EBA Engineering Consultants Ltd.

Civil, Geotechnical and Materials Engineers

Geotechnical

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EBA ENGINEERING

GEOTECHNICAL REPORT
MacPHERSON AREA "A" GRANULAR RESOURCES
WHITEHORSE, YUKON

0201-10721

December, 1991

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MacPHERSON AREA "A" GRANULAR RESOURCES
WHITEHORSE, YUKON

submitted to:

GOVERNMENT OF YUKON
DEPARTMENT OF COMMUNITY & TRANSPORTATION
LANDS BRANCH

prepared by:

EBA ENGINEERING CONSULTANTS LTD.
WHITEHORSE, YUKON

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1.0 SUMMARY

Subsequent to reviewing and analyzing data from previous studies as well as this current granular source evaluation, results indicate that MacPherson Area "A" is a significant granular source. The gravel source has been delineated as encompassing an area in excess of 100 hectares with an average depth of 10 m of gravel and/or sand throughout. Using conservative consumption figures, there appears to be approximately 50 years worth of various aggregate products.

Utilizing standard construction and processing methods, Area "A" can supply pit run gravel; crushed sub-base aggregate; crushed basecourse aggregate; asphalt aggregate; concrete aggregate; concrete sand; bedding sand; drain rock; and rip rap material.

The challenge of extracting gravel from MacPherson Area "A" is establishing a development plan which is compatible with the proximity to a residential subdivision and its general location at the intersection of two major highways. The design concept presented herein has taken these factors into account.

2.0 INTRODUCTION

EBA Engineering Consultants Ltd. (EBA) was retained by the Government of Yukon (YTG), Community and Transportation Services, Lands Branch to collect existing information and to conduct a site investigation in MacPherson Area "A", Whitehorse, Yukon. The site investigated is shown on Figure 1, and is located west of the MacPherson Subdivision, northwest of the intersection of the Alaska Highway and North Klondike Highway. The purpose of the study was to identify and test the area's potential for granular resources.

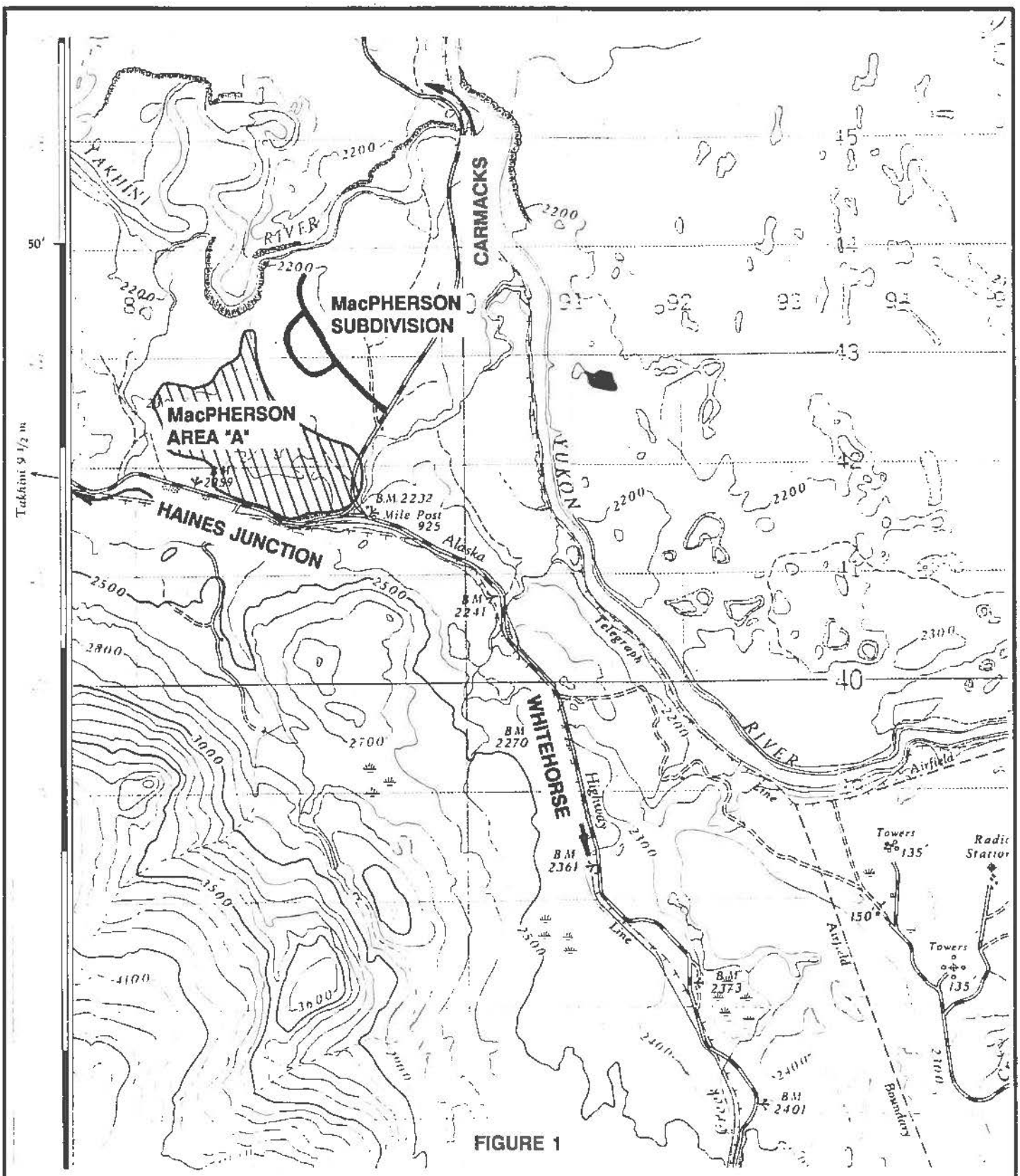


FIGURE 1

EBA Engineering Consultants Ltd.		PROJECT	**MacPHERSON GRANULAR RESOURCE STUDY**
CLIENT	**GOVERNMENT OF YUKON LANDS BRANCH**	TITLE	**GENERAL LOCATION MAP**
DATE **1991-11-04**	DWN / CHKD	DWG NO.	**0201-10721**

The area was formerly designated as PWA-1 in the R.G. Hilker Ltd. 1977 "Inventory of Gravel, Sand, and Loam Deposits in the Whitehorse Metropolitan Area" and was subsequently investigated in 1978 by R.M. Hardy & Associates Ltd. report entitled "Whitehorse Gravel Survey - Alaska Highway & Mayo Road".

Authorization to proceed with the present study was received from Mr. Ross Burnett, Planning Technician, Lands Branch in a letter dated 91-07-17.

This report presents a detailed description of the MacPherson Area "A" granular source and includes existing site conditions as well as a possible production and development option.

3.0 SCOPE AND OBJECTIVES

The scope of this project as stated in the EBA project proposal is as follows:

- To evaluate the significance of the MacPherson Area "A" granular source relative to the future needs of the Whitehorse area contractors.

- To conduct an exploration, sampling and laboratory testing program to evaluate the quantity and quality of the granular materials/products available throughout the subject site.

- To complete a report including the following:
  - a) Location map delineating the source
  - b) Site plan(s) showing the location of previous and present testholes as well as previous geophysical surveys
  - c) Quantity estimates utilizing site profiles
  - d) Site development guidelines
  - e) Relative significance of the area as a granular source for future use

4.0 GRANULAR SOURCE INVESTIGATION

4.1 General Approach

The following major tasks were identified at the outset of the program:

1. Undertake preliminary work including the collection and review of existing data and information; as well as an airphoto interpretation to select tentative access routes and assess source boundaries.

2. Execute the field exploration and sampling program

3. Conduct a laboratory testing program

4. Undertake analysis and evaluation of the granular source, identifying all factors influencing extraction and production of aggregate.

Substantial preliminary work was undertaken in an attempt to reduce the time and expense required for an extensive field exploration program. The primary objectives of the field exploration program were to verify the results of previous investigations; to obtain up-to-date site specific information; and to collect representative samples of the various soil types encountered. Initially, a testpitting program was undertaken to determine detailed stratigraphy of the area and to obtain bulk samples for laboratory testing and analysis. Geophysical surveys conducted by R.M. Hardy and Associates during the 1978 site study were then utilized to evaluate the stratigraphic continuity of the granular source.

A subsequent drilling program to verify the geophysical results was also proposed. Due to land use complications, the drilling was not carried out. However, aspects of the testpitting operations yielded some of the information which was to be determined by the proposed drilling program. Specifically, because of elevation changes along the sideslopes of the kettleholes found throughout the site, observations verifying the presence of gravel to depths

in excess of 10 m were possible. Also, the high percentage of oversize (cobbles and boulders) throughout much of the site would have made drilling very difficult and possibly expensive due to auger damage.

4.2 Field Exploration

Access information obtained from airphoto interpretation was confirmed during a brief site reconnaissance and indicated that travel along existing trails with a tracked backhoe was feasible. No additional equipment would be necessary to clear access trails.

The testpitting program was completed on 1991-08-07 and 1991-08-08 utilizing a CAT 225 tracked backhoe owned and operated by Cascade Industries but contracted through IBEX Contracting Ltd. of Whitehorse.

A total of 14 testpits were excavated throughout the area delineated in the proposal request. The testpits were excavated to depths ranging from 1.5 m to 5.0 m. Each testpit was logged, noting descriptions of overburden, stratigraphy and the details pertinent to granular source evaluation. The percentage of oversized material was visually estimated for a representative number of testpits and descriptions of sidewall stability based on testpit slough were presented. Representative samples were collected from most testpits. Samples retained consisted of material less than 100 mm in size, where applicable. Samples were generally 2 kg to 3 kg in size and were tested for natural moisture content at specific depths throughout the testpit. The remainder of the samples from the testpits chosen for additional testing were combined (if similar) to form a representative bulk sample which was sent to EBA's Edmonton laboratory for trial crushing and grain size distribution determination.

The detailed logs and applicable laboratory test results as well as corresponding test result report forms are presented in Appendix A of this report. Also presented in Appendix A are site plans showing the location and scope of previous site works (Drawing 10721-A-01) as well as the current testpit locations, source boundaries, and other pertinent information (Drawing 10721-A-02).

4.3 Geophysical Surveys

The EM31 and EM34 geophysical survey data collected by R.M. Hardy and Associates in 1978 was very helpful in delineating the extent and depth of the granular deposits as well as overburden thickness and type. Results correlate nicely with EBA's current testpitting program as well as the 1978 Hardy testpitting program and are the basis for quantity estimates presented herein.

4.4 Oversize Material Determination

The amount of cobbles and boulders (75 mm plus) was estimated in selective testpits to provide a rough correlation to grain size distribution curves. The oversize percentages, where applicable, are presented on the testpit logs presented in Appendix A.

4.5 Survey Control

Evidence of the previous field programs was still apparent. Therefore, it was felt that it was unnecessary to provide additional elevation information. Elevations utilized for quantity estimates were taken from Figure 14 of the 1978 R.M. Hardy report.

5.0 LABORATORY TESTING

All samples obtained during the current field investigation were initially delivered to EBA's Whitehorse laboratory for testing. Testing performed in the Whitehorse laboratory included:

- washed particle size distribution testing
- natural moisture content testing
- visual soil classification

Selected soil samples were combined and shipped to EBA's Edmonton laboratory for further evaluation. The tests performed in Edmonton included:

- trial crushing to 12.5 mm nominal size
- trial crushing to 20 mm nominal size
- grain size testing on crushed samples

All laboratory testing was conducted in accordance to ASTM and/or CSA procedures and specifications. Test results are presented on the testpit logs and attached particle size distribution report forms in Appendix A and are summarized with the aggregate quality summary of pit run gravel in Appendix B.

6.0 DEPOSIT DESCRIPTION

6.1 Surficial Features

6.1.1 General Location

The MacPherson Area "A" is located northwest of the intersection of the Alaska Highway and the North Klondike Highway at the north end of Whitehorse. The deposit is loosely bordered by the North Klondike Highway on the east side; the Alaska Highway on the south side; MacPherson subdivision to the north and a steep sided gully which extends from the Alaska Highway to the Takhini River along the west side.

6.1.2 Morphology and Topography

The granular deposit is considered to be an ice-contact glaciofluvial deposit with numerous kettle holes caused by material deposited over stagnant ice. The surface topography varies from rolling to rugged. Variations in elevation as great as 20 m exists throughout the central portion of the site. The sideslopes of the kettle holes are considered steep.

6.1.3 Vegetation

Site vegetation generally consists of dense immature pine throughout the north half of the deposit and moderately dense white spruce with some pine and poplars throughout the south half of the site. Sparse, mature poplars line most of the kettle hole slopes. Willows can also be found along most trails. Maximum butt diameters of approximately 300 mm were noted for occasional pine trees in excess of 15 m in height.

6.1.4 Drainage

Aside from the steep sided gully noted at the west edge of the subject site, no drainage courses were noted. The area appears to be well drained with no evidence of ponding. If ponding were to occur, it would be in localized depressions during spring runoff when seasonal frost is responsible for trapping snow melt.

6.1.5 Access

The site is dissected with numerous trails. No new routes had to be cut to gain access. Although portions of the trails utilized would be too steep for vehicular access, the tracked backhoe contracted for this project had no problems moving between testpit locations.

6.2 Subsurface Soil Conditions

The site is generally overlain by between 0.2 and 0.5 m of silt with an organic veneer at the surface. Below the surficial silts, gravels and sands were encountered to an undetermined depth. Generally the gravel is coarse with an average percentage oversize of 20% (visual approximation of material greater than 100 mm) throughout all but the northern edge of the deposit. Due to the method of deposition, layers of silt and silty gravels can be expected at random locations throughout the site. As is common in heavily glaciated area, stratification can be discontinuous and variation should be anticipated during extraction.

No ground water, permafrost or seasonal frost was noted during current or previous investigations. Profiles depicting the random nature of the deposit are presented as Figure 14 in the 1978 R.M. Hardy report. Photographs of the spoil piles taken during the EBA investigation are presented in Appendix C of this report.

7.0 AGGREGATE SOURCE EVALUATION

Borrow source evaluation is based primarily on material quality and quantity with consideration being given to land status, tenure, proposed land use, haul distance and effects on other development in the area.

7.1 Aggregate Quality

Material suitability was initially determined on the basis of particle size distribution. Further analysis assessing physical properties of the material has also been completed during this investigation and in the 1978 R.M. Hardy investigation. Laboratory test results indicate the presence of good quality aggregates for the supply or production of the various products required in the Whitehorse area. The report forms in Appendix B present the grain size distribution results plotted against the specification bands of various aggregate products utilized in the Whitehorse area. Results show that by removing the cobbles and boulders, the pit run material is a non-frost susceptible product which is adequate for engineered fills, embankments and underground utility backfill. Trial laboratory crushing performed on material found throughout Area "A" resulted in gradations which meet the specifications for 20 mm crushed basecourse aggregate and 12.5 mm asphalt aggregate. Theoretical splits calculated on the sand portions of all pit run tests resulted in gradations which meet the specifications for concrete sand and bedding sand. The results of physical testing performed on samples collected during the 1978 R.M. Hardy report are summarized below:

- Sodium Sulphate Soundness (ASTM C-88)
  coarse aggregate - avg. of 5 tests 0.6% loss
  fine aggregate - avg. of 5 tests 3.3.% loss
- less than 8% loss is acceptable

- Los Angeles Abrasion (ASTM C131 Grading B)
  average of 3 tests 13.6% loss
  - less than 40% loss is acceptable

- Petrographic Analysis
  average of 12 tests PN=116
  indicating fair to good quality aggregate

- Lightweight Pieces (ASTM C123)
  average of 5 tests .11%
  which is acceptable

Formal test results are presented following the testpit logs in the 1978 R.M. Hardy report.

The various products that can be processed from material found in MacPherson Area "A" along with processing requirements are listed in Table 1 - PRELIMINARY ASSESSMENT OF PROCESSING REQUIREMENTS. Standard crushing, screening, and washing processing methods are all that is anticipated to produce the products listed.

TABLE 1

PRELIMINARY ASSESSMENT OF PROCESSING REQUIREMENTS

Products Available from Area "A"	Available as Pit Run	Screening Only Required	Crushing Required	Washing Required	Comments
Non-frost susceptible pit run gravel	No	Yes	No	No	Screen off oversize
40 mm crushed gravel for sub-base material	No	No	Yes	No	Remove some oversize prior to crushing
20 mm crushed gravel for basecourse	No	No	Yes	No	Remove some oversize prior to crushing
12.5 mm crushed gravel for asphalt aggregate	No	No	Yes	No	Some removal of oversize is expected and split pile production may be preferable
Coarse aggregate for concrete	No	No	Yes	No	Remove some oversize prior to crushing
Concrete sand	No	No	No	Yes	Washing of material passing 5,000 μm sieve is required
Bedding Sand	No	Yes	No	No	Material <5,000μm sieve acceptable as bedding sand
Rip Rap	No	Yes	No	No	Up to 30% oversize in area may be utilized as rip rap

7.2 Aggregate Quantities

It is estimated that approximately 100 hectares of developable land currently exists within the delineated source boundaries and comprises the leases, access road and buffer zone shown on Drawing 10721-C-03 in Appendix C. An average of 5.9 m of gravel has been proven based on existing testpit information and 10.0 m is very probable based on geophysical data and sideslope observations made during the site works. It is conservatively estimated that 10,000,000 m^3 of coarse gravel and/or sand exists within Area "A". With current yearly gravel consumption rates of over 100,000 m^3/year, and projected consumption of up to 200,000 m^3 in the future, MacPherson Area "A" could conceivably supply gravel to the Whitehorse area for approximately 50 years.

8.0 SITE DEVELOPMENT GUIDELINES

The following sections provide general granular source development considerations for MacPherson Area "A".

8.1 Site Access

In Appendix C of this report, a possible concept for 12 gravel leases varying in size from 5.3 ha to 9.7 ha (average lease size of 7.1 ha) is presented. The configuration as presented would provide 11 leases containing significant volumes of processable coarse gravel and one lease (numbered No. 7 on Drawing 10721-C-03) for public use. Proposed Lease No. 7 likely contains higher volumes of sand than gravel. The sand would then be available to the contractors requiring blend sand for processing.

The site is accessed along an existing trail which meets the North Klondike Highway halfway between the MacPherson Subdivision entrance and the Alaska Highway intersection. The trail provides access to an existing pit. The remainder of the proposed haul road has been walked and construction of a haul road appears feasible. The major portion of this route would be founded on a gravel base which would withstand heavy rolling traffic. Other advantages of the proposed access route are:

- The central portion of the site is accessed at lower elevations taking advantage of the natural barrier between the gravel source and MacPherson Subdivision.

