MACKENZIE RIVER BASIN STUDY PROGRAM
1978-81

HYDROLOGIC SYSTEMS

SUMMARY OF AVAILABLE WATER QUALITY INFORMATION 1979

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Prepared by

Water Quality Branch
Inland Waters Directorate
Environmental Management Service
Environment Canada

Ottawa, Ontario
September, 1979

SYNOPSIS

The following report is a summary of the water quality information available for the Mackenzie River Basin. In the preparation of this report the Water Quality Branch collected, assessed, tabulated and described the water quality data provided by both government and private agencies. The availability of data to describe the influence of existing and proposed developments was discussed. Present and possible future data gaps were highlighted.

Included in the report are recommendations for future action.

LETTER OF TRANSMITTAL

September 14, 1979

G.H. Morton
Regional Chief
Alberta/NWT District
Water Survey of Canada
Inland Waters Directorate
Western and Northern Region
Calgary, Alberta
T2G 4X3

Dear Mr. Morton:

As part of the Mackenzie River Basin Study Program 1978-81, it is my pleasure to provide the Hydrologic System Advisory Group with a completed report in response to Schedule A, Phase I of the Letter of Agreement between yourself and K.W. Reid signed February 7 and 12, 1979 respectively. This report summarizes and describes all the currently available water quality data pertaining to the Mackenzie River Basin.

Although the report was planned, organized and produced by the Water Quality Branch, it could not have been completed without the help of both federal and provincial government agencies and representatives from the private sector. I would particularly like to acknowledge the cooperation of Dr. G.J. Brunskill, Fisheries and Marine Service, Dr. M.J.R. Clark, Pollution Control Branch, British Columbia Ministry of Environment, J.N. Jasper, Department of Indian and Northern Affairs, Dr. A. Masuda, Water Quality Control Branch, Alberta Ministry of Environment. I would also like to acknowledge the contributions made by the following persons from the Water Quality Branch: D.L. Egar, project coordinator, J.H. Temple and E.R. Watt, authors, M.E. Lamb and G.L. Miller, computer programming, H. Block, information and advice, M.S. Kelley, table compilations and report preparation and B.G. McMillan for providing secretarial expertise.

Yours sincerely

W.J. Traversy
Chief, Monitoring and Surveys Division

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CHAPTER I

INTRODUCTION

The update of the water quality section of the Mackenzie Basin Reference Binder began in April 1979. Requests for data, along with a questionnaire were sent out to all provincial agencies, and private and public companies known to have taken water samples within the Mackenzie River drainage basin. The major bulk of the data processed had either federal or provincial government origins while data from non-government sources were often effluent oriented or of a one sample only nature.

A. Report Preparation

The data contained in the bar charts for each sub-basin of the Mackenzie River Basin were reviewed in accordance to information obtained from an April 1979 NAQUADAT retrieval, Department of Indian and Northern Affairs (DINA), Alberta and British Columbia governments and personal communications. Periods of record presented in the Mackenzie Basin Reference Binder were updated and in some cases corrected and all stations having two samples or less on record were deleted. Some stations with three samples were omitted on the basis of subjective decision.

Personal communication concerning the DINA data indicated that most of the historical data on record before the creation of the Water

Resources Branch (pre-1972) were collected by various agencies and very little is known about the rationale for collection or the quality of the sample or its analysis. Since there is a significant quantity of data on the historical record, it should be considered as valuable until proven otherwise. Stations with very few samples or a short period of record have been deleted; however, stations with significant sample numbers and period of record may also have been selectively eliminated.

Individual stations provided by each contributor, on the basis of their geographical location, were assigned to one of the following sub-basins which compose the Mackenzie River Drainage Basin:

Sub-basin 1 - Athabasca River Drainage
2 - Peace River
3 - Liard River
4 - Hay River
5 - Great Slave Lake Drainage
6 - Great Bear Lake Drainage
7 - Mackenzie River

The addition and deletion of stations within each sub-basin necessitated the renumbering of the sub-basin maps which appeared in the Reference Binder. The number of each sub-basin began at the headwaters of the main stem and continued consecutively towards the mouth of the river. Similarly, the numbering continued on the next closest tributary to the headwaters until all station locations were numbered.

B. Tables

The information pretaining to each individual sub-basin has been presented in a tabular format, with the following titles:

Map Stn. No.: - Assigned as previously described; the consecutive numbering of each station in the sub-basin.

1. Contributor Station Number: Alphanumeric entries correspond to the NAQUADAT and the Alberta Government station lists. Stations submitted by the British Columbia Ministry of Environment, Pollution Control Branch, are designated by seven digit numbers, while some DINA stations not found on NAQUADAT have been designated by one or two digit numbers.

2. Station Description: An abridged version of data file descriptions.

3. Contributor: Letter abbreviations to indicate the supplier of data as follows:

W.Q.B.	Water Quality Branch, D.O.E. NAQUADAT data files
DINA	Department of Indian and Northern Affairs (Data taken from W.Q.B. NAQUADAT data storage as well as contribution from DINA)
F.W.I.	Freshwater Institute (from NAQUADAT data files)
F & M	Fisheries and Marine Service (from NAQUADAT data files)
SASK.	Saskatchewan Ministry of Environment (from NAQUADAT data files)
B.C.	British Columbia Ministry of Environment, Water Resources Services, Pollution Control Branch, E.Q.U.I.S. computer data storage files.

C. Data Contributors and Availability of Data

1. Water Quality Branch, Inland Waters Directorate, Department of Environment: All Water Quality Branch data as well as the data collected during a number of special studies are stored on the NAQUADAT data storage and retrieval system in Ottawa.

2. Pollution Control Branch, Water Resources Services, British Columbia Ministry of Environment: Data collected by various agencies, both government and non-government, are stored on the Pollution Control Branch data storage and retrieval system known as E.Q.U.I.S. The major contributor to the file is the Water Investigation Branch which has conducted environmental studies including the monitoring of domestic water supplies and studying the effects of industrial and municipal waste disposal on receiving waters in the Peace River system.

3. Alberta Ministry of Environment: Data collected by the Alberta Ministry of Environment are stored on a data storage and retrieval system in Edmonton. Most of the historical data on file were collected to determine the affect of industrial effluent on receiving streams. Sampling was carried out during winter when flows are low; consequently, the various constituents would be at their greatest. Therefore, the data are, in general, seasonal in nature, but the number of samples and period of record warranted their inclusion in the report. The historical stations have been abandoned in favour of a limited Trend Determination Network on a few major streams.

4. Department of Indian and Northern Affairs (DINA): Problems related to shortage of manpower in Yellowknife prevented a complete reply to the questionnaire. The department does not have a computer storage system and a complete reply would have required many hours of work that were not available because of field work demands. Information received, however, indicated that the data collected since the formation of the Water Resources Branch are of good to excellent quality. The bulk of the sampling by the Branch is carried out to monitor the effects of mine waste discharge on receiving waters or to monitor mine or domestic water supply.

5. Fisheries and Marine Service and Freshwater Institute: Not all Fisheries and Marine Service water quality data are contained on computer storage system. A limited amount is stored on the Water Quality Branch NAQUADAT system and a portion has been presented in a series of publications. A large quantity, however, has not been organized for study; recent cutbacks both in staff and funds will delay the publishing of this data. The only stations included in the report, however, due to time constraints, were those stored on NAQUADAT. The published material is primarily concerned with rates of sediment transport and a few chemical parameters. Special studies undertaken by the Fisheries and Marine Service and the Freshwater Institute have been conducted over a minimum of three years; all water samples have been taken at hydrometric stations to allow close correlation with discharge measurements. The special studies were designed; (1) to provide an estimation of the rates of mechanical and chemical weathering in watersheds of varying physical

and biological characteristics and to compare these with weathering rates found elsewhere on the globe, (2) to estimate dissolved salt and suspended sediment annual loads to the Beaufort Sea, and (3) to provide a rational basis for discussing increased erosion rates due to pipeline and road construction in the Mackenzie Valley. Personal communication has indicated that there has been good quality control both in the field and in the lab.

D. Parameter Analysis Code

The parameters or parameter groups analyzed at each station in the Mackenzie River Basin have been documented in the Tables under the heading Parm. Anal. Codes A-J were developed by Water Quality Branch, Western and Northern Region to provide information on the data available on NAQUADAT.

A - Turbidity, pH, Conductivity, Temperature, Colour, Cl, F, RKN, NO_3 & NO_2, Total P, K, Na, Mg, Ca, HCO_3, SO_4, (Al, Ba, Cd, Cr, Cu, Mn, Pb, An) extractable, Co, Fe, T & P Alkalinity, Total Hardness, SiO_2, TIC, TOC, Chlorophyll A.

B - Sampled on a monthly basis, Temperature, pH, Conductivity, D.O., Turbidity, Colour, T & P Alkalinity, Total Hardness, Chlorophyll A, Cl, F, Ca, SO_4, SiO_2, Na, CO_3, K, NO_3 & NO_2, TKN, Mg, TIC, TOC, Total P.

Along with the above parameters, the following are sampled quarterly, HCO_3, Al, Ba, Cd, Cr, Co, Cu, Fe, Mn, Ni, Pb, Sr, Zn, B, Mo, As, Se, Hg, Cn, Phenols.

With all of the above Phenoxy Herbicides and PCB's are sampled during special programs.

C - Cl, F, Na, Ca, SiO_2, Total Hardness, SO_4, TKN, NO_3 & NO_2, TIC, TOC, T & P Alkalinity, Ortho PO_4, Total P, Total Inorganic, PO_4, Residue, pH, Conductivity, K.

D - Mercury only.

E - 0003 quarterly (73-74), metals only (72-73), some special organics (71-74).

F - Sampled on a monthly basis, pH, T & P Alkalinity, Conductivity, Turbidity, Colour, Ca, Total Hardness, Na, K, F, Fe, Total P, Inorganic P., Ortho PO_4, TKN, NO_3 & NO_2, TIC, TOC, SO_4, Cl.

Along with the above, the following are sampled quarterly, Cu, Pb, Zn, Hg, Mn, As, Cd, B, Ba, Cr, Se, Insecticides, Herbicides, PCB's, Standard Plate Count, Fecal Coliform, Fecal Streptococci, Total Coliform.

G - Conductivity, Turbidity, Temperature, Total P, Total N, Total Coliform, Fecal Coliform, Fecal Streptococci.

H - Sampled on a monthly basis, Ca, Cl, pH, K, NFR, Conductance, Na, SO_4, Turbidity, Ammonia, NO_3 & NO_2, Total N, TKN, O-PO_4, Total P, TIC, TOC, DIC, DOC, Total Coliforms, Fecal Coliforms, Fecal Streptococci, phenols.

Sampled on a quarterly basis, Al, Ba, Cd, Cr, Co, Cu, Fe, Pb, Li, Mn, Hg, Mc, Ni, Ag, Sr, V, Zn, As, B, Se, Chlorinated Hydrocarbons, PCB's, Organophosphorus, Pesticides, Herbicides.

I - Sampled on a quarterly basis, Turbidity, pH, Conductivity, Temperature, Colour, Cl, F, TKN, NO_3 & NO_2, Total P, K, Na, Mg, Ca, HCO_3, CO_3, SO_4, (Al, Ba, Cd, Cr, Cu, Mn, Pb, Zn, Ni, Hg) extractable, Co, Fe, T & P Alkalinity, Total Hardness, SiO_2, TIC, ROC, Chlorophyll A, NFR, Radioactivity.

J - Sampled on a quarterly basis, all of Code I less radioactivity.

Parameter group codes K-Z were assigned to outline the Water Quality data available for stations which have not been coded by the Water Quality Branch, Western and Northern Region.

K - Physical Properties, Major Ions, Metals

L - Physical Properties, Major Ions, Metals, Nutrients

M - Physical Properties, Major Ions, Metals, Nutrients, Organics

N - Physical Properties, Major Ions, Metals, Nutrients, Organics, Bacteria

O - Physical Properties, Major Ions, Metals, Nutrients, Biochemical

P - Physical Properties, Major Ions, Metals, Nutrients, Biochemical, Organics, Miscellaneous

Q - Physical Properties, Major Ions, Metals, Biochemical, Organics, Nutrients, Miscellaneous, Bacteria

R - Physical Properties, Metals, Major Ions, Biochemical, Nutrients, Miscellaneous

S - Physical Properties, Metals, Biochemical, Organics, Nutrients, Miscellaneous

T - Physical Properties, Major Ions, Metals, Organics, Nutrients, Miscellaneous

U - Physical Properties, Major Ions, Biochemical, Nutrients, Miscellaneous

V - Physical Properties, Major Ions, Metals, Nutrients, Miscellaneous

W - Physical Properties, Major Ions, Metals, Organics, Nutrients, Miscellaneous, Bacteria

X - Physical Properties, Biochemical, Nutrients, Miscellaneous

Y - Physical Properties, Major Ions, Metals, Biochemical, Nutrients, Miscellaneous, Bacteria

Z - Physical Properties, Major Ions, Metals, Nutrients, Bacteria

E. Information Organization

Information from all major contributors was arranged under individual headings, NAQUADAT data, Alberta Government data, etc. A list of parameters studied at all stations provided by each contributor was composed for each sub-basin. Individual stations which received special attention, i.e. had other parameters analyzed were identified and the additional parameters analyzed were listed.

All station locations remaining throughout each sub-basin, after selection processes were plotted (solid black circle) and numbered. Stations where more than fifteen samples had been taken in a relatively short time period and stations designated as important by the various submitters were identified and located (black triangle) on a second map. Along with the selected stations, the map also provides the geographical locations of sensitive areas, hydro sites, highways, pipelines, dredging locations, etc.

The information available for each sub-basin was received and discussed in relation to the existing and proposed developments within the sub-basin. Finally, recommendations have been made to develop a more informative water quality data base for the Mackenzie drainage basin.

CHAPTER II

SUB-BASIN 1 - ATHABASCA RIVER DRAINAGE

Water quality data for sub-basin 1 are available from NAQUADAT and the Alberta Government Water Quality data file.

A. NAQUADAT Data

NAQUADATA data includes a wide range of parameters studied throughout the sub-basin. A considerable number of nutrient and metal parameters have been analyzed along with major ions, physical parameters and PCB's.

Significant numbers of samples have been analyzed throughout the sub-basin for the following parameters:

1. Colour Apparent
2. Specific Conductance
3. Temperature Water
4. Turbidity
5. Alkalinity Total
6. Alkalinity Phenolphthalein
7. pH
8. Residue Nonfilterable
9. Residue Fixed Nonfilterable
10. Hardness Total
11. Lead Extractable
12. Cadmium Extractable
13. Barium Extractable
14. Mercury Extractable
15. Zinc Extractable
16. Arsenic Dissolved
17. Manganese Extractable
18. Iron Dissolved Fe^{++} & Fe^{+++}
19. Iron Extractable
20. Nickel Extractable
21. Copper Extractable
22. Chromium Extractable

23. Fluoride Dissolved
24. Potassium Dissolved
25. Sodium Dissolved
26. Calcium Dissolved
27. Sulphate Dissolved
28. Chloride Dissolved
29. Magnesium Dissolved
30. Carbon Total Organic
31. Carbon Total Inorganic
32. Nitrogen Total Kjeldahl
33. Nitrogen Dissolved NO_3 & NO_2
34. Silica Reactive
35. Phosphorous Dissolved Ortho PO_4
36. Phosphorous Dissolved Inorganic PO_4
37. Phosphorous Total
38. Aroclor 1254
39. Aroclor 1248

Within the sub-basin the National Parks Study, June 1976 - October 1976 was carried out at stations 00AL07AA0028-00AL07AA0056: at least fifteen samples were analyzed for each parameter during the five month period of record. Program requirements included the analyses of the following parameters:

1. Colour Apparent
2. Specific Conductance
3. Temperature Water
4. Turbidity
5. pH
6. Phosphorous Total
7. Nitrogen Total Kjeldahl
8. Nitrogen Dissolved Nitrate
9. Coliforms Fecal MF
10. Strep. Fecal MF
11. Coliforms Total MF

In addition to the parameters studied throughout the sub-basin, certain parameters have been sampled significantly at selected stations.

00AL07AA0007, 00AL07AA0023 (Map #13,17)

1. Aroclor 1254
2. Aroclor 1248
3. Gamma BHC Lindane

00AL07AA0015 (Map #11)

1. Aroclor 1254
2. Aroclor 1248

00AL07BE0001 (Map #27)

1. Zinc Dissolved
2. Magnesium Dissolved
3. Copper Extractable
4. Manganese Dissolved
5. Strontium Extractable
6. Molybdenum Extractable
7. Aluminum Dissolved
8. Nitrogen Dissolved Nitrate
9. Nitrogen Dissolved Ammonia
10. Oxygen Consumed
11. Residue Filterable
12. Residue Fixed Filterable
13. Phenolic Material

00AL07CD0001, 00AL07DA0001 (Map #107,29)

1. Phenolic Material

00AL07AF0001-00AL07AF0003 (Map #74-76)

1. Copper Dissolved
2. Manganese Dissolved
3. Lead Dissolved
4. Zinc Dissolved
5. Phenolic Material
6. Tannin and Lignin

The following parameters were analyzed in the sub-basin but with reduced frequency and at fewer locations:

1. Lithium Extractable
2. Boron Dissolved
3. Cobalt Extractable
4. Vanadium Extractable
5. Manganese Dissolved
6. Selenium Dissolved
7. Antimony Extractable
8. Thallium Extractable
9. Strontium Extractable
10. Molybdenum Extractable
11. Silver Extractable
12. Aroclor 1260
13. Aroclor 1254
14. Aroclor 1248
15. Alpha-Endo-Sulfhan
16. Gamma BHC Lindane

17. Aldrin
18. Dieldrin
19. MCPA
20. 2,4-D
21. 2,4,5-T
22. 2,4-DB
23. 2,4-DP
24. P,P-DDT
25. P,P-DDD
26. P,P-DDE
27. P,P-Methoxy-Chlor
28. Heptachlor
29. Heptachlor Epoxide
30. Oxygen Dissolved
31. Cyanide Dissolved
32. Coliforms Total MF
33. Coliforms MPN
34. Coliforms Fecal MF
35. Strep. Fecal MF
36. Std. Plate Count
37. Chlorophyll A

Water quality stations with fifteen samples or more:

1. 00AL07AA0007 (Map #13)
2. 00AL07AA0009-00AL07AA0056
3. 00AL07AB0001 (Map #67)
4. 00AD07AD0001 (Map #19)
5. 00AL07AE0001 (Map #22)
6. 00AL07AF0001 (Map #74)
7. 00AL07AF0002 (Map #75)
8. 00AL07AF0003 (Map #76)
9. 00AL07AG0001 (Map #79)
10. 00AL07BB0003 (Map # 83)
11. 00AL07BC0001 (Map # 85)
12. 00AL07BE0001 (Map # 27)
13. 00AL07BJ0001 (Map # 88)
14. 00AL07CD0001 (Map #107)
15. 00AL07DA0001 (Map # 29)
16. 00AL07LA0001 (Map # 1)
17. 00AL07LC0001 (Map # 3)
18. 00AL07MB0001 (Map # 6)

B. Alberta Government Data

Data are available from stations sampled by the Alberta government throughout the Athabasca River drainage.

The parameters listed below are analyzed at all stations throughout the sub-basin:

1. Temperature of Water
2. Specific Conductance
3. Turbidity
4. pH
5. Alkalinity Phenolphthalein
6. Alkalinity Total
7. Carbonate
8. Bicarbonate
9. Hardness Total
10. Calcium Dissolved
11. Magnesium Dissolved
12. Sodium Dissolved
13. Potassium Dissolved
14. Chloride Dissolved
15. Sulphate Dissolved
16. Fluoride Dissolved
17. Oxygen Total COD
18. Nitrogen Total Calculated
19. Nitrogen Dissolved Nitrite
20. Nitrogen Dissolved NO_3 & NO_2
21. Nitrogen Dissolved Ammonia
22. Phosphate Total
23. Phosphorous Total Phosphate
24. Total Dissolved Solids
25. Iron Extractable
26. Copper Extractable
27. Cobalt Extractable

The following list includes all those parameters which have been analyzed at selected locations in the sub-basin and do not appear in the list of parameters analyzed throughout the sub-basin:

1. Mercury Total
2. Cadmium Total
3. Cadmium Extractable
4. Copper Total
5. Lead Total
6. Lead Extractable
7. Manganese Total
8. Manganese Extractable
9. Nickel Total
10. Nickel Extractable
11. Zinc Total
12. Zinc Extractable
13. Cobalt Total
14. Molybdenum Extractable
15. Chromium Total
16. Chromium Extractable
17. Vanadium Extractable
18. Iron Total
19. Carbon Total Organic
20. Carbon Total Inorganic

21. Nitrogen Total Kjeldahl
22. Phosphorous Dissolved Ortho PO_4
23. Phosphorous Total
24. Silica Reactive
25. Oxygen Dissolved
26. Oxygen BOD
27. Odour Threshold Number
28. Hydrocarbons
29. Oil and Grease
30. Phenolic Material
31. N-Alkyl Surfactants
32. Tannin and Lignin
33. Coliforms Fecal MPN
34. Coliforms Total MPN
35. Std. Plate Count
36. Residue Nonfilterable
37. Residue Total
38. Residue Fixed Total

Water quality stations with fifteen samples or more:

1. 00AT07DA2180 (Map #32)
2. 00AT07AD2060 (Map #20)
3. 00AT07AG2080 (Map #23)
4. 00AT07AG2120 (Map #80)
5. 00AT07BE2000 (Map #90)
6. 00AT07BE2200 (Map #91)
7. 00AT07BE2400 (Map #92)
8. 00AT07BE2800 (Map #94)
9. 00AT07BE2900 (Map #95)
10. 00AT07BE3000 (Map #96)
11. 00AT07BE3200 (Map #97)
12. 00AT07BE3400 (Map # 98)
13. 00AT07BE3600 (Map # 99)
14. 00AT07BE3800 (Map #100)
15. 00AT07BE4000 (Map #101)
16. 00AT07BE4200 (Map #102)
17. 00AT07BE4400 (Map #103)
18. 00AT07BE4600 (Map #104)
19. 00AT07BE4800 (Map #105)
20. 00AT08CB2160 (Map # 28)
21. 00AT07DA2170 (Map # 30)

WATER QUALITY STATIONS

Sub-Basin 1 - Athabasca River Drainage

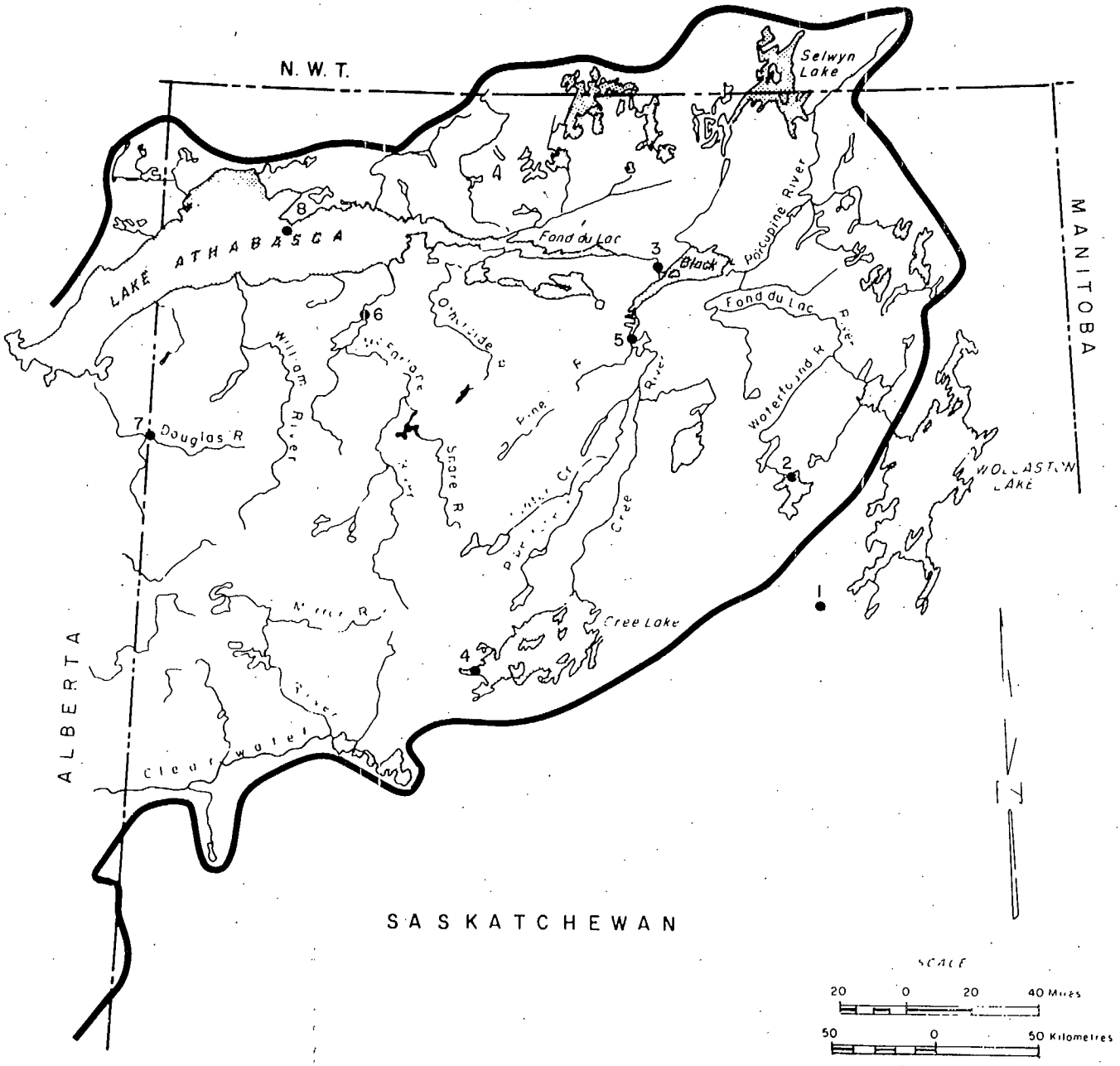


FIGURE 1 (a)

