SAND AND GRAVEL RESOURCES OF THE
SPIRIT RIVER REGION
BOUNDED BY THE PEACE RIVER,
ALBERTA-B.C. BORDER,
SMOKY RIVER AND SOUTHERN BOUNDARIES
OF MAP SHEETS
83M/13-83M/16 AND 83N/13

W.A.D. Edwards
D.W. Scafe

March, 1990
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ABSTRACT

A compilation and evaluation of existing sand and gravel resource information for the Spirit River area was completed by the Alberta Geological Survey for Alberta Forestry, Lands and Wildlife, Public Lands Division. Data were obtained from Alberta Transportation & Utilities (pit data), Alberta Environment (water well logs) and Alberta Research Council (geological) for the study.

The only economic source of gravel in the area is of alluvial origin and consists of terraces and bars primarily in the Peace River valley. Glacial and preglacial deposits occur in the region but are of no importance in the study area.

Further gravel exploration should focus on the river valleys. Since gravel is in short supply and exploration prospects are limited, it may be expedient to concentrate on alternative materials or more effective transportation plans rather than primary searches.
INTRODUCTION

This study is part of a program initiated in 1976 by the Alberta Research Council (ARC) and Alberta Forestry, Lands and Wildlife (AFLW) to provide information on the sand and gravel resources of Alberta. The area of study (figure 1), level of detail and roles of the participants were determined by representatives of the Public Lands Division of AFLW, Alberta Transportation and Utilities (AT&U) and the Alberta Geological Survey (AGS) a department of ARC at a meeting on September 13, 1989.

A reconnaissance level study (level 5 on figure 2) of the area bounded by the southern bank of the Peace River, Alberta-B.C. border, west bank of Smoky River and souther boundaries of NTS map sheets 83M/13-16 and 83N/13 was completed by AGS.

ACKNOWLEDGMENTS

Public Lands Division of AFLW provided the funds for the geological study. Alberta Transportation and Utilities provided testing and sampling data and Alberta Environment (AE) provided water well records.

METHODS

The study consists of compilation of existing information. Information available for the area includes water well logs from Alberta Environment, a surficial geology report by the ARC, information on sand and gravel pits from AT&U and an aggregate resource potential map by ARC for the northeast tip of the area and a bedrock topography map by ARC.

Deposits are grouped by their geological mode of formation. Their potential for containing gravel is assessed.

GEOLOGY

PHYSIOGRAPHY AND BEDROCK

The survey area lies primarily in the Peace River Lowland, a relatively flat region underlain by thick, fine grained, glaciolacustrine sediments over Cretaceous sandstones and shales. The Saddle Hills Upland and Wapiti Plain rise above the lowland and bring bedrock to the surface.

SURFICIAL GEOLGY

Most surficial materials in the survey area are glaciolacustrine clay, silt and sand (light brown in figure 3). A thin mantle of eolian outwash
Figure 1. Study area
## Aggregate Inventory Mapping Levels

<table>
<thead>
<tr>
<th>Format</th>
<th>Reconnaissance Study 5</th>
<th>Enhanced Reconnaissance Study 4</th>
<th>Regional Mapping 3</th>
<th>Detailed Mapping 2</th>
<th>Deposit Evaluation 1</th>
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<td>1:250,000 (approx. 11x14 townships)</td>
<td>1:50,000 (approx. 3x3 townships)</td>
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<td>1:10,000 or larger</td>
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<td>Only potential areas suitable for finding deposits shown. Fairly quick and inexpensive to produce.</td>
<td>Potential areas suitable for finding deposits are shown. Some deposits are examined.</td>
<td>Estimates deposit boundaries and gives quality and quantity estimations.</td>
<td>Establishes deposit boundaries. Refines quantity/quality information.</td>
<td>Precise quality and quantity estimates. Deposit variations identified.</td>
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<td>Special projects only.</td>
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Figure 2. Study Levels
- Water well logs with clay, till or shale (Alberta Environment)
- Alberta Transportation & Utilities data sites (interpreted as alluvial terraces or bars)
- Alberta Transportation & Utilities data sites (interpreted as weathered bedrock)
- Alberta Geological Survey data sites (interpreted as alluvial terraces or bars)

Buried sand and gravel (Jones, 1966, Carlson and Hackbarth, 1974, Fox, Richardson and Sham, 1987)

Shaftesbury buried valley (Carlson and Hackbarth, 1974)

Scale 1:506880  Figure 3. Sand and gravel resources in the Spirit River area
or alluvial silts, sand or minor gravel (light yellow in figure 3) overlies the glaciolacustrine materials in a portion of the eastern part of the study area. A few, small patches of mainly clayey till are scattered throughout the western part of the study area (light green in figure 3). Surficial geology information is derived from the report by Jones (1966).