- The area is accessed off the north Klondike Highway. Alaska Highway traffic (particularly the recreational vehicle traffic) would be inconvenienced by truck traffic entering and leaving the gravel source at the top of the hill west of the North Klondike Highway intersection. This could be potentially dangerous. Traffic on the North Klondike Highway is already slowing for the stop sign at the Alaska Highway intersection and would be less inconvenienced by slow moving truck traffic.

- The existing trail forms a dogleg just west of the North Klondike Highway and this would minimize the visual impact of access road construction as well as assisting in preventing excess dust pollution.

- The access road intersects the North Alaska Highway along a relatively flat, straight section minimizing the accident potential by maximizing site distances.

8.2 Clearing and Salvage

Clearing within each lease should extend a minimum of 10 to 15 m beyond the perimeter of the pit and yard areas to prevent contamination of borrow materials. Clearing should extend 20 m to 30 m beyond the sides of the pit parallel to the direction of slope to allow placement of stripped topsoil and wasted overburden. A 100 m buffer is recommended between the western lot lines of the MacPherson subdivision and the rear of the eastern leases.

8.3 Stripping and Grubbing

All unsuitable overburden should be removed and windrowed to the side of each lease. The windrows should be placed parallel to the slope direction to prevent ponding of surface runoff and contamination of the borrow materials.

8.4 Drainage Considerations

The floor of the yard should be graded to provide positive drainage away from the stockpiles. Upon completion of the borrow excavation, drainage must prevent water from collecting in any portion of the pit.

8.5 Pit Restoration Procedures

Restoration of the pit area within the subject site should consist of four major components:

- disposal of rejected and grubbed materials
- backfilling of pits and stabilization of the pit walls
- drainage and erosion control
- revegetation of the disturbed areas

Disposal of debris and brush should be accomplished by hauling to a waste disposal facility. Burial or stockpiling for future backfilling operations is not recommended because it complicates future land use by establishing unmapped areas of deleterious materials. Timber which is marketable as firewood may be harvested during development. Due to the proximity to a residential subdivision and the prevailing south winds, burning should not be allowed. All discarded machinery, parts, scrap metal, oil containers and other combustibles or non-combustibles must also be removed from site.

Stripped overburden soils may be utilized during restoration. It is doubtful whether sufficient quantities of organic soils exist throughout the subject site, but if adequate volumes exist, it should be utilized as a layer of finish topsoil.

The borrow pits should be backfilled using available non-organic soils. The sideslope of the pit areas should be dressed to at least 2:1 (horizontal:vertical) or as designated by Land Use authorities. All slopes and cleared areas should be free of waste material and left in neat, trim and tidy condition.

All obstructions to natural drainage caused by construction should be removed, and the area restored. Grading should be such that water does not collect in any portion of the excavated area and is prevented from channelling and down cutting.

Stripped organic material and fine grained overburden soils can be used for surface reclamation. The re-establishment of vegetation should be initiated by seeding the slopes and allowing reinvasion of natural vegetation. The soils may require enrichment to initially sustain revegetation.

9.0 MacPHERSON AREA "A" LAND USE RECOMMENDATIONS

Development of the MacPherson Area "A" granular source may be affected by the following factors:

- the proximity to the MacPherson Subdivision
- the location of a land claim area (site C-19, interim protected) at the southwest corner of the subject site
- the utilization of the site as a recreational area with existing hiking/ski trails
- area is currently zoned for country residential development
- regulations governing the minimum setback from an existing residential development do not exist

Existence of a granular source area near a residential subdivision may be possible in light of the following:

- A natural boundary (the ridge west of MacPherson subdivision) exists between the granular source area and the residential area. Based on the possible concept presented in Appendix C, the natural buffer will minimize visual and noise factors. If additional separation is required, significant vegetation exists which will further buffer the MacPherson residential area.

- Recreational use trails can be re-established north of the subject site. A loop extending from the north edge of the deposit to the banks of the Takhini River would provide the MacPherson residents with a hiking/ski trail of equal visual appeal. Test holes in the area north of the gravel source indicate the presence of fine grained soils which are unacceptable for on-site sewage disposal (Klohn Leonoff 1991 report). Utilization as a recreational area would be an appropriate alternative.

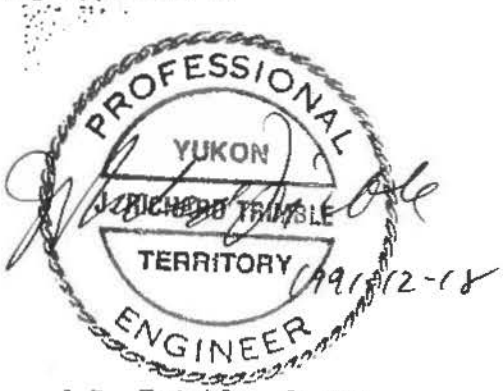
- The current country residential zoning may warrant reconsideration given the topography of the area. Within the central portion of the subject site a significant portion is currently unacceptable for residential development due to steep slopes where kettle holes exist. From a long range point of view, it is recommended that an imaginative land use plan be developed and, through gravel extraction, the area could be appropriately graded to properly facilitate residential development.

- To further facilitate the possibility of co-existence, it is recommended that extraction and crushing operations only (rather than asphalt and/or concrete production) be allowed at the subject site. The present central location of the major asphalt and concrete suppliers (South Access Area) could be maintained for asphalt and concrete production, thus reducing noise, dust, and odours in the MacPherson area. This will also eliminate the need to establish a costly water source for the subject area which may be prohibitive for a single operator. It is estimated that a high volume water well (preferable and less expensive to piped water from the Takhini River) will cost about $25,000, including the pump.

10.0 CLOSURE

The information and recommendations presented herein are based on data obtained from fourteen (14) testpits excavated at the subject site, in conjunction with data from previous work. The conditions as reported herein are believed representative of the site; however, should different conditions be encountered during subsequent phases of the site development, we request that EBA be notified so that our recommendations can be re-evaluated in the light of new findings. Additional information concerning the use of this report is presented in the General Conditions preceding Appendix A.

Respectfully submitted,
EBA Engineering Consultants Ltd.



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EBA ENGINEERING CONSULTANTS LTD.

GEOTECHNICAL REPORT
GENERAL CONDITIONS

A.1 USE OF REPORT AND OWNERSHIP

This geotechnical report pertains to a specific site and development. It is not applicable to adjacent sites nor is it valid for types of development other than that to which it refers. Any variation from the site, or development, necessitates a geotechnical review in order to determine the validity of the design concepts evolved herein.

This report is not to be reproduced in part or in whole without consent in writing from EBA Engineering Consultants Ltd. (EBA). Additional copies of the report, if required, may be obtained upon request. Isolated information, logs of borings, or profiles are not to be reproduced, copied or transferred.

A.2 NATURE AND EXACTNESS OF SOIL DESCRIPTION

Classification and identification of soils are based upon commonly accepted methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system prevail, they are specifically mentioned.

Classification and identification of soil and geologic units are judgmental in nature as to both type and condition. EBA does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

A.3 LOGS OF BORINGS

The boring logs are a compilation of conditions and classification of soils as obtained from field observations and laboratory testing of selected samples. Soil zones have been interpreted. Change from one geologic zone to the other, indicated on the logs as a distinct line, is in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil zone transition elevations may require special evaluation.

A.4 STRATIGRAPHIC AND GEOLOGIC SECTIONS

The stratigraphic and geologic sections indicated on drawings contained in this report are evolved from logs of borings. Stratigraphy is known precisely only at the locations of the borings. Actual geology and stratigraphy between borings may vary from that shown on these drawings. Natural variations in geologic conditions are inherent and a function of historic environment. EBA does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of exact locations of geologic units is necessary, it is cautioned that such determination requires special attention.

A.5 GROUNDWATER CONDITIONS

Groundwater conditions represented in this report refer only to those observed at the times recorded on logs of borings, and/or within the text of this report. These conditions vary with geologic detail between borings; annual, seasonal and special meteorologic conditions; and with construction activity. Where instruments have been established to record groundwater variations on an ongoing basis, the records will be specifically referred to. Interpretation of groundwater conditions from observations and records is judgmental and constitutes an evaluation of circumstances as influenced by geology, meteorology and construction activity. Deviations from these observations, may occur. No other warranty, express, or implied, is made by EBA.

A.6 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geologic materials to meteorological elements. Many geologic materials deteriorate rapidly upon exposure to climatic elements. Severe deterioration of materials may be caused by precipitation and/or the action of frost on exposures. Unless otherwise specifically indicated in this report, walls and floors of excavations must be protected from elements, particularly all forms of moisture, desiccation from arid conditions and frost action.

A.7 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise advised, support of excavation walls, ground adjacent to anticipated construction activity and of structures adjacent to the construction, must be provided. The support of ground and structures adjacent to the anticipated construction, with preservation of adjacent ground and structures from the adverse impact of construction activity, is therefore required.

A.8 INFLUENCE OF CONSTRUCTION ACTIVITY

There is a direct correlation between construction activity and adjacent structural performance. The influence of all anticipated construction activities should by considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known. EBA provides no warranty in respect to adverse circumstances resulting from construction activity.

A.9 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geologic deposits, the judgmental character of the art of soil and foundation engineering, as well the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations then may serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein to the benefit of the project.

A.10 DRAINAGE SYSTEMS

Where drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwised specified, it is a condition of this report that effective drainage systems are required and that they must be considered in relation to project purpose and function.

A.11 BEARING CAPACITY

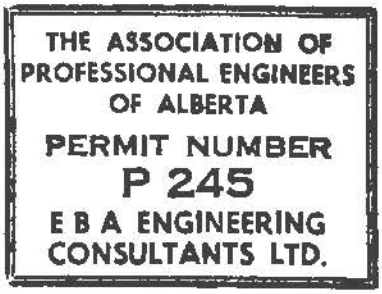
Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil type and soil condition. Construction activity and environmental circumstances can materially change a soil condition. The elevation at which a soil type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geologic materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil conditions assumed in this report exist in fact.

A.12 SAMPLES

EBA will retain all soil and rock samples for 30 days. Further storage or transfer of samples can be made at owner expense upon written request.

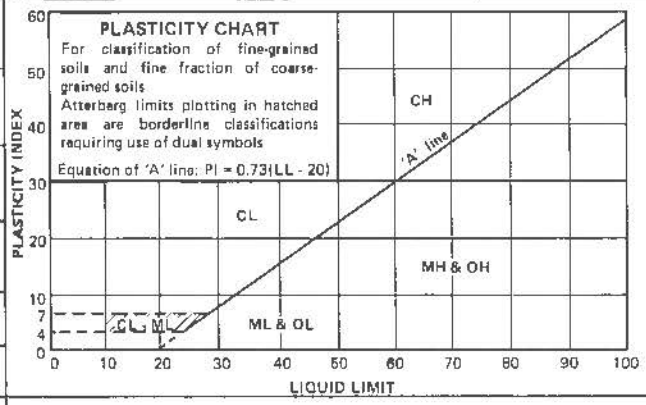
A.13 STANDARD OF CARE

Services performed by EBA for this report are conducted in a manner consistent with that level and skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty, express or implied, is made.



UNIFIED SOIL CLASSIFICATION†

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES	CLASSIFICATION CRITERIA	
COARSE-GRAINED SOILS More than 50% retained on No. 200 sieve*	GRAVELS 50% or more of coarse fraction retained on No. 4 sieve	CLEAN GRAVELS	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	Classification on basis of percentage of fines Less than 5% pass No. 200 sieve GW, GP, SW, SP More than 12% pass No. 200 sieve GM, GC, SM, SC 5% to 12% pass No. 200 sieve Borderline classification requiring use of dual symbols	$C_U = D_{60}/D_{10}$ Greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
			GP	Poorly-graded gravels and gravel-sand mixtures, little or no fines		Not meeting both criteria for GW
		GRAVELS WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits plot below 'A' line or plasticity index less than 4
			GC	Clayey gravels, gravel-sand clay mixtures		Atterberg limits plot above 'A' line and plasticity index greater than 7
	SANDS More than 50% of coarse fraction passes No. 4 sieve	CLEAN SANDS	SW	Well-graded sands and gravelly sands, little or no fines		$C_U = D_{60}/D_{10}$ Greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
			SP	Poorly-graded sands and gravelly sands, little or no fines		Not meeting both criteria for SW
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures		Atterberg limits plot below 'A' line or plasticity index less than 4
			SC	Clayey sands, sand-clay mixtures		Atterberg limits plot above 'A' line and plasticity index greater than 7
FINE-GRAINED SOILS 50% or more passes No. 200 sieve*	SILTS AND CLAYS Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
			OL	Organic silts and organic silty clays of low plasticity		
	SILTS AND CLAYS Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts		
			CH	Inorganic clay of high plasticity, fat clays		
			OH	Organic clays of medium to high plasticity		
HIGHLY ORGANIC SOILS			PT	Peat, muck and other highly organic soils		



*Based on the material passing the 3 in. (75 mm) sieve
†ASTM Designation D 2487, for identification procedure see D 2488

GROUND ICE DESCRIPTION

ICE NOT VISIBLE

GROUP SYMBOLS	SYMBOLS	SUBGROUP DESCRIPTION	
N	Nf	Poorly-bonded or friable	
	Nbn	No excess ice, well-bonded	
	Nbe	Excess ice, well-bonded	

NOTE:

1. *Dual symbols are used to indicate borderline or mixed ice classifications*
2. *Visual estimates of ice contents indicated on borehole logs ± 5%*
3. *This system of ground ice description has been modified from NRC Technical Memo 79, Guide to the Field Description of Permafrost for Engineering Purposes*

LEGEND

Soil  Ice 

VISIBLE ICE LESS THAN 50% BY VOLUME

GROUP SYMBOLS	SYMBOLS	SUBGROUP DESCRIPTION	
V	Vx	Individual ice crystals or inclusions	
	Vc	Ice coatings on particles	
	Vr	Random or irregularly oriented ice formations	
	Vs	Stratified or distinctly oriented ice formations	

VISIBLE ICE GREATER THAN 50% BY VOLUME

ICE	ICE + Soil Type	Ice with soil inclusions	
	ICE	Ice without soil inclusions (greater than 25 mm [1 in.] thick)	

General Notes on EBA Soil Classification System

The soil is named after its PRINCIPAL COMPONENT, and modified by other components as follows:

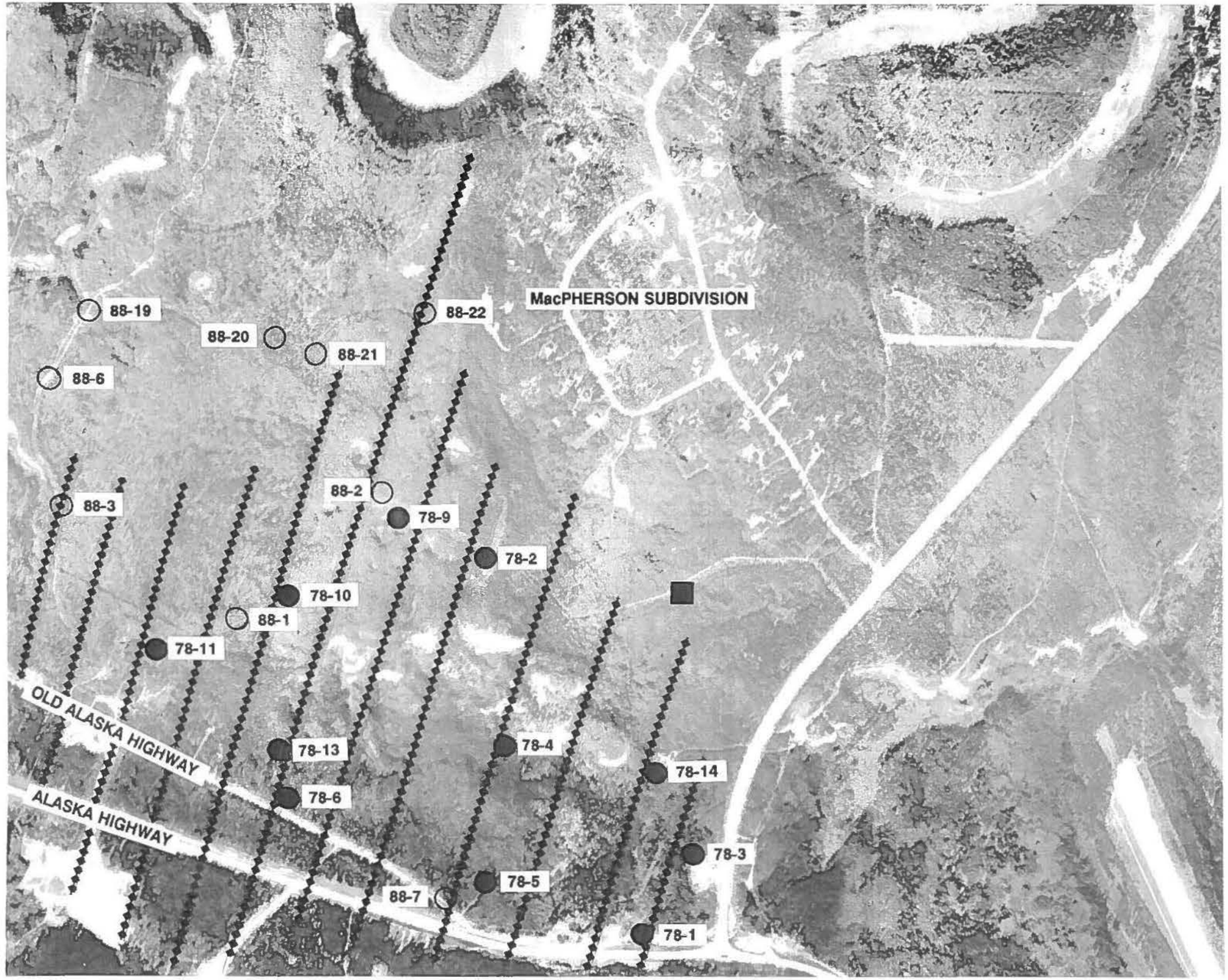
Presence of Component XXX	Modifier
greater than 35%	AND XXX
21% to 35%	XXX-ey
11% to 20%	some XXX
1% to 10%	trace of XXX

Examples

clay	silt	sand	gravel	
65%	15%	10%	10%	CLAY(CL)-some silt, trace of sand, trace of gravel
5%	10%	45%	40%	SAND AND GRAVEL(SM)-trace of silt, trace of clay
10%	65%	25%	--	SILT(ML)-sandy, trace of clay

The USC classification (see other side) is presented in parenthesis after the PRINCIPAL COMPONENT.

