HOGGAN ENGINEERING & TESTING (1980) LTD.

An Affiliate of J. R. Paine & Associates Ltd.

HOGGAN ENGINEERING & TESTING (1980) LTD.

GEOTECHNICAL INVESTIGATION
NORDENSKIOLD RIVER CROSSING
CARMACKS, YUKON

J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS
EDMONTON — GRANDE PRAIRIE — WHITEHORSE — PEACE RIVER

COVER SHEET

TO: NAME: MR. BRUCE FULCHER
COMPANY: TRANS ENG.
FAX NO: 667-2647

This is page 1 of 1 pages. If you should oxperience any difficulties, please call (403) 668-4648.

FROM: NAME: MIKE BILLOWITS
COMPANY: J.R. PAINE & ASSOCIATES LTD.
14 Burns Road, Whitehorse, Yukon, Y1A 4Y9
Fax: 668 - 2400

COMMENTS: Re.: GEOTECHNICAL INVESTIGATION
NORDENSKIOLD RIVER CROSSING
CARMACKS, YUKON

I HAVE JUST NOTICED AN ERROR ON TOP OF PAGE 4 ON THE ABOVE MENTIONED REPORT. IT SHOULD READ :

"By injecting water into the test hole in this fashion, the static ground water level could not be confirmed. However, it is believed that the static groundwater level may be higher than the observed level of free water at the time of the investigation."

PLEASE CONSIDER THIS FAX AS AN ADDENDUM TO THE ABOVE MENTIONED REPORT.

REGARDS,

DATE: 22 Nov, 1994 TIME: 12:00 pm

HOGGAN ENGINEERING & TESTING (1980) LTD.

REPORT NO: 8002-232

GEOTECHNICAL INVESTIGATION
NORDENSKIOLD RIVER CROSSING
CARMACKS, YUKON

OCTOBER, 1994

HOGGAN ENGINEERING & TESTING (1980) LTD.
14 BURNS ROAD
WHITEHORSE, YUKON
Y1A 4Y9

REPORT NO: 8002-232

GEOTECHNICAL INVESTIGATION
NORDENSKIOLD RIVER CROSSING
CARMACKS, YUKON

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- Location Of Study Area
- Site Sketch
- Photo Sheet

APPENDIX "B"
- Test Hole Logs With Laboratory Results

1.0 INTRODUCTION

As part of the possible Freegold Road Route, J.R. Paine & Associates Ltd. was retained to assess the feasibility of upgrading the existing bridge crossing at the Nordenskiold River. The location of the study area within the Village of Carmacks is shown in Appendix "A".

The objective of our study was to determine the existing subsurface soil profile in order to make recommendations for the development of a new bridge foundation system.

The study involved initiating a drilling program, performing laboratory analyses, and developing recommendations for design.

Authorization to proceed was received by Mr Bruce Fulcher. The field work was conducted on October 21, 1994 and October 22, 1994.

2.0 FIELD AND LABORATORY PROGRAM

The field program involved obtaining soils data from deep test holes both on the north and south side of the existing Nordenskiold Bridge. This was accomplished by utilizing a CME 75 truck mounted drill rig on contract with IBEX Contracting Ltd.. Both hollow stem and solid stem continuous flight augers were used in the drilling program.

The original intent was to employ the hollow stem augers in order to facilitate Standard Penetration Tests (SPT) at regular intervals. However, there occurred a dense cobble and boulder stratum on both sides of the bridge which could only be penetrated using the solid stem augers. Once through the boulder stratum, the hollow stem augers were used for the remainder of the hole depth.

In total, seven test holes were drilled in the vicinity of Nordenskiold River and the locations are provided on the site sketch attached in Appendix "A" or on the individual test hole log found in Appendix "B". TH #2-94 and TH #3-94 were drilled October 18, 1994 as part of the "Freegold Road Access Routes" drilling program performed by our firm. TH #35-94 to TH #39-94 were drilled October 21, 1994 and October 22, 1994 in order to further define the soil properties in the vicinity of the

J. R. Paine & Associates Ltd.
CONSULTING AND TESTING ENGINEERS
EDMONTON — GRANDE PRAIRIE — WHITEHORSE — PEACE RIVER

ADDRESS ALL CORRESPONDENCE TO:
14 Burns Road
Whitehorse, Yukon
Y1A 4Y9

File No: 8002-232

March 21, 1995

GOVERNMENT OF YUKON
Community and Transportation Services
Transportation Engineering Branch **S-3**
Box 2703
Whitehorse, Yukon
Y1A 2C6

Attention: Mr. Bruce Fulcher, Manager, Geotechnical Services

Dear Sir:

Re: Geotechnical Investigation
Nordenskiold River Crossing
Carmacks, Yukon

This letter is further to a geotechnical report, Report #8002-232, submitted by Hoggan Engineering & Testing (1980) Ltd. in December, 1994.

The objective of this letter is to address the potential for deep foundation for the proposed bridge over the Nordenskiold River, Carmacks, Yukon.

Within the original report a deep foundation was not discussed in detail due to the difficulty which may be encountered in penetrating the dense boulder stratum and the variable nature of the soil stratigraphy.

Following further discussionS with Mr. Bruce Fulcher and Mr. Clarence Jack of Government of Yukon, Transportation Engineering Branch, the option of a deep foundation consisting of driven pipe piles was to be considered based on the assumption that penetration of the noted cobble/boulder layer can be achieved.

Pile Axial Capacity

Utilizing two methods, firstly, the single pile-static analysis (CFEM, 3rd Edition, 1992), and secondly, single pile-standard penetration test analysis (Meyerhof, 1976), the axial capacity of a pile foundation given varying depths of pile penetration and pile diameters were determined.

The results of the two analyses have been presented in graphical and tabular form in the Appendix of this letter.

The major assumptions that were made in undertaking the analysis were as follows.

1) The analysis were based on a soil stratigraphy consisting of loose to medium dense sand with an average Standard Penetration Test (SPT) N value of 21 and a toe N value of 12. This stratigraphy would be consistent with the soils encountered at Test Holes #36-94 and #39-94.
2) Static groundwater table at 4.0 metres below the ground surface.
3) Linear increase in vertical effective stress with depth below the ground surface. For the static analysis this assumption may lead to an over estimate of axial capacity with pile lengths greater than 20 pile diameters.
4) No reduction (or increase) in shaft resistance will occur as a result of penetration of the pile through the upper cobble and boulder layer (relative to the underlying sand stratums).
5) A factor of safety of 4 would be suitable for both analyses.
6) Sand stratum exists to 20 metres below the existing ground surface.

The calculated axial capacities for the two methodologies give varying results. Below 10 metres in depth the static analysis gives the lower axial capacity while above 10 metres the SPT analysis gives the lower capacity.

For the purposes of this project, it is recommended that the values obtained in the SPT analysis be utilized for design purposes and that a minimum pile length of 10 metres be driven. The minimum length of pile of 10 metres will assure that a suitable depth of pile to compensate for disturbance of the surface soil stratigraphy. In using the axial capacities obtained by the SPT analysis the design would be based on the conservative values.

Should bearing capacities greater than those outlined in the SPT analysis be required it may be prudent to undertake a in situ pile load test.

The pile group capacity for driven piles in cohesionless soils may be considered to be equal to the sum of the individual pile capacities.

Pile Settlements

For load levels given in the SPT analysis the settlement of pile can be calculated using an imperial formula (Vesic, 1970,1977). The settlement estimate would be estimated up to 15 millimetres including pile settlement and elastic deformation of pile shaft. This settlement assumes the following.

-Pile diameter (nominal), 0.9 metres

-Pile wall thickness, 12.5 millimetre

-Pile length, 20 metres

-Applied load, 1000 kN

-Elastic modulus or pile, 200,000 MPa

Installation

Due to the likelihood of difficult driving conditions the use of a specially designed pile shoe and pile driving cap is recommended to protect the pile toe and head during installation.

In addition to utilizing the pile shoe to protect from pile damage the open pile will also allow for inspection of pile integrity and the straightness.

CONCLUSIONS

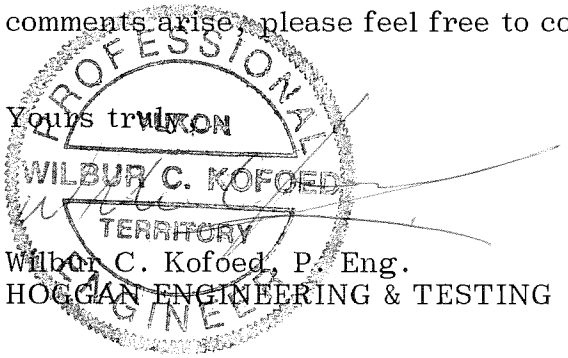
A range of pile axial capacities have been given which vary due to pile length and pile diameter.

For the purposes of this analysis a range of diameters and lengths have been chosen. Should the actual chosen pile size or depth not conform to the table of values given, the undersigned may be contacted for reevaluation of the chosen pile.

Given the variable nature of the soils encountered on this site, it may be prudent to closely monitor all pile installations to ensure suitable driving resistance are attained. Evaluating driving resistance may encompass utilizing pile driving formulae such as the Hiley or Engineering News or Modified Engineering News.

We trust the above is satisfactory for your purposes. Should any questions or comments arise, please feel free to contact the undersigned.

Yours truly,



Wilbur C. Kofoed, P. Eng.
HOGGAN ENGINEERING & TESTING (1980) LTD.

Attached:
APPENDIX I
- **Axial Capacity - Standard Penetration Test Analysis**

APPENDIX II
- **Axial Capacity - Static Analysis**

WCK/mf

APPENDIX I
- Axial Capacity -
Standard Penetration Test Analysis

AXIAL CAPACITY - SPT ANALYSIS

Basic Formula

$R = mN A_t + m \bar{N} D A_s$ = Pile Capacity

Where

m = Empirical Coefficient

N = SPT Index At Pile Toe

A_t = Pile Toe Area

m = Empirical Coefficient

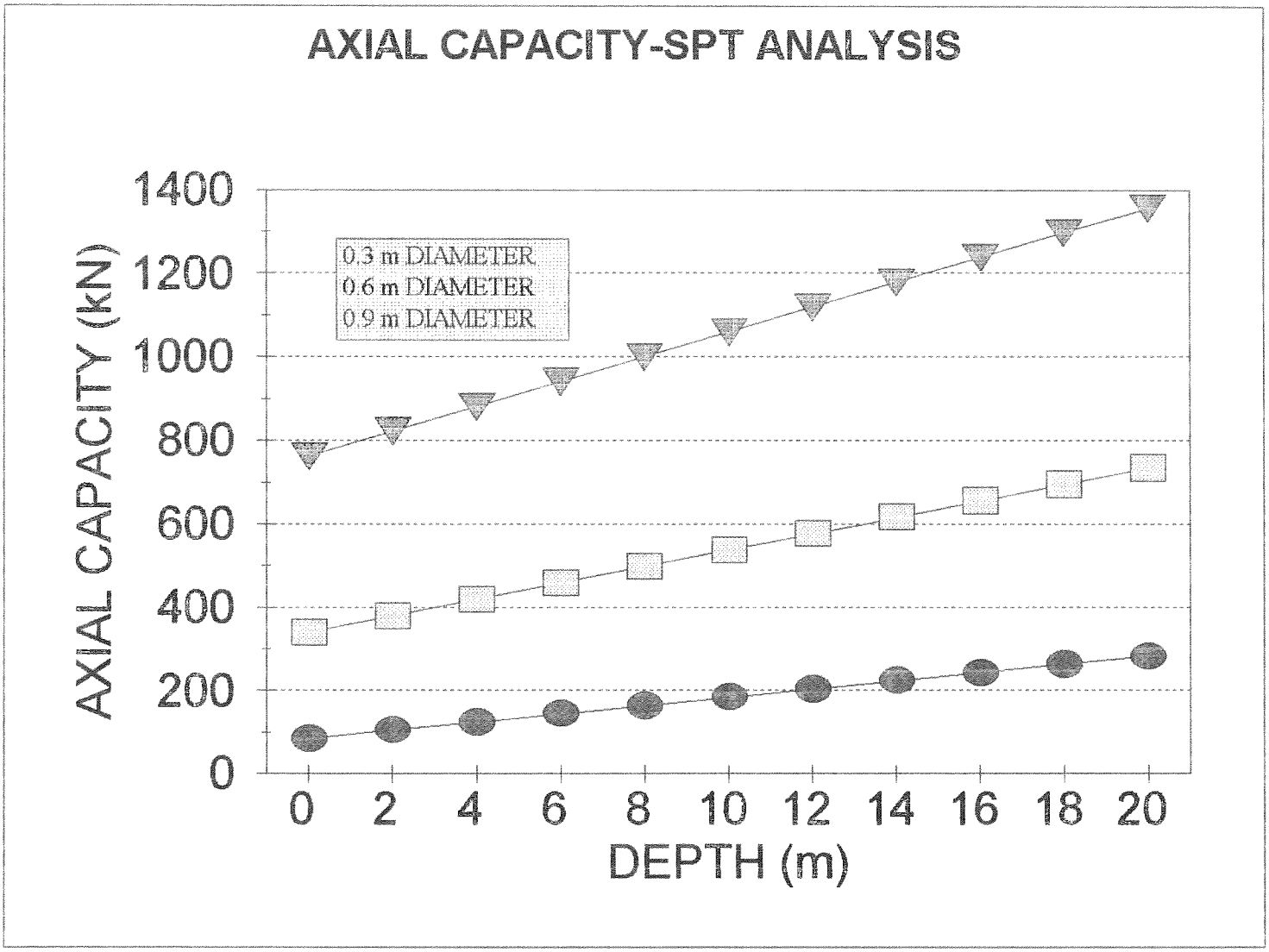
$\bar{N}$ = Average SPT Index Along The Pile

D = Pile Embedment Length

A_s = Pile Unit Shaft Area

AXIAL CAPACITY-STANDARD PENETRATION TEST ANALYSIS
-cohesionless soil

depth (m)	axial capacity for given diameter (kN) 0.3 (m)	0.6 (m)	0.9 (m)
0	84.8	339.1	763.0
2	104.6	378.7	822.4
4	124.3	418.2	881.7
6	144.1	457.8	941.1
8	163.9	497.4	1000.4
10	183.7	536.9	1059.8
12	203.5	576.5	1119.1
14	223.3	616.1	1178.4
16	243.0	655.6	1237.8
18	262.8	695.2	1297.1
20	282.6	734.8	1356.5


AXIAL CAPACITY-SPT ANALYSIS
AXIAL CAPACITY (kN)
1400
1200
1000
800
600
400
200
0
0.3 m DIAMETER
0.6 m DIAMETER
0.9 m DIAMETER
0
2
4
6
8
10
12
14
16
18
20
DEPTH (m)

APPENDIX II
•Axial Capacity - Static Analysis

AXIAL CAPACITY - STATIC ANALYSIS

Basic Formula

$R = \text{Summation } Cq_s \Delta z + A_t\, q_b = \text{Pile Capacity}$

$q_s = S_v' k_s M \text{ Tan } (PHI') = BS_v'$

$q_b = N_t S_b'$

Where

C = Pile Circumference

L = Embedded Length

Δz= Segments of L

A_t= Pile Base Area

B = Combined Shaft Resistance Factor

k_s= Coefficient of Lateral Earth Pressure

S_v'= Vertical Effective Stress Adjacent To Pile

M = Pile - Soil Interface Friction Factor

N_t= Bearing Capacity Factor

S_b'= Vertical Effective Stress At Pile Base

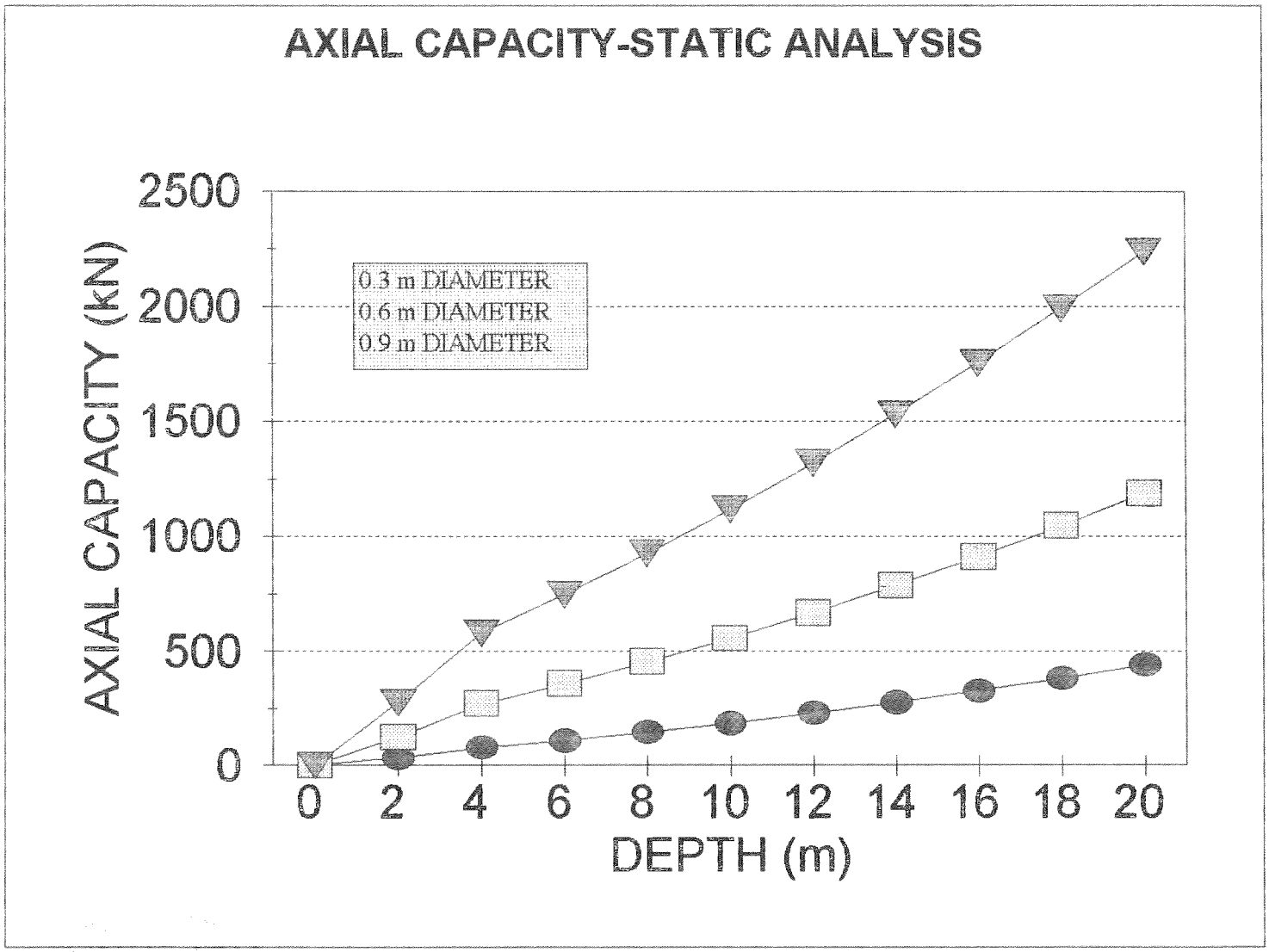
AXIAL CAPACITY---STATIC ANALYSIS
- cohesionless soil

depth (m)	vertical stress (kPa)	vertical effective stress (kPa)	shaft factor	shear stress (shaft) (kPa)
0 to 2	16.5	16.5	0.6	9.9
2 to 4	49.4	49.4	0.6	29.7
4 to 6	82.4	72.6	0.6	43.5
6 to 8	115.3	85.9	0.6	51.5
8 to 10	148.3	99.2	0.6	59.5
10 to 12	181.2	112.6	0.6	67.5
12 to 14	214.2	125.9	0.6	75.5
14 to 16	247.1	139.2	0.6	83.5
16 to 18	280.1	152.6	0.6	91.5
18 to 20	313.0	165.9	0.6	99.6

depth (m)	vertical stress (kPa)	vertical effective stress (kPa)	bearing factor	bearing capacity (tip) (kPa)
0	0	0	50	0
2	32.9	32.9	50	1647.4
4	65.9	65.9	50	3294.8
6	98.8	79.2	50	3961.6
8	131.8	92.6	50	4628.4
10	164.7	105.9	50	5295.2
12	197.7	119.2	50	5962.0
14	230.6	132.6	50	6628.9
16	263.6	145.9	50	7295.7
18	296.5	159.2	50	7962.5
20	329.5	172.6	50	8629.3

axial capacity for given diameter (kN)

depth (m)	0.3 (m)	0.6 (m)	0.9 (m)
0	0	0	0
2	33.8	125.9	275.9
4	76.9	270.4	579.7
6	109.2	358.5	747.3
8	145.2	454.3	926.1
10	185.0	557.5	1116.3
12	228.6	668.3	1317.8
14	276.0	786.7	1530.5
16	327.1	912.6	1754.6
18	382.1	1046.0	1990.0
20	440.7	1186.9	2236.7