SAND AND GRAVEL RESOURCES

In the Peace River region sand and gravel can be assigned to one of four geological categories. These categories are alluvial, glacial, preglacial and weathered bedrock. The alluvial deposits are terraces, bars or beds of present rivers. The glacial deposits are of outwash or ice-contact (kame, esker) origin. The preglacial sources include upland deposits such as on the Peace Hills, Halverson Ridge or Swan Hills or buried valley deposits such as the Grimshaw Gravels located west of Peace River town near Cardinal Lake (figure 3). The sources that are derived from weathered bedrock are generally sandy and of limited occurrence (red dot on figure 3).

In the study area all four categories potentially are present. However, the terraces, bars or beds or rivers (primarily the Peace River) appear to be the only major economic source of gravel (purple and green dots on figure 3).

All information used in this study was obtained from the Alberta Research Council (Carlson and Hackbarth, 1974, Fox, Richardson and Sham, 1987 and Jones, 1966), Alberta Transportation and Utilities (data files, see Appendix A) or Alberta Environment (water well logs).

ALLUVIAL SOURCES

Table 1 lists current pits (AT&U), reservations (AT&U) and potential deposits (Fox et al 1987). Of the twenty one sites listed, twelve are in the Peace River valley, three along Smoky River, two on Burnt River and one on Pouce Coupe River. Thus, eighteen of the currently used (purple dots in figure 3) or potential sites (green dots in figure 3) are of alluvial origin (figure 3 and table 1). These terraces and bars are the principle sources of gravel for the study area.
Table 1. Sand and gravel resources currently identified in the study area.

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<tr>
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<th>Probable Origin</th>
<th>Physiographic Locality</th>
<th>Material</th>
<th>Status</th>
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</table>
GLACIAL SOURCES

Eolian and outwash sediments were mapped by Jones (1966). These are believed to be thin and sandy and to have little or no potential as a source of granular resources. Water wells (black dots in figure 3) in the study area indicate only clay or till. There is, therefore, no apparent potential indicated for material of a glacial source.

PREGLACIAL SOURCES

Jones (1966) and Fox et al (1987) mapped buried gravels north of the study area (Jones west of the sixth meridian, Fox et al east of the sixth meridian, figure 3). Carlson and Hackbarth (1979) also note areas of very deep drift (over 400 ft) in this area and map the thalweg of a buried valley (Shaftesbury Channel). This buried channel and a tributary valley along the Burnt River is shown on figure 3. The relative location and elevation of the Shaftesbury Channel and the Grimshaw Gravels suggest that the gravels may be a high level terrace in the preglacial valley. These types of gravel deposits can be excellent sources of aggregate with huge reserves and high percentage of coarse, hard rock. The possibility of preglacial terraces in the study area south of the Peace River must be considered.

The water wells in the central part of the study area (figure 3) indicate till and not buried sand or gravel. The Shaftesbury Channel is shown to trend northwestward (Carlson and Hackbarth, 1979). Buried gravels are shown by Jones (1966) north of the Peace River at Peace Grove and Eureka River (figure 3). This suggests that the preglacial terraces occur on the north side of the Peace River but not within the study area.

Preglacial sand and gravel outcrop near Watino (figure 3) in the Smoky River valley. Orientation of the gravel clasts and beds indicates a northeasterly flow (Liverman et al, 1989). The Smoky River may trace the course of a small buried valley north from Watino. If this is the case, other gravel beds may be present along the Smoky River in the eastern part of the study area. The gravel exposed near Watino is thin and deeply covered, however, and the economic value of such gravels is low.

WEATHERED BEDROCK

Jones (1966) maps residual materials (weathered bedrock) in the northwestern part of the study area. AT&U data show a number of pits, probably in sand, in the vicinity. If these deposits are formed from
weathered bedrock they do not contain gravel. If weathering has been of a preglacial cap of gravel on bedrock, some gravel will be present in the lag. In general, weathered bedrock is not a usual or productive source of gravel or sand in Alberta.