WATER QUALITY STATIONS

Sub-Basin 1 - Athabasca River Drainage

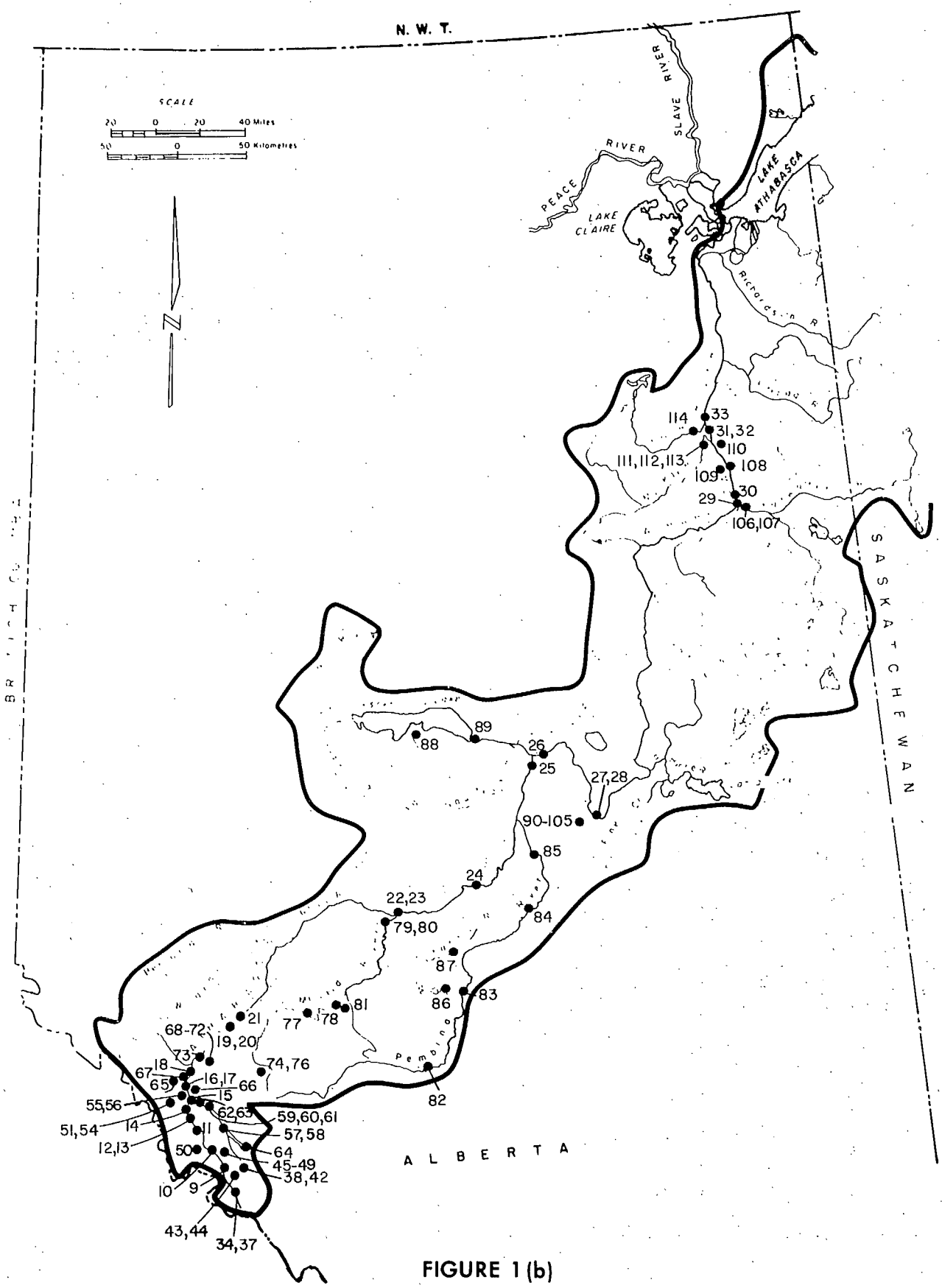


FIGURE 1 (b)

Table 1

Sub-Basin 1 - Athabasca River Stations

MAP STN. NO.	CONTRIBUTOR STATION NUMBER	STATION DESCRIPTION	CONTRIBUTOR	RATIONALE FOR ACTIVE STATIONS	REASONS FOR DISCONTINUING STATIONS	PARM. ANAL.	PERIOD OF RECORD 1960 1965 1970 1975 1979
1	00SA07LA0001	GEIKIE RIVER BELOW JUNCTION OF WHEELER RIVER	WQB,SASK	1		I	
2	01SA07LB0001	WATERBURY LAKE AT CREW CABIN	WQB			N	
3	00SA07LC0001	FOND DU LAC RIVER AT OUTLET OF BLACK LAKE	WQB	1		A,J	
4	01SA07LD0001	CREE LAKE AT CABLE BAY	WQB			Q	
5	00SA07LD0001	CREE RIVER AT OUTLET OF WAPATA LAKE	WQB		1	A	
6	00SA07MB0001	MCFARLANE RIVER AT OUTLET OF DAVY LAKE	WQB	1		A,J	
7	00SA07MA0001	DOUGLAS RIVER BELOW CONF WITH CLUFF CR.	WQB	1		I	
8	01SA07MC0001	LAKE ATHABASCA NEAR CRACKINGSTONE POINT	WQB		1,2	N	
9	00AL07AA0010	ATHABASCA RIVER 1.35 MI. ABOVE SUNWAPTA RIVER	WQB		2	F	
10	00AL07AA0014	ATHABASCA RIVER 4.5 MI. BELOW SUNWAPTA RIVER	WQB		2	F	
11	00AL07AA0015	ATHABASCA RIVER AT HWY 93A ATHABASCA FALLS	WQB	5		B,F	
12	00AL07AA0017	ATHABASCA RIVER AT HWY 39A 3.8 MI ABOVE ASTORIA RIVER	WQB		2	F	
13	00AL07AA0007	ATHABASCA RIVER ABOVE JASPER	WQB		2	B,E F,G	
14	00AL07AA0043	ATHABASCA RIVER AT FORT POINT BRIDGE	WQB		2	G	
15	00AL07AA0019	ATHABASCA RIVER 2 MILES BELOW JASPER	WQB		2	F,G	
16	00AL07AA0021	ATHABASCA RIVER 0.5 MILES ABOVE HENRY HOUSE	WQB		2	F	
17	00AL07AA0023	ATHABASCA RIVER AT HWY 16 BELOW SNARING RIVER	WQB	5		B,F,G	
18	00AL07AA0025	ATHABASCA RIVER 2.05 MI BELOW DEVONA	WQB		2	F	
19	00AL07AD0001	ATHABASCA RIVER AT HINTON	WQB		1,2	A,B,E	
20	00AT07AD2060	ATHABASCA RIVER AT HINTON	ALTA		8	Q	
21	00AT07AD2075	ATHABASCA RIVER BELOW HINTON	ALTA		8	Q	
22	00AL07AE0001	ATHABASCA RIVER AT WHITECOURT	WQB		1,2	A,E	
23	00AT07AG2080	ATHABASCA RIVER AT WHITECOURT	ALTA		8	Q	
24	00AL07BD0002	ATHABASCA RIVER NEAR FORT ASSINIBOINE (AT HWY 18)	WQB		2	E	
25	00AL07BD0004	ATHABASCA RIVER NEAR HONDO	WQB		1,2	A,E	
26	00AT07BK2140	ATHABASCA RIVER ABOVE SMITH	ALTA		8	Q	
27	00AL07BE0001	ATHABASCA RIVER AT ATHABASCA	WQB	1		A,B E,H	
28	00AT07CB2160	ATHABASCA RIVER AT TOWN OF ATHABASCA	ALTA	8		Q	
29	00AL07DA0001	ATHABASCA RIVER AT FORT MACMURRAY	WQB		1	A,B	
30	00AT07DA2170	ATHABASCA RIVER AT TAR ISLAND	ALTA		8	Q	

TABLE 1 (cont'd)

Sub-Basin 1 - Athabasca River Stations

MAP STN. NO.	CONTRIBUTOR STATION NUMBER	STATION DESCRIPTION	CONTRIBUTOR	RATIONALE FOR ACTIVE STATIONS	REASONS FOR DISCONTINUING STATIONS	PARM. ANAL.	PERIOD OF RECORD 1960 1965 1970 1975 1979
31	00AL07DA0003	ATHABASCA RIVER AT FORT MACKAY	WQB		1	B	
32	00AT07DA2180	ATHABASCA RIVER AT FORT MACKAY	ALTA		8	Q	
33	00AT07DA2182	ATHABASCA RIVER AT BITUMOUNT	ALTA		8	P	
34	00AL07AA0044	RIPPLE CREEK 1.35 MI ABOVE SUNWAPTA RIVER	WQB		2	G	
35	00AL07AA0045	RIPPLE CREEK ABOVE RIPPLE LAKE	WQB		2	G	
36	00AL07AA0046	RIPPLE CREEK BELOW RIPPLE LAKE	WQB		2	G	
37	00AL07AA0047	RIPPLE CREEK OPPOSITE ICEFIELDS INFO. CENTRE	WQB		2	G	
38	00AL07AA0048	SUNWAPTA RIVER AT SHIVERS AND GOOSEBUMPS BRIDGE	WQB		2	G	
39	00AL07AA0049	SUNWAPTA RIVER BELOW SUNWAPTA LAKE	WQB		2	G	
40	00AL07AA0009	SUNWAPTA RIVER AT ATHABASCA GLACIER	WQB		2	E,F,G	
41	00AL07AA0011	SUNWAPTA RIVER 3.8 MI BELOW BEAUTY CREEK	WQB		2	F,G	
42	00AL07AA0013	SUNWAPTA RIVER ABOVE SUNWAPTA FALLS	WQB		2	Q	
43	00AL07AA0050	TANGLE CREEK ABOVE WORK COMPOUND	WQB		2	G	
44	00AL07AA0051	TANGLE CREEK BELOW WORK COMPOUND	WQB		2	G	
45	00AL07AA0052	POBOKTAN CREEK ABOVE WARDEN STATION	WQB		2	G	
46	00AL07AA0012	POBOKTAN CREEK AT HWY 93	WQB		2	F,G	
47	00AL07AA0053	BUCK CREEK AT HWY 93 ABOVE ROAD CROSSING	WQB		2	G	
48	00AL07AA0054	BUCK CREEK 100 YDS BELOW HWY 93	WQB		2	G	
49	00AL07AA0055	BUCK CREEK AT MOUTH	WQB		2	G	
50	00AL07AA0016	WHIRLPOOL RIVER AT HWY 93A	WQB		2	F	
51	00AL07AA0029	MIETTE RIVER ABOVE DECOIGNE WARDEN STATION	WQB		2	G	
52	00AL07AA0028	MIETTE RIVER BELOW DECOIGNE WARDEN STATION	WQB		2	G	
53	00AL07AA0026	MIETTE RIVER ABOVE GEIKIE	WQB		2	F	
54	00AL07AA0030	MIETTE RIVER 2.5 MI ABOVE HWY 16 ROAD CROSSING	WQB		2	G	
55	00AL07AA0056	MIETTE RIVER AT HWY 16 WEST OF JASPER	WQB		2	G	
56	00AL07AA0018	MIETTE RIVER AT HWY 93A (AT THE MOUTH)	WQB		2	F	
57	00AL07AA0031	MALIGNE RIVER AT OUTLET OF MALIGNE LAKE	WQB		2	G	
58	00AL07AA0032	MALIGNE RIVER 2.5 MI BELOW MALIGNE LAKE (AT SECOND BRIDGE)	WQB		2	G	

TABLE 1 (cont'd)

Sub-Basin 1 - Athabasca River Stations

MAP STN. NO.	CONTRIBUTOR STATION NUMBER	STATION DESCRIPTION	CONTRIBUTOR	RATIONALE FOR ACTIVE STATIONS	REASONS FOR DISCONTINUING STATIONS	PARM. ANAL.	PERIOD OF RECORD 1960 1965 1970 1975 1979
59	00AL07AA0027	MALIGNE RIVER AT OUTLET OF MEDICINE LAKE	WQB		2	F, G	
60	00AL07AA0033	MALIGNE RIVER ABOVE MEDICINE LAKE	WQB		2	F	
61	00AL07AA0035	MALIGNE RIVER ABOVE MALIGNE CANYON (AT FOURTH BRIDGE)	WQB		2	G	
62	00AL07AA0036	MALIGNE RIVER BELOW MALIGNE CANYON (AT FIFTH BRIDGE)	WQB		2	G	
63	00AL07AA0020	MALIGNE RIVER 0.1 MI ABOVE MOUTH	WQB		2	F, G	
64	00AL07AA0034	BEAVER CR ABOVE MALGINE LAKE	WQB		2	G	
65	00AL07AA0022	SNARING RIVER AT HWY 16	WQB		2	B, F, G	
66	00AL07AA0024	ROCKY RIVER AT HWY 16 (NEAR THE MOUTH)	WQB		2	F	
67	00AL07AB0001	SNAKE INDIAN RIVER 1.2 MI ABOVE DEVONA FLATS	WQB		2	F	
68	00AL07AA0037	SULPHUR CREEK ABOVE MIETTE HOT SPRINGS	WQB		2	G	
69	00AL07AA0038	SULPHUR CREEK ABOVE MIETTE HOT SPRINGS ROAD CROSSING	WQB		2	G	
70	00AL07AA0039	SULPHUR CREEK BELOW MIETTE HOT SPRINGS ROAD CROSSING	WQB		2	G	
71	00AL07AA0040	SULPHUR CREEK 150 YDS BELOW MIETTE HOT SPRINGS ROAD CROSSING	WQB		2	G	
72	00AL07AA0041	SULPHUR CREEK ABOVE CONF WITH FIDDLE RIVER	WQB		2	G	
73	00AL07AA0042	FIDDLE RIVER 3 MI BELOW SULPHUR CREEK	WQB		2	F	
74	00AL07AF0001	WAMPUS CREEK NEAR HINTON	WQB		1, 2	C	
75	00AL07AF0002	DEERLICK CREEK NEAR HINTON	WQB		1, 2	C	
76	00AL07AF0003	EUNICE CREEK NEAR HINTON	WQB		1, 2	C	
77	00AL07AG0007	MCLEOD RIVER SOUTH OF EDSON (AT HWY 47)	WQB		1, 2	Q	
78	00AL07AG0008	MCLEOD RIVER AT HWY 16	WQB		1, 2	E	
79	00AL07AG0001	MCLEOD RIVER AT WHITECOURT	WQB		1, 2	A, E	
80	00AT07AG2120	MCLEOD RIVER AT WHITECOURT	ALTA		8	Q	
81	00AL07AG0004	WOLF CREEK AT HWY 16	WQB		1, 2	E	
82	00AL07BA0001	PEMBINA RIVER BELOW PADDY CREEK	WQB		1, 2	E	
83	00AL07BB0003	PEMBINA RIVER AT ENTWISTLE	WQB		1, 2	Q	
84	00AL07BC0006	PEMBINA RIVER AT MANALA	WQB		1, 2	E	
85	00AL07BC0001	PEMBINA RIVER AT JARVIE	WQB		1, 2	A, B, E	
86	00AL07BB0007	LOBSTICK RIVER AT WILDWOOD	WQB		1, 2	E	
87	00AL07BB0009	PADDLE RIVER NEAR ROCHFORT BRIDGE	WQB		1, 2	E	
88	00AL07BJ0001	SWAN RIVER NEAR KINUSO	WQB		1, 2	A, E	
89	00AL07BK0005	LESSER SLAVE RIVER AT SLAVE LAKE	WQB		1, 2	E	
90	00AT07BE2000	SOUTH BASIN, S.E. INLET BAPTISTE LAKE	ALTA		9	R	

TABLE 1 (cont'd)

Sub-Basin 1 - Athabasca River Stations

MAP STN. NO.	CONTRIBUTOR STATION NUMBER	STATION DESCRIPTION	CONTRIBUTOR	RATIONALE FOR ACTIVE STATIONS	REASONS FOR DISCONTINUING STATIONS	PARM. ANAL.	PERIOD OF RECORD 1960 1965 1970 1975 1979
91	00AT07BE2200	CULVERT CR TRIB. TO BAPTISTE LAKE	ALTA		9	R	
92	00AT07BE2400	OUTHOUSE CR TRIB. TO BAPTISTE LAKE	ALTA		9	R	
93	00AT07BE2600	BAPTISTE LAKE PROJECT	ALTA		9	R	
94	00AT07BE2800	TRIB. TO BAPTISTE LAKE INTO SOUTH INLET 2.	ALTA		9	R	
95	00AT07BE2900	NW TRIB TO SOUTH INLET OF TRIB TO BAPTISTE LAKE	ATLA		9	R	
96	00AT07BE3000	TRIB TO BAPTISTE LAKE INTO SOUTH INLET 3	ALTA		9	R	
97	00AT07BE3200	GORSAK'S SPRING BAPTISTE LAKE PROJECT	ALTA		9	R	
98	00AT07BE3400	CROUCHER CR TRIB TO BAPTISTE LAKE	ALTA		9	R	
99	00AT07BE3600	NARROWS SW TRIB TO BAPTISTE LAKE	ALTA		9	R	
100	00AT07BE3800	NARROWS NW TRIB TO BAPTISTE LAKE	ALTA		9	R	
101	00AT07BE4000	NORTH BASIN BTM. WEST SIDE	ALTA		9	R	
102	00AT07BE4200	TRIB TO BTM. NORTH BASIN WEST SIDE OF BAPTISTE LAKE	ALTA		9	R	
103	00AT07BE4400	TRIB TO TOP NORTH BASIN WEST SIDE OF BAPTISTE LAKE	ALTA		9	R	
104	00AT07BE4600	CATTLE CROSSING CR. TRIB TO BAPTISTE LAKE	ALTA		9	R	
105	00AT07BE4800	OUTLET CR FROM BAPTISTE LAKE	ALTA		9	R	
106	00AL07CD0002	CLEARWATER RIVER AT UPPER WINGDAM	WQB		1,2	A	
107	00AL07CD0001	CLEARWATER RIVER ABOVE FORT MACMURRAY	WQB		1,2	Q	
108	00AT07DA2177	STEEPBANK RIVER	ALTA		8	P	
109	00AT07DA0180	BEAVER R ABOVE SYNCRUDE	ALTA		8	Q	
110	00AT07DA2178	MUSKEG RIVER	ALTA		8	P	
111	00AT07DB0030	DUNKIRK R NEAR FT MACKAY	ALTA		8	Q	
112	00AT07DB2176	MACKAY RIVER	ALTA		8	P	
113	00AT07DB2179	DOVER RIVER	ALTA		8	P	
114	00AT07DA2181	ELLS RIVER	ALTA		8	P	

SUB-BASIN 1 - ATHABASCA RIVER DRAINAGE

Water Quality Stations
Sensitive Areas
Expected Resource Projects And Developments

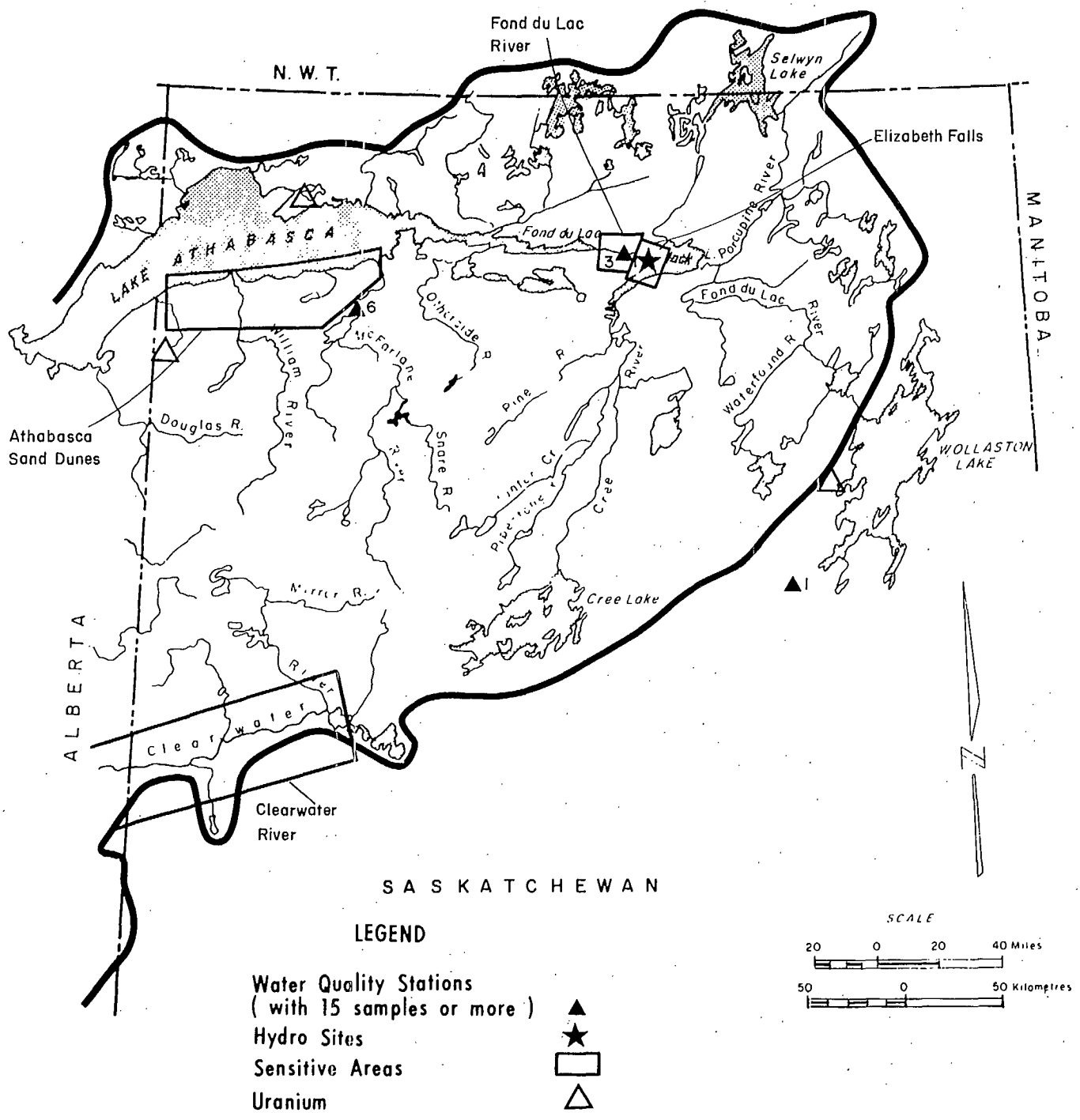


FIGURE 2 (a)

SUB-BASIN 1 - ATHABASCA RIVER DRAINAGE

Water Quality Stations
Sensitive Areas
Expected Resource Projects And Developments

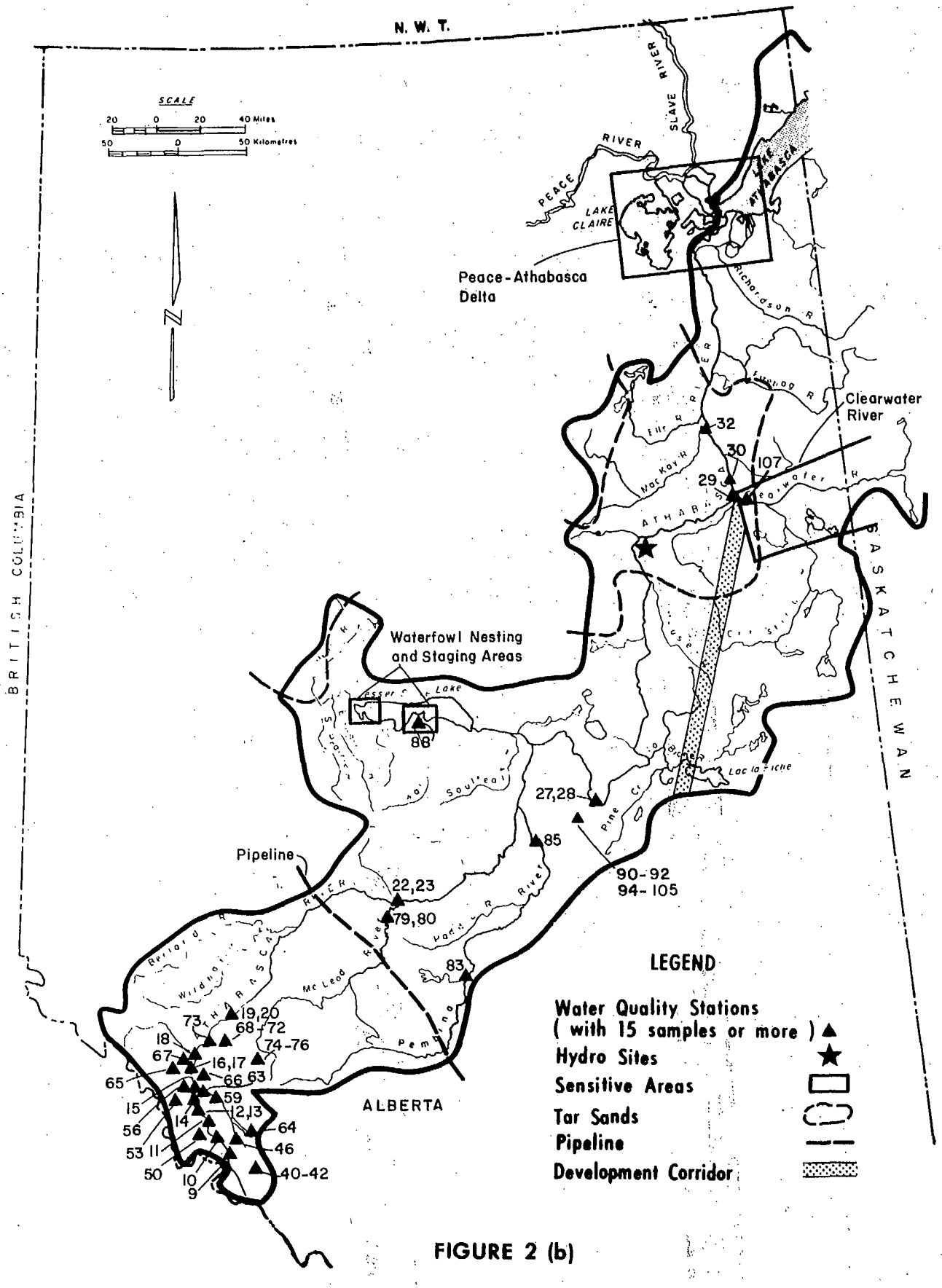


FIGURE 2 (b)

C. Discussion

The headwaters of the Athabasca River originate within Jasper National Park; the Water Quality Branch, under agreement with Parks Canada, has conducted a special study of the area. Figure 2(a) indicates that there are many water quality stations in the area with 15 samples or more; however, almost all have been discontinued and the period of record for most is short with a limited number of parameters. The parameters studied were chosen in efforts to describe the human influence on the receiving waters of the Park. There are only two stations remaining active within the park, one is at Athabasca Falls (00AL07AA0015, Map #11) and the other is on the Athabasca River (00AL07AA023, Map #17) below Snaring River. Parameters analyzed at these stations included those which are commonly studied at stations throughout the sub-basin, plus a number of pesticides.

