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DRAFT REPORT
GEOTECHNICAL ASSESSMENT
PA 2295.01.01

1.0 SITE DESCRIPTION

The proposed McLean Lake community subdivision will cover approximately 280 ha and is located west of the Alaska Highway in the southern part of the City of Whitehorse, Yukon Territory.

The site is bounded on the north and west by McLean Creek which flows in a well defined valley. The Alaska Highway delineates the eastern boundary. A steep bank (20-30 m high), a tailings pond and rough terrain in the form of kames, eskers, and kettles delineates the southern boundary of the site. See the attached Drawing D-2295-1 which shows the approximate location of the site boundary.

The site consists of a prominent ridge which runs in a southeast to northwest direction. Slope gradients generally range up to 10% except in small isolated areas where gradients are up to 20%. Vehicle access is provided by a single lane, undeveloped trail which passes through the complete site. Several short trails branch off to squatter locations throughout the site. Natural drainage from the prominent ridge to the surrounding boundaries is excellent.

2.0 INVESTIGATIONS

This phase of the work included a review of existing data, air photo interpretation, detailed site inspection, test pitting, percolation testing and water supply assessment. These various activities are described in the following paragraphs.

2.1 Review of Data

This included collection of all topographic maps, air photographs, published geologic maps, and discussions with officials of the Community and Transportation Services Department.

2.2 Air Photo Interpretation

This phase of the work was done by J.D. Mollard and Associates. A copy of Dr. Mollards report is attached in Appendix I.

Dr. Mollard provided a discussion of bedrock and surficial geology, a sequence of geologic events since glaciation, terrain typing and an assessment of hydrogeology in the area.

The predominate terrain unit within the study area has been classified as Mb+Mb/R. Mb is the symbol for moraine blanket in which the till is estimated to be 3 m or more in thickness. The Mb/R symbol refers to those areas where the till thickness to bedrock is less than 3 m thick. The anticipated soils type in this particular terrain unit would be bouldery silty sand till. The local bedrock in the area was classified as being rough, igneous intrusive (granitic) rock.

The hydrogeological assessment indicated that the potential for developing large capacity water wells in the till is extremely low. The only possible source of groundwater on site is in the fractured granite bedrock which could yield small quantities of water sufficient for a single family household.

2.3 Field Test Pits

Prior to test pitting, a detailed site inspection was made by geotechnical engineers along existing trails or cleared lines. Soil exposures were classified in the field. Several bedrock exposures were noted along the top of the main ridge in the area.

A series of 31 test pits were set out throughout the area. Test pits were located along existing trails or cleared lines and provided good coverage of the area. Test pits were excavated to depths which varied between 1 m and 2.5 m below ground surface. Some sloughing of the soil in the sides of many of the test pits was recorded. Samples were taken approximately at 1 m intervals in each test pit. Observations were made with respect to thickness of organic topsoil, presence of water, sloughing, and size of boulders or cobbles in the soil. Photographs of each test pit and the excavated soil were

taken. One copy of the photographs will be provided under separate cover. The locations of all test pits are shown on Drawing D-2295-1.

2.4 Laboratory Testing

All samples were classified in our laboratory and moisture contents calculated. Grain size analyses (7) were taken in selected test pits at different depths throughout the site area. Grain size analyses were also done on five other samples taken at the same depth as percolation tests. Logs of the test pits are attached in Appendix II. Results of the grain size tests are attached in Appendix III.

2.5 Percolation Tests

Five percolation tests were carried out at selected test pit locations. The tests were done in accordance with the University of Minnesota on "Site Sewage Treatment Manual" instructions outlined in "How to Run a Percolation Test".

The program for the percolation testing was set out after the completion of the initial test pitting investigation. Based on the visual classifications of the soil types it was decided that some trial tests would be done in those areas where clean gravel and sand soils were encountered in test pits. These were in the north part of the site in the vicinity of test pits 1 to 4 inclusive and in the southwest part of the site in the vicinity of test pits 11 to 14 inclusive. The trial test consisted of dumping buckets of water into the test pits and observing how fast water drained away. In the two test pits checked, test pit 1 and test pit 13, the water seeped into the granular soil in less than 30 seconds. On the basis of these tests it was decided to concentrate the percolation testing on the higher ground where a higher percentage of silt and sand were mixed with the predominately granular type of soil.

Several attempts were made to establish a procedure for doing the tests:

- i) The first attempt was to hand auger holes down to the 1.5 to 2.0 m depth. The coarse gravel and cobbles stopped holes at depths of between 0.3 and 0.6 m depths below the ground surface.
- ii) The second attempt was to excavate a test pit down to the test depth using a rubber tired backhoe. At the bottom of the test pit, a hole was hand augered to a further 0.30 m (12 inches) below the test pit bottom. The casing was installed, the test pit was partially backfilled and the percolation test was then carried out as per the University of Minnesota instruction. This test method was used in test pit 31 and an average percolation rate of 20.7 minutes per inch as obtained. This test method was not continued because of the cost of requiring a backhoe on site during the period covered by the test.
- iii) The third attempt used a truck mounted CME 750 auger drill for drilling a series of holes up to a depth of about 1.8 m below the existing ground surface.

There were problems with the hole caving and sloughing in spite of repeated attempts to clean out the holes. The PVC casing (percometer) was installed in each hole with varying amounts of sloughed material between the bottom of the casing and bottom of the augered hole. A diagram showing the thickness of slough and the casing location in each hole is given on each test data sheet.

Percolation tests were started on November 18, 1986. Each hole was allowed to soak for approximately four hours before actual percolation testing started. Tests were done in a 4 inch PVC pipe, perforated at the bottom section and installed in the 7 inch diameter drill hole. The tests were done generally in accordance with the University of Minnesota standards. A

mixture of less than 5% antifreeze was used with the water, as a precaution against possible freezing conditions. Four tests were done adjacent to test pits 7, 9, 15 and 17.

Results of all tests are attached in Appendix III.

Samples of the soil were taken at the same elevation as the percolation test for grain size analysis. All of the grain size tests are plotted on a single sheet for comparison with grain size curves completed in the test pits. Results are attached in Appendix III.

All of the percolation tests discussed in ii) and iii) above could not be conducted in strict accordance with the University of Minnesota standards. However, the tests do indicate ranges of percolation rates which are considered representative for the materials tests.

2.6 Water Supply Assessment

The water supply problem within the site area, was briefly discussed by J.D. Mollard in his report. It was his opinion that the successful development of a shallow well in the morainal deposits at the site would be extremely unlikely. The underlying granitic rock may supply very small quantities of water sufficient for a single residence.

Conversations with Mr. D. Jameison of Midnight Sun Drilling indicated that wells in the granitic rock have been developed locally with very low yields in the order of 1 to 3 gallons per minute. His opinion of the McLean Lake site was that wells would have to be about 200 ft. deep in order to provide yields of 1 to 3 gallons per minute.

Some potential for shallow groundwater supply exists in those areas where gravel and sand overlies till particularly in the north and south west part of the site. In the north end in the small valley of McLean Creek, the gravel and sand stratum is being charged by the

creek flow. In the south west part of the site, in the area of kames and kettles, which are predominantly gravel and sand, the recharge would likely be caused by rainfall and the existence of groundwater would be extremely erratic. It is also doubtful that these shallow groundwater sources in the gravel and sand stratum could be developed because of potential contamination.

Several inquiries were also made regarding wells in the vicinity of the McLean Lake subdivision. The available information is summarized below:

East Side of Alaska Highway

i) General Enterprises Concrete Batch Plant, Alaska Highway

They have a 74 ft. deep well which was installed in 1962. No well record available but they indicated that the well yields a lot of water and can be pumped all day. The well could be in gravel above bedrock, or could be a perched water table. They use this well during winter, but in summer, they pump water from nearby creek (from McLean Lake) which passes through their property. They do not know the water consumption for their operations.

ii) Melberg Verrico Contracting Ltd.

No water well attempted at their site. They use water delivery.

iii) Paddle Wheel Village

A 300 ft. deep well was installed by Midnight Sun in May 1979. A flow of 20 gallons/minute was obtained. The log is attached in Appendix II.

iv Robinson, South Access Road

A 600 ft. deep well was installed by Midnight Sun, apparently 500 ft. into bedrock. Well produces water.

West Side of Alaska Highway

v) Canyon Crescent

Midnight Sun did some maintenance work on a well there but has no log. Apparently the well is about a 100 ft. deep.

vi) Philmar R.V. Service, Mile 912

They have a 40 ft. deep well, about 20 years old. The well is 2 ft. wide, apparently dug, not drilled. Not great volume but they can get 900 gals every 2 to 3 days. When pumped dry, takes about 2.5 days to recharge.

vii) McGuire (trucker) Mile 912

They have a 60 ft. deep well, about 3 ft. diameter and perhaps 15 to 20 years old. No drill log. Water is not suitable for drinking. Appears to be a low capacity well, capacity varies with time of year. Runs dry if they pump "full blast" for 1 hour, but takes only about 1/2 hour to recharge.

3.0

SOIL CONDITIONS

The results of the field and laboratory investigation has confirmed the soil types which exist in the terrain units as described in Mollards report (Appendix I). Detailed test pit logs are attached in Appendix II. See Drawing D-2295-1 for locations of the test pits. The soil conditions are as follows:

- The central part of site is underlain by firm silt and/or medium dense silty sand and gravel (Ablation or reworked till) overlying dense to very dense sand and gravel with some silt binder (Mollard's Mb+Mb/R lodgement or glacial till). Bedrock outcrops observed for about 200 to 250 m along existing survey line east of the existing main access road. Bedrock encountered at shallow depths, 0.4 m and 1.6 m, in TP 86-16 and 86-17 respectively.

- TP 86-1 to -4 inclusive in the low areas at the north end of site near the existing creek encountered clean sands and gravels (Mollard's Mc meltwater channel deposits). Note the clean sand and gravel in TP 86-4 was underlain at 1.0 m depth by till deposit.
- TP 86-10 through -14 in the hummocky areas at the southwest end of site encountered clean sands, gravels and cobbles (Mollard's Gkc+Mbc meltwater channel deposits). Note TP 86-12 near the lake encountered water at 1.1 m depth.
- TP 86-21 to -23 in hummocky areas at the southeast end of site encountered clean sands, gravels and cobbles similar to those at southwest end of site (Mollard's Gk). Here, bedrock outcrops were observed in two areas: on slope below road between TP 86-20 and -21 and on slope below road between TP 86-23 and -24.
- Sand and gravel deposits are exposed in several cut slopes along east side of site, adjacent to Alaska Highway.
- Except for TP 86-12 near lake, no water was encountered in any of the other test pits. Test pit depths varied from 0.4 m to 2.2 m.
- Bedrock outcrops are generally massive granitic rock.
- Numerous low ridges (1 to 5 m high) oriented perpendicular to the flow direction were observed to be a bouldery till deposit. Large boulders 0.6 to 1.0 m in size are present on the ground surface of ridges. These ridges are Crevasse fillings as located in Mollard's report.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Soils

The soil conditions are considered to be relatively uniform over the major part of the site area that is suitable for development. This

is the high ground that is enclosed by the heavy solid line that is shown on the attached drawing (D-2295-1) and generally identified as Mb or Mb/R in the Mollard report. Areas where bedrock is at or close to the surface is also shown on Drawing D-2295-1.

The soils are silty sands and gravels of low plasticity with an estimated 10-15% over the 100 mm size which extends up to 300 or 400 mm boulder sizes. The percentage of silt is variable between 15% and 40%. The density of the soil appears to be loose near the surface and gradually increases with depth. The fact that many of the test pits sides collapsed confirms the loose density of the soils near the surface.

4.2 Percolation Tests

Five percolation tests were carried out in the silty sand and gravel soils down to about the 1.5 m depth. Results of the tests are summarized on the following table.

