WATER QUALITY OF

THE ELBOW RIVER

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OVERVIEW

The Elbow River is a tributary of the Bow River in the South Saskatchewan River basin. It flows through Subalpine, Boreal Foothill, and Aspen Parkland ecoregions before joining the Bow River in downtown Calgary. Urban development along the Elbow River upstream of Calgary is limited, as much of the watershed here is used for recreation or agriculture. There is one mainstem impoundment on the Elbow River, the Glenmore Reservoir, which was completed in 1932 and now provides Calgary with approximately 50% of it's drinking water. City of Calgary officials have expressed concern that drinking water quality may deteriorate because proposed residential development upstream of the reservoir could increase the loading of nutrients and other contaminants.

Because of ongoing concerns with respect to this important watershed, Alberta Environment initiated a detailed survey of the river in 1988 to develop a basin overview of water quality. The specific objectives of this survey were to: 1) assess the effects of existing development on water quality of the Elbow River upstream of Calgary; 2) examine phosphorus loading patterns and determine major sources, particularly during peak flow conditions; and 3) provide baseline data to assess the effects of future development. Because the limnology of the reservoir was not investigated in this study, no attempt has been made to link river water quality with reservoir conditions.

This report summarizes the major findings of the investigation. The reader should note that the design and implementation of appropriate management strategies to protect river water quality for future use will inevitably require more detailed, site-specific study.

In general, water quality was good upstream of Calgary, although increases in particulate matter during peak flow conditions predictably reduced water quality for short periods. There were few cases of any variables exceeding Canadian Water Quality Guidelines or Alberta Surface Water Quality Objectives and most that occurred did so during peak flow. There were no licensed municipal or industrial discharges upstream of Calgary during the period of study (1988-1990).

Most of the phosphorus in the river upstream of the Glenmore Reservoir was in particulate form. High levels of particulate phosphorus were transported by the Elbow River during peak flow between the site downstream of Bragg Creek and the Sarcee Barracks Bridge site, probably as a result of scouring of the floodplain or erosion of the river's banks.

Average phosphorus levels upstream of Bragg Creek were usually below the analytical detection limit. A comparison with historical data suggested that the development of Kananaskis Country in the Elbow River watershed did not increase nitrogen and phosphorus levels in the river between 1979 and 1988-1989. Nitrite+nitrate levels upstream of Calgary decreased between 1982 and 1990, whereas calcium, magnesium, and chloride concentrations increased over the same period.

Three main tributaries were also sampled during the study. McLean and Bragg creeks appeared to have little effect on water quality of the Elbow River, probably because of dilution. Lott Creek, however, had a higher discharge and therefore, a greater loading of

total nitrogen, total phosphorus, and fecal coliforms into the Elbow River than did the other two creeks.

At the 9th Avenue Bridge site near the mouth, the Elbow River is influenced by urban stormwater and, to a much lesser degree other effluents and had elevated levels of aluminum, barium, iron, sodium, potassium, chloride, epilithic chlorophyll a, fecal and total coliforms, nitrate+nitrite, and total nitrogen. Aluminum levels exceeded the Canadian Water Quality Guideline to protect aquatic life in over 50% of the samples at this site, and total coliform levels frequently exceeded the Alberta Surface Water Quality Objectives for recreational use.

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1.0 INTRODUCTION

The Elbow River is a tributary of the Bow River in the South Saskatchewan River basin, originating in the eastern slopes of the Rocky Mountains. It flows through Subalpine, Boreal Foothills, and Aspen Parkland ecoregions to join the Bow River near downtown Calgary (Figure 1). There is one mainstem impoundment on the Elbow River, the Glenmore Reservoir, which was completed in 1932. In 1988, the Glenmore Reservoir provided the City of Calgary with approximately 50% of its drinking water supply (Hargesheimer and Lewis 1988).

The primary water quality concern for the Elbow River basin is the effect of increased upstream development on the water quality of Glenmore Reservoir. Agricultural, recreational, and residential developments may increase phosphorus and nitrogen loads to the reservoir, providing nutrients for algal blooms (Marshall, Macklin, Monaghan Ltd., 1984). Based on the Vollenweider eutrophication model and using 1982-83 data, the reservoir was classified as slightly eutrophic (Marshall, Macklin, Monaghan Ltd. 1984), and in 1986 it was classified as bordering on mesotrophic (Hargesheimer and Lewis 1988). Taste and odour problems in reservoir water have been reported occasionally by Calgary residents (Dixon 1991). In addition to nutrients, the Elbow River basin appears to provide the Glenmore Reservoir with the majority of its total suspended solids, turbidity, total alkalinity, total iron, fluoride, and barium loadings (Marshall, Macklin, Monaghan Ltd. 1984). The reservoir also receives direct stormwater inputs from the City of Calgary.

Because of ongoing concerns with respect to this important watershed, Alberta Environment initiated a detailed survey of the river in 1988 to develop a basin overview of water quality. The specific objectives of this survey were to: 1) assess the effects of present development on water quality of the Elbow River upstream of Calgary; 2) examine phosphorus loading patterns and determine major sources, particularly during peak flow conditions; and 3) provide baseline data to assess the effects of future development. The limnology of the Glenmore Reservoir was not addressed in this investigation.

1.1 STUDY AREA

In its headwaters, the Elbow River is a fast flowing, single-channel stream that flows through subalpine meadows and boreal forest. This region is used extensively for recreation as part of Kananaskis Country, with facilities for hiking, overnight camping, and

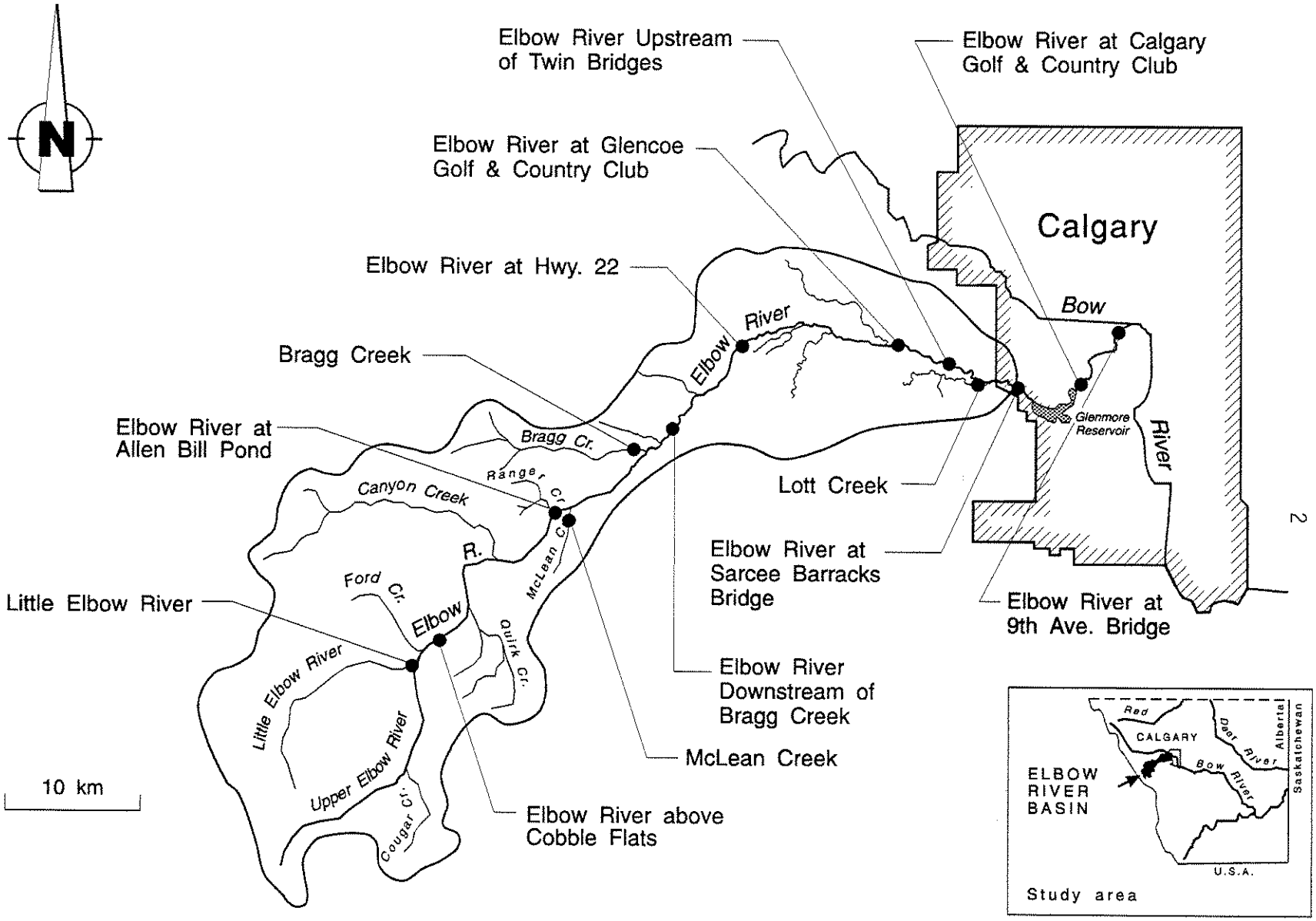

Figure 1. Elbow River Basin showing routine sampling locations.

horseback riding. Downstream of Bragg Creek, the channel begins to divide and meander, and the adjacent terrain changes from boreal forest to aspen parkland. Along this reach of the river there is increased agricultural activity. Between the sites upstream of the Twin Bridges and the Glenmore Dam, the increased meandering is accompanied by some slumping of the river's banks.

Four main tributaries were sampled routinely in this investigation: the Little Elbow River, McLean Creek, Bragg Creek, and Lott Creek. The Little Elbow River was the furthest upstream site and was assumed to be representative of pristine conditions. This site was selected because of the difficulty gaining access to the upper Elbow River in this area, and was treated as a mainstem site. The other three tributaries were sampled to assess their effects on water quality of the main river. McLean Creek enters the Elbow River in Kananaskis Country. Discharge at the McLean Creek sampling site is regulated by bottom release from a new reservoir (McLean Reservoir), which was constructed in 1985. Bragg Creek joins the Elbow River at the town of Bragg Creek and the lower Bragg Creek basin drains agricultural areas. Lott Creek is the largest of the three tributaries and flows into the Elbow River upstream of Sarcee Barracks Bridge. Lott Creek is spring-fed and therefore discharge is relatively constant throughout the year.

2.0 BASIN CHARACTERISTICS

2.1 HYDROLOGIC AND GEOMORPHIC FEATURES

The Elbow River originates from Elbow Lake (115° 00' 15s W, 50° 37' 20s N), in the eastern slopes region of the Rocky Mountains. Approximately 120 km downstream, the Elbow River joins the Bow River near downtown Calgary (Figure 1). The watershed covers 1230 km^2 of land within the Alpine, Subalpine, Boreal Forest, and Aspen Parkland ecoregions. The Elbow River is one of the steepest rivers in Alberta, originating at 2095 m above sea level and joining the Bow River at an elevation of 1033 m above sea level (Figure 2). The river bed is predominantly gravelly, cobble-sized alluvium (Hudson 1983).

The Glenmore Reservoir is 12 km upstream of the confluence with the Bow River. Seasonal flow patterns below the Glenmore Reservoir were similar to unregulated flows at Bragg Creek except that the peak discharge was less pronounced (Figures 3, 4). Peak flows in the Elbow River basin occur during mountain snowmelt, about 60% of the total annual

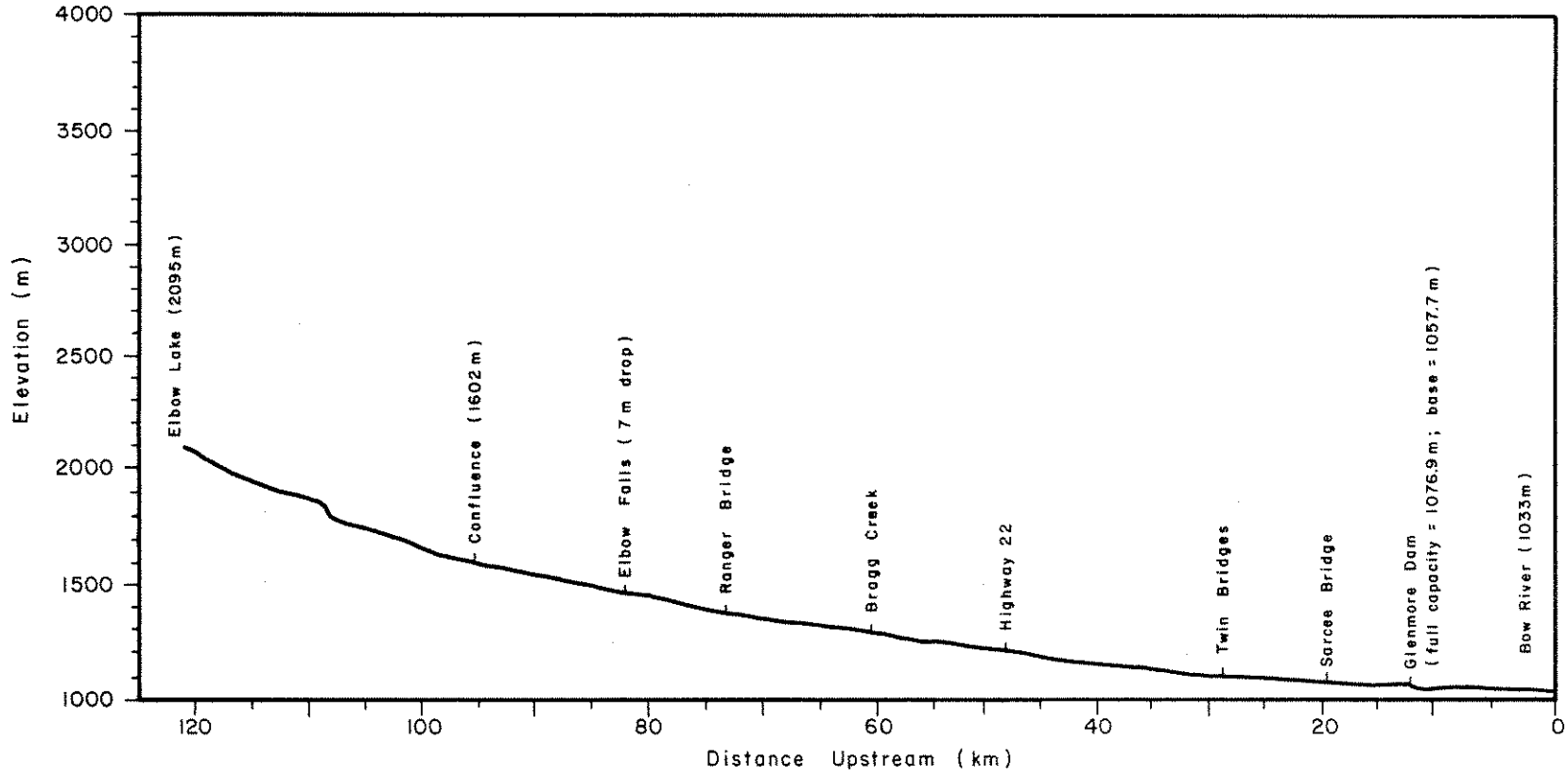

Figure 2. Elbow River longitudinal profile (from Hudson 1983).

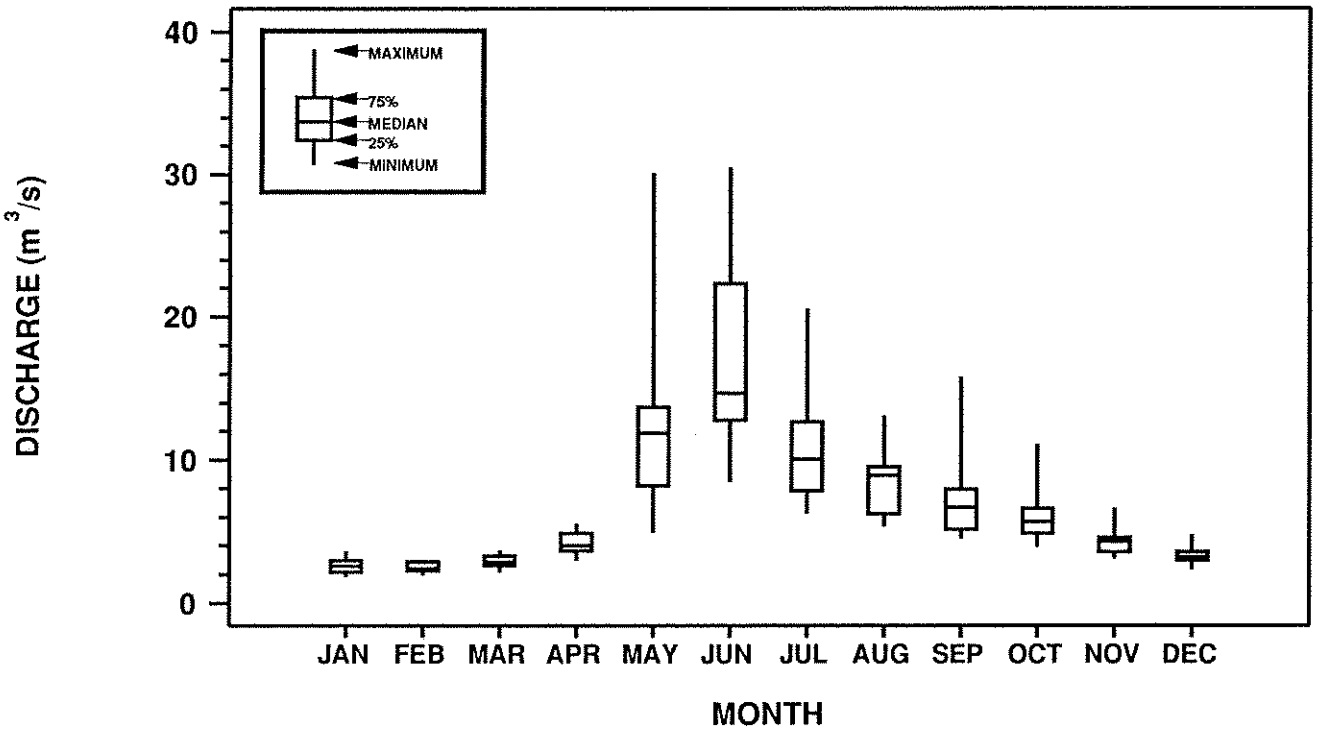

Figure 3. Median monthly discharge of the Elbow River as recorded at the Bragg Creek gauging station between 1968 and 1989.

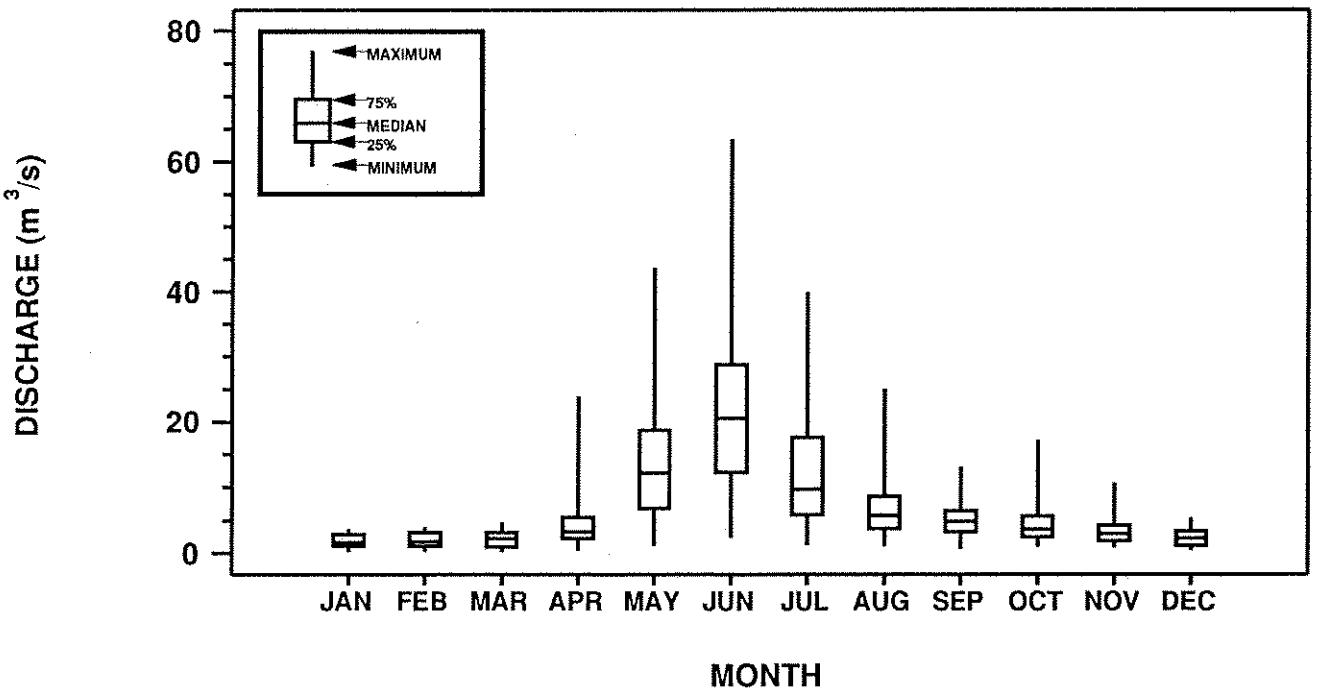

Figure 4. Median monthly discharge of the Elbow River as recorded below the Glenmore Dam gauging station between 1932 and 1990.

discharge occurring between May and July. June is usually the month of highest flow, 25% of the total annual discharge taking place then (Hudson 1983; Figure 3).

According to Hudson (1983), the sediment yield regime of the Elbow River basin is controlled by the hydrologic regime and the sediment supply regime. The steep, gravel bed river has a typical high latitude runoff regime. Flows are low during winter when the river is frozen over. Winter snowfall is effectively redistributed so that it is largely removed over a short period to produce a spring snowmelt flood which may be enhanced by rainfall. Summer rainfall may generate several, generally smaller, flood peaks following the main spring flood. Small magnitude floods tend to be generated from snowmelt in the mountains and upper foothills, rainfall may complicate the response. Large floods are produced as the result of a combination of rainfall and snowmelt from the whole of the basin.

The annual sediment export from the Elbow River watershed has been estimated at approximately 62 t/km^2 per yr. Sediment loads are highest during spring runoff, with 98% of the total annual sediment load entering the river between May and July and 75% entering in June (Hudson 1983). This pattern of the majority of sediment loading occurring during peak flow is typical of Alberta rivers. The regional mean annual sediment exports reported for Alberta watersheds are 75 t/km^2 per yr for rivers in the mountains and 50 t/km^2 per yr for mountain-source rivers flowing in prairie regions (Dickinson and Wall 1977).

In contrast, the upstream watershed of the Elbow River contributes little of the sediment load to this river: 11-34 t/km^2 per yr enters upstream of Bragg Creek, compared to 138 t/km^2 per yr entering between Bragg Creek and the Glenmore Reservoir. Bedrock in the upstream reaches produces little sediment and the banks of the river here have more vegetative cover, which may decrease erosion. Downstream, the river's banks hold less vegetation and are composed of sands and silts that are easily eroded.

Solute yields average 25 t/km^2 per yr in the plains compared to 98 t/km^2 per yr in the mountains. The lower yields in the plains are thought to be a result of the shorter residence time of groundwater in this region (Hudson 1983).

2.2 CLIMATE, GEOLOGY AND ECOREGIONS

Because it lies in the cool temperate zone, the Elbow River watershed has a continental climate, with long summer days and short winter days. Mean annual air temperatures are near 4°C; January is usually the coldest month and July the warmest

month (Meyboom 1961). Mean January temperatures are approximately -10°C, and mean July temperatures are 10°-15°C. Cold winter weather is punctuated by chinooks, which combine warm temperatures and high winds to increase evaporation. The average growing season is short, with a frost-free period of less than 60 days throughout the watershed. Total annual precipitation is usually 45-50 cm, approximately half of which falls between June and August (Hardy 1967). Precipitation is generally highest in June and lowest in January (Meyboom 1961).

The front ranges of the cordillera, the foothills, and the plains of the Alberta syncline are the three main physiographic zones through which the Elbow River flows (Hudson 1983). Upstream of the confluence of the Elbow and Little Elbow rivers the bedrock is of Palaeozoic origin, consisting primarily of marine limestone and dolomite rock (Figure 5: Seagel 1971; Hudson 1983). Six different Mesozoic shale and sandstone formations form the bedrock of the Elbow River channel between the confluence of the Elbow and Little Elbow rivers and the study site at Highway 22 (Figure 5: Seagel 1971). Downstream of Highway 22, the tertiary Paskapoo Formation forms the bedrock and consists of quartz, feldspar, and a chert/calcareous matrix. Bedrock in most of the Elbow River basin is overlain by glacial and lacustrine deposits from the Pleistocene glaciation. Upstream of Highway 22, the Cordilleran ice sheet was dominant, whereas downstream, the Laurentian ice sheet dominated (Seagel 1971). There is speculation that the boundary between these ice sheets lies further east of Highway 22, although the specific location was not identified (Hudson 1983).

Groundwater has been estimated to account for approximately 40% of the total flow into the Elbow River basin between August and April (Meyboom 1961). The area upstream of Bragg Creek recharges groundwater, whereas between Bragg Creek and the Sarcee Barracks Bridge, groundwater flows into the Elbow River, as indicated by an inverse relationship between total dissolved solids and discharge (Hudson 1983). Solutes in this reach appear to be primarily from rock weathering; below Bragg Creek, regional groundwater appears to be the main source of solutes.

Soils in the alpine and subalpine regions are poorly developed. The boreal foothills are characterized by gray podzols, typified by leached surface soils and deeper soils enriched with clay and organics. The aspen parklands have black chernozem soils that are higher in nitrogen (Hardy 1967) and represent the main cultivated region in the watershed.

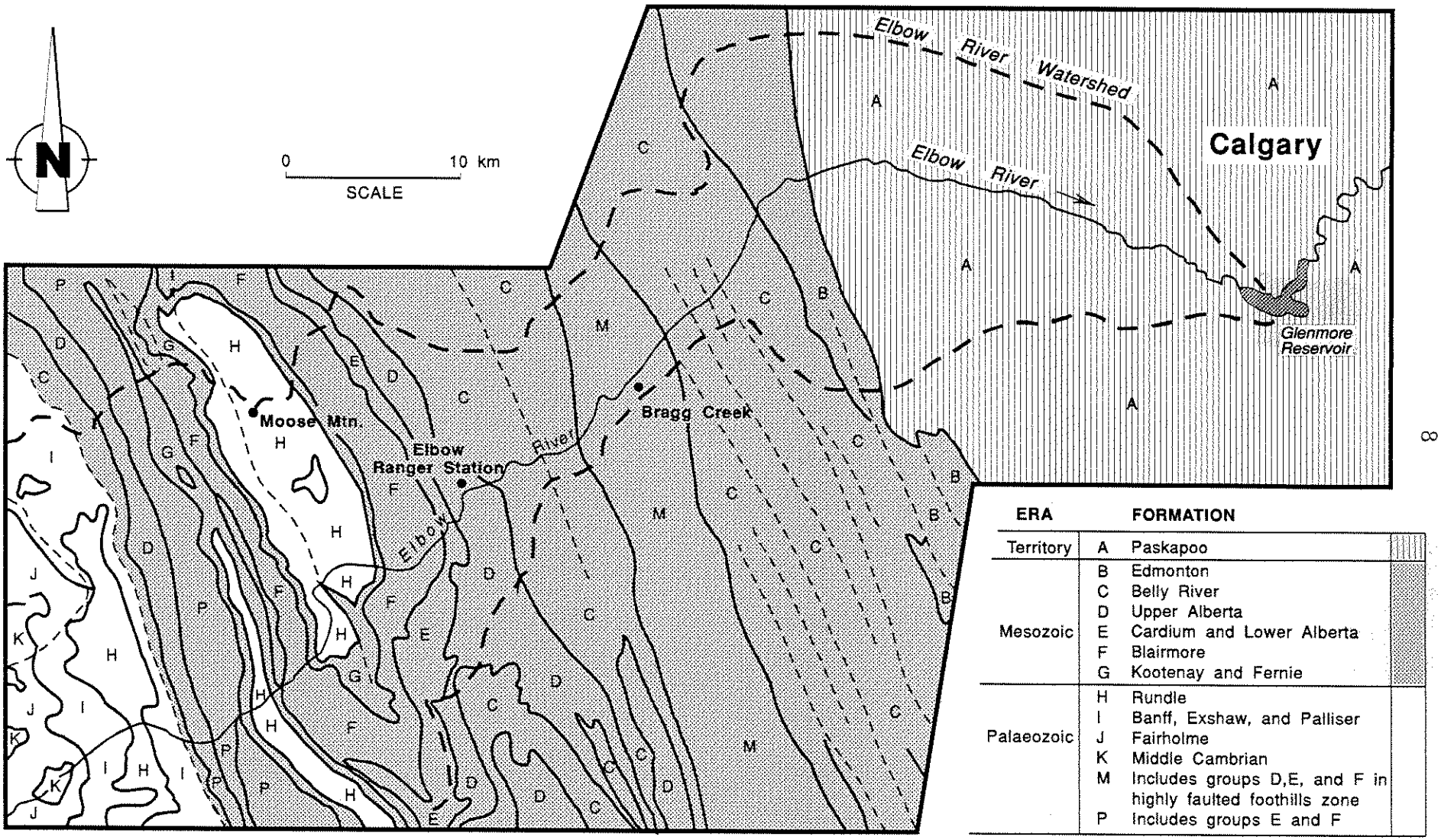

Figure 5. Bedrock geology of the Elbow River Basin (from Seagal 1971).

2.3 BASIN DEVELOPMENT AND LAND USE

During this study (1988-1990) there were no licensed discharges of municipal or industrial effluents into the Elbow River upstream of Calgary. Sewage has occasionally overflowed from the lift station at Redwood Meadows to a quarry north of the station (Pentney 1992). This lift station is along Highway 22 near the north boundary of the Sarcee Indian Reserve, and pumps sewage to an irrigation system in the reserve. Such an overflow was reported June 2, 1990. There was no surface flow to the Elbow River when this overflow was inspected. Below the Glenmore Reservoir, the City of Calgary is licensed to discharge effluent from its water treatment plant.

Land within the Elbow River watershed is used primarily for recreational and agricultural activities. Approximately 60% of the watershed is within Kananaskis Country (Figure 1) and is used for recreation, and about 20% of the watershed is used for agricultural purposes, primarily ranching. Only 2% of the watershed was within the Calgary city limits in 1988. There are few developments around the study sites upstream of the Bragg Creek townsite because here the Elbow River flows through Kananaskis Country and is affected primarily by recreational users (e.g. backpackers, hikers, horseback riders). In summer, cattle range throughout Kananaskis Country; this could contribute additional coliforms, nutrients, and suspended sediments to the river. Two gas plants are located close to the watershed boundaries: Esso-Quirk Creek and Shell-Jumpingpound.

The town of Bragg Creek is the only community on the Elbow River upstream of Calgary. In autumn 1984, coliform, nitrate, and chloride concentrations in the river were evaluated to determine whether septic tank leachates from the Bragg Creek area were contaminating the Elbow River. Levels of these variables either did not change or decreased in the area from upstream to downstream of the Bragg Creek townsite, suggesting that septic tank leachates were not causing a detectable effect on Elbow River water quality at that time (Appendix I). There are residential developments and ranches along Bragg Creek and Iron Creek.

Downstream of the Bragg Creek townsite, Lyon Mountain Creek joins the Elbow River. Lyon Mountain Creek includes water that drains from Wintergreen Golf and Ski Resort area; this water settles in a wetland area upstream of its confluence with the Elbow River. Near Lyon Mountain Creek, residential housing and a golf course are currently under construction. The next downstream reach of the Elbow River flows through the Sarcee

Indian Reserve. A residential area, Redwood Meadows, and a golf course are situated in this reach. Downstream of the Reserve, the land adjacent to the Elbow River is primarily cultivated or used as range for cattle. Some of the cultivated areas have irrigation withdrawal permits for water from the Elbow River. Irrigation return flows may enter the Elbow River via Milburn and Lott creeks, although specific data are not available to confirm this. Several summer camps are located in this area, and local residents also withdraw water for domestic use.

The Glencoe Golf and Country Club is the first golf course downstream of Highway 22. Two more golf courses adjacent to the Elbow River are currently operating between the Glencoe Golf and Country Club and the Calgary city limits; several more are proposed or are already under construction. The land adjoining the reach of the Elbow River from the Glencoe Golf and Country Club to the Calgary city limits includes residential developments, as well as farms and ranches. At Lott Creek, a fish hatchery was operated during the period of this study. This area was also under consideration for a 700-house residential development and a golf course. Between Lott Creek and the Glenmore Dam, much of the river flows through Glenmore Park and land leased to the military by the Sarcee Nation for training.

Upstream of the Glenmore Reservoir the City of Calgary has two storm sewers that discharge intermittently into the Elbow River. Five major storm sewers discharge directly into the reservoir (Hargesheimer and Lewis 1988). The Glenmore water treatment plant discharges effluent into the Elbow River below the reservoir. The effluent contains marginally increased levels of chloride and sulphate from its dechlorination process and also suspended solids when settling basins are back-flushed (Seidner 1991). Alum is used in the water treatment process, and the resulting flocculent material was also discharged to the Elbow River during the period of this investigation. Downstream, the Elbow River flows through industrial and residential areas, a golf course, fair grounds, and recreational parks. Many storm sewers discharge into this reach; thus, water quality varies, particularly following storms.

3.0 METHODS

3.1 FIELD METHODS

The Elbow River was sampled at ten mainstem and three tributary sites (Figure 1, Table 1) between April 1988 and March 1989. Additional sampling was conducted during the

Table 1. Elbow River basin sampling sites and NAQUADAT location codes

ABBREVIATION	SITE NAME	NAQUADAT CODE
TR3	Lott Creek (at mouth)	00AL05BJ0300*
TR2	Bragg Creek (near mouth)	00AL05BJ0400*
TR1	McLean Creek (near mouth)	00AL05BJ0500*
LER	Little Elbow River (near mouth)	00AL05BJ0600*
-	Little Elbow River near confluence with Elbow River	00AL05BJ0700
ER1	Elbow River above Cobble Flats	00AL05BJ0800*
-	Ranger Creek (near mouth)	00AL05BJ0810
ER2	Elbow River at Allen Bill Pond	00AL05BJ0900*
-	Iron Creek (near mouth)	00AL05BJ1100
-	Elbow River below Bragg Creek Provincial Park	00AL05BJ1500
ER3	Elbow River downstream of Bragg Creek town	00AL05BJ1600*
-	Lyon Mountain Creek	00AL05BJ1620
-	Elbow River at Redwood Water Plant	00AL05BJ1640
-	Harris Creek (near mouth)	00AL05BJ1650
-	Elbow River below Redwood Meadows	00AL05BJ1660
ER4	Elbow River at Highway 22	00AL05BJ1700*
-	Elbow River above Pirmez Creek	00AL05BJ1740
-	Pirmez Creek (near mouth)	00AL05BJ1750
-	Millburn Creek (near mouth)	00AL05BJ1760
ER5	Elbow River at Glencoe Golf and Country Club	00AL05BJ1800*
ER6	Elbow River upstream of Twin Bridges	00AL05BJ1900*
ER7	Elbow River at Sarcee Barracks Bridge	00AL05BJ2050*
-	Elbow River at Sarcee Barracks Bridge; 24 h comp.	00AL05BJ2051
-	Elbow River at Weasel Head Bridge	00AL05BJ2060
-	Elbow River below Glenmore Dam	00AL05BJ2100
ER8	Elbow River at Calgary Golf and Country Club	00AL05BJ2150*
-	Elbow River at Riverdale Parking Lot	00AL05BJ2160
-	Elbow River below Stanley Park	00AL05BJ2170
-	Elbow River below Mission Bridge	00AL05BJ2180
-	Elbow River at Lindsay Park	00AL05BJ2190
-	Elbow River above Stampede Stables	00AL05BJ2195
-	Elbow River at Stampede Grounds	00AL05BJ2200
ER9	Elbow River at 9th Avenue Bridge	00AL05BJ2300*
BOW	Bow River at Cochrane	00AL05BH0017
RDR	Red Deer River above Highway 2	00AL05CC0004
HWR	Highwood River above High River	00AL05BL1500
OR1	Oldman River near Fort McLeod	00AL05AB0300
OR2	Oldman River near Lethbridge	00AL05AD0002

* Sites sampled routinely in 1988-89

spring peak flow conditions of 1989 and 1990. Samples were collected over two days, every three weeks from June to September and monthly the rest of the year. A precalibrated Hydrolab 4041 meter was used to measure conductivity, pH, dissolved oxygen (DO), and temperature in the main flow of the river. Samples for water chemistry analysis were collected using standard sampling techniques (Alberta Environment 1988). At each mainstem site, along a transect, right, centre, and left bank water samples were collected in a stainless steel bucket. The three samples were combined in a Nalgene container to obtain a composite sample from that transect. Both the stainless steel bucket and the Nalgene container were acid-washed and triple-rinsed between sample collections to prevent contamination between sites. Grab samples were collected at the tributary sites. Each was poured into a pre-cleaned bottle, preserved as required, and transported on ice to the laboratory (Alberta Environmental Center (AEC) at Vegreville or Chemex Labs Alberta Inc., Calgary) within 24 hours. Dissolved nitrogen and phosphorus were collected by filtering water samples through a 0.45 mm Millipore filter within 10 h of collection. All analytical methods used for water samples are listed by NAQUADAT code in Table 2.

Daily composite samples were collected for phosphorus analysis from the Elbow River at the Sarcee Barracks Bridge. An ISCO automated sampler was installed at the bridge for the duration of mountain snowmelt in 1989 and 1990. Subsamples were collected every 3 h in pre-cleaned bottles containing preservative. The sampler was serviced every 2-3 days, and 24-h composite samples were shipped weekly to the AEC laboratory. These samples were used to calculate total phosphorus loading to the reservoir during peak flow. Phosphorus loading during the remainder of the year was not addressed, as phosphorus levels were then generally near the detection limit (Section 4.19).

To determine sources of phosphorus loading to the river, synoptic samples for nutrient analysis were collected during peak flow conditions on June 9, 1989 and on June 4 and June 26, 1990. Sample collections were timed so as to sample nutrient concentrations in the same parcel of water as it moved downstream. In 1989, samples were collected at all sites from Cobble Flats to the Sarcee Barracks Bridge, whereas on June 4, 1990, water samples were taken from downstream of Bragg Creek Provincial Park to the Sarcee Barracks Bridge, and on June 26, 1990 from Highway 22 to the Sarcee Barracks Bridge (Figure 6).

Samples for fecal and total coliform counts were collected at each site. Grab samples were collected in sterilized bottles, kept on ice, and transported to the Provincial

Table 2. Water chemistry variables for the Elbow River study with NAQUADAT codes

VARIABLE	AEC CODES	CHEMEX NAQUADAT CODES
Temperature (water)		02061F
pH		10301F
Specific conductivity		02041F
Dissolved oxygen		08102F
Temperature (air)		02066F
Phenolphthalein alkalinity		10151L
Total alkalinity		10101L
Bicarbonate		06201L
Carbonate (dissolved)		06301L
Calcium (dissolved)		20103L
Magnesium (dissolved)		12102L
Sodium (dissolved)		11103L
Potassium (dissolved)		19103L
Chloride (dissolved)		17203L
Total hardness		10602L
Fecal coliforms		36011L
Total coliforms		36001L
Fluoride (dissolved)		09107L
Sulphate (dissolved)		16306L
Total organic carbon		06005L
Dissolved organic carbon		06104L
Total organic nitrogen		07403L
Total nitrogen		07602L
Total ammonia nitrogen		07505L
Dissolved nitrite & nitrate	07111L	07110L
Total kjeldahl nitrogen	07021L	07015L
Total dissolved phosphorus	15105L	15103L
Total phosphorus	15421L	15406L
Particulate phosphorus	15901L	15901L
Iron extractable		26304L
Nonfilterable residue	10401L	10401L
Turbidity		02074L
Total dissolved solids		00201L
Silica reactive		14105L
Filterable residue		10451L
Aluminum (extractable)		13303L
Cadmium (extractable)		48302L
Copper (extractable)		29305L
Lead (extractable)		82302L
Barium (extractable)		56301L
Zinc (extractable)		30305L
Chromium (extractable)		24302L
Cobalt (extractable)		27302L
Phenolic material		06537L
Colour (true)		02021L

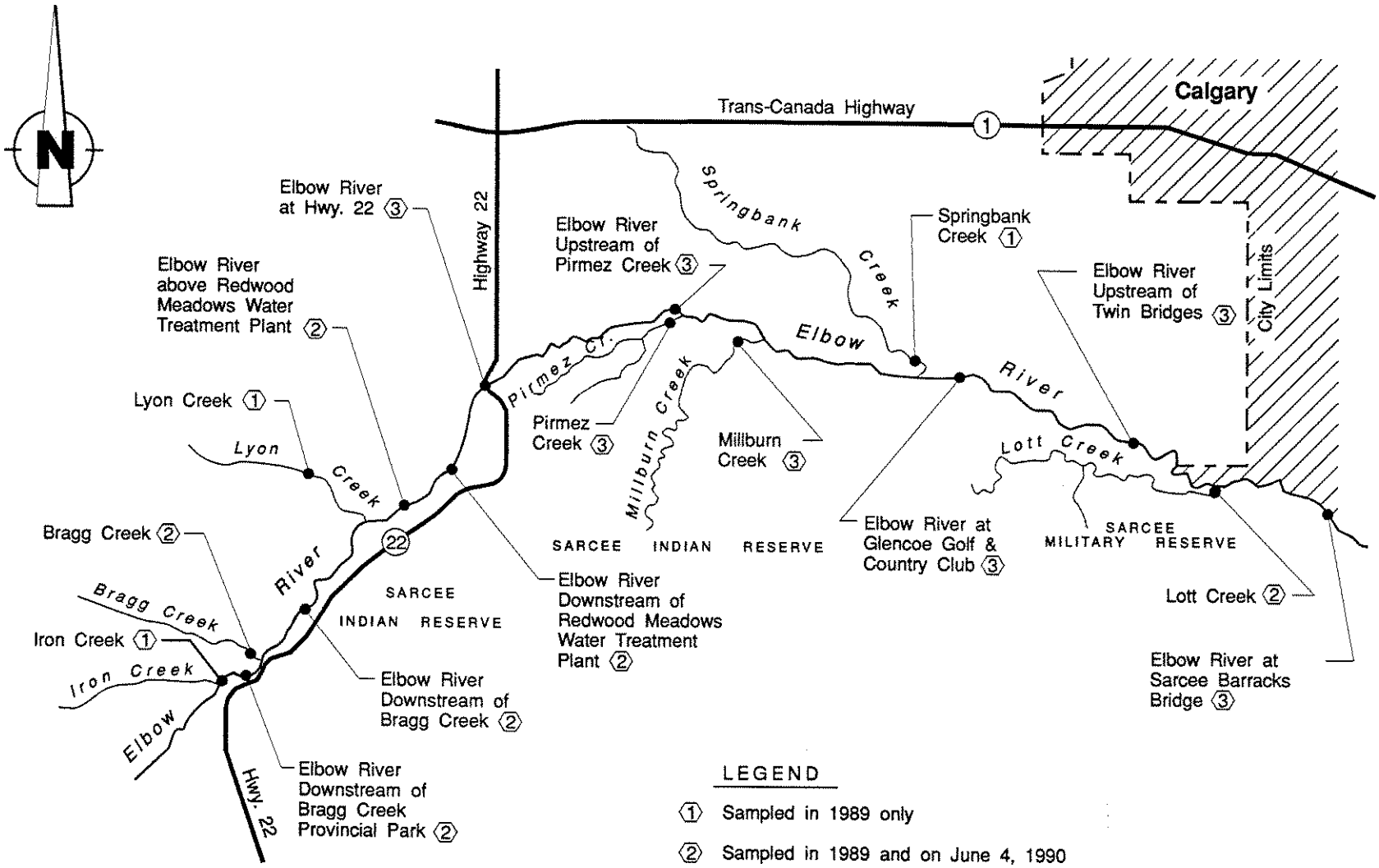

Figure 6. Sampling locations for peak flow surveys in 1989 and 1990 downstream of McLean Creek

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Laboratory of Public Health in Calgary within 24 h. Sampling frequency upstream and downstream of Glenmore Reservoir enabled assessment of bacterial water quality for both irrigation and recreational uses.

Epilithic chlorophyll a samples to estimate benthic algal biomass were collected from May until freeze-up (which varied from September to December, depending on elevation). Three replicate samples per site were collected, each consisting of 4 cm^2 of vegetation scraped from each of three rocks (i.e. 12 cm^2 total). Samples were preserved using $MgCO_3$, then frozen and shipped to the EQMB laboratory in Edmonton for analysis by the Moss (1967) technique.

Sediment samples were collected in the autumn of 1988 and during peak flow in the spring of 1989 and 1990. Sediment samples were obtained by allowing sediment from floodwater to settle for 48 h in 5 gallon vessels held in a refrigerated storage area. During lower flow conditions, an "airlift" sampler that uses nitrogen gas was used to collect sediment from the river bed. These sediments were frozen and shipped to AEC for analysis of organic compounds. The different forms of phosphorus in floodwater sediments were determined at Chemex Labs Alberta Inc. using the methods of Mayer and Williams (1981).

Long-term data (1982-1990) for major ions and nutrients in the Elbow River were provided by the City of Calgary. Between 1982 and 1988 samples were collected at the Sarcee Barracks Bridge, and between 1989 and 1990, at the Twin Bridges site. Samples were collected two to four times per month during March to November. These data were used to determine whether any trends occurred at this location during this period. Historic data collected during the development of Kananaskis Country (1978-79) were also available for sites upstream of Highway 22 (Appendix II). Other miscellaneous data collected by Alberta Environment are occasionally referenced in this document.

3.2 QUALITY ASSURANCE/QUALITY CONTROL

In addition to each laboratory's ongoing internal quality assurance program, field samples were collected as replicates (on two occasions) or blanks (on three occasions) to evaluate sample handling QA/QC. Most metals were analyzed once using the blank samples and once using the replicate samples. Aluminum was analyzed in the replicate samples on both occasions. Blank samples were also submitted with the ISCO daily phosphorus samples

on nine occasions. Quality assurance samples were submitted "blind" (i.e. with a fictitious Elbow River site label) to the lab.

3.3 DATA ANALYSIS

All variables from the current survey were tested for site-to-site similarities using the Kruskall-Wallis test (Siegel 1956). When water quality data fluctuate with time of year, variation in the data increases. This increased variation is called seasonality and can be removed from the data by using a water quality statistics program called WQStat II (Phillips et al. 1988). The occurrence of seasonality was determined by inspecting box and whisker plots. If seasonality appeared to be a factor, data were de-seasonalized before medians were compared. Differences between single years were compared using the Mann-Whitney test in WQStat II.

All long-term data from the City of Calgary's program were initially analyzed for flow dependency by regressing concentration against mean daily discharge, as measured at the nearest gauging station. When the slope was significantly greater than 0 ($P<0.05$) and the regression model explained a significant amount of the variation, the variable was considered to be flow-dependent. Flow-adjusted concentrations for flow-dependent variables were calculated by subtracting the expected concentration, obtained from the regression analysis, from the actual concentration to determine the residual. For flow-dependent variables, both actual and flow-adjusted concentrations were analyzed for trends, using either the Seasonal Kendall Tau test or the Kendall test (Phillips et al. 1988). Each variable from the two time periods (1982-1988 and 1982-1990) was also tested separately to ensure that trends were not a result of a change in sampling location. These data were analyzed using an IBM-AT personal computer and a LOTUS 1-2-3 program developed to test for flow-dependency and to calculate flow-adjusted concentrations (Shaw et al. 1990).

Median annual values for variables in water samples collected from two sites on the Elbow River, at Allen Bill Pond (ER2) and at the Sarcee Barracks Bridge (ER7), were compared visually with data from five other sites on southern Alberta rivers: the Bow River at Cochrane, the Red Deer River at Highway 2, the Highwood River above High River, the Oldman River near Fort McLeod, and the Oldman River near Lethbridge (Alberta Environment, unpublished data). These river sites were selected for comparison because the

rivers flow through similar ecosystems, i.e. they originate in subalpine areas and flow through boreal foothills and aspen parkland. All the sites were upstream of large municipalities, and in each basin there is agricultural activity. Three sites were long-term river network sites: the Bow and Red Deer rivers, and the Oldman River near Lethbridge; data for these rivers in 1988 were compared to Elbow River data. Data from the Highwood River (collected in 1984-1985) and from the Oldman River near Fort McLeod (collected in 1985-1986) were also compared. All data used in this comparison were generated from Chemex Labs using identical laboratory methods.

Quality assurance was evaluated by comparing the mean of the blank samples with the expected value. Chemex Labs Alberta Inc. provided acceptance limits for blanks (one to three times the detection limit for all variables except Ph (5.0-6.0), specific conductance (<10 µS/cm), total alkalinity (<10 mg/L), and silica concentrations, which may exceed three times the detection limit). Duplicate samples were evaluated for precision by calculating the percent difference in the results of the two samples. The average percent difference was calculated, and less than a five percent difference was considered to be acceptable.

Peak flow phosphorus sample concentrations were used to calculate phosphorus load in the river. The program used (Alberta Environment, unpublished) calculates phosphorus load using mean daily discharge and mean daily phosphorus concentrations:

$$ANE = \sum_{i=1}^{n} \frac{(DNE_i + DNE_{i+1}) \times (D_{i+1} - D_i)}{2}$$

where:

n	= number of sampling days
DNE	= daily nutrient export value
D	= Julian calendar date of sample collection
ANE	= annual nutrient export value

3.4 WATER QUALITY OBJECTIVES AND GUIDELINES

Water quality was assessed by comparing all concentrations of appropriate variables with the Canadian Water Quality Guidelines (CWQG) for the protection of freshwater life (CCREM 1987) (or the other most restrictive use) and the Alberta Surface

Water Quality Objectives (ASWQO) (Alberta Environment 1977a). Values outside these guidelines were described as being non-compliant. Neither the ASWQO nor the CWQG are legal standards; thus, non-compliance does not imply that enforcement action is required. Also, natural water quality may not be within the suggested limits (Alberta Environment 1977a).

4.0 RESULTS AND DISCUSSION

4.1 QUALITY ASSURANCE/QUALITY CONTROL

Most of the quality control samples were within the expected ranges of values for both blank and duplicate samples. Twenty of the 27 variables analyzed in the blank samples were within the expected range (Table 3), and four of the seven variables that were out of the predicted range were detected at <1% of normal Elbow River levels. The three variables that were outside the expected range and high relative to Elbow River levels were total Kjeldahl nitrogen, total nitrogen, and sodium.

Phosphorus was detected in three of the nine blanks at levels greater than expected in the ISCO daily composite samples, and the other six sample results were less than three times the detection limit. Only one result (0.012 mg/L) was close to the range of phosphorus concentrations measured in Elbow River water.

Similar results showed up in the duplicate grab samples, 23 of 30 of the variables analyzed having less than a 5% difference in measured level (Table 3). Four variables with greater than a 5% difference (turbidity, nonfilterable residue, total nitrogen and total phosphorus), are influenced by concentrations of particulate matter in the water. Sulphate, barium, and zinc were the other variables for which more than a 5% difference in concentrations was detected between samples.

These QA/QC data indicate some degree of background contamination in organic nitrogen and sodium analyses, the full extent of which is unknown. Total variance in duplicate samples analyzed for particulate constituents was occasionally high, but most sample data reported below are based on composites consisting of 3 sample units.

Table 3. Results of quality assurance/quality control analysis for routine river sampling

VARIABLE	BLANK SAMPLES		DUPLICATE SAMPLES
	Expected Value	Sample Result (x ± 1 S.D.) (n = 3)	Average % Difference (n = 2)
Calcium (mg/L)	L0.01-0.03	0.39±0.53	L0.5
Magnesium (mg/L)	L0.01-0.03	0.13±0.15	L0.5
Sodium (mg/L)	L0.01-0.03	0.34±0.57	0
Potassium (mg/L)	L0.01-0.03	L0.01±0	1
Chloride (mg/L)	L0.01-0.03	L0.01±0	3
Sulphate (mg/L)	L0.1-0.3	0.37±0.29	5.5
Phenolphthalene alkalinity (mg/L)	L0.1-0.3	0.10±0	0
Total alkalinity (mg/L)	L10	1.83±0.45	L0.5
pH (units)	5.0-6.0	5.29±0.03	L1
Carbonate (mg/L)	L0.50-1.50	L0.50±0	0
Bicarbonate (mg/L)	L0.50-1.50	2.2±0.55	L1
Total hardness (mg/L)	L0.50-1.50	1.4±1.99	L0.5
Fluoride (mg/L)	L0.05-0.15	L0.05±0	0
Silica, reactive (mg/L)	L0.06-0.18	L0.02±0	L1
Specific conductance (µS/cm)	L10	3.43±3.78	2
Turbidity (NTU)	L0.10-0.30	0.22±0.14	25
Colour (Pt Co Units)	L5.0-15.0	5.80±3.82	0
Phenols (mg/L)	L0.001-0.003	0.001*	not analyzed
Total organic carbon (mg/L)	L0.10-0.30	0.12±0.08	3.5
Dissolved organic carbon (mg/L)	L0.10-0.30	0.10±0.09	4
Total ammonia nitrogen (mg/L)	L0.01-0.03	L0.01±0	0
Total Kjeldahl nitrogen (mg/L)	L0.02-0.06	0.07±0.05	0
Nitrite + nitrate nitrogen (mg/L)	L0.003-0.009	L0.003±0	2.5
Total nitrogen (mg/L)	L0.02-0.06	0.07±0.05	5
Total dissolved phosphorus (mg/L)	L0.003-0.009	L0.003±0	0
Total phosphorus (mg/L)	L0.003-0.009	L0.003±0	23
Total filterable residue (mg/L)	L1.0-3.0	2.67±2.08	2
Total nonfilterable residue (mg/L)	L0.04-0.12	L0.04±0	27
Aluminum (mg/L)	L0.01-0.03	L0.01*	1.5
Arsenic (mg/L)	L0.0002-0.0006	L0.0002*	0*
Barium (mg/L)	L0.01-0.03	L0.01*	12
Cadmium (mg/L)	L0.001-0.003	L0.001*	0*
Chromium (mg/L)	L0.001-0.003	L0.001*	0*
Cobalt (mg/L)	L0.001-0.003	L0.001*	0*
Copper (mg/L)	L0.001-0.003	L0.001*	0*
Iron (mg/L)	L0.01-0.03	L0.01*	0*
Lead (mg/L)	L0.002-0.006	L0.002*	0*
Mercury (mg/L)	L0.05-0.15	L0.05*	0*
Zinc (mg/L)	L0.001-0.003	L0.001*	50

* Analyzed in only one sample

4.2 COMPLIANCE WITH WATER QUALITY OBJECTIVES AND GUIDELINES

All variables which exceeded the CWQG and ASWQO are summarized in Tables 4 and 5 respectively. Where applicable, the appropriate guideline or objective and the corresponding use are indicated on the box and whisker diagram for each variable.

4.3 TEMPERATURE

Water temperatures generally followed patterns similar to air temperatures: highest in summer (late June to August) and lowest in winter (November to March). There was a general longitudinal trend toward an increase in temperature from the headwaters of the Elbow River to its confluence with the Bow River (Figure 7). The longitudinal trend of increasing temperature from the headwaters of a river downstream is typical (Hynes 1970), as reaches further downstream are often wider and more open, and therefore, receive greater solar radiation. These observations, however, also reflect diurnal variation, as the upstream sites were usually sampled earlier in the day than were the downstream sites. The summer's maximum observed temperatures ranged from 8°C at the Elbow River above Cobble Flats to 22°C near the confluence with the Bow River. Median annual water temperatures in the Elbow River at Allen Bill Pond (ER2) and the Sarcee Barracks Bridge (ER7) were higher than in the Highwood River and similar to the water temperatures of three other southern Alberta rivers (Figure 8).

4.4 SPECIFIC CONDUCTANCE

Specific conductance is a measure of water's ability to conduct an electrical current (McNeely et al. 1979; Clesceri et al. 1989).

In winter, specific conductance increased in water samples from the headwaters of the Elbow River to the site at Highway 22; it was lower in samples collected between Highway 22 and the 9th Avenue Bridge. Sites of the river with statistically homogenous (similar) specific conductance levels included: (1) the Little Elbow River to the Elbow River at Cobble Flats, (2) the Elbow River at Allen Bill Pond to Highway 22, (3) the Elbow River at the Glencoe Golf and Country Club to the Calgary Golf and Country Club, and (4) the Elbow River at 9th Avenue Bridge. Water from the site at the 9th Avenue Bridge had the highest specific conductance readings measured (Figure 9). Specific conductance was higher in samples collected during the winter than during the summer. The seasonal trend in

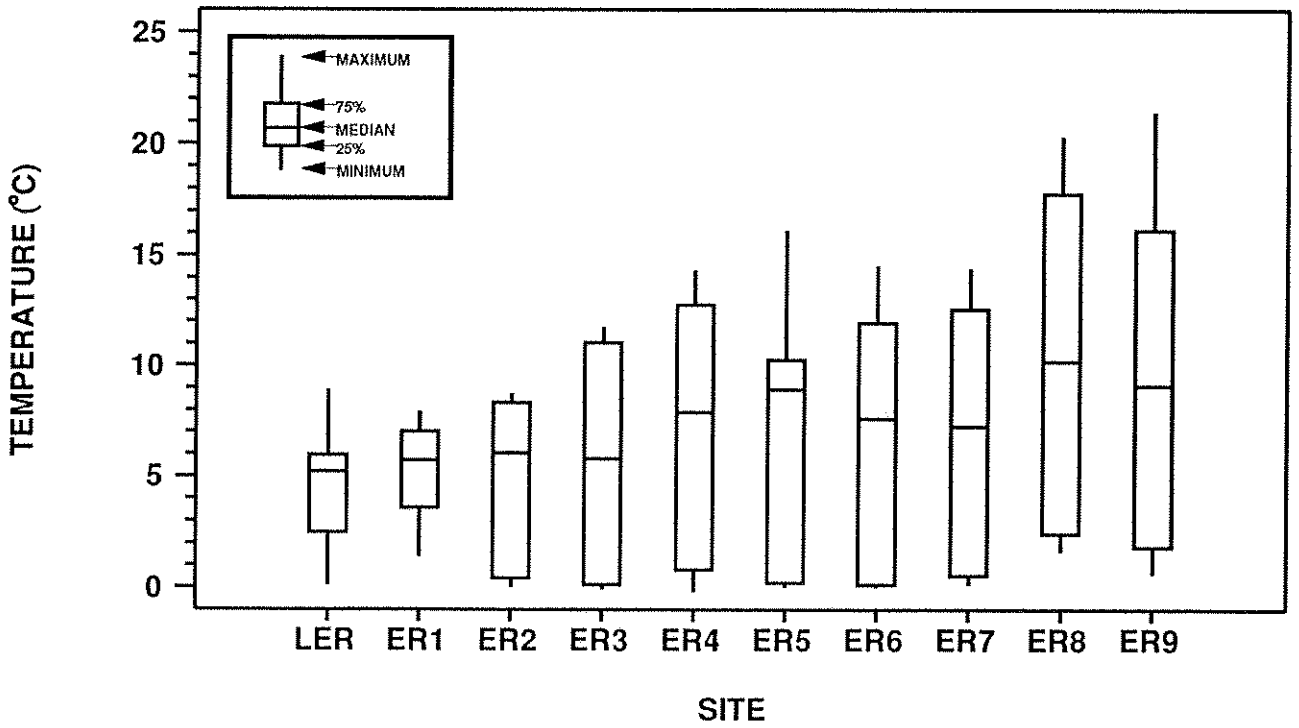

Figure 7. Longitudinal trends in annual temperatures measured in the Elbow River.

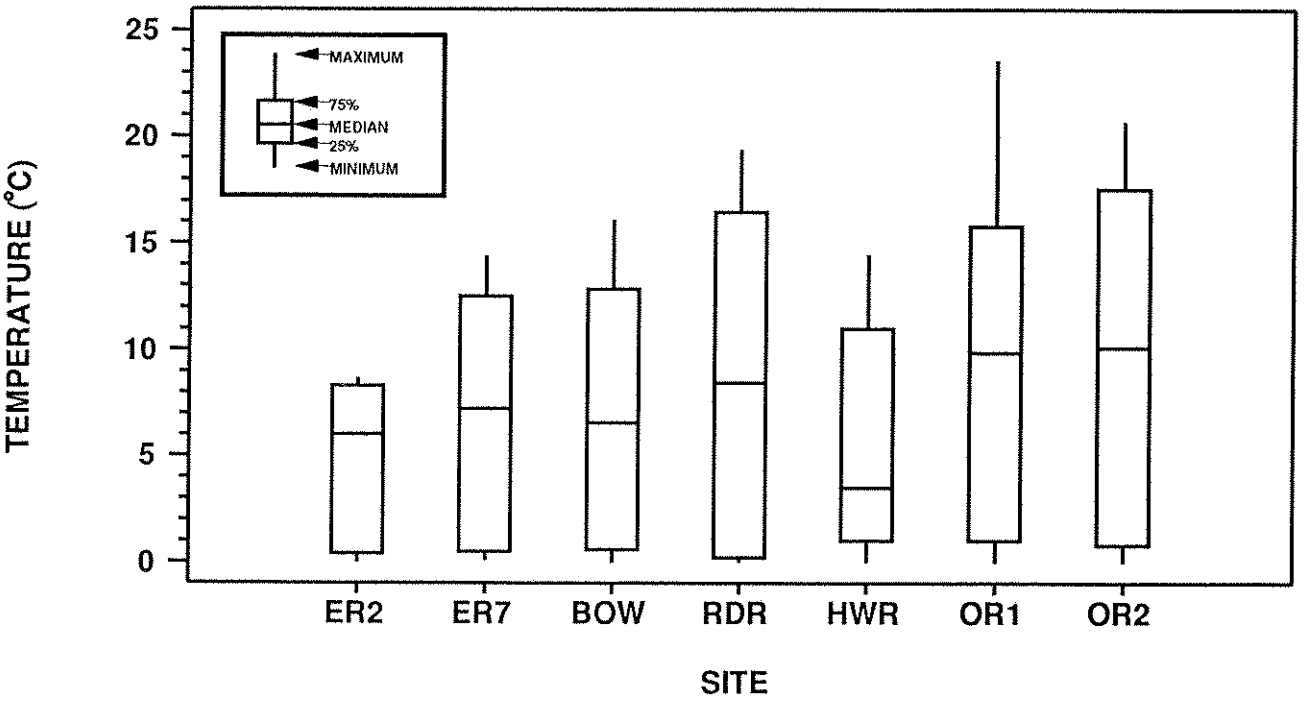

Figure 8. Comparison of annual temperatures in five southern Alberta rivers.

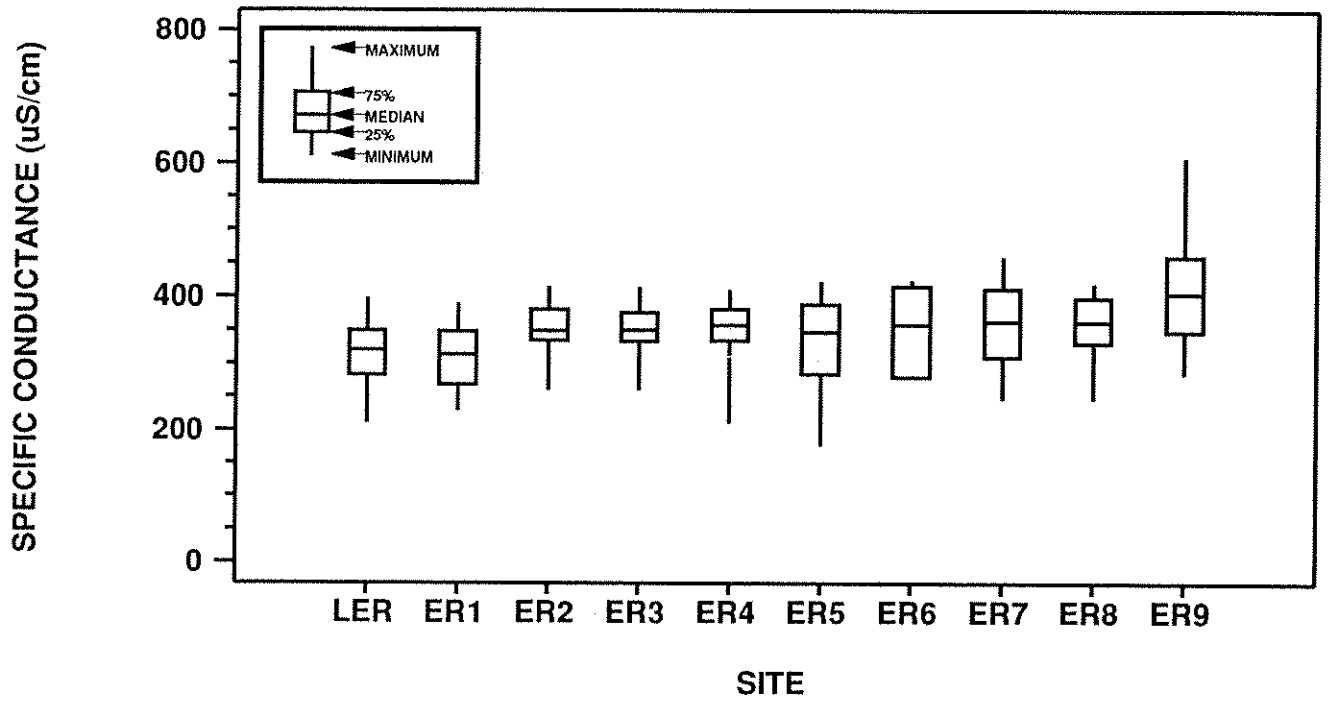

Figure 9. Longitudinal trends in specific conductance in the Elbow River.

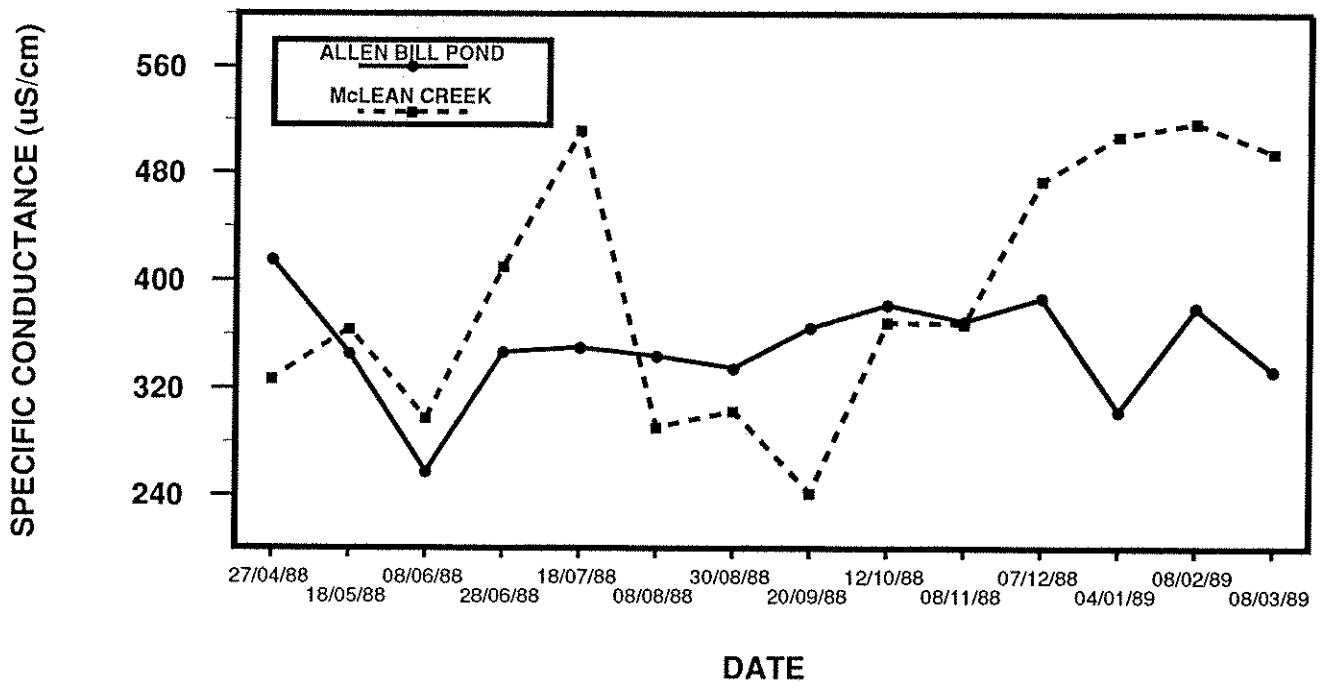

Figure 10. Specific conductance levels in McLean Creek and the adjacent upstream site, the Elbow River at Allen Bill Pond, between April 1988 and March 1989.

specific conductance measured in the Elbow River is common in Alberta, as groundwater typically has a higher specific conductance and contributes a greater percentage of the flow to the river during winter.

