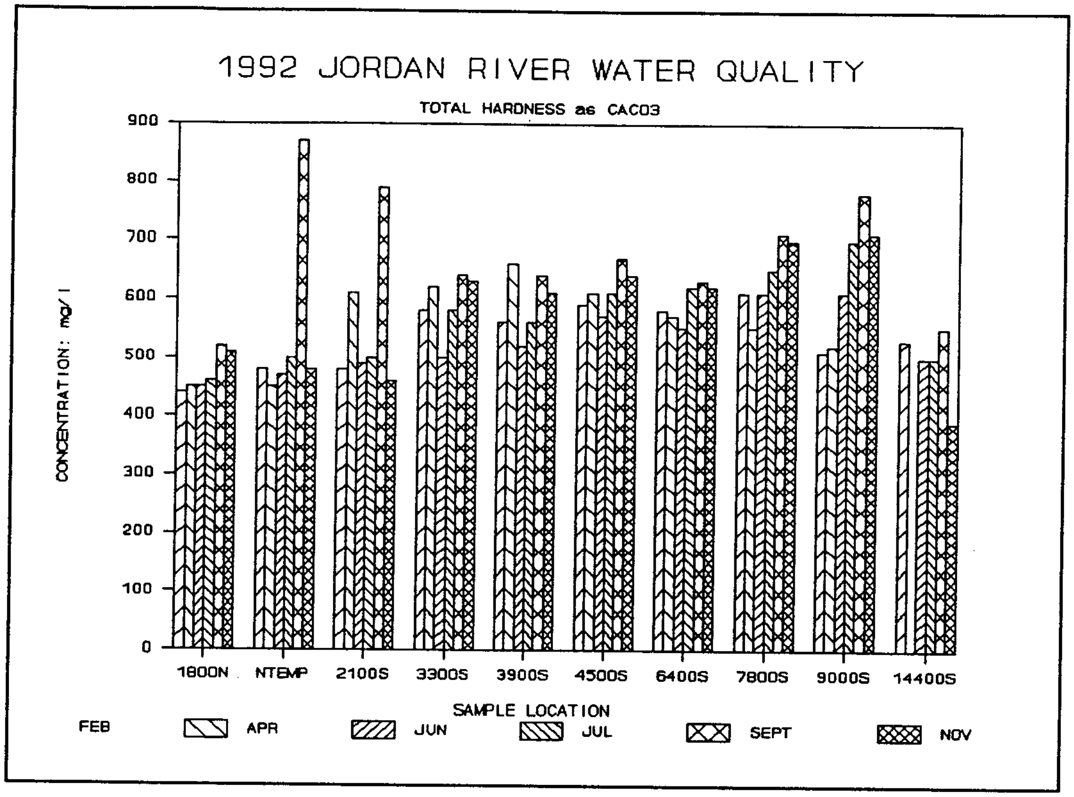

1992 JORDAN RIVER WATER QUALITY
TOTAL DISSOLVED OXYGEN
CONCENTRATION: mg/l
1800N NTEMP 2100S 3300S 3900S 4500S 6400S 7800S 9000S 14400S
SAMPLE LOCATION
FEB APR JUN JUL SEPT NOV

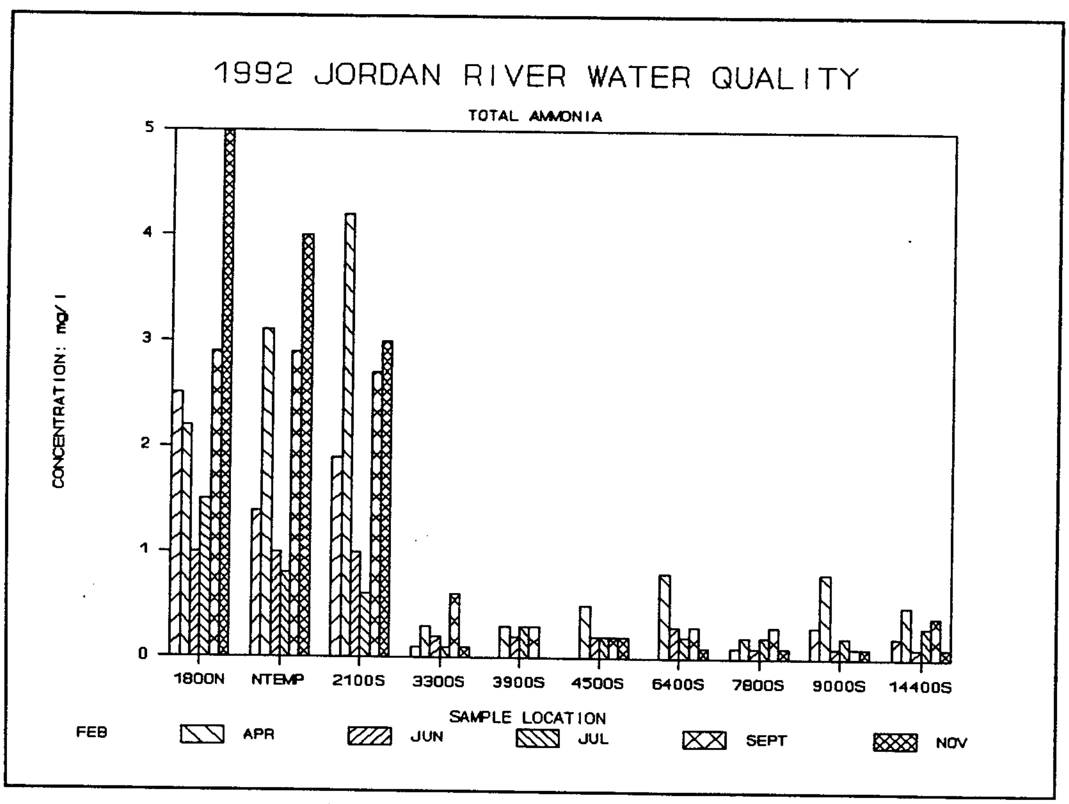

1992 JORDAN RIVER WATER QUALITY
TOTAL COLIFORM BACTERIA
CONCENTRATION: mg/l (Thousands)
0
1
2
3
4
5
6
7
8
9
10
11
12
1800N
NTEMP
2100S
3300S
3900S
4500S
6400S
7800S
9000S
14400S
SAMPLE LOCATION
FEB
APR
JUN
JUL
SEPT
NOV