Most of the expected developments and resource projects, however, occur downstream of Jasper National Park. Coal deposits throughout the portion of the sub-basin above Hondo are not expected to be developed in the near future, but a proposed pipeline is to be constructed across the sub-basin as indicated in Figure 2(a). Historical data are available immediately downstream of the pipeline crossing but the closest active stations, (250 km) downstream of the crossing, are at Athabasca (00AL07BE0001, Map #27, and 00AT07CB2160, Map #38). A wide range of parameters have been analyzed at these stations including a wide variety of metals and nutrients.

The closest station upstream of the pipeline crossing is located below Hinton (00AT07AD2075, Map #21), but was last sampled in 1976 and has less than 15 samples on record. Two stations located at Hinton (00AT07AD2060, Map #20 and 00AL07AD0001, Map #19) have been sampled more than 15 times for a variety of parameters but both have been discontinued. The pipeline also crosses the McLeod and Pembina Rivers; stations are located below both crossings, but not above. Both have been discontinued but there are more than 15 samples for each station.

Waterfowl nesting and staging areas on Lesser Slave Lake occur downstream of tributaries which flow through the edge of a tar sands deposit. The only station located to monitor any effects of development of the tar sands is on the Lesser Slave River at the outlet of the Lake (00AL07BK0005, Map #89); however, this station has been discontinued and has less than 15 samples on record for a limited number of parameters.

Above Fort McMurray, on the Athabasca River, there is expected to be a hydroelectric power installation and there is the possibility of development within the upstream part of the tar sands deposits. Also, a development corridor extending from Edmonton to Fort McMurray which may cross tributaries to the Athabasca River is expected in the near future. A station at the town of Athabasca (00AL07BE0001, Map #27) is well situated to monitor inputs from upstream to this development area. A station at Fort McMurray (00AL07DA0001, Map #29) is the first station downstream after these proposed developments. It has a significant period of record with more than 15 samples taken; it was, however, discontinued in 1978. The Clearwater River has been designated as a

sensitive area and has been monitored at two stations near its downstream end near Fort McMurray. Both stations have been discontinued; however, data for a number of parameters during a significant period of record are available from one of the stations.

The Peace-Athabasca Delta is located downstream from the area of major tar sands development. Alberta Environment and Water Quality Branch stations below Tar Island have fewer than 15 samples with a fair number of parameters analyzed; there are no stations below Bitumont. There has been some intensive research work carried out by O.S.E.R.P. within this area but the future of the work is unclear.

The section of the Athabasca River sub-basin in Saskatchewan, except for the Clearwater River and a few smaller rivers, drains into Lake Athabasca. The headwaters of the Fond du lac River, because of a dam, have been extended to include Wollaston Lake. An active water quality station on the Wheeler River above Wollaston Lake has an extensive period of record and more than 15 samples. A uranium mine is being developed on the west side of Wollaston Lake, as well two sensitive areas have been designated on the Fond du lac River, Elizabeth Falls and the stretch of the river itself from below the falls to lake Athabasca. A hydroelectric development has been planned for Elizabeth Falls. An active water quality station (OOSA07LC0001, Map #3) is located at the outlet of Black Lake just upstream of the falls with more than 15 samples on record and a variety of parameters analyzed.

There are several tributaries to Lake Athabasca which flow through the Athabasca sand dunes area, only one of which has a water

quality station. The McFarlane River at the outlet of Davy Lake has an active station (00SA07MB0001, Map #6) with more than 15 samples on record and a variety of parameters analyzed. Near the Alberta-Saskatchewan Border, south of the Lake, there is a developing uranium mine; there are no water quality stations on any of the rivers draining the area. Another uranium mine is located on the north shore of the Lake; in close proximity is station 01SA07MC0001 (Map #8) at Crackingstone Point. The period of record is not very extensive and there were fewer than 15 samples taken before it was discontinued.

D. Data Gaps

1. The points at which the Mackenzie Valley Pipeline will cross the rivers of the sub-basin are well monitored historically but the present monitoring is inadequate to take account of the pipeline activities.

2. If the portion of the tar sands deposit that is contained within the headwaters of the Lesser Slave Lake drainage basin is developed, the waterfowl nesting and staging areas upstream of the lake will be affected. At present there is no monitoring activity in this area.

3. Below the town of Athabasca, the tributaries of the Athabasca that flow through the development corridor will be affected and, at present, there is no monitoring in the area until Fort McMurray.

4. There is a need for clarification of any plans for monitoring below the Athabasca tar sands developments as there does not appear to be any commitment for a long term sampling program to take account of inputs

to the Peace Athabasca Delta.

5. A uranium mine under development in Saskatchewan, south of Lake Athabasca, near the Alberta border, is likely to affect the quality of the water of the streams draining the area. At present there is no monitoring activity in this area.

CHAPTER III

SUB-BASIN 2 - PEACE RIVER DRAINAGE

Water quality data for sub-basin 2 has been collected from three major data sources, NAQUADAT and the Alberta and British Columbia governments.

A. NAQUADAT DATA

Information from NAQUADAT indicates that a number of parameters are analyzed throughout the sub-basin, including:

1. Colour Apparent
2. Specific Conductance
3. Temperature Water
4. Turbidity
5. Alkalinity Total
6. Alkalinity Phenolphthalein
7. pH
8. Hardness Total
9. Residue Nonfilterable
10. Residue Fixed Nonfilterable
11. Aluminum Extractable
12. Manganese Extractable
13. Iron Extractable
14. Cobalt Extractable
15. Nickel Extractable
16. Copper Extractable
17. Zinc Extractable
18. Strontium Extractable
19. Molybdenum Extractable
20. Silver Extractable
21. Cadmium Extractable
22. Barium Extractable
23. Lead Extractable
24. Fluoride Dissolved
25. Sulphate Dissolved
26. Chloride Dissolved
27. Potassium Dissolved
28. Calcium Dissolved
29. Sodium Dissolved
30. Carbon Total Organic

31. Carbon Total Inorganic
32. Nitrogen Dissolved NO_3 & NO_2
33. Silica Reactive

From this list it can be seen that a number of metal constituents are analyzed; in contrast only a few nutrient parameters have been studied throughout the sub-basin. NAQUADAT information is also available for physical parameters and major ions, but is lacking for pesticides, herbicides, PCB's, hydrocarbons, oxygen related parameters and biochemical compounds.

The following NAQUADAT stations in addition to the above mentioned parameters have significant numbers of samples taken for the listed parameters.

00AL07GA0001 (Map #132)

1. Copper Dissolved
2. Zinc Dissolved
3. Lead Dissolved
4. Manganese Dissolved
5. Iron Dissolved Fe^{++} & Fe^{+++}
6. Carbon Total Organic
7. Carbon Total Inorganic
8. Nitrogen Dissolved NO_3 & NO_2
9. Phosphorous Dissolved Ortho PO_4
10. Phosphorous Dissolved Inorganic PO_4

00AL07GE0001 (Map #141)

1. Oxygen Dissolved

00AL07GJ0001 (Map #137)

1. Boron Dissolved
2. Nitrogen Dissolved NO_3 & NO_2
3. Oxygen Dissolved
4. Aroclor 1248
5. Aroclor 1254
6. Aroclor 1260
7. 2,4-DB
8. 2,4-DP

00AL07HA0001 (Map #24)

1. Aluminum Dissolved
2. Manganese Dissolved
3. Nitrogen Dissolved Nitrate
4. Nitrogen Dissolved NO_3 & NO_2
5. Nitrogen Dissolved Ammonia
6. Phosphorous Dissolved Inorganic PO_4
7. Oxygen Consumed

00AL07HF0001 (Map #25)

1. Nitrogen Dissolved NO_3 & NO_2
2. P,P-DDT
3. P,P-DDD
4. P,P-DDE
5. P,P-Methoxychlor
6. Heptachlor
7. Heptachlor Epoxide

00AL07KC0001 (Map #26)

1. Zinc Dissolved
2. Nitrogen Dissolved NO_3 & NO_2

00BC07FA0003, 00BC07FB0001 (Map #10,74)

1. Iron Extractable
2. Nitrogen Dissolved
3. Residue Filterable
4. Residue Fixed Filterable
5. Residue Fixed Nonfilterable

00BC07FD0005 (Map #130)

1. Arsenic Extractable
2. Selenium Extractable
3. Manganese Extractable
4. Iron Extractable
5. Cobalt Extractable
6. Nickel Extractable
7. Copper Extractable
8. Strontium Extractable
9. Molybdenum Extractable
10. Cadmium Extractable
11. Barium Extractable
12. Lead Extractable
13. Nitrogen Dissolved
14. Carbon Total Organic
15. Carbon Total Inorganic
16. Nitrogen Dissolved NO_3 & NO_2
17. Phosphorous Total
18. Phenolic Material
19. Tannin and Lignin
20. Residue Filterable
21. Residue Fixed Nonfilterable
22. Residue Fixed Filterable

The following parameters were analyzed within the sub-basin but with reduced frequency and at fewer locations.

1. Vanadium Extractable
2. Chromium Extractable
3. Manganese Dissolved
4. Iron Dissolved Fe^{++} & Fe^{+++}
5. Arsenic Dissolved
6. Antimony Extractable
7. Mercury Extractable
8. Thallium Extractable
9. Lithium Extractable
10. Boron Dissolved
11. Magnesium Dissolved
12. Oxygen Consumed
13. Chlorophyll A
14. Nitrogen Total Kjeldahl
15. Nitrogen Dissolved Ammonia
16. Phosphorous Dissolved Ortho PO_4
17. Phosphorous Total
18. Alpha-Endosulfhan
19. Beta-Endosulfhan
20. Gamme-BHC Lindane
21. Aldrin
22. Dieldrin
23. Aroclor 1254
24. Aroclor 1248
25. Aroclor 1260
26. 2,4-D
27. 2,4,5-T
28. MCPA
29. Residue Filterable
30. Residue Fixed Filterable

Water quality stations with fifteen samples or more:

1. 00AL07GA0001 (Map #132)
2. 00AL07GE0001 (Map #141)
3. 00AL07GJ0001 (Map #137)
4. 00AL07HA0001 (Map # 24)
5. 00AL07HF0001 (Map # 25)
6. 00AL07JD0001 (Map #162)
7. 00AL07KC0001 (Map # 26)
8. 00AL07KE0001 (Map #163)
9. 00BC07EF0001 (Map # 1)
10. 00BC07FA0003 (Map # 10)
11. 00BC07FB0001 (Map # 74)
12. 00BC07FD0005 (Map # 19)

B. Alberta Government Data

The Alberta government has sampled at a number of locations within the Peace River sub-basin. Station 00AT07FD2030 (Map #21), Peace River at Dunvegan is active and has the most samples taken and parameters analyzed. Station 00AT07GJ2060 (Map #138), Smoky River at Watino is also active.

The following list contains the parameters studied throughout the sub-basin:

1. Temperature of Water
2. Specific Conductance
3. Turbidity
4. pH
5. Alkalinity Phenolphthalein
6. Alkalinity Total
7. Hardness Total
8. Carbonate
9. Bicarbonate
10. Calcium Dissolved
11. Magnesium Dissolved
12. Sodium Dissolved
13. Potassium Dissolved
14. Iron Total
15. Iron Extractable
16. Mercury Total
17. Cadmium Total
18. Cadmium Extractable
19. Copper Total
20. Lead Total
21. Manganese Total
22. Nickel Total
23. Zinc Extractable
24. Cobalt Total
25. Chromium Total
26. Chloride Dissolved
27. Sulphate Dissolved
28. Fluoride Dissolved
29. Nitrogen Dissolved NO_3 & NO_2
30. Nitrogen Total Ammonia
31. Nitrogen Total Calculated
32. Nitrate Dissolved
33. Nitrogen Dissolved Nitrite
34. Phosphorous Total Phosphate
35. Phosphate Total
36. Oxygen Dissolved
37. Oxygen BOD
38. Oxygen Total COD
39. Coliforms Fecal MPN
40. Coliforms Total MPN

41. Std. Plate Count
42. Oil and Grease
43. Phenolic Material
44. Odour Threshold Number
45. Surfactants N-Alkyl Sulphonates
46. Tannin and Lignin
47. Residue Total
48. Total Dissolved Solids

Analyzed but not at all stations within the sub-basin are:

1. Copper Extractable
2. Lead Extractable
3. Manganese Extractable
4. Nickel Extractable
5. Silver Extractable
6. Cobalt Extractable
7. Chromium Hexavalent
8. Chromium Extractable
9. Molybdenum Extractable
10. Arsenic Dissolved
11. Carbon Dissolved Inorganic
12. Carbon Dissolved Organic
13. Carbon Total Organic
14. Carbon Total Inorganic
15. Nitrogen Total Ammonia
16. Nitrogen Total Kjeldahl
17. Silica Reactive
18. Phosphorous Dissolved Ortho PO_4
19. Hydrocarbons

Water quality stations with fifteen samples or more:

1. 00AT07FD2030 (Map # 21)
2. 00AT07HA2040 (Map # 22)
3. 00AT07HA2041 (Map # 23)
4. 00AT07GA2010 (Map #133)
5. 00AT07GA2020 (Map #134)
6. 00AT07GE2019 (Map #142)
7. 00AT07GJ2060 (Map #138)

C. British Columbia Government Data

British Columbia government data is available from 126 stations within the Peace River basin; however only 19 of these stations have fifteen or more samples for the majority of the parameters analyzed.

Few parameters are analyzed at each station throughout the sub-basin but those which are include:

1. Specific Conductance
2. pH
3. Calcium Dissolved
4. Phosphorous Total

The following parameters have been analyzed within the sub-basin:

1. Turbidity
2. Colour
3. Salinity
4. Alkalinity Phenolphthalein
5. Alkalinity Total
6. Hardness Total
7. Bicarbonate
8. Carbon Dioxide Free
9. Acid 8.3
10. Aluminum Total
11. Chromium Dissolved
12. Mercury Total
13. Mercury Dissolved
14. Zinc Dissolved
15. Iron Total
16. Iron Dissolved
17. Vanadium Dissolved
18. Vanadium Total
19. Cadmium Total
20. Arsenic Total
21. Copper Total
22. Copper Dissolved
23. Lead Total
24. Lead Dissolved
25. Nickel Total
26. Zinc Total
27. Zinc Dissolved
28. Molybdenum Total

29. Chromium Total
30. Manganese Total
31. Magnesium Total
32. Magnesium Dissolved
33. Sodium Dissolved
34. Potassium Dissolved
35. Chloride Dissolved
36. Sulphate Dissolved
37. Fluoride Dissolved
38. Sulphide Total
39. Carbon Total Organic
40. Carbon Total Inorganic
41. Nitrogen Total Organic Calculated
42. Nitrogen Total Calculated
43. Nitrogen Dissolved Ammonia
44. Nitrate Dissolved
45. Nitrogen Dissolved Nitrite
46. Nitrogen Dissolved NO_3 & NO_2
47. Nitrogen Total Kjeldahl
48. Phosphorous Dissolved Ortho PO_4
49. Silica Reactive
50. Coliforms Fecal MPN
51. Coliforms Total MPN
52. Oxygen Dissolved
53. Oxygen Total COD
54. Chlorophyll
55. Phenolic Material
57. Surfactants N-Alkyl Sulphonates
58. Residue Nonfilterable
59. Residue Total
60. Residue Filterable

Water quality stations with fifteen samples or more:

1. 0400169 (Map # 2)
2. 0400388 (Map # 99)
3. 0400389 (Map #100)
4. 0400390 (Map #101)
5. 0400391 (Map #102)
6. 0400392 (Map #103)
7. 0400393 (Map #104)
8. 0400394 (Map #105)
9. 0400395 (Map #106)
10. 1177703 (Map # 73)
11. 1177704 (Map # 73)
12. 1177701 (Map # 86)
13. 1177702 (Map # 88)
14. 1177708 (Map # 94)
15. 1177712 (Map # 92)
16. 1177705 (Map # 76)
17. 1177706 (Map # 77)
18. 1177711 (Map # 95)
19. 0400701 (Map # 36)

WATER QUALITY STATIONS
Sub-Basin 2 - Peace River Drainage

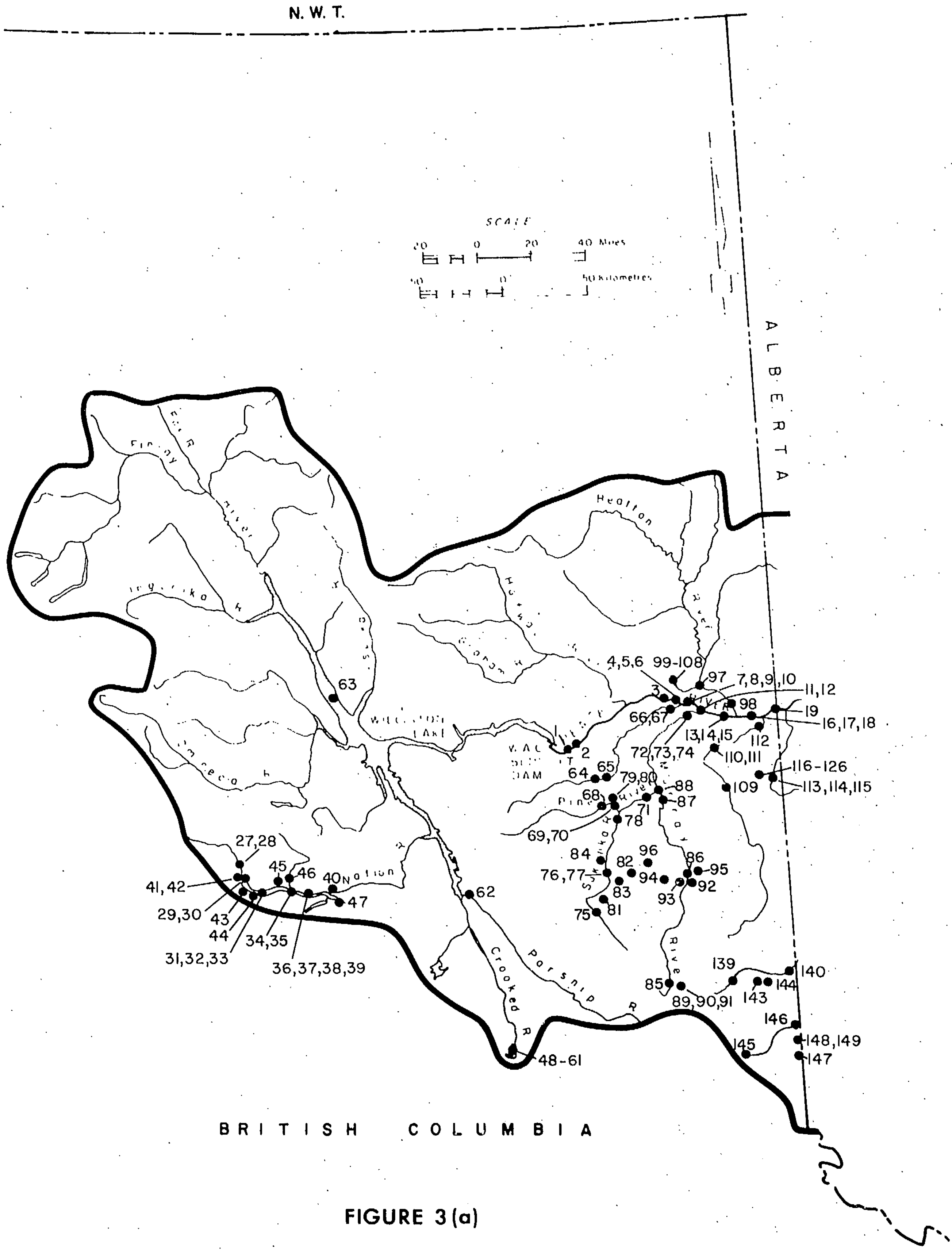


FIGURE 3(a)

WATER QUALITY STATIONS
Sub-Basin 2 - Peace River Drainage

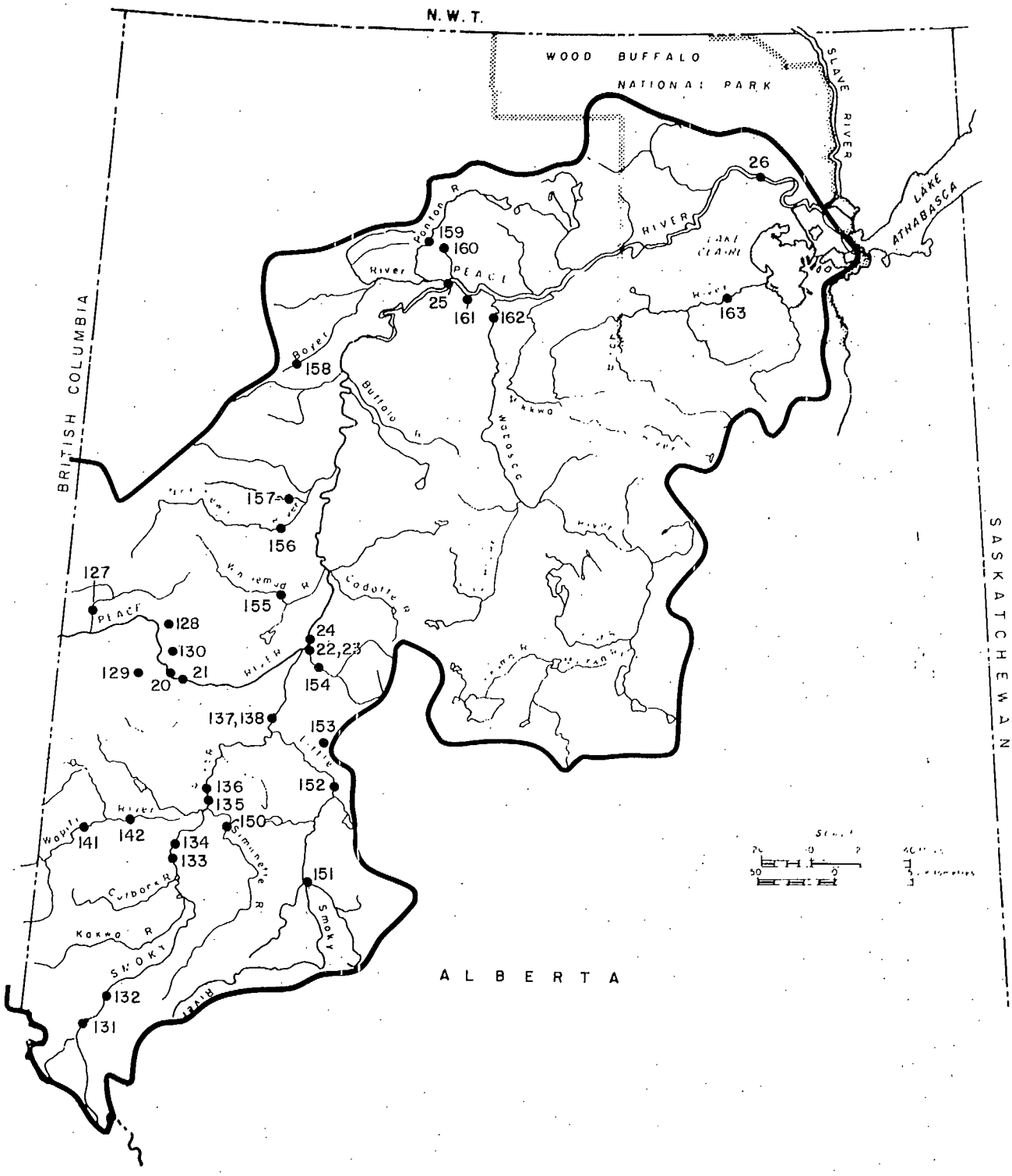


FIGURE 3 (b)

TABLE 2

Sub-Basin 2 - Peace River Stations

MAP STN. NO.	CONTRIBUTOR STATION NUMBER	STATION DESCRIPTION	CONTRIBUTOR	RATIONALE FOR ACTIVE STATIONS	REASONS FOR DISCONTINUING STATIONS	PARM. ANAL.	PERIOD OF RECORD 1960 1965 1970 1975 1979
1	00BC07EF0001	PEACE RIVER AT HWY 29 BRIDGE HUDSON HOPE BRITISH COL.	WQB		1	P	
2	0400169	PEACE RIVER-HUDSON HOPE AT FERRY CROSSING-14 MILES BELOW PEACE RIVER CANYON	BC		5	R	
3	0400492	PEACE RIVER AT OLD FORT			6	R	
4	0400134	2 MI UPSTREAM FROM THE CITY OF FORT ST. JOHN SANITARY DISCHARGE INTO THE PEACE RIVER STATION #1	BC		7	Q	
5	0400135	2 MI UPSTREAM FROM THE CITY OF FORT ST. JOHN SANITARY DISCHARGE INTO THE PEACE RIVER STATION #2	BC		7	Q	
6	0400136	2 MI UPSTREAM FROM THE CITY OF FORT ST. JOHN SANITARY DISCHARGE INTO THE PEACE RIVER STATION #3	BC		7	Q	
7	0400138	PEACE RIVER #2 STATION #1 100 YDS. ABOVE RAILWAY BRIDGE	BC		6	Q	
8	0400139	PEACE RIVER #2 STATION #2 100 YDS. ABOVE RAILWAY BRIDGE	BC		6	Q	
9	0400140	PEACE RIVER #2 STATION #3 100 YDS. ABOVE RAILWAY BRIDGE	BC		6	Q	
10	00BC07FA0003	PEACE RIVER NEAR TAYLOR RAILWAY BRIDGE BR. COL.	WQB		1	V	
11	0400157	PACIFIC PETROLEUMS TAYLOR-RAW WATER FROM PUMP BEARING COOLING WATER SUPPLY LINE IN SERVICE WATER PUMPHOUSE	BC		7	S	
12	00BC07FD0002	PEACE RIVER AT HWY 97 BRIDGE TAYLOR BR. COL.	WQB		1	T	
13	0400142	PEACE RIVER #3 STN #1 4 MI D/S FROM ALASKA HWY JUST U/S OF A SMALL CREEK ON THE NORTH SIDE	BC		6	Q	
14	0400143	PEACE RIVER #3 STN #2 4 MI D/S FROM ALASKA HWY JUST U/S OF A SMALL CREEK ON THE NORTH SIDE	BC		6	Q	
15	0400144	PEACE RIVER #3 STN #3 4 MI D/S FROM ALASKA HWY JUST U/S OF A SMALL CREEK ON THE NORTH SIDE	BC		6	Q	
16	0400146	PEACE RIVER #4 STN #1 6 MI D/S FROM BEATTON R. 100 YDS. U/S FROM RASPBERRY ISLAND	BC		6	Q	
17	0400147	PEACE RIVER #4 STN #2 6 MI D/S FROM BEATTON R. 100 YDS. U/S FROM RASPBERRY ISLAND	BC		6	Q	
18	0400148	PEACE RIVER #4 STN #3 6 MI D/S FROM BEATTON R. 100 YDS. U/S FROM RASPBERRY ISLAND	BC		6	Q	
19	00BC07FD0005	PEACE RIVER AT CLAYHURST FERRY NEAR BC ALBERTA BORDER BRITISH COLUMBIA	WQB		1	T	

