

EBA Engineering Consultants Ltd.

Civil, Geotechnical and Materials Engineers

Geotechnical



**GEOTECHNICAL REPORT
MacPHERSON AREA "B" GRANULAR RESOURCES
WHITEHORSE, YUKON**

0201-10721

December, 1991





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WHITEHORSE, YUKON

submitted to:

GOVERNMENT OF YUKON
DEPARTMENT OF COMMUNITY & TRANSPORTATION
LANDS BRANCH

prepared by:

EBA ENGINEERING CONSULTANTS LTD.
WHITEHORSE, YUKON

0201-10721

December, 1991

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0201-10721

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1.0 SUMMARY

Based primarily on the findings of this geotechnical evaluation, with additional data from previous reports being used to augment current findings, the development of MacPherson Area "B" as a granular source appears feasible. Approximately 45 hectares has been delineated for granular source development. Estimated volumes of 3,500,000 m³ of coarse gravel and 3,500,000 m³ of sand exist within the proposed development boundaries and should supply Whitehorse for at least 35 years.

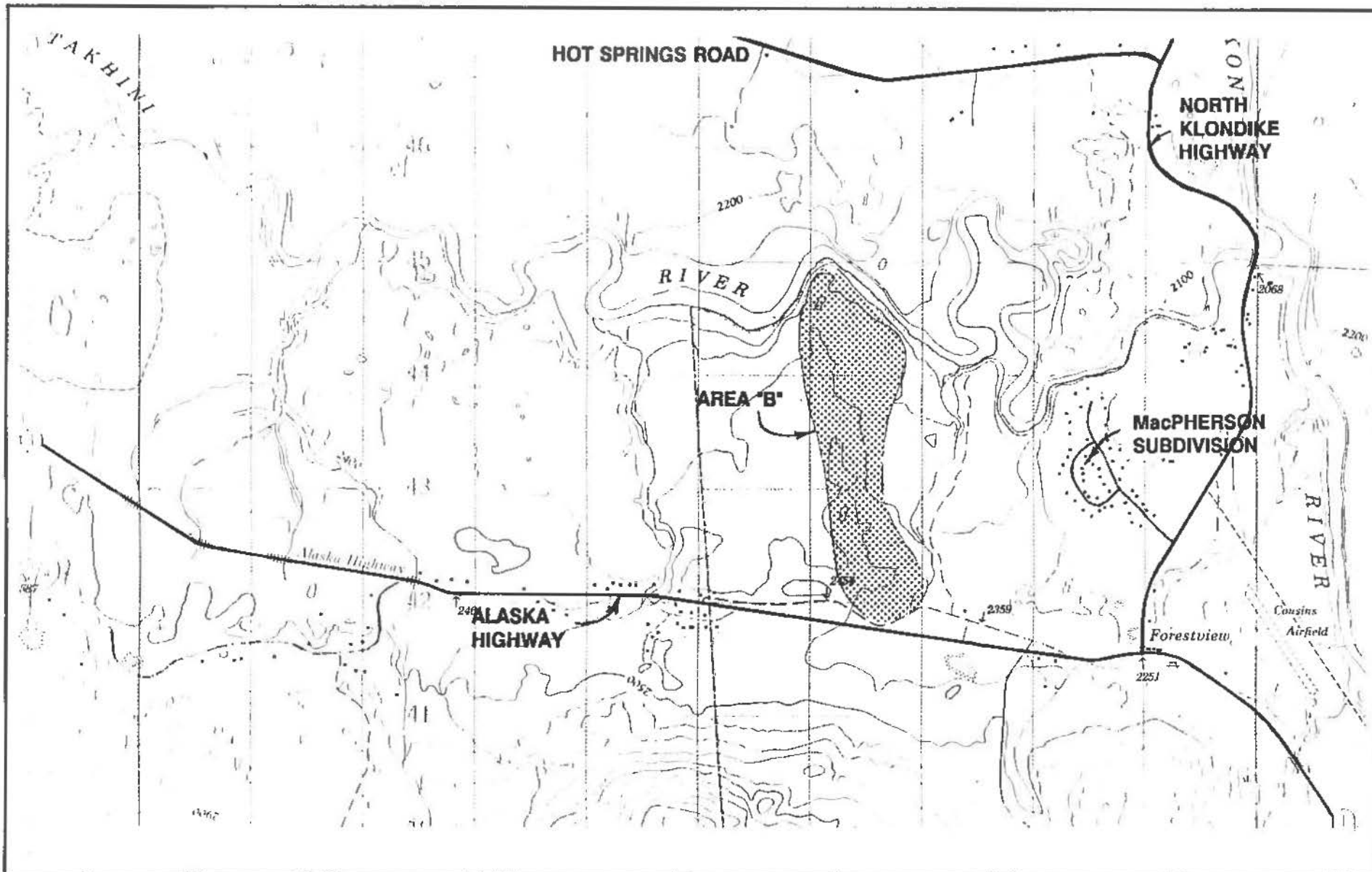
Utilizing standard construction and processing methods, Area "B" can supply pit run; crushed basecourse and sub-base aggregates; asphalt aggregate; concrete aggregate; concrete sand; bedding sand and drain rock.

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 "B", Whitehorse, Yukon. The site investigated is shown on Figure 1, and extends north from the Alaska Highway to the Takhini River approximately 2.5 km west of the Alaska Highway, North Klondike Highway intersection. The purpose of this study was to delineate and test the area for future granular resource potential.

The area was formerly designated as the western half of source 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 during the 1978 study completed 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 1991-07-17.



| | | | | | | | | |
|---|----------|-----|---------|--|--------------------|---------|-----------------|-------------------|
| EBA Engineering Consultants Ltd. | | | PROJECT | MacPHERSON GRANULAR RESOURCE STUDY | | | | |
| CLIENT | | | TITLE | GENERAL LOCATION MAP OF MacPHERSON AREA "B" | | | | |
| DATE | 91-11-10 | DWN | MCP | CHKD | <i>[Signature]</i> | DWG NO. | FIGURE 1 | 0201-10721 |

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

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 "B" 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. The geophysical survey results obtained by R.M. Hardy and Associates during the 1978 site study were then reviewed and found to be inconclusive for determining the continuity of gravel deposits throughout the subject site.

A subsequent drilling program to verify the geophysical results was also proposed. However, the rugged terrain encountered would have made access by a drill rig difficult and probably impossible. The drilling program was therefore cancelled.

4.2 Field Exploration

Access information obtained from airphoto interpretation was confirmed during a brief site reconnaissance and indicated that the subject site could be accessed along the trail utilized by Klohn Leonoff in 1988 but travel between testpits along the deposit would require trampling of small trees (<100 mm butt diameter) by the excavation equipment contracted for the project.

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 26 testpits were excavated throughout the boundaries of 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 location, source boundaries, and other pertinent information (Drawing 10721-A-02).

4.3 Geophysical Surveys

The EM31 and EM34 geophysical survey program completed by R.M. Hardy and Associates in 1978 didn't extend to the north end of the subject site and results were inconclusive when compared with testpit data. The survey didn't accurately delineate the areas containing gravel from those containing sand.

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 Contour Map Utilization

Presented in the 1991 Klohn Leonoff study which includes Area "B", is a contour map which provides an accurate presentation of the slopes and elevation differences found throughout the subject site. This map was very useful for calculating volumes of granular material found along the ridge comprising the Area "B" deposit.

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 "B" is located within the Whitehorse city limits west of Area "A". It is 2.5 km west of the intersection of the Alaska Highway and the North Klondike Highway. Generally speaking, the deposit is a ridge extending from the Alaska Highway to the Takhini River and west of the steep-sided gully system which separates Area "A" from Area "B".

6.1.2 Morphology and Topography

The subject site is a complex ice-contact glaciofluvial deposit. The surface topography varies from gently rolling to rugged. Variations in elevation as great as 35 m exists throughout the site with numerous sideslopes as steep as 30° along south and east exposures of areas containing gravel.

6.1.3 Vegetation

Site vegetation generally consists of dense immature pine regrowth resulting from recent forest fire damage. Some areas of dense poplars and willows can be found along the east edge of the proposed site boundaries. In areas containing gravel, the south and east slopes are generally grass covered with sparse poplars.

6.1.4 Drainage

No drainage courses were noted during the field investigation. The area appears to be well drained with no evidence of ponding. If ponding were to occur, it would be in localized low lying areas during spring runoff when seasonal frost is responsible for trapping snow melt.

6.1.5 Access

The area was accessed along the trail utilized during the recent Klohn Leonoff investigation. However, to properly delineate the subject site, a route had to be established running back and forth across the ice-contact glaciofluvial deposit. The investigation commenced at the north end of the deposit and proceeded south. Travel proceeded so that no backtracking along trails was necessary therefore minimizing disturbance. Efforts were made to ensure that all disturbed vegetation was lying flat and land use guidelines were adhered to.

6.2 Subsurface Soil Conditions

The subsurface characteristics of the site are very complex, resulting in varying soil conditions throughout the length of the deposit. In general, a profile crossing the area from west to east would show medium to fine grained sands along the west side of the site; sand and gravel in the central portion; and fine sand becoming silt along the east edge. An area with shallow bedrock exists in the southwest corner. No groundwater, permafrost or seasonal frost was noted during current or previous investigations. Detailed subsurface information is presented on the testpit logs in Appendix A of this report. Photographs of spoil piles of representative testpits are presented in Appendix C.

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 analysis. Los Angeles Abrasion testing and Sodium Soundness testing has also been completed on representative samples from Area "B". A cursory comparison between the test results for Area "B" aggregates and all

previous and current test results for Area "A" was also completed to obtain a relative overview of the aggregates from both sites. In general, the gravel from Area "B" was finer and Los Angeles Abrasion and Sodium Soundness test results lower than the Area "A" results but were still well within acceptable limits for use in aggregate processing. In Appendix B, Area "B" Los Angeles Abrasion and Sodium Soundness test results are presented following the report forms summarizing the grain size distribution curves for various aggregate products utilized in the Whitehorse area. Other test results indicate that non-frost susceptible gravel exists as pit run, basecourse gravel and asphalt aggregate can be produced by conventional crushing and screening operations and numerous gradations of sand are available throughout Area "B" for blending etc.

The various products that can be processed from material found in Area "B" are listed in Table 1 - PRELIMINARY ASSESSMENT OF PROCESSING REQUIREMENTS. Standard crushing, screening, blending, and washing processing methods are all that is anticipated to produce the products listed. A preliminary assessment of processing requirement for each of the products is also included.

7.2 Aggregate Quantities

Approximately 45 hectares of developable area has been delineated on Drawing 10721-C-01 in Appendix C. Within each of the seven leases presented on the possible design concept, approximately equal amounts of gravel and sand are anticipated. Based on existing contour information, approximately 20 m of gravel exists along each slope delineated as having gravel. Preliminary volume estimates indicate that each lease should have 500,000 m³ of gravel and approximately equal volumes (500,000 m³) of sand available for use or production. Estimated totals for the seven leases presented in the concept plan in Appendix C indicate that 3,500,000 m³ of gravel and equal amounts of sand (3,500,000 m³) exist throughout Area "B". Reserves of at least 35 years are anticipated based conservatively on future consumption rates of 200,000 m³ per year.

TABLE 1
PRELIMINARY ASSESSMENT OF PROCESS REQUIREMENTS

| Products Available from Area "B" | 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 - waste will be minimal |
| 40 mm crushed gravel for sub-base material | No | No | Yes | No | Some blending may be required |
| 20 mm crushed gravel for basecourse | No | No | Yes | No | Some blending may be required |
| 12.5 mm crushed gravel for asphalt aggregate | No | No | Yes | No | Split pile production required |
| Coarse aggregate for concrete | No | No | Yes | No | Some blending may be required |
| Concrete sand and blend sand | No | No | No | Yes | Numerous gradations of sand available on-site |
| Bedding Sand | No | Yes | No | No | Material <5,000 μ m sieve acceptable as bedding sand |
| Rip Rap | N/A | N/A | N/A | N/A | Not available in MacPherson Area "B" |

8.0 SITE DEVELOPMENT GUIDELINES

The following sections provide general development considerations for MacPherson Area "B".

8.1 Site Access

In Appendix C of this report, a possible concept for 7 quarry leases varying in size from 4.8 ha to 7.0 ha (average size 6.2 ha) is presented. The site is accessed from along the old Alaska Highway alignment approximately 2.5 km west of the North Klondike Highway intersection. The proposed access route has been evaluated by airphoto interpretation and construction of a haul road appears feasible. The route, as shown on the west side of the deposit, would be founded on a sand subgrade which will require minimal granular sub-base and basecourse construction to resist heavy rolling traffic whereas the east side would require roadway construction over silty subgrade soils in some sections complicating access road construction.

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.

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 all debris, timber and brush should be accomplished by either burning or hauling to a waste disposal facility. Burial of grubbed material is not recommended because it complicates future land use by establishing unmapped areas of deleterious materials. All discarded machinery, parts, scrap metal, oil containers and other combustibles or non-combustibles must also be removed from site.

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 soils including wasted overburden, etc. 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.

Revegetation shall be accomplished by redistributing stripped organic material over the pit walls and floor, seeding and/or allowing reinvasion of natural vegetation. Fine grained overburden soils can normally be used for surface reclamation; however, the fertility of these soils may require enrichment to sustain revegetation.

9.0 SIGNIFICANCE OF AREA "B" AS A GRANULAR SOURCE

Development of Area "B" as a granular source has both positive and negative implications. On the positive side, the following factors exist:

- A favourable variety of granular materials exists in Area "B" with equal volumes of sand and gravel throughout much of the site. Quantities should be sufficient to supply the Whitehorse area with the majority of its granular needs for approximately 35 years.
- No specialized processing of raw aggregates will be required to produce the various granular materials utilized in the Whitehorse area. Products requiring blending will be possible with material found in MacPherson Area "B".
- Granular material in Area "B" is slightly finer than in Area "A" meaning less removal of oversize material and potentially cheaper crushing costs.
- Clearing of access roads etc. will be relatively easy due to the lack of large trees. The presence of sand as the subgrade material should provide an adequate base for access road construction.

- Visual impact will be minimal. The area borders the old Alaska Highway alignment providing a buffer from the present Alaska Highway alignment.
- Problems associated with granular extractions operations (visual, dust, noise and odours) will also be minimal because of existing distances to present residential development.

Negative factors affecting development are as follows:

- Area will require rezoning (currently zoned for Country Residential development).
- Numerous design configurations were considered, but the concept presented as Drawing 10721-C-01 in Appendix C seems to access the area and divide the granular resources most equitably. However, it only provides seven leases which is less than the number of operators which may be seeking leases in the future.
- More than 3.0 km of haul road will need to be constructed, which is approximately three times the length of proposed access road to Area "A".
- Based on test well information by Klohn Leonoff 1991 and current drilling rates, it appears that a high volume water well to supply water for concrete aggregate washing will cost approximately \$25,000 to establish which may be inhibitive to a leaseholder. However, if adequate yields are available, a single well may service more than one lease to help defer costs. A well is considered preferable to piped water from the Takhini River due to the costs of pipeline construction, and difficult water intake structure construction caused by observed instability of the Takhini River banks.
- Haul distances to other areas of Whitehorse are substantial. Round trip distances to outlying Whitehorse subdivisions will

certainly inhibit the supply and placement of asphalt and concrete due to temperature and time considerations. However, these concerns can be eliminated by producing aggregates in MacPherson Area "B", and having them hauled and stockpiled at the present South Access processing facilities.

A final recommendation would be to conduct further geotechnical work prior to site development. The work completed to date was the delineation of the subject site as depicted in the proposal request. At the final design stage it would be beneficial to have established the lease boundaries on an air photo base map and then conduct a geotechnical investigation consisting of 4 or 5 testpits in each proposed lease. Specific information concerning volumes of sand, gravel, and blend sand for each lease would then be available enabling more management control when placing future operators.

10.0 CLOSURE

The information and recommendations presented herein are based on data obtained from twenty-six (26) 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.



M.C. Plaunt, C.E.T.
Engineering Technologist

MCP/JRT/rsz



J.R. Trimble, P.Eng.
Project Director
Office Manager

**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.

UNIFIED SOIL CLASSIFICATION†

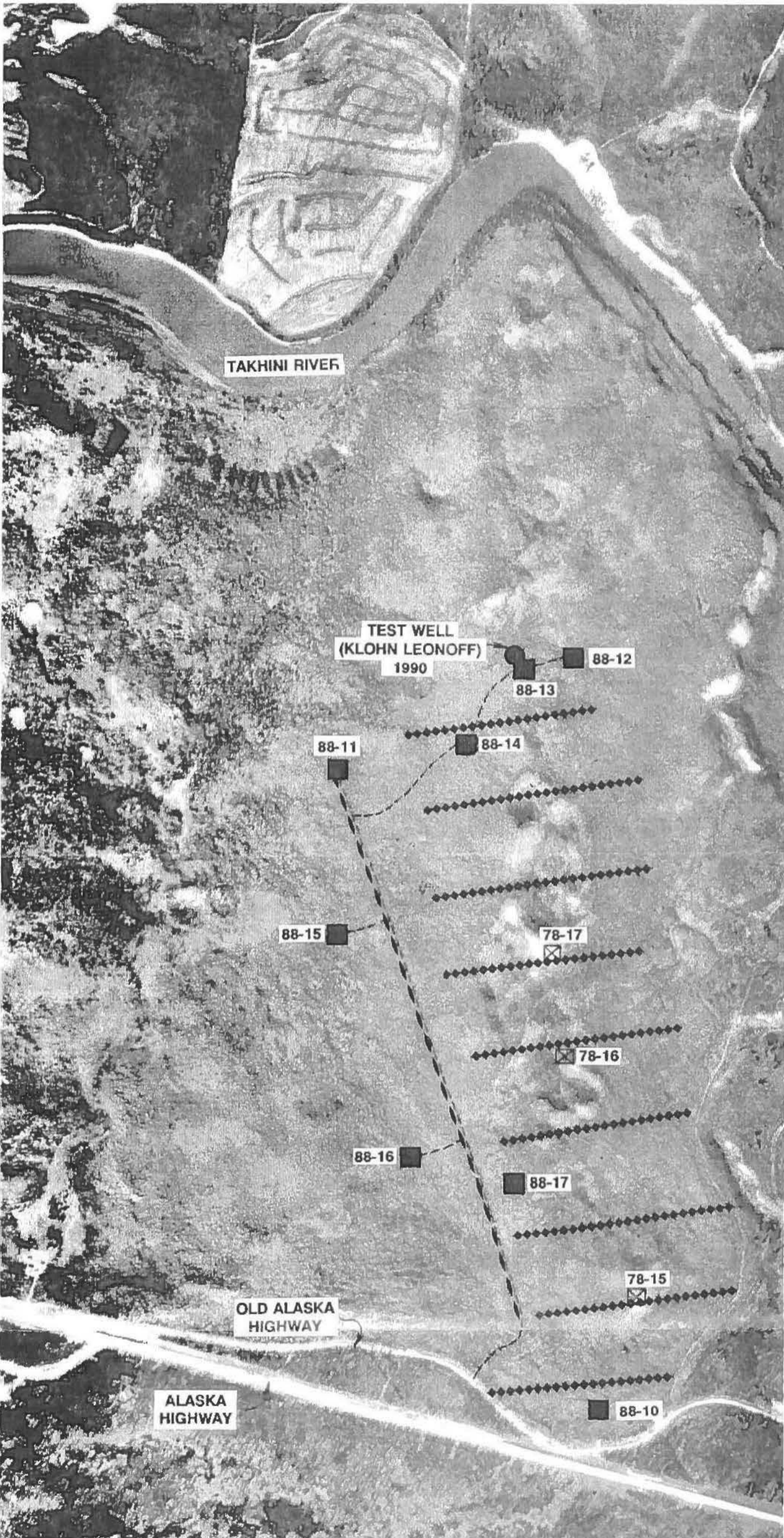
| MAJOR DIVISIONS | | GROUP SYMBOLS | TYPICAL NAMES | CLASSIFICATION CRITERIA | |
|---|---|--------------------|--|--|---|
| COARSE-GRAINED SOILS More than 50% retained on No. 200 sieve* | GRAVELS 50% or more of coarse fraction retained on No. 4 sieve | CLEAN GRAVELS | GW | Well-graded gravels and gravel-sand mixtures, little or no fines | |
| | | GRAVELS WITH FINES | GP | Poorly-graded gravels and gravel-sand mixtures, little or no fines | |
| | | GRAVELS WITH FINES | GM | Silty gravels, gravel-sand-silt mixtures | |
| | | GRAVELS WITH FINES | GC | Clayey gravels, gravel-sand clay mixtures | |
| | SANDS More than 50% of coarse fraction passes No. 4 sieve | CLEAN SANDS | SW | Well-graded sands and gravelly sands, little or no fines | |
| | | CLEAN SANDS | SP | Poorly-graded sands and gravelly sands, little or no fines | |
| | | SANDS WITH FINES | SM | Silty sands, sand-silt mixtures | |
| | | SANDS WITH FINES | SC | Clayey sands, sand-clay mixtures | |
| | | | | $C_u = D_{60}/D_{10}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3 Not meeting both criteria for GW | |
| | | | | Atterberg limits plot below 'A' line or plasticity index less than 4 Atterberg limits plot above 'A' line and plasticity index greater than 7 Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols | |
| 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 | | |
| | | | | $C_u = D_{60}/D_{10}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3 Not meeting both criteria for SW | |
| | | | Atterberg limits plot below 'A' line or plasticity index less than 4 Atterberg limits plot above 'A' line and plasticity index greater than 7 Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols | | |
| | PLASTICITY CHART For classification of fine-grained soils and fine fraction of coarse-grained soils Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols Equation of 'A' line: $PI = 0.73(LL - 20)$ | | | | |
| | 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 | | | | VISIBLE ICE LESS THAN 50% BY VOLUME | | | | | |
|-----------------|---------|----------------------------|--|-------------------------------------|---------|---|--|--|--|
| GROUP SYMBOLS | SYMBOLS | SUBGROUP DESCRIPTION | IMAGE | GROUP SYMBOLS | SYMBOLS | SUBGROUP DESCRIPTION | IMAGE | | |
| N | Nf | Poorly-bonded or friable | | V | Vx | Individual ice crystals or inclusions | | | |
| | Nbn | No excess ice, well-bonded | | | Vc | Ice coatings on particles | | | |
| | Nbe | Excess ice, well-bonded | | | 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) | | | | | | |

NOTE:
 1. Dual symbols are used to indicate borderline or mixed ice classifications
 2. Visual estimates of ice contents indicated on borehole logs \pm 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

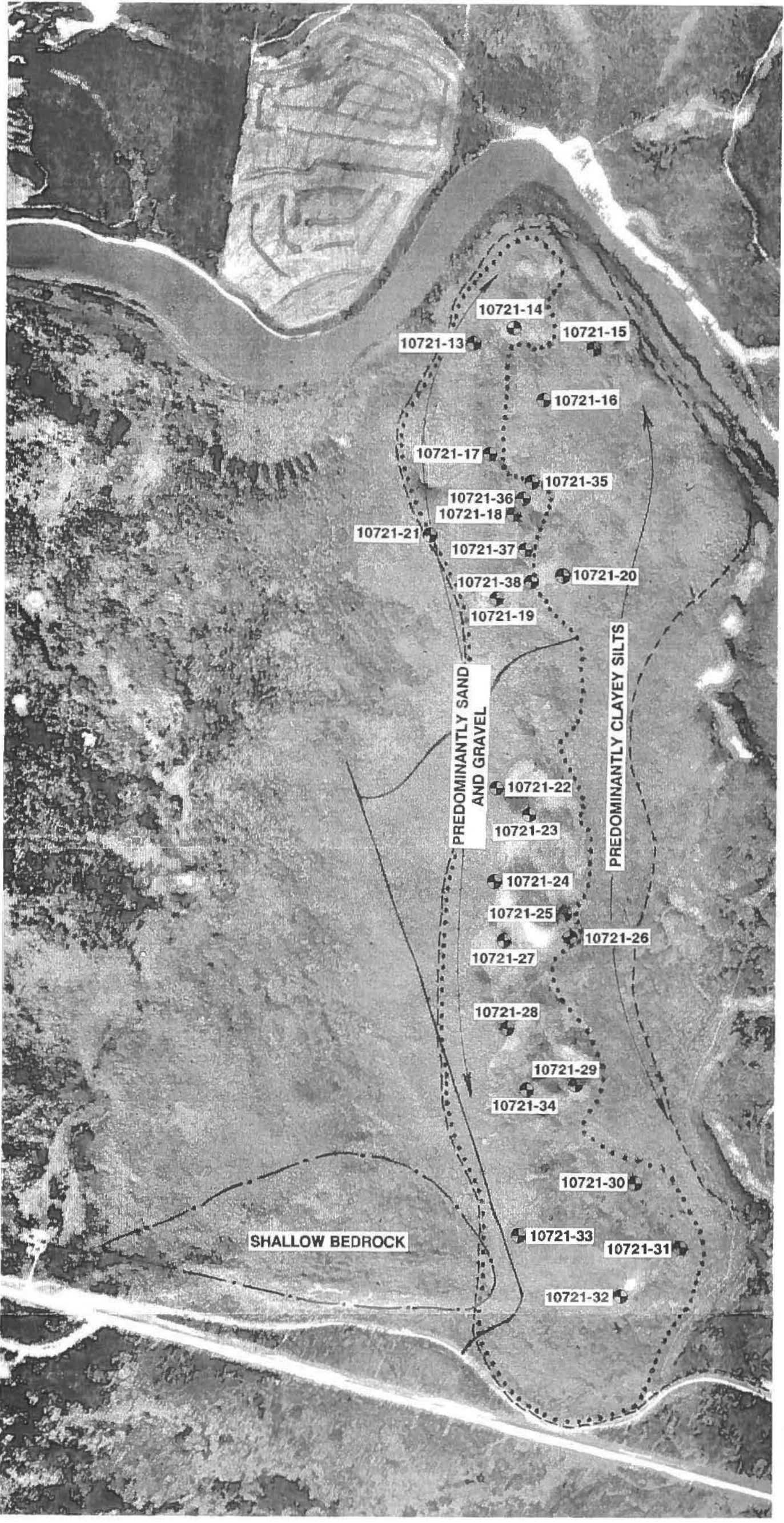


MCPHERSON AREA "B"

