SAND AND GRAVEL RESOURCES
OF THE
WHITECOURT AREA, ALBERTA

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## **ABSTRACT**

The Whitecourt area is located 160 km west-northwest of the city of Edmonton and encompasses 1900 km². A study of the sand and gravel resources of the area was conducted in 1978 to provide information on the distribution and availability of the resource. Seven weeks of field investigations, including hammer drilling at selected sites, revealed that the most important sources of granular material in the area are associated with the Athabasca and McLeod River Valleys. Terrace and floodplain deposits of these rivers contain coarse gravel and coarse sandy gravel which is as much as 20 m thick. These deposits are the major source of granular material in the area. Major deposits of sand and gravel away from the two rivers were not found in the area.

## INTRODUCTION

This study is part of a program initated in 1976 by Alberta Energy and Natural Resources and the Alberta Research Council to provide information on the sand and gravel resources of the province. Alberta Energy and Natural Resources provides the funding for the program and input into the selection of study areas. The actual investigations are conducted by the Geological Survey Department of the Alberta Research Council.

The information acquired by these studies provides the data base needed for resource management and land use planning with respect to sand and gravel for both public and private lands. The studies also provide a starting point for detailed exploration programs.

The program is concerned with delineating and describing presently exploitable deposits and identifying deposits with future potential. The deposits described are, in general, mappable at a scale of 1:50,000, have a thickness of at least 1 m, and have a ratio of overburden to gravel and sand of no more than 1:1. Volume figures are estimates based on geological interpretations of the deposits and not detailed subsurface data.

## LOCATION OF STUDY AREA

Figure 1 shows the areas of the province which have been completed or are presently being studied under the program. The Whitecourt study area is located 160 km west-northwest of the city of Edmonton and encompasses  $1900 \text{ km}^2$ . Detailed boundaries of the area and major cultural and physical features are shown in figure 2. The population centres are Whitecourt (population approximately 5000) situated in the centre of the area and Blue Ridge (population approximately 250) in the east.

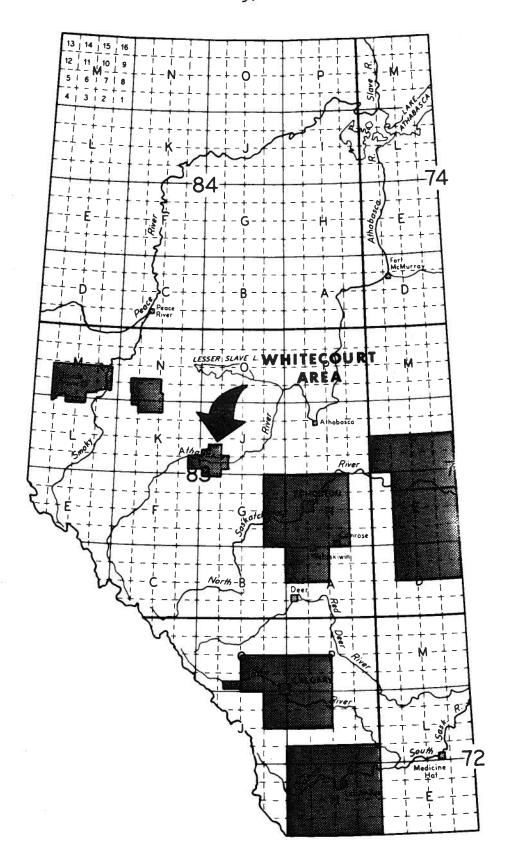


FIGURE 1. Sand and gravel resources — field study areas  $\boldsymbol{r}$ 

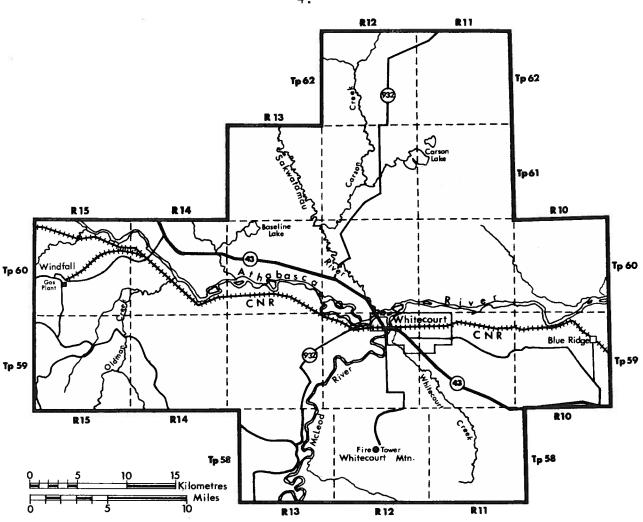


FIGURE 2. Whitecourt study area

## PREVIOUS WORK

The 1:250,000 scale surficial geology maps (D.A. St. Onge, 1967, 1975) were the major source of preexisting information on the granular resources. Additional data was obtained from the bedrock topography map of the Whitecourt area (Carlson and Green, 1977) and the hydrogeology map by Tokarsky (1977). Approximately 150 water well lithologs on file with the Groundwater Department of Alberta Research were also available for examination.

## METHODS OF STUDY

The study was initiated by the compilation and review of existing applicable information on the surficial and subsurface geology. A preliminary airphoto interpretation of the area was also performed prior to field investigations.

Seven weeks of field investigations, conducted in the summer of 1978, consisted of:

- (1) further airphoto interpretation;
- (2) truck and foot traverses to locate and outline potential deposits;
- (3) the description of exposed sand and gravel sections and active or abandoned pits;
- (4) field sieving of granular material at selected sites;
- (5) the collection of samples for later grain size analyses at the Alberta Research Council laboratory in Edmonton;
- (6) drilling and sampling with a Becker BDT-250 hammer drill in selected areas (34 testholes were drilled).

Terms used in this report include those of the industrial grain size classification (Fig. 3), the textural subdivisions shown in figure 4 and those described in the glossary (Appendix A).

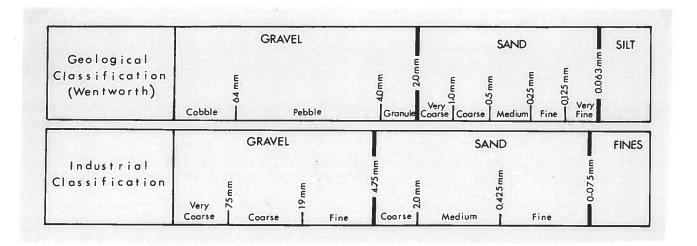


FIGURE 3. Geological and industrial grain size classifications

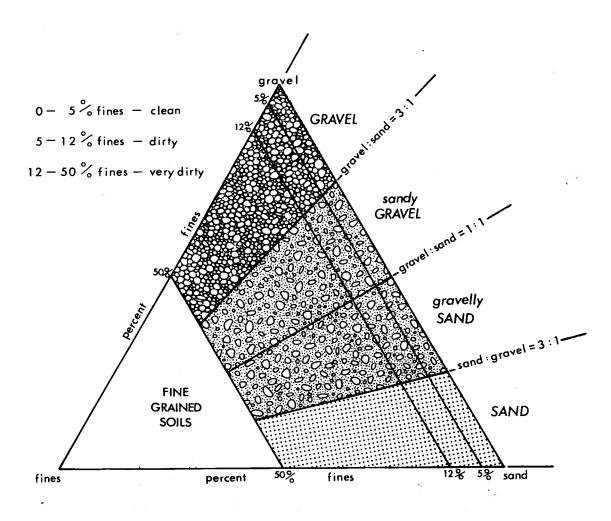


FIGURE 4. Terms for unconsolidated granular material

## **ACKNOWLEDGMENTS**

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#### BEDROCK GEOLOGY

The bedrock units underlying the area are the Paskapoo, Whitemud, Battle and Wapiti Formations (Green, 1972). All are nonmarine sediments of Early Tertiary or Upper Cretaceous age. These formations are composed mainly of gray feld-spathic sandstone, gray bentonitic siltstone or mudstone and scattered coal beds.

The relatively soft, weak nature of the bedrock makes it an objectionable material as a clast constituent of sand and gravel deposits and unsuitable as a source of quarry rock for the production of construction materials.

#### SURFICIAL GEOLOGY

#### **PHYSIOGRAPHY**

The study area ranges in elevation from 1160 m above sea level atop Whitecourt Mountain (Fig. 2) to 670 m above sea level in the Athabasca River Valley near the eastern boundary of the area. The topography generally reflects the underlying bedrock surface, which is covered with 0 to 50 m of unconsolidated surficial materials. Local topography varies from rugged, hilly, upland areas and steep stream valley sides to flat floodplain and glacial lake bottom areas.

Major topographic features within the area are Whitecourt Mountain and the valleys of the Athabasca and McLeod Rivers (Fig. 2).

