AQUATIC BIOPHYSICAL INVENTORY
OF MAJOR TRIBUTARIES IN
THE AOSERP STUDY AREA
VOLUME II  ATLAS

by
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Eric B. Watton
Kathryn A. Bruce

LGL
LIMITED
environmental research associate

for
alberta

ALBERTA OIL SANDS
ENVIRONMENTAL
RESEARCH PROGRAM

Project  WS 3.4
April  1980
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FIREBAG   RIVER
### NUMBERS OF FISH COLLECTED (1978)

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<th>Species</th>
<th>Adults</th>
<th>Juvelines and Young-of-the-year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>May</td>
<td>September</td>
<td>Total</td>
</tr>
<tr>
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<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>lake whitefish</td>
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<tr>
<td>longnose sucker</td>
<td>2</td>
<td>0</td>
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<td>northern pike</td>
<td>1</td>
<td>0</td>
<td>1</td>
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<tr>
<td>walleye</td>
<td>2</td>
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<td>4</td>
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<tr>
<td>white sucker</td>
<td>1</td>
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</tr>
<tr>
<td>Total</td>
<td>28</td>
<td>6</td>
<td>34</td>
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</tbody>
</table>

### PHYSICAL CHARACTERISTICS

- **Reach length (km):** 13.0
- **Channel width (m):** 95
- **Channel area (ha):** 123.5
- **Gradient (m/kg):** 0.3
- **Flow character:** swirling, rolling
- **Total pools (§):** 90
  - Pattern: irregularly meandering
  - Confinement: unconfined
  - Unstable banks (§): 40
  - Substrate composition (§):
    - Fines (≤2 mm): 95
    - Gravel (2-84 mm): 5
    - Boulders (≥64 mm): 0
    - Bedrock and/or cobbles: 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 nine-spine stickleback, which were captured further upstream in the Firebag River, may spawn in the occasional gravelly 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.

### M加盖IC INVERTEBRATES

No benthic samples were taken in this reach.

### RIPARIAN VEGETATION

- Bank coverage (§): 30
- Coniferous trees: 30
- Deciduous trees: 65
- Shrubs: 10
- Barren: 0
- Channel cover (§): 0
- Overhang: 0
- Crown: 0

### BENTHIC MACROINVERTEBRATES

No data available for this reach.

### BENTHIC MACROINVERTEBRATE PRODUCTIVITY

No data available for this reach.

### STREAM GAUGING DATA

No data available for this reach.

### WATER QUALITY

<table>
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<tr>
<th>Parameter</th>
<th>Mean</th>
<th>Maximum</th>
<th>Minimum</th>
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<td>129.1</td>
<td>100.2</td>
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<tr>
<td>Total hardness (mg CaCO3/l)</td>
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<td>96.1</td>
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<tr>
<td>Conductance (µS/cm)</td>
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<td>231</td>
<td>171</td>
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<tr>
<td>Total turbidity</td>
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<td>100</td>
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<td>Total non-turbidity</td>
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<td>100</td>
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<td>Residue (mg/l)</td>
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<td>13</td>
<td>&lt;0.4</td>
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<tr>
<td>Total organic carbon (mg C/l)</td>
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<td>Silica (mg SiO2/l)</td>
<td>0.006</td>
<td>0.099</td>
<td>&lt;0.005</td>
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<tr>
<td>Nitrate and nitrite nitrogen (mg N/l)</td>
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<td>0.047</td>
<td>0.015</td>
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<tr>
<td>Total phosphorus (mg P/l)</td>
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<td>Chlorides (mg/l)</td>
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<tr>
<td>Sulfate (mg/l)</td>
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<td>5.0</td>
<td>0.1</td>
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</table>

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

### AQUATIC BIOPHYSICAL INVENTORY

**FIREBAG RIVER**

Reach 1

(km 0 to km 13)

Prepared by: LSL LIMITED
### Numbers of Fish Collected (1978)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th></th>
<th>Total Numbers</th>
<th></th>
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</thead>
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<td>May</td>
<td>September</td>
<td>May</td>
<td>September</td>
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<tr>
<td>Arctic grayling</td>
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<td>Brook stickleback</td>
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<td>0</td>
</tr>
<tr>
<td>Lake chub</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Lake whitefish</td>
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<td>3</td>
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<td>0</td>
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<tr>
<td>Longnosed dace</td>
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<tr>
<td>Pearl dace</td>
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<td>0</td>
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<tr>
<td>Silly scalpin</td>
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<tr>
<td>Walleye</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>White sucker</td>
<td>0</td>
<td>1</td>
<td>0</td>
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<tr>
<td>Total</td>
<td>6</td>
<td>5</td>
<td>162</td>
<td>162</td>
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</table>

### Physical Characteristics

- Reach length (km): 32.5
- Channel width (m): 80
- Channel area (ha): 265.0
- Gradient (%): 0.6
- Flow character: swirling, rolling, broken
- Total pools (%): 90
- Pattern: irregularly meandering
- Confined: confined
- Unstable banks (%): 25
- Substrate composition (%):
  - Fine (1/2 mm): 70
  - Gravel (2-64 mm): 25
  - Larges (>64 mm): 5
- Bedrock and/or cobbles: 2

### Reach Description and Fish Utilization

This reach is located above the Athabasca River floodplain and is irregularly meandering with some near-parallel outcrops up to 40 m high. Areas with unstable banks are common. Gradient and water velocities are greater than those in reach I 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 varied, with swirling, rolling and broken waters. Finely comprise the majority of the substrate. Emergent 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 occur 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, longnosed dace and white sucker were captured. The presence of these smaller fish suggests that there is at least some feeding potential for northernpike 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.

### Water Quality

- Water Survey of Canada station number: 0782001
- Mean temperature: 7.6°C
- Maximum temperature: 24.5°C
- Mean dissolved oxygen: 10.5 mg/L
- Maximum dissolved oxygen: 10.9 mg/L
- Conductivity: 153.2 μS/cm
- Total Kjeldahl nitrogen: 0.041 mg/L
- Total phosphorus: 0.001 mg/L
- Orthophosphate (Ca form): 0.004 mg/L
- Alkalinity: 0.1 mg/L

### Aquatic Biophysical Inventory

**Firebag River**

- Reach 2 (km 13.0 to km 45.5)

**Swimming pool conditions, top of reach 2, at km 36.**

Broken waters at km 28.5.
POINT SAMPLE DATA

LEGEND

AQUATIC BIOPHYSICAL INVENTORY
FIREBAG RIVER
Reach 2 Section 1 (km 13 to km 29)
Scale 1:25,000

prepared by LSL
### Numbers of Fish Collected (1998)

<table>
<thead>
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<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-Year</th>
<th>Total Numbers</th>
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<tbody>
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<td>September</td>
<td>May</td>
</tr>
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<td>Arctic grayling</td>
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<td>1</td>
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<td>Lake chub</td>
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<tr>
<td>Longnose dace</td>
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<td>Longnose sucker</td>
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<td>Northern pike</td>
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<tr>
<td>Pearl dace</td>
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<td>Silver spadefish</td>
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<tr>
<td>Unidentified suckers</td>
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</tr>
<tr>
<td>White sucker</td>
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<tr>
<td><strong>Total</strong></td>
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<td><strong>6</strong></td>
<td><strong>6</strong></td>
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</table>

### 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
- **Confinement:** Frequently confined
- **Unstable banks (%)** 20
- **Substrate composition (%)**
  - Finaxes (<2 cm): 10
  - Gravels (2-64 cm): 25
  - Large (>65 cm): 5
- **Bedrock and/or all sand**: Low

### Reach Description and Fish Utilization

This section is a short, irregularly meandering reach. River banks are up to 60 m high and unstable areas are common. Water velocities and gradients are moderately high. Flow character throughout the reach is almost entirely rolling, and pools comprise about half of the total reach area. Large (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 gravelly shallow backwaters, areas shaded by overhanging vegetation, and substrate composed of gravels and large stones provides good rearing areas for most fish species. In the reach, large numbers of young lake chub, white sucker and longnose sucker were captured in this reach. Most young forage fish prefer the quieter sheltered areas, whereas young Arctic grayling prefer rocky substrates. The areas of overhanging riparian vegetation and the numerous pools provide good rearing and feeding areas for larger fish. The high numbers of forage fish, particularly lake chub, provide a good food source for piscivorous fish. Although there are many pools in this reach, the relatively shallow water depths may preclude overwintering of fish.

### Benthic Invertebrates

- **Trichoptera:** Not observed
- **Plecoptera:** Not observed
- **Hexadonta:** Not observed
- **Orthoptera:** Not observed
- **Diptera:** Not observed
- **Chironomidae:** Not observed

### Riparian Vegetation

- **Bank coverage (%)**
  - Coniferous trees: 20
  - Deciduous trees: 40
  - Shrubs: 60
  - Grasses: 20
  - Barren: 0
- **Channel cover (%)**
  - Overhang: 2
  - Crown: 0

### Benthic Algal Productivity

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<th>Bank coverage (%)</th>
<th>Coniferous trees</th>
<th>Deciduous trees</th>
<th>Shrubs</th>
<th>Grasses</th>
<th>Barren</th>
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</tbody>
</table>

### Stream Gaging Data

- No data available for this reach

### Water Quality

- No data available for this reach

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**AQUATIC BIOPHYSICAL INVENTORY**

**FIREBAG RIVER**

Reach 3 (km 45.5 to km 52.0)

**alberta**

**ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM**

prepared by **LSL LIMITED**
### Numbers of Fish Collected (1978)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Yearlings of the Year</th>
<th>Total Numbers</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>May</td>
<td>September</td>
<td>May</td>
</tr>
<tr>
<td>Arctic Grayling</td>
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<tr>
<td>Lake Chub</td>
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<td>0</td>
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<tr>
<td>Longnose Dace</td>
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<td>0</td>
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</tr>
<tr>
<td>Longnose sucker</td>
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<tr>
<td>Nine-spine Stickleback</td>
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<td>Northern Pike</td>
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<tr>
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</tr>
<tr>
<td>Total</td>
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<td>9</td>
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</table>

### Physical Characteristics

- **Reach length (km)**: 23.0
- **Channel width (m)**: 5.0
- **Channel area (ha)**: 12.6
- **Gradient (m/km)**: 1.0
- **Flow character**: swirling
- **Total pools (1)**: 81
- **Pattern**: irregularly meandering
- **Confined**: frequently confined
- **Unusual banks (1)**: 40
- **Substrate composition (%)**
  - 4-16 mm: 5
  - 16-32 mm: 30
  - 32-64 mm: 5
  - 64-128 mm: 40
  - bedrock and/or oil sand: 10
- **Debris**: moderate

### Reach Description and Fish Utilization

Due to river erosion of sand-clay and sand-bluen 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. Large boulders and gravel are dominant substrates. Deciduous trees dominate riparian vegetation, and grasses and sedges are dominant shrubs overtopping the channel. None 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 caught. Adult spring spawners captured here in the spring include arctic grayling, longnose sucker and walleye. Bearing potential for most young fish is considered to be good because of the presence of areas protected by overhanging vegetation, rocky substrates and moderate quantities of debris. Young lake trout 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 trout, provide good feeding areas for walleye and northern pike. Although pools comprise a high percentage of the total reach area, water depths are shallow and fish overwintering is probably limited to isolated deep pools.

### Benthic Invertebrates

**Macrostomia**
- *Plectrodes*
  - *Opisthodora*

**Insects**
- *Diptera*
- *Orthoptera*
- *Hemiptera*
- *Coleoptera*

**Odonata**
- *Dy:Anymphus*
- *Plocamia*

**Trichoptera**
- *Gyrocoryphus*
- *Hydrochopidae*
- *Stiropus*

**Coleoptera**
- *Eriodera*
- *Diptera*
- *Tipulidae*
- *Ephemerellidae*
- *Naucoridae*
- *Coreidae*
- *Eriocnemisidae*
- *Aphalacridae*
- *Ischnorhinae*
- *Mimela*
- *Empididae*

### Riparian Vegetation

- Bank coverage (%): 10
- Coniferous trees: 70
- Deciduous trees: 20
- Grasses: 40
- Berries: 0

### Benthic Algal Productivity

No data available for this reach.

### Stream Gaging Data

No data available for this reach.

### Water Quality

No data available for this reach.

