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BOARD OF SALT LAKE COUNTY COMMISSIONERS

COMMISSION STAFF OFFICE

SECTION 305B WATER QUALITY ASSESSMENT UPDATE FOR THE JORDAN RIVER SUB-BASIN

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February, 1994

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SALT LAKE COUNTY 305B WATER QUALITY ASSESSMENT UPDATE

Steven F. Jensen, Water Resources
Planning Coordinator
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INTRODUCTION

As the designated area-wide water quality planning agency for the Salt Lake drainage basin, the Salt Lake County Commission Staff has identified priority watersheds concurrent with implementation of section 319 nonpoint source planning programs. Other program areas, principally concerning groundwater, have received increased attention.

Significant activities have been undertaken in:

- **Watershed monitoring and management**
- **Jordan River assessment and development of conservation & restoration programs**
- **Stormwater management**
- **Irrigation canal monitoring**
- **Underground storage tank regulation**
- **Development of waste management programs under RCRA and CERCLA**
- **Groundwater monitoring & regulation.**

These efforts are summarized in the context of problem assessment/monitoring, programs implemented or underway, and proposed control actions.

WASATCH WATERSHEDS

Municipal watershed management continues to be a high priority for water pollution control efforts in Salt Lake County. Since 1988, a cooperative agreement between Salt Lake City, U.S. Forest Service, and Salt Lake County enables implementation of an integrated automatic water quality monitoring network, including Millcreek, Big Cottonwood, and Little Cottonwood Canyons. This agreement will be further amended to reflect shifts in priorities.

Current problem assessment emphasizes stormwater discharges within stream segments in order to develop wasteloads for each sub-watershed area. Wasteload analysis will enable further assessment of key nonpoint pollution sources and abatement of problem areas. Priority water quality parameters are sediment, heavy metals, and bacteria. Bio-assessment of macroinvertebrate populations is also underway in all three canyons.

Significant degradation of water quality has been documented from absence of effective land use management within Little & Big Cottonwood and Millcreek watersheds.

A. MILLCREEK CANYON WATERSHED

Increased implementation of management practices has occurred in Millcreek canyon, where damage to the watershed has resulted in remediation at Church Fork, Box Elder, and Terraces Campgrounds. Fees charged to vehicles entering the canyon have resulted annual revenues of $ 200,000 which have been passed-on to the Forest to implement campground and stream-zone restoration. To date, about one-half $ million has been re-invested in the Millcreek watershed.

Public awareness programs regarding dog-waste clean up have resulted in reduction of coliform bacteria pollution usually associated with spring runoff conditions.

B. LITTLE COTTONWOOD CANYON WATERSHED

Parking lot runoff continues to receive attention in all watersheds, but particularly in Little Cottonwood, where a pilot demonstration project in Alta showed that catch basins modified to trap sediment and floatables, coupled with wetland detention & overland flow within the riparian buffer zone, significantly reduced contaminants from paved lots. Continued data gathering at this pilot site have provided valuable guidance for future pollution control requirements.

The U.S. Army Corps of Engineers has taken the lead in requiring that snow storage from unpaved lots not be allowed in lower montane wetlands, and has made contact with each Wasatch Range ski resort to pave parking facilities, and create alternative runoff control systems than natural wetlands. Brighton, Solitude, Alta, and Snowbird are all planning parking lot modifications and paving.

Water quality standards for lead and zinc have been exceeded in Little Cottonwood Creek in the vicinity of the upper by-pass road. The problems occurred during August, 1991, and were 2-3 times the one-hour acute standard for both lead and zinc. Further assessment of the sources is planned, together with management practices to be funded under section 319.

The Town of Alta is pursuing a wetland conservation program in Albion Basin, based on an advance identification project completed in Autumn of 1992. Water quality analysis should be implemented in these important resource areas to further document pollutant retention functions of mountain wetlands. Recent studies by the U.S. Geological Survey indicate these complexes to be important in trapping radioactive elements (mainly uranioum) native to metamorphic geology like granite or grandiorite. Wetland fens composed of peat are particularly important to this function.

C. BIG COTTONWOOD CANYON WATERSHED

Ski resort development and installation of a sanitary sewer system have been under way for the last five years. Water quality data have shown no sustained or serious violation of standards, although some minor excursions from baseline water quality conditions have occurred.

Stormwater monitoring has been successful in documenting improper land management activities, such as road construction in Mineral Fork, and should be continued at more strategic locations where nonpoint sources can be more exactly identified.

JORDAN RIVER MANAGEMENT

The next priority for pollution control assessment, evaluation, and implementation is the Jordan River. **Fishery and recreational uses have been impaired in the Jordan, and increased management of the river will facilitate restoration of these uses.**

There are four main components to increased river management. These include wetland conservation, stormwater discharge and nonpoint source remediation, municipal wastewater management, and acquisition of data using more effective sampling techniques.

WETLAND CONSERVATION

A new program is underway to develop a comprehensive wetland conservation plan for about 2000 acres for wetlands which fall into this unsuitable category. The plan will result in permanent acquisition of wetlands or conservation through purchase, easements, zoning, or other measures. An advanced identification of Jordan River wetlands was completed which targets wetlands presumptively unsuitable for Section 404 discharge/fill permits.

The comprehensive wetland conservation plan is about 25% complete, with mapping and ACAD applications remaining. Several restoration and enhancement projects are being implemented along the Jordan River corridor, including:

- The Little Dell Dam mitigation project between 3300-3900 South along the Jordan River.
- Oxbow restoration and constructed wetlands along the Murray Parkway at 6400 South to I-215.
- Wetland expansion and restoration at the Murray Parkway site North of I-215.
- Wetland mitigation sites for 7200 South extension construction activity and industrial park development between 6400 South to 7800 South.

- Potential golf course mitigation and enhancement sites in conjunction with Riverton, Sandy and South Jordan proposals.
- Wetland acquisition, restoration, enhancement, and management plans being developed in Riverton and Bluffdale in cooperation with the State Division of Wildlife Resources and the Bluffdale Open Space Master Plan (in process).

Some of these and other wetland sites have been placed under the Salt Lake County Adopt-A-Wetland Program, where interested groups take part in wetland revegetation, clean-up, education, and other management processes.

STORMWATER AND NONPOINT SOURCE PROGRAMS

Two major sources of water pollution have impaired protected uses of the Jordan River. They are stormwater discharges from a complex drainage network, and hydrologic modifications to the River over several years.

A. Stormwater Permit Application & Management

Salt Lake County submitted the Part I stormwater permit application to the State of Utah on November 18, 1991. The permit was drafted by the county consultant, Eckhoff, Watson & Preator, and involved extensive consultation with the City-County Health Department in the areas of legal authority, mostly in the matter of control over illicit discharges to publicly owned storm sewers.

As a major component of the application and future management strategy, the City-County Health Department has initiated a joint stormwater investigation/enforcement strategy and policy in cooperation with the County Attorney. This program will strongly augment the county's ability to enforce existing laws prohibiting illicit discharges of both toxic and non-toxic controlled pollutants, and strengthen collection of data to provide evidence for effective prosecution of violations.

Dry weather monitoring of drainages conducted last summer, (a mandatory component of the permit application), resulted in disclosure of numerous discharges which exceed the fecal coliform standard (200 coliforms/100 ml). The Health Department will follow-up in these areas to further identify sources and enforce existing regulations to reduce nonpoint loads to coveyance facilities and waters of the county.

Also, industrial dischargers with Standard Industrial Codes (SIC's) were identified and printed out on the County-wide Permit Land Use Map, which will facilitate future investigation targeting and priorities for site-specific assessments.

Permits will be issued which require "soft" management practices which focus on source prevention, rather than "end of the pipe" measures. A public information/education project is now under way. Effluent criteria may be developed in the 1994 Clean Water Act amendments, which would have to be met during storm runoff periods. Permits are being issued on a county-wide basis, and monitored with co-permittees, such as municipal corporations.

B. Nonpoint Source Management

Murray City and Salt Lake County have implemented a demonstration project involving stream restoration techniques designed to control both hydrologic modification effects and stormwater discharge utilizing wetlands. The project features enhancement of both understory and overstory riparian vegetation and a continuous trail. Nonpoint pollution sources continue to be regulated through coordinated planning with stormwater permits, wetland conservation, and implementation of the Jordan River parkway concept.

This demonstration has proven effective, and received the first annual national EPA award for nonpoint source pollution control in 1992. These measures will be replicated upstream on the Jordan River, concentrating on reaches with high instability and numerous nonpoint discharges.

Based on the demonstration, a nonpoint plan for hydrologic modifications has been completed which features a "meander corridor" buffer within which future river restoration and management will occur. The meander corridor ordinance will be administered by Salt Lake County, and create a streamside buffer which varies between 200-800 feet.

MUNICIPAL WASTEWATER EVALUATIONS

The Central Valley Water Reclamation Facility (CVWRF) has conducted comprehensive fishery studies of the lower Jordan River to determine if proposed changes in Ammonia discharge would affect reproduction of warmwater game fish. The results determined that fish density & diversity in the River is impaired by water pollution and lack of adequate physical habitat.

Salt Lake County, CVWRF, State Water Pollution Control & Division of Wildlife Resources are cooperated in these studies, which indicate that heavy metal contamination could be a factor in fish reproduction, as well as habitat limitations. Fish tissue analyses were conducted to determine any potential impairment to fish reproduction or human health from consumption.
Additional studies should continue over the next two to three years to enable statistical analysis and formulation of valid conclusions.

IMPROVED DATA ACQUISITION

Grab sampling techniques net little substantive data relating to contaminant loads entrained in bottom or suspended sediment. Most heavy metals will be found at higher concentrations in the lower water column nearest the sediment loads. The inability of grab sampling to typify the water column across the river cross-section implies the need to use more effective sampling techniques.

Salt Lake County began collecting water quality data from 19 sites using Equal Width-Integrated sampling. This technique employed a USGS DH-48 style sampler lowered into the entire water column across the stream section. The result was greater accuracy in reporting existing pollutant load conditions in the river, which increases confidence in future management decision-making.

However, in the last 2-3 years, this technique has been modified due to lack of replacement parts for the DH-48. The Health Department is attempting to secure the needed equipment to continue proper sampling techniques.

IRRIGATION CANAL MANAGEMENT

A. Herbicide Application/Management

Treatment of irrigation canals with acrolein and other hazardous chemicals has resulted in fish kills in both the Jordan River and its tributaries. Application of herbicides has been more closely monitored to prevent such incidents, with canal companies informing local wildlife and health agencies prior to use of herbicides, to enable regulation and monitoring in compliance with prescribed application rates.

B. Irrigation Canal "Sluicing" Management

Irrigation canals have been routinely "sluiced" at the diversion structures to clean organic-laden sediment from constricting the operation of the diversions. This resulted in violation of water quality standards and fish kills which subsequently are being addressed in state hydrologic modification managmement practices in the the state NPS plan.

The Salt Lake City-County Health Department issued an administrative order to require the canal companies to coordinate with Salt Lake County prior to any sluicing operations.

GROUNDWATER MANAGEMENT

Several categories of groundwater contamination and management are being addressed in Salt Lake County. They include regulation of leaking underground storage tanks, assessment and remediation activities conducted under authority of the Resource Conservation & Recovery Act (RCRA), the Comprehensive Environmental Response Compensation & Liability Act (CERCLA), ambient monitoring of the shallow unconfined aquifer, and increased management of deep confined aquifer sources used for public drinking water supply.

A. UNDERGROUND STORAGE TANKS

Salt Lake County has been forced to deal with leaking underground gasoline tanks over the last three years. Plumes have entered private homes, endangering public health and safety. The county has conducted extensive inspections and required dozens of tank removals prior to development of either state or EPA regulations.

The major activity of involvement by the City-County Health Department in groundwater management has been regulation of underground storage tanks. During 1990-91, the Health Department initiated a fee program in cooperation with the State of Utah to develop funding mechanisms to operate inspection, monitoring, and compliance activities.

The state provides grants to Salt Lake County to assist in the management of this program, to which the county provides matching funds from fees. In the last two years, the state and county have expended about $ 170,00 to identify and monitor 1500 tanks. The number of tanks has been reduced to about 1000 tanks, of which half are monitored with shallow wells.

About 500 tanks have been pulled from contaminated ground, and soil removal or bio-remediation has occurred to reduce or eliminate the contamination. The tanks are distributed throughout Salt Lake Valley, and are generally very old ones installed in the 1960's.

B. GROUNDWATER MONITORING

The principal monitoring responsibility by City-County Health in the area of landfill sampling, which is conducted twice annually.

Other monitoring activities are conducted on about 100 CERCLA sites in Salt Lake valley, by EPA, the State of Utah, or their designated contractors.

Ambient groundwater monitoring is routinely conducted by the U.S. Geological Survey on the shallow and deep aquifers.

Federal and state regulations are being developed, together with fee structures to fund inspection & enforcement activities. For this program to be effective, local resources must be developed and trained to undertake extensive and time-consuming inspection, monitoring, and enforcement activities associated with tank problems.

EPA has been funding studies for estimation of flow velocities within the deep confined aquifer, mainly in the Sandy area.

The Salt Lake County Conservancy District is studying artificial recharge to the principal aquifer as a means of stabilizing declining water levels.

The State Division of Health has received funds to develop information on shallow aquifer contamination from nonpoint sources in the urban area of Salt Lake valley, focusing on lawn fertilizer application rates. No substantive information has been developed from this project to date.

The State Department of Agriculture is developing models for estimation of agricultural-originated groundwater pollutants in the Southwest corner of Salt Lake Valley.

CERCLA SUPERFUND SITES

The EPA Superfund program lists 203 sites in Utah for which assessment, remediation and clean-up projects are being prepared. **Almost half of these sites (93) are in Salt Lake County.**

The 1988 305b assessment recommended diverting Superfund dollars for administrative support to local health programs to augment shortfalls in local revenues to deal with these problems. The county will work to implement this recommendation.

The fate of the Sharon Steel Tailing Pile is still to be determined.

WATER QUALITY DATA

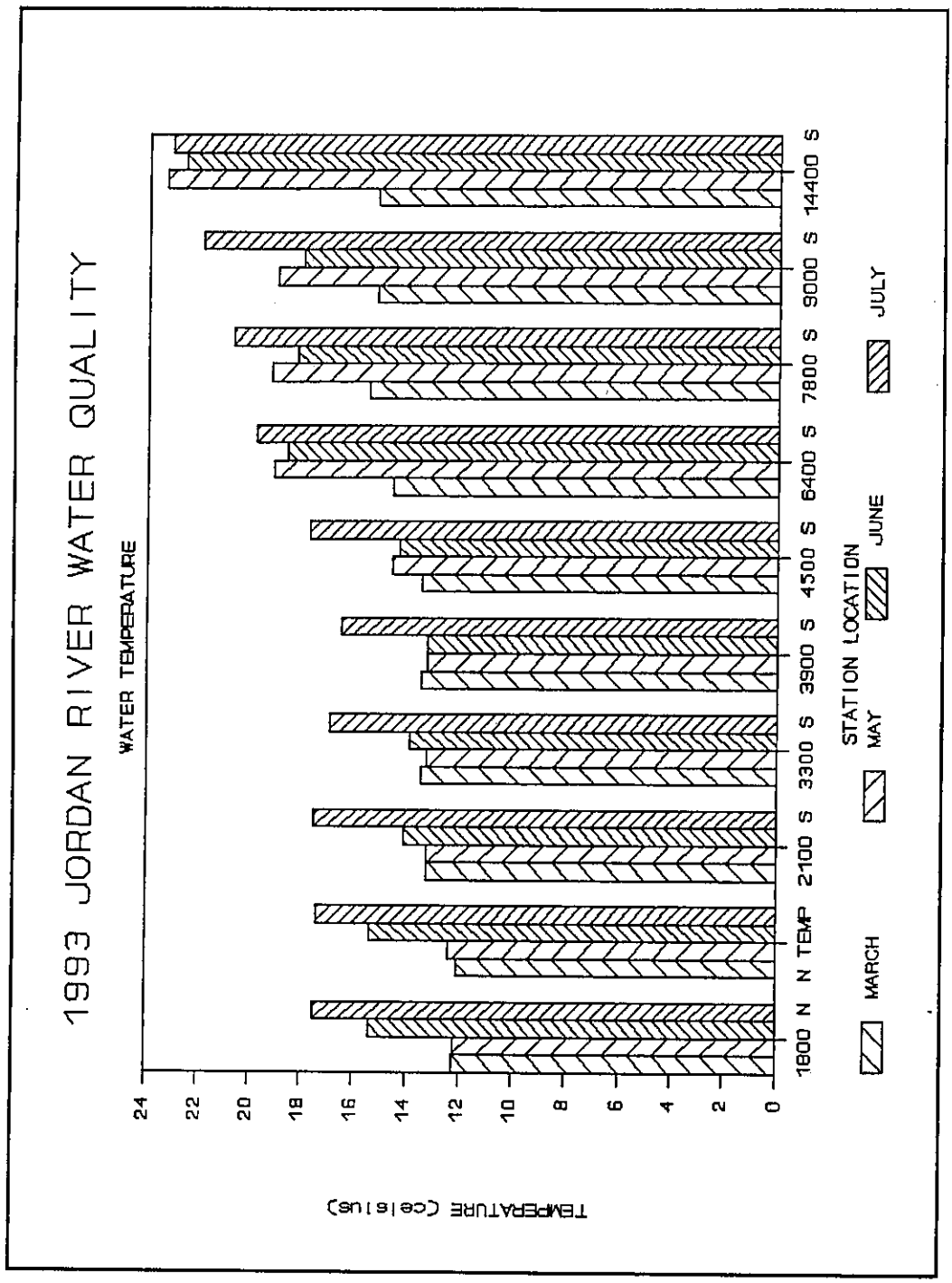
The most current water quality data for the Jordan River and its tributaries is attached in the Appendices. The Canyon data are summarized in individual annual reports.

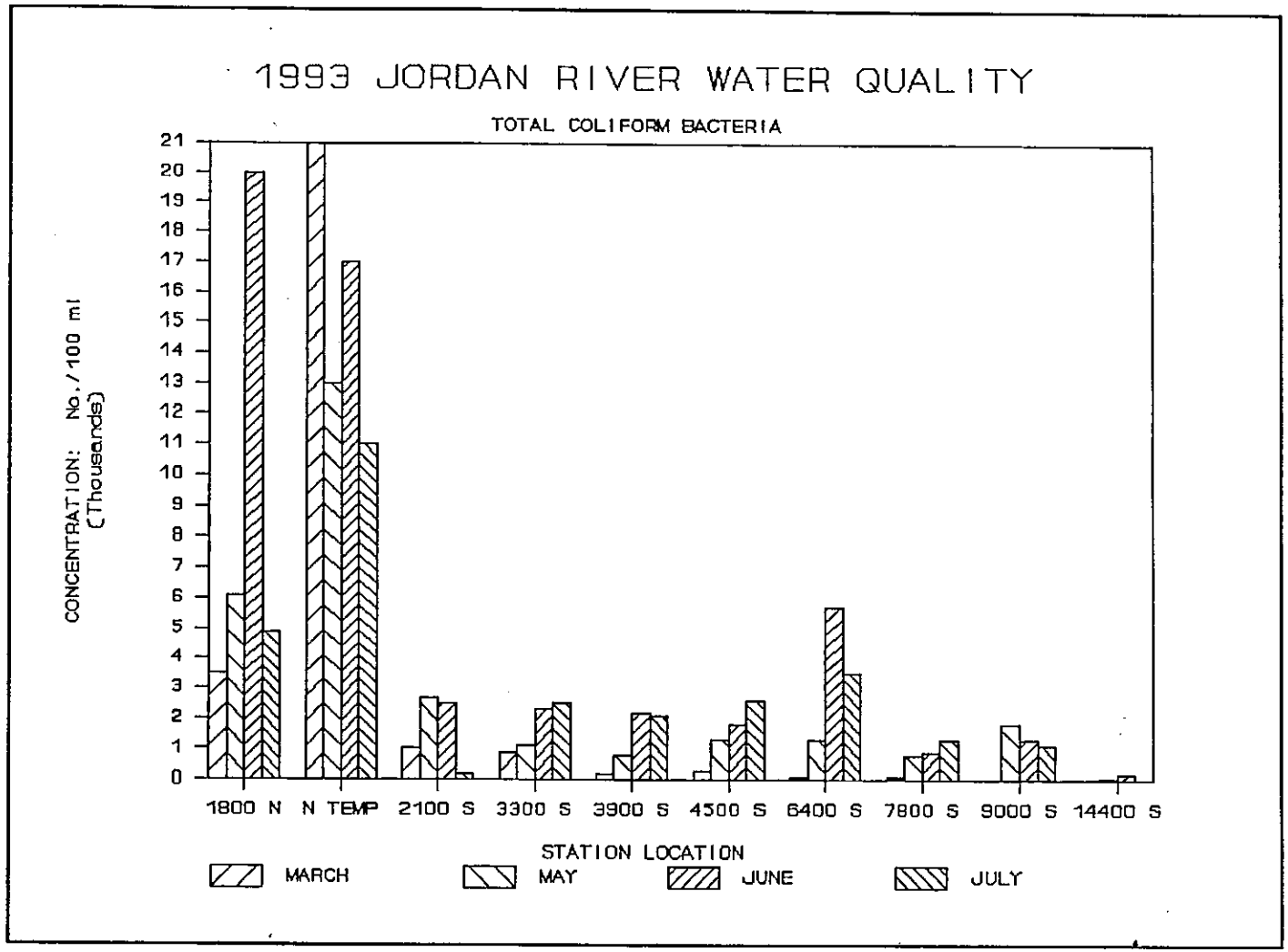
A summary of the water quality problems of priority watersheds and stream segments is shown in Table One.

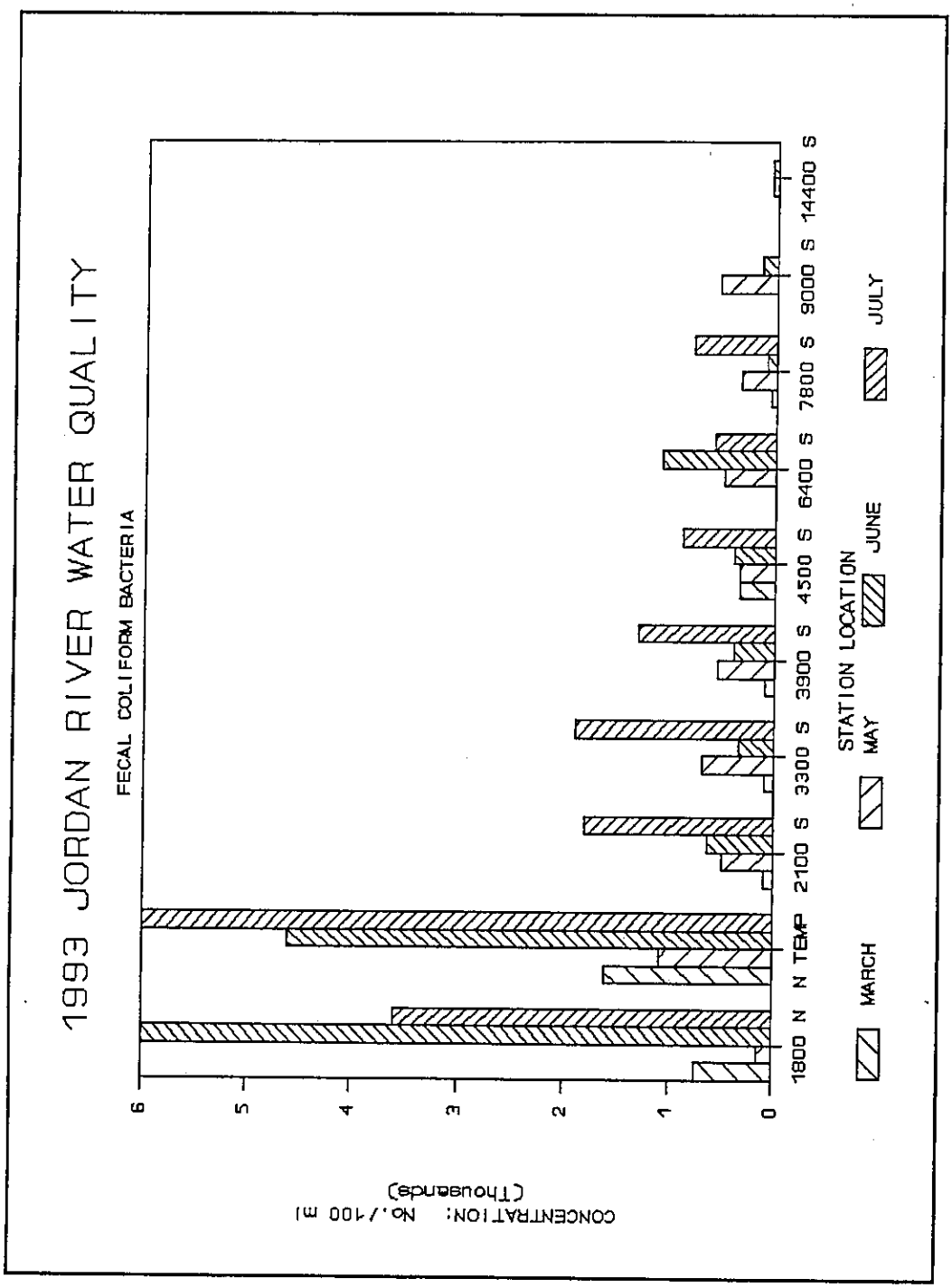
JORDAN RIVER
WATER QUALITY PROBLEM PARAMETERS
AND POTENTIAL SOURCES

PARAMETER	AFFECTED SEGMENT	POTENTIAL SOURCES
Suspended Sediment	3300-4500 South 9000-14400 South	Hydrologic Modif. Bed/Bank Erosion Construction
Total Phosphorus	6400 South 2100 South-1800 North	Agriculture/Hyd.Mod. Urban
Total Ammonia	2100 South-1800 North	Urban/Irrigation
Total Nitrate	5400 South-1800 North	Urban/Irrigation Hydrologic Modif.
Total Zinc	6400-3300 South	Hydrolgic Modif. Urban/Illicit Mining
Total Lead	7800-3300 South North Temp-1800 North	Hydrologic Modif. Mining Urban
5-Day BOD	4500 South-1800 North	Urban/Irrigation
Dissolved Oxygen	N Temple-1800 North	Urban/Irrigation Hydrologic Modif.
Coliform Bacteria (Total and Fecal)	6400 South-1800 North	Hydrologic Modif. Irrigation/Urban Agriculture/Illicit

Flooding in 1983-84 aggravated bank-cutting which increased downstream sediment loads requiring dredging. Upstream dredging of the outlet of Utah Lake enlarged the channel to drain the Lake faster. This may produce higher velocities and volumes of critical flows.