<u>Percolation Test No.</u>	<u>Depth of Test in m</u>	<u>% Passing No. 200 Sieve</u>	<u>Percolation Rate minutes/inch</u>
7A	1.3	14	3.8
9A	1.5	23	8.2
15A	1.3	23	26.0
17A	1.1	23	5.0
31	1.1	32	20.7

Based on the percolation rates obtained, it is considered to be feasible to develop septic fields in this area. Some inconsistencies in the data is evident; ie, samples with the same silt content have percolation rates which vary between 5.0 and 26 minutes per inch. This could be related to the density of the soil and the percentage of gravel sizes that are present in the soil.

Some additional testing should be completed when the conceptual plan has been finalized.

4.3 Water Supply

As discussed previously, the development of an on site water supply will probably require the drilling of a deep well for each residence. It was concluded during the Whitehorse meeting on October 31, 1986 that the drilling of the trial well will not be carried out at this time.

4.4 Site Development Considerations

Permafrost

No evidence of permafrost was encountered in any of the test pits. Deep excavations in road cuts, quarries, etc. also show no evidence of permafrost.

Road Construction

Grading for access roads in the site should be restricted to shallow cuts and fills in the order of 1 or 2 m. Soils are suitable for roadway construction, however, the large percentage of boulders will cause finishing and fine grading problems. Therefore, all boulders or cobbles that cannot be incorporated into the shallow fills should be separated and hauled from the site.

Erosion

Some erosion in the silty sand and gravel soils will occur along road ditches etc. The large percentage of gravel and cobble sizes in the soil will soon provide an erosion resistant cover at the bottom of all ditches.

Foundations

Soil conditions are favourable for the support of all residential structures on conventional concrete basement type of foundations. Pressure treated wood foundations could also be used at this location.

With respect to residence foundations, it is pointed out that bedrock is at or very close to the surface along the high ground in the center of the area. Some checking to confirm bedrock may result in cost savings to the lot owner.

Site Grading

Grading within the complete development should be kept to an absolute minimum. The thickness of top soil is very thin. Once the topsoil is removed, the coarse granular material will be exposed.

OFFICE AIRPHOTO STUDY
OF TERRAIN CONDITIONS IN
PROPOSED DEVELOPMENT AREA
SOUTH OF WHITEHORSE, YUKON

Prepared for:

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OFFICE AIRPHOTO STUDY OF TERRAIN CONDITIONS
IN PROPOSED DEVELOPMENT AREA
SOUTH OF WHITEHORSE, YUKON

STUDY OBJECTIVES

The objectives of this office study are to map the bedrock geology, surface geology, terrain types, and hydrogeology at and near a proposed study area south of Whitehorse, infer the sequence of relevant geologic events, and relate the geology and terrain types to subdivision and acreage land development. Some of the factors affecting land development problems and costs, and that require assessment, include the origin and composition of surface and near-surface materials, topography, content of surface boulders, internal soil drainage, depth to bedrock, sources of construction materials, existing road access, soil erodibility when areas are denuded of trees, building foundation quality, potential sources of groundwater supply, and considerations relating to the installation of underground utilities.

DATA SOURCES

Two sets of stereoscopic airphotos were obtained. One set was flown July 1978, and has a scale of approximately 1:27,000. The other set was flown in 1979 and has a scale of approximately 1:56,000.

A small-scale bedrock geology map was also examined. Scale of the bedrock map was so small that it permitted identification of generalized locations only of granitic rocks at and north of the study area, and sedimentary and volcanic bedrock to the south (Figure 1).

PRINCIPAL TERRAIN TYPES (FIGURE 2)

All terrain types shown in the mosaic of Figure 2 are described again in Appendix A.

In order to assess the quality of different terrain types for relatively intensive (e.g. suburban) and extensive (acreage) land development, it is desirable to know the landforms and the soil and rock materials in them. The terrain types are comprised of landforms and surface materials. Each terrain type contains a characteristic topography, internal drainage, surface material or group of materials, a typical variability of material in the horizontal and vertical directions, and range of geotechnical properties.

Essentially unsorted and unstratified glacier-deposited bouldery silty sand till material occurs in fluted ground moraine, indicated by the capital symbol M (for morainal). Here thin ablation till overlies lodgement till (Figure 3).

Water sorted and water stratified deposits of glacial origin consist mainly of a thin capping of sand and gravel over thick stratified glaciofluvial and glaciolacustrine silt and silty sand till. Areas of stratified drift are indicated by the capital letter G (for surface glaciofluvial and near-surface glaciolacustrine). Ice-contact glaciofluvial deposits Gk, Gkc, and Gek are kettled, some of the deep conical depressions separating narrow ridges. Proglacial outwash and outwash-delta sand and gravel

terraces are indicated by the symbol Gt. Subscript designations Gt₁ and Gt₂ are used to indicate a lower terrace (Gt₁) below a slightly higher terrace (Gt₂). The surface sand and gravel in these terraces is expected to be thin over thick silt in most places. Differences between the ice-contact and proglacial glaciofluvial landforms from a land development standpoint consist mainly of topography and lateral and vertical variations in grain-size composition. Gt areas are more nearly level and generally less variable in composition, continuity, and thickness of the surface granular layer.

Nonglacial (postglacial) sand and gravel terraces formed by Yukon River lateral erosion are alluvial in origin, which is indicated by the symbol A. These flats are only a few metres above present river level. The granular material in them is likely capped by a layer of overbank floodplain silt.

Meltwater channels (MC) are a common feature of the landscape around Whitehorse. Some of them form narrow canyons eroded into bedrock. Most of them, however, have been eroded into glacial drift sediments.

Mesozoic age igneous intrusive (granitic) rock is the dominant bedrock in the study area. It is highly fractured and locally decomposed, possibly by ascending hydrothermal solutions. Granitic type rock occurs in the immediate study area, whereas intermingled areas of Mesozoic sedimentary

(e.g. limestone, shale) and volcanic rocks occur south of the study area (Figure 1).

Occurrences of peat (organic soil deposits) in the study area are quite small and widely separated. They occupy the bottoms of relatively small poorly drained wet depressions, which occur in short segments of abandoned meltwater channels and in the bottoms of kettleholes, where the water table is at or very near ground surface.

Isolated natural and manmade (cultural) features in the study area include deep steep-sided kettleholes (K), small lakes (L), a tailings pond (TP), gravel pits (P), a relatively small copper mine rock quarry (Q), a large copper mine excavation and related facilities (M), a power canal (PC), glacial fluting indicating ice flow direction, and small subparallel crevasse filling ridges (Figures 2 and 4). These subtle minor ridges may have a slightly different physical composition from the underlying till. They occur most frequently in the western part of the proposed development area (Figure 4).

(Note (a) that Figure 4 shows only a small portion of Figure 2, and (b) that in preparing the Figure 4 mosaic the airphotos were mismatched, indicated on the right side.)

LAND DEVELOPMENT CHARACTERISTICS OF VARIOUS TERRAIN UNITS

Morainal areas (M)

Morainal areas are shown as Mb, the lower case letter b suggesting that the surface till was deposited as a sheet or "blanket." The till in Mb areas is expected to be thick enough and continuous enough so that bedrock does not outcrop. Bedrock in Mb areas probably lies below a depth of about 3 m on average (i.e. approximate basement excavation depth). Because till might be thinner than 3 m locally, I have indicated this possibility by means of the symbol Mb/R. In Mb+Mb/R areas, the Mb/R areas probably total less than 25% of the combined area.

Two limiting factors for land development in Mb areas are surface boulders and compact subsoils. Permeability of the till is expected to decrease with depth. The till in Mb is unlikely to contain large inclusions of clean sand or gravel. This is suggested by subglacial deposition effects apparent in the landscape (e.g. fluting).

The chance of developing large capacity water wells in clean sand pockets in the till in Mb areas is low. However, wells that penetrate through the into drift cover into fractured granitic bedrock may yield small quantities of water, possibly sufficient for single family household usage.

Where the topography is steeper, road ditches may erode during times of high runoff. Strength of till material is expected to be high, and the compressibility of the till in foundations should be low. I observed no evidence of permafrost. Scattered, isolated permafrost pockets might exist; but they are not detectable from the airphotos.

Glaciofluvial deposits (G)

These deposits include relatively thin and discontinuous ice-contact sand and gravel deposits over waterlaid (glaciofluvial and glaciolacustrine) silt and till in Gk and Gkc areas. Somewhat thicker sand and gravel deposits occur in knobby and ridgy kame-and-esker complexes, shown as Gek. Terraced proglacial outwash and outwash delta deposits (Gt) occur south of the airport and again south of the study area (Figure 2). These terraces are level or nearly so, and are benched. The proglacial deposits (Gt) should contain more uniform granular materials and better topography than Gk areas. The chances of finding boulders are also less in Gt than in Mb and some Gk areas. Kame terraces appear higher on valley sides outside the mapped area.

Where medium to coarse sand in G terrain types is thicker, and extends a few metres below the water table, wells in aquifers may offer a practical alternative to a dependable source of water supply for multiple dwellings lawn sprinkling, and other uses. The best places to investigate for locating larger capacity water wells are

along the shores of water bodies in kettleholes and along the shores of larger lakes (Figures 2 and 4). Several sites have been marked with a circled X for field reconnaissance checking. Close field inspection may discover whether or not clean sand exists at the shoreline and is likely to extend a significant distance below adjacent lake levels.

Alluvial terraces (A)

Low alluvial terraces (At) are also places to investigate for a large source of induced-infiltration groundwater. Careful field examinations along shoreline exposures of in situ (not sloughed) sand and gravel is desirable (Figures 2 and 4).

INFERRED SEQUENCE OF GEOLOGIC EVENTS

An inferred sequence of geologic events that influences the quality of building sites and groundwater prospects is listed in Appendix B. Significance of the events is also included in Appendix B.

MAIN PHYSICAL LIMITATIONS TO LAND DEVELOPMENT

Certain of the terrain units identified in this office airphoto study possess limitations for land development (see Appendices A to F). Units with limitations in parentheses are as follows: Gk, Gkc, Gek (mainly hummocky topography,

steep slopes, potential frost heave problems in thick silty subsoils); At (possible flooding from exceptional runoff events); MC (poor topography, high water table, wet basements); R (rock excavation, utility trenching constraints, irregular topography); Pt (high water table, soft compressible foundations, acid attack on Mb concrete); Mb (surface boulders, high slopes locally, higher costs of basement and trenching excavation, harvesting of stones in tree-cleared fields).

ALTERNATIVE LAND DEVELOPMENT AREAS THAT APPEAR COMPETITIVE (FIGURE 5)

I terrain typed a fairly large region surrounding your outlined study area (Figure 2) because I wanted to get a good feeling for the sequence of geologic events that might significantly influence problems and costs of land development (Appendix B). I did my terrain mapping on the larger scale (1:27,000) airphotos. This regional mapping indicated that perhaps I should examine the smaller scale (1:56,000) airphotos to determine whether or not any competitive-looking alternative land development areas exist, and that appear to possess better overall physical conditions.

As a result I identified 10 alternative areas in addition to your outlined study area. Nearly all 10 areas appear to hold prospects of better topography, less boulderiness, and better chances of obtaining water supplies at less cost. However, existing road access to some areas is less attractive. Several of the areas are remote from Whitehorse, a city having a population of around 17,000.

Many natural and manmade factors (Appendices C, D, E, F) could be assessed and compared. But this was not possible within my terms of reference and budget. However, it did not take very long to identify the alternative areas, and to estimate approximate acreages. So I did this. You can decide whether or not your client would be interested in doing any follow-up assessment.