- ☒ 1978 TESTPITS
R.M. HARDY AND ASSOC.
- ◆◆◆◆ 1978 EM31 GEOPHYSICAL
SURVEY LINES -
R.M. HARDY AND ASSOC.
- 1988 TESTPITS
KLOHN LEONOFF YUKON
- 1980 ES-1225
SEISMIC LINE -
FRONTIER GEOSCIENCES INC.
FOR KLOHN LEONOFF YUKON
- - - - - EXISTING TRAIL
ACCESSING AREA



| | | | | |
|----------------------------------|----------|------|---|-------------------|
| EBA Engineering Consultants Ltd. | | | PROJECT MCPHERSON GRANULAR SOURCE STUDY | |
| CLIENT GOVERNMENT OF YUKON | | | TITLE SUMMARY OF PREVIOUSLY COMPLETED SITE INVESTIGATIONS | |
| DATE | 91-11-09 | DWN. | MCP | CHKD. <i>JVVW</i> |
| | | | FILE NO. | 0201-10721 |
| | | | 10721-A-01 | |



McPHERSON AREA "B"

- 1991 EBA TESTPIT LOCATIONS
- EXISTING AREA ACCESS
- - - GRANULAR SOURCE AS DELINEATED IN 1991 KLOHN LEONOFF REPORT
- REVISED SOURCE AREA BOUNDARIES
- · - · DELINEATED AREA WITH SHALLOW BEDROCK

0 500
APPROXIMATE SCALE (m)

| | | | | |
|----------------------------------|----------|--------------------------|---|------------|
| EBA Engineering Consultants Ltd. | | | PROJECT McPHERSON GRANULAR SOURCE STUDY | |
| CLIENT GOVERNMENT OF YUKON | | | TITLE SITE PLAN SHOWING 1991 TESTPIT LOCATIONS AND SOURCE BOUNDARIES | |
| DATE 91-11-09 | DWN. MCP | CHKD. <i>[Signature]</i> | FILE NO. 0201-10721 | 10721-A-02 |

| | | |
|---|------------------------------------|------------------------|
| McPHERSON GRANULAR RESOURCE STUDY | CLIENT: GOVERNMENT OF YUKON | BOREHOLE No. 10721-13 |
| McPHERSON B (SEE SITE PLAN) | BACKHOE: CAT 225 TRACKED BACKHOE | Project No: 0201-10721 |
| WHITEHORSE, YUKON | UTM ZONE: 8 N6744580.00 E486000.00 | ELEVATION 0.00 (m) |
| SAMPLE TYPE <input type="checkbox"/> GRAB SAMPLE <input checked="" type="checkbox"/> NO RECOVERY <input checked="" type="checkbox"/> STANDARD PEN. <input type="checkbox"/> 75 mm SPOON <input type="checkbox"/> CORREL BARREL <input type="checkbox"/> | | |

| DEPTH (m) | SAMPLE TYPE | SAMPLE NO | USC | SOIL DESCRIPTION | STANDARD PENETRATION | | PERCENT GRAVEL | | | | PERCENT SAND | | | | PERCENT SILT OR FINES | | | | PERCENT CLAY | | | | DEPTH (ft) |
|-----------|-------------|-----------|-----|--|----------------------|----|----------------|----|----|----|--------------|----|----|----|-----------------------|----|----|----|--------------|----|----|------|------------|
| | | | | | 10 | 20 | 30 | 40 | 20 | 40 | 60 | 80 | 20 | 40 | 60 | 80 | 20 | 40 | 60 | 80 | 20 | 40 | |
| 0.0 | | | | MOSS AND TEA GROUND COVER, ORGANIC ROOT MAT | | | | | | | | | | | | | | | | | | 0.0 | |
| | | | | SILT—some clay, rootlets throughout, moist, soft medium brown | | | | | | | | | | | | | | | | | | | |
| | | 1 | | SAND—trace of fine gravel, trace of silt, well graded, damp, medium brown | | | | | | | | | | | | | | | | | | 2.0 | |
| -1.0 | | | | -becomes well graded sand below 1.0 m | | | | | | | | | | | | | | | | | | 4.0 | |
| | | 2 | | | | | | | | | | | | | | | | | | | | 6.0 | |
| | | | | GRAVEL AND SAND—trace of silt, well rounded up to 150 mm, <5% over 75 mm, well graded sand, damp, loose, sloughing badly, medium brown | | | | | | | | | | | | | | | | | | 8.0 | |
| -3.0 | | 3 | | | | | | | | | | | | | | | | | | | | 10.0 | |
| | | | | SAND—some gravel, trace of silt, damp, loose, greyish brown, interface is variable | | | | | | | | | | | | | | | | | | 12.0 | |
| -4.0 | | 4 | | | | | | | | | | | | | | | | | | | | 14.0 | |
| | | | | END OF TESTPIT 4.0 | | | | | | | | | | | | | | | | | | 16.0 | |
| 5.0 | | | | NOTE: Too fine to crush | | | | | | | | | | | | | | | | | | | |

EBA Engineering Consultants Ltd.
Whitehorse, Yukon

COMPLETION DEPTH 4.0 m

COMPLETE 91/08/09

LOGGED BY JRT

DWG NO.

Page 1 of 1

EBA Engineering Consultants Ltd.

PARTICLE - SIZE ANALYSIS OF SOILS

Project: Mac Pherson B Granular Study
Whitehorse, Yukon

Project Number: 0201-10721

Date Tested: 91-09-20

Borehole Number: 10721-13

Depth: 2.5 m and 3.3 m

Soil Description: GRAVEL (GP) AND SAND - trace of silt

Cu: 64

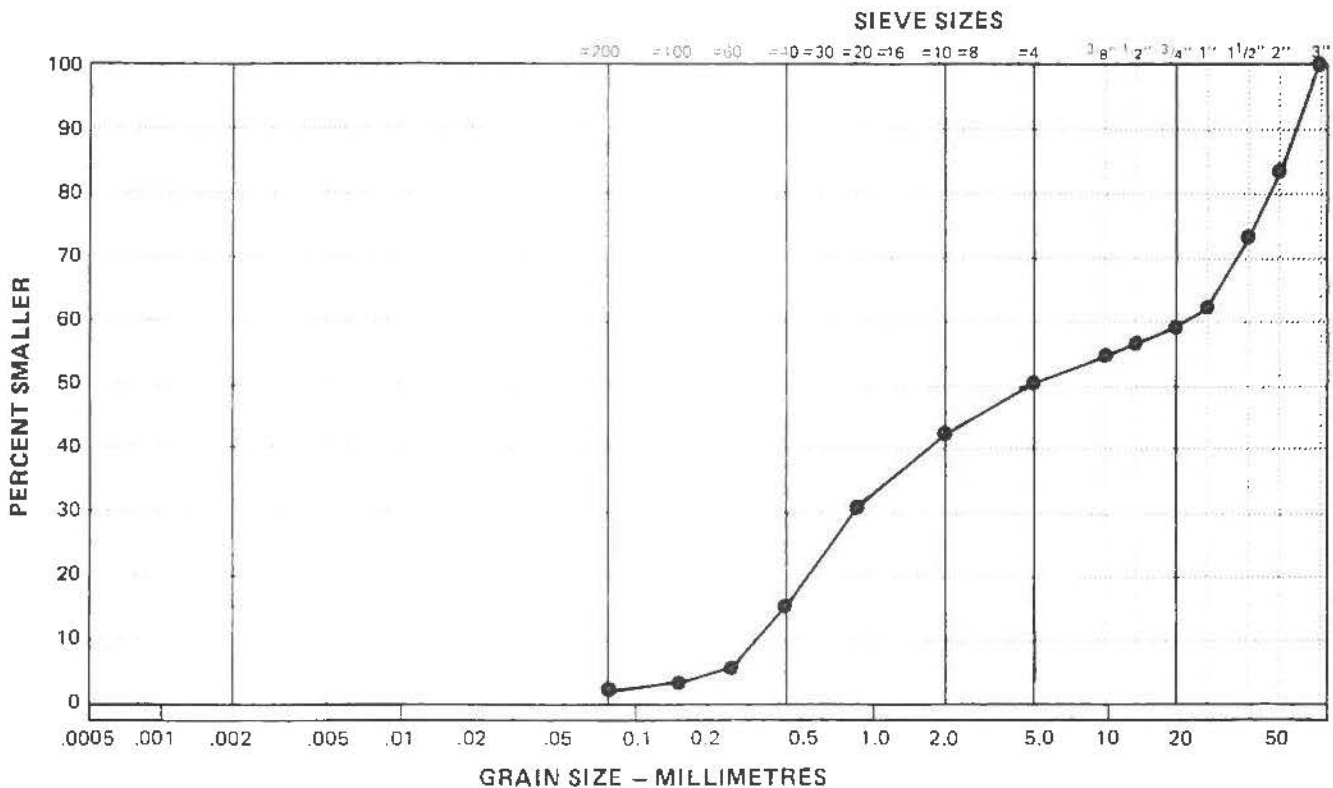
Cc: 0.1

Natural Moisture Content: _____ %

Remarks: 2" Sieve: 83.2% Passing

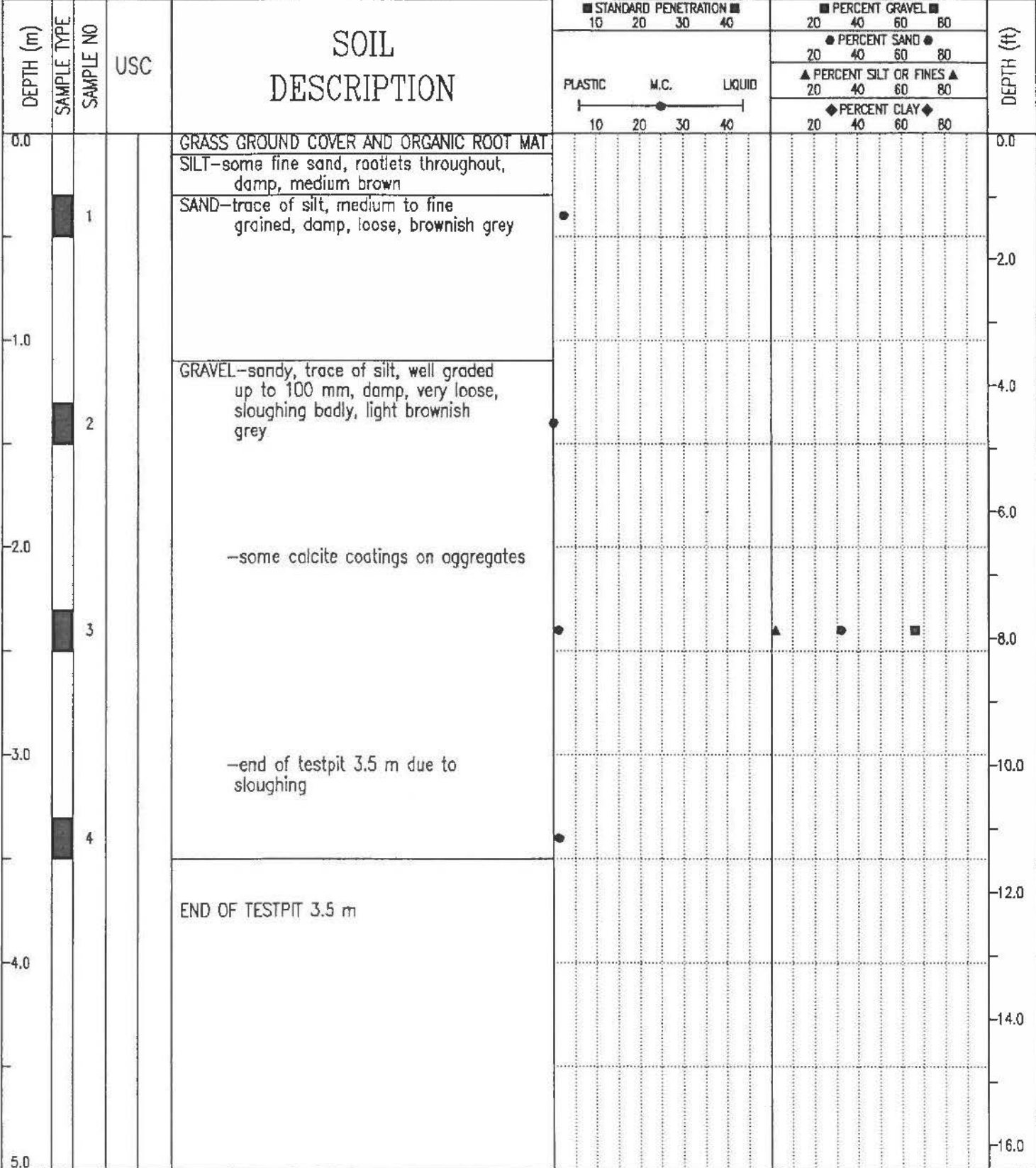
| SIEVE | PERCENTAGE PASSING |
|---------|--------------------|
| 3" | 100.0 |
| 1 1/2" | 73.5 |
| 1" | 61.6 |
| 3/4" | 59.2 |
| 1/2" | 57.4 |
| 3/8" | 55.2 |
| No. 4 | 50.1 |
| No. 10 | 42.1 |
| No. 20 | 30.7 |
| No. 40 | 16.1 |
| No. 60 | 6.4 |
| No. 100 | 3.3 |
| No. 200 | 2.7 |

| CLAY | SILT | SAND | | | GRAVEL | |
|------|------|------|--------|--------|--------|--------|
| | | FINE | MEDIUM | COARSE | FINE | COARSE |



| | | |
|-----------------------------------|------------------------------------|------------------------|
| McPHERSON GRANULAR RESOURCE STUDY | CLIENT: GOVERNMENT OF YUKON | BOREHOLE No. 10721-14 |
| McPHERSON B (SEE SITE PLAN) | BACKHOE: CAT 225 TRACKED BACKHOE | Project No: 0201-10721 |
| WHITEHORSE, YUKON | UTM ZONE: 8 N6744650.00 E486075.00 | ELEVATION 0.00 (m) |

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



| | | | |
|---|---------|------------------------|-------------------|
| EBA Engineering Consultants Ltd. Whitehorse, Yukon | | COMPLETION DEPTH 3.5 m | COMPLETE 91/08/09 |
| LOGGED BY JRT | DWG NO. | Page 1 of 1 | |

EBA Engineering Consultants Ltd.

PARTICLE SIZE ANALYSIS OF SOILS

Project: MacPherson B Granular Study
Whitehorse, Yukon

Project Number: 0201-10721

Date Tested: 91-09-20

Borehole Number: 10721-14

Depth: 0.5 m, 1.5 m, 2.5 m, and 3.5 m

Soil Description: GRAVEL (GW) - sandy, trace of silt

Cu: 83

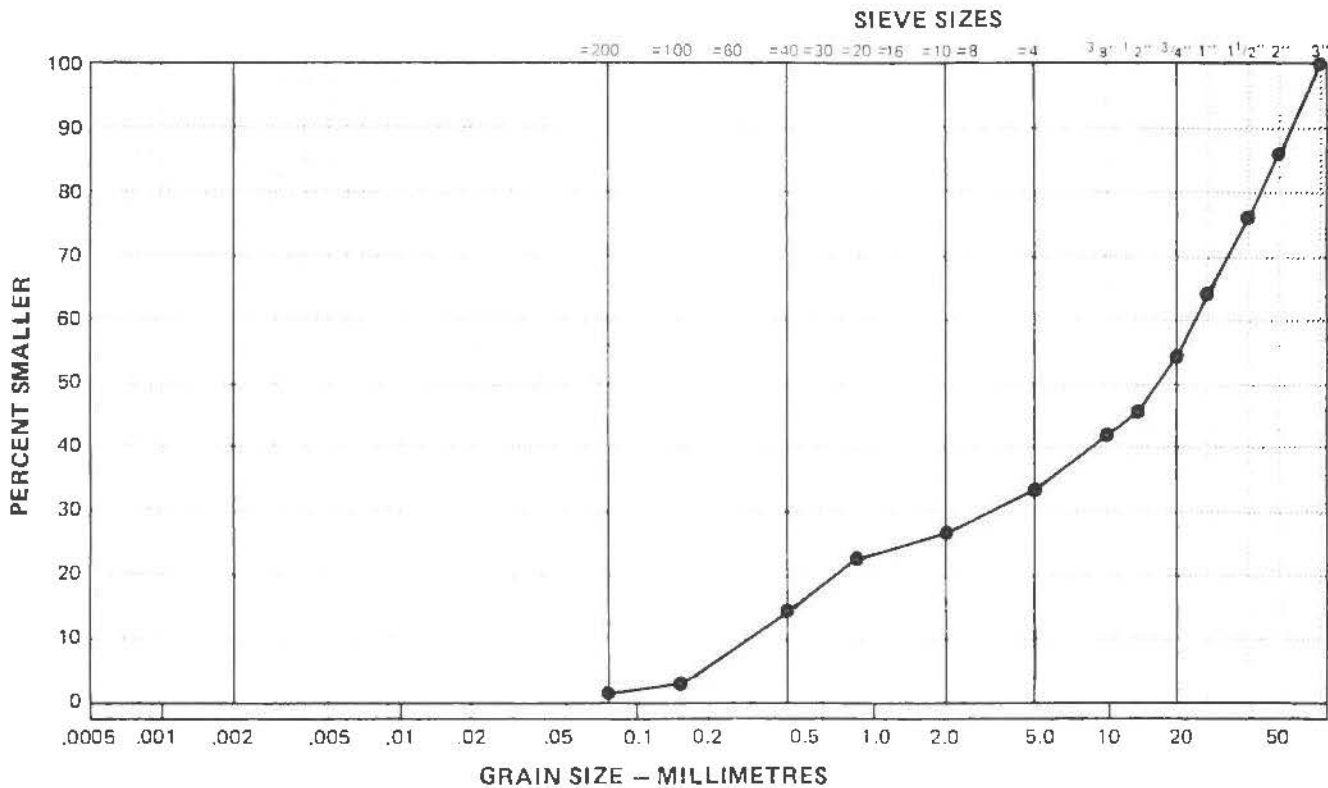
Cc: 1.4

Natural Moisture Content: _____ %

Remarks: 2" Sieve: 86.2% Passing

| SIEVE | PERCENTAGE PASSING |
|---------|--------------------|
| 3" | 100.0 |
| 1 1/2" | 76.4 |
| 1" | 64.4 |
| 3/4" | 54.3 |
| 1/2" | 45.7 |
| 3/8" | 41.5 |
| No. 4 | 33.8 |
| No. 10 | 27.2 |
| No. 20 | 22.2 |
| No. 40 | 14.2 |
| No. 60 | 6.6 |
| No. 100 | 3.0 |
| No. 200 | 1.6 |

| CLAY | SILT | SAND | | | GRAVEL | |
|------|------|------|--------|--------|--------|--------|
| | | FINE | MEDIUM | COARSE | FINE | COARSE |



| | | |
|--|------------------------------------|------------------------|
| McPHERSON GRANULAR RESOURCE STUDY | CLIENT: GOVERNMENT OF YUKON | BOREHOLE No. 10721-15 |
| McPHERSON B (SEE SITE PLAN) | BACKHOE: CAT 225 TRACKED BACKHOE | Project No: 0201-10721 |
| WHITEHORSE, YUKON | UTM ZONE: 8 N6744550.00 E486450.00 | ELEVATION 0.00 (m) |
| SAMPLE TYPE <input type="checkbox"/> GRAB SAMPLE <input checked="" type="checkbox"/> NO RECOVERY <input checked="" type="checkbox"/> STANDARD PEN. <input type="checkbox"/> 75 mm SPOON <input type="checkbox"/> CRREL BARREL <input type="checkbox"/> | | |

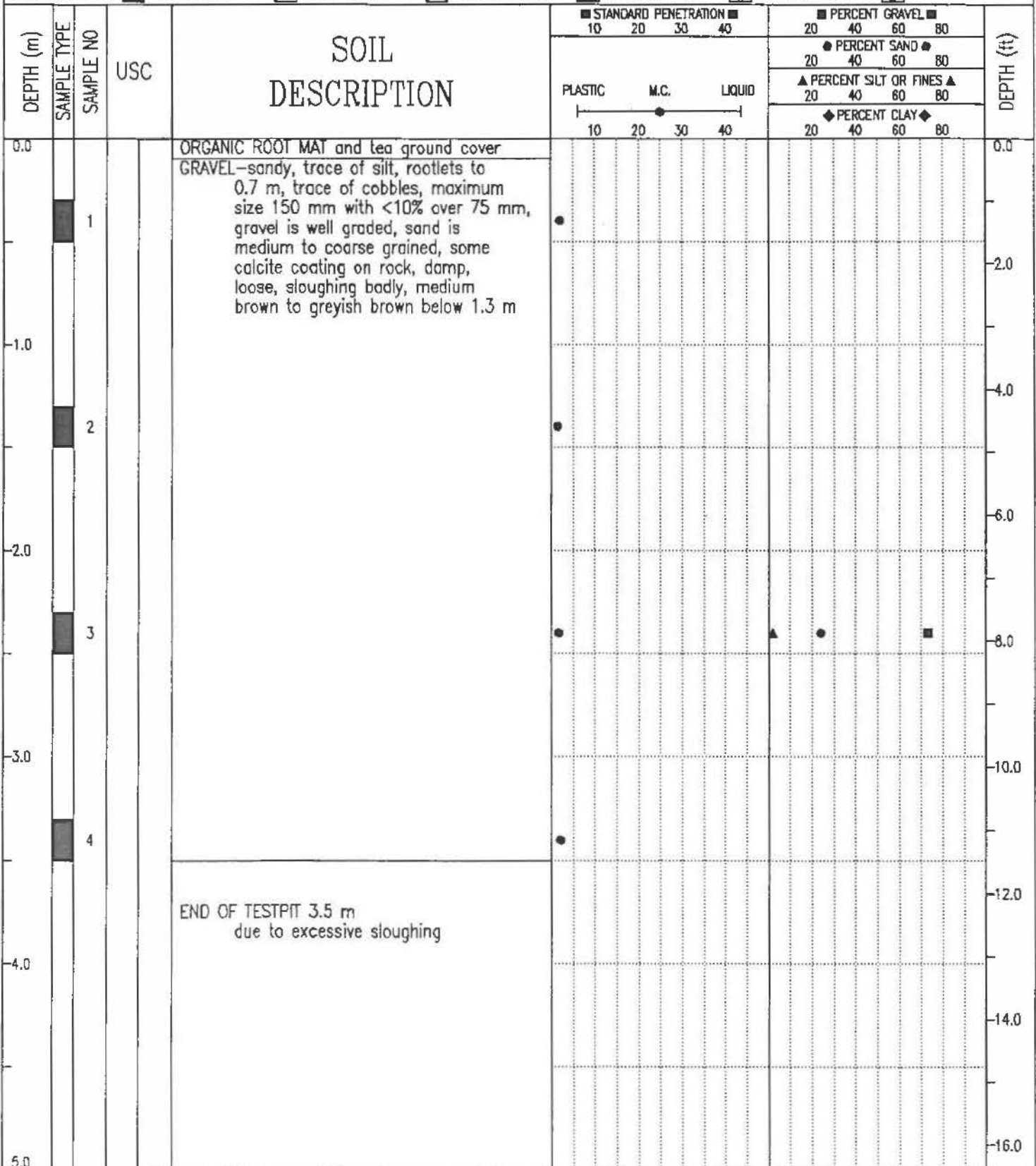
| DEPTH (m) | SAMPLE TYPE | SAMPLE NO | USC | SOIL DESCRIPTION | STANDARD PENETRATION | | PERCENT GRAVEL | | | | DEPTH (ft) |
|-----------|-------------|-----------|-----|---|----------------------|----|----------------|----|----|----|------------|
| | | | | | 10 | 20 | 20 | 40 | 60 | 80 | |
| 0.0 | | | | ORGANIC ROOT MAT—very little tea ground cover | | | | | | | 0.0 |
| | | 1 | | SILT—sandy, rootlets throughout, occasional cobble, damp, firm, medium brown | | | | | | | 2.0 |
| -1.0 | | 2 | | SILT—trace of fine sand, trace of rootlets, horizontal, parallel, laminae with occasional organic inclusions, damp, firm, light greyish brown | | | | | | | 4.0 |
| -2.0 | | 3 | | SAND—some fine gravel, trace of silt, sand is well graded, damp, loose, sloughing badly, medium brownish grey | | | | | | | 8.0 |
| -3.0 | | 4 | | SILT—trace of fine sand, trace of clay, damp, firm, light greyish brown | | | | | | | 10.0 |
| -4.0 | | | | | | | | | | | 12.0 |
| -5.0 | | | | END OF TESTPIT 4.5 m | | | | | | | 16.0 |
| | | | | NOTE: Excavated at edge of deposit with poplars and willows on slope to east | | | | | | | 18.0 |
| | | | | | | | | | | | 20.0 |
| | | | | | | | | | | | 22.0 |