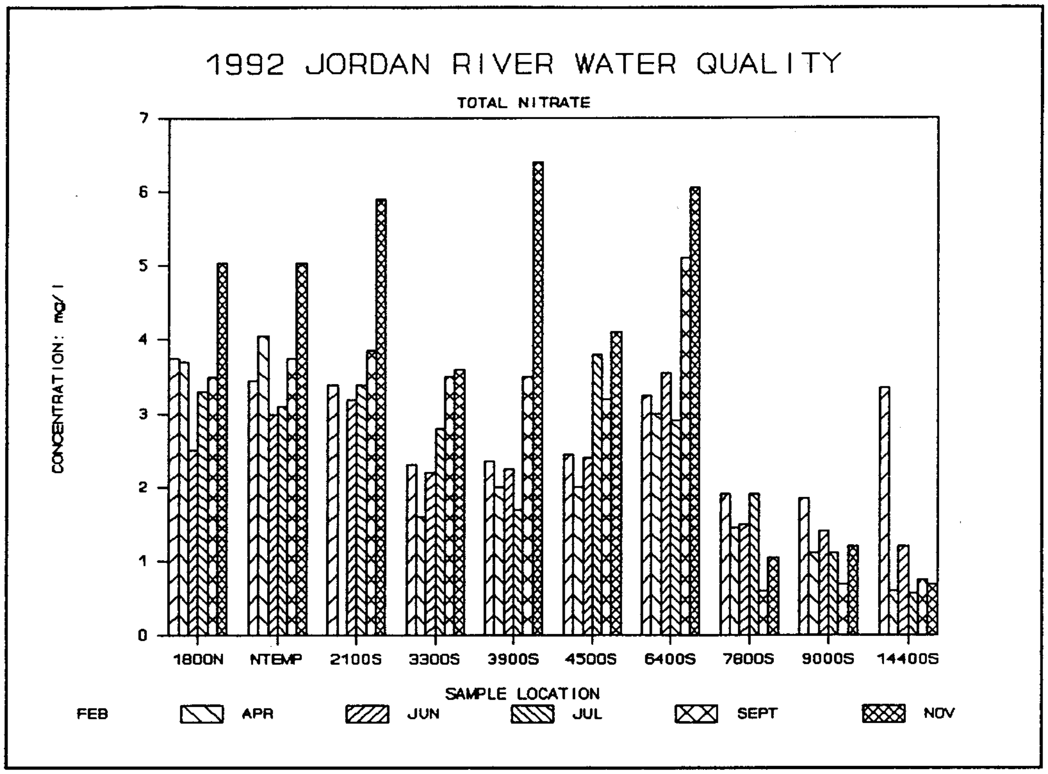

1992 JORDAN RIVER WATER QUALITY
FECAL COLIFORM BACTERIA
CONCENTRATION: mg/l (Thousands)
0
1
2
3
4
5
6
7
8
9
1800N
NTEMP
2100S
3300S
3900S
4500S
6400S
7800S
9000S
14400S
SAMPLE LOCATION
FEB
APR
JUN
JUL
SEPT
NOV

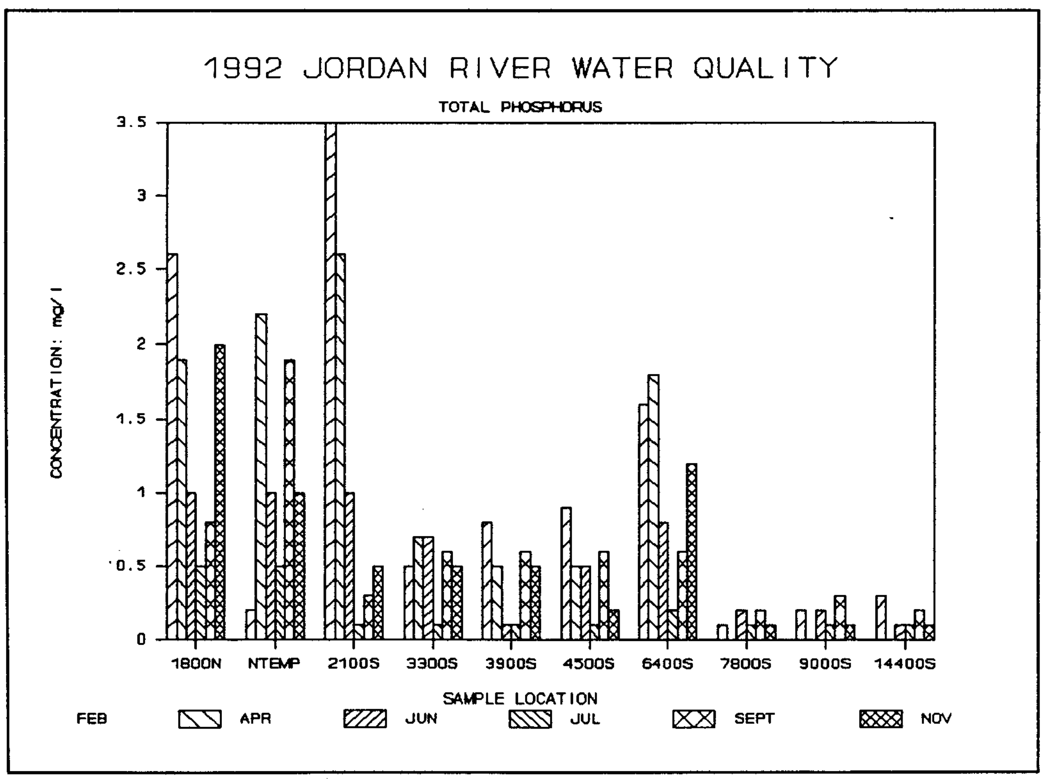

1992 JORDAN RIVER WATER QUALITY
TOTAL ARSENIC
CONCENTRATION: ug/l
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
1800N
NTEMP
2100S
3300S
3900S
4500S
6400S
7800S
9000S
14400S
SAMPLE LOCATION
FEB
APR
JUN
JUL
SEPT
NOV


1992 JORDAN RIVER WATER QUALITY
TOTAL SELENIUM
CONCENTRATION: ug/l
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
1800N
NTEMP
2100S
3300S
3900S
4500S
6400S
7800S
9000S
14400S
SAMPLE LOCATION
FEB
APR
JUN
JUL
SEPT
NOV