SUMMARY AND CONCLUSIONS

1. Assuming that small and scattered acreages are required for land development, I would recommend Gt terrain over other terrain types. Reasons include better topography, less stoniness or boulderiness, better internal soil drainage, better possibilities for small "on property" groundwater supplies, greater ease of vehicle traffic across tree-cleared areas on the acreages, and less chance of striking bedrock in excavations made for basements and underground utilities. Permafrost is less of a concern in areas of thick sand and gravel, and is expected to be widely scattered in isolated occurrences.
2. I would carefully examine the shorelines of small kettlehole lakes and of larger Schvatka Lake to discover local reaches where the shoreline material

consists dominantly of clean, well sorted, medium to coarse sand that is likely to extend several metres below water level. The objective of such field inspection is a scheme that might be less costly to develop for multiple dwellings and related water use over a period of years.

3. Large capacity water well development may require that the well driller be able to remove silt and fine sand from an envelope surrounding the well screen. The driller should also be able to install gravel-pack wells. This level of well logging, construction, and development sophistication is not required for small water wells drilled in bedrock and that may yield in the order of 1 to 3 l/gpm each. Local well drillers will likely have some knowledge of what the reliable safe yield of wells in granitic bedrock is likely to be, and whether or not there are any unusual difficult development problems. One should also check water quality carefully to determine whether toxic chemical wastes have entered local groundwater systems -- either naturally or the result of man's activities.
4. It may be worthwhile to make a reconnaissance type study of some of the 10 other alternative site areas that I have identified. Some of the alternatives might be deleted from consideration rather easily because of poor access, distance from Whitehorse, property ownership, and perhaps other factors.

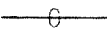

APPENDIX A

REGION SOUTH OF WHITEHORSE, YUKON TERRAIN LEGEND

<u>Symbol</u>	<u>Description of terrain unit</u>
Mb	Silty sand till with boulders. Commonly a thin cap of relatively loose bouldery ablation till overlies a more compact subglacially-deposited lodgement till (see Figure 1 for explanation of terminology). Mb stands for moraine blanket, in which the till is typically 3 m or more thick overlying bedrock.
Mb/R	Relatively thin till over bedrock, where the till is less than 3 m thick over bedrock. May appear as minor constituent in which Mb is dominant.
Mbc	Moraine blanket in areas where one or more superglacial meltwater streams cut through stagnant (dead) ice and into underlying soil and rock materials.
Gk	Highly kettled intermingled outwash and ice-contact glaciofluvial sand and gravel deposits, often silty and commonly thin overlying thick glacial-lake silts or till. The capping of surficial granular material is discontinuous in some localities, and is expected to be variable in thickness and grain-size composition. Materials in Gk areas were deposited over large blocks of glacier ice, which, after burial, melted out to form steep-sided kettleholes, which are shown as K.
Gkc	A terrain unit having a similar composition to Gk but crossed by meltwater channels that cut through stagnant glacier ice and into the underlying glacial and bedrock materials.
Gek	Esker/kame complex, consisting of sharp knobs and low winding ridges of dominantly sand and gravel with a cover of silt.
Gt ₁	Lower-level granular terraces consisting mostly of valley outwash sand and gravel that varies from clean to silty. May be thin over thick silts.
Gt ₂	Higher-level granular terraces consisting of valley outwash sand and gravel that varies from clean to silty. May be thin over thick silts.

At	Very low level modern (postglacial) alluvial terraces consisting of sand and gravel. Slightly elevated above Schwatka Lake and the Yukon River.
MC	Larger meltwater channel.
R	Bedrock. Mostly rough igneous intrusive (<u>e.g.</u> granitic) rock. Includes volcanic and sedimentary rocks in southern parts of the mapped area. Thin pockets of drift occur among rock outcrops.
Pt	Shallow organic deposits. High water table.
D	Modern delta in the Yukon River.

Features

K	Large steep-sided kettleholes
(L)	Lake
TP	Tailings pond
P	Gravel pit
Q	Rock quarry in decomposed granitic bedrock
M	Openpit mine area along with associated facilities
	Ice flow direction
	Small crevasse fillings. Probably bouldery till that either was squeezed into cracks on the underside of a stagnant glacier or was washed or dumped into enlarging crevices on the glacier's upper surface, and thus open to the sky
PC	Power canal leading to power plant
(X)	Places to examine exposure in the field, mainly bordering a surface water body. For consideration of a major potential induced-infiltration groundwater source for proposed development area

APPENDIX B

INFERRED SEQUENCE OF GEOLOGIC EVENTS AND SIGNIFICANCE, WHERE APPLICABLE IN LAND DEVELOPMENT EVENTS ARE NUMBERED OLDEST TO YOUNGEST

<u>Event</u>	<u>Description</u>
1	Multiple glaciations of the Whitehorse region. Surface effects of glaciations that are older than the last one are not apparent in any significant way in the present-day landscape.
2	Last glaciation with glacier flow paralleling the Yukon River valley. Erosion of bedrock uplands. Deposition of a blanket of till, consisting of loose bouldery ablation till veneer over more compact and less bouldery lodgement till, Mb (<u>see</u> Figure 3 for terminology).
3	Glacier stagnation and downwasting in the Yukon Valley. Deposition of thick glaciofluvial and glaciolacustrine silt and ice-rafted till over ice-block remnants in the central part of the valley followed by deposition of ice-contact sand and gravel in Gk and Gkc areas.
4	Cutting of superglacial meltwater channels. These channels eroded through stagnant (dead) ice. Deposition of valley outwash and outwash-deltas (Gt ₁ and Gt ₂).
5	Meltout of large buried ice blocks in Gk areas.
6	Downcutting by the Yukon River and erosion of the main valley fill along the Yukon Valley.
7	Deposition of sand and gravel on eroded alluvial flats next to the river (At).
8	Development of mines in bedrock (M and Q) and gravel pits.

Significance of inferred geologic events

- (a) Mb till areas are likely to be bouldery at the surface and to overlie fractured, weathered granitic rock in the subsurface. Boulders may be an impediment to basement access and utility service construction. Water wells in granitic rock may yield small supplies (1 to 3 Igpm). The highly decomposed granitic rocks at mines, resulting from hydrothermal alteration, may be a localized phenomenon. Away from decomposed granitic rock, the bedrock may have reduced permeabilities.
- (b) Gk and Gt areas will be sandy to gravelly and may be variable from point to point. Granular material may vary greatly in thickness and silt content from point to point -- and much more so in Gk areas than in Gt areas. The surface sand and gravel layer over silt or till may be thin in places in both Gk and Gt areas.
- (c) Mb areas should be dry and moderately well to well drained.
- (d) The best places to develop large groundwater supplies are where clean medium to coarse sand occurs along the shores of kettlehole lakes and manmade reservoirs, as Schwatka Lake. Field reconnaissance is required to better assess the possibilities. For large capacity supplies, well drillers should preferably have available E-logging equipment, be able to remove silt and fine sand from around well screens during well development, and be able to install gravel packs.

APPENDIX C

<input checked="" type="checkbox"/> Primary importance	Typical Land Uses					
<input type="checkbox"/> Secondary importance	Light Structure Construction	Heavy Structure Construction	Waste Disposal	Building Material Resources	Ease of Excavation	Road performance
Geologic Conditions						
Physical properties of soils and rocks	X	X	X	X	X	X
Slope stability	X	X	O	O	O	X
Thickness of surficial materials	X	X	O	X	O	O
Depth to groundwater	X	X	X	X	O	O
Supply of surface water	O	O	O	X	O	O
Danger of flooding	X	X	X	X	X	X

PRIMARY AND SECONDARY IMPORTANCE OF SELECTED GEOLOGIC
CONDITIONS FOR TYPICAL LAND USES AT NORTHERN COMMUNITIES

APPENDIX D

Climate

Precipitation
Temperature
Radiation
Fog
Winds
Frost
Storms
Cold air drainage
Slope aspect

Geology

Surface deposits
Bedrock outcrops
Bedrock type
Bedrock structure
Unique formations
Stable formations
Depth to bedrock
Building materials
Weathering
Economic minerals
Landforms

Soils

Soil type
Soil texture
Soil depth
Soil erodibility
Soil permeability
Internal drainage
Soft or weak mineral soils
Organic (peat) deposits
Bearing capacity
Slope instability
Stoniness (boulderiness)
Soil productivity (lawns/gardens)

Topography

Elevation
Slopes
Slope rim
Relief variation
Orientation

Water

Watershed size and relief
Drainage patterns
Streamflow
Groundwater table position
Aquifer prospects
Lakes
Rivers and creeks
Wetlands
Springs
Waterfalls
Flooding potential
Water quantity
Water quality
Water temperature
Dissolved and suspended solids
Biological productivity
Shoreline type (use)
Shoreline quality

Vegetation

Vegetation type (trees, shrubs)
Vegetation quality
Stand density
Shore and bank community
Fields
Forested areas
Natural associations of vegetation
Understory
Overstory

Wildlife

Wildlife type
Wildlife habitat quality
Prime habitats
Major ecotones
Uniqueness
Wilderness

APPENDIX E

Natural Factors

1. Geologic base and landforms.
2. Topography—topographic maps, slope analysis.
3. Hydrography—streams, lakes, swamps, bogs, and watershed drainage.
4. Soils—classification of types and uses.
5. Vegetation.
6. Wildlife.
7. Climatic factors—solar orientation, summer and winter winds, precipitation, and humidity.

Cultural Factors

1. Existing land use—ownership of adjacent property, and off-site nuisances.
2. Linkages.
3. Traffic and transit—vehicular and pedestrian circulation on or adjacent to site.
4. Density and floor area ratio.
5. Utilities—sanitary and storm systems, water, gas, and electric.
6. Existing buildings.
7. Historic factors—historic buildings or landmarks.

Aesthetic Factors

1. Natural features.
2. Spatial pattern—views, spaces, and sequences.

NATURAL, CULTURAL AND AESTHETIC FACTORS TO EVALUATE IN COMMUNITY PLANNING

APPENDIX F

Process	Description of hazard
Flooding	Overtopping of river and stream banks by water produced by sudden cloudbursts, prolonged rains, tropical storms or seasonal thaws; breakage or overtopping of dams; ponding or backing up of water because of inadequate drainage
Erosion and sedimentation	Removal of soil and rock materials by surface water and depositing of these materials on floodplains and deltas.
Landsliding	Perceptible downslope movement of earth masses.
Faulting	Relative displacement of adjacent rock masses along a major fracture in the earth's crust.
Ground motion	Shaking of the ground caused by an earthquake.
Subsidence	Sinking of the ground surface caused by compression or collapse of earth materials; common in areas with poorly compacted, organic, or collapsible soils and commonly caused by withdrawal of groundwater, oil, or gas; or collapse over underground openings, such as mine workings or natural caverns.
Expansive soils	Soils that swell when they absorb water and shrink when they dry out.
High water table	Upper level of underground water close to ground surface causing submergence of underground structures, such as septic tank systems, foundations, utility lines, and storage tanks.
Seacliff retreat	Recession of seacliffs by erosion and landsliding.
Beach destruction	Loss of beaches owing to erosion and (or) loss of sand supply.
Migration of sand dunes	Wind-induced inland movement of sand accelerated by the disturbance of vegetative cover.
Saltwater intrusion	Subsurface migration of seawater inland into areas from which freshwater has been withdrawn, contaminating freshwater supplies.

