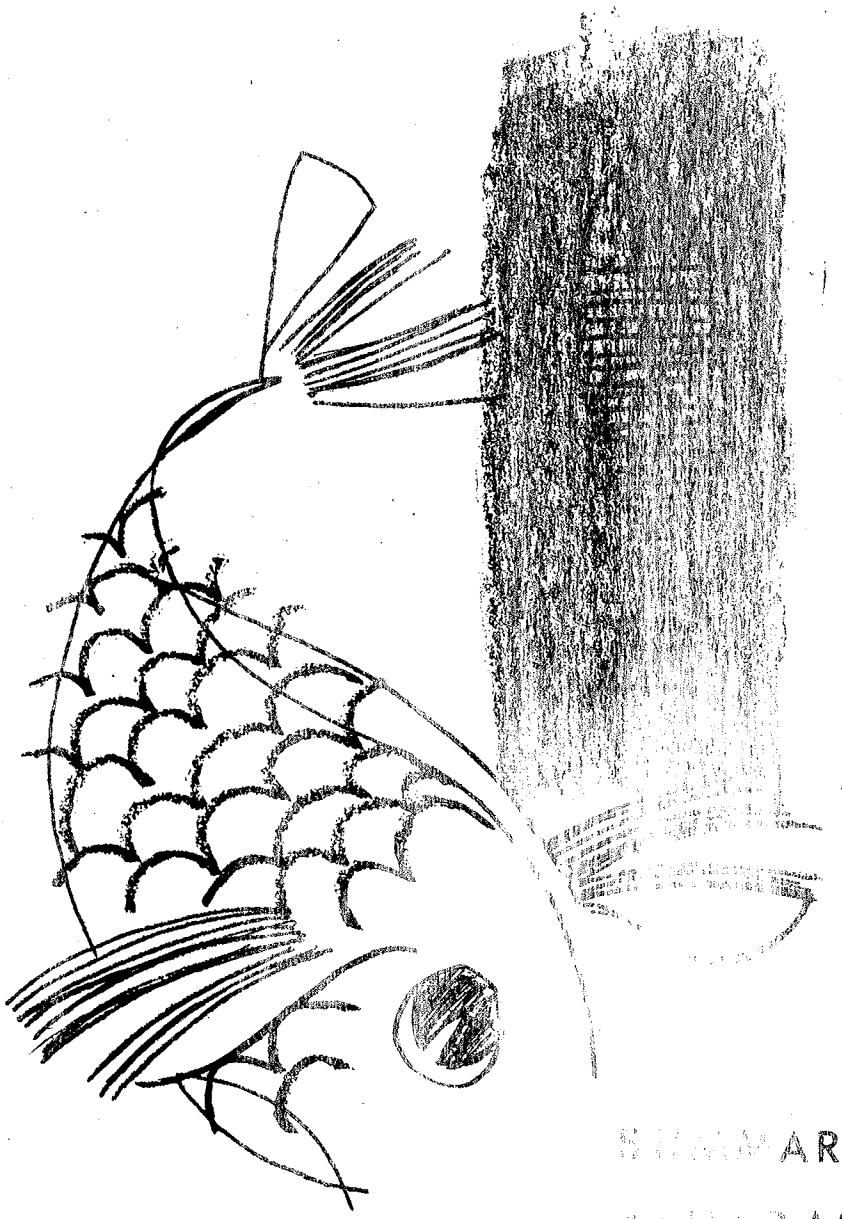

SUMMARY REPORT
ATHABASCA RIVER
POLLUTION SURVEY
1968 - 1969

ENVIRONMENTAL HEALTH SERVICES DIVISION
GOVERNMENT OF THE PROVINCE OF ALBERTA
DEPARTMENT OF HEALTH

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SUMMARY REPORT

ATHABASCA RIVER SURVEY

1968 - 1969

I INTRODUCTION

The Athabasca River serves as a source of water supply and a receiving stream for the wastes of two major industries and several communities (Table 1). This report presents the summary of water quality in the Athabasca River during six sampling surveys. River profiles of selected pollutants are presented in Appendix A and detailed analyses are presented in Appendix B and C. The sampling locations are listed as follows (Figure 1):

AR1	Hinton - above Northwest Pulp & Power
AR2	Obed Ferry
AR3	Whitecourt Bridge on Hwy. 43
AR4	Smith - C.P.R. Bridge
AR5	Athabasca - North of Athabasca town site
AR6	Fort McMurray, Tar Island, above G.C.O.S.
LS1	Lesser Slave River, 5 miles above Smith
ML1	McLeod River, Whitecourt Bridge on Highway 43

II FLOWS IN THE ATHABASCA RIVER

The daily flows in the Athabasca River at Hinton (Station 7AD-2), Whitecourt (Station 7AE-1), Athabasca (Station 7BE-1), Ft. McMurray (Station 7DA-1), and of the Lesser Slave River at Highway #2 (Station 07BK006) are presented in Figures 2, 3, 4, 5, and 6.

At Hinton the minimum average monthly flow was 1140 c.f.s. in

. . . . 2

February while a minimum daily flow of 1000 c.f.s. was recorded on December 10, 1968. The Athabasca River is augmented by the inclusion of the McLeod River and Lesser Slave River. The minimum average monthly flow at the Ft. McMurray station was 4157 c.f.s. in March with a minimum daily flow of 3830 c.f.s. on March 28, 1969.

Within the 1% - 30% frequency level (Figure 7), flows at Hinton were higher than had been the case during the past twelve years.

III LOADINGS TO THE ATHABASCA RIVER

The total loading to the Athabasca River is presented in Table II. These data are based on analyses of samples collected during survey periods and are representative of the pollutant load imposed upon the river. The Biochemical Oxygen Demand load remained relatively constant, ranging from 19,000 to 23,000 pounds per day.

The Oil and Grease loading varied from 780 pounds per day (October 29, 1968) to 16,000 pounds per day (February 19, 1969).

Phenolic loadings ranged from 30 pounds per day to 170 pounds per day. Restraint of these higher emissions will be required to reduce the potential of an undesirable taste being imparted to drinking water supplies.

Tannins and Lignins varied from 7600 pounds per day (November 27, 1968) to 17,000 pounds per day (October 29, 1968).

The Nutrient loading (Ammonia Nitrogen, Nitrate Nitrogen, Phosphates) and Arsenic loading were maintained at a minimal level throughout the winter.

IV DISSOLVED OXYGEN AND BIOCHEMICAL OXYGEN DEMAND IN THE ATHABASCA RIVER

The maximum, minimum, and median values of Dissolved Oxygen and Biochemical Oxygen Demand in the Athabasca River corresponding to increasing distances downstream of Hinton are illustrated in Figure 8. These profiles of median values show that approximately 1.0 mg/l of Biochemical Oxygen Demanding materials are being absorbed in the River while the oxygen utilized from Hinton to Athabasca is about 2.0 mg/l. Additional flow from the Lesser Slave River served to increase the lowest median Dissolved Oxygen concentration of 8.8 mg/l at Athabasca to 12.3 mg/l at Fort McMurray.

V THRESHOLD ODOR NUMBER

Threshold Odor Numbers are profiled in Figure 9. Maximum values ranged from 2 M upstream of Hinton to 32 WR at Whitecourt. A value of 16 CH was observed at Fort McMurray on November 27, 1968. An odor number of 100 WR was observed at Obed on November 26, 1968.

VI BACTERIOLOGICAL CONSTITUENTS

The profiles of maximum, minimum and median values for Most Probable Number of Coliforms and Most Probable Number of Escherichia Coli is presented in Figure 9. These particular indicators of sewage contamination were at minimal levels and not considered to be excessive. Median values of Standard Plate Count showed an increase of 170 organisms per ml. between Hinton and Ft. McMurray, similarly E. Coli showed a range of 6 organisms per ml.

VII CONCLUSIONS

Dissolved oxygen concentrations in the Athabasca River remained above the guide lines of acceptability (5 mg/l). The loading of

Biochemical Oxygen Demanding materials to the River remained essentially the same as that of the previous winter survey. Threshold Odor Numbers in the River exceeded the guide line criteria of 8 on several occasions and more stringent control of odorous waste waters will be required. The Bacteriological Constituents in the Athabasca River remained at a minimal level and were not considered excessive.

P.G. Shewchuk, P.Eng.,
Water Pollution Control Section.

PGS/nw

July 10, 1969.

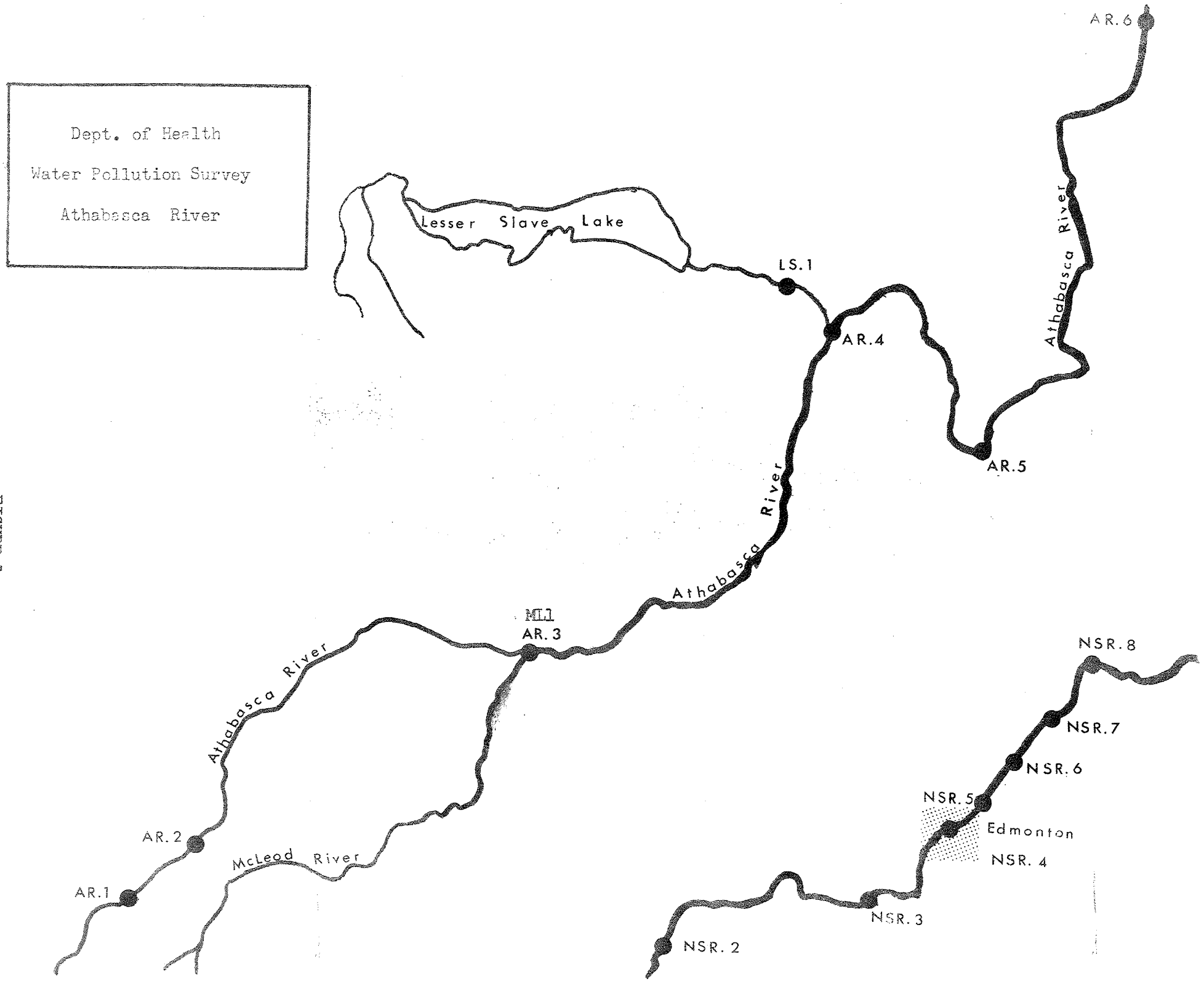
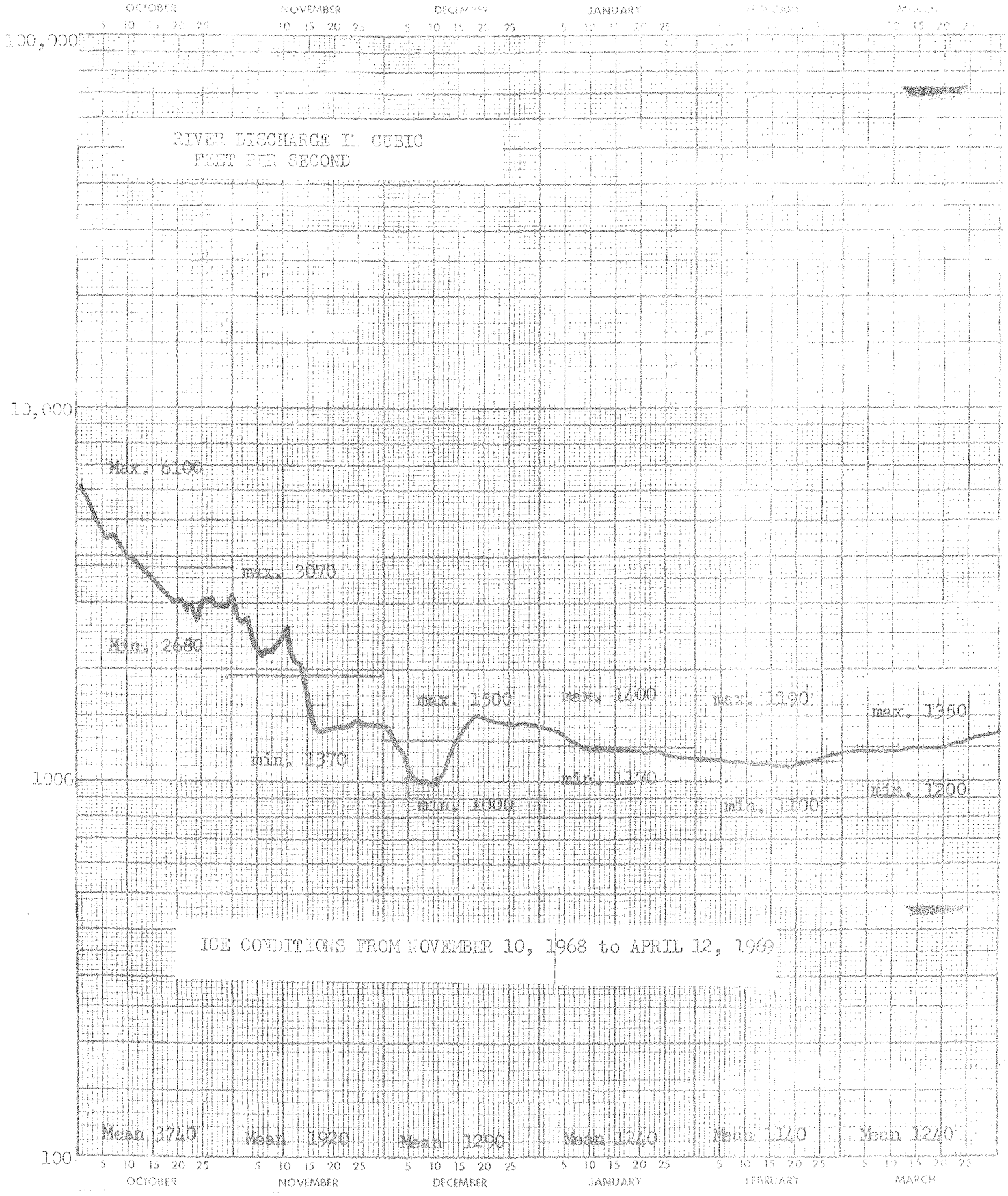
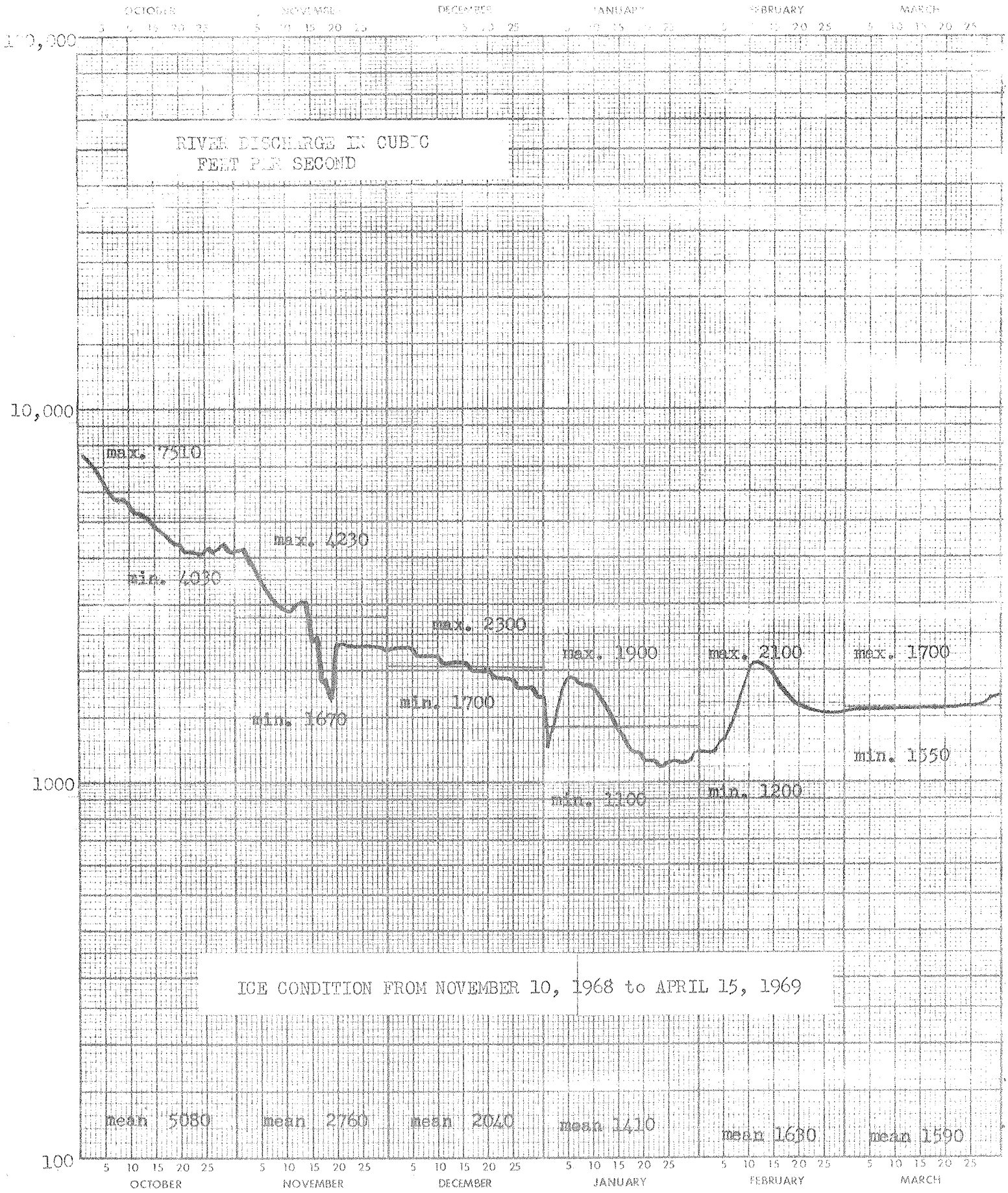