AXIAL CAPACITY-STATIC ANALYSIS
AXIAL CAPACITY (kN)
2500
2000
1500
1000
500
0
0.3 m DIAMETER
0.6 m DIAMETER
0.9 m DIAMETER
0
2
4
6
8
10
12
14
16
18
20
DEPTH (m)

Nordenskiold River. The locations of TH #2-94 and TH #3-94 were determined according to the method described in our October 28, 1994 report. The locations of TH #35-94 to TH #39-94 are given relative to existing power poles as shown on the attached site sketch. This was performed utilizing a hip chain and hand held compass.

While drilling, continuous visual descriptions were noted and are provided on the individual test hole logs. Soil samples were retained at regular intervals for the purpose of laboratory analyses. Auger cuttings were retrieved from the solid stem augers while split spoon samples were taken from the SPT sampler when the hollow stem augers were utilized.

The Standard Penetration Test (SPT) was conducted in those test holes where hollow stem augers were employed. This is a dynamic testing and sampling method which involves driving a split barrel sampler in the soil with a 63.5 kilogram weight having a free fall of 760 millimetres. The blows required to drive the sampler 300 millimetres, after an initial penetration of 150 millimetres, is referred to as the SPT "N" value. The Standard Penetration Test is useful in providing a guide to the in-situ engineering properties and in providing a sample of the soil for classification purposes. The SPT is best suited for sands for the ability to obtain reliable samples and to apply the "N" value to allowable bearing capacity determination.

Physical laboratory tests included moisture content determination and grain size analysis on all samples retained. All laboratory results are provided in Appendix "B".

3.0 SITE CONDITIONS

Refer to the site sketches and photo sheets provided in Appendix "A" for an appreciation of the site conditions at the time of our investigation.

The immediate study area was typical of a floodplain controlled topography as part of the Nordenskiold and Yukon River systems. However, there was a marked increase in elevation noted approximately 60 to 80 meters north of the river.

Vegetation included willow bushes immediately adjacent to the river with semi-mature

white spruce along the higher elevations. Existing structures included two houses, a barn, and three abandoned historical buildings.

4.0 SUBSURFACE SOIL CONDITIONS

The subsurface soil profile encountered in each test hole is shown on the individual test hole log provided in Appendix "B". However, the following trends in soil stratigraphy are described below.

The most notable feature encountered was a dense cobble and boulder stratum of approximately 1.3 meters in thickness. This occurred both on the north and south sides of the river at depths of 3.3 meters and 1.5 meters, respectively. Given that the top of TH #38-94 (north side) was approximately 1 metre lower in elevation than TH #39-94 (south side),it appears that the boulder stratum dips to the north.

Above the boulder stratum, there occurred a well graded, medium dense gravel material at the north side of the river (represented as TH #38-94). Below the boulder stratum in the same test hole location, there occurred varying sandy gravel and gravelly sand stratums of approximately 1 meter thickness. Auger action indicated possible cobble presence in the gravel stratums.

The surficial soils on the south side of the river (represented as TH #39-94) were composed of silty sand to 0.7 meters followed by gravelly sand, trace of silt to the boulder stratum at 1.5 meters. Below the boulder stratum, the soil consisted of a poorly graded coarse grained sand. This material varied little in its composition from its initial occurrence at 2.7 meters to the end of the test hole at 16.8 meters.

Free water occurred at and below the boulder stratum in all test holes that progressed to this depth. Given that TH #38-94 was drilled directly adjacent to the Nordenskiold River (refer to Site Sketch and Photo Sheet in Appendix "A"), it was unusual to encounter free water at a depth of 4.3 meters. Further, the sand stratums underlying the boulder layer at both deep test holes (TH #38-94 and TH #39-94, respectively) appeared to be under a pore water pressure in excess of hydrostatic conditions. This was noted as the sand rose inside the hollow stem casing during the preparation of the SPT sampler. In order to perform the SPT test, the water level in the test hole was maintained above the piezometric level in the sand by

introducing a constant "Slug" in the test hole. By injecting water into the test hole in this fashion, the static groundwater level may not be higher than that observed in the test hole locations at the time of the investigation.

The Standard Penetration Tests (SPT) were performed in TH #35-94, TH #36-94, and TH #38-94. The surficial sandy gravel and gravelly sand occurring above the boulder stratum appeared to have high resistance to SPT sampler penetration with "N" values in excess of 100 blows per 300 millimetres. The poorly graded sand material below the boulder layer had SPT "N" values in the range of 12 to 33 blows per 300 millimetres advance. These results are variable and not deemed sufficient for pile shaft resistance development.

5.0 INTERPRETATION OF DATA

In order to offer recommendations for various bridge foundation options, interpretations of the geotechnical conditions are required. Those foundation options which we have identified are:

A) Spread Footing/Shallow Raft Foundation
B) End Bearing Pier Foundation
C) Deep Pile Foundation

The deep pile foundation would involve supporting the bridge with driven piles which extend into the underlying sand and sandy gravel stratums. It is not believed that this would be possible due to the likely obstruction of the dense boulder stratum. Further, the poorly graded sand material on the south side of the river appeared to have variable resistance to SPT penetration. With no deep end bearing stratum within 16.8 metres, it appears that deep piles are not suited for the soil conditions of this study area.

It may be possible to found the bridge on a shallow pier system which would be end bearing on the dense boulder stratum. This stratum is dipping to the north with the maximum depth at approximately 4.2 metres below the existing road level (note that the top of TH #38-94 was approximately 1.0 metre below the road elevation at the north side of the bridge). However, given that such stratums may be discontinuous both in composition and in thickness, the allowable load for the piers would be limited.

The spread footing or shallow raft foundation could be integrated into the existing sandy gravel and gravelly sand surficial soil stratums occurring at the north and south sides, respectively. The surficial soil was well graded, medium dense, and well suited for a footing foundation system.

6.0 RECOMMENDATIONS

Following the above analyses, it appears that the footing foundation system is the most appropriate option for bridge foundation design. The following recommendations are base on this system.

1. The proposed bridge may be founded on a spread footing or "raft" system placed at a depth of at least 2.0 metres. This depth is measured from the contact surface of the footing to the final ground elevation and is purposed to provide frost protection for the isolated exterior footing.
2. Allowable soil bearing values should not exceed 250 kilopascals for the footing placed within the underlying sandy gravel or gravelly sand stratums. This figure includes the total of all live and dead loads. Again, this value is given assuming the above quoted 2.0 metre depth of backfill.
3. The surficial silty sand or sandy silt material above the gravelly sand on the south side of the bridge must be removed prior to footing placement. The footing excavation should be inspected by J.R. Paine & Associates Ltd. personnel to ensure that the footing system is founded on the appropriate soil stratum as consistent with our geotechnical investigation.
4. The footings must be placed on undisturbed native material only. No loose, disturbed, remoulded or slough material should be allowed to remain in the open footing excavations. Hand cleaning is advised if an acceptable surface cannot be prepared by mechanical equipment.
5. The head slope must not exceed a 2:1 (horizontal : vertical) grade, with the recommended 2 metre cover (both lateral and vertical) maintained. If this is not possible, a restraining structure such as a cantilever or counterfort must be integrated into the footing system.
6. The slope adjacent to the river should be safeguarded from erosion by placing rip-rap or taking similar protective measures.
7. It is believed that consolidation settlement will not occur due to the absence of fine grained soils. However, immediate settlement in the order of 20

millimetres may occur under the loading conditions described above.

8. Although free water occurred at depths of 3 to 4 metres below the existing ground surface, water migration may occur to the river elevation. As such, dewatering may be necessary in footing excavations during construction.

7.0 CONCLUSIONS

It appears that the study area is characteristic of an alluvial valley bottom deposit. The variable sand, gravel, and boulder deposits indicate an active environment of deposition possibly of glacial origin.

The existence of the dense boulder stratum precludes the use of a deep pile system. This boulder layer may be utilized for an end bearing pier system, however, allowable loads may be limited due to probable inconsistencies of the stratum.

This site appears to be best suited for a spread footing/raft foundation system as outlined in our "6.0 Recommendations" chapter. The footing system must be founded within the existing well graded gravel or sand stratums.

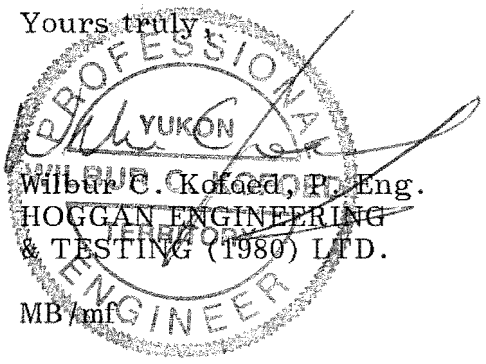
CLOSURE

This report has been prepared for the exclusive and confidential use of the Government of Yukon and applies only to the geotechnical investigation described above. The recommendations given are based on the subsurface soil conditions encountered during test excavations, current construction techniques and generally accepted engineering practices. No other warrantee, expressed or implied, is used. Due to geological randomness of many soil formations, no interpolations of soil conditions between test holes have been made or implied. Soil conditions are known only at the test hole locations. Should other soils be encountered during construction or other information pertinent to the foundation become available, the recommendation may be altered or modified in writing by the undersigned.

HOGGAN ENGINEERING & TESTING (1980) LTD.

We trust the above is satisfactory for your purpose. However, should any questions or comments arise, please feel free to contact the undersigned.

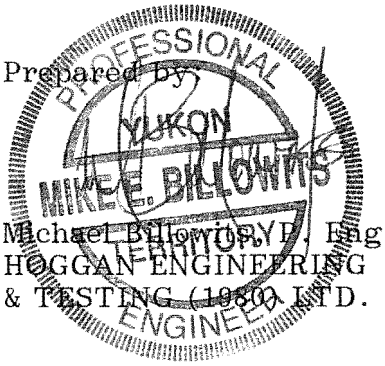
Yours truly,



Wilbur C. Kofoed, P. Eng.
HOGGAN ENGINEERING
& TESTING (1980) LTD.

MB/mf

Prepared by

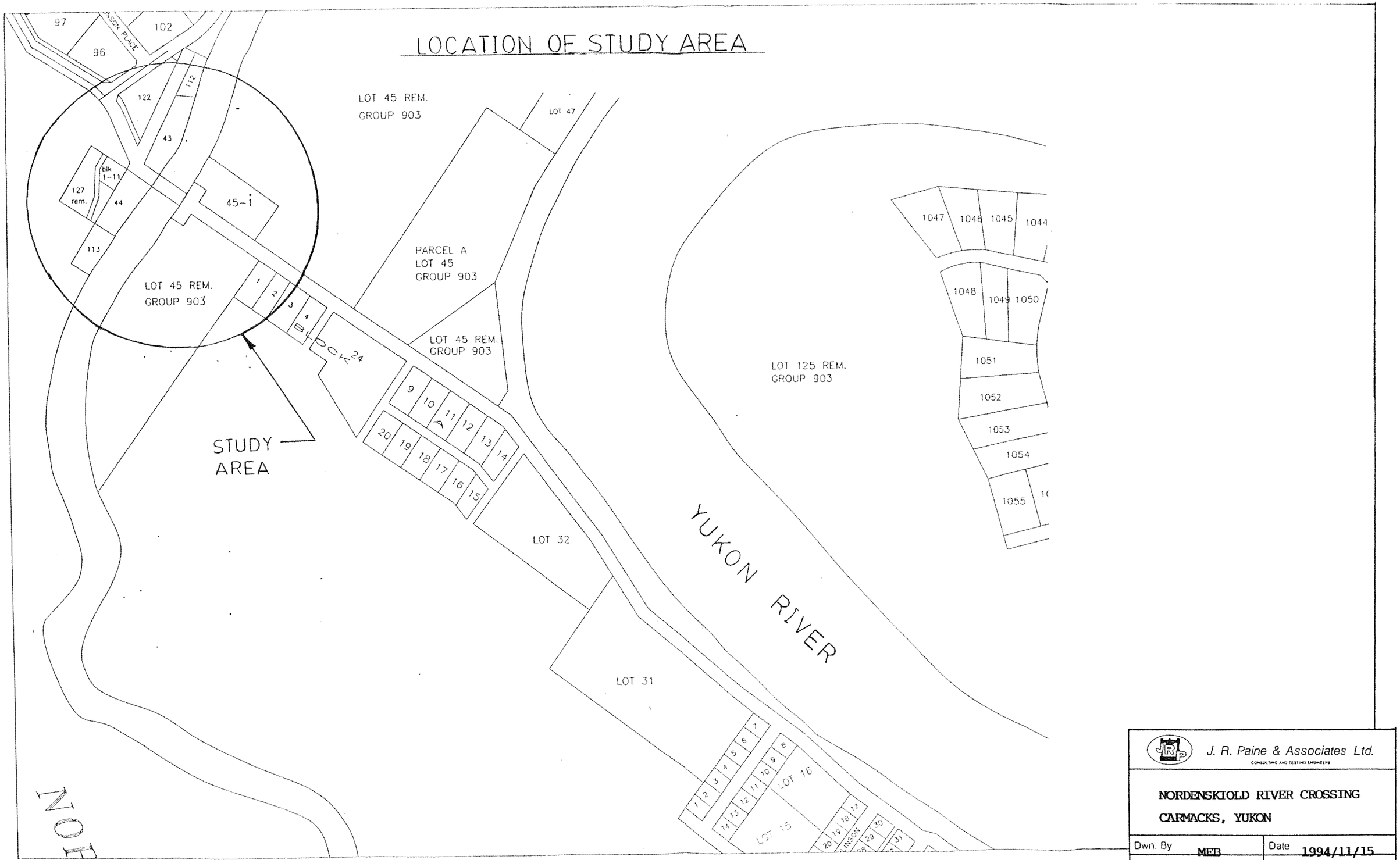


Michael Billowits, P. Eng.
HOGGAN ENGINEERING
& TESTING (1980) LTD.