**NATURAL HAZARDS TO CONSIDER DURING TERRAIN
ANALYSIS AND PLANNING OF COMMUNITY
DEVELOPMENTS ALONG NORTHERN LAKES AND RIVER
VALLEYS**



GENERALIZED BEDROCK GEOLOGY MAP
WEST OF YUKON RIVER, WHITEHORSE, YUKON



REGION SOUTH OF WHITEHORSE, YUKON
TERRAIN LEGEND

Symbol	Description of terrain unit
Mb	Silty sand till with boulders. Commonly a thin cap of relatively loose bouldery ablation till overlies a more compact subglacially-deposited lodgement till (see Figure 1 for explanation of terminology). Mb stands for moraine blanket, in which the till is typically 3 m or more thick overlying bedrock.
Mb/R	Relatively thin till over bedrock, where the till is less than 3 m thick over bedrock. May appear as minor constituent in which Mb is dominant.
Mbc	Moraine blanket in areas where one or more superglacial meltwater streams cut through stagnant (dead) ice and into underlying soil and rock materials.
Gk	Highly kettled intermingled outwash and ice-contact glaciofluvial sand and gravel deposits, often silty and commonly thin overlying thick glacial-lake silts or till. The capping of surficial granular material is discontinuous in some localities, and is expected to be variable in thickness and grain-size composition. Materials in Gk areas were deposited over large blocks of glacier ice, which, after burial, melted out to form steep-sided kettleholes, which are shown as K.
Gkc	A terrain unit having a similar composition to Gk but crossed by meltwater channels that cut through stagnant glacier ice and into the underlying glacial and bedrock materials.
Gek	Esker/kame complex, consisting of sharp knobs and low winding ridges of dominantly sand and gravel with a cover of silt.
Gt1	Lower-level granular terraces consisting mostly of valley outwash sand and gravel that varies from clean to silty. May be thin over thick silts.
Gt2	Higher-level granular terraces consisting of valley outwash sand and gravel that varies from clean to silty. May be thin over thick silts.

At	Very low level modern (postglacial) alluvial terraces consisting of sand and gravel. Slightly elevated above Schwatka Lake and the Yukon River.
MC	Larger meltwater channel.
R	Bedrock. Mostly rough igneous intrusive (e.g. granitic) rock. Includes volcanic and sedimentary rocks in southern parts of the mapped area. Thin pockets of drift occur among rock outcrops.
Pt	Shallow organic deposits. High water table.
D	Modern delta in the Yukon River.

Features

K	Large steep-sided kettleholes
(L)	Lake
TP	Tailings pond
P	Gravel pit
Q	Rock quarry in decomposed granitic bedrock
M	Openpit mine area along with associated facilities
—	Ice flow direction
~~~~~	Small crevasse fillings. Probably bouldery till that either was squeezed into cracks on the underside of a stagnant glacier or was washed or dumped into enlarging crevices on the glacier's upper surface, and thus open to the sky
PC	Power canal leading to power plant
⊙	Places to examine exposure in the field, mainly bordering a surface water body. For consideration of a major potential induced-infiltration groundwater source for proposed development area



Proposed development area

WHITEHORSE, YUKON

PHOTOMOSAIC SHOWING TERRAIN TYPES IN  
VICINITY OF PROPOSED DEVELOPMENT AREA



J.D.Mollard And Associates Limited  
October, 1986

FIGURE 2

GENETIC TYPE OF TILL (based on mode of release and deposition from ice)	PROBABLE POSITION OF DEBRIS TRANSPORT BY GLACIAL ICE	PROBABLE POSITION AT TIME OF DEBRIS RELEASE FROM ICE	EQUIVALENT TERMS IN COMMON USE
FLOW TILL	ENGLACIAL	SUPRAGLACIAL	ABLATION TILL
MELTOUT TILL	ENGLACIAL AND BASAL	SUPRAGLACIAL (Ablation meltout till)	SUPRAGLACIAL TILL
		SUBGLACIAL (Basal meltout till)	BASAL TILL
LODGEMENT TILL	BASAL	SUBGLACIAL	SUBGLACIAL TILL
WATERLAIN TILL (released from floating ice)	BASAL	SUBGLACIAL	SUBAQUEOUS TILL

## CLASSIFICATION OF TILLS

( from Mollard and Janes, 1984. )



FIGURE 3





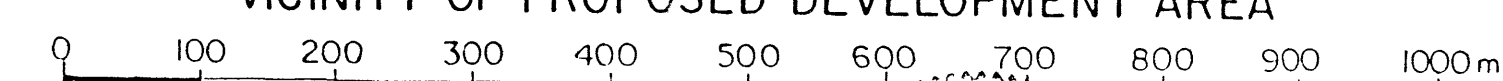
# REGION SOUTH OF WHITEHORSE, YUKON TERRAIN LEGEND

Symbol	Description of terrain unit
Mb	Silty sand till with boulders. Commonly a thin cap of relatively loose bouldery ablation till overlies a more compact subglacially-deposited lodgement till (see Figure 1 for explanation of terminology). Mb stands for moraine blanket, in which the till is typically 3 m or more thick overlying bedrock.
Mb/R	Relatively thin till over bedrock, where the till is less than 3 m thick over bedrock. May appear as minor constituent in which Mb is dominant.
Mbc	Moraine blanket in areas where one or more superglacial meltwater streams cut through stagnant (dead) ice and into underlying soil and rock materials.
Gk	Highly kettled intermingled outwash and ice-contact glaciofluvial sand and gravel deposits, often silty and commonly thin overlying thick glacial-lake silts or till. The capping of surficial granular material is discontinuous in some localities, and is expected to be variable in thickness and grain-size composition. Materials in Gk areas were deposited over large blocks of glacier ice, which, after burial, melted out to form steep-sided kettleholes, which are shown as K.
Gkc	A terrain unit having a similar composition to Gk but crossed by meltwater channels that cut through stagnant glacier ice and into the underlying glacial and bedrock materials.
Gek	Esker/kame complex, consisting of sharp knobs and low winding ridges of dominantly sand and gravel with a cover of silt.
Gt1	Lower-level granular terraces consisting mostly of valley outwash sand and gravel that varies from clean to silty. May be thin over thick silts.
Gt2	Higher-level granular terraces consisting of valley outwash sand and gravel that varies from clean to silty. May be thin over thick silts.
At	Very low level modern (postglacial) alluvial terraces consisting of sand and gravel. Slightly elevated above Schwatka Lake and the Yukon River.
MC	Larger meltwater channel.
R	Bedrock. Mostly rough igneous intrusive (e.g. granitic) rock. Includes volcanic and sedimentary rocks in southern parts of the mapped area. Thin pockets of drift occur among rock outcrops.
Pt	Shallow organic deposits. High water table.
D	Modern delta in the Yukon River.

NOTE:  
Photos mis-matched  
by 200 to 300m

Features	
K	Large steep-sided kettleholes
(L)	Lake
TP	Tailings pond
P	Gravel pit
Q	Rock quarry in decomposed granitic bedrock
M	Openpit mine area along with associated facilities
→	Ice flow direction
~~~~~	Small crevasse fillings. Probably bouldery till that either was squeezed into cracks on the underside of a stagnant glacier or was washed or dumped into enlarging crevices on the glacier's upper surface, and thus open to the sky
PC	Power canal leading to power plant
⊗	Places to examine exposure in the field, mainly bordering a surface water body. For consideration of a major potential induced-infiltration groundwater source for proposed development area

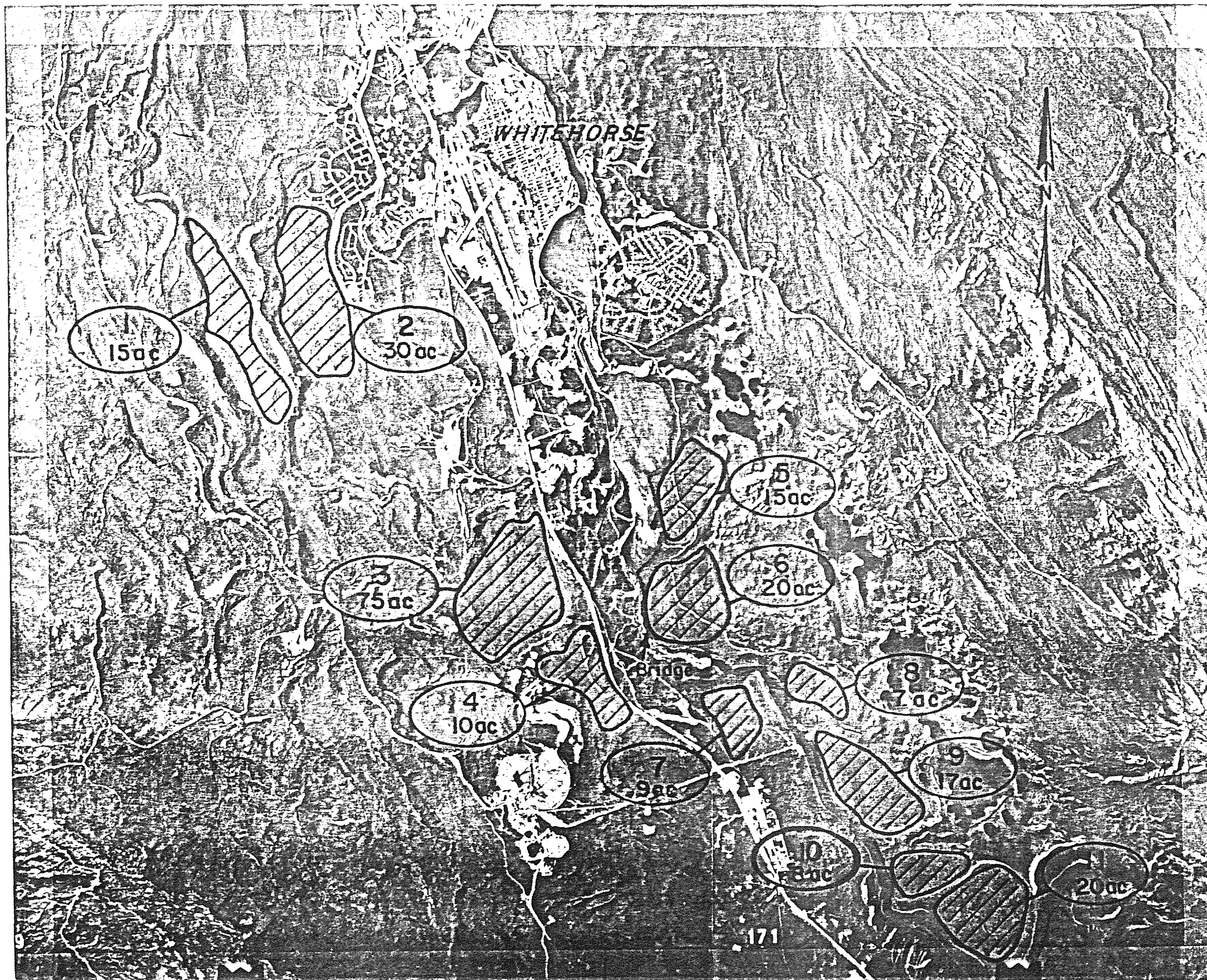
WHITEHORSE, YUKON PHOTOMOSAIC SHOWING TERRAIN TYPES IN VICINITY OF PROPOSED DEVELOPMENT AREA



J D Mollard And Associates Limited
October, 1986

[Handwritten signature]

FIGURE 4



J.D. Mollard

PHOTOMOSAIC SHOWING POTENTIAL
 SUBDIVISION AND/OR ACREAGE AREAS
 SOUTH OF WHITEHORSE, YUKON

0 1 2 3 4 5 Km

J.D. Mollard And Associates Limited
 October, 1986

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR		UNCONFINED COMPRESSION kPa					
WEIGHT HAMMER 63.5 Kg					ELEV GROUND 726 m		100 200 300 400					
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1		FIELD VANE LAB VANE UNCONF					
DEPTH ELEV	O.D I.D	BLOWS 15m	NO.		DESCRIPTION OF MATERIAL		PLASTIC LIMIT	WATER CONTENT		LIQUID LIMIT		
						X	0		X			
						10	30	50	70	90 %		
0.5			1		TOPSOIL -silty sand and gravel -greyish brown, roots							
	B				0.3 m	SAND -brown, fine to medium -some coarse sand						
1.0					0.6 m	SAND AND GRAVEL - brown, subrounded to rounded - coarse sand and gravel with some cobbles to 6" size, clean						
1.5					1.0 m	GRAVELLY SAND - brown - subrounded to rounded gravel to 4" size - well graded, clean - dense to medium dense						
2.0	B		2		END TO TEST PIT AT 1.7 m.							
2.5					NOTES: No water encountered. Two buckets of water were poured into the test pit. Water seeped away in less than 30 sec.							
3.0												
3.5												
4.0												
4.5												
5.0												



