WATER QUALITY STATUS REPORT ● REPORT NO. 57

UPPER PORTNEUF RIVER
Caribou County, Idaho
1985

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INTRODUCTION

PURPOSE

The purpose of this study was to document the water quality status of the Upper Portneuf River, provide information and education to area farmers and ranchers concerning agricultural non-point sources of pollution, and in combination with Soil Conservation Service land based information determine where critically eroding areas are in the watershed. The Division of Environment is also interested in determining if a grant for implementation of Best Management Practices in the watershed would reduce adverse water quality impacts.

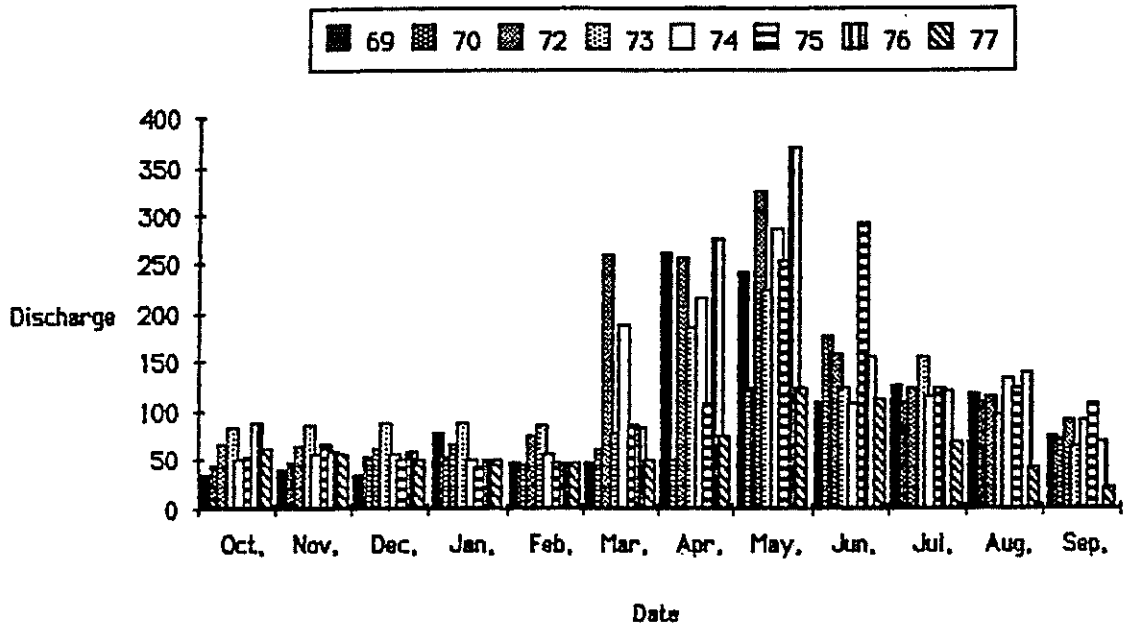
AREA

The Upper Portneuf River drainage, above the Kelly Road Bridge, encompasses 272,000 acres. Thirty percent of these acres are used as dry cropland, eight percent as irrigated cropland and sixty-two percent as range and woodland. The main tributaries to the Portneuf River in this area are Topance Creek, Twentyfour Mile Creek and Eighteen Mile Creek. The river flows from the Fort Hall Indian Reservation south to Lava Hot Springs and then west and north through Pocatello and into American Falls Reservoir. The Upper Portneuf River is impounded by Portneuf Reservoir (capacity 23,695 acre feet) which discharges into the Marsh Valley - Downey Canal joining the Portneuf River one half mile above the Kelly Road Bridge. Irrigation flows are maintained from June to August.

HYDROLOGY

Mean monthly discharge of the Portneuf River as measured at the old USGS Pebble station (13072000) over an eight year period from 1969 to 1977 is shown in Figure 1. Flows do not reflect a normal hydrologic regime because of the influence of the Portneuf Reservoir which sustains flows through the irrigation season. Discharge surges from fifty cfs to 200-300 cfs during the March to May runoff. Irrigation flows are

Figure 1. Mean Monthly Flow at Pebble USGS Gaging Station for Years 1969 to 1977



maintained at 100 cfs from June to August. Maximum monthly mean flows occur during run off.

BENEFICIAL USES

The waters of the Portnuef River are protected by the State of Idaho for irrigation, livestock watering, fishing, swimming, wading, cold water fish reproduction and fish habitat. Portions of the Portnuef River adjacent to the study area support a popular sport fishery.

SOILS

The soils and river morphology are indicative of an old, highly eroded river basin. This river drains soils that are formed in loess, silty alluvium and volcanic ash. Hills in the area are of relatively low relief. The entire drainage basin's parent soil materials consist of basalts, gravels, glacial lake and shoreline deposits, moraines, and some loess mantles. There are also volcanic deposits of ash and lava flows, some granite formations and marine sediments and limestone. The majority of the cropland in this area lies on low relief flats and hills. Dry cropland areas do extend onto erosive grades.

SEDIMENT SOURCES

Since the majority of the crop land in this area is utilized for dry land agriculture this may be a primary source of sediment for waterways. Irrigated lands may also be contributing. Grazing activities probably introduce pollutants in the spring melt water and as livestock cave unstable banks into streams. Concentrated winter livestock operations and small dairies may also contribute bacteria and manure to tributaries. Canal bank erosion could be a problem because of flow accelerating structures along the Marsh Valley/Downey Canal.

MATERIALS AND METHODS

STATIONS

Ten stations were sampled at least biweekly from March 1st to October 31, 1985. Weekly sampling was undertaken during high flows to increase accuracy and insure representative data. A few one time samples were collected on intermittent streams. Station locations are shown on figure 2. Legal descriptions and Storet numbers are in the appendix.

PRINCIPAL STATIONS

Portneuf River Station 1- Elevation 5350 ft., river mile 78.7. Lies below Portneuf Reservoir on the canal. This station reflects changes in flow regulated by the reservoir and documents its effect on nutrient content of downstream waters.

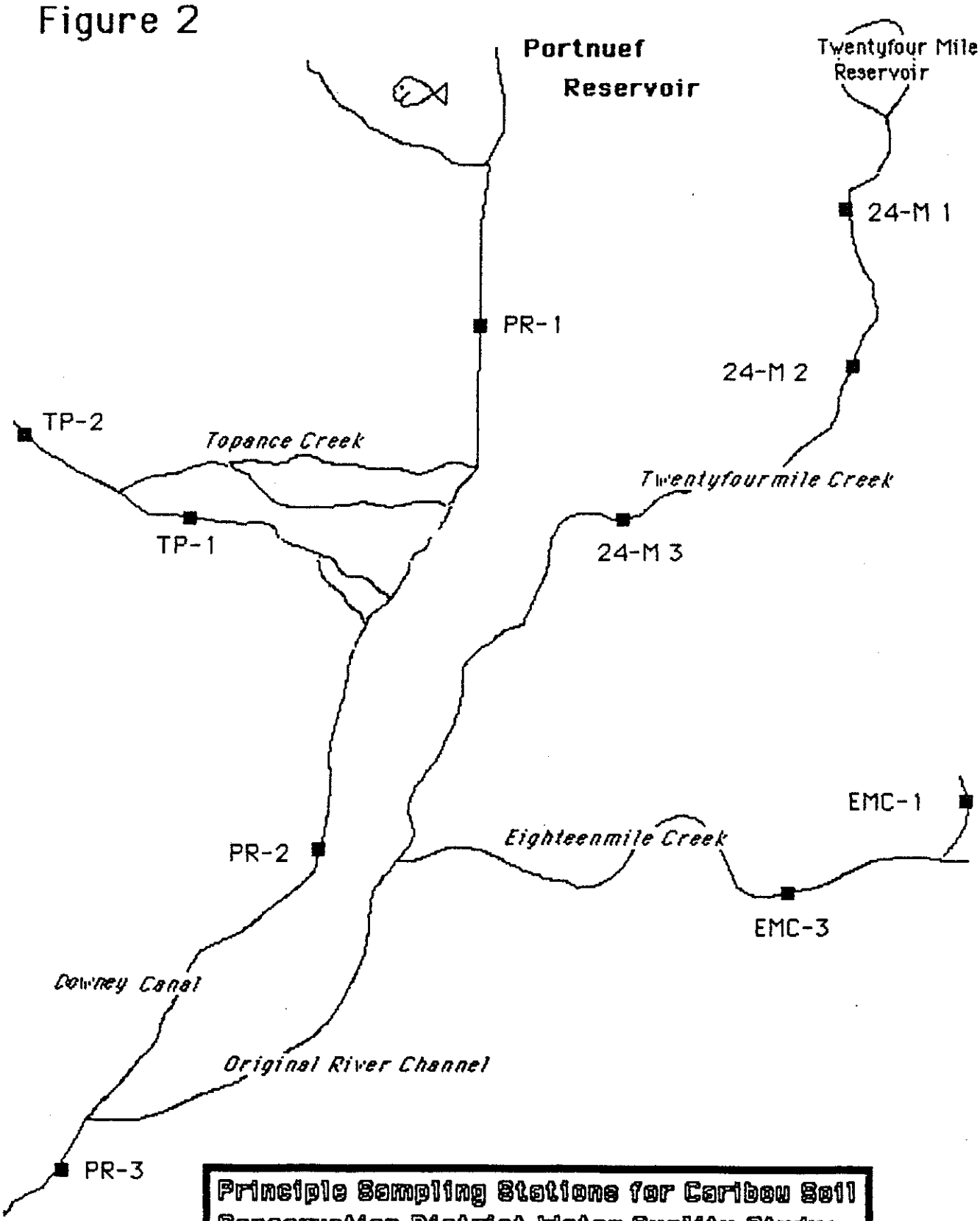
Portneuf River Station 2- Elevation 5320 ft., river mile 76. Lies along the Chesterfield Church road. This station is on the canal and not on the original river channel. This station also reflects the effect of the reservoir but adds canal bank erosion effects.

Portneuf River Station 3- Elevation 5312, river mile 69.7, 4.8 miles upstream from Pebble Creek. Lies at Kelly Road Bridge (Steel Bridge, or at the site of the USGS gauging station called Pebble). reflects the output of the entire drainage above this point.

Lower Topance Cr. Station (TP-1)- Elevation 5330, 2 miles due north of Chesterfield Church on county road. Lies in the alluvial fan of the creek and encompasses only one of the forks of the stream. Irrigation withdrawals upstream reduce flows in this area. Irrigation water management for pasture production affects water quality above this site as does use of the land for grazing.

Upper Topance Cr. Station (TP-2)-Elevation 5600 ft., lies at the Caribou National Forest Boundary. Summer grazing affects water quality upstream of this site. The site lies within the canyon formed by the tributary. Stream bottom materials consist of cobble and sands.

Figure 2



Principle Sampling Stations for Caribou Soil Conservation District Water Quality Study

Upper Eighteenmile Cr. Station-(EMC-1) Elevation 5494 ft. and 2/3 of a mile north of county road intersection. This station is in a small subdrainage of Eighteen-mile Creek and is a small spring of high quality.

Lower Eighteenmile Cr. Station-(EMC-3) Elevation 5338 ft., lies about 4 miles from its confluence with the original river channel and reflects water quality effects from summer pasturing of horses, and winter cattle feeding operations. The station lies at a culvert on the road directly north out of Bancroft, Idaho about 3 3/4 miles south of Chesterfield. The creek enters a substantial marsh prior to its confluence with the river.

Twenty-four Mile Creek

Station 1 - below 24 Mile Creek Reservoir at culvert crossing road, one mile southeast of reservoir spillway. This station reflects uses of the land for irrigation water storage and rangeland. Water quality is generally high.

Station 2 - Elevation 5400 ft. At county road crossing adjacent to small dairy operation near Chesterfield. This site includes impacts from a small dairy immediately next to the stream, stream channel erosion that has occurred upstream of this station, irrigation return flows or stock ditch water, and dryland agriculture from an area east and north of this site.

Station 3 - Elevation 5320. West of county road 2/3 of a mile, near a ranch. This station picks up effects contributed by livestock wintering in the immediate area. Channelization efforts for water control above this site have been ineffective.

INTERMITTENT DRAINAGES AND MISCELLANEOUS STATIONS

Feeder Canal for Portneuf Reservoir- Elevation 5414. This station was for assessment of stream bank erosion and erosion from fields above the canal as it flows from Topance Creek to the Reservoir. Flows are sustained in the canal intermittently but usually occur during the spring runoff.

Call Place Station- Elevation 5305 feet, 2/3 of a mile north of the Kelly Road intersection with the highway. This is a drainage that discharges to the Portneuf River during the spring in the form of overland run off and during the remainder of the year as a set of springs of high quality. The drainage could include land five miles east of Bancroft.

SAMPLE COLLECTION AND ANALYSIS

Suspended sediment samples were collected with a DH-48 suspended sediment sampler. Flows were taken using a Marsh-McBirney flow meter according to standard field procedures. Dissolved oxygen, conductivity and temperature were obtained potentiometrically using Yellow Springs Instrument Co. dissolved oxygen (model # 54A) and conductivity meters (model # 33). Sample methods conformed to standard practices, two one-liter water chemistry samples were collected from the center of the stream flow and preserved with 2 ml of HNO_3 for metals, and 2 ml of H_2SO_4 for nutrient samples. Idaho Bureau of Laboratories performed the analyses according to standard methods American Public Health Association. Bacteriological samples were collected into 250 ml sterile polyethelene bottles and analysed according to methods described by the American Public Health Association at District Health Department Laboratories.

PARAMETERS

The following parameters (units, STORET #) were measured in the Portneuf River and its tributaries:

Temperature, ^{0}, C.
Dissolved Oxygen, mg/L,
pH, SU, 00403
Turbidity, NTU, 00076
Suspended Sediment, mg/L, 80154
(Non-filterable Residue)
Nitrate, mg/L, 00620
Ortho-phosphate, mg/L, 70507
Total Phosphorus, mg/L, 00665
COD, mg/L, 00335, 00340
Calcium, mg/L, 00916
Magnesium, mg/L, 00927
Sodium, mg/L, 00929
Potassium, mg/L, 00937

Nitrite, mg/L, 00615

Ammonia, mg/L, 00615

Total Kjeldahl Nitrogen, mg/L, 00625

Cadmium, ug/L, 01028

Chromium, ug/L, 01030

Copper, ug/L, 01040

Iron, ug/L, 01046

Manganese, ug/L, 01056

Nickel, ug/L, 01065

Silver, ug/L, 01075

Zinc, ug/L, 01090

Sulphate, mg/L, 00945

Arsenic, ug/L, 01000

Boron, ug/L, 01022

Total Coliform Bacteria

Fecal Coliform Bacteria, #/100ml, 31616

Fecal Streptococcus Bacteria, #/100ml, 31679

DATA ANALYSIS

Data were analyzed by using stream concentration trend plots developed for each station in the drainage. Trend-lines can be compared between comparable tributary stations to determine differences and establish land treatment priorities. Flow-weighted average lbs/day were calculated at each station using the statistical analysis program in the STORET system. Monthly flow-weighted averages show the time trends and facilitate comparisons between stations for parameters affected by stream flow. Yearly averages can be compared between stations having similar stream flows.

Data for parameters mentioned above are stored in the STORET data management system. Important parameters for determining water quality effects due to agricultural practices are as follows: fecal coliform bacteria, fecal streptococcal bacteria, turbidity, suspended sediment, nitrate, total kjeldahl nitrogen, total phosphorus and ortho-phosphorus. Results from tests for these parameters, in combination with streamflow information, will serve as points of discussion.

RESULTS AND DISCUSSION

SEDIMENT

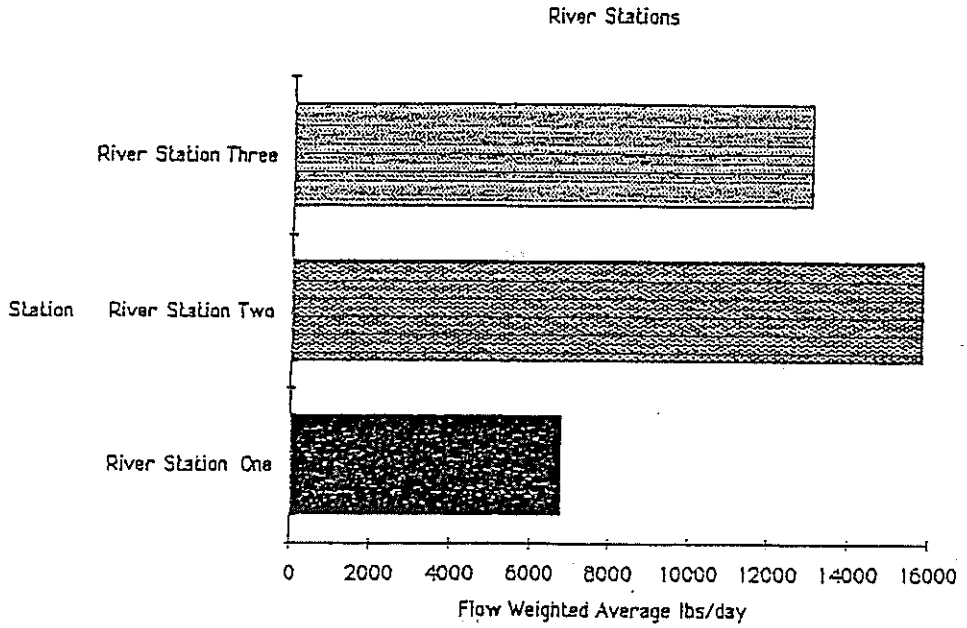
River and Downey Canal

The total amount of sediment passing river station 3 in the monitoring period was not the highest among the three river stations. Measurements at station two, on the Downey Canal showed more sediment in the monitoring period than any other station in the drainage. This might be expected since flows are maintained at an artifically high level to provide irrigation water to farmers (see figure 3). The effects of domestic and wild mammals and birds are added when they feed in the waterway, pass through it, or graze the banks. Weight of cattle on the canal banks increase the amount of sloughing which adds more soil material to the waterway. The difference between station one and two for average pounds of sediment is 9054 lbs (yearly flow-weighted average). The difference between sediment content at station two and three can be attributed to the diluting effect of springs, and the original river channel, joining the canal approximately 1/2 mile above station 3.