1993 JORDAN RIVER WATER QUALITY
WATER TEMPERATURE
TEMPERATURE (celsius)
0
2
4
6
8
10
12
14
16
18
20
22
24
1800 N N TEMP
2100 S
3300 S
3900 S
4500 S
6400 S
7800 S
9000 S
14400 S
STATION LOCATION
MARCH
MAY
JUNE
JULY


1993 JORDAN RIVER WATER QUALITY
TOTAL COLIFORM BACTERIA
CONCENTRATION: No./100 ml
(Thousands)
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1800 N
N TEMP
2100 S
3300 S
3900 S
4500 S
6400 S
7800 S
9000 S
14400 S
STATION LOCATION
MARCH
MAY
JUNE
JULY


1993 JORDAN RIVER WATER QUALITY
FECAL COLIFORM BACTERIA
CONCENTRATION: No./100 ml
(Thousands)
0
1
2
3
4
5
6
1800 N
N TEMP
2100 S
3300 S
3900 S
4500 S
6400 S
7800 S
9000 S
14400 S
STATION LOCATION
MARCH
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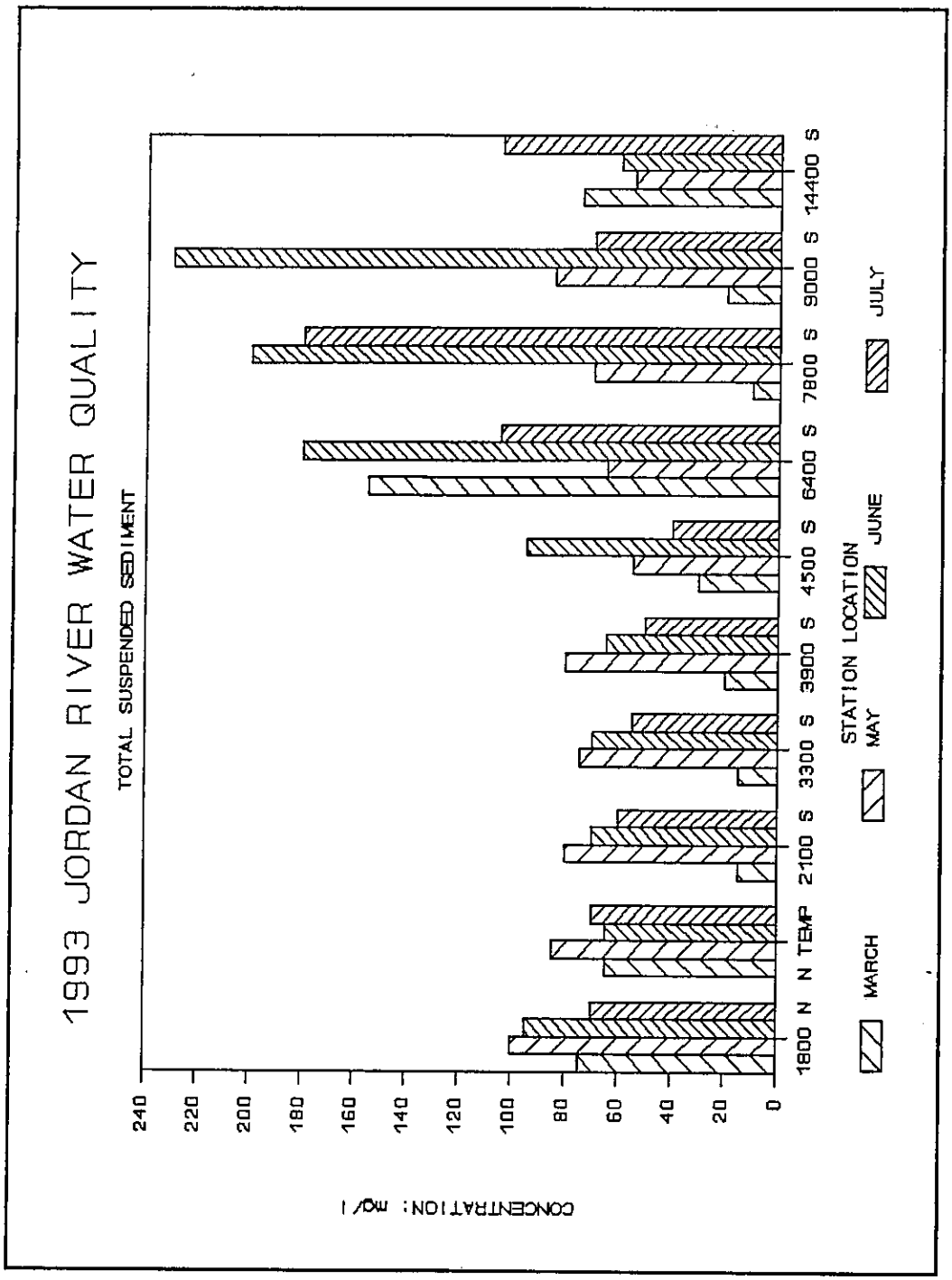
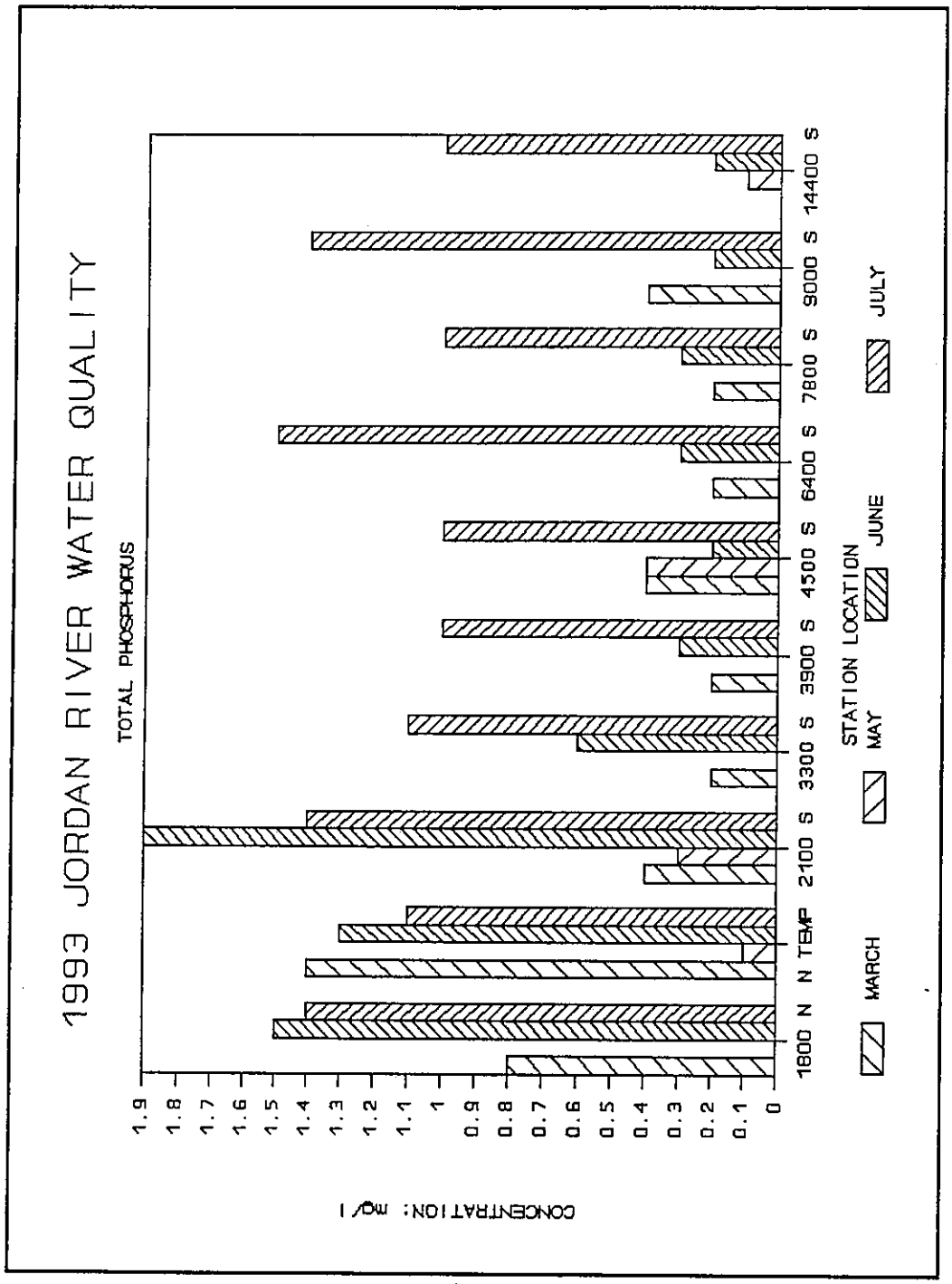
JUNE
JULY


1993 JORDAN RIVER WATER QUALITY
TOTAL SUSPENDED SEDIMENT
CONCENTRATION: mg/l
240
220
200
180
160
140
120
100
80
60
40
20
0
1800 N
N TEMP
2100 S
3300 S
3900 S
4500 S
6400 S
7800 S
9000 S
14400 S
STATION LOCATION
MARCH
MAY
JUNE
JULY


1993 JORDAN RIVER WATER QUALITY
TOTAL PHOSPHORUS
CONCENTRATION: mg/l
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1600 N
N TEMP
2100 S
3300 S
3900 S
4500 S
6400 S
7800 S
9000 S
14400 S
STATION LOCATION
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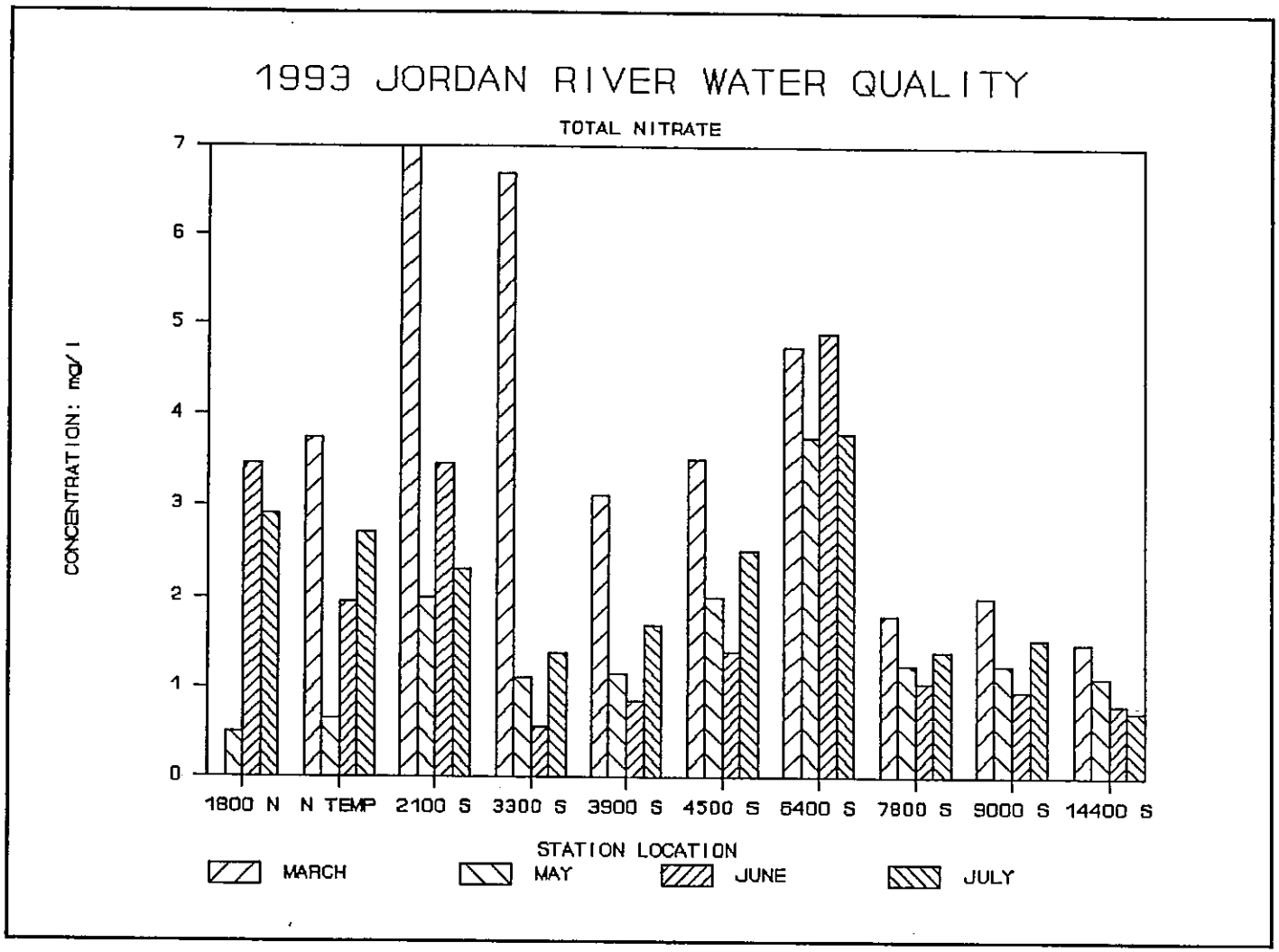
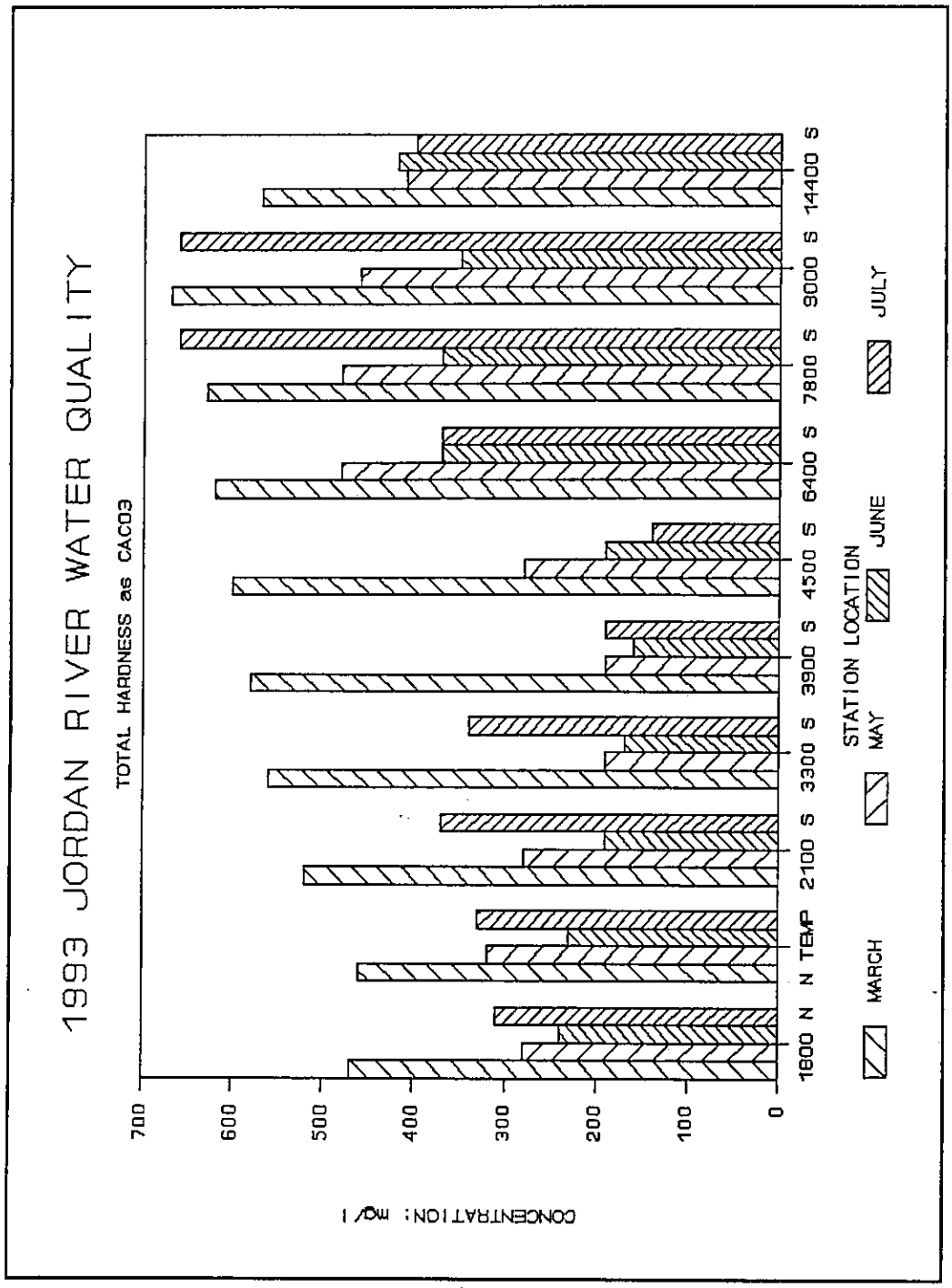
JUNE
JULY


1993 JORDAN RIVER WATER QUALITY
TOTAL NITRATE
CONCENTRATION: mg/l
0
1
2
3
4
5
6
7
1800 N
N TEMP
2100 S
3300 S
3900 S
4500 S
6400 S
7800 S
9000 S
14400 S
STATION LOCATION
MARCH
MAY
JUNE
JULY


1993 JORDAN RIVER WATER QUALITY
TOTAL HARDNESS as CACO3
CONCENTRATION: mg/l
0
100
200
300
400
500
600
700
1600 N
N TEMP
2100 S
3300 S
3900 S
4500 S
6400 S
7800 S
9000 S
14400 S
STATION LOCATION
MARCH
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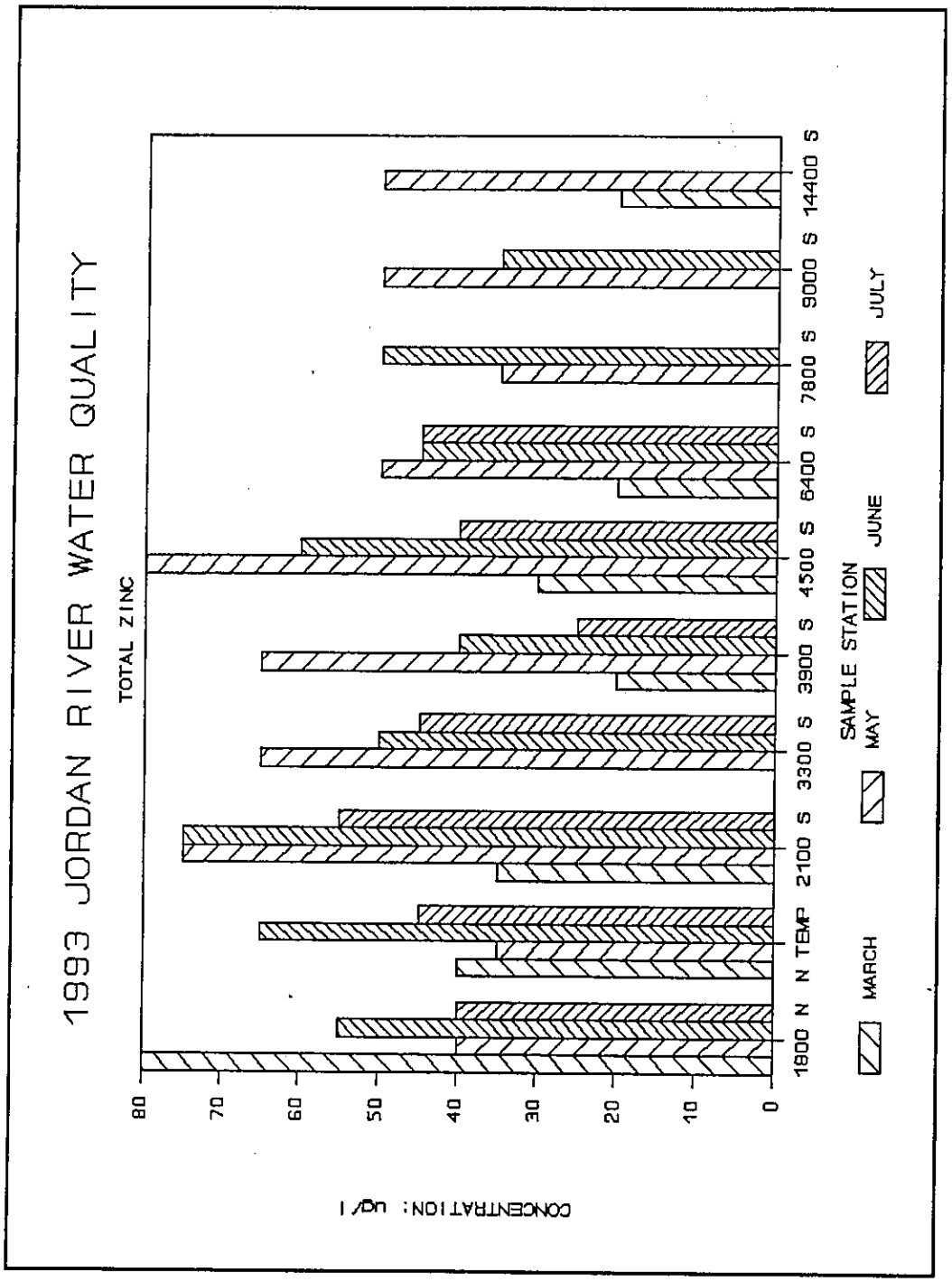
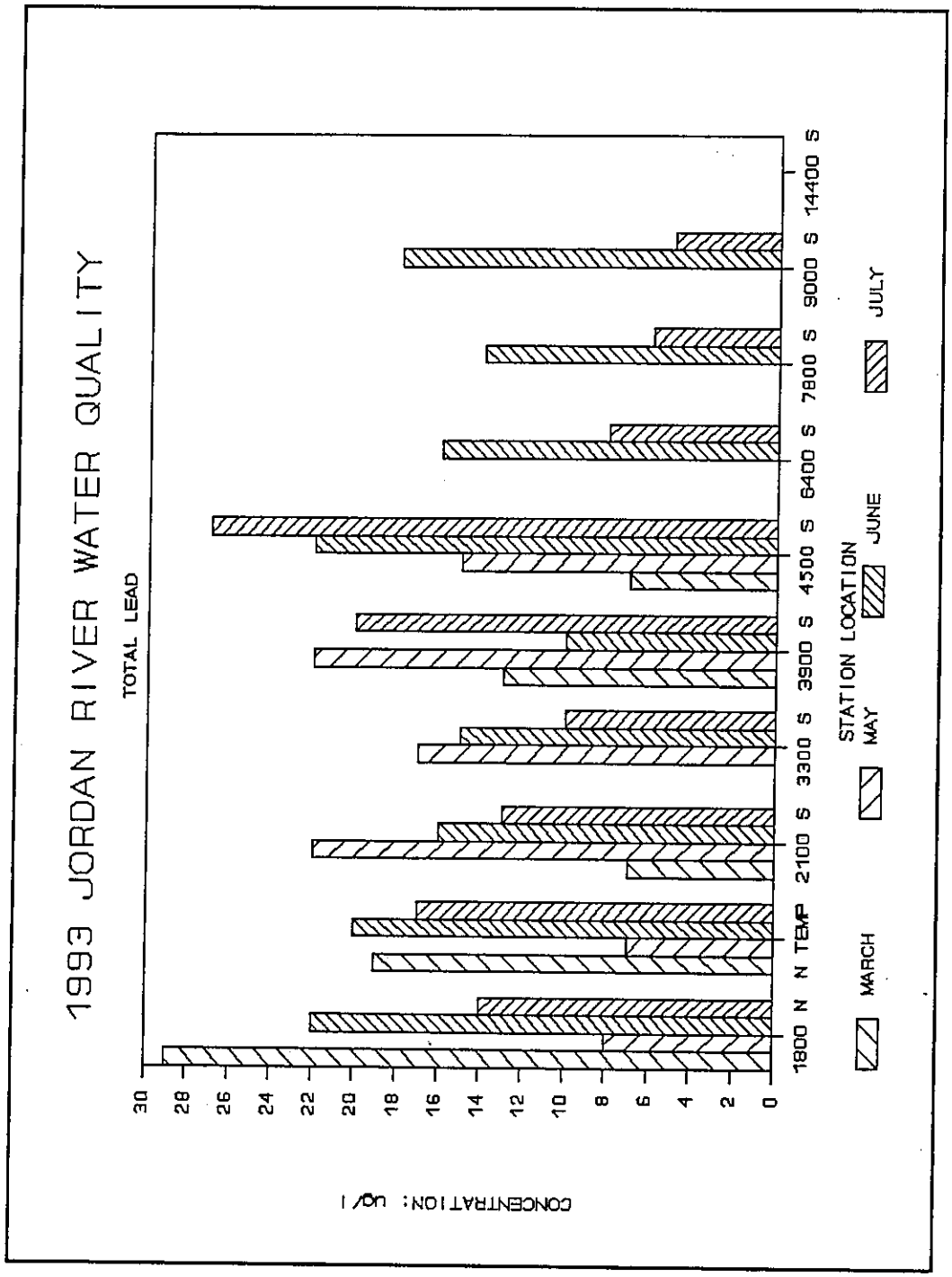
JUNE
JULY


