SAND AND GRAVEL RESOURCES OF THE PEACE RIVER AREA

Open File Report 1991-21

(Tp86 TO NORTHERN BOUNDARY OF MAP SHEET 84C FROM R16 TO EAST BANK OF PEACE RIVER)

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1989

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ABSTRACT

A portion of Peace River (84C) map sheet was studied in 1988 to determine the distribution and characteristics of the sand and gravel resource. The study area, approximately 3250 km^2 in size, is investigated at two levels of detail. Approximately 830 km^2 is covered at a regional mapping level and the remainder is covered at an enhanced reconnaissance level. The program consisted of compiling existing information, air photo interpretation, field evaluation of all sites and laboratory analyses of samples collected. Sand and gravel is limited in the area. Terraces along the Peace River are the major prospects for sand and gravel but there is not nearly as much gravel in the terraces as believed previously. Glaciofluvial deposits northwest of Cadotte Lake are predominantly sand.

INTRODUCTION

This study is part of a program initiated in 1976 by the Alberta Research Council and Alberta Energy and Natural Resources to provide information on the aggregate resources of the Province of Alberta. The program continues with the support of Alberta Transportation and Utliities and Alberta Forestry, Lands and Wildlife. The area of study (Figure 1), level of detail and emphasis of the project were determined by representatives of Alberta Transportation and Utilities (ATU) and the Land Information Division of Alberta Forest Lands and Wildlife (AFLW). The actual investigations were conducted by the Alberta Geological Survey, a department of the Alberta Research Council.

The study area is in the Peace River (84C) National Topographic System map sheet from the south boundary of Tp86 to the northern boundary of the map sheet and from the east boundary of R16 to the east bank of the Peace River. Total area is approximately 3250km^2. Access in the area is limited to Secondary Road 686 in the southeastern corner of the study area.

Part of the study is completed at the regional mapping level (Category 3, Table 1). This type of mapping is designed to provide a minimum data level for local and regional planning and management of aggregate resources in the province and to form a base for resource management. The level three study covers an area from the southern boundary of Tp86 to the northern boundary of Tp90 from the eastern boundary of R19 to the east bank of the Peace River. This area is approximately 830km^2. The remainder of the study area is completed at the enhanced reconnaissance level (Categoary 4, Table 1). This level of mapping is designed to provide a minimum data level for local and regional planning and management of aggregate resources in the province and to form a base from which further exploration can proceed.

ACKNOWLEDGMENTS

Dianne Goulet performed the laboratory analyses. Summer student

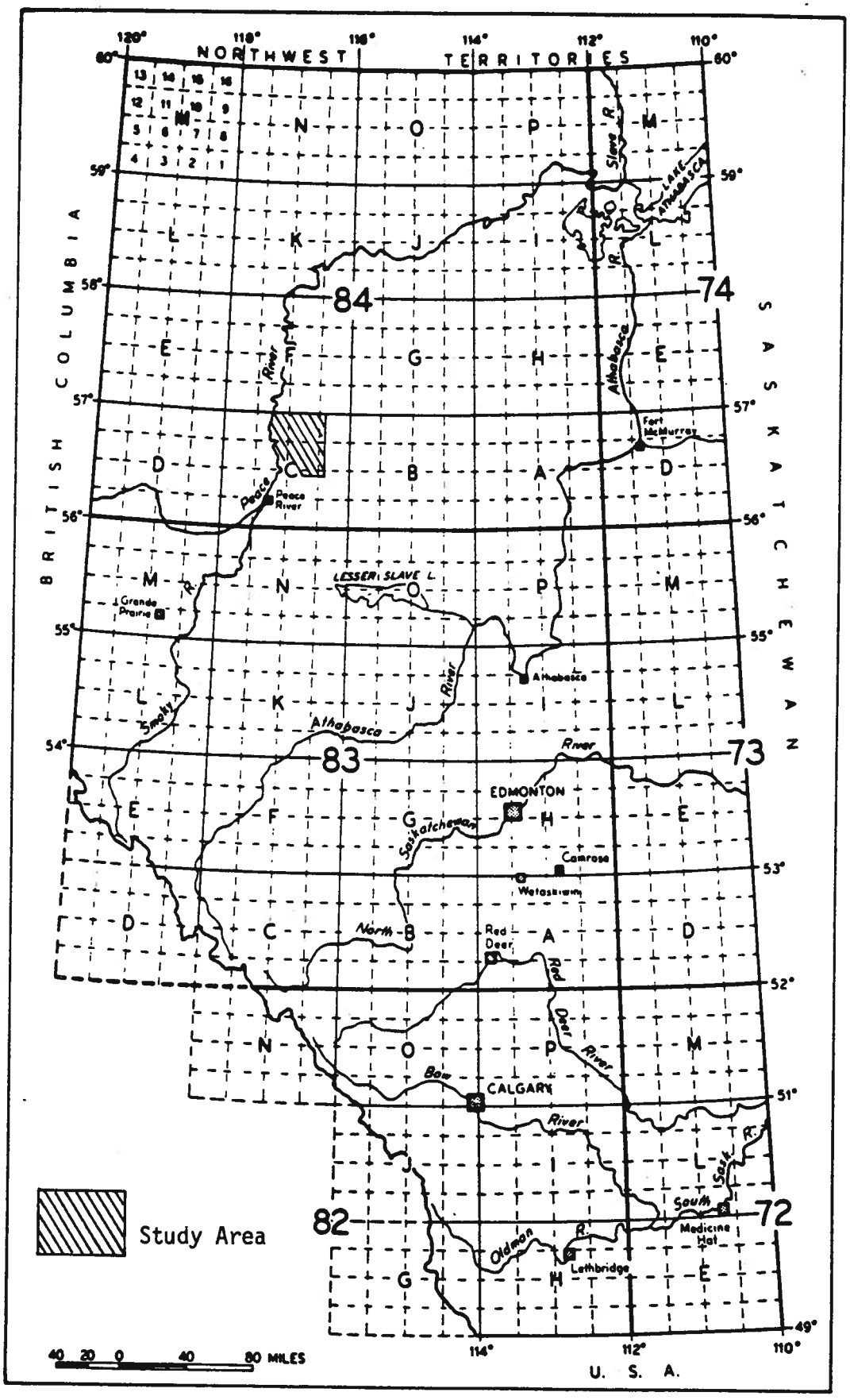


Figure 1. Location Map

Table 1. AGGREGATE INVENTORY MAPPING LEVELS

Format	Reconnaissance Study 5	Enhanced Reconnaissance Study 4	Regional Mapping 3	Detailed Mapping 2	Deposit Evaluation 1
Scale (Common)	1:250,000 (approx. 11x14 townships)	1:250,000 (approx. 11x14 townships)	1:50,000 (approx. 3x3 townships)	1:10,000	1:10,000 or larger
Mapping Methodology	Derived from existing surficial geology information. Aerial photograph interpretation.	Derived from existing surficial geology information. Aerial photograph interpretation. Some field traverses and site examination.	Aerial photograph interpretation Field traverses. Site examinations. Selected deposit testing. Laboratory testing.	Sedimentological studies. Site examination. Deposit testing. Laboratory testing.	Test pitting on an established grid. Hole logging. Materials analysis.
Uses	Broad scale planning. Preliminary aggregate exploration.	Broad scale planning. Preliminary aggregate exploration. Preliminary resource assessment.	Land use planning. Resource management. Resource estimates.	Land management. Reserve estimates. Deposit management.	Deposit evaluation. Development plan preparation.
Comments	Only potential areas suitable for finding deposits shown.	Potential areas suitable for finding deposits are shown. Some deposits are examined.	Estimates deposit boundaries and gives quality and quantity estimations.	Establishes deposit boundaries. Refines quantity/quality information.	Precise quality and quantity estimates. Deposit variations identified.
	Fairly quick and inexpensive to produce.	A map will take 6 months to a year to produce.	A map may take 8 months to a year to produce.	Fairly expensive survey.	Very expensive survey.
Output	2 map sheets per prof-year.	1 map sheet per prof-year.	2 to 3 map sheets per prof-year.	Special projects only.	Special projects only.

Slavko Stuhec gave very competent assistance in the field and the office. Funds for the project were provided by Alberta Transportation and Utilities and Land Information Services Division of Alberta Forestry and Wildlife. Peace River Forest Land Use Officer Gordon Krassman and East Peace District Chief Ranger Ken McCrae were very helpful in arranging helicopter transport and in providing information needed during the project.

METHODS

The study was initiated with the review and compilation of data from the files of Alberta Transportation and Utilities and from water well logs filed at Alberta Environment.

This information was incorporated into the air photo interpretation of J.D. Mollard and Associates Ltd. following criteria set out by the Alberta Geological Survey. The initial air photo interpretation of the study area delineated only 43 prospects that could contain sand or gravel. Some of these prospects are very small. Because so few prospects were suggested, a field plan was developed to visit or at least fly over every prospect. This was accomplished during field work conducted in July and August, 1988. Access to some sites is possible by foot, three-wheeled all terrain vehicle or truck. Travel in this area for normal vehicular traffic is extremely limited, however, and helicopter access was required for most sites. Samples were returned to the laboratory for grain size and petrographic analyses. Geophysical traverses using a Geonics EM31 were made in an attempt to delineate the extent of buried granular material on the terraces of the Peace River.

GEOLOGY

Bedrock

The Lower Cretaceous Peace River Formation crops out along the Peace River in the study area (Figure 2). This formation contains the fine

grained quartzose sandstone of the Cadotte Member, the dark gray silty shale of the Harmon Member and the fine grained glauconitic sandstone with silty interbeds in the lower part of the Notikewin Member (Green, 1972).

The Upper and Lower Cretaceous Shaftesbury Formation underlies the western part of the study area. This marine, dark gray, fish scale-bearing shale, silty in the upper part, contains numerous nodules, thin beds of concretionary ironstone and bentonitic partings.

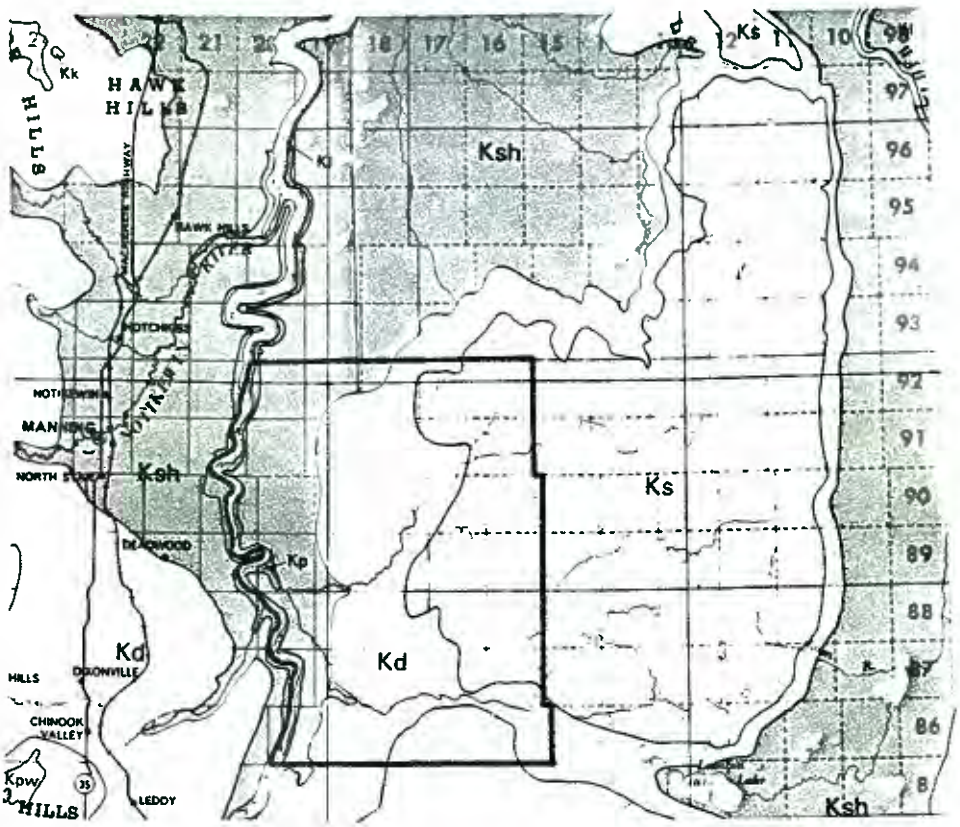
The Upper Cretaceous, deltaic Dunvegan Formation forms outliers such as Mount Watt northwest of High Level and the Rainbow Ridge Upland. The Formation also occurs towards the base of the Clear Hills, Caribou Mountains, Buffalo Head Hills and the Utikuma Upland areas, all of which are capped by the shale or silty shale of the Smoky Group sediments. The Kaskapau Formation and Lower Smoky Group are Upper Cretaceous marine shales and silty shales with concretionary ironstone beds.

Preglacial History

A major uplift of the region began at the end of the Cordilleran orogeny (Cretaceous-Paleocene time). The only evidence of the next 55 million years (from about 57 to 2 million years ago) are the 'preglacial' gravels left as remnant deposits by rivers flowing from the mountains and eroding away the plains. The oldest preglacial gravels in northwestern Alberta form the cap on the Swan Hills. Gravel on the Clear Hills, Caribou Mountains and Halverson ridge are somewhat younger, probably mid to late Tertiary. The youngest preglacial gravels in the region are the Grimshaw Gravels exposed in gravel pits near the town of Grimshaw. The Grimshaw Gravels are the lowest in elevation of the preglacial gravels and were deposited in a broad valley which, in part, is followed by the present Peace River. The Grimshaw Gravels are equivalent to the Saskatchewan Sands and Gravels present in many parts of Alberta (Edwards, 1988).

Glacial History

The study area was overridden by the Continental (Laurentide) ice



CRETACEOUS

UPPER CRETACEOUS

Ks — **SMOKY GROUP**: dark grey shale and silty shale, nodules and thin beds of concretionary ironstone, includes unnamed dark grey shale unit on Caribou Mountains and Buffalo Head Hills, marine

Kd — **DUNVEGAN FORMATION**: grey, fine-grained, feldspathic sandstone with hard calcareous beds; laminated siltstone and grey silty shale, deltaic to marine

UPPER AND LOWER CRETACEOUS

Ksh — **SHAFTESBURY FORMATION**: dark grey fish scale bearing shale, silty in upper part, numerous nodules and thin beds of concretionary ironstone; bentonite partings, lower part with thin silty and sandy intervals; marine

LOWER CRETACEOUS

Kp — **PEACE RIVER FORMATION**: fine-grained quartzose sandstone (Cadotte Member); dark grey silty shale (Harmon Member); fine grained glauconitic sandstone, silty interbeds in lower part (Notikewin Member); shoreline complex

Figure 2. Bedrock geology in the study area (Green, 1974)

sheet from the northeast during Late Wisconsinan time (24,000 to 10,000 years before present). The ice sheet scoured upland areas and deposited a mantle of glacial drift over the remainder of the area. MacDonald (1984) reports that the area from central Alberta to nearly half way down the Mackenzie River valley in the Northwest Territories was deglaciated by at least 10,500 yrs. B.P. Drainage, to the northeast from Alberta, blocked by retreating ice resulted in the formation of extensive glacial lakes in the major valleys. The lakes, eventually drained as the ice retreated from the study area, left extensive areas of glaciolacustrine sediments.