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. 86-1
DATE Oct 15-24/99 PLATE

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR		UNCONFINED COMPRESSION kPa					
WEIGHT HAMMER 63.5 kg					ELEV GROUND 725 m		100 200 300 400					
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1		● FIELD VANE ▲ LAB VANE ■ UNCONF					
DEPTH ELEV	O.D. I.D.	BLOWS 15mm	NO.		DESCRIPTION OF MATERIAL		PLASTIC LIMIT		WATER CONTENT		LIQUID LIMIT	
						X		0			X	
						10	30	50	70	90	%	
0.5	B		1	0.15	SILT - organic, roots, topsoil, clayey, brown, soft.						○	
				0.4	PEAT - black, fibrous, soft - roots, tree stems	○						
1.0	B		2									
1.5					SAND - brown - fine to medium - gravelly - some silt binder - medium dense to dense - trace of cobble to 6" subrounded							
	B		3			○						
2.0					END OF TEST PIT AT 1.8 m.							
2.5					NOTES: No water encountered.							
3.0												
3.5												
4.0												
4.5												
5.0												



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-2
DATE Oct 20-24/86 PLATE

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR		UNCONFINED COMPRESSION kPa			
WEIGHT HAMMER 63.5 Kg					ELEV GROUND 726 m		100 200 300 400			
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1		● FIELD VANE △ LAB VANE ■ UNCONF			
DEPTH ELEV	O.D. I.D.	BLOWS 150mm	NO.		DESCRIPTION OF MATERIAL		PLASTIC LIMIT	WATER CONTENT	LIQUID LIMIT	
						X	0	X		
						10	50	70	90 %	
0.15					TOPSOIL - silty sand, greyish brown					
0.5					SANDY GRAVEL - brown - clean - coarse sand & gravel to 4" - well graded, subangular - medium dense to dense					
1.0	B		1							
1.1					SAND - brown - fine to medium - medium dense - clean - little gravel					
1.5										
	B		2							
2.0					END OF TEST PIT AT 1.7 m					
2.5					NOTES: No water encountered.					
3.0										
3.5										
4.0										
4.5										
5.0										



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-3
DATE Oct 20-24/96 PLATE

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa												
WEIGHT HAMMER 63.5 Kg					ELEV GROUND 726 m	100 200 300 400												
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1	● FIELD VANE ▲ LAB VANE ■ UNCONF												
DEPTH ELEV	O.D. I.D.	BLOWS 150mm	NO.		DESCRIPTION OF MATERIAL	PLASTIC LIMIT	WATER CONTENT	LIQUID LIMIT										
					X 10 30 50 70 90 %													
0.1					0.1	TOPSOIL - grassed, brown, silty sand												
0.5					1		SAND AND GRAVEL - brown, clean - fine to medium sand, subrounded - gravel - trace cobbles to 5" - medium dense to dense				○							
1.0	B																	
1.5				2		SAND AND GRAVEL - greyish brown, subrounded - trace silt (weak binder) - medium dense to dense				○								
	B																	
2.0					END OF TEST PIT AT 1.6 m.													
					NOTES: No water encountered													
2.5																		
3.0																		
3.5																		
4.0																		
4.5																		
5.0																		



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-4
DATE Oct 20-24/86 PLATE

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR	UNSATURATED COMPRESSION kPa			
WEIGHT HAMMER 63.5 Kg					ELEV GROUND 734 m	100 200 300 400			
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1	FIELD VANE LAB VANE UNCONF			
DEPTH ELEV	OD ID	BLOWS 15m	NO.		DESCRIPTION OF MATERIAL	PLASTIC LIMIT	WATER CONTENT	LIQUID LIMIT	
					X --- 0 --- X 10 30 50 70 90 %				
				0.1	TOPSOIL - silty sand, peaty, roots & stems				
0.5	B		1	0.6	SAND - brown, fine to medium - fairly clayey, trace silt - medium dense to dense				
1.0					SAND AND GRAVEL - greyish brown - fine to medium sand - trace silt - subrounded gravel to 3" some cobbles to 8" size - medium dense to dense				
1.5	B		2						
2.0					END OF TEST PIT AT 1.6 m				
					NOTES: No water encountered.				
2.5									
3.0									
3.5									
4.0									
4.5									
5.0									



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-5
DATE Oct 20-24/86 PLATE

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa						
WEIGHT HAMMER 63.5 Kg					ELEV GROUND 759 m	100 200 300 400						
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1	● FIELD VANE Δ LAB VANE ■ UNCONF						
DEPTH ELEV	O.D. I.D.	BLOWS 15m	NO.		DESCRIPTION OF MATERIAL				PLASTIC LIMIT	WATER CONTENT	LIQUID LIMIT	
								X	0	X		
								10	30	50	70	90 %
0.5	B		1	0.15	TOPSOIL							
					- grass, wood, peaty silt							
					SILT							
					- greyish brown, mottled							
					- firm, low to medium plastic							
					- friable							
					- fine roots slightly organic							
1.0					SAND AND GRAVEL							
					- grey, fine to medium sand							
					- trace silt							
					- subrounded gravel & cobbles to 6" size							
1.5	B		2		- dense							
2.0					END OF TEST PIT AT 1.6 m							
					NOTES: No water encountered.							
2.5												
3.0												
3.5												
4.0												
4.5												
5.0												



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-6
DATE Oct 20-24/96 PLATE

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa				
WEIGHT HAMMER 63.5 Kg					ELEV GROUND 750 m	100 200 300 400				
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1	FIELD VANE LAB VANE UNCONF				
DEPTH ELEV	O.D. I.D.	BLOWS 15mm	NO.		DESCRIPTION OF MATERIAL	PLASTIC LIMIT	WATER CONTENT		LIQUID LIMIT	
X					X				X	
10						50	50	70	90 %	
0.5	B		1	0.15 TOPSOIL - grass, woods, roots, silt						
1.0				SAND AND GRAVEL - brown & grey - fine to medium sand - fairly clean - subrounded gravel & cobbles to 6 " size. - odd boulder to 12" size - medium dense to dense						
1.5	B		2							
2.0				END OF TEST PIT AT 1.6 m.						
2.5				NOTES: No water encountered.						
3.0										
3.5										
4.0										
4.5										
5.0										



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-7
DATE Oct 20-24/86 PLATE

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa				
WEIGHT HAMMER 63.5 kg					ELEV GROUND 746 m	100 200 300 400				
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1	FIELD VANE LAB VANE UNCONF				
DEPTH ELEV	O.D. I.D.	BLOWS 15mm	NO.		DESCRIPTION OF MATERIAL	PLASTIC LIMIT	WATER CONTENT	LIQUID LIMIT		
			1	0.15 TOPSOIL - grass, roots, peaty						
0.5	B		2	0.4 SILT - brown & grey mottled						
	B			0.6 - firm, medium plastic						
1.0				SAND - brown, trace of silt						
				- fine						
1.5	B		3	SAND AND GRAVEL - fine to medium sand						
				- subrounded gravel & cobbles to 6" size, medium dense to dense						
				- trace silt						
2.0				END OF TEST PIT AT 1.5 m.						
				NOTES: No water encountered.						
2.5										
3.0										
3.5										
4.0										
4.5										
5.0										



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-8
DATE Oct 20-24/86 PLATE

TEST HOLE LOG



SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa								
WEIGHT HAMMER 63.5 Kg					ELEV GROUND 769 m	100 200 300 400								
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1	● FIELD VANE ▲ LAB VANE ■ UNCONF								
DEPTH ELEV	O.D. I.D.	BLOWS 15m	NO.		DESCRIPTION OF MATERIAL					PLASTIC LIMIT	WATER CONTENT	LIQUID LIMIT		
										X			X	
										10	30	50	70	90 %
				0.15	TOPSOIL - grass, roots, organic, silt									
0.5	B		1		SAND - gravelly to 4" size - trace to some silt, brown - odd cobbles & boulders to 12" size (subrounded) - medium dense to dense					○				
1.0				1.0										
1.5	B		2		SAND - fine to coarse - clean - dense to very dense (Decomposed Granite)					○				
2.0					END OF TEST PIT AT 1.5 m.									
					NOTES: No water encountered.									
2.5														
3.0														
3.5														
4.0														
4.5														
5.0														



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-9
DATE Oct 20-24/86 PLATE

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR		UNCONFINED COMPRESSION kPa					
WEIGHT HAMMER 63.5 Kg					ELEV GROUND 780 m		100 200 300 400					
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1		● FIELD VANE ▲ LAB VANE ■ UNCONF					
DEPTH ELEV	O.D. I.D.	BLOWS 15mm	NO.		DESCRIPTION OF MATERIAL		PLASTIC LIMIT		WATER CONTENT		LIQUID LIMIT	
						X					X	
						10	30	50	70	90	%	
0.5	B		1		0.2 TOPSOIL - grass, roots - organic silt							
1.0					GRAVEL AND COBBLES - subrounded to 6" size - fine roots to 1.0 m depth - medium dense - sand matrix - grey-brown							
1.5	B		2									
2.0					END OF TEST PIT AT 1.6 m.							
					NOTES: No water encountered.							
2.5												
3.0												
3.5												
4.0												
4.5												
5.0												



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JOB No PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-10
DATE Oct 20-24/86 PLATE

TEST HOLE LOG




SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa						
WEIGHT HAMMER 63.5 Kg					ELEV GROUND 776 m	100 200 300 400						
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1	● FIELD VANE ▲ LAB VANE ■ UNCONF						
DEPTH ELEV	OD ID	BLOWS 15m	NO.		DESCRIPTION OF MATERIAL				PLASTIC LIMIT	WATER CONTENT	LIQUID LIMIT	
						X	10	30	50	70	90	X
0.5	B		1	0.15	TOPSOIL - grass, roots, brown, silt							
1.0	B		2	0.7	GRAVEL AND COBBLES - subrounded - cobbles to 6" size - medium dense - brown							
1.5	B		3		SAND AND GRAVEL - fine to medium sand - subrounded gravel to 6" size - dense - boulders to 18" size							
2.0					END OF TEST PIT AT 1.6 m							
2.5					NOTES: No water encountered.							
3.0												
3.5												
4.0												
4.5												
5.0												



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JOB No PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-11
DATE Oct 20-24/86 PLATE

TEST HOLE LOG


SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa												
WEIGHT HAMMER 63.5 kg					ELEV GROUND 775 m	100 200 300 400												
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1	● FIELD VANE ▲ LAB VANE ■ UNCONF												
DEPTH ELEV	O.D. I.D.	BLOWS 150	NO.		DESCRIPTION OF MATERIAL	PLASTIC LIMIT	WATER CONTENT		LIQUID LIMIT									
					X-----X													
					10 30 50 70 90 %													
0.15					0.15	PEAT AND TOPSOIL - black												
0.5	B		1				SILTY SAND AND GRAVEL - till like matrix - subrounded gravel - trace cobble to 5" size - brown				○							
1.0																		
1.5	B		2			SAND AND GRAVEL - clean - saturated below 1.0 m - medium to coarse sand and gravel to 3" size				○								
2.0																		
2.5					END OF TEST PIT AT 1.5 m													
3.0					NOTES: Water at 1.1 m.													
3.5																		
4.0																		
4.5																		
5.0																		



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-12
DATE Oct 20-24/86 PLATE

TEST HOLE LOG


SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa									
WEIGHT HAMMER 63.5 Kg					ELEV GROUND 782 m	100 200 300 400									
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1	● FIELD VANE ▲ LAB VANE ■ UNCONF									
DEPTH ELEV	O.D I.D	BLOWS 1.5m	NO.		DESCRIPTION OF MATERIAL					PLASTIC LIMIT	WATER CONTENT	LIQUID LIMIT			
										X	0	X			
										10	30	50	70	90%	
					0.15	TOPSOIL - grass, roots, silty sand									
0.5	B		1		GRAVEL AND COBBLES - subrounded - some boulders to 12" size - some coarse sand - roots to 1.0 m depth - brown										
1.0															
1.5	B		2												
2.0					END OF TEST PIT AT 1.4 m.										
2.5					NOTES: No water encountered. Two buckets of water were poured into the test pit. Water seeped away in less than 30 sec.										
3.0															
3.5															
4.0															
4.5															
5.0															