Specific conductance levels were negatively correlated with flow in water samples from all sites upstream of Sarcee Barracks Bridge except McLean Creek. In McLean Creek specific conductance underwent large fluctuations, not related to flow or season (Figure 10), but probably reflecting the new reservoir's influence on water quality. The flooded soils may have increased the salinity of McLean Creek. In general, specific conductance in Elbow River water was similar to water from the other southern Alberta rivers surveyed (Figure 11).

4.5 COLOUR

Colour in Elbow River water increased during peak flow in the spring and again in the autumn at all sites. Water from most mainstem sites had colour values below the detection limit in the spring and summer, except during peak flow. There were no significant longitudinal differences in colour in water samples collected along the Elbow River (Figure 12) although Bragg Creek and McLean Creek were somewhat stained. Increases in colour may be related to the addition of organic material from decomposing plant material over winter and in the fall after leaf drop.

4.6 TURBIDITY

Turbidity is a measure of the light-scattering properties of water. Inorganic particles such as silt and clay, and organic matter such as microorganisms contribute to turbidity (McNeely et al. 1979; Clesceri et al. 1989). In general, turbidity increased in water collected from the headwaters of the Elbow River to Glenmore Dam. Variance in turbidity measurements, however, was great enough that differences between sites were not statistically significant (Figure 13). Turbidity increased with increased flow in samples collected upstream of the Glenmore Dam, but otherwise did not show a particular trend with season. With high rainfall, overland flow increases soil erosion (Dickinson and Wall 1977), particularly in cultivated areas where tilled soils are more erodible before crop growth occurs (Smith et al. 1987). Turbidity measurements during peak flow conditions at all sites exceeded CWQG (Table 4). These very high turbidity measurements were treated as statistical outliers and excluded from figures by the software used to generate Figure 13, but

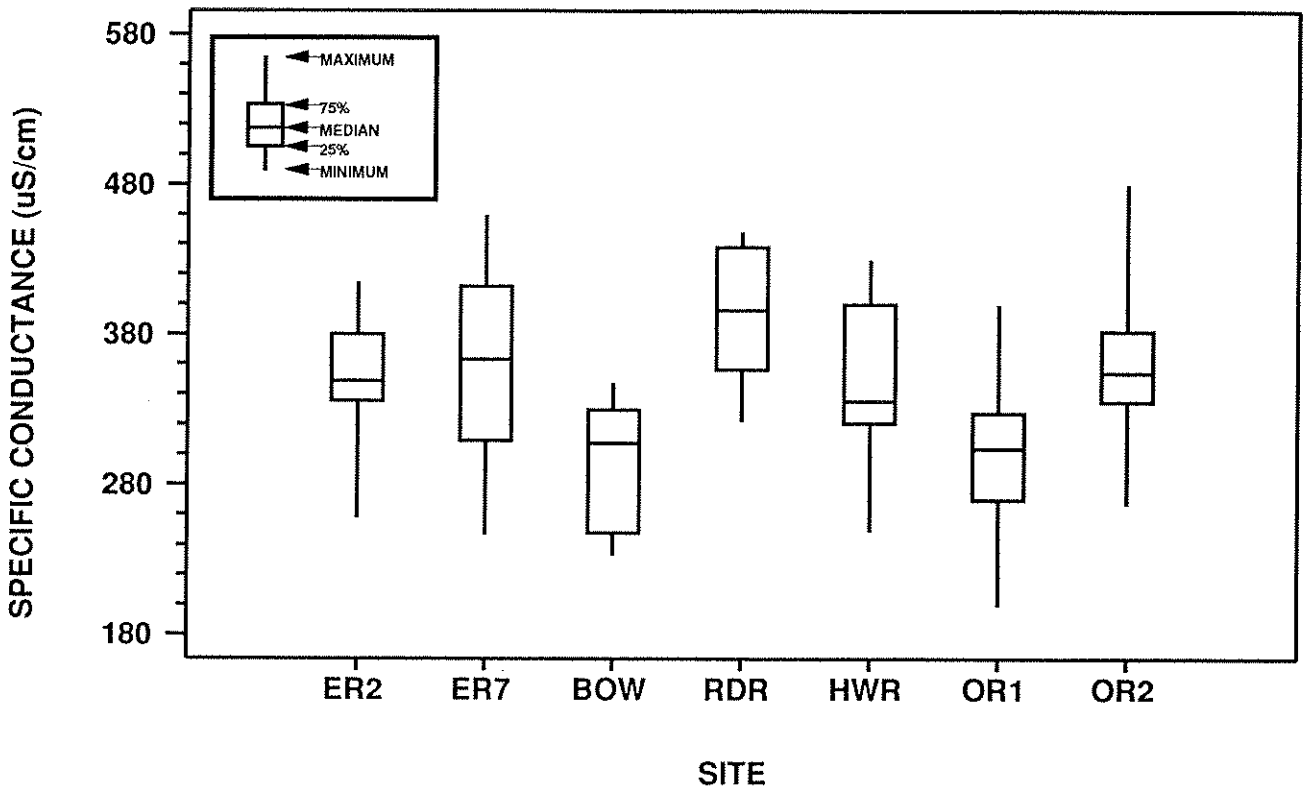

Figure 11. Comparison of annual specific conductance in five southern Alberta rivers.

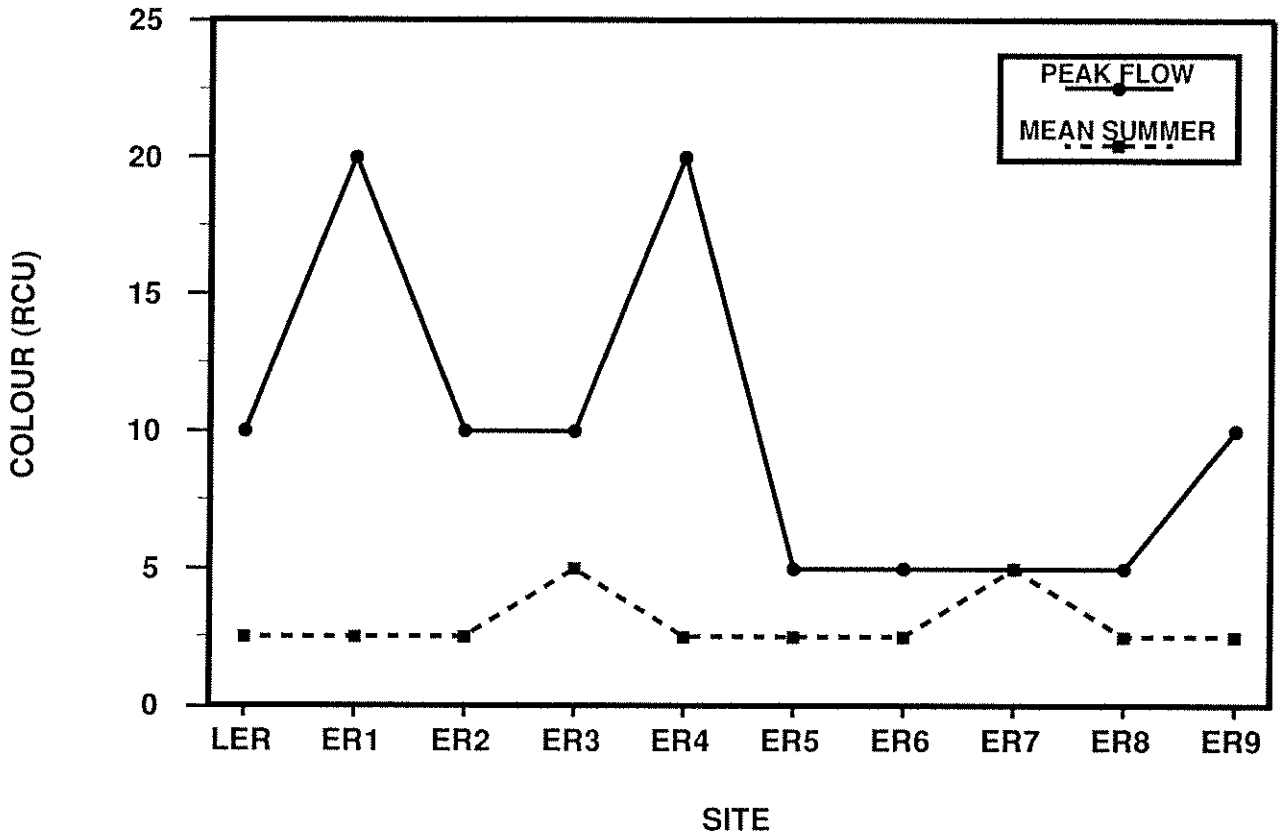

Figure 12. Colour levels measured in the Elbow River during summer (late June to end of August) and peak flow: June 7 - sites from Glencoe Golf and Country Club to 9th Avenue Bridge; June 8 - sites from Little Elbow River to Highway 22. Sites are represented here as being equidistant, although in reality they are not.

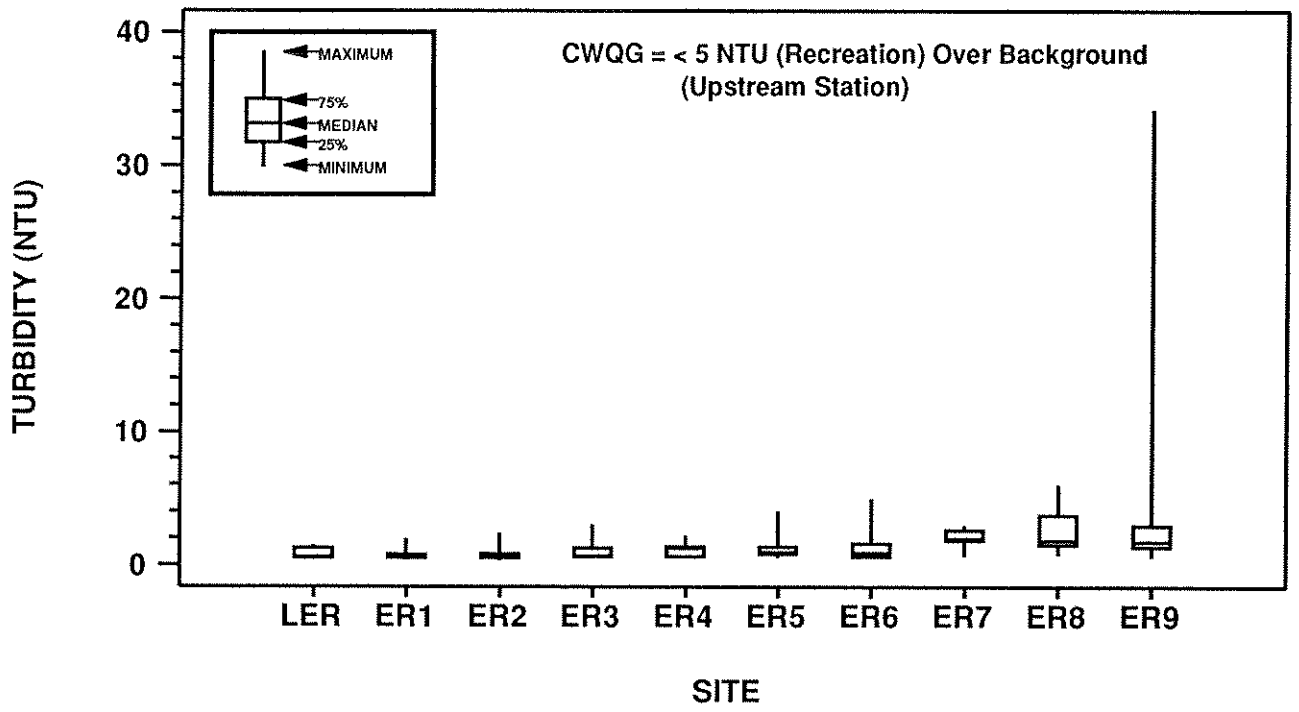

Figure 13. Longitudinal trends in annual turbidity levels in the Elbow River.

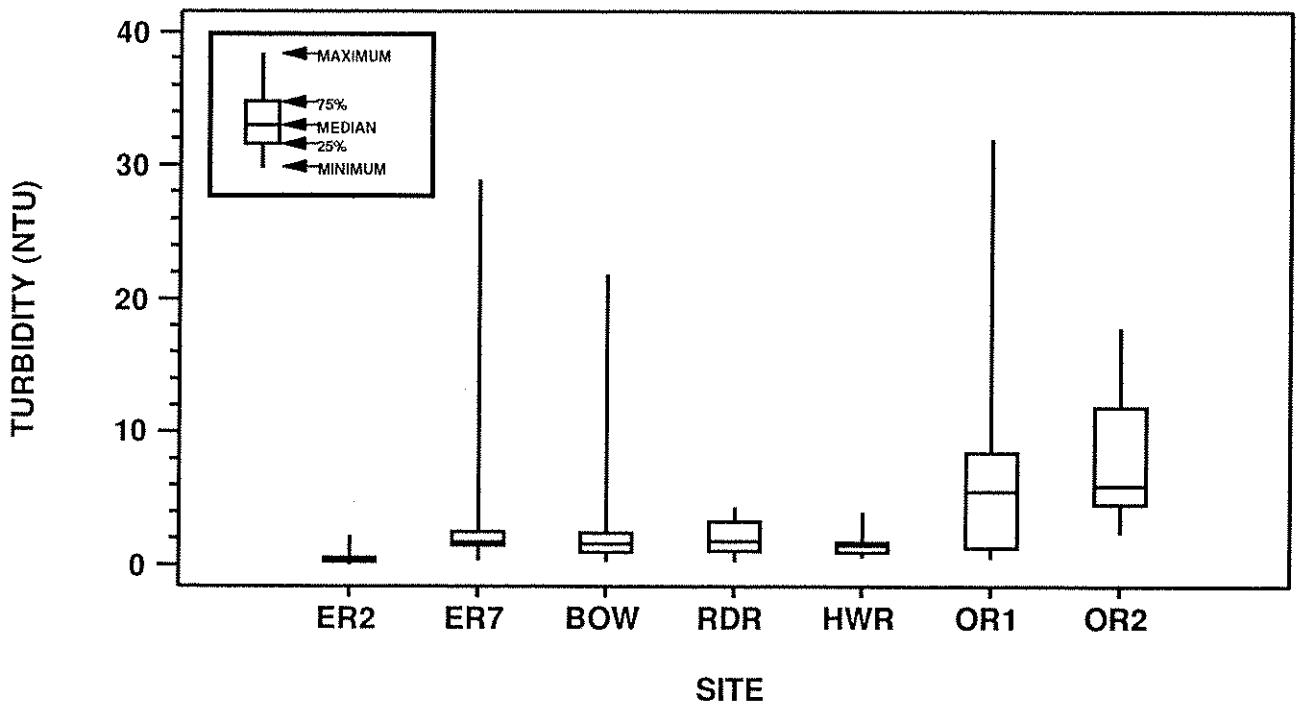

Figure 14. Comparison of annual turbidity levels in five southern Alberta rivers.

Table 4. Number of samples exceeding Canadian Water Quality Guidelines in the Elbow River and its tributaries

VARIABLE	Site	No. of Non-Compliant Samples	Total No. of Samples
Copper	Elbow River at 9th Avenue Bridge	1	6
Chromium	McLean Creek (near mouth)	1	6
	Elbow River downstream of Bragg Creek	1	6
	Elbow River at 9th Avenue Bridge	1	6
Iron	McLean Creek (near mouth)	1	6
Mercury[a]	Elbow River at Highway 22	1	6
Lead	Elbow River downstream of Bragg Creek	1	6
Aluminum[b]	Elbow River at Calgary Golf and Country Club	9	13
	Elbow River at 9th Avenue Bridge	9	13
Dissolved oxygen (for early life stages - cold water species)	Elbow River above Cobble Flats	1	12
	Elbow River downstream of Bragg Creek	3	14
	Elbow River at Highway 22	4	14
	Elbow River at Calgary Golf and Country Club	5	14
	Elbow River upstream of Twin Bridges	5	14
	Elbow River at Sarcee Barracks Bridge	2	14
	Elbow River at Calgary Golf and Country Club	4	14
	Elbow River at 9th Avenue Bridge	3	14
	Lott Creek (near mouth)	6	13
	Bragg Creek (near mouth)	4	14
	McLean Creek (near mouth)	5	14
Phenolic compounds[c]	Bragg Creek (near mouth)	1	6
	Little Elbow River (near mouth)	1	5
	McLean Creek (near mouth)	2	6
	Elbow River above Cobble Flats	1	6
	Elbow River at Allen Bill Pond	1	6
	Elbow River downstream of Bragg Creek	1	6
	Elbow River at Glencoe Golf and Country Club	1	6
	Elbow River upstream of Twin Bridges	1	6
	Lott Creek (near mouth)	2	6
	Elbow River at Sarcee Barracks Bridge	1	6
	Elbow River at Calgary Golf and Country Club	1	6
Turbidity[c,e]	Little Elbow River (near mouth)	1	12
	Elbow River above Cobble Flats	1	12
	Elbow River at Allen Bill Pond	1	14
	Elbow River downstream of Bragg Creek	1	14
	Elbow River at Highway 22	1	14
	Elbow River at Glencoe Golf and Country Club	1	14
	Elbow River upstream of Twin Bridges	1	14
	Elbow River at Sarcee Barracks Bridge	1	14
	Elbow River at 9th Avenue Bridge	2	14
	Bragg Creek (near mouth)	2	14
	McLean Creek (near mouth)	1	14
Fecal coliforms[d]	Bragg Creek (near mouth)	6	20
	Elbow River at Highway 22	1	20
	Elbow River at Glencoe Golf and Country Club	1	17
	Lott Creek (near mouth)	6	20
	McLean Creek	3	17

Notes: Samples taken between April 1988 and June 1990. Guidelines for protection of freshwater life were used, expect where indicated.

[a] Detection limit greater than guideline

[b] CWQG is for total aluminum, thus extractable aluminum results represent a conservative interpretation

[c] Recreational water quality and aesthetics

[d] Tentative guideline for irrigation water (100 fecal coliforms per 100 mL)

[e] Guideline for total suspended solids (≥ 10 mg/L over background) was also exceeded on the same dates as turbidity, except at McLean Creek

were definitely included in the assessment of water quality using CWQG. The data are presented in Appendix II. Turbidity as high as 410 NTU was measured at the Highway 22 site during the spring flood in 1988. Unusually high total phosphorus, coliforms, and nonfilterable residue measurements were also excluded from figures, but are presented in Appendix II (see below).

Turbidity levels in lower Elbow River water were similar to those in Bow, Highwood, and Red Deer River waters, but lower than in Oldman River water (Figure 14).

4.7 pH

The pH of water is a measure of the concentration of hydrogen ions in solution (Clesceri et al. 1989). The pH of Elbow River water was always neutral to basic which is normal for rivers in southern Alberta. It increased from fall to spring, probably because of increased groundwater flow into the river, which may contain greater concentrations of bicarbonate. There was no general longitudinal trend in pH levels (Figure 15).

After deseasonalizing the data, pH levels in water from the mainstem sites were found to be similar. Only water from the Elbow River at Cobble Flats differed significantly from six other sites, specifically samples collected from the Elbow River at Allen Bill Pond and from the Elbow River between Highway 22 and the Calgary Golf and Country Club. Elbow River water had somewhat lower pH levels than water from the other southern Alberta rivers surveyed (Figure 16). All pH measurements were within the CWQG and the ASWQO.

4.8 ALKALINITY

Alkalinity is a measure of the acid-buffering capacity of water. Bicarbonate and hydroxide ions are primarily responsible for alkalinity (McNeely et al. 1979; Clesceri et al. 1989).

Alkalinity levels increased in a downstream direction from the headwaters to the Glenmore Reservoir (Figure 17). Following deseasonalization of the data, alkalinity values of water collected from the following sites were statistically similar: (1) the Little Elbow River to the Elbow River at Allen Bill Pond, (2) the Elbow River downstream of Bragg Creek to Highway 22, and (3) all downstream sites, except the site at the Glencoe Golf and Country Club, which was different from the Sarcee Barracks Bridge and 9th Avenue Bridge sites.

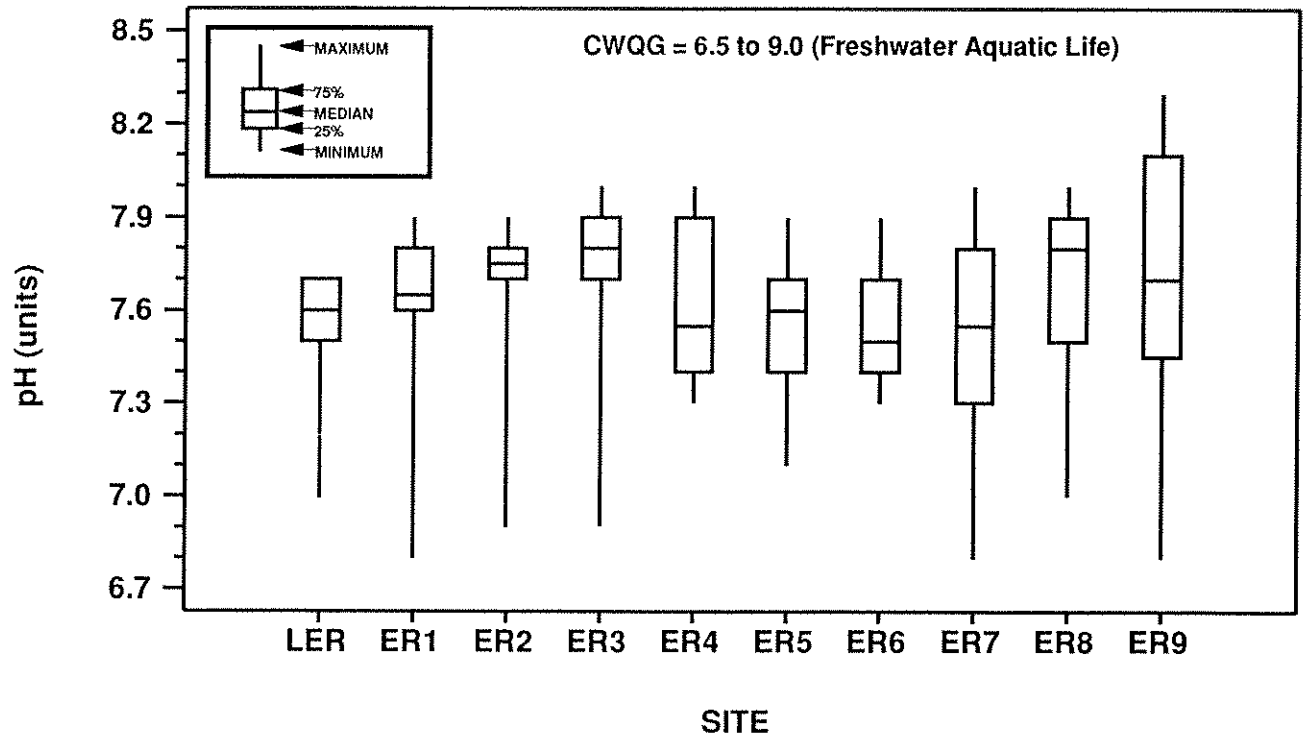

Figure 15. Longitudinal trends in annual pH levels in the Elbow River.

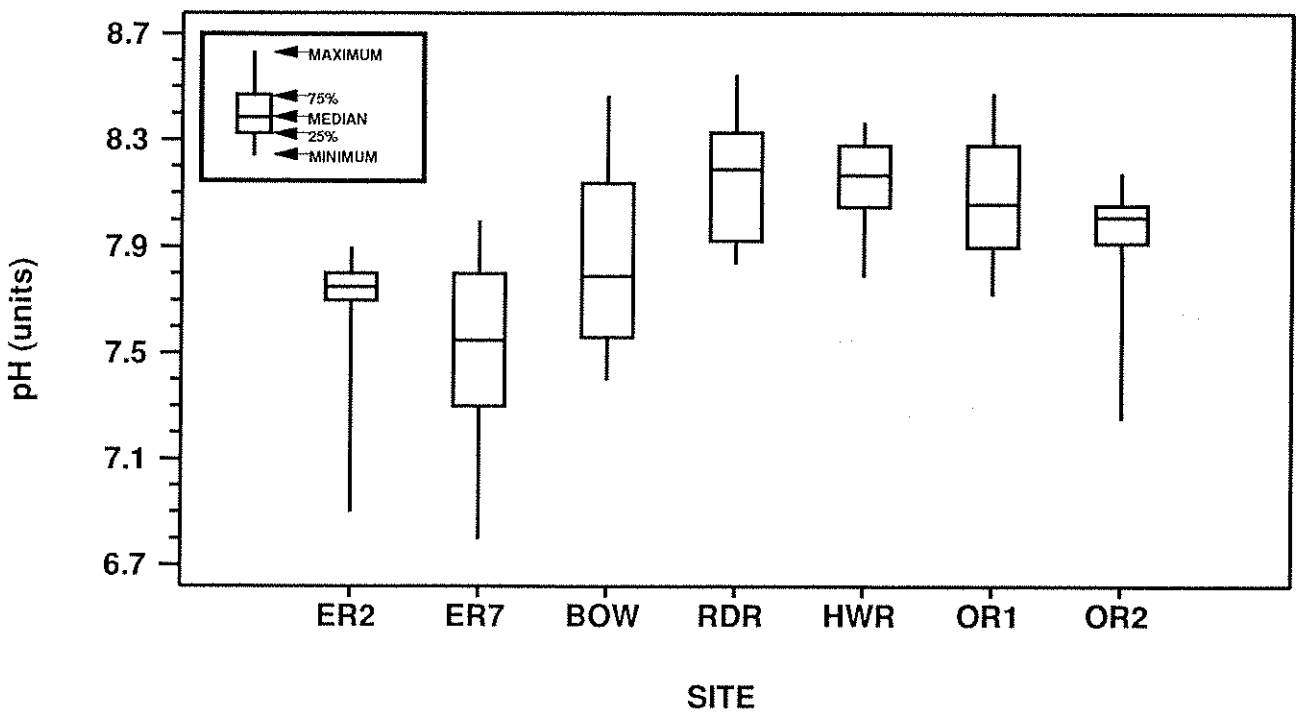

Figure 16. Comparison of annual pH levels in five southern Alberta rivers.

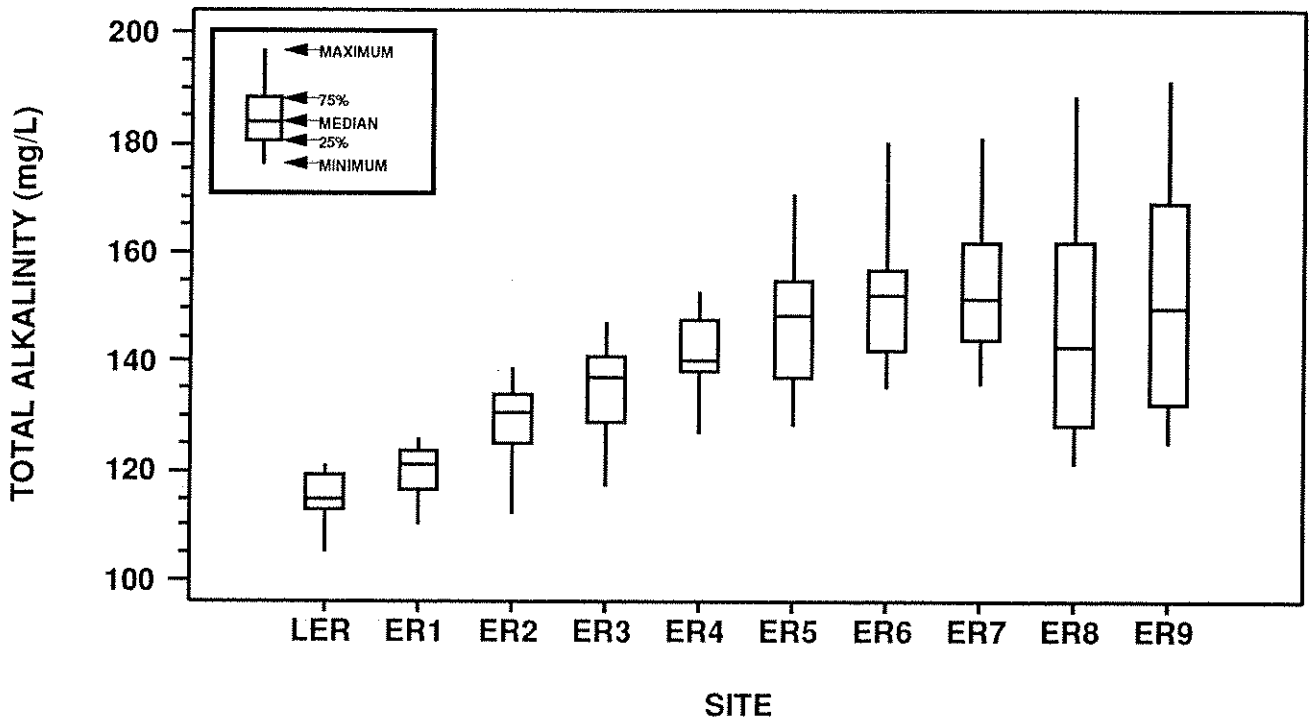

Figure 17. Longitudinal trends in annual alkalinity concentrations in the Elbow River.

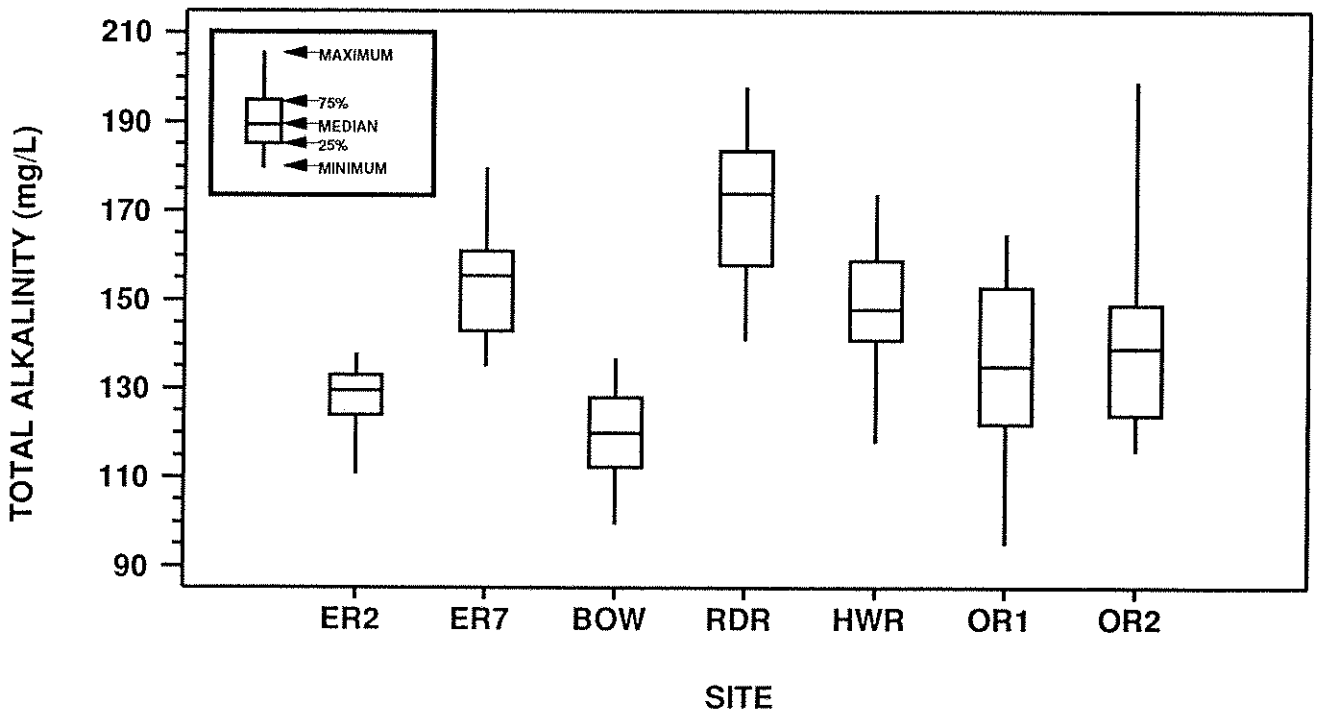

Figure 18. Comparison of annual alkalinity concentrations in five southern Alberta rivers.

The highest alkalinity measurements were obtained during autumn. Southern Alberta rivers typically have high bicarbonate levels, and are therefore highly alkaline. Total alkalinity levels were similar in the Elbow River at Allen Bill Pond and in the Bow River, and levels at the Sarcee Barracks Bridge site were similar to those at the Highwood River and both Oldman River sites. Both Elbow River sites had lower alkalinity levels than did the Red Deer River site (Figure 18).

4.9 HARDNESS

Hardness is a measure of the ability to produce lather in water and depends mainly on the concentration of calcium and magnesium ions (McNeely et al. 1979; Clesceri et al. 1989). All water samples collected from the Elbow River and its tributaries would be classified as hard to very hard (CCREM 1987), probably because of groundwater flow into the river and the availability of calcium and magnesium in the soil and bedrock.

In general, hardness increased in samples collected from the headwaters of the Elbow River to the Glenmore Reservoir. The sites with similar hardness levels included: 1) the Little Elbow River to the Elbow River at Cobble Flats, 2) the Elbow River at Allen Bill Pond to Highway 22, and 3) all sites downstream of Highway 22 (Figure 19). Although water from all five of the southern Alberta rivers that were compared was classified as being from hard to very hard, the two Elbow River sites had slightly harder water than did the others. The exception was water in the Red Deer River, which had comparable hardness values to water from the Elbow River at Allen Bill Pond (Figure 20). Differences in bedrock or soil composition of the various river reaches may also account for differences in water hardness between sites or rivers.

4.10 TOTAL DISSOLVED SOLIDS AND RESIDUES

Total dissolved solids (TDS) indicates the amount of dissolved substances in water and can be defined by calculation (NAQUADAT Code 201L) or may be related to total filterable residue (CCREM 1987). TDS and filterable residue levels increased from the headwaters of the Elbow River to its confluence with the Bow River (Figures 21, 22). They also increased in winter, probably because of increased proportion of groundwater in the river during this season, and then decreased in summer. Sites of the river with statistically similar TDS levels included: 1) the Little Elbow River to the Elbow River at Allen Bill Pond,

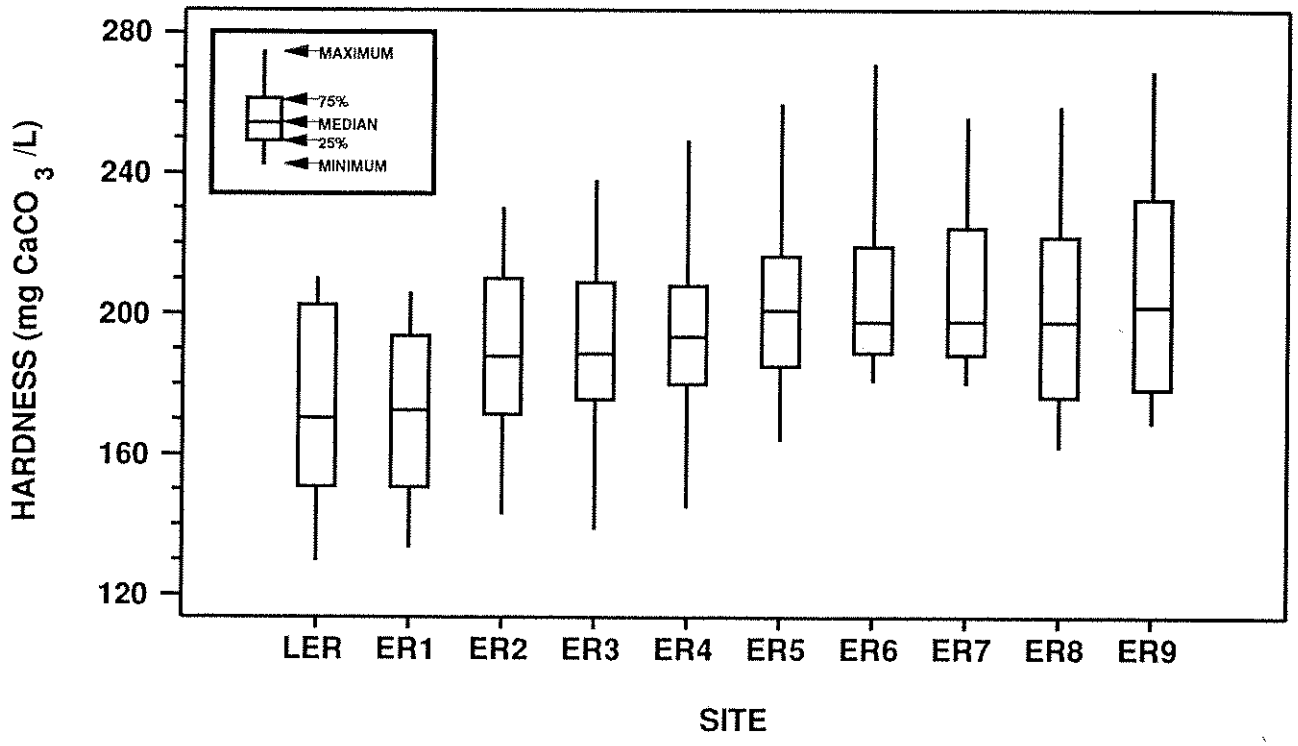

Figure 19. Longitudinal trends in annual hardness concentrations in the Elbow River.

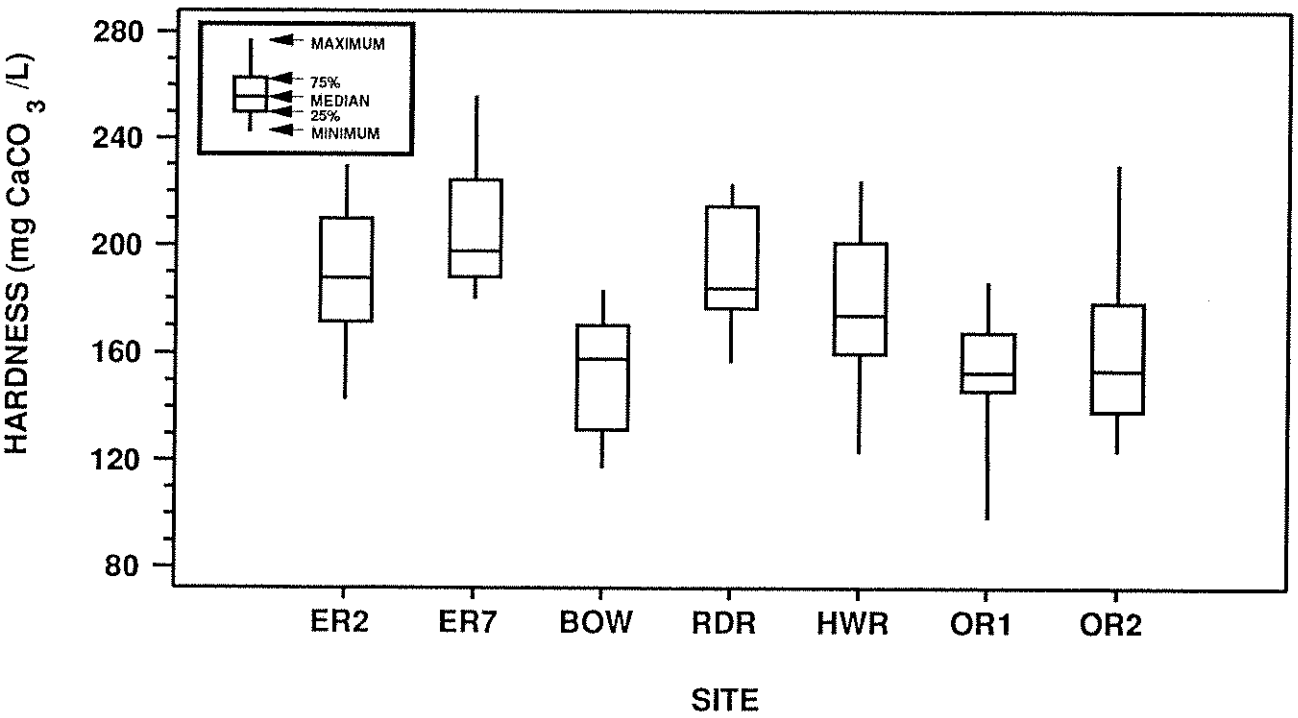

Figure 20. Comparison of annual hardness concentrations in five southern Alberta rivers.

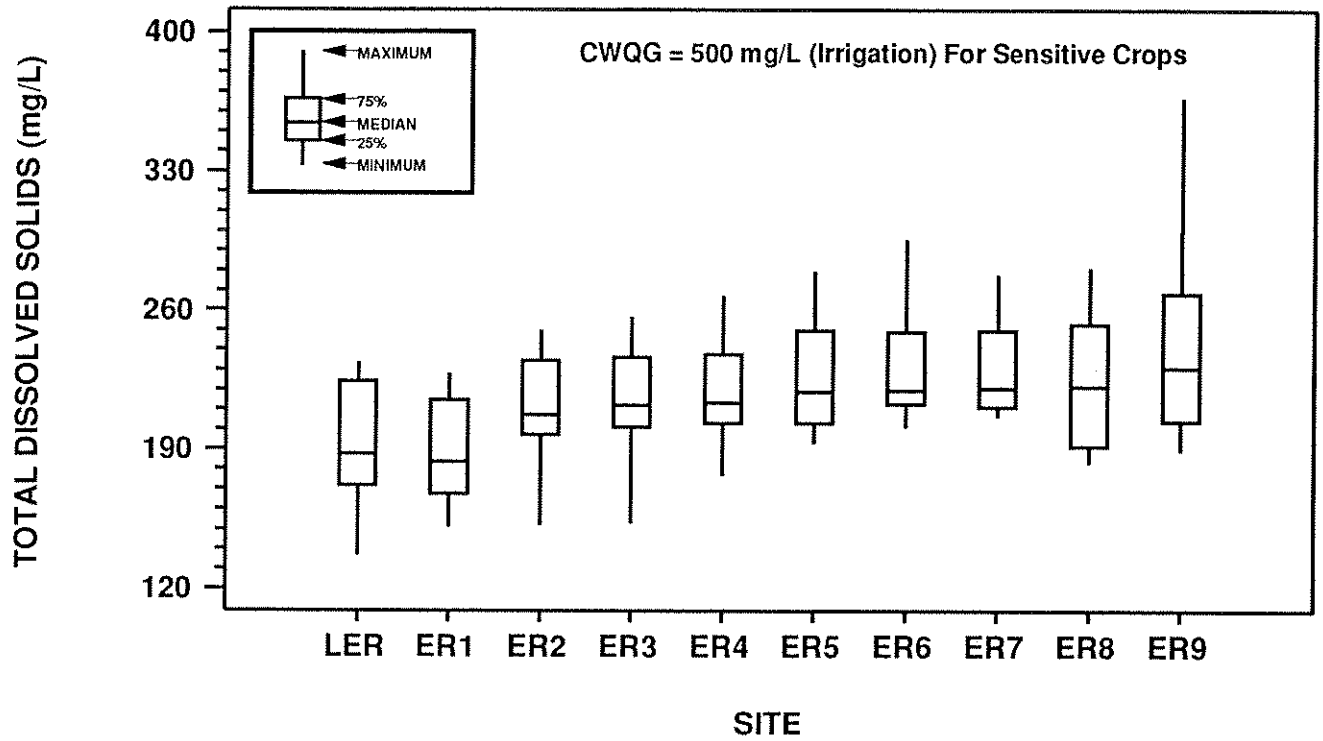

Figure 21. Longitudinal trends in annual total dissolved solid levels in the Elbow River.

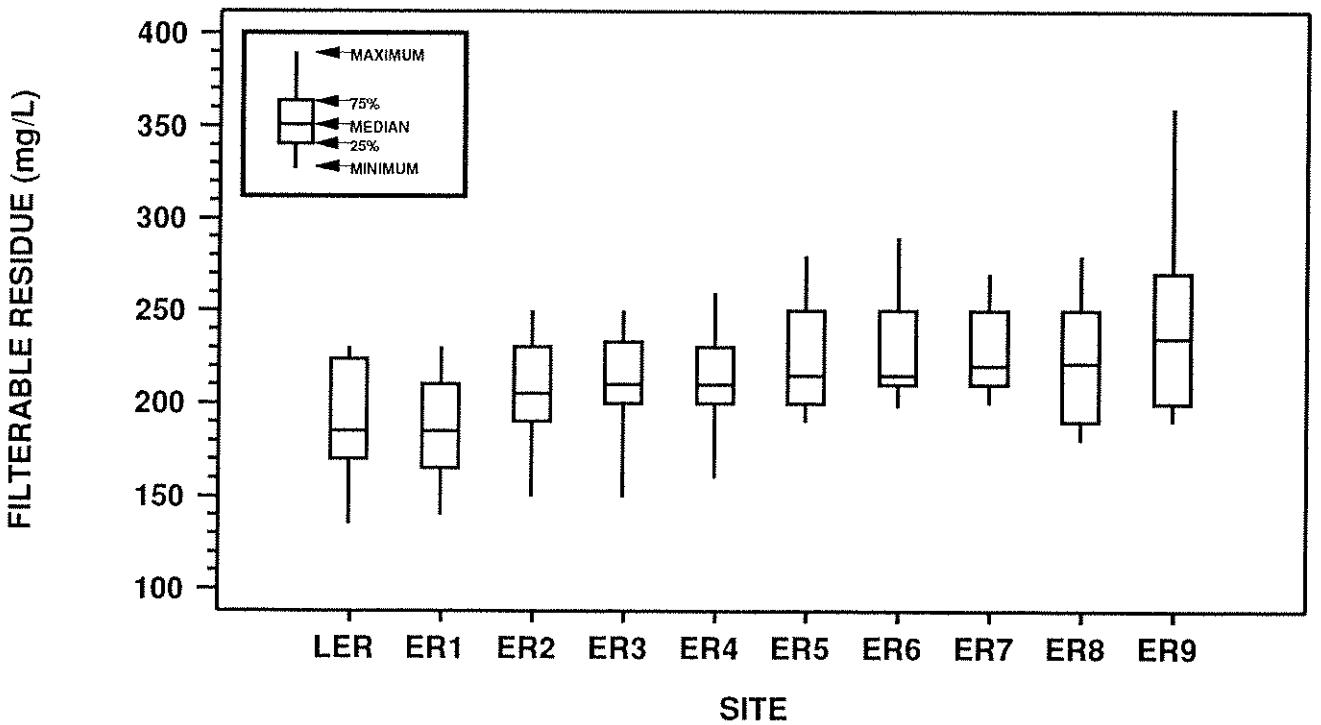

Figure 22. Longitudinal trends in annual filterable residue levels in the Elbow River.

2) the Elbow River at Allen Bill Pond to the Glencoe Golf and Country Club, 3) the Elbow River upstream of the Twin Bridges to the Calgary Golf and Country Club, and 4) the Elbow River at the Sarcee Barracks Bridge to the 9th Avenue Bridge.

Filterable residue was the main fraction of total residue except during peak flow. Filterable residue increased in water samples from the headwaters of the Elbow River to the confluence with the Bow River. Those sites of the river with statistically similar filterable residue levels included: 1) the Little Elbow River to the Elbow River at Highway 22 (except for the Elbow River above Cobble Flats, which had levels similar only to the Little Elbow River), 2) the Elbow River downstream of Bragg Creek to upstream of the Twin Bridges and the Calgary Golf and Country Club site, and 3) the Elbow River at the Glencoe Golf and Country Club to the 9th Avenue Bridge. Nonfilterable residue levels were usually very low and were similar in water collected from all sites except during peak flow (Figure 23).

The levels of TDS and filterable residue in Elbow River water were similar to those in the Red Deer River and higher than those in the Bow, Highwood, and Oldman rivers (Figures 24, 25). Nonfilterable residue levels in Elbow River water were lower than in samples from the Oldman River sites and similar to those in the other three southern Alberta rivers surveyed (Figure 26).

4.11 MAJOR IONS

The major ions in the Elbow River are calcium (Ca^{2+}), magnesium (Mg^{2+}), sodium (Na^{+}), potassium (K^{+}), bicarbonate (HCO_3^{-}), sulphate (SO_4^{2+}), chloride (Cl^{-}), and carbonate (CO_3^{2-}). Values for concentrations of most of the major ions were statistically similar in water samples from the following sites: (1) the Little Elbow River to the Elbow River at Allen Bill Pond, (2) the Elbow River downstream of Bragg Creek to Highway 22, and (3) all downstream sites (chloride, sodium and potassium concentrations, however, were higher in the river downstream of the Glenmore Reservoir). In general, all of the major ions, except SO_4^{2-}, increased in concentration in samples collected from the headwaters of the Elbow River to the confluence with the Bow River (Figures 27-33). Magnesium and sulphate concentrations were lower in water from tributary creeks than from mainstem sites, whereas HCO_3^{-}, Ca^{2+}, Na^{+}, K^{+}, and Cl^{-} concentrations were usually higher in tributary creek water than in mainstem water. Ca^{2+}, Mg^{2+}, HCO_3^{-}, and SO_4^{2-} concentrations were higher in winter

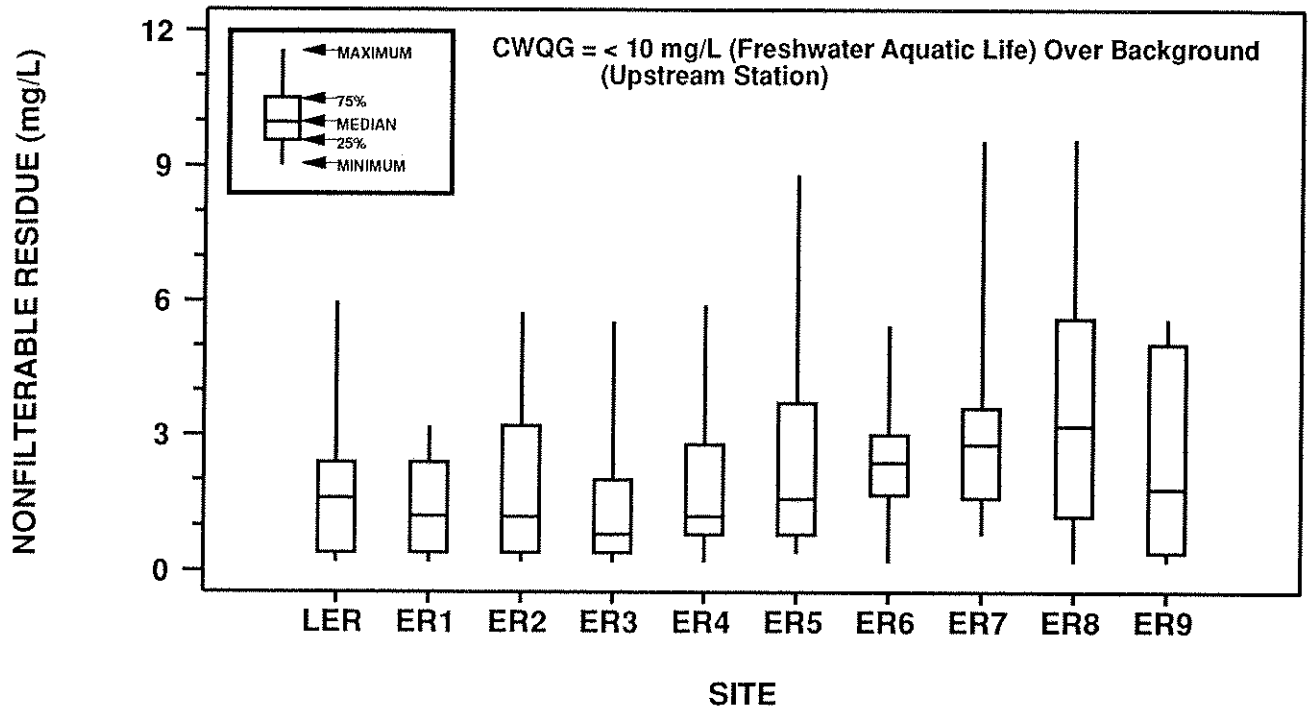

Figure 23. Longitudinal trends in annual nonfilterable residue levels in the Elbow River.

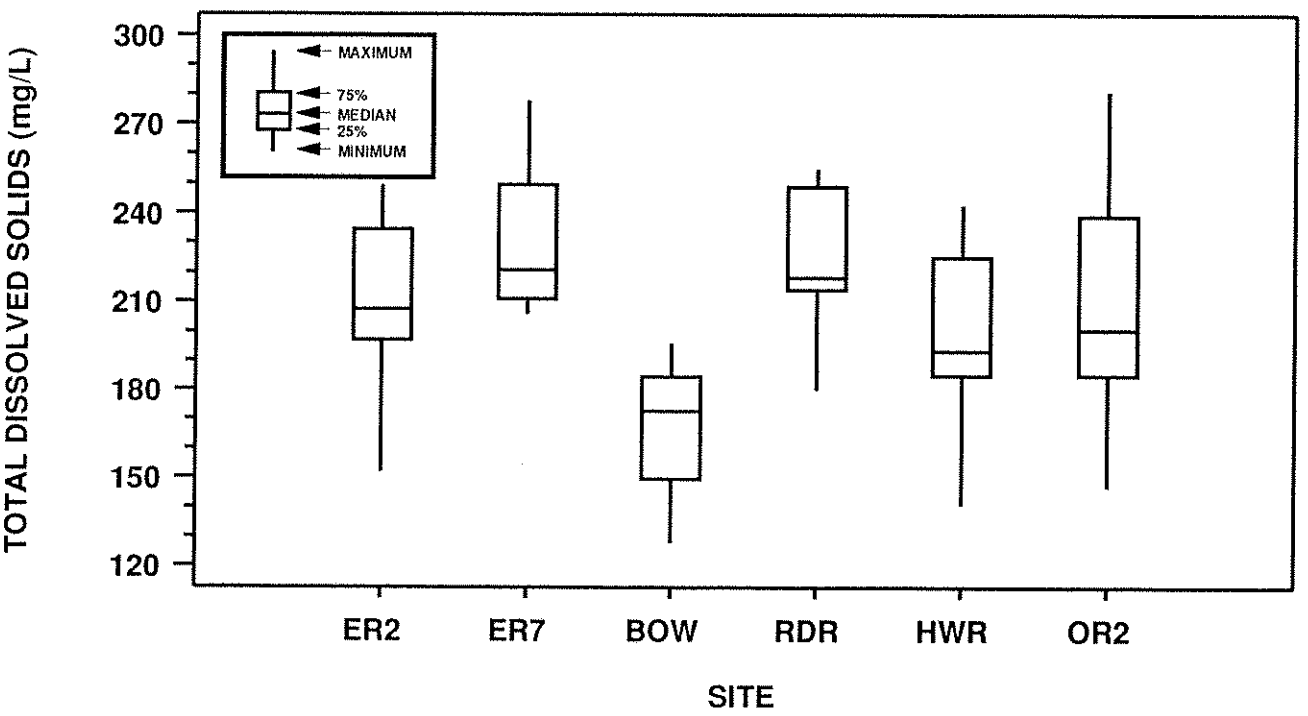

Figure 24. Comparison of annual total dissolved solid levels in five southern Alberta rivers.

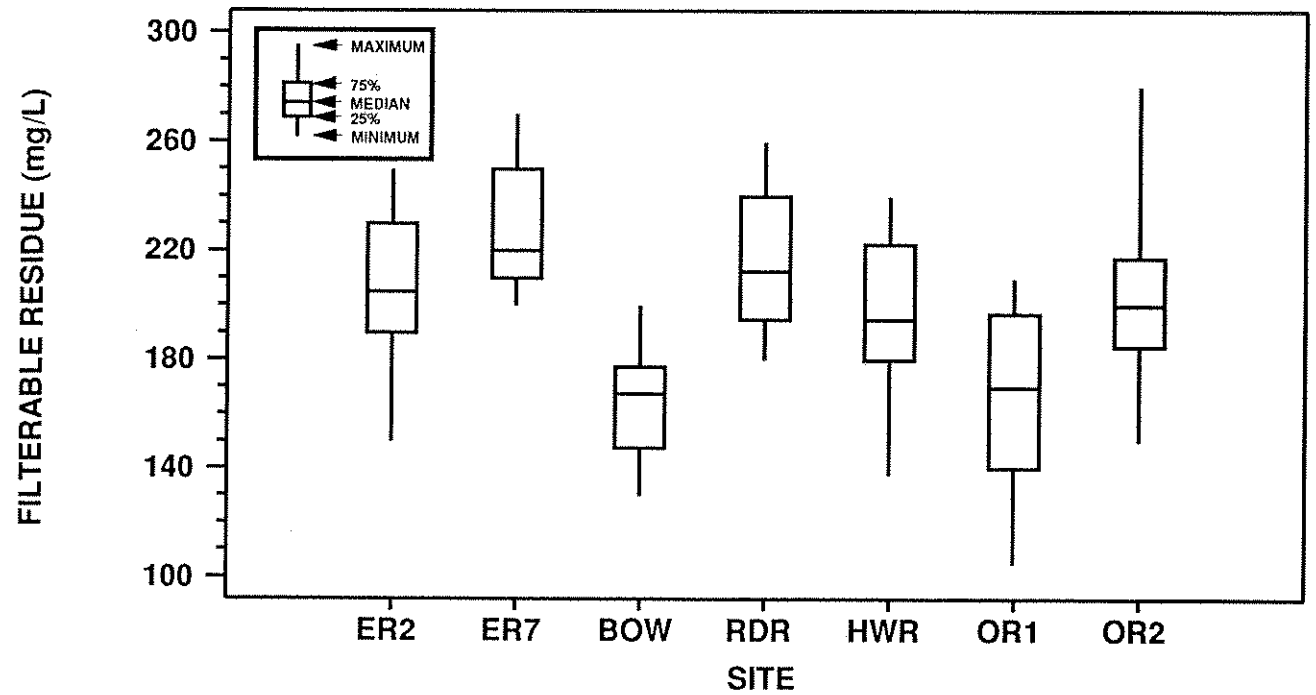

Figure 25. Comparison of annual filterable residue levels in five southern Alberta rivers.

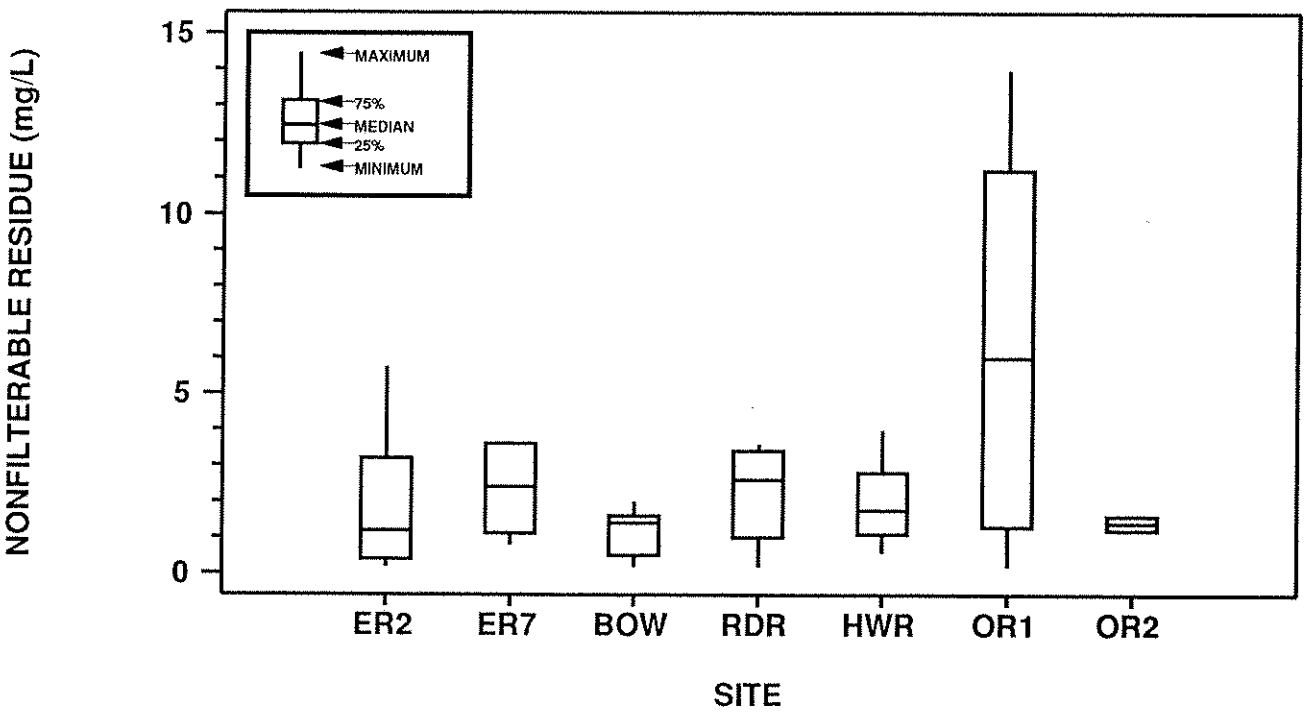

Figure 26. Comparison of annual nonfilterable residue levels in five southern Alberta rivers.

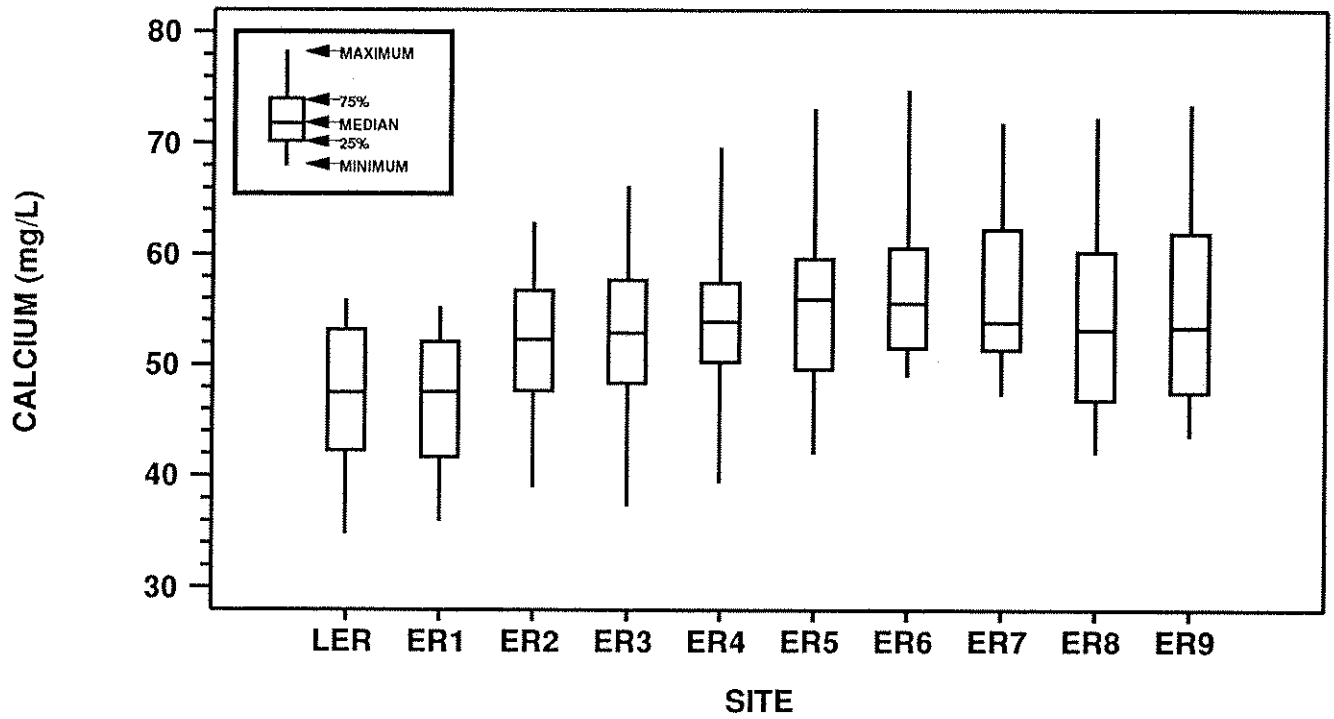

Figure 27. Longitudinal trends in annual calcium concentrations in the Elbow River.

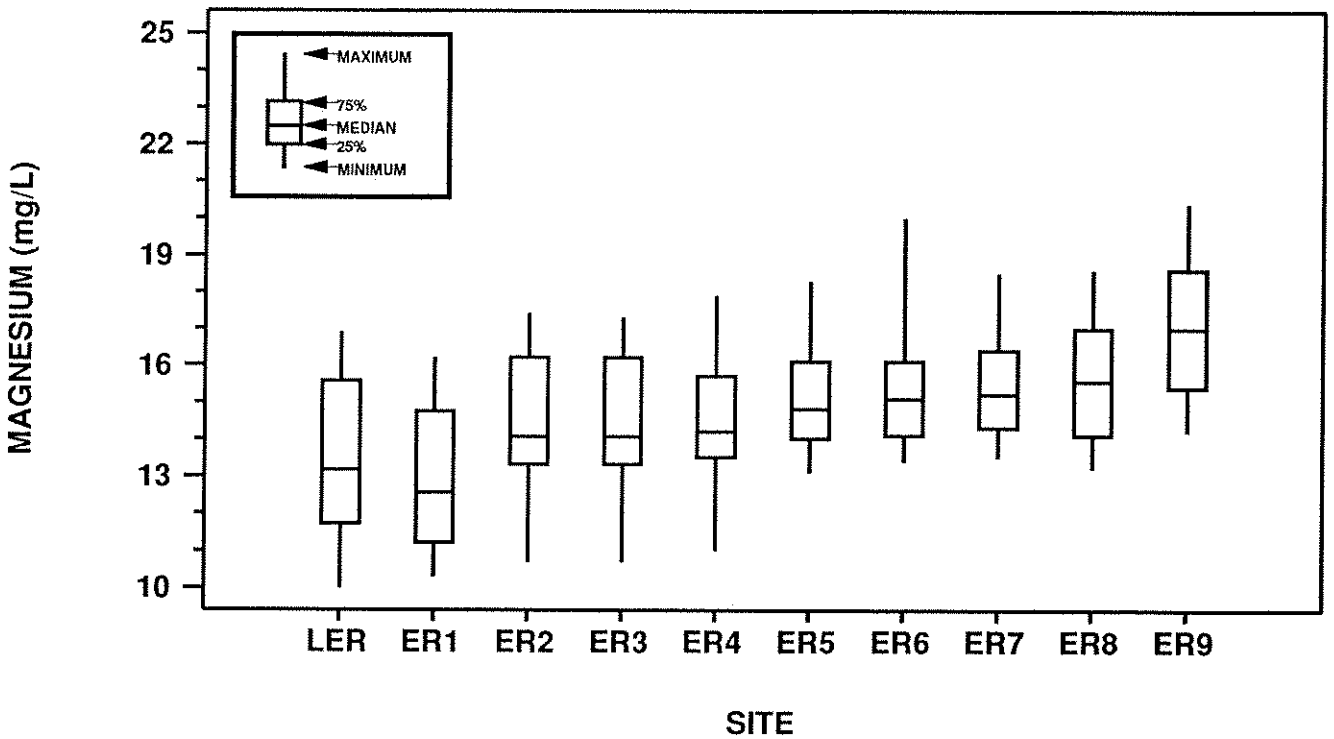

Figure 28. Longitudinal trends in annual magnesium concentrations in the Elbow River.

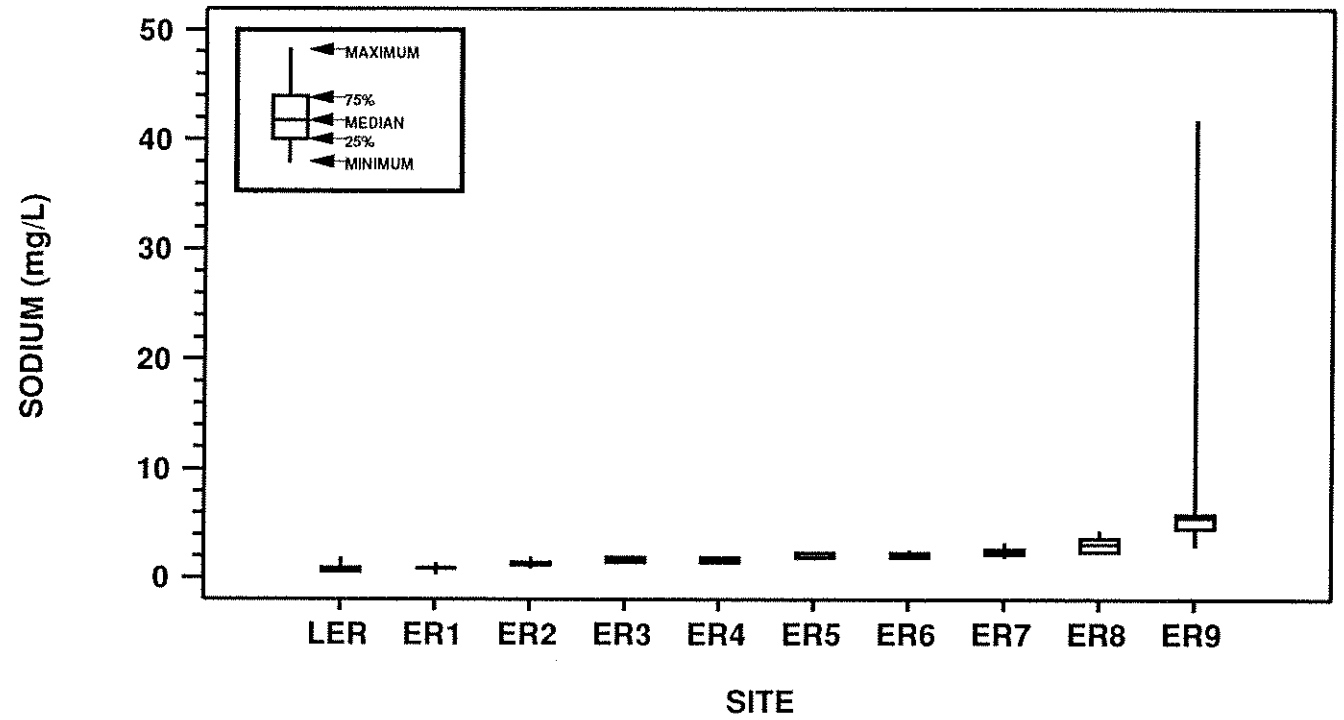

Figure 29. Longitudinal trends in annual sodium concentrations in the Elbow River.