| | | |
|---|------------------------|-------------------|
| EBA Engineering Consultants Ltd. Whitehorse, Yukon | COMPLETION DEPTH 4.5 m | COMPLETE 91/08/09 |
| | LOGGED BY JRT | DWG NO. |
| | | Page 1 of 1 |

| | | |
|---|------------------------------------|------------------------|
| McPHERSON GRANULAR RESOURCE STUDY | CLIENT: GOVERNMENT OF YUKON | BOREHOLE No. 10721-16 |
| McPHERSON B (SEE SITE PLAN) | BACKHOE: CAT 225 TRACKED BACKHOE | Project No: 0201-10721 |
| WHITEHORSE, YUKON | UTM ZONE: 8 N6744560.00 E486250.00 | ELEVATION 0.00 (m) |
| SAMPLE TYPE <input type="checkbox"/> GRAB SAMPLE <input checked="" type="checkbox"/> NO RECOVERY <input checked="" type="checkbox"/> STANDARD PEN. <input checked="" type="checkbox"/> 75 mm SPOON <input type="checkbox"/> CRREL BARREL <input type="checkbox"/> | | |

| DEPTH (m) | SAMPLE TYPE | SAMPLE NO | USC | SOIL DESCRIPTION | STANDARD PENETRATION | | PERCENT GRAVEL | | | | DEPTH (ft) | |
|-----------|-------------|-----------|-----|---|----------------------|----|----------------|----|----|----|------------|-----|
| | | | | | 10 | 20 | 30 | 40 | 20 | 40 | | 60 |
| 0.0 | | | | ORGANIC ROOT MAT with tea ground cover SILT—some fine sand, rootlets throughout, damp, medium brown | | | | | | | | 0.0 |
| | | 1 | | -silt becomes fine and uniform, firm and greyish brown in colour | | | | | | | | |
| -1.0 | | | | | | | | | | | | |
| | | 2 | | | | | | | | | | |
| -2.0 | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| -3.0 | | | | -occasional cobble below 2.5 m | | | | | | | | |
| | | | | | | | | | | | | |
| -4.0 | | | | -very firm below 3.0 m | | | | | | | | |
| | | 3 | | | | | | | | | | |
| -5.0 | | | | END OF TESTPIT 4.5 m | | | | | | | | |

| | | |
|--|------------------------------------|------------------------|
| McPHERSON GRANULAR RESOURCE STUDY | CLIENT: GOVERNMENT OF YUKON | BOREHOLE No. 10721-17 |
| McPHERSON B (SEE SITE PLAN) | BACKHOE: CAT 225 TRACKED BACKHOE | Project No: 0201-10721 |
| WHITEHORSE, YUKON | UTM ZONE: 8 N6744610.00 E486000.00 | ELEVATION 0.00 (m) |
| SAMPLE TYPE <input checked="" type="checkbox"/> GRAB SAMPLE <input checked="" type="checkbox"/> NO RECOVERY <input checked="" type="checkbox"/> STANDARD PEN. <input checked="" type="checkbox"/> 75 mm SPOON <input type="checkbox"/> CRREL BARREL <input type="checkbox"/> | | |



LARGE AGGREGATE ANALYSIS REPORT

Project: McPHERSON GRANULAR STUDY Sample Number: 4836.3
 Address: _____ Sample Location: TP 17, AREA "B".
 Project Number: 201 -10721
 Date Sampled: _____ By: _____ Time: _____ Temp.: _____ °C
 Client: Y. T. G. -LANDS BRANCH Date Tested: 91-09-05
WHITEHORSE, Y. T. Tested By: ATE
 Natural Moisture Content: _____
 Crushed Faces: _____ 1 _____ 2

Attention: _____

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

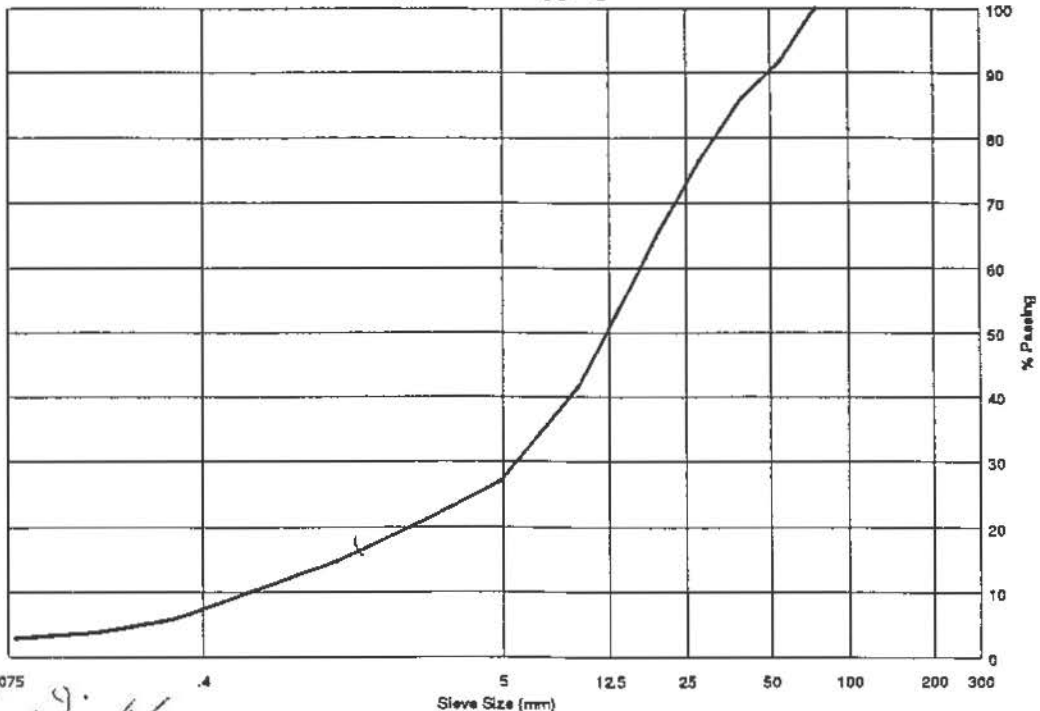
Cu: _____

Cc: _____

Remarks: _____

Grading Curve of Aggregate

| Sieve Size | % Passing |
|------------|-----------|
| 75.0 | 100.0 |
| 56.0 | 91.8 |
| 40.0 | 86.0 |
| 28.0 | 76.4 |
| 20.0 | 65.7 |
| 14.0 | 53.1 |
| 10.0 | 41.4 |
| 5.00 | 26.6 |
| 2.50 | 20.1 |
| 1.25 | 14.2 |
| .630 | 9.6 |
| .315 | 5.2 |
| .160 | 2.9 |
| .080 | 2.0 |



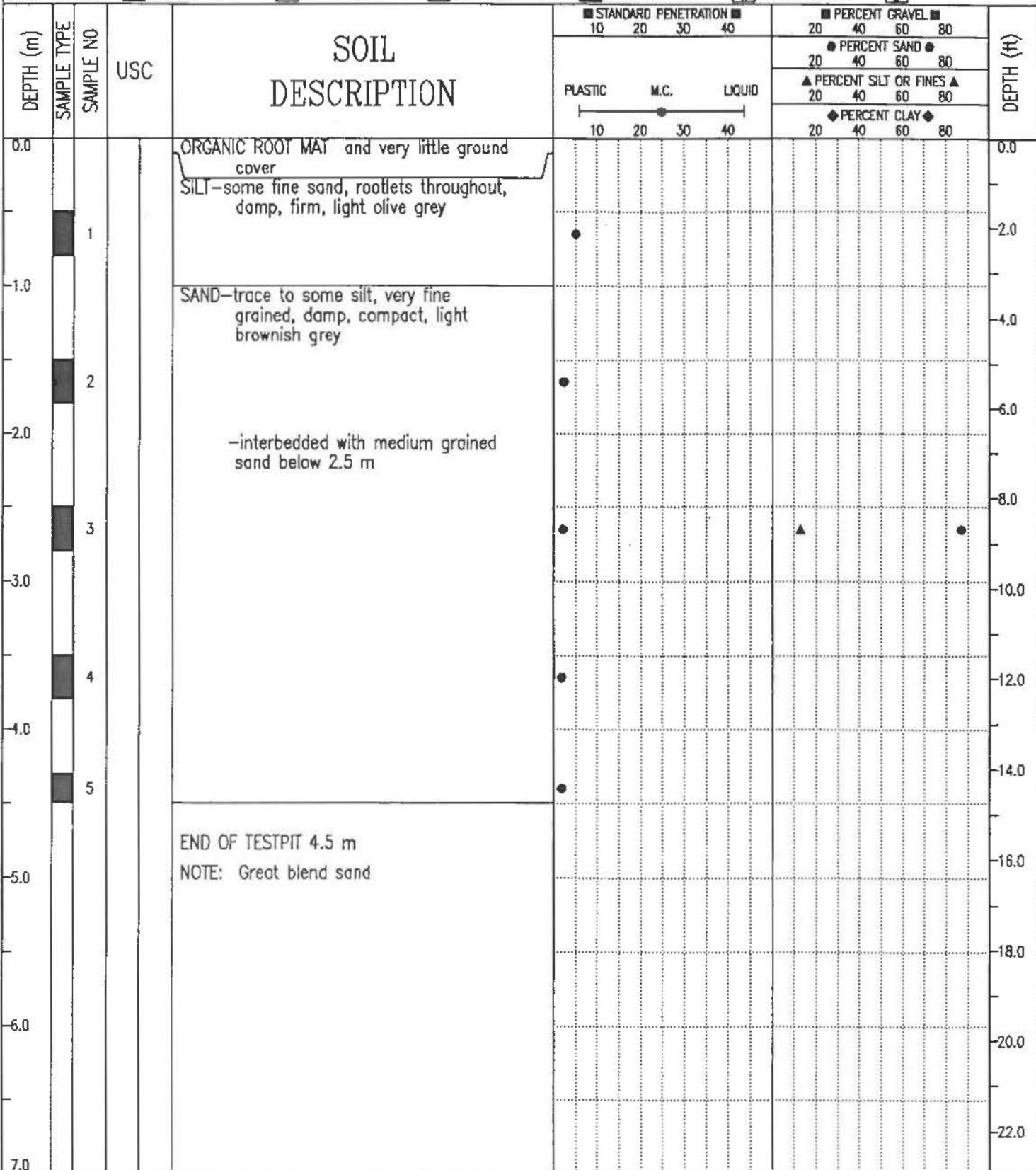
Reviewed By: Hubert J. Noble P. Eng.

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| | | |
|---|------------------------------------|------------------------|
| McPHERSON GRANULAR RESOURCE STUDY | CLIENT: GOVERNMENT OF YUKON | BOREHOLE No. 10721-18 |
| McPHERSON B (SEE SITE PLAN) | BACKHOE: CAT 225 TRACKED BACKHOE | Project No: 0201-10721 |
| WHITEHORSE, YUKON | UTM ZONE: 8 N6744320.00 E486060.00 | ELEVATION 0.00 (m) |
| SAMPLE TYPE <input type="checkbox"/> GRAB SAMPLE <input checked="" type="checkbox"/> NO RECOVERY <input checked="" type="checkbox"/> STANDARD PEN. <input type="checkbox"/> 75 mm SPOON <input type="checkbox"/> CORREL BARREL <input type="checkbox"/> | | |



EBA Engineering Consultants Ltd.
Whitehorse, Yukon

| | |
|------------------------|-------------------|
| COMPLETION DEPTH 4.5 m | COMPLETE 91/08/09 |
| LOGGED BY JRT | DWG NO. |
| | Page 1 of 1 |

EBA Engineering Consultants Ltd.

PARTICLE - SIZE ANALYSIS OF SOILS

Project: MacPherson B Granular Study
Whitehorse, Yukon

Project Number: 0201-10721

Date Tested: 91-09-20

Borehole Number: 10721-18

Depth: 2.5 m

Soil Description: SAND (SM) - some silt

Cu: _____

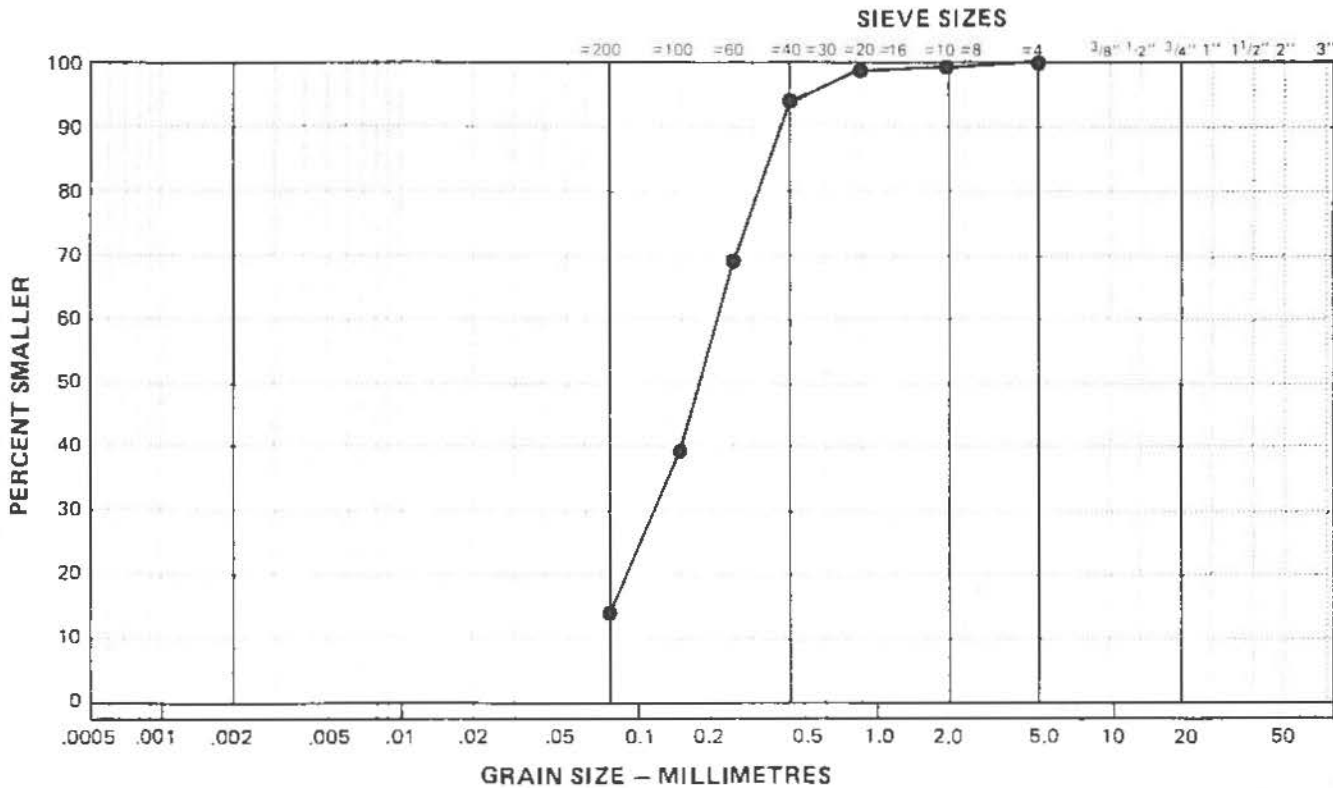
Cc: _____

Natural Moisture Content: _____ %

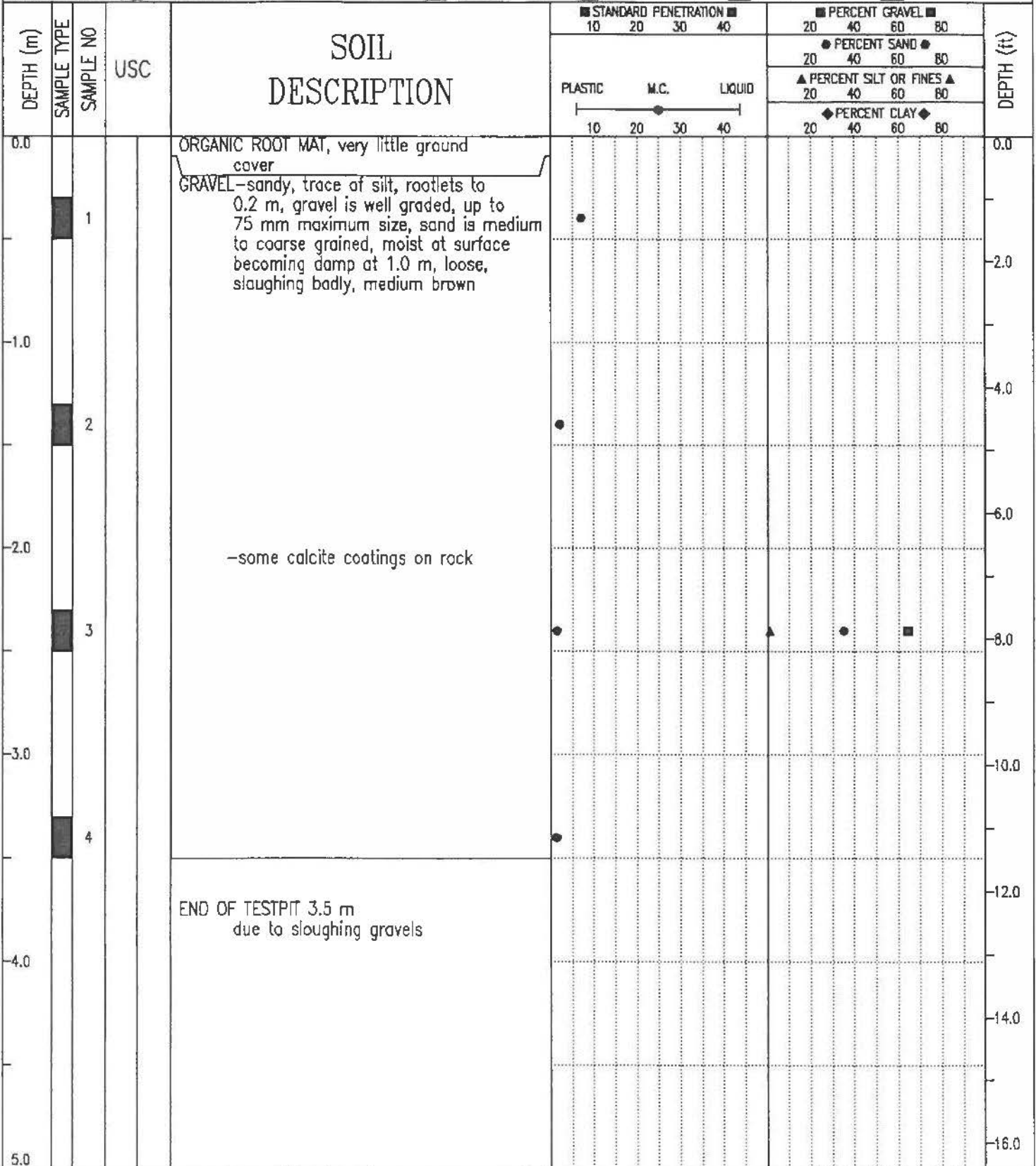
Remarks: BLEND SAND

| SIEVE | PERCENTAGE PASSING |
|---------|--------------------|
| 3" | |
| 1 1/2" | |
| 1" | |
| 3/4" | |
| 1/2" | |
| 3/8" | |
| No. 4 | 100.0 |
| No. 10 | 99.9 |
| No. 20 | 99.5 |
| No. 40 | 93.6 |
| No. 60 | 69.7 |
| No. 100 | 39.6 |
| No. 200 | 13.5 |

| CLAY | SILT | SAND | | | GRAVEL | |
|------|------|------|--------|--------|--------|--------|
| | | FINE | MEDIUM | COARSE | FINE | COARSE |



| | | |
|---|------------------------------------|------------------------|
| McPHERSON GRANULAR RESOURCE STUDY | CLIENT: GOVERNMENT OF YUKON | BOREHOLE No. 10721-19 |
| McPHERSON B (SEE SITE PLAN) | BACKHOE: CAT 225 TRACKED BACKHOE | Project No: 0201-10721 |
| WHITEHORSE, YUKON | UTM ZONE: 8 N6744100.00 E486090.00 | ELEVATION 0.00 (m) |
| SAMPLE TYPE <input type="checkbox"/> GRAB SAMPLE <input checked="" type="checkbox"/> NO RECOVERY <input checked="" type="checkbox"/> STANDARD PEN. <input type="checkbox"/> 75 mm SPDOON <input type="checkbox"/> CRREL BARREL <input type="checkbox"/> | | |



| | | |
|---|------------------------|-------------------|
| EBA Engineering Consultants Ltd. Whitehorse, Yukon | COMPLETION DEPTH 3.5 m | COMPLETE 91/08/09 |
| | LOGGED BY JRT | OWG NO. |

LARGE AGGREGATE ANALYSIS REPORT

Project: McPHERSON GRANULAR STUDY

Sample Number: 4838.5

Address: _____

Sample Location: TP 19, AREA "B".

Project Number: 201 -10721

Date Sampled: 91-08-23 By: _____

Time: _____ Temp.: _____ °C

Client: Y. T. G. -LANDS BRANCH

Date Tested: 91-09-04

WHITEHORSE, Y. T.

Tested By: ATE

Natural Moisture Content: _____

Crushed Faces: _____ 1 _____ 2

Attention: _____

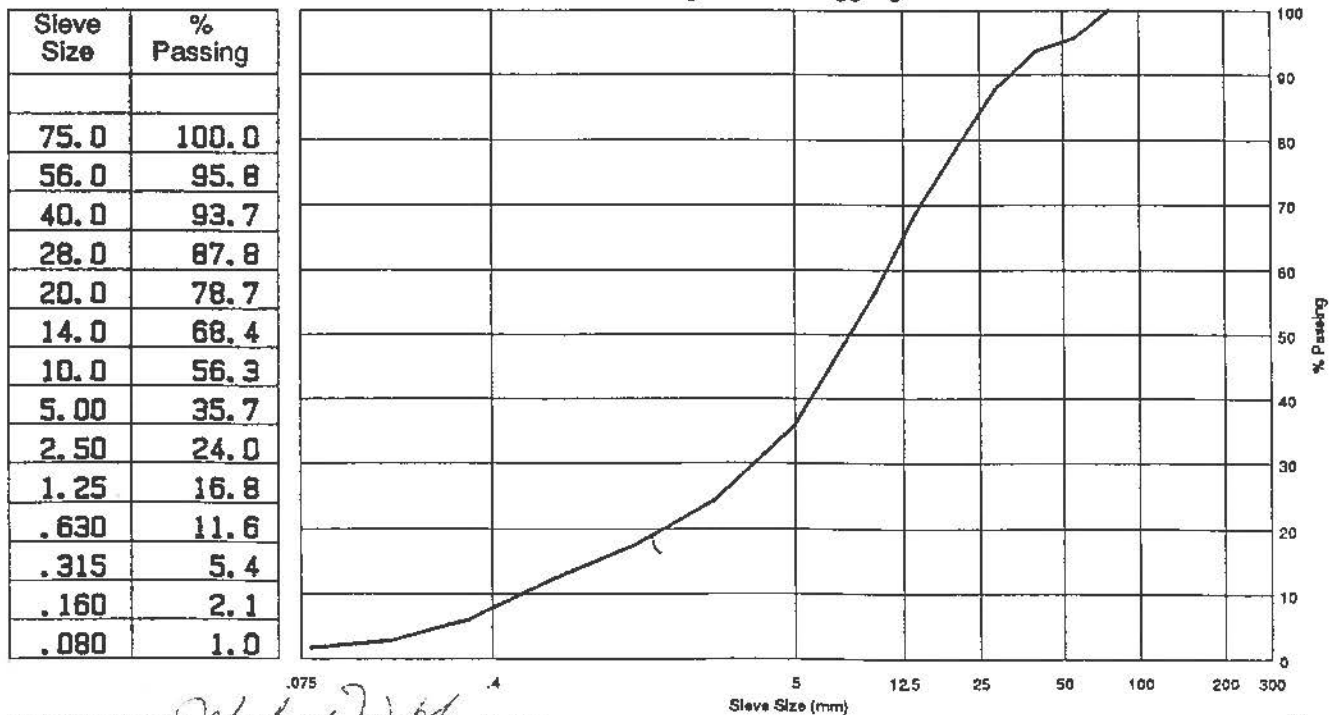
Soil Description: GRAVEL (75 mm MAX.) PIT RUN, SANDY, TR. SILT, BROWN.