Tributaries

The single tributary contributing the greatest amount of sediment is Twentyfour Mile Creek (figure 4). The sediment yield of either Station 2 or 3 on Twentyfour Mile Creek is greater than any other comparable tributary station by a factor of two. The source of sediment for this stream is thought to be from bank and gully erosion caused by an extreme runoff year between 1981 and 1983. Evidence of altered channels exists in areas where sediment would be expected to drop out. Agriculturally utilized lands exist between the upper and middle Twentyfour Mile Creek stations but this may not account for this water quality degradation. Comparable sites on Eighteen Mile Creek and Topance Creek show half the amount of sediment transport of this tributary. Both of these tributaries show at least a doubling of the sediment yield between upstream and

Figure 3: Yearly Flow-weighted Average Pounds Per Day of Suspended Sediment for River Stations



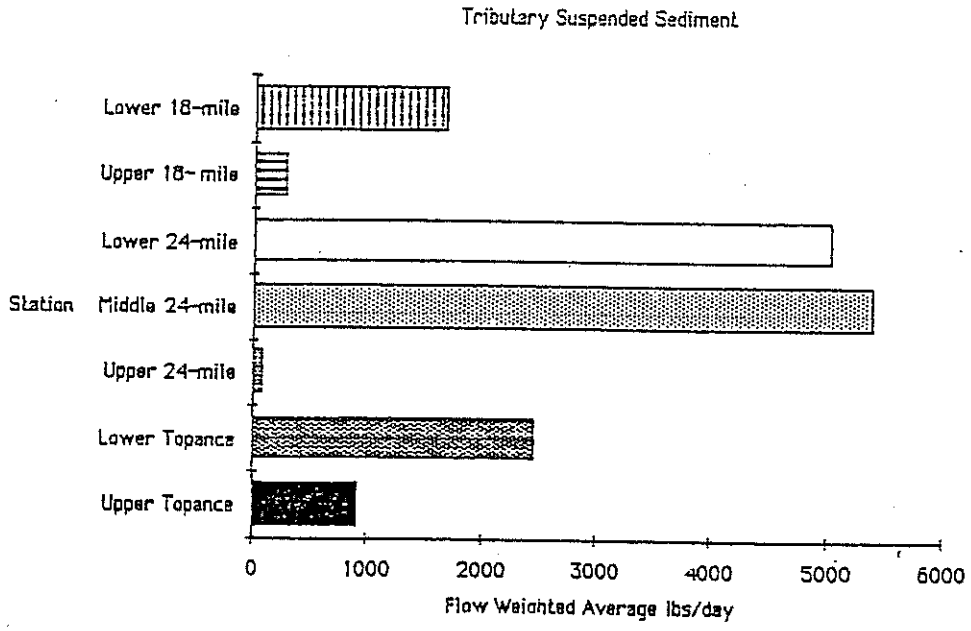


Figure 4: Yearly Flow-weighted Average Pounds Per Day of Suspended Sediment for Tributary Stations

downstream stations.

Monthly trends in suspended sediment load for river stations one, two and three (figures 5, 6 and 7) show the effect of runoff on sediment transport. The month of highest transport at each station is April. Irrigation needs increase sediment loads during July to September (figure 5). At the peak of runoff in April, station 3 had the greatest discharge of sediment at 755,866 pounds/day (figure 7). Increased loading of sediment at station one during April, May and June could be explained by the influence of runoff upon Portnuef Reservoir. There are areas of dryland agriculture adjacent to the reservoir that could contribute sediment to it. Additionally, the feeder canal that runs from Topance Creek to the reservoir carries water and sediment to the reservoir. At the peak of runoff this canal was carrying about 183,427 lbs/day of sediment into the reservoir. This is higher than any single measurement in the drainage. This canal only runs early in the spring for a couple of weeks to insure adequate irrigation water for the summer at about 100 to 120 cfs.

River turbidity levels are generally correlated with increased sediment loads. Increased turbidity occurred at river stations two and three (figures 9 and 10) during the period of maximum sediment transport. Increased turbidity in September at river stations one and two (figures 8 and 9) can probably be attributed to a decrease in water releases above station one which caused an increased movement of bottom materials in these areas.

Sediment rating curves (figures 11-13) were used as a means for comparing stream stations. Consistent relationships were not seen between discharge and suspended sediment concentrations.

Tributary Turbidities and Sediment

Runoff remains as the period of greatest sediment movement and

Figure 5: Monthly Trends for Suspended Sediment Flow-weighted Average Pounds Per Day at River Station One

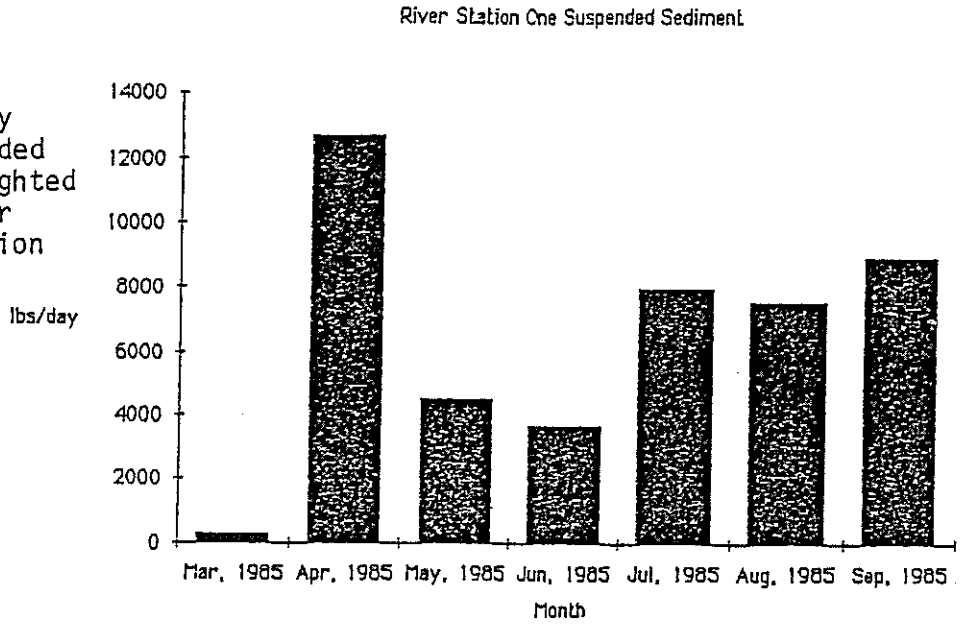


Figure 6: Monthly Trends for Suspended Sediment Flow-weighted Average Pounds Per Day at River Station Two

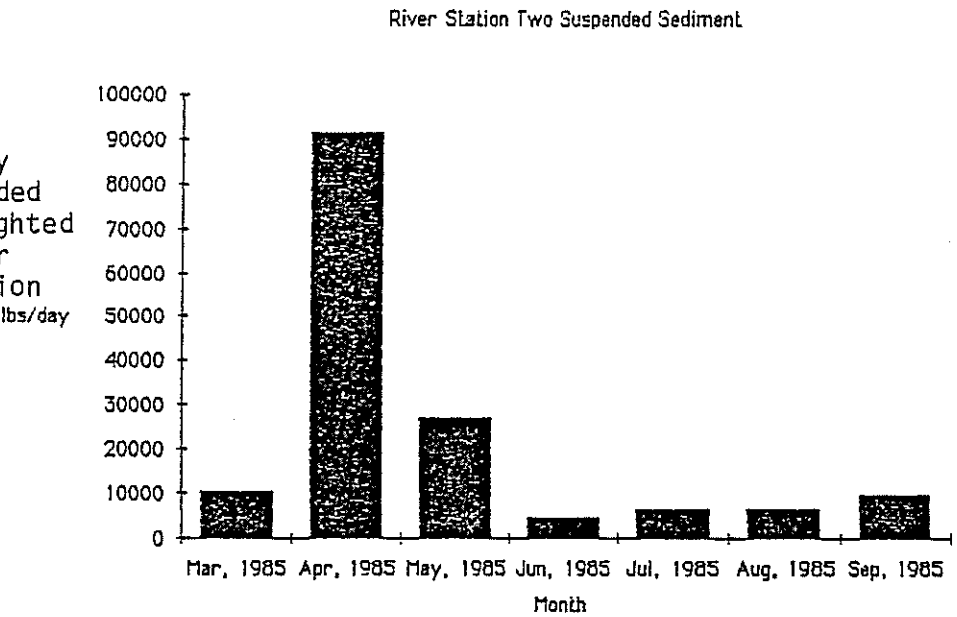


Figure 7: Monthly Trends for Suspended Sediment Flow-weighted Average Pounds Per Day at River Station Three