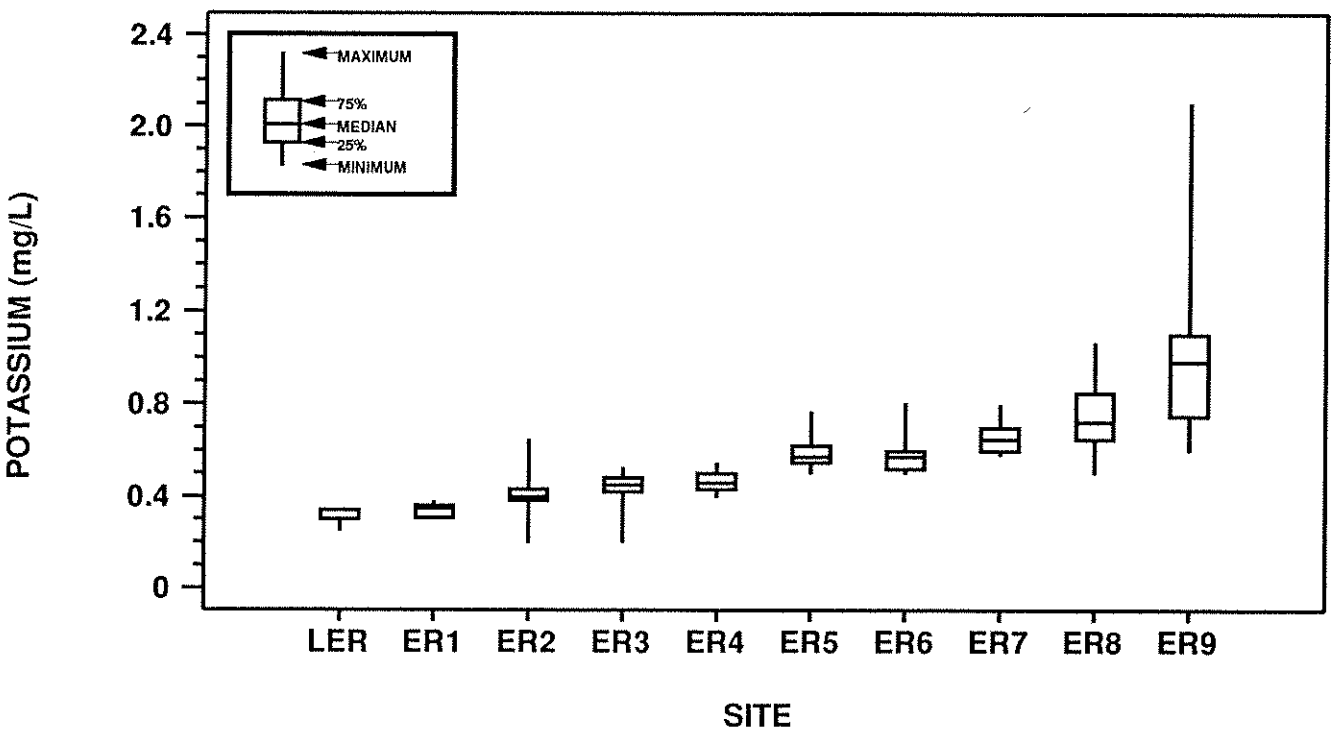

Figure 30. Longitudinal trends in annual potassium concentrations in the Elbow River.

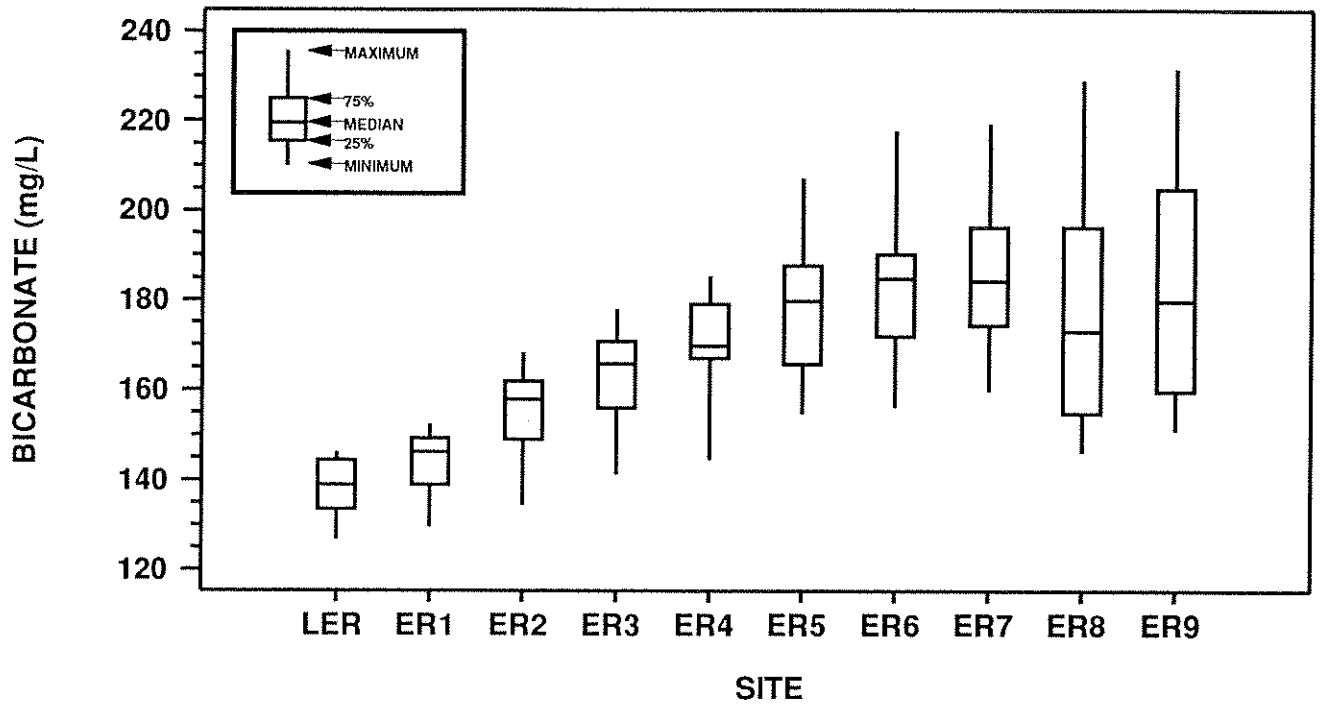

Figure 31. Longitudinal trends in annual bicarbonate concentrations in the Elbow River.

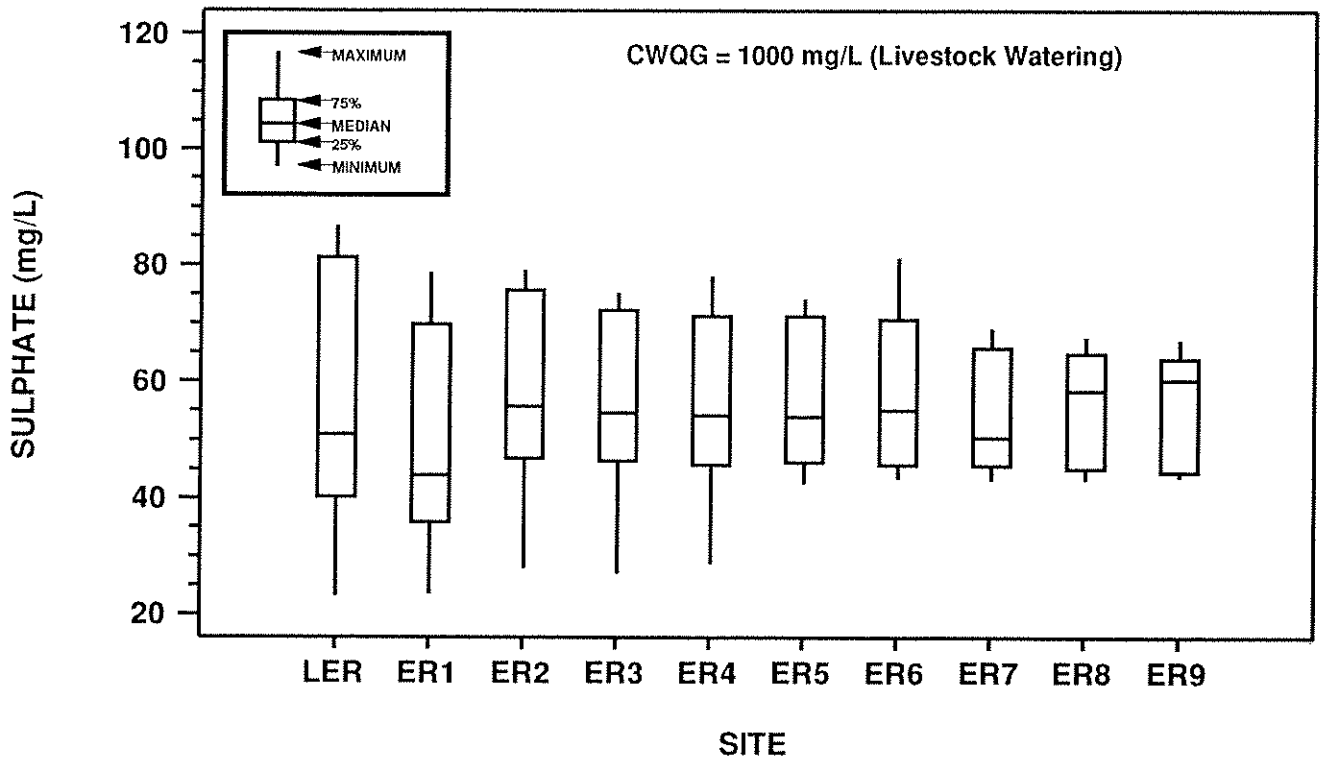

Figure 32. Longitudinal trends in annual sulphate concentrations in the Elbow River.

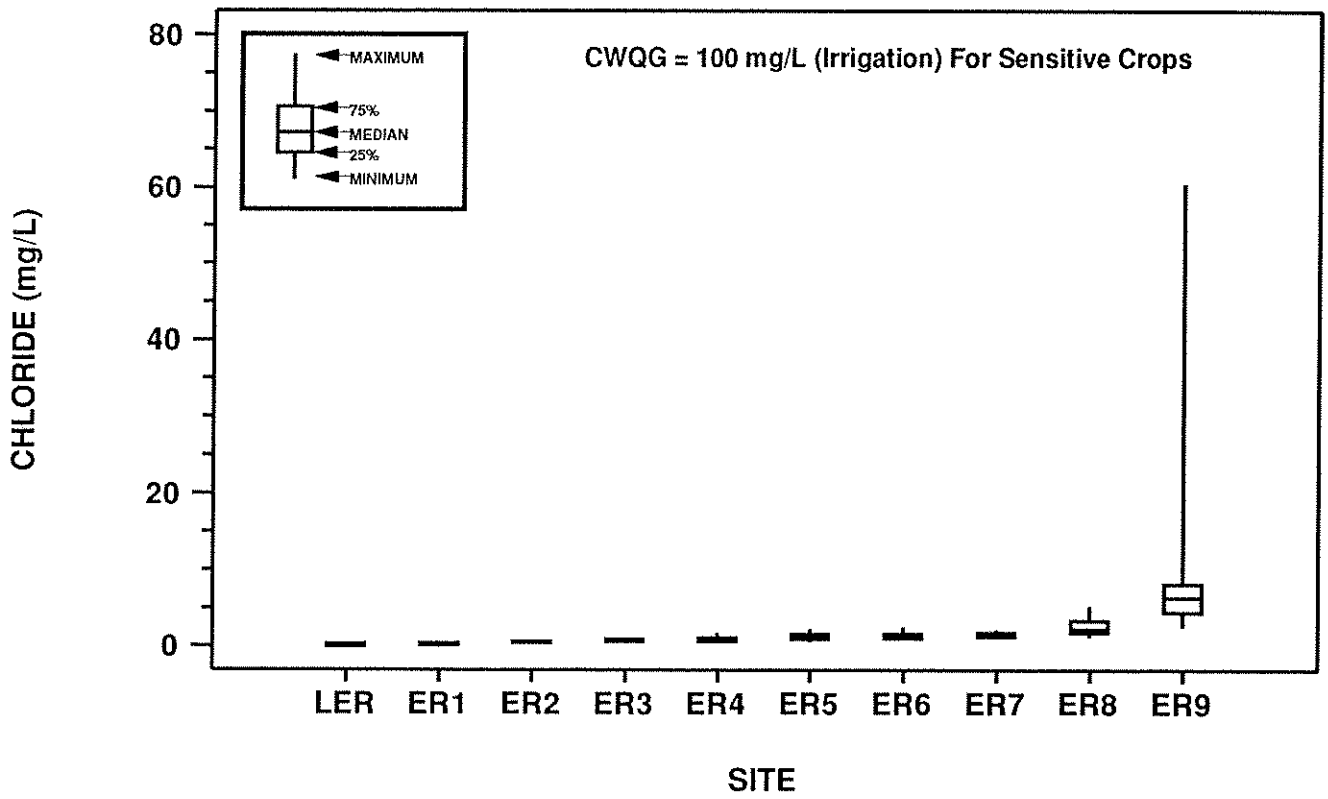

Figure 33. Longitudinal trends in annual chloride concentrations in the Elbow River.

than in summer. Carbonate levels were usually below the detection limit at all sites and were not analyzed statistically.

Bicarbonate levels in the Elbow River were always high, as bicarbonate is the predominant form of inorganic carbon present when the pH of water is between 7 and 9 (Wetzel 1983); this was the pH range measured in the Elbow River. The limestone bedrock in the Elbow River basin is the probable source of bicarbonate. Sodium and chloride concentrations increased downstream of the Glenmore Dam, but much more so below ER8. These increases probably reflect minor chloride discharges from the Glenmore water treatment plant (Seidner 1991), or may reflect increased salt content in urban runoff directly entering Glenmore Reservoir (Hargesheimer and Lewis 1988). The most dramatic changes (between ER8 and ER9) probably reflect stormwater or other unknown inputs to the Elbow River below the reservoir.

Long-term data describing the major ions analyzed by the City of Calgary (Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, SO_4^{2-}, and Cl^{-}) were inversely correlated with flow (Table 6), which indicate that groundwater may be an important source of these ions. No trend was detected in either actual or flow-adjusted levels of Na^{+}, K^{+}, and SO_4^{2-} over the periods 1982-1988 and 1982-1990. However, Ca^{2+}, Mg^{2+}, and Cl^{-} concentrations all increased significantly between both 1982-1988 and 1982-1990 (Figures 34, 35, 36). Chloride was the only flow-adjusted major ion that showed significant seasonality.

The Elbow River had lower concentrations of Na^{+} and K^{+} than did either the Red Deer River or the Oldman River at Lethbridge (Figures 37, 38), perhaps because of differences in soils or underlying bedrock. Sulphate and Ca^{2+} concentrations were higher in the Elbow River than in the other four rivers surveyed (Figures 39, 40). Magnesium levels in the Elbow River were similar to levels in the Oldman River at Lethbridge and in the Red Deer River, and higher than in the other three rivers (Figure 41). Chloride concentrations were similar in the Elbow River at Allen Bill Pond and in the Highwood River, and concentrations in the Elbow River at the Sarcee Barracks Bridge were was similar to those in the Bow River and the Oldman River at Lethbridge (Figure 42). HCO_3^{-} concentrations were similar in all five southern Alberta rivers surveyed (Figure 43).

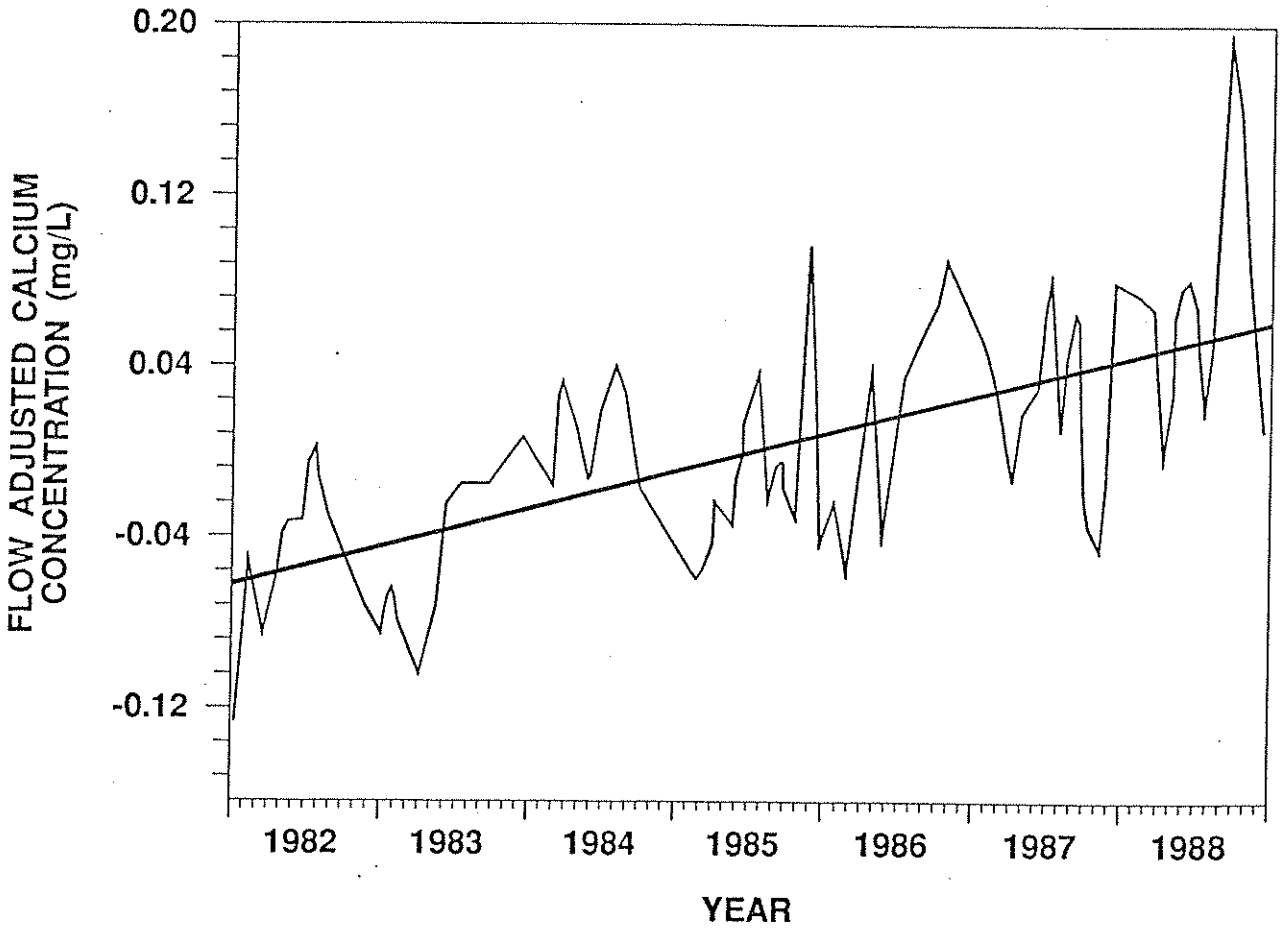

Figure 34. Increase in flow-adjusted calcium concentrations at Sarcee Bridge from 1982 to 1988.

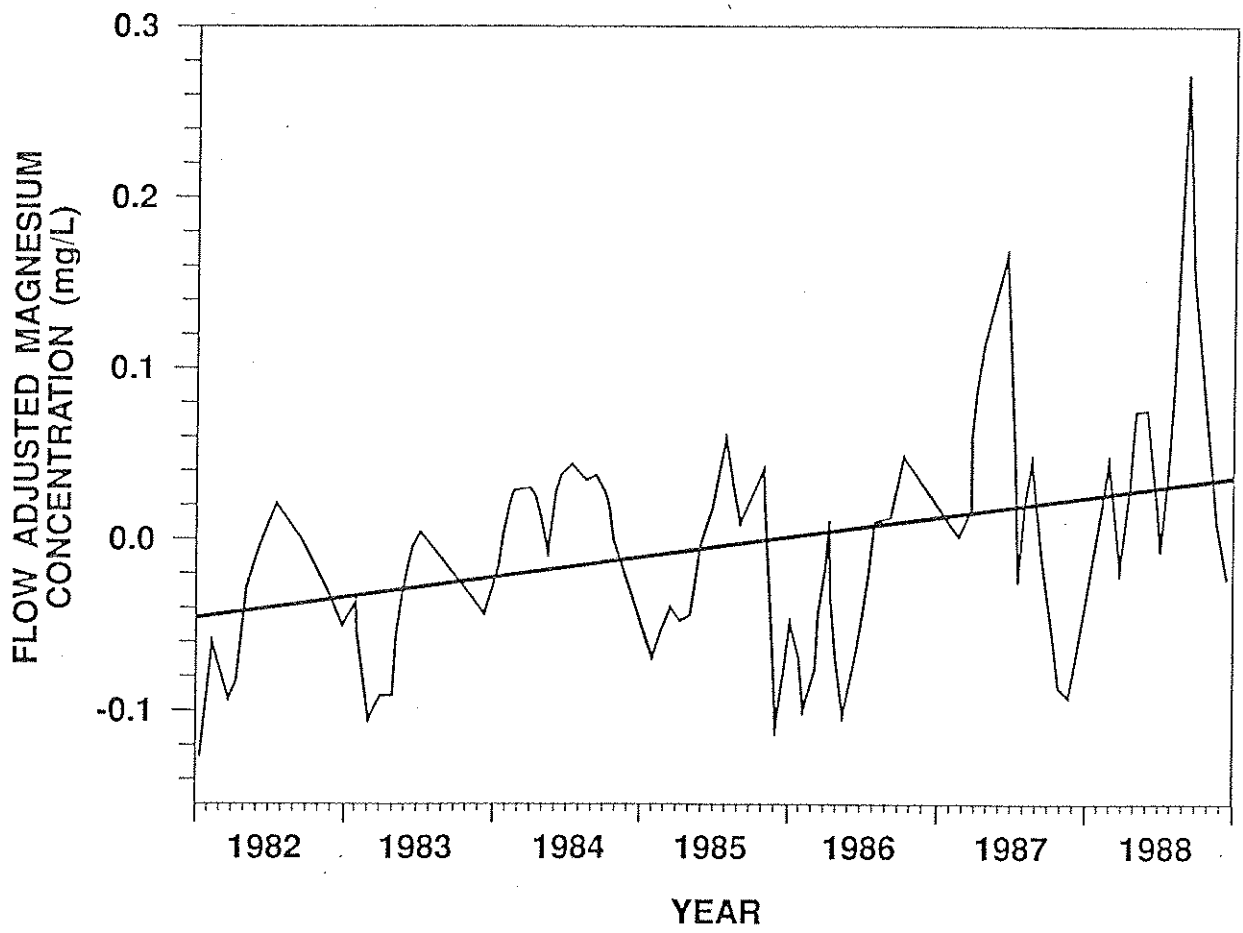

Figure 35. Increase in flow-adjusted magnesium concentrations at Sarcee Bridge from 1982 to 1988.

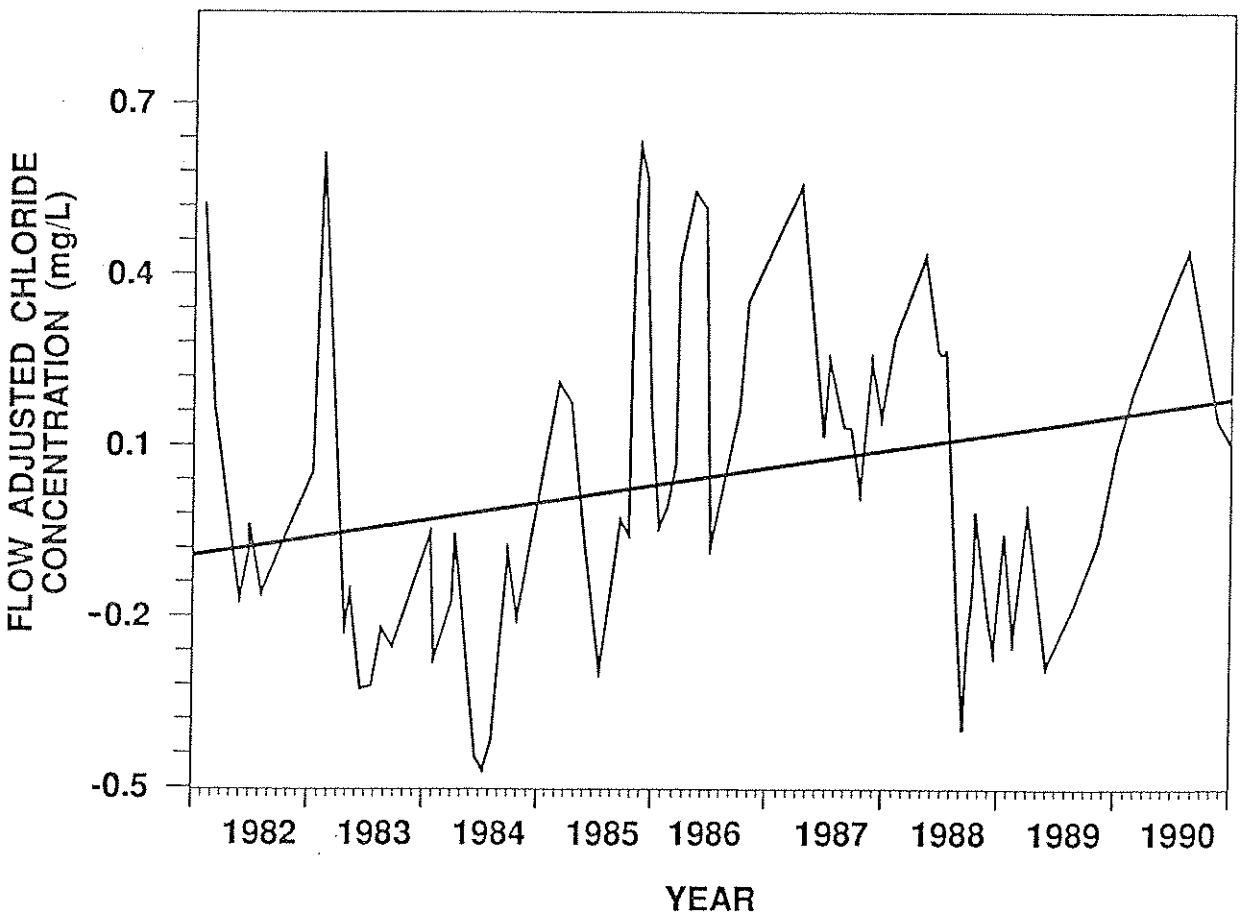

Figure 36. Increase in flow-adjusted chloride concentrations at Sarcee Bridge from 1982 to 1988 and at Twin Bridges from 1989 to 1990.

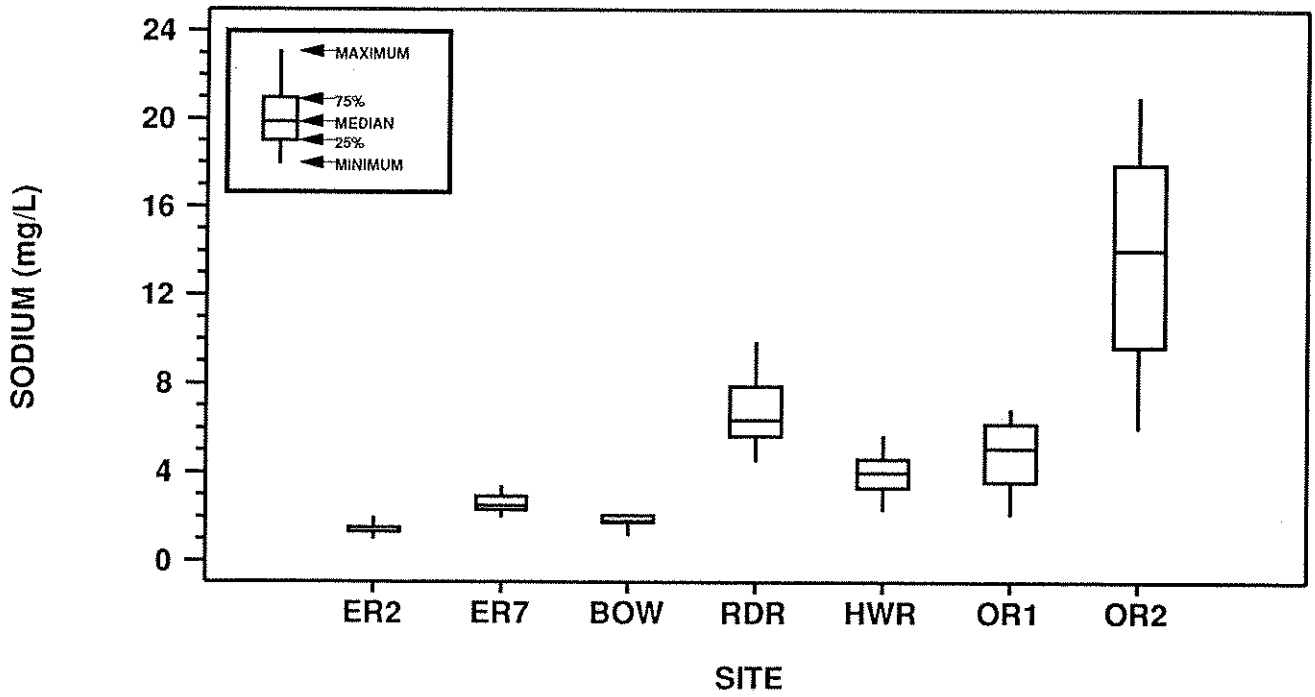

Figure 37. Comparison of annual sodium concentrations in five southern Alberta rivers.

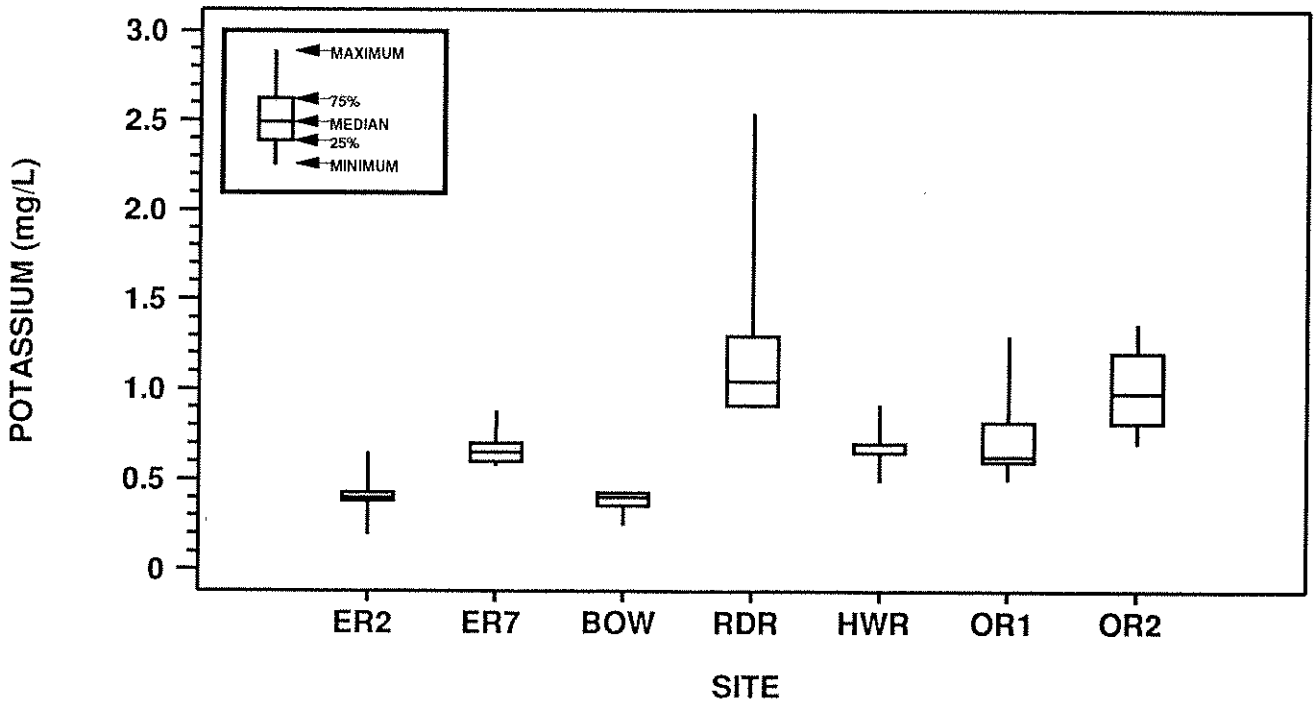

Figure 38. Comparison of annual potassium concentrations in five southern Alberta rivers.

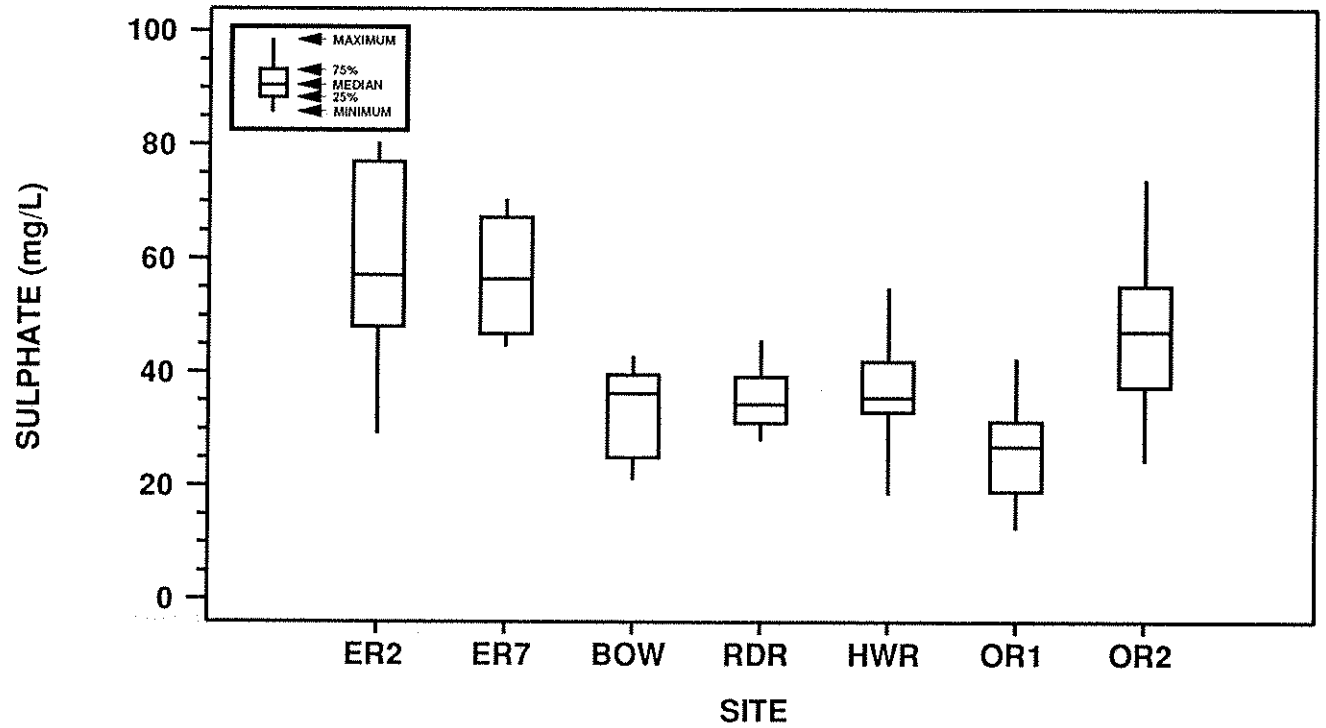

Figure 39. Comparison of annual sulphate concentrations in five southern Alberta rivers.

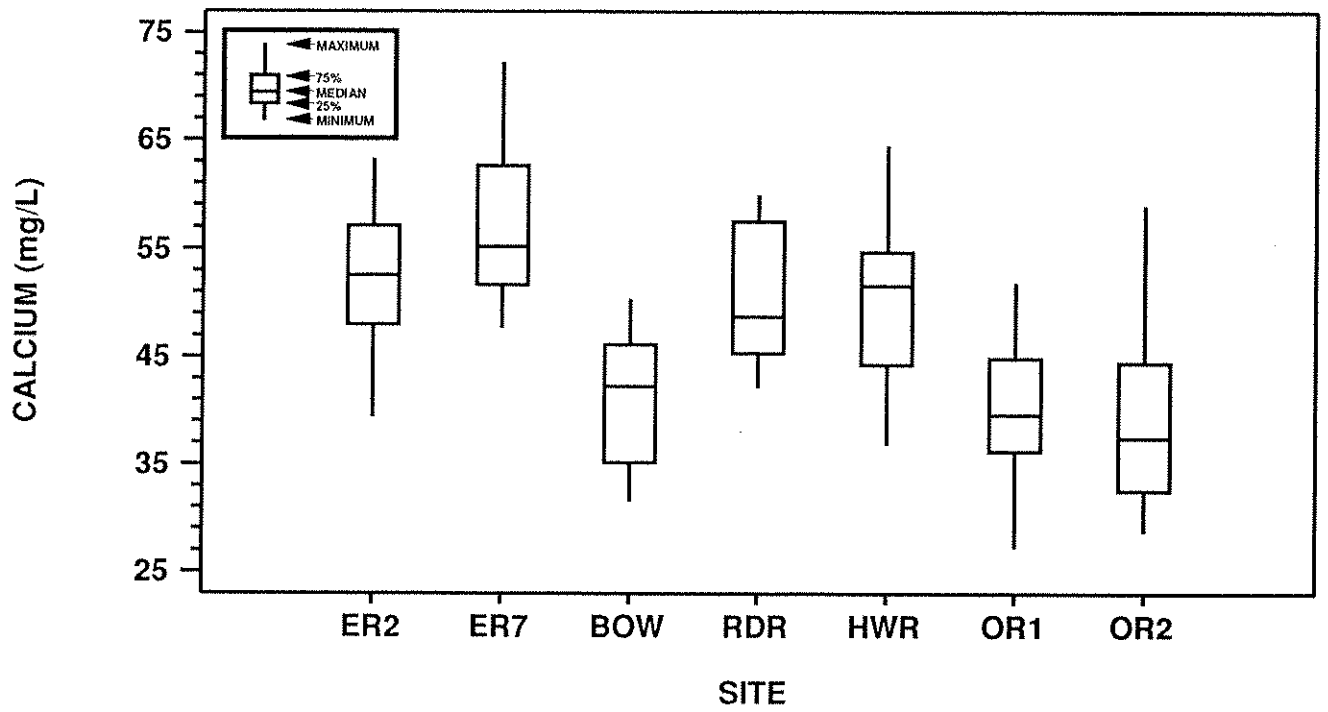

Figure 40. Comparison of annual calcium concentrations in five southern Alberta rivers.

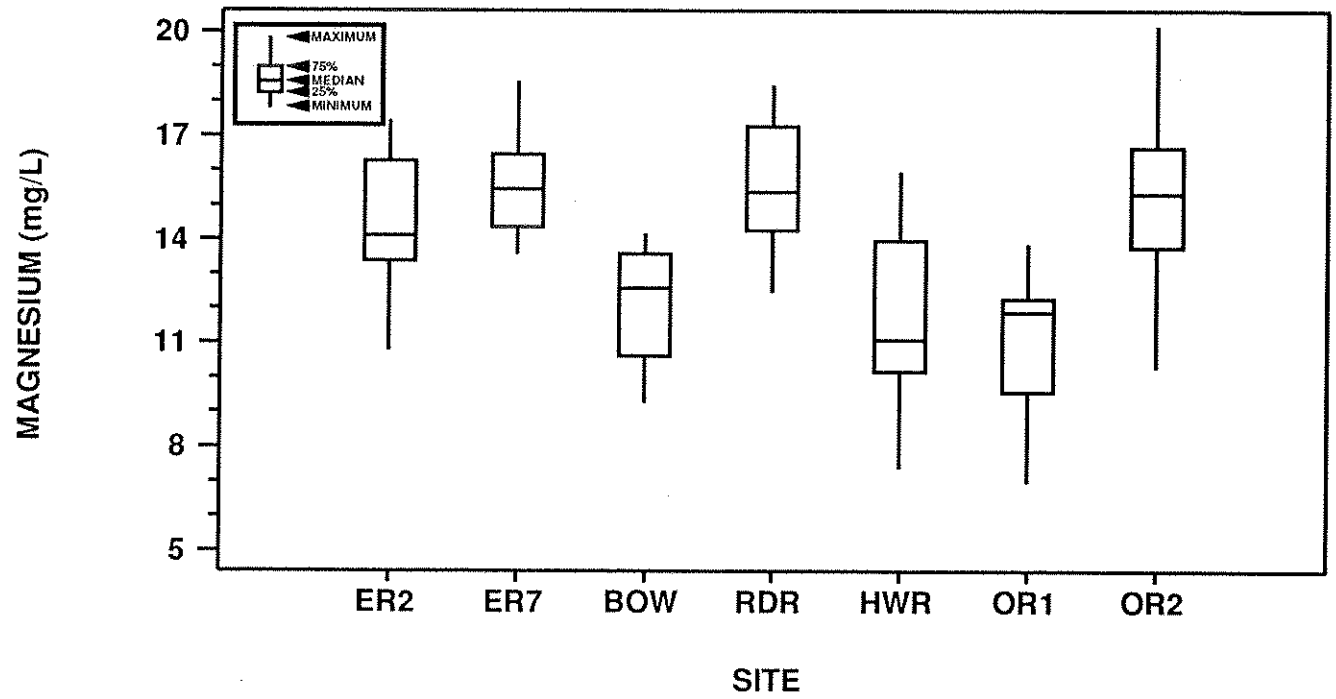

Figure 41. Comparison of annual magnesium concentrations in five southern Alberta rivers.

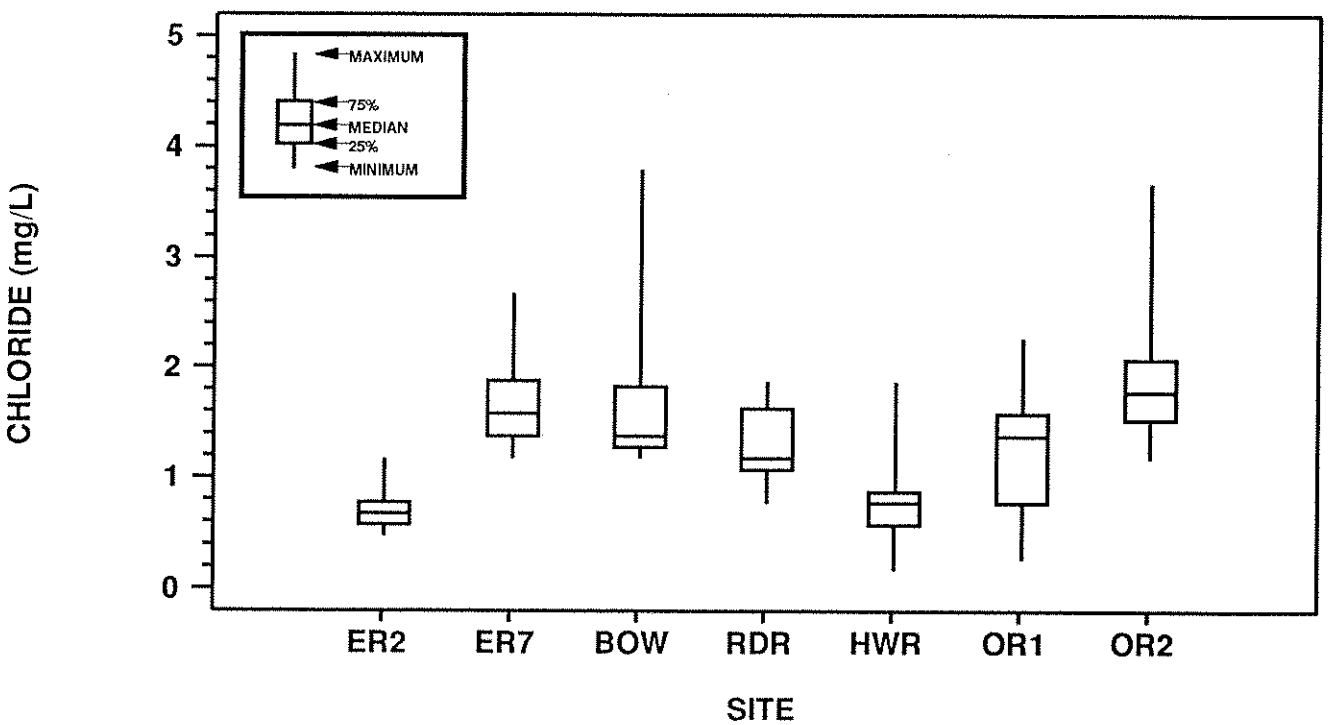

Figure 42. Comparison of annual chloride concentrations in five southern Alberta rivers.

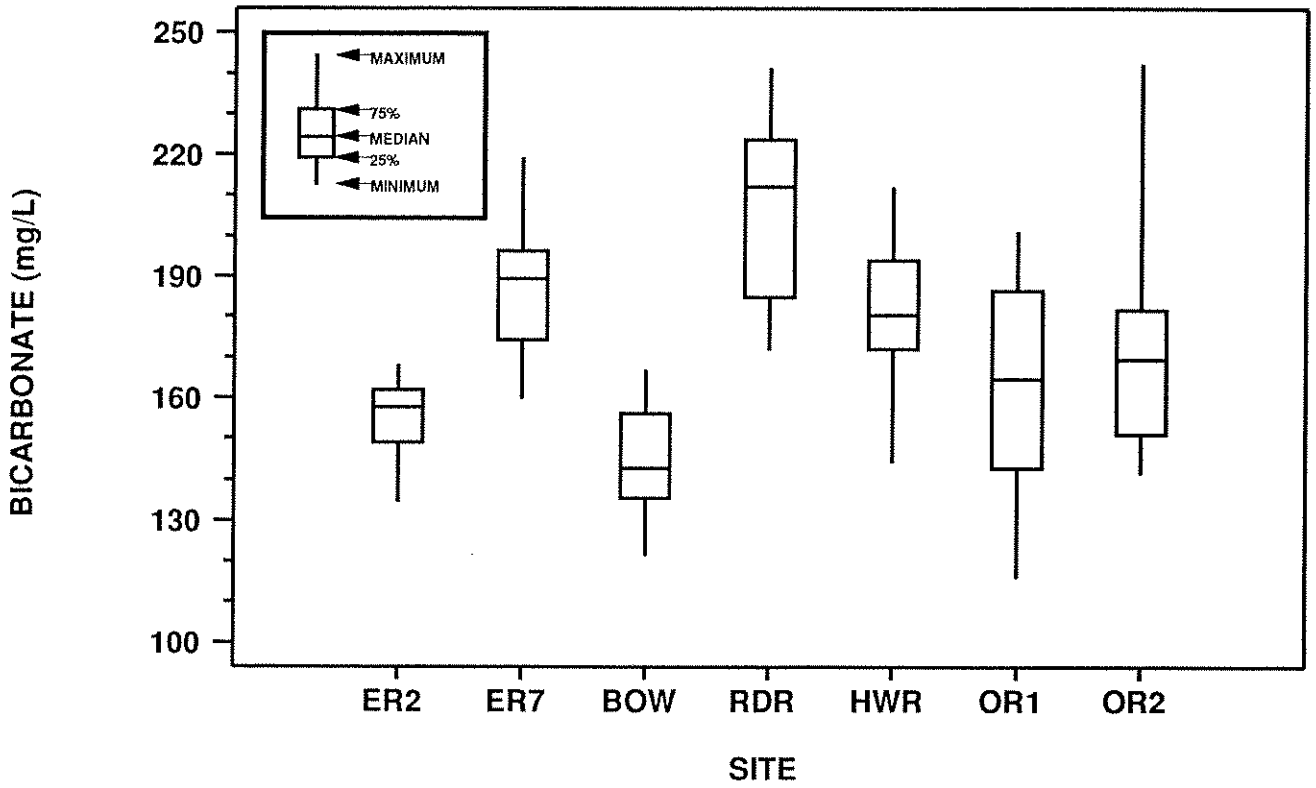

Figure 43. Comparison of annual bicarbonate concentrations in five southern Alberta rivers.

4.12 FLUORIDE

Fluoride is released from the weathering of shale bedrock, such as underlies much of the upstream reaches of the Elbow River watershed. Man-made sources of fluoride include insecticides and herbicides (McNeely et al. 1979). Fluoride concentrations increased in Elbow River water between Cobble Flats and Allen Bill Pond, then decreased until the river reached its confluence with the Bow River. Those sites of the river with statistically homogeneous fluoride concentrations included: (1) the Little Elbow River to the Elbow River at Cobble Flats, (2) the Elbow River at Allen Bill Pond to the Sarcee Barracks Bridge, and (3) the two sites below the Glenmore Dam (Figure 44). Fluoride concentrations did not increase in areas of the Elbow River where the watershed has adjoining agricultural activity; thus, most of the fluoride is probably from natural rock weathering. Because fluoride levels decreased with increasing flow, groundwater is a likely source of this ion. Fluoride levels in the tributaries were all lower than the levels in the nearest mainstem site (Figure 45). Median fluoride levels in the Elbow River were higher than in the other rivers that were compared, although higher levels were occasionally measured in the Highwood River (Figure 46).

4.13 DISSOLVED OXYGEN

Dissolved oxygen (DO) concentrations were high (>8 mg/L) in all samples (Figure 47). The Elbow River is fast-flowing, and atmospheric oxygen is easily added to the water. DO concentrations were always highest in the spring and fall and lowest in summer. Oxygen saturation was always greater than 80% upstream of the Glenmore Reservoir. Downstream of the Glenmore Dam, oxygen saturation was more variable; several summer measurements were greater than 100% (Figure 48). Such supersaturation of DO is common, however, and higher levels have been calculated for the Bow and Oldman rivers (e.g., Sosiak 1991). Although concentrations of dissolved oxygen decreased slightly from the headwaters of the Elbow River to the confluence with the Bow River, oxygen saturation showed little change.

The oxygen results occasionally did not comply with the CWQG for the protection of early life stages of cold water fish species (9.5 mg/L) (Table 4). However, the departures from the guidelines were small and as indicated above, never dropped below the 6.5 mg/L level suggested to protect adult life stages of the same fish group. The only known spawning

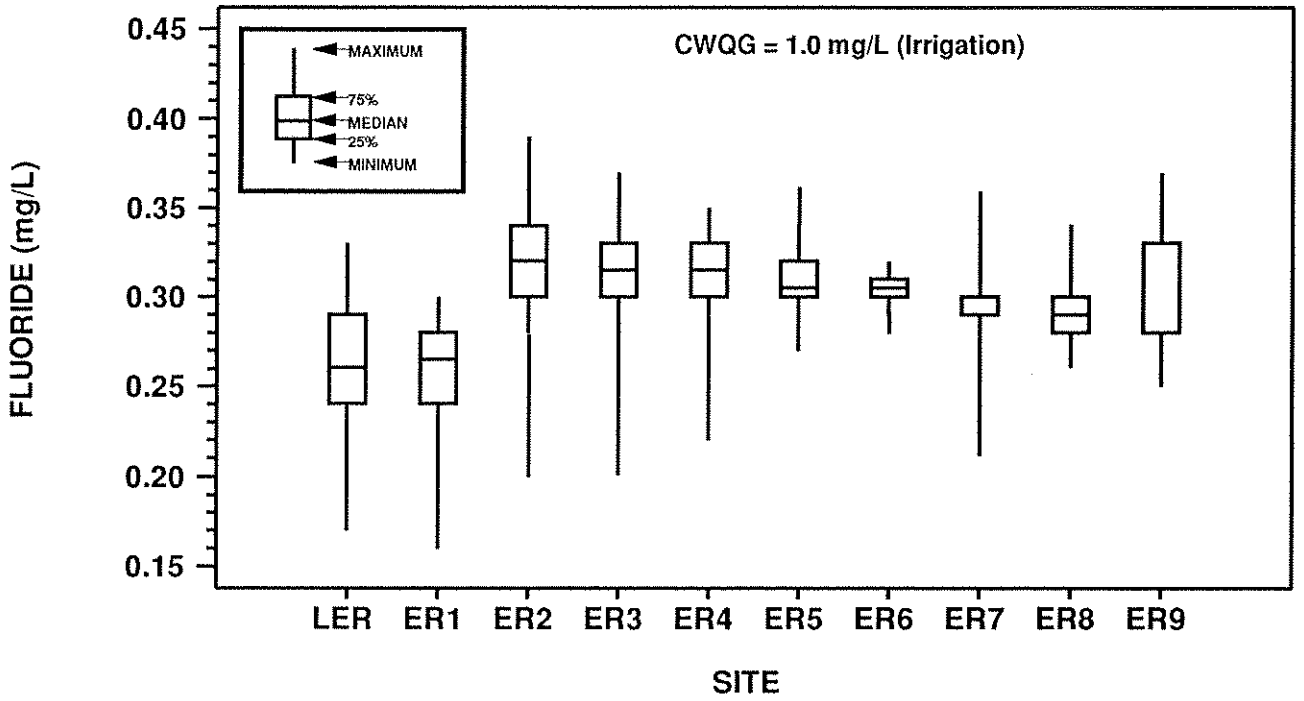

Figure 44. Longitudinal trends in annual fluoride concentrations in the Elbow River.

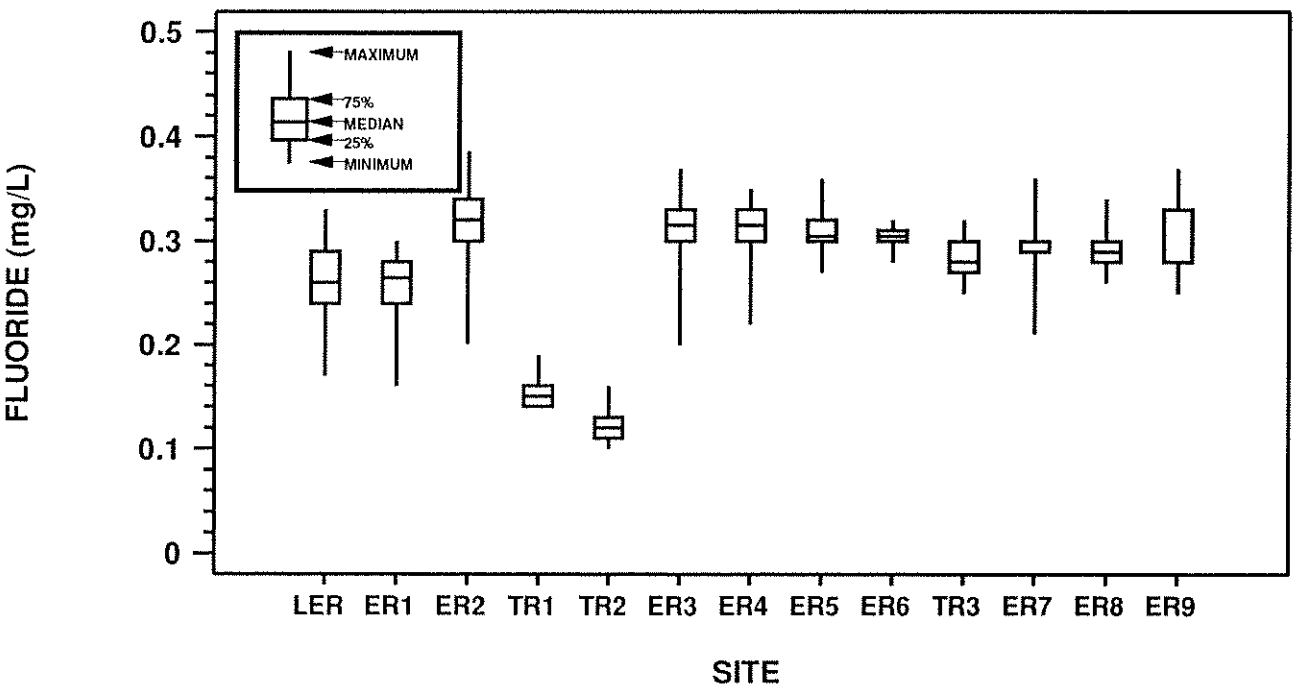

Figure 45. Comparison of annual fluoride concentrations at Elbow River mainstem and tributary sites.

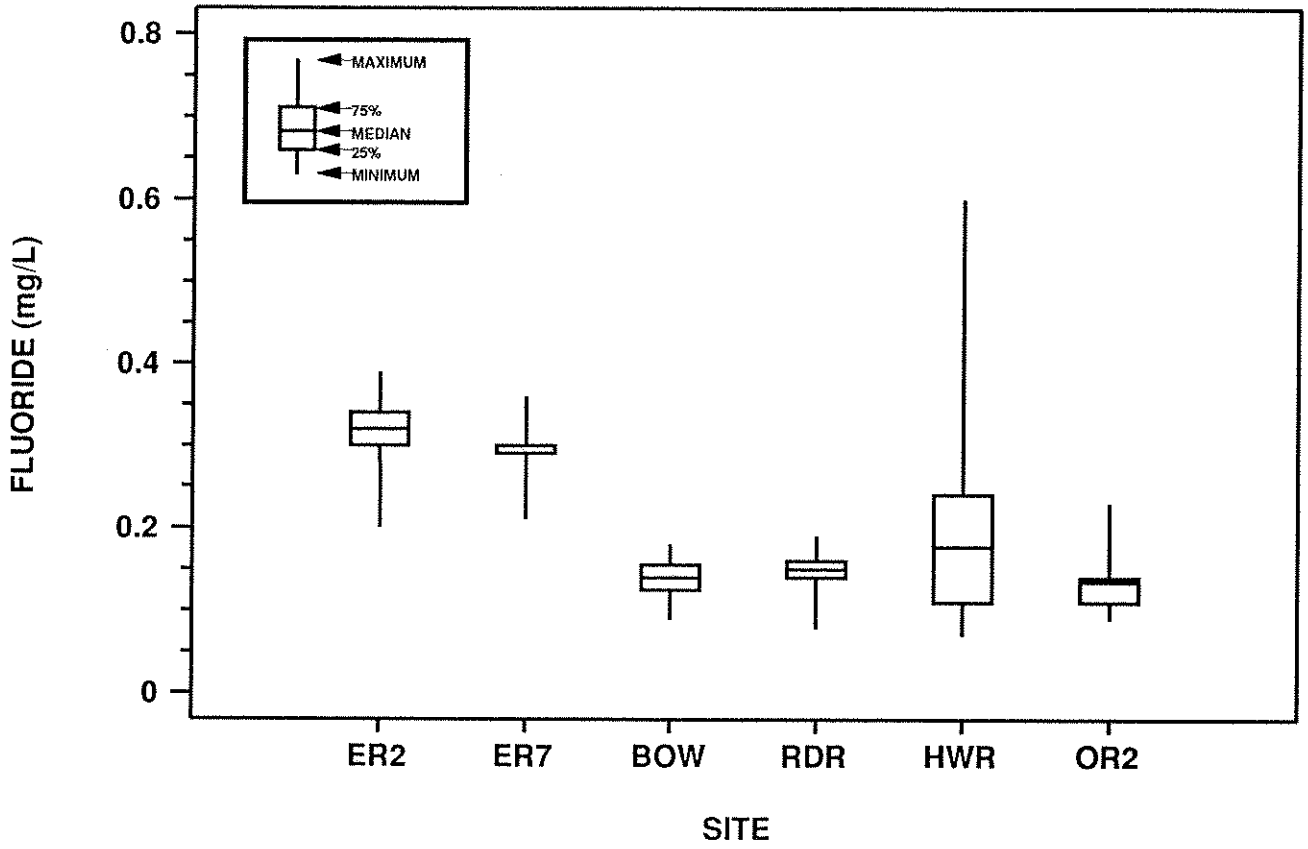

Figure 46. Comparison of annual fluoride concentrations in five southern Alberta rivers.

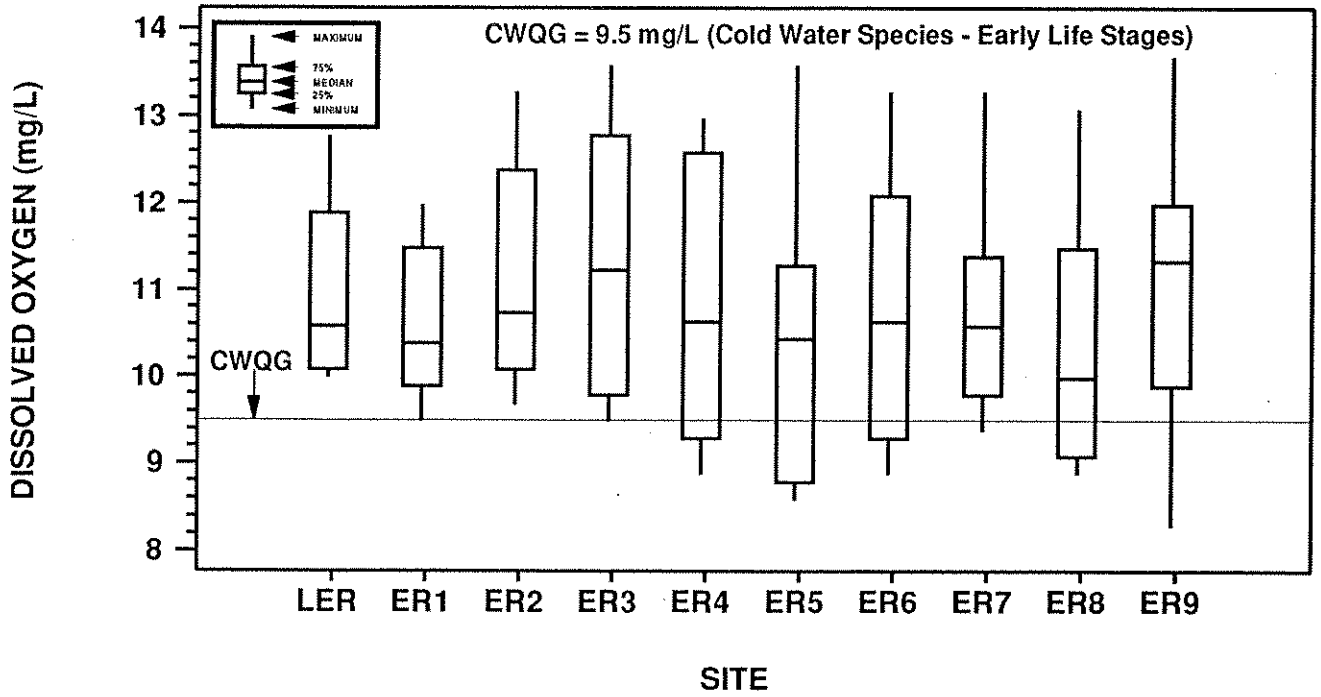

Figure 47. Longitudinal trends in annual dissolved oxygen concentrations in the Elbow River.

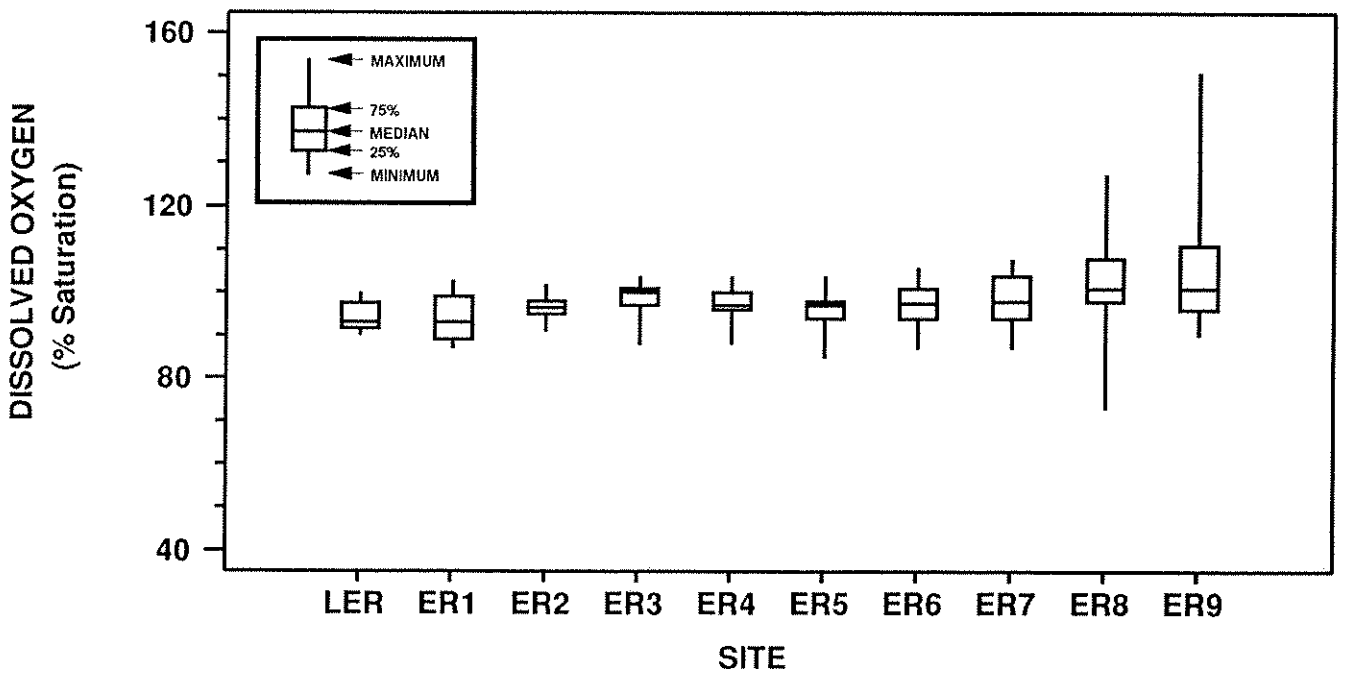

Figure 48. Longitudinal trends in annual percent saturation of dissolved oxygen in the Elbow River.

area where the early life stage guideline was not attained was near ER8 (Calgary Golf and Country Club). This area is used by Bow River brown trout for spawning (Sosiak 1983); the observed non-compliance value occurred once (8.9 mg/L) and appears to be a minor concern. However, more information on spawning areas and diurnal DO fluctuation throughout the Elbow River basin would be desirable.

4.14 METALS

Iron, zinc, barium, and aluminum were detected in the water at most Elbow River sites. These four metals are all also common in bedrock and soils (CCREM 1987). Barium is dissolved from feldspars, which are components of the bedrock underlying the watershed between Highway 22 and Calgary (Seagel 1971). Iron is found in sandstone formations (McNeely et al. 1979), which underlie most of the Elbow River (Seagel 1971). Aluminum is the third most abundant element in the earth's crust, and some aluminum salts are highly soluble in water (McNeely et al. 1979).

Barium and iron were usually detected in very low concentrations, whereas zinc and aluminum were only detected in approximately 50% of the samples (Figures 49-52). There was an increase in both barium and iron concentrations from the headwater sites to the confluence with the Bow River (Figures 49, 51). Both iron and barium concentrations were highest in Bragg Creek and McLean Creek (Figures 53, 54).

Aluminum concentrations in the Elbow River increased downstream of the Glenmore Dam, probably because of the alum discharges from the Glenmore water treatment plant. Alum is now (1992) trucked from this site; this may reduce the amount of aluminum entering and/or accumulating in the Elbow River. Aluminum levels were not compliant with CWQG in 9 of 13 samples collected at both the Calgary Golf and Country Club site and the 9th Avenue Bridge site. CCREM (1987) states that this tentative guideline is based on total aluminum, including particulate forms which may have reduced toxicity. Research conducted at the Alberta Environmental Centre (1986) concluded that alum sludge had low toxicity to rainbow trout (Oncorhynchus mykiss). However, smothering of fish eggs in gravel and effects on benthic invertebrates were not included in this study.