Dept. of Health
Water Pollution Survey
Athabasca River
Lesser Slave Lake
LS.1
AR.4
AR.5
AR.6
Athabasca River
Athabasca River
Athabasca River
ML1
AR.3
AR.2
AR.1
McLeod River
NSR.8
NSR.7
NSR.6
NSR.5
Edmonton
NSR.4
NSR.3
NSR.2

FIGURE 1



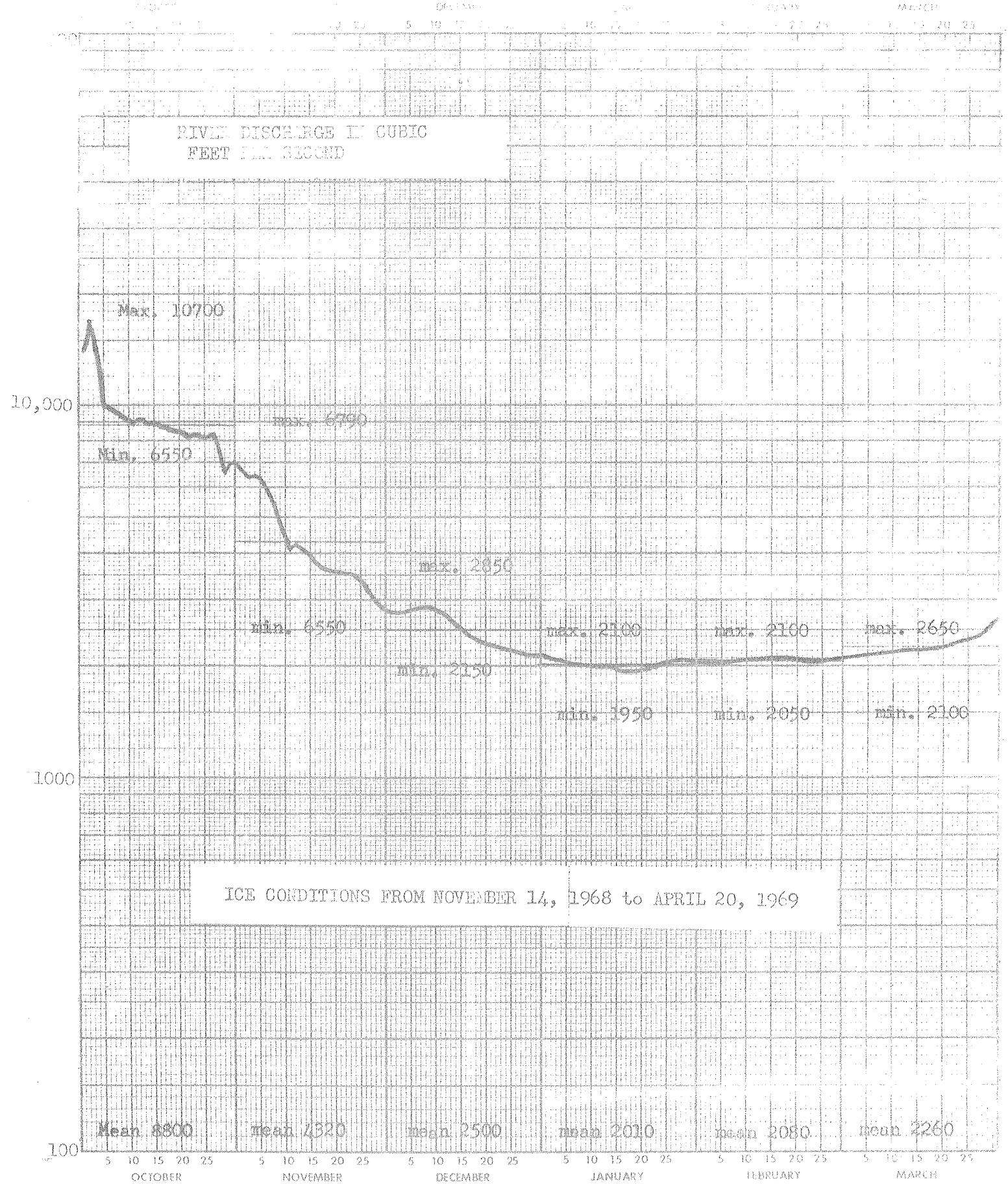
ATHABASCA RIVER AT HINTON STATION NO. 7AD-2

FIGURE 2



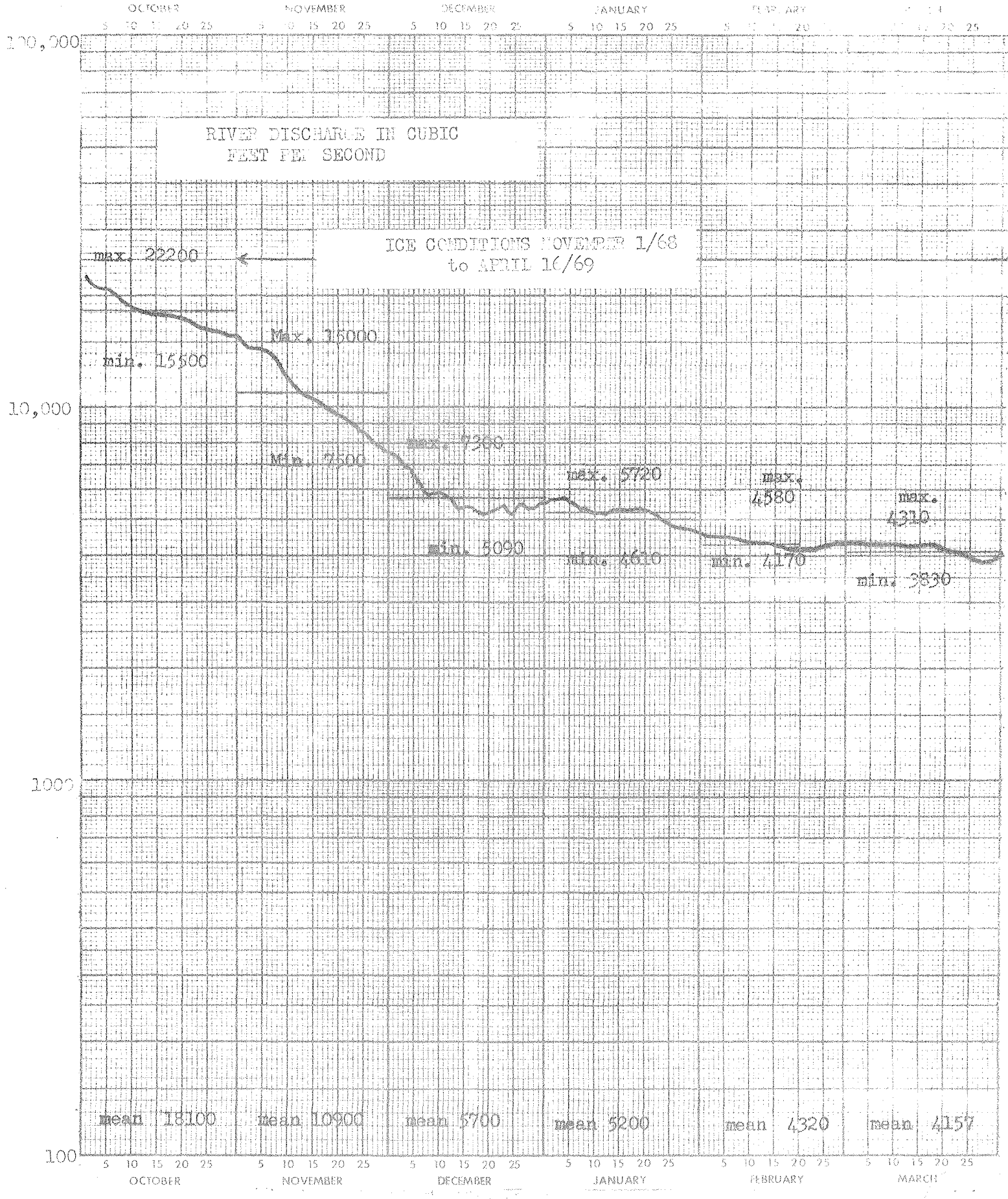
ATHABASCA RIVER NEAR WHITECOURT STATION NO. 7AE-1

FIGURE 3



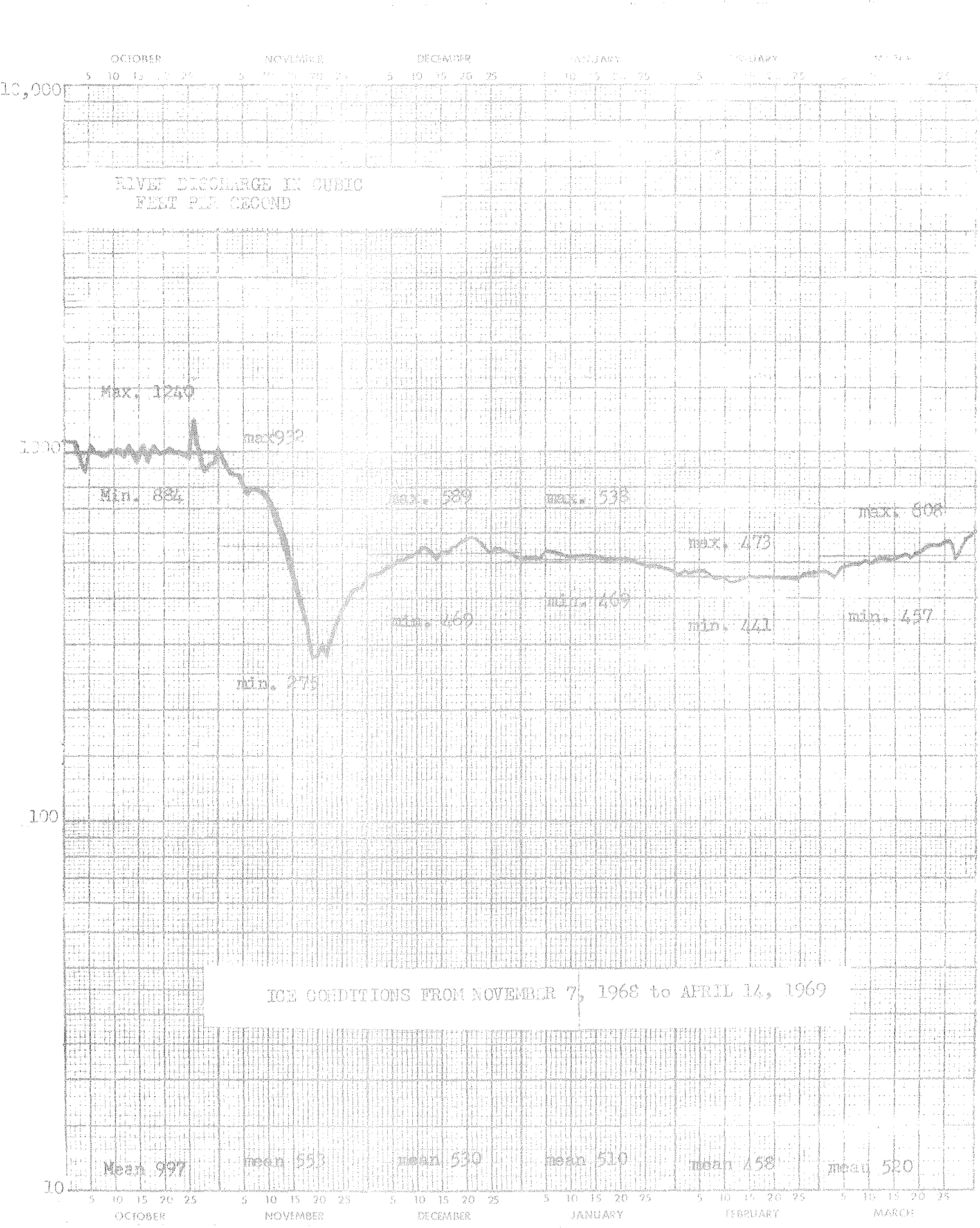
ATHABASCA RIVER AT ATHABASCA STATION NO. 7BE-1

FIGURE 4



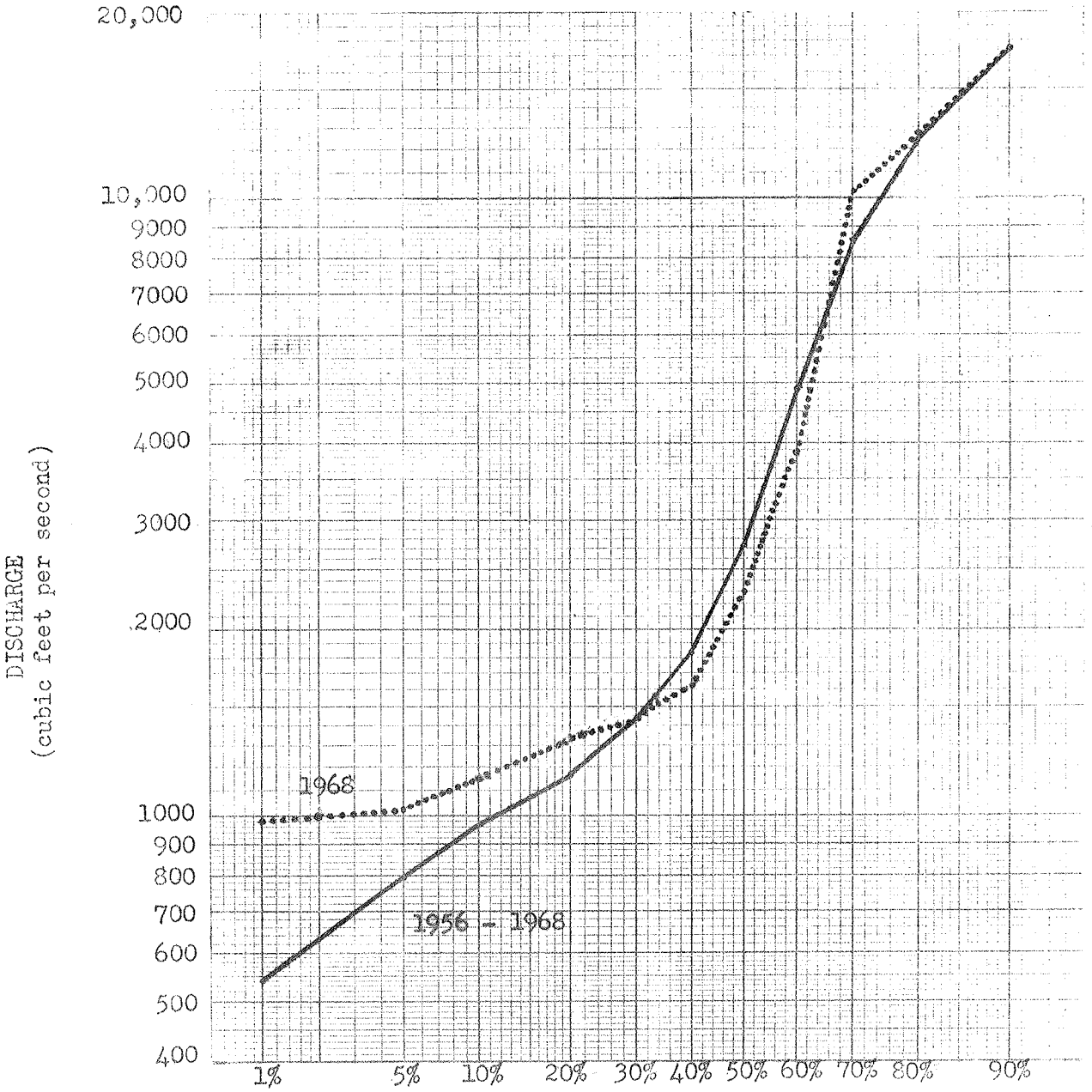
ATHABASCA RIVER BELOW FT. McMURRAY STATION NO. 7DA-1

FIGURE 5



LESSER SLAVE RIVER AT HWY. # 2 STATION NO. 07BH006

FIGURE 6



STATISTICAL FLOW ANALYSIS FOR THE ATHABASCA RIVER AT HINTON

1956-1968	Maximum Flow is	36,200 cubic feet per second
	Minimum Flow is	382 cubic feet per second
1968	Maximum Flow is	35,400 cubic feet per second
	Minimum Flow is	970 cubic feet per second

