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**Geotechnical Evaluation
Proposed Airport Connector Road
Teslin, Yukon – 2017**



Prepared For: Village of Teslin

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Proposed Airport Connector Road
Teslin, Yukon – 2017**

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1.0 INTRODUCTION

Our firm was retained by *Village of Teslin* to conduct a geotechnical evaluation of an area located near the Teslin Airport to determine the feasibility of constructing a road through the region. The purpose of the road is to link a series of community subdivisions (Airport West, Teslin Airport and Airport East) to allow for a safe alternative to by-pass portions of the Alaska Highway. In addition, the new connector road would allow for access to new lands which could ultimately be developed for industrial/commercial purposes.

The study area, which measures ~27 ha in size, is comprised of ~15 ha of *Teslin Tlingit Council (TTC)* Land Selection C-3B and *Yukon Government* lands (portions of Lot 1030-2), the extreme eastern realms of which, lie within the *Village of Teslin (VoT)* municipality.

The study area is located immediately north of the Teslin Airport (Lot 1030-1) as noted in Figure 1.

Authorization to proceed with the geotechnical evaluation was granted by *Déslin Development Corporation (DDC)* - Project Manager, Mr. Adam Grinde on September 4th, 2017. The field work was subsequently conducted between September 11th and October 6th, 2017 in accordance with our August 7th, 2017 proposal.

The findings of our evaluation have been presented herein along with a description of our methodology which was utilized to conduct the work.

2.0 SCOPE-OF-WORK

Our scope-of-work involved conducting a literature review as well as field and laboratory work programs to characterize the study area from a geotechnical perspective. The intent of our evaluation was to assess the near surface soil conditions within the study area to better assess potential development options for the proposed Airport Connector Road and provide geotechnical recommendations to allow for road construction.



3.0 METHODOLOGY

Our methodology was comprised of a literature review as well as field and laboratory work programs as described below.

3.1 Literature Review

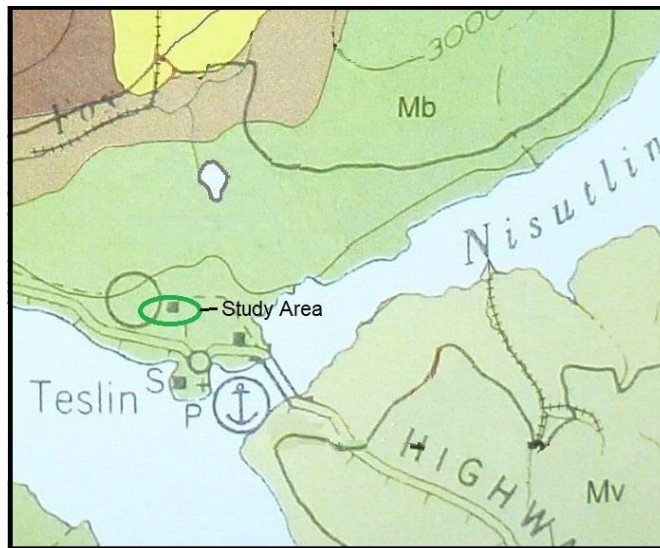
A literature review was conducted to evaluate satellite imagery, a selection of aerial photos, topographical data and other technical resources which were readily available for the study area. This information was utilized to evaluate the regional conditions and detail the field work program.

The following sources of information were reviewed;

Surficial Geology Map

Map 1891A – Scale 1:125,000 of the Teslin area (compiled by *S.R. Morison and R.W. Klassen, 1997*).

The surficial geology map identified landform terrain types and indicated the generic composition with textural, morphological and erosional modifiers as follows;



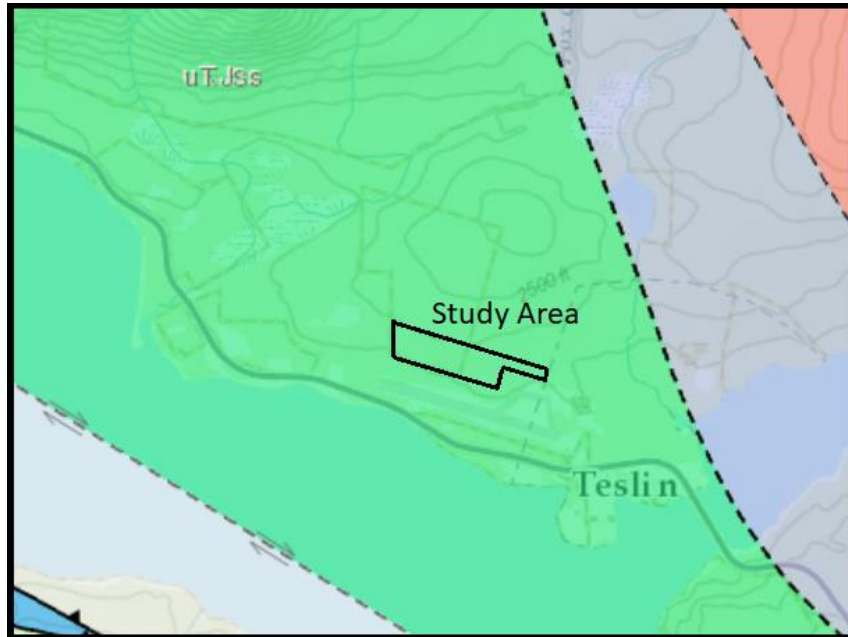
Bedrock Geology Map

A bedrock geology map, available through the *Yukon Geological Survey*, identified the regional bedrock types and characteristics within the study area. The map was entitled *Yukon Bedrock Geology Map* – *Yukon Geological Survey* – Open File



2016-1 - 1:1,000,000 scale compiled by M.Colpron, S.Israel, D.Murphy, L.Pigage, and D.Moynihan.

A more detailed delineation of these contacts was found on the *Yukon Geological Survey* website and has been attached as follows;



Topographical Information

The regional topography was assessed by viewing a 1:50,000 scale topographical map (NTS – 105C02 Teslin) and *Yukon Geology* and *Water Placer Atlas* websites.

Aerial Photographs

A selection of aerial photographs were obtained from *YG – Energy, Mines and Resources* to allow for a more detailed assessment through airphoto terrain analysis. Of those available, the August 16th, 1984 airphotos (from flight line A26589 # 6-9) provided the best resolution. As such, it has been attached for reference purposes in Appendix B.

Satellite Imagery

A review of satellite imagery from *Google Earth* allowed for an assessment of the site conditions relative to more recent imagery. The imagery which was available dated between June 1st, 2008 and March 27th, 2013.



Other Resources

The *Yukon Government – Water Placer Atlas* website was reviewed as it provided the boundaries of various land dispositions, drainage regimes and other similar types of information. The corresponding boundaries of the study area have been illustrated on the *Water Placer Atlas* map as noted below.



Technical Reports

The following technical reports were reviewed;

- Geotechnical Evaluation – Preliminary Site Assessment – Proposed Airport Connector Road, dated August 26th, 2015 prepared by our firm.

This report presented preliminary findings relative to crossing the low-lying wet region located within the study area. Shallow soil samples were retained during a hand auger program to allow for laboratory analysis. In brief, the soil and site conditions which were encountered suggested road construction through the low-lying wet region would be feasible.



- Designated Office Evaluation Report – Teslin Connector Road prepared by the *Yukon Environmental and Socio-Economic Assessment Board* (YESAB) Project No 2017-0105 dated May 31, 2017.

This *YESAB* evaluation was conducted to determine whether or not there would be adverse environmental or socio-economic effects inside or outside Yukon. In brief, their evaluation recommended the project be allowed to proceed as no adverse effects were identified.

3.2 Field Work Program

The field work program was comprised of utility locates, a site reconnaissance and a test pit excavation program.

Utility Locates

Utility locates were conducted prior to test pit excavation in order to confirm that the proposed test pit locations were clear of potential underground hazards. This involved contacting *Northwestel* and *ATCO Electric Yukon*. In brief, beyond the airport road system, there were no utilities located within the study area.

Site Reconnaissance

A site reconnaissance was conducted by the undersigned on September 11th, 2017 to note the field conditions and geological features within (and just beyond) the study area.

During this time, the region was traversed on foot with the *DDC* Project Manager, such that both local and regional field conditions and geological features could be observed. During this time, our observations were documented through a combination of field notes, GPS waypoints and photographs. These observations have been summarized in Section 4.0 – Site Conditions, below.

Test Pit Program

A test pit program was conducted on October 5th and 6th, 2017 to assess the sub-surface conditions at select locations within the study area. This component of work was overseen and directed by the undersigned.



The test pits were excavated across the study area to better characterize the types of terrain which were identified during the site reconnaissance. The work consisted of excavating eleven (11) test pits utilizing a *Kubota kx-057* tracked excavator equipped with a digging bucket. The excavator was supplied and operated by *Flag Hill Woodworks* of Teslin, Yukon.



Conditions at TP 8-17

The test pits were excavated to an average depth of 1.6 meters (but varied between 0.7 and 2.0 meters) below the existing ground surface at the approximate locations noted in Figure 2.

Survey

The test pit locations were surveyed during the work utilizing a hand-held GPS unit. Although the elevations varied, given the regional nature of the study, each test pit was given an arbitrary elevation of 100.0 meters.

Test Pit Soil Logs

During the test pit excavations, field soil logs were maintained by the undersigned to record the stratigraphy of the soils that were encountered.

In brief, the following information was recorded;

Soil description

(depths, color, relative moisture content and density, gradation/plasticity, inclusions, oxidation, transition zones)

Sample depths and types

Comments regarding excavation effort

Other local observations

This information was utilized along with visual observations and the results of the laboratory analysis in order to compile the Test Pit Soil Logs which have been enclosed in Appendix A. In addition to the soil logs, this appendix also includes a test pit legend and a description of the *Unified Soil Classification System* which was utilized in classifying the soil.

Sampling Program

A total of forty-two (49) soil samples were retained at regular intervals during the test pit excavations to allow for laboratory analysis (as described in Section 3.3, below).



Typically, samples located within the upper meter of each test pit were retained by hand from the excavation sidewalls. The remainder of the samples were retained from the leading edge of the excavator bucket.



TP 9-17 Sidewall Samples

Once the soil samples were retained, they were described on the field soil logs, sealed in air-tight plastic bags and numbered consecutively to allow for subsequent laboratory analysis.

Test Pit Termination

The test pits were terminated at an average depth of 1.6 meters, but varied between 0.7 meters (TP 7-17) and 2.0 meters (TP 8-17).

Each of these test pits were terminated within soils which were classified as either till or else possible till deposits.

Refusal was encountered in only one of the test pits (TP 7-17) at a depth of 0.7 meters below the ground surface. The refusal was due to the presence of a large boulder or possible bedrock.

The test pit excavations were each left open for approximately 10 minutes following excavation in order to assess the excavation sidewall stability over the course of time. In addition, this time allowed for observations of groundwater seepage to be made.

In brief, although there were no signs of sidewall slough, the sidewall stability in the test pits excavated in Area 3 (TP 1-17 & TP 8-17) was considered poor due to the saturated soil conditions which were encountered at these locations.

Free flowing groundwater was encountered in TP 1-17 & TP 8-17 at a depth of approximately 0.35 meters below the ground surface.



TP 1-17



The groundwater influx in TP 1-17 was considerable enough to force abandonment of the test pit at a depth of 1.4 meters. By comparison, although a steady influx was observed in TP 8-17, the rate of groundwater seepage was not enough to halt excavation.

Oxidized soils were noted at some locations within the glacial till indicating the presence of seasonally/intermittent groundwater flow.

Following our observations, all test pit excavations were backfilled with the excavation spoils. The test pits locations were subsequently marked utilizing survey lathe to allow for subsequent field location if required.

Photographic Documentation


Photos were taken during the course of the evaluation to document the field work, soil samples and site conditions.

3.3 Laboratory Work Program




A physical laboratory analysis was conducted between October 9th and 27th, 2017 at our Whitehorse laboratory facilities in order to characterize the index properties and conditions of the retained soil samples.