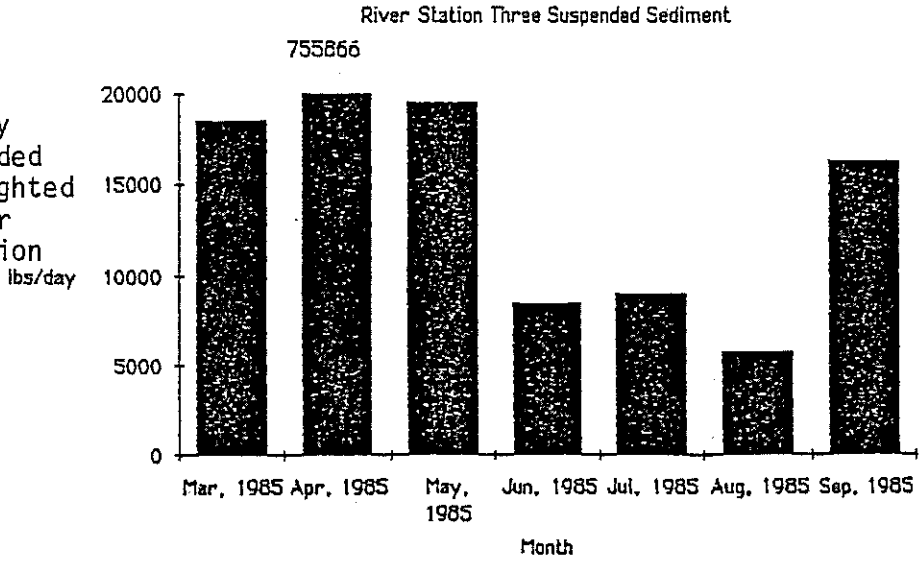


Figure 8

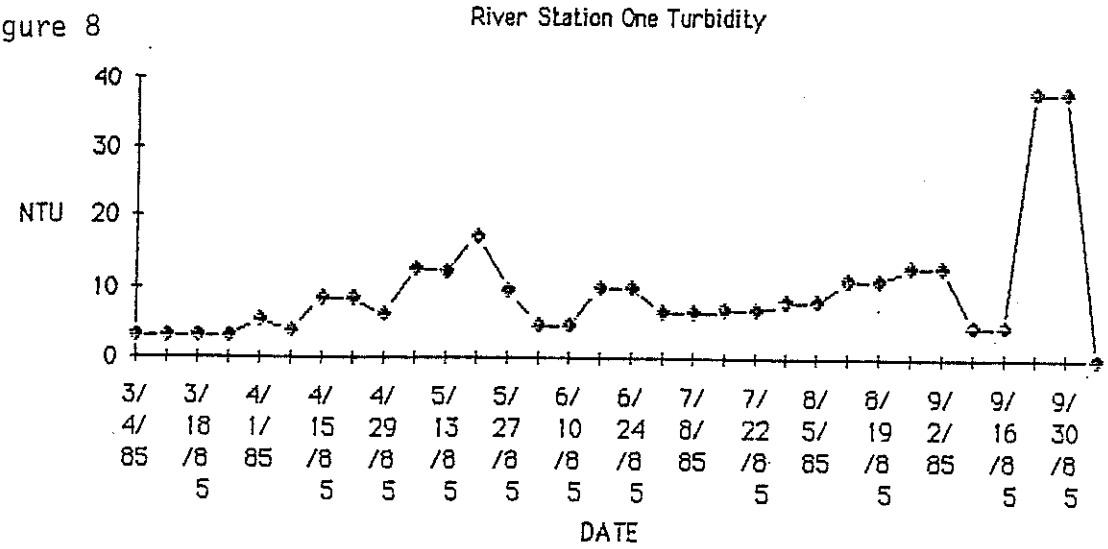


Figure 9

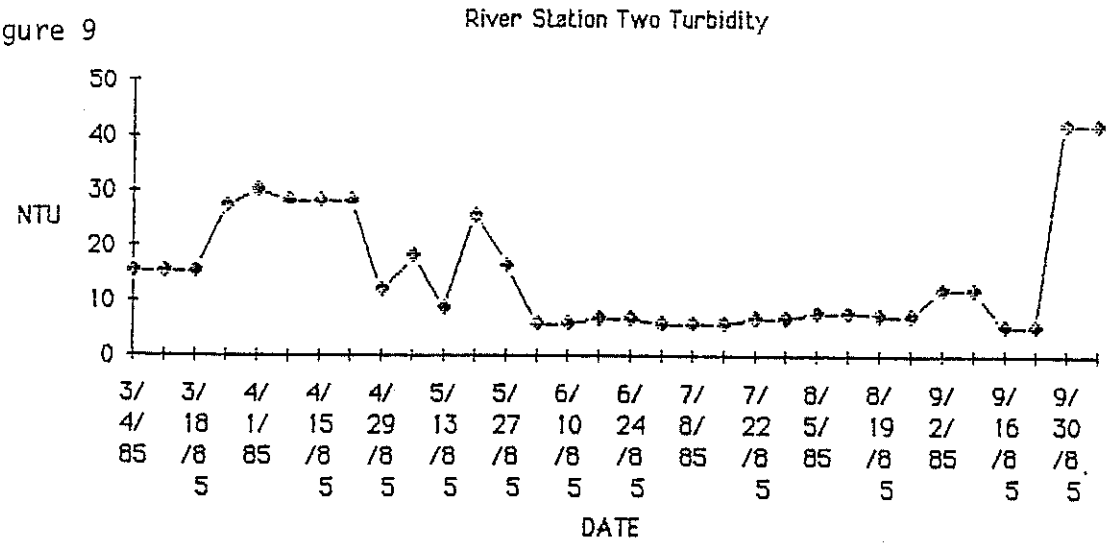


Figure 10

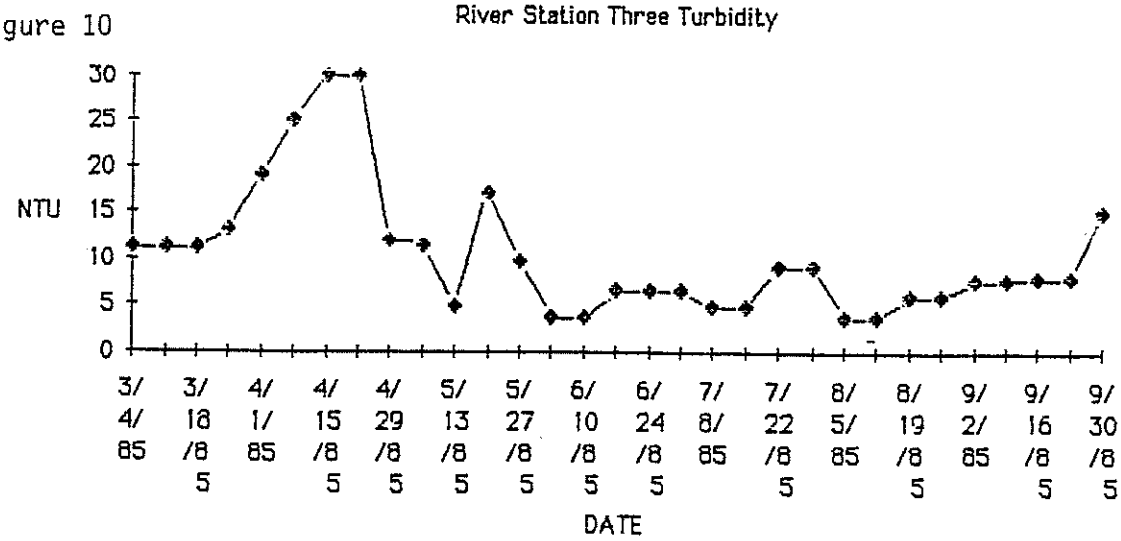


Figure 11

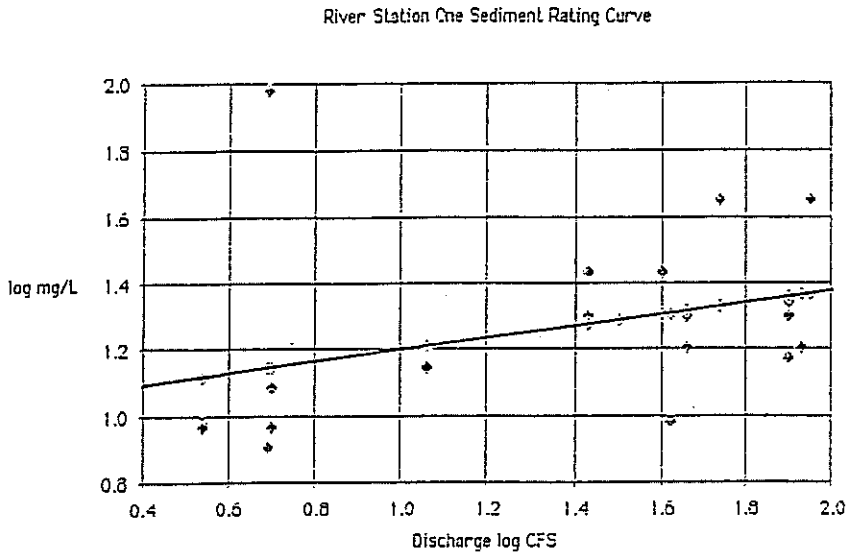


Figure 12

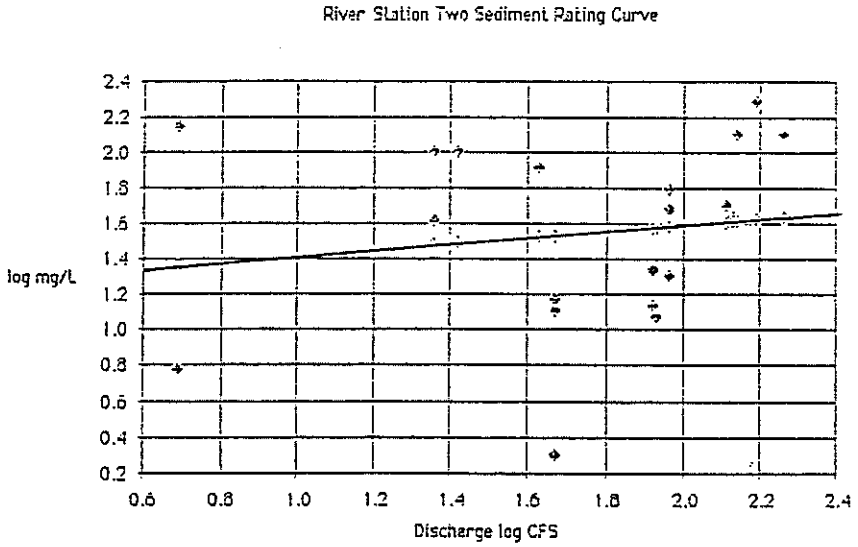
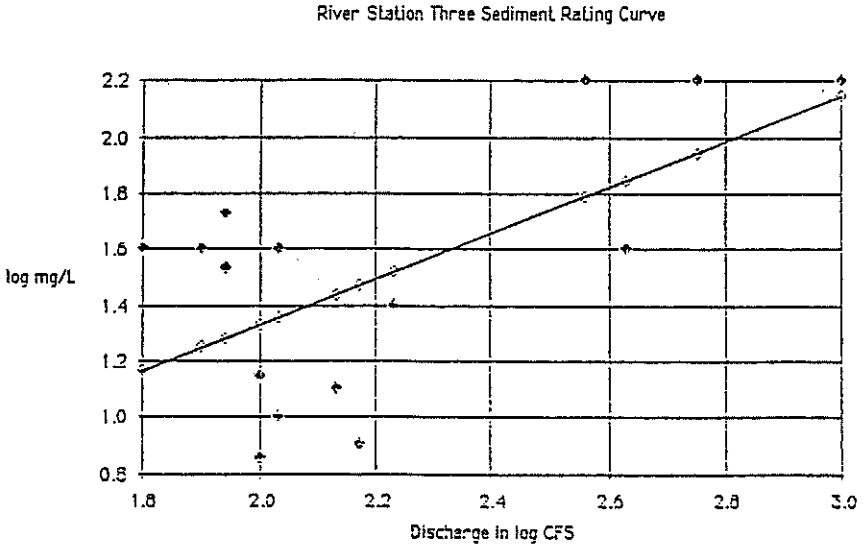


Figure 13



increased turbidities. The yearly trends among tributaries for sediment and turbidity are similar. They differ with respect to the amount of sediment moved in runoff waters (figures 14-19). The lower Topance Creek station exhibited increased turbidities in July, the lowest sediment yielding month at this station (figure 20-21). The reason for this increased turbidity is cattle activity in the streams drainage immediately upstream of the sampling station.

Bacterial Concentrations

All bacterial pollution in the watershed is associated with livestock and waterfowl. The ratio of fecal coliform to fecal streptococcal bacteria did not indicate a human source (see appendix for examples) for most stations during the year. Fecal Coliform/Streptococcus ratios vary inversely with flow. When flows are reduced in the small tributary streams during the summer months more fecal coliform bacteria seem to occur than fecal streptococcus. This may be explained in the case of Topance Creek by (figure 49) the presence of a house some distance upstream of the sample station. There may be some human source on this tributary since the ratio at the peak is greater than four to one. Although the ratio varies (figure 50) above the 0.7 figure on Twentyfour Mile Creek on four occasions the ratio never approaches that indicative of human fecal contamination.

The bacterial quality of water at the river stations generally remained good during the runoff period (figure 22). Increased flows tend to decrease the concentration of bacteria by dilution in the river and canal. The spike of bacterial numbers in a sample gathered from station one during late July is unexplained. Irrigation releases from the reservoir would tend to dilute the bacteria concentrations at this time. A noticeable depression of numbers occurs at station two from mid-June until early September. The peak in bacterial concentrations during September maybe attributable to a lowering of irrigation water demand

Figure 14 Twentyfourmile Creek Middle Station Turbidities

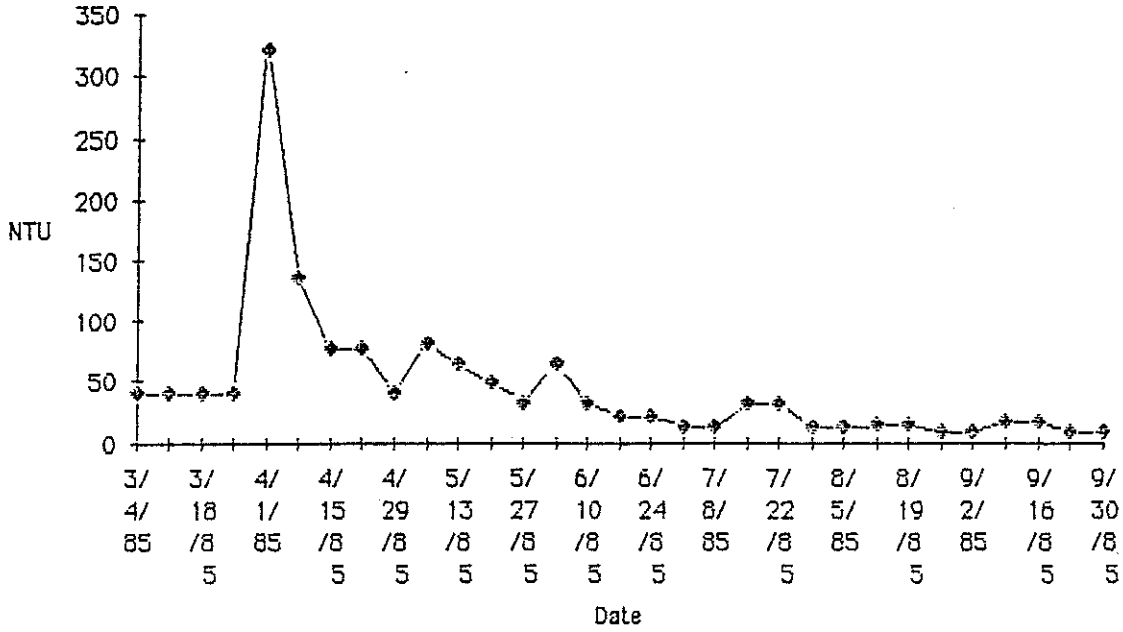


Figure 15 Twentyfourmile Creek Lower Station Turbidities

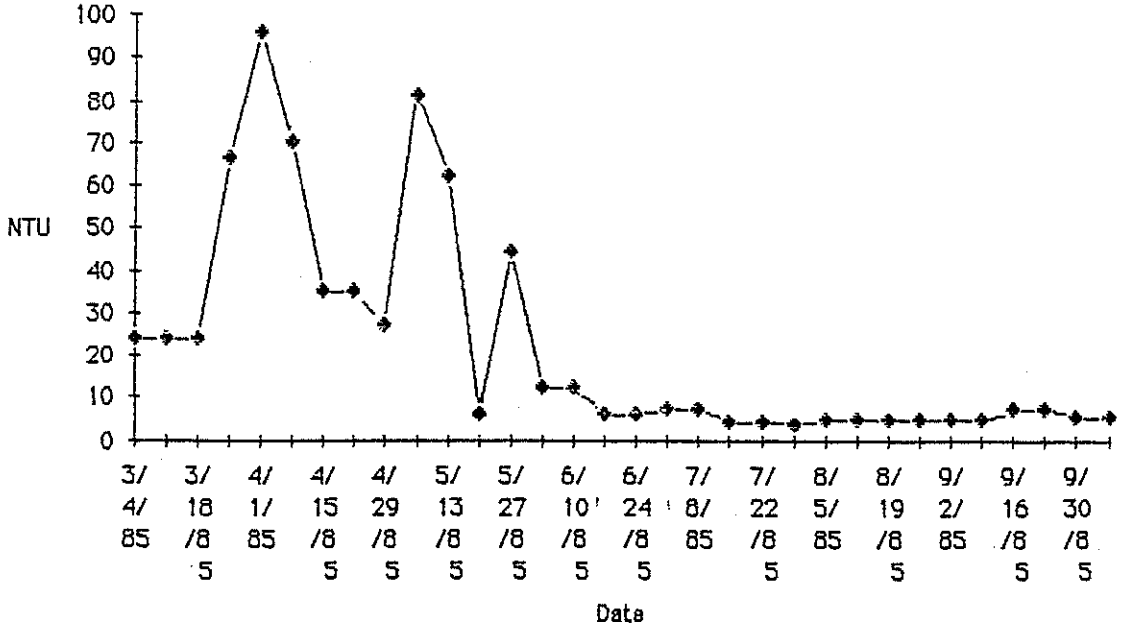
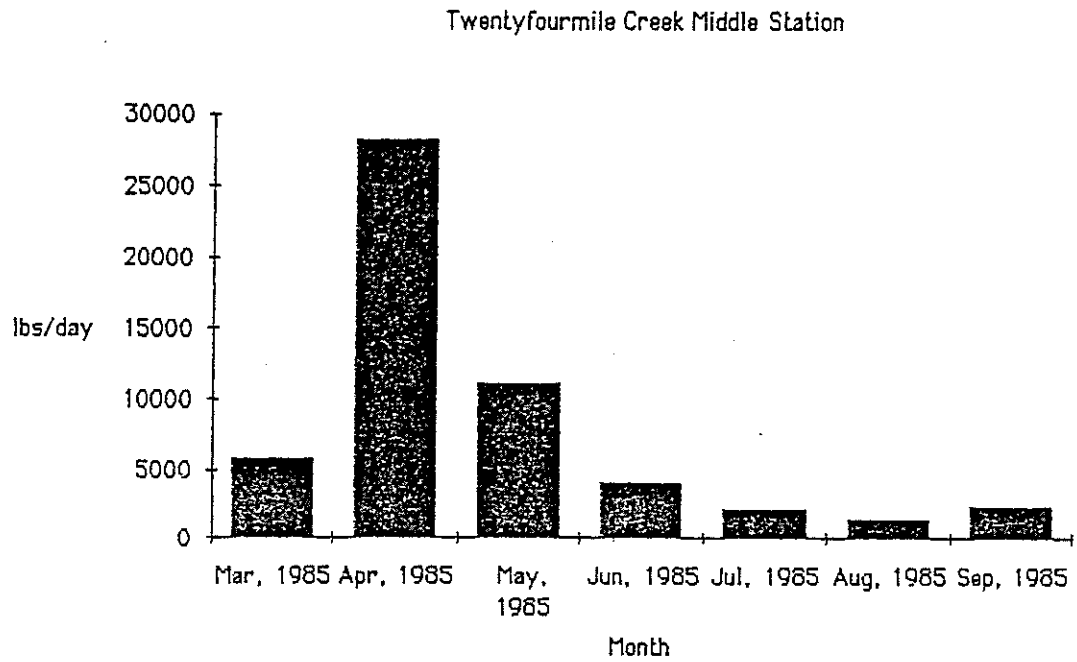


Figure 16: Monthly Flow-weighted Average Pounds Per Day of Suspended Sediment on Twenty Four Mile Creek at Station Two (middle)



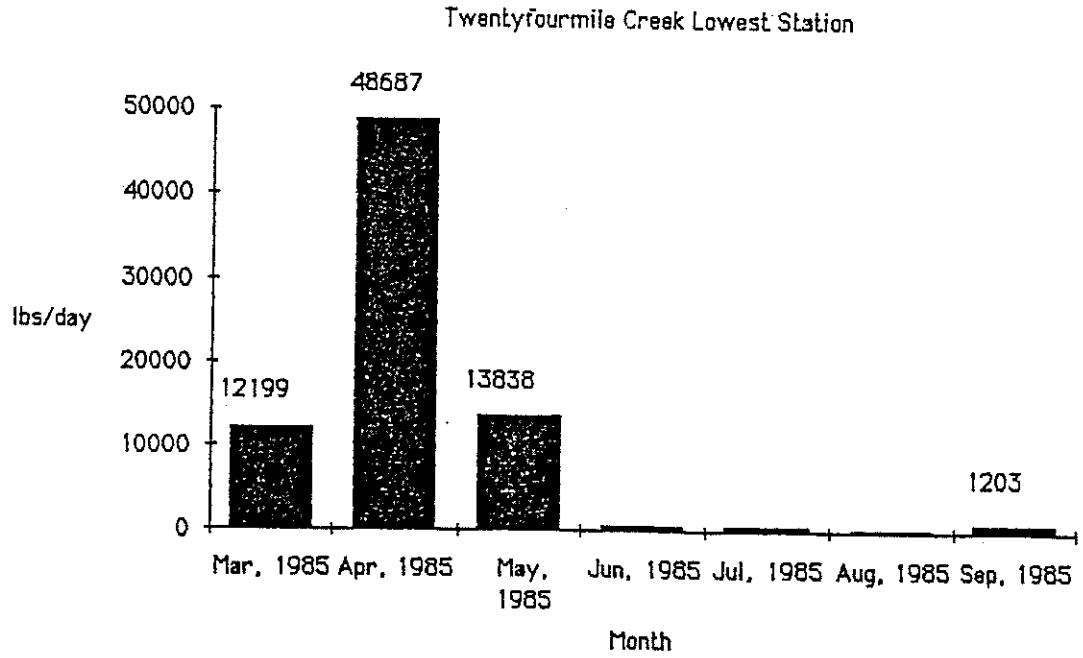
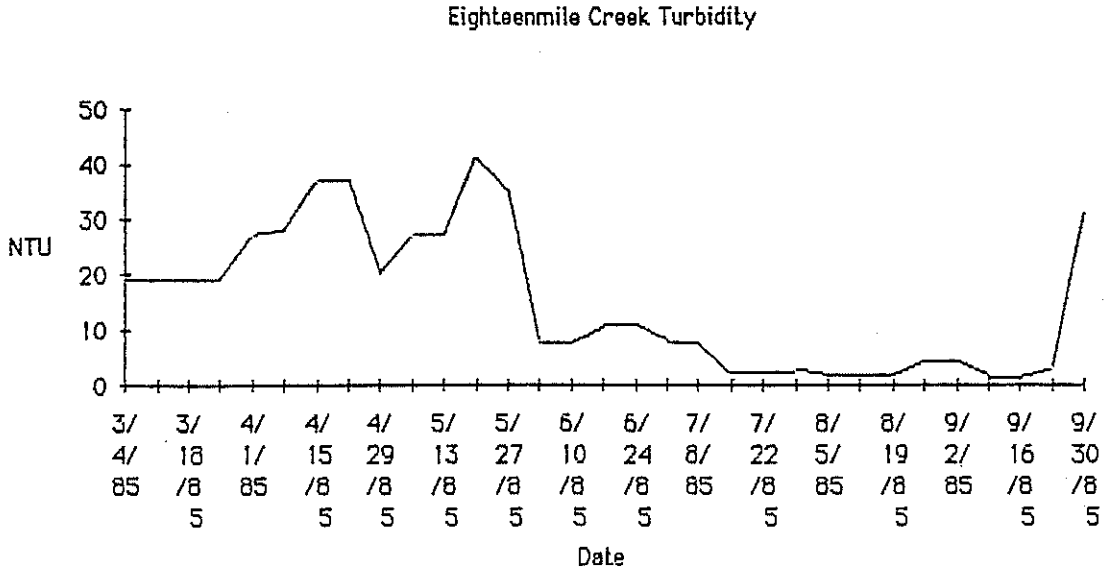


Figure 17: Monthly Flow-weighted Average Pounds Per Day of Suspended Sediment on Twenty Four Mile Creek at Station Three (lower)