FIGURE 7

Maximum, Minimum Values of River Components Downstream of Hinton

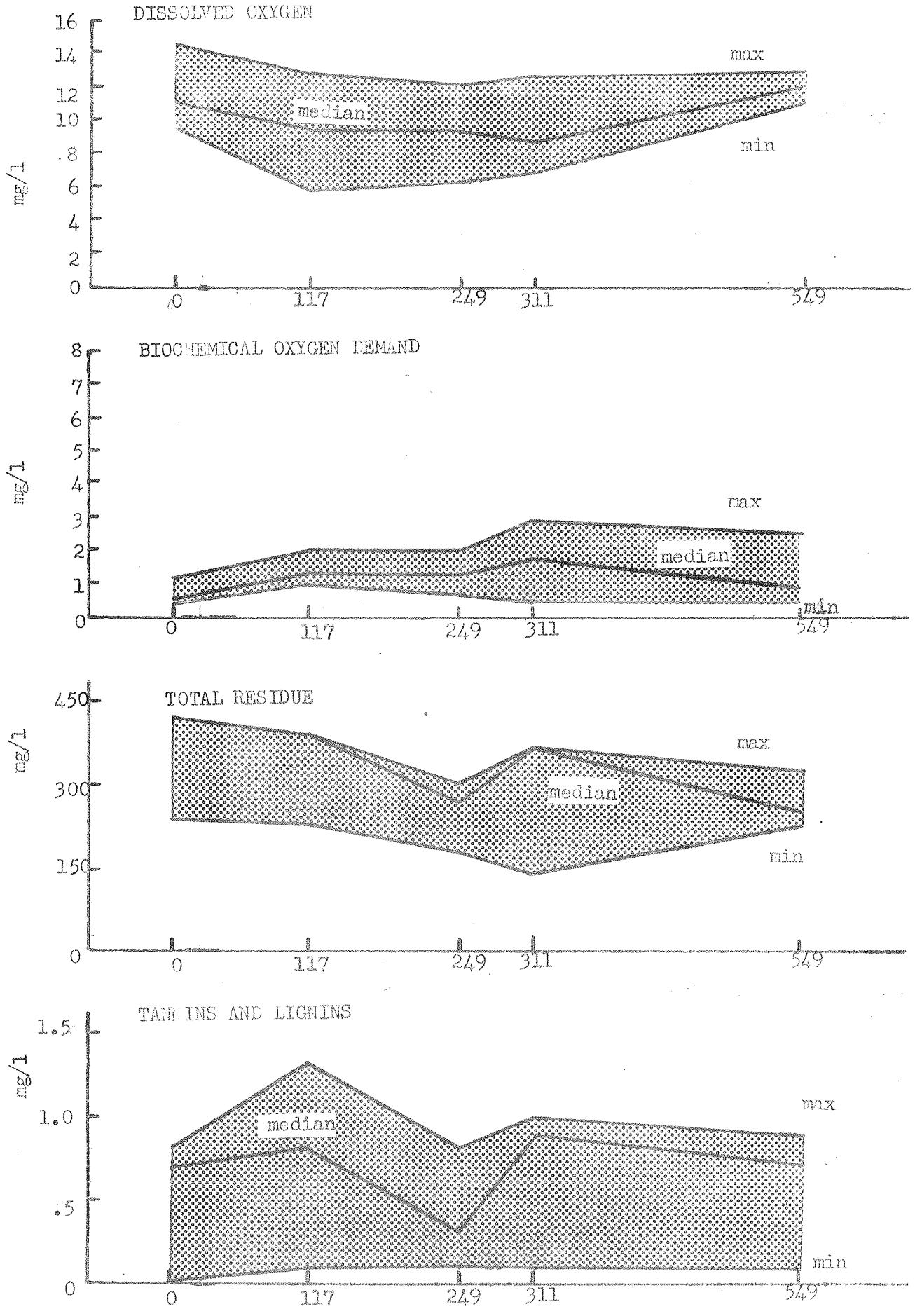
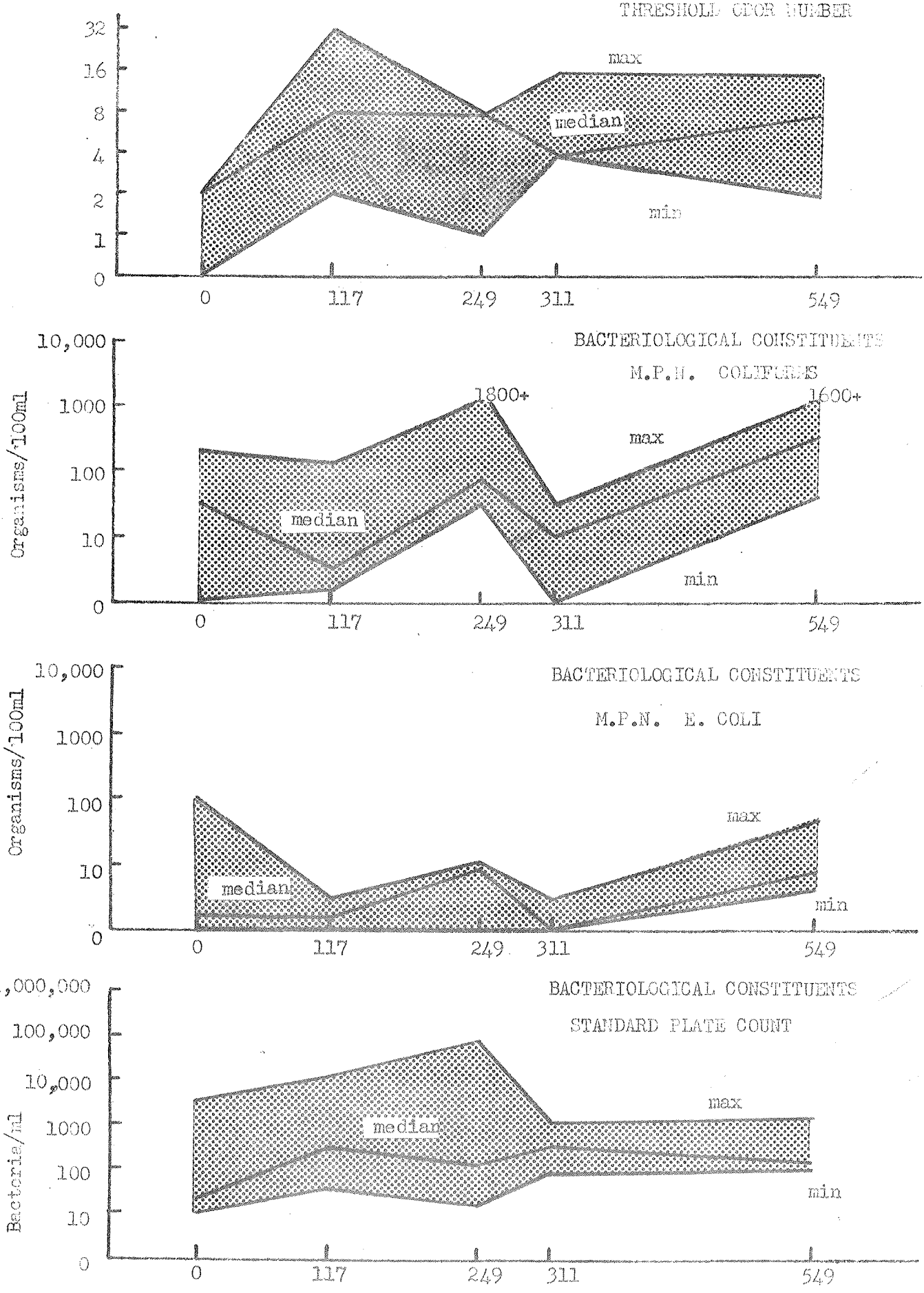


FIGURE 8

Maximum, Minimum Values of River Components Downstream of Hinton



MILES DOWNSTREAM FROM HINTON

FIGURE 9

TABLE 1

Athabasca River User and Effluent

Dischargers

Type of Discharge and Treatment	Source	Discharged To:
1. Industrial waste (secondary)	NORTHWESTERN PULP AND POWER	Athabasca River
2. Domestic Sewage	HINTON	NWP&P Treatment Facility
3. Domestic Sewage (anaerobic lagoon)	WHITECOURT	Athabasca River
4. Domestic Sewage (Raw)	ATHABASCA	Athabasca River
5. Domestic Sewage (anaerobic lagoon)	McMURRAY	Clearwater River
6. Industrial waste (A.P.I. Separators) (Settling ponds)	GREAT CANADIAN OIL SANDS LIMITED	Athabasca River

Drinking Water Users

User	Source	Type of Treatment
Hinton	Athabasca River	Complete (through NWP&P)
Whitecourt	McLeod River	Chlorination
Athabasca	Athabasca River	Complete
McMurray	Athabasca River	Complete

TABLE II

TOTAL LOADINGS TO THE ATHABASCA RIVER IN LBS/DAY

Sampling Date	Oct. 29/68	Nov. 27/68	Dec. 17/68	Jan. 28/69	Feb. 19/69
River Discharge c.f.s.	2940	1430	1420	1180	1100
Biochemical Oxygen Demand	20000	23000	19000	22000	20000
Chemical Oxygen Demand	120000	160000	140000	120000	130000
Total Residue	280000	350000	340000	270000	330000
Ignition Loss of Total Residue	98000	160000	120000	86000	110000
Nonfiltrable Residue	43000	60000	16000	27000	22000
Ignition Loss of Nonfiltrable Residue	20000	37000	16000	26000	18000
Oils & Greases	980	3300	780	3600	16000
Phenols	170	30	70	130	170
Chlorides	60000	99000	83000	-	-
Phosphates	250	200	350	-	-
Sulphates	33000	54000	37000	-	-
Tannins & Lignins	17000	7600	8000	-	-
Ammonia Nitrogen	1600	2000	2000	-	-
Nitrate Nitrogen	1000	1300	200	-	-
Arsenic	5.5	1.1	-	4.7	2.1
Hydrogen Sulfide	-	-	-	10	.4

APPENDIX A

INDEX TO APPENDIX A

EXPLANATORY NOTES AND DEFINITIONS

FOR

PARAMETERS USED IN THIS PAPER

1.	Algae -	A microbial plant growth present in water supplies, causing taste and odour.
2.	Alkalinity -	Capacity of a water to neutralize acids, caused by the presence of bicarbonate and carbonate ions and hydroxide.
3.	Ammonia Nitrogen - (NH_3-N)	commonly called a nutrient as it is an essential part of protein in all living organisms; produces oxygen demand.
4.	Biochemical Oxygen-Demand, 5-Day @ 20° (B.O.D.)	the amount of molecular oxygen required to stabilize the decomposable matter present in a water; commonly found by a five-day incubation period at 20°C. It measures the effect of a combination of substances and conditions.
5.	Carbon Chloroform-Extract (CCE)	a measure of the amount of industrial organic contaminants, particularly synthetic chemicals, present in a water supply.
6.	Chemical Oxygen-Demand (C.O.D.)	the amount of molecular oxygen required to oxidize that portion of the organic matter in a sample which is susceptible to oxidation by a strong chemical oxidant.
7.	Coliform -	a type of bacteria generally present in water in the same concentrations as pathogenic organisms, and used as an indication of the concentration of pathogenes.
8.	Composite Sample -	a series of grab samples generally taken for a 24-hour period indicative of an average of the concentrations of contaminants for the sampling period.
9.	Colour -	taken as the color of the liquid after turbidity is removed; due to decay of organic material in the water.
10.	Dissolved Oxygen - (D.O.)	oxygen present in the water supply, indicating the ability of a stream to assimilate organic matter.
11.	Grab sample -	a single sample representative of stream flow, usually collected at middepth in the middle of the stream.
12.	Most Probable No. - (M.P.N.)	of coliform organims in a water sample; it is the density more likely to produce a particular result.
13.	Nonfiltrable Residue-	see Suspended Solids.
14.	Oils & Greases -	their insolubility in water and low specific gravity reduce reaeration of the stream.
15.	pH -	a measure of the alkalinity or acidity of a water supply, A value of 7.0 indicates neutral water, below 7.0 is acidic and above 7.0 is alkaline or basic.

16. Phenols – an organic compound from industrial waste or naturally occurring with its own characteristic taste and odor. Chlorination will intensify the taste and odor.

17. Phosphate – (PO_4) commonly called a nutrient, it will interfere with coagulation and promote algal growth.

18. Threshold Odor No. – (T.O.N.) a value given to a water to indicate its relative strength of odour; the number of times the odor-bearing sample has to be diluted with odor-free water for the odor to be just detectable.

19. Suspended Solids – small particles such as clay, organic materials, or plankton which are in suspension in the water.

20. Turbidity – a measure of the extent to which the intensity of light passing through the water is reduced by the suspended matter.

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2. Clark, J.W. and Viessman Jr., Warren, Water Supply and Pollution Control, International Textbook Company, Scranton, Pennsylvania.
3. McKee, J.E., and Wolf, H.W., Water Quality Criteria, 2nd Edition, 1963, The Resources Agency of California, State Water Quality Control Board.
4. Province of Saskatchewan, Water Quality Criteria, April 1968.

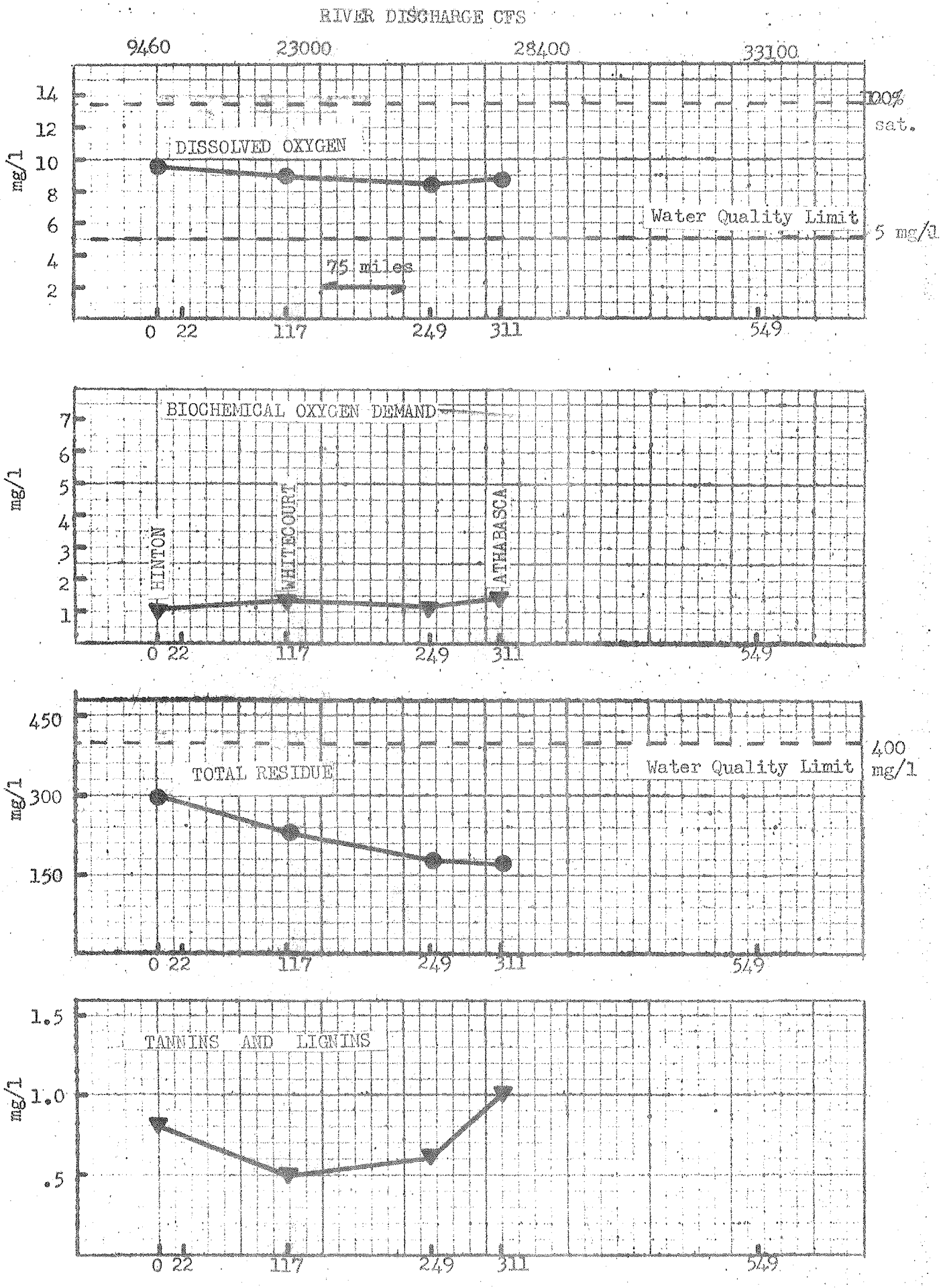
WATER POLLUTION CONTROL

ODOR TYPE

Abreviation	Nature of Odor	Description-Such as Odors of
A	Aromatic (Spicy)	Camphor, cloves, lavender, lemon
AC	cucumber	Synura
B	Balsamic (Flowery)	Geranium violet, vanilla
BG	geranium	Asterionella
BN	nasturtium	Aphanizomenon
BS	sweetish	Coelosphaerium
BV	violets	Mallomonas
C	Chemical	Industrial waste or treatment chemicals
CC	chlorinous	Free chlorine
CH	hydrocarbons	Oil Refinery wastes
CM	medicinal	Phenol and iodoform
CS	sulfuretted	Hydrogen Sulfide
D	Disagreeable	(Pronounced unpleasant Odors)
DF	Fishy	Uroglenopsis and Dinobryon
DP	pigpen	Anabaena
DS	septic	Stale sewage
E	Earthy	Dam earth
EP	peaty	Peat
G	Grassy	Crushed grass
M	Musty	Decomposing straw
MN	moldy	Damp cellar
V	Vegetable	Root vegetables
WR	Wood Resin	

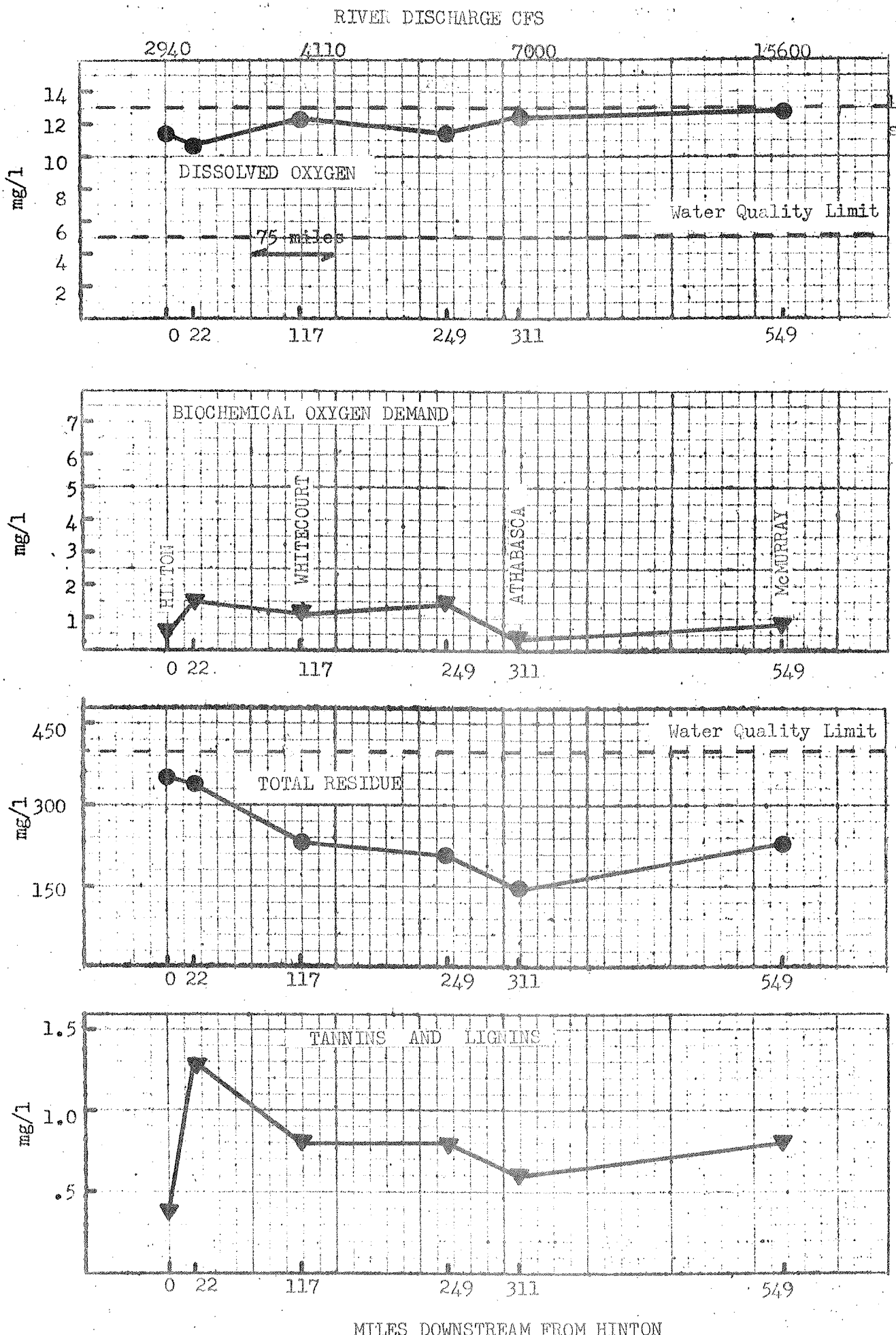
ATHABASCA RIVER SAMPLING RESULTS

JULY 31 - AUGUST 1, 1968



ATHABASCA RIVER SAMPLING RESULTS

OCTOBER 29 - 30, 1968



ATHABASCA RIVER SAMPLING RESULTS

OCTOBER 29 - 30 , 1968

RIVER DISCHARGE CFS

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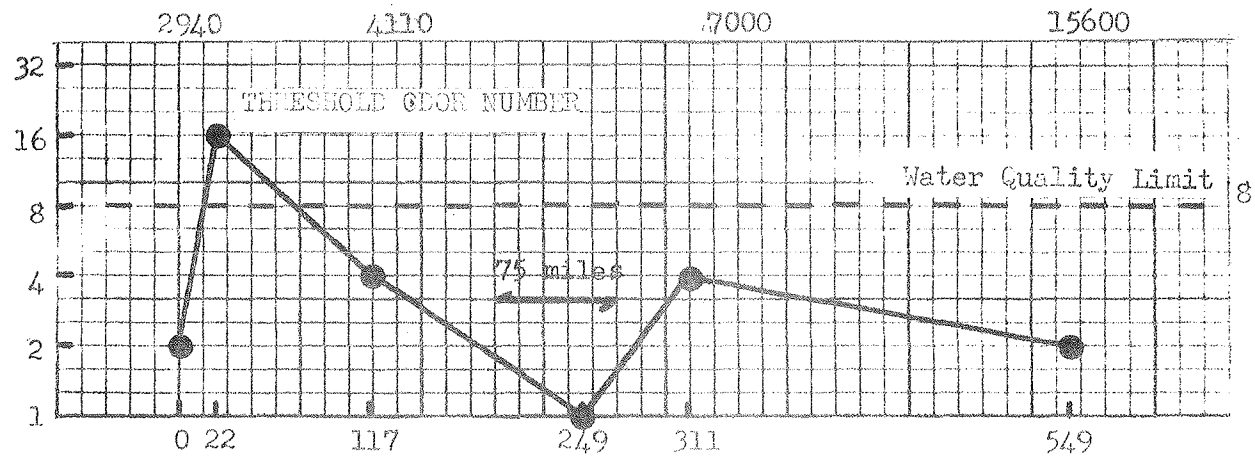