APPENDIX A



MacPHERSON AREA "A"

- TEST PIT LOCATIONS (KLOHN LEONOFF '88)
- TEST PIT LOCATIONS (HARDY '78)
- EM 31 AND EM 34 SURVEY LINES (HARDY '78)
- EXISTING WELL CASING (HYDRO. CONS. '76)

0 500 1000

SCALE (m)

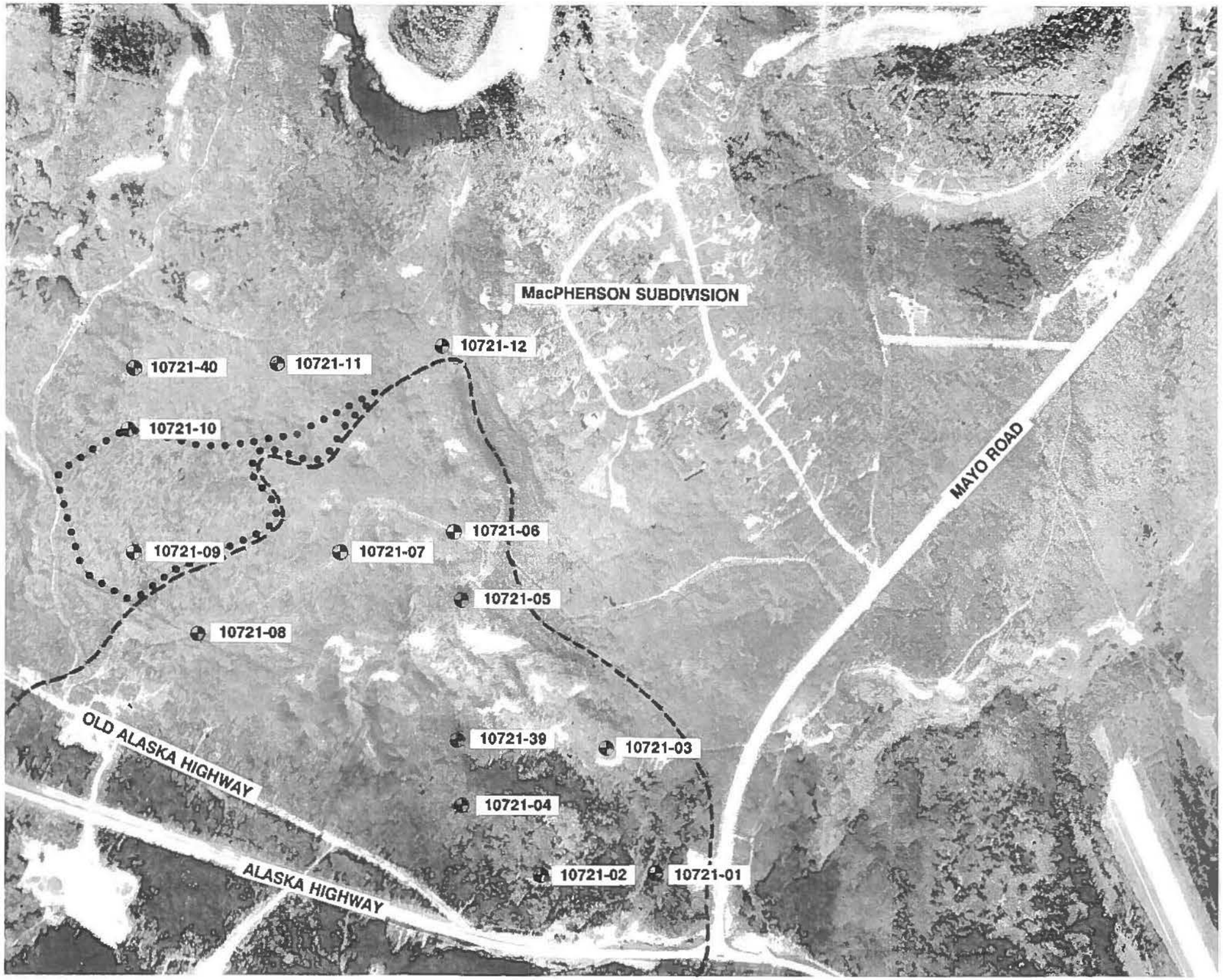
EBA Engineering Consultants Ltd.

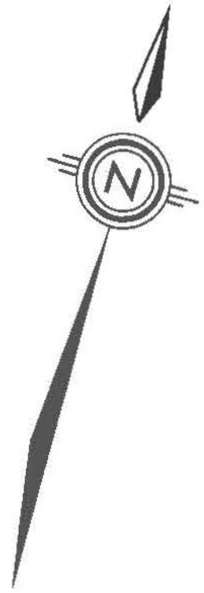
PROJECT: MacPHERSON GRANULAR SOURCE STUDY

CLIENT: GOVERNMENT OF YUKON

TITLE: SUMMARY OF PREVIOUSLY COMPLETED SITE INVESTIGATIONS

DATE	DWN.	CHKD.	FILE NO.	
91-12-14	MCP		0201-10721	10721-A-01





MacPHERSON AREA "A"

1991 TESTPIT LOCATIONS

APPROXIMATE LIMITS OF GRANULAR DEPOSIT

APPROXIMATE LIMITS OF SAND DEPOSIT

0 500 1000

SCALE (m)

EBA Engineering Consultants Ltd.

PROJECT: MacPHERSON GRANULAR SOURCE STUDY

CLIENT: GOVERNMENT OF YUKON

TITLE: SITE PLAN SHOWING 1991 TESTPIT LOCATIONS

DATE	DWN.	CHKD.	FILE NO.	
91-12-14	MCP		0201-10721	10721-A-02

McPHERSON GRANULAR RESOURCE STUDY	CLIENT: GOVERNMENT OF YUKON	BOREHOLE No. 10721-01
McPHERSON AREA "A"	BACKHOE: CAT 225 TRACKED BACKHOE	Project No: 0201-1D721
WHITEHORSE, YUKON	UTM ZONE: 8 N6741700.00 E488750.00	ELEVATION 0.00 (m)

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | STANDARD PEN. | 75 mm SPOON | CRREL BARREL

SOIL DESCRIPTION

STANDARD PENETRATION 10 20 30 40 | PLASTIC M.C. LIQUID 10 20 30 40

PERCENT GRAVEL 20 40 60 80 | PERCENT SAND 20 40 60 80 | PERCENT SILT OR FINES 20 40 60 80 | PERCENT CLAY 20 40 60 80

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	USC	SOIL DESCRIPTION
0.0				ORGANIC ROOTMAT WITH TEA GROUND COVER
				SILT–some fine sand, rootlets throughout, damp, medium brown
		1		GRAVEL–sandy, trace of silt, occasional cobbles and boulders up to 300 mm maximum size, gravel is well graded, sand is medium to coarse, cobbles and boulders are subangular and have calcite coatings, damp, compact(est.), greyish brown
1.0				
		2		
2.0				–slightly damper and cleaner with depth
		3		
3.0				
		4		
4.0				
		5		
5.0				END OF TESTPIT 5.0 m
				NOTE: 30% over 100 mm below 3.0 m 20% over 100 mm above 3.0 m
6.0				
7.0				

DEPTH (ft): 0.0, 2.0, 4.0, 6.0, 8.0, 10.0, 12.0, 14.0, 16.0, 18.0, 20.0, 22.0

EBA Engineering Consultants Ltd. Whitehorse, Yukon	COMPLETION DEPTH 5.0 m	COMPLETE 91/08/07
	LOGGED BY MCP	DWG NO.
		Page 1 of 1

LARGE AGGREGATE ANALYSIS REPORT

Project: McPHERSON GRANULAR STUDY
Address:
Project Number: 201 -10721
Date Sampled: 91-09-23 By:
Client: Y.T.G.-LANDS BRANCH
WHITEHORSE, Y.T.

Attention:

Sample Number: 4838.13
Sample Location: TP 01, AREA "A".

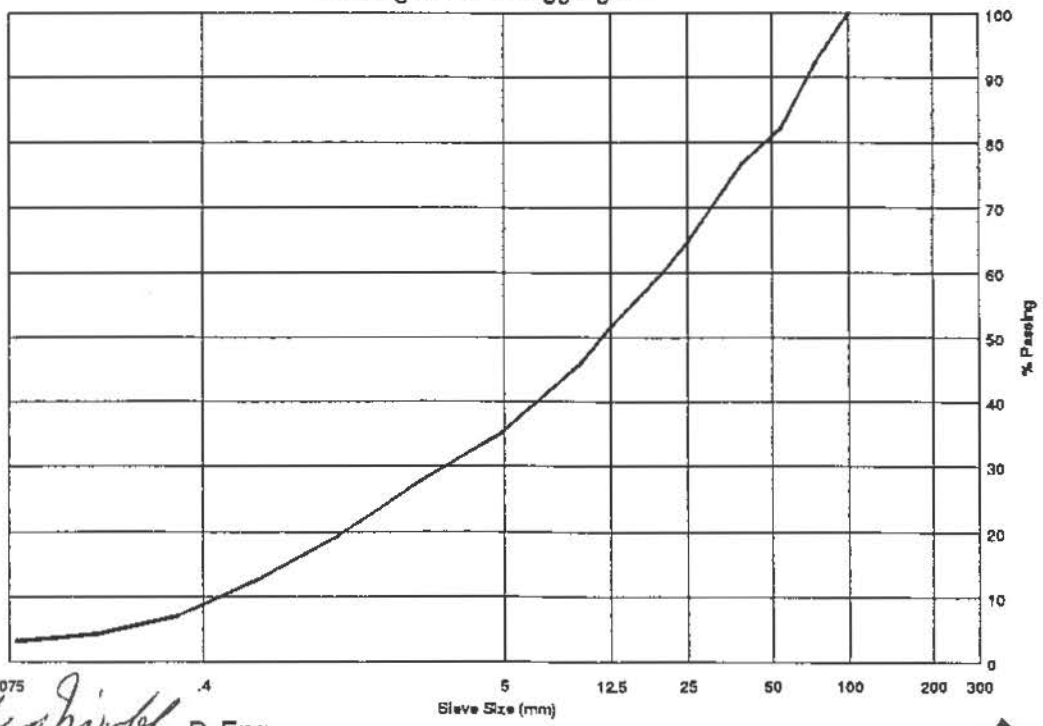
Time: Temp.: °C
Date Tested: 91-09-06
Tested By: ATE
Natural Moisture Content: 2.2
Crushed Faces: ☐ 1 ☐ 2

Soil Description: GRAVEL (100 mm MAX.), SANDY, TR. SILT, BROWN.

Cu:
Cc:
Remarks:

Sieve Size	% Passing
100.	100.0
75.0	92.3
56.0	82.1
40.0	76.6
25.0	64.3
20.0	59.4
12.5	50.5
10.0	45.7
5.00	34.9
2.50	27.5
1.25	19.0
.630	12.1
.315	6.4
.160	3.6
.080	2.5

Grading Curve of Aggregate



Reviewed By: P. Eng.

eba

AGGREGATE ANALYSIS REPORT

Project: McPHERSON GRANULAR STUDY
Address:
Project Number: 201 -10721
Date Sampled: 91-08-23 By:
Client: Y. T. G. -LANDS BRANCH
WHITEHORSE, Y. T.

Attention:

Sample Number: 4838.14
Sample Location: TP 1, AREA "A".

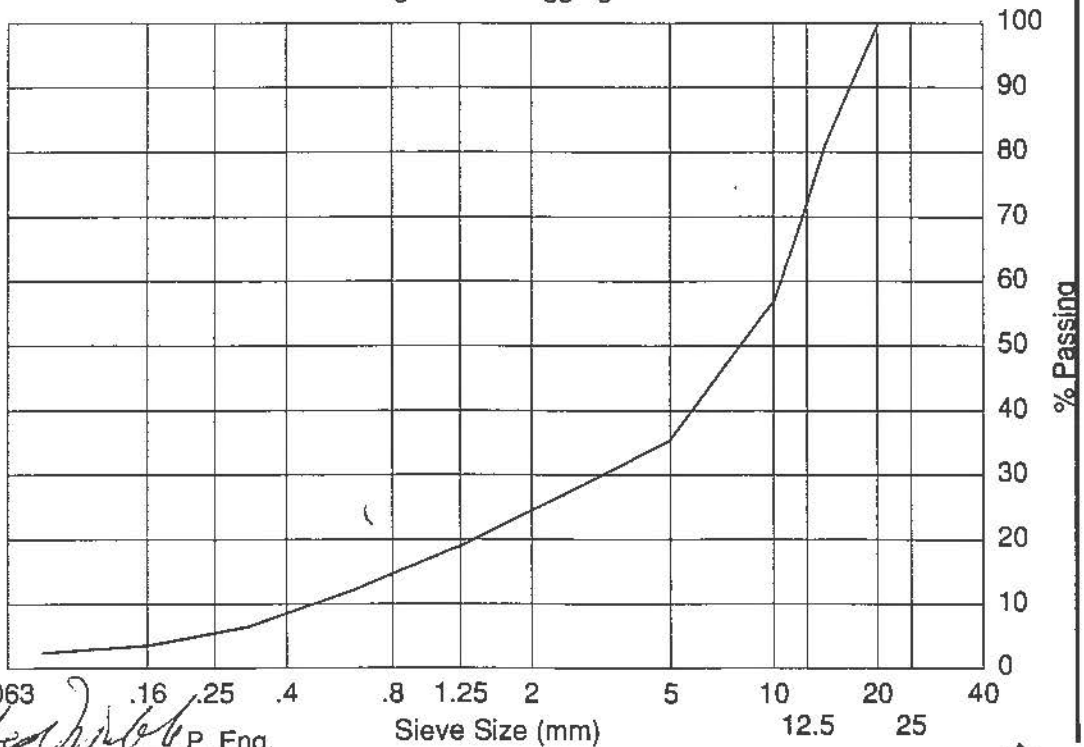
Time: Temp.: °C
Date Tested: 91-09-06
Tested By: ATE
Natural Moisture Content:
Crushed Faces: ☐1 ☐ 2

Soil Description: GRAVEL (20 mm MAX.), SANDY, TR. SILT, BROWN.

Cu:
Cc:
Remarks: LAB CRUSHED.

Sieve Size	% Passing
20.0	100.0
14.0	81.1
12.5	72.5
10.0	56.9
5.00	35.4
2.50	27.1
1.25	19.0
.630	12.3
.315	6.5
.160	3.5
.080	2.3

Grading Curve of Aggregate



Reviewed By: P. Eng.

McPHERSON GRANULAR RESOURCE STUDY	CLIENT: GOVERNMENT OF YUKON	BOREHOLE No. 10721-02
McPHERSON AREA "A"	BACKHOE: CAT 225 TRACKED BACKHOE	Project No: 0201-10721
WHITEHORSE, YUKON	UTM ZONE: 8 N6741690.00 E488550.00	ELEVATION 0.00 (m)

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | STANDARD PEN. | 75 mm SPOON | CRREL BARREL

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	USC	SOIL DESCRIPTION
0.0				TEA GROUND COVER AND ORGANIC ROOT MAT
		1		SILT–sandy, fine grained, uniform, rootlets to 1.0 m, damp, light brown
1.0				
		2		GRAVEL–silty, some sand, cobbles and boulders to 500 mm, subangular, damp, dense, light brown
2.0				
		3		
3.0				–very tough to excavate
		4		
4.0				
		5		
5.0				END OF TESTPIT 5.0 m NOTE: Hole excavated at edge of deposit
6.0				
7.0				

STANDARD PENETRATION 10 20 30 40 | PLASTIC M.C. LIQUID 10 20 30 40

PERCENT GRAVEL 20 40 60 80 | PERCENT SAND 20 40 60 80 | PERCENT SILT OR FINES 20 40 60 80 | PERCENT CLAY 20 40 60 80

DEPTH (ft): 0.0, 2.0, 4.0, 6.0, 8.0, 10.0, 12.0, 14.0, 16.0, 18.0, 20.0, 22.0

EBA Engineering Consultants Ltd.
Whitehorse, Yukon

COMPLETION DEPTH 5.0 m | COMPLETE 91/08/07

LOGGED BY MCP | DWG NO. | Page 1 of 1

McPHERSON GRANULAR RESOURCE STUDY	CLIENT: GOVERNMENT OF YUKON	BOREHOLE No. 10721-03
McPHERSON AREA "A"	BACKHOE: CAT 225 TRACKED BACKHOE	Project No: 0201-10721
WHITEHORSE, YUKON	UTM ZONE: 8 N6741940.00 E488540.00	ELEVATION 0.00 (m)

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | STANDARD PEN. | 75 mm SPOON | CRREL BARREL

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	USC	SOIL DESCRIPTION
0.0				ORGANIC ROOT MAT AND TEA GROUND COVER
				SILT–trace of clay, trace of fine sand, rootlets throughout, moist, dark brown
		1		SAND–trace of silt, trace of fine gravel, rootlets to 0.6 m
1.0				
		2		SILT–some fine sand, rootlets throughout
				GRAVEL–sandy, trace of silt, rootlets throughout clast supported, coarse, subangular, damp, greyish brown
2.0				
		3		–silt lens from 2.5 to 2.7 m
				GRAVEL–sandy, trace of silt, cobbles and boulders to 250 mm, sand is medium to coarse, gravel is subangular with calcite coatings, damp, loose (sloughing badly), medium brown
3.0				
		4		–hole ended due to excessive sloughing
				END OF TESTPIT 3.5 m
4.0				
5.0				

STANDARD PENETRATION 10 20 30 40

PLASTIC M.C. LIQUID 10 20 30 40

PERCENT GRAVEL 20 40 60 80

PERCENT SAND 20 40 60 80

PERCENT SILT OR FINES 20 40 60 80

PERCENT CLAY 20 40 60 80

DEPTH (ft): 0.0, 2.0, 4.0, 6.0, 8.0, 10.0, 12.0, 14.0, 16.0

EBA Engineering Consultants Ltd.
Whitehorse, Yukon

COMPLETION DEPTH 3.5 m		COMPLETE 91/08/07
LOGGED BY MCP	DWG NO.	Page 1 of 1

McPHERSON GRANULAR RESOURCE STUDY	CLIENT: GOVERNMENT OF YUKON	BOREHOLE No. 10721-04
McPHERSON AREA "A"	BACKHOE: CAT 225 TRACKED BACKHOE	Project No: 0201-10721
WHITEHORSE, YUKON	UTM ZONE: 8 N6741750.00 E488150.00	ELEVATION 0.00 (m)

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | STANDARD PEN. | 75 mm SPOON | CRREL BARREL

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	USC	SOIL DESCRIPTION
0.0				ORGANIC ROOTMAT WITH TEA GROUND COVER
				SILT–sandy, rootlets throughout, damp to moist, soft, medium brown (rusty)
				GRAVEL–sandy, trace of silt, cobbles and boulders up to 1000 mm in size, sand is medium to coarse, damp, dense, medium brown
1.0		1		
		2		
				–fewer boulders, sand becomes well graded and colour becomes greyish brown
2.0				
		3		
3.0				–sand becomes coarser with some rootlets in sand matrix
		4		
4.0				–rock coated with calcite
		5		
				END OF TESTPIT 4.5 m
5.0				NOTE: Occasional boulder along ground surface, approx. 30% over 100 mm
6.0				
7.0				

■ STANDARD PENETRATION ■ 10 20 30 40

PLASTIC M.C. LIQUID 10 20 30 40

■ PERCENT GRAVEL ■ 20 40 60 80

● PERCENT SAND ● 20 40 60 80

▲ PERCENT SILT OR FINES ▲ 20 40 60 80

◆ PERCENT CLAY ◆ 20 40 60 80

DEPTH (ft): 0.0, 2.0, 4.0, 6.0, 8.0, 10.0, 12.0, 14.0, 16.0, 18.0, 20.0, 22.0

EBA Engineering Consultants Ltd.
Whitehorse, Yukon

COMPLETION DEPTH 4.5 m | COMPLETE 91/08/07

LOGGED BY MCP | DWG NO. | Page 1 of 1

LARGE AGGREGATE ANALYSIS REPORT

Project: McPHERSON GRANULAR STUDY
Address:
Project Number: 201 -10721
Date Sampled: 91-08-23 By:
Client: Y. T. G. -LANDS BRANCH
WHITEHORSE, Y. T.