SUMMARY

The western half of the study area does not seem to have significant potential for new deposits other than in the river valleys. The eolian and outwash material in the eastern half of the study area probably has little value but may be covering other outwash or even preglacial deposits. This possibility is remote but is not discounted as water well information is not available to check the suggestion.

RECOMMENDATIONS

The search for gravel should be concentrated in the major river valleys in the study area. An alternate source of course aggregate is manufactured aggregate that can be produced by burning, in a rotary kiln, the abundant glaciolacustrine clays present in the area. Gravels hauled from outside the study area also should be considered. Crushed stone from within the area probably is not a likely source for aggregate because of the soft nature of the local sandstone but rail or barge transport of competent material from B.C. could be considered. The economics of long gravel haul distances should be weighed against the costs of further exploration in the area, manufactured aggregate or crushed stone. Haul distances from the buried deposits north of the Peace River possibly could be shortened if south-shore stockpiling was performed during the winter months using ice bridges as the mode of access.
REFERENCES


APPENDIX 1

Sand and gravel information provided by Alberta Transportation & Utilities
REQUIRED PROCEDURE FOR OPERATIONS IN THE **FOURTH CREEK** PIT
S.W., 1/4 SEC. 13, TP. 82, RGE. 7, W. 6, M

**NOTE:**
- O: Begin aggregate excavation in area "B" outlined with a dashed line
- U: Begin aggregate excavation in area designated by the engineer
- O: Place overburden in area "P" outlined with a dashed line
- U: Place overburden in area designated by the engineer

**LEGEND:**
- OP = OPEN PIT
- A = AGGREGATE AREA
- D = DEPLETED AREA
- O = OVERBURDEN AREA
- TS = TOPSOIL

---

**DATE:** May 16, 1989

[Signature]
FOR MATERIALS ENGINEERING BRANCH
The above reservation is requested on the above land.

R. W. Harrell, E. Eng.
Agitator Era Engineer
for Requesting Agency

RECORDS, Note
Please remove written reservations dated 16-11-65.

To be entered in the records of the Department.

OLD SURFACE MATERIALS RESERVATION REQUIRING FIELD
INVESTIGATION PRIOR TO CANCELLATION OR APPLICATION
FOR A 'D' - RESERVATION
FIVE YEARS

LAND LOCATION

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Bed and Bars of the river, PT. of LSD 9 East of the river all in sect NE9, NW9 (Bed of river), SE9 (Bed of river).

CC - diary
- Transportation
- Spirit River West - Faldoff
- Reg. mg.- Spirit River East

E & HR. CONTROL No. CNT6500052
E & HR. REF. No. GT 80-13-W6
EFFECTIVE DATE 1/1/65
EXPIRE DATE 30-11-65
APPROVED

FILE RECORDS

Reflected to:

AFS [ ]  F&W [ ] PARKS [ ] TRANS. [ ] ENVIRONMENT [ ] Other [ ]

Remarks and Comments

LSAS OPERATION

INPUT ID: 1501
1X ins: 19/0/12 - 89
VERIFIED 2/8 DATE 13.4.84

Permissive Use

Reservation Approved

This reservation expires on

For Assist. Deputy Minister
**ALBERTA TRANSPORTATION UTILITIES (MATHEWS ENG. BRANCH)**

**Purpose of the Amendment**
- Add Land
- Delete Land
- Amend Expiry Date
- Amend Code
- Amend Other (see explanation)

**Explanation for Amendment Change:**

**Amended Agency Comments:**

**Agency Contact Person:**

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**SRPU Conflicts**
- Yes
- No
- see attached

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**Purpose**
- 0541

**Restriction**
- /

**Exception(s)**

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**Copies for:**

**File Records**
- Minerals
- Other

**Comments:**
The grade in this pit was recommended for base course only. It now is depleted and used only as a stockpile area.
OCATION: LSO 1314 Section 15 Township 79 Range 2 W1/2 Met

O - overburden
G - Gravel
S - Sund

Received Permission To
Excavate But Left For Future

High Bank

10.3 m G
10 m G
8 m G
4 m G
2.5 m G
3 m G
4 m G
5 m G
6 m G
7 m G
8 m G
9 m G
10 m G