Silver, cadmium, and cobalt were at or below detection limits in most samples. Single samples for copper, chromium, iron, mercury, and lead exceeded CWQG at various locations (Table 4), and at times apparently unrelated to flow. Note that guideline values are

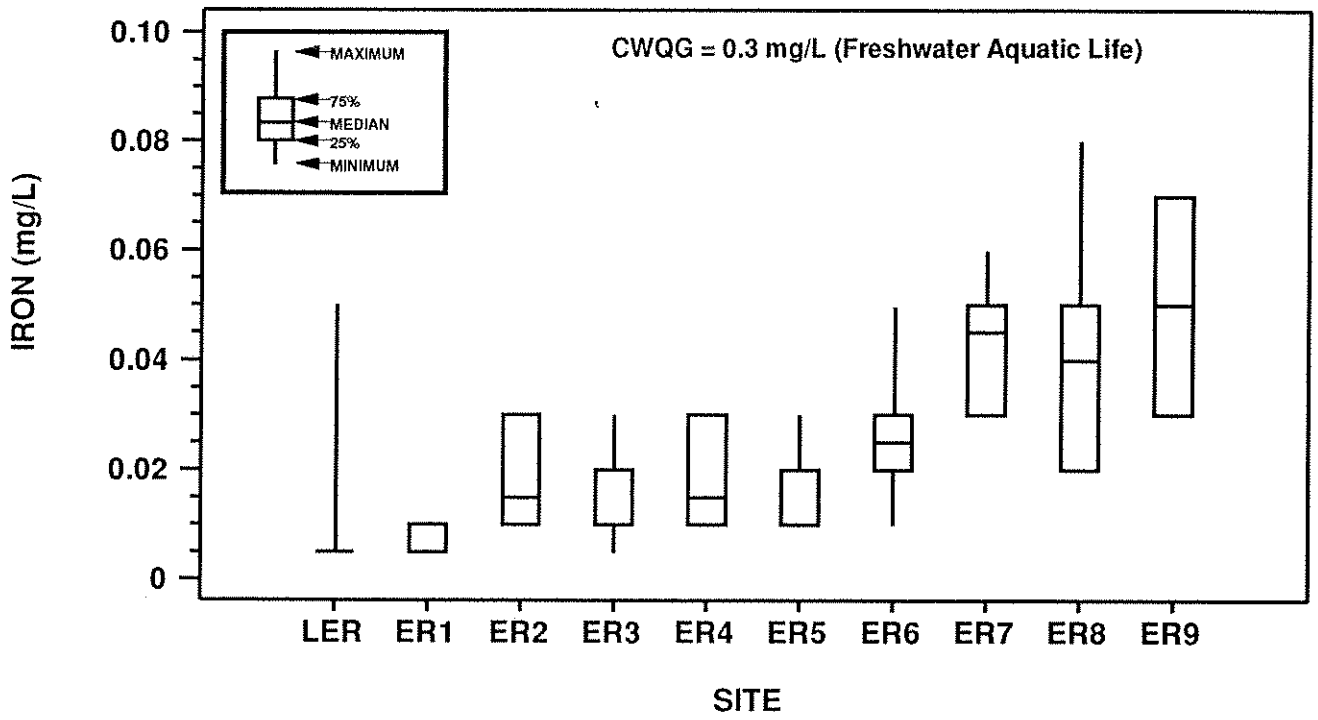

Figure 49. Longitudinal trends in annual iron concentrations in the Elbow River.

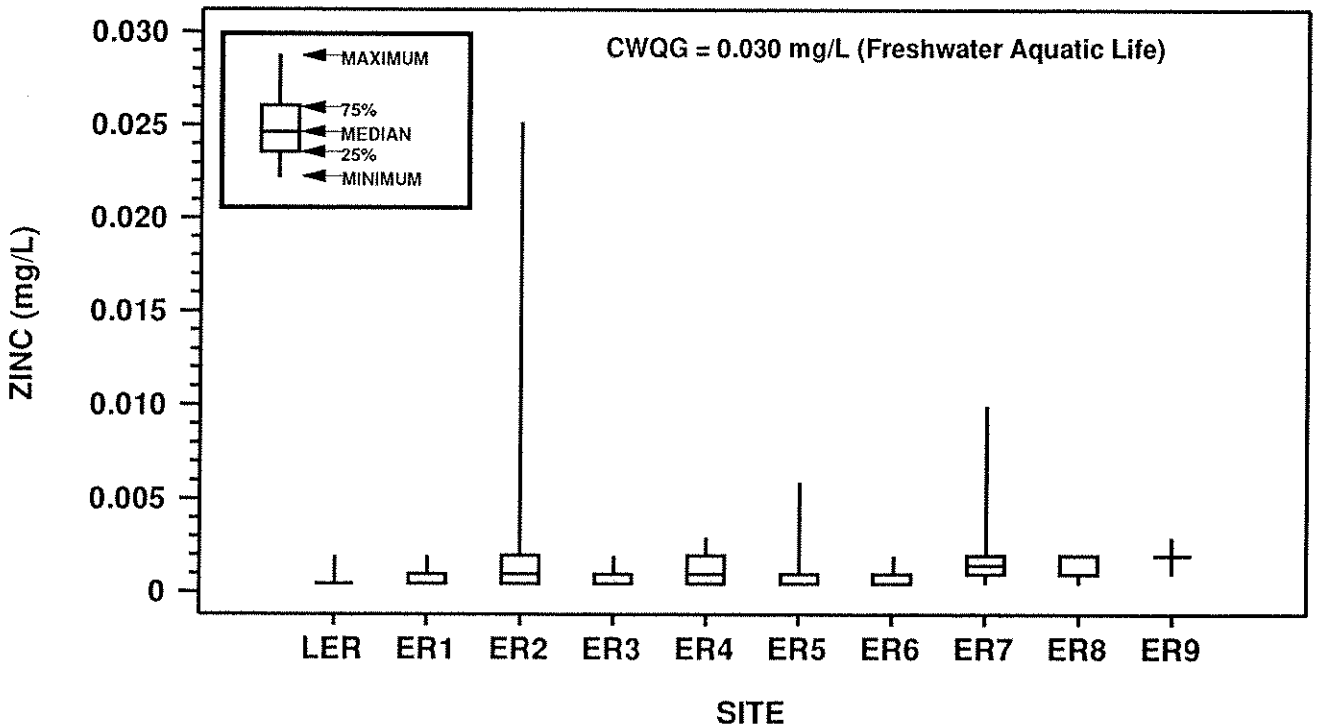

Figure 50. Longitudinal trends in annual zinc concentrations in the Elbow River.

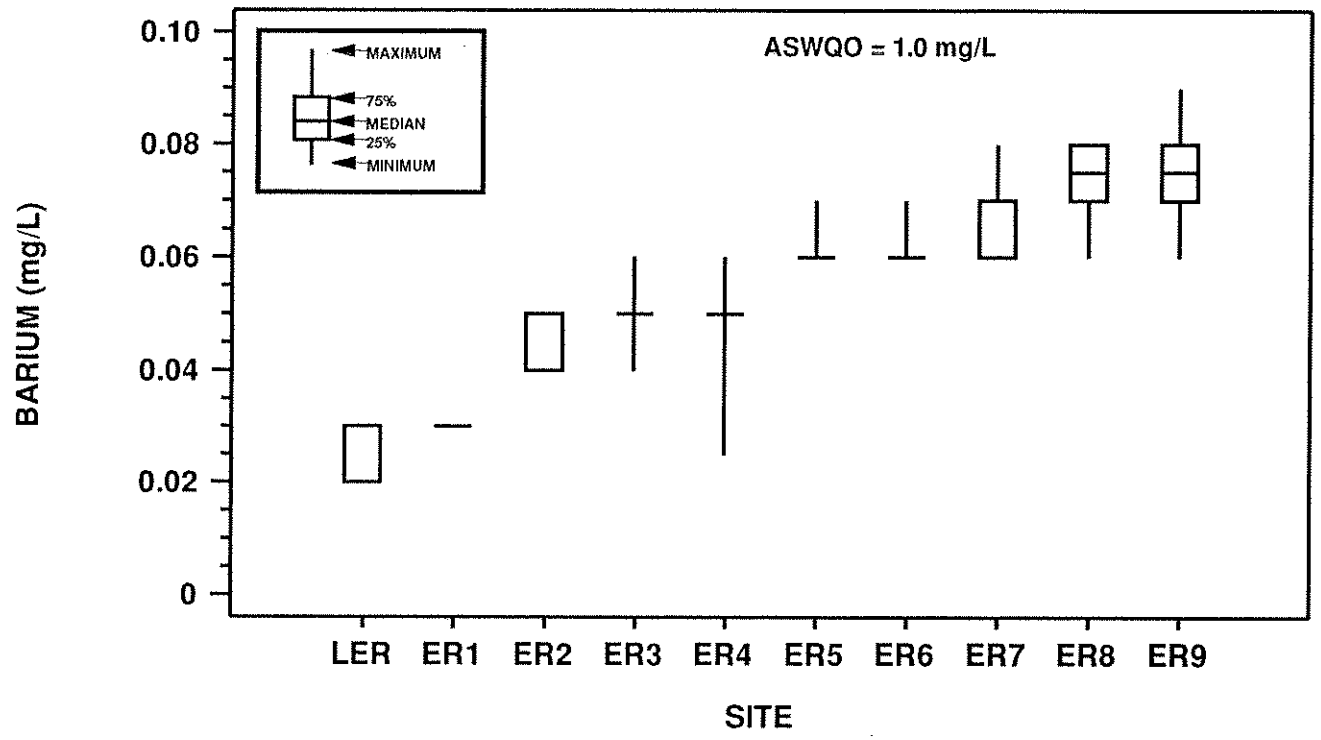

Figure 51. Longitudinal trends in annual barium concentrations in the Elbow River.

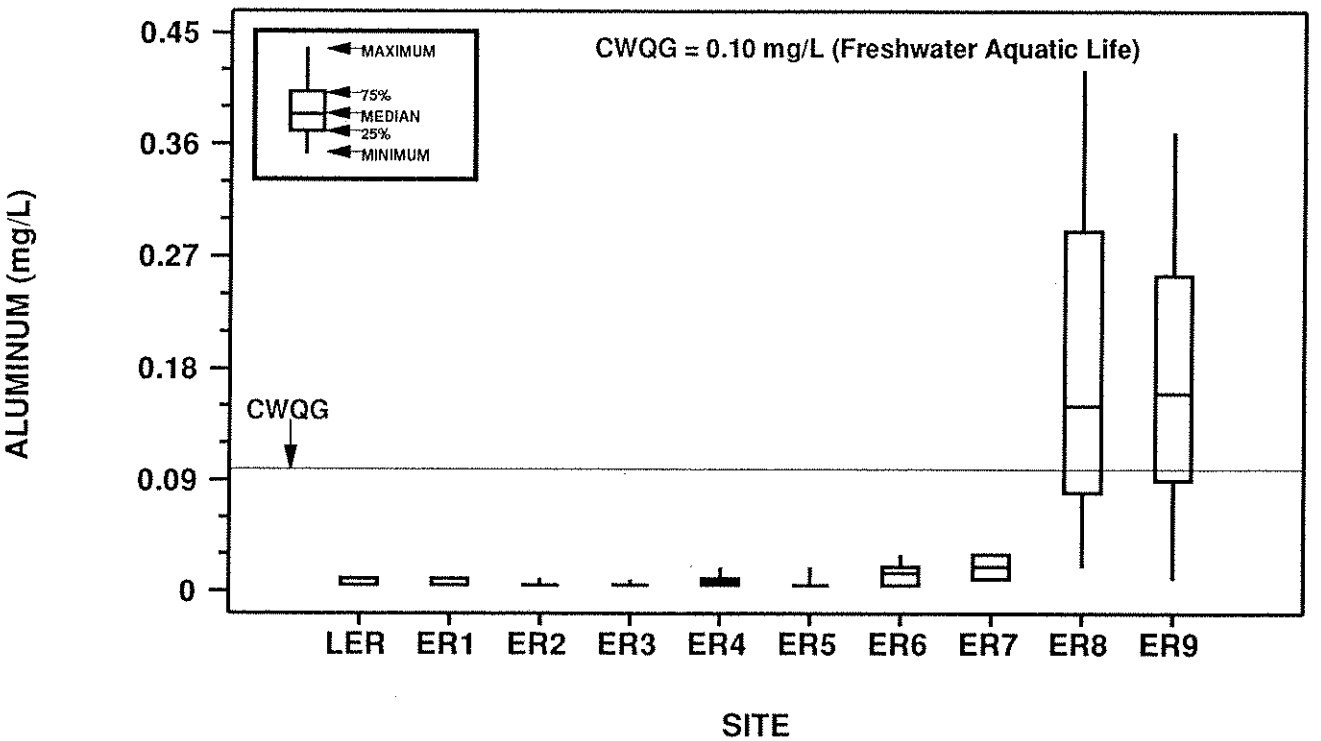

Figure 52. Longitudinal trends in annual aluminum concentrations in the Elbow River.

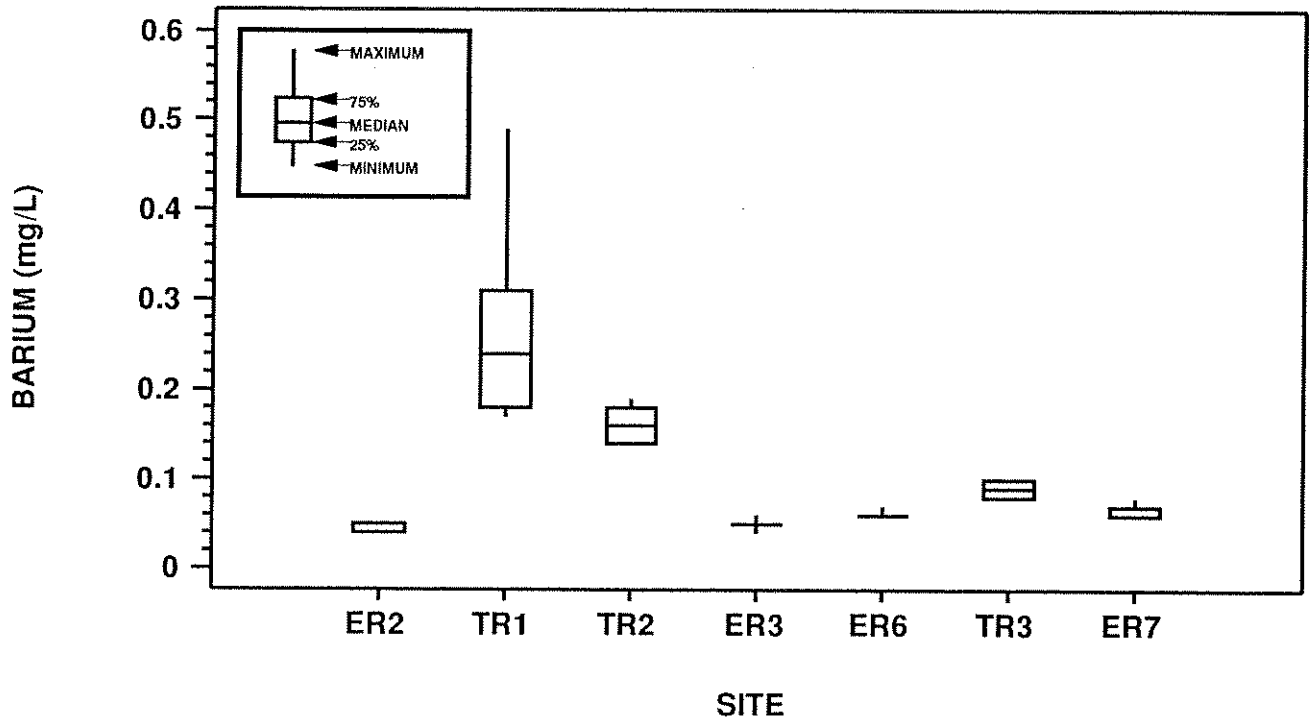

Figure 53. Comparison of annual barium concentrations in Elbow River tributaries and adjacent mainstem sites.

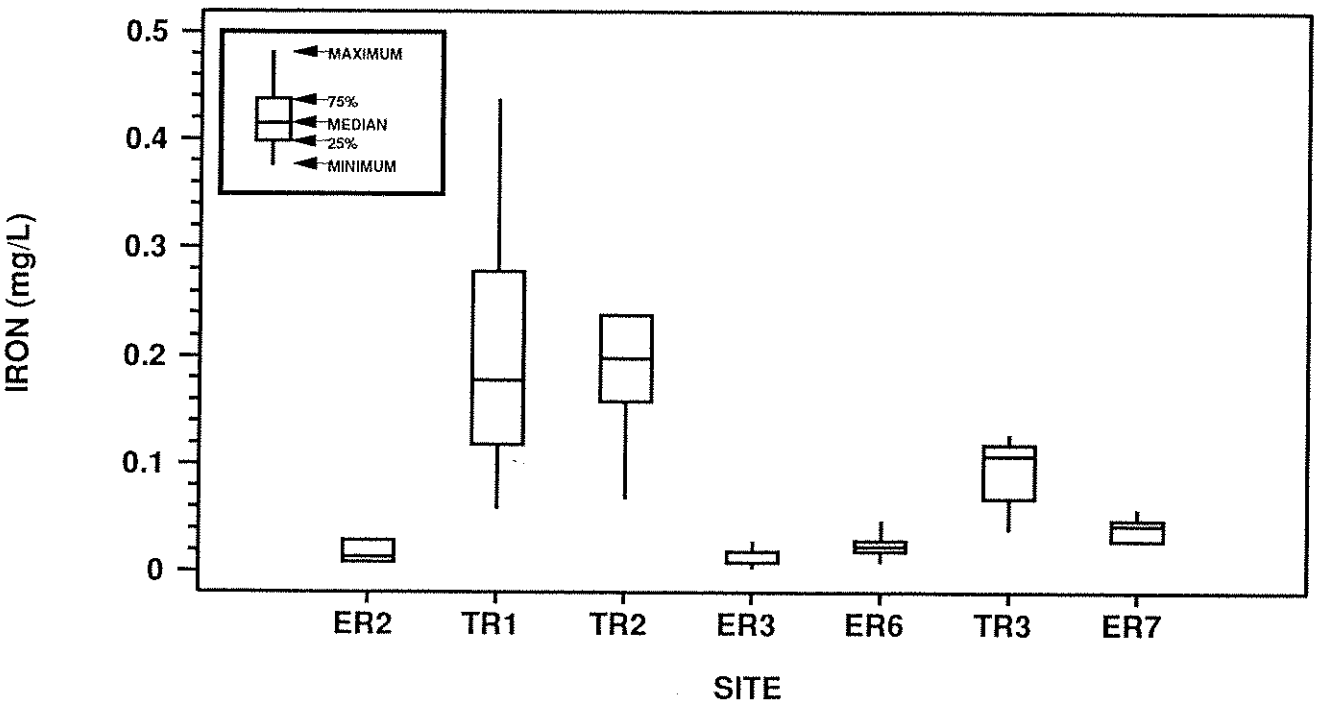

Figure 54. Comparison of annual iron concentrations in Elbow River tributaries and adjacent mainstem sites.

often close to method detection limits, which are the least accurate areas of analytical measurement.

Arsenic and zinc concentrations in Elbow River water were lower than in the four other rivers surveyed (Figures 55, 56). Aluminum concentrations were higher at the two Oldman River sites than at the upper Elbow River sites (above the Glenmore Reservoir). Concentrations in the Bow and Red Deer were similar to ER2 and ER7 (Figure 57). Barium levels were similar in the Elbow River at Allen Bill Pond and in Bow River water, and lower in the Elbow River compared to the Red Deer and Oldman rivers (Figure 58). Copper and iron concentrations were lower in the Elbow River than in the Oldman River and higher than in the Bow and Red Deer rivers (Figures 59, 60). Lead levels were frequently below the detection limit at all sites except the Oldman River near Fort McLeod (Figure 61).

4.15 TRACE ORGANIC COMPOUNDS

The herbicide, pesticide, and priority pollutant scans run on both water and sediment samples in July and September 1988 detected only phthalate esters and phenolic compounds (Appendix III). Phenolic compound concentrations exceeded CWQG in both spring and autumn (Table 4) at various sites. Low levels of phenolic compounds were found in all five of the southern Alberta rivers that were compared in this study (Figure 62). The Oldman River near Fort McLeod and the Highwood River had higher levels of phenolic compounds than did the Elbow River (Figure 62). Phenolics occur naturally, primarily as a result of decaying vegetation (McNeely et al. 1979). Phenolic compounds were detected during spring runoff when decaying vegetation was probably being washed into the river.

Phthalate esters are used in plastics, rubbing alcohol, insect repellents, and insecticides. Low levels of phthalate esters detected in other Alberta rivers have been attributed to false positive identification at the laboratory (Shaw et al. 1990) and may explain phthalate ester occurrences in the Elbow River. Overall, trace organic compounds were not found consistently in the Elbow River basin during the summer or autumn.

4.16 TOTAL AND DISSOLVED ORGANIC CARBON

Levels of organic carbon, both total (TOC) and dissolved (DOC), were lower in the mainstem than levels measured in McLean and Bragg creeks. Most TOC in the samples was dissolved, and the two fractions showed similar longitudinal patterns (Figures 63, 64). Those

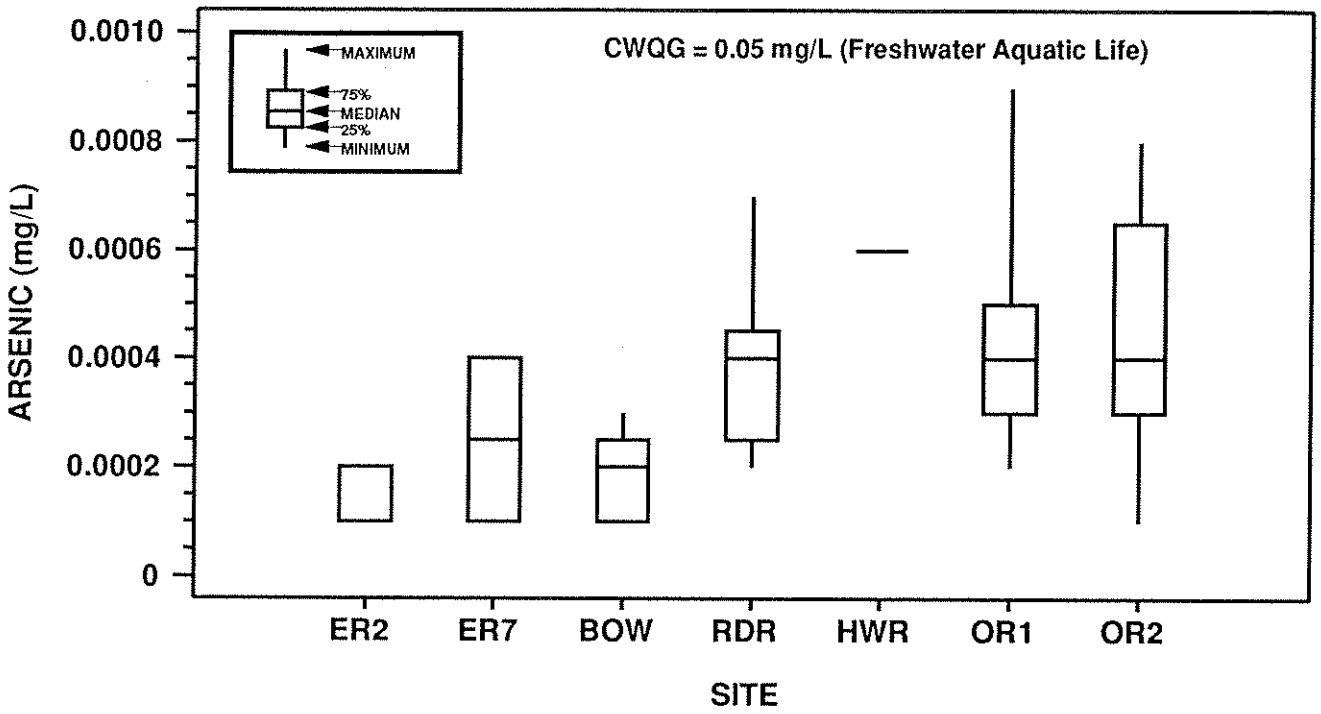

Figure 55. Comparison of annual arsenic concentrations in five southern Alberta rivers.

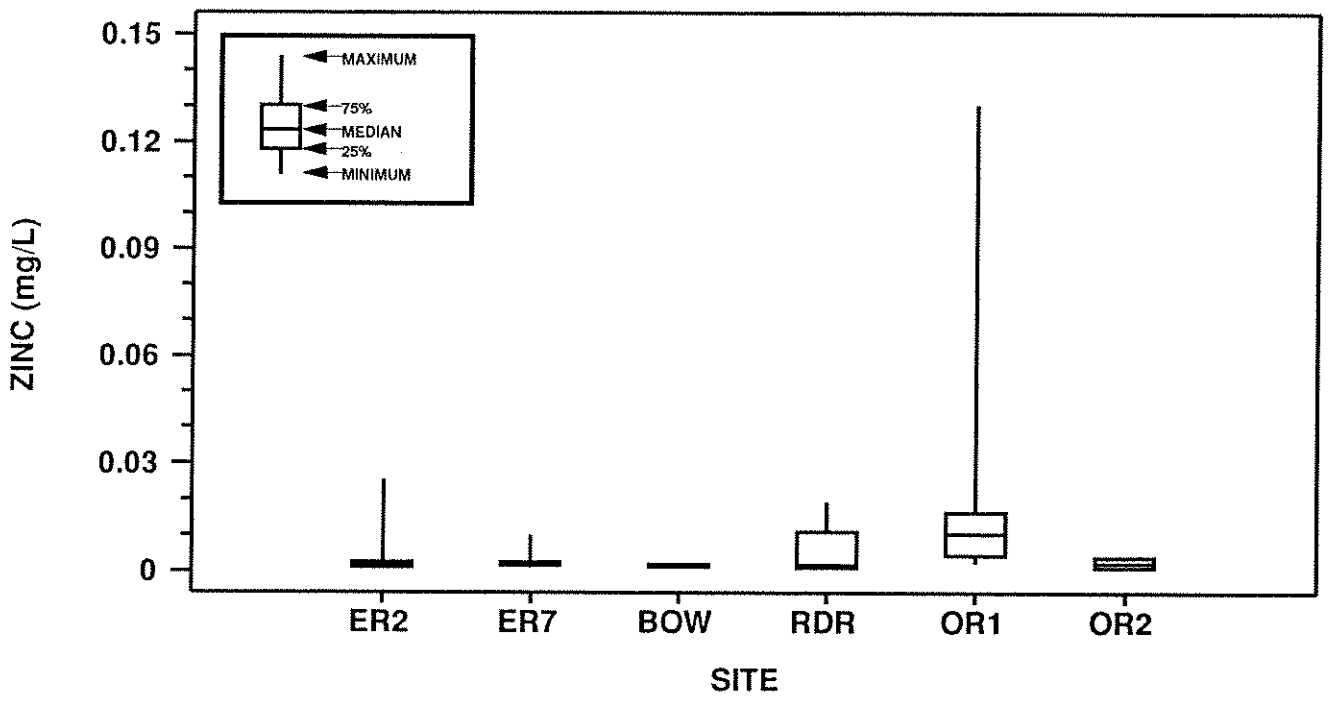

Figure 56. Comparison of annual zinc concentrations in four southern Alberta rivers.

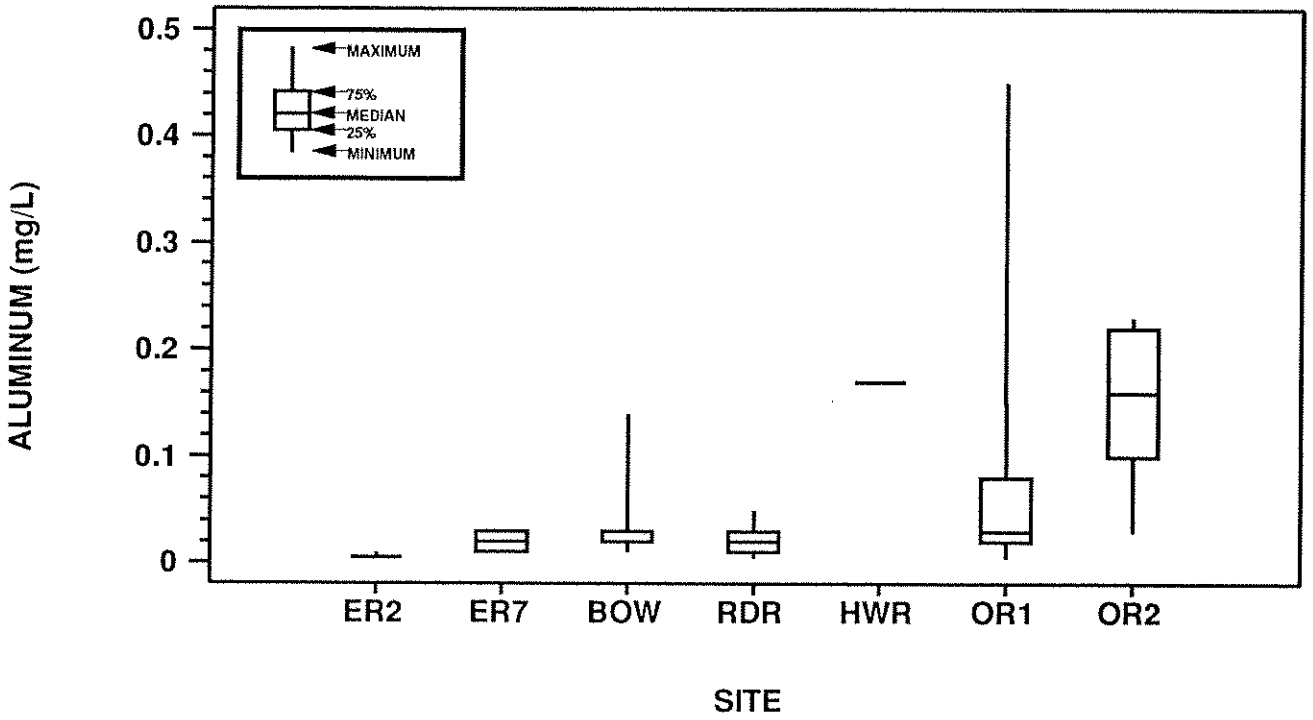

Figure 57. Comparison of annual aluminum concentrations in five southern Alberta rivers.

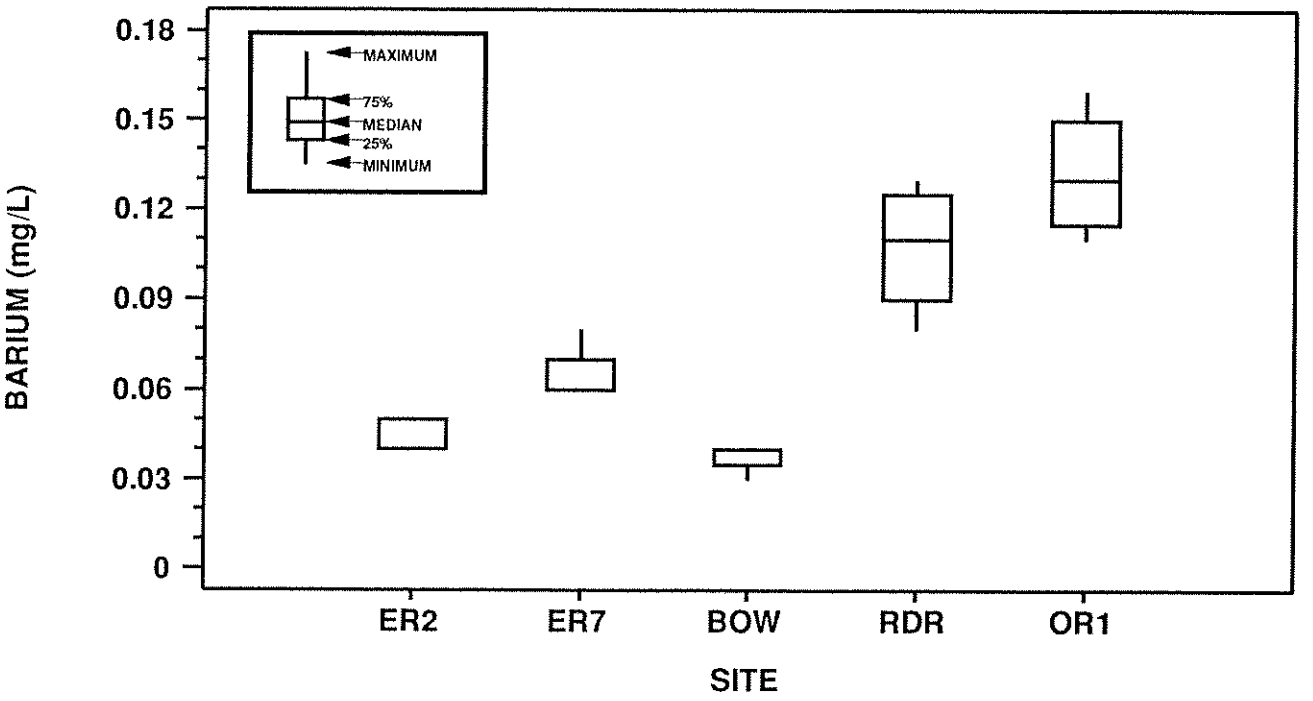

Figure 58. Comparison of annual barium concentrations in four southern Alberta rivers.

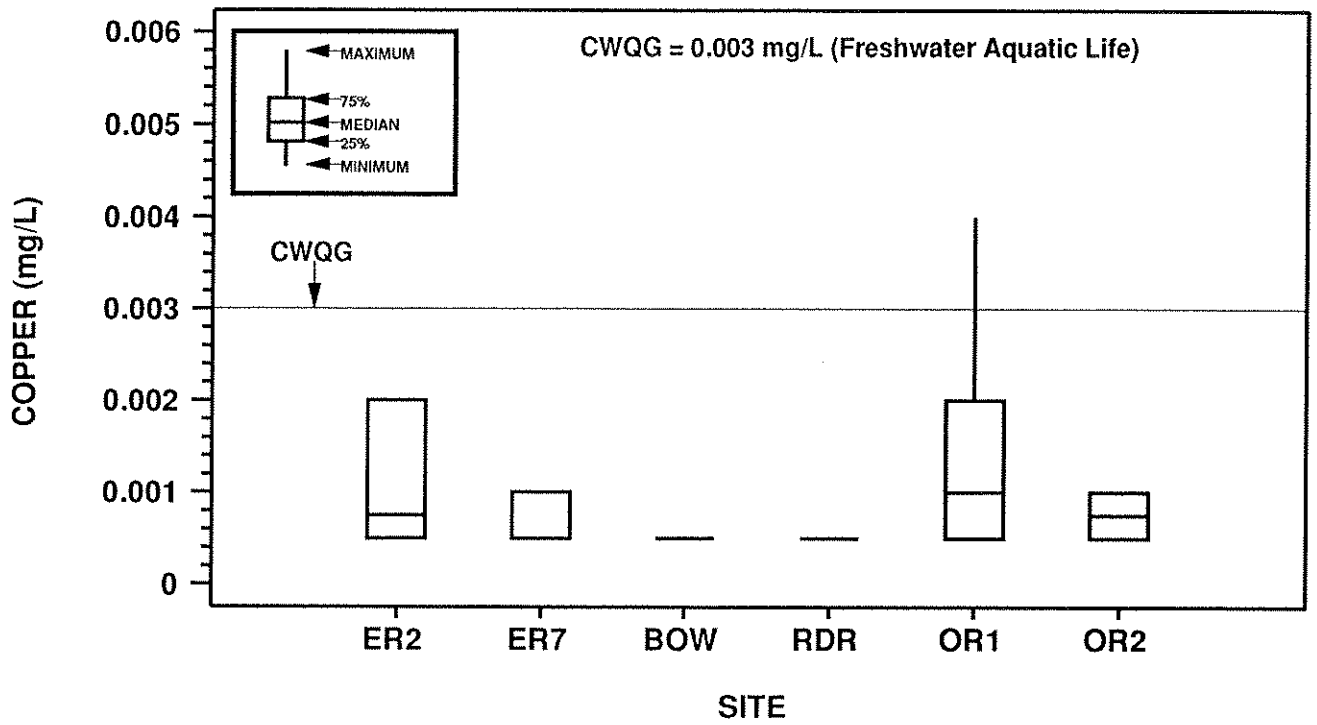

Figure 59. Comparison of annual copper concentrations in four southern Alberta rivers.

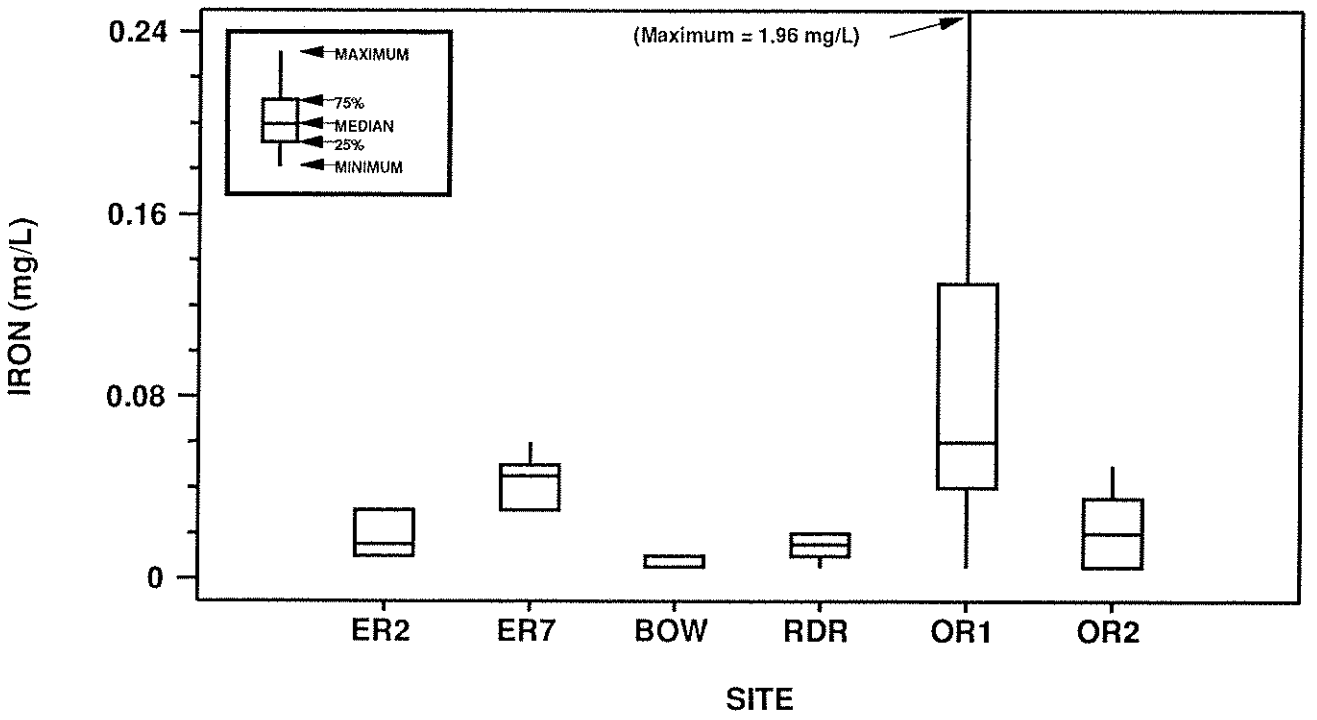

Figure 60. Comparison of annual iron concentrations in four southern Alberta rivers.

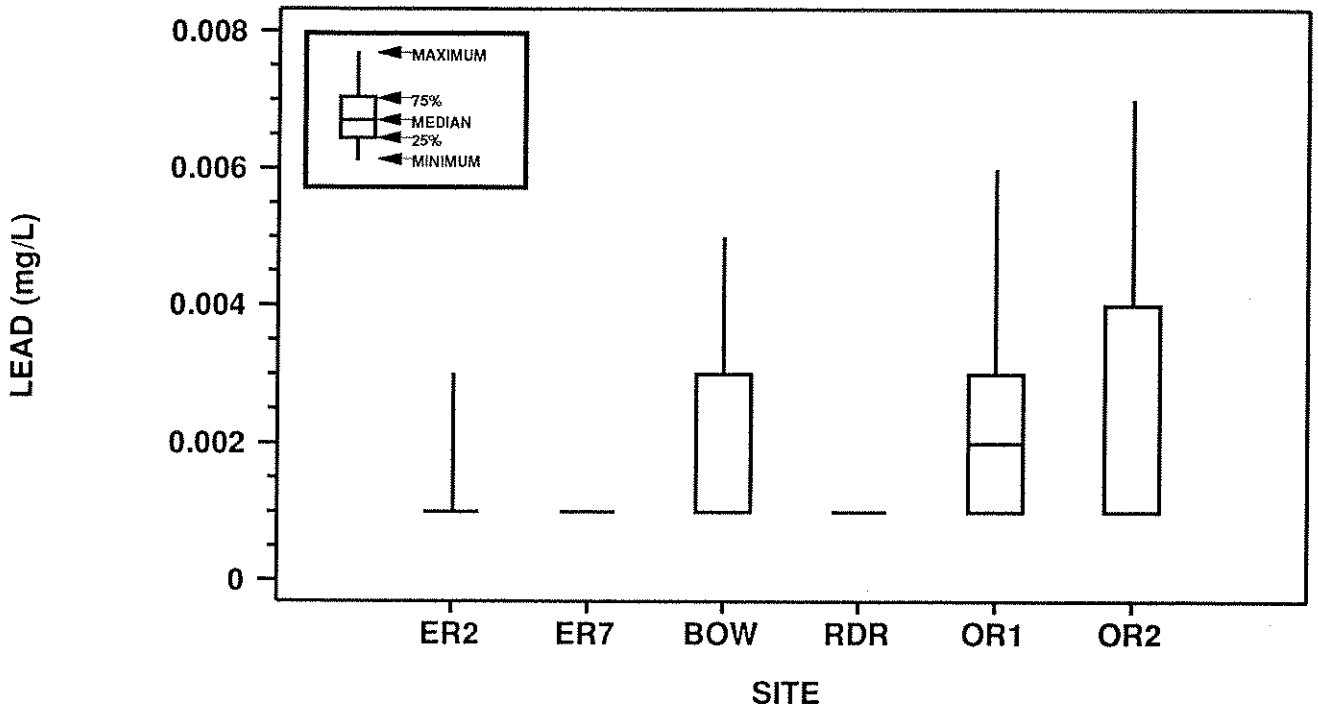

Figure 61. Comparison of annual lead concentrations in four southern Alberta rivers.

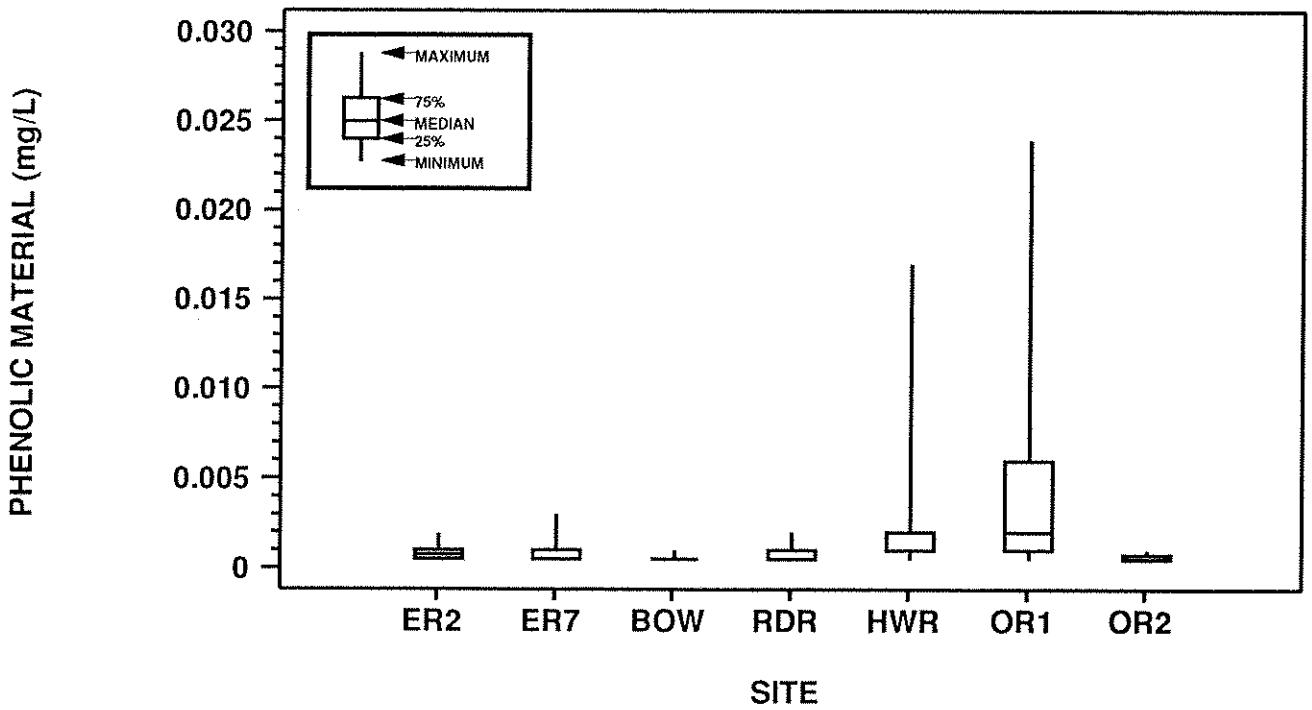

Figure 62. Comparison of annual concentrations of phenolic material in five southern Alberta rivers.

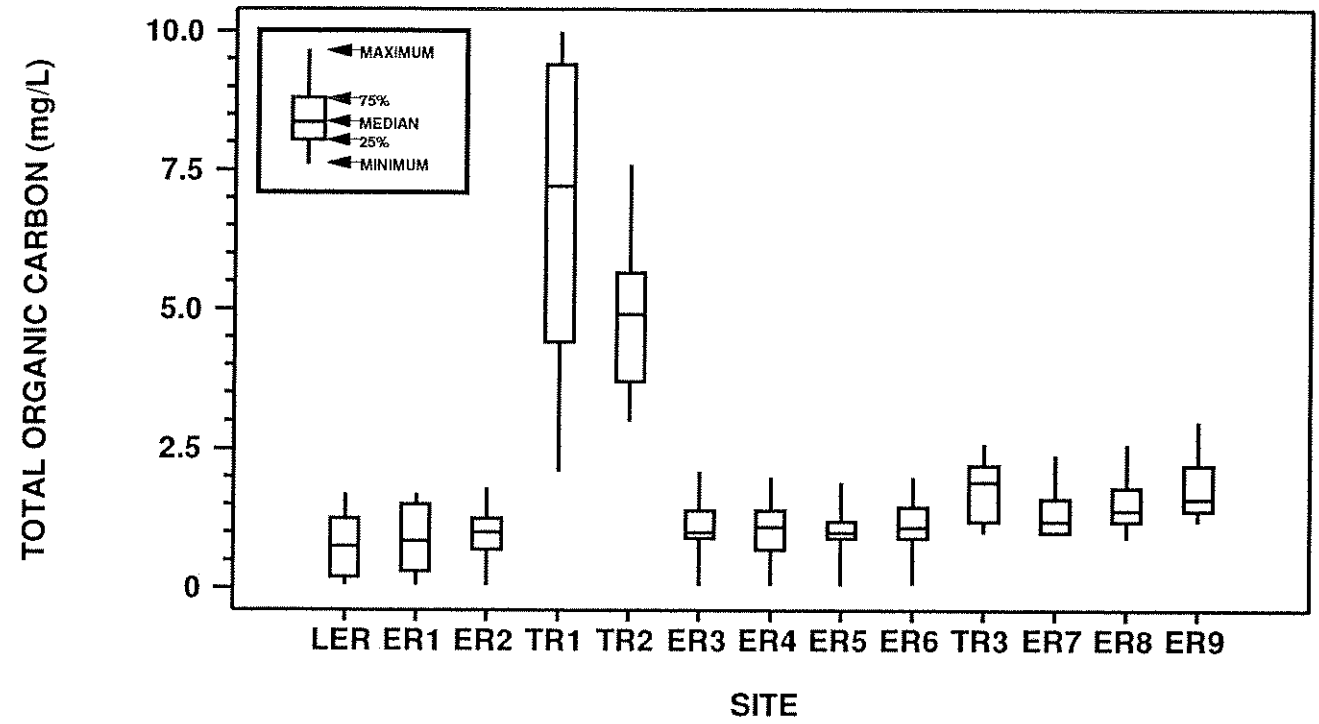

Figure 63. Longitudinal trends in annual concentrations of total organic carbon at Elbow River mainstem and tributary sites.

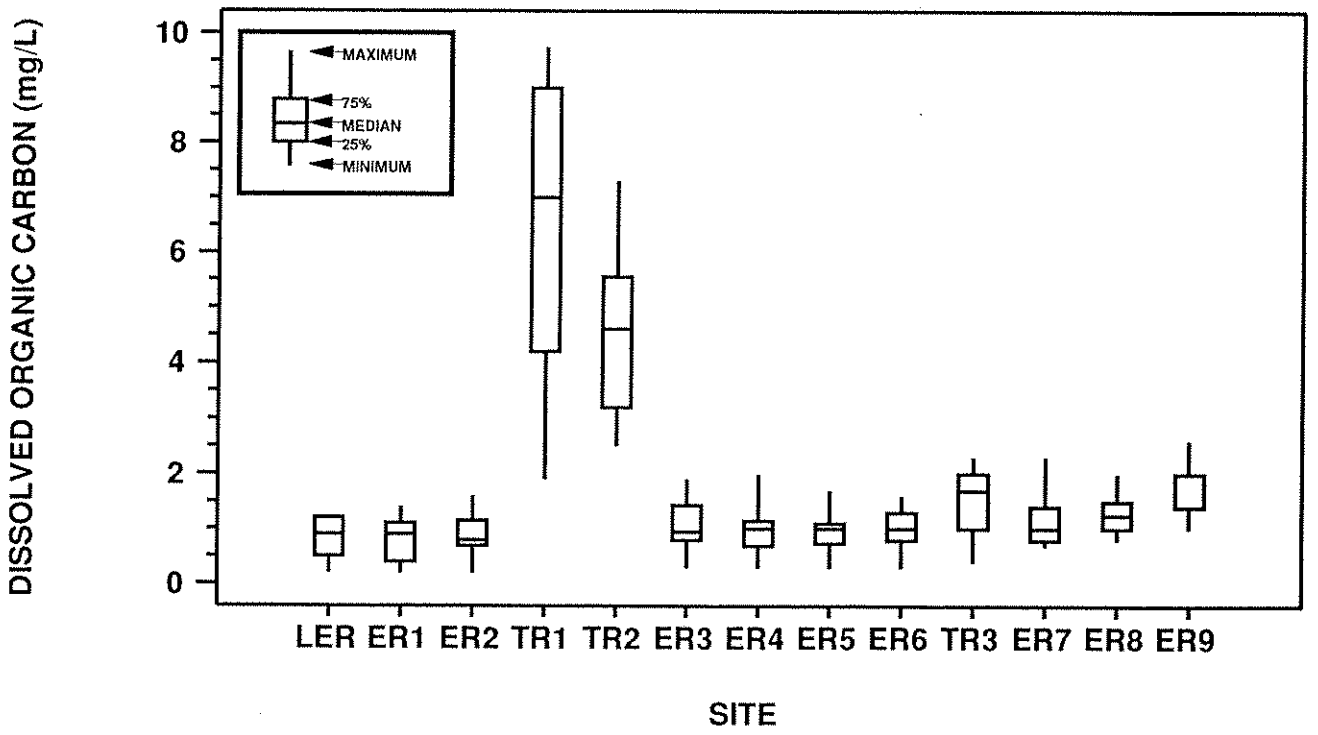

Figure 64. Longitudinal trends in annual concentrations of dissolved organic carbon at Elbow River mainstem and tributary sites.

sites of the Elbow River with statistically similar total and dissolved organic carbon levels were: (1) the Little Elbow River to the Elbow River at Allen Bill Pond, (2) the Elbow River downstream of Bragg Creek to the Sarcee Barracks Bridge, and (3) the two sites below the Glenmore Dam. Total organic carbon levels increased in the autumn in the Elbow River. POC levels were always low and did not differ between sites or with season.

The source of organic carbon was probably natural, from allochthonous (external) detrital inputs. Input of organic carbon from agricultural sources appeared to be low along the mainstem, as there was no difference in organic carbon levels between sites upstream and downstream of cultivated land. McLean Creek may acquire organic acids from wetland areas draining into it. Higher levels in Bragg Creek may reflect the influence of agricultural activity.

TOC concentrations at the Elbow River sites were similar to concentrations in the Bow River and lower than concentrations in the Red Deer, Highwood, and Oldman rivers (Figure 65). Dissolved organic carbon levels showed a similar pattern, although there were no data for the Highwood River (Figure 66).

4.17 BACTERIA

Total and fecal coliform concentrations were statistically similar at all mainstem sites except the Elbow River at the 9th Avenue Bridge, where they were much higher than at the other sites. Both total and fecal coliform concentrations were generally low at sites upstream of the 9th Avenue Bridge, except during mountain snowmelt.

Non-compliance with ASWQO for recreation based on single samples (greater than 2400 total coliforms per 100 mL) and the CWQG for irrigation (greater than 1000 total coliforms per 100 mL) occurred consistently at the 9th Avenue Bridge (Figure 67; Table 5). Coliform concentrations in single samples from the three tributary creeks and the Elbow River at Highway 22 and the Glencoe Golf and Country Club were all non-compliant with tentative CWQG for irrigation (based on fecal coliforms) on at least one occasion (Table 4). However, further sampling should be performed before irrigation practices are restricted. Note that statistical outliers and tributaries are not indicated on Figures 67 and 68 but all data are summarized in Appendix II. Also note that these coliform plots present ranges and medians rather than the geometric means calculated for guideline comparisons, and medians on some plots may be superimposed on the 25 percentile.

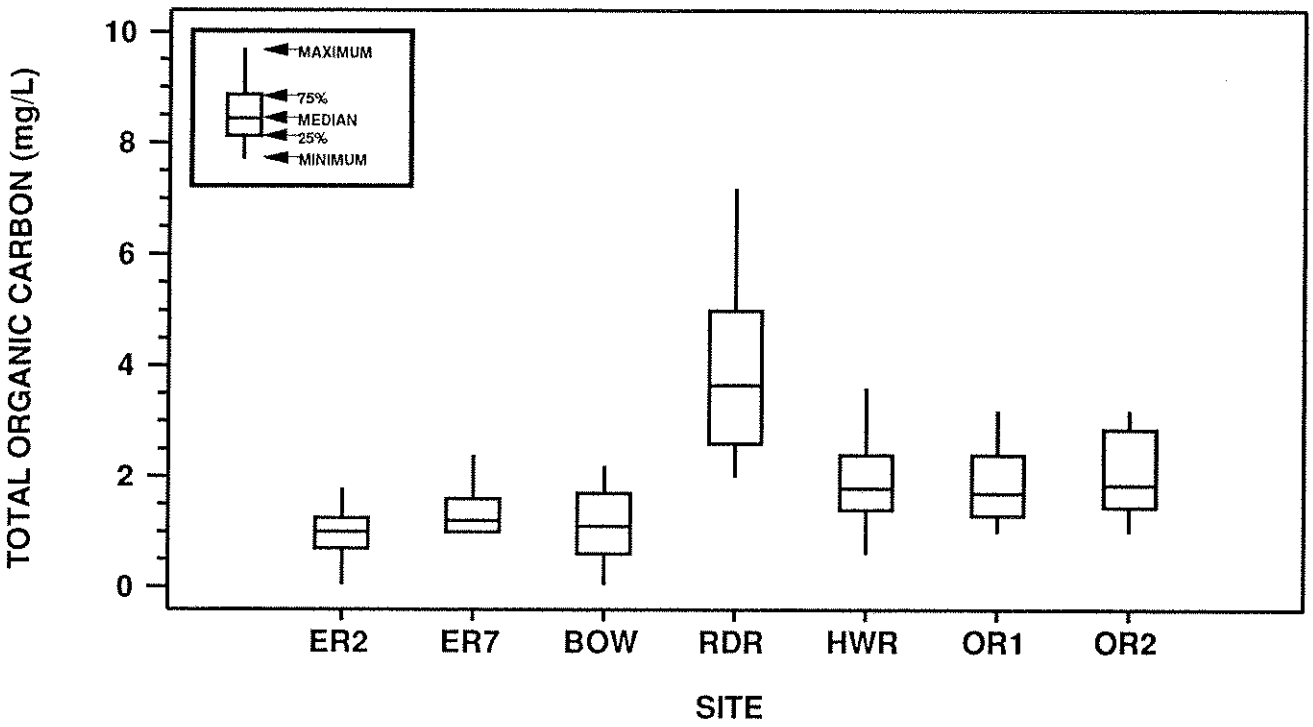

Figure 65. Comparison of annual concentrations of total organic carbon in five southern Alberta rivers.

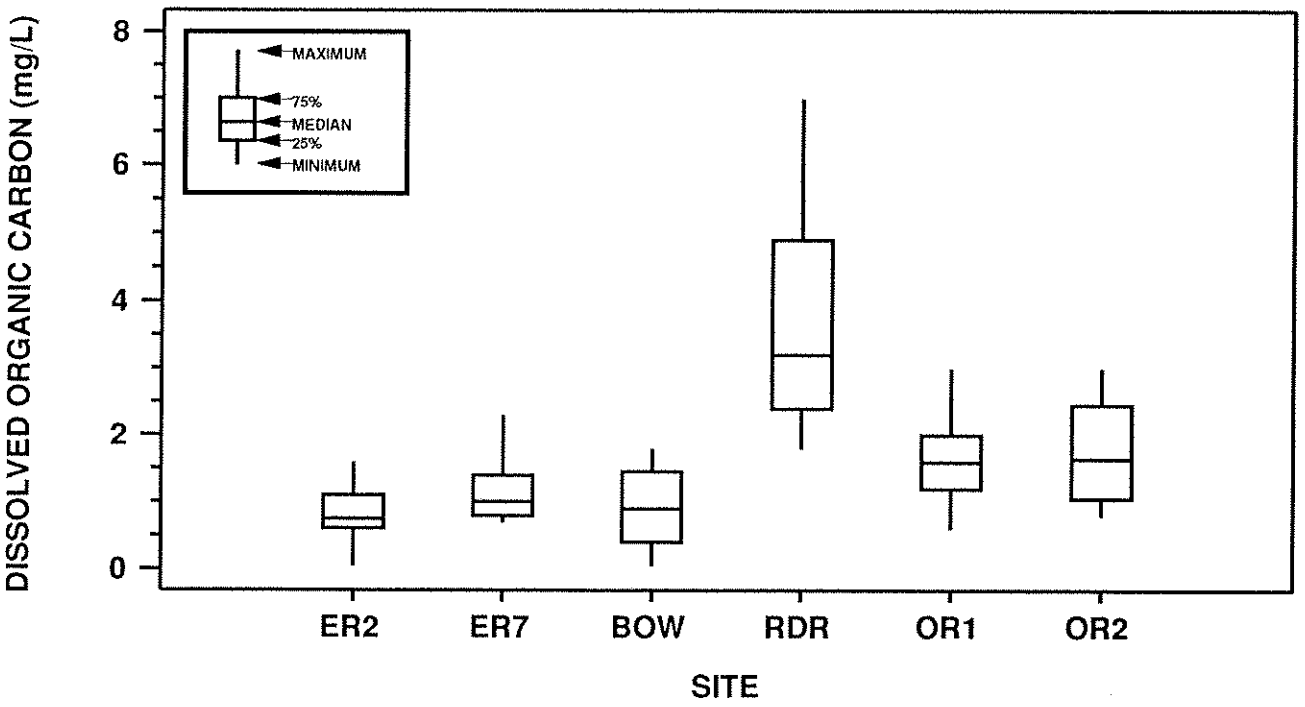

Figure 66. Comparison of annual concentrations of dissolved organic carbon in four southern Alberta rivers.

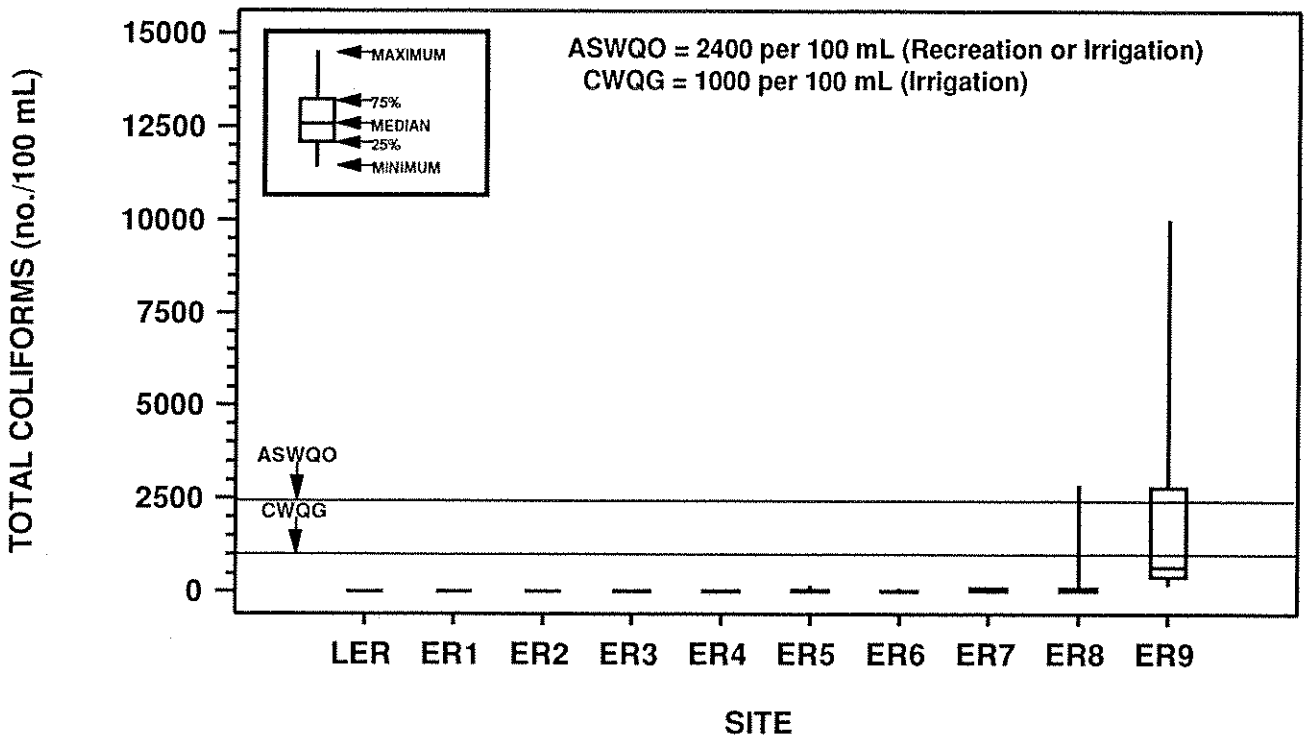

Figure 67. Longitudinal trends in annual total coliform levels in the Elbow River (single samples).

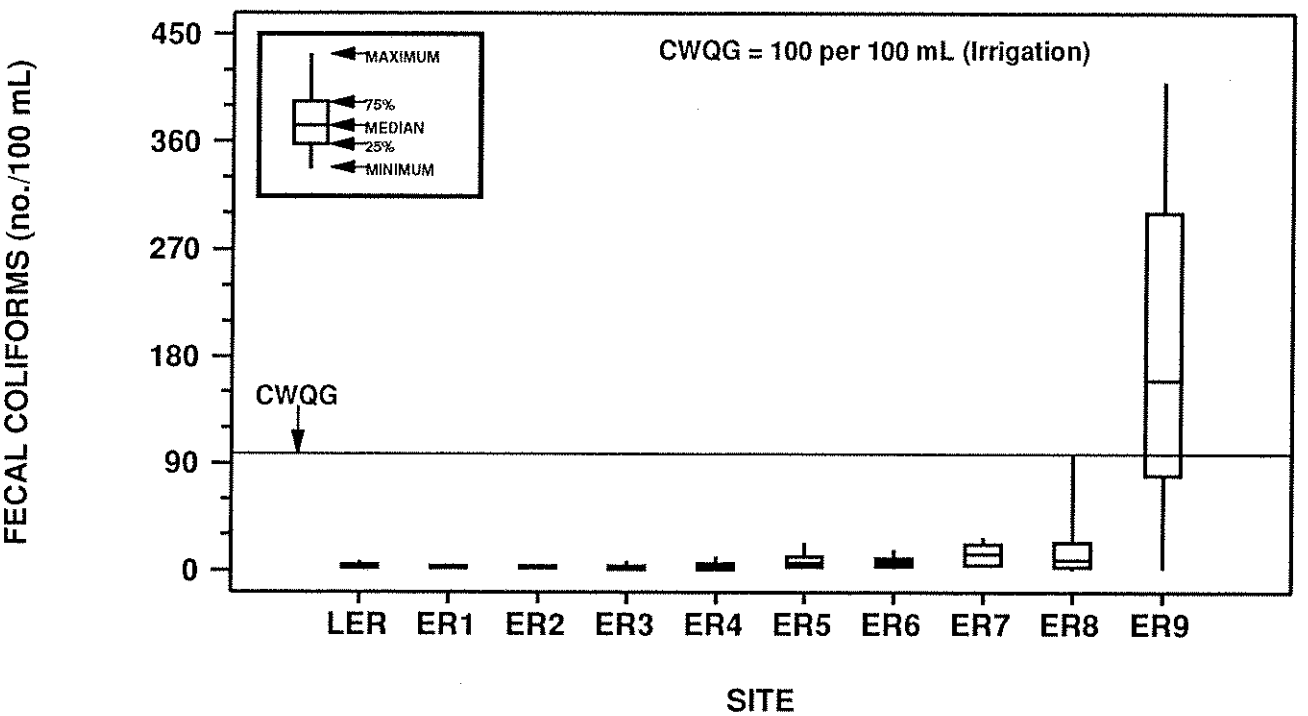

Figure 68. Longitudinal trends in annual fecal coliform levels in the Elbow River (single samples).

Table 5. Number of samples exceeding Alberta Surface Water Quality Objectives in the Elbow River and McLean Creek

Variable	Site	No. of Non-Compliant Samples	No. of Total Samples
Total coliforms	Elbow River at Calgary Golf and Country Club	1	20
	Elbow River at 9th Avenue Bridge	7	20
Iron	McLean Creek (near mouth)	1	6
Total nitrogen	Elbow River at Highway 22	1	14
	Elbow River upstream of Twin Bridges	1	14
	Elbow River at 9th Avenue Bridge	1	14
Total phosphorus	Elbow River downstream of Bragg Creek	1	14
	Elbow River at Highway 22	1	14
	Elbow River at Sarcee Barracks Bridge - ISCO sampler	2	46
	June 1989 time-of-travel survey	1	19
	May 1990 time-of-travel survey	7	14
	June 1990 time-of-travel survey	1	7

Note: Samples taken between April 1988 and June 1990.
Total coliform densities evaluated with instantaneous ASWQO (2400 per 100 mL).

ASWQO for recreation were also exceeded for multiple samples (greater than 1000 total coliforms per 100 mL based on the geometric mean of five samples per month) during detailed surveys in June and August 1988, and June 1989. Non-compliant sites included the Elbow River at the Calgary Golf and Country Club (Figure 71) and at the 9th Avenue Bridge (Figures 69, 71, and 73). More intensive sampling between the Calgary Golf and Country Club and the 9th Avenue Bridge indicated a consistent increase in coliform concentrations near the 9th Avenue Bridge and lower concentrations upstream (Figures 73, 74) The cause of the large increase in coliform counts at the 9th Avenue Bridge site is not known, and requires further investigation. There are both a sanitary sewer line crossing and one storm sewer discharge immediately upstream from this site.

4.18 CHLOROPHYLL a

Epilithic chlorophyll a concentrations were low (generally less than 10 mg/m^2) at the Elbow River sites upstream of the Sarcee Barracks Bridge. The lowest concentrations occurred between Highway 22 and upstream of the Twin Bridges. The substrate of the river is relatively unstable in this reach, which may affect the amount of epilithic chlorophyll a. Higher algal biomass occurred downstream of the Twin Bridges, with a peak value of 881 mg/m^2 at the 9th Avenue Bridge (Figure 75). This level is similar to that reported for a site on the Bow River downstream of Calgary (Charlton et al. 1986) and probably reflects the combined effects of flow regulation and high nutrient levels.