Most of the area is heavily treed with limited access to normal vehicular traffic. Exceptions to this are the agricultural areas south and east of Whitecourt.

## SURFICIAL DEPOSITS

As mentioned previously, the bedrock is covered with as much as 50 m of unconsolidated surficial materials. Figure 5 (pocket) shows the generalized distribution of these surficial deposits.

Till, in the form of ground moraine and hummocky moraine (Fig. 5, units 2 and 3), is the most abundant surficial material in the area. The till, a mixture of clay, silt, sand and gravel, is composed mainly of material derived from the local bedrock but other material from as far away as the Precambrian Shield is also present. Coarse, quartzite clasts, probably incorporated from the Tertiary gravels in the Swan Hills area to the north, are locally abundant in the till.

Glacial lake deposits (Fig. 5, unit 4) are present in two localities within the study area. The deposits are composed mainly of silt and clayey silt. Very fine sand is also locally present. In most cases the glacial lake sediments overlie till.

A large quantity of deltaic material (Fig. 5, unit 5) is present on both sides of the Athabasca River throughout the area. These deposits are composed mainly of fine grained sand and some silt. Wind action has modified these deltaic sands into dune form in many localities.

Fluvioglacial deposits (Fig. 5, unit 6) within the area tend to be thin discontinuous deposits of silty sand with minor gravel.

The only other major material in the area is the alluvium associated with the Athabasca and McLeod Rivers (Fig. 5, unit 7). These deposits are composed mainly of coarse gravel and are the most important source of granular material in the area.

## GRANULAR RESOURCES OF THE WHITECOURT AREA

## INTRODUCTION

This section discusses the individual deposits or areas of granular material. The discussions are based mainly on surface geological observations and limited subsurface and laboratory data.

As detailed investigations of the areas have not been performed, the descriptions should be used only as a guide for the location of potentially exploitable deposits. Persons involved with planning and zoning should use the information supplied in this report to get an overall feeling for the granular reserves in the area and the effects various land-use decisions may have on long-term supplies.

The location of granular deposits, pits, testholes and some of the sample sites are shown on 1:50,000 scale maps (Figs. 7, 8 and 9, in pocket). Figure 6 (below) is the index map for the above figures.

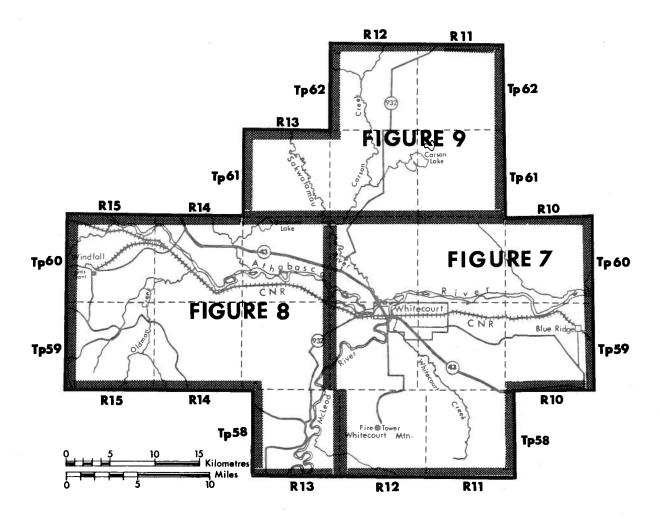


FIGURE 6. Index map of 1:50,000 scale figures

Lithologic descriptions of the testholes drilled during the study are presented in Appendix B.

Area 1 (Fig. 7; Tp 58, R 12)

Area 1 is the upper part of Whitecourt Mountain which is covered by a discontinuous cap (3 m maximum thickness) of Tertiary age sand and gravel (Fig. 5, unit 1). The granular material present is coarse to very coarse, sandy gravel with up to ten percent fines (Fig. 10). Subrounded to rounded quartzite clasts are the predominant gravel size material.

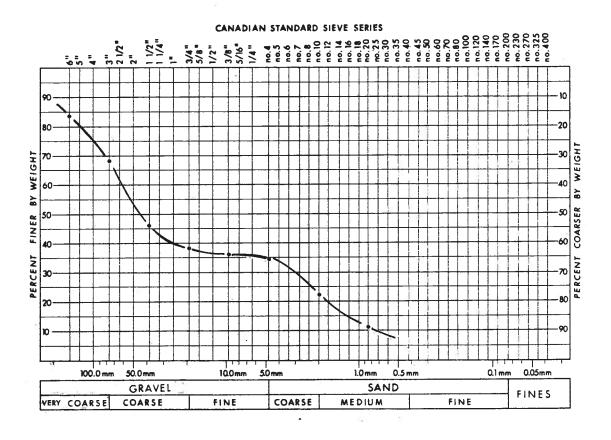


FIGURE 10. Gradation curve of sample from Area 1

Due to the discontinuous nature of the deposit and the high proportion of fines, this area is expected to be useful only for the maintenance or construction of local roads.

Area 2 (Fig. 7; Sec 36, Tp 58, R 12)

Area 2 is a small showing of outwash material exposed in a roadcut. It is not thought to have a significant areal extent but is included in the discussion because of the gradation of the material.

As figure 11 shows, the material is a clean, gravelly, medium to coarse sand. This type of deposit would be ideal for the production of fine aggregate for concrete if a large enough volume of the material could be proven.

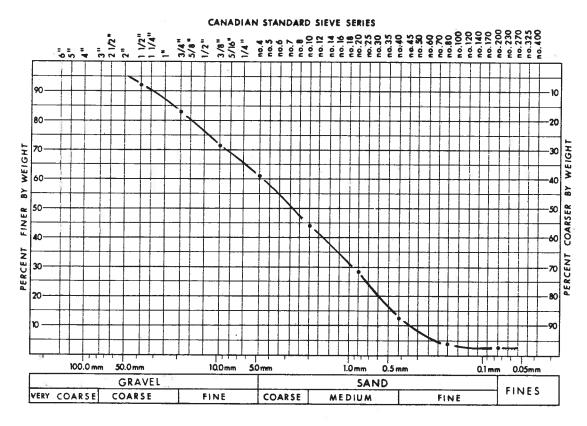


FIGURE 11. Gradation curve of sample from Area 2

Area 3 (Fig. 7; Sec 28, Tp 59, R 10)

This is an area that contains deposits of glacially transported or deformed, unconsolidated granular material. In some places up to 50 percent of the gravel clasts have been broken by the mechanism of point loading. Even more unusual is

the fact that the resultant pieces are generally undisturbed; that is, the original clast form is still present but made up of a number of pieces.

Gravel size clasts vary from angular to well rounded as a result of this breaking. Also, the material is much easier to crush than other deposits with the same rock types present, suggesting the intact clasts contain incipient fractures.

The gravel consists of quartzite with minor amounts of durable sandstone. An occasional granitic clast is found near the top of exposed sections.

Four deposits of this type are known in area 3, each marked by an active or abandoned pit. The geology is quite variable both within and between the pits. In some places, till overlies the granular material, in others lacustrine sediments form the overburden and in others overburden is absent. The amount of gravel size material present varies from 70 percent in some deposits to 30 percent in others. Figure 12 shows the gradation of a sample from the most westerly pit which has the highest gravel content. The other pits contain less than 50 percent gravel. The sand in the deposits is generally fine grained and silty. It is not known what sediments underlie the deposits.

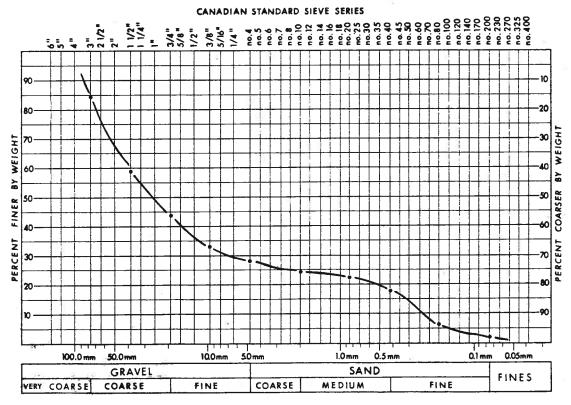


FIGURE 12. Gradation curve of sample from area 3

Subsurface exploration in the area could possibly delineate additional sites with some potential but future reserves of gravel in the area are not expected to exceed  $100,000 \text{ m}^3$ . Some pits have been abandoned because of the high content of silty, fine grained sand which is useful only as fill material.

Area 4 (Fig. 7; Sec 1, Tp 60, R 10)

Area 4 is a low terrace about 10 m above the present floodplain of the Athabasca River. This 100 hectare area contains approximately  $5,000,000 \text{ m}^3$  of granular material and is an important source of gravel in the eastern part of the study region.