1993 JORDAN RIVER WATER QUALITY
TOTAL ZINC
CONCENTRATION: ug/l
0
10
20
30
40
50
60
70
80
1900 N
N TEMP
2100 S
3300 S
3900 S
4500 S
6400 S
7800 S
9000 S
14400 S
SAMPLE STATION
MARCH
MAY
JUNE
JULY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TOTAL LEAD
CONCENTRATION: ug/l
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
1800 N
N TEMP
2100 S
3300 S
3900 S
4500 S
6400 S
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9000 S
14400 S
STATION LOCATION
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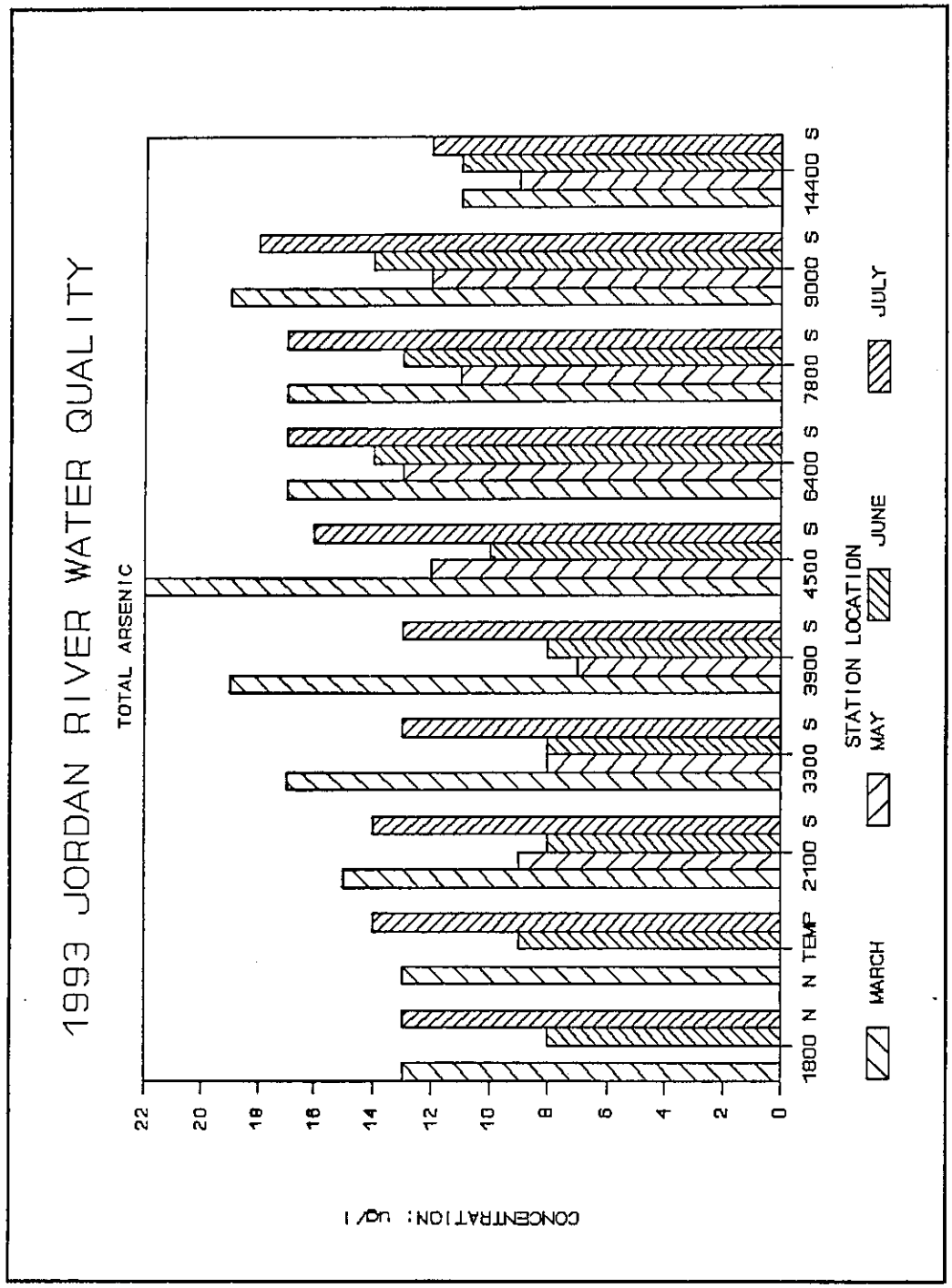
JUNE
JULY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TOTAL ARSENIC
CONCENTRATION: ug/l
0
2
4
6
8
10
12
14
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18
20
22
1800 N
N TEMP
2100 S
3300 S
3900 S
4500 S
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14400 S
STATION LOCATION
MARCH
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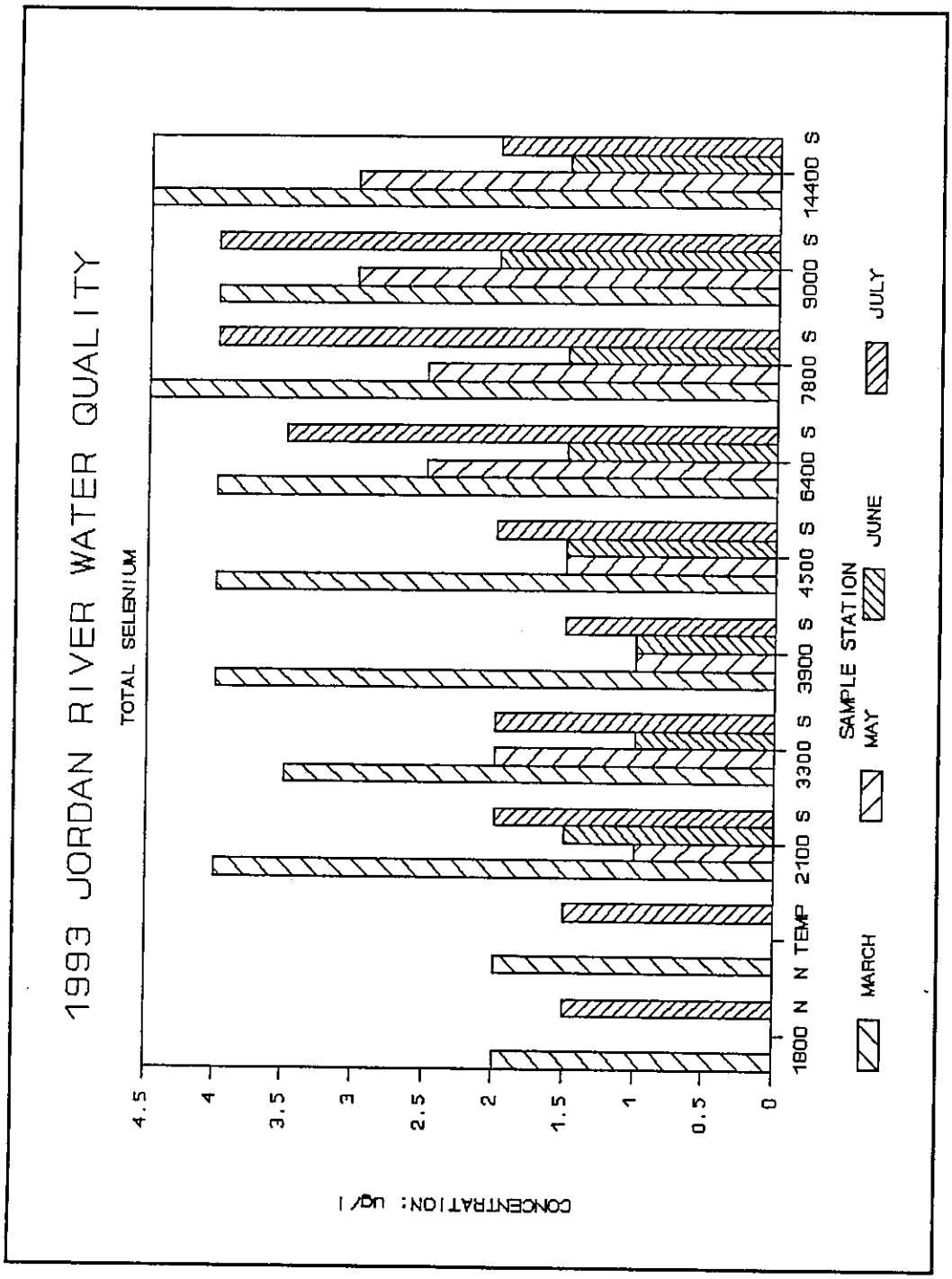
JUNE
JULY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TOTAL SELENIUM
CONCENTRATION: ug/l
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1800 N
N TEMP
2100 S
3300 S
3900 S
4500 S
6400 S
7800 S
9000 S
14400 S
SAMPLE STATION
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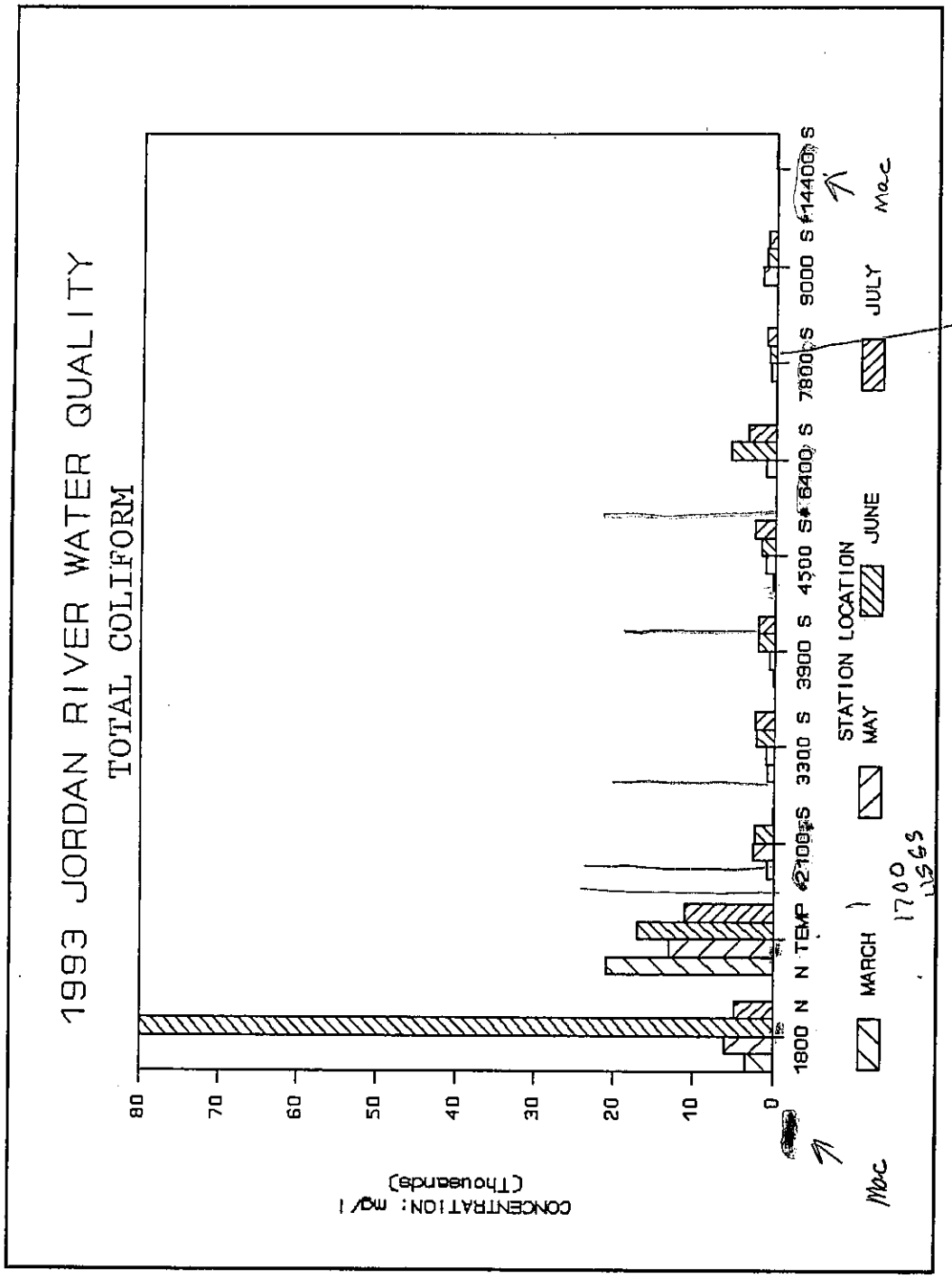
JUNE
JULY


1993 JORDAN RIVER WATER QUALITY
TOTAL COLIFORM
CONCENTRATION: mg/l
(Thousands)
80
70
60
50
40
30
20
10
0
1800 N
N TEMP
2100 S
3300 S
3900 S
4500 S
6400 S
7800 S
9000 S
11400 S
STATION LOCATION
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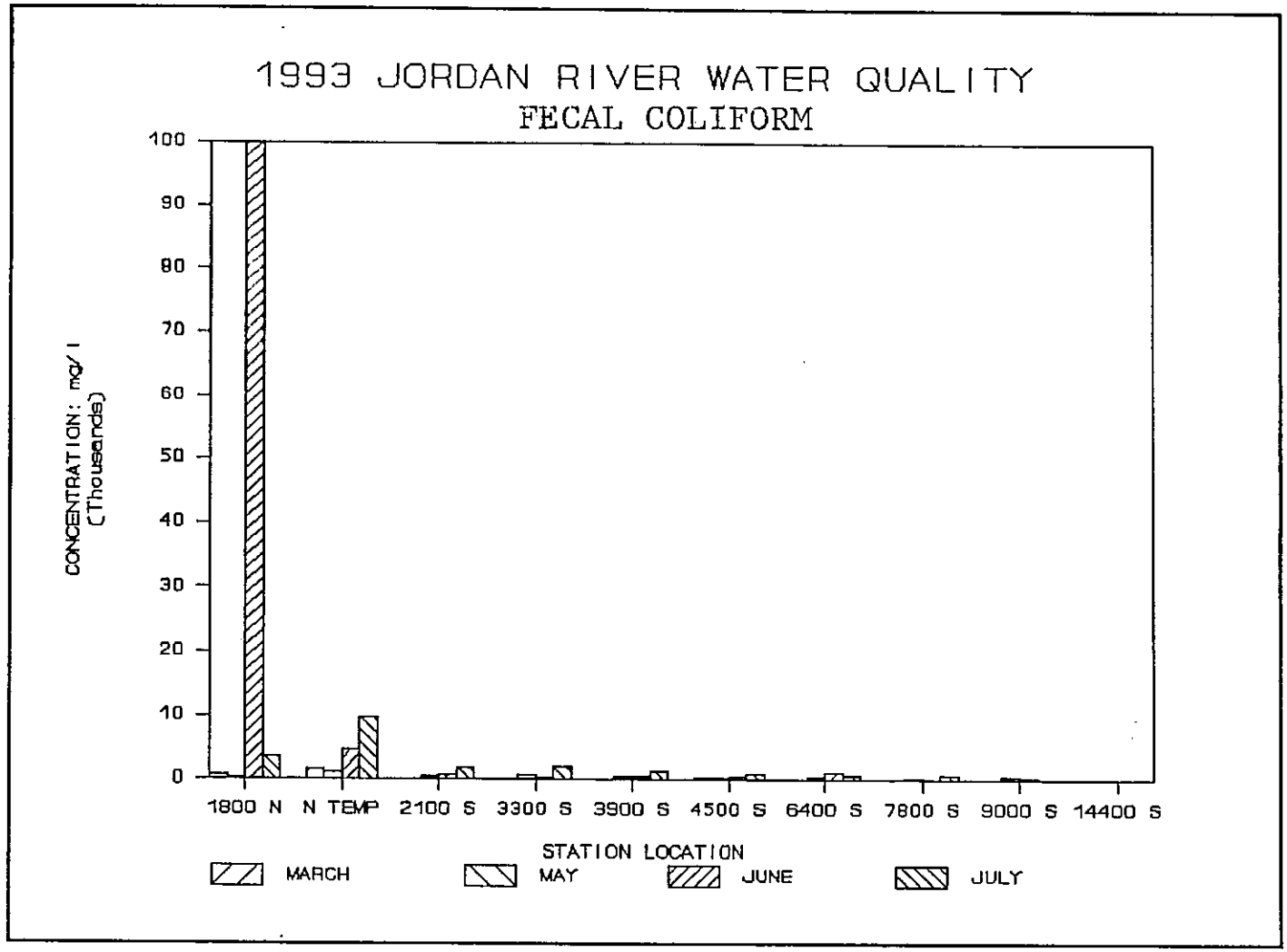
MAY
JUNE
JULY
Mac
Mac
17000
11565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FECAL COLIFORM
CONCENTRATION: mg/l
(Thousands)
100
90
80
70
60
50
40
30
20
10
0
1800 N
N TEMP
2100 S
3300 S
3900 S
4500 S
6400 S
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STATION LOCATION
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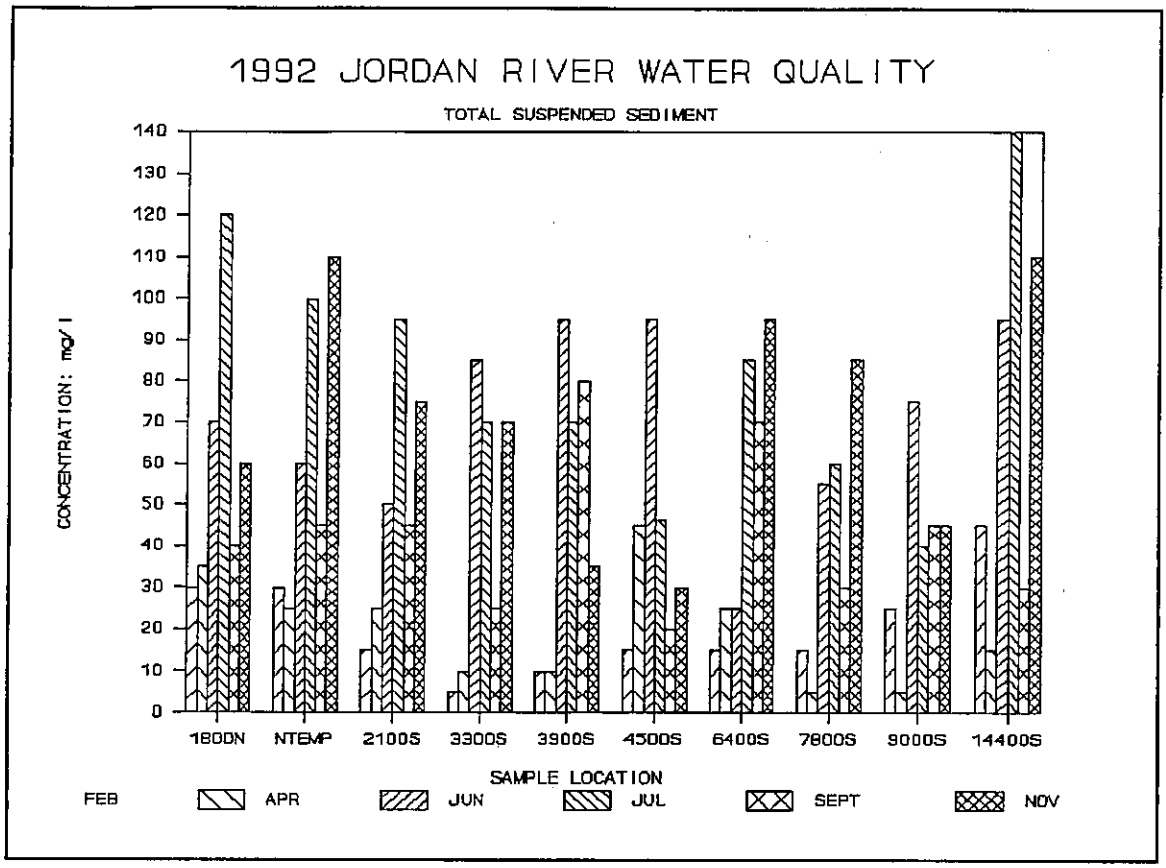
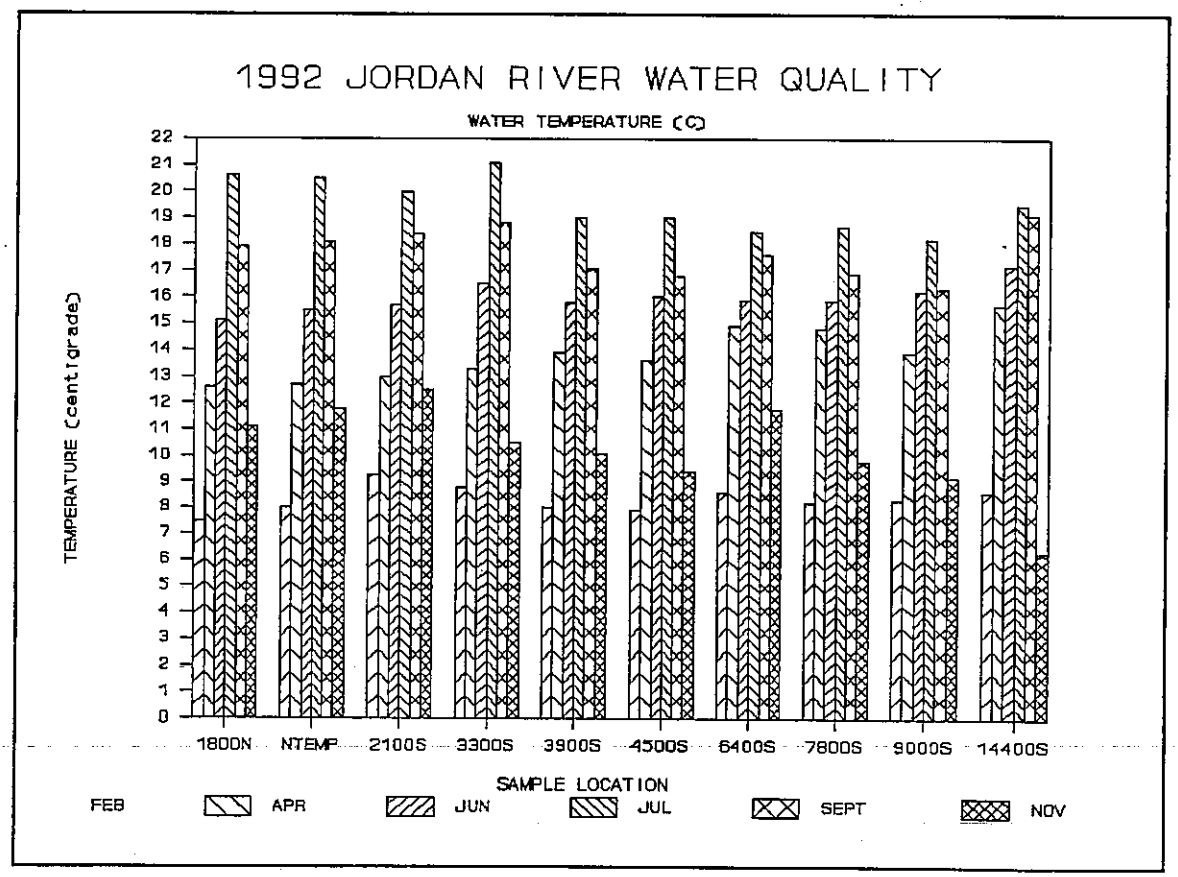
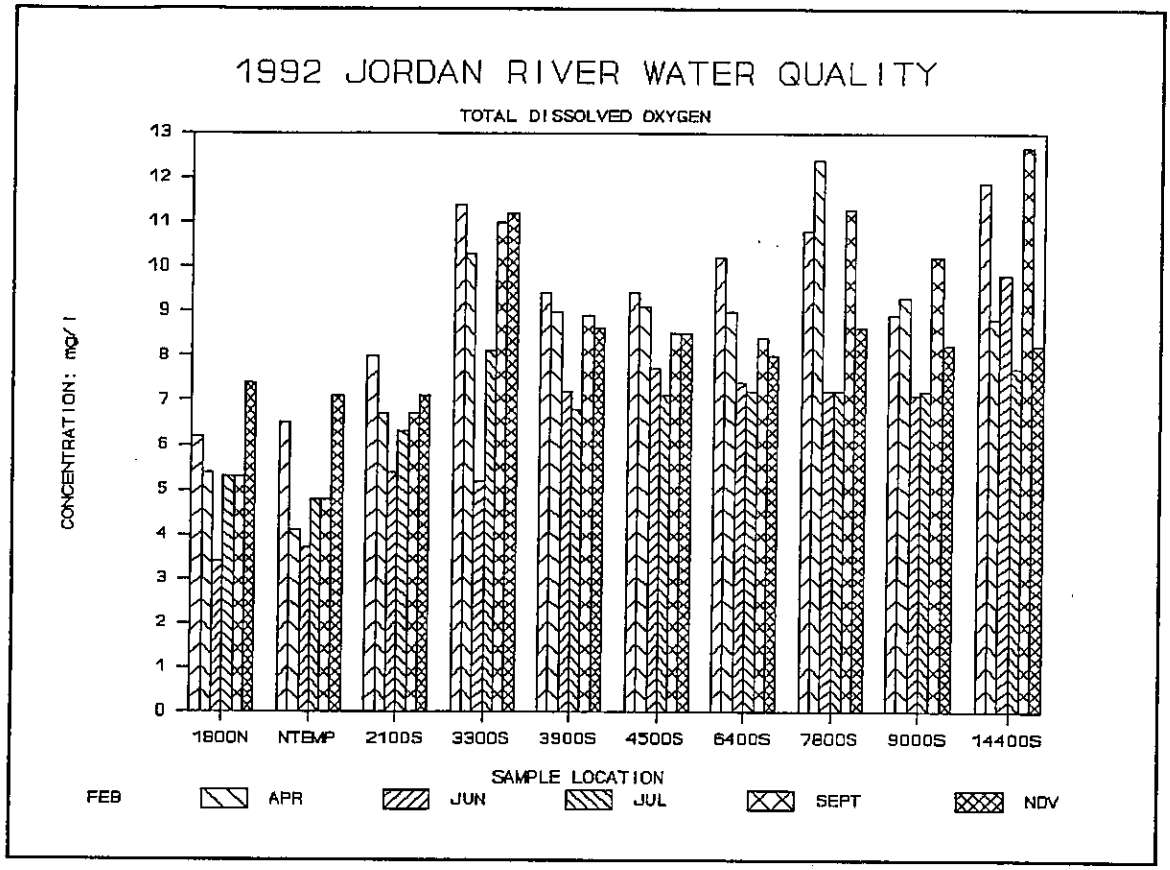
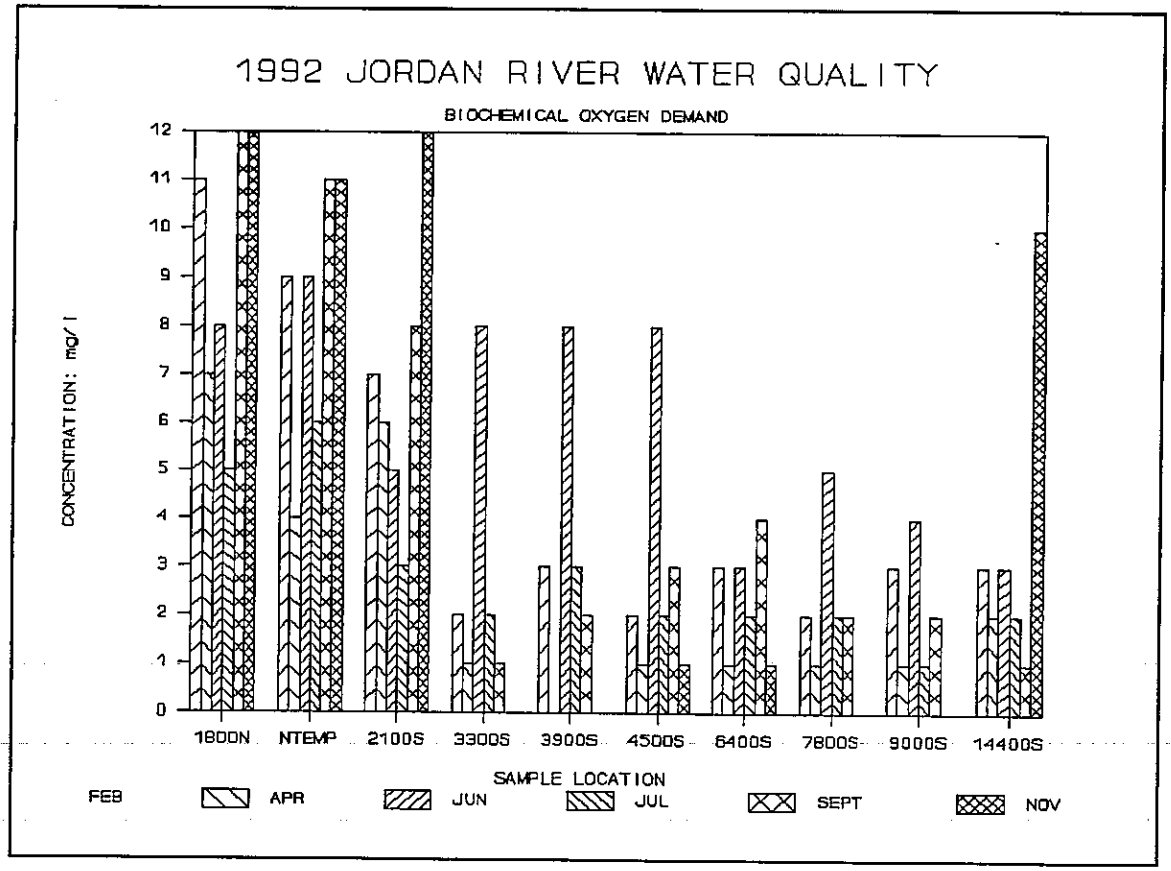
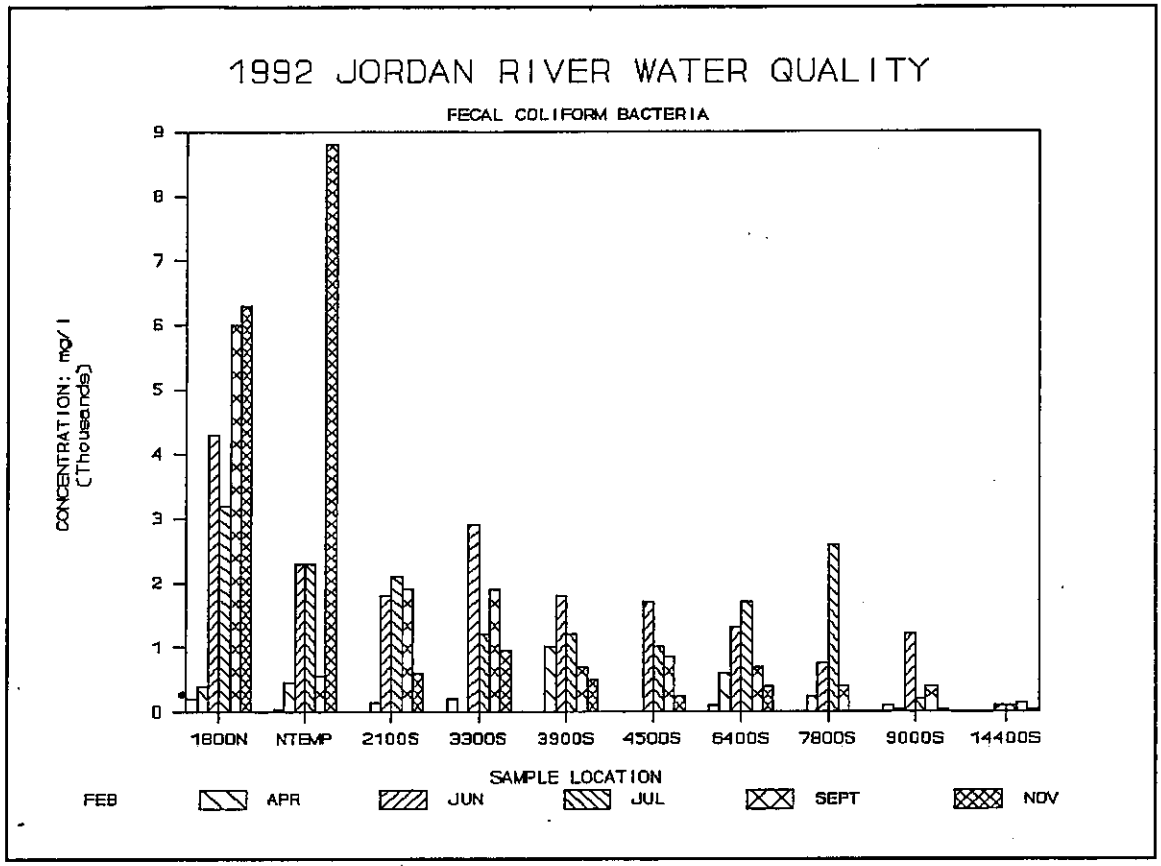
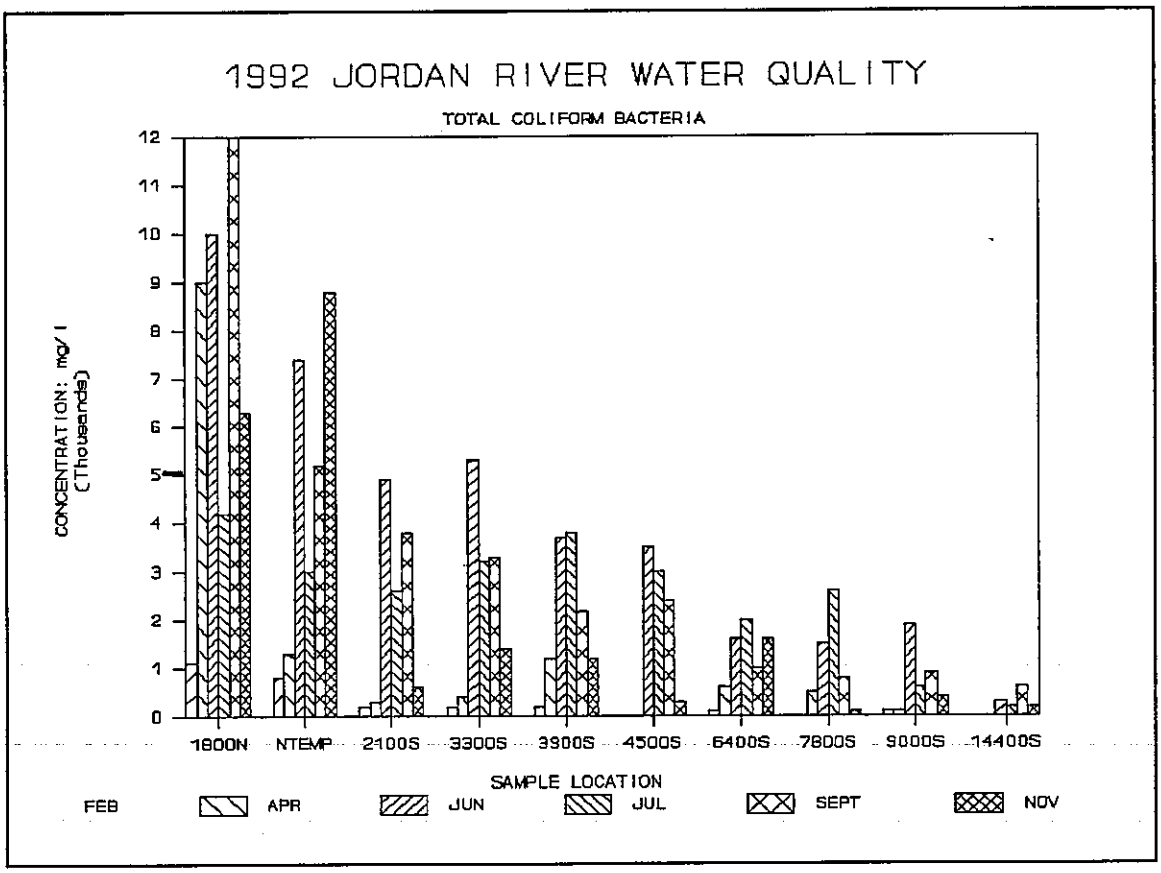