In the study area, higher ground to the east is covered by till (Figure 3, unit 6) and the western part, from the Peace River valley to about 2000 feet (610m) elevation, has an upper layer of glaciolacustrine silt and clay covering the till.

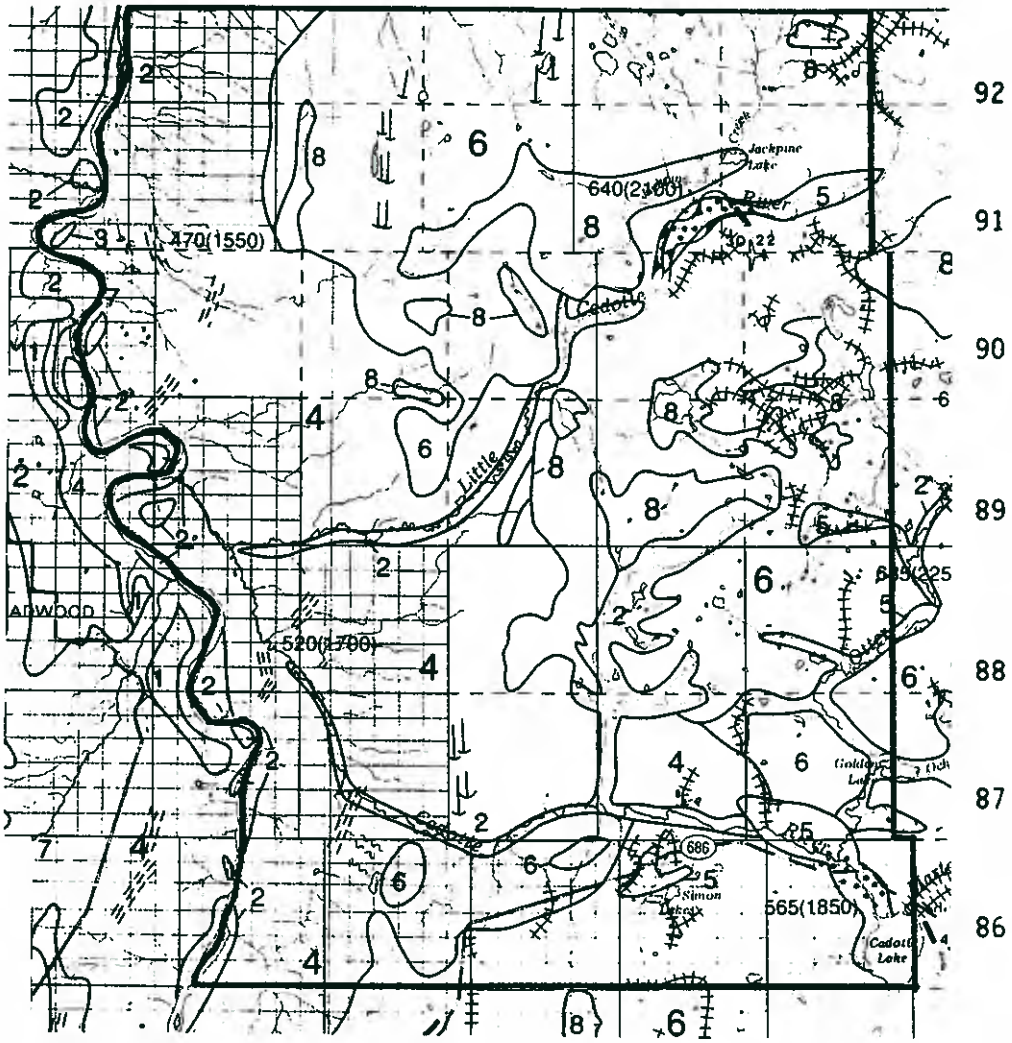
The distribution of surficial deposits in the study area shown in figure 3 is based on the surficial map of Fox, Richardson, Gowan and Sham (1987). The map units were delineated by air photo interpretation, are based on their mode of origin, and indicate the predominant materials to a depth of approximately 1m.

Postglacial History

After deglaciation and drainage of the glacial lakes the present drainage system was established. In the initial stages of down cutting along the Peace River, sands and gravels were deposited along what is now the rim of the valley by bank overflow. Later down cutting led to terrace development. These terraces now provide a potential source of sand and gravel.

SAND AND GRAVEL RESOURCES

The sand and gravel prospects in this study can be divided into two basic types and are located in three general areas. Prospects with a glaciofluvial origin are in the Cadotte and Jackpine Lake areas. Alluvial



SURFICIAL DEPOSITS

Type	Materials
1. Eolian	sand
2. Alluvium	gravel to clay
3. Recent lacustrine	silt and clay, minor sand
4. Glaciolacustrine	silt and clay, minor sand
5. Glaciofluvial	sand to gravel
6. Till	gravel to clay
7. Colluvium	gravel to clay
8. Organic	

LANDFORMS

Glacial grooves & drumlinoids
Abandoned channel
Outwash plain
Ice-thrust ridges
Abandoned shoreline
Highlevel record of glaciation 670(2200)
(approx. elevation metres (feet))

Figure 3. Surficial geology in the study area (Fox, Richardson, Gowan and Sham, 1987).

terrace deposits are along the Peace River valley.

The glaciofluvial prospects are predominantly sand. The lack of gravel in these deposits is due in part to the fine grained nature of the bedrock eroded during glaciation. The Smoky Group and Shaftesbury Formation shales did not provide a source of gravel size material for inclusion in the glaciofluvial deposits. Local material that was added is predomintly ironstone, a material deleterious to concrete aggregate. These prospects have relatively low economic potential.

Terrace deposits in the Peace River valley in this study area were described previously by Fox, Richardson and Sham (1987) as predominantly gravel. This information, gathered at level 5 (Table 1), is derived from air photo interpretation and a general understanding of the geology of the area. All deposits outlined by Fox, Richardson and Sham (1987) were field checked during the course of this more detailed investigation (level 3) and have been reinterpreted. Deposit 14 (Fox, Richardson and Sham, 1987), where it falls within the study area, contains no granular material and has not been shown on figure 5 (in pocket) as a prospect. Deposits 16, 25 and 27 contain no granular material and have not been shown on figure 8 (in pocket) as prospects. Deposit 18 is only a thin wedge of granular material and has not been shown on figure 8 as a prospect. Deposits 29 and 31 contain no granular material and have not been shown on figure 9 (in pocket) as prospects. Deposits 20, 22 and 24 have been verified as prospects and are shown as deposits 1, 2, 3, 4 and 5 on figure 8. Deposit 22 now is divided into deposits 2 and 3 (Plate 1) because it consists of terraces at two different elevations. Deposit 24 now is divided into deposits 4 (Plate 2) and 5 for the same reason. The deposits are not gravel deposits, as suggested by Fox, Richardson and Sham (1987), but are sand deposits. Deposits 3 and 4, figure 8 are gravelly sand.

The new information from this study contributes to a greater understanding of gravel deposition in the area and warrants a review of two of the working hypotheses that guided Fox, Richardson and Sham (1987) in the development of their regional sand and gravel map.

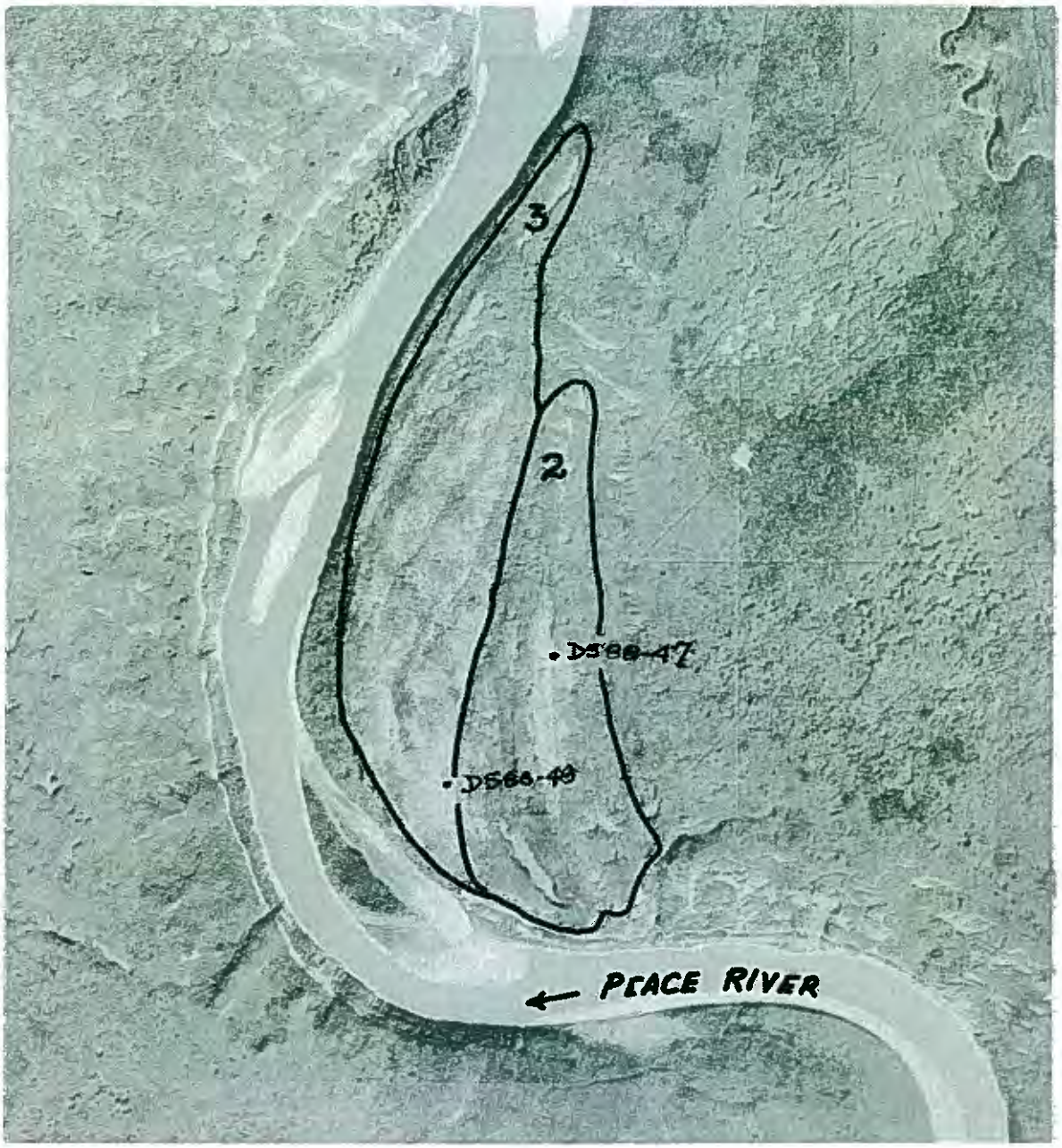


Plate 1. Alluvial terraces on the Peace River. Terrace deposit 2 (figure 8) has an elevation of 1400 feet and contains sand. Terrace deposit 3 has and elevation of 1300 feet and contains gravelly sand.

Plate 2. A terrace at 1500 feet elevation (by helicopter altimeter) along the Peace River is composed of iron stained, clean, gravelly sand with approximately 30% gravel and 5% oversize material. Granite clasts from the Canadian Shield are abundant.

Peace River terraces were believed by Fox, Richardson and Sham (1987) to change from gravel, to sand and gravel, to sand downstream from south of the city of Peace River to Fort Vermilion. Peace River terrace deposits are almost exclusively described as gravel by Fox, Richardson and Sham (1987) as far as township 92 which is at the north boundary of the present study area. Field work for this study shows that of the 10 deposits identified by Fox, Richardson and Sham (1987) only three of their deposits (Table 2) really are deposits and consist of sand or gravelly sand and not gravel. This casts their first hypothesis into doubt. The relative abundance of gravel in these terrace deposits does not seem to be due to the general deposition of the Peace River itself (ie. coarse upstream, fine downstream).

Table 2. Reevaluation of Peace River terrace deposits

Deposit (Fox, Richardson and Sham, 1987)	Description	Potential	Deposit (This Study)	Description	Potential
14	gravel	high		no prospect	
16	sand & gravel	medium		no prospect	
18	sand & gravel	medium		no prospect	
20	gravel	high	1	sand	high
22	sand & gravel	medium	2	sand	high
			3	gravelly sand	high
24	gravel	high	4	gravelly sand	high
			5	sand	high
25	gravel	high		no prospect	
27	gravel	high		no prospect	
29	sand & gravel	medium		no prospect	
31	gravel	high		no prospect	

A second hypothesis used in the earlier study was that the higher and older terraces contain more igneous rocks from the Canadian Shield (glacial transport) and lower terraces contain more quartzite from the preglacial gravels. It was believed that early stages of the Peace River development

involved erosion of till and release of rocks from the Canadian Shield. Lower terraces received more mountain quartzite as the preglacial channels were dissected. Terraces checked in the course of this study do not show this transition. Table 3 shows the elevation and relative amounts of Canadian Shield (granite, gneiss and schist), quartzite and ironstone clasts for five terraces in figure 8. Canadian Shield rocks do not show any significant decrease nor quartzite any increase from high to low terraces. The lack of abundant quartzite in the gravel at any level and the generally low gravel content in all deposits seems to indicate very little supply of preglacial clasts to the terraces in this area. The general hypothesis of highest quartzite at lowest levels may hold in parts of the Peace River region close to preglacial outcrops but does not hold in this study area.

Table 3. Elevation and rock types in five Peace River terrace deposits from map sheet 84C/11

Deposit	Elevation (ft)	Rock Types		
		Igneous	Quartzite	Ironstone
5	1160	abundant	present	abundant
1	1220	present	present	abundant
3	1300	abundant	present	very abundant
2	1400	abundant	present	abundant
4	1500	abundant	present	minor

Table 3 demonstrates the general increase in abundance of local rock types as the Peace River eroded downward. Ironstone is a common constituent of the Shaftesbury Formation which outcrops along the upper part of the Peace River valley in the study area. Ironstone is a minor part of the gravel in terrace deposit 4 which is at the top of the valley. As the river eroded through the Shaftesbury shales ironstone became an abundant and then very abundant component of the terrace material.

Preglacial gravels come close enough to the surface to be mined in the vicinity of Grimshaw, southwest of the study area. The preglacial channel which contains these gravels trends north-northeast from the Cardinal Lake area and the possibility was considered that the channel passes beneath the

eastern portion of the study area. No air photo expression or exposure of gravel was found to indicate that this is the case. Quartzite is present but not abundant in the terraces in the study area. The current level of knowledge suggests to the authors that preglacial gravels are not present on the east side of the Peace River in this area.

CONCLUSIONS

Terraces along the Peace River are the major prospects for sand and gravel but there is not nearly as much gravel in the study area as believed previously. Clasts of gravel size and oversize that can be crushed to gravel size seldom exceed 25% of the material in any deposit.

There is less quartzite from preglacial deposits than anticipated. Ironstone is abundant, weathered schist is present and both of these materials are detremental to the use of these materials for concrete.

RECOMMENDATIONS

Terraces along the Peace River should be investigated by extensive geophysical and drilling programs to delineate their area, thickness and clast content. Ground access would have to be established.

The potential exists for preglacial sands and gravels to be buried below the glaciolacustrine cover in the study area. A small drilling program in the area most likely to be the location of a preglacial channel the sands and gravels could determine whether this projection is valid. The discovery of preglacial material in the area would provide a source of high quality material.