The granular material is a coarse to very coarse gravel with less than 25 percent fine grained, silty sand (Fig. 13). The amount of silt (fines) varies from place to place within the deposit (op cit). Clasts seldom exceed 30 cm in diameter though elongate boulders up to 1.5 m in length are present rarely. Although still coarse, the gravel becomes finer and better sorted in a downstream direction within the terrace.

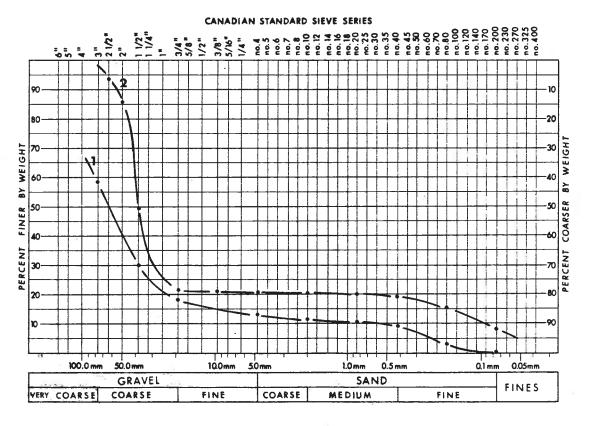


FIGURE 13. Gradation curves of samples from Area 4

The gravel is composed of mainly subrounded to rounded quartzite clasts with lesser amounts of durable sandstone and carbonate clasts. Occasional granitic clasts are found throughout the material. The large elongate boulders mentioned above are composed of soft sandstone derived from the local bedrock.

The unconsolidated granular material (up to 7 m thick) is thought to rest directly on sandstone bedrock and is covered by 0 to 2 m of sandy silt overburden. The entire undeveloped portion of the area is heavily treed.

Three pits have been worked in the area over the years and as much as  $500,000 \text{ m}^3$  of material has been removed.

Area 5 (Fig. 7; SE part of Tp 60, R 10)

Area 5 is the floodplain on the north side of the Athabasca River. As much as  $10,000,000 \, \mathrm{m}^3$  of granular material may be present in this area but the near-surface water table makes extraction uneconomical at the present time.

The granular material is coarse gravel and fine sand. Silt overburden is present in some portions of the area.

Area 6 (Fig. 7; Sec 3, Tp 60, R 10)

This area is a small remnant terrace similar in composition to Area 4. One to 2 m of silt overlies as much as 4 m of coarse quartzite gravel which contains up to 30 percent fine grained sand. Beds of fine grained sand are also present in the deposit. The granular material lies directly on sandstone bedrock.

One pit is present and remaining reserves in the area are less than  $100,000 \text{ m}^3$ .

Area 7 (Fig. 7; Tp 59-60, R 11)

Area 7 is the large floodplain of the Athabasca River east of the town of Whitecourt. Up to  $100,000,000 \, \mathrm{m}^3$  of granular material is present in this area.

The granular material is covered by an average of 3 m of silt to fine grained sand. This cover is thickest along the southern edge of the floodplain. The granular material averages 5.5 m thick and rests on bedrock.

Coarse gravel (with 20 to 25 percent sand) composed of quartzite clasts with a few granitic clasts makes up the bulk of the granular material. A few fine grained sand beds and zones of sandy gravel are also present.

The high water table (averaging 3.5 m below the surface) is a major restriction to the exploitation of the granular material in this area.

Area 8 (Fig. 7; Sec 33, Tp 59, R 11)

This area is an erosional remnant about 4 to 5 m above the previously discussed floodplain (Area 7). Over  $1,000,000 \text{ m}^3$  of coarse gravel to coarse sandy gravel should be extractable. An additional  $2,000,000 \text{ m}^3$  or more lies beneath the water table, which is 6 m below the surface.

The gravel, which averages 12 m in thickness, outcrops in the southern part of the deposit but is overlain by 3 to 4 m of fine grained sand in the northern part. Fine grained sand beds, up to 2.5 m thick, also occur within the gravel. Siltstone bedrock underlies the granular material.

Figure 14 shows the gradation of a sample taken from the large pit in the deposit. The maximum clast size is 20 cm in diameter.

The gravel size material is composed mainly of hard, durable quartzite clasts.

Area 9 (Figs. 7 and 8; Tp 58-59, R 12-13)

Area 9 includes all of the active or abandoned floodplains of the McLeod River in the study area. An average of 4 to 5 m of coarse sandy gravel overlain by up to 1.5 m of silt covers many of these floodplains. More than  $40,000,000 \text{ m}^3$ 

of gravel may be present. The granular material overlies till in the south and rests directly on bedrock in the northern part of this area.

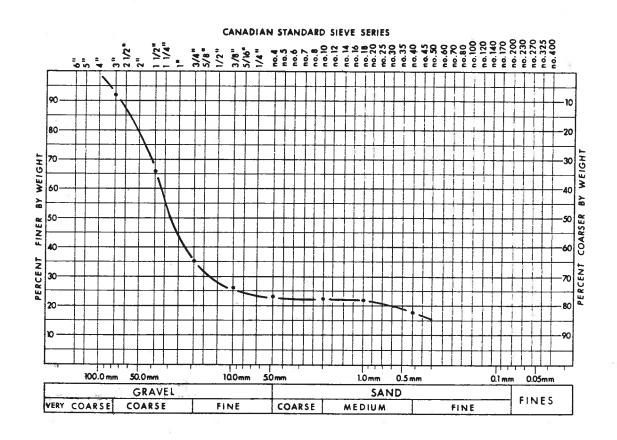


FIGURE 14. Gradation curve of sample from Area 8

The gradation of the material differs from that of the gravels associated with the Athabasca River; the gravel is still classified as coarse but there is generally a higher percentage of fine gravel present (Fig. 15). Medium and coarse sand, usually absent in the Athabasca River deposits, can form up to 20 percent of the McLeod deposits. As many uses require fine gravel and medium to coarse sand, these deposits are more desirable than the Athabasca River deposits.

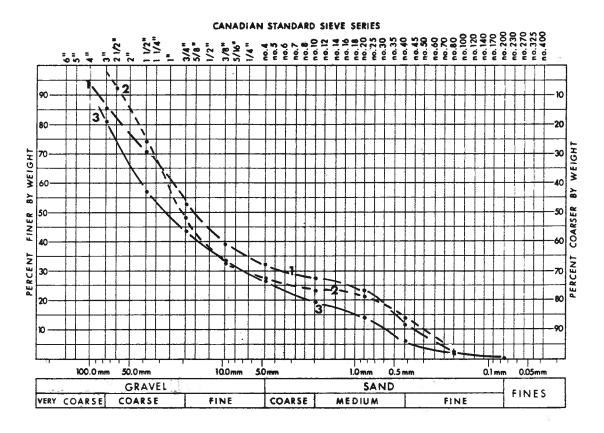


FIGURE 15. Gradation curves of samples from Area 9

Another difference between the McLeod River gravels and the Athabasca River gravels is the clast lithology. Subrounded quartzite clasts are still the predominant constituent in the McLeod River material, but up to 10 percent subangular, granitic clasts of Precambrian Shield origin are also present.

Although a high water table characterizes these floodplain deposits, subsurface testing for and monitoring of the water table should locate sites where sizeable quantities of material could be extracted. Objectionable amounts of silt may be present in the granular material at some locations.

Area 10 (Fig. 7; Sec 33-34, Tp 59, R 12)

Area 10, a low terrace on the south side of the Athabasca River, has supplied granular material to the surrounding area since it was first settled. Remaining recoverable reserves are in the order of  $2,000,000 \text{ m}^3$ .

The granular material, a coarse quartzite gravel with up to 25 percent fine grained sand, outcrops and ranges from 5 to 10 m thick. Figure 16 illustrates the gradation of the material.

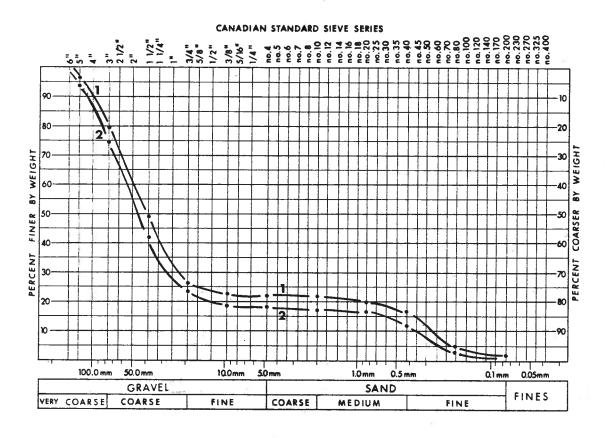


FIGURE 16. Gradation curves of samples from Area 10

The deposit lies directly on siltstone bedrock.