APPENDIX "A"

- Location Of Study Area
- Site Sketch
- Photo Sheet

LOCATION OF STUDY AREA

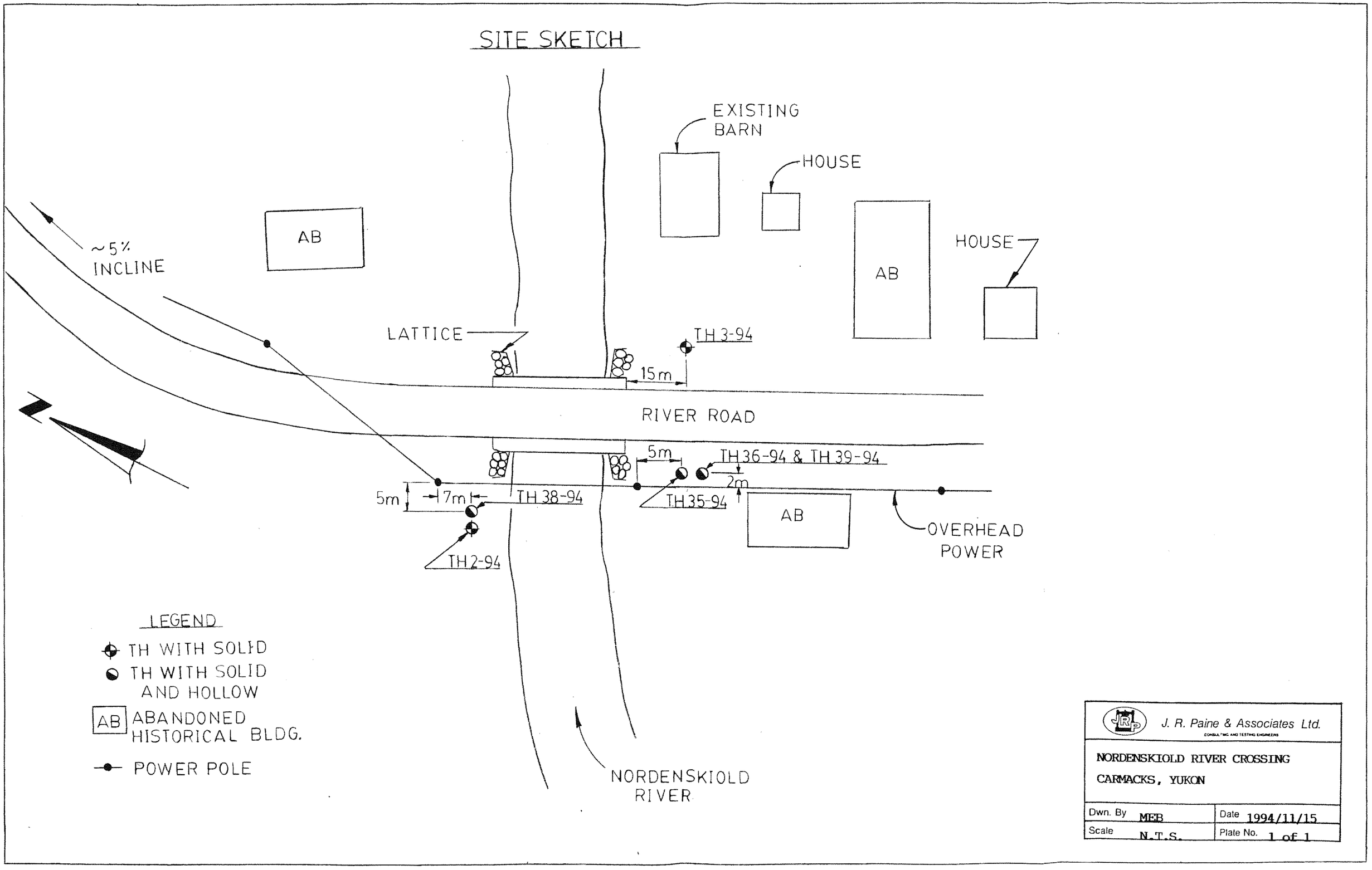


J. R. Paine & Associates Ltd.
CONSULTING AND TESTING ENGINEERS

NORDENSKIOLD RIVER CROSSING
CARMACKS, YUKON

Dwn. By	MEB	Date	1994/11/15
Scale	N.T.S.	Plate No.	1 of 1

SITE SKETCH



LEGEND

- TH WITH SOLID
- TH WITH SOLID AND HOLLOW
- AB ABANDONED HISTORICAL BLDG.
- POWER POLE

J. R. Paine & Associates Ltd.
CONSULTING AND TESTING ENGINEERS

NORDENSKIOLD RIVER CROSSING
CARMACKS, YUKON

Dwn. By MEB	Date 1994/11/15
Scale N.T.S.	Plate No. 1 of 1

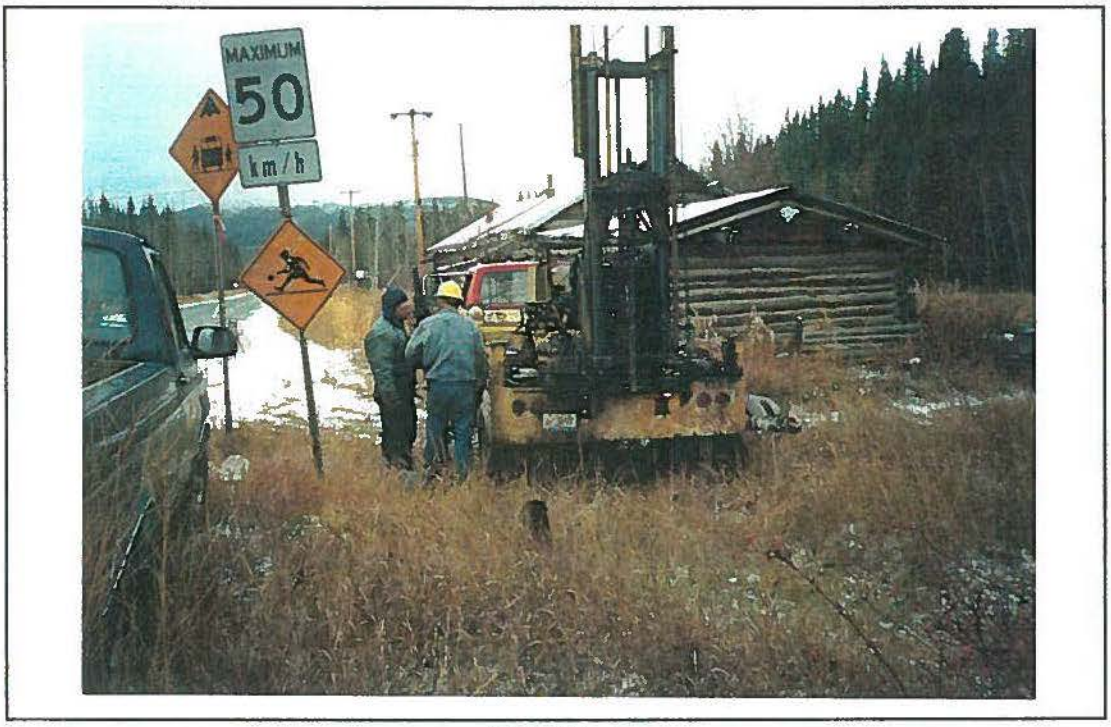


Photo 1
- looking north from bridge at TH#36-94
- note abandoned bldg in background

Photo 2
- looking southeast at TH#38-94
- note river, power pole

APPENDIX "B"

- Test Hole Logs With Laboratory Results

Table 1.1 Unified Soil Classification System (adapted from U.S. Army Corps of Engineers, 1953)

Major division			Group symbol	Typical name	Field identification procedure	Laboratory classification procedure (see Fig. 1.13)		
Coarse-grained soils, more than half of material larger than no. 200 sieve size	Gravels, more than half of coarse fraction larger than no. 4 sieve size	Clean gravels (little or no fines)	GW	Well-graded, gravel-sand mixtures, little or no fines	Wide range in grain sizes and substantial amounts of intermediate particle sizes	Determine percentages of gravel and sand from grain-size curve; depending on percentage of fines (fraction smaller than no. 200 sieve size) coarse-grained soils are classified as follows: Less than 5% = GW, GP, SW, SP More than 12% = GM, GC, SM, SC 5–12% = borderline cases requiring use of dual symbols	$C_u = D_{60}/D_{10} > 4$ $C_c = 1 < D_{30}^2/D_{10}\,D_{60} < 3$	
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines	Predominantly one size or a range of sizes with some intermediate sizes missing		Not meeting all gradation requirements for GW	
		Gravels with fines (appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures	Nonplastic fines or fines with low plasticity (for identification procedures see ML)		Atterberg limits below A line or PI < 4	Above A line with 4 < PI < 7 are borderline cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures	Plastic fines (for identification procedures see CL)		Atterberg limits above A line with PI > 7	
	Sands, more than half of coarse fraction smaller than no. 4 sieve size	Clean sands (little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	Wide range in grain size and substantial amounts of all intermediate particle sizes		$C_u = D_{60}/D_{10} > 6$ $C_c = 1 < D_{30}^2/D_{10}\,D_{60} < 3$	
			SP	Poorly-graded sands or gravelly sands, little or no fines	Predominantly one size or a range of sizes with some intermediate sizes missing		Not meeting all gradation requirements for SW	
		Sands with fines (appreciable amount of fines)	SM	Silty sands, sand-silt mixtures	Nonplastic fines or fines with low plasticity (for indentification procedures see ML)		Atterberg limits below A line or PI < 4	Above A line with 4 < PI < 7 are borderline cases requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures	Plastic fines (for indentification procedures see CL)		Atterberg limits above A line with PI > 7	

			Identification procedures on fraction smaller than no. 40 sieve size		
			Dry strength (crushing characteristics)	Dilatancy (reaction to shaking)	Toughness (consistency near PL)
Fine-grained soils, more than half of material smaller than no. 200 sieve size	Silts and clays, liquid limit < 50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	None to slight	Quick to slow	None
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	Medium to high	None to very slow	Medium
		OL	Organic silts and organic silty clays of low plasticity	Slight to medium	Slow	Slight
	Silts and clays, liquid limit > 50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	Slight to medium	Slow to none	Slight to medium
		CH	Inorganic clays of high plasticity, fat clays	High to very high	None	None
		OH	Organic clays of medium to high plasticity, organic silts	Medium to high	None to very slow	Slight to medium
Highly organic soils		Pt	Peat and other highly organic soils	Readily identified by color, odor, spongy feel, and frequently by fibrous texture		

(see notes on p. 28)

YTG, Transportation Engineering Branch	Freegold Road Access Routes	BOREHOLE No: TH#2-94
Ibex Contracting Ltd.	Sta 2+110 Left (approximate)	Project No: 8002-232
C.M.E. Truck Mounted Drill	13m Offset Left of C.L /Adjacent River	ELEVATION: 0.000 (m)

SAMPLE TYPE: TUBE | LOST | AUGER | BULK | SPT | CORE

SOILS DESCRIPTION

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	SPT(N)	SOILS DESCRIPTION	USC	SOIL SYMBOL	DEPTH (m)
0.0				-sand, fine grained, trace of silt, damp, loose, light-brown	SP-SM		0.0
				0.15M			
					GW-GM		
1.0	⊠	5		-sandy gravel, some silt, fine to medium grained sand sizes, medium dense, damp, light-brown			1.0
				1.20M			
	⊠	6		-silty gravelly sand, fine to medium grained sand sizes, clean coarser grained sand lenses @ 1.85m to 75mm in thickness, medium dense, damp, brown			
2.0					SW-SM		2.0
				2.75M			
3.0	⊠	7		*note:(cobble and boulder layer to 1.50m in depth) -sandy gravel, trace of silt, medium to coarse grained sand sizes, clean coarse grained sand lenses to 15mm throughout, dense, damp, grey-brown			3.0
4.0				4.10M			4.0
	⊠	8		*note:(easier drilling possibly due to water migration) -sandy gravel, trace of silt, fine to medium grained sand sizes, medium dense, moist, brown			
5.0					GW-GM		5.0
6.0	⊠	9		-sandy gravel, trace of silt, fine to medium grained sand sizes, medium dense, moist, brown			6.0
7.0							7.0
	⊠	10		-sandy gravel, fine to medium grained sand sizes, medium dense, moist, brown			
8.0							8.0

LIQUID: 10 20 30 40 | PLASTIC: 10 20 30 40 | PLASTIC M.C. LIQUID: 10 20 30 40

CLAY: 20 40 60 80 | SILT: 20 40 60 80 | SAND: 20 40 60 80 | GRAVEL: 20 40 60 80

J. R. PAINE & ASSOCIATES
Edmonton, Alberta

LOGGED BY: MJK	COMPLETION DEPTH: 10.9 m
REVIEWED BY: WCK/MJK	COMPLETE: 94/10/18
Fig. No: 1	Page 1 of 2

YTG, Transportation Engineering Branch	Freegold Road Access Routes	BOREHOLE No: TH#2-94
Ibex Contracting Ltd.	Sta 2+110 Left (approximate)	Project No: 8002-232
C.M.E. Truck Mounted Drill	13m Offset Left of C.L /Adjacent River	ELEVATION: 0.000 (m)

SAMPLE TYPE: TUBE | LOST | AUGER | BULK | SPT | CORE

SOILS DESCRIPTION

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	SPT(N)	SOILS DESCRIPTION	USC	SOIL SYMBOL	DEPTH (m)
8.0							8.0
9.0	AUGER	11		-gravelly sand to sandy gravel, fine to medium grained sand sizes, medium dense, moist, brown (possible bad sample due to auger action)	GW-GM		9.0
10.0							10.0
11.0	AUGER	12		-sandy gravel, trace of silt, fine to medium grained sand sizes, medium dense, moist, brown			11.0
				End of hole @ 10.85M			
12.0				Notes: 1st Refusal @ 2.75m, moved ahead 1 metre. 2nd Refusal @ 2.90m, moved ahead 1 metre. The auger action changed around 4 metres, possibly due water ingression.			12.0
13.0							13.0
14.0							14.0
15.0							15.0
16.0							16.0

LIQUID ■ 10 20 30 40 | PLASTIC ▲ 10 20 30 40 | PLASTIC M.C. LIQUID 10 20 30 40

CLAY ● 20 40 60 80 | SILT ▲ 20 40 60 80 | SAND ■ 20 40 60 80 | GRAVEL ◆ 20 40 60 80

J. R. PAINE & ASSOCIATES Edmonton, Alberta	LOGGED BY: MJK	COMPLETION DEPTH: 10.9 m
	REVIEWED BY: WCK/MJK	COMPLETE: 94/10/18
	Fig. No: 1	Page 2 of 2

HOGGAN ENGINEERING & TESTING (1980) LTD.

An Affiliate of J. R. Paine & Associates Ltd.

3051 Parsons Road, Edmonton, Alberta T6N 1C8

SCREEN ANALYSIS

Sample: 5 Depth: 0.91 - 1.07m

Location: TH # 2-94

Client: YTG, Transportation Engineering

Project: Freegold Road Access Routes

Made by: MK&GV Job No.: 8002-232

Ck'd by: _____ Date: 1994/10/21 to 27

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					100.0
25,000	25.0					94.3
20,000	20.0					90.3
12,500	12.5					79.8
10,000	10.0					75.2
5,000	5.0					62.2
2500	2.5					53.2
1,250	1.25					45.9
800	0.800					40.2
630	0.630					36.3
315	0.315					29.5
250	0.250					26.2
160	0.160					18.6
80	0.080					12.2

Description of Sample: Sandy Gravel, some silt GW-GM

Method of Preparation: _____ Dry _____ Washed X

Remarks:

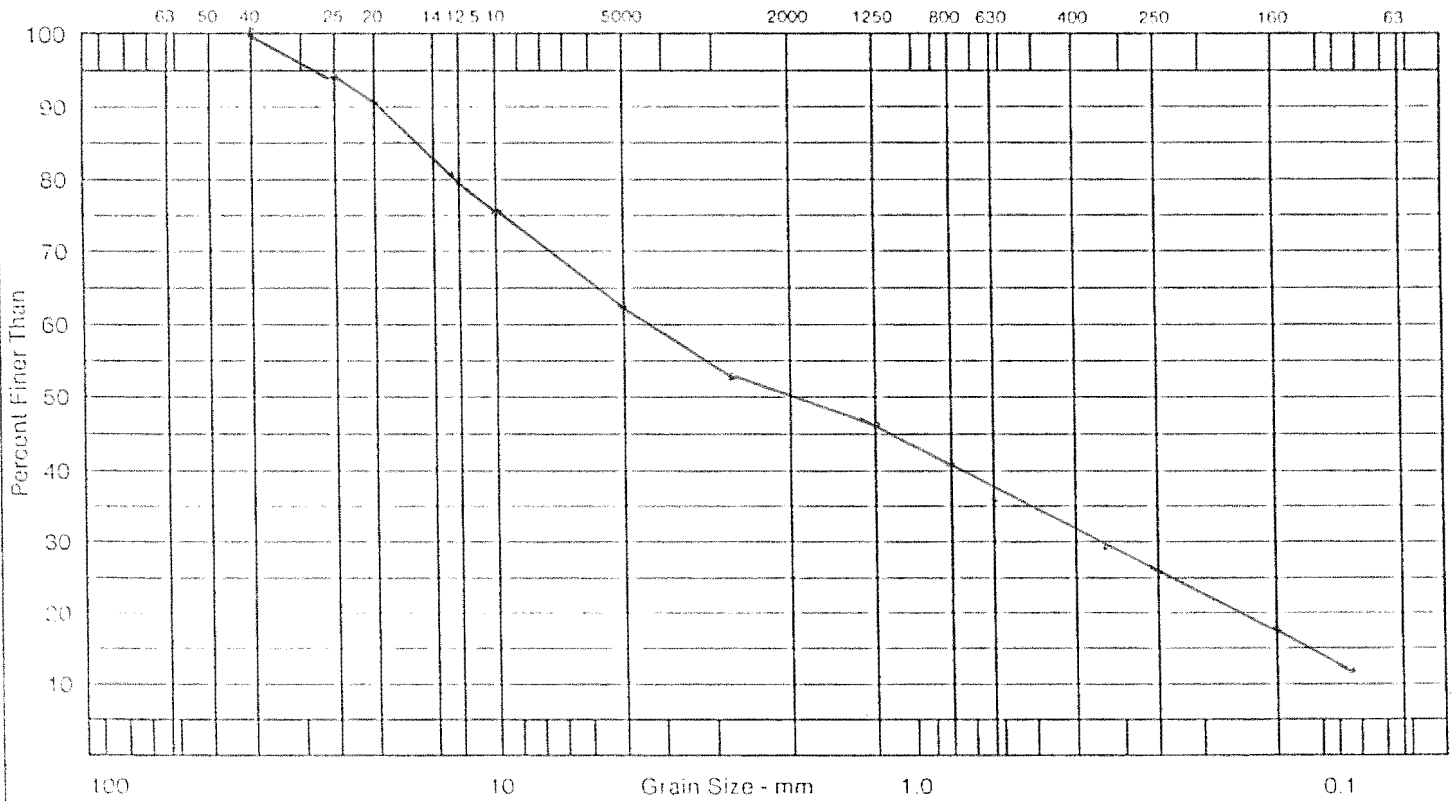
Moisture: 4.4 %

Gravel: 46.8 %

Sand: 41.0 %

Silt: 12.2 %

Time of Sieving: Min. 15



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SCREEN ANALYSIS

Sample: 6 Depth: 1.52 - 1.68m

Location: TH # 2-94

Client: YTG, Transportation Engineering

Project: Freegold Road Access Routes

Made by: MK&GV Job No.: 8002-232

Ck'd by: _____ Date: 1994/10/21 to 27

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					100.0
40,000	40.0					87.4
25,000	25.0					82.8
20,000	20.0					75.2
12,500	12.5					69.5
10,000	10.0					67.4
5,000	5.0					60.9
2500	2.5					55.8
1,250	1.25					50.2
800	0.800					45.4
630	0.630					42.2
315	0.315					35.8
250	0.250					32.3
160	0.160					23.4
80	0.080					15.2