1992 JORDAN RIVER WATER QUALITY
TOTAL HARDNESS as CACO3
CONCENTRATION: mg/l
900
800
700
600
500
400
300
200
100
0
1800N
NTEMP
2100S
3300S
3900S
4500S
6400S
7800S
9000S
14400S
SAMPLE LOCATION
FEB
APR
JUN
JUL
SEPT
NOV


1992 JORDAN RIVER WATER QUALITY
TOTAL AMMONIA
CONCENTRATION: mg/l
5
4
3
2
1
0
1800N
NTEMP
2100S
3300S
3900S
4500S
6400S
7800S
9000S
14400S
SAMPLE LOCATION
FEB
APR
JUN
JUL
SEPT
NOV


1992 JORDAN RIVER WATER QUALITY
TOTAL NITRATE
CONCENTRATION: mg/l
0
1
2
3
4
5
6
7
1800N
NTEMP
2100S
3300S
3900S
4500S
6400S
7800S
9000S
14400S
SAMPLE LOCATION
FEB
APR
JUN
JUL
SEPT
NOV


1992 JORDAN RIVER WATER QUALITY
TOTAL PHOSPHORUS
CONCENTRATION: mg/l
0
0.5
1
1.5
2
2.5
3
3.5
1800N
NTEMP
2100S
3300S
3900S
4500S
6400S
7800S
9000S
14400S
SAMPLE LOCATION
FEB
APR
JUN
JUL
SEPT
NOV

APPENDIX C: Data Worksheets

Site 1 ID#499460 Bluffdale 14600 South and Jordan River Crossing SE Bank

Classifications 2B 3A 4

DATE	Total Coliform Wastewater CFU/100mL (values in blue indicate holding times exceeded no more than 1 hour 22 min., values in green represent TNTC)	Fecal Coliform Wastewater CFU/100mL (values in blue indicate holding times exceeded no more than 1 hour 22 min.)	Total Phosphorus as P mg/L	Bio-Oxygen Demand mg/L (missed value not included in totals)	Total Suspended Solids mg/L	Total Dissolved Solids mg/L (Red values are QC biased high.)	*E. coli* Wastewater CFU/100mL (values of "0" in this column are replaced with a "1" for g-mean calculations but are not included in the sum)	Degrees Celsius (Red indicates temperature above MAX)	Dissolved Oxygen
June 2, 2004	400	40	0.08	2	42.8	1160	1	18	6.64
June 9, 2004	200	30	0.08	2	34	1160	1	17	4.74
June 16, 2004	400	100	0.1	2	52.8	1228	300	16.7	5.33
June 22, 2004	600	250	0.15	2	62.4	1208	100	16.7	6.87
June 24, 2004	1600	900	0.15	2	91.6	1256	300	DO meter malfunction	
June 29, 2004	1700	150	0.11	2.6 missed	76	1310	400	18.14	6.68
July 1, 2004	1600	100	0.1	1.5	61.6	1316	800	17.3	6.68
July 7, 2004	600	680	0.08	2	57.2	1312	1	18.3	6.3
July 14, 2004	200	60	0.1	2	63.2	1366	200	21.1	6.62
July 21, 2004	1400	200	0.12	2	76.8	1362	400	21.5	5.9
July 27, 2004	400	100	0.16	1.2	63.2	1376	400	20	7.46
July 29, 2004	600	60	0.12	1.7	62	1356	400	19.2	6.2
August 4, 2004	600	100	0.12	1.7	59.6	1386	200	18.8	4.96
August 10, 2004	4000	300	0.09	1.6	71.6	1396	1	19	6.16
August 12, 2004	2000	100	0.06	1	65.6	1430	1	19	6.25
August 17, 2004	1000	100	0.11	1.3	59.6	1458	1	19.7	6.36
August 19, 2004	1000	200	0.09	1.3	45.6	1400	1000	18.4	6.67
August 25, 2004	2000	200	0.12	2	40.8	1470	1	16	7.01
N=	18	18	18	17	18	18	18	17	17
SUM=	20,300.00	3,670.00	1.94	29.30	1,086.40	23,950.00	4,500.00	307.84	99.83
AVG=	1,127.78	203.89	0.11	1.72	60.36	1,330.56	250.00	18.11	5.87
30-day Averages		Red indicates 30-day average value exceeded standard							
6/2 - 6/29	816.67	245.00	0.11	2.00	59.93	1,220.33	183.67	17.31	6.05
7/1 - 7/29	800.00	200.00	0.11	1.73	64.00	1,348.00	366.83	19.57	6.53
8/4 - 8/25	1,766.67	166.67	0.10	1.48	57.13	1,708.00	200.67	18.48	6.24
Geometric Means:		Red indicates g-mean value exceeded standard							
6/2 - 6/29	611.38	126.25	0.11	2.00	56.74	1,219.20	39.15	17.30	
7/1 - 7/29	633.30	130.31	0.11	1.70	63.73	1,347.77	147.36	19.51	
8/4 - 8/25	1,457.85	151.31	0.10	1.45	56.06	1,422.98	7.65	18.44	
LIMITS:	MAX 2B = 5000 30-day geometric mean	MAX 2B = 200 30-day geometric mean	MAX = 0.05 30-day geometric mean	MAX = 5.0 30-day geometric mean	INDICATOR MAX 2B = 35 MAX 3B = 90 30-day geometric mean	MAX 4 irrigation = 1200 MAX 4 stock watering = 2000 30-day geometric mean	Proposed 30-day geometric mean of 206/100 mL and MAX 940 for a grab sample	MAX 3A = 20.0	MIN = 6.5 (30-day average)