1992 JORDAN RIVER WATER QUALITY
TOTAL SUSPENDED SEDIMENT
CONCENTRATION: mg/l
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
1800N
NTEMP
2100S
3300S
3900S
4500S
6400S
7800S
9000S
14400S
SAMPLE LOCATION
FEB
APR
JUN
JUL
SEPT
NOV

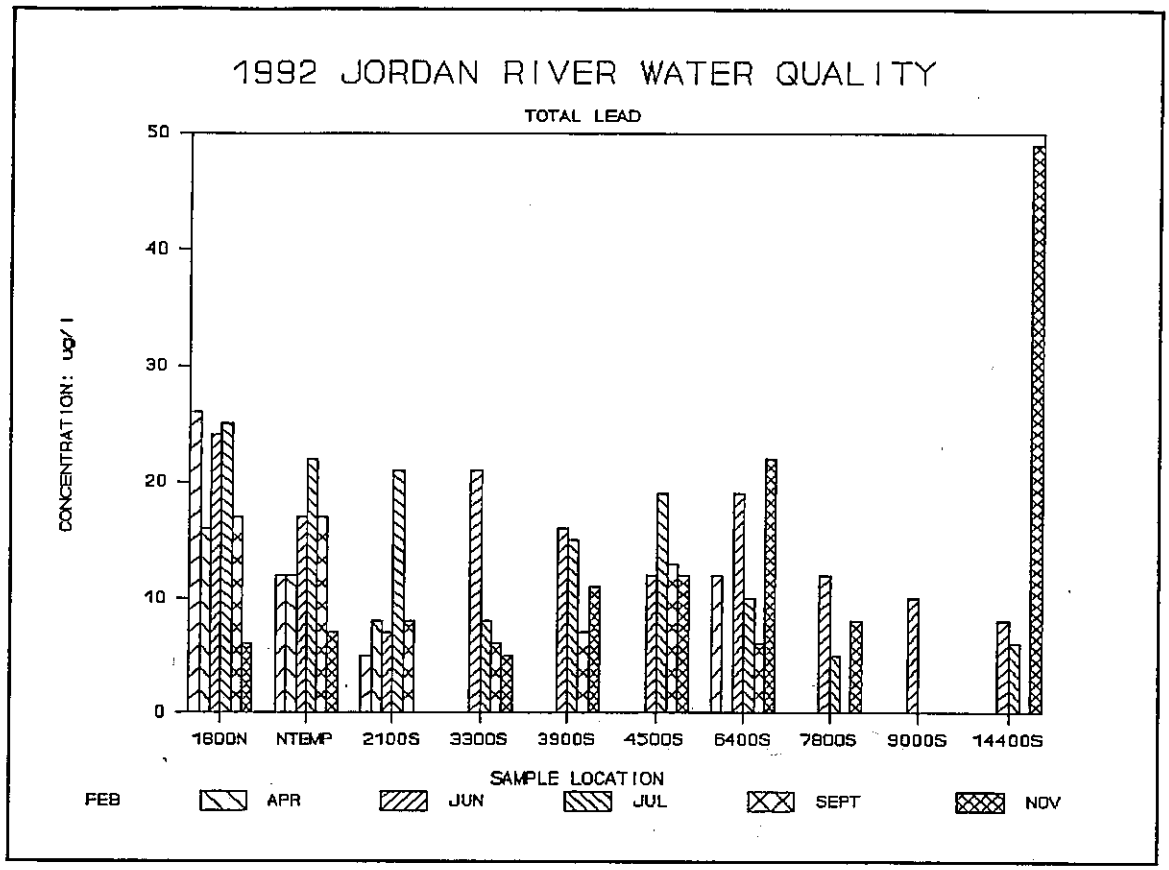

1992 JORDAN RIVER WATER QUALITY
WATER TEMPERATURE (C)
TEMPERATURE (centigrade)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
1800N
NTEMP
2100S
3300S
3900S
4500S
6400S
7800S
9000S
14400S
SAMPLE LOCATION
FEB
APR
JUN
JUL
SEPT
NOV

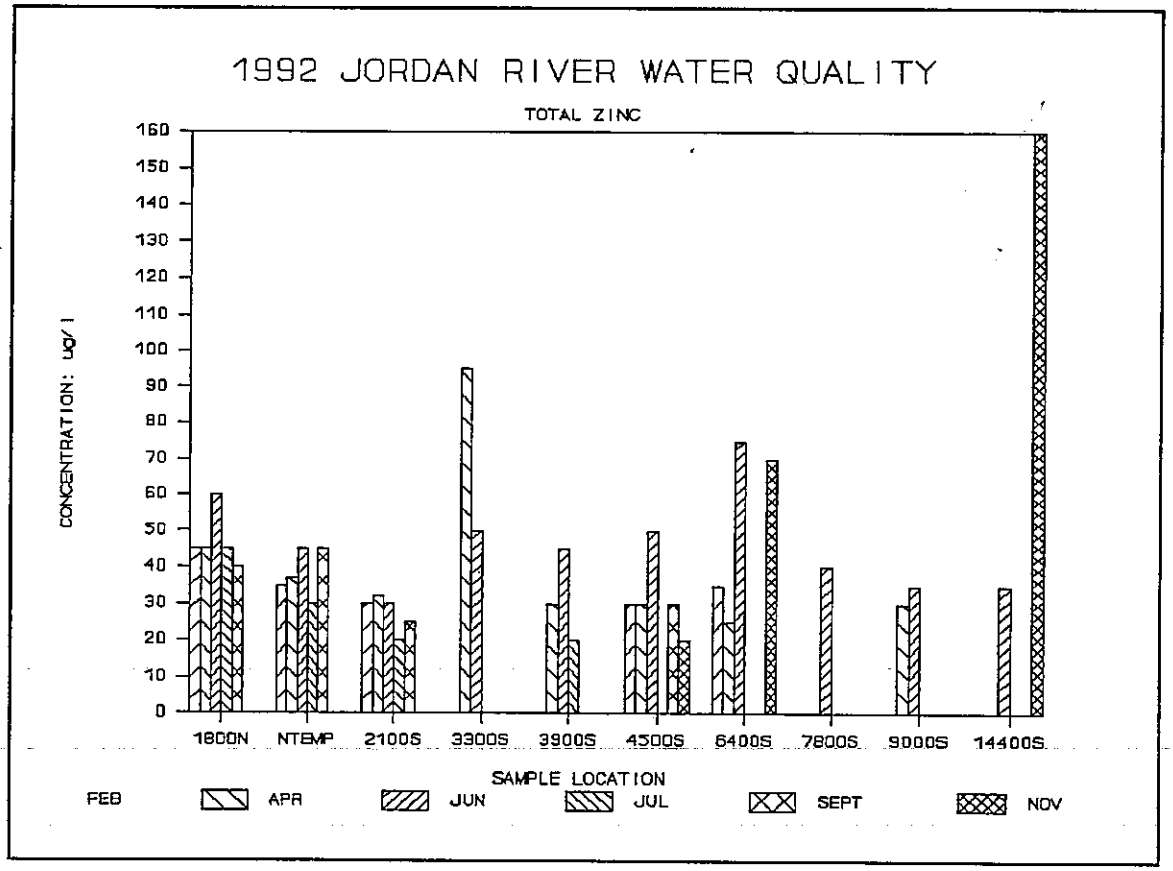

1992 JORDAN RIVER WATER QUALITY
TOTAL DISSOLVED OXYGEN
CONCENTRATION: mg/l
0
1
2
3
4
5
6
7
8
9
10
11
12
13
1800N
NTEMP
2100S
3300S
3900S
4500S
6400S
7800S
9000S
14400S
SAMPLE LOCATION
FEB
APR
JUN
JUL
SEPT
NOV

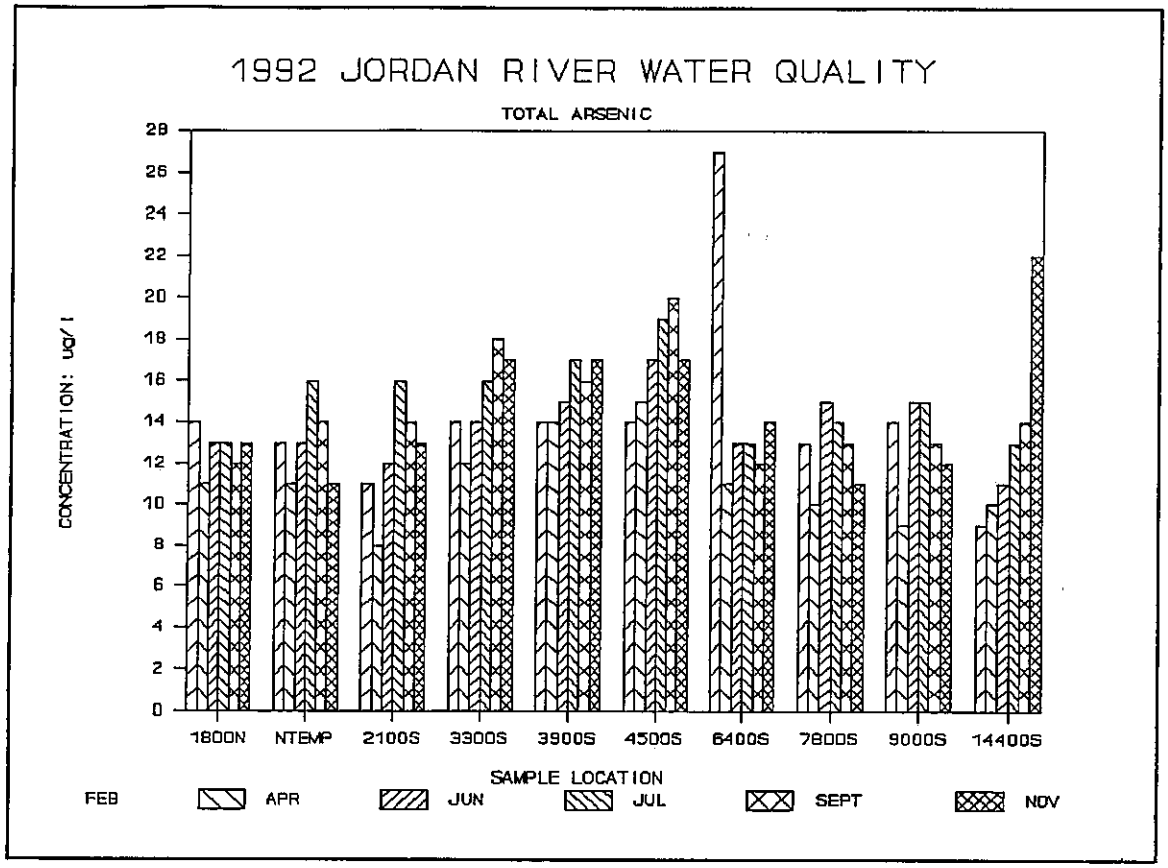

1992 JORDAN RIVER WATER QUALITY
BIOCHEMICAL OXYGEN DEMAND
CONCENTRATION: mg/l
0
1
2
3
4
5
6
7
8
9
10
11
12
1800N
NTEMP
2100S
3300S
3900S
4500S
6400S
7800S
9000S
14400S
SAMPLE LOCATION
FEB
APR
JUN
JUL
SEPT
NOV

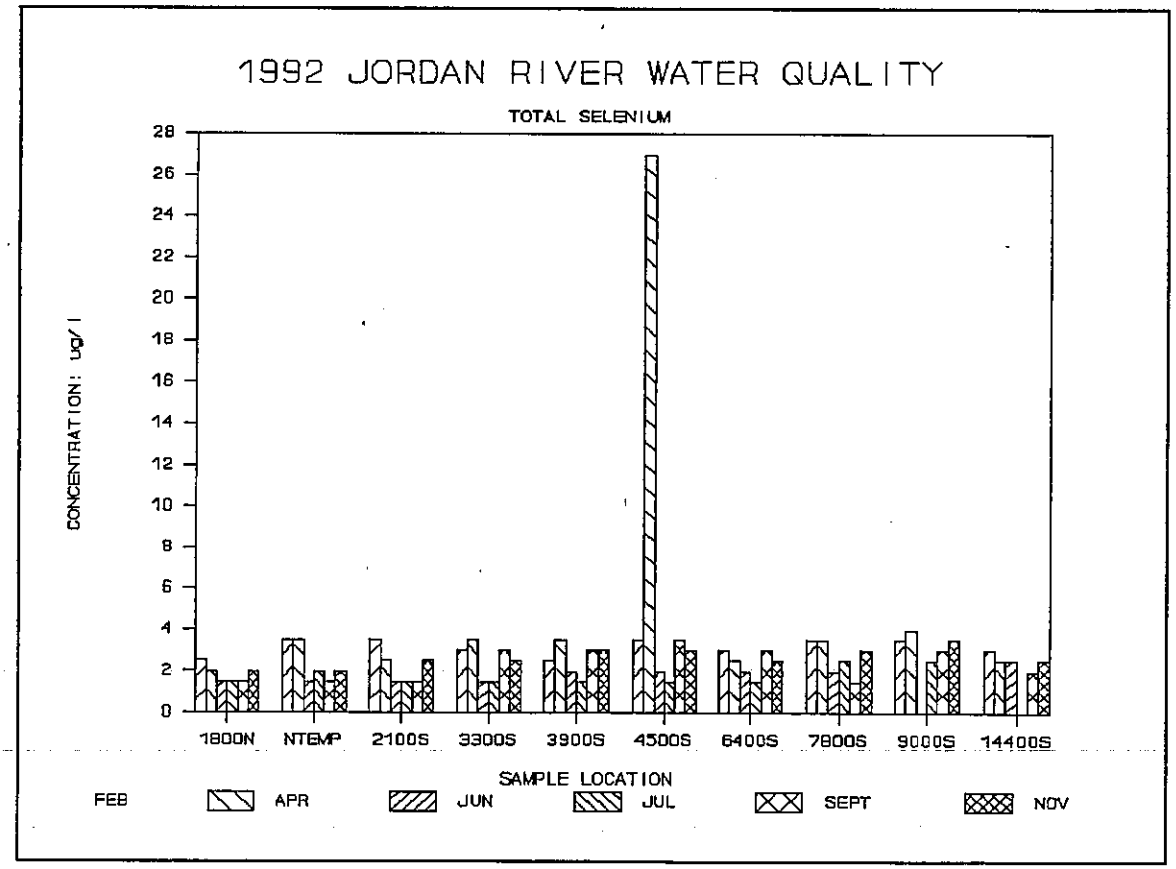

1992 JORDAN RIVER WATER QUALITY
FECAL COLIFORM BACTERIA
CONCENTRATION: mg/l
(Thousands)
0
1
2
3
4
5
6
7
8
9
1800N
NTEMP
2100S
3300S
3900S
4500S
6400S
7800S
9000S
14400S
SAMPLE LOCATION
FEB
APR
JUN
JUL
SEPT
NOV

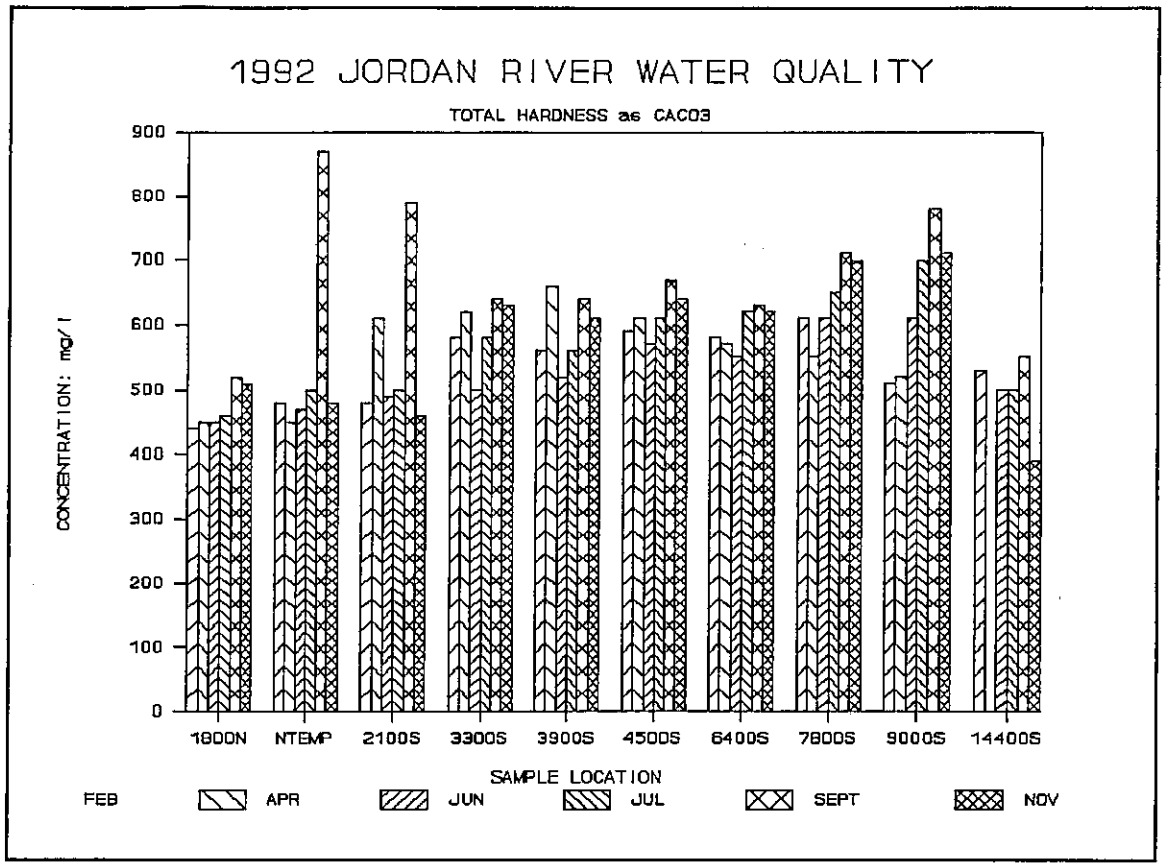

1992 JORDAN RIVER WATER QUALITY
TOTAL COLIFORM BACTERIA
CONCENTRATION: mg/l
(Thousands)
0
1
2
3
4
5
6
7
8
9
10
11
12
1800N
NTEMP
2100S
3300S
3900S
4500S
6400S
7800S
9000S
14400S
SAMPLE LOCATION
FEB
APR
JUN
JUL
SEPT
NOV

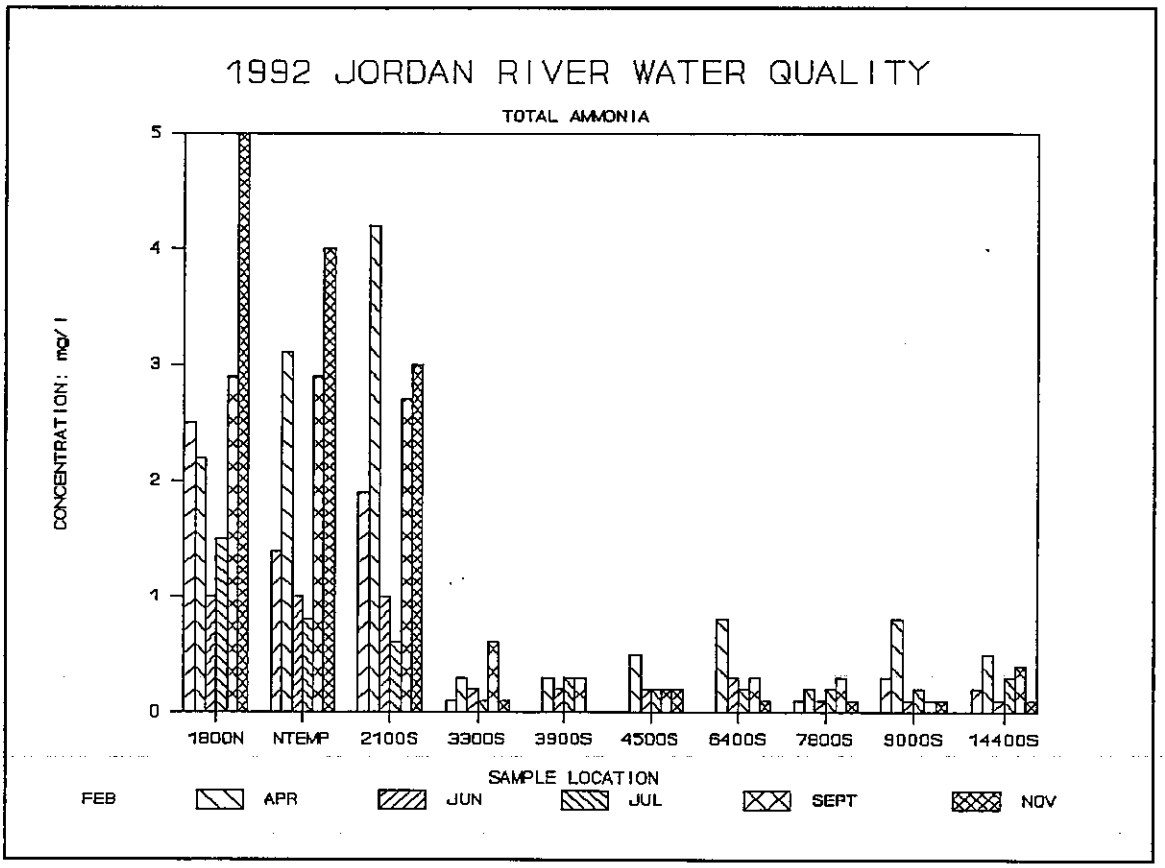

1992 JORDAN RIVER WATER QUALITY
TOTAL LEAD
CONCENTRATION: ug/l
0
10
20
30
40
50
1800N
NTEMP
2100S
3300S
3900S
4500S
6400S
7800S
9000S
14400S
SAMPLE LOCATION
FEB
APR
JUN
JUL
SEPT
NOV

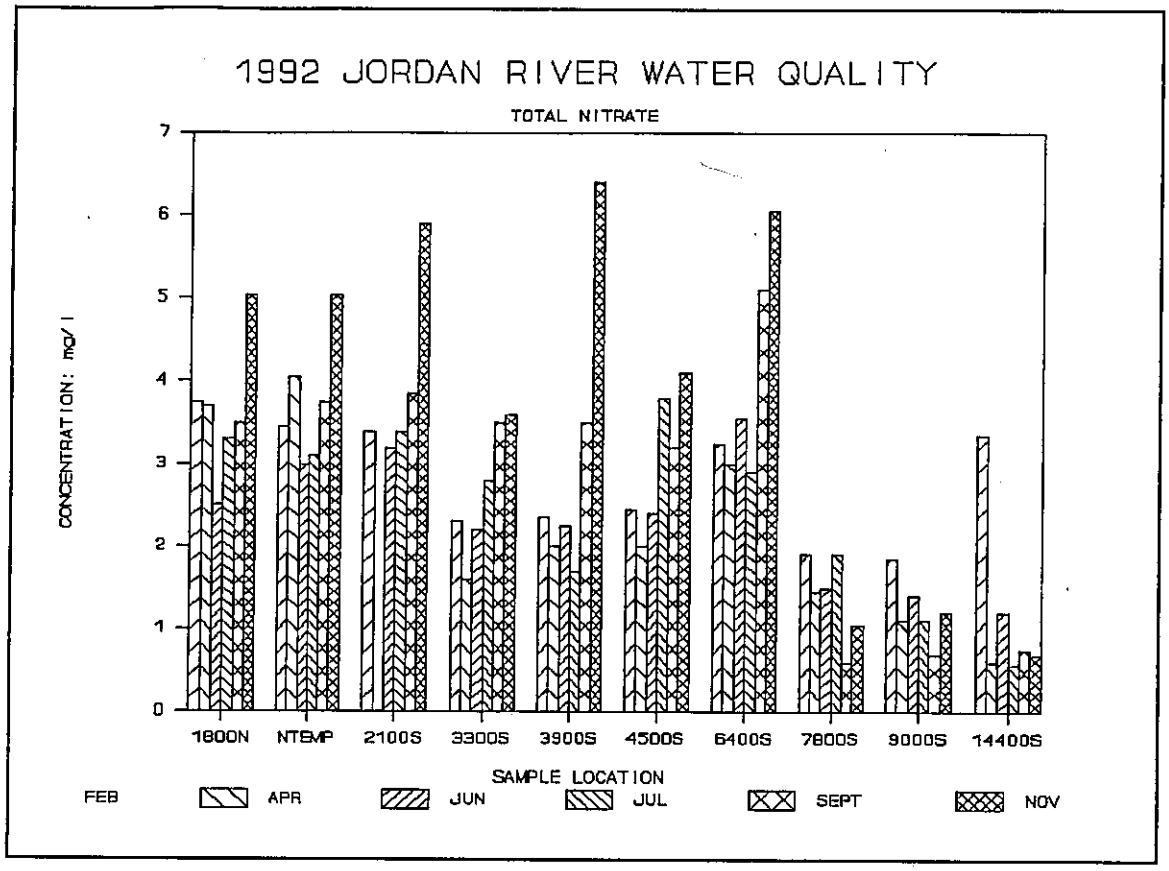

1992 JORDAN RIVER WATER QUALITY
TOTAL ZINC
CONCENTRATION: ug/l
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
1800N
NTEMP
2100S
3300S
3900S
4500S
6400S
7800S
9000S
14400S
SAMPLE LOCATION
FEB
APR
JUN
JUL
SEPT
NOV