Area 11 (Fig. 7; Sec 7-8, Tp 60, R 12)

Area 11 is a low terrace on the north side of the Athabasca River similar to Area 10. Over  $10,000,000~\text{m}^3$  of coarse gravel should exist in this area.

Figure 17 shows a typical gradation of this coarse gravel which carries approximately 20 percent fine grained sand. The gravel is composed predominantly of quartzite clasts with a minor amount of hard sandstone clasts and an occasional granitic clast.

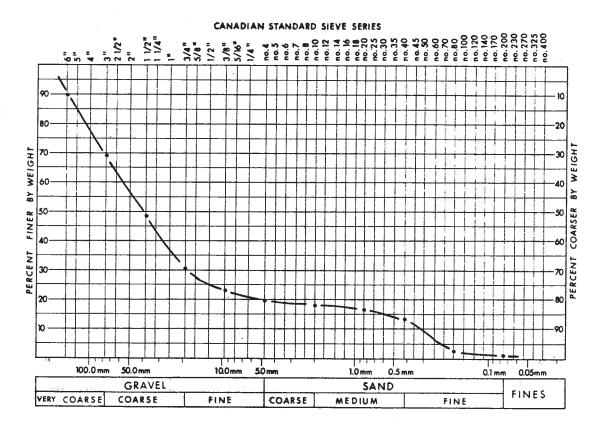


FIGURE 17. Gradation curve of sample from Area 11

The granular material is over 10 m thick and as in Area 10 lies directly on siltstone bedrock. Only one pit has been developed in this area to date but with a water table below 6 m it is a likely area for further development.

Area 12 (Figs. 8 and 9; Sec 7-9, Tp 60, R 12; Sec 12, Tp 60, R 13)

Area 12 is a high terrace containing a minimum of 20,000,000 m<sup>3</sup> of coarse gravel to coarse sandy gravel. This volume may be double if conditions in the western portion of the area, for which data is not available, prove to be similar to the eastern part. Most of the area is well drained and has a water table more than 10 m below the surface.

Subrounded quartzite clasts make up over 80 percent of the gravel size material in the deposits. The remainder of the gravel size material is composed of durable sandstone and carbonate clasts with an occasional granitic clast.

As figure 18 illustrates, the grain size distribution of the material is similar to other deposits associated with the Athabasca River.

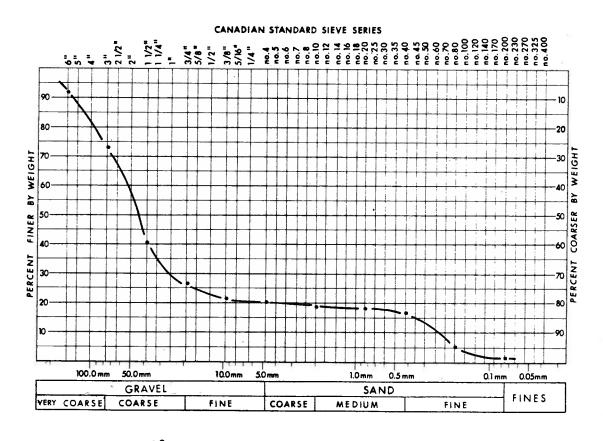


FIGURE 18. Gradation curve of sample from Area 12

Generally the gravel, which is up to 20 m thick, outcrops but locally it may be overlain by up to 2 m of fine grained sand. Discontinuous seams of fine grained sand up to 2 m thick are also present within the deposit as well as silty clay seams up to 1.5 m thick.

Area 13 (Fig. 8; Sec 30, Tp 58, R 13)

This small kame-like deposit is composed predominantly of fine-grained sand (Fig. 19).

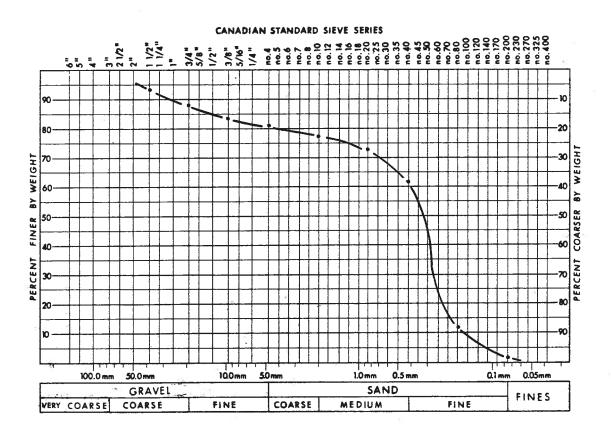


FIGURE 19. Gradation curve of sample from Area 13

The mound shaped deposit is approximately 6 m high and has no overburden. Gravel size material, which makes up about 20 percent of the deposit, is composed of quartzite and granitic clasts.

Because of the limited areal extent of this feature large reserves of material are not present. The deposit may, however, be valuable for special use products such as mortar sand.

Area 14 (Fig. 8; Sec 31, Tp 59, R 15)

This is an area of thin, discontinuous outwash. The granular material, generally less than 1 m thick, outcrops and is underlain by till. It varies from coarse, sandy gravel to fine sand.

Due to the thin discontinuous nature of this deposit and a high water table significant extractable reserves are not expected to be present in this area.

Area 15 (Fig. 8; Sec 4, Tp 60, R 15)

Area 15 is an unusual group of deposits with similarities to Area 3. A number of elongate, somewhat drumlin-shaped ridges are covered with granular material which has been severely broken up by glacial action. The ridges which trend in a N 30° W direction appear to be cored by sandstone and siltstone bedrock.

An exposure in a small pit at the south end of one of the ridges reveals 6 m of coarse, angular to rounded, sandy gravel over the bedrock. The gravel clasts are predominantly quartzite with a small percentage of hard sandstone and carbonate clasts. Granitic clasts from the Precambrian Shield are absent suggesting the material is of preglacial origin.

Coarse to fine grained sand makes up approximately 30 percent of the granular material. The material varies from clean to dirty over short distances.

It is not known what thickness of granular material is present on top of the heavily treed ridges but it is thought that the cover thins considerably and reserves will be minimal.

Area 16 (Fig. 8; Sec 19, Tp 60, R 14)

Area 16 is an erosional remnant approximately 30 m above the present river level. A large quantity of granular material has been extracted from the area but remaining reserves should exceed 1,500,000  $m^3$ .

The material which outcrops is up to 15 m thick, and is a clean, coarse gravel with about 20 percent medium to fine sand (Fig. 20).

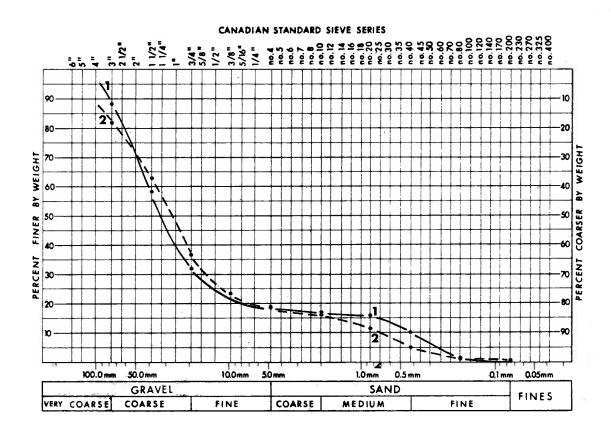


FIGURE 20. Gradation curve of sample from Area 16

As in the alluvial deposits associated with the Athabasca River the gravel size material is mainly subrounded to rounded quartzite clasts with lesser amounts of hard sandstone and carbonate clasts.

A high water table is not a problem in this deposit and material is easily excavated from the area.

Area 17 (Fig. 8; Sec 31-32, Tp 60, R 15)

This is a low terrace approximately 8 m above the floodplain of the Athabasca River. The area is well drained and has a water table 6 to 8 m below the surface. Over  $3,000,000 \text{ m}^3$  of coarse gravel are present above the water table.

The material, composed mainly of quartzite clasts, carries about 20 to 25 percent sand, most of which is fine grained (Fig. 21). Occasional fine sand beds also occur within the deposits.

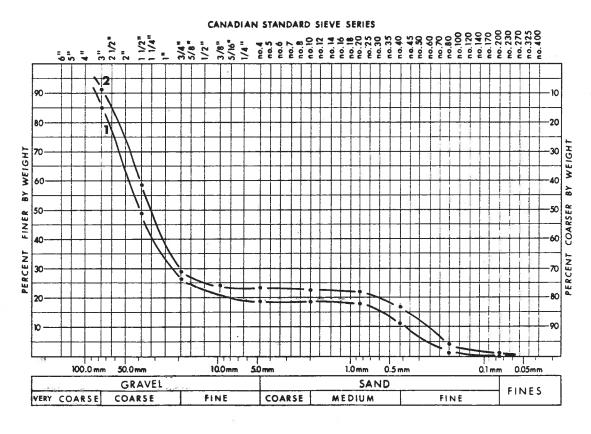


FIGURE 21. Gradation curves of samples From Area 17

The coarse gravel, which outcrops, averages 15 m thick and is underlain by siltstone bedrock.