Cu: _____

Cc: _____

Remarks: _____

Grading Curve of Aggregate



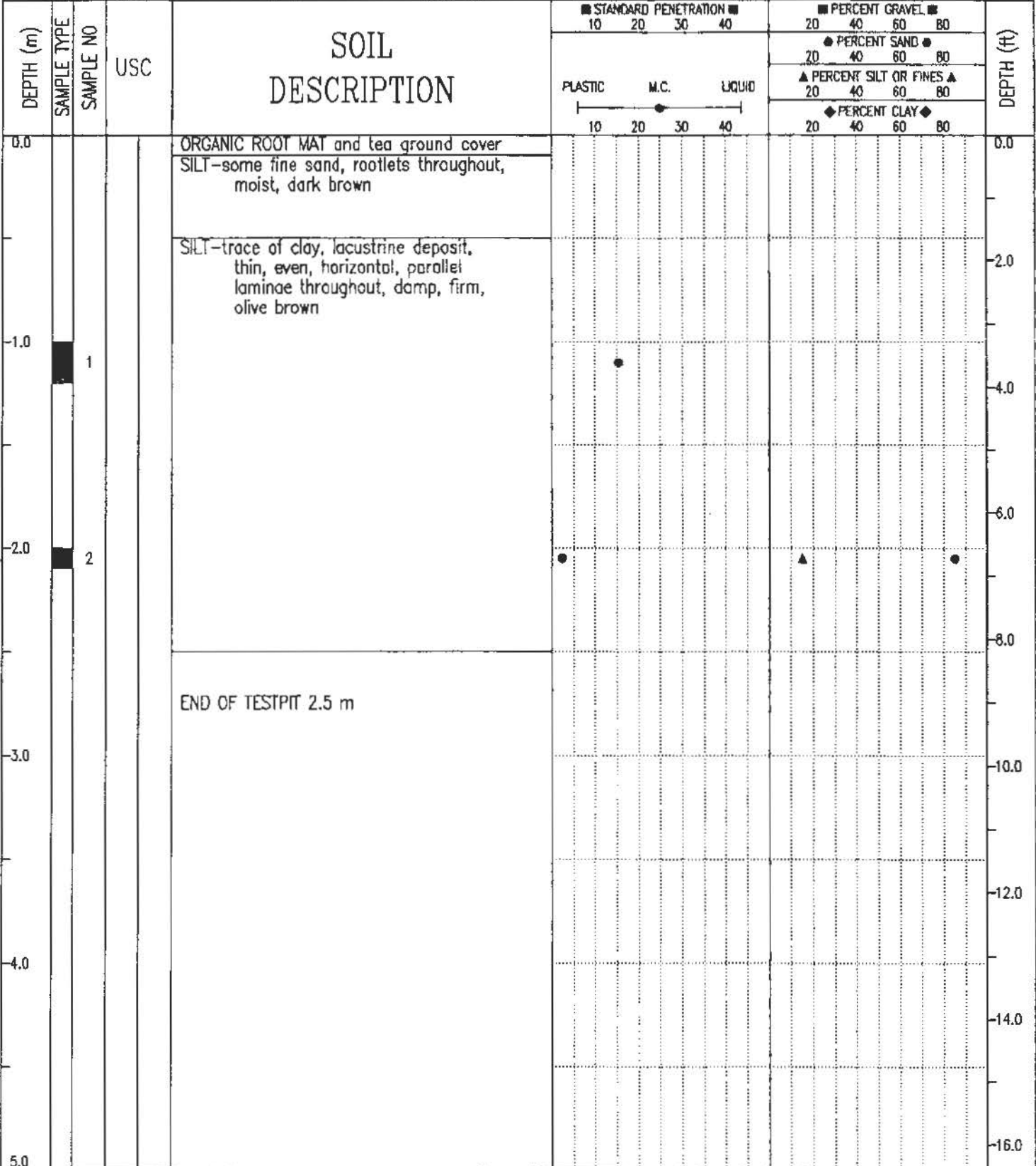
Reviewed By: *Michael M. O'Connell* P. Eng.

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| | | |
|---|------------------------------------|------------------------|
| McPHERSON GRANULAR RESOURCE STUDY | CLIENT: GOVERNMENT OF YUKON | BOREHOLE No. 10721-20 |
| McPHERSON B (SEE SITE PLAN) | BACKHOE: CAT 225 TRACKED BACKHOE | Project No: 0201-10721 |
| WHITEHORSE, YUKON | UTM ZONE: 8 N6744090.00 E486220.00 | ELEVATION 0.00 (m) |
| SAMPLE TYPE <input type="checkbox"/> GRAB SAMPLE <input checked="" type="checkbox"/> NO RECOVERY <input checked="" type="checkbox"/> STANDARD PEN. <input type="checkbox"/> 75 mm SPOON <input type="checkbox"/> CORREL BARREL <input type="checkbox"/> | | |



| | | | |
|---|---------|------------------------|-------------------|
| EBA Engineering Consultants Ltd. Whitehorse, Yukon | | COMPLETION DEPTH 2.5 m | COMPLETE 91/08/09 |
| LOGGED BY JRT | DWG NO. | Page 1 of 1 | |

EBA Engineering Consultants Ltd.

PARTICLE - SIZE ANALYSIS OF SOILS

Project: MacPherson B Granular Study
Whitehorse, Yukon

Project Number: 0201-10721

Date Tested: 91-09-20

Borehole Number: 10721-20

Depth: _____

Soil Description: SAND (SM) - some silt

Cu: _____

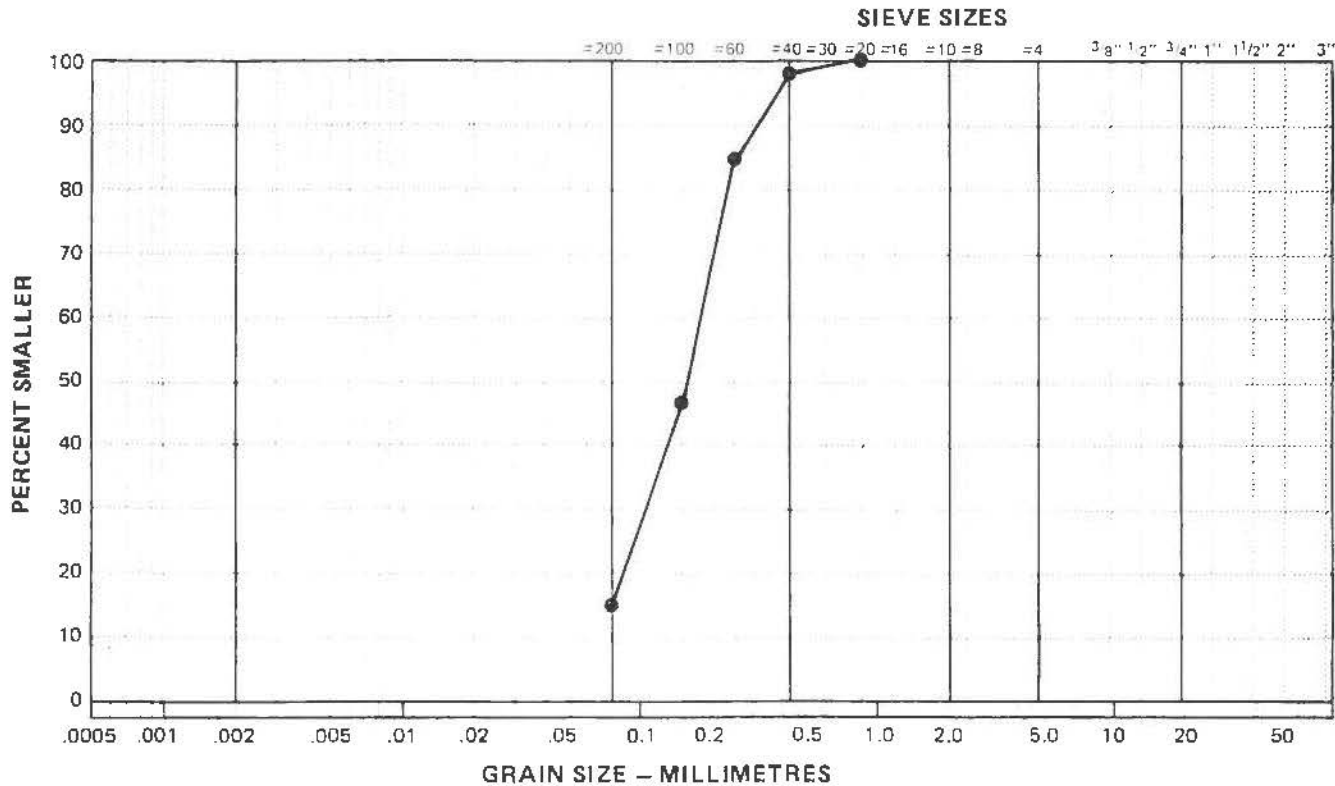
Cc: _____

Natural Moisture Content: _____ %

Remarks: Blend Sand

| SIEVE | PERCENTAGE PASSING |
|---------|--------------------|
| 3" | |
| 1 1/2" | |
| 1" | |
| 3/4" | |
| 1/2" | |
| 3/8" | |
| No. 4 | |
| No. 10 | |
| No. 20 | 100.0 |
| No. 40 | 98.7 |
| No. 60 | 84.4 |
| No. 100 | 47.8 |
| No. 200 | 15.3 |

| CLAY | SILT | SAND | | | GRAVEL | |
|------|------|------|--------|--------|--------|--------|
| | | FINE | MEDIUM | COARSE | FINE | COARSE |



| | | |
|-----------------------------------|------------------------------------|------------------------|
| McPHERSON GRANULAR RESOURCE STUDY | CLIENT: GOVERNMENT OF YUKON | BOREHOLE No. 10721-21 |
| McPHERSON B (SEE SITE PLAN) | BACKHOE: CAT 225 TRACKED BACKHOE | Project No: Q201-10721 |
| WHITEHORSE, YUKON | UTM ZONE: 8 N6744150.00 E485950.00 | 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 | | PERCENT GRAVEL | | | | PERCENT SAND | | | | PERCENT SILT OR FINES | | | | PERCENT CLAY | | | | DEPTH (ft) |
|-----------|-------------|-----------|-----|---|----------------------|----|----------------|----|----|----|--------------|----|----|----|-----------------------|----|----|----|--------------|----|------|----|------------|
| | | | | | 10 | 20 | 20 | 40 | 60 | 80 | 20 | 40 | 60 | 80 | 20 | 40 | 60 | 80 | 20 | 40 | 60 | 80 | |
| 0.0 | | | | ORGANIC ROOT MAT and tea ground cover | | | | | | | | | | | | | | | | | 0.0 | | |
| | | | | SILT—some clay, rootlets throughout, moist, dark brown | | | | | | | | | | | | | | | | | | | |
| | | 1 | | SAND—trace of silt, trace of fine gravel, medium to coarse grained, moist, dark brown | | | | | | | | | | | | | | | | | 2.0 | | |
| | | | | SILT—trace of clay, trace of rootlets, trace of volcanic ash, damp, brownish grey | | | | | | | | | | | | | | | | | | | |
| 1.0 | | | | SAND—trace of silt, trace of fine gravel, fine sand lenses throughout, damp, loose, sloughing badly, dark brownish grey | | | | | | | | | | | | | | | | | 4.0 | | |
| | | 2 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| 2.0 | | | | | | | | | | | | | | | | | | | | | | | |
| | | 3 | | | | | | | | | | | | | | | | | | | 8.0 | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| 3.0 | | | | | | | | | | | | | | | | | | | | | | | |
| | | 4 | | | | | | | | | | | | | | | | | | | 12.0 | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| 4.0 | | | | | | | | | | | | | | | | | | | | | 14.0 | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| 5.0 | | | | END OF TESTPIT 4.5 m | | | | | | | | | | | | | | | | | 16.0 | | |

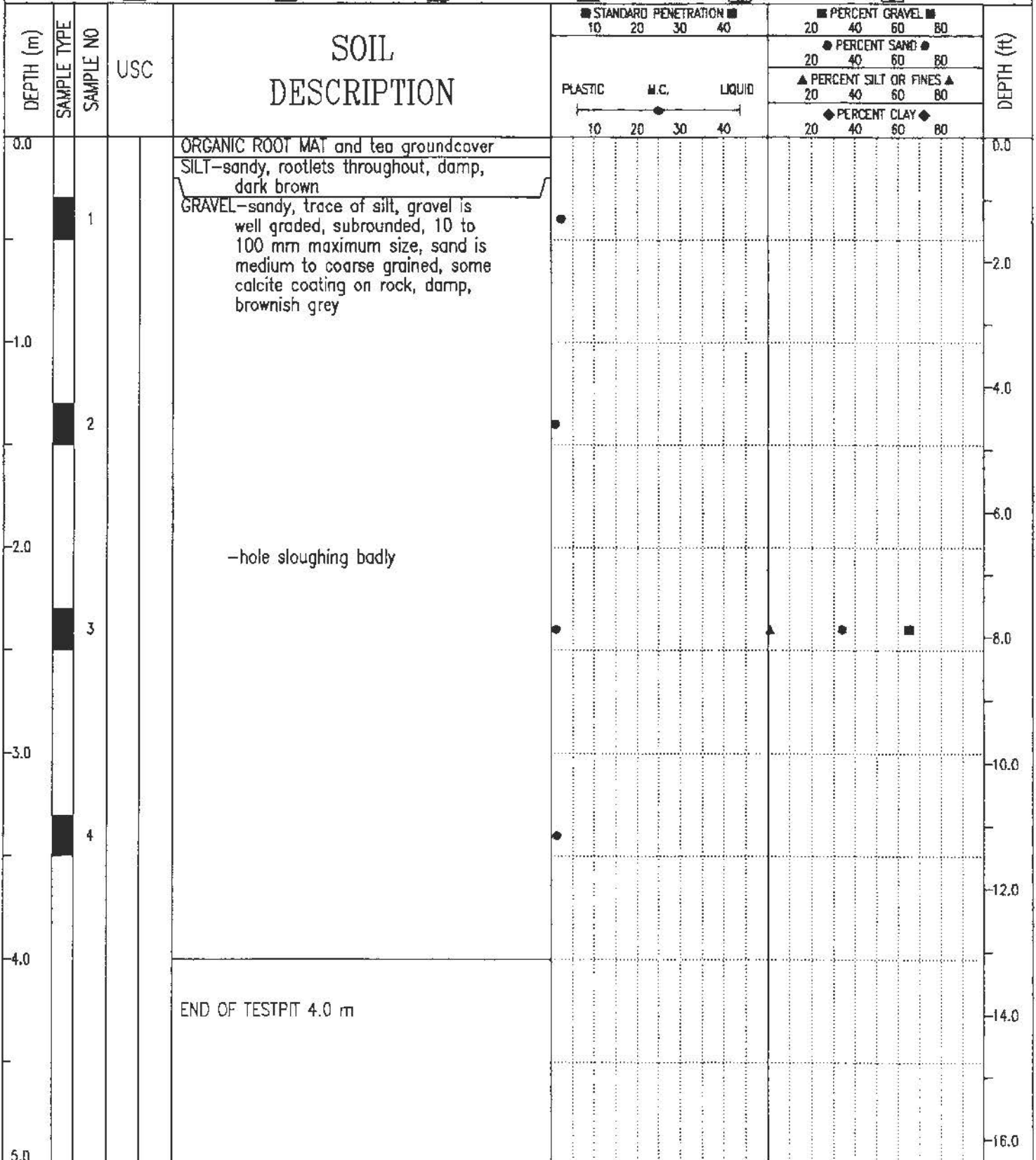
| | | |
|-----------------------------------|------------------------------------|------------------------|
| McPHERSON GRANULAR RESOURCE STUDY | CLIENT: GOVERNMENT OF YUKON | BOREHOLE No. 10721-22 |
| McPHERSON B (SEE SITE PLAN) | BACKHOE: CAT 225 TRACKED BACKHOE | Project No: 0201-10721 |
| WHITEHORSE, YUKON | UTM ZONE: 8 N6743400.00 E486140.00 | 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 | | PERCENT GRAVEL | | | | PERCENT SAND | | | | PERCENT SILT OR FINES | | | | PERCENT CLAY | | | | DEPTH (ft) |
|-----------|-------------|-----------|-----|---|----------------------|----|----------------|----|----|----|--------------|----|----|----|-----------------------|----|----|----|--------------|----|----|-----|------------|
| | | | | | 10 | 20 | 30 | 40 | 20 | 40 | 60 | 80 | 20 | 40 | 60 | 80 | 20 | 40 | 60 | 80 | 20 | 40 | |
| 0.0 | | | | ORGANIC ROOT MAT - sparse tea ground cover | | | | | | | | | | | | | | | | | | 0.0 | |
| | | 1 | | SILT - some sand, rootlets throughout, some sand lenses, rootlets to 0.7 m, moist, medium brown | | | | | | | | | | | | | | | | | | | |
| 1.0 | | | | SAND - trace of silt, trace of fine gravel, sand is medium to coarse, damp, loose, sloughing badly, greyish brown | | | | | | | | | | | | | | | | | | | |
| | | 2 | | | | | | | | | | | | | | | | | | | | | |
| 2.0 | | | | -interbedded coarse and medium coarse sand | | | | | | | | | | | | | | | | | | | |
| | | 3 | | | | | | | | | | | | | | | | | | | | | |
| 3.0 | | | | | | | | | | | | | | | | | | | | | | | |
| | | 4 | | | | | | | | | | | | | | | | | | | | | |
| 4.0 | | | | -end of testpit 4.0 m due to sloughing sands | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| 5.0 | | | | END OF TESTPIT 4.0 m | | | | | | | | | | | | | | | | | | | |

| | | |
|---|------------------------|-------------------|
| EBA Engineering Consultants Ltd. Whitehorse, Yukon | COMPLETION DEPTH 4.0 m | COMPLETE 91/08/10 |
| | LOGGED BY JRT | DWG NO. |

| | | |
|--|------------------------------------|------------------------|
| McPHERSON GRANULAR RESOURCE STUDY | CLIENT: GOVERNMENT OF YUKON | BORE-HOLE No. 10721-23 |
| McPHERSON B (SEE SITE PLAN) | BACKHOE: CAT 225 TRACKED BACKHOE | Project No: 0201-10721 |
| WHITEHORSE, YUKON | UTM ZONE: 8 N6743330.00 E486200.00 | ELEVATION 0.00 (m) |
| SAMPLE TYPE <input type="checkbox"/> GRAB SAMPLE <input checked="" type="checkbox"/> NO RECOVERY <input checked="" type="checkbox"/> STANDARD PEN. <input type="checkbox"/> 75 mm SPOON <input type="checkbox"/> CRREL BARREL <input type="checkbox"/> | | |



EBA Engineering Consultants Ltd.
Whitehorse, Yukon

COMPLETION DEPTH 4.0 m

COMPLETE 91/08/10

LOGGED BY JRT

DWG NO.

Page 1 of 1

LARGE AGGREGATE ANALYSIS REPORT

Project: McPHERSON GRANULAR STUDY

Sample Number: 4838. B

Address: _____

Sample Location: TP 23, AREA "B".

Project Number: 201 -10721

Date Sampled: 91-08-23 By: _____

Time: _____ Temp.: _____ °C

Client: Y. T. G. -LANDS BRANCH

Date Tested: 91-09-05

WHITEHORSE, Y. T.

Tested By: ATE

Natural Moisture Content: _____

Crushed Faces: _____ 1 _____ 2

Attention: _____

Soil Description: GRAVEL (75 mm MAX.), SANDY, TR. SILT, BROWN.

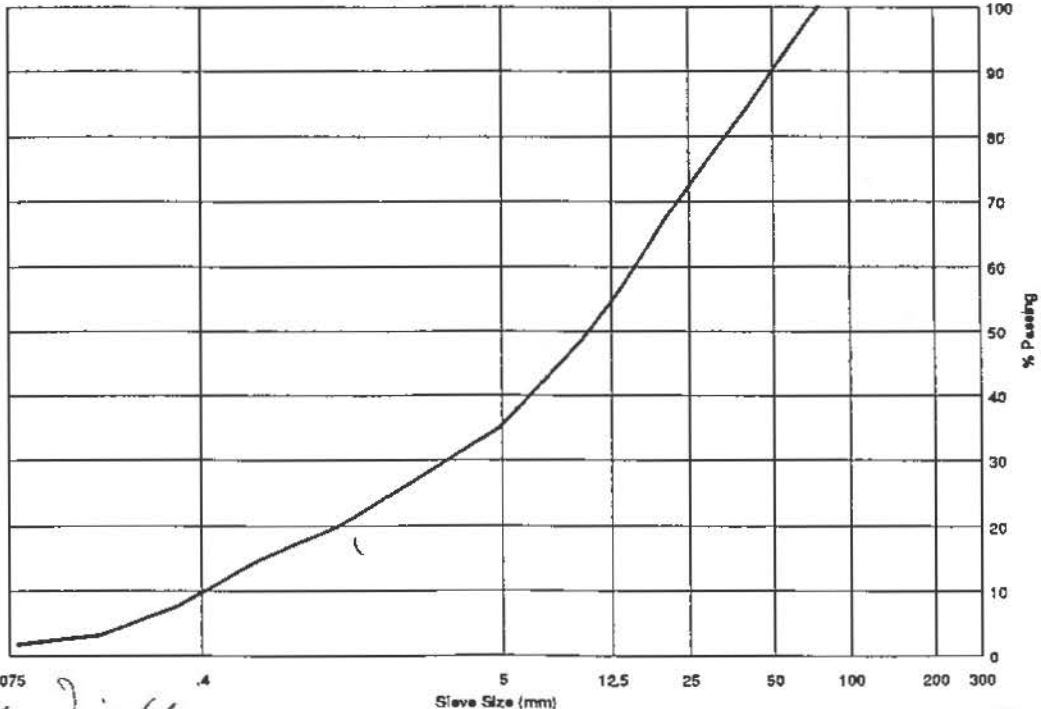
Cu: _____

Cc: _____

Remarks: _____

Grading Curve of Aggregate

| Sieve Size | % Passing |
|------------|-----------|
| 75.0 | 100.0 |
| 56.0 | 92.8 |
| 40.0 | 84.0 |
| 28.0 | 75.4 |
| 20.0 | 66.8 |
| 14.0 | 56.6 |
| 10.0 | 48.5 |
| 5.00 | 34.9 |
| 2.50 | 27.0 |
| 1.25 | 19.4 |
| .630 | 14.0 |
| .315 | 7.0 |
| .160 | 2.5 |
| .080 | 1.1 |



Reviewed By: William J. Noble P. Eng.

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| | | |
|-----------------------------------|------------------------------------|------------------------|
| McPHERSON GRANULAR RESOURCE STUDY | CLIENT: GOVERNMENT OF YUKON | BOREHOLE No. 10721-24 |
| McPHERSON B (SEE SITE PLAN) | BACKHOE: CAT 225 TRACKED BACKHOE | Project No: 0201-10721 |
| WHITEHORSE, YUKON | UTM ZONE: 8 N6743210.00 E486180.00 | 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 | | PERCENT GRAVEL | | PERCENT SAND | | PERCENT SILT OR FINES | | PERCENT CLAY | | DEPTH (ft) |
|-----------|-------------|-----------|-----|--|----------------------|----|----------------|----|--------------|----|-----------------------|----|--------------|----|------------|
| | | | | | 10 | 20 | 20 | 40 | 20 | 40 | 20 | 40 | 20 | 40 | |
| 0.0 | | | | ORGANIC ROOT MAT and tea ground cover SILT-sandy, rootlets throughout | | | | | | | | | | | 0.0 |
| 1.0 | | 1 | | | | | | | | | | | | | 2.0 |
| 2.0 | | 2 | | | | | | | | | | | | | 6.0 |
| 3.0 | | 3 | | SAND-trace of silt, trace of gravel, rootlets to 0.5 m, medium to coarse grained, damp, compact, medium brown | | | | | | | | | | | 8.0 |
| 4.0 | | 4 | | -becomes fine to medium grained and greyish brown below 1.0 m | | | | | | | | | | | 10.0 |
| 4.5 | | | | -interbedded with medium grained sand throughout | | | | | | | | | | | 12.0 |
| 5.0 | | | | END OF TESTPIT 4.5 m | | | | | | | | | | | 16.0 |

| | | |
|-----------------------------------|------------------------------------|------------------------|
| McPHERSON GRANULAR RESOURCE STUDY | CLIENT: GOVERNMENT OF YUKON | BOREHOLE No. 10721-26 |
| McPHERSON B (SEE SITE PLAN) | BACKHOE: CAT 225 TRACKED BACKHOE | Project No: 0201-10721 |
| WHITEHORSE, YUKON | UTM ZONE: 8 N6743060.00 E486450.00 | ELEVATION 0.00 (m) |

SAMPLE TYPE GRAB SAMPLE NO RECOVERY STANDARD PEN. 75 mm SPOON CORREL. BARREL

| DEPTH (m) | SAMPLE TYPE | SAMPLE NO | USC | SOIL DESCRIPTION | STANDARD PENETRATION | | | | PERCENT GRAVEL | | | | PERCENT SAND | | | | PERCENT SILT OR FINES | | | | PERCENT CLAY | | | | DEPTH (ft) |
|-----------|-------------|-----------|-----|--|----------------------|----|----|----|----------------|----|----|----|--------------|----|----|----|-----------------------|----|----|----|--------------|----|----|----|------------|
| | | | | | 10 | 20 | 30 | 40 | 20 | 40 | 60 | 80 | 20 | 40 | 60 | 80 | 20 | 40 | 60 | 80 | 20 | 40 | 60 | 80 | |
| 0.0 | | | | ORGANIC ROOT MAT, grass and tea ground cover SILT-sandy, trace of gravel, rootlets to 0.7 m, damp, dark brown | | | | | | | | | | | | | | | | | | | | | 0.0 |
| -1.0 | | | | GRAVEL-sand, trace of silt, gravel up to 150 mm in size, well graded, sand is fine to medium grained, coarser with depth, calcite coatings on rock, damp, loose, greyish brown | | | | | | | | | | | | | | | | | | | | | -4.0 |
| -2.0 | | 1 | | | | | | | | | | | | | | | | | | | | | | | -6.0 |
| -3.0 | | | | END OF TESTPIT 3.0 m | | | | | | | | | | | | | | | | | | | | | -10.0 |
| -4.0 | | | | | | | | | | | | | | | | | | | | | | | | | -12.0 |
| -5.0 | | | | | | | | | | | | | | | | | | | | | | | | | -16.0 |

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.