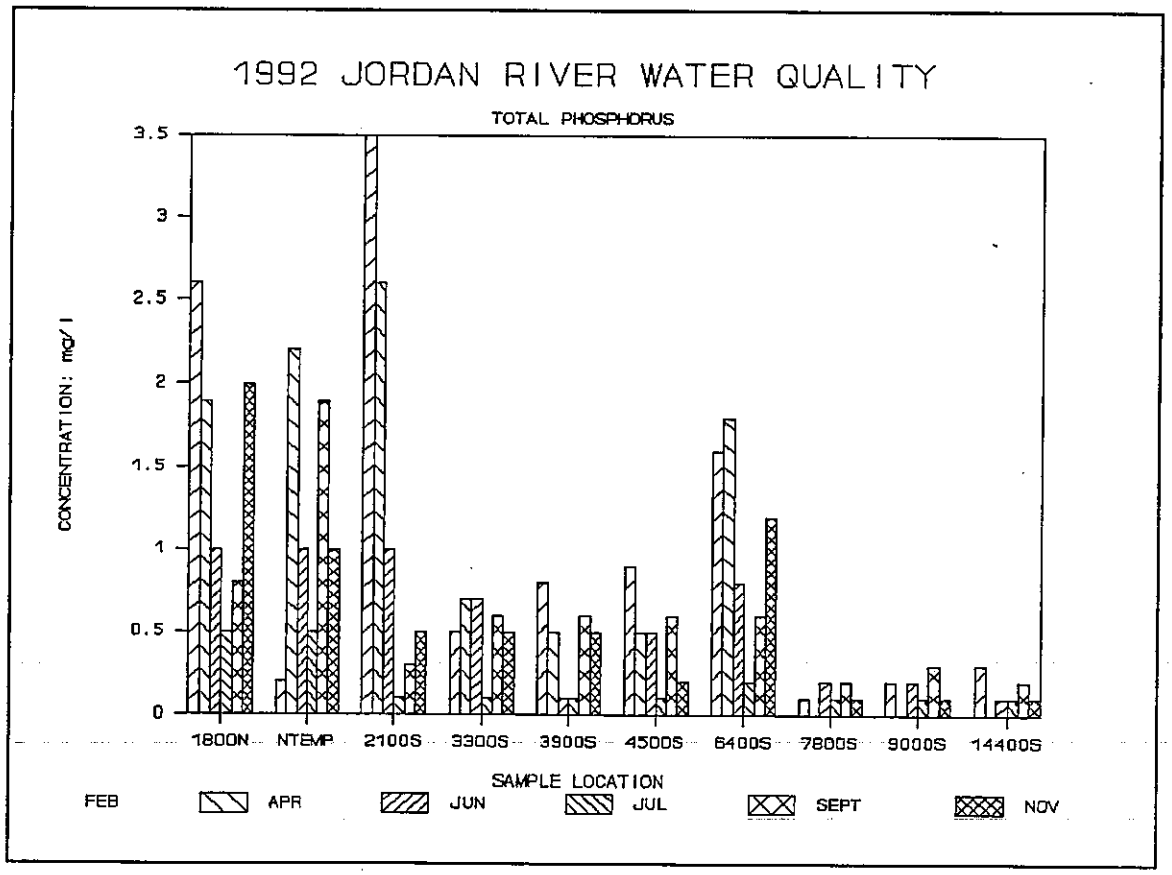

1992 JORDAN RIVER WATER QUALITY
TOTAL ARSENIC
CONCENTRATION: ug/l
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
1800N
NTEMP
2100S
3300S
3900S
4500S
6400S
7800S
9000S
14400S
SAMPLE LOCATION
FEB
APR
JUN
JUL
SEPT
NOV


1992 JORDAN RIVER WATER QUALITY
TOTAL SELENIUM
CONCENTRATION: ug/l
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
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

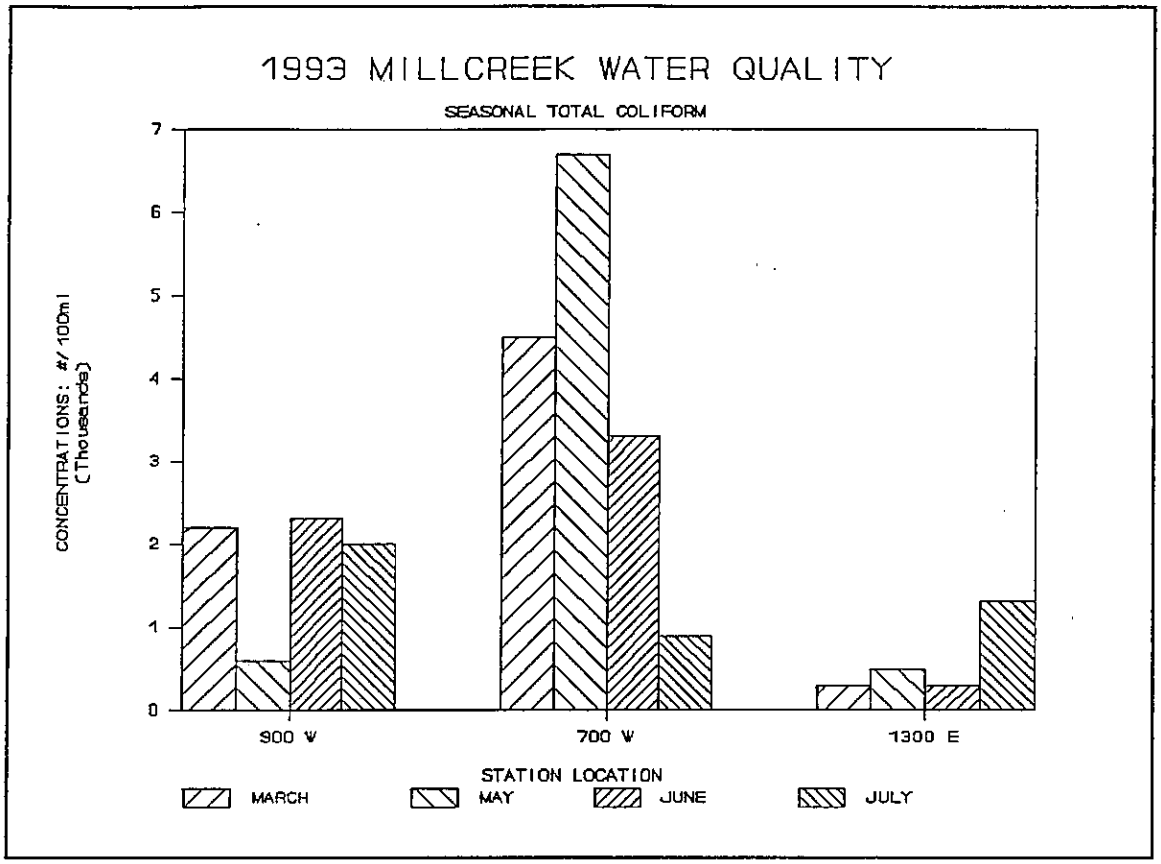

1992 JORDAN RIVER WATER QUALITY
TOTAL NITRATE
CONCENTRATION: mg/l
0
1
2
3
4
5
6
7
1800N
NTEMP
2100S
3300S
3900S
4500S
6400S
7800S
9000S
14400S
SAMPLE LOCATION
FEB
APR
JUN
JUL
SEPT
NOV

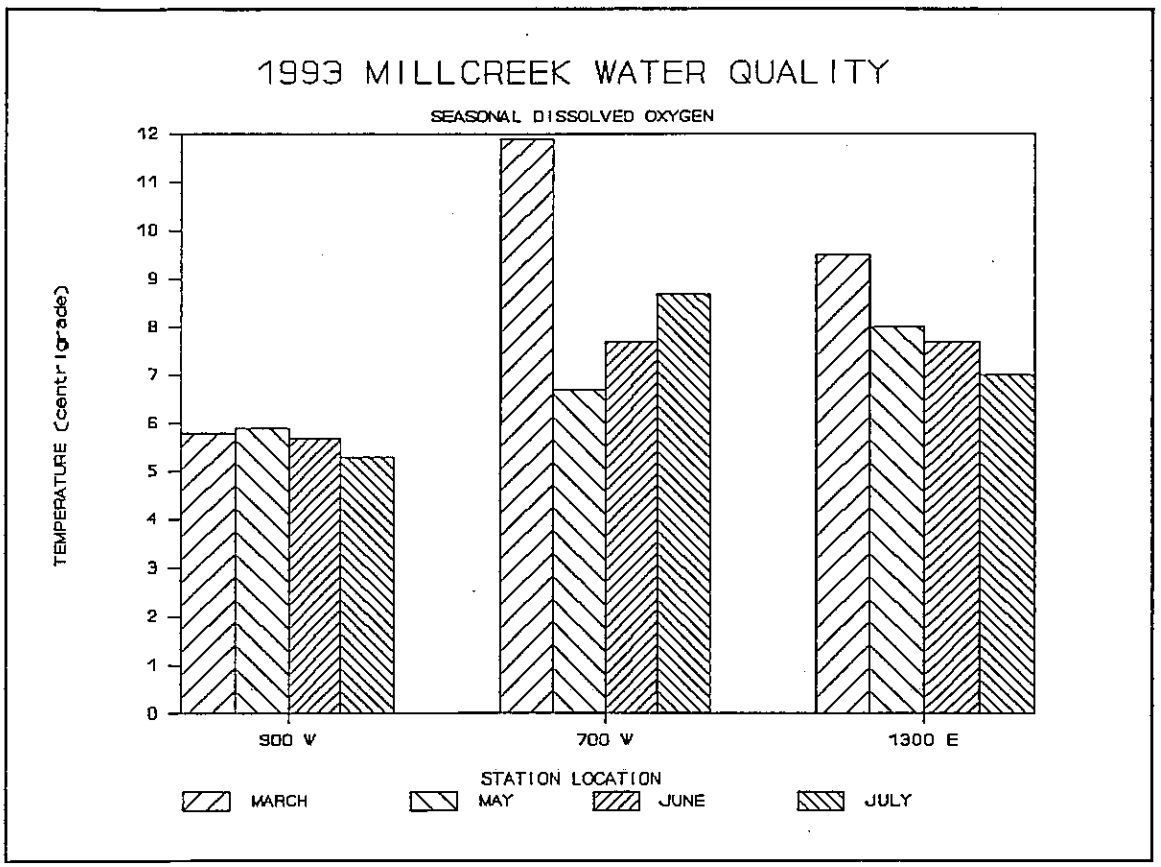

1992 JORDAN RIVER WATER QUALITY
TOTAL PHOSPHORUS
CONCENTRATION: mg/l
0
0.5
1
1.5
2
2.5
3
3.5
1800N
NTEMP
2100S
3300S
3900S
4500S
6400S
7800S
9000S
14400S
SAMPLE LOCATION
FEB
APR
JUN
JUL
SEPT
NOV

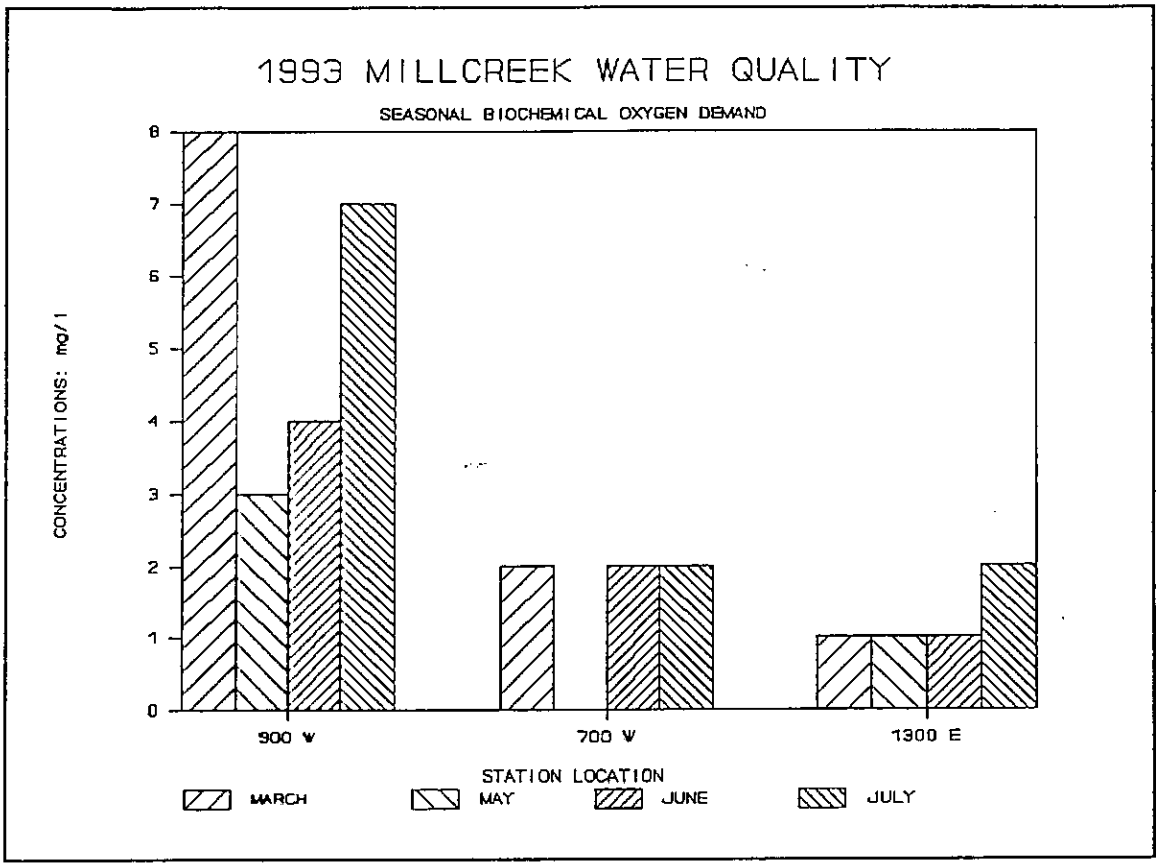
MILLCREEK VALLEY SEGMENT
WATER QUALITY PROBLEM PARAMETERS
AND POTENTIAL SOURCES

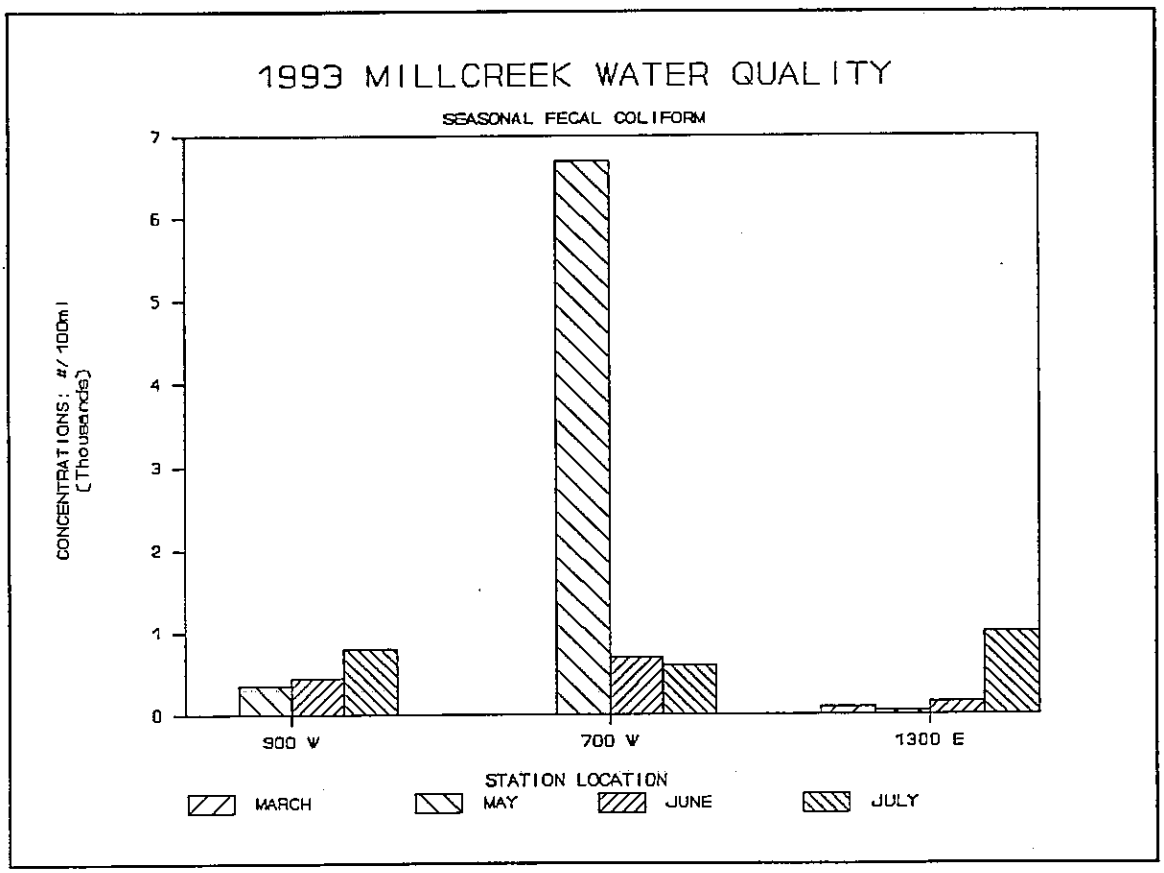
AFFECTED SEGMENT	PARAMETER	POTENTIAL SOURCES
Millcreek @ 700 W	Total Coliform	Illicit Discharges Waterfowl Bank Erosion Urban Runoff
Millcreek @ 700 W	Fecal Coliform	Illicity Discharges Domestic Solid Waste Waterfowl Urban Runoff
Millcreek @ 900 W	Dissolved Oxygen	Stream Gradient Hydrologic Modif. Urban Runoff Municipal Wastewater
Millcreek @ 900 W	Biochemical Oxygen Demand	Municipal Wastewater Urban Runoff Hydrologic Modif.
Millcreek 700--900 W	Suspended Sediment	Bank Erosion Construction Hydrologic Modif. Urban Runoff
Millcreek @ 900 W	Total Nitrate	Municipal Wastewater Irrigation Returns Groundwater Urban Runoff
Millcreek @ 900 W	Total Phosphorus**	Municipal Wastewater Irrigation Returns Groundwater Urban Runoff

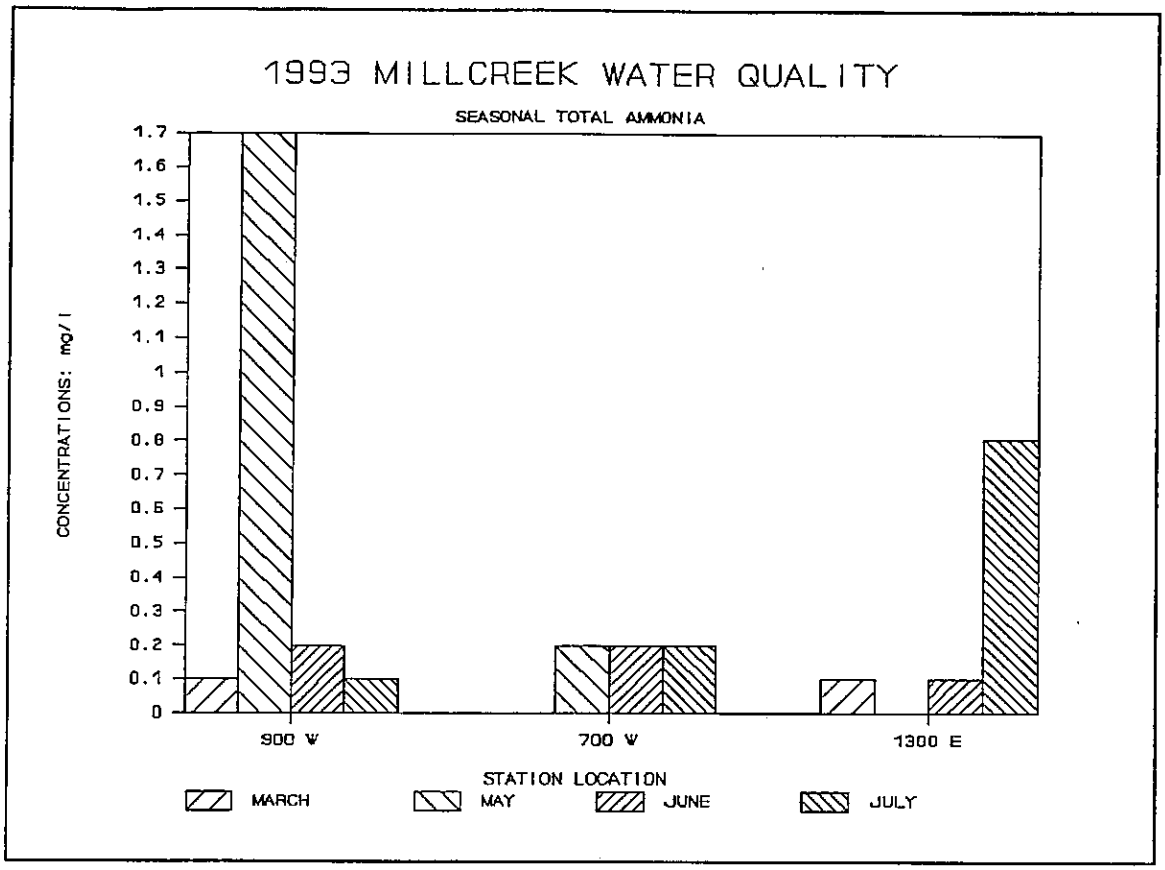
** Phosphate as P (Total Phosphorus) is an indicator parameter meaning that further investigations should be conducted to develop more information where these levels are exceeded.

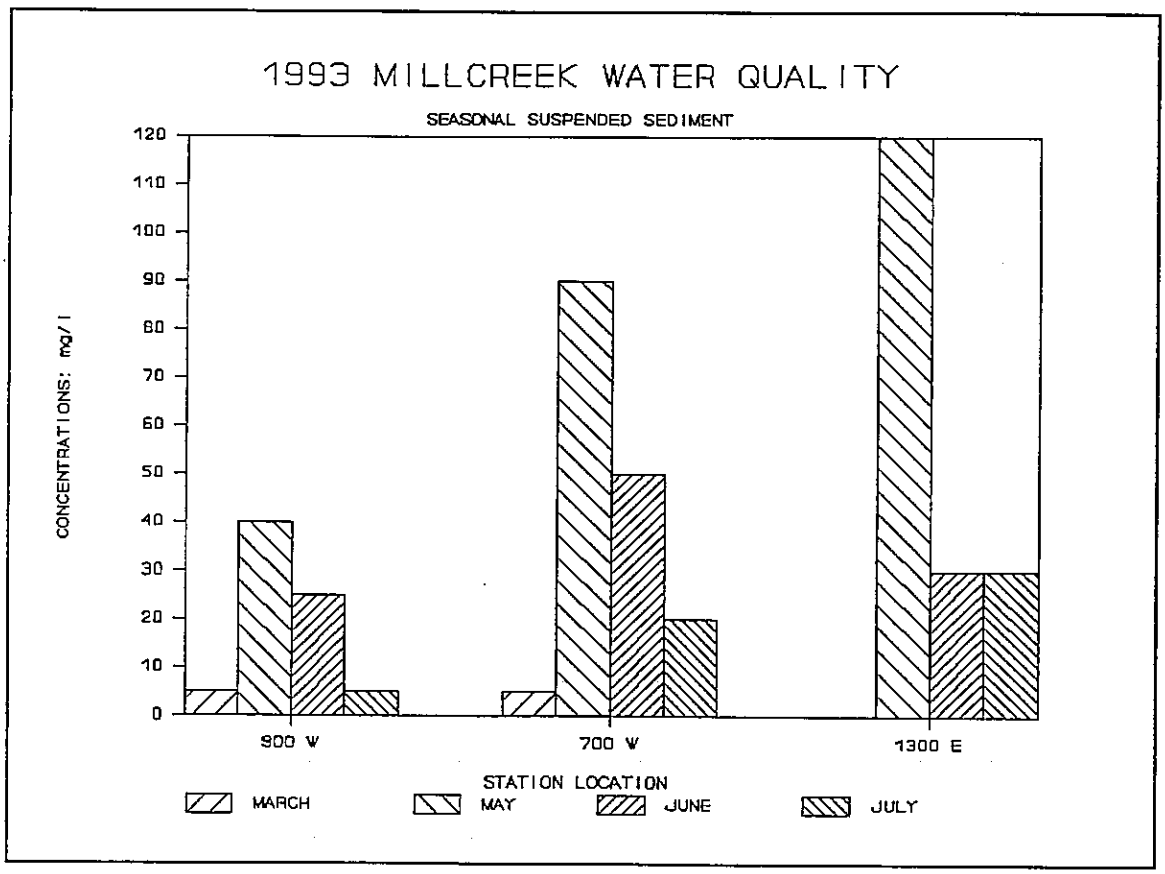

1993 MILLCREEK WATER QUALITY
SEASONAL TOTAL COLIFORM
CONCENTRATIONS: #/100ml (Thousands)
0
1
2
3
4
5
6
7
900 W
700 W
1300 E
STATION LOCATION
MARCH
MAY
JUNE
JULY