11.5 m G
12 m G
13 m G
14 m G
15 m G
16 m G
17 m G
18 m G
19 m G
20 m G
21 m G
22 m G
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69 m G
70 m G
71 m G
72 m G
73 m G
74 m G
75 m G
76 m G
77 m G
78 m G
79 m G
80 m G
81 m G
82 m G
83 m G
84 m G
85 m G
86 m G
87 m G
88 m G
89 m G
90 m G
91 m G
92 m G
93 m G
94 m G
95 m G
96 m G
97 m G
98 m G
99 m G
100 m G
Pursuant to the Public Lands Act and Regulations hereunder the above named operator is hereby authorized to remove only

cubic yards or

cubic meters of PIT RUN from the above lands.

This licence does not entitle the operator to remove stockpiled surface materials unless placed there by the operator. Removal of surface materials in excess of the amount approved by this licence is illegal and is subject to a penalty. If more surface materials are required, please contact the Office from Where This Licence Was Obtained. This authority is granted to the operator complying with the attached schedule of conditions. Upon completion of operations or upon expiration of this surface materials licence, whichever date occurs first, you must complete the attached SURFACE MATERIALS RETURN and forward it to the OFFICE FROM WHERE THIS LICENCE WAS OBTAINED within 30 days. Further dispositions may be withheld until this is received. This licence does not grant the operator a right of exclusive possession to the land described in the licence nor does it grant to the operator the right, to the exclusion of others, to remove and take away from the land, the surface materials within and under the land.

P.I. FIELD SERVICES

FOREST
**Reserve/Notation Amend**

**Client I.D. No.:** 000000000 - 001

**Purpose of the Amendment:**
- [ ] Add Land
- [ ] Delete Land
- [ ] Amend Expiry Date
- [ ] Amend Code
- [ ] Amend Other (see explanation)

**Explanation for Amendment Change:**
- Amended Agency Comments: Please amend for a 5-year term
- Agency Contact Person: [signature]

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- [ ] see attached

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**Action by**
- Doc/SRPU (App)
- Admin. Support
- Land Mgt
- Doc/SRPU (Disp)
- File Records

**Referral Dates**
- Land Mgt
- AFS
- F & W
- Envir.
- Transp.
- Minerals
- Other

**Comments:**

**Amendment Data:**
- [YM] 88-09-10
- [YMD] 92-10-03

**LSAS Note:**
- UT ID: LSASI 07

**LSAS:**
- 18 80411

**AOM Public Lands:**
- [signature]
- [date: APR 13 '83]
**GRavel Pit REPORT**

**Name of Pit:**

**Owner:**

**Location:**

**Dead Haul Routes:** Anderes, east of stockpile, down and past

**Condition of Dead haul:** Except through pit area

**Condition of Pit**

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<thead>
<tr>
<th>Depth of Overburden</th>
<th>Depth of Gravel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ft.</td>
<td>Ft.</td>
</tr>
</tbody>
</table>

**Water Level from Surface:** Variable

**Type of Gravel:** (Coarse, Fine, Clean, etc.)

**Surface Area of Pit:**

**Estimated Yardage Still Available:**

**Gravel Removed:** (All quantities less Asphalt)

<table>
<thead>
<tr>
<th>Description of Work</th>
<th>Tons</th>
<th>Cu. Yds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pit-Run Granular</td>
<td></td>
<td></td>
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<tr>
<td>Pit-Run Sand</td>
<td></td>
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<tr>
<td>Designation Class</td>
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<tr>
<td>Granular Supply for Culverts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material for Dead Haul</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total Removed:** 16,337 cu. yds.

**Prospects of More Gravel**

**Adjoining Pit:**

**Near Pit:**

**In The District:** 1/4 Sec. Twp. Rge. W.

**Remarks:** Granular lies on small benches and mound.

**Date:**

**Engineer:**

**Note:**

Make sketch showing dead haul routes with distances on reverse side. This form to be sent to Edmonton upon completion of using pit. One form for each pit used.

Show mileage of common haul point, dead haul distance in miles, location of pit relative to 1 section and project.

Also enlarge sketch of pit showing excavated portion relative to test holes.