The analysis was comprised of the following analysis;

<i>Description of Analysis</i>	<i>ASTM Analysis</i>	<i>Quantity</i>
Moisture Content	D 2216-92	49
Grain Size Distribution	D 422-633	17

The results of the moisture analysis have been denoted as 'MC' ( - Symbol) on the Test Pit Soil Logs enclosed in Appendix A.

The grain size distribution analysis was conducted in order to assist in soil classification utilizing the *Unified Soils Classification System*.

The results of the analysis have been noted on the Soil Logs with the percent composition of fines (silt & clay), sand and gravel denoted with the symbols - ,  & , respectively.



4.0 SITE CONDITIONS

4.1 Study Area

The study area is located immediately north of the Teslin Airport as noted in Figure 1.

Measuring approximately 27 ha in size, the study area is comprised of both *Teslin Tlingit Council (TTC)* and *Yukon Government* lands, the extreme eastern realms of which lie within the *Village of Teslin* municipality. The western half is comprised of a ~15 ha portion of *TTC* land selection C-3B. The eastern half lies in *YG/VoT* lands (portions of Lot 1030-2).

The site is bound by Teslin Airport lands (Lot 1030-1) which lie to the south. A cut-line is located along this southern boundary. A square *Nav Canada* site is located immediately north of the study areas eastern half. A former (50-meter-wide) cat trail (which has become overgrown), trends approximately north-south along the eastern side of the site.



Former cat trail facing south

4.2 Physiographic Region

The study area lies in the southern lakes district of Yukon, approximately 750 meters away from the eastern shores of Teslin Lake. Located in the Pelly Mountains, the terrain is dominated by gentle (6-12%) slopes. The northern boundary of the study area lies at elevations in the order of 730 meters. Lower elevations, in the order of 700 meters prevail along its south boundary. The nearby mountains, which lie to the north of the site, are of the Big Salmon Range. While regionally, these mountains rise to elevations in the order of 1500 meters, the local terrain which overlies the study area has a maximum elevation of ~810 meters. Teslin Lake lies at an elevation of ~684 meters.

4.3 Site Description

The study area is comprised of four distinct areas, the approximate limits of which have been illustrated in Figure 3.



The terrain in these areas varied as follows;

- Area 1 – Elevated Terrain
The terrain in this area lay several meters higher in elevation relative to the peripheral drainage areas and drainage course identified in Area 3. Healthy forests dominated this region. The slope angle in this region varies between 8-12%.
- Area 2 - Peripheral Drainage Areas
These regions (2a & 2b) lie adjacent to the existing (Area 3) drainage course and coincide with areas of former (or else seasonally intermittent) drainage. Portions of these areas slope steeply towards Area 3.



Site Conditions at TP 10-17

- Area 3 - Drainage Course
Relative to the other areas within the study area, this area lies several meters lower. The area is best characterized as a swamp, with regions of thick saturated organic deposits, standing water, stunted black spruce trees and signs of potential permafrost noted throughout. However, it also contains small areas of isolated terrain islands where more erosion resistant soil units are present.



This area may have infilled following channel erosion which occurred during the glacial recession.



The area likely harbors permafrost at some locations. Lower slope angles in the order of 6% are present in this area.

- Area 4 – Historical Disturbed Region

This area is located in an historically developed region of the airport where building structures and related infrastructure were once present. An existing roadway is located in this area.



4.4 Geomorphology

The surficial geology map described the area as being comprised of morainal blanket (Glacial Till) deposits. Morainal blankets consist of lodgment and ablation till with a silty to sandy matrix which varies between 1 to 30 meters thick. The morphological expression is described as gently irregular to strongly irregular bedrock controlled topography blanketed by till. Although not identified (likely due to the scale of mapping), the glacial tills are covered with glaciofluvial and organic materials.

The glacial till deposits are characterized by unsorted mixtures of clay, silt, sand and gravels which were deposited during melting of glacial ice. These deposits also contain cobble to boulder sized materials.

The glacial tills are overlain with a thin (100-200 mm) veneer of glaciofluvial deposits comprised of predominately granular (silty sand) materials. These materials were deposited by glacial meltwaters during the glacial retreat.



The above noted glacially derived deposits are covered with a veneer of surficial organics. Fills overlie some regions of the study area due to both historical and more recent development.

Soil Stratigraphy

In general, the subsurface soil units which were encountered in the study area can be classified as;

Fills

Although fills were not encountered during our test pit program, three regions of fill were identified within the study area during the site reconnaissance. These areas are comprised of Waste Piles A & B and Area 4, as illustrated in Figure 4.

The nature of the fills in these areas will vary as follows;

Waste Pile A

This area is comprised of a considerable amount of grubbing and stripping materials which are remnants from the construction of the Airport West Subdivision.

Waste Pile B

This area also harbors remnant waste debris from the Airport West Subdivision. However, the profile suggests the amount of waste (stripping/grubbing) is less than what would encountered in the Waste Pile A area.

Area 4

Located along the eastern arm of the study area, the fills in this region will be comprised of predominately granular based materials which are remnants of historical development of the airport area. As with all fills and historically developed areas, deleterious materials may also be encountered in the form of fine-grained soils, organics, former septic fields, concrete building foundations, etc.

Organic Stratum

This stratum is generally comprised of moist soft organics and organic silts.

The thickness of this stratum varied. In general, this stratum measured on average 85 mm thick (but varied between 50 to 100 mm) in regions where test pits were excavated beyond the realms of the low-lying drainage course.



Otherwise, in the regions within (or near) the drainage course (Areas 2 & 3), this stratum was thicker, measuring on average 400 mm (but varied between 300 and 500 mm).

This stratum overlay glaciofluvial deposits.

Glaciofluvial Deposits

Based upon the laboratory analysis, these deposits are predominately comprised of loose, damp to moist, reddish-brown silty gravelly sands (SM) but may also be comprised of finer silt/clay sized materials. The thickness of these deposits varied between 100 to 200 mm.

On average, the moisture content of these deposits measured 10.8% (but varied between 6.4 to 21.8%), indicating generally damp conditions.

These deposits overlay glacial till deposits.

Glacial Till Deposits

These deposits are comprised of unsorted silt, sand and gravel mixtures which contain varying amounts of both fractured and sub-rounded cobble to boulder sized materials.

The laboratory analysis generally classified the materials as silty sands (SM) which contained varying amounts of gravel.



TP 4-17



TP 6-17



The nature of the deposit varied with depth. In general, compact grey-brown tills were encountered immediately below the glaciofluvial deposits at an average depth of 0.25 meters. Platy fracture rocks (which measured up to 500 mm in size at some locations) were encountered in nine (9) of the eleven (11) test pits at the interface between the glaciofluvial and glacial till deposits at this depth. While this zone of till contained cobble to boulder sized materials at some locations, the frequency of cobbles and boulders increased beyond a depth of 1.0 meters where dense dark-grey-brown tills were generally encountered. Here, sub-rounded and fractured boulders in size to 1.3 meters and 0.7 meters, respectively, were encountered. As with generally all till deposits, larger boulders can be expected.



Surficial boulders in size to 2.0 meters were noted sporadically throughout the study area.

Local Soil Variations

Although a similar soil stratigraphy was encountered in each of the four areas, the following variations were noted;

Area 1 – Elevated Regions (TP 2-17 through TP 7-17)

The soils in this area were predominately comprised of glacial tills which were overlain with a 150 mm thick glaciofluvial veneer and on average 85 mm of organics. TP 7-17 encountered refusal at a depth of 0.7 meters suggesting large boulders or possibly bedrock, are located in this area.

The average moisture content of the glacial tills in this area was noted to be 4.7% (but varied between 2.9 to 7.1%).

Area 2 - Peripheral Drainage Areas (TP 9-17 & TP 10-17)

The soil stratigraphy in Area 2a & 2b are similar to those in Area 1. However, the organic stratum in this area is thicker, measuring on average 350 mm thick. While glacial tills were clearly identified in Area 2a, the soils in Area 2b were classified as possible tills as identifying features were subdued and higher moisture contents were encountered.

Shallow seepage zones and higher soil moisture contents of are likely in this area.



The average moisture content of the glacial tills in this area was noted to be 10.3% (but varied between 6.4 to 17.7%).

Area 3 - Drainage Course (TP 1-17 & TP 8-17)

The underlying deposits in this area are comprised of wet to saturated glaciofluvial materials, glacial tills and potential sheet-wash deposits. Sheet-wash deposits are comprised of surface regolith which has been deposited as a result of thin overland surface flows. This region harbored the thickest layer of organics, measuring between 400 to 500 mm thick.

The average moisture content of the glacial tills in this area was noted to be 14.2% (but varied between 10.0 to 16.6%).

Area 4 – Historically Developed Region (TP 11-17)

While glacial tills (which are overlain with glaciofluvial deposits and a 100 mm thick organic stratum) were encountered at the test pit location, construction fills and remnants of building infrastructure (i.e. concrete foundations, septic fields, etc.) may be present in this Area.

The average moisture content of the glacial tills in this area was noted to be 6.2% (but varied between 5.7 to 6.6%).

Glaciation

Evidence shows that the glacial features are likely associated with the Cordilleran Ice Sheet. Glacial advancement in this region was identified as being towards the north.

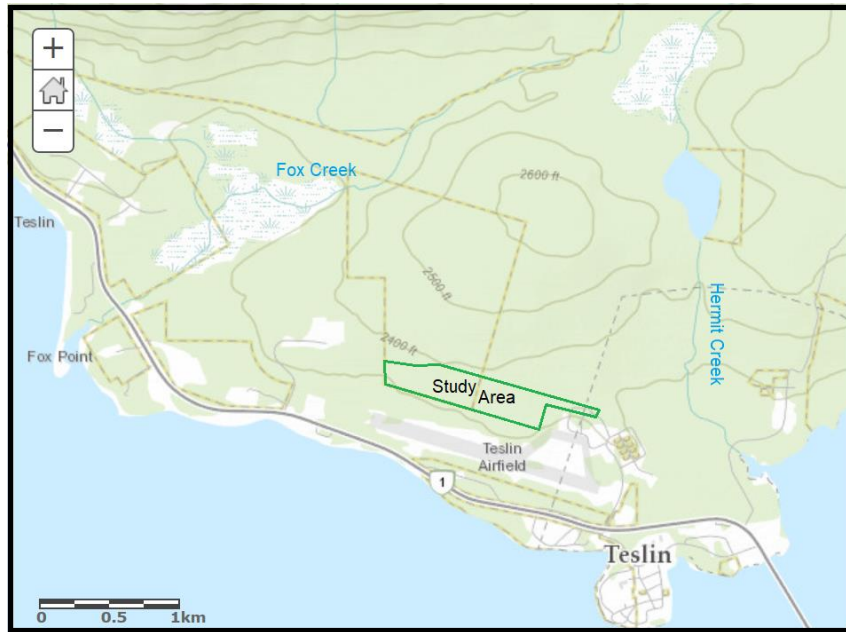
Permafrost

The study area lies within the zone of sporadic discontinuous permafrost. Although permafrost was not encountered during our subsurface investigation, the site reconnaissance identified several areas within the swamp (Area 3) where it may be present as evidenced by the presence of stunted growth and leaning black spruce trees.

Typically, permafrost may be present in regions which are well insulated, heavily shaded and/or located on the north sides of slopes. The permafrost may vary from poorly bonded soils with no-visible ice to large ice lenses.

Watercourses

The study area lies between Fox and Hermit Creeks, as noted in the attached topographical map (retained from *Yukon Geology* website).



The study area lies approximately 800 meters north of Teslin Lake. While there was no indication of flowing surface waters, a former drainage course was identified in the Area 3 (as noted in Figure 3). This region of the study area allows for drainage of higher elevation terrain located to the north, some of which is subterranean.

Groundwater

Near surface groundwater was encountered at a depth of 0.35 meters below the ground surface in the region of Area 3. This groundwater is present in the form of seepage zones and sheet-wash flows given the nature of the terrain and soil types in this area. The direction of groundwater flow is towards the south where lower elevations prevail.

The presence of oxidized zones within the glacial tills located in Areas 1 and 2b suggests that groundwater flow may be seasonally intermittent.