Attention:

Sample Number: 4838. 15
Sample Location: TP 4, AREA "A"

Time: Temp.: °C
Date Tested: 91-09-09
Tested By: ATE
Natural Moisture Content: 2. 9
Crushed Faces: ☐ 1 ☐ 2

Soil Description: PIT RUN, GRAVEL (100 mm MAX.), SANDY, TR. SILT, BROWN.

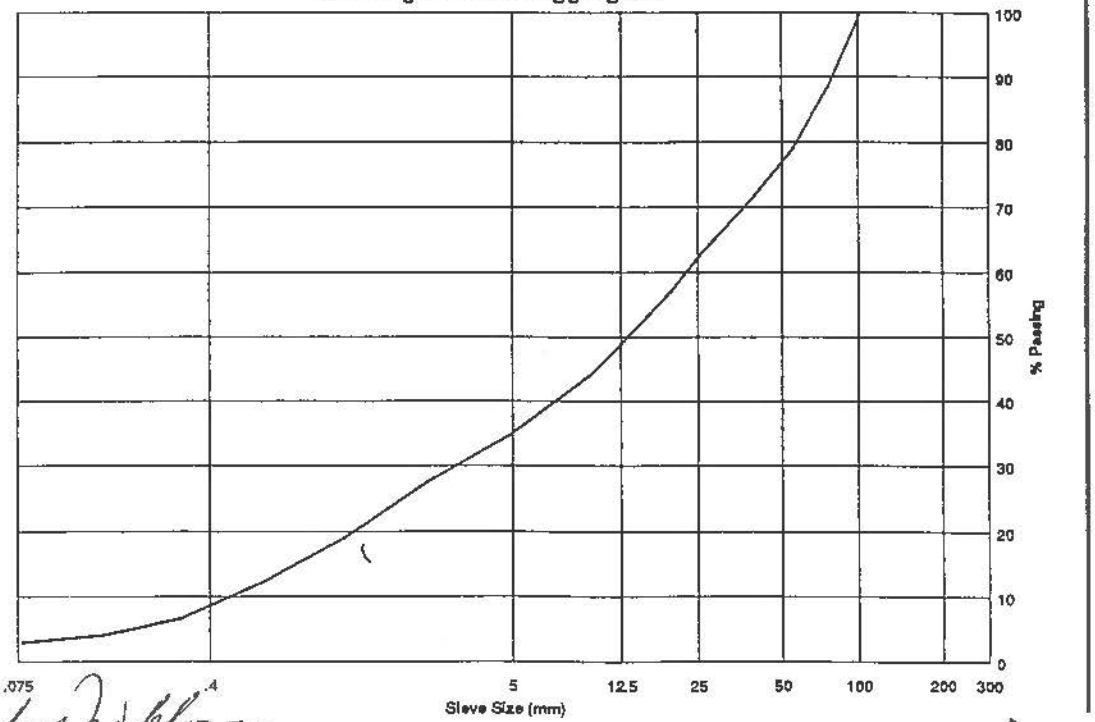
Cu:

Cc:

Remarks:

Sieve Size	% Passing
100.	100. 0
75. 0	88. 3
56. 0	78. 8
40. 0	71. 4
25. 0	62. 2
20. 0	57. 1
12. 5	48. 0
10. 0	43. 9
5. 00	34. 6
2. 50	27. 3
1. 25	18. 6
. 630	11. 8
. 315	6. 2
. 160	3. 5
. 080	2. 4

Grading Curve of Aggregate



Reviewed By: P. Eng.

eba

2234PLOT

AGGREGATE ANALYSIS REPORT

Project: McPHERSON GRANULAR STUDY
Address:
Project Number: 201 -10721
Date Sampled: 91-08-23 By:
Client: Y. T. G. -LANDS BRANCH
WHITEHORSE, Y. T.
Attention:

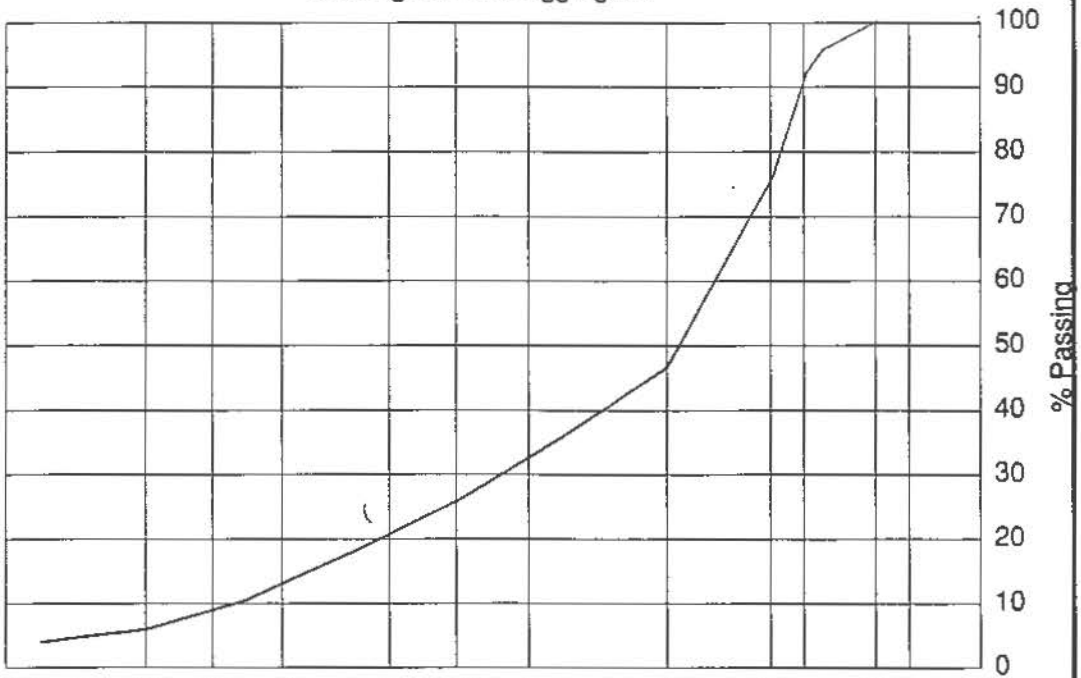
Sample Number: 4838. 16
Sample Location: TP 4, AREA "A"
Time: Temp.: °C
Date Tested: 91-09-09
Tested By: ATE
Natural Moisture Content: 0. 0
Crushed Faces: ☐1 ☐ 2

Soil Description: GRAVEL AND SAND (20 mm MAX.), TR. SILT, BROWN

Cu:
Cc:
Remarks: LAB CRUSHED TO 20 mm

Sieve Size	% Passing
20. 0	100. 0
14. 0	95. 6
12. 5	91. 8
10. 0	75. 7
5. 00	46. 5
2. 50	35. 8
1. 25	25. 7
. 630	17. 8
. 315	10. 2
. 160	5. 7
. 080	3. 7

Grading Curve of Aggregate



Reviewed By: P. Eng.

McPHERSON GRANULAR RESOURCE STUDY	CLIENT: GOVERNMENT OF YUKON	BOREHOLE No. 10721-05
McPHERSON AREA "A"	BACKHOE: CAT 225 TRACKED BACKHOE	Project No: 0201-10721
WHITEHORSE, YUKON	UTM ZONE: 8 N6742180.00 E488150.00	ELEVATION 0.00 (m)

SAMPLE TYPE: GRAB SAMPLE; NO RECOVERY; STANDARD PEN.; 75 mm SPOON; CRREL BARREL

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	USC	SOIL DESCRIPTION
0.0				MOSS AND TEA GROUNDCOVER, rootlets throughout
				SILT-some fine sand, rootlets throughout
		1		GRAVEL-sandy, trace of silt, cobbles and boulders to 700 mm throughout, rootlets to 1.3 m, trace of calcite coatings on rock, damp, compact to dense, greyish brown
1.0				-estimate 15% over 100 mm in size
		2		
2.0				-consistent throughout
		3		
3.0				
		4		
4.0				
		5		
5.0				END OF TESTPIT 4.5 m NOTE: Excavated at top of rise – front face
6.0				
7.0				

STANDARD PENETRATION 10 20 30 40

PLASTIC M.C. LIQUID 10 20 30 40

PERCENT GRAVEL 20 40 60 80

PERCENT SAND 20 40 60 80

PERCENT SILT OR FINES 20 40 60 80

PERCENT CLAY 20 40 60 80

DEPTH (ft): 0.0, 2.0, 4.0, 6.0, 8.0, 10.0, 12.0, 14.0, 16.0, 18.0, 20.0, 22.0

EBA Engineering Consultants Ltd. Whitehorse, Yukon	COMPLETION DEPTH 4.5 m	COMPLETE 91/08/08
	LOGGED BY MCP	DWG NO.
		Page 1 of 1

LARGE AGGREGATE ANALYSIS REPORT

Project: McPHERSON GRANULAR STUDY
Address:
Project Number: 201 -10721
Date Sampled: 91-08-23 By:
Client: Y. T. G. -LANDS BRANCH
WHITEHORSE, Y. T.

Attention:

Sample Number: 4838. 17
Sample Location: TP 5, AREA "A".

Time: Temp.: °C
Date Tested: 91-09-09
Tested By: ATE
Natural Moisture Content: 2. 3
Crushed Faces: ☐ 1 ☐ 2

Soil Description: PIT RUN, GRAVEL (100 mm MAX.), SANDY, TR. SILT, BROWN .

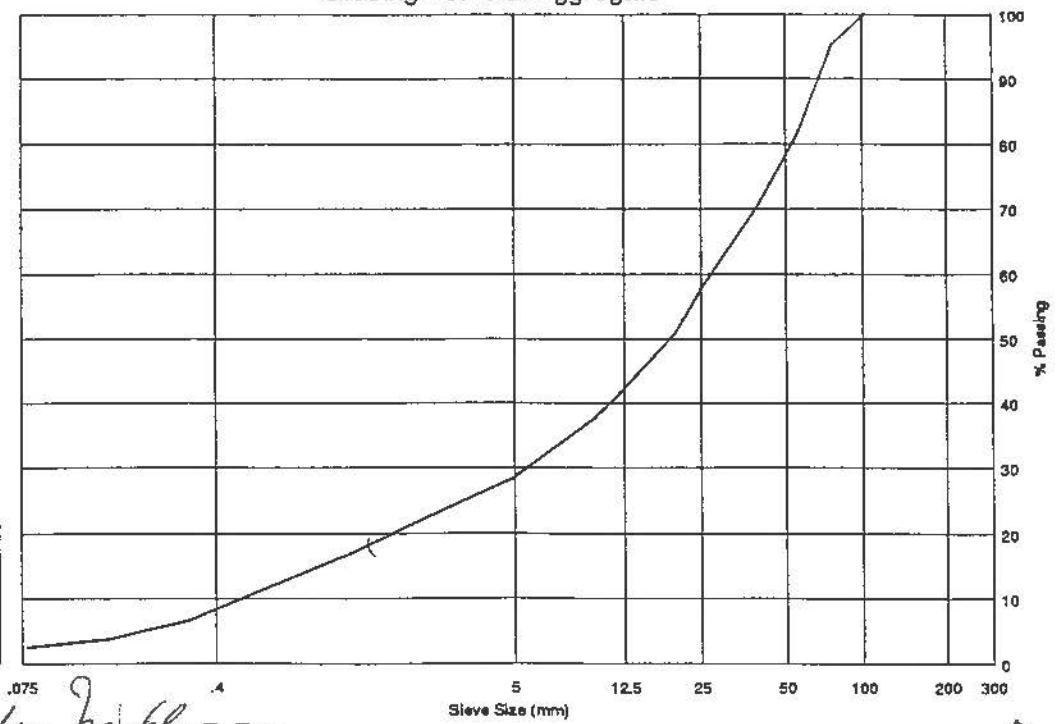
Cu:

Cc:

Remarks:

Sieve Size	% Passing
100.	100. 0
75. 0	95. 2
56. 0	81. 3
40. 0	70. 1
25. 0	57. 6
20. 0	50. 7
12. 5	41. 5
10. 0	37. 5
5. 00	28. 2
2. 50	22. 5
1. 25	16. 5
. 630	11. 4
. 315	6. 2
. 160	3. 3
. 080	2. 1

Grading Curve of Aggregate



Reviewed By: P. Eng.

2234PLOT

AGGREGATE ANALYSIS REPORT

Project: McPHERSON GRANULAR STUDY
Address:
Project Number: 201 -10721
Date Sampled: 91-08-23 By:
Client: Y. T. G. -LANDS BRANCH
WHITEHORSE, Y. T.

Attention:

Sample Number: 4838.18
Sample Location: TP 5, AREA "A"

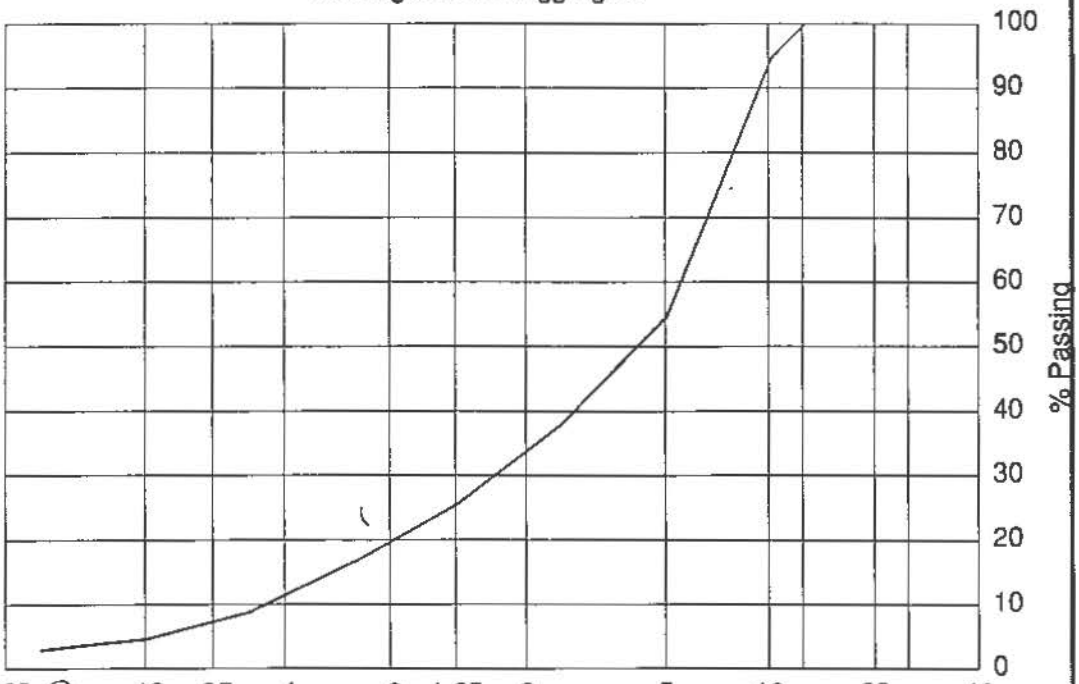
Time: Temp.: °C
Date Tested: 91-09-09
Tested By: ATE
Natural Moisture Content: 0.0
Crushed Faces: ☐1 ☐ 2

Soil Description: SAND AND GRAVEL (12.5 mm MAX.), TR. SILT, BROWN

Cu:
Cc:
Remarks: LAB CRUSHED TO 12.5 mm

Sieve Size	% Passing
12.5	100.0
10.0	94.6
5.00	54.6
2.50	37.9
1.25	25.6
.630	16.7
.315	8.8
.160	4.6
.080	2.9

Grading Curve of Aggregate



Reviewed By: J. Michael Winkler P. Eng.

eba

McPHERSON GRANULAR RESOURCE STUDY	CLIENT: GOVERNMENT OF YUKON	BOREHOLE No. 10721-06
McPHERSON AREA "A"	BACKHOE: CAT 225 TRACKED BACKHOE	Project No: 0201-10721
WHITEHORSE, YUKON	UTM ZONE: 8 N6742410.00 E488150.00	ELEVATION 0.00 (m)

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | STANDARD PEN. | 75 mm SPOON | CRREL BARREL

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	USC	SOIL DESCRIPTION
0.0				ORGANIC ROOT MAT with tea and grass ground cover, rootlets throughout
				SILT–some fine sand, rootlets throughout moist, medium brown
		1		GRAVEL–sandy, trace of silt, rootlets to 1.2 m, damp to moist, compact, medium brown
				–medium gravel from 0.7 to 1.2 m
1.0				–gravelly sand lens from 1.0 to 1.3 m
		2		
				–cobbles and boulders up to 300 mm below 1.5 m
2.0				
		3		
				–finer again below 2.5 m (less cobbles)
				–sand is medium to coarse below 2.5m
3.0				–silty lens at 3.0 m
		4		
4.0				–moisture increases below 4.0 m
		5		
5.0				END OF TESTPIT 4.8 m
6.0				
7.0				

