HIGHWAY CONSTRUCTION

km 1949.6 to km 1966
ALASKA HIGHWAY, Y.T.

VOLUME 3
CENTRELINE TESTING

This Data Package prepared for project viewing:

Addendum 1 Km 1956+150 to Km 1956+250 and Km 1958+650 to Km 1959+250 cuts.

June, 1993

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Geotechnical Services
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GEOTECHNICAL INVESTIGATION
HIGHWAY CONSTRUCTION
km 1949.6 to km 1966, ALASKA HIGHWAY, Y.T.
CENTRELINE, GRANULAR & BORROW TESTING

CONTENTS

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GEOTECHNICAL INVESTIGATION DATA

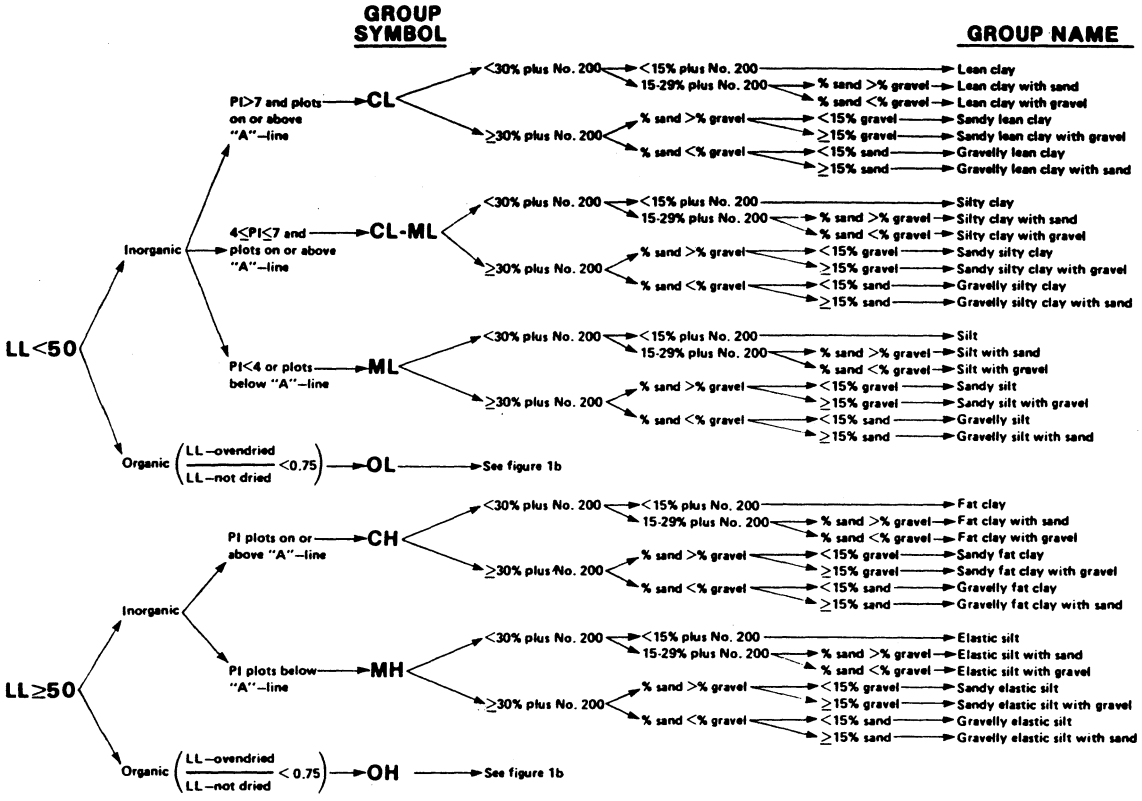
This geotechnical investigation data is provided to assist in the interpretation of soil conditions encountered within this project area. The data presented was prepared solely for Departmental designing and estimating purposes.

The description of material/soil description shown on the subsurface exploration and test reports is a textural description based on identification of retrieved material by the field drilling technician at the time of investigation. This description may be modified following laboratory testing and classification of selected samples. The system used is based on the ASTM standards for identification and classification of soils. Permafrost classifications and groundwater levels are indicated as detected at time of drilling, unless otherwise noted. Changes in moisture or frost conditions should be anticipated depending on the season, time lapse or amount of development work done since the date of investigation.

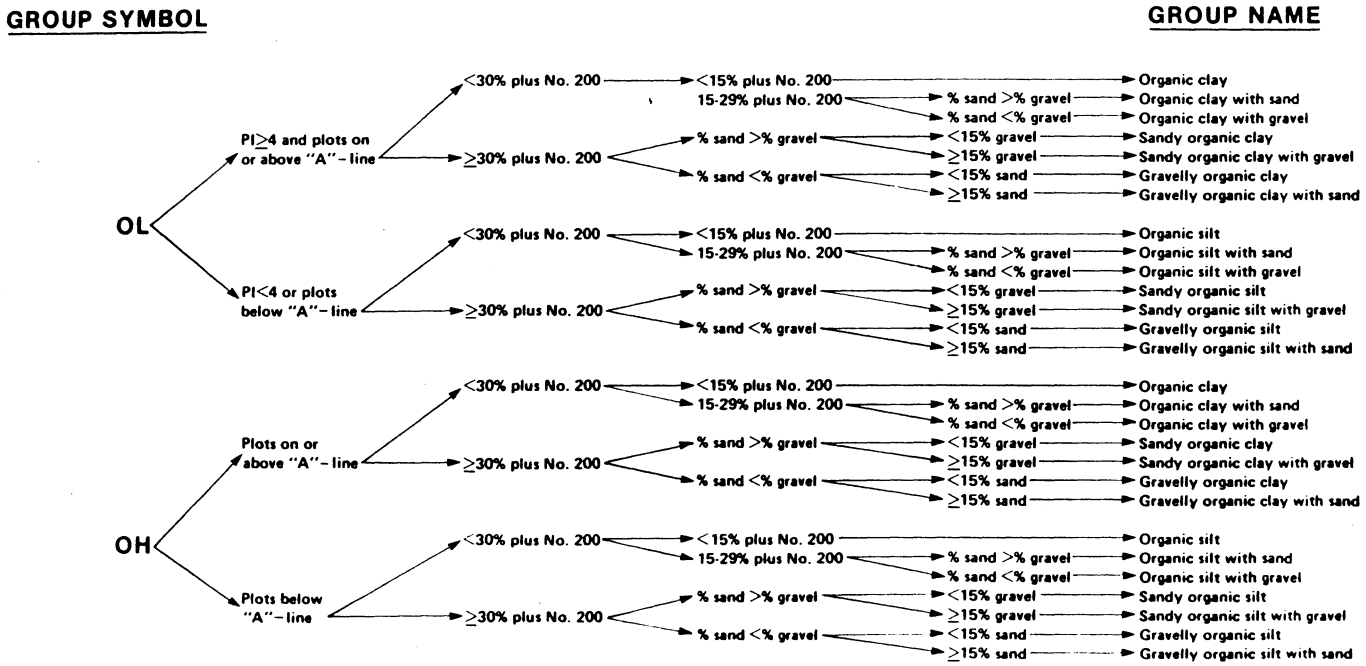
The sample identification and laboratory testing data is provided to give detailed physical properties of selected retrieved samples within the subsurface profile. These tests may be conducted on disturbed samples and may exhibit properties different from the native materials. The sample classification may also vary from the soil description due to variations within the sampled strata or because of changes resulting from the sampling method or excavation equipment used.