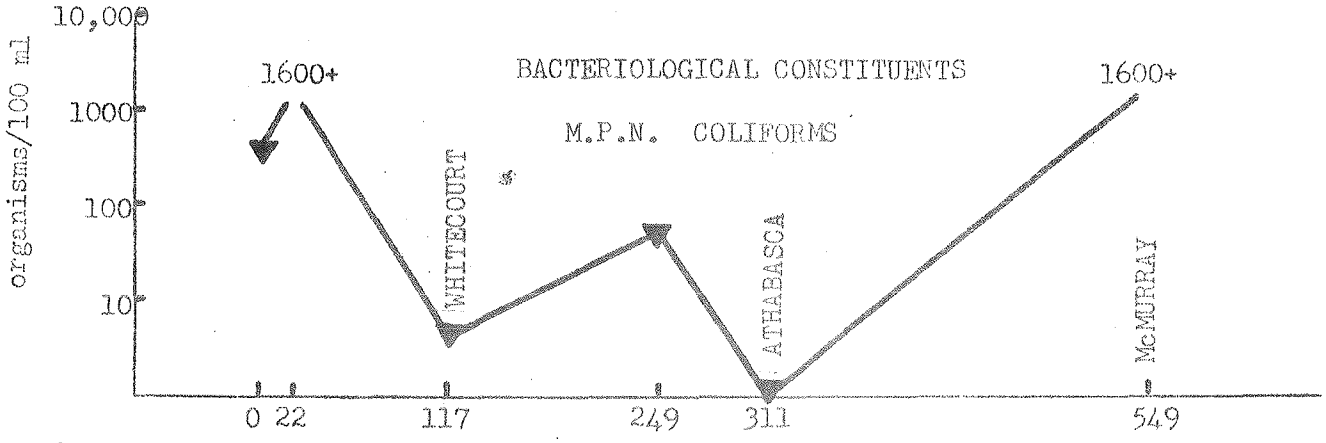

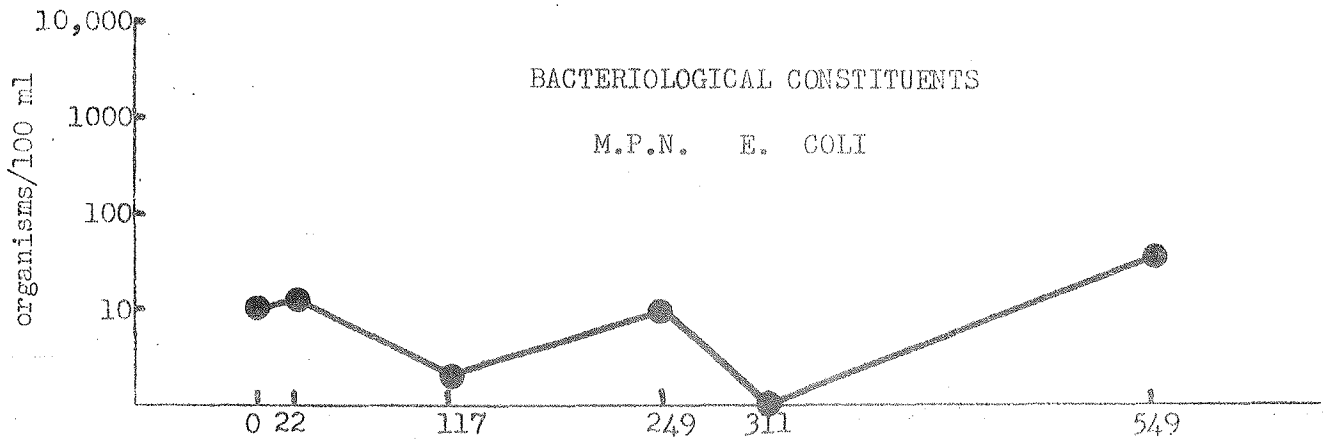

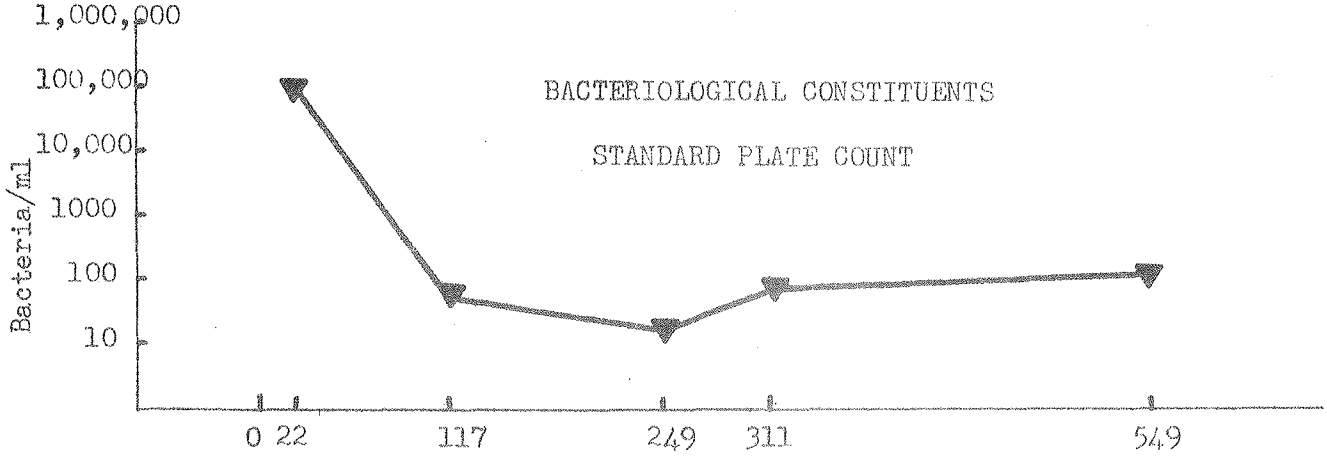

ATHABASCA RIVER SAMPLING RESULTS

Nov. 26 - 27, 1968

RIVER DISCHARGE CFS

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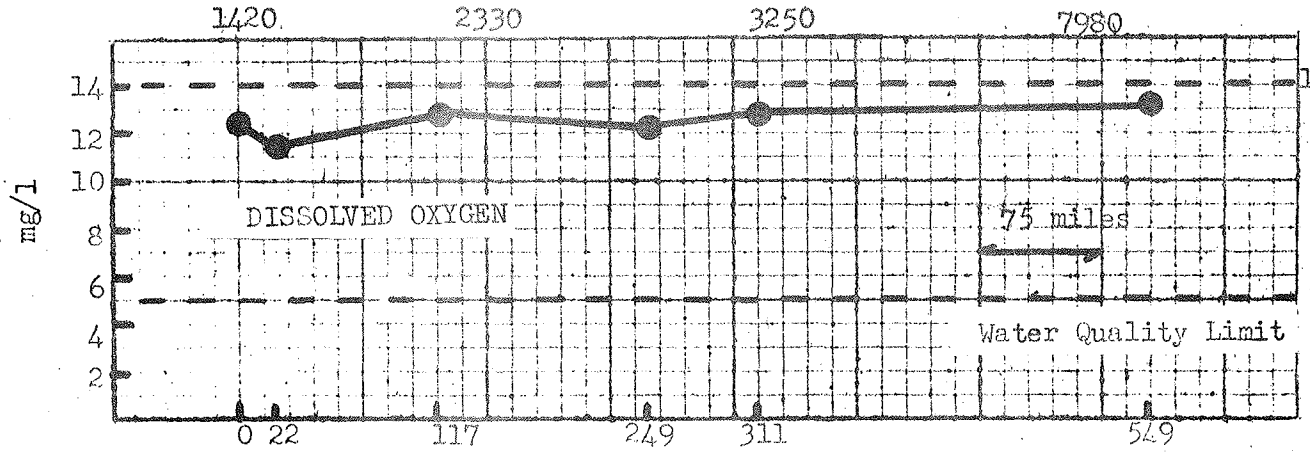

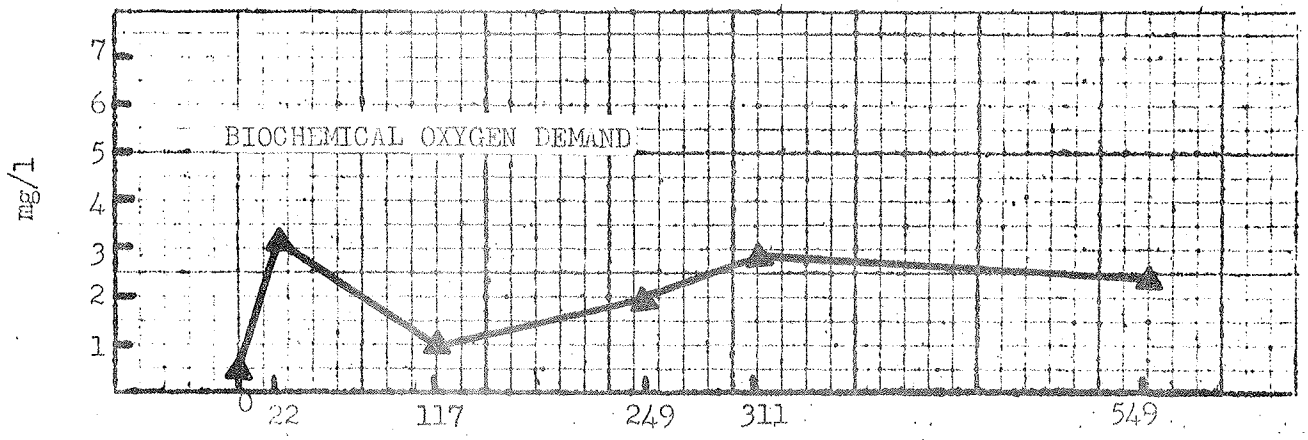

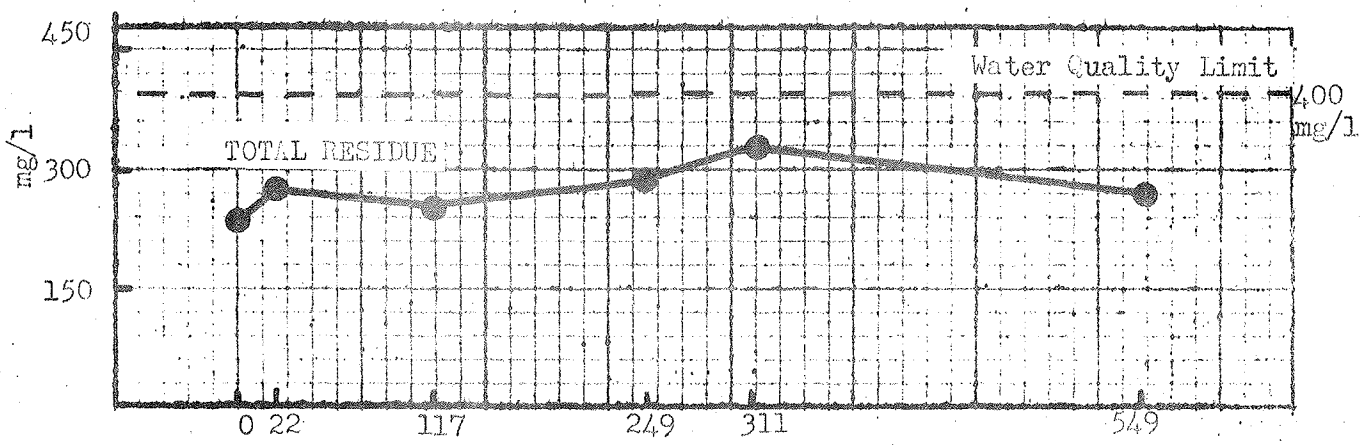

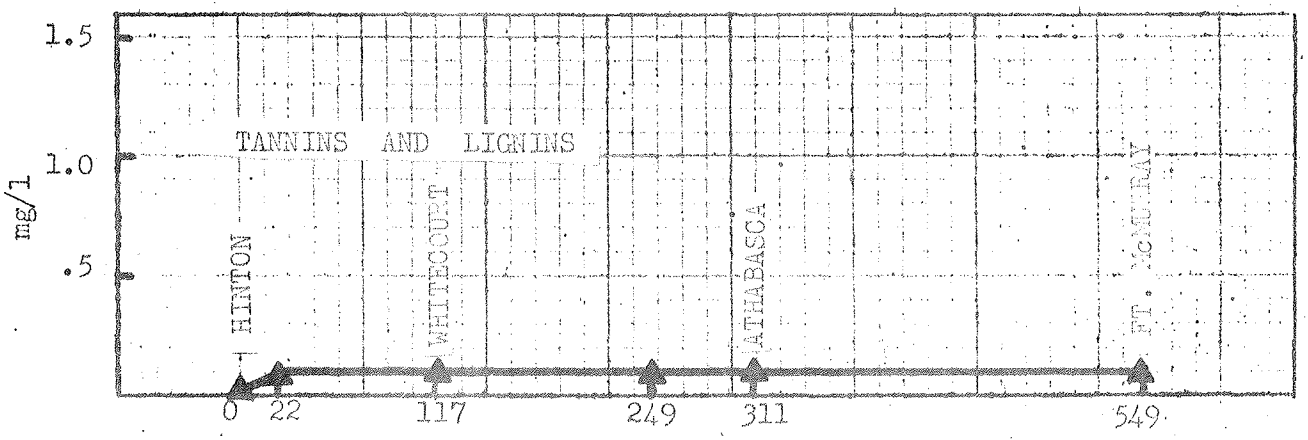

RIVER DISTANCE DOWNSTREAM FROM HINTON

ATHABASCA RIVER SAMPLING RESULTS
Nov. 26 - 27, 1968

RIVER DISCHARGE CFS

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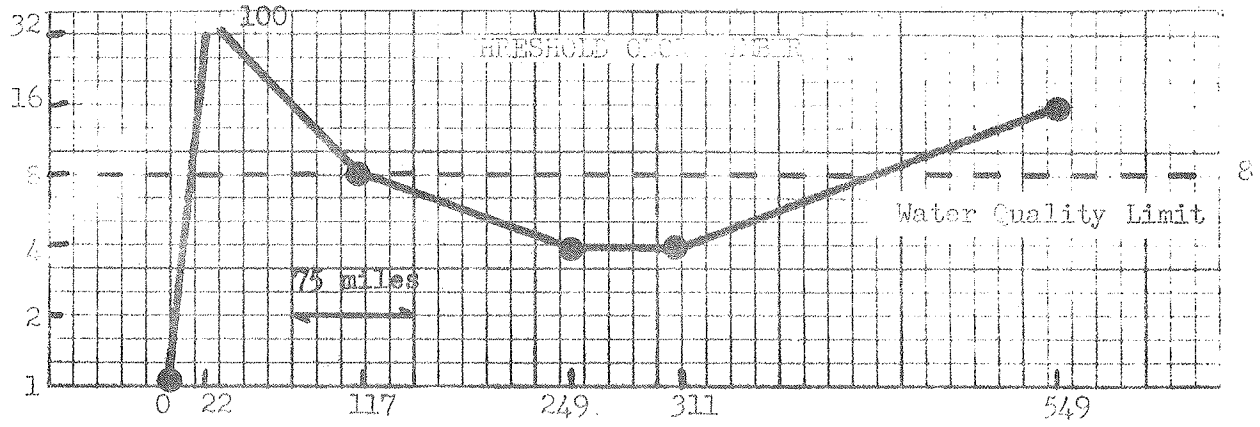
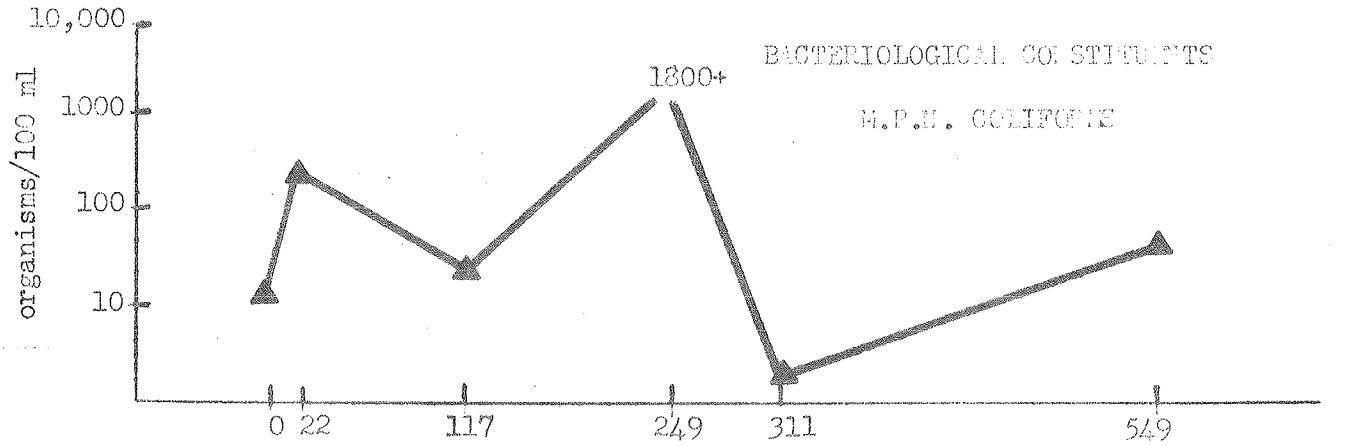
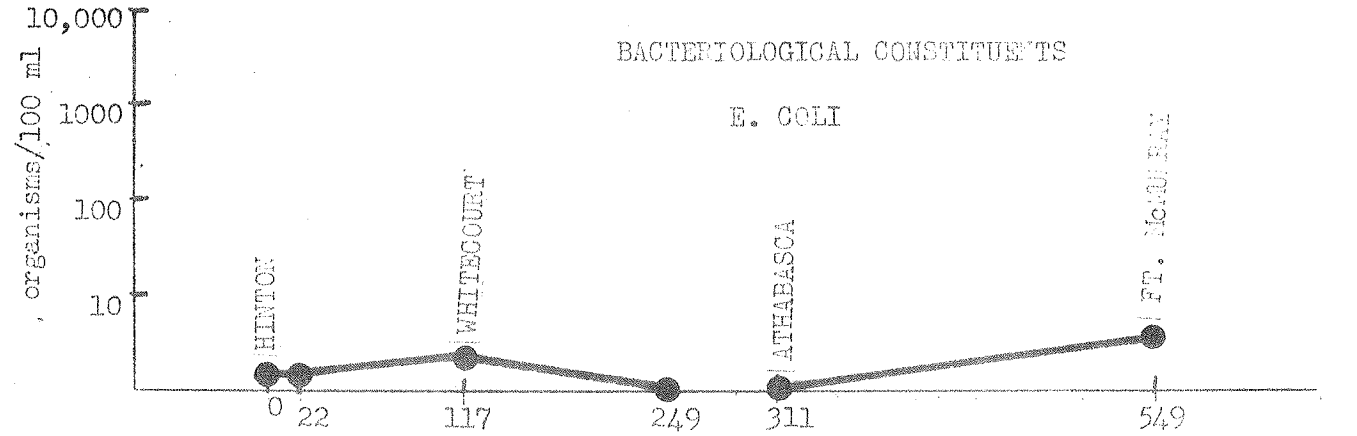