4.5 Surficial Geology

While the surficial geology map (1891A) of the Teslin area (compiled by *S.R. Morison and R.W. Klassen, 1997*), described the area as being comprised of morainal blanket (Glacial Till) deposits, these deposits were overlain with a thin (~150 mm) veneer of glaciofluvial deposits (and organics). The omission of the glaciofluvial deposits in the surficial geology map was likely due to the scale of mapping. As the till was deposited as a blanket, shallow bedrock may be present.



4.6 Bedrock Geology

The *Yukon Geology* website indicated that this area of Teslin is underlain with sedimentary augite bearing sandstone, siltstone and mudstone from the Triassic period.

The nature of refusal in test pit TP 7-17 suggests that bedrock may be encountered at shallow depths within this region of the study area. TP 1-17 encountered fractured rocks which could also be an indication of shallow bedrock.



Otherwise, bedrock was not encountered in any of the other test pits.



5.0 DISCUSSIONS

Based upon the information retained during our literature review, field and laboratory work programs, the soil types and terrain conditions will allow for road construction through conventional cut/fill construction methodologies. However, additional consideration will be required during design and construction as geotechnical constraints exist due to the presence of poor soil conditions, deleterious fills and varying terrain conditions. As such, for discussion purposes, we have proposed an alternate (Road A) alignment for the connector road (as illustrated in Figure 4), to minimize the distance where poor founding (Area 3) soils will need to be traversed and to avoid the waste piles located along the Airport West Subdivision Road. In addition, an envisioned alignment for a potential future road, Road B, which would allow for industrial/commercial lot development of regions within the study area and the Airport Reservation (Lot 1030-1), has been illustrated in the figure.

5.1 Geotechnical Considerations

The geotechnical considerations will vary across the study area as follows;

Waste Piles A & B – If the proposed road alignment intersects either of these areas, then the waste stripping and grubbing materials in these areas will need to be removed from within the road envelope in order to allow for establishment of roadway embankment fills.

Area 1 – The soils in these regions will generally be suitable for use as road subgrade materials following removal of the organic stratum. However, as bedrock may be encountered in the region near TP 7-17, ditch and roadway design elevations may be difficult to establish if cuts (> 0.5 m) are required near the test pit.

Area 2a & 2b – The suitability of the road subgrade will vary in these areas following removal of the organic stratum. As such, sub-excavation may be required to remove saturated/wet soils which will have poor bearing capacities. Caution will be required in regions where sub-excavations are conducted as it will be important to maintain sub-drainage in these areas.

Area 3 – Any road alignment through this low-lying wet region will require the removal of the thick organic stratum and potential sub-excavation of poor sub-grade materials. As surface and near surface groundwater will be encountered



in this area, ditches and culverts will be required to control the local drainage, prior to, during and following road construction.

If permafrost is encountered, the organic stratum should be left in place prior to backfill such that it can serve as an insulator. Additional consideration would be required depending upon the permafrost conditions.

As poor soil conditions can be expected throughout this region, the roadway embankments in these areas will need to be more robust relative to other regions of the alignment. Ideally, this should include the construction of a sub-base layer comprised of rock (or else other type of coarse-grained granular material) placed upon geotextile filter fabric. This rock sub-base layer should extend approximately 1 meter beyond the toe edge of the road embankment. The road in this area should be constructed utilizing 3 to 1 (horizontal to vertical) side-slopes.

The road right-of-way in this area will need to be expanded to accommodate the up-gradient interception ditches, down-gradient drainage ditches as well as the initial rock sub-base layer.

Area 4 – The soils in this region will generally be suitable for use as road sub-grade following removal of the organic stratum. However, if poor quality fills or remnants of building infrastructure are encountered, then these materials will need to be removed until suitable founding materials are exposed in order to allow for road construction.

5.2 Potential Road Alignments

In assessing the proposed *YESAB* and Road A alignments, consideration should be given to the difficulty in construction and overall road lengths.

Construction Feasibility

While construction of the proposed *YESAB* and Road A alignments are feasible, the *YESAB* alignment may prove to be more difficult as it crosses larger portions of Area 3 (where poor soil conditions are anticipated).

Based upon the proposed alignments, the *YESAB* road will traverse ~300 meters of Area 3 relative to ~110 meters which would need to be crossed in the Road A alignment. This comparison excludes the potential terrain islands which were



identified along the *YESAB* alignment in our August 26th, 2015 Preliminary Site Assessment.

As the intersection of the proposed *YESAB* alignment and the Airport West Subdivision Road coincides with Waste Pile A, road construction at this location will require additional consideration as these former grubbing and stripping materials will need to be removed in order to allow for proper roadway embankment construction.

By comparison, less preparatory work would be required at the Road A intersection (with Airport West Subdivision Road) as waste piles are not present and as the local elevations are more favorable for road tie-in.

Road Length

The proposed *YESAB* alignment measures approximately 1750 meters in length within the study area.

By comparison, the newly proposed alignment for Road A will measure approximately 1400 meters in length.

5.3 Other Considerations

Construction Methodologies

Road construction in Areas 2 & 3 should involve staged excavation and backfill methodologies such that the coarse rock sub-base layer can progressively pad over regions where poor soil conditions are encountered.

Ditches

The construction of an upgradient interceptor ditch should be incorporated into the design to assist in controlling local drainage in the region of Area 3. The interception ditch(es) should be configured in such a manner so as to direct up-gradient flow towards the designated culvert(s).

Consideration could be given to constructing a drainage ditch through the region of Area 3 to assist in local drainage as noted in Figure 5. This may ultimately allow for infilling of regions in Areas 2 & 3 as determined on a case-by-case basis.



Ideally, ditching work should be conducted in the early winter/spring, when frozen ground conditions will prevail. The use of rig mats may be required to allow for adequate bearing for construction equipment. Ditch construction during the summer/fall months would not be recommended given the poor soil conditions in this region.

The approximate locations and configuration of potential ditch alignments and culvert locations in the region of Area 3 have been identified in Figure 5. Other culverts, ditch blocks and erosion control measures should be incorporated into the road design as may be required.

Local Road Upgrades

The existing roads located within the Airport West Subdivision and the Teslin Airport Subdivision would need to be upgraded to allow for public use.



Airport West Subdivision Road Conditions

Civil Design

The civil design parameters should be verified relative to any road alignment through the study area.

BST Schedule

As the road will be crossing areas where poor ground conditions are present, the surface of the roadway may not stabilize in this area until several seasons following construction. As such, the application of a BST layer in this area may need to be delayed until the roadway stabilizes. Regular road maintenance (e.g. grading) will be required during this interim stabilization period.



6.0 RECOMMENDATIONS

6.1 General

While the following geotechnical recommendations have been provided to allow for road construction through the study area, additional recommendations would need to be provided in the event that permafrost is encountered.

6.2 Deleterious Materials

The organic stratum, Waste Piles A & B and potentially deleterious fills are not suitable to support structural loads. As such, these materials should be removed to expose suitable approved glaciofluvial and/or glacial till sub-grade materials.

If seasonal frost is encountered at the sub-grade elevations, the frozen soils should be sub-excavated until thawed soils are encountered.

If permanently frozen soils are encountered, then additional consideration will be required as the use of conventional road construction methodologies will not be suitable. Caution should be exercised where clearing is to be undertaken in regions where permafrost is encountered as the removal of the tree cover and/or thaw surficial organic mat will result in undesirable thaw-degradation of the underlying soils.

The resulting excavations should be backfilled utilizing non-frost-susceptible materials which are placed and compacted in accordance with Section 6.3 – Road Construction.

In general, the deleterious materials should be suitable for use as general purpose fill so long as they are frost free and are placed and compacted in accordance with the recommendations provided herein. Organic soils should be utilized as soil cover in non-structural areas. Frozen soils will not be suitable for use and so should be wasted in designated areas.

Where excavation common materials are to be utilized for fill in non-structural applications, they should be placed in 300 mm thick lifts which are compacted to 95% of the materials Proctor maximum dry density at (or near, $\pm 2\%$) its optimum moisture content. These regions should be graded so as to maintain positive drainage. Otherwise the granular glaciofluvial and glacial till deposits will be suitable for use as embankment fills so long as they are placed and compacted as outlined herein.



6.3 Road Structure

The road structure should be comprised of the following;

THICKNESS ^A	COMPACTION ^B	COMPOSITION ^C
200 mm	100 %	20 mm minus crushed granular aggregate, overlying
200 mm	98 %	80 mm minus sub-base course aggregate, overlying
300-900 mm ^D	95 %	200 mm minus pit run sub-base, overlying
1000 mm ^E	As directed	rock sub-base, overlying
NA	NA	^F filter fabric, overlying
NA	95 %	^G approved native sub-grade materials

Notes; ^A – All materials should be placed in uniform, level lifts that do not exceed 200 mm in thickness, as measured following compaction. The exception to this would be the rock sub-base layer where the thickness could be increased as determined in the field.

^B – Indicates percent compaction relative to the materials Proctor maximum dry density at (or near, $\pm 2\%$) its optimum moisture content.

^C – The imported fills should be comprised of a well graded sand and gravel mixture and should conform to the grain size distributions specified in Appendix C – Imported Fill Specifications

^D – The thickness of the pit run sub-base will vary. This granular course can measure 300 mm thick in regions where dense glacial deposits are encountered. Otherwise the thickness should be increased up to 900 mm in regions where poor founding soils are encountered or where embankments are to be constructed. If heavy traffic loads are anticipated, then the thickness of this granular course should measure no less than 600 mm.

^E – This rock sub-base layer should be incorporated in regions of Area 2 & 3 where poor founding soils are anticipated. This sub-base layer should be overlain with geotextile fabric prior to placement of successive granular courses.



^F – Geotextile fabric should be utilized in Areas 2 & 3 and where poor soil conditions/types are encountered at the sub-grade elevation.

^G - The sub-grade surface should be proof-rolled in Areas 1 & 4. If excessive deflections are noted, then these regions should be sub-excavated to allow for construction as directed by qualified geotechnical personnel. This surface (and subsequent lifts of backfill) should be shaped with a 3% road crown to promote drainage.

6.4 Excavations

Excavations should be conducted utilizing a heavy tracked excavator equipped with a smooth lip (clean-up) bucket, to minimize disturbance of the native sub-grade materials.

While excavation difficulties are not expected under thawed conditions, large boulders may be encountered and so this should be considered as additional measures may be required to facilitate their removal. Additional consideration may be required if bedrock is encountered.

Loose, disturbed, remolded or slough materials should not be allowed to remain in prepared excavation(s). If a suitable founding surface cannot be prepared through mechanical means, then hand cleaning may be necessary.

The sub-grade materials are subject to a loss of strength if they are disturbed and as such, equipment should not be allowed to operate directly on the sub-grade surfaces.

The sub-grade surfaces should be shaped with a 3% crown to promote sub-drainage. If sub-excavation is required, the base of the excavation should be shaped to allow for sub-drainage to daylight into adjacent ditch invert(s) or else ditch off-takes.

A 3:1 back-slope should be incorporated into the design in order to provide for worker safety and maintain slope stability. This angle of repose may need to be reduced where fine-grained (or wet/saturated) deposits are encountered. All cut slopes should be verified by qualified personnel at the time of construction and (if required) modified by the construction contractor to accommodate the actual soil conditions which are encountered.



6.5 Area 3 Interception and Drainage Ditches

Interception and drainage ditches in this area should extend a minimum of 0.5 meters beyond the depth of the organic mat (estimate 1.0 meters total ditch depth).

6.6 Inclement Weather

The sub-grade, excavations and construction materials should be protected from drying, freezing, rain, snow, surface waters and groundwater at all times. Protective tarps should be utilized to protect the sub-grade and construction materials from desiccation, freezing and precipitation.

The glacial deposits are moisture sensitive and so construction operations may need to cease or be altered at times of precipitation until drier weather conditions prevail.

The glacial deposits are frost susceptible and so it is critical that construction work is conducted during the summer months. If construction work is scheduled in the spring or early summer months, additional consideration may be required as seasonally frozen soils may be present. Caution should be exercised to ensure frozen soils are not present within the road envelope at the time of construction or are utilized during road construction.

6.7 Temporary Stockpiles

Stockpiled materials should be protected from segregation and the ingress of snow, frost, rain and surface waters at all times.