TABLE 2 (cont'd)

Sub-Basin 2-Peace River Stations

MAP STN. NO.	CONTRIBUTOR STATION NUMBER	STATION DESCRIPTION	CONTRIBUTOR	RATIONALE FOR ACTIVE STATIONS	REASONS FOR DISCONTINUING STATIONS	PARM. ANAL.	PERIOD OF RECORD 1960 1965 1970 1975 1979
20	00AL07FD0002	PEACE RIVER AT HWY #2 DUNVEGAN	WQB		1,2	A,E	
21	00AT07FD2030	PEACE RIVER AT DUNVEGAN	ALTA	8		Q	
22	00AT07HA2040	PEACE R ABOVE PEACE R.	ALTA		8	Q	
23	00AT07HA2041	PEACE R-ABOVE PEACE R EAST BANK	ALTA		8	Q	
24	00AL07HA0001	PEACE RIVER AT PEACE RIVER	WQB		1,2	A,B	
25	00AL07HF0001	PEACE RIVER AT FORT VERMILION	WQB		1,2	A,E	
26	00AL07KC0001	PEACE RIVER AT PEACE POINT	WQB		1,2	A	
27	0400685	NATION R. AT INLET TO INDATA LAKE	BC		4	V	
28	0400686	INDATA LAKE AT CENTRE OF LAKE	BC		4	R	
29	0400687	NATION R. AT OUTLET FROM INDATA LAKE	BC		4	V	
30	0400690	NATION R. AT INLET TO TCHENTLO LAKE	BC		4	V	
31	0400693	STN #1 TCHENTLO LAKE AT WESTERN BEND NEAR MIDDLE OF LAKE	BC		4	R	
32	0400695	STN #2 TCHENTLO LAKE AT MIDDLE NEAR ISLAND	BC		4	V	
33	0400696	STN #3 TCHENTLO LAKE AT EASTERN BEND AT MIDDLE OF LAKE	BC		4	V	
34	0400698	NATION R. AT OUTLET FROM TCHENTLO LAKE	BC		4	V	
35	0400699	NATION R. AT INLET TO CHUCHI LAKE	BC		4	V	
36	0400701	CHUCHI LAKE STN #1 CHUCHI LAKE AT MIDDLE NEAR SMALL ISLAND AT WESTERN END	BC		4	V	
37	0400702	CHUCHI LAKE STN #2 CHUCHI LAKE AT MIDDLE OF MAIN REACH	BC		4	V	
38	0400703	CHUCHI LAKE STN #3 CHUCHI LAKE AT EASTERN END OF MAIN REACH	BC		4	V	
39	0400705	STN #4 CHUCHI LAKE AT EASTERN BAY NEAR ISLAND	BC		4	V	
40	0400706	NATION R. AT OUTLET FROM CHUCHI LAKE	BC		4	V	
41	0400688	ROTTACKER CREEK AT CONF. WITH NATION R. NEAR OUTLET FROM INDATA LAKE	BC		4	V	
42	0400689	TRIBUTARY FROM ALBERT LAKE DRAINING TO NATION R. BTWN. INDATA LAKE AND TCHENTLO LK.	BC		4	V	
43	0400691	STREAM FROM PURVIS LAKE AT INLET TO TCHENTLO LAKE	BC		4	V	
44	0400694	STREAM FROM AIRLINE LAKE AT INLET TO TCHENTLO LAKE	BC		4	V	

TABLE 2 (cont'd)

Sub-Basin 2-Peace River Stations

MAP STN. NO.	CONTRIBUTOR STATION NUMBER	STATION DESCRIPTION	CONTRIBUTOR	RATIONALE FOR ACTIVE STATIONS	REASONS FOR DISCONTINUING STATIONS	PARM. ANAL.	PERIOD OF RECORD 1960 1965 1970 1975 1979
45	0400697	AHDATAY CREEK AT INLET TO TCHENTLO LAKE	BC		4	V	
46	0400700	KLAWLI R. AT INLET TO CHUCHI LAKE	BC		4	V	
47	0400704	STREAM FROM WITCH LAKE AT INLET TO CHUCHI LAKE	BC		4	V	
48	0400741	UPSTREAM FROM THE SUMMIT LAKE DUMP SITE	BC	6		W	
49	0400740	DOWNSTREAM FROM THE SUMMIT LAKE DUMP SITE	BC	6		W	
50	0400828	SUMMIT LAKE #1 MIDDLE OF BAY AT WEST END OF LAKE NEAR INLET STREAM	BC	6		X	
51	0400829	SUMMIT LAKE #2 SOUTH SIDE OF LAKE WEST ARM	BC	6		X	
52	0400830	SUMMIT LAKE #3 SOUTH SIDE OF LAKE WEST ARM	BC	6		X	
53	0400831	SUMMIT LAKE #4 SOUTH SIDE OF LAKE WEST ARM	BC	6		X	
54	0400832	SUMMIT LAKE #5 EAST END OF LAKE	BC	6		X	
55	0400833	SUMMIT LAKE #6 EAST SIDE OF LAKE MIDDLE OF BAY	BC	6		X	
56	0400834	SUMMIT LAKE #7 NORTH-EAST SHORE	BC	6		X	
57	0400835	SUMMIT LAKE #8 NORTH-EAST SHORE	BC	6		X	
58	0400836	SUMMIT LAKE #9 NORTH END OF LAKE NEAR OUTLET OF LAKE	BC	6		X	
59	0400837	SUMMIT LAKE #10 WEST END OF LAKE NEAR MIDDLE OF BAY	BC	6		X	
60	0400838	SUMMIT LAKE #11 WEST SHORE-LINE	BC	6		X	
61	0400839	SUMMIT LAKE #12 NORTH SHORE WEST ARM OF LAKE	BC	6		X	
62	00BC07EE0001	PARSNIP RIVER AT HWY 97 BRIDGE WINDY POINT B. C.	WQB		1	R	
63	0400651	WILLISTON LK. AT MACKENZIE EFFLUENT DISCHARGE I. D. Z.	BC		5	Y	
64	0400567	MOBERLY R. ABOVE INLET TO LAKE ON INDIAN RESERVE	BC		4	P	
65	00BC07FB0004	MOBERLY RIVER AT HWY 29 BRIDGE AT OUTLET OF MOBERLY LK. B. C.	WQB		1	R	
66	0400137	PEACE RIVER BACKWATER ABOVE CONF. WITH PEACE RIVER	BC		6	Q	
67	0400302	MOBERLY R. ABOVE CONF. PEACE RIVER	BC		6	Q	
68	0400562	PINE RIVER AT HASLER CR. BELOW HART HWY BRIDGE NEAR HASLER CR. CONFLUENCE	BC		4	P	

TABLE 2 (cont'd)

Sub-Basin 2-Peace River Stations

MAP STN. NO.	CONTRIBUTOR STATION NUMBER	STATION DESCRIPTION	CONTRIBUTOR	RATIONALE FOR ACTIVE STATIONS	REASONS FOR DISCONTINUING STATIONS	PARM. ANAL.	PERIOD OF RECORD 1960 1965 1970 1975 1979
69	0400561	PINE R. AT TWIDWELL BEND OPP. OF CONF. WITH SUKUNKA R. AT TWIDWELL BEND	BC		5	P	
70	1177704	NORTH BANK PINE R. AT CHETWYND VILLAGE PUMPHOUSE	BC		4	Q	
71	0400560	PINE RIVER AT EAST PINE UP-STREAM OF CONF. OF MURRAY R.	BC		5	P	
72	0400141	PINE R. ABOVE CONF. WITH PEACE RIVER	BC		6	Q	
73	1177703	EAST BANK PINE R. AT PEACE ISLAND PARK ABOVE PINE-PEACE CONFLUENCE	BC		4	Q	
74	00BC07FB0001	PINE R. NEAR MOUTH 3.2 KM SOUTH OF TAYLOR B.C.	WQB		1	V	
75	1177714	SUKUNKA R. ABOVE WINDFALL CR. AT 100 LINE BRIDGE	BC		4	Q	
76	1177705	EAST BANK SUKUNKA R. ABOUT 5 KM ABOVE BURNT R. AND 10 KM BELOW SKEETER CR.	BC		4	Q	
77	1177706	EAST BANK SUKUNKA R. ABOUT 5 KM ABOVE BURNT R. AND 10 KM BELOW SKEETER CR.	BC		4	Q	
78	0400556	SUKUNKA R. ABOVE CONF. WITH PINE R. NEAR TWIDWELL BEND	BC		5	P	
79	1177745	CENTURION CR. JUST ABOVE CONF. WITH PINE RIVER	BC	7		Q	
80	1177747	CENTURION CR. ABOVE THE CHETWYND VILLAGE	BC	7		Q	
81	1177716	WINDFALL CR. AT 100 LINE ROAD CROSSING	BC		4	R	
82	1177717	CHAMBERLAIN CR. AT 100 LINE ROAD CROSSING	BC		4	R	
83	1177718	SKEETER CR. AT 100 LINE ROAD CROSSING	BC		4	R	
84	1177720	BURNT R. NEAR CONF. WITH SUKUNKA RIVER	BC		4	R	
85	1177724	MURRAY R. BELOW IMPERIAL CR. AT KINUSEO FALLS RD. BRIDGE	BC		4	Q	
86	1177701	MURRAY R. AT SECOND MAJOR MEANDER ABOUT 2 MI BELOW WOLVERINE RIVER	BC		4	Q	
87	0400552	MURRAY R. AT EAST PINE BELOW COLDSTREAM CR.	BC		5	P	
88	1177702	EAST BANK MURRAY R. 100 M ABOVE PINE R. CONF.	BC		4	Q	
89	1177728	KINUSEO CR. ABOVE FIVE CABIN CREEK	BC		4	P	
90	1177725	KINUSEO CR. BELOW FIVE CABIN CR. AT KINUSEO FALLS ROAD CROSSING	BC		4	Q	

TABLE 2 (cont'd)

Sub-Basin 2 - Peace River Stations

MAP STN. NO.	CONTRIBUTOR STATION NUMBER	STATION DESCRIPTION	CONTRIBUTOR	RATIONALE FOR ACTIVE STATIONS	REASONS FOR DISCONTINUING STATIONS	PARM. ANAL.	PERIOD OF RECORD 1960 1965 1970 1975 1979
91	1177726	FIVE CABIN CR. NEAR CONF. WITH KINUSEO CR. AT KINUSEO FALLS ROAD CROSSING	BC		4	Q	
92	1177712	FLATBED CR. ABOUT 0.8 KM ABOVE MURRAY-FLATBED CONF.	BC	7		Q	
93	1177710	WOLVERINE R. BELOW BULLMOOSE CREEK	BC		4	Q	
94	1177708	MAIN CHANNEL BULLMOOSE CR. AT 200 LINE BRIDGE	BC	7		Q	
95	1177711	QUALITY CR. AT WOOD PRESERVERS CAMP.	BC	7		Q	
96	1177723	MEIKLE CR. AT 200 LINE ROAD CROSSING	BC	7		P	
97	00BC07FC0002	BEATTON R. 9.92 KM END OF FORT ST. JOHN HWY BRIDGE B.C.	WQB		1	T	
98	0400145	BEATTON R. ABOVE CONF. WITH PEACE RIVER	BC		6	Q	
99	0400388	CHARLIE LK. STN #1 NEAR OUTLET FROM LAKE	BC		4	U	
100	0400389	CHARLIE LK. STN #2 SOUTH END OF LAKE 100 FEET FROM SHORE	BC		4	U	
101	0400390	CHARLIE LK. STN #3 SOUTH END OF LAKE 150 FEET FROM SHORE	BC		4	U	
102	0400391	CHARLIE LK. STN #4 MIDDLE OF LAKE NORTH AND EAST OF GOLF COURSE	BC		4	U	
103	0400392	CHARLIE LK. STN #5 EAST SHORELINE OF LAKE 150 FEET SHORE	BC		4	U	
104	0400393	CHARLIE LK. STN #6 WEST SHORELINE 150 FEET FROM SHORE	BC		4	U	
105	0400394	CHARLIE LK. STN #7 MIDDLE OF LAKE NORTH END	BC		4	U	
106	0400395	CHARLIE LK. STN #8 NORTH END OF LAKE	BC		4	U	
107	0400396	SOUTH SIDE OF BRIDGE AT THE SOUTH END OF CHARLIE LK.	BC		4	U	
108	0400397	CHARLIE LK. TRIBUTARY-SOUTH SIDE OF STODDART CREEK	BC		4	U	
109	0400545	KISKATINAW R. AT ARRAS NEAR HART HWY BRIDGE	BC		5	P	
110	00BC07FD0007	KISKATINAW R. ALASKA HWY BRIDGE NEAR FARMINGTON B.C.	WQB		1	T	
111	0400544	KISKATINAW R. AT ALASKA HWY BRIDGE	BC		5	P	
112	0400149	KISKATINAW R. ABOVE CONF. WITH PEACE RIVER	BC		6	Q	
113	0410040	POUCE COUPE R. UPSTREAM 1/2 MI FROM CONF. WITH DAWSON CR.	BC		7	Q	
114	0410041	DOWNSTREAM OF CONF. OF POUCE COUPE AND DAWSON CR.	BC		7	Q	

TABLE 2 (cont'd)

Sub-Basin 2 - Peace River Stations

MAP STN. NO.	CONTRIBUTOR STATION NUMBER	STATION DESCRIPTION	CONTRIBUTOR	RATIONALE FOR ACTIVE STATIONS	REASONS FOR DISCONTINUING STATIONS	PARM. ANAL.	PERIOD OF RECORD 1960 1965 1970 1975 1979
115	0410042	POUCE COUPE R. AT SPIRIT R. ROAD BRIDGE	BC		7	Q	
116	0410031	DAWSON CR 100 FT DOWNSTREAM OF CONF. WITH UNNAMED CR.	BC		7	Q	
117	0410032	AT INTERSECTION OF HART HWY AND DAWSON CR.	BC		7	Q	
118	0410034	INTERSECTION OF HWY #2 AND DAWSON CR.	BC		7	Q	
119	0410035	DAWSON CR. 150 YDS UPSTREAM DISCHARGE	BC		7	Q	
120	0410036	DAWSON CR. 20 FEET DOWN-STREAM OF DISCHARGE	BC		7	Q	
121	0410037	DAWSON CR. 150 FEET DOWN-STREAM OF DISCHARGE	BC		7	Q	
122	0410038	100 YDS. DOWNSTREAM OF DAWSON CR. REFUSE SITE	BC		7	Q	
123	0410050	100 YDS. UPSTREAM OF CITY OF DAWSON CR. REFUSE SITE	BC	6		R	
124	0410051	DAWSON CR. AT REFUSE SITE	BC	6		R	
125	0410052	100 FT. D/S OF DAWSON CR. REFUSE SITE	BC	6		R	
126	0410033	SOUTH DAWSON CR. AT 17 AVE.	BC		6	Q	
127	00AL07FD0004	CLEAR RIVER NEAR BEAR CANYON	WQB		1,2	E	
128	00AL07FD0006	MONTAGNEUSE CR. NEAR HINES CREEK	WQB		1,2	E	
129	00AL07FD0003	KSITUAN R. WEST OF SPIRIT RIVER	WQB		1,2	E	
130	00AL07FD0005	HINES CR. NEAR FAIRVIEW	WQB		1,2	E	
131	00AL07GA0002	SMOKY R. NEAR GRANDE CACHE	WQB		1,2	E	
132	00AL07GA0001	SMOKY R. ABOVE HELL'S CR	WQB		1	A,B	
133	00AT07GA2010	SMOKY R-U/S OF MCINTYRE PORCUPINE MINES	ALTA		8	Q	
134	00AT07GA2020	SMOKY R-D/S OF MCINTYRE PORCUPINE MINES	ALTA		8	Q	
135	00AT07GJ2020	SMOKY R AT GOODWIN	ALTA		8	Q	
136	00AL07GJ0003	SMOKY R. EAST OF BEZANSON	WQB		1,2	A,E	
137	00AL07GJ0001	SMOKY R. AT WATINO	WQB	1		A,B E,H	
138	00AT07GJ2060	SMOKY R. AT WATINO HWY #49 BRIDGE	ALTA	8		Q	
139	1177732	WAPITI R. UPSTREAM ABOVE PROPOSED COAL DEVEL.	BC		4	R	
140	1177733	WAPITI R. NEAR B.C.-ALBERTA BOUNDARY	BC		4	Q	
141	00AL07GE0001	WAPITI R. SOUTH OF GRANDE PRAIRIE	WQB		1,2	A,B,E	
142	00AT07GE2010	WAPITI R-GROVEDALE	ALTA		8	Q	
143	1177736	RED DEER CR. DOWNSTREAM ABOVE WAPITI RIVER	BC		4	R	
144	1177737	BELCOURT CR. DOWNSTREAM ABOVE WAPITI RIVER	BC		4	R	

TABLE 2 (cont'd)

Sub-Basin 2 - Peace River Stations

MAP STN. NO.	CONTRIBUTOR STATION NUMBER	STATION DESCRIPTION	CONTRIBUTOR	RATIONALE FOR ACTIVE STATIONS	REASONS FOR DISCONTINUING STATIONS	PARM. ANAL.	PERIOD OF RECORD 1960 1965 1970 1975 1979
145	1177734	NARRAWAY R. UPSTREAM ABOVE PROPOSED COAL DEVEL.	BC		4	R	
146	1177735	NARRAWAY R. NEAR B. C. -ALTA. BOUNDARY	BC		4	P	
147	1177742	TORRENS R. BELOW PROPOSED COAL DEVELOPMENT NEAR B. C. -ALTA. BORDER	BC		4	Q	
148	1177738	SAXON CR. DOWNSTREAM NEAR MOUTH	BC		4	Q	
149	1177739	SAXON CR. UPSTREAM BELOW PROPOSED COAL DEVEL.	BC		4	R	
150	00AL07GF0008	SIMONETTE R. NEAR GODDWIN	WQB		1,2	E	
151	00AL07GG0001	LITTLE SMOKY RIVER AT HWY #43	WQB		1,2	A	
152	00AL07GH0003	LITTLE SMOKY R. SOUTH OF GUY	WQB		1,2	A,E	
153	00AL07GG0004	WASKAHIGAN R. AT HWY #43	WQB		1,2	A,E	
154	00AL07HA0007	HEART RIVER NEAR NAMPA	WQB		1,2	E	
155	00AL07HA0008	WHITEMUD R. NEAR DIXONVILLE	WQB		1,2	E	
156	00AL07HC0006	NOTIKEWIN R. AT MANNING	WQB		1,2	E	
157	00AL07HC0007	HOTCHKISS R. AT HOTCHKISS	WQB		1,2	E	
158	00AL07HF0002	KEG RIVER AT KEG R. CABINS	WQB		1,2	A	
159	00AL07JF0001	PONTON R. AT ROCKY LANE	WQB		1,2	A,E	
160	00AL07JF0003	CARIBOU R. EAST OF ROCKY LANE	WQB		1,2	E	
161	00AL07JD0003	BEAR R. SOUTH OF FORT VERMILION	WQB		1,2	C	
162	00AL07JD0001	WABASCA R. AT WADLIN	WQB		1,2	A	
163	00AL07KE0001	BIRCH R. BELOW ALICE CR	WQB		1,2	A	

SUB-BASIN 2 - PEACE RIVER DRAINAGE

Water Quality Stations
Sensitive Areas
Expected Resource Projects And Developments

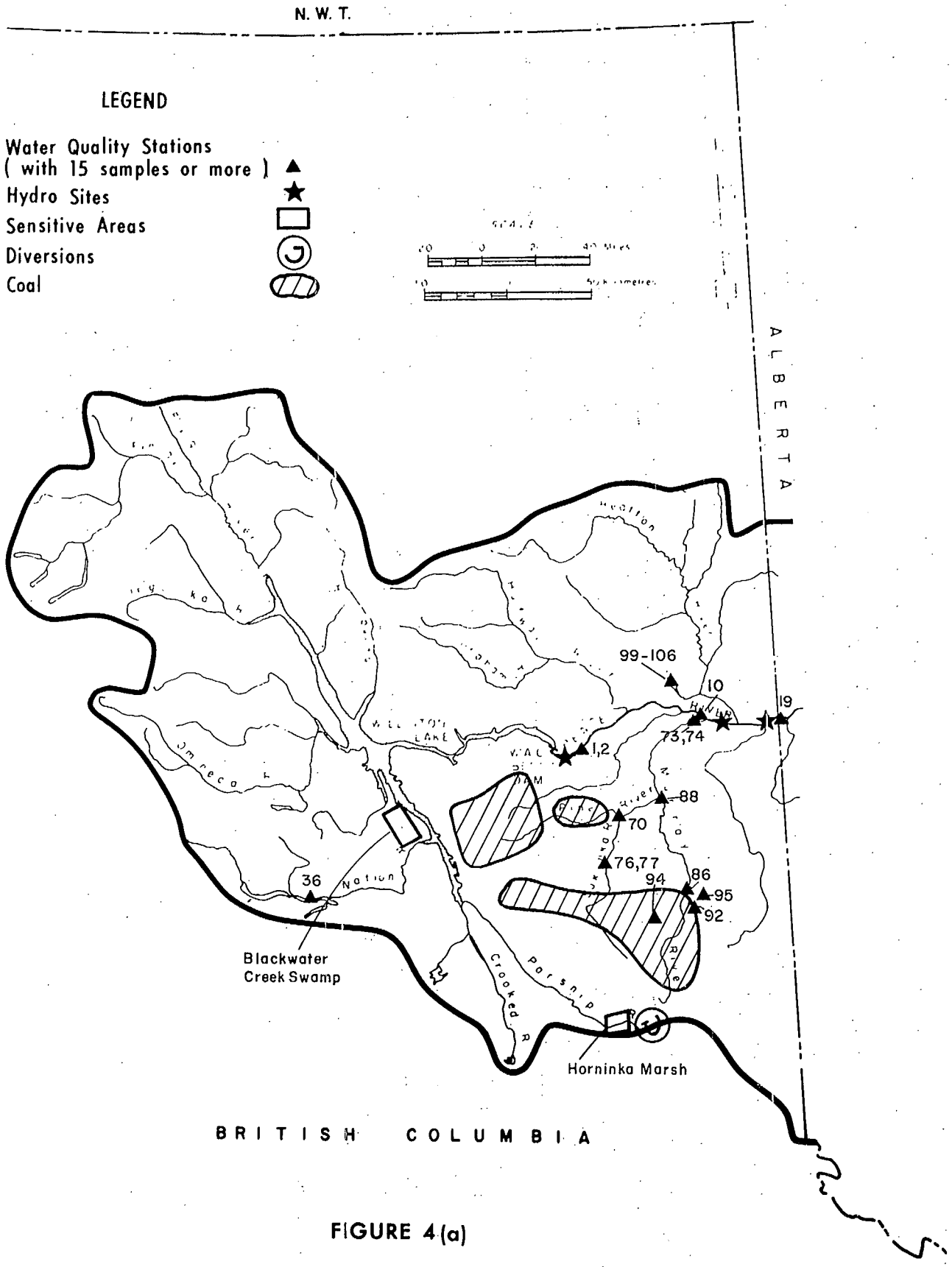
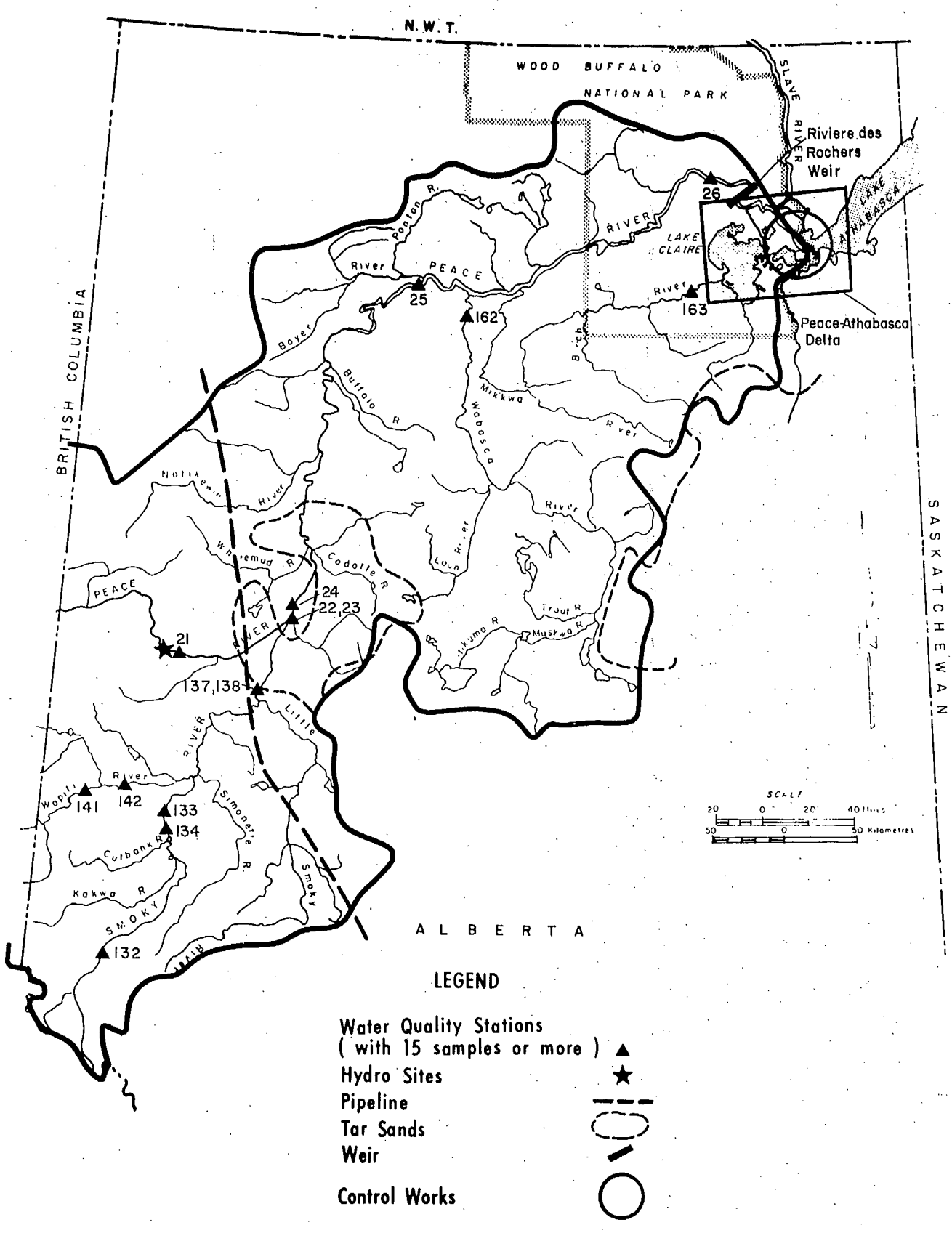


FIGURE 4 (a)

SUB-BASIN 2 - PEACE RIVER DRAINAGE

Water Quality Stations
Sensitive Areas
Expected Resource Projects And Developments



LEGEND

Water Quality Stations
(with 15 samples or more) ▲
Hydro Sites ★
Pipeline
Tar Sands
Weir
Control Works

FIGURE 4 (b)

C. Discussion

The Peace River headwaters originate in the mountains of British Columbia and make their way to Williston Lake. Very few of the tributaries have been monitored and those that have, do not have long periods of record. The only stations monitored in 1978 were part of a special study of Summit Lake. The upper Nation River has been studied intensively but all stations have since been discontinued. The Horninka Marsh near the planned McGregor Diversion, in the upper Parsnip River basin, has been designated as a sensitive area. Only one station (00BC07EE0001, Map #62) situated near the mouth of the Parsnip River, and discontinued in 1970, provides information as background to detect any changes in conditions due to the diversion.