### Aquatic Biophysical Inventory

**Firebag River**

Reach 4

(km 52 to km 75)

Prepared by LSL Limited
**Physical Characteristics**

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-Year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>May</td>
<td>September</td>
<td>May</td>
</tr>
<tr>
<td>Arctic grayling</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Flathead chub</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lake chub</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Longnose dace</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Longnose sucker</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Northern pike</td>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Trout-peninsula</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Unidentified suckers</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>White sucker</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
</tbody>
</table>

- **Reach length (km):** 21.0
- **Channel width (m):** 50
- **Channel area (ha):** 105.0
- **Gradient (°/km):** 1.7
- **Flow character:** swirling, rolling broken
- **Total pools (%):** 25
- **Pattern:** irregularly meandering
- **Confined:** frequently confined
- **Unstable banks (%):** 30
- **Substrate composition (%):**
  - Fine (≤ 2 mm): 10
  - Gravel (2-64 mm): 40
  - Boulders (≥ 64 mm): 50
- **Bedrock and/or all sand:** 0
- **Debris:** low

**Riffle Section of Reach 5 at km 80.**

**Riparian Vegetation**

<table>
<thead>
<tr>
<th>Species</th>
<th>Bank coverage (%)</th>
<th>Canopy trees</th>
<th>Deciduous trees</th>
<th>Shrubs</th>
<th>Grasses</th>
<th>Berries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ephemeroptera</td>
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<td>No data</td>
<td>No data</td>
<td>No data</td>
<td>No data</td>
<td>No data</td>
</tr>
</tbody>
</table>

**Beetle Algal Productivity**

- No data available for this reach

**Stream Sampling Data**

- No data available for this reach

**Water Quality**

- No data available for this reach

**Aquatic Biophysical Inventory**

**Firebag River**

- Reach 5
  - (km 75 to km 96)

**Prepared by LSL Limited**
NUMBERS OF FISH COLLECTED (1989)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults May</th>
<th>Adults September</th>
<th>Juveniles May</th>
<th>Juveniles September</th>
<th>Total Numbers May</th>
<th>Total Numbers September</th>
</tr>
</thead>
<tbody>
<tr>
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<td>1</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>48</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>longnose dace</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>longnose sucker</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>ninespine stickleback</td>
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<td>0</td>
<td>0</td>
<td>0</td>
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<td>2</td>
</tr>
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<td>5</td>
<td>7</td>
<td>12</td>
<td>19</td>
<td>7</td>
<td>19</td>
</tr>
<tr>
<td>slime sculpin</td>
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<td>0</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>trout-perch</td>
<td>0</td>
<td>0</td>
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<td>5</td>
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<td>5</td>
</tr>
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<td>unident. suckers</td>
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<td>31</td>
<td>0</td>
<td>31</td>
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<tr>
<td>walleye</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>white sucker</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>17</td>
<td>7</td>
<td>105</td>
<td>15</td>
<td>122</td>
</tr>
</tbody>
</table>

PHYSICAL CHARACTERISTICS

- Reach Length (km): 27.0
- Channel width (m): 30
- Channel area (ha): 81.0
- Gradient (°/km): 3.3
- Flow character: rolling, broken
- Total pools (%): 30
- Pattern: irregularly meandering
- Unstable banks (%): 5
- Substrate composition (%): fines (≤2 mm) 10, gravels (2-64 mm) 30, boulders (≥64 mm) 60
- Bedrock and/or silt sand
- 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 meandering pool. The river banks are generally stable.

This reach has the steadiest 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 large stones dominate the substrates. Deciduous shrubs dominate riparian vegetation and overhanging the channel in some areas.

The potential of this reach for spawning of both sport and forage fish is considered to be excellent. Numerous gravelly 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. Most arctic grayling, northern pike and walleye were captured in the spring in this reach. The potential for forage 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. Walleye can feed in the more placid backwaters and side sloughs. Fish probably overwinter only in the deeper backwaters of the reach.

BENTHIC INVERTEBRATES

<table>
<thead>
<tr>
<th>COUPLUMNIA</th>
<th>Pontocheilus</th>
<th>Phoxinus</th>
<th>Rutilus</th>
<th>Tullius</th>
<th>Emergerium</th>
<th>Epiobius</th>
<th>Leptolepis</th>
<th>Nith人次</th>
<th>Pyrocestus</th>
<th>Stagniella</th>
<th>Tanytarsus</th>
</tr>
</thead>
<tbody>
<tr>
<td>PELECYPHA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

BENTHIC ALgal PRODUCTIVITY

- No data available for this reach

RIparian VEgetation

- Bank coverage (%): Coniferous trees 25, Deciduous trees 15, Shrubs 50, Grasses 25, Bare 0
- Channel cover (%): Overhang 2, Crown 0

STREAM GRAVITY DATA

- No data available for this reach

WATER QUALITY

- No data available for this reach

AQUATIC BIOPHYSICAL INVENTORY

FIREBAG RIVER

Reach 6

(km 96 to km 123)

prepared by LSL LIMITED
MARGUERITE RIVER
**NUMBERS OF FISH COLLECTED (1979).**

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults May</th>
<th>Adults September</th>
<th>Juveniles and Young-of-the-Year May</th>
<th>Juveniles and Young-of-the-Year September</th>
<th>Total numbers May</th>
<th>Total numbers September</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arctic grayling</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>1</td>
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<tr>
<td>Lake chub</td>
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<td>0</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Longnose dace</td>
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<td>13</td>
<td>0</td>
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<td>1</td>
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<td>1</td>
<td>10</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Northern pike</td>
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<td>0</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Stoney sculpin</td>
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<td>1</td>
<td></td>
</tr>
<tr>
<td>Trout-perch</td>
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<td>0</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Unidentified suckers</td>
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<td>0</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>White sucker</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6</strong></td>
<td><strong>5</strong></td>
<td><strong>1</strong></td>
<td><strong>50</strong></td>
<td><strong>7</strong></td>
<td><strong>55</strong></td>
</tr>
</tbody>
</table>

**PHYSICAL CHARACTERISTICS**

- *Reach length (km):* 3.0
- *Channel width (m):* 4.0
- *Channel area (ha):* 1.0
- *Gradient (¢%/km):* 1.4
- *Flow character:* Broken, tumbling
- *Total pools (¢):* 10
- *Pattern:* Irregular
- *Confined:* Frequently confined
- *Unstable banks (¢):* 10
- *Substrate composition (¢):*
  - *Fines (≥2 mm):* 10
  - *Gravels (2-64 mm):* 25
  - *Larger (≥64 mm):* 45
  - *Bedrock and/or silt 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 ridges. Substrate composition is varied, with gravels and fines 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 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 rocks 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 several species were captured in this reach. Because of the relatively high water velocities and low number of pools, the rearing 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.

**REPTILIAN 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*

---

**AQUATIC BIOPHYSICAL INVENTORY**

**MARGERITE RIVER**

*Reach 1 (km 0 to km 3)*

*Alberta Oil Sands Environmental Research Program*

Prepared by LSL Limited
### Numbers of Fish Collected (1978)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-Year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>May</td>
<td>September</td>
<td>May</td>
</tr>
<tr>
<td>arctic grayling</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>brook stickleback</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>lake chub</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>longnose dace</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>longnose sucker</td>
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</tr>
<tr>
<td>salmonhead sculpin</td>
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<td>0</td>
</tr>
<tr>
<td>trout-perch</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>unidentified suckers</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>white sucker</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
<td>0</td>
<td>11</td>
</tr>
</tbody>
</table>

### Physical Characteristics
- **Reach length (km)**: 16.5
- **Channel width (m)**: 30
- **Channel area (ha)**: 46.5
- **Gradient (m/m)**: 0.8
- **Flow character**: placid, swirling
- **Total pools (%)**: 90
- **Pattern**: tortuously meandering
- **Confined**: confined
- **Suitable banks (%)**: 25
- **Substrate composition (%)**:
  - Fine <2 mm: 70
  - Gravel 2-44 mm: 30
  - Larger >44 mm: 0
  - Bedrock and/or cobbles: 0
- **Debris**: 0

### 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. Confierous 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. Adults were captured in this reach during the study. Nesting 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 pelicans, such as northern pelican. Nesting 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**
- **Insecta**
- **Ephemeroptera**
- **Trichoptera**
- **Diptera**

#### Mertic Algal Productivity
No data available for this reach

#### Stream Sounding Data
No data available for this reach

#### Water Quality
No data available for this reach

### Aquatic Biophysical Inventory
**Marguerite River**

| Reach 2
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(km 3.0 to km 18.5)</td>
</tr>
</tbody>
</table>

*Overhanging vegetation at km 5.*

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

Prepared by LSL Limited
### Numbers of Fish Collected (1993)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults May-September</th>
<th>Juveniles May-September</th>
<th>Total Numbers May-September</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arctic Grayling</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Lake Chub</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Longnose Dace</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Longnose Sucker</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mountain Whitefish</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Northern Pike</td>
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<td>0</td>
</tr>
<tr>
<td>Slender Sculpin</td>
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<tr>
<td>Trout-Perc</td>
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<td>0</td>
</tr>
<tr>
<td>Unidentified Suckers</td>
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<td>0</td>
</tr>
<tr>
<td>White sucker</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
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<td>7</td>
<td>7</td>
</tr>
</tbody>
</table>

### Physical Characteristics

- **Reach length (km):** 1.5
- **Channel width (m):** 26
- **Channel area (ha):** 3.0
- **Gradient (°/100 m):** 3.0
- **Flow character:** Broken, rippling
- **Total pools (0):** 10
- **Polarized:** Irregularly meandering
- **Confinement:** Confined
- **Unstable banks (%):** 25
- **Substrate composition (%):**
  - Finnes (≤2 mm): 30
  - Gravels (2-64 mm): 15
  - Coarse rocks (64-256 mm): 10
  - Bedrock and/or oil sand: 15
- **Debris:** Moderate

### Riparian Vegetation

- **Rank coverage (%):**
  - Coniferous trees: 25
  - Deciduous trees: 25
  - Shrubs: 25
  - Scasses: 25
  - Berries: 0
- **Channel cover (%):**
  - Overhang: 10
  - Crown: 0

### Aquatic Biophysical Inventory

**Marguerite River**

**Reach 3**

**(km 18.5 to km 20.0)**

*Prepared by LSI Limited*
### NUMBERS OF FISH COLLECTED (1978)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults May</th>
<th>Adults September</th>
<th>Juvenile and Young-of-the-year May</th>
<th>Juvenile and Young-of-the-year September</th>
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<th>Total Numbers September</th>
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</tr>
<tr>
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<td>0</td>
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<td>15</td>
<td>1</td>
<td>15</td>
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<tr>
<td>northern pike</td>
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<td>0</td>
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<td>2</td>
</tr>
<tr>
<td>pearl dace</td>
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<td>0</td>
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<td>6</td>
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<tr>
<td>slimy sculpin</td>
<td>0</td>
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<td>12</td>
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<td>unidentified suckers</td>
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<td>6</td>
<td>348</td>
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</tbody>
</table>

### PHYSICAL CHARACTERISTICS

- Reach length (km): 41.0
- Channel width (m): 25
- Channel area (ha): 100.5
- Gradient (‰): 3.4
- Flow character: placid
- Total pools (%): 95

- Pattern: Irregularly meandering
- Confine: Occasionally confined
- Stable banks (%): 20
- Substrate composition (%):
  - Fines (<2 mm): 90
  - Gravels (2-64 mm): 0
  - Larges (64-256 mm): 10
  - Bedrock and/or all sand: 0
  - Debris: High

### REACH DESCRIPTION AND CODDITUAL 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 on 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 rearing 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

- **Plecoptera**
  - Hesperoperla
  - Phylloperla
- **Ephemera**
  - Simulium
- **Insecta**
  - Hemiptera
  - Coleoptera
  - Trichoptera
  - Lepidoptera/Philaenoptera
- **Dinopera**
- **Tipulidae**
  - Chironomidae
  - Chlorocerinae
  - Tanypodinae
  - Orthocladiinae

### BENTHIC ALGAL PRODUCTIVITY

No data available for this reach

### STREAM GAGES DATA

No data available for this reach

### WATER QUALITY

No data available for this reach

### AQUATIC BIOPHYSICAL INVENTORY

**MARGUERITE RIVER**

Reach 4

(km 20 to km 61)

Alberta Oil Sands Environmental Research Program

Prepared by LSL Limited
### Numbers of Fish Collected (1978)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juvenile-of-the-year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>May</td>
<td>September</td>
<td>May</td>
</tr>
<tr>
<td>Arctic Grayling</td>
<td>0</td>
<td>ND</td>
<td>6</td>
</tr>
<tr>
<td>Slender Sculpin</td>
<td>3</td>
<td>ND</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>ND</td>
<td>13</td>
</tr>
</tbody>
</table>

### Physical Characteristics

- Reach length (km): 14.0
- Channel width (m): 20
- Channel area (ha): 28.0
- Gradient (m/m): 0.8
- Flow character: rolling, broken
- Total pools (%): 25
- Pattern: irregularly meandering
- Confluence: unconfined
- Uneven banks (%): 5
- Substrate composition (%): fines (<2 mm): 20, gravel (2-64 mm): 20, large (164 mm): 40, bedrock and/or cobble sand: 20, debris: high

### Reach Description and Fish Utilization

This reach is the uppermost segment 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 large rocks with fines and gravel. 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 A, 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 rocks substrate materials provide good to excellent rearing conditions for most fish. The potential for nesting 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 valuable. Shallow water depths and the relative paucity of deep pools limit overwintering potential in this reach.

### Riparian Vegetation

- Bank coverage (%):
  - Coniferous trees: 15
  - Deciduous trees: 65
  - Shrubs: 25
  - Gravels: 10
  - Barren: 0
- Channel cover (%):
  - Overhang: 10
  - Crown: 0

### Benthic Algal Productivity

No data available for this reach.

