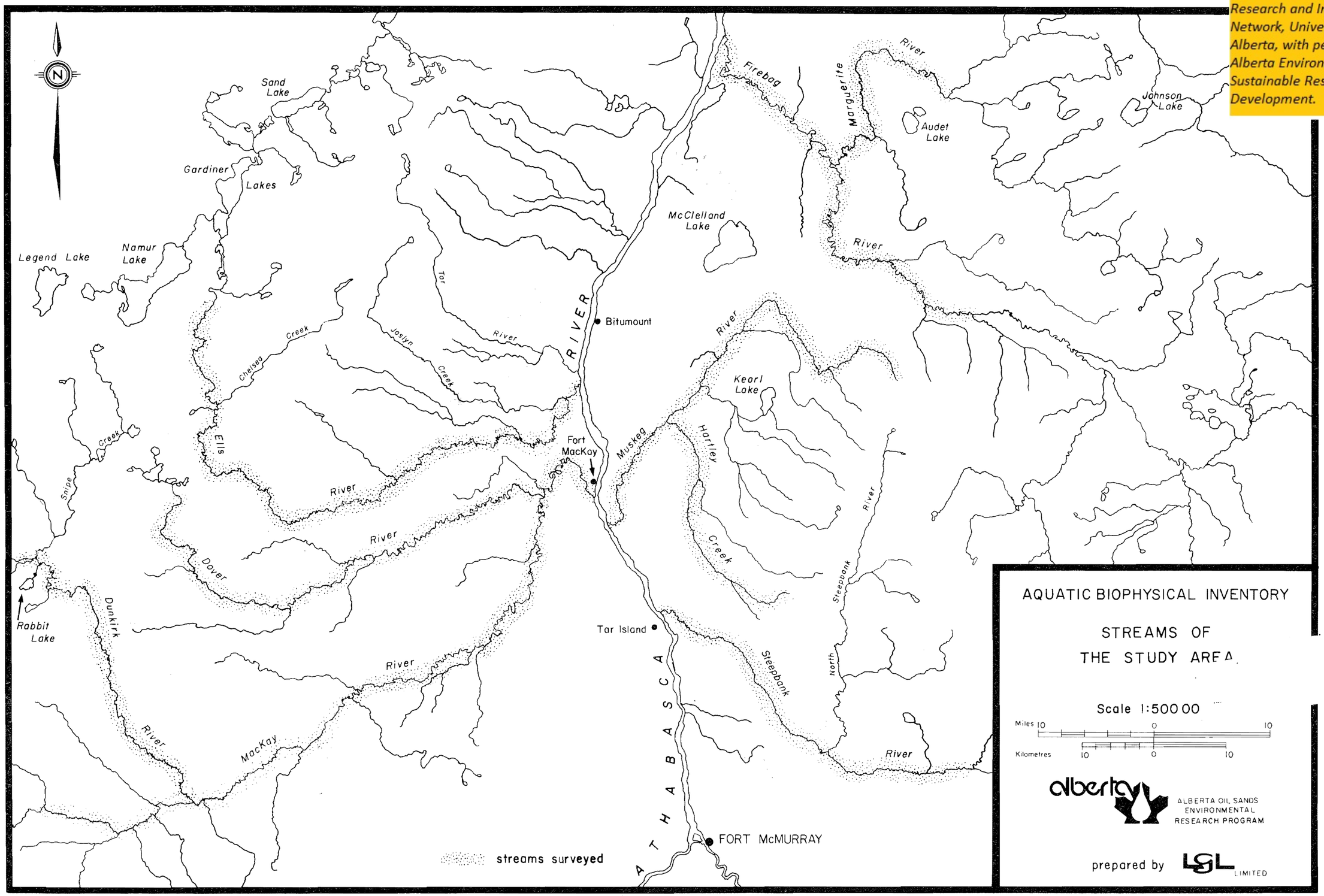

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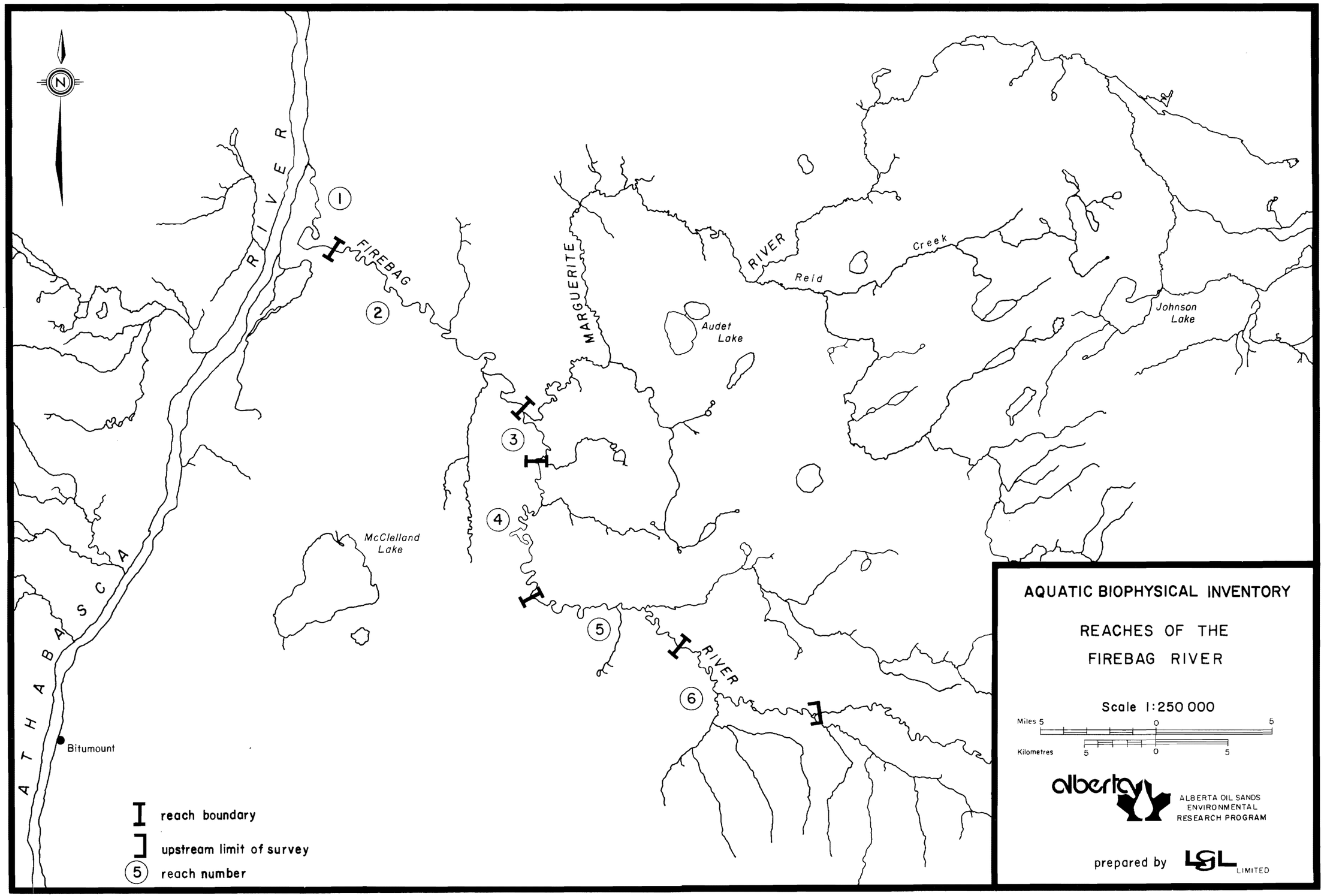
FIREBAG RIVER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reach number
AQUATIC BIOPHYSICAL INVENTORY
REACHES OF THE
FIREBAG RIVER
Scale 1:250 000
Miles 5 0 5
Kilometres 5 0 5
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ALBERTA OIL SANDS
ENVIRONMENTAL
RESEARCH PROGRAM
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LGL LIMITED

NUMBERS OF FISH COLLECTED (1978)

Species	Adults		Juveniles and Young-of-the-year		Total Numbers	
	May	September	May	September	May	September
lake chub	ND	0	ND	3	ND	3
lake whitefish	ND	22	ND	1	ND	23
longnose sucker	ND	2	ND	0	ND	2
northern pike	ND	1	ND	0	ND	1
walleye	ND	2	ND	2	ND	4
white sucker	ND	1	ND	0	ND	1
Total	ND	28	ND	6	ND	34

PHYSICAL CHARACTERISTICS

Reach length (km)	13.0
Channel width (m)	95
Channel area (ha)	123.5
Gradient (m/km)	0.3
Flow character	swirling, rolling
Total pools (%)	90
Pattern	irregularly meandering
Confinement	unconfined
Unstable banks (%)	40
Substrate composition (%)	
fines (<2 mm)	95
gravels (2-64 mm)	5
larges (>64 mm)	0
bedrock and/or oil sand	0
Debris	low

REACH DESCRIPTION AND FISH UTILIZATION

This reach, which lies largely within the Athabasca River floodplain, is irregularly meandering and has many areas of unstable banks. Water levels and flow in at least the lower portion of this reach are affected by water level fluctuations in the Athabasca River. Gradient and water velocities in this section are the lowest in the studied portion of the Firebag River. Water flow is primarily swirling and a high proportion of the reach is composed of pools. The substrate is almost entirely fines. Although deciduous shrubs are an abundant component of the riparian vegetation, little of this growth overhangs the channel.

Northern pike, which were captured in this reach, and brook and ninespine stickleback, which were captured further upstream in the Firebag River, may spawn in the occasional grassy shallows along the banks within this reach. Adult lake whitefish, captured in this reach during autumn, may also spawn here. Although lake whitefish prefer to spawn over rocky substrates, they will spawn over sandy substrates. Several forage fish species (e.g., trout-perch and pearl dace) that spawn over sandy substrates were captured within other reaches of the Firebag River; they may spawn in this reach. The reach is considered to be a relatively good rearing area for fish because of the slow waters and the presence of log debris and grassy shallows within which young fish may take refuge. Log jams, overhanging banks, and the many deep pools provide excellent resting and feeding areas for adult fish of larger piscivores such as walleye and northern pike. The many pools and relatively deep water in the reach provide abundant overwintering areas for fish.

BENTHIC INVERTEBRATES

No benthic samples were taken in this reach.

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	30
Deciduous trees	30
Shrubs	45
Grasses	10
Barren	0
Channel cover (%)	
Overhang	0
Crown	0

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

Water Survey of Canada station number 00AT07DC0011

	Mean	Maximum	Minimum
Total alkalinity (mg $CaCO_3$/l)	111.7	129.2	100.2
pH	7.77	7.89	7.68
Total hardness (mg $CaCO_3$/l)	108.5	124.0	94.1
Conductance (µS/cm)	198	231	171
Total filterable residue fixed (mg/l)	110	130	100
Total non-filterable residue fixed (mg/l)	6	13	<0.4
Total organic carbon (mg C/l)	9.2	11.0	7.0
Silica (mg SiO_2/l)	11.8	16.0	9.7
Nitrate and nitrite nitrogen (mg N/l)	0.046	0.090	<0.003
Total Kjeldahl nitrogen (mg N/l)	0.95	1.07	0.82
Total Phosphorus (mg P/l)	0.044	0.051	0.034
Orthophosphate (mg P/l)	0.013	0.016	0.010
Sulphate (mg SO_4/l)	3.0	5.0	0.1

Data for the period January 1976 to December 1977 obtained from the National Water Quality Data Bank (NAQUADAT).

Slow-moving pool conditions at km 5.

Swirling flow at km 9 is typical of reach 1.

AQUATIC BIOPHYSICAL INVENTORY
FIREBAG RIVER
Reach 1
(km 0 to km 13)

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FISH COLLECTIONS

GN — LKWF, LNSK, NTPK, WALL, WTSK

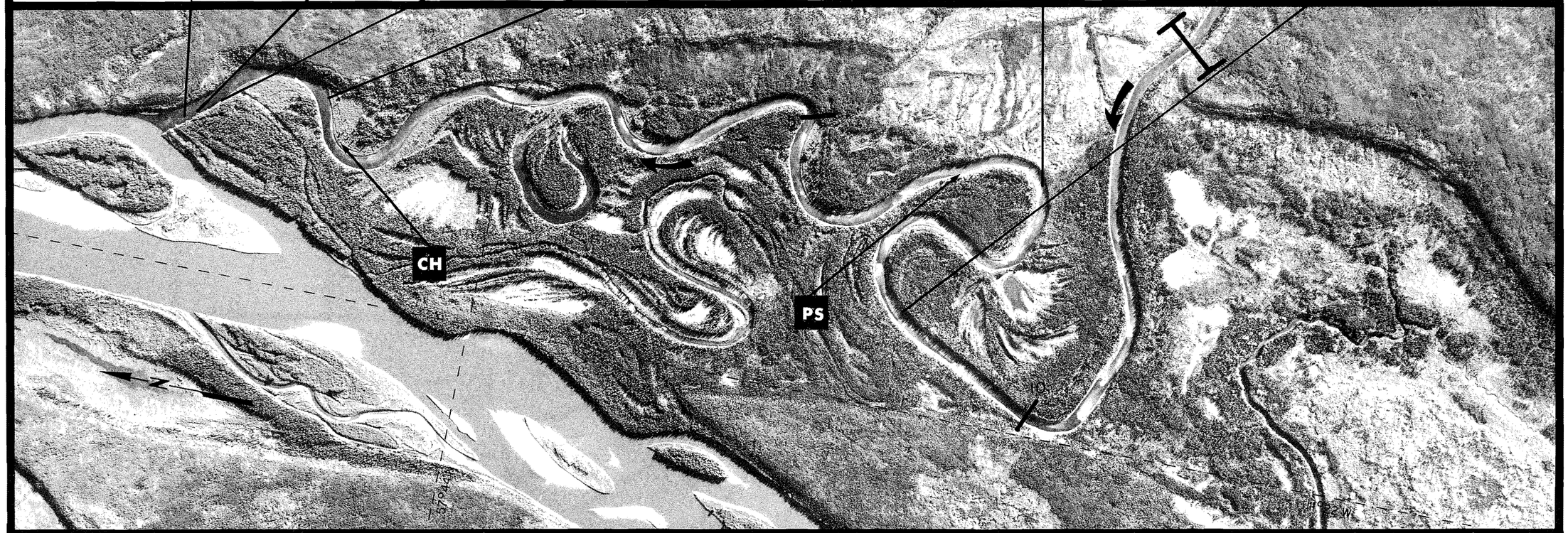
GN — LKWF, WALL

GN — NO CATCH

SN — NO CATCH

SN — NO CATCH

DN — LKCH

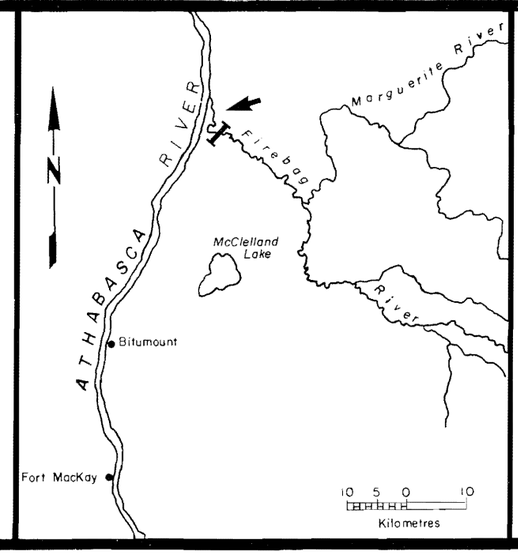


POINT SAMPLE DATA

Location	km 6.5
Date	26/05/78
Hydraulics	
channel width (m)	60
wet width (m)	60
maximum depth (m)	ND
average depth (m)	2.0
velocity (m/s)	0.70
flow character	placid, swirling
Substrate Composition (%)	
fines (< 2 mm)	80
gravels (2–64 mm)	10
larges (>64 mm)	10
bedrock and/or oil sand	0
Bank	
height (m)	3.5
form	repose
stability	stable
texture	sand
vegetation (% coverage)	
coniferous trees	40
deciduous trees	20
shrubs	20
grasses	10
barren	0
Water Quality	
temperature (°C)	9.0
dissolved oxygen (mg/l)	ND
conductivity (µmhos/cm)	ND
pH	ND

LEGEND

AN	angling	ARGR	arctic grayling
CF	counting fence	BKST	brook stickleback
DN	dip net	BRMN	brassy minnow
EF	electrofisher	BURB	burbot
GN	gill net	DLVR	Dolly Varden
KS	kick sample	EGGS	unidentified fish eggs
SF	small fish collections made using a combination of methods	EMSH	emerald shiner
SN	seine	FLCH	flathead chub
AP	benthic algal productivity station	FSDC	finescale dace
BI	benthic invertebrate collection site	FTMN	fathead minnow
CH	water quality station	GOLD	goldeye
PS	point sample	LKCH	lake chub
SG	stream gauging station	LKCS	lake cisco
35	kilometres from mouth	LKWF	lake whitefish
	flow direction	LNDC	longnose dace
	reach boundary	LNSK	longnose sucker
	upstream limit of survey	MTWF	mountain whitefish
	division between sections of a reach	NRDC	northern redbelly dace
		NSST	ninespine stickleback
		NTPK	northern pike
		PLDC	pearl dace
		SLSC	slimy sculpin
		SPSC	spoonhead sculpin
		SPSH	spottail shiner
		TRPC	trout-perch
		UNSK	unidentified sucker species
		WALL	walleye
		WTSK	white sucker
		YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

FIREBAG RIVER

Reach 1

(km 0 to km 13)

Scale 1 : 25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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NUMBERS OF FISH COLLECTED (1978)

Species	Adults		Juveniles and Young-of-the-year		Total Numbers	
	May	September	May	September	May	September
arctic grayling	0	0	1	0	1	0
brook stickleback	0	0	1	0	1	0
lake chub	0	0	37	0	37	0
lake whitefish	0	3	0	0	0	3
longnose dace	0	0	30	0	30	0
longnose sucker	0	0	0	1	0	1
pearl dace	0	0	11	0	11	0
slimy sculpin	0	0	9	2	9	2
walleye	0	1	0	0	0	1
white sucker	0	1	73	0	73	1
Total	0	5	162	3	162	8

PHYSICAL CHARACTERISTICS

Reach length (km)	32.5
Channel width (m)	80
Channel area (ha)	260.0
Gradient (m/km)	0.6
Flow character	swirling, rolling, broken
Total pools (%)	90
Pattern	irregularly meandering
Confinement	confined
Unstable banks (%)	25
Substrate composition (%)	
fines (<2 mm)	70
gravels (2-64 mm)	25
larges (>64 mm)	3
bedrock and/or oil sand	2
Debris	low

REACH DESCRIPTION AND FISH UTILIZATION

This reach is located above the Athabasca River floodplain and is irregularly meandering with some near-vertical cut banks up to 40 m high. Areas with unstable banks are common. Gradient and water velocities are greater than those in Reach 1 but lower than those in upstream reaches of the Firebag River. The water is moderately deep and although some rapids are present, pools comprise most of the total reach area. Flow character is mixed, with swirling, rolling and broken waters. Fines comprise the majority of the substrate. Coniferous and deciduous trees predominate in the riparian vegetation and there is no overhanging vegetation.

Lake whitefish and a few of the forage fish species captured in the Firebag River that spawn over sandy substrates may spawn in this reach. Limited spawning of other fish species that normally spawn over gravelly substrates may also occur. Because of the relatively low water velocities and presence of debris, the rearing potential for fish is considered to be moderate. During the spring, moderate numbers of young lake chub, longnose dace and white sucker were captured. The presence of these smaller fish suggests that there is at least some feeding potential for northern pike and walleye in this reach. The many pools and moderately deep waters provide resting and feeding areas for adults of larger fish and also provide good overwintering areas.

BENTHIC INVERTEBRATES

- OLIGOCHAETA
- GASTROPODA
  - *Ferrissia*
  - *Gyraulus*
  - *Stagnicola*
- PELECYPODA
  - *Musculium*
  - *Sphaerium*
- INSECTA
  - Ephemeroptera
    - *Baetis*
    - *Ephemerella*
    - *Paraleptophlebia*
    - *Stenonema*
  - Odonata
    - *Ophiogomphus*
  - Plecoptera
    - *Claassenia*
    - *Isoperla*
    - *Pteronarcys*
    - *Taeniopteryx*
  - Trichoptera
    - *Amiocentrus*
    - *Brachycentrus*
    - *Cheumatopsyche*
    - *Glossosoma*
    - *Hydropsyche*
    - *Lepidostoma*
    - *Oecetis*
    - *Polycentropus*
    - *Psychomyia*
  - Diptera
    - Tipulidae
    - Ceratopogonidae
    - Chironomidae
      - Chironominae
      - Tanypodinae
      - Orthocladiinae
    - Simuliidae
    - Tabanidae
    - Rhagionidae
      - *Atherix*
    - Empididae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	40
Deciduous trees	35
Shrubs	10
Grasses	20
Barren	0
Channel cover (%)	
Overhang	0
Crown	0

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

Water Survey of Canada station number 07DC001

Maximum total annual discharge:	1075.6 x 10^6 m^3 (1975)
Minimum total annual discharge:	341.7 x 10^6 m^3 (1976)
Maximum annual mean discharge:	33.98 m^3/s (1975)
Minimum annual mean discharge:	21.72 m^3/s (1976)
Maximum monthly mean discharge:	97.13 m^3/s (August 1973)
Minimum monthly mean discharge:	7.08 m^3/s (February 1972)
Maximum daily discharge:	238.14 m^3/s (Aug. 10, 1973)
Minimum daily discharge:	6.94 m^3/s (Feb. 10, 1978)

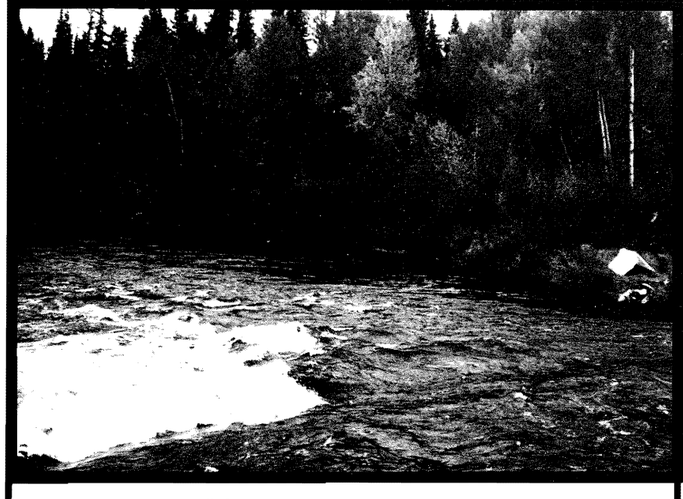
Data for 1971 to 1978 compiled from Loeppky and Spitzer (1977), Warner and Spitzer (1979) and Warner (1979).

WATER QUALITY

Water Survey of Canada station number 00AT07DC0010

	Mean	Maximum	Minimum
Total alkalinity (mg $CaCO_3$/l)	111.0	219.0	43.2
pH	7.70	8.40	5.60
Total hardness (mg $CaCO_3$/l)	112.0	227.0	63.9
Conductance (µS/cm)	208	433	105
Total filterable residue fixed (mg/l)	105	149	60
Total non-filterable residue fixed (mg/l)	4	56	<0.4
Total organic carbon (mg C/l)	11.0	24.5	1.0
Silica (mg SiO_2/l)	13.1	29.6	6.6
Nitrate and nitrite nitrogen (mg N/l)	0.080	0.400	<0.003
Total Kjeldahl nitrogen (mg N/l)	0.89	5.40	0.20
Total Phosphorus (mg P/l)	0.050	0.180	0.023
Orthophosphate (mg P/l)	0.020	0.060	0.005
Sulphate (mg SO_4/l)	4.7	17.5	0.1

Data for the period January 1976 to December 1979 obtained from the National Water Quality Data Bank (NAQUADAT).



Broken waters at km 28.5.

Swirling pool conditions, typical of reach 2, at km 36.

AQUATIC BIOPHYSICAL INVENTORY
FIREBAG RIVER
Reach 2
(km 13.0 to km 45.5)

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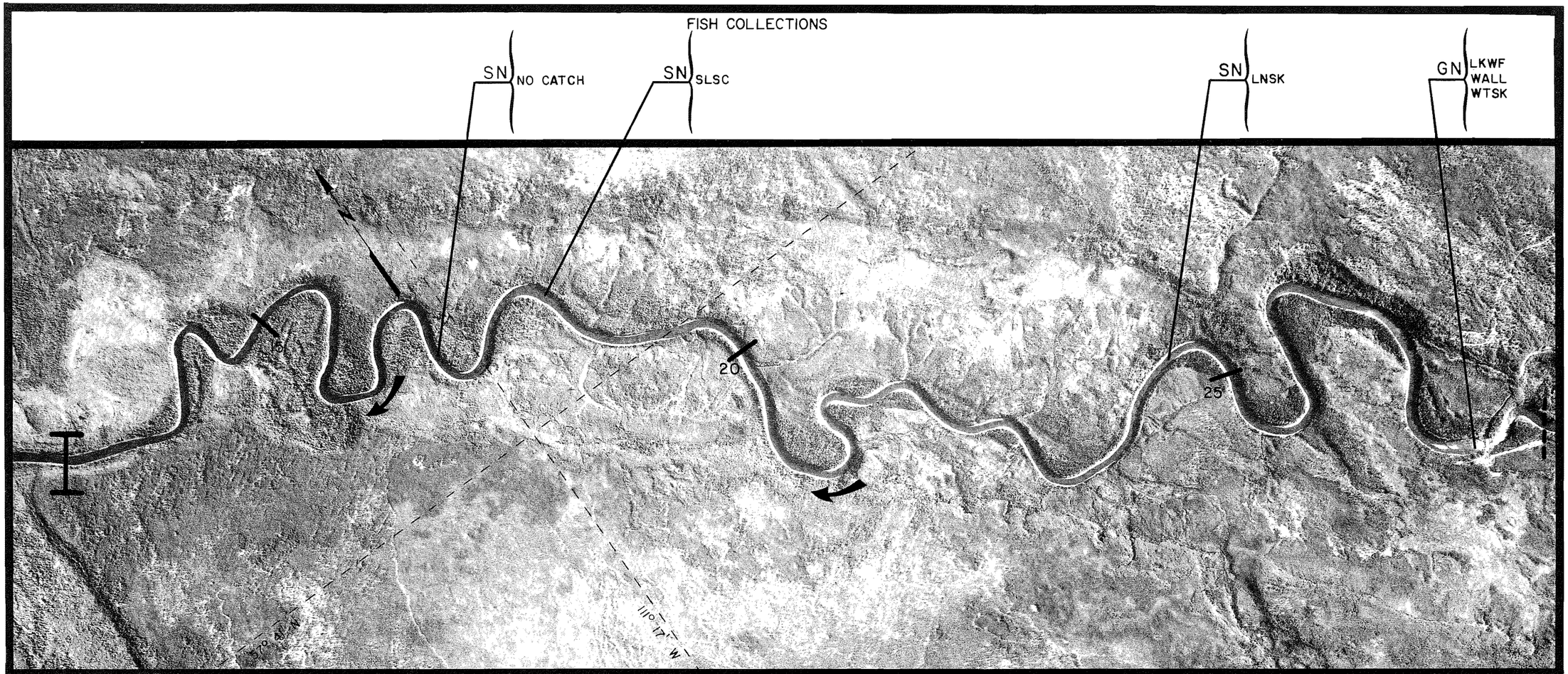


POINT SAMPLE DATA

Location
Date
Hydraulics
- channel width (m)
- wet width (m)
- maximum depth (m)
- average depth (m)
- velocity (m/s)
- flow character

Substrate Composition (%)
- fines (< 2 mm)
- gravels (2–64 mm)
- larges (> 64 mm)
- bedrock and/or oil sand

Bank
- height (m)
- form
- stability
- texture

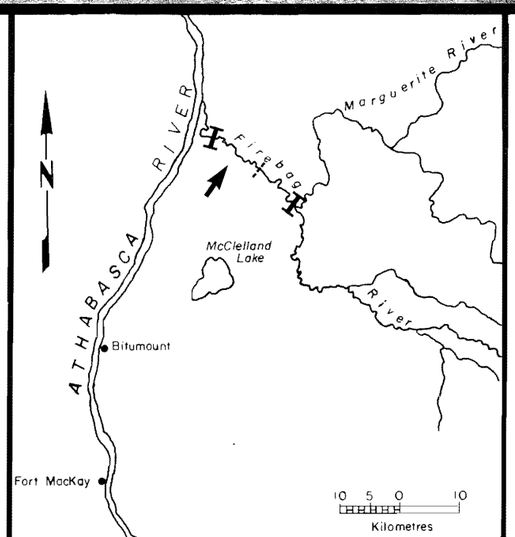
- vegetation (% coverage)
  - coniferous trees
  - deciduous trees
  - shrubs
  - grasses
  - barren

Water Quality
- temperature (°C)
- dissolved oxygen (mg/l)
- conductivity (µmhos/cm)
- pH

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

FIREBAG RIVER

Reach 2 Section 1

(km 13 to km 29)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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FISH COLLECTIONS

SN: ARGR, BKST, LNDC, SLSC, WTSK

SN: LNDC, SLSC

SN: NO CATCH

SN: LKCH, LNDC, PLDC, SLSC, WTSK

KS: EGGS

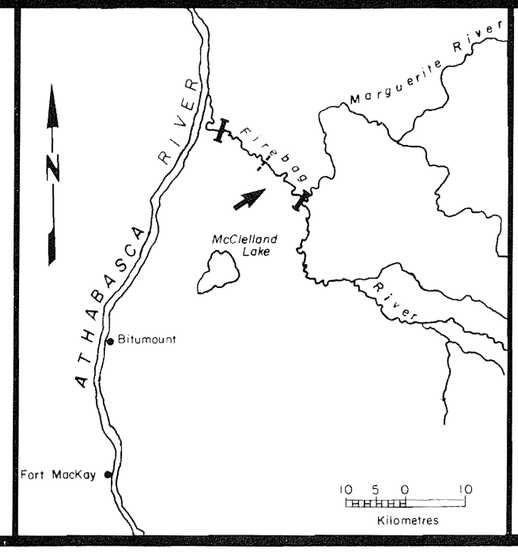
POINT SAMPLE DATA

	km 29.5	km 33	km 41	km 45
Location				
Date	25/05/78	25/05/78	25/05/78	23/05/78
Hydraulics				
channel width (m)	50	55	80	45
wet width (m)	50	55	80	45
maximum depth (m)	ND	ND	ND	ND
average depth (m)	2.0	1.0	1.0	1.0
velocity (m/s)	0.80	0.80	0.90	1.40
flow character	placid, swirling	swirling	swirling, rolling	rolling, broken
Substrate Composition (%)				
fines (< 2 mm)	80	40	30	25
gravels (2–64 mm)	20	30	20	15
larges (>64 mm)	0	30	50	60
bedrock and/or oil sand	0	0	0	0
Bank				
height (m)	4.5	0.8	1.5	2.0
form	repose	ND	repose	repose
stability	stable	ND	stable	stable
texture	sand	sand, clay	sand, clay	sand
vegetation (% coverage)				
coniferous trees	30	40	60	45
deciduous trees	20	30	30	25
shrubs	15	15	20	55
grasses	15	20	20	30
barren	10	0	0	0
Water Quality				
temperature (°C)	11.0	11.0	11.0	12.0
dissolved oxygen (mg/l)	ND	ND	ND	ND
conductivity (µmhos/cm)	ND	ND	ND	ND
pH	ND	ND	ND	ND

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
	reach boundary
	upstream limit of survey
	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

FIREBAG RIVER

Reach 2 Section 2

(km 29.0 to km 45.5)

Scale 1: 25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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NUMBERS OF FISH COLLECTED (1978)

Species	Adults		Juveniles and Young-of-the-year		Total Numbers	
	May	September	May	September	May	September
arctic grayling	1	1	1	0	2	1
lake chub	0	0	136	381	136	381
longnose dace	0	0	0	19	0	19
longnose sucker	5	1	56	10	61	11
northern pike	0	2	0	0	0	2
pearl dace	0	0	13	0	13	0
slimy sculpin	0	0	0	3	0	3
trout-perch	0	0	11	0	11	0
unidentified suckers	0	0	0	20	0	20
white sucker	0	0	251	27	251	27
Total	6	4	468	460	474	464

PHYSICAL CHARACTERISTICS

Reach length (km)	6.5
Channel width (m)	45
Channel area (ha)	29.3
Gradient (m/km)	1.9
Flow character	rolling
Total pools (%)	50
Pattern	irregular
Confinement	frequently confined
Unstable banks (%)	20
Substrate composition (%)	
fines (<2 mm)	10
gravels (2-64 mm)	25
larges (>64 mm)	60
bedrock and/or oil sand	5
Debris	low

REACH DESCRIPTION AND FISH UTILIZATION

This section is a short, irregularly meandering reach. River banks are up to 40 m high and unstable areas are common. Water velocities and gradient are moderately high. Flow character throughout the reach is almost entirely rolling, and pools comprise about half of the total reach area. Larges (rubble and boulders) and gravels are dominant substrates. Deciduous trees form the dominant component of the riparian vegetation, and coniferous trees, deciduous shrubs and grasses are all present in smaller amounts. Some vegetation overhangs the river.

The potential of this reach for spawning is considered to be good or excellent for most fish that occur in the river, because it contains a diversity of substrate sizes, current velocities and water depths. Unidentified fish eggs, collected in late May, provided proof of spawning in the reach. Adults of arctic grayling and longnose sucker, both spring spawners, were captured in May. The combination of occasional grassy shallow backwaters, areas shaded by overhanging vegetation, and substrate composed of gravels and larges provides good rearing areas for most fish species in the river. Large numbers of young lake chub, white sucker and longnose sucker were captured in this reach. Most young forage fish prefer the quiet sheltered areas, whereas young arctic grayling prefer rocky substrates. The areas of overhanging riparian vegetation and the numerous pools provide good resting and feeding areas for larger fish. The high numbers of forage fish, particularly lake chub, provide a good food source for piscivorous fishes. Although there are many pools in this reach, the relatively shallow water depths may preclude overwintering of fish.

BENTHIC INVERTEBRATES

- OLIGOCHAETA
- GASTROPODA
  - *Physa*
- PELECYPODA
  - *Musculium*
- INSECTA
  - Ephemeroptera
    - *Baetis*
    - *Rhithrogena*
    - *Stenonema*
  - Odonata
    - *Ophiogomphus*
  - Plecoptera
    - *Isoperla*
  - Trichoptera
    - *Cheumatopsyche*
    - *Glossosoma*
    - *Hydropsyche*
  - Diptera
    - Chironomidae
      - Chironominae
      - Tanypodinae
      - Orthocladiinae
    - Rhagionidae
      - *Atherix*

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	20
Deciduous trees	40
Shrubs	20
Grasses	20
Barren	0
Channel cover (%)	
Overhang	2
Crown	0

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

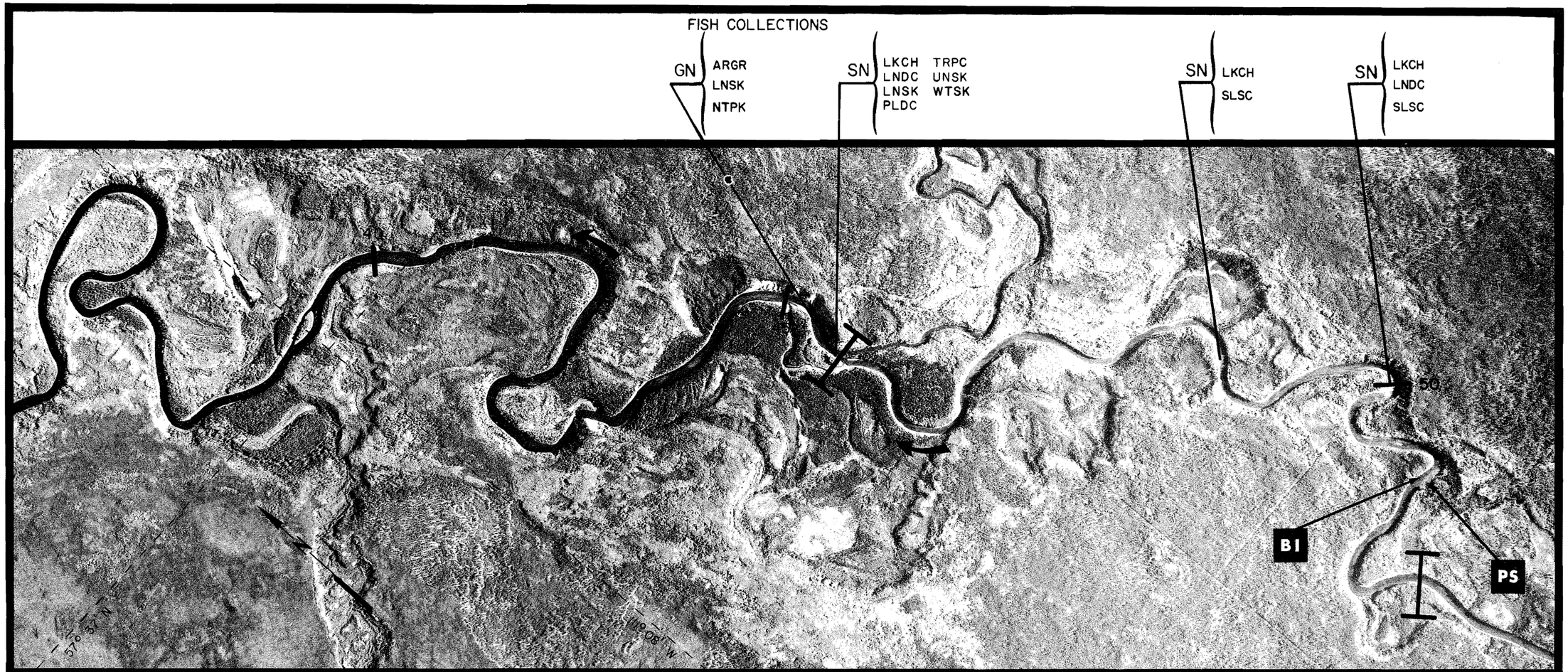
No data available for this reach

A placid section at km 51.5 near the upper boundary of reach 3.

AQUATIC BIOPHYSICAL INVENTORY
FIREBAG RIVER
Reach 3
(km 45.5 to km 52.0)

alberta oil sands environmental research program

prepared by LGL LIMITED



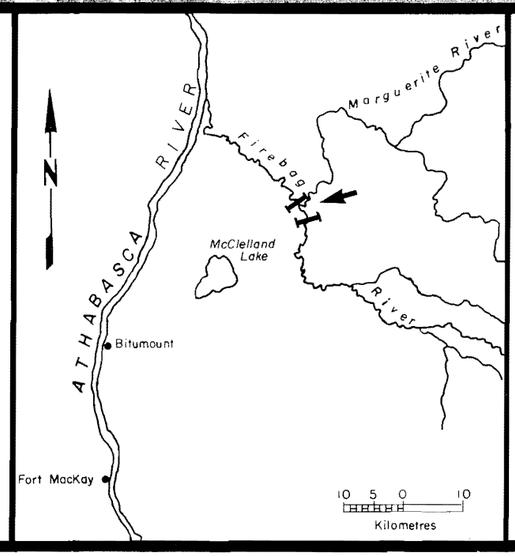
POINT SAMPLE DATA

Location	km 51
Date	23/05/78
Hydraulics	
channel width (m)	45
wet width (m)	45
maximum depth (m)	ND
average depth (m)	0.7
velocity (m/s)	0.95
flow character	rolling
Substrate Composition (%)	
fines (< 2mm)	25
gravels (2–64mm)	25
larges (>64mm)	50
bedrock and/or oil sand	0
Bank	
height (m)	1.5
form	repose
stability	stable
texture	clay,sand
vegetation (% coverage)	
coniferous trees	10
deciduous trees	65
shrubs	25
grasses	30
barren	0
Water Quality	
temperature (°C)	12.0
dissolved oxygen (mg/l)	ND
conductivity (µmhos/cm)	ND
pH	ND

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
	reach boundary
	upstream limit of survey
	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

FIREBAG RIVER

Reach 3

(km 45.5 to km 52.0)

Scale 1: 25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

alberta

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (1978)

Species	Adults		Juveniles and Young-of-the-year		Total Numbers	
	May	September	May	September	May	September
arctic grayling	3	0	3	0	6	0
lake chub	0	0	0	132	0	132
longnose dace	0	0	0	50	0	50
longnose sucker	2	0	1	23	3	23
ninespine stickleback	0	0	0	2	0	2
northern pike	0	4	0	0	0	4
pearl dace	0	0	0	10	0	10
slimy sculpin	0	0	2	3	2	3
trout-perch	0	0	0	3	0	3
unidentified suckers	0	0	0	5	0	5
walleye	1	2	1	0	2	2
white sucker	0	5	2	14	2	19
Total	6	11	9	242	15	253

PHYSICAL CHARACTERISTICS

Reach length (km)	23.0
Channel width (m)	55
Channel area (ha)	126.5
Gradient (m/km)	1.0
Flow character	swirling
Total pools (%)	85
Pattern	irregularly meandering
Confinement	frequently confined
Unstable banks (%)	40
Substrate composition (%)	
fines (<2 mm)	15
gravels (2-64 mm)	35
larges (>64 mm)	40
bedrock and/or oil sand	10
Debris	moderate

REACH DESCRIPTION AND FISH UTILIZATION

Due to river erosion of sand-clay and sand-bitumen cut banks, many of the river banks in this irregularly meandering reach are unstable. Water velocities and gradient are moderate. A high proportion of the reach is composed of pools, and the flow character is swirling throughout almost the entire reach. Larges (rubble and boulders) and gravels are dominant substrates. Deciduous trees dominate riparian vegetation, and grasses and deciduous shrubs overhang the channel. More debris is found in this reach than in any other surveyed in the Firebag River.

Because of the diversity of substrate sizes, current velocities and water depths, the spawning potential of this reach for most fish that are found in the river is considered to be good to excellent. Unidentified fish eggs were collected in gravelly shallows in late May and all adults captured in this reach in the spring were spent. Adult spring spawners captured here in the spring include arctic grayling, longnose sucker and walleye. Rearing potential for most young fish is considered to be good because of the presence of areas sheltered by overhanging vegetation, rocky substrates and moderate quantities of debris. Young lake chub and longnose dace were particularly numerous in this reach. The high number of pools and areas shaded by overhanging vegetation provide good feeding and resting areas for larger fish. Sheltered backwaters inhabited by forage fish, particularly lake chub, provide good feeding areas for walleye and northern pike. Although pools compose a high percentage of the total reach area, water depths are shallow and fish overwintering is probably limited to isolated deep pools.

BENTHIC INVERTEBRATES

- NEMATODA
- PELECYPODA
  - *Sphaerium*
- INSECTA
  - Ephemeroptera
    - *Baetis*
    - *Ephemerella*
    - *Rhithrogena*
  - Odonata
    - *Ophiogomphus*
  - Plecoptera
    - *Diura*
    - *Isoperla*
    - *Pteronarcys*
  - Trichoptera
    - *Brachycentrus*
    - *Cheumatopsyche*
    - *Hydropsyche*
    - *Lepidostoma*
    - *Potamyia*
  - Coleoptera
    - Elmidae
  - Diptera
    - Tipulidae
    - Chironomidae
      - Chironominae
      - Tanypodinae
    - Simuliidae
    - Rhagionidae
      - *Atherix*
    - Empididae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	10
Deciduous trees	70
Shrubs	20
Grasses	45
Barren	0
Channel cover (%)	
Overhang	2
Crown	0

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

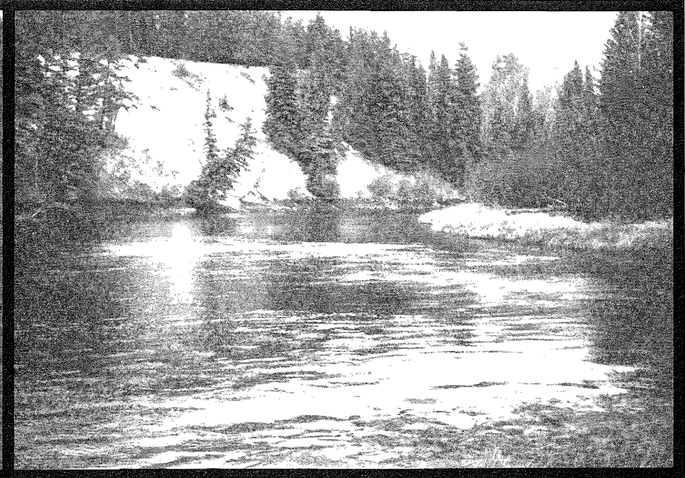
STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach

Swirling flow character at km 60.5 is representative of reach 4.

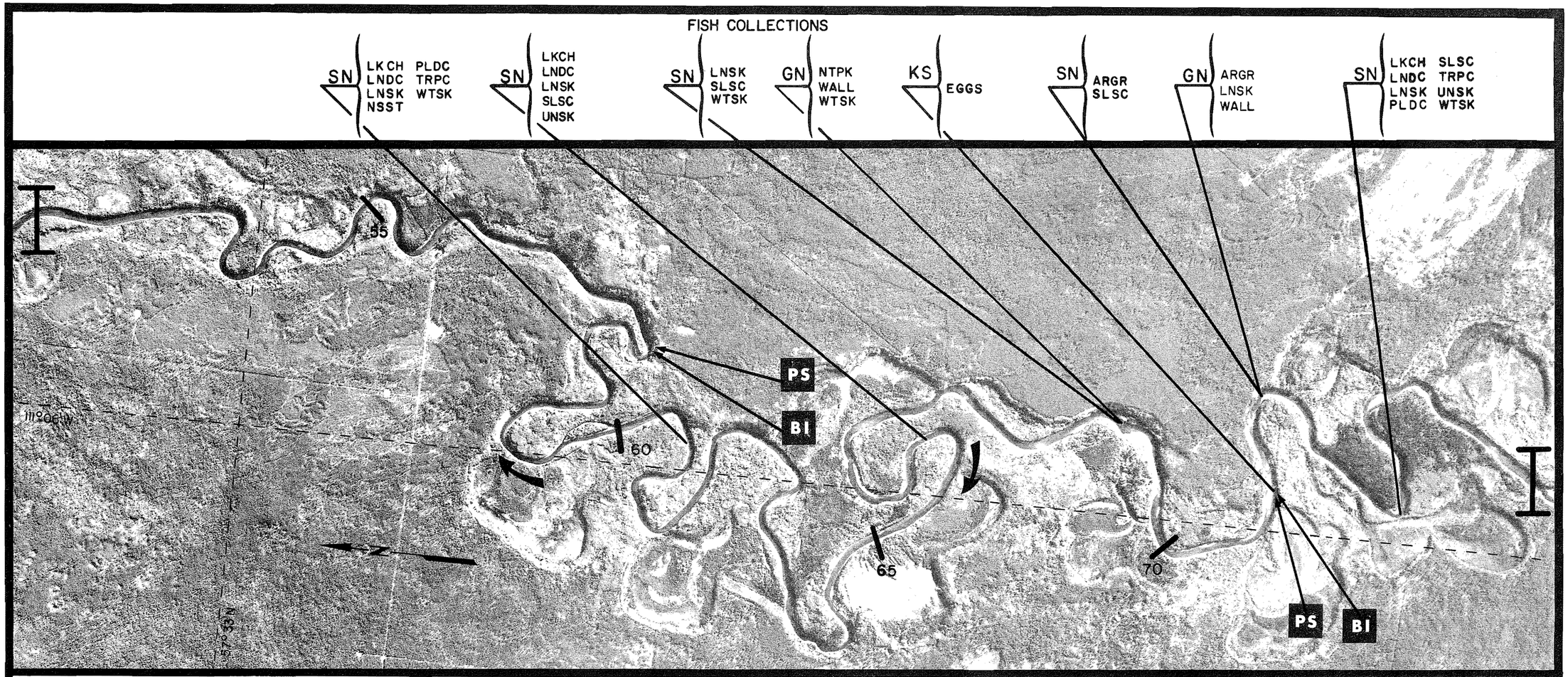


Sand and clay bank at km 71.5.

AQUATIC BIOPHYSICAL INVENTORY
FIREBAG RIVER
Reach 4
(km 52 to km 75)

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

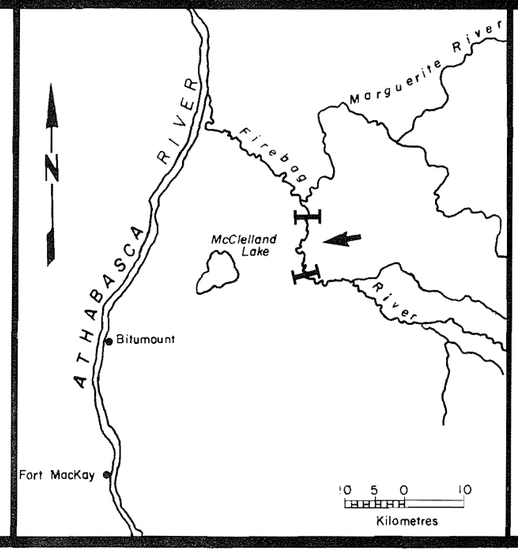


POINT SAMPLE DATA

Location	km 57.5	km 71
Date	23/05/78	22/05/78
Hydraulics		
channel width (m)	50	60
wet width (m)	50	60
maximum depth (m)	ND	ND
average depth (m)	2.0	0.5
velocity (m/s)	0.70	0.95
flow character	placid, swirling	swirling, rolling
Substrate Composition (%)		
fines (< 2mm)	90	20
gravels (2–64mm)	10	60
larges (>64mm)	0	20
bedrock and/or oil sand	0	0
Bank		
height (m)	3.0	1.0
form	repose	repose
stability	failing	failing
texture	sand	sand, clay, oil sand
vegetation (% coverage)		
coniferous trees	10	45
deciduous trees	75	35
shrubs	15	20
grasses	25	25
barren	5	15
Water Quality		
temperature (°C)	12.0	13.0
dissolved oxygen (mg/l)	ND	ND
conductivity (µmhos/cm)	ND	ND
pH	ND	ND

LEGEND

AN	angling	ARGR	arctic grayling
CF	counting fence	BKST	brook stickleback
DN	dip net	BRMN	brassy minnow
EF	electrofisher	BURB	burbot
GN	gill net	DLVR	Dolly Varden
KS	kick sample	EGGS	unidentified fish eggs
SF	small fish collections made using a combination of methods	EMSH	emerald shiner
		FLCH	flathead chub
SN	seine	FSDC	finescale dace
AP	benthic algal productivity station	FTMN	fathead minnow
		GOLD	goldeye
BI	benthic invertebrate collection site	LKCH	lake chub
		LKCS	lake cisco
CH	water quality station	LKWF	lake whitefish
		LNDC	longnose dace
PS	point sample	LNSK	longnose sucker
		MTWF	mountain whitefish
SG	stream gauging station	NRDC	northern redbelly dace
		NSST	ninespine stickleback
35	kilometres from mouth	NTPK	northern pike
		PLDC	pearl dace
	flow direction	SLSC	slimy sculpin
		SPSC	spoonhead sculpin
	reach boundary	SPSH	spottail shiner
		TRPC	trout-perch
	upstream limit of survey	UNSK	unidentified sucker species
		WALL	walleye
	division between sections of a reach	WTSK	white sucker
		YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

FIREBAG RIVER

Reach 4

(km 52 to km 75)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (1978)

Species	Adults		Juveniles and Young-of-the-year		Total Numbers	
	May	September	May	September	May	September
arctic grayling	0	3	0	35	0	38
flathead chub	0	0	0	1	0	1
lake chub	0	0	0	12	0	12
longnose dace	0	0	0	4	0	4
longnose sucker	0	0	0	2	0	2
northern pike	0	4	0	1	0	5
trout-perch	0	0	0	2	0	2
unidentified suckers	0	0	0	10	0	10
white sucker	0	1	3	1	3	2
Total	0	8	3	68	3	76

PHYSICAL CHARACTERISTICS

Reach length (km)	21.0
Channel width (m)	50
Channel area (ha)	105.0
Gradient (m/km)	1.7
Flow character	swirling, rolling broken
Total pools (%)	25
Pattern	irregularly meandering
Confinement	frequently confined
Unstable banks (%)	30
Substrate composition (%)	
fines (<2 mm)	10
gravels (2-64 mm)	40
larges (>64 mm)	50
bedrock and/or oil sand	0
Debris	low

REACH DESCRIPTION AND FISH UTILIZATION

This reach is essentially a riffle area. Only a relatively small proportion of the reach area is composed of pools, and waters are generally shallow. Areas of unstable river banks are numerous in this irregularly meandering reach. Moderate water velocities and gradient prevail in this reach and the flow character varies from swirling to rolling to broken. The substrate consists primarily of larges and gravels. Riparian vegetation is mostly deciduous trees, grasses and deciduous shrubs, some of which overhang the banks.

The diversity of water velocities, water depths and substrate sizes provide good spawning areas which are suitable for most fish species that are found in the Firebag River. Fine substrates are suitable for spawning of trout-perch and pearl dace and also possibly for spawning of lake whitefish. Grassy shallows in areas with fine substrates are suitable for northern pike spawning. All other species found in the river (including arctic grayling) may spawn over the substrates composed of gravels and larges. Unidentified fish eggs were collected from an area with rubble and gravel substrates in this reach. Areas sheltered by overhanging riparian vegetation, grassy shallows and sheltered backwaters provide good rearing areas for the young of most fish species in the river, and the abundance of gravel and rubble substrates is excellent for young arctic grayling. Relatively high numbers of young arctic grayling were captured in this reach. Backwaters sheltered by overhanging vegetation are suitable areas for most larger fish to rest and feed. The predominating riffle areas provide good feeding habitat for arctic grayling. Overwintering potential is limited to the few deep pools in the reach.

BENTHIC INVERTEBRATES

- OLIGOCHAETA
- GASTROPODA
  - *Gyraulus*
- PELECYPODA
  - *Musculium*
  - *Sphaerium*
- INSECTA
  - Ephemeroptera
    - *Baetis*
    - *Stenonema*
  - Plecoptera
    - *Claassenia*
    - *Diura*
    - *Isoperla*
    - *Pteronarcys*
  - Trichoptera
    - *Cheumatopsyche*
    - *Glossosoma*
    - *Hydropsyche*
    - *Lepidostoma*
  - Coleoptera
    - Elmidae
  - Diptera
    - Chironomidae
      - Chironominae
      - Tanypodinae
    - Simuliidae
    - Tabanidae
    - Rhagionidae
      - *Atherix*
    - Empididae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	10
Deciduous trees	55
Shrubs	35
Grasses	40
Barren	20
Channel cover (%)	
Overhang	2
Crown	0

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach

Riffle section of reach 5 at km 80.

AQUATIC BIOPHYSICAL INVENTORY
FIREBAG RIVER
Reach 5
(km 75 to km 96)

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prepared by LGL LIMITED

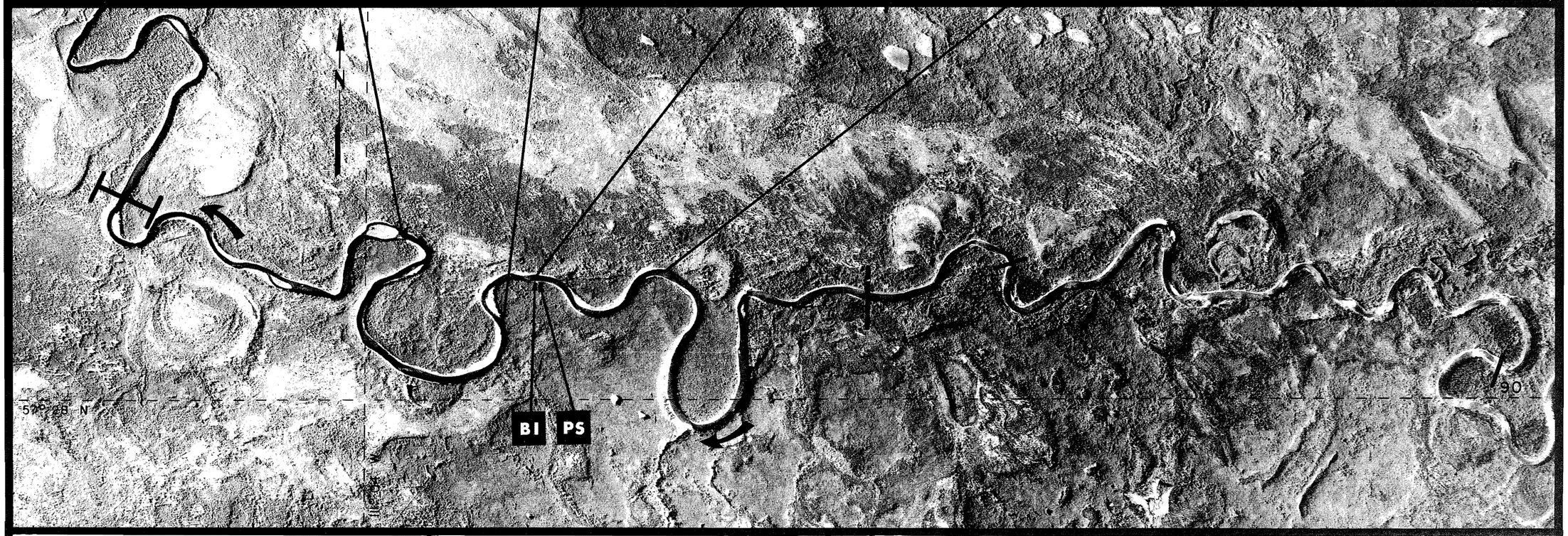
FISH COLLECTIONS

GN: ARGR

SN: ARGR, LNDC, NTPK, TRPC, UNSK

SN: WTSK

SN: FLCH, LKCH, LNDC, LNSK



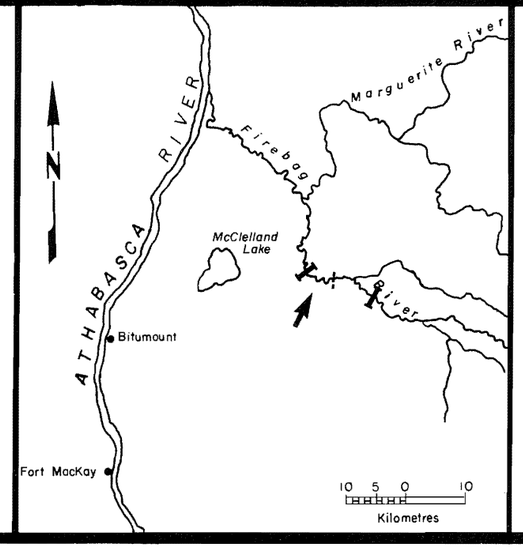
POINT SAMPLE DATA

Location	km 80
Date	22/05/78
Hydraulics	
channel width (m)	60
wet width (m)	60
maximum depth (m)	ND
average depth (m)	1.0
velocity (m/s)	1.10
flow character	rolling
Substrate Composition (%)	
fines (< 2mm)	60
gravels (2–64mm)	30
larges (>64mm)	10
bedrock and/or oil sand	0
Bank	
height (m)	0.8
form	steep
stability	falling
texture	sand
vegetation (% coverage)	
coniferous trees	2
deciduous trees	65
shrubs	30
grasses	45
barren	5
Water Quality	
temperature (°C)	ND
dissolved oxygen (mg/l)	ND
conductivity (µmhos/cm)	ND
pH	ND

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

FIREBAG RIVER

Reach 5 Section 1

(km 75 to km 84)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

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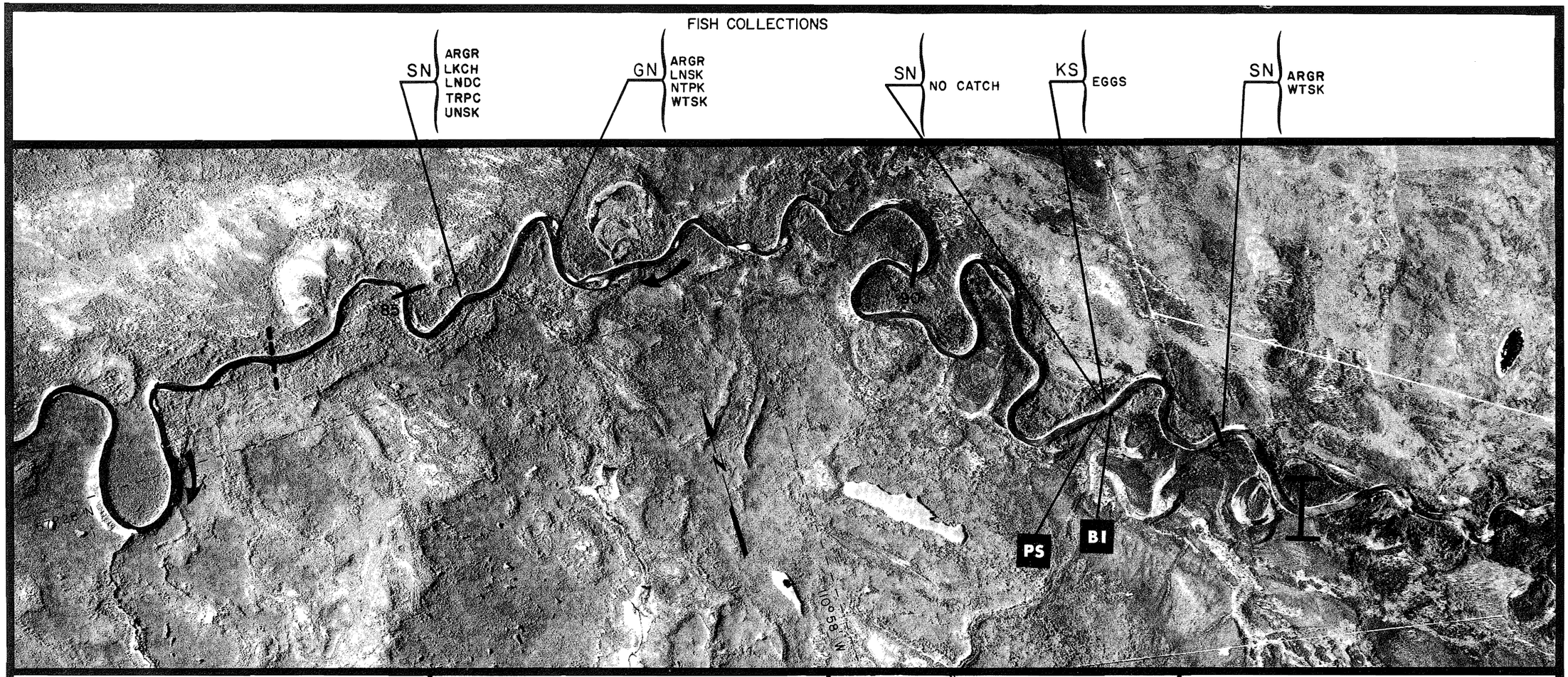


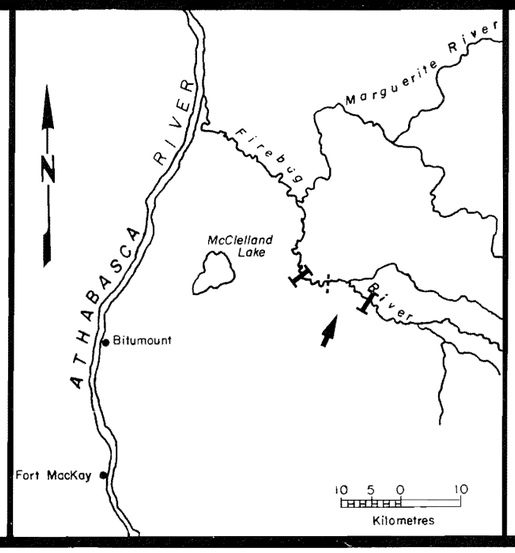
POINT SAMPLE DATA

Location	km 94
Date	22/05/78
Hydraulics	
channel width (m)	55
wet width (m)	55
maximum depth (m)	ND
average depth (m)	0.4
velocity (m/s)	0.90
flow character	rolling, broken
Substrate Composition (%)	
fines (< 2mm)	20
gravels (2–64mm)	50
larges (>64mm)	30
bedrock and/or oil sand	0
Bank	
height (m)	0.3
form	repose
stability	stable
texture	ND
vegetation (% coverage)	
coniferous trees	10
deciduous trees	75
shrubs	25
grasses	30
barren	0
Water Quality	
temperature (°C)	13.0
dissolved oxygen (mg/l)	ND
conductivity (µmhos/cm)	ND
pH	ND

LEGEND

AN angling
CF counting fence
DN dip net
EF electrofisher
GN gill net
KS kick sample
SF small fish collections made using a combination of methods
SN seine
AP benthic algal productivity station
BI benthic invertebrate collection site
CH water quality station
PS point sample
SG stream gauging station
35 kilometres from mouth
flow direction
reach boundary
upstream limit of survey
division between sections of a reach

ARGR arctic grayling
BKST brook stickleback
BRMN brassy minnow
BURB burbot
DLVR Dolly Varden
EGGS unidentified fish eggs
EMSH emerald shiner
FLCH flathead chub
FSDC finescale dace
FTMN fathead minnow
GOLD goldeye
LKCH lake chub
LKCS lake cisco
LKWF lake whitefish
LNDC longnose dace
LNSK longnose sucker
MTWF mountain whitefish
NRDC northern redbelly dace
NSST ninespine stickleback
NTPK northern pike
PLDC pearl dace
SLSC slimy sculpin
SPSC spoonhead sculpin
SPSH spottail shiner
TRPC trout-perch
UNSK unidentified sucker species
WALL walleye
WTSK white sucker
YLPR yellow perch



AQUATIC BIOPHYSICAL INVENTORY

FIREBAG RIVER

Reach 5 Section 2

(km 84 to km 96)

Scale 1:25 000

Miles 0.5 0 1 0.5

Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (1978)

Species	Adults		Juveniles and Young-of-the-year		Total Numbers	
	May	September	May	September	May	September
arctic grayling	1	1	3	47	4	48
lake chub	0	0	0	1	0	1
longnose dace	0	0	1	5	1	5
longnose sucker	0	1	1	0	1	1
ninespine stickleback	0	0	0	2	0	2
northern pike	5	7	0	12	5	19
slimy sculpin	0	0	2	5	2	5
trout-perch	0	0	0	1	0	1
unidentified suckers	0	0	0	31	0	31
walleye	2	0	0	0	2	0
white sucker	0	8	0	1	0	9
Total	8	17	7	105	15	122

PHYSICAL CHARACTERISTICS

Reach length (km)	27.0
Channel width (m)	30
Channel area (ha)	81.0
Gradient (m/km)	3.3
Flow character	rolling, broken
Total pools (%)	30
Pattern	irregularly meandering
Confinement	unconfined
Unstable banks (%)	5
Substrate composition (%)	
fines (<2 mm)	10
gravels (2-64 mm)	30
larges (>64 mm)	60
bedrock and/or oil sand	0
Debris	low

REACH DESCRIPTION AND FISH UTILIZATION

This section, the most upstream reach of the portion of the Firebag River that was surveyed, meanders irregularly and is primarily an extensive riffle zone with the occasional moving pool. The river banks are generally stable. This reach has the steepest gradient and highest water velocities encountered in the surveyed portion of the Firebag River. Waters are shallow and the flow character is rolling and broken. A relatively small proportion of the reach is pools. As in Reach 5, gravels and larges are the dominant components of the substrate material. Deciduous shrubs dominate riparian vegetation and overhang the channel in some areas.

The potential of this reach for spawning of both sport and forage fish is considered to be excellent. Numerous grassy side sloughs provide good spawning areas for northern pike and some forage fish. The many areas with rocky substrates are excellent spawning areas for arctic grayling and some species of forage fish. Walleye in the reach may spawn in a variety of areas. (Adult arctic grayling, northern pike and walleye were captured in the spring in this reach.) Rearing potential for sport fish is considered to be excellent; many young-of-the-year arctic grayling were captured in shallow gravel riffles, and young-of-the-year northern pike were captured in weedy areas with sandy substrates. The gravelly riffle areas should provide excellent feeding areas for arctic grayling, and northern pike and walleye can feed in the more placid backeddies and side sloughs. Fish probably overwinter only in the deeper backwaters of the reach.

BENTHIC INVERTEBRATES

- GASTROPODA
  - *Ferrissia*
- PELECYPODA
  - *Musculium*
- INSECTA
  - Ephemeroptera
    - *Stenonema*
  - Trichoptera
    - *Ceraclea*
    - *Chewmatopsyche*
    - *Glossosoma*
    - *Polycentropus*
  - Coleoptera
    - Elmidae
  - Diptera
    - Tipulidae
    - Chironomidae
      - Chironominae
      - Tanypodinae
      - Orthocladiinae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	25
Deciduous trees	15
Shrubs	40
Grasses	25
Barren	0
Channel cover (%)	
Overhang	2
Crown	0

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

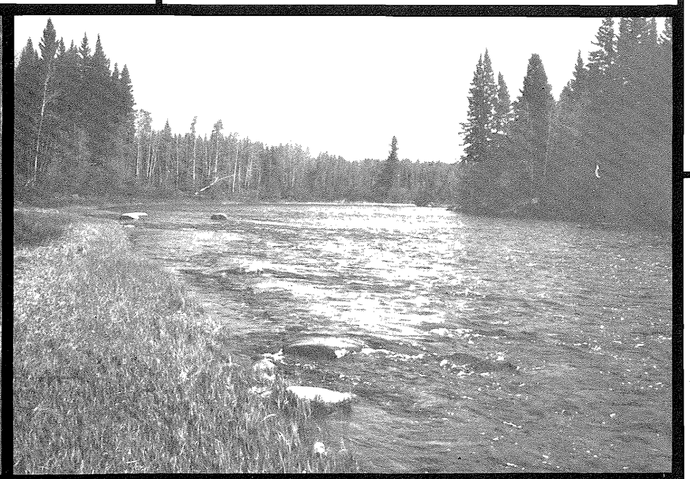
STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach

Unstable sand and clay bank at km 109.5.



Extensive riffle section at km 120 is typical of reach 6.

AQUATIC BIOPHYSICAL INVENTORY
FIREBAG RIVER
Reach 6
(km 96 to km 123)

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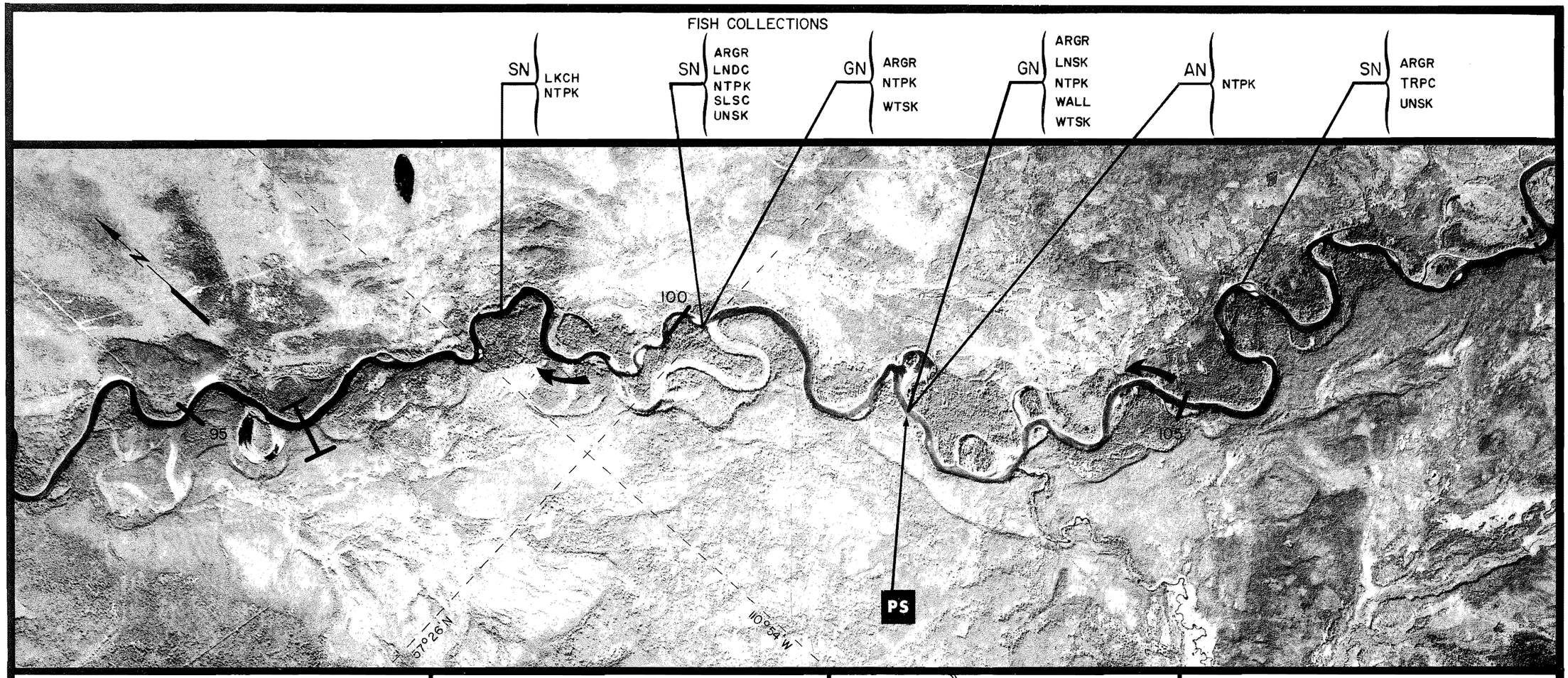


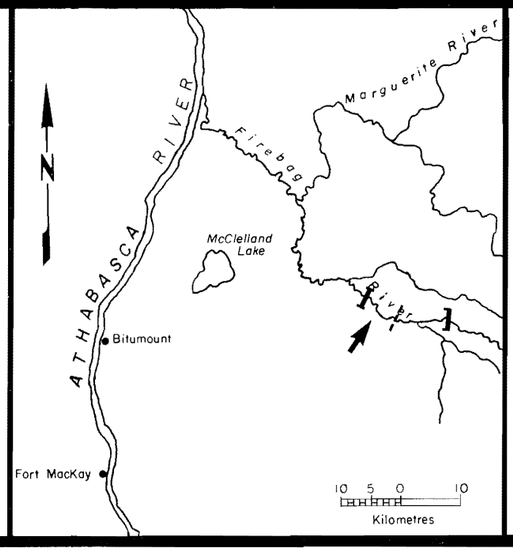
POINT SAMPLE DATA

Location	km 102.5
Date	22/05/78
Hydraulics	
channel width (m)	50
wet width (m)	50
maximum depth (m)	ND
average depth (m)	2.0
velocity (m/s)	ND
flow character	placid, swirling
Substrate Composition (%)	
fines (< 2 mm)	40
gravels (2–64 mm)	20
larges (>64 mm)	40
bedrock and/or oil sand	0
Bank	
height (m)	0.5
form	repose
stability	stable
texture	sand
vegetation (% coverage)	
coniferous trees	10
deciduous trees	30
shrubs	50
grasses	80
barren	0
Water Quality	
temperature (°C)	12.0
dissolved oxygen (mg/l)	ND
conductivity (µmhos/cm)	ND
pH	ND

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
	reach boundary
	upstream limit of survey
	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

FIREBAG RIVER

Reach 6 Section 1

(km 96.0 to km 109.5)

Scale 1 : 25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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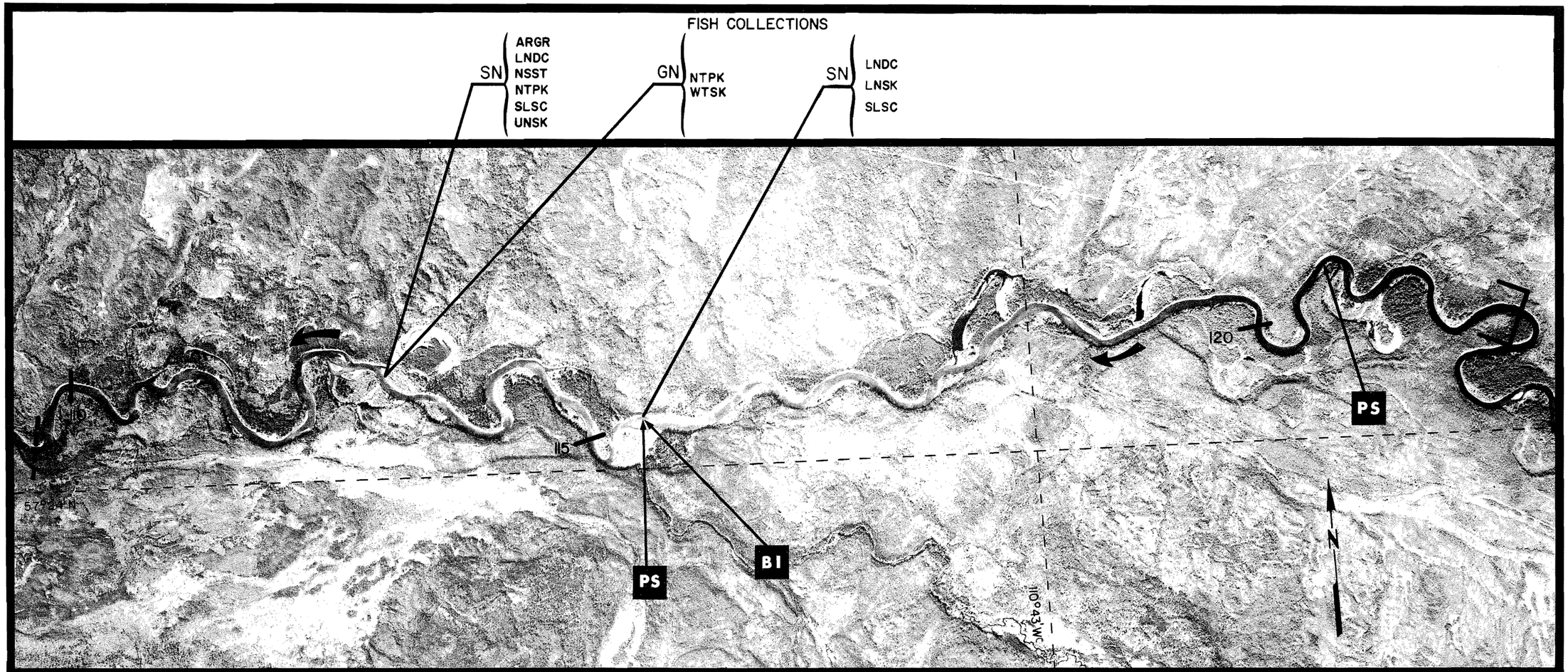


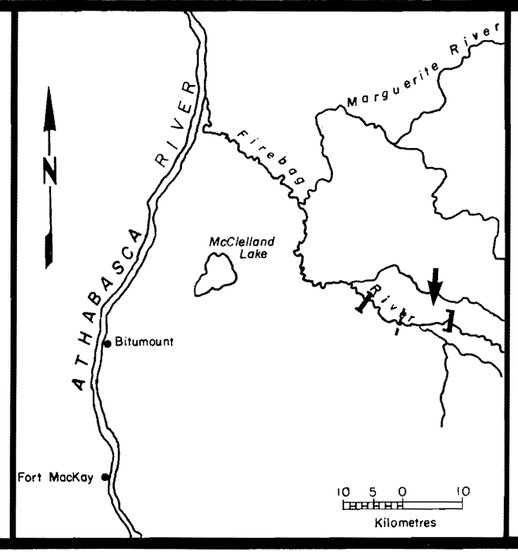
POINT SAMPLE DATA

	km 115	km 121
Location		
Date	21/05/78	21/05/78
Hydraulics		
channel width (m)	25	35
wet width (m)	25	35
maximum depth (m)	ND	ND
average depth (m)	0.8	1.0
velocity (m/s)	ND	1.20
flow character	rolling	rolling, broken
Substrate Composition (%)		
fines (< 2mm)	0	2
gravels (2–64mm)	25	3
larges (>64mm)	75	95
bedrock and/or oil sand	0	0
Bank		
height (m)	2.0	2.5
form	repose	repose
stability	stable	stable
texture	ND	ND
vegetation (% coverage)		
coniferous trees	ND	30
deciduous trees	ND	20
shrubs	20	10
grasses	70	70
barren	0	0
Water Quality		
temperature (°C)	ND	14.0
dissolved oxygen (mg/l)	ND	ND
conductivity (µmhos/cm)	ND	ND
pH	ND	ND

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

FIREBAG RIVER

Reach 6 Section 2

(km 109.5 to km 123.0)

Scale 1 : 25000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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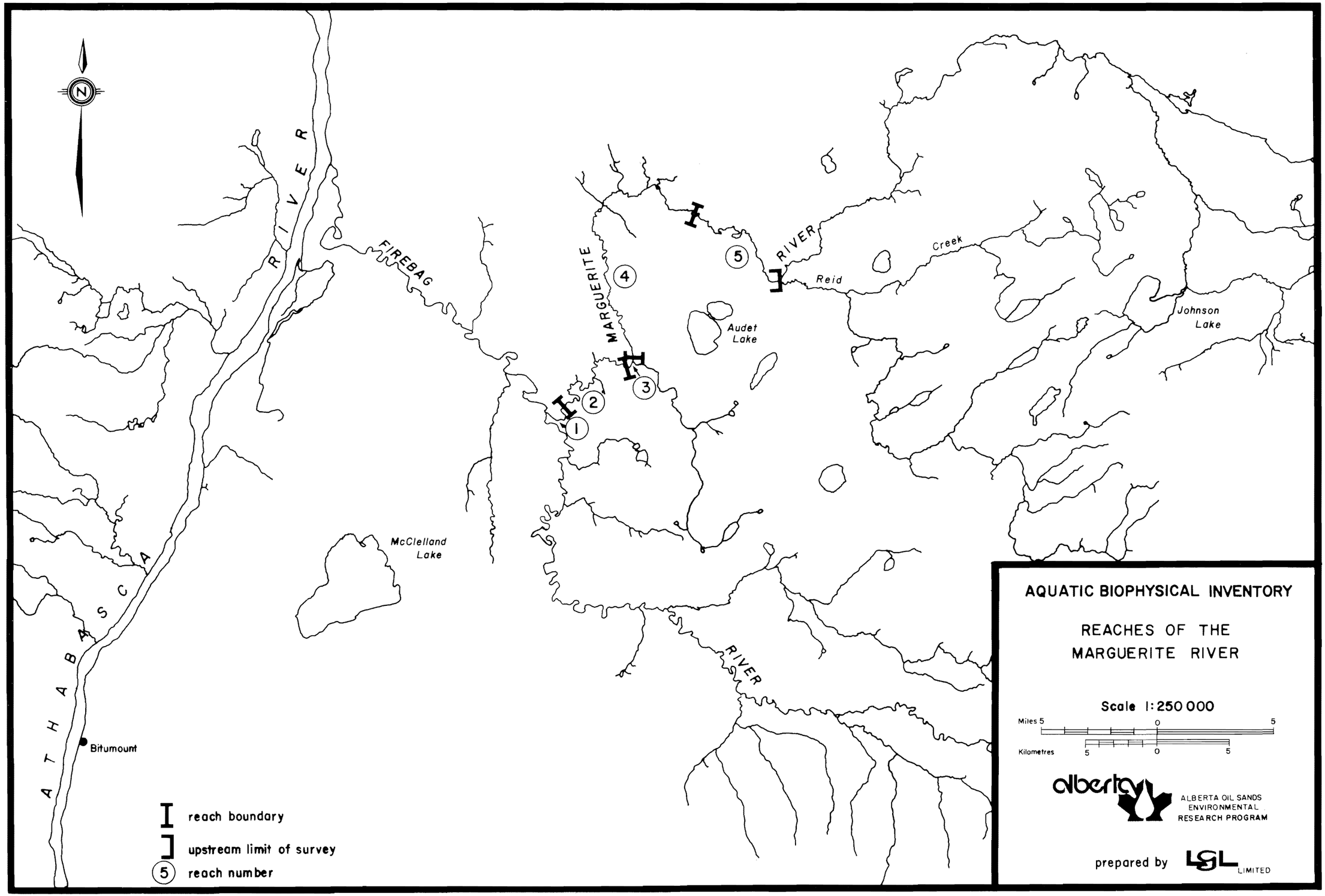
MARGUERITE RIVER


N
RIVER
FIREBAG
MARGUERITE
RIVER
Reid
Creek
Audet
Lake
Johnson
Lake
McClelland
Lake
ATHABASCA
RIVER
Bitumount
1
2
3
4
5
reach boundary
upstream limit of survey
reach number
AQUATIC BIOPHYSICAL INVENTORY
REACHES OF THE
MARGUERITE RIVER
Scale 1:250 000
Miles 5 0 5
Kilometres 5 0 5
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RESEARCH PROGRAM
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NUMBERS OF FISH COLLECTED (1978)

Species	Adults		Juveniles and Young-of-the-year		Total numbers	
	May	September	May	September	May	September
arctic grayling	1	1	1	0	2	1
lake chub	0	0	0	8	0	8
longnose dace	0	0	0	13	0	13
longnose sucker	5	1	0	10	5	11
northern pike	0	2	0	0	0	2
slimy sculpin	0	0	0	1	0	1
trout-perch	0	1	0	7	0	8
unidentified suckers	0	0	0	3	0	3
white sucker	0	0	0	8	0	8
Total	6	5	1	50	7	55

PHYSICAL CHARACTERISTICS

Reach length (km)	3.0
Channel width (m)	40
Channel area (ha)	12.0
Gradient (m/km)	1.4
Flow character	broken, tumbling
Total pools (%)	10
Pattern	irregular
Confinement	frequently confined
Unstable banks (%)	10
Substrate composition (%)	
fines (<2 mm)	10
gravels (2-64 mm)	25
larges (>64 mm)	45
bedrock and/or oil sand	20
Debris	moderate

REACH DESCRIPTION AND FISH UTILIZATION

A relatively short reach, this section flows in an irregular pattern and the river banks are relatively stable. Water velocities are the highest and gradient is the second highest recorded in the surveyed portion of the river. A low proportion of the total reach area is composed of pools. The flow character is primarily broken and tumbling, with occasional white-water rapids where the river flows over limestone ledges. Substrate composition is varied, with gravels and larges predominating. Deciduous trees and grasses dominate the riparian vegetation and there is a moderate amount of vegetation overhanging the channel.