These descriptions are not intended to be conclusive as to the nature of any material encountered, or to conditions between or around the test borings/pits.

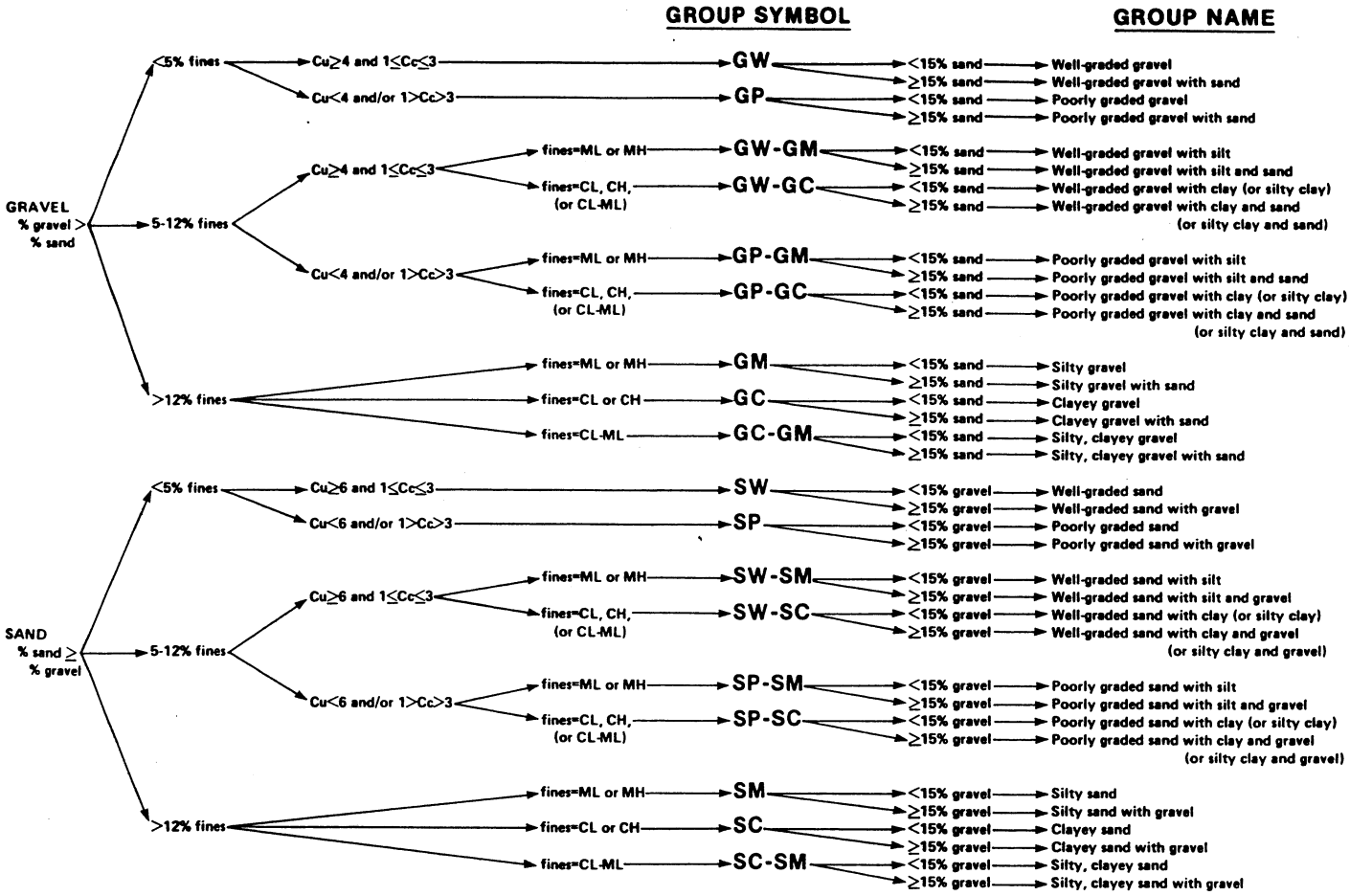
It is recommended that a site inspection, combined with consideration of the regional geology and climatic conditions be conducted. An evaluation of the investigation methods and development work done since the time of investigation should be done prior to interpreting the subsurface conditions for construction purposes.