### Stream Seaweed 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)

*Alberta Oil Sands Environmental Research Program*

Prepared by LSL Limited
MUSKEG RIVER
NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearl dace</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Slender sculpin</td>
<td>0</td>
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<td>2</td>
</tr>
<tr>
<td>Total</td>
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PHYSICAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
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<tbody>
<tr>
<td>Reach length (km)</td>
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<tr>
<td>Channel width (m)</td>
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</tr>
<tr>
<td>Channel area (ha)</td>
<td>1.3</td>
</tr>
<tr>
<td>Gradient (m/km)</td>
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</tr>
<tr>
<td>Flow character</td>
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<tr>
<td>Total pools (1)</td>
<td>65</td>
</tr>
<tr>
<td>Pattern</td>
<td>Sinuous</td>
</tr>
<tr>
<td>Confinement</td>
<td>Unconfirmed</td>
</tr>
<tr>
<td>Unstable banks  (1)</td>
<td>30</td>
</tr>
<tr>
<td>Substrate composition (1)</td>
<td></td>
</tr>
<tr>
<td>Finely (&lt;2 mm)</td>
<td>20</td>
</tr>
<tr>
<td>Gravels (2-16 mm)</td>
<td>50</td>
</tr>
<tr>
<td>Larger (&gt;16 mm)</td>
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<tr>
<td>Bedrock and/or oil sand</td>
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UNSTABLE BANKS (1)

BENTHIC INVERTEBRATES

| Taxonomy       | Rank cover (%)
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<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Oligochaeta</td>
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</tr>
<tr>
<td>Gastrotricha</td>
<td>10</td>
</tr>
<tr>
<td>Protura</td>
<td>10</td>
</tr>
<tr>
<td>Trichoptera</td>
<td>10</td>
</tr>
<tr>
<td>Plecoptera</td>
<td>10</td>
</tr>
<tr>
<td>Nematoda</td>
<td>15</td>
</tr>
<tr>
<td>Insecta</td>
<td>10</td>
</tr>
<tr>
<td>Ephemeroptera</td>
<td>10</td>
</tr>
<tr>
<td>Plecoptera</td>
<td>10</td>
</tr>
<tr>
<td>Neuroptera</td>
<td>10</td>
</tr>
<tr>
<td>Diptera</td>
<td>10</td>
</tr>
<tr>
<td>Chironomidae</td>
<td>10</td>
</tr>
<tr>
<td>Trichoptera</td>
<td>10</td>
</tr>
</tbody>
</table>

REACH DESCRIPTION AND FISH UTILIZATION

This lower reach of the Musk 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 cobblestones. 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 Musk River (e.g., Arctic grayling, longnose sucker, white sucker, trout-perch), most of these species are believed to spawn farther upstream in the Musk 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 reach region of the Musk River would appear to provide good forage for piscivorous species. The reach region may also be of some importance as a rearing 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 ALGAL PRODUCTIVITY

| Taxonomy       | Rank cover (%)
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Oligochaeta</td>
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<td>Gastrotricha</td>
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<td>Protura</td>
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<td>Trichoptera</td>
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<td>Plecoptera</td>
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<td>Nematoda</td>
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<td>Insecta</td>
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<td>Ephemeroptera</td>
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<td>Plecoptera</td>
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<td>Neuroptera</td>
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<td>Diptera</td>
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<td>Chironomidae</td>
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<tr>
<td>Trichoptera</td>
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STREAM SEDIMENT DATA

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WATER QUALITY

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<th>Feature</th>
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<tbody>
<tr>
<td>Water Survey of Canada station number</td>
<td>D4A060029</td>
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<tr>
<td>Total alkalinity (mg CaCO3/l)</td>
<td>250-790</td>
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<tr>
<td>DO (mg/l)</td>
<td>7.0-8.3</td>
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<tr>
<td>Total hardness (mg CaCO3/l)</td>
<td>289.2-408.3</td>
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<tr>
<td>Conductance (uS/cm)</td>
<td>473-1580</td>
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<tr>
<td>Total dissolved residue fixed (mg/l)</td>
<td>241-228</td>
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<tr>
<td>Total non-dissolved residue fixed (mg/l)</td>
<td>5-8</td>
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<tr>
<td>Total organic carbon (mg/l)</td>
<td>70.5-80.0</td>
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<tr>
<td>Silica (mg/l)</td>
<td>15.0-53.0</td>
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<tr>
<td>Alkalinity and dissolved nitrogen (mg/l)</td>
<td>0.030-0.070</td>
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<tr>
<td>Total dissolved phosphorus (mg/l)</td>
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<tr>
<td>Total dissolved nitrogen (mg/l)</td>
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<tr>
<td>Total dissolved sulphate (mg/l)</td>
<td>3.5-16.0</td>
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</table>

Data for the period January 1970 to December 1979 obtained from the National Water Quality Data Bank (MSA060029).

AQUATIC BIOPHYSICAL INVENTORY

MUSK CRIVER

Reach 1

(km 0.0 to km 0.5)

Musk River 30 km upstream from confluence with the Athabasca River.

Confluence of the Musk River with the Athabasca River.

Prepared by LSL LIMITED
**Physical Characteristics**

- **Reach length (km)**: 8.5
- **Channel width (m)**: 15
- **Channel area (ha)**: 15.2
- **Gradient (c/km)**: 1.7
- **Flow character**: swirling, rolling, broken
- **Total pools (3)**: 40
- **Total adults**: 4
- **Total young-of-the-year**: 27

**Beach 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 large stones, 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, silvery 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 pelagic species. Water depths in the pools are moderately deep and at least some pool areas may be suitable overwintering sites for some fish.

**Hypotrich Invertebrates**

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Young-of-the-year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>arctic grayling</td>
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<td>2</td>
<td>2</td>
</tr>
<tr>
<td>longnose dace</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>pearl dace</td>
<td>3</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>silvery sculpin</td>
<td>1</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>white sucker</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
<td>27</td>
<td>31</td>
</tr>
</tbody>
</table>

**Riparian Vegetation**

- **Bank coverage (%)**
  - Coniferous trees: 15
  - Deciduous trees: 65
  - Shrubs: 35
  - Grasses: 65
  - Berries: 5
- **Channel cover (%)**
  - Overhang: 2
  - Crown: 2

**Riparian Algal Productivity**

No data available for this reach.

**Stream Causing Data**

No data available for this reach.

**Water Quality**

No data available for this reach.
**Numbers of Fish Collected (September 1979)**

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-Year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>longnose sucker</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>northern pike</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>pearl dace</td>
<td>0</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>slimy spladin</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>22</td>
<td>25</td>
</tr>
</tbody>
</table>

**Physical Characteristics**

- **Reach length (km)**: 7.5
- **Channel width (m)**: 16
- **Channel area (ha)**: 1.5
- **Gradient (m/km)**: 1.0
- **Flow character**: pleated, swirling, rolling
- **Total pools (1)**: 80
- **Pattern**: Irregularly meandering
- **Confinement**: occasionally confined
- **Unstable banks (1)**: 10
- **Substrate composition (1)**: 
  - Fine sand (2-63 mm): 30
  - Gravel (6-64 mm): 50
  - Largemouth bass (1-4 mm): 20
  - Redrock and/or silt sand: 3
- **Debris**: moderate

**Riparian Vegetation**

- **Bank coverage (%)**: 10
- **Confined trees**: 10
- **Deciduous trees**: 60
- **Shrubs**: 50
- **Grasses**: 65
- **Bare**: 2

**Benthic Algal Productivity**

- Standing crop expressed as cell counts (number·m⁻²): mean = 7.69 x 10^12
- Maximum = 5.5 x 10^12
- Minimum = 1.3 x 10^12

- Standing crop expressed as chlorophyll a (μg·m⁻²): mean = 77.7
- Maximum = 87.7
- Minimum = 66.7

- Primary productivity (mg·C·m⁻²·d⁻¹): mean = 26.4
- Maximum = 103.5
- Minimum = 6.3

Data from Michal et al. (1980).

**Stream Water Quality**

- Water Survey of Canada station number: 073A000
- Maximum total annual discharge: 193.9 x 10⁶ cfs (1924)
- Minimum total annual discharge: 16.4 x 10⁶ cfs (1955)
- Maximum annual mean discharge: 8.31 m³/s (1974)
- Minimum annual mean discharge: 0.01 m³/s (1956)
- Maximum monthly mean discharge: 21.95 m³/s (September 1978)
- Minimum monthly mean discharge: 0.12 m³/s (April 1929)
- Data for 1924 to 1958 compiled from Leopold and Spitzer (1967), Garner and Spitzer (1959) and Garner (1959).

- Temperature (°C): Mean = 12.9, Minimum = 7.6, Maximum = 29.1
- Dissolved oxygen (mg/L): Mean = 9.0, Minimum = 4.0, Maximum = 14.4
- Total alkalinity (mg CaCO₃/L): Mean = 173.4, Minimum = 120.0, Maximum = 230.5
- Total hardness (mg CaCO₃/L): Mean = 73.8, Minimum = 39.2, Maximum = 121.1
- Conductivity (mS/m): Mean = 399.5, Minimum = 159.3, Maximum = 530.0
- TDS (mg/L): Mean = 104.6, Minimum = 59.4, Maximum = 159.8
- Total nitrogen (mg/L): Mean = 10.6, Minimum = 0.10, Maximum = 32.3
- Nitrate and nitrite nitrogen (mg/L): Mean = 0.00, Minimum = 0.00, Maximum = 0.00
- Total phosphorus (mg/L): Mean = 0.00, Minimum = 0.00, Maximum = 0.00
- Orthophosphate (mg/L): Mean = 0.00, Minimum = 0.00, Maximum = 0.00
- Chloride (mg/L): Mean = 4.6, Minimum = 2.5, Maximum = 6.1

Data for the period January 1976 to December 1979 obtained from the National Water Quality Data Base (NWQDB).
**PHYSICAL CHARACTERISTICS**

<table>
<thead>
<tr>
<th></th>
<th>Adults</th>
<th>Juvenile and&lt;br&gt;Young-of-the-year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>smart dace</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>white sucker</td>
<td>0</td>
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<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
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<td>2</td>
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</tbody>
</table>

**REACH DESCRIPTION AND FISH UTILIZATION**

This long, low-gradient reach meanders through a large area of marshy terrain 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 Harlley 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 to dense throughout the reach. The reach appears to be suitable for spawning for many species. Current potential is good because it has ample cover provided by woody debris and aquatic vegetation. Water depths in this reach appear to be sufficient to allow overwintering of fish.

**BENTHIC INVERTEBRATES**

<table>
<thead>
<tr>
<th>Order</th>
<th>Family</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastropoda</td>
<td><em>Lymnaea</em></td>
<td><em>Lymnaea stagnalis</em></td>
</tr>
<tr>
<td><em>Physella</em></td>
<td><em>Physella peregra</em></td>
<td><em>Physella peregra</em></td>
</tr>
<tr>
<td><em>Pila</em></td>
<td><em>Pila cretica</em></td>
<td><em>Pila cretica</em></td>
</tr>
<tr>
<td><em>Planorbaria</em></td>
<td><em>Planorbaria denticulata</em></td>
<td><em>Planorbaria denticulata</em></td>
</tr>
<tr>
<td><em>Potamopyrgus</em></td>
<td><em>Potamopyrgus laevis</em></td>
<td><em>Potamopyrgus laevis</em></td>
</tr>
<tr>
<td><em>Semisulcospira</em></td>
<td><em>Semisulcospira</em></td>
<td><em>Semisulcospira</em></td>
</tr>
</tbody>
</table>

**RIPARIAN VEGETATION**

- Bank coverage: 1 (Sedimentation)
- Deciduous trees: 30
- Shrubs: 15
- Grasses: 95
- Barren: 0
- Channel cover: 1 (Sedimentation)
- Shrubs: 10

**BENTHIC PLANKTON PRODUCTIVITY**

No data available for this reach.

**STREAM SEDIMENT DATA**

No data available for this reach.

**WATER QUALITY**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkalinity (mg CaCO3/l)</td>
<td>212.3</td>
<td>327.2</td>
<td>76.0</td>
</tr>
<tr>
<td>pH</td>
<td>7.00</td>
<td>8.20</td>
<td>7.10</td>
</tr>
<tr>
<td>Total hardness (mg CaCO3/l)</td>
<td>207.5</td>
<td>297.4</td>
<td>235.6</td>
</tr>
<tr>
<td>Dissolved oxygen (mg/l)</td>
<td>6.00</td>
<td>6.00</td>
<td>5.90</td>
</tr>
<tr>
<td>Residual Fused (mg/l)</td>
<td>203</td>
<td>203</td>
<td>131</td>
</tr>
<tr>
<td>Residual Fused (mg/l)</td>
<td>4.50</td>
<td>5.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Total Organic Carbon (mg/l)</td>
<td>95.0</td>
<td>95.0</td>
<td>95.0</td>
</tr>
<tr>
<td>Total Nitrogen (mg/l)</td>
<td>11.5</td>
<td>17.5</td>
<td>14.2</td>
</tr>
<tr>
<td>Total Phosphorus (mg/l)</td>
<td>0.009</td>
<td>0.010</td>
<td>0.009</td>
</tr>
</tbody>
</table>

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

**AQUATIC BIOPHYSICAL INVENTORY**

**MUSKEG RIVER**

Reach 4 (km 16.5 to km 80.0)

Fluctuating, sparsely vegetated banks at km 77.5 are typical of this reach.

Dense overhanging bank vegetation at km 22.