Area 18 (Figs. 7 and 8; Tp 60, R 12-15)

This area includes all of the floodplain of the Athabasca River situated west of the town of Whitecourt and within the study area. The 1 to 2 km wide floodplain should contain over 100,000,000 m<sup>3</sup> of granular material, most of which is coarse gravel. The bulk of this material, however, is below the shallow water table.

Deposits of granular material 1 to 2 m above the surrounding floodplain are present throughout the area and are generally easily recognized from aerial photographs by their cover of pine trees. Exploitation of these areas could be economical for short haul local uses.

As the land use of the floodplain is not likely to change, this large reserve of granular material will be available when it becomes necessary or economical to extract material which is below a water table.

Area 19 (Fig. 9; Sec 24, Tp 61, R 11)

Area 19 is an esker approximately 10 m high and 1 km long. Hand testpitting on the feature to a depth of 1.5 m revealed brown, fine sand with a few gravel clasts. It is possible that the esker is cored with coarser material and could, for that reason, warrant further investigation.

Area 20 (Fig. 9; Sec 4, 5, and 8, Tp 61, R 13)

Occasional small pockets of dirty, sandy outwash gravel less than 1 m thick were observed in this area. These pockets are useful only for local road use. Larger, thicker deposits are not expected to be present in the area.

Area 21 (Fig. 9; Sec 11, Tp 62, R 11)

This area is a small mound shaped feature containing coarse granular material which has been severely crushed or broken up by glacial deformation. As in Areas 3 and 15 many of the broken clasts are in an *in situ* position.

The broken clasts, which appear to have been of a hard, durable quartzite composition, range in degree of disintegration from simply being broken into two pieces to being completely pulverized to sand size and finer material. Figure 22 shows the resultant grain size distribution of a sample of this material compared to a typical quartzite gravel of the Athabasca River.

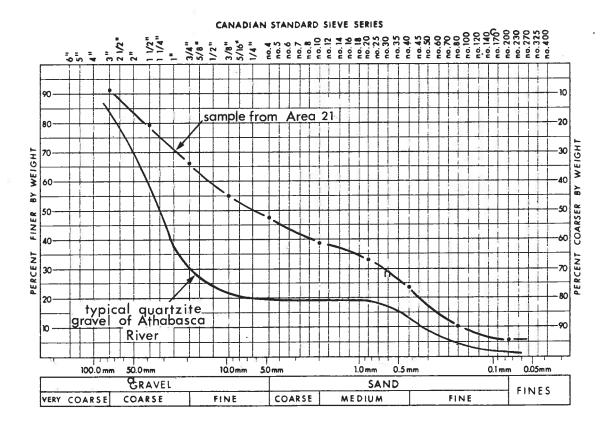


FIGURE 22. Gradation curves of sample from Area 21 and a typical quartzite gravel of the Athabasca River

Although the material has a desirable gradation for a variety of uses it is felt that it would not meet the physical requirements for many uses due to internal clast weaknesses. The material has been used on local roads and remaining reserves in this small deposit are less than 50,000 m<sup>3</sup>.

Area 22 (Fig. 9; Sec 9, Tp 62, R 11)

This is an area of granular material situated on the side of what may be a former meltwater channel. The material occurs at the surface and is a very coarse to coarse, dirty gravel with a maximum clast size of 30 cm (Fig. 23).

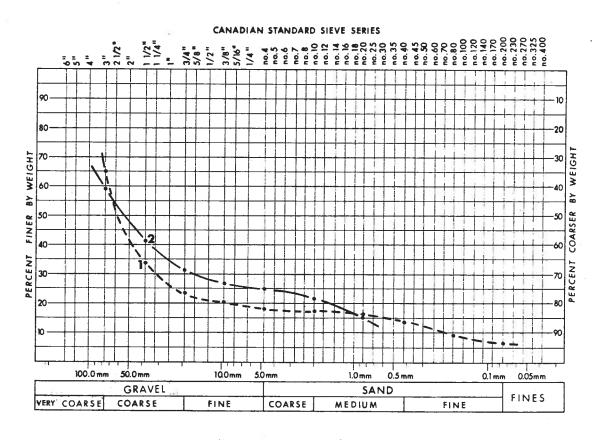


FIGURE 23. Gradation curves of samples from Area 22

The deposit could be either outwash material or a lag deposit left behind by meltwater which eroded into the previously deposited fill. Because of the coarseness of the material and the amount of fines present the latter origin is favored.

The material consists of subangular to rounded quartzite clasts and minor durable sandstone, carbonate and granitic clasts.

The thickness of the granular material is not known but the unfavorable characteristics of the deposit — dirty and very coarse — limit its potential for future development.

Area 23 (Fig. 9; Sec 20, Tp 62, R 12)

Area 23 is a deposit of outwash material which outcrops adjacent to Carson Creek. It consists of coarse gravel to coarse sandy gravel (Fig. 24, curve 1) with discontinuous medium sand lenses (Fig. 24, curve 2). The sand lenses which are up to 1.5 m thick and pinch out over short distances make up less than 20 percent of the deposit.

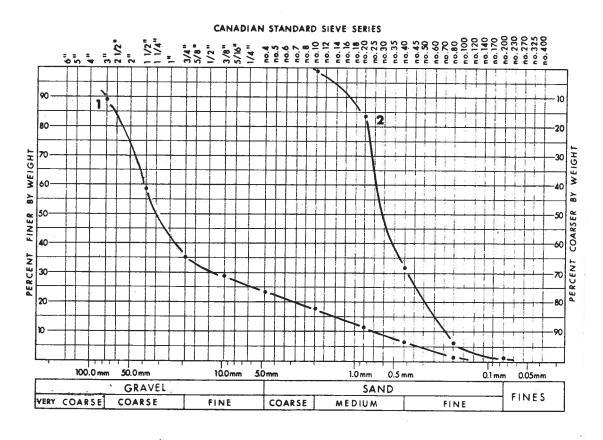


FIGURE 24. Gradation curves of samples from Area 23

The gravel size material varies from subangular to rounded and is composed predominantly of quartzite clasts with minor sandstone, carbonate and granitic clasts. Sand within the gravel (approximately 25 percent) is well graded from coarse to fine (Fig. 24, curve 1).

Subsurface testing will be required to determine the areal extent and continuity of this deposit.

Area 24 (Fig. 9; Sec 19, Tp 62, R 12)

Very coarse dirty gravel up to 2 m thick outcrops in this area. The granular material is thought to be a lag deposit resulting from meltwater eroding and washing previously deposited till as in Area 22. Figure 25 shows the grain size gradation of a sample of this very coarse, dirty gravel.

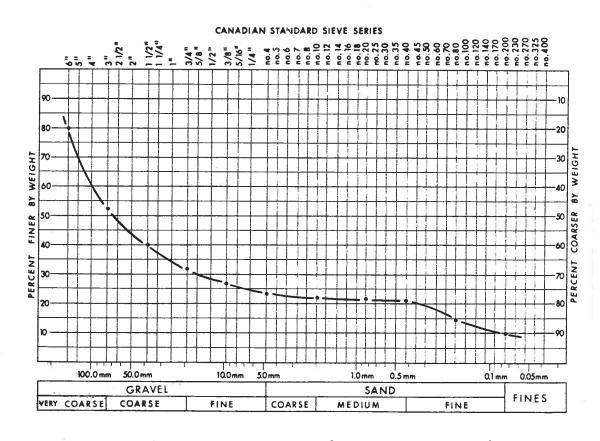


FIGURE 25. Gradation curve of sample from Area 24

The areal extent of the deposit is not known but it is thought to be discontinuous.

Area 25 (Fig. 9; Sec 27, 34, Tp 62, R 11)

These areas represent small pockets of material similar to Area 24 (coarse to very coarse dirty gravel). These small concentrations of granular material are generally less than 1 m thick and have very little potential other than for local road usage. Other similar 'washed till' deposits are present in the northern part of the area (Fig. 9) but are not thought to have significant potential.

#### SUMMARY

From the preceding section it is evident that the bulk of the granular resources in the area are associated with the Athabasca and McLeod Rivers. The material is generally coarse gravel to coarse sandy gravel composed mainly of hard, durable quartzite clasts.