6.8 Surface and Groundwater

The sub-grade materials may be subject to a loss of strength if they become wet or saturated. As such, site drainage should be carefully controlled so as to direct water away from excavations. Ditches should be incorporated into the design and construction phases to control perimeter drainage.

Surface and groundwater should be removed from excavations at all times during construction. As such, the contractor should be prepared to undertake conventional construction dewatering to ensure a dry working area.



6.9 Temporary Excavations & Worker Safety

Worker safety is paramount.

Temporary excavations to conventional depths at this site should comply with current *Occupational Health & Safety Regulations*.

While the excavation sidewall (slope) stability will be dependent upon the material characteristics, configuration of the excavation and length of exposure, in general, two to one cut slopes should provide adequate slope stability during excavation of the anticipated excavation common materials. Slope stability will however be poor where wet/saturated, loose or fine-grained materials are encountered and so more gradual cut slopes will be required in these areas to minimize the potential for slope failure.

The contractor should be prepared to adjust their construction methodology and excavation profiles as soil conditions dictate.

6.10 Construction Monitoring & Quality Control

During construction, qualified geotechnical personnel should inspect all sub-grade surfaces prior to backfill to verify that the materials noted at the sub-grade elevation are consistent with those identified in the applicable geotechnical report. Side-slope parameters should be verified in the field by qualified personnel during the time of construction.

Materials testing services should be provided during road construction to assess the suitability of the structural fills and conduct in-situ field density (compaction) testing.

6.11 Additional Assessments

A detailed site survey should be conducted to allow for additional evaluation from a geotechnical and civil design perspective as the scale of mapping provided in the 1:50,000 scale topographical map was too large to note site specific variations in local elevations. The survey will assist in identifying surface drainage and erosion control requirements.

The civil design parameters for the new connector road alignment (i.e. lines of sight, radius of curvature, etc.) should be verified by qualified civil engineering personnel.



7.0 CONCLUSIONS

Based upon the retained information, the soil types and conditions which were encountered in the study area will be favorable to allow for road construction utilizing conventional cut/fill construction methodologies. However, additional consideration will be required where the road alignment crosses low-lying regions (Areas 2 & 3) where poor founding soils and wet/saturated conditions are anticipated or where bedrock is encountered.

The thickness of the road structure may vary between 0.7 to 2.3 meters depending upon the composition of the sub-grade and anticipated traffic loads.

Additional consideration would be required in regions where permafrost is encountered as the organic mat should be left intact (for use as insulation) prior to road construction.

A site survey and civil engineering assessment should be conducted to better characterize the site and identify design parameters.



8.0 LIMITATIONS

This report is intended for the sole use of the *Village of Teslin*.

No portion of this report may be used as a separate entity; it is intended to be read in its entirety.

Any use of this report by a third party is the responsibility of such third party.

The content within this report reflects our best judgment in light of the information available to our firm at the time of report preparation. Our recommendations are based upon the subsurface conditions encountered at the time of our evaluation, current construction techniques and generally accepted engineering practices.

The anticipated construction conditions have been discussed, but only to the extent that they may influence design decisions. Prospective contractors should be aware that the data presented may not be sufficient to assess all factors that may have an effect upon construction. Any references to construction methods contained herein, express our opinion and are not intended to direct contractors on how to carry out construction.

It is important to emphasize that a geotechnical evaluation is, in fact, based upon random sampling and that our comments are based upon the results obtained at the test pit and sample locations. Due to the geomorphological nature of the deposits encountered, interpolations of subsurface conditions between the test locations have not been made or been implied. Our evaluation is limited as undisturbed samples were not retained and that a limited amount of sampling and testing was conducted.

Given the nature of our assessment and scale of mapping, the information contained herein may not be sufficient to assess all factors that may have an effect upon design and construction and so this should be considered.

Should unexpected subsurface soils or conditions be encountered during future evaluations of the study area or during construction, our firm should be notified immediately in order to confirm the suitability of our recommendations and conclusions. If required, our firm may alter or modify our recommendations and conclusions at such time.

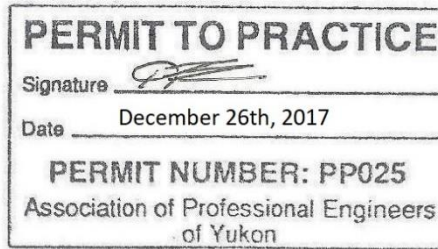


9.0 CLOSURE

Thank you for providing our firm with the opportunity to conduct the above noted evaluation. We trust that the information we have provided will be suitable for your purposes, however, if you should have any questions or concerns, please feel free to contact the undersigned at your convenience.

Respectfully Submitted,

CHILKOOT GEOLOGICAL ENGINEERS LTD.

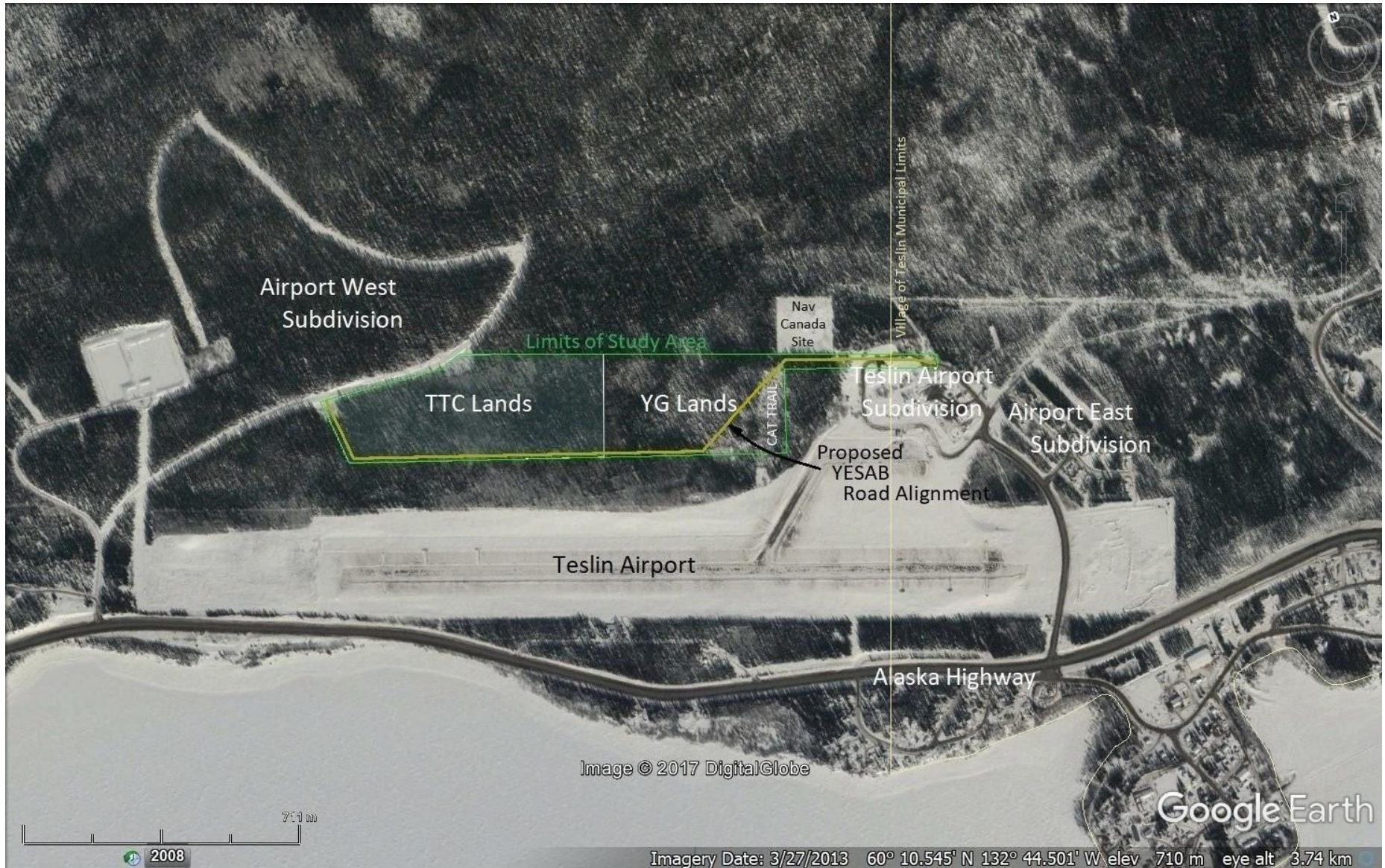


Tares Dhara, P.Eng.
Senior Geotechnical Engineer

TD/td



Geotechnical Evaluation
Proposed Airport Connector Road – Teslin, Yukon - 2017
Figure 1 – Location of Study Area





Geotechnical Evaluation
Proposed Airport Connector Road – Teslin, Yukon - 2017
Figure 2 – Test Pit Locations





Geotechnical Evaluation
Proposed Airport Connector Road – Teslin, Yukon - 2017
Figure 3 – Terrain Areas





Geotechnical Evaluation
Proposed Airport Connector Road – Teslin, Yukon - 2017
Figure 4 – Proposed Road A & B Alignments





Geotechnical Evaluation
Proposed Airport Connector Road – Teslin, Yukon - 2017
Figure 5 – Proposed Area 3 Ditch Configuration





APPENDIX A

Test Pit Soil Logs



SOIL LOG LEGEND

Soil Description

The soil is named after its principal component and modified by other components as follows;

<u>Percent of Component</u>	<u>Modifier</u>
> 15 %	XXX - ey
11% to 15%	some XXX
5% to 10%	trace XXX

Examples;

<u>SILT</u>	<u>SAND</u>	<u>GRAVEL</u>	<u>Description</u>
6	32	62	Sandy Gravel trace Silt
55	6	39	Gravelly Silt trace Sand
43	36	21	Silty Gravelly Sand

Note: In the cases where the coarse fraction (sand & gravel) comprise > 50% of the sample, then the larger component of the coarse fraction becomes the principal component.

Undrained Shear Strength of Cohesive Soils

Consistency	Undrained Shear Strength	
	p.s.f	kN/m ²
Very Soft	< 375	<20
Soft	375-750	20-40
Firm	750-1500	40-75
Stiff	1500-3000	75-150
Very Stiff	3000-6000	150-300
Hard	>6000	<300



Relative Density (Qualitative Classification)

Cohesive Soils

- Very Soft - Exudes between fingers when squeezed by hand
- Soft - Moulded by light finger pressure
- Firm - Moulded by strong finger pressure
- Stiff - Cannot be moulded by fingers – Can be indented by thumb
- Very Stiff - Can only be indented by thumbnail
- Hard - Cannot be indented by thumbnail

Granular Soils

- Very Loose - Considerable sidewall sloughage noted
- Loose - Some sidewall sloughage noted – Easy digging
- Compact/ Medium-Dense - Unimpeded excavation – little to no sidewall sloughage
- Dense - Considerable effort required during excavation – Stable vertical sidewalls
- Very Dense - Extreme difficulty in excavation

Soil Log - Sample Type

Symbol

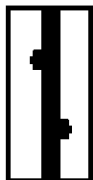
Test Pitting

Drilling



Grab Sample
Retained from excavation sidewall or base

Auger Sample
Retained from Auger flighting



Bucket Sample
Retained from leading edge of excavator bucket

Split-Spoon Sample
Retained from Split-Spoon Sampler tube



Relative Moisture

Described as - *dry, damp, moist, wet* or *saturated* - relative to the principal soil matrix.

For example, a moisture content of 10 percent may be classified as '*moist*' for a coarse grained soil (sand or gravel) but '*damp*' for a fine grained (silt) soil.

The moisture content is recorded as a percentage (%) of the weight of water within the soil sample relative to the dry weight of the sample.

Recovery

Refers to the (linear) amount of sample retained after driving the Split Spoon (SPT) sampler tube 18 inches.