Figure 18: Trend For Turbidity in Eighteen Mile Creek at Lowest Sampling Station



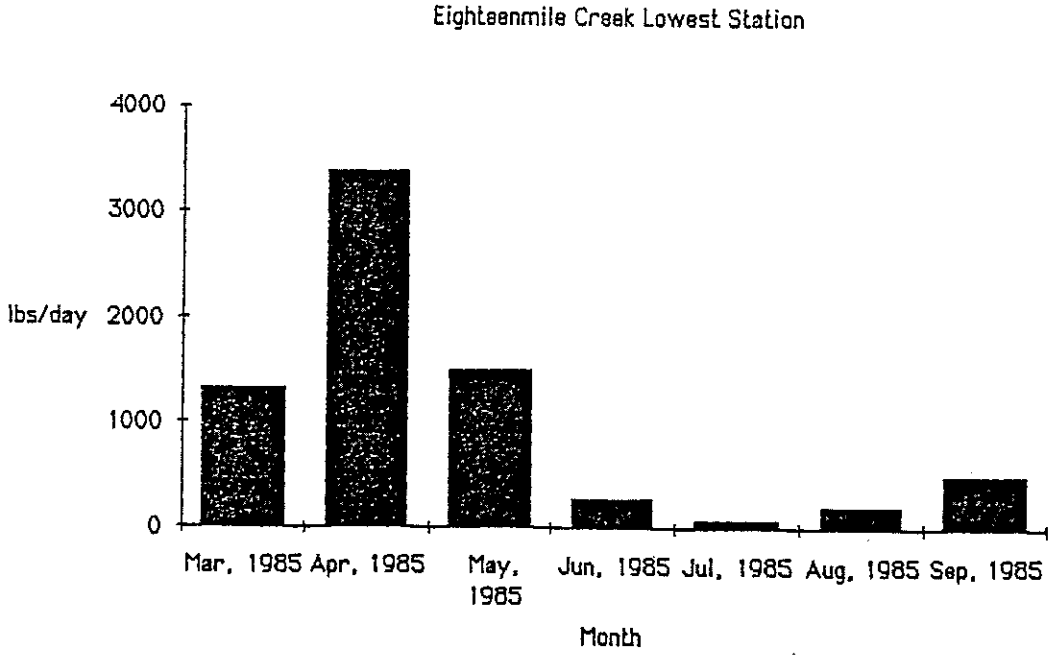
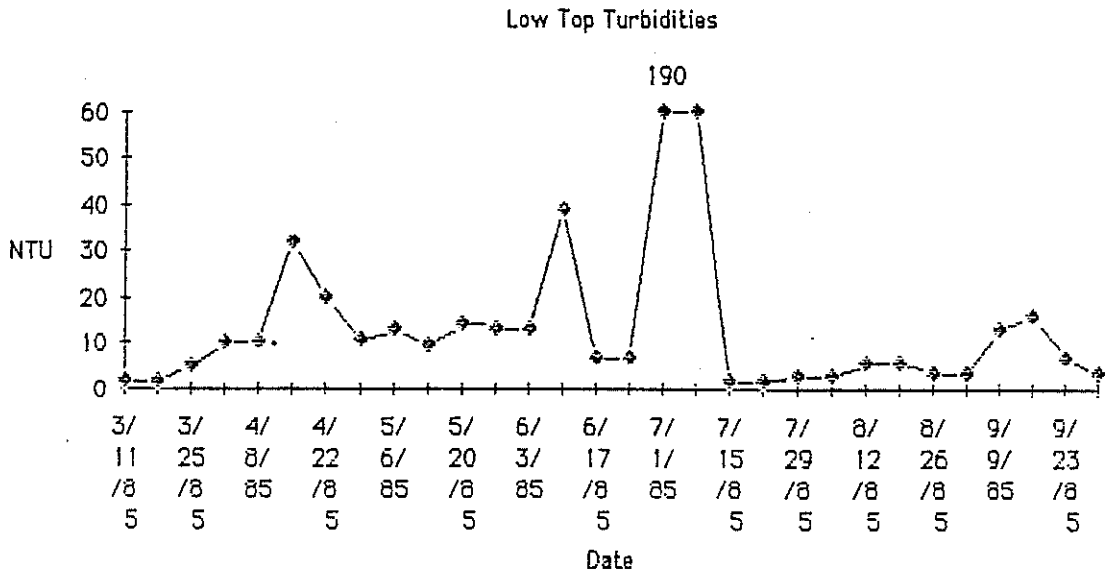


Figure 19: Monthly Flow-weighted Average Pounds Per day of Suspended Sediment in Eighteen Mile Creek at Lowest Sampling Station

Figure 20: Trend for Turbidity in Lower Topance Creek



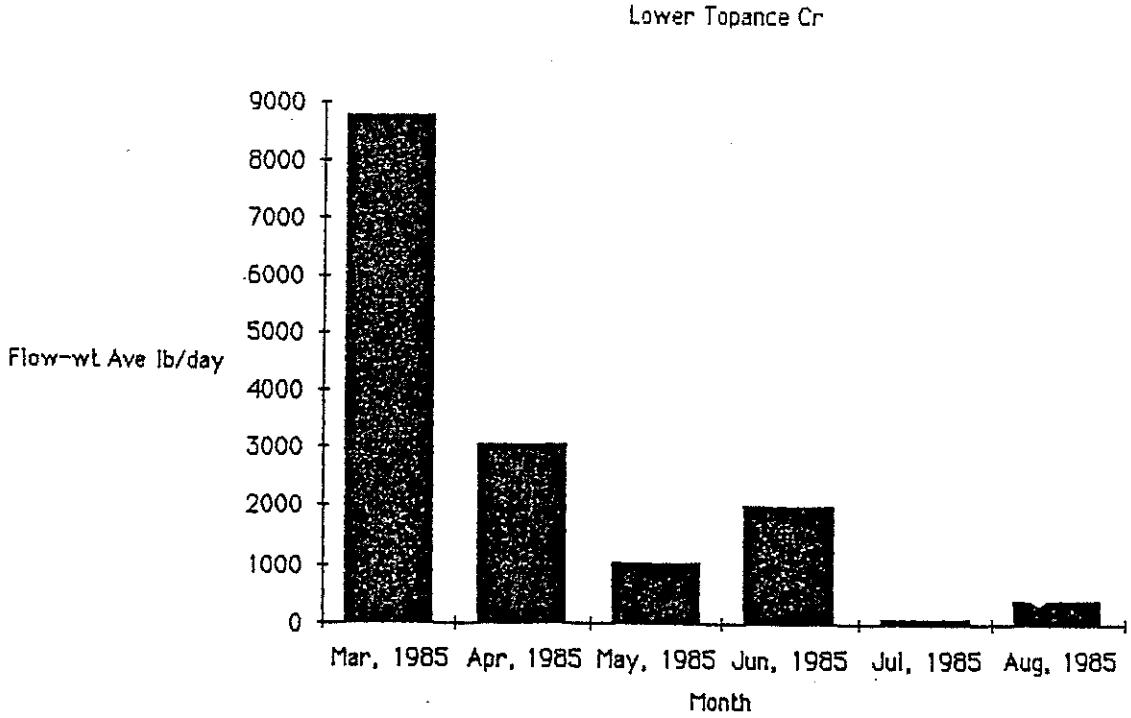
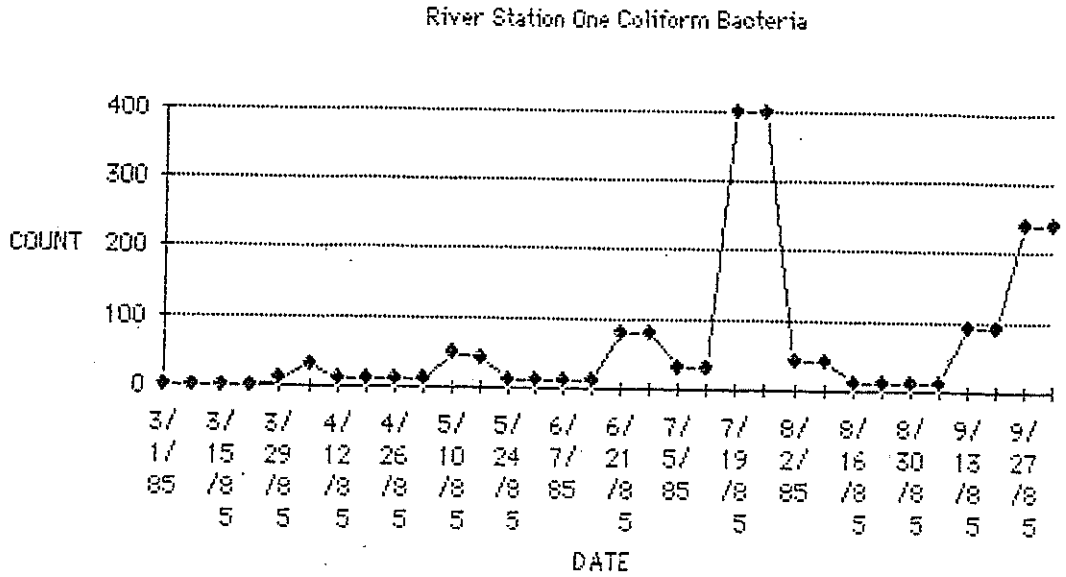
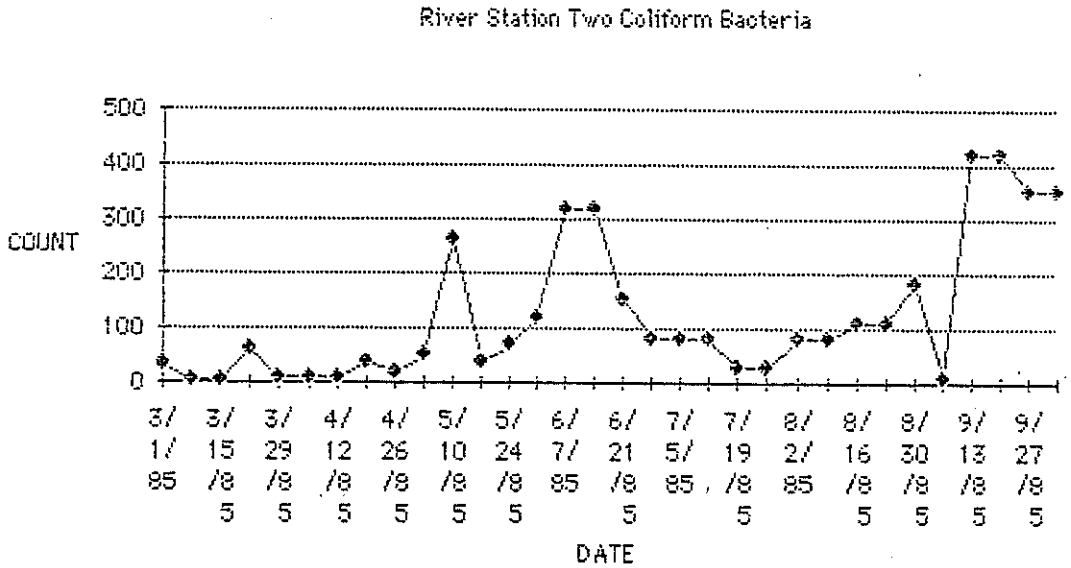


Figure 21: Monthly Flow-weighted Average Pounds Per Day of Suspended Sediment in Lower Topance Creek





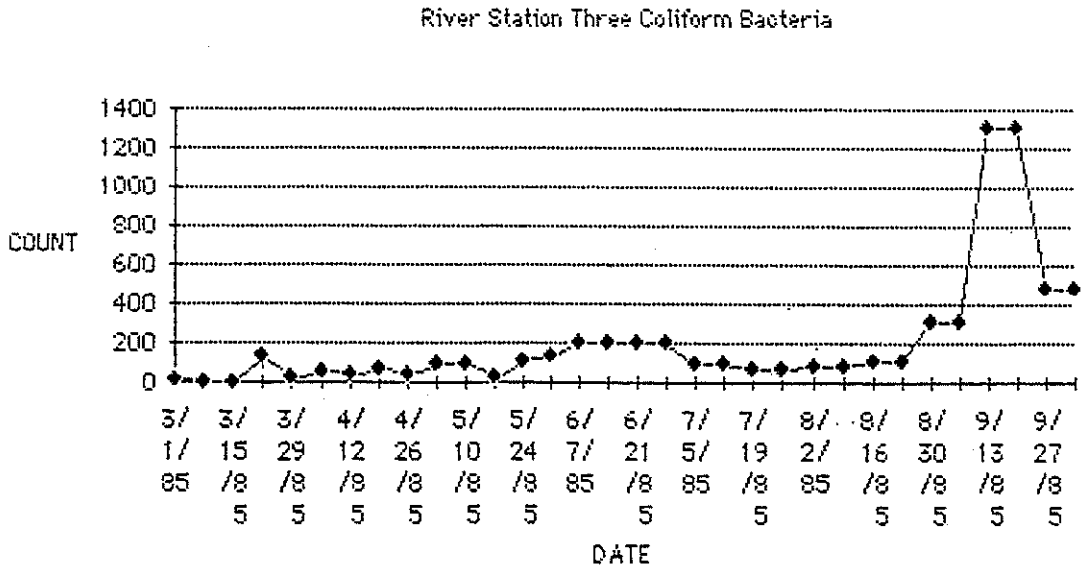


Figure 22: Trends For Fecal Coliform Bacterial Concentrations in a 100 ml Sample of Water From River Stations One, Two and Three

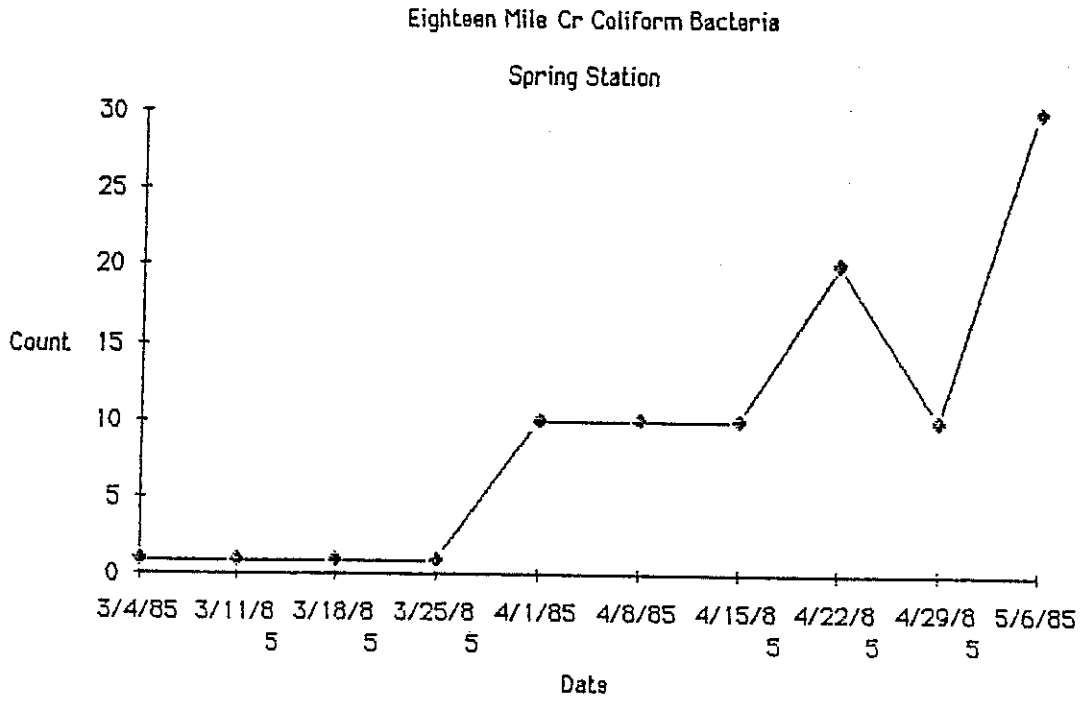


Figure 23: Fecal Coliform Bacterial Concentrations in a 100 ml Sample of Water from Eighteen Mile Creek at the Headwaters

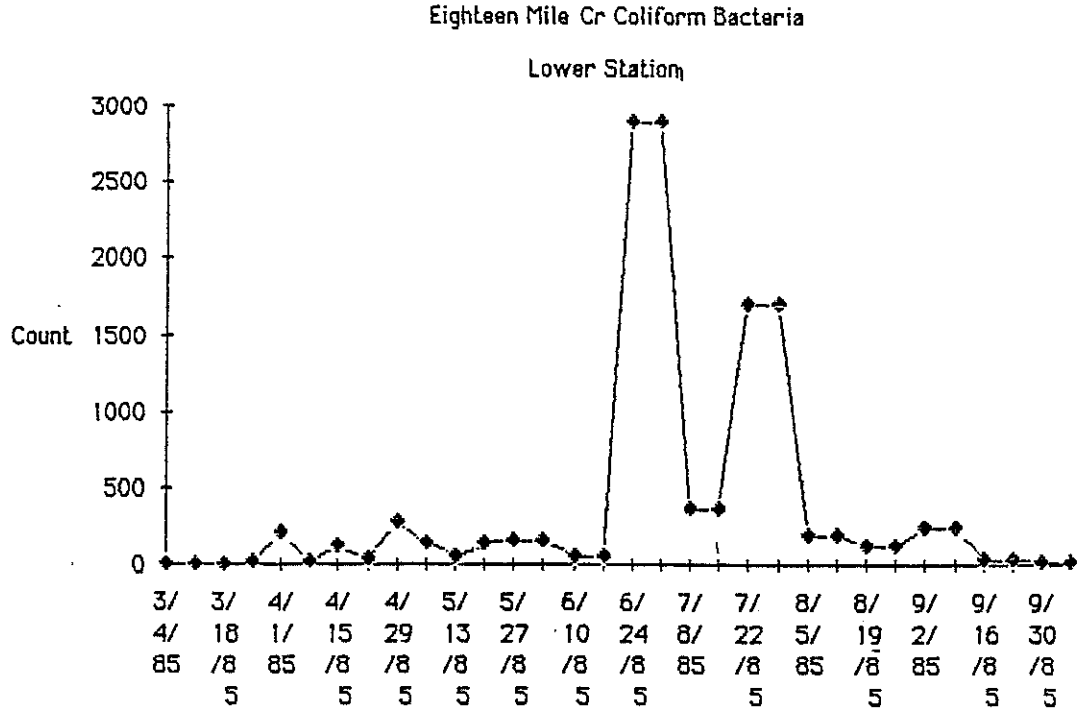


Figure 24: Fecal Coliform Bacterial Concentrations in a 100 ml Sample of Water from Eighteen Mile Creek at the Lower Station

and an increase in the waterfowl population in the area.