4.19 NUTRIENTS

The addition of nutrients to the Glenmore Reservoir has been of major concern to the City of Calgary, as nutrients may stimulate phytoplankton growth and thereby cause taste and odour problems. Dissolved nitrite+nitrate concentrations decreased from the headwaters of the Elbow River to downstream of the Glenmore Dam and were much higher near the mouth of the river (Figure 76). Nitrite+nitrate consists mainly of nitrate, as nitrite is unstable in the presence of oxygen (McNeely et al. 1979). Nitrate is readily absorbed by aquatic plants (Hynes 1970), and therefore, aquatic vegetation probably removed nitrates from the river during the growing season. The sites of the river that had statistically similar nitrite+nitrate concentrations included: (1) the Little Elbow River to the Elbow River at Highway 22, (2) the Elbow River at Highway 22 to the Sarcee Barracks Bridge, (3) the Elbow

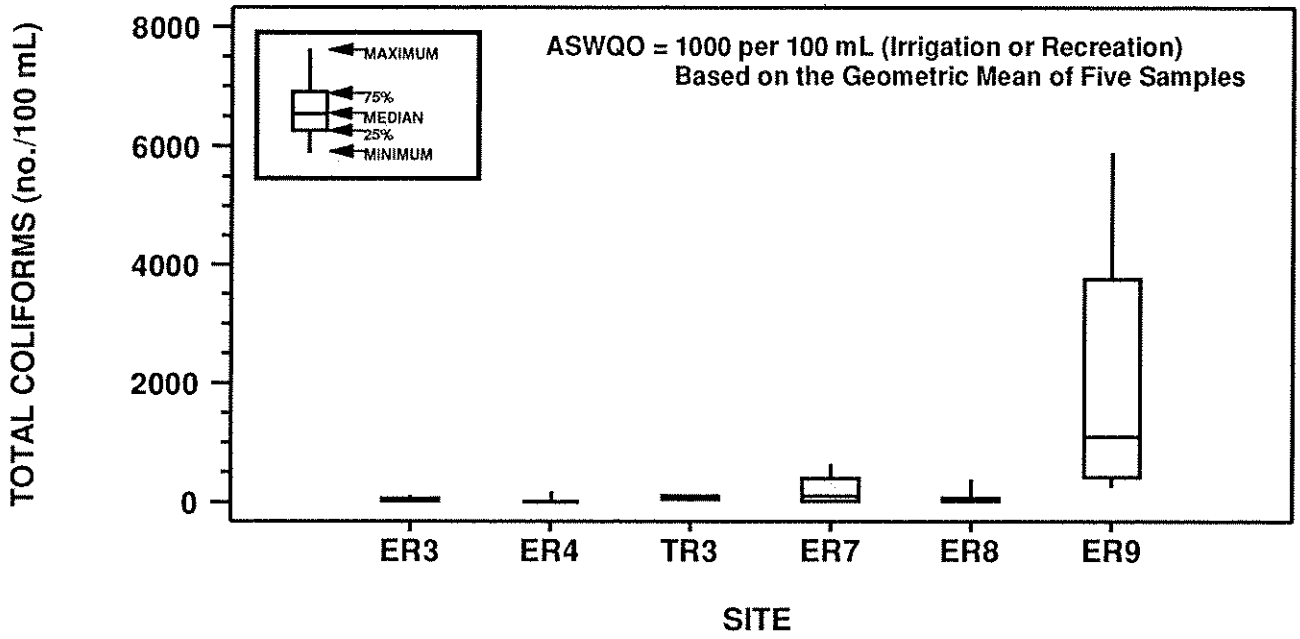

Figure 69. Total coliform levels in the Elbow River and one tributary from the Bragg Creek townsite to the confluence with the Bow River. Five samples were collected at each site between May 18, 1988 and June 13, 1988, during spring high flow.

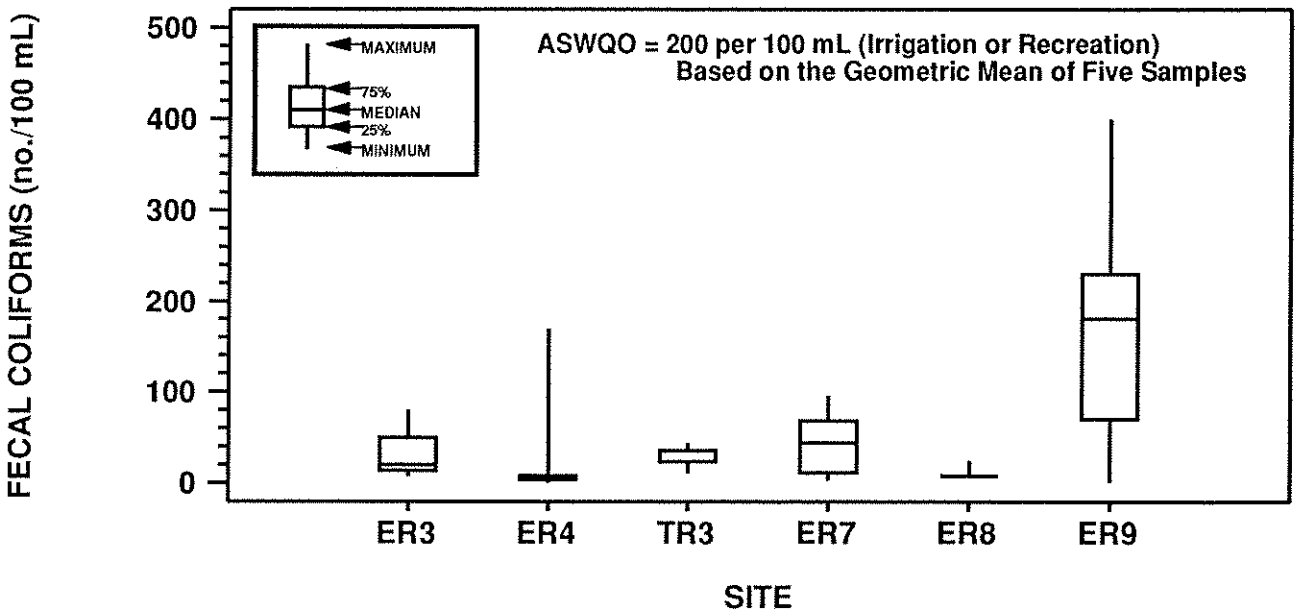

Figure 70. Fecal coliform levels in the Elbow River and one tributary from the Bragg Creek townsite to the confluence with the Bow River. Five samples were collected at each site between May 18, 1988 and June 13, 1988, during spring high flow.

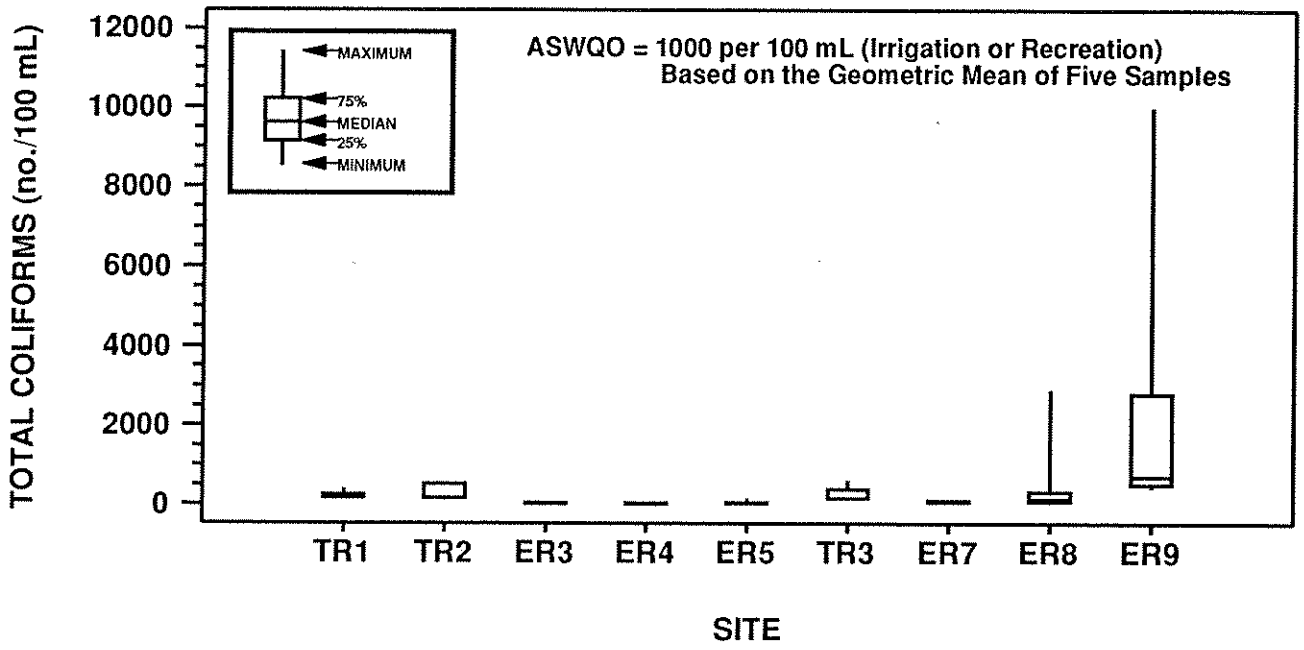

Figure 71. Total coliform levels in the Elbow River and its tributaries from McLean Creek to the confluence with the Bow River. Five samples were collected at each site between August 8, 1988 and September 6, 1988.

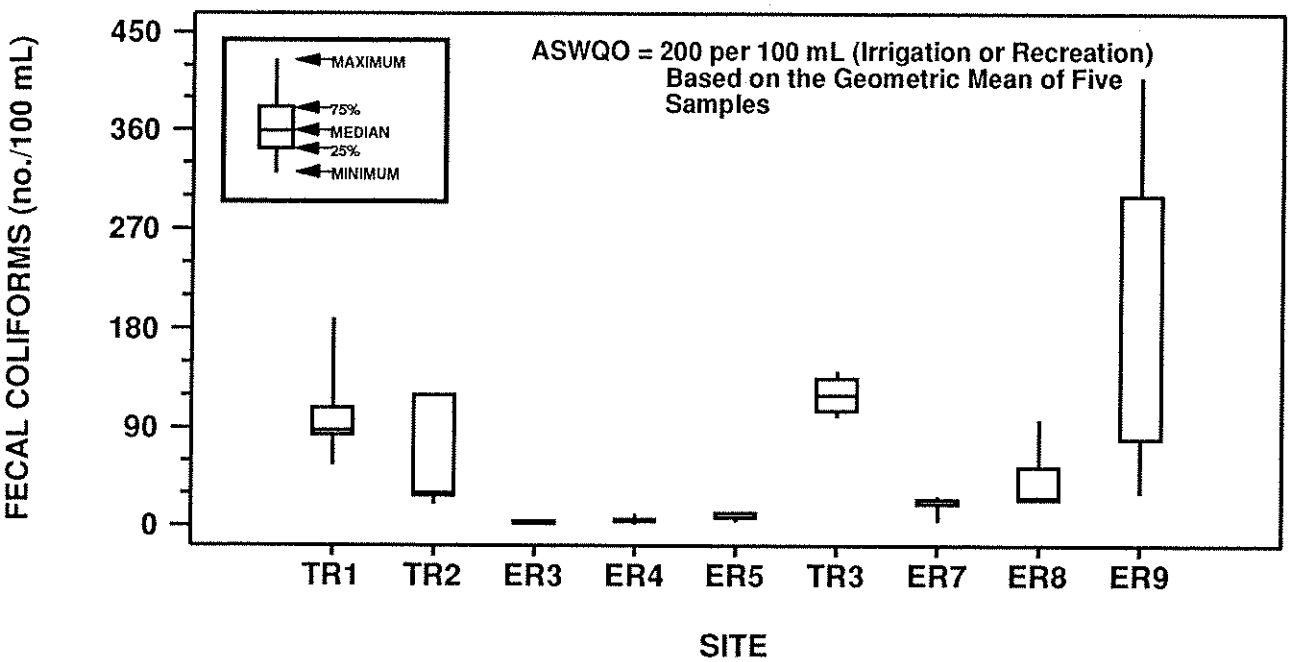

Figure 72. Fecal coliform levels in the Elbow River and its tributaries from McLean Creek to the confluence with the Bow River. Five samples were collected at each site between August 8, 1988 and September 6, 1988.

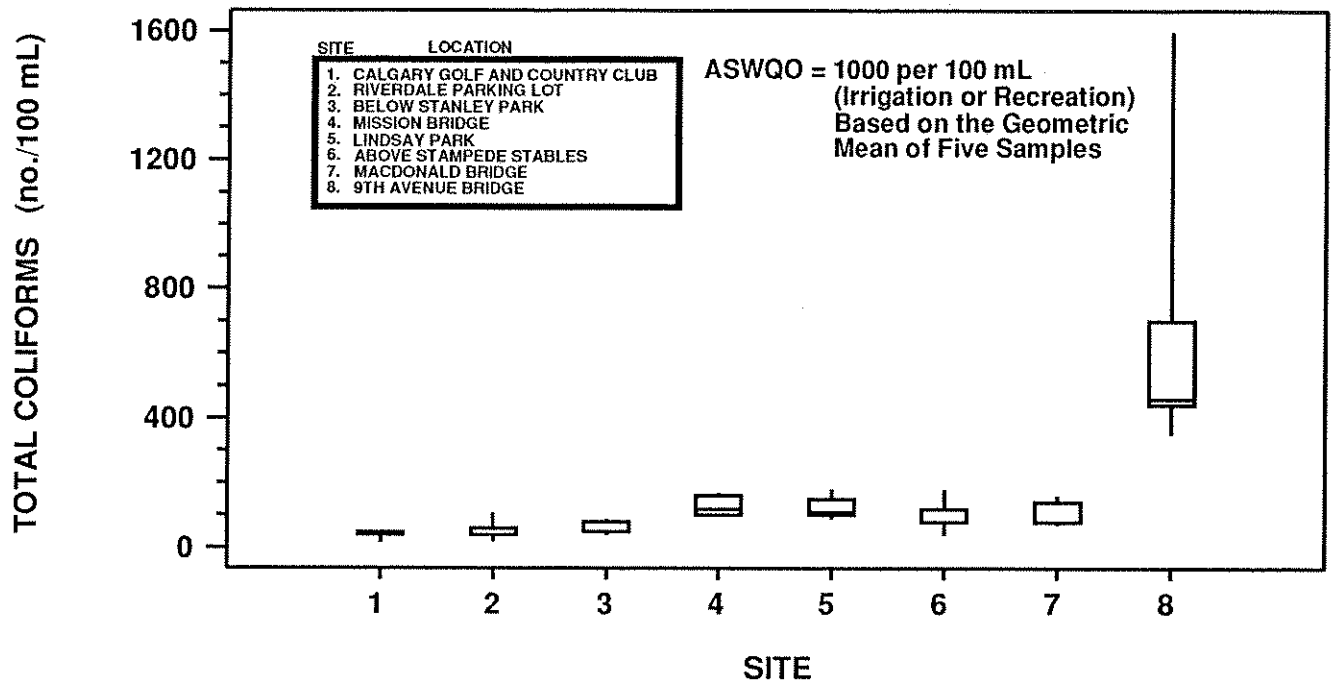

Figure 73. Total coliform levels in the Elbow River from the Glenmore Reservoir to the confluence with the Bow River. Five samples were collected at each site between May 30, 1989 and June 27, 1989.

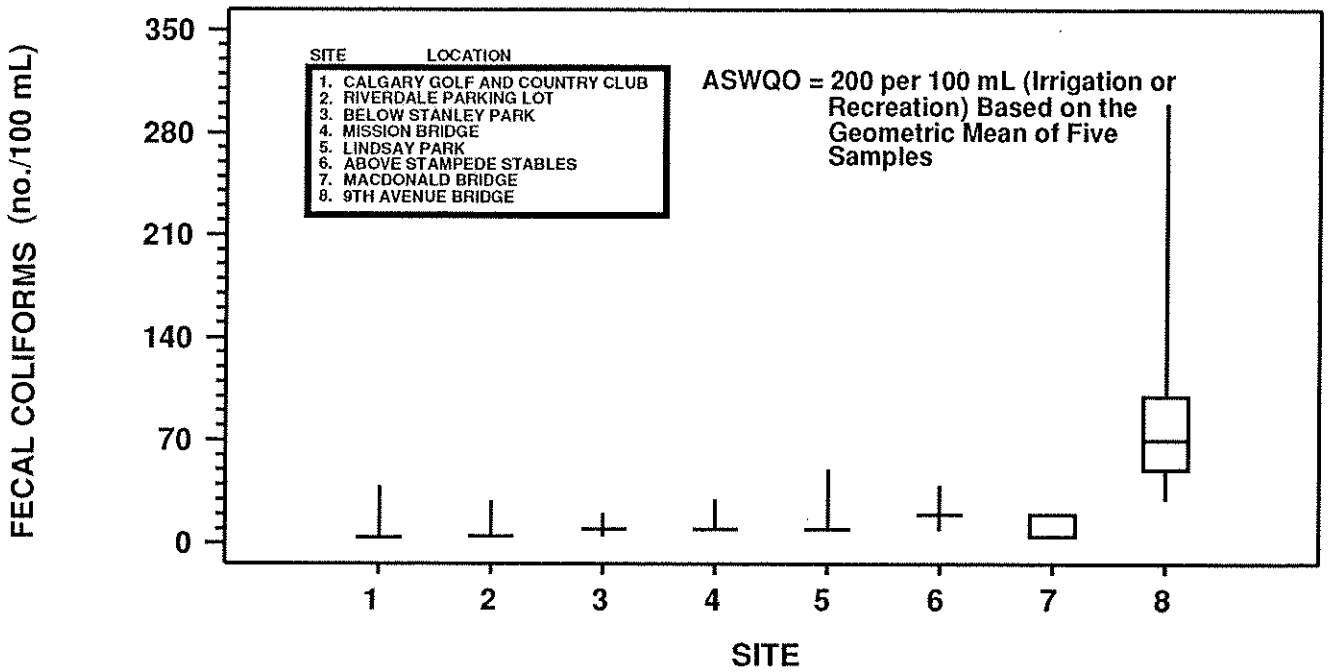

Figure 74. Fecal coliform levels in the Elbow River from the Glenmore Reservoir to the confluence with the Bow River. Five samples were collected at each site between May 30, 1989 and June 27, 1989.

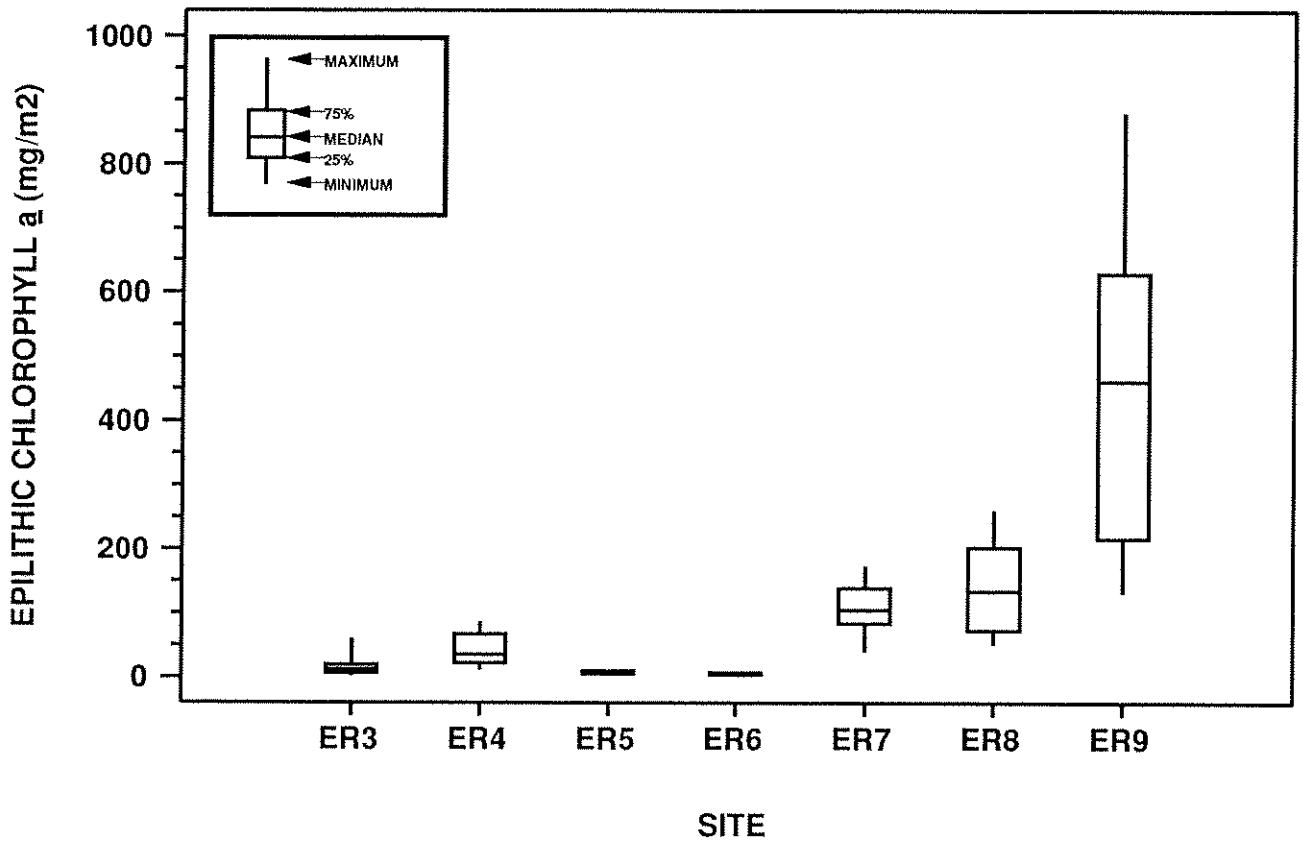

Figure 75. Longitudinal trends in annual epilithic chlorophyll a concentrations in the Elbow River from the Bragg Creek townsite to the confluence with the Bow River.

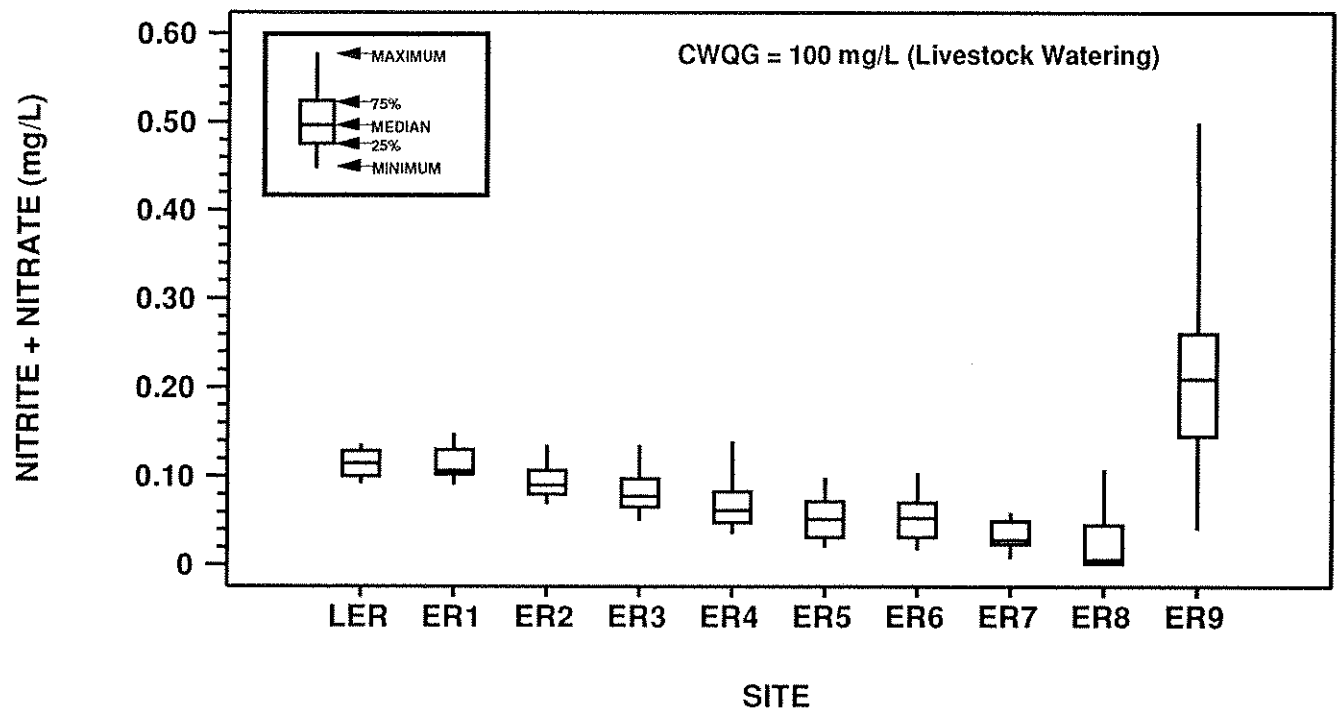

Figure 76. Longitudinal trends in annual nitrite-nitrate concentrations in the Elbow River.

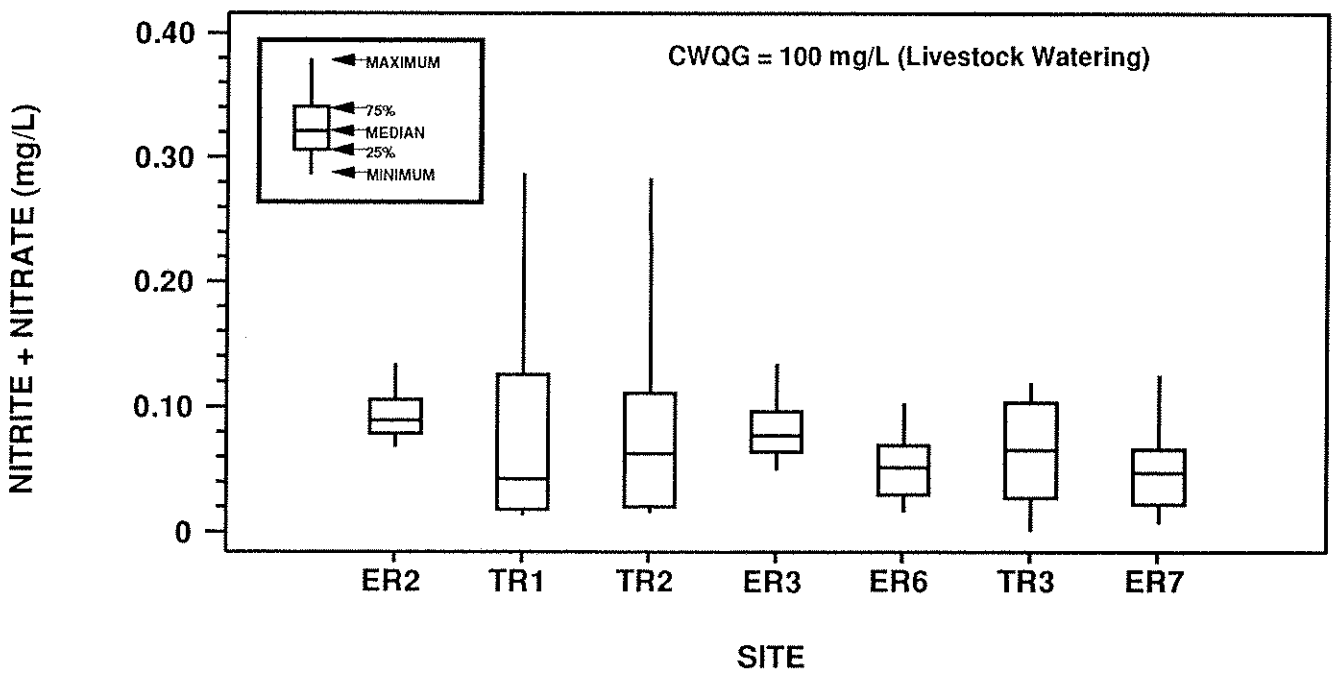

Figure 77. Annual nitrite-nitrate concentrations in Elbow River tributaries and adjacent mainstem sites.

River at Calgary Golf and Country Club, and (4) the Elbow River at the 9th Avenue Bridge. McLean and Bragg creeks had lower concentrations of nitrite+nitrate than did adjacent mainstem sites, whereas nitrite+nitrate levels in Lott Creek were similar to those at adjacent mainstem sites (Figure 77). Nitrite+nitrate levels at all sites except the 9th Avenue Bridge site (near the confluence with the Bow River) increased from fall to spring, then decreased during the summer.

Nitrate levels measured by the City of Calgary were inversely correlated with flow (Table 6). They showed significant seasonality and decreased between both 1982-88 (Figure 78) and 1982-90. Both actual and flow-adjusted nitrate levels decreased.

Total Kjeldahl nitrogen (TKN) concentrations increased below the Glenmore Reservoir, although TKN variance was much higher at two of the upstream sites (Highway 22 and upstream of the Twin Bridges) than at the other mainstem sites (Figure 79). Above the Glenmore Reservoir, TKN levels increased with peak flow in the spring, then decreased throughout the rest of the year. Overland flow, scouring of the floodplain and bank erosion would add organic nitrogen to the river during peak flow. There was comparatively little variances in TKN levels measured throughout the year below the Glenmore Dam.

Ammonia concentrations were at or below the detection limit in most mainstem samples, but higher in the tributary samples. No evidence of ammonia toxicity is reflected in these data.

Total nitrogen was mainly composed of TKN, and thus, concentrations fluctuated in a pattern similar to those of TKN. The Elbow River at the 9th Avenue Bridge site had significantly different total nitrogen levels from all upstream sites, which were not different from each other (Figure 80).

Total nitrogen concentrations did not change significantly between years at the three sites in Kananaskis Country (McLean Creek, the Little Elbow River, and the Elbow River at Allen Bill Pond), which were sampled in 1978-79 and 1988-89 (Appendix II). The Elbow River was sampled at McLean Creek Campground in 1978-79 and Allen Bill Pond in 1988-89, which is slightly upstream. The Elbow River at Highway 22 and upstream of the Twin Bridges was also sampled in 1979 and 1988-89, and again no significant change in total nitrogen levels was measured between study periods. Recent development of the upper watershed has not led to measurable increases in total nitrogen concentrations in the upper Elbow River.

Table 6. Flow dependency and trends in concentrations of flow-adjusted major ions and nutrients at long-term sites

VARIABLE	REGRESSION EQUATION	r^2	d.f.	KENDALL τ
Nitrate	log x = -0.39 log Q - 1.16	0.07*	234	-3.33*
Ammonium[a]	log x = 0.22 log Q - 3.47	0.03	75	N/A
Calcium	log x = -0.12 log Q + 4.30	0.53*	206	5.18*
Chloride	log x = -0.23 log Q + 0.84	0.14*	225	2.44*
Fluoride	log x = -0.07 log Q - 1.08	0.04*	224	-1.82
Magnesium	log x = -0.13 log Q + 2.99	0.46*	232	3.25*
Potassium	log x = -0.14 log Q - 0.15	0.07*	239	-1.85
Sodium	log x = -0.17 log Q + 1.11	0.11*	239	1.20
Sulphate	log x = -0.31 log Q + 4.62	0.75*	241	-1.30

Notes: Samples were collected between 1982 and 1988 at Sarcee Barracks Bridge and between 1988 and 1990 at Twin Bridges. Data supplied by the City of Calgary.

* $p<0.05$

[a] Not enough data for trend testing

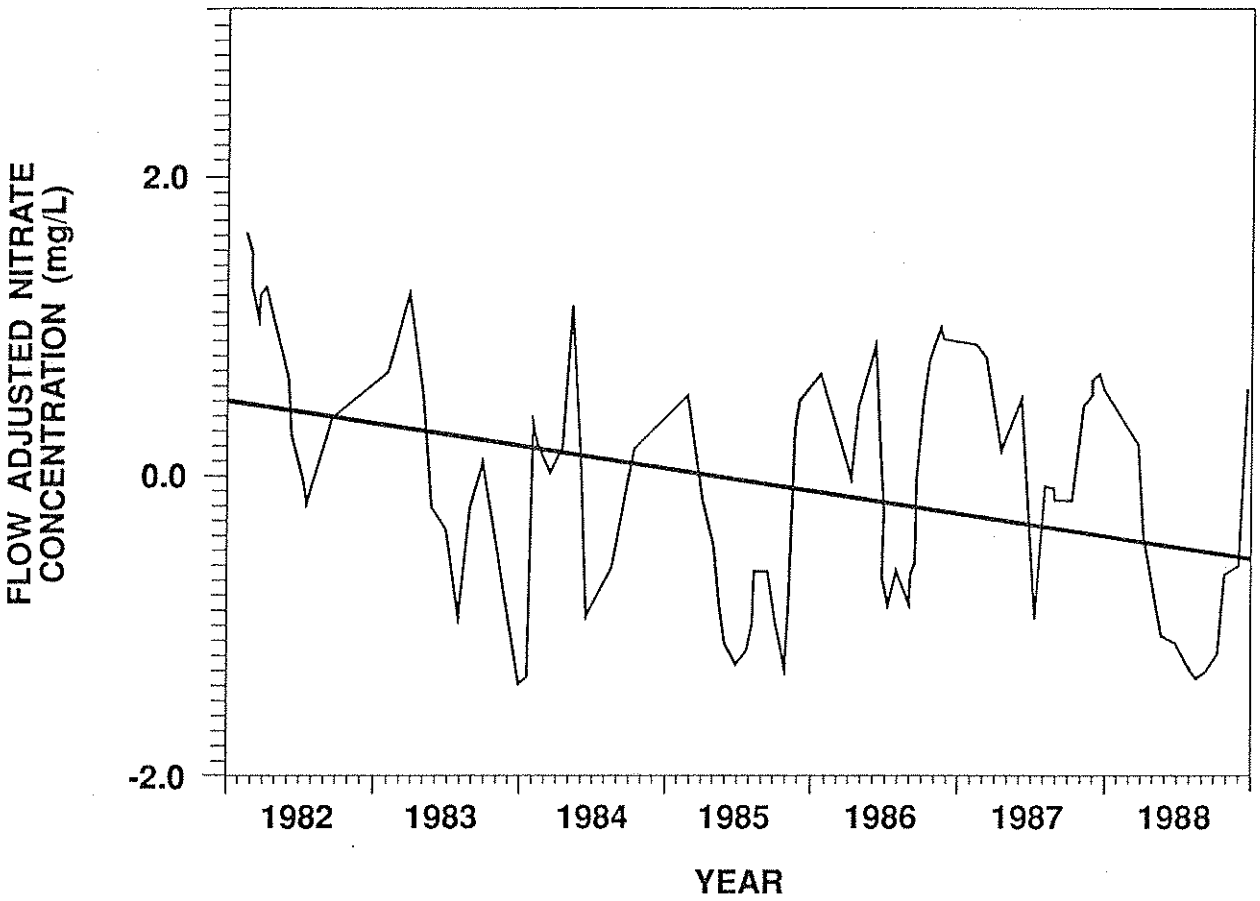

Figure 78. Decrease in flow-adjusted nitrate concentrations at Sarcee Bridge from 1982 to 1988.

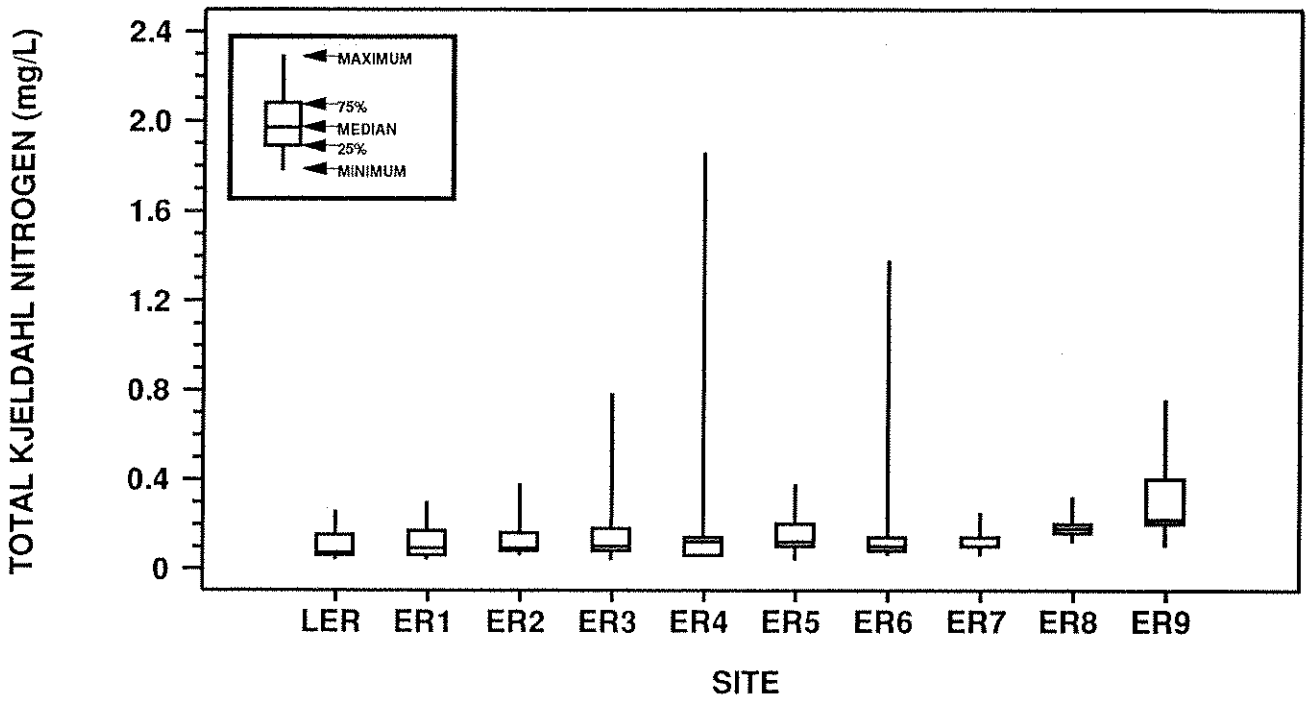

Figure 79. Longitudinal trends in annual concentrations of total Kjeldahl nitrogen in the Elbow River.

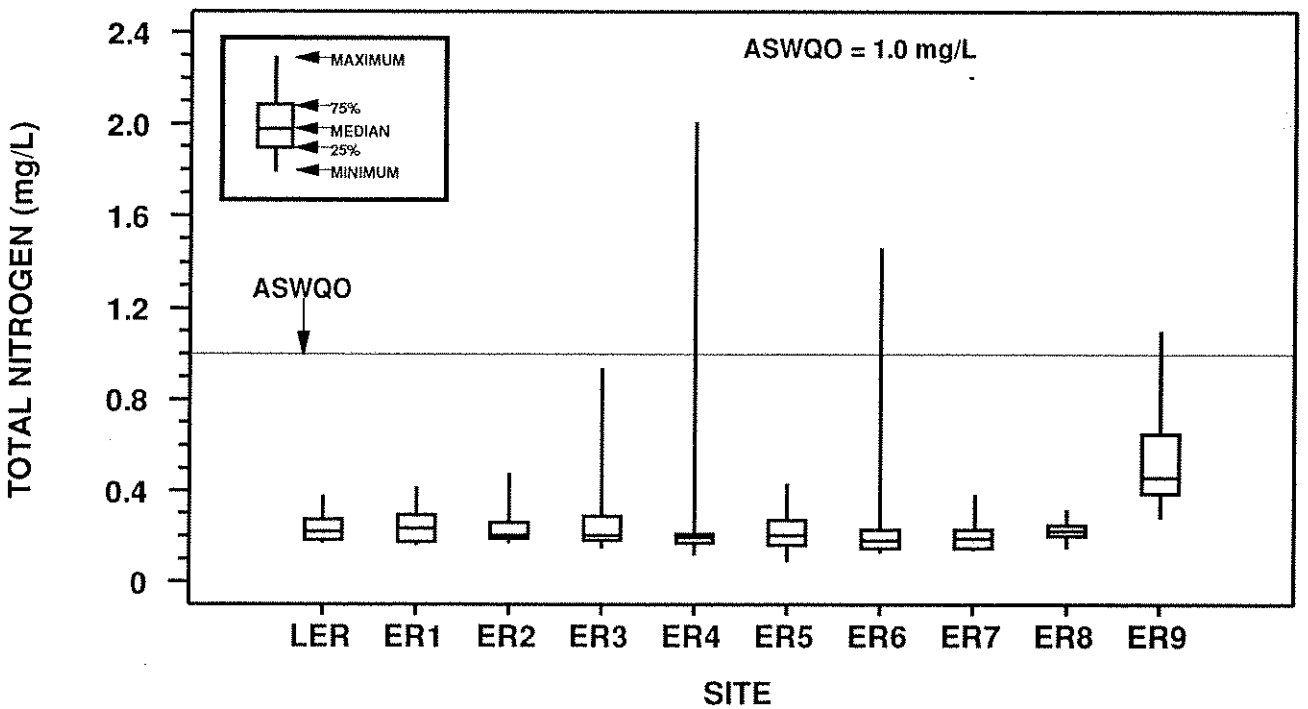

Figure 80. Longitudinal trends in annual concentrations of total nitrogen in the Elbow River.

No significant difference in total nitrogen concentrations was detected in miscellaneous historic data collected from the 9th Avenue Bridge in 1985-1986 when compared to the current data (Appendix II). Non-compliance with ASWQO for freshwater life occurred on one of fourteen sampling occasions at the Elbow River at Highway 22, upstream of the Twin Bridges and at the 9th Avenue Bridge (Table 5).

In general, total phosphorus concentrations were low (near the detection limit) in samples from the headwaters of the Elbow River to the site at Highway 22. Downstream of Highway 22, total phosphorus concentrations increased slightly, though not significantly, until the river reached the site adjacent to the Calgary Golf and Country Club (ER8 - Figure 81). There was no difference in total phosphorus concentrations from the Little Elbow River to the Elbow River upstream of the Twin Bridges. Levels in the Elbow River at the Sarcee Barracks Bridge were different only from those at the two furthest upstream sites (the Little Elbow River and the Elbow River at Cobble Flats) and the Elbow River at the Calgary Golf and Country Club. The latter site had total phosphorus concentrations higher than all other sites except the Elbow River at the 9th Avenue Bridge. Total phosphorus was significantly lower in 1988-89 than in 1978-79 at McLean Creek, but not different between years at any other site (Appendix II). The slight decrease at McLean Creek could reflect the effects of the reservoir built upstream from the site between the sampling years. It should also be noted that all 1978-79 phosphorus data from the other sites were measured with a less sensitive analytical method.

Most of the phosphorus fraction was particulate, as dissolved phosphorus was usually near the detection limit (Figures 81, 82). (Note: values less than the dissolved phosphorus detection limit of 0.003 mg/L were assigned a value equal to one half of the detection limit (0.0015) mg/L in WQStat II analyses.) The tributary streams, particularly Lott Creek, had much higher concentrations of total phosphorus than did the mainstem sites (Figure 83). Non-compliance with ASWQO for freshwater life occurred at those sites downstream of Bragg Creek in both 1989 and 1990 during peak flow (Table 5).

Synoptic samples collected from the Elbow River (allowing for time-of-travel) indicated increasing levels of phosphorus in the reach from upstream of the Twin Bridges to the Sarcee Barracks Bridge on all three sampling occasions (Figures 84, 85, 86). On June 9, 1989, total phosphorus concentrations also increased between the site at Highway 22 and the site above Pirmez Creek. The increase was in the particulate fraction; there was no

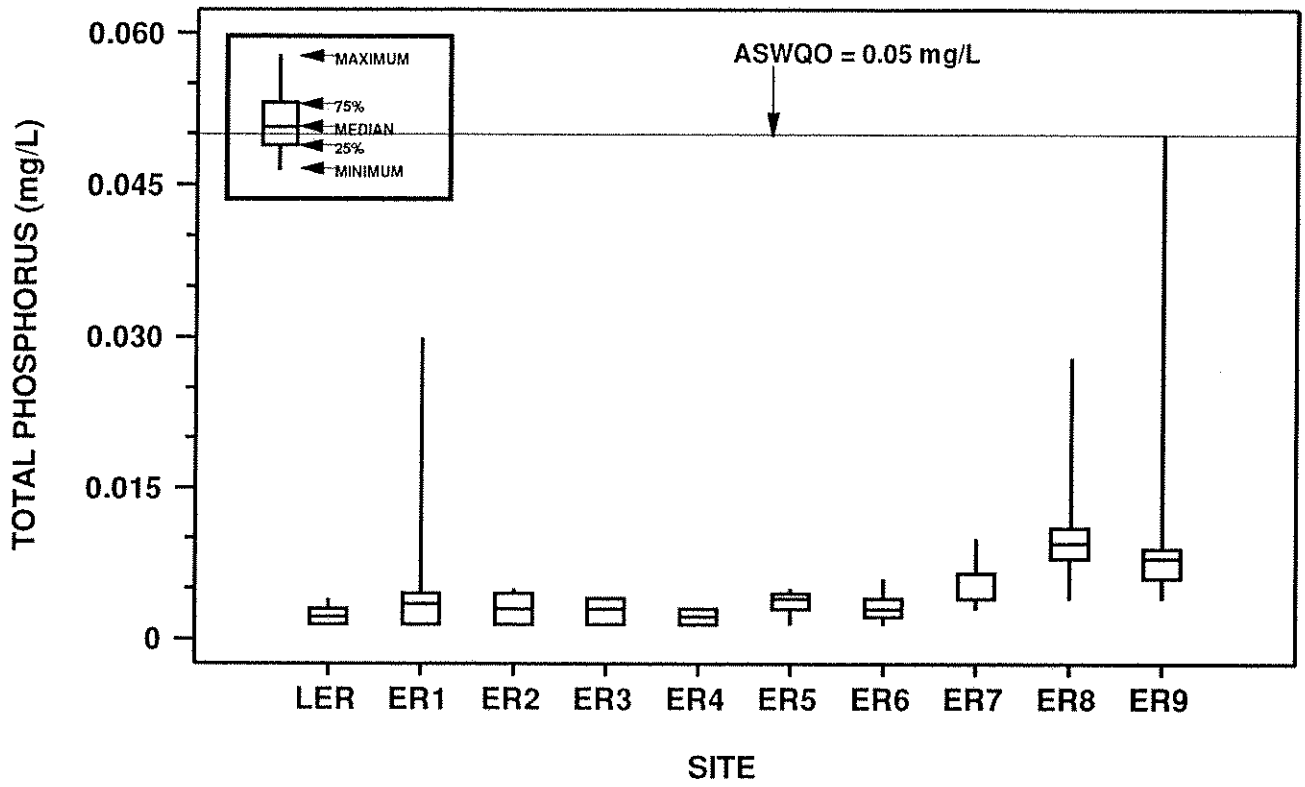

Figure 81. Longitudinal trends in annual concentrations of total phosphorus in the Elbow River. Phosphorus concentrations measured in time-and-travel samples are not included in this figure.

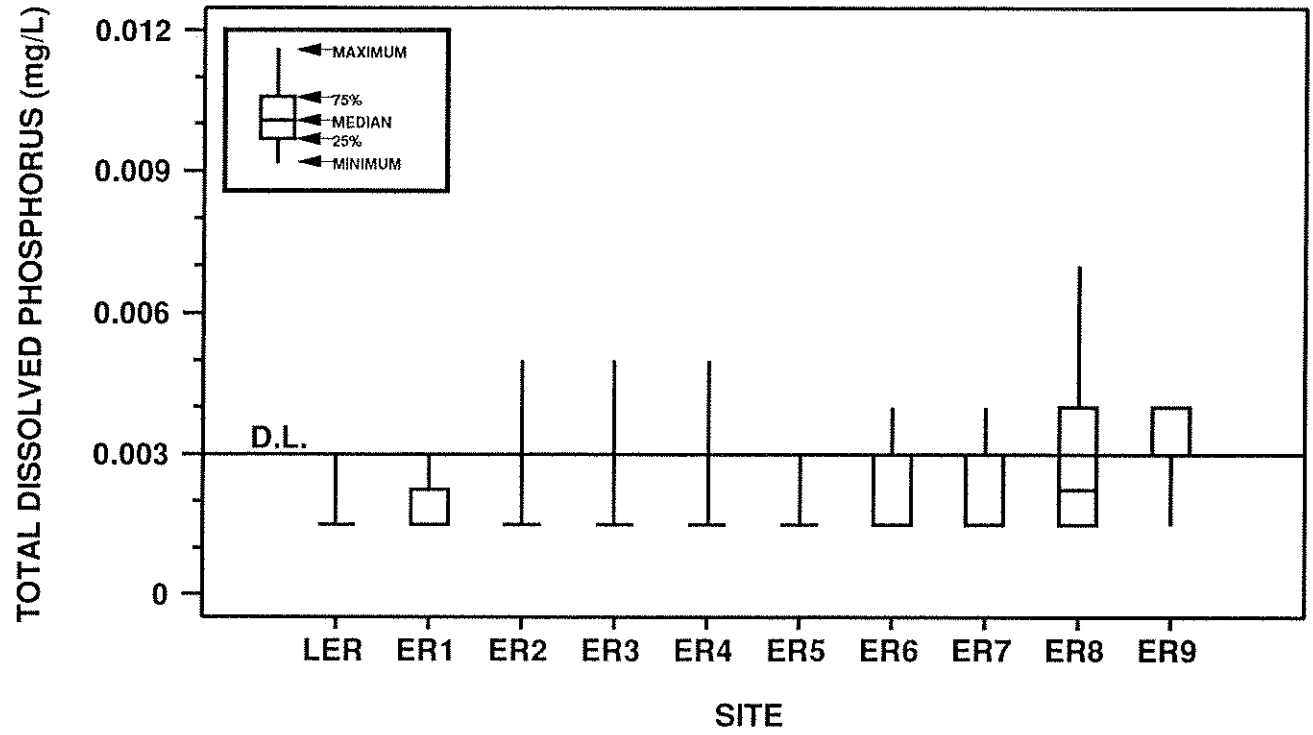

Figure 82. Longitudinal trends in annual concentrations of total dissolved phosphorus in the Elbow River. (D.L.= detection limit)

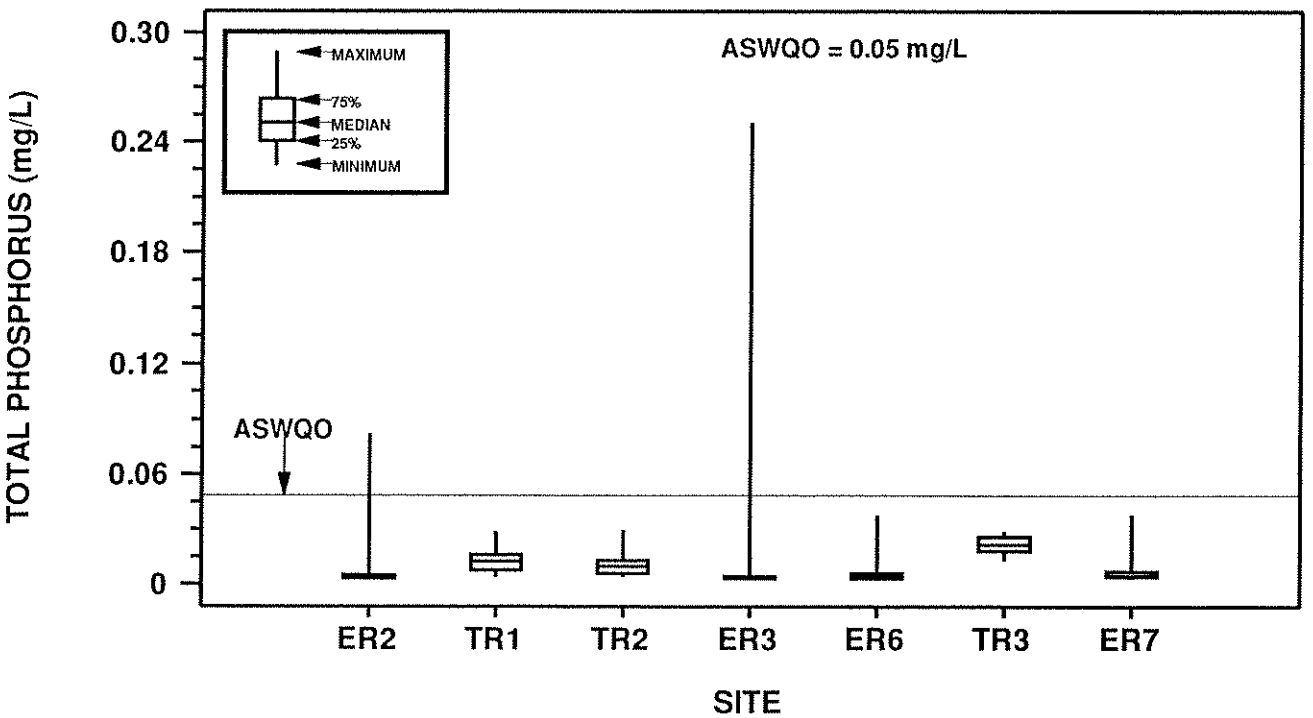

Figure 83. Annual concentrations of total phosphorus in Elbow River tributaries and adjacent mainstem sites.

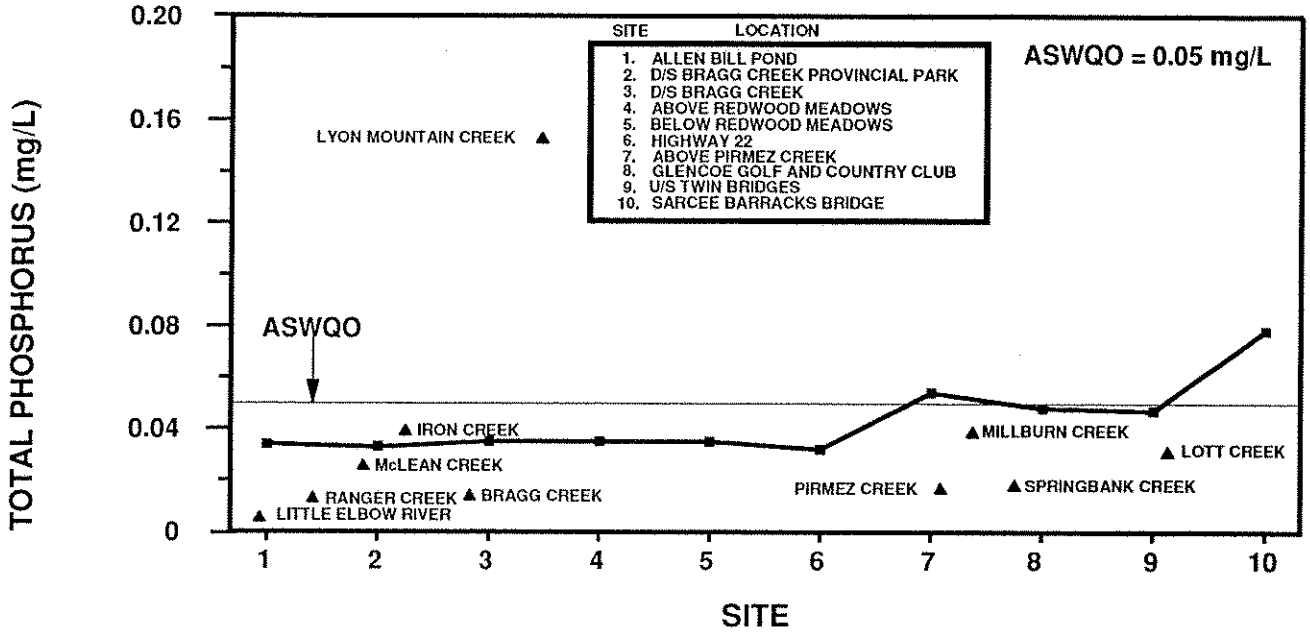

Figure 84. Concentrations of total phosphorus in the Elbow River and its tributaries on June 9, 1989. Sample collections were timed to account for flow rate such that the same slug of water was sampled at each location. (Distances and tributary locations not to scale.)

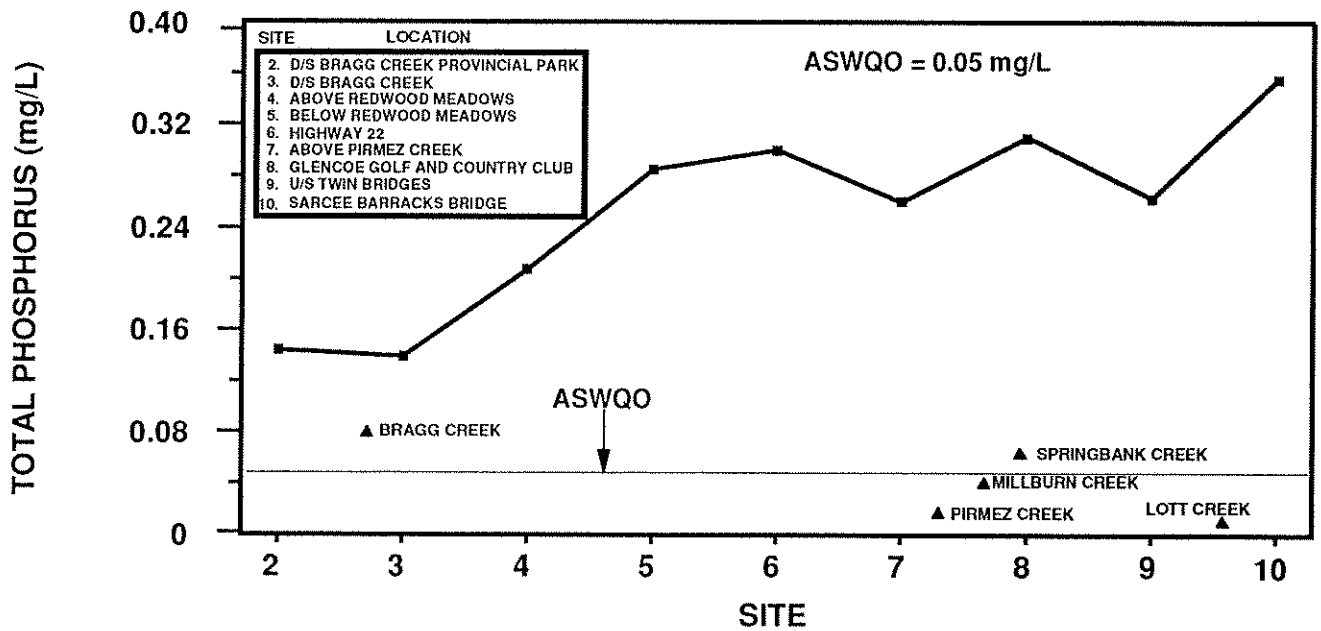

Figure 85. Concentrations of total phosphorus in the Elbow River and two tributaries on June 4, 1990. Sample collections were timed to account for flow rate such that the same slug of water was sampled at each location. (Distances and tributary locations not to scale.)

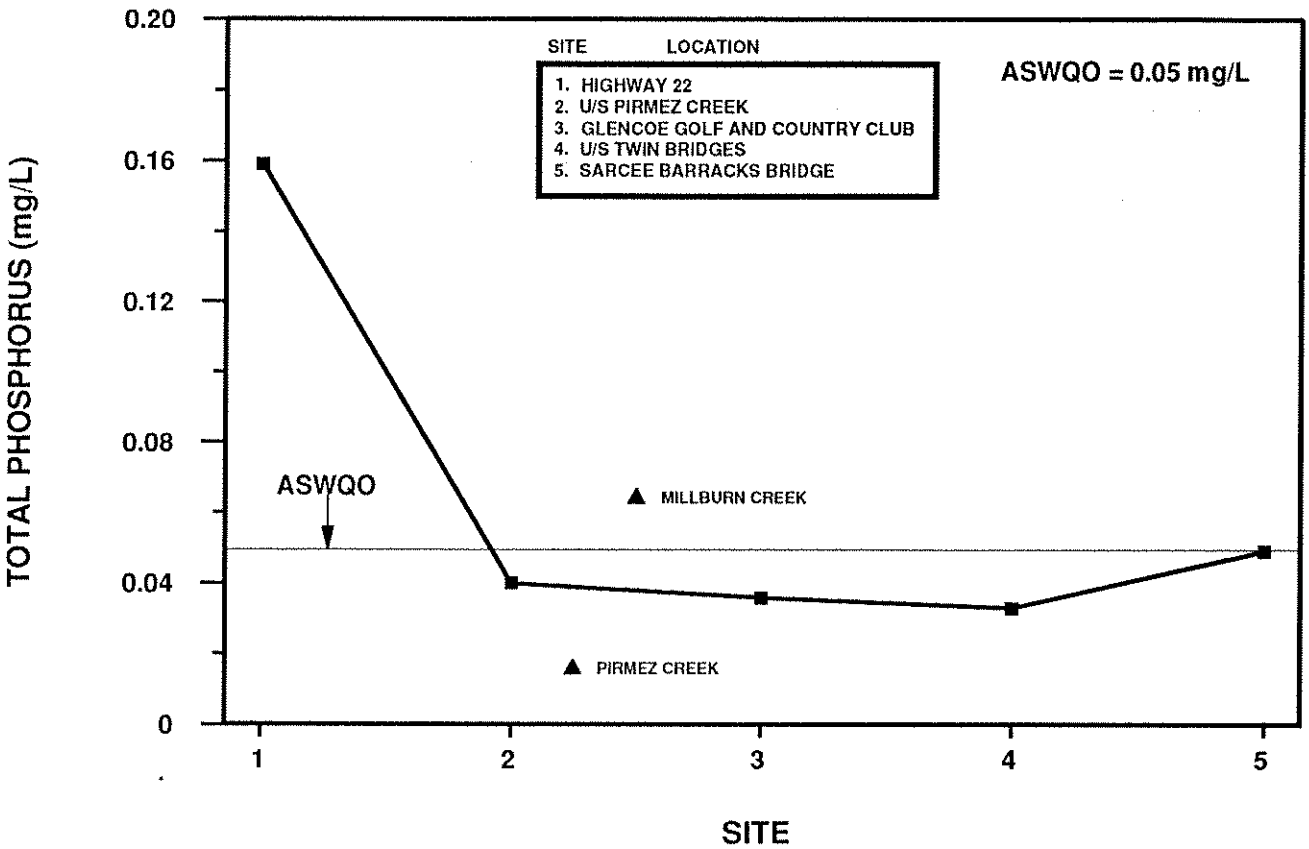

Figure 86. Concentrations of total phosphorus in the Elbow River and two tributaries on June 26, 1990. Sample collections were timed to account for flow rate such that the same slug of water was sampled at each location.

difference in dissolved phosphorus concentrations. This reach contains no major tributary streams. Scouring of the floodplain, overland flow or seasonal runoff, and bank erosion may have contributed to this phosphorus loading. On June 9, 1989, all of the tributaries except Lyon Mountain Creek had much lower concentrations of particulate and total phosphorus, but much higher concentrations of dissolved phosphorus than did the mainstem sites. Although Lyon Mountain Creek had high concentrations of total and particulate phosphorus on the one date that it was sampled, there was no increase seen in either phosphorus fraction in the nearest downstream Elbow River site.

On June 4, 1990, total phosphorus concentrations increased the most between: (1) the Bragg Creek townsite and the site downstream of Redwood Meadows, (2) the site upstream of the Twin Bridges and the Sarcee Barracks Bridge site (Figure 85). Lyon Mountain Creek enters the Elbow River between Bragg Creek and upstream of Redwood Meadows, and spring flow in 1990 was higher than normal. However, there are no tributaries that enter near the Redwood Meadows water treatment sites.

On June 26, 1990, total phosphorus concentrations were highest at the Highway 22 site. Below Highway 22, phosphorus concentrations decreased, then increased slightly between the site upstream of the Twin Bridges and the Sarcee Barracks Bridge site (Figure 86). In all cases, most of the total phosphorus was in particulate form and no change was seen in dissolved phosphorus levels. Bank slumpage in this area may contribute to total phosphorus levels.

Total phosphorus concentrations in tributary streams during the two 1990 surveys showed a similar pattern to that seen in 1989: higher dissolved phosphorus concentrations and lower particulate and total phosphorus concentrations than at adjacent mainstem sites. The one exception to this pattern was Millburn Creek, which had both high dissolved and total phosphorus concentrations. Phosphorus concentrations decreased, however, between the Elbow River sites upstream and downstream of the confluence with Millburn Creek.

Total phosphorus loading calculated from ISCO samples at the Sarcee Barracks Bridge site during peak flow was 1083 kg over 24 days in 1989 and 6924 kg over 29 days in 1990. This probably accounts for approximately 75% of the total annual phosphorus entering Glenmore Reservoir from the Elbow River, as most phosphorus was in particulate form, and approximately 75% of the total sediment transport occurs in June (Hudson 1983). These river loading estimates are far greater than the 425-550 kg total annual phosphorus loading

that Marshall, Macklin, Monaghan Ltd. (1985) estimated for all storm sewers entering the Glenmore Reservoir during wet years. Average daily phosphorus loading was approximately five times greater in spring 1990 (238 kg/day) than in spring 1989 (45 kg/day). The increase was partially because of flow, which was greater in 1990, but also because of higher phosphorus concentrations in 1990 (0.060 $\pm$ 0.052 (mean $\pm$ 1 S.D.) mg/L) than in 1989 (0.035 $\pm$ 0.021 (mean $\pm$ 1 S.D.) mg/L).

Although total phosphorus (TP) concentrations in suspended sediment were slightly lower in 1990 than in 1989, total suspended sediment levels in water samples were much higher (Table 7). Relatively little of this phosphorus was non-apatite inorganic phosphorus (NAIP), and there was no consistent longitudinal trend in either TP or NAIP. The biologically available portion of this phosphorus was not measured. Cross et al. (1986), however, found that NAIP was highly correlated with biologically available phosphorus (algal assays) along the Bow River, where it ranged from 147 to 660 mg/g (17-38% of TP) in airlift sediment samples downstream of Calgary. Sediment NAIP in the Elbow River ranged from 23 to 52 mg/g (4-14% of TP), which suggests that relatively little of the Elbow River sediment phosphorus was biologically available. It should be noted, however, that sediment phosphorus samples from the Bow and Elbow rivers were collected using different methods.

Kallqvist and Berge (1990) reported that about 40% of the phosphorus in runoff from cereal cultivation fields was biologically available for algae. The Elbow River watershed contains 5853 ha in oats and barley and 1522 ha in other crops (Marshall, Macklin, Monaghan Ltd. 1985). Testing of the Elbow River water by algal assay would determine the amount of runoff phosphorus that is available to stimulate algal growth.

Nutrient levels in the Elbow River were slightly lower than in the other four southern Alberta rivers surveyed. Total nitrogen concentrations were similar in the Elbow and Bow rivers, and lower in the Elbow River than in the Red Deer, Highwood, and Oldman rivers (Figure 87). Total phosphorus levels were lowest in the Elbow River at Allen Bill Pond. The Elbow River at the Sarcee Barracks Bridge had total phosphorus levels similar to those in the Bow and Highwood rivers, and lower levels than in the Red Deer and Oldman rivers (Figure 88).

Table 7. Phosphorus concentrations in suspended sediment from the Elbow River during peak flow conditions (1989 and 1990)

SITE	YEAR	TOTAL SUSPENDED SOLIDS[a] (mg/L)	TOTAL PHOSPHORUS (µg/g)	APATITE INORGANIC PHOSPHORUS (µg/g)	NON-APATITE INORGANIC PHOSPHORUS (µg/g)	ORGANIC PHOSPHORUS (µg/g)
Downstream of Bragg Creek	1989	19	569	263	49	257
	1990	215	359	-	52	-
Highway 22	1989	32	581	400	25	156
	1990	456	337	-	46	-
Sarcee Barracks Bridge	1989	74	519	415	23	81
	1990	442	412	-	50	-

Note: Samples taken on June 7, 1989 and June 20, 1990

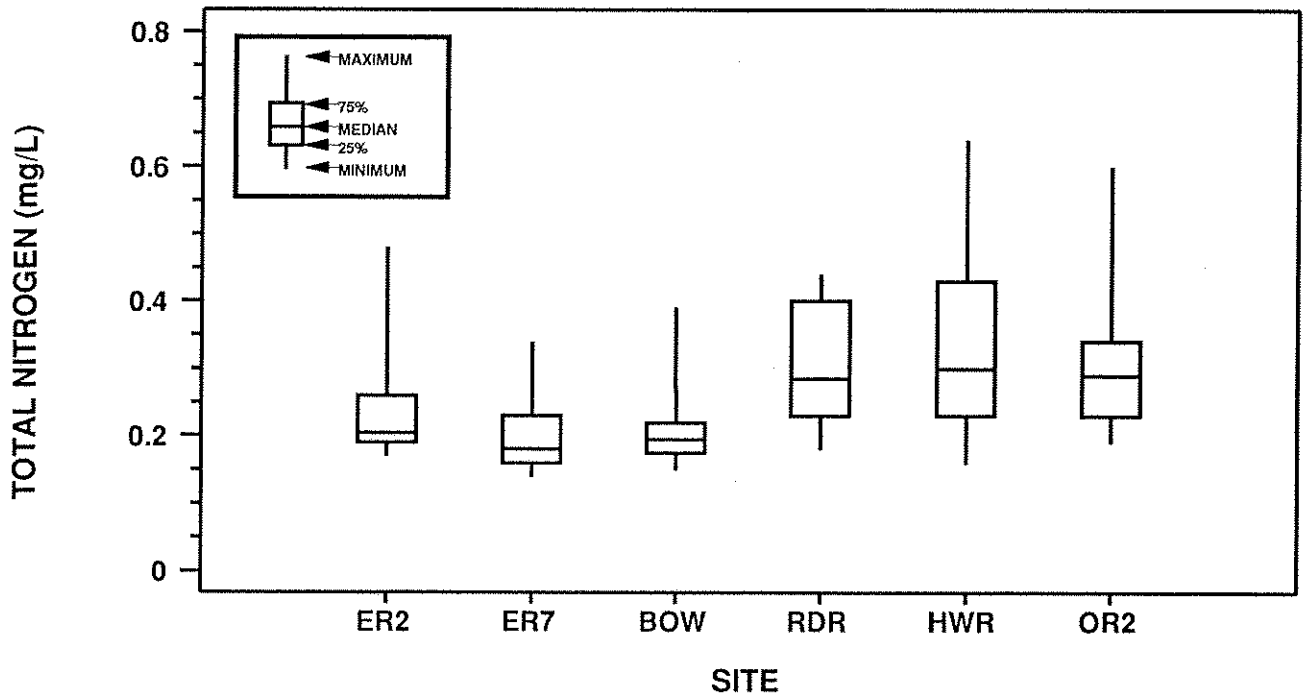

Figure 87. Comparison of annual concentrations of total nitrogen in five southern Alberta rivers.