Recorded as a percentage (i.e. 12 inch sample/18 drive = 66 %)

N-Value

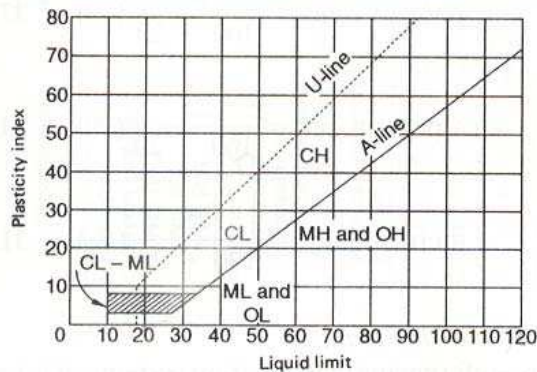
Refers to the total number of blows required to drive the Split Spoon sampler tube the final 12 inches of the 18 inch drive.

Relative Density based upon SPT 'N' Value

Non-cohesive (Granular) Soil		Cohesive (Clayey) Soils	
Relative Density	Blows per Foot (N-value)	Consistency	Blows per Foot (N-value)
<i>Very Loose</i>	< 5	<i>Very Soft</i>	0 to 2
<i>Loose</i>	5 to 9	<i>Soft</i>	3 to 4
<i>Compact</i>	10 to 29	<i>Firm</i>	5 to 8
<i>Dense</i>	30 to 50	<i>Stiff</i>	9 to 15
<i>Very Dense</i>	> 50	<i>Very Stiff</i>	16 to 30
		<i>Hard</i>	> 30

Unified Soil Classification System
(ASTM Designation D-2487)

Major division	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 GP Poorly graded gravels and gravel-sand mixtures, little or no fines GM Silty gravels, gravel-sand-silt mixtures GC Clayey gravels, gravel-sand-clay mixtures	$C_u = D_{60}/D_{10}$ Greater than 4 $C_z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ 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
		Gravels with fines	SW Well-graded sands and gravelly sands, little or no fines SP Poorly graded sands and gravelly sands, little or no fines SM Silty sands, sand-silt mixtures SC Clayey sands, sand-clay mixtures	$C_u = D_{60}/D_{10}$ Greater than 6 $C_z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ 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
		Clean sands	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 MH Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts CH Inorganic clays of high plasticity, fat clays OH Organic clays of medium to high plasticity	Check plasticity chart
	Sands More than 50% of coarse fraction passes No. 4 sieve	Sands with fines	Silty and Clays Liquid limit 50% or less	Silty and Clays Liquid limit greater than 50%
		Sands with fines		
	Fine-grained soils 50% or more passes No. 200 sieve	Silty and Clays Liquid limit 50% or less		
		Silty and Clays Liquid limit greater than 50%		
	Highly organic soils	Pt	Peat, muck and other highly organic soils	Fibrous organic matter; will char, burn, or glow



Plasticity chart for the classification of fine-grained soils.
Tests made on fraction finer than No. 40 sieve.

Unified Soil Classification System

Figure 18. UNIFIED SOIL CLASSIFICATION SYSTEM

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TEST PIT SOIL LOG

Client : Village of Teslin
Location : Teslin, Yukon
Project : Geotechnical Evaluation - Airport Connector Road
Date Excavated: Oct.5, 2017

Elevation : 100.0 meters
TP Termination Depth: 1.4 meters
Instrumentation: NA
Weather: Partly Cloudy +4 to +11 C

TEST PIT

1-17

Sheet 1 of 1

Elev. (m)	Depth		Stratigraphic Description	Relative Density	Relative Moisture	Field Sample					Laboratory Results (%)				USCS/NRC Depth (m)	Symbol	Elev. (m)	
	ft	m				Type	Number	Temperature (degrees C)	Recovery %	Penetration (kg/cm ²)	SPT ^N	▲ - FINES	● - SAND MC ○ - LL	■ - GRAVEL				
100.0	0.10	0.10	ORGANICS (100 mm) w/ rootlets, black - grass and weed cover	soft	moist	×	1	NA	NA	NA	NA	20				398.0	ORG	99.9
99.5	0.40	0.40	ORGANICS & ORGANIC SILT w/ rootlets, black	soft	moist	×	2	NA	NA	NA	NA	14.5				99.6	OL	99.5
99.0	1.40	1.40	SILTY GRAVELLY SAND (POSSIBLE TILL) w/ fractured and sub-rounded cobbles - odd fractured boulder in size to 400 mm, poorly graded, fine to medium grained, dark grey-brown	compact	wet	×	3	NA	NA	NA	NA	16.6				98.7	SM	98.6
98.5	1.40	1.40	- as above			■						25.0				98.5		98.5
98.0			End of TP @ 1.4 m - Groundwater encountered at 0.4 m - Test pit abandoned due to excessive influx of groundwater									30.1				98.0		98.0
97.5												45.9				97.5		97.5

Excavated By : Flag Hill Woodworks

Excavator Type : Kubota kx057

Bucket Type : Digging

Water Level(s)

▽ During Excavation ▽ After Excavation
▼ At End of Excavation

Logged By : T.Dhara, P.Eng.
Date : Oct.5, 2017

Data Entry By : T.Dhara, P.Eng.
Date : Nov.25-Dec.3, 2017

Reviewed By: *[Signature]*
Date : Dec.5, 2017

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TEST PIT SOIL LOG

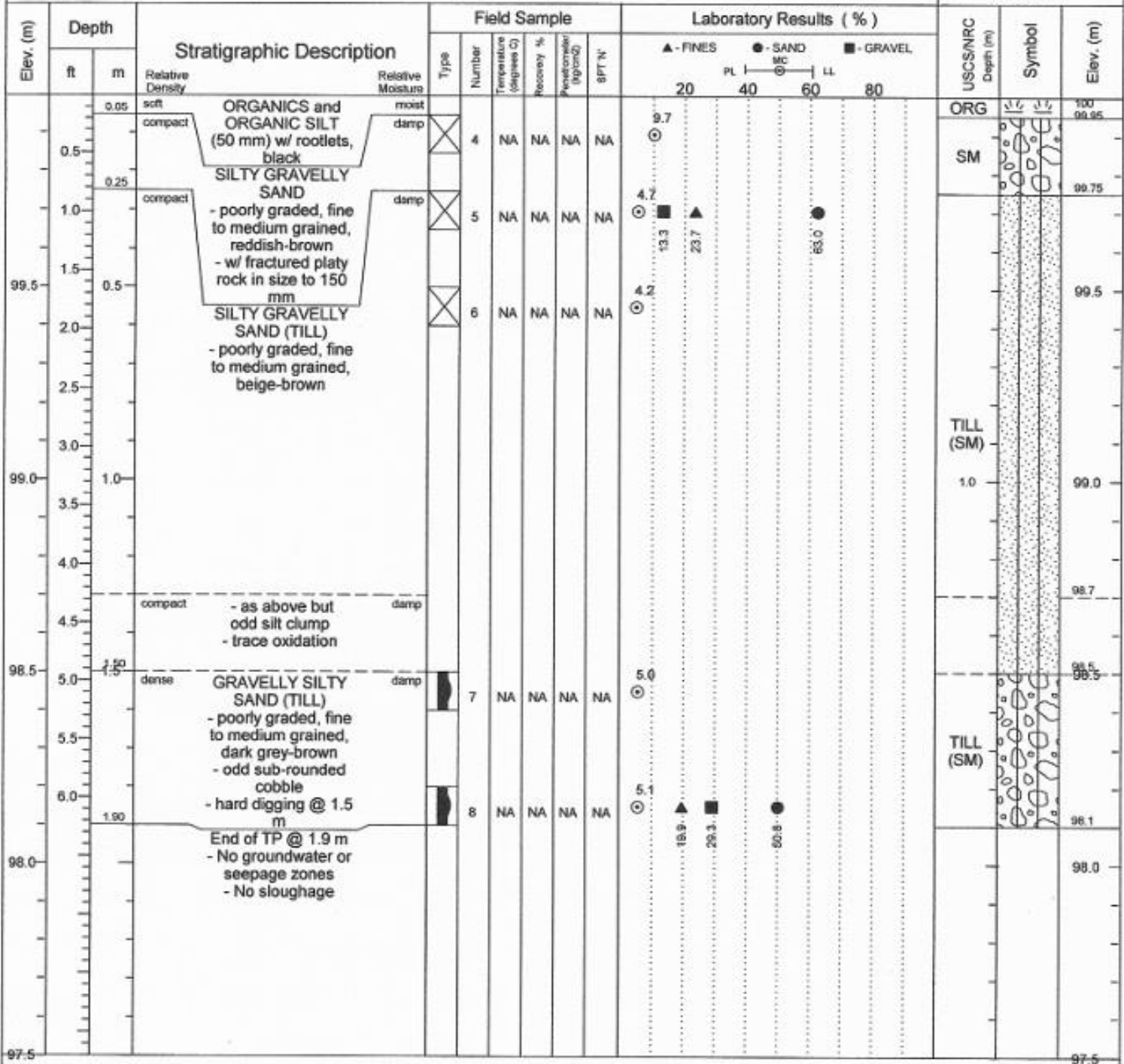
Client : Village of Teslin
Location : Teslin, Yukon
Project : Geotechnical Evaluation - Airport Connector Road
Date Excavated: Oct.5, 2017

Elevation : 100.0 meters
TP Termination Depth: 1.9 meters
Instrumentation: NA
Weather: Partly Cloudy +4 to +11 C

TEST PIT

2-17

Sheet 1 of 1



Excavated By : Flag Hill Woodworks

Excavator Type : Kubota kx057

Bucket Type : Digging

Water Level(s)

During Excavation After Excavation

At End of Excavation

Logged By : T.Dhara, P.Eng.

Date : Oct.5, 2017

Data Entry By : T.Dhara, P.Eng.

Date : Nov.25-Dec.3, 2017

Reviewed By:

Date : Dec.5, 2017

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TEST PIT SOIL LOG

Client : Village of Teslin
Location : Teslin, Yukon
Project : Geotechnical Evaluation - Airport Connector Road
Date Excavated: Oct.5, 2017

Elevation : 100.0 meters
TP Termination Depth: 1.3 meters
Instrumentation: NA
Weather: Partly Cloudy +4 to +11 C

TEST PIT

3-17

Sheet 1 of 1

Elev. (m)	Depth		Stratigraphic Description	Relative Density	Relative Moisture	Field Sample					Laboratory Results (%)				USCS/NRC Depth (m)	Symbol	Elev. (m)
	ft	m				Type	Number	Temperature (degrees C)	Nucleon %	Penetration (kg/cm2)	SPT N	PL	MC	LL			
100.0			ORGANICS & MOSS (100 mm) - w/ rootlets, black	soft	moist										ORG	100.0	
99.9	0.10	0.5	SILTY SAND w/ fractured rock in size to 150 mm, poorly graded, fine to medium grained, reddish-brown	compact	damp	9	NA	NA	NA	NA	9.0				SM	99.9	
99.75	0.25	1.0	SILTY SANDY GRAVEL (TILL) w/ rootlets to 0.4 m - poorly graded, fine to medium grained, beige-brown	compact	damp	10	NA	NA	NA	NA	3.9					99.75	
99.6		1.5	- as above but no rootlets	compact	damp	11	NA	NA	NA	NA	3.8	19.0	34.1	80.0	TILL (GM)	99.6	
99.5	0.5	2.0	- as above but fractured and sub-rounded cobbles - odd boulder in size to 300 mm - dark grey-brown	dense	damp											99.5	
99.2	0.80	2.5														99.2	
99.0	1.0	3.0														99.0	
98.7	1.30	4.0	End of TP @ 1.3 m - No groundwater or seepage zones - No sloughage			12	NA	NA	NA	NA	4.4					98.7	

Excavated By : Flag Hill Woodworks

Excavator Type : Kubota kx057

Bucket Type : Digging

Water Level(s)

During Excavation After Excavation

At End of Excavation

Logged By : T.Dhara, P.Eng.

Date : Oct.5, 2017

Data Entry By : T.Dhara, P.Eng.