Site 2 ID#499409 Jordan River about 5400 South at Pedestrian Bridge

Classifications 2B 3A 4

DATE	Total Coliform Wastewater CFU/100mL values in blue indicate holding times exceeded no more than 1 hour 22 min., values in green represent TNTC	Fecal Coliform Wastewater CFU/100mL values in blue indicate holding times exceeded no more than 1 hour 22 min.	Total Phosphorus as P mg/L	Bio-Oxygen Demand mg/L	Total Suspended Solids mg/L	Total Dissolved Solids mg/L Red values are QC biased high.	*E. coli* Wastewater CFU/100mL values of "0" in this column are replaced with a "1" for g-mean calculations but are not included in the sum	Degrees Celsius Red indicates temperature above MAX	Dissolved Oxygen
June 2, 2004	1400	120	0.66	2	54	1276	200	17.2	6.75
June 9, 2004	2200	310	0.71	2	38.8	1170	1	16.9	5.29
June 16, 2004	1400	420	0.66	2	34.8	1256	400	16.9	6.63
June 22, 2004	2100	5400	0.58	2	30.4	1248	300	17.1	7.45
June 24, 2004	2200	840	0.79	2	14.4	1310	100	18.3	7.69
June 29, 2004	4200	440	0.72	2	32	1346	400	17.8	6.91
July 1, 2004	2800	340	0.78	2	37.2	1342	1800	17.8	6.8
July 7, 2004	3200	20	0.73	2	24	1280	1	18.6	6.59
July 14, 2004	2200	380	0.77	2	26	1354	1	19.6	6.77
July 21, 2004	6000	280	0.82	2	23.6	1370	1	20.1	7.87
July 27, 2004	9800	1440	0.83	0.1	21.6	1386	2400	19.3	7.1
July 29, 2004	5400	760	0.83	1	20.8	1394	1400	18.9	6.52
August 4, 2004	7000	2320	0.72	1.5	27.2	1192	800	19.1	4.86
August 10, 2004	4000	1100	0.78	1.5	12.8	1408	1000	18.6	6.52
August 12, 2004	2000	600	0.8	0.8	16	1424	1	18.7	6.47
August 17, 2004	6000	1500	0.82	1.7	13.2	1424	2000	18.9	6.51
August 19, 2004	6000	2700	0.76	1.2	14.8	1438	2000	18.4	7.02
August 25, 2004	5000	200	0.78	2	3.2	1366	1	16.7	6.5
N=	18	18	18	18	18	18	18	18	18
SUM =	72900.00	19170.00	13.54	29.80	444.80	23984.00	12800.00	322.90	114.25
AVG=	4050.00	1065.00	0.75	1.66	24.71	1332.44	711.11	17.94	6.35
30-day Averages		Red indicates 30-day average value exceeded standard.							
6/2 - 6/29	2,250.00	1,255.00	0.69	2.00	34.07	1,267.67	233.50	17.37	6.79
7/1 - 7/29	4,900.00	536.67	0.79	1.52	25.53	1,354.33	933.83	19.05	6.94
8/4 - 8/25	5,000.00	1,403.33	0.78	1.45	14.53	1,650.40	1,160.40	18.40	6.31
Geometric Means:		Red indicates g-mean value exceeded standard.							
6/2 - 6/29	2,266.15	763.74	0.69	2.00	28.53	1,264.57	86.35	17.39	
7/1 - 7/29	4,292.90	304.16	0.79	1.08	25.03	1,353.80	42.68	19.04	
8/4 - 8/25	4,647.76	1,036.54	0.78	1.39	12.31	1,372.52	121.39	18.38	
LIMITS:	MAX 2B = 5000 30-day geometric mean	MAX 2B = 200 30-day geometric mean	MAX = 0.05 30-day geometric mean	MAX = 5.0 30-day geometric mean	INDICATOR MAX 2B = 35 MAX 3B = 90 30-day geometric mean	MAX 4 irrigation = 1200 MAX 4 stock watering = 2000 30-day geometric mean	Proposed 30-day geometric mean of 206/100 mL and MAX 940 for a grab sample	MAX 3A = 20.0	MIN = 6.5 (30-day average)

Site 3 ID#499232 Jordan River 1100 West 2100 South

Classifications **2B 3B 4**

DATE	Total Coliform Wastewater CFU/100mL values in blue indicate holding times exceeded no more than 1 hour 22 min., values in green represent TNTC	Fecal Coliform Wastewater CFU/100mL values in blue indicate holding times exceeded less than 32 hours	Total Phosphorus as P mg/L	Bio-Oxygen Demand mg/L	Total Suspended Solids mg/L	Total Dissolved Solids mg/L Red values are QC biased high.	*E. coli* Wastewater CFU/100mL values of "0" in this column are replaced with a "1" for g-mean calculations but are not included in the sum	Degrees Celsius	Dissolved Oxygen Red indicates inst. min. below standard (site specific criteria - see table 2.14.5)
June 2, 2004	1800	190	0.88	2.1	22.4	912	400	15	7.28
June 9, 2004	1700	240	0.48	2	22	532	400	14.3	7.3
June 16, 2004	1200	280	0.89	2	19.2	846	100	16.4	5.98
June 22, 2004	900	280	0.98	2	19.2	914	100	17.5	6.24
June 24, 2004	800	820	1.34	2	15.2	1016	500	19.1	5.6
June 29, 2004	5400	400	1.14	3.2	20.4	1064	400	18.8	5.62
July 1, 2004	3800	360	1.02	2.2	16.8	1124	2200	19	5.49
July 7, 2004	1600	260	1.27	2.2	38.8	1112	1	20.2	4.86
July 14, 2004	2800	200	1.37	2.9	24	1158	1	21.1	4.51
July 21, 2004	6000	500	1.1	2.2	34.8	1114	1	21.8	5.73
July 27, 2004	3800	840	1.24	3.2	42	1230	800	21	7.93
July 29, 2004	4200	360	1.31	2.8	32.8	1228	1000	20.6	4.67
August 4, 2004	12400	2640	1.15	3.5	31.6	1164	1800	20.9	3.61
August 10, 2004	7000	400	1.32	3	24.8	1204	2000	20.7	4.75
August 12, 2004	7000	300	1.24	3.2	27.2	1242	1	20.8	4.87
August 17, 2004	2000	700	1.26	4	32.4	1258	1	20.6	4.99
August 19, 2004	5000	2700	1.15	4.8	22.8	1188	1000	20	4.78
August 25, 2004	5000	1700	0.99	4	12	1140	1	17.9	5.36
N=	18	18	18	18	18	18	18	18	18
SUM =	72,400.00	13,170.00	20.13	51.30	458.40	19,446.00	10,700.00	339.70	93.57
AVG=	4,022.22	731.67	1.12	2.85	25.47	1,080.33	594.44	18.87	5.20
30-day Averages		Red indicates 30-day average value exceeded standard.							
6/2 - 6/29	1,966.67	368.33	0.95	2.22	19.73	880.67	316.67	16.85	6.34
7/1 - 7/29	3,700.00	420.00	1.22	2.58	31.53	1,161.00	667.17	20.62	5.53
8/4 - 8/25	6,400.00	1,406.67	1.19	3.75	25.13	1,439.20	800.50	20.15	4.73
Geometric Means:		Red indicates g-mean value exceeded standard.							
6/2 - 6/29	1,513.11	361.48	0.91	2.20	19.06	850.38	240.22	17.13	
7/1 - 7/29	3,430.63	376.11	1.21	2.55	30.14	1,159.92	34.75	20.60	
8/4 - 8/25	5,585.96	1,002.96	1.18	3.70	23.95	1,198.63	39.15	20.12	
LIMITS:	MAX 2B = 5000 30-day geometric mean	MAX 2B = 200 30-day geometric mean	MAX = 0.05 30-day geometric mean	MAX = 5.0 30-day geometric mean	INDICATOR MAX 2B = 35 MAX 3B = 90 30-day geometric mean	MAX 4 irrigation = 1200 MAX 4 stock watering = 2000 30-day geometric mean	Proposed 30-day geometric mean of 206/100 mL and MAX 940 for a grab sample	MAX 3B = 27.0	MIN = 5.5 (30-day average) MIN = 4.5 (inst. Min. May-July) MIN = 4.0 (inst. Min. August - April)