The diversity of substrate types in this reach provides spawning areas which are probably suitable for many of the fish species found in the Marguerite River. Arctic grayling, mountain whitefish, suckers, and some of the minnows may spawn over the rocky substrates, and the remaining species may spawn over either the rocky or the sandy substrates. Adult arctic grayling and longnose suckers, both spring spawners, were captured here in the spring. The rocky substrates, moderate quantities of debris, and overhanging vegetation provide some rearing areas for several fish species. Young individuals of seven species were captured in this reach. Because of the relatively high water velocities and low number of pools, the resting and feeding potential for larger fish is considered to be low, although some larger fish may inhabit areas near the banks which are shaded by overhanging vegetation. Shallow water depths and the low number of pools preclude significant overwintering of fish in the reach.

BENTHIC INVERTEBRATES

- GASTROPODA
  - *Stagnicola*
- PELECYPODA
  - *Musculium*
  - *Sphaerium*
- INSECTA
  - Ephemeroptera
    - *Baetis*
    - *Drunella*
    - *Ephemera*
    - *Paraleptophlebia*
    - *Stenonema*
  - Plecoptera
    - *Pteronarcys*
  - Trichoptera
    - *Cheumatopsyche*
    - *Glossosoma*
    - *Lepidostoma*
  - Diptera
    - Chironomidae
      - Tanypodinae
    - Rhagionidae
      - *Atherix*
    - Empididae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	20
Deciduous trees	40
Shrubs	20
Grasses	40
Barren	0
Channel cover (%)	
Overhang	5
Crown	0

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach

Marguerite River at km 0.5.

AQUATIC BIOPHYSICAL INVENTORY
MARGUERITE RIVER

Reach 1
(km 0 to km 3)

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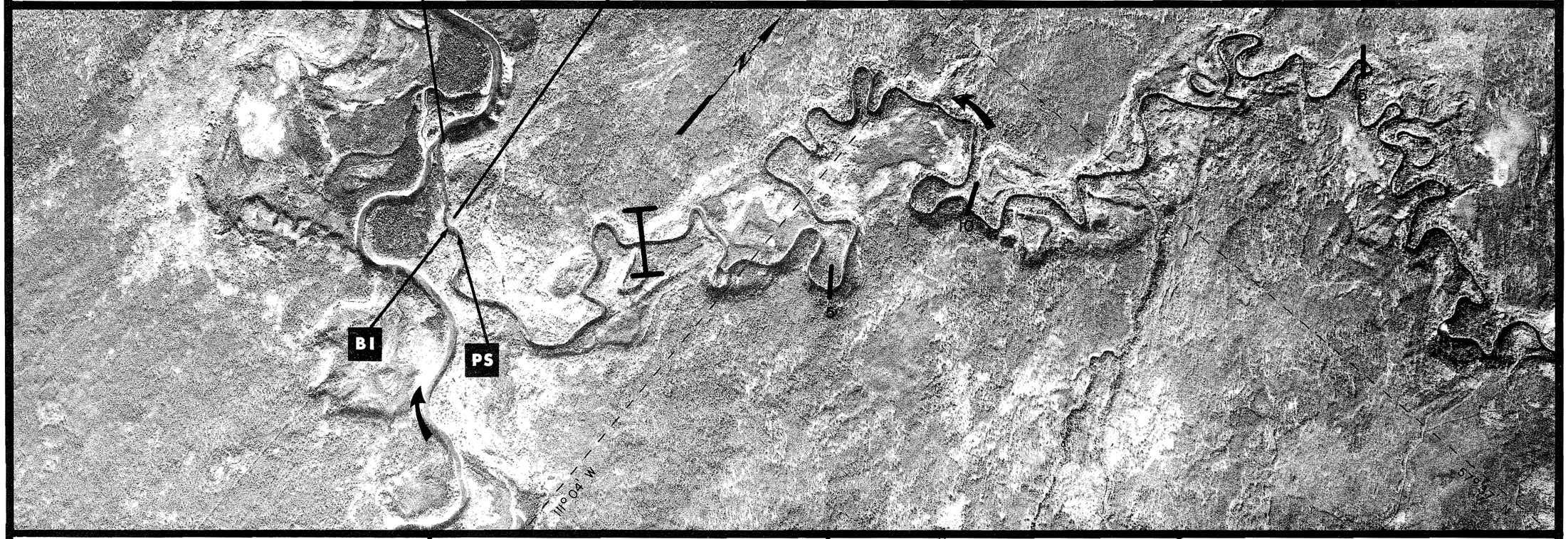
FISH COLLECTIONS

GN: ARGR, LNSK, NTPK

SN: LKCH, LNDC, LNSK, SLSC, TRPC, UNSK, WTSK

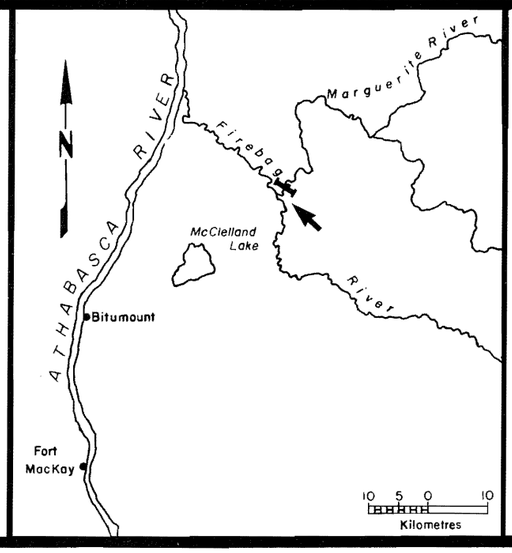


POINT SAMPLE DATA

Location	km 0.5
Date	28/05/78
Hydraulics	
channel width (m)	50
wet width (m)	50
maximum depth (m)	ND
average depth (m)	1.0
velocity (m/s)	1.00
flow character	swirling, rolling
Substrate Composition (%)	
fines (< 2mm)	5
gravels (2–64mm)	45
larges (>64mm)	50
bedrock and/or oil sand	0
Bank	
height (m)	2.5
form	reposo
stability	stable
texture	sand
vegetation (% coverage)	
coniferous trees	5
deciduous trees	70
shrubs	30
grasses	50
barren	0
Water Quality	
temperature (°C)	10.0
dissolved oxygen (mg/l)	ND
conductivity (µmhos/cm)	ND
pH	ND

LEGEND

AN angling	ARGR arctic grayling
CF counting fence	BKST brook stickleback
DN dip net	BRMN brassy minnow
EF electrofisher	BURB burbot
GN gill net	DLVR Dolly Varden
KS kick sample	EGGS unidentified fish eggs
SF small fish collections made using a combination of methods	EMSH emerald shiner
SN seine	FLCH flathead chub
AP benthic algal productivity station	FSDC finescale dace
BI benthic invertebrate collection site	FTMN fathead minnow
CH water quality station	GOLD goldeye
PS point sample	LKCH lake chub
SG stream gauging station	LKCS lake cisco
35 kilometres from mouth	LKWF lake whitefish
flow direction	LNDC longnose dace
reach boundary	LNSK longnose sucker
upstream limit of survey	MTWF mountain whitefish
division between sections of a reach	NRDC northern redbelly dace
	NSST ninespine stickleback
	NTPK northern pike
	PLDC pearl dace
	SLSC slimy sculpin
	SPSC spoonhead sculpin
	SPSH spottail shiner
	TRPC trout-perch
	UNSK unidentified sucker species
	WALL walleye
	WTSK white sucker
	YLPR yellow perch



AQUATIC BIOPHYSICAL INVENTORY

MARGUERITE RIVER

Reach 1

(km 0 to km 3)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (1978)

Species	Adults		Juveniles and Young-of-the-year		Total Numbers	
	May	September	May	September	May	September
arctic grayling	0	0	3	0	3	0
brook stickleback	0	0	0	1	0	1
lake chub	0	0	1	44	1	44
longnose dace	0	0	0	9	0	9
longnose sucker	0	0	2	14	2	14
slimy sculpin	0	0	0	4	0	4
spoonhead sculpin	0	0	2	0	2	0
trout-perch	0	0	0	3	0	3
unidentified suckers	0	0	0	7	0	7
white sucker	0	0	3	8	3	8
Total	0	0	11	90	11	90

PHYSICAL CHARACTERISTICS

Reach length (km)	15.5
Channel width (m)	30
Channel area (ha)	46.5
Gradient (m/km)	0.8
Flow character	placid, swirling
Total pools (%)	90
Pattern	tortuously meandering
Confinement	confined
Unstable banks (%)	25
Substrate composition (%)	
fines (<2 mm)	70
gravels (2-64 mm)	30
larges (>64 mm)	0
bedrock and/or oil sand	0
Debris	low

REACH DESCRIPTION AND FISH UTILIZATION

This section is tortuously meandering and is essentially a long continuously swirling or placid pool. Gradient and water velocities are moderate. The substrate is mostly fines with some gravels. Coniferous and deciduous trees and deciduous shrubs are all important components of the riparian vegetation, and grasses are abundant. A moderate amount of vegetation overhangs the channel.

The predominating sandy substrates provide areas suitable for spawning of a few of the forage fish (e.g., trout-perch, pearl dace) found in the reach. Areas with gravelly substrates which may be suitable for spawning of the other species found in the river are limited. No adults were captured in this reach during the study. Rearing potential is considered to be poor to moderate; the moderate amount of overhanging vegetation and the small amount of debris provide the only suitable areas. Young lake chub were the most abundant fish collected. Moderate numbers of small forage fish and young of larger species captured in the reach provide a food source for piscivores, such as northern pike. Resting and feeding potential for larger fish is considered to be good to excellent because of the many pools in the reach. Overwintering potential is considered to be excellent because of the generally deep waters and large number of pools.

BENTHIC INVERTEBRATES

OLIGOCHAETA
PELECYPODA
Musculium
INSECTA
Hemiptera
Corixidae
Diptera
Tipulidae
Chironomidae
Chironominae
Tanypodinae
Orthocladiinae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	25
Deciduous trees	25
Shrubs	25
Grasses	60
Barren	0
Channel cover (%)	
Overhang	5
Crown	0

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

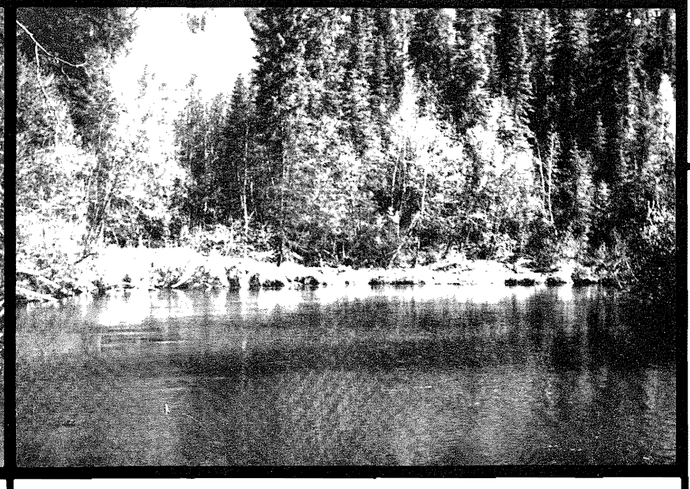
STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach

Overhanging vegetation at km 5.



Placid pool, typical of reach 2, at km 10.5.

AQUATIC BIOPHYSICAL INVENTORY
MARGUERITE RIVER
Reach 2
(km 3.0 to km 18.5)

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

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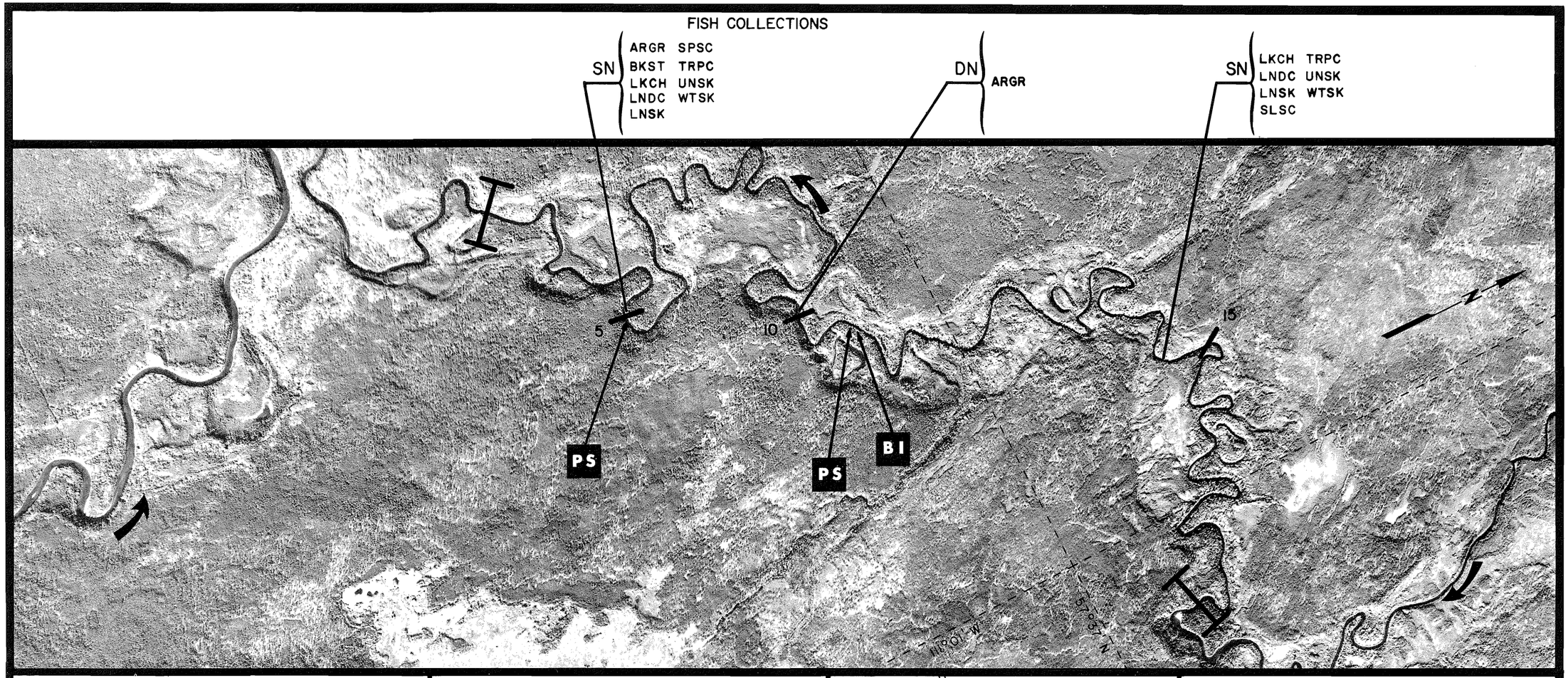
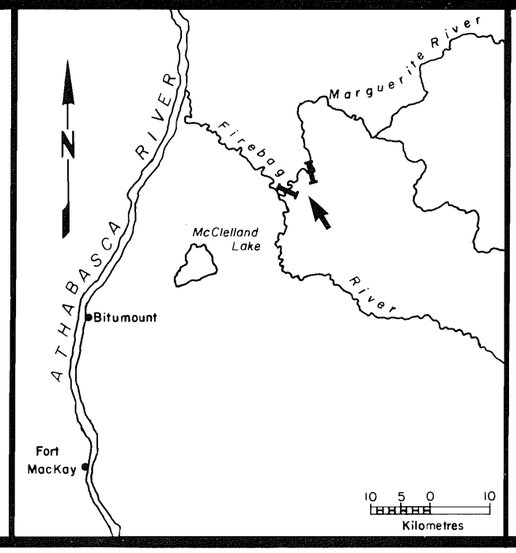


POINT SAMPLE DATA

	km 5	km 10.5
Location		
Date	27/05/78	27/05/78
Hydraulics		
channel width (m)	30	25
wet width (m)	30	25
maximum depth (m)	ND	ND
average depth (m)	ND	2.0
velocity (m/s)	0.80	0.80
flow character	placid	placid
Substrate Composition (%)		
fines (< 2 mm)	100	100
gravels (2–64 mm)	0	0
larges (>64 mm)	0	0
bedrock and/or oil sand	0	0
Bank		
height (m)	5.0	6.5
form	repose	repose
stability	stable	stable
texture	sand	sand
vegetation (% coverage)		
coniferous trees	80	25
deciduous trees	5	35
shrubs	10	20
grasses	75	10
barren	5	0
Water Quality		
temperature (°C)	10.0	10.0
dissolved oxygen (mg/l)	ND	ND
conductivity (µmhos/cm)	ND	ND
pH	ND	ND

LEGEND

AN angling	ARGR arctic grayling
CF counting fence	BKST brook stickleback
DN dip net	BRMN brassy minnow
EF electrofisher	BURB burbot
GN gill net	DLVR Dolly Varden
KS kick sample	EGGS unidentified fish eggs
SF small fish collections made using a combination of methods	EMSH emerald shiner
SN seine	FLCH flathead chub
AP benthic algal productivity station	FSDC finescale dace
BI benthic invertebrate collection site	FTMN fathead minnow
CH water quality station	GOLD goldeye
PS point sample	LKCH lake chub
SG stream gauging station	LKCS lake cisco
35 kilometres from mouth	LKWF lake whitefish
flow direction	LNDC longnose dace
I reach boundary	LNSK longnose sucker
] upstream limit of survey	MTWF mountain whitefish
division between sections of a reach	NRDC northern redbelly dace
	NSST ninespine stickleback
	NTPK northern pike
	PLDC pearl dace
	SLSC slimy sculpin
	SPSC spoonhead sculpin
	SPSH spottail shiner
	TRPC trout-perch
	UNSK unidentified sucker species
	WALL walleye
	WTSK white sucker
	YLPR yellow perch



AQUATIC BIOPHYSICAL INVENTORY

MARGUERITE RIVER

Reach 2

(km 3.0 to km 18.5)

Scale 1: 25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

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NUMBERS OF FISH COLLECTED (1978)

Species	Adults		Juveniles and Young-of-the-year		Total Numbers	
	May	September	May	September	May	September
arctic grayling	0	0	5	4	5	4
lake chub	0	0	0	3	0	3
longnose dace	0	0	1	2	1	2
longnose sucker	0	0	0	7	0	7
mountain whitefish	0	0	0	6	0	6
northern pike	0	2	0	0	0	2
slimy sculpin	0	1	13	47	13	48
trout-perch	0	0	1	0	1	0
unidentified suckers	0	0	0	1	0	1
white sucker	0	0	4	4	4	4
Total	0	3	24	74	24	77

PHYSICAL CHARACTERISTICS

Reach length (km)	1.5
Channel width (m)	25
Channel area (ha)	3.8
Gradient (m/km)	3.0
Flow character	broken, tumbling
Total pools (%)	10
Pattern	irregularly meandering
Confinement	confined
Unstable banks (%)	25
Substrate composition (%)	
fines (<2 mm)	30
gravels (2-64 mm)	15
larges (>64 mm)	40
bedrock and/or oil sand	15
Debris	moderate

REACH DESCRIPTION AND FISH UTILIZATION

This reach is a short section which is almost entirely riffles. Gradient is the highest and water velocities the second highest in the surveyed portion of the Marguerite River. Substrate types are varied, with larges and fines being the most abundant. Coniferous and deciduous trees, deciduous shrubs, and grasses are all important components of the riparian vegetation and a fairly high proportion of the channel is covered by overhanging shrubs.

Because the reach contains a diversity of substrate sizes, current velocities, and water depths, spawning potential is considered to be good to excellent. The collection of unidentified fish eggs in late May provided proof of spawning in the reach. Rearing potential is considered to be good because of the rocky substrates, moderate quantities of debris, and the relative abundance of overhanging vegetation. Young of eight fish species were captured in this reach and slimy sculpin were especially abundant. Resting and feeding potential for larger fish is considered to be poor to moderate; the major suitable areas being those under overhanging vegetation. Relatively high water velocities and the low number of pools limit the resting and feeding potential for larger fish. Shallow water depths and the low number of pools probably preclude overwintering of fish.

BENTHIC INVERTEBRATES

- OLIGOCHAETA
- HIRUDINEA
- INSECTA
  - Ephemeroptera
    - *Baetis*
    - *Drunella*
    - *Ephemerella*
    - *Stenonema*
  - Odonata
    - *Ophiogomphus*
  - Hemiptera
    - Corixidae
  - Trichoptera
    - *Ceraclea*
    - *Glossosoma*
    - *Lepidostoma*
    - *Micrasema*
    - *Oecetis*
    - *Polycentropus*
  - Coleoptera
    - Elmidae
  - Diptera
    - Tipulidae
    - Psychodidae
    - Chironomidae
      - Chironominae
      - Tanypodinae
      - Orthocladiinae
    - Simuliidae
    - Rhagionidae
      - *Atherix*
    - Empididae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	25
Deciduous trees	25
Shrubs	25
Grasses	25
Barren	0
Channel cover (%)	
Overhang	10
Crown	0

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach

Large riffle area at km 19.5.

AQUATIC BIOPHYSICAL INVENTORY
MARGUERITE RIVER
Reach 3
(km 18.5 to km 20.0)

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prepared by LGL LIMITED

FISH COLLECTIONS

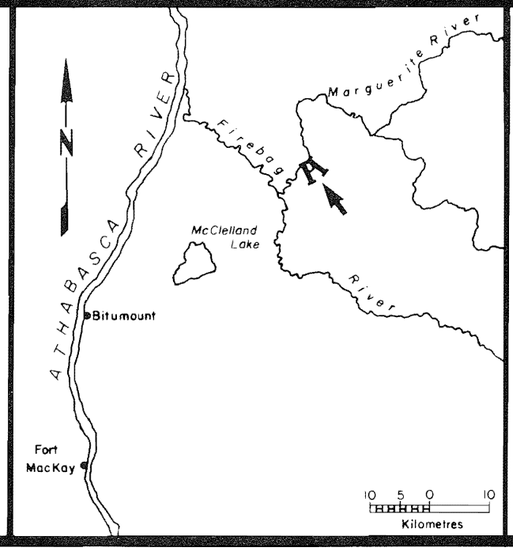
GN: NTPK
DN: EGGS
KS: EGGS
SN: ARGR SLSC LKCH TRPC LNDC UNSK LNSK WTSK MTWF

POINT SAMPLE DATA

Location	km 19.5
Date	27/05/78
Hydraulics	
channel width (m)	32
wet width (m)	32
maximum depth (m)	ND
average depth (m)	0.8
velocity (m/s)	1.20
flow character	broken
Substrate Composition (%)	
fines (< 2mm)	50
gravels (2–64mm)	0
larges (>64mm)	50
bedrock and/or oil sand	0
Bank	
height (m)	1.0
form	repose
stability	stable
texture	sand
vegetation (% coverage)	
coniferous trees	45
deciduous trees	35
shrubs	55
grasses	5
barren	0
Water Quality	
temperature (°C)	9.5
dissolved oxygen (mg/l)	ND
conductivity (µmhos/cm)	ND
pH	ND

LEGEND

AN angling	ARGR arctic grayling
CF counting fence	BKST brook stickleback
DN dip net	BRMN brassy minnow
EF electrofisher	BURB burbot
GN gill net	DLVR Dolly Varden
KS kick sample	EGGS unidentified fish eggs
SF small fish collections made using a combination of methods	EMSH emerald shiner
SN seine	FLCH flathead chub
AP benthic algal productivity station	FSDC finescale dace
	FTMN fathead minnow
	GOLD goldeye
BI benthic invertebrate collection site	LKCH lake chub
	LKCS lake cisco
CH water quality station	LKWF lake whitefish
	LNDC longnose dace
PS point sample	LNSK longnose sucker
	MTWF mountain whitefish
SG stream gauging station	NRDC northern redbelly dace
	NSST ninespine stickleback
35 kilometres from mouth	NTPK northern pike
	PLDC pearl dace
flow direction	SLSC slimy sculpin
	SPSC spoonhead sculpin
reach boundary	SPSH spottail shiner
	TRPC trout-perch
upstream limit of survey	UNSK unidentified sucker species
	WALL walleye
division between sections of a reach	WTSK white sucker
	YLPR yellow perch



AQUATIC BIOPHYSICAL INVENTORY

MARGUERITE RIVER

Reach 3

(km 18.5 to km 20.0)

Scale 1: 25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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NUMBERS OF FISH COLLECTED (1978)

Species	Adults		Juveniles and Young-of-the-year		Total Numbers	
	May	September	May	September	May	September
arctic grayling	0	1	4	0	4	1
brook stickleback	0	0	0	2	0	2
lake chub	0	0	0	244	0	244
longnose dace	0	0	0	1	0	1
longnose sucker	0	0	1	15	1	15
northern pike	0	2	0	0	0	2
pearl dace	0	0	0	4	0	4
slimy sculpin	0	1	0	17	0	18
spoonhead sculpin	0	0	1	1	1	1
trout-perch	0	0	0	22	0	22
unidentified suckers	0	0	0	8	0	8
white sucker	0	2	0	34	0	36
Total	0	6	6	348	6	354

PHYSICAL CHARACTERISTICS

Reach length (km)	41.0
Channel width (m)	25
Channel area (ha)	102.5
Gradient (m/km)	0.4
Flow character	placid
Total pools (%)	90
Pattern	irregularly meandering
Confinement	occasionally confined
Unstable banks (%)	20
Substrate composition (%)	
fines (<2 mm)	90
gravels (2-64 mm)	0
larges (>64 mm)	10
bedrock and/or oil sand	0
Debris	high

REACH DESCRIPTION AND FISH UTILIZATION

This is the longest of the reaches in the surveyed portion of the Marguerite River, and it is essentially a long, irregularly meandering placid pool. Water velocities and gradient are the lowest in the surveyed portion of the river. Most of the substrate in the reach is fines, but larges are present in some areas. Riparian vegetation is dominated by coniferous trees and deciduous shrubs and a relatively high proportion of the channel area is covered by overhanging vegetation. Large quantities of debris are present in this reach.

The substrate material in this reach is not suitable for spawning by the majority of the fish species captured in the reach. A few forage fish that normally spawn over sandy substrates would find ample suitable spawning areas in this reach. Large quantities of debris, an abundance of overhanging vegetation, and low water velocities provide good to excellent rearing areas in the reach. Very high numbers of young fish, particularly lake chub, were captured here in September. Excellent resting and feeding habitat for larger fish in the reach is provided by the many pools and areas sheltered by overhanging vegetation and debris. Piscivores have an abundant food supply in this reach. Although there are many pools in the reach, they may not be deep enough for fish to overwinter in.

BENTHIC INVERTEBRATES

OLIGOCHAETA
HIRUDINEA
PELECYPODA
Musculium
INSECTA
Hemiptera
Corixidae
Trichoptera
Limnephilus/Philarctus
Diptera
Tipulidae
Chironomidae
Chironominae
Tanypodinae
Orthocladiinae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	50
Deciduous trees	5
Shrubs	45
Grasses	20
Barren	0
Channel cover (%)	
Overhang	20
Crown	0

BENTHIC ALGAL PRODUCTIVITY

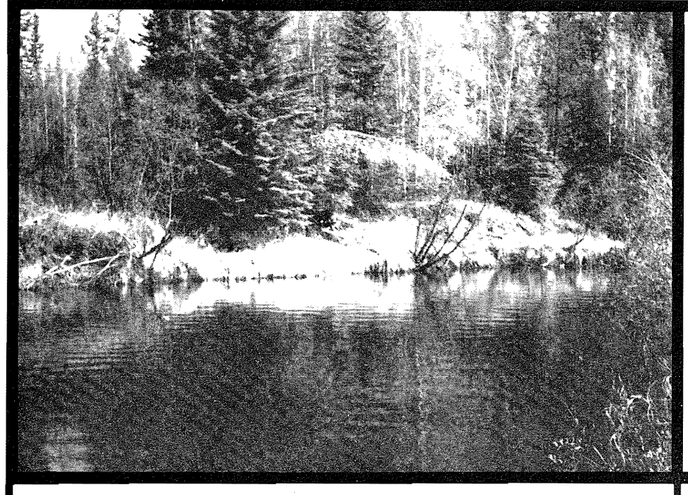
No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach



Slow-moving pool at km 45 is representative of reach 4.

AQUATIC BIOPHYSICAL INVENTORY
MARGUERITE RIVER

Reach 4
(km 20 to km 61)

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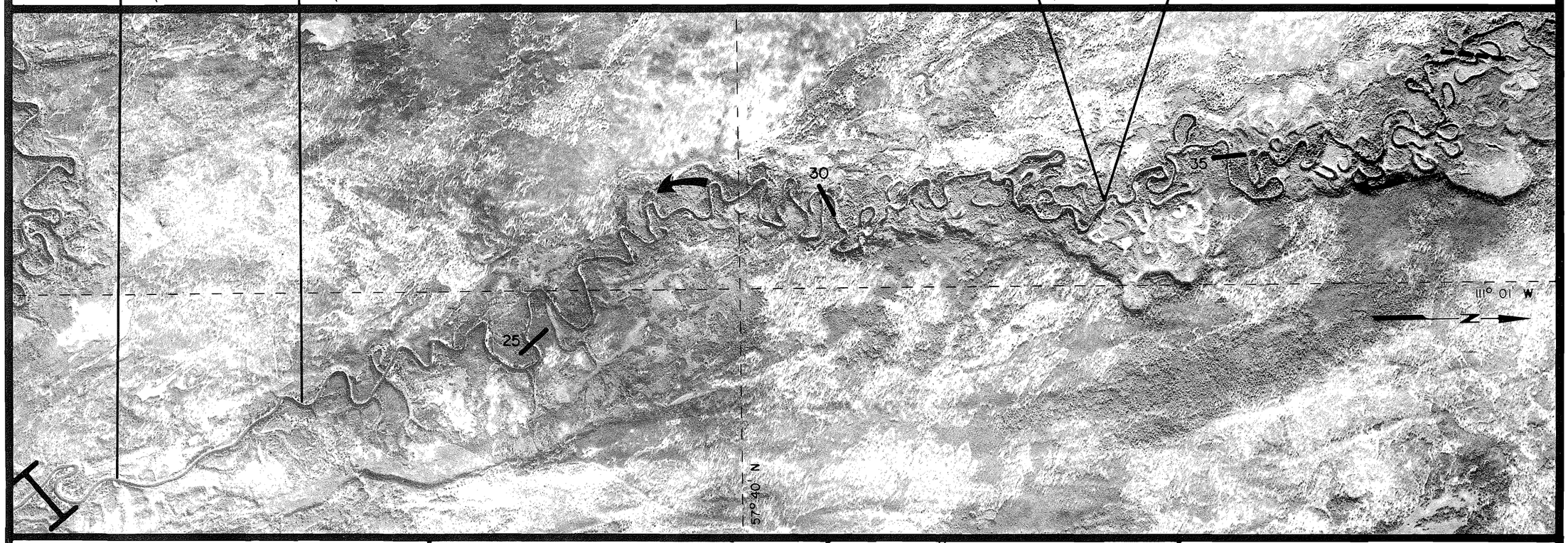
FISH COLLECTIONS

SN: LKCH, LNDC, LNSK, TRPC, WTSK

GN: NO CATCH

SN: LKCH SPSC, LNSK TRPC, PLDC WTSK, SLSC

GN: ARGR, NTPK, WTSK



POINT SAMPLE DATA

Location
Date
Hydraulics
- channel width (m)
- wet width (m)
- maximum depth (m)
- average depth (m)
- velocity (m/s)
- flow character

Substrate Composition (%)
- fines (< 2 mm)
- gravels (2–64 mm)
- larges (>64 mm)
- bedrock and/or oil sand

Bank
- height (m)
- form
- stability
- texture

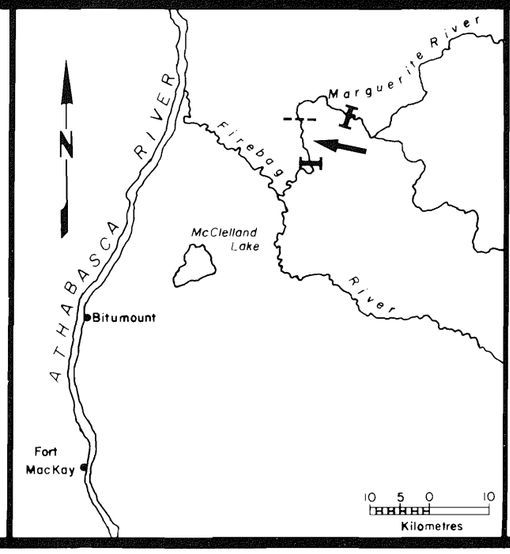
- vegetation (% coverage)
  - coniferous trees
  - deciduous trees
  - shrubs
  - grasses
  - barren

Water Quality
- temperature (°C)
- dissolved oxygen (mg/l)
- conductivity (µmhos/cm)
- pH

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

MARGUERITE RIVER

Reach 4 Section 1

(km 20 to km 39)

Scale 1: 25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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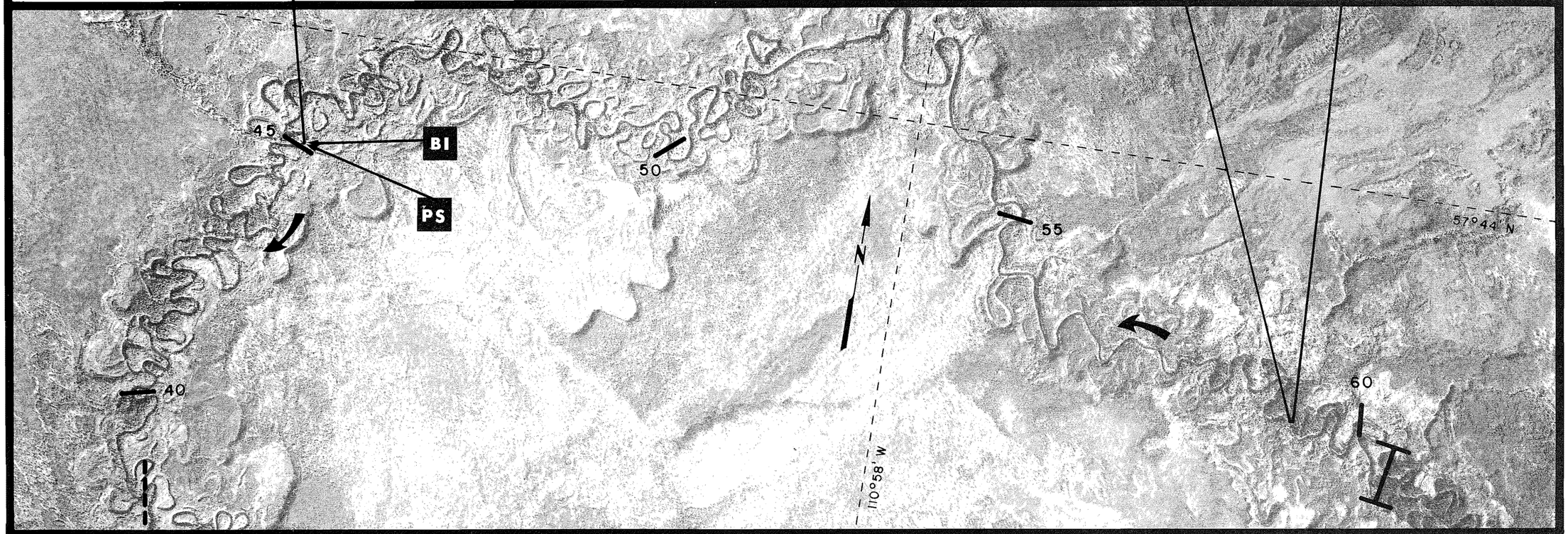
FISH COLLECTIONS

SN ARGR LNSK SPSC

GN NO CATCH

SN BKST TRPC LKCH UNSK LNSK WTSK SLSC



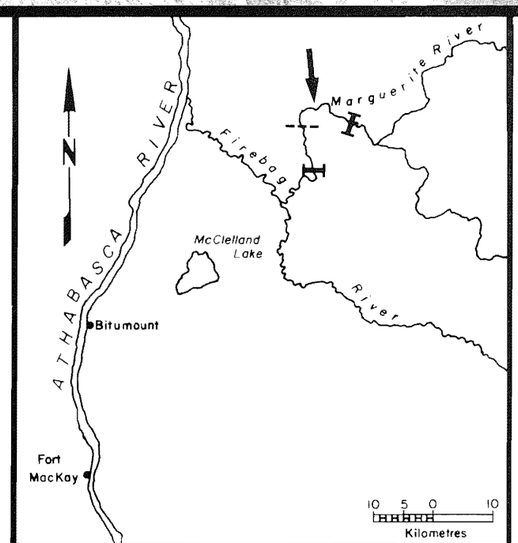
POINT SAMPLE DATA

Location	km 45
Date	27/05/78
Hydraulics	
channel width (m)	28
wet width (m)	28
maximum depth (m)	ND
average depth (m)	0.8
velocity (m/s)	0.40
flow character	placid
Substrate Composition (%)	
fines (< 2 mm)	100
gravels (2–64 mm)	0
larges (>64 mm)	0
bedrock and/or oil sand	0
Bank	
height (m)	2.5
form	repose
stability	stable
texture	sand
vegetation (% coverage)	
coniferous trees	10
deciduous trees	25
shrubs	40
grasses	20
barren	0
Water Quality	
temperature (°C)	8.0
dissolved oxygen (mg/l)	ND
conductivity (µmhos/cm)	ND
pH	ND

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
	reach boundary
	upstream limit of survey
	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

MARGUERITE RIVER

Reach 4 Section 2

(km 39 to km 61)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

alberta

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (1978)

Species	Adults		Juveniles and Young-of-the-year		Total Numbers	
	May	September	May	September	May	September
arctic grayling	0	ND	6	ND	6	ND
slimy sculpin	3	ND	7	ND	10	ND
Total	3	ND	13	ND	16	ND

PHYSICAL CHARACTERISTICS

Reach length (km)	14.0
Channel width (m)	20
Channel area (ha)	28.0
Gradient (m/km)	0.8
Flow character	rolling, broken
Total pools (%)	20
Pattern	irregularly meandering
Confinement	unconfined
Unstable banks (%)	5
Substrate composition (%)	
fines (<2 mm)	20
gravels (2-64 mm)	20
larges (>64 mm)	40
bedrock and/or oil sand	20
Debris	high

REACH DESCRIPTION AND FISH UTILIZATION

This reach is the uppermost section of the surveyed portion of the Marguerite River. It is an irregularly meandering section with stable banks. Gradient and water velocities are moderate and the majority of the reach is riffles. The substrate is characterized by an abundance of larges mixed with fines and gravels. Deciduous trees are the dominant component of the riparian vegetation and a relatively high proportion of the channel is shaded by overhanging vegetation. As in Reach 4, large quantities of debris are present in this reach.

Although very few fish were collected in this reach during the study, conditions are considered to be excellent for spawning of most fish species in the Marguerite River because of the diversity of water depths, water velocities and substrate sizes. An abundance of debris, overhanging vegetation, and rocky substrate materials provides good to excellent rearing conditions for most fish. The potential for resting and feeding of larger fish is considered to be only fair; the few pools present and those areas shaded by overhanging vegetation would be most suitable. Shallow water depths and the relative paucity of deep pools limit overwintering potential in this reach.

BENTHIC INVERTEBRATES

- OLIGOCHAETA
- HIRUDINEA
  - Glossiphoniidae
- GASTROPODA
  - *Stagnicola*
- PELECYPODA
  - *Musculium*
  - *Sphaerium*
- INSECTA
  - Ephemeroptera
    - *Baetis*
    - *Drunella*
    - *Ephemerella*
    - *Paraleptophlebia*
    - *Stenonema*
  - Odonata
    - *Ophiogomphus*
  - Plecoptera
    - *Claassenia*
    - *Isoperla*
    - *Pteronarcys*
  - Trichoptera
    - *Glossosoma*
    - *Hydropsyche*
    - *Lepidostoma*
    - *Oecetis*
    - *Polycentropus*
  - Coleoptera
    - Elmidae
  - Diptera
    - Tipulidae
    - Psychodidae
    - Chironomidae
      - Chironominae
      - Tanypodinae
      - Orthocladiinae
    - Simuliidae
    - Rhagionidae
      - *Atherix*
    - Empididae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	15
Deciduous trees	65
Shrubs	20
Grasses	10
Barren	0
Channel cover (%)	
Overhang	10
Crown	0

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach

AQUATIC BIOPHYSICAL INVENTORY
MARGUERITE RIVER
Reach 5
(km 61 to km 75)

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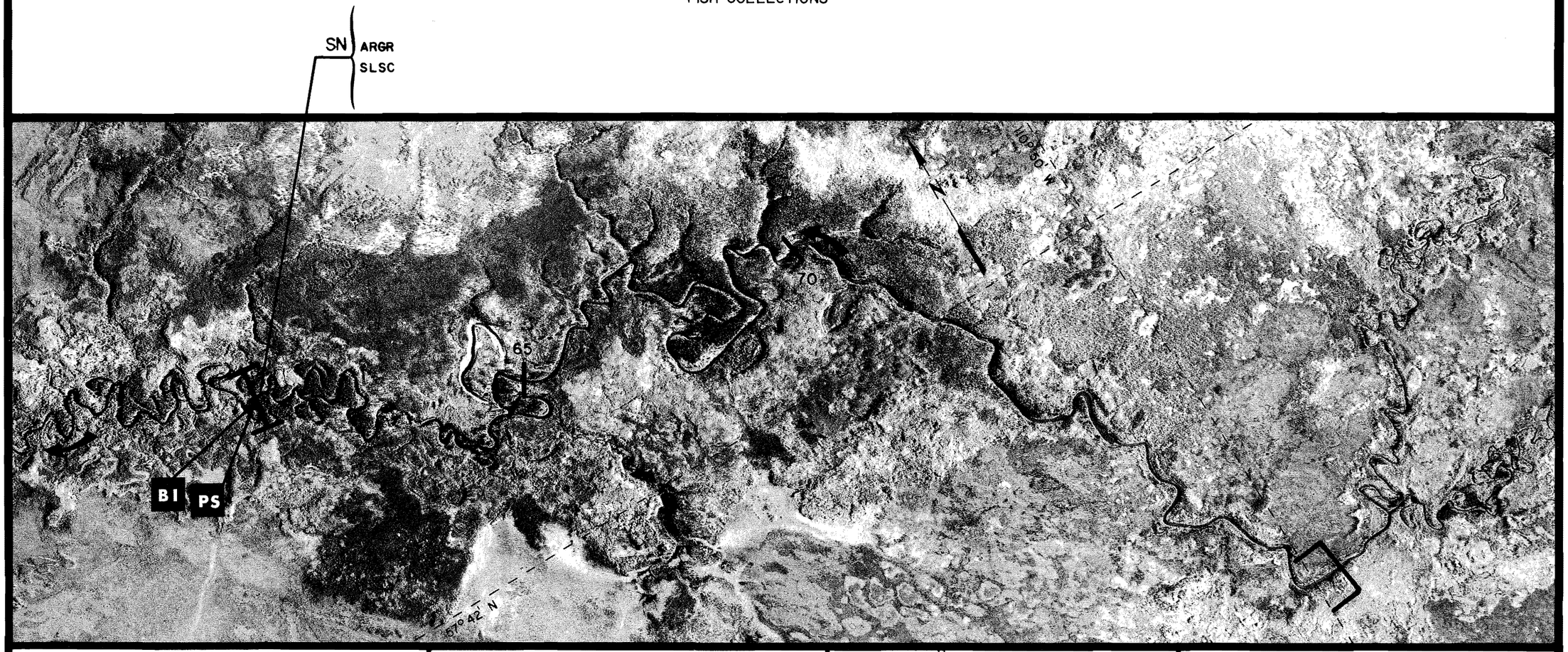
FISH COLLECTIONS



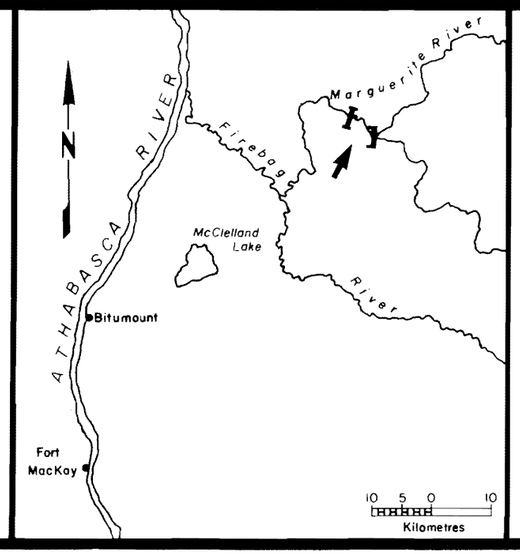
POINT SAMPLE DATA

Location	km 61
Date	27/05/78
Hydraulics	
channel width (m)	50
wet width (m)	50
maximum depth (m)	ND
average depth (m)	ND
velocity (m/s)	1.20
flow character	swirling, broken
Substrate Composition (%)	
fines (< 2 mm)	50
gravels (2–64 mm)	10
larges (> 64 mm)	40
bedrock and/or oil sand	0
Bank	
height (m)	2.5
form	repose
stability	stable
texture	sand
vegetation (% coverage)	
coniferous trees	35
deciduous trees	20
shrubs	40
grasses	30
barren	0
Water Quality	
temperature (°C)	8.0
dissolved oxygen (mg/l)	ND
conductivity (µmhos/cm)	ND
pH	ND

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

MARGUERITE RIVER

Reach 5

(km 61 to km 75)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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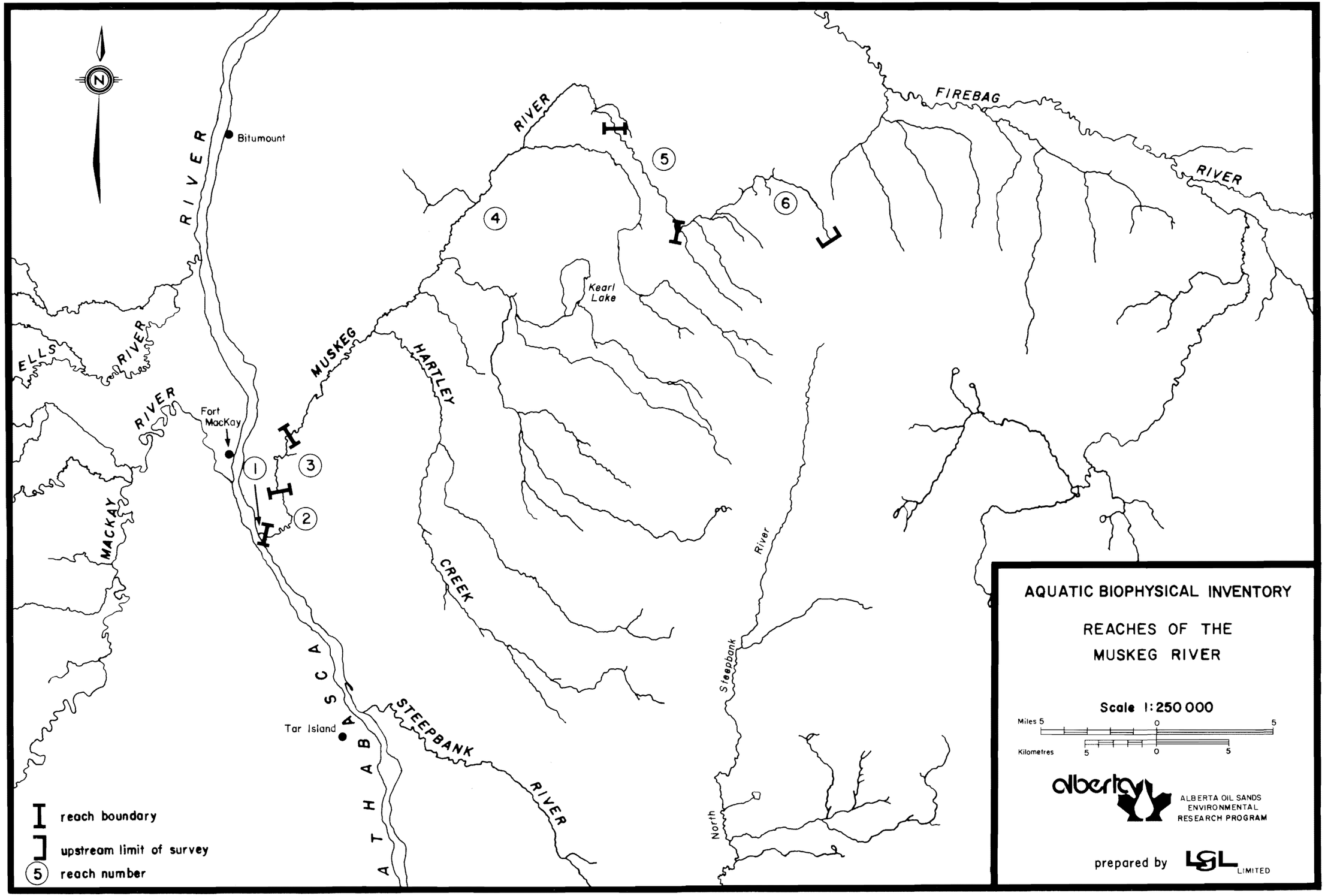
MUSKEG RIVER


N
Bitumount
RIVER
ELLS
RIVER
RIVER
Fort MacKay
MACKAY
MUSKEG
HARTLEY
RIVER
CREEK
Kearl Lake
FIREBAG
RIVER
ATHABASCA
Tar Island
STEEPBANK
RIVER
Steepbank
River
North
1
2
3
4
5
6
reach boundary
upstream limit of survey
reach number
AQUATIC BIOPHYSICAL INVENTORY
REACHES OF THE
MUSKEG RIVER
Scale 1:250 000
Miles 5 0 5
Kilometres 5 0 5
alberta
ALBERTA OIL SANDS
ENVIRONMENTAL
RESEARCH PROGRAM
prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

Species	Adults	Juveniles and Young-of-the-year	Total Numbers
pearl dace	0	2	2
slimy sculpin	0	2	2
Total	0	4	4

PHYSICAL CHARACTERISTICS

Reach length (km)	0.5
Channel width (m)	24
Channel area (ha)	1.2
Gradient (m/km)	3.5
Flow character	swirling, rolling
Total pools (%)	65
Pattern	sinuous
Confinement	unconfined
Unstable banks (%)	30
Substrate composition (%)	
fines (<2 mm)	20
gravels (2-64 mm)	50
larges (>64 mm)	30
bedrock and/or oil sand	0
Debris	low

REACH DESCRIPTION AND FISH UTILIZATION

This lower reach of the Muskeg River extends 0.5 km upstream from the confluence with the Athabasca River. It lies within the floodplain of the Athabasca River and is consequently influenced by fluctuations of water levels in that river. The gradient is moderately high, and although pools comprise the majority of the reach area, the presence of riffles is a prominent feature. There is a relatively high proportion of unstable banks. The substrate in most areas consists primarily of fines and gravels, but there are several areas with substrates containing substantial proportions of cobbles. The riparian vegetation is dominated by deciduous trees. Deciduous shrubs are also fairly abundant and some conifers are present. Little vegetation overhangs the river channel.

Although the sand and gravel substrates and the variety of water velocities in this reach would appear to provide areas suitable for spawning of several species of fish that occur in the Muskeg River (e.g., arctic grayling, longnose sucker, white sucker, trout-perch), most of these species are believed to spawn farther upstream in the Muskeg River. Rearing potential for most species is considered good; there are ample shallow backwater areas that provide suitable habitat. Juveniles and young-of-the-year of several species have been collected in this reach. The presence of forage species and young-of-the-year suckers in the mouth region of the Muskeg River would appear to provide good forage for piscivorous species. The mouth region may also be of some importance as a resting area during upstream migrations of some species (e.g., lake whitefish and walleye) in the Athabasca River. Water depths in this reach are generally shallow and may not be sufficient for overwintering of fish.

BENTHIC INVERTEBRATES

- OLIGOCHAETA
- GASTROPODA
  - *Ferrissia*
  - *Gyraulus*
  - *Stagnicola*
- PELECYPODA
  - *Musculium*
- INSECTA
  - Ephemeroptera
    - *Stenonema*
  - Diptera
    - Chironomidae
      - Chironominae
    - Tabanidae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	5
Deciduous trees	70
Shrubs	30
Grasses	30
Barren	5
Channel cover (%)	
Overhang	2
Crown	0

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

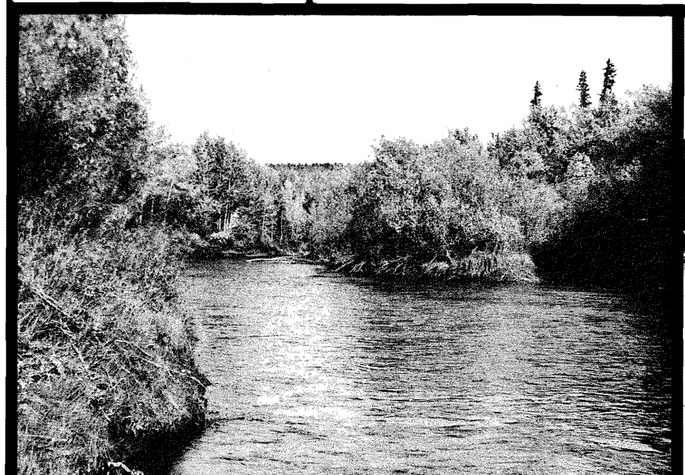
No data available for this reach

WATER QUALITY

Water Survey of Canada station number 00AT07DA0079

	Mean	Maximum	Minimum
Total alkalinity (mg $CaCO_3$/l)	255.0	790.0	113.6
pH	7.90	8.30	7.40
Total hardness (mg $CaCO_3$/l)	229.2	638.3	97.4
Conductance (µS/cm)	473	1360	205
Total filterable residue fixed (mg/l)	241	728	90
Total non-filterable residue fixed (mg/l)	3	8	<0.4
Total organic carbon (mg C/l)	25.0	63.0	10.0
Silica (mg SiO_2/l)	15.0	57.0	2.6
Nitrate and nitrite nitrogen (mg N/l)	0.130	0.600	0.010
Total Kjeldahl nitrogen (mg N/l)	1.75	3.94	0.55
Total Phosphorus (mg P/l)	0.030	0.070	0.005
Orthophosphate (mg P/l)	0.010	0.020	0.004
Sulphate (mg SO_4/l)	3.5	10.9	0.5

Data for the period January 1976 to December 1979 obtained from the National Water Quality Data Bank (NAQUADAT).



Muskeg River 30 m upstream from confluence with the Athabasca River.

Confluence of the Muskeg River with the Athabasca River.

AQUATIC BIOPHYSICAL INVENTORY

MUSKEG RIVER

Reach 1

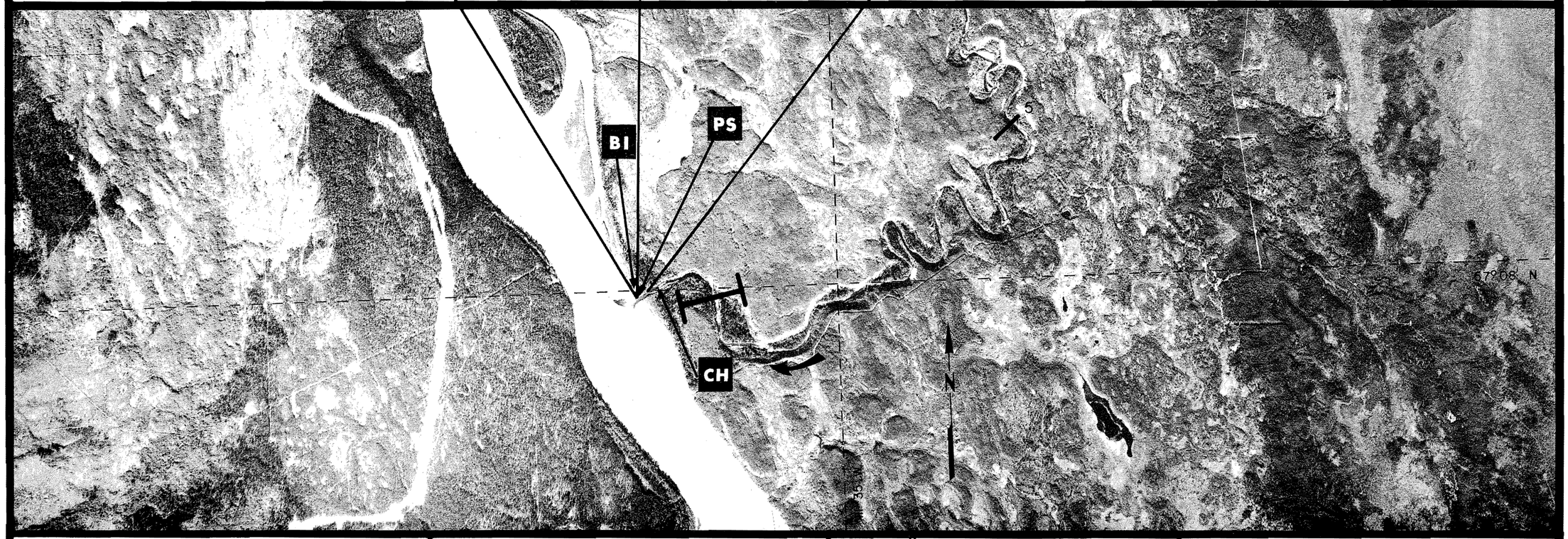
(km 0.0 to km 0.5)

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS

SN	PLDC, SLSC	
EF	NO CATCH	
SF*	ARGR, LKCH, LNDC, SLSC	TRPC, UNSK, YLPR



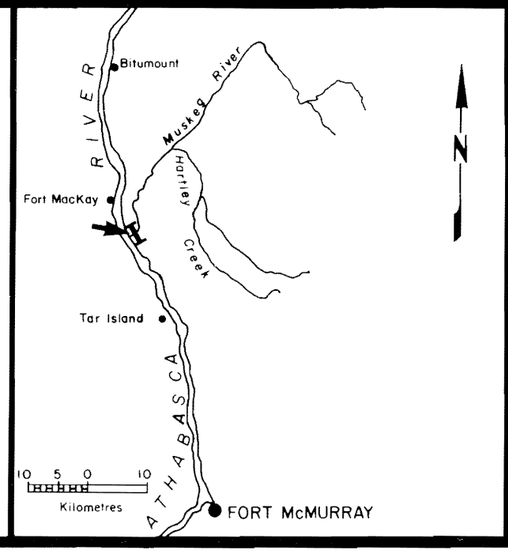
POINT SAMPLE DATA

Location	km 0.03
Date	19/09/79
Hydraulics	
channel width (m)	24.4
wet width (m)	18.8
maximum depth (m)	0.8
average depth (m)	0.6
velocity (m/s)	0.67
flow character	swirling
Substrate Composition (%)	
fines (< 2mm)	35
gravels (2–64mm)	55
larges (>64mm)	10
bedrock and/or oil sand	0
Bank	
height (m)	1.5
form	repose
stability	stable
texture	silt, sand
vegetation (% coverage)	
coniferous trees	5
deciduous trees	75
shrubs	25
grasses	40
barren	5
Water Quality	
temperature (°C)	10.0
dissolved oxygen (mg/l)	9
conductivity (µmhos/cm)	260
pH	8.60

LEGEND

AN	angling	ARGR	arctic grayling
CF	counting fence	BKST	brook stickleback
DN	dip net	BRMN	brassy minnow
EF	electrofisher	BURB	burbot
GN	gill net	DLVR	Dolly Varden
KS	kick sample	EGGS	unidentified fish eggs
SF	small fish collections made using a combination of methods	EMSH	emerald shiner
SN	seine	FLCH	flathead chub
AP	benthic algal productivity station	FSDC	finescale dace
BI	benthic invertebrate collection site	FTMN	fathead minnow
CH	water quality station	GOLD	goldeye
PS	point sample	LKCH	lake chub
SG	stream gauging station	LKCS	lake cisco
35	kilometres from mouth	LKWF	lake whitefish
	flow direction	LNDC	longnose dace
	reach boundary	LNSK	longnose sucker
	upstream limit of survey	MTWF	mountain whitefish
	division between sections of a reach	NRDC	northern redbelly dace
		NSST	ninespine stickleback
		NTPK	northern pike
		PLDC	pearl dace
		SLSC	slimy sculpin
		SPSC	spoonhead sculpin
		SPSH	spottail shiner
		TRPC	trout-perch
		UNSK	unidentified sucker species
		WALL	walleye
		WTSK	white sucker
		YLPR	yellow perch

* Data from Bond and Machniak (1979)



AQUATIC BIOPHYSICAL INVENTORY

MUSKEG RIVER

Reach I

(km 0.0 to km 0.5)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

alberta

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

Species	Adults	Juveniles and Young-of-the-year	Total Numbers
arctic grayling	0	2	2
longnose dace	0	4	4
pearl dace	3	8	11
slimy sculpin	1	11	12
white sucker	0	2	2
Total	4	27	31

PHYSICAL CHARACTERISTICS

Reach length (km)	8.5
Channel width (m)	15
Channel area (ha)	12.8
Gradient (m/km)	3.2
Flow character	swirling, rolling, broken
Total pools (%)	30
Pattern	irregularly meandering
Confinement	entrenched
Unstable banks (%)	55
Substrate composition (%)	
fines (<2 mm)	10
gravels (2-64 mm)	70
larges (>64 mm)	20
bedrock and/or oil sand	0
Debris	moderate

REACH DESCRIPTION AND FISH UTILIZATION

This irregularly meandering section of the Muskeg River is entrenched in a deep, narrow canyon with a high proportion of unstable banks. The high, slumping banks appear to be composed primarily of sand, gravel and silt. The gradient is relatively high and the reach is a series of alternating pools and riffles. The substrate consists primarily of gravels and larges, but some sand and silt are present in pool areas. The riparian vegetation is dominated by deciduous trees and shrubs, but coniferous trees are also fairly abundant. Little vegetation overhangs the river channel in this reach. Moderate amounts of woody debris are present along the edges of the channel.

The series of pools and riffles and the variety of substrates in this reach provide excellent spawning potential for many of the fish species that occur in the Muskeg River (e.g., arctic grayling, white sucker, longnose sucker, longnose dace, lake chub, slimy sculpin, trout-perch). The numerous shallow areas along the sides of the channel, where water velocities are low and debris provides some shelter, are good rearing areas for a variety of fish species. The many shallow gravel riffles provide good feeding areas for juvenile arctic grayling. The pools of this reach are very good areas for resting and feeding of larger fish, and the variety of forage species provides an abundant food source for piscivorous species. Water depths in the pools are moderately deep and at least some pool areas may be suitable overwintering sites for some fish.

BENTHIC INVERTEBRATES

- GASTROPODA
  - *Ferrissia*
  - *Gyraulus*
  - *Stagnicola*
- PELECYPODA
  - *Musculium*
- INSECTA
  - Ephemeroptera
    - *Baetis*
    - *Baetisca*
    - *Ephemerella*
    - *Stenonema*
  - Odonata
    - *Ophiogomphus*
  - Plecoptera
    - *Acroneuria*
    - *Diura*
    - *Isogenus*
    - *Oemopteryx*
    - *Pteronarcys*
    - *Taeniopteryx*
  - Trichoptera
    - *Brachycentrus*
    - *Chemmatopsyche*
    - *Hydropsyche*
    - *Lepidostoma*
    - *Oecetis*
    - *Polycentropus*
  - Coleoptera
    - Dryopidae
    - Elmidae
  - Diptera
    - Tipulidae
    - Chironomidae
      - Chironominae
      - Tanypodinae
    - Tabanidae
    - Rhagionidae
      - *Atherix*
    - Dolichopodidae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	15
Deciduous trees	65
Shrubs	35
Grasses	45
Barren	5
Channel cover (%)	
Overhang	2
Crown	2

BENTHIC ALGAL PRODUCTIVITY

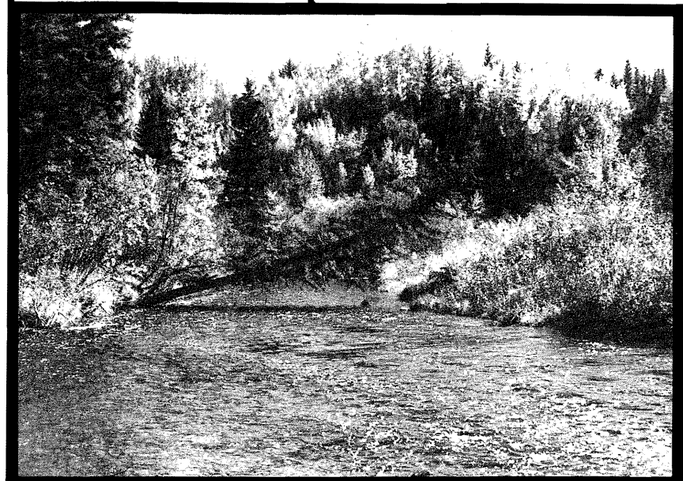
No data available for this reach

STREAM GAUGING DATA

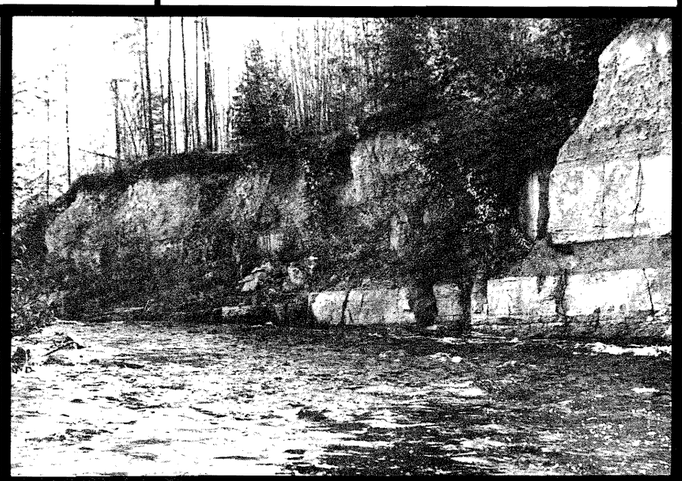
No data available for this reach

WATER QUALITY

No data available for this reach



Muskeg River at km 4.2.



Unstable bedrock and gravel bank at km 7.

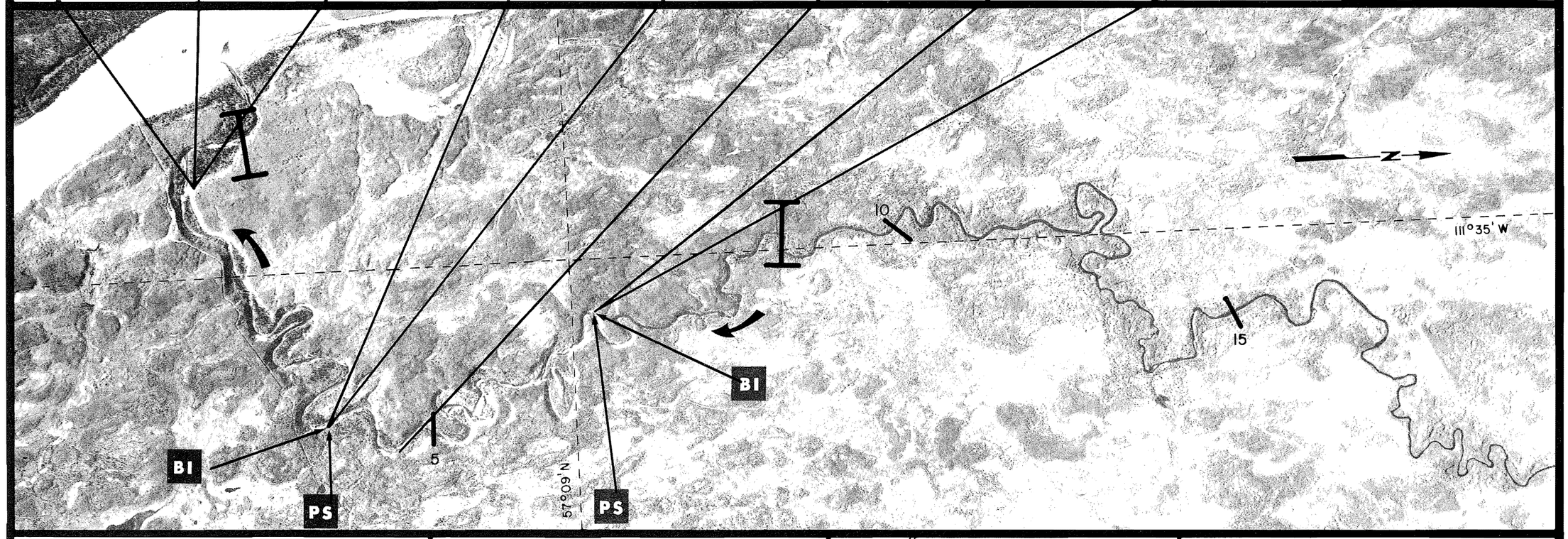
AQUATIC BIOPHYSICAL INVENTORY
MUSKEG RIVER
Reach 2
(km 0.5 to km 9.0)

alberta — ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS

SF*	ARGR LNSK TRPC BURB MTWF UNSK FTMN NSST WTSK LKCH NTPK YLPR LKWF PLDC LNDC SLSC	
CF*	ARGR LNSK BURB MTWF DLVR NTPK LKCS WALL LKWF WTSK	
SN*	LNDC PLDC TRPC WTSK	
SN	ARGR PLDC SLSC WTSK	
EF	WTSK	
SN*	ARGR	
SN	ARGR LNDC PLDC SLSC	
KS	SLSC	



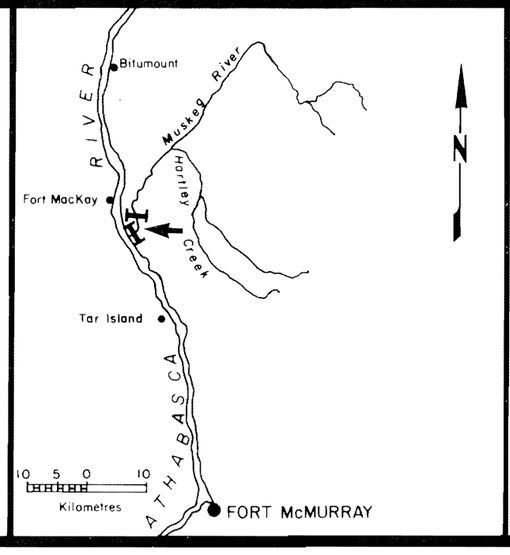
POINT SAMPLE DATA

	km 4.2	km 7.0
Location		
Date	19/09/79	19/09/79
Hydroulics		
channel width (m)	15.2	16.8
wet width (m)	15.2	12.8
maximum depth (m)	0.8	0.7
average depth (m)	0.5	0.5
velocity (m/s)	0.84	1.04
flow character	swirling, rolling, broken	rolling, broken
Substrate Composition (%)		
fines (< 2 mm)	10	10
gravels (2–64 mm)	80	75
larges (>64 mm)	10	15
bedrock and/or oil sand	0	0
Bank		
height (m)	0.5	1.0
form	steep	steep
stability	stable	failing
texture	sand, gravel, silt	sand, gravel, larges
vegetation (% coverage)		
coniferous trees	20	10
deciduous trees	65	65
shrubs	60	25
grasses	75	40
barren	0	10
Water Quality		
temperature (°C)	12.5	11.0
dissolved oxygen (mg/l)	9	9
conductivity (µmhos/cm)	245	255
pH	8.15	7.96

LEGEND

AN	angling	ARGR	arctic grayling
CF	counting fence	BKST	brook stickleback
DN	dip net	BRMN	brassy minnow
EF	electrofisher	BURB	burbot
GN	gill net	DLVR	Dolly Varden
KS	kick sample	EGGS	unidentified fish eggs
SF	small fish collections made using a combination of methods	EMSH	emerald shiner
SN	seine	FLCH	flathead chub
AP	benthic algal productivity station	FSDC	finescale dace
BI	benthic invertebrate collection site	FTMN	fathead minnow
CH	water quality station	GOLD	goldeye
PS	point sample	LKCH	lake chub
SG	stream gauging station	LKCS	lake cisco
35	kilometres from mouth	LKWF	lake whitefish
	flow direction	LNDC	longnose dace
	reach boundary	LNSK	longnose sucker
	upstream limit of survey	MTWF	mountain whitefish
	division between sections of a reach	NRDC	northern redbelly dace
		NSST	ninespine stickleback
		NTPK	northern pike
		PLDC	pearl dace
		SLSC	slimy sculpin
		SPSC	spoonhead sculpin
		SPSH	spottail shiner
		TRPC	trout-perch
		UNSK	unidentified sucker species
		WALL	walleye
		WTSK	white sucker
		YLPR	yellow perch

* Data from Bond and Machniak (1979)



AQUATIC BIOPHYSICAL INVENTORY

MUSKEG RIVER

Reach 2

(km 0.5 to km 9.0)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

Species	Adults	Juveniles and Young-of-the-year	Total Numbers
longnose sucker	0	2	2
northern pike	2	2	4
pearl dace	0	17	17
slimy sculpin	1	1	2
Total	3	22	25

PHYSICAL CHARACTERISTICS

Reach length (km)	7.5
Channel width (m)	14
Channel area (ha)	10.5
Gradient (m/km)	1.0
Flow character	placid, swirling, rolling
Total pools (%)	80
Pattern	irregularly meandering
Confinement	occasionally confined
Unstable banks (%)	10
Substrate composition (%)	
fines (<2 mm)	30
gravels (2-64 mm)	50
larges (>64 mm)	20
bedrock and/or oil sand	0
Debris	moderate

REACH DESCRIPTION AND FISH UTILIZATION

This relatively short and irregularly meandering section of the Muskeg River is a region of transition between the low gradient Reach 4 and the high gradient Reach 2. The gradient is moderate and the flow character is mixed, varying from placid to swirling to rolling. Most of the reach area is composed of pools. The substrate is composed mainly of sand, gravels and cobbles, but some silt is present in pools and backwaters. The riparian vegetation is mostly deciduous trees and shrubs, with some conifers in the lower portion of the reach. Some vegetation overhangs the channel in most areas. Moderate amounts of debris are present along the edges of the river channel.

The spawning potential of this reach is good for those species that spawn over gravel substrates (e.g., arctic grayling, longnose sucker, white sucker, trout-perch, longnose dace). There are a few backwater areas with low to moderate amounts of aquatic vegetation that may provide suitable habitat for limited spawning of northern pike and brook stickleback in this reach. The numerous shallow areas with low water velocities and gravel substrates, the occasional weedy shallows, and the moderate amounts of debris and overhanging vegetation provide good rearing habitat. In most areas of this reach the water is moderately deep, and at least some of the pools are probably suitable for overwintering of fish.

BENTHIC INVERTEBRATES

- OLIGOCHAETA
- GASTROPODA
  - *Gyraulus*
- PELECYPODA
  - *Musculium*
  - *Pisidium*
  - *Sphaerium*
- INSECTA
  - Ephemeroptera
    - *Ameletus*
    - *Baetis*
    - *Baetisca*
    - *Paraleptophlebia*
    - *Stenonema*
  - Odonata
    - *Perithemis*
  - Plecoptera
    - *Pteronarcys*
    - *Taeniopteryx*
  - Hemiptera
    - Corixidae
  - Trichoptera
    - *Cheumatopsyche*
    - *Lepidostoma*
  - Coleoptera
    - Elmidae
  - Diptera
    - Chironomidae
      - Tanypodinae
    - Tabanidae
    - Dolichopodidae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	10
Deciduous trees	65
Shrubs	35
Grasses	55
Barren	2
Channel cover (%)	
Overhang	5
Crown	2

BENTHIC ALGAL PRODUCTIVITY

Standing crop expressed as cell counts (number·m^{-2})
- mean: 1.9×10^{10}
- maximum: 3.9×10^{10}
- minimum: 1.1×10^{10}

Standing crop expressed as chlorophyll *a* (mg·m^{-2})
- mean: 27.3
- maximum: 65.7
- minimum: 8.7

Primary productivity (mg C·h^{-1}·m^{-2})
- mean: 26.5
- maximum: 107.8
- minimum: 6.9

Data from Hickman *et al.* (1980).

STREAM GAUGING DATA

Water Survey of Canada station number 07DA008

Maximum total annual discharge:	199.8×10^6 m^3 (1974)
Minimum total annual discharge:	65.6×10^6 m^3 (1976)
Maximum annual mean discharge:	6.31 m^3/s (1974)
Minimum annual mean discharge:	2.07 m^3/s (1976)
Maximum monthly mean discharge:	21.95 m^3/s (September 1978)
Minimum monthly mean discharge:	0.21 m^3/s (December 1976)
Maximum daily discharge:	42.19 m^3/s (Apr. 28, 1974)
Minimum daily discharge:	0.14 m^3/s (Dec. 17, 1976)

Data for 1974 to 1978 compiled from Loeppky and Spitzer (1977), Warner and Spitzer (1979) and Warner (1979).

WATER QUALITY

Water Survey of Canada station number 00AT07DA0080

	Mean	Maximum	Minimum
Total alkalinity (mg $CaCO_3$/l)	172.4	289.0	55.7
pH	7.80	8.29	7.28
Total hardness (mg $CaCO_3$/l)	171.5	280.9	59.7
Conductance (µS/cm)	309	520	115
Total filterable residue fixed (mg/l)	156	308	49
Total non-filterable residue fixed (mg/l)	2	39	<0.4
Total organic carbon (mg C/l)	25.0	53.0	6.0
Silica (mg SiO_2/l)	9.0	25.0	1.8
Nitrate and nitrite nitrogen (mg N/l)	0.040	0.310	<0.003
Total Kjeldahl nitrogen (mg N/l)	1.20	3.00	0.28
Total Phosphorus (mg P/l)	0.040	0.190	0.005
Orthophosphate (mg P/l)	0.010	0.041	<0.003
Sulphate (mg SO_4/l)	5.3	42.5	0.1

Data for the period January 1976 to December 1979 obtained from the National Water Quality Data Bank (NAQUADAT).

Swirling and rolling flow, common in this reach, at km 10.4.

A large, swirling pool at km 13.8.