Description of Sample: Silty Gravelly Sand SW-SM

Method of Preparation _____ Dry _____ Washed X

Remarks

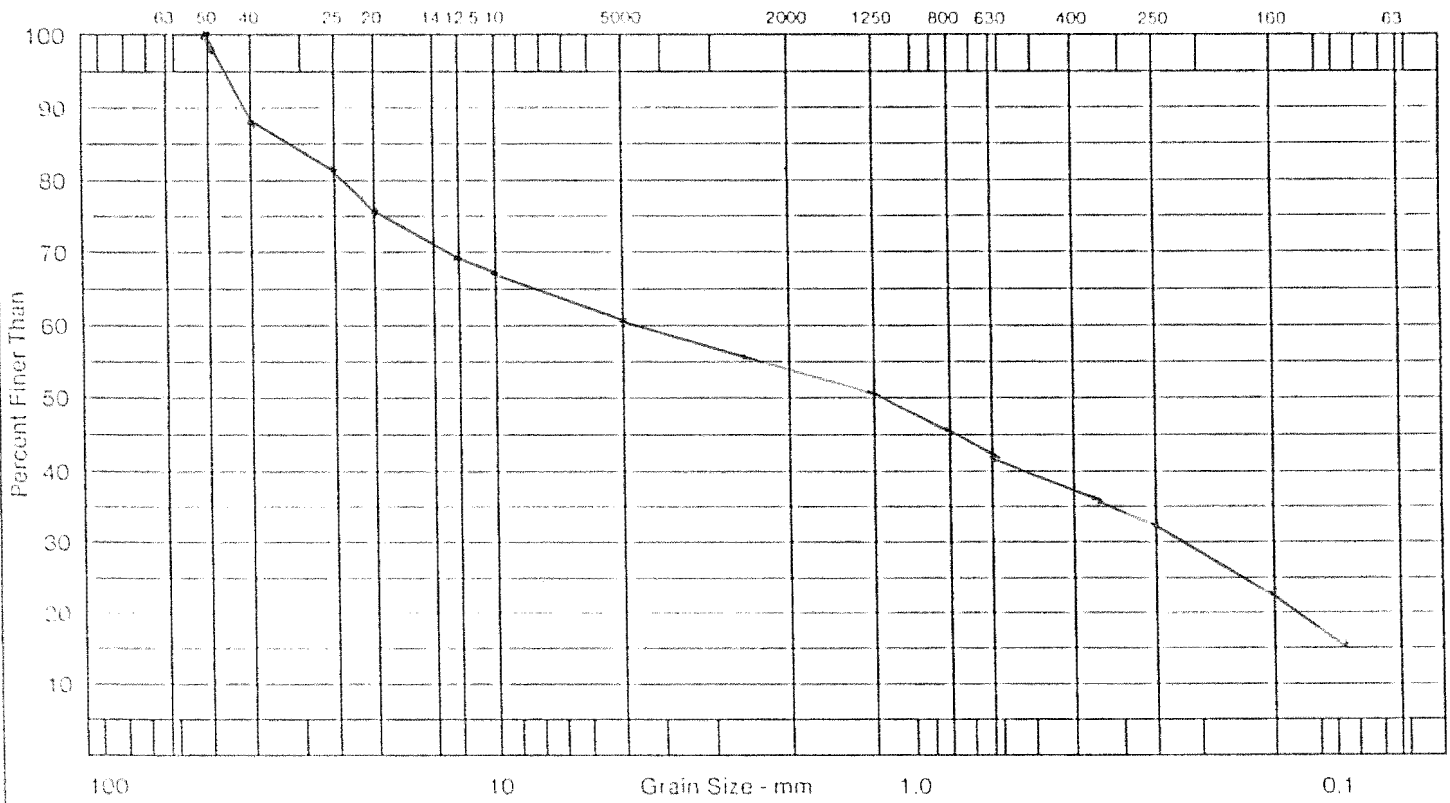
Moisture: 4.3 %

Gravel: 39.1 %

Sand: 45.7 %

Silt: 15.2 %

Time of Sieving _____ Min. 15



HOGGAN ENGINEERING & TESTING (1980) LTD.

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SCREEN ANALYSIS

Sample: 7 Depth: 3.05-3.20m
Location: TH # 2-94

Client: YTG, Transportation Engineering
Project: Freegold Road Access Routes
Made by: MK&GV Job No.: 8002-232
Ck'd by: _____ Date: 1994/10/21 to 27

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					100.0
40,000	40.0					85.3
25,000	25.0					74.2
20,000	20.0					68.0
12,500	12.5					50.7
10,000	10.0					44.8
5,000	5.0					34.0
2500	2.5					28.0
1,250	1.25					23.9
800	0.800					21.7
630	0.630					20.4
315	0.315					18.0
250	0.250					16.5
160	0.160					12.3
80	0.080					8.1

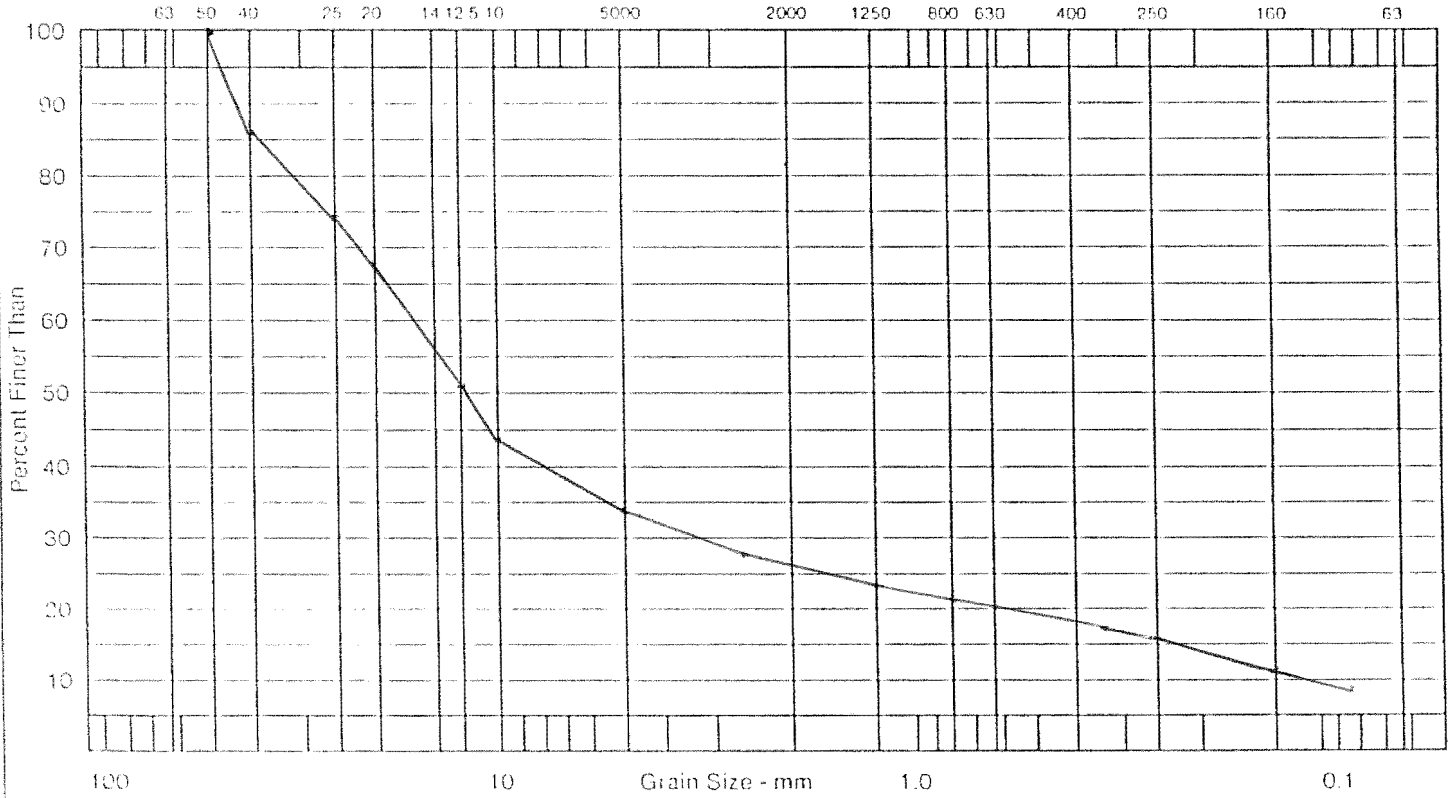
Description of Sample: Sandy Gravel, trace of silt GW

Method of Preparation _____ Dry _____ Washed X

Remarks

Moisture: 27 %
Gravel: 66.0 %
Sand: 25.9 %
Silt: 8.1 %

Time of Sieving _____ Min. 15



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SCREEN ANALYSIS

Sample: 8 Depth: 4.57 - 4.72m

Location: TH # 2-94

Client: YTG, Transportation Engineering

Project: Freegold Road Access Routes

Made by: MK&GV Job No.: 8002-232

Ck'd by: _____ Date: 1994/10/21 to 27

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					100.0
40,000	40.0					90.3
25,000	25.0					86.4
20,000	20.0					84.6
12,500	12.5					69.5
10,000	10.0					60.5
5,000	5.0					43.7
2500	2.5					34.1
1,250	1.25					26.6
800	0.800					22.6
630	0.630					20.3
315	0.315					16.8
250	0.250					15.2
160	0.160					12.0
80	0.080					9.0

Description of Sample: Sandy Gravel, trace of Silt GW-GM

Method of Preparation _____ Dry _____ Washed X

Remarks

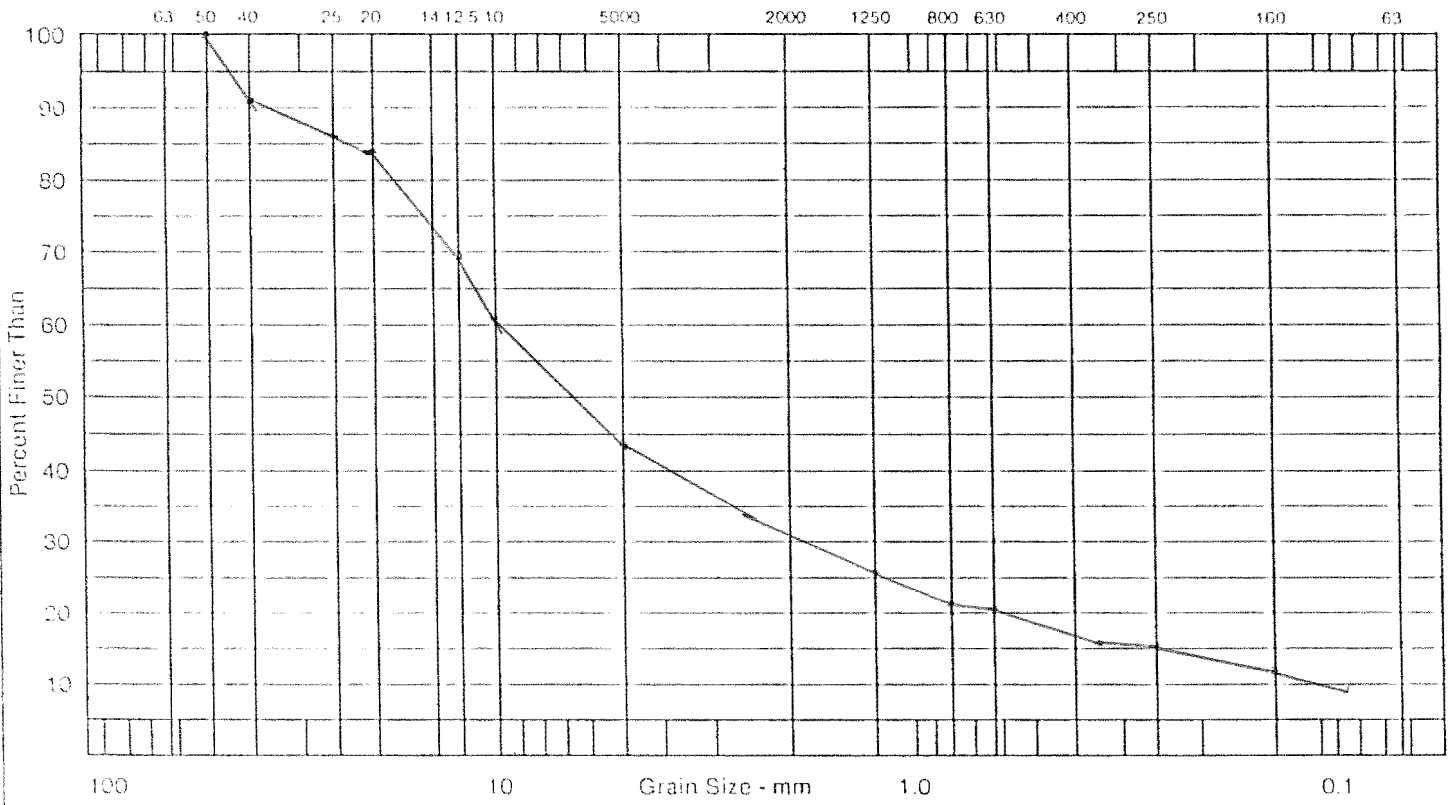
Moisture: 8.1 %

Gravel: 56.3 %

Sand: 34.7 %

Silt: 9.0 %

Time of Sieving Min. 15



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SCREEN ANALYSIS

Sample: 9 Depth: 6.10-6.25m

Location: TH # 2-94

Client: YTG, Transportation Engineering

Project: Freegold Road Access Routes

Made by: MK&GV Job No.: 8002-232

Ck'd by: _____ Date: 1994/10/21 to 27

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					100.0
40,000	40.0					90.2
25,000	25.0					86.9
20,000	20.0					84.2
12,500	12.5					74.4
10,000	10.0					69.7
5,000	5.0					50.0
2500	2.5					38.7
1,250	1.25					30.9
800	0.800					26.4
630	0.630					23.8
315	0.315					19.6
250	0.250					17.3
160	0.160					10.8
80	0.080					5.8

Description of Sample: Sandy, Gravel, trace of silt (GW-GM)

Time of Sieving: Min. 15

Method of Preparation: _____ Dry _____ Washed X

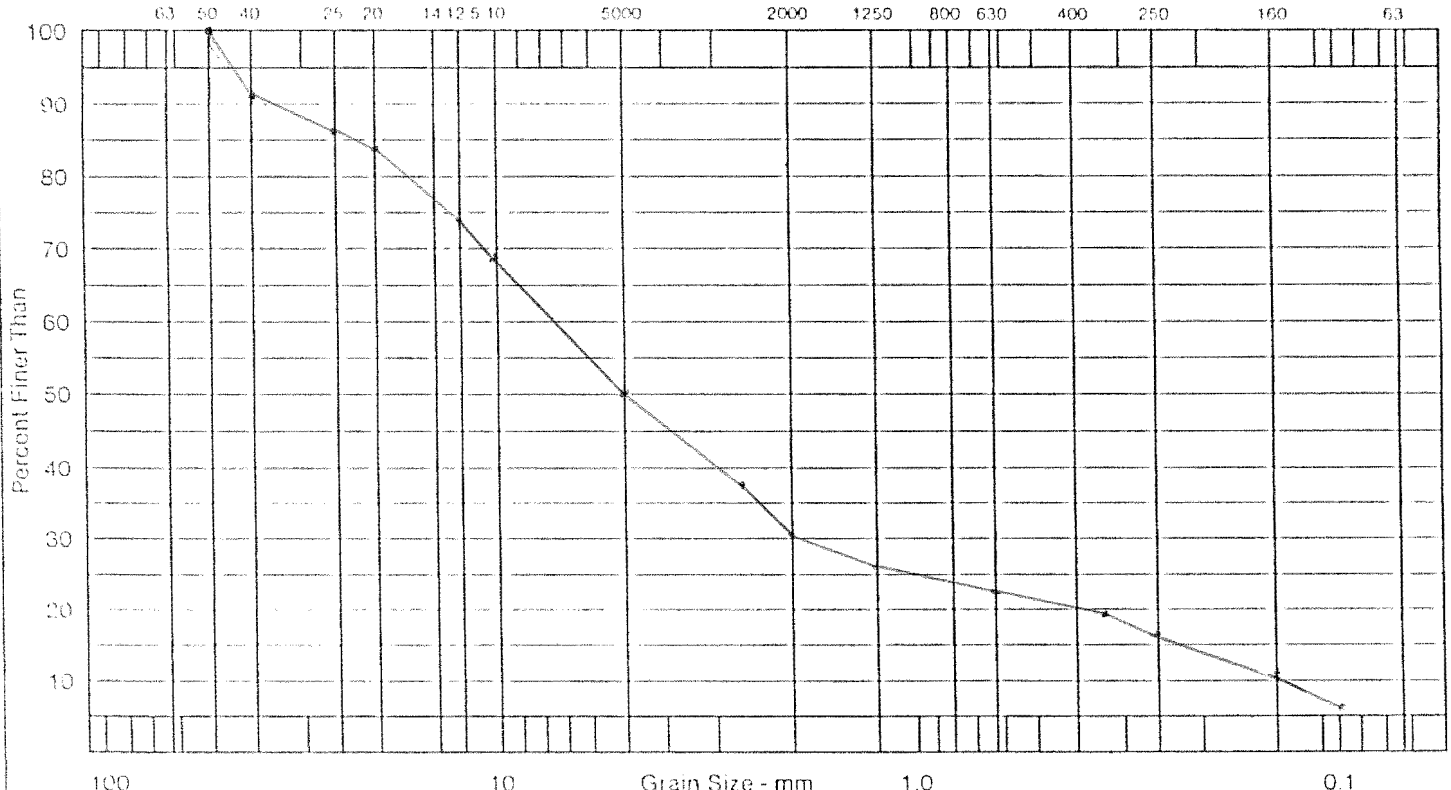
Remarks:

Moisture: 9.4 %

Gravel: 50.0 %

Sand: 44.2 %

Silt: 5.8 %



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SCREEN ANALYSIS

Client: YTG. Transportation Engineering
Project: Freegold Road Access Routes
Sample: 10 Depth: 7.62 - 7.77m
Location: TH # 2-94
Made by: MK&GV Job No.: 8002-232
Ck'd by: _____ Date: 1994/10/21 to 27

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					100.0
25,000	25.0					89.0
20,000	20.0					78.6
12,500	12.5					68.4
10,000	10.0					63.1
5,000	5.0					48.6
2500	2.5					39.5
1,250	1.25					32.0
800	0.800					27.8
630	0.630					25.4
315	0.315					20.4
250	0.250					17.2
160	0.160					10.0
80	0.080					4.9