Site 4 ID#499227 Jordan River at California Avenue Pesdestrain Bridge

Classifications 2B 3B 4

DATE	Total Coliform Wastewater CFU/100mL values in green represent TNTC	Fecal Coliform Wastewater CFU/100mL	Total Phosphorus as P mg/L	Bio-Oxygen Demand mg/L	Total Suspended Solids mg/L	Total Dissolved Solids mg/L Red values are QC biased high.	*E. coli* Wastewater CFU/100mL values of "0" in this column are replaced with a "1" for g-mean calculations but are not included in the sum	Degrees Celsius	Dissolved Oxygen Red indicates inst. min. below standard (site specific criteria - see table 2.14.5)	
June 2, 2004	1400	190	0.81	2	24.8	926	300	15.9	6.96	
June 9, 2004	1400	220	0.51	2.6	21.2	506	400	15	6.91	
June 16, 2004	1200	440	0.9	2.5	16.4	820	100	17	5.82	
June 22, 2004	1200	580	0.96	2	20	928	400	18.1	6.32	
June 24, 2004	800	980	1.27	2.7	16.4	1016	300	19.9	5.67	
June 29, 2004	3300	900	1.24	4.9	14.8	994	300	19.3	4.15	
July 1, 2004	4800	640	1.23	3.2	19.6	1084	1000	19.6	5.42	
July 7, 2004	1600	320	1.42	3.7	16.4	1090	600	20.8	4.89	
July 14, 2004	1400	360	1.45	3.3	22.4	1138	400	21.6	4.3	
July 21, 2004	8000	420	1.22	3.1	36.8	1124	1	22.3	5.13	
July 27, 2004	13600	920	1.41	3.9	41.2	1202	1	21.3	5.45	
July 29, 2004	3000	520	1.49	4	38	1170	600	21.2	4.56	
August 4, 2004	11600	3360	1.3	4.6	33.6	1078	1200	21.2	3.73	
August 10, 2004	11000	900	1.35	5.4	28.4	1182	1	n/a	n/a	recalibration
August 12, 2004	7000	500	1.34	4.6	24.4	1236	1	21.2	4.65	
August 17, 2004	3000	400	1.35	5	30	1240	1	20.8	4.78	
August 19, 2004	10000	2100	1.24	5.5	27.2	1186	3000	20.1	4.68	
August 25, 2004	14000	800	1.11	5.9	28	1126	2000	18	5.12	
N=	18	18	18	18	18	18	18	17	17	
SUM =	98,300.00	14,550.00	21.60	68.90	459.60	19,046.00	10,600.00	328.30	83.54	
AVG=	5,461.11	808.33	1.20	3.83	25.53	1,058.11	588.89	19.31	4.91	
30-day Averages		Red indicates 30-day average value exceeded standard.								
6/2 - 6/29	1,550.00	551.67	0.95	2.78	18.93	865.00	300.00	17.53	5.97	
7/1 - 7/29	5,400.00	530.00	1.37	3.53	29.07	1,134.67	433.67	21.13	4.96	
8/4 - 8/25	9,433.33	1,343.33	1.28	5.17	28.60	1,409.60	1,033.83	20.26	4.59	
Geometric Means:		Red indicates g-mean value exceeded standard.								
6/2 - 6/29	1,397.07	548.22	0.93	2.80	17.60	827.86	270.19	17.77		
7/1 - 7/29	3,898.28	495.58	1.37	3.52	27.31	1,133.90	72.40	21.12		
8/4 - 8/25	8,492.45	1,002.66	1.28	5.14	28.47	1,173.23	43.94	20.22		
LIMITS:	MAX 2B = 5000 30-day geometric mean	MAX 2B = 200 30-day geometric mean	MAX = 0.05 30-day geometric mean	MAX = 5.0 30-day geometric mean	INDICATOR MAX 2B = 35 MAX 3B = 90 30-day geometric mean	MAX 4 irrigation = 1200 MAX 4 stock watering = 2000 30-day geometric mean	Proposed 30-day geometric mean of 206/100 mL and MAX 940 for a grab sample	MAX 3B = 27.0	MIN = 5.5 (30-day average) MIN = 4.5 (inst. Min. May-July) MIN = 4.0 (inst. Min. August - April)	