AQUATIC BIOPHYSICAL INVENTORY

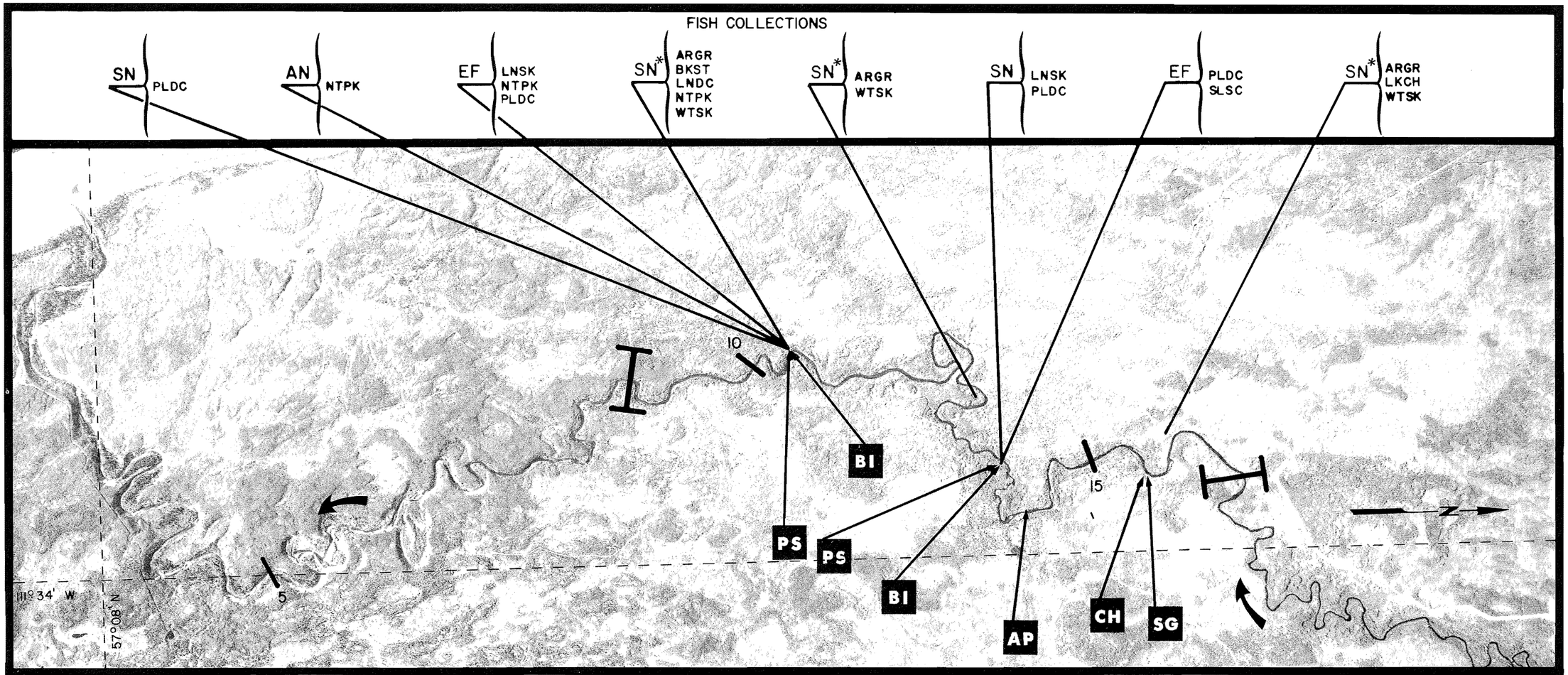
MUSKEG RIVER

Reach 3

(km 9.0 to km 16.5)

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED



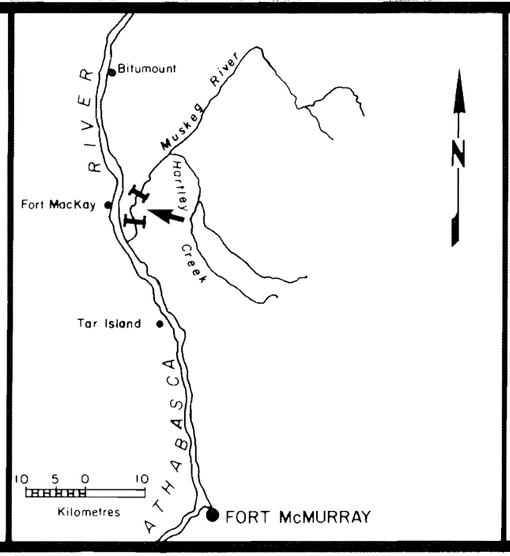
POINT SAMPLE DATA

Location	km 10.4	km 13.8
Date	21/09/79	20/09/79
Hydraulics		
channel width (m)	18.3	13.7
wet width (m)	14.6	10.7
maximum depth (m)	1.1	1.5
average depth (m)	0.8	0.8
velocity (m/s)	0.83	0.98
flow character	swirling, rolling	placid, swirling
Substrate Composition (%)		
fines (< 2 mm)	20	30
gravels (2–64 mm)	30	70
larges (> 64 mm)	50	0
bedrock and/or oil sand	0	0
Bank		
height (m)	1.5	0.5
form	repose	repose
stability	stable	stable
texture	sandy silt	silty sand, gravel
vegetation (% coverage)		
coniferous trees	40	0
deciduous trees	55	75
shrubs	35	30
grasses	85	20
barren	0	10
Water Quality		
temperature (°C)	10.5	10.0
dissolved oxygen (mg/l)	9	9
conductivity (µmhos/cm)	190	235
pH	7.88	7.68

LEGEND

AN angling	ARGR arctic grayling
CF counting fence	BKST brook stickleback
DN dip net	BRMN brassy minnow
EF electrofisher	BURB burbot
GN gill net	DLVR Dolly Varden
KS kick sample	EGGS unidentified fish eggs
SF small fish collections made using a combination of methods	EMSH emerald shiner
SN seine	FLCH flathead chub
AP benthic algal productivity station	FSDC finescale dace
BI benthic invertebrate collection site	FTMN fathead minnow
CH water quality station	GOLD goldeye
PS point sample	LKCH lake chub
SG stream gauging station	LKCS lake cisco
35 kilometres from mouth	LKWF lake whitefish
flow direction	LNDC longnose dace
reach boundary	LNSK longnose sucker
upstream limit of survey	MTWF mountain whitefish
division between sections of a reach	NRDC northern redbelly dace
	NSST ninespine stickleback
	NTPK northern pike
	PLDC pearl dace
	SLSC slimy sculpin
	SPSC spoonhead sculpin
	SPSH spottail shiner
	TRPC trout-perch
	UNSK unidentified sucker species
	WALL walleye
	WTSK white sucker
	YLPR yellow perch

* Data from Bond and Machniak (1979)



AQUATIC BIOPHYSICAL INVENTORY

MUSKEG RIVER

Reach 3

(km 9.0 to km 16.5)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

Species	Adults	Juveniles and Young-of-the-year	Total Numbers
pearl dace	0	1	1
white sucker	0	1	1
Total	0	2	2

PHYSICAL CHARACTERISTICS

Reach length (km)	63.5
Channel width (m)	10
Channel area (ha)	63.5
Gradient (m/km)	0.3
Flow character	placid
Total pools (%)	95
Pattern	tortuously meandering, irregularly meandering
Confinement	unconfined
Unstable banks (%)	0
Substrate composition (%)	
fines (<2 mm)	100
gravels (2-64 mm)	0
larges (>64 mm)	0
bedrock and/or oil sand	0
Debris	moderate

REACH DESCRIPTION AND FISH UTILIZATION

This long, low-gradient reach meanders through a large area of marshy treed muskeg. The reach is nearly all pools and the water flow is slow. The stream is deep and the banks drop off sharply at the edge of the channel. There are many beaver dams in this reach, particularly upstream from Hartley Creek. The substrate is entirely silt and sand with moderate to very high organic detritus content. Aquatic vegetation is abundant. The riparian vegetation is almost entirely deciduous trees and shrubs with a very dense growth of grasses. Channel cover due to overhanging shrubs varies from moderate in the lower portion of the reach to very high in the upper portion of the reach. Channel debris also varies from moderate to high.

The abundant aquatic vegetation in this reach provides numerous areas suitable for spawning of brook stickleback and northern pike. The reach does not appear to be suitable for spawning of other species. Rearing potential is good because there is ample shelter provided by woody debris and aquatic vegetation. Water depths in this reach appear to be sufficient to allow overwintering of fish.

BENTHIC INVERTEBRATES

- OLIGOCHAETA
- GASTROPODA
  - *Ferrissia*
- PELECYPODA
  - *Sphaerium*
- CRUSTACEA
  - Cladocera
  - Copepoda
  - Amphipoda
    - *Gammarus pseudolimnaeus*
- INSECTA
  - Ephemeroptera
    - *Ameletus*
    - *Paraleptophlebia*
  - Plecoptera
    - *Isoperla*
  - Hemiptera
    - Corixidae
  - Megaloptera
    - *Sialis*
  - Trichoptera
    - *Oncosmoecus*
  - Diptera
    - Chironomidae
      - Chironominae
      - Tanypodinae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	2
Deciduous trees	80
Shrubs	15
Grasses	95
Barren	0
Channel cover (%)	
Overhang	15
Crown	10

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

Water Survey of Canada station number 00AT07DA0085

	Mean	Maximum	Minimum
Total alkalinity (mg $CaCO_3$/l)	212.3	327.2	76.0
pH	7.60	8.20	7.10
Total hardness (mg $CaCO_3$/l)	207.7	327.6	74.6
Conductance (µS/cm)	380	610	120
Total filterable residue fixed (mg/l)	203	331	79
Total non-filterable residue fixed (mg/l)	4	30	<0.4
Total organic carbon (mg C/l)	25.0	45.0	10.0
Silica (mg SiO_2/l)	11.2	17.0	4.2
Nitrate and nitrite nitrogen (mg N/l)	0.030	0.140	0.005
Total Kjeldahl nitrogen (mg N/l)	1.45	5.50	0.50
Total Phosphorus (mg P/l)	0.080	0.250	0.020
Orthophosphate (mg P/l)	0.010	0.030	0.006
Sulphate (mg SO_4/l)	3.7	9.2	0.1

Data for the period January 1976 to December 1979 obtained from the National Water Quality Data Bank (NAQUADAT).

Placid flow and heavily grassed banks at km 27.5 are typical of this reach.

Dense overhanging bank vegetation at km 42.

AQUATIC BIOPHYSICAL INVENTORY
MUSKEG RIVER
Reach 4
(km 16.5 to km 80.0)

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

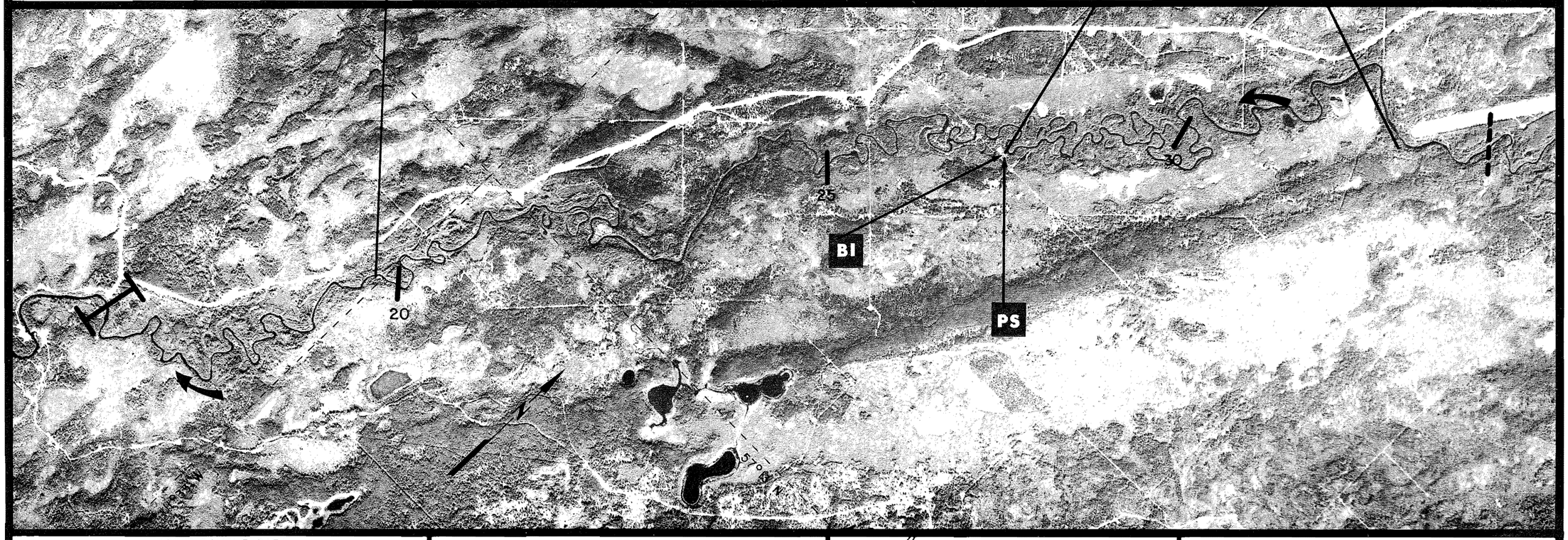
prepared by LGL LIMITED

FISH COLLECTIONS

SF* ARGR LNDC BKST SLSC LKCH UNSK LKWF WTSK

EF PLDC WTSK

SN* BKST LKCH WTSK



POINT SAMPLE DATA

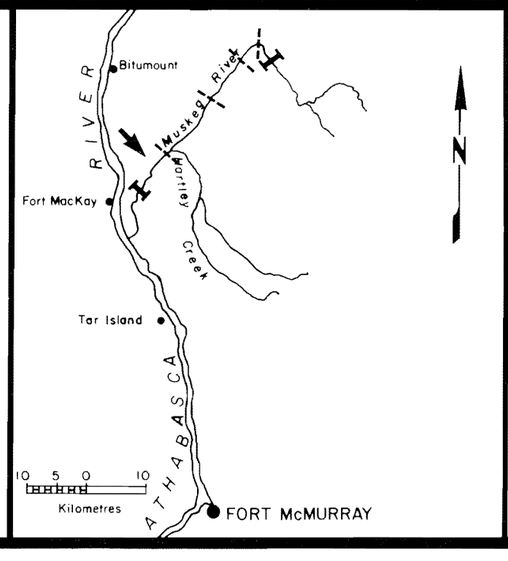
Location	km 27.5
Date	20/09/79
Hydraulics	
channel width (m)	10.7
wet width (m)	10.7
maximum depth (m)	2.0
average depth (m)	1.0
velocity (m/s)	0.59
flow character	placid, swirling
Substrate Composition (%)	
fines (< 2mm)	100
gravels (2–64mm)	0
lorges (>64mm)	0
bedrock and/or oil sand	0
Bank	
height (m)	1.0
form	repose
stability	stable
texture	sandy silt, organic
vegetation (% coverage)	
coniferous trees	0
deciduous trees	75
shrubs	20
grasses	95
barren	0
Water Quality	
temperature (°C)	10.5
dissolved oxygen (mg/l)	8
conductivity (µmhos/cm)	182
pH	7.78

LEGEND

AN angling
CF counting fence
DN dip net
EF electrofisher
GN gill net
KS kick sample
SF small fish collections made using a combination of methods
SN seine
AP benthic algal productivity station
BI benthic invertebrate collection site
CH water quality station
PS point sample
SG stream gauging station
35 kilometres from mouth
flow direction
reach boundary
upstream limit of survey
division between sections of a reach

ARGR arctic grayling
BKST brook stickleback
BRMN brassy minnow
BURB burbot
DLVR Dolly Varden
EGGS unidentified fish eggs
EMSH emerald shiner
FLCH flathead chub
FSDC finescale dace
FTMN fathead minnow
GOLD goldeye
LKCH lake chub
LKCS lake cisco
LKWF lake whitefish
LNDC longnose dace
LNSK longnose sucker
MTWF mountain whitefish
NRDC northern redbelly dace
NSST ninespine stickleback
NTPK northern pike
PLDC pearl dace
SLSC slimy sculpin
SPSC spoonhead sculpin
SPSH spottail shiner
TRPC trout-perch
UNSK unidentified sucker species
WALL walleye
WTSK white sucker
YLPR yellow perch

*Data from Bond and Machniak (1979)



AQUATIC BIOPHYSICAL INVENTORY

MUSKEG RIVER

Reach 4 Section 1

(km 16.5 to km 33.0)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

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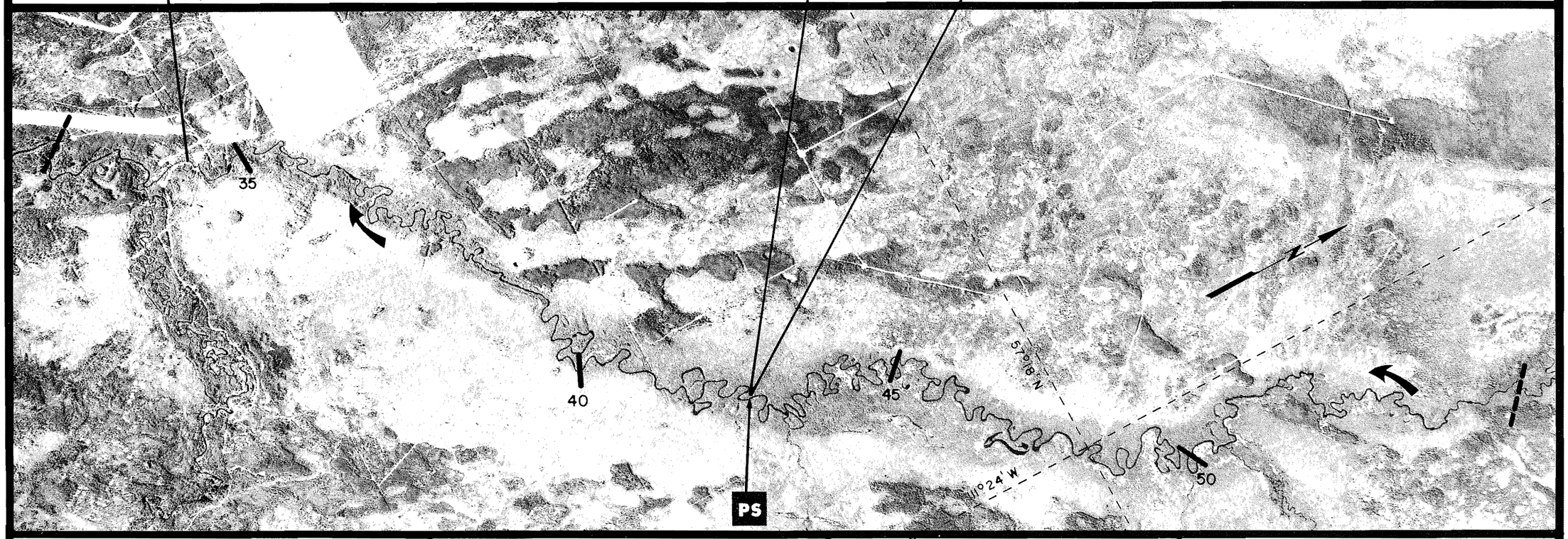
FISH COLLECTIONS

SF* BKST, LKCH, LNSK, NTPK, UNSK, WTSK

EF NO CATCH

AN NO CATCH



POINT SAMPLE DATA

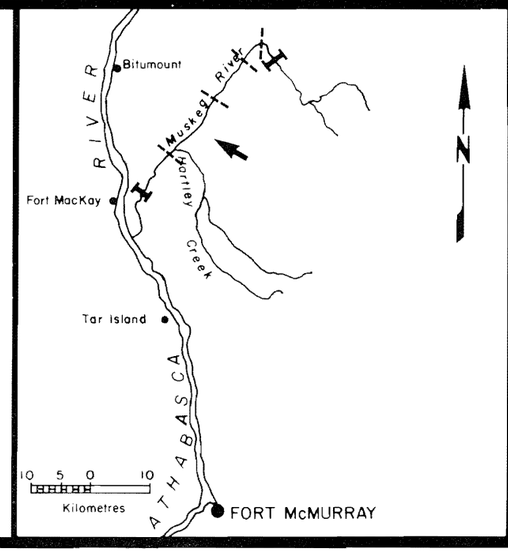
Location	km 42.0
Date	21/09/79
Hydraulics	
channel width (m)	11.0
wet width (m)	11.0
maximum depth (m)	1.5
average depth (m)	1.0
velocity (m/s)	0.25
flow character	placid
Substrate Composition (%)	
fines (< 2mm)	100
gravels (2–64mm)	0
larges (>64mm)	0
bedrock and/or oil sand	0
Bank	
height (m)	0.5
form	repose
stability	stable
texture	silt, organic
vegetation (% coverage)	
coniferous trees	0
deciduous trees	75
shrubs	10
grasses	95
barren	0
Water Quality	
temperature (°C)	9.0
dissolved oxygen (mg/l)	8
conductivity (µmhos/cm)	196
pH	7.56

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
	reach boundary
	upstream limit of survey
	division between sections of a reach

* Data from Bond and Machniak (1979)

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

MUSKEG RIVER

Reach 4 Section 2

(km 33 to km 54)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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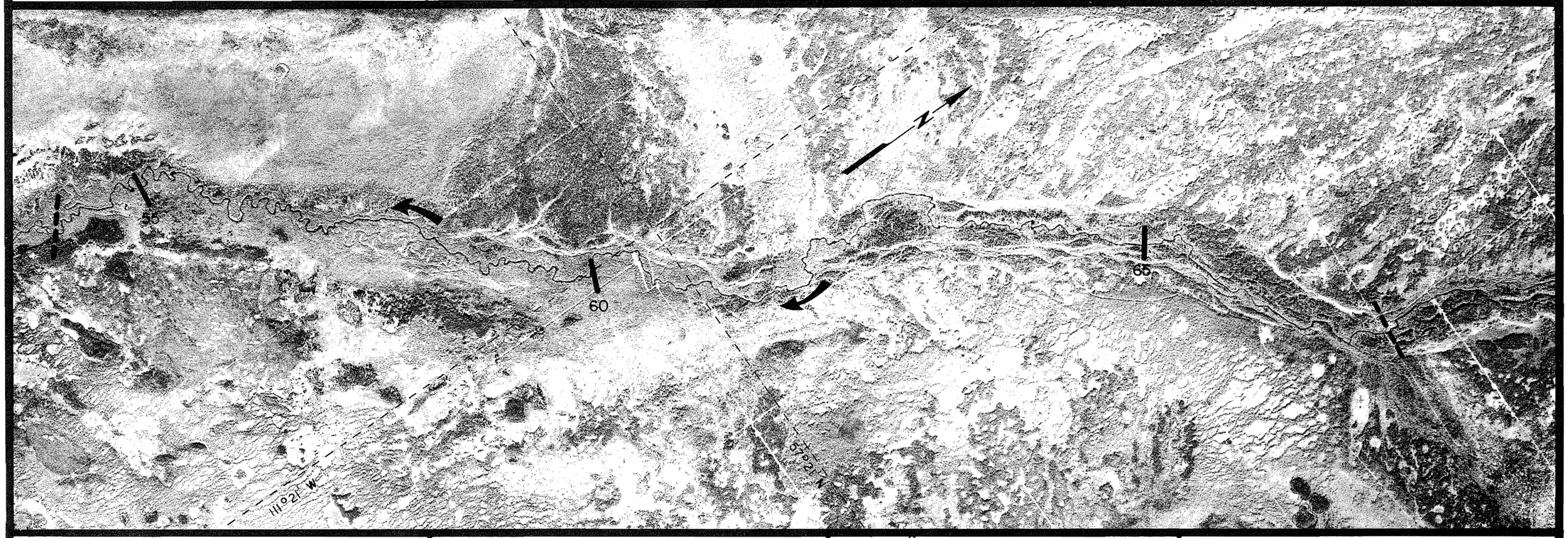
prepared by LGL LIMITED

FISH COLLECTIONS



POINT SAMPLE DATA

Location
Date
Hydraulics
- channel width (m)
- wet width (m)
- maximum depth (m)
- average depth (m)
- velocity (m/s)
- flow character

Substrate Composition (%)
- fines (< 2 mm)
- gravels (2–64 mm)
- larges (> 64 mm)
- bedrock and/or oil sand

Bank
- height (m)
- form
- stability
- texture

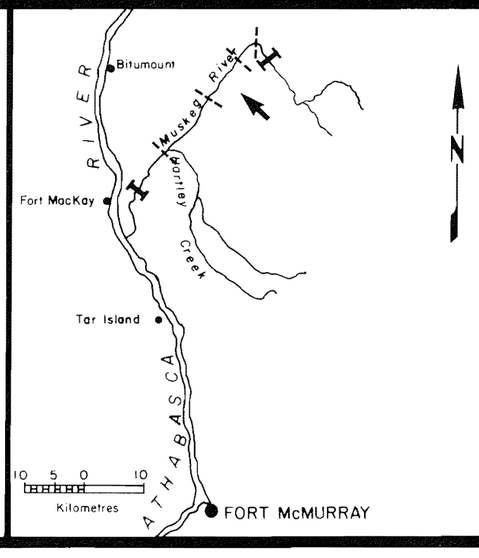
- vegetation (% coverage)
  - coniferous trees
  - deciduous trees
  - shrubs
  - grasses
  - barren

Water Quality
- temperature (°C)
- dissolved oxygen (mg/l)
- conductivity (µmhos/cm)
- pH

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

MUSKEG RIVER

Reach 4 Section 3

(km 54 to km 67)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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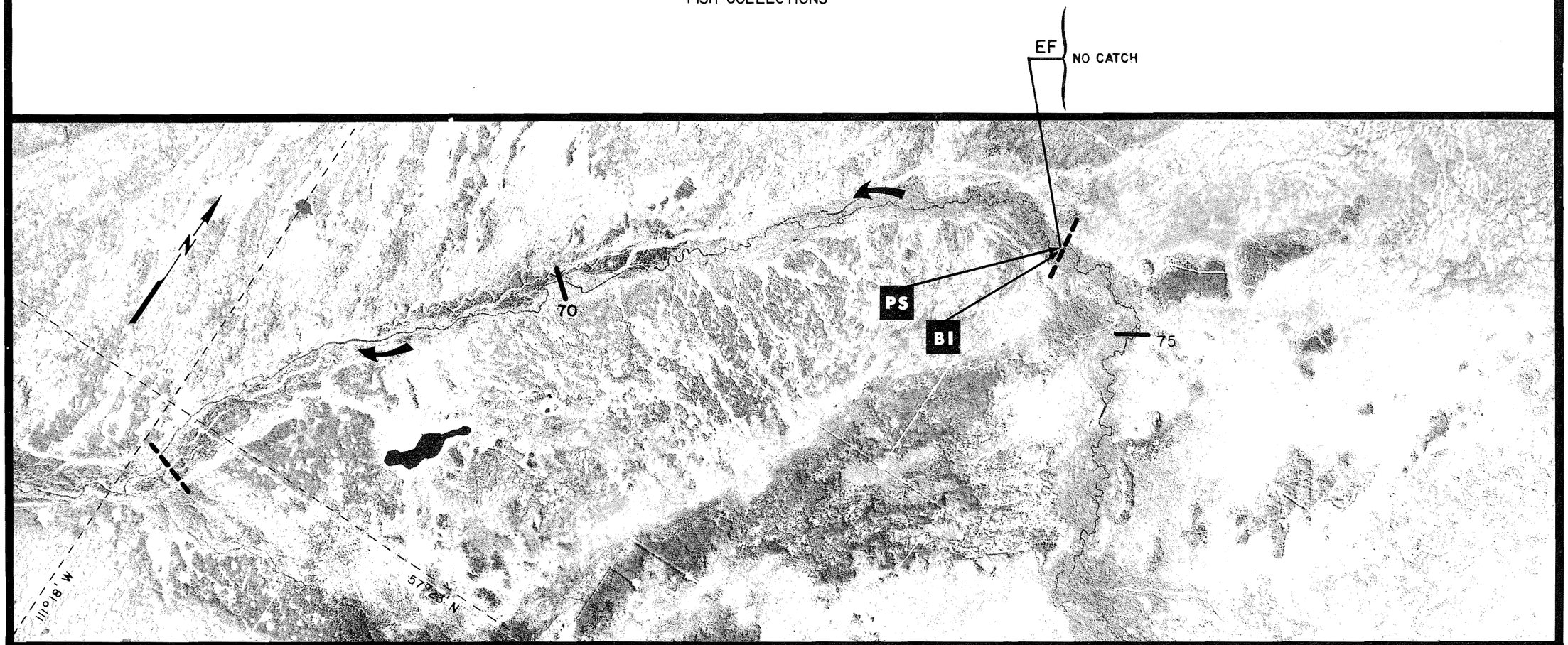
ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS



POINT SAMPLE DATA

Location	km 74.0
Date	21/09/79
Hydraulics	
channel width (m)	8.4
wet width (m)	8.4
maximum depth (m)	1.5
average depth (m)	1.0
velocity (m/s)	0.15
flow character	placid
Substrate Composition (%)	
fines (< 2mm)	100
gravels (2–64mm)	0
larges (>64mm)	0
bedrock and/or oil sand	0
Bank	
height (m)	0.4
form	steep
stability	stable
texture	organic, silt
vegetation (% coverage)	
coniferous trees	5
deciduous trees	90
shrubs	15
grasses	95
barren	0
Water Quality	
temperature (°C)	8.5
dissolved oxygen (mg/l)	6
conductivity (µmhos/cm)	205
pH	7.39

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
	reach boundary
	upstream limit of survey
	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
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LNSK	longnose sucker
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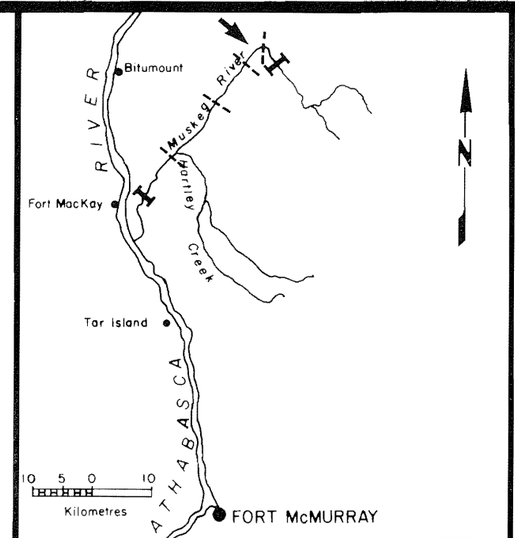
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

MUSKEG RIVER

Reach 4 Section 4

(km 67 to km 74)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

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FISH COLLECTIONS

SF* BKST

CH

75

57°26' N

111°13' W

POINT SAMPLE DATA

Location
Date
Hydraulics
- channel width (m)
- wet width (m)
- maximum depth (m)
- average depth (m)
- velocity (m/s)
- flow character

Substrate Composition (%)
- fines (< 2 mm)
- gravels (2–64 mm)
- larges (> 64 mm)
- bedrock and/or oil sand

Bank
- height (m)
- form
- stability
- texture

- vegetation (% coverage)
  - coniferous trees
  - deciduous trees
  - shrubs
  - grasses
  - barren

Water Quality
- temperature (°C)
- dissolved oxygen (mg/l)
- conductivity (µmhos/cm)
- pH

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
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PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
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EMSH	emerald shiner
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LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
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SLSC	slimy sculpin
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TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
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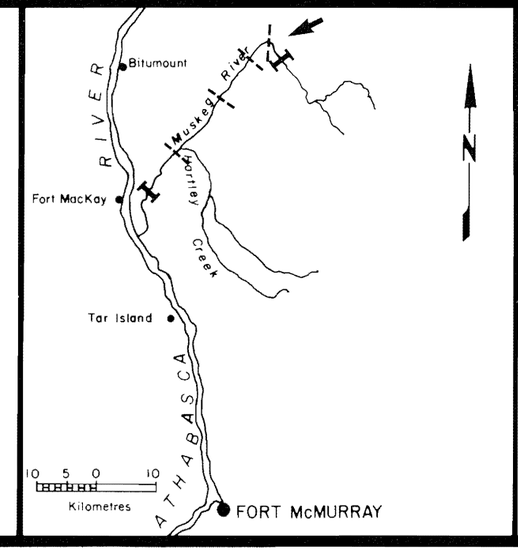
YLPR	yellow perch

*Data from Bond and Machniak (1979)



AQUATIC BIOPHYSICAL INVENTORY

MUSKEG RIVER

Reach 4 Section 5

(km 74 to km 80)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

Species	Adults	Juveniles and Young-of-the-year	Total Numbers
brook stickleback	2	2	4
pearl dace	0	2	2
white sucker	0	2	2
Total	2	6	8

PHYSICAL CHARACTERISTICS

Reach length (km)	13.0
Channel width (m)	9
Channel area (ha)	11.7
Gradient (m/km)	2.8
Flow character	placid, swirling
Total pools (%)	90
Pattern	irregularly meandering
Confinement	occasionally confined
Unstable banks (%)	0
Substrate composition (%)	
fines (<2 mm)	80
gravels (2-64 mm)	10
larges (>64 mm)	10
bedrock and/or oil sand	0
Debris	high

REACH DESCRIPTION AND FISH UTILIZATION

This section of the Muskeg River has a much higher gradient than does Reach 4. The reach is almost entirely pools, however, because the flow is impeded by numerous beaver dams. The substrate is generally sand and silt with moderate organic detritus content, but there are some areas with fairly high proportions of gravels and cobbles. Coniferous trees dominate the riparian vegetation over much of the reach, but deciduous trees and shrubs are also abundant and there is a dense growth of grasses. Channel cover is very high due to overhanging shrubs. Sunken woody debris is abundant.

Movement of the larger fish into this reach from downstream regions is severely limited by beaver dams. Only brook stickleback, lake chub, pearl dace, and a few young-of-the-year white suckers have been collected in this reach. The brook stickleback, lake chub, and pearl dace are almost certainly year-round residents of this reach.

BENTHIC INVERTEBRATES

- OLIGOCHAETA
- GASTROPODA
  - *Gyraulus*
  - *Physa*
  - *Valvata*
- PELECYPODA
  - *Anodonta*
  - *Musculium*
  - *Pisidium*
  - *Sphaerium*
- INSECTA
  - Ephemeroptera
    - *Ameletus*
    - *Ephemera*
    - *Ephemerella*
    - *Paraleptophlebia*
    - *Stenonema*
  - Odonata
    - Libellulidae
  - Plecoptera
    - *Nemoura*
    - *Oemopteryx*
    - *Pteronarcys*
  - Hemiptera
    - Corixidae
  - Trichoptera
    - *Brachycentrus*
    - *Glossosoma*
    - *Hydropsyche*
    - *Lepidostoma*
    - *Limnephilus/Philarctus*
    - *Micrasema*
    - *Oxyethira*
    - *Potamyia*
    - *Ptilostomis*
  - Coleoptera
    - Elmidae
  - Diptera
    - Ceratopogonidae
    - Chironomidae
      - Chironominae
      - Tanypodinae
      - Orthocladiinae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	60
Deciduous trees	35
Shrubs	15
Grasses	90
Barren	0
Channel cover (%)	
Overhang	45
Crown	30

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

Water Survey of Canada station number 00AT07DA0094

	Mean	Maximum	Minimum
Total alkalinity (mg $CaCO_3$/l)	238.3	720.0	74.2
pH	7.80	8.00	7.50
Total hardness (mg $CaCO_3$/l)	224.8	656.0	78.3
Conductance (µS/cm)	417	1200	142
Total filterable residue fixed (mg/l)	206	691	81
Total non-filterable residue fixed (mg/l)	7	30	<0.4
Total organic carbon (mg C/l)	21.0	29.0	12.0
Silica (mg SiO_2/l)	19.0	72.0	4.0
Nitrate and nitrite nitrogen (mg N/l)	0.010	0.010	<0.003
Total Kjeldahl nitrogen (mg N/l)	2.05	4.90	0.39
Total Phosphorus (mg P/l)	0.130	0.320	0.031
Orthophosphate (mg P/l)	0.020	0.060	0.010
Sulphate (mg SO_4/l)	4.6	8.5	0.5

Data for the period January 1976 to December 1979 obtained from the National Water Quality Data Bank (NAQUADAT).

Dense overhanging bank vegetation and abundant debris, typical of reach 5, at km 83.7.

A section of reach 5 flowing through dense spruce forest at km 90.

AQUATIC BIOPHYSICAL INVENTORY

MUSKEG RIVER

Reach 5

(km 80 to km 93)

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

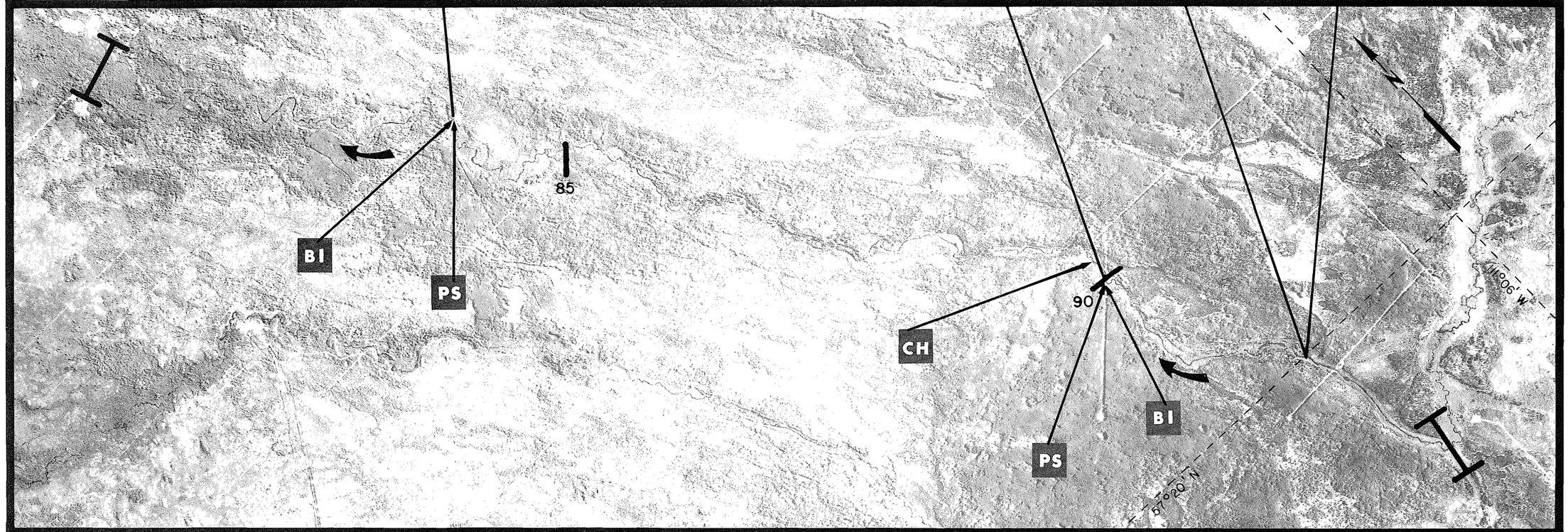
FISH COLLECTIONS

EF BKST WTSK

EF BKST PLDC WTSK

SF* BKST LKCH WTSK

SN* BKST LKCH



POINT SAMPLE DATA

Location	km 83.7	km 90.0
Date	21/09/79	24/09/79
Hydraulics		
channel width (m)	7.9	9.5
wet width (m)	7.9	9.5
maximum depth (m)	1.2	0.7
average depth (m)	0.8	0.4
velocity (m/s)	ND	0.29
flow character	placid, swirling	placid, swirling
Substrate Composition (%)		
fines (< 2mm)	100	60
gravels (2–64mm)	0	15
larges (>64mm)	0	25
bedrock and/or oil sand	0	0
Bank		
height (m)	0.6	0.8
form	**repose**	**steep**
stability	stable	stable
texture	silt, sand	sandy silt, organic
vegetation (% coverage)		
coniferous trees	15	70
deciduous trees	65	25
shrubs	15	10
grasses	90	90
barren	0	0
Water Quality		
temperature (°C)	10.0	10.0
dissolved oxygen (mg/l)	9	8
conductivity (µmhos/cm)	212	215
pH	7.85	7.81

LEGEND

AN angling
CF counting fence
DN dip net
EF electrofisher
GN gill net
KS kick sample
SF small fish collections made using a combination of methods
SN seine
AP benthic algal productivity station
BI benthic invertebrate collection site
CH water quality station
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35 kilometres from mouth
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LNSK longnose sucker
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NRDC northern redbelly dace
NSST ninespine stickleback
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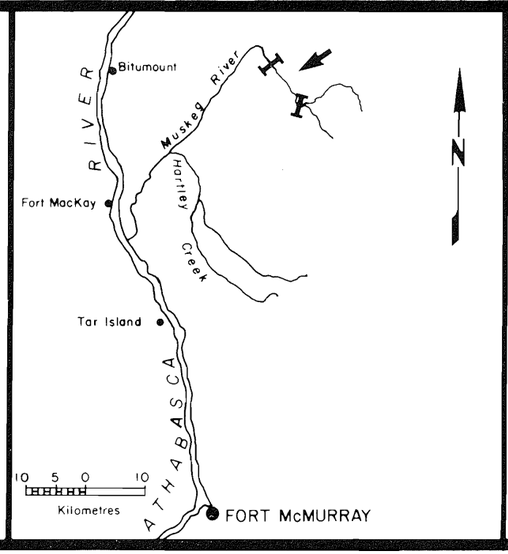
* Data from Bond and Machniak (1979)



AQUATIC BIOPHYSICAL INVENTORY

MUSKEG RIVER

Reach 5

(km 80 to km 93)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

alberta

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

No fish collections were made in this reach.

PHYSICAL CHARACTERISTICS

Reach length (km)	19.0
Channel width (m)	8
Channel area (ha)	15.2
Gradient (m/km)	4.2
Flow character	placid
Total pools (%)	100
Pattern	irregularly meandering
Confinement	unconfined
Unstable banks (%)	0
Substrate composition (%)	
fines (<2 mm)	100
gravels (2-64 mm)	0
larges (>64 mm)	0
bedrock and/or oil sand	0
Debris	high

REACH DESCRIPTION AND FISH UTILIZATION

This section of the Muskeg River meanders in an irregular pattern through a very marshy region. Although the gradient is high, there are many beaver dams that reduce the flow, and the reach consequently consists entirely of placid pools. No sites were sampled in this reach, but it is expected that the substrate is probably sand and silt with a high organic detritus content. Riparian vegetation consists of deciduous trees and shrubs and a dense growth of grasses. The stream channel is almost completely covered by overhanging vegetation, and woody debris is abundant.

No fish collections were made in this reach. It is probable, however, that the habitat is suitable only for brook stickleback, which would be year-round residents of the area.

BENTHIC INVERTEBRATES

No benthic samples were taken in this reach.

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	2
Deciduous trees	65
Shrubs	25
Grasses	90
Barren	0
Channel cover (%)	
Overhang	60
Crown	20

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach

AQUATIC BIOPHYSICAL INVENTORY
MUSKEG RIVER
Reach 6
(km 93 to km 112)

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS

POINT SAMPLE DATA

Location
Date
Hydraulics
- channel width (m)
- wet width (m)
- maximum depth (m)
- average depth (m)
- velocity (m/s)
- flow character

Substrate Composition (%)
- fines (< 2 mm)
- gravels (2–64 mm)
- larges (> 64 mm)
- bedrock and/or oil sand

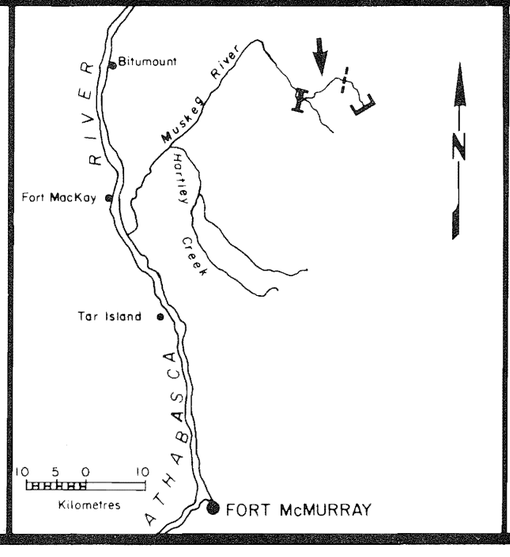
Bank
- height (m)
- form
- stability
- texture

- vegetation (% coverage)
  - coniferous trees
  - deciduous trees
  - shrubs
  - grasses
  - barren

Water Quality
- temperature (°C)
- dissolved oxygen (mg/l)
- conductivity (µmhos/cm)
- pH

LEGEND

AN	angling	ARGR	arctic grayling
CF	counting fence	BKST	brook stickleback
DN	dip net	BRMN	brassy minnow
EF	electrofisher	BURB	burbot
GN	gill net	DLVR	Dolly Varden
KS	kick sample	EGGS	unidentified fish eggs
SF	small fish collections made using a combination of methods	EMSH	emerald shiner
SN	seine	FLCH	flathead chub
AP	benthic algal productivity station	FSDC	finescale dace
BI	benthic invertebrate collection site	FTMN	fathead minnow
CH	water quality station	GOLD	goldeye
PS	point sample	LKCH	lake chub
SG	stream gauging station	LKCS	lake cisco
35	kilometres from mouth	LKWF	lake whitefish
	flow direction	LNDC	longnose dace
	reach boundary	LNSK	longnose sucker
	upstream limit of survey	MTWF	mountain whitefish
	division between sections of a reach	NRDC	northern redbelly dace
		NSST	ninespine stickleback
		NTPK	northern pike
		PLDC	pearl dace
		SLSC	slimy sculpin
		SPSC	spoonhead sculpin
		SPSH	spottail shiner
		TRPC	trout-perch
		UNSK	unidentified sucker species
		WALL	walleye
		WTSK	white sucker
		YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

MUSKEG RIVER

Reach 6 Section 1

(km 93 to km 104)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS

POINT SAMPLE DATA

Location
Date
Hydraulics
- channel width (m)
- wet width (m)
- maximum depth (m)
- average depth (m)
- velocity (m/s)
- flow character

Substrate Composition (%)
- fines (< 2 mm)
- gravels (2–64 mm)
- larges (> 64 mm)
- bedrock and/or oil sand

Bank
- height (m)
- form
- stability
- texture

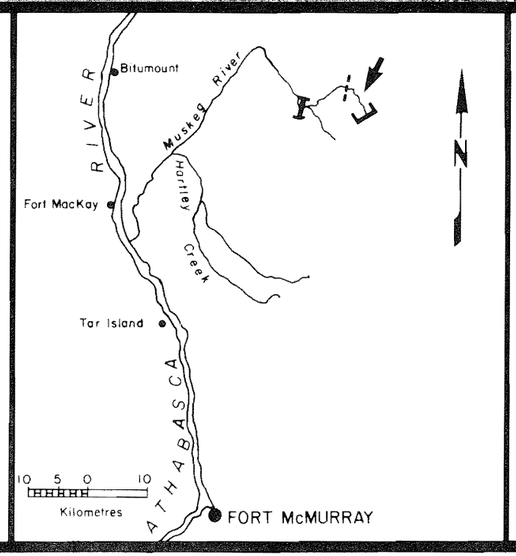
- vegetation (% coverage)
  - coniferous trees
  - deciduous trees
  - shrubs
  - grasses
  - barren

Water Quality
- temperature (°C)
- dissolved oxygen (mg/l)
- conductivity (µmhos/cm)
- pH

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
	reach boundary
	upstream limit of survey
	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

MUSKEG RIVER

Reach 6 Section 2

(km 104 to km 112)

Scale 1:25 000

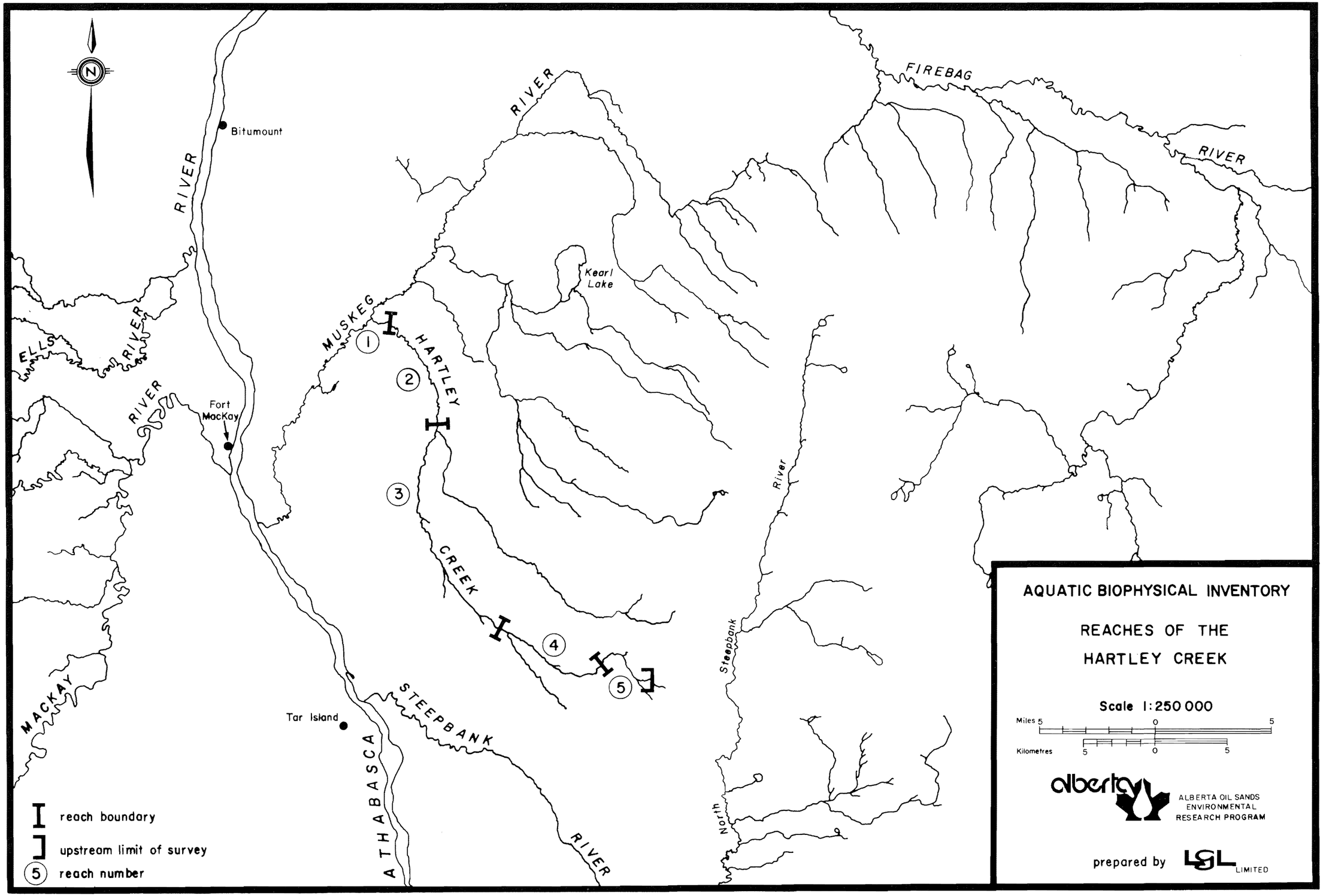
Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

HARTLEY CREEK


N
Bitumount
RIVER
ELLS
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Fort MacKay
MACKAY
RIVER
MUSKEG
HARTLEY
CREEK
Kearl Lake
FIREBAG
RIVER
River
Steepbank
North
Tar Island
ATHABASCA
STEEPBANK
RIVER
1
2
3
4
5
reach boundary
upstream limit of survey
reach number
AQUATIC BIOPHYSICAL INVENTORY
REACHES OF THE
HARTLEY CREEK
Scale 1:250 000
Miles 5 0 5
Kilometres 5 0 5
alberta
ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM
prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

Species	Adults	Juveniles and Young-of-the-year	Total Numbers
brook stickleback	1	0	1
pearl dace	0	3	3
Total	1	3	4

PHYSICAL CHARACTERISTICS

Reach length (km)	4.5
Channel width (m)	9
Channel area (ha)	4.1
Gradient (m/km)	1.1
Flow character	placid, swirling
Total pools (%)	95
Pattern	tortuously meandering
Confinement	unconfined
Unstable banks (%)	0
Substrate composition (%)	
fines (<2 mm)	100
gravels (2-64 mm)	0
larges (>64 mm)	0
bedrock and/or oil sand	0
Debris	moderate

REACH DESCRIPTION AND FISH UTILIZATION

This short, tortuously meandering reach extends upstream 4.5 km from the confluence of Hartley Creek and the Muskeg River. The gradient is relatively low and the reach is almost entirely pools with placid or swirling flow. The substrate is entirely silt and sand with a low organic detritus content. The riparian vegetation consists of deciduous trees and shrubs and a dense growth of grasses. Substantial amounts of shrubs overhang the stream channel throughout this reach. There is a moderate amount of debris in the channel.

Weedy areas along the banks provide good spawning habitat for brook stickleback and northern pike. The spawning potential of this reach for other species is considered poor. Some areas with sand substrates may be suitable for spawning of pearl dace and lake chub. The low water velocities and the abundant debris, overhanging vegetation, and aquatic vegetation along the banks provide good rearing conditions in this reach. The water is moderately deep throughout the reach and appears to be sufficient for overwintering of fish.

BENTHIC INVERTEBRATES

- NEMATODA
- OLIGOCHAETA
- PELECYPODA
  - *Musculium*
- INSECTA
  - Ephemeroptera
    - *Ameletus*
    - *Paraleptophlebia*
  - Hemiptera
    - Corixidae
  - Diptera
    - Chironomidae
      - Tanypodinae
      - Orthocladiinae
    - Tabanidae
    - Dolichopodidae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	0
Deciduous trees	75
Shrubs	35
Grasses	90
Barren	0
Channel cover (%)	
Overhang	10
Crown	10

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

Water Survey of Canada station number 07DA009

Maximum total annual discharge:	62.2 x 10^6 m^3 (1978)
Minimum total annual discharge:	20.1 x 10^6 m^3 (1977)
Maximum annual mean discharge:	1.97 m^3/s (1978)
Minimum annual mean discharge:	0.63 m^3/s (1977)
Maximum monthly mean discharge:	9.20 m^3/s (September 1978)
Minimum monthly mean discharge:	0.01 m^3/s (February 1978)
Maximum daily discharge:	14.81 m^3/s (July 20, 1975)
Minimum daily discharge:	0.01 m^3/s (Jan. 12, 1978)

Data for 1975 to 1978 compiled from Loeppky and Spitzer (1977), Warner and Spitzer (1979) and Warner (1979).

WATER QUALITY

Water Survey of Canada station number 00AT07DA0090

	Mean	Maximum	Minimum
Total alkalinity (mg $CaCO_3$/l)	163.4	348.2	46.4
pH	7.70	8.65	7.20
Total hardness (mg $CaCO_3$/l)	140.0	317.0	43.1
Conductance (µS/cm)	292	660	100
Total filterable residue fixed (mg/l)	144	383	49
Total non-filterable residue fixed (mg/l)	15	400	<0.4
Total organic carbon (mg C/l)	28.0	96.0	9.0
Silica (mg SiO_2/l)	8.8	16.8	1.7
Nitrate and nitrite nitrogen (mg N/l)	0.050	0.420	<0.003
Total Kjeldahl nitrogen (mg N/l)	1.23	4.05	0.35
Total Phosphorus (mg P/l)	0.050	0.330	0.005
Orthophosphate (mg P/l)	0.010	0.060	0.004
Sulphate (mg SO_4/l)	5.0	14.0	0.1

Data for the period January 1976 to December 1979 obtained from the National Water Quality Data Bank (NAQUADAT).

Hartley Creek at km 1.

Placid flow and abundant overhanging vegetation at km 1 are characteristic of this reach.

AQUATIC BIOPHYSICAL INVENTORY
HARTLEY CREEK
Reach 1
(km 0.0 to km 4.5)

alberta ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

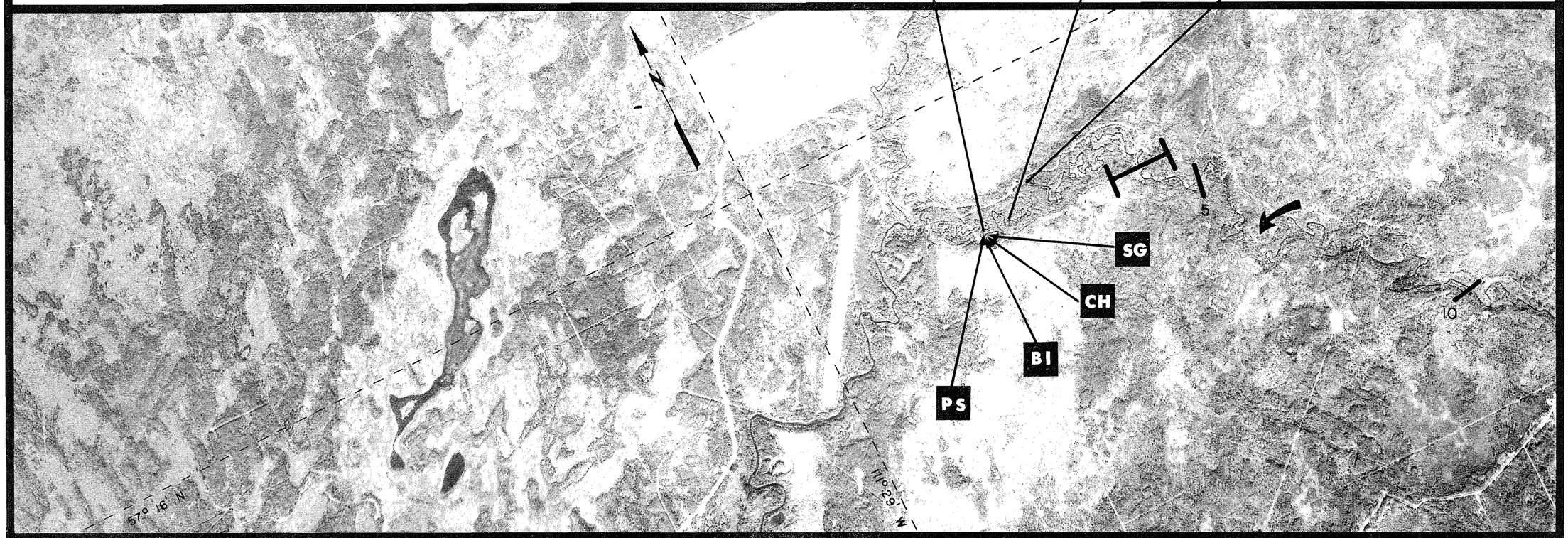
prepared by LGL LIMITED

FISH COLLECTIONS

EF: BKST, PLDC

SN*: BKST, LKCH, LNSK

SF*: ARGR, BKST, LKCH, LNSK, SLSC, WTSK



POINT SAMPLE DATA

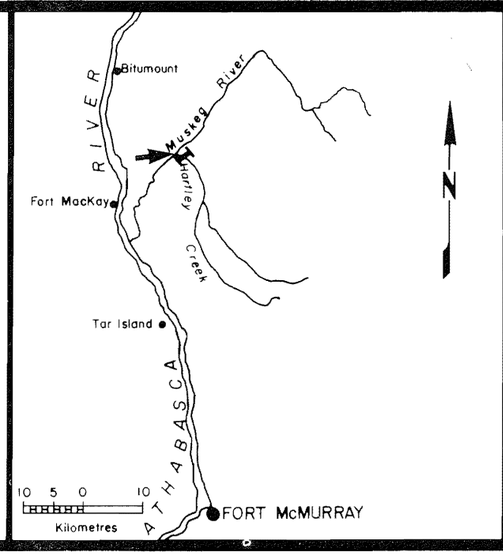
Location	km 1.0
Date	22/09/79
Hydraulics	
channel width (m)	8.5
wet width (m)	8.5
maximum depth (m)	1.5
overage depth (m)	0.8
velocity (m/s)	0.43
flow character	placid, swirling
Substrate Composition (%)	
fines (< 2mm)	100
gravels (2–64mm)	0
larges (>64mm)	0
bedrock and/or oil sand	0
Bank	
height (m)	1.0
form	repose
stability	stable
texture	silty sand
vegetation (% coverage)	
coniferous trees	0
deciduous trees	80
shrubs	30
grasses	90
barren	0
Water Quality	
temperature (°C)	8.0
dissolved oxygen (mg/l)	9
conductivity (µmhos/cm)	130
pH	7.89

LEGEND

AN angling	CF counting fence
DN dip net	EF electrofisher
GN gill net	KS kick sample
SF small fish collections made using a combination of methods	SN seine
AP benthic algal productivity station	
BI benthic invertebrate collection site	
CH water quality station	
PS point sample	
SG stream gauging station	
35 kilometres from mouth	
flow direction	
reach boundary	
upstream limit of survey	
division between sections of a reach	

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch

* Data from Bond and Machniak (1979)



AQUATIC BIOPHYSICAL INVENTORY

HARTLEY CREEK

Reach 1

(km 0.0 to km 4.5)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

Species	Adults	Juveniles and Young-of-the-year	Total Numbers
arctic grayling	0	2	2
brook stickleback	3	1	4
slimy sculpin	0	3	3
white sucker	0	1	1
Total	3	7	10

PHYSICAL CHARACTERISTICS

Reach length (km)	16.5
Channel width (m)	10
Channel area (ha)	16.5
Gradient (m/km)	2.1
Flow character	placid, swirling, rolling
Total pools (%)	70
Pattern	irregularly meandering
Confinement	occasionally confined
Unstable banks (%)	0
Substrate composition (%)	
fines (<2 mm)	90
gravels (2-64 mm)	5
larges (>64 mm)	5
bedrock and/or oil sand	0
Debris	moderate

REACH DESCRIPTION AND FISH UTILIZATION

This irregularly meandering section of Hartley Creek has a moderate gradient. Although the reach is mostly pools, riffle areas are fairly numerous. The flow character is mixed, varying from placid to swirling to rolling. There were several beaver dams present in this reach at the time the stream was surveyed in 1979. The substrate in most of the reach is sand with small amounts of silt; however, a number of areas (the riffle sections) do have gravelly and cobble substrates. Most quiet areas along the banks have some aquatic vegetation. The riparian vegetation is primarily deciduous trees and shrubs, but there are scattered patches of conifers. There is also a dense growth of grasses, and there is some overhanging vegetation throughout this reach. Moderate amounts of debris are present in the stream channel.

The sections of this reach with gravel and cobble substrates provide good spawning potential for a number of fish species (e.g., arctic grayling, longnose sucker, white sucker, longnose dace, slimy sculpin). The weedy shallow areas along the banks probably provide suitable spawning habitat for brook stickleback. The rearing potential of this reach is considered good because there are many areas with low water velocities and abundant shelter. The many deep pools in this reach are probably good for resting and feeding of larger fish. Water depths appear to be sufficient for overwintering of fish.

BENTHIC INVERTEBRATES

- NEMATODA
- OLIGOCHAETA
- GASTROPODA
  - *Ferrissia*
  - *Gyraulus*
- PELECYPODA
  - *Musculium*
  - *Pisidium*
  - *Sphaerium*
- ARACHNIDA
  - Hydracarina
- INSECTA
  - Ephemeroptera
    - *Ameletus*
    - *Drunella*
    - *Paraleptophlebia*
    - *Stenonema*
  - Plecoptera
    - *Claassenia*
    - *Isogenus*
    - *Isoperla*
    - *Nemoura*
    - *Pteronarcella*
    - *Pteronarcys*
    - *Taeniopteryx*
  - Trichoptera
    - *Brachycentrus*
    - *Chewatopsyche*
    - *Hydropsyche*
    - *Limnephilus*
    - *Micrasema*
  - Coleoptera
    - Dryopidae
    - Elmidae
  - Diptera
    - Tipulidae
    - Ceratopogonidae
    - Chironomidae
      - Chironominae
      - Tanypodinae
      - Orthocladiinae
    - Tabanidae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	15
Deciduous trees	40
Shrubs	35
Grasses	85
Barren	0
Channel cover (%)	
Overhang	5
Crown	10

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

Water Survey of Canada station number 00AT07DA0082

	Mean	Maximum	Minimum
Total alkalinity (mg $CaCO_3$/l)	134.4	303.0	56.4
pH	7.70	8.30	7.30
Total hardness (mg $CaCO_3$/l)	116.6	275.9	51.0
Conductance (µS/cm)	247	550	115
Total filterable residue fixed (mg/l)	125	346	50
Total non-filterable residue fixed (mg/l)	5	14	<0.4
Total organic carbon (mg C/l)	25.0	41.0	12.0
Silica (mg SiO_2/l)	7.8	17.0	1.8
Nitrate and nitrite nitrogen (mg N/l)	0.060	0.240	0.010
Total Kjeldahl nitrogen (mg N/l)	0.85	1.50	0.30
Total Phosphorus (mg P/l)	0.040	0.080	0.005
Orthophosphate (mg P/l)	0.010	0.011	0.005
Sulphate (mg SO_4/l)	3.9	13.2	0.1

Data for the period January 1976 to December 1979 obtained from the National Water Quality Data Bank (NAQUADAT).

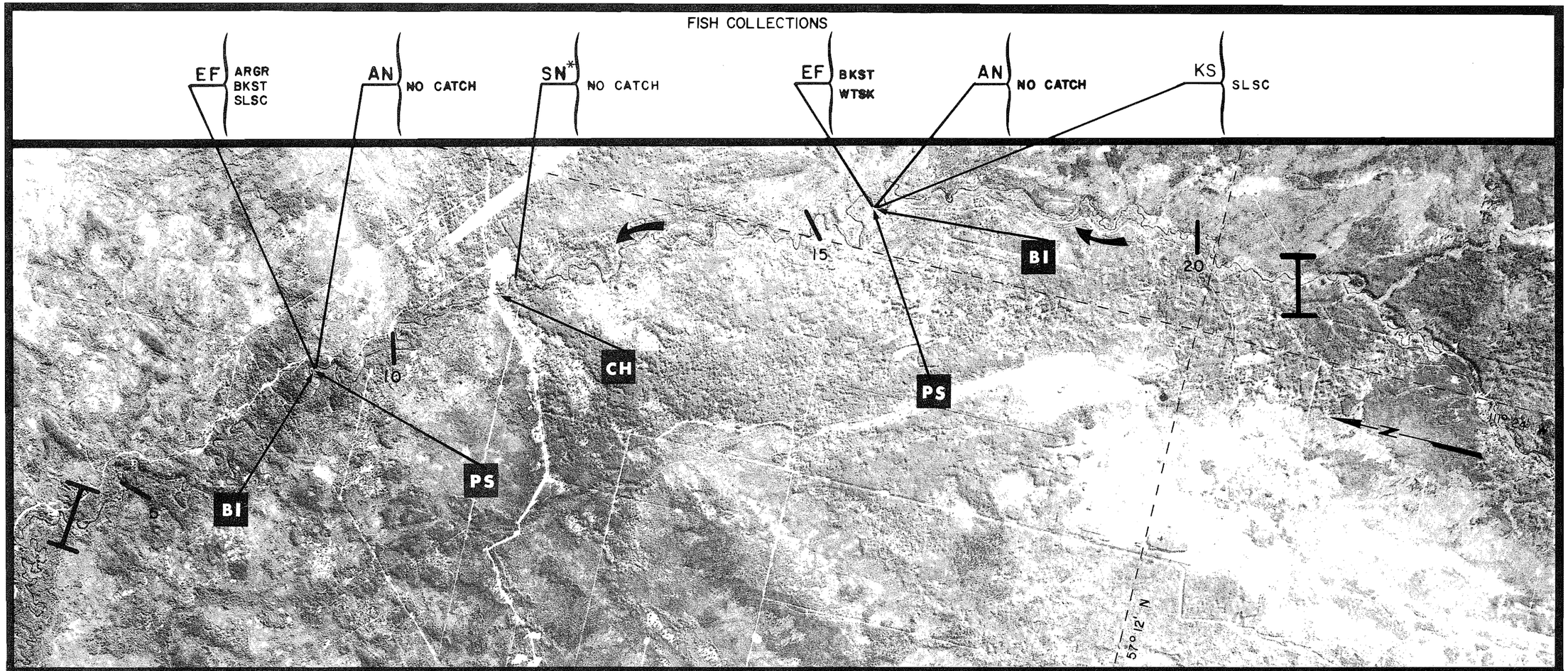
A small riffle area at km 8.7.

Placid pool at km 16.2.

AQUATIC BIOPHYSICAL INVENTORY
HARTLEY CREEK
Reach 2
(km 4.5 to km 21.0)

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED



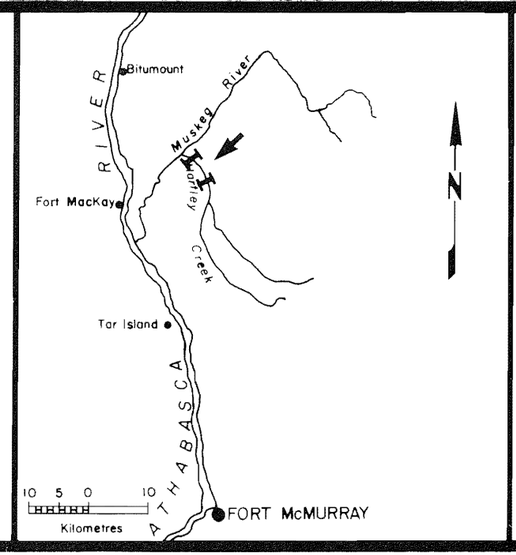
POINT SAMPLE DATA

	km 8.7	km 16.2
Location		
Date	22/09/79	22/09/79
Hydraulics		
channel width (m)	11.0	9.0
wet width (m)	11.0	9.0
maximum depth (m)	1.5	1.5
average depth (m)	0.8	0.7
velocity (m/s)	0.76	0.61
flow character	placid, swirling, rolling	placid, swirling, rolling
Substrate Composition (%)		
fines (< 2mm)	90	95
gravels (2-64mm)	5	5
larges (>64mm)	5	0
bedrock and/or oil sand	0	0
Bank		
height (m)	1.5	1.0
form	repose	undercut
stability	stable	stable
texture	sandy silt	silty sand
vegetation (% coverage)		
coniferous trees	2	30
deciduous trees	40	45
shrubs	30	35
grasses	80	95
barren	0	0
Water Quality		
temperature (°C)	7.5	9.0
dissolved oxygen (mg/l)	9	9
conductivity (µmhos/cm)	ND	130
pH	7.80	7.61

LEGEND

AN angling	ARGR arctic grayling
CF counting fence	BKST brook stickleback
DN dip net	BRMN brassy minnow
EF electrofisher	BURB burbot
GN gill net	DLVR Dolly Varden
KS kick sample	EGGS unidentified fish eggs
SF small fish collections made using a combination of methods	EMSH emerald shiner
SN seine	FLCH flathead chub
AP benthic algal productivity station	FSDC finescale dace
BI benthic invertebrate collection site	FTMN fathead minnow
CH water quality station	GOLD goldeye
PS point sample	LKCH lake chub
SG stream gauging station	LKCS lake cisco
35 kilometres from mouth	LKWF lake whitefish
flow direction	LNDC longnose dace
reach boundary	LNSK longnose sucker
upstream limit of survey	MTWF mountain whitefish
division between sections of a reach	NRDC northern redbelly dace
	NSST ninespine stickleback
	NTPK northern pike
	PLDC pearl dace
	SLSC slimy sculpin
	SPSC spoonhead sculpin
	SPSH spottail shiner
	TRPC trout-perch
	UNSK unidentified sucker species
	WALL walleye
	WTSK white sucker
	YLPR yellow perch

* Data from Bond and Machniak (1979)



AQUATIC BIOPHYSICAL INVENTORY

HARTLEY CREEK

Reach 2

(km 4.5 to km 21.0)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

alberta

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

Species	Adults	Juveniles and Young-of-the-year	Total Numbers
pearl dace	0	3	3
Total	0	3	3

PHYSICAL CHARACTERISTICS

Reach length (km)	28.0
Channel width (m)	7
Channel area (ha)	19.6
Gradient (m/km)	1.3
Flow character	placid, swirling
Total pools (%)	95
Pattern	tortuously meandering
Confinement	unconfined
Unstable banks (%)	0
Substrate composition (%)	
fines (<2 mm)	90
gravels (2-64 mm)	5
larges (>64 mm)	5
bedrock and/or oil sand	0
Debris	high

REACH DESCRIPTION AND FISH UTILIZATION

This section of Hartley Creek meanders in a tortuous pattern through a marshy area. The gradient is low and the flow is generally placid or swirling. A high proportion of the reach consists of pools, but there are some small riffle areas. Several beaver dams were present in this reach at the time the stream was surveyed in 1979. Although the substrate in most of the reach consists of sand and silt, there are a few areas with gravel and cobble substrates. The riparian vegetation is dominated by deciduous trees and shrubs and some areas of coniferous trees are present. There is a very dense growth of grasses, and the channel cover due to overhanging shrubs is fairly high. Large amounts of woody debris are present in the stream channel.

The spawning potential of this reach for those species that require gravel substrates is considered poor. The only suitable locations are the few small riffle areas. Many areas with sand substrates are probably suitable for spawning of pearl dace, and the abundant aquatic vegetation provides suitable spawning habitat for brook stickleback. The low water velocities, the aquatic vegetation, and the large amounts of debris provide many areas that appear suitable for rearing purposes. Water depths in this reach appear to be sufficient to allow overwintering of fish.

BENTHIC INVERTEBRATES

- OLIGOCHAETA
- PELECYPODA
- ARACHNIDA
  - Hydracarina
- CRUSTACEA
  - Amphipoda
    - *Gammarus pseudolimnaeus*
    - *Hyalella azteca*
- INSECTA
  - Ephemeroptera
    - *Baetis*
    - *Paraleptophlebia*
  - Odonata
    - Libellulidae
  - Hemiptera
    - Corixidae
  - Trichoptera
    - *Limnephilus/Philarctus*
    - *Oxyethira*
  - Coleoptera
    - Gyrinidae
    - Elmidae
  - Diptera
    - Ceratopogonidae
    - Chironomidae
      - Chironominae
      - Tanypodinae
    - Tabanidae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	15
Deciduous trees	60
Shrubs	20
Grasses	95
Barren	0
Channel cover (%)	
Overhang	25
Crown	5

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

Water Survey of Canada station number 00AT07DA0095

	Mean	Maximum	Minimum
Total alkalinity (mg $CaCO_3$/l)	163.0	307.0	70.0
pH	7.50	8.10	7.00
Total hardness (mg $CaCO_3$/l)	135.0	252.6	60.5
Conductance (µS/cm)	306	590	131
Total filterable residue fixed (mg/l)	155	322	74
Total non-filterable residue fixed (mg/l)	15	46	<0.4
Total organic carbon (mg C/l)	25.0	40.5	7.0
Silica (mg SiO_2/l)	8.3	20.0	3.4
Nitrate and nitrite nitrogen (mg N/l)	0.01	0.01	0.006
Total Kjeldahl nitrogen (mg N/l)	1.42	4.17	0.10
Total Phosphorus (mg P/l)	0.110	0.500	0.014
Orthophosphate (mg P/l)	0.020	0.040	<0.003
Sulphate (mg SO_4/l)	5.3	10.8	0.6

Data for the period January 1976 to December 1979 obtained from the National Water Quality Data Bank (NAQUADAT).

Hartley Creek at km 26.

Overhanging shrubs and heavily grassed banks at km 38.5.

AQUATIC BIOPHYSICAL INVENTORY
HARTLEY CREEK
Reach 3
(km 21 to km 49)

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

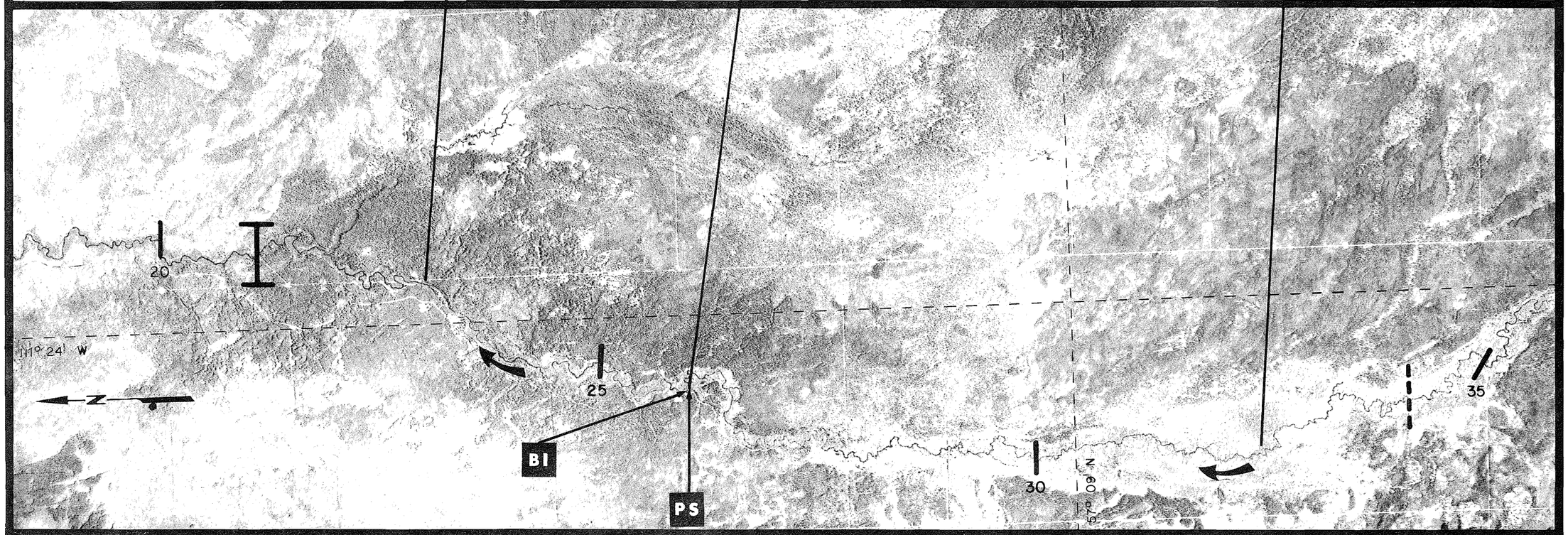
prepared by LGL LIMITED

FISH COLLECTIONS

SN* BKST

EF PLDC

SF* BKST, LKCH, LNDC, SLSC, WTSK



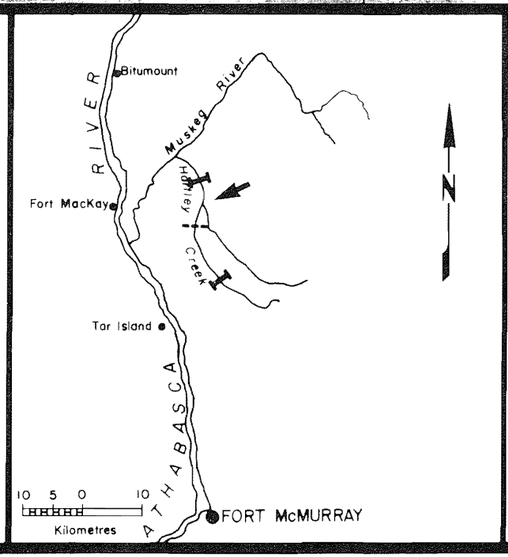
POINT SAMPLE DATA

Location	km 26.0
Date	23/09/79
Hydraulics	
channel width (m)	7.3
wet width (m)	7.3
maximum depth (m)	1.5
average depth (m)	0.9
velocity (m/s)	0.50
flow character	placid, swirling
Substrate Composition (%)	
fines (< 2 mm)	75
gravels (2–64 mm)	10
larges (> 64 mm)	15
bedrock and/or oil sand	0
Bank	
height (m)	0.6
form	repose
stability	stable
texture	sandy silt, organic
vegetation (% coverage)	
coniferous trees	45
deciduous trees	55
shrubs	10
grasses	95
barren	0
Water Quality	
temperature (°C)	8.0
dissolved oxygen (mg/l)	8
conductivity (µmhos/cm)	130
pH	7.35

LEGEND

AN angling	ARGR arctic grayling
CF counting fence	BKST brook stickleback
DN dip net	BRMN brassy minnow
EF electrofisher	BURB burbot
GN gill net	DLVR Dolly Varden
KS kick sample	EGGS unidentified fish eggs
SF small fish collections made using a combination of methods	EMSH emerald shiner
SN seine	FLCH flathead chub
AP benthic algal productivity station	FSDC finescale dace
BI benthic invertebrate collection site	FTMN fathead minnow
CH water quality station	GOLD goldeye
PS point sample	LKCH lake chub
SG stream gauging station	LKCS lake cisco
35 kilometres from mouth	LKWF lake whitefish
flow direction	LNDC longnose dace
reach boundary	LNSK longnose sucker
upstream limit of survey	MTWF mountain whitefish
division between sections of a reach	NRDC northern redbelly dace
	NSST ninespine stickleback
	NTPK northern pike
	PLDC pearl dace
	SLSC slimy sculpin
	SPSC spoonhead sculpin
	SPSH spottail shiner
	TRPC trout-perch
	UNSK unidentified sucker species
	WALL walleye
	WTSK white sucker
	YLPR yellow perch

* Data from Bond and Machniak (1979)



AQUATIC BIOPHYSICAL INVENTORY

HARTLEY CREEK

Reach 3 Section 1

(km 21 to km 34)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

alberta

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

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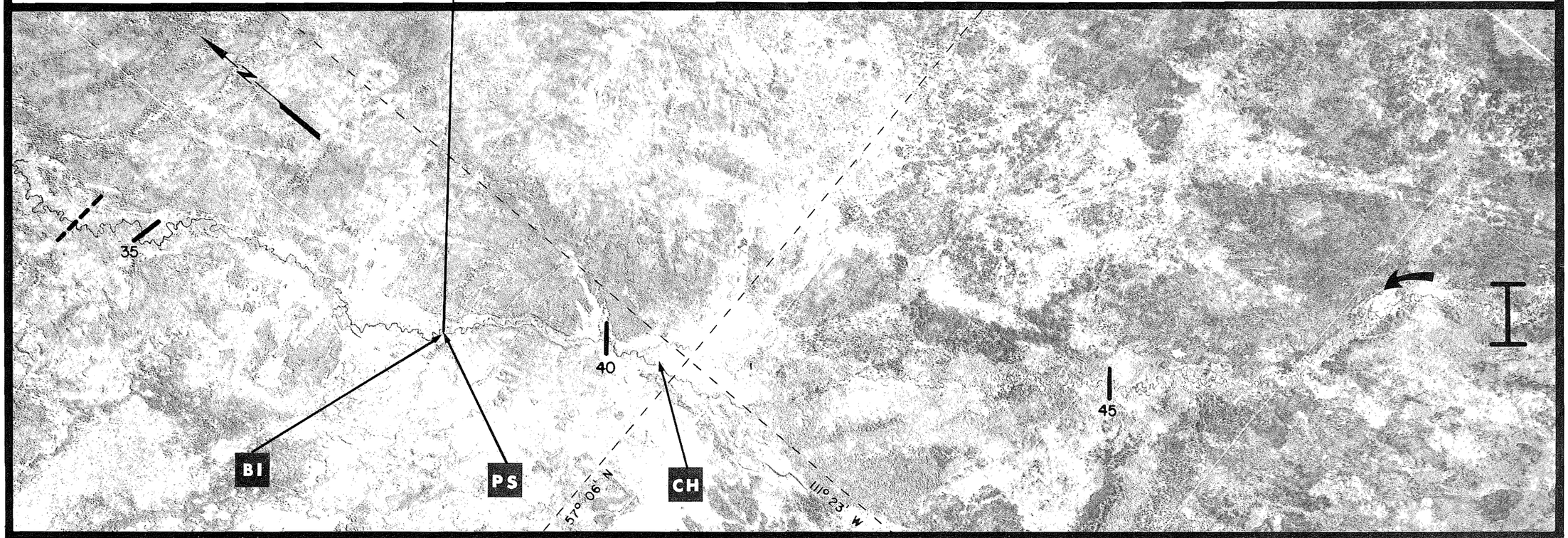
FISH COLLECTIONS

EF
PLDC



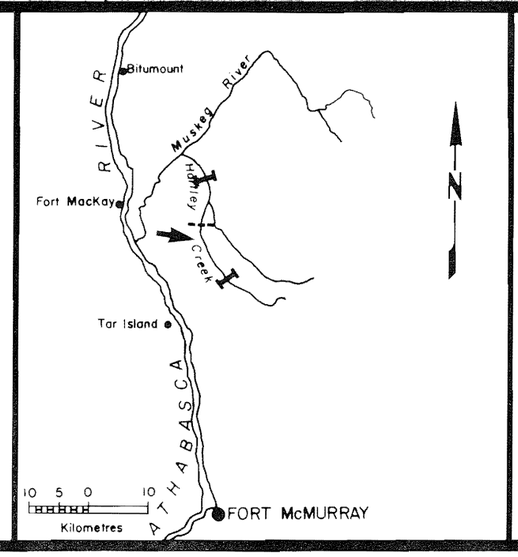
POINT SAMPLE DATA

Location	km 38.5
Date	23/09/79
Hydraulics	
channel width (m)	6.7
wet width (m)	6.7
maximum depth (m)	1.5
average depth (m)	0.9
velocity (m/s)	0.34
flow character	placid, swirling
Substrate Composition (%)	
fines (< 2mm)	100
gravels (2–64mm)	0
larges (> 64mm)	0
bedrock and/or oil sand	0
Bank	
height (m)	1.0
form	repose
stability	stable
texture	sandy silt, organic
vegetation (% coverage)	
coniferous trees	5
deciduous trees	60
shrubs	15
grasses	95
barren	0
Water Quality	
temperature (°C)	9.0
dissolved oxygen (mg/l)	8
conductivity (µmhos/cm)	140
pH	7.40

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
	reach boundary
	upstream limit of survey
	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

HARTLEY CREEK

Reach 3 Section 2

(km 34 to km 49)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

alberta

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

Species	Adults	Juveniles and Young-of-the-year	Total Numbers
brook stickleback	6	4	10
white sucker	0	22	22
Total	6	26	32

PHYSICAL CHARACTERISTICS

Reach length (km)	12.5
Channel width (m)	20
Channel area (ha)	25.0
Gradient (m/km)	6.6
Flow character	placid, swirling, rolling
Total pools (%)	90
Pattern	irregularly meandering
Confinement	occasionally confined
Unstable banks (%)	0
Substrate composition (%)	
fines (<2 mm)	95
gravels (2-64 mm)	5
larges (>64 mm)	0
bedrock and/or oil sand	0
Debris	high

REACH DESCRIPTION AND FISH UTILIZATION

This irregularly meandering section of Hartley Creek has a high gradient, and the flow character is mixed, varying from placid to swirling to rolling. Although the gradient is high, flow is impeded by the very many beaver dams, some of which are partially vegetated and appear to be very old. Because of the many beaver dams, the majority of the reach consists of pools. Some riffle areas are present immediately downstream from beaver dams. Substrates in most of the reach consist of silt and sand, but some gravel is present in the short riffle areas. The riparian vegetation is dominated by deciduous trees and shrubs in much of the reach, but coniferous trees are abundant in some areas. There are relatively small amounts of overhanging vegetation and large amounts of debris.