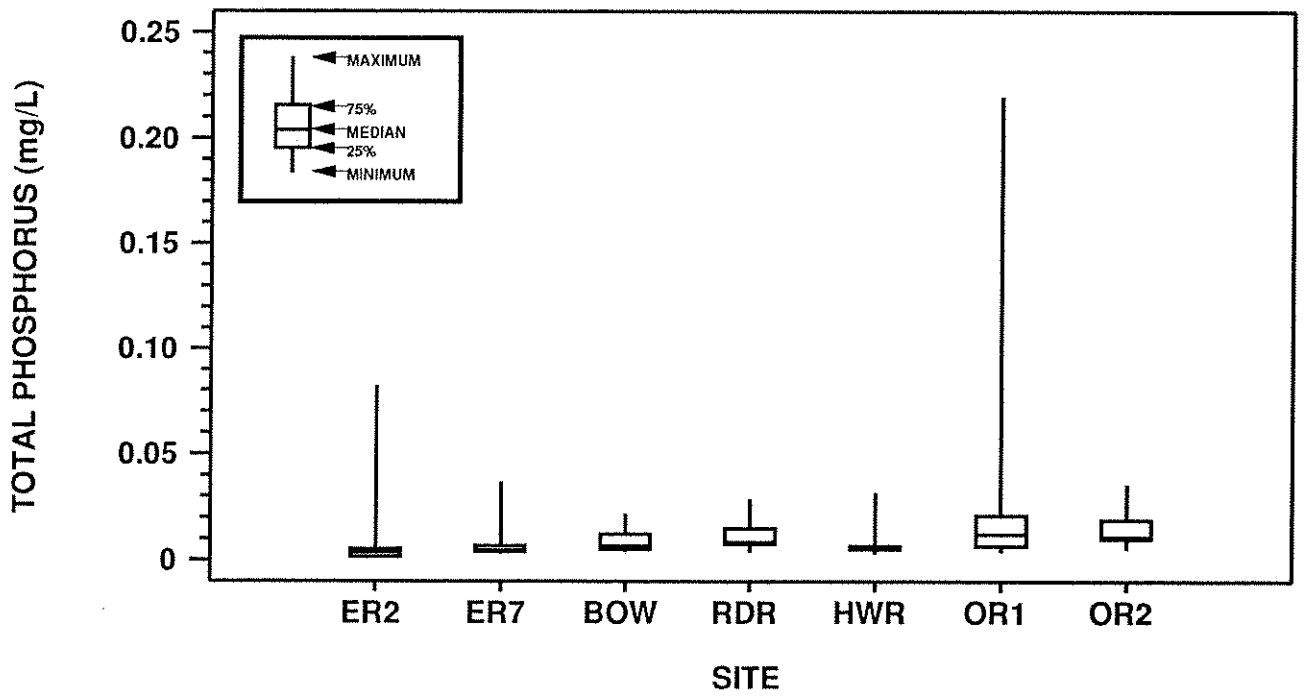

Figure 88. Comparison of annual concentrations of total phosphorus in five southern Alberta rivers.

4.20 MASS LOADINGS FROM TRIBUTARIES

The three tributary creeks showed similar temporal trends in loading. Concentrations of most variables were higher in tributary streams compared to adjacent mainstem sites. However, flow rates in McLean Creek and Bragg Creek were very low relative to flow in the Elbow River. Thus, higher levels of nutrients and coliforms in Bragg and McLean creeks were diluted sufficiently in the Elbow River that levels in the river did not appear to increase downstream of these tributaries (Table 8; Appendix IV). However, loads of all variables in Lott Creek were greater than 5% of the adjacent mainstem site. Fecal coliform loads increased in the Elbow River between the sites upstream and downstream of Lott Creek, but there was no change in total coliform loads along the same reach. Loads of total phosphorus, TKN, and total nitrogen also increased in the Elbow River from upstream to downstream of Lott Creek. One storm sewer and several seasonal tributaries also empty into the Elbow River upstream of the Sarcee Barracks Bridge, but were not sampled in this investigation.

5.0 CONCLUSIONS

In general, water quality in the Elbow River upstream of Calgary was good. In this reach, all variables were usually in compliance with CWQG and ASWQO, except during peak flow.

Phosphorus and fecal coliform loadings were much higher during spring runoff. However, most of the phosphorus entering the river during peak flow is in particulate form and may not be highly bio-available for macrophytes and algae.

Groundwater input to the Elbow River was indicated by elevated levels of TDS, major ions, hardness, alkalinity, and specific conductance downstream of probable groundwater inflow areas. This suggests that groundwater quality should be considered in development proposals, and monitoring of groundwater quality may be desirable.

Nutrient levels in the watershed upstream of Highway 22 did not change measurably between 1979 and 1989. Thus, development of Kananaskis Country apparently has not increased the amounts of nutrients entering the Elbow River. Upstream of Calgary, nitrate concentrations decreased between 1982 and 1990. We assume that this could reflect either decreased loading or increased uptake by aquatic plants along the Elbow River. In contrast, calcium, chloride, and magnesium concentrations increased between 1982 and 1990,

Table 8. Mean tributary load as a percentage of the immediate upstream load in the Elbow River

VARIABLE	SAMPLE SIZE	MCLEAN CREEK (%)[a]	BRAGG CREEK (%)[a]	LOTT CREEK (%)[a]
Flow	12	0.47±0.33	1.90±1.20	6.15±4.38
Alkalinity	12	0.68±0.36	2.53±1.26	6.85±4.22
Hardness	12	0.49±0.28	1.76±0.93	6.44±3.90
TDS	12	0.49±0.29	1.80±0.92	6.43±3.81
Ca	12	0.51±0.28	1.81±0.91	6.46±3.94
Mg	12	0.45±0.28	1.57±0.81	6.81±3.78
Na	12	2.13±1.35	10.42±5.57	9.48±4.98
K	12	1.29±0.74	6.01±2.91	9.85±5.85
HCO_3	12	0.68±0.36	2.81±1.62	6.87±4.21
Cl	12	2.52±0.90	12.26±7.77	8.51±3.76
SO_4	12	0.11±0.12	0.33±0.18	5.61±3.07
Fl	12	0.25±0.20	0.74±0.47	5.72±3.96
Si	12	0.84±0.63	3.81±2.27	7.01±5.06
TON	(n = 12)	1.69±1.89 (n = 12)	5.27±4.29 (n = 11)	13.09±11.68
NH_4	12	0.74±0.69	2.34±1.54	51.05±51.04
NO_2+NO_3-N	12	0.26±0.14	1.05±0.65	8.70±7.66
TKN	12	1.60±1.77	5.00±3.99	14.98±15.55
TN	12	1.04±0.97	3.60±2.36	20.16±26.55
DP	12	1.13±1.24	2.60±1.68	25.28±15.09
PP	(n = 12)	1.81±1.95 (n = 6)	8.24±9.61 (n = 6)	26.04±18.93
TP	12	1.43±1.40	4.42±3.59	35.16±24.70
TCOL	12	7.88±11.19	63.72±68.87	63.17±119.32
FCOL	12	8.37±8.73	39.82±63.07	61.05±103.31
Phenols	5	0.37±0.13	1.50±0.69	10.05±10.69
Al	5	0.35±0.14	2.16±1.64	11.74±17.60
As	5	0.68±0.46	3.39±2.55	15.37±17.26
Ba	5	2.34±0.55	5.77±2.20	10.36±7.34
Cr	5	0.33±0.09	1.25±0.40	6.90±4.92
Cu	5	0.28±0.15	1.43±0.81	6.62±5.24
Fe	5	4.20±4.33	20.24±22.64	37.41±67.68
Zn	(n = 5)	3.57±3.51 (n = 5)	1.02±1.02 (n = 4)	10.0±3.87
DOC	12	32.63±88.89	72.21±170.45	12.69±21.63
POC	(n = 10)	0.09±1.47 (n = 10)	27.76±8.30 (n = 12)	9.03±6.82

[a] These numbers represent average percentages from 13 surveys conducted from May 1988 to March 1989 (Appendix IV)

perhaps because of the increased use of road salt in the area or changes in groundwater quality or inflow.

The Elbow River had higher specific conductance, hardness, TDS, filterable residue, sulphate, and fluoride levels compared with the other rivers in southern Alberta that were surveyed. These higher levels may have been the result of differences in bedrock and groundwater composition in the different watersheds. The levels of nutrients, organic carbon, major ions, metals, pH, and alkalinity in the Elbow River were similar to, or lower than, levels of these variables in the four other southern Alberta rivers surveyed.

McLean and Bragg creeks appeared to have little effect on water quality of the Elbow River, probably because of dilution. Lott Creek, however, had a higher discharge and therefore, a greater loading of total nitrogen, total phosphorus, and fecal coliforms into the Elbow River than did the other two creeks.

Water quality in the lower Elbow River appears to be degraded, with bacterial and aluminum contamination evident at the 9th Avenue Bridge site. Nutrient levels are also higher at this site, and are manifested by comparatively high levels of epilithic chlorophyll a. High levels of sodium and chloride between the Calgary Golf and Country Club and the 9th Street Bridge are indicative of stormwater or other unknown inputs.

This report is intended to provide a basin-wide perspective on water quality in the Elbow River. The reader should note that design and implementation of appropriate management strategies to protect river water quality for future uses will inevitably require more detailed, site-specific investigations.

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Appendix I. Elbow River at Bragg Creek

Table 1. Elbow River Sites at Bragg Creek

SITE NO.	LOCATION
1	Below Provincial Park, near Shell station (00AL05BJ1500)
2	At Water Survey of Canada gauge
3	At Herron property
4	At new temporary bridge
5	At Martineau residence at downstream village limits (Sarcee Reserve boundary - 00AL05BJ1600)

Appendix I. (cont'd)

Table 2. Elbow River at Bragg Creek Sampling Results

PARAMETER	OCTOBER 24, 1983					OCTOBER 31, 1983				
	SITE LOCATION					SITE LOCATION				
	1	2	3	4	5	1	2	3	4	5
Calcium	51	53	54	53	53	54	54	53	55	52
Magnesium	15.1	15.2	15	15.1	15.2	15.5	15.6	15.5	15.5	15.4
Sodium	1.6	1.6	1.6	1.6	1.6	1.6	1.7	1.6	1.8	1.8
Potassium	0.39	0.4	0.42	0.42	0.42	0.45	0.43	0.40	0.48	0.47
Chloride	0.80	1.1	0.90	1.20	1.0	0.70	0.80	0.70	1.2	0.80
Sulphate	61.5	60.0	60.0	59.0	60.0	63.5	65.0	64.5	62.5	63.5
PP Alkalinity	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Alkalinity	134	135	136	135	136	130	135	135	134	135
pH	8.14	8.15	8.16	8.16	8.16	8.19	8.2	8.22	8.21	8.23
Bicarbonate	163.5	165.0	166.0	165	166	158.5	165	165	163.5	165
Total Hardness	190.0	195.0	197.0	195	195	199	199	196	201	193
Fluoride	0.17	0.18	0.20	0.22	0.22	0.26	0.31	0.31	0.30	0.30
Silica	3.98	4.00	4.04	4.04	4.06	4.06	4.15	4.15	4.20	4.15
Conductance	379	376	381	360	357	364	365	357	361	362
T. Filterable Residue	215	218	220	220	222	230	230	230	220	270
Nitrite Nitrogen	0.006	0.013	0.006	0.004	0.013	<0.003	<0.003	<0.003	<0.003	<0.003
Nitrate, Nitrite N	0.096	0.084	0.078	0.080	0.080	0.106	0.106	0.092	0.089	0.102
Iron	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Coliform	4	4	2	Nil	4	Nil	Nil	1	3	1
Fecal Coliform	4	4	Nil	Nil	2	Nil	Nil	Nil	Nil	1

Appendix II.

NAQUADAT SUMMARY REPORT MAY 11, 1992

SURFACE WATER DATA

STATION 00AL05BJ0500 LAT. 50D 53M 30S LONG. 114D 40M 0S PR 3 UTM 11 664100E 5640150N FOR APR 27, 1988 TO MAR 08, 1989
MCLEAN CREEK NEAR THE MOUTH - KANANASKIS PROJECT

	SUBM ID	02061F TEMPERATURE OF WATER	10301F PH	10301L PH	02041F SPECIFIC CONDUCT.	02041L SPECIFIC CONDUCT.	08101F OXYGEN DISSOLVED DO O2	08101L OXYGEN DISSOLVED DO O2	02066F TEMPERATURE AIR
		DEG.C	PH UNITS	PH UNITS	US/CM	US/CM	MG/L	MG/L	DEG.C.
SAMPLES(FLAGS)		14(0)	11(0)	14(0)	13(0)	14(0)	14(0)		14(0)
LOW		.0	7.1	7.21	242.	316.0	8.5		-6.
HIGH		13.3	7.8	8.45	518.	560.0	12.5		18.
AVERAGE		6.2			389.9	407.1	10.16		9.9
STD.DEV.		5.2			98.6	85.7	1.29		5.5
PERCNT:10TH		.0	7.2	7.39	291.	318.0	8.6		-5.0
25TH		.3	7.2	7.88	303.	324.0	9.1		-3.
MEDIAN 50TH		6.6	7.2	8.10	368.	380.5	10.15		11.0
75TH		11.5	7.5	8.19	495.	481.0	11.1		14.
90TH		12.6	7.5	8.39	512.	537.0	12.2		17.
SECONDARY CODE							02F		

	SUBM ID	10151L ALKALINITY PHENOL PHTHALEIN	10101L ALKALINITY TOTAL	06202L BICARBONT. (CALCD.)	06302L CARBONATE DISSOLVED	20103L CALCIUM DISSOLVED	12102L MAGNESIUM DISSOLVED	19103L POTASSIUM DISSOLVED	17203L CHLORIDE DISSOLVED
		CACO3 MG/L	CACO3 MG/L	HCO3 MG/L	CO3 MG/L	CA MG/L	MG MG/L	K MG/L	CL MG/L
SAMPLES(FLAGS)		14(13)	14(0)	14(0)	14(13)	14(0)	14(0)	14(0)	14(0)
LOW		L.10	144.00	175.5	L.5	44.10	11.00	.75	1.60
HIGH		6.40	307.00	374.2	7.7	90.50	19.40	1.32	8.00
AVERAGE		.55*	206.79	251.0	1.0*	61.66	14.42	1.04	4.04
STD.DEV.		1.68*	54.01	66.6	1.9*	16.07	3.12	.15	1.95
PERCNT:10TH		L.10	153.00	186.5	L.5	45.40	11.30	.87	1.70
25TH		L.10	161.00	196.3	L.5	48.70	12.40	.90	2.70
MEDIAN 50TH		L.10	186.00	226.7	L.5	55.00	12.75	1.06	3.75
75TH		L.10	234.00	285.3	L.5	75.20	17.10	1.10	5.60
90TH		L.10	295.00	359.6	L.5	89.00	19.20	1.25	6.40
SECONDARY CODE									

	SUBM ID	10603L HARDNESS TOTAL	36011L COLIFORMS FECAL	36001L COLIFORMS TOTAL	09107L FLUORIDE DISSOLVED	16306L SULPHATE DISSOLVED	06005L CARBON TOTAL ORGANIC	06104L CARBON DISSOLVED ORGANIC	07403L NITROGEN TOTAL ORG. (CALCD.)
		CACO3 MG/L	MPN NO/100ML	MPN NO/100ML	F MG/L	S04 MG/L	C MG/L	C MG/L	N MG/L
SAMPLES(FLAGS)		14(0)	17(5)	17(4)	14(0)	14(0)	14(0)	14(0)	14(4)
LOW		160.01	L4.	L4.	.14	7.20	2.10	1.90	Q.190
HIGH		306.10	290.	430.	.19	15.50	10.00	9.75	.740
AVERAGE		213.52	60.6*	94.9*	.15	11.94	6.78	6.58	.374*
STD.DEV.		52.78	79.1*	116.8*	.01	2.33	2.72	2.70	.154*
PERCNT:10TH		161.29	L4.	L4.	.14	10.10	2.80	2.70	Q.190
25TH		167.03	4.	L10.	.14	10.50	4.40	4.20	.230
MEDIAN 50TH		189.77	16.	28.	.15	11.45	7.20	7.00	.370
75TH		258.38	88.	124.	.16	13.50	9.40	9.00	.420
90TH		300.70	190.	252.	.16	15.40	9.60	9.60	.550
SECONDARY CODE		05L							

STATION 00AL05BJ0500 LAT. 50D 53M 30S LONG. 114D 40M 0S PR 3 UTM 11 664100E 5640150N FOR APR 27, 1988 TO JUN 07, 1989
MCLEAN CREEK NEAR THE MOUTH - KANANASKIS PROJECT

	SUBM ID	07602L NITROGEN DISSOLVED N	07505L NITROGEN TOTAL AMMONIA N	07562L NITROGEN DISSOLVED AMMONIA N	07110L NITROGEN DISSOLVED NO3 & NO2 N	07015L NITROGEN TOTAL KJELDAHL N	15103L PHOSPHORUS DISSOLVED	15406L PHOSPHORUS TOTAL	15901L PHOSPHORUS PARTICULATE (CALCD.)
		MG/L	MG/L	MG/L	MG/L	MG/L	P MG/L	P MG/L	P MG/L
SAMPLES(FLAGS)		14(0)	14(4)		14(0)	14(0)	15(0)	15(0)	15(0)
LOW		.344	L.010		.014	.200	.003	.004	.001
HIGH		.824	.020		.288	.760	.017	.029	.022
AVERAGE		.482	.014*		.093	.389	.007	.014	.007
STD.DEV.		.115	.005*		.100	.157	.004	.008	.006
PERCNT:10TH		.388	L.010		.015	.200	.003	.004	.001
25TH		.430	L.010		.019	.240	.005	.008	.003
MEDIAN 50TH		.451	.010		.043	.380	.007	.014	.006
75TH		.500	.020		.126	.440	.009	.020	.008
90TH		.576	.020		.280	.560	.011	.028	.017
SECONDARY CODE							05L	21L	

	SUBM ID	26304L IRON EXTRBLE.	10401L RESIDUE NONFILTR.	02074L TURBIDITY	00201L TOTAL DISSOLVED SOLIDS (CALCD.)	00205L TOTAL DISSOLVED SOLIDS	14102L SILICA REACTIVE	10451L RESIDUE FILTERABLE	13303L ALUMINUM EXTRBLE.
		FE MG/L	MG/L	NTU	MG/L	MG/L	SIO2 MG/L	MG/L	AL MG/L
SAMPLES(FLAGS)		6(0)	15(0)	14(0)	14(0)		14(0)	14(0)	6(2)
LOW		.060	.4	.6	173.0		4.95	169.0	L.010
HIGH		.440	10.0	8.9	327.5		8.60	323.0	.010
AVERAGE		.210	2.5	2.1	230.7		7.16	225.1	.010*
STD.DEV.		.140	2.5	2.1	52.5		1.18	52.7	.000*
PERCNT:10TH			.8	.7	179.3		5.42	170.0	
25TH		.120	.8	1.2	181.5		6.41	180.0	L.010
MEDIAN 50TH		.180	1.6	1.6	210.3		7.45	205.0	.010
75TH		.280	4.0	2.5	266.4		8.00	260.0	.010
90TH			4.7	2.8	308.3		8.56	300.0	
SECONDARY CODE			07L				05L		

		48302L CADMIUM EXTRBLE.	29305L COPPER EXTRBLE.	82302L LEAD EXTRBLE.	56301L BARIUM EXTRBLE.	30305L ZINC EXTRBLE.	24302L CHROMIUM EXTRBLE.	27302L COBALT EXTRBLE.	33304L ARSENIC EXTRACTABLE
	SUBM ID	CD MG/L	CU MG/L	PB MG/L	BA MG/L	ZN MG/L	CR MG/L	CO MG/L	AS MG/L
SAMPLES(FLAGS)		6(6)	6(5)	6(6)	6(0)	6(0)	6(4)	6(5)	6(1)
LOW		L.0010	L.001	L.0020	.170	.008	L.001	L.001	L.0002
HIGH		L.0010	.001	L.0020	.490	.023	.003	.001	.0006
AVERAGE			.001*		.272	.016	.001*	.001*	.0004*
STD.DEV.			.000*		.120	.006	.001*	.000*	.0002*
PERCNT:10TH									
25TH		L.0010	L.001	L.0020	.180	.010	L.001	L.001	.0003
MEDIAN 50TH		L.0010	L.001	L.0020	.240	.017	L.001	L.001	.0004
75TH		L.0010	L.001	L.0020	.310	.020	.002	L.001	.0006
90TH									
SECONDARY CODE									

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q
STATION 00AL05BJ0500 LAT. 50D 53M 30S LONG. 114D 40M 0S PR 3 UTM 11 664100E 5640150N FOR APR 27, 1988 TO MAR 08, 1989
MCLEAN CREEK NEAR THE MOUTH - KANANASKIS PROJECT

		80011L MERCURY TOTAL	80015L MERCURY TOTAL	06537L PHENOLIC MATERIAL	02021L COLOUR TRUE	08202L OXYGEN BIOCHEMICAL DEMAND-BOD O2	08301L OXYGEN TOTAL COD O2	06722L CHLOROPHYLL A EPILITHIC SUBSAMPLE (TEMPLATE)
	SUBM ID	HG UG/L	HG MG/L	PHENOL MG/L	REL. UNITS	MG/L	MG/L	MG/M2
SAMPLES(FLAGS)		6(6)		6(1)	14(1)		2(0)	
LOW		L.050		L.001	L5.000		20.00	
HIGH		L.050		.003	40.000		28.00	
AVERAGE				.002*	19.286*		24.00	
STD.DEV.				.001*	11.906*		5.66	
PERCNT:10TH					5.000			
25TH		L.050		.001	10.000			
MEDIAN 50TH		L.050		.001	20.000		24.00	
75TH		L.050		.003	30.000			
90TH					40.000			
SECONDARY CODE								

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ0400 LAT. 50D 56M 50S LONG. 114D 34M 35S PR 3 UTM 11 670250E 5646550N FOR APR 27, 1988 TO MAR 08, 1989
BRAGG CREEK NEAR MOUTH
JUNE 1988

		02061F TEMPERATURE OF WATER	10301F PH	10301L PH	02041F SPECIFIC CONDUCT.	02041L SPECIFIC CONDUCT.	08101F OXYGEN DISSOLVED DO O2	08101L OXYGEN DISSOLVED DO O2	02066F TEMPERATURE AIR
	SUBM ID	DEG.C	PH UNITS	PH UNITS	US/CM	US/CM	MG/L	MG/L	DEG.C.
SAMPLES(FLAGS)		14(0)	13(0)	14(0)	13(0)	14(0)	14(0)		14(0)
LOW		-.3	7.0	7.12	224.	276.0	8.7		-7.
HIGH		14.4	8.0	8.42	437.	494.0	12.9		17.
AVERAGE		6.4			334.8	374.0	10.74		10.3
STD.DEV.		5.9			53.7	73.7	1.50		5.4
PERCNT:10TH		-.2	7.1	7.46	291.	308.0	8.8		-6.
25TH		-.1	7.2	7.77	313.	314.0	9.2		-4.
MEDIAN 50TH		5.9	7.5	8.04	322.	358.5	11.10		10.5
75TH		12.0	7.7	8.13	362.	416.0	11.8		16.
90TH		14.1	7.8	8.38	413.	486.0	12.7		17.
SECONDARY CODE							02F		

		10151L ALKALINITY PHENOL PHTHALEIN	10101L ALKALINITY TOTAL	06202L BICARBONT. (CALCD.)	06302L CARBONATE DISSOLVED	20103L CALCIUM DISSOLVED	12102L MAGNESIUM DISSOLVED	19103L POTASSIUM DISSOLVED	17203L CHLORIDE DISSOLVED
	SUBM ID	CACO3 MG/L	CACO3 MG/L	HCO3 MG/L	CO3 MG/L	CA MG/L	MG MG/L	K MG/L	CL MG/L
SAMPLES(FLAGS)		14(13)	14(0)	14(0)	14(13)	14(0)	14(0)	14(0)	14(0)
LOW		L.10	134.00	163.4	L.5	38.10	8.50	.89	1.70
HIGH		6.00	246.00	300.0	7.2	73.90	16.80	1.80	6.70
AVERAGE		.52*	186.79	226.7	1.0*	54.04	12.74	1.30	4.05
STD.DEV.		1.58*	36.98	46.1	1.8*	11.79	2.80	.30	1.89
PERCNT:10TH		L.10	157.00	180.4	L.5	43.50	9.90	1.00	2.10
25TH		L.10	158.00	191.4	L.5	44.20	10.30	1.10	2.40
MEDIAN 50TH		L.10	171.00	209.0	L.5	50.25	12.15	1.15	3.45
75TH		L.10	219.00	267.0	L.5	65.10	15.60	1.60	6.40
90TH		L.10	239.00	291.3	L.5	73.20	16.60	1.76	6.60
SECONDARY CODE									

		10603L HARDNESS TOTAL	36011L COLIFORMS FECAL	36001L COLIFORMS TOTAL	09107L FLUORIDE DISSOLVED	16306L SULPHATE DISSOLVED	06005L CARBON TOTAL ORGANIC C	06104L CARBON DISSOLVED ORGANIC C	07403L NITROGEN TOTAL ORG. (CALCD.) N
	SUBM ID	CACO3 MG/L	MPN NO/100ML	MPN NO/100ML	F MG/L	SO4 MG/L	MG/L	MG/L	MG/L
SAMPLES(FLAGS)		14(0)	20(2)	20(1)	14(0)	14(0)	14(0)	14(0)	14(2)
LOW		130.24	L4.	8.	.10	5.90	3.00	2.50	.190
HIGH		253.90	500.	1200.	.16	18.80	7.60	7.30	.700
AVERAGE		187.52	84.3*	230.0*	.12	11.24	4.90	4.55	.333*
STD.DEV.		40.35	123.1*	301.7*	.02	4.21	1.38	1.48	.143*
PERCNT:10TH		149.50	4.0	9.0*	.10	6.60	3.30	2.60	.230
25TH		155.89	9.0*	16.0	.11	7.70	3.70	3.20	.230
MEDIAN 50TH		177.89	29.0	135.0	.12	11.20	4.90	4.60	.280
75TH		224.90	120.0	360.0	.13	13.50	5.65	5.55	.390
90TH		251.33	225.0	580.0	.14	18.50	7.00	6.60	.540
SECONDARY CODE		05L							

STATION 00AL05BJ0400 LAT. 50D 56M 50S LONG. 114D 34M 35S PR 3 UTM 11 670250E 5646550N FOR APR 27, 1988 TO MAY 28, 1990
BRAGG CREEK NEAR MOUTH
JUNE 1988

	SUBM ID	07602L NITROGEN DISSOLVED N MG/L	07505L NITROGEN TOTAL AMMONIA N MG/L	07562L NITROGEN DISSOLVED AMMONIA N MG/L	07110L NITROGEN DISSOLVED NO3 & NO2 N MG/L	07015L NITROGEN TOTAL KJELDAHL N MG/L	15103L PHOSPHORUS DISSOLVED P MG/L	15406L PHOSPHORUS TOTAL P MG/L	15901L PHOSPHORUS PARTICULATE (CALCD.) P MG/L
SAMPLES(FLAGS)		14(0)	14(2)		14(0)	14(0)	16(1)	16(0)	16(1)
LOW		.285	L.010		.016	.200	L.003	.004	.001
HIGH		.797	.020		.284	.720	.012	.084	.072
AVERAGE		.439	.013*		.093	.346	.005*	.016	.011*
STD.DEV.		.147	.005*		.090	.146	.003*	.019	.017*
PERCNT:10TH		.289	L.010		.018	.240	.003	.005	.002
25TH		.303	.010		.021	.240	.004	.006	.003
MEDIAN 50TH		.426	.010		.063	.290	.005	.011	.005
75TH		.511	.020		.111	.400	.006	.015	.009
90TH		.584	.020		.240	.560	.009	.029	.023
SECONDARY CODE							05L	21L	

	SUBM ID	26304L IRON EXTRBLE. FE MG/L	10401L RESIDUE NONFILTR. MG/L	02074L TURBIDITY NTU	00201L TOTAL DISSOLVED SOLIDS (CALCD.) MG/L	00205L TOTAL DISSOLVED SOLIDS MG/L	14102L SILICA REACTIVE SIO2 MG/L	10451L RESIDUE FILTERABLE MG/L	13303L ALUMINUM EXTRBLE. AL MG/L
SAMPLES(FLAGS)		6(0)	16(1)	14(0)	14(0)		14(0)	14(0)	6(1)
LOW		.070	L.4	.6	156.4		6.20	150.0	L.010
HIGH		.240	123.6	118.0	280.2		9.54	271.0	.020
AVERAGE		.185	15.2*	11.2	212.0		8.18	205.6	.015*
STD.DEV.		.067	32.6*	31.0	42.7		.98	42.1	.005*
PERCNT:10TH			1.6	.9	172.2		6.50	170.0	
25TH		.160	2.0	1.2	179.5		7.70	170.0	.010
MEDIAN 50TH		.200	2.8	1.9	197.8		8.20	191.0	.015
75TH		.240	6.2	3.0	246.3		8.95	240.0	.020
90TH			61.	15.0	277.3		9.22	270.0	
SECONDARY CODE			07L				05L		

	SUBM ID	48302L CADMIUM EXTRBLE. CD MG/L	29305L COPPER EXTRBLE. CU MG/L	82302L LEAD EXTRBLE. PB MG/L	56301L BARIUM EXTRBLE. BA MG/L	30305L ZINC EXTRBLE. ZN MG/L	24302L CHROMIUM EXTRBLE. CR MG/L	27302L COBALT EXTRBLE. CO MG/L	33304L ARSENIC EXTRACTABLE AS MG/L
SAMPLES(FLAGS)		6(6)	6(3)	6(6)	6(0)	6(3)	6(4)	6(6)	6(2)
LOW		L.0010	L.001	L.0020	.140	L.001	L.001	L.001	L.0002
HIGH		L.0010	.002	L.0020	.190	.003	.001	L.001	.0006
AVERAGE			.001*		.162	.001*	.001*		.0004*
STD.DEV.			.000*		.021	.001*	.000*		.0002*
PERCNT:10TH									
25TH		L.0010	L.001	L.0020	.140	L.001	L.001	L.001	L.0002
MEDIAN 50TH		L.0010	.001*	L.0020	.160	.001*	L.001	L.001	.0004
75TH		L.0010	.001	L.0020	.180	.001	.001	L.001	.0006
90TH									
SECONDARY CODE									

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ0400 LAT. 50D 56M 50S LONG. 114D 34M 35S PR 3 UTM 11 670250E 5646550N FOR APR 27, 1988 TO MAR 08, 1989
BRAGG CREEK NEAR MOUTH
JUNE 1988

	SUBM ID	80011L MERCURY TOTAL HG UG/L	80015L MERCURY TOTAL HG MG/L	06537L PHENOLIC MATERIAL PHENOL MG/L	02021L COLOUR TRUE REL. UNITS	08202L OXYGEN BIOCHEMICAL DEMAND-BOD O2 MG/L	08301L OXYGEN TOTAL COD O2 MG/L	06722L CHLOROPHYLL A EPILITHIC SUBSAMPLE (TEMPLATE) MG/M2
SAMPLES(FLAGS)		6(6)		6(1)	14(1)		2(0)	
LOW		L.050		L.001	L5.000		15.00	
HIGH		L.050		.002	40.000		23.00	
AVERAGE				.001*	15.000*		19.00	
STD.DEV.				.000*	10.561*		5.66	
PERCNT:10TH					5.000			
25TH		L.050		.001	5.000			
MEDIAN 50TH		L.050		.001	10.000		19.00	
75TH		L.050		.001	20.000			
90TH					30.000			
SECONDARY CODE								

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ0300 LAT. 50D 0M 15S LONG. 114D 13M 20S PR 3 UTM 11 699050E 5542550N FOR APR 26, 1988 TO MAR 09, 1989
LOTT CREEK AT MOUTH
JUNE 1988

	SUBM ID	02061F TEMPERATURE OF WATER DEG.C	10301F PH PH UNITS	10301L PH PH UNITS	02041F SPECIFIC CONDUCT. US/CM	02041L SPECIFIC CONDUCT. US/CM	08101F OXYGEN DISSOLVED DO O2 MG/L	08101L OXYGEN DISSOLVED DO O2 MG/L	02066F TEMPERATURE AIR DEG.C.
SAMPLES(FLAGS)		14(0)	9(0)	14(0)	10(0)	14(0)	13(0)		14(0)
LOW		.0	6.8	7.25	279.	398.0	6.2		-10.
HIGH		15.1	7.6	8.31	461.	456.0	12.0		21.
AVERAGE		7.3			353.1	441.3	9.37		11.7
STD.DEV.		5.4			51.1	14.9	2.28		6.3
PERCNT:10TH		.9		7.52	302.0	431.0	6.2		-5.0
25TH		1.2	6.9	7.68	326.	436.0	7.1		-3.
MEDIAN 50TH		8.6	7.4	7.95	340.5	443.0	9.5		13.5
75TH		11.3	7.6	8.08	366.	453.0	11.3		15.
90TH		13.3		8.15	437.5	454.0	12.0		20.
SECONDARY CODE							02F		

	SUBM ID	10151L ALKALINITY PHENOL PHTHALEIN CACO3 MG/L	10101L ALKALINITY TOTAL CACO3 MG/L	06202L BICARBONT. (CALCD.) HCO3 MG/L	06302L CARBONATE DISSOLVED CO3 MG/L	20103L CALCIUM DISSOLVED CA MG/L	12102L MAGNESIUM DISSOLVED MG MG/L	19103L POTASSIUM DISSOLVED K MG/L	17203L CHLORIDE DISSOLVED CL MG/L
SAMPLES(FLAGS)		14(14)	14(0)	14(0)	14(14)	14(0)	14(0)	14(0)	14(0)
LOW		L.10	159.00	193.8	L.5	53.00	15.60	.85	1.30
HIGH		L.10	186.00	226.7	L.5	71.10	18.50	1.20	3.20
AVERAGE			174.29	212.5		63.09	16.96	.97	2.13
STD.DEV.			7.33	8.9		4.86	.86	.10	.58
PERCNT:10TH		L.10	167.00	203.6	L.5	56.20	15.60	.85	1.50
25TH		L.10	169.00	206.0	L.5	60.00	16.40	.88	1.80
MEDIAN 50TH		L.10	175.00	213.3	L.5	63.75	17.20	.97	2.00
75TH		L.10	178.00	217.0	L.5	66.20	17.50	1.00	2.40
90TH		L.10	183.00	223.1	L.5	68.70	17.90	1.10	3.10
SECONDARY CODE									

	SUBM ID	10603L HARDNESS TOTAL CACO3 MG/L	36011L COLIFORMS FECAL MPN NO/100ML	36001L COLIFORMS TOTAL MPN NO/100ML	09107L FLUORIDE DISSOLVED F MG/L	16306L SULPHATE DISSOLVED SO4 MG/L	06005L CARBON TOTAL ORGANIC C MG/L	06104L CARBON DISSOLVED ORGANIC C MG/L	07403L NITROGEN TOTAL ORG. (CALCD.) N MG/L
SAMPLES(FLAGS)		14(0)	20(2)	20(1)	14(0)	14(0)	14(0)	14(0)	14(0)
LOW		202.88	L4.	4.	.25	44.70	1.00	.40	.150
HIGH		251.43	168.	770.	.32	68.50	2.60	2.30	.620
AVERAGE		227.51	58.2*	184.6*	.28	57.59	1.81	1.57	.233
STD.DEV.		14.41	51.8*	215.0*	.02	7.91	.52	.53	.118
PERCNT:10TH		208.00	6.0	11.0*	.26	45.20	1.10	1.00	.160
25TH		216.96	14.0	60.0	.27	51.20	1.20	1.00	.180
MEDIAN 50TH		228.15	38.0	124.0	.28	59.40	1.90	1.70	.200
75TH		237.71	104.0	164.0	.30	63.50	2.20	2.00	.230
90TH		244.60	135.0	610.0	.31	65.50	2.30	2.10	.300
SECONDARY CODE		05L							

STATION 00AL05BJ0300 LAT. 50D 0M 15S LONG. 114D 13M 20S PR 3 UTM 11 699050E 5542550N FOR APR 26, 1988 TO MAY 28, 1990
LOTT CREEK AT MOUTH
JUNE 1988

	SUBM ID	07602L NITROGEN DISSOLVED N MG/L	07505L NITROGEN TOTAL AMMONIA N MG/L	07562L NITROGEN DISSOLVED AMMONIA N MG/L	07110L NITROGEN DISSOLVED NO3 & NO2 N MG/L	07015L NITROGEN TOTAL KJELDAHL N MG/L	15103L PHOSPHORUS DISSOLVED P MG/L	15406L PHOSPHORUS TOTAL P MG/L	15901L PHOSPHORUS PARTICULATE (CALCD.) P MG/L
SAMPLES(FLAGS)		14(2)	14(0)		14(2)	14(0)	16(0)	16(0)	16(0)
LOW		.217	.010		L.003	.180	.006	.013	.004
HIGH		.658	.100		.120	.640	.019	.029	.013
AVERAGE		.348*	.051		.063*	.284	.013	.022	.009
STD.DEV.		.118*	.033		.043*	.112	.004	.005	.003
PERCNT:10TH		.228	.010		L.003	.200	.006	.016	.005
25TH		Q.243	.020		.028	.240	.010	.018	.007
MEDIAN 50TH		.344	.055		.067	.260	.014	.022	.010
75TH		.400	.080		.104	.280	.016	.026	.012
90TH		.470	.100		.112	.360	.018	.029	.012
SECONDARY CODE							05L	21L	

	SUBM ID	26304L IRON EXTRBLE. FE MG/L	10401L RESIDUE NONFILTR. MG/L	02074L TURBIDITY NTU	00201L TOTAL DISSOLVED SOLIDS (CALCD.) MG/L	00205L TOTAL DISSOLVED SOLIDS MG/L	14102L SILICA REACTIVE SIO2 MG/L	10451L RESIDUE FILTERABLE MG/L	13303L ALUMINUM EXTRBLE. AL MG/L
SAMPLES(FLAGS)		6(0)	16(0)	14(0)	14(0)		14(0)	14(0)	6(1)
LOW		.040	.8	.6	237.1		3.15	230.0	L.010
HIGH		.130	7.9	5.2	276.1		6.20	270.0	.030
AVERAGE		.097	3.6	1.6	253.8		4.73	250.4	.015*
STD.DEV.		.034	2.1	1.3	11.8		.95	11.4	.008*
PERCNT:10TH			1.2	.6	239.2		3.46	240.0	
25TH		.070	2.0	.7	246.4		4.07	240.0	.010
MEDIAN 50TH		.110	3.4	1.2	252.1		4.52	250.0	.010
75TH		.120	4.7	1.8	257.8		5.55	256.0	.020
90TH			7.	3.4	273.8		6.00	270.0	
SECONDARY CODE			07L				05L		

	SUBM ID	48302L CADMIUM EXTRBLE. CD MG/L	29305L COPPER EXTRBLE. CU MG/L	82302L LEAD EXTRBLE. PB MG/L	56301L BARIUM EXTRBLE. BA MG/L	30305L ZINC EXTRBLE. ZN MG/L	24302L CHROMIUM EXTRBLE. CR MG/L	27302L COBALT EXTRBLE. CO MG/L	33304L ARSENIC EXTRACTABLE AS MG/L
SAMPLES(FLAGS)		6(6)	6(5)	6(5)	6(0)	6(2)	6(6)	6(5)	5(0)
LOW		L.0010	L.001	L.0020	.080	L.001	L.001	L.001	.0003
HIGH		L.0010	.001	.0020	.100	.008	L.001	.002	.0030
AVERAGE			.001*	.0020*	.090	.002*		.001*	.0009
STD.DEV.			.000*	.0000*	.009	.003*		.000*	.0012
PERCNT:10TH									
25TH		L.0010	L.001	L.0020	.080	L.001	L.001	L.001	.0003
MEDIAN 50TH		L.0010	L.001	L.0020	.090	.001	L.001	L.001	.0004
75TH		L.0010	L.001	L.0020	.100	.001	L.001	L.001	.0007
90TH									
SECONDARY CODE									

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ0300 LAT. 50D 0M 15S LONG. 114D 13M 20S PR 3 UTM 11 699050E 5542550N FOR APR 26, 1988 TO MAR 09, 1989
LOTT CREEK AT MOUTH
JUNE 1988

	SUBM ID	80011L MERCURY TOTAL HG UG/L	80015L MERCURY TOTAL HG MG/L	06537L PHENOLIC MATERIAL PHENOL MG/L	02021L COLOUR TRUE REL. UNITS	08202L OXYGEN BIOCHEMICAL DEMAND-BOD O2 MG/L	08301L OXYGEN TOTAL COD O2 MG/L	06722L CHLOROPHYLL A EPILITHIC SUBSAMPLE (TEMPLATE) MG/M2
SAMPLES(FLAGS)		6(6)		6(2)	14(6)	1(0)	2(0)	
LOW		L.050		L.001	L5.000	.40	5.00	
HIGH		L.050		.006	10.000	.40	10.00	
AVERAGE				.002*	6.786*		7.50	
STD.DEV.				.002*	2.486*		3.54	
PERCNT:10TH					L5.000			
25TH		L.050		L.001	L5.000			
MEDIAN 50TH		L.050		.001	5.000		7.50	
75TH		L.050		.002	10.000			
90TH					10.000			
SECONDARY CODE								

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ0600 LAT. 50D 47M 20S LONG. 114D 52M 15S PR 3 UTM 11 650100E 5628300N FOR APR 27, 1988 TO JAN 04, 1989
LITTLE ELBOW RIVER NEAR MOUTH
JUNE 1988

	SUBM ID	02061F TEMPERATURE OF WATER DEG.C	10301F PH PH UNITS	10301L PH PH UNITS	02041F SPECIFIC CONDUCT. US/CM	02041L SPECIFIC CONDUCT. US/CM	08101F OXYGEN DISSOLVED DO O2 MG/L	08101L OXYGEN DISSOLVED DO O2 MG/L	02066F TEMPERATURE AIR DEG.C.
SAMPLES(FLAGS)		12(0)	11(0)	12(0)	12(0)	12(0)	12(0)		12(0)
LOW		.1	7.0	7.10	211.	242.0	9.9		-5.
HIGH		8.9	7.7	8.25	398.	403.0	12.7		17.0
AVERAGE		4.5			312.0	337.2	10.90		9.8
STD.DEV.		2.7			54.9	47.1	1.04		6.1
PERCNT:10TH		.5	7.2	7.29	227.	277.0	10.0		-1.
25TH		2.5	7.5	7.37	282.5	308.0	10.00		1.0
MEDIAN 50TH		5.2	7.6	7.66	320.5	346.0	10.50		11.5
75TH		6.0	7.7	7.87	349.0	376.5	11.80		15.5
90TH		7.2	7.7	8.24	363.	383.0	12.5		16.0
SECONDARY CODE							02F		

	SUBM ID	10151L ALKALINITY PHENOL PHTHALEIN CACO3 MG/L	10101L ALKALINITY TOTAL CACO3 MG/L	06202L BICARBONT. (CALCD.) HCO3 MG/L	06302L CARBONATE DISSOLVED CO3 MG/L	20103L CALCIUM DISSOLVED CA MG/L	12102L MAGNESIUM DISSOLVED MG MG/L	19103L POTASSIUM DISSOLVED K MG/L	17203L CHLORIDE DISSOLVED CL MG/L
SAMPLES(FLAGS)		12(12)	12(0)	12(0)	12(12)	12(0)	12(0)	12(0)	12(3)
LOW		L.10	104.00	126.8	L.5	35.20	10.10	.25	L.01
HIGH		L.10	120.00	146.3	L.5	56.30	17.00	.35	.50
AVERAGE			114.17	139.2		47.59	13.60	.31	.22*
STD.DEV.			4.97	6.1		6.62	2.32	.03	.16*
PERCNT:10TH		L.10	108.00	131.7	L.5	40.70	11.30	.30	L.01
25TH		L.10	111.50	135.9	L.5	42.65	11.80	.30	.06*
MEDIAN 50TH		L.10	114.00	139.0	L.5	47.85	13.25	.30	.25
75TH		L.10	118.50	144.4	L.5	53.50	15.85	.33	.30
90TH		L.10	120.00	146.3	L.5	55.70	16.90	.35	.40
SECONDARY CODE									

	SUBM ID	10603L HARDNESS TOTAL CACO3 MG/L	36011L COLIFORMS FECAL MPN NO/100ML	36001L COLIFORMS TOTAL MPN NO/100ML	09107L FLUORIDE DISSOLVED F MG/L	16306L SULPHATE DISSOLVED SO4 MG/L	06005L CARBON TOTAL ORGANIC C MG/L	06104L CARBON DISSOLVED ORGANIC C MG/L	07403L NITROGEN TOTAL ORG. (CALCD.) N MG/L
SAMPLES(FLAGS)		12(0)	12(9)	12(9)	12(0)	12(0)	12(2)	12(3)	12(10)
LOW		129.57	L4.	L4.	.17	24.40	L.10	L.10	Q.050
HIGH		210.31	L10.	L10.	.33	88.00	1.70	1.20	Q.270
AVERAGE		174.96	5.3*	5.7*	.26	58.93	.76*	.64*	.118*
STD.DEV.		25.92	2.5*	2.5*	.04	21.83	.57*	.46*	.072*
PERCNT:10TH		149.51	L4.	L4.	.22	40.00	L.10	L.10	Q.070
25TH		154.57	L4.0	L4.0	.24	41.45	.20	.15*	.070
MEDIAN 50TH		174.17	L4.0	L4.0	.26	52.20	.75	.65	.080
75TH		198.98	6.0	8.0	.29	82.50	1.25	1.10	.160
90TH		209.22	L10.	L10.	.30	85.00	1.40	1.20	Q.230
SECONDARY CODE		05L							

STATION 00AL05BJ0600 LAT. 50D 47M 20S LONG. 114D 52M 15S PR 3 UTM 11 650100E 5628300N FOR APR 27, 1988 TO JAN 04, 1989
LITTLE ELBOW RIVER NEAR MOUTH
JUNE 1988

	SUBM ID	07602L NITROGEN DISSOLVED N MG/L	07505L NITROGEN TOTAL AMMONIA N MG/L	07562L NITROGEN DISSOLVED AMMONIA N MG/L	07110L NITROGEN DISSOLVED NO3 & NO2 N MG/L	07015L NITROGEN TOTAL KJELDAHL N MG/L	15103L PHOSPHORUS DISSOLVED P MG/L	15406L PHOSPHORUS TOTAL P MG/L	15901L PHOSPHORUS PARTICULATE (CALCD.) P MG/L
SAMPLES(FLAGS)		12(0)	12(10)		12(0)	12(0)	12(10)	12(5)	12(10)
LOW		.172	L.010		.092	.060	L.003	L.003	Q.000
HIGH		.375	.010		.136	.280	.008	.048	.040
AVERAGE		.242	.010*		.114	.128	.003*	.007*	.004*
STD.DEV.		.072	.000*		.015	.072	.001*	.013*	.011*
PERCNT:10TH		.172	L.010		.093	.080	L.003	L.003	Q.000
25TH		.184	L.010		.100	.080	L.003	L.003	.000
MEDIAN 50TH		.217	L.010		.115	.090	L.003	.003	.000
75TH		.279	L.010		.129	.170	L.003	.004	.001
90TH		.370	.010		.131	.240	.003	.006	Q.003
SECONDARY CODE									

	SUBM ID	26304L IRON EXTRBLE. FE MG/L	10401L RESIDUE NONFILTR. MG/L	02074L TURBIDITY NTU	00201L TOTAL DISSOLVED SOLIDS (CALCD.) MG/L	00205L TOTAL DISSOLVED SOLIDS MG/L	14102L SILICA REACTIVE SIO2 MG/L	10451L RESIDUE FILTERABLE MG/L	13303L ALUMINUM EXTRBLE. AL MG/L
SAMPLES(FLAGS)		5(4)	12(2)	12(0)	12(3)		12(0)	12(0)	5(2)
LOW		L.010	L.4	.3	Q136.8		2.40	135.0	L.010
HIGH		.050	60.0	46.0	233.8		4.05	230.0	.010
AVERAGE		.018*	6.6*	4.4	193.7*		3.64	191.4	.010*
STD.DEV.		.018*	16.9*	13.1	31.2*		.41	31.6	.000*
PERCNT:10TH			L.4	.3	Q165.9		3.64	160.0	
25TH		L.010	.6	.3	171.6		3.65	170.0	L.010
MEDIAN 50TH		L.010	1.6	.4	187.6		3.69	185.0	.010
75TH		L.010	2.6	1.1	223.9		3.80	223.5	.010
90TH			6.0	1.3	231.7		3.90	230.0	
SECONDARY CODE							05L		

	SUBM ID	48302L CADMIUM EXTRBLE. CD MG/L	29305L COPPER EXTRBLE. CU MG/L	82302L LEAD EXTRBLE. PB MG/L	56301L BARIUM EXTRBLE. BA MG/L	30305L ZINC EXTRBLE. ZN MG/L	24302L CHROMIUM EXTRBLE. CR MG/L	27302L COBALT EXTRBLE. CO MG/L	33304L ARSENIC EXTRACTABLE AS MG/L
SAMPLES(FLAGS)		5(5)	5(4)	5(4)	5(0)	5(4)	5(5)	5(4)	5(3)
LOW		L.0010	L.001	L.0020	.020	L.001	L.001	L.001	L.0002
HIGH		L.0010	.002	.0030	.030	.002	L.001	.002	.0003
AVERAGE			.001*	.0022*	.026	.001*		.001*	.0002*
STD.DEV.			.000*	.0004*	.005	.000*		.000*	.0000*
PERCNT:10TH									
25TH		L.0010	L.001	L.0020	.020	L.001	L.001	L.001	L.0002
MEDIAN 50TH		L.0010	L.001	L.0020	.030	L.001	L.001	L.001	L.0002
75TH		L.0010	L.001	L.0020	.030	L.001	L.001	L.001	.0002
90TH									
SECONDARY CODE									

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ0600 LAT. 50D 47M 20S LONG. 114D 52M 15S PR 3 UTM 11 650100E 5628300N FOR APR 27, 1988 TO JAN 04, 1989
LITTLE ELBOW RIVER NEAR MOUTH
JUNE 1988

	SUBM ID	80011L MERCURY TOTAL HG UG/L	80015L MERCURY TOTAL HG MG/L	06537L PHENOLIC MATERIAL PHENOL MG/L	02021L COLOUR TRUE REL. UNITS	08202L OXYGEN BIOCHEMICAL DEMAND-BOD O2 MG/L	08301L OXYGEN TOTAL COD O2 MG/L	06722L CHLOROPHYLL A EPILITHIC SUBSAMPLE (TEMPLATE) MG/M2
SAMPLES(FLAGS)		5(5)		5(3)	12(6)		2(1)	
LOW		L.050		L.001	L5.000		L5.00	
HIGH		L.050		.002	10.000		12.00	
AVERAGE				.001*	7.083*		8.50*	
STD.DEV.				.000*	2.575*		4.95*	
PERCNT:10TH					L5.000			
25TH		L.050		L.001	L5.000			
MEDIAN 50TH		L.050		L.001	5.000*		8.50*	
75TH		L.050		.001	10.000			
90TH					10.000			
SECONDARY CODE								

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ0800 LAT. 50D 48M 50S LONG. 114D 47M 50S PR 3 UTM 11 655200E 5631200N FOR APR 27, 1988 TO JAN 04, 1989
ELBOW RIVER ABOVE COBBLE FLATS
JUNE 1988

	SUBM ID	02061F TEMPERATURE OF WATER DEG.C	10301F PH PH UNITS	10301L PH PH UNITS	02041F SPECIFIC CONDUCT. US/CM	02041L SPECIFIC CONDUCT. US/CM	08101F OXYGEN DISSOLVED DO O2 MG/L	08101L OXYGEN DISSOLVED DO O2 MG/L	02066F TEMPERATURE AIR DEG.C.
SAMPLES(FLAGS)		12(0)	10(0)	12(0)	12(0)	12(0)	12(0)		12(0)
LOW		1.4	6.8	7.06	230.	251.0	9.4		-3.
HIGH		7.9	7.9	8.36	391.	381.0	12.6		16.0
AVERAGE		5.2			305.3	327.6	10.65		9.4
STD.DEV.		2.2			52.9	38.8	.98		5.6
PERCNT:10TH		1.7	7.10	7.07	237.	287.0	9.6		-2.
25TH		3.6	7.6	7.32	257.0	303.0	9.90		1.5
MEDIAN 50TH		5.7	7.65	7.65	308.0	327.5	10.40		11.0
75TH		7.0	7.8	8.01	340.5	361.5	11.40		14.5
90TH		7.2	7.85	8.24	379.	372.0	11.9		15.0
SECONDARY CODE							02F		

	SUBM ID	10151L ALKALINITY PHENOL PHTHALEIN CACO3 MG/L	10101L ALKALINITY TOTAL CACO3 MG/L	06202L BICARBONT. (CALCD.) HCO3 MG/L	06302L CARBONATE DISSOLVED CO3 MG/L	20103L CALCIUM DISSOLVED CA MG/L	12102L MAGNESIUM DISSOLVED MG MG/L	19103L POTASSIUM DISSOLVED K MG/L	17203L CHLORIDE DISSOLVED CL MG/L
SAMPLES(FLAGS)		12(11)	12(0)	12(0)	12(11)	12(0)	12(0)	12(0)	12(2)
LOW		L.10	109.00	129.7	L.5	36.30	10.40	.30	L.01
HIGH		4.30	125.00	152.4	5.2	55.60	16.30	.38	.70
AVERAGE		.45*	118.75	143.9	.9*	47.15	13.02	.34	.31*
STD.DEV.		1.21*	4.92	7.3	1.3*	5.98	1.97	.03	.22*
PERCNT:10TH		L.10	112.00	132.9	L.5	40.90	10.90	.30	L.01
25TH		L.10	115.50	139.0	L.5	42.05	11.30	.31	.15
MEDIAN 50TH		L.10	120.00	146.3	L.5	47.90	12.65	.35	.30
75TH		L.10	122.50	149.3	L.5	52.40	14.85	.36	.45
90TH		L.10	124.00	151.2	L.5	54.20	15.50	.37	.60
SECONDARY CODE									

	SUBM ID	10603L HARDNESS TOTAL CACO3 MG/L	36011L COLIFORMS FECAL MPN NO/100ML	36001L COLIFORMS TOTAL MPN NO/100ML	09107L FLUORIDE DISSOLVED F MG/L	16306L SULPHATE DISSOLVED SO4 MG/L	06005L CARBON TOTAL ORGANIC C MG/L	06104L CARBON DISSOLVED ORGANIC C MG/L	07403L NITROGEN TOTAL ORG. (CALCD.) N MG/L
SAMPLES(FLAGS)		12(0)	12(10)	12(8)	12(0)	12(0)	12(2)	12(2)	12(9)
LOW		133.56	L4.	L4.	.16	24.80	L.10	L.10	Q.050
HIGH		206.09	L10.	16.	.30	80.00	1.70	1.40	Q.310
AVERAGE		171.45	4.5*	7.0*	.26	51.25	.88*	.70*	.125*
STD.DEV.		22.82	1.7*	4.8*	.04	18.63	.61*	.48*	.076*
PERCNT:10TH		147.11	L4.	L4.	.19	33.30	L.10	L.10	Q.070
25TH		151.64	L4.0	L4.0	.24	37.15	.30	.20	.070
MEDIAN 50TH		172.61	L4.0	L4.0	.27	45.15	.85	.80	.100
75TH		192.13	4.0*	10.0*	.28	71.00	1.50	1.05	.180
90TH		199.30	4.	16.	.30	76.00	1.60	1.30	Q.190
SECONDARY CODE		05L							

STATION 00AL05BJ0800 LAT. 50D 48M 50S LONG. 114D 47M 50S PR 3 UTM 11 655200E 5631200N FOR APR 27, 1988 TO JAN 04, 1989
ELBOW RIVER ABOVE COBBLE FLATS
JUNE 1988

	SUBM ID	07602L NITROGEN DISSOLVED N MG/L	07505L NITROGEN TOTAL AMMONIA N MG/L	07562L NITROGEN DISSOLVED AMMONIA N MG/L	07110L NITROGEN DISSOLVED NO3 & NO2 N MG/L	07015L NITROGEN TOTAL KJELDAHL N MG/L	15103L PHOSPHORUS DISSOLVED P MG/L	15406L PHOSPHORUS TOTAL P MG/L	15901L PHOSPHORUS PARTICULATE (CALCD.) P MG/L
SAMPLES(FLAGS)		12(0)	12(9)		12(0)	12(0)	12(9)	12(4)	12(9)
LOW		.170	L.010		.090	.060	L.003	L.003	Q.000
HIGH		.421	.010		.148	.320	.003	.030	.027
AVERAGE		.249	.010*		.114	.135	.003*	.006*	.003*
STD.DEV.		.078	.000*		.018	.076	.000*	.008*	.008*
PERCNT:10TH		.174	L.010		.094	.080	L.003	L.003	Q.000
25TH		.186	L.010		.102	.080	L.003	L.003	.000
MEDIAN 50TH		.232	L.010		.107	.110	L.003	.004	.001
75TH		.305	.010*		.129	.190	.003*	.005	.002
90TH		.328	.010		.134	.200	.003	.006	Q.003
SECONDARY CODE									

	SUBM ID	26304L IRON EXTRBLE. FE MG/L	10401L RESIDUE NONFILTR. MG/L	02074L TURBIDITY NTU	00201L TOTAL DISSOLVED SOLIDS (CALCD.) MG/L	00205L TOTAL DISSOLVED SOLIDS MG/L	14102L SILICA REACTIVE SIO2 MG/L	10451L RESIDUE FILTERABLE MG/L	13303L ALUMINUM EXTRBLE. AL MG/L
SAMPLES(FLAGS)		5(3)	12(1)	12(0)	12(2)		12(0)	12(0)	5(3)
LOW		L.010	L.4	.2	Q151.0		2.62	140.0	L.010
HIGH		.010	45.2	41.0	228.3		4.94	230.0	.010
AVERAGE		.010*	5.0*	3.9	188.2*		3.88	185.8	.010*
STD.DEV.		.000*	12.7*	11.7	26.2*		.51	27.5	.000*
PERCNT:10TH			.4	.2	Q161.2		3.75	160.0	
25TH		L.010	.4	.3	167.5		3.80	165.0	L.010
MEDIAN 50TH		L.010	1.3	.4	183.1		3.90	185.0	L.010
75TH		.010	2.6	.9	214.6		4.01	210.0	.010
90TH			3.2	1.8	222.5		4.10	220.0	
SECONDARY CODE							05L		

	SUBM ID	48302L CADMIUM EXTRBLE. CD MG/L	29305L COPPER EXTRBLE. CU MG/L	82302L LEAD EXTRBLE. PB MG/L	56301L BARIUM EXTRBLE. BA MG/L	30305L ZINC EXTRBLE. ZN MG/L	24302L CHROMIUM EXTRBLE. CR MG/L	27302L COBALT EXTRBLE. CO MG/L	33304L ARSENIC EXTRACTABLE AS MG/L
SAMPLES(FLAGS)		5(5)	5(4)	5(4)	5(0)	5(3)	5(4)	5(4)	5(4)
LOW		L.0010	L.001	L.0020	.030	L.001	L.001	L.001	L.0002
HIGH		L.0010	.001	.0020	.030	.002	.002	.001	.0002
AVERAGE			.001*	.0020*	.030	.001*	.001*	.001*	.0002*
STD.DEV.			.000*	.0000*	.000	.000*	.000*	.000*	.0000*
PERCNT:10TH									
25TH		L.0010	L.001	L.0020	.030	L.001	L.001	L.001	L.0002
MEDIAN 50TH		L.0010	L.001	L.0020	.030	L.001	L.001	L.001	L.0002
75TH		L.0010	L.001	L.0020	.030	.001	L.001	L.001	L.0002
90TH									
SECONDARY CODE									

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ0800 LAT. 50D 48M 50S LONG. 114D 47M 50S PR 3 UTM 11 655200E 5631200N FOR APR 27, 1988 TO JAN 04, 1989
ELBOW RIVER ABOVE COBBLE FLATS
JUNE 1988

	SUBM ID	80011L MERCURY TOTAL HG UG/L	80015L MERCURY TOTAL HG MG/L	06537L PHENOLIC MATERIAL PHENOL MG/L	02021L COLOUR TRUE REL. UNITS	08202L OXYGEN BIOCHEMICAL DEMAND-BOD O2 MG/L	08301L OXYGEN TOTAL COD O2 MG/L	06722L CHLOROPHYLL A EPILITHIC SUBSAMPLE (TEMPLATE) MG/M2
SAMPLES(FLAGS)		5(5)		5(3)	12(6)		1(0)	
LOW		L.050		L.001	L5.000		7.00	
HIGH		L.050		.002	20.000		7.00	
AVERAGE				.001*	7.917*			
STD.DEV.				.000*	4.502*			
PERCNT:10TH					L5.000			
25TH		L.050		L.001	L5.000			
MEDIAN 50TH		L.050		L.001	5.000*			
75TH		L.050		.001	10.000			
90TH					10.000			
SECONDARY CODE								

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ0900 LAT. 50D 54M 0S LONG. 114D 40M 55S PR 3 UTM 11 663000E 5641050N FOR APR 27, 1988 TO MAR 08, 1989
ELBOW RIVER AT ALLEN BILL POND
KANANASKIS PROJECT

	SUBM ID	02061F TEMPERATURE OF WATER DEG.C	10301F PH PH UNITS	10301L PH PH UNITS	02041F SPECIFIC CONDUCT. US/CM	02041L SPECIFIC CONDUCT. US/CM	08101F OXYGEN DISSOLVED DO O2 MG/L	08101L OXYGEN DISSOLVED DO O2 MG/L	02066F TEMPERATURE AIR DEG.C.
SAMPLES(FLAGS)		14(0)	14(0)	14(0)	14(0)	14(0)	14(0)		14(0)
LOW		.0	6.9	7.18	258.	262.0	9.6		-5.
HIGH		8.7	7.9	8.51	415.	412.0	13.2		17.0
AVERAGE		4.8			351.1	362.4	11.06		9.5
STD.DEV.		3.6			38.6	39.4	1.25		5.3
PERCNT:10TH		.1	7.5	7.30	303.	330.0	9.7		-5.
25TH		.4	7.7	7.64	335.	341.0	10.0		-3.
MEDIAN 50TH		6.0	7.75	7.77	348.5	365.0	10.65		10.5
75TH		8.3	7.8	8.32	380.	386.0	12.3		14.
90TH		8.5	7.9	8.44	387.	406.0	12.8		16.
SECONDARY CODE							02F		

		10151L ALKALINITY PHENOL PHTHALEIN	10101L ALKALINITY TOTAL	06202L BICARBONT. (CALCD.)	06302L CARBONATE DISSOLVED	20103L CALCIUM DISSOLVED	12102L MAGNESIUM DISSOLVED	19103L POTASSIUM DISSOLVED	17203L CHLORIDE DISSOLVED
	SUBM ID	CACO3 MG/L	CACO3 MG/L	HCO3 MG/L	CO3 MG/L	CA MG/L	MG MG/L	K MG/L	CL MG/L
SAMPLES(FLAGS)		14(12)	14(0)	14(0)	14(12)	14(0)	14(0)	14(0)	14(0)
LOW		L.10	111.00	134.6	L.5	39.40	10.80	.20	.40
HIGH		5.80	138.00	168.2	7.0	63.30	17.50	.65	1.10
AVERAGE		.86*	127.93	154.1	1.4*	52.60	14.54	.41	.61
STD.DEV.		1.93*	6.92	10.7	2.2*	6.09	1.89	.10	.20
PERCNT:10TH		L.10	122.00	135.3	L.5	46.40	12.50	.35	.40
25TH		L.10	124.00	149.0	L.5	48.00	13.40	.38	.50
MEDIAN 50TH		L.10	129.50	157.9	L.5	52.60	14.15	.40	.60
75TH		L.10	133.00	162.0	L.5	57.10	16.30	.43	.70
90TH		5.00	135.00	164.6	6.0	57.80	16.40	.48	.80
SECONDARY CODE									

		10603L HARDNESS TOTAL	36011L COLIFORMS FECAL	36001L COLIFORMS TOTAL	09107L FLUORIDE DISSOLVED	16306L SULPHATE DISSOLVED	06005L CARBON TOTAL ORGANIC	06104L CARBON DISSOLVED ORGANIC	07403L NITROGEN TOTAL ORG. (CALCD.)
	SUBM ID	CACO3 MG/L	MPN NO/100ML	MPN NO/100ML	F MG/L	S04 MG/L	C MG/L	C MG/L	N MG/L
SAMPLES(FLAGS)		14(0)	14(11)	14(9)	14(0)	14(0)	14(2)	14(2)	14(12)
LOW		142.95	L4.	L4.	.20	29.20	L.10	L.10	Q.070
HIGH		230.28	L10.	20.	.39	80.50	1.80	1.60	Q.390
AVERAGE		191.35	4.4*	7.6*	.32	60.64	.93*	.78*	.141*
STD.DEV.		22.83	1.6*	5.7*	.05	16.36	.53*	.46*	.092*
PERCNT:10TH		170.60	L4.	L4.	.28	43.10	L.10	L.10	.090
25TH		171.45	L4.	L4.	.30	48.10	.70	.60	Q.090
MEDIAN 50TH		188.74	L4.0	L4.0	.32	57.05	1.00	.75	.100
75TH		210.00	4.	L10.	.34	77.00	1.25	1.10	Q.170
90TH		212.00	4.	16.	.39	79.00	1.60	1.50	Q.290
SECONDARY CODE		05L							

STATION 00AL05BJ0900 LAT. 50D 54M 0S LONG. 114D 40M 55S PR 3 UTM 11 663000E 5641050N FOR APR 27, 1988 TO JUN 07, 1989
ELBOW RIVER AT ALLEN BILL POND
KANANASKIS PROJECT

		07602L NITROGEN DISSOLVED	07505L NITROGEN TOTAL AMMONIA	07562L NITROGEN DISSOLVED AMMONIA	07110L NITROGEN DISSOLVED NO3 & NO2	07015L NITROGEN TOTAL KJELDAHL	15103L PHOSPHORUS DISSOLVED	15406L PHOSPHORUS TOTAL	15901L PHOSPHORUS PARTICULATE (CALCD.)
	SUBM ID	N MG/L	N MG/L	N MG/L	N MG/L	N MG/L	P MG/L	P MG/L	P MG/L
SAMPLES(FLAGS)		14(0)	14(12)		14(0)	14(0)	15(11)	15(4)	15(11)
LOW		.169	L.010		.069	.080	L.003	L.003	Q.000
HIGH		.481	.010		.135	.400	.022	.082	.077
AVERAGE		.245	.010*		.094	.151	.004*	.011*	.007*
STD.DEV.		.097	.000*		.019	.092	.005*	.021*	.020*
PERCNT:10TH		.172	L.010		.072	.100	L.003	L.003	Q.000
25TH		.186	L.010		.079	.100	L.003	L.003	Q.000
MEDIAN 50TH		.206	L.010		.090	.110	L.003	.004	.001
75TH		.259	L.010		.106	.180	.003	.005	Q.002
90TH		.435	.010		.118	.300	.005	.034	.012
SECONDARY CODE							05L	21L	

		26304L IRON EXTRBLE.	10401L RESIDUE NONFILTR.	02074L TURBIDITY	00201L TOTAL DISSOLVED SOLIDS (CALCD.)	00205L TOTAL DISSOLVED SOLIDS	14102L SILICA REACTIVE	10451L RESIDUE FILTERABLE	13303L ALUMINUM EXTRBLE.
	SUBM ID	FE MG/L	MG/L	NTU	MG/L	MG/L	SIO2 MG/L	MG/L	AL MG/L
SAMPLES(FLAGS)		6(0)	15(3)	14(0)	14(0)		14(0)	14(0)	6(5)
LOW		.010	L.4	.2	151.8		2.75	150.0	L.010
HIGH		.030	135.0	110.0	249.8		4.50	250.0	.010
AVERAGE		.018	11.3*	8.5	211.2		4.12	208.4	.010*
STD.DEV.		.010	34.3*	29.2	27.0		.41	27.1	.000*
PERCNT:10TH			L.4	.2	185.2		4.05	180.0	
25TH		.010	.4	.3	197.3		4.10	190.0	L.010
MEDIAN 50TH		.015	2.0	.5	207.5		4.20	205.0	L.010
75TH		.030	5.1	1.2	234.4		4.30	230.0	L.010
90TH			7.	2.2	238.4		4.40	235.0	
SECONDARY CODE			07L				05L		