Prepared by LSL LIMITED.
AQUATIC BIOPHYSICAL INVENTORY
MUSKEG RIVER
Reach 4 Section 2
(km 33 to km 54)
Scale 1:25,000
prepared by LGL LIMITED
PHYSICAL CHARACTERISTICS

Reach length (km) 13.0
Channel width (m) 9
Channel area (ha) 11.7
Gradient (m/km) 2.8
Flow character place, swirling
Total pools (1) 40
Pattern Irregularly meandering
Confinement occasionally confined
Omologous banks (1) 0
Substrate composition (1)
Fine Sand (2-64 mm) 80
Gravel (2-64 mm) 10
Larger (1-64 mm) 10
bedrock and/or all 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 gravel and cobbles. Continuous 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.

WATER QUALITY

Water Survey of Canada station number 03A072840094

- Mean
- Maximum
- Minimum
Total alkalinity (mg CaCO₃/l) 298.3 322.0 274.2
pH 7.96 8.00 7.00
Total hardness (mg CaCO₃/l) 294.2 685.0 78.3
Conductance (µS/cm) 417 1200 142
Total
residue fixed (mg/l) 206 591 81
Iron (µg/l) 3.7 8.0 0.2
Vanadium (µg/l) 0.350 0.510 0.003
Nitrate and nitrite nitrogen (µg/l) 0.00 0.510 0.003
Total Kjeldahl nitrogen (µg/l) 2.05 4.10 0.10
Total Phosphorus (µg/l) 0.130 0.520 0.015
Dissolved phosphorus (µg/l) 0.000 0.460 0.010
Sulphate (µg/l) 4.0 8.5 0.1

Data for the period January 1973 to December 1979 obtained from the National Water Quality Data Bank (NADWQDB).

AQUATIC BIOPHYSICAL INVENTORY

MUSKEG RIVER
Reach 5
(km 80 to km 93)

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

Dense overhanging bank vegetation and abundant debris, typical of reach 5, on R. 7.
**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 INDIGENETES**

No benthic samples were taken in this reach.

<table>
<thead>
<tr>
<th>BENTHIC AGAL PRODUCTIVITY</th>
<th>RAPID VEGETATION</th>
<th>BENTHIC INDIGENETES</th>
<th>PHYSICAL CHARACTERISTICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>No data available for this reach</td>
<td>No data available for this reach</td>
<td>No data available for this reach</td>
<td>Reach length (km) 13.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Channel width (m) 8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Channel area (ha) 15.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Gradient (m/km) 4.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Flow character placid</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total pools (%) 100</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pattern Irregularly meandering</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Confined unconfined</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Unusable banks (%) 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Substrate composition (%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fines (0.2 mm) 100</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Gravel (2-64 mm) 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Larger (&gt;64 mm) 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bedrock and/or oil sand 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Debris high</td>
</tr>
</tbody>
</table>

**STREAM CATEGIZING 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)
HARTLEY CREEK
## Reach Description and Fish Utilization

This short, tortuously meandering reach extends upstream 4.5 km from the confluence of Hartley Creek and the Waskesiu 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.

Windy areas along the banks provide good spawning habitat for brook stickelback 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 high water velocities and the abundant riparian 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.

## Fish Utilization

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-Year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>brook stickelback</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>pearl dace</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

## Riparian Vegetation

<table>
<thead>
<tr>
<th>Plant Type</th>
<th>Bank Coverage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coniferous trees</td>
<td></td>
</tr>
<tr>
<td>Deciduous trees</td>
<td>0</td>
</tr>
<tr>
<td>Shrubs</td>
<td>35</td>
</tr>
<tr>
<td>Grasses</td>
<td>90</td>
</tr>
<tr>
<td>Barren</td>
<td>0</td>
</tr>
</tbody>
</table>

## Benthic Algal Productivity

No data available for this reach.

## Streamflow Data

Water Survey of Canada station number 036053

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Maximum</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total annual discharge</td>
<td>62.2 x 10^6 m³</td>
<td>28.1 x 10^6 m³</td>
</tr>
<tr>
<td>Mean annual discharge</td>
<td>1.97 m³/s</td>
<td>0.85 m³/s</td>
</tr>
<tr>
<td>Mean monthly discharge</td>
<td>9.50 m³/s</td>
<td>3.00 m³/s</td>
</tr>
<tr>
<td>Daily discharge</td>
<td>16.95 m³</td>
<td>0.05 m³</td>
</tr>
</tbody>
</table>

## Water Quality

Water Survey of Canada station number 004702085090

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total alkalinity (mg CaCO₃/l)</td>
<td>103.4</td>
<td>30.2</td>
</tr>
<tr>
<td>Nitrate (mg N/l)</td>
<td>0.050</td>
<td>0.020</td>
</tr>
<tr>
<td>Total Kjeldahl nitrogen (mg N/l)</td>
<td>1.23</td>
<td>0.05</td>
</tr>
<tr>
<td>Total phosphorus (mg P/l)</td>
<td>0.010</td>
<td>0.000</td>
</tr>
<tr>
<td>Orthophosphate (mg P/l)</td>
<td>0.010</td>
<td>0.000</td>
</tr>
</tbody>
</table>

## Aquatic Biophysical Inventory

**HARTLEY CREEK**

Reach 1

(km 0.0 to km 4.5)

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

Prepared by LSL WATERS.
NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>arctic grayling</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>brook stickleback</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>aliny snipe</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>white sucker</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>7</td>
<td>10</td>
</tr>
</tbody>
</table>

PHYSICAL CHARACTERISTICS

- Reach length (km): 16.5
- Channel width (m): 10
- Channel area (ha): 16.5
- Gradient (m/m): 2.1
- Flow character: place, swirling, rolling
- Total pools (%): 20
- Pattern: irregularly meandering
- Confined: occasionally confined
- Unstable banks (%): 0
- Substrate composition (%):
  - Fin. silt 30
  - Gravel (2-64 mm): 5
  - Large (64 mm+): 5
  - Bedrock and/or all 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 place 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, snow shiner). 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 rearing and feeding of larger fish. Water depths appear to be sufficient for overwintering of fish.

BENTHIC INVERTEBRATES

- Mayfly
- Oligochaeta
- Gastropoda
- Pelecypoda
- Annelida
- Hydrozoa

REPARIAN VEGETATION

- Bank coverage (%):
  - Coniferous trees: 15
  - Deciduous trees: 40
  - Shrubs: 30
  - Grasses: 86
  - Bulrush: 0

- Channel cover (%):
  - Overhang: 5
  - Creek: 10

BENTHIC ALGA PRODUCTIVITY

No data available for this reach

STREAM CARRYING DATA

No data available for this reach

WATER QUALITY

- Water Survey of Canada station number: 03A029400B2
- Data for the period January 1956 to December 1979 obtained from the National Water Quality Data Bank (M920484B7)

AQUATIC BIOPHYSICAL INVENTORY

HARTLEY CREEK

Reach 2
(km 4.5 to km 21.0)
### PHYSICAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>pearl dace</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

- **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 (100)**: 95
- **Pattern**: tortuously meandering
- **Confined**: unconfined
- **Unstable banks (100)**: 0
- **Substrate composition (100)**:
  - Fine (0-2 mm): 90
  - Gravel (2-64 mm): 5
  - Sand (64-256 mm): 5
  - Bedrock and/or gravel: 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 decumbent 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. Most areas with sand substrates are probably suitable for spawning of pearl dace, and the abundant aquatic vegetation provides suitable spawning habitats 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 depth in this reach appear to be sufficient to allow overwintering of fish.

### NATURAL ALGAL PRODUCTIVITY

No data available for this reach.

### RIPARIAN VEGETATION

<table>
<thead>
<tr>
<th>Bank coverage (%)</th>
<th>Coniferous trees</th>
<th>Deciduous trees</th>
<th>Shrubs</th>
<th>Barrens</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15</td>
<td>60</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Channel cover (%)</td>
<td>Overhang</td>
<td>Crown</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### AQUATIC BIOPHYSICAL INVENTORY

**HARTLEY CREEK**

**Reach 3**

(km 21 to km 49)

Prepared by LSL LIMITED

**WATER QUALITY**

- **Water Survey of Canada station number**: 00AT02040985
- **Mean Total alkalinity (mg CaCO3/l)**: 160.5
- **Mean Total hardness (mg CaCO3/l)**: 140.0
- **Mean Conductance (μS/cm)**: 390.0
- **Mean Total filtrable residue (mg/l)**: 155.0
- **Mean Total nonfiltrable residue (mg/l)**: 15
- **Mean Total organic carbon (mg/l)**: 27.0
- **Mean Nitrate (mg N/l)**: 0.21
- **Mean Total ammonium (mg N/l)**: 0.16
- **Mean orthophosphate (mg P/l)**: 0.020

Data for the period January 1979 to December 1979 obtained from the National Water Quality Data Bank (NAWQDB).
**Fish Collection**

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-Year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brook stickleback</td>
<td>6</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>White sucker</td>
<td>0</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>26</td>
<td>32</td>
</tr>
</tbody>
</table>

**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 (1): 90
- Fingers: occasionally confined
- Unstable banks (1): 2
- Substrate composition (1):
  - Flows (1-2 cm): 90%
  - Gravel (0-64 mm): 5%
  - Rocks (64 mm): 0
  - Bedrock and/or all 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**

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Abundance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hirudinea</td>
<td>10</td>
</tr>
<tr>
<td>Ephemeroptera</td>
<td>10</td>
</tr>
<tr>
<td>Trichoptera</td>
<td>5</td>
</tr>
<tr>
<td>Coleoptera</td>
<td>5</td>
</tr>
<tr>
<td>Odonata</td>
<td>5</td>
</tr>
<tr>
<td>Annelida</td>
<td>5</td>
</tr>
<tr>
<td>Mollusca</td>
<td>5</td>
</tr>
<tr>
<td>Branchiura</td>
<td>5</td>
</tr>
<tr>
<td>Oligochaeta</td>
<td>5</td>
</tr>
</tbody>
</table>

**Riparian Vegetation**

- Bank coverage (%): 30
- Coniferous trees: 20
- Deciduous trees: 40
- Shrubs: 25
- Grasses: 30
- Berries: 0
- Channel cover (%):
  - Overhang: 5
  - Crown: 5

**Aquatic Biophysical Inventory**

**Hartley Creek**

Reach 4

(km 49.0 to km 61.5)

Prepared by LSL LIMITED
STEEP BANK RIVER
NUMBERS OF FISH COLLECTED (1978)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juvenile and Young-of-the-Year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>June</td>
<td>September</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Arctic Grayling</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lake Chub</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Longnose Dace</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Longnose Sucker</td>
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<td>0</td>
<td>0</td>
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<tr>
<td>Mountain Whitefish</td>
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<td>0</td>
</tr>
<tr>
<td>Pearl Dace</td>
<td>0</td>
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<tr>
<td>Slender Suckmin</td>
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<tr>
<td>Spoonhead Suckmin</td>
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<tr>
<td>Trout-Perch</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Unidentified Suckers</td>
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</tr>
<tr>
<td>White Sucker</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Total</td>
<td>5</td>
<td>4</td>
<td>9</td>
</tr>
</tbody>
</table>

PHYSICAL CHARACTERISTICS

- Reach length (km): 2.0
- Channel width (m): 40
- Channel area (ha): 4.0
- Gradient (%): 3.7
- Flow character: swirling, rolling
- Total pools (1): 50
- Pattern: irregular
- Confinement: occasionally confined
- Unstable banks (1): 10
- Substrate composition (1): fines (0-2 mm): 15
- gravel <2-6 mm>: 50
- large >6-16 mm: 35
- bedrock and/or cobbles: 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 sandy 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 slender suckmin were particularly abundant in September. The moderately deep water and numerous pools in the reach provide suitable rearing, 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).

RIPARIAN VEGETATION

- Coniferous trees: 25
- Deciduous trees: 50
- Shrubs: 15
- Grasses: 5
- Barren: 3
- Channel cover (%):
  - Overhang: 0
  - Crown: 0
- Standing crop expressed as cell counts (number/m²):
  - mean: 1.6 x 10³
  - median: 1.6 x 10³
  - minimum: 1.0 x 10³
- Standing crop expressed as chlorophyll a (mg/m²):
  - mean: 50
  - median: 20
  - minimum: 10
- Primary productivity (g C/m²/yr):
  - mean: 8
  - median: 5
  - minimum: 3.5

Data from Hickman et al. (1980).

AQUATIC BIOPHYSICAL INVENTORY

STEEP BANK RIVER

Reach 1
(km 0 to km 2)

CONFLUENCE OF THE STEEP BANK WITH THE ATHABASCA RIVER.
### Numbers of Fish Collected (1995)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-Year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>June</td>
<td>September</td>
<td>June</td>
</tr>
<tr>
<td>Arctic grayling</td>
<td>0</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Lake chub</td>
<td>0</td>
<td></td>
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</tr>
<tr>
<td>Longnose dace</td>
<td>0</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Longnose sucker</td>
<td>0</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Pearl dace</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Slime sculpin</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>White sucker</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>0</td>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>

### Physical Characteristics

- **Reach length (km)**: 12.0
- **Channel width (m)**: 12
- **Channel area (ha)**: 14.8
- **Gradient (m/m)**: 3.1
- **Flow character**: Rolling, broken
- **Total pools (5)**: 59
- **Pattern**: Irregularly meandering
- **Confluence**: Entrenched
- **Umbrella banks (1)**: 20
- **Substrate composition (%)**: Finer (≤2 mm) 15, gravel (2-64 mm) 30, larger (>64 mm) 60, bedrock and/or oil sand 15

### Benthic Invertebrates

- No benthic samples were taken in this reach.