Site 5 ID#499203 Jordan River at 700 South

Classifications 2B 3B 4

DATE	Total Coliform Wastewater CFU/100mL (values in green represent TNTC)	Fecal Coliform Wastewater CFU/100mL	Total Phosphorus as P mg/L	Bio-Oxygen Demand mg/L	Total Suspended Solids mg/L	Total Dissolved Solids mg/L (Red values are QC biased high.)	*E. coli* Wastewater CFU/100mL (values of "0" in this column are replaced with a "1" for g-mean calculations but are not included in the sum)	Degrees Celsius	Dissolved Oxygen (Red indicates inst. min. below standard (site specific criteria - see table 2.14.5))
June 2, 2004	2600	260	0.87	2.1	33.2	926	600	17.1	6.11
June 9, 2004	1000	280	0.49	2.5	22.4	572	200	16.2	6.22
June 16, 2004	2000	360	0.93	3.2	23.6	802	700	17.5	5.43
June 22, 2004	1300	290	0.9	3.7	24.8	858	100	18.4	5.53
June 24, 2004	2500	980	1.25	2.8	12	928	400	19.9	5.09
June 29, 2004	6300	1730	1.11	5.1	17.2	972	700	19.4	3.84
July 1, 2004	3800	440	1.03	3.1	16	1006	1800	19.5	5.11
July 7, 2004	2400	280	1.23	3.5	22.8	1032	1	20.8	4.7
July 14, 2004	2800	460	1.25	3.7	28.4	1094	1	21.6	4.45
July 21, 2004	7000	380	1.13	3.7	44	1050	1	22.3	5.08
July 27, 2004	10400	640	1.35	4.6	38.8	1130	1000	21.5	5.38
July 29, 2004	5200	660	1.38	4.5	36.4	1124	600	21.4	4.31
August 4, 2004	32800	8800	1.21	4	39.6	1062	4200	21.2	3.56
August 10, 2004	6000	500	1.25	5	26.4	1146	1	21.3	4.76
August 12, 2004	16000	2500	1.17	4.8	17.6	1156	1	21.4	4.55
August 17, 2004	20000	900	1.29	5.6	22	1142	1000	21	4.45
August 19, 2004	7000	2500	1.05	8	22.8	1146	1000	20.1	4.7
August 25, 2004	23000	2200	0.96	6	23.2	1038	1	18	4.8
N=	18	18	18	18	18	18	18	18	18
SUM =	152,100.00	24,160.00	19.85	75.90	471.20	18,184.00	12,300.00	352.60	82.07
AVG=	8,450.00	1,342.22	1.10	4.22	26.18	1,010.22	683.33	19.59	4.56
30-day Averages		Red indicates 30-day average value exceeded standard.							
6/2 - 6/29	2,616.67	650.00	0.93	3.23	22.20	843.00	450.00	18.08	5.37
7/1 - 7/29	5,266.67	476.67	1.23	3.85	31.07	1,072.67	567.17	21.18	4.84
8/4 - 8/25	17,466.67	2,900.00	1.16	5.57	25.27	1,338.00	1,033.83	20.50	4.47
Geometric Means:		Red indicates g-mean value exceeded standard.							
6/2 - 6/29	2,101.12	548.31	0.89	3.35	19.34	812.93	330.11	18.23	
7/1 - 7/29	4,615.46	456.89	1.22	3.81	29.39	1,071.65	32.03	21.16	
8/4 - 8/25	14,711.83	1,946.85	1.15	5.44	24.46	1,114.00	40.17	20.46	
LIMITS:	MAX 2B = 5000 30-day geometric mean	MAX 2B = 200 30-day geometric mean	MAX = 0.05 30-day geometric mean	MAX = 5.0 30-day geometric mean	INDICATOR MAX 2B = 35 MAX 3B = 90 30-day geometric mean	MAX 4 irrigation = 1200 MAX 4 stock watering = 2000 30-day geometric mean	Proposed 30-day geometric mean of 206/100 mL and MAX 940 for a grab sample	MAX 3B = 27.0	MIN = 5.5 (30-day average) MIN = 4.5 (inst. Min. May-July) MIN = 4.0 (inst. Min. August - April)

Site 6 ID#499194 Jordan River at 400 South NE Bank
Classifications 2B 3B 4

DATE	Total Coliform Wastewater CFU/100mL values in green represent TNTC	Fecal Coliform Wastewater CFU/100mL	Total Phosphorus as P mg/L	Bio-Oxygen Demand mg/L	Total Suspended Solids mg/L	Total Dissolved Solids mg/L Red values are QC biased high.	*E. coli* Wastewater CFU/100mL values of "0" in this column are replaced with a "1" for g-mean calculations but are not included in the sum	Degrees Celsius	Dissolved Oxygen Red indicates inst. min. below standard (site specific criteria - see table 2.14.5)
June 2, 2004	3000	210	0.68	3.2	32.8	902	400	17.4	5.78
June 9, 2004	700	300	0.58	2	26	586	300	16.4	5.91
June 16, 2004	2200	250	0.95	3	18	802	100	17.7	5.12
June 22, 2004	1900	1120	1.04	3.8	26.8	836	100	18.5	5.46
June 24, 2004	1700	840	1.2	3.3	13.2	938	200	19.9	5.06
June 29, 2004	5200	1680	0.93	5.2	19.2	974	100	19.4	3.98
July 1, 2004	13000	800	1.04	3.2	27.2	1006	2800	19.5	4.92
July 7, 2004	1800	520	1.17	3.5	24.4	1046	800	20.8	4.73
July 14, 2004	3000	420	1.2	5	28.4	1102	200	21.7	4.5
July 21, 2004	15600	1180	1.14	3.3	36.8	1060	1	22.4	5.02
July 27, 2004	8800	620	1.33	4.4	38.4	1128	600	21.5	4.57
July 29, 2004	3200	500	1.39	4.6	50	1122	1	21.5	4.2
August 4, 2004	28000	9760	1.17	4.1	39.6	416	5200	21.3	3.28
August 10, 2004	10000	900	1.26	6.7	26	1154	1	21.4	4.3
August 12, 2004	9000	1100	1.14	5.3	20	1154	1	21.3	4.41
August 17, 2004	10000	400	1.25	7	18.8	1150	1	21.1	4.24
August 19, 2004	4000	2000	1.06	5.4	22	1152	2000	20.2	4.48
August 25, 2004	42000	4800	1.07	6.5	30	1018	1000	18.1	4.63
N=	18	18	18	18	18	18	18	18	18
SUM =	163,100.00	27,400.00	19.60	79.50	497.60	17,546.00	13,800.00	355.10	79.59
AVG=	9,061.11	1,522.22	1.09	4.42	27.64	974.78	766.67	19.73	4.42
30-day Averages		Red indicates 30-day average value exceeded standard.							
6/2 - 6/29	2,450.00	733.33	0.90	3.42	22.67	839.67	200.00	18.22	5.22
7/1 - 7/29	7,566.67	673.33	1.21	4.00	34.20	1,077.33	733.67	21.23	4.66
8/4 - 8/25	17,166.67	3,160.00	1.16	5.83	26.07	1,208.80	1,367.17	20.57	4.22
Geometric Means:		Red indicates g-mean value exceeded standard.							
6/2 - 6/29	1,916.66	652.79	0.91	3.30	19.97	814.72	143.10	18.34	
7/1 - 7/29	5,599.93	632.31	1.21	3.94	33.17	1,076.43	80.34	21.21	
8/4 - 8/25	12,718.96	1,826.29	1.16	5.74	25.19	952.58	46.72	20.53	
LIMITS:	MAX 2B = 5000 30-day geometric mean	MAX 2B = 200 30-day geometric mean	MAX = 0.05 30-day geometric mean	MAX = 5.0 30-day geometric mean	INDICATOR MAX 2B = 35 MAX 3B = 90 30-day geometric mean	MAX 4 irrigation = 1200 MAX 4 stock watering = 2000 30-day geometric mean	Proposed 30-day geometric mean of 206/100 mL and MAX 940 for a grab sample	MAX 3B = 27.0	MIN = 5.5 (30-day average) MIN = 4.5 (inst. Min. May-July) MIN = 4.0 (inst. Min. August - April)