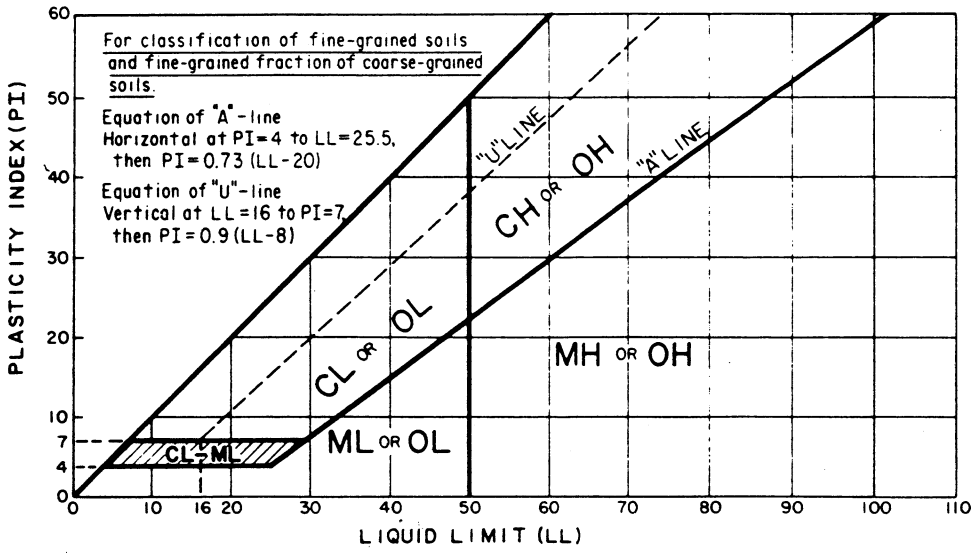
Flow chart for classifying fine-grained soil.



Flow chart for classifying organic soil.



Flow chart for classifying coarse-grained soil.



Plasticity chart.

CRITERIA FOR ASSIGNING GROUP SYMBOLS AND GROUP NAMES USING LABORATORY TESTS [a]				SOIL CLASSIFICATION	
				GROUP SYMBOL	GROUP NAME [b]
COARSE-GRAINED SOILS more than 50% retained on No. 200 sieve	GRAVELS More than 50% of coarse fraction retained on No. 4 sieve	CLEAN GRAVELS Less than 5% fines [c]	$C_u \geq 4$ and $1 \leq C_c \leq 3$ [e]	GW	Well-graded gravel [f]
			$C_u < 4$ and/or $1 > C_c > 3$ [e]	GP	Poorly graded gravel [f]
		GRAVELS WITH FINES More than 12% fines [c]	Fines classify as ML or MH	GM	Silty gravel [f,g,h]
			Fines classify as CL or CH	GC	Clayey gravel [f,g,h]
	SANDS 50% or more of coarse fraction passes No. 4 sieve	CLEAN SANDS Less than 5% fines [d]	$C_u \geq 6$ and $1 \leq C_c \leq 3$ [e]	SW	Well-graded sand [i]
			$C_u < 6$ and/or $1 > C_c > 3$ [e]	SP	Poorly graded sand [i]
		SANDS WITH FINES More than 12% fines [d]	Fines classify as ML or MH	SM	Silty sand [g,h,i]
			Fines classify as CL or CH	SC	Clayey sand [g,h,i]
FINE-GRAINED SOILS 50% or more passed the No. 200 sieve	SILTS AND CLAYS Liquid limit less than 50%	inorganic	PI > 7 and plots on or above "A" line [j]	CL	Lean clay [k,l,m]
			PI < 4 or plots below "A" line [j]	ML	Silt [k,l,m]
		organic	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OL	Organic clay [k, l, m, n] Organic silt [k, l, m, o]
	SILTS AND CLAYS Liquid limit 50% or more	inorganic	PI plots on or above "A" line	CH	Fat clay [k,l,m]
			PI plots below "A" line	MH	Elastic silt [k,l,m]
		organic	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OH	Organic clay [k, l, m, p] Organic silt [k, l, m, q]
Highly organic soils		Primarily organic matter, dark in color, and organic odor		PT	Peat

a. Based on the material passing the 3-in (75-mm) sieve.
b. If field sample contained cobbles and/or boulders, add "with cobbles and/or boulders" to group name.
c. Gravels with 5 to 12% fines require dual symbols
   GW-GM well graded gravel with silt
   GW-GC well graded gravel with clay
   GP-GM poorly graded gravel with silt
   GP-GC poorly graded gravel with clay
d. Sands with 5 to 12% fines require dual symbols
   SW-SM well graded sand with silt
   SW-SC well graded sand with clay
   SP-SM poorly graded sand with silt
   SP-SC poorly graded sand with clay
e. $C_u = D_{60}/D_{10}$ $\quad C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
f. If soil contains $\geq$ 15% sand, add "with sand" to group name.
g. If fines classify as CL-ML, use dual symbol GC-GM, SC-SM.
h. If fines are organic, add "with organic fines" to group name.
i. If soil contains $\geq$ 15% gravel, add "with gravel" to group name.
j. If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.
k. If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel" whichever is predominant.
l. If soil contains $\geq$ 30% plus No. 200, predominantly sand, add "sandy" to group name.
m. If soil contains $\geq$ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
n. PI $\geq$ 4 and plots on or above "A" line.
o. PI $<$ 4 or plots below "A" line.
p. PI plots on or above "A" line.
q. PI plots below "A" line.