This reach is not considered to be suitable for spawning of most fish species; suitable substrates are extremely limited and the beaver dams severely limit movements of larger fish. There are many areas with abundant aquatic vegetation that are good spawning and rearing areas for brook stickleback. This species is undoubtedly a year-round resident in this reach.

BENTHIC INVERTEBRATES

- OLIGOCHAETA
- HIRUDINEA
  - Glossiphoniidae
- GASTROPODA
- CRUSTACEA
  - Amphipoda
    - *Hyalella azteca*
- INSECTA
  - Ephemeroptera
    - *Caenis*
    - *Paraleptophlebia*
  - Odonata
    - Libellulidae
  - Hemiptera
    - Corixidae
  - Megaloptera
    - *Sialis*
  - Trichoptera
    - *Glossosoma*
    - *Hydropsyche*
    - *Lepidostoma*
    - *Ptilostomis*
  - Coleoptera
    - Haliplidae
    - Dytiscidae
    - Elmidae
  - Diptera
    - Tipulidae
    - Ceratopogonidae
    - Chironomidae
      - Chironominae
      - Tanypodinae
      - Orthocladiinae
    - Tabanidae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	30
Deciduous trees	40
Shrubs	25
Grasses	90
Barren	0
Channel cover (%)	
Overhang	5
Crown	5

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

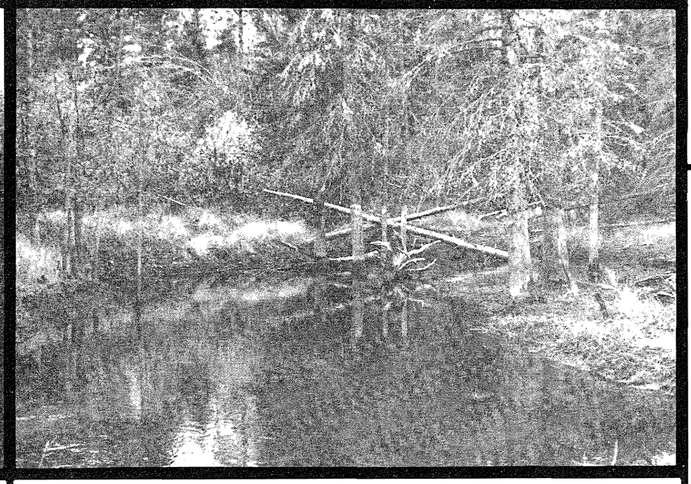
STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach

Pond created by beaver dam at km 52.5.



Area of old beaver dam impoundment at km 61.

AQUATIC BIOPHYSICAL INVENTORY
HARTLEY CREEK
Reach 4
(km 49.0 to km 61.5)

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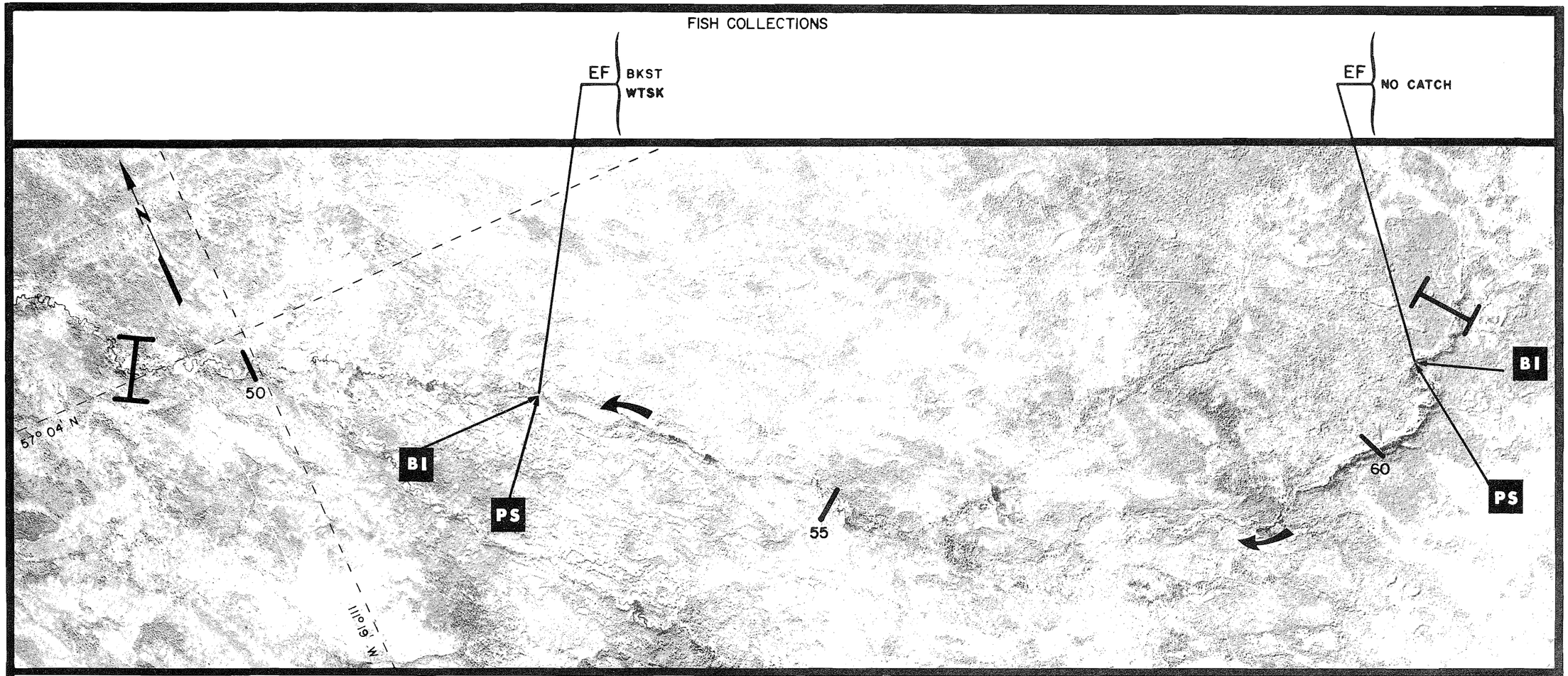


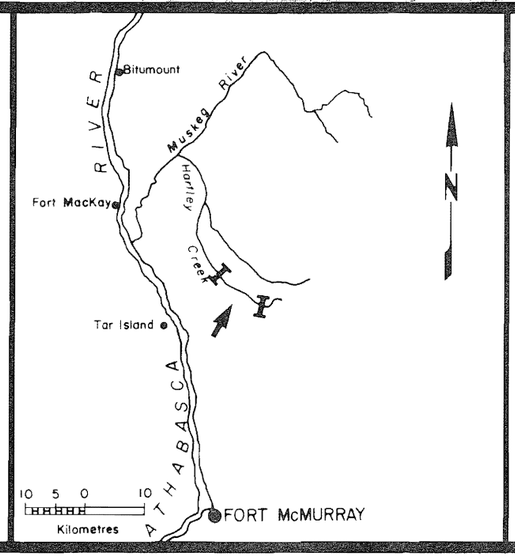
POINT SAMPLE DATA

		km 52.5	km 61.0
Location			
Date		23/09/79	24/09/79
Hydraulics			
	channel width (m)	18.0	24.0
	wet width (m)	9.5	6.7
	maximum depth (m)	2.0	0.8
	average depth (m)	0.6	0.4
	velocity (m/s)	0.13	0.24
	flow character	placid, swirling	placid, swirling, rolling
Substrate Composition (%)			
	fines (< 2mm)	100	95
	gravels (2–64mm)	0	5
	larges (>64mm)	0	0
	bedrock and/or oil sand	0	0
Bank			
	height (m)	0.5	0.6
	form	repose	repose
	stability	stable	stable
	texture	silty sand, organic	silt, sand, organic
	vegetation (% coverage)		
	coniferous trees	35	35
	deciduous trees	40	5
	shrubs	25	15
	grasses	95	90
	barren	0	0
Water Quality			
	temperature (°C)	10.5	7.5
	dissolved oxygen (mg/l)	8	9
	conductivity (μmhos/cm)	130	84
	pH	7.66	7.39

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

HARTLEY CREEK

Reach 4

(km 49.0 to km 61.5)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

No fish collections were made in this reach.

PHYSICAL CHARACTERISTICS

Reach length (km)	7.5
Channel width (m)	15
Channel area (ha)	11.3
Gradient (m/km)	5.2
Flow character	placid
Total pools (%)	100
Pattern	irregularly meandering
Confinement	unconfined
Unstable banks (%)	0
Substrate composition (%)	
fines (<2 mm)	100
gravels (2-64 mm)	0
larges (>64 mm)	0
bedrock and/or oil sand	0
Debris	high

REACH DESCRIPTION AND FISH UTILIZATION

This section of Hartley Creek meanders in an irregular pattern through a very marshy area. Although the gradient is high, water flow is impeded by numerous beaver dams and the region is poorly drained. The reach consists entirely of placid pools. Although no sites were sampled in this reach, the substrate is believed to consist of sand and silt, and it probably has a high organic detritus content. The riparian vegetation is a mixture of coniferous trees, deciduous trees, and deciduous shrubs. There is also a very dense growth of grasses. A large proportion of the stream is covered by overhanging vegetation and there is a large amount of debris.

No fish collections were made in this reach. It is probable, however, that the habitat is suitable only for brook stickleback, which would be year-round residents of the area.

BENTHIC INVERTEBRATES

No benthic samples were taken in this reach.

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	35
Deciduous trees	25
Shrubs	35
Grasses	95
Barren	0
Channel cover (%)	
Overhang	35
Crown	20

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach

AQUATIC BIOPHYSICAL INVENTORY
HARTLEY CREEK
Reach 5
(km 61.5 to km 69.0)

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS

POINT SAMPLE DATA

Location
Date
Hydraulics
- channel width (m)
- wet width (m)
- maximum depth (m)
- average depth (m)
- velocity (m/s)
- flow character

Substrate Composition (%)
- fines (< 2mm)
- gravels (2–64mm)
- larges (>64mm)
- bedrock and/or oil sand

Bank
- height (m)
- form
- stability
- texture

- vegetation (% coverage)
  - coniferous trees
  - deciduous trees
  - shrubs
  - grasses
  - barren

Water Quality
- temperature (°C)
- dissolved oxygen (mg/l)
- conductivity (µmhos/cm)
- pH

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
	reach boundary
	upstream limit of survey
	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
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LNDC	longnose dace
LNSK	longnose sucker
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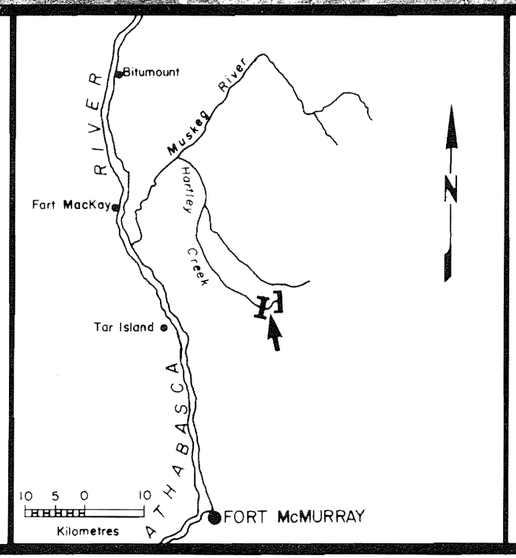
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

HARTLEY CREEK

Reach 5

(km 61.5 to km 69.0)

Scale 1:25 000

Miles 0.5 0 0.5
Kilometres 0.5 0 0.5

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ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

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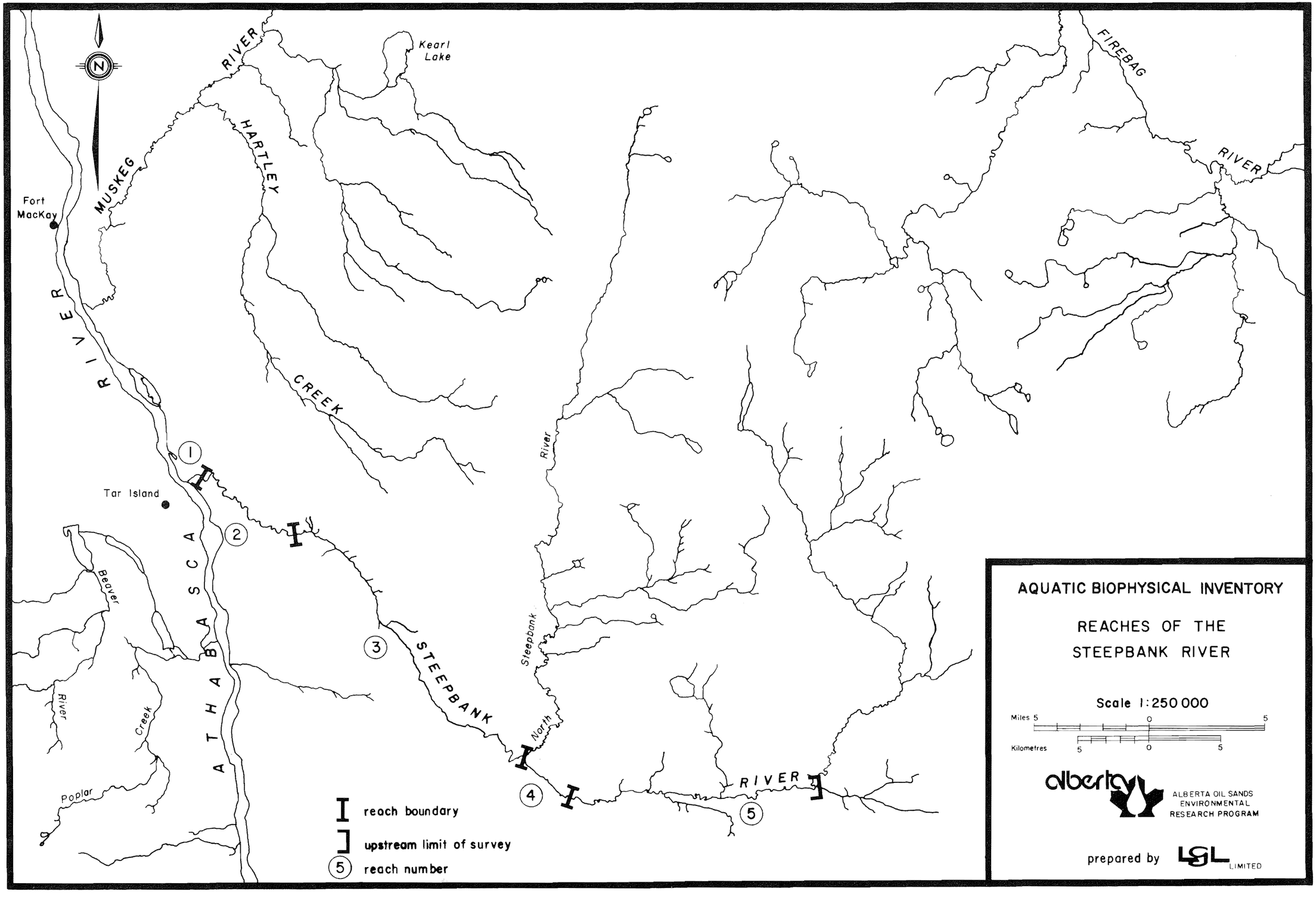
STEEPBANK RIVER


N
RIVER
Kearl Lake
HARTLEY
MUSKEG
Fort MacKay
RIVER
CREEK
FIREBAG
RIVER
River
1
Tar Island
2
ATHABASCA
Beaver
River
Creek
Poplar
3
STEEPBANK
Steepbank
North
4
RIVER
5
reach boundary
upstream limit of survey
reach number
AQUATIC BIOPHYSICAL INVENTORY
REACHES OF THE
STEEPBANK RIVER
Scale 1:250 000
Miles 5 0 5
Kilometres 5 0 5
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ALBERTA OIL SANDS
ENVIRONMENTAL
RESEARCH PROGRAM
prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (1978)

Species	Adults		Juveniles and Young-of-the-year		Total Numbers	
	June	September	June	September	June	September
arctic grayling	0	0	0	6	0	6
lake chub	1	0	0	7	0	8
longnose dace	1	0	4	3	5	3
longnose sucker	0	0	2	4	2	4
mountain whitefish	0	0	0	4	0	4
pearl dace	0	0	0	2	0	2
slimy sculpin	0	0	0	48	0	48
spoonhead sculpin	2	0	0	0	2	0
trout-perch	1	4	3	7	4	11
unidentified suckers	0	0	0	2	0	2
white sucker	0	0	0	2	0	2
Total	5	4	9	85	13	90

PHYSICAL CHARACTERISTICS

Reach length (km)	2.0
Channel width (m)	20
Channel area (ha)	4.0
Gradient (m/km)	2.7
Flow character	swirling, rolling
Total pools (%)	50
Pattern	irregular
Confinement	occasionally confined
Unstable banks (%)	10
Substrate composition (%)	
fines (<2 mm)	15
gravels (2-64 mm)	50
larges (>64 mm)	35
bedrock and/or oil sand	0
Debris	low

REACH DESCRIPTION AND FISH UTILIZATION

This short, lower reach of the Steepbank River lies within the Athabasca River floodplain and is affected by water levels in that river. Gradient is relatively high and there are a few areas of unstable banks. Flow character is primarily swirling and rolling and about half of the total reach area is composed of pools. Gravels and larges are the dominant substrate materials. Riparian vegetation is dominated by deciduous trees but conifers are also fairly abundant. There is no vegetation overhanging the river channel.

Spawning potential for fish that normally spawn over rocky substrates is excellent and there are also some areas that are suitable for fish that normally spawn over sandy substrates. Adults of several forage fish species were captured in this reach during the study. Rearing potential is considered to be moderate; the most suitable rearing areas in the reach are the spaces between large stones and rocks. Young slimy sculpin were particularly abundant in September. The moderately deep water and numerous pools in the reach provide suitable resting, feeding and overwintering areas for larger fish. There are numerous forage species and young of larger species in this reach that would serve as prey for piscivores (e.g., northern pike, walleye).

BENTHIC INVERTEBRATES

- INSECTA
  - Ephemeroptera
    - *Baetis*
    - *Ephemerella*
    - *Rhithrogena*
    - *Stenonema*
  - Odonata
    - *Ophiogomphus*
  - Plecoptera
    - *Isoperla*
  - Trichoptera
    - *Chewatopsyche*
  - Diptera
    - Chironomidae
      - Chironominae
      - Tanypodinae
      - Orthocladiinae
    - Simuliidae
    - Rhagionidae
      - *Atherix*
    - Empididae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	25
Deciduous trees	50
Shrubs	15
Grasses	5
Barren	5
Channel cover (%)	
Overhang	0
Crown	0

BENTHIC ALGAL PRODUCTIVITY

Standing crop expressed as cell counts (number·m^{-2})
- mean: 1.6×10^{10}
- maximum: 2.6×10^{10}
- minimum: 1.9×10^{10}

Standing crop expressed as chlorophyll *a* (mg·m^{-2})
- mean: 43.5
- maximum: 229.8
- minimum: 3.0

Primary productivity (mg C·h^{-1}·m^{-2})
- mean: 9.9
- maximum: 19.3
- minimum: 3.4

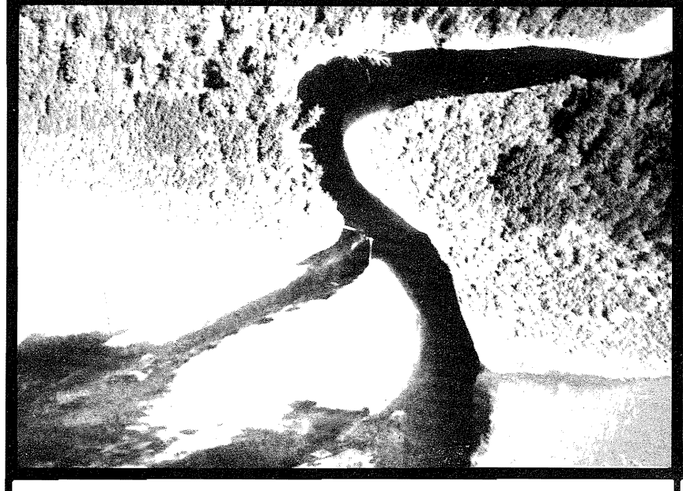
Data from Hickman *et al.* (1980).

STREAM GAUGING DATA

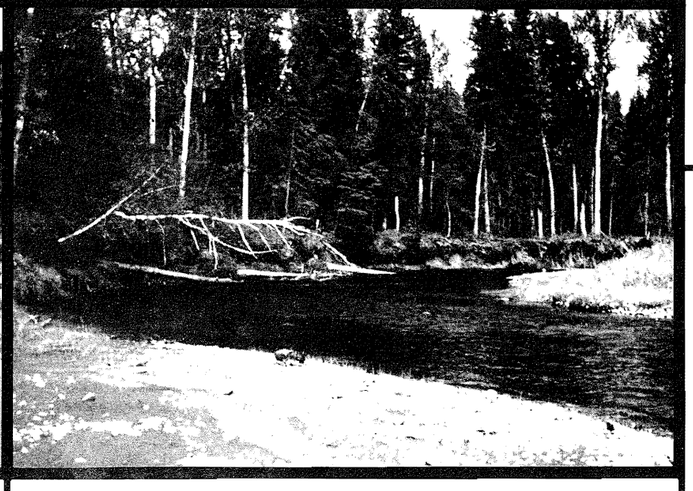
No data available for this reach

WATER QUALITY

No data available for this reach



Confluence of the Steepbank River with the Athabasca River.



Undercut bank at km 2.

AQUATIC BIOPHYSICAL INVENTORY
STEEPBANK RIVER

Reach 1

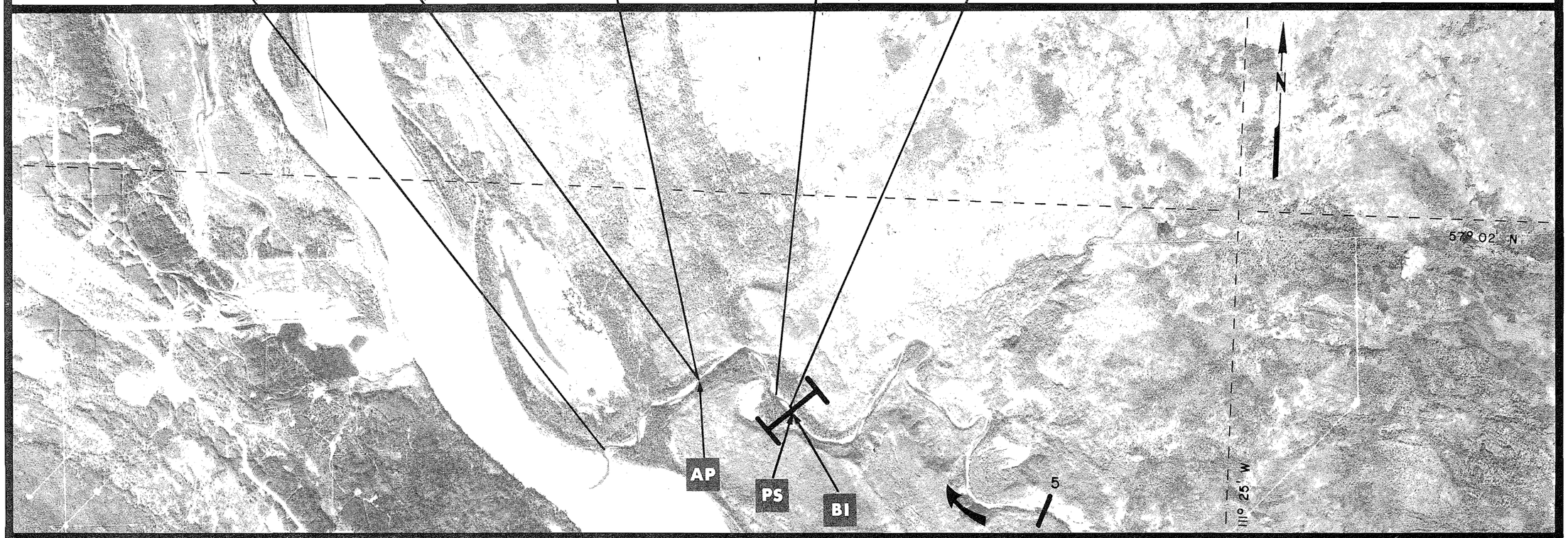
(km 0 to km 2)

alberta — ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS

SF *	LNDC	SPSH	SF *	BKST	LNDC	SPSH	CF *	ARGR	LKCS	SLSC	SN	ARGR	PLDC	SN	EGGS		
	LNSK	TRPC		BRMN	LNSK	TRPC		BURB	LKWF	TRPC		LKCH	SLSC		LNDC		
	PLDC	WTSK		BURB	MTWF	UNSK		DLVR	LNDC	WALL		LNDC	TRPC		LNSK		
	SLSC	YLPR		FTMN	NRDC	WTSK		FLCH	LNSK	WTSK		LNSK	UNSK		SPSC		
				LKCH	PLDC	YLPR		GOLD	MTWF			MTWF	WTSK		TRPC		
				LKWF	SLSC			LKCH	NTPK								



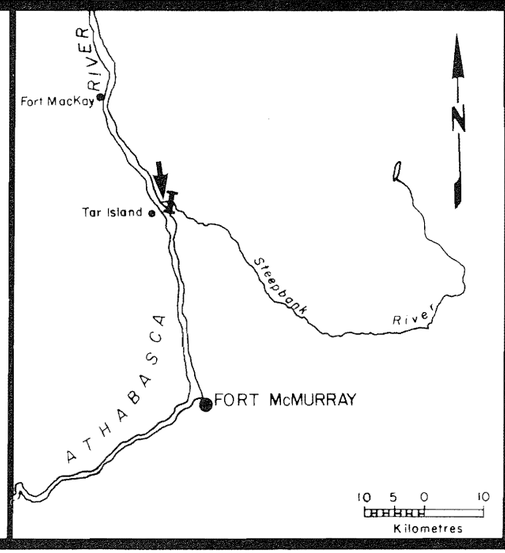
POINT SAMPLE DATA

Location	km 2
Date	04/06/78
Hydraulics	
channel width (m)	20
wet width (m)	10
maximum depth (m)	ND
average depth (m)	0.5
velocity (m/s)	1.80
flow character	rolling
Substrate Composition (%)	
fines (< 2mm)	15
gravels (2–64mm)	50
larges (>64mm)	35
bedrock and/or oil sand	0
Bank	
height (m)	1.5
form	undercut
stability	failing
texture	sand, gravel
vegetation (% coverage)	
coniferous trees	25
deciduous trees	50
shrubs	15
grasses	5
barren	5
Water Quality	
temperature (°C)	15.0
dissolved oxygen (mg/l)	ND
conductivity (µmhos/cm)	ND
pH	ND

LEGEND

AN	angling	ARGR	arctic grayling
CF	counting fence	BKST	brook stickleback
DN	dip net	BRMN	brassy minnow
EF	electrofisher	BURB	burbot
GN	gill net	DLVR	Dolly Varden
KS	kick sample	EGGS	unidentified fish eggs
SF	small fish collections made using a combination of methods	EMSH	emerald shiner
		FLCH	flathead chub
SN	seine	FSDC	finescale dace
AP	benthic algal productivity station	FTMN	fathead minnow
		GOLD	goldeye
BI	benthic invertebrate collection site	LKCH	lake chub
		LKCS	lake cisco
CH	water quality station	LKWF	lake whitefish
PS	point sample	LNDC	longnose dace
		LNSK	longnose sucker
SG	stream gauging station	MTWF	mountain whitefish
		NRDC	northern redbelly dace
35	kilometres from mouth	NSST	ninespine stickleback
		NTPK	northern pike
	flow direction	PLDC	pearl dace
		SLSC	slimy sculpin
	reach boundary	SPSC	spoonhead sculpin
		SPSH	spottail shiner
	upstream limit of survey	TRPC	trout-perch
		UNSK	unidentified sucker species
	division between sections of a reach	WALL	walleye
		WTSK	white sucker
		YLPR	yellow perch

* Data from Machniak and Bond (1979)



AQUATIC BIOPHYSICAL INVENTORY

STEEPBANK RIVER

Reach 1

(km 0 to km 2)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

alberta

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (1978)

Species	Adults		Juveniles and Young-of-the-year		Total Numbers	
	June	September	June	September	June	September
arctic grayling	0	31	0	6	0	37
lake chub	0	0	0	6	0	6
longnose dace	0	0	0	2	0	2
longnose sucker	0	0	0	1	0	1
pearl dace	0	0	2	0	2	0
slimy sculpin	0	9	0	51	0	60
white sucker	0	2	0	0	0	2
Total	0	42	2	66	2	108

PHYSICAL CHARACTERISTICS

Reach length (km)	12.0
Channel width (m)	12
Channel area (ha)	14.4
Gradient (m/km)	3.1
Flow character	rolling, broken
Total pools (%)	50
Pattern	irregularly meandering
Confinement	entrenched
Unstable banks (%)	20
Substrate composition (%)	
fines (<2 mm)	15
gravels (2-64 mm)	30
larges (>64 mm)	40
bedrock and/or oil sand	15
Debris	low

REACH DESCRIPTION AND FISH UTILIZATION

This irregularly meandering section of the Steepbank River is confined within deep (up to 60 m) canyon walls of the McMurray Oil Sands formation, and areas of unstable banks are numerous. Although gradient and water velocities are relatively high, about half of the area of this reach is composed of pools. The substrate is composed primarily of larges and gravels. Riparian vegetation is dominated by deciduous trees, but conifers are also fairly abundant. There is no vegetation overhanging the channel.

Because of the diversity of substrate sizes and water velocities and depths, the spawning potential is considered to be excellent, particularly for those species that prefer to spawn over rocky substrates. A relatively high number of adult arctic grayling were captured in this reach. The potential for rearing purposes is considered to be moderate, with the large rocky substrates providing the major suitable areas. The most abundant young fish captured during the study were slimy sculpin. This reach is rated as good for resting and feeding of larger fish because the water is relatively deep and pools are numerous. For similar reasons, overwintering potential is considered to be good.

BENTHIC INVERTEBRATES

No benthic samples were taken in this reach.

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	20
Deciduous trees	50
Shrubs	15
Grasses	10
Barren	15
Channel cover (%)	
Overhang	0
Crown	0

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

Water Survey of Canada station number 07DA006

Maximum total annual discharge:	331.8 x 10^6 m^3 (1975)
Minimum total annual discharge:	95.8 x 10^6 m^3 (1977)
Maximum annual mean discharge:	10.53 m^3/s (1975)
Minimum annual mean discharge:	3.03 m^3/s (1977)
Maximum monthly mean discharge:	30.30 m^3/s (September 1975)
Minimum monthly mean discharge:	0.30 m^3/s (December 1977)
Maximum daily discharge:	60.88 m^3/s (Apr. 27, 1974)
Minimum daily discharge:	0.25 m^3/s (Dec. 18, 1977)

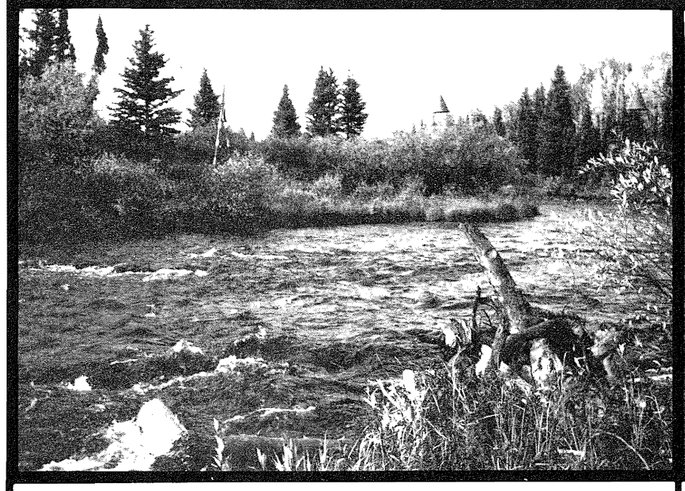
Data for 1972 to 1978 compiled from Loeppky and Spitzer (1977), Warner and Spitzer (1979) and Warner (1979).

WATER QUALITY

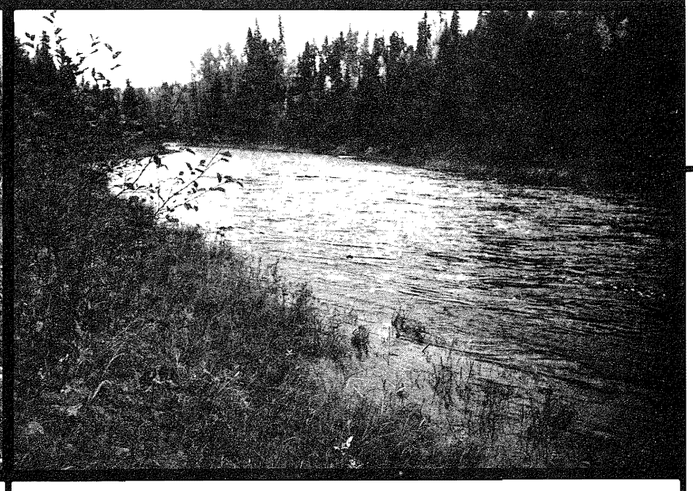
Water Survey of Canada station number 00AT07DA0060

	Mean	Maximum	Minimum
Total alkalinity (mg $CaCO_3$/l)	168.0	362.0	43.8
pH	7.70	8.70	7.00
Total hardness (mg $CaCO_3$/l)	148.0	272.8	49.8
Conductance (µS/cm)	307	625	89
Total filterable residue fixed (mg/l)	153	364	40
Total non-filterable residue fixed (mg/l)	17	151	<0.4
Total organic carbon (mg C/l)	20.0	33.0	6.5
Silica (mg SiO_2/l)	8.0	14.5	1.3
Nitrate and nitrite nitrogen (mg N/l)	0.110	0.406	<0.003
Total Kjeldahl nitrogen (mg N/l)	1.00	2.28	0.36
Total Phosphorus (mg P/l)	0.060	0.220	0.016
Orthophosphate (mg P/l)	0.030	0.150	<0.003
Sulphate (mg SO_4/l)	8.0	16.0	1.9

Data for the period January 1976 to December 1979 obtained from the National Water Quality Data Bank (NAQUADAT).



Site of the Water Survey of Canada stream gauging station at km 8.

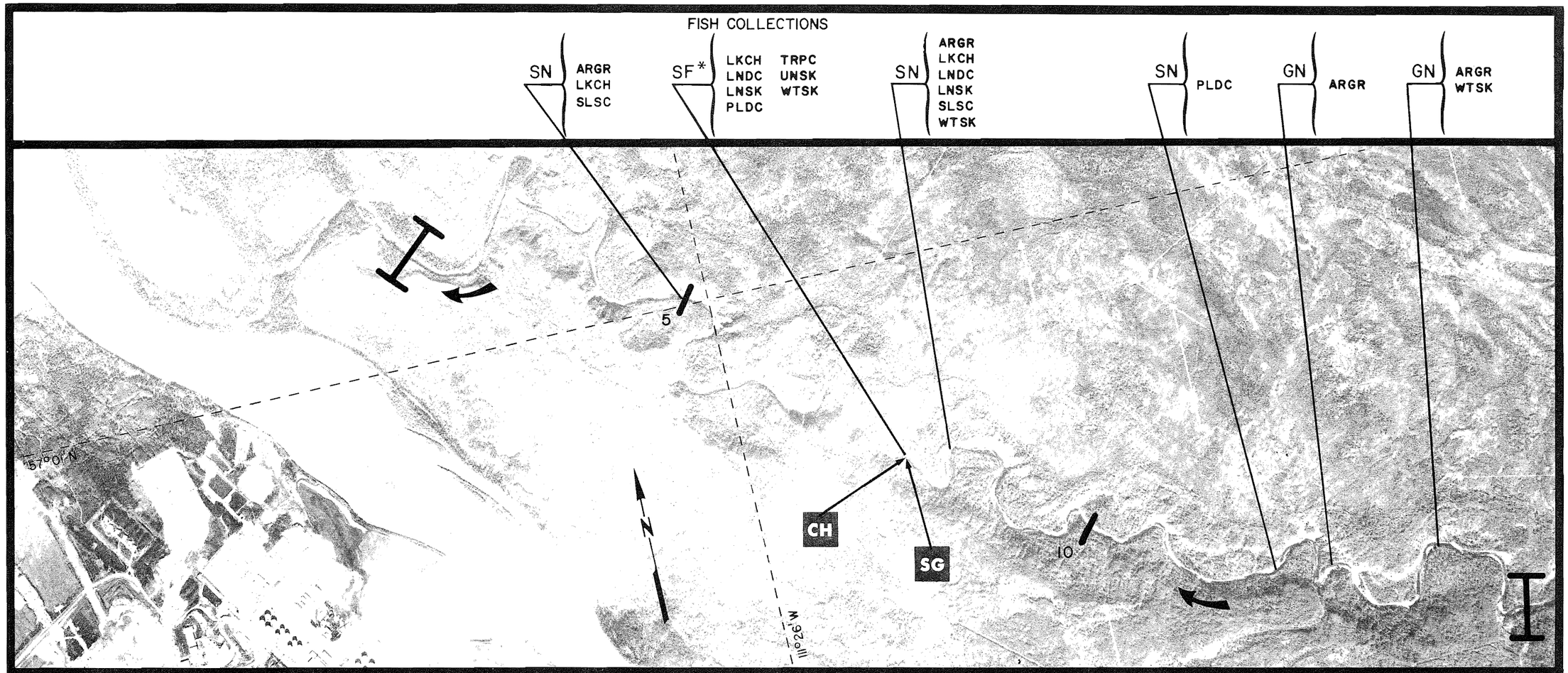


Steepbank River at km 12.

AQUATIC BIOPHYSICAL INVENTORY
STEEPBANK RIVER
Reach 2
(km 2 to km 14)

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED



POINT SAMPLE DATA

Location
Date
Hydraulics
- channel width (m)
- wet width (m)
- maximum depth (m)
- average depth (m)
- velocity (m/s)
- flow character

Substrate Composition (%)
- fines (< 2mm)
- gravels (2–64mm)
- larges (>64mm)
- bedrock and/or oil sand

Bank
- height (m)
- form
- stability
- texture

- vegetation (% coverage)
  - coniferous trees
  - deciduous trees
  - shrubs
  - grasses
  - barren

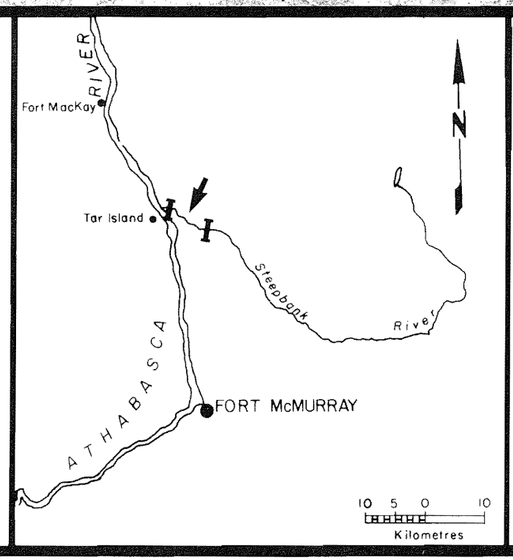
Water Quality
- temperature (°C)
- dissolved oxygen (mg/l)
- conductivity (µmhos/cm)
- pH

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch

* Data from Machniak and Bond (1979)



AQUATIC BIOPHYSICAL INVENTORY

STEEPBANK RIVER

Reach 2
(km 2 to km 14)

Scale 1:25 000

Miles 0.5 0 0.5
Kilometres 0.5 0 0.5

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prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (1978)

Species	Adults		Juveniles and Young-of-the-year		Total Numbers	
	June	September	June	September	June	September
arctic grayling	2	0	2	2	4	2
lake chub	0	4	8	22	8	26
longnose dace	1	0	11	10	12	10
longnose sucker	2	0	2	8	4	8
pearl dace	0	0	6	11	6	11
slimy sculpin	5	0	7	69	12	69
trout-perch	0	0	11	7	11	7
walleye	0	0	2	0	2	0
white sucker	0	0	3	8	3	8
Total	10	4	52	137	62	141

PHYSICAL CHARACTERISTICS

Reach length (km)	28.0
Channel width (m)	12
Channel area (ha)	33.6
Gradient (m/km)	4.4
Flow character	swirling, rolling, broken
Total pools (%)	40
Pattern	sinuous
Confinement	confined
Unstable banks (%)	10
Substrate composition (%)	
fines (<2 mm)	15
gravels (2-64 mm)	45
larges (>64 mm)	40
bedrock and/or oil sand	0
Debris	low

REACH DESCRIPTION AND FISH UTILIZATION

This reach extends upstream from the near-vertical canyon walls of Reach 2 to the confluence of the Steepbank and North Steepbank rivers. This section flows in a sinuous pattern and the gradient is the highest recorded for the Steepbank River. Water velocity is generally high and flow character varies from swirling to rolling to broken. Pools compose a lower proportion of the reach than in other sections of the river. Substrates are composed primarily of gravels and larges. Coniferous trees are the dominant riparian vegetation and there is little vegetation overhanging the channel.

The diversity of substrate sizes, stream velocities, and water depths provides areas that should be excellent for spawning of most fish species found in the river, particularly those that require rocky substrates to spawn over. Arctic grayling adults netted here during this study were either developing or spent adults, and may have spawned in this reach. The grassy shallows present in this reach are excellent for spawning of northern pike and stickleback. Rearing potential for most fish is considered to be good because of the rocky substrates and grassy areas along the insides of bends where the water is shallow. Higher numbers of young fish were captured in the reach during this study than in other sections of the Steepbank River. The numbers of slimy sculpin were particularly high. Suitable areas for larger fish to rest and feed are found in the pools. Moderately deep waters and pools provide some overwintering potential for fish.

BENTHIC INVERTEBRATES

- OLIGOCHAETA
- INSECTA
  - Ephemeroptera
    - *Baetis*
    - *Baetisca*
    - *Drunella*
    - *Ephemerella*
    - *Rhithrogena*
    - *Stenonema*
  - Odonata
    - *Ophiogomphus*
  - Plecoptera
    - *Claassenia*
    - *Diura*
    - *Hastaperla*
    - *Isogenus*
    - *Pteronarcys*
    - *Taeniopteryx*
  - Trichoptera
    - *Brachycentrus*
    - *Ceraclea*
    - *Chematopsyche*
    - *Glossosoma*
    - *Hydropsyche*
    - *Hydroptila*
    - *Lepidostoma*
    - *Micrasema*
    - *Polycentropus*
  - Diptera
    - Tipulidae
    - Psychodidae
    - Ceratopogonidae
    - Chironomidae
      - Chironominae
      - Tanypodinae
      - Orthocladiinae
    - Simuliidae
    - Tabanidae
    - Rhagionidae
      - *Atherix*
    - Empididae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	60
Deciduous trees	25
Shrubs	10
Grasses	10
Barren	0
Channel Cover (%)	
Overhang	2
Crown	0

BENTHIC ALGAL PRODUCTIVITY

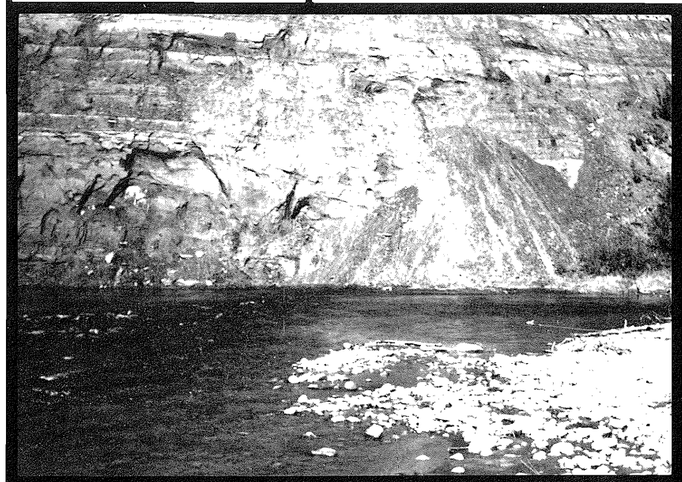
No data available for this reach

STREAM GAUGING DATA

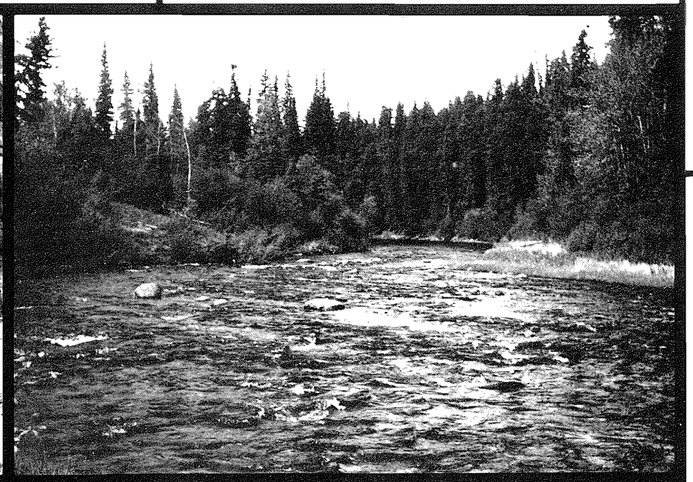
No data available for this reach

WATER QUALITY

No data available for this reach



High, unstable sand and gravel bank at km 15.



Section of riffles at km 30.

AQUATIC BIOPHYSICAL INVENTORY
STEEPBANK RIVER
Reach 3
(km 14 to km 42)

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FISH COLLECTIONS

KS — EGGS

SN — ARGR, LKCH, LNDC, LNSK, PLDC, SLSC, WTSK

GN — ARGR, LNSK

AN — WALL

SF* — LKCH, LNDC, LNSK, PLDC, SLSC, TRPC

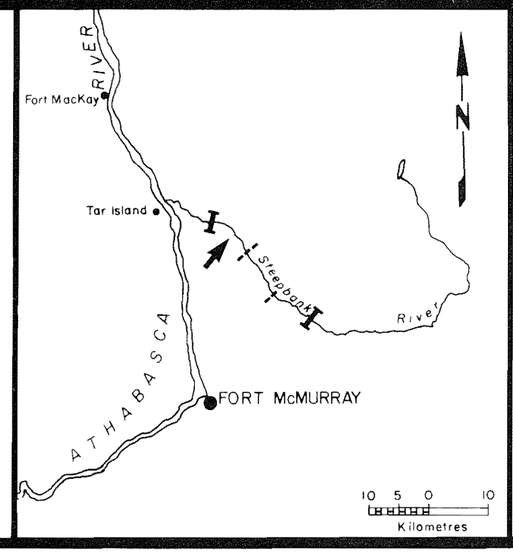
POINT SAMPLE DATA

Location	km 15
Date	04/06/78
Hydraulics	
channel width (m)	25
wet width (m)	10
maximum depth (m)	ND
average depth (m)	0.5
velocity (m/s)	1.25
flow character	rolling
Substrate Composition (%)	
fines (< 2mm)	10
gravels (2–64mm)	25
larges (>64mm)	65
bedrock and/or oil sand	0
Bank	
height (m)	1.0
form	undercut
stability	failing
texture	sand, gravel
vegetation (% coverage)	
coniferous trees	15
deciduous trees	55
shrubs	15
grasses	10
barren	20
Water Quality	
temperature (°C)	19.0
dissolved oxygen (mg/l)	ND
conductivity (µmhos/cm)	ND
pH	ND

LEGEND

AN angling	ARGR arctic grayling
CF counting fence	BKST brook stickleback
DN dip net	BRMN brassy minnow
EF electrofisher	BURB burbot
GN gill net	DLVR Dolly Varden
KS kick sample	EGGS unidentified fish eggs
SF small fish collections made using a combination of methods	EMSH emerald shiner
SN seine	FLCH flathead chub
AP benthic algal productivity station	FSDC finescale dace
BI benthic invertebrate collection site	FTMN fathead minnow
CH water quality station	GOLD goldeye
PS point sample	LKCH lake chub
SG stream gauging station	LKCS lake cisco
35 kilometres from mouth	LKWF lake whitefish
flow direction	LNDC longnose dace
I reach boundary	LNSK longnose sucker
] upstream limit of survey	MTWF mountain whitefish
⋮ division between sections of a reach	NRDC northern redbelly dace
	NSST ninespine stickleback
	NTPK northern pike
	PLDC pearl dace
	SLSC slimy sculpin
	SPSC spoonhead sculpin
	SPSH spottail shiner
	TRPC trout-perch
	UNSK unidentified sucker species
	WALL walleye
	WTSK white sucker
	YLPR yellow perch

* Data from Machniak and Bond (1979)



AQUATIC BIOPHYSICAL INVENTORY

STEEPBANK RIVER

Reach 3 Section 1
(km 14 to km 23)

Scale 1:25 000

Miles 0.5 0 0.5
Kilometres 0.5 0 0.5

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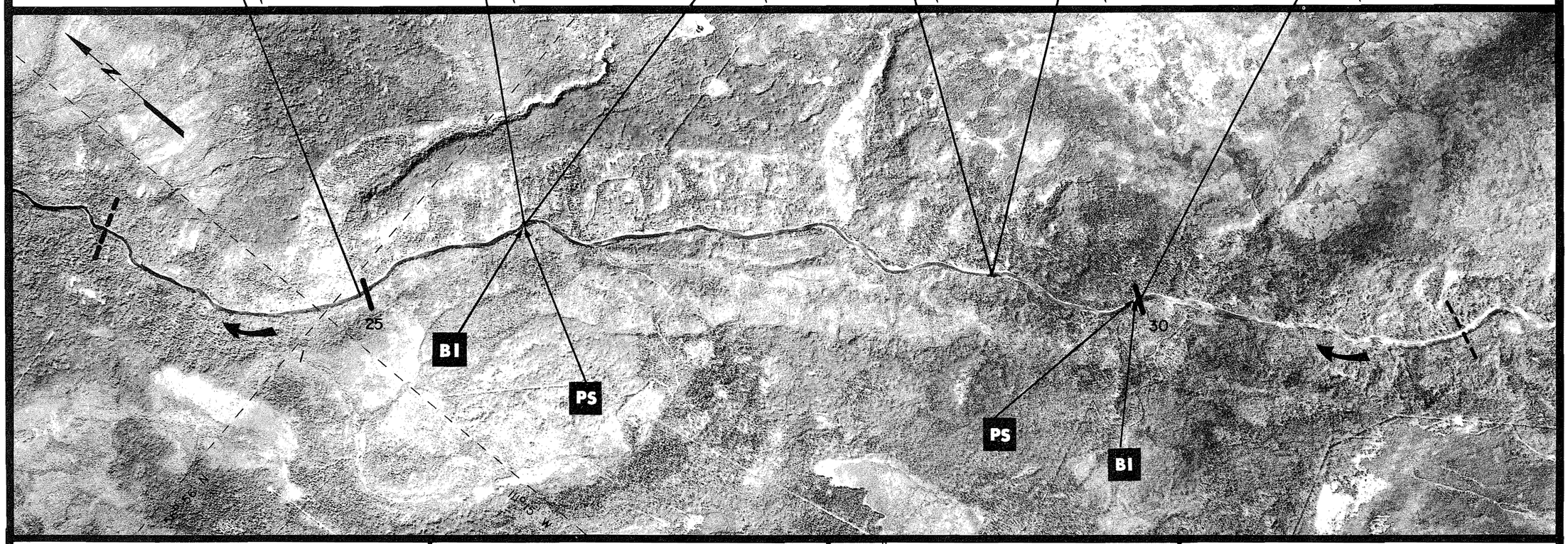
FISH COLLECTIONS

SF*	ARGR, LKCH, LNDC, LNSK, PLDC, SLSC, TRPC, WTSK	
SN	LKCH, LNDC, LNSK, PLDC, SLSC, TRPC, WTSK	
KS	EGGS	
SN	LKCH, LNDC, LNSK, PLDC, SLSC, WTSK	
EF	LKCH, LNDC, LNSK, PLDC, SLSC, TRPC, WTSK	
SN	ARGR, LNDC, SLSC	



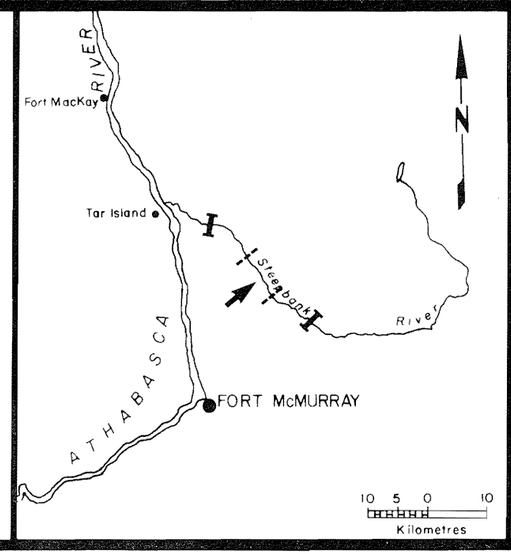
POINT SAMPLE DATA

	km 26	km 30
Location		
Date	04/06/78	04/06/78
Hydraulics		
channel width (m)	12	14
wet width (m)	12	14
maximum depth (m)	ND	ND
average depth (m)	1.0	0.5
velocity (m/s)	0.60	0.90
flow character	placid, swirling	rolling, broken
Substrate Composition (%)		
fines (< 2mm)	40	25
gravels (2–64mm)	10	10
larges (>64mm)	50	65
bedrock and/or oil sand	0	0
Bank		
height (m)	2.5	2.5
form	repose	repose
stability	stable	stable
texture	sand, gravel	sand, gravel
vegetation (% coverage)		
coniferous trees	20	45
deciduous trees	30	15
shrubs	30	40
grasses	45	30
barren	0	0
Water Quality		
temperature (°C)	17.0	18.0
dissolved oxygen (mg/l)	ND	ND
conductivity (µmhos/cm)	ND	ND
pH	ND	ND

LEGEND

AN	angling	ARGR	arctic grayling
CF	counting fence	BKST	brook stickleback
DN	dip net	BRMN	brassy minnow
EF	electrofisher	BURB	burbot
GN	gill net	DLVR	Dolly Varden
KS	kick sample	EGGS	unidentified fish eggs
SF	small fish collections made using a combination of methods	EMSH	emerald shiner
SN	seine	FLCH	flathead chub
AP	benthic algal productivity station	FSDC	finescale dace
BI	benthic invertebrate collection site	FTMN	fathead minnow
CH	water quality station	GOLD	goldeye
PS	point sample	LKCH	lake chub
SG	stream gauging station	LKCS	lake cisco
35	kilometres from mouth	LKWF	lake whitefish
	flow direction	LNDC	longnose dace
I	reach boundary	LNSK	longnose sucker
]	upstream limit of survey	MTWF	mountain whitefish
⋮	division between sections of a reach	NRDC	northern redbelly dace
		NSST	ninespine stickleback
		NTPK	northern pike
		PLDC	pearl dace
		SLSC	slimy sculpin
		SPSC	spoonhead sculpin
		SPSH	spottail shiner
		TRPC	trout-perch
		UNSK	unidentified sucker species
		WALL	walleye
		WTSK	white sucker
		YLPR	yellow perch

* Data from Machniak and Bond (1979)



AQUATIC BIOPHYSICAL INVENTORY

STEEPBANK RIVER

Reach 3 Section 2
(km 23 to km 32)

Scale 1:25 000

Miles 0.5 0 0.5
Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

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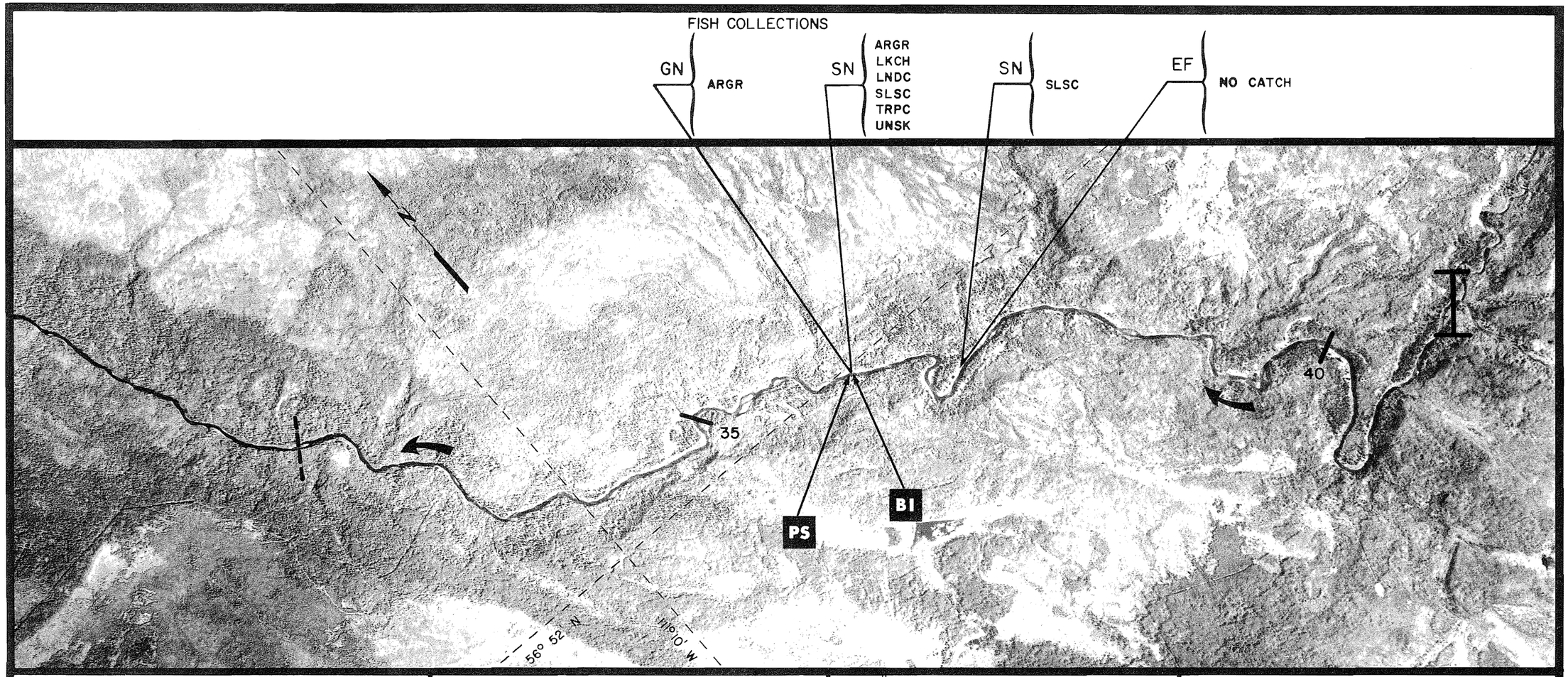
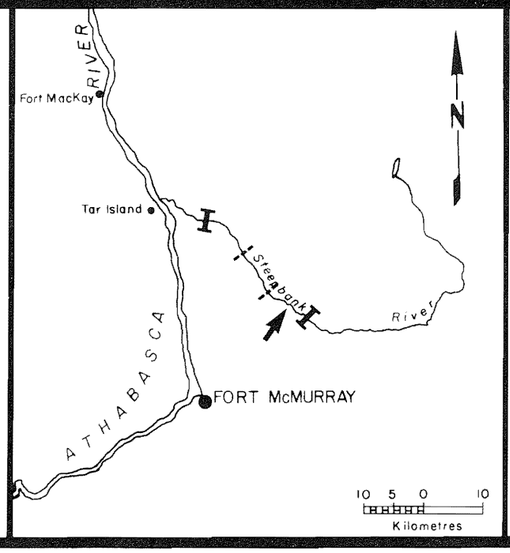


POINT SAMPLE DATA

Location	km 36
Date	03/06/78
Hydraulics	
channel width (m)	15
wet width (m)	15
maximum depth (m)	ND
average depth (m)	0.5
velocity (m/s)	0.90
flow character	swirling, rolling
Substrate Composition (%)	
fines (< 2mm)	15
gravels (2–64mm)	45
larges (>64mm)	40
bedrock and/or oil sand	0
Bank	
height (m)	2.0
form	repose
stability	stable
texture	sand, gravel
vegetation (% coverage)	
coniferous trees	50
deciduous trees	5
shrubs	15
grasses	20
barren	0
Water Quality	
temperature (°C)	17.0
dissolved oxygen (mg/l)	ND
conductivity (µmhos/cm)	ND
pH	ND

LEGEND

AN	angling	ARGR	arctic grayling
CF	counting fence	BKST	brook stickleback
DN	dip net	BRMN	brassy minnow
EF	electrofisher	BURB	burbot
GN	gill net	DLVR	Dolly Varden
KS	kick sample	EGGS	unidentified fish eggs
SF	small fish collections made using a combination of methods	EMSH	emerald shiner
		FLCH	flathead chub
SN	seine	FSDC	finescale dace
AP	benthic algal productivity station	FTMN	fathead minnow
		GOLD	goldeye
BI	benthic invertebrate collection site	LKCH	lake chub
		LKCS	lake cisco
CH	water quality station	LKWF	lake whitefish
		LNDC	longnose dace
PS	point sample	LNSK	longnose sucker
		MTWF	mountain whitefish
SG	stream gauging station	NRDC	northern redbelly dace
		NSST	ninespine stickleback
35	kilometres from mouth	NTPK	northern pike
		PLDC	pearl dace
	flow direction	SLSC	slimy sculpin
		SPSC	spoonhead sculpin
I	reach boundary	SPSH	spottail shiner
		TRPC	trout-perch
]	upstream limit of survey	UNSK	unidentified sucker species
		WALL	walleye
⋮	division between sections of a reach	WTSK	white sucker
		YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

STEEPBANK RIVER

Reach 3 Section 3
(km 32 to km 42)

Scale 1:25 000

Miles 0.5 0 0.5
Kilometres 0.5 0 0.5

alberta

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

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NUMBERS OF FISH COLLECTED (1978)

Species	Adults		Juveniles and Young-of-the-year		Total Numbers	
	June	September	June	September	June	September
arctic grayling	0	0	0	0	0	0
brook stickleback	0	0	0	1	0	1
longnose dace	2	0	0	1	2	1
pearl dace	0	0	2	0	2	0
slimy sculpin	2	1	3	17	5	18
unidentified fry	N/A	N/A	13	0	13	0
Total	4	1	18	19	22	20

PHYSICAL CHARACTERISTICS

Reach length (km)	5.0
Channel width (m)	10
Channel area (ha)	5.0
Gradient (m/km)	2.0
Flow character	swirling, rolling, broken
Total pools (%)	50
Pattern	sinuous
Confinement	confined
Unstable banks (%)	5
Substrate composition (%)	
fines (<2 mm)	20
gravels (2-64 mm)	20
larges (>64 mm)	60
bedrock and/or oil sand	0
Debris	low

REACH DESCRIPTION AND FISH UTILIZATION

This short reach flows in a sinuous pattern and the gradient and water velocities are moderate. Approximately half of the reach area consists of pools. The river banks are stable. The substrate consists mainly of larges with smaller amounts of both fines and gravels. The riparian vegetation consists of a dense growth of grasses and a mixture of deciduous shrubs, deciduous trees and coniferous trees. Little vegetation overhangs the channel.

Spawning potential in this reach is excellent for those fish that require rocky substrates. There are also numerous areas that are suitable for fish that normally spawn over sandy substrates. Suitable rearing areas for many fish are found in the rocky substrates (young-of-the-year fish) and the few areas sheltered by overhanging vegetation (juvenile fish). Pools provide the major suitable resting and feeding areas for larger fish. Although pools are numerous in this reach, they are not particularly deep; therefore, overwintering potential may be limited.

BENTHIC INVERTEBRATES

- PELECYPODA
  - *Musculium*
- INSECTA
  - Ephemeroptera
    - *Baetis*
    - *Cinygmula*
    - *Drunella*
    - *Ephemerella*
    - *Stenonema*
  - Odonata
    - *Ophiogomphus*
  - Trichoptera
    - *Brachycentrus*
    - *Cheumatopsyche*
    - *Glossosoma*
    - *Hydropsyche*
    - *Hydroptila*
    - *Lepidostoma*
    - *Micrasema*
    - *Potamyia*
  - Diptera
    - Chironomidae
      - Chironominae
      - Tanypodinae
      - Orthocladiinae
    - Simuliidae
    - Tabanidae
    - Rhagionidae
      - *Atherix*
    - Empididae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	30
Deciduous trees	30
Shrubs	50
Grasses	50
Barren	0
Channel cover (%)	
Overhang	2
Crown	0

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach

Aerial view of reach 4, looking downstream from about km 44.

Riffle area with large substrate material at km 46.

AQUATIC BIOPHYSICAL INVENTORY

STEEPBANK RIVER

Reach 4

(km 42 to km 47)

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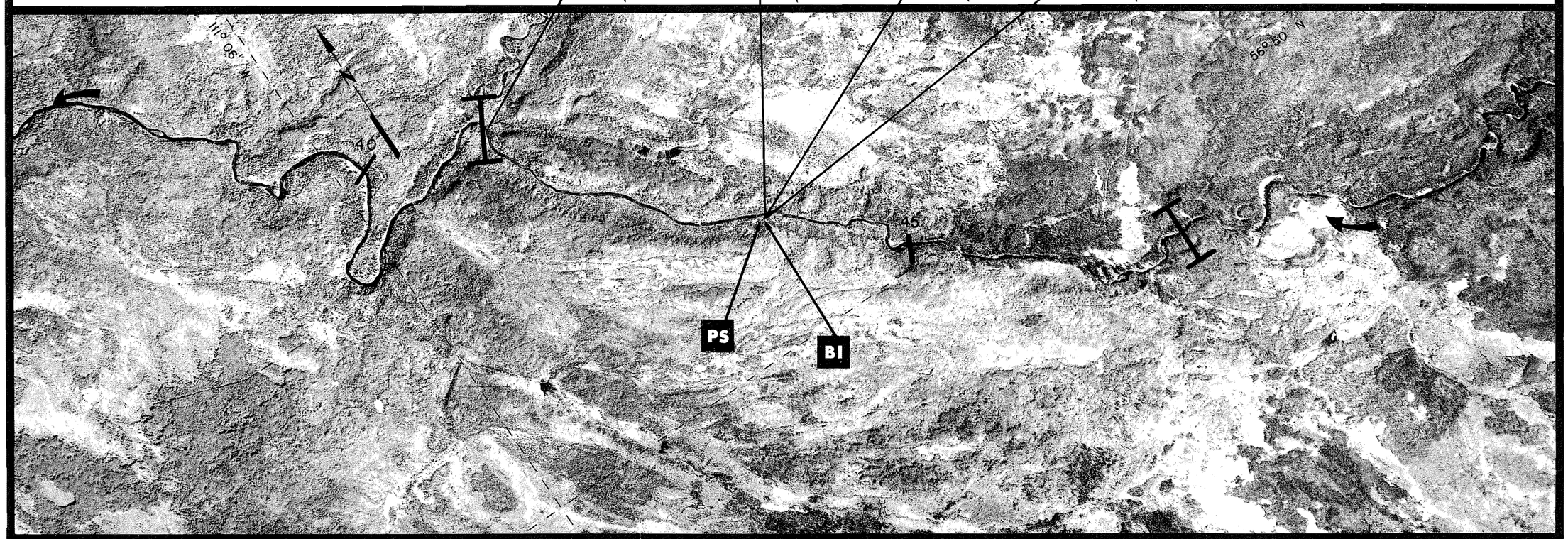
FISH COLLECTIONS

SF*	LKCH, LNDC, LNSK, PLDC, SLSC, UNSK
SN	LNDC, SLSC, UFRY
KS	EGGS, UFRY
EF	BKST, LNDC, PLDC



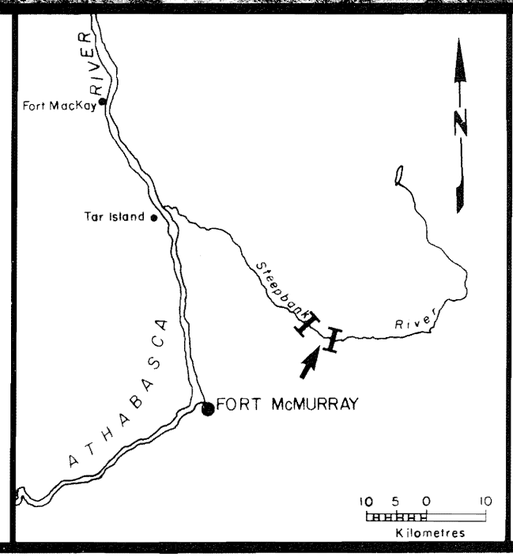
POINT SAMPLE DATA

Location	km 44
Date	03/06/78
Hydraulics	
channel width (m)	10
wet width (m)	10
maximum depth (m)	ND
average depth (m)	1.0
velocity (m/s)	1.00
flow character	rolling, broken
Substrate Composition (%)	
fines (< 2 mm)	25
gravels (2–64 mm)	15
larges (> 64 mm)	60
bedrock and/or oil sand	0
Bank	
height (m)	2.0
form	repose
stability	stable
texture	sand
vegetation (% coverage)	
coniferous trees	15
deciduous trees	25
shrubs	50
grasses	50
barren	0
Water Quality	
temperature (°C)	16.0
dissolved oxygen (mg/l)	ND
conductivity (µmhos/cm)	ND
pH	ND

LEGEND

AN	angling	ARGR	arctic grayling
CF	counting fence	BKST	brook stickleback
DN	dip net	BRMN	brassy minnow
EF	electrofisher	BURB	burbot
GN	gill net	DLVR	Dolly Varden
KS	kick sample	EGGS	unidentified fish eggs
SF	small fish collections made using a combination of methods	EMSH	emerald shiner
		FLCH	flathead chub
SN	seine	FSDC	finescale dace
AP	benthic algal productivity station	FTMN	fathead minnow
		GOLD	goldeye
BI	benthic invertebrate collection site	LKCH	lake chub
		LKCS	lake cisco
CH	water quality station	LKWF	lake whitefish
		LNDC	longnose dace
PS	point sample	LNSK	longnose sucker
		MTWF	mountain whitefish
SG	stream gauging station	NRDC	northern redbelly dace
		NSST	ninespine stickleback
35	kilometres from mouth	NTPK	northern pike
		PLDC	pearl dace
	flow direction	SLSC	slimy sculpin
		SPSC	spoonhead sculpin
I	reach boundary	SPSH	spottail shiner
		TRPC	trout-perch
]	upstream limit of survey	UNSK	unidentified sucker species
		WALL	walleye
⋮	division between sections of a reach	WTSK	white sucker
		YLPR	yellow perch
		UFRY	unidentified fry

* Data from Machniak and Bond (1979)



AQUATIC BIOPHYSICAL INVENTORY

STEEPBANK RIVER

Reach 4

(km 42 to km 47)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

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NUMBERS OF FISH COLLECTED (1978)

Species	Adults		Juveniles and Young-of-the-year		Total Numbers	
	June	September	June	September	June	September
arctic grayling	0	0	0	0	0	0
brook stickleback	0	0	0	1	0	1
lake chub	0	0	4	1	4	1
longnose sucker	0	0	1	3	1	3
pearl dace	0	18	27	21	27	39
slimy sculpin	1	5	3	3	4	8
trout-perch	0	3	5	4	5	7
unidentified suckers	0	0	0	3	0	3
white sucker	0	0	2	2	2	2
Total	1	26	42	38	43	64

PHYSICAL CHARACTERISTICS

Reach length (km)	28.0
Channel width (m)	12
Channel area (ha)	33.6
Gradient (m/km)	1.3
Flow character	placid
Total pools (%)	90
Pattern	irregularly meandering
Confinement	occasionally confined
Unstable banks (%)	5
Substrate composition (%)	
fines (<2 mm)	90
gravels (2-64 mm)	10
larges (>64 mm)	0
bedrock and/or oil sand	0
Debris	high

REACH DESCRIPTION AND FISH UTILIZATION

This section of the Steepbank River is essentially a narrow, irregularly meandering pool with relatively placid waters. Both gradient and water velocities are the lowest recorded for the river, and water depths are somewhat greater than in other sections of the river. The river banks in this reach are stable. The substrate is almost entirely fines, with a very low proportion of gravels. Large amounts of debris and frequent log obstructions exist in the reach. Deciduous trees and shrubs are more abundant in the riparian vegetation than are conifers and grasses are very abundant. There is a moderate amount of overhanging vegetation.

Spawning potential for those fish that will spawn over sandy substrates (e.g., several minnows, trout-perch, coregonids, and goldeye) is good in this reach. Waters are probably sufficiently deep to allow burbot spawning in the winter under the ice (this species will spawn over sandy substrates). Grassy shallows in this reach are suitable for spawning of northern pike and stickleback. Because of the slow water velocities, grassy shallows, and the abundance of sheltered areas provided by debris, logs, and overhanging vegetation, the rearing potential for many fish is considered to be excellent. The many pools and areas sheltered by overhanging vegetation, debris, and logs provide excellent resting and feeding areas for larger fish. Overwintering potential is good due to the generally deep waters and numerous pools.

BENTHIC INVERTEBRATES

- NEMATODA
- GASTROPODA
  - *Gyraulus*
- PELECYPODA
  - *Musculium*
- INSECTA
  - Ephemeroptera
    - *Baetis*
    - *Caenis*
    - *Ephemerella*
    - *Stenonema*
  - Plecoptera
  - Hemiptera
    - Corixidae
  - Trichoptera
    - *Brachycentrus*
    - *Homophylax*
    - *Lepidostoma*
    - *Micrasema*
    - *Oxyethira*
  - Diptera
    - Tipulidae
    - Chironomidae
      - Chironominae
      - Tanypodinae
      - Orthociadiinae
    - Tabanidae
    - Empididae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	15
Deciduous trees	30
Shrubs	30
Grasses	65
Barren	0
Channel cover (%)	
Overhang	10
Crown	0

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

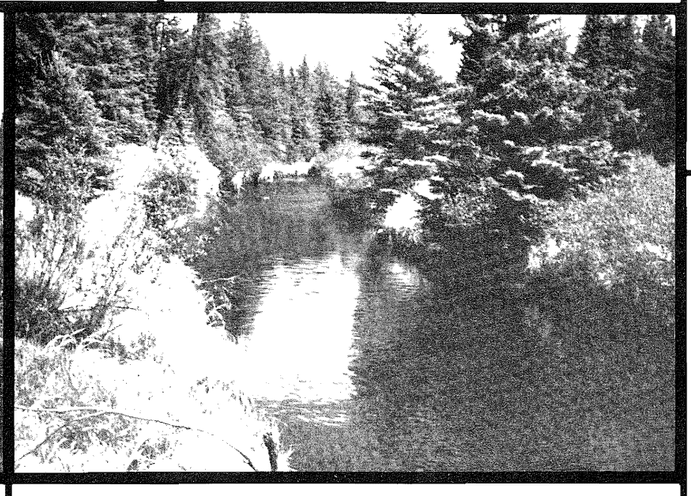
STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach

Placid, slow-moving pool at km 60.



A typical section of reach 5 at km 75.