Site 7 ID#499191 Jordan River at North Temple

Classifications 2B 3B 4

DATE	Total Coliform Wastewater CFU/100mL values in green represent TNTC	Fecal Coliform Wastewater CFU/100mL	Total Phosphorus as P mg/L	Bio-Oxygen Demand mg/L	Total Suspended Solids mg/L	Total Dissolved Solids mg/L Red values are QC biased high.	*E. coli* Wastewater CFU/100mL values of "0" in this column are replaced with a "1" for g-mean calculations but are not included in the sum	Degrees Celsius	Dissolved Oxygen Red indicates inst. min. below standard (site specific criteria - see table 2.14.5)
June 2, 2004	2400	180	0.86	3.4	34.4	1000	500	17.9	5.39
June 9, 2004	1800	330	0.55	2.1	26.8	596	400	16.7	5.87
June 16, 2004	4000	260	1.03	2.9	22.8	842	500	18	5.21
June 22, 2004	8400	340	0.99	3.2	32	838	100	18.7	5.36
June 24, 2004	1500	760	1.14	2.8	16	932	600	20	5.01
June 29, 2004	4000	1100	0.98	5.2	20	950	100	19.4	4.01
July 1, 2004	9400	640	0.98	3.4	28.8	1002	2400	19.6	5.25
July 7, 2004	2800	280	1.14	3.6	29.2	1056	800	20.9	5.12
July 14, 2004	6200	400	1.2	3.3	27.6	1102	800	21.8	5.12
July 21, 2004	9800	1100	1.03	4.2	43.2	1068	1	22.5	5.86
July 27, 2004	7200	740	1.34	5.2	40	1128	200	21.6	5.29
July 29, 2004	4800	320	1.35	5.2	41.2	1124	1	21.5	4.87
August 4, 2004	38400	10960	1.16	4.2	40	1074	2200	21.4	3.88
August 10, 2004	9000	900	1.21	6.2	31.6	1146	1000	21.5	5.22
August 12, 2004	9000	800	1.22	5.9	32.8	1142	1	21.5	5.22
August 17, 2004	4000	700	1.21	6.8	21.2	1140	1000	21.2	5.11
August 19, 2004	8000	100	1.08	6.2	32	1140	1000	20.3	5.32
August 25, 2004	55000	4100	1.02	5	32.4	1052	1	18.1	5.3
N=	18	18	18	18	18	18	18	18	18
SUM =	185,700.00	24,010.00	19.49	78.80	552.00	18,332.00	11,600.00	358.60	88.41
AVG=	10,316.67	1,333.89	1.08	4.38	30.67	1,018.44	644.44	19.92	4.91
30-day Averages		Red indicates 30-day average value exceeded standard.							
6/2 - 6/29	3,683.33	495.00	0.93	3.27	25.33	859.67	366.67	18.45	5.14
7/1 - 7/29	6,700.00	580.00	1.17	4.15	35.00	1,080.00	700.33	21.32	5.25
8/4 - 8/25	20,566.67	2,926.67	1.15	5.72	31.67	1,338.80	867.00	20.67	5.01
Geometric Means:		Red indicates g-mean value exceeded standard.							
6/2 - 6/29	3,250.52	475.81	0.91	3.09	22.87	820.71	260.52	18.52	
7/1 - 7/29	6,171.81	515.07	1.16	4.08	34.38	1,079.10	82.14	21.30	
8/4 - 8/25	13,275.62	1,145.96	1.15	5.65	31.14	1,115.01	114.04	20.63	
LIMITS:	MAX 2B = 5000 30-day geometric mean	MAX 2B = 200 30-day geometric mean	MAX = 0.05 30-day geometric mean	MAX = 5.0 30-day geometric mean	INDICATOR MAX 2B = 35 MAX 3B = 90 30-day geometric mean	MAX 4 irrigation = 1200 MAX 4 stock watering = 2000 30-day geometric mean	Proposed 30-day geometric mean of 206/100 mL and MAX 940 for a grab sample	MAX 3B = 27.0	MIN = 5.5 (30-day average) MIN = 4.5 (inst. Min. May-July) MIN = 4.0 (inst. Min. August - April)