Most of the  $40,000,000 \text{ m}^3$  of granular material which occurs above the water table in the Athabasca River terraces should be recoverable. Using a generous rate of population growth for the area of five percent annually and a generous consumption rate of  $10 \text{ m}^3$  of sand and gravel per capita per year, these terraces alone, if reserved for aggregate extraction, could supply the area's needs until the middle of the next century.

Well graded sand is not nearly as plentiful in the area as the coarse gravel. The sand which occurs in the Athabasca River deposits does not meet the specifications required for fine aggregate for concrete purposes due to its uniform, fine grained texture. The sand included in the McLeod River deposits is better graded and does meet the grain size specifications for fine aggregate for concrete purposes. Extraction of material from the McLeod River deposits is complicated by a high water table throughout most of the area but this should still be more economical than the crushing of coarser material to form the sand.

The large volume of deltaic material (unit 5) and the fluvioglacial deposits (unit 6) shown on figure 5 are composed mainly of fine sand and silt and are of little use except as fill material.

Coal and carbonaceous particles can be present in objectionable amounts (depending on the final use) in the sand fraction of all types of deposits. The amount of these materials present varies over short distances within individual deposits and there appears to be no way of predicting the amounts present other than by detailed subsurface testing.

The prospects of finding large quantities of good quality granular material in areas away from the Athabasca and McLeod River Valleys are limited and it is expected that the two valleys will continue to be the major sources of granular material for the study area.

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#### APPENDIX A

## GLOSSARY

- alluvium material deposited during relatively recent geological time by running water; includes clay, silt, sand, or gravel in stream beds, floodplains, terraces, alluvial fans, etc.
- bedrock in-place pre-Quaternary material exposed at the surface or underlying the surficial material.
- bentonitic said of a material with a high content of the mineral montmorillonite, usually exhibiting pronounced swelling upon wetting.
- carbonate clast a rock fragment derived from sedimentary rock composed chiefly of calcite and/or dolomite.
- deltaic deposit a body of sediment deposited by a stream flowing into the standing water of a lake or the sea.
- Early Tertiary the beginning of the period thought to have covered the span of time between 65 and 1.5 million years ago the age of mammals.
- esker a narrow ridge, often long and sinuous, composed of sand and/or gravel deposited by a meltwater stream flowing in or on glacier ice.
- floodplain flat land bordering a stream and subject to periodic flooding by the stream. Two or more levels may be present.
- fluvioglacial deposits material deposited by streams flowing from, on or within melting glacier ice, generally composed of sorted, stratified sand and gravel; includes outwash, kame, esker, etc.

- glacial lake deposit material deposited in lakes affected by glacier ice or by meltwater flowing directly from glaciers; composed of well-sorted clay, silt, or sand.
- granitic clast a rock fragment derived from a coarse grained, plutonic rock composed principally of quartz and alkali feldspar.
- granular material (unconsolidated) natural occurring mineral sediment in which more than 50 percent of the sediment is greater than .075 mm in diameter.

  Syn: sand and gravel.
- lacustrine (deposit) material deposited in a lake.
- outwash a glaciofluvial deposit formed in front of the margin of glacier ice; a pitted outwash deposit is a deposit whose otherwise flat surface is marked by many irregular shallow depressions.
- overburden the soil, silt, till, or other unconsolidated material overlying a gravel or sand deposit which must be removed prior to mining.
- Precambrian Shield geologic region of Canada within which Precambrian crystalline and sedimentary complexes are exposed. Syn: Canadian Shield.
- quartzite clast a rock fragment derived from a sedimentary or metamorphic rock consisting of quartz grains or crystals cemented with secondary silica such that the rock breaks across or through the grains rather than around them.
- sandstone a clastic sedimentary rock composed principally of fragments of sand size (usually quartz) united by a cementing material (commonly silica, iron oxide, or calcium carbonate).
- siltstone an indurated or somewhat indurated silt having the texture and composition but lacking the fine lamination or fissility of shale.

terrace - a relatively flat, elongate surface bounded by an ascending slope on one side and a descending slope on the other side. Alluvial terrace - terraces composed of sediments (commonly sand and gravel) originally deposited by stream action and later cut through by the stream, leaving the former floodplain surface some distance above the bed of the present stream.

till - unsorted and unstratified sediment deposited directly by glacier ice.

Upper Cretaceous - the final period of the Mesozoic era, thought to have covered the span of time between 100 and 65 million years ago.

## APPENDIX B

## TESTHOLE LOGS

Lithologic descriptions, as listed, have been condensed from data contained in testhole logs on file at the Alberta Research Council.

Testhole	Loc	catio	n (W	5)		Donath		
No.	Lsd	Sec	Тр	R	Lithologic Description of Material	Depth (m)		
1	SE3	2	60	11	Silt, clay (road bed material)	0.0 to 0.9		
					Silt-fine grained sand, light brown	0.9 to 2.7		
					Gravel, coarse, brown (wet at 4.6)	2.7 to 4.6		
					Sand, medium-fine grained, gray	4.6 to 5.2		
					Gravel, coarse, gray	5.2 to 11.0		
2	NE16	34	59	11	Road bed material	0.0 to 0.9		
					Silt-clay, gray	0.9 to 2.1		
					Silt-clay, brown, moist-wet	2.1 to 3.0		
					Gravel, coarse, pred. quartzite (wet at 4.3)	3.0 to 9.1		
					Bedrock (silt-sandstone), light gray	9.1 to 10.7		
3	NW5	35	59	11	Silt (road bed material)	0.0 to 1.2		
					Sand and silt, gray, clayey (free water at 3.7)	1.2 to 5.2		
	a a				Sand, medium-fine, few gravel seams	5.2 to 9.1		
					Gravel, coarse, gray	9.1 to 11.1		
					Bedrock (siltstone-sandstone)	11.1 to 11.4		
4	SW2	4	60	11	Road fill changing to brown, fine grained, silty sand	0.0 to 2.3		
					Gravel, coarse, dark brown-gray (free water at 4.9)	2.3 to 8.4		
					Bedrock (siltstone), gray	8.4 to 8.8		

Testhole	Lo	catio	on (W	5)	·	Depth		
No.	Lsd	Sec	Тр	R	Lithologic Description of Material	*	(m	
5	NW13	33	59	11	Silt-very fine grained sand Gravel, coarse, dark brown-gray		to to	3.7 8.4
					(free water at 4.6)	J•1	LO	0.7
					Bedrock (siltstone), bluish gray	8.4	to	8.5
6	SEI	6	60	11	Road fill and medium-fine sand (free water at 1.8)	0.0	to	2.0
					Gravel, coarse, brownish gray (sand seam 7.3 to 7.9)	2.0	to	9.6
					Bedrock (siltstone), light gray	9.6	to	10.1
7	4	6	60	11	Road fill	0.0	to	0.6
					Silt-very fine grained sand, brown (some free water at 1.8)	0.6	to	1.8
					Gravel, coarse, brown-gray	1.8	to	6.4
					Sand and gravel, gray	6.4	to	14.0
8	NE13	29	59	11	Silt, brown-gray, clayey (free water at 4.3)	0.0	to	8.8
9	NE4	32	59	11	Silt, clayey, sandy	0.0	to	6.7
10	sw6	32	59	11	Gravel, coarse, sandy, brown	0.0	to	3.4
					Sand (free water at 5.2)	3.4	to	5.2
					Gravel and sand	5.2	to 1	12.5
					Bedrock (siltstone), light gray	12.5	to 1	13.1
11	NE5	32	59	11	Sand, fine grained, brown	0.0	to	2.7
					Gravel and sand, brown (free water at 6.4)	2.7	to 1	11.9
					Bedrock (siltstone), light gray	11.9	to l	2.2

Testhole	Lo	catio	n (W	5)		Depth		
No.	Lsd	Sec	Тр	R	Lithologic Description of Material	(m)		
12	SE11	32	59	11	Sand, fine grained, brown, dry	0.0 to 3.4		
					Gravel and sand, brown (free water at 6.4)	3.4 to 11.6		
13	7	32	59	11	Gravel, coarse, sandy	0.0 to 1.8		
					Gravel, coarse, sandy, dark brown (free water at 6.1)	1.8 to 6.7		
					Sand, medium-fine grained, gray	6.7 to 9.1		
					Gravel, coarse and sand, medium-fine	9.1 to 15.7		
					Bedrock (coal), black	15.7 to 15.8		
14	10	32	59	11	Sand, medium-fine, brownish gray	0.0 to 1.8		
					Sand and silt, gray, clayey	1.8 to 3.7		
					Gravel, coarse (free water at 4.1)	3.7 to 7.6		
					Bedrock (siltstone), light gray	7.6 to 7.9		
15	NW1	7	60	12	Gravel, coarse (free water at 6.0)	0.0 to 10.4		
					Bedrock (shale-siltstone), gray	10.4 to 11.0		
16	3	8	60	12	Gravel, coarse (free water at 8.5)	0.0 to 11.0		
		(8)			Bedrock (silt-sandstone), light gray	11.0 to 11.3		
17	SWI	8	60	12	Gravel, coarse, sandy 7.0 to 8.2 (free water at 10.7)	0.0 to 13.4		
					Bedrock (siltstone), gray	13.4 to 14.0		
18	NE13	4	60	12	Clay, silty, slightly gravelly	0.0 to 7.6		
					Gravel, coarse, gray (free water at 10.7)	7.6 to 11.6		
	120				Bedrock (siltstone-shale), dark brown	11.6 to 12.2		