Date : Nov.25-Dec.3, 2017

Reviewed By:

Date : Dec.5, 2017

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TEST PIT SOIL LOG

Client : Village of Teslin
Location : Teslin, Yukon
Project : Geotechnical Evaluation - Airport Connector Road
Date Excavated: Oct.5, 2017

Elevation : 100.0 meters
TP Termination Depth: 1.8 meters
Instrumentation: NA
Weather: Partly Cloudy +4 to +11 C

TEST PIT

4-17

Sheet 1 of 1

Elev. (m)	Depth		Stratigraphic Description	Field Sample					Laboratory Results (%)				USCS/NRC Depth (m)	Symbol	Elev. (m)		
	ft	m		Type	Number	Temperature (degrees C)	Recovery %	Permeability (g/cm2)	SPT N	▲ - FINES	● - SAND	■ - GRAVEL				PL	MC
100.0			soft ORGANICS & ORGANIC SILT (100 mm) w/ rootlets, black	moist												ORG	100.0
99.9	0.10		compact	moist	13	NA	NA	NA	NA	11.3						GP	99.9
99.8	0.20		compact SANDY GRAVEL some SILT - poorly graded, reddish brown - w/ platy rock in size to 300 mm	dry-damp	14	NA	NA	NA	NA	4.1							99.8
99.5	0.5		SILTY SAND some GRAVEL (TILL) - poorly graded, fine to medium grained, beige-brown		15	NA	NA	NA	NA	3.0						TILL (SM)	99.5
99.3	0.70		dense - w/ fractured rock in size to 0.7 m	dry-damp													99.3
99.0	1.0		GRAVELLY SILTY SAND (TILL) - poorly graded, fine to medium grained, dark grey-brown - harder digging - odd sub-rounded cobble - odd boulder in size to 400 mm		16	NA	NA	NA	NA	2.9						TILL (SM)	99.0
98.5	1.5		- as above		17	NA	NA	NA	NA	3.6							98.5
98.3	1.80		End of TP @ 1.8 m - No groundwater or seepage zones - No sloughage							15.3							98.3
98.0																	98.0
97.5																	97.5

Excavated By : Flag Hill Woodworks

Excavator Type : Kubota kx057

Bucket Type : Digging

Water Level(s)

During Excavation After Excavation
 At End of Excavation

Logged By : T.Dhara, P.Eng.

Date : Oct.5, 2017

Data Entry By : T.Dhara, P.Eng.

Date : Nov.25-Dec.3, 2017

Reviewed By:

Date : Dec.5, 2017

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TEST PIT SOIL LOG

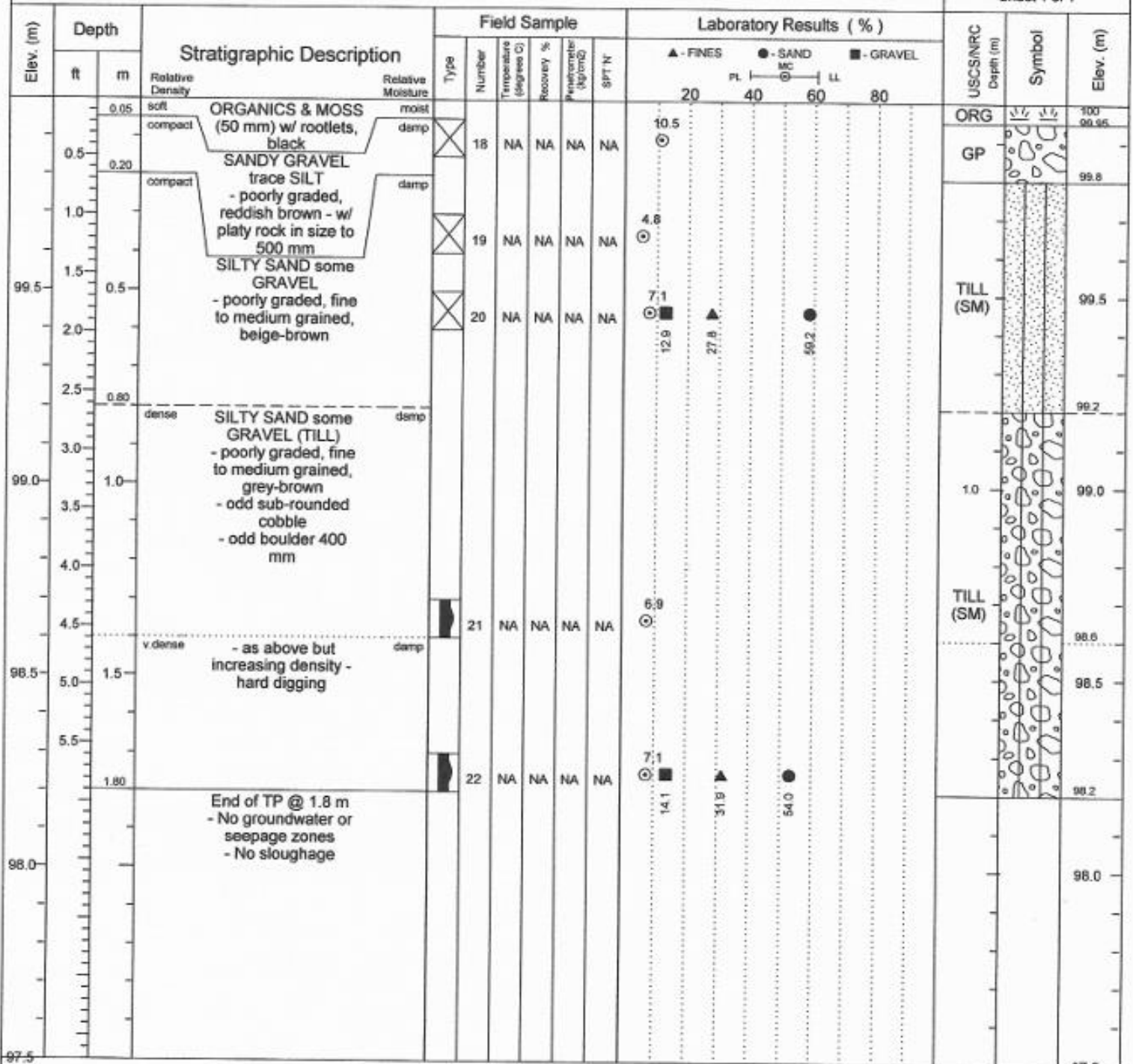
Client : Village of Teslin
Location : Teslin, Yukon
Project : Geotechnical Evaluation - Airport Connector Road
Date Excavated: Oct.5, 2017

Elevation : 100.0 meters
TP Termination Depth: 1.8 meters
Instrumentation: NA
Weather: Partly Cloudy +4 to +11 C

TEST PIT

5-17

Sheet 1 of 1



Excavated By : Flag Hill Woodworks

Excavator Type : Kubota kx057

Bucket Type : Digging

Water Level(s)

During Excavation After Excavation
 At End of Excavation

Logged By : T.Dhara, P.Eng.
Date : Oct.5, 2017

Data Entry By : T.Dhara, P.Eng.
Date : Nov.25-Dec.3, 2017

Reviewed By:
Date : Dec.5, 2017

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TEST PIT SOIL LOG

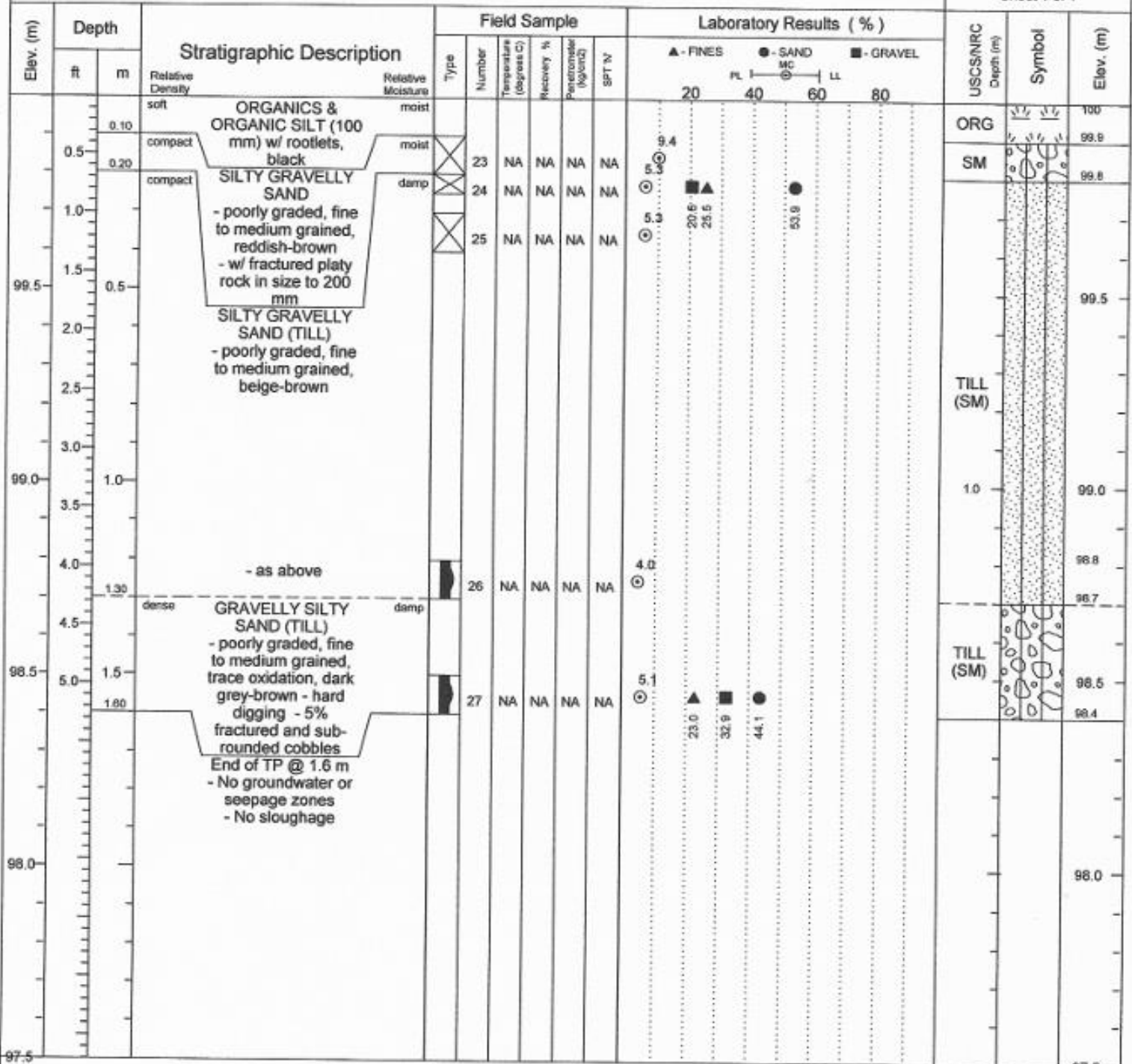
Client : Village of Teslin
Location : Teslin, Yukon
Project : Geotechnical Evaluation - Airport Connector Road
Date Excavated: Oct.5, 2017

Elevation : 100.0 meters
TP Termination Depth: 1.6 meters
Instrumentation: NA
Weather: Partly Cloudy +4 to +11 C

TEST PIT

6-17

Sheet 1 of 1



Excavated By : Flag Hill Woodworks

Excavator Type : Kubota kx057

Bucket Type : Digging

Water Level(s)

During Excavation
 After Excavation
 At End of Excavation

Logged By : T.Dhara, P.Eng.

Date : Oct.5, 2017

Data Entry By : T.Dhara, P.Eng.

Date : Nov.25-Dec.3, 2017

Reviewed By:

Date : Dec.5, 2017

CHILKOOT GEOLOGICAL ENGINEERS LTD.