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-13
DATE Oct 20-24/86 PLATE

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa				
WEIGHT HAMMER 63.5 Kg					ELEV GROUND 778 m	100 200 300 400				
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1	● FIELD VANE ▲ LAB VANE ■ UNCONF				
DEPTH ELEV	O.D. I.D.	BLOWS 150mm	NO.		DESCRIPTION OF MATERIAL	PLASTIC LIMIT	WATER CONTENT		LIQUID LIMIT	
					X 10 30 50 70 90 %					
0.5	B		1	 <p>0.15 TOPSOIL - grass, roots, brown silt</p> <p>GRAVEL AND SAND - fine to medium sand - gravel subrounded - some cobbles to 5" size - medium dense - grey-brown</p>						
1.0										
1.5	B		2							
2.0					END OF TEST PIT AT 1.5 m					
2.5					NOTES: No water encountered.					
3.0										
3.5										
4.0										
4.5										
5.0										



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-14
DATE Oct 20-24/86 PLATE

TEST HOLE LOG

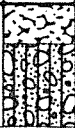
SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa			
WEIGHT HAMMER 63.5 kg					ELEV GROUND 782 m	100 200 300 400			
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1	FIELD VANE LAB VANE UNCONF			
DEPTH ELEV	O.D. I.D.	BLOWS 150mm	NO.		DESCRIPTION OF MATERIAL	PLASTIC LIMIT	WATER CONTENT	LIQUID LIMIT	
					X --- 0 --- X 10 30 50 70 90 %				
0.5	B		1	0.15 TOPSOIL - roots, grass, organic silt					
1.0				0.7 SAND AND GRAVEL - silty, medium dense - subrounded - gravel to 3" size					
1.5	B		2	SAND AND GRAVEL - fine to medium sand - trace cobble to 5" size - dense, trace of silt - grey					
2.0				END OF TEST PIT AT 1.5 m.					
2.5				NOTES: No water encountered.					
3.0									
3.5									
4.0									
4.5									
5.0									



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-15
DATE Oct 20-24/86 PLATE

TEST HOLE LOG


SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa							
WEIGHT HAMMER 63.5 Kg					ELEV GROUND 798 m	100 200 300 400							
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1	FIELD VANE LAB VANE UNCONF							
DEPTH ELEV	O.D. I.D.	BLOWS 15mm	NO.		DESCRIPTION OF MATERIAL				PLASTIC LIMIT	WATER CONTENT	LIQUID LIMIT		
						X	10	30	50	70	90	X	
					0.15	TOPSOIL							
	B		1			- grass, roots, silt, brown							
0.5						GRAVELLY SAND							
						- trace of gravel							
						- medium dense							
1.0						- rock, smooth							
						- very hard at 0.4 m							
						END OF TEST PIT AT 0.4 m							
1.5						NOTES: No water encountered.							
2.0													
2.5													
3.0													
3.5													
4.0													
4.5													
5.0													



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-16
DATE Oct 20-24/86 PLATE

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa								
WEIGHT HAMMER 63.5 Kg					ELEV GROUND 798 m	100 200 300 400								
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1	● FIELD VANE ▲ LAB VANE ■ UNCONF								
DEPTH ELEV	O.D. I.D.	BLOWS 150mm	NO.		DESCRIPTION OF MATERIAL					PLASTIC LIMIT	WATER CONTENT	LIQUID LIMIT		
										X	0	X		
										10	30	50	70	90%
0.15			1		TOPSOIL - grass, roots, silt									
0.5	B				GRAVELLY SAND - fine to medium sand - subrounded gravel to 3" size									
1.0			2		SILTY SAND AND GRAVEL - till like matrix - subrounded cobble to 8" size - zones of some decomposed granite - grey (Bedrock at 1.6 m)									
1.5	B		3											
2.0					END OF TEST PIT AT 1.6 m.									
					NOTES: No water encountered.									
2.5														
3.0														
3.5														
4.0														
4.5														
5.0														



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-17
DATE Oct 20-24/86 PLATE

TEST HOLE LOG


SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa							
WEIGHT HAMMER 63.5 Kg					ELEV GROUND	100	200	300	400				
HEIGHT DROP 0.76 m					CO-ORD LOCATION	● FIELD VANE ▲ LAB VANE ■ UNCONF							
DEPTH ELEV	O.D. I.D.	BLOWS 15mm	NO.		DESCRIPTION OF MATERIAL	PLASTIC LIMIT	WATER CONTENT		LIQUID LIMIT				
						X	10	30	0	50	70	90	X
				0.15	TOPSOIL - grass, roots, silty sand								
0.5	B		1		SAND AND SILT - fine to medium - pockets of silt								
				0.8	- brown								
1.0	B		2		SAND - trace subrounded gravel - boulders to 18" size - fine to medium sand - medium dense - brown								
1.5													
	B		3										
2.0				2.0									
	B		4		GRAVELLY SAND - subrounded gravel to 3" size - trace cobble to 6" size (sub- rounded) - some silt fines								
2.5													
					END OF TEST PIT AT 2.2 m								
3.0					NOTES: No water encountered.								
3.5													
4.0													
4.5													
5.0													



KLOHN LEONOFF
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JOB No. PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-18
DATE Oct 20-24/86 PLATE

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa				
WEIGHT HAMMER 63.5 kg					ELEV GROUND	100 200 300 400				
HEIGHT DROP 0.76 m					CO-ORD LOCATION	FIELD VANE LAB VANE UNCONF				
DEPTH ELEV	O.D. I.D.	BLOWS 1 5 10	NO.		DESCRIPTION OF MATERIAL	PLASTIC LIMIT	WATER CONTENT			LIQUID LIMIT
					X - - - - - X					
					10 30 50 70 90 %					
0.5	B		1		0.6	SILTY SAND AND GRAVEL - loose to medium dense - some cobble to 8" size				
1.0	B		2		SAND AND GRAVEL - very dense, some silt binder - subrounded gravel - some cobbles to 6" size					
1.5					END OF TEST PIT AT 1.2 m.					
2.0					NOTES: No water encountered.					
2.5										
3.0										
3.5										
4.0										
4.5										
5.0										



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-19
DATE Oct 20-24/86 PLATE

TEST HOLE LOG


SAMPLE DATA				SYMBOL	ELEV COLLAR		UNCONFINED COMPRESSION kPa					
WEIGHT HAMMER 63.5 Kg					ELEV GROUND 752 m		100 200 300 400					
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1		FIELD VANE		LAB VANE		UNCONF	
DEPTH ELEV	O.D I.D	BLOWS 15m	NO.		DESCRIPTION OF MATERIAL		PLASTIC LIMIT	WATER CONTENT	LIQUID LIMIT			
						X	10	30	50	70	90	X
				0.1	TOPSOIL - roots, grass, silt							
0.5	B		1	0.5	SILT - firm, trace of fine sand - low plastic, brown							
1.0	B		2	1.0	SAND AND GRAVEL - fine to medium sand - sub rounded gravel, med. dense							
1.5	B		3		SAND AND GRAVEL - subrounded gravel - trace of silt - some cobble to 5" size - very dense							
2.0					END OF TEST PIT AT 1.4 m.							
2.5					NOTES: No water encountered.							
3.0												
3.5												
4.0												
4.5												
5.0												



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-20
DATE Oct 20-24/86 PLATE

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa								
WEIGHT HAMMER 63.5 Kg					ELEV GROUND 740 m	100 200 300 400								
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1	FIELD VANE LAB VANE UNCONF								
DEPTH ELEV	O.D. I.D.	BLOWS 15mm	NO.		DESCRIPTION OF MATERIAL					PLASTIC LIMIT	WATER CONTENT	LIQUID LIMIT		
										X	0	X		
										10	30	50	70	90%
0.5	B		1		0.2	SILT - low plastic - organic, soft	○							
	B		2		SAND AND GRAVEL - clean - subrounded gravel - some cobble to 6" size - medium dense to dense - brown			○						
1.0														
1.5	B	3												
2.0					END OF TEST PIT AT 1.6 m.									
2.5					NOTES: No water encountered.									
3.0														
3.5														
4.0														
4.5														
5.0														



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No PA 2295.01.01
 PROJECT McLean Lake Subdivision
 LOCATION Whitehorse, Yukon
 TEST PIT No. TP86-21
 DATE Oct 20-24/86 PLATE

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR		UNCONFINED COMPRESSION kPa							
WEIGHT HAMMER 63.5 Kg					ELEV GROUND 736 m		100 200 300 400							
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1		FIELD VANE LAB VANE UNCONF							
DEPTH ELEV	O.D I.D	BLOWS 15mm	NO.		DESCRIPTION OF MATERIAL		PLASTIC LIMIT WATER CONTENT LIQUID LIMIT							
						X	10	30	50	70	90	X		
0.5	B		1	0.2	TOPSOIL - silt, some sand, roots									
1.0	B		2		GRAVEL AND COBBLES - subrounded gravel and cobbles - some boulders to 18" size - fairly clean - medium dense to dense									
1.5					END OF TEST PIT AT 1.1 m									
2.0					NOTES: No water encountered.									
2.5														
3.0														
3.5														
4.0														
4.5														
5.0														



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-22
DATE Oct 20-24/86 PLATE

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa							
WEIGHT HAMMER 63.5 Kg					ELEV GROUND 737 m	100 200 300 400							
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1	● FIELD VANE Δ LAB VANE ■ UNCONF							
DEPTH ELEV	O.D. I.D.	BLOWS 15mm	NO.		DESCRIPTION OF MATERIAL				PLASTIC LIMIT	WATER CONTENT	LIQUID LIMIT		
								X	0	X			
								10	30	50	70	90%	
0.1					TOPSOIL - roots, sandy silt								
0.5					GRAVEL AND COBBLES - subrounded gravel and cobbles - some boulders to 1 ft. size - medium to dense - clean - sandy matrix, brown								
1.0	B		1										
1.5					END OF TEST PIT AT 1.1 m.								
2.0					NOTES: No water encountered.								
2.5													
3.0													
3.5													
4.0													
4.5													
5.0													



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JOB No. PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-23
DATE Oct 20-24/86 PLATE

TEST HOLE LOG



SAMPLE DATA				SYMBOL	ELEV COLLAR		UNCONFINED COMPRESSION kPa			
WEIGHT HAMMER 63.5 kg					ELEV GROUND 736 m		100 200 300 400			
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1		● FIELD VANE ▲ LAB VANE ■ UNCONF			
DEPTH ELEV	O.D. T.D.	BLOWS 15m	NO.		DESCRIPTION OF MATERIAL		PLASTIC LIMIT	WATER CONTENT	LIQUID LIMIT	
						X	0	X		
						10	30	50	70	90 %
0.5	B		1	0.2	TOPSOIL - roots, grass, silt					
1.0					SILT - white grey - brown - dry - powdery - firm					
1.5										
2.0	B		2		GRAVEL AND SAND - subrounded to rounded gravel - some cobble to 5" size - matrix of fine dry sand - light brown					
2.5					END OF TEST PIT AT 1.8 m.					
3.0					NOTES: No water encountered.					
3.5										
4.0										
4.5										
5.0										



KLOHN LEONOFF
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JOB No. PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-24
DATE Oct 20-24/86 PLATE