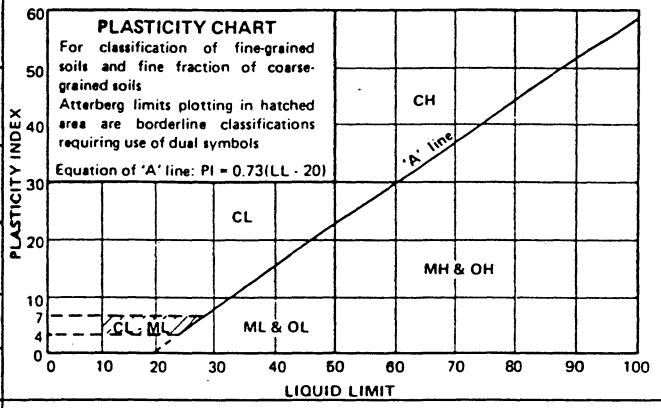
Soil classification chart

UNIFIED SOIL CLASSIFICATION†

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES	CLASSIFICATION CRITERIA	
COARSE-GRAINED SOILS More than 50% retained on No. 200 sieve*	GRAVELS 50% or more of coarse fraction retained on No. 4 sieve	CLEAN GRAVELS	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	$C_u = D_{60}/D_{10}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			GP	Poorly-graded gravels and gravel-sand mixtures, little or no fines	Not meeting both criteria for GW	
		GRAVELS WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures	Atterberg limits plot below 'A' line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			GC	Clayey gravels, gravel-sand clay mixtures	Atterberg limits plot above 'A' line and plasticity index greater than 7	
	SANDS More than 50% of coarse fraction passes No. 4 sieve	CLEAN SANDS	SW	Well-graded sands and gravelly sands, little or no fines	$C_u = D_{60}/D_{10}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			SP	Poorly-graded sands and gravelly sands, little or no fines	Not meeting both criteria for SW	
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures	Atterberg limits plot below 'A' line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures	Atterberg limits plot above 'A' line and plasticity index greater than 7	

Classification on basis of percentage of fines
Less than 5% pass No. 200 sieve: GW, GP, SW, SP
More than 12% pass No. 200 sieve: GM, GC, SM, SC
5% to 12% pass No. 200 sieve: Borderline classification requiring use of dual symbols

FINE-GRAINED SOILS 50% or more passes No. 200 sieve*	SILTS AND CLAYS Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands	
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
			OL	Organic silts and organic silty clays of low plasticity	
	SILTS AND CLAYS Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts	
			CH	Inorganic clay of high plasticity, fat clays	
			OH	Organic clays of medium to high plasticity	
HIGHLY ORGANIC SOILS			PT	Peat, muck and other highly organic soils	