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APPENDIX 1

PIT/SITE DESCRIPTIONS FOR MAP AREA 84C/6

Site Location: LSD8 Sec17 Tp86 R20 W5M

Site Description:

Terrace 5m thick immediately above river level composed of silt with clasts to 30cm fewer than 1%.

APPENDIX 2

PIT/SITE DESCRIPTIONS FOR MAP AREA 84C/7

DEPOSIT 1

LOCATION: Sec 29-32 Tp86 R17 W5M

No. of associated pits/sites: 1

No. of samples analysed: 1

DEPOSIT DESCRIPTION:

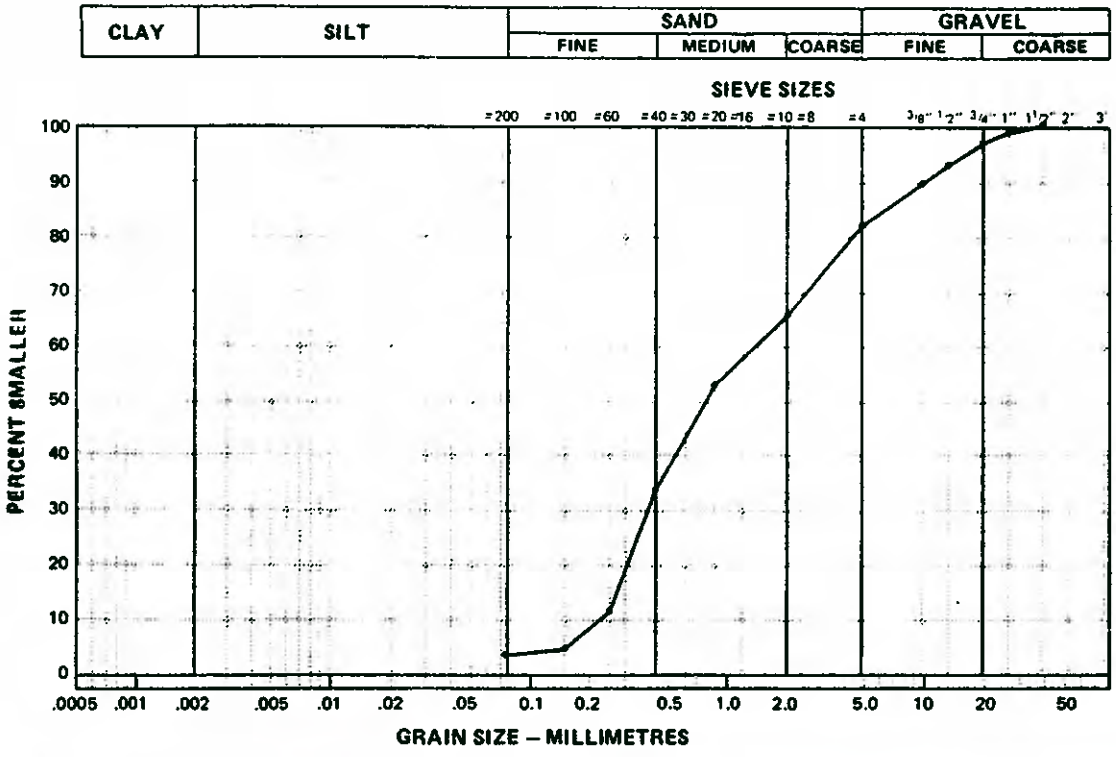
See pit description below.

Pit Location: SecSW32 Tp86 R17 W5M

Pit Description:

Approximately 6m of clean, medium to coarse grained sand with clasts to 15cm exposed below 1m of till in hummocky topography. Clasts are primarily igneous rocks from the Canadian Shield, with quartzite, sandstone, limestone and abundant ironstone.

Gradation:	% cobbles	20% gravel
	80% sand	% fines



APPENDIX 3

PIT/SITE DESCRIPTIONS FOR MAP AREA 84C/8

DEPOSIT

LOCATION: Sec 21-24,26-28 Tp86 R16 W5M

No. of associated pits/sites: 0

No. of samples analysed: 0

DEPOSIT DESCRIPTION:

Flyover. Fine to medium grained sand with few clasts in scars left by fallen trees.

DEPOSIT

LOCATION: Sec 25,26 Tp86 R16 W5M

No. of associated pits/sites: 0

No. of samples analysed: 0

DEPOSIT DESCRIPTION:

Flyover. Fine to medium grained sand with few clasts in scars left by fallen trees.

DEPOSIT

LOCATION: Sec 25-27,34,35 Tp86 R16 W5M

No. of associated pits/sites: 1

No. of samples analysed: 0

DEPOSIT DESCRIPTION:

See site description below.

Site Location: LSD5 Sec35 Tp86 R16 W4M

Site Description:

Roadcut in 3.5m of clean, fine to medium grained sand with clasts to 5cm fewer than 0.3%.

DEPOSIT

LOCATION: Sec 27 Tp86 R16 W5M

No. of associated pits/sites: 1

No. of samples analysed: 1

DEPOSIT DESCRIPTION:

See site description below.

Pit Location: LSD11 Sec27 Tp86 R16 W5M

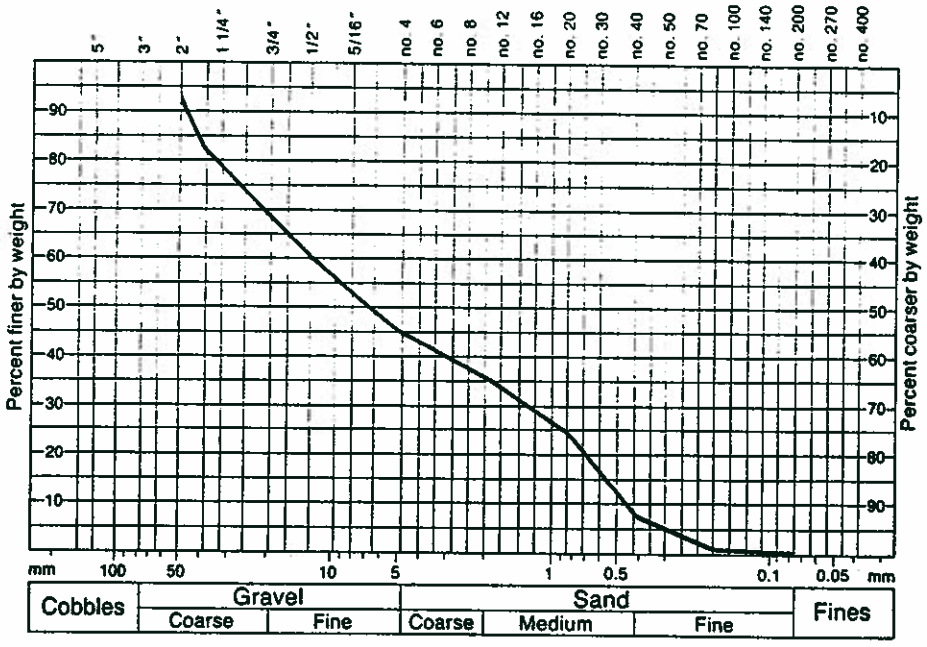
Pit Description:

Clean, fine to medium grained sand with clasts to 15cm fewer than 15% exposed in a pit of 2m maximum depth. Pit has a till floor and the water table is at 1.75m. Clasts are primarily igneous rocks from the Canadian Shield with limestone, hard sandstone, quartzite and ironstone. Bedding is horizontal and calcite encrustation is common on the weathered surface of clasts.

Gradation:	% cobbles	48% gravel
	45% sand	% fines

Gradation curve

Canadian standard sieve series



DEPOSIT

LOCATION: Sec 32 Tp86 R16 W5M

No. of associated pits/sites: 1

No. of samples analysed: 1

DEPOSIT DESCRIPTION:

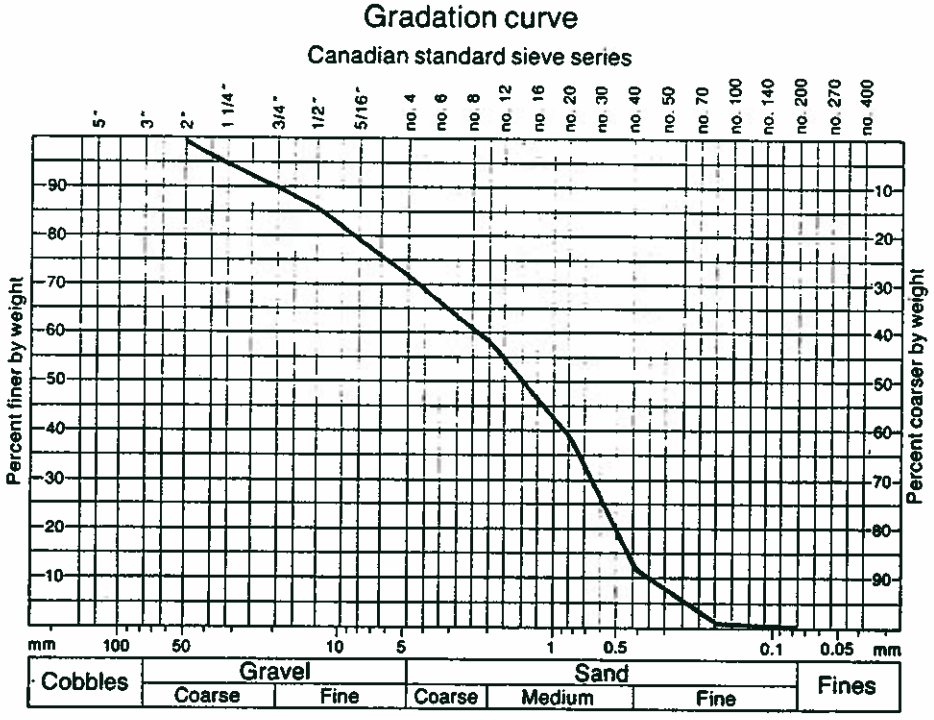
See pit description below.

Pit Location: LSD7 Sec32 Tp86 R16 W5M

Pit Description:

Highwall of 3m of cross bedded, mostly clean, medium to coarse grained sand with stringers of fine sand. Clasts to 25cm are present in a lens of dirty, iron stained material. Most clasts are smaller than 7.5cm and are igneous rocks from the Canadian Shield with soft sandstone, quartzite, clay clasts and ironstone. Water table is at 3m. A lens of till 1.5m high is present above the floor of the pit at the east end of the highwall.

Gradation: % cobbles 27% gravel
72% sand % fines



APPENDIX 4

PIT/SITE DESCRIPTIONS FROM MAP AREA 84C/9

DEPOSIT

LOCATION: Sec 32 Tp86 R16 W5M

No. of associated pits/sites: 1

No. of samples analysed: 2

DEPOSIT DESCRIPTION:

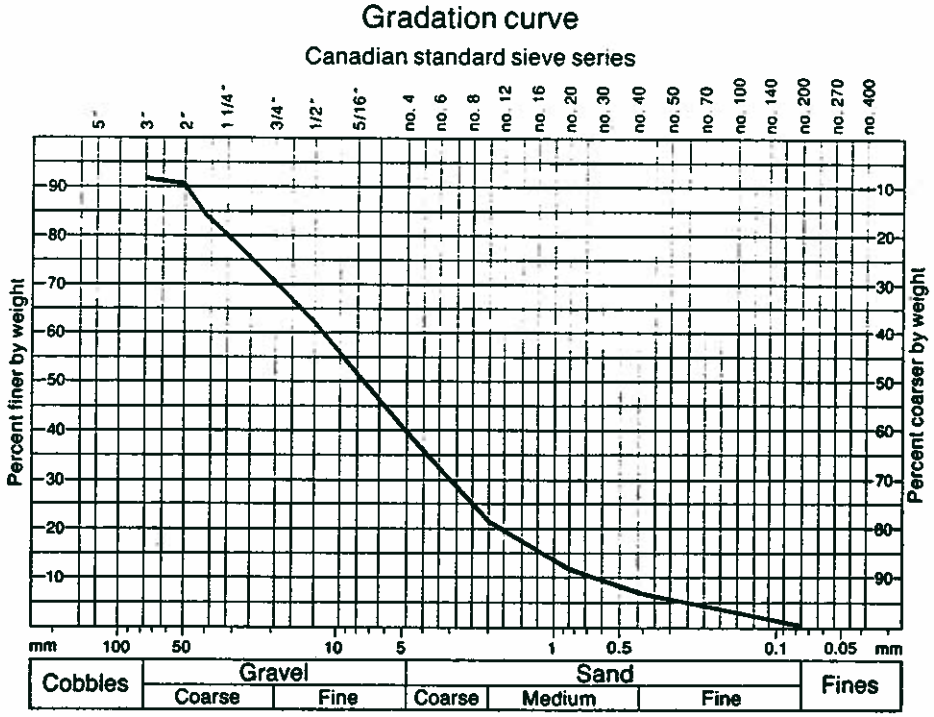
See pit description below.

Pit Location: LSD11 Sec32 Tp86 R16 W5M

Pit Description:

Disused pit with sloped sides except for one highwall 5m high of grossly horizontally bedded, dirty, coarse to medium grained sand. Oversize clasts to 90cm less than 3% and gravel less than 15% consist of igneous rocks from the Canadian Shield, including abundant weathered schist clasts, hard and soft sandstone, minor quartzite and abundant ironstone. Lenses of till and what appears to be shale bedrock are common in the highwall. "Pit run" from this pit probably contained fines as high as 20%. Samples are from the cleanest areas present in the highwall.

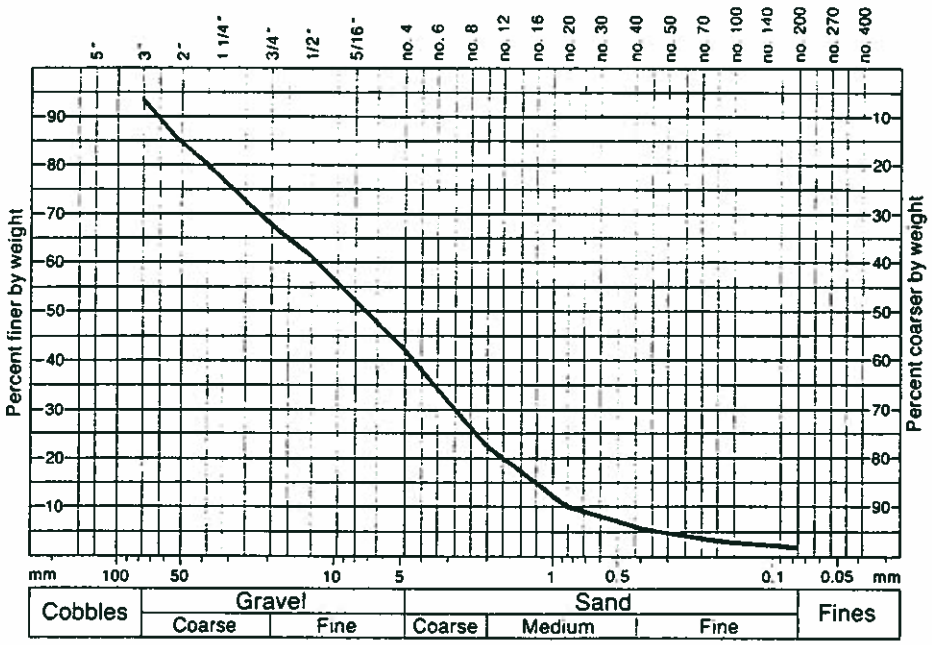
Gradation:	% cobbles	53% gravel
	40% sand	% fines



Gradation: % cobbles 50% gravel
42% sand 3% fines

Gradation curve

Canadian standard sieve series



DEPOSIT

LOCATION: Sec 1,2,12 Tp88 R16 W5M

No. of associated pits/sites: 1

No. of samples analysed: 0

DEPOSIT DESCRIPTION:

See site description below.