Sample Number: 4838.9
 Sample Location: TP 26, AREA "B".
 Time: _____ Temp.: _____ °C
 Date Tested: 91-09-04
 Tested By: ATE
 Natural Moisture Content: _____
 Crushed Faces: _____ 1 _____ 2

Attention: _____

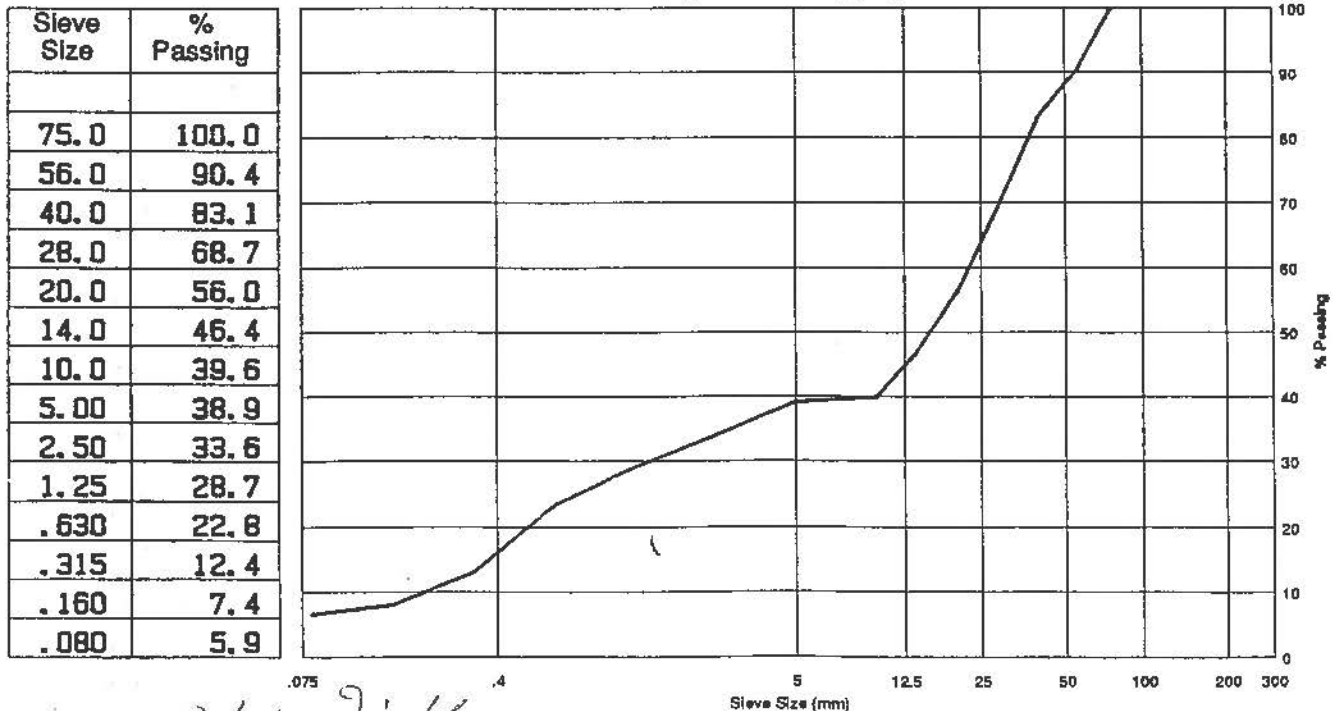
Soil Description: PIT RUN, GRAVEL (75 mm MAX.) AND SAND, TR. SILT, BROWN.

Cu: _____

Cc: _____

Remarks: _____

Grading Curve of Aggregate



Reviewed By: William M. Noble P. Eng.

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| | | |
|-----------------------------------|------------------------------------|------------------------|
| McPHERSON GRANULAR RESOURCE STUDY | CLIENT: GOVERNMENT OF YUKON | BOREHOLE No. 10721-27 |
| McPHERSON B (SEE SITE PLAN) | BACKHOE: CAT 225 TRACKED BACKHOE | Project No: 0201-10721 |
| WHITEHORSE, YUKON | UTM ZONE: 8 N6742995.00 E486250.00 | ELEVATION 0.00 (m) |

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

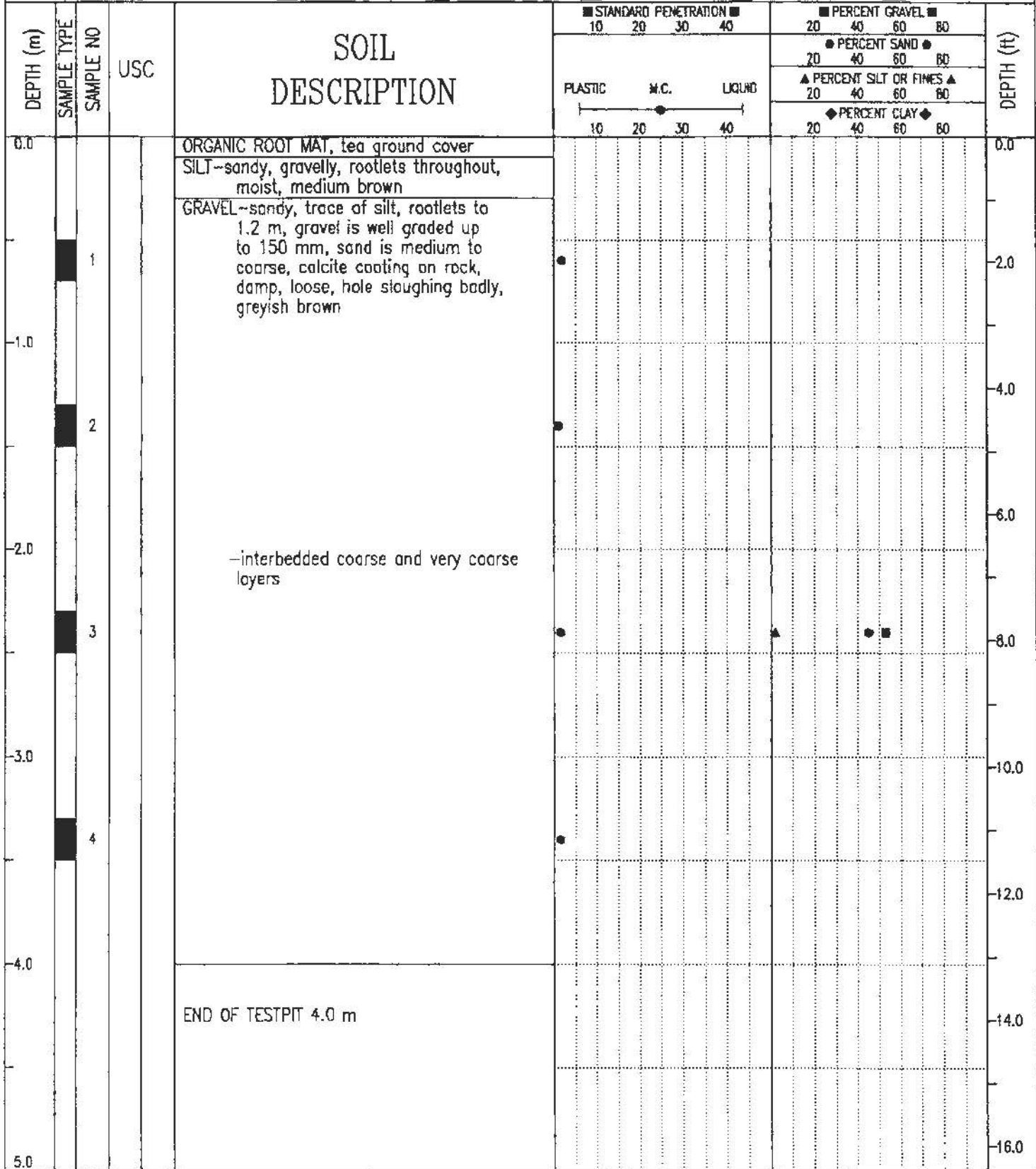
| DEPTH (m) | SAMPLE TYPE | SAMPLE NO | USC | SOIL DESCRIPTION | STANDARD PENETRATION | | PERCENT GRAVEL | | PERCENT SAND | | PERCENT SILT OR FINES | | PERCENT CLAY | | DEPTH (ft) |
|-----------|-------------|-----------|-----|--|----------------------|----|----------------|----|--------------|----|-----------------------|----|--------------|----|------------|
| | | | | | 10 | 20 | 30 | 40 | 20 | 40 | 60 | 80 | 20 | 40 | |
| 0.0 | | | | ORGANIC ROOT MAT and tea ground cover SILT-sandy, rootlets throughout, damp, medium brown | | | | | | | | | | | 0.0 |
| 1.0 | | 1 | | GRAVEL-sandy, trace of silt, rootlets to 1.2 m, gravel is fine, uniform, 50 mm maximum size, sand is medium to coarse grained, damp, loose, medium brown | | | | | | | | | | | 2.0 |
| 2.0 | | 2 | | SAND-trace of silt, trace of gravel, interbedded coarse and fine throughout depth of testpit | | | | | | | | | | | 6.0 |
| 3.0 | | 3 | | -hole terminated due to sloughing | | | | | | | | | | | 10.0 |
| 4.0 | | | | END OF TESTPIT 3.5 m | | | | | | | | | | | 12.0 |

| | | |
|-----------------------------------|------------------------------------|------------------------|
| McPHERSON GRANULAR RESOURCE STUDY | CLIENT: GOVERNMENT OF YUKON | BOREHOLE No. 10721-28 |
| McPHERSON B (SEE SITE PLAN) | BACKHOE: CAT 225 TRACKED BACKHOE | Project No: 0201-10721 |
| WHITEHORSE, YUKON | UTM ZONE: 8 N6742750.00 E486240.00 | ELEVATION 0.00 (m) |

SAMPLE TYPE GRAB SAMPLE NO RECOVERY STANDARD PEN. 75 mm SPOON CORREL BARREL

| DEPTH (m) | SAMPLE TYPE | SAMPLE NO | USC | SOIL DESCRIPTION | STANDARD PENETRATION | | | | PERCENT GRAVEL | | | | DEPTH (ft) | |
|-----------|-------------|-----------|-----|---|----------------------|----|----|----|----------------|----|----|----|------------|------|
| | | | | | 10 | 20 | 30 | 40 | 20 | 40 | 60 | 80 | | |
| 0.0 | | | | ORGANIC ROOT MAT with tea ground cover | | | | | | | | | | 0.0 |
| | | | | SILT-sandy, rootlets to 0.5 m, moist, medium brown | | | | | | | | | | |
| | | 1 | | SAND-some silt to trace of silt, occasional rootlets, fine to medium grained, damp, greyish brown | | | | | | | | | | 2.0 |
| -1.0 | | | | | | | | | | | | | | |
| | | 2 | | -becomes coarser and cleaner with traces of fine to medium grained gravel, damp, greyish brown | | | | | | | | | | 6.0 |
| -2.0 | | | | | | | | | | | | | | |
| | | 3 | | -hole sloughing | | | | | | | | | | 10.0 |
| -3.0 | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | 12.0 |
| -4.0 | | | | END OF TESTPIT 4.0 m | | | | | | | | | | 14.0 |
| | | | | | | | | | | | | | | 16.0 |

| | | |
|-----------------------------------|---|---|
| McPHERSON GRANULAR RESOURCE STUDY | CLIENT: GOVERNMENT OF YUKON | BOREHOLE No. 10721-29 |
| McPHERSON B (SEE SITE PLAN) | BACKHOE: CAT 225 TRACKED BACKHOE | Project No: 0201-10721 |
| WHITEHORSE, YUKON | UTM ZONE: 8 N6742660.00 E486460.00 | ELEVATION 0.00 (m) |
| SAMPLE TYPE | <input checked="" type="checkbox"/> GRAB SAMPLE | <input checked="" type="checkbox"/> NO RECOVERY |
| | <input checked="" type="checkbox"/> STANDARD PEN. | <input type="checkbox"/> 75 mm SPOON |
| | <input type="checkbox"/> CRREL BARREL | <input type="checkbox"/> |



LARGE AGGREGATE ANALYSIS REPORT

Project: McPHERSON GRANULAR STUDY

Sample Number: 4838.11

Address: _____

Sample Location: TP 29, AREA "B".

Project Number: 2D1 -10721

Date Sampled: 91-09-23 By: _____

Time: _____ Temp.: _____ °C

Client: Y. T. G. -LANDS BRANCH

Date Tested: 91-09-06

WHITEHORSE, Y. T.

Tested By: ATE

Natural Moisture Content: 2.1

Crushed Faces: _____ 1 _____ 2

Attention: _____

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

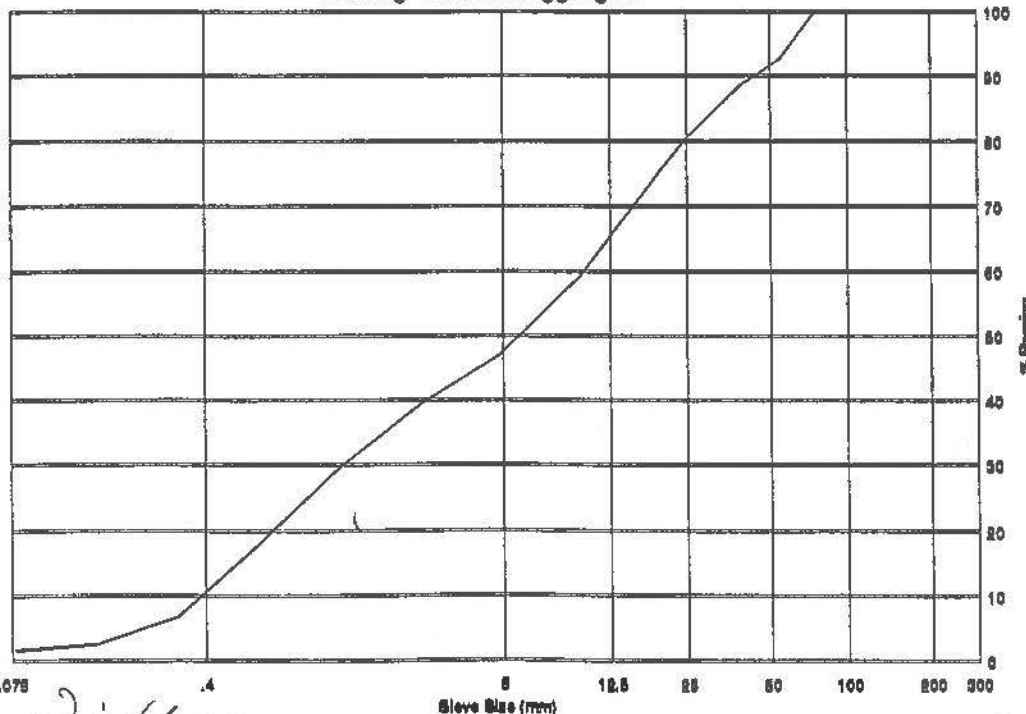
Cu: _____

Cc: _____

Remarks: _____

Grading Curve of Aggregate

| Sieve Size | % Passing |
|------------|-----------|
| 75.0 | 100.0 |
| 56.0 | 92.7 |
| 40.0 | 88.7 |
| 25.0 | 80.5 |
| 20.0 | 75.5 |
| 12.5 | 64.4 |
| 10.0 | 59.0 |
| 5.00 | 46.9 |
| 2.50 | 39.2 |
| 1.25 | 29.3 |
| .630 | 17.5 |
| .315 | 6.3 |
| .160 | 2.1 |
| .080 | 1.2 |



Reviewed By: Walter J. Winkler P. Eng.

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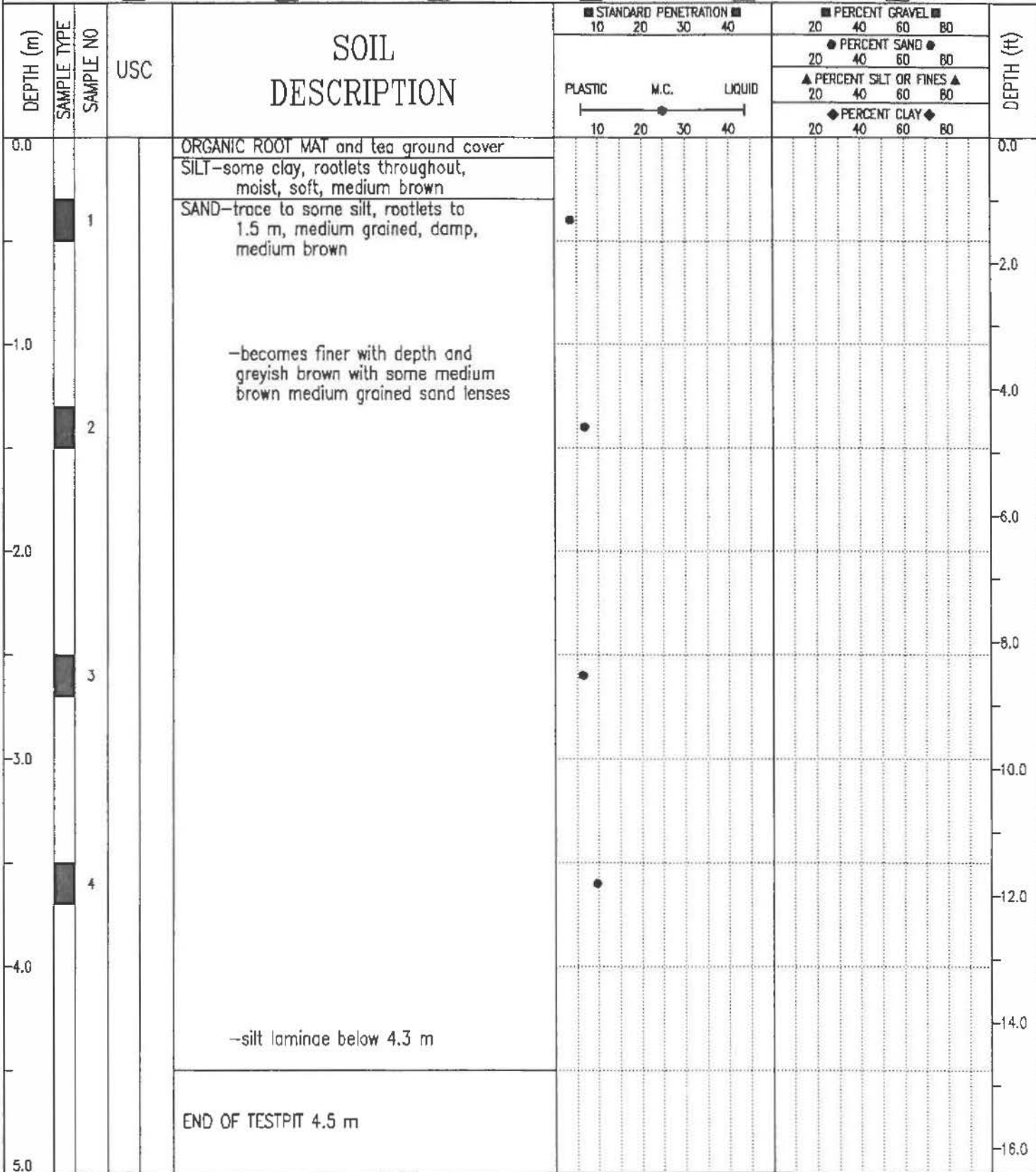
| | | |
|-----------------------------------|------------------------------------|------------------------|
| McPHERSON GRANULAR RESOURCE STUDY | CLIENT: GOVERNMENT OF YUKON | BOREHOLE No. 10721-30 |
| McPHERSON B (SEE SITE PLAN) | BACKHOE: CAT 225 TRACKED BACKHOE | Project No: 0201-10721 |
| WHITEHORSE, YUKON | UTM ZONE: 8 N6742510.00 E486620.00 | 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 | | | | PERCENT GRAVEL | | | | DEPTH (ft) |
|-----------|-------------|-----------|-----|---|----------------------|----|----|----|----------------|----|----|----|------------|
| | | | | | 10 | 20 | 30 | 40 | 20 | 40 | 60 | 80 | |
| 0.0 | | | | ORGANIC ROOT MAT with tea ground cover SILT—some sand, rootlets to 0.4 m, damp, medium brown | | | | | | | | | 0.0 |
| 1.0 | | 1 | | SAND—trace of silt, occasional gravel in matrix, silt lens at 1.2 m | | | | | | | | | 2.0 |
| 2.0 | | 2 | | —gravel seam from 1.2 to 1.5 m | | | | | | | | | 4.0 |
| 3.0 | | 3 | | SAND AND GRAVEL—trace of silt, gravel is well graded, up to 75 mm, sand is medium to fine grained, some calcitic coatings on rock, damp, greyish brown, compact | | | | | | | | | 10.0 |
| 4.0 | | 4 | | —becomes GRAVEL AND SAND with trace of silt below 3.5 m | | | | | | | | | 12.0 |
| 5.0 | | | | END OF TESTPIT 4.5 m | | | | | | | | | 16.0 |

| | | |
|---|------------------------|-------------------|
| EBA Engineering Consultants Ltd. Whitehorse, Yukon | COMPLETION DEPTH 4.5 m | COMPLETE 91/08/10 |
| | LOGGED BY JRT | OWG NO. |

| | | |
|--|------------------------------------|------------------------|
| McPHERSON GRANULAR RESOURCE STUDY | CLIENT: GOVERNMENT OF YUKON | BOREHOLE No. 10721-31 |
| McPHERSON B (SEE SITE PLAN) | BACKHOE: CAT 225 TRACKED BACKHOE | Project No: 0201-10721 |
| WHITEHORSE, YUKON | UTM ZONE: 8 N6742400.00 E486760.00 | ELEVATION 0.00 (m) |
| SAMPLE TYPE <input checked="" type="checkbox"/> GRAB SAMPLE <input checked="" type="checkbox"/> NO RECOVERY <input checked="" type="checkbox"/> STANDARD PEN. <input checked="" type="checkbox"/> 75 mm SPDON <input type="checkbox"/> CRREL BARREL <input type="checkbox"/> | | |



| | | |
|---|------------------------|-------------------|
| EBA Engineering Consultants Ltd. Whitehorse, Yukon | COMPLETION DEPTH 4.5 m | COMPLETE 91/08/10 |
| | LOGGED BY JRT | DWG NO. |

| | | |
|-----------------------------------|------------------------------------|------------------------|
| McPHERSON GRANULAR RESOURCE STUDY | CLIENT: GOVERNMENT OF YUKON | BOREHOLE No. 10721-32 |
| McPHERSON B (SEE SITE PLAN) | BACKHOE: CAT 225 TRACKED BACKHOE | Project No: 0201-10721 |
| WHITEHORSE, YUKON | UTM ZONE: 8 N6742250.00 E486590.00 | ELEVATION 0.00 (m) |