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR		UNCONFINED COMPRESSION kPa					
WEIGHT HAMMER 63.5 Kg					ELEV GROUND 793 m		100 200 300 400					
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1		● FIELD VANE ▲ LAB VANE ■ UNCONF					
DEPTH ELEV	O.D. I.D.	BLOWS 15m	NO.		DESCRIPTION OF MATERIAL		PLASTIC LIMIT		WATER CONTENT		LIQUID LIMIT	
						X	10	30	50	70	90	X
					0.15	TOPSOIL - grass, roots, silt						
0.5	B		1			SAND AND GRAVEL - trace silt - subrounded gravel - boulders to 18" size	○					
1.0					0.9	- medium dense to dense						
	B		2			SAND AND GRAVEL - very dense - subrounded gravel - some cobbles to 5" size	○					
1.5												
2.0					END OF TEST PIT AT 1.3 m.							
2.5					NOTES: No water encountered.							
3.0												
3.5												
4.0												
4.5												
5.0												



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-25
DATE Oct 20-24/86 PLATE

TEST HOLE LOG

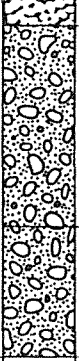
SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa		
WEIGHT HAMMER 63.5 Kg					ELEV GROUND 797 m	100 200 300 400		
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1	● FIELD VANE Δ LAB VANE ■ UNCONF		
DEPTH ELEV	O.D. I.D.	BLOWS 15m	NO.		DESCRIPTION OF MATERIAL	PLASTIC LIMIT	WATER CONTENT	LIQUID LIMIT
					X 10 30 50 70 90 %			
0.5	B		1	0.1 TOPSOIL - grass, roots				
				0.3 SILTY SAND - fine to medium grained sand	○			
				0.6 - firm				
1.0				SAND - gravelly, trace silt				
1.5	B		2	SAND AND GRAVEL - subrounded gravel - trace to some cobble - trace silt	○			
				- medium dense to dense, brown				
2.0				END OF TEST PIT AT 1.6 m.				
				NOTES: No water encountered.				
2.5								
3.0								
3.5								
4.0								
4.5								
5.0								



KLOHN LEONOFF
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JOB No. PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-26
DATE Oct 20-24/86 PLATE

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR		UNCONFINED COMPRESSION kPa							
WEIGHT HAMMER 63.5 Kg					ELEV GROUND 797 m		100 200 300 400							
HEIGHT DROP 0.76 m					CO-ORD. LOCATION See Drawing D-2295-1		● FIELD VANE Δ LAB VANE ■ UNCONF							
DEPTH ELEV	O.D. I.D.	BLOWS 15m	NO.		DESCRIPTION OF MATERIAL		PLASTIC LIMIT		WATER CONTENT		LIQUID LIMIT			
						X	10	30	50	70	90	X		
					0.1	TOPSOIL								
						- roots, organics, silt								
0.5	B		1			SAND AND GRAVEL								
						- some silt								
						- subrounded gravel								
1.0						- medium dense								
	B		2			SAND AND GRAVEL								
						- very dense								
						- traces of decomposed rock								
1.5						- fine to medium sand								
						- grey								
						END OF TEST PIT AT 1.2 m.								
						NOTES: No water encountered.								
2.0														
2.5														
3.0														
3.5														
4.0														
4.5														
5.0														



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-27
DATE Oct 20-24/86 PLATE

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa						
WEIGHT HAMMER 63.5 Kg					ELEV GROUND	100 200 300 400						
HEIGHT DROP 0.76 m					ELEV GROUND	FIELD VANE LAB VANE UNCONF						
DEPTH ELEV	O.D. I.D.	BLOWS 15m	NO.		CO-ORD LOCATION	PLASTIC LIMIT	WATER CONTENT		LIQUID LIMIT			
					DESCRIPTION OF MATERIAL	X	10	30	50	70	90	X
					0.1 TOPSOIL - roots							
0.5	B		1		SILTY SAND AND GRAVEL - subrounded gravel - fine to medium sand							
					0.7 - boulders to 12" size							
1.0	B		2		SAND AND GRAVEL - grey - trace silt, binder - subrounded gravel - trace cobble to 4" size							
1.5												
					END OF TEST PIT AT 1.2 m.							
2.0					NOTES: No water encountered.							
2.5												
3.0												
3.5												
4.0												
4.5												
5.0												



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-28
DATE Oct 20-24/86 PLATE

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa							
WEIGHT HAMMER 63.5 Kg					ELEV GROUND	100 200 300 400							
HEIGHT DROP 0.76 m					ELEV GROUND	● FIELD VANE Δ LAB VANE ■ UNCONF							
DEPTH ELEV	O.D. I.D.	BLOWS 15m	NO.		CO-ORD LOCATION	PLASTIC LIMIT	WATER CONTENT		LIQUID LIMIT				
					See Drawing D-2295-1	X	10	30	0	50	70	90	X
					DESCRIPTION OF MATERIAL								
0.5					0.1	TOPSOIL - grass, roots, silty sand							
1.0	B		1		1.0	SAND AND GRAVEL - subrounded gravel - some cobble and boulder to 12" size - medium dense - some silt, brown	○						
1.5	B		2			SAND AND GRAVEL - very dense - fine to medium sand - subrounded gravel, grey		○					
2.0					END OF TEST PIT AT 1.3 m.								
2.5					NOTES: No water encountered.								
3.0													
3.5													
4.0													
4.5													
5.0													



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-29
DATE Oct 20-24/86 PLATE

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa			
WEIGHT HAMMER 63.5 kg					ELEV GROUND 792 m	100 200 300 400 ● FIELD VANE Δ LAB VANE ■ UNCONF			
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1	PLASTIC LIMIT	WATER CONTENT		LIQUID LIMIT
DEPTH ELEV	O.D. I.D.	BLOWS 15m	NO.		DESCRIPTION OF MATERIAL	X 10	0	50	70
0.5	B	1		0.15 TOPSOIL - grass, roots, silt					
				SILT - dry - firm - some fine sand					
1.0	B	2		SAND AND GRAVEL - subrounded gravel - some silt binder - trace cobble to 6" size - dense, grey-brown					
1.5				END OF TEST PIT AT 1.4 m.					
2.0				NOTES: No water encountered.					
2.5									
3.0									
3.5									
4.0									
4.5									
5.0									



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-30
DATE Oct 20-24/86 PLATE

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR		UNCONFINED COMPRESSION kPa						
WEIGHT HAMMER 63.5 kg					ELEV GROUND 797 m		100 200 300 400						
HEIGHT DROP 0.76 m					CO-ORD LOCATION See Drawing D-2295-1		● FIELD VANE ▲ LAB VANE ■ UNCONF						
DEPTH ELEV	O.D. I.D.	BLOWS 1.5m	NO.		DESCRIPTION OF MATERIAL		PLASTIC LIMIT	WATER CONTENT			LIQUID LIMIT		
						X	10	30	50	70	90	X	
				0.1	TOPSOIL - grass, silt								
0.5	B		1		SILTY SAND AND GRAVEL - subrounded gravel - some cobble and boulders to 18" size	○							
				0.8	- brown								
1.0	B		2		SAND AND GRAVEL - dense - silty - trace cobble	○							
1.5													
2.0					END OF TEST PIT AT 1.0 m.								
					NOTES: No water encountered.								
2.5													
3.0													
3.5													
4.0													
4.5													
5.0													



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 2295.01.01
PROJECT McLean Lake Subdivision
LOCATION Whitehorse, Yukon
TEST PIT No. TP86-31
DATE Oct 20-24/86 PLATE

PERCOLATION TEST DATA SHEET

Percolation test readings made by A. Sy / I. Blown on 86/11/18 starting at 1:44 a.m. (p.m.)

Test hole location MacLean Lake, Hole number 86-7A, Date hole was prepared 86/11/18

Depth of hole bottom 60 inches, Diameter of hole 7 inches

Soil data from test hole:

Depth, inches	Soil texture
<u>0-0.15 m</u>	<u>Topsoil</u>
<u>0.15-1.6 m</u>	<u>Sand & gravel (glacial till)</u>
<u>USED A CMC AUGER, HOLE SLOUGHED 12"</u>	

Method of scratching sidewall

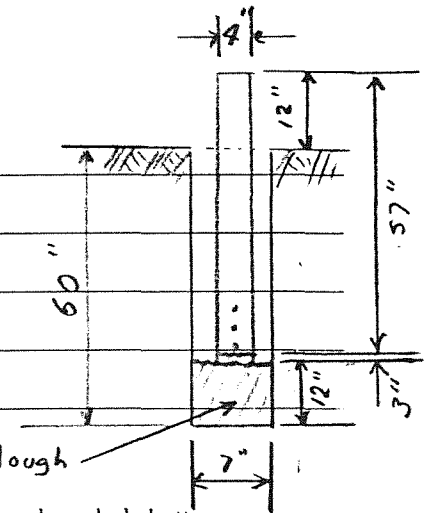
Depth of gravel in bottom of hole 1 inches

Date and hour of initial water filling 86/11/18 9:00, Depth of initial water filling 37 inches above hole bottom

Method used to maintain at least 12 inches of water depth in hole for at least 4 hours Manual refilling, Maximum water depth above hole bottom during test 24 inches

Time	Time interval, minutes	Measurement, inches	Drop in water level, inches	Percolation rate, minutes per inch	Remarks
<u>1:44:05</u>		<u>48</u>			<u>fill</u>
<u>2:07:10</u>	<u>23:05</u>	<u>54</u>	<u>6</u>	<u>3.8</u>	
<u>3:00:00</u>		<u>50</u>			<u>refill</u>
<u>3:18:50</u>	<u>18:30</u>	<u>55</u>	<u>5</u>	<u>3.7</u>	
<u>3:51:10</u>		<u>48</u>			<u>refill</u>
<u>4:19:20</u>	<u>28:10</u>	<u>55</u>	<u>7</u>	<u>4.0</u>	
<u>4:26:00</u>		<u>51 1/2</u>			<u>refill</u>
<u>4:32:00</u>	<u>6:00</u>	<u>53</u>	<u>1 1/2</u>	<u>4.0</u>	
<u>3:21:00</u>		<u>45</u>			<u>refill</u>
<u>3:48:10</u>	<u>27:10</u>	<u>53 1/2</u>	<u>8 1/2</u>	<u>3.2</u>	

Percolation rate = 3.8 minutes per inch.



PERCOLATION TEST DATA SHEET

Percolation test readings made by A. Sy/I Blown on 8/11/18 starting at 2:53 ^{a.m.}_{p.m.}

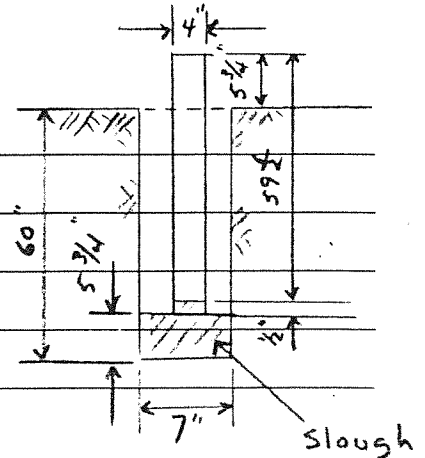
Test hole location MacLean Lake, Hole number 86-9A, Date hole was prepared 8/11/18

Depth of hole bottom 60 inches, Diameter of hole 7 inches

Soil data from test hole:

Depth, inches
0 - 0.15 m
0.15 - 1.0 m
1.0 - 1.5 m

Soil texture
Topsoil
Sand, gravelly (ablation till?)
Sand (decomposed granite?)