■ STANDARD PENETRATION ■ 10 20 30 40

PLASTIC M.C. LIQUID 10 20 30 40

■ PERCENT GRAVEL ■ 20 40 60 80

● PERCENT SAND ● 20 40 60 80

▲ PERCENT SILT OR FINES ▲ 20 40 60 80

◆ PERCENT CLAY ◆ 20 40 60 80

DEPTH (ft): 0.0, 2.0, 4.0, 6.0, 8.0, 10.0, 12.0, 14.0, 16.0, 18.0, 20.0, 22.0

EBA Engineering Consultants Ltd.
Whitehorse, Yukon

COMPLETION DEPTH 4.8 m		COMPLETE 91/08/08
LOGGED BY MCP	DWG NO.	Page 1 of 1

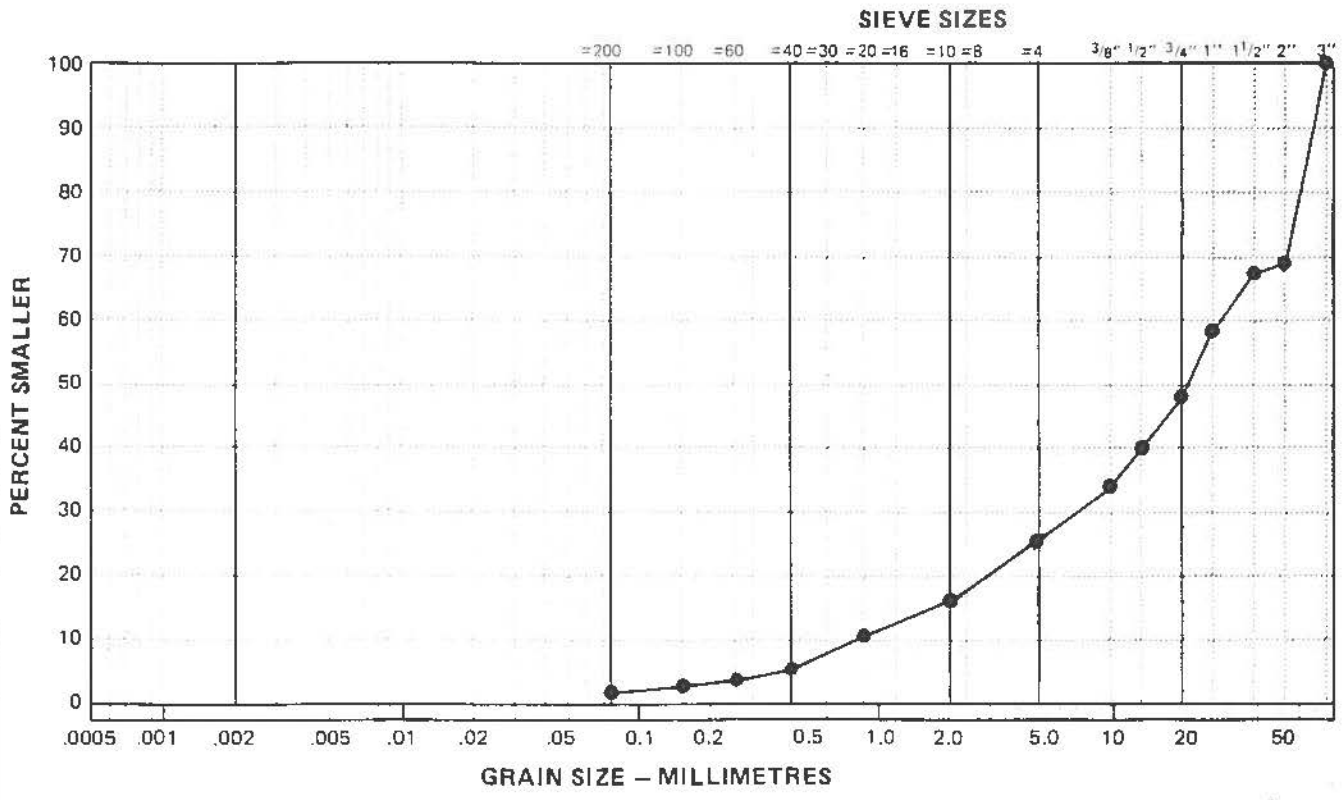
EBA Engineering Consultants Ltd.

PARTICLE - SIZE ANALYSIS OF SOILS

Project: MacPherson A Granular Study
Whitehorse, Yukon
Project Number: 0201-10721
Date Tested: 91-09-19
Borehole Number: 10721-06
Depth: 1.5 m, 2.5 m, 3.5 m, and 4.5 m
Soil Description: GRAVEL (GW) - sandy, trace of silt
Cu: 37.5
Cc: 2.0
Natural Moisture Content: ____ %
Remarks: 2" Sieve: 69.7% passing

SIEVE	PERCENTAGE PASSING
3"	100.0
1 1/2"	67.6
1"	53.5
3/4"	48.3
1/2"	40.0
3/8"	34.1
No. 4	25.2
No. 10	16.7
No. 20	10.2
No. 40	5.1
No. 60	2.8
No. 100	1.9
No. 200	1.4

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



Tested in accordance with ASTM D422 unless otherwise noted.

McPHERSON GRANULAR RESOURCE STUDY	CLIENT: GOVERNMENT OF YUKON	BOREHOLE No. 10721-07
McPHERSON AREA "A"	BACKHOE: CAT 225 TRACKED BACKHOE	Project No: 0201-10721
WHITEHORSE, YUKON	UTM ZONE: 8 N6742340.00 E487800.00	ELEVATION 0.00 (m)

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | STANDARD PEN. | 75 mm SPOON | CRREL BARREL

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	USC	SOIL DESCRIPTION
0.0				ORGANIC ROOT MAT AND TEA GROUND COVER–rootlets throughout
				SILT–some fine sand, rootlets throughout, damp, medium brown
		1		GRAVEL AND SAND–trace of silt, rootlets to 1.2 m, gravel is subrounded up to 75 mm, sand is well graded, moist, medium brown
1.0				–gravelly, sand lens from 1.0 to 1.3 m
		2		
2.0				
		3		GRAVEL–sandy, trace of silt, occasional cobble to 200 mm, sand is medium to coarse, damp, loose, greyish brown
3.0				
		4		
4.0				
		5		
				END OF TESTPIT 4.5 m
5.0				NOTE: Quite a bit finer than in previous holes (too fine to crush)
6.0				
7.0				

STANDARD PENETRATION 10 20 30 40

PLASTIC M.C. LIQUID 10 20 30 40

PERCENT GRAVEL 20 40 60 80

PERCENT SAND 20 40 60 80

PERCENT SILT OR FINES 20 40 60 80

PERCENT CLAY 20 40 60 80

DEPTH (ft): 0.0, 2.0, 4.0, 6.0, 8.0, 10.0, 12.0, 14.0, 16.0, 18.0, 20.0, 22.0

EBA Engineering Consultants Ltd. Whitehorse, Yukon	COMPLETION DEPTH 4.5 m	COMPLETE 91/08/08
	LOGGED BY MCP	DWG NO.
		Page 1 of 1

McPHERSON GRANULAR RESOURCE STUDY	CLIENT: GOVERNMENT OF YUKON	BOREHOLE No. 10721-08
McPHERSON AREA "A"	BACKHOE: CAT 225 TRACKED BACKHOE	Project No: 0201-10721
WHITEHORSE, YUKON	UTM ZONE: 8 N6742140.00 E487620.00	ELEVATION 0.00 (m)

SAMPLE TYPE: GRAB SAMPLE; NO RECOVERY; STANDARD PEN.; 75 mm SPOON; CRREL BARREL

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	USC	SOIL DESCRIPTION
0.0				TEA GROUND COVER
				SILT–some fine sand, rootlets throughout, moist, medium brown
		1		GRAVEL–sandy, trace of silt, occasional cobbles and boulders, rootlets to 1.0 m, up to 300 mm maximum size, damp, greyish brown
1.0				–sand lens from 0.9 to 1.2 m
		2		
2.0				
		3		SAND–trace of silt, fine to medium grained damp, greyish brown
3.0				
		4		GRAVEL–sandy, trace of silt, cobbles and boulders to 400 mm, damp, compact, greyish brown
4.0				
		5		
				END OF TESTPIT 4.5 m
				NOTE: Coarser again, nice gravel
5.0				
6.0				
7.0				

STANDARD PENETRATION 10 20 30 40

PLASTIC M.C. LIQUID 10 20 30 40

PERCENT GRAVEL 20 40 60 80

PERCENT SAND 20 40 60 80

PERCENT SILT OR FINES 20 40 60 80

PERCENT CLAY 20 40 60 80

DEPTH (ft): 0.0, 2.0, 4.0, 6.0, 8.0, 10.0, 12.0, 14.0, 16.0, 18.0, 20.0, 22.0

EBA Engineering Consultants Ltd.
Whitehorse, Yukon

COMPLETION DEPTH 4.5 m		COMPLETE 91/08/08
LOGGED BY MCP	DWG NO.	Page 1 of 1

LARGE AGGREGATE ANALYSIS REPORT

Project: McPHERSON GRANULAR STUDY
Address:
Project Number: 201 -10721
Date Sampled: 91-09-23 By:
Client: Y. T. G. -LANDS BRANCH
WHITEHORSE, Y. T.
Attention:

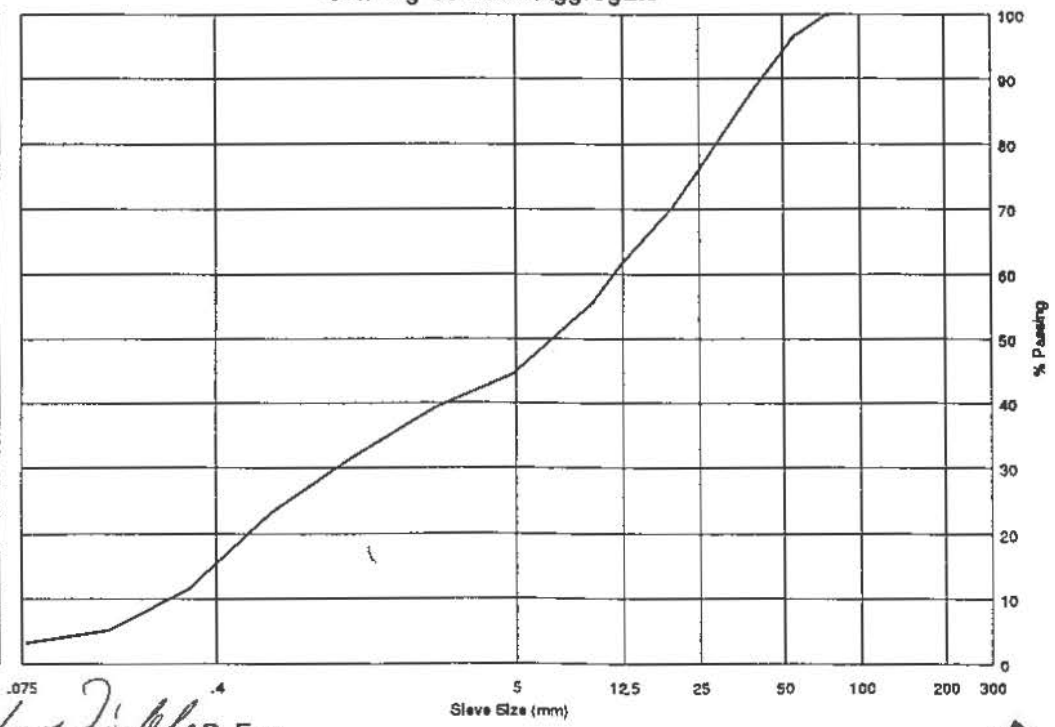
Sample Number: 4838. 19
Sample Location: TP 8, AREA "A"
Time: Temp.: °C
Date Tested: 91-09-09
Tested By: ATE
Natural Moisture Content: 4. 7
Crushed Faces: ☐ 1 ☐ 2

Soil Description: PIT RUN, GRAVEL (75 mm MAX.), AND SAND, TR. SILT, BROWN.

Cu:
Cc:
Remarks:

Sieve Size	% Passing
75. 0	100. 0
56. 0	96. 5
40. 0	88. 4
25. 0	76. 1
20. 0	70. 3
12. 5	60. 9
10. 0	55. 5
5. 00	44. 4
2. 50	38. 9
1. 25	31. 4
. 630	22. 9
. 315	11. 2
. 160	4. 8
. 080	2. 9

Grading Curve of Aggregate



Reviewed By: P. Eng.

2234PLOT

AGGREGATE ANALYSIS REPORT

Project: McPHERSON GRANULAR STUDY
Address:
Project Number: 201 -10721
Date Sampled: 91-08-23 By:
Client: Y. T. G. -LANDS BRANCH
WHITEHORSE, Y. T.

Attention:

Sample Number: 4838. 20
Sample Location: TP 8, AREA "A"

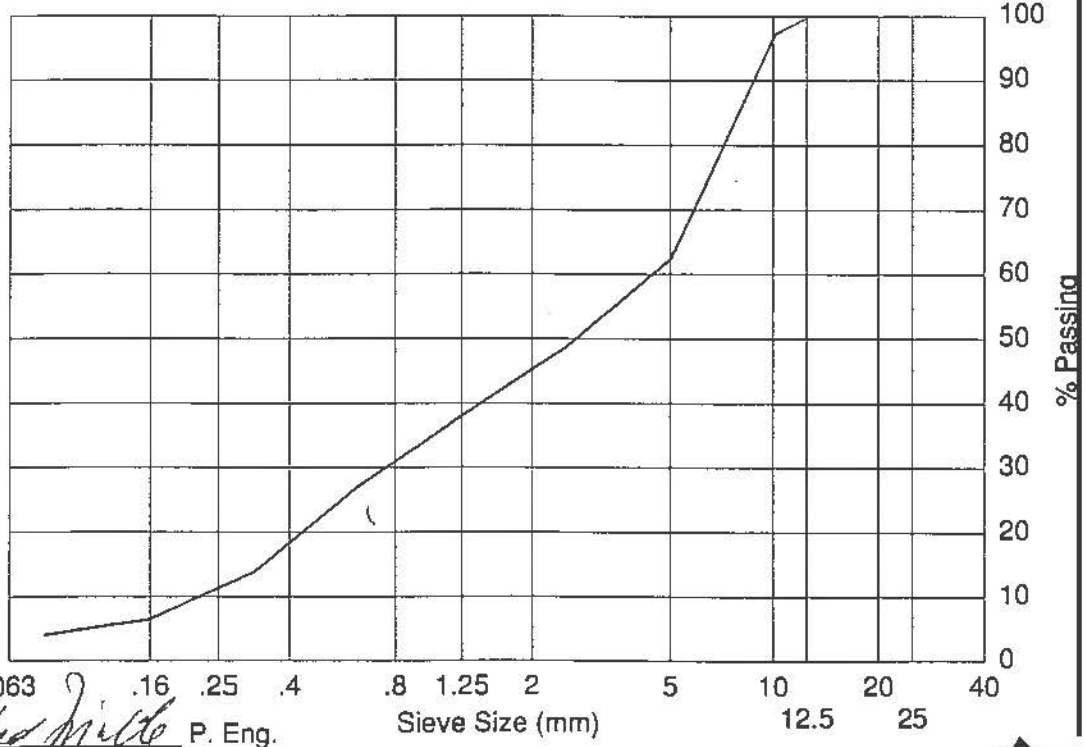
Time: Temp.: °C
Date Tested: 91-09-09
Tested By: ATE
Natural Moisture Content: 0. 0
Crushed Faces: ☐1 ☐ 2

Soil Description: SAND AND GRAVEL (12.5 mm MAX.), TR. SILT, BROWN

Cu:
Cc:
Remarks: LAB CRUSHED TO 12.5 mm

Sieve Size	% Passing
12.5	100.0
10.0	97.1
5.00	62.4
2.50	48.8
1.25	38.1
.630	27.3
.315	13.8
.160	6.5
.080	4.0

Grading Curve of Aggregate



Reviewed By: P. Eng.