Site Location: LSD11 Sec1 Tp88 R16 W5M

Site Description:

Clean, fine to medium grained sand with clasts to 5cm fewer than 0.5%.

APPENDIX 5

PIT/SITE DESCRIPTIONS FOR MAP AREA 84C/10

DEPOSIT 1

LOCATION: Sec 8 Tp87 R17 W5M

No. of associated pits/sites: 1

No. of samples analysed: 0

DEPOSIT DESCRIPTION:

See site description below.

Site Location: LSD5 Sec8 Tp87 R17 W5M

Site Description:

Approximately 20m above the river in poplar with scattered spruce forest. Iron stained, clean, fine to mekium grained sand with clasts to 10cm fewer than 0.5% in pit dug to 40cm.

DEPOSIT 2

LOCATION: Sec 3,4,9,10 Tp87 R17 W5M

No. of associated pits/sites: 1

No. of samples analysed: 0

DEPOSIT DESCRIPTION:

See site description below.

Site Location: LSD1 Sec9 Tp87 R17 W5M

Site Description:

Small clearing in poplar and spruce forest. Soil approximately 10cm thick overlies iron stained, fine to medium grained sand with clasts to 25cm fewer than 5%. Clasts are primarily larger than 5cm and are igneous rocks from the Canadian Shield and quartzite.

DEPOSIT 3

LOCATION: Sec 1 Tp87 R17 W5M
Sec 6 Tp87 R16 W5M

No. of associated pits/sites: 1

No. of samples analysed: 0

DEPOSIT DESCRIPTION:

See site description below.

Site Location: LSD2 Sec1 Tp87 R17 W5M

Site Description:

Large clearing in pine, poplar and scattered spruce forest in bend of Cadotte River. Approximately 15cm of clayey silt over iron stained, clayey silt to fine sand with clast to 15cm fewer than 10%. Clasts are primarily igneous rocks from the Canadian Shield with quartzite. Sand coarsens slightly with depth in pit dug to 55cm.

DEPOSIT 4

LOCATION: Sec 13,24 Tp87 R17 W5M
Sec 17-19 Tp87 R16 W5M

No. of associated pits/sites: 1

No. of samples analysed: 0

DEPOSIT DESCRIPTION:

See site description below.

Site Location: LSD10 Sec18 Tp87 R16 W5M

Site Description:

Hummocky topography under clearing in pine with poplar forest. Iron stained, clean, fine to medium grained sand with no clasts. Pit dug to 40cm.

DEPOSIT 5

LOCATION: Sec 35,35 Tp87 R17 W5M

No. of associated pits/sites: 1

No. of samples analysed: 0

DEPOSIT DESCRIPTION:

See site description below.

Site Location: LSD11 Sec36 Tp87 R17 W5M

Site Description:

Very large clearing in pine and poplar forest. Iron stained, clean, fine to medium grained sand with no clasts. Pit dug to 75cm.

PIT/SITE DESCRIPTIONS OUTSIDE DEPOSITS

Site Location: LSD8 Sec2 Tp87 R17 W5M

Site Description:

Clearing in poplar forest on north bank of Cadotte River. Organic, slightly clayey silt approximately 15cm thick overlies iron stained clayey silt with clasts to 20cm fewer than 5%.

Site Location: LSD13 Sec4 Tp87 R17 W5M

Site Description:

Large grassy clearing. Organic, clayey silt over clayey silt with no clasts.

Site Location: LSD8 Sec2 Tp87 R19 W5M

Site Description:

Large, open, weed covered terrace. River silt below organic-rich soil to 20cm.

Site Location: LSD6 Sec4 Tp87 R18 W5M

Site Description:

Large, grassy clearing in poplar forest 3m above the Cadotte River. Organic, slightly clayey, silty soil, over slightly clayey silt. No clasts.

Site Location: LSD2 Sec11 Tp87 R18 W5M

Site Description:

Cut bank of Cadotte River approximately 3m high exposes clean, banded, river silt. Some bands are high in organic matter. No clasts.

Site Location: LSD15 Sec35 Tp86 R18 W5M

Site Description:

Silt to fine grained sandy clay. No clasts.

Pit Location: LSD16 Sec31 Tp86 R16 W5M

Pit Description:

Abandoned, depleted, reclaimed pit of iron stained sand with clasts to 35cm fewer than 15%. The pit appears to have removed a hummock of the material.

APPENDIX 6

PIT/SITE DESCRIPTIONS FOR MAP AREA 84C/11

DEPOSIT 1

LOCATION: Sec 14,15,23,26 Tp87 R20 W5M

No. of associated pits/sites: 1

No. of samples analysed: 1

DEPOSIT DESCRIPTION:

See site description below.

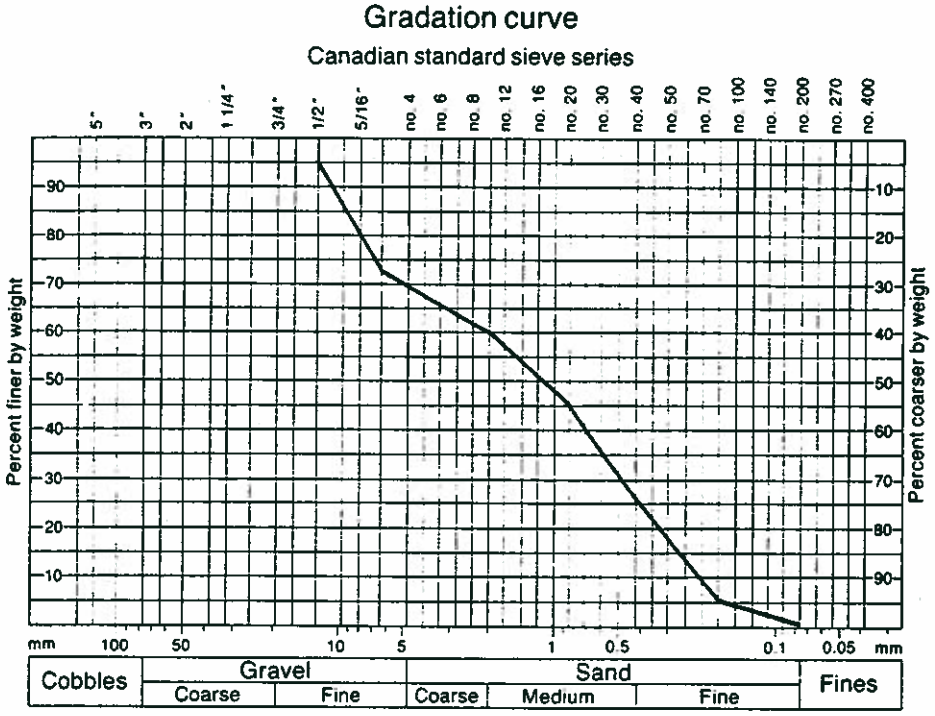
Site Location: LSD4 Sec23 Tp87 R20 W5M

Site Description:

Clearing on a terrace in poplar forest with 30cm of clay soil over dirty, iron stained, moist sand with a layer of oversize clasts at the contact. Oversize clasts to 25cm 3%, gravel 25%, sand 62% and fines 10% in 0.8m pit. Clasts are igneous rocks from the Canadian Shield, hard and soft sandstone, quartzite and abundant ironstone. Elevation 1220' on helicopter altimeter.

Due to helicopter weight restrictions the sample collected was passed through a 16mm sieve in the field.

Gradation: % cobbles 25% gravel
68% sand 2% fines



DEPOSIT 2

LOCATION: Sec 33 Tp87 R20 W5M
Sec 4,9 Tp88 R20 W5M

No. of associated pits/sites: 1

No. of samples analysed: 1

DEPOSIT DESCRIPTION:

See site description below.

Site Location: LSD2 Sec4 Tp88 R20 W5M

Site Description:

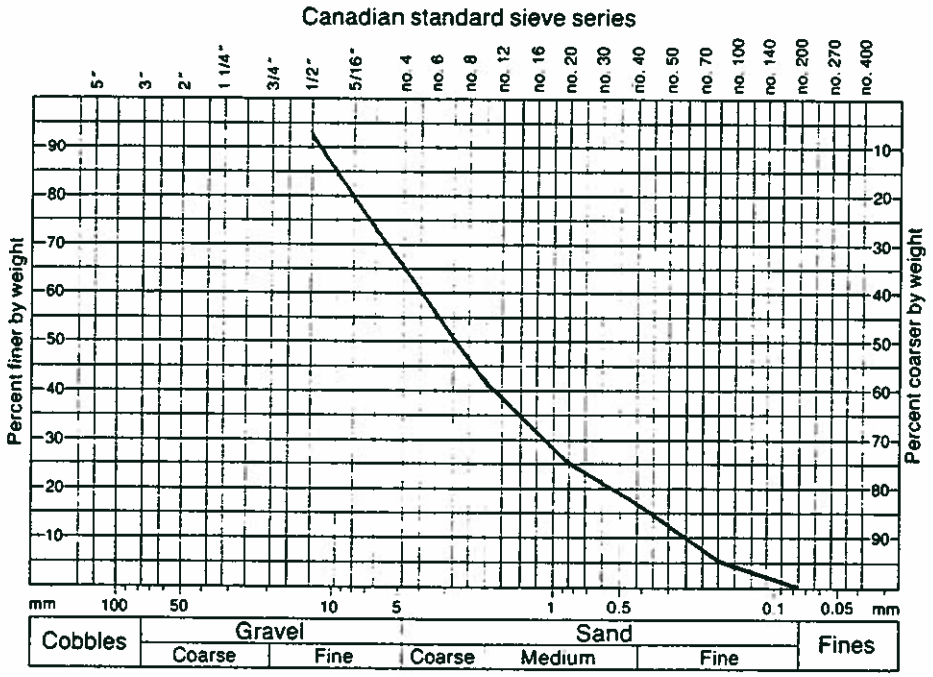
Large clearing in poplar forest on a terrace at 1400' elevation by helicopter altimeter. Approximately 15cm of iron stained clay soil over dry, iron stained, fine to medium grained sand with oversize clasts 5%, gravel 15% and fines 3%. Iron stain decreases slightly

with depth in a 0.75m pit. Orientation of tabular clasts suggests horizontal bedding. Clasts are igneous rocks from the Candaian Shield, including some weathered schist. Also present are hard and soft sandstone, quartzite, a few soft shale clasts and abundant ironstone. The ironstone, shale and weathered schist clasts are deleterious components for concrete.

Due to helicopter weight restrictions the sample collected was passed through a 16mm sieve in the field.

Gradation: % cobbles 28% gravel
65% sand % fines

Gradation curve



DEPOSIT 3

LOCATION: Sec 32,33 Tp87 R20 W5M
Sec 4,5,8,9 Tp88 R20 W5M

No. of associated pits/sites: 3

No. of samples analysed: 1

DEPOSIT DESCRIPTION:

Approximately 15cm soil overburden over iron stained, clean sand with variable amounts of clasts primarily from the Canadian Shield.

Site Location: LSD6 Sec9 Tp88 R20 W5M

Site Description:

Iron stained, fine to medium grained sand with clasts fewer than 1%.

Site Location: LSD12 Sec33 Tp87 R20 W5M

Site Description:

Terrace with soil overburden less than 15cm over fine to medium grained sand with clasts of granite, gneiss and ironstone. Clasts to 30cm.

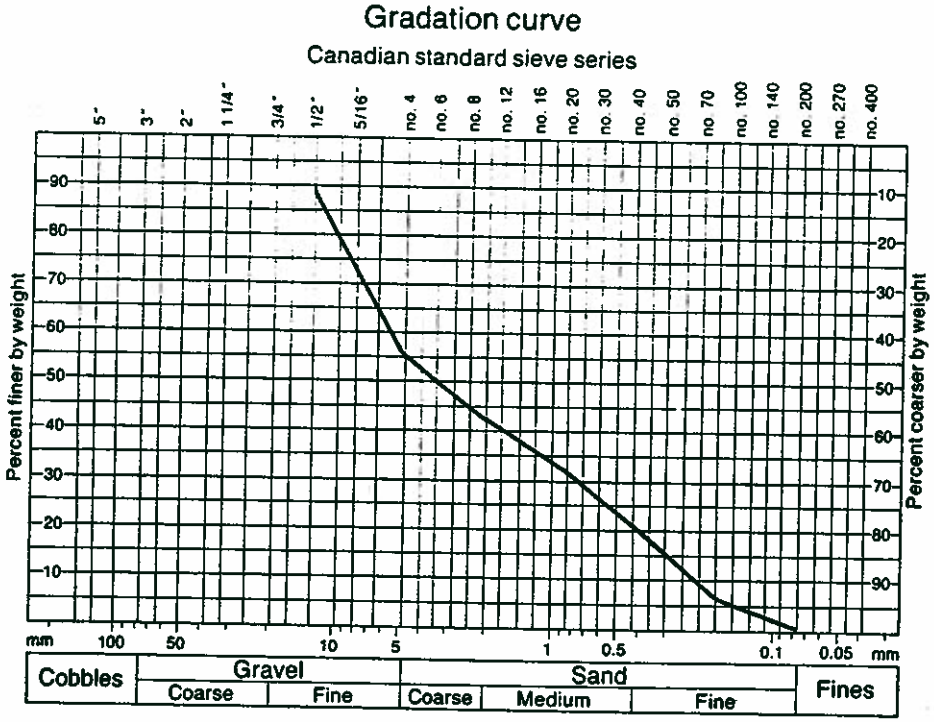
Site Location: LSD11 Sec33 Tp87 R20 W5M

Site Description:

Very large opening in poplar forest on a terrace at 1300' elevation by helicopter altimeter. Approximately 15cm of soil overburden over iron stained, clean, gravelly sand. Oversize clasts to 35cm 5%, gravel 35% and fines 2%. Clasts are abundant granite and gneiss from the Canadian Shield with minor schist, limestone and clay plus very abundant ironstone. Pit dug to 0.8m.

Due to helicopter weight limitations the sample collected was passed through a 16mm sieve in the field.

Gradation: % cobbles 33% gravel
55% sand % fines



DEPOSIT 4

LOCATION: Sec 1,2,11,12 Tp89 R21 W5M

No. of associated pits/sites: 2

No. of samples analysed: 1

DEPOSIT DESCRIPTION:

Approximately 15cm of silt and clay over iron stained, clean gravelly sand. Clasts are primarily igneous rocks from the Canadian Shield.

Site Location: LSD14 Sec1 Tp89 R21 W5M

Site Description:

Terrace with overburdern approximately 15cm thick over sand with rounded quartzite clasts.