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

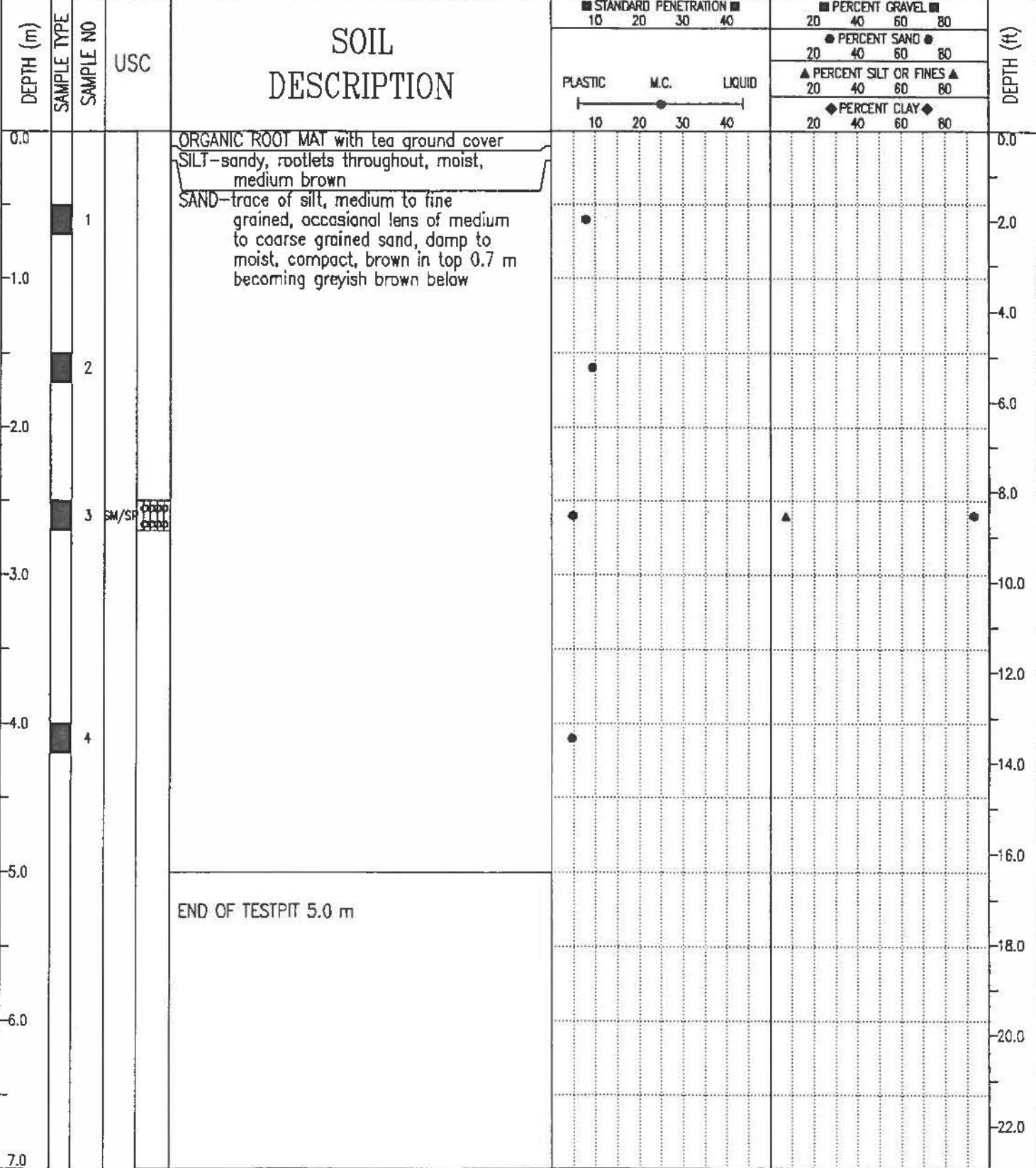
| DEPTH (m) | SAMPLE TYPE | SAMPLE NO | USC | SOIL DESCRIPTION | STANDARD PENETRATION | | PERCENT GRAVEL | | PERCENT SAND | | PERCENT SILT OR FINES | | PERCENT CLAY | | DEPTH (ft) |
|-----------|-------------|-----------|-----|---|----------------------|----|----------------|----|--------------|----|-----------------------|----|--------------|----|------------|
| | | | | | 10 | 20 | 20 | 40 | 20 | 40 | 20 | 40 | 20 | 40 | |
| 0.0 | | | | ROOT MAT and shrub ground cover | | | | | | | | | | | 0.0 |
| | | | | SILT-some clay, trace of sand, rootlets, damp, medium brown | | | | | | | | | | | |
| | | 1 | | SAND-trace of silt, medium grained, trace of rootlets, damp, greyish brown | | | | | | | | | | | 2.0 |
| | | | | SILT LENSES from 0.6 to 1.0 m | | | | | | | | | | | |
| -1.0 | | | | SAND-trace of silt, interbedded fine grained and medium grained sand, horizontally bedded, damp, loose, light brownish grey | | | | | | | | | | | 4.0 |
| | | 2 | | | | | | | | | | | | | 6.0 |
| -2.0 | | | | | | | | | | | | | | | 8.0 |
| | | 3 | | | | | | | | | | | | | 10.0 |
| -3.0 | | | | -hole sloughing | | | | | | | | | | | 12.0 |
| | | 4 | | | | | | | | | | | | | 14.0 |
| -4.0 | | | | | | | | | | | | | | | 16.0 |
| -5.0 | | | | END OF TESTPIT 4.8 m | | | | | | | | | | | 18.0 |
| -6.0 | | | | | | | | | | | | | | | 20.0 |
| -7.0 | | | | | | | | | | | | | | | 22.0 |

EBA Engineering Consultants Ltd.
Whitehorse, Yukon

| | |
|------------------------|-------------------|
| COMPLETION DEPTH 4.8 m | COMPLETE 91/08/10 |
| LOGGED BY JRT | DWG NO. |
| | Page 1 of 1 |

| | | |
|-----------------------------------|------------------------------------|------------------------|
| McPHERSON GRANULAR RESOURCE STUDY | CLIENT: GOVERNMENT OF YUKON | BOREHOLE No. 10721-33 |
| McPHERSON B (SEE SITE PLAN) | BACKHOE: CAT 225 TRACKED BACKHOE | Project No: 0201-10721 |
| WHITEHORSE, YUKON | UTM ZONE: 8 N6742300.00 E486310.00 | ELEVATION 0.00 (m) |

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



| | | |
|---|------------------------|-------------------|
| EBA Engineering Consultants Ltd. Whitehorse, Yukon | COMPLETION DEPTH 5.0 m | COMPLETE 91/08/10 |
| | LOGGED BY JRT | DWG NO. |

EBA Engineering Consultants Ltd.

PARTICLE - SIZE ANALYSIS OF SOILS

Project: MacPherson B Granular Study
Whitehorse, Yukon

Project Number: 0201-10721

Date Tested: 91-09-20

Borehole Number: 10721-33

Depth: 2.5 m

Soil Description: SAND (SM/SP) - trace of silt

Cu: .3

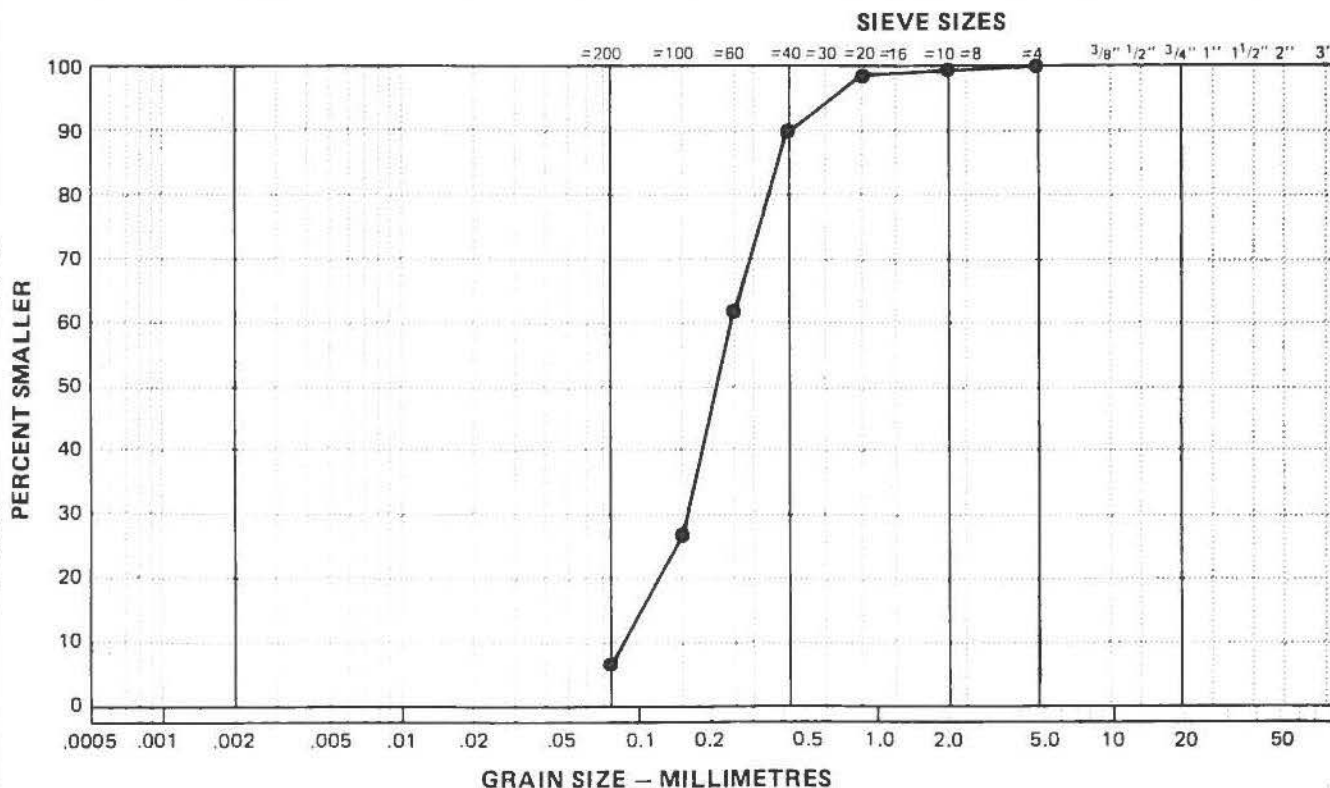
Cc: .05

Natural Moisture Content: _____ %

Remarks: _____

| SIEVE | PERCENTAGE PASSING |
|---------|--------------------|
| 3" | |
| 1 1/2" | |
| 1" | |
| 3/4" | |
| 1/2" | |
| 3/8" | |
| No. 4 | 100.0 |
| No. 10 | 99.9 |
| No. 20 | 99.0 |
| No. 40 | 90.0 |
| No. 60 | 61.3 |
| No. 100 | 27.2 |
| No. 200 | 7.0 |

| CLAY | SILT | SAND | | | GRAVEL | |
|------|------|------|--------|--------|--------|--------|
| | | FINE | MEDIUM | COARSE | FINE | COARSE |

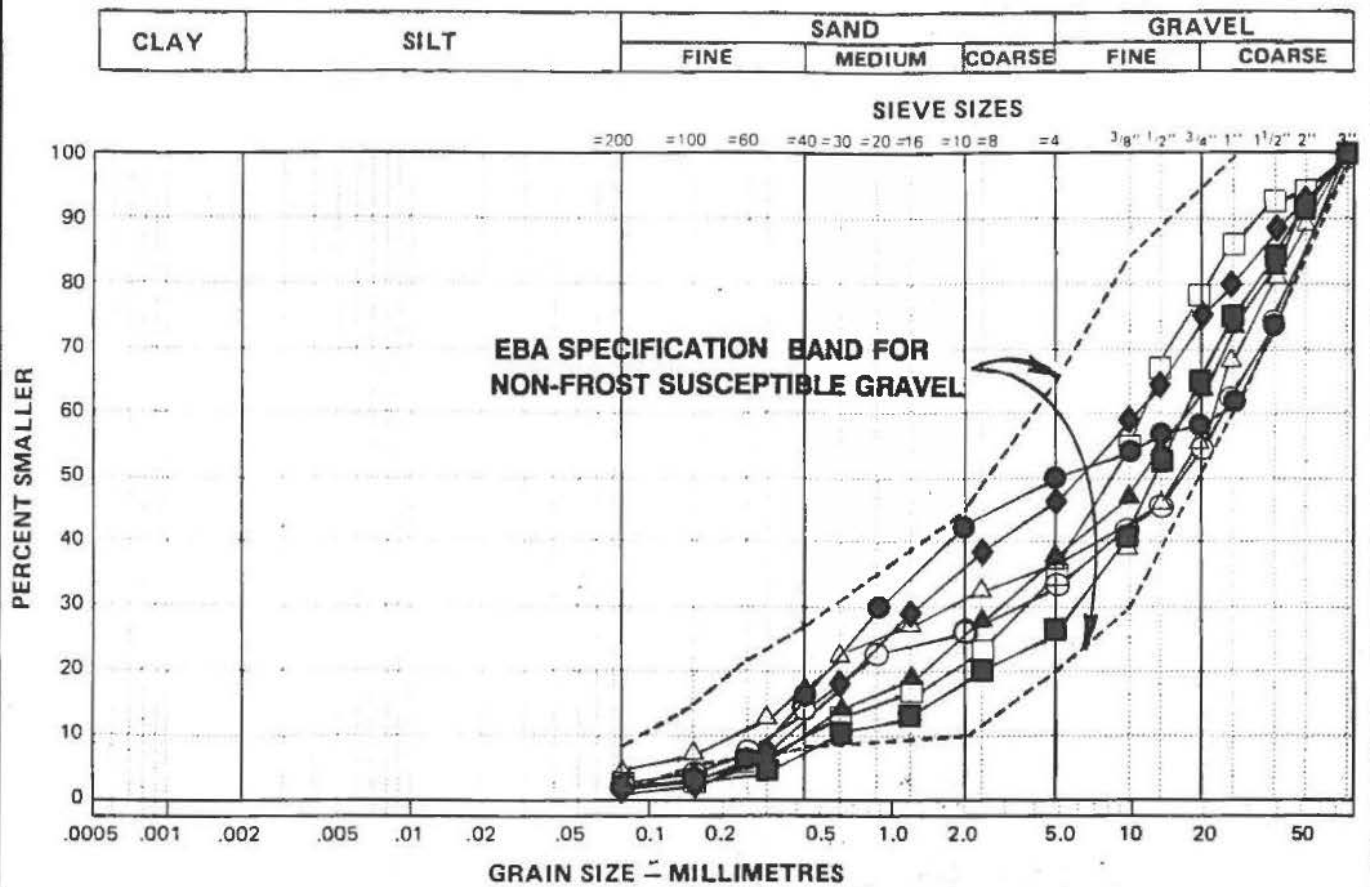


| | | |
|---|------------------------------------|------------------------|
| McPHERSON GRANULAR RESOURCE STUDY | CLIENT: GOVERNMENT OF YUKON | BOREHOLE No. 10721-34 |
| McPHERSON B (SEE SITE PLAN) | BACKHOE: CAT 225 TRACKED BACKHOE | Project No: 0201-10721 |
| WHITEHORSE, YUKON | UTM ZONE: 8 N6742510.00 E486220.00 | ELEVATION 0.00 (m) |
| SAMPLE TYPE <input type="checkbox"/> GRAB SAMPLE <input checked="" type="checkbox"/> NO RECOVERY <input checked="" type="checkbox"/> STANDARD PEN. <input checked="" type="checkbox"/> 75 mm SPOON <input type="checkbox"/> CRREL BARREL <input type="checkbox"/> | | |

| DEPTH (m) | SAMPLE TYPE | SAMPLE NO | USC | SOIL DESCRIPTION | STANDARD PENETRATION | | | | PERCENT GRAVEL | | | | DEPTH (ft) |
|-----------|-------------|-----------|-----|--|----------------------|----|----|----|----------------|----|----|----|------------|
| | | | | | 10 | 20 | 30 | 40 | 20 | 40 | 60 | 80 | |
| 0.0 | | | | ORGANIC ROOT MAT - no ground cover SILT - some sand, rootlets throughout, damp to moist, medium brown | | | | | | | | | 0.0 |
| | | | | SAND - trace to some silt, medium to fine grained, moist, medium brown - sand becomes fine grained, occasional organic inclusions, damp, greyish brown | | | | | | | | | -2.0 |
| -1.0 | | | | | | | | | | | | | -4.0 |
| -2.0 | | | | | | | | | | | | | -6.0 |
| -3.0 | | | | | | | | | | | | | -8.0 |
| | | | | END OF TESTPIT 3.0 m | | | | | | | | | -10.0 |
| | | | | | | | | | | | | | -12.0 |
| | | | | | | | | | | | | | -14.0 |
| | | | | | | | | | | | | | -16.0 |

| | | |
|---|------------------------|-------------------|
| EBA Engineering Consultants Ltd. Whitehorse, Yukon | COMPLETION DEPTH 3.0 m | COMPLETE 91/08/10 |
| | LOGGED BY JRT | DWG NO. |

SUMMARY OF GRAIN SIZE ANALYSIS - MacPHERSON AREA "B"



| SYMBOL | BOREHOLE NUMBER | DEPTH (m) | DESCRIPTION | | | | Cu | Cc | U.S.C. |
|--------|-----------------|-----------|-------------|----------|----------|------------|-----|----|--------|
| | | | CLAY (%) | SILT (%) | SAND (%) | GRAVEL (%) | | | |
| ● | 10721-13 | 2.5 - 3.3 | 3 | 47 | 50 | 64 | 0.1 | GP | |
| ○ | 10721-14 | 0.5 - 3.5 | 2 | 34 | 66 | 83 | 1.4 | GW | |
| ■ | 10721-17 | 0.5 - 3.5 | 2 | 25 | 73 | 30 | 1.2 | GW | |
| □ | 10721-19 | 0.5 - 3.5 | 1 | 35 | 64 | 24 | 0.7 | GP | |
| ▲ | 10721-23 | 0.5 - 3.5 | 1 | 34 | 65 | 50 | 0.3 | GP | |
| △ | 10721-28 | 0.5 - 3.5 | 6 | 33 | 61 | 67 | 0.1 | GP | |
| ◆ | 10721-29 | 0.5 - 3.5 | 1 | 48 | 53 | 20 | 0.5 | GP | |

SUMMARY OF GRAIN SIZE DISTRIBUTION TESTING FOR INVESTIGATION COMPLETED BY EBA - 1991

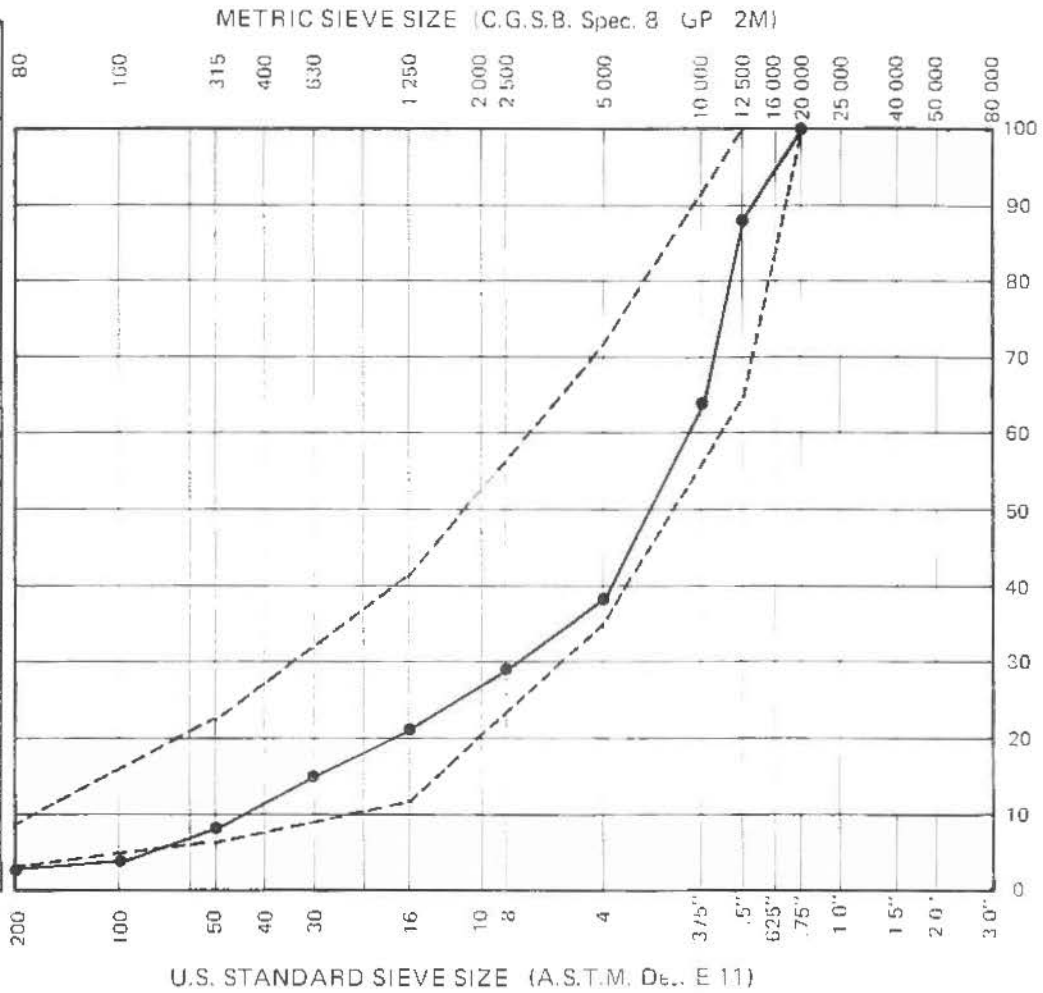


EBA Engineering Consultants Ltd.

AGGREGATE ANALYSIS REPORT

Project: McPherson Granular Study Sample Number: _____
 Address: Area "B" Sample Description: Average of 3 tests of 20 mm
Crushed Basecourse Aggregate
 Project Number: 0201-10721 Natural Moisture Content: _____ %
 Date Tested: _____ Organic Content: _____ % State of Alaska Method
 Client: Government of Yukon Colour Plate No.: _____ Other _____
 _____ Organic Impurities _____
 Attention: Mr. Ross Burnett 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 | 100.0 |
| .625" | 16 000 | |
| .5" | 12 500 | 88.0 |
| .375" | 10 000 | 64.0 |
| No. 4 | 5 000 | 38.0 |
| No. 8 | 2 500 | 29.0 |
| 16 | 1 250 | 21.0 |
| 30 | 630 | 15.0 |
| 40 | 400 | |
| 50 | 315 | 8.0 |
| 100 | 160 | 4.0 |
| 200 | 80 | 3.0 |



Remarks: Trial crush results presented following this report form

Reviewed By: *Walter Trindle* P.Eng.

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AGGREGATE ANALYSIS REPORT

Project: McPHERSON GRANULAR STUDY

Sample Number: 4838.4

Address: _____

Sample Location: TP 17, AREA "B"

Project Number: 201 -10721

Date Sampled: 91-08-23 By: _____

Client: Y. T. G. -LANDS BRANCH

Time: _____ Temp.: _____ °C

WHITEHORSE, Y. T.

Date Tested: 91-09-05

Tested By: ATE

Natural Moisture Content: _____

Attention: _____

Crushed Faces: 1 2

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

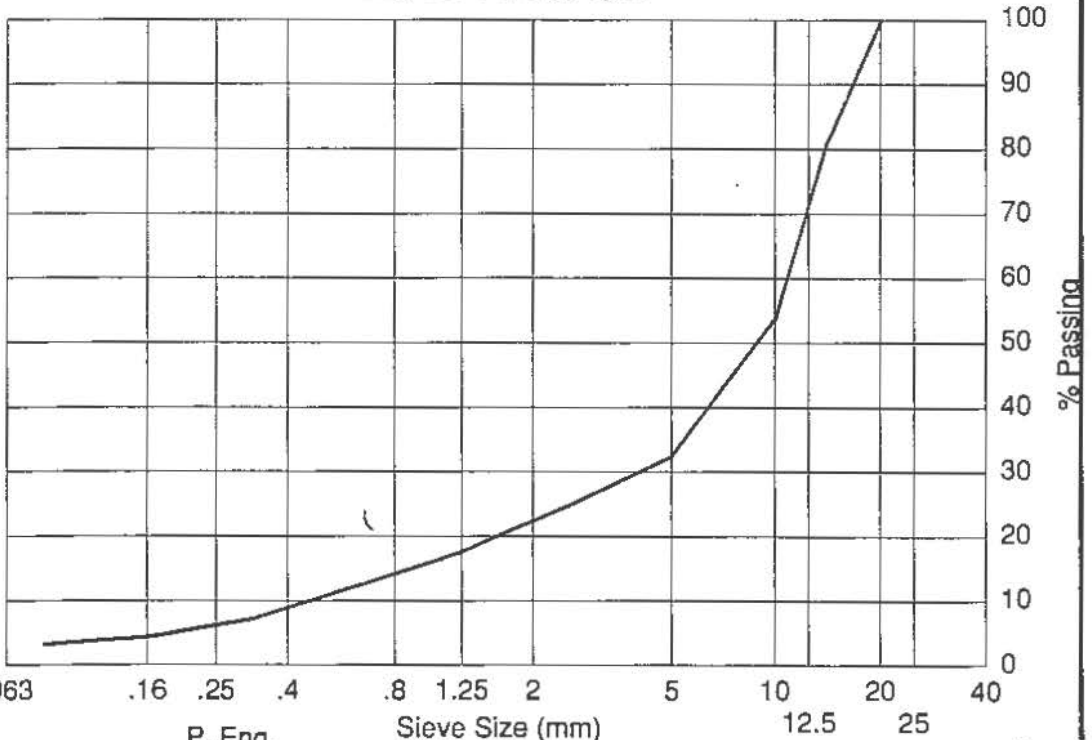
Cu: _____

Cc: _____

Remarks: LAB CRUSHED.