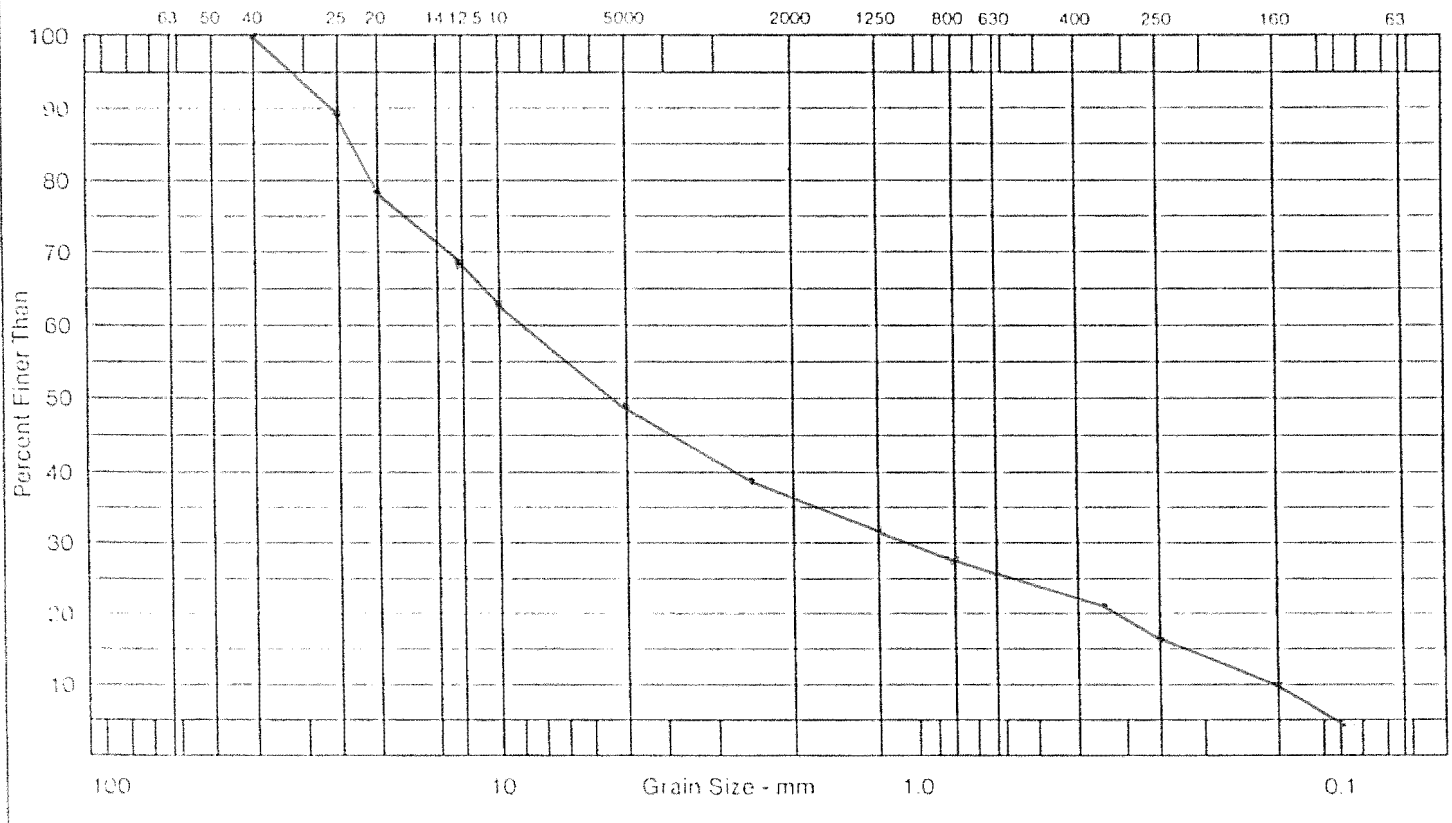
Description of Sample: Sandy Gravel, GW

Time of Sieving: Min. 15

Method of Preparation: _____ Dry: _____ Washed: X

Remarks:

Moisture: 9.7 %
Gravel: 51.4 %
Sand: 43.7 %
Silt: 4.9 %



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SCREEN ANALYSIS

Sample: 11 Depth: 9.14-9.30m

Location: TH # 2-94

Client: YTG, Transportation Engineering

Project: Freegold Road Access Routes

Made by: MK&GV Job No.: 8002-232

Ck'd by: _____ Date: 1994/10/21 to 27

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than grns	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					100.0
25,000	25.0					91.5
20,000	20.0					87.1
12,500	12.5					78.8
10,000	10.0					72.0
5,000	5.0					58.2
2500	2.5					48.5
1,250	1.25					39.8
800	0.800					34.8
630	0.630					32.0
315	0.315					26.4
250	0.250					23.8
160	0.160					13.0
80	0.080					6.0

Description of Sample: Gravelly Sand, trace of silt SW-SM

Time of Sieving _____ Min. 15

Method of Preparation _____ Dry _____ Washed X

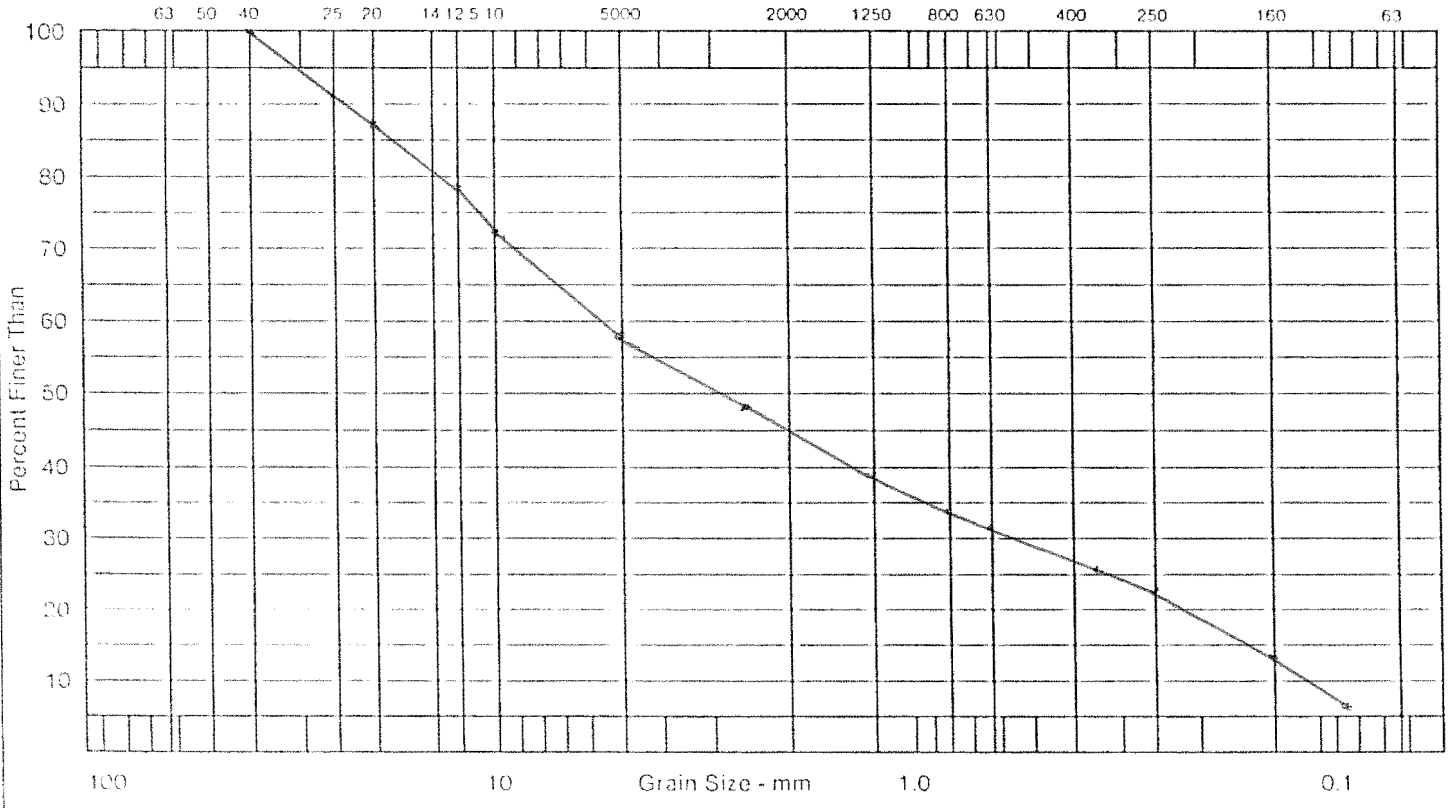
Remarks

Moisture: 8.6 %

Gravel: 41.8 %

Sand: 52.2 %

Silt: 6.0 %



HOGGAN ENGINEERING & TESTING (1980) LTD.

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SCREEN ANALYSIS

Sample: 12 Depth: 10.67 - 10.82m

Location: TH # 2-94

Client: YTG, Transportation Engineering

Project: Freegold Road Access Routes

Made by: MK&GV Job No.: 8002-232

Ck'd by: _____ Date: 1994/10/21 to 27

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					100.0
40,000	40.0					87.9
25,000	25.0					83.6
20,000	20.0					77.7
12,500	12.5					68.5
10,000	10.0					63.2
5,000	5.0					51.0
2500	2.5					42.3
1,250	1.25					35.8
800	0.800					31.8
630	0.630					29.5
315	0.315					24.6
250	0.250					22.0
160	0.160					14.3
80	0.080					7.2

Description of Sample: Sandy Gravel, trace of silt GW-GM

Time of Sieving: Min. 15

Method of Preparation: _____ Dry _____ Washed X

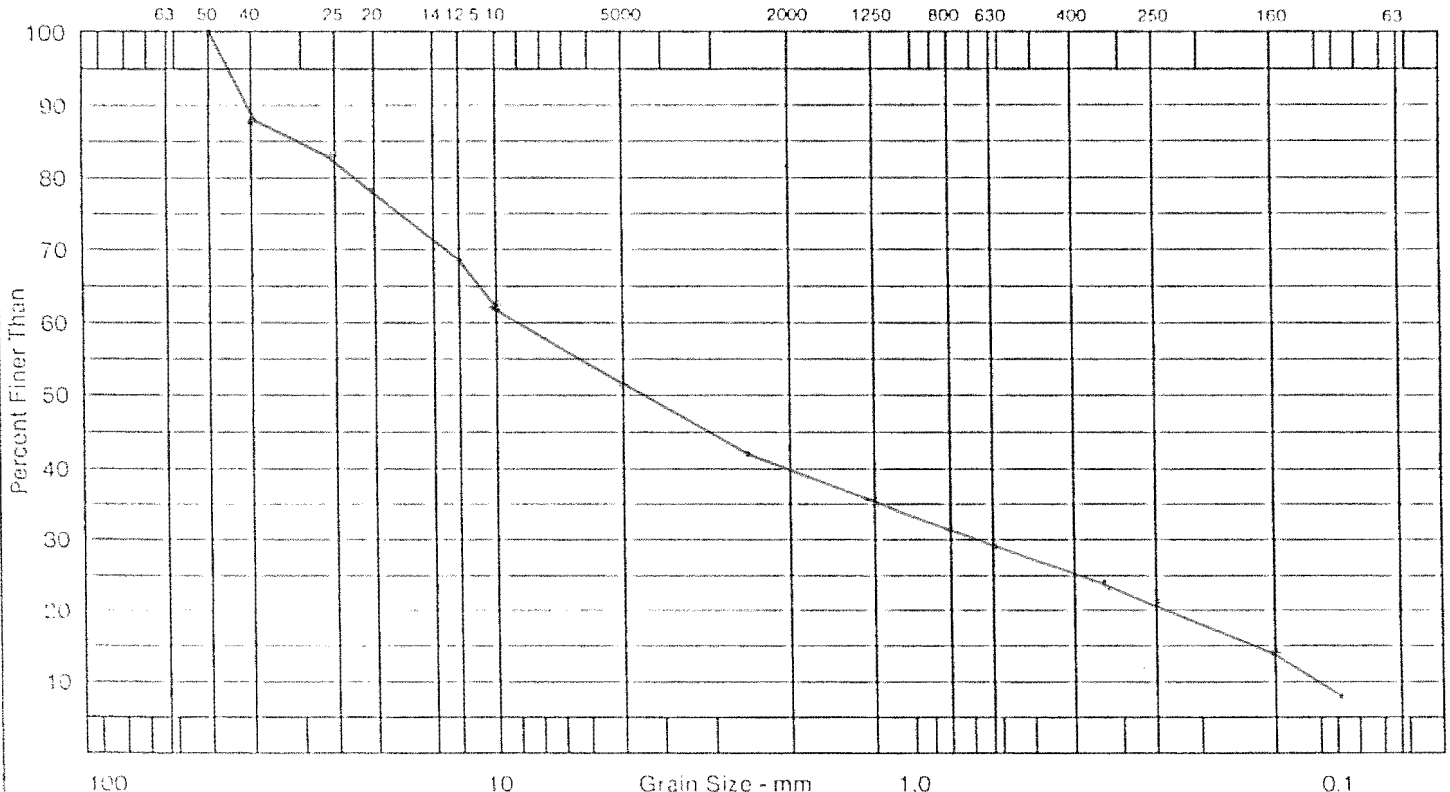
Remarks:

Moisture: 7.5 %

Gravel: 49.0 %

Sand: 43.8 %

Silt: 7.2 %



YTG, Transportation Engineering Branch	Freegold Road Access Routes	BOREHOLE No: TH#3-94
Ibex Contracting Ltd.	Sta 1+975 (approximately)	Project No: 8002-232
C.M.E. Truck Mounted Drill	15 metres East of Bridge	ELEVATION: 0.000 (m)

SAMPLE TYPE: TUBE | LOST | AUGER | BULK | SPT | CORE

SOILS DESCRIPTION

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	SPT(N)	SOILS DESCRIPTION	USC	SOIL SYMBOL	DEPTH (m)
0.0							0.0
	AUGER	13		-sandy gravel, trace to some silt, fine to medium grained sand sizes, medium dense, damp, brown	GW-GM		
				0.15M			
1.0	AUGER	14		-sandy silt, fine grained sand sizes, 50mm volcanic ash lense @ the interface with the silty sand stratum, firm, damp, grey-brown	ML		1.0
	AUGER	15		1.05M			
				-silty sand, fine to medium grained with coarser oxidized lenses throughout, firm, damp, grey-brown	SM		
2.0				1.70M			2.0
3.0				-sandy gravel, trace of silt, fine to medium grained sand sizes, dense, damp, grey-brown *hard drilling @ 3.35m	GW-GM		3.0
4.0	LOST			-lost sample due to auger action.			4.0
				End of Hole @ 4.10M			
5.0				Notes: 1st Refusal @ 3.50m, moved ahead 1 metre. 2nd Refusal @ 4.10m, moved ahead 1 metre.			5.0
6.0							6.0
7.0							7.0
8.0							8.0

LIQUID ■ 10 20 30 40 | PLASTIC ▲ 10 20 30 40 | PLASTIC M.C. LIQUID 10 20 30 40

CLAY ● 20 40 60 80 | SILT ▲ 20 40 60 80 | SAND ■ 20 40 60 80 | GRAVEL ◆ 20 40 60 80

J. R. PAINE & ASSOCIATES
Edmonton, Alberta

LOGGED BY: MJK	COMPLETION DEPTH: 4.1 m
REVIEWED BY: WCK/MJK	COMPLETE: 94/10/19
Fig. No: 2	Page 1 of 1

HOGGAN ENGINEERING & TESTING (1980) LTD.

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3051 Parsons Road, Edmonton, Alberta T6N 1C8

SCREEN ANALYSIS

Sample: 13 Depth: 0.91 - 1.07m

Location: TH # 3-94

Client: YTG, Transportation Engineering

Project: Freegold Road Access Routes

Made by: MK&GV Job No.: 8002-232

Ck'd by: _____ Date: 1994/10/21 to 27

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					
25,000	25.0					
20,000	20.0					
12,500	12.5					
10,000	10.0					100.0
5,000	5.0					99.6
2500	2.5					98.9
1,250	1.25					98.5
800	0.800					98.2
630	0.630					98.0
315	0.315					97.4
250	0.250					96.2
160	0.160					89.9
80	0.080					77.5

Description of Sample: Sandy Silt, ML

Time of Sieving: Min. 15

Method of Preparation: _____ Dry _____ Washed X

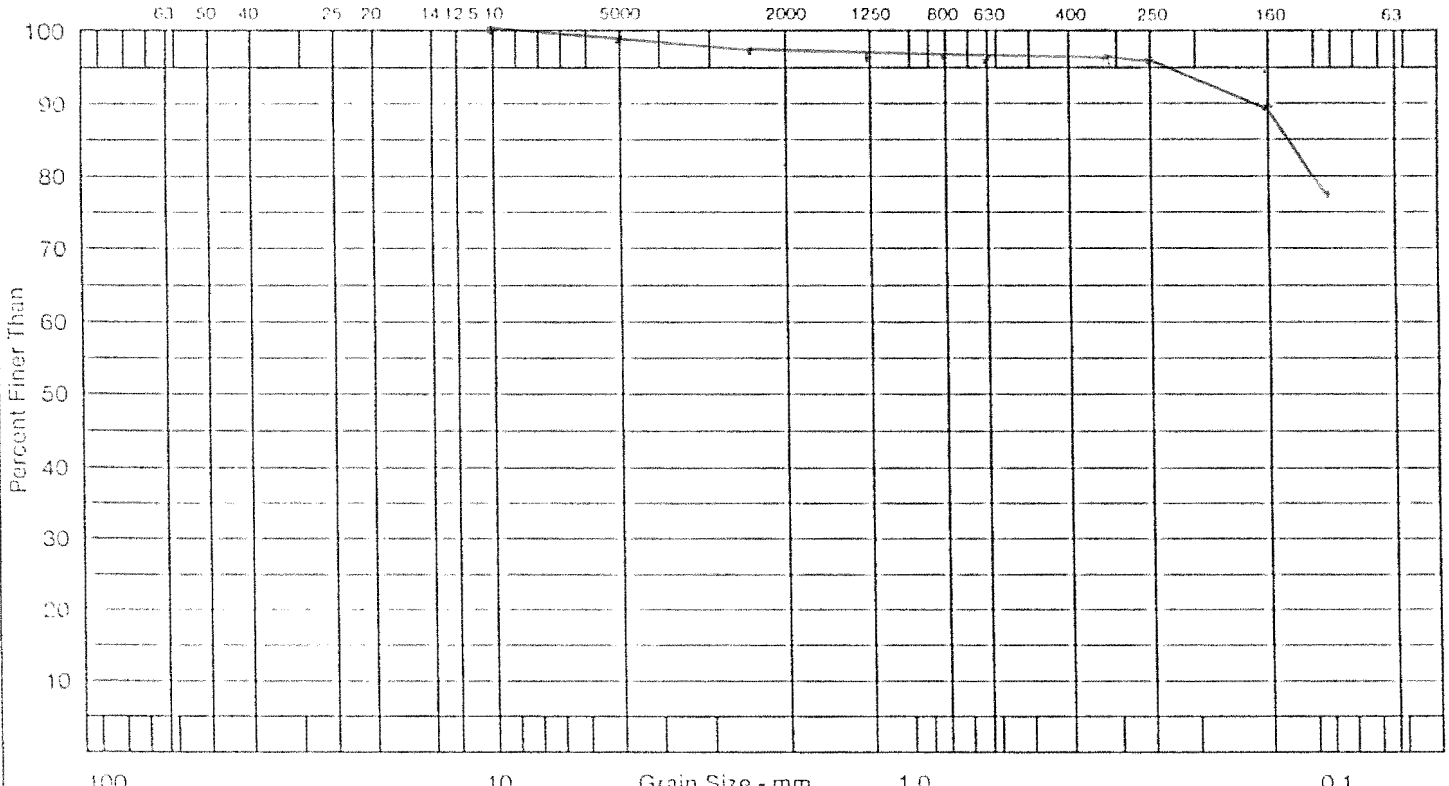
Remarks:

Moisture: 21.1 %

Gravel: 0.4 %

Sand: 22.1 %

Silt: 77.5 %



HOGGAN ENGINEERING & TESTING (1980) LTD.