### Riparian Vegetation

- Bank coverage (1)
  - Coniferous trees: 20
  - Deciduous trees: 50
  - Shrubs: 10
  - Grasses: 10
  - Vines: 10
- Channel cover (5)
  - Reeds: 9
  - Cattails: 0

### Benthic Algal Productivity

- No data available for this reach.

### Stream Discharge Data

- **Water Survey of Canada station number:** 007022804804
- Maximum total annual discharge: 3,311.8 m³/s (1975)
- Maximum annual mean discharge: 1,001.5 m³/s (1975)
- Maximum annual mean storage: 1,001.5 m³/s (1975)
- Maximum monthly mean discharge: 50.3 m³/s (September 1975)
- Maximum daily discharge: 60.1 m³/s (Apr. 27, 1975)
- Minimum daily discharge: 0.23 m³/s (Dec. 18, 1977)

### Water Quality Data

- **Water Survey of Canada station number:** 007022804808
- Mean: 168.3, 166.0, 307
- Maximum: 320.4, 320.4, 625
- Minimum: 10.4, 10.4, 85
- **Total alkalinity (mg CaCO3/l):** 149, 146.3, 166.0
- **pH:** 7.30, 7.30, 7.30
- **Total hardness (mg CaCO3/l):** 146.3, 166.0, 307
- **Conductance (μS/cm):** 29.0, 31.0, 29.0
- **Dissolved oxygen (mg/l):** 153, 153, 304
- **Residual fixed (mg/l):** 153, 153, 304
- **Total organic carbon (mg/kg):** 153, 153, 304
- **Silica (mg/l):** 8.2, 8.2, 14.5
- **Nitrate and nitrite nitrogen (mg N/l):** 0.011, 0.011, 0.046
- **Total Kjeldahl nitrogen (mg N/l):** 0.128, 0.128, 0.128
- **Total phosphorus (mg P/l):** 0.010, 0.010, 0.010
- **Dissolved phosphate (mg P/l):** 0.010, 0.010, 0.010
- **Sulphate (mg SO4/l):** 8.5, 8.5, 8.5

### Aquatic Biophysical Inventory

#### Steepbank River

- Reach 2 (km 2 to km 14)

[Image of the water survey of Canada stream discharge station at km 8.] [Image of Steepbank River at km 12.]
### Numbers of Fish Collected (1988)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-Year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>June</td>
<td>September</td>
<td>June</td>
</tr>
<tr>
<td>Arctic grayling</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Lake chub</td>
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<tr>
<td>Longnose dace</td>
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</tr>
<tr>
<td>Longnose sucker</td>
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<td>2</td>
</tr>
<tr>
<td>Pearl dace</td>
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<td>6</td>
</tr>
<tr>
<td>Slender sculpin</td>
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<td>7</td>
</tr>
<tr>
<td>Trout shiner</td>
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<td>0</td>
<td>11</td>
</tr>
<tr>
<td>Wall-eyed</td>
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</tr>
<tr>
<td>White sucker</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
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<td>4</td>
<td>52</td>
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</table>

### Physical Characteristics

- Reach length (km): 28.0
- Channel width (m): 12
- Channel area (ha): 3.6
- Gradient (m/km): 4.5
- Flow character: swirling, rolling, broken
- Total pools (5): 40
- Pattern: sinuous
- Confined: confined
- Unstable banks: 10
- Substrate composition:
  - fines (<2 mm): 15
  - gravel (2-64 mm): 65
  - larger (>64 mm): 10
  - bedrock and/or cobble: 0
- Debris: low

### Benthic Invertebrates

#### Insects
- Ephemeroptera
  - Chironomidae
    - Steleacridae
    - Hydropsychidae
    - Calopterygidae
    - Odonata
      - Calopterygidae
      - Ephemeroptera
    - Plecoptera
    - Trichoptera
      - Limnephilidae
      - Lepidostoma
    - Diplopoda
    - Diplopoda
- Trilobidae
- Psychidae
- Corixidae
- Chironomidae
- Heptageniidae
- Simuliidae
- Tabanidae
- Rhingiaidae
- Ephemerida

### Benthic Algal Productivity
- Bank coverage: 50
  - Confined trees: 20
  - Deciduous trees: 25
  - Shrub: 10
  - Grasses: 10
  - Barren: 0
- Channel Cover: 7
  - Overhang: 3
  - Crown: 0

### Stream Qualifying Data
- No data available for this reach

### Water Quality
- No data available for this reach

### 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 of the Steepbank River is characterized by high gradients and steep canyon walls. Water velocity is generally high, and the flow character varies from swirling to rolling to broken. Pools comprise a lower proportion of the total reach than in other sections of the river. Substrates are composed primarily of gravels and large rocks. Confined 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 gravel beds present in this reach are excellent for spawning of northern pike and stockeeback. The potential for large fish is considered to be good because of the rocky substrates and gravelly areas along the banks of the river where the water is shallow. Higher numbers of young fish were captured in this reach during this study than in other sections of the Steepbank River. The numbers of slender sculpins were particularly high. Suitable areas for large fish to rest and feed are found in the pools. Moderately deep waters and pools provide some overwintering potential for fish.
NUMBER OF FISH COLLECTED (1981)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juvenile and Young-of-the-Year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>June</td>
<td>September</td>
<td>June</td>
</tr>
<tr>
<td>Arctic grayling</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Brook stickleback</td>
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</tr>
<tr>
<td>Longnose dace</td>
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<tr>
<td>Pearl dace</td>
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<tr>
<td>Slimy sculpin</td>
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</tr>
<tr>
<td>Unidentified fry</td>
<td>NK</td>
<td>NK</td>
<td>NK</td>
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<tr>
<td>Total</td>
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PHYSICAL CHARACTERISTICS

- Reach length (km): 5.0
- Channel width (m): 15
- Channel area (ha): 5.0
- Gradient (m/m): 2.0
- Flow character: swirling, rolling, broken
- Total pools (2): 50
- Pattern: sinuous
- Confined: confined
- Unstable banks (2): 5
- Substrate composition (5):
  - Fine (≤2 mm): 20
  - Gravel (2-64 mm): 20
  - Largay (>64 mm): 60
- Bedrock and/or soil: 10
- 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 large rocks with smaller amounts of both fines and gravel. 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 these 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 substrate (juvenile fish) and in the fine areas chattered by overhanging vegetation (juvenile fish). Pools provide the major suitable rearing and feeding areas for larger fish. Although pools are numerous in this reach, they are not particularly deep; therefore, overwintering potential may be limited.

REPAIRABLE VEGETATION

- Bank cover (3): 30
- Coniferous trees: 30
- Deciduous trees: 30
- Shrubs: 50
- Grasses: 50
- Bared: 0
- Channel cover (3): 2
- Overhanging crown: 0

AERIAL VIEW OF REACH 4, LOOKING DOWNSTREAM FROM KM 44.
**Logistics of Fish Collected**

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
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<th></th>
<th>Total Numbers</th>
</tr>
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<tr>
<td></td>
<td>June</td>
<td>September</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arctic Grayling</td>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Brook Stickleback</td>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lake Chub</td>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Longnose Sucker</td>
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<td>1</td>
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<tr>
<td>Pearl Dace</td>
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<tr>
<td>Silver Suckmin</td>
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<td>Trout Perch</td>
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<tr>
<td>Unidentified Suckers</td>
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<tr>
<td>White Suckers</td>
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<td>2</td>
<td>2</td>
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<tr>
<td><strong>Total</strong></td>
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<td>26</td>
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<td>49</td>
</tr>
</tbody>
</table>

**Physical Characteristics**

- Reach length (km): 28.0
- Channel width (m): 12
- Channel area (ha): 33.4
- Gradient (%): 1.3
- Flow character: pied
- Total pools (%): 50
- Patterns: irregularly meandering
- Confine: occasionally confined
- Unstable banks (m): 5
- Substrate composition (%): 50
- Flies (0-2 mm): 0
- Gravel (2-64 mm): 10
- Larger (64+ mm): 0
- Bedrock and/or alluvial: 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 gradients 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 gravel. Large amounts of debris and frequent log obstructions exist in the reach. Deciduous trees and shrubs are more abundant in the riparian vegetation than conifers and grasses are very abundant. There is a moderate amount of overhanging vegetation.

Spawning potential for these fish that will spawn over sandy substrates (e.g., several stones, trout-perch, brook chub, and goldfish) 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 rearing and feeding areas for larger fish. Overwintering potential is good due to the generally deep waters and numerous pools.

**Benthic Invertebrates**

- Mollusca
- Gastropoda
- Pelecypoda
- Arachnida
- Insecta
- Plecoptera
- Ephemeroptera
- Trichoptera
- Diptera
- Odonata

**Riparian Vegetation**

- Bank coverage (%): 16
- Coniferous trees: 16
- Deciduous trees: 20
- Shrubs: 20
- Grasses: 20
- Barren: 20
- Channel cover (%): 10
- Overhang: 10
- Crown: 10

**Benthic Algal Productivity**

No data available for this reach.

**Stream Glueing Data**

No data available for this reach.

**Water Quality**

No data available for this reach.

**Aquatic Biophysical Inventory**

**Steeplebank River**

*Reach 5*

(km 47 to km 75)

*Alberta Oil Sands Environment Research Program*

Prepared by LSL Limited
MACKAY RIVER
### Numbers of Fish Collected (September 1979)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longnose Dace</td>
<td>0</td>
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<td>1</td>
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<tr>
<td>Pearl Dace</td>
<td>0</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>White sucker</td>
<td>4</td>
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<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
<td>16</td>
<td>20</td>
</tr>
</tbody>
</table>

### Physical Characteristics

- **Reach length (km)**: 1.4
- **Channel width (m)**: 70
- **Channel area (ha)**: 9.8
- **Gravel size (m/m³)**: 1.4
- **Flow character**: swirling
- **Total pools (%)**: 80
- **Confined**: confined
- **Unstable banks (m)**: 45
- **Substrate composition (%):**
  - Fine (0-2 mm): 25
  - Gravels (2-64 mm): 45
  - Bedrock and/or sand: 15
  - Debris: 10

### 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 side 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.

### Aquatic Biophysical Inventory

**Mackay River**

**Reach 1**

(0.0 km to 1.4 km)

**AQUATIC BIOPHYSICAL INVENTORY**

**Stream Gaging Data**

No data available for this reach

**Physical Characteristics**

- **Reach length (km)**: 1.4
- **Channel width (m)**: 70
- **Channel area (ha)**: 9.8
- **Gravel size (m/m³)**: 1.4
- **Flow character**: swirling
- **Total pools (%)**: 80
- **Confined**: confined
- **Unstable banks (m)**: 45
- **Substrate composition (%):**
  - Fine (0-2 mm): 25
  - Gravels (2-64 mm): 45
  - Bedrock and/or sand: 15
  - Debris: 10

**Benthic Invertebrates**

<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
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<tr>
<td>Ephemeroptera</td>
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</tr>
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<td>Bivalve</td>
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</tr>
<tr>
<td>Cladoceran</td>
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</table>

**Benthic Algal Productivity**

No data available for this reach

**Water Quality**

No data available for this reach

---

Bridge on highway 65 at km 0.6.