AQUATIC BIOPHYSICAL INVENTORY

STEEPBANK RIVER

Reach 5

(km 47 to km 75)

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FISH COLLECTIONS

SN	LNSK, PLDC, SLSC, TRPC, WTSK	
EF	SLSC	
SF*	ARGR, BKST, LNSK, SLSC, TRPC, UNSK, WTSK	

POINT SAMPLE DATA

Location
Date
Hydraulics
- channel width (m)
- wet width (m)
- maximum depth (m)
- average depth (m)
- velocity (m/s)
- flow character

Substrate Composition (%)
- fines (< 2mm)
- gravels (2–64mm)
- larges (>64mm)
- bedrock and/or oil sand

Bank
- height (m)
- form
- stability
- texture

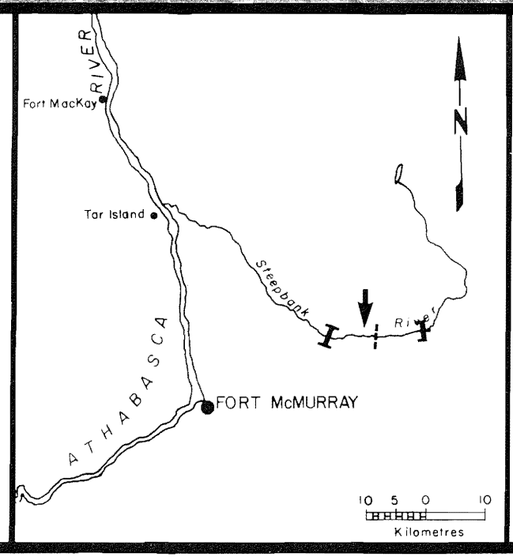
- vegetation (% coverage)
  - coniferous trees
  - deciduous trees
  - shrubs
  - grasses
  - barren

Water Quality
- temperature (°C)
- dissolved oxygen (mg/l)
- conductivity (µmhos/cm)
- pH

LEGEND

AN	angling	ARGR	arctic grayling
CF	counting fence	BKST	brook stickleback
DN	dip net	BRMN	brassy minnow
EF	electrofisher	BURB	burbot
GN	gill net	DLVR	Dolly Varden
KS	kick sample	EGGS	unidentified fish eggs
SF	small fish collections made using a combination of methods	EMSH	emerald shiner
SN	seine	FLCH	flathead chub
AP	benthic algal productivity station	FSDC	finescale dace
BI	benthic invertebrate collection site	FTMN	fathead minnow
CH	water quality station	GOLD	goldeye
PS	point sample	LKCH	lake chub
SG	stream gauging station	LKCS	lake cisco
35	kilometres from mouth	LKWF	lake whitefish
	flow direction	LNDC	longnose dace
	reach boundary	LNSK	longnose sucker
	upstream limit of survey	MTWF	mountain whitefish
	division between sections of a reach	NRDC	northern redbelly dace
		NSST	ninespine stickleback
		NTPK	northern pike
		PLDC	pearl dace
		SLSC	slimy sculpin
		SPSC	spoonhead sculpin
		SPSH	spottail shiner
		TRPC	trout-perch
		UNSK	unidentified sucker species
		WALL	walleye
		WTSK	white sucker
		YLPR	yellow perch

* Data from Machniak and Bond (1979)



AQUATIC BIOPHYSICAL INVENTORY

STEEPBANK RIVER

Reach 5 Section 1
(km 47.0 to km 59.7)

Scale 1:25 000

Miles 0.5 0 0.5
Kilometres 0.5 0 0.5

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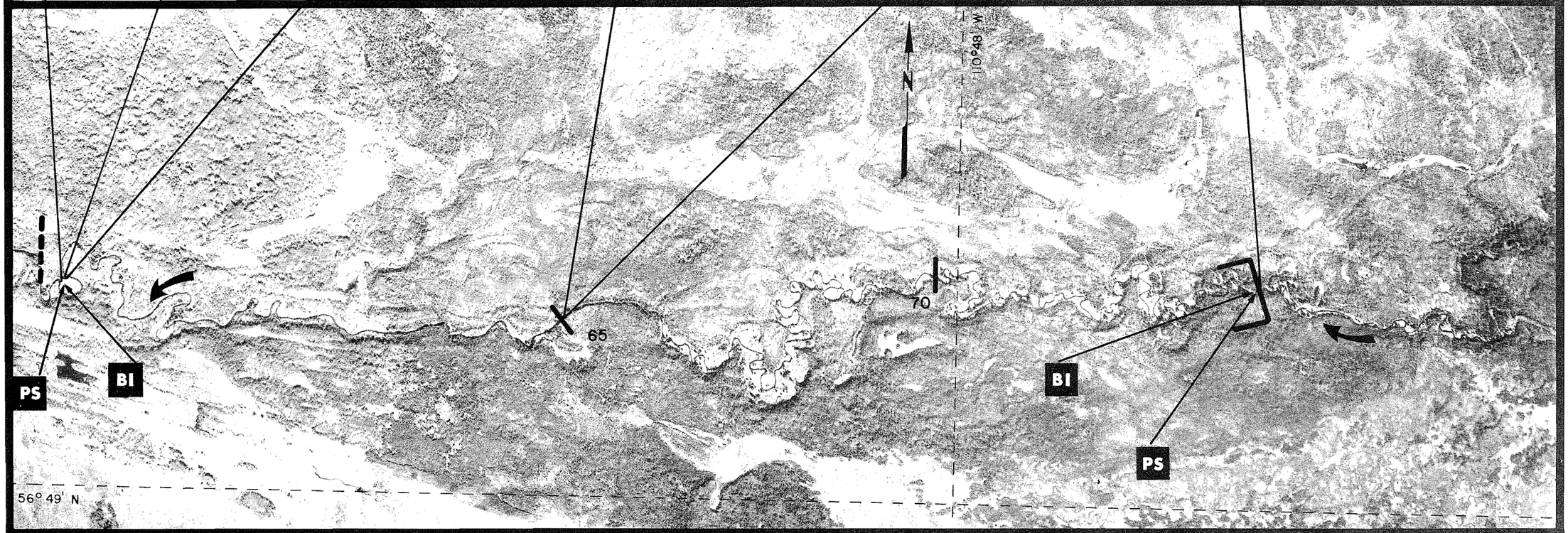
FISH COLLECTIONS

SN	LKCH LNSK PLDC SLSC TRPC WTSK	EF	BKST LKCH PLDC TRPC UNSK	GN	NO CATCH	SN	NO CATCH	EF	LNSK PLDC SLSC TRPC	SN	LKCH PLDC SLSC

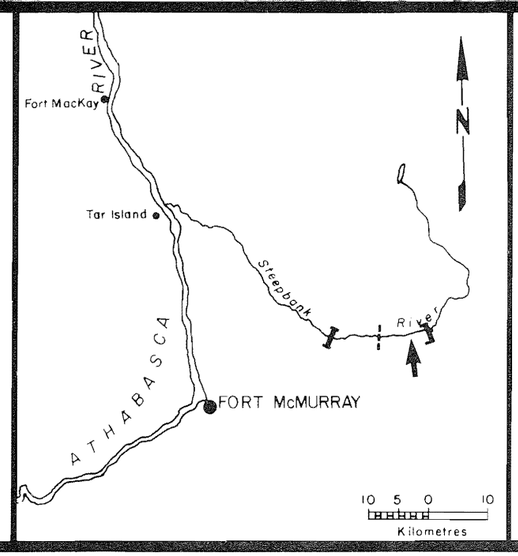


POINT SAMPLE DATA

	km 60	km 75
Location		
Date	03/06/78	03/06/78
Hydraulics		
channel width (m)	5.0	5.0
wet width (m)	5.0	5.0
maximum depth (m)	ND	ND
average depth (m)	1.5	1.0
velocity (m/s)	0.45	0.45
flow character	placid	placid
Substrate Composition (%)		
fines (< 2 mm)	100	100
gravels (2–64 mm)	0	0
larges (> 64 mm)	0	0
bedrock and/or oil sand	0	0
Bank		
height (m)	3.5	2.5
form	repose	undercut
stability	stable	stable
texture	sand, clay	sand
vegetation (% coverage)		
coniferous trees	20	35
deciduous trees	35	15
shrubs	20	30
grasses	65	50
barren	5	0
Water Quality		
temperature (°C)	16.0	15.0
dissolved oxygen (mg/l)	ND	ND
conductivity (µmhos/cm)	ND	ND
pH	ND	ND

LEGEND

AN	angling	ARGR	arctic grayling
CF	counting fence	BKST	brook stickleback
DN	dip net	BRMN	brassy minnow
EF	electrofisher	BURB	burbot
GN	gill net	DLVR	Dolly Varden
KS	kick sample	EGGS	unidentified fish eggs
SF	small fish collections made using a combination of methods	EMSH	emerald shiner
		FLCH	flathead chub
SN	seine	FSDC	finescale dace
AP	benthic algal productivity station	FTMN	fathead minnow
		GOLD	goldeye
BI	benthic invertebrate collection site	LKCH	lake chub
		LKCS	lake cisco
CH	water quality station	LKWF	lake whitefish
PS	point sample	LNDC	longnose dace
		LNSK	longnose sucker
SG	stream gauging station	MTWF	mountain whitefish
		NRDC	northern redbelly dace
35	kilometres from mouth	NSST	ninespine stickleback
		NTPK	northern pike
	flow direction	PLDC	pearl dace
		SLSC	slimy sculpin
	reach boundary	SPSC	spoonhead sculpin
		SPSH	spottail shiner
	upstream limit of survey	TRPC	trout-perch
		UNSK	unidentified sucker species
	division between sections of a reach	WALL	walleye
		WTSK	white sucker
		YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

STEEPBANK RIVER

Reach 5 Section 2
(km 59.7 to km 75.0)

Scale 1:25 000

Miles 0.5 0 0.5
Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

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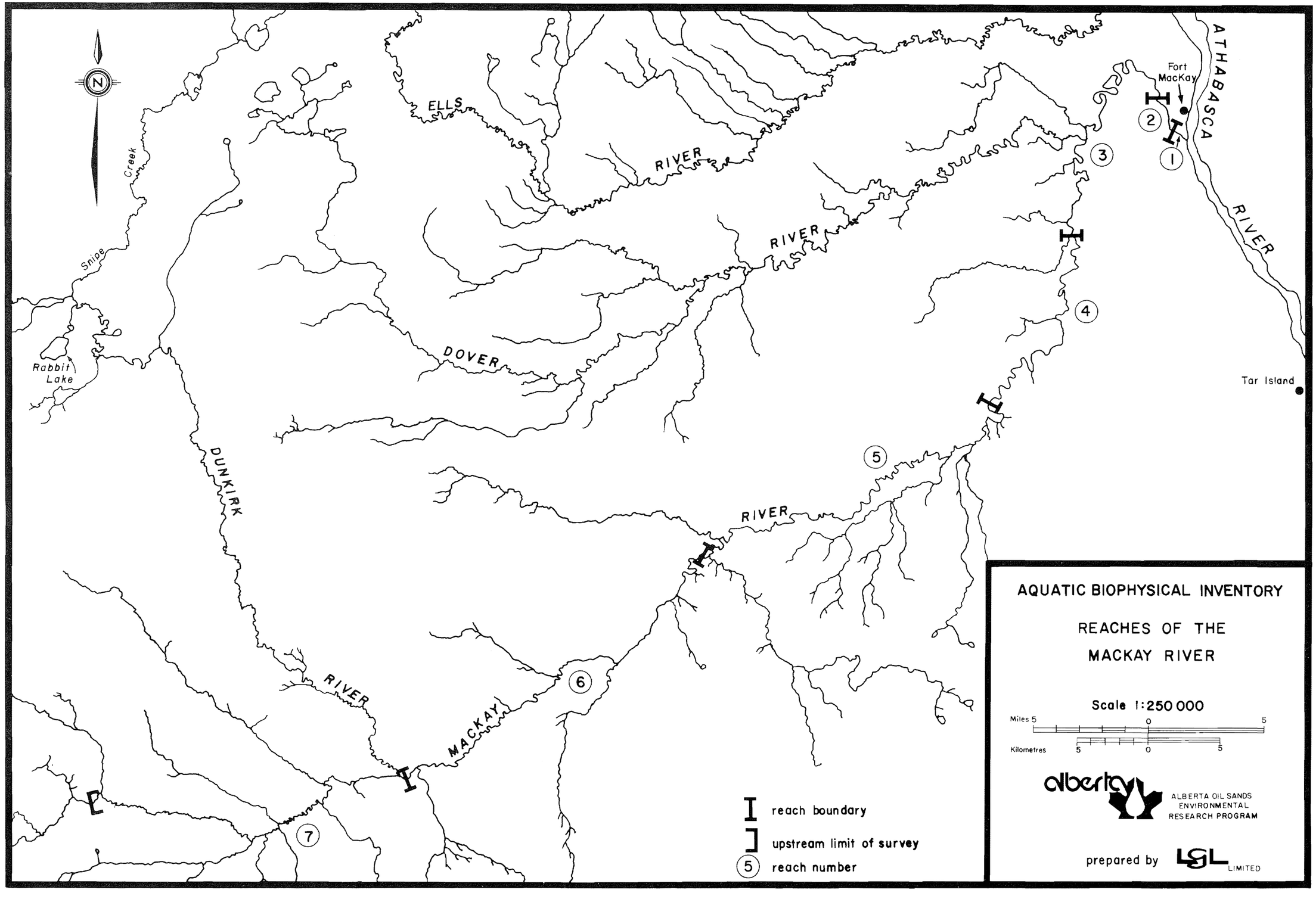
MACKAY RIVER


N
Snipe Creek
Rabbit Lake
ELLS RIVER
DOVER RIVER
DUNKIRK RIVER
MACKAY RIVER
ATHABASCA RIVER
Fort MacKay
Tar Island
1
2
3
4
5
6
7
reach boundary
upstream limit of survey
reach number
AQUATIC BIOPHYSICAL INVENTORY
REACHES OF THE
MACKAY RIVER
Scale 1:250 000
Miles 5 0 5
Kilometres 5 0 5
ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM
prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

Species	Adults	Juveniles and Young-of-the-year	Total Numbers
longnose dace	0	1	1
pearl dace	0	13	13
white sucker	4	2	6
Total	4	16	20

PHYSICAL CHARACTERISTICS

Reach length (km)	1.4
Channel width (m)	70
Channel area (ha)	9.8
Gradient (m/km)	1.4
Flow character	swirling
Total pools (%)	90
Pattern	straight
Confinement	confined
Unstable banks (%)	45
Substrate composition (%)	
fines (<2 mm)	25
gravels (2-64 mm)	45
larges (>64 mm)	15
bedrock and/or oil sand	15
Debris	low

REACH DESCRIPTION AND FISH UTILIZATION

This wide lower reach of the MacKay River is within the Athabasca River floodplain and flows in a straight pattern. There are a few high slumping banks and many areas with unstable, undercut banks. Gravel bars are numerous and some sand bars are present at the mouth of the river. The gradient is moderate, and flow characteristics in the reach are almost entirely shallow, swirling pool conditions. The substrate consists primarily of gravels, with some areas of sand. Deciduous trees and shrubs dominate the riparian vegetation, but conifers are also fairly numerous and grasses are abundant. Very little vegetation overhangs the wide channel.

The gravel substrate in this reach possibly provides suitable spawning areas for some of the fish species present in the MacKay River (e.g., longnose sucker, white sucker, trout-perch). Some of the areas with sandy substrates and moderate currents may be suitable for spawning by a few of the forage fish species, particularly pearl dace. Because of the general lack of debris or other shelter, this area is not considered to provide good rearing habitat. Although the mouth area may provide a resting area for fish migrating upstream in the Athabasca River, the potential for resting and feeding of adult fish is considered poor in the majority of the reach because there is little shelter and water depths are shallow. The shallow water probably precludes overwintering of fish in this reach.

BENTHIC INVERTEBRATES

OLIGOCHAETA
INSECTA
- Ephemeroptera
  - *Baetis*
  - *Paraleptophlebia*
- Trichoptera
  - *Hydropsyche*
- Diptera
  - Simuliidae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	30
Deciduous trees	65
Shrubs	70
Grasses	85
Barren	5
Channel cover (%)	
Overhang	1
Crown	0

BENTHIC ALGAL PRODUCTIVITY

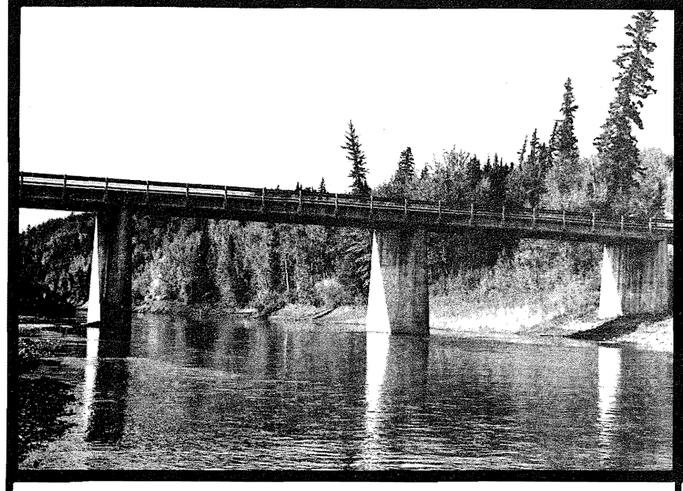
No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach



Bridge on highway 63 at km 0.6.

Looking downstream from km 0.6 towards confluence with the Athabasca River.

AQUATIC BIOPHYSICAL INVENTORY

MACKAY RIVER

Reach 1

(km 0.0 to km 1.4)

alberta oil sands environmental research program

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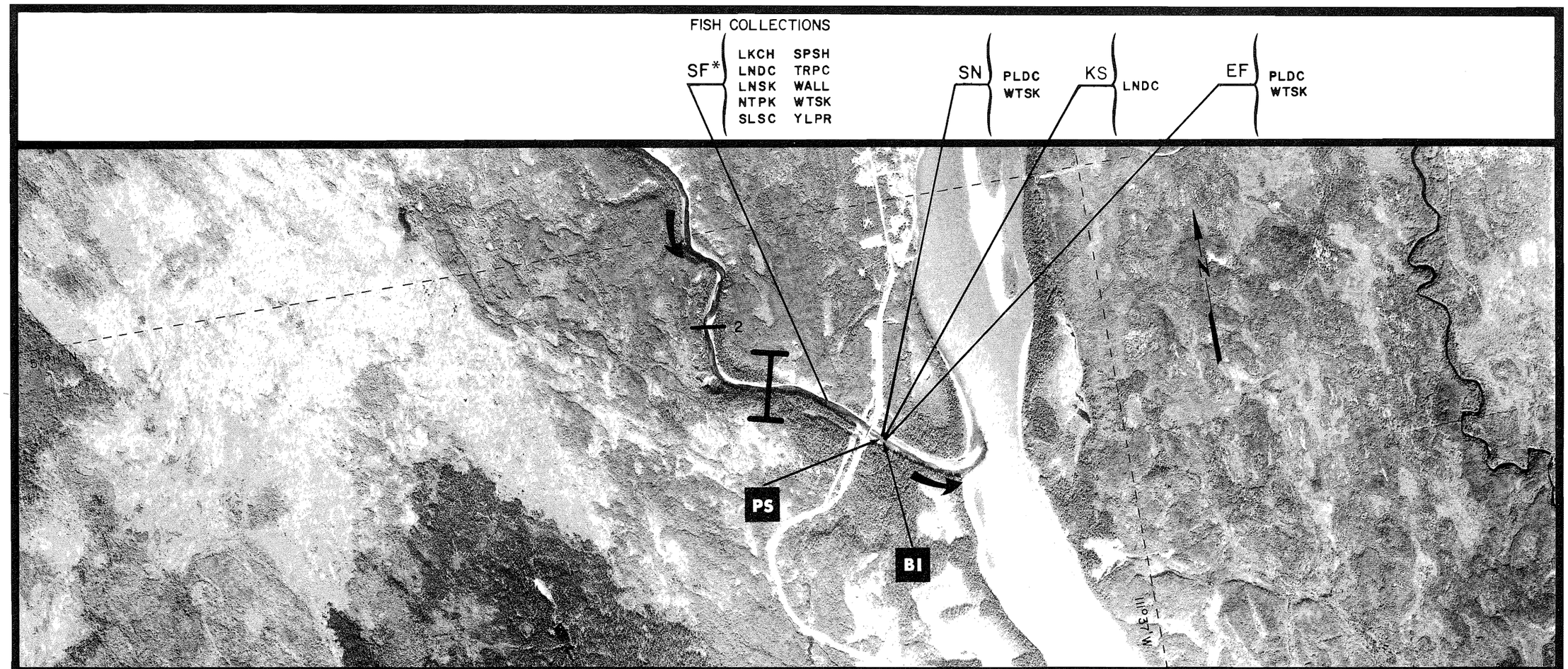


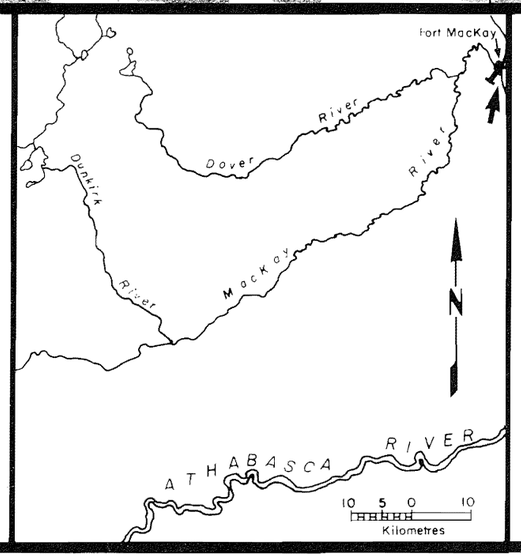
POINT SAMPLE DATA

Location	km 0.6
Date	14/09/79
Hydraulics	
channel width (m)	72.0
wet width (m)	42.0
maximum depth (m)	0.8
average depth (m)	0.5
velocity (m/s)	0.78
flow character	swirling
Substrate Composition (%)	
fines (< 2mm)	15
gravels (2–64mm)	50
larges (>64mm)	10
bedrock and/or oil sand	25
Bank	
height (m)	1.5
form	steep
stability	failing
texture	silty sand, gravel
vegetation (% coverage)	
coniferous trees	25
deciduous trees	50
shrubs	70
grasses	85
barren	5
Water Quality	
temperature (°C)	13.0
dissolved oxygen (mg/l)	9
conductivity (µmhos/cm)	320
pH	8.39

LEGEND

AN	angling	ARGR	arctic grayling
CF	counting fence	BKST	brook stickleback
DN	dip net	BRMN	brassy minnow
EF	electrofisher	BURB	burbot
GN	gill net	DLVR	Dolly Vorden
KS	kick sample	EGGS	unidentified fish eggs
SF	small fish collections made using a combination of methods	EMSH	emerald shiner
		FLCH	flathead chub
SN	seine	FSDC	finescale dace
AP	benthic algal productivity station	FTMN	fathead minnow
		GOLD	goldeye
BI	benthic invertebrate collection site	LKCH	lake chub
		LKCS	lake cisco
CH	water quality station	LKWF	lake whitefish
		LNDC	longnose dace
PS	point sample	LNSK	longnose sucker
		MTWF	mountain whitefish
SG	stream gauging station	NRDC	northern redbelly dace
		NSST	ninespine stickleback
35	kilometres from mouth	NTPK	northern pike
		PLDC	pearl dace
	flow direction	SLSC	slimy sculpin
		SPSC	spoonhead sculpin
	reach boundary	SPSH	spottail shiner
		TRPC	trout-perch
	upstream limit of survey	UNSK	unidentified sucker species
		WALL	walleye
	division between sections of a reach	WTSK	white sucker
		YLPR	yellow perch

* Data from Machniak *et al.* (1980)



AQUATIC BIOPHYSICAL INVENTORY
MACKAY RIVER

Reach 1
(km 0.0 to km 1.4)

Scale 1:25 000

Miles 0.5 0 0.5
Kilometres 0.5 0 0.5

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NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

	Adults	Juveniles and Young-of-the-year	Total Numbers
pearl dace	2	42	44
trout-perch	0	26	26
walleye	0	4	4
white sucker	0	10	10
Total	2	82	84

PHYSICAL CHARACTERISTICS

Reach length (km)	3.1
Channel width (m)	31
Channel area (ha)	9.6
Gradient (m/km)	1.5
Flow character	swirling
Total pools (%)	95
Pattern	sinuous
Confinement	entrenched
Unstable banks (%)	25
Substrate composition (%)	
fines (<2 mm)	35
gravels (2-64 mm)	60
larges (>64 mm)	0
bedrock and/or oil sand	5
Debris	low

REACH DESCRIPTION AND FISH UTILIZATION

This short reach lies just above the Athabasca River floodplain and flows in a sinuous pattern through a narrow valley. The steep valley walls are 40 to 50 m high and there are several areas with high, near-vertical, slumping banks. The gradient is moderate and the reach consists almost entirely of swirling pools. The substrate consists of gravels with some sandy areas. Riparian vegetation is primarily deciduous trees and shrubs with some stands of conifers. Grasses are also abundant.

This reach provides many areas that should be good for spawning of those fish species that require gravel substrates. Arctic grayling, longnose sucker, white sucker and trout-perch have all been collected in the lower reaches of the MacKay River and all spawn over gravel substrates. Rearing potential is considered fair; some grassy shallow areas provide the only suitable habitat. Because of the relatively deep water and the many pools, the potential for adult fish resting and feeding is considered good. The deep pools also provide several good areas for overwintering of fish.

BENTHIC INVERTEBRATES

- OLIGOCHAETA
- GASTROPODA
  - *Ferrissia*
- PELECYPODA
  - *Musculium*
- INSECTA
  - Collembola
  - Ephemeroptera
    - *Ameletus*
    - *Baetisca*
    - *Caenis*
    - *Paraleptophlebia*
  - Odonata
    - *Aeshna*
    - *Ophiogomphus*
  - Plecoptera
    - *Pteronarcys*
  - Trichoptera
    - *Oecetis*
    - *Polycentropus*
  - Diptera
    - Tipulidae
    - Ceratopogonidae
    - Chironomidae
      - Chironominae
    - Simuliidae
    - Tabanidae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	30
Deciduous trees	60
Shrubs	30
Grasses	60
Barren	5
Channel cover (%)	
Overhang	1
Crown	0

BENTHIC ALGAL PRODUCTIVITY

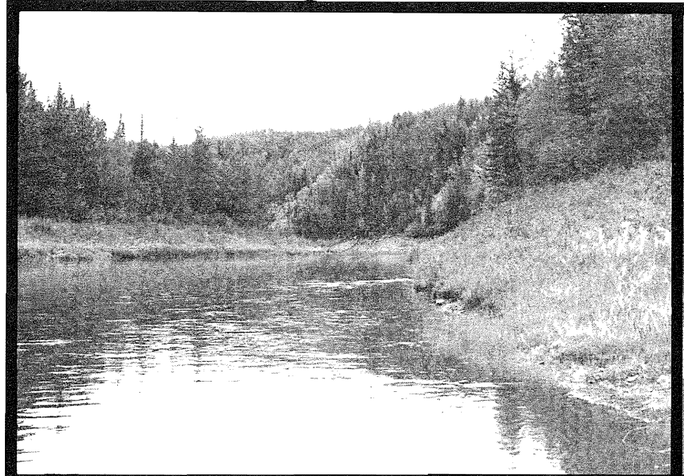
No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach



Swirling flow character, typical of reach 2, at km 2.5.

MacKay River at km 2.5.

AQUATIC BIOPHYSICAL INVENTORY
MACKAY RIVER
Reach 2
(km 1.4 to km 4.2)

alberta oil sands environmental research program

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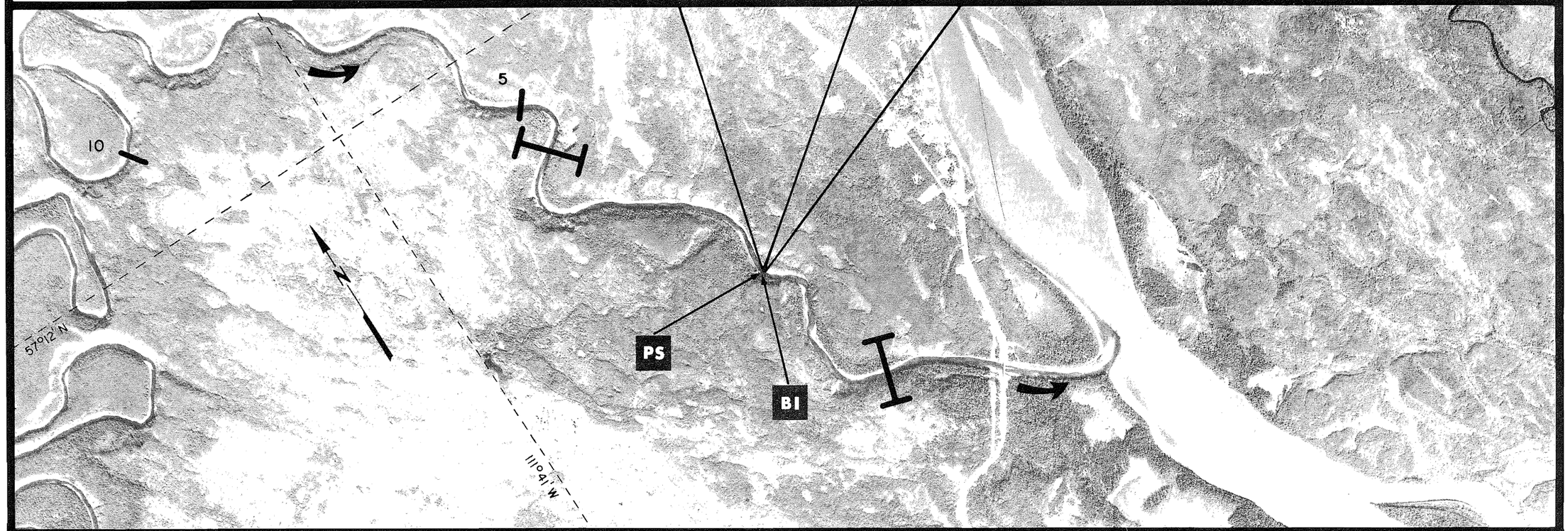
FISH COLLECTIONS

GN*	NO CATCH	
SN	PLDC, TRPC, WALL, WTSK	
KS	PLDC, TRPC	



POINT SAMPLE DATA

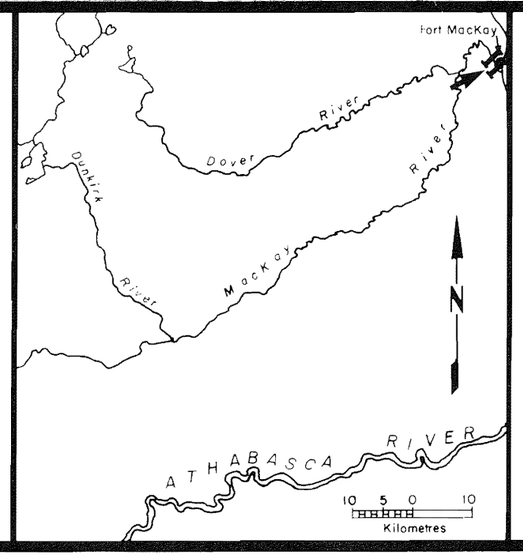
Location	km 2.5
Date	12/09/79
Hydraulics	
channel width (m)	38.1
wet width (m)	24.4
maximum depth (m)	1.5
average depth (m)	0.6
velocity (m/s)	0.55
flow character	placid, swirling
Substrate Composition (%)	
fines (< 2mm)	20
gravels (2–64mm)	65
larges (>64mm)	0
bedrock and/or oil sand	15
Bank	
height (m)	0.8
form	steep
stability	failing
texture	silt, sand, gravel, larges, oil sand
vegetation (% coverage)	
coniferous trees	5
deciduous trees	25
shrubs	35
grasses	30
barren	15
Water Quality	
temperature (°C)	9.5
dissolved oxygen (mg/l)	9
conductivity (µmhos/cm)	490
pH	8.28

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

* Data from Machniak *et al.* (1980)

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY
MACKAY RIVER
Reach 2
(km 1.4 to km 4.5)

Scale 1 : 25 000

Miles 0.5 0 0.5
Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

Species	Adults	Juveniles and Young-of-the-year	Total Numbers
flathead chub	0	3	3
lake chub	1	9	10
longnose dace	0	5	5
longnose sucker	0	2	2
pearl dace	0	207	207
slimy sculpin	0	2	2
spoonhead sculpin	1	0	1
trout-perch	8	11	19
unidentified fry	N/A	20	20
walleye	0	3	3
white sucker	0	6	6
Total	10	268	278

PHYSICAL CHARACTERISTICS

Reach length (km)	35.5
Channel width (m)	28
Channel area (ha)	99.4
Gradient (m/km)	1.3
Flow character	swirling, rolling, broken
Total pools (%)	75
Pattern	tortuously meandering
Confinement	entrenched
Unstable banks (%)	60
Substrate composition (%)	
fines (<2 mm)	10
gravels (2-64 mm)	30
larges (>64 mm)	20
bedrock and/or oil sand	40
Debris	low

REACH DESCRIPTION AND FISH UTILIZATION

This tortuously meandering section is entrenched within a canyon that is cut 40 to 50 m deep into the McMurray Oil Sands formation. There is a very high proportion of unstable banks, which are primarily high, near-vertical, slumping areas. Exposed oil sands deposits are common, and a film of oil on the water surface is visible from the air in many places. Gradient and water velocities are moderate, and there are numerous riffle areas in addition to many relatively deep pools. The substrate consists primarily of gravels and larges with oil sand being a major component of the substrate in many places. The riparian vegetation is dominated by deciduous trees and shrubs and there are scattered patches of conifers. Very little vegetation overhangs the banks.

Several areas, where the substrate is primarily gravel, appear suitable for spawning of a number of fish species (e.g., arctic grayling, longnose sucker, white sucker, trout-perch). Suitable rearing areas for young-of-the-year of many species are provided by the numerous shallow areas with slow currents and gravel and rock substrates. Adults and juveniles of most fish species that occur in the MacKay River have been collected in this reach. The numerous pools of this reach provide good resting and feeding areas for adult fish and the abundance of forage fish species and young of other species provides good feeding potential for piscivores. The water depths in many of the large pools in this reach are probably sufficient to allow overwintering by fish.

BENTHIC INVERTEBRATES

- OLIGOCHAETA
- PELECYPODA
  - *Musculium*
  - *Pisidium*
  - *Sphaerium*
- INSECTA
  - Ephemeroptera
    - *Ameletus*
    - *Baetis*
    - *Baetisca*
    - *Paraleptophlebia*
    - *Stenonema*
  - Odonata
    - *Ophiogomphus*
  - Hemiptera
  - Trichoptera
    - *Cheumatopsyche*
  - Diptera
    - Tipulidae
    - Chironomidae
      - Chironominae
      - Orthocladiinae
    - Tabanidae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	5
Deciduous trees	65
Shrubs	40
Grasses	60
Barren	10
Channel cover (%)	
Overhang	1
Crown	0

BENTHIC ALGAL PRODUCTIVITY

Standing crop expressed as cell counts (number·m^{-2})
- mean: 381.0×10^{10}
- maximum: 1400.0×10^{10}
- minimum: 14.0×10^{10}

Standing crop expressed as chlorophyll *a* (mg·m^{-2})
- mean: 12.6
- maximum: 30.7
- minimum: 0.3

Primary productivity (mg C·h^{-1}·m^{-2})
- mean: 8.2
- maximum: 26.0
- minimum: 0.5

Data from Hickman *et al.* (1980).

STREAM GAUGING DATA

Water Survey of Canada station number 07DB001

Maximum total annual discharge:	852.3×10^6 m^3 (1973)
Minimum total annual discharge:	185.0×10^6 m^3 (1977)
Maximum annual mean discharge:	27.01 m^3/s (1973)
Minimum annual mean discharge:	5.89 m^3/s (1977)
Maximum monthly mean discharge:	157.16 m^3/s (June 1973)
Minimum monthly mean discharge:	0.10 m^3/s (February 1973)
Maximum daily discharge:	302.99 m^3/s (June 18, 1973)
Minimum daily discharge:	0.02 m^3/s (March 2, 1973)

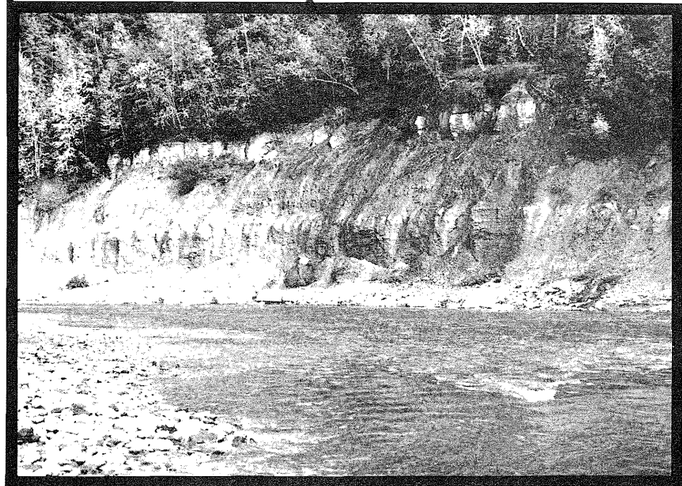
Data for 1972 to 1978 compiled from Loeppky and Spitzer (1977), Warner and Spitzer (1979) and Warner (1979).

WATER QUALITY

Water Survey of Canada station number 00AT07DB0011

	Mean	Maximum	Minimum
Total alkalinity (mg $CaCO_3$/l)	163.0	577.0	13.4
pH	7.80	8.50	6.90
Total hardness (mg $CaCO_3$/l)	166.0	493.1	59.3
Conductance (µS/cm)	392	1370	102
Total filterable residue fixed (mg/l)	198	781	51
Total non-filterable residue fixed (mg/l)	35	463	<0.4
Total organic carbon (mg C/l)	31.0	59.0	9.0
Silica (mg SiO_2/l)	6.9	20.0	1.0
Nitrate and nitrite nitrogen (mg N/l)	0.130	0.694	<0.003
Total Kjeldahl nitrogen (mg N/l)	1.35	4.20	0.31
Total Phosphorus (mg P/l)	0.080	0.260	0.024
Orthophosphate (mg P/l)	0.030	0.100	<0.003
Sulphate (mg SO_4/l)	34.0	100.0	1.2

Data for the period January 1976 to December 1979 obtained from the National Water Quality Data Bank (NAQUADAT).



Unstable bank at km 13.8.

MacKay River at km 28.5.

AQUATIC BIOPHYSICAL INVENTORY
MACKAY RIVER
Reach 3
(km 4.2 to km 40.0)

alberta oil sands environmental research program

prepared by LGL LIMITED

FISH COLLECTIONS

POINT SAMPLE DATA

Location
Date
Hydraulics
- channel width (m)
- wet width (m)
- maximum depth (m)
- average depth (m)
- velocity (m/s)
- flow character

Substrate Composition (%)
- fines (< 2 mm)
- gravels (2–64 mm)
- larges (> 64 mm)
- bedrock and/or oil sand

Bank
- height (m)
- form
- stability
- texture

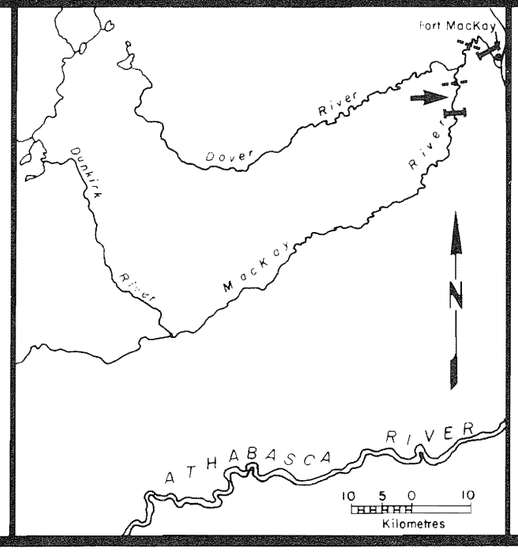
Vegetation (% coverage)
- coniferous trees
- deciduous trees
- shrubs
- grasses
- barren

Water Quality
- temperature (°C)
- dissolved oxygen (mg/l)
- conductivity (µmhos/cm)
- pH

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
¦	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

MACKAY RIVER

Reach 3 Section 3
(km 35.5 to km 40.0)

Scale 1 : 25 000

Miles 0.5 0 0.5
Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

Species	Adults	Juveniles and Young-of-the-year	Total Numbers
finescale dace	4	15	19
longnose dace	0	11	11
pearl dace	0	128	128
trout-perch	0	3	3
white sucker	0	4	4
Total	4	161	165

PHYSICAL CHARACTERISTICS

Reach length (km)	25.5
Channel width (m)	50
Channel area (ha)	127.5
Gradient (m/km)	2.2
Flow character	swirling, rolling
Total pools (%)	60
Pattern	irregularly meandering
Confinement	confined
Unstable banks (%)	15
Substrate composition (%)	
fines (<2 mm)	20
gravels (2-64 mm)	40
larges (>64 mm)	40
bedrock and/or oil sand	0
Debris	low

REACH DESCRIPTION AND FISH UTILIZATION

This irregularly meandering section is confined by the valley walls, but evidence of lateral channel movement (i.e., oxbows and meander scars) within the valley is present. The banks on the outside of bends in the river are often steep and slumping, but the proportion of the banks that are unstable is much less than in Reach 3. The gradient in this reach is steeper than in Reach 3 and water velocities are relatively high. Pools comprise a little over half of the reach area and are generally shallow. The substrate in this reach consists primarily of larges and coarse gravels, with sand and silt present in the pools. Although the riparian vegetation is mostly deciduous trees and shrubs, some patches of conifers are present and grasses are abundant.

The gravel substrates and many riffles in this reach provide areas that are excellent for spawning of arctic grayling, longnose sucker, white sucker, longnose dace and trout-perch. Those areas with large rocks and slower currents are probably suitable for spawning of lake chub and slimy sculpin. The rearing potential of this reach is considered good because areas with large rock substrates provide adequate shelter. Areas suitable for resting and feeding of adult fish are provided by the numerous pools in this reach. Because forage fish are abundant in this reach, feeding potential for piscivorous species is considered good. Because the pools in this reach are relatively shallow, overwintering of fish is probably not possible except in isolated deep pools.

BENTHIC INVERTEBRATES

- NEMATODA
- OLIGOCHAETA
- GASTROPODA
  - *Gyraulus*
- PELECYPODA
  - *Musculium*
  - *Pisidium*
- INSECTA
  - Ephemeroptera
    - *Ameletus*
    - *Baetisca*
    - *Ephemera*
    - *Ephemerella*
    - *Paraleptophlebia*
    - *Stenonema*
  - Odonata
    - *Ophiogomphus*
  - Plecoptera
  - Trichoptera
    - *Hydropsyche*
  - Diptera
    - Tipulidae
    - Chironomidae
      - Chironominae
      - Tanypodinae
      - Orthocladiinae
    - Tabanidae
    - Dolichopodidae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	15
Deciduous trees	50
Shrubs	45
Grasses	70
Barren	5
Channel cover (%)	
Overhang	0
Crown	0

BENTHIC ALGAL PRODUCTIVITY

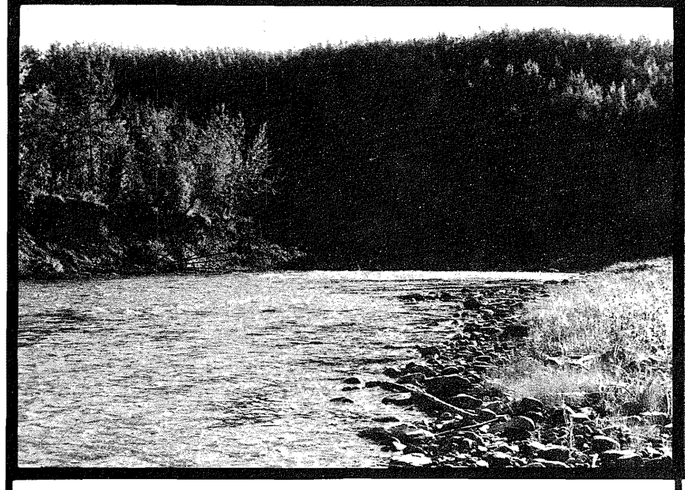
No data available for this reach

STREAM GAUGING DATA

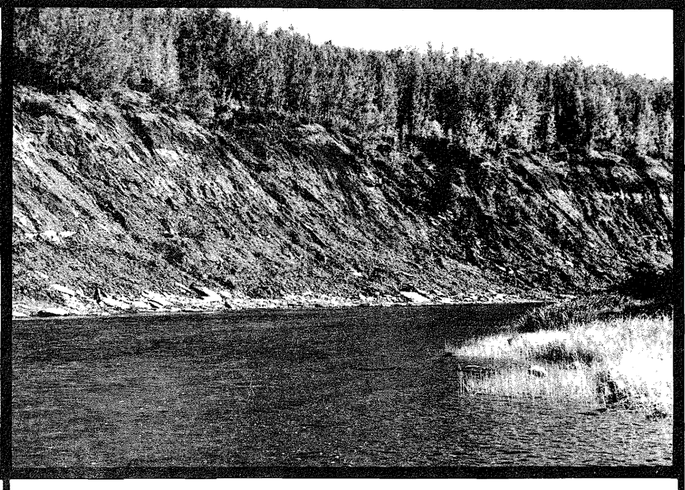
No data available for this reach

WATER QUALITY

No data available for this reach



Section of riffles with slumping bank on left at km 45.1.



High, eroding bank of sand and silt at km 63.8.

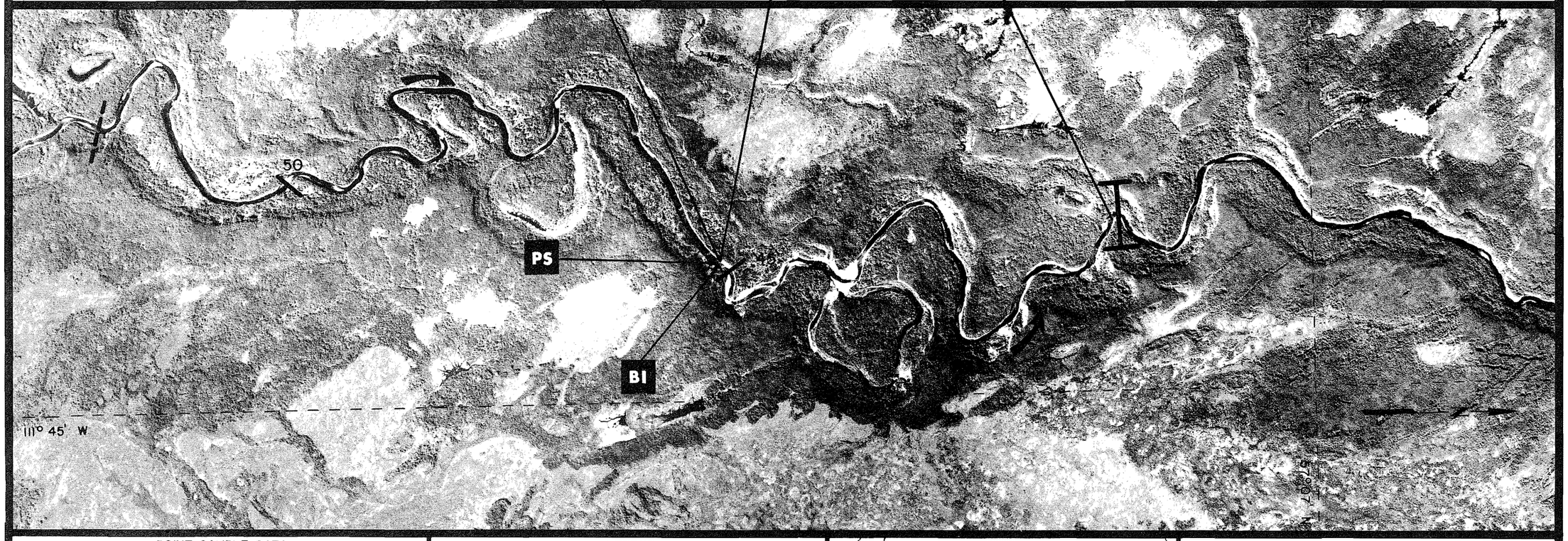
AQUATIC BIOPHYSICAL INVENTORY
MACKAY RIVER
Reach 4
(km 40.0 to km 65.5)

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS

SN	LNDC	
	PLDC	
EF	FSDC	
	LNDC	
	PLDC	
SF*	BKST	NTPK
	LKCH	SLSC
	LNDC	TRPC
	LNSK	WTSK



POINT SAMPLE DATA

Location	km 45.1
Date	13/09/79
Hydraulics	
channel width (m)	42.7
wet width (m)	25.9
maximum depth (m)	0.8
average depth (m)	0.6
velocity (m/s)	0.96
flow character	swirling, rolling, broken
Substrate Composition (%)	
fines (< 2mm)	20
gravels (2–64mm)	40
larges (>64mm)	40
bedrock and/or oil sand	0
Bank	
height (m)	1.5
form	undercut
stability	failing
texture	silt, sand, gravel, larges
vegetation (% coverage)	
coniferous trees	0
deciduous trees	40
shrubs	30
grasses	45
barren	15
Water Quality	
temperature (°C)	9.0
dissolved oxygen (mg/l)	9
conductivity (µmhos/cm)	210
pH	8.04

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
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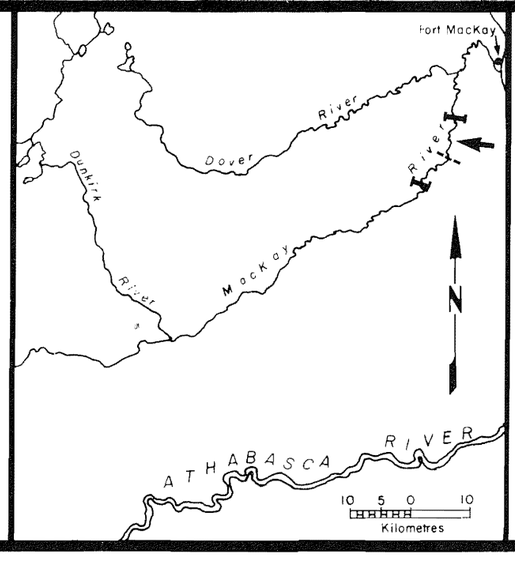
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch

*Data from Machniak *et al.* (1980)



AQUATIC BIOPHYSICAL INVENTORY

MACKAY RIVER

Reach 4 Section 1

(km 40 to km 52)

Scale 1 : 25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

alberta

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS

EF: FSDC, LNDC, PLDC, WTSK

SN: FSDC, LNDC, PLDC, TRPC, WTSK

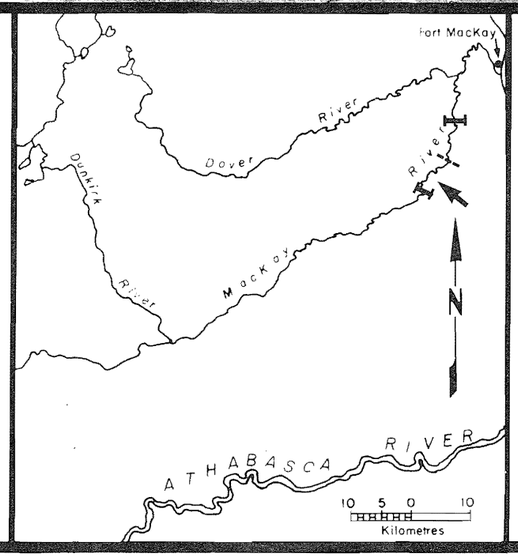
POINT SAMPLE DATA

Location	km 63.8
Date	13/09/79
Hydraulics	
channel width (m)	55.0
wet width (m)	30.5
maximum depth (m)	1.0
average depth (m)	0.5
velocity (m/s)	0.81
flow character	swirling, rolling, broken
Substrate Composition (%)	
fines (< 2 mm)	15
gravels (2–64 mm)	45
larges (> 64 mm)	40
bedrock and/or oil sand	0
Bank	
height (m)	1.5
form	undercut
stability	stable
texture	silt, sand, gravel, larges
vegetation (% coverage)	
coniferous trees	0
deciduous trees	45
shrubs	65
grasses	80
barren	2
Water Quality	
temperature (°C)	10.5
dissolved oxygen (mg/l)	9
conductivity (µmhos/cm)	270
pH	8.12

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
	reach boundary
	upstream limit of survey
	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

MACKAY RIVER

Reach 4 Section 2

(km 52.0 to km 65.5)

Scale 1 : 25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

Species	Adults	Juveniles and Young-of-the-year	Total Numbers
finescale dace	1	0	1
longnose dace	0	2	2
pearl dace	10	206	216
trout-perch	0	2	2
white sucker	0	9	9
Total	11	219	230

PHYSICAL CHARACTERISTICS

Reach length (km)	46.0
Channel width (m)	45
Channel area (ha)	207.0
Gradient (m/km)	2.4
Flow character	swirling, rolling, broken
Total pools (%)	40
Pattern	irregularly meandering
Confinement	frequently confined
Unstable banks (%)	10
Substrate composition (%)	
fines (<2 mm)	10
gravels (2-64 mm)	50
larges (>64 mm)	40
bedrock and/or oil sand	0
Debris	low

REACH DESCRIPTION AND FISH UTILIZATION

This long, irregularly meandering section has a relatively high gradient and is essentially a series of riffles. The proportion of the reach area that consists of pools is the lowest in the surveyed portion of the MacKay River, and the flow character varies from swirling to rolling to broken. Areas with unstable banks are fairly common but are less frequent here than in the four lower reaches of the river. The substrate is almost entirely larges and gravels, with some sandy areas in quiet shallows along the banks. Coniferous trees are a dominant component of the riparian vegetation and deciduous trees and shrubs are also numerous. There is usually a dense growth of grasses along the banks and very little overhanging vegetation.

Although the spawning potential of this reach is considered good for arctic grayling, suckers, longnose dace and slimy sculpin, high water velocities and the large sizes of the substrate materials may limit spawning over much of the reach. The rearing potential of this reach is considered moderate; shelter is provided by large rocks in shallow areas along the banks and there are few grassy shallows. Because there are relatively few pools and the water is generally shallow and swiftly flowing, the resting and feeding potential for adults of the larger species is relatively poor. However, the many riffle areas should provide good feeding habitat for arctic grayling. The water depths in most of this reach are probably not sufficient for overwintering of fish.

BENTHIC INVERTEBRATES

- NEMATODA
- OLIGOCHAETA
- GASTROPODA
  - *Ferrissia*
  - *Gyraulus*
- PELECYPODA
  - *Musculium*
  - *Sphaerium*
- ARACHNIDA
  - Hydracarina
- CRUSTACEA
  - Cladocera
  - Amphipoda
    - *Hyalella azteca*
- INSECTA
  - Ephemeroptera
    - *Ameletus*
    - *Baetis*
    - *Caenis*
    - *Ephemera*
    - *Paraleptophlebia*
    - *Parameletus*
    - *Stenonema*
  - Odonata
    - *Ophiogomphus*
    - *Agrion*
  - Plecoptera
    - *Acroneuria*
    - *Diura*
  - Hemiptera
    - Corixidae
  - Megaloptera
    - *Sialis*
  - Trichoptera
    - *Brachycentrus*
    - *Ceraclea*
    - *Cheumatopsyche*
    - *Hydropsyche*
    - *Hydroptila*
    - *Oecetis*
    - *Polycentropus*
  - Coleoptera
    - Elmidae
  - Diptera
    - Chaoboridae
    - Ceratopogonidae
    - Chironomidae
    - Tabanidae
    - Dolichopodidae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	50
Deciduous trees	30
Shrubs	30
Grasses	85
Barren	5
Channel cover (%)	
Overhang	1
Crown	1

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

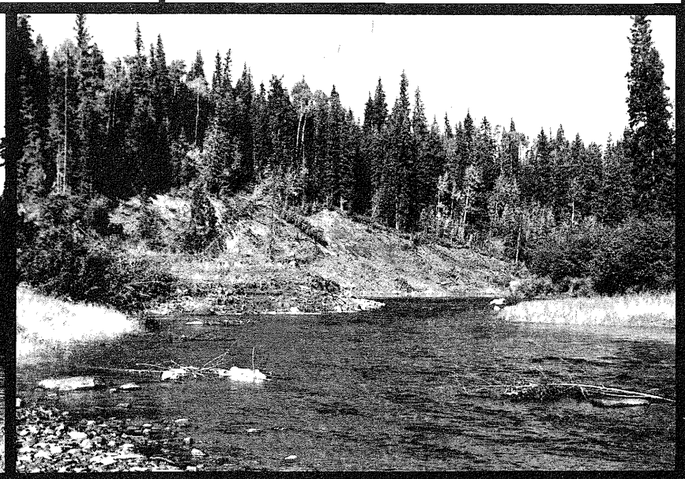
STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach

Recent slide at km 73.5 has entered river channel.



Long, swirling pool at km 91.5.

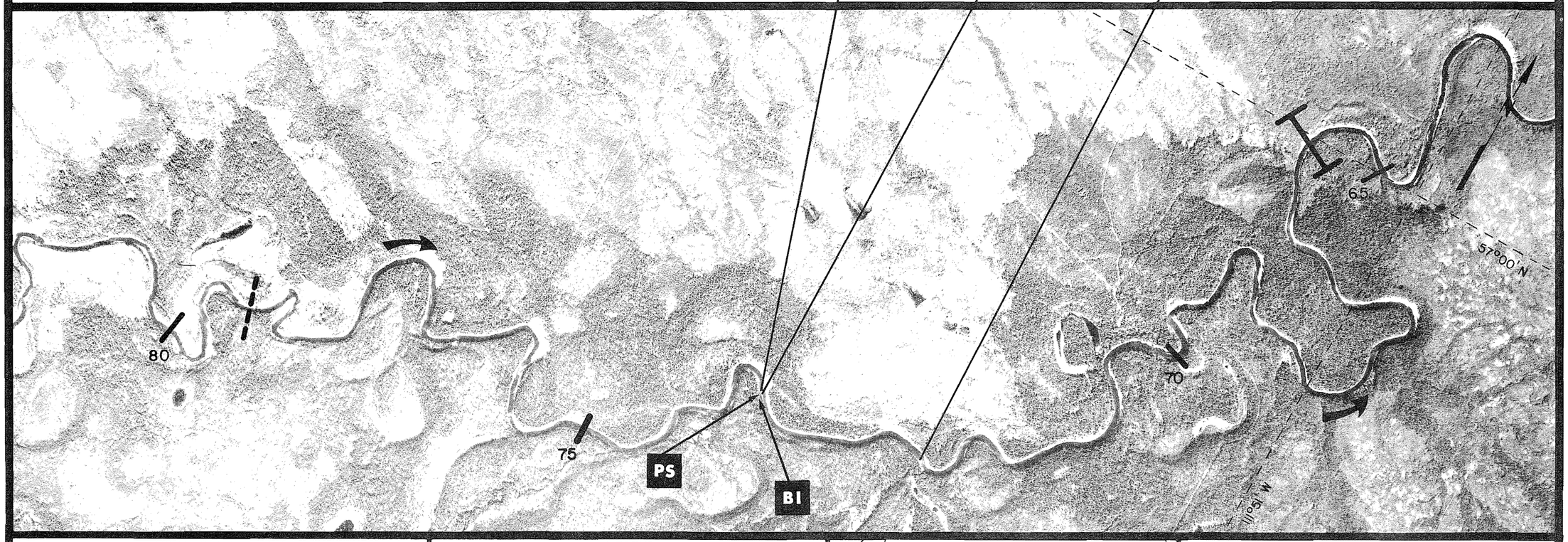
AQUATIC BIOPHYSICAL INVENTORY
MACKAY RIVER
Reach 5
(km 65.5 to km 111.5)

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS

SN	LNDC	EF	PLDC	SF*	ARGR LNSK
	PLDC				BKST PLDC
	WTSK				FSDC SLSC
					LKCH TRPC
					LNDC WTSK



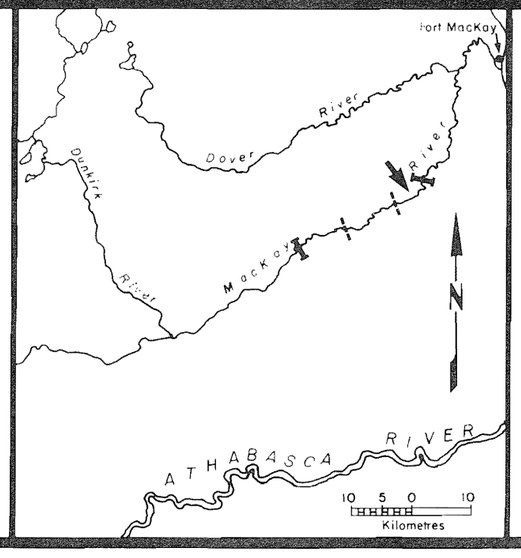
POINT SAMPLE DATA

Location	km 73.5
Date	15/09/79
Hydraulics	
channel width (m)	60.0
wet width (m)	24.0
maximum depth (m)	0.9
average depth (m)	0.4
velocity (m/s)	0.93
flow character	swirling, rolling, broken
Substrate Composition (%)	
fines (< 2 mm)	10
gravels (2–64 mm)	50
larges (>64 mm)	40
bedrock and/or oil sand	0
Bank	
height (m)	2.0
form	steep
stability	failing
texture	silt, sand
vegetation (% coverage)	
coniferous trees	50
deciduous trees	30
shrubs	30
grasses	85
barren	5
Water Quality	
temperature (°C)	11.0
dissolved oxygen (mg/l)	10
conductivity (µmhos/cm)	230
pH	8.12

LEGEND

AN	angling	ARGR	arctic grayling
CF	counting fence	BKST	brook stickleback
DN	dip net	BRMN	brassy minnow
EF	electrofisher	BURB	burbot
GN	gill net	DLVR	Dolly Varden
KS	kick sample	EGGS	unidentified fish eggs
SF	small fish collections made using a combination of methods	EMSH	emerald shiner
SN	seine	FLCH	flathead chub
AP	benthic algal productivity station	FSDC	finescale dace
BI	benthic invertebrate collection site	FTMN	fathead minnow
CH	water quality station	GOLD	goldeye
PS	point sample	LKCH	lake chub
SG	stream gauging station	LKCS	lake cisco
35	kilometres from mouth	LKWF	lake whitefish
	flow direction	LNDC	longnose dace
	reach boundary	LNSK	longnose sucker
	upstream limit of survey	MTWF	mountain whitefish
	division between sections of a reach	NRDC	northern redbelly dace
		NSST	ninespine stickleback
		NTPK	northern pike
		PLDC	pearl dace
		SLSC	slimy sculpin
		SPSC	spoonhead sculpin
		SPSH	spottail shiner
		TRPC	trout-perch
		UNSK	unidentified sucker species
		WALL	walleye
		WTSK	white sucker
		YLPR	yellow perch

* Data from Machniak *et al.* (1980)



AQUATIC BIOPHYSICAL INVENTORY

MACKAY RIVER

Reach 5 Section 1

(km 65.5 to km 79.0)

Scale 1 : 25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS

SN: FSDC, PLDC, WTSK

EF: PLDC, TRPC, WTSK

POINT SAMPLE DATA

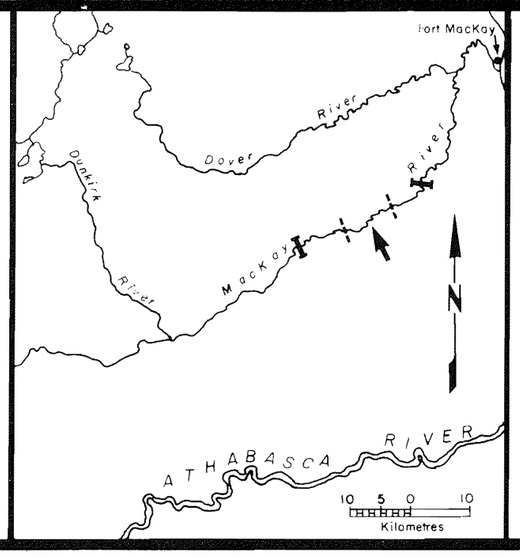
Location	km 91.5
Date	13/09/79
Hydraulics	
channel width (m)	35.0
wet width (m)	18.0
maximum depth (m)	0.9
average depth (m)	0.5
velocity (m/s)	0.85
flow character	swirling, rolling, broken
Substrate Composition (%)	
fines (< 2mm)	10
gravels (2–64mm)	50
larges (>64mm)	40
bedrock and/or oil sand	0
Bank	
height (m)	1.5
form	repose
stability	stable
texture	sandy silt, gravel, larges
vegetation (% coverage)	
coniferous trees	40
deciduous trees	25
shrubs	20
grasses	90
barren	0
Water Quality	
temperature (°C)	11.5
dissolved oxygen (mg/l)	9
conductivity (µmhos/cm)	220
pH	8.07

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

* Data from Machniak *et al.* (1980)

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

MACKAY RIVER

Reach 5 Section 2

(km 79 to km 96)

Scale 1 : 25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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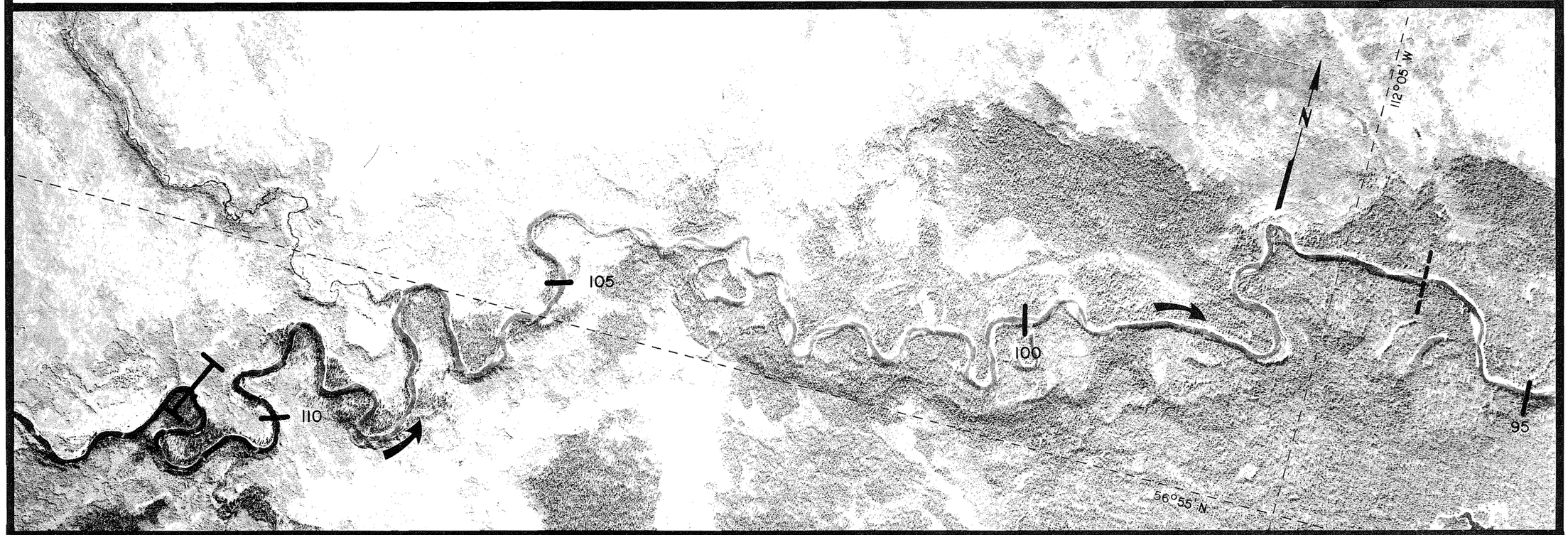
ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS



POINT SAMPLE DATA

Location
Date
Hydraulics
- channel width (m)
- wet width (m)
- maximum depth (m)
- average depth (m)
- velocity (m/s)
- flow character

Substrate Composition (%)
- fines (< 2 mm)
- gravels (2–64 mm)
- larges (> 64 mm)
- bedrock and/or oil sand

Bank
- height (m)
- form
- stability
- texture

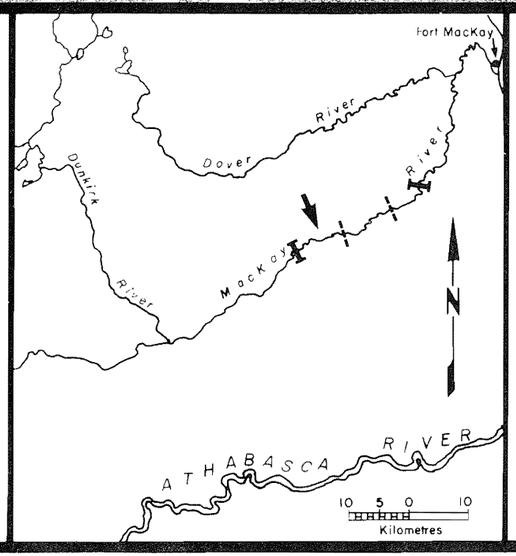
- vegetation (% coverage)
  - coniferous trees
  - deciduous trees
  - shrubs
  - grasses
  - barren

Water Quality
- temperature (°C)
- dissolved oxygen (mg/l)
- conductivity (µmhos/cm)
- pH

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

MACKAY RIVER

Reach 5 Section 3
(km 96.0 to km 111.5)

Scale 1 : 25 000

Miles 0.5 0 0.5
Kilometres 0.5 0 0.5

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ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

Species	Adults	Juveniles and Young-of-the-year	Total Numbers
finescale dace	0	14	14
northern pike	0	3	3
pearl dace	2	89	91
slimy sculpin	4	0	4
white sucker	1	9	10
Total	7	115	122

PHYSICAL CHARACTERISTICS

Reach length (km)	40.0
Channel width (m)	38
Channel area (ha)	152.0
Gradient (m/km)	0.7
Flow character	placid, swirling, rolling
Total pools (%)	90
Pattern	irregularly meandering
Confinement	occasionally confined
Unstable banks (%)	2
Substrate composition (%)	
fines (<2 mm)	50
gravels (2-64 mm)	35
larges (>64 mm)	15
bedrock and/or oil sand	0
Debris	high

REACH DESCRIPTION AND FISH UTILIZATION

This section of the MacKay River has a much lower gradient than Reach 5 and meanders in an irregular pattern. Most of the reach consists of pools with placid or swirling flow, but there are a few riffle sections. Several beaver dams were present in this reach at the time the river was surveyed in 1979. The substrate consists primarily of fines and small gravels with some cobbles and boulders. Coniferous trees dominate the riparian vegetation over much of the reach, but deciduous trees and shrubs are also abundant and there is a dense growth of grasses in most places. There is a large amount of debris in the channel.

For most of the larger fish species, the spawning potential of the reach is poor. There are many areas, however, that are probably suitable for spawning of some forage fish species that spawn over sand or silt substrates. Some northern pike may also spawn in this reach. The rearing potential of this reach is considered very good; shelter is provided by abundant debris in shallow pool areas and there are some weedy shallows. The many deep pools and abundant debris provide good resting and feeding areas for adults of some of the larger fish species, particularly suckers and northern pike. The water depths over much of the reach are probably sufficient to allow overwintering of fish.

BENTHIC INVERTEBRATES

- OLIGOCHAETA
- GASTROPODA
  - *Ferrissia*
  - *Cyraulus*
  - *Lymnaea*
- PELECYPODA
  - *Musculium*
- ARACHNIDA
  - Hydracarina
- CRUSTACEA
  - Cladocera
- INSECTA
  - Ephemeroptera
    - *Ameletus*
    - *Baetis*
    - *Baetisca*
    - *Caenis*
    - *Ephemera*
    - *Paraleptophlebia*
    - *Stenonema*
  - Odonata
    - *Ophiogomphus*
  - Plecoptera
    - *Arcynopteryx*
    - *Pteronarcys*
    - *Taeniopteryx*
  - Megaloptera
    - *Sialis*
  - Trichoptera
    - *Ceraclea*
    - *Hydropsyche*
    - *Lepidostoma*
    - *Ochrotrichia*
    - *Oecetis*
    - *Polycentropus*
  - Coleoptera
    - Elmidae
  - Diptera
    - Tipulidae
    - Chironomidae
      - Chironominae
      - Tanypodinae
      - Orthocladiinae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	50
Deciduous trees	35
Shrubs	50
Grasses	85
Barren	2
Channel cover (%)	
Overhang	2
Crown	1

BENTHIC ALGAL PRODUCTIVITY

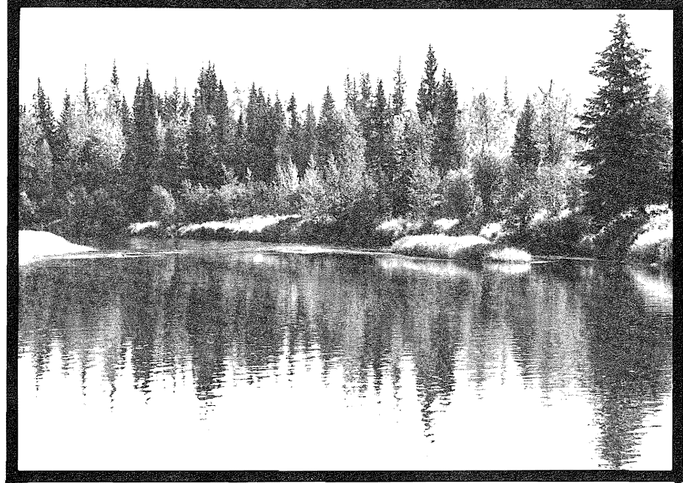
No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach



A typical area of reach 6 at km 141.5.

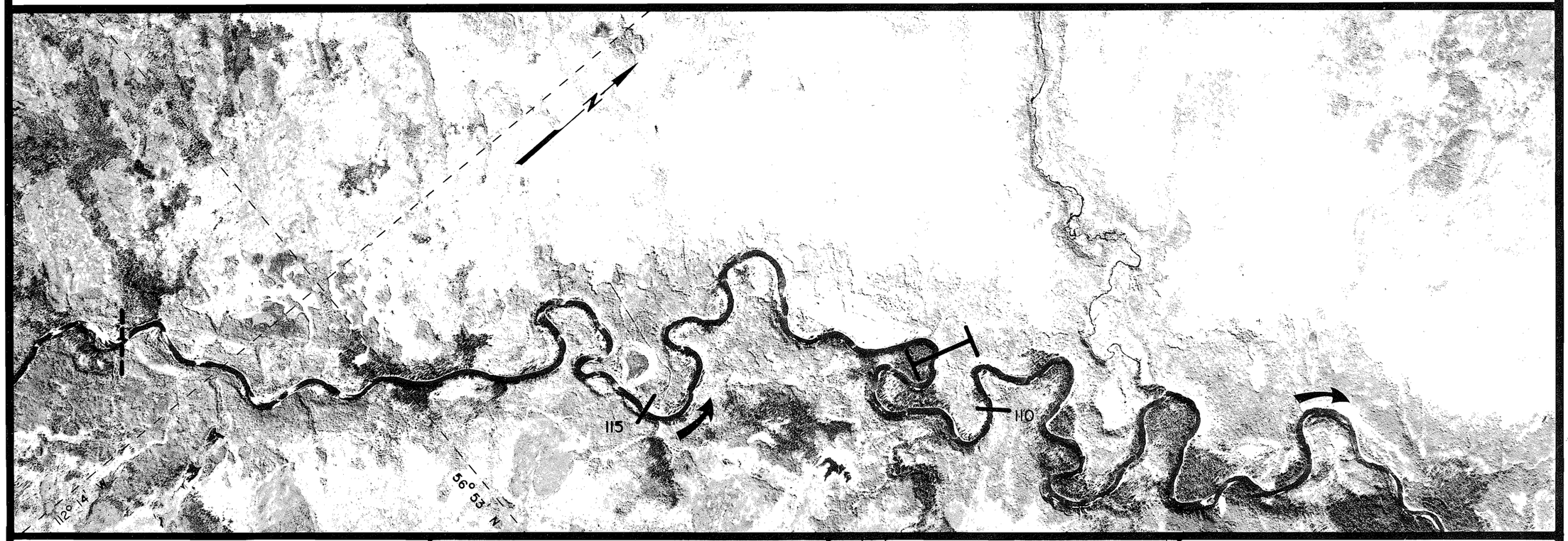
Large, deep pool at km 122.8.

AQUATIC BIOPHYSICAL INVENTORY
MACKAY RIVER
Reach 6
(km 111.5 to km 151.5)

alberta oil sands environmental research program

prepared by LGL LIMITED

FISH COLLECTIONS



POINT SAMPLE DATA

Location
Date
Hydraulics
- channel width (m)
- wet width (m)
- maximum depth (m)
- average depth (m)
- velocity (m/s)
- flow character

Substrate Composition (%)
- fines (< 2 mm)
- gravels (2–64 mm)
- larges (> 64 mm)
- bedrock and/or oil sand

Bank
- height (m)
- form
- stability
- texture

- vegetation (% coverage)
  - coniferous trees
  - deciduous trees
  - shrubs
  - grasses
  - barren

Water Quality
- temperature (°C)
- dissolved oxygen (mg/l)
- conductivity (μmhos/cm)
- pH

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
	reach boundary
	upstream limit of survey
	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
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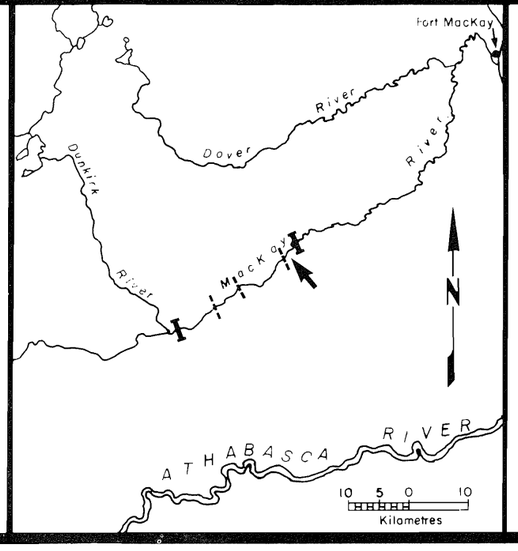
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY
MACKAY RIVER

Reach 6 Section 1
(km 111.5 to km 120.0)

Scale 1 : 25 000

Miles 0.5 0 0.5
Kilometres 0.5 0 0.5

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ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS

SF*	FSDC	NTPK	SN	FSDC	DN	PLDC	EF	WTSK
	LKCH	PLDC		NTPK				
	LNDC	WALL		PLDC				
	LNSK	WTSK		SLSC				

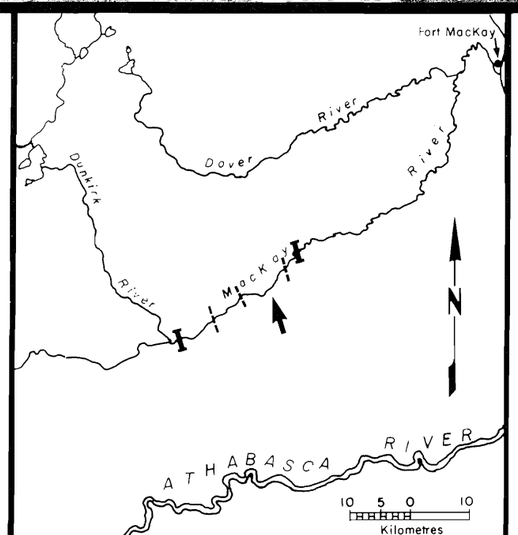
POINT SAMPLE DATA

Location	km 122.8
Date	14/09/79
Hydraulics	
channel width (m)	48.8
wet width (m)	33.5
maximum depth (m)	2.0
average depth (m)	0.9
velocity (m/s)	0.29
flow character	placid, swirling
Substrate Composition (%)	
fines (< 2mm)	65
gravels (2–64mm)	20
larges (>64mm)	15
bedrock and/or oil sand	0
Bank	
height (m)	1.5
form	undercut
stability	stable
texture	sandy silt
vegetation (% coverage)	
coniferous trees	10
deciduous trees	65
shrubs	65
grasses	95
barren	2
Water Quality	
temperature (°C)	11.0
dissolved oxygen (mg/l)	9
conductivity (µmhos/cm)	240
pH	7.86

LEGEND

AN	angling	ARGR	arctic grayling
CF	counting fence	BKST	brook stickleback
DN	dip net	BRMN	brassy minnow
EF	electrofisher	BURB	burbot
GN	gill net	DLVR	Dolly Varden
KS	kick sample	EGGS	unidentified fish eggs
SF	small fish collections made using a combination of methods	EMSH	emerald shiner
		FLCH	flathead chub
SN	seine	FSDC	finescale dace
AP	benthic algal productivity station	FTMN	fathead minnow
		GOLD	goldeye
BI	benthic invertebrate collection site	LKCH	lake chub
		LKCS	lake cisco
CH	water quality station	LKWF	lake whitefish
		LNDC	longnose dace
PS	point sample	LNSK	longnose sucker
		MTWF	mountain whitefish
SG	stream gauging station	NRDC	northern redbelly dace
		NSST	ninespine stickleback
35	kilometres from mouth	NTPK	northern pike
		PLDC	pearl dace
	flow direction	SLSC	slimy sculpin
		SPSC	spoonhead sculpin
	reach boundary	SPSH	spottail shiner
		TRPC	trout-perch
	upstream limit of survey	UNSK	unidentified sucker species
		WALL	walleye
	division between sections of a reach	WTSK	white sucker
		YLPR	yellow perch

* Data from Machniak *et al.* (1980)



AQUATIC BIOPHYSICAL INVENTORY

MACKAY RIVER

Reach 6 Section 2

(km 120.0 to km 131.8)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS

POINT SAMPLE DATA

Location
Date
Hydraulics
- channel width (m)
- wet width (m)
- maximum depth (m)
- average depth (m)
- velocity (m/s)
- flow character

Substrate Composition (%)
- fines (< 2 mm)
- gravels (2–64 mm)
- larges (> 64 mm)
- bedrock and/or oil sand

Bank
- height (m)
- farm
- stability
- texture

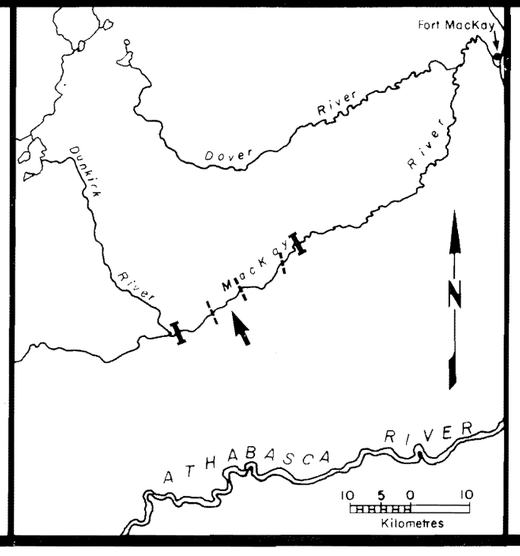
- vegetation (% coverage)
  - coniferous trees
  - deciduous trees
  - shrubs
  - grasses
  - barren

Water Quality
- temperature (°C)
- dissolved oxygen (mg/l)
- conductivity (µmhos/cm)
- pH

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

MACKAY RIVER

Reach 6 Section 3

(km 131.8 to km 140.0)

Scale 1 : 25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

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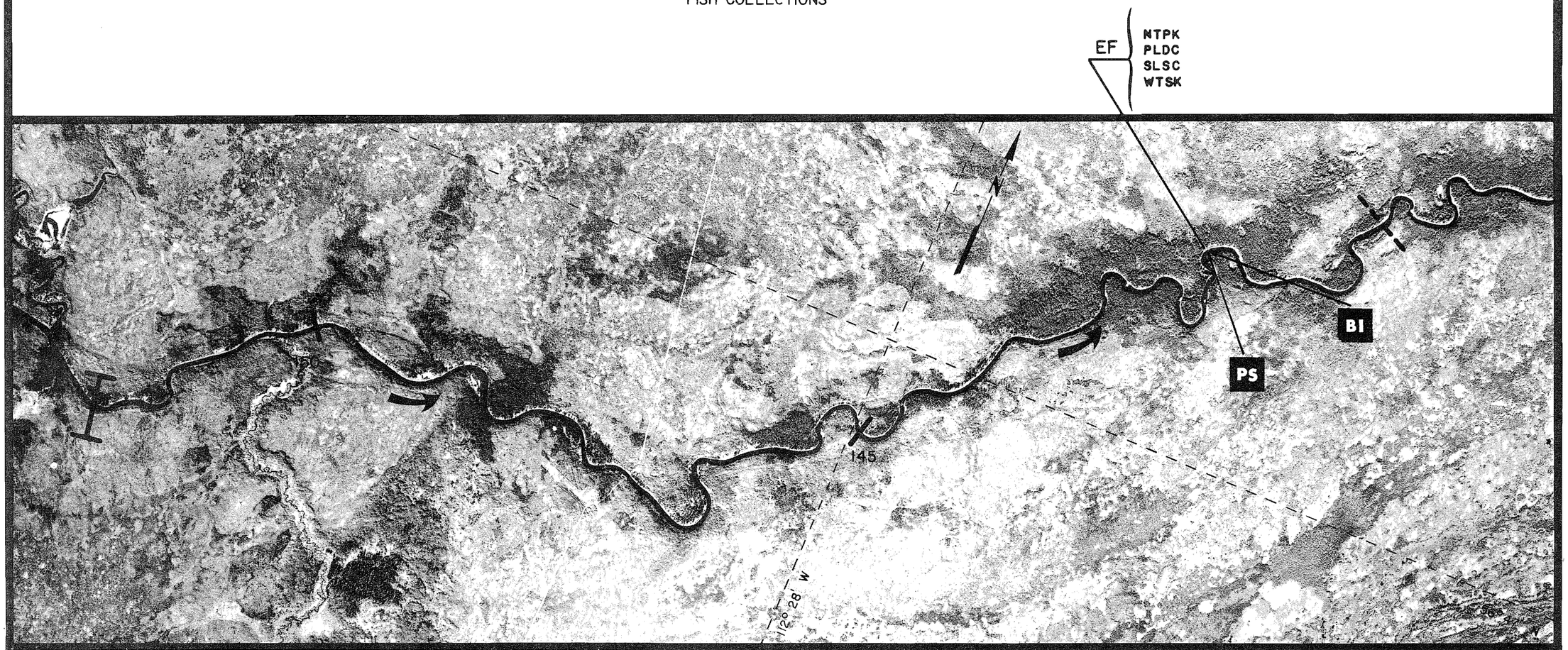
FISH COLLECTIONS



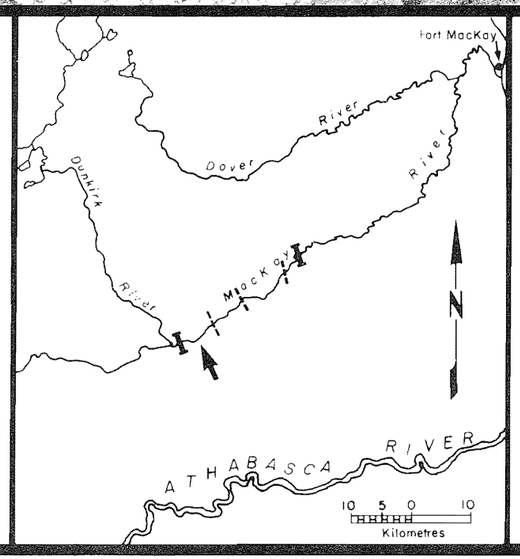
POINT SAMPLE DATA

Location	km 141.5
Date	14/09/79
Hydraulics	
channel width (m)	33.5
wet width (m)	24.4
maximum depth (m)	1.3
average depth (m)	0.8
velocity (m/s)	0.36
flow character	placid, swirling, rolling
Substrate Composition (%)	
fines (< 2mm)	30
gravels (2–64mm)	55
larges (> 64mm)	15
bedrock and/or oil sand	0
Bank	
height (m)	1.0
form	undercut
stability	stable
texture	sand, silt
vegetation (% coverage)	
coniferous trees	60
deciduous trees	10
shrubs	30
grasses	95
barren	2
Water Quality	
temperature (°C)	11.0
dissolved oxygen (mg/l)	8
conductivity (µmhos/cm)	270
pH	7.84

LEGEND

AN	angling	ARGR	arctic grayling
CF	counting fence	BKST	brook stickleback
DN	dip net	BRMN	brassy minnow
EF	electrofisher	BURB	burbot
GN	gill net	DLVR	Dolly Varden
KS	kick sample	EGGS	unidentified fish eggs
SF	small fish collections made using a combination of methods	EMSH	emerald shiner
		FLCH	flathead chub
SN	seine	FSDC	finescale dace
AP	benthic algal productivity station	FTMN	fathead minnow
		GOLD	goldeye
BI	benthic invertebrate collection site	LKCH	lake chub
		LKCS	lake cisco
CH	water quality station	LKWF	lake whitefish
		LNDC	longnose dace
PS	point sample	LNSK	longnose sucker
		MTWF	mountain whitefish
SG	stream gauging station	NRDC	northern redbelly dace
		NSST	ninespine stickleback
35	kilometres from mouth	NTPK	northern pike
		PLDC	pearl dace
	flow direction	SLSC	slimy sculpin
		SPSC	spoonhead sculpin
I	reach boundary	SPSH	spottail shiner
		TRPC	trout-perch
]	upstream limit of survey	UNSK	unidentified sucker species
		WALL	walleye
⋮	division between sections of a reach	WTSK	white sucker
		YLPR	yellow perch

* Data from Machniak *et al.* (1980)



AQUATIC BIOPHYSICAL INVENTORY

MACKAY RIVER

Reach 6 Section 4

(km 140.0 to km 151.5)

Scale 1 : 25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

Species	Adults	Juveniles and Young-of-the-year	Total Numbers
NO FISH CAUGHT			

PHYSICAL CHARACTERISTICS

Reach length (km)	45.5
Channel width (m)	10
Channel area (ha)	45.5
Gradient (m/km)	0.5
Flow character	placid
Total pools (%)	100
Pattern	tortuously meandering
Confinement	unconfined
Unstable banks (%)	0
Substrate composition (%)	
fines (<2 mm)	100
gravels (2-64 mm)	0
larges (>64 mm)	0
bedrock and/or oil sand	0
Debris	high

REACH DESCRIPTION AND FISH UTILIZATION

This uppermost reach of the surveyed portion of the MacKay River meanders in a tortuous pattern through a marshy area of treed muskeg. Several beaver dams were present at the time the river was surveyed in 1979. The gradient is very low and the flow is sluggish through the entire reach. The substrate consists of silt and clay with organic detritus. Aquatic vegetation is abundant, and there is a large amount of debris in the channel. The riparian vegetation is dominated by deciduous shrubs and a very dense growth of grasses. Deciduous trees are also numerous and there are some patches of conifers.