Method of scratching sidewall _____

Depth of gravel in bottom of hole 1 inches

Date and hour of initial water filling 8/11/18 11:05, Depth of initial water filling 19 3/4 inches above hole bottom

Method used to maintain at least 12 inches of water depth in hole for at least 4 hours Manual refilling
_____, Maximum water depth above hole bottom during test 19 3/4 inches

Time	Time interval, minutes	Measurement, inches	Drop in water level, inches	Percolation rate, minutes per inch	Remarks
2:55:15		52 1/4			No. 18 Fill
3:15:50	20:35	55	2 3/4	7.5	
3:15:45		52			Refill
3:42:00	26:15	56	4	6.6	
3:44:45		52			Refill
3:53:55	9:10	53	1	9.3	
4:37:00		46 1/2			Refill
4:53:20	16:30	50	1 3/4	9.3	
10:11:15		52 1/4			No. 19 Refill
11:17:30	30:15	56	3 1/4	8.1	

Percolation rate = 8.2 minutes per inch.

PERCOLATION TEST DATA SHEET

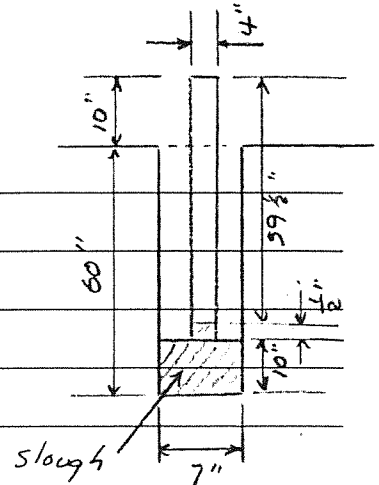
Percolation test readings made by A Sy/I Blown on 8/11/18 starting at 3:30 a.m.
(date) p.m.

Test hole location McLean Lake, Hole number 86-15A, Date hole was prepared 8/11/18

Depth of hole bottom 60 inches, Diameter of hole 7 inches

Soil data from test hole:

Depth, inches	Soil texture
<u>0 - 0.15 m</u>	<u>Topsoil</u>
<u>0.15 - 0.7 m</u>	<u>Silty sand & gravel</u>
<u>0.7 m - 1.5 m</u>	<u>sand & gravel (ablation 1.1?)</u>



Method of scratching sidewall

Depth of gravel in bottom of hole 1/2 inches

Date and hour of initial water filling 8/11/18 12:20, Depth of initial water filling 32 inches above hole bottom

Method used to maintain at least 12 inches of water depth in hole for at least 4 hours Manual refill

Maximum water depth above hole bottom during test 19 inches

Time	Time interval, minutes	Measurement, inches	Drop in water level, inches	Percolation rate, minutes per inch	Remarks
<u>3:30:45</u>		<u>52 3/4</u>			<u>No. 18 Fill</u>
<u>3:41:15</u>	<u>19:30</u>	<u>53 1/2</u>	<u>0.75</u>	<u>26.0</u>	
<u>3:53:35</u>		<u>51</u>			<u>Refill</u>
<u>4:45:45</u>	<u>1:12:10</u>	<u>53 1/2</u>	<u>2 1/2</u>	<u>28.9</u>	
<u>1:15:00</u>		<u>52 1/4</u>			<u>No. 19 Fill</u>
<u>1:45:00</u>	<u>30:00</u>	<u>53 1/2</u>	<u>1 1/4</u>	<u>24</u>	
<u>1:48:00</u>		<u>52 1/4</u>			<u>Refill</u>
<u>2:18:00</u>	<u>30:00</u>	<u>53 1/2</u>	<u>1 1/4</u>	<u>24</u>	

Percolation rate = 26 minutes per inch.

PERCOLATION TEST DATA SHEET

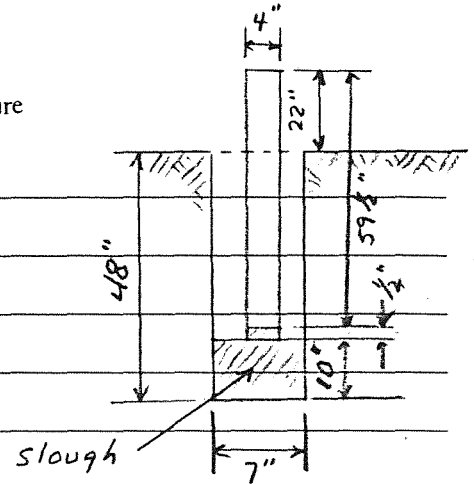
Percolation test readings made by A. Sy / I Blown on 86/11/18 & 19 starting at 2:34 a.m.
(date) p.m.

Test hole location MacLean Lake, Hole number 86-178, Date hole was prepared 86/11/18

Depth of hole bottom 48" inches, Diameter of hole 7 inches

Soil data from test hole:

Depth, inches	Soil texture
<u>0 - 0.15 m</u>	<u>Topsoil</u>
<u>0.1 - 0.5 m</u>	<u>Silty, gravelly sand</u>
<u>0.5 - 1.6</u>	<u>Silty, sand & gravel, some decomposed granite</u>



Method of scratching sidewall _____

Depth of gravel in bottom of hole 1/2 inches

Date and hour of initial water filling 86/11/18 10:55, Depth of initial water filling 23 inches above hole bottom

Method used to maintain at least 12 inches of water depth in hole for at least 4 hours Manual refilling
 _____, Maximum water depth above hole bottom during test 18 5/8 inches

Time	Time interval, minutes	Measurement, inches	Drop in water level, inches	Percolation rate, minutes per inch	Remarks
<u>2:34:30</u>		<u>52 1/2</u>			<u>Fill Nov. 18/86</u>
<u>2:39:30</u>	<u>5:00</u>	<u>54</u>	<u>1 1/2</u>	<u>3.5</u>	
<u>3:27:45</u>		<u>52 3/4</u>			<u>Refill</u>
<u>3:36:55</u>	<u>9:10</u>	<u>55</u>	<u>2 1/4</u>	<u>4.1</u>	
<u>11:46:40</u>		<u>51 3/8</u>			<u>Fill Nov. 19/86</u>
<u>12:07:30</u>	<u>21:10</u>	<u>55 1/8</u>	<u>3 3/4</u>	<u>5.7</u>	
<u>12:10:40</u>		<u>51 1/2</u>			<u>Refill</u>
<u>12:32:00</u>	<u>21:20</u>	<u>55 1/4</u>	<u>3 3/4</u>	<u>5.7</u>	

Percolation rate = 5 minutes per inch.

PERCOLATION TEST DATA SHEET

Percolation test readings made by A. Sy on 10/25/86 starting at 3.12 ^{a.m.} _{p.m.}

Test hole location MACLEAN LAKE, Hole number 86-311, Date hole was prepared 10/24/86

Depth of hole bottom 48 inches, Diameter of hole 8 to 10 inches

Soil data from test hole:

Depth, inches

0 - 0.1 m

TOPSOIL

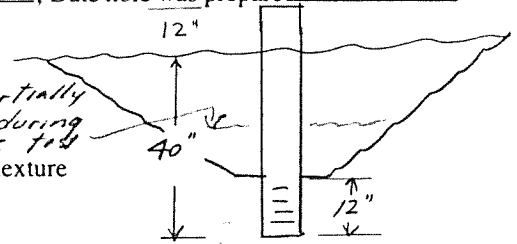
0.1 - 0.8 m

SILTY SAND & GRAVEL (ABLATION TILL)

0.8 - 1.8 m

SILTY SAND & GRAVEL (GLACIAL TILL)

Test pit partially
backfilled during
pore test
Soil texture



Method of scratching sidewall _____

Depth of gravel in bottom of hole _____ inches

Date and hour of initial water filling 10/24/86; 5 p.m., Depth of initial water filling 12 inches above hole bottom

Method used to maintain at least 12 inches of water depth in hole for at least 4 hours _____

_____, Maximum water depth above hole bottom during test 8 inches

Time	Time interval, minutes	Measurement, inches	Drop in water level, inches	Percolation rate, minutes per inch	Remarks
		<u>59"</u>			<u>Bottom of hole</u>
<u>3.12 p.m.</u>	<u>0</u>	<u>50 ¹²/₁₆"</u>			<u>Fill</u>
<u>3.24 p.m.</u>	<u>12</u>	<u>51 ¹¹/₁₆"</u>			
<u>3.36 p.m.</u>	<u>24</u>	<u>52 ⁵/₁₆"</u>			
<u>3.42 p.m.</u>	<u>30</u>	<u>52 ⁹/₁₆"</u>	<u>1 ¹³/₁₆</u>	<u>16.55</u>	
<u>3.44 p.m.</u>	<u>0</u>	<u>50 ¹⁴/₁₆"</u>			<u>Refill</u>
<u>4.14 p.m.</u>	<u>30</u>	<u>52 ⁶/₁₆"</u>	<u>1 ¹/₄₂</u>	<u>20.00</u>	
<u>4.16 p.m.</u>	<u>0</u>	<u>51</u>			<u>Refill</u>
<u>4.46 p.m.</u>	<u>30</u>	<u>52 ⁷/₁₆"</u>	<u>1 ⁷/₁₆</u>	<u>20.87</u>	
<u>4.48 p.m.</u>	<u>0</u>	<u>50 ¹²/₁₆"</u>			<u>Refill</u>
<u>5.20 p.m.</u>	<u>32</u>	<u>52 ⁴/₁₆"</u>	<u>1 ¹/₂</u>	<u>21.33</u>	
		<u>Ave = $\frac{20 + 20.87 + 21.33}{3}$</u>		<u>= 20.7</u>	

Percolation rate = 20.7 minutes per inch. SILTY SAND & GRAVEL (GLACIAL TILL)



P.O. Box 4391

FIELD REPORT

Started *May 30*.....1979

Completed *May 31*....1979

NAME AND ADDRESS OF CLIENT	DESCRIPTION OF WORK	LOCATION OF WORK
<i>Paddyman</i>	<i>10/10</i>	<i>Paddle Wheel</i>

FORMATION LOG		DESCRIPTION OF WORK	TIME			
FROM	TO		DATE	FROM	TO	HOURS
		<i>Moving and setting up</i>	<i>May 30</i>	<i>8:00</i>	<i>9:00</i>	<i>1</i>
<i>0</i>	<i>12</i>	<i>Gravel cobbles</i>	<i>"</i>	<i>9:00</i>	<i>6:30</i>	<i>9.5</i>
<i>12</i>	<i>21</i>	<i>sand Gravel</i>				
<i>21</i>	<i>30</i>	<i>Gravelly till</i>				
<i>30</i>	<i>43</i>	<i>Gravel silty sand</i>				
<i>43</i>	<i>48</i>	<i>silt</i>				
<i>48</i>	<i>52</i>	<i>Gravelly till</i>				
<i>57</i>	<i>84</i>	<i>Till</i>				
<i>84</i>	<i>141</i>	<i>clay silt some Gravel</i>				
<i>141</i>	<i>155</i>	<i>Till</i>				
<i>155</i>	<i>185</i>	<i>Hard silt clay some Gravel</i>				
		<i>Landings (shop)</i>	<i>May 31</i>	<i>8:00</i>	<i>9:00</i>	<i>1</i>
<i>185</i>	<i>239</i>	<i>Hard silt clay</i>	<i>"</i>	<i>9:00</i>	<i>1:00</i>	<i>4</i>
<i>239</i>	<i>248</i>	<i>silt</i>				
<i>248</i>	<i>252</i>	<i>fine sand</i>				
<i>252</i>	<i>255</i>	<i>bed rock</i>				
		<i>Developing</i>	<i>"</i>	<i>1:00</i>	<i>2:30</i>	<i>1.5</i>
		<i>Moving off to shop</i>	<i>"</i>	<i>2:30</i>	<i>4:00</i>	<i>1.5</i>

Recd. of Casing & Pipe
Size Type Size Type

Remarks:

Feet Inch Feet Inch

21 4 21 6
21 5 21 5
21 3 21 5
20 1 21 5
13 21 7
21 5 5 4
21 5

STATIC LEVEL

Ground level

Top of casing *73 rising*

Total Rig Time *18.5* hrs.

Total Standby hrs.

Drilling Mud sacks

SIGNATURES

MIDNIGHT SUN.....
TITLE.....

CLIENT.....
TITLE.....