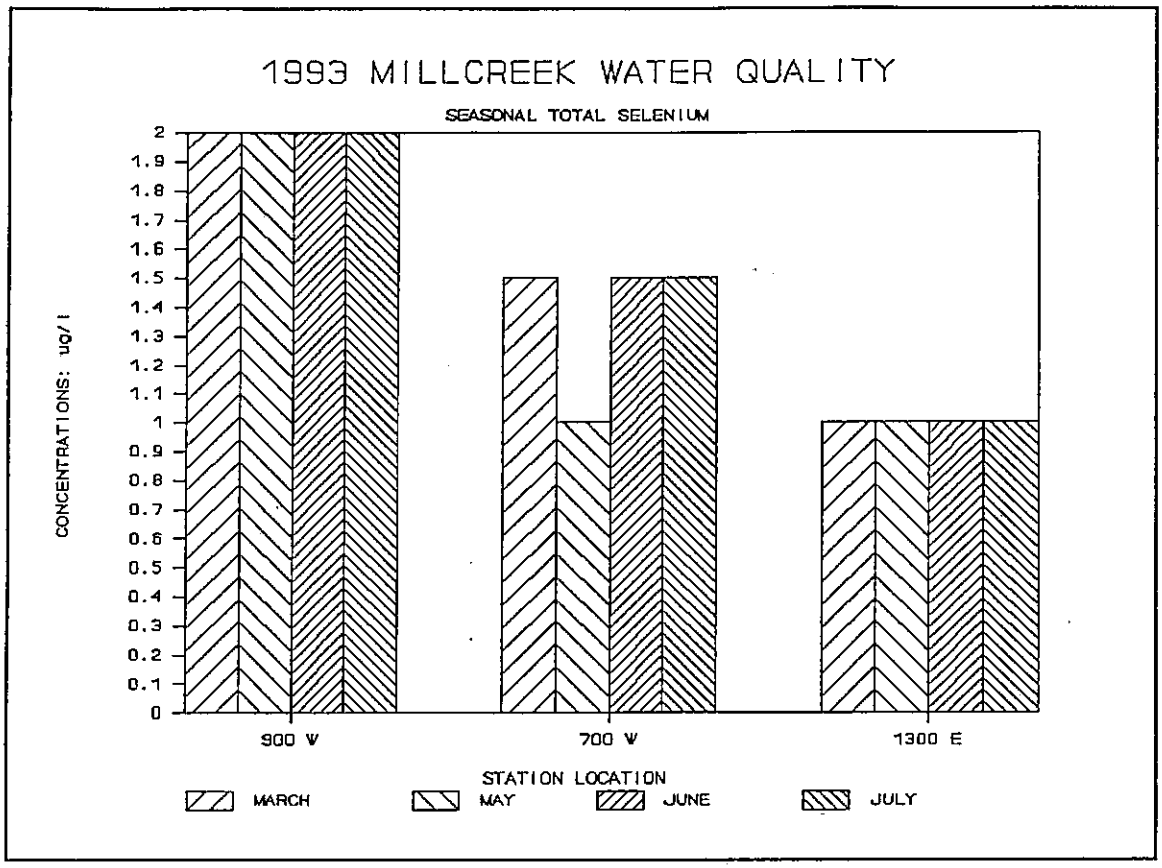

1993 MILLCREEK WATER QUALITY
SEASONAL DISSOLVED OXYGEN
TEMPERATURE (centrigrade)
0
1
2
3
4
5
6
7
8
9
10
11
12
900 W
700 W
1300 E
STATION LOCATION
MARCH
MAY
JUNE
JULY

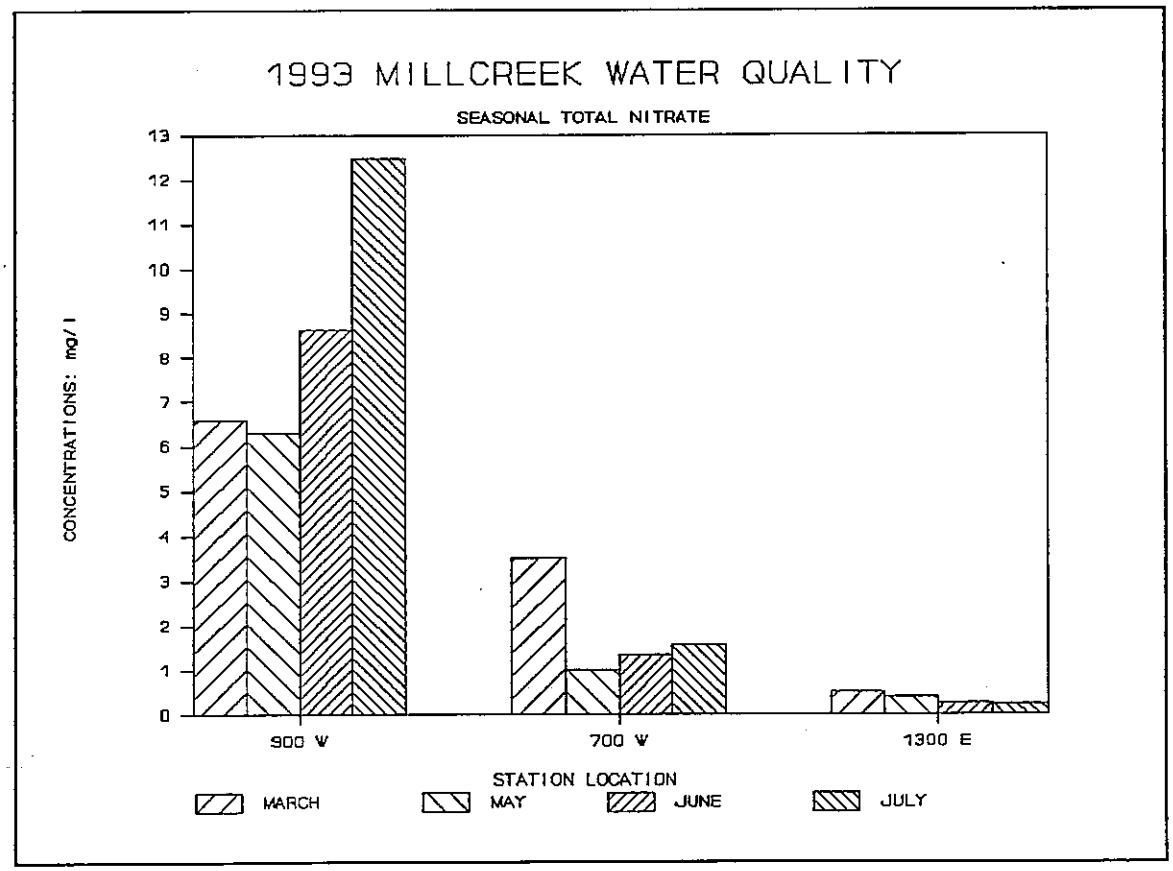

1993 MILLCREEK WATER QUALITY
SEASONAL BIOCHEMICAL OXYGEN DEMAND
CONCENTRATIONS: mg/l
0
1
2
3
4
5
6
7
8
900 W
700 W
1300 E
STATION LOCATION
MARCH
MAY
JUNE
JULY

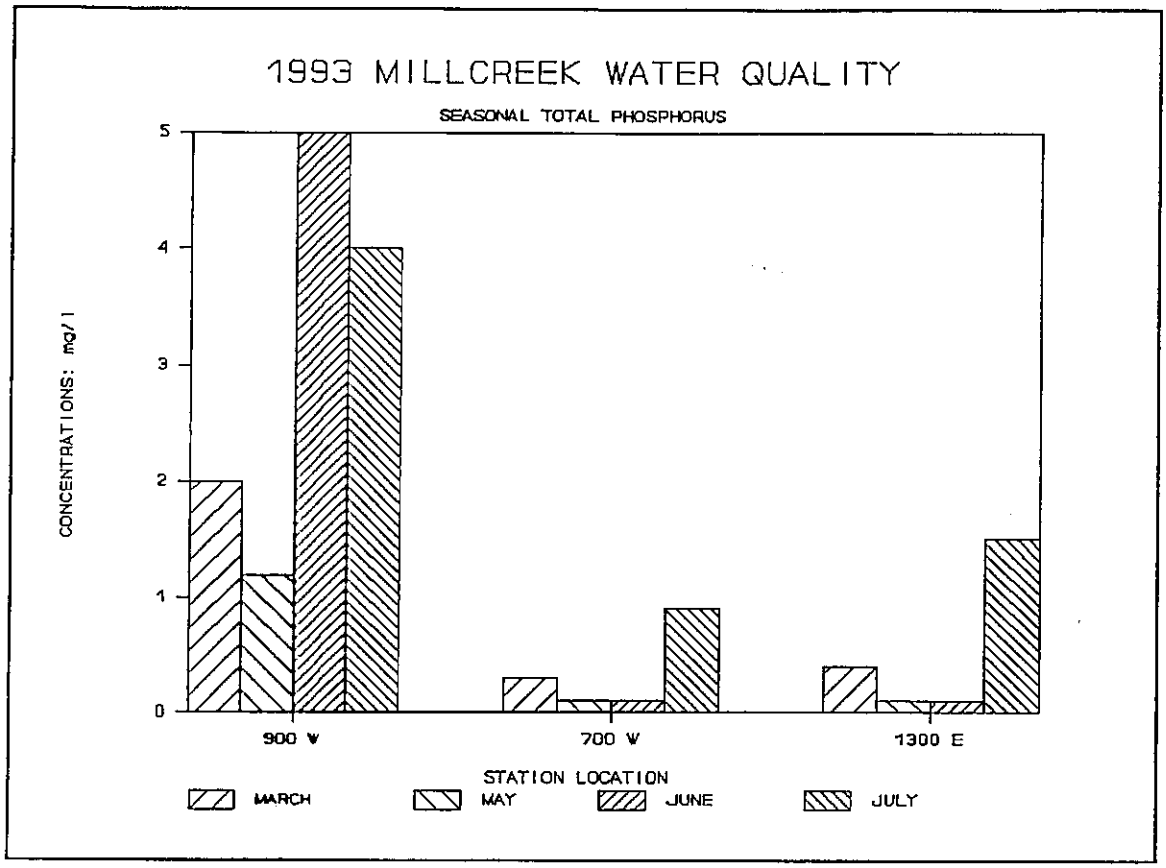

1993 MILLCREEK WATER QUALITY
SEASONAL FECAL COLIFORM
CONCENTRATIONS: #/100ml
(Thousands)
0
1
2
3
4
5
6
7
900 W
700 W
1300 E
STATION LOCATION
MARCH
MAY
JUNE
JULY

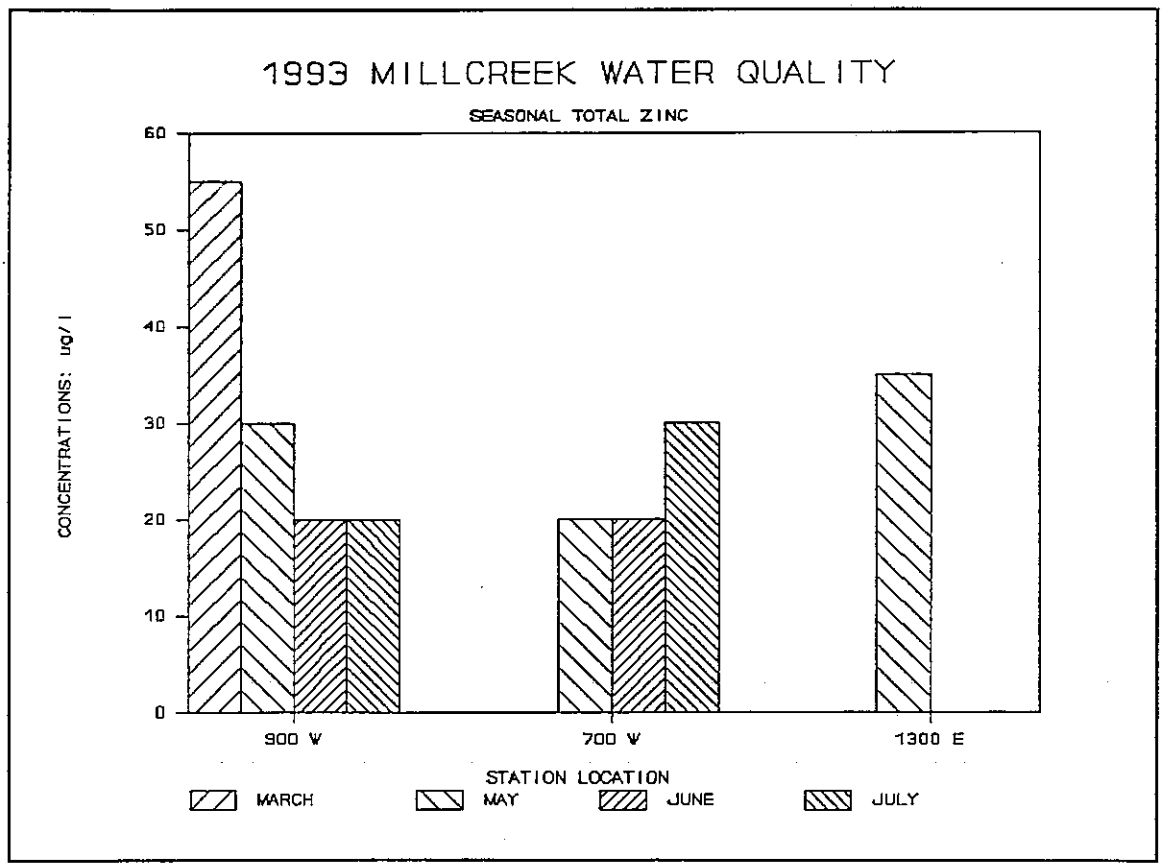

1993 MILLCREEK WATER QUALITY
SEASONAL TOTAL AMMONIA
CONCENTRATIONS: mg/l
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
900 W
700 W
1300 E
STATION LOCATION
MARCH
MAY
JUNE
JULY

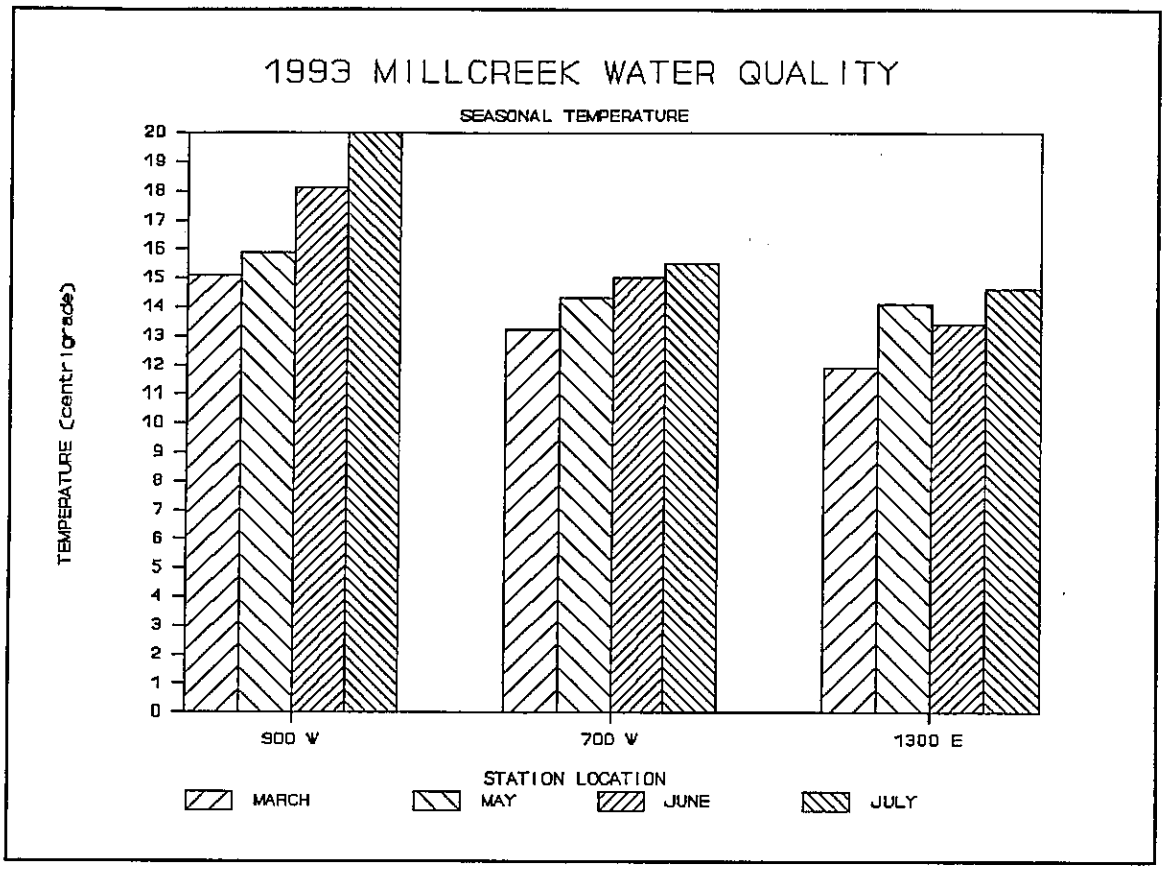

1993 MILLCREEK WATER QUALITY
SEASONAL SUSPENDED SEDIMENT
CONCENTRATIONS: mg/l
120
110
100
90
80
70
60
50
40
30
20
10
0
900 W
700 W
1300 E
STATION LOCATION
MARCH
MAY
JUNE
JULY


1993 MILLCREEK WATER QUALITY
SEASONAL TOTAL SELENIUM
CONCENTRATIONS: ug/l
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
900 W
700 W
1300 E
STATION LOCATION
MARCH
MAY
JUNE
JULY


1993 MILLCREEK WATER QUALITY
SEASONAL TOTAL NITRATE
CONCENTRATIONS: mg/l
13
12
11
10
9
8
7
6
5
4
3
2
1
0
900 W
700 W
1300 E
STATION LOCATION
MARCH
MAY
JUNE
JULY


1993 MILLCREEK WATER QUALITY
SEASONAL TOTAL PHOSPHORUS
CONCENTRATIONS: mg/l
0
1
2
3
4
5
900 W
700 W
1300 E
STATION LOCATION
MARCH
MAY
JUNE
JULY

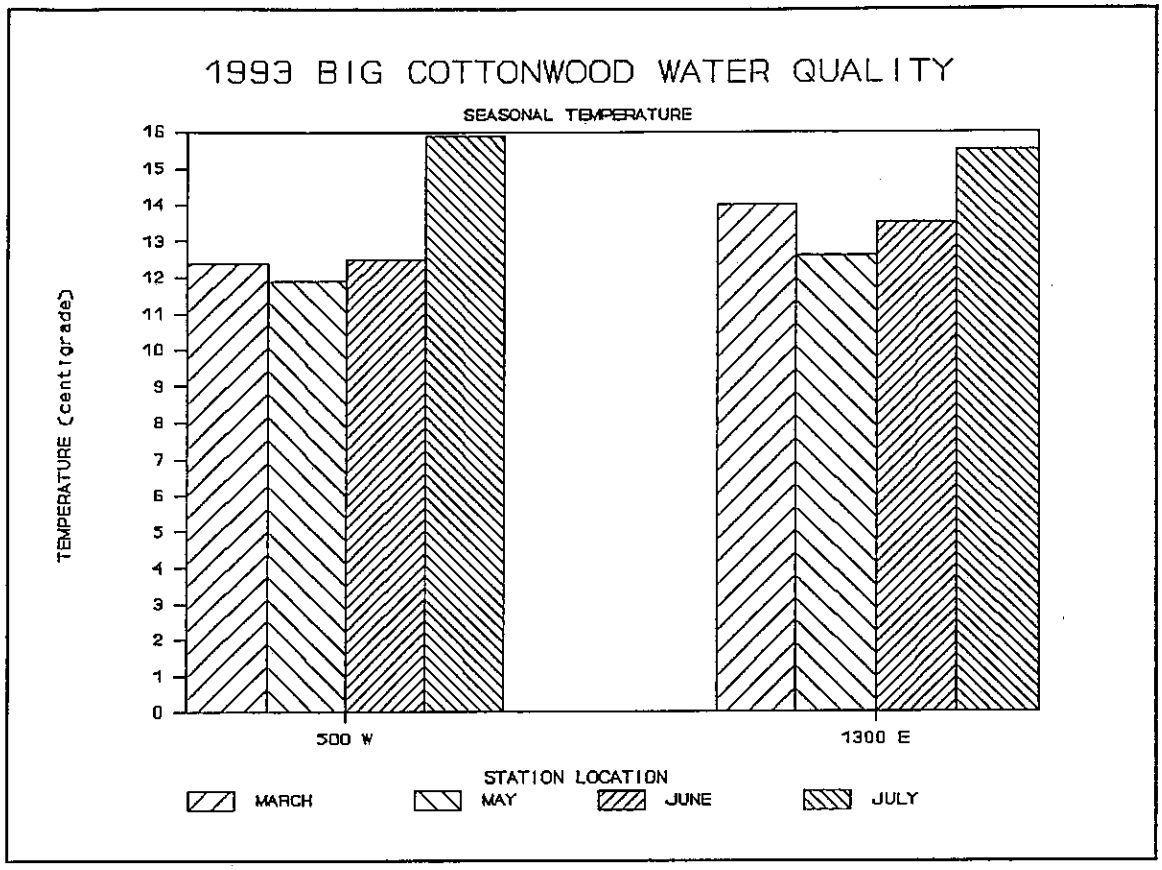

1993 MILLCREEK WATER QUALITY
SEASONAL TOTAL ZINC
CONCENTRATIONS: ug/l
0
10
20
30
40
50
60
900 W
700 W
1300 E
STATION LOCATION
MARCH
MAY
JUNE
JULY

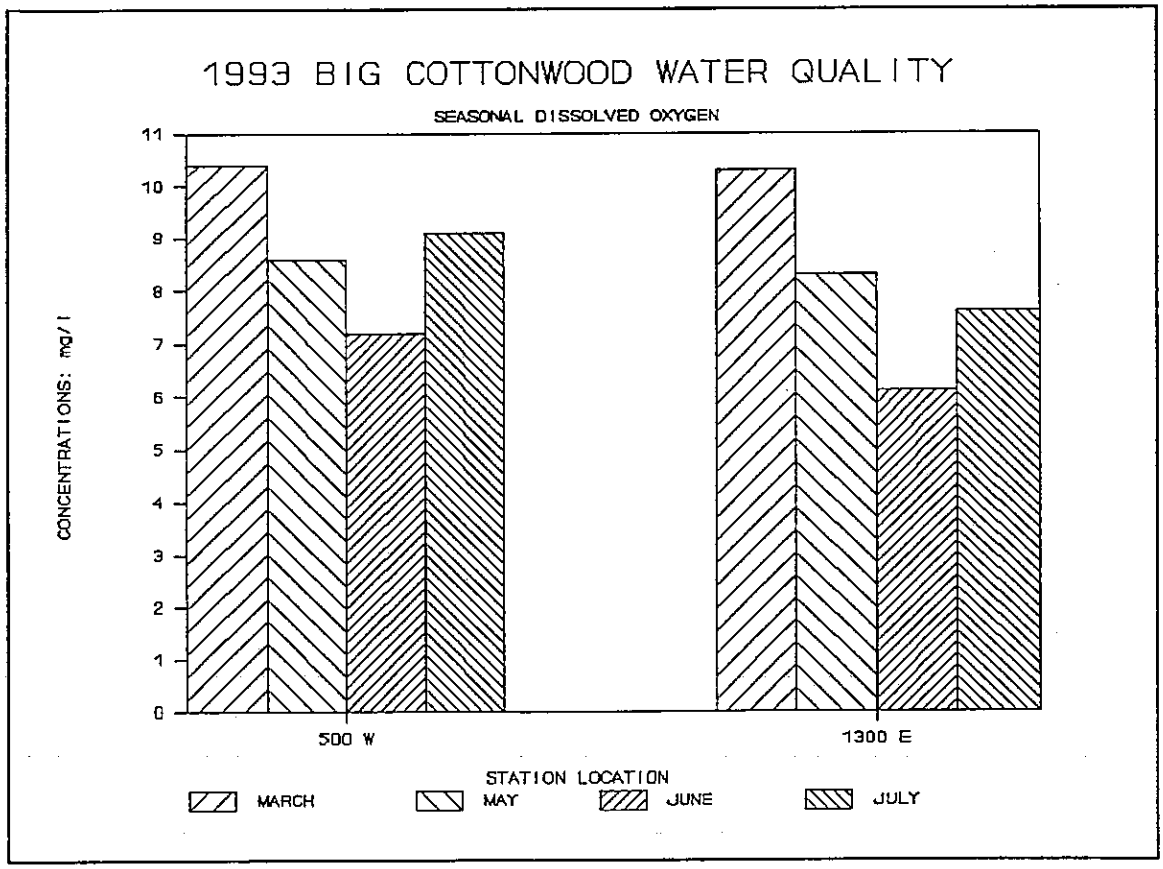

1993 MILLCREEK WATER QUALITY
SEASONAL TEMPERATURE
TEMPERATURE (centrigrade)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
900 W
700 W
1300 E
STATION LOCATION
MARCH
MAY
JUNE
JULY

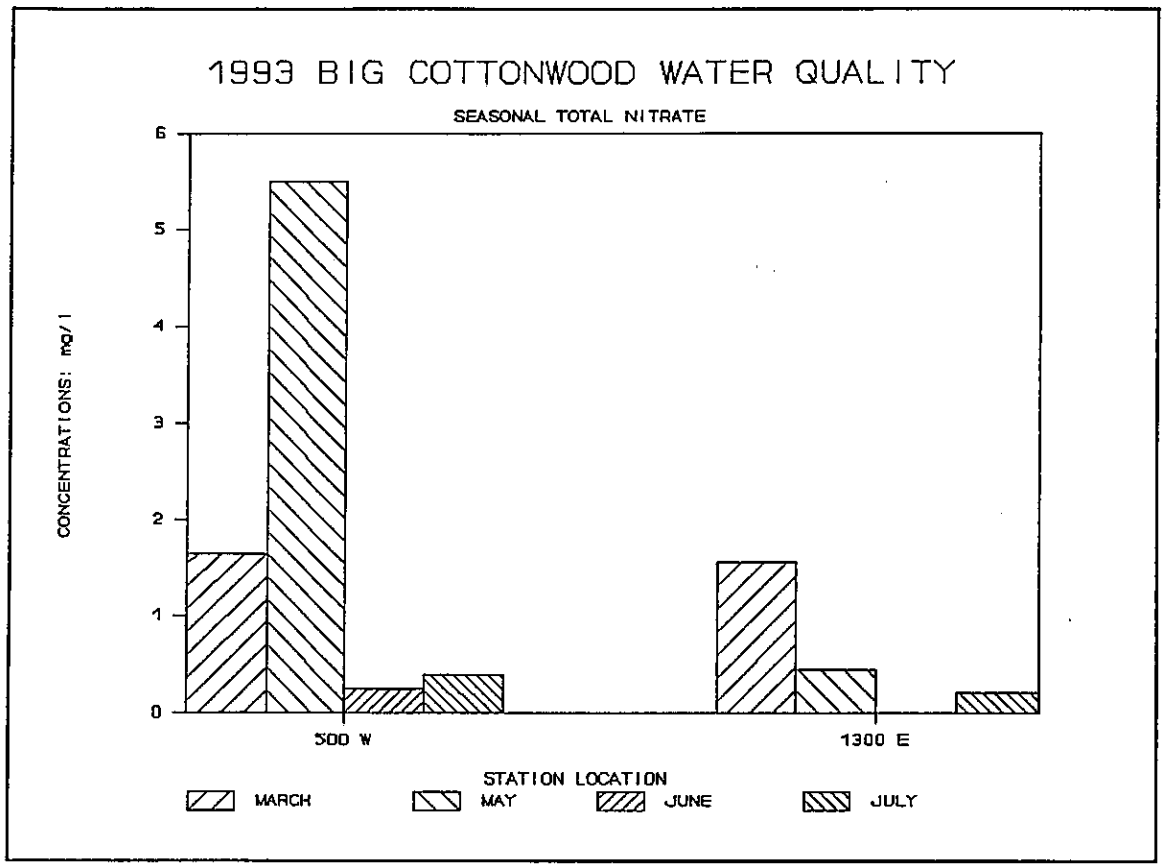
BIG & LITTLE COTTONWOOD VALLEY SEGMENT
WATER QUALITY PROBLEM PARAMETERS
AND POTENTIAL SOURCES