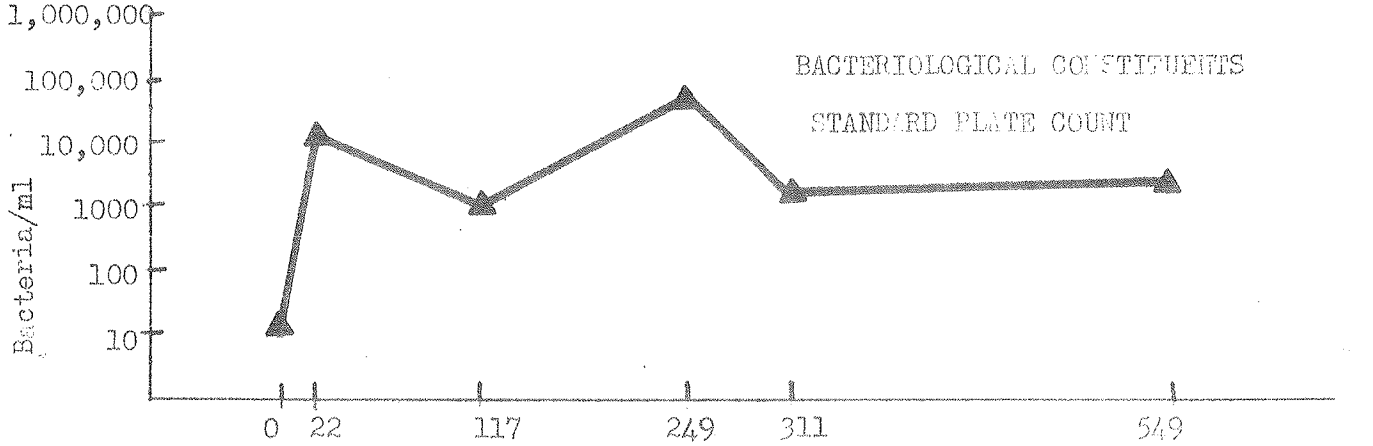
BACTERIOLOGICAL CONSTITUENTS

M.P.N. COLIFORMS



BACTERIOLOGICAL CONSTITUENTS

E. COLI



BACTERIOLOGICAL CONSTITUENTS

STANDARD PLATE COUNT

RIVER DISTANCE DOWNSTREAM FROM HINTON

ATHABASCA RIVER SAMPLING RESULTS

Dec. 17 - 18, 1968

RIVER DISCHARGE CFS

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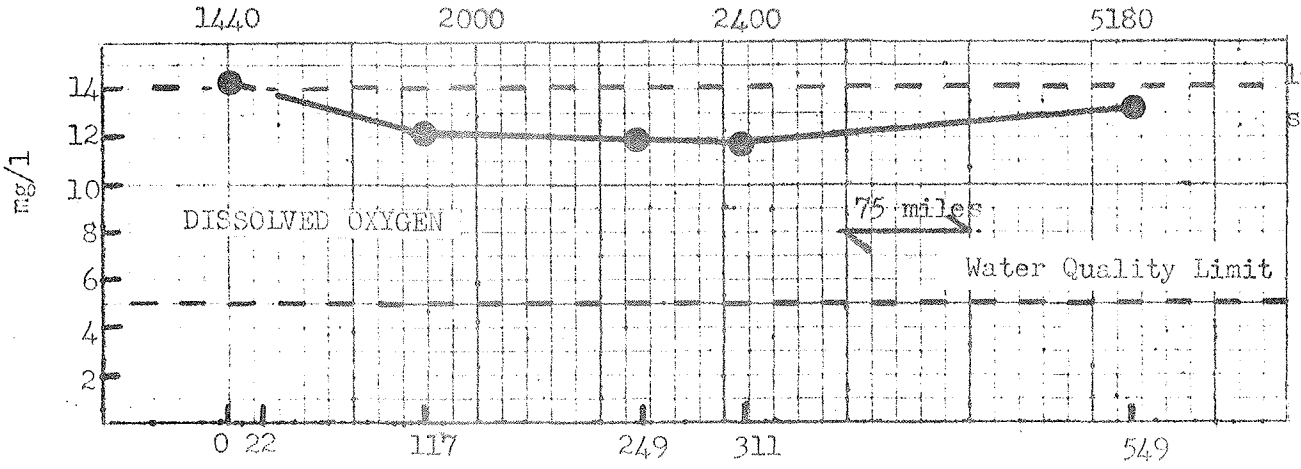

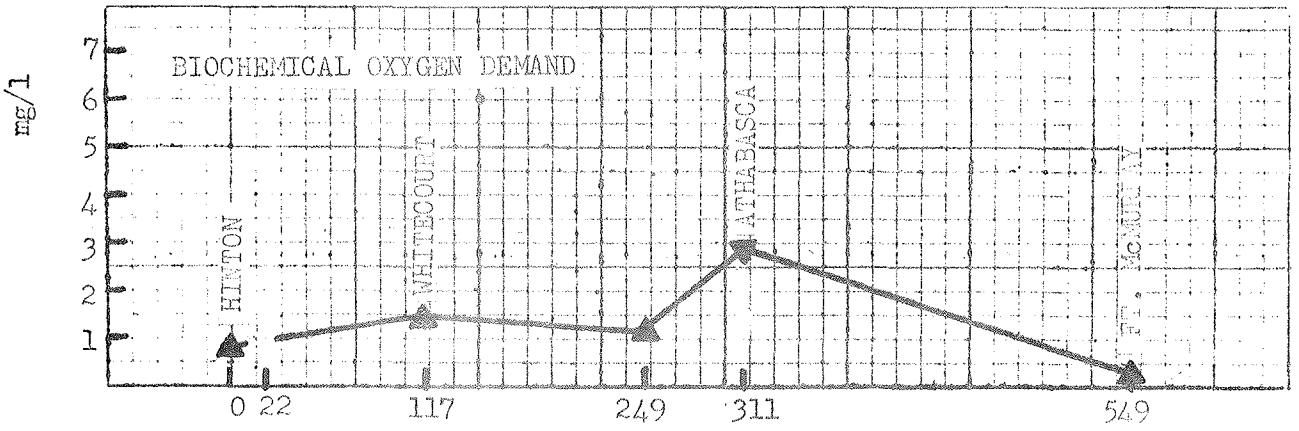

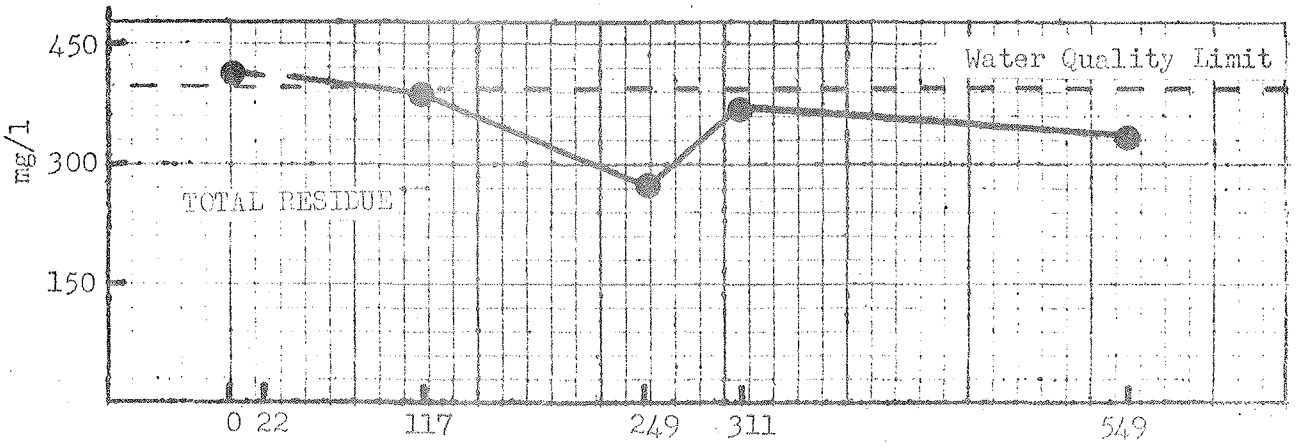

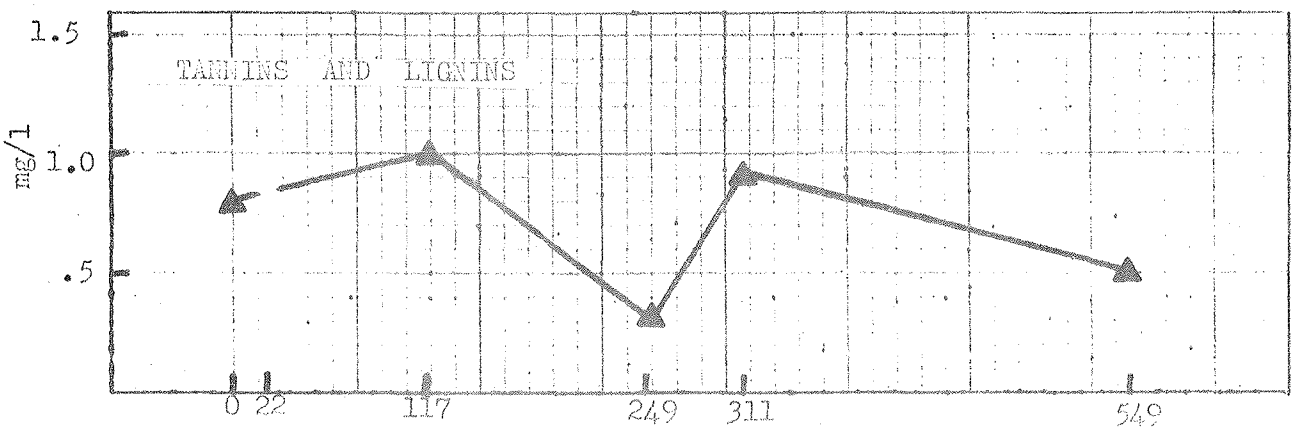

RIVER MILES DOWNSTREAM FROM HINTON

ATHABASCA RIVER SANITY RESULTS

Dec. 17 - 18, 1968

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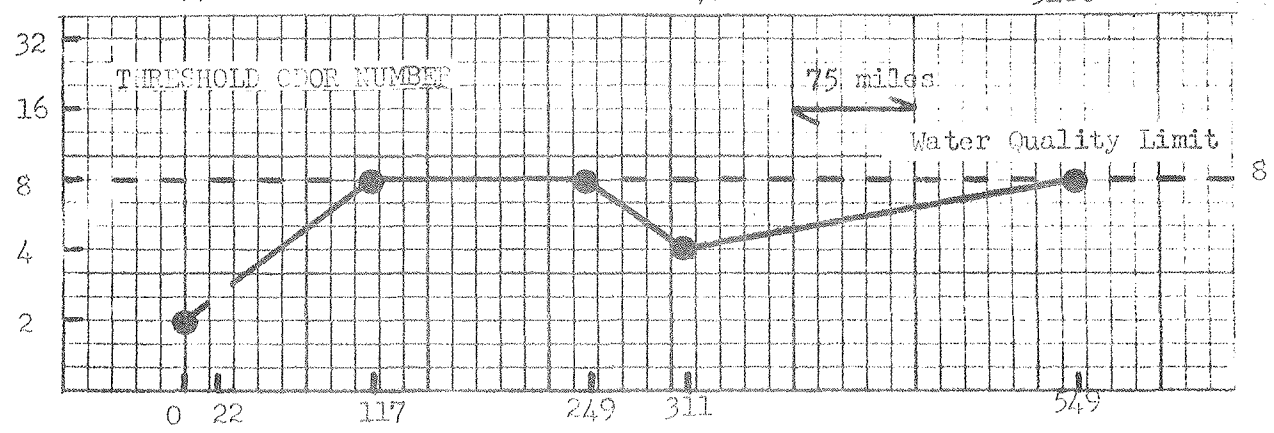
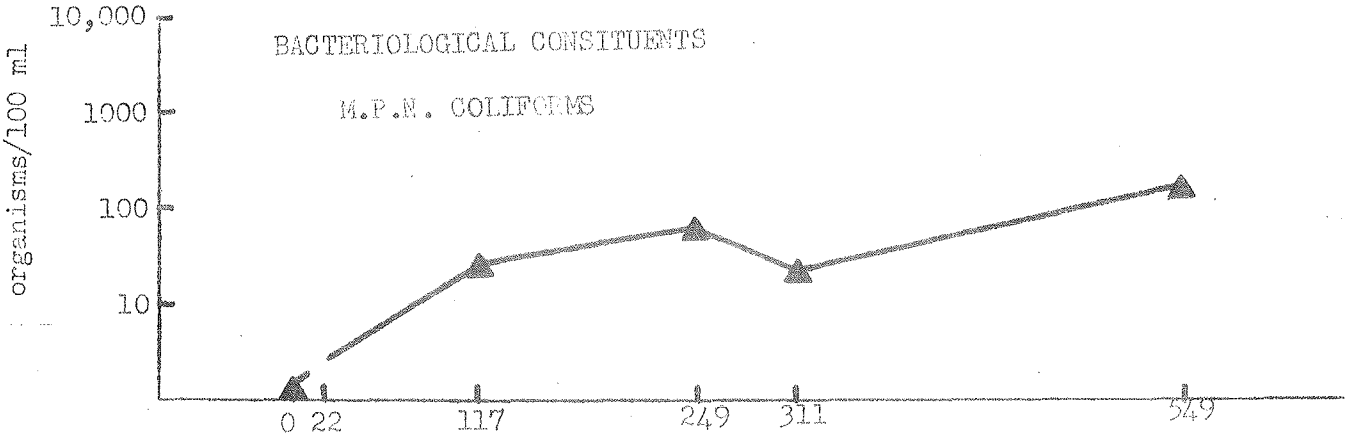
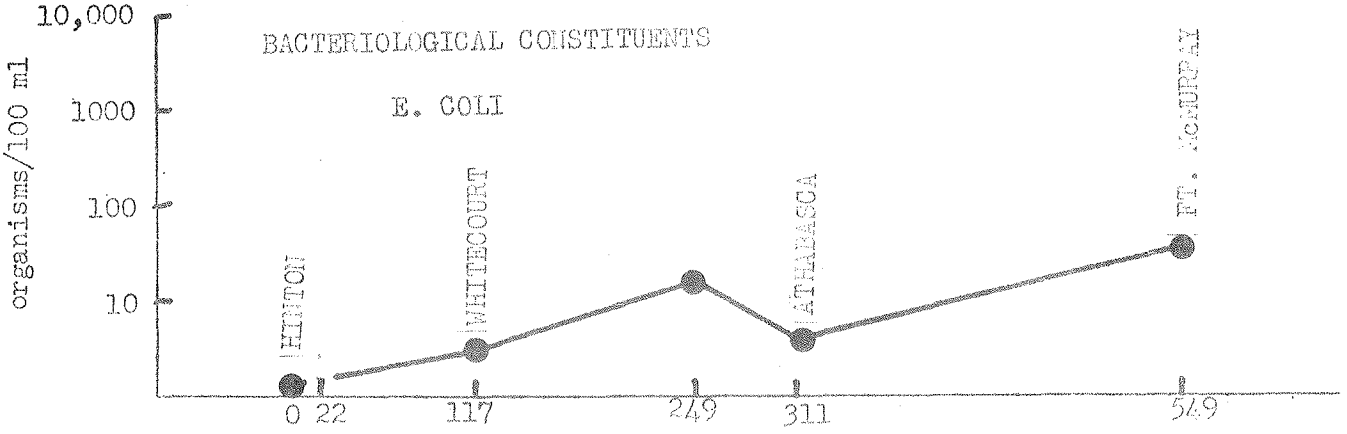
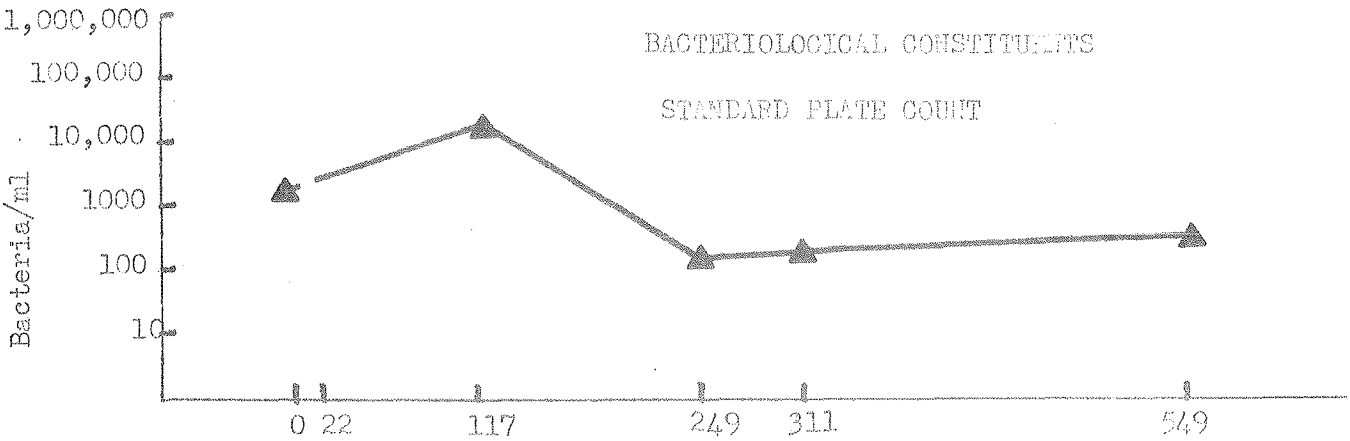