Grading Curve of Aggregate

| Sieve Size | % Passing |
|------------|-----------|
| 20.0 | 100.0 |
| 14.0 | 80.9 |
| 10.0 | 53.8 |
| 5.00 | 32.2 |
| 2.50 | 24.5 |
| 1.25 | 17.5 |
| .630 | 12.1 |
| .315 | 6.9 |
| .160 | 3.9 |
| .080 | 2.7 |



Reviewed By: _____ P. Eng.

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AGGREGATE ANALYSIS REPORT

Project: McPHERSON GRANULAR STUDY

Sample Number: 4838.6

Address: _____

Sample Location: TP 19, AREA "B".

Project Number: 201 -10721

Date Sampled: 91-08-23 By: _____

Client: Y. T. G. -LANDS BRANCH

Time: _____ Temp.: _____ °C

WHITEHORSE, Y. T.

Date Tested: 91-09-04

Tested By: ATE

Natural Moisture Content: _____

Attention: _____

Crushed Faces: 1 2

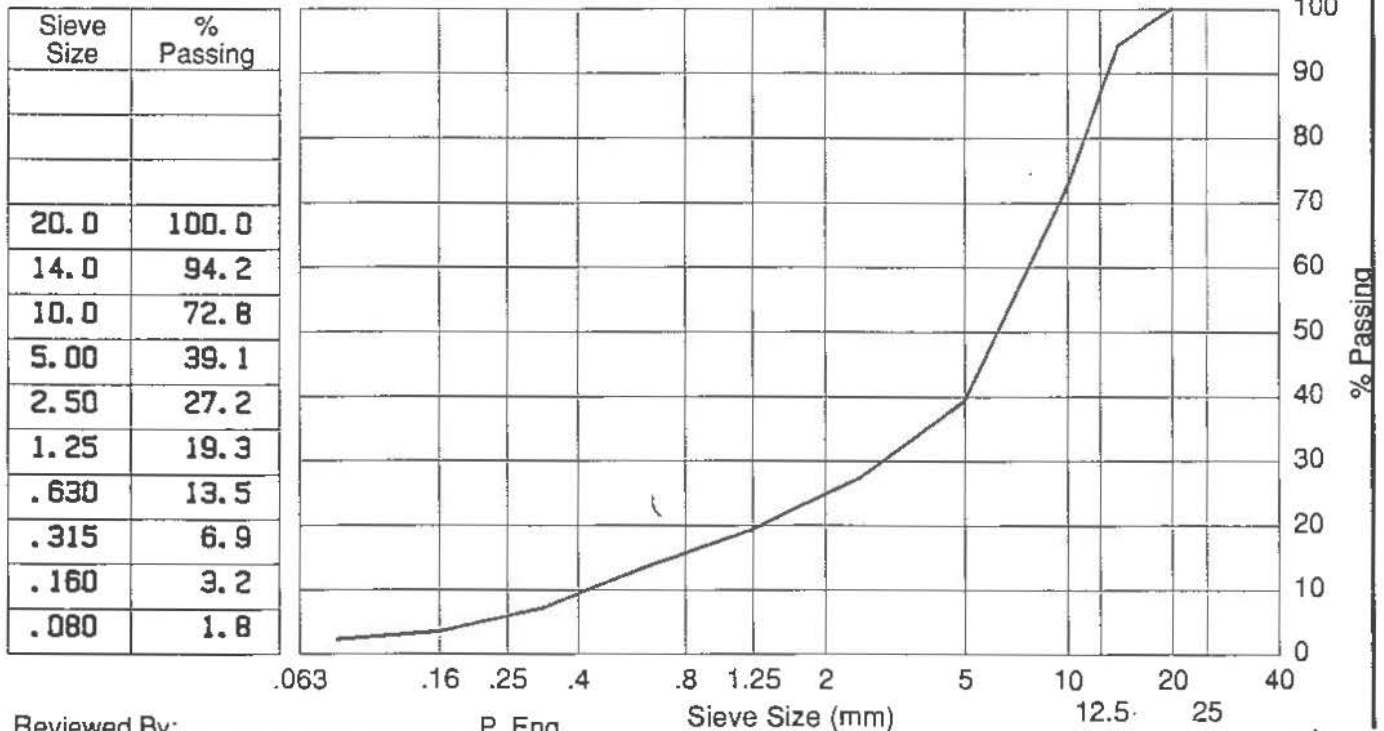
Soil Description: GRAVEL (20 mm MAX.) AND SAND, TR. SILT, BROWN.

Cu: _____

Cc: _____

Remarks: LAB CRUSHED.

Grading Curve of Aggregate



Reviewed By: _____ P. Eng.

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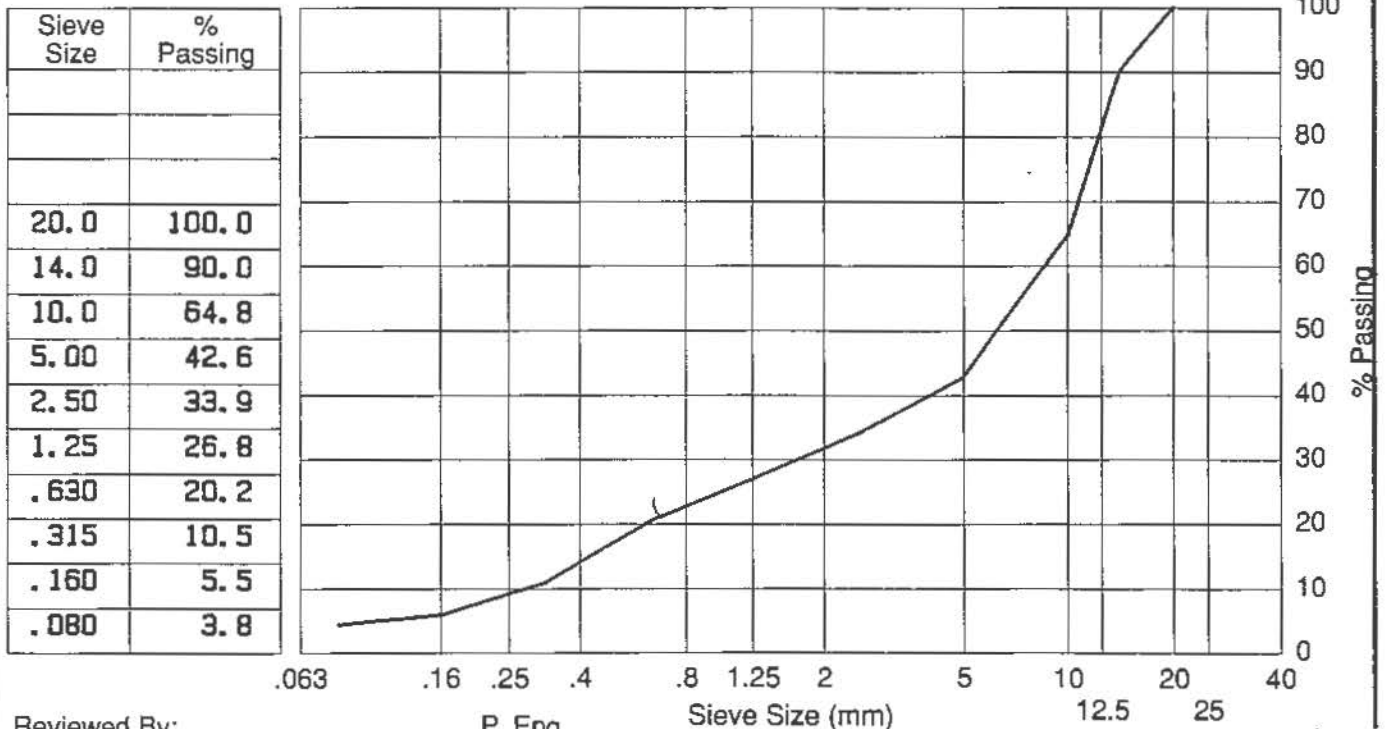


AGGREGATE ANALYSIS REPORT

Project: McPHERSON GRANULAR STUDY Sample Number: 4838.10
 Address: _____ Sample Location: TP 26, AREA "B"
 Project Number: 201 -10721
 Date Sampled: 91-08-23 By: _____
 Client: Y. T. G. -LANDS BRANCH Time: _____ Temp.: _____ °C
WHITEHORSE, Y. T. Date Tested: 91-09-05
 _____ Tested By: ATE
 _____ Natural Moisture Content: _____
 Attention: _____ Crushed Faces: _____ 1 _____ 2
 Soil Description: GRAVEL (20 mm MAX.) AND SAND, TR. SILT, BROWN.

Cu: _____
 Cc: _____
 Remarks: LAB CRUSH

Grading Curve of Aggregate



Reviewed By: _____ P. Eng.

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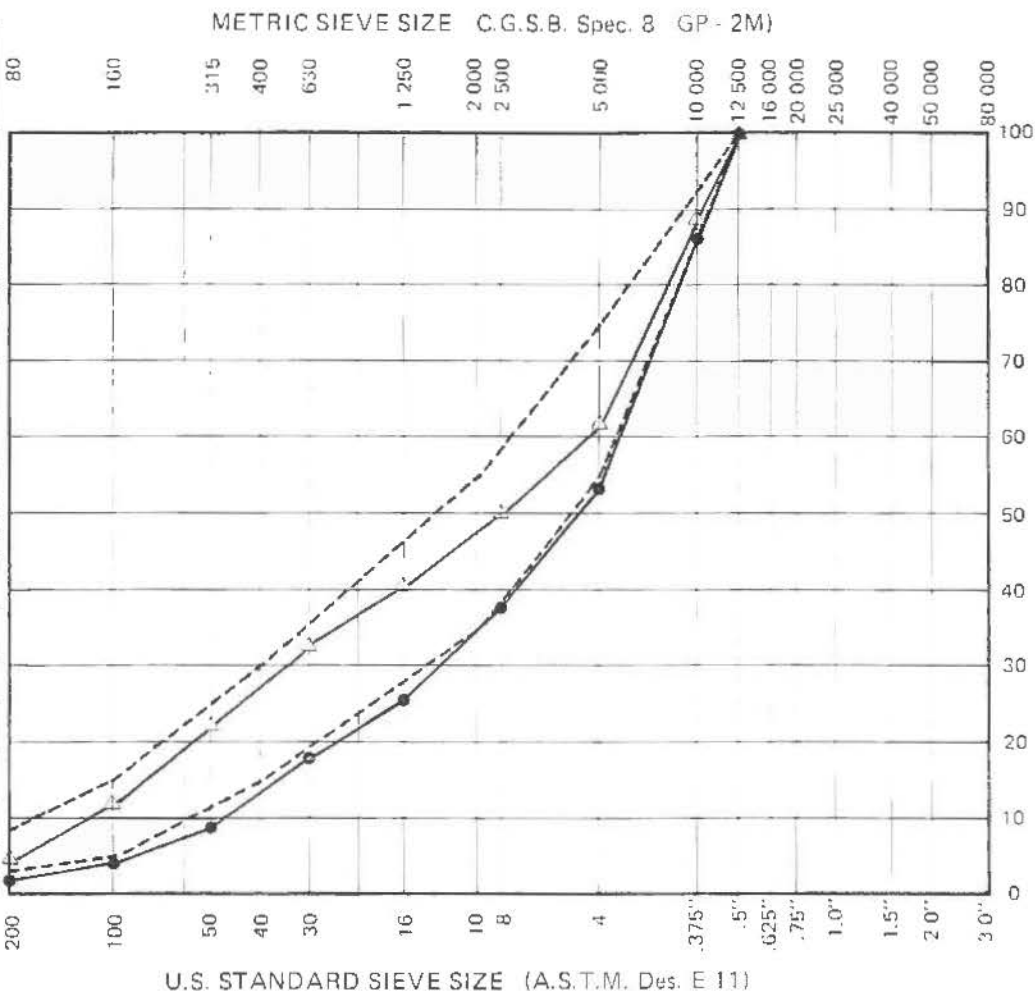


EBA Engineering Consultants Ltd.

AGGREGATE ANALYSIS REPORT

Project: McPherson Granular Study Sample Number: _____
 Address: Area "B" Sample Description: Average of two trial crush tests for 12.5 mm asphalt aggregate
 Project Number: 0201-10721 Natural Moisture Content: _____ %
 Date Tested: _____ Organic Content: _____ % State of Alaska Method
 Client: Government of Yukon Colour Plate No.: _____ Other _____
 _____ Organic Impurities _____
 Bulk Relative Density: _____
 Attention: Mr. Ross Burnett 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 | 100.0 |
| .375" | 10 000 | 86.0 |
| No. 4 | 5 000 | 53.0 |
| No. 8 | 2 500 | 37.0 |
| 16 | 1 250 | 26.0 |
| 30 | 630 | 17.0 |
| 40 | 400 | |
| 50 | 315 | 8.0 |
| 100 | 160 | 4.0 |
| 200 | 80 | 2.0 |



Remarks: • Theoretical blend of 20% blend sand and 80% crushed gravel
• Average of crushed gravel only

Reviewed By: Wicked Kumble P.Eng.
 Trial crush and blend sand results follow this report form



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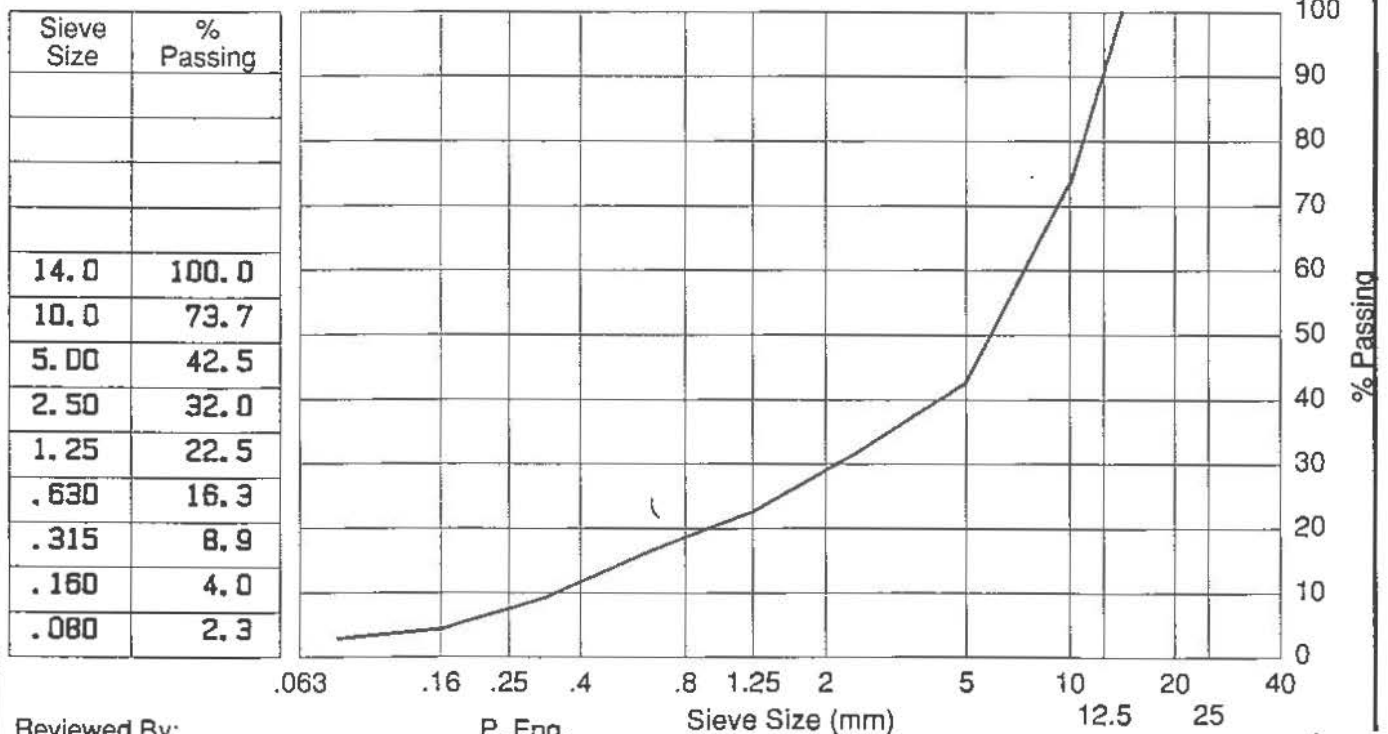
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AGGREGATE ANALYSIS REPORT

Project: McPHERSON GRANULAR STUDY Sample Number: 4838.7
 Address: _____ Sample Location: TP 23, AREA "B"
 Project Number: 201 -10721
 Date Sampled: 91-08-23 By: _____
 Client: Y. T. G. -LANDS BRANCH Time: _____ Temp.: _____ °C
WHITEHORSE, Y. T. Date Tested: 91-09-06
 _____ Tested By: ATE
 _____ Natural Moisture Content: _____
 Attention: _____ Crushed Faces: _____ 1 _____ 2
 Soil Description: GRAVEL (12.5 mm MAX.) AND SAND, TR. SILT, BROWN.

Cu: _____
 Cc: _____
 Remarks: LAB CRUSHED.

Grading Curve of Aggregate



Reviewed By: _____ P. Eng.

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AGGREGATE ANALYSIS REPORT

Project: McPHERSON GRANULAR STUDY

Sample Number: 4838.12

Address: _____

Sample Location: TP 29, AREA "B"

Project Number: 201 -10721

Date Sampled: 91-08-23 By: _____

Client: Y. T. G. -LANDS BRANCH

Time: _____ Temp.: _____ °C

WHITEHORSE, Y. T.

Date Tested: 91-09-09

Tested By: ATE

Natural Moisture Content: 0.0

Attention: _____

Crushed Faces: _____ 1 _____ 2

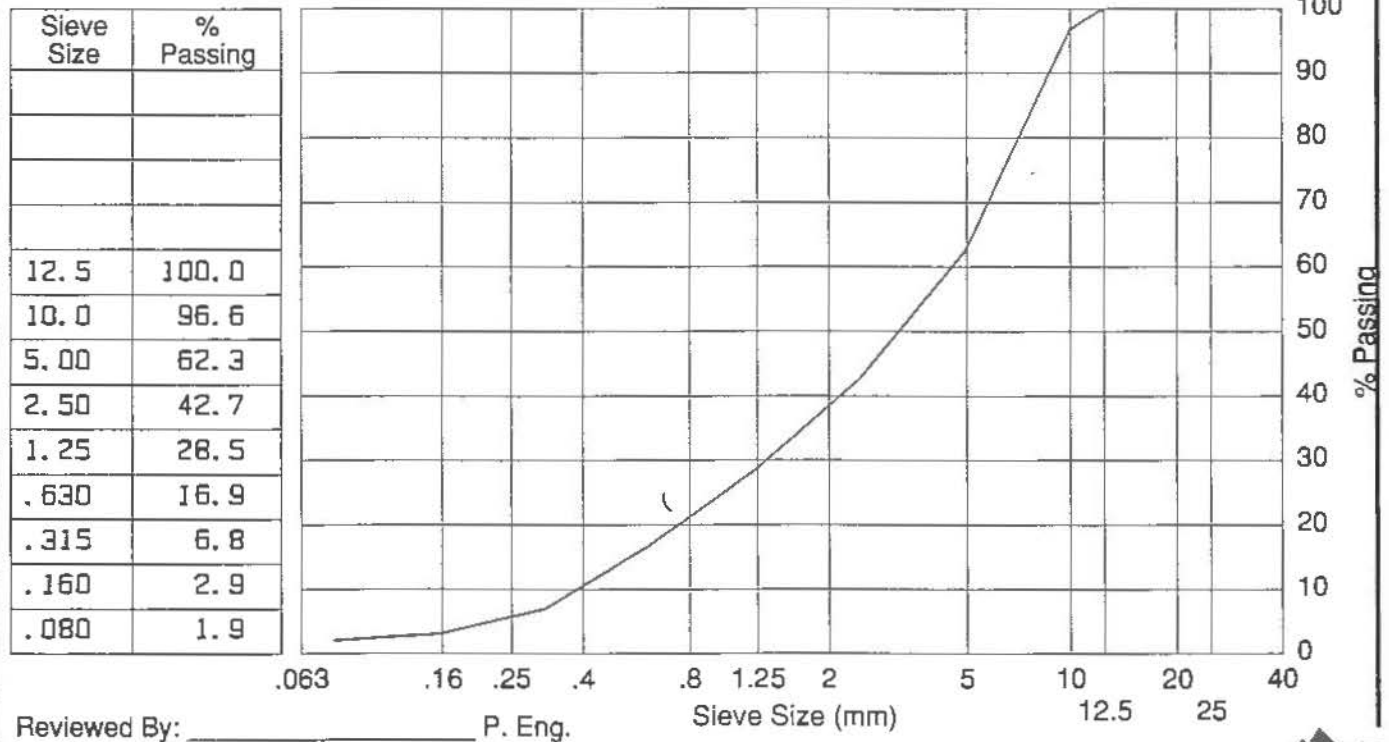
Soil Description: SAND AND GRAVEL (12.5 mm MAX.), TR. SILT, BROWN

Cu: _____

Cc: _____

Remarks: LAB CRUSHED TO 12.5 mm

Grading Curve of Aggregate



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PARTICLE - SIZE ANALYSIS OF SOILS

Project: MacPherson B Granular Study
Whitehorse, Yukon

Project Number: 0201-10721

Date Tested: 91-09-20

Borehole Number: 10721-18

Depth: 2.5 m

Soil Description: SAND (SM) - some silt

Cu: _____

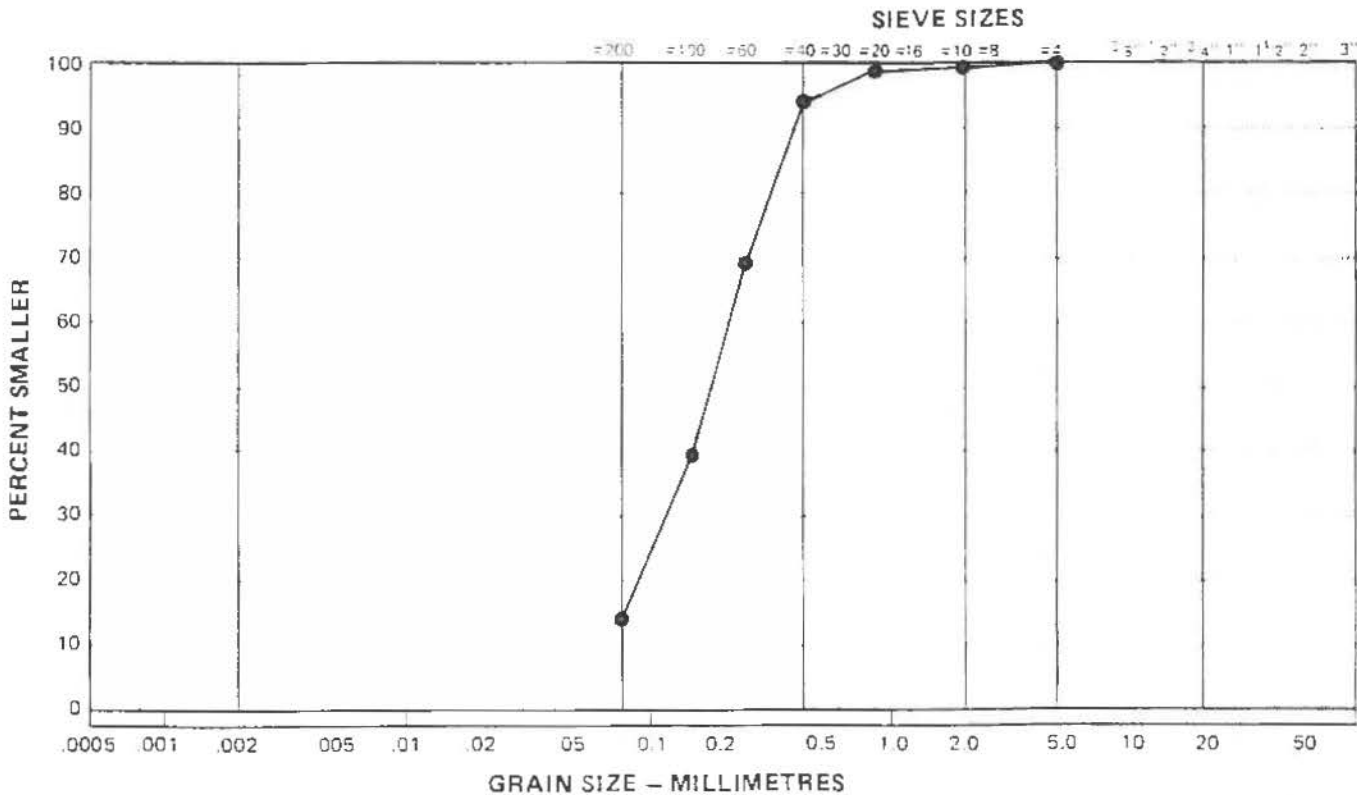
Cc: _____

Natural Moisture Content: _____ %

Remarks: BLEND SAND

| SIEVE | PERCENTAGE PASSING |
|---------|--------------------|
| 3" | |
| 1 1/2" | |
| 1" | |
| 3/4" | |
| 1/2" | |
| 3/8" | |
| No. 4 | 100.0 |
| No. 10 | 99.9 |
| No. 20 | 99.5 |
| No. 40 | 93.6 |
| No. 60 | 69.7 |
| No. 100 | 39.6 |
| No. 200 | 13.5 |