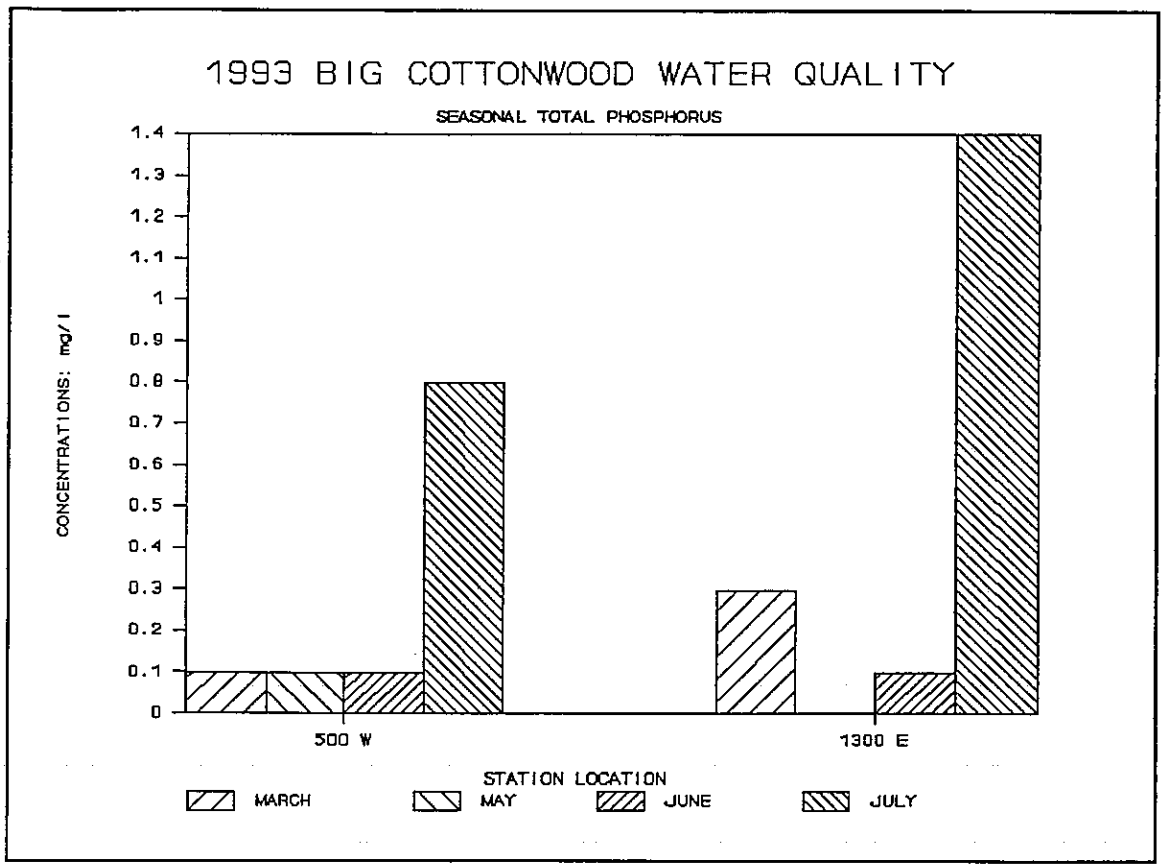
AFFECTED SEGMENT	PARAMETER	POTENTIAL SOURCES
Little Cottonwood @ 360 W	Fecal Coliform	Illicit Discharge Waterfowl Urban Runoff
Little Cottonwood @ 360 W--1300 E	Total Phosphorus**	Irrigation Returns Urban Runoff Groundwater
Little Cottonwood @ 360 W--1300 E	Total Lead	Mining Hydrologic Modif. Urban Runoff
Little Cottonwood @ 360 W--1300 E	Total Zinc	Mining Urban Runoff HydrologicModif.
Big Cottonwood @ 500 W--1300 E	Fecal Coliform	Illicit Discharge Waterfowl Urban Runoff
Big Cottonwood @ 500 W--1300 E	Total Phosphorus**	Irrigation Returns Urban Runoff Groundwater
Big Cottonwood @ 500 W--1300 E	Total Lead	Mining Hydrologic Modif. Urban Runoff
Big Cottonwood @ 500 W--1300 E	Total Nitrate	Irrigation Returns Urban Runoff Groundwater

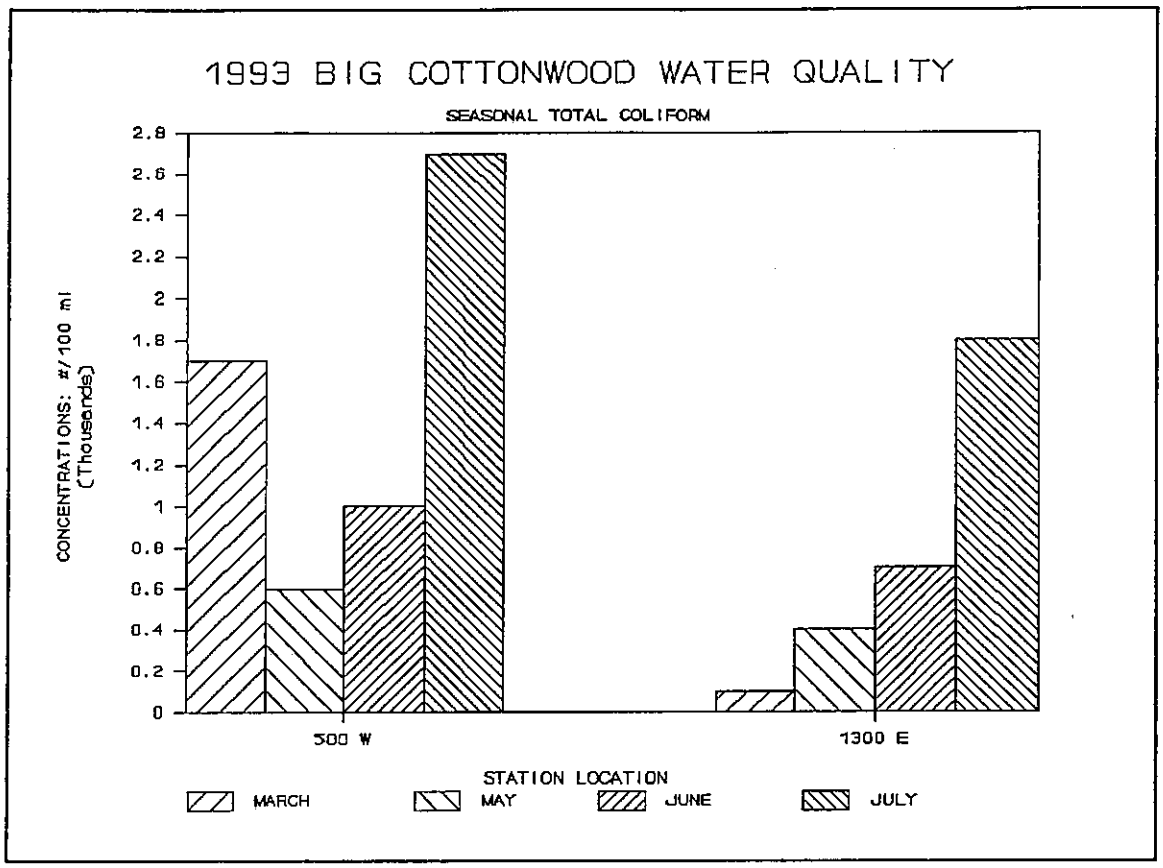
** Phosphate as P (Total Phosphorus) is an indicator parameter meaning that further investigations should be conducted to develop more information where these levels are exceeded.

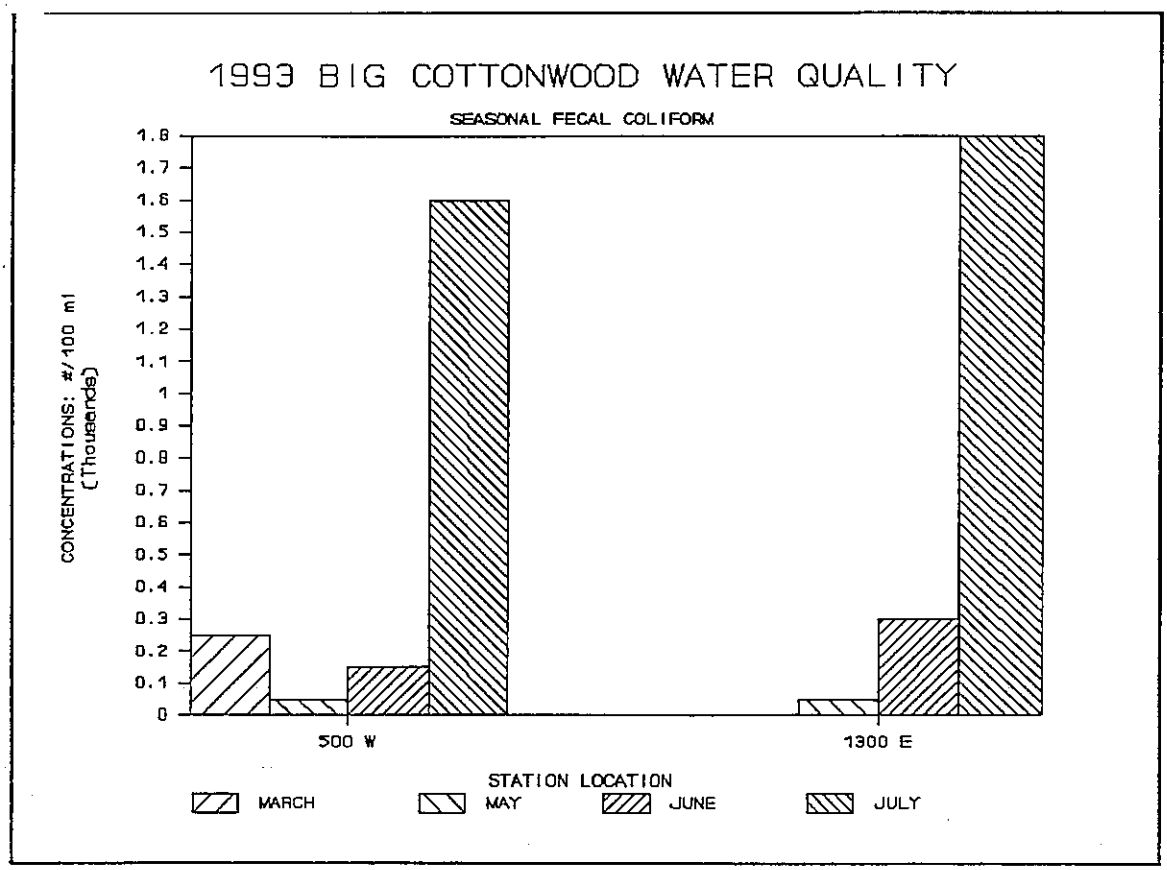

1993 BIG COTTONWOOD WATER QUALITY
SEASONAL TEMPERATURE
TEMPERATURE (centigrade)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
500 W
1300 E
STATION LOCATION
MARCH
MAY
JUNE
JULY

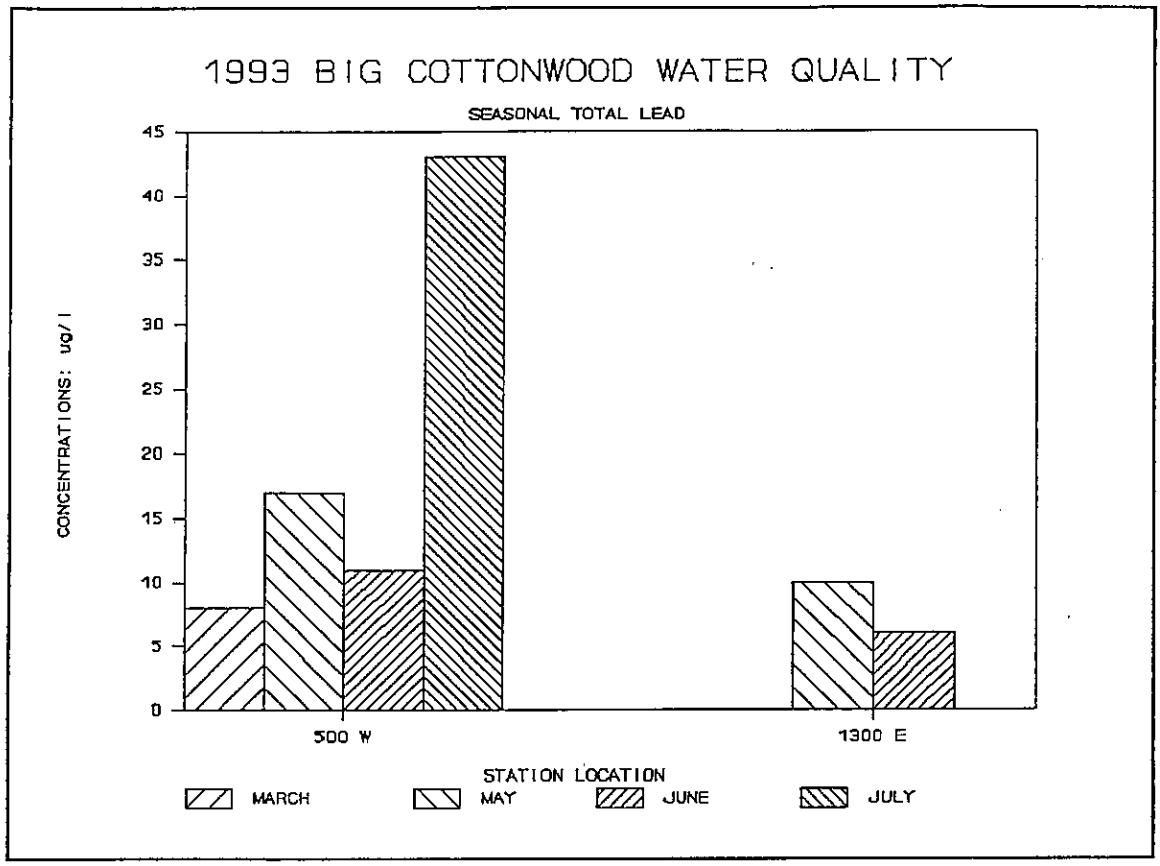

1993 BIG COTTONWOOD WATER QUALITY
SEASONAL DISSOLVED OXYGEN
CONCENTRATIONS: mg/l
0
1
2
3
4
5
6
7
8
9
10
11
500 W
1300 E
STATION LOCATION
MARCH
MAY
JUNE
JULY

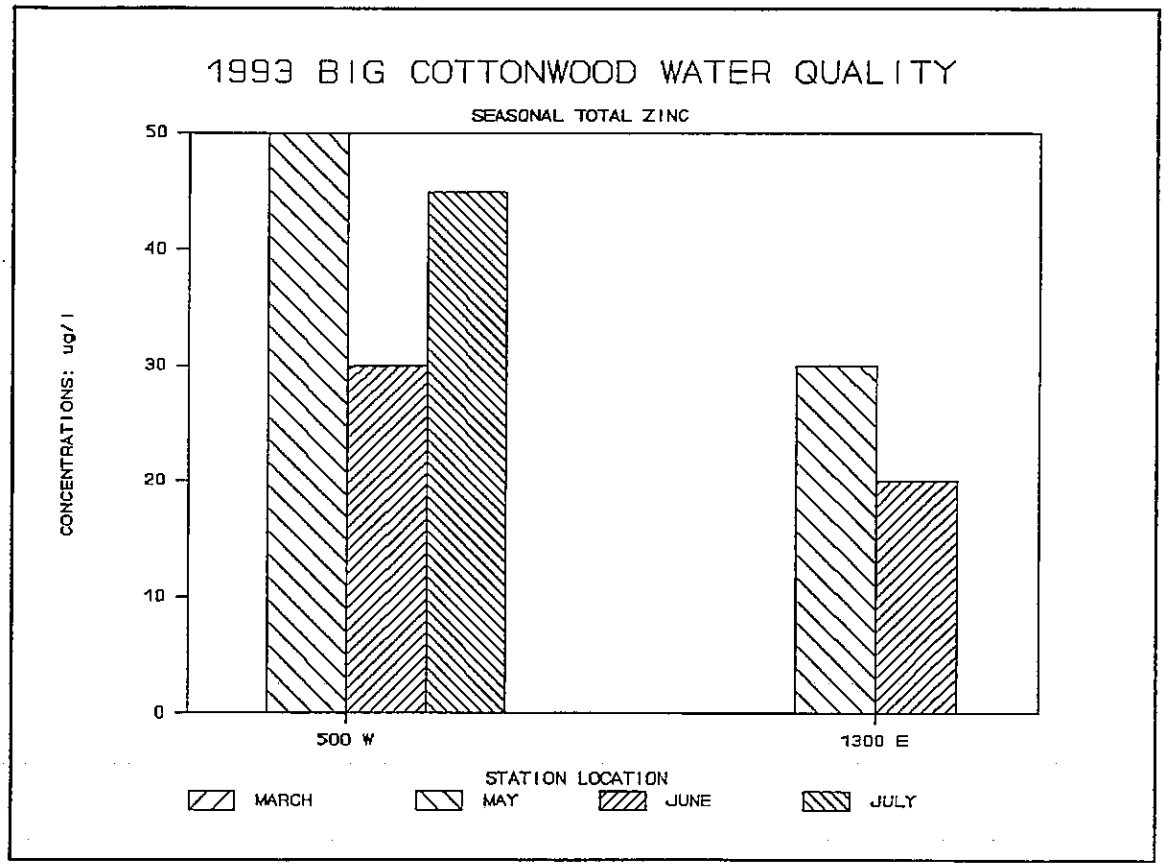

1993 BIG COTTONWOOD WATER QUALITY
SEASONAL TOTAL NITRATE
CONCENTRATIONS: mg/l
0
1
2
3
4
5
6
500 W
1300 E
STATION LOCATION
MARCH
MAY
JUNE
JULY

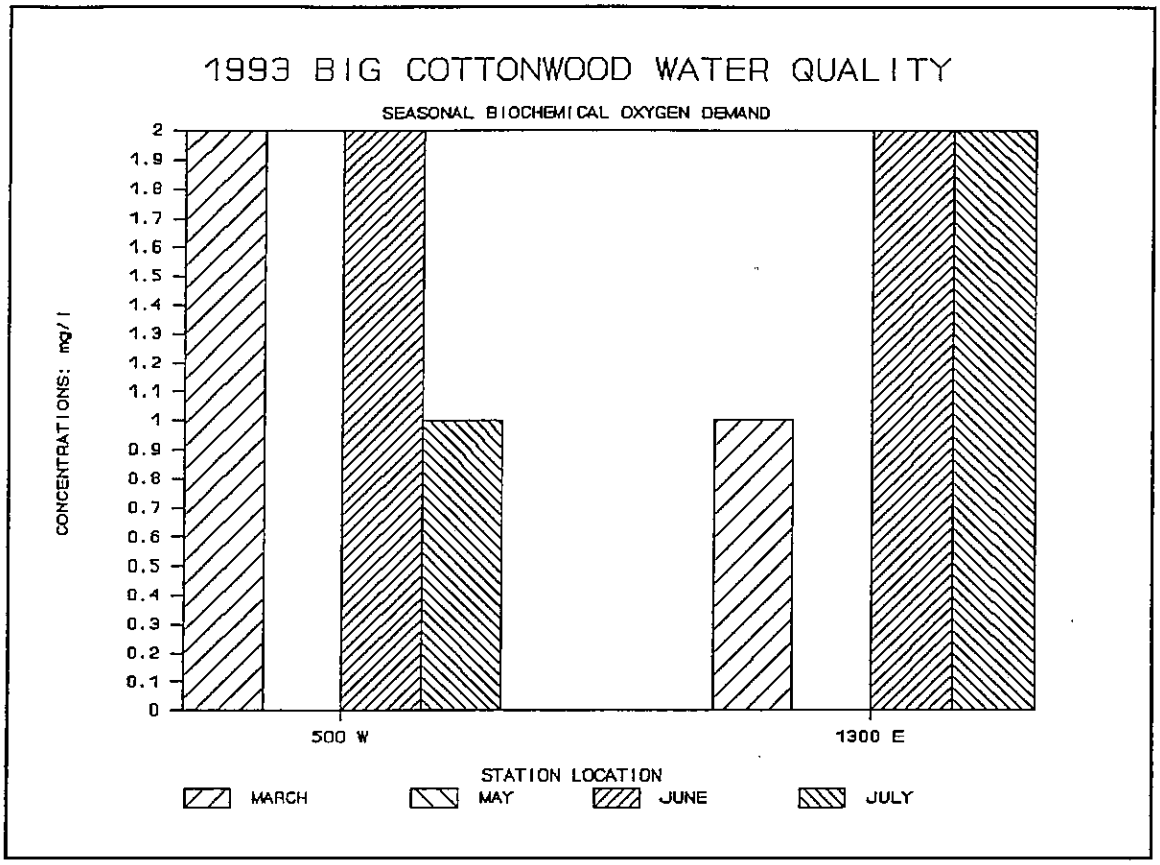

1993 BIG COTTONWOOD WATER QUALITY
SEASONAL TOTAL PHOSPHORUS
CONCENTRATIONS: mg/l
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
500 W
1300 E
STATION LOCATION
MARCH
MAY
JUNE
JULY

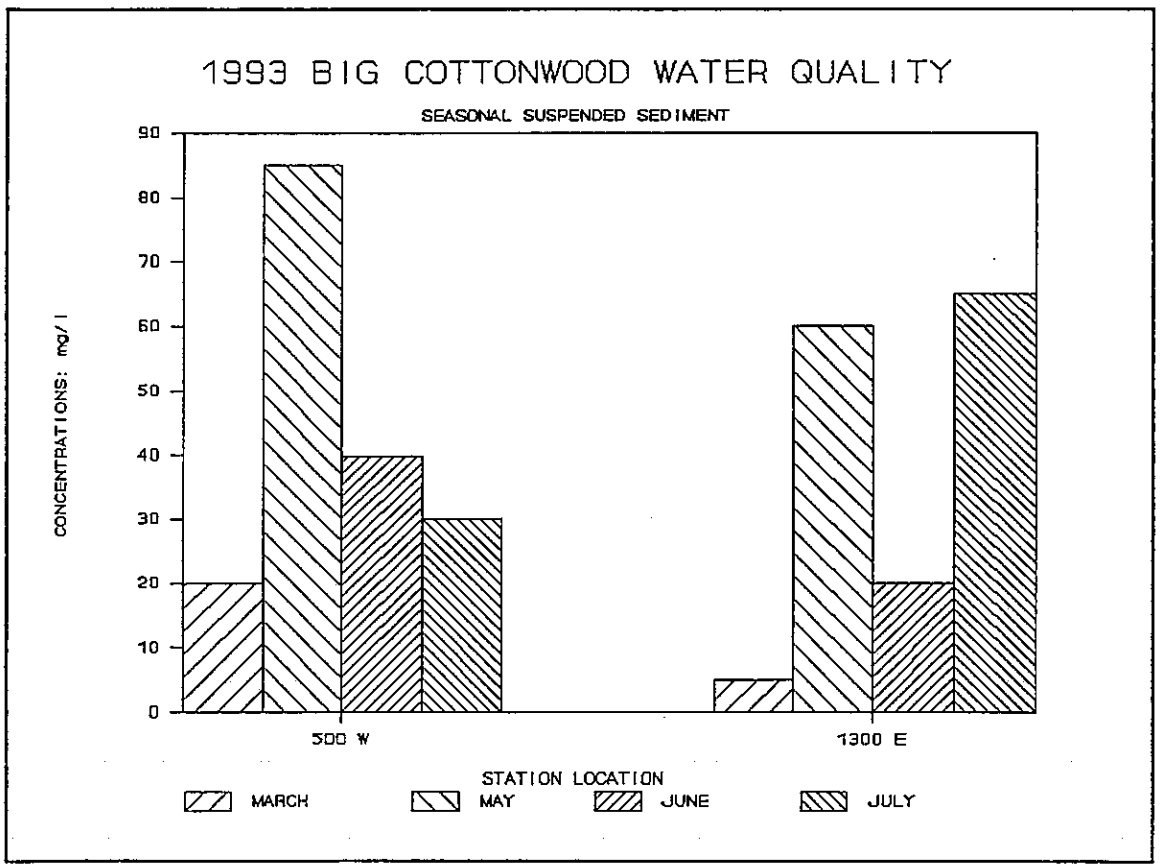

1993 BIG COTTONWOOD WATER QUALITY
SEASONAL TOTAL COLIFORM
CONCENTRATIONS: #/100 ml (Thousands)
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
500 W
1300 E
STATION LOCATION
MARCH
MAY
JUNE
JULY

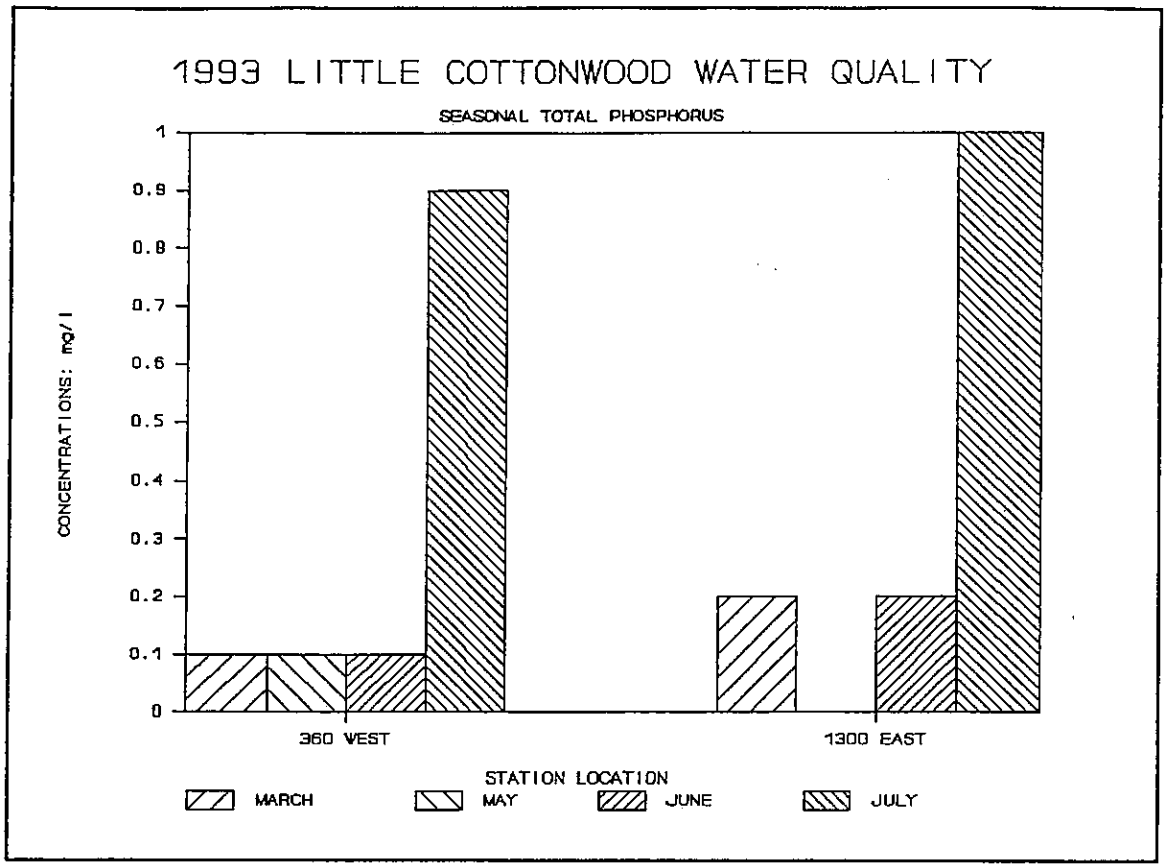

1993 BIG COTTONWOOD WATER QUALITY
SEASONAL FECAL COLIFORM
CONCENTRATIONS: #/100 ml (Thousands)
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
500 W
1300 E
STATION LOCATION
MARCH
MAY
JUNE
JULY