Looking downstream from km 0.6 towards confluence with the Athabasca River.
### Numbers of Fish Collected (September 1978)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-Year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearl dace</td>
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<td>44</td>
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<tr>
<td>Trout-perch</td>
<td>0</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>Silt-eel</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>White sucker</td>
<td>0</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>2</td>
<td>82</td>
<td>84</td>
</tr>
</tbody>
</table>

### Physical Characteristics

- **Reach length (km)**: 3.1
- **Channel width (m)**: 31
- **Channel area (ha)**: 9.6
- **Gradient (m/ha)**: 1.5
- **Flow character**: Swirling
- **Total pools (%)**: 95
- **Pattern**: Sinuous
- **Confinement**: Entrained
- **Unstable banks (%)**: 25
- **Substrate composition (%):**
  - Gravel (1-2 mm): 35
  - Gravel (2-64 mm): 60
  - Boulders (16A m): 5
  - Bedrock and/or alluvial sand: 5
  - Debris: Low

### Riparian Vegetation

- **Salix obtusa**
- **Salix lasiandra**
- **Populus deltoides**
- **Ephedra densa**
- **Zizyphus lotus**
- **Moringa oleifera**
- **Atriplex hortensis**
- **Atriplex canescens**
- **Atriplex patula**
- **Atriplex aegyptiaca**
- **Atriplex nummularia**
- **Atriplex portulacoides**
- **Atriplex spongiosa**
- **Atriplex argentea**
- **Atriplex hirta**
- **Atriplex triplinervis**
- **Atriplex patula**
- **Atriplex aegyptiaca**
- **Atriplex nummularia**
- **Atriplex portulacoides**
- **Atriplex spongiosa**
- **Atriplex argentea**
- **Atriplex hirta**

### Benthic Algal Productivity

- **Benthic Algal Productivity**
  - No data available for this reach

### Stream Grading Data

- **Stream Grading Data**
  - No data available for this reach

### Water Quality

- **Water Quality**
  - No data available for this reach

### Aquatic Biophysical Inventory

**Mackay River**

- **Reach 2**
  - (km 1.4 to km 4.2)

**Prepared by**

[Alberta Oil Sands Environmental Research Program]

[LSL Limited]
### NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>flathead chub</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>lake chub</td>
<td>1</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>longspine dace</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>longspine sucker</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>pearl dace</td>
<td>0</td>
<td>202</td>
<td>202</td>
</tr>
<tr>
<td>silvery sculpin</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>spawnhead sculpin</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>trout-perch</td>
<td>8</td>
<td>11</td>
<td>19</td>
</tr>
<tr>
<td>unidentified fry</td>
<td>N/A</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>white sucker</td>
<td>0</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>268</td>
<td>278</td>
</tr>
</tbody>
</table>

### PHYSICAL CHARACTERISTICS

- **Reach length (km):** 35.5
- **Channel width (m):** 28
- **Channel area (ha):** 99.4
- **Gradient (m/km):** 1.1
- **Flow character:** swirling, rolling, broken
- **Total pools (75):**
- **Pattern:** tortuously meandering
- **Confined:** entrenched
- **Unstable banks:** 60
- **Substrate composition (cm):**
  - fines (2-12): 10
  - gravel (2-64): 30
  - lagoons (164): 20
  - bedrock and/or oil sand: 60
- **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, meandering, 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 ruffle areas in addition to many relatively deep pools. The substrate consists primarily of gravels and large oil sands 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, longspine 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 west 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 ANUEROPHYTE S

- **EPELOPORA:**
  - Mannheimi
  - Salticum
  - Spumula

- **INSECTA:**
  - Ephemeridae
  - Perlidae
  - Limnephilidae

- **DROSANA:**
  - Chironomus
  - Chironomidae

### SYMPHATIC VEGETATION

- **Bank coverage (%):**
  - Grasses: 60
  - Shrubs: 10
  - Trees: 5
- **Channel cover (%):**
  - Overhang: 1
  - Crown: 0

### BENTHIC RAIN PRODUCTIVITY

- **Standing crop expressed as cell counts (number·m⁻³):**
  - mean: 182.6 ± 0.01
  - maximum: 1448.0 ± 0.01
  - minimum: 14.6 ± 0.01
- **Standing crop expressed as chlorophyll a (μg·m⁻³):**
  - mean: 22.2 ± 0.01
  - maximum: 49.7 ± 0.01
  - minimum: 0.0 ± 0.01
- **Primary productivity (μg C·m⁻²·h⁻¹):**
  - mean: 36.8 ± 0.01
  - maximum: 26.9 ± 0.01
  - minimum: 18.3 ± 0.01

(Data from Hickman et al., 1981)

### STREAM SAMPLING DATA

- **Water Survey of Canada station number:** 078001
- **Maximum total annual discharge:** 852.5 x 10⁶ m³ (1973)
- **Minimum total annual discharge:** 165.0 x 10⁶ m³ (1977)
- **Maximum mean annual discharge:** 27.81 m³/s (1979)
- **Minimum mean annual discharge:** 2.89 m³/s (1977)
- **Maximum monthly mean discharge:** 197.16 m³/s (June 1973)
- **Minimum monthly mean discharge:** 0.35 m³/s (February 1973)
- **Maximum daily discharge:** 301.29 m³/s (June 10, 1973)
- **Minimum daily discharge:** 0.32 m³/s (March 2, 1973)
- **Data for 1972 to 1978 compiled from Longley and Spitzer (1977) and Warner and Spitzer (1978).**

### WATER QUALITY

- **Water Survey of Canada station number:** 0972000001
- **Mean:**
  - Total alkalinity (μg CaCO₃/l): 163.2 ± 0.01
  - pH: 7.96 ± 0.01
  - Temperature (°C): 13.4 ± 0.01
  - Total hardness (μg CaCO₃/l): 166.8 ± 0.01
  - Conductivity (μS/cm): 102 ± 0.01
  - Chloride: 1370 ± 0.01
  - Total fluoride: 198 ± 0.01
  - Phosphate (P): 15 ± 0.01
  - Silica (μg SiO₂/l): 69.3 ± 0.01
  - Nitrate and nitrite nitrogen (μg N/l): 0.23 ± 0.01
  - Total Kjeldahl nitrogen (μg N/l): 1.2 ± 0.01
  - Total phosphorus (μg P/l): 0.08 ± 0.01
  - Orthophosphate (μg P/l): 0.0 ± 0.01
  - Sulphate (μg SO₄²⁻/l): 34 ± 0.01

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

### AQUATIC BIOPHYSICAL INVENTORY

#### MACKAY RIVER

- **Reach 3 (km 4.2 to km 40.0)**

Prepared by LSL Limited

Photo: Obertie Oil Sands Environmental Research Program
### Numbers of Fish Collected (September 1979)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-Year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finegill dace</td>
<td>4</td>
<td>15</td>
<td>19</td>
</tr>
<tr>
<td>Longnose dace</td>
<td>0</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Pearl dace</td>
<td>0</td>
<td>128</td>
<td>128</td>
</tr>
<tr>
<td>Trout-perch</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>White sucker</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
<td>164</td>
<td>165</td>
</tr>
</tbody>
</table>

### Physical Characteristics

- **Reach length (km):** 25.5
- **Channel width (m):** 50
- **Channel area (ha):** 127.5
- **Gradient (m/km):** 2.3
- **Flow character:** swirling, rolling
- **Total pools (3):** 60
- **Pattern:** irregularly meandering
- **Confinement:** confined
- **Unstable banks (3):** 15
- **Substrate composition (3):**
  - Fines (<2 mm): 20
  - Gravels (2-64 mm): 40
  - Largers (>64 mm): 40
  - Bedrock and/or cobbles: 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 large 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 graminoids are abundant.

The gravel substrates and ripples 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 Sturgeon and smelt. The rearing potential of this reach is considered good because areas with large rock substrates provide adequate shelter. Areas suitable for rearing 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

#### Hemiptera
- Gomphidae
- Anisoptera

#### Gastropoda
- Helicidae

#### Malacostraca
- Teleostei
- Anguillidae
- Perciformes
- Carangidae
- Scombridae
- Cynoglossidae

#### Insecta
- Ephemeroptera
- Plecoptera
- Tricoptera
- Thysanoptera
- Neuroptera
- Coleoptera
- Diptera
- Hymenoptera
- Orthoptera
- Lepidoptera

#### Deformia
- Triphylaceus
- Ameletus
- Nematocera
- Odonata

#### Oligochaeta
- Tubificidae
- Tubificides

### Riparian Vegetation

- Bank coverage (%)
  - Coniferous trees: 15
  - Deciduous trees: 30
  - Shrubs: 45
  - Grasses: 20
  - Barren: 5

- Channel cover (%)
  - Other: 0
  - Crown: 0

### Aquatic Biophysical Inventory

**Mackay River**

Reach 4

(km 40.0 to km 65.5)

Prepared by LSL Limited
### Numbers of Fish Collected (September 1979)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finnescale dace</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Longnose dace</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Pearl dace</td>
<td>10</td>
<td>206</td>
<td>216</td>
</tr>
<tr>
<td>Trout-perch</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>White sucker</td>
<td>0</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>219</td>
<td>230</td>
</tr>
</tbody>
</table>

### Physical Characteristics
- **Reach length (km)**: 46.0
- **Channel width (m)**: 46
- **Channel area (ha)**: 207.0
- **Gradient (m/km)**: 2.4
- **Flow character**: Weir, rolling, broken
- **Total pools (5)**: 40
- **Pattern**: Irregularly meandering
- **Confined**: Frequently confined
- **Usable banks (1)**: 10
- **Substrate composition (1)**:
  - Fines (<2 mm): 10
  - Gravel (3-64 mm): 50
  - Lenses (64-256 mm): 46
  - Bedrock and/or cobbles: 0
  - Debris: low

### Benthic Invertebrates
- **Dinoflagellates**
- **Green algae**
- **Red algae**
- **Chlorophyta**
- **Bacillariophyceae**
- **Chrysophyceae**
- **Eucaryotae**
- **Ciliophora**
- **Turbellaria**
- **Rotifera**
- **Diptera**
- **Odonata**
- **Mollusca**
- **Annelida**
- **Gastropoda**
- **Decapoda**
- **Echinodermata**
- **Tunicata**
- **Chordata**

### Benthic Algal Productivity
No data available for this reach

### Phytoplankton Data
No data available for this reach

### Repararian Vegetation
- **Bank coverage (1)**:
  - Coniferous trees: 50
  - Deciduous trees: 30
  - Shrubs: 30
  - Grasses: 85
  - Barren: 5
- **Channel cover (3)**:
  - Overhang: 1
  - Crown: 1

### Aquatic Biophysical Inventory
#### Mackay River
**Reach 5**
(km 65.5 to km 81.5)

**Recent slide at km 73.5 has entered river channel.**

**Long, whirling pool at km 91.5.**

### Water Quality
No data available for this reach

---

*Alberta Oil Sands Environmental Research Program*

Prepared by LSL Limited
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 silty 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

<table>
<thead>
<tr>
<th>CLASS</th>
<th>ORDER</th>
<th>FAMILY</th>
<th>GENUS</th>
<th>SPECIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>GASTROPODA</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PELECYPoda</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ANACOCHA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRUSTacea</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EUBERIDA</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>INSECTA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### RIPARIAN VEGETATION

- Bank coverage (1)
- Coniferous trees (50)
- Deciduous trees (35)
- Shrubs (50)
- Grasses (65)
- Berries (7)

### PHYSICAL CHARACTERISTICS

- Reach length (km): 6.0
- Channel width (m): 38
- Channel area (ha): 152.0
- Gradient (total): 0.7
- Flow character: placid, swirling, rolling
- Total pools (1): 50
- Pattern: irregularly meandering
- Confusion: occasionally confined
- Usable banks (1): 2
- Substrate composition (1)
  - Fines (1-2 mm): 50
  - Gravels (2-6 mm): 35
  - Large (6+ mm): 15
  - Bedrock and/or alluvial sand: 0
  - Debris: high

### AQUATIC BIOPHYSICAL INVENTORY

**MACKAY RIVER**

**Reach 6**

(km 131.5 to km 131.5)

Prepared by LSL LIMITED
### Physical Characteristics

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Reach length (km)</td>
<td>45.5</td>
</tr>
<tr>
<td>Channel width (m)</td>
<td>10</td>
</tr>
<tr>
<td>Channel area (ha)</td>
<td>45.5</td>
</tr>
<tr>
<td>Gradient (m/km)</td>
<td>0.5</td>
</tr>
<tr>
<td>Flow character</td>
<td>Placid</td>
</tr>
<tr>
<td>Total pools (1)</td>
<td>100</td>
</tr>
<tr>
<td>Pattern</td>
<td>Tortuously meandering</td>
</tr>
<tr>
<td>Confinement</td>
<td>Unconfined</td>
</tr>
<tr>
<td>Unstable banks (1)</td>
<td>0</td>
</tr>
<tr>
<td>Substrate composition (1)</td>
<td>100</td>
</tr>
<tr>
<td>Fines (&lt;2 mm)</td>
<td>0</td>
</tr>
<tr>
<td>Gravel (2-64 mm)</td>
<td>0</td>
</tr>
<tr>
<td>Boulders (&gt;64 mm)</td>
<td>0</td>
</tr>
<tr>
<td>Bedrock and/or alluvial sand</td>
<td>0</td>
</tr>
<tr>
<td>Debris</td>
<td>High</td>
</tr>
</tbody>
</table>

### Riparian Vegetation

- **Best coverage:** 20
- **Coniferous trees:** 20
- **Deciduous trees:** 46
- **Shrubs:** 60
- **Grasses:** 90
- **Bark:** 0
- **Channel cover (%):** 50
- **Diaphanous:** 2
- **Crown:** 2

### Benthic Algal Productivity

No data available for this reach.

### Stream Qaulity Data

No data available for this reach.

### Water Quality

No data available for this reach.

### Aquatic Biophysical Inventory

**Mackay River**

**Reach 7**

(km 151.5 to km 200.0)

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

Very sluggish flow and dense aquatic vegetation at km 186.

---

This uppermost reach of the surveyed portion of the Mackay River meanders in a tortuous pattern through a marshy area of cattail marsh. 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 provide 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.
DOVER  RIVER
### Numbers of Fish Collected (September 1970)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-Year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longnose dace</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Longnose sucker</td>
<td>0</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Pearl dace</td>
<td>0</td>
<td>122</td>
<td>122</td>
</tr>
<tr>
<td>White sucker</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
<td>139</td>
<td>139</td>
</tr>
</tbody>
</table>

### Physical Characteristics

- Reach length (km): 12.5
- Channel width (m): 10
- Channel area (ha): 15.5
- Gradient (‰): 6.1
- Flow character: swirling, rolling, broken
- Total pools (1): 70
- Patterns: Irregularly meandering
- Confinement: confined
- Unstable banks (1): 40
- Substrate composition (%):
  - Fines (12 mm): 20
  - Gravels (2-64 mm): 40
  - Large (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 soil, sand, and gravel. Several larger dams were present at the time the survey was conducted in 1970. Although the gradient in this reach is relatively high and ripples 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 large cobbles, fine gravel, and stones. There are areas of 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 litter, including 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 near 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 the pearl dace. Numerous shallow bank areas and the abundant shelter provided by debris and some aquatic vegetation provide very good rearing potential in this reach. Good rearing 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.