The abundant aquatic vegetation in this reach provides excellent spawning habitat for northern pike and brook stickleback. The reach does not appear to be suitable for spawning of other species. The large amount of debris and aquatic vegetation in this reach provides suitable rearing habitat for some species (e.g., brook stickleback and northern pike) and the water depth in this reach appears to be sufficient to allow overwintering of fish.

BENTHIC INVERTEBRATES

- NEMATODA
- OLIGOCHAETA
- HIRUDINEA
- GASTROPODA
  - *Aplexa*
  - *Gyraulus*
  - *Helisoma*
  - *Physa*
  - *Promenetus*
  - *Valvata*
- PELECYPODA
  - *Sphaerium*
- CRUSTACEA
  - Cladocera
  - Amphipoda
    - *Gammarus pseudolimnaeus*
    - *Hyalella azteca*
- INSECTA
  - Ephemeroptera
    - *Ameletus*
    - *Baetis*
    - *Baetisca*
    - *Caenis*
    - *Paraleptophlebia*
  - Odonata
    - Libellulidae
      - *Perithemis*
    - Agriidae
  - Hemiptera
    - Corixidae
  - Trichoptera
    - *Limnephilus*
    - *Onocosmoecus*
    - *Phryganea*
    - *Polycentropus*
    - *Ptilostomis*
  - Coleoptera
    - Dytiscidae
    - Elmidae
    - Chrysomelidae
  - Diptera
    - Chaoboridae
    - Culicidae
    - Ceratopogonidae
    - Chironomidae
      - Chironominae
      - Tanypodinae
      - Orthocladiinae
    - Tabanidae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	20
Deciduous trees	45
Shrubs	60
Grasses	90
Barren	0
Channel cover (%)	
Overhang	10
Crown	2

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach

Placid flow and dense aquatic vegetation at km 158 is characteristic of reach 7.

Very sluggish flow and dense aquatic vegetation at km 186.

AQUATIC BIOPHYSICAL INVENTORY
MACKAY RIVER
Reach 7
(km 151.5 to km 200.0)

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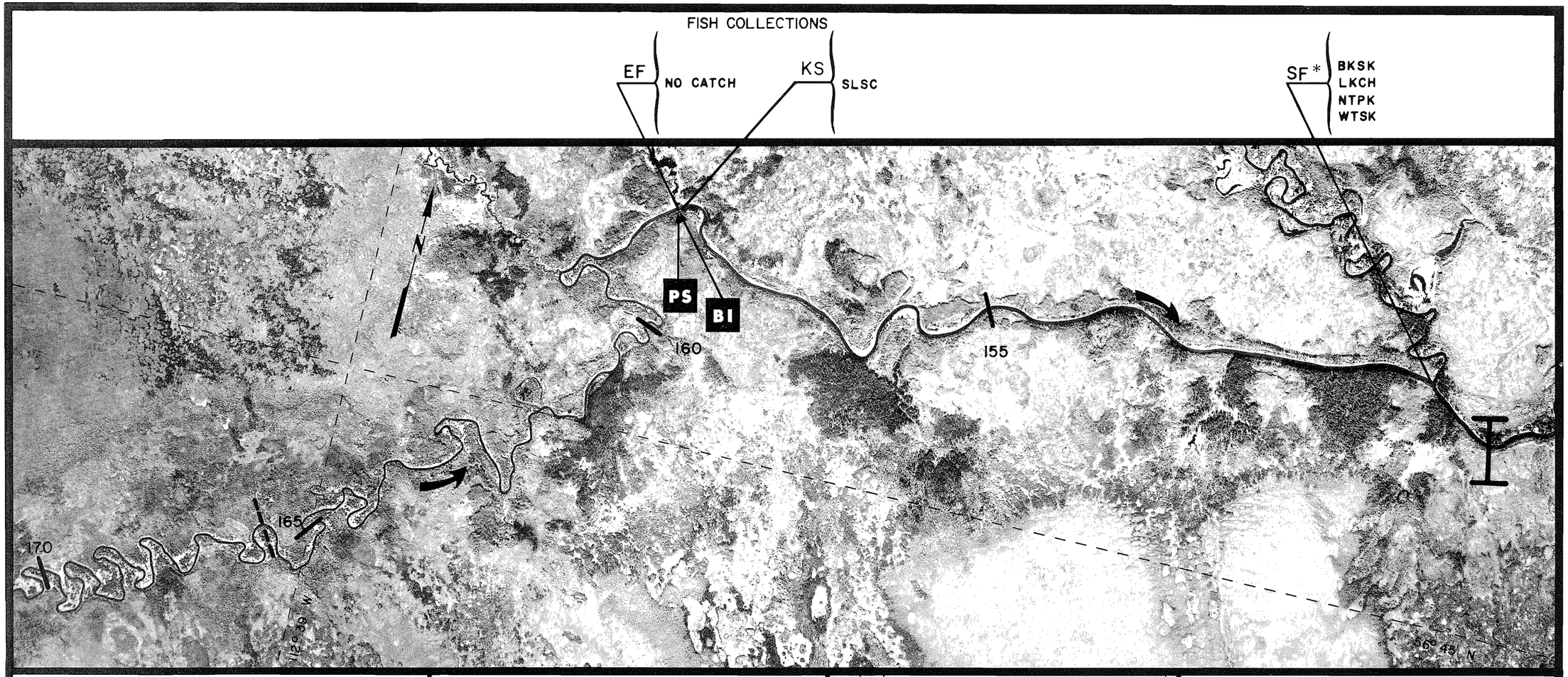
prepared by LGL LIMITED



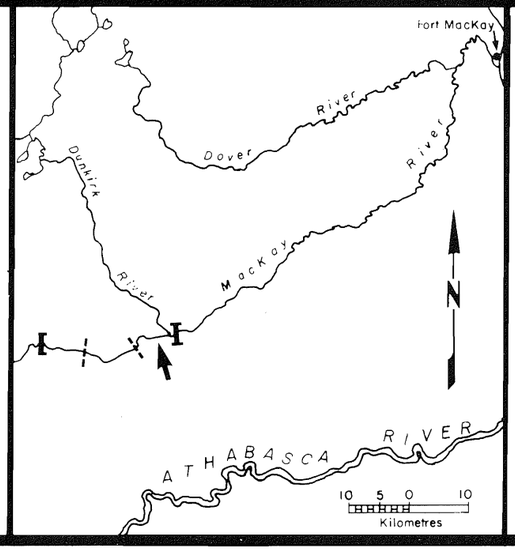
POINT SAMPLE DATA

Location	km 158.0
Date	15/09/79
Hydraulics	
channel width (m)	23.0
wet width (m)	23.0
maximum depth (m)	1.5
average depth (m)	0.9
velocity (m/s)	0.24
flow character	placid
Substrate Composition (%)	
fines (< 2mm)	100
gravels (2–64mm)	0
larges (>64mm)	0
bedrock and/or oil sand	0
Bank	
height (m)	1.5
form	repose
stability	stable
texture	silt, organic
vegetation (% coverage)	
coniferous trees	10
deciduous trees	60
shrubs	20
grasses	95
barren	0
Water Quality	
temperature (°C)	13.0
dissolved oxygen (mg/l)	7
conductivity (µmhos/cm)	220
pH	7.43

LEGEND

AN angling	ARGR arctic grayling
CF counting fence	BKST brook stickleback
DN dip net	BRMN brassy minnow
EF electrofisher	BURB burbot
GN gill net	DLVR Dolly Varden
KS kick sample	EGGS unidentified fish eggs
SF small fish collections made using a combination of methods	EMSH emerald shiner
SN seine	FLCH flathead chub
AP benthic algal productivity station	FSDC finescale dace
BI benthic invertebrate collection site	FTMN fathead minnow
CH water quality station	GOLD goldeye
PS point sample	LKCH lake chub
SG stream gauging station	LKCS lake cisco
35 kilometres from mouth	LKWF lake whitefish
flow direction	LNDC longnose dace
reach boundary	LNSK longnose sucker
upstream limit of survey	MTWF mountain whitefish
division between sections of a reach	NRDC northern redbelly dace
	NSST ninespine stickleback
	NTPK northern pike
	PLDC pearl dace
	SLSC slimy sculpin
	SPSC spoonhead sculpin
	SPSH spottail shiner
	TRPC trout-perch
	UNSK unidentified sucker species
	WALL walleye
	WTSK white sucker
	YLPR yellow perch

* Data from Machniak *et al.* (1980)



AQUATIC BIOPHYSICAL INVENTORY
MACKAY RIVER

Reach 7 Section 1
(km 151.5 to km 166.0)

Scale 1:25 000

Miles 0.5 0 0.5
Kilometres 0.5 0 0.5

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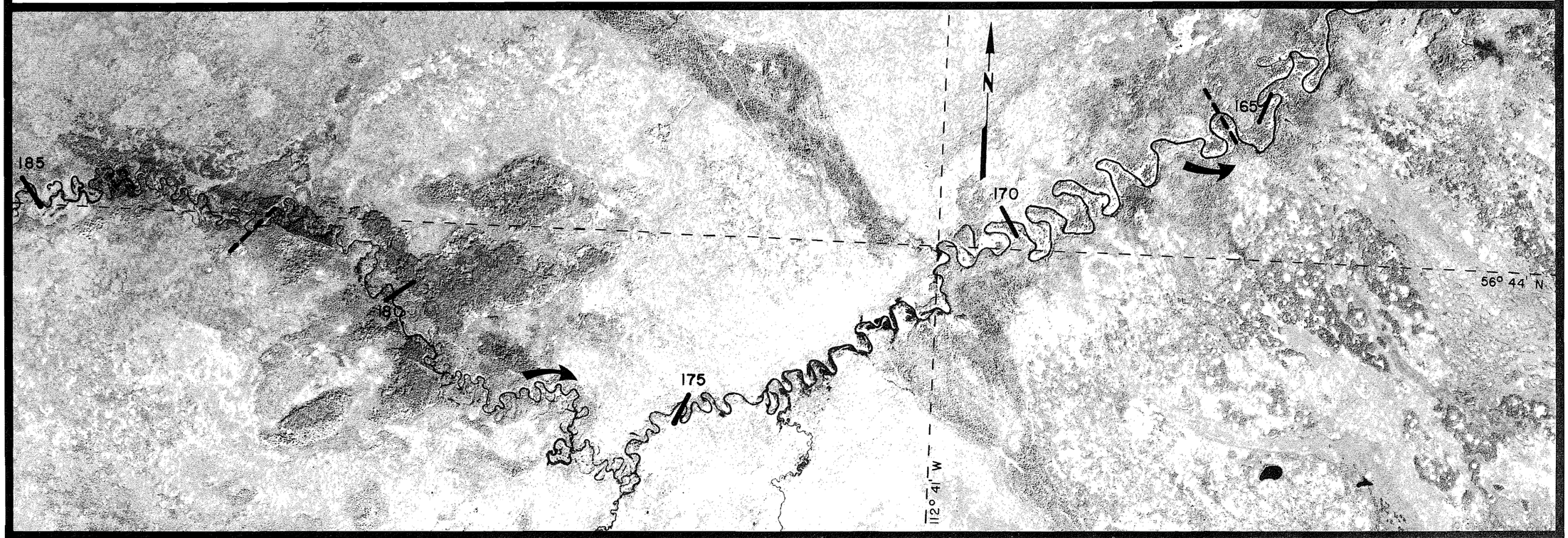
ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS



POINT SAMPLE DATA

Location
Date
Hydraulics
- channel width (m)
- wet width (m)
- maximum depth (m)
- average depth (m)
- velocity (m/s)
- flow character

Substrate Composition (%)
- fines (< 2mm)
- gravels (2–64mm)
- larges (>64mm)
- bedrock and/or oil sand

Bank
- height (m)
- form
- stability
- texture

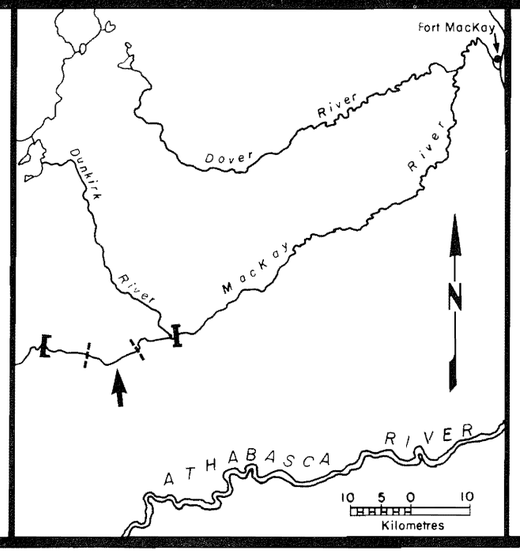
- vegetation (% coverage)
  - coniferous trees
  - deciduous trees
  - shrubs
  - grasses
  - barren

Water Quality
- temperature (°C)
- dissolved oxygen (mg/l)
- conductivity (µmhos/cm)
- pH

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

MACKAY RIVER

Reach 7 Section 2
(km 166 to km 182)

Scale 1 : 25 000

Miles 0.5 0 0.5
Kilometres 0.5 0 0.5

alberta

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS

EF NO CATCH

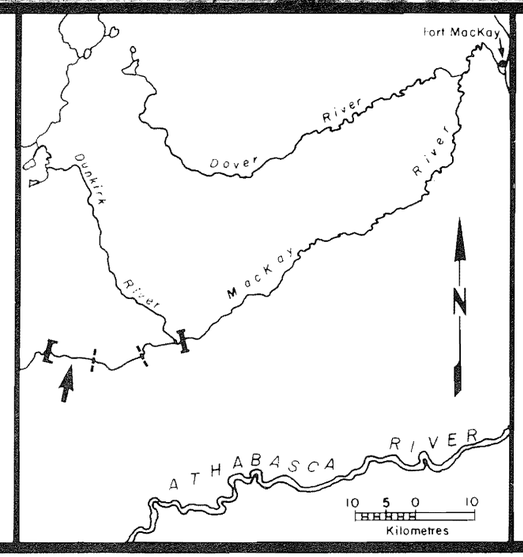
POINT SAMPLE DATA

Location	km 186.0
Date	15/09/79
Hydraulics	
channel width (m)	9.3
wet width (m)	9.3
maximum depth (m)	1.5
average depth (m)	0.9
velocity (m/s)	0.16
flow character	placid
Substrate Composition (%)	
fines (< 2mm)	100
gravels (2--64mm)	0
larges (>64mm)	0
bedrock and/or oil sand	0
Bank	
height (m)	1.0
form	repose
stability	stable
texture	silt , organic
vegetation (% coverage)	
coniferous trees	5
deciduous trees	30
shrubs	10
grasses	100
barren	0
Water Quality	
temperature (°C)	14.0
dissolved oxygen (mg/l)	7
conductivity (µmhos/cm)	240
pH	7.19

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
	reach boundary
	upstream limit of survey
	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

MACKAY RIVER

Reach 7 Section 3

(km 182 to km 197)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

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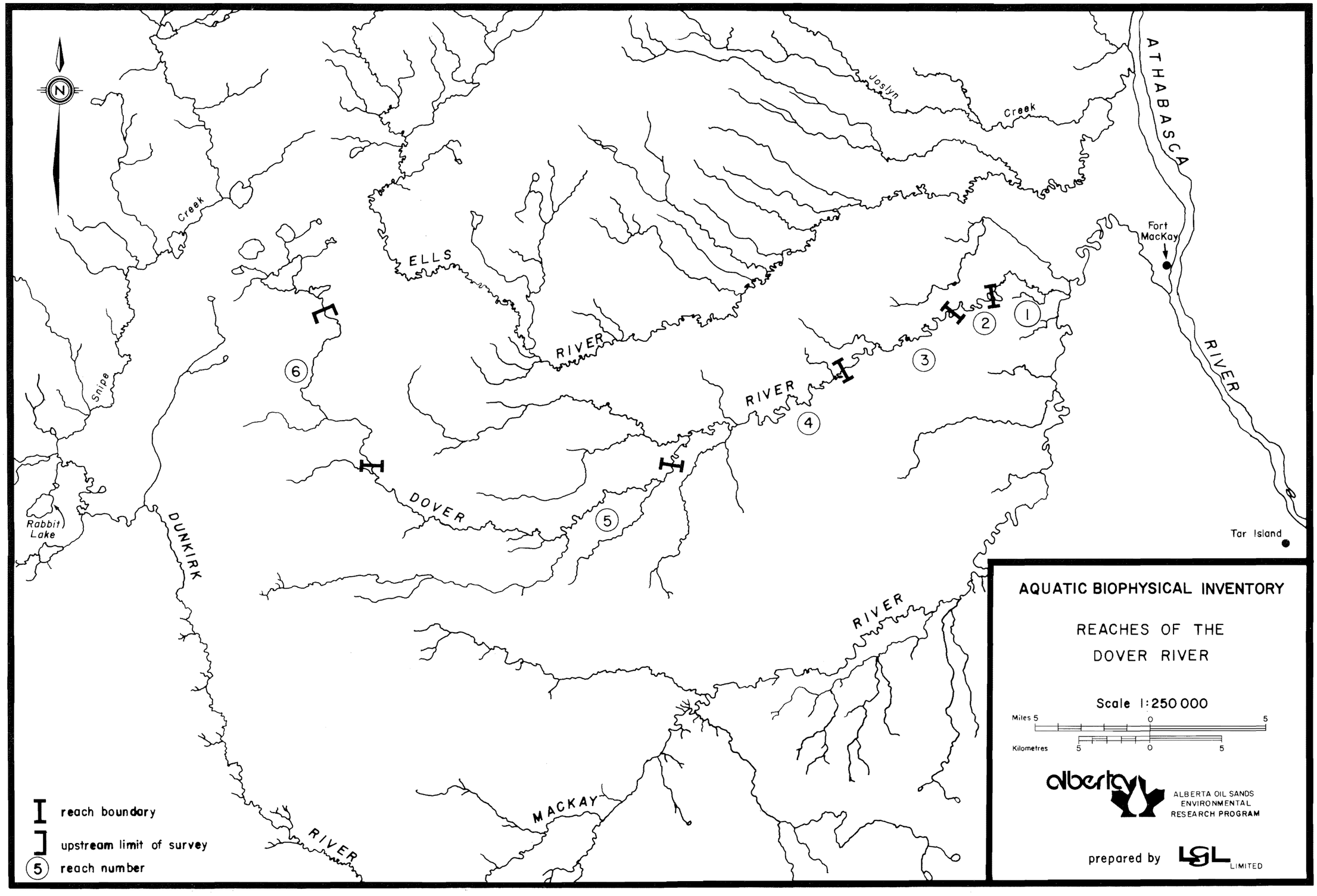
DOVER RIVER


N
Joslyn
Creek
ATHABASCA
RIVER
Fort
MacKay
Creek
ELLS
RIVER
Snipe
6
RIVER
4
3
2
1
DOVER
5
Rabbit
Lake
DUNKIRK
RIVER
Tar Island
RIVER
MACKAY
RIVER
reach boundary
upstream limit of survey
5 reach number
AQUATIC BIOPHYSICAL INVENTORY
REACHES OF THE
DOVER RIVER
Scale 1:250 000
Miles 5 0 5
Kilometres 5 0 5
alberta
ALBERTA OIL SANDS
ENVIRONMENTAL
RESEARCH PROGRAM
prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

Species	Adults	Juveniles and Young-of-the-year	Total Numbers
longnose dace	0	3	3
longnose sucker	0	13	13
pearl dace	0	122	122
white sucker	0	1	1
Total	0	139	139

PHYSICAL CHARACTERISTICS

Reach length (km)	12.5
Channel width (m)	10
Channel area (ha)	12.5
Gradient (m/km)	4.1
Flow character	swirling, rolling, broken
Total pools (%)	70
Pattern	irregularly meandering
Confinement	confined
Unstable banks (%)	40
Substrate composition (%)	
fines (<2 mm)	20
gravels (2-64 mm)	40
larges (>64 mm)	35
bedrock and/or oil sand	5
Debris	moderate

REACH DESCRIPTION AND FISH UTILIZATION

This lower reach of the Dover River is a high gradient section that extends upstream 12.5 km from the confluence with the MacKay River. The river channel is irregularly meandering, and there is a relatively high proportion of unstable banks that consist of silt, sand and gravel. Several beaver dams were present at the time the river was surveyed in 1979. Although the gradient in this reach is relatively high and riffles are numerous, water velocities in most of the reach are moderate and a high proportion of the reach consists of pools. The substrate consists primarily of larges and coarse gravels, but there are areas with sand and fine gravel substrates. The riparian vegetation is mostly deciduous trees and shrubs, with some patches of coniferous trees. There is a relatively dense growth of grasses and little overhanging vegetation. A moderate amount of debris is present in the river channel.

The spawning potential of this reach is considered good for several species of fish that have been collected from the Dover River. The numerous riffle areas provide suitable spawning locations for some species that spawn over gravel substrates (e.g., white sucker, longnose dace). Other areas with sand and fine gravel substrates may be suitable for spawning of some of the forage fish, particularly pearl dace. Numerous shallow backwaters and the abundant shelter provided by debris and some aquatic vegetation provide very good rearing potential in this reach. Good resting and feeding locations for larger fish are provided by the numerous swirling pools. There are a number of moderately deep pools that are probably suitable for overwintering of fish.

BENTHIC INVERTEBRATES

- OLIGOCHAETA
- HIRUDINEA
  - Glossiphoniidae
- GASTROPODA
  - *Ferrissia*
  - *Gyraulus*
  - *Lymnaea*
- PELECYPODA
  - *Musculium*
- ARACHNIDA
  - Hydracarina
- INSECTA
  - Ephemeroptera
    - *Ameletus*
    - *Caenis*
    - *Ephemera*
    - *Paraleptophlebia*
    - *Stenonema*
  - Odonata
    - *Ophiogomphus*
  - Plecoptera
    - *Isoperla*
    - *Taeniopteryx*
  - Hemiptera
    - Corixidae
  - Megaloptera
    - *Sialis*
  - Trichoptera
    - *Chewatopsyche*
    - *Helicopsyche*
    - *Lepidostoma*
    - *Oecetis*
    - *Potamyia*
  - Coleoptera
    - Elmidae
  - Diptera
    - Tipulidae
    - Ceratopogonidae
    - Chironomidae
      - Chironominae
      - Tanypodinae
    - Simuliidae
    - Tabanidae
    - Rhagionidae
      - *Atherix*
    - Syrphidae
    - Ephyridae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	2
Deciduous trees	60
Shrubs	40
Grasses	80
Barren	5
Channel cover (%)	
Overhang	2
Crown	2

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

Water Survey of Canada station number 07DB002

Maximum total annual discharge:	ND
Minimum total annual discharge:	ND
Maximum annual mean discharge:	ND
Minimum annual mean discharge:	ND
Maximum monthly mean discharge:	9.74 m^3/s (April 1976)
Mininum monthly mean discharge:	0.03 m^3/s (March 1977)
Maximum daily discharge:	24.61 m^3/s (April 13, 1976)
Minimum daily discharge:	0.03 m^3/s (March 3, 1977)

Data for 1975 to 1977 compiled from Loeppky and Spitzer (1977) and Warner and Spitzer (1979).

WATER QUALITY

Water Survey of Canada station number 00AT07DB0020

	Mean	Maximum	Minimum
Total alkalinity (mg $CaCO_3$/l)	286.1	462.2	67.2
pH	7.99	8.40	7.50
Total hardness (mg $CaCO_3$/l)	216.7	339.4	56.9
Conductance (µS/cm)	564	920	120
Total filterable residue fixed (mg/l)	323	519	123
Total non-filterable residue fixed (mg/l)	17	92	2
Total organic carbon (mg C/l)	26.0	47.0	14.0
Silica (mg SiO_2/l)	8.9	15.7	2.1
Nitrate and nitrite nitrogen (mg N/l)	0.140	0.500	<0.003
Total Kjeldahl nitrogen (mg N/l)	1.24	2.12	0.50
Total Phosphorus (mg P/l)	0.090	0.300	0.030
Orthophosphate (mg P/l)	0.020	0.039	0.005
Sulphate (mg SO_4/l)	31.4	83.0	6.5

Data for the period January 1976 to December 1979 obtained from the National Water Quality Data Bank (NAQUADAT).

A section of riffles at km 0.1.

Swirling pool area and large substrate material at km 8.5.

AQUATIC BIOPHYSICAL INVENTORY

DOVER RIVER

Reach 1

(km 0.0 to km 12.5)

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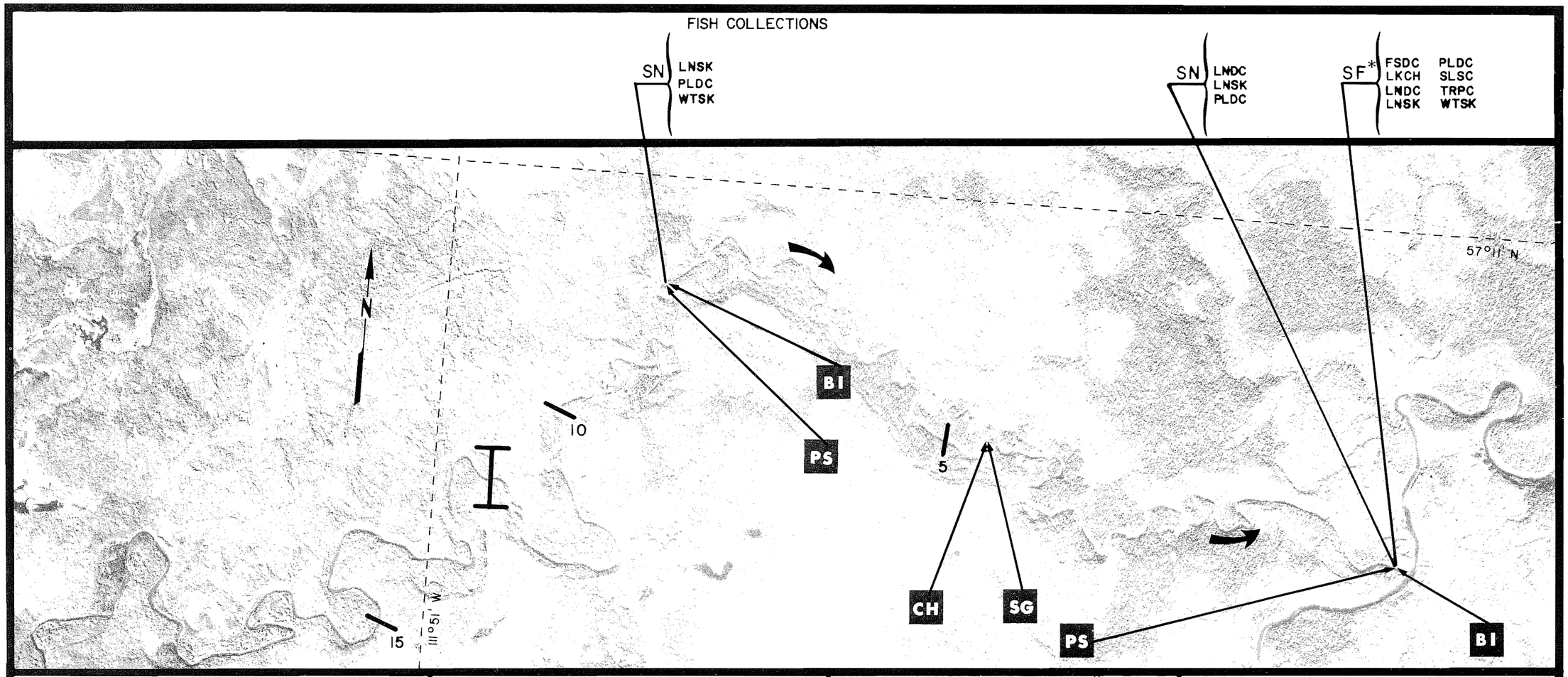


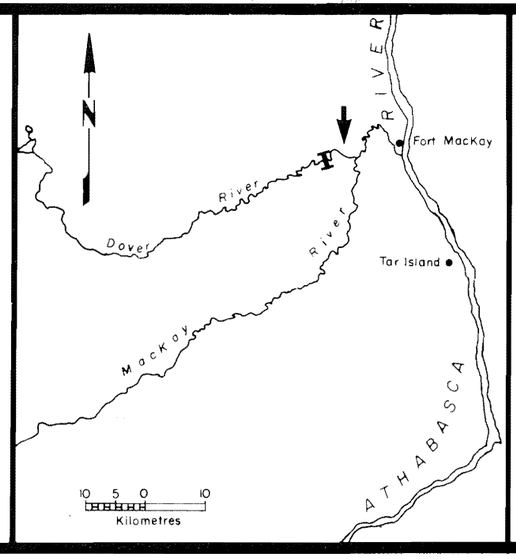
POINT SAMPLE DATA

Location	km 0.1	km 8.5
Date	09/09/79	09/09/79
Hydraulics		
channel width (m)	18.9	22.9
wet width (m)	10.4	12.2
maximum depth (m)	0.5	1.0
average depth (m)	0.3	0.4
velocity (m/s)	0.36	0.29
flow character	swirling, rolling	swirling, rolling broken
Substrate Composition (%)		
fines (< 2mm)	10	10
gravels (2–64mm)	80	55
larges (>64mm)	8	35
bedrock and/or oil sand	2	0
Bank		
height (m)	1.5	1.0
form	repose	undercut
stability	stable	failing
texture	sand, gravel, larges	sand, silt, gravel, larges
vegetation (% coverage)		
coniferous trees	0	2
deciduous trees	70	50
shrubs	60	25
grasses	80	80
barren	0	5
Water Quality		
temperature (°C)	11.5	12.0
dissolved oxygen (mg/l)	9	9
conductivity (µmhos/cm)	620	430
pH	8.45	8.45

LEGEND

AN	angling	ARGR	arctic grayling
CF	counting fence	BKST	brook stickleback
DN	dip net	BRMN	brassy minnow
EF	electrofisher	BURB	burbot
GN	gill net	DLVR	Dolly Varden
KS	kick sample	EGGS	unidentified fish eggs
SF	small fish collections made using a combination of methods	EMSH	emerald shiner
SN	seine	FLCH	flathead chub
AP	benthic algal productivity station	FSDC	finescale dace
BI	benthic invertebrate collection site	FTMN	fathead minnow
CH	water quality station	GOLD	goldeye
PS	point sample	LKCH	lake chub
SG	stream gauging station	LKCS	lake cisco
35	kilometres from mouth	LKWF	lake whitefish
	flow direction	LNDC	longnose dace
I	reach boundary	LNSK	longnose sucker
]	upstream limit of survey	MTWF	mountain whitefish
⋮	division between sections of a reach	NRDC	northern redbelly dace
		NSST	ninespine stickleback
		NTPK	northern pike
		PLDC	pearl dace
		SLSC	slimy sculpin
		SPSC	spoonhead sculpin
		SPSH	spottail shiner
		TRPC	trout-perch
		UNSK	unidentified sucker species
		WALL	walleye
		WTSK	white sucker
		YLPR	yellow perch

*Data from Machniak *et al.* (1980)



AQUATIC BIOPHYSICAL INVENTORY
DOVER RIVER

Reach 1

(km 0.0 to km 12.5)

Scale 1: 25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

alberta OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

Species	Adults	Juveniles and Young-of-the-year	Total Numbers
slimy sculpin	0	3	3
white sucker	0	1	1
Total	0	4	4

PHYSICAL CHARACTERISTICS

Reach length (km)	7.0
Channel width (m)	15
Channel area (ha)	10.5
Gradient (m/km)	2.2
Flow character	placid, swirling
Total pools (%)	95
Pattern	irregularly meandering
Confinement	frequently confined
Unstable banks (%)	15
Substrate composition (%)	
fines (<2 mm)	40
gravels (2-64 mm)	35
larges (>64 mm)	20
bedrock and/or oil sand	5
Debris	moderate

REACH DESCRIPTION AND FISH UTILIZATION

This short reach is a region of transition between Reach 3, which has a low gradient, and Reach 1, which has a steep gradient. The river channel meanders in an irregular pattern and there are a few areas with high, unstable banks. These banks appear to be composed of silt, sand and gravel. Exposed oil sands deposits are also evident in some places. Although the gradient is moderate, the flow is mostly placid and slow due to the large number of beaver dams in this reach. There are high proportions of silt and sand in the substrate, but gravels and larges are also abundant, particularly downstream from beaver dams. The riparian vegetation is dominated by deciduous trees and shrubs, but there are some scattered patches of conifers. Grasses are abundant and there is some overhanging vegetation in most areas. There is a moderate amount of debris in the river channel.

The potential of this reach for spawning of the larger fish species is considered low; suitable substrates and riffle areas are not abundant, and the beaver dams probably severely limit upstream movement of the larger fish. The small gravelly areas downstream from beaver dams may be suitable for spawning of some forage fish species (e.g., pearl dace, trout-perch, slimy sculpin). Some suckers may also spawn in this reach. The shallow backwaters, abundant debris, and overhanging vegetation provide very good rearing habitat, and the deep beaver impoundments are suitable overwintering areas for forage fish and possibly suckers.

BENTHIC INVERTEBRATES

NEMATODA
OLIGOCHAETA
HIRUDINEA
GASTROPODA
- *Ferrissia*
- *Gyraulus*

PELECYPODA
- *Musculium*
- *Sphaerium*

INSECTA
- Ephemeroptera
  - *Ameletus*
  - *Caenis*
  - *Ephemera*
  - *Stenonema*
- Odonata
  - *Ophiogomphus*
- Trichoptera
  - *Brachycentrus*
  - *Cheumatopsyche*
  - *Helicopsyche*
  - *Hydropsyche*
  - *Lepidostoma*
  - *Oecetis*
- Coleoptera
  - Elmidae
- Diptera
  - Tipulidae
  - Chironomidae
    - Tanypodinae
  - Tabanidae
  - Rhagionidae
    - *Atherix*
  - Dolichopodidae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	2
Deciduous trees	40
Shrubs	50
Grasses	70
Barren	5
Channel cover (%)	
Overhang	5
Crown	2

BENTHIC ALGAL PRODUCTIVITY

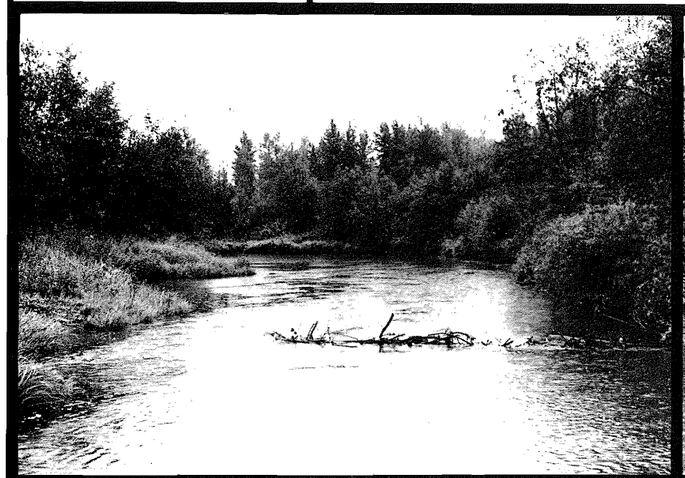
No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach



Placid and swirling pool area at km 15.9 is representative of reach 2.

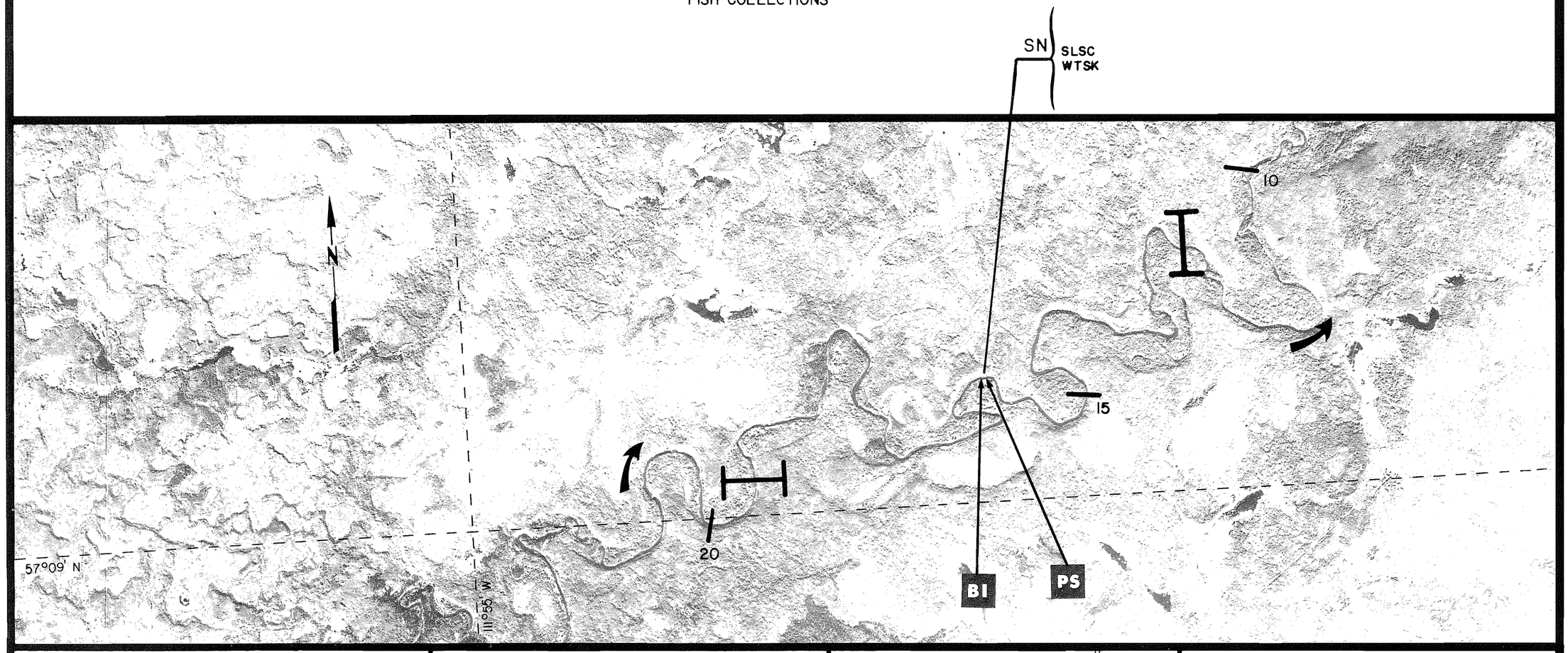
Dover River at km 15.9.

AQUATIC BIOPHYSICAL INVENTORY
DOVER RIVER
Reach 2
(km 12.5 to km 19.5)

alberta oil sands environmental research program

prepared by LGL LIMITED

FISH COLLECTIONS



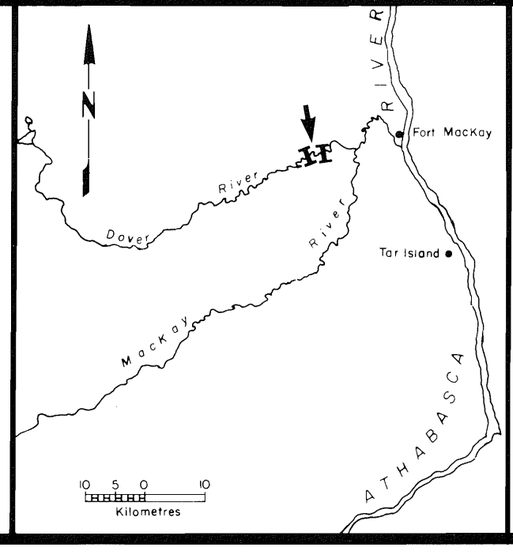
POINT SAMPLE DATA

Location	km 15.9
Date	10/09/79
Hydraulics	
channel width (m)	19.8
wet width (m)	12.8
maximum depth (m)	0.4
average depth (m)	0.3
velocity (m/s)	0.27
flow character	placid, swirling
Substrate Composition (%)	
fines (< 2mm)	10
gravels (2–64mm)	50
larges (>64mm)	40
bedrock and/or oil sand	0
Bank	
height (m)	1.5
form	steep
stability	failing
texture	sand, gravel, larges
vegetation (% coverage)	
coniferous trees	2
deciduous trees	35
shrubs	50
grasses	65
barren	10
Water Quality	
temperature (°C)	11.0
dissolved oxygen (mg/l)	8
conductivity (µmhos/cm)	580
pH	8.24

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY
DOVER RIVER
Reach 2
(km 12.5 to km 19.5)

Scale 1: 25 000

Miles 0.5 0 0.5
Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

Species	Adults	Juveniles and Young-of-the-year	Total Numbers
northern pike	0	1	1
trout-perch	0	2	2
white sucker	0	5	5
Total	0	8	8

PHYSICAL CHARACTERISTICS

Reach length (km)	19.7
Channel width (m)	20
Channel area (ha)	39.4
Gradient (m/km)	0.9
Flow character	placid
Total pools (%)	100
Pattern	irregularly meandering
Confinement	occasionally confined
Unstable banks (%)	5
Substrate composition (%)	
fines (<2 mm)	95
gravels (2-64 mm)	5
larges (>64 mm)	0
bedrock and/or oil sand	0
Debris	moderate

REACH DESCRIPTION AND FISH UTILIZATION

This section of the Dover River meanders in an irregular pattern through an area of treed muskeg. The gradient is low and the reach is virtually all placid pools. Beaver dams are very numerous. The substrate is almost entirely sand and silt with some organic detritus, but there are some small areas with gravel substrates immediately downstream from beaver dams. The river banks are stable and well vegetated. The riparian vegetation is dominated by deciduous shrubs and a dense growth of grasses. Deciduous trees are also numerous, but only scattered patches of conifers are present. In most areas, some grasses and shrubs overhang the river channel. Debris in the river channel, most of which appears to be the result of beaver activity, is moderate.

Because the numerous beaver dams are certain to severely limit the movement of larger fish and because areas with gravel substrates are few, the spawning potential for most of the larger fish species is considered to be poor. There are many areas, however, that appear to be suitable for spawning of those forage fish that will spawn over sandy substrates (e.g., pearl dace, trout-perch). Some spawning of suckers may also occur in this reach and the moderate amounts of aquatic vegetation may provide some spawning areas for brook stickleback and northern pike. The numerous weedy shallows, abundant debris, and overhanging vegetation provide good rearing areas in this reach. Juvenile northern pike, trout-perch and white sucker were collected here. The deep ponds formed behind beaver dams provide good overwintering areas.

BENTHIC INVERTEBRATES

- NEMATODA
- OLIGOCHAETA
- GASTROPODA
  - *Gyraulus*
- PELECYPODA
  - *Pisidium*
- CRUSTACEA
  - Cladocera
    - *Daphnia* sp.
  - Amphipoda
    - *Hyalella azteca*
- INSECTA
  - Ephemeroptera
    - *Ameletus*
    - *Baetis*
    - *Caenis*.
    - *Ephemera*
    - *Ephemerella*
    - *Paraleptophlebia*
  - Odonata
    - *Aeshna*
    - *Ophiogomphus*
  - Hemiptera
    - Corixidae
  - Megaloptera
    - *Sialis*
  - Trichoptera
    - *Lenarchus*
    - *Nemotaulius*
    - *Polycentropus*
    - *Ptilostomis*
  - Coleoptera
    - Dytiscidae
    - Gyrinidae
    - Elmidae
    - Chrysomelidae
      - *Donacia*
  - Diptera
    - Chironomidae
      - Chironominae
      - Tanypodinae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	2
Deciduous trees	30
Shrubs	60
Grasses	90
Barren	0
Channel cover (%)	
Overhang	5
Crown	2

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach

Beaver dam at km 31.5.

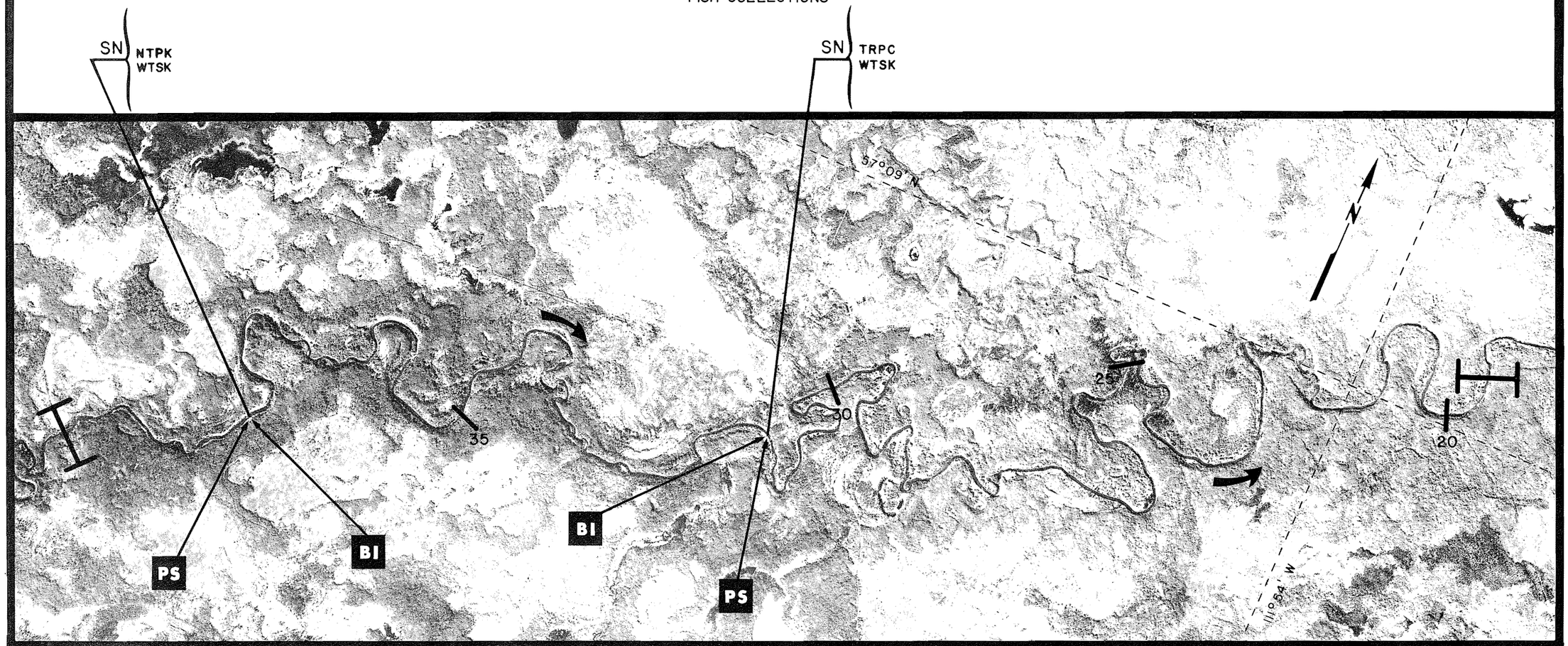
Pool upstream of beaver dam at km 31.5.

AQUATIC BIOPHYSICAL INVENTORY
DOVER RIVER
Reach 3
(km 19.5 to km 39.2)

alberta oil sands environmental research program

prepared by LGL LIMITED

FISH COLLECTIONS

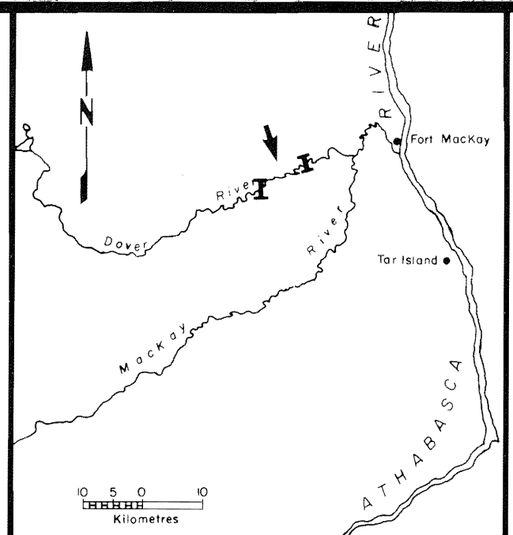


POINT SAMPLE DATA

Location	km 31.5	km 38.0
Date	10/09/79	10/09/79
Hydraulics		
channel width (m)	16.2	20.7
wet width (m)	16.2	20.7
maximum depth (m)	1.5	2.0
average depth (m)	1.0	0.8
velocity (m/s)	0.15	0.09
flow character	**placid**	**placid**
Substrate Composition (%)		
fines (< 2mm)	95	100
gravels (2–64mm)	5	0
larges (>64mm)	0	0
bedrock and/or oil sand	0	0
Bank		
height (m)	2.0	1.5
form	**undercut**	**repose**
stability	**stable**	**stable**
texture	**sandy silt**	**silty sand**
vegetation (% coverage)		
coniferous trees	2	0
deciduous trees	35	15
shrubs	70	25
grasses	85	95
barren	0	0
Water Quality		
temperature (°C)	11.0	11.0
dissolved oxygen (mg/l)	8	8
conductivity (µmhos/cm)	540	500
pH	8.25	8.14

LEGEND

AN angling	ARGR arctic grayling
CF counting fence	BKST brook stickleback
DN dip net	BRMN brassy minnow
EF electrofisher	BURB burbot
GN gill net	DLVR Dolly Varden
KS kick sample	EGGS unidentified fish eggs
SF small fish collections made using a combination of methods	EMSH emerald shiner
SN seine	FLCH flathead chub
AP benthic algal productivity station	FSDC finescale dace
BI benthic invertebrate collection site	FTMN fathead minnow
CH water quality station	GOLD goldeye
PS point sample	LKCH lake chub
SG stream gauging station	LKCS lake cisco
35 kilometres from mouth	LKWF lake whitefish
flow direction	LNDC longnose dace
reach boundary	LNSK longnose sucker
upstream limit of survey	MTWF mountain whitefish
division between sections of a reach	NRDC northern redbelly dace
	NSST ninespine stickleback
	NTPK northern pike
	PLDC pearl dace
	SLSC slimy sculpin
	SPSC spoonhead sculpin
	SPSH spottail shiner
	TRPC trout-perch
	UNSK unidentified sucker species
	WALL walleye
	WTSK white sucker
	YLPR yellow perch



AQUATIC BIOPHYSICAL INVENTORY

DOVER RIVER

Reach 3

(km 9.5 to km 39.2)

Scale 1: 25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

Species	Adults	Juveniles and Young-of-the-year	Total Numbers
pearl dace	0	1	1
slimy sculpin	0	3	3
white sucker	0	1	1
Total	0	5	5

PHYSICAL CHARACTERISTICS

Reach length (km)	36.8
Channel width (m)	14
Channel area (ha)	51.5
Gradient (m/km)	1.0
Flow character	placid, swirling
Total pools (%)	100
Pattern	tortuously meandering
Confinement	unconfined
Unstable banks (%)	5
Substrate composition (%)	
fines (<2 mm)	60
gravels (2-64 mm)	40
larges (>64 mm)	0
bedrock and/or oil sand	0
Debris	high

REACH DESCRIPTION AND FISH UTILIZATION

This tortuously meandering reach has a low gradient similar to that of Reach 3, and the entire reach consists of slowly flowing pools. Beaver dams are numerous, although not as abundant as in Reach 3. The stream is fairly deep and the banks are undercut and stabilized by vegetation. The substrate consists of silt and sand throughout much of the reach, but areas with sand and fine gravel substrates are fairly numerous. The riparian vegetation consists of deciduous shrubs and trees with scattered patches of conifers. There is also a dense growth of grasses. Shrubs and grasses overhang the river channel throughout the reach and there are large amounts of debris in the channel.

The areas with sand and gravel substrates in this reach may provide suitable spawning areas for several of the forage fish species that have been collected here (e.g., lake chub, pearl dace, trout-perch, slimy sculpin). Longnose suckers and white suckers have been collected in this reach and some spawning of these species may also occur in the reach. Several areas with low to moderate amounts of aquatic vegetation are probably suitable for spawning of brook stickleback. The large amounts of debris, undercut banks, and overhanging vegetation provide abundant rearing areas. The water depth is probably sufficient to allow overwintering of fish.

BENTHIC INVERTEBRATES

- OLIGOCHAETA
- GASTROPODA
  - *Ferrissia*
  - *Gyraulus*
  - *Stagnicola*
  - *Valvata*
- PELECYPODA
  - *Musculium*
  - *Sphaerium*
- CRUSTACEA
  - Cladocera
- INSECTA
  - Ephemeroptera
    - *Ameletus*
    - *Baetisca*
    - *Caenis*
    - *Ephemera*
    - *Ephemerella*
    - *Paraleptophlebia*
    - *Parameletus*
    - *Stenonema*
  - Plecoptera
    - *Isogenus*
  - Hemiptera
    - Corixidae
  - Megaloptera
    - *Sialis*
  - Trichoptera
    - *Arctopsyche*
    - *Oecetis*
    - *Polycentropus*
  - Diptera
    - Chironomidae
      - Chironominae
    - Tabanidae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	10
Deciduous trees	50
Shrubs	65
Grasses	90
Barren	0
Channel cover (%)	
Overhang	10
Crown	5

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach

Placid flow and overhanging bank vegetation at km 47.5 are typical of reach 4.

Dover River at km 63.

AQUATIC BIOPHYSICAL INVENTORY
DOVER RIVER
Reach 4
(km 39.2 to km 76.0)

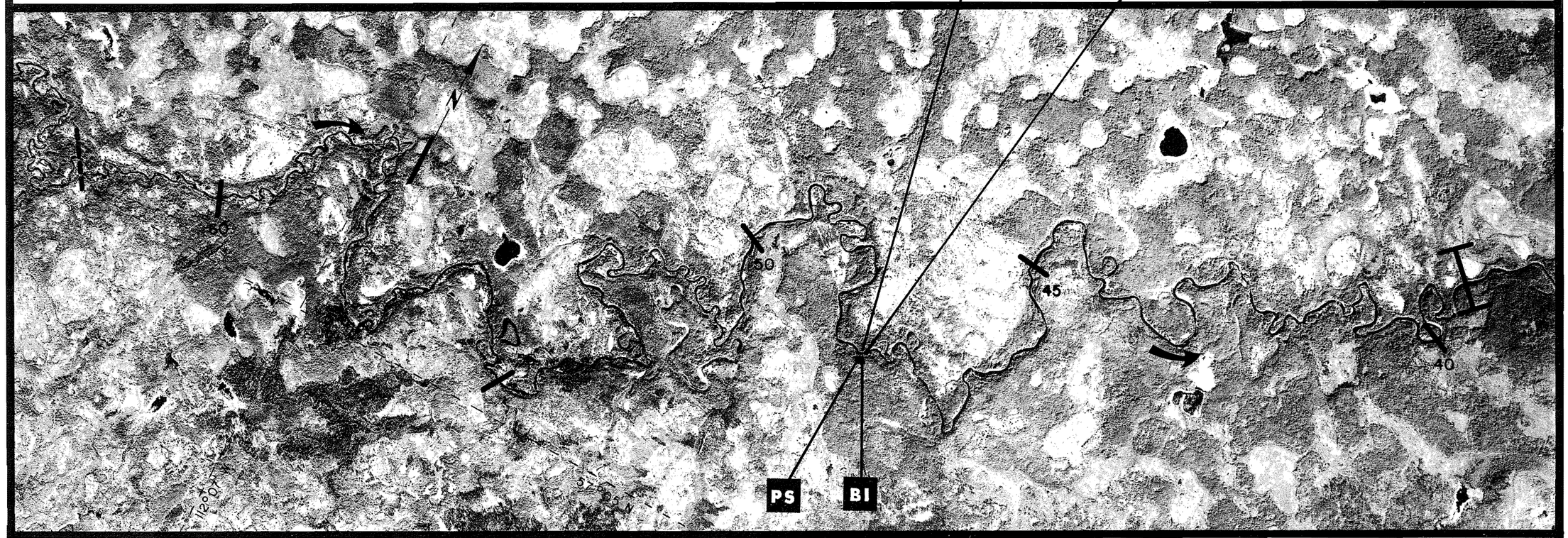
alberta — ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS

EF PLDC

AN NO CATCH



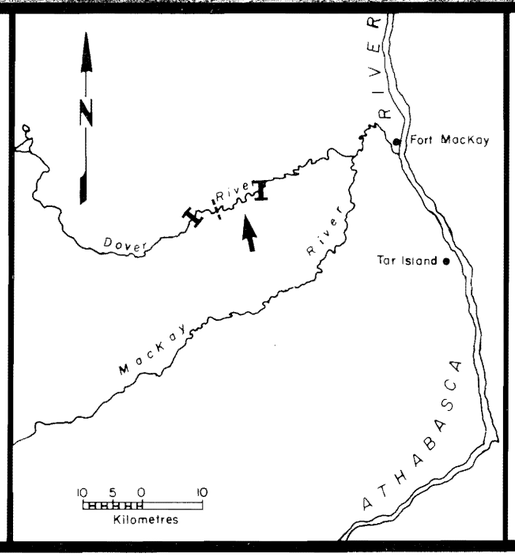
POINT SAMPLE DATA

Location	km 47.5
Date	11/09/79
Hydraulics	
channel width (m)	14.0
wet width (m)	14.0
maximum depth (m)	1.0
average depth (m)	0.9
velocity (m/s)	0.28
flow character	placid, swirling
Substrate Composition (%)	
fines (< 2mm)	20
gravels (2–64mm)	70
larges (>64mm)	10
bedrock and/or oil sand	0
Bank	
height (m)	2.5
form	undercut
stability	stable
texture	sandy silt
vegetation (% coverage)	
coniferous trees	2
deciduous trees	40
shrubs	15
grasses	95
barren	0
Water Quality	
temperature (°C)	10.0
dissolved oxygen (mg/l)	8
conductivity (µmhos/cm)	410
pH	8.05

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
	reach boundary
	upstream limit of survey
	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY
DOVER RIVER

Reach 4 Section 1

(km 39.2 to km 61.0)

Scale 1: 25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

alberta

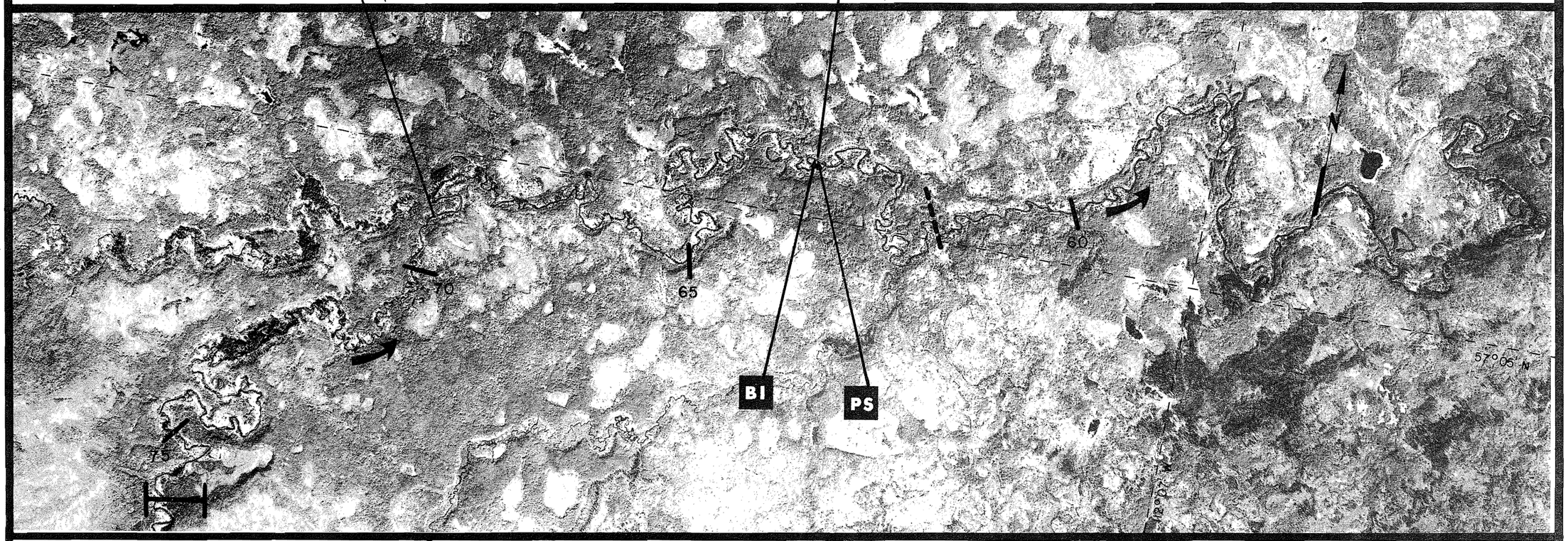
ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS

SF * BKST TRPC LKCH WTSK LNSK YLPR SLSC

SN SLSC WTSK



POINT SAMPLE DATA

Location	km 63.0
Date	09/09/79
Hydraulics	
channel width (m)	14.6
wet width (m)	14.6
maximum depth (m)	1.1
average depth (m)	0.9
velocity (m/s)	0.06
flow character	placid
Substrate Composition (%)	
fines (< 2 mm)	25
gravels (2–64 mm)	40
larges (> 64 mm)	35
bedrock and/or oil sand	0
Bank	
height (m)	2.0
form	undercut
stability	stable
texture	silty sand
vegetation (% coverage)	
coniferous trees	2
deciduous trees	50
shrubs	80
grasses	70
barren	0
Water Quality	
temperature (°C)	11.0
dissolved oxygen (mg/l)	7
conductivity (µmhos/cm)	340
pH	8.15

LEGEND

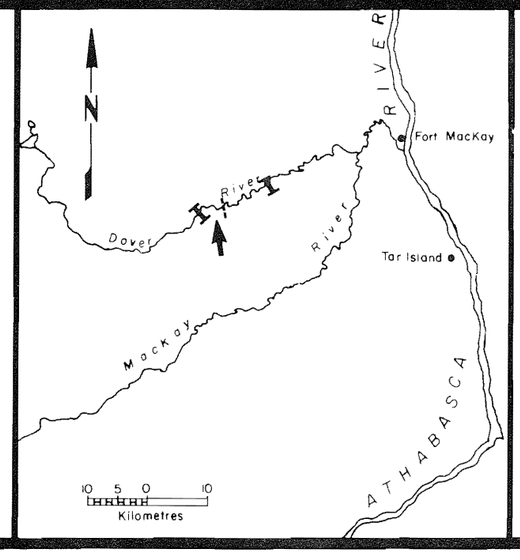
AN angling
CF counting fence
DN dip net
EF electrofisher
GN gill net
KS kick sample
SF small fish collections made using a combination of methods
SN seine

AP benthic algal productivity station
BI benthic invertebrate collection site
CH water quality station
PS point sample
SG stream gauging station

35 kilometres from mouth
flow direction
reach boundary
upstream limit of survey
division between sections of a reach

ARGR arctic grayling
BKST brook stickleback
BRMN brassy minnow
BURB burbot
DLVR Dolly Varden
EGGS unidentified fish eggs
EMSH emerald shiner
FLCH flathead chub
FSDC finescale dace
FTMN fathead minnow
GOLD goldeye
LKCH lake chub
LKCS lake cisco
LKWF lake whitefish
LNDC longnose dace
LNSK longnose sucker
MTWF mountain whitefish
NRDC northern redbelly dace
NSST ninespine stickleback
NTPK northern pike
PLDC pearl dace
SLSC slimy sculpin
SPSC spoonhead sculpin
SPSH spottail shiner
TRPC trout-perch
UNSK unidentified sucker species
WALL walleye
WTSK white sucker
YLPR yellow perch

* Data from Machniak *et al.* (1980)



AQUATIC BIOPHYSICAL INVENTORY

DOVER RIVER

Reach 4 Section 2

(km 61 to km 76)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

Species	Adults	Juveniles and Young-of-the-year	Total Numbers
pearl dace	0	4	4
Total	0	4	4

PHYSICAL CHARACTERISTICS

Reach length (km)	56.5
Channel width (m)	7
Channel area (ha)	39.6
Gradient (m/km)	1.6
Flow character	placid, swirling
Total pools (%)	100
Pattern	tortuously meandering
Confinement	occasionally confined
Unstable banks (%)	2
Substrate composition (%)	
fines (<2 mm)	95
gravels (2-64 mm)	5
larges (>64 mm)	0
bedrock and/or oil sand	0
Debris	high

REACH DESCRIPTION AND FISH UTILIZATION

This section of the Dover River meanders in a tortuous pattern through an area of muskeg. The gradient is fairly low, but somewhat steeper than the gradient in Reaches 3 and 4. Beaver dams are fairly numerous and the reach is entirely pools. The river banks are undercut, but are stabilized by vegetation. The substrate is almost entirely silt and sand, with only a few small areas of sand and gravel. Organic detritus is also abundant in the substrate material. The riparian vegetation consists of a mixture of deciduous trees, coniferous trees, and deciduous shrubs. There is also a dense growth of grasses. Much of the river channel is covered by overhanging shrubs and trees. There are large amounts of woody debris in the channel and many places where dead trees have fallen into the water.

This reach does not contain areas suitable for spawning of most fish species that occur in the Dover River. There are some areas with aquatic vegetation that may be suitable for brook stickleback spawning. Pearl dace may also spawn over some of the sandy substrates in this reach. The rearing potential is good due to the large amounts of debris, undercut banks, and abundant overhanging vegetation. Water depths are probably sufficient for overwintering of fish.

BENTHIC INVERTEBRATES

OLIGOCHAETA
GASTROPODA
Physa
PELECYPODA
Musculium
INSECTA
Ephemeroptera
Paraleptophlebia
Diptera
Ceratopogonidae
Chironomidae
Chironominae
Tanypodinae
Tabanidae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	45
Deciduous trees	25
Shrubs	35
Grasses	85
Barren	0
Channel cover (%)	
Overhang	20
Crown	25

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach

Slow-moving pool and overhanging bank vegetation at km 86 are representative of reach 5.

Abundant debris at km 86 is typical of this reach.

AQUATIC BIOPHYSICAL INVENTORY
DOVER RIVER
Reach 5
(km 76.0 to km 132.5)

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

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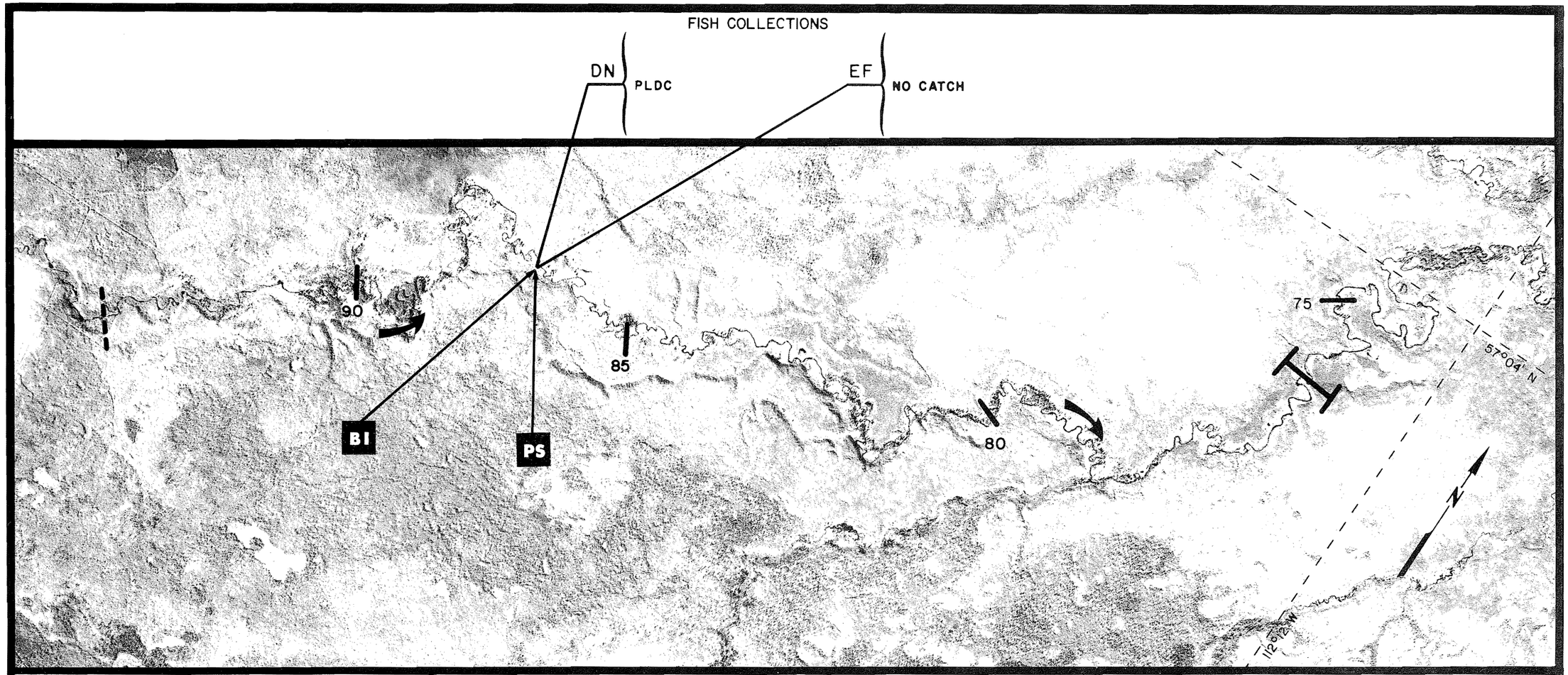


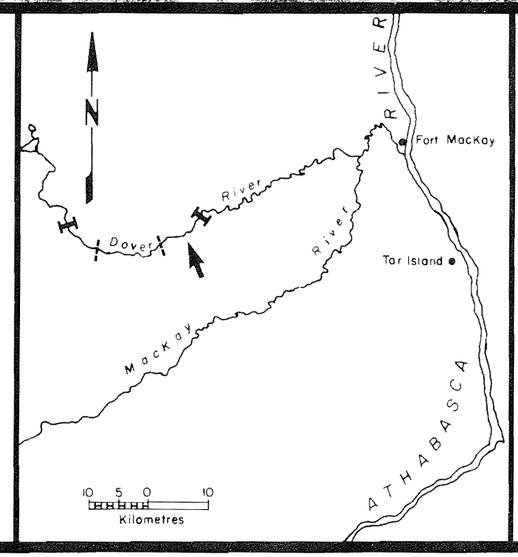
POINT SAMPLE DATA

Location	km 86.0
Date	11/09/79
Hydraulics	
channel width (m)	7.6
wet width (m)	7.6
maximum depth (m)	1.2
average depth (m)	1.1
velocity (m/s)	0.35
flow character	placid, swirling
Substrate Composition (%)	
fines (< 2mm)	100
gravels (2–64mm)	0
larges (>64mm)	0
bedrock and/or oil sand	0
Bank	
height (m)	1.2
form	undercut
stability	stable
texture	sand, silt, organic
vegetation (% coverage)	
coniferous trees	20
deciduous trees	20
shrubs	15
grasses	95
barren	0
Water Quality	
temperature (°C)	8.5
dissolved oxygen (mg/l)	9
conductivity (µmhos/cm)	390
pH	7.85

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY
DOVER RIVER
Reach 5 Section 1
(km 76 to km 93)

Scale 1: 25 000

Miles 0.5 0 0.5
Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

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FISH COLLECTIONS

POINT SAMPLE DATA

Location
Date
Hydraulics
- channel width (m)
- wet width (m)
- maximum depth (m)
- average depth (m)
- velocity (m/s)
- flow character

Substrate Composition (%)
- fines (< 2mm)
- gravels (2–64mm)
- larges (>64mm)
- bedrock and/or oil sand

Bank
- height (m)
- form
- stability
- texture

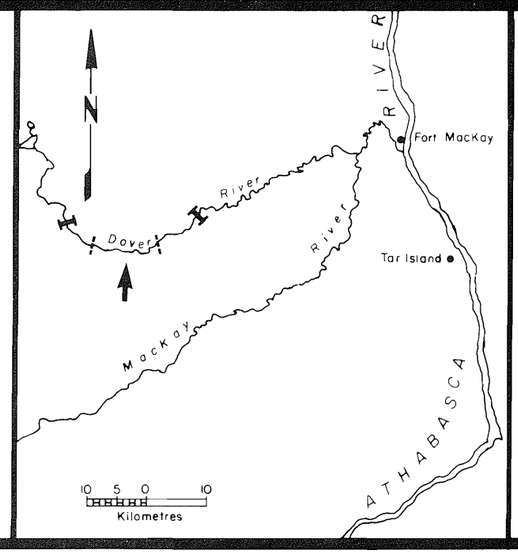
- vegetation (% coverage)
  - coniferous trees
  - deciduous trees
  - shrubs
  - grasses
  - barren

Water Quality
- temperature (°C)
- dissolved oxygen (mg/l)
- conductivity (µmhos/cm)
- pH

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

DOVER RIVER

Reach 5 Section 2

(km 93.0 to km 120.5)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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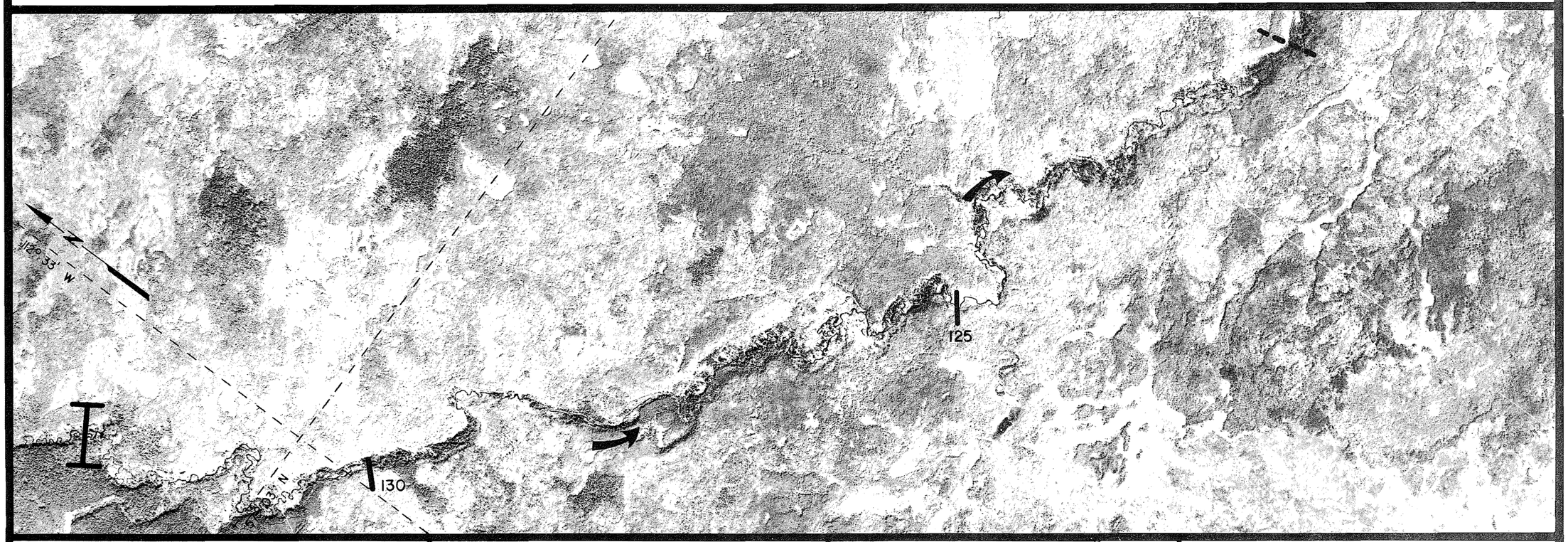
FISH COLLECTIONS



POINT SAMPLE DATA

Location
Date
Hydraulics
- channel width (m)
- wet width (m)
- maximum depth (m)
- average depth (m)
- velocity (m/s)
- flow character

Substrate Composition (%)
- fines (< 2mm)
- gravels (2–64mm)
- larges (>64mm)
- bedrock and/or oil sand

Bank
- height (m)
- form
- stability
- texture

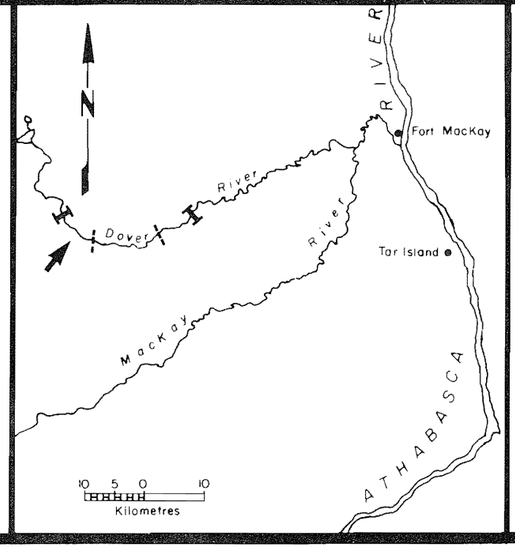
- vegetation (% coverage)
  - coniferous trees
  - deciduous trees
  - shrubs
  - grasses
  - barren

Water Quality
- temperature (°C)
- dissolved oxygen (mg/l)
- conductivity (μmhos/cm)
- pH

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

DOVER RIVER

Reach 5 Section 3

(km 120.5 to km 132.5)

Scale 1: 25 000

Miles 0.5 0 0.5
Kilometres 0.5 0 0.5

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prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

Species	Adults	Juveniles and Young-of-the-year	Total Numbers
brook stickleback	9	7	16
Total	9	7	16

PHYSICAL CHARACTERISTICS

Reach length (km)	21.5
Channel width (m)	75
Channel area (ha)	161.3
Gradient (m/km)	1.8
Flow character	placid
Total pools (%)	100
Pattern	irregular
Confinement	unconfined
Unstable banks (%)	0
Substrate composition (%)	
fines (<2 mm)	95
gravels (2-64 mm)	5
larges (>64 mm)	0
bedrock and/or oil sand	0
Debris	moderate

REACH DESCRIPTION AND FISH UTILIZATION

This reach is a long marshy section in a muskeg region. The gradient is low and the stream flow is very slow. Many beaver dams are present throughout this reach. The substrate consists almost entirely of sand, silt, and organic detritus, but there are a few areas with fine gravel substrates. The riparian vegetation is primarily grasses and deciduous shrubs, but there are also some deciduous and coniferous trees. There is a relatively large amount of overhanging vegetation and moderate amounts of debris in the river channel.