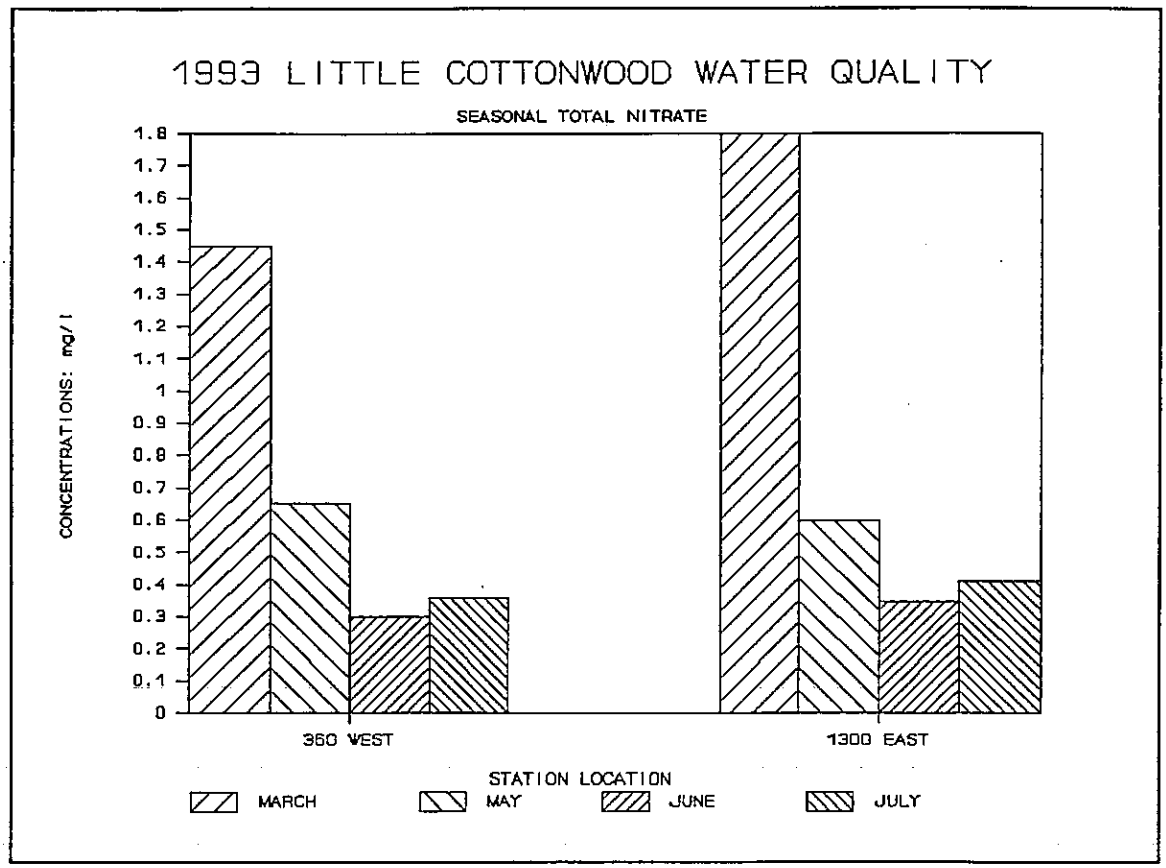

1993 BIG COTTONWOOD WATER QUALITY
SEASONAL TOTAL LEAD
CONCENTRATIONS: ug/l
45
40
35
30
25
20
15
10
5
0
500 W
1300 E
STATION LOCATION
MARCH
MAY
JUNE
JULY

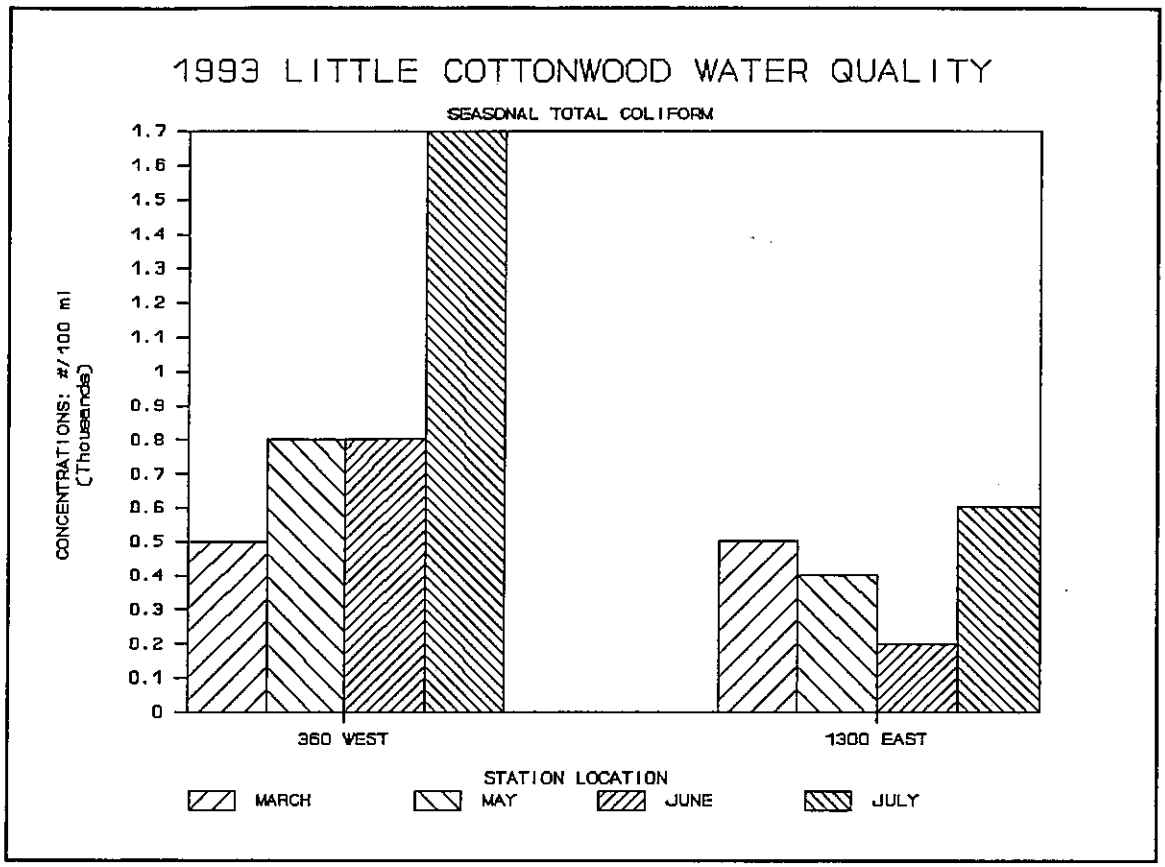

1993 BIG COTTONWOOD WATER QUALITY
SEASONAL TOTAL ZINC
CONCENTRATIONS: ug/l
50
40
30
20
10
0
500 W
1300 E
STATION LOCATION
MARCH
MAY
JUNE
JULY

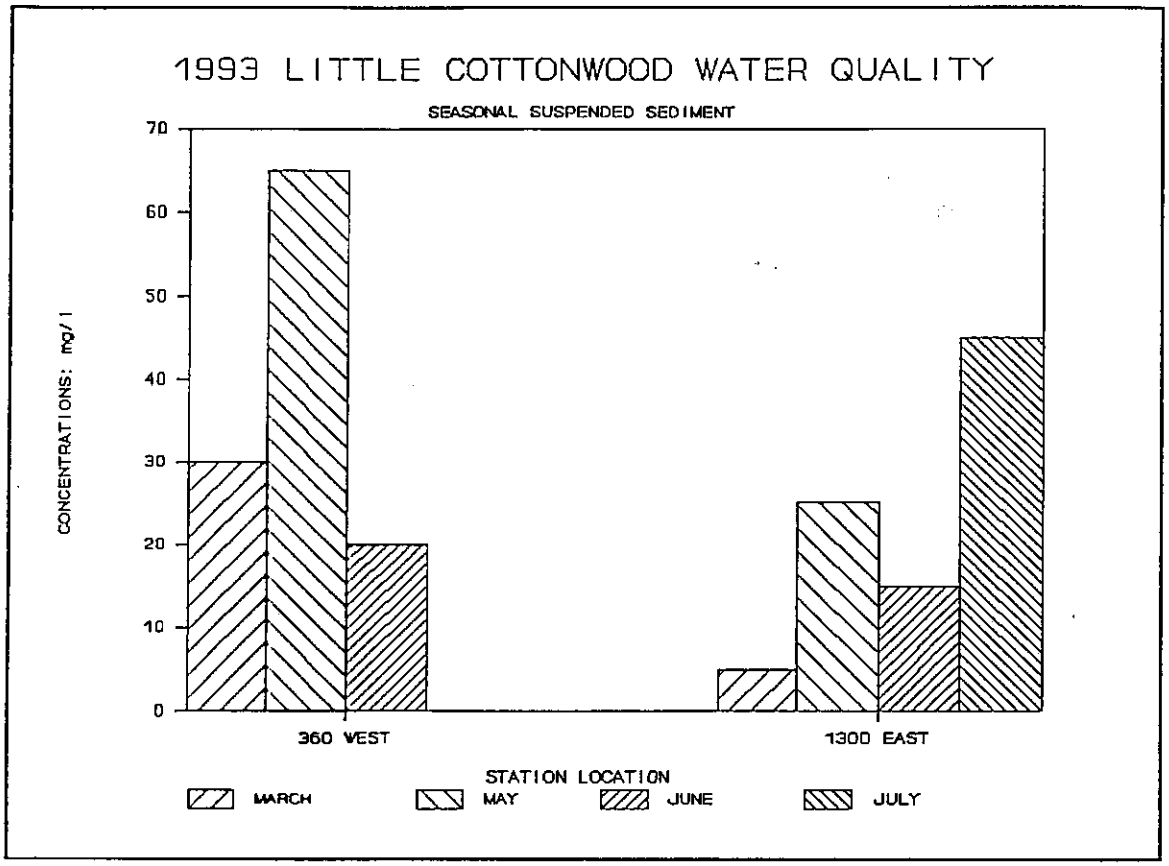

1993 BIG COTTONWOOD WATER QUALITY
SEASONAL BIOCHEMICAL OXYGEN DEMAND
CONCENTRATIONS: mg/l
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
500 W
1300 E
STATION LOCATION
MARCH
MAY
JUNE
JULY

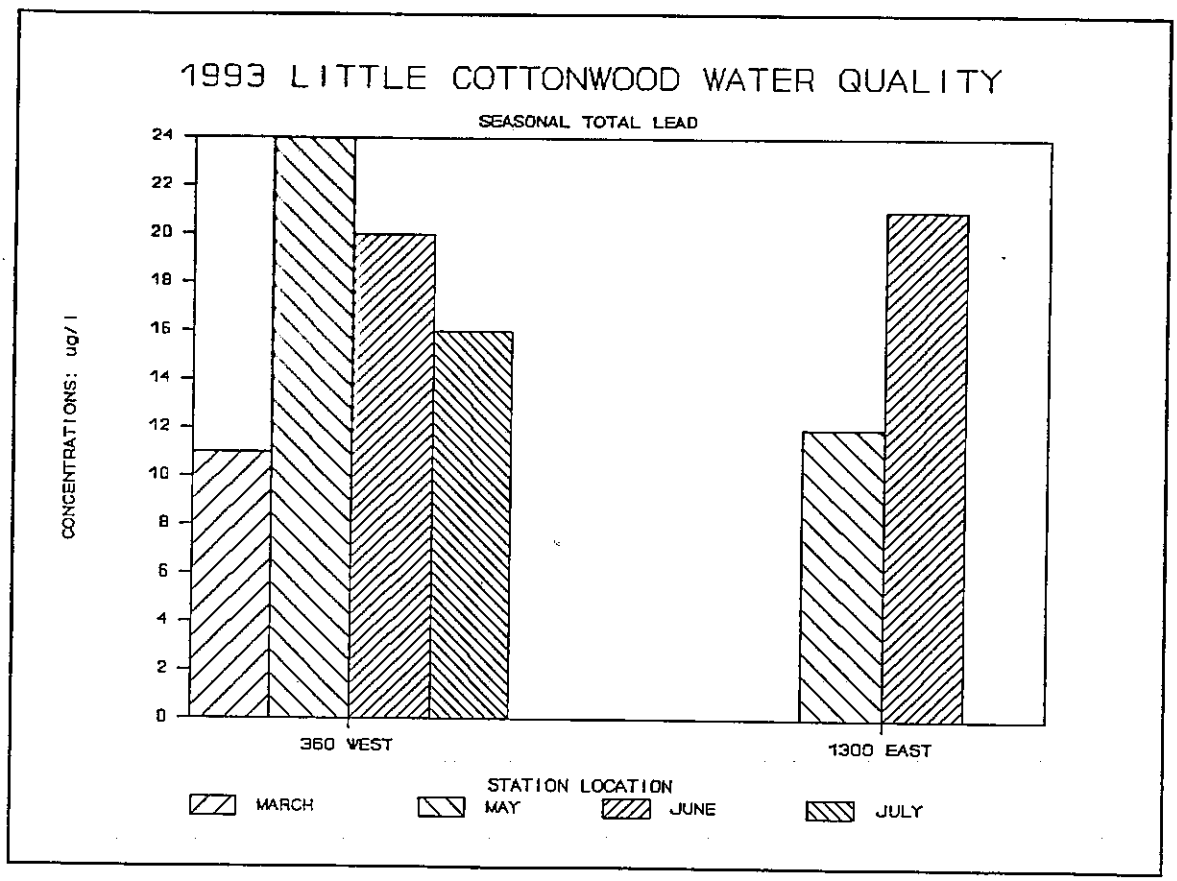

1993 BIG COTTONWOOD WATER QUALITY
SEASONAL SUSPENDED SEDIMENT
CONCENTRATIONS: mg/l
90
80
70
60
50
40
30
20
10
0
500 W
1300 E
STATION LOCATION
MARCH
MAY
JUNE
JULY

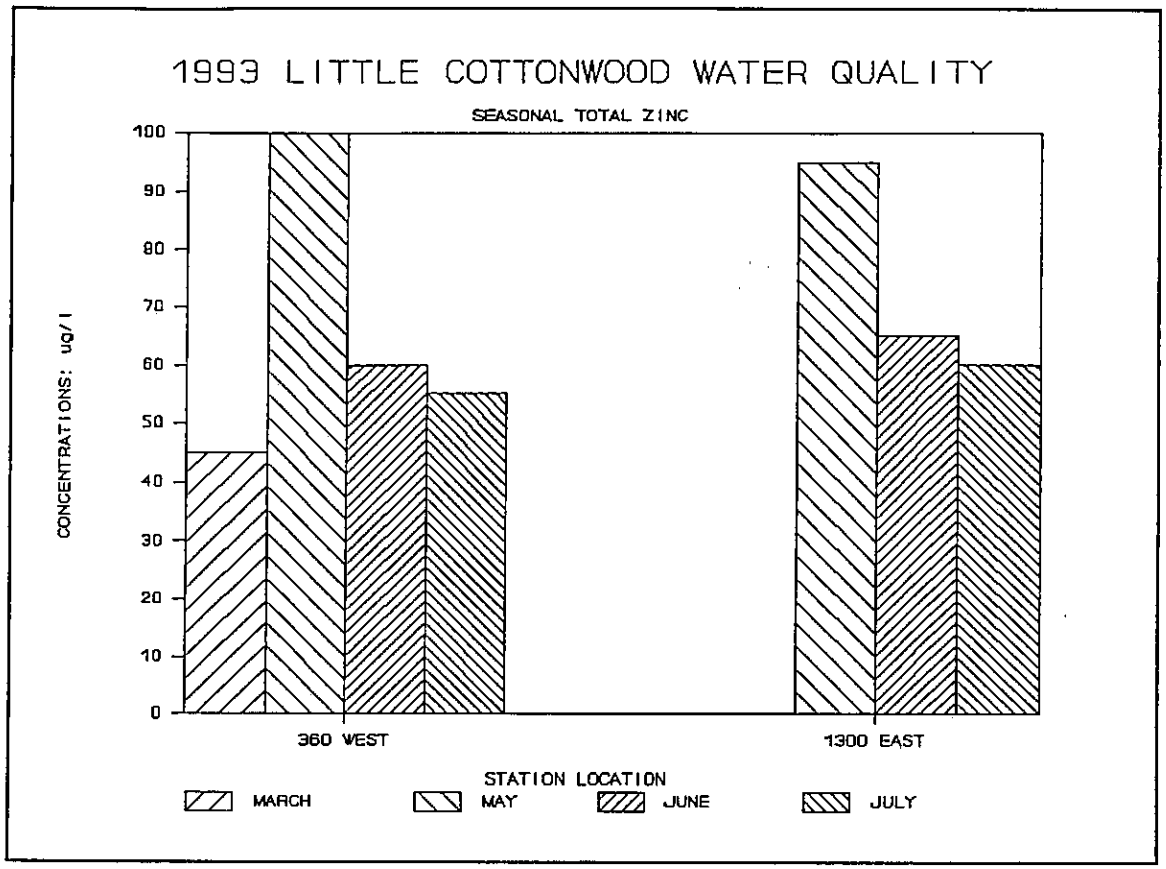

1993 LITTLE COTTONWOOD WATER QUALITY
SEASONAL TOTAL PHOSPHORUS
CONCENTRATIONS: mg/l
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
360 WEST
1300 EAST
STATION LOCATION
MARCH
MAY
JUNE
JULY

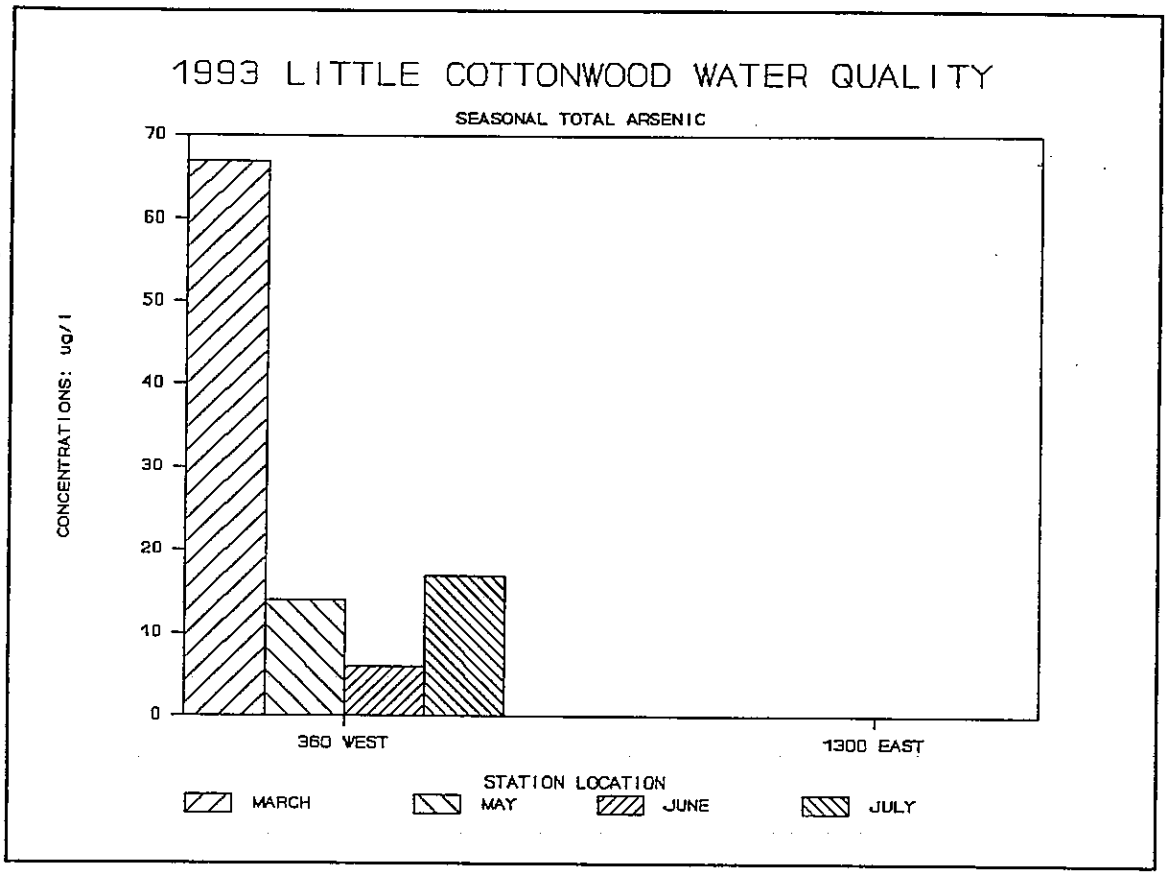

1993 LITTLE COTTONWOOD WATER QUALITY
SEASONAL TOTAL NITRATE
CONCENTRATIONS: mg/l
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
360 WEST
1300 EAST
STATION LOCATION
MARCH
MAY
JUNE
JULY

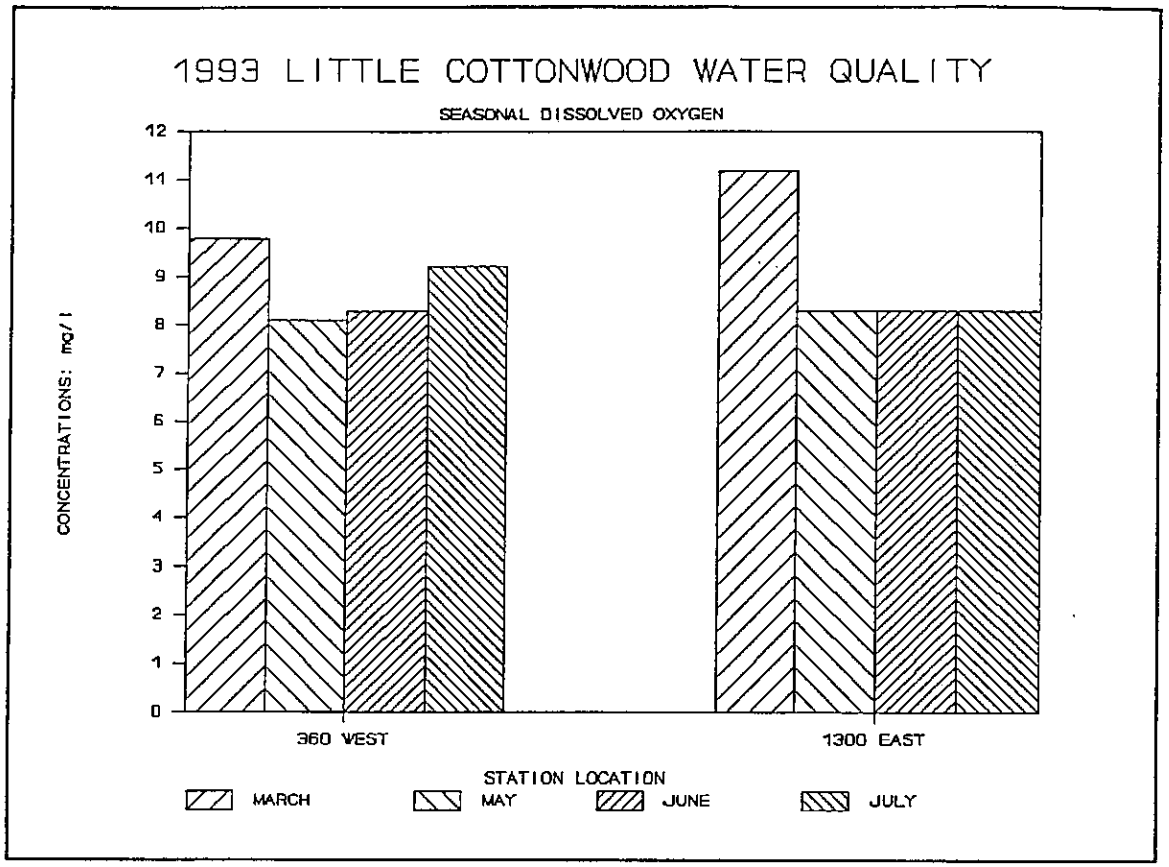

1993 LITTLE COTTONWOOD WATER QUALITY
SEASONAL TOTAL COLIFORM
CONCENTRATIONS: #/100 ml
(Thousands)
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
360 WEST
1300 EAST
STATION LOCATION
MARCH
MAY
JUNE
JULY

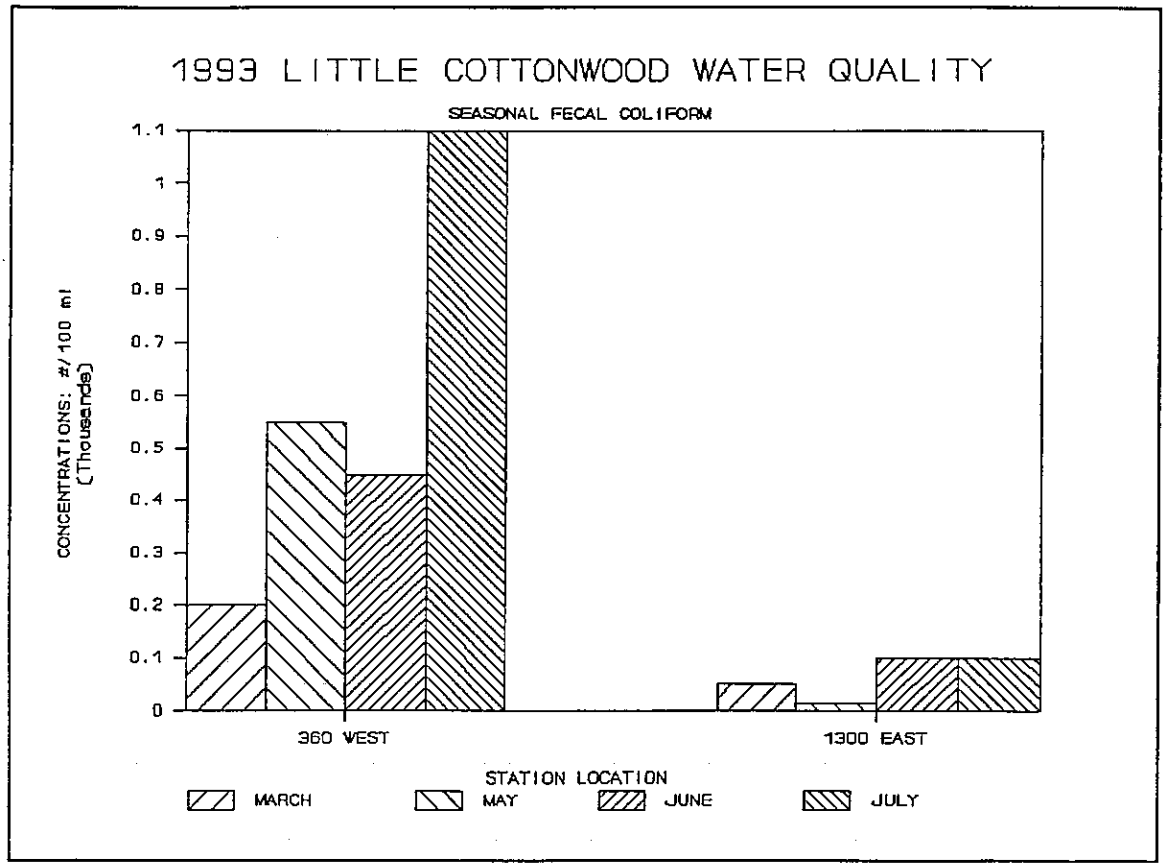

1993 LITTLE COTTONWOOD WATER QUALITY
SEASONAL SUSPENDED SEDIMENT
CONCENTRATIONS: mg/l
70
60
50
40
30
20
10
0
360 WEST
1300 EAST
STATION LOCATION
MARCH
MAY
JUNE
JULY


1993 LITTLE COTTONWOOD WATER QUALITY
SEASONAL TOTAL LEAD
CONCENTRATIONS: ug/l
24
22
20
18
16
14
12
10
8
6
4
2
0
360 WEST
1300 EAST
STATION LOCATION
MARCH
MAY
JUNE
JULY


1993 LITTLE COTTONWOOD WATER QUALITY
SEASONAL TOTAL ZINC
CONCENTRATIONS: ug/l
100
90
80
70
60
50
40
30
20
10
0
360 WEST
1300 EAST
STATION LOCATION
MARCH
MAY
JUNE
JULY


1993 LITTLE COTTONWOOD WATER QUALITY
SEASONAL TOTAL ARSENIC
CONCENTRATIONS: ug/l
70
60
50
40
30
20
10
0
360 WEST
1300 EAST
STATION LOCATION
MARCH
MAY
JUNE
JULY


1993 LITTLE COTTONWOOD WATER QUALITY
SEASONAL DISSOLVED OXYGEN
CONCENTRATIONS: mg/l
12
11
10
9
8
7
6
5
4
3
2
1
0
360 WEST
1300 EAST
STATION LOCATION
MARCH
MAY
JUNE
JULY


1993 LITTLE COTTONWOOD WATER QUALITY
SEASONAL FECAL COLIFORM
CONCENTRATIONS: #/100 ml
(Thousands)
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
360 WEST
1300 EAST
STATION LOCATION
MARCH
MAY
JUNE
JULY