Several hydroelectric installations have been planned on the Peace River between the W.A.C. Bennett Dam and the Alberta border. A number of water quality stations, which have since been discontinued, were established along this stretch of the river; four of these stations have more than 15 samples on record with a considerable number of parameters analyzed.

In conjunction with the project planned for Dunvegan, two stations are on record. Station 00AL07FP0002 (Map #20) has been discontinued, but the other (00AT07FD2030, Map #21) has more than 15 samples on record and has now been designated as part of a trend assessment network by the Alberta government. On the Peace River below Dunvegan, a pipeline crossing has been planned; also a tar sands deposit

occurs which stretches a considerable distance downstream. Downstream of the pipeline crossing below the confluence of the Peace and Smoky Rivers, there are three stations on record with 15 samples or more and a reasonable list of parameters analyzed, including metals and nutrients; however, all three have been discontinued. These stations are located near the centre of the tar sands deposit; closest station downstream of the deposit is at Fort Vermillion. The pipeline will cross the Smoky and Little Smoky Rivers on which there are stations above and below the point of crossing. The Whitemud and Notikewan Rivers, also in the path of the pipeline, are only sampled downstream of the proposed crossing. Two stations (00AL07GJ0001, Map #137, and 00AT07GJ2060, Map #138) located on the Smoky River are in the vicinity of a producing coal mine, the pipeline crossing and the tar sands. Only 00AT07GJ2060 (Map #138) is still active and a part of the Alberta Environment trend determination network.

The Moberly, Murray, Pine, Sukunka, Kiskatinaw, Wapiti, Narraway, and Torrens Rivers all flow through areas of future coal development; all have a considerable number of stations on record. Twelve of these stations have more than 15 samples taken for an extensive list of parameters; six of these stations were sampled in 1978.

Just upstream of the Peace-Athabasca Delta, on the Peace River, the Rivière des Rochers Wier is planned and, although there are no stations downstream of the Weir, there is one at Peace Point (00AL07KC0001, Map #26) with more than 15 samples on record; the station, however, was discontinued in 1970. The only other station above the Delta included

in the Peace River sub-basin is on the Birch River below Alice Creek (00AL07KE0001, Map #163). This station has a significant number of samples on record, but was discontinued in 1970.

D. Data Gaps

1. There is insufficient data on record for the Peace River sub-basin for the following parameter groups: nutrients, pesticides, herbicides, PCB's, hydrocarbons, oxygen related parameters and biochemical compounds.

2. Presently, the Parsnip River drainage basin is without monitoring activity and the upper part of the basin has insufficient historical information. If the McGregor Diversion proceeds as planned in the headwaters of the river, the Horninka Marsh sensitive area could be affected and the existing data gap could become more serious.

3. There is considerable historical data avilable for the Peace River, from downstream of the W.A.C. Bennet Dam to the Alberta border, but when the new dams are constructed on this stretch the present level of monitoring activity may be insufficient.

4. When the Mackenzie Valley Pipeline crosses the Peace River sub-basin, more strategic sampling locationsthan at present, may have to be established to allow monitoring of any changes in water quality.

5. A data gap exists between the town of Peace River and the Peace Delta, as there is no present monitoring activity, and if the tar sands deposits are developed, it could become serious.

6. The Peace-Athabasca Delta is void of active monitoring and with all the developments proposed on the Peace River as well as those already described on the Athabasca River, a serious lack of information on the input to the Delta may result.

CHAPTER IV

SUB-BASIN 3 - LIARD RIVER DRAINAGE

Water quality information for the Liard River sub-basin was compiled from NAQUADAT and DINA data.

A. NAQUADAT Data

The analyses for parameters studied throughout the sub-basin as contained on NAQUADAT indicate that very few metal and nutrient parameters have been studied. Totally lacking from the list of parameters studied throughout the sub-basin are pesticides, herbicides, hydrocarbons, PCB's and oxygen related parameters.

The following parameters are analyzed throughout the sub-basin:

1. Colour Apparent
2. Specific Conductance
3. Temperature Water
4. Turbidity
5. pH
6. Alkalinity Total
7. Alkalinity Phenolphthalein
8. Residue Nonfilterable
9. Residue Fixed Nonfilterable
10. Hardness Total
11. Zinc Extractable
12. Arsenic Dissolved
13. Sodium Dissolved
14. Fluoride Dissolved
15. Chloride Dissolved
16. Sulphate Dissolved
17. Potassium Dissolved
18. Calcium Dissolved
19. Silica Reactive
20. Carbon Total Organic
21. Carbon Total Inorganic
22. Nitrogen Dissolved NO_3 & NO_2

In addition to the parameters studied throughout the sub-basin, certain parameters have been sampled significantly at selected stations.

00NW10ED0002, 0004, 0005 (Map #5,10,3)

1. Lithium Extractable
2. Vanadium Extractable
3. Chromium Extractable
4. Strontium Extractable
5. Boron Dissolved
6. Lead Extractable
7. Molybdenum Extractable
8. Cadmium Extractable
9. Zinc Extractable
10. Manganese Extractable
11. Iron Extractable
12. Cobalt Extractable
13. Copper Extractable
14. Nickel Extractable
15. Nitrogen Total Kjeldahl
16. Phosphorous Dissolved Ortho PO_4
17. Phosphorous Total Inorganic PO_4
18. Phosphorous Dissolved Inorganic PO_4
19. Phosphorous Total Dissolved

00NW10EA0001 (Map #11)

1. Iron Extractable

00NW10EA0005 (Map #15)

1. Nickel Dissolved

00NW10EC0001 (Map #1)

1. Iron Dissolved Fe^{++} & Fe^{+++}
2. Fluoride Dissolved
3. Residue Fixed Nonfilterable

00NW10ED0001 (Map #2)

1. Iron Dissolved Fe^{++} & Fe^{+++}
2. Zinc Dissolved
3. Manganese Dissolved
4. Magnesium Dissolved
5. Nitrogen Dissolved Nitrate

00NW10ED0007 (Map #6)

1. Turbidity Light Penetration
2. Oxygen Dissolved
3. Manganese Dissolved
4. Cadmium Dissolved
5. Zinc Dissolved
6. Iron Dissolved Fe^{++} & Fe^{+++}
7. Magnesium Dissolved
8. Silicon Soluble Ortho-Silicate
9. Phosphorous Total Dissolved
10. Nitrogen Dissolved

Water quality stations with fifteen samples or more:

1. 00NW10EA0001 (Map #11)
2. 00NW10EA0002 (Map #13)
3. 00NW10EA0003 (Map #17)
4. 00NW10EA0005 (Map #15)
5. 00NW10EB0001 (Map # 8)
6. 00NW10EC0001 (Map # 9)
7. 00NW10ED0001 (Map # 2)
8. 00NW10ED0002 (Map # 5)
9. 00NW10ED0004 (Map #10)
10. 00NW10ED0005 (Map # 3)
11. 00NW10ED0007 (Map # 6)
12. 00YT10AA0001 (Map # 1)
13. 00YT10AB0001 (Map # 7)

B. DINA Data

The DINA water quality file includes monthly data for two stations in the Liard River sub-basin.

Parameters analyzed included:

1. pH
2. Specific Conductance
3. Total Alkalinity
4. Total Hardness
5. Suspended Solids
6. Copper
7. Lead
8. Nickel
9. Iron
10. Sulphate
11. Chloride
12. Nitrate
13. Phosphate
14. Cyanide

Water quality stations with fifteen samples or more:

4 and 5 (Map #'s 12,14).

WATER QUALITY STATIONS
Sub-Basin 3-Liard River Drainage

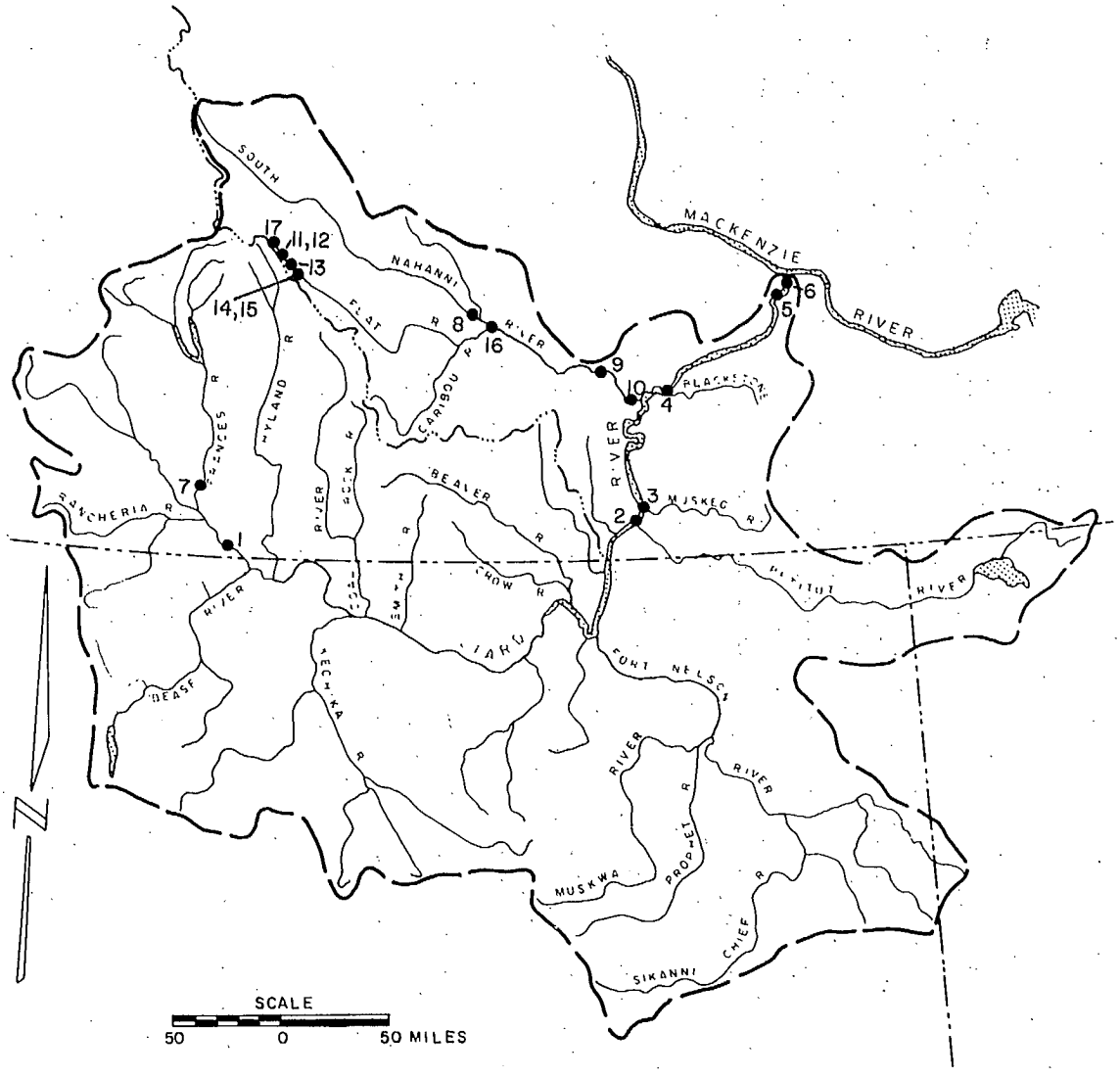


FIGURE 5

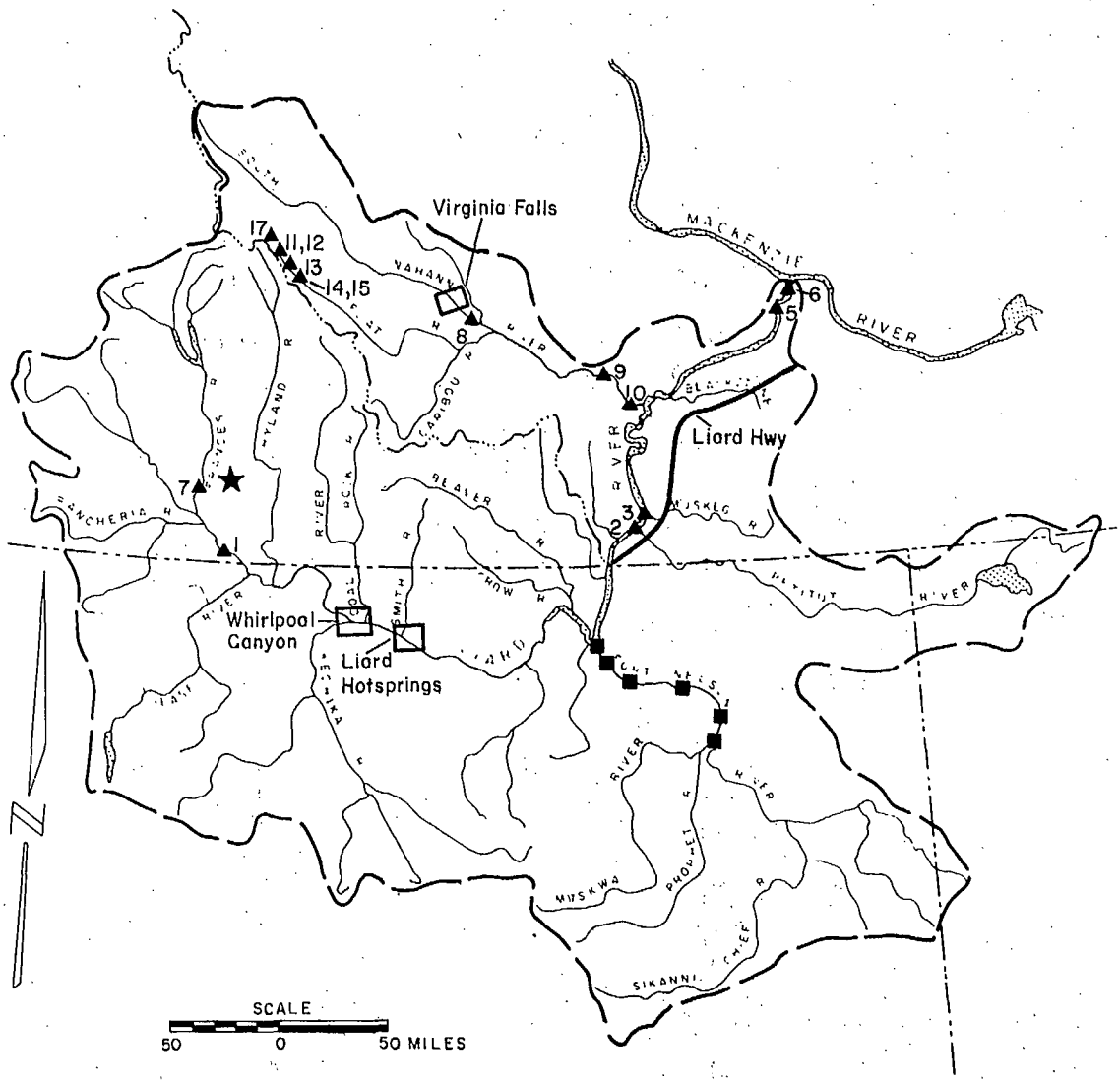
TABLE 3

Sub-Basin 3 - Liard River Stations

MAP STN. NO.	CONTRIBUTOR STATION NUMBER	STATION DESCRIPTION	CONTRIBUTOR	RATIONALE FOR ACTIVE STATIONS	REASONS FOR DISCONTINUING STATIONS	PARM. ANAL.	PERIOD OF RECORD 1960 1965 1970 1975 1979
1	00YT10AA0001	LIARD R. AT W.S.C. GUAGE AT BRIDGE ON ALASKA HWY.	WQB		1	R	
2	00NW10ED0001	LIARD RIVER AT FT. LIARD	WQB, FWI, F&M		1, 11	R	
3	00NW10ED0005	LIARD RIVER BELOW FT. LIARD	WQB		2	A	
4	00NW10ED0003	LIARD RIVER AT NAHANNI BUTTE	WQB, F&M		2, 11	A	
5	00NW10ED0002	LIARD RIVER ABOVE FT. SIMPSON	WQB, F&M		2, 11	A	
6	00NW10ED0007	LIARD RIVER UPSTREAM LIARD AND MACKENZIE RIVERS	FWI		11	R	
7	00YT10AB0001	FRANCES R. AT W.S.C. GUAGE AT BRIDGE NORTH OF WATSON LK.	WQB		1	R	
8	00NW10EB0001	SOUTH NAHANNI R. ABOVE VIRGINIA	WQB, FWI		1, 2, 11	A	
9	00NW10EC0001	SOUTH NAHANNI R. ABOVE CLAUSEN CREEK	WQB, FWI DINA		1, 2 11, 10	A	
10	00NW10ED0004	SOUTH NAHANNI R. ABOVE MOUTH OF PRAIRIE CR. AT NAHANNI BUTTE	WQB, DINA		2, 10	A	
11	00NW10EA0001	FLAT RIVER ABOVE MINE RAW WATER INTAKE	WQB, DINA		1, 10	R	
12	4	FLAT RIVER ABOVE CANTUNG MINE	DINA	10		L	
13	00NW10EA0002	FLAT RIVER AT CAUSEWAY CULVERT	DINA		10	R	
14	5	FLAT RIVER BELOW TAILINGS POND DISCHARGE	DINA	9		L	
15	00NW10EA0005	FLAT RIVER 1 MI DOWNSTREAM OF TAILINGS DISCHARGE	DINA		10	A	
16	00NW10EA0004	FLAT RIVER NEAR MOUTH	WQB, DINA		1, 10	A	
17	00NW10EA0003	SARDINE CR. AT CULVERT AT ROAD TO WATSON LAKE	WQB, DINA		1, 10	L	

SUB-BASIN 3 - LIARD RIVER DRAINAGE

Water Quality Stations
Sensitive Areas
Expected Resource Projects And Developments



LEGEND

Water Quality Stations (with 15 samples or more) ▲
Hydro Sites ★
Sensitive Areas ▭
Dredging ■
Highways ~

FIGURE 6

C. Discussion

In the upper reaches of the Liard River, Yukon Territory, a hydroelectric development has been planned on the Frances River and a possible diversion from the Hyland River into Frances Lake. Two water quality stations, both discontinued in 1975, were established in the area, one on the Frances River and the other on the Liard River near the B.C.-Yukon Territory Border; both have 15 samples or more on record. The Liard River enters British Columbia just downstream of station 00YT10AA0001 (Map #1) and flows a considerable distance within B.C. before entering the Northwest Territories not far from Fort Liard. There are no water quality stations along this stretch of the river. Within the section of the Liard drainage basin in B.C., there is a copper mine, an asbestos mine, two sensitive areas, (Whirlpool Canyon and Liard Hotsprings), and expected dredging on the Fort Nelson River. In addition there is a possibility that the Liard Highway will cross the Liard River at the B.C./Northwest Territories Border. Two stations, with 15 samples or more, are located at and below Fort Liard; however, both were discontinued in 1975. Six stations, with 15 samples or more on record, are located on the upper reaches of the Flat River, which monitor the river above and below the Canada Tungsten mine; however, only two of these are still active. There are two stations on record near the mouth of the Liard River, station 00NW10ED0007 (Map #6), which has a very short period of record and has been discontinued, and station 00NW10ED0002 (Map #5) which has a long period of record, a reasonable

variety of parameters analyzed, and is still active.

D. Data Gaps

1. There is an insufficient amount of data on record for the Liard River sub-basin for metals, nutrients, and oxygen related parameters.

2. There is inadequate monitoring activity along the section of the Liard River within the province of British Columbia. This is augmented by the fact that there are two mines, two sensitive areas and the possibility of dredging taking place in this area.

3. If the Liard Highway crosses the river upstream of Fort Liard, the stations near the town will provide important background data but will have to be reactivated at the time of construction. Also, the highway may cross tributaries to the Liard River on its route down the river valley and since the only active station is located at the mouth, at Fort Simpson, any changes in the water quality resulting from the construction would not be adequately monitored.

CHAPTER V

SUB-BASIN 4 - HAY RIVER DRAINAGE

A. NAQUADAT Data

All of the following information was collected from NAQUADAT as none of the other contributing agencies provided data from this sub-basin.

Station 00NW07)B0001 (Map #1) Steen River near Steen has the widest range of parameters analyzed as well as the greatest number of samples taken during the period of record.

Certain parameters are analyzed throughout the sub-basin which include physical parameters, metals, major ions, and a few nutrient parameters. There is no information indicating significant numbers of analyses for parameters such as pesticides, herbicides, hydrocarbons, PCB's and oxygen related parameters.

The following is a list of the parameters analyzed throughout the sub-basin:

1. Colour Apparent
2. Specific Conductance
3. Temperature Water
4. Turbidity
5. Alkalinity Total
6. Alkalinity Phenolphthalein
7. pH
8. Hardness Total
9. Fluoride Dissolved
10. Lithium Extractable
11. Manganese Extractable
12. Boron Dissolved

13. Aluminum Extractable
14. Vanadium Extractable
15. Chromium Extractable
16. Iron Extractable
17. Cobalt Extractable
18. Nickel Extractable
19. Copper Extractable
20. Zinc Extractable
21. Arsenic Dissolved
22. Strontium Extractable
23. Molybdenum Extractable
24. Silver Extractable
25. Cadmium Extractable
26. Lead Extractable
27. Sodium Dissolved
28. Sulphate Dissolved
29. Chloride Dissolved
30. Potassium Dissolved
31. Carbon Total Organic
32. Carbon Total Inorganic
33. Nitrogen Total Kjeldahl
34. Nitrogen Dissolved NO_3 & NO_2
35. Silica Reactive

In addition to the parameters analyzed throughout the sub-basin, significant sample numbers have been taken for analyses of the following parameters at station 00NW070B0001 (Map #1):

1. Phosphorous Dissolved Ortho PO_4
2. Phosphorous Total Inorganic PO_4
3. Phosphorous Dissolved Inorganic PO_4
4. Phosphorous Total
5. Calcium Dissolved
6. Manganese Dissolved
7. Iron Dissolved
8. Copper Dissolved
9. Zinc Dissolved
10. Lead Dissolved
11. Residue Nonfilterable
12. Residue Fixed Nonfilterable

Extractable antimony, barium, mercury and thallium were also analyzed in the sub-basin, at a few locations with reduced frequency during the period of record.