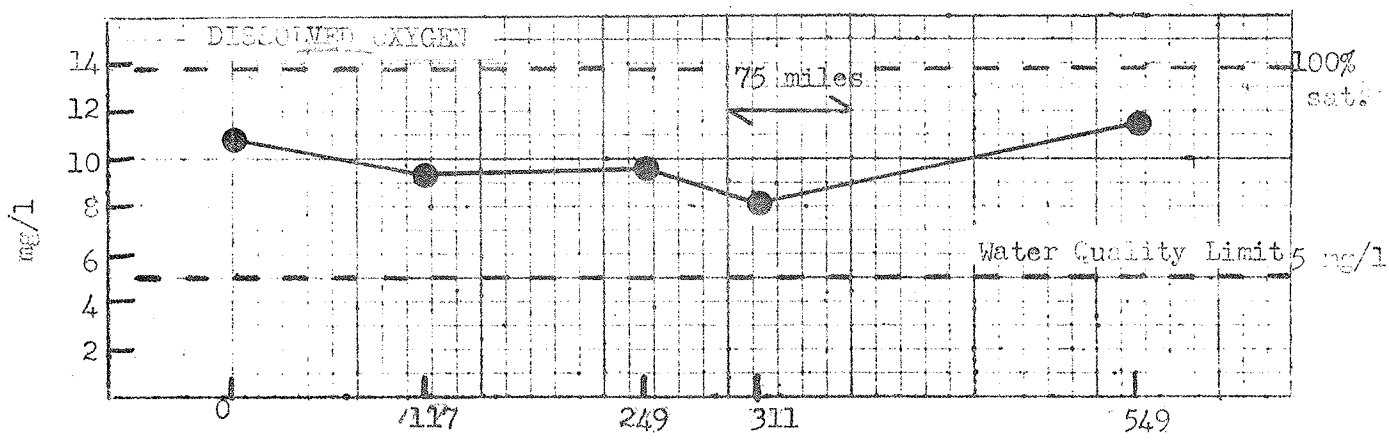


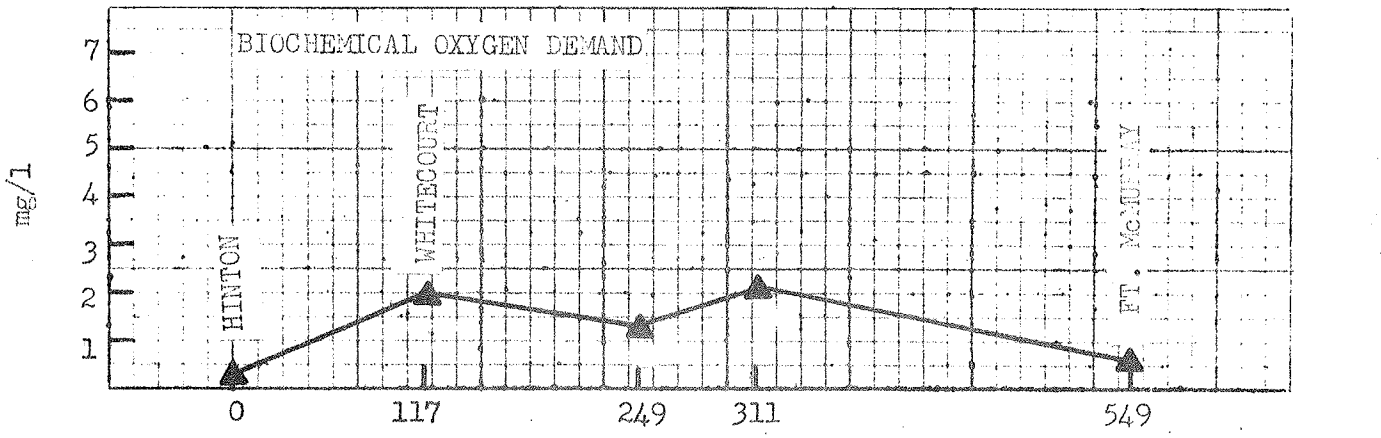
MILES DOWNSTREAM FROM HINTON

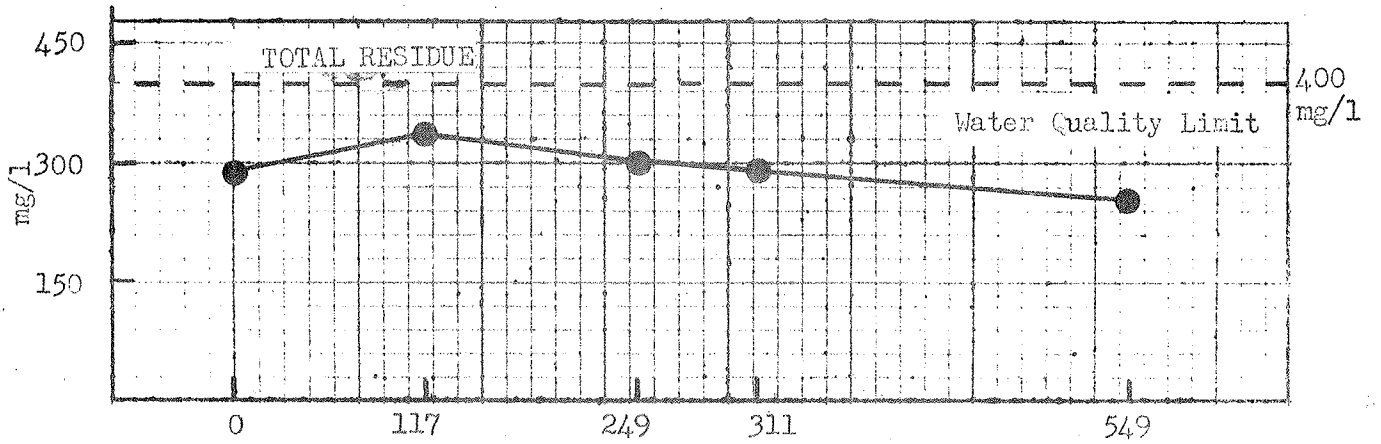
ATHABASCA RIVER SAMPLING RESULTS

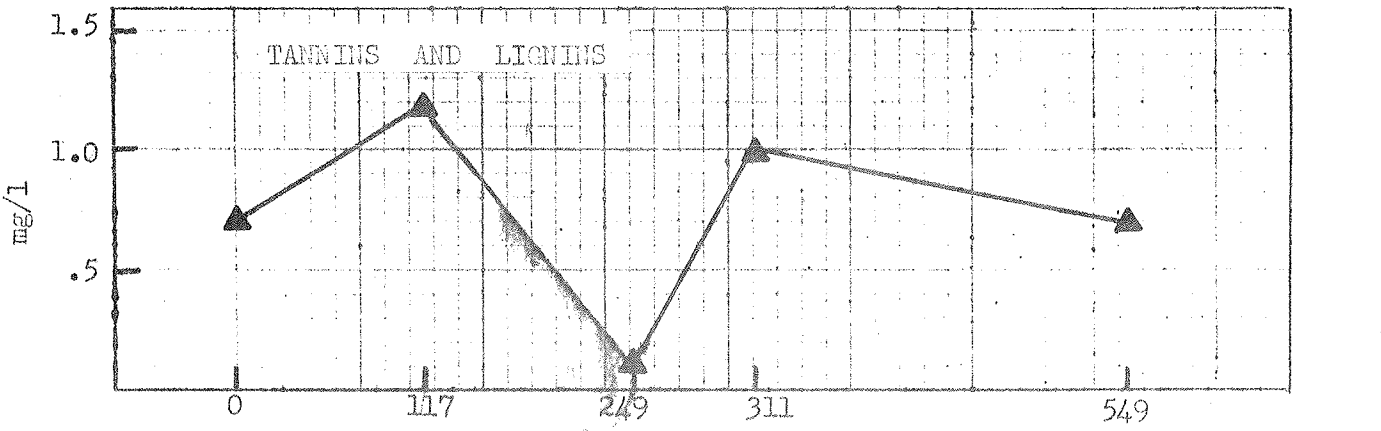
Jan. 28, 29, 1969
Feb. 5, 1969

1180- - - - - RIVER DISCHARGE CFS - - - - - - - - - - - - - 4420







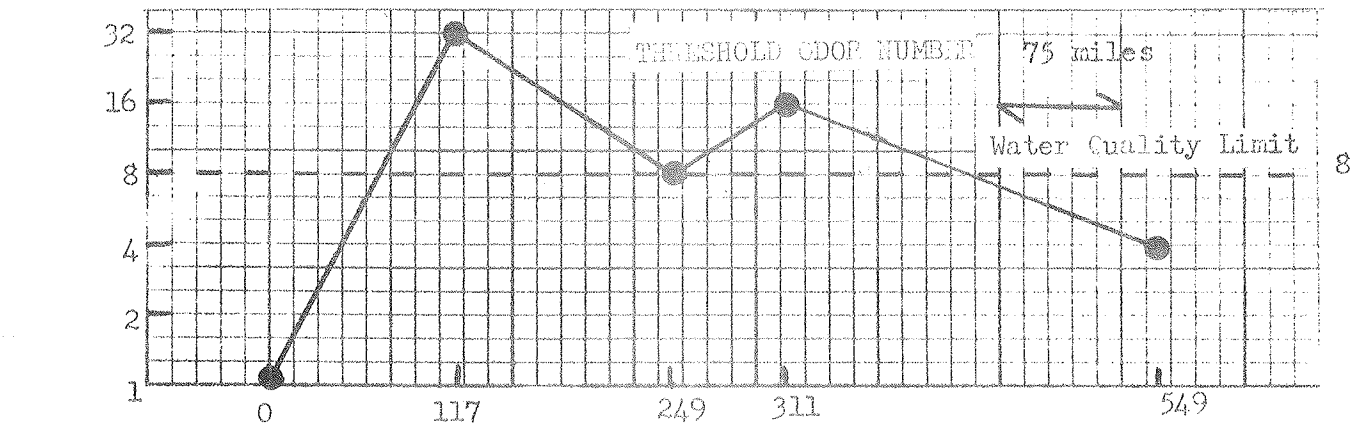


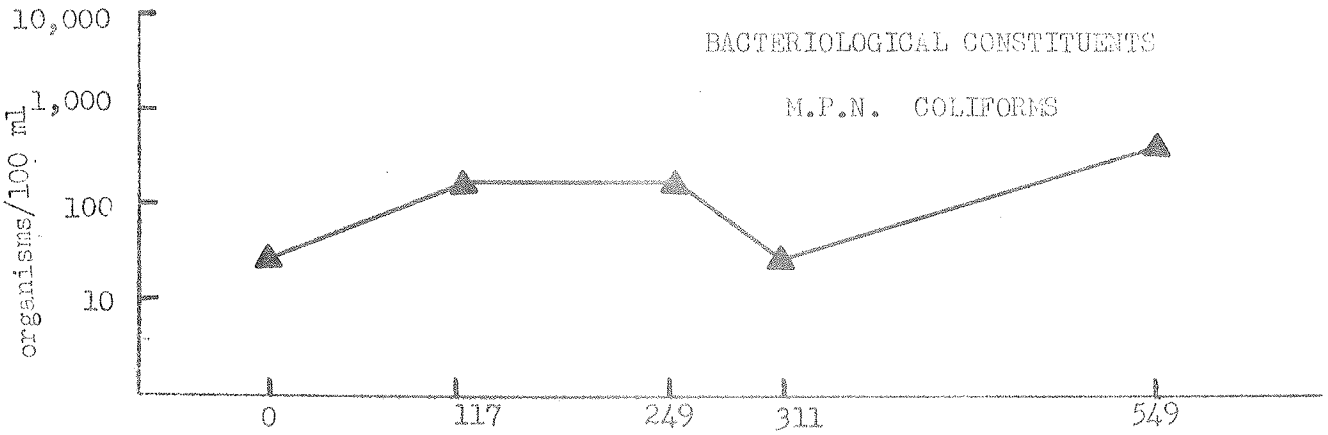
MILES DOWNSTREAM FROM HINTON

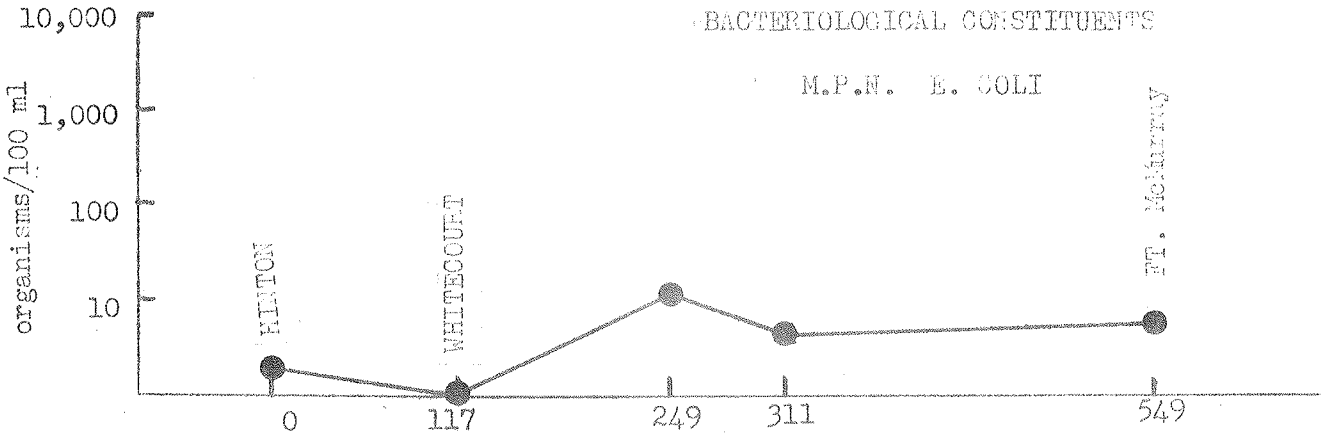
ATHABASCA RIVER SAMPLING RESULTS

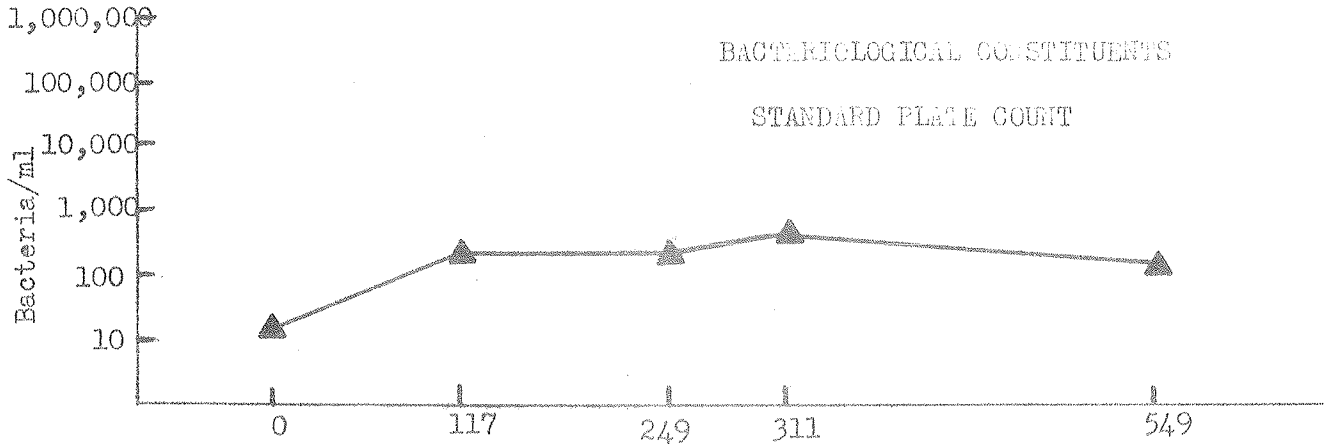
Jan. 28, 29, 1969
Feb. 5, 1969

1180 - - - - - - - - RIVER DISCHARGE CFS- - - - - - - - -4480





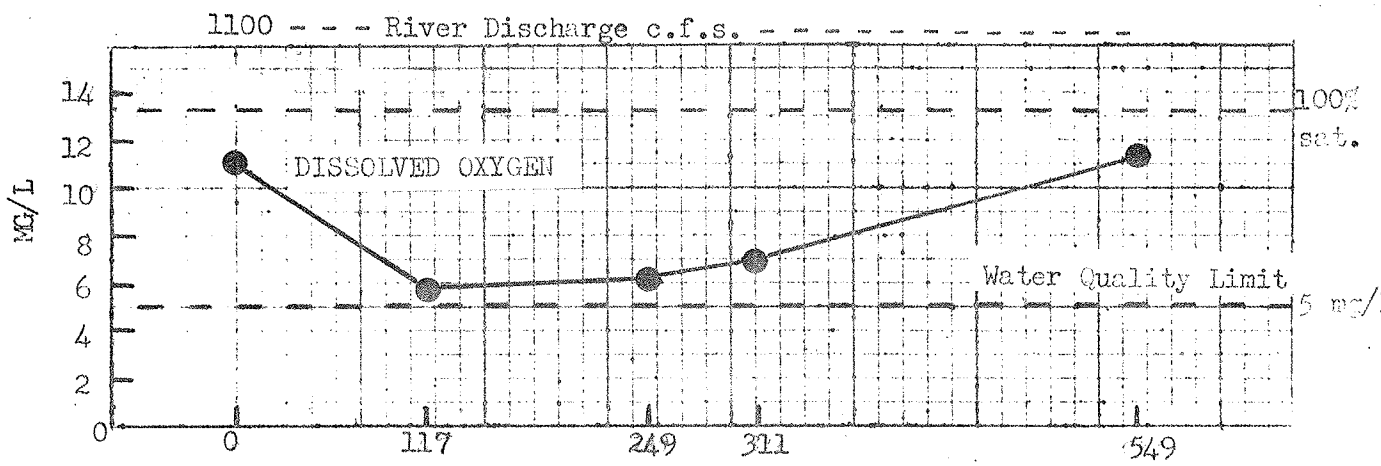


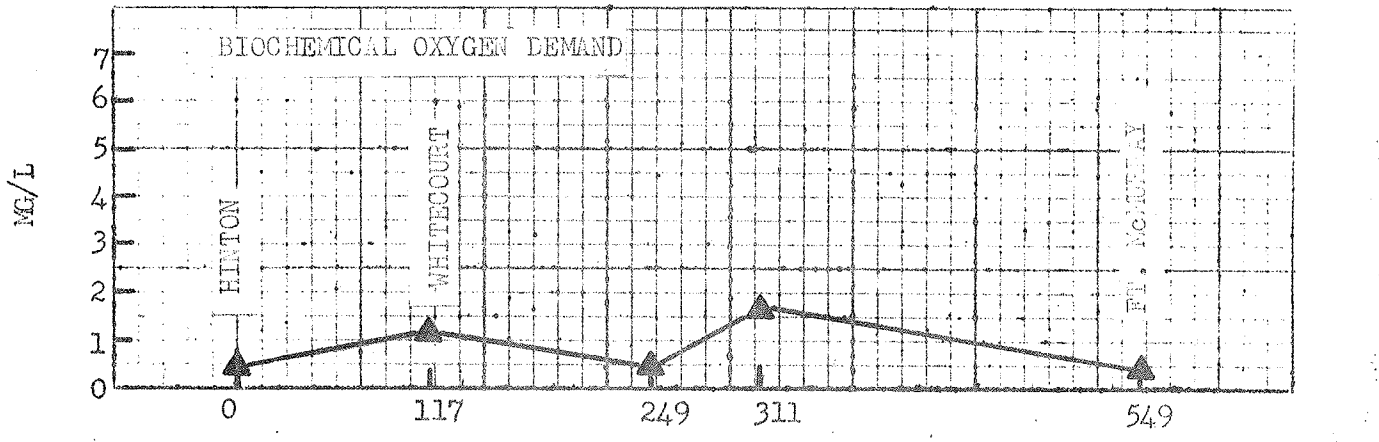


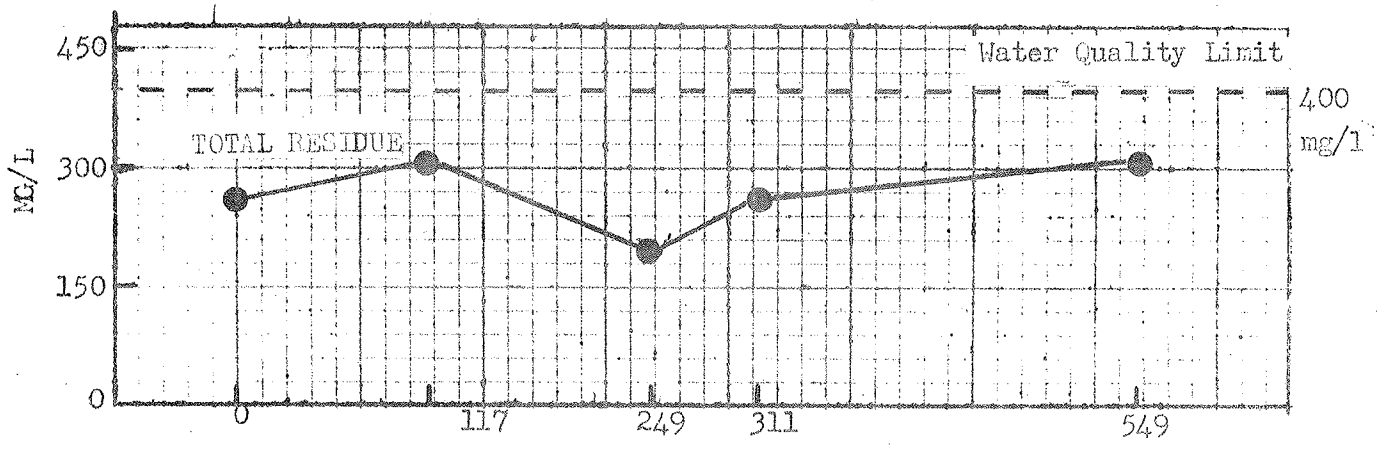
MILES DOWNSTREAM FROM HINTON

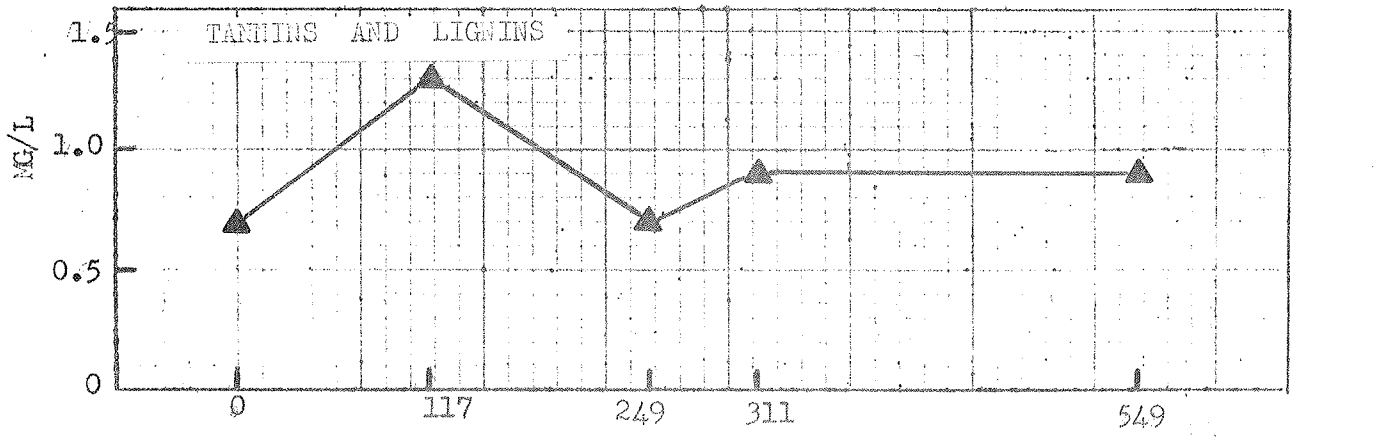
ATHABASCA RIVER SAMPLING RESULTS

Feb. 19 - 26, 1969

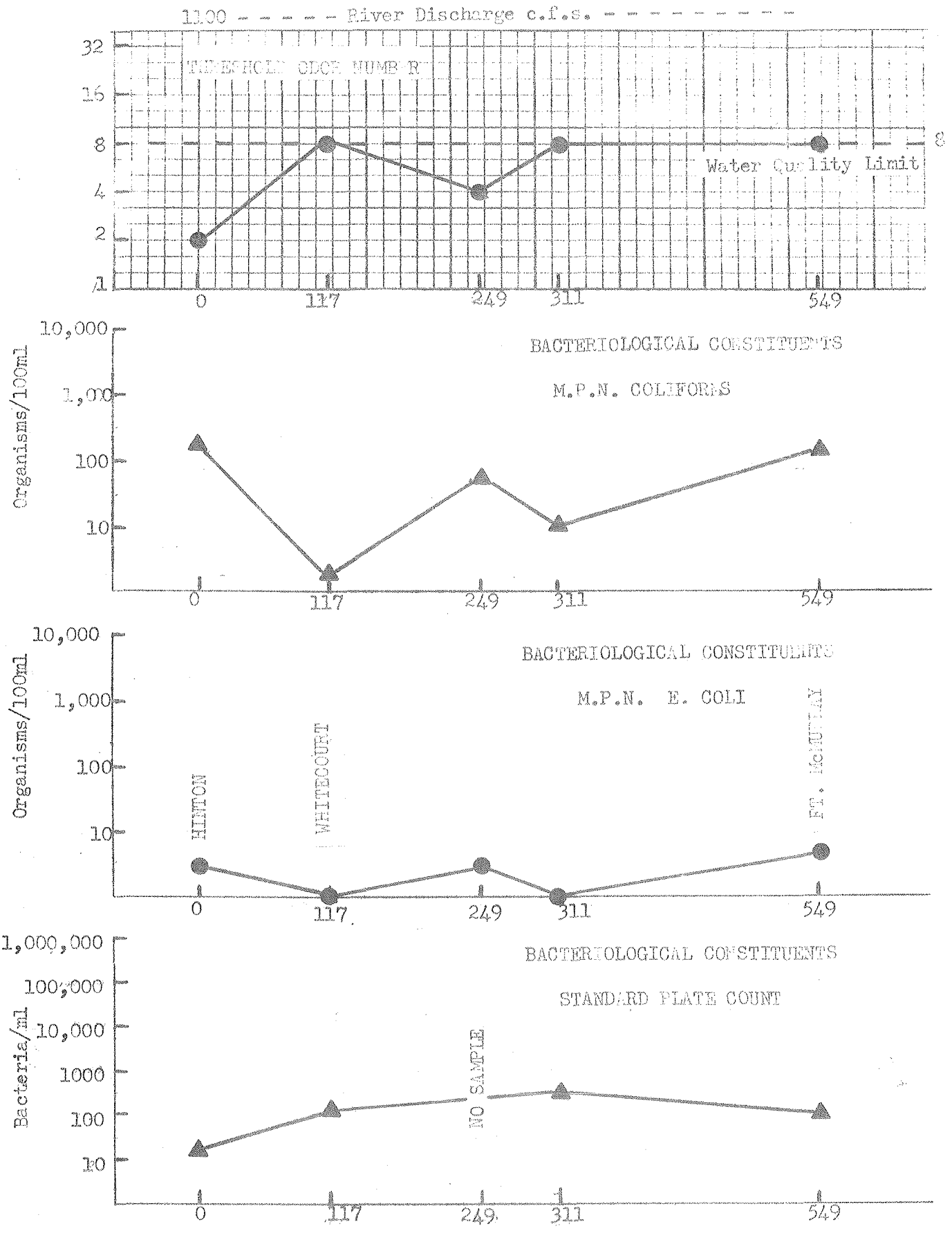








MILES DOWNSTREAM FROM HINTON


1100 - - - - - River Discharge c.f.s. - - - - - - - - - -
32
16
8
4
2
1
THRESHOLD ODOR NUMBER
Water Quality Limit
0
117
249
311
549
10,000
1,000
100
10
Organisms/100ml
BACTERIOLOGICAL CONSTITUENTS
M.P.N. COLIFORMS
BACTERIOLOGICAL CONSTITUENTS
M.P.N. E. COLI
HINTON
WHITECOURT
FT. MCMURRAY
1,000,000
100,000
10,000
1000
100
10
Bacteria/ml
BACTERIOLOGICAL CONSTITUENTS
STANDARD PLATE COUNT
NO SAMPLE
MILES DOWNSTREAM FROM HINTON

APPENDIX B

INDEX TO APPENDIX B

Average, Maximum, Minimum, Median Values

AR1 ATHABASCA RIVER ABOVE HINTON 1968-6

	AVERAGE	MAXIMUM	MINIMUM	MEDIAN
DISSOLVED OXYGEN MG/L	11.65	14.40	9.50	11.10
BOD MG/L	0.58	1.10	0.30	0.40
HYDROGEN ION CONC.,PH	8.03	8.20	7.70	8.10
ALKALINITY MG/L	130.17	188.00	97.00	120.00
TOTAL RESIDUE MG/L	310.33	418.00	238.00	418.00
INGITION LOSS MG/L	53.00	92.00	28.00	36.00
TURBIDITY AS SIO2 MG/L	42.33	160.00	10.00	14.00
TOTAL HARDNESS MG/L	184.40	306.00	70.00	186.00
CHLORIDES MG/L	1.83	4.00	0.00	1.00
AMMONIA NITROGEN MG/L	0.18	0.30	0.00	0.20
SULFATES AS SO4 MG/L	86.00	126.00	20.00	80.00
NITRATE NITROGEN MG/L	0.13	0.30	0.00	0.10
TOTAL PHOS.AS PO4 MG/L	0.23	0.60	0.00	0.10
PHENOLS PPB	1.17	5.00	0.00	0.00
FLUORIDES MG/L	0.20	0.34	0.08	0.20
TANNINS & LIGNINS MG/L	0.57	0.80	0.00	0.70
COLIFORM M.P.N./100ML.	167.00	350.00	0.00	49.00
M.P.N. OF E COLI/100ML	19.83	100.00	0.00	2.00
STANDARD PLATE COUNT/ML	1712.	6000.	10.	30.

AR3 ATHABASCA RIVER WHITECOURT BRIDGE 1968-69

	AVERAGE	MAXIMUM	MINIMUM	MEDIAN
DISSOLVED OXYGEN MG/L	10.25	12.80	5.80	9.40
BOD MG/L	1.43	2.00	1.00	1.20
HYDROGEN ION CONC.,PH	7.98	8.30	7.60	8.00
ALKALINITY MG/L	142.50	172.00	105.00	143.00
TOTAL RESIDUE MG/L	293.00	390.00	230.00	390.00
IGNITION LOSS MG/L	62.33	98.00	40.00	42.00
TURBIDITY AS SIO2 MG/L	29.67	120.00	9.00	11.00
CHLORIDES MG/L	9.50	14.00	3.00	9.00
AMMONIA NITROGEN MG/L	0.33	0.50	0.20	0.30
SULFATES AS SO4 MG/L	70.17	112.00	19.00	62.00
NITRATE NITROGEN MG/L	0.13	0.20	0.00	0.10
TOTAL PHOS.AS PO4 MG/L	0.13	0.30	0.00	0.10
PHENOLS PPB	2.67	7.00	0.00	2.00
TANNINS & LIGNINS MG/L	0.82	1.30	0.10	0.80
COLIFORM M.P.N./100ML.	73.17	220.00	2.00	4.50
M.P.N. OF E COLI/100ML	1.63	4.00	0.00	1.80
STANDARD PLATE COUNT/ML	3777.	11000.	50.	480.

AR4 ATHABASCA RIVER ABOVE SMITH 1968-69

	AVERAGE	MAXIMUM	MINIMUM	MEDIAN
DISSOLVED OXYGEN MG/L	10.02	12.20	6.20	9.60
BOD MG/L	1.28	2.00	0.50	1.30
HYDROGEN ION CONC.,PH	7.83	8.20	7.30	8.00
ALKALINITY MG/L	130.33	175.00	85.00	130.00
TOTAL RESIDUE MG/L	241.33	302.00	178.00	274.00
IGNITION LOSS MG/L	79.33	128.00	38.00	74.00
TURBIDITY AS SIO2 MG/L	20.17	46.00	10.00	11.00