Tributary bacterial trends are dramatically impacted by livestock activity and runoff from grazing and wintering areas. A small spring in the headwaters of Eighteen Mile Creek showed increased bacterial numbers during the spring warming trend. This was most likely due to goats that were penned close by (Figure 23). Lower Eighteen Mile Creek also shows an increase in bacterial concentrations associated with spring runoff (figure 24) but this is overshadowed by the summer concentrations possibly due to pasturing horses in the vicinity of the sampling station.

Lower Topance Creek also shows increased bacterial concentrations due to the effects of livestock grazing in the pasture above this sampling station (see figure 25). Similarly, a dairy operation has affected bacterial quality of the water on Twentyfour Mile Creek (figure 26). Smaller peaks in March, April and May are due to runoff from the barnyard adjacent to the stream at station two. Summer peak concentrations in this stream are transmitted downstream to station three from station two on this tributary (see figure 27). The trends for these stations are similar at these two stations from June to September. No cattle grazed above site three during the 1985 pasture season. However, many cattle were wintered and calved immediately upstream of station three which may account for the April 1, 1985 concentration of about 3400 coliform bacteria per 100 ml of water.

Figure 25: Trend For Fecal Coliform Bacteria in 100 ml of Water from Lower Topance Creek

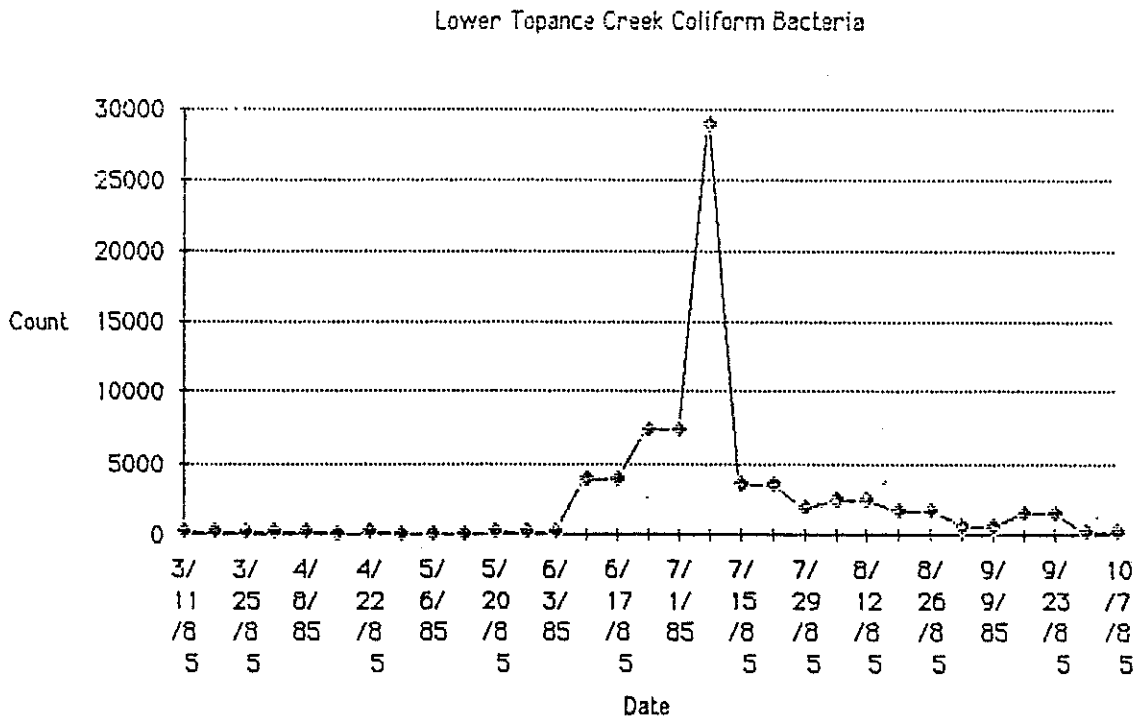
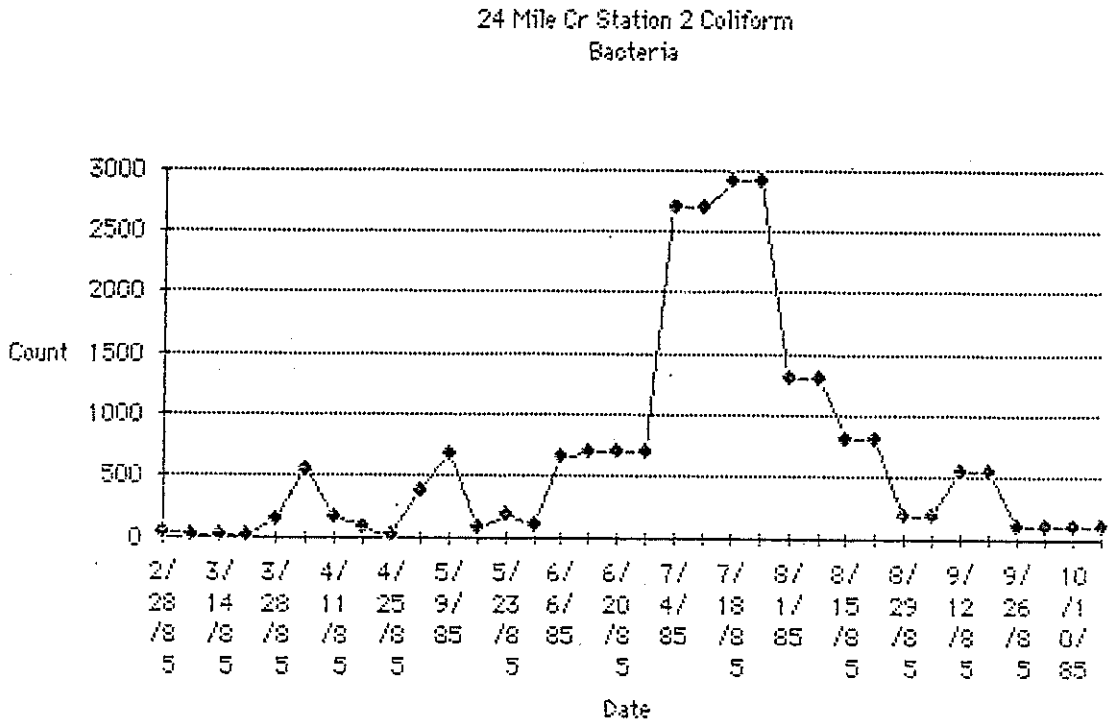


Figure 26: Trend For Fecal Coliform Bacterial Concentrations in 100 ml Samples of Water from Twenty Four Mile Creek at Station 2 (middle)



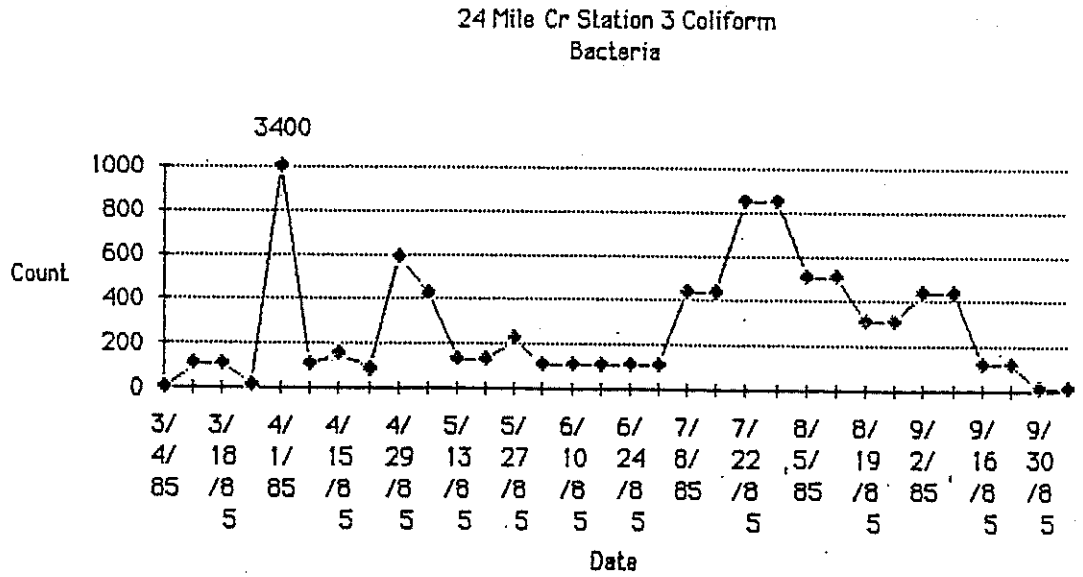


Figure 27: Trend for Fecal Coliform Bacterial Concentrations in 100 ml Samples of Water From Twenty Four Mile Creek at Station 3 (lower)

Nutrient Concentrations in River and Tributaries

Nitrogen

Organic nitrogen concentrations (as TKN) measured at the river stations increase during periods of overland runoff in April (figure 28-30). The peak in September on figure 28 is thought to be due to the die off of algae in Portneuf Reservoir. Lowered nitrate concentrations during warmer months are indicative of periods of plant and algae uptake of nitrogen. Nitrate concentrations remain high in the river at and below station three (figure 30). The US EPA water quality criterion, to prevent nuisance algae growth, for nitrate (0.3 mg/l) is exceeded at this station for a large percentage of the year. Comparatively, the canal at station two shows the same seasonal pattern at lower concentrations (figure 29).

Tributary concentrations of organic and inorganic nitrogen compounds generally increased during runoff in watersheds containing livestock wintering areas or dairy operations (figures 30-34). The lower Topance Creek area showed elevated levels of organic nitrogen concentrations during June and July and are thought to be due to livestock grazing activities in the watershed (figure 34). This is suported by an increased level of fecal coliform and streptococcal bacteria corresponding to the peak in organic nitrogen (see figure 25).

Phosphorus

Increased concentration of both ortho-phosphorus and total phosphorus correspond with the period of increased overland runoff and snowmelt (figures 35 - 37). The US EPA recommended phosphorus criteria, to prevent nuisance algae growth, of 0.1 mg/l is exceeded during the runoff phase of the hydrograph and in June and late September at river station three (figure 37). These latter peaks could be the result of wild and domestic animal activity in riparian areas. Similar trends are

noticeable at stations one and two (figures 35 and 37).

Tributaries also show increased concentrations of phosphorus compounds during runoff (figures 38 - 41). Peak concentrations of total phosphorus are correlated with the position of the station in the watershed. Lower stations have smaller peaks for total phosphorus than upper stations due to settling out of the sediment associated fraction of phosphorus (compare peak on figures 38 and 39, and review station descriptions). This is further supported by the lower Eighteen Mile Creek trend for these elements. Anomalous trends are noticeable in Lower Topance Creek which maybe explained by the effects of livestock in the area (figure 41).

Nutrient Loads

Monthly average nutrient export (Nitrate, Organic Nitrogen, Total Phosphorus and Ortho-Phosphorus) in pounds per day for each river station is shown in figures 42-44. The effect of spring runoff is not shown at station one (figure 42) due to the Portneuf Reservoirs lack of discharge before June. High nutrient loss, especially organic nitrogen, in September is probably due to algae death in the reservoir upstream of this station.

Tributary nutrient export is shown on figures 45 - 48. Lower Eighteen Mile and Lower Twenty-four Mile Creek (figures 46 & 47) stations showed the greatest nutrient losses during the spring runoff. All tributaries exhibit the same nutrient loss patterns irrespective of proximity to livestock populations. Land treatment priorities for nutrient retention can be established by comparing streams of similar yearly average flows (see table 1). Land above the Lower Eighteen Mile Creek station needs to be managed to control loss of nitrogen to the stream. The Twentyfour Mile Creek drainage needs to be managed to control phosphorus losses. Comparison of maximum nutrient export during the runoff phase of the hydrograph (figures 30-33) shows that Eighteen and Twentyfour Mile Creeks export nitrogen and phosphorus most at this time.

SUMMARY

Sediment

Most of the sediment movement in the drainage occurs during the runoff portion of the year. April of 1985 was the month of greatest sediment movement at all of the stations. The entire drainage discharged 755866 lbs/day of sediment at the peak of runoff. Canal bank erosion was responsible for the amount of sediment carried by the canal to exceed other areas in the drainage and the entire drainage as a whole. Sustained flows in the canal contribute to greater sediment transport when compared to streams under a natural flow pattern.

Twentyfour Mile Creek carried twice the ammount of sediment than any other tributary in the year under study. This is due to instability of streambanks in the upper reaches of the stream. This erosion has caused altered stream channels and flooding in depositional areas of the watercourse. Lower Topance Creek carried about half the sediment that Twentyfour Mile Creek did and Eighteen Mile Creek carried the next greatest ammount.

Bacteria

The ratio of fecal coliform to fecal streptococcal bacteria (<0.7) indicate that all bacterial contamination in the watershed comes from a nonhuman source. Samples taken directly downstream from livestock grazing areas, winter feeding operations and dairies show livestock to be a source of contamination for all tributaries and the river. Waterfowl are a source of contamination in the fall when birds stage prior to migration.

Nutrients

The primary period of nutrient loss (nitrogen and phosphorus) for the watershed is during spring runoff. Eighteen Mile Creek is the tributary that losses the most nitrogen and Twentyfour Mile Creek losses the most phosphorus. Nitrogen concentration in waters varied with plant uptake of inorganic nitrogen, and leaching of inorganic and organic nitrogen from

livestock wastes. Death of algae in the Portnuef Reservoir also increased organic and inorganic nitrogen in river and canal waters. Phosphorus concentration in water varied with runoff and sediment transport.

CONCLUSIONS

Stream bank erosion, sheet and rill erosion and gully erosion have all contributed to past and present problems in this drainage. Conservation practices should be installed in areas the Soil Conservation Service determines to be areas of critical erosion. Priority stream segments for sediment control determined from Water Quality data are the Marsh Valley/Downey canal. Twentyfour Mile Creek and the Topance feeder canal.

Bacterial numbers may be reduced if access to streams by livestock are curtailed. Priority tributaries for control measures are Twentyfour Mile Creek, Topance Creek, and Eighteen Mile Creek.

Land treatment practices that control erosion should also help control phosphorous losses in Twentyfour Mile Creek. Practices to control nitrogen losses should be applied to Eighteen Mile Creek.