		48302L CADMIUM EXTRBLE.	29305L COPPER EXTRBLE.	82302L LEAD EXTRBLE.	56301L BARIUM EXTRBLE.	30305L ZINC EXTRBLE.	24302L CHROMIUM EXTRBLE.	27302L COBALT EXTRBLE.	33304L ARSENIC EXTRACTABLE
	SUBM ID	CD MG/L	CU MG/L	PB MG/L	BA MG/L	ZN MG/L	CR MG/L	CO MG/L	AS MG/L
SAMPLES(FLAGS)		6(5)	6(3)	6(5)	6(0)	6(2)	6(4)	6(5)	6(4)
LOW		L.0010	L.001	L.0020	.040	L.001	L.001	L.001	L.0002
HIGH		.0010	.002	.0030	.050	.025	.002	.001	.0002
AVERAGE		.0010*	.001*	.0022*	.043	.005*	.001*	.001*	.0002*
STD.DEV.		.0000*	.001*	.0004*	.005	.010*	.000*	.000*	.0000*
PERCNT:10TH									
25TH		L.0010	L.001	L.0020	.040	L.001	L.001	L.001	L.0002
MEDIAN 50TH		L.0010	.001*	L.0020	.040	.001	L.001	L.001	L.0002
75TH		L.0010	.002	L.0020	.050	.002	.001	L.001	.0002
90TH									
SECONDARY CODE									

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ0900 LAT. 50D 54M 0S LONG. 114D 40M 55S PR 3 UTM 11 663000E 5641050N FOR APR 27, 1988 TO MAR 08, 1989
ELBOW RIVER AT ALLEN BILL POND
KANANASKIS PROJECT

	SUBM ID	80011L MERCURY TOTAL HG UG/L	80015L MERCURY TOTAL HG MG/L	06537L PHENOLIC MATERIAL PHENOL MG/L	02021L COLOUR TRUE REL. UNITS	08202L OXYGEN BIOCHEMICAL DEMAND-BOD O2 MG/L	08301L OXYGEN TOTAL COD O2 MG/L	06722L CHLOROPHYLL A EPILITHIC SUBSAMPLE (TEMPLATE) MG/M2
SAMPLES(FLAGS)		6(6)		6(3)	14(6)		1(0)	
LOW		L.050		L.001	L5.000		6.00	
HIGH		L.050		.002	10.000		6.00	
AVERAGE				.001*	7.143*			
STD.DEV.				.000*	2.568*			
PERCNT:10TH					L5.000			
25TH		L.050		L.001	L5.000			
MEDIAN 50TH		L.050		.001*	5.000			
75TH		L.050		.001	10.000			
90TH					10.000			
SECONDARY CODE								

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ1600 LAT. 50D 57M 30S LONG. 114D 33M 30S PR 3 UTM 11 671500E 5647800N FOR APR 27, 1988 TO MAR 08, 1989
ELBOW RIVER D/S OF BRAGG CREEK TOWN
JUNE 1988

	SUBM ID	02061F TEMPERATURE OF WATER DEG.C	10301F PH PH UNITS	10301L PH PH UNITS	02041F SPECIFIC CONDUCT. US/CM	02041L SPECIFIC CONDUCT. US/CM	08101F OXYGEN DISSOLVED DO O2 MG/L	08101L OXYGEN DISSOLVED DO O2 MG/L	02066F TEMPERATURE AIR DEG.C.
SAMPLES(FLAGS)		14(0)	13(0)	14(0)	14(0)	14(0)	14(0)		14(0)
LOW		-.1	6.9	7.18	261.	266.0	9.4		-11.
HIGH		11.7	8.0	8.40	414.	426.0	13.5		18.
AVERAGE		5.5			344.2	367.4	11.14		10.8
STD.DEV.		4.6			46.3	41.6	1.51		5.2
PERCNT:10TH		.0	7.4	7.39	274.	335.0	9.4		-9.
25TH		.1	7.7	7.69	306.	339.0	9.7		-4.
MEDIAN 50TH		5.8	7.8	7.74	349.0	366.5	11.15		10.5
75TH		11.0	7.9	8.07	376.	404.0	12.7		15.
90TH		11.2	8.0	8.16	412.	407.0	13.0		17.
SECONDARY CODE							02F		

	SUBM ID	10151L ALKALINITY PHENOL PHTHALEIN CACO3 MG/L	10101L ALKALINITY TOTAL CACO3 MG/L	06202L BICARBONT. (CALCD.) HCO3 MG/L	06302L CARBONATE DISSOLVED CO3 MG/L	20103L CALCIUM DISSOLVED CA MG/L	12102L MAGNESIUM DISSOLVED MG MG/L	19103L POTASSIUM DISSOLVED K MG/L	17203L CHLORIDE DISSOLVED CL MG/L
SAMPLES(FLAGS)		14(13)	14(0)	14(0)	14(13)	14(0)	14(0)	14(0)	14(0)
LOW		L.10	116.00	141.4	L.5	37.70	10.80	.20	.60
HIGH		4.80	146.00	178.0	5.8	66.60	17.40	.53	1.90
AVERAGE		.44*	134.43	163.0	.9*	53.72	14.59	.43	.91
STD.DEV.		1.26*	7.82	10.7	1.4*	7.28	1.97	.08	.33
PERCNT:10TH		L.10	128.00	144.3	L.5	46.80	12.30	.34	.60
25TH		L.10	128.00	156.0	L.5	48.70	13.40	.42	.70
MEDIAN 50TH		L.10	136.00	165.8	L.5	53.20	14.15	.45	.85
75TH		L.10	140.00	170.7	L.5	58.00	16.30	.48	1.00
90TH		L.10	144.00	175.5	L.5	62.30	17.30	.50	1.20
SECONDARY CODE									

	SUBM ID	10603L HARDNESS TOTAL CACO3 MG/L	36011L COLIFORMS FECAL MPN NO/100ML	36001L COLIFORMS TOTAL MPN NO/100ML	09107L FLUORIDE DISSOLVED F MG/L	16306L SULPHATE DISSOLVED S04 MG/L	06005L CARBON TOTAL ORGANIC C MG/L	06104L CARBON DISSOLVED ORGANIC C MG/L	07403L NITROGEN TOTAL ORG. (CALCD.) N MG/L
SAMPLES(FLAGS)		14(0)	18(7)	18(5)	14(0)	14(0)	14(2)	14(2)	14(13)
LOW		138.70	L2.	L2.	.20	28.30	L.10	L.10	Q.050
HIGH		238.12	80.	110.	.37	76.50	2.10	1.90	Q.790
AVERAGE		194.33	9.6*	16.3*	.31	58.80	1.11*	.93*	.190*
STD.DEV.		26.07	18.5*	26.6*	.05	15.36	.60*	.57*	.196*
PERCNT:10TH		169.63	L2.	L2.	.22	42.70	L.10	L.10	Q.090
25TH		175.67	L2.	2.	.30	47.60	.90	.60	Q.090
MEDIAN 50TH		190.99	2.0	6.0	.32	55.90	1.00	.85	.110
75TH		208.80	L10.	20.	.33	73.50	1.40	1.25	Q.190
90TH		226.96	20.	48.	.35	75.00	2.00	1.80	Q.430
SECONDARY CODE		05L							

STATION 00AL05BJ1600 LAT. 50D 57M 30S LONG. 114D 33M 30S PR 3 UTM 11 671500E 5647800N FOR APR 27, 1988 TO MAY 28, 1990
ELBOW RIVER D/S OF BRAGG CREEK TOWN
JUNE 1988

	SUBM ID	07602L NITROGEN DISSOLVED N MG/L	07505L NITROGEN TOTAL AMMONIA N MG/L	07562L NITROGEN DISSOLVED AMMONIA N MG/L	07110L NITROGEN DISSOLVED NO3 & NO2 N MG/L	07015L NITROGEN TOTAL KJELDAHL N MG/L	15103L PHOSPHORUS DISSOLVED P MG/L	15406L PHOSPHORUS TOTAL P MG/L	15901L PHOSPHORUS PARTICULATE (CALCD.) P MG/L
SAMPLES(FLAGS)		14(0)	14(13)		14(0)	14(0)	16(11)	16(5)	16(11)
LOW		.152	L.010		.050	.060	.002	L.003	Q.000
HIGH		.935	.010		.135	.800	.005	.250	.245
AVERAGE		.281	.010*		.081	.200	.003*	.029*	.026*
STD.DEV.		.210	.000*		.025	.196	.001*	.068*	.067*
PERCNT:10TH		.168	L.010		.052	.100	L.003	L.003	Q.000
25TH		.176	L.010		.065	.100	L.003	L.003	.000
MEDIAN 50TH		.202	L.010		.078	.120	L.003	.004	.001
75TH		.286	L.010		.097	.200	.003*	.005	.002
90TH		.509	L.010		.116	.440	.005	.139	.134
SECONDARY CODE							05L	21L	

	SUBM ID	26304L IRON EXTRBLE. FE MG/L	10401L RESIDUE NONFILTR. MG/L	02074L TURBIDITY NTU	00201L TOTAL DISSOLVED SOLIDS (CALCD.) MG/L	00205L TOTAL DISSOLVED SOLIDS MG/L	14102L SILICA REACTIVE SIO2 MG/L	10451L RESIDUE FILTERABLE MG/L	13303L ALUMINUM EXTRBLE. AL MG/L
SAMPLES(FLAGS)		6(1)	16(2)	14(0)	14(0)		14(0)	14(0)	6(5)
LOW		L.010	L.4	.3	152.5		3.30	150.0	L.010
HIGH		.030	332.0	228.0	256.5		4.78	250.0	.010
AVERAGE		.015*	37.2*	17.1	215.2		4.34	212.4	.010*
STD.DEV.		.008*	96.2*	60.7	27.8		.34	26.8	.000*
PERCNT:10TH			L.4	.3	188.2		4.25	190.0	
25TH		.010	.4	.4	200.7		4.30	200.0	L.010
MEDIAN 50TH		.010	1.4	.5	212.1		4.35	210.0	L.010
75TH		.020	4.8	1.2	236.1		4.40	233.0	L.010
90TH			224.	2.9	245.9		4.70	240.0	
SECONDARY CODE			07L				05L		

	SUBM ID	48302L CADMIUM EXTRBLE. CD MG/L	29305L COPPER EXTRBLE. CU MG/L	82302L LEAD EXTRBLE. PB MG/L	56301L BARIUM EXTRBLE. BA MG/L	30305L ZINC EXTRBLE. ZN MG/L	24302L CHROMIUM EXTRBLE. CR MG/L	27302L COBALT EXTRBLE. CO MG/L	33304L ARSENIC EXTRACTABLE AS MG/L
SAMPLES(FLAGS)		6(6)	6(5)	6(5)	6(0)	6(2)	6(2)	6(6)	6(4)
LOW		L.0010	L.001	L.0020	.040	L.001	L.001	L.001	L.0002
HIGH		L.0010	.001	.0020	.060	.002	.005	L.001	.0002
AVERAGE			.001*	.0020*	.050	.001*	.002*		.0002*
STD.DEV.			.000*	.0000*	.006	.000*	.002*		.0000*
PERCNT:10TH									
25TH		L.0010	L.001	L.0020	.050	L.001	L.001	L.001	L.0002
MEDIAN 50TH		L.0010	L.001	L.0020	.050	.001	.001	L.001	L.0002
75TH		L.0010	L.001	L.0020	.050	.001	.002	L.001	.0002
90TH									
SECONDARY CODE									

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ1600 LAT. 50D 57M 30S LONG. 114D 33M 30S PR 3 UTM 11 671500E 5647800N FOR APR 27, 1988 TO MAR 08, 1989
ELBOW RIVER D/S OF BRAGG CREEK TOWN
JUNE 1988

	SUBM ID	80011L MERCURY TOTAL HG UG/L	80015L MERCURY TOTAL HG MG/L	06537L PHENOLIC MATERIAL PHENOL MG/L	02021L COLOUR TRUE REL. UNITS	08202L OXYGEN BIOCHEMICAL DEMAND-BOD O2 MG/L	08301L OXYGEN TOTAL COD O2 MG/L	06722L CHLOROPHYLL A EPILITHIC SUBSAMPLE (TEMPLATE) MG/M2
SAMPLES(FLAGS)		6(6)		6(3)	14(6)		1(0)	8(1)
LOW		L.050		L.001	L5.000		5.00	2.045
HIGH		L.050		.007	10.000		5.00	61.146
AVERAGE				.002*	7.143*			18.719*
STD.DEV.				.002*	2.568*			18.642*
PERCNT:10TH					L5.000			
25TH		L.050		L.001	L5.000			7.003
MEDIAN 50TH		L.050		.001*	5.000			14.827
75TH		L.050		.001	10.000			21.452*
90TH					10.000			
SECONDARY CODE								

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ1700 LAT. 51D 1M 55S LONG. 114D 28M 5S PR 3 UTM 11 677550E 5656200N FOR APR 27, 1988 TO MAR 08, 1989
ELBOW RIVER AT HIGHWAY #22

	SUBM ID	02061F TEMPERATURE OF WATER DEG.C	10301F PH PH UNITS	10301L PH PH UNITS	02041F SPECIFIC CONDUCT. US/CM	02041L SPECIFIC CONDUCT. US/CM	08101F OXYGEN DISSOLVED DO O2 MG/L	08101L OXYGEN DISSOLVED DO O2 MG/L	02066F TEMPERATURE AIR DEG.C.
SAMPLES(FLAGS)		15(0)	11(0)	14(0)	14(0)	14(0)	15(0)		15(0)
LOW		-.2	7.3	7.06	212.	273.0	8.8		-12.
HIGH		14.3	8.0	8.45	411.	440.0	12.9		22.
AVERAGE		6.8			351.9	373.9	10.66		11.9
STD.DEV.		5.3			50.6	40.8	1.58		6.0
PERCNT:10TH		.2	7.4	7.38	312.	332.0	8.9		-10.
25TH		.8	7.4	7.60	330.	359.0	9.2		2.
MEDIAN 50TH		8.6	7.5	7.86	355.5	372.0	10.5		13.
75TH		12.7	7.9	8.07	382.	404.0	12.5		16.
90TH		13.1	8.0	8.45	407.	414.0	12.9		20.
SECONDARY CODE							02F		

	SUBM ID	10151L ALKALINITY PHENOL PHTHALEIN CACO3 MG/L	10101L ALKALINITY TOTAL CACO3 MG/L	06202L BICARBONT. (CALCD.) HCO3 MG/L	06302L CARBONATE DISSOLVED CO3 MG/L	20103L CALCIUM DISSOLVED CA MG/L	12102L MAGNESIUM DISSOLVED MG MG/L	19103L POTASSIUM DISSOLVED K MG/L	17203L CHLORIDE DISSOLVED CL MG/L
SAMPLES(FLAGS)		14(12)	14(0)	14(0)	14(12)	14(0)	14(0)	14(0)	14(0)
LOW		L.10	126.00	144.8	L.5	39.80	11.10	.40	.40
HIGH		3.60	152.00	185.3	4.3	70.10	18.00	.55	1.80
AVERAGE		.59*	140.50	170.1	1.0*	54.44	14.68	.47	.93
STD.DEV.		1.25*	7.05	11.1	1.4*	7.09	1.81	.05	.34
PERCNT:10TH		L.10	130.00	149.9	L.5	48.20	13.00	.40	.70
25TH		L.10	137.00	167.0	L.5	50.60	13.60	.43	.70
MEDIAN 50TH		L.10	139.00	169.7	L.5	54.25	14.30	.46	.85
75TH		L.10	147.00	179.0	L.5	57.80	15.80	.50	1.20
90TH		3.50	148.00	180.4	4.2	63.00	17.00	.52	1.20
SECONDARY CODE									

		10603L HARDNESS TOTAL	36011L COLIFORMS FECAL	36001L COLIFORMS TOTAL	09107L FLUORIDE DISSOLVED	16306L SULPHATE DISSOLVED	06005L CARBON TOTAL ORGANIC	06104L CARBON DISSOLVED ORGANIC	07403L NITROGEN TOTAL ORG. (CALCD.)
	SUBM ID	CACO3 MG/L	MPN NO/100ML	MPN NO/100ML	F MG/L	SO4 MG/L	C MG/L	C MG/L	N MG/L
SAMPLES(FLAGS)		14(0)	22(6)	21(5)	14(0)	14(0)	14(2)	14(2)	14(13)
LOW		145.00	L2.	L2.	.22	30.00	L.10	L.10	Q.070
HIGH		249.34	170.	170.	.35	79.50	2.00	2.00	1.870
AVERAGE		196.47	12.0*	18.2*	.31	58.13	1.09*	.89*	.260*
STD.DEV.		24.88	35.4*	36.7*	.03	15.01	.61*	.54*	.473*
PERCNT:10TH		177.58	L2.	L2.	.29	43.40	L.10	L.10	Q.070
25TH		180.01	2.	2.	.30	47.00	.70	.60	Q.070
MEDIAN 50TH		194.48	4.0	6.	.32	55.45	1.10	.95	.130
75TH		208.03	6.	14.	.33	72.50	1.40	1.10	Q.150
90TH		227.47	L10.	30.	.35	73.50	2.00	1.70	Q.450
SECONDARY CODE		05L							

STATION 00AL05BJ1700 LAT. 51D 1M 55S LONG. 114D 28M 5S PR 3 UTM 11 677550E 5656200N FOR APR 27, 1988 TO JUN 25, 1990
ELBOW RIVER AT HIGHWAY #22

		07602L NITROGEN DISSOLVED	07505L NITROGEN TOTAL AMMONIA	07562L NITROGEN DISSOLVED AMMONIA	07110L NITROGEN DISSOLVED NO3 & NO2	07015L NITROGEN TOTAL KJELDAHL	15103L PHOSPHORUS DISSOLVED	15406L PHOSPHORUS TOTAL	15901L PHOSPHORUS PARTICULATE (CALCD.)
	SUBM ID	N MG/L	N MG/L	N MG/L	N MG/L	N MG/L	P MG/L	P MG/L	P MG/L
SAMPLES(FLAGS)		14(0)	14(13)		14(0)	14(0)	17(11)	17(5)	17(11)
LOW		.120	L.010		.035	.080	L.003	L.003	Q.000
HIGH		2.020	.010		.140	1.880	.030	.455	.450
AVERAGE		.339	.010*		.069	.270	.005*	.058*	.053*
STD.DEV.		.493	.000*		.029	.473	.007*	.129*	.127*
PERCNT:10TH		.124	L.010		.040	.080	L.003	L.003	Q.000
25TH		.175	L.010		.045	.080	L.003	L.003	Q.000
MEDIAN 50TH		.198	L.010		.061	.140	L.003	.003	Q.000
75TH		.212	L.010		.082	.160	.003	.005	.002
90TH		.514	L.010		.102	.460	.006	.300	.294
SECONDARY CODE							05L	21L	

		26304L IRON EXTRBLE.	10401L RESIDUE NONFILTR.	02074L TURBIDITY	00201L TOTAL DISSOLVED SOLIDS (CALCD.)	00205L TOTAL DISSOLVED SOLIDS	14102L SILICA REACTIVE	10451L RESIDUE FILTERABLE	13303L ALUMINUM EXTRBLE.
	SUBM ID	FE MG/L	MG/L	NTU	MG/L	MG/L	SIO2 MG/L	MG/L	AL MG/L
SAMPLES(FLAGS)		6(0)	17(2)	14(0)	14(0)		14(0)	14(0)	6(3)
LOW		.010	L.4	.4	176.6		4.27	160.0	L.010
HIGH		.030	683.0	410.0	267.3		4.70	260.0	.020
AVERAGE		.018	68.3*	30.1	219.2		4.47	213.9	.012*
STD.DEV.		.010	183.1*	109.3	23.9		.16	25.1	.004*
PERCNT:10TH			L.4	.4	196.4		4.27	190.0	
25TH		.010	.8	.5	203.1		4.30	200.0	L.010
MEDIAN 50TH		.015	2.8	1.0	213.5		4.44	210.0	.010*
75TH		.030	5.9	1.3	237.3		4.60	230.0	.010
90TH			383.	2.0	246.4		4.70	240.0	
SECONDARY CODE			07L				05L		

		48302L CADMIUM EXTRBLE.	29305L COPPER EXTRBLE.	82302L LEAD EXTRBLE.	56301L BARIUM EXTRBLE.	30305L ZINC EXTRBLE.	24302L CHROMIUM EXTRBLE.	27302L COBALT EXTRBLE.	33304L ARSENIC EXTRACTABLE
	SUBM ID	CD MG/L	CU MG/L	PB MG/L	BA MG/L	ZN MG/L	CR MG/L	CO MG/L	AS MG/L
SAMPLES(FLAGS)		6(6)	6(4)	6(5)	6(0)	6(2)	6(5)	6(5)	6(3)
LOW		L.0010	L.001	L.0020	.050	L.001	L.001	L.001	L.0002
HIGH		L.0010	.002	.0060	.060	.003	.001	.002	.0002
AVERAGE			.001*	.0027*	.052	.002*	.001*	.001*	.0002*
STD.DEV.			.000*	.0016*	.004	.001*	.000*	.000*	.0000*
PERCNT:10TH									
25TH		L.0010	L.001	L.0020	.050	L.001	L.001	L.001	L.0002
MEDIAN 50TH		L.0010	L.001	L.0020	.050	.001	L.001	L.001	.0002*
75TH		L.0010	.001	L.0020	.050	.002	L.001	L.001	.0002
90TH									
SECONDARY CODE									

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ1700 LAT. 51D 1M 55S LONG. 114D 28M 5S PR 3 UTM 11 677550E 5656200N FOR APR 27, 1988 TO MAR 08, 1989
ELBOW RIVER AT HIGHWAY #22

		80011L MERCURY TOTAL	80015L MERCURY TOTAL	06537L PHENOLIC MATERIAL	02021L COLOUR TRUE	08202L OXYGEN BIOCHEMICAL DEMAND-BOD	08301L OXYGEN TOTAL COD	06722L CHLOROPHYLL A EPILITHIC SUBSAMPLE (TEMPLATE)
	SUBM ID	HG UG/L	HG MG/L	PHENOL MG/L	REL. UNITS	O2 MG/L	O2 MG/L	MG/M2
SAMPLES(FLAGS)		6(5)		6(3)	14(6)			9(0)
LOW		L.050		L.001	L5.000			12.659
HIGH		.100		.001	20.000			87.715
AVERAGE		.058*		.001*	7.500*			43.400
STD.DEV.		.020*		.000*	4.274*			27.030
PERCNT:10TH					L5.000			
25TH		L.050		L.001	L5.000			21.864
MEDIAN 50TH		L.050		.001*	5.000			34.928
75TH		L.050		.001	10.000			67.067
90TH					10.000			
SECONDARY CODE								

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ1800 LAT. 51D 1M 55S LONG. 114D 18M 15S PR 3 UTM 11 689050E 5656600N FOR APR 26, 1988 TO MAR 08, 1989
ELBOW RIVER AT GLENCOE GOLF CLUB
JUNE 1988

	SUBM ID	02061F TEMPERATURE OF WATER	10301F PH	10301L PH	02041F SPECIFIC CONDUCT.	02041L SPECIFIC CONDUCT.	08101F OXYGEN DISSOLVED DO O2	08101L OXYGEN DISSOLVED DO O2	02066F TEMPERATURE AIR
		DEG.C	PH UNITS	PH UNITS	US/CM	US/CM	MG/L	MG/L	DEG.C.
SAMPLES(FLAGS)		14(0)	13(0)	14(0)	11(0)	14(0)	14(0)		14(0)
LOW		.0	7.1	7.36	262.	333.0	8.5		-6.
HIGH		16.1	7.9	8.44	424.	460.0	13.5		21.
AVERAGE		7.3			347.4	397.6	10.36		11.1
STD.DEV.		6.0			55.2	34.8	1.61		6.3
PERCNT:10TH		.0	7.3	7.46	283.	358.0	8.6		-5.
25TH		.2	7.4	7.69	286.	381.0	8.7		-2.0
MEDIAN 50TH		8.9	7.6	7.99	354.	392.5	10.35		13.0
75TH		10.2	7.7	8.22	396.	417.0	11.2		16.
90TH		14.5	7.8	8.40	411.	452.0	12.6		18.
SECONDARY CODE							02F		

	SUBM ID	10151L ALKALINITY PHENOL PHTHALEIN CACO3	10101L ALKALINITY TOTAL CACO3	06202L BICARBONT. (CALCD.) HCO3	06302L CARBONATE DISSOLVED CO3	20103L CALCIUM DISSOLVED CA	12102L MAGNESIUM DISSOLVED MG	19103L POTASSIUM DISSOLVED K	17203L CHLORIDE DISSOLVED CL
		MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
SAMPLES(FLAGS)		14(13)	14(0)	14(0)	14(13)	14(0)	14(0)	14(0)	14(0)
LOW		L.10	127.00	154.8	L.5	42.40	13.20	.50	.70
HIGH		3.80	170.00	207.2	4.6	73.60	18.40	.77	2.40
AVERAGE		.36*	147.00	178.5	.8*	56.64	15.36	.59	1.36
STD.DEV.		.99*	12.10	15.6	1.1*	8.34	1.63	.07	.48
PERCNT:10TH		L.10	135.00	155.3	L.5	49.10	13.50	.50	.70
25TH		L.10	136.00	165.8	L.5	50.00	14.10	.55	1.00
MEDIAN 50TH		L.10	147.50	179.8	L.5	56.30	14.90	.58	1.40
75TH		L.10	154.00	187.7	L.5	60.00	16.20	.62	1.70
90TH		L.10	166.00	202.4	L.5	70.50	18.40	.67	1.90
SECONDARY CODE									

	SUBM ID	10603L HARDNESS TOTAL CACO3	36011L COLIFORMS FECAL MPN	36001L COLIFORMS TOTAL MPN	09107L FLUORIDE DISSOLVED F	16306L SULPHATE DISSOLVED SO4	06005L CARBON TOTAL ORGANIC C	06104L CARBON DISSOLVED ORGANIC C	07403L NITROGEN TOTAL ORG. (CALCD.) N
		MG/L	NO/100ML	NO/100ML	MG/L	MG/L	MG/L	MG/L	MG/L
SAMPLES(FLAGS)		14(0)	17(5)	17(3)	14(0)	14(0)	14(2)	14(2)	14(11)
LOW		164.04	L4.	L4.	.27	43.80	L.10	L.10	Q.050
HIGH		259.73	310.	800.	.36	75.50	1.90	1.70	.390
AVERAGE		204.78	26.6*	77.4*	.31	59.17	1.05*	.86*	.165*
STD.DEV.		27.01	73.3*	189.5*	.02	12.74	.51*	.44*	.103*
PERCNT:10TH		179.82	L4.	L4.	.29	46.50	L.10	L.10	.060
25TH		185.08	4.	8.	.30	47.40	.90	.70	Q.110
MEDIAN 50TH		201.64	8.	32.	.31	55.20	1.00	.90	.130
75TH		216.43	12.	44.	.32	72.50	1.20	1.00	Q.210
90TH		251.98	24.	150.	.34	74.00	1.80	1.40	.350
SECONDARY CODE		05L							

STATION 00AL05BJ1800 LAT. 51D 1M 55S LONG. 114D 18M 15S PR 3 UTM 11 689050E 5656600N FOR APR 26, 1988 TO JUN 25, 1990
ELBOW RIVER AT GLENCOE GOLF CLUB
JUNE 1988

	SUBM ID	07602L NITROGEN DISSOLVED N	07505L NITROGEN TOTAL AMMONIA N	07562L NITROGEN DISSOLVED AMMONIA N	07110L NITROGEN DISSOLVED NO3 & NO2 N	07015L NITROGEN TOTAL KJELDAHL N	15103L PHOSPHORUS DISSOLVED P	15406L PHOSPHORUS TOTAL P	15901L PHOSPHORUS PARTICULATE (CALCD.) P
		MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
SAMPLES(FLAGS)		15(0)	14(11)		15(0)	15(0)	17(12)	17(1)	17(12)
LOW		.089	L.010		.020	.060	L.002	L.003	Q.000
HIGH		.444	.020		.098	.400	.009	.310	.304
AVERAGE		.227	.011*		.056	.171	.003*	.030*	.026*
STD.DEV.		.104	.003*		.024	.101	.002*	.074*	.074*
PERCNT:10TH		.111	L.010		.026	.080	L.003	.003	Q.000
25TH		.160	L.010		.031	.10	L.003	.003	Q.000
MEDIAN 50TH		.192	L.010		.052	.140	L.003	.004	Q.001
75TH		.267	L.010		.076	.220	.003	.007	Q.004
90TH		.441	.010		.089	.360	.006	.062	Q.059
SECONDARY CODE					11L	21L	05L	21L	

	SUBM ID	26304L IRON EXTRBLE. FE	10401L RESIDUE NONFILTR.	02074L TURBIDITY	00201L TOTAL DISSOLVED SOLIDS (CALCD.)	00205L TOTAL DISSOLVED SOLIDS	14102L SILICA REACTIVE SIO2	10451L RESIDUE FILTERABLE	13303L ALUMINUM EXTRBLE. AL
		MG/L	MG/L	NTU	MG/L	MG/L	MG/L	MG/L	MG/L
SAMPLES(FLAGS)		6(0)	17(0)	14(0)	14(0)		14(0)	14(0)	6(5)
LOW		.010	.4	.4	193.0		4.12	190.0	L.010
HIGH		.030	408.	57.0	279.5		5.00	280.0	.020
AVERAGE		.018	33.2	5.1	228.1		4.57	225.4	.012*
STD.DEV.		.008	98.5	15.0	27.2		.23	28.6	.004*
PERCNT:10TH			.4	.4	197.8		4.30	195.0	
25TH		.010	.8	.6	203.3		4.40	200.0	L.010
MEDIAN 50TH		.020	2.0	.9	218.8		4.59	215.0	L.010
75TH		.020	8.	1.7	249.5		4.76	250.0	L.010
90TH			76.4	3.9	270.7		4.80	270.0	
SECONDARY CODE			07L				05L		

		48302L CADMIUM EXTRBLE.	29305L COPPER EXTRBLE.	82302L LEAD EXTRBLE.	56301L BARIUM EXTRBLE.	30305L ZINC EXTRBLE.	24302L CHROMIUM EXTRBLE.	27302L COBALT EXTRBLE.	33304L ARSENIC EXTRACTABLE
	SUBM ID	CD MG/L	CU MG/L	PB MG/L	BA MG/L	ZN MG/L	CR MG/L	CO MG/L	AS MG/L
SAMPLES(FLAGS)		6(6)	6(5)	6(5)	6(0)	6(2)	6(5)	6(5)	6(2)
LOW		L.0010	L.001	L.0020	.060	L.001	L.001	L.001	L.0002
HIGH		L.0010	.001	.0020	.070	.006	.002	.002	.0003
AVERAGE			.001*	.0020*	.062	.002*	.001*	.001*	.0002*
STD.DEV.			.000*	.0000*	.004	.002*	.000*	.000*	.0000*
PERCNT:10TH									
25TH		L.0010	L.001	L.0020	.060	L.001	L.001	L.001	L.0002
MEDIAN 50TH		L.0010	L.001	L.0020	.060	.001	L.001	L.001	.0002
75TH		L.0010	L.001	L.0020	.060	.001	L.001	L.001	.0002
90TH									
SECONDARY CODE									

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ1800 LAT. 51D 1M 55S LONG. 114D 18M 15S PR 3 UTM 11 689050E 5656600N FOR APR 26, 1988 TO MAR 08, 1989
ELBOW RIVER AT GLENCOE GOLF CLUB
JUNE 1988

		80011L MERCURY TOTAL	80015L MERCURY TOTAL	06537L PHENOLIC MATERIAL	02021L COLOUR TRUE	08202L OXYGEN BIOCHEMICAL DEMAND-BOD	08301L OXYGEN TOTAL COD	06722L CHLOROPHYLL A EPILITHIC SUBSAMPLE (TEMPLATE)
	SUBM ID	HG UG/L	HG MG/L	PHENOL MG/L	REL. UNITS	O2 MG/L	O2 MG/L	MG/M2
SAMPLES(FLAGS)		6(6)		6(3)	14(6)			6(1)
LOW		L.050		L.001	L5.000			L0.
HIGH		L.050		.004	10.000			10.826
AVERAGE				.002*	6.429*			6.172*
STD.DEV.				.001*	2.344*			3.822*
PERCNT:10TH					L5.000			
25TH		L.050		L.001	L5.000			4.310
MEDIAN 50TH		L.050		.001*	5.000			5.183
75TH		L.050		.001	10.000			10.530
90TH					10.000			
SECONDARY CODE								

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ1900 LAT. 51D 1M 0S LONG. 114D 14M 25S PR 3 UTM 11 693550E 5655100N FOR APR 26, 1988 TO MAR 08, 1989
ELBOW RIVER AT HIGHWAY # 8 UPSTREAM OF TWIN BRIDGES

		02061F TEMPERATURE OF WATER	10301F PH	10301L PH	02041F SPECIFIC CONDUCT.	02041L SPECIFIC CONDUCT.	08101F OXYGEN DISSOLVED DO O2	08101L OXYGEN DISSOLVED DO O2	02066F TEMPERATURE AIR
	SUBM ID	DEG.C	PH UNITS	PH UNITS	US/CM	US/CM	MG/L	MG/L	DEG.C.
SAMPLES(FLAGS)		14(0)	13(0)	14(0)	10(0)	14(0)	14(0)		14(0)
LOW		.0	7.3	7.44	280.	344.0	8.8		-5.
HIGH		14.5	7.9	8.42	425.	487.0	13.2		19.
AVERAGE		6.6			362.2	402.2	10.70		10.4
STD.DEV.		5.6			60.9	38.7	1.58		6.0
PERCNT:10TH		.0	7.4	7.45	280.0	356.0	9.0		-5.
25TH		.1	7.4	7.55	283.	385.0	9.2		-2.0
MEDIAN 50TH		7.6	7.5	7.95	377.5	393.5	10.55		13.0
75TH		11.9	7.7	8.19	415.	416.0	12.0		14.
90TH		13.8	7.8	8.42	422.0	463.0	13.1		17.
SECONDARY CODE							02F		

		10151L ALKALINITY PHENOL PHTHALEIN	10101L ALKALINITY TOTAL	06202L BICARBONT. (CALCD.)	06302L CARBONATE DISSOLVED	20103L CALCIUM DISSOLVED	12102L MAGNESIUM DISSOLVED	19103L POTASSIUM DISSOLVED	17203L CHLORIDE DISSOLVED
	SUBM ID	CACO3 MG/L	CACO3 MG/L	HCO3 MG/L	CO3 MG/L	CA MG/L	MG MG/L	K MG/L	CL MG/L
SAMPLES(FLAGS)		14(13)	14(0)	14(0)	14(13)	14(0)	14(0)	14(0)	14(0)
LOW		L.10	134.00	156.3	L.5	49.30	13.50	.50	.90
HIGH		4.40	179.00	218.2	5.3	75.20	20.10	.81	2.50
AVERAGE		.41*	151.07	183.4	.8*	57.86	15.55	.58	1.44
STD.DEV.		1.15*	12.82	16.8	1.3*	7.97	1.89	.09	.45
PERCNT:10TH		L.10	137.00	163.4	L.5	50.00	13.50	.50	1.00
25TH		L.10	141.00	171.9	L.5	51.90	14.20	.52	1.10
MEDIAN 50TH		L.10	151.50	184.7	L.5	55.95	15.20	.58	1.40
75TH		L.10	156.00	190.2	L.5	61.00	16.20	.60	1.70
90TH		L.10	172.00	209.7	L.5	72.70	18.50	.70	2.00
SECONDARY CODE									

		10603L HARDNESS TOTAL	36011L COLIFORMS FECAL	36001L COLIFORMS TOTAL	09107L FLUORIDE DISSOLVED	16306L SULPHATE DISSOLVED	06005L CARBON TOTAL ORGANIC C	06104L CARBON DISSOLVED ORGANIC C	07403L NITROGEN TOTAL ORG. (CALCD.) N
	SUBM ID	CACO3 MG/L	MPN NO/100ML	MPN NO/100ML	F MG/L	S04 MG/L	MG/L	MG/L	MG/L
SAMPLES(FLAGS)		14(0)	15(2)	15(2)	14(0)	14(0)	14(1)	14(1)	14(9)
LOW		180.82	2.	L4.	.28	44.70	L.10	L.10	Q.070
HIGH		270.73	90.	270.	.33	82.50	2.00	1.60	Q1.390
AVERAGE		208.66	13.7*	44.8*	.31	59.57	1.16*	1.01*	.219*
STD.DEV.		27.30	21.6*	69.0*	.01	13.72	.47*	.41*	.342*
PERCNT:10TH		181.80	L4.	4.	.29	46.10	.80	.70	Q.090
25TH		189.02	4.	L10.	.30	46.90	.90	.80	Q.090
MEDIAN 50TH		199.56	8.	18.	.31	56.30	1.10	.90	.110
75TH		219.00	14.	70.	.31	72.00	1.45	1.30	.150
90TH		257.90	18.	92.	.33	75.50	1.80	1.60	.310
SECONDARY CODE		05L							

STATION 00AL05BJ1900 LAT. 51D 1M 0S LONG. 114D 14M 25S PR 3 UTM 11 693550E 5655100N FOR APR 26, 1988 TO JUN 25, 1990
ELBOW RIVER UPSTREAM OF TWIN BRIDGES
AT HIGHWAY # 8

	SUBM ID	07602L NITROGEN DISSOLVED N MG/L	07505L NITROGEN TOTAL AMMONIA N MG/L	07562L NITROGEN DISSOLVED AMMONIA N MG/L	07110L NITROGEN DISSOLVED NO3 & NO2 N MG/L	07015L NITROGEN TOTAL KJELDAHL N MG/L	15103L PHOSPHORUS DISSOLVED P MG/L	15406L PHOSPHORUS TOTAL P MG/L	15901L PHOSPHORUS PARTICULATE (CALCD.) P MG/L
SAMPLES(FLAGS)		15(0)	14(9)		15(0)	15(0)	17(10)	17(3)	17(10)
LOW		.129	L.010		.017	.080	L.002	L.003	Q.000
HIGH		1.456	.030		.104	1.400	.008	.263	.256
AVERAGE		.277	.011*		.056	.221	.004*	.025*	.022*
STD.DEV.		.333	.005*		.026	.331	.002*	.063*	.062*
PERCNT:10TH		.137	L.010		.026	.09	L.003	L.003	Q.000
25TH		.146	L.010		.031	.100	L.003	.003	Q.000
MEDIAN 50TH		.173	L.010		.056	.120	L.003	.004	Q.001
75TH		.225	.010		.072	.160	.003	.008	Q.005
90TH		.390	.010		.095	.320	.007	.047	.039
SECONDARY CODE					11L	21L	05L	21L	

	SUBM ID	26304L IRON EXTRBLE. FE MG/L	10401L RESIDUE NONFILTR. MG/L	02074L TURBIDITY NTU	00201L TOTAL DISSOLVED SOLIDS (CALCD.) MG/L	00205L TOTAL DISSOLVED SOLIDS MG/L	14102L SILICA REACTIVE SIO2 MG/L	10451L RESIDUE FILTERABLE MG/L	13303L ALUMINUM EXTRBLE. AL MG/L
SAMPLES(FLAGS)		6(0)	17(1)	14(0)	14(0)		14(0)	14(0)	6(2)
LOW		.010	L.4	.3	200.7		1.98	198.0	L.010
HIGH		.050	332.	31.0	295.7		5.24	290.0	.030
AVERAGE		.027	29.7*	3.4	232.3		4.39	229.1	.017*
STD.DEV.		.014	79.6*	8.0	29.0		.75	29.1	.008*
PERCNT:10TH			.8	.4	203.2		4.00	200.0	
25TH		.020	2.2	.5	212.9		4.35	210.0	L.010
MEDIAN 50TH		.025	2.8	1.0	219.5		4.56	215.0	.015
75TH		.030	11.6	1.8	248.9		4.77	250.0	.020
90TH			48.8	4.8	280.0		4.80	280.0	
SECONDARY CODE			07L				05L		

	SUBM ID	48302L CADMIUM EXTRBLE. CD MG/L	29305L COPPER EXTRBLE. CU MG/L	82302L LEAD EXTRBLE. PB MG/L	56301L BARIUM EXTRBLE. BA MG/L	30305L ZINC EXTRBLE. ZN MG/L	24302L CHROMIUM EXTRBLE. CR MG/L	27302L COBALT EXTRBLE. CO MG/L	33304L ARSENIC EXTRACTABLE AS MG/L
SAMPLES(FLAGS)		6(6)	6(5)	6(5)	6(0)	6(2)	6(5)	6(5)	6(4)
LOW		L.0010	L.001	L.0020	.060	L.001	L.001	L.001	L.0002
HIGH		L.0010	.002	.0020	.070	.002	.001	.001	.0008
AVERAGE			.001*	.0020*	.062	.001*	.001*	.001*	.0003*
STD.DEV.			.000*	.0000*	.004	.000*	.000*	.000*	.0002*
PERCNT:10TH									
25TH		L.0010	L.001	L.0020	.060	L.001	L.001	L.001	L.0002
MEDIAN 50TH		L.0010	L.001	L.0020	.060	.001	L.001	L.001	L.0002
75TH		L.0010	L.001	L.0020	.060	.001	L.001	L.001	.0002
90TH									
SECONDARY CODE									

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ1900 LAT. 51D 1M 0S LONG. 114D 14M 25S PR 3 UTM 11 693550E 5655100N FOR APR 26, 1988 TO MAR 08, 1989
ELBOW RIVER UPSTREAM OF TWIN BRIDGES
AT HIGHWAY # 8

	SUBM ID	80011L MERCURY TOTAL HG UG/L	80015L MERCURY TOTAL HG MG/L	06537L PHENOLIC MATERIAL PHENOL MG/L	02021L COLOUR TRUE REL. UNITS	08202L OXYGEN BIOCHEMICAL DEMAND-BOD O2 MG/L	08301L OXYGEN TOTAL COD O2 MG/L	06722L CHLOROPHYLL A EPILITHIC SUBSAMPLE (TEMPLATE) MG/M2
SAMPLES(FLAGS)		6(6)		6(3)	14(6)			9(3)
LOW		L.050		L.001	L5.000			L0.
HIGH		L.050		.004	10.000			6.636
AVERAGE				.002*	6.429*			4.104*
STD.DEV.				.001*	2.344*			2.111*
PERCNT:10TH					L5.000			
25TH		L.050		L.001	L5.000			L1.969
MEDIAN 50TH		L.050		.001*	5.000			4.596
75TH		L.050		.001	10.000			5.505
90TH					10.000			
SECONDARY CODE								

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ2050 LAT. 50D 59M 42S LONG. 114D 9M 55S PR 3 UTM 11 698950E 5652850N FOR APR 26, 1988 TO MAR 09, 1989
ELBOW RIVER AT SARCEE BRIDGE
JUNE 1988

	SUBM ID	02061F TEMPERATURE OF WATER DEG.C	10301F PH PH UNITS	10301L PH PH UNITS	02041F SPECIFIC CONDUCT. US/CM	02041L SPECIFIC CONDUCT. US/CM	08101F OXYGEN DISSOLVED DO O2 MG/L	08101L OXYGEN DISSOLVED DO O2 MG/L	02066F TEMPERATURE AIR DEG.C.
SAMPLES(FLAGS)		13(0)	13(0)	14(0)	12(0)	14(0)	14(0)		14(0)
LOW		.1	7.2	7.29	305.	359.0	9.3		-6.0
HIGH		14.4	8.0	8.47	460.	475.0	13.2		20.
AVERAGE		6.2			377.3	411.1	10.76		10.9
STD.DEV.		5.4			48.0	34.3	1.25		6.4
PERCNT:10TH		.2	7.3	7.46	309.	367.0	9.4		-5.
25TH		.5	7.3	7.57	347.5	392.0	9.7		-2.0
MEDIAN 50TH		7.1	7.6	7.93	376.0	405.0	10.65		11.5
75TH		9.9	7.8	8.14	413.0	425.0	11.6		17.
90TH		13.9	7.9	8.38	434.	462.0	12.6		20.
SECONDARY CODE							02F		

	SUBM ID	10151L ALKALINITY PHENOL PHTHALEIN CACO3 MG/L	10101L ALKALINITY TOTAL CACO3 MG/L	06202L BICARBONT. (CALCD.) HCO3 MG/L	06302L CARBONATE DISSOLVED CO3 MG/L	20103L CALCIUM DISSOLVED CA MG/L	12102L MAGNESIUM DISSOLVED MG MG/L	19103L POTASSIUM DISSOLVED K MG/L	17203L CHLORIDE DISSOLVED CL MG/L
SAMPLES(FLAGS)		14(13)	14(0)	14(0)	14(13)	14(0)	14(0)	14(0)	14(0)
LOW		L.10	135.00	159.9	L.5	47.70	13.60	.58	1.10
HIGH		5.90	180.00	219.4	7.1	72.30	18.60	.88	9.70
AVERAGE		.51*	155.07	188.0	1.0*	57.69	15.79	.68	2.19
STD.DEV.		1.55*	13.22	17.5	1.8*	7.75	1.58	.08	2.20
PERCNT:10TH		L.10	142.00	164.6	L.5	49.50	13.90	.60	1.20
25TH		L.10	143.00	174.3	L.5	51.70	14.40	.60	1.30
MEDIAN 50TH		L.10	155.50	189.6	L.5	55.20	15.50	.65	1.55
75TH		L.10	161.00	196.3	L.5	62.60	16.50	.70	1.80
90TH		L.10	175.00	213.3	L.5	71.20	18.30	.80	2.60
SECONDARY CODE									

	SUBM ID	10603L HARDNESS TOTAL CACO3 MG/L	36011L COLIFORMS FECAL MPN NO/100ML	36001L COLIFORMS TOTAL MPN NO/100ML	09107L FLUORIDE DISSOLVED F MG/L	16306L SULPHATE DISSOLVED S04 MG/L	06005L CARBON TOTAL ORGANIC C MG/L	06104L CARBON DISSOLVED ORGANIC C MG/L	07403L NITROGEN TOTAL ORG. (CALCD.) N MG/L
SAMPLES(FLAGS)		14(0)	20(1)	20(1)	14(0)	14(0)	14(0)	14(0)	14(8)
LOW		180.17	4.	L10.	.21	44.50	1.00	.70	.070
HIGH		256.07	96.	650.	.36	70.50	2.40	2.30	.320
AVERAGE		209.19	24.5*	102.8*	.30	57.29	1.34	1.13	.154*
STD.DEV.		25.16	23.1*	154.7*	.03	10.30	.42	.43	.070*
PERCNT:10TH		183.86	4.0	11.0	.27	45.70	1.00	.70	Q.090
25TH		188.37	11.0*	16.0	.29	46.80	1.00	.80	Q.110
MEDIAN 50TH		198.87	20.0	58.0	.30	56.40	1.20	1.00	.150
75TH		224.41	28.0	95.0	.30	67.20	1.60	1.40	Q.150
90TH		254.56	56.0	267.0	.33	69.50	1.90	1.50	.270
SECONDARY CODE		05L							

STATION 00AL05BJ2050 LAT. 50D 59M 42S LONG. 114D 9M 55S PR 3 UTM 11 698950E 5652850N FOR APR 26, 1988 TO JUN 25, 1990
ELBOW RIVER AT SARCEE BRIDGE
JUNE 1988

	SUBM ID	07602L NITROGEN DISSOLVED N MG/L	07505L NITROGEN TOTAL AMMONIA N MG/L	07562L NITROGEN DISSOLVED AMMONIA N MG/L	07110L NITROGEN DISSOLVED NO3 & NO2 N MG/L	07015L NITROGEN TOTAL KJELDAHL N MG/L	15103L PHOSPHORUS DISSOLVED P MG/L	15406L PHOSPHORUS TOTAL P MG/L	15901L PHOSPHORUS PARTICULATE (CALCD.) P MG/L
SAMPLES(FLAGS)		15(0)	14(8)		15(0)	15(0)	17(6)	21(0)	17(6)
LOW		.140	L.010		.008	.080	.002	.003	Q.000
HIGH		.466	.020		.126	.340	.010	.550	.349
AVERAGE		.213	.011*		.053	.159	.004*	.103	.031*
STD.DEV.		.088	.003*		.033	.072	.002*	.170	.084*
PERCNT:10TH		.143	L.010		.020	.09	L.003	.004	.001
25TH		.160	L.010		.023	.120	L.003	.004	Q.001
MEDIAN 50TH		.183	L.010		.049	.160	.003	.007	.003
75TH		.228	.010		.078	.160	.003	.070	.007
90TH		.339	.010		.103	.280	.006	.355	.067
SECONDARY CODE					11L	21L	05L	21L	

	SUBM ID	26304L IRON EXTRBLE. FE MG/L	10401L RESIDUE NONFILTR. MG/L	02074L TURBIDITY NTU	00201L TOTAL DISSOLVED SOLIDS (CALCD.) MG/L	00205L TOTAL DISSOLVED SOLIDS MG/L	14102L SILICA REACTIVE SIO2 MG/L	10451L RESIDUE FILTERABLE MG/L	13303L ALUMINUM EXTRBLE. AL MG/L
SAMPLES(FLAGS)		6(0)	17(0)	14(0)	14(0)		14(0)	14(0)	6(0)
LOW		.030	.8	.5	206.1		3.69	200.0	.010
HIGH		.060	440.	29.0	277.8		5.25	270.0	.030
AVERAGE		.043	38.9	3.7	234.3		4.62	230.7	.020
STD.DEV.		.012	105.9	7.3	26.4		.40	26.4	.009
PERCNT:10TH			.8	.5	206.8		4.10	203.0	
25TH		.030	2.4	1.6	210.8		4.38	210.0	.010
MEDIAN 50TH		.045	3.6	1.9	222.9		4.67	220.0	.020
75TH		.050	9.6	2.6	257.1		4.80	250.0	.030
90TH			74.	2.8	272.5		5.18	270.0	
SECONDARY CODE			07L				05L		

	SUBM ID	48302L CADMIUM EXTRBLE. CD MG/L	29305L COPPER EXTRBLE. CU MG/L	82302L LEAD EXTRBLE. PB MG/L	56301L BARIUM EXTRBLE. BA MG/L	30305L ZINC EXTRBLE. ZN MG/L	24302L CHROMIUM EXTRBLE. CR MG/L	27302L COBALT EXTRBLE. CO MG/L	33304L ARSENIC EXTRACTABLE AS MG/L
SAMPLES(FLAGS)		6(6)	6(4)	6(6)	6(0)	6(1)	6(5)	6(6)	6(2)
LOW		L.0010	L.001	L.0020	.060	L.001	L.001	L.001	L.0002
HIGH		L.0010	.001	L.0020	.080	.010	.002	L.001	.0004
AVERAGE			.001*		.068	.003*	.001*		.0003*
STD.DEV.			.000*		.008	.004*	.000*		.0001*
PERCNT:10TH									
25TH		L.0010	L.001	L.0020	.060	.001	L.001	L.001	L.0002
MEDIAN 50TH		L.0010	L.001	L.0020	.070	.002	L.001	L.001	.0003
75TH		L.0010	.001	L.0020	.070	.002	L.001	L.001	.0004
90TH									
SECONDARY CODE									

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ2050 LAT. 50D 59M 42S LONG. 114D 9M 55S PR 3 UTM 11 698950E 5652850N FOR APR 26, 1988 TO MAR 09, 1989
ELBOW RIVER AT SARCEE BRIDGE
JUNE 1988

	SUBM ID	80011L MERCURY TOTAL HG UG/L	80015L MERCURY TOTAL HG MG/L	06537L PHENOLIC MATERIAL PHENOL MG/L	02021L COLOUR TRUE REL. UNITS	08202L OXYGEN BIOCHEMICAL DEMAND-BOD O2 MG/L	08301L OXYGEN TOTAL COD O2 MG/L	06722L CHLOROPHYLL A EPILITHIC SUBSAMPLE (TEMPLATE) MG/M2
SAMPLES(FLAGS)		6(6)		6(4)	14(6)			8(0)
LOW		L.050		L.001	L5.000			40.581
HIGH		L.050		.003	10.000			174.40
AVERAGE				.001*	6.429*			108.480
STD.DEV.				.001*	2.344*			43.614
PERCNT:10TH					L5.000			
25TH		L.050		L.001	L5.000			78.219
MEDIAN 50TH		L.050		L.001	5.000			105.120
75TH		L.050		.001	10.000			143.090
90TH					10.000			
SECONDARY CODE								

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ2051 LAT. 50D 59M 42S LONG. 114D 9M 55S PR 3 UTM 11 698950E 5652850N FOR MAY 29, 1989 TO JUN 29, 1990
ELBOW RIVER AT SARCEE BRIDGE
24 HOUR COMPOSITE SAMPLE

	SUBM ID	07602L NITROGEN DISSOLVED N MG/L	07505L NITROGEN TOTAL AMMONIA N MG/L	07562L NITROGEN DISSOLVED AMMONIA N MG/L	07110L NITROGEN DISSOLVED NO3 & NO2 N MG/L	07015L NITROGEN TOTAL KJELDAHL N MG/L	15103L PHOSPHORUS DISSOLVED P MG/L	15406L PHOSPHORUS TOTAL P MG/L	15901L PHOSPHORUS PARTICULATE (CALCD.) P MG/L
SAMPLES(FLAGS)								44(0)	
LOW								.014	
HIGH								.245	
AVERAGE								.051	
STD.DEV.								.045	
PERCNT:10TH								.022	
25TH								.025	
MEDIAN 50TH								.033	
75TH								.059	
90TH								.116	
SECONDARY CODE								21L	

STATION 00AL05BJ2150 LAT. 51D 0M 20S LONG. 114D 5M 45S PR 3 UTM 11 703750E 5654250N FOR APR 26, 1988 TO MAR 08, 1989
ELBOW RIVER AT CALGARY GOLF AND COUNTRY CLUB

	SUBM ID	02061F TEMPERATURE OF WATER DEG.C	10301F PH PH UNITS	10301L PH PH UNITS	02041F SPECIFIC CONDUCT. US/CM	02041L SPECIFIC CONDUCT. US/CM	08101F OXYGEN DISSOLVED DO O2 MG/L	08101L OXYGEN DISSOLVED DO O2 MG/L	02066F TEMPERATURE AIR DEG.C.
SAMPLES(FLAGS)		14(0)	14(0)	14(0)	12(0)	14(0)	14(0)		14(0)
LOW		1.6	7.0	7.21	247.	324.0	8.8		-7.
HIGH		20.3	8.0	8.29	420.	478.0	13.0		19.
AVERAGE		10.0			355.1	391.5	10.30		9.4
STD.DEV.		7.0			55.0	49.9	1.36		6.4
PERCNT:10TH		1.8	7.3	7.32	270.	326.0	8.9		-4.
25TH		2.4	7.5	7.68	330.5	345.0	9.0		-1.
MEDIAN 50TH		10.2	7.80	7.98	362.0	391.0	9.90		8.0
75TH		17.7	7.9	8.12	398.0	425.0	11.4		17.
90TH		18.5	7.9	8.19	417.	466.0	12.0		18.
SECONDARY CODE							02F		

	SUBM ID	10151L ALKALINITY PHENOL PHTHALEIN CACO3 MG/L	10101L ALKALINITY TOTAL CACO3 MG/L	06202L BICARBONT. (CALCD.) HCO3 MG/L	06302L CARBONATE DISSOLVED CO3 MG/L	20103L CALCIUM DISSOLVED CA MG/L	12102L MAGNESIUM DISSOLVED MG MG/L	19103L POTASSIUM DISSOLVED K MG/L	17203L CHLORIDE DISSOLVED CL MG/L
SAMPLES(FLAGS)		14(14)	14(0)	14(0)	14(14)	14(0)	14(0)	14(0)	14(0)
LOW		L.1	120.00	146.3	L.5	42.40	13.30	.50	1.40
HIGH		L.10	188.00	229.0	L.5	72.80	18.70	1.07	5.30
AVERAGE			146.86	179.0		54.84	15.82	.75	2.69
STD.DEV.			22.06	26.9		9.07	1.81	.17	1.18
PERCNT:10TH		L.10	124.00	151.2	L.5	44.40	13.60	.55	1.50
25TH		L.10	127.00	154.8	L.5	47.20	14.20	.65	1.80
MEDIAN 50TH		L.10	142.00	173.1	L.5	53.55	15.65	.73	2.35
75TH		L.10	161.00	196.3	L.5	60.60	17.10	.85	3.50
90TH		L.10	184.00	224.3	L.5	67.60	18.50	1.00	4.30
SECONDARY CODE									

	SUBM ID	10603L HARDNESS TOTAL CACO3 MG/L	36011L COLIFORMS FECAL MPN NO/100ML	36001L COLIFORMS TOTAL MPN NO/100ML	09107L FLUORIDE DISSOLVED F MG/L	16306L SULPHATE DISSOLVED SO4 MG/L	06005L CARBON TOTAL ORGANIC C MG/L	06104L CARBON DISSOLVED ORGANIC C MG/L	07403L NITROGEN TOTAL ORG. (CALCD.) N MG/L
SAMPLES(FLAGS)		14(0)	25(5)	25(4)	14(0)	14(0)	14(0)	14(0)	14(7)
LOW		161.98	L2.	L4.	.26	44.40	.90	.80	.130
HIGH		258.97	98.	2900.	.34	69.00	2.60	2.00	.330
AVERAGE		202.19	17.3*	179.4*	.30	56.28	1.55	1.31	.199*
STD.DEV.		29.93	21.7*	574.5*	.02	9.80	.48	.34	.047*
PERCNT:10TH		167.80	L2.	L4.	.28	45.20	1.00	.90	Q.150
25TH		176.45	4.	16.	.28	46.30	1.20	1.00	Q.170
MEDIAN 50TH		197.70	8.	36.	.29	59.60	1.40	1.25	.190
75TH		221.88	24.	80.	.30	66.00	1.80	1.50	Q.210
90TH		244.60	40.0	320.	.33	67.50	2.30	1.80	Q.230
SECONDARY CODE		05L							

STATION 00AL05BJ2150 LAT. 51D 0M 20S LONG. 114D 5M 45S PR 3 UTM 11 703750E 5654250N FOR APR 26, 1988 TO MAR 08, 1989
ELBOW RIVER AT CALGARY GOLF AND COUNTRY CLUB

	SUBM ID	07602L NITROGEN DISSOLVED N MG/L	07505L NITROGEN TOTAL AMMONIA N MG/L	07562L NITROGEN DISSOLVED AMMONIA N MG/L	07110L NITROGEN DISSOLVED NO3 & NO2 N MG/L	07015L NITROGEN TOTAL KJELDAHL N MG/L	15103L PHOSPHORUS DISSOLVED P MG/L	15406L PHOSPHORUS TOTAL P MG/L	15901L PHOSPHORUS PARTICULATE (CALCD.) P MG/L
SAMPLES(FLAGS)		14(5)	14(7)		14(5)	14(0)	14(7)	14(0)	14(7)
LOW		.151	L.010		L.003	.140	L.003	.004	Q.001
HIGH		.348	.020		.108	.340	.007	.028	.024
AVERAGE		.238*	.011*		.028*	.210	.004*	.011	.007*
STD.DEV.		.060*	.004*		.038*	.047	.001*	.006	.006*
PERCNT:10TH		Q.183	L.010		L.003	.160	L.003	.004	Q.001
25TH		Q.203	L.010		L.003	.180	L.003	.008	.004
MEDIAN 50TH		.225	.010*		.006	.200	.003*	.010	.006
75TH		.246	.010		.045	.220	.004	.011	Q.007
90TH		Q.343	.020		.101	.240	.004	.020	.017
SECONDARY CODE									

	SUBM ID	26304L IRON EXTRBLE. FE MG/L	10401L RESIDUE NONFILTR. MG/L	02074L TURBIDITY NTU	00201L TOTAL DISSOLVED SOLIDS (CALCD.) MG/L	00205L TOTAL DISSOLVED SOLIDS MG/L	14102L SILICA REACTIVE SIO2 MG/L	10451L RESIDUE FILTERABLE MG/L	13303L ALUMINUM EXTRBLE. AL MG/L
SAMPLES(FLAGS)		6(0)	14(1)	14(0)	14(0)		14(0)	14(0)	13(0)
LOW		.020	L.4	.6	183.4		2.80	180.0	.020
HIGH		.08	13.1	5.8	281.5		6.05	280.0	1.380
AVERAGE		.042	4.8*	2.4	225.8		4.13	226.4	.338
STD.DEV.		.023	3.9*	1.7	33.7		.89	33.6	.419
PERCNT:10TH			.8	.8	187.6		3.12	190.0	.070
25TH		.020	1.2	1.3	191.3		3.42	190.0	.100
MEDIAN 50TH		.040	3.6	1.6	221.8		4.24	221.5	.170
75TH		.050	7.6	3.5	252.8		4.50	250.0	.320
90TH			9.6	5.4	280.7		5.30	280.0	1.100
SECONDARY CODE							05L		

	SUBM ID	48302L CADMIUM EXTRBLE. CD MG/L	29305L COPPER EXTRBLE. CU MG/L	82302L LEAD EXTRBLE. PB MG/L	56301L BARIUM EXTRBLE. BA MG/L	30305L ZINC EXTRBLE. ZN MG/L	24302L CHROMIUM EXTRBLE. CR MG/L	27302L COBALT EXTRBLE. CO MG/L	33304L ARSENIC EXTRACTABLE AS MG/L
SAMPLES(FLAGS)		6(6)	6(5)	6(6)	6(0)	6(1)	6(4)	6(6)	6(4)
LOW		L.001	L.001	L.002	.060	L.001	L.001	L.001	L.0002
HIGH		L.0010	.001	L.0020	.080	.002	.001	L.001	.0004
AVERAGE			.001*		.073	.002*	.001*		.0002*
STD.DEV.			.000*		.008	.001*	.000*		.0001*
PERCNT:10TH									
25TH		L.0010	L.001	L.0020	.070	.001	L.001	L.001	L.0002
MEDIAN 50TH		L.0010	L.001	L.0020	.075	.002	L.001	L.001	L.0002
75TH		L.0010	L.001	L.0020	.080	.002	.001	L.001	.0003
90TH									
SECONDARY CODE									

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ2150 LAT. 51D 0M 20S LONG. 114D 5M 45S PR 3 UTM 11 703750E 5654250N FOR APR 26, 1988 TO MAR 08, 1989
ELBOW RIVER AT CALGARY GOLF AND COUNTRY CLUB

	SUBM ID	80011L MERCURY TOTAL HG UG/L	80015L MERCURY TOTAL HG MG/L	06537L PHENOLIC MATERIAL PHENOL MG/L	02021L COLOUR TRUE REL. UNITS	08202L OXYGEN BIOCHEMICAL DEMAND-BOD O2 MG/L	08301L OXYGEN TOTAL COD O2 MG/L	06722L CHLOROPHYLL A EPILITHIC SUBSAMPLE (TEMPLATE) MG/M2
SAMPLES(FLAGS)		6(6)		6(3)	14(6)		1(0)	8(0)
LOW		L.05		L.001	L5.00		15.00	58.149
HIGH		L.050		.002	10.000		15.00	261.62
AVERAGE				.001*	6.429*			147.207
STD.DEV.				.000*	2.344*			70.504
PERCNT:10TH					L5.000			
25TH		L.050		L.001	L5.000			91.920
MEDIAN 50TH		L.050		.001*	5.000			133.670
75TH		L.050		.001	10.000			203.355
90TH					10.000			
SECONDARY CODE								

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ2300 LAT. 51D 2M 35S LONG. 114D 2M 30S PR 3 UTM 11 707400E 5658550N FOR APR 26, 1988 TO MAR 08, 1989
ELBOW RIVER AT 9TH. AVE. BRIDGE

	SUBM ID	02061F TEMPERATURE OF WATER DEG.C	10301F PH PH UNITS	10301L PH PH UNITS	02041F SPECIFIC CONDUCT. US/CM	02041L SPECIFIC CONDUCT. US/CM	08101F OXYGEN DISSOLVED DO O2 MG/L	08101L OXYGEN DISSOLVED DO O2 MG/L	02066F TEMPERATURE AIR DEG.C.
SAMPLES(FLAGS)		14(0)	11(0)	14(0)	13(0)	14(0)	14(0)		14(0)
LOW		.6	7.2	7.40	285.	334.0	8.2		-7.
HIGH		21.4	8.3	8.41	610.	678.0	13.6		20.
AVERAGE		9.5			411.1	428.5	10.93		9.6
STD.DEV.		7.5			87.3	87.4	1.57		6.8
PERCNT:10TH		1.1	7.4	7.45	312.	351.0	9.0		-5.
25TH		1.8	7.5	7.53	348.	359.0	9.8		0.
MEDIAN 50TH		9.1	7.8	7.94	405.	417.0	11.25		7.5
75TH		16.1	8.2	8.10	460.	458.0	11.9		18.
90TH		19.5	8.3	8.34	480.	505.0	12.9		19.
SECONDARY CODE							02F		

		10151L ALKALINITY PHENOL PHTHALEIN	10101L ALKALINITY TOTAL	06202L BICARBONT. (CALCD.)	06302L CARBONATE DISSOLVED	20103L CALCIUM DISSOLVED	12102L MAGNESIUM DISSOLVED	19103L POTASSIUM DISSOLVED	17203L CHLORIDE DISSOLVED
	SUBM ID	CACO3 MG/L	CACO3 MG/L	HCO3 MG/L	CO3 MG/L	CA MG/L	MG MG/L	K MG/L	CL MG/L
SAMPLES(FLAGS)		14(13)	14(0)	14(0)	14(13)	14(0)	14(0)	14(0)	14(0)
LOW		L.10	124.00	151.2	L.5	44.00	14.30	.60	2.50
HIGH		3.40	190.00	231.6	4.1	73.90	20.50	2.10	60.50
AVERAGE		.34*	151.71	184.3	.8*	55.59	17.04	.99	10.14
STD.DEV.		.88*	21.92	26.9	1.0*	9.37	1.95	.36	14.65
PERCNT:10TH		L.10	126.00	153.6	L.5	44.00	14.30	.72	3.70
25TH		L.10	131.00	159.7	L.5	47.90	15.50	.75	4.60
MEDIAN 50TH		L.10	148.50	179.8	L.5	53.75	17.10	.99	6.55
75TH		L.10	168.00	204.8	L.5	62.30	18.70	1.10	8.20
90TH		L.10	185.00	225.0	L.5	68.60	19.70	1.18	10.40
SECONDARY CODE									

		10603L HARDNESS TOTAL	36011L COLIFORMS FECAL	36001L COLIFORMS TOTAL	09107L FLUORIDE DISSOLVED	16306L SULPHATE DISSOLVED	06005L CARBON TOTAL ORGANIC	06104L CARBON DISSOLVED ORGANIC	07403L NITROGEN TOTAL ORG. (CALCD.)
	SUBM ID	CACO3 MG/L	MPN NO/100ML	MPN NO/100ML	F MG/L	S04 MG/L	C MG/L	C MG/L	N MG/L
SAMPLES(FLAGS)		14(0)	25(1)	25(0)	14(0)	14(0)	14(0)	14(0)	14(5)
LOW		168.86	L4.	170.	.25	44.90	1.20	1.00	.110
HIGH		269.13	700.	180000.	.37	68.50	3.00	2.60	.770
AVERAGE		209.09	189.4*	9587.7	.30	57.04	1.84	1.59	.294*
STD.DEV.		31.09	163.8*	35771.6	.03	9.91	.61	.49	.175*
PERCNT:10TH		173.80	30.	260.	.27	45.60	1.20	1.00	Q.150
25TH		178.61	70.	430.	.28	45.80	1.40	1.40	.210
MEDIAN 50TH		202.90	140.	700.	.28	61.50	1.60	1.40	.230
75TH		232.72	300.	2800.	.33	65.20	2.20	2.00	.410
90TH		252.59	410.	10000.	.34	68.00	3.00	2.30	.490
SECONDARY CODE		05L							

STATION 00AL05BJ2300 LAT. 51D 2M 35S LONG. 114D 2M 30S PR 3 UTM 11 707400E 5658550N FOR APR 26, 1988 TO MAR 08, 1989
ELBOW RIVER AT 9TH. AVE. BRIDGE

		07602L NITROGEN DISSOLVED N	07505L NITROGEN TOTAL AMMONIA N	07562L NITROGEN DISSOLVED AMMONIA N	07110L NITROGEN DISSOLVED NO3 & NO2 N	07015L NITROGEN TOTAL KJELDAHL N	15103L PHOSPHORUS DISSOLVED	15406L PHOSPHORUS TOTAL	15901L PHOSPHORUS PARTICULATE (CALCD.)
	SUBM ID	MG/L	MG/L	MG/L	MG/L	MG/L	P MG/L	P MG/L	P MG/L
SAMPLES(FLAGS)		14(0)	14(5)		14(0)	14(0)	14(2)	14(0)	14(2)
LOW		.234	L.010		.040	.120	L.003	.004	.001
HIGH		1.100	.110		.500	.780	.012	.050	.038
AVERAGE		.534	.020*		.220	.314	.004*	.012	.008*
STD.DEV.		.250	.028*		.137	.184	.002*	.012	.010*
PERCNT:10TH		.280	L.010		.057	.160	L.003	.006	Q.003
25TH		.385	L.010		.145	.220	.003	.006	.003
MEDIAN 50TH		.459	.010		.209	.240	.003	.008	.004
75TH		.650	.010		.260	.420	.004	.009	.006
90TH		.980	.050		.430	.600	.004	.024	.021
SECONDARY CODE									