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

GROUND ICE DESCRIPTION

ICE NOT VISIBLE

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

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

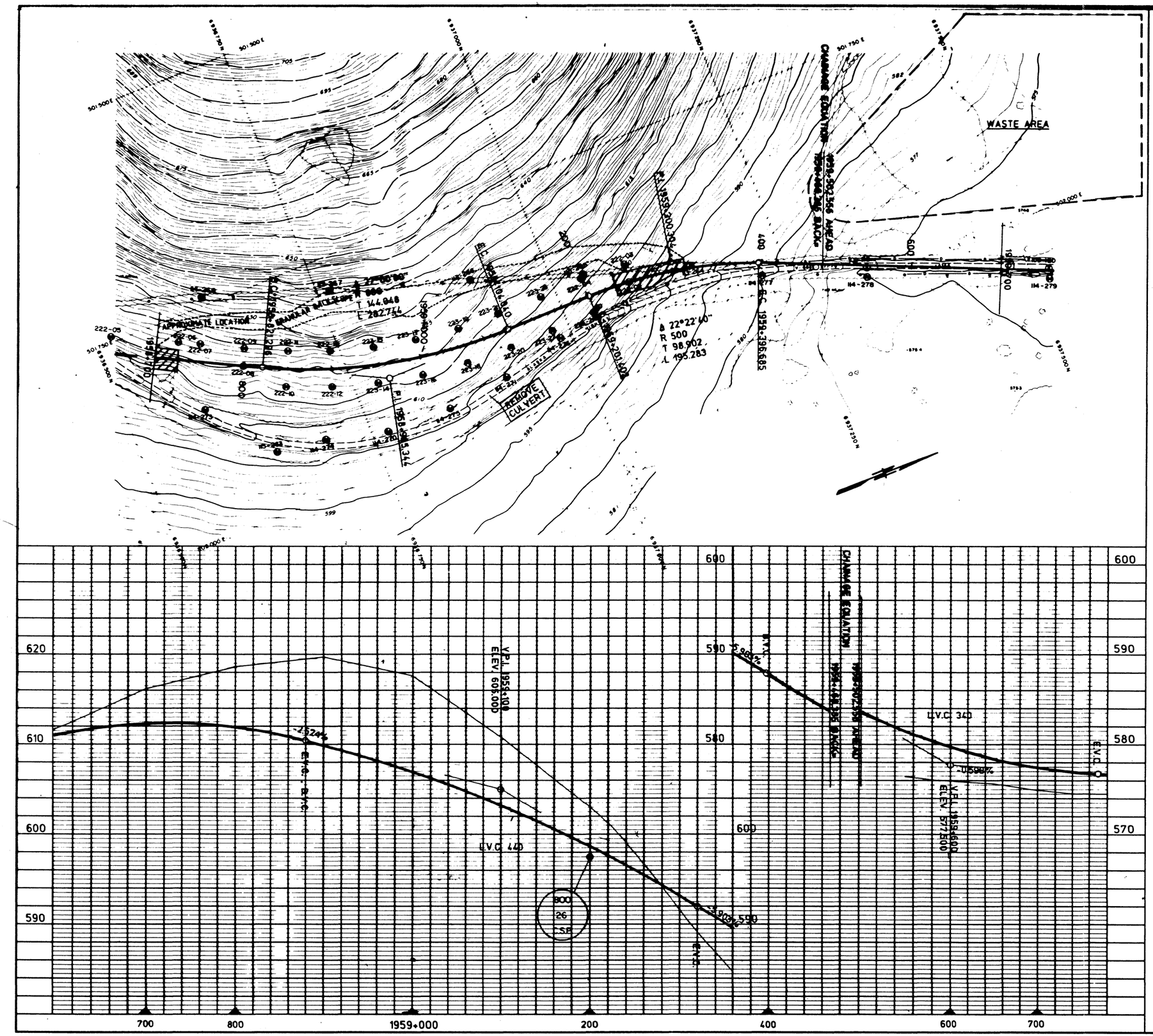
LEGEND
Soil  Ice 

VISIBLE ICE LESS THAN 50% BY VOLUME

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

VISIBLE ICE GREATER THAN 50% BY VOLUME

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



Yukon
Community and Transportation Services
Transportation Engineering Branch

SHAKWAK

Compiled By:
AÉRO PHOTO INC
QUÉBEC CANADA
JUNE-OCTOBER 1977

Horizontal Scale: 1:2000	Contour Interval: 1 METRE
Compilation Photos A24208 23,22,21	Photo Scale 1:8000
Drawn by: TECH. SERVICE Date: APRIL 93	Designed by: D. FINLAYSON Date: APRIL 93
Checked by: P. KNYSH P.ENG. Date: 93-05-31	
Approved by: J.B. COXFORD P.ENG. Date: 93-06-01	
Surveyed by:	

Legend

Revisions
ADDENDUM #1. 93-06-11

Horizontal Scale: 1:2000	Vertical Scale: 1:200
NTS. No. 115 K/10	Drwg. No. 218 B-1
Sheet 11 of 20	

SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 222-01
SHAKWAK PROJECT	A/H Km 1949.6-1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1956+150 centerline	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ⊘ S.P.T. ⊠ AUGER ■ BULK ▯▯ TUBE ▮▯ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲PERCENT FINES▲ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	ORGANIC MATERIAL						0.0
	SILT -with decomposed rock -some large rocks >76mm	⊠	01				
1.0							1.0
2.0	END OF HOLE at 2.0m -refusal						2.0
3.0							3.0
4.0							4.0
5.0							5.0
6.0							6.0
7.0							7.0
8.0							8.0
9.0							9.0
10.0							10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 2.0 m	COMPLETE 93/06/01	
	LOGGED BY S.H.	DWG NO.	Page 1 of 1

SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 222-01A
SHAKWAK PROJECT	A/H Km 1949.6-1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1956+152 centerline	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ⊘ S.P.T. ⊠ AUGER ■ BULK ▯▯ TUBE ▮▯ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲ PERCENT FINES ▲ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	ORGANIC MATERIAL						0.0
	SILT -light brown -damp -some pea-gravel	⊠	02				
1.0							1.0
	SILT -light brown -rock fragments	⊠	03				
2.0							2.0
	SILT -brown -with angular rock -decomposed bedrock with hard layers	⊠	04				
3.0							3.0
	-harder drilling	⊠	05				
4.0	END OF HOLE at 4.2m						4.0
5.0							5.0
6.0							6.0
7.0							7.0
8.0							8.0
9.0							9.0
10.0							10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 4.2 m	COMPLETE 93/06/01	
	LOGGED BY S.H.	DWG NO.	Page 1 of 1

SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 222-02
SHAKWAK PROJECT	A/H Km 1949.6-1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1956+250 centerline	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ⊘ S.P.T. ⊠ AUGER ■ BULK ▯▯ TUBE ▮▯ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲PERCENT FINES▲ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	ORGANIC MATERIAL -visible ice						0.0
	SILT -frozen	⊠	06				
1.0	-harder drilling						1.0
	SILT -light grey -frozen -NO visible ice	⊠	07				
2.0							2.0
3.0	-hard drilling -Ice chunks						3.0
	SILT with gravel -light brown -frozen	⊠	08				
4.0	-hard drilling						4.0
5.0	-silt with rock fragments in ice						5.0
	SILT with ice lenses -frozen	⊠	09				
6.0	END OF HOLE at 6.0m -no bedrock encountered						6.0
7.0							7.0
8.0							8.0
9.0							9.0
10.0							10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 6.0 m	COMPLETE 93/06/01
	LOGGED BY S.H.	DWG NO.
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SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 222-03
SHAKWAK PROJECT	A/H Km 1949.6-1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1959+250 o/s 20m Lt.	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ⊘ S.P.T. ⊠ AUGER ■ BULK ▯▯ TUBE ▮▯ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲PERCENT FINES▲ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	ORGANIC MATERIAL -frozen						0.0
	SILT -dark brown -visible ice	⊠	10				
1.0							1.0
2.0							2.0
	SILTY SAND WITH GRAVEL (SM) -brown -frozen -rock fragments	⊠	11	● ▲	SM		
3.0							3.0
	CLAYEY SAND (SC) -light brown -frozen	⊠	12	● ▲	SC		
4.0							4.0
5.0	-very hard drilling -frozen -drill overheating -no more samples						5.0
6.0							6.0
7.0	END OF HOLE at 7.0m -refusal						7.0
8.0							8.0
9.0							9.0
10.0							10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 7.0 m	COMPLETE 93/06/01
	LOGGED BY S.H.	DWG NO.
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SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 222-04
SHAKWAK PROJECT	A/H Km 1949.6-1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1959+200 o/s 20m Lt.	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ⊘ S.P.T. ⊠ AUGER ■ BULK ▯▯ TUBE ▮▯ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲ PERCENT FINES ▲ 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	ORGANIC MATERIAL						0.0
	Silty SAND -frozen -visible ice	⊠	13				
1.0	Silty SAND with gravel -frozen	⊠	14				1.0
2.0							2.0
	Gravelly SILT -frozen	⊠	15				
3.0							3.0
	Decomposed BEDROCK (Soft) -very hard drilling						
4.0							4.0
		⊠	16				
5.0	-very hard drilling						5.0
	END OF HOLE at 5.8m						
6.0							6.0
7.0							7.0
8.0							8.0
9.0							9.0
10.0							10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 5.8 m	COMPLETE 93/06/02	
	LOGGED BY S.H.	DWG NO.	Page 1 of 1

SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 222-05
SHAKWAK PROJECT	A/H Km 1949.6-1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1958+650 o/s 20m Lt.	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ⊘ S.P.T. ⊠ AUGER ■ BULK ▯▯ TUBE ▮▯ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲PERCENT FINES▲ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	ORGANIC MATERIAL						0.0
	SILT -grey						
1.0	SILT -dark brown -saturated	⊠	17				1.0
2.0	-easy drilling						2.0
3.0		⊠	18				3.0
	-frozen below 3.5m						
4.0		⊠	19				4.0
5.0	-no ice visible						5.0
6.0							6.0
7.0	SANDY SILT (ML) -light brown -frozen	⊠	20	● ▲	ML		7.0
8.0							8.0
9.0		⊠	21	● ▲	ML		9.0
	END OF HOLE at 9.00m -no refusal						
10.0							10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 9.0 m	COMPLETE 93/06/04
	LOGGED BY S.H.	DWG NO.
		Page 1 of 1

SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 222-06
SHAKWAK PROJECT	A/H Km 1949.6-1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1958+725 o/s 20m Lt.	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ⊘ S.P.T. ⊠ AUGER ■ BULK ▯▯ TUBE ▮▯ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲ PERCENT FINES ▲ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	ORGANIC MATERIAL						0.0
	SILT with sand -light brown -frozen -NO visible ice						
1.0		⊠	22				1.0
	SILT -grey -frozen						
2.0							2.0
		⊠	23				
3.0	-harder drilling						3.0
4.0	SILT with sand -dark grey -frozen -trace of organics	⊠	24				4.0
5.0							5.0
	SILT -light brown -dry -some rock fragments	⊠	25				
6.0							6.0
7.0	SILT with rock fragments -light brown -dry	⊠	26				7.0
	END OF HOLE at 7.7m						
8.0							8.0
9.0							9.0
10.0							10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 7.7 m	COMPLETE 93/06/04	
	LOGGED BY S.H.	DWG NO.	Page 1 of 1

SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 222-07
SHAKWAK PROJECT	A/H Km 1949.6-1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1958+750 o/s 20m Lt.	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ⊘ S.P.T. ⊠ AUGER ■ BULK ▯▯ TUBE ▮▯ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲ PERCENT FINES ▲ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	ORGANIC MATERIAL -frozen						0.0
	Sandy SILT -dark grey -frozen	⊠	27				
1.0							1.0
	Silty SAND with rock fragments						
2.0							2.0
		⊠	28				
3.0							3.0
4.0							4.0
	-very hard drilling						
5.0							5.0
	ROCK (broken)	⊠	29				
6.0	END OF HOLE at 5.9m -refusal						6.0
7.0							7.0
8.0							8.0
9.0							9.0
10.0							10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 5.9 m	COMPLETE 93/06/04
	LOGGED BY S.H.	DWG NO.
		Page 1 of 1

SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 222-08
SHAKWAK PROJECT	A/H Km 1949.6-1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1958+800 centerline	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ⊘ S.P.T. ⊠ AUGER ■ BULK ▯▯ TUBE ▮▯ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲ PERCENT FINES ▲ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	ORGANIC MATERIAL						0.0
	SILT -brown -frozen						
1.0		⊠	30				1.0
	SILT -grey -frozen						
2.0	-steady drilling						2.0
		⊠	31				
3.0	-drill grinding -visible ice						3.0
4.0							4.0
	-large ice chunks some silt	⊠	32				
5.0		⊠	33				5.0
	SILT -brown -frozen						
6.0	-visible ice						6.0
7.0	Gravelly SILT -brown and grey -frozen	⊠	34				7.0
	END OF HOLE at 7.4m -refusal						
8.0							8.0
9.0							9.0
10.0							10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 7.4 m	COMPLETE 93/06/04
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SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 222-09
SHAKWAK PROJECT	A/H Km 1949.6-1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1958+800 o/s 20m Lt.	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ⊘ S.P.T. ⊠ AUGER ■ BULK ▯▯ TUBE ▮▯ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲ PERCENT FINES ▲ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	ORGANIC MATERIAL						0.0
	SILT -brown -frozen -no visible ice	⊠	35				
1.0							1.0
2.0	SILT -grey -frozen -no visible ice -harder drilling	⊠	36	H ● ▲	ML		2.0
3.0							3.0
	SILTY GRAVEL (GM) -frozen	⊠	37	● ▲	GM		
4.0							4.0
5.0	-very hard drilling						5.0
6.0	END OF HOLE at 6.0m						6.0
7.0							7.0
8.0							8.0
9.0							9.0
10.0							10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 6.0 m	COMPLETE 93/06/04
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SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 222-10
SHAKWAK PROJECT	A/H Km 1949.6-1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1958+850 o/s 20m Rt.	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ⊘ S.P.T. ⊠ AUGER ■ BULK ▯▯ TUBE ▮▯ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲ PERCENT FINES ▲ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	ORGANIC MATERIAL						0.0
	SILT -brown, grey -frozen						
1.0		⊠	38				1.0
	-organic material, wood ect.						
2.0							2.0
	SILT -grey -frozen	⊠	39				
3.0							3.0
	SILT -light brown -frozen -ice chunks	⊠	40				
4.0							4.0
	ICE						
5.0	SILT -light brown -frozen						5.0
6.0	END OF HOLE at 6.0m						6.0
7.0							7.0
8.0							8.0
9.0							9.0
10.0							10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 6.0 m	COMPLETE 93/06/04
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SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 222-11
SHAKWAK PROJECT	A/H Km 1949.6-1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1958+850 o/s 20m Lt.	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ⊘ S.P.T. ⊠ AUGER ■ BULK ▯▯ TUBE ▮▯ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲PERCENT FINES▲ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	ORGANIC MATERIAL						0.0
	SILT -dark brown -frozen -trace of organics -smooth drilling	⊠	41				
1.0							1.0
2.0							2.0
	Gravelly SILT -brown -frozen -trace of organics, wood ect.	⊠	42				
3.0							3.0
	SILT -with Angular rock fragments	⊠	43				
4.0							4.0
	-hard drilling						
5.0	END OF HOLE at 5.1m -refusal						5.0
6.0							6.0
7.0							7.0
8.0							8.0
9.0							9.0
10.0							10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 5.1 m	COMPLETE 93/06/04	
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SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 222-12
SHAKWAK PROJECT	A/H Km 1949.6-1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1958+900 o/s 20m Rt.	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ⊘ S.P.T. ⊠ AUGER ■ BULK ▯▯ TUBE ▮▯ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲ PERCENT FINES ▲ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	ORGANIC MATERIAL						0.0
	SILT -brown -frozen -visible ice	⊠	44				
1.0							1.0
	SILT -ice rich	⊠	45				
2.0							2.0
3.0	ICE LENSE						3.0
4.0	SILT (ML) -frozen						4.0
		⊠	46	I ● ▲	ML		
5.0							5.0
6.0		⊠	47	I ● ▲	ML		6.0
	END OF HOLE at 6.2m						
7.0							7.0
8.0							8.0
9.0							9.0
10.0							10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 6.4 m	COMPLETE 93/06/05
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SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 222-13
SHAKWAK PROJECT	A/H Km 1949.6-1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1958+900 o/s 19m Lt.	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ⊘ S.P.T. ⊠ AUGER ■ BULK ▯▯ TUBE ▮▯ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲ PERCENT FINES ▲ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	SILT -brown -frozen						0.0
1.0	-easy drilling	⊠	48				1.0
2.0							2.0
	SILT -brown -frozen	⊠	49				
3.0	-visible ice -lots of ice						3.0
4.0	SILT -grey/brown -frozen -No visible ice	⊠	50				4.0
5.0	-rock fragments						5.0
6.0							6.0
7.0							7.0
8.0	-rock fragments with silt	⊠	51				8.0
	END OF HOLE at 8.6m						
9.0							9.0
10.0							10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 8.6 m	COMPLETE 93/06/05	
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SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 223-14
SHAKWAK PROJECT	A/H Km 1949.6-1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1958+950 o/s 20m Rt.	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ⊘ S.P.T. ⊠ AUGER ■ BULK ▯▯ TUBE ▮▯ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲PERCENT FINES▲ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	ORGANIC MATERIAL						0.0
	SILT -grey -frozen -visible ice	⊠	52				
1.0							1.0
2.0							2.0
	-easy drilling	⊠	53				
3.0							3.0
4.0							4.0
	SILT -grey/brown -frozen -no visible ice	⊠	54				
5.0							5.0
		⊠	55				
6.0	END OF HOLE at 6.0m						6.0
7.0							7.0
8.0							8.0
9.0							9.0
10.0							10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 6.0 m	COMPLETE 93/06/05
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SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 223-15
SHAKWAK PROJECT	A/H Km 1949.6–1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1958+950 o/s 20m Lt.	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ⊘ S.P.T. ⊠ AUGER ■ BULK ▯▯ TUBE ▮▯ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲PERCENT FINES▲ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	ORGANIC MATERIAL						0.0
	SILT –grey/brown –trace organics –frozen –visible ice	⊠	56				
1.0							1.0
2.0							2.0
	SILT –brown –frozen –visible ice	⊠	57				
3.0							3.0
4.0							4.0
	SILT –predominantly rock fragments –grinding drilling after 4.6m	⊠	58				
5.0							5.0
6.0	END OF HOLE at 6.0m –refusal						6.0
7.0							7.0
8.0							8.0
9.0							9.0
10.0							10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 6.0 m	COMPLETE 93/06/05
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SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 223-16
SHAKWAK PROJECT	A/H Km 1949.6-1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1959+000 o/s 20m Rt.	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ⊘ S.P.T. ⊠ AUGER ■ BULK ▯▯ TUBE ▮▯ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲ PERCENT FINES ▲ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	ORGANIC MATERIAL						0.0
	SILT -grey/brown -frozen -easy drilling	⊠	59				
1.0							1.0