Site 8 ID#499186 Jordan River at 1800 North

Classifications 2B 3B 3D 4

DATE	Total Coliform Wastewater CFU/100mL (values in green represent TNTC)	Fecal Coliform Wastewater CFU/100mL	Total Phosphorus as P mg/L	Bio-Oxygen Demand mg/L	Total Suspended Solids mg/L	Total Dissolved Solids mg/L (Red values are QC biased high.)	*E. coli* Wastewater CFU/100mL (values of "0" in this column are replaced with a "1" for g-mean calculations but are not included in the sum)	Degrees Celsius	Dissolved Oxygen (Red indicates inst. min. below standard (site specific criteria - see table 2.14.5))
June 2, 2004	3600	200	0.77	3.9	28.8	854	1	18.9	5.3
June 9, 2004	1800	350	0.57	2.4	43.2	618	1	17.8	5.68
June 16, 2004	3000	370	0.76	2.9	32.4	848	600	18.6	5.52
June 22, 2004	2100	520	0.75	3	24.8	842	1	19.2	6.12
June 24, 2004	1700	540	0.94	2.1	24.8	896	200	20.3	6.48
June 29, 2004	5600	1900	0.96	3.6	31.2	944	700	19.5	3.8
July 1, 2004	7400	600	0.93	1.4	38	980	2800	19.8	5.95
July 7, 2004	2400	600	1.12	2.7	44.8	1000	1000	20.9	5.16
July 14, 2004	5600	600	1.18	2.6	47.6	1072	1	22	5.36
July 21, 2004	10200	940	0.87	3	37.2	1054	1	22.5	5.86
July 27, 2004	8800	840	1.29	3.9	62	1108	1	22	5.6
July 29, 2004	3800	740	1.01	3.7	52.4	1124	800	21.8	5.24
August 4, 2004	28800	12400	0.69	4.2	24.4	894	3400	21.6	3.29
August 10, 2004	7000	300	0.95	4.4	39.2	1138	1	21.7	5.64
August 12, 2004	11000	900	1	3.3	41.6	1154	1000	21.3	5.78
August 17, 2004	5000	600	1.08	7.2	33.6	1138	1	21.4	5.68
August 19, 2004	6000	1500	0.99	4.9	35.6	1136	4000	20.6	4.5
August 25, 2004	16000	1800	0.85	3.9	22.8	1074	1000	18	5.58
N=	18	18	18	18	18	18	18	18	18
SUM =	129,800.00	25,700.00	16.71	63.10	664.40	17,874.00	15,500.00	359.90	88.54
AVG=	7,211.11	1,427.78	0.93	3.51	36.91	993.00	861.11	19.99	4.92
30-day Averages		Red indicates 30-day average value exceeded standard.							
6/2 - 6/29	2,966.67	646.67	0.79	2.98	30.87	833.67	250.50	19.05	5.48
7/1 - 7/29	6,366.67	720.00	1.07	2.88	47.00	1,056.33	767.17	21.50	5.53
8/4 - 8/25	12,300.00	2,916.67	0.93	4.65	32.87	1,306.80	1,567.00	20.77	5.08
Geometric Means:		Red indicates g-mean value exceeded standard.							
6/2 - 6/29	2,550.64	585.98	0.78	2.75	30.61	821.10	38.45	19.06	
7/1 - 7/29	5,689.62	708.24	1.06	2.74	46.25	1,055.02	36.17	21.48	
8/4 - 8/25	10,104.64	1,325.51	0.92	4.51	32.06	1,084.85	154.50	20.72	
LIMITS:	MAX 2B = 5000 30-day geometric mean	MAX 2B = 200 30-day geometric mean	MAX = 0.05 30-day geometric mean	MAX = 5.0 30-day geometric mean	INDICATOR MAX 2B = 35 MAX 3B = 90 30-day geometric mean	MAX 4 irrigation = 1200 MAX 4 stock watering = 2000 30-day geometric mean	Proposed 30-day geometric mean of 206/100 mL and MAX 940 for a grab sample	MAX 3B = 27.0	MIN = 5.5 (30-day average) MIN = 4.5 (inst. Min. May-July) MIN = 4.0 (inst. Min. August - April)

Site 9 ID#499182 Jordan River at Cudahy Lane Davis County
Classifications 2B 3B 3D 4

DATE	Total Coliform Wastewater CFU/100mL values in green represent TNTC	Fecal Coliform Wastewater CFU/100mL	Total Phosphorus as P mg/L	Bio-Oxygen Demand mg/L	Total Suspended Solids mg/L	Total Dissolved Solids mg/L Red values are QC biased high.	*E. coli* Wastewater CFU/100mL values of "0" in this column are replaced with a "1" for g-mean calculations but are not included in the sum -green values are above standards	Degrees Celsius	Dissolved Oxygen Red indicates inst. min. below standard (site specific criteria - see table 2.14.5)
June 2, 2004	1900	180	0.71	2.2	31.6	828	500	18.8	5.58
June 9, 2004	1700	280	0.55	2	44	616	300	17.8	5.85
June 16, 2004	3100	520	0.82	2.7	33.6	806	1000	18.8	5.7
June 22, 2004	1500	350	0.78	2	34.8	788	100	19.4	6.19
June 24, 2004	1100	680	0.95	3.2	34	876	400	20.6	6.67
June 29, 2004	3900	1100	0.8	6.6	24	908	100	19.5	3.34
July 1, 2004	8000	440	0.98	1.5	40	962	600	19.8	5.62
July 7, 2004	3200	680	1.16	2.5	47.6	1020	1000	21	5.34
July 14, 2004	3600	460	1.17	2.7	48.4	1064	200	22.2	5
July 21, 2004	8600	1300	0.94	2.5	32	1028	1	23	5.29
July 27, 2004	8000	960	1.27	3.4	64.8	1064	400	22.4	5.46
July 29, 2004	5400	600	1.24	3	56	1090	1800	21.8	4.66
August 4, 2004	26400	9600	0.92	3	16	920	2600	21.5	3.42
August 10, 2004	10000	400	1.1	2.4	29.2	1098	1	22	5.33
August 12, 2004	12000	700	1.09	2.3	28.8	1126	1	22	4.73
August 17, 2004	4000	300	1.11	3.5	24.8	1104	1	21.6	5.02
August 19, 2004	11000	900	1.07	3.1	22.4	1132	1000	20.9	5.06
August 25, 2004	8000	1700	0.96	3.5	6.4	1040	1	18	4.95
N=	18	18	18	18	18	18	18	18	18
SUM =	121,400.00	21,150.00	17.62	52.10	618.40	17,470.00	10,000.00	366.10	88.21
AVG=	6,744.44	1,175.00	0.98	2.89	34.36	970.56	555.56	20.34	4.90
30-day Averages		Red indicates 30-day average value exceeded standard.							
6/2 - 6/29	2,200.00	518.33	0.77	3.12	33.67	803.67	400.00	19.15	5.56
7/1 - 7/29	6,133.33	740.00	1.13	2.60	48.13	1,038.00	666.83	21.70	5.23
8/4 - 8/25	11,900.00	2,266.67	1.04	2.97	21.27	1,284.00	600.67	21.00	4.75
Geometric Means:		Red indicates g-mean value exceeded standard.							
6/2 - 6/29	2,023.35	520.27	0.77	2.96	33.47	791.78	260.52	19.20	
7/1 - 7/29	5,698.42	684.72	1.12	2.52	46.94	1,037.16	210.26	21.67	
8/4 - 8/25	10,183.29	1,035.64	1.04	2.93	19.05	1,067.32	11.73	20.95	
LIMITS:	MAX 2B = 5000 30-day geometric mean	MAX 2B = 200 30-day geometric mean	MAX = 0.05 30-day geometric mean	MAX = 5.0 30-day geometric mean	INDICATOR MAX 2B = 35 MAX 3B = 90 30-day geometric mean	MAX 4 irrigation = 1200 MAX 4 stock watering = 2000 30-day geometric mean	Proposed 30-day geometric mean of 206/100 mL and MAX 940 for a grab sample	MAX 3B = 27.0	MIN = 5.5 (30-day average) MIN = 4.5 (inst. Min. May-July) MIN = 4.0 (inst. Min. August - April)