CHLORIDES MG/L	4.17	7.00	2.00	3.00
AMMONIA NITROGEN MG/L	0.43	0.80	0.20	0.30
SULFATES AS SO4 MG/L	36.67	46.00	18.00	40.00
NITRATE NITROGEN MG/L	0.15	0.30	0.10	0.10
TOTAL PHOS.AS PO4 MG/L	0.25	0.50	0.10	0.10
PHENOLS PPB	4.50	6.00	1.00	5.00
TANNINS & LIGNINS MG/L	0.43	0.80	0.10	0.30
COLIFORM M.P.N./100ML.		1800.00+	49.00	79.00
M.P.N. OF E COLI/100ML	8.20	14.00	0.00	9.00
STANDARD PLATE COUNT/ML	22645.	90000.	20.	110.

ATHABASCA RIVER AT ATHABASCA 1960-6

	AVERAGE	MAXIMUM	MINIMUM	MEDIAN
DISSOLVED OXYGEN MG/L	10.20	12.80	7.00	8.80
BOD MG/L	1.87	2.80	0.30	1.70
HYDROGEN ION CONC.,PH	7.90	8.20	7.50	7.90
ALKALINITY MG/L	151.50	174.00	98.00	165.00
TOTAL RESIDUE MG/L	261.33	370.00	144.00	370.00
IGNITION LOSS MG/L	74.33	126.00	42.00	62.00
TURBIDITY AS SIO2 MG/L	15.83	36.00	6.00	9.00
CHLORIDES MG/L	7.00	9.00	5.00	6.00
AMMONIA NITROGEN MG/L	0.37	0.60	0.20	0.20
SULFATES AS SO4 MG/L	52.00	76.00	20.00	56.00
NITRATE NITROGEN MG/L	0.17	0.50	0.10	0.10
TOTAL PHOS.AS PO4 MG/L	0.17	0.50	0.00	0.10
PHENOLS PPB	3.17	5.00	2.00	3.00
TANNINS & LIGNINS MG/L	0.75	1.00	0.10	0.90
COLIFORM M.P.N./100ML.	15.20	49.00	0.00	11.00
M.P.N. OF E COLI/100ML	1.70	4.50	0.00	0.00
STANDARD PLATE COUNT/ML	484.	1200.	80.	450.

ML1 MCLEOD RIVER AT WHITECOURT 1968-69

	AVERAGE	MAXIMUM	MINIMUM	MEDIAN
DISSOLVED OXYGEN MG/L	8.86	12.30	5.80	8.50
BOD MG/L	0.40	0.60	0.20	0.40
HYDROGEN ION CONC.,PH	8.04	8.30	7.70	8.10
ALKALINITY MG/L	222.40	281.00	160.00	231.00
TOTAL RESIDUE MG/L	302.40	382.00	226.00	382.00
INGITION LOSS MG/L	92.80	168.00	28.00	106.00
TURBIDITY AS SIO2 MG/L	13.40	46.00	4.00	6.00
CHLORIDES MG/L	1.40	4.00	0.00	1.00
AMMONIA NITROGEN MG/L	0.40	0.80	0.20	0.30
SULFATES AS SO4 MG/L	18.20	24.00	11.00	18.00
NITRATE NITROGEN MG/L	0.16	0.40	0.00	0.10
TOTAL PHOS.AS PO4 MG/L	0.10	0.30	0.00	0.10
PHENOLS PPB	1.60	2.00	1.00	2.00
TANNINS & LIGNINS MG/L	0.58	0.90	0.10	0.60
COLIFORM M.P.N./100ML.	14.40	70.00	0.00	0.00
M.P.N. OF E COLI/100ML	3.00	13.00	0.00	0.00
STANDARD PLATE COUNT/ML	5260.	25000.	1.	70.

21 LESSER SLAVE RIVER ABOVE SMITH 1968-69

	AVERAGE	MAXIMUM	MINIMUM	MEDIAN
DISSOLVED OXYGEN MG/L	11.93	13.40	8.90	12.30
BOD MG/L	1.15	1.70	0.50	1.00
HYDROGEN ION CONC.,PH	7.83	8.00	7.70	7.70
ALKALINITY MG/L	98.67	135.00	81.00	93.00
TOTAL RESIDUE MG/L	179.67	244.00	138.00	162.00
IGNITION LOSS MG/L	46.33	98.00	10.00	28.00
TURBIDITY AS SIO2 MG/L	21.17	72.00	6.00	10.00
CHLORIDES MG/L	2.00	7.00	0.00	1.00
PHENOLS PPB	5.75	11.00	3.00	3.00
FLUORIDES MG/L	0.13	0.17	0.09	0.12
COLIFORM M.P.N./100ML.	32.20	41.00	22.00	33.00
M.P.N. OF E COLI/100ML	7.32	14.00	2.00	9.30
STANDARD PLATE COUNT/ML	2590.	10000.	70.	120.

AR6 ATHABASCA RIVER BELOW FORT MCMURRAY AND ABOVE GCOS. 1968-69

	AVERAGE	MAXIMUM	MINIMUM	MEDIAN
DISSOLVED OXYGEN MG/L	12.20	13.10	11.30	12.30
BOD MG/L	0.90	2.40	0.30	0.60
HYDROGEN ION CONC.,PH	7.80	8.10	7.30	7.90
ALKALINITY MG/L	131.60	146.00	102.00	143.00
TOTAL RESIDUE MG/L	279.60	338.00	228.00	258.00
INGITION LOSS MG/L	87.60	106.00	56.00	94.00
TURBIDITY AS SIO2 MG/L	17.00	21.00	9.00	18.00
TOTAL HARDNESS MG/L	152.00	216.00	66.00	156.00
CHLORIDES MG/L	22.00	31.00	12.00	22.00
AMMONIA NITROGEN MG/L	0.44	1.10	0.20	0.30
SULFATES AS SO4 MG/L	53.50	58.00	50.00	50.00
NITRATE NITROGEN MG/L	0.12	0.20	0.00	0.10
TOTAL PHOS.AS PO4 MG/L	0.06	0.10	0.00	0.10
PHENOLS PPB	5.40	10.00	3.00	5.00
OILS AND GREASES MG/L	1.58	3.80	0.20	1.50
FLUORIDES MG/L	0.16	0.24	0.11	0.17
TANNINS & LIGNINS MG/L	0.60	0.90	0.10	0.70
COLIFORM M.P.N./100ML.		1600.00*	59.00	540.00
M.P.N. OF E COLI/100ML	24.48	70.00	6.10	8.20
STANDARD PLATE COUNT/ML	448.	1500.	110.	200.