WATER QUALITY STATIONS
Sub-Basin 4 - Hay River Drainage

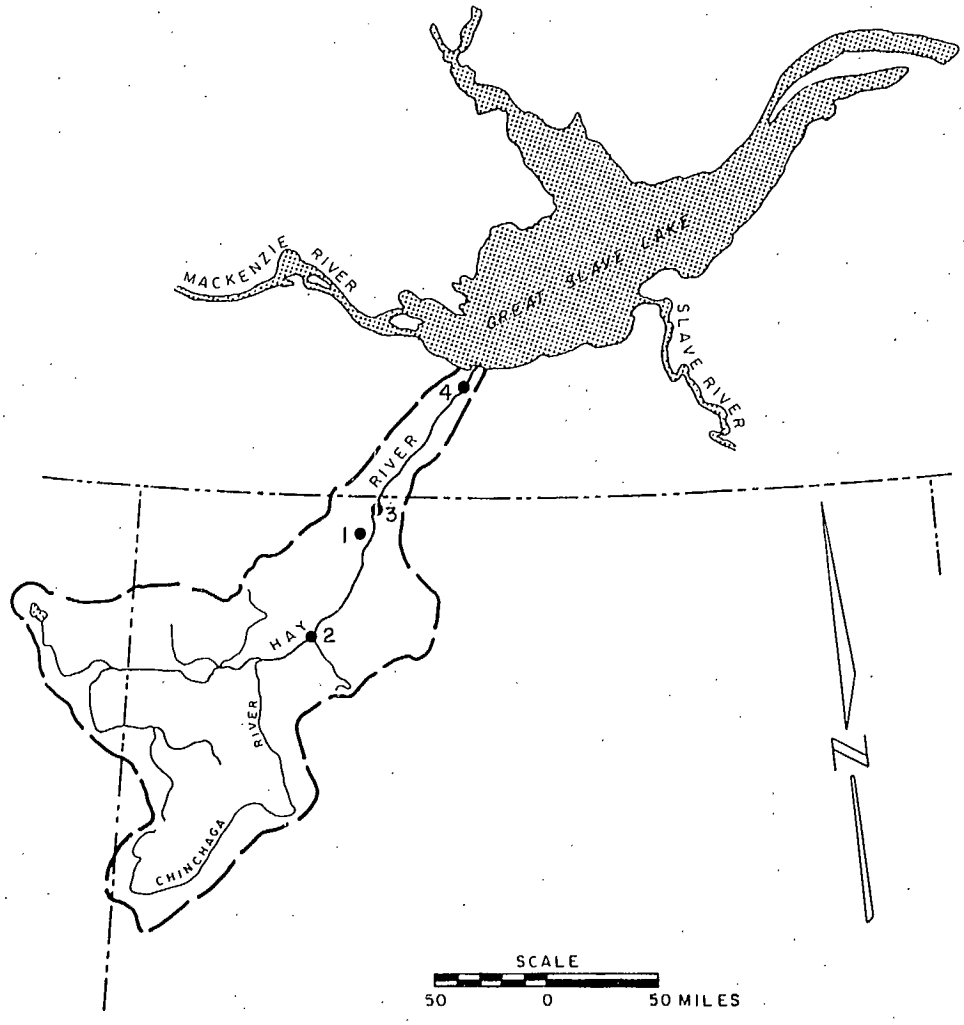


FIGURE 7

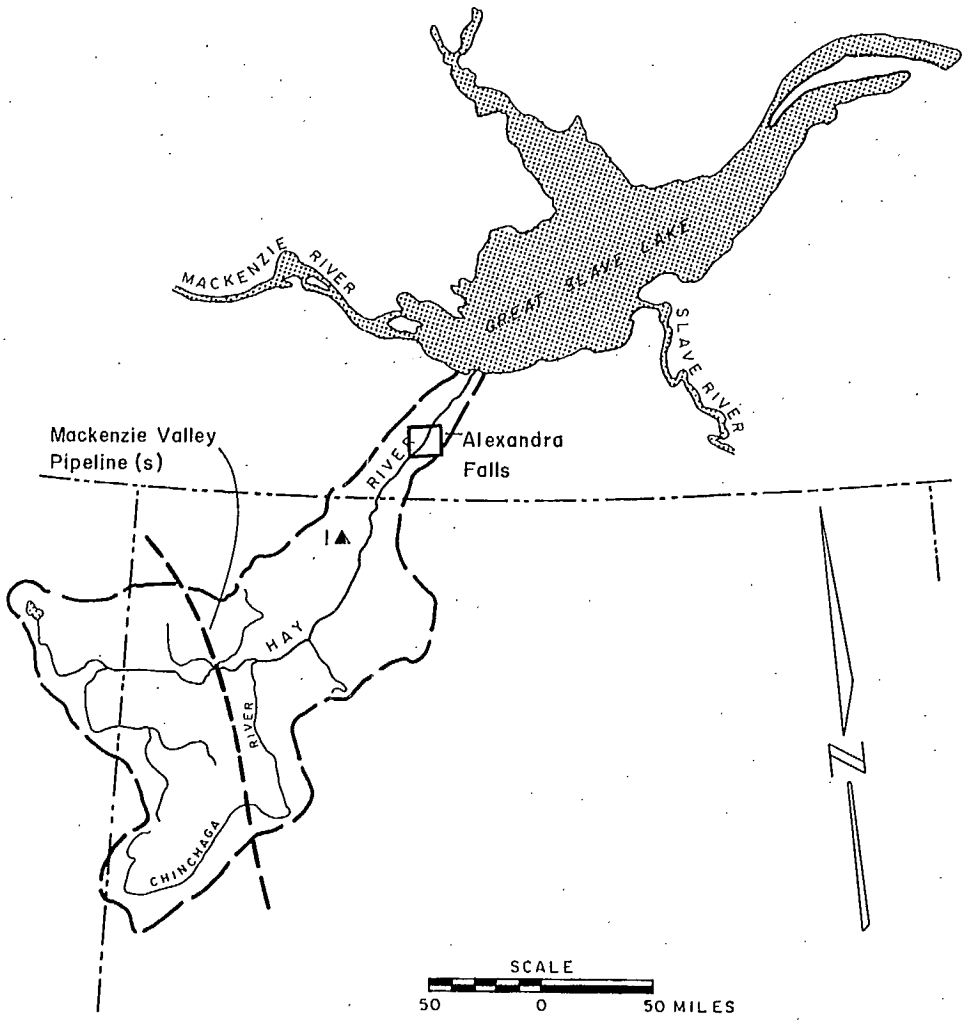
TABLE 4

Sub-Basin 4 - Hay River Stations

MAP STN. NO.	CONTRIBUTOR STATION NUMBER	STATION DESCRIPTION	CONTRIBUTOR	RATIONALE FOR ACTIVE STATIONS	REASONS FOR DISCONTINUING STATIONS	PARM. ANAL.	PERIOD OF RECORD 1960 1965 1970 1975 1979
1	00AL07OB0001	STEEN RIVER NEAR STEEN	WQB		1,2	A,E	[redacted]
2	00AL07OB0002	HAY RIVER NEAR MEANDER	WQB		1,2	A,E	[redacted]
3	00AL07OB0003	HAY RIVER AT INDIAN CABINS	WQB		1,2	E	[redacted]
4	00NW07OB0001	HAY RIVER AT HWY #15	WQB		1,2	A	[redacted]

SUB-BASIN 4 - HAY RIVER DRAINAGE

Water Quality Stations
Sensitive Areas
Expected Resource Projects And Developments



LEGEND

Water Quality Stations
(with 15 samples or more) ▲
Sensitive Areas
Pipeline

FIGURE 8

B. Discussion

The Hay River is the smallest sub-basin in the Mackenzie River Basin and there are only four water quality stations on record, only one of which has more than 15 samples and all four have not been sampled since 1974. One station (00AL070B0001, Map #1) on the Steen River has more parameters analyzed than any of the others including a wide variety of metal and nutrient constituents. The Mackenzie Valley pipeline is planned to cross the upper reaches of the Hay River and the closest water quality station (00AL070B0002, Map #2) to the crossing is not far downstream. There are stations on record above and below Alexandra Falls, but as mentioned above, all are discontinued.

C. Data Gaps

All stations within the Hay River sub-basin have been discontinued since 1974. This may represent a data gap within the sub-basin if the route of the Mackenzie Valley Pipeline proceeds as planned.

CHAPTER VI

SUB-BASIN 5 - GREAT SLAVE LAKE DRAINAGE

Water quality data are available from both NAQUADAT and DINA.

A. NAQUADAT Data

Information from NAQUADAT reveals that a number of parameters are analyzed throughout the sub-basin, including:

1. Colour Apparent
2. Specific Conductance
3. Temperature Water
4. Turbidity
5. Alkalinity Total
6. Alkalinity Phenolphthalein
7. pH
8. Hardness Total
9. Iron Extractable
10. Nickel Extractable
11. Copper Extractable
12. Zinc Extractable
13. Cadmium Extractable
14. Sodium Dissolved
15. Sulphate Dissolved
16. Chloride Dissolved
17. Potassium Dissolved
18. Calcium Dissolved
19. Nitrogen Dissolved NO_3 & NO_2
20. Silica Reactive

The number of parameters studied in each parameter group is not extensive, and parameter analyses from a number of parameter groups is not-existent. Nutrients in general are not analyzed throughout the basin but they are studied extensively at certain stations.

The following NAQUADAT stations, in addition to the above mentioned parameters, have significant numbers of samples taken for the

listed parameters.

00NW07PA0002 (Map #9)

1. Carbon Total Organic
2. Carbon Total Inorganic
3. Phosphorous Dissolved Ortho PO_4
4. Phosphorous Total Inorganic PO_4
5. Phosphorous Dissolved Inorganic PO_4
6. Strontium Extractable

00NW07SB0003 (Map #15)

1. Cyanide

00NW07SB0005 - 00NW07SB0007 (Map #18,20,22)

1. Bicarbonate Calculated
2. Nitrogen Dissolved
3. Silicon Sol. Ortho-Silicate
4. Magnesium Dissolved

00NW07UC0001 (Map #30)

1. Manganese Extractable
2. Chromium Extractable
3. Lithium Extractable
4. Boron Dissolved
5. Lead Extractable
6. Fluoride Dissolved
7. Strontium Extractable
8. Molybdenum Extractable
9. Carbon Total Organic
10. Carbon Total Inorganic
11. Nitrogen Total Kjeldahl
12. Phosphorous Dissolved Ortho PO_4
13. Phosphorous Total Inorganic PO_4
14. Phosphorous Dissolved Inorganic PO_4

01NW07SB001 (Map #25)

1. Zinc Dissolved
2. Lead Dissolved
3. Fluoride Dissolved
4. Carbon Total Organic
5. Carbon Total Inorganic
6. Phosphorous Dissolved Ortho PO_4
7. Phosphorous Total Inorganic PO_4
8. Phosphorous Dissolved Inorganic PO_4

01NW07SB0005 - 01NW07SB0007 (Map #21,19,17)

1. Copper Dissolved
2. Bicarbonate Calculated
3. Nitrogen Dissolved
4. Oxygen Dissolved
5. Manganese Dissolved
6. Iron Dissolved Fe^{++} & Fe^{+++}
7. Cadmium Dissolved
8. Residue Nonfilterable
9. Magnesium Dissolved
10. Silicon Sol. Ortho-Silicate
11. Zinc Dissolved
12. Arsenic Dissolved
13. Lead Dissolved
14. Turbidity Light Penetrn.

The following parameters were analyzed in the sub-basin but with reduced frequency and at fewer locations.

1. Iron Dissolved Fe^{++} & Fe^{+++}
2. Cobalt Extractable
3. Copper Dissolved
4. Arsenic Dissolved
5. Molybdenum Extractable
6. Lead Dissolved

Water quality stations with fifteen samples or more:

1. 00AL07NB0001 (Map # 1)
2. 00AL07NB0003 (Map # 4)
3. 00NW07PA0002 (Map # 9)
4. 00NW07PB0002 (Map # 7)
5. 00NW07QC0001 (Map #10)
6. 00NW07RD0001 (Map #11)
7. 00NW07SA0001 (Map #29)
8. 00NW07SB0003 (Map #24)
9. 00NW07SB0005 (Map #18)
10. 00NW07SB0006 (Map #20)
11. 00NW07SB0007 (Map #22)
12. 00NW07SB0008 (Map #14)
13. 00NW07UC0001 (Map #30)
14. 01NW07SB0001 (Map #25)
15. 01NW07SB0003 (Map #24)
16. 00NW07SB0005 (Map #18)
17. 01NW07SB0006 (Map #19)
18. 01NW07SB0007 (Map #17)

B. DINA Data

DINA has a data record for the Great Slave Lake drainage which includes eight stations. Stations 12 and 14 are sampled monthly,

9, 10, 13 and 19 are sampled biannually, 15 quarterly while station 21 is sampled intensively.

Parameters studied include:

1. pH
2. Temperature of Water
3. Specific Conductance
4. Turbidity
5. Colour
6. Total Alkalinity
7. Total Hardness
8. Suspended Solids
9. Total Dissolved Solids
10. Cadmium
11. Chromium
12. Cobalt
13. Iron
14. Lead
15. Manganese
16. Nickel
17. Zinc
18. Copper
19. Arsenic
20. Barium
21. Silver
22. Mercury
23. Calcium
24. Magnesium
25. Potassium
26. Sodium
27. Chlordie
28. Sulphate
29. Silica
30. Nitrate
31. Ammonia
32. Phosphate
33. Cyanide
34. Oil and Grease
35. Total Coliform
36. Fecal Coliform
37. Strontium
38. Vanadium
39. Beryllium
40. Aluminum
41. Titanium
42. Zirconium
43. Thallium
44. Bioassays

WATER QUALITY STATIONS
Sub - Basin 5 - Great Slave Lake Drainage

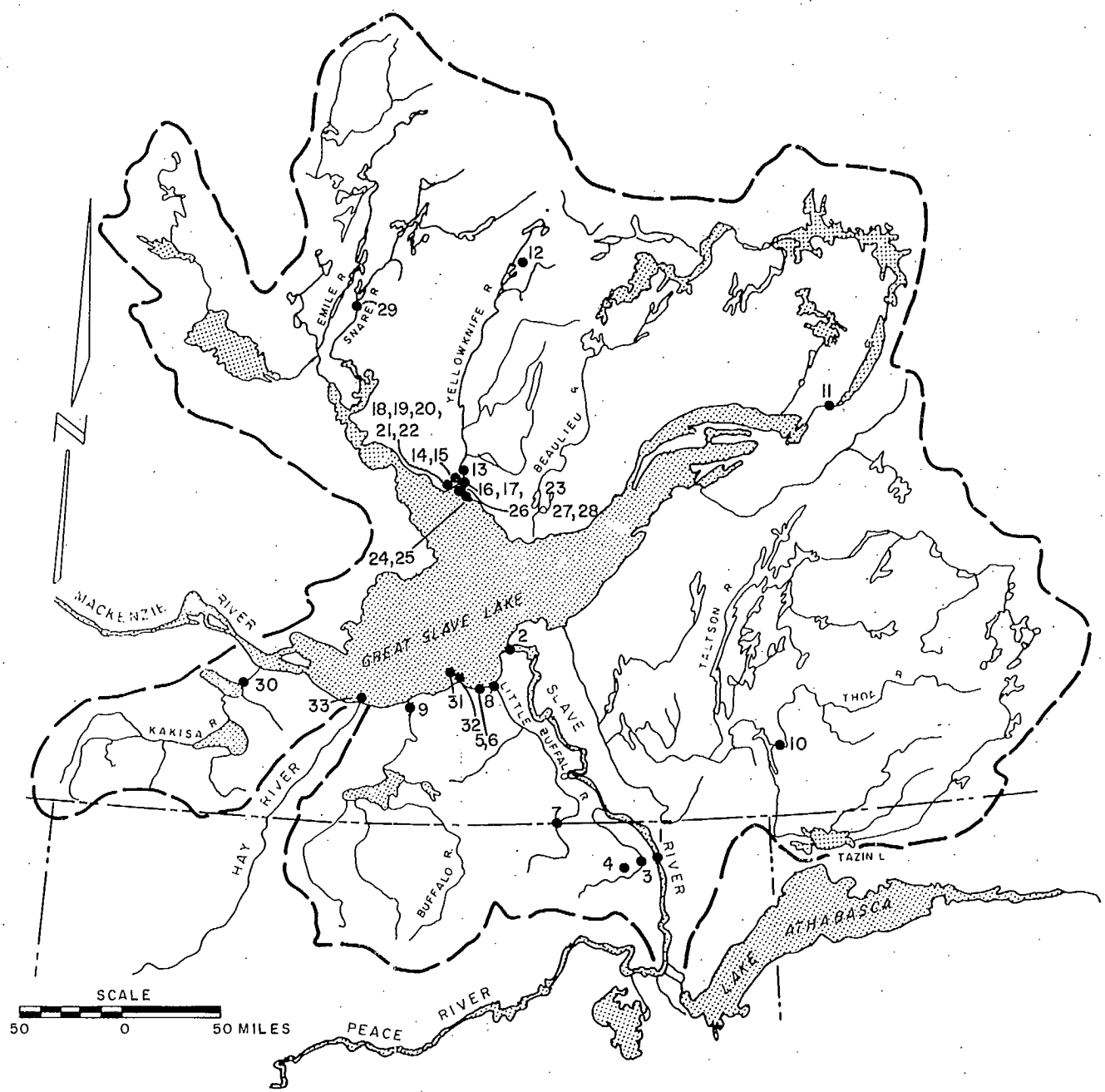


FIGURE 9

TABLE 5

Sub-Basin 5 - Great Slave Lake Stations

MAP STN. NO.	CONTRIBUTOR STATION NUMBER	STATION DESCRIPTION	CONTRIBUTOR	RATIONALE FOR ACTIVE STATIONS	REASONS FOR DISCONTINUING STATIONS	PARM. ANAL.	PERIOD OF RECORD 1960 1965 1970 1975 1979
1	00AL07NB0001	SLAVE RIVER AT FITZGERALD	WQB	4		A	
2	00NW07NC0002	SLAVE RIVER AT WEST CHANNEL	WQB		1	A	
3	00AL07NB0004	SALT RIVER BELOW PEACE POINT HWY	WQB		1	A	
4	00AL07NB0003	BENCHMARK CREEK NEAR FT. SMITH	WQB		1	A	
5	00NW07PB0004	PAULETTE CR. AT HWY 6 CULVERT COMINCO PINE POINT MINES	DINA		10	V	
6	12	PAULETTE CR AT NWT HWY #6	DINA	9		K	
7	00NW07PB0002	LITTLE BUFFALO RIVER AT HWY #15	WQB		2	A	
8	00NW07PB0003	LITTLE BUFFALO RIVER AT PINE POINT	WQB		2	A	
9	00NW07PA0002	BUFFALO RIVER AT HWY #5	WQB		2	A	
10	00NW07QC0001	THOA RIVER ABOVE HILL ISLAND LAKE	WQB, DINA		1, 10	A	
11	00NW07RD0001	LOCKHART RIVER	WQB, DINA	2	10	A	
12	21	GIAQUE LAKE	DINA	10		L	
13	19	YELLOWKNIFE R ABOVE INGRAHAM TRAIL	DINA	10		N	
14	00NW07SB0008	BAKER CR. 4000 FT ABOVE MILL	DINA		10	V	
15	00NW07SB0003	BAKER CR. NEAR DISCHARGE INTO YELLOWKNIFE BAY	DINA, F&M		10, 11	V	
16	00NW07SB0004	BAKER CR. AT BRIDGE AT GIANT YELLOWKNIFE MINES	DINA, F&M		10, 11	V	
17	01NW07SB0007	FRAME LK. 0.05 KM SOUTH OF NORTH SHORE	FWI		11	R	
18	00NW07SB0005	INFLOW STREAM FLOWING INTO GRACE LAKE	DINA, F&M		10, 11	R	
19	01NW07SB0006	GRACE LAKE ABOUT 1.2 KM SW OF OUTLET TO KAM LAKE	DINA, FWI		10, 11	R	
20	00NW07SB0006	INFLOW STREAM TO KAM LAKE FROM GRACE LAKE	DINA, FWI		10, 11	V	
21	01NW07SB0005	KAM LAKE ABOUT 1.2 KM SOUTH OF SEWER INFLOW AND 0.35 KM NW OF PUD LAKE INFLOW	F&M, FWI		10, 11	R	
22	00NW07SB0007	OUTFLOW STREAM FROM KAM LK.	FWI		11	V	
23	01NW07SB0002	SOUTH MEG LAKE AT COMINCO MINE NW TERRITORIES	DINA, F&M		10, 11	V	
24	01NW07SB0003	YELLOWKNIFE BAY GREAT SLAVE LAKE AT FRESHWATER INTAKE FOR MILL	DINA, F&M		10, 11	V	
25	01NW07SB0001	GREAT SLAVE LAKE AT YELLOW-KNIFE NW TERRITORIES	WQB		1	R	
26	01NW07SB0009	YELLOWKNIFE BAY GREAT SLAVE LAKE AT MILL FRESHWATER INTAKE	DINA		10, 11	V	
27	14	GREAT SLAVE LAKE UPPER YELLOWKNIFE BAY	DINA	10		M	
28	15	GREAT SLAVE LAKE MID YELLOWKNIFE BAY	DINA	10		K	
29	00NW07SA0001	SNARE RIVER AT OUTLET OF BIG SPRUCE LAKE	WQB		1	O	
30	00NW07UC0001	KAKISA RIVER AT OUTLET TO KAKISA LAKE	WQB, DINA F&M		2, 10, 11	A	

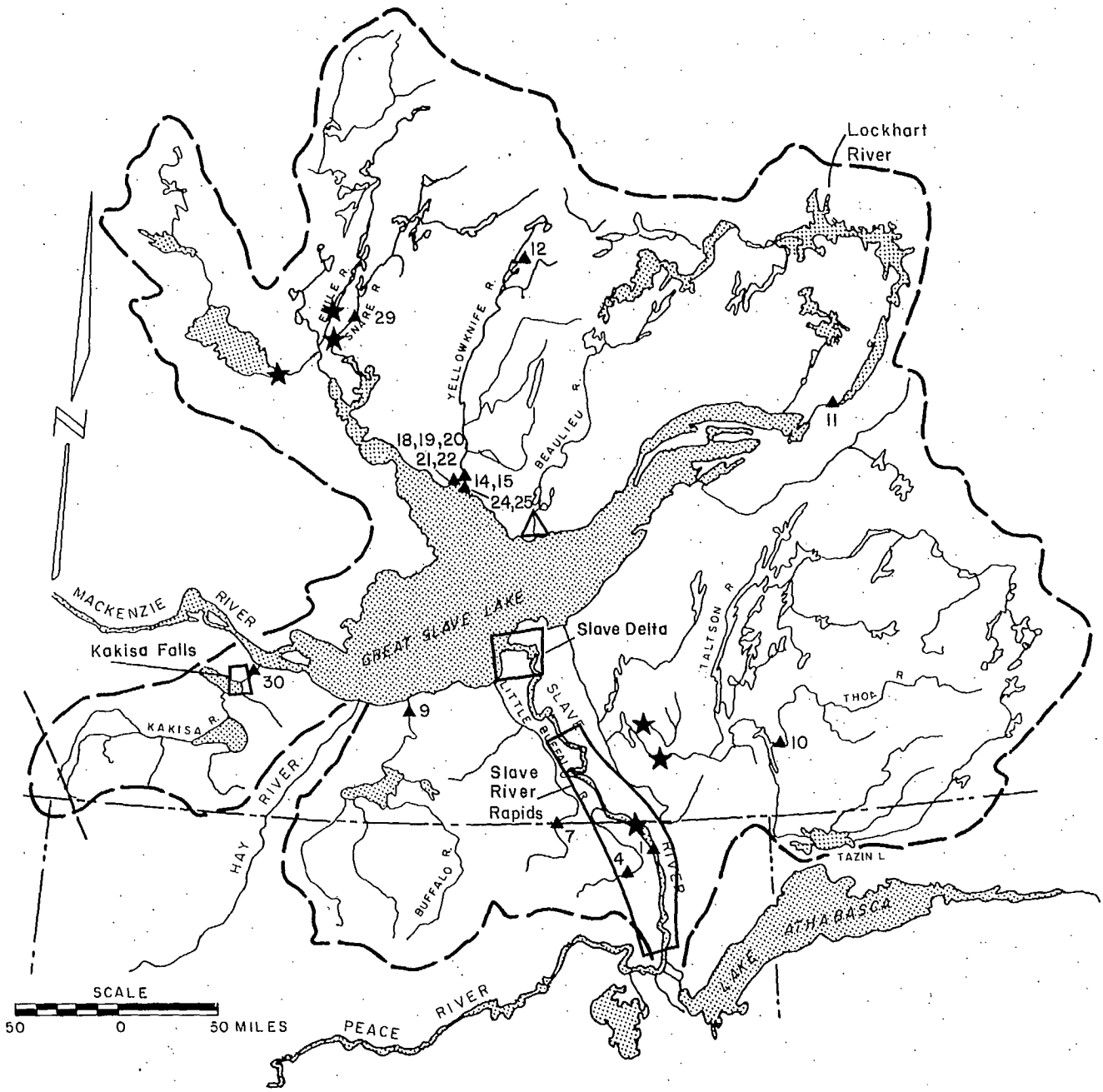
TABLE 5 (cont'd)

Sub-Basin 5 - Great Slave Lake Stations

MAP STN. NO.	CONTRIBUTOR STATION NUMBER	STATION DESCRIPTION	CONTRIBUTOR	RATIONALE FOR ACTIVE STATIONS	REASONS FOR DISCONTINUING STATIONS	PARM. ANAL.	PERIOD OF RECORD 1960 1965 1970 1975 1979
31	9	GREAT SLAVE LAKE NEAR PINE POINT	DINA	10		K	
32	10	GREAT SLAVE LAKE NEAR PRESQU'ILE POINT	DINA	9		L	
33	13	GREAT SLAVE LAKE NEAR MOUTH OF HAY RIVER	DINA	10		L	

SUB-BASIN 5 - GREAT SLAVE LAKE DRAINAGE

Water Quality Stations
Sensitive Areas
Expected Resource Projects And Developments



LEGEND

Water Quality Stations (with 15 samples or more) ▲
Hydro Sites ★
Sensitive Areas □
Uranium △
Pipeline ———

FIGURE 10

C. Discussion

Below the Peace-Athabasca Delta on the Slave River there are two sensitive areas, the Slave River Rapids and the Slave Delta. Near the border of the Northwest Territories and Alberta, a hydroelectric project has been planned at Mountain Rapids. There are only two water quality stations on record for the entire Slave River and both have been discontinued. Station 00NW07NC0001 (Map #2) Slave River at west channel has a short period of record and was last sampled in 1974; station 00AL07NB0001 (Map #1) at Fitzgerald has more than one hundred samples over a long period of record. Both stations do not have an extensive list of parameters analyzed.

There are two planned hydroelectric developments on the Taltson River; Elsie Falls and Twin Gorges. The only water quality station, in the river basin, is situated upstream of the Thoa River; it was sampled for only a limited number of constituents and has since been discontinued.

A water quality station 00NW07PA0002 (Map #9) downstream of a lead and zinc mine on the Buffal River was sampled for the parameters usually studied throughout the sub-basin as well as a number of other metals and nutrients. The station, however, was discontinued in 1975. Another lead and zinc mine is located near the Little Buffalo River on Paulette Creek. None of the stations on Paulette Creek have more than fifteen samples on record but one station (12, Map #6) is presently active with a limited number of metal parameters analyzed.

There is a possibility that the Mackenzie Valley pipeline will pass through the headwaters of the Kakisa River. Below Kakisa Lake, Kakisa Falls has been designated a sensitive area; fortunately, a water quality station (OONWO7UC0001, Map #30) on the Kakisa River is located near the Falls. Although the station has been discontinued, the parameters analyzed include those generally analyzed throughout the sub-basin plus a more in depth list of nutrients and metals.

Several hydroelectric developments have been planned for the Northwest of the sub-basin. Sites at the outlet of Lac La Martre and on the Emile River are located in areas where no water quality stations have been established. The hydroelectric development planned for the Snare River is in the proximity of station OONWO7SA0001 (Map #29). The station is above the proposed dam and was last sampled in 1971.

On the upper Yellowknife River there is presently a special study at Giaque Lake (21, Map #21, DINA) to investigate mercury pollution in the Yellowknife water supply. A station above Ingraham Trail (19, Map #13, DINA) on the Yellowknife River is also active and is used to monitor the Yellowknife city water supply. Several mines around the city of Yellowknife are on streams draining the area into Yellowknife Bay. In this region, only two stations located on Yellowknife Bay (14 & 15, Map Nos. 27 & 28, DINA) are presently active for the monitoring of mine water supply. Historically, seven other stations on various streams and lakes in the area, have been sampled fifteen times or more and the list of parameters analyzed includes a number of metal and nutrient parameters in addition to the constituents sampled throughout the sub-basin.