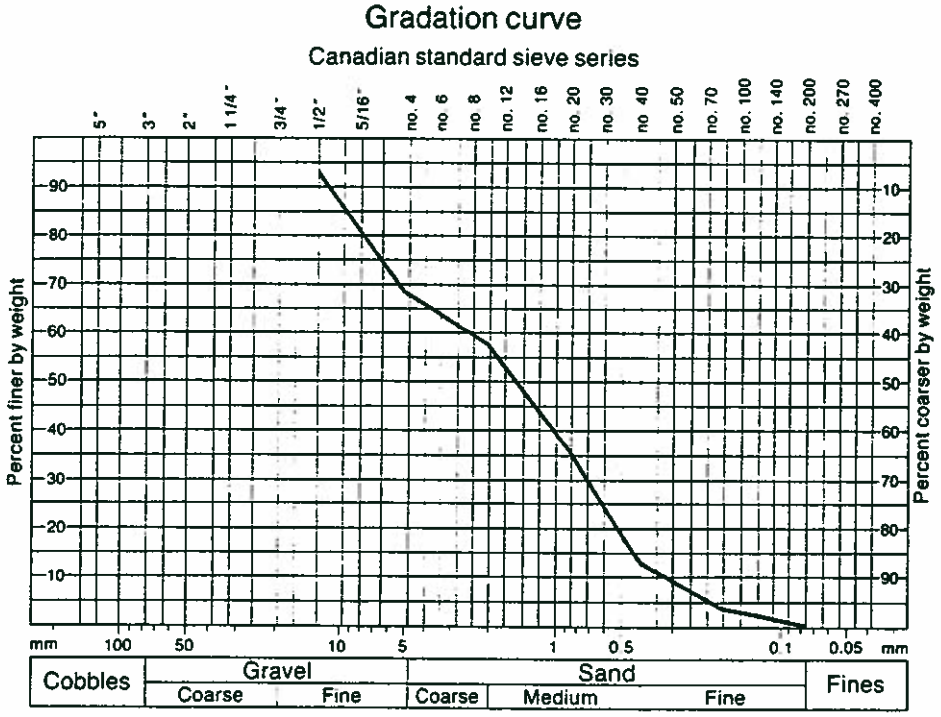
Site Location: LSD4 Sec12 Tp89 R21 W5M

Site Description:

Large clearing in poplar forest on flat terrace at 1500' elevation by helicopter altimeter. Iron stained, clean, gravelly sand below 15cm of silt and clay overburden. Sand is fine to medium grained. Oversize clasts to 35cm 5%, gravel 30% and fines 5%. Clasts are primarily igneous rocks from the Canadian Shield with quartzite and minor ironstone in a pit dug to 0.9m.

Because of helicopter weight limitations the sample collected was passed through a 16mm sieve in the field.

Gradation: % cobbles 25% gravel
68% sand % fines



DEPOSIT 5

LOCATION: Sec 11-14 Tp89 R21 W5M

No. of associated pits/sites: 1

No. of samples analysed: 1

DEPOSIT DESCRIPTION:

See site description below.

Site Location: LSD16 Sec11 Tp89 R21 W5M

Site Description:

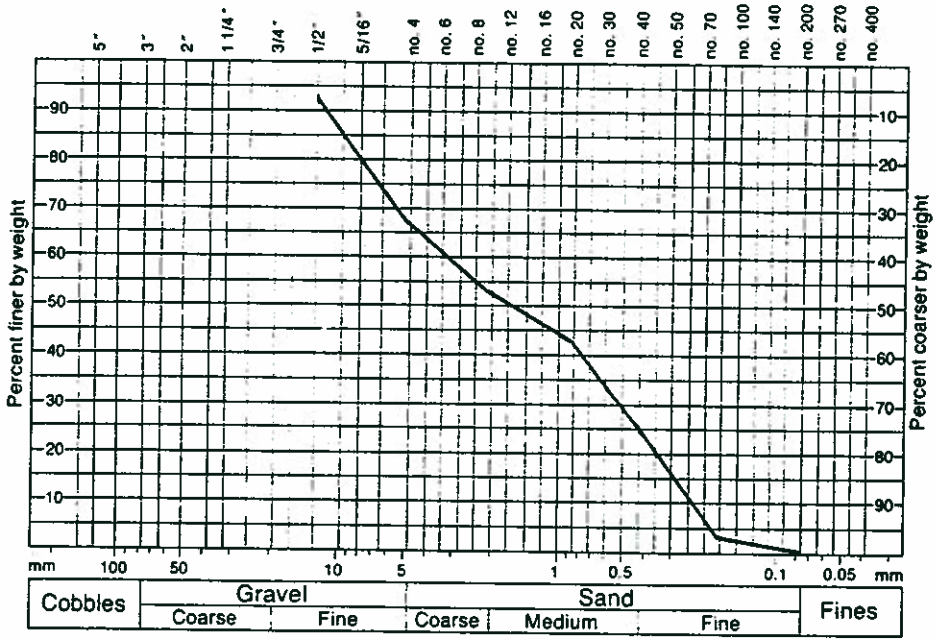
Clearing approximately 110m long by 50m wide in poplar with spruce forest on terrace at 1160' elevation by helicopter altimeter. Material is heavily iron stained, fine to medium grained sand with oversize clasts to 25cm 3%, gravel 20% and fines 2%. Clasts are primarily igneous rocks from the Canadian Shield, hard sandstone, tabular quartzite, chert and abundant ironstone.

Because of helicopter weight limitations the sample collected was passed through a 16mm sieve in the field.

Gradation: % cobbles 27% gravel
66% sand % fines

Gradation curve

Canadian standard sieve series



DEPOSIT 6

LOCATION: Sec 11,12 Tp88 R20 W5M

No. of associated pits/sites: 1

No. of samples analysed: 0

DEPOSIT DESCRIPTION:

See site description below

Site Location: LSD16 Sec11 Tp88 R20 W5M

Site Description:

Lens of clean, fine to medium grained sand containing lenses of gravelly sand with clasts to 30cm over shale bedrock. Maximum thickness of the gravelly sand lenses is 75cm. Silt and clay soil overburden varies from 15-35cm. Clasts are primarily igneous rocks from the Canadian Shield.

DEPOSIT 7

LOCATION: Sec 31 Tp87 R19 W5M

No. of associated pits/sites: 1

No. of samples analysed: 0

DEPOSIT DESCRIPTION:

See site description below.

Site Location: LSD10 Sec31 Tp87 R19 W5M

Site Description:

Approximately 1m of silt to fine sand with primarily oversize clasts to 35cm over shale bedrock is present in riverbank.

PIT/SITE DESCRIPTIONS OUTSIDE DEPOSITS

Site Location: LSD1 Sec10 Tp87 R20 W5M

Site Description:

Clearing in poplar forest. Approximately 35cm of clay soil over shale bedrock. Area may be a slump block.

Site Location: LSD16 Sec10 Tp87 R20 W5M

Site Description:

Flyover. Wedge of gravel, approximately 5m high and probably no more than 3m thick at its widest spot, butting on to bedrock along the Peace River. Both the river side and the bedrock contact side of the wedge are very steeply dipping. This material would be very difficult to mine.

Site Location: LSD9 Sec33 Tp86 R20 W5M

Site Description:

Wedge of iron stained, cross bedded gravel and sand with clasts to 30cm, approximately 10m high and probably no more than 1m thick at its widest spot butting on to bedrock along the Peace River. Both the river side and the bedrock contact side of the wedge are very steeply dipping. Clasts are igneous rocks from the Canadian Shield, quartzite

and limestone.

APPENDIX 7

PIT/SITE DESCRIPTIONS FOR MAP AREA 84C/14

Site Location: LSD13 Sec10 Tp90 R21 W5M

Site Description:

Steep SW facing clearing along Peace River. Silt and clay with clasts to 5cm fewer than 0.3%.

Site Location: LSD16 Sec19 Tp90 R19 W5M

Site Description:

Clayey silt soil 10cm thick over silty clay with no clasts in a pit dug to 55cm.

APPENDIX 8

PIT/SITE DESCRIPTIONS FOR MAP AREA 84C/15

DEPOSIT 1

LOCATION: Sec 33 Tp90 R17 W5M
Sec 2,3,10,11 Tp91 R17 W5M

No. of associated pits/sites: 2

No. of samples analysed: 0

DEPOSIT DESCRIPTION:

See site descriptions below.

Site Location: LSD8 Sec33 Tp90 R17 W5M

Site Description:

Approximately 2cm of silty soil over approximately 5cm of iron stained fine to medium grained sand with clasts to 15cm fewer than 5% over clayey sand with clasts to 15cm fewer than 1%.

Site Location: LSD6 Sec11 Tp91 R17 W5M

Site Description:

Iron stained, clean, fine to medium grained sand with not clasts in apit dug to 50cm.

PIT/SITE DESCRIPTIONS OUTSIDE OF DEPOSITS

Site Location: LSD15 Sec11 Tp91 R17 W5M

Site Description:

Clayey silt with clasts to 7.5cm fewer than 0.5% in a pit dug to 40cm.

APPENDIX 9

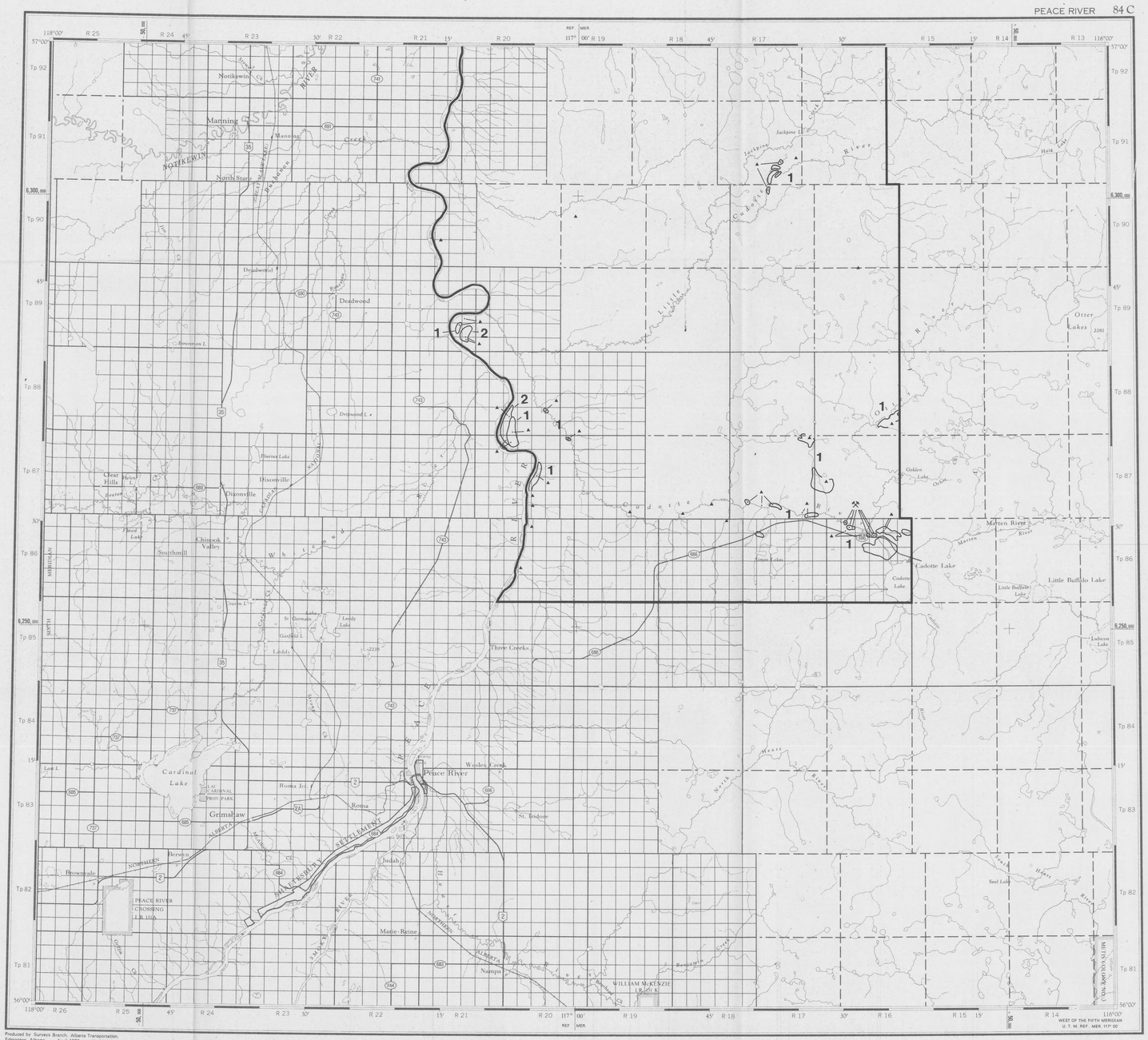
PIT/SITE DESCRIPTIONS FOR MAP AREA 84C/16

Site Location: LSD13 Sec34 Tp89 R16 W5M

Site Description:

Approximately 20cm of clayey silt with clasts to 20cm fewer than 0.5% over sandy clay with no clasts in a pit dug to 40cm.

84C Peace River



This reconnaissance-level, aggregate potential map is derived from published information, aerial photograph interpretation and limited field checking. As such, deposit outlines are assumed and material descriptions are either assumed or approximate. The sources of information used to produce this map are listed below and terms used in the legend are defined in the ternary diagram.

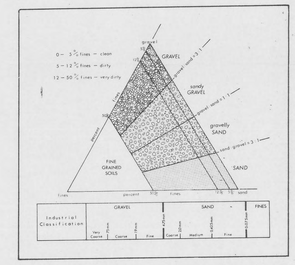
1 Sand, most commonly fine to medium grained, clean

2 Gravelly sand, most commonly fine to medium grained, clean

⚒ Pit, active or inactive

▲ Sample and/or description site

—— Assumed boundary from air photo interpretation



Published sources of information

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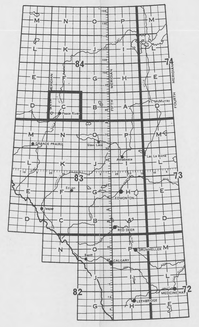


Aggregate Resources

84C Peace River 1:250,000

D.W. Scafe, W.A.D. Edwards, D.R. Boisvert

Published 1989
Geology and compilation 1988 89
Figure 4

This sand and gravel resource map was prepared by the Alberta Geological Survey as part of an ongoing aggregate inventory of Alberta. This information shown on this map is intended for general land-use planning, land management and aggregate exploration until such time as more detailed maps or reports are available for the area.

Cartography by Alberta Research Council

ALBERTA RESEARCH COUNCIL
Natural Resources Division
Alberta Geological Survey

84C CFR 81-21

84 C/6 1:50,000 CANADA EDITION 2 84 C/6

Produced by the SURVEYS AND MAPPING BRANCH, DEPARTMENT OF ENERGY, MINES AND RESOURCES. Updated from aerial photographs taken in 1970 and 1974. Culture check 1974. Printed 1976.

Copies may be obtained from the Canada Map Office, Department of Energy, Mines and Resources, Ottawa, or your nearest map dealer.

Roads:	Routes:		
loose or stabilized surface, all weather	gravier aggloméré, toute saison	2 lanes or more / 2 voies ou plus	less than 2 lanes / moins de 2 voies
loose surface, dry weather and unclassified streets	de gravier, temps sec et rues hors classe		
cart track	de terre		
trail, cut line or portage	sentier, percée ou portage		

FOR COMPLETE REFERENCE SEE REVERSE SIDE — POUR UNE LISTE COMPLÈTE DES SIGNES, VOIR AU VERSO

WEBERVILLE

ALBERTA

WEST OF FIFTH MERIDIAN - OUEST DU CINQUIÈME MÉRIDIEN

Scale 1:50,000 Échelle

Miles 1 0 1 2 3 Miles
Metres 1000 0 1000 2000 3000 4000 Mètres
Yards 1000 0 1000 2000 3000 4000 Yards

CONTOUR INTERVAL 50 FEET
Elevations in Feet above Mean Sea Level
North American Datum 1927
Transverse Mercator Projection

ÉQUIDISTANCE DES COURBES 50 PIEDS
Élévations en pieds au dessus du niveau moyen de la mer
Système de référence géodésique nord-américain, 1927
Projection transverse de Mercator

Établie par la DIRECTION DES LEVÉS ET DE LA CARTOGRAPHIE, MINISTÈRE DE L'ÉNERGIE, DES MINES ET DES RESSOURCES. Mise à jour à l'aide de photographies aériennes prises en 1970 et 1974. Vérification des ouvrages en 1974. Imprimée en 1976.