Figure 28: Concentrations of Nitrate and Total Kjeldahl Nitrogen in River Station One for the Sampling Period

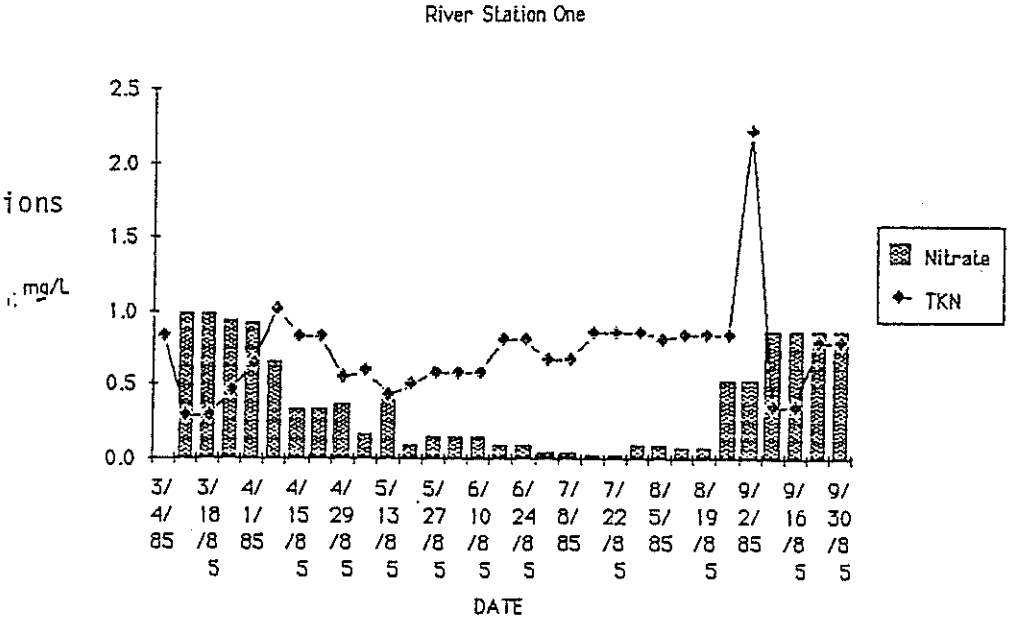


Figure 29: Concentrations of Nitrate and Total Kjeldahl Nitrogen in River Station Two for the Sampling Period

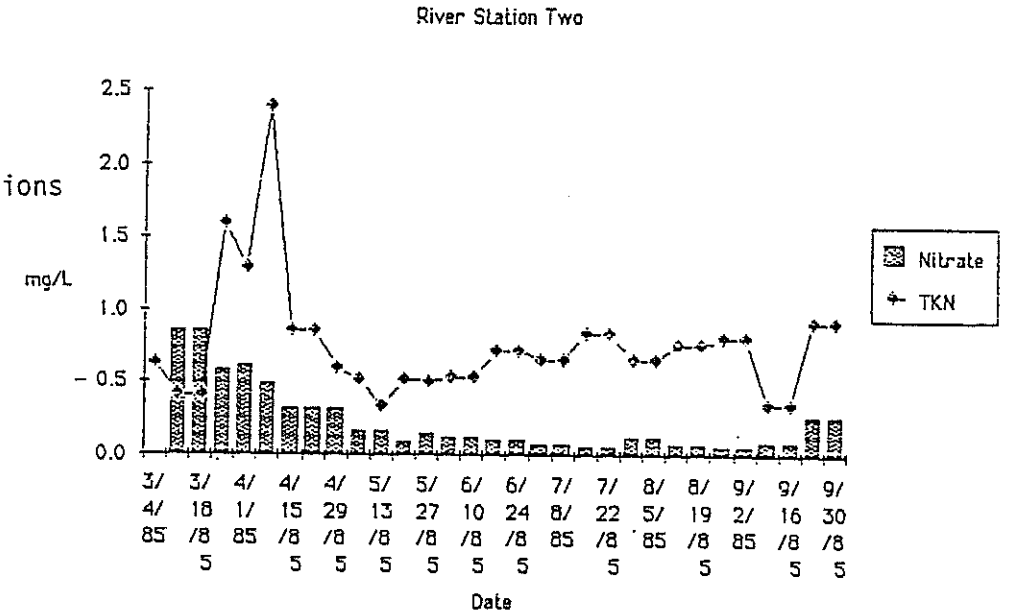


Figure 30: Lower Eighteen Mile Creek Concentrations of Nitrate and Total Kjeldahl Nitrogen

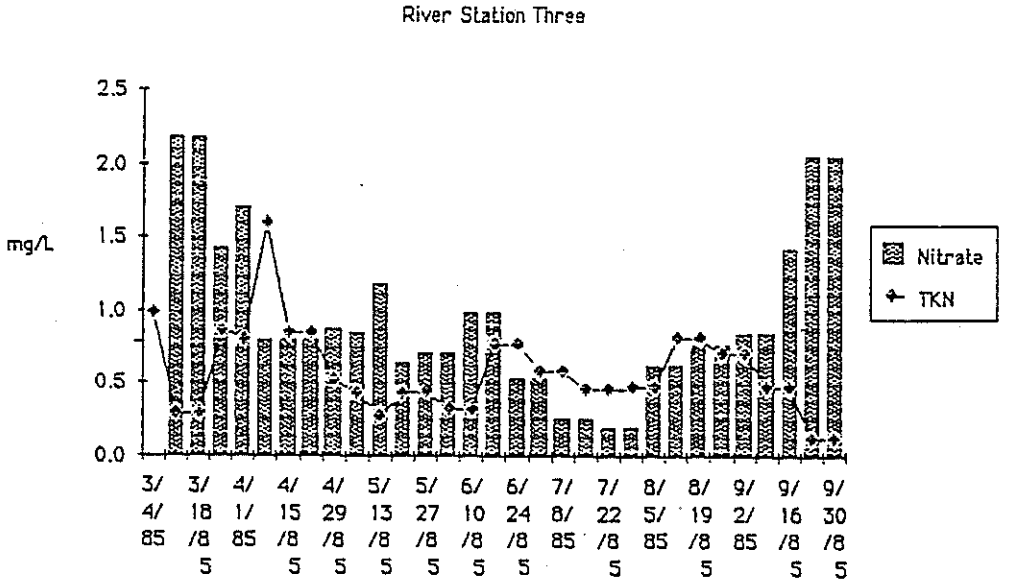


Figure 31: Concentrations of Nitrate and Total Kjeldahl Nitrogen in Twenty Four Mile Creek at Station Two

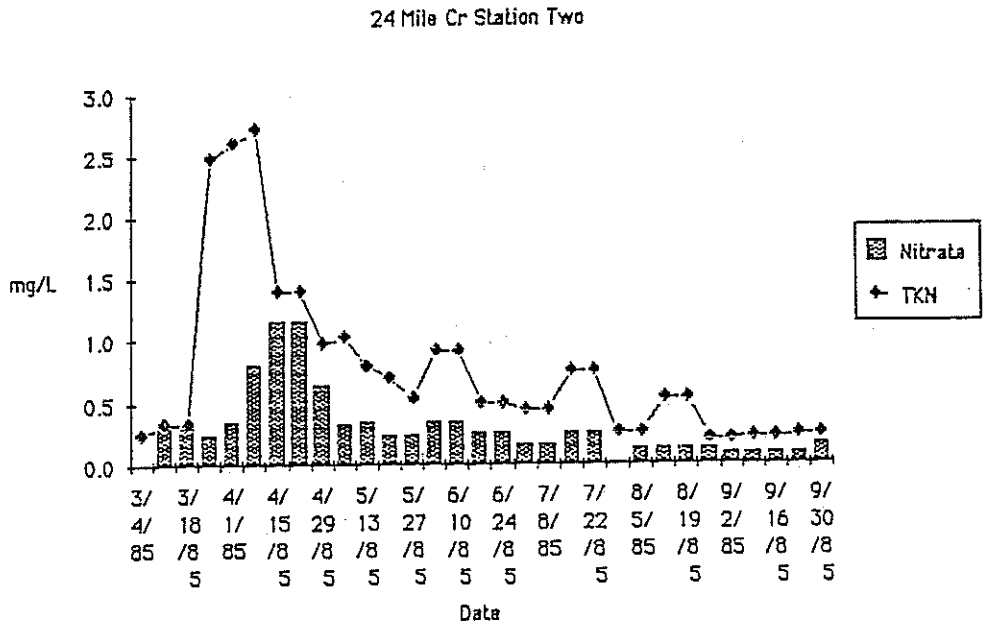


Figure 32: Concentrations of Nitrate and Total Kjeldahl Nitrogen in Twenty Four Mile Creek at Station Three

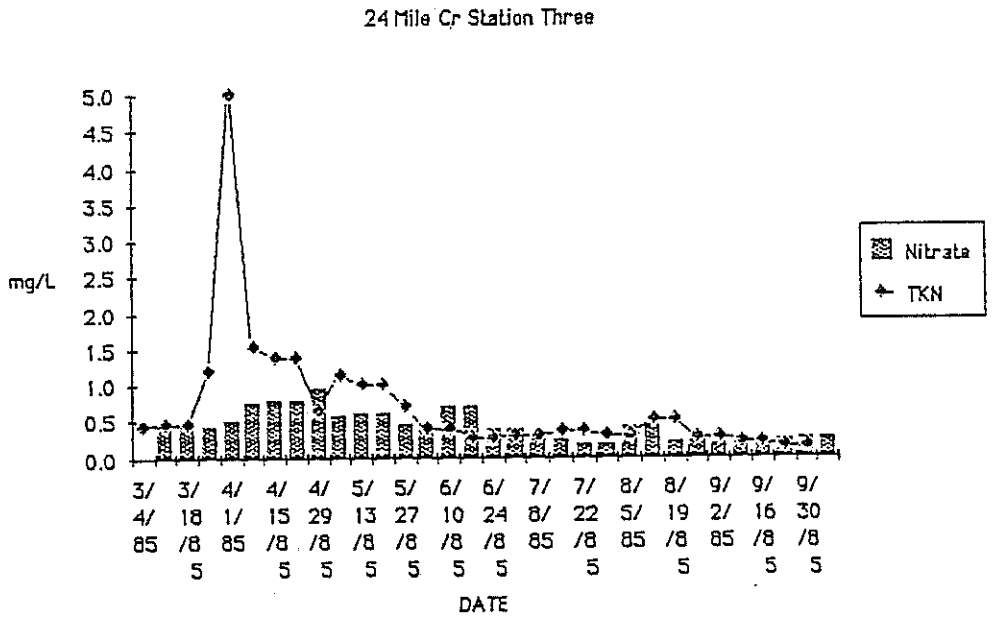


Figure 33: Lower Eighteen Mile Creek Concentrations of Nitrate and Total Kjeldahl Nitrogen

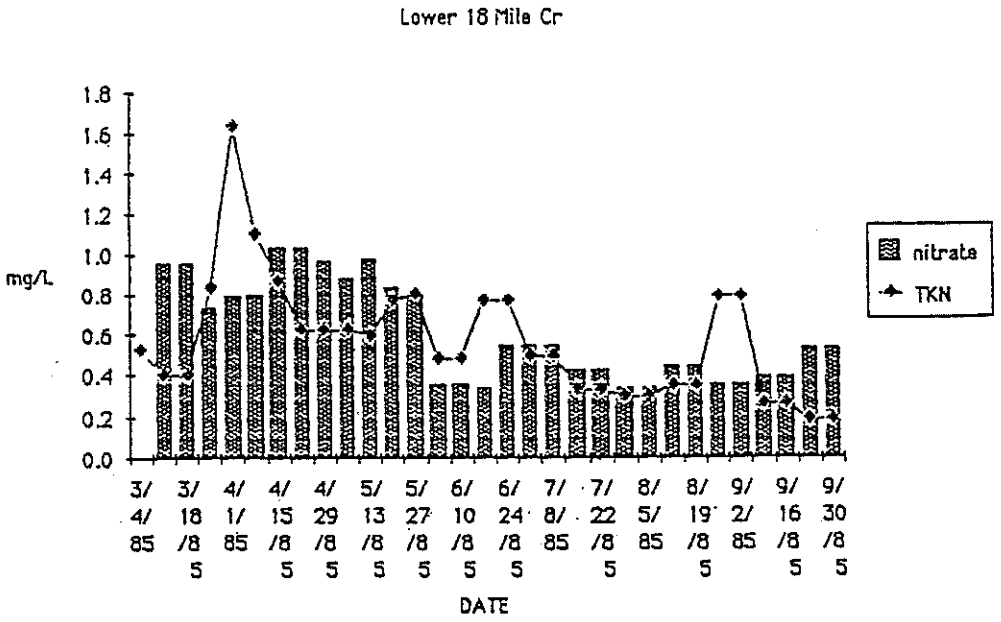


Figure 34: Lower Topance Creek Concentrations of Nitrate and Total Kjeldahl Nitrogen

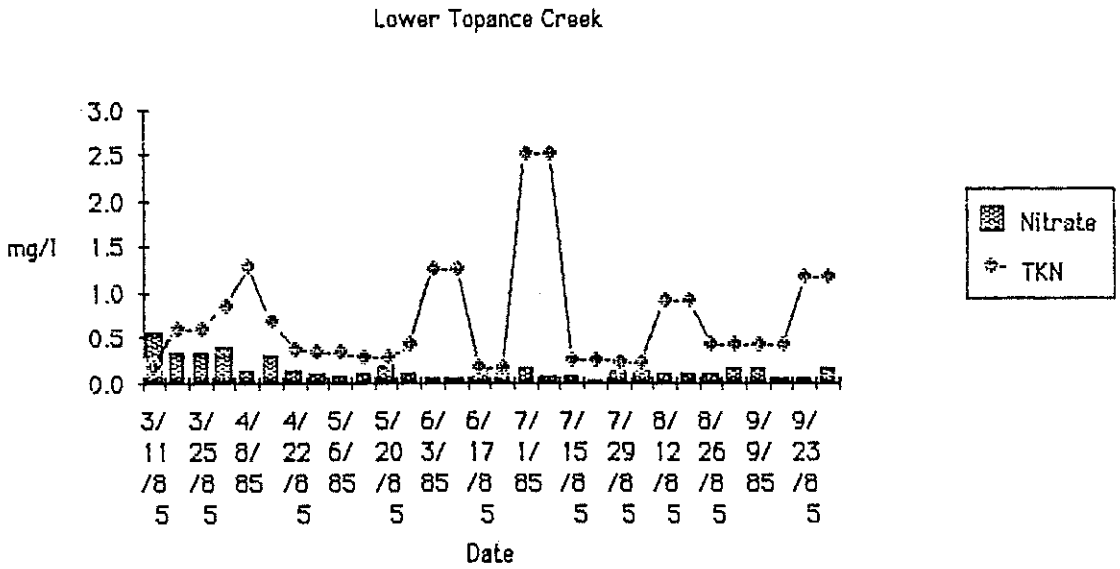


Figure 35: River Station One, Concentrations of Total and Ortho-phosphorus

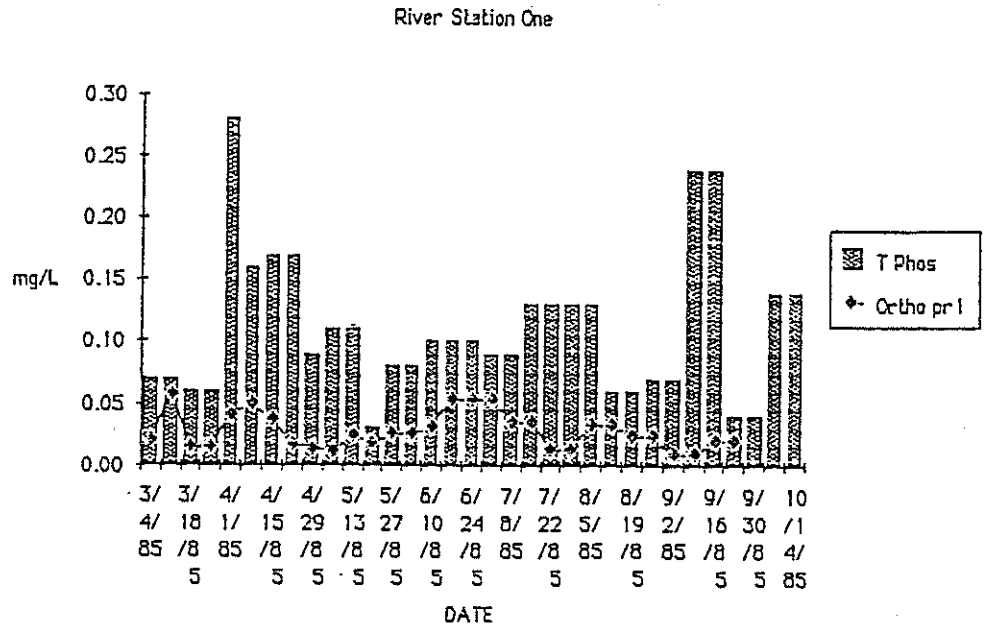


Figure 36: River Station Two, Concentrations of Total and Ortho-phosphorus

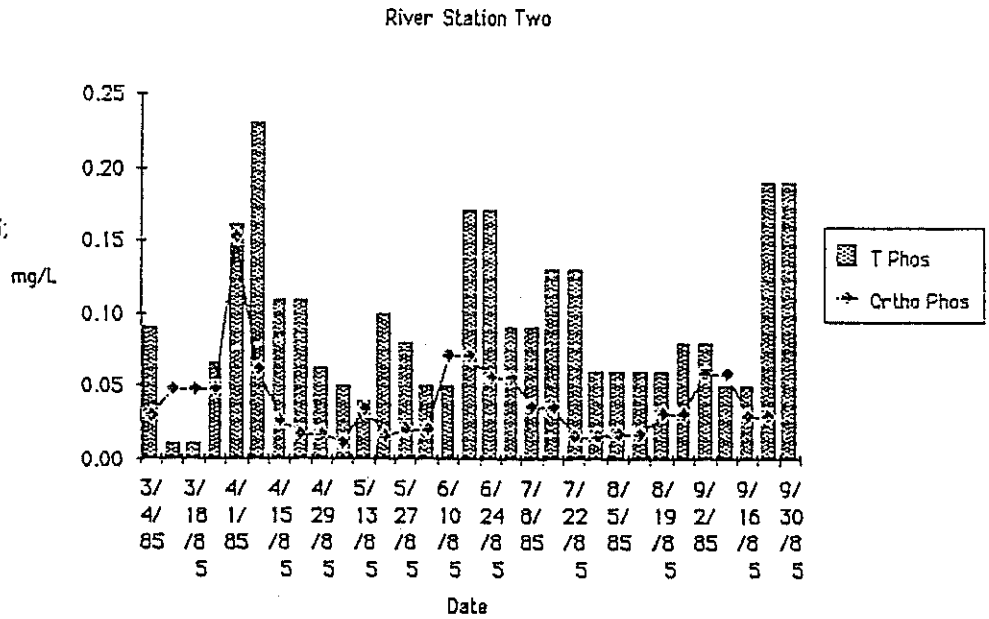


Figure 37: River Station Three, Concentrations of Total and Ortho-phosphorus

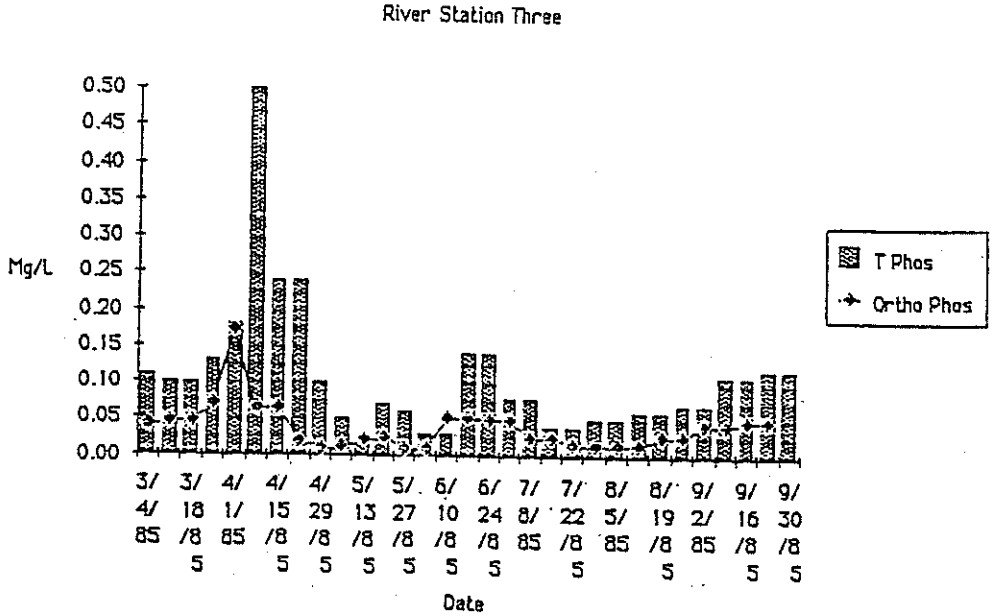


Figure 38:
Twenty Four Mile Creek Station Two, Concentrations of Total and Ortho-phosphorus