		26304L IRON EXTRBLE.	10401L RESIDUE NONFILTR.	02074L TURBIDITY	00201L TOTAL DISSOLVED SOLIDS (CALCD.)	00205L TOTAL DISSOLVED SOLIDS	14102L SILICA REACTIVE	10451L RESIDUE FILTERABLE	13303L ALUMINUM EXTRBLE.
	SUBM ID	FE MG/L	MG/L	NTU	MG/L	MG/L	SIO2 MG/L	MG/L	AL MG/L
SAMPLES(FLAGS)		6(0)	14(1)	14(0)	14(0)		14(0)	14(0)	13(0)
LOW		.030	L.4	.4	189.2		1.46	190.0	.010
HIGH		.070	29.1	34.0	367.0		5.20	360.0	.520
AVERAGE		.050	5.2*	4.6	243.1		3.33	242.2	.202
STD.DEV.		.019	7.6*	8.8	48.5		1.19	47.3	.143
PERCNT:10TH			.4	.7	194.6		1.70	190.0	.070
25TH		.030	.4	1.1	204.5		2.45	200.0	.100
MEDIAN 50TH		.050	3.2	1.5	231.0		3.28	235.0	.190
75TH		.070	5.4	2.7	268.4		4.05	270.0	.300
90TH			11.6	9.8	300.2		5.20	300.0	.370
SECONDARY CODE							05L		

		48302L CADMIUM EXTRBLE.	29305L COPPER EXTRBLE.	82302L LEAD EXTRBLE.	56301L BARIUM EXTRBLE.	30305L ZINC EXTRBLE.	24302L CHROMIUM EXTRBLE.	27302L COBALT EXTRBLE.	33304L ARSENIC EXTRACTABLE
	SUBM ID	CD MG/L	CU MG/L	PB MG/L	BA MG/L	ZN MG/L	CR MG/L	CO MG/L	AS MG/L
SAMPLES(FLAGS)		6(6)	6(3)	6(5)	6(0)	6(0)	6(4)	6(5)	6(2)
LOW		L.0010	L.001	L.0020	.060	.001	L.001	L.001	L.0002
HIGH		L.0010	.006	.0040	.090	.003	.008	.001	.0013
AVERAGE			.002*	.0023*	.075	.002	.002*	.001*	.0005*
STD.DEV.			.002*	.0008*	.010	.001	.003*	.000*	.0004*
PERCNT:10TH									
25TH		L.0010	L.001	L.0020	.070	.002	L.001	L.001	L.0002
MEDIAN 50TH		L.0010	.001*	L.0020	.075	.002	L.001	L.001	.0003
75TH		L.0010	.002	L.0020	.080	.002	.002	L.001	.0004
90TH									
SECONDARY CODE									

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ2300 LAT. 51D 2M 35S LONG. 114D 2M 30S PR 3 UTM 11 707400E 5658550N FOR APR 26, 1988 TO MAR 08, 1989
ELBOW RIVER AT 9TH. AVE. BRIDGE

	SUBM ID	80011L MERCURY TOTAL HG UG/L	80015L MERCURY TOTAL HG MG/L	06537L PHENOLIC MATERIAL PHENOL MG/L	02021L COLOUR TRUE REL. UNITS	08202L OXYGEN BIOCHEMICAL DEMAND-BOD O2 MG/L	08301L OXYGEN TOTAL COD O2 MG/L	06722L CHLOROPHYLL A EPILITHIC SUBSAMPLE (TEMPLATE) MG/M2
SAMPLES(FLAGS)		6(6)		6(2)	14(6)			7(0)
LOW		L.050		L.001	L5.000			131.44
HIGH		L.050		.001	10.000			880.65
AVERAGE				.001*	6.786*			400.223
STD.DEV.				.000*	2.486*			262.376
PERCNT:10TH					L5.000			
25TH		L.050		L.001	L5.000			156.13
MEDIAN 50TH		L.050		.001	5.000			439.93
75TH		L.050		.001	10.000			490.76
90TH					10.000			
SECONDARY CODE								

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ2160 LAT. 51D 1M 0S LONG. 114D 5M 30S PR 3 UTM 11 704000E 5655500N FOR MAY 30, 1989 TO JUN 27, 1989
ELBOW RIVER AT THE RIVERDALE PARKING LOT
JUNE 1989

	SUBM ID	10603L HARDNESS TOTAL CACO3 MG/L	36011L COLIFORMS FECAL MPN NO/100ML	36001L COLIFORMS TOTAL MPN NO/100ML	09107L FLUORIDE DISSOLVED F MG/L	16306L SULPHATE DISSOLVED SO4 MG/L	06005L CARBON TOTAL ORGANIC C MG/L	06104L CARBON DISSOLVED ORGANIC C MG/L	07403L NITROGEN TOTAL ORG. (CALCD.) N MG/L
SAMPLES(FLAGS)			5(3)	5(0)					
LOW			L10.	20.					
HIGH			40.	110.					
AVERAGE			20.0*	54.0					
STD.DEV.			14.1*	34.4					
PERCNT:10TH									
25TH			L10.	40.					
MEDIAN 50TH			L10.	40.					
75TH			30.	60.					
90TH									
SECONDARY CODE									

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ2170 LAT. 51D 1M 20S LONG. 114D 4M 10S PR 3 UTM 11 705550E 5656150N FOR MAY 30, 1989 TO JUN 27, 1989
ELBOW RIVER BELOW STANLEY PARK
JUNE 1989

	SUBM ID	10603L HARDNESS TOTAL CACO3 MG/L	36011L COLIFORMS FECAL MPN NO/100ML	36001L COLIFORMS TOTAL MPN NO/100ML	09107L FLUORIDE DISSOLVED F MG/L	16306L SULPHATE DISSOLVED SO4 MG/L	06005L CARBON TOTAL ORGANIC C MG/L	06104L CARBON DISSOLVED ORGANIC C MG/L	07403L NITROGEN TOTAL ORG. (CALCD.) N MG/L
SAMPLES(FLAGS)			5(0)	5(0)					
LOW			10.	40.					
HIGH			40.	90.					
AVERAGE			18.0	68.0					
STD.DEV.			13.0	21.7					
PERCNT:10TH									
25TH			10.	50.					
MEDIAN 50TH			10.	80.					
75TH			20.	80.					
90TH									
SECONDARY CODE									

STATION 00AL05BJ2180 LAT. 51D 1M 50S LONG. 114D 3M 50S PR 3 UTM 11 705900E 5657100N FOR MAY 30, 1989 TO JUN 27, 1989
ELBOW RIVER BELOW MISSION BRIDGE
JUNE 1989

	SUBM ID	10603L HARDNESS TOTAL CACO3 MG/L	36011L COLIFORMS FECAL MPN NO/100ML	36001L COLIFORMS TOTAL MPN NO/100ML	09107L FLUORIDE DISSOLVED F MG/L	16306L SULPHATE DISSOLVED SO4 MG/L	06005L CARBON TOTAL ORGANIC C MG/L	06104L CARBON DISSOLVED ORGANIC C MG/L	07403L NITROGEN TOTAL ORG. (CALCD.) N MG/L
SAMPLES(FLAGS)			5(0)	5(0)					
LOW			10.	100.					
HIGH			30.	170.					
AVERAGE			14.0	130.0					
STD.DEV.			8.9	33.2					
PERCNT:10TH									
25TH			10.	100.					
MEDIAN 50TH			10.	120.					
75TH			10.	160.					
90TH									
SECONDARY CODE									

STATION 00AL05BJ2190 LAT. 51D 2M 5S LONG. 114D 4M 5S PR 3 UTM 11 705600E 5657550N FOR MAY 30, 1989 TO JUN 27, 1989
ELBOW RIVER AT LINDSEY PARK
JUNE 1989

	SUBM ID	10603L HARDNESS TOTAL CACO3 MG/L	36011L COLIFORMS FECAL MPN NO/100ML	36001L COLIFORMS TOTAL MPN NO/100ML	09107L FLUORIDE DISSOLVED F MG/L	16306L SULPHATE DISSOLVED SO4 MG/L	06005L CARBON TOTAL ORGANIC C MG/L	06104L CARBON DISSOLVED ORGANIC C MG/L	07403L NITROGEN TOTAL ORG. (CALCD.) N MG/L
SAMPLES(FLAGS)			5(0)	5(0)					
LOW			10.	90.					
HIGH			50.	180.					
AVERAGE			18.0	126.0					
STD.DEV.			17.9	37.8					
PERCNT:10TH									
25TH			10.	100.					
MEDIAN 50TH			10.	110.					
75TH			10.	150.					
90TH									
SECONDARY CODE									

STATION 00AL05BJ2195 LAT. 51D 1M 45S LONG. 114D 3M 10S PR 3 UTM 11 706650E 5657000N FOR MAY 30, 1989 TO JUN 27, 1989
ELBOW RIVER ABOVE STAMPEDE STABLES
JUNE 1989

	SUBM ID	10603L HARDNESS TOTAL CACO3 MG/L	36011L COLIFORMS FECAL MPN NO/100ML	36001L COLIFORMS TOTAL MPN NO/100ML	09107L FLUORIDE DISSOLVED F MG/L	16306L SULPHATE DISSOLVED S04 MG/L	06005L CARBON TOTAL ORGANIC C MG/L	06104L CARBON DISSOLVED ORGANIC C MG/L	07403L NITROGEN TOTAL ORG. (CALCD.) N MG/L
SAMPLES(FLAGS)			5(0)	5(0)					
LOW			10.	40.					
HIGH			40.	180.					
AVERAGE			22.0	108.0					
STD.DEV.			11.0	52.2					
PERCNT:10TH									
25TH			20.	80.					
MEDIAN 50TH			20.	120.					
75TH			20.	120.					
90TH									
SECONDARY CODE									

STATION 00AL05BJ2250 LAT. 51D 2M 30S LONG. 114D 2M 40S PR 3 UTM 11 707200E 5658400N FOR MAY 30, 1989 TO JUN 27, 1989
ELBOW RIVER AT MACDONALD BRIDGE
JUNE 1989

	SUBM ID	10603L HARDNESS TOTAL CACO3 MG/L	36011L COLIFORMS FECAL MPN NO/100ML	36001L COLIFORMS TOTAL MPN NO/100ML	09107L FLUORIDE DISSOLVED F MG/L	16306L SULPHATE DISSOLVED S04 MG/L	06005L CARBON TOTAL ORGANIC C MG/L	06104L CARBON DISSOLVED ORGANIC C MG/L	07403L NITROGEN TOTAL ORG. (CALCD.) N MG/L
SAMPLES(FLAGS)			5(2)	5(0)					
LOW			L10.	70.					
HIGH			20.	160.					
AVERAGE			16.0*	118.0					
STD.DEV.			5.5*	40.2					
PERCNT:10TH									
25TH			L10.	80.					
MEDIAN 50TH			20.	140.					
75TH			20.	140.					
90TH									
SECONDARY CODE									

* THESE STATISTICS INCLUDE VALUES FLAGGED WITH L,GOR Q

STATION 00AL05BJ0810 LAT. 50D 54M 10S LONG. 114D 41M 0S PR 3 UTM 11 662900E 5641350N FOR JUN 07, 1989 TO JUN 07, 1989
RANGER CREEK NEAR THE MOUTH
JUNE 1989

	SUBM ID	07602L NITROGEN DISSOLVED N MG/L	07505L NITROGEN TOTAL AMMONIA N MG/L	07562L NITROGEN DISSOLVED AMMONIA N MG/L	07110L NITROGEN DISSOLVED NO3 & NO2 N MG/L	07015L NITROGEN TOTAL KJELDAHL N MG/L	15103L PHOSPHORUS DISSOLVED P MG/L	15406L PHOSPHORUS TOTAL P MG/L	15901L PHOSPHORUS PARTICULATE (CALCD.) P MG/L
SAMPLES(FLAGS)							1(0)	1(0)	1(0)
LOW							.008	.013	.005
HIGH							.008	.013	.005
AVERAGE									
STD.DEV.									
PERCNT:10TH									
25TH									
MEDIAN 50TH									
75TH									
90TH									
SECONDARY CODE							05L	21L	

	SUBM ID	26304L IRON EXTRBLE. FE MG/L	10401L RESIDUE NONFILTR. MG/L	02074L TURBIDITY NTU	00201L TOTAL DISSOLVED SOLIDS (CALCD.) MG/L	00205L TOTAL DISSOLVED SOLIDS MG/L	14102L SILICA REACTIVE SIO2 MG/L	10451L RESIDUE FILTERABLE MG/L	13303L ALUMINUM EXTRBLE. AL MG/L
SAMPLES(FLAGS)			1(0)						
LOW			1.						
HIGH			1.						
AVERAGE									
STD.DEV.									
PERCNT:10TH									
25TH									
MEDIAN 50TH									
75TH									
90TH									
SECONDARY CODE			07L						

STATION 00AL05BJ1100 LAT. 50D 56M 25S LONG. 114D 37M 20S PR 3 UTM 11 667050E 5645650N FOR JUN 07, 1989 TO JUN 07, 1989
IRON CREEK NEAR THE MOUTH
JUNE 1989

	SUBM ID	07602L NITROGEN DISSOLVED N MG/L	07505L NITROGEN TOTAL AMMONIA N MG/L	07562L NITROGEN DISSOLVED AMMONIA N MG/L	07110L NITROGEN DISSOLVED NO3 & NO2 N MG/L	07015L NITROGEN TOTAL KJELDAHL N MG/L	15103L PHOSPHORUS DISSOLVED P MG/L	15406L PHOSPHORUS TOTAL P MG/L	15901L PHOSPHORUS PARTICULATE (CALCD.) P MG/L
SAMPLES(FLAGS)							1(0)	1(0)	1(0)
LOW							.007	.037	.030
HIGH							.007	.037	.030
AVERAGE									
STD.DEV.									
PERCNT:10TH									
25TH									
MEDIAN 50TH									
75TH									
90TH									
SECONDARY CODE							05L	21L	

STATION 00AL05BJ1500 LAT. 50D 56M 30S LONG. 114D 34M 35S PR 3 UTM 11 670300E 5645900N FOR JUN 07, 1989 TO MAY 28, 1990
ELBOW RIVER BELOW PROVINCIAL PARK

	SUBM ID	07602L NITROGEN DISSOLVED N MG/L	07505L NITROGEN TOTAL AMMONIA N MG/L	07562L NITROGEN DISSOLVED AMMONIA N MG/L	07110L NITROGEN DISSOLVED NO3 & NO2 N MG/L	07015L NITROGEN TOTAL KJELDAHL N MG/L	15103L PHOSPHORUS DISSOLVED P MG/L	15406L PHOSPHORUS TOTAL P MG/L	15901L PHOSPHORUS PARTICULATE (CALCD.) P MG/L
SAMPLES(FLAGS)							2(0)	2(0)	2(0)
LOW							.005	.033	.028
HIGH							.005	.144	.139
AVERAGE							.005	.089	.084
STD.DEV.							.000	.078	.078
PERCNT:10TH									
25TH									
MEDIAN 50TH							.005	.089	.084
75TH									
90TH									
SECONDARY CODE							05L	21L	

	SUBM ID	26304L IRON EXTRBLE. FE MG/L	10401L RESIDUE NONFILTR. MG/L	02074L TURBIDITY NTU	00201L TOTAL DISSOLVED SOLIDS (CALCD.) MG/L	00205L TOTAL DISSOLVED SOLIDS MG/L	14102L SILICA REACTIVE SIO2 MG/L	10451L RESIDUE FILTERABLE MG/L	13303L ALUMINUM EXTRBLE. AL MG/L
SAMPLES(FLAGS)			2(0)						
LOW			14.						
HIGH			194.						
AVERAGE			104.0						
STD.DEV.			127.3						
PERCNT:10TH									
25TH									
MEDIAN 50TH			104.0						
75TH									
90TH									
SECONDARY CODE			07L						

	SUBM ID	26304L IRON EXTRBLE. FE MG/L	10401L RESIDUE NONFILTR. MG/L	02074L TURBIDITY NTU	00201L TOTAL DISSOLVED SOLIDS (CALCD.) MG/L	00205L TOTAL DISSOLVED SOLIDS MG/L	14102L SILICA REACTIVE SIO2 MG/L	10451L RESIDUE FILTERABLE MG/L	13303L ALUMINUM EXTRBLE. AL MG/L
SAMPLES(FLAGS)			1(0)						
LOW			1.						
HIGH			1.						
AVERAGE									
STD.DEV.									
PERCNT:10TH									
25TH									
MEDIAN 50TH									
75TH									
90TH									
SECONDARY CODE			07L						

STATION 00AL05BJ1620 LAT. 50D 59M 20S LONG. 114D 33M 30S PR 3 UTM 11 671400E 5651200N FOR JUN 07, 1989 TO JUN 07, 1989
LYON MOUNTAIN CREEK NORTH OF POND
JUNE 1989

	SUBM ID	07602L NITROGEN DISSOLVED N MG/L	07505L NITROGEN TOTAL AMMONIA N MG/L	07562L NITROGEN DISSOLVED AMMONIA N MG/L	07110L NITROGEN DISSOLVED NO3 & NO2 N MG/L	07015L NITROGEN TOTAL KJELDAHL N MG/L	15103L PHOSPHORUS DISSOLVED P MG/L	15406L PHOSPHORUS TOTAL P MG/L	15901L PHOSPHORUS PARTICULATE (CALCD.) P MG/L
SAMPLES(FLAGS)							1(0)	1(0)	1(0)
LOW							.017	.152	.135
HIGH							.017	.152	.135
AVERAGE									
STD.DEV.									
PERCNT:10TH									
25TH									
MEDIAN 50TH									
75TH									
90TH									
SECONDARY CODE							05L	21L	

	SUBM ID	26304L IRON EXTRBLE. FE MG/L	10401L RESIDUE NONFILTR. MG/L	02074L TURBIDITY NTU	00201L TOTAL DISSOLVED SOLIDS (CALCD.) MG/L	00205L TOTAL DISSOLVED SOLIDS MG/L	14102L SILICA REACTIVE SIO2 MG/L	10451L RESIDUE FILTERABLE MG/L	13303L ALUMINUM EXTRBLE. AL MG/L
SAMPLES(FLAGS)			1(0)						
LOW			46.						
HIGH			46.						
AVERAGE									
STD.DEV.									
PERCNT:10TH									
25TH									
MEDIAN 50TH									
75TH									
90TH									
SECONDARY CODE			07L						

STATION 00AL05BJ1640 LAT. 50D 58M 50S LONG. 114D 31M 40S PR 3 UTM 11 673550E 5650350N FOR JUN 07, 1989 TO MAY 28, 1990
ELBOW RIVER AT THE REDWOOD WATER PLANT
JUNE 1989

	SUBM ID	07602L NITROGEN DISSOLVED N MG/L	07505L NITROGEN TOTAL AMMONIA N MG/L	07562L NITROGEN DISSOLVED AMMONIA N MG/L	07110L NITROGEN DISSOLVED NO3 & NO2 N MG/L	07015L NITROGEN TOTAL KJELDAHL N MG/L	15103L PHOSPHORUS DISSOLVED P MG/L	15406L PHOSPHORUS TOTAL P MG/L	15901L PHOSPHORUS PARTICULATE (CALCD.) P MG/L
SAMPLES(FLAGS)							1(0)	2(0)	1(0)
LOW							.015	.035	.193
HIGH							.015	.208	.193
AVERAGE								.122	
STD.DEV.								.122	
PERCNT:10TH									
25TH									
MEDIAN 50TH								.122	
75TH									
90TH									
SECONDARY CODE							05L	21L	

	SUBM ID	26304L IRON EXTRBLE. FE MG/L	10401L RESIDUE NONFILTR. MG/L	02074L TURBIDITY NTU	00201L TOTAL DISSOLVED SOLIDS (CALCD.) MG/L	00205L TOTAL DISSOLVED SOLIDS MG/L	14102L SILICA REACTIVE SIO2 MG/L	10451L RESIDUE FILTERABLE MG/L	13303L ALUMINUM EXTRBLE. AL MG/L
SAMPLES(FLAGS)			2(0)						
LOW			30.						
HIGH			169.						
AVERAGE			99.5						
STD.DEV.			98.3						
PERCNT:10TH									
25TH									
MEDIAN 50TH			99.5						
75TH									
90TH									
SECONDARY CODE			07L						

STATION 00AL05BJ1660 LAT. 51D 0M 30S LONG. 114D 29M 40S PR 3 UTM 11 675800E 5653500N FOR JUN 07, 1989 TO MAY 28, 1990
ELBOW RIVER BELOW REDWOOD MEADOWS
JUNE 1989

	SUBM ID	07602L NITROGEN DISSOLVED N MG/L	07505L NITROGEN TOTAL AMMONIA N MG/L	07562L NITROGEN DISSOLVED AMMONIA N MG/L	07110L NITROGEN DISSOLVED NO3 & NO2 N MG/L	07015L NITROGEN TOTAL KJELDAHL N MG/L	15103L PHOSPHORUS DISSOLVED P MG/L	15406L PHOSPHORUS TOTAL P MG/L	15901L PHOSPHORUS PARTICULATE (CALCD.) P MG/L
SAMPLES(FLAGS)							2(0)	2(0)	2(0)
LOW							.002	.035	.033
HIGH							.006	.285	.279
AVERAGE							.004	.160	.156
STD.DEV.							.003	.177	.174
PERCNT:10TH									
25TH									
MEDIAN 50TH							.004	.160	.156
75TH									
90TH									
SECONDARY CODE							05L	21L	

	SUBM ID	26304L IRON EXTRBLE. FE MG/L	10401L RESIDUE NONFILTR. MG/L	02074L TURBIDITY NTU	00201L TOTAL DISSOLVED SOLIDS (CALCD.) MG/L	00205L TOTAL DISSOLVED SOLIDS MG/L	14102L SILICA REACTIVE SIO2 MG/L	10451L RESIDUE FILTERABLE MG/L	13303L ALUMINUM EXTRBLE. AL MG/L
SAMPLES(FLAGS)			2(0)						
LOW			22.						
HIGH			364.						
AVERAGE			193.0						
STD.DEV.			241.8						
PERCNT:10TH									
25TH									
MEDIAN 50TH			193.0						
75TH									
90TH									
SECONDARY CODE			07L						

STATION 00AL05BJ1740 LAT. 51D 2M 50S LONG. 114D 23M 40S PR 3 UTM 11 682650E 5658100N FOR JUN 07, 1989 TO JUN 25, 1990
ELBOW RIVER ABOVE PIRMEZ CREEK
JUNE 1989

	SUBM ID	07602L NITROGEN DISSOLVED N MG/L	07505L NITROGEN TOTAL AMMONIA N MG/L	07562L NITROGEN DISSOLVED AMMONIA N MG/L	07110L NITROGEN DISSOLVED NO3 & NO2 N MG/L	07015L NITROGEN TOTAL KJELDAHL N MG/L	15103L PHOSPHORUS DISSOLVED P MG/L	15406L PHOSPHORUS TOTAL P MG/L	15901L PHOSPHORUS PARTICULATE (CALCD.) P MG/L
SAMPLES(FLAGS)		1(0)			1(0)	1(0)	3(0)	3(0)	3(0)
LOW		.158			.078	.08	.005	.040	.035
HIGH		.158			.078	.08	.171	.260	.089
AVERAGE							.061	.118	.057
STD.DEV.							.096	.123	.028
PERCNT:10TH									
25TH									
MEDIAN 50TH							.006	.054	.048
75TH									
90TH									
SECONDARY CODE					11L	21L	05L	21L	

		26304L IRON EXTRBLE.	10401L RESIDUE NONFILTR.	02074L TURBIDITY	00201L TOTAL DISSOLVED SOLIDS (CALCD.)	00205L TOTAL DISSOLVED SOLIDS	14102L SILICA REACTIVE	10451L RESIDUE FILTERABLE	13303L ALUMINUM EXTRBLE.
	SUBM ID	FE MG/L	MG/L	NTU	MG/L	MG/L	SIO2 MG/L	MG/L	AL MG/L
SAMPLES(FLAGS)			3(0)						
LOW			39.						
HIGH			419.						
AVERAGE			169.3						
STD.DEV.			216.3						
PERCNT:10TH									
25TH									
MEDIAN 50TH			50.						
75TH									
90TH									
SECONDARY CODE			07L						

STATION 00AL05BJ1750 LAT. 51D 2M 45S LONG. 114D 23M 50S PR 3 UTM 11 682450E 5657900N FOR JUN 07, 1989 TO JUN 25, 1990
PIRMEZ CREEK NEAR THE MOUTH
JUNE 1989

		07602L NITROGEN DISSOLVED N	07505L NITROGEN TOTAL AMMONIA N	07562L NITROGEN DISSOLVED AMMONIA N	07110L NITROGEN DISSOLVED NO3 & NO2 N	07015L NITROGEN TOTAL KJELDAHL N	15103L PHOSPHORUS DISSOLVED	15406L PHOSPHORUS TOTAL	15901L PHOSPHORUS PARTICULATE (CALCD.)
	SUBM ID	MG/L	MG/L	MG/L	MG/L	MG/L	P MG/L	P MG/L	P MG/L
SAMPLES(FLAGS)		1(0)			1(0)	1(0)	3(0)	3(0)	3(0)
LOW		1.130			.920	.21	.003	.015	.012
HIGH		1.130			.920	.21	.009	.022	.013
AVERAGE							.006	.018	.012
STD.DEV.							.003	.004	.001
PERCNT:10TH									
25TH									
MEDIAN 50TH							.005	.017	.012
75TH									
90TH									
SECONDARY CODE					11L	21L	05L	21L	

		26304L IRON EXTRBLE.	10401L RESIDUE NONFILTR.	02074L TURBIDITY	00201L TOTAL DISSOLVED SOLIDS (CALCD.)	00205L TOTAL DISSOLVED SOLIDS	14102L SILICA REACTIVE	10451L RESIDUE FILTERABLE	13303L ALUMINUM EXTRBLE.
	SUBM ID	FE MG/L	MG/L	NTU	MG/L	MG/L	SIO2 MG/L	MG/L	AL MG/L
SAMPLES(FLAGS)			3(0)						
LOW			4.						
HIGH			11.						
AVERAGE			8.3						
STD.DEV.			3.8						
PERCNT:10TH									
25TH									
MEDIAN 50TH			10.						
75TH									
90TH									
SECONDARY CODE			07L						

STATION 00AL05BJ1755 LAT. 51D 2M 27S LONG. 114D 22M 31S PR 3 UTM 11 684000E 5657400N FOR JUN 07, 1989 TO JUN 25, 1990
MILLBURN CREEK NEAR THE MOUTH
JUNE 1989

		07602L NITROGEN DISSOLVED N	07505L NITROGEN TOTAL AMMONIA N	07562L NITROGEN DISSOLVED AMMONIA N	07110L NITROGEN DISSOLVED NO3 & NO2 N	07015L NITROGEN TOTAL KJELDAHL N	15103L PHOSPHORUS DISSOLVED	15406L PHOSPHORUS TOTAL	15901L PHOSPHORUS PARTICULATE (CALCD.)
	SUBM ID	MG/L	MG/L	MG/L	MG/L	MG/L	P MG/L	P MG/L	P MG/L
SAMPLES(FLAGS)		1(0)			1(0)	1(0)	3(0)	3(0)	3(0)
LOW		.813			.073	.74	.024	.036	.012
HIGH		.813			.073	.74	.047	.065	.018
AVERAGE							.035	.050	.014
STD.DEV.							.012	.015	.003
PERCNT:10TH									
25TH									
MEDIAN 50TH							.035	.048	.013
75TH									
90TH									
SECONDARY CODE					11L	21L	05L	21L	

		26304L IRON EXTRBLE.	10401L RESIDUE NONFILTR.	02074L TURBIDITY	00201L TOTAL DISSOLVED SOLIDS (CALCD.)	00205L TOTAL DISSOLVED SOLIDS	14102L SILICA REACTIVE	10451L RESIDUE FILTERABLE	13303L ALUMINUM EXTRBLE.
	SUBM ID	FE MG/L	MG/L	NTU	MG/L	MG/L	SIO2 MG/L	MG/L	AL MG/L
SAMPLES(FLAGS)			3(0)						
LOW			1.						
HIGH			7.						
AVERAGE			3.3						
STD.DEV.			3.2						
PERCNT:10TH									
25TH									
MEDIAN 50TH			2.						
75TH									
90TH									
SECONDARY CODE			07L						

STATION 00AL05BJ1760 LAT. 51D 2M 0S LONG. 114D 18M 10S PR 3 UTM 11 689100E 5656750N FOR JUN 07, 1989 TO MAY 28, 1990
SPRINGBANK CREEK NEAR THE MOUTH
JUNE 1989

	SUBM ID	07602L NITROGEN DISSOLVED N MG/L	07505L NITROGEN TOTAL AMMONIA N MG/L	07562L NITROGEN DISSOLVED AMMONIA N MG/L	07110L NITROGEN DISSOLVED NO3 & NO2 N MG/L	07015L NITROGEN TOTAL KJELDAHL N MG/L	15103L PHOSPHORUS DISSOLVED P MG/L	15406L PHOSPHORUS TOTAL P MG/L	15901L PHOSPHORUS PARTICULATE (CALCD.) P MG/L
SAMPLES(FLAGS)							2(0)	2(0)	2(0)
LOW							.016	.017	.001
HIGH							.058	.069	.011
AVERAGE							.037	.043	.006
STD.DEV.							.030	.037	.007
PERCNT:10TH									
25TH									
MEDIAN 50TH							.037	.043	.006
75TH									
90TH									
SECONDARY CODE							05L	21L	

	SUBM ID	26304L IRON EXTRBLE. FE MG/L	10401L RESIDUE NONFILTR. MG/L	02074L TURBIDITY NTU	00201L TOTAL DISSOLVED SOLIDS (CALCD.) MG/L	00205L TOTAL DISSOLVED SOLIDS MG/L	14102L SILICA REACTIVE SIO2 MG/L	10451L RESIDUE FILTERABLE MG/L	13303L ALUMINUM EXTRBLE. AL MG/L
SAMPLES(FLAGS)			2(0)						
LOW			2.						
HIGH			2.						
AVERAGE			2.0						
STD.DEV.			.0						
PERCNT:10TH									
25TH									
MEDIAN 50TH			2.0						
75TH									
90TH									
SECONDARY CODE			07L						

Appendix III: Elbow River herbicide/pesticide priority pollutants.

ORGANONITROGEN PESTICIDES

NAQUADAT CODE	COMPOUND	DETECTION LIMIT (mg/L^{-1})
94023	Atrazine	1.00
94024	Matacil^{R} (Aminocarb)	100.00
93030	Bromacil (Isocil)	0.05
93033	Dinitramine^{R} (Cobex^{R})	0.03
94025	Cyanazine	0.03
94026	Diazinon^{R}	0.50
93034	Dinoseb	0.15
93035	Metribuzin	0.03
94027	Prometryne	1.50
93036	Propanil	0.70
94028	Propazine	1.00
94029	Simazine	1.00
93031	Terbacil	0.10
93032	Trifluralin (Treflan^{R})	0.03

ORGANOPHOSPHORUS PESTICIDES

NAQUADAT CODE	COMPOUND	DETECTION LIMIT (mg/L^{-1})
94000	Aspon^{R}	0.50
94001	Crutomate (Ruelene^{R})	2.00
94002	Fensulfothion (Dasanit^{R})	4.00
94003	Dichlorovos (Vapona^{R}, DDVP^{R})	0.20
94004	DEF^{R}	0.05
94005	Demeton (Systox^{R})	7.00
95006	Dimethoate (Cygon^{R})	0.15
95007	Disulfoton (Di-Syston^{R})	25.00
95008	Ethion	0.05
95009	Fethion^{R}	1.25
95010	Fenitrothion	0.05
95011	Fonofos (Dyfonate^{R})	0.05
95012	Guthion^{R}	2.00
95013	Malathion^{R}	0.17
95014	Methyl Parathion	0.05
95015	Methyl Trithion^{R}	0.25
95016	Mevinphos^{R} (Phosdrin^{R})	0.20
95017	Mocap^{R}	0.15
95018	Paraoxon^{R}	0.10
95019	Parathion	0.06
95020	Phorate (Thimet^{R})	0.20
95021	Fenchlorphos^{R} (Ronnel)	0.10
95022	Tetrachlorovinphos (Gardona^{R})	0.03

Sampled: July 18/19, 1988 at: E/R at 9th Avenue Bridge, E/R at Sarcee Barracks Bridge, E/R d/s Glencoe Golf and Country Club, E/R at Highway 22, Glencoe inflow channel

Results: No Detections

Appendix III. (Cont'd.)

ORGANOCHLORINE PESTICIDE SCAN

NAQUADAT CODE	COMPOUND	DETECTION LIMIT (mg/L^{-1})
93000	Alachlor	0.040
93001	alpha-Chlordane	0.020
93002	y-Chlordane	0.005
93003	Captan	0.150
93004	Dacthal^{R} (Chlorthal Methyl)	0.010
93005	o,p'-DDD	0.010
93006	p,p'-DDD	0.010
93007	o,p'-DDE	0.010
93008	p,p'-DDE	0.010
93009	o,p'-DDT	0.020
93010	p,p'-DDT	0.020
93011	Diallate (Avadex^{R})	0.800
93012	Dieldrin	0.010
93013	Dursban^{R} (Lorsban^{R}, Chloropyrifos)	0.012
93014	alpha-Endosulfan	0.010
93015	beta-Endosulfan	0.010
93016	Endrin	0.010
93017	Heptachlor	0.010
93018	Heptachlor epoxide	0.010
93019	Hexachlorobenzene (HCB)	0.005
93020	alpha-Hexachlorocyclohexane	0.010
93021	beta-Hexachlorocyclohexane	0.010
93022	y-Hexachlorocyclohexane (Lindane)	0.010
93023	delta-Hexachlorocyclohexane	0.010
93024	Methoxychlor	0.030
93025	Mirex	0.020
93026	Perthane^{R}	0.250
93027	Ramrod^{R} (Propachlor)	0.100
93028	Triallate (Avadex BW^{R})	0.040

Sampled: July 18/19, 1988 at: E/R at 9th Avenue Bridge, E/R at Sarcee Barracks Bridge, E/R d/s Glencoe Golf and Country Club, E/R at Highway 22, Glencoe inflow channel

Results: No Detections

Appendix III. (Cont'd.)

CHLORINATED HERBICIDE ACIDS SCAN

NAQUADAT CODE	COMPOUND	DETECTION LIMIT (mg/L^{-1})
93037	2,4-D	0.20
93038	2,4,5-T	0.20
93039	Pichloram (Tordon^{R})	0.30
93040	Diclofop-methyl (Hoe Grass^{R})	0.20
93041	Dicamba (Banvel^{R})	0.20
93042	Silvex	0.30
93043	2,4-DB	0.30
93044	2,4-DP	0.20
N/A	MCPA	2.00

Sampled: July 18/19, 1988 at: E/R at 9th Avenue Bridge, E/R at Sarcee Barracks Bridge, E/R d/s Glencoe Golf and Country Club, E/R at Highway 22, Glencoe inflow channel

Results: No Detections

N/A	*Carbaryl	0.20
N/A	*Carbofuran	1.0
N/A	Chloropyrifos	0.02
N/A	Dimethoate	0.15
N/A	Lindane	0.01
N/A	Malathion	0.17
N/A	Simazine	1.00
N/A	Trifluralin	0.03
N/A	Atrazine	1.0
N/A	Bromacil	0.05
N/A	Bromoxynil	0.20
N/A	Dicamba	0.20
N/A	MCPA	0.20
N/A	Picloram	0.30
N/A	Triallate	0.04
N/A	2,4-D	0.20

Sampled: Sept. 20, 1988 at: E/R at Highway 22

Sampled: Sept. 21, 1988 at: Glencoe Creek (near mouth), E/R at Sarcee Barracks Bridge, E/R at 9th Avenue Bridge.

* Also sampled on June 18/19, 1988 at Glencoe inflow channel, E/R at 9th Avenue Bridge, E/R at Sarcee Barracks Bridge, E/R d/s Glencoe Golf and Country Club, E/R at Highway 22

Results: No Detections

Appendix III. (Cont'd.)

ORGANIC ANALYSIS

NAQUADAT CODE	COMPOUND	DETECTION LIMIT ($\mu g/L^{-1}$)
95000	Benzoic Acid	2.0
95001	4-Chloro-3-Methylphenol	1.0
95002	2-Chlorophenol	2.0
95003	2,4-Dichlorophenol	1.0
95004	2,4-Dimethylphenol	2.0
95005	2-Methyl-4,6-Dinitrophenol	1.0
95006	2,4-Dinitrophenol	1.0
95007	Hexadecanoic Acid	3.0
95008	2-Nitrophenol	1.0
95009	4-Nitrophenol	1.0
95010	Pentachlorophenol	1.0
95011	Phenol	1.0
95012	2,4,5-Trichlorophenol	1.0
95013	2,4,6-Trichlorophenol	1.0
95014	Acenaphthene	1.0
95015	Acenaphthylene	1.0
95016	Anthracene	1.0
95017	Benzo(a)Anthracene	1.0
95018	Benzo(k)Fluoranthene	1.0
95019	Benzo(ghi)Perylene	2.0
95020	Benzo(a)Pyrene	1.0
95021	Chrysene	1.0
95022	Dibenzo(ah)Anthracene	5.0
95023	Fluoranthene	1.0
95024	Fluorene	1.0
95025	Indeno(1,2,3-cd)Pyrene	1.0
95026	Naphthalene	1.0
95027	Perylene	1.0
95028	Phenanthrene	1.0
95029	Pyrene	1.0
95030	Isophorone	1.0
95031	Benzo(b)Fluoranthene	1.0
95032	2-Chloronaphthalene	1.0
95033	Hexachlorobenzene	1.0
95034	Hexachlorobutadiene	5.0
95035	Hexachlorocyclopentadiene	1.0
95036	Hexachloroethane	5.0
95037	1,2,4-Trichlorobenzene	1.0
95038	Benzidine	2.0
95039	2,4-Dinitrotoluene	1.0
95040	2,6-Dinitrotoluene	1.0
95041	1,2-Diphenylhydrazine	1.0
95042	Nitrobenzene	1.0
95043	n-Nitrosodiphenylamine	1.0
95044	n-Nitroso-di-n-Propylamine	2.0
95045	4-Bromophenyl Phenyl Ether	1.0
95046	Bis(2-Chloroethoxy)Methane	1.0
95047	Bis(2-Chloroethyl)Ether	1.0
95048	Bis(2-Chloroisopropyl)Ether	1.0
95049	4-Chlorophenyl Phenyl Ether	1.0
95050	Butylbenzylphthalate	1.0
95051	Dibutylphthalate	1.0
95052	Diethylphthalate	1.0
95053	Dimethylphthalate	1.0
95054	Di-n-Octylphthalate	1.0
95055	Bis(2-Ethylhexyl)Phthalate	1.0

Results: Detections

95055	Bis(2-Ethylhexyl)Phthalate	E/R at 9th Avenue Bridge 07/19/88	1.0
95055	Bis(2-Ethylhexyl)Phthalate	E/R at Sarcee Barracks Bridge (07/19/88)	1.0
95055	Bis(2-Ethylhexyl)Phthalate	E/R at Highway 22 (07/18/88)	6.0
95055	Bis(2-Ethylhexyl)Phthalate	E/R at Glencoe GC (07/18/88)	2.0
95055	Bis(2-Ethylhexyl)Phthalate	Glencoe inflow channel (07/19/88)	3.0

Appendix IV. Tributary load as a percentage of upstream Elbow River load.

MAY 18

VARIABLE	E/R AT ALLEN BILL POND	MCLEAN CREEK	BRAGG CREEK	E/R U/S TWIN BRIDGES	LOTT CREEK
Flow	8.12	0.046	0.176	9.75	0.330
Alkalinity	122.0	177.0	160.0	137.0	169.0
Hardness	171.2	161.3	152.8	185.0	226.2
TDS	197.0	197.0	181.0	216.0	255.0
Ca	46.4	52.0	44.0	49.3	62.0
Mg	13.4	12.4	10.4	15.0	17.3
Na	1.0	6.0	8.3	2.0	4.0
K	0.35	1.17	1.1	0.55	0.88
HCO_3	135.0	200.0	180.0	156.0	206.0
Cl	0.8	4.0	3.2	1.5	2.9
SO_4	58.0	15.5	12.6	61.2	63.2
Fl	0.31	0.16	0.13	0.32	0.28
Si	4.15	4.95	6.2	4.46	3.46
TON	0.090	0.340	0.260	0.150	0.230
NH_4	0.010	0.020	0.020	0.010	0.010
NO_2+NO_3-N	0.107	0.043	0.023	0.065	L0.003
TKN	0.100	0.360	0.280	0.160	0.240
TN	0.207	0.403	0.303	0.225	0.243
DP	L0.003	0.005	0.004	0.003	0.008
PP	0.000	0.006	0.006	0.005	0.012
TP	0.003	0.011	0.010	0.008	0.020
TCOL (#/100 mL)	L4.0	100.0	280.0	4.0	12.0
FCOL (#/100 mL)	L4.0	100.0	148.0	4.0	12.0
Phenols	N/A	N/A	N/A	N/A	N/A
Al*	N/A	N/A	N/A	N/A	N/A
As	N/A	N/A	N/A	N/A	N/A
Ba*	N/A	N/A	N/A	N/A	N/A
Cr	N/A	N/A	N/A	N/A	N/A
Cu	N/A	N/A	N/A	N/A	N/A
Fe	N/A	N/A	N/A	N/A	N/A
Zn*	N/A	N/A	N/A	N/A	N/A
DOC	0.7	7.5	4.6	1.0	1.7
POC	0.1	0.3	0.2	0.2	0.1

NOTE: Samples taken near mouths of tributaries.

* Extractable

Appendix IV. (Cont'd.)

JUNE 7

VARIABLE	E/R AT ALLEN BILL POND	MCLEAN CREEK	BRAGG CREEK	E/R U/S TWIN BRIDGES	LOTT CREEK
Flow	14.3	0.114	0.248	19.0	0.345
Alkalinity	111.0	155.0	160.0	134.0	169.0
Hardness	143.0	161.3	158.3	181.8	233.7
TDS	152.0	175.0	183.0	201.0	258.0
Ca	39.4	44.1	44.2	50.0	65.0
Mg	10.8	12.4	11.6	13.8	17.3
Na	2.0	8.3	8.3	2.3	5.0
K	0.38	1.0	1.1	0.52	1.0
HCO_3	135.0	189.0	195.0	163.0	206.0
Cl	0.6	1.6	1.7	1.7	3.1
SO_4	29.2	14.8	10.9	47.2	61.0
Fl	0.20	0.15	0.11	0.28	0.26
Si	2.75	5.42	9.54	4.77	3.99
TON	0.290	0.550	0.450	0.310	0.250
NH_4	L0.010	0.010	0.010	0.010	0.030
NO_2+NO_3-N	0.135	0.016	0.018	0.070	0.051
TKN	0.300	0.560	0.460	0.320	0.280
TN	0.435	0.576	0.478	0.390	0.331
DP	0.005	0.007	0.006	0.003	0.018
PP	0.077	0.022	0.023	0.034	0.006
TP	0.082	0.029	0.029	0.037	0.024
TCOL (#/100 mL)	16.0	100.0	1200.0	L4.0	100.0
FCOL (#/100 mL)	L4.0	100.0	500.0	L4.0	36.0
Phenols	N/A	N/A	N/A	N/A	N/A
Al*	N/A	N/A	N/A	N/A	N/A
As	N/A	N/A	N/A	N/A	N/A
Ba*	N/A	N/A	N/A	N/A	N/A
Cr	N/A	N/A	N/A	N/A	N/A
Cu	N/A	N/A	N/A	N/A	N/A
Fe	N/A	N/A	N/A	N/A	N/A
Zn*	N/A	N/A	N/A	N/A	N/A
DOC	1.6	8.7	5.5	0.80	1.8
POC	0.2	0.3	0.1	0.20	0.40

NOTE: Samples taken near mouths of tributaries.

* Extractable

Appendix IV. (Cont'd.)

JUNE 27

VARIABLE	E/R AT ALLEN BILL POND	MCLEAN CREEK	BRAGG CREEK	E/R U/S TWIN BRIDGES	LOTT CREEK
Flow	8.21	0.021	0.062	12.2	0.346
Alkalinity	126.0	208.0	198.0	141.0	167.0
Hardness	170.6	213.3	189.6	180.8	213.7
TDS	189.0	228.0	217.0	203.0	244.0
Ca	47.0	62.1	55.1	50.1	59.8
Mg	12.9	14.1	12.6	13.5	15.6
Na	1.3	6.3	8.5	2.0	3.5
K	0.4	1.1	1.6	0.55	0.85
HCO_3	141.0	254.0	241.0	172.0	204.0
Cl	0.7	2.7	2.4	1.0	1.8
SO_4	47.1	10.8	8.5	46.9	57.8
Fl	0.28	0.15	0.14	0.30	0.26
Si	4.08	6.41	9.22	4.56	4.54
TON	0.390	0.740	0.700	0.150	0.620
NH_4	L0.010	0.010	0.020	0.030	0.020
NO_2+NO_3-N	0.081	0.064	0.077	0.040	0.018
TKN	0.400	0.760	0.720	0.180	0.640
TN	0.481	0.824	0.797	0.220	0.658
DP	L0.003	0.005	0.005	L0.003	0.017
PP	0.00	0.003	0.007	0.000	0.010
TP	L0.003	0.008	0.012	L0.003	0.027
TCOL (#/100 mL)	L4.0	430.0	630.0	92.0	64.0
FCOL (#/100 mL)	L4.0	290.0	90.0	16.0	40.0
Phenols	0.002	0.003	0.002	0.004	0.006
Al*	L0.010	0.010	0.020	0.020	0.01
As	0.0002	0.0004	0.0005	L0.0002	0.003
Ba*	0.040	0.270	0.180	0.060	0.080
Cr	L0.001	L0.001	0.001	L0.001	L0.001
Cu	0.002	L0.001	L0.001	0.002	L0.001
Fe	0.01	0.12	0.16	0.02	0.13
Zn*	0.025	0.023	0.003	0.002	0.008
DOC	0.8	8.2	5.6	0.8	1.8
POC	0.2	0.3	0.4	0.2	0.4

NOTE: Samples taken near mouths of tributaries.

* Extractable

Appendix IV. (Cont'd.)

JULY 26

VARIABLE	E/R AT ALLEN BILL POND	MCLEAN CREEK	BRAGG CREEK	E/R U/S TWIN BRIDGES	LOTT CREEK
Flow	5.61	0.008	0.038	9.02	0.317
Alkalinity	122.0	231.0	211.0	145.0	173.0
Hardness	182.4	238.3	201.8	197.7	223.3
TDS	198.0	252.0	230.0	214.0	247.0
Ca	50.3	68.3	59.3	55.7	62.8
Mg	13.8	16.4	13.0	14.2	16.1
Na	1.5	6.5	9.0	2.0	3.5
K	0.65	1.25	1.8	0.52	0.95
HCO_3	149.0	282.0	257.0	177.0	211.0
Cl	0.8	6.4	5.2	1.4	2.4
SO_4	53.4	7.2	6.6	51.4	53.7
Fl	0.34	0.19	0.16	0.31	0.32
Si	4.10	7.16	8.2	1.98	4.11
TON	0.090	0.230	0.390	0.110	0.180
NH_4	L0.010	0.010	0.010	0.010	0.060
NO_2+NO_3-N	0.072	0.104	0.111	0.017	L0.003
TKN	0.100	0.240	0.400	0.120	0.240
TN	0.172	0.344	0.511	0.137	0.243
DP	0.003	0.007	0.008	0.003	0.016
PP	0.002	0.003	0.005	0.001	0.013
TP	0.005	0.010	0.013	0.004	0.029
TCOL (#/100 mL)	4.0	20.0	56.0	20.0	128.0
FCOL (#/100 mL)	4.0	16.0	24.0	8.0	32.0
Phenols	N/A	N/A	N/A	N/A	N/A
Al*	N/A	N/A	N/A	N/A	N/A
As	N/A	N/A	N/A	N/A	N/A
Ba*	N/A	N/A	N/A	N/A	N/A
Cr	N/A	N/A	N/A	N/A	N/A
Cu	N/A	N/A	N/A	N/A	N/A
Fe	N/A	N/A	N/A	N/A	N/A
Zn*	N/A	N/A	N/A	N/A	N/A
DOC	0.20	4.2	4.6	1.4	2.0
POC	0.00	0.2	0.4	0.1	0.6

NOTE: Samples taken near mouths of tributaries.

* Extractable

Appendix IV. (Cont'd.)

AUGUST 9/10

VARIABLE	E/R AT ALLEN BILL POND	MCLEAN CREEK	BRAGG CREEK	E/R U/S TWIN BRIDGES	LOTT CREEK
Flow	10.1	0.044	0.24	6.51	0.351
Alkalinity	125.0	186.0	134.0	146.0	178.0
Hardness	171.5	183.3	130.2	191.8	217.0
TDS	185.0	207.0	156.0	209.0	246.0
Ca	48.0	52.4	38.1	54.5	61.1
Mg	12.5	12.7	8.5	13.5	15.6
Na	1.5	6.5	6.0	2.0	4.0
K	0.4	1.05	1.1	0.6	1.0
HCO_3	152.0	227.0	163.0	178.0	217.0
Cl	0.5	3.5	6.6	1.1	2.2
SO_4	43.1	11.5	7.7	44.7	51.2
Fl	0.30	0.16	0.12	0.30	0.28
Si	4.19	7.29	7.94	4.59	4.49
TON	0.170	0.420	0.540	0.090	2.00
NH_4	L0.010	0.020	0.020	L0.010	0.20
NO_2+NO_3-N	0.079	0.015	0.021	0.041	0.031
TKN	0.180	0.440	0.560	0.100	0.220
TN	0.259	0.455	0.581	0.141	2.51
DP	0.003	0.008	0.006	L0.003	0.016
PP	0.001	0.008	0.010	0.001	0.005
TP	0.004	0.016	0.016	0.004	0.021
TCOL (#/100 mL)	20.0	230.0	530.0	70.0	156.0
FCOL (#/100 mL)	4.0	190.0	120.0	14.0	128.0
Phenols	N/A	N/A	N/A	N/A	N/A
Al*	N/A	N/A	N/A	N/A	N/A
As	N/A	N/A	N/A	N/A	N/A
Ba*	N/A	N/A	N/A	N/A	N/A
Cr	N/A	N/A	N/A	N/A	N/A
Cu	N/A	N/A	N/A	N/A	N/A
Fe	N/A	N/A	N/A	N/A	N/A
Zn*	N/A	N/A	N/A	N/A	N/A
DOC	L0.10	9.0	7.3	L0.1	1.5
POC	0.00	0.4	0.3	L0.1	0.1

NOTE: Samples taken near mouths of tributaries.

* Extractable

Appendix IV. (Cont'd.)

AUGUST 30

VARIABLE	E/R AT ALLEN BILL POND	MCLEAN CREEK	BRAGG CREEK	E/R U/S TWIN BRIDGES	LOTT CREEK
Flow	8.34	0.039	0.153	12.2	0.352
Alkalinity	130.0	153.0	160.0	152.0	177.0
Hardness	187.8	167.0	161.6	189.0	208.0
TDS	199.0	179.0	180.0	213.3	239.7
Ca	52.9	48.7	47.7	51.9	56.2
Mg	13.5	11.0	10.3	14.4	16.4
Na	1.3	6.0	7.3	2.0	3.8
K	0.41	0.90	1.2	0.6	1.1
HCO_3	158.0	187.0	195.0	185.3	215.8
Cl	0.4	2.7	2.4	1.0	2.0
SO_4	48.1	11.0	6.9	47.2	49.1
Fl	0.29	0.15	0.10	0.3	0.3
Si	4.20	7.15	7.70	4.6	4.40
TON	0.090	0.400	0.270	0.11	0.16
NH_4	L0.010	0.020	0.010	0.01	0.02
NO_2+NO_3-N	0.069	0.019	0.021	0.026	0.037
TKN	0.100	0.420	0.280	0.12	0.18
TN	0.169	0.439	0.301	0.15	0.22
DP	L0.003	0.009	0.005	0.003	0.016
PP	0.002	0.006	0.005	0.001	0.010
TP	0.005	0.015	0.010	0.004	0.026
TCOL (#/100 mL)	16.0	124.0	152.0	18.0	168.0
FCOL (#/100 mL)	4.0	88.0	28.0	4.0	100.0
Phenols	L0.001	0.001	0.001	0.001	0.001
Al*	L0.010	L0.010	0.010	L0.01	L0.01
As	L0.0002	L0.0002	L0.0002	0.0008	0.0002
Ba*	0.040	0.180	0.150	0.06	0.09
Cr	L0.001	L0.001	L0.001	L0.001	L0.001
Cu	0.002	L0.001	0.001	L0.001	L0.001
Fe	0.03	0.28	0.23	0.03	0.12
Zn*	0.025	0.010	L0.001	N/A	0.94
DOC	0.60	9.75	5.55	1.3	1.6
POC	0.65	0.25	0.10	0.1	0.4

NOTE: Samples taken near mouths of tributaries.

* Extractable

Appendix IV. (Cont'd.)

SEPTEMBER 20

VARIABLE	E/R AT ALLEN BILL POND	MCLEAN CREEK	BRAGG CREEK	E/R U/S TWIN BRIDGES	LOTT CREEK
Flow	6.68	0.088	0.341	8.12	0.318
Alkalinity	135.0	161.0	158.0	156.0	183.0
Hardness	187.9	163.3	149.5	197.4	292.9
TDS	205.0	182.0	172.0	218.0	237.8
Ca	52.1	46.4	43.5	53.6	53.0
Mg	14.0	11.5	9.9	15.4	17.1
Na	1.5	6.0	6.8	2.3	3.8
K	0.45	0.90	1.0	0.62	1.2
HCO_3	165.0	196.0	193.0	190.2	223.1
Cl	0.6	1.7	2.1	1.1	1.8
SO_4	51.4	10.1	5.9	46.1	45.2
Fl	0.31	0.16	0.12	0.3	0.28
Si	4.40	8.30	8.2	4.8	5.20
TON	0.090	0.500	0.310	0.11	0.00
NH_4	L0.010	0.020	0.010	L0.01	0.05
NO_2+NO_3-N	0.078	0.014	0.016	0.031	0.087
TKN	0.100	0.520	0.320	0.12	0.05
TN	0.178	0.534	0.336	0.15	0.35
DP	L0.003	0.011	0.004	L0.003	0.014
PP	0.004	0.017	0.013	0.000	0.011
TP	0.007	0.028	0.017	0.003	0.025
TCOL (#/100 mL)	L4.0	100.0	156.0	88.0	600.0
FCOL (#/100 mL)	L4.0	44.0	48.0	2.0	108.0
Phenols	N/A	N/A	N/A	N/A	N/A
Al*	N/A	N/A	N/A	N/A	N/A
As	N/A	N/A	N/A	N/A	N/A
Ba*	N/A	N/A	N/A	N/A	N/A
Cr	N/A	N/A	N/A	N/A	N/A
Cu	N/A	N/A	N/A	N/A	N/A
Fe	N/A	N/A	N/A	N/A	N/A
Zn*	N/A	N/A	N/A	N/A	N/A
DOC	1.5	9.6	5.0	1.6	2.3
POC	0.1	0.0	0.1	0.4	0.0

NOTE: Samples taken near mouths of tributaries.

* Extractable

Appendix IV. (Cont'd.)

OCTOBER 11/12

VARIABLE	E/R AT ALLEN BILL POND	MCLEAN CREEK	BRAGG CREEK	E/R U/S TWIN BRIDGES	LOTT CREEK
Flow	6.00	0.029	0.151	6.09	0.313
Alkalinity	134.0	182.0	157.0	159.0	186.0
Hardness	189.6	186.9	155.9	201.4	230.1
TDS	210.1	205.6	176.6	221.9	249.6
Ca	52.3	54.0	45.4	56.2	64.7
Mg	14.3	12.6	10.3	14.8	16.6
Na	1.5	6.3	6.9	2.25	3.5
K	0.2	0.75	0.89	0.5	1.0
HCO_3	163.3	221.9	191.4	193.8	226.7
Cl	0.4	2.9	2.20	0.9	1.3
SO_4	56.1	11.9	8.4	46.9	44.7
Fl	0.3	0.14	0.11	0.31	0.3
Si	4.26	7.70	8.07	4.5	5.55
TON	0.11	0.42	0.25	0.09	0.21
NH_4	0.01	0.02	0.01	L0.01	0.07
NO_2+NO_3-N	0.080	0.036	0.025	0.029	0.082
TKN	0.12	0.44	0.26	0.10	0.28
TN	0.20	0.48	0.29	0.13	0.36
DP	L0.003	0.007	0.003	L0.003	0.014
PP	0.000	0.004	0.003	0.000	0.012
TP	0.003	0.011	0.006	0.003	0.026
TCOL (#/100 mL)	8.0	24.0	160.0	24.0	100.0
FCOL (#/100 mL)	L4.0	16.0	8.0	10.0	8.0
Phenols	L0.001	L0.001	0.001	L0.001	L0.001
Al*	L0.01	0.01	0.02	0.01	0.01
As	L0.0002	0.0006	0.0006	0.0002	0.0004
Ba*	0.04	0.21	0.14	0.06	0.09
Cr	0.002	L0.001	L0.001	L0.001	L0.001
Cu	L0.001	L0.001	L0.001	L0.001	L0.001
Fe	0.01	0.24	0.24	0.02	0.11
Zn*	L0.001	0.014	L0.001	L0.001	L0.001
DOC	1.2	9.3	6.6	1.6	2.1
POC	0.2	0.1	0.4	0.2	0.2

NOTE: Samples taken near mouths of tributaries.

* Extractable

Appendix IV. (Cont'd.)

NOVEMBER 1

VARIABLE	E/R AT ALLEN BILL POND	MCLEAN CREEK	BRAGG CREEK	E/R U/S TWIN BRIDGES	LOTT CREEK
Flow	5.40	0.026	0.123	4.93	0.329
Alkalinity	131.0	186.0	182.0	152.0	182.0
Hardness	205.4	192.7	196.0	222.9	244.6
TDS	238.1	213.4	209.7	253.7	276.8
Ca	56.3	56.0	52.8	62.5	68.7
Mg	15.7	12.8	15.6	16.2	17.7
Na	1.3	6.5	7.9	2.1	3.5
K	0.4	0.87	1.1	0.5	1.0
HCO_3	159.7	226.7	223.0	185.3	221.9
Cl	0.4	2.3	3.2	1.1	1.5
SO_4	80.5	15.4	11.5	75.0	68.5
Fl	0.34	0.14	0.11	0.3	0.28
Si	4.2	7.7	8.07	4.56	6.0
TON	0.11	0.35	0.23	0.13	0.16
NH_4	L0.01	0.01	0.01	L0.01	0.10
NO_2+NO_3-N	0.081	0.028	0.049	0.049	0.104
TKN	0.12	0.36	0.24	0.14	0.26
TN	0.20	0.39	0.29	0.19	0.36
DP	L0.003	0.006	L0.003	L0.003	0.011
PP	0.002	0.008	0.003	0.000	0.008
TP	0.005	0.014	0.006	L0.003	0.019
TCOL (#/100 mL)	L4.0	28.0	28.0	18.0	132.0
FCOL (#/100 mL)	L4.0	4.0	8.0	8.0	16.0
Phenols	N/A	N/A	N/A	N/A	N/A
Al*	N/A	N/A	N/A	N/A	N/A
As	N/A	N/A	N/A	N/A	N/A
Ba*	N/A	N/A	N/A	N/A	N/A
Cr	N/A	N/A	N/A	N/A	N/A
Cu	N/A	N/A	N/A	N/A	N/A
Fe	N/A	N/A	N/A	N/A	N/A
Zn*	N/A	N/A	N/A	N/A	N/A
DOC	L0.01	6.5	2.6	0.8	1.0
POC	L0.04	0.1	1.1	0.1	0.1

NOTE: Samples taken near mouths of tributaries.

* Extractable

Appendix IV. (Cont'd.)

DECEMBER 7

VARIABLE	E/R AT ALLEN BILL POND	MCLEAN CREEK	BRAGG CREEK	E/R U/S TWIN BRIDGES	LOTT CREEK
Flow	3.66	0.014	0.050	3.60	0.334
Alkalinity	131.0	234.0	219.0	151.0	178.0
Hardness	212.0	258.4	224.9	217.4	237.5
TDS	231.2	267.1	246.9	248.5	266.9
Ca	57.8	75.2	65.1	60.3	66.2
Mg	16.4	17.1	15.1	16.2	17.5
Na	1.4	6.8	8.9	2.4	3.5
K	0.35	0.95	1.09	0.7	0.97
HCO_3	159.7	285.2	267.0	184.1	217.0
Cl	0.50	4.1	3.7	1.4	1.90
SO_4	71.0	13.3	12.5	72.0	63.5
Fl	0.33	0.15	0.11	0.29	0.28
Si	4.34	8.56	8.50	4.30	5.8
TON	0.11	0.31	0.23	0.09	0.15
NH_4	L0.01	0.01	L0.01	L0.01	0.09
NO_2+NO_3-N	0.103	0.126	0.102	0.068	0.101
TKN	0.12	0.32	0.24	0.10	0.24
TN	0.22	0.45	0.34	0.17	0.34
DP	L0.003	0.007	0.004	L0.003	0.013
PP	0.000	0.008	0.005	0.001	0.005
TP	0.003	0.015	0.009	0.004	0.018
TCOL (#/100 mL)	L4.0	8.0	12.0	18.0	4.0
FCOL (#/100 mL)	L4.0	8.0	4.0	18.0	L4.0
Phenols	0.001	0.001	L0.001	L0.001	L0.001
Al*	L0.01	L0.01	L0.01	0.03	0.02
As	0.0002	0.0004	0.0006	L0.0002	0.0003
Ba*	0.04	0.31	0.17	0.06	0.10
Cr	L0.001	L0.001	L0.001	L0.001	L0.001
Cu	L0.001	L0.001	L0.001	L0.001	L0.001
Fe	0.03	0.12	0.17	0.05	0.04
Zn*	L0.001	0.020	L0.001	L0.001	L0.001
DOC	0.7	4.7	2.5	0.7	0.4
POC	0.2	0.4	0.5	0.3	0.6

NOTE: Samples taken near mouths of tributaries.

* Extractable

Appendix IV. (Cont'd.)

JANUARY 3-5

VARIABLE	E/R AT ALLEN BILL POND	MCLEAN CREEK	BRAGG CREEK	E/R U/S TWIN BRIDGES	LOTT CREEK
Flow	3.1	0.006	0.03	2.38	0.349
Alkalinity	129.0	276.0	234.0	179.0	169.0
Hardness	210.3	300.7	253.9	270.7	237.7
TDS	235.2	305.5	275.1	296.3	250.4
Ca	57.1	89.0	73.9	75.2	66.6
Mg	16.4	19.0	16.8	20.1	17.3
Na	1.5	6.2	10.7	2.7	3.5
K	0.43	1.1	1.58	0.81	0.95
HCO_3	157.3	336.0	285.0	218.2	206.0
Cl	0.50	5.6	6.5	1.7	1.7
SO_4	77.0	10.2	15.1	82.5	54.1
Fl	0.33	0.15	0.12	0.31	0.27
Si	4.05	7.65	9.10	5.24	4.07
TON	0.07	0.19	0.19	0.07	0.20
NH_4	L0.01	L0.01	L0.01	L0.01	0.10
NO_2+NO_3-N	0.106	0.230	0.210	0.072	0.112
TKN	0.08	0.20	0.20	0.08	0.30
TN	0.19	0.43	0.41	0.15	0.41
DP	L0.003	0.003	0.003	L0.003	0.012
PP	0.000	0.001	0.001	0.000	0.004
TP	L0.003	0.004	0.004	0.003	0.016
TCOL (#/100 mL)	L4.0	L4.0	8.0	22.0	164.0
FCOL (#/100 mL)	L4.0	L4.0	L4.0	6.0	4.0
Phenols	N/A	N/A	N/A	N/A	N/A
Al*	N/A	N/A	N/A	N/A	N/A
As	N/A	N/A	N/A	N/A	N/A
Ba*	N/A	N/A	N/A	N/A	N/A
Cr	N/A	N/A	N/A	N/A	N/A
Cu	N/A	N/A	N/A	N/A	N/A
Fe	N/A	N/A	N/A	N/A	N/A
Zn*	N/A	N/A	N/A	N/A	N/A
DOC	1.1	3.8	3.1	1.3	1.7
POC	0.1	0.0	0.4	0.1	0.1

NOTE: Samples taken near mouths of tributaries.

* Extractable

Appendix IV. (Cont'd.)

FEBRUARY 8

VARIABLE	E/R AT ALLEN BILL POND	MCLEAN CREEK	BRAGG CREEK	E/R U/S TWIN BRIDGES	LOTT CREEK
Flow	1.93	0.003	0.02	2.09	0.300
Alkalinity	138.0	295.0	239.0	172.0	178.0
Hardness	230.3	277.0	251.3	257.9	251.4
TDS	250.6	309.7	281.5	280.8	274.6
Ca	63.3	79.2	73.2	72.7	71.1
Mg	17.5	19.2	16.6	18.5	17.9
Na	1.6	6.0	10.6	2.7	3.3
K	0.42	1.07	1.76	0.6	0.96
HCO_3	168.2	359.0	291.3	209.7	217.0
Cl	0.6	6.40	6.70	2.00	2.00
SO_4	79.0	11.4	18.8	75.5	65.5
Fl	0.39	0.14	0.12	0.33	0.31
Si	4.50	8.0	9.1	4.80	6.20
TON	0.09	0.19	0.29	0.11	0.20
NH_4	L0.01	L0.01	L0.01	L0.01	0.08
NO_2+NO_3-N	0.118	0.288	0.284	0.104	0.12
TKN	0.10	0.20	0.30	0.12	0.28
TN	0.22	0.49	0.58	0.22	0.40
DP	L0.003	0.003	0.003	L0.003	0.009
PP	0.000	0.001	0.002	0.000	0.008
TP	L0.003	0.004	0.005	L0.003	0.017
TCOL (#/100 mL)	L4.0	L4.0	10.0	4.0	120.0
FCOL (#/100 mL)	L4.0	L4.0	10.0	4.0	92.0
Phenols	0.001	0.001	0.001	L0.001	0.002
Al*	0.01	0.01	0.01	L0.01	0.03
As	0.0002	0.0003	0.0003	L0.0002	0.0003
Ba*	0.05	0.49	0.19	0.07	0.10
Cr	0.001	0.002	L0.001	0.001	L0.001
Cu	L0.001	L0.001	0.001	L0.001	0.001
Fe	0.01	0.06	0.07	0.01	0.11
Zn*	0.001	0.19	0.001	0.001	0.001
DOC	0.8	2.7	3.3	1.1	1.0
POC	0.2	0.1	0.5	0.2	0.2

NOTE: Samples taken near mouths of tributaries.

* Extractable

Appendix IV. (Cont'd.)

MARCH 8

VARIABLE	E/R AT ALLEN BILL POND	MCLEAN CREEK	BRAGG CREEK	E/R U/S TWIN BRIDGES	LOTT CREEK
Flow	N/A	N/A	N/A	261	N/A
Alkalinity	133.0	307.0	246.0	153.0	171.0
Hardness	210.0	306.1	233.4	219.0	225.8
TDS	239.2	328.4	277.4	249.6	258.6
Ca	57.5	90.5	67.0	61.0	62.0
Mg	16.1	19.4	16.0	16.1	17.2
Na	1.6	6.2	11.2	2.4	3.2
K	0.38	1.07	1.6	0.5	0.8
HCO_3	162.0	374.2	300.0	187.0	208.4
Cl	0.70	8.0	6.4	1.7	2.0
SO_4	78.0	10.5	18.5	71.0	65.5
Fl	0.39	0.16	0.12	0.31	0.27
Si	4.3	7.16	8.95	4.35	5.0
TON	0.09	0.21	0.23	0.15	0.23
NH_4	L0.01	L0.01	0.01	L0.01	0.01
NO_2+NO_3-N	0.105	0.28	0.24	0.095	0.074
TKN	0.10	0.22	0.24	0.16	0.24
TN	0.20	0.50	0.48	0.26	0.31
DP	L0.003	0.003	0.004	L0.003	L0.003
PP	0.001	0.002	0.002	0.000	0.001
TP	0.004	0.005	0.006	L0.003	0.004
TCOL (#/100 mL)	L4.0	L4.0	8.0	10.0	164.0
FCOL (#/100 mL)	L4.0	L4.0	4.0	8.0	60.0
Phenols	N/A	N/A	N/A	N/A	N/A
Al*	N/A	N/A	N/A	N/A	N/A
As	N/A	N/A	N/A	N/A	N/A
Ba*	N/A	N/A	N/A	N/A	N/A
Cr	N/A	N/A	N/A	N/A	N/A
Cu	N/A	N/A	N/A	N/A	N/A
Fe	N/A	N/A	N/A	N/A	N/A
Zn*	N/A	N/A	N/A	N/A	N/A
DOC	1.1	1.9	3.2	0.8	2.1
POC	0.1	0.2	0.1	0.1	0.1

NOTE: Samples taken near mouths of tributaries.

* Extractable