An Affiliate of J. R. Paine & Associates Ltd.

3051 Parsons Road, Edmonton, Alberta T6N 1C8

SCREEN ANALYSIS

Sample: 14 Depth: 1.52 - 1.68m

Location: TH # 3-94

Client: YTG, Transportation Engineering

Project: Freegold Road Access Routes

Made by: MK&GV Job No.: 8002-232

Ck'd by: _____ Date: 1994/10/21 to 27

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					
25,000	25.0					
20,000	20.0					
12,500	12.5					100.0
10,000	10.0					98.6
5,000	5.0					97.0
2500	2.5					95.6
1,250	1.25					93.7
800	0.800					91.7
630	0.630					89.9
315	0.315					83.4
250	0.250					76.3
160	0.160					43.4
80	0.080					17.7

Description of Sample: Silty Sand, SM

Time of Sieving: Min. 15

Method of Preparation: Dry _____ Washed X

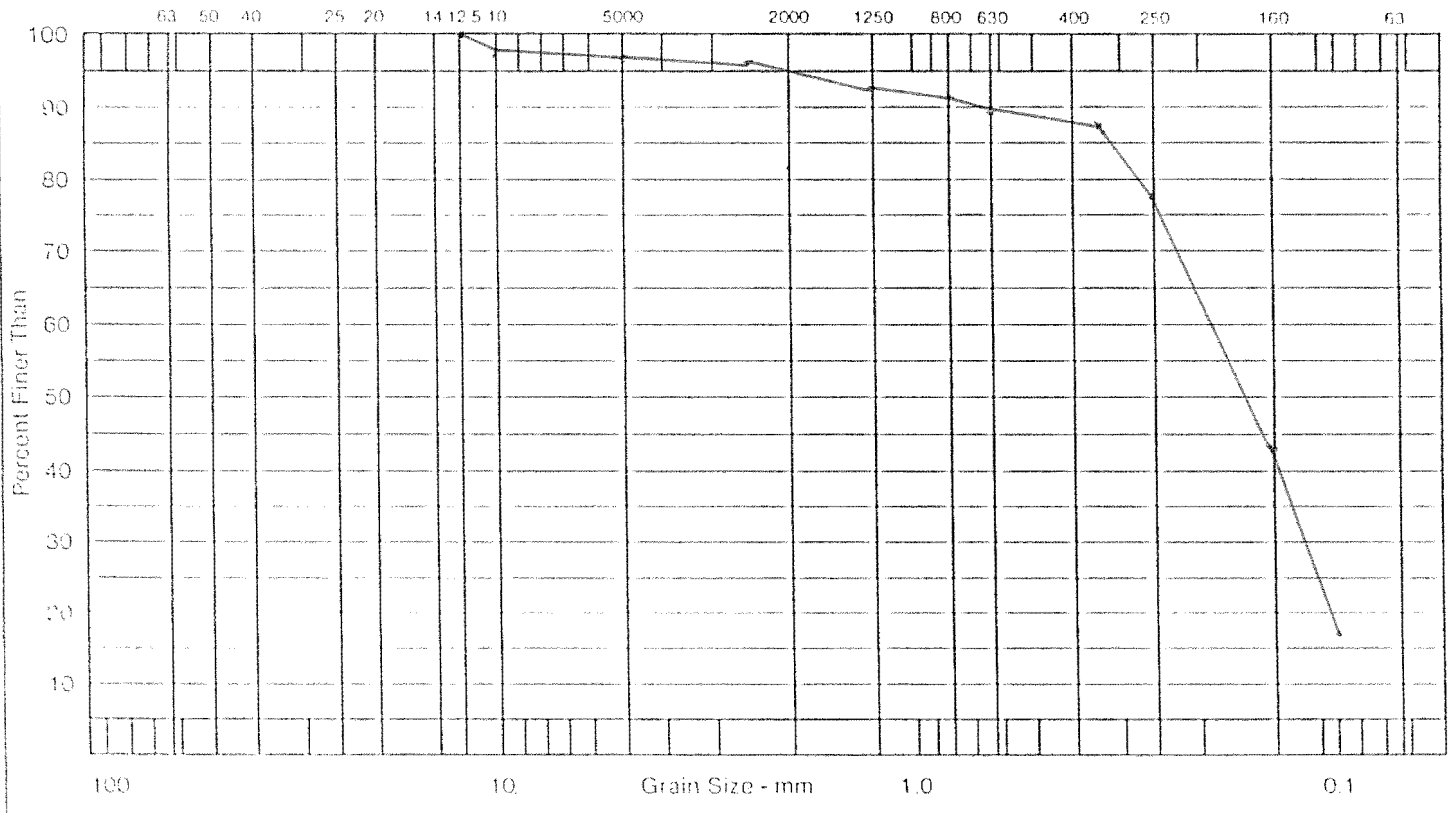
Remarks:

Moisture: 12.1 %

Gravel: 3.0 %

Sand: 79.3 %

Silt: 17.7 %



HOGGAN ENGINEERING & TESTING (1980) LTD.

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3051 Parsons Road, Edmonton, Alberta T6N 1C8

SCREEN ANALYSIS

Sample: 15 Depth: 3.05-3.20m

Location: TH # 3-94

Client: YTG, Transportation Engineering

Project: Freegold Road Access Routes

Made by: MK&GV Job No.: 8002-232

Ck'd by: _____ Date: 1994/10/21 to 27

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					100.0
40,000	40.0					89.0
25,000	25.0					82.1
20,000	20.0					75.4
12,500	12.5					63.5
10,000	10.0					58.1
5,000	5.0					48.2
2500	2.5					41.4
1,250	1.25					35.8
800	0.800					31.2
630	0.630					27.5
315	0.315					19.6
250	0.250					15.9
160	0.160					9.7
80	0.080					6.3

Description of Sample: Sandy Gravel, trace of silt GW-GM

Time of Sieving: Min 15

Method of Preparation: _____ Dry _____ Washed X

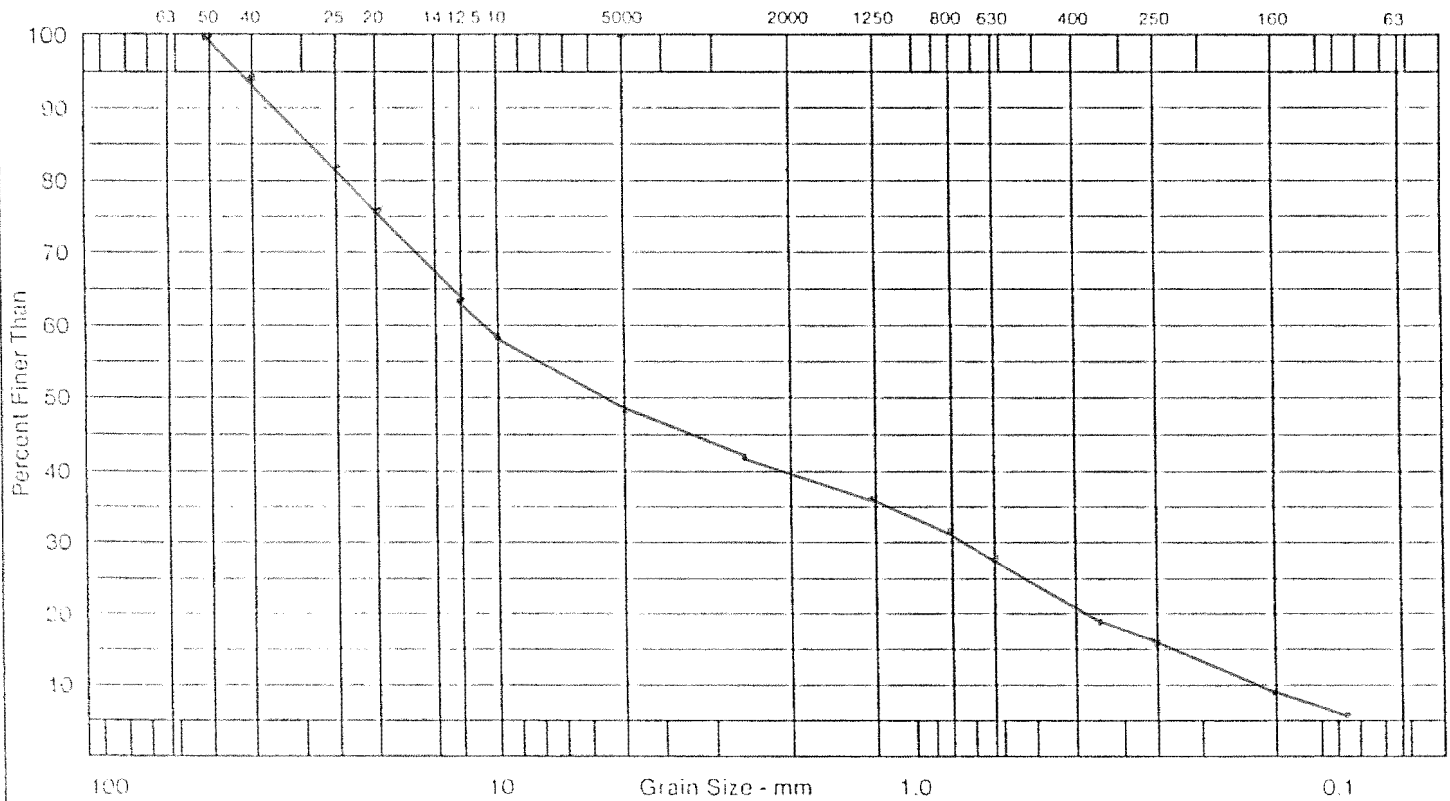
Remarks:

Moisture: 2.5 %

Gravel: 51.8 %

Sand: 41.9 %

Silt: 6.3 %

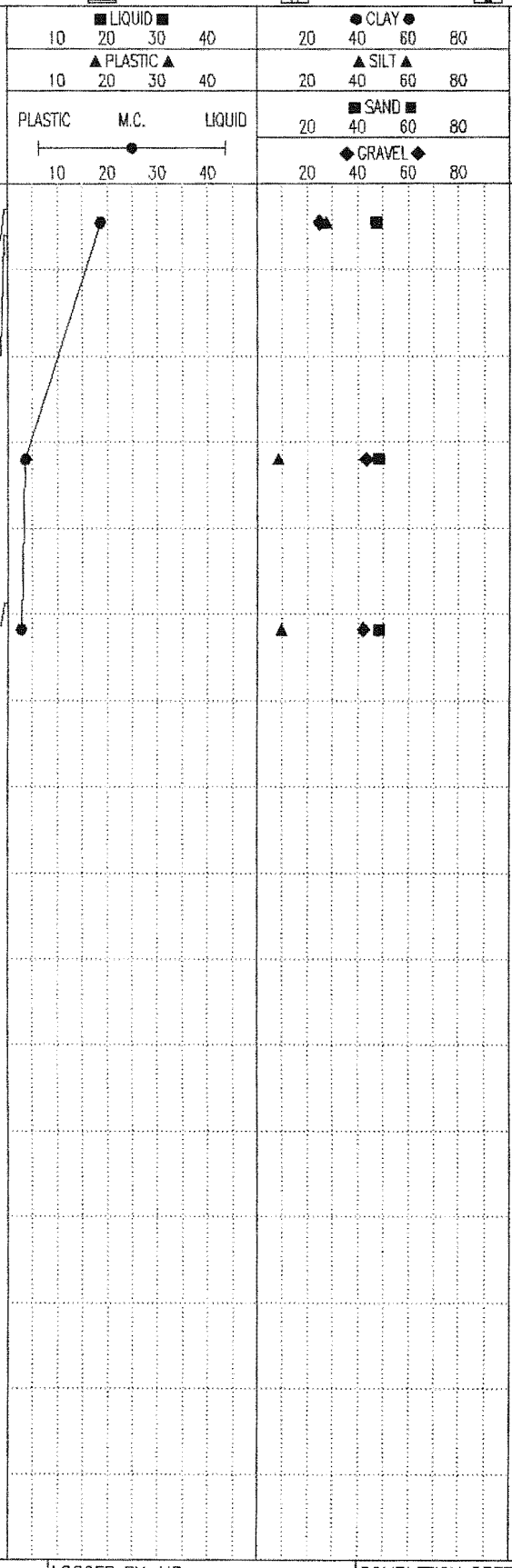


YTG, Transportation Engineering Branch	Freegold Road Access Routes	BOREHOLE No: TH#35-94
Ibex Contracting, CME 750 Truck Mounted	Nordenskiold Bridge Area – see attached	Project No: 8002-232
Drill Rig utilizing hollow stem augers	site sketch for location	ELEVATION: 0.000 (m)

SAMPLE TYPE ■ TUBE ☒ LOST ☒ AUGER ▤ BULK ▥ SPT ▮ CORE

SOILS DESCRIPTION

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	SPT(N)	SOILS DESCRIPTION
0.0	☒	140		ORGANICS –grass cover, shrubs
				0.15m
				GRAVELLY SILTY SAND –wet (due to precipitation), brown, rich in organics, rounded gravels
1.0				0.3m
				GRAVELLY SAND –trace silt, fine to coarse grained sand brown, dry, medium dense, oxidation, gravel both rounded and angular
	▮	141	120	NOTE: drilling action indicates that cobbles begin at 1.2 metres
2.0				
	▮	142	100	NOTE: very difficult drilling begins @2.4m
				2.44m
				REFUSAL @2.44 m
3.0				
4.0				
5.0				
6.0				NOTE: –in order to achieve a deep test hole, the drill rig was moved 1 m north and drilling progressed with solid stem augers as per TH#36-94 –the SPT count at 2.4 metres 100+ with less than 150 mm advance
7.0				
8.0				



USC	SOIL SYMBOL	DEPTH (m)
PT		0.0
SM		
SW		1.0
		2.0
		3.0
		4.0
		5.0
		6.0
		7.0
		8.0

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LOGGED BY: MB	COMPLETION DEPTH: 3.7 m
REVIEWED BY: WCK	COMPLETE: 94/10/21
Fig. No:	Page 1 of 1

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SCREEN ANALYSIS

Client: YTG, Transportation Engineering
Project: Freegold Road Access Routes
Sample: 140 Depth:
Location: TH # 35-94
Made by: MB/RK Job No.: 8002-232
Ck'd by: Date: 1994/10/31 & 11/04

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					100.0
25,000	25.0					82.3
20,000	20.0					82.3
12,500	12.5					81.3
10,000	10.0					79.0
5,000	5.0					75.1
2500	2.5					72.4
1,250	1.25					70.3
800	0.800					68.0
630	0.630					65.6
400	0.400					58.4
315	0.315					53.0
160	0.160					37.6
80	0.080					37.6

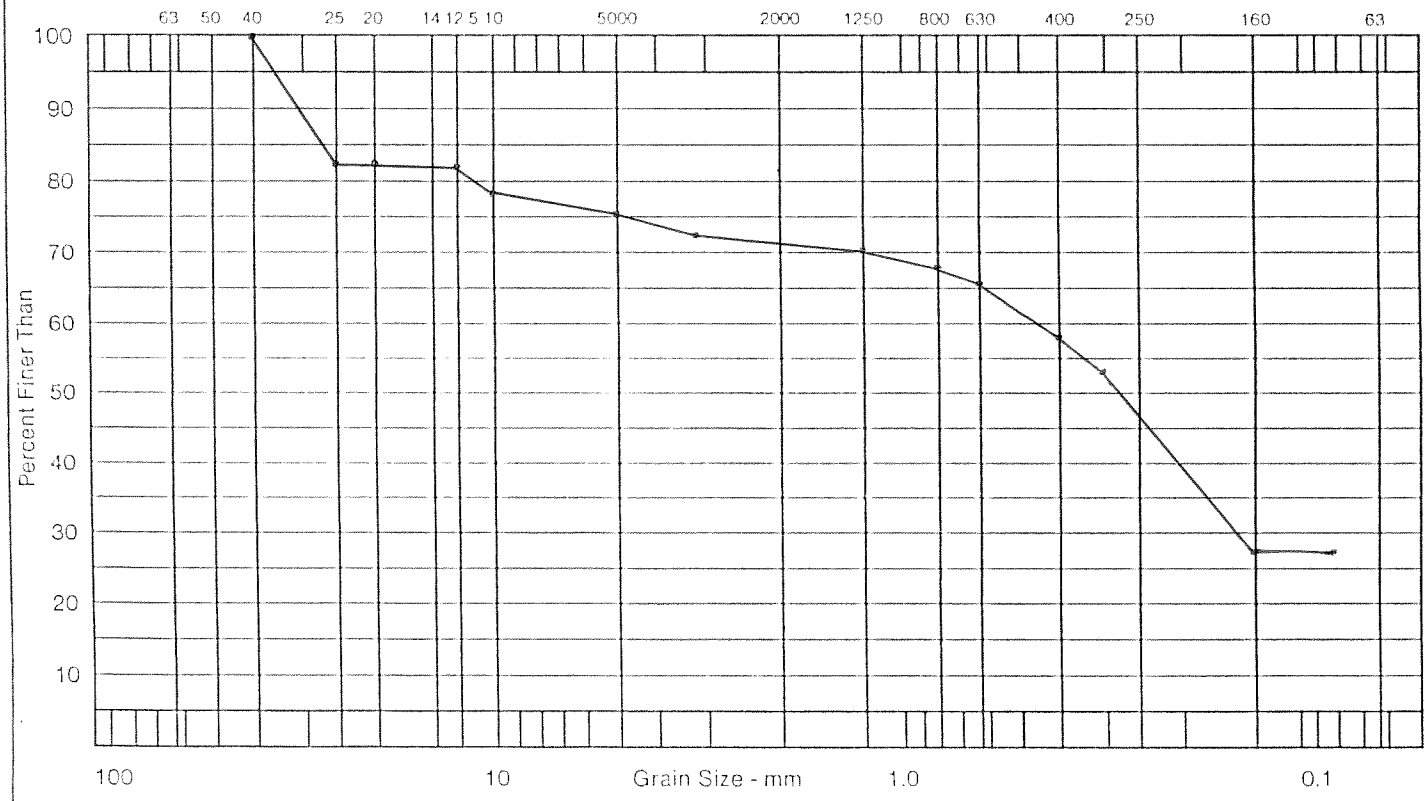
Description of Sample: Gravelly, Silty, Sand, SM