McPHERSON GRANULAR RESOURCE STUDY	CLIENT: GOVERNMENT OF YUKON	BOREHOLE No. 10721-09
McPHERSON AREA "A"	BACKHOE: CAT 225 TRACKED BACKHOE	Project No: 0201-10721
WHITEHORSE, YUKON	UTM ZONE: 8 N6742260.00 E487480.00	ELEVATION 0.00 (m)

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | STANDARD PEN. | 75 mm SPOON | CRREL BARREL

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	USC	SOIL DESCRIPTION
0.0				ORGANIC ROOT MAT WITH MOSS AND TEA GROUNDCOVER
				SILT–some clay, rootlets, moist, medium brown
		1		SAND–trace of silt, well graded, damp, compact, greyish brown
1.0				
				GRAVEL–sandy, trace of silt, gravel is subrounded up to 75 mm, sand is medium to coarse, damp, compact, greyish–brown
		2		
2.0				
		3		SAND–trace to some silt, fine grained, light greyish–brown
				–medium to coarse sand
3.0				–fine silty sand below 3.0 m
		4		
4.0				
5.0				END OF TESTPIT 4.5 m

STANDARD PENETRATION 10 20 30 40

PLASTIC M.C. LIQUID 10 20 30 40

PERCENT GRAVEL 20 40 60 80

PERCENT SAND 20 40 60 80

PERCENT SILT OR FINES 20 40 60 80

PERCENT CLAY 20 40 60 80

DEPTH (ft): 0.0, 2.0, 4.0, 6.0, 8.0, 10.0, 12.0, 14.0, 16.0

EBA Engineering Consultants Ltd. Whitehorse, Yukon	COMPLETION DEPTH 4.5 m	COMPLETE 91/08/08
	LOGGED BY MCP	DWG NO.
		Page 1 of 1

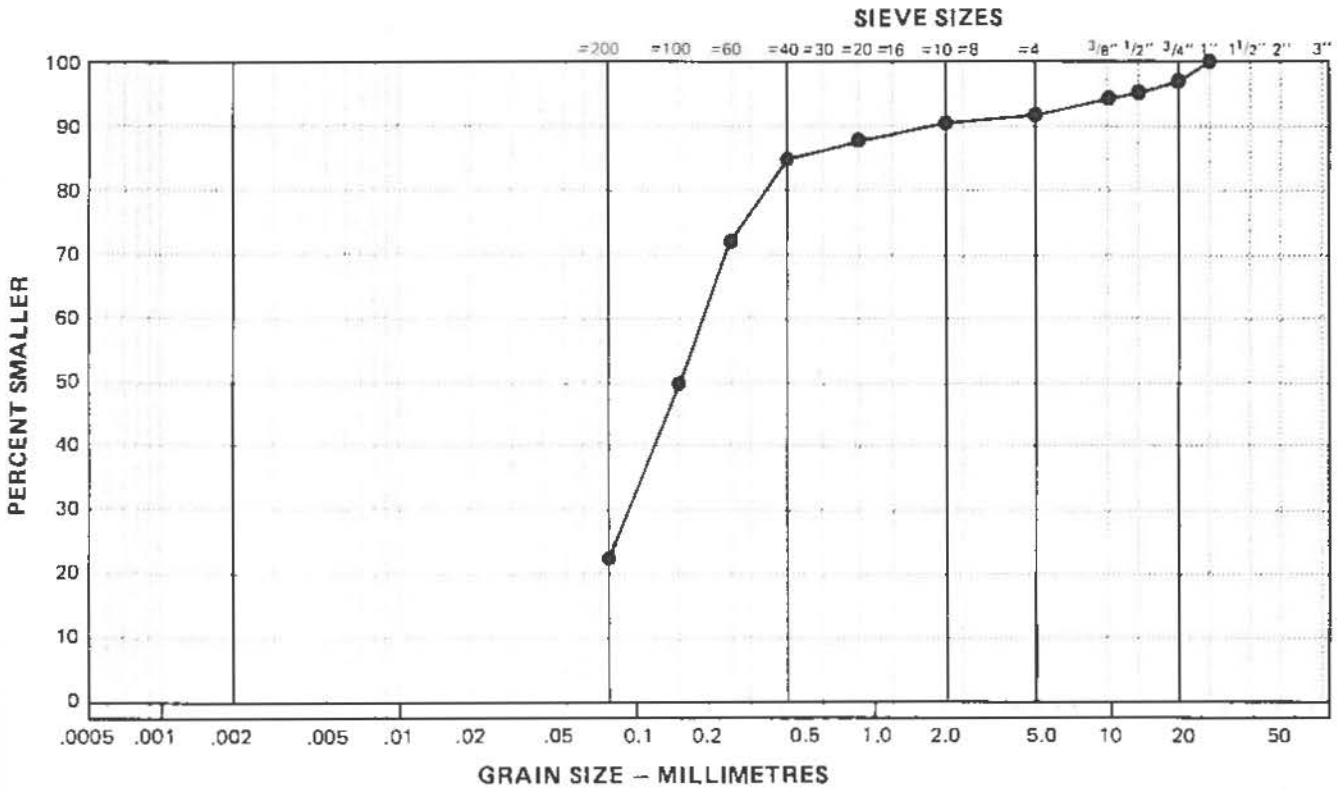
EBA Engineering Consultants Ltd.

PARTICLE - SIZE ANALYSIS OF SOILS

Project: MacPherson A Granular Study
Whitehorse, Yukon
Project Number: 0201-10721
Date Tested: 91-09-19
Borehole Number: 10721-09
Depth: 3.5 m
Soil Description: SAND (SM) - silty, trace of fine gravel
Cu:
Cc:
Natural Moisture Content: %
Remarks:

SIEVE	PERCENTAGE PASSING
3"	
1 1/2"	
1"	100.0
3/4"	97.7
1/2"	95.8
3/8"	94.5
No. 4	92.3
No. 10	90.5
No. 20	88.6
No. 40	84.7
No. 60	71.5
No. 100	50.0
No. 200	21.7

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



Tested in accordance with ASTM D422 unless otherwise noted.

McPHERSON GRANULAR RESOURCE STUDY	CLIENT: GOVERNMENT OF YUKON	BOREHOLE No. 10721-10
McPHERSON AREA "A"	BACKHOE: CAT 225 TRACKED BACKHOE	Project No: 0201-10721
WHITEHORSE, YUKON	UTM ZONE: 8 N6742420.00 E487340.00	ELEVATION 0.00 (m)

SAMPLE TYPE: GRAB SAMPLE; NO RECOVERY; STANDARD PEN.; 75 mm SPOON; CRREL BARREL

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	USC	SOIL DESCRIPTION	DEPTH (ft)
0.0				SILT–some clay, rootlets, moist, medium brown	0.0
		1		GRAVEL–sandy, trace of silt, rootlets to 1.0 m, gravel is medium, up to 75 mm in size, no oversize, moist, compact, medium brown –silt lens 0.7 to 0.9 m	2.0
1.0				SAND–trace to some silt, medium grained, damp, light grey	4.0
		2		–interbedded medium to fine grained sand	6.0
2.0					8.0
3.0					10.0
		3		SAND–some silt, fine grained, uniform, light grey, damp	12.0
4.0				END OF TESTPIT 4.0 m	14.0
					16.0
5.0					

STANDARD PENETRATION 10 20 30 40; PLASTIC M.C. LIQUID 10 20 30 40

PERCENT GRAVEL 20 40 60 80; PERCENT SAND 20 40 60 80; PERCENT SILT OR FINES 20 40 60 80; PERCENT CLAY 20 40 60 80

EBA Engineering Consultants Ltd. Whitehorse, Yukon	COMPLETION DEPTH 4.0 m	COMPLETE 91/08/08
	LOGGED BY MCP	DWG NO.
		Page 1 of 1

McPHERSON GRANULAR RESOURCE STUDY	CLIENT: GOVERNMENT OF YUKON	BOREHOLE No. 10721-11
McPHERSON AREA "A"	BACKHOE: CAT 225 TRACKED BACKHOE	Project No: 0201-10721
WHITEHORSE, YUKON	UTM ZONE: 8 N6742700.00 E487600.00	ELEVATION 0.00 (m)

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | STANDARD PEN. | 75 mm SPOON | CRREL BARREL

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	USC	SOIL DESCRIPTION
0.0				ORGANIC ROOT MAT WITH TEA AND GRASS GROUND COVER
				SILT-some fine sand, very uniform, damp, firm, medium brown
		1		
1.0				-horizontal parallel laminae, greyish olive below 0.5 m
		2		
2.0				
3.0				END OF TESTPIT 3.0 m
4.0				
5.0				

STANDARD PENETRATION 10 20 30 40

PLASTIC M.C. LIQUID 10 20 30 40

PERCENT GRAVEL 20 40 60 80

PERCENT SAND 20 40 60 80

PERCENT SILT OR FINES 20 40 60 80

PERCENT CLAY 20 40 60 80

DEPTH (ft): 0.0, 2.0, 4.0, 6.0, 8.0, 10.0, 12.0, 14.0, 16.0

EBA Engineering Consultants Ltd. Whitehorse, Yukon	COMPLETION DEPTH 3.0 m	COMPLETE 91/08/08
	LOGGED BY MCP / DWG NO.	Page 1 of 1

McPHERSON GRANULAR RESOURCE STUDY	CLIENT: GOVERNMENT OF YUKON	BOREHOLE No. 10721-12
McPHERSON AREA "A"	BACKHOE: CAT 225 TRACKED BACKHOE	Project No: 0201-10721
WHITEHORSE, YUKON	UTM ZONE: 8 N6742800.00 E488050.00	ELEVATION 0.00 (m)

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | STANDARD PEN. | 75 mm SPOON | CRREL BARREL

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	USC	SOIL DESCRIPTION
0.0				ORGANIC ROOT MAT WITH TEA GROUND COVER
				SILT–some clay, rootlets throughout, moist, brown
		1		GRAVEL–some sand, some silt, up to 75 mm maximum size, rootlets to 0.8 m
1.0				SILT–some clay, trace of fine sand, damp to moist, stiff, light olive grey –even parallel laminae to depth of testpit
2.0		2		
3.0				
				END OF TESTPIT 3.5 m
4.0				
5.0				

STANDARD PENETRATION 10 20 30 40

PLASTIC M.C. LIQUID 10 20 30 40

PERCENT GRAVEL 20 40 60 80

PERCENT SAND 20 40 60 80

PERCENT SILT OR FINES 20 40 60 80

PERCENT CLAY 20 40 60 80

DEPTH (ft): 0.0, 2.0, 4.0, 6.0, 8.0, 10.0, 12.0, 14.0, 16.0

EBA Engineering Consultants Ltd.
Whitehorse, Yukon

COMPLETION DEPTH 3.5 m		COMPLETE 91/08/08
LOGGED BY MCP	DWG NO.	Page 1 of 1

McPHERSON GRANULAR RESOURCE STUDY	CLIENT: GOVERNMENT OF YUKON	BOREHOLE No. 10721-39
McPHERSON AREA "A"	BACKHOE: CAT 225 TRACKED BACKHOE	Project No: 0201-10721
WHITEHORSE, YUKON	UTM ZONE: 8 N6742030.00 E488180.00	ELEVATION 0.00 (m)

SAMPLE TYPE ■ GRAB SAMPLE ⊘ NO RECOVERY ⊠ STANDARD PEN. ▤ 75 mm SPOON ▯▯ CRREL BARREL

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	USC	SOIL DESCRIPTION	STANDARD PENETRATION 10 20 30 40 / PLASTIC M.C. LIQUID 10 20 30 40	PERCENT GRAVEL 20 40 60 80 / PERCENT SAND 20 40 60 80 / PERCENT SILT OR FINES 20 40 60 80 / PERCENT CLAY 20 40 60 80	DEPTH (ft)
0.0				ORGANIC ROOT MAT WITH GRASS GROUND COVER			0.0
				GRAVEL–sandy, trace of silt, siltier near surface, damp, loose, medium brown			
1.0							2.0
							4.0
2.0				END OF TESTPIT 1.5 m			6.0
							8.0
3.0							10.0
							12.0
4.0							14.0
							16.0
5.0							

EBA Engineering Consultants Ltd. Whitehorse, Yukon	COMPLETION DEPTH 1.5 m	COMPLETE 91/08/08
	LOGGED BY MCP / DWG NO.	Page 1 of 1

McPHERSON GRANULAR RESOURCE STUDY	CLIENT: GOVERNMENT OF YUKON	BOREHOLE No. 10721-40
McPHERSON AREA "A"	BACKHOE: CAT 225 TRACKED BACKHOE	Project No: 0201-10721
WHITEHORSE, YUKON	UTM ZONE: 8 N6742580.00 E487290.00	ELEVATION 0.00 (m)

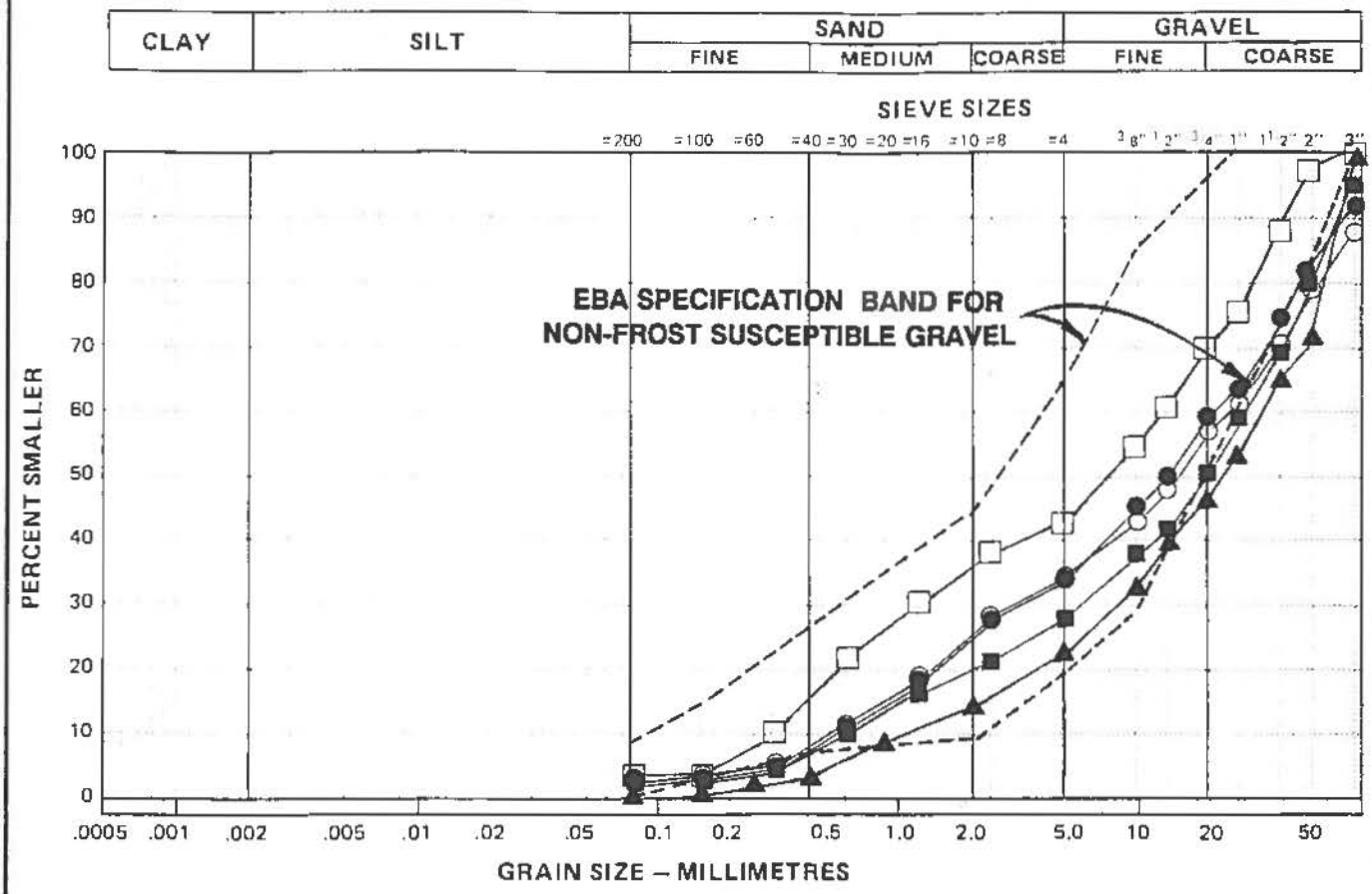
SAMPLE TYPE ■ GRAB SAMPLE ▨ NO RECOVERY ⊠ STANDARD PEN. ▤ 75 mm SPOON ▯ CRREL BARREL

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	USC	SOIL DESCRIPTION	STANDARD PENETRATION 10 20 30 40 / PLASTIC M.C. LIQUID 10 20 30 40	PERCENT GRAVEL 20 40 60 80 / PERCENT SAND 20 40 60 80 / PERCENT SILT OR FINES 20 40 60 80 / PERCENT CLAY 20 40 60 80	DEPTH (ft)
0.0				ORGANIC ROOT MAT, some rootlets, moist, brown			0.0
				SILT-some fine sand, moist, medium olive brown			
							2.0
1.0				-becomes SILT-some clay, even, parallel laminae, moist, firm to stiff, dark olive			4.0
							6.0
2.0							
							8.0
				END OF TESTPIT 2.5 m			
3.0							10.0
							12.0
4.0							
							14.0
							16.0
5.0							

EBA Engineering Consultants Ltd. Whitehorse, Yukon	COMPLETION DEPTH 2.5 m	COMPLETE 91/08/08
	LOGGED BY MCP / DWG NO.	Page 1 of 1

APPENDIX B

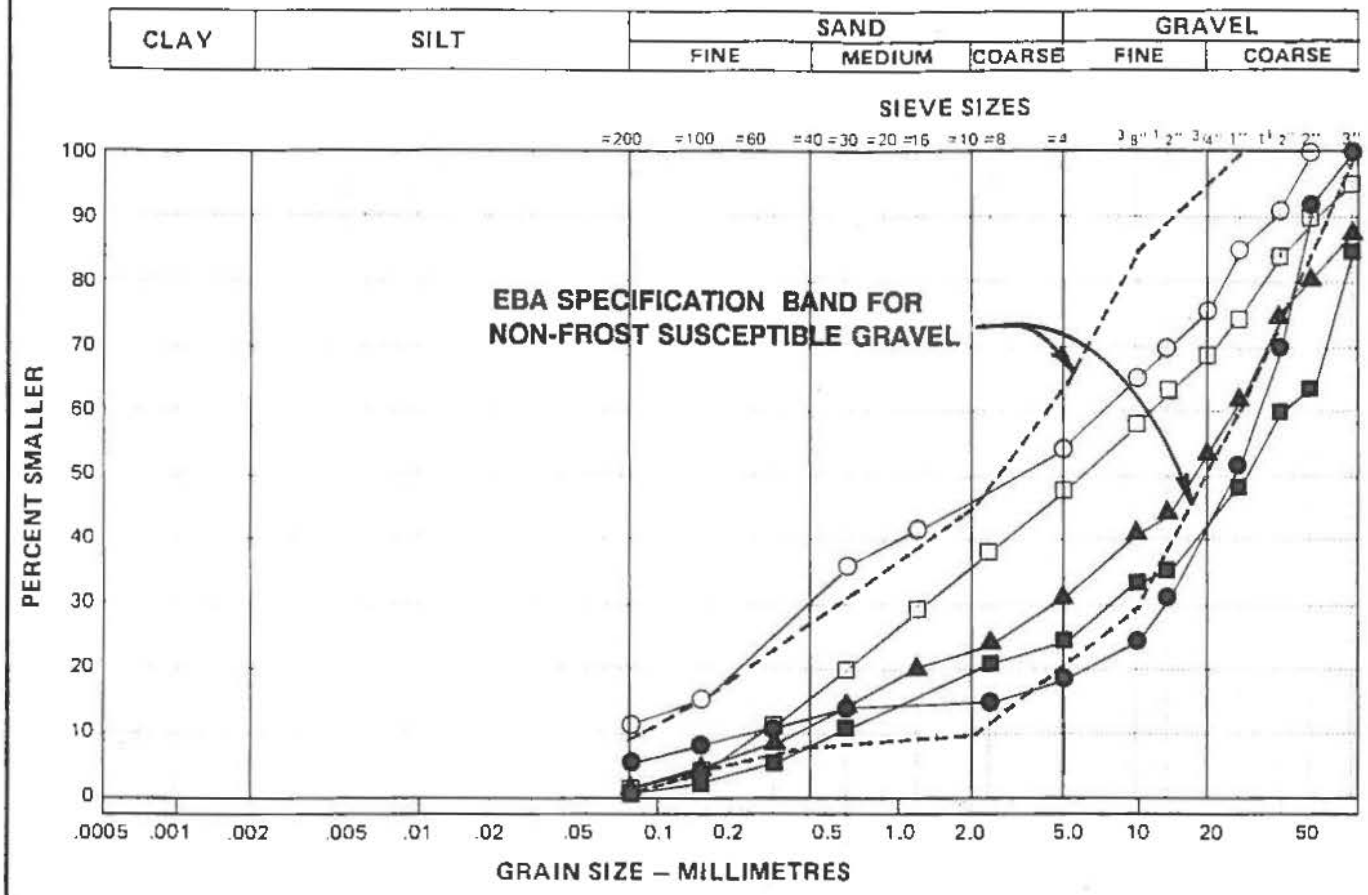
SUMMARY OF GRAIN SIZE ANALYSES MacPHERSON AREA "A"



SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
●	10721-01	0.5 - 4.5	3		32	65	40	0.4	GP
○	10721-04	1.5 - 4.5	2		33	65	52	0.2	GP
■	10721-05	0.5 - 4.5	2		26	72	50	0.7	GP
□	10721-08	0.5 - 4.5	3		41	56	50	0.1	GP
▲	10721-06	1.5 - 4.5	2		23	75	37	2.0	GW

SUMMARY OF GRAIN SIZE DISTRIBUTION DATA FROM 1991 EBA INVESTIGATION

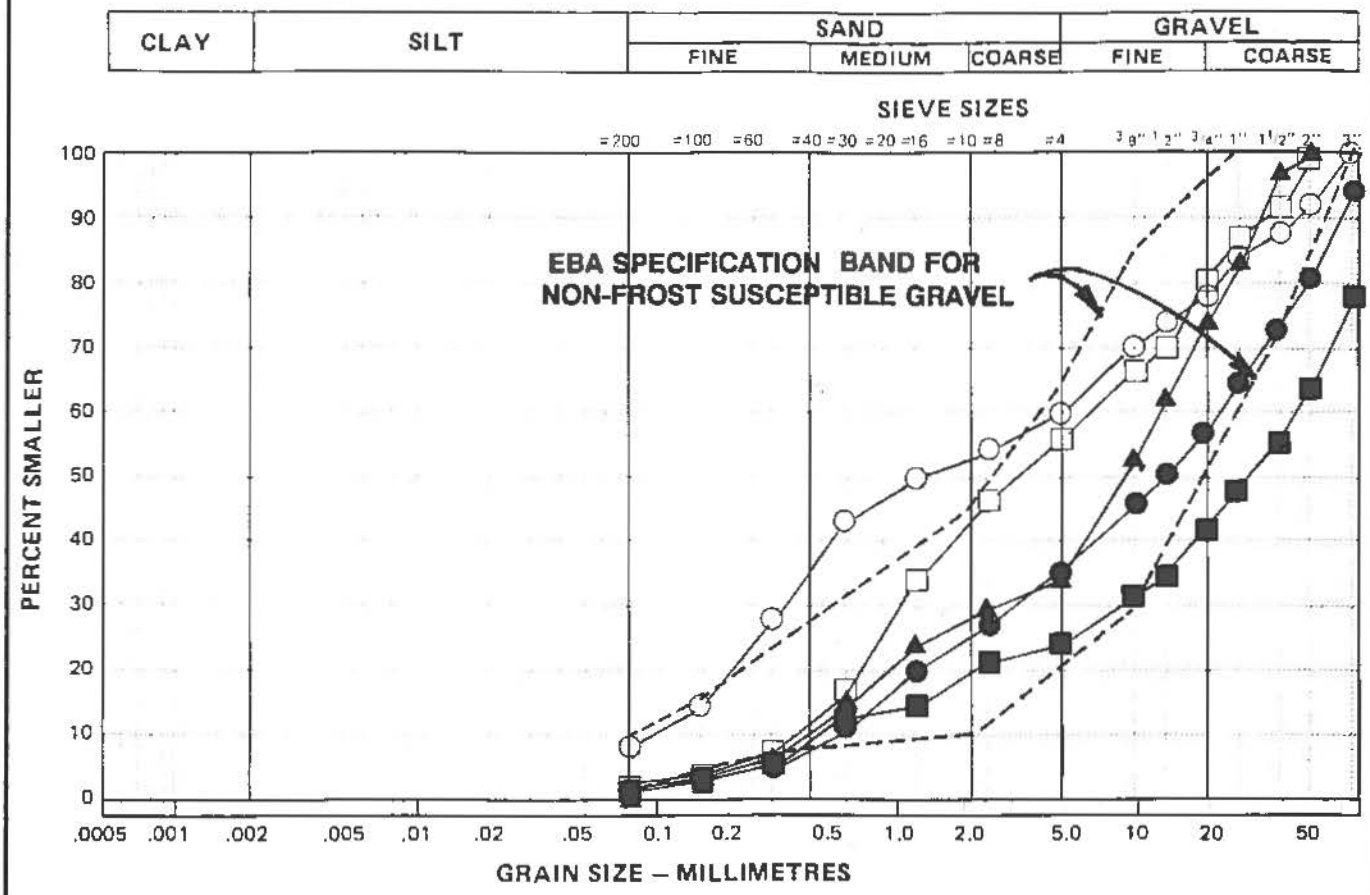
SUMMARY OF GRAIN SIZE ANALYSES MacPHERSON AREA "A"



SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
●	78-1	2.5	5		13	82	150	20	GP
○	78-2	1.0	11		44	45	12.5	0.5	GM/GP
■	78-2	3.0	2		22	76	80	2.5	GW
□	78-3	4.0	2		46	52	4	0.5	GP
▲	78-4	1.0 - 1.5	3		28	69	63	2.0	GW

SUMMARY OF GRAIN SIZE DISTRIBUTION DATA PRESENTED IN 1978 R.M. HARDY REPORT

SUMMARY OF GRAIN SIZE ANALYSES MacPHERSON AREA "A"



SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
●	78-5	1.5	2		33	65	42	0.6	GP
○	78-5	6.0	8		52	40	50	0.1	SM/SP
■	78-6	0.5	2		23	75	100	0.8	GP
□	78-6	2.0	2		55	43	15	0.4	GP
▲	78-9	1.0	1		34	65	26	0.4	GP

SUMMARY OF GRAIN SIZE DISTRIBUTION DATA PRESENTED IN 1978 R.M. HARDY REPORT

EBA Engineering Consultants Ltd.

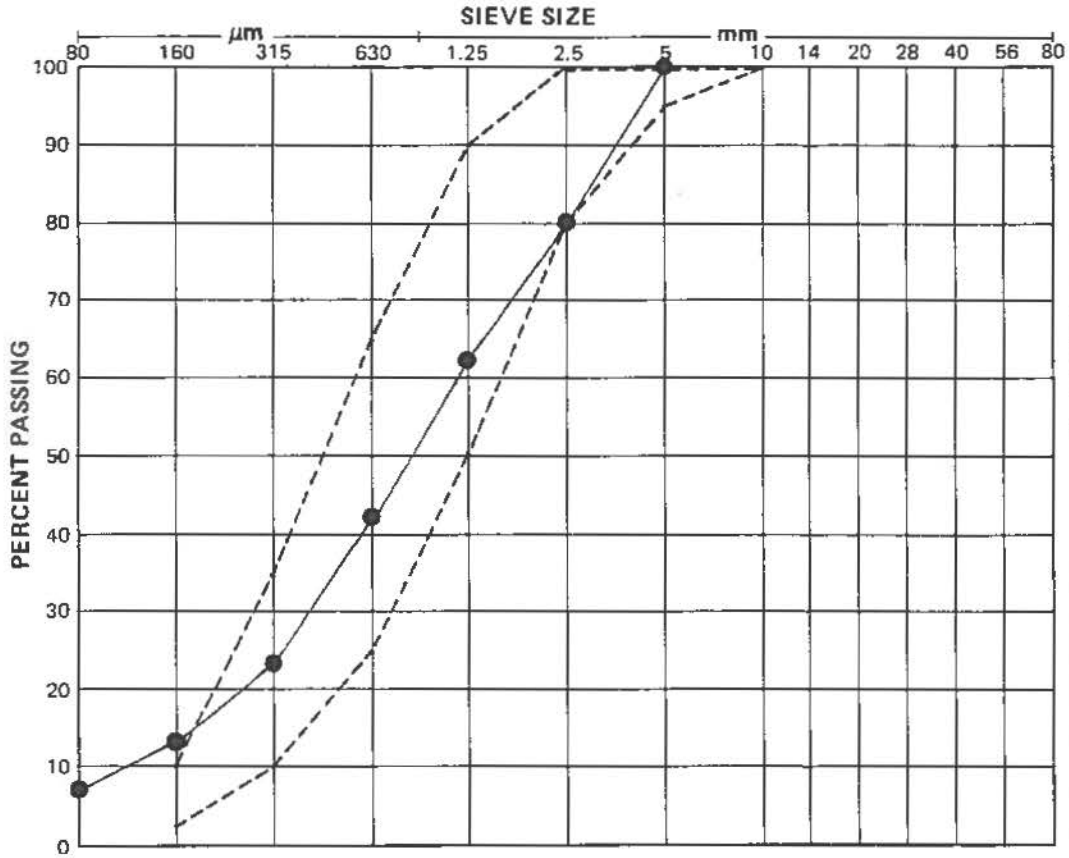
Standard A 283 Concrete Testing Laboratory Type II with all Options

AGGREGATE ANALYSIS REPORT
(CONCRETE AGGREGATE)

Project: McPherson Granular Study
Address: Area "A"
Project Number: 0201-10721
Date Tested: _____ **By:** _____
Client: Government of Yukon
Attention: Mr. Ross Burnett

Sample Number: Concrete Sand
Sample Description: Sand Portion of Grain Size Tests
Natural Moisture Content: _____ %
Organic Content: _____ % (State of Alaska Method)
Plate Number: _____ (Organic Impurities in Sands for Concrete)
Bulk Relative Density: _____
Bulk Relative Density (SSD): _____
Apparent Relative Density: _____
Absorption: _____ %

Sieve	% Passing
80 mm	
56 mm	
40 mm	
28 mm	
20 mm	
14 mm	
10 mm	
5 mm	100.0
2.5 mm	80.0
1.25 mm	62.0
630 µm	42.0
315 µm	24.0
160 µm	13.0
80 µm	8.0
F.M.	2.8



Remarks: Distribution curve is the average of 17 tests performed during the 1978 Hardy study and the 1991 EBA study.

NOTE: A testing service only has been provided in reporting these test data. Engineering interpretation or evaluation of such test data will be provided upon request.

Reviewed By: _____ **P. Eng.**

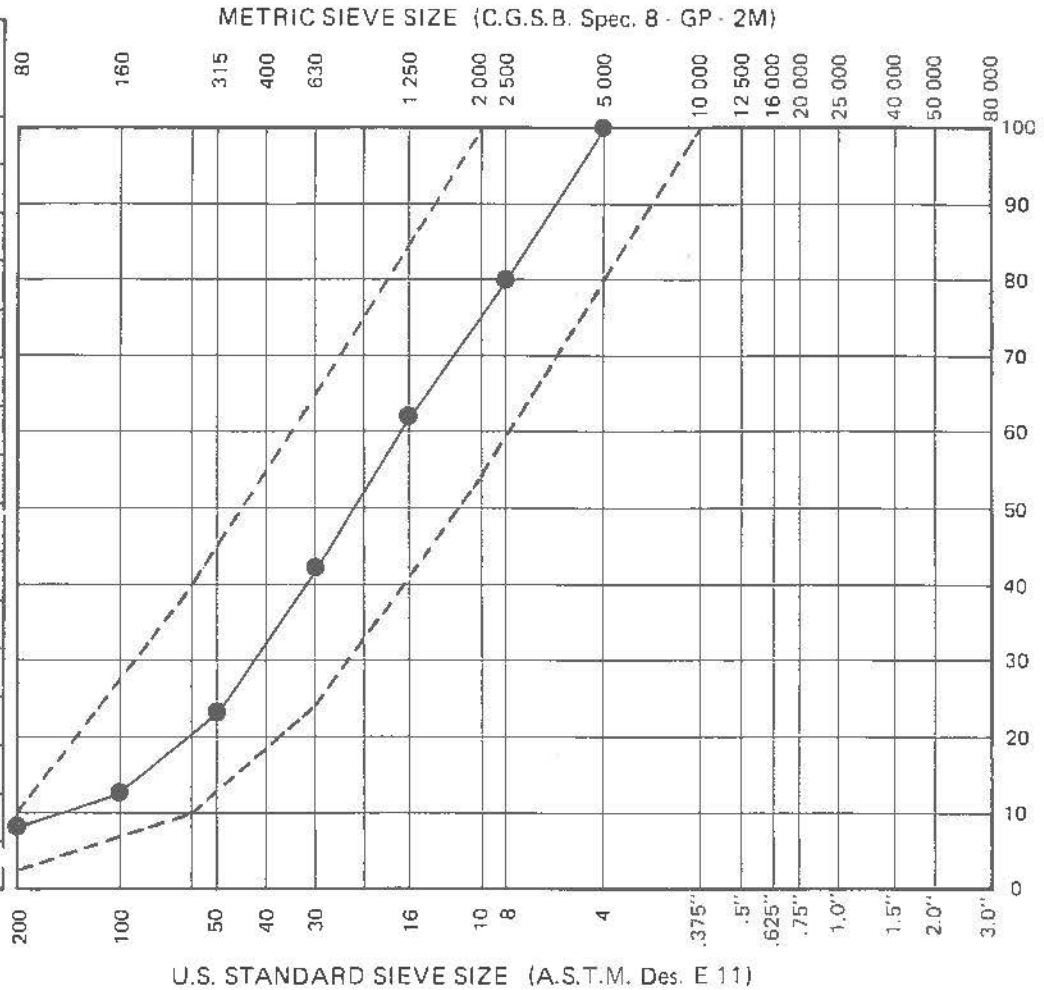
EBA Engineering Consultants Ltd.

AGGREGATE ANALYSIS REPORT

Project: McPherson Granular Study
Address: Area "A"
Project Number: 0201-10721
Date Tested:
Client: Government of Yukon
Attention: Mr. Ross Burnett

Sample Number: Bedding Sand
Sample Description: Sand Portion of Grain Size Tests
Natural Moisture Content: %
Organic Content: % State of Alaska Method ☐ Other
Colour Plate No.: Organic Impurities
Bulk Relative Density:
Bulk Relative Density (SSD):
Apparent Relative Density:
Absorption: %

SIEVE SIZES		% PASSING
U.S.	METRIC	
3"	80 000	
2"	50 000	
1.5"	40 000	
1"	25 000	
.75"	20 000	
.625"	16 000	
.5"	12 500	
.375"	10 000	
No. 4	5 000	100.0
No. 8	2 500	80.0
16	1 250	62.0
30	630	42.0
40	400	
50	315	24.0
100	160	13.0
200	80	8.0



Remarks: Distribution curve is the average of 17 tests performed during the 1978 Hardy and 1991 EBA studies.

Reviewed By: P.Eng.

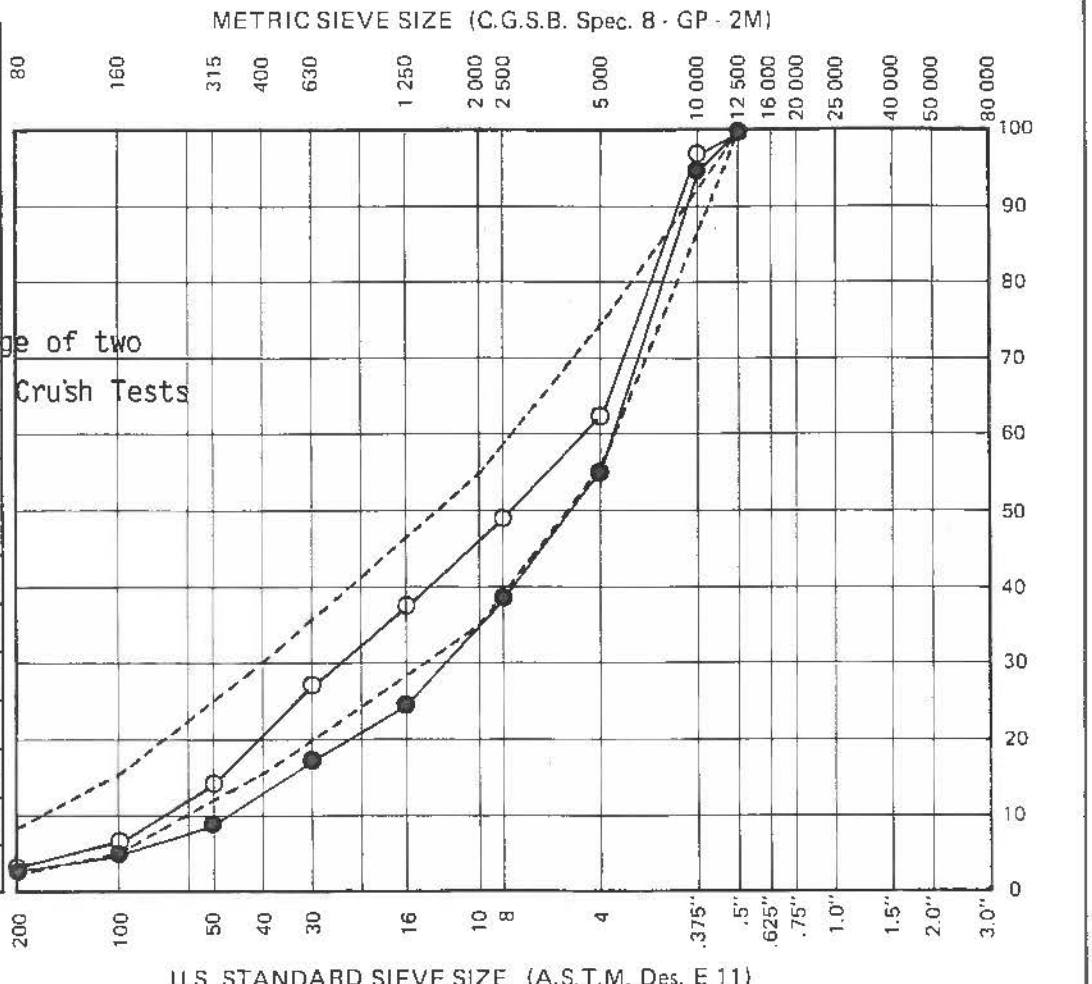
EBA Engineering Consultants Ltd.