APPENDIX C

INDEX TO APPENDIX C

DAY	31	29	27	17	28	19
MONTH	JUL	OCT	NOV	DEC	JAN	FEB
YEAR	1968	1968	1968	1968	1969	1969
COMPOSITE OR GRAB SAMPLE	G	G	G	G	G	G
INITIAL SAMPLING TIME	1000	1200	1300	1200	1500	1300
TEMPERATURE, DEG.CENT.	15.0	4.0	0.0	0.0	0.0	0.0
BAROMETRIC PRES. IN.HG	27.70	26.30	*0.00	*0.00	*0.00	26.70
DISSOLVED OXYGEN, MG/L	9.5	11.5	12.5	14.4	10.9	11.1
PERCENT SATURATION	101.	100.	*00.	*00.	*00.	85.
BIOCHEM. OX. DEMAND MG/L	1.1	0.5	0.4	0.8	0.3	0.4
HYDROGEN ION CONC.,PH	7.7	8.2	8.1	8.1	8.2	7.9
ALKALINITY MG/L	97	120	120	188	131	125
THRESHOLD ODOR NO.,TYPE	1 M	2 M	0	2 M	1 M	2 M
TOTAL RESIDUE MG/L	300	354	238	418	286	266
IGNITION LOSS MG/L	62	92	36	66	28	34
TURBIDITY AS SIO2 MG/L	160	44	15	14	10	11
TOTAL HARDNESS MG/L	70	146	186	306	*00	214
CHLORIDES MG/L	1	3	0	2	4	1
AMMONIA NITROGEN MG/L	0.2	0.2	0.3	0.3	0.0	0.1
NITRATE NITROGEN MG/L	0.0	0.1	0.1	0.3	0.2	0.1
SULFATES AS SO4 MG/L	20	70	80	126	104	116
TOTAL PHOS.AS PO4 MG/L	0.6	0.5	0.0	0.1	0.1	0.1
PHENOLS PPB	5	0	0	1	1	0
OILS & GREASES MG/L	0.0	*.0	*.0	*.0	*.0	*.0
FLUORIDES MG/L	0.08	0.20	0.16	0.34	*.00	0.22
TANNINS & LIGNINS MG/L	0.8	0.4	0.0	0.8	0.7	0.7
COLIFORM M.P.N./100ML.	350.	350.	13.	0.	49.	240.
MPN OF E COLI/100ML	11.	100.	2.	0.	2.	4.
STD. PLATE COUNT/ML	6000	*00000	10	2500	20	30
RIVER DISCHARGE C.F.S.	19100.	2940.	1430.	1420.	1180.	1100.

* DENOTES DATA NOT AVAILABLE

DAY	29	26
MONTH	OCT	NOV
YEAR	1968	1968
COMPOSITE OR GRAB SAMPLE	G	G
INITIAL SAMPLING TIME	1000	1430
TEMPERATURE, DEG.CENT.	5.0	0.0
BAROMETRIC PRES. IN.HG	26.35	*0.00
DISSOLVED OXYGEN, MG/L	10.7	11.5
PERCENT SATURATION	95.	*0C.
BIOCHEM. OX. DEMAND MG/L	1.5	3.1
HYDROGEN ION CONC.,PH	8.1	7.8
ALKALINITY MG/L	116	111
THRESHOLD ODOR NO.,TYPE	16 WR	100 WR
TOTAL RESIDUE MG/L	338	272
IGNITION LOSS MG/L	110	62
TURBIDITY AS SIO2 MG/L	53	34
CHLORIDES MG/L	8	11
AMMONIA NITROGEN MG/L	0.6	0.4
NITRATE NITROGEN MG/L	0.2	0.1
SULFATES AS SO4 MG/L	96	74
TOTAL PHOS.AS PO4 MG/L	0.2	0.0
PHENOLS PPB	9	8
TANNINS & LIGNINS MG/L	1.3	0.1
COLIFORM M.P.N./100ML.	1600.*	350.
MPN OF E COLI/100ML	11.	2.
STD. PLATE COUNT/ML	100000	17000

* DENOTES DATA NOT AVAILABLE

AR3 ATHABASCA RIVER WHITECOURT BRIDGE 1968-69

DAY	31	29	26	17	28	19
MONTH	JUL	OCT	NOV	DEC	JAN	FEB
YEAR	1968	1968	1968	1968	1969	1969
COMPOSITE OR GRAB SAMPLE	G	G	G	G	G	G
INITIAL SAMPLING TIME	1900	1600	1700	1730	1900	1700
TEMPERATURE, DEG.CENT.	18.5	4.0	0.0	0.0	0.0	0.0
BAROMETRIC PRES. IN.HG	27.80	26.70	*0.00	*0.00	*0.00	27.55
DISSOLVED OXYGEN, MG/L	9.0	12.4	12.8	12.1	9.4	5.8
PERCENT SATURATION	103.	106.	*00.	*00.	*00.	43.
BIOCHEM. OX. DEMAND MG/L	1.3	1.1	1.0	2.0	2.0	1.2
HYDROGEN ION CONC.,PH	7.6	8.3	8.2	8.2	8.0	7.6
ALKALINITY MG/L	105	125	143	172	164	146
THRESHOLD ODOR NO.,TYPE	2 M	4 WR	8 WR	8 WR	32 WR	8 WR
TOTAL RESIDUE MG/L	230	238	256	390	340	304
IGNITION LOSS MG/L	40	98	40	84	70	42
TURBIDITY AS SIO2 MG/L	120	9	12	16	10	11
CHLORIDES MG/L	3	9	9	10	14	12
AMMONIA NITROGEN MG/L	0.2	0.4	0.3	0.5	0.2	0.4
NITRATE NITROGEN MG/L	0.0	0.2	0.2	0.1	0.2	0.1
SULFATES AS SO4 MG/L	19	62	58	82	88	112
TOTAL PHOS.AS PO4 MG/L	0.3	0.2	0.0	0.1	0.2	0.0
PHENOLS PPB	3	0	1	7	2	3
TANNINS & LIGNINS MG/L	0.5	0.8	0.1	1.0	1.2	1.3
COLIFORM M.P.N./100ML.	220.	5.	38.	5.	170.	2.
MPN OF E COLI/100ML	2.	2.	4.	2.	0.	0.
STD. PLATE COUNT/ML	10000	50	930	11000	480	200
RIVER DISCHARGE C.F.S.	23000.	4350.	2330.	2000.	1150.	1760.

* DENOTES DATA NOT AVAILABLE

DAY	1	30	27	17	29	19
MONTH	AUG	OCT	NOV	DEC	JAN	FEB
YEAR	1968	1968	1968	1968	1969	1969
COMPOSITE OR GRAB SAMPLE	G	G	G	G	G	G
INITIAL SAMPLING TIME	1430	1130	1030	1130	1130	1600
TEMPERATURE, DEG.CENT.	21.0	2.0	0.0	0.0	0.0	0.0
BAROMETRIC PRES. IN.HG	*0.00	27.50	*0.00	*0.00	28.22	*0.00
DISSOLVED OXYGEN, MG/L	8.6	11.5	12.2	12.0	9.6	6.2
PERCENT SATURATION	*00.	91.	*00.	*00.	70.	*00.
BIOCHEM. OX. DEMAND MG/L	1.2	1.4	2.0	1.3	1.3	0.5
HYDROGEN ION CONC.,PH	8.2	8.0	8.0	7.3	8.0	7.5
ALKALINITY MG/L	85	88	156	148	175	130
THRESHOLD ODOR NO.,TYPE	8 M	1 M	4 WR	8 M	8 WR	4 WR
TOTAL RESIDUE MG/L	178	208	288	274	302	198
IGNITION LOSS MG/L	52	74	128	78	106	38
TURBIDITY AS SIO2 MG/L	46	10	22	11	21	11
CHLORIDES MG/L	7	5	5	3	2	3
AMMONIA NITROGEN MG/L	0.3	0.8	0.6	0.2	0.3	0.4
NITRATE NITROGEN MG/L	0.3	0.1	0.1	0.2	0.1	0.1
SULFATES AS SO4 MG/L	18	26	44	46	40	46
TOTAL PHOS.AS PO4 MG/L	0.5	0.3	0.1	0.1	0.4	0.1
PHENOLS PPB	6	6	5	1	3	6
TANNINS & LIGNINS MG/L	0.6	0.8	0.1	0.3	0.1	0.7
COLIFORM M.P.N./100ML.	*0000.	49.	1800.*	70.	170.	79.
MPN OF E COLI/100ML	*000.	9.	0.	14.	14.	4.
STD. PLATE COUNT/ML	*00000	20	90000	110	450	*00000

* DENOTES DATA NOT AVAILABLE

PROVINCE OF ALBERTA

AR5 ATHABASCA RIVER AT ATHABASCA 1968-69

DAY	1	30	27	17	29	19
MONTH	AUG	OCT	NOV	DEC	JAN	FEB
YEAR	1968	1968	1968	1968	1969	1969
COMPOSITE OR GRAB SAMPLE	G	G	G	G	G	G
INITIAL SAMPLING TIME	1200	1000	930	1000	940	1345
TEMPERATURE, DEG.CENT.	19.0	2.0	0.0	0.0	0.0	0.0
BAROMETRIC PRES. IN.HG	*0.00	27.50	*0.00	*0.00	28.53	*0.00
DISSOLVED OXYGEN, MG/L	8.8	12.5	12.8	11.8	8.3	7.0
PERCENT SATURATION	*00.	99.	*00.	*00.	60.	*00.
BIOCHEM. OX. DEMAND MG/L	1.4	0.3	2.8	2.8	2.2	1.7
HYDROGEN ION CONC.,PH	7.9	8.2	8.1	7.7	8.0	7.5
ALKALINITY MG/L	98	130	174	172	170	165
THRESHOLD ODOR NO.,TYPE	4 M	4 M	4 WR	4 M	16 WR	8 WR
TOTAL RESIDUE MG/L	174	144	330	370	290	260
IGNITION LOSS MG/L	42	74	86	126	62	56
TURBIDITY AS SIO2 MG/L	36	9	24	9	11	6
CHLORIDES MG/L	8	5	6	6	9	8
AMMONIA NITROGEN MG/L	0.2	0.6	0.6	0.2	0.2	0.4
NITRATE NITROGEN MG/L	0.1	0.1	0.1	0.5	0.1	0.1
SULFATES AS SO4 MG/L	20	42	56	58	60	76
TOTAL PHOS.AS PO4 MG/L	0.5	0.1	0.0	0.1	0.2	0.1
PHENOLS PPB	2	3	2	5	3	4
OILS & GREASES MG/L	1.7	*.0	*.0	*.0	2.9	5.1
TANNINS & LIGNINS MG/L	1.0	0.6	0.1	0.9	1.0	0.9
COLIFORM M.P.N./100ML.	*0000.	0.	2.	14.	49.	11.
MPN OF E COLI/100ML	*0000.	0.	0.	4.	5.	0.
STD. PLATE COUNT/ML	*00000	80	1200	140	550	450
RIVER DISCHARGE C.F.S.	2840C.	687C.	3100.	2400.	2070.	2100.

* DENOTES DATA NOT AVAILABLE

DAY	30	27	18	5	26
MONTH	OCT	NOV	DEC	FEB	FEB
YEAR	1968	1968	1968	1969	1969
COMPOSITE OR GRAB SAMPLE	G	G	G	G	G
INITIAL SAMPLING TIME	1100	1030	1345	1400	1300
TEMPERATURE, DEG.CENT.	2.0	0.0	0.0	0.0	0.0
BAROMETRIC PRES. IN.HG	*0.00	29.40	29.10	*0.00	29.40
DISSOLVED OXYGEN, MG/L	12.8	13.1	12.3	11.5	11.3
PERCENT SATURATION	*00.	91.	87.	*00.	79.
BIOCHEM. OX. DEMAND MG/L	0.8	2.4	0.3	0.6	0.4
HYDROGEN ION CONC.,PH	8.0	8.1	7.9	7.7	7.3
ALKALINITY MG/L	102	123	146	143	144
THRESHOLD ODOR NO.,TYPE	2 M	16 CH	8 M	4 M	8 E
TOTAL RESIDUE MG/L	228	270	338	258	304
IGNITION LOSS MG/L	94	86	106	56	96
TURBIDITY AS SIO2 MG/L	18	18	9	21	19
TOTAL HARDNESS MG/L	66	146	216	176	156
CHLORIDES MG/L	12	31	19	26	22
AMMONIA NITROGEN MG/L	0.2	0.3	0.3	1.1	0.3
NITRATE NITROGEN MG/L	0.0	0.1	0.2	0.2	0.1
SULFATES AS SO4 MG/L	56	*00	50	50	58
TOTAL PHOS.AS PO4 MG/L	0.1	0.0	0.1	0.1	0.0
PHENOLS PPB	6	10	3	5	3
OILS & GREASES MG/L	0.6	0.2	1.5	1.8	3.8
FLUORIDES MG/L	0.24	0.17	0.17	0.11	0.13
TANNINS & LIGNINS MG/L	0.8	0.1	0.5	0.7	0.9
COLIFORM M.P.N./100ML.	1600.*	59.	540.	920.	220.
MPN OF E COLI/100ML	32.	6.	70.	8.	6.
STD. PLATE COUNT/ML	110	1500	200	300	130
RIVER DISCHARGE C.F.S.	15500.	7980.	5090.	4480.	*0000.

* DENOTES DATA NOT AVAILABLE

DAY	31	29	26	17	19
MONTH	JUL	OCT	NOV	DEC	FEB
YEAR	1968	1968	1968	1968	1969
COMPOSITE OR GRAB SAMPLE	G	G	G	G	G
INITIAL SAMPLING TIME	1930	1600	1700	1730	1715
TEMPERATURE, DEG.CENT.	18.0	4.0	0.0	0.0	0.0
BAROMETRIC PRES. IN.HG	27.80	28.70	*0.00	*0.00	27.55
DISSOLVED OXYGEN, MG/L	8.5	12.3	9.5	8.2	5.8
PERCENT SATURATION	96.	98.	*00.	*00.	43.
BIOCHEM. OX. DEMAND MG/L	0.5	0.6	0.4	0.3	0.2
HYDROGEN ION CONC., PH	8.3	8.3	8.1	7.7	7.8
ALKALINITY MG/L	160	180	281	231	260
THRESHOLD ODOR NO., TYPE	4 M	2 M	2 M	4 M	4 M
TOTAL RESIDUE MG/L	226	254	378	382	272
IGNITION LOSS MG/L	56	106	168	106	28
TURBIDITY AS SIO2 MG/L	46	4	5	6	6
TOTAL HARDNESS MG/L	72	*00	*00	*00	*00
CHLORIDES MG/L	4	2	0	0	1
AMMONIA NITROGEN MG/L	0.8	0.4	0.3	0.3	0.2
NITRATE NITROGEN MG/L	0.0	0.1	0.2	0.4	0.1
SULFATES AS SO4 MG/L	11	18	24	18	20
TOTAL PHOS.AS PO4 MG/L	0.3	0.1	0.0	0.1	0.0
PHENOLS PPB	2	2	1	2	1
OILS & GREASES MG/L	1.4	0.4	*.0	*.0	*.0
FLUORIDES MG/L	0.09	*.00	*.00	*.00	*.00
TANNINS & LIGNINS MG/L	0.9	0.7	0.1	0.6	0.6
COLIFORM M.P.N./100ML.	70.	2.	0.	0.	0.
MPN OF E COLI/100ML	13.	2.	0.	0.	0.
STD. PLATE COUNT/ML	25000	70	30	1200	1

* DENOTES DATA NOT AVAILABLE

EG1 EDSON CREEK [illegible]ING ROAD BY GAS PLANT 1968-69

DAY	31
MONTH	JUL
YEAR	1968
COMPOSITE OR GRAB SAMPLE	G
INITIAL SAMPLING TIME	1430
HYDROGEN ION CONC.,PH	6.9
ALKALINITY MG/L	99
THRESHOLD ODOR NO.,TYPE	50 CH
TOTAL RESIDUE MG/L	364
IGNITION LOSS MG/L	94
TURBIDITY AS SIO2 MG/L	42
CHLORIDES MG/L	22
AMMONIA NITROGEN MG/L	2.0
NITRATE NITROGEN MG/L	0.2
SULFATES AS SO4 MG/L	155
TOTAL PHOS.AS PO4 MG/L	1.2
PHENOLS PPB	17
OILS & GREASES MG/L	9.8
TANNINS & LIGNINS MG/L	1.8
COLIFORM M.P.N./100ML.	1800.
MPN OF E COLI/100ML	0.
STD. PLATE COUNT/ML	*00000

* DENOTES DATA NOT AVAILABLE

DAY	31
MONTH	JUL
YEAR	1968
COMPOSITE OR GRAB SAMPLE	G
INITIAL SAMPLING TIME	1500
HYDROGEN ION CONC.,PH	7.4
ALKALINITY MG/L	181
THRESHOLD ODOR NO.,TYPE	16 CH
TOTAL RESIDUE MG/L	556
IGNITION LOSS MG/L	152
TURBIDITY AS SIO2 MG/L	12
CHLORIDES MG/L	20
AMMONIA NITROGEN MG/L	1.5
NITRATE NITROGEN MG/L	0.1
SULFATES AS SO4 MG/L	76
TOTAL PHOS.AS PO4 MG/L	0.8
PHENOLS PPB	15
OILS & GREASES MG/L	0.2
TANNINS & LIGNINS MG/L	1.1
NICKEL MG/L	*0.00
COPPER MG/L	0.00
MPN OF E COLI/100ML	0.

* DENOTES DATA NOT AVAILABLE

DAY	1	30	27	17	29	19
MONTH	AUG	OCT	NOV	DEC	JAN	FEB
YEAR	1968	1968	1968	1968	1969	1969
COMPOSITE OR GRAB SAMPLE	G	G	G	C	G	G
INITIAL SAMPLING TIME	1500	1130	1130	1200	1200	1530
TEMPERATURE, DEG.CENT.	20.0	3.0	0.0	0.0	0.0	0.0
BAROMETRIC PRES. IN.HG	*0.00	27.40	*0.00	*0.00	28.30	*0.00
DISSOLVED OXYGEN, MG/L	8.9	11.9	12.3	12.4	13.4	12.7
PERCENT SATURATION	*00.	96.	*00.	*00.	97.	*00.
BIOCHEM. OX. DEMAND MG/L	1.0	1.3	1.7	1.4	1.0	0.5
HYDROGEN ION CONC.,PH	8.0	7.9	7.7	7.7	8.0	7.7
ALKALINITY MG/L	93	81	89	96	135	98
THRESHOLD ODOR NO.,TYPE	8 M	4 M	2 M	0	0	4 DF
TOTAL RESIDUE MG/L	190	244	158	162	186	138
IGNITION LOSS MG/L	40	98	10	26	76	28
TURBIDITY AS SIO2 MG/L	72	10	22	6	6	11
CHLORIDES MG/L	7	3	0	0	1	1
PHENOLS PPB	11	*0	*0	6	3	3
OILS & GREASES MG/L	0.4	*.0	*.0	*.0	*.0	*.0
FLUORIDES MG/L	0.09	0.09	0.12	0.13	0.17	0.16
COLIFORM M.P.N./100ML.	*0000.	31.	34.	41.	22.	33.
MPN OF E COLI/100ML	*0000.	2.	9.	14.	9.	2.
STD. PLATE COUNT/ML	*00000	10000	170	120	70	*00000
RIVER DISCHARGE C.F.S.	1190.	936.	419.	550.	485.	455.

* DENOTES DATA NOT AVAILABLE