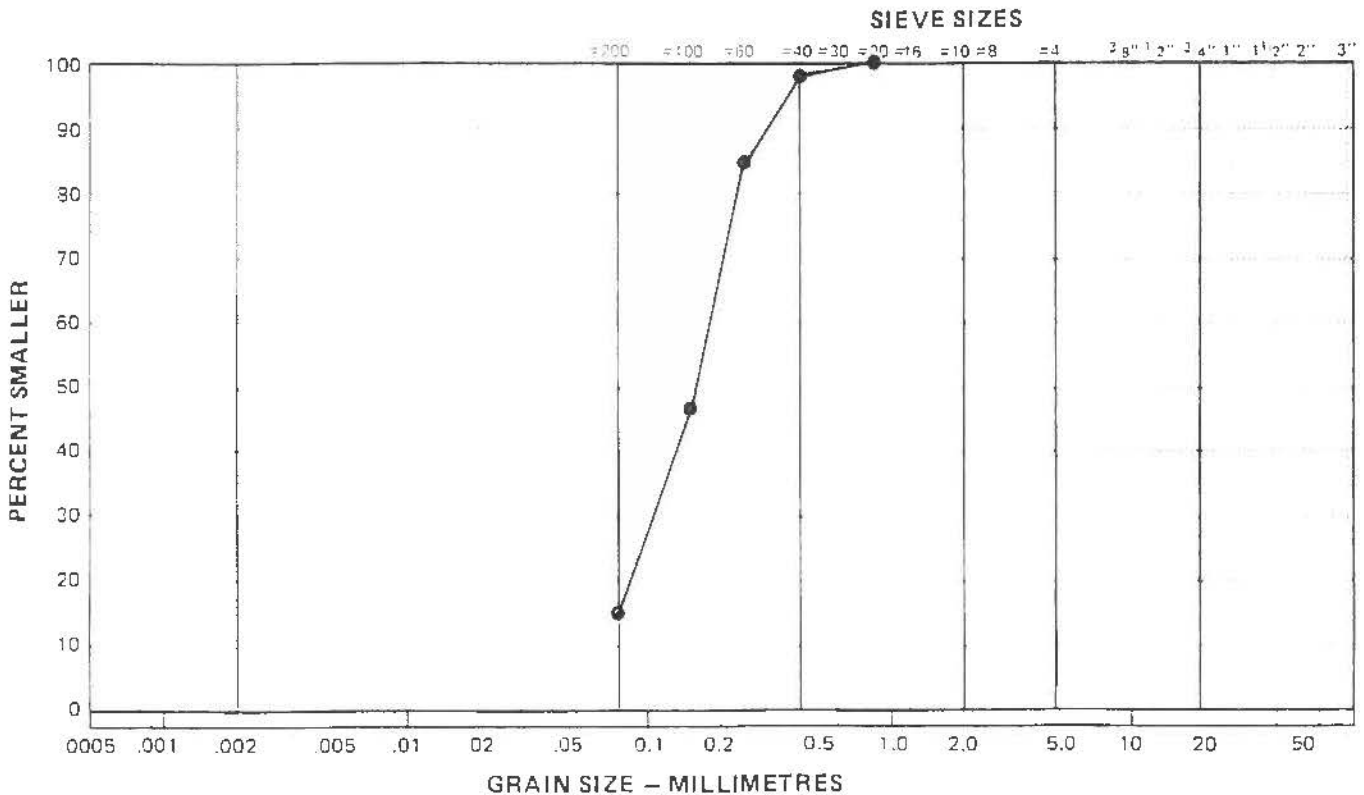
| CLAY | SILT | SAND | | | GRAVEL | |
|------|------|------|--------|--------|--------|--------|
| | | FINE | MEDIUM | COARSE | FINE | COARSE |



PARTICLE - SIZE ANALYSIS OF SOILS

| | | |
|--|---------|--------------------|
| Project: <u>MacPherson B Granular Study</u> | SIEVE | PERCENTAGE PASSING |
| <u>Whitehorse, Yukon</u> | 3" | |
| Project Number: <u>0201-10721</u> | 1 1/2" | |
| Date Tested: <u>91-09-20</u> | 1" | |
| Borehole Number: <u>10721-20</u> | 3/4" | |
| Depth: _____ | 1/2" | |
| Soil Description: <u>SAND (SM) - some silt</u> | 3/8" | |
| Cu: _____ | No. 4 | |
| Cc: _____ | No. 10 | |
| Natural Moisture Content: _____ % | No. 20 | 100.0 |
| Remarks: <u>Blend Sand</u> | No. 40 | 98.7 |
| | No. 60 | 84.4 |
| | No. 100 | 47.8 |
| | No. 200 | 15.3 |

| CLAY | SILT | SAND | | | GRAVEL | |
|------|------|------|--------|--------|--------|--------|
| | | FINE | MEDIUM | COARSE | FINE | COARSE |



EBA Engineering Consultants Ltd.



Standard A 283
Concrete Testing
Laboratory Type II
with all Options

AGGREGATE ANALYSIS REPORT (CONCRETE AGGREGATE)

Project: McPherson Granular Study Sample Number: _____
 Address: Area "B" Sample Description: Concrete Sand
 Project Number: 0201-10721 Natural Moisture Content: _____ %
 Date Tested: _____ By: _____ Organic Content: _____ %
State of Alaska Method
 Client: Government of Yukon Plate Number: _____
Organic Impurities in Sands for Concrete
 Attention: Mr. Ross Burnett 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 | 78.0 |
| 1.25 mm | 58.0 |
| 630 μm | 37.0 |
| 315 μm | 17.0 |
| 160 μm | 8.0 |
| 80 μm | 5.0 |
| F.M. | 3.0 |



Remarks: Average from sand portions of seven grain size analyses performed on pit run gravel

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: J. Wheeler Drinkwater P. Eng.

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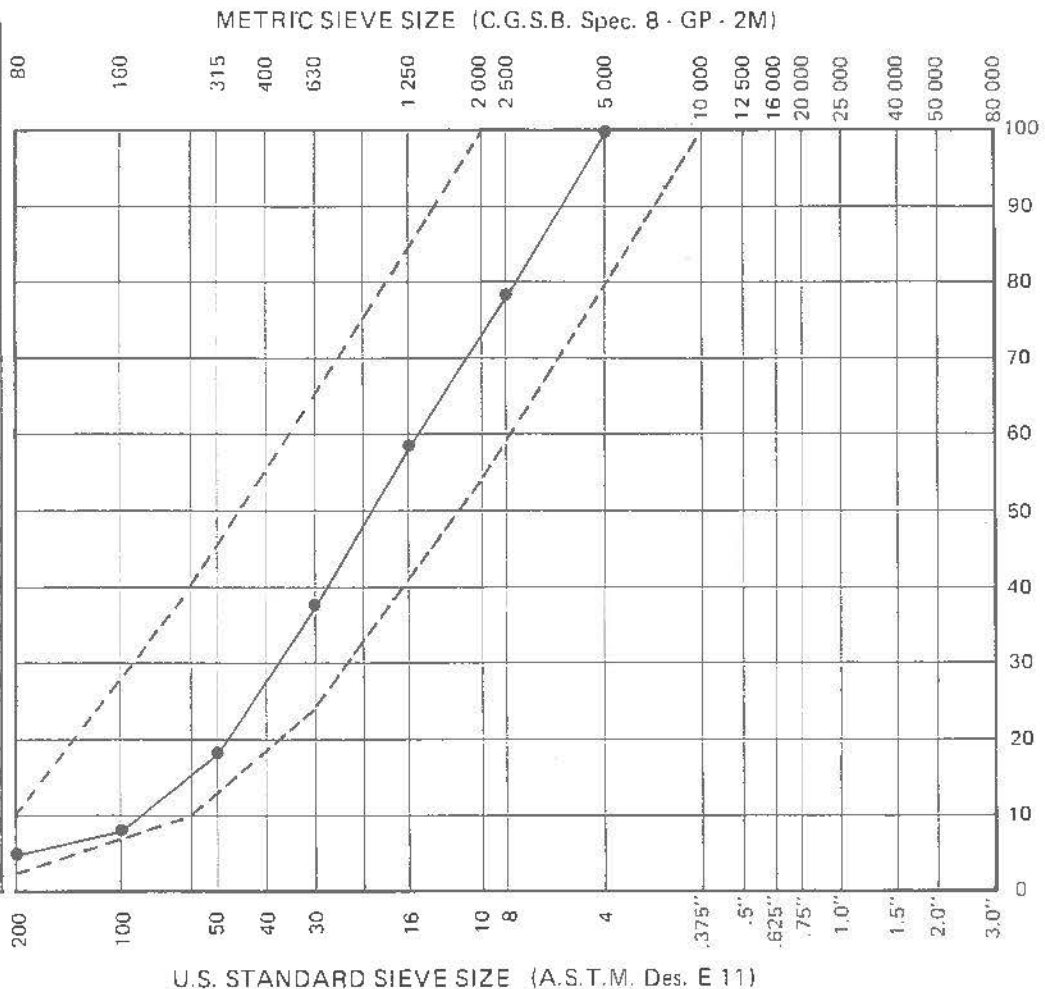


EBA Engineering Consultants Ltd.

AGGREGATE ANALYSIS REPORT

Project: McPherson Granular Study Sample Number: _____
 Address: Area "B" Sample Description: Bedding Sand
 Project Number: 0201-10721 Natural Moisture Content: _____ %
 Date Tested: _____ Organic Content: _____ % State of Alaska Method
 Client: Government of Yukon Colour Plate No.: _____ Other _____
 Attention: Mr. Ross Burnett 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 | 78.0 |
| 16 | 1 250 | 58.0 |
| 30 | 630 | 37.0 |
| 40 | 400 | |
| 50 | 315 | 17.0 |
| 100 | 160 | 8.0 |
| 200 | 80 | 5.0 |



Remarks: Average from sand portions of seven grain size analyses performed on pit run gravel

Reviewed By: Whitaker Diabla P.Eng.



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McPHERSON GRANULAR STUDY
AREAS "A" AND "B"
SUMMARY OF AGGREGATE SUITABILITY TESTS

Sodium Soundness CSA A23.2-9A

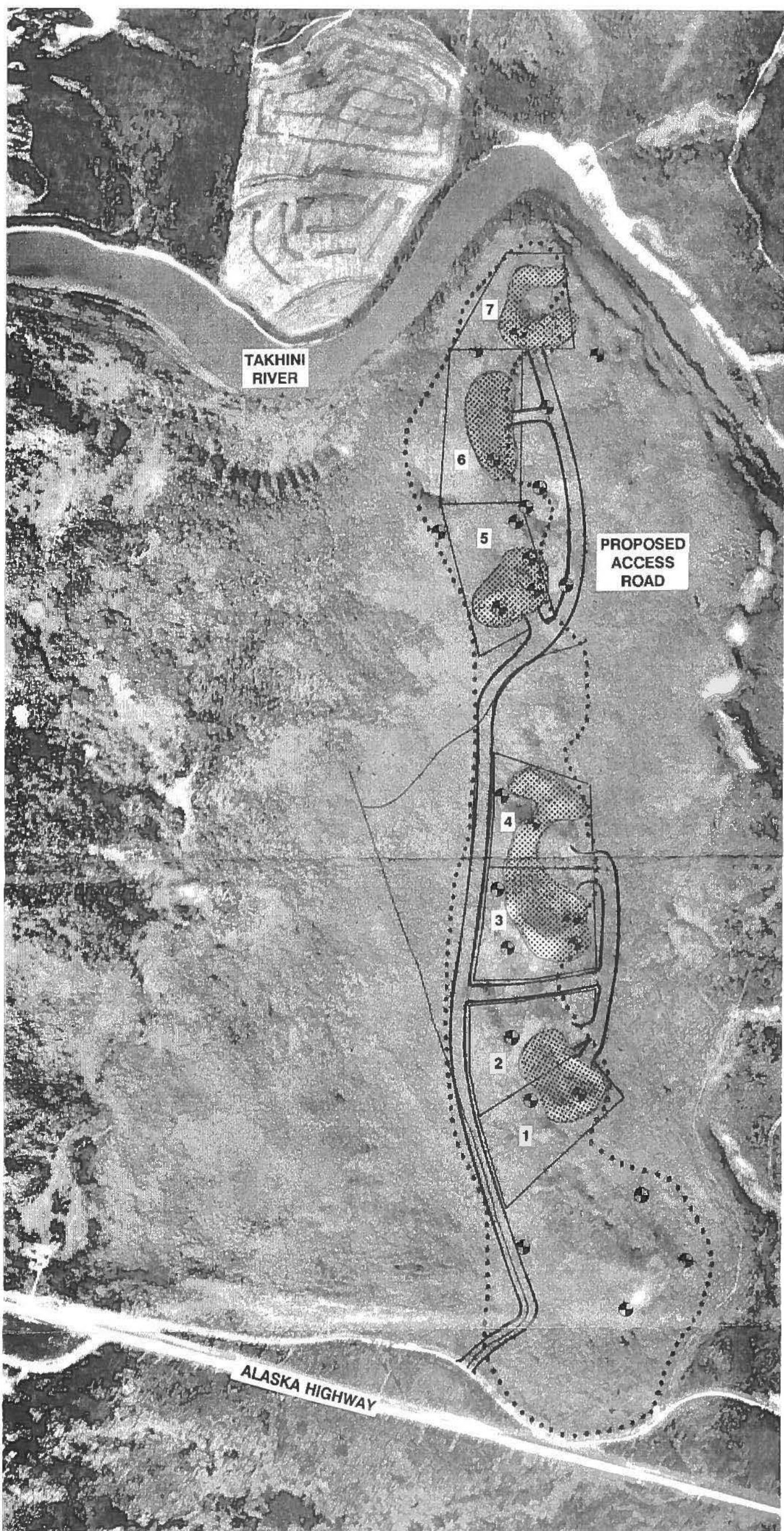
| | EBA 1991 (Avg. of 2 tests) | R.M. Hardy 1978 (Avg. of 3 tests) |
|------------------|-------------------------------|--------------------------------------|
| Coarse Aggregate | 1.6% Loss | 0.8% Loss |
| Fine Aggregate | 4.2% Loss | 3.3% Loss |

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



McPHERSON AREA "B"

● 1991 EBA TESTPIT LOCATIONS

▨ DELINEATED AREA CONTAINING COARSE GRAVEL

PROPOSED LEASE SIZES

- 1) 6.5 ha
- 2) 4.8 ha
- 3) 7.0 ha
- 4) 6.2 ha
- 5) 7.0 ha
- 6) 7.0 ha
- 7) 4.8 ha

0 500
APPROXIMATE SCALE (m)

| | | | | |
|---|-----------------|--------------------------|---|-------------------|
| <i>EBA Engineering Consultants Ltd.</i> | | | PROJECT McPHERSON GRANULAR SOURCE STUDY | |
| CLIENT GOVERNMENT OF YUKON | | | TITLE POSSIBLE DESIGN CONCEPT WITH RECOMMENDED ACCESS ROUTE | |
| DATE 91-11-09 | DWN. MCP | CHKD. <i>[Signature]</i> | FILE NO. 0201-10721 | 10721-C-01 |

MacPHERSON AREA "B" PHOTOS

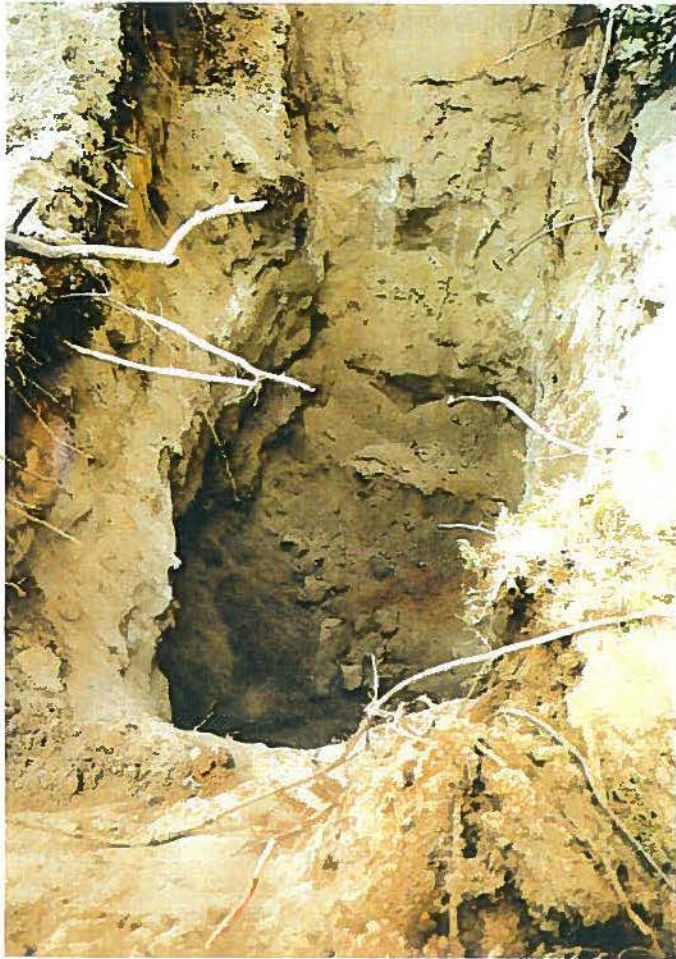


10721-13



10721-14

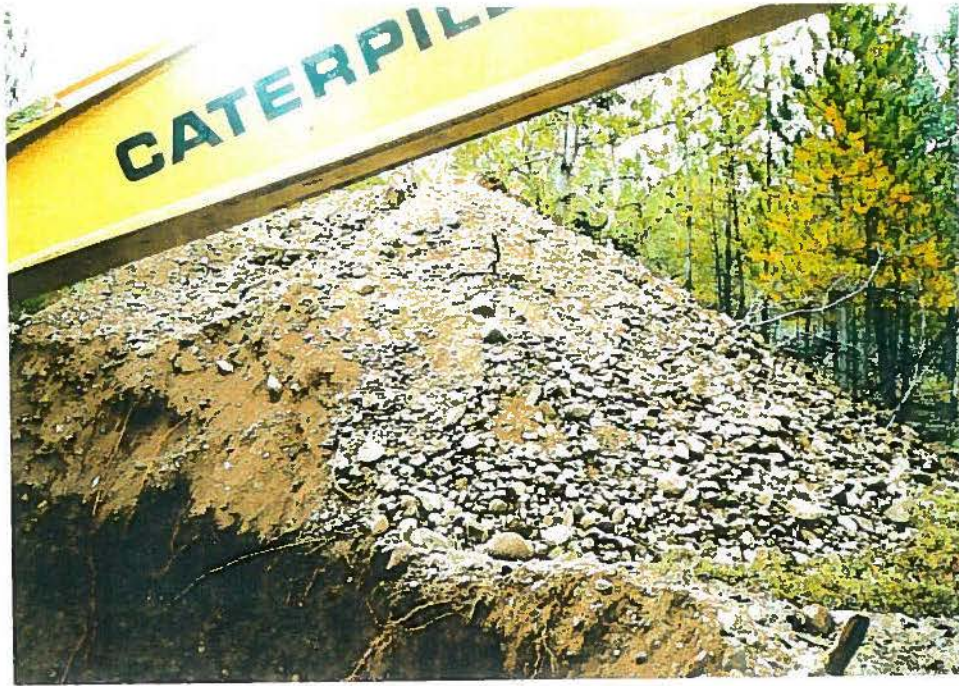
**Photo not representative
of coarseness of gravel**



10721-15
(SILT)



10721-16
(SILT)



10721-17



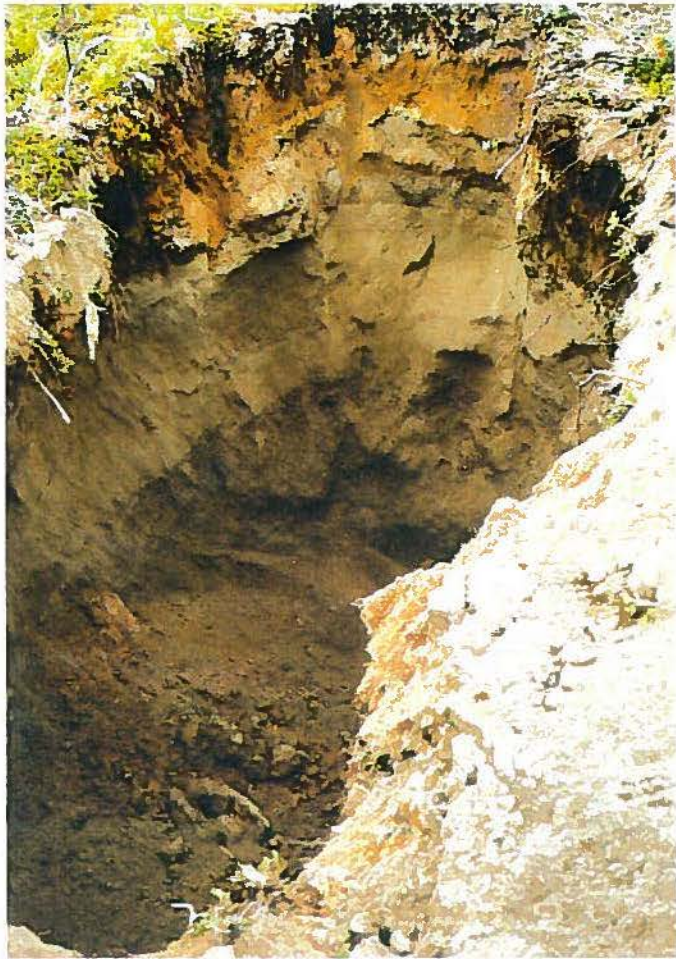
10721-18
(BLEND SAND)



10721-19

Looking south from 10721-19
(note access road)





10721-21



10721-22



10721-23



10721-24



10721-25



Gravel exposure
west of TP's 10721-25
and 10721-26



10721-26



Upslope from
10721-26



10721-27

10721-28
(SAND)





10721-29

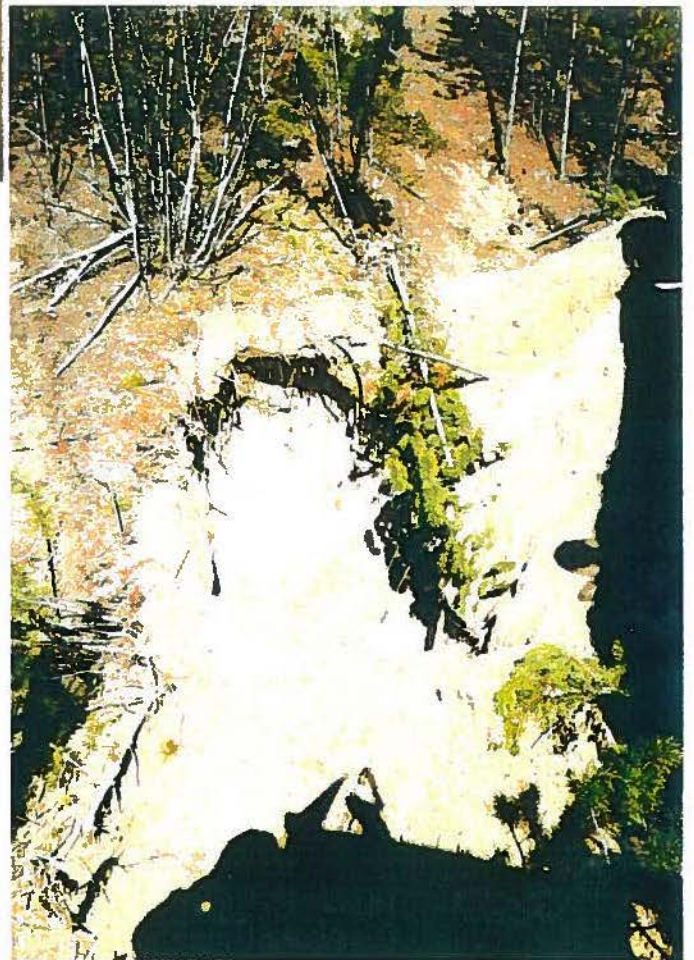


10721-30



**10721-32
(SILT OVER FINE SAND)**

**10721-34
(MEDIUM TO FINE SAND)**



11/11

12-01
006