5B Bennett Road, Whitehorse, Yukon
(867) 335-5804 chilkoote.eng@gmail.com



TEST PIT SOIL LOG

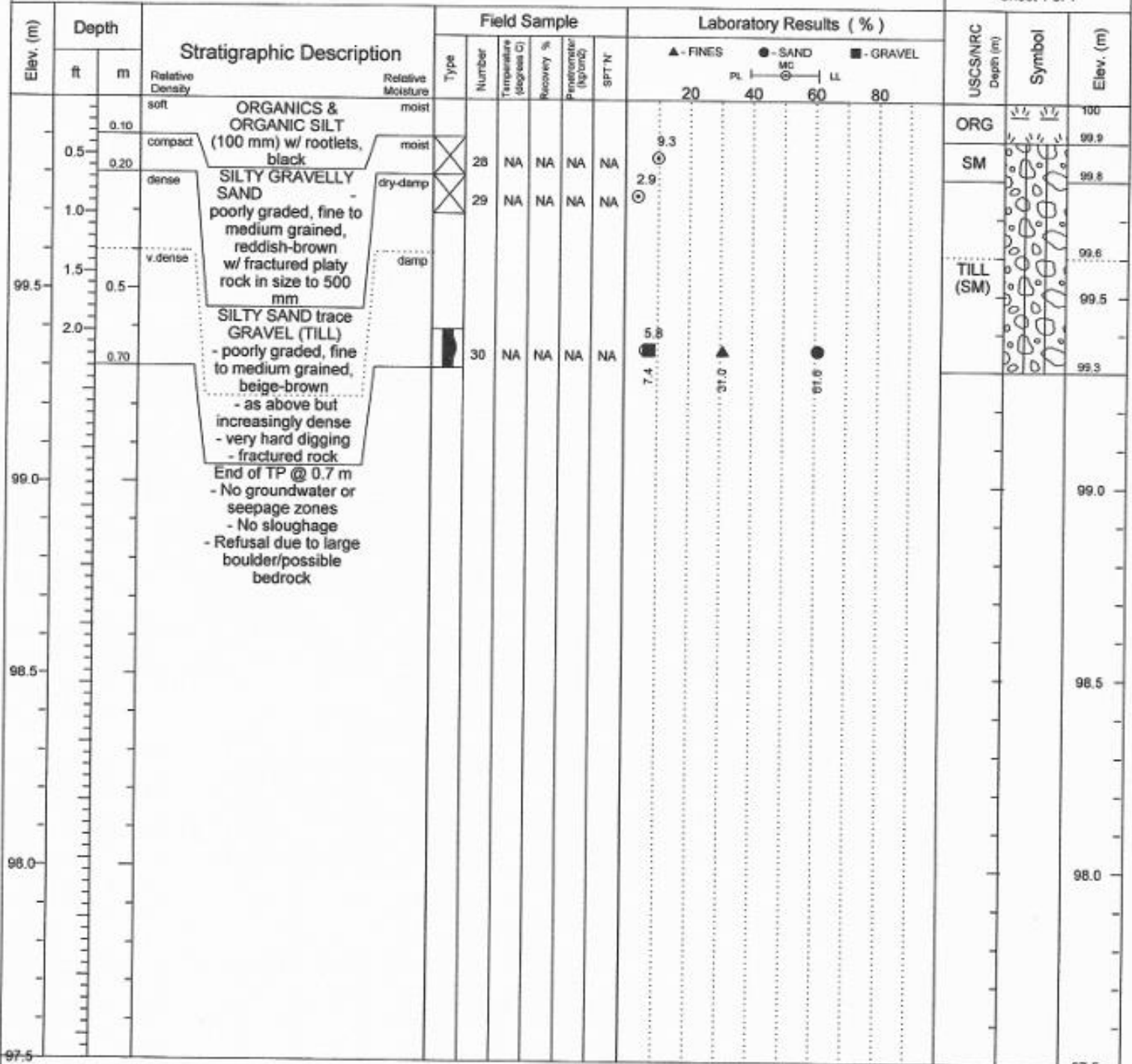
Client : Village of Teslin
Location : Teslin, Yukon
Project : Geotechnical Evaluation - Airport Connector Road
Date Excavated : Oct.6, 2017

Elevation : 100.0 meters
TP Termination Depth: 0.7 meters
Instrumentation: NA
Weather: Partly Cloudy 0 to +9 C

TEST PIT

7-17

Sheet 1 of 1



Excavated By : Flag Hill Woodworks

Excavator Type : Kubota kx057

Bucket Type : Digging

Water Level(s)

During Excavation After Excavation
 At End of Excavation

Logged By : T.Dhara, P.Eng.
Date : Oct.6, 2017

Data Entry By : T.Dhara, P.Eng.
Date : Nov.25-Dec.3, 2017

Reviewed By:
Date : Dec.5, 2017

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TEST PIT SOIL LOG

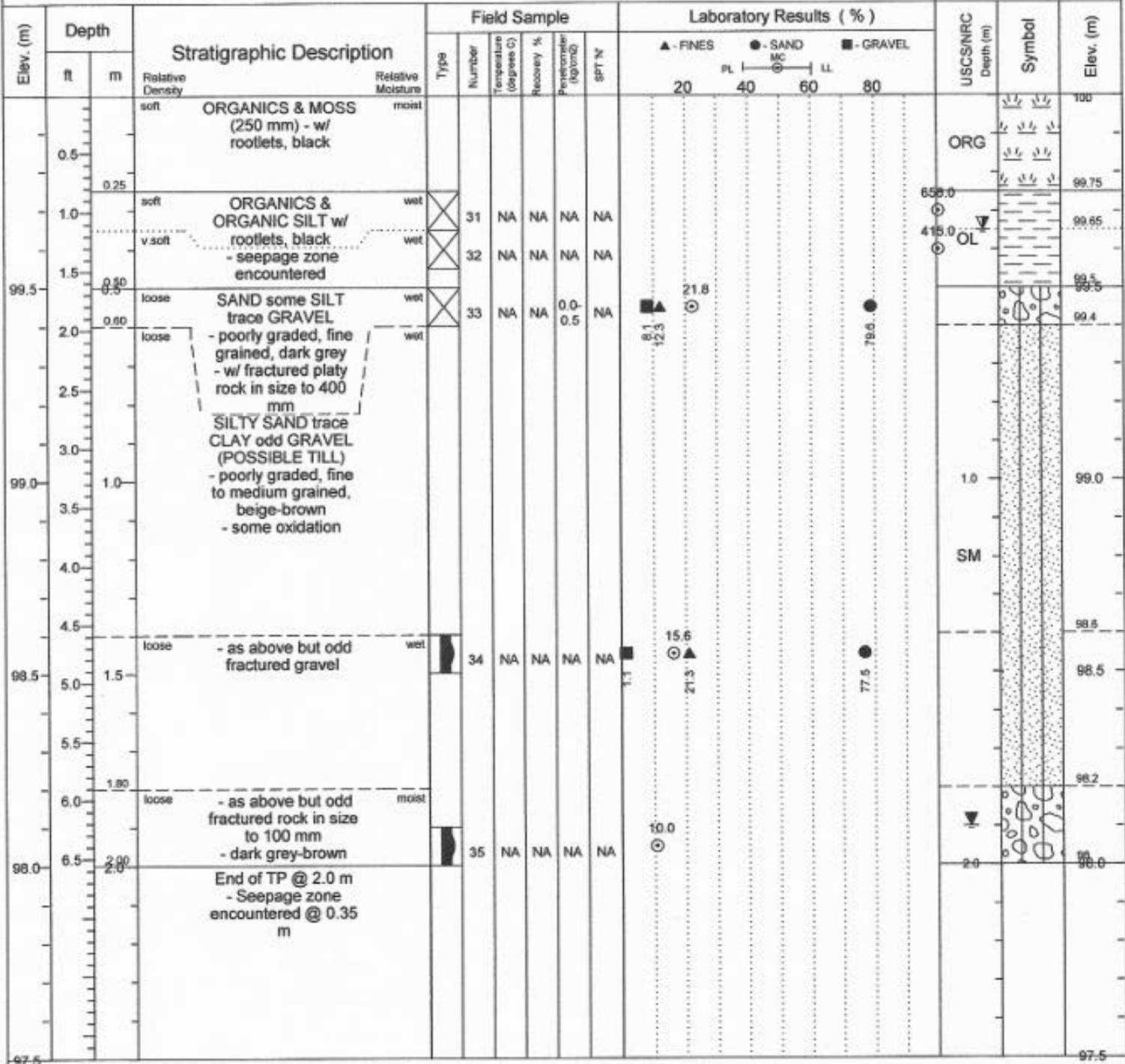
Client : Village of Teslin
Location : Teslin, Yukon
Project : Geotechnical Evaluation - Airport Connector Road
Date Excavated: Oct.6, 2017

Elevation : 100.0 meters
TP Termination Depth: 2 meters
Instrumentation: NA
Weather: Partly Cloudy 0 to +9 C

TEST PIT

8-17

Sheet 1 of 1



Excavated By : Flag Hill Woodworks

Excavator Type : Kubota kx057

Bucket Type : Digging

Water Level(s)

During Excavation
 After Excavation
 At End of Excavation

Logged By : T.Dhara, P.Eng.
Date : Oct.6, 2017

Data Entry By : T.Dhara, P.Eng.
Date : Nov.25-Dec.3, 2017

Reviewed By:
Date : Dec.5, 2017

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TEST PIT SOIL LOG

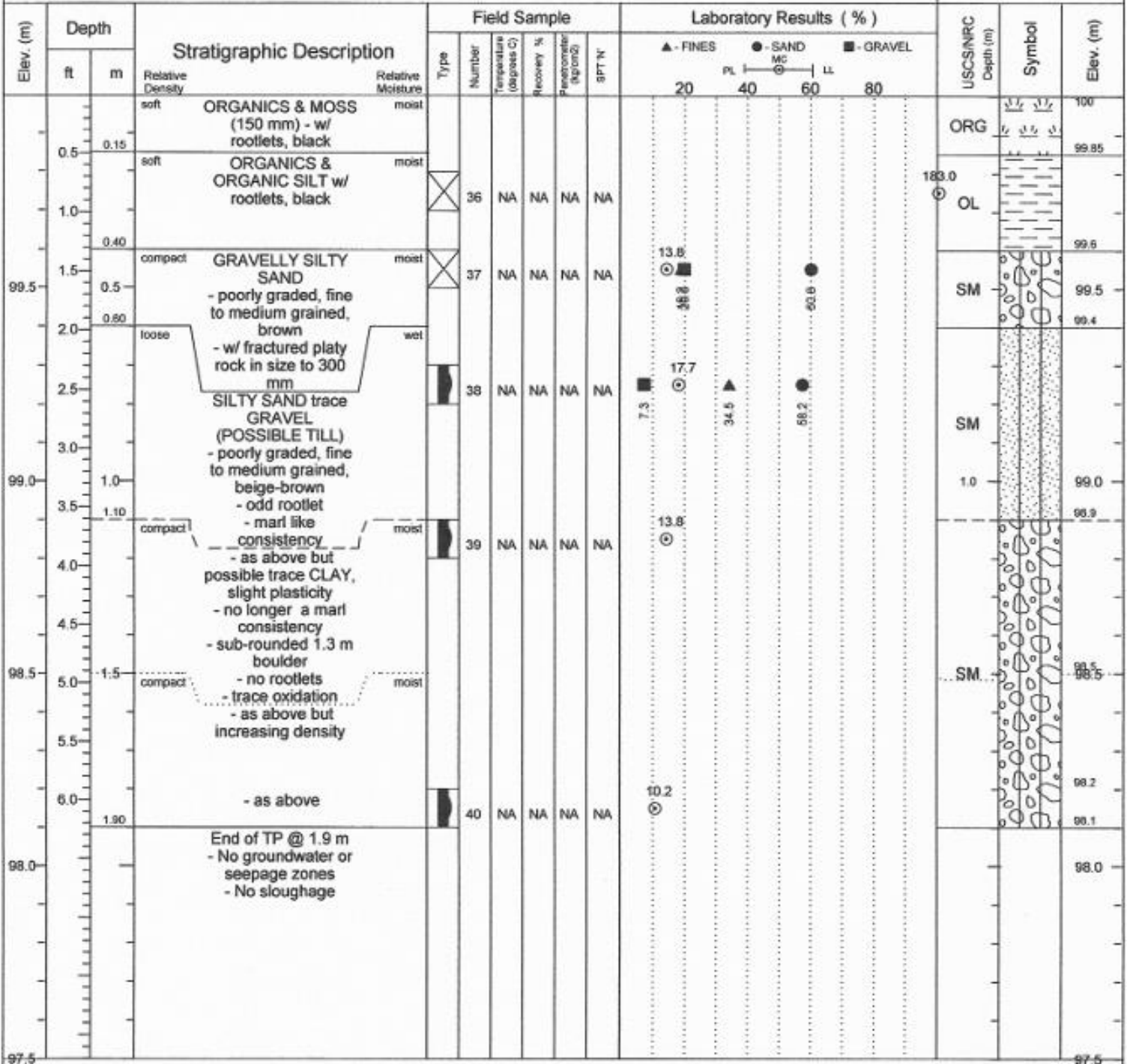
Client : Village of Teslin
Location : Teslin, Yukon
Project : Geotechnical Evaluation - Airport Connector Road
Date Excavated: Oct.6, 2017