AGGREGATE ANALYSIS REPORT

Project: McPherson Granular Study
Address: Area "A"
Project Number: 0201-10721
Date Tested:
Client: Government of Yukon
Attention: Mr. Ross Burnett

Sample Number: Proposed Asphalt Aggregate
Sample Description: Trial Crush
12.5 mm Crushed Gravel
Natural Moisture Content: %
Organic Content: %
State of Alaska Method ☐
Other
Colour Plate No.: Organic Impurities
Bulk Relative Density:
Bulk Relative Density (SSD):
Apparent Relative Density:
Absorption: %

SIEVE SIZES		% PASSING
U.S.	METRIC	
3"	80 000	
2"	50 000	
1.5"	40 000	
1"	25 000	
.75"	20 000	Average of two
.625"	16 000	Trial Crush Tests
.5"	12 500	100.0
.375"	10 000	96.0
No. 4	5 000	59.0
No. 8	2 500	44.0
16	1 250	32.0
30	630	22.0
40	400	
50	315	12.0
100	160	6.0
200	80	4.0



Remarks: ● 10721-05 0.5 m - 4.5 m - Trial crush on combined samples
○ 10721-08 0.5 m - 4.5 m - Trial crush on combined samples

Reviewed By: P.Eng.

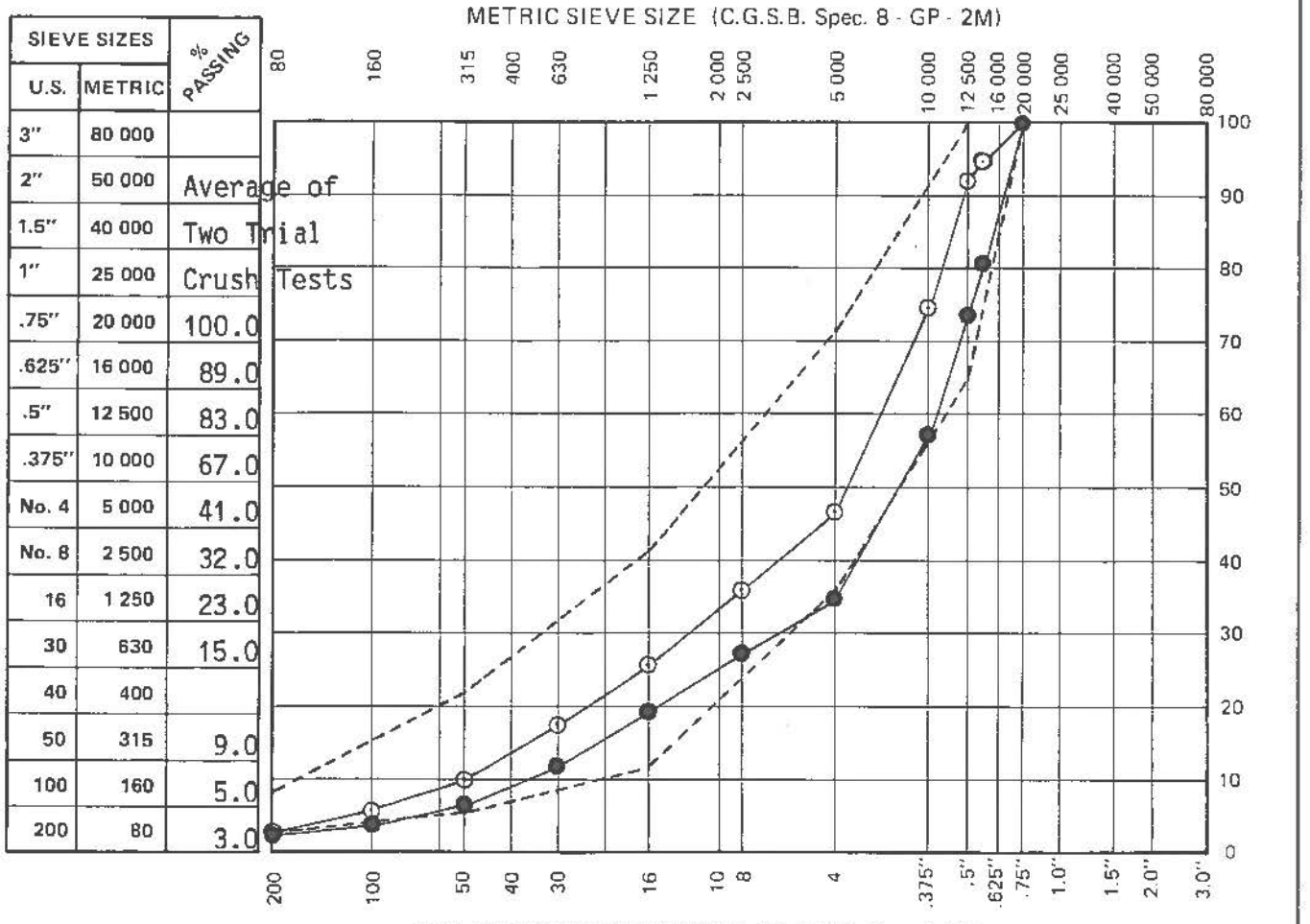
EBA Engineering Consultants Ltd.

AGGREGATE ANALYSIS REPORT

Project: McPherson Ganular Study
Address: Area "A"
Project Number: 0201-10721
Date Tested:
Client: Government of Yukon
Attention: Mr. Ross Burnett

Sample Number: Proposed Basecourse Aggregate
Sample Description: Trial Crush - 20 mm Crushed Gravel
Natural Moisture Content: ____ %
Organic Content: ____ % State of Alaska Method ☐ Other ____
Colour Plate No.: ____ Organic Impurities
Bulk Relative Density:
Bulk Relative Density (SSD):
Apparent Relative Density:
Absorption: ____ %

SIEVE SIZES		% PASSING
U.S.	METRIC	
3"	80 000	
2"	50 000	Average of
1.5"	40 000	Two Trial
1"	25 000	Crush Tests
.75"	20 000	100.0
.625"	16 000	89.0
.5"	12 500	83.0
.375"	10 000	67.0
No. 4	5 000	41.0
No. 8	2 500	32.0
16	1 250	23.0
30	630	15.0
40	400	
50	315	9.0
100	160	5.0
200	80	3.0



Remarks:
● 10721-01 0.5 m - 4.5 m - Trial crush on combined samples
○ 10721-04 1.5 m - 4.5 m - Trial crush on combined samples

Reviewed By: _____ P.Eng.

MacPherson GRANULAR STUDY

AREAS "A" AND "B"

SUMMARY OF AGGREGATE SUITABILITY TESTS

Sodium Soundness CSA A23.2-9A

	EBA 1991 (Avg. of 2 tests)	R.M. Hardy 1978 (Avg. of 3 tests)
Coarse Aggregate	1.6% Loss	0.8% Loss
Fine Aggregate	4.2% Loss	3.3% Loss

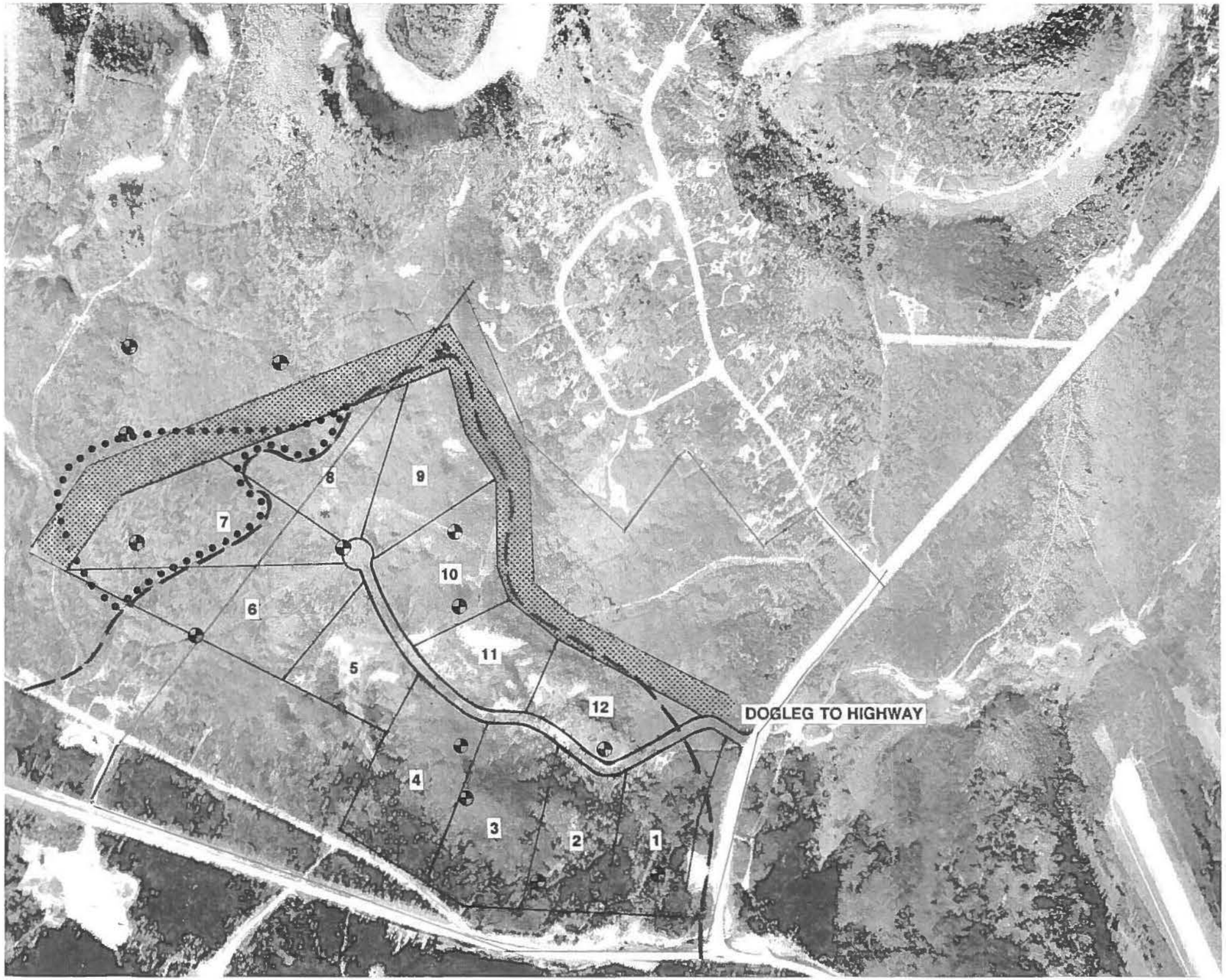
Less than 8% is acceptable

Los Angeles Abrasion ASTM C131

	EBA 1991 (One test)	R.M. Hardy 1978 (Avg. of 3 tests)
Grading "B"	17.3% Loss	14.6% Loss

Less than 40% is acceptable

APPENDIX C



MacPHERSON AREA "A"

'91 TESTPIT LOCATIONS

APPROXIMATE LIMITS OF SAND DEPOSIT

APPROXIMATE LIMITS OF GRANULAR DEPOSIT

BUFFER ZONE (distance may be adjusted)

LEASE SIZES

1) 7.2 ha	5) 6.3 ha	9) 5.6 ha
2) 7.5 ha	6) 6.7 ha	10) 7.5 ha
3) 9.7 ha	7) 9.0 ha	11) 5.3 ha
4) 8.3 ha	8) 6.4 ha	12) 6.0 ha

0 500 1000

SCALE (m)

EBA Engineering Consultants Ltd.

PROJECT: MacPHERSON GRANULAR SOURCE STUDY

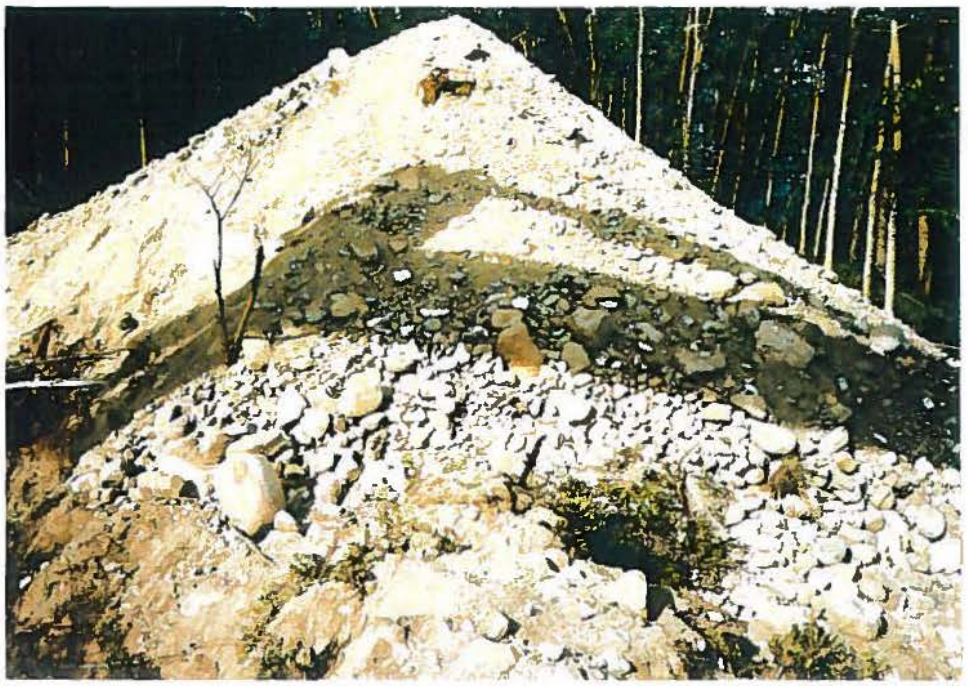
CLIENT: GOVERNMENT OF YUKON

TITLE: POSSIBLE DESIGN CONCEPT WITH RECOMMENDED ACCESS ROUTE

DATE	DWN.	CHKD.	FILE NO.	
91-12-14	MCP		0201-10721	10721-C-03

MacPHERSON AREA "A" PHOTOS

10721-01

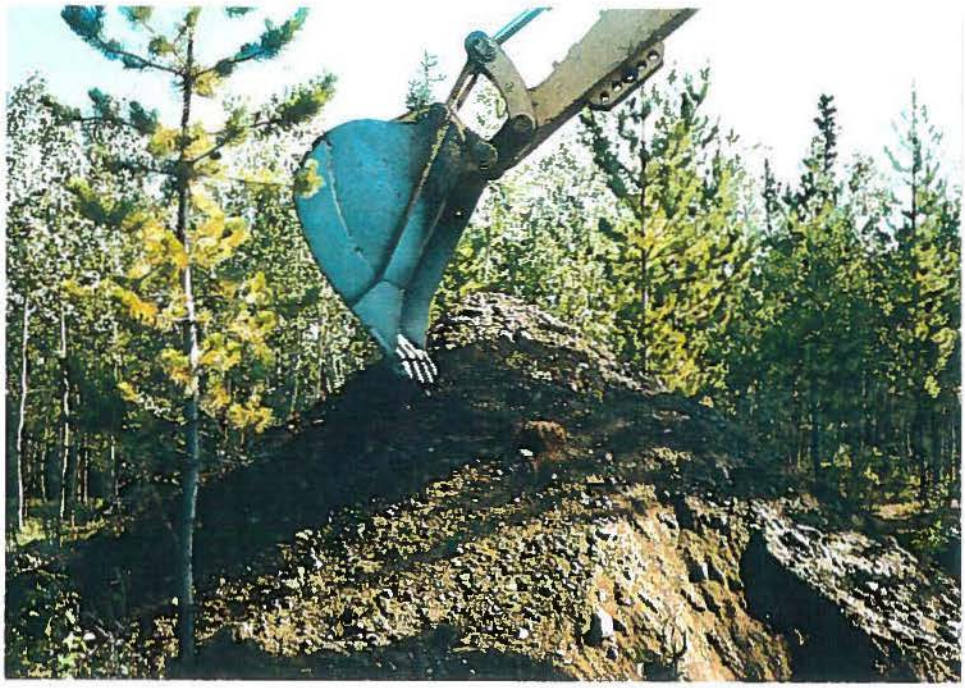


10721-03

10721-04

10721-05

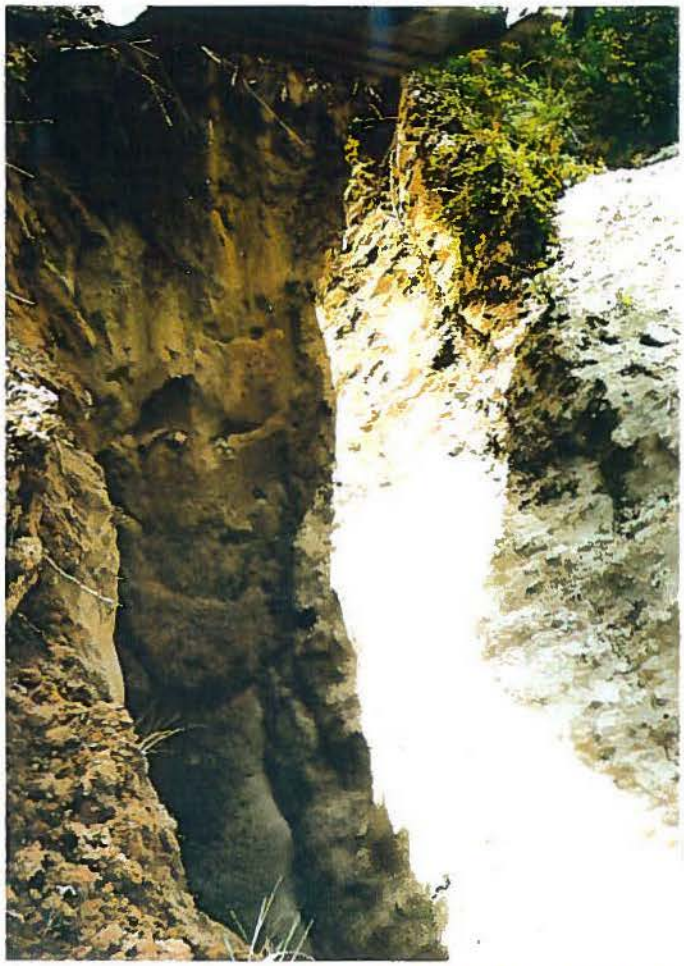
10721-06



10721-07

10721-08 (GRAVEL MUCH COARSER THAN PHOTO INDICATES)

10721-09



10721-10 (SAND)

10721-11
(SILT)

ER-01
007