Time of Sieving: Min. 15

Method of Preparation: Dry: Washed: X

Remarks:

Moisture: 18.6%
Gravel: 24.9 %
Sand: 47.5 %
Silt: 37.6 %



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SCREEN ANALYSIS

Client: YTG, Transportation Engineering
Project: Freegold Road Access Routes
Sample: 141 Depth:
Location:
Made by: MB/RK Job No.: 8002-232
TH # 35-94 Ck'd by: Date: 1994/10/31 & 11/04

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					100.0
25,000	25.0					95.7
20,000	20.0					94.0
12,500	12.5					79.5
10,000	10.0					73.6
5,000	5.0					56.5
2500	2.5					44.5
1,250	1.25					34.9
800	0.800					29.2
630	0.630					26.0
400	0.400					19.9
315	0.315					17.1
160	0.160					8.3
80	0.080					9.3

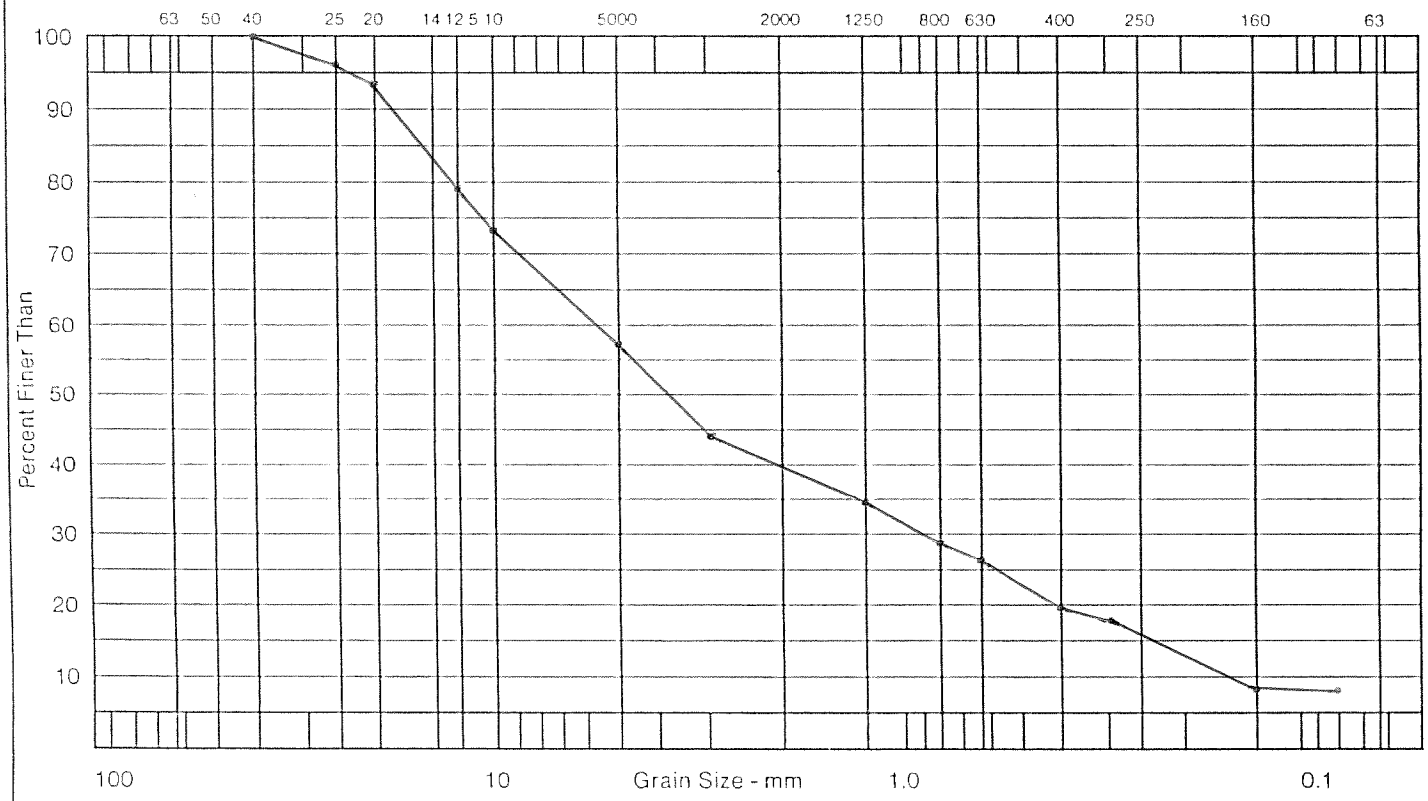
Description of Sample: Gravelly Sand, Trace of Silt, SW

Time of Sieving: Min. 15

Method of Preparation: Dry: Washed: X

Remarks:

Moisture: 3.6 %
Gravel: 43.5 %
Sand: 43.2 %
Silt: 8.3 %



HOGGAN ENGINEERING & TESTING (1980) LTD.

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SCREEN ANALYSIS

Client: YTG, Transportation Engineering
Project: Freegold Road Access Routes
Sample: 142 Depth:
Location:
Made by: MB/RK Job No.: 8002-232
TH # 35-94 Ck'd by: Date: 1994/10/31 & 11/04

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					
25,000	25.0					
20,000	20.0					100.0
12,500	12.5					81.4
10,000	10.0					72.0
5,000	5.0					57.8
2500	2.5					46.9
1,250	1.25					38.1
800	0.800					33.2
630	0.630					30.3
400	0.400					23.9
315	0.315					20.4
160	0.160					14.4
80	0.080					9.5

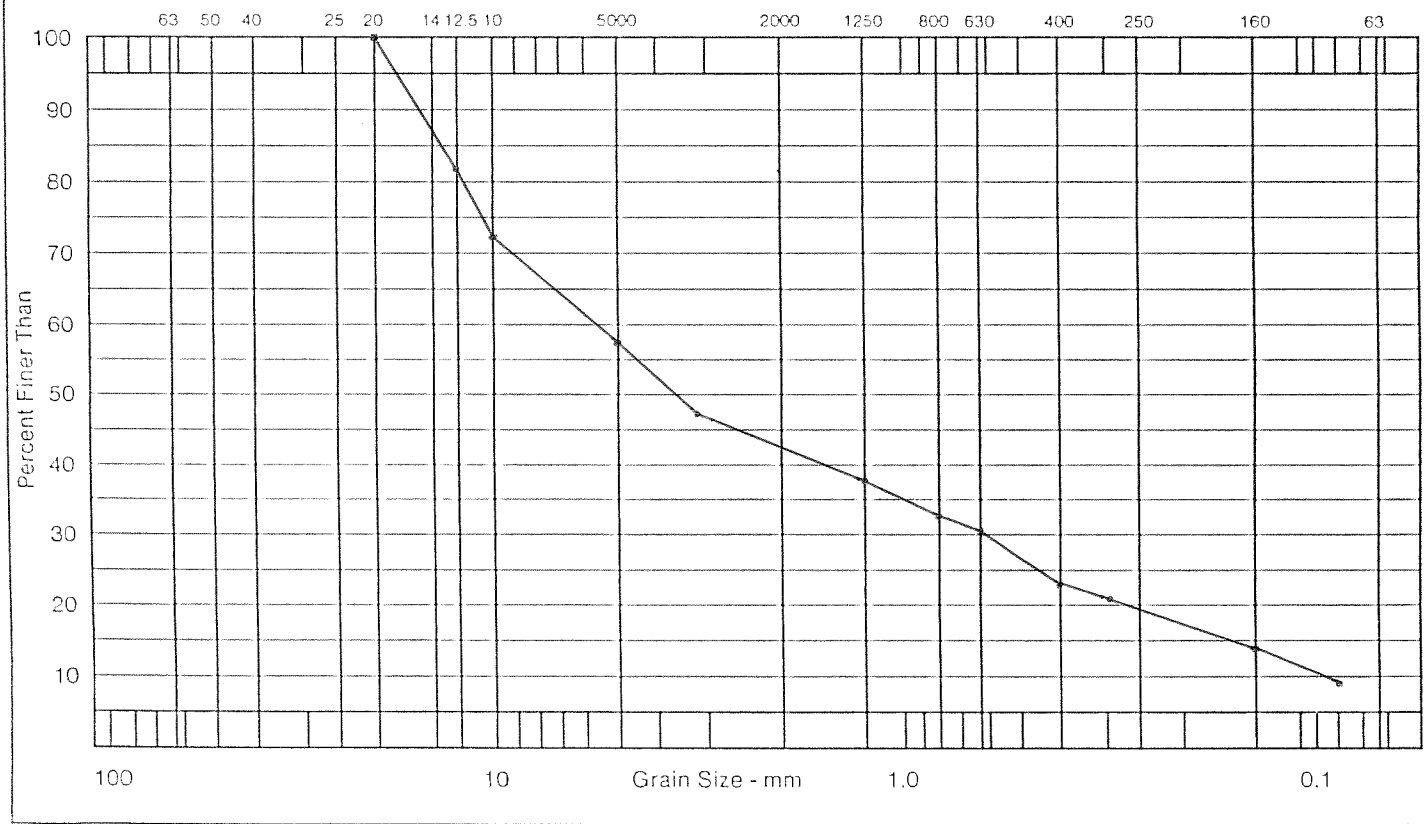
Description of Sample: Gravelly Sand, Trace of Silt, SW

Time of Sieving: Min. 15

Method of Preparation: Dry: Washed: X

Remarks:

Moisture: 2.7 %
Gravel: 42.2 %
Sand: 48.3 %
Silt: 9.5 %



YTG, Transportation Engineering Branch	Freegold Road Access Routes	BOREHOLE No: TH#36-94
Ibex Contracting Ltd., CME 75 Truck	Nordenskiold Bridge area - see site	Project No: 8002-232
mounted rig utilizing solid stem augers	sketch for location of TH#36-94	ELEVATION: 0.000 (m)

SAMPLE TYPE: TUBE | LOST | AUGER | BULK | SPT | CORE

SOILS DESCRIPTION

LIQUID 10 20 30 40 | PLASTIC 10 20 30 40 | PLASTIC M.C. LIQUID 10 20 30 40 | CLAY 20 40 60 80 | SILT 20 40 60 80 | SAND 20 40 60 80 | GRAVEL 20 40 60 80

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	SPT(N)	SOILS DESCRIPTION	USC	SOIL SYMBOL	DEPTH (m)
0.0							0.0
	X	143		SILTY SAND -rich in organics, wet (precip.) 0.2m	SM		
	X	144		SILTY SAND -medium grained sand, dry, brown, medium dense, trace oxidation 0.76m	SM		
1.0							1.0
	X	145		GRAVELLY SAND -trace silt, medium grained sand, dry, rounded gravel, dense, oxidation 1.52m	SW		
2.0				COBBLE AND BOULDER STRATUM -boulders present making drilling very difficult, no split spoon sample retrieved - however, rock chips to 30mm diametre retrieved on auger resembling granite 2.74m	GP		2.0
3.0				SAND -coarse grained, oxidized throughout, damp, rusty brown in colour, medium dense, easy drilling, poorly graded			3.0
	X	146					
4.0							4.0
		147	29	-gravelly sand seam occurs at 4.6 m, sand becomes moist			
5.0 ▼				NOTE: free water is noted at 5.18 metres	SW		5.0 ▼
6.0							6.0
		148	12	-saturated sample retrieved from split spoon			
7.0							7.0
		149	18	-sand, some gravel			
8.0							8.0

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LOGGED BY: MB	COMPLETION DEPTH: 11.0 m
REVIEWED BY: WCK	COMPLETE: 94/10/21
Fig. No:	Page 1 of 2

YTG, Transportation Engineering Branch	Freegold Road Access Routes	BOREHOLE No: TH#36-94
Ibex Contracting Ltd., CME 75 Truck	Nordenskiold Bridge area - see site	Project No: 8002-232
mounted rig utilizing solid stem augers	sketch for location of TH#36-94	ELEVATION: 0.000 (m)

SAMPLE TYPE ■ TUBE ⧄ LOST ⊠ AUGER ▤ BULK ▥ SPT ▮ CORE

SOILS DESCRIPTION

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	SPT(N)	SOILS DESCRIPTION	USC	SOIL SYMBOL	DEPTH (m)
8.0							8.0
9.0	▥	150	33	-sand, trace silt, medium to fine grained	SW		9.0
10.0							10.0
11.0	⧄	151	15	-no sample retrieved in split spoon, assumed that sand becomes more fine with depth due to decrease in SPT resistance			11.0
				11.0m			
				END OF HOLE @ 11.0m			
12.0							12.0
13.0							13.0
14.0				NOTE:-free water encountered at 5.18 m -once the rock stratum was penetrated the hollow stem augers were employed at 3.66 m			14.0
15.0							15.0
16.0							16.0

LIQUID ■ 10 20 30 40 | PLASTIC ▲ 10 20 30 40 | PLASTIC M.C. LIQUID 10 20 30 40

CLAY ● 20 40 60 80 | SILT ▲ 20 40 60 80 | SAND ■ 20 40 60 80 | GRAVEL ◆ 20 40 60 80

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LOGGED BY: MB	COMPLETION DEPTH: 11.0 m
REVIEWED BY: WCK	COMPLETE: 94/10/21
Fig. No:	Page 2 of 2

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SCREEN ANALYSIS

Client: YTG, Transportation Engineering
Project: Freegold Road Access Routes
Sample: 143 Depth:
Location: TH # 36-94
Made by: MB/RK Job No.: 8002-232
Ck'd by: Date: 1994/10/31 & 11/04

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					
25,000	25.0					
20,000	20.0					
12,500	12.5					100.0
10,000	10.0					98.8
5,000	5.0					98.2
2500	2.5					97.8
1,250	1.25					96.9
800	0.800					96.0
630	0.630					94.9
400	0.400					91.9
315	0.315					87.6
160	0.160					71.2
80	0.080					48.0

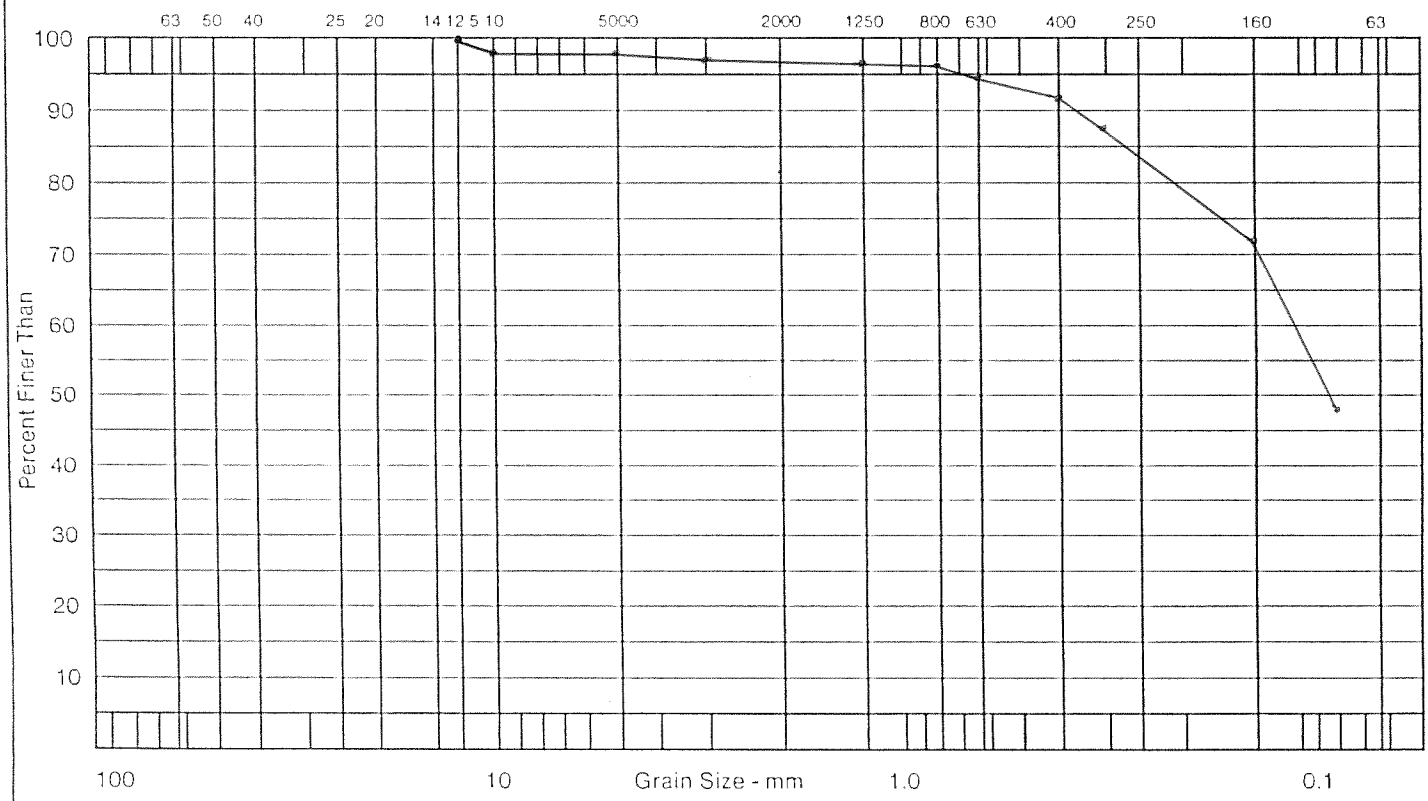
Description of Sample: Sandy Silt to Silty Sand, ML-SM

Time of Sieving: Min. 15

Method of Preparation: Dry Washed X

Remarks:

Moisture: 18.0 %
Gravel: 1.8 %
Sand: 50.2 %
Silt: 48.0 %



HOGGAN ENGINEERING & TESTING (1980) LTD.