	•		<i>1</i>	\		
Testhole No.		catio Sec	n (W Tp	5) R	Lithologic Description of Material	Depth (m)
				1	1. storeget besoft performer hader ray	, ymy
19	15	4	60	12	Gravel, coarse (free water at 6.7)	0.0 to 7.6
					Sand, coarse, gravelly, gray	7.6 to 19.5
20	NEI	8	60	12	Gravel, coarse, pred. quartzite	0.0 to 3.0
					Clay	3.0 to 4.3
					Gravel, coarse, pred. quartzite (free water at 12.5)	4.3 to 13.4
21	4	9	60	12	Gravel, predominantly quartzite	0.0 to 2.4
					Sand, fine grained, gravelly, brown	2.4 to 4.3
					Gravel, coarse, dry	4.3 to 12.8
					Clay, dark gray, thinly laminated	12.8 to 13.7
22	NW9	7	60	12	Sand, fine-medium grained, brown	0.0 to 1.5
					Gravel, coarse, sandy (becoming wet at 13.4) (free water at 15.2)	1.5 to 21.3
23	15	19	60	14	Gravel, fine-coarse, sandy brown	0.0 to 14.8
					Clay, silty, brown-gray	14.8 to 16.6
24	2	31	60	15	Gravel, coarse (free water at 6.1)	0.0 to 11.6
					Sand and gravel	11.6 to 15.8
lit					Bedrock (siltstone), gray	15.8 to 16.5
25	4	32	60	15	Gravel, coarse, sandy	0.0 to 4.3
					Gravel and sand	4.3 to 7.9
					Sand, fine grained, clayey (wet at 8.5)	7.9 to 14.6
		~			Sand and gravel	14.6 to 19.8
					Bedrock (siltstone), gray	19.8 to 20.1

Testhole	Lo	catio	n (W	5)		Dept	- h
No.	Lsd	Sec	Тр	R	Lithologic Description of Material	<i>р</i> ер (m)	
26	NE2	32	60	15	Gravel, coarse, sandy (free water at 8.8)	0.0 to	11.6
27	6	33	59	12	Gravel and sand (free water at 4.0)	0.0 to	5.2
					Bedrock (siltstone), gray	5.2 to	5.8
28	NE2	33	59	12	Gravel, predominantly quartzite (free water at 9.1)	0.0 to	9.4
					Bedrock (siltstone), gray	9.4 to	10.7
29	SE9	20	59	12	Road fill, clay and organics	0.0 to	1.2
					Gravel, predominantly quartzite (wet at 5.2)	1.2 to	7.0
					Bedrock? (no return)	7.0 to	8.8
30	SE12	20	59	12	Gravel, sandy, brown-gray (wet at 5.6)	0.0 to	8.7
					Bedrock (siltstone-sandstone)	8.7 to	9.0
31	SW2	19	59	12	Silt	0.0 to	0.6
					Gravel, coarse, sandy (free water at 2.4)	0.6 to	3.2
					Bedrock (sandstone-siltstone), gray	3.2 to	4.9
32	NW12	26	58	13	Silt	0.0 to	1.5
					Gravel, coarse, sandy (free water at 4.6)	1.5 to	6.7
					Clay, sandy, silty (till-like)	6.7 to	8.2

Testhole No.	Lo	catio	n (W	5)		Depth		
	Lsd	Sec	Тр	R	Lithologic Description of Material	(m)		
33	NE7	22	58	13	Road fill	0.0 to	0.6	
					Gravel, coarse, sandy, brown	0.6 to	3.8	
					Clay, sandy, silty (till-like)	3.8 to	4.4	
34	NE8	27	59	12	Road fill and silt	0.0 to	1.2	
				Gravel, coarse, sandy, clean (water table at 4.0)	1.2 to	6.2		
					Bedrock (siltstone), greenish gray	6.2 to	6.6	

## LEGEND GEOLOGICAL BOUNDARY QUATERNARY (Recent and Pleistocene) (approximate) 10 BOGS AND MARSHES Tp 62 peat, muck flat or ridged 9 COLLUVIUM SCALE 1:250,000 thinly mantled bedrock and steep valley sides 8 ALLUVIUM AND COLLUVIUM undifferentiated, Tp 61 stream valleys 7 ALLUVIUM gravel, sand, silt flat, some abandoned channels 6 FLUVIOGLACIAL DEPOSITS sand, minor gravel undulating to hummocky Tp 60 Windfall 5 DELTAIC DEPOSITS sand, silt rolling, mounds and ridges 4 GLACIAL LAKE DEPOSITS silt, fine sand, clay flat to hummocky Tp 59 3 GROUND MORAINE till: mixture of clay, silt, sand, gravel, flat to rolling 2 HUMMOCKY MORAINE till: mixture of clay, silt R 15 R 10 R 14 sand, gravel, rolling to hilly TERTIARY (Paleocene) Tp 58 1 OLD ALLUVIUM gravel, sand flat to rolling Geology modified from D.A. St. Onge, 1967, 1975. R 13 R 12 R 11

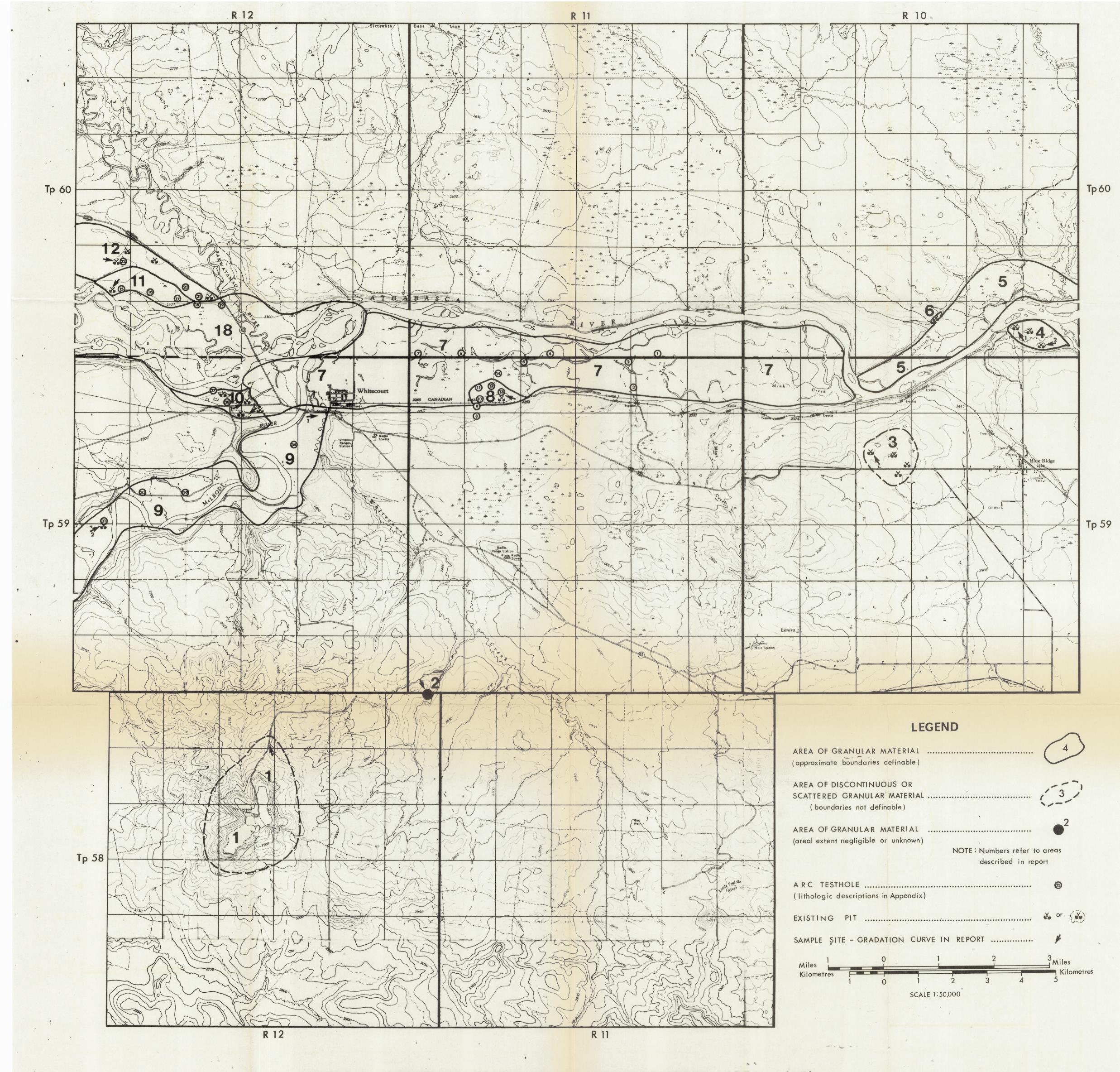


FIGURE 7. GRANULAR RESOURCES OF THE WHITECOURT AREA (SE)