The abundant aquatic vegetation in this reach provides good spawning potential for brook stickleback and possibly northern pike (only brook stickleback were collected from this reach). Spawning potential for other species is considered poor, but some forage species (e.g., pearl dace) may be able to spawn successfully in this reach. Rearing potential is considered good because ample cover is provided by log debris and aquatic vegetation. Water depths are probably sufficient to allow overwintering of fish.

BENTHIC INVERTEBRATES

- OLIGOCHAETA
- CRUSTACEA
  - Cladocera
  - Amphipoda
    - *Hyalella azteca*
- INSECTA
  - Ephemeroptera
    - *Baetis*
  - Diptera
    - Chironomidae
      - Chironominae
      - Orthocladiinae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	10
Deciduous trees	10
Shrubs	80
Grasses	90
Barren	0
Channel cover (%)	
Overhang	15
Crown	10

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach

Beaver dam on Dover River at km 134.5.

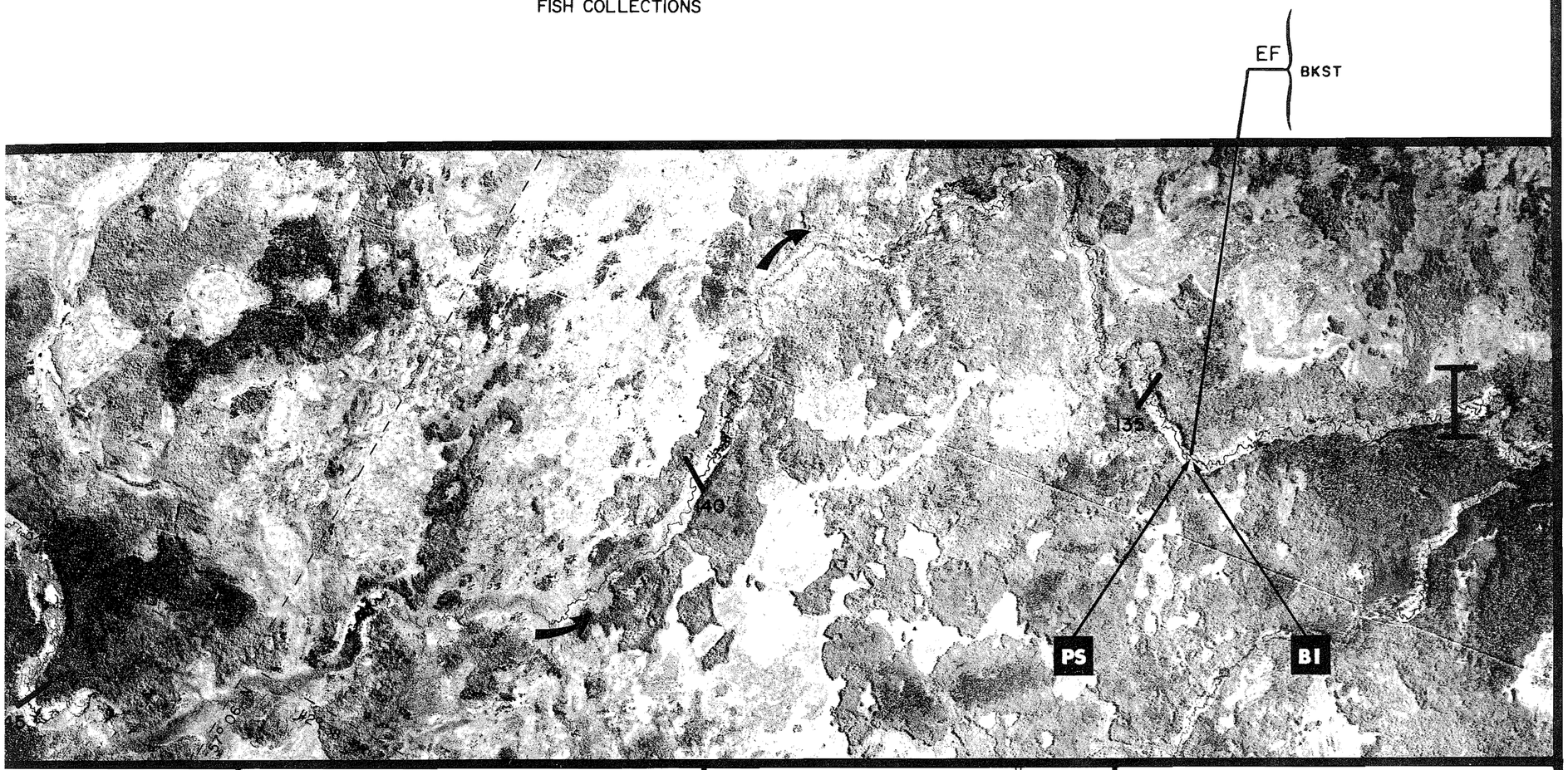
Large pond behind beaver dam at km 134.5.

AQUATIC BIOPHYSICAL INVENTORY
DOVER RIVER
Reach 6
(km 132.5 to km 154.0)

alberta oil sands environmental research program

prepared by LGL LIMITED

FISH COLLECTIONS



PLE DATA

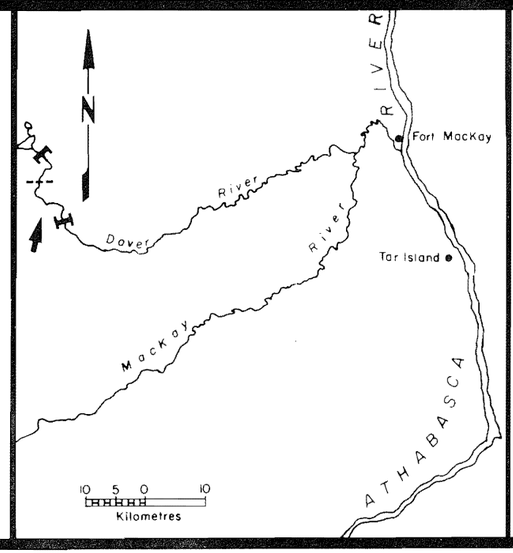
34.5
/79

silt, organic

0

LEGEND

AN	angling	ARGR	arctic grayling
CF	counting fence	BKST	brook stickleback
DN	dip net	BRMN	brassy minnow
EF	electrofisher	BURB	burbot
GN	gill net	DLVR	Dolly Varden
KS	kick sample	EGGS	unidentified fish eggs
SF	small fish collections made using a combination of methods	EMSH	emerald shiner
		FLCH	flathead chub
SN	seine	FSDC	finescale dace
AP	benthic algal productivity station	FTMN	fathead minnow
		GOLD	goldeye
BI	benthic invertebrate collection site	LKCH	lake chub
		LKCS	lake cisco
CH	water quality station	LKWF	lake whitefish
PS	point sample	LNDC	longnose dace
		LNSK	longnose sucker
SG	stream gauging station	MTWF	mountain whitefish
		NRDC	northern redbelly dace
35	kilometres from mouth	NSST	ninespine stickleback
		NTPK	northern pike
	flow direction	PLDC	pearl dace
I	reach boundary	SLSC	slimy sculpin
]	upstream limit of survey	SPSC	spoonhead sculpin
		SPSH	spottail shiner
	division between sections of a reach	TRPC	trout-perch
		UNSK	unidentified sucker species
		WALL	walleye
		WTSK	white sucker
		YLPR	yellow perch

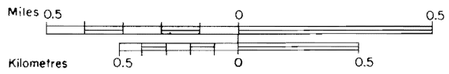


AQUATIC BIOPHYSICAL INVENTORY
DOVER RIVER

Reach 6 Section 1

(km 132.5 to km 146.0)

Scale 1: 25 000



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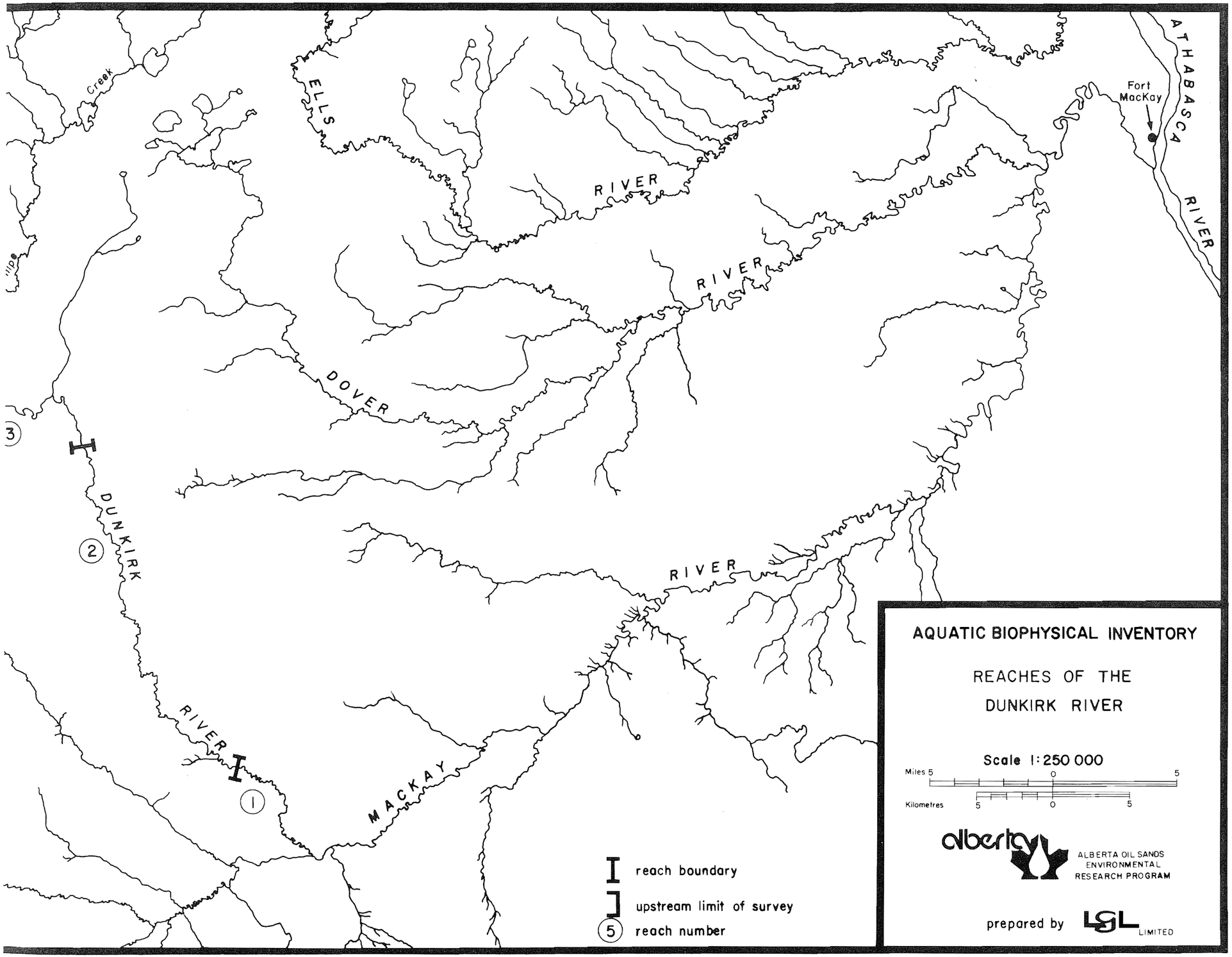

AQUATIC BIOPHYSICAL INVENTORY

REACHES OF THE
DUNKIRK RIVER

Scale 1:250 000

Miles 5 0 5

Kilometres 5 0 5

ALBERTA OIL SANDS
ENVIRONMENTAL
RESEARCH PROGRAM

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BIOPHYSICAL INVENTORY

DOVER RIVER

ıch 6 Section 2

n 146 to km 154)

Scale 1:25 000

0 0.5

0 0.5

ALBERTA OIL SANDS
ENVIRONMENTAL
RESEARCH PROGRAM

ırepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

Species	Adults	Juveniles and Young-of-the-year	Total Numbers
brook stickleback	3	0	3
northern pike	0	1	1
pearl dace	0	11	11
trout-perch	4	6	10
white sucker	0	11	11
Total	7	29	36

PHYSICAL CHARACTERISTICS

Reach length (km)	16.5
Channel width (m)	17
Channel area (ha)	28.1
Gradient (m/km)	0.4
Flow character	placid
Total pools (%)	100
Pattern	tortuously meandering
Confinement	unconfined
Unstable banks (%)	0
Substrate composition (%)	
fines (<2 mm)	100
gravels (2-64 mm)	0
larges (>64 mm)	0
bedrock and/or oil sand	0
Debris	high

REACH DESCRIPTION AND FISH UTILIZATION

This lower reach of the Dunkirk River is a tortuously meandering section that flows through an area of treed muskeg. The gradient is very low and the entire reach is a placid pool area. The substrate consists of sand and silt with a fairly high content of organic detritus. Deciduous shrubs and trees dominate the riparian vegetation, but conifers are also abundant in some areas. There is also a very dense growth of grasses. Shrubs and grasses overhang the river channel throughout most of the reach. Debris in the river channel is abundant and there are many locations where trees have fallen into or across the river.

Aquatic vegetation is fairly abundant in this reach and provides very good spawning habitat for northern pike and brook stickleback. The spawning potential for other species is poor, but some forage fish species that will spawn over sandy substrates may spawn successfully at some locations in this reach. Low water velocities, and the ample shelter provided by debris and aquatic vegetation create an excellent rearing habitat for northern pike, brook stickleback, and other forage species. The presence of juvenile white suckers indicates that the area is also suitable for rearing of that species. Water depths appear to be sufficient to allow overwintering of fish in at least the lower portion of the reach.

BENTHIC INVERTEBRATES

- NEMATODA
- OLIGOCHAETA
- HIRUDINEA
  - Glossiphoniidae
- GASTROPODA
  - *Aplexa*
  - *Gyraulus*
  - *Stagnicola*
- PELECYPODA
  - *Pisidium*
  - *Sphaerium*
- CRUSTACEA
  - Amphipoda
    - *Gammarus pseudolimnaeus*
    - *Hyalella azteca*
- INSECTA
  - Ephemeroptera
    - *Ameletus*
    - *Baetis*
    - *Baetidae*
    - *Hexagenia*
    - *Paraleptophlebia*
    - *Siphlonurus*
  - Odonata
    - Aeshnidae
      - *Aeshna*
    - Agriidae
  - Plecoptera
    - *Pteronarcys*
  - Hemiptera
    - Corixidae
    - Gerridae
  - Trichoptera
    - *Agrypnia*
    - *Brachycentrus*
    - *Lepidostoma*
  - Coleoptera
    - Dytiscidae
    - Noteridae
    - Elmidae
  - Diptera
    - Tipulidae
    - Ceratopogonidae
    - Chironomidae
      - Chironominae
      - Tanypodinae
      - Orthocladiinae
    - Tabanidae
    - Empididae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	25
Deciduous trees	45
Shrubs	50
Grasses	95
Barren	0
Channel cover (%)	
Overhang	5
Crown	0

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach

Placid pool conditions, typical of this reach, at km 4.5.

Slumping, undercut bank at km 14.2.

AQUATIC BIOPHYSICAL INVENTORY

DUNKIRK RIVER

Reach 1

(km 0 to km 16)

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS

SN NTPK PLDC WTSK
EF PLDC TRPC WTSK
SN BKST TRPC WTSK
EF BKST TRPC WTSK
SF* BKST LKCH NTPK SLSC TRPC WTSK

POINT SAMPLE DATA

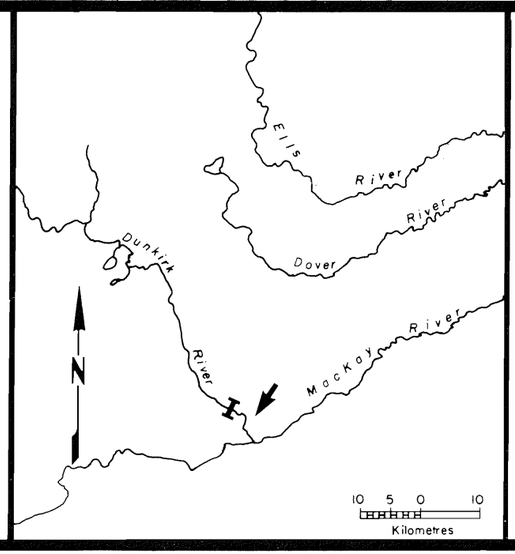
Location	km 4.5	km 14.2
Date	18/09/79	18/09/79
Hydraulics		
channel width (m)	16.5	18.0
wet width (m)	16.5	15.0
maximum depth (m)	1.5	0.7
average depth (m)	1.0	0.6
velocity (m/s)	0.32	1.44
flow character	placid	placid, swirling
Substrate Composition (%)		
fines (< 2mm)	100	100
gravels (2–64mm)	0	0
larges (>64mm)	0	0
bedrock and/or oil sand	0	0
Bank		
height (m)	2.0	2.0
form	repose	undercut
stability	stable	failing
texture	silty sand	silty sand
vegetation (% coverage)		
coniferous trees	5	50
deciduous trees	65	35
shrubs	30	20
grasses	90	60
barren	0	2
Water Quality		
temperature (°C)	11.0	11.5
dissolved oxygen (mg/l)	8	8
conductivity (µmhos/cm)	240	235
pH	8.03	8.06

LEGEND

AN angling
CF counting fence
DN dip net
EF electrofisher
GN gill net
KS kick sample
SF small fish collections made using a combination of methods
SN seine
AP benthic algal productivity station
BI benthic invertebrate collection site
CH water quality station
PS point sample
SG stream gauging station
35 kilometres from mouth
flow direction
reach boundary
upstream limit of survey
division between sections of a reach

ARGR arctic grayling
BKST brook stickleback
BRMN brassy minnow
BURB burbot
DLVR Dolly Varden
EGGS unidentified fish eggs
EMSH emerald shiner
FLCH flathead chub
FSDC finescale dace
FTMN fathead minnow
GOLD goldeye
LKCH lake chub
LKCS lake cisco
LKWF lake whitefish
LNDC longnose dace
LNSK longnose sucker
MTWF mountain whitefish
NRDC northern redbelly dace
NSST ninespine stickleback
NTPK northern pike
PLDC pearl dace
SLSC slimy sculpin
SPSC spoonhead sculpin
SPSH spottail shiner
TRPC trout-perch
UNSK unidentified sucker species
WALL walleye
WTSK white sucker
YLPR yellow perch

* Data from Machniak *et al.* (1980)



AQUATIC BIOPHYSICAL INVENTORY

DUNKIRK RIVER

Reach I

(km 0.0 to km 16.5)

Scale 1:25 000

Miles 0.5 0 0.5
Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

Species	Adults	Juveniles and Young-of-the-year	Total Numbers
brook stickleback	2	0	2
longnose sucker	0	1	1
northern pike	0	3	3
pearl dace	12	40	52
slimy sculpin	3	0	3
trout-perch	4	3	7
white sucker	0	2	2
Total	21	49	70

PHYSICAL CHARACTERISTICS

Reach length (km)	39.7
Channel width (m)	22
Channel area (ha)	87.3
Gradient (m/km)	0.9
Flow character	placid, swirling, rolling
Total pools (%)	90
Pattern	irregularly meandering
Confinement	occasionally confined
Unstable banks (%)	5
Substrate composition (%)	
fines (<2 mm)	50
gravels (2-64 mm)	30
larges (>64 mm)	20
bedrock and/or oil sand	0
Debris	high

REACH DESCRIPTION AND FISH UTILIZATION

This irregularly meandering section of the Dunkirk River has a slightly steeper gradient than Reach 1. Although most of the reach consists of pools with placid and swirling flow, there are some riffle areas. Beaver dams are fairly numerous in this reach. The substrate consists mainly of sand and gravel with some cobbles and boulders. Towards the upper end of the reach, the substrate is composed of more silt and sand and less gravel than in the lower portion of the reach. The river banks are generally stable and well vegetated. The riparian vegetation is a mixture of coniferous trees, deciduous trees, and deciduous shrubs. There is also a dense growth of grasses. Moderate amounts of shrubs and grasses overhang the river channel and there are large amounts of woody debris in the channel.

The gravel and sand substrates present in this reach provide areas that appear to be suitable for spawning of arctic grayling, longnose sucker, white sucker, slimy sculpin, lake chub, trout-perch, and pearl dace. The rearing potential of this reach is very good, due to the many areas with low water velocities and abundant shelter (provided by debris and some aquatic vegetation). The pools in this reach are moderately deep and many of them are probably suitable for overwintering of fish.

BENTHIC INVERTEBRATES

- OLIGOCHAETA
- HIRUDINEA
- GASTROPODA
  - *Ferrissia*
  - *Gyraulus*
  - *Valvata*
- PELECYPODA
  - *Musculium*
  - *Sphaerium*
- ARACHNIDA
  - Hydracarina
- INSECTA
  - Ephemeroptera
    - *Ameletus*
    - *Baetis*
    - *Baetisca*
    - *Ephemera*
    - *Paraleptophlebia*
    - *Stenonema*
  - Odonata
    - *Ophiogomphus*
  - Plecoptera
    - *Diura*
    - *Isogenus*
    - *Isoperla*
    - *Pteronarcys*
    - *Taeniopteryx*
  - Hemiptera
    - Corixidae
  - Megaloptera
    - *Sialis*
  - Trichoptera
    - *Apatania*
    - *Brachycentrus*
    - *Ceraclea*
    - *Chewmatopsyche*
    - *Glossosoma*
    - *Helicopsyche*
    - *Hydropsyche*
    - *Hydroptila*
    - *Lepidostoma*
    - *Oecetis*
    - *Polycentropus*
  - Coleoptera
    - Dryopidae
    - Elmidae
  - Diptera
    - Tipulidae
    - Chironomidae
    - Tabanidae
    - Ephydridae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	45
Deciduous trees	45
Shrubs	35
Grasses	80
Barren	0
Channel cover (%)	
Overhang	5
Crown	2

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

Water Survey of Canada station number 07DB003

Maximum total annual discharge:	182.6×10^6 m^3 (1978)
Minimum total annual discharge:	70.8×10^6 m^3 (1977)
Maximum annual mean discharge:	5.78 m^3/s (1978)
Minimum annual mean discharge:	2.25 m^3/s (1977)
Maximum monthly mean discharge:	23.11 m^3/s (September 1978)
Minimum monthly mean discharge:	0.03 m^3/s (January 1976)
Maximum daily dischárge:	33.70 m^3/s (Sept. 18, 1978)
Minimum daily discharge:	0.02 m^3/s (Feb. 28, 1978)

Data for 1975 to 1978 compiled from Loeppky and Spitzer (1977), Warner and Spitzer (1979) and Warner (1979).

WATER QUALITY

Water Survey of Canada station number 00AT07DB0030

	Mean	Maximum	Minimum
Total alkalinity (mg $CaCO_3$/l)	144.0	273.0	39.5
pH	7.60	8.50	6.65
Total hardness (mg $CaCO_3$/l)	156.0	267.i	47.2
Conductance (µS/cm)	313	595	83
Total filterable residue fixed (mg/l)	150	348	49
Total non-filterable residue fixed (mg/l)	12	105	<0.4
Total organic carbon (mg C/l)	29.0	44.0	17.0
Silica (mg SiO_2/l)	8.0	14.5	1.5
Nitrate and nitrite nitrogen (mg N/l)	0.130	0.470	<0.003
Total Kjeldahl nitrogen (mg N/l)	1.37	2.41	0.58
Total Phosphorus (mg P/l)	0.130	0.500	0.046
Orthophosphate (mg P/l)	0.040	0.180	0.008
Sulphate (mg SO_4/l)	31.0	159.0	9.2

Data for the period January 1976 to December 1979 obtained from the National Water Quality Data Bank (NAQUADAT).

Swirling pool conditions at km 26.5.

Dunkirk River at km 40.8.

AQUATIC BIOPHYSICAL INVENTORY
DUNKIRK RIVER
Reach 2
(km 16.0 to km 56.2)

alberta oil sands environmental research program

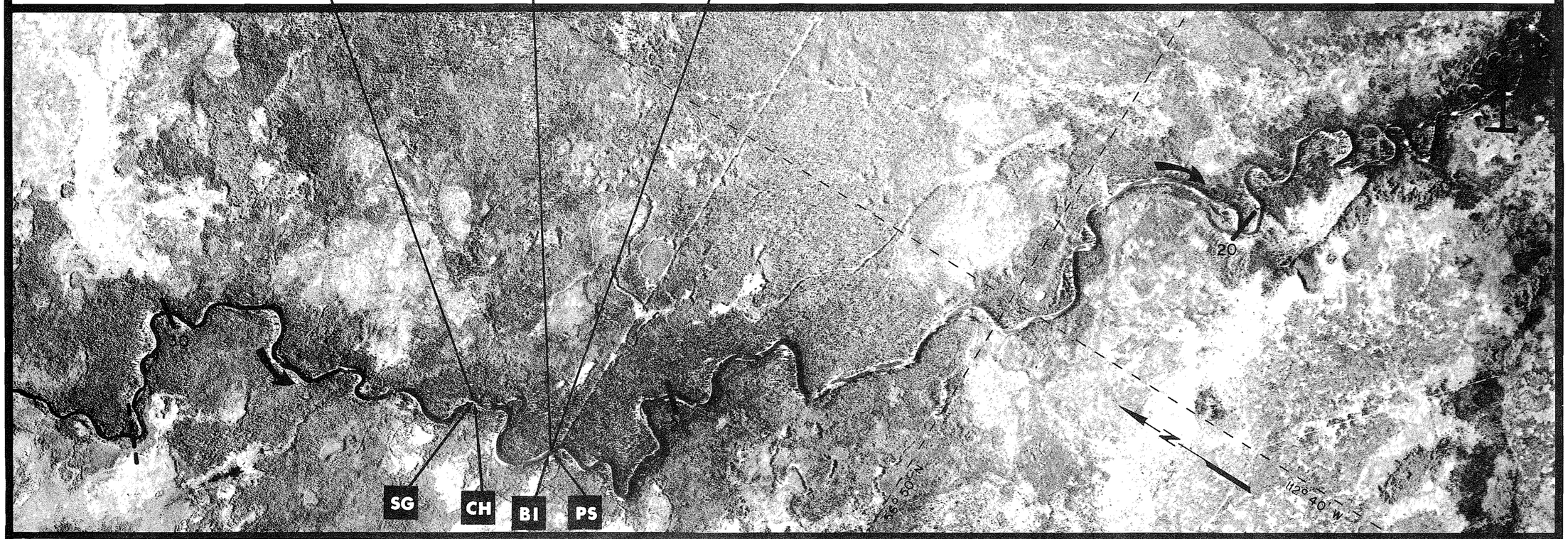
prepared by LGL LIMITED

FISH COLLECTIONS

SF* BKST SLSC LKCH TRPC LNSK WTSK NTPK

SN PLDC TRPC

EF NTPK PLDC SLSC TRPC WTSK



POINT SAMPLE DATA

Location	km 26.5
Date	18/09/79
Hydraulics	
channel width (m)	22.5
wet width (m)	22.5
maximum depth (m)	0.6
average depth (m)	0.5
velocity (m/s)	0.38
flow character	placid, swirling
Substrate Composition (%)	
fines (< 2 mm)	15
gravels (2–64 mm)	50
larges (>64 mm)	35
bedrock and/or oil sand	0
Bank	
height (m)	1.5
form	repose
stability	stable
texture	sandy silt
vegetation (% coverage)	
coniferous trees	75
deciduous trees	15
shrubs	20
grasses	50
barren	0
Water Quality	
temperature (°C)	13.0
dissolved oxygen (mg/l)	9
conductivity (µmhos/cm)	240
pH	8.13

LEGEND

AN angling
CF counting fence
DN dip net
EF electrofisher
GN gill net
KS kick sample
SF small fish collections made using a combination of methods
SN seine
AP benthic algal productivity station
BI benthic invertebrate collection site
CH water quality station
PS point sample
SG stream gauging station
35 kilometres from mouth
flow direction
reach boundary
upstream limit of survey
division between sections of a reach

ARGR arctic grayling
BKST brook stickleback
BRMN brassy minnow
BURB burbot
DLVR Dolly Varden
EGGS unidentified fish eggs
EMSH emerald shiner
FLCH flathead chub
FSDC finescale dace
FTMN fathead minnow
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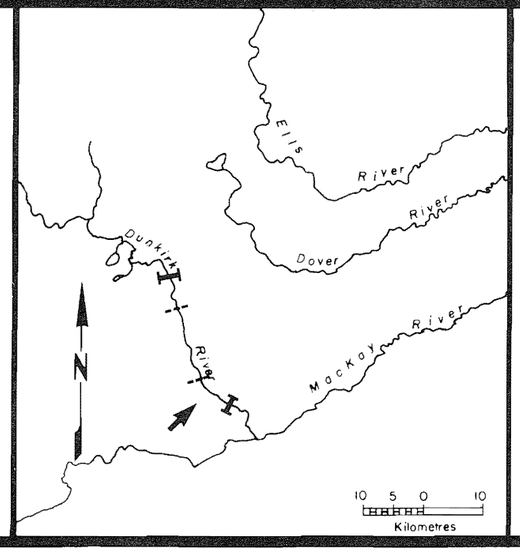
NTPK northern pike
PLDC pearl dace
SLSC slimy sculpin
SPSC spoonhead sculpin
SPSH spottail shiner
TRPC trout-perch
UNSK unidentified sucker species
WALL walleye
WTSK white sucker
YLPR yellow perch

* Data from Machniak *et al.* (1980)



AQUATIC BIOPHYSICAL INVENTORY

DUNKIRK RIVER

Reach 2 Section 1

(km 16.5 to km 31.0)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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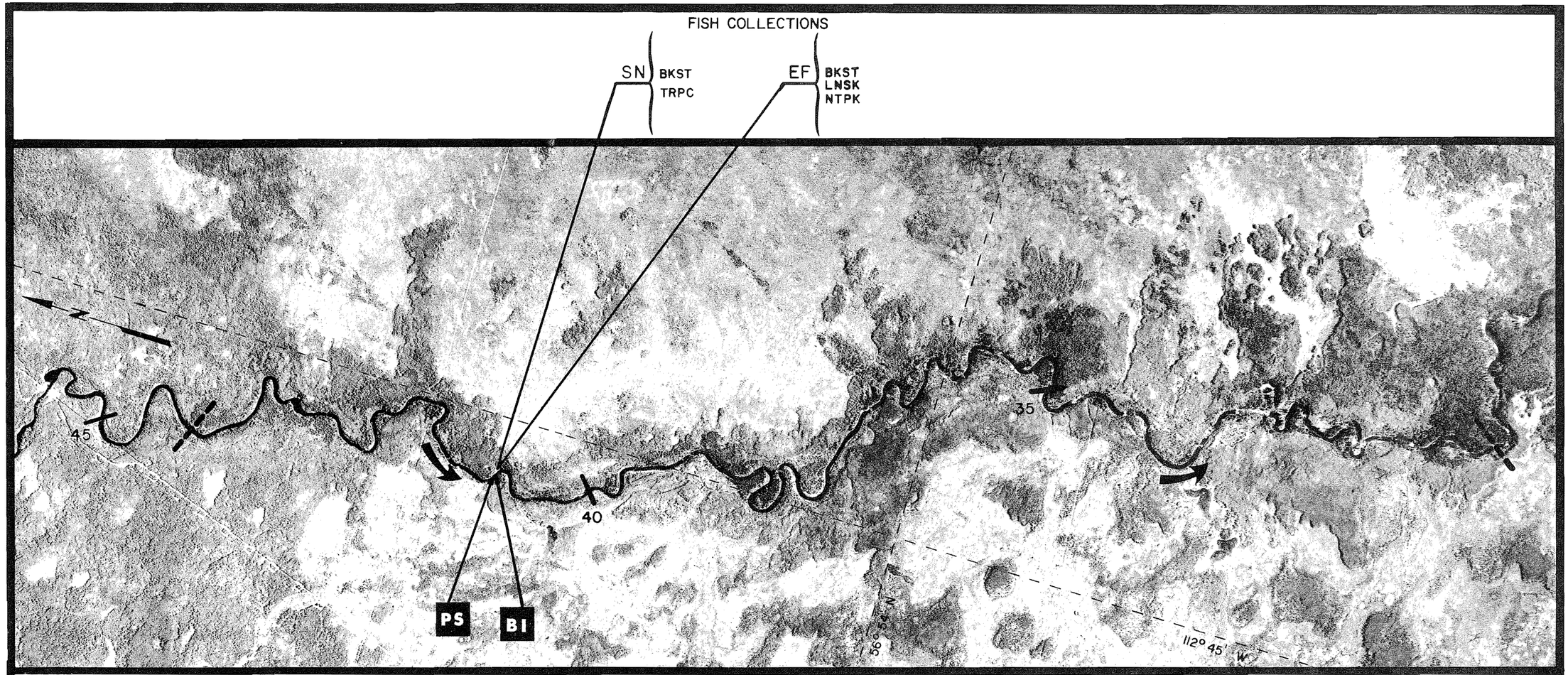


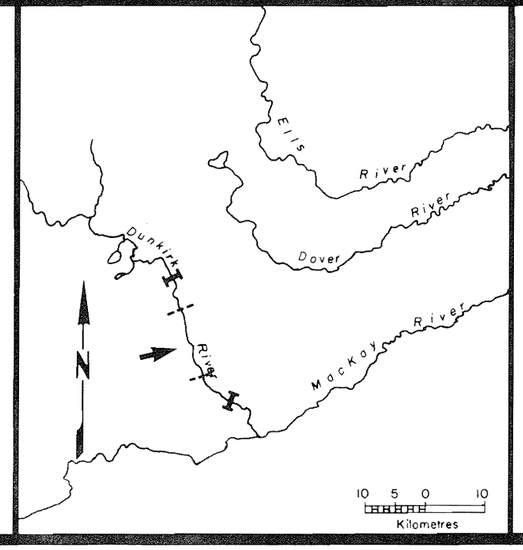
POINT SAMPLE DATA

Location	km 40.8
Date	16/09/79
Hydraulics	
channel width (m)	21.0
wet width (m)	21.0
maximum depth (m)	1.3
average depth (m)	0.8
velocity (m/s)	0.23
flow character	placid
Substrate Composition (%)	
fines (< 2mm)	60
gravels (2–64mm)	35
larges (>64mm)	5
bedrock and/or oil sand	0
Bank	
height (m)	1.0
form	repose
stability	stable
texture	sandy silt
vegetation (% coverage)	
coniferous trees	10
deciduous trees	70
shrubs	10
grasses	85
barren	0
Water Quality	
temperature (°C)	12.0
dissolved oxygen (mg/l)	8
conductivity (µmhos/cm)	235
pH	7.95

LEGEND

AN angling
CF counting fence
DN dip net
EF electrofisher
GN gill net
KS kick sample
SF small fish collections made using a combination of methods
SN seine
AP benthic algal productivity station
BI benthic invertebrate collection site
CH water quality station
PS point sample
SG stream gauging station
35 kilometres from mouth
flow direction
reach boundary
upstream limit of survey
division between sections of a reach

ARGR arctic grayling
BKST brook stickleback
BRMN brassy minnow
BURB burbot
DLVR Dolly Varden
EGGS unidentified fish eggs
EMSH emerald shiner
FLCH flathead chub
FSDC finescale dace
FTMN fathead minnow
GOLD goldeye
LKCH lake chub
LKCS lake cisco
LKWF lake whitefish
LNDC longnose dace
LNSK longnose sucker
MTWF mountain whitefish
NRDC northern redbelly dace
NSST ninespine stickleback
NTPK northern pike
PLDC pearl dace
SLSC slimy sculpin
SPSC spoonhead sculpin
SPSH spottail shiner
TRPC trout-perch
UNSK unidentified sucker species
WALL walleye
WTSK white sucker
YLPR yellow perch



AQUATIC BIOPHYSICAL INVENTORY

DUNKIRK RIVER

Reach 2 Section 2

(km 31 to km 44)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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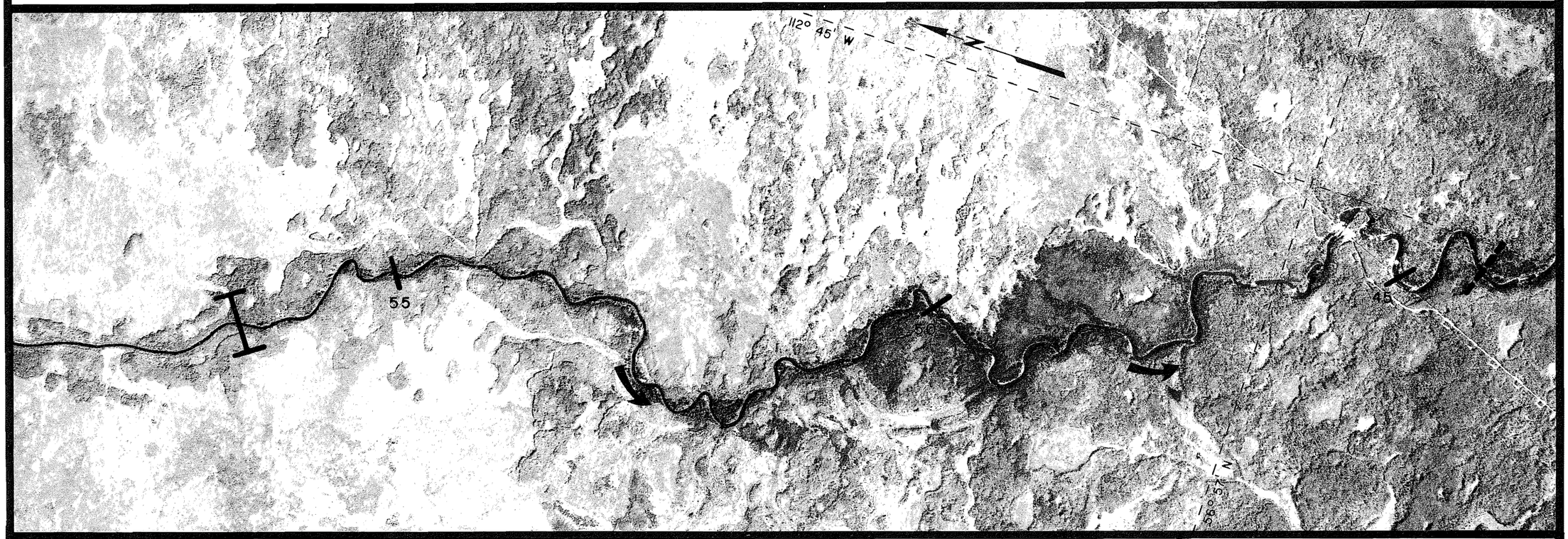


POINT SAMPLE DATA

Location
Date
Hydraulics
- channel width (m)
- wet width (m)
- maximum depth (m)
- average depth (m)
- velocity (m/s)
- flow character

Substrate Composition (%)
- fines (< 2mm)
- gravels (2–64mm)
- larges (>64mm)
- bedrock and/or oil sand

Bank
- height (m)
- form
- stability
- texture

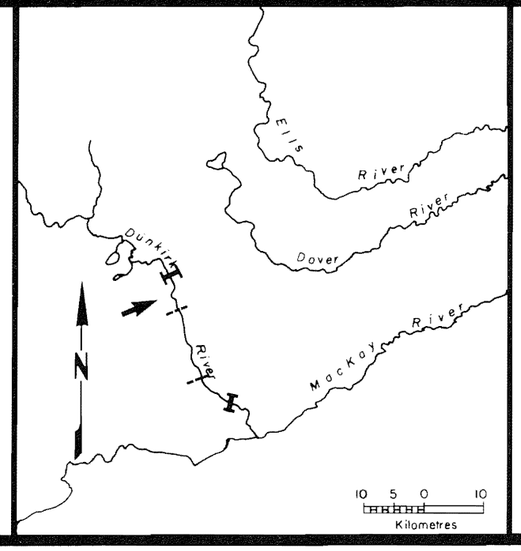
- vegetation (% coverage)
  - coniferous trees
  - deciduous trees
  - shrubs
  - grasses
  - barren

Water Quality
- temperature (°C)
- dissolved oxygen (mg/l)
- conductivity (µmhos/cm)
- pH

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

DUNKIRK RIVER

Reach 2 Section 3

(km 44.0 to km 56.2)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

Species	Adults	Juveniles and Young-of-the-year	Total Numbers
arctic grayling	1	0	1
brook stickleback	2	0	2
northern pike	0	2	2
pearl dace	0	7	7
Total	3	9	12

PHYSICAL CHARACTERISTICS

Reach length (km)	27.8
Channel width (m)	13
Channel area (ha)	36.1
Gradient (m/km)	0.2
Flow character	placid
Total pools (%)	100
Pattern	irregularly meandering
Confinement	unconfined
Unstable banks (%)	2
Substrate composition (%)	
fines (<2 mm)	100
gravels (2-64 mm)	0
larges (>64 mm)	0
bedrock and/or oil sand	0
Debris	moderate

REACH DESCRIPTION AND FISH UTILIZATION

This uppermost reach of the surveyed portion of the Dunkirk River meanders in an irregular pattern through a marshy muskeg region. The gradient is very low, the stream channel is deep, and the water flow is slow. The substrate is entirely silt with a high organic detritus content. Aquatic vegetation is abundant. The riparian vegetation consists primarily of deciduous trees and shrubs, but patches of coniferous trees are also fairly numerous. Fairly large amounts of shrubs and grasses overhang the river channel throughout the reach. Moderate amounts of debris are present in the channel.

The abundant aquatic vegetation in this reach provides many areas suitable for spawning of northern pike and brook stickleback. The reach does not appear to be suitable for spawning of other fish species. Rearing potential is good because of the low water velocities, the shade provided by overhanging vegetation, and the ample shelter provided by woody debris and aquatic vegetation. Water depths in this reach appear to be sufficient to allow overwintering of fish.

BENTHIC INVERTEBRATES

- OLIGOCHAETA
- HIRUDINEA
  - Glossiphoniidae
- GASTROPODA
- PELECYPODA
  - *Musculium*
  - *Pisidium*
- CRUSTACEA
  - Cladocera
  - Amphipoda
    - *Gammarus pseudolimnaeus*
    - *Hyalella azteca*
- INSECTA
  - Ephemeroptera
    - *Ameletus*
    - *Caenis*
    - *Hexagenia*
    - *Paraleptophlebia*
  - Odonata
    - *Aeshna*
  - Hemiptera
    - Corixidae
  - Megaloptera
    - *Sialis*
  - Trichoptera
    - *Lepidostoma*
    - *Limnephilus/Philarctus*
    - *Phryganea*
    - *Polycentropus*
    - *Ptilostomis*
  - Coleoptera
    - Dryopidae
    - Elmidae
  - Diptera
    - Ceratopogonidae
    - Chironomidae
      - Chironominae
      - Tanypodinae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	15
Deciduous trees	40
Shrubs	15
Grasses	95
Barren	0
Channel cover (%)	
Overhang	15
Crown	10

BENTHIC ALGAL PRODUCTIVITY

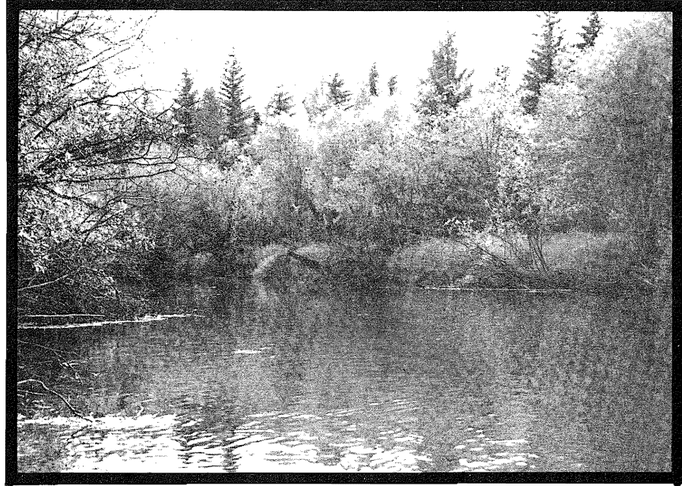
No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach



A representative section of reach 3 at km 58.5.

Overhanging bank vegetation and abundant aquatic vegetation at km 82.2.

AQUATIC BIOPHYSICAL INVENTORY

DUNKIRK RIVER

Reach 3

(km 56.2 to km 84.0)

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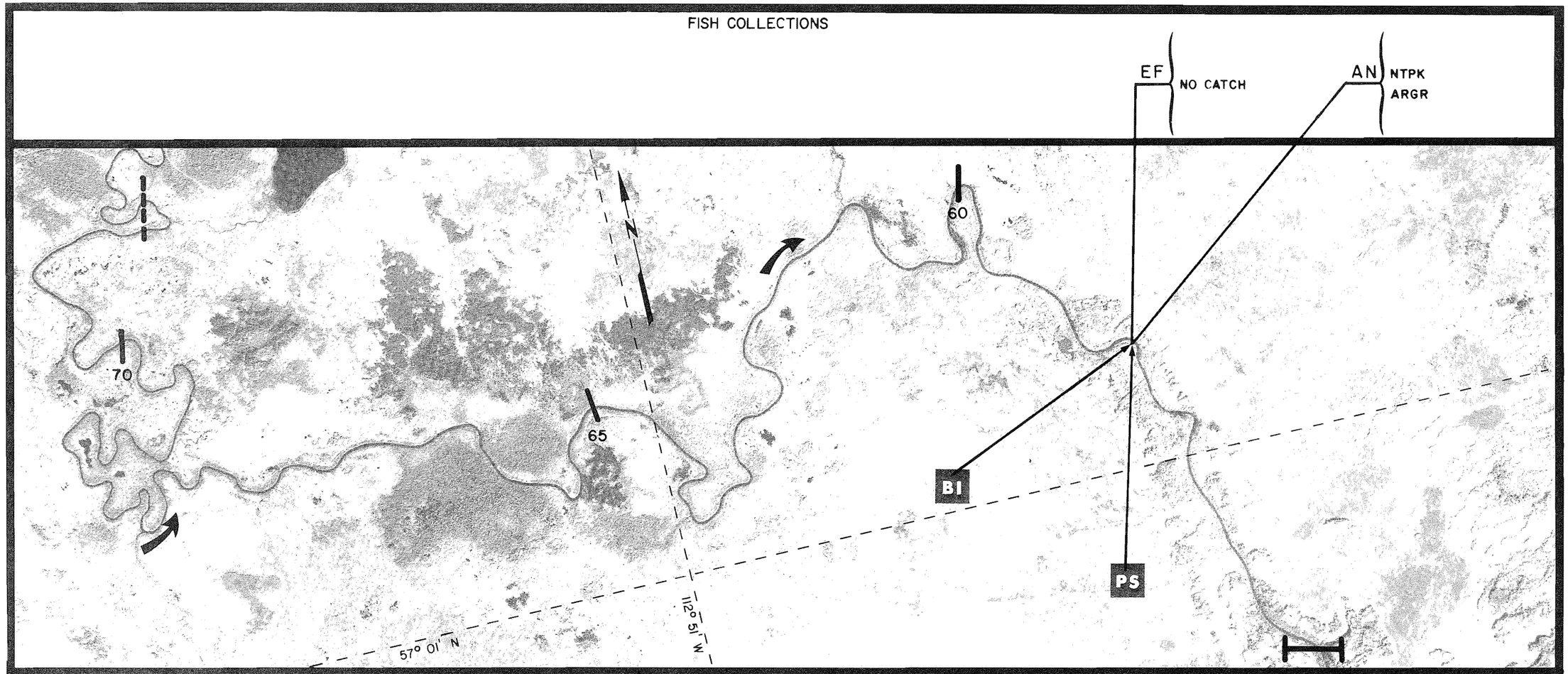
FISH COLLECTIONS



POINT SAMPLE DATA

Location	km 58.5
Date	16/09/79
Hydraulics	
channel width (m)	16.5
wet width (m)	16.5
maximum depth (m)	1.5
average depth (m)	1.0
velocity (m/s)	0.30
flow character	placid
Substrate Composition (%)	
fines (< 2mm)	100
gravels (2–64mm)	0
larges (>64mm)	0
bedrock and/or oil sand	0
Bank	
height (m)	1.0
form	repose
stability	stable
texture	silt, organic
vegetation (% coverage)	
coniferous trees	10
deciduous trees	60
shrubs	5
grasses	85
barren	0
Water Quality	
temperature (°C)	12.0
dissolved oxygen (mg/l)	8
conductivity (µmhos/cm)	245
pH	7.81

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
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GOLD	goldeye
LKCH	lake chub
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LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
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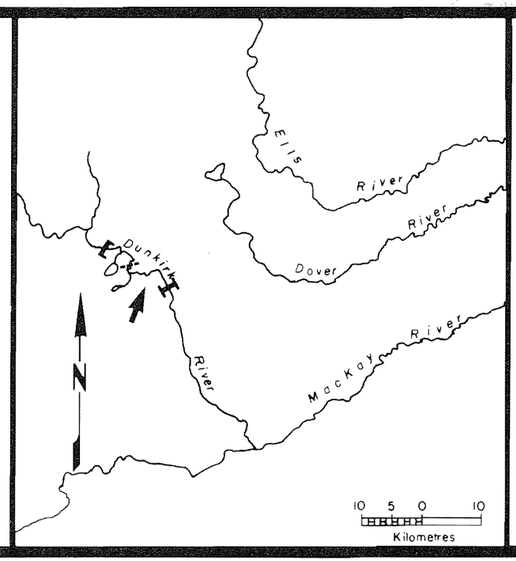
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

DUNKIRK RIVER

Reach 3 Section 1

(km 56.2 to km 72.0)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

alberta

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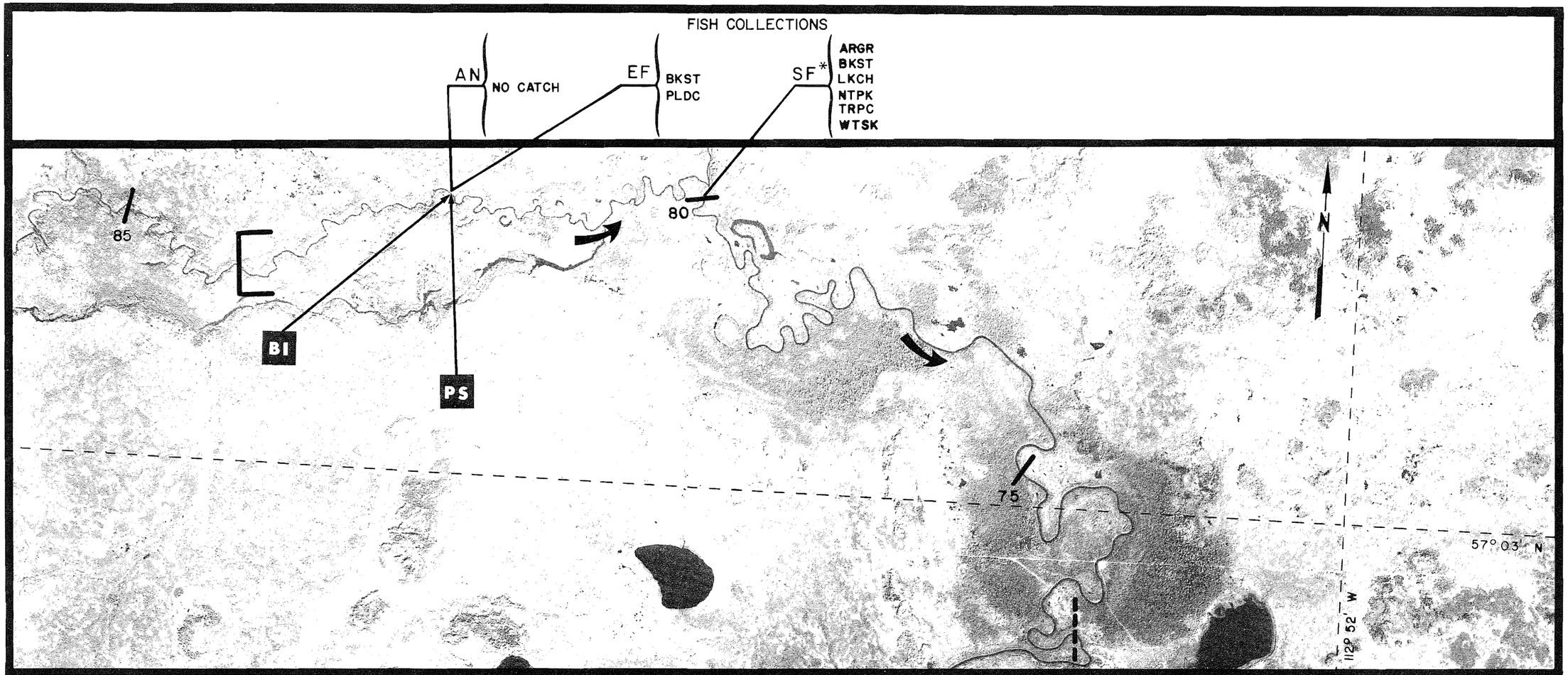


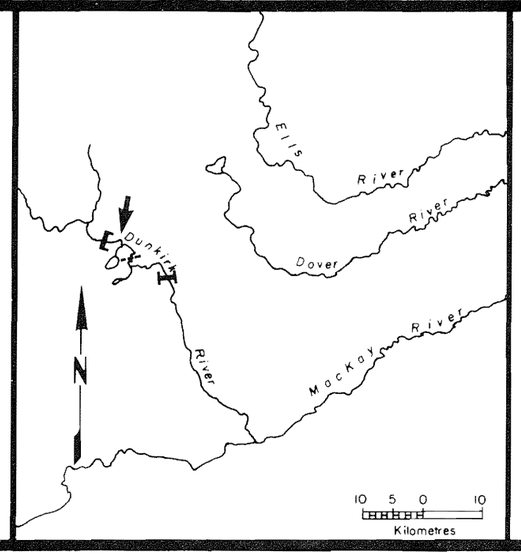
POINT SAMPLE DATA

Location	km 82.2
Date	16/09/79
Hydraulics	
channel width (m)	10.0
wet width (m)	10.0
maximum depth (m)	2.0
average depth (m)	1.0
velocity (m/s)	0.29
flow character	placid
Substrate Composition (%)	
fines (< 2mm)	100
gravels (2–64mm)	0
larges (>64mm)	0
bedrock and/or oil sand	0
Bank	
height (m)	1.5
form	repose
stability	stable
texture	silt, organic
vegetation (% coverage)	
coniferous trees	5
deciduous trees	45
shrubs	5
grasses	100
barren	0
Water Quality	
temperature (°C)	11.0
dissolved oxygen (mg/l)	8
conductivity (µmhos/cm)	215
pH	7.84

LEGEND

AN	angling	ARGR	arctic grayling
CF	counting fence	BKST	brook stickleback
DN	dip net	BRMN	brassy minnow
EF	electrofisher	BURB	burbot
GN	gill net	DLVR	Dolly Varden
KS	kick sample	EGGS	unidentified fish eggs
SF	small fish collections made using a combination of methods	EMSH	emerald shiner
SN	seine	FLCH	flathead chub
		FSDC	finescale dace
AP	benthic algal productivity station	FTMN	fathead minnow
BI	benthic invertebrate collection site	GOLD	goldeye
		LKCH	lake chub
CH	water quality station	LKCS	lake cisco
		LKWF	lake whitefish
PS	point sample	LNDC	longnose dace
		LNSK	longnose sucker
SG	stream gauging station	MTWF	mountain whitefish
		NRDC	northern redbelly dace
35	kilometres from mouth	NSST	ninespine stickleback
		NTPK	northern pike
	flow direction	PLDC	pearl dace
	reach boundary	SLSC	slimy sculpin
	upstream limit of survey	SPSC	spoonhead sculpin
	division between sections of a reach	SPSH	spottail shiner
		TRPC	trout-perch
		UNSK	unidentified sucker species
		WALL	walleye
		WTSK	white sucker
		YLPR	yellow perch

* Data from Machniak *et al.* (1980)



AQUATIC BIOPHYSICAL INVENTORY

DUNKIRK RIVER

Reach 3 Section 2

(km 72 to km 84)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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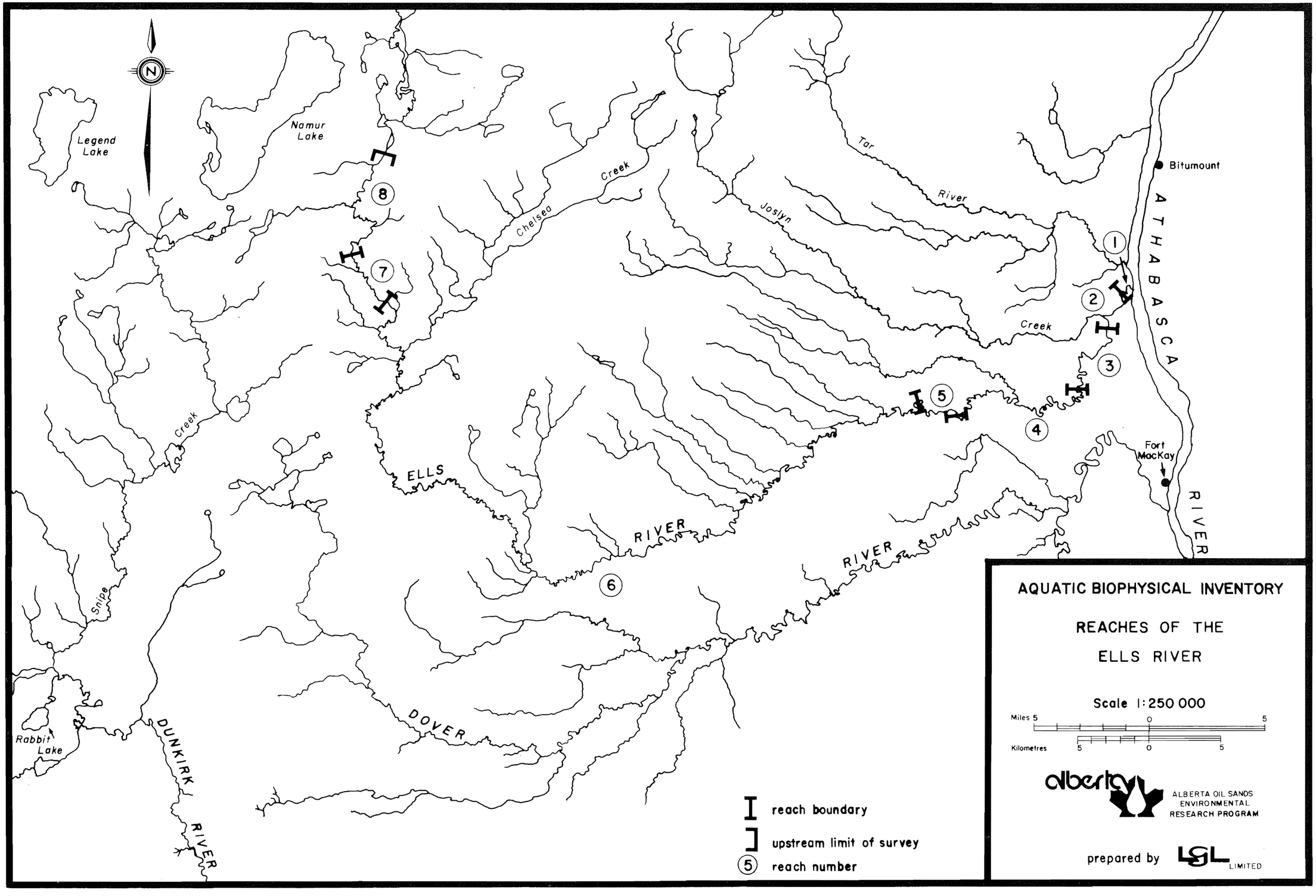
ELLS RIVER


N
Legend Lake
Namur Lake
Chelsea Creek
Joslyn Creek
Tar River
Bitumount
ATHABASCA RIVER
Fort MacKay
ELLS RIVER
DOVER RIVER
DUNKIRK RIVER
Snipe Creek
Rabbit Lake
1
2
3
4
5
6
7
8
reach boundary
upstream limit of survey
reach number
AQUATIC BIOPHYSICAL INVENTORY
REACHES OF THE
ELLS RIVER
Scale 1:250 000
Miles 5 0 5
Kilometres 5 0 5
ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM
prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (1978)

Species	Adults		Juveniles and Young-of-the-year		Total Numbers	
	June	September	June	September	June	September
burbot	ND	1	ND	0	ND	1
flathead chub	ND	1	ND	1	ND	2
goldeye	ND	7	ND	6	ND	13
lake whitefish	ND	6	ND	0	ND	6
longnose sucker	ND	3	ND	1	ND	4
mountain whitefish	ND	1	ND	0	ND	1
northern pike	ND	0	ND	1	ND	1
walleye	ND	3	ND	2	ND	5
Total	ND	22	ND	11	ND	33

PHYSICAL CHARACTERISTICS

Reach length (km)	2.5
Channel width (m)	35
Channel area (ha)	8.8
Gradient (m/km)	1.7
Flow character	placid, swirling
Total pools (%)	100
Pattern	tortuously meandering
Confinement	occasionally confined
Unstable banks (%)	20
Substrate composition (%)	
fines (<2 mm)	100
gravels (2-64 mm)	0
larges (>64 mm)	0
bedrock and/or oil sand	0
Debris	low

REACH DESCRIPTION AND FISH UTILIZATION

Much of this short, tortuously meandering section of the Ells River lies within the Athabasca River floodplain. The gradient is fairly low and the entire reach is a pool with either placid or swirling flow. In most areas of the reach, the water is relatively deep. The substrate material is entirely fines. The riparian vegetation is dominated by deciduous trees and shrubs, but some conifers are present. There is also a fairly dense growth of grasses. None of the bank vegetation overhangs the channel.

Spawning potential for those fish species that usually spawn over sandy substrates is considered to be excellent. No suitable spawning areas exist for species that require gravel substrates. Very few areas within this reach are suitable for fish rearing. The slow water velocities may permit young fish to inhabit waters within the reach, but there are only a limited number of areas that provide suitable shelter. Resting and feeding potential for larger fish is considered to be moderate to good because the reach is essentially a deep continuous pool. However, there are few areas that provide any shelter. Because of the generally deep water and extensive pools, the overwintering potential of this reach is considered to be excellent.

BENTHIC INVERTEBRATES

No benthic samples were taken in this reach.

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	5
Deciduous trees	45
Shrubs	35
Grasses	75
Barren	0
Channel cover (%)	
Overhang	0
Crown	0

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

Water Survey of Canada station number 00AT07DA0098

	Mean	Maximum	Minimum
Total alkalinity (mg $CaCO_3$/l)	79.9	105.1	62.9
pH	7.70	8.05	7.30
Total hardness (mg $CaCO_3$/l)	75.0	88.0	65.0
Conductance (µS/cm)	178	250	115
Total filterable residue fixed (mg/l)	80	114	50
Total non-filterable residue fixed (mg/l)	11	38	<0.4
Total organic carbon (mg C/l)	19.0	40.5	12.0
Silica (mg SiO_2/l)	3.2	9.0	<0.2
Nitrate and nitrite nitrogen (mg N/l)	0.090	0.280	<0.003
Total Kjeldahl nitrogen (mg N/l)	0.99	1.78	0.64
Total Phosphorus (mg P/l)	0.051	0.170	0.016
Orthophosphate (mg P/l)	0.013	0.034	0.005
Sulphate (mg SO_4/l)	17.0	23.8	7.4

Data for the period January 1976 to December 1979 obtained from the National Water Quality Data Bank (NAQUADAT).

Wide, placid section of the Ells River at km 1.

AQUATIC BIOPHYSICAL INVENTORY
ELLS RIVER
Reach 1
(km 0.0 to km 2.5)

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS

GN	BURB	
	GOLD	
	FLCH	
	LNSK	
	WALL	
GN	FLCH	MTWF
	GOLD	NTPK
	LKWF	WALL
	LNSK	
GN	GOLD	
	LKWF	
	LNSK	
	WALL	

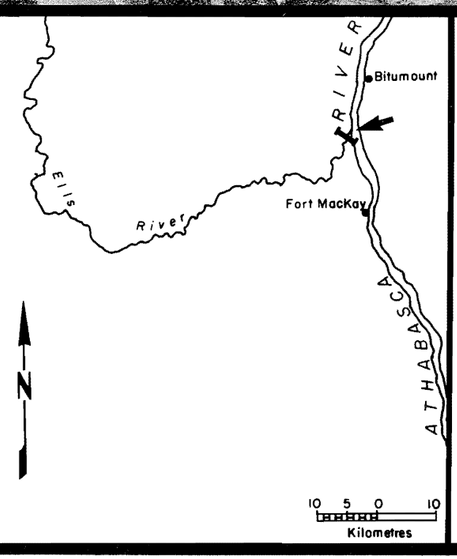
POINT SAMPLE DATA

Location	km 0.5
Date	02/06/78
Hydraulics	
channel width (m)	32
wet width (m)	30
maximum depth (m)	ND
average depth (m)	2.0
velocity (m/s)	0.50
flow character	placid, swirling
Substrate Composition (%)	
fines (< 2mm)	100
gravels (2–64mm)	0
larges (>64mm)	0
bedrock and/or oil sand	0
Bank	
height (m)	4.5
form	ND
stability	ND
texture	sand
vegetation (% coverage)	
coniferous trees	2
deciduous trees	45
shrubs	35
grasses	75
barren	0
Water Quality	
temperature (°C)	17.5
dissolved oxygen (mg/l)	ND
conductivity (µmhos/cm)	ND
pH	ND

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
	reach boundary
	upstream limit of survey
	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

ELLS RIVER

Reach I

(km 0.0 to km 2.5)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (1978)

Species	Adults		Juveniles and Young-of-the-year		Total Numbers	
	June	September	June	September	June	September
brook stickleback	0	0	1	2	1	2
lake chub	0	21	9	119	9	140
longnose dace	0	0	8	13	8	13
longnose sucker	0	0	3	21	3	21
mountain whitefish	0	0	0	1	0	1
northern pike	0	0	1	0	1	0
slimy sculpin	0	0	0	17	0	17
trout-perch	0	0	0	18	0	18
unidentified suckers	0	0	0	2	0	2
walleye	0	0	2	0	2	0
white sucker	0	0	4	12	4	12
Total	0	21	28	205	28	226

PHYSICAL CHARACTERISTICS

Reach length (km)	5.5
Channel width (m)	35
Channel area (ha)	19.3
Gradient (m/km)	1.6
Flow character	placid, swirling
Total pools (%)	100
Pattern	irregularly meandering
Confinement	confined
Unstable banks (%)	40
Substrate composition (%)	
fines (<2 mm)	90
gravels (2-64 mm)	10
larges (>64 mm)	0
bedrock and/or oil sand	0
Debris	moderate

REACH DESCRIPTION AND FISH UTILIZATION

This relatively short, irregularly meandering reach lies above the Athabasca River floodplain. The gradient is relatively low and this entire section of the river consists of deep pools with placid and swirling flow. The substrate is composed primarily of fines, but a few areas contain gravels. Deciduous trees and shrubs are the dominant components of the riparian vegetation, but some patches of conifers are also present. Little vegetation overhangs the channel.

Most areas within the reach provide suitable spawning grounds for those fish that normally spawn over sandy substrates. Only a few areas are suitable for spawning by those fish that prefer gravel substrates. Rearing potential in this reach is considered to be moderate; slow water velocities and moderate quantities of debris provide suitable rearing areas. Moderate numbers of young-of-the-year and juvenile fish, particularly lake chub, were captured in this section of the river during the study. Resting and feeding potential for larger fish is considered to be good to excellent because of the many deep pools and areas sheltered by debris. There is a variety of smaller fishes in this reach that may serve as prey for piscivorous species such as walleye and northern pike. Overwintering potential is considered to be excellent because of the deep pools.

BENTHIC INVERTEBRATES

No benthic samples were taken in this reach.

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	10
Deciduous trees	50
Shrubs	25
Grasses	15
Barren	0
Channel cover (%)	
Overhang	2
Crown	0

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach

Undercut banks at km 4.

AQUATIC BIOPHYSICAL INVENTORY

ELLS RIVER

Reach 2

(km 2.5 to km 8.0)

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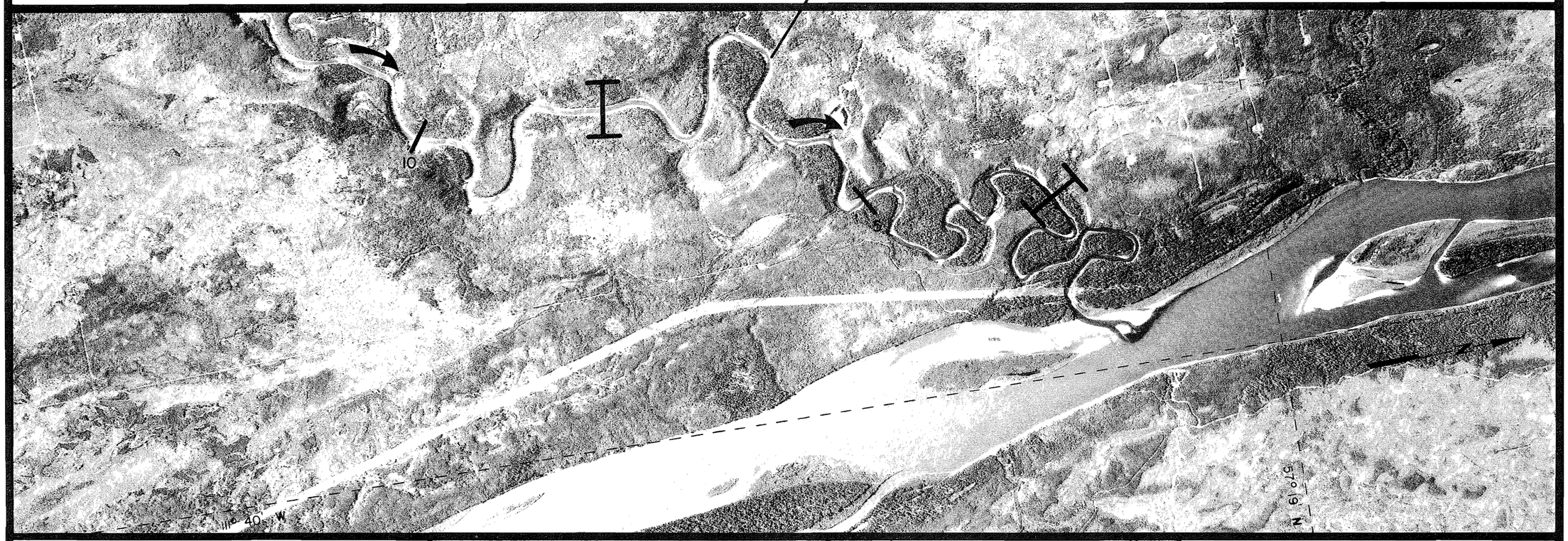
prepared by LGL LIMITED

FISH COLLECTIONS

SN: BKST SLSC LKCH TRPC LNDC UNSK LNSK WALL MTWF WTSK NTPK



POINT SAMPLE DATA

Location
Date
Hydraulics
- channel width (m)
- wet width (m)
- maximum depth (m)
- average depth (m)
- velocity (m/s)
- flow character

Substrate Composition (%)
- fines (< 2mm)
- gravels (2–64mm)
- larges (>64mm)
- bedrock and/or oil sand

Bank
- height (m)
- form
- stability
- texture

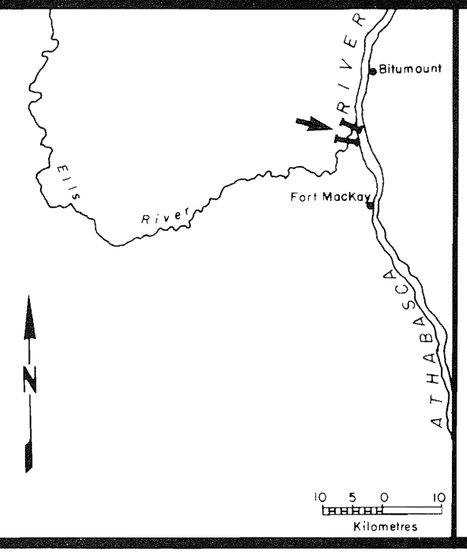
- vegetation (% coverage)
  - coniferous trees
  - deciduous trees
  - shrubs
  - grasses
  - barren

Water Quality
- temperature (°C)
- dissolved oxygen (mg/l)
- conductivity (µmhos/cm)
- pH

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

ELLS RIVER

Reach 2

(km 2.5 to km 8.0)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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NUMBERS OF FISH COLLECTED (1978)

Species	Adults		Juveniles and Young-of-the-year		Total Numbers	
	June	September	June	September	June	September
goldeye	0	0	3	0	3	0
lake chub	4	6	22	119	26	125
longnose dace	0	0	2	10	2	10
longnose sucker	0	1	0	3	0	4
trout-perch	0	2	0	4	0	6
white sucker	0	0	0	2	0	2
Total	4	9	27	138	31	147

PHYSICAL CHARACTERISTICS

Reach length (km)	10.0
Channel width (m)	30
Channel area (ha)	30.0
Gradient (m/km)	3.8
Flow character	swirling, rolling, broken
Total pools (%)	75
Pattern	irregularly meandering
Confinement	entrenched
Unstable banks (%)	35
Substrate composition (%)	
fines (<2 mm)	25
gravels (2-64 mm)	25
larges (>64 mm)	40
bedrock and/or oil sand	10
Debris	low

REACH DESCRIPTION AND FISH UTILIZATION

This section of the Ells River is entrenched within a narrow deep canyon and meanders in an irregular pattern. Although the gradient is high and riffle sections are numerous, a relatively high proportion of the reach is composed of pools. The flow character is mixed, varying from swirling to rolling to broken, and water depths are generally shallow. Substrate composition is varied; larges predominate, but gravels and fines also compose substantial proportions of the substrate. The riparian vegetation is a mixture of coniferous and deciduous trees; deciduous shrubs are also fairly abundant. A small amount of vegetation overhangs the channel.

Because of the diversity of substrate materials and water velocities and depths, spawning potential in this section of the river is considered to be excellent for most fish species that occur in the Ells River. Suitable areas for the rearing of fish include the rocky substrates, a few areas sheltered by overhanging vegetation, and the scattered grassy shallows. Moderate numbers of young fish, particularly lake chub, were captured in this reach during the study. The numerous pools and the few areas shaded by overhanging vegetation provide good resting and feeding potential for larger fish. Although a large proportion of the reach is composed of pools, only a few of these areas are deep enough to provide suitable overwintering areas for fish.

BENTHIC INVERTEBRATES

- OLIGOCHAETA
- INSECTA
  - Ephemeroptera
    - *Baetis*
    - *Ephemerella*
    - *Hexagenia*
  - Odonata
    - *Ophiogomphus*
  - Plecoptera
    - *Hastaperla*
    - *Isogenus*
    - *Isoperla*
    - *Pteronarcys*
  - Coleoptera
    - Elmidae
  - Diptera
    - Tipulidae
    - Chironomidae
      - Chironominae
      - Tanypodinae
      - Orthocladiinae
    - Simuliidae
    - Rhagionidae
      - *Atherix*

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	45
Deciduous trees	60
Shrubs	25
Grasses	30
Barren	0
Channel cover (%)	
Overhang	2
Crown	0

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

Water Survey of Canada station number 07DA017

Maximum total annual discharge:	324.4 x 10^6 m^3 (1978)
Minimum total annual discharge:	135.9 x 10^6 m^3 (1977)
Maximum annual mean discharge:	10.31 m^3/s (1978)
Minimum annual mean discharge:	4.30 m^3/s (1977)
Maximum monthly mean discharge:	27.78 m^3/s (May 1978)
Minimum monthly mean discharge:	0.64 m^3/s (March 1977)
Maximum daily discharge:	49.84 m^3/s (Apr. 14, 1976)
Minimum daily discharge:	0.46 m^3/s (Mar. 26, 1977)

Data for 1975 to 1978 compiled from Loeppky and Spitzer (1977), Warner and Spitzer (1979) and Warner (1979).

WATER QUALITY

Water Survey of Canada station number 00AT07DA0170

	Mean	Maximum	Minimum
Total alkalinity (mg $CaCO_3$/l)	93.4	150.4	53.6
pH	7.70	8.30	7.20
Total hardness (mg $CaCO_3$/l)	92.5	140.2	58.5
Conductance (µS/cm)	211	370	110
Total filterable residue fixed (mg/l)	110	179	57
Total non-filterable residue fixed (mg/l)	22	326	<0.4
Total organic carbon (mg C/l)	15.0	41.5	7.5
Silica (mg SiO_2/l)	4.0	9.9	0.4
Nitrate and nitrite nitrogen (mg N/l)	0.130	0.430	0.003
Total Kjeldahl nitrogen (mg N/l)	0.87	2.17	0.20
Total Phosphorus (mg P/l)	0.050	0.340	0.009
Orthophosphate (mg P/l)	0.010	0.060	<0.003
Sulphate (mg SO_4/l)	16.7	30.2	9.3

Data for the period January 1976 to December 1979 obtained from the National Water Quality Data Bank (NAQUADAT).

Ells River at km 14.

High, unstable bank at km 16.

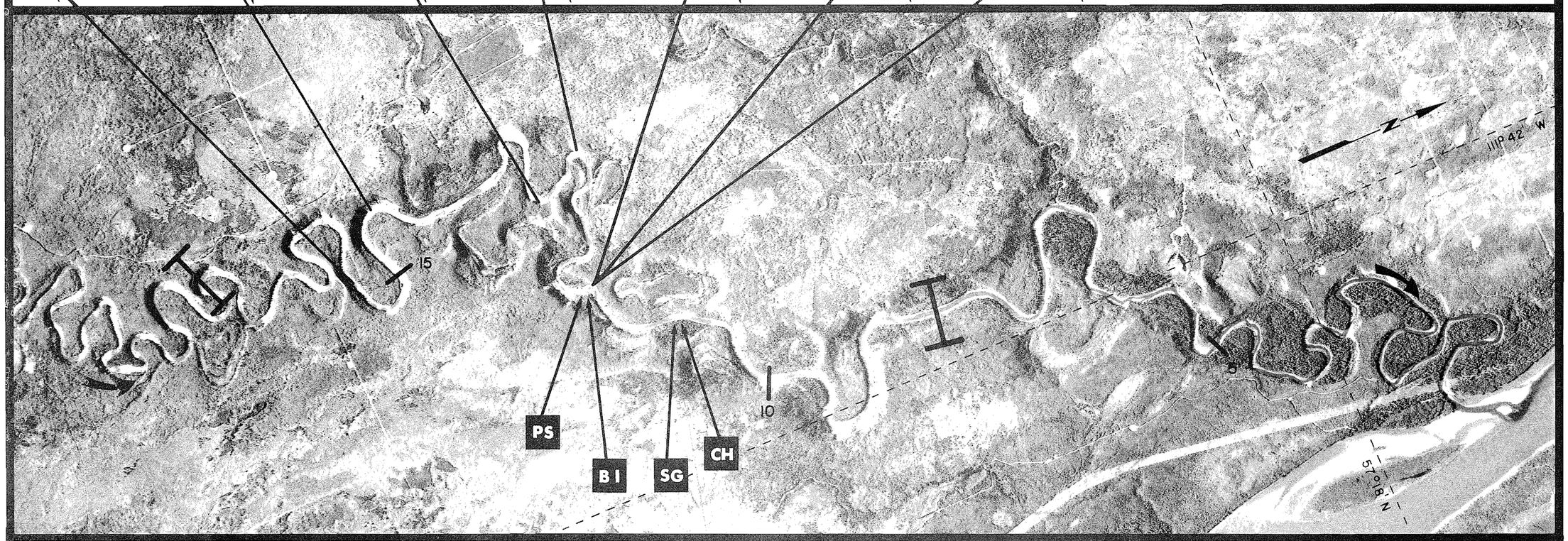
AQUATIC BIOPHYSICAL INVENTORY
ELLS RIVER
Reach 3
(km 8 to km 18)

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS

SN	LKCH, LNDC, LNSK, TRPC, WTSK	
SN	LKCH, LNDC, TRPC	
SN	NO CATCH	
SN	LKCH, LNDC, LNSK, TRPC	
GN	GOLD, LNSK	
KS	EGGS	
SN	LKCH, LNDC	



POINT SAMPLE DATA

Location	km 11.5
Date	02/06/78
Hydraulics	
channel width (m)	35
wet width (m)	25
maximum depth (m)	ND
average depth (m)	1.3
velocity (m/s)	1.40
flow character	rolling
Substrate Composition (%)	
fines (< 2mm)	30
gravels (2–64mm)	30
larges (>64mm)	10
bedrock and/or oil sand	30
Bank	
height (m)	3.5
form	steep
stability	failing
texture	oil sands, larges
vegetation (% coverage)	
coniferous trees	5
deciduous trees	75
shrubs	25
grasses	15
barren	25
Water Quality	
temperature (°C)	18.0
dissolved oxygen (mg/l)	ND
conductivity (µmhos/cm)	ND
pH	ND

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
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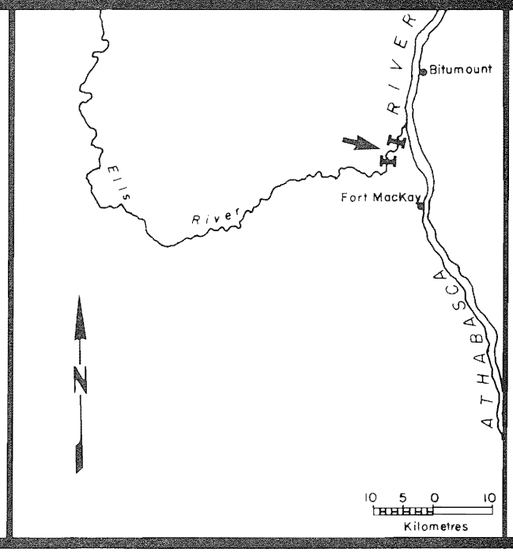
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

ELLS RIVER

Reach 3
(km 8 to km 18)

Scale 1:25 000

Miles 0.5 0 0.5
Kilometres 0.5 0 0.5

alberta — ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (1978)

Species	Adults		Juveniles and Young-of-the-year		Total Numbers	
	June	September	June	September	June	September
lake chub	0	15	288	428	288	443
longnose dace	0	0	24	17	24	17
longnose sucker	0	0	33	46	33	46
northern pike	0	2	0	0	0	2
pearl dace	0	1	4	59	4	60
trout-perch	0	3	9	1	9	4
unidentified suckers	0	0	0	6	0	6
white sucker	0	1	80	43	80	44
Total	0	22	438	600	438	622

PHYSICAL CHARACTERISTICS

Reach length (km)	27.0
Channel width (m)	30
Channel area (ha)	81.0
Gradient (m/km)	0.9
Flow character	swirling, rolling
Total pools (%)	80
Pattern	tortuously meandering
Confinement	confined
Unstable banks (%)	40
Substrate composition (%)	
fines (<2 mm)	15
gravels (2-64 mm)	30
larges (>64 mm)	50
bedrock and/or oil sand	5
Debris	low

REACH DESCRIPTION AND FISH UTILIZATION

This reach is a tortuously meandering section of the Ells River, with a relatively low gradient and swirling and rolling flow. Most of the reach is composed of pools and the water is moderately deep. The substrate consists primarily of larges and gravels, but sand and silt substrates are present in some areas. Riparian vegetation is mostly deciduous trees, but scattered coniferous trees are present. There is a relatively small amount of overhanging vegetation.