Ces cartes sont en vente au Bureau des Cartes du Canada, ministère de l'Energie, des Mines et des Ressources, Ottawa, ou chez le vendeur le plus près.

GENERAL COMMENTS

DEPOSIT CHARACTERISTICS

Deposit Number	Material Description	Reserves (1000 m³) Gravel	Reserves (1000 m³) Sand	Additional Comments	Texture (%) Gravel	Texture (%) Sand	Texture (%) Fines	(%) Wear	Overburden Thickness (m)	Deposit Thickness (m)	Deposit Area (ha)	Deposit Genesis	Additional Comments
LEVEL 3 - Regional Mapping Study Area NO DEPOSITS													

Deposit Number — Granular deposits shown on this map may have commercial possibilities. That assumption followed from two criteria used in the mapping process: study of the area considered only granular deposits greater than one metre thick, and covering an area more than one hectare; and it only considered deposits where the mineral-aggregate thickness was greater than the overburden thickness. Although the scale of mapping did not permit investigation of all small deposits, many small deposits containing existing pits are indicated.

Material Description — Sand and gravel has a variety of applications, such as concrete for construction, asphalt concrete, subbase and base course aggregate for roads, gravel and sand for road surfaces, and pit run for fill. Gradation, rock hardness, and binding characteristics, are some of the specific qualities that are considered in aggregate towards determining its end use. This map indicates these, and other, geological qualities of the sand and gravel within each deposit, but does not indicate their potential uses. The terms used in the table are defined in the figure below.

Reserves — The method of calculating in cubic metres the aggregate reserves of deposits took four basic steps. First, the area, in hectares, of each deposit was determined using aerial photographs. Second, geological interpretation, sometimes supported by subsurface information, was assumed in determining the geometry of each deposit, to estimate an overall, average deposit thickness in metres. Third, geological study and limited sample analyses demined the texture (gradation) of sediments in the deposit, and an overall average percentage of gravel and sand. Finally, the volume was calculated as follows: reserve gravel (m³) = area (ha) × thickness (m) × 10,000 × % gravel; the same formula was used for sand.

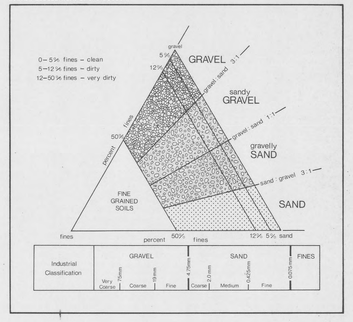
Texture — The texture of the sediment refers to the percentage of particles of various sizes. For mineral aggregate, the most important fractions are the gravel and sand. The actual dimensions of the clasts and particles in these fractions are given in the figure. The values given for a particular deposit were determined from a field estimate, or from laboratory analysis, of one or more samples from that deposit. Where more than one sample is taken the tabulated number is the mean value.

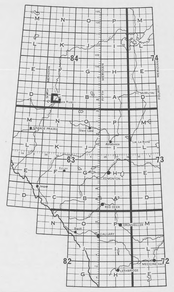
Wear — The resistance of gravel-size clasts to wear or abrasion can be measured in a laboratory test (ASTM-C131, Los Angeles Abrasion Testing). The amount of material that breaks down into smaller sizes is measured and related to the original sample weight in terms of percent wear. The higher the percentage wear the more susceptible the gravel is to breakdown under stress. Gravel with a percentage wear of less than 40 is considered very resistant.

Overburden Thickness — The thickness of non-economic material, or overburden, covering a deposit, sometimes is a limiting factor in the exploitation of an aggregate deposit. The tabulated values given are approximate overburden thicknesses as determined from geological investigations and subsurface testing.

Deposit Area — Deposits in this study were delineated by interpretation of aerial photographs and the contacts should be considered approximate. Information is precise only where test holes, or geological sections, are indicated.

Deposit Genesis — The genesis, or formation, of deposits is vital to the understanding of the gradational nature, extent and geometry of the deposit. This understanding forms the basis for extrapolation from a limited number of known points (test holes, pits, sections) and permits an overall assessment of the deposit.





Map Legend

- 3 Deposit number
- Assumed boundary from air photo interpretation
- Active or inactive pit
- Sample and/or description site

Aggregate Resources

84C/6 Weberville

D.W. Scafe, W.A.D. Edwards, D.R. Boisvert

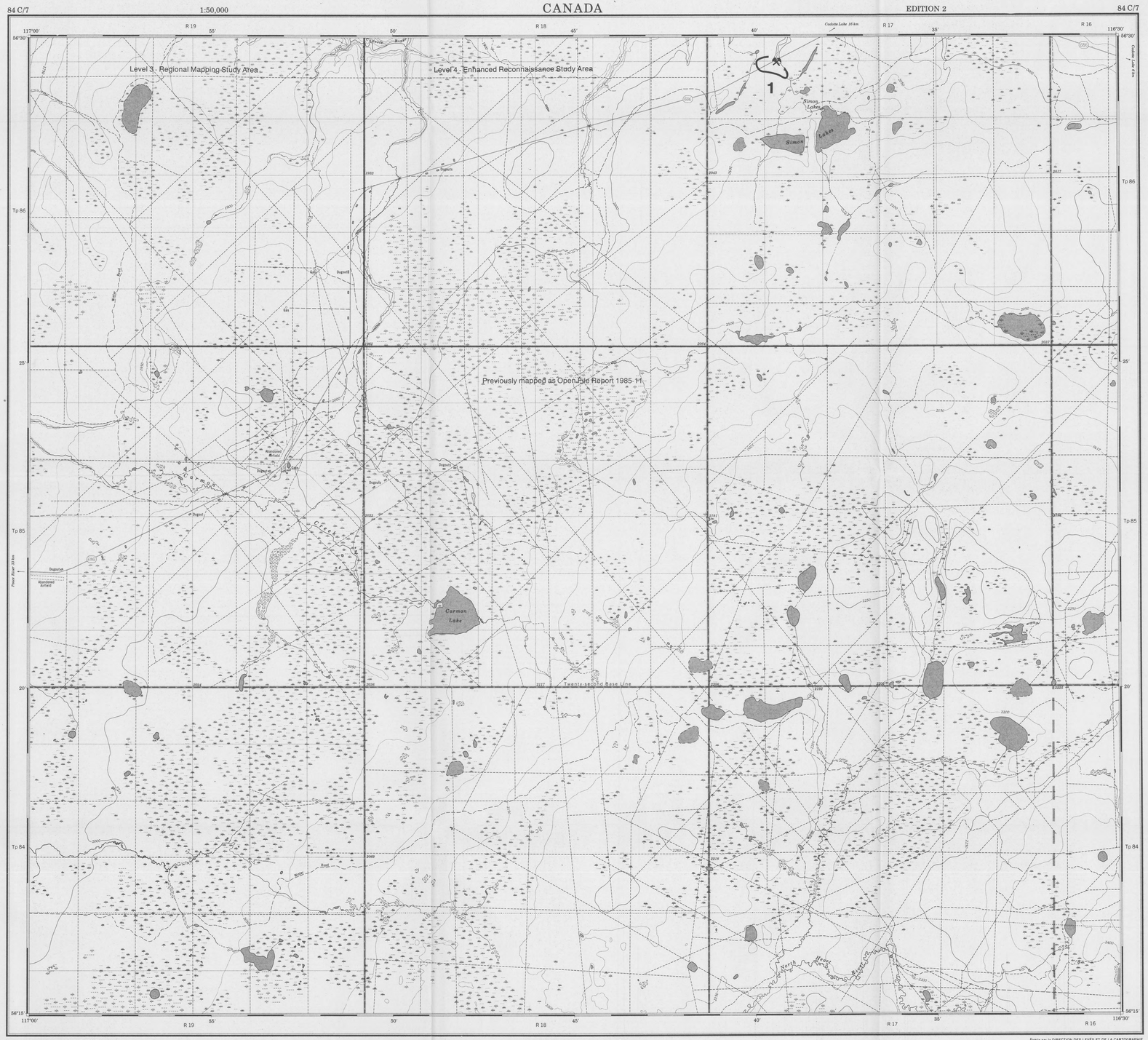
Published 1989
Figure 5

This is a sand and gravel resource map prepared by the Alberta Geological Survey as part of a series at a scale of 1:50,000. The series represents an ongoing aggregate inventory of Alberta which provides data for general land-use planning, land management or aggregate exploration. Please note that the delineation of deposits and calculation of reserves are approximations only. Alberta Energy and Natural Resources provides financial support for the Aggregate Inventory.

Cartography by Alberta Research Council, Graphic Services, J.K. Mathie.

ALBERTA RESEARCH COUNCIL
Natural Resources Division
Alberta Geological Survey

84 C/7 1:50,000 CANADA EDITION 2 84 C/7



Produced by the SURVEYS AND MAPPING BRANCH, DEPARTMENT OF ENERGY, MINES AND RESOURCES. Updated from aerial photographs taken in 1974. Culture check 1976. Information current as of 1976.

Copies may be obtained from the Canada Map Office, Department of Energy, Mines and Resources, Ottawa, or your nearest map dealer.

Roads:	Routes:		
loose or stabilized surface, all weather	gravier aggloméré, toute saison	2 lanes or more 2 voies ou plus	less than 2 lanes moins de 2 voies
loose surface, dry weather and unclassified streets	de gravier, temps sec et rues hors classe		
cart track	de ferme		
trail, cut line or portage	sentier, percée ou portage		

FOR COMPLETE REFERENCE SEE REVERSE SIDE POUR UNE LISTE COMPLÈTE DES SIGNES, VOIR AU VERSO

SIMON LAKES

IMPROVEMENT DISTRICT 17

ALBERTA

WEST OF FIFTH MERIDIAN-OUEST DU CINQUIÈME MÉRIDIEN

Scale 1:50,000 Échelle

Miles 1 0 1 2 3 Miles

Metres 1000 0 1000 2000 3000 4000 Mètres

Yards 1000 0 1000 2000 3000 4000 Yarges

CONTOUR INTERVAL 50 FEET
Elevations in Feet above Mean Sea Level
North American Datum 1927
Transverse Mercator Projection

ÉQUIDISTANCE DES COURBES 50 PIEDS
Élévations en pieds au-dessus du niveau moyen de la mer
Système de référence géodésique nord-américain, 1927
Projection transverse de Mercator

Établi par la DIRECTION DES LEVÉS ET DE LA CARTOGRAPHIE, MINISTÈRE DE L'ÉNERGIE, DES MINES ET DES RESSOURCES. Mise à jour à partir de photographies aériennes prises en 1974. Vérification des ouvrages en 1976. Renseignements à jour en 1976.

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GENERAL COMMENTS

DEPOSIT CHARACTERISTICS

Deposit Number	Material Description	Reserves (1000 m³) Gravel	Reserves (1000 m³) Sand	Additional Comments	Texture (%) Gravel	Texture (%) Sand	Texture (%) Fines	(%) Wear	Overburden Thickness (m)	Deposit Thickness (m)	Deposit Area (ha)	Deposit Genesis	Additional Comments
LEVEL 3 - Regional Mapping Study Area NO DEPOSITS													
LEVEL 4 - Enhanced Reconnaissance Study Area													
1	gravelly sand			clean, coarse grained					1.5	7.5	32	outwash	

Deposit Number — Granular deposits shown on this map may have commercial possibilities. That assumption followed from two criteria used in the mapping process: study of the area considered only granular deposits greater than one metre thick, and covering an area more than one hectare; and it only considered deposits where the mineral-aggregate thickness was greater than the overburden thickness. Although the scale of mapping did not permit investigation of all small deposits, many small deposits containing existing pits are indicated.

Material Description — Sand and gravel has a variety of applications, such as concrete for construction, asphalt concrete, subbase and base course aggregate for roads; gravel and sand for road surfaces, and pit run for fill. Gradation, rock hardness, and binding characteristics, are some of the specific qualities that are considered in aggregate towards determining its end use. This map indicates these, and other, geological qualities of the sand and gravel within each deposit, but does not indicate their potential uses. The terms used in the table are defined in the figure below.

Reserves — The method of calculating in cubic metres the aggregate reserves of deposits took four basic steps. First, the area, in hectares, of each deposit was determined using aerial photographs. Second, geological interpretation, sometimes supported by subsurface information, was assumed in determining the geometry of each deposit; to estimate an overall, average deposit thickness in metres. Third, geological study and limited sample analyses determined the texture (gradation) of sediments in the deposit, and an overall average percentage of gravel and sand. Finally, the volume was calculated as follows: reserve gravel (m^3) = area (ha) × thickness (m) × 10,000 × % gravel; the same formula was used for sand.

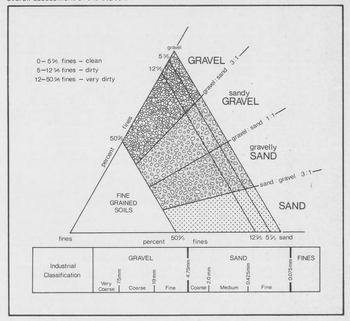
Texture — The texture of the sediment refers to the percentage of particles of various sizes. For mineral aggregate, the most important fractions are the gravel and sand. The actual dimensions of the clasts and particles in these fractions are given in the figure. The values given for a particular deposit were determined from a field estimate, or from laboratory analysis, of one or more samples from that deposit. Where more than one sample is taken the tabulated number is the mean value.

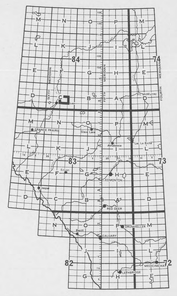
Wear — The resistance of gravel-size clasts to wear or abrasion can be measured in a laboratory test (ASTM-C131, Los Angeles Abrasion Testing). The amount of material that breaks down into smaller sizes is measured and related to the original sample weight in terms of percent wear. The higher the percentage wear the more susceptible the gravel is to breakdown under stress. Gravel with a percentage wear of less than 40 is considered very resistant.

Overburden Thickness — The thickness of non-economic material, or overburden, covering a deposit, sometimes is a limiting factor in the exploitation of an aggregate deposit. The tabulated values given are approximate overburden thicknesses as determined from geological investigations and subsurface testing.

Deposit Area — Deposits in this study were delineated by interpretation of aerial photographs and the contacts should be considered approximate. Information is precise only where test holes, or geological sections, are indicated.

Deposit Genesis — The genesis, or formation, of deposits is vital to the understanding of the gradational nature, extent and geometry of the deposit. This understanding forms the basis for extrapolation from a limited number of known points (test holes, pits, sections) and permits an overall assessment of the deposit.