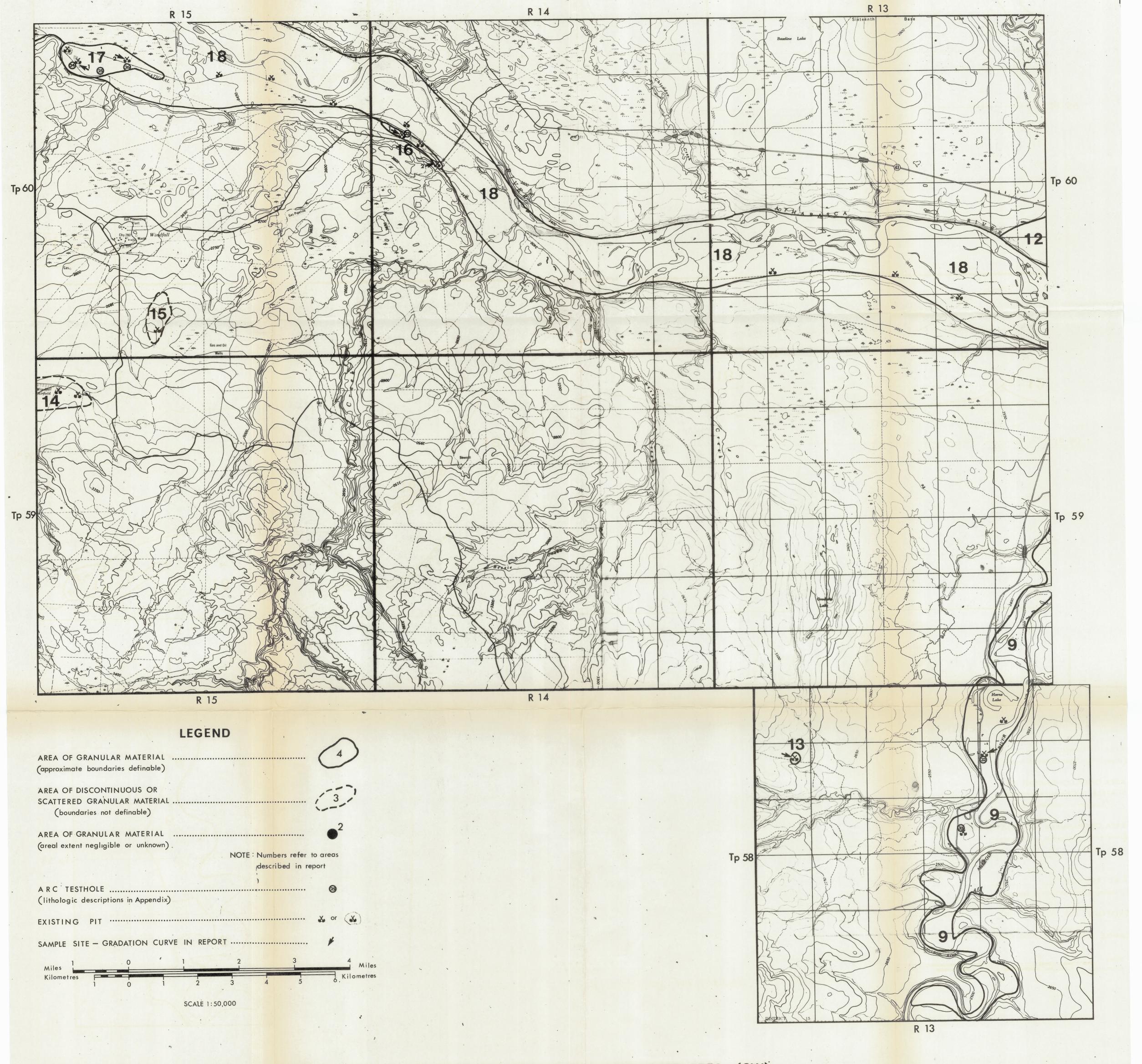


FIGURE 8. GRANULAR RESOURCES OF THE WHITECOURT AREA (SW)

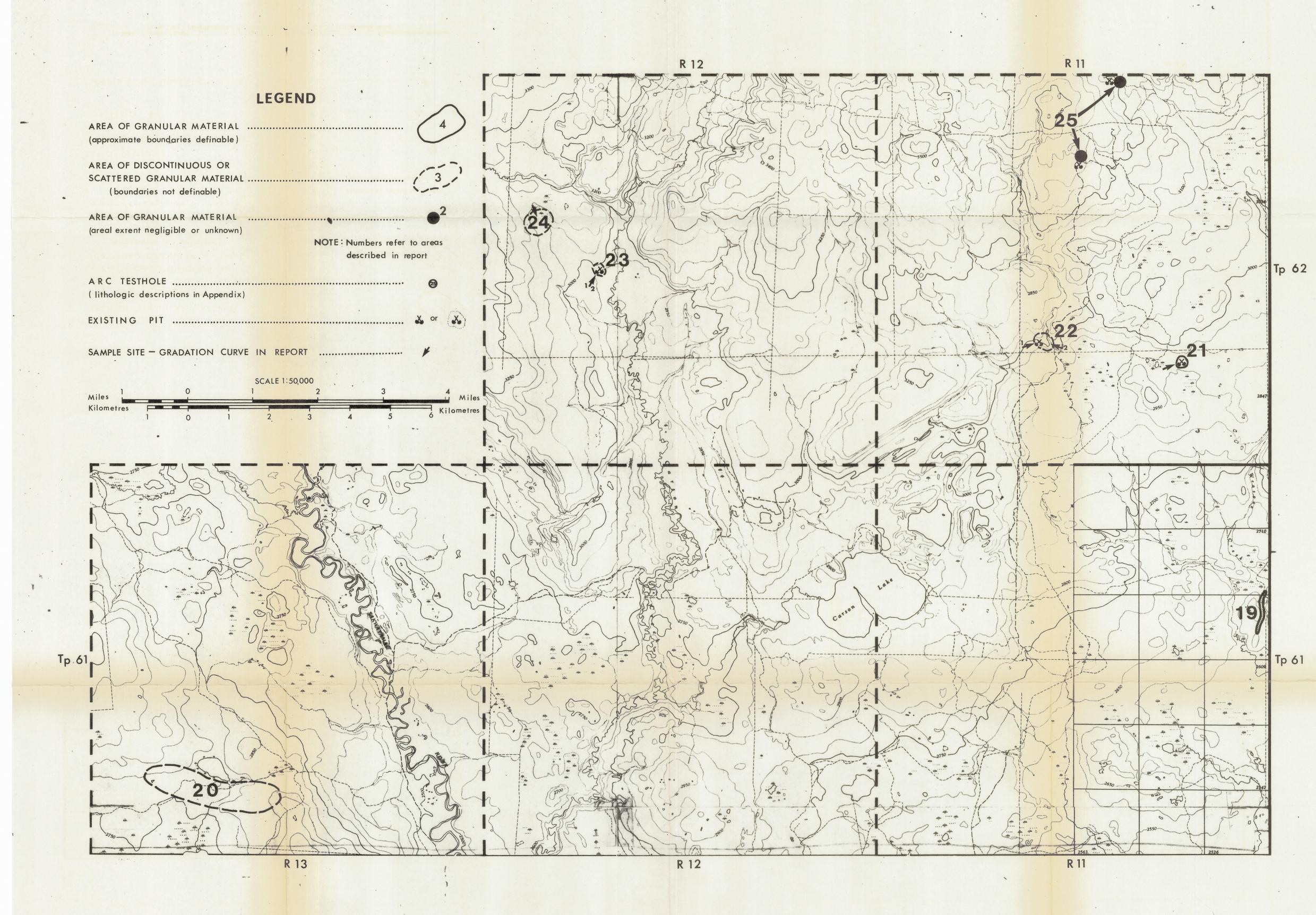


FIGURE 9. GRANULAR RESOURCES OF THE WHITECOURT AREA (N)