### aquatic biophysical inventory

**DOVER RIVER**

Reach 1 (km 0.0 to km 12.5)

**Prepared by LSL Limited**

### Aquatic Biophysical Inventory

**DOVER RIVER**

Reach 1 (km 0.0 to km 12.5)

**Prepared by LSL Limited**

---

**Water Quality**

- Water Survey of Canada station number 0708002

### Extensive Algal Productivity

**Nymphaea alpina**

- Invasive
- No data available for this reach

### Stream Grazing Data

- Maximum total annual discharge: 120
- Maximum annual mean discharge: 80
- Maximum total monthly mean discharge: 9.2
- Minimum total monthly mean discharge: 9.1
- Maximum daily discharge: 32.4
- Minimum daily discharge: 0.5
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 soil and sand 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 cobbles 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 cattails. 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.

AQUATIC BIOPHYSICAL INVENTORY

DOVER RIVER

Reach 2

(km 12.5 to km 19.5)
### Numbers of Fish Collected (September 1978)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-Year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Pike</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Trout</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>White Sucker</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

### Physical Characteristics

- Reach length (km): 18.7
- Channel width (m): 20
- Channel area (ha): 39.4
- Gradient (m/km): 0.3
- Flow character: placid
- Total pools (5): 100
- Pattern: irregularly meandering
- Confined: occasionally confined
- Instable banks (1): 5
- Substrate composition (%):
  - Finest (≤0.01 mm): 90
  - Gravels (2-64 mm): 5
  - Largers (64-256 mm): 0
  - Bedrock and/or old sand: 0
  - Debris: moderate

### Riparian Vegetation

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

### Aquatic Biophysical Inventory

**Dover River**

Reach 3

(km 19.5 to km 39.2)

Prepared by LSL Environmental Research Program

Alberta Oil Sands Environmental Research Program

Beaver dam at km 31.5.

Pool upstream of beaver dam at km 31.5.

Water Quality

No data available for this reach.
**PHYSICAL CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>pearl dace</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>slinky sculpin</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>white sucker</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

**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 clear 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 most 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, slinky 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 VEGETATION**

<table>
<thead>
<tr>
<th>Species</th>
<th>Bank cover (1)</th>
<th>Channel cover (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coniferous trees</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Deciduous trees</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Shrubs</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Grasses</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Sedges</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Channel cover (1)</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Overhemp</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

**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**

**DOVER RIVER**

Reach 4
(km 39.2 to km 76.0)

Prepared by LSL Limited
TABLE 4-3: 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.

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

Alberta Oil Sands Environmental Research Program
Prepared by LSL Limited
NUMBERS OF FISH COLLECTED (SEPTEMBER 1978)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Young-of-the-year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brook stickleback</td>
<td>9</td>
<td>7</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>7</td>
<td>16</td>
</tr>
</tbody>
</table>

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 (m): 100
- Pattern: Irregular
- Confined: Unconfined
- Instable banks (m): 0
- Substrate composition (%): Finnes (≤2 mm): 95, gravel (2-16 mm): 5, larges (>16 mm): 0, bedrock and/or sand: 0, debris: Moderate

REACH DESCRIPTION AND FISHER UTILIZATION

This reach is a long, narrow 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. Feeding 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.

SEMPHIC INVERTEBRATES

- Cladocera
- Chironomidae
- Ostracoda
- Nematoda
- Ephemeroptera
- Hexapoda
- Diptera

RIPARIAN VEGETATION

- Bank coverage (%): Coniferous trees: 10, Deciduous trees: 10, Shrubs: 80, Foreses: 90, Barren: 0
- Channel cover (%): Evergreen: 15, Herb: 10

AMBIENT ALCAL 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

DOVER RIVER

Reach 6
(km 132.5 to km 154.0)

Prepared by LSL Limited
DUNKIRK  RIVER
### Numbers of Fish Collected (September 1979)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-Year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>brown stickback</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>northern pike</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>perch</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>trout-perch</td>
<td>4</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>white sucker</td>
<td>0</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>7</td>
<td>29</td>
<td>36</td>
</tr>
</tbody>
</table>

### Physical Characteristics

- **Reach length (km):** 16.5
- **Channel width (m):** 17
- **Channel area (ha):** 28.1
- **Gradient (m/km):** 3.4
- **Flow character:** Placid
- **Total pools (5):** 100
- **Pattern:** tortuously meandering
- **Confinement:** Unconfined
- **Obstrucible banks:** 0
- **Substrate composition:**
  - Fines (0-2 mm): 0
  - Gravels (2-64 mm): 0
  - Larger (64-256 mm): 0
  - Bedrock and/or alluvial sand: 0
  - Debris: high

### Reach Description and Fish Utilization

This lower reach of the Dunkirk River is a tortuously meandering section that flows through a narrow area of floodplain. 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. Trees in the river channel are 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 habitats for northern pike and brown stickback. 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, brown stickback, and other forage species. The presence of juvenile white suckers indicates that the area is also suitable for rearing of these species. Water depths appear to be sufficient to allow overwintering of fish in at least the lower portion of the reach.

### Aquatic Biophysical Inventory

**Dunkirk River**

**Reach 1**

(Km 0 to Km 16)

Prepared by: Alberta Oil Sands Environment Research Program

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

Sumply, undercut bank at Km 4.2.
**NUMBERS OF FISH COLLECTED (SEPTEMBER 1979)**

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juvenile and Youthoff-year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>brook stickleback</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>longnose sucker</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>northern pike</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>peal dace</td>
<td>12</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>slippery eel</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>trout-perch</td>
<td>6</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>white sucker</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>9</td>
<td>30</td>
</tr>
</tbody>
</table>

**PHYSICAL CHARACTERISTICS**

- Reach Length (km): 35.7
- Channel width (m): 22
- Channel area (ha): 83.3
- Geology (ton): 8.9
- Flow character: placid, swirling, rolling
- Total pools (%): 96
- Pattern: irregularly meandering
- Confinement: occasionally confined
- Unstable banks (%): 1
- Substrate composition (%):
  - fines (≤2 mm): 50
  - gravel (2-64 mm): 40
  - bedrock and/or silt/sand: 0
  - debris: high

**RIPARIAN VEGETATION**

- Bank coverage (%):
  - Coniferous trees: 45
  - Deciduous trees: 45
  - Shrubs: 35
  - Grasses: 80
  - Other: 0
- Channel cover (%):
  - Overstory: 5
  - Crown: 2

**BENTHIC ALGAL PRODUCTIVITY**

No data available for this reach.

**STREAM GROSSING DATA**

- Water Survey of Canada station number 0780005
- Maximum total annual discharge: 105.0 x 10^3 m³/s (1978)
- Minimum total annual discharge: 75.0 x 10^3 m³/s (1979)
- Maximum annual mean discharge: 5.5 m³/s (1955)
- Maximum annual mean discharge (September 1978): 2.25 m³/s
- Maximum monthly mean discharge (January 1976): 2.13 m³/s
- Maximum daily discharge: 33.39 m³/s (Feb. 20, 1978)

**WATER QUALITY**

- Water Survey of Canada station number 004709280039
- Maximum: Minimum
- Total alkalinity (mg CaCO₃/l): 156.0 - 275.0
- Hardness (mg CaCO₃/l): 156.0 - 263.0
- Dissolved Oxygen (mg/l): 7.13 - 9.55
- Total phosphates (mg/l): 0.005 - 0.100
- Soluble reactive phosphorus (mg/l): 0.005 - 0.100

**AQUATIC BIOPHYSICAL INVENTORY DUNKIRK RIVER**

**Reach 2**

(km 16.0 to km 56.2)

Prepared by LSL Research Limited

Data for the period January 1976 to December 1979 obtained from the National Water Quality Data Bank (NRQDB).
NUMBERS OF FISH COLLECTED (SEPTEMBER 1990)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arctic Grayling</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Brook Stickleback</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Shortnose Dace</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Pearl Dace</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>9</td>
<td>12</td>
</tr>
</tbody>
</table>

PHYSICAL CHARACTERISTICS

- Reach length (km): 27.0
- Channel width (m): 13.0
- Channel area (m²): 36.1
- Gradient (‰): 0.2
- Flow character: Placid
- Total pools (L): 100
- Pattern: Irregularly meandering
- Confinement: Unconfined
- Unstable banks: 2
- Substrate composition (%):
  - Silt: 100
  - Gravel: 0
  - Shells: 0
  - Bedrock and/or till sand: 0
- Debris: Moderate

REACH DESCRIPTION AND FISH UTILIZATION

This upstream reach of the surveyed portion of the Dunkirk River meanders in an irregular pattern through a marshy, mucky 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 overgrew 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 depth in this reach appears to be sufficient to allow overwintering of fish.

AQUATIC BIOPHYSICAL INVENTORY

DUNKIRK RIVER

Reach 3

(km 56.2 to km 84.0)

A representative section of reach 3 at km 58.5.

Overhanging bank vegetation and abundant aquatic vegetation at km 82.2.
ELLS  RIVER
### Physical Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Adults</th>
<th>Juveniles and Young-of-the-year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>June</td>
<td>September</td>
<td>June</td>
</tr>
<tr>
<td>Burbot</td>
<td>ND</td>
<td>1</td>
<td>ND</td>
</tr>
<tr>
<td>Flattened chub</td>
<td>ND</td>
<td>1</td>
<td>ND</td>
</tr>
<tr>
<td>Goldeye</td>
<td>ND</td>
<td>1</td>
<td>ND</td>
</tr>
<tr>
<td>Lake whitefish</td>
<td>ND</td>
<td>6</td>
<td>ND</td>
</tr>
<tr>
<td>Longnose sucker</td>
<td>ND</td>
<td>3</td>
<td>ND</td>
</tr>
<tr>
<td>Mountain whitefish</td>
<td>ND</td>
<td>1</td>
<td>ND</td>
</tr>
<tr>
<td>Northern pike</td>
<td>ND</td>
<td>0</td>
<td>ND</td>
</tr>
<tr>
<td>Walleye</td>
<td>3</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>ND</td>
<td>22</td>
<td>ND</td>
</tr>
</tbody>
</table>

### 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 fine. 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. Nesting 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 overwhelming potential of this reach is considered to be excellent.

### Sentic Invertebrates

No Sentic samples were taken in this reach.

### Riparian Vegetation

<table>
<thead>
<tr>
<th>Rank coverage (%)</th>
<th>No data available for this reach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confusus trees</td>
<td>5</td>
</tr>
<tr>
<td>Deciduous trees</td>
<td>45</td>
</tr>
<tr>
<td>Shrubs</td>
<td>35</td>
</tr>
<tr>
<td>Grazes</td>
<td>35</td>
</tr>
<tr>
<td>Barren</td>
<td>0</td>
</tr>
<tr>
<td>Channel cover (%)</td>
<td>0</td>
</tr>
<tr>
<td>Overhang</td>
<td>0</td>
</tr>
<tr>
<td>Crown</td>
<td>0</td>
</tr>
</tbody>
</table>

### Sentic Algal Productivity

No data available for this reach.

### Stream Gauging Data

No data available for this reach.

### Water Quality

<table>
<thead>
<tr>
<th>Water Survey of Canada station number</th>
<th>00A07020A092E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date (Day-Month-Year)</td>
<td>5-29-1979</td>
</tr>
<tr>
<td>Measurement</td>
<td>1178.0</td>
</tr>
<tr>
<td>Temperature</td>
<td>7.20</td>
</tr>
<tr>
<td>Dissolved oxygen (mg/L)</td>
<td>7.0</td>
</tr>
<tr>
<td>Total hardness (mg CaCO₃/L)</td>
<td>70.0</td>
</tr>
<tr>
<td>Conductivity (µS/cm)</td>
<td>130</td>
</tr>
<tr>
<td>Total dissolved solids (mg/L)</td>
<td>80.0</td>
</tr>
<tr>
<td>Total non-filterable</td>
<td>80.0</td>
</tr>
<tr>
<td>Total non-filterable total fluoride</td>
<td>80.0</td>
</tr>
<tr>
<td>Total organic carbon (mg/L)</td>
<td>19.0</td>
</tr>
<tr>
<td>Nitrate (mg/L)</td>
<td>1.2</td>
</tr>
<tr>
<td>Nitrite and nitrate nitrogen (mg/L)</td>
<td>0.000</td>
</tr>
<tr>
<td>Total Kjeldahl nitrogen (mg/L)</td>
<td>0.000</td>
</tr>
<tr>
<td>Total Phosphorus (mg/L)</td>
<td>0.051</td>
</tr>
<tr>
<td>Orthophosphate (mg P/L)</td>
<td>0.003</td>
</tr>
<tr>
<td>Sulphate (mg SO₄/L)</td>
<td>17.0</td>
</tr>
</tbody>
</table>

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

### Aquatic Biophysical Inventory

**Ells River**

*Reach 1 (km 0.0 to km 2.5)*

![Image of Ells River section]

*Wide, placid section of the Ells River at km 1.*
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 gravel. Deciduous trees and shrubs are the dominant components of the riparian vegetation, but some patches of conifers are also present. Little vegetation overlies 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. Overutilizing potential is considered to be excellent because of the deep pools.