Map Legend

- 3 Deposit number
- Assumed boundary from air photo interpretation
- Active or inactive pit
- ▲ Sample and/or description site

Aggregate Resources

84C/7 Simon Lakes

D.W. Scafe, W.A.D. Edwards, D.R. Boisvert

Published 1989
Figure 6

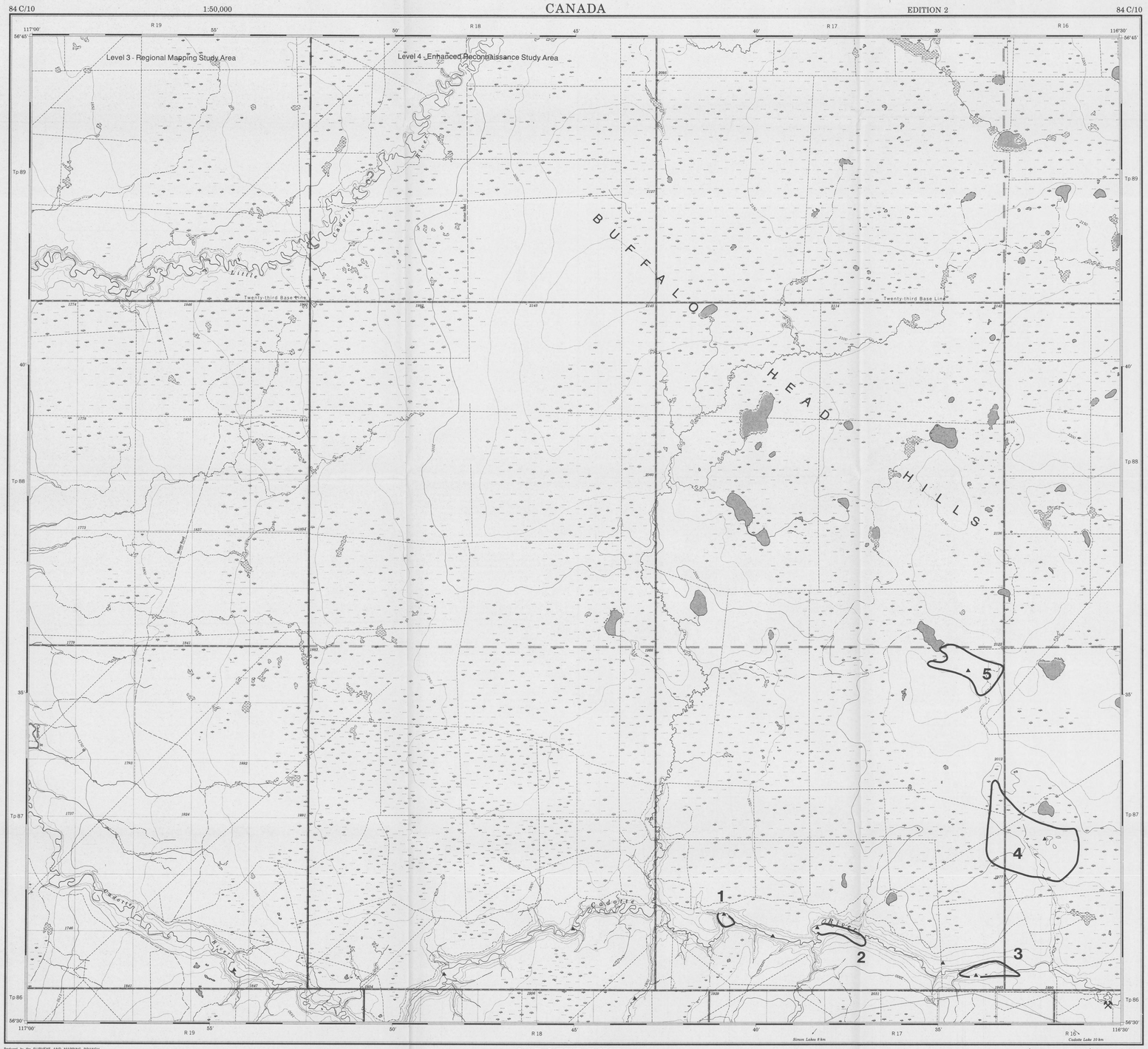
This is a sand and gravel resource map prepared by the Alberta Geological Survey as part of a series at a scale of 1:50,000. The series represents an ongoing aggregate inventory of Alberta which provides data for general land-use planning, land management or aggregate exploration. Please note that the delineation of deposits and calculation of reserves are approximations only. Alberta Energy and Natural Resources provides financial support for the Aggregate Inventory.

Cartography by Alberta Research Council, Graphic Services, J.K. Matthe.

ALBERTA RESEARCH COUNCIL
Natural Resources Division
Alberta Geological Survey

84C/10 Cadotte River

84 C/10 1:50,000 CANADA EDITION 2 84 C/10



CADOTTE RIVER

IMPROVEMENT DISTRICT 17

ALBERTA

WEST OF FIFTH MERIDIAN-OUEST DU CINQUIÈME MÉRIDIEN

Scale 1:50,000 Échelle

Miles 1 0 1 2 3 Miles

Metres 1000 0 1000 2000 3000 4000 Metres

Yards 1000 0 1000 2000 3000 4000 Verges

CONTOUR INTERVAL 50 FEET
Elevations in Feet above Mean Sea Level
North American Datum 1927
Transverse Mercator Projection

ÉQUIDISTANCE DES COURBES 50 PIEDS
Élévations en pieds au-dessus du niveau moyen de la mer
Système de référence géodésique nord-américain, 1927
Projection transverse de Mercator

Produced by the SURVEYS AND MAPPING BRANCH, DEPARTMENT OF ENERGY, MINES AND RESOURCES. Field data compiled by D.W. Scafe in 1974. Culture check 1976. Information current as of 1976.

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Roads: Routes:

loose or stabilized surface, all weather	gravier aggloméré, toute saison	2 lanes or more 2 voies ou plus	less than 2 lanes moins de 2 voies
loose surface, dry weather and unclassified streets	de gravier, temps sec et rues hors classe		
cart tracks	de terre		
trail, cut line or portage	sentier, percée ou portage		

FOR COMPLETE REFERENCE SEE REVERSE SIDE POUR UNE LISTE COMPLÈTE DES SIGNES, VOIR AU VERSO

Établi par la DIRECTION DES LEVÉS ET DE LA CARTOGRAPHIE, MINISTÈRE DE L'ÉNERGIE, DES MINES ET DES RESSOURCES. Mise à jour à l'aide de photographies aériennes prises en 1974; vérification des limites et renseignements à jour en 1976.

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GENERAL COMMENTS

DEPOSIT CHARACTERISTICS

Deposit Number	Material Description	Reserves (1000 m³) Gravel	Reserves (1000 m³) Sand	Additional Comments	Texture (%) Gravel	Texture (%) Sand	Texture (%) Fines	(%) Wear	Overburden Thickness (m)	Deposit Thickness (m)	Deposit Area (ha)	Deposit Genesis	Additional Comments
LEVEL 3 - Regional Mapping Study Area NO DEPOSITS													
LEVEL 4 - Enhanced Reconnaissance Study Area													
1	sand			iron stained, fine to medium grained							15	fluvial	clasts fewer than 0.5%
2	sand			iron stained, fine to medium grained					0.1 0.15		42 54	fluvial fluvial	clasts fewer than 5% clasts fewer than 10%
3	sand			iron stained, fine grained									
4	sand			clean, fine to medium grained							431	ice contact	no clasts
5	sand			clean, fine to medium grained							133	outwash	no clasts

Deposit Number — Granular deposits shown on this map may have commercial possibilities. That assumption followed from two criteria used in the mapping process: study of the area considered only granular deposits greater than one metre thick, and covering an area more than one hectare; and it only considered deposits where the mineral–aggregate thickness was greater than the overburden thickness. Although the scale of mapping did not permit investigation of all small deposits, many small deposits containing existing pits are indicated.

Material Description — Sand and gravel has a variety of applications, such as concrete for construction, asphalt concrete, subbase and base course aggregate for roads, gravel and sand for road surfaces, and pit run for fill. Gradation, rock hardness, and binding characteristics, are some of the specific qualities that are considered in aggregate towards determining its end use. This map indicates these, and other, geological qualities of the sand and gravel within each deposit, but does not indicate their potential uses. The terms used in the table are defined in the figure below.

Reserves — The method of calculating in cubic metres the aggregate reserves of deposits took four basic steps. First, the area, in hectares, of each deposit was determined using aerial photographs. Second, geological interpretation, sometimes supported by subsurface information, was assumed in determining the geometry of each deposit, to estimate an overall, average deposit thickness in metres. Third, geological study and limited sample analyses determined the texture (gradation) of sediments in the deposit, and an overall average percentage of gravel and sand. Finally, the volume was calculated as follows: reserve gravel (m³) = area (ha) × thickness (m) × 10,000 × % gravel; the same formula was used for sand.

Texture — The texture of the sediment refers to the percentage of particles of various sizes. For mineral aggregate, the most important fractions are the gravel and sand. The actual dimensions of the clasts and particles in these fractions are given in the figure. The values given for a particular deposit were determined from a field estimate, or from laboratory analysis, of one or more samples from that deposit. Where more than one sample is taken the tabulated number is the mean value.

Wear — The resistance of gravel-size clasts to wear or abrasion can be measured in a laboratory test (ASTM-C131, Los Angeles Abrasion Testing). The amount of material that breaks down into smaller sizes is measured and related to the original sample weight in terms of percent wear. The higher the percentage wear the more susceptible the gravel is to breakdown under stress. Gravel with a percentage wear of less than 40 is considered very resistant.

Overburden Thickness — The thickness of non-economic material, or overburden, covering a deposit, sometimes is a limiting factor in the exploitation of an aggregate deposit. The tabulated values given are approximate overburden thicknesses as determined from geological investigations and subsurface testing.

Deposit Area — Deposits in this study were delineated by interpretation of aerial photographs and the contacts should be considered approximate. Information is precise only where test holes, or geological sections, are indicated.

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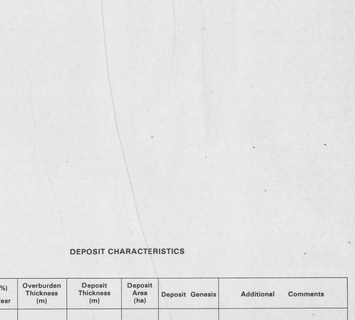

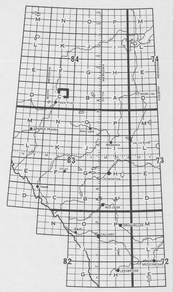

Map Legend

- 3 Deposit number
- Assumed boundary from air photo interpretation
- Active or inactive pit
- ▲ Sample and/or description site

Aggregate Resources

84C/10 Cadotte River

D.W. Scafe, W.A.D. Edwards, D.R. Boisvert

Published 1989
Figure 7

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Cartography by Alberta Research Council, Graphic Services, J.K. Matthie.

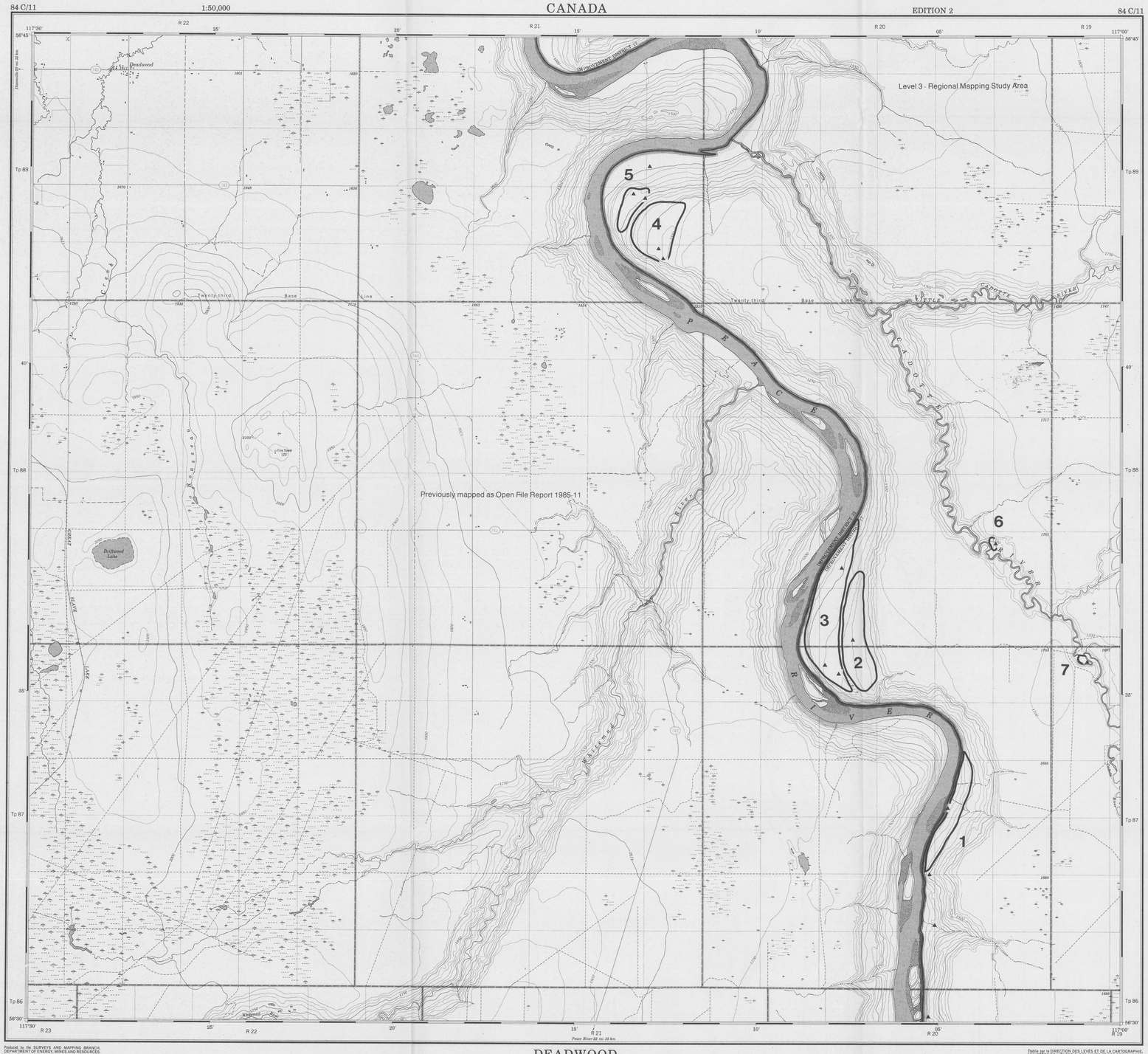
ALBERTA RESEARCH COUNCIL

Natural Resources Division
Alberta Geological Survey

84C/11 Deadwood

84C/11 OFR 1991-31

84 C/11 1:50,000 CANADA EDITION 2 84 C/11



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Roads: Routes

loose or stabilized surface, all weather ... gravier agglomeré, toute saison ... 2 lanes or more / 2 voies ou plus ... less than 2 lanes / moins de 2 voies

loose surface, dry weather and unclassified streets ... de gravier, temps sec et rues hors classe ...

cart track ... de terre ...

trail, cut line or portage ... sentier, percée ou portage ...