A potential uranium mine operated by Consolidated Shunsby has been planned near the mouth of the Beaulieu River; at present there are no water quality stations in the vicinity.

The Lockhart River, designated a sensitive area, is monitored at one station (00NW07RD0001, Map #11) which is below Artillery Lake. This station is presently active, with more than 15 samples on record, but the parameter list is limited.

D. Data Gaps

1. The entire Slave River is void of active monitoring activity and given, that there are two sensitive areas on the river and a planned hydroelectric development, a data gap exists now and may become serious when the dam is built.

2. There are two hydroelectric developments planned on the Taltson River and there is very little background data available and no active stations whatever.

3. If the Mackenzie Valley Pipeline proceeds as planned across the headwaters of the Kakisa River, the absence of active monitoring stations may produce a more significant data gap than exists at present.

4. There is a lack of background data for the Emile River and Rivière la Martre and there are hydroelectric developments planned for both, as well as the Snare River. Historical data exists for the Snare River but all three rivers are without any active stations.

5. A data gap exists on the Beaulieu River as there is no background information or active stations to pick up any changes in water quality which may result from the uranium mine proposed for the area.

CHAPTER VII

SUB-BASIN 6 - GREAT BEAR LAKE DRAINAGE

Water quality information for the Great Bear Lake drainage has been collected from both NAQUADAT and DINA data files.

A. NAQUADAT Data

NAQUADAT data indicates that a number of physical parameters, metals, major ions and a very few nutrients are analyzed throughout the sub-basin. It appears that pesticides, herbicides, PCB's, hydrocarbons and oxygen related parameters are not analyzed.

The following is a list of parameters analyzed throughout the sub-basin:

1. Colour Apparent
2. Specific Conductance
3. Temperature Water
4. Turbidity
5. Hardness Total
6. Alkalinity Total
7. Alkalinity Phenolphthalein
8. pH
9. Lead Extractable
10. Cadmium Extractable
11. Nickel Extractable
12. Copper Extractable
13. Zinc Extractable
14. Arsenic Dissolved
15. Iron Extractable
16. Cobalt Extractable
17. Manganese Extractable
18. Sulphate Dissolved
19. Chloride Dissolved
20. Potassium Dissolved
21. Calcium Dissolved
22. Sodium Dissolved

23. Silica Reactive
24. Nitrogen Dissolved NO_3 & NO_2

In addition to the parameters studied throughout the sub-basin, four station locations have been sampled significantly for other parameters or have received special attention resulting in increased sample numbers.

00NW10JA0001 (Map #1)

1. Nitrogen Total Kjeldahl
2. Nitrogen Dissolved NO_3 & NO_2
3. Fluoride Dissolved
4. Barium Extractable

00NW10JA0002 (Map #2)

1. Nitrogen Dissolved NO_3 & NO_2

00NW10JC0001 (Map #14)

1. Nitrogen Dissolved NO_3 & NO_2
2. Fluoride Dissolved

00NW10JC0002 (Map #6)

1. Nitrogen Dissolved NO_3 & NO_2
2. Nitrogen Total Kjeldahl
3. Phosphorous Dissolved Ortho PO_4
4. Phosphorous Dissolved Inorganic PO_4
5. Carbon Total Organic
6. Carbon Total Inorganic
7. Fluoride Dissolved
8. Boron Dissolved
9. Molybdenum Extractable
10. Strontium Extractable
11. Chromium Extractable
12. Vanadium Extractable
13. Lithium Extractable

The following parameters are analyzed in the sub-basin but with reduced frequency and at fewer locations.

1. Iron Dissolved Fe^{++} & Fe^{+++}
2. Silver Extractable
3. Carbon Total Organic
4. Carbon Total Inorganic
5. Nitrogen Total Kjeldahl
6. Phosphorous Total Dissolved

Water quality stations with fifteen samples or more:

1. 00NW10JA0001 (Map # 1)
2. 00NW10JA0002 (Map # 2)
3. 00NW10JC0001 (Map #14)
4. 00NW10JC0002 (Map #16)

B. DINA Data

Information collected from DINA indicated that six stations are located in the Great Bear Lake drainage. Stations 1,2 and 3 (Map #'s 3,4,5) sampled quarterly while 6,7 and 8 (Map #'s 7,8,9) were sampled quarterly for part of the period of record and biannually for the remainder.

Parameters studied included:

1. Specific Conductance
2. Turbidity
3. Total Alkalinity
4. Arsenic
5. Copper
6. Iron
7. Lead
8. Nickel
9. Zinc
10. Cobalt

WATER QUALITY STATIONS
Sub-Basin 6- Great Bear Lake Drainage

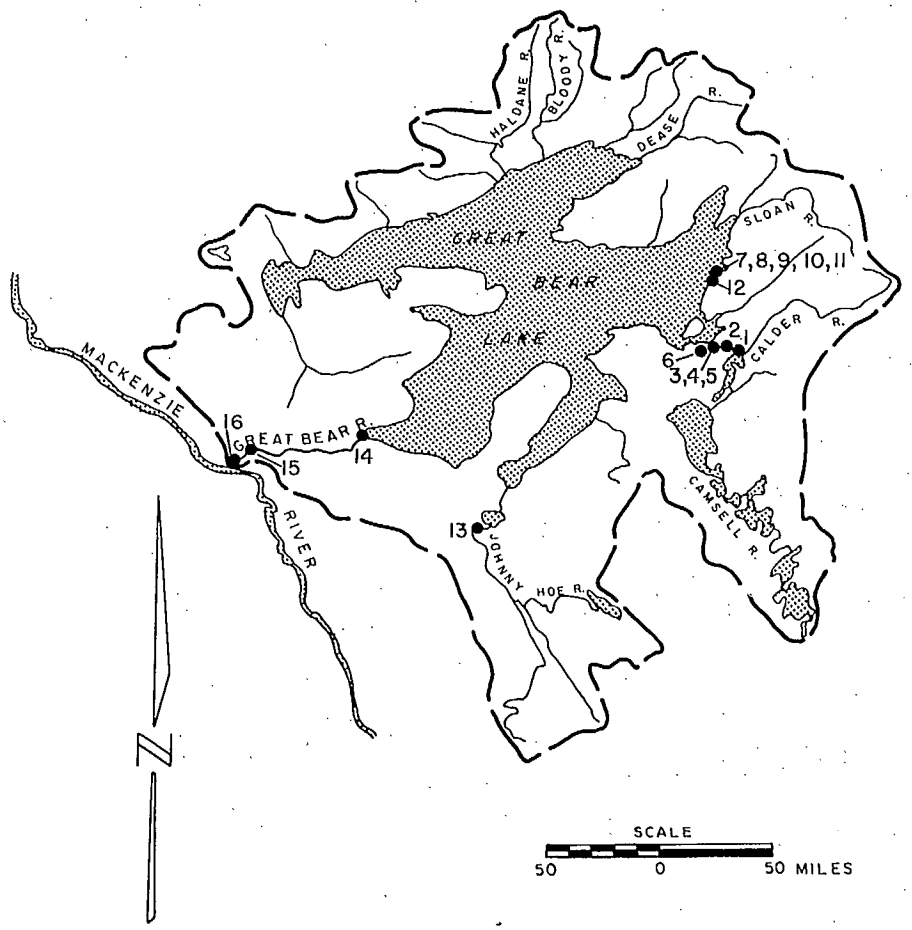


FIGURE 11

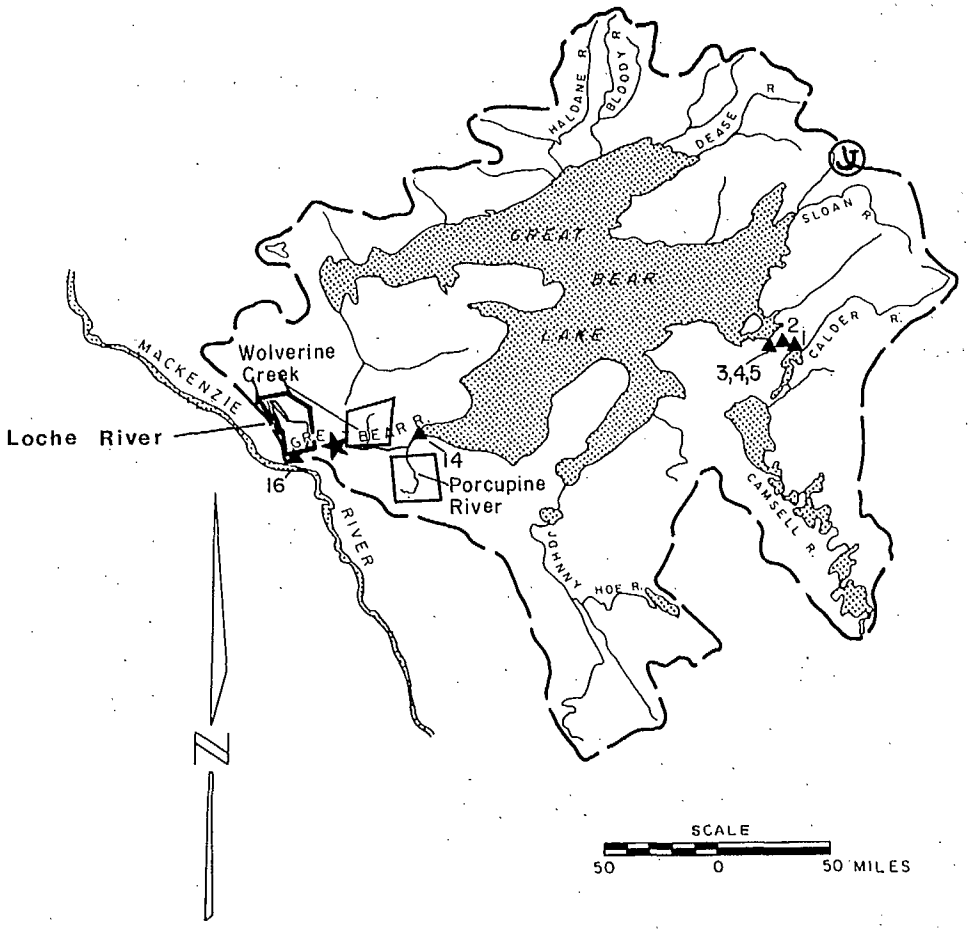
TABLE 6

Sub-Basin 6 - Great Bear Lake Stations

MAP STN. NO.	CONTRIBUTOR STATION NUMBER	STATION DESCRIPTION	CONTRIBUTOR	RATIONALE FOR ACTIVE STATIONS	REASONS FOR DISCONTINUING STATIONS	PARM. ANAL.	PERIOD OF RECORD 1960 1965 1970 1975 1979
1	00NW10JA0001	CAMSELL RIVER AT OUTLET OF CLUT LAKE	WQB, DINA	2, 9		A	
2	00NW10JA0002	CAMSELL RIVER AT MILL FRESH WATER INTAKE	WQB, DINA		3, 10	A	
3	1	CAMSELL R BELOW RAINY LK.	DINA	10		K	
4	2	CAMSELL R 150 M BELOW TAILINGS POND MOOSE BAY	DINA	9		K	
5	3	CAMSELL R 1 KM FROM TAILINGS POND DISCHARGE MOOSE BAY	DINA	9		K	
6	01NW10JA0005	HOHUM LAKE 40 FT FROM TERRA MINE TAILINGS EFFLUENT	DINA, F&M		10, 11	V	
7	6	GREAT BEAR LAKE LABINE BAY NEAR PORT RADIUM	DINA	10		K	
8	7	GREAT BEAR CREEK BELOW TAILINGS POND NEAR PORT RADIUM	DINA	9		K	
9	8	GREAT BEAR LAKE NEAR BEAR CREEK PORT RADIUM	DINA	9		K	
10	01NW10JA0009	FRESHWATER INTAKE AT MAIN PUMPHOUSE ON NORTH SIDE OF LABINE BAY	DINA		10	L	
11	01NW10JA0002	LABINE BAY RAW WATER AT MAIN PUMPHOUSE ECHO BAY MINE STN 3	DINA, F&M		10	V	
12	01NW10JA0004	LABINE BAY RAW WATER AT DREDGE PUMPHOUSE ECHO BAY MINE STN 2	DINA		10	V	
13	00NW10JB0001	JOHNNY HOE RIVER ABOVE LAC STE. THERESE	WQB, DINA		1	A	
14	00NW10JC0001	GREAT BEAR RIVER AT OUTLET OF GREAT BEAR LAKE	WQB, FWI	2, 11		A	
15	00NW10JC0003	GREAT BEAR RIVER UPSTREAM FROM JUNCTION OF GREAT BEAR AND BRACKETT RIVERS	WQB, FWI		1, 11	A	
16	00NW10JC0002	GREAT BEAR RIVER AT MOUTH NEAR FORT NORMAN	WQB, F&M		3, 11	A	

SUB-BASIN 6 - GREAT BEAR LAKE DRAINAGE

Water Quality Stations
Sensitive Areas
Expected Resource Projects And Developments



LEGEND

Water Quality Stations
(with 15 samples or more) ▲
Hydro Sites ★
Sensitive Areas □
Diversions Ⓙ

FIGURE 12

C. Discussion

Monitoring activity in the Great Bear Lake sub-basin has been concentrated on the Great Bear River and near two producing silver and copper mines. On the Eastern side of the lake, at Echo Bay Mines, there are six stations on record, four of which are active; however, all have less than 15 samples. The list of parameters includes selected metals, major ions, physical parameters and radium 226. Six stations are also located at the Terra Mines site on the Camsell River, three are active and four have been sampled 15 times of more; parameters analyzed include a number of metals and major ions.

In the north east of the sub-basin, a diversion has been planned to route water from the Coppermine River into the Great Bear drainage basin; there are, however, no water quality stations in the immediate area. Three stations exist on the Great Bear River, two have more than 15 samples on record, one of which (00NW10JC0001, Map #14) is still active. In addition a hydroelectric development above Fort Norman has been planned. Above the proposed dam in the area of the head pond, there are two sensitive areas, Wolverine Creek and Porcupine River, tributaries of the Great Bear River. Downstream of the dam, a discontinued station (00NW10JC0002, Map #16) near Fort Norman has been sampled for a wide variety of parameters, including several nutrient and metal constituents. The Loche River, a tributary of the Great Bear River, has also been designated a sensitive area, situated below the proposed dam upstream of the station 00NW10JC0002 (Map #16).

D. Data Gaps

The hydroelectric development planned for the Great Bear River and its accompanying project to divert water from the Coppermine River into Great Bear Lake, may increase the seriousness of a data gap which exists downstream of the dam site since the station at Fort Norman has been discontinued. Also the changes brought about by the diversion may affect any or all of the sensitive areas along the river.

CHAPTER VIII

SUB-BASIN 7 - MACKENZIE RIVER DRAINAGE

Water quality data for sub-basin 7 are available from NAQUADAT and DINA data files.

A. NAQUADAT Data

NAQUADAT data includes a wide variety of nutrient parameters, metals, major ions and physical parameters. Analyses for pesticides, herbicides, hydrocarbons and PCB's have not been carried out.

The following list outlines the parameters analyzed throughout the sub-basin:

1. Colour Apparent
2. Specific Conductance
3. Temperature Water
4. Turbidity
5. Alkalinity Total
6. Alkalinity Phenolphthalein
7. pH
8. Residue Nonfilterable
9. Residue Fixed Nonfilterable
10. Hardness Total
11. Manganese Dissolved
12. Manganese Extractable
13. Iron Dissolved
14. Iron Extractable
15. Cobalt Extractable
16. Nickel Extractable
17. Copper Extractable
18. Zinc Extractable
19. Arsenic Dissolved
20. Strontium Extractable
21. Molybdenum Extractable
22. Cadmium Extractable
23. Lead Extractable
24. Lithium Extractable

25. Magnesium Dissolved
26. Boron Dissolved
27. Fluoride Dissolved
28. Sodium Dissolved
29. Sulphate Dissolved
30. Chloride Dissolved
31. Potassium Dissolved
32. Calcium Dissolved
33. Carbon Total Organic
34. Carbon Total Inorganic
35. Nitrogen Total Kjeldahl
36. Nitrogen Dissolved NO_3 & NO_2
37. Silica Reactive
38. Phosphorous Total Dissolved
39. Phosphorous Dissolved Ortho PO_4
40. Phosphorous Total Inorganic PO_4
41. Phosphorous Dissolve Inorganic PO_4
42. Phosphorous Total Dissolved

Significant sample numbers were taken from some stations for parameters not generally studied throughout the sub-basin:

00NW10FB0001 (Map # 1)
00NW10FB0003 (Map #28)
00NW10FB0005 (Map # 2)
00NW10GC0002 (Map #38)
00NW10GC0004 (Map #30)
00NW10GC0007 (Map #36)
00NW10LC0011 (Map #15)
00NW10LC0012 (Map #12)

1. Nitrogen Dissolved
2. Oxygen Dissolved

00NW10GC0001 (Map # 3)

1. Phosphate Total

00NW10KA0003 (Map # 5)

1. Nitrogen Dissolved

00NW10KA0001 (Map # 7)

1. Oxygen Consumed

00NW10LA0003 (Map #10)

1. Oxygen Consumed
2. Phosphate Total

The following parameters were analyzed in the sub-basin but with reduced frequency and at fewer locations:

1. Turbidity Light Penetrn.
2. Bicarbonate Lab Calc.
3. Oxygen Dissolved
4. Vanadium Extractable
5. Chromium Extractable
6. Copper Dissolved

7. Zinc Dissolved
8. Arsenic Extractable
9. Selenium Extractable
10. Silver Extractable
11. Cadmium Dissolved
12. Tungsten Extractable
13. Mercury Extractable
14. Lead Dissolved
15. Carbon Organic Particulate
16. Nitrogen Dissolved Nitrate
17. Nitrogen Dissolved Ammonia
18. Nitrogen Dissolved
19. Nitrogen Particulate
20. Silicon Soluble Ortho Silicate
21. Phenolic Material
22. Cyanide

Water quality stations with fifteen samples or more:

1. OONW10FA0002 (Map #26)
2. OONW10FA0003 (Map #27)
3. OONW10FB0001 (Map # 1)
4. OONW10FB0003 (Map #28)
5. OONW10FB0005 (Map # 2)
6. OONW10FC0001 (Map #24)
7. OONW10GB0002 (Map #41)
8. OONW10GB0003 (Map #40)
9. OONW10GC0001 (Map # 3)
10. OONW10GC0002 (Map #38)
11. OONW10GC0004 (Map #30)
12. OONW10GC0007 (Map #36)
13. OONW10GC0010 (Map #32)
14. OONW10GD0001 (Map #39)
15. OONW10HA0001 (Map #48)
16. OONW10HA0006 (Map #46)
17. OONW10HA0007 (Map #47)
18. OONW10HA0008 (Map #45)
19. OONW10HA0009 (Map #44)
20. OONW10HB0004 (Map #43)
21. OONW10HC0001 (Map # 4)
22. OONW10HC0005 (Map #42)
23. OONW10KA0001 (Map # 7)
24. OONW10KA0002 (Map # 6)
25. OONW10KA0003 (Map # 5)
26. OONW10KC0002 (Map #49)
27. OONW10KD0001 (Map #50)
28. OONW10LA0003 (Map #10)
29. OONW10LA0004 (Map #53)
30. OONW10LA0006 (Map #52)
31. OONW10LB0002 (Map # 8)
32. OONW10LC0010 (Map #16)
33. OONW10LC0011 (Map #15)
34. OONW10LC0012 (Map #12)
35. OONW10LD0001 (Map # 9)
36. OONW10LD0002 (Map #51)
37. OONW10MC0001 (Map #55)
38. OONW10MC0002 (Map #56)
39. OONW10MC0005 (Map #11)
40. OOYT10MA0001 (Map #54)

B. DINA Data

Two stations in the Mackenzie River sub-basin are sampled on a quarterly basis by DINA.

The parameters studied include:

1. pH
2. Specific Conductance
3. Turbidity
4. Colour
5. Total Hardness
6. Total Alkalinity
7. Arsenic
8. Cadmium
9. Copper
10. Iron
11. Lead
12. Nickel
13. Zinc
14. Chromium
15. Manganese
16. Mercury
17. Sodium
18. Potassium
19. Chloride
20. Calcium
21. Sulphate
22. Nitrate
23. Silica
24. Phosphorous
25. Total Coliform
26. Fecal Coliform

WATER QUALITY STATIONS

Sub-Basin 7 - Mackenzie River Drainage

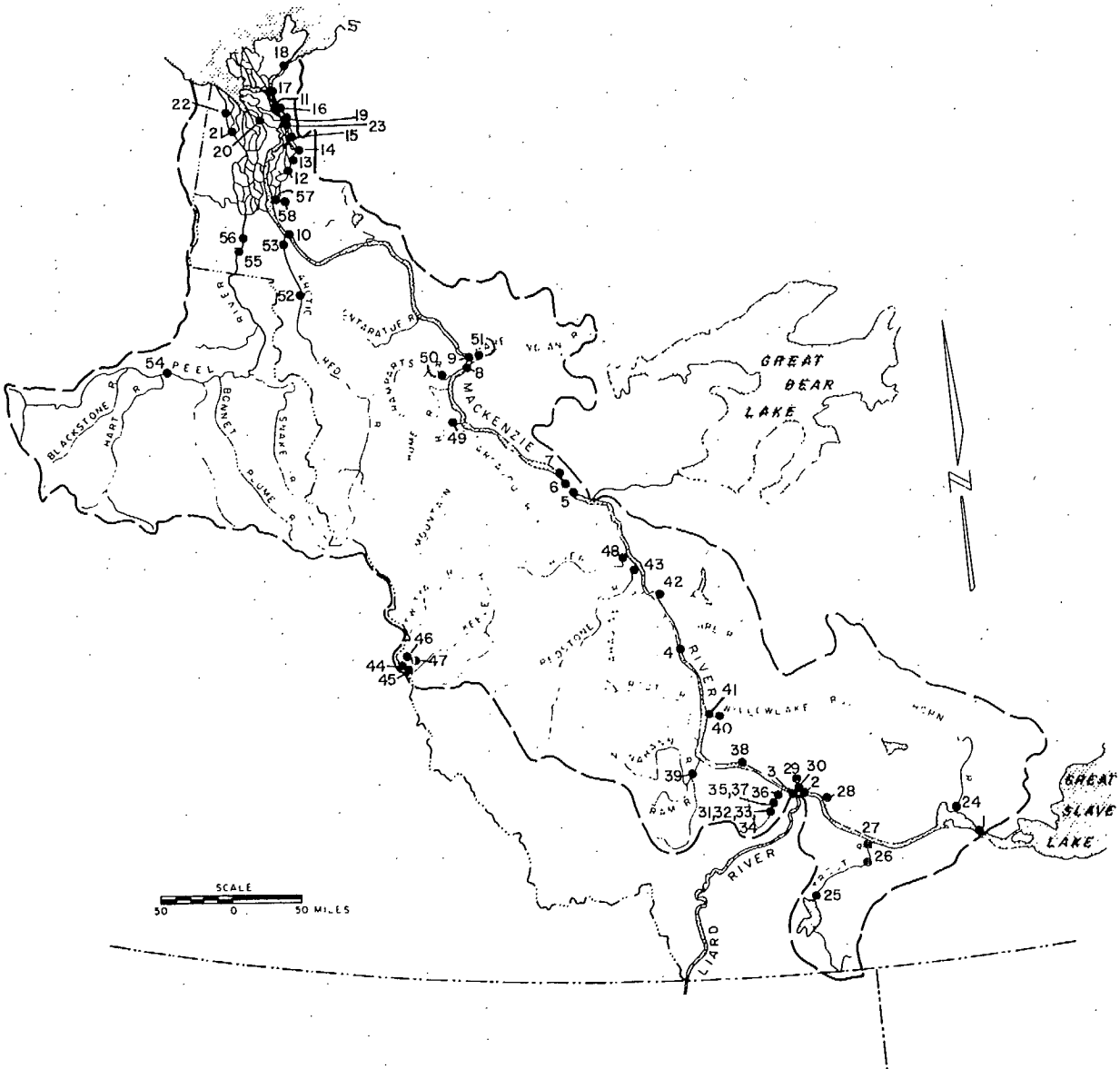


FIGURE 13

TABLE 7

Sub-Basin 7 - Mackenzie River Stations

MAP STN. NO.	CONTRIBUTOR STATION NUMBER	STATION DESCRIPTION	CONTRIBUTOR	RATIONALE FOR ACTIVE STATIONS	REASONS FOR DISCONTINUING STATIONS	PARM. ANAL.	PERIOD OF RECORD 1960 1965 1970 1975 1979
1	00NW10FB0001	MACKENZIE RIVER NEAR FT. PROVIDENCE	WQB, FWI	2		A	
2	00NW10FB0005	MACKENZIE RIVER UPSTREAM JUNCTION MACKENZIE AND LIARD RIVERS	FWI		11	R	
3	00NW10GC0001	MACKENZIE RIVER NEAR FT. SIMPSON	WQB, F&M		1, 11	A	
4	00NW10HC0001	MACKENZIE RIVER NEAR WRIGLEY	WQB		2	A	
5	00NW10KA0003	MACKENZIE R. 20 MI UPSTREAM FROM NORMAN WELLS	FWI		11	R	
6	00NW10KA0002	MACKENZIE R. 14.5 MI ABOVE NORMAN WELLS	WQB		2, 3	A	
7	00NW10KA0001	MACKENZIE R. AT NORMAN WELLS	WQB	2		A	
8	00NW10LB0002	MACKENZIE R. ABOVE FORT GOOD HOPE	WQB		2	A	
9	00NW10LD0001	MACKENZIE R. AT FORT GOOD HOPE	WQB		1	A	
10	00NW10LA0003	MACKENZIE R. UPSTREAM FROM I. H. D. STA. AT ARCTIC RED R.	WQB, FWI F&M	2, 3		A	
11	00NW10MC0005	MACKENZIE R. MAIN CHANNEL	FWI		11	R	
12	00NW10LC0012	MACKENZIE R. EAST CHANNEL	FWI		11	R	
13	00NW10LC0006	MACKENZIE R. EAST CHANNEL	FWI		11	R	
14	00NW10LC0005	MACKENZIE R. EAST CHANNEL	FWI		11	R	
15	00NW10LC0011	MACKENZIE R. EAST CHANNEL	FWI		11	R	
16	00NW10LC0010	MACKENZIE R. EAST CHANNEL	FWI		11	R	
17	00NW10LC0009	MACKENZIE R. EAST CHANNEL	FWI		11	R	
18	00NW10LC0008	MACKENZIE R. EAST CHANNEL	FWI		11	R	
19	16	MACKENZIE R. EAST CHANNEL NEAR INUVIK	DINA	10		L	
20	00NW10MC0007	MACKENZIE R. NAPOIAK CHANNEL	FWI		11	R	
21	00NW10MC0004	MACKENZIE R. WEST CHANNEL	FWI		11	R	
22	00NW10MC0003	MACKENZIE R. WEST CHANNEL	FWI		11	R	
23	17	HIDDEN LAKE NEAR INUVIK	DINA	10		Z	
24	00NW10FC0001	HORN RIVER NEAR MOUTH	WQB		2	A	
25	00NW10FA0001	TROUT RIVER NEAR OUTLET TROUT LAKE	WQB, F&M		3	A	
26	00NW10FA0002	TROUT RIVER 2 MI FROM MOUTH	WQB, FWI F&M		2	A	
27	00NW10FA0003	TROUT RIVER AT FT. SIMPSON HWY	WQB, FWI		2	A	
28	00NW10FB0003	RABBITSKIN RIVER UPSTREAM FROM MOUTH	FWI, F&M		11	R	
29	00NW10GC0003	HARRIS RIVER 0.5 MI FROM MOUTH	FWI, F&M		11	R	
30	00NW10GC0004	HARRIS RIVER 0.25 MI FROM MOUTH	FWI, F&M		11	R	
31	00NW10GC0009	MARTIN RIVER DOWNSTREAM EDGE OF POOL	FWI		11	R	
32	00NW10GC0010	MARTIN RIVER DOWNSTREAM BTWN BRIDGE CROSSING & ROAD	FWI		11	R	
33	00NW10GC0011	MARTIN RIVER UPSTREAM BTWN BRIDGE CROSSING & ROAD	FWI		11	R	