Spawning potential in this section of the river is considered to be excellent for those fish that normally spawn over rocky substrates, and moderate for those that normally spawn over sandy substrates. Numerous backwater pools, weedy sheltered areas alongside the river bank, areas shaded by overhanging riparian vegetation, and rocky substrates provide excellent rearing opportunities for most fish species found in the Ells River. Very high numbers of young fish, particularly lake chub, were captured in this section of the river during the survey. Resting and feeding potential for larger fish is considered to be excellent because of the many pools and the areas along the banks that are sheltered by overhanging vegetation. There appears to be an abundant food supply for piscivorous fish. Particularly large numbers of smaller fish were collected in this reach. Overwintering potential is rated as moderate to good; the many pools provide suitable areas for larger fish.

BENTHIC INVERTEBRATES

- NEMATODA
- OLIGOCHAETA
- INSECTA
  - Ephemeroptera
    - *Baetis*
    - *Ephemerella*
    - *Stenonema*
  - Odonata
    - *Ophiogomphus*
  - Plecoptera
    - *Isoperla*
    - *Leuctra*
  - Trichoptera
    - *Hydropsyche*
  - Coleoptera
    - Elmidae
  - Diptera
    - Chironomidae
      - Chironominae
      - Tanypodinae
    - Simuliidae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	5
Deciduous trees	85
Shrubs	10
Grasses	10
Barren	5
Channel cover (%)	
Overhang	2
Crown	0

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

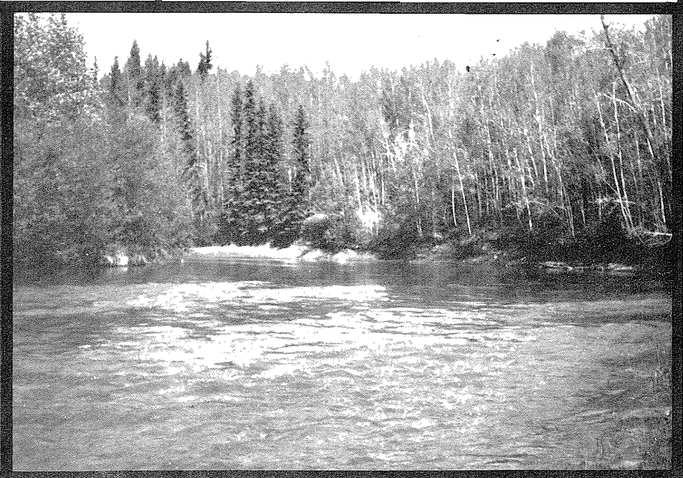
STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach

Long section of eroded bank at km 22.



Swirling and rolling flow character at km 26 is typical of reach 4.

AQUATIC BIOPHYSICAL INVENTORY
ELLS RIVER
Reach 4
(km 18 to km 45)

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS

SN	LKCH, LNDC, LNSK, PLDC, UNSK, WTSK	
SN	LKCH, LNDC, LNSK, WTSK	
GN	NTPK, WTSK	
SN	LKCH TRPC, LNDC UNSK, LNSK WTSK, PLDC	
KS	EGGS	
SN	LKCH SLSC, LNDC TRPC, LNSK UNSK, PLDC WTSK	

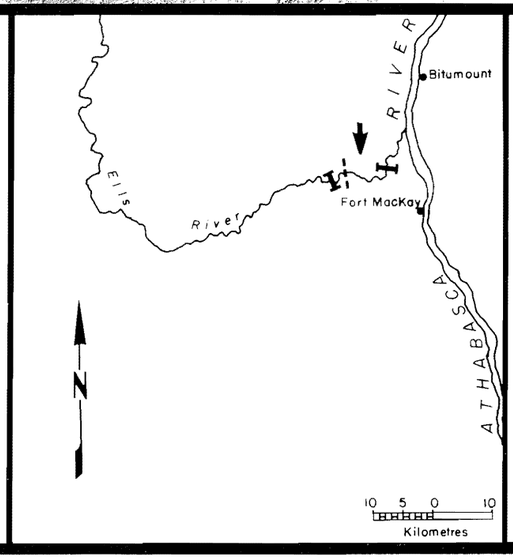
POINT SAMPLE DATA

Location	km 25.5
Date	02/06/78
Hydraulics	
channel width (m)	30
wet width (m)	25
maximum depth (m)	ND
average depth (m)	1.0
velocity (m/s)	1.60
flow character	swirling, rolling
Substrate Composition (%)	
fines (< 2mm)	15
gravels (2–64mm)	30
larges (> 64mm)	55
bedrock and/or oil sand	0
Bank	
height (m)	2.3
form	undercut
stability	stable
texture	sand, gravel, oil sand
vegetation (% coverage)	
coniferous trees	5
deciduous trees	85
shrubs	10
grasses	10
barren	2
Water Quality	
temperature (°C)	16.0
dissolved oxygen (mg/l)	ND
conductivity (µmhos/cm)	ND
pH	ND

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

ELLS RIVER

Reach 4 Section 1

(km 18 to km 37)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS

SN	LKCH
	LNDC
	LNSK

SN	LKCH
	LNSK
	TRPC
	WTSK

POINT SAMPLE DATA

Location
Date
Hydraulics
- channel width (m)
- wet width (m)
- maximum depth (m)
- average depth (m)
- velocity (m/s)
- flow character

Substrate Composition (%)
- fines (< 2 mm)
- gravels (2–64 mm)
- larges (> 64 mm)
- bedrock and/or oil sand

Bank
- height (m)
- form
- stability
- texture

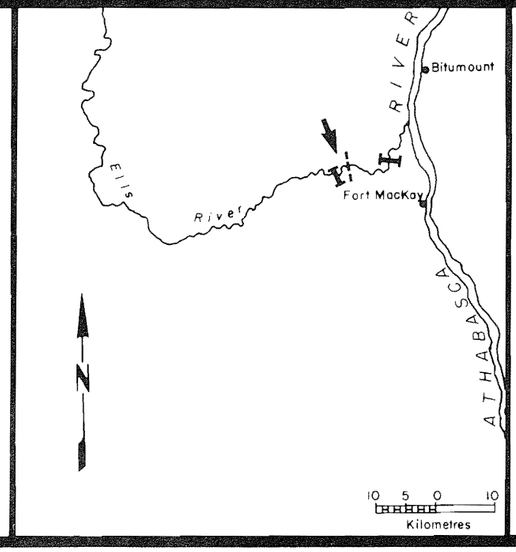
- vegetation (% coverage)
  - coniferous trees
  - deciduous trees
  - shrubs
  - grasses
  - barren

Water Quality
- temperature (°C)
- dissolved oxygen (mg/l)
- conductivity (μmhos/cm)
- pH

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

ELLS RIVER

Reach 4 Section 2

(km 37 to km 45)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH CAPTURED (1978)

Species	Adults		Juveniles and Young-of-the-year		Total Numbers	
	June	September	June	September	June	September
arctic grayling	ND	0	ND	1	ND	1
lake chub	ND	10	ND	56	ND	66
longnose dace	ND	0	ND	17	ND	17
longnose sucker	ND	1	ND	11	ND	12
northern pike	ND	1	ND	0	ND	1
pearl dace	ND	0	ND	4	ND	4
trout-perch	ND	28	ND	1	ND	29
unidentified suckers	ND	0	ND	1	ND	1
Total	ND	40	ND	91	ND	131

PHYSICAL CHARACTERISTICS

Reach length (km)	6.0
Channel width (m)	25
Channel area (ha)	15.0
Gradient (m/km)	4.1
Flow character	rolling, broken
Total pools (%)	25
Pattern	irregularly meandering
Confinement	confined
Unstable banks (%)	20
Substrate composition (%)	
fines (<2 mm)	20
gravels (2-64 mm)	30
larges (>64 mm)	45
bedrock and/or oil sand	5
Debris	moderate

REACH DESCRIPTION AND FISH UTILIZATION

This section is a short, irregularly meandering reach that is essentially a series of riffles. Although gradient and water velocities are relatively high, there is a moderate number of pools. Water depths are fairly shallow over most of the reach. Substrates are predominantly larges and gravels, but there are also numerous areas with sandy substrates. Deciduous trees and shrubs comprise the major part of the riparian vegetation, and there is a small amount of vegetation that overhangs the channel. There is a moderate amount of debris in this reach.

The diversity of substrate sizes, current velocities and water depths provides excellent spawning potential for most fish species that occur in the Ells River, particularly for those fish that prefer to spawn over rocky substrates. Rearing potential is considered to be good because the moderate quantities of debris and the rocky substrates provide suitable shelter. Some areas along the banks that are shaded by overhanging vegetation are also suitable rearing areas. Suitable resting and feeding areas for larger fish are found in some of the areas sheltered by overhanging vegetation and debris. However, only a few backwater pools and eddies in the reach provide sufficiently deep waters for larger fish; resting and feeding potential for these fish is therefore considered to be poor. Shallow water depths and the paucity of deep pools preclude significant overwintering of fish in this reach.

BENTHIC INVERTEBRATES

No benthic samples were taken in this reach.

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	10
Deciduous trees	60
Shrubs	25
Grasses	20
Barren	0
Channel cover (%)	
Overhang	2
Crown	0

BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach

AQUATIC BIOPHYSICAL INVENTORY

ELLS RIVER

Reach 5

(km 45 to km 51)

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS

SN	ARGR, LKCH, LNDC, LNSK	
SN	LKCH, LNSK	
SN	LKCH, LNDC, LNSK, PLDC, TRPC, UNSK	
GN	LNSK, NTPK	

POINT SAMPLE DATA

Location
Date
Hydraulics
- channel width (m)
- wet width (m)
- maximum depth (m)
- average depth (m)
- velocity (m/s)
- flow character

Substrate Composition (%)
- fines (< 2 mm)
- gravels (2–64 mm)
- larges (> 64 mm)
- bedrock and/or oil sand

Bank
- height (m)
- form
- stability
- texture

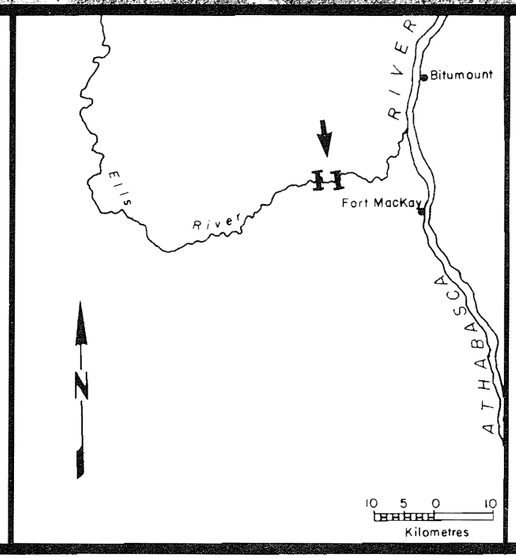
- vegetation (% coverage)
  - coniferous trees
  - deciduous trees
  - shrubs
  - grasses
  - barren

Water Quality
- temperature (°C)
- dissolved oxygen (mg/l)
- conductivity (μmhos/cm)
- pH

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
	reach boundary
	upstream limit of survey
	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

ELLS RIVER

Reach 5

(km 45 to km 51)

Scale 1:25 000

Miles 0.5 0 0.5
Kilometres 0.5 0 0.5

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ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (1978)

Species	Adults		Juveniles and Young-of-the-year		Total Numbers	
	May/June	September	May/June	September	May/June	September
arctic grayling	0	0	29	4	29	4
lake chub	0	48	238	298	238	346
longnose dace	1	1	97	38	98	39
longnose sucker	1	0	32	11	33	11
northern pike	0	5	0	0	0	5
pearl dace	0	0	2	48	2	48
slimy sculpin	39	3	2	3	41	6
spoonhead sculpin	0	0	1	0	1	0
trout-perch	19	61	35	27	54	88
unidentified suckers	0	0	0	11	0	11
walleye	2	2	0	0	2	2
white sucker	3	9	42	37	45	46
Total	65	129	478	477	543	606

PHYSICAL CHARACTERISTICS

Reach length (km)	123.0
Channel width (m)	30
Channel area (ha)	369.0
Gradient (m/km)	1.9
Flow character	swirling, rolling, broken
Total pools (%)	60
Pattern	tortuously meandering
Confinement	frequently confined
Unstable banks (%)	35
Substrate composition (%)	
fines (<2 mm)	30
gravels (2-64 mm)	30
larges (>64 mm)	40
bedrock and/or oil sand	0
Debris	moderate

REACH DESCRIPTION AND FISH UTILIZATION

This section is a long, tortuously meandering reach with a moderate gradient. It is a series of alternating pools and riffles, and just over half of the reach area is composed of pools. Water depths are relatively shallow over most of the reach. Substrates are varied, depending on location in the reach, and consist of larges, gravels and fines. The riparian vegetation is dominated by deciduous trees and shrubs, but grasses and significant numbers of conifers are also present. There is somewhat more overhanging vegetation in this section than in other reaches in the surveyed portion of the river.

Because of the variety of habitats provided by the long series of pools and riffles, the spawning potential of this reach is considered to be excellent for fish that normally spawn over rocky or sandy substrates. Adults of several species that spawn in the spring were captured here in May and June during this study. Areas sheltered by overhanging bank vegetation and debris and areas with rocky substrates provide excellent rearing habitat for many fish species. Very high numbers of young fish, particularly lake chub, were captured in the reach during this study. Overhanging vegetation, moderate quantities of debris, and numerous pools provide good resting and feeding areas for larger fish, particularly the piscivorous species. Overwintering potential for fish is considered to be moderate; many of the pools are probably too shallow to provide suitable overwintering areas.

BENTHIC INVERTEBRATES

- NEMATODA
- OLIGOCHAETA
- GASTROPODA
  - *Ferrissia*
  - *Gyraulus*
- PELECYPODA
  - *Musculium*
- INSECTA
  - Ephemeroptera
    - *Baetis*
    - *Baetisca*
    - *Epeorus*
    - *Ephemerella*
    - *Rhithrogena*
    - *Stenonema*
  - Odonata
    - *Ophiogomphus*
  - Plecoptera
    - *Hastaperla*
    - *Isogenus*
    - *Isoperla*
    - *Leuctra*
    - *Nemoura*
    - *Oemopteryx*
    - *Pteronarcys*
  - Hemiptera
  - Trichoptera
    - *Amiocentrus*
    - *Brachycentrus*
    - *Chematopsyche*
    - *Glossosoma*
    - *Homophylax*
    - *Hydropsyche*
    - *Lepidostoma*
    - *Oecetis*
    - *Polycentropus*
    - *Potamyia*
  - Coleoptera
    - Dryopidae
    - Elmidae
  - Diptera
    - Tipulidae
    - Ceratopogonidae
    - Chironomidae
      - Chironominae
      - Tanypodinae
      - Orthocladiinae
    - Simuliidae
    - Rhagionidae
      - *Atherix*
    - Empididae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	20
Deciduous trees	50
Shrubs	30
Grasses	30
Barren	0
Channel cover (%)	
Overhang	5
Crown	0

BENTHIC ALGAL PRODUCTIVITY

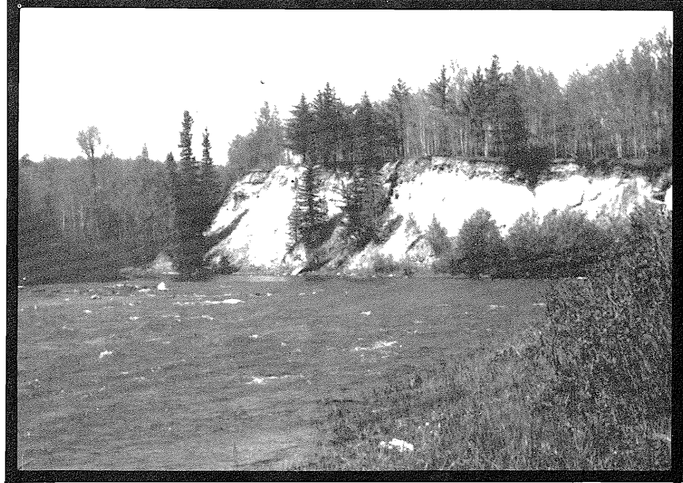
No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach



A riffle section and high, unstable bank at km 107.

An area of slower, swirling flow and heavily grassed banks at km 141.

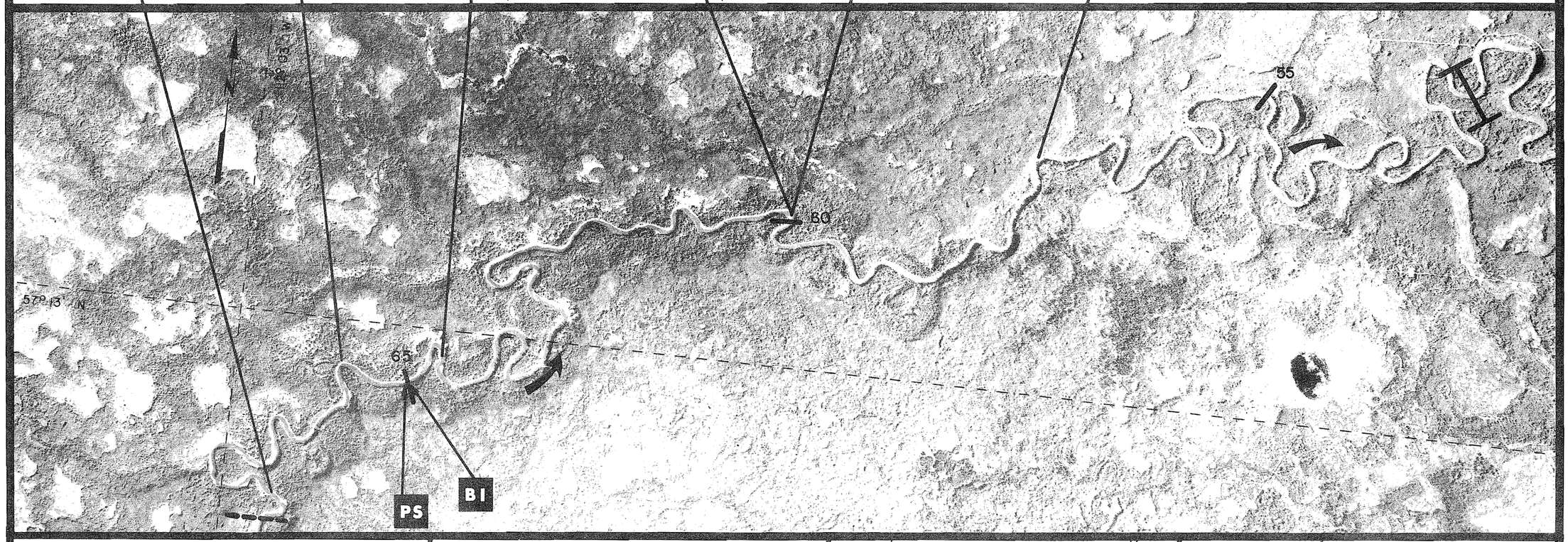
AQUATIC BIOPHYSICAL INVENTORY
ELLS RIVER
Reach 6
(km 51 to km 174)

alberta oil sands environmental research program

prepared by LGL LIMITED

FISH COLLECTIONS

SN: LKCH, LNDC, PLDC	GN: NTPK, WTSK	SN: ARGR, LKCH, LNDC, LNSK, PLDC, TRPC, UNSK, WTSK	GN: NTPK, WALL, WTSK	SN: LKCH, LNDC, PLDC, TRPC, UNSK	SN: LKCH, LNDC, LNSK, TRPC, WTSK



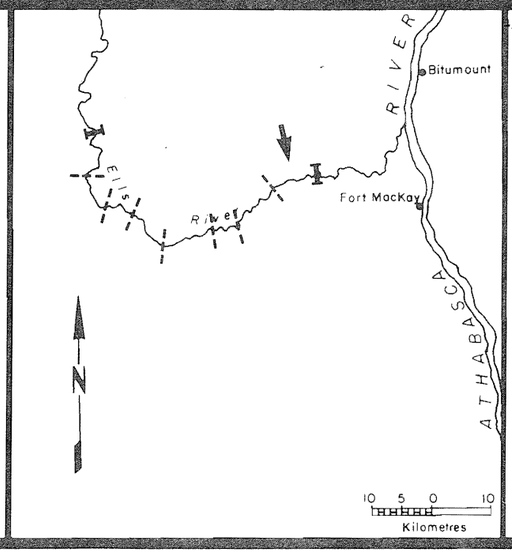
POINT SAMPLE DATA

Location	km 65
Date	31/05/78
Hydraulics	
channel width (m)	28
wet width (m)	28
maximum depth (m)	ND
average depth (m)	1.3
velocity (m/s)	1.30
flow character	swirling, rolling
Substrate Composition (%)	
fines (< 2mm)	25
gravels (2–64mm)	35
larges (>64mm)	40
bedrock and/or oil sand	0
Bank	
height (m)	2.8
form	steep
stability	talking
texture	sand, clay
vegetation (% coverage)	
coniferous trees	10
deciduous trees	80
shrubs	20
grasses	25
barren	0
Water Quality	
temperature (°C)	13.5
dissolved oxygen (mg/l)	ND
conductivity (µmhos/cm)	ND
pH	ND

LEGEND

AN angling	CF counting fence
DN dip net	EF electrofisher
GN gill net	KS kick sample
SF small fish collections made using a combination of methods	SN seine
AP benthic algal productivity station	BI benthic invertebrate collection site
CH water quality station	PS point sample
SG stream gauging station	35 kilometres from mouth
flow direction	reach boundary
upstream limit of survey	division between sections of a reach

ARGR arctic grayling	BKST brook stickleback
BRMN brassy minnow	BURB burbot
DLVR Dolly Varden	EGGS unidentified fish eggs
EMSH emerald shiner	FLCH flathead chub
FSDC finescale dace	FTMN fathead minnow
GOLD goldeye	LKCH lake chub
LKCS lake cisco	LKWF lake whitefish
LNDC longnose dace	LNSK longnose sucker
MTWF mountain whitefish	NRDC northern redbelly dace
NSST ninespine stickleback	NTPK northern pike
PLDC pearl dace	SLSC slimy sculpin
SPSC spoonhead sculpin	SPSH spottail shiner
TRPC trout-perch	UNSK unidentified sucker species
WALL walleye	WTSK white sucker
YLPR yellow perch	



AQUATIC BIOPHYSICAL INVENTORY

ELLS RIVER

Reach 6 Section 1

(km 51 to km 68)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

alberta

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

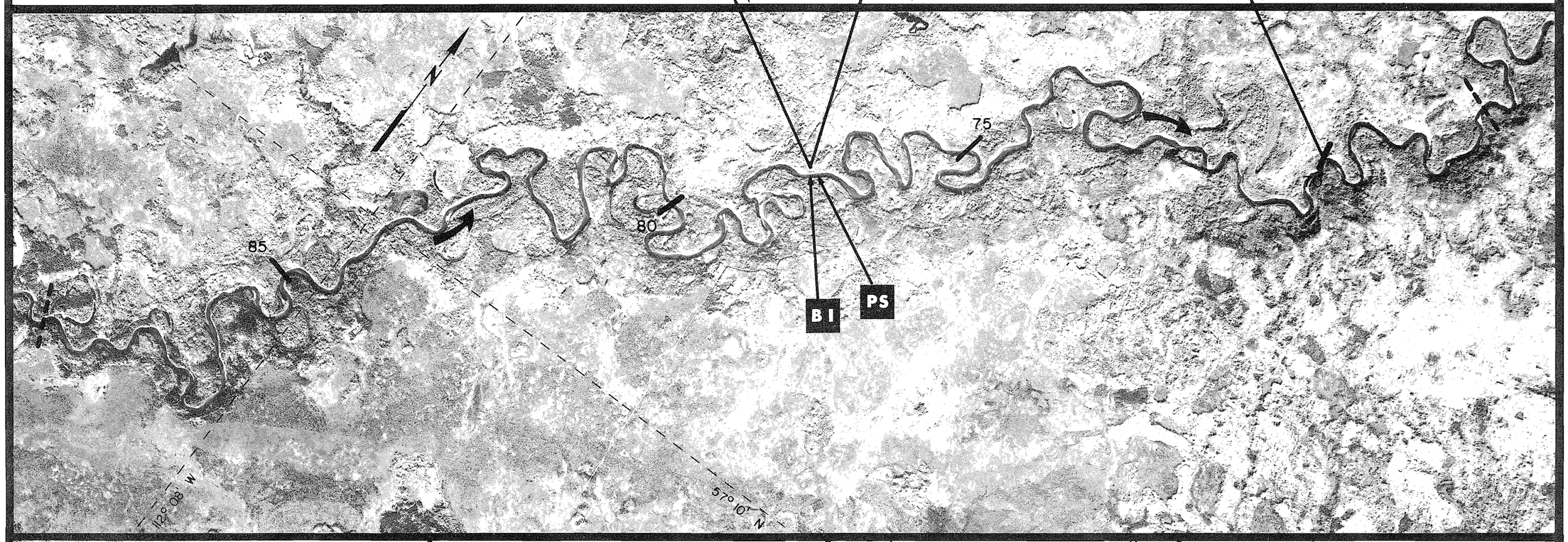
prepared by LGL LIMITED

FISH COLLECTIONS

KS — EGGS

SN — LKCH, LNDC, LNSK, PLDC, TRPC, WTSK

SN — ARGR, LKCH, LNDC, PLDC, SLSC, TRPC, WTSK

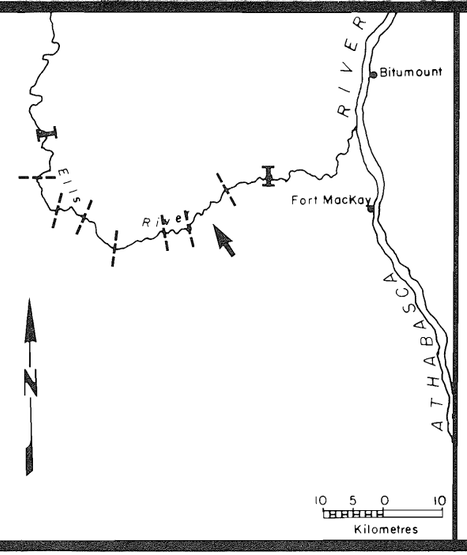


POINT SAMPLE DATA

Location	km 77
Date	31/05/78
Hydraulics	
channel width (m)	30
wet width (m)	30
maximum depth (m)	ND
average depth (m)	1.2
velocity (m/s)	0.90
flow character	swirling, rolling
Substrate Composition (%)	
fines (< 2 mm)	30
gravels (2–64 mm)	30
larges (>64 mm)	40
bedrock and/or oil sand	0
Bank	
height (m)	2.5
form	repose
stability	stable
texture	sand, larges
vegetation (% coverage)	
coniferous trees	0
deciduous trees	85
shrubs	25
grasses	20
barren	0
Water Quality	
temperature (°C)	12.5
dissolved oxygen (mg/l)	ND
conductivity (µmhos/cm)	ND
pH	ND

LEGEND

AN angling	ARGR arctic grayling
CF counting fence	BKST brook stickleback
DN dip net	BRMN brassy minnow
EF electrofisher	BURB burbot
GN gill net	DLVR Dolly Vorden
KS kick sample	EGGS unidentified fish eggs
SF small fish collections made using a combination of methods	EMSH emerald shiner
SN seine	FLCH flathead chub
AP benthic algal productivity station	FSDC finescale dace
BI benthic invertebrate collection site	FTMN fathead minnow
CH water quality station	GOLD goldeye
PS point sample	LKCH lake chub
SG stream gauging station	LKCS lake cisco
35 kilometres from mouth	LKWF lake whitefish
flow direction	LNDC longnose dace
reach boundary	LNSK longnose sucker
upstream limit of survey	MTWF mountain whitefish
division between sections of a reach	NRDC northern redbelly dace
	NSST ninespine stickleback
	NTPK northern pike
	PLDC pearl dace
	SLSC slimy sculpin
	SPSC spoonhead sculpin
	SPSH spottail shiner
	TRPC trout-perch
	UNSK unidentified sucker species
	WALL walleye
	WTSK white sucker
	YLPR yellow perch



AQUATIC BIOPHYSICAL INVENTORY

ELLS RIVER

Reach 6 Section 2

(km 68 to km 88)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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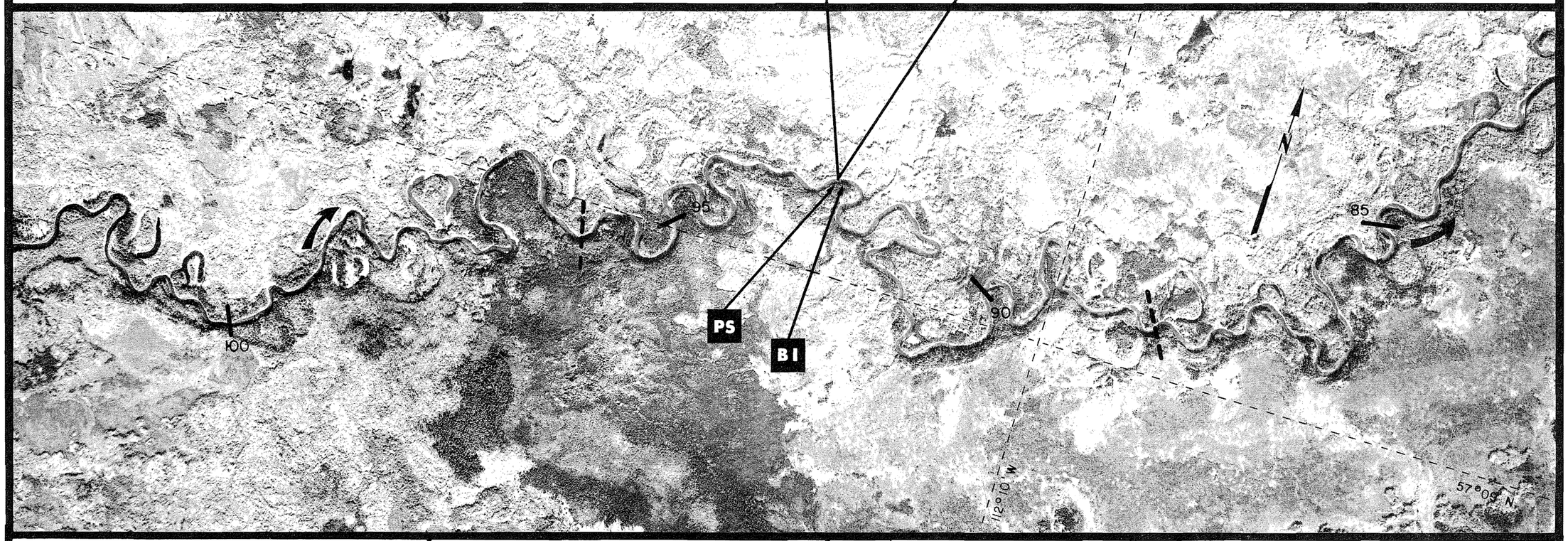
prepared by LGL LIMITED

FISH COLLECTIONS

KS — EGGS

SN — LKCH, LNDC, PLDC, TRPC



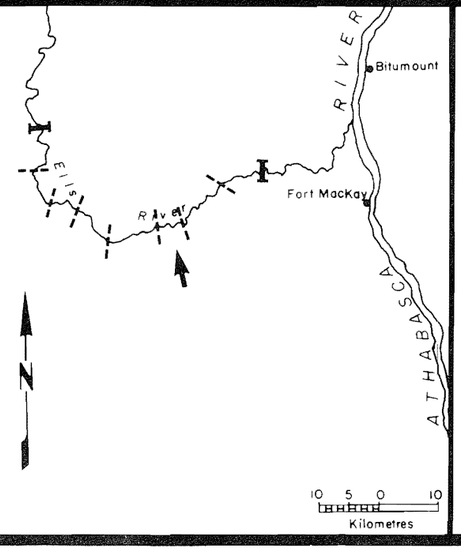
POINT SAMPLE DATA

Location	km 93
Date	30/05/78
Hydraulics	
channel width (m)	28
wet width (m)	28
maximum depth (m)	ND
average depth (m)	1.0
velocity (m/s)	1.00
flow character	swirling
Substrate Composition (%)	
fines (< 2mm)	20
gravels (2–64mm)	40
larges (>64mm)	40
bedrock and/or oil sand	0
Bank	
height (m)	2.5
form	repose
stability	stable
texture	sand, gravel
vegetation (% coverage)	
coniferous trees	10
deciduous trees	75
shrubs	40
grasses	15
barren	0
Water Quality	
temperature (°C)	13.5
dissolved oxygen (mg/l)	ND
conductivity (µmhos/cm)	ND
pH	ND

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

ELLS RIVER

Reach 6 Section 3

(km 88 to km 96)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

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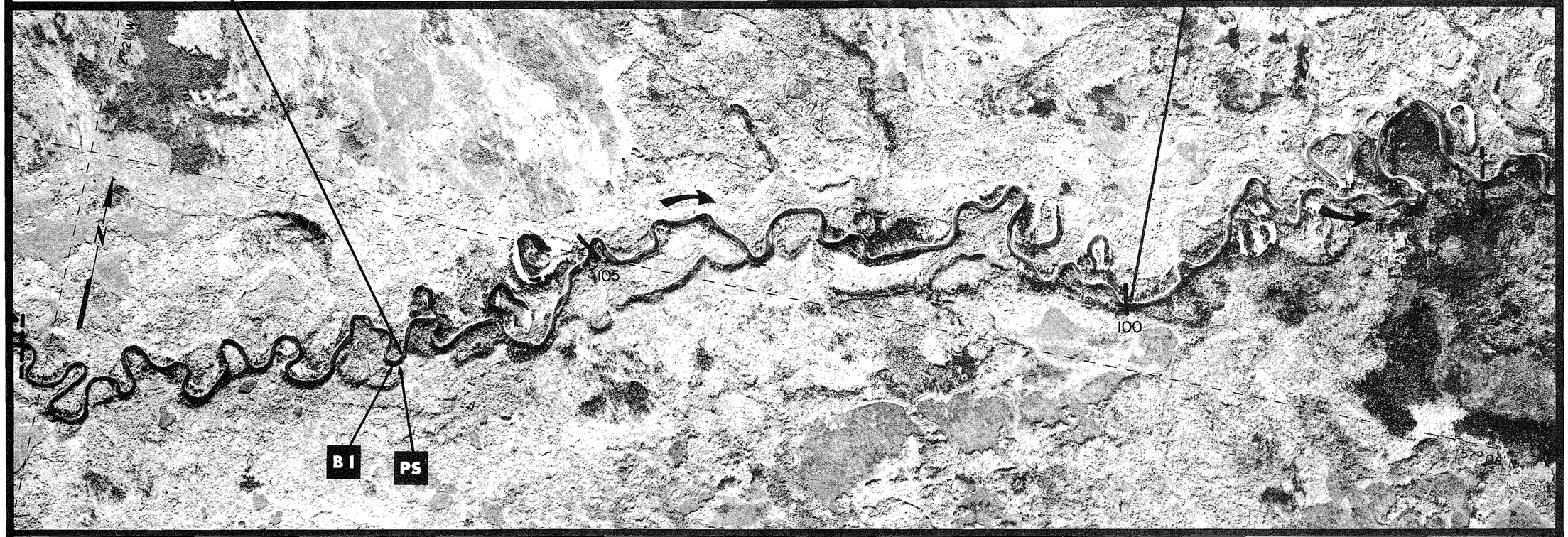
FISH COLLECTIONS

SN: LKCH, LNDC, LNSK, SLSC

GN: LNSK, WALL, WTSK

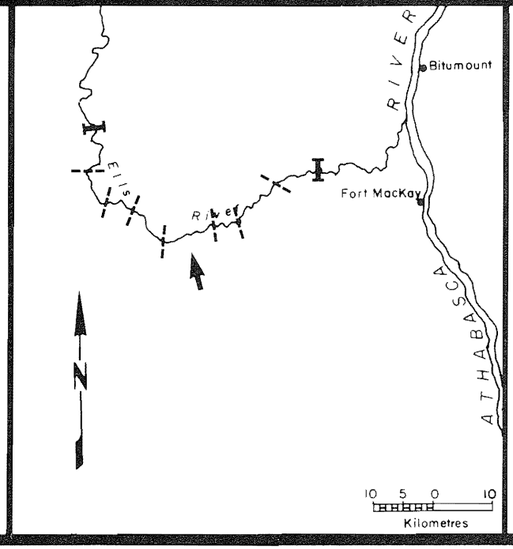


POINT SAMPLE DATA

Location	km 107
Date	30/05/78
Hydraulics	
channel width (m)	32
wet width (m)	32
maximum depth (m)	ND
average depth (m)	1.5
velocity (m/s)	2.00
flow character	swirling, rolling, broken
Substrate Composition (%)	
fines (< 2mm)	15
gravels (2–64mm)	10
larges (>64mm)	75
bedrock and/or oil sand	0
Bank	
height (m)	2.0
form	steep
stability	failing
texture	sand, gravel
vegetation (% coverage)	
coniferous trees	5
deciduous trees	75
shrubs	25
grasses	40
barren	0
Water Quality	
temperature (°C)	12.0
dissolved oxygen (mg/l)	ND
conductivity (µmhos/cm)	ND
pH	ND

LEGEND

AN	angling	ARGR	arctic grayling
CF	counting fence	BKST	brook stickleback
DN	dip net	BRMN	brassy minnow
EF	electrofisher	BURB	burbot
GN	gill net	DLVR	Dolly Varden
KS	kick sample	EGGS	unidentified fish eggs
SF	small fish collections made using a combination of methods	EMSH	emerald shiner
		FLCH	flathead chub
SN	seine	FSDC	finescale dace
AP	benthic algal productivity station	FTMN	fathead minnow
		GOLD	goldeye
BI	benthic invertebrate collection site	LKCH	lake chub
		LKCS	lake cisco
CH	water quality station	LKWF	lake whitefish
		LNDC	longnose dace
PS	point sample	LNSK	longnose sucker
		MTWF	mountain whitefish
SG	stream gauging station	NRDC	northern redbelly dace
		NSST	ninespine stickleback
35	kilometres from mouth	NTPK	northern pike
		PLDC	pearl dace
	flow direction	SLSC	slimy sculpin
		SPSC	spoonhead sculpin
	reach boundary	SPSH	spottail shiner
		TRPC	trout-perch
	upstream limit of survey	UNSK	unidentified sucker species
		WALL	walleye
	division between sections of a reach	WTSK	white sucker
		YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

ELLS RIVER

Reach 6 Section 4

(km 96 to km 112)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

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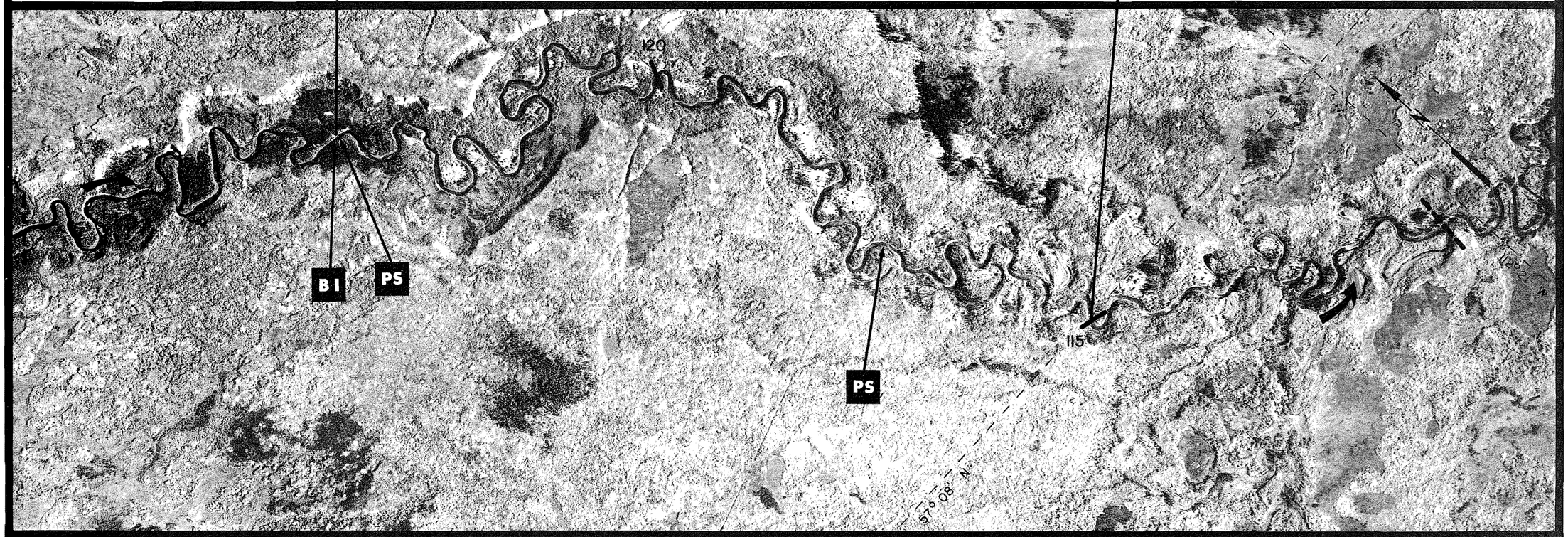
FISH COLLECTIONS

SN: ARGR LKCH LNDC LNSK SLSC SPSC WTSK

SN: ARGR LKCH LNDC SLSC WTSK



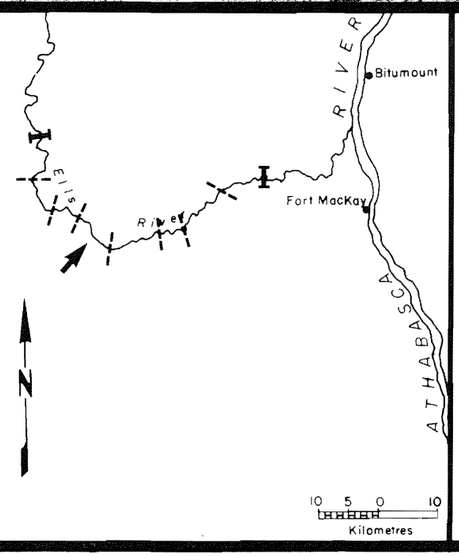
POINT SAMPLE DATA

	km 117	km 125
Location		
Date	30/05/78	29/05/78
Hydraulics		
channel width (m)	40	30
wet width (m)	25	30
maximum depth (m)	ND	ND
average depth (m)	0.8	1.0
velocity (m/s)	1.25	1.60
flow character	rolling, broken	rolling, broken
Substrate Composition (%)		
fines (< 2mm)	40	20
gravels (2–64mm)	40	30
larges (>64mm)	20	50
bedrock and/or oil sand	0	0
Bank		
height (m)	1.5	1.8
form	repose	undercut
stability	stable	failing
texture	sand, gravel	sand, larges
vegetation (% coverage)		
coniferous trees	5	35
deciduous trees	20	65
shrubs	45	25
grasses	25	45
barren	5	0
Water Quality		
temperature (°C)	12.0	11.0
dissolved oxygen (mg/l)	ND	ND
conductivity (µmhos/cm)	ND	ND
pH	ND	ND

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

ELLS RIVER

Reach 6 Section 5

(km 112 to km 129)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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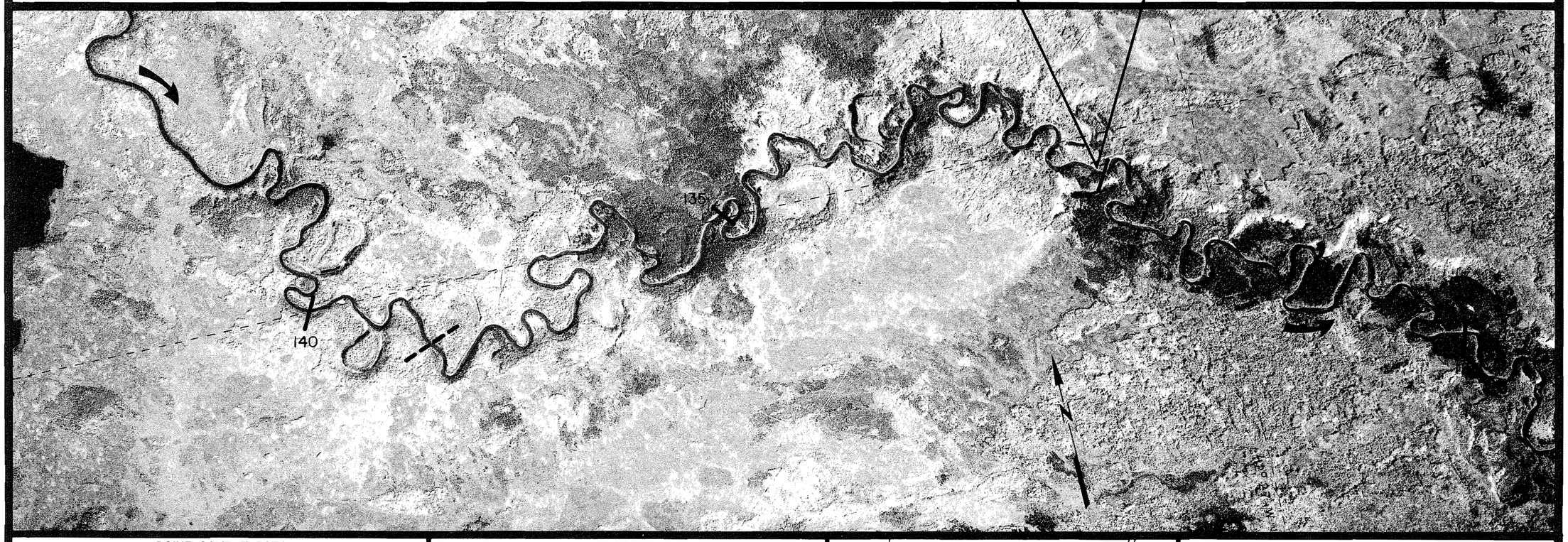
ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS

SN: LKCH, LNDC, PLDC, SLSC, WTSK

EF: ARGR, LKCH, LNDC, LNSK, SLSC, WTSK



POINT SAMPLE DATA

Location
Date
Hydraulics
- channel width (m)
- wet width (m)
- maximum depth (m)
- average depth (m)
- velocity (m/s)
- flow character

Substrate Composition (%)
- fines (< 2 mm)
- gravels (2–64 mm)
- larges (> 64 mm)
- bedrock and/or oil sand

Bank
- height (m)
- form
- stability
- texture

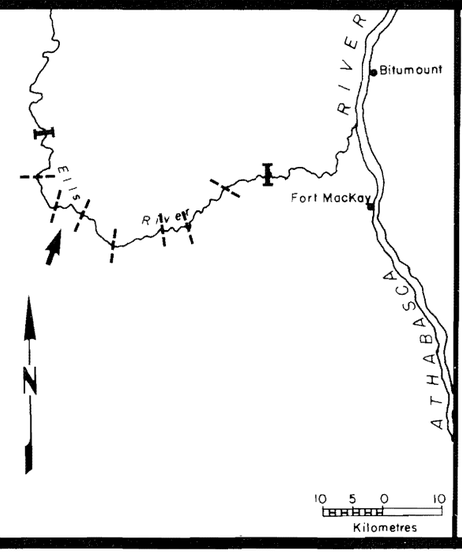
Vegetation (% coverage)
- coniferous trees
- deciduous trees
- shrubs
- grasses
- barren

Water Quality
- temperature (°C)
- dissolved oxygen (mg/l)
- conductivity (µmhos/cm)
- pH

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

ELLS RIVER

Reach 6 Section 6

(km 129 to km 139)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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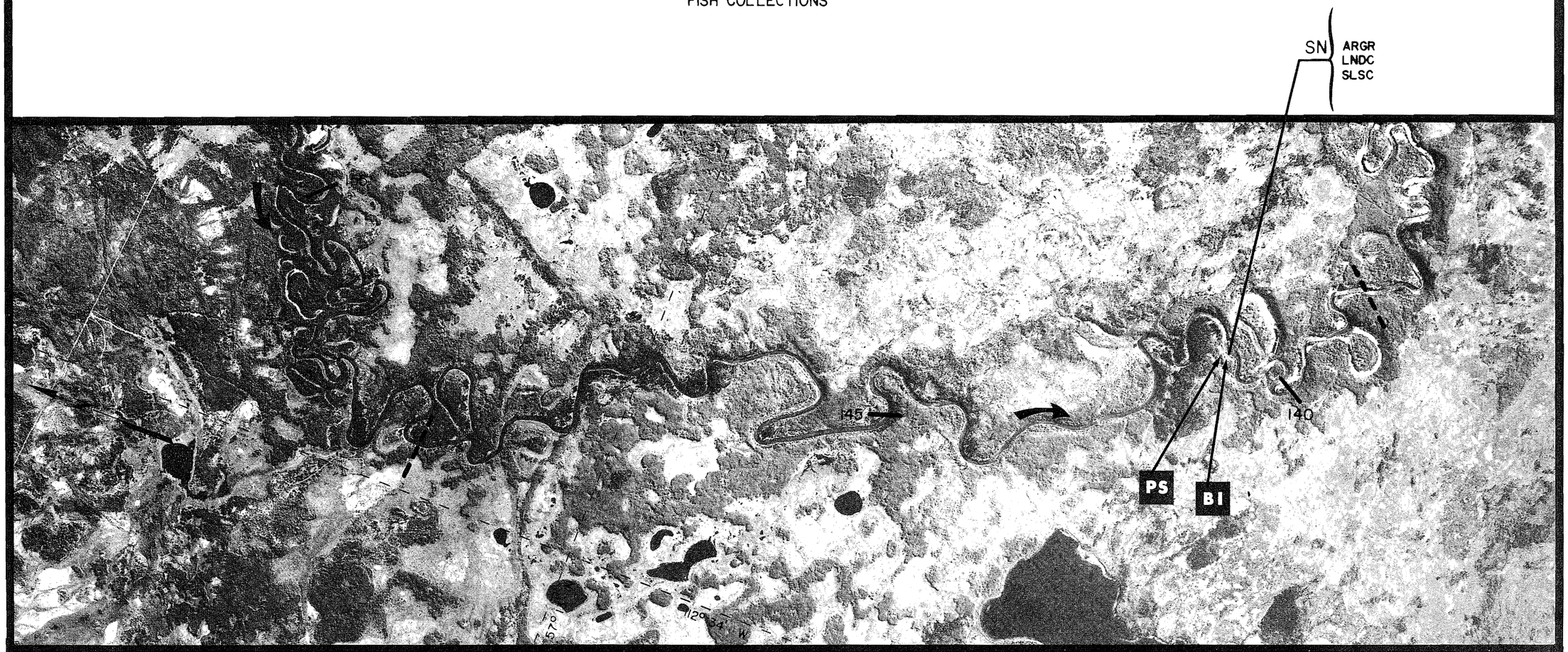
FISH COLLECTIONS

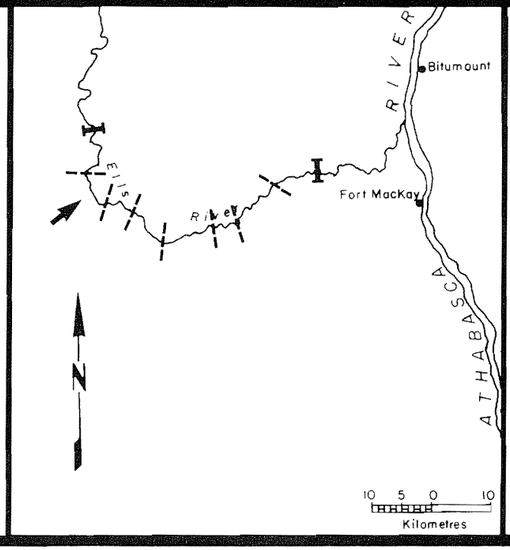


POINT SAMPLE DATA

Location	km 141
Date	29/05/78
Hydraulics	
channel width (m)	35
wet width (m)	35
maximum depth (m)	ND
average depth (m)	1.0
velocity (m/s)	1.40
flow character	swirling, rolling
Substrate Composition (%)	
fines (< 2mm)	75
gravels (2–64mm)	5
larges (> 64mm)	20
bedrock and/or oil sand	0
Bank	
height (m)	1.8
form	repose
stability	stable
texture	sand, gravel
vegetation (% coverage)	
coniferous trees	80
deciduous trees	10
shrubs	5
grasses	15
barren	0
Water Quality	
temperature (°C)	11.5
dissolved oxygen (mg/l)	ND
conductivity (µmhos/cm)	ND
pH	ND

LEGEND

AN angling	ARGR arctic grayling
CF counting fence	BKST brook stickleback
DN dip net	BRMN brassy minnow
EF electrofisher	BURB burbot
GN gill net	DLVR Dolly Varden
KS kick sample	EGGS unidentified fish eggs
SF small fish collections made using a combination of methods	EMSH emerald shiner
SN seine	FLCH flathead chub
AP benthic algal productivity station	FSDC finescale dace
BI benthic invertebrate collection site	FTMN fathead minnow
CH water quality station	GOLD goldeye
PS point sample	LKCH lake chub
SG stream gauging station	LKCS lake cisco
35 kilometres from mouth	LKWF lake whitefish
flow direction	LNDC longnose dace
reach boundary	LNSK longnose sucker
upstream limit of survey	MTWF mountain whitefish
division between sections of a reach	NRDC northern redbelly dace
	NSST ninespine stickleback
	NTPK northern pike
	PLDC pearl dace
	SLSC slimy sculpin
	SPSC spoonhead sculpin
	SPSH spottail shiner
	TRPC trout-perch
	UNSK unidentified sucker species
	WALL walleye
	WTSK white sucker
	YLPR yellow perch



AQUATIC BIOPHYSICAL INVENTORY

ELLS RIVER

Reach 6 Section 7

(km 139 to km 150)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

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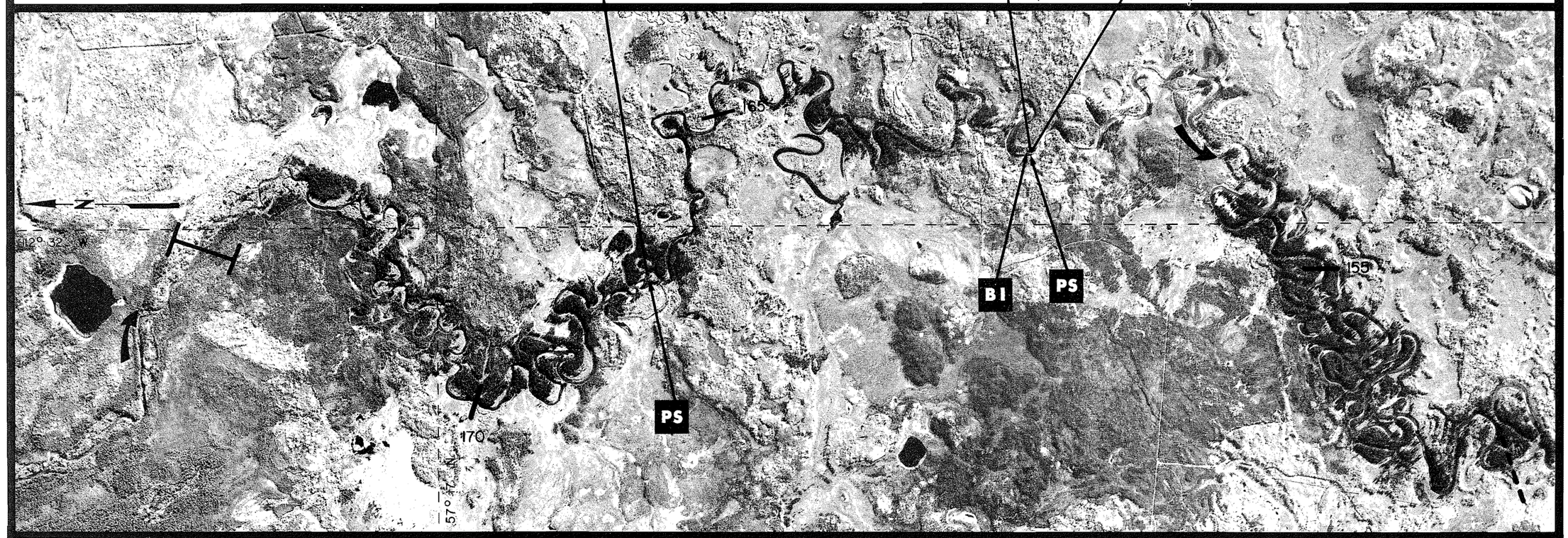
FISH COLLECTIONS

SN: LNDC, LNSK, SLSC

GN: NTPK

SN: ARGR SLSC, LKCH TRPC, LNDC UNSK, LNSK WTSK



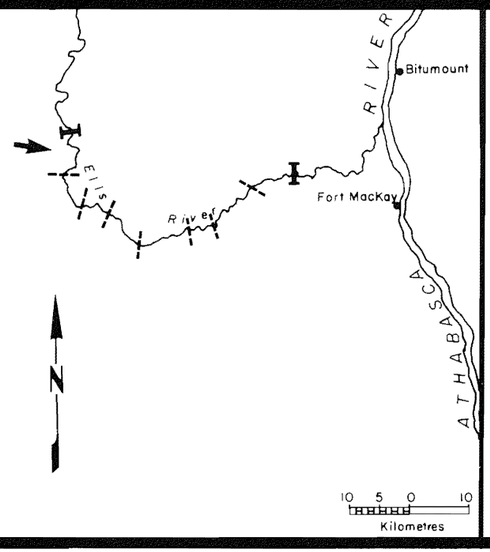
POINT SAMPLE DATA

Location	km 160	km 167
Date	29/05/78	29/05/78
Hydraulics		
channel width (m)	40	25
wet width (m)	20	25
maximum depth (m)	ND	ND
average depth (m)	0.8	1.0
velocity (m/s)	1.10	1.10
flow character	rolling, broken	swirling
Substrate Composition (%)		
fines (< 2mm)	45	100
gravels (2–64mm)	35	0
larges (>64mm)	20	0
bedrock and/or oil sand	0	0
Bank		
height (m)	2.5	2.0
form	repose	ND
stability	stable	ND
texture	sand, gravel	sand
vegetation (% coverage)		
coniferous trees	5	70
deciduous trees	5	0
shrubs	65	10
grasses	35	15
barren	0	0
Water Quality		
temperature (°C)	11.0	ND
dissolved oxygen (mg/l)	ND	ND
conductivity (µmhos/cm)	ND	ND
pH	ND	ND

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
FTMN	fathead minnow
GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
WTSK	white sucker
YLPR	yellow perch



AQUATIC BIOPHYSICAL INVENTORY

ELLS RIVER

Reach 6 Section 8

(km 150 to km 174)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

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NUMBERS OF FISH CAPTURED (1978)

Species	Adults		Juveniles and Young-of-the-year		Total Numbers	
	June	September	June	September	June	September
arctic grayling	0	0	3	1	3	1
lake chub	0	0	3	0	3	0
longnose dace	0	0	3	0	3	0
longnose sucker	0	0	15	0	15	0
slimy sculpin	0	1	4	5	4	6
white sucker	0	0	34	0	34	0
Total	0	1	62	6	62	7

PHYSICAL CHARACTERISTICS

Reach length (km)	6.0
Channel width (m)	20
Channel area (ha)	12.0
Gradient (m/km)	7.2
Flow character	rolling, broken
Total pools (%)	20
Pattern	irregularly meandering
Confinement	confined
Unstable banks (%)	10
Substrate composition (%)	
fines (<2 mm)	15
gravels (2-64 mm)	40
larges (>64 mm)	40
bedrock and/or oil sand	5
Debris	moderate

REACH DESCRIPTION AND FISH UTILIZATION

This section is a short, irregularly meandering reach that is predominantly broken riffles and white water rapids. Both the gradient and the water velocities are the highest recorded within the surveyed portion of the Ells River. The average water depth is shallow. Larges and gravels are the predominant substrate materials, but fines are also found in numerous areas within the reach. Deciduous trees and shrubs are the most abundant vegetation types along the river bank, but coniferous trees also comprise a significant proportion of the riparian vegetation. A small amount of vegetation overhangs the channel.

The diversity of water depths, water velocities, and substrate sizes in this reach provides a number of areas that may be suitable for spawning of several species of fish, particularly those that normally spawn over rocky substrates. In many areas, however, the water velocities may be too high for spawning to occur. Moderate quantities of debris and rocky substrates provide moderate to good rearing areas for most fish species, but high water velocities throughout most of the reach may limit the rearing potential. Resting and feeding potential for larger fish is considered poor to fair. Some overhanging vegetation and moderate quantities of debris provide a number of sheltered areas, but very few pools exist for larger fish to inhabit. The generally shallow water depths and the limited number of pools preclude significant overwintering of fish in this reach.

BENTHIC INVERTEBRATES

- OLIGOCHAETA
- CRUSTACEA
  - Amphipoda
    - *Hyalella azteca*
- INSECTA
  - Ephemeroptera
    - *Baetis*
  - Odonata
    - *Ophiogomphus*
  - Trichoptera
    - *Ceraclea*
    - *Cheumatopsyche*
    - *Glossosoma*
    - *Hydropsyche*
    - *Lepidostoma*
  - Coleoptera
    - Elmidae
  - Diptera
    - Tipulidae
    - Chironomidae
      - Chironominae
      - Orthocladiinae
    - Simuliidae
    - Tabanidae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	20
Deciduous trees	50
Shrubs	30
Grasses	40
Barren	10
Channel cover (%)	
Overhang	2
Crown	0

BENTHIC ALGAL PRODUCTIVITY

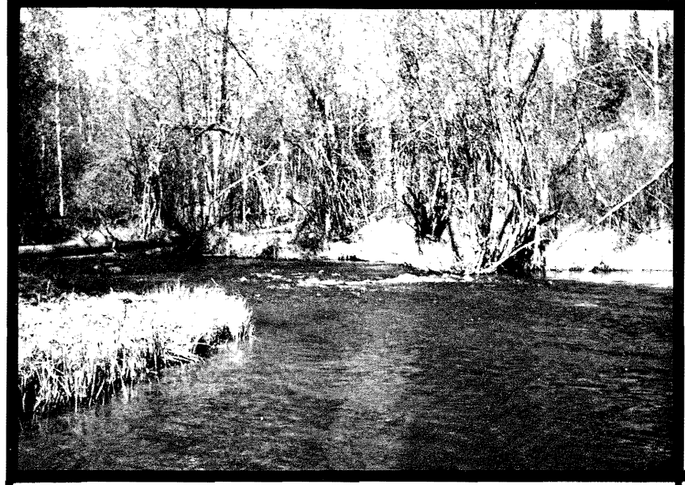
No data available for this reach

STREAM GAUGING DATA

No data available for this reach

WATER QUALITY

No data available for this reach



A typical area of reach 7 at km 177.5.

AQUATIC BIOPHYSICAL INVENTORY
ELLS RIVER
Reach 7
(km 174 to km 180)

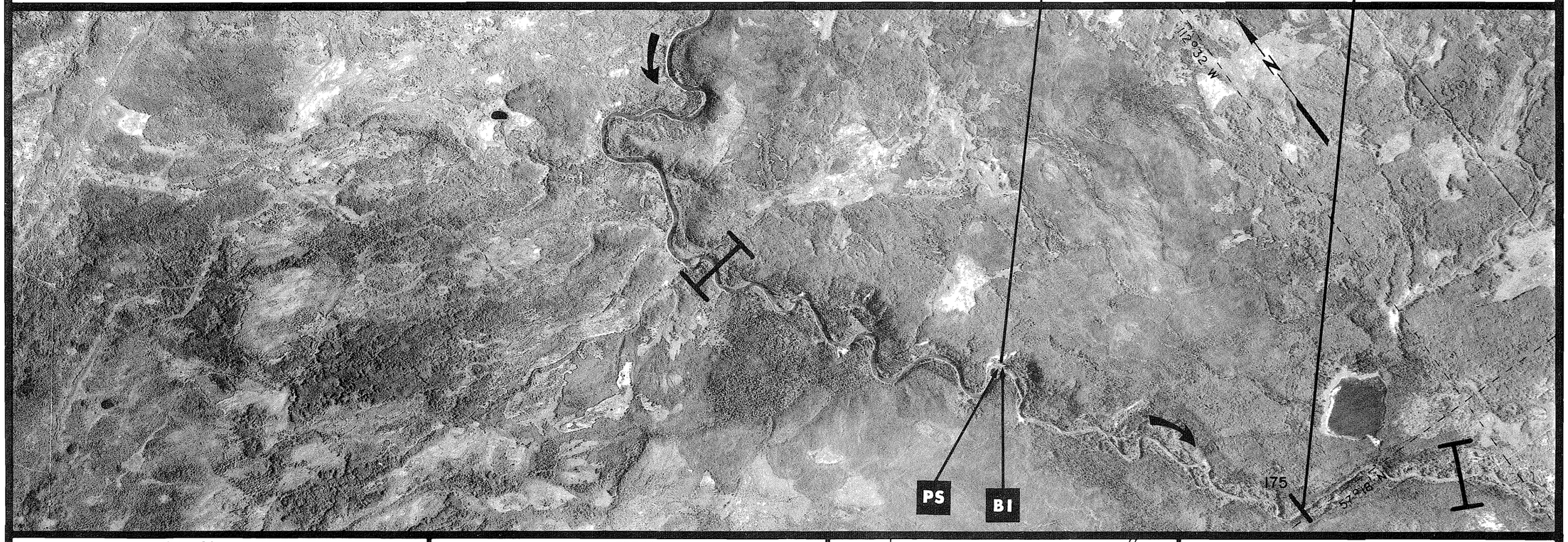
alberta — ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS

SN: ARGR, LKCH, LNDC, LNSK, SLSC, WTSK

SN: ARGR, SLSC

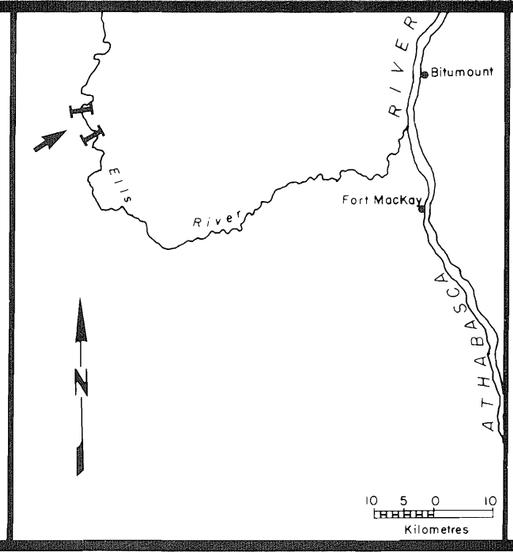


POINT SAMPLE DATA

Location	km 177.5
Date	01/06/78
Hydraulics	
channel width (m)	35
wet width (m)	35
maximum depth (m)	ND
average depth (m)	0.8
velocity (m/s)	3.30
flow character	rolling, broken
Substrate Composition (%)	
fines (< 2mm)	20
gravels (2–64mm)	30
larges (>64mm)	50
bedrock and/or oil sand	0
Bank	
height (m)	1.3
form	repose
stability	stable
texture	sand, gravel
vegetation (% coverage)	
coniferous trees	15
deciduous trees	35
shrubs	65
grasses	50
barren	0
Water Quality	
temperature (°C)	12.0
dissolved oxygen (mg/l)	ND
conductivity (µmhos/cm)	ND
pH	ND

LEGEND

AN angling	ARGR arctic grayling
CF counting fence	BKST brook stickleback
DN dip net	BRMN brassy minnow
EF electrofisher	BURB burbot
GN gill net	DLVR Dolly Varden
KS kick sample	EGGS unidentified fish eggs
SF small fish collections made using a combination of methods	EMSH emerald shiner
SN seine	FLCH flathead chub
AP benthic algal productivity station	FSDC finescale dace
BI benthic invertebrate collection site	FTMN fathead minnow
CH water quality station	GOLD goldeye
PS point sample	LKCH lake chub
SG stream gauging station	LKCS lake cisco
35 kilometres from mouth	LKWF lake whitefish
flow direction	LNDC longnose dace
I reach boundary	LNSK longnose sucker
] upstream limit of survey	MTWF mountain whitefish
division between sections of a reach	NRDC northern redbelly dace
	NSST ninespine stickleback
	NTPK northern pike
	PLDC pearl dace
	SLSC slimy sculpin
	SPSC spoonhead sculpin
	SPSH spottail shiner
	TRPC trout-perch
	UNSK unidentified sucker species
	WALL walleye
	WTSK white sucker
	YLPR yellow perch



AQUATIC BIOPHYSICAL INVENTORY

ELLS RIVER

Reach 7

(km 174 to km 180)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

NUMBERS OF FISH COLLECTED (1978)

Species	Adults		Juveniles and Young-of-the-year		Total Numbers	
	June	September	June	September	June	September
arctic grayling	0	0	4	0	4	0
lake chub	0	5	6	3	6	8
longnose dace	0	0	4	38	4	38
longnose sucker	0	0	99	32	99	32
northern pike	0	2	0	1	0	3
slimy sculpin	3	0	6	0	9	0
unidentified suckers	0	0	1	32	1	32
walleye	0	0	0	1	0	1
white sucker	0	0	134	19	134	19
Total	3	7	254	126	257	133

PHYSICAL CHARACTERISTICS

Reach length (km)	13.0
Channel width (m)	30
Channel area (ha)	39.0
Gradient (m/km)	5.0
Flow character	swirling, rolling, broken
Total pools (%)	50
Pattern	irregularly meandering
Confinement	confined
Unstable banks (%)	5
Substrate composition (%)	
fines (<2 mm)	15
gravels (2-64 mm)	25
larges (>64 mm)	60
bedrock and/or oil sand	0
Debris	moderate

REACH DESCRIPTION AND FISH UTILIZATION

This section is the most upstream reach of the surveyed portion of the Ells River. The gradient is relatively high and the flow character is mixed, varying from swirling to rolling to broken. Approximately half of the total reach area is composed of pools and the water is moderately deep in many areas. Large rocks and boulders are the dominant substrate materials, but significant amounts of gravels and fines are also present. The riparian vegetation consists primarily of deciduous trees and shrubs, with some scattered conifers. There is a small amount of overhanging vegetation.

The spawning potential of this reach is considered to be excellent for many of the fish species that occur in the Ells River, because of the diversity in substrate sizes, water velocities and water depths. The reach is a particularly attractive spawning area for those fish that prefer rocky substrates. Rocky substrates and moderate quantities of debris provide good to excellent rearing opportunities for most fish species found in the Ells River. Some areas along the banks that are shaded by overhanging vegetation also provide suitable rearing habitat. Moderately high numbers of young fish, particularly white and longnose suckers, were captured in the reach during this study. Resting and feeding potential for larger fish is considered to be good, because of the numerous pools and areas sheltered by debris. Suitable overwintering areas are found in the numerous, relatively deep pools.

BENTHIC INVERTEBRATES

- GASTROPODA
  - *Stagnicola*
- INSECTA
  - Ephemeroptera
    - *Ameletus*
    - *Baetis*
    - *Ephemerella*
    - *Stenonema*
  - Odonata
    - *Ophiogomphus*
  - Plecoptera
    - *Leuctra*
    - *Oemopteryx*
    - *Taeniopteryx*
  - Trichoptera
    - *Brachycentrus*
    - *Cheumatopsyche*
    - *Glossosoma*
    - *Hydropsyche*
    - *Lepidostoma*
    - *Oecetis*
    - *Polycentropus*
  - Coleoptera
    - Elmidae
  - Diptera
    - Tipulidae
    - Chironomidae
      - Chironominae
      - Tanypodinae
      - Orthocladiinae
    - Simuliidae
    - Tabanidae
    - Dolichopodidae

RIPARIAN VEGETATION

Bank coverage (%)	
Coniferous trees	5
Deciduous trees	55
Shrubs	40
Grasses	30
Barren	0
Channel cover (%)	
Overhang	2
Crown	0

BENTHIC ALGAL PRODUCTIVITY

Standing crop expressed as cell counts (number·m^{-2})
- mean: 435.0×10^{10}
- maximum: 702.0×10^{10}
- minimum: 36.0×10^{10}

Standing crop expressed as chlorophyll *a* (mg·m^{-2})
- mean: 43.3
- maximum: 84.5
- minimum: 24.0

Primary productivity (mg C·h^{-1}·m^{-2})
- mean: 20.6
- maximum: 52.5
- minimum: 1.1

Data from Hickman *et al.* (1980).

STREAM GAUGING DATA

Water Survey of Canada station number 07DA010

Maximum total annual discharge:	203.5×10^6 m^3 (1978)
Minimum total annual discharge:	108.4×10^6 m^3 (1977)
Maximum annual mean discharge:	6.46 m^3/s (1978)
Minimum annual mean discharge:	3.43 m^3/s (1977)
Maximum monthly mean discharge:	25.46 m^3/s (July 1975)
Minimum monthly mean discharge:	0.21 m^3/s (March 1977)
Maximum daily discharge:	34.83 m^3/s (July 6, 1975)
Minimum daily discharge:	0.20 m^3/s (Mar. 15, 1977)

Data for 1975 to 1978 compiled from Loeppky and Spitzer (1977), Warner and Spitzer (1979) and Warner (1979).

WATER QUALITY

Water Survey of Canada station number 00AT07DA0100

	Mean	Maximum	Minimum
Total alkalinity (mg $CaCO_3$/l)	62.3	211.6	37.8
pH	7.40	8.10	6.88
Total hardness (mg $CaCO_3$/l)	58.9	72.6	39.4
Conductance (µS/cm)	130	400	70
Total filterable residue fixed (mg/l)	62	173	37
Total non-filterable residue fixed (mg/l)	4	56	<0.4
Total organic carbon (mg C/l)	13.0	25.0	7.0
Silica (mg SiO_2/l)	3.8	12.5	0.4
Nitrate and nitrite nitrogen (mg N/l)	0.090	0.370	<0.003
Total Kjeldahl nitrogen (mg N/l)	1.00	7.85	0.10
Total Phosphorus (mg P/l)	0.050	0.150	0.026
Orthophosphate (mg P/l)	0.010	0.040	<0.003
Sulphate (mg SO_4/l)	6.4	9.5	3.2

Data for the period January 1976 to December 1979 obtained from the National Water Quality Data Bank (NAQUADAT).

Ells River at km 185.5.

AQUATIC BIOPHYSICAL INVENTORY

ELLS RIVER

Reach 8

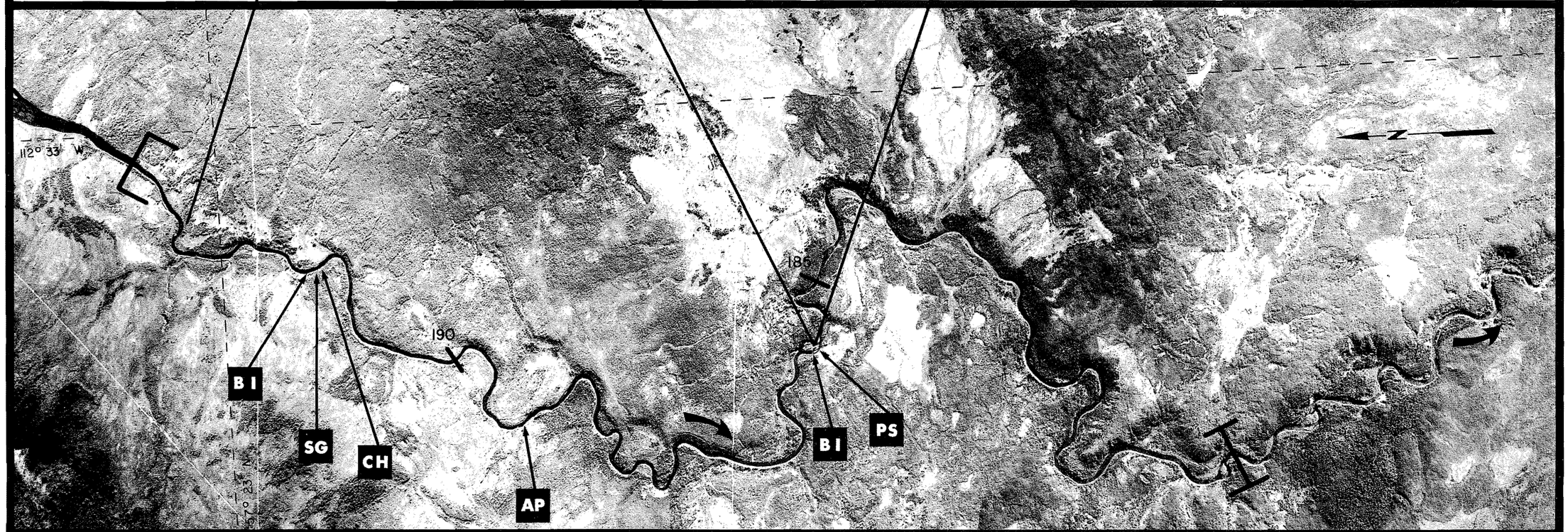
(km 180 to km 193)

alberta — ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

prepared by LGL LIMITED

FISH COLLECTIONS

GN	NO CATCH	
GN	ARGR, LNDC, LNSK, NTPK, UNSK	
SN	LKCH, LNDC, LNSK, SLSC, UNSK, WALL, WTSK	



POINT SAMPLE DATA

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Date	01/06/78
Hydraulics	
channel width (m)	30
wet width (m)	30
maximum depth (m)	ND
average depth (m)	0.8
velocity (m/s)	1.50
flow character	rolling, broken
Substrate Composition (%)	
fines (< 2mm)	15
gravels (2–64mm)	45
larges (>64mm)	40
bedrock and/or oil sand	0
Bank	
height (m)	1.3
form	repose
stability	stable
texture	sand, larges
vegetation (% coverage)	
coniferous trees	65
deciduous trees	10
shrubs	40
grasses	50
barren	0
Water Quality	
temperature (°C)	14.0
dissolved oxygen (mg/l)	ND
conductivity (µmhos/cm)	ND
pH	ND

LEGEND

AN	angling
CF	counting fence
DN	dip net
EF	electrofisher
GN	gill net
KS	kick sample
SF	small fish collections made using a combination of methods
SN	seine
AP	benthic algal productivity station
BI	benthic invertebrate collection site
CH	water quality station
PS	point sample
SG	stream gauging station
35	kilometres from mouth
	flow direction
I	reach boundary
]	upstream limit of survey
⋮	division between sections of a reach

ARGR	arctic grayling
BKST	brook stickleback
BRMN	brassy minnow
BURB	burbot
DLVR	Dolly Varden
EGGS	unidentified fish eggs
EMSH	emerald shiner
FLCH	flathead chub
FSDC	finescale dace
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GOLD	goldeye
LKCH	lake chub
LKCS	lake cisco
LKWF	lake whitefish
LNDC	longnose dace
LNSK	longnose sucker
MTWF	mountain whitefish
NRDC	northern redbelly dace
NSST	ninespine stickleback
NTPK	northern pike
PLDC	pearl dace
SLSC	slimy sculpin
SPSC	spoonhead sculpin
SPSH	spottail shiner
TRPC	trout-perch
UNSK	unidentified sucker species
WALL	walleye
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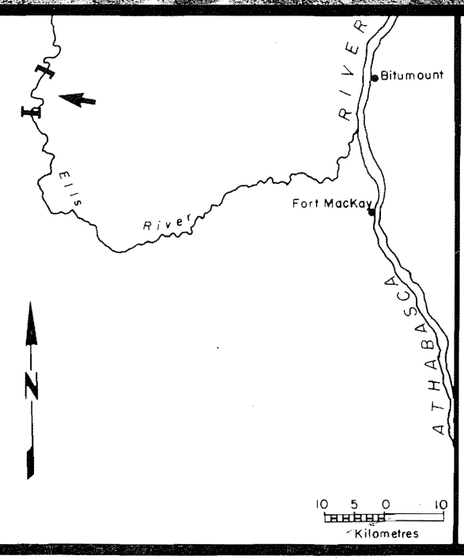

AQUATIC BIOPHYSICAL INVENTORY

ELLS RIVER

Reach 8

(km 180 to km 193)

Scale 1:25 000

Miles 0.5 0 0.5

Kilometres 0.5 0 0.5

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