Elevation : 100.0 meters
TP Termination Depth: 1.9 meters
Instrumentation: NA
Weather: Partly Cloudy 0 to +9 C

TEST PIT

9-17

Sheet 1 of 1



Excavated By : Flag Hill Woodworks

Excavator Type : Kubota kx057

Bucket Type : Digging

Water Level(s)
 During Excavation After Excavation
 At End of Excavation

Logged By : T.Dhara, P.Eng.
Date : Oct.6, 2017

Data Entry By : T.Dhara, P.Eng.
Date : Nov.25-Dec.3, 2017

Reviewed By:
Date : Dec.5, 2017

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TEST PIT SOIL LOG

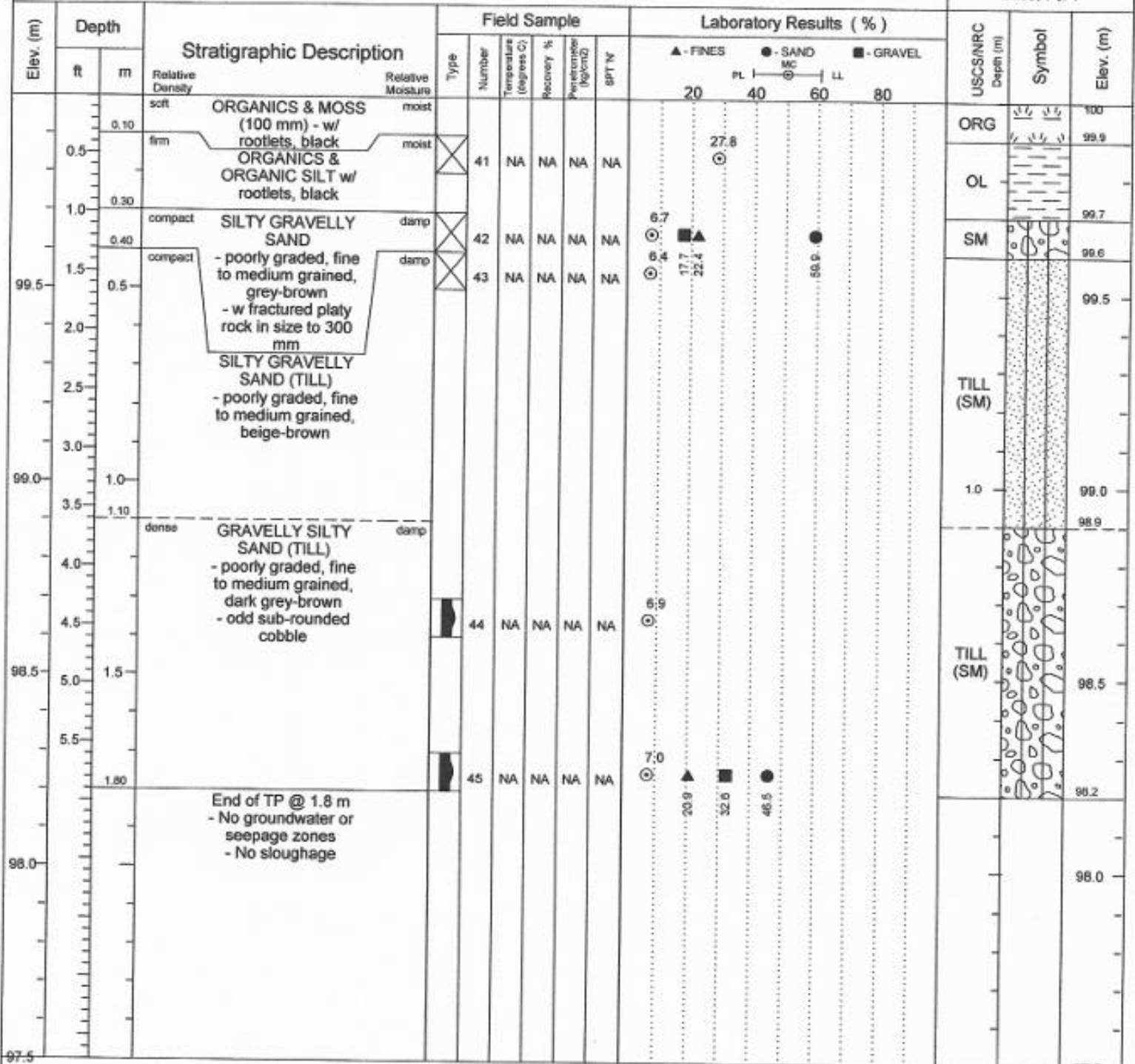
Client : Village of Teslin
Location : Teslin, Yukon
Project : Geotechnical Evaluation - Airport Connector Road
Date Excavated: Oct.6, 2017

Elevation : 100.0 meters
TP Termination Depth: 1.8 meters
Instrumentation: NA
Weather: Partly Cloudy 0 to +9 C

TEST PIT

10-17

Sheet 1 of 1



Excavated By : Flag Hill Woodworks

Excavator Type : Kubota kx057

Bucket Type : Digging

Water Level(s)
 During Excavation
 After Excavation
 At End of Excavation

Logged By : T.Dhara, P.Eng.
Date : Oct.6, 2017

Data Entry By : T.Dhara, P.Eng.
Date : Nov.25-Dec.3, 2017

Reviewed By: *TD*
Date : Dec.5, 2017

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TEST PIT SOIL LOG

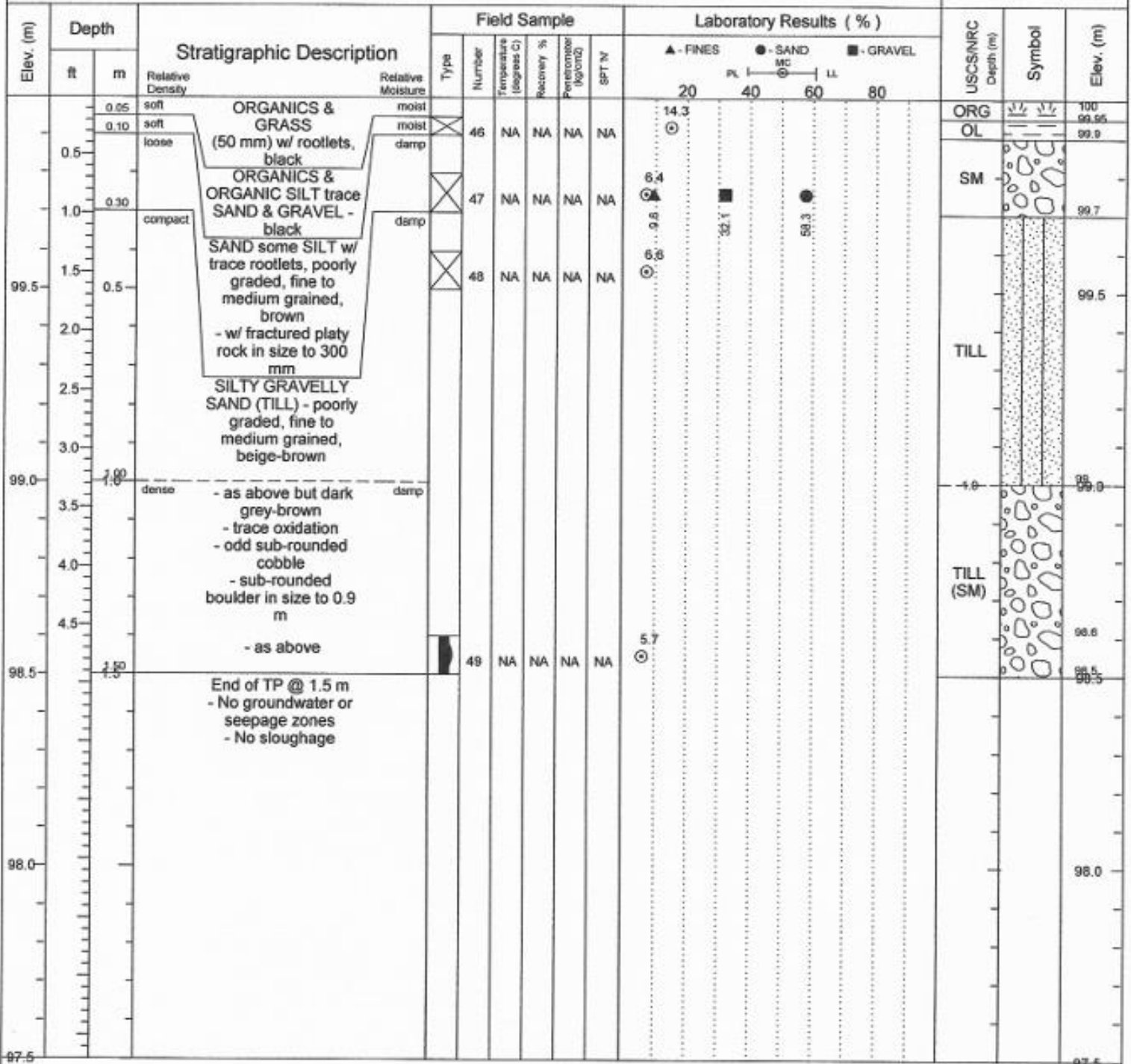
Client : Village of Teslin
Location : Teslin, Yukon
Project : Geotechnical Evaluation - Airport Connector Road
Date Excavated : Oct.6, 2017

Elevation : 100.0 meters
TP Termination Depth: 1.5 meters
Instrumentation: NA
Weather: Partly Cloudy 0 to +9 C

TEST PIT

11-17

Sheet 1 of 1



Excavated By : Flag Hill Woodworks

Excavator Type : Kubota kx057

Bucket Type : Digging

Water Level(s)

During Excavation
 After Excavation
 At End of Excavation

Logged By : T.Dhara, P.Eng.

Date : Oct.6, 2017

Data Entry By : T.Dhara, P.Eng.

Date : Nov.25-Dec.3, 2017

Reviewed By:

Date : Dec.5, 2017



Geotechnical Evaluation
Proposed Connector Road – Teslin, Yukon - 2017
Appendix B –1984 Airphoto



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Appendix C

Recommended Grain Size Distribution for Imported Fill

Gran E Pit Run	
Sieve Size (mm)	% Passing By Wt
200	100
80	75-100
25	55-100
12.5	42-84
5	26-65
1.25	11-47
0.315	3-30
0.08	2-13
LA Abrasion 35 % Max Loss	

80 mm minus Sub-base	
Sieve Size (mm)	% Passing By Wt
80	100
25	60-100
12.5	40-90
5	20-65
1.25	9-35
0.315	3-15
0.08	0-8
LA Abrasion 35 % Max Loss	

Clear Stone	
Sieve Size (mm)	% Passing By Wt
28	100
20	70-100
12.5	55-100
10	30-80
5	0-40
2	0-10
NA	NA
LA Abrasion 35 % Max Loss	

Bedding Sand	
Sieve Size (mm)	% Passing By Wt
10	100
5	80-100
2	55-100
0.63	25-65
0.25	10-40
0.08	2-10

20 mm minus Base Course	
Sieve Size (mm)	% Passing By Wt
20	100
12.5	64-100
5	36-72
1.25	12-42
0.315	4-22
0.08	3-6

Class I Rip-Rap	
Sieve Size (mm)	% Passing By Wt
450	100
350	80
300	50
200	20

Class II Rip-Rap	
Sieve Size (mm)	% Passing By Wt
800	100
600	80
500	50
300	20

Class III Rip-Rap	
Sieve Size (mm)	% Passing By Wt
1200	100
900	80
800	50
500	20