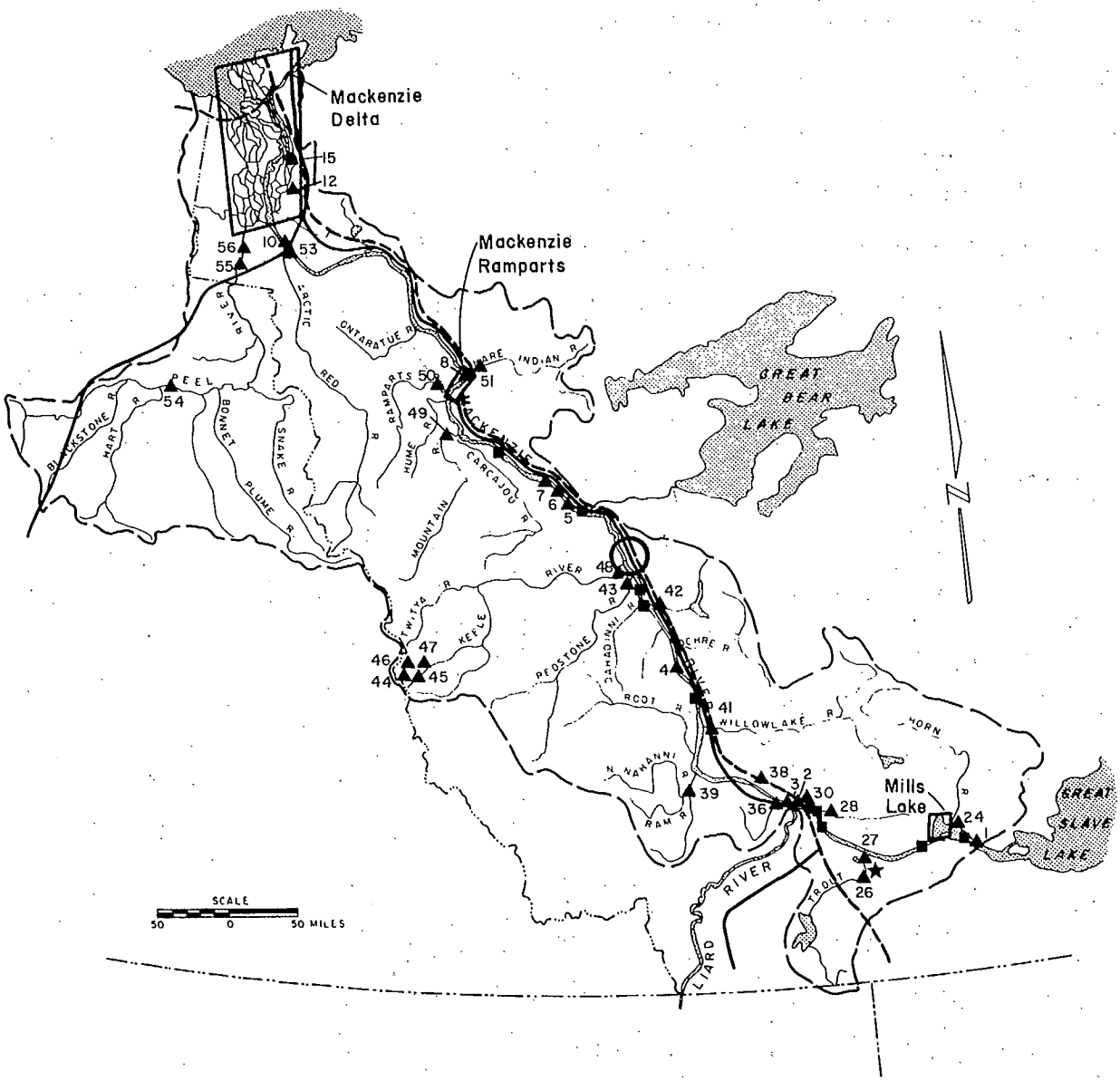
TABLE 7 (cont'd)

Sub-Basin 7 Mackenzie River Stations

MAP STN. NO.	CONTRIBUTOR STATION NUMBER	STATION DESCRIPTION	CONTRIBUTOR	RATIONALE FOR ACTIVE STATIONS	REASONS FOR DISCONTINUING STATIONS	PARM. ANAL.	PERIOD OF RECORD 1960 1965 1970 1975 1979
34	00NW10GC0013	MARTIN RIVER DOWNSTREAM FROM BRIDGE CROSSING	FWI		11	R	
35	00NW10GC0006	MARTIN RIVER 1.5 MI UPSTREAM FROM MOUTH	FWI		11	R	
36	00NW10GC0007	MARTIN RIVER 0.5 MI UPSTREAM FROM MOUTH	FWI		11	R	
37	00NW10GC0008	MARTIN RIVER UPSTREAM EDGE OF POOL	FWI		11	R	
38	00NW10GC0002	TRAIL RIVER UPSTREAM	FWI, F&M		11	R	
39	00NW10GD0001	NORTH NAHANNI RIVER 5 MI FROM MOUTH	WQB		2	A	
40	00NW10GB0003	WILLOW LAKE RIVER AT W.S.C. GAUGE ABOVE MOUTH	FWI		11	R	
41	00NW10GB0002	WILLOW LAKE RIVER NEAR THE MOUTH	WQB		2	A	
42	00NW10HC0005	BLACKWATER RIVER AT MOUTH	WQB		2	A	
43	00NW10HB0004	REDSTONE RIVER AT MOUTH	WQB		2	A	
44	00NW10HA0009	DALE CR. AT ACCESS ROAD TO AMAX MINE. MACMILLAN PASS	DINA		10	P	
45	00NW10HA0008	UNNAMED CR. AT NORTH CANOL ROAD CROSSING. AMAX MINE. MACMILLAN PASS	DINA		10	P	
46	00NW10HA0006	TSICHU R. AT CIRQUE CR. AT AMAX MINE ABOVE CONF. WITH MACMILLAN	DINA		10	P	
47	00NW10HA0007	TSICHU R. AT NORTH CANOL ROAD CROSSING. AMAX MINE. MACMILLAN PASS	DINA		10	P	
48	00NW10HA0001	KEELE RIVER 4 MI FROM MOUTH	WQB		2	A	
49	00NW10KC0002	MOUNTAIN RIVER 3 MI FROM MOUTH	WQB, FFS		2	A	
50	00NW10KD0001	RAMPARTS RIVER 2.5 MI FROM MOUTH	WQB		2	A	
51	00NW10LD0002	HARE INDIAN RIVER NEAR THE MOUTH	WQB		2	A	
52	00NW10LA0006	ARCTIC RED R. ABOVE MARTIN HOUSE	FWI		11	R	
53	00NW10LA0004	ARCTIC RED R. 1.5 MI FROM MOUTH	WQB, FWI FFS		2	A	
54	00YT10MA0001	PEEL R. AT W.S.C. GUAGE ABOVE CANYON CR. YUKON TERRITORY	WQB		2	V	
55	00NW10MC0001	PEEL R. ABOVE FT. MCPHERSON	WQB		2	A	
56	00NW10MC0002	PEEL R. AT FT. MCPHERSON	WQB	2,3			
57	00NW10LC0001	RENGLENG R. UPSTREAM JUNCTION OF DEMPSTER HWY	FWI		11	R	
58	00NW10LC0002	RENGLENG R. DOWNSTREAM JUNCTION OF DEMPSTER HWY	FWI		11	R	

SUB-BASIN 7 - MACKENZIE RIVER DRAINAGE

Water Quality Stations
Sensitive Areas
Expected Resource Projects And Developments



LEGEND

- Water Quality Stations (with 15 samples or more) ▲
- Hydro Sites ★
- Sensitive Areas ▭
- Dredging ■
- Highways ———
- Pipeline – – –
- Control Works ○

FIGURE 14

C. Discussion

The Mackenzie River sub-basin begins at Fort Providence near the outlet from Great Slave Lake. At Fort Providence, there is an active water quality station 00NW10FB0001 (Map #1) with an extensive period of record and list of parameters analyzed. Mills Lake on the Mackenzie River, just downstream of Fort Providence, has been designated a sensitive area and dredging activity is expected just above the lake. The closest water quality station, however, is downstream of Mills Lake.

A hydroelectric development on the Trout River has been planned and the Mackenzie Valley Pipeline is expected to cross above the dam. Three water quality stations provide data above and below the proposed dam, but all three have been discontinued. Station 00NW10FA0001 (Map #25) at the outlet of Trout Lake has been sampled less than 15 times whereas the other two stations (00NW10FA0002, Map #26 and 00NW10FA0003, Map #27) downstream of the proposed dam have more than 15 samples on record and an extensive list of parameters analyzed.

Two water quality stations on the Mackenzie River are located just below the proposed pipeline crossing near Fort Simpson. One station, 00NW10FB0005 (Map #2), last sampled in 1974, is situated upstream of the junction of the Mackenzie and Liard Rivers, but unfortunately does not have a very long period of record. The other station (00NW10GC0001, Map #3) is located at Fort Simpson and has a much longer period of record which terminated in 1975. Both stations have more than 15 samples on record and have a fair variety of parameters

analyzed including several nutrient constituents. Although the stations mentioned above would be well situated with respect to the pipeline crossing and dredging the nearest station downstream of the highway crossing is at Wrigley and it too was discontinued in 1975. Dredging activity has been planned for the Mackenzie River above Wrigley.

The pipeline and the Highway cross numerous tributaries of the Mackenzie on their route down the valley. All of the major tributaries, which include the Great Bear River, have water quality stations near the point of crossing. These stations, which have been discontinued, have been sampled at least 15 times for a wide variety of parameters.

Downstream of the confluence of the Keele and Mackenzie Rivers a control structure has been planned to regulate the flow of the Mackenzie River. The closest upstream water quality station is 290 km away at Wrigley while downstream, the first station is located a similar distance away near Norman Wells. Both stations were discontinued in 1975 but provide data from more than fifteen samples for a number of parameters. At Norman Wells, however, there is an active water quality station (00NW10KA0001, Map #7) with many samples taken during an extensive period of record.

The Dempster Highway crosses the headwaters of the Peel River and again further downstream. The crossings are upstream of station 00YT10MA0001 (Map #54) Canyon Creek, discontinued in 1975; station 00NW10MC0001 (Map #55) discontinued in 1970 and station 00NW10MC0002

(Map #56) still active near Fort McPherson. The Highway continues and later crosses the Mackenzie River near Arctic Red River where there is an active water quality station (00NW10LA0003, Map #10). The station at Arctic Red River is important as it is located to monitor inputs to the sensitive Mackenzie Delta area.

There are many stations within the Delta area. Near Inuvik two stations (16, Map #19 and 17, Map #23) are presently active and are sampled on a quarterly basis by DINA. All other stations which had a limited number of parameters analyzed were part of a special study by the Freshwater Institute and were discontinued in 1975.

Within the Delta Area, the Mackenzie Valley Pipeline will run to the Beaufort Sea; a branch pipeline will also cross the Delta leading west into the Yukon near the Beaufort Sea.

D. Data Gaps

1. With the increase in population and development activity along the Mackenzie Valley, the list of parameters analyzed may need to be expanded to eliminate the possibility of data gaps. With the rapid growth of industry, particularly oil and gas, it will be necessary to sample for a list of parameters not already studied.

2. If dredging takes place as planned below Fort Providence, the Mills Lake sensitive area will be affected and there are no stations which could monitor the water entering the lake. Dredging is also planned for the stretch of river from below the lake to Fort Simpson and the lack of

present monitoring activity could result in a more significant data gap than exists at present.

3. Since there are only two active stations in the upper half of the sub-basin, one at Fort Providence,(map#1), and the other at Norman Wells,(map#7), a major data gap exists. If the pipeline and highway cross this stretch of the Mackenzie River and dredging takes place as expected, the data gap will increase in magnitude. A river control structure may also be constructed on the river near the confluence with the Keele River.

4. Below Norman Wells the next active station on the Mackenzie River is located at Arctic Red River, (map#10), The lack of up to date information for this part of the river represents a data gap and may become serious if the dredging takes place as planned upstream of the Ramparts sensitive area.

5. Although the active station at Arctic Red River,(map#10), monitors inputs to the Mackenzie Delta sensitive area, pipeline construction is expected within the delta itself. As there is very little monitoring in the delta, the lack of information about changes in water quality due to the construction may become more significant.

CHAPTER IX

CONCLUSIONS

A. Sub-Basin 1 - Athabasca River Drainage

Historically, the headwaters of the Athabasca River, originating in Jasper National Park and the mainstem of the river at Fort McMurray, have received considerable sampling attention. Monitoring in general has been conducted in the upper regions of the drainage basin, particularly on the Athabasca, Pembina and McLeod Rivers.

The 300 km stretch of the Athabasca between the town of Athabasca and Fort McMurray has not been monitored and the stretch between Bitumont and the Athabasca Delta may need more attention.

The region of the sub-basin lying within the province of Saskatchewan has been sampled at a number of strategic locations scattered throughout the area.

B. Sub-Basin 2 - Peace River Drainage

Generally very little sampling has been carried out above the W.A.C. Bennet dam; however, downstream en route to the Alberta border, a considerable amount has been done. The coal mining regions of British Columbia drained by the Moberly, Pine, Sukunka, Murray and Kiskatinaw

Rivers have recently been sampled intensively.

In Alberta, the Smoky River, which drains into the Peace River above Peace River has received considerable attention. The Peace, after leaving Peace River is sampled 240 km downstream at Fort Vermillion. The next station sampled is a similar distance further downstream at Peace Point.

The Peace-Athabasca Delta Region has received attention in the past from the O.S.E.R.P. research contracts but stands out as a region requiring monitoring on a long term basis. Perhaps without the impending developments, sampling programs are sufficient, but certainly with the onset of future developments, modified sampling programs must be developed.

C. Sub-Basin 3 - Liard River Drainage

The entire Liard River drainage located within the Province of British Columbia is void of any sampling activity. Within this portion of the sub-basin, two sensitive areas, Whirpool Canyon and Liard Hotsprings, have been identified. Along the Fort Nelson River, a number of locations have been proposed for dredging; also there is a possibility that the Liard highway will cross the Liard River near the British Columbia/Northwest Territories border. It appears that this region is lacking in water quality information.

The first station along the Liard is located upstream of Fort Liard followed by a station of long record at Fort Liard. Other stations are not encountered downstream of Fort Liard until Fort Simpson near the

confluence of the Mackenzie River. There are, however, no developments planned for this stretch of the river.

D. Sub-Basin 4 - Hay River Drainage

All stations on record for the Hay River Drainage were discontinued in 1974. The proposed route for the Mackenzie Valley Pipeline cuts through the upper regions of the watershed while downstream 80 km above Great Slave Lake, Alexandra Falls has been designated a sensitive area. No data are available for the watershed above the pipeline crossing, data are available, however, for stations above and below Alexandra Falls.

E. Sub-Basin 5 - Great Slave Lake Drainage

It appears that very little sampling has been carried out along the Slave River. Both the Slave River rapids and the Slave Delta may be influenced by the presence of a hydroelectric development in the future and, therefore, should receive more attention. Two hydroelectric projects have also been slated for the Taltson River, which lacks significant water quality data. Three more stations proposed on the Snare and Emile Rivers and the outfall from Lac La Martre are all in a region void of sampling save for one station on the Snare River.

In recent years considerable monitoring has been carried out in Yellowknife and the surrounding area; however, no samples have been take on the Beaulieu River, the location of a possible uranium mine.

F. Sub-Basin 6 - Great Bear Lake Drainage

Monitoring is concentrated at the east end of the Lake in the region of two major mining complexes as well as long the Great Bear River leading from Great Bear Lake to the Mackenzie River. The rest of the basin is generally ignored. The only planned development is the diversion of the Coppermine River in conjunction with the hydroelectric site on the Great Bear River.

G. Sub-Basin 7 - Mackenzie River Drainage

Water quality information is available for the headwaters of the Mackenzie; however, none has been collected downstream of the dredging operations being carried out above the Mills Lake sensitive area. Considerable historical data are available which describes the major tributaries to the Mackenzie. Generally station locations are abundant except along the 280 km stretch of the river from Fort Good Hope to Arctic Red River. In light of the proposed developments it is questionable whether the number and locations of stations will suffice to provide the required information to describe the influence they will have on the System. The station at Arctic Red River provides inform-

ation on the quality of the water entering the Mackenzie Delta; however, only one active station at Inuvik provides data for this vast sensitive area.

H. Recommendation

From the review of the water quality data available for the Mackenzie River Basin, a number of weaknesses may be forthcoming with the exercising of various development proposals. When the development corridor from Edmonton to Fort McMurray becomes reality and if the upstream end of the Athabasca tar sands is developed, it is recommended that monitoring should be carried out along the 300 km stretch of the river from the town of Athabasca to Fort McMurray.

Analyses of the data available for the Peace River sub-basin indicates quite vividly the lack of sampling below the expected tar sands development near the town of Peace River. Monitoring should be implemented in this region and also a coordinated long term monitoring strategy should be sought for the Peace-Athabasca Delta region.

Within the Liard River drainage a sampling program should be initiated in the British Columbia region of the sub-basin to describe the water quality in conjunction with two sensitive areas, Whirlpool Canyon and Liard Hotsprings.

Since all stations within the Hay River Drainage have been discontinued, it may be advantageous to establish a station downstream of the proposed Mackenzie Valley Pipeline. If the pipeline is routed through this region a downstream station would be required.

Both the Great Slave and Great Bear Lake sub-basins are regions proposed for considerable hydroelectric power development; consequently, it will be necessary to establish stations to adequately describe the influence of these developments on the water quality.

In the Mackenzie River drainage, it may become necessary to consider further water quality coverage in the Delta region. The development of the Mackenzie Valley Highway and associated pipeline most certainly will have an impact on the water quality of the sub-basin and consequently a plan should be prepared to deal with these developments.

In order to begin work to interpret the information referenced in this report, some work should be done to collect all data in computer compatible form. British Columbia and Alberta data are presently on computer storage and hopefully arrangements can be made to have tapes prepared and integrated with the data already on NAQUADAT and other compatible formats. Data from the Freshwater Institute, Fisheries and Marine Service and DINA need considerable preparatory work as they are not presently on a computer storage-retrieval system.

After reviewing available water quality data concerning the Mackenzie River Basin, the authors recommend the following four steps as necessary to develop an adequate long term water quality monitoring system for the basin:

Step 1: A short term survey should be undertaken immediately to provide at least a minimum of information on areas in which major data gaps have been identified in this report.

Step 2: An interpretive report should be written describing water quality conditions throughout the basin. All currently available data should be used in this assessment along with data from the short term survey. It is only during such an interpretation that the real worth and adequacy of existing data can be fully assessed.

Step 3: Concurrent with Step 2 a report should be written which summarizes the impacts on water quality which may occur due to developments expected within the basin. This report should also suggest, in general terms, how best to monitor these kinds of impacts.

Step 4: Using the reports from Steps 2 and 3 a long term monitoring plan for the basin could be developed.

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APPENDICES

APPENDIX A

OTHER AVAILABLE WATER QUALITY INFORMATION

A. Fisheries and Marine Service

General Physical and Chemical Data for water and sediment of the Mackenzie and Procupine Watersheds and rates of transport of dissolved and suspended elements at selected stations in the Mackenzie and Porcupine Watersheds 1971-74.

1. Regions of Study: Mackenzie mainstem rivers and streams, Yukon rivers and streams, Mackenzie Delta channels, rivers, streams and the Beaufort Sea, and Mackenzie Delta lakes.

2. Parameters Analyzed: Temperature, dissolved oxygen, pH and specific conductivity, total suspended sediment, secchi visibility, colour at half secchi depth, major mineral constituents of suspended sediment. Total Dissolved: Calcium, magnesium, sodium, potassium, sulphate, chloride, bicarbonate, nitrogen, phosphorus, silica, iron, manganese, zinc, copper, lead, arsenic, aluminum, cadmium. Total Suspended: Calcium, magnesium, sodium, potassium, silica, aluminum, titanium, iron, manganese, zinc, lead, copper, cobalt, chromium, cadmium, carbon, nitrogen, phosphorus.

B. Westcoast Transmission Company Ltd.

1. Regions of Study: Water quality data compiled along the Alaska Highway Pipeline route, Northern British Columbia. Stations were located at the Dease R., Trepanier Creek, Tatisno Creek, Liard R. (west), Coal R., Smith R., Teeter Creek, Troat R., Toad R., Muskwa R., Prophet R., Fort Nelson R., Hay R., Sulphur Creek, Crusty Creek, Kyklo Creek, and other water courses along the pipeline route.

2. Parameters Analyzed: One sample only data from the 1976 open water season and the March 4-11, 1978 study. The 1976 study conducted by F.F. Slaney and Company Limited was collected for Gulf Interstate Engineering, Houston, Texas. The 1978 study was carried out by Associated Resource Consultants, and included analyses for pH, conductance, turbidity, volatile suspended solids and dissolved oxygen. Alkalinity, pH, hardness (total), dissolved oxygen, temperature, conductivity, turbidity, suspended solids (total, fixed, volatile), dissolved solids (total, fixed, volatile, colour).

C. Great Canadian Oil Sands Ltd.

1. Region of Study: Effluent data describing the water quality entering the Athabasca River.

2. Parameters Analyzed: Sampling was carried out daily from 1974 - August 1, 1978. Since August sampling has been carried out on a three times a week basis. Total suspended solids, oil and grease, COD, BOD, phenols, ammonia, nitrogen, sulphide, odor, pH, total organic carbon, temperature, cadmium, chromium, cobalt, copper, lead, manganese, nickel, tin, zinc, selenium, mercury, arsenic, vanadium.

D. British Columbia Hydro and Power Authority

1. Region of Study: Two stations on the Liard River

2. Parameters Analyzed: Single sample data collected July 26, 1978. Alkalinity, pH, conductivity, suspended solids, dissolved solids, hardness, chloride, fluoride, nitrate-nitrite, sulphate, total phosphate, Kjeldahl nitrogen. As well as dissolved calcium, magnesium, potassium, sodium, iron, lead, manganese, zinc, aluminum, copper, nickel, cobalt, cadmium, molybdenum.

E. Alberta Oil Sands Environmental Research Project

1. Region of Study: Northeast Alberta including the lower Athabasca River and Peace-Athabasca Delta.

2. Numerous research projects have been carried out under the direction of O.S.E.R.P. and are summarized in annual reports. Details and data of individual studies are contained in reports available from the O.S.E.R.P. office in Edmonton.

APPENDIX B

STATION RATIONALE CODE

The rationale for each water quality station is documented in the Tables under the headings: 'Rationale For Active Stations', and 'Reasons For Discontinuing Stations'.

A. Rationale for Active Stations

Water Quality Branch

1. Site is part of a federal-provincial agreement.
2. Branch collecting data at these locations by special arrangement at the request of the regional director. The data are required; (1) to provide baseline information, (2) by the Mackenzie study group, and (3) for environmental assessment studies.
3. Branch required to monitor quality of ocean loading streams.
4. Branch required to monitor quality of interjurisdictional streams.
5. Site is part of an agreement with Parks Canada

British Columbia Water Resources Service

6. Water Investigation Branch monitoring water supply and/or effects of effluent on receiving waters.
7. Special study. Water Investigation Branch collecting data; (1) to provide baseline information and/or (2) for environmental assessment studies.

Alberta Ministry of Environment

8. Station is part of a 'Trend Determination' network.

Dept. of Indian and Northern Affairs

9. Monitoring of effects of mine effluent on receiving waters.

10. Monitoring of domestic and mine freshwater supply.

Freshwater Institute and Fisheres and Marine Service

11. Samples collected for study; (1) to estimate rates of mechanical and chemical weathering of watersheds, (2) to estimate dissolved salt and suspended sediment annual loads to the Beaufort Sea, (3) to provide a rational basis for discussing increased erosion rates due to pipelines and road construction.

B. Reasons for Discontinuing Stations

Water Quality Branch

1. Sampling discontinued during redefinition of Branch role and/or because of inadequate resources.

2. Location sampled as part of special study. Study completed.

3. Sampling discontinued when it was found that a more accessible site provided equivalent information.

British Columbia Water Resources Service

4. Water Investigation Branch, location sampled as part of special study. Study completed.

5. Water Rights Branch sampling carried out in accordance with Water Rights permits. Requirement satisfied.

6. Water Investigation Branch sampling discontinued due to re-allocation of resources.

7. Water Investigation Branch monitoring water supply and/or effects of effluent on receiving waters. Study complete.

Alberta Ministry of Environment

8. Sampling discontinued due to re-allocation of resources. (data was collected to determine effect of industrial effluent on receiving streams).

9. Location sampled as part of special study. Study complete. (Baptiste Lake samples obtained to determine nutrient inputs to the lake).

Dept. of Indian and Northern Affairs

10. Sampling discontinued due to re-allocation of resources.

Freshwater Institute and Fisheries and Marine Service

11. Sampling discontinued due to (1) re-allocation of resources or (2) completion of special study.