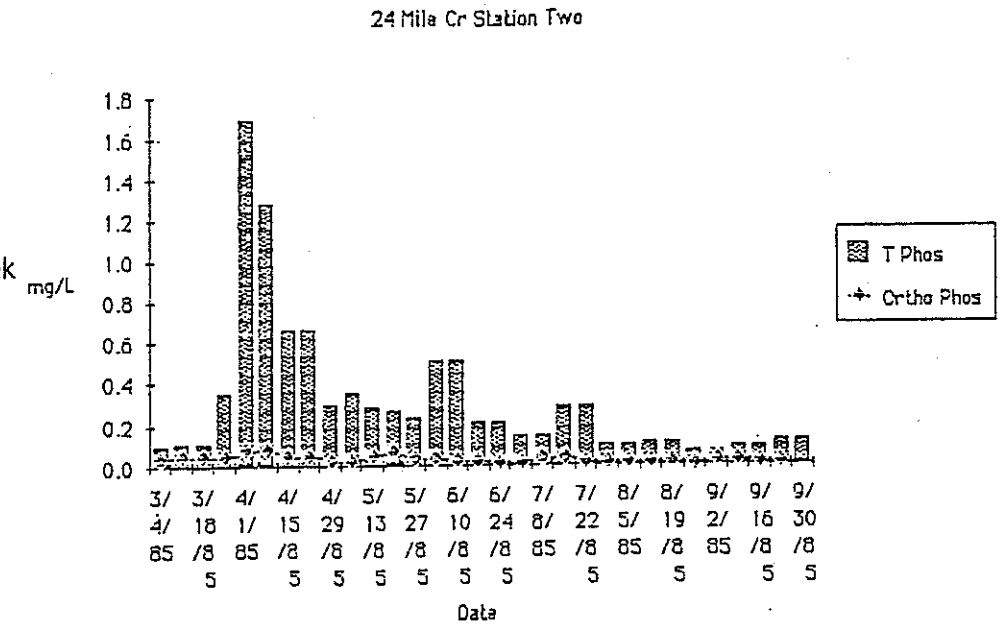


Figure 39:
Twenty Four Mile Creek Station Three, Concentrations of Total and Ortho-phosphorus

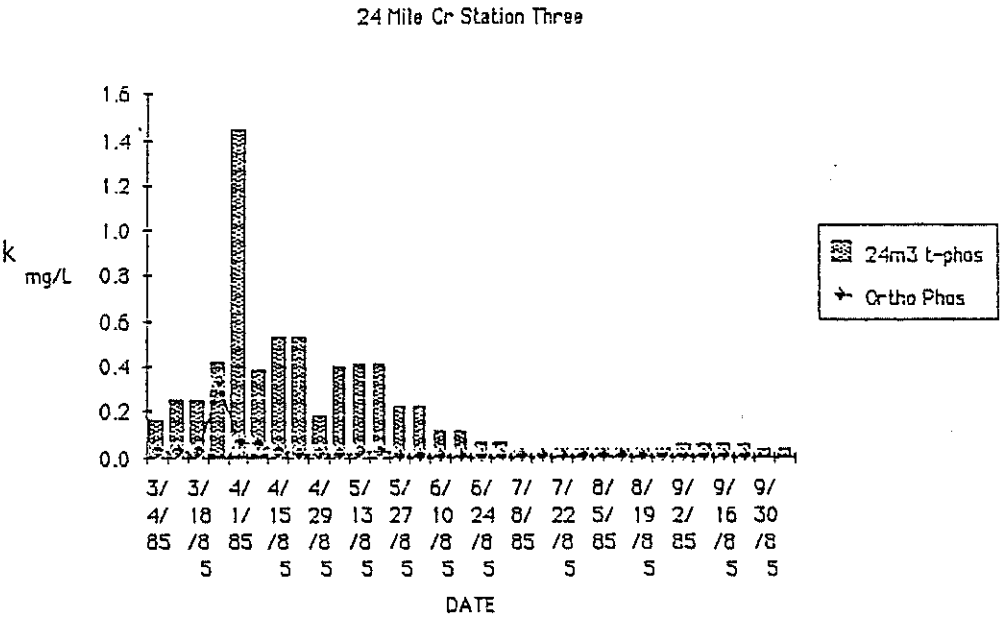


Figure 40:
Lower Eighteen Mile Creek, Concentrations of Total and Ortho-phosphorus

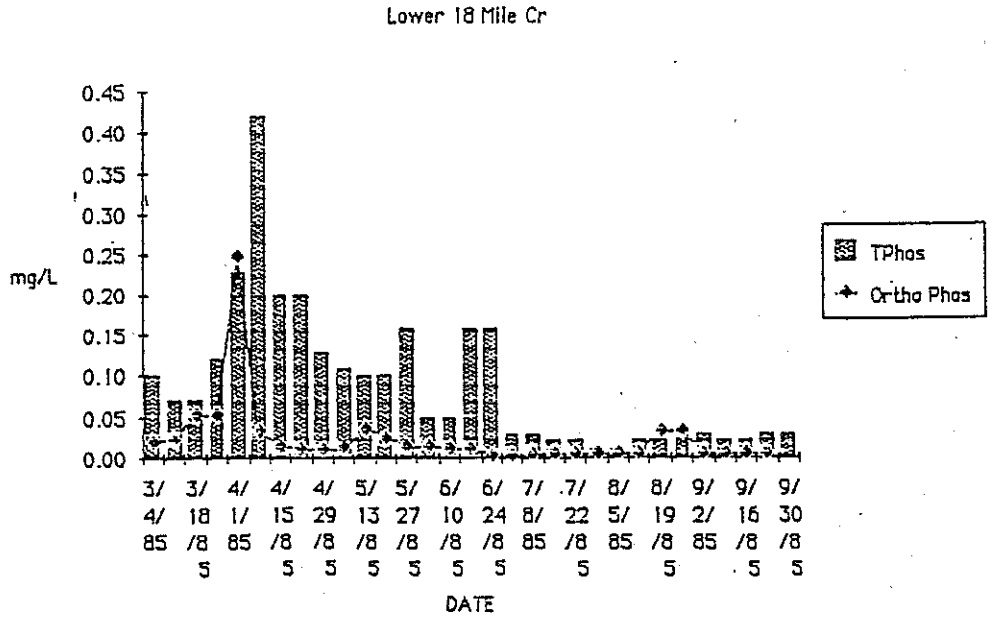


Figure 41: Lower Topance Creek, Concentrations of Total and Ortho-phosphorus

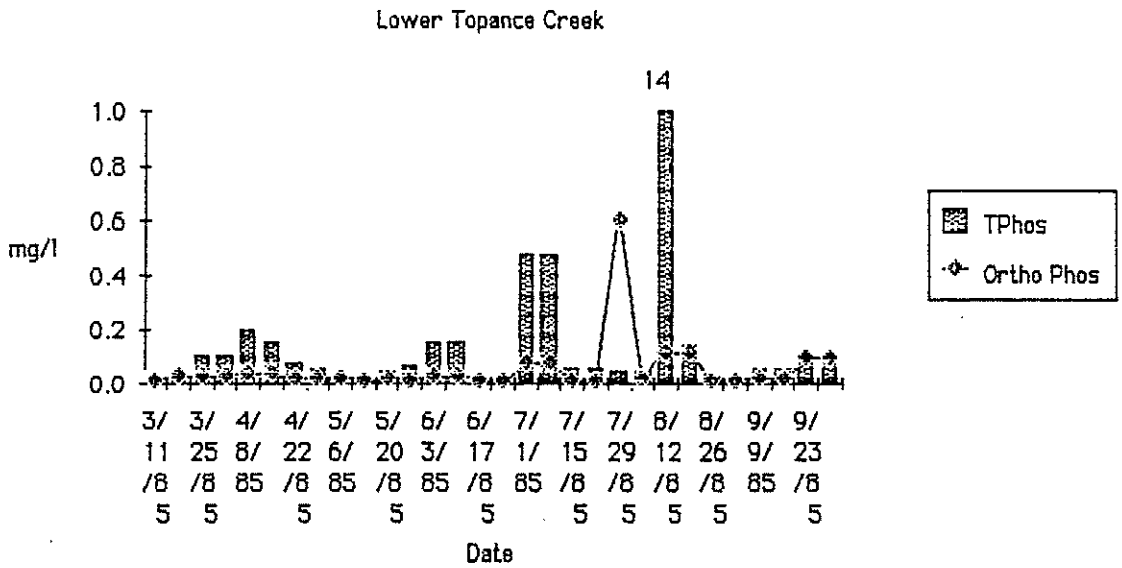


Figure 42: Monthly Flow-weighted Average Pounds Per Day for Nutrients at River Station One

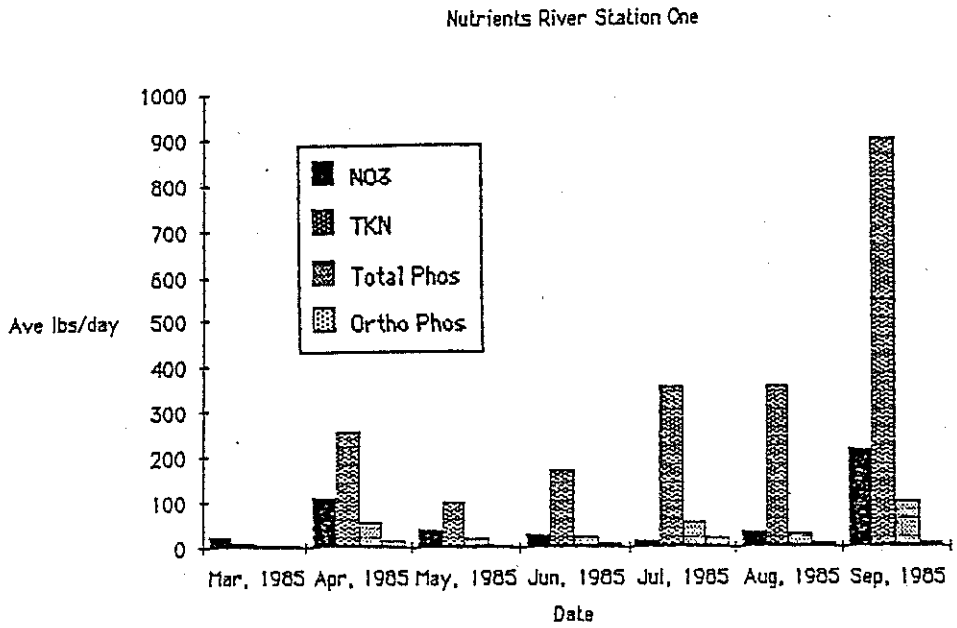


Figure 43: Monthly Flow-weighted Average Pounds Per Day for Nutrients at River Station Two

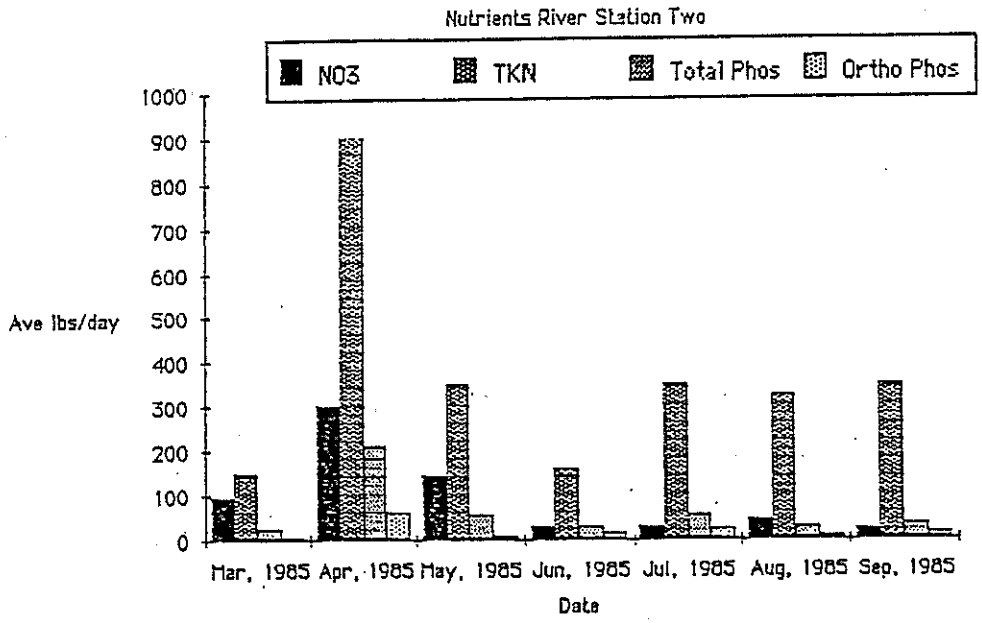


Figure 44: Monthly Flow-weighted Average Pounds Per Day for Nutrients at River Station Three

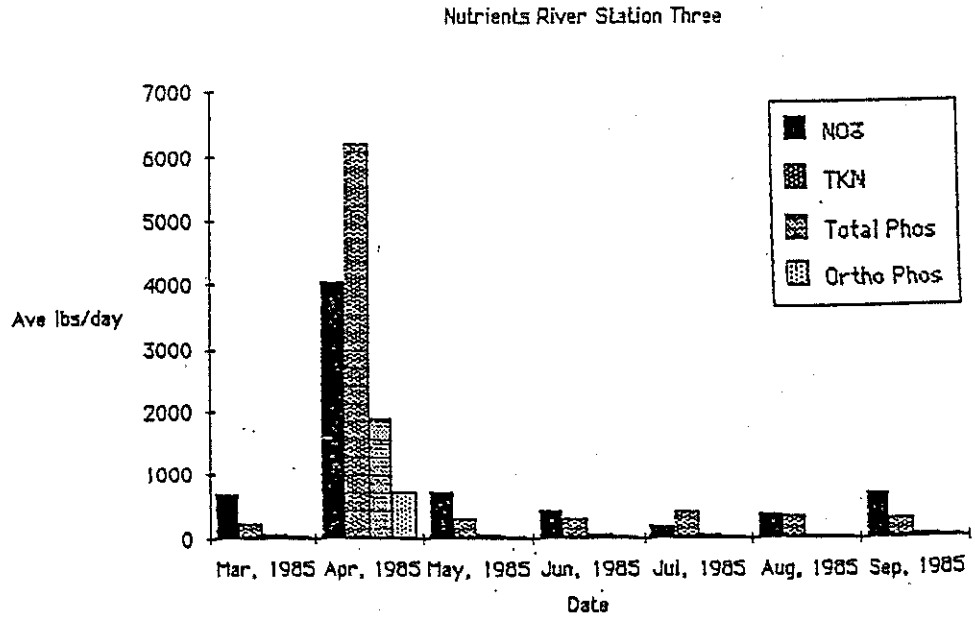
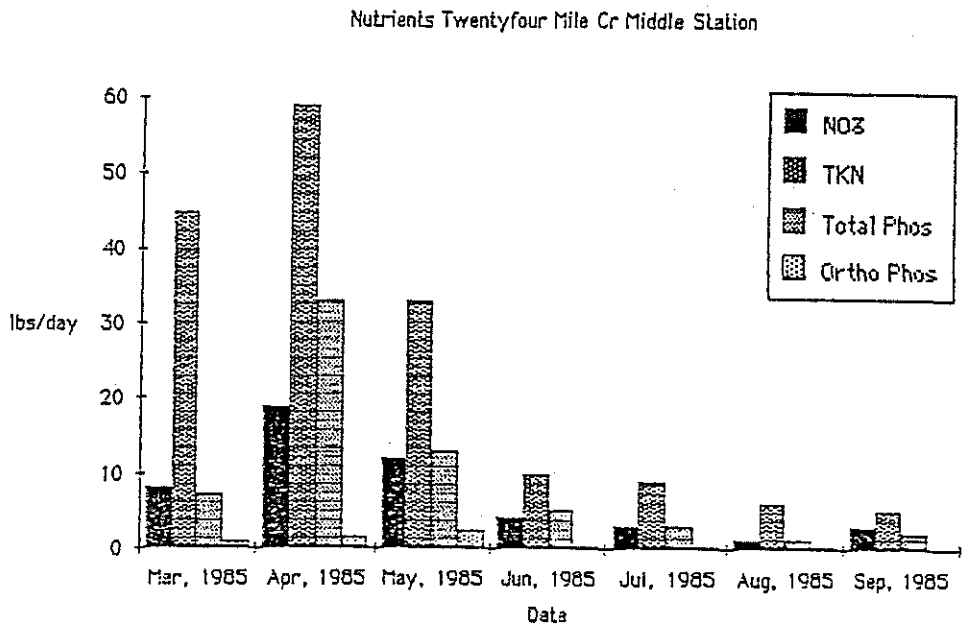