2.0	SILT -grey -frozen						2.0
		⊠	60				
3.0							3.0
4.0							4.0
		⊠	61				
5.0							5.0
	SILT -grey -frozen -visible ice						
6.0							6.0
		⊠	62				
7.0							7.0
		⊠	63				
8.0	-denser material						8.0
	ROCK -no sample -hole squeezing						
9.0	END OF HOLE at 8.7m						9.0
10.0							10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 8.7 m	COMPLETE 93/06/05
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SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 223-17
SHAKWAK PROJECT	A/H Km 1949.6-1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1959+000 o/s 20m Lt.	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ⊘ S.P.T. ⊠ AUGER ■ BULK ▯▯ TUBE ▮▯ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲PERCENT FINES▲ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	SILTY SAND -brown -dry -easy drilling	⊠	64				0.0
1.0							1.0
2.0		⊠	65				2.0
3.0							3.0
4.0	SANDY SILT -grey -frozen	⊠	66				4.0
5.0							5.0
6.0							6.0
7.0	SILT -brown -few pebbles -frozen	⊠	67				7.0
8.0	-rocks at 7.9m SILT -grey -frozen -visible ice	⊠	68				8.0
9.0	ROCK -grinding drilling						9.0
10.0	END OF HOLE at 9.6m -refusal						10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 9.6 m	COMPLETE 93/06/05
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SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 223-18
SHAKWAK PROJECT	A/H Km 1949.6-1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1959+050 o/s 20m Rt.	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ⊘ S.P.T. ⊠ AUGER ■ BULK ▯▯ TUBE ▮▯ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲PERCENT FINES▲ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	SILT -grey -organics in upper 0.1m -frozen -easy drilling						0.0
1.0		⊠	69				1.0
2.0							2.0
		⊠	70				
3.0	-softer at 3.6m						3.0
4.0	-organic odour from 4.0 to 4.4m	⊠	71				4.0
5.0							5.0
	SILT -brown/grey -frozen -smooth drilling	⊠	72				
6.0							6.0
7.0							7.0
8.0	-some pebbles below 8.2 -grey below 8.2m -soft	⊠	73				8.0
9.0	END OF HOLE at 9.0m						9.0
10.0							10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 9.0 m	COMPLETE 93/06/05
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SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 223-19
SHAKWAK PROJECT	A/H Km 1949.6-1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1959+050 o/s 20m Lt.	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ⊘ S.P.T. ⊠ AUGER ■ BULK ▯▯ TUBE ◨ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲PERCENT FINES▲ 20 40 60 80 / PLASTIC M.C. LIQUID / 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	ORGANIC MATERIAL						0.0
	SILT -grey/brown -few roots to 0.5m -frozen below 0.4m	⊠	74				
1.0							1.0
2.0							2.0
	SILT -grey -frozen	⊠	75				
3.0							3.0
4.0		⊠	76				4.0
5.0	ROCK -brownish grey -grindy drilling						5.0
6.0							6.0
7.0	END OF HOLE at 6.9m -refusal						7.0
8.0							8.0
9.0							9.0
10.0							10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 6.9 m	COMPLETE 93/06/05
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SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 223-20
SHAKWAK PROJECT	A/H Km 1949.6-1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1959+100 o/s 20m Rt.	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ⊘ S.P.T. ⊠ AUGER ■ BULK ▯▯ TUBE ▯■ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲PERCENT FINES▲ 20 40 60 80 / PLASTIC M.C. LIQUID / 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	ORGANIC MATERIAL						0.0
	SILT -grey -frozen -slow drilling -visible ice	⊠	77				
1.0							1.0
2.0		⊠	78				2.0
3.0							3.0
4.0							4.0
	SILT -grey -frozen -smooth drilling	⊠	79				
5.0	END OF HOLE at 5.2m						5.0
6.0							6.0
7.0							7.0
8.0							8.0
9.0							9.0
10.0							10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 5.2 m	COMPLETE 93/06/05
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SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 223-21
SHAKWAK PROJECT	A/H Km 1949.6–1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1959+100 o/s 20m Lt.	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ⊘ S.P.T. ⊠ AUGER ■ BULK ▯▯ TUBE ▮▯ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲PERCENT FINES▲ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	ORGANIC MATERIAL						0.0
	SILT –brown/grey –frozen –easy drilling	⊠	80				
1.0							1.0
2.0							2.0
	–grey below 2.6m	⊠	81				
3.0							3.0
4.0	SILT –light brown –rock fragments –frozen –grindy drilling	⊠	82				4.0
5.0							5.0
		⊠	83				
6.0	END OF HOLE at 6.2m –refusal						6.0
7.0							7.0
8.0							8.0
9.0							9.0
10.0							10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 6.2 m	COMPLETE 93/06/06
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SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 223-22
SHAKWAK PROJECT	A/H Km 1949.6-1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1959+150 o/s 20m Rt.	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ⊘ S.P.T. ⊠ AUGER ■ BULK ▯▯ TUBE ▮▯ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲PERCENT FINES▲ 20 40 60 80 / PLASTIC M.C. LIQUID / 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	ORGANIC MATERIAL						0.0
	SILT -brown/grey -frozen	⊠	84				
1.0							1.0
2.0	SILTY GRAVEL -wood fragments	⊠	85				2.0
3.0							3.0
	ROCK -brown -silty -frozen -visible ice -grindy drilling						
4.0							4.0
	-no visible ice below 4.4m	⊠	86				
5.0							5.0
	-smoother drilling below 5.4m	⊠	87				
6.0	END OF HOLE at 6.0m -refusal						6.0
7.0							7.0
8.0							8.0
9.0							9.0
10.0							10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 6.0 m	COMPLETE 93/06/06
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SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 223-23
SHAKWAK PROJECT	A/H Km 1949.6–1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1959+150 o/s 20m Lt.	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ⊘ S.P.T. ⊠ AUGER ■ BULK ▯▯ TUBE ▯■ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲ PERCENT FINES ▲ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	SANDY SILT (ML) –brownish grey –frozen –visible ice	⊠	88	I ● ▲	ML		0.0
1.0							1.0
	SILTY GRAVEL WITH SAND (GM) –frozen –rock fragments	⊠	89	● I ▲	GM		
2.0							2.0
	SILTY SAND WITH GRAVEL (SM) –bright brown –frozen	⊠	90	● I ▲	SM		
3.0							3.0
4.0							4.0
5.0							5.0
		⊠	91				
6.0							6.0
7.0							7.0
8.0							8.0
		⊠	92				
9.0	END OF HOLE at 9.0m						9.0
10.0							10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 9.0 m	COMPLETE 93/06/06
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SUBSURFACE EXPLORATION AND TEST REPORT	ALASKA HIGHWAY PRE-ENGINEERING	BOREHOLE No. 223-24
SHAKWAK PROJECT	A/H Km 1949.6–1966.0	Project No: SEGMENT 18 B
DRILL: CME 750 150mm Dia. SOLID STEM	LOCATION: STA 1959+200 o/s 20m Rt.	ELEVATION 0.000 (m)

SAMPLE TYPE ■ RETURN ☒ S.P.T. ☒ AUGER ■ BULK ▯▯ TUBE ▮▯ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲PERCENT FINES▲ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	USC	PERMAFROST DESCRIPTION	DEPTH (m)
0.0	ORGANIC MATERIAL						0.0
	SILT –grey –frozen						
1.0		☒	93				1.0
2.0		☒	94				2.0
3.0							3.0
	ROCK fragments –some silt –grindy drilling						
4.0		☒	95				4.0
5.0	END OF HOLE at 5.0m –refusal						5.0
6.0							6.0
7.0							7.0
8.0							8.0
9.0							9.0
10.0							10.0

Public Works Canada Whitehorse, Yukon Territory.	COMPLETION DEPTH 5.0 m	COMPLETE 93/06/06
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