AQUATIC BIOPHYSICAL INVENTORY

ELLIS RIVER
Reach 2
(km 2.5 to km 8.0)
### NUMBER OF FISH COLLECTED (1978)

<table>
<thead>
<tr>
<th>Species</th>
<th>June</th>
<th>September</th>
<th>Adults</th>
<th>Juniors and Young-of-the-Year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>silverblue</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>lake chub</td>
<td>4</td>
<td>6</td>
<td>22</td>
<td>119</td>
<td>125</td>
</tr>
<tr>
<td>longjaw dace</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>longjaw sucker</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>trout-salmon</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>white sucker</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
<td>9</td>
<td>27</td>
<td>138</td>
<td>165</td>
</tr>
</tbody>
</table>

### PHYSICAL CHARACTERISTICS

- Reach length (km): 10.0
- Channel width (m): 30
- Channel area (ha): 30.0
- Gradient (m/m): 3.8
- Flow character: swirling, rolling, broken
- Total pools (%): 75
- Pattern: irregularly meandering
- Vegetation: riparian

### REACH DESCRIPTION AND FISH UTILIZATION

This section of the Ellis River is entrenched within a narrow deep canyon and meanders in an irregular pattern. Although the gradient is high and riffles 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; large pebbles dominate, but gravels and fines also compose significant 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 Ellis River. Suitable areas for the rearing of fish include the rocky substrates, a few areas sheltered by overhanging vegetation, and the scattered gravelly 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 areas 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.

### DENTAL-ALGINitates

- Ephemeroptera
- Plecoptera
- Odonata
- Coleoptera
- Diptera
- Cladocera
- Annelida

### RESEARCH INFORMATION


### PHYSIO DURATION DATA

- Water Survey of Canada station number 07294017
- Mean total annual discharge: 325.4 ± 107 m³
- Minimum total annual discharge: 152.9 ± 107 m³
- Maximum total annual discharge: 525.0 ± 107 m³
- Minimum monthly mean discharge: 85.4 ± 106 m³
- Maximum daily discharge: 139.8 ± 107 m³

### WATER QUALITY

- Total alkalinity (mg CaCO₃/1): 95.4 ± 106 mg/1
- Total hardness (mg CaCO₃/1): 7.78 ± 0.00 mg/1
- Total hardness (mg CaCO₃/1): 0.5 ± 0.00 mg/1
- Total hardness (mg CaCO₃/1): 211 ± 0.00 mg/1
- Total hardness (mg CaCO₃/1): 110 ± 0.00 mg/1
- Total hardness (mg CaCO₃/1): 57 ± 0.00 mg/1
- Total non-dissolved solids: 22.9 ± 0.00 mg/1
- Total organic carbon (mg CO₂): 4.05 ± 0.00 mg/1
- Total nitrogen: 0.130 ± 0.00 mg/1
- Total potassium: 0.150 ± 0.00 mg/1
- Total sodium: 0.50 ± 0.00 mg/1
- Total phosphate: 0.100 ± 0.00 mg/1

AQUATIC BIOPHYSICAL INVENTORY

ELLIS RIVER

Reach 3

(km 8 to km 18)

Prepared by LSL LIMITED

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

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**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 large and gravel, 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. Rearing and feeding potential for larger fish is considered to be excellent because of the many pools and the areas along the banks that are shaded 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.

**Aquatic Biophysical Inventory**

**Ells River**

Reach 4

(km 18 to km 45)

Prepared by LSL LIMITED

---

**Physical Characteristics**

- Reach length (km): 27.0
- Channel width (m): 3.0
- Channel area (ha): 51.0
- Gradient (%/km): 0.9
- Flow character: swirling, rolling
- Total pools (%): 80
- Pattern: tortuously meandering
- Confinement: confined
- Unstable banks (%): 40
- Substrate composition (%):
  - Gravel (<2 mm): 15
  - Gravel (2-64 mm): 30
  - Gravel (64-256 mm): 50
  - Bedrock and/or alluvial sand: 5
- Debris: low

**Riparian Vegetation**

- **Aquatixae Algal Productivity:**
  - Bank cover (%): 2
  - Crown: 0

- **Stream Grading Data:**
  - No data available for this reach

- **Water Quality:**
  - No data available for this reach

---

**General Information**

- **Numbers of Fish Collected (1978):**
  - Lake chub: 0 15 288 628 288 443
  - Longnose dace: 0 0 24 17 24 17
  - Longnose sucker: 0 0 33 46 33 46
  - Northern pike: 0 0 0 0 0 0
  - Pearl dace: 0 1 4 39 4 60
  - Trout-perch: 0 0 0 6 0 0
  - Unidentified suckers: 0 0 3 6 4 4
  - White sucker: 0 0 3 43 3 44
  - Total: 0 0 30 600 630 622

---

**Invertebrates**

- ** налог-да**
  - Oligochaeta
    - **Eisenia fetida**
    - **Heterodrilus**
    - **Lumbricus**
  - **Oligochaeta**
    - **Oligochaeta**
    - **Polychaeta**
    - **Nemertea**
    - **Odonata**
    - **Odonata**
    - **Plecoptera**
    - **Zygoptera**
    - **Trichoptera**
    - **Hexagenia**
    - **Coleoptera**
    - **Ephemera**
    - **Bijorcha**
    - **Characidae**
    - **Chironomidae**
    - **Tanaidaceae**
  - **Sessile**

---

**Long section of eroded bank at km 22.**

**Swirling and rolling flow character at km 26 is typical of reach 4.**
### NUMBERS OF FISH CAPTURED (1998)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>June</td>
<td>September</td>
<td>June</td>
</tr>
<tr>
<td>arctic grayling</td>
<td>ND</td>
<td>0</td>
<td>ND</td>
</tr>
<tr>
<td>lake chub</td>
<td>ND</td>
<td>10</td>
<td>ND</td>
</tr>
<tr>
<td>longnose dace</td>
<td>ND</td>
<td>0</td>
<td>ND</td>
</tr>
<tr>
<td>longnose sucker</td>
<td>ND</td>
<td>1</td>
<td>ND</td>
</tr>
<tr>
<td>northern pike</td>
<td>ND</td>
<td>1</td>
<td>ND</td>
</tr>
<tr>
<td>pearl dace</td>
<td>ND</td>
<td>0</td>
<td>ND</td>
</tr>
<tr>
<td>trout-perch</td>
<td>ND</td>
<td>28</td>
<td>ND</td>
</tr>
<tr>
<td>unidentified suckers</td>
<td>ND</td>
<td>0</td>
<td>ND</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>ND</strong></td>
<td><strong>60</strong></td>
<td><strong>ND</strong></td>
</tr>
</tbody>
</table>

### PHYSICAL CHARACTERISTICS

- Reach length (km): 6.0
- Channel width (m): 25
- Channel area (ha): 15.0
- Gradient (m/km): 6.7
- Flow character: rolling, broken
- Total pools (3): 25
- Pattern: irregularly meandering
- Confinement: confined
- Unstable banks (3): 20
- Substrate composition (3): 20
- Fines (<2 mm): 20
- Gravels (2-64 mm): 30
- Largers (>64 mm): 45
- Bedrock and/or cobbles: 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. Substraates are predominantly larger 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 substrates sizes, current velocities and water depths provides excellent spawning potential for most fish species that occur in the Eells River, particularly for those fish that prefer to spawn over rocky substrates. Riffle 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; rearing and feeding potential for these fish is therefore considered to be poor. Shallow water depths and the paucity of deep pools preclude significant over-wintering of fish in this reach.

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### AQUATIC BIOPHYSICAL INVENTORY

**EELLS RIVER**

Reach 5

(50 km to 51 km)

Alberta Oil Sands Environmental Research Program

Prepared by LSL Limited
### Numbers of Fish Collected (1976)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-Year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>May/June</td>
<td>September</td>
<td>May/June</td>
</tr>
<tr>
<td>Arctic Grayling</td>
<td>0</td>
<td>4</td>
<td>29</td>
</tr>
<tr>
<td>Lake Chub</td>
<td>0</td>
<td>48</td>
<td>238</td>
</tr>
<tr>
<td>Longnose Dace</td>
<td>1</td>
<td>3</td>
<td>92</td>
</tr>
<tr>
<td>Longnose sucker</td>
<td>1</td>
<td>0</td>
<td>32</td>
</tr>
<tr>
<td>Northern Pike</td>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Pearl Dace</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ringed Suckers</td>
<td>39</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Spawning Suckers</td>
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<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Trout-Pearch</td>
<td>19</td>
<td>61</td>
<td>35</td>
</tr>
<tr>
<td>Unidentified suckers</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>WALLEYE</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>White sucker</td>
<td>5</td>
<td>5</td>
<td>42</td>
</tr>
<tr>
<td>Total</td>
<td>65</td>
<td>129</td>
<td>478</td>
</tr>
</tbody>
</table>

### Physical Characteristics

- **Reach length (km):** 123.0
- **Channel width (m):** 10
- **Channel area (ha):** 360.0
- **Gradient (%):** 1.3
- **Flow character:** swirling, rolling, broken
- **Total pools (5):** 60
- **Patterm:** tortuously meandering
- **Confine:** frequently confined
- **Invertebrate banks:** 35
- **Substrate:**
  - **Finnes (≤2 mm):** 10
  - **Gravel (2-64 mm):** 10
  - **Larges (≥64 mm):** 10
  - **Bedrock and/or soil:** 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, with about half of the reach area 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 large, gravelly cobbles. The riparian vegetation is dominated by deciduous trees and shrubs, but grasses and significant numbers of forbs are also present. There is some 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 on rocky or sandy substrates.** Adults of several species that spawn in the spring were captured here in May and June during this study. Other fish sheltered by overhanging bank vegetation and debris and areas with rocky substrates provide excellent rearing habitats 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 rearing and feeding areas for larger fish, particularly the pelagicus 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

- **SNAKES:**
  - **Crotalus:** Pacific Gopher Snake
  - **PELICANIA:** Muscovy Duck

### Riparian Vegetation

- **Rank coverage:**
  - **Coniferous trees:** 20
  - **Deciduous trees:** 30
  - **Shrubs:** 30
  - **Grasses:** 30
  - **_index:** 0

- **Channel cover:**
  - **Ferns:** 5
  - **Crown:** 0

### Benthic Algal Productivity

- No data available for this reach

### Stream Stage 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.
## Numbers of Fish Captured (1979)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-Year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>June</td>
<td>September</td>
<td>June</td>
</tr>
<tr>
<td>arctic grayling</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>lake chub</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>longnose dace</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>longnose sucker</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>stoner sculpin</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>white sucker</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

### Physical Characteristics

- **Reach length (km):** 6.0
- **Channel width (m):** 10
- **Channel area (ha):** 12.0
- **Gradient (ft/m):** 7.2
- **Flow character:** Rolling, broken
- **Total pools (10):** 20
- **Pattern:** Irregularly meandering
- **Confinement:** Confined
- **Benthic habitat (1):** 10
- **Substrate composition (1):**
  - Fines (1-2 mm): 15
  - Gravels (2-54 mm): 40
  - Gravels (54-164 mm): 40
  - Bedrock and/or cobbles: 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. Largers and gravels are the predominant substrate materials, but fines are also found in numerous areas within the reach.

Build-up 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 overshadows 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. Nesting 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.

### Riparian Vegetation

- **Bank cover (%)**
  - Coniferous trees: 20
  - Deciduous trees: 50
  - Shrubs: 30
  - Grasses: 40
  - Berries: 10

- **Channel cover (%)**
  - Overstory: 2
  - Crown: 0

### Benthic Algal Productivity

No data available for this reach

### Stream Gauging Data

No data available for this reach

### Aquatic Biophysical Inventory

**Ells River**

Reach 7 (km 174 to km 180)

Prepared by LSL Limited
NUMBERS OF FISH COLLECTED (1978)

<table>
<thead>
<tr>
<th>Species</th>
<th>Adults</th>
<th>Juveniles and Young-of-the-year</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>June</td>
<td>September</td>
<td>June</td>
</tr>
<tr>
<td>Arctic grayling</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Lake chub</td>
<td>0</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Longnose dace</td>
<td>0</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Longnose sucker</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Northern shiner</td>
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<td>1</td>
</tr>
<tr>
<td>Slender shiner</td>
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</tr>
<tr>
<td>Unidentified suckers</td>
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<td>0</td>
</tr>
<tr>
<td>Walleye</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>White sucker</td>
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<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>7</td>
<td>254</td>
</tr>
</tbody>
</table>

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 (1): 50
- Patterns: irregularly meandering
- Confinement: confined
- Soluble salts (g/l): 5
- Substrate composition (5%):
  - Flows (0-2 mm): 15
  - Gravels (2-64 mm): 25
  - Largers (1-64 mm): 60
  - Bedrock and/or all sand: 0
- Debris: moderate

REACH DESCRIPTION AND FISH UTILIZATION

This section is the most upstream reach of the surveyed portion of the Ellis 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 flows 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 Ellis 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 Ellis 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. Rearing 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.

AQUATIC BIOPHYSICAL INVENTORY

ELLS RIVER
Reach 8 (km 180 to km 193)

Prepared by LSL Limited