Figure 45: Monthly Flow-weighted Average Pounds Per Day for Nutrients in Twenty Four Mile Creek at Station 2 (middle)



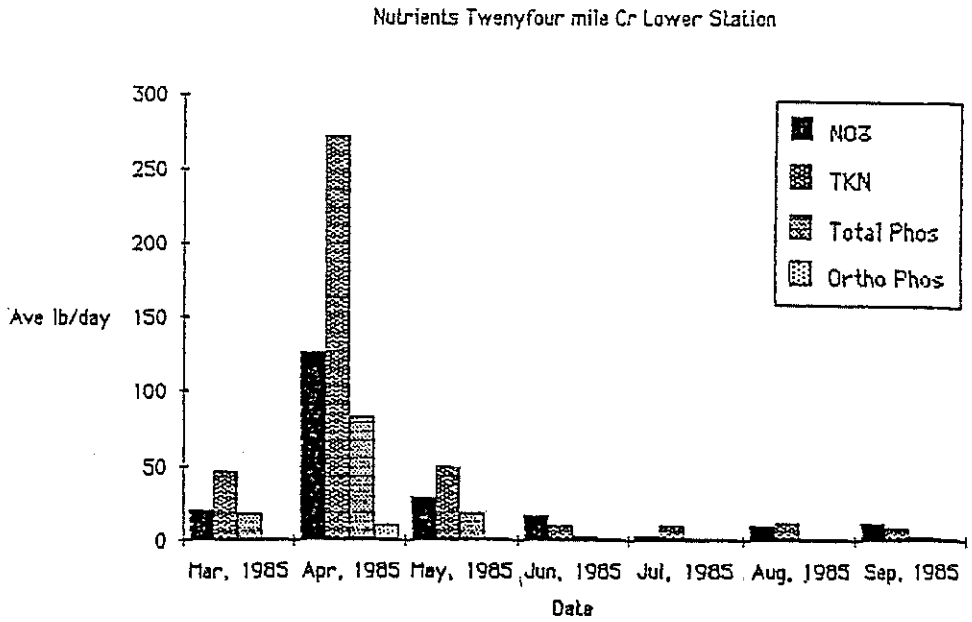


Figure 46: Monthly Flow-weighted Average Pounds Per Day for Nutrients in Twenty Four Mile Creek at Station 3 (lower)

Figure 47: Monthly Flow-weighted Average Pounds Per Day for Nutrients in Eighteen Mile Creek at Lowest Station

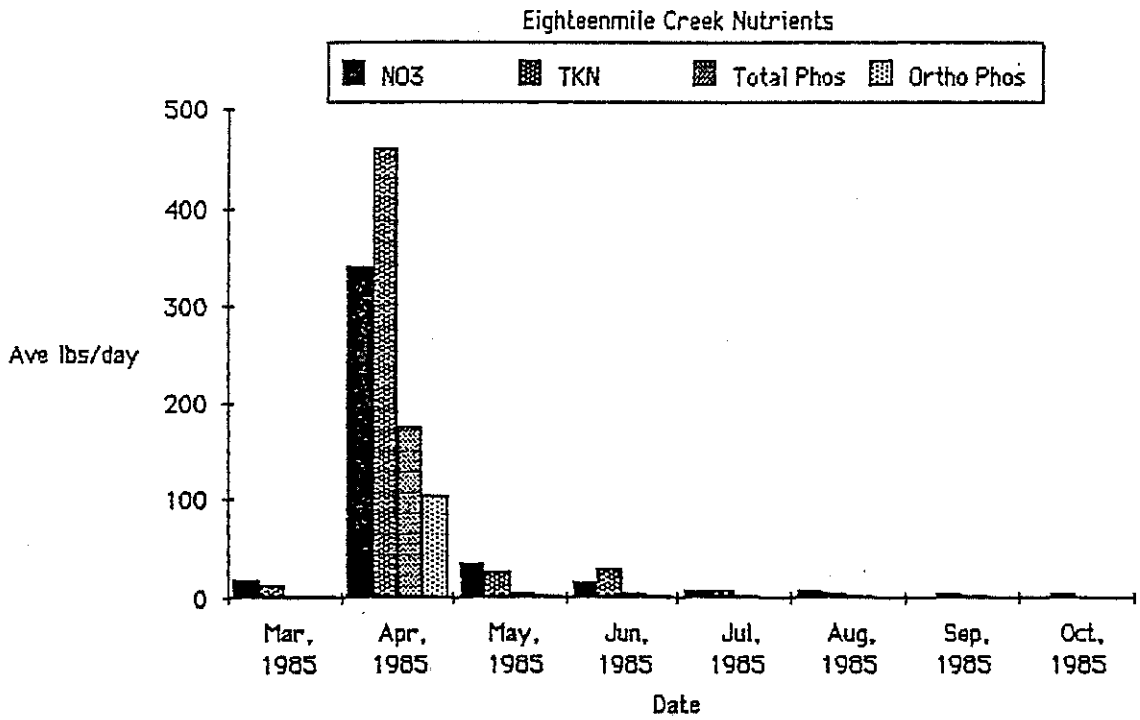


Figure 48: Monthly Flow-weighted Average Pounds Per Day For Nutrients At Lower Topance Creek Station

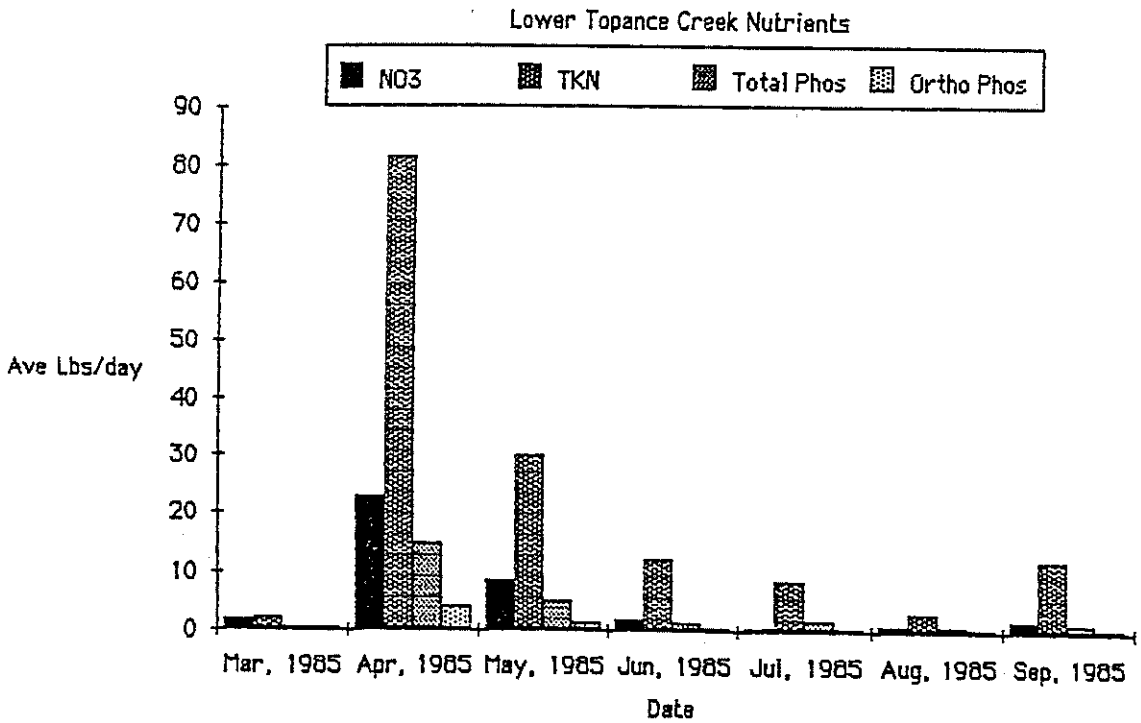


TABLE 1. Flow-weighted Average Pounds Per Day for Nutrients Ranked by Yearly Average Flow (in cfs).

Station	Average Flow (cfs)	Nutrients in Pounds Per Day			
		NO_3	TKN	T-Phos	Ortho-Phos
Eighteen Mile Creek (upper)	2	3	3	0.3	0.05
Eighteen Mile Creek (lower)	5	19	18	3	0.38
Twenty-four Mile Creek (middle)	5	6.5	16	6.5	0.99
Twenty-four Mile Creek (upper)	7	0.42	1.5	0.19	0.01
Twenty-four Mile Creek (lower)	8	16.6	23.4	7.2	0.5
Topance Creek (lower)	11	6.5	25	3.7	0.8
Topance Creek (upper)	16	9.3	20.5	2.8	0.81
River Station 1	68	54	365	42	11
River Station 2	117	82	327	44	12
River Station 3	125	517	336	46	16

Literature Cited

American Public Health Association. Standard Methods for the Examination of Water and Wastewater. 1985.

Kitterell, FW. Apractical Guide to Water Quality Studies of Streams. U. S. Derparetment of the Interior, Federal Water Pollution Control Administration. 1969.

United States Environmental Protection Agency. Quality Criteria for Water. USEPA. Washington D. C., 1976.

Appendix

PORTNEUF RIVER SURVEY (Ag.)

116 = 851601

Station #	Description	Latitude/Longitude	River Mile	Elevation	STORET #
PR-1	Portneuf R bl confl of Topance Ck	42°50'45"/111°56'02"	324.30/371.20/78.7	5,325'	2080420
PR-2	Portneuf R E of Chesterfield Church 1 mi	42°49'30"/111°55'45"	324.30/371.20/76.4	5,323'	2080421
PR-3	Portneuf R ab confl of Pebble Cr	42°47'12"/111°58'47"	324.30/371.20/69.7	5,312'	2080041
EMC-1	18 Mi Ck @ Hatch-2/3 mi N of Intersection	42°49'10"/111°50'47"	324.30/371.20/76.8/.90/6.9	5,494'	2080425
EMC-2	Intermittent to 18 Mi Ck-2/3 mi W of Intersection	42°48'25"/111°51'38"	324.30/371.20/76.8/.90/5.8	5,422'	2080426
EMC-3	18 Mi Ck @ Brdg ab EW Rd-S @ Chesterfield	42°48'35"/111°53'09"	324.30/371.20/76.8/.90/3.8	5,378'	2080427
EMC-4	18 Mi Ck N @ Substation Rd-Brdg	42°49'55"/111°54'35"	324.30/371.20/76.8/.10/.9	5,328'	2080428
EMC-5	18 Mi Ck N of Substation-7 mi S	42°50'10"/111°54'35"	324.30/371.20/76.8/.90/.7	5,338'	2080429
TMC-1	24 Mi Ck-1 mi SE of Reservoir Spillway	42°53'30"/111°52'45"	324.30/371.20/76.8/7.0	5,755'	2080432
TMC-2	24 Mi Ck-E of Chesterfield along EW Rdway	42°51'50"/111°53'27"	324.30/371.20/76.8/4.5	5,390'	2080433
TMC-3	24 Mi Ck-W of Substation Rd-2/3 mi Nr Ranch	42°50'13"/111°55'24"	324.30/371.20/76.8/1.3	5,320'	2080434
WBC-1	W Branch Canal Nr Gravel Pit-1 mi SW Bancroft	42°42'00"/111°53'38"	None	5,480'	2080437
WBC-2	W Branch Canal @ RR Bridge by Hwy	42°44'30"/111°55'00"	None	5,440'	2080438
TPC-1	Topance Ck where Ck crosses Rd	42°51'19"/111°59'00"	324.30/371.20/78.7/3.1	5,333'	2080444
TPC-2	Topance Ck @ Forest Service Boundary	42°52'19"/112°02'43"	324.30/371.20/78.7/7.8	5,760'	2080445
#1	Corral Drain	42°46'05"/111°58'20"	None	5,330'	2080446
#4	Topance Canal @ Reservoir (Feeder Canal)	42°52'46"/111°57'00"	None	5,400'	2080447

Figure 49

Topance Creek Trend for Fecal Coliform/Fecal Streptococcus Ratio

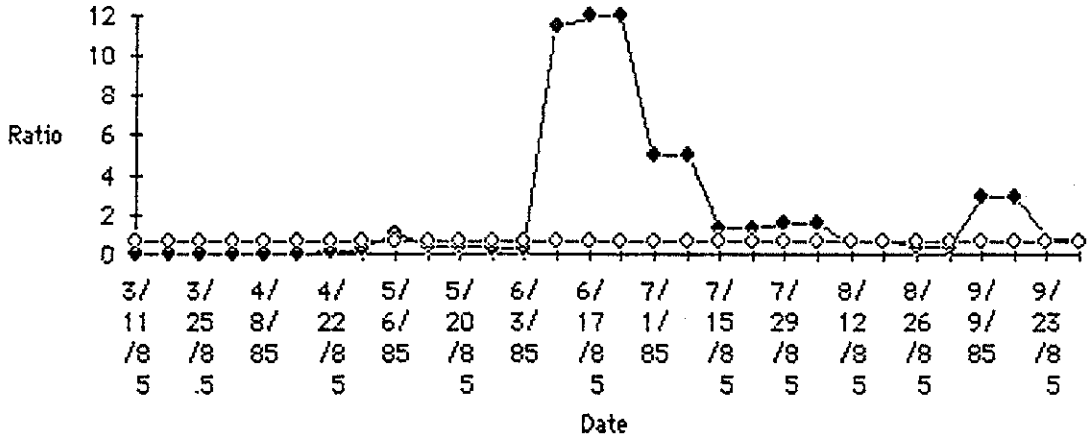


Figure 50

Twentyfour Mile Creek Trend for Fecal Coliform/Fecal Streptococcus Ratio

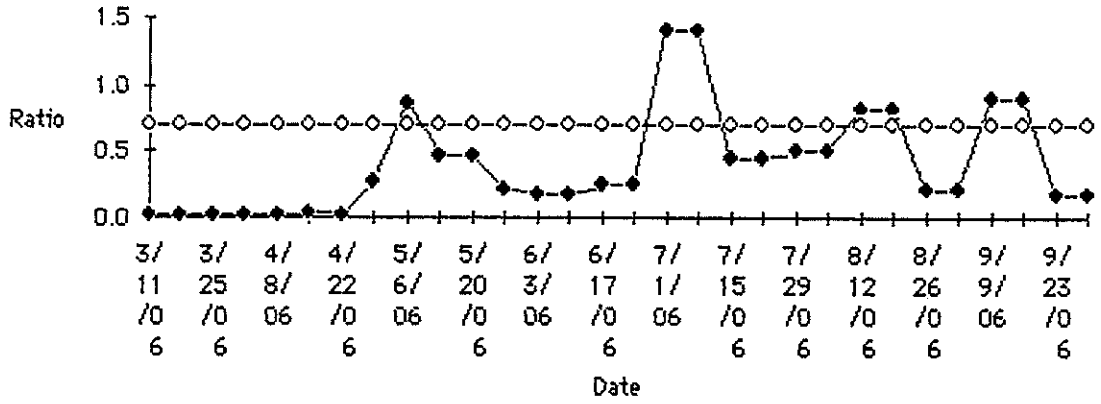
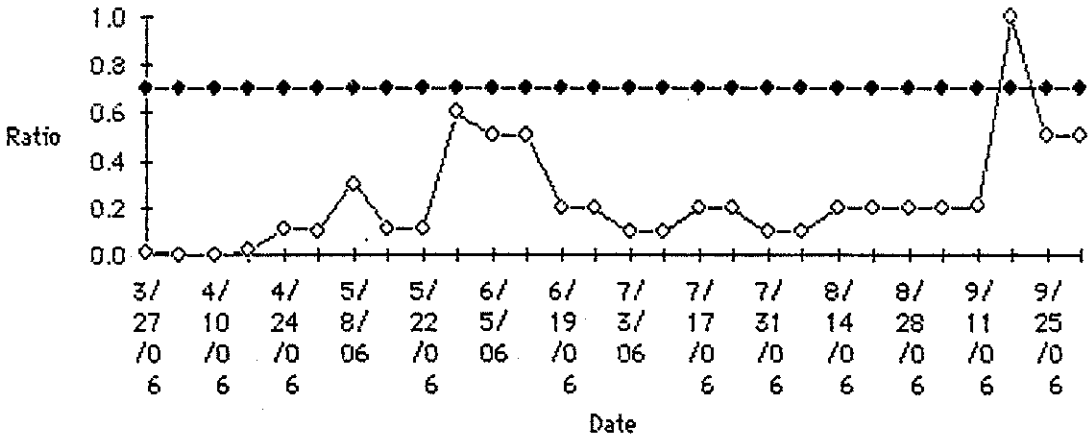


Figure 51

Fecal Coliform/Streptococcus Ratio At River Station Three