FOR COMPLETE REFERENCE SEE REVERSE SIDE — POUR UNE LISTE COMPLÈTE DES SIGNES, VOIR AU VERSO

DEADWOOD

ALBERTA

WEST OF FIFTH MERIDIAN - OUEST DU CINQUIÈME MÉRIDIEN

Scale 1:50,000 Echelle

Miles 1 0 1 2 3 Miles

Metres 1000 0 1000 2000 3000 4000 Mètres

Yards 1000 0 1000 2000 3000 4000 Verges

CONTOUR INTERVAL 50 FEET
Elevations in Feet above Mean Sea Level
North American Datum 1927
Transverse Mercator Projection

EQUIDISTANCE DES COURBES 50 PIEDS
Élévations en pieds au dessus du niveau moyen de la mer
Système de référence géodésique nord américain, 1927
Projection transverse de Mercator

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GENERAL COMMENTS

DEPOSIT CHARACTERISTICS

Deposit Number	Material Description	Reserves (1000 m³) Gravel	Reserves (1000 m³) Sand	Additional Comments	Texture (%) Gravel	Texture (%) Sand	Texture (%) Fines	(%) Wear	Overburden Thickness (m)	Deposit Thickness (m)	Deposit Area (ha)	Deposit Genesis	Additional Comments
LEVEL 3 - Regional Mapping Study Area													
1	sand	360	910	iron stained, dirty, fine to medium grained	25	62	10		0.3	1	146	fluvial	1220' on helicopter altimeter
2	sand	242	1242	iron stained, fine to medium grained	15	77	3		0.15	0.75	215	fluvial	1400' on helicopter altimeter
3	gravelly sand	2254	3735	iron stained, fine to medium grained	35	58	2		0.15	2	322	fluvial	1300' on helicopter altimeter
4	gravelly sand	1056	2112	iron stained, fine to medium grained	30	60	5		0.15	2	176	fluvial	1500' on helicopter altimeter
5	sand	128	480	heavily iron stained, fine to coarse grained	20	75	2		0.15	1	64	fluvial	1160' on helicopter altimeter
6	sand			fine to medium grained					0.15-0.35	0.75	5	fluvial	gravelly sand lenses
7	sand			fine grained						1	7	fluvial	clasts primarily oversize

Deposit Number — Granular deposits shown on this map may have commercial possibilities. That assumption followed from two criteria used in the mapping process: study of the area considered only granular deposits greater than one metre thick, and covering an area more than one hectare; and it only considered deposits where the mineral-aggregate thickness was greater than the overburden thickness. Although the scale of mapping did not permit investigation of all small deposits, many small deposits containing existing pits are indicated.

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Texture — The texture of the sediment refers to the percentage of particles of various sizes. For mineral aggregate, the most important fractions are the gravel and sand. The actual dimensions of the clasts and particles in these fractions are given in the figure. The values given for a particular deposit were determined from a field estimate, or from laboratory analysis, of one or more samples from that deposit. Where more than one sample is taken the tabulated number is the mean value.

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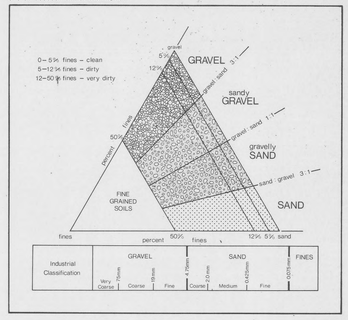

Map Legend

3 Deposit number

Assumed boundary from air photo interpretation

Active or inactive pit

Sample and/or description site

Aggregate Resources

84C/11 Deadwood

D.W. Scafe, W.A.D. Edwards, D.R. Boisvert

Published 1989
Figure 8

This is a sand and gravel resource map prepared by the Alberta Geological Survey as part of a series at a scale of 1:50,000. The series represents an ongoing aggregate resource study which provides data for general land-use planning, land management or aggregate exploration. Please note that the delineation of deposits and calculation of reserves are approximations only. Alberta Energy and Natural Resources provides financial support for the Aggregate Inventory.

Cartography by Alberta Research Council, Graphic Services, J.K. Matthe.

ALBERTA RESEARCH COUNCIL
Natural Resources Division
Alberta Geological Survey

84C/14 Buchanan Creek

84 C/14 1:50,000 CANADA EDITION 2 84 C/14

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Roads: Routes:
loose or stabilized surface, all weather... gravier aggloméré, toute saison... 2 lanes or more / 2 voies ou plus — less than 2 lanes / moins de 2 voies
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cart track... de terre...
trail, cut line or portage... sentier, percée ou portage...

FOR COMPLETE REFERENCE SEE REVERSE SIDE POUR UNE LISTE COMPLÈTE DES SIGNES VOIR AU VERSO

BUCHANAN CREEK
ALBERTA
WEST OF FIFTH MERIDIAN · OUEST DU CINQUIÈME MÉRIDIEN

Scale 1:50,000 Échelle

Miles 1 0 1 2 3 Miles
Metres 1000 0 1000 2000 3000 4000 Mètres
Yards 1000 0 1000 2000 3000 4000 Yards

CONTOUR INTERVAL 50 FEET
Elevations in Feet above Mean Sea Level
North American Datum 1927
Transverse Mercator Projection

ÉQUIDISTANCE DES COURBES 50 PIEDS
Élévations en pieds au-dessus du niveau moyen de la mer
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Projection transverse de Mercator

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GENERAL COMMENTS

LEVEL 3 - Regional Mapping Study Area
NO DEPOSITS

LEVEL 4 - Enhanced Reconnaissance Study Area
NO DEPOSITS

DEPOSIT CHARACTERISTICS

Deposit Number	Material Description	Reserves (1000 m³) Gravel	Reserves (1000 m³) Sand	Additional Comments	Texture (%) Gravel	Texture (%) Sand	Texture (%) Fines	(%) Wear	Overburden Thickness (m)	Deposit Thickness (m)	Deposit Area (ha)	Deposit Genesis	Additional Comments

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Texture — The texture of the sediment refers to the percentage of particles of various sizes. For mineral aggregate, the most important fractions are the gravel and sand. The actual dimensions of the clasts and particles in these fractions are given in the figure. The values given for a particular deposit were determined from a field estimate, or from laboratory analysis, of one or more samples from that deposit. Where more than one sample is taken the tabulated number is the mean value.

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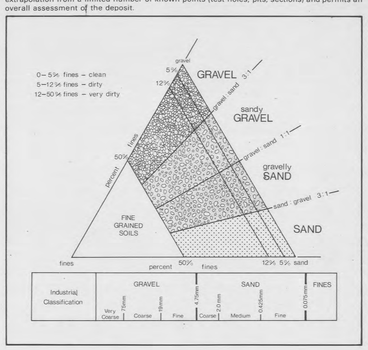

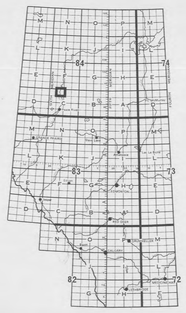

Map Legend

3 Deposit number
Assumed boundary from air photo interpretation
Active or inactive pit
▲ Sample and/or description site

Aggregate Resources

84C/14 Buchanan Creek

D.W. Scafe, W.A.D. Edwards, D.R. Boisvert

Published 1989
Figure 9

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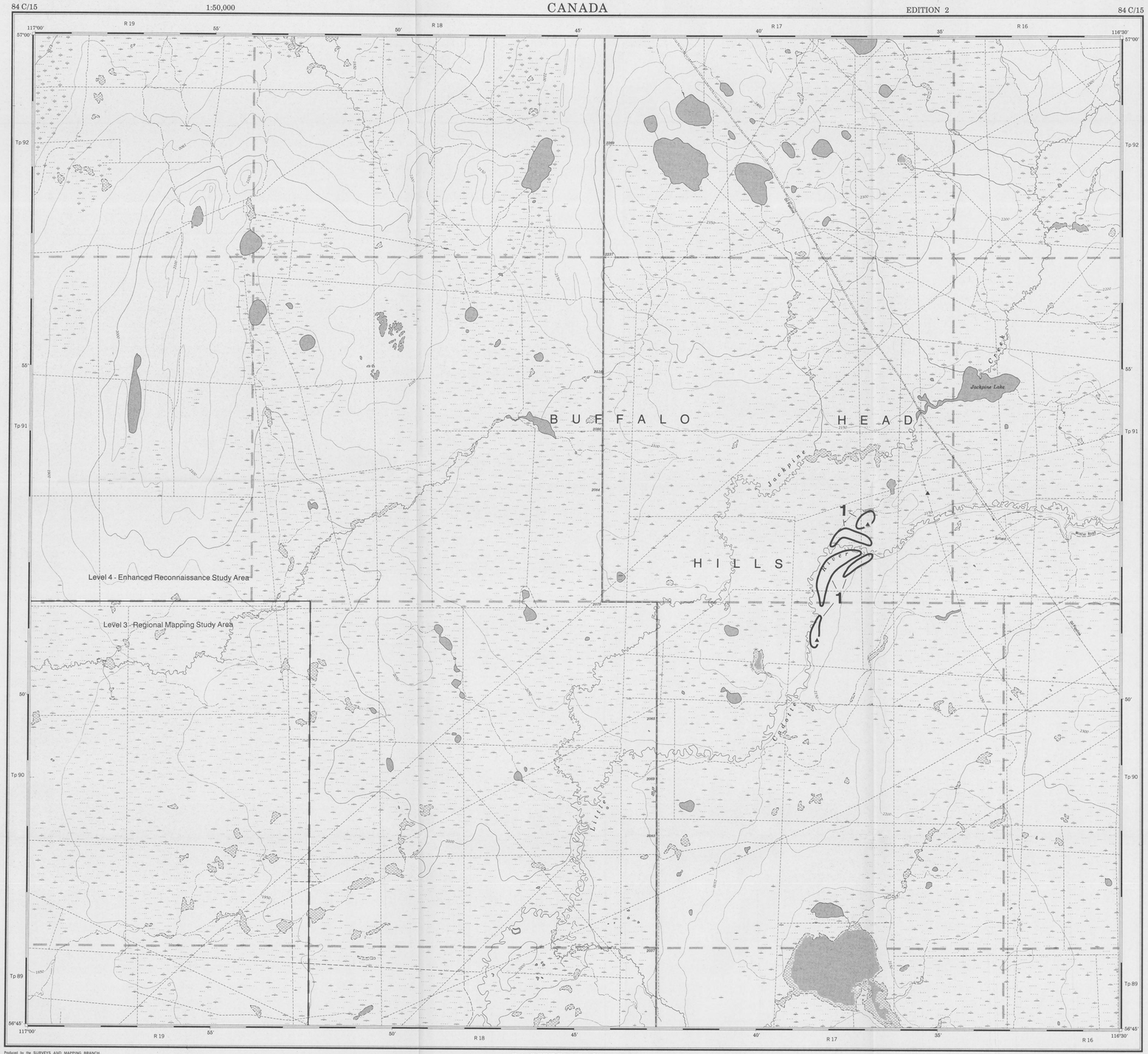
Cartography by Alberta Research Council, Graphic Services, J.K. Matthie.

ALBERTA RESEARCH COUNCIL
Natural Resources Division
Alberta Geological Survey

84C/15 Jackpine Creek

84 C/15 1:50,000 CANADA EDITION 2 84 C/15



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Roads: Routes:
cart track ..... de terre .....
trail, cut line or portage ..... sentier, percée ou portage .....
FOR COMPLETE REFERENCE SEE REVERSE SIDE POUR UNE LISTE COMPLÈTE DES SIGNES, VOIR AU VERSO

JACKPINE CREEK

IMPROVEMENT DISTRICT 17
ALBERTA
WEST OF FIFTH MERIDIAN-OUEST DU CINQUIÈME MÉRIDIEN
Scale 1:50,000 Échelle

Miles 1 0 1 2 3 Milles
Metres 1000 0 1000 2000 3000 4000 Mètres
Yards 1000 0 1000 2000 3000 4000 Verges

CONTOUR INTERVAL 50 FEET
Elevations in Feet above Mean Sea Level
North American Datum 1927
Transverse Mercator Projection

ÉQUIDISTANCE DES COURBES 50 PIEDS
Élévations en pieds au-dessus du niveau moyen de la mer
Système de référence géodésique nord-américain, 1927
Projection transverse de Mercator

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GENERAL COMMENTS

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LEVEL 3 - Regional Mapping Study Area NO DEPOSITS													
LEVEL 4 - Enhanced Reconnaissance Study Area													
1	sand			fine to medium grained					0		149	fluvial terrace	

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Reserves — The method of calculating in cubic metres the aggregate reserves of deposits took four basic steps. First, the area, in hectares, of each deposit was determined using aerial photographs. Second, geological interpretation, sometimes supported by subsurface information, was assumed in determining the geometry of each deposit, to estimate an overall, average deposit thickness in metres. Third, geological study and limited sample analyses determined the texture (gradation) of sediments in the deposit, and an overall average percentage of gravel and sand. Finally, the volume was calculated as follows: reserve gravel (m^3) = area (ha) × thickness (m) × 10,000 × % gravel; the same formula was used for sand.

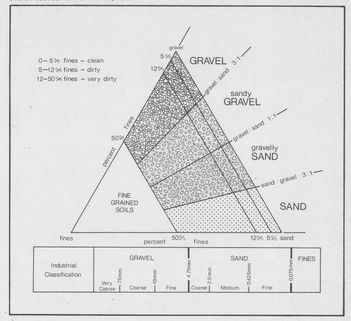
Texture — The texture of the sediment refers to the percentage of particles of various sizes. For mineral aggregate, the most important fractions are the gravel and sand. The actual dimensions of the clasts and particles in these fractions are given in the figure. The values given for a particular deposit were determined from a field estimate, or from laboratory analysis, of one or more samples from that deposit. Where more than one sample is taken the tabulated number is the mean value.

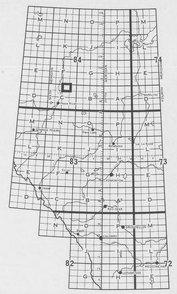
Wear — The resistance of gravel-size clasts to wear or abrasion can be measured in a laboratory test (ASTM-C131, Los Angeles Abrasion Testing). The amount of material that breaks down into smaller sizes is measured and related to the original sample weight in terms of percent wear. The higher the percentage wear the more susceptible the gravel is to breakdown under stress. Gravel with a percentage wear of less than 40 is considered very resistant.

Overburden Thickness — The thickness of non-economic material, or overburden, covering a deposit, sometimes is a limiting factor in the exploitation of an aggregate deposit. The tabulated values given are approximate overburden thicknesses as determined from geological investigations and subsurface testing.

Deposit Area — Deposits in this study were delineated by interpretation of aerial photographs and the contacts should be considered approximate. Information is precise only where test holes, or geological sections, are indicated.

Deposit Genesis — The genesis, or formation, of deposits is vital to the understanding of the gradational nature, extent and geometry of the deposit. This understanding forms the basis for extrapolation from a limited number of known points (test holes, pits, sections) and permits an overall assessment of the deposit.





Map Legend

- 3 Deposit number
- Assumed boundary from air photo interpretation
- Active or inactive pit
- ▲ Sample and/or description site

Aggregate Resources

84C/15 Jackpine Creek

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Figure 10

This is a sand and gravel resource map prepared by the Alberta Geological Survey as part of a series at a scale of 1:50,000. The series represents an ongoing aggregate inventory of Alberta which provides data for general land-use planning, land management or aggregate exploration. Please note that the delineation of deposits and calculation of reserves are approximations only. Alberta Energy and Natural Resources provides financial support for the Aggregate Inventory.

Cartography by Alberta Research Council, Graphic Services, J.K. Matthie.

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