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3051 Parsons Road, Edmonton, Alberta T6N 1C8

SCREEN ANALYSIS

Client: YTG, Transportation Engineering
Project: Freegold Road Access Routes
Sample: 144 Depth:
Location: TH # 36-94
Made by: MB/RK Job No.: 8002-232
Ck'd by: Date: 1994/10/31 & 11/04

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					
25,000	25.0					
20,000	20.0					
12,500	12.5					
10,000	10.0					100.0
5,000	5.0					99.5
2500	2.5					99.0
1,250	1.25					97.9
800	0.800					95.5
630	0.630					92.7
400	0.400					84.1
315	0.315					78.6
160	0.160					53.3
80	0.080					24.6

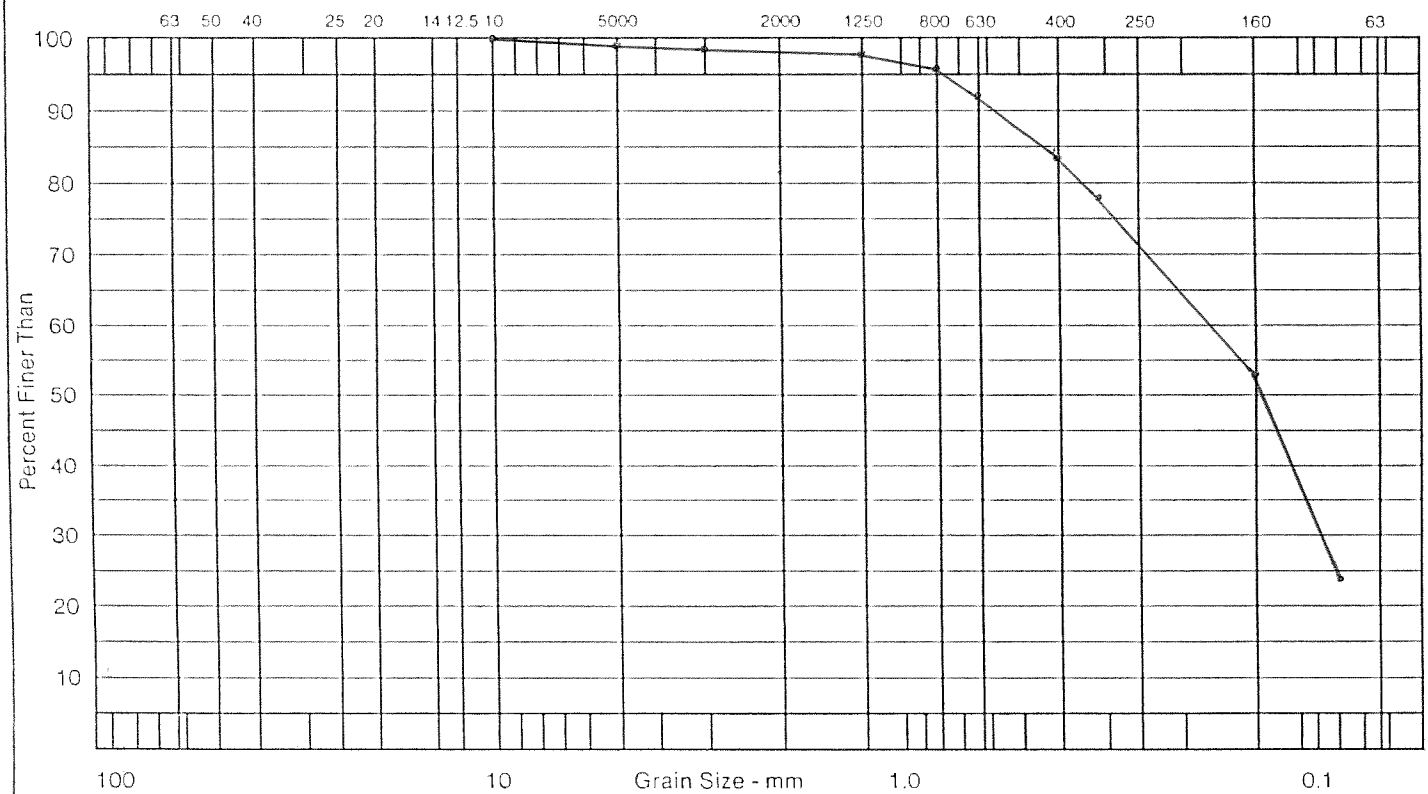
Description of Sample: Silty Sand, SM

Method of Preparation: Dry: Washed: X

Remarks:

Moisture: 5.8 %
Gravel: 0.5 %
Sand: 74.9 %
Silt: 24.6 %

Time of Sieving: Min. 15



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SCREEN ANALYSIS

Client: YTG, Transportation Engineering
Project: Freegold Road Access Routes
Sample: 145 Depth:
Location: TH # 36-94
Made by: MB/RK Job No.: 8002-232
Ck'd by: Date: 1994/10/31 & 11/04

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					
25,000	25.0					100.0
20,000	20.0					92.3
12,500	12.5					74.8
10,000	10.0					68.0
5,000	5.0					58.0
2500	2.5					51.9
1,250	1.25					46.4
800	0.800					40.6
630	0.630					36.0
400	0.400					23.3
315	0.315					17.9
160	0.160					10.7
80	0.080					5.6

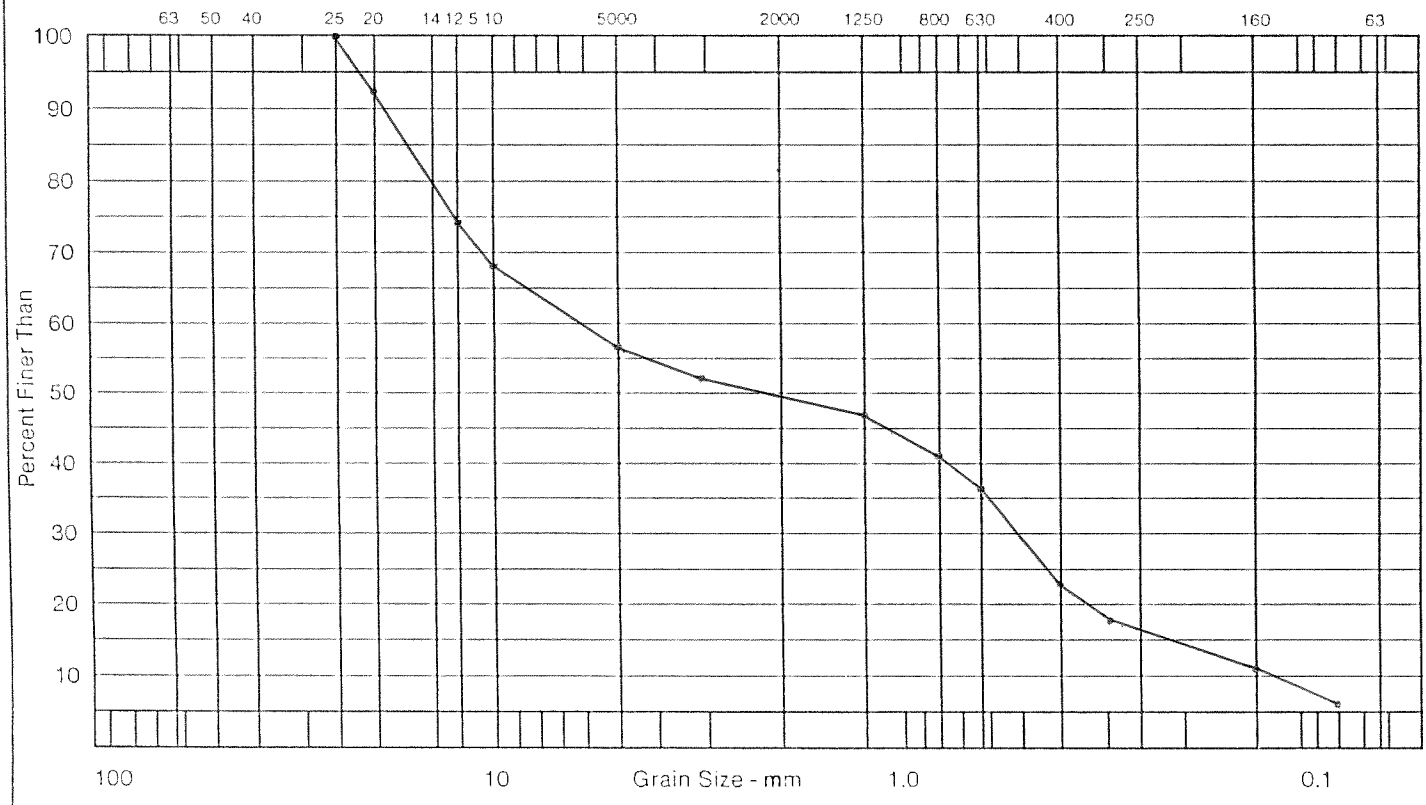
Description of Sample: Gravelly Sand, Trace of Silt, SW

Time of Sieving: Min. 15

Method of Preparation: Dry: Washed: X

Remarks:

Moisture: 3.5 %
Gravel: 44.0 %
Sand: 50.4 %
Silt: 5.6 %



HOGGAN ENGINEERING & TESTING (1980) LTD.

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3051 Parsons Road, Edmonton, Alberta T6N 1C8

SCREEN ANALYSIS

Client: YTG, Transportation Engineering

Sample: 146 Depth:

Project: Freegold Road Access Routes

Location: TH # 96-94

Made by: MB/RK Job No.: 8002-232

Ck'd by: Date: 1994/10/31 & 11/04

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					
25,000	25.0					
20,000	20.0					
12,500	12.5					100.0
10,000	10.0					99.0
5,000	5.0					95.2
2500	2.5					87.8
1,250	1.25					69.5
800	0.800					45.9
630	0.630					32.6
400	0.400					16.4
315	0.315					12.3
160	0.160					7.8
80	0.080					5.0

Description of Sample: Sand, Trace of Silt, Siv

Method of Preparation: Dry ____ Washed X

Remarks:

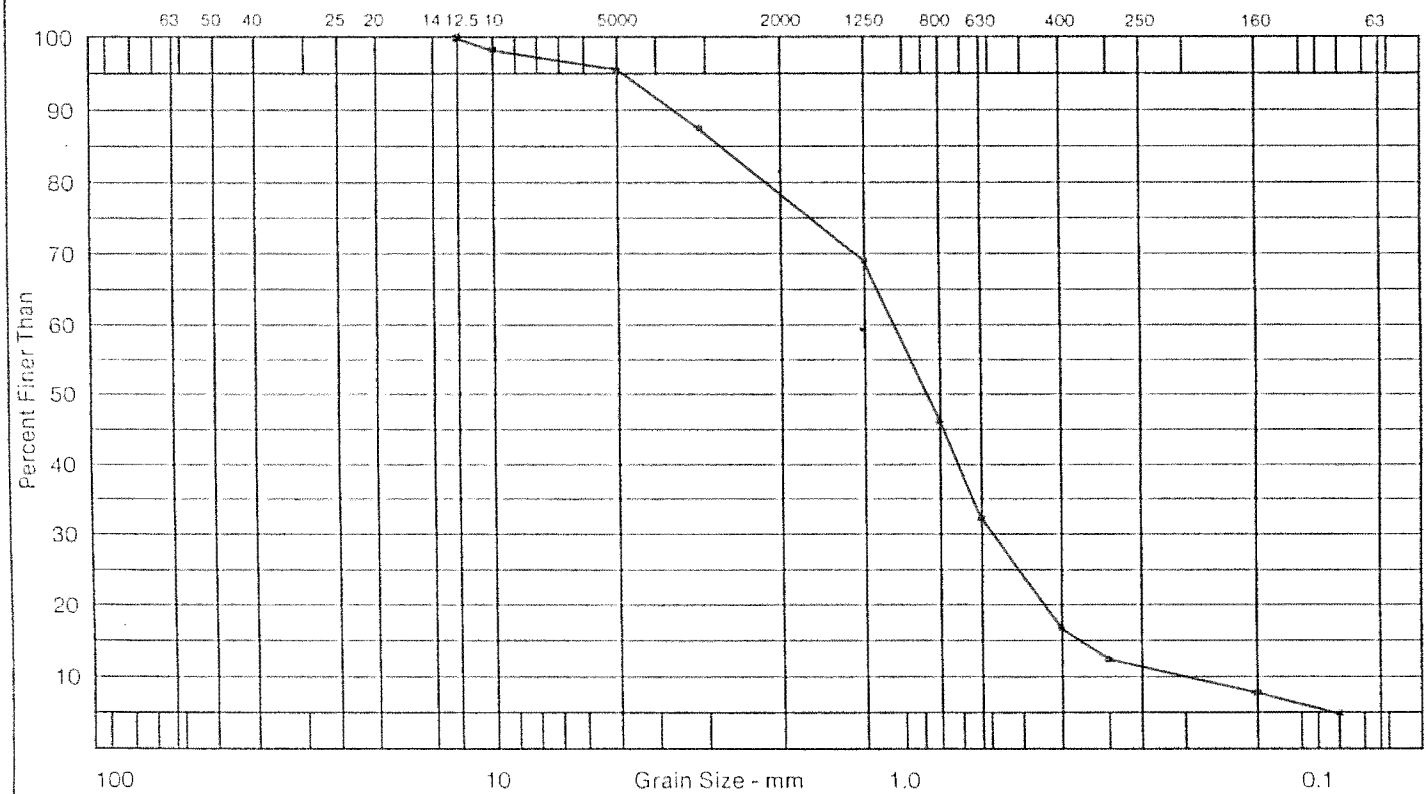
Moisture: 4.9 %

Gravel: 4.8 %

Sand: 90.2 %

Silt: 5.0 %

Time of Sieving ____ Min. 15



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SCREEN ANALYSIS

Client: YTG, Transportation Engineering
Project: Freegold Road Access Routes
Sample: 147 Depth:
Location: TH # 36-94
Made by: MB/RK Job No.: 8002-232
Ck'd by: Date: 1994/10/31 & 11/04

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					
25,000	25.0					
20,000	20.0					100.0
12,500	12.5					98.8
10,000	10.0					93.3
5,000	5.0					82.3
2500	2.5					67.4
1,250	1.25					55.7
800	0.800					42.6
630	0.630					33.1
400	0.400					16.5
315	0.315					11.5
160	0.160					6.3
80	0.080					3.9

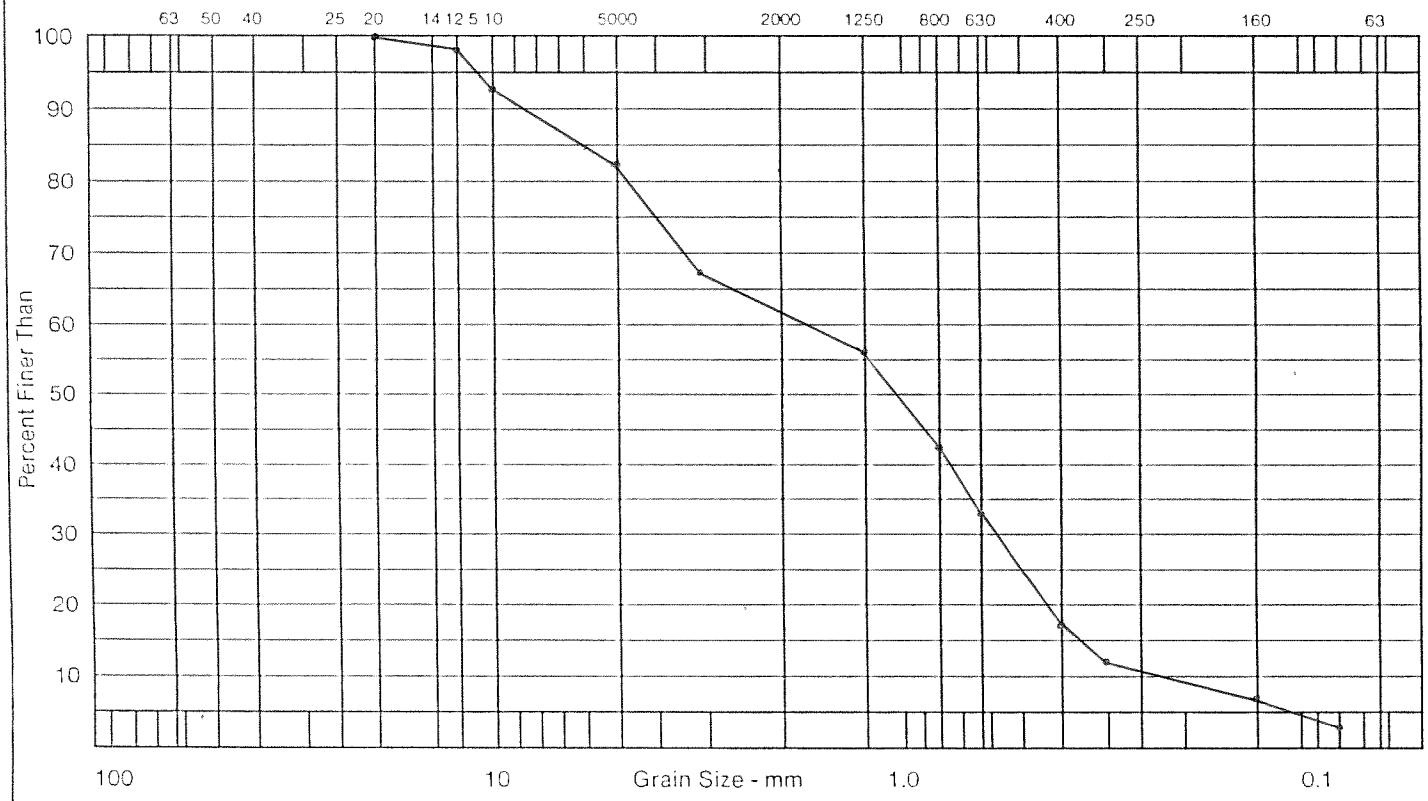
Description of Sample: Gravelly Sand, SW

Method of Preparation: Dry: Washed: X

Remarks:

Moisture: 6.8 %
Gravel: 17.7 %
Sand: 78.4 %
Silt: 3.9 %

Time of Sieving: Min. 15



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SCREEN ANALYSIS

Sample: 148 Depth:

Location: TH # 36-94

Client: YTG, Transportation Engineering

Project: Freegold Road Access Routes

Made by: MB/RK Job No.: 8002-232

Ck'd by: Date: 1994/10/31 & 11/04

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					
25,000	25.0					
20,000	20.0					
12,500	12.5					100.0
10,000	10.0					99.4
5,000	5.0					96.3
2500	2.5					91.6
1,250	1.25					78.8
800	0.800					61.4
630	0.630					45.3
400	0.400					21.1
315	0.315					13.5
160	0.160					6.1
80	0.080					2.9

Description of Sample: Sand, Silt

Time of Sieving: Min. 15

Method of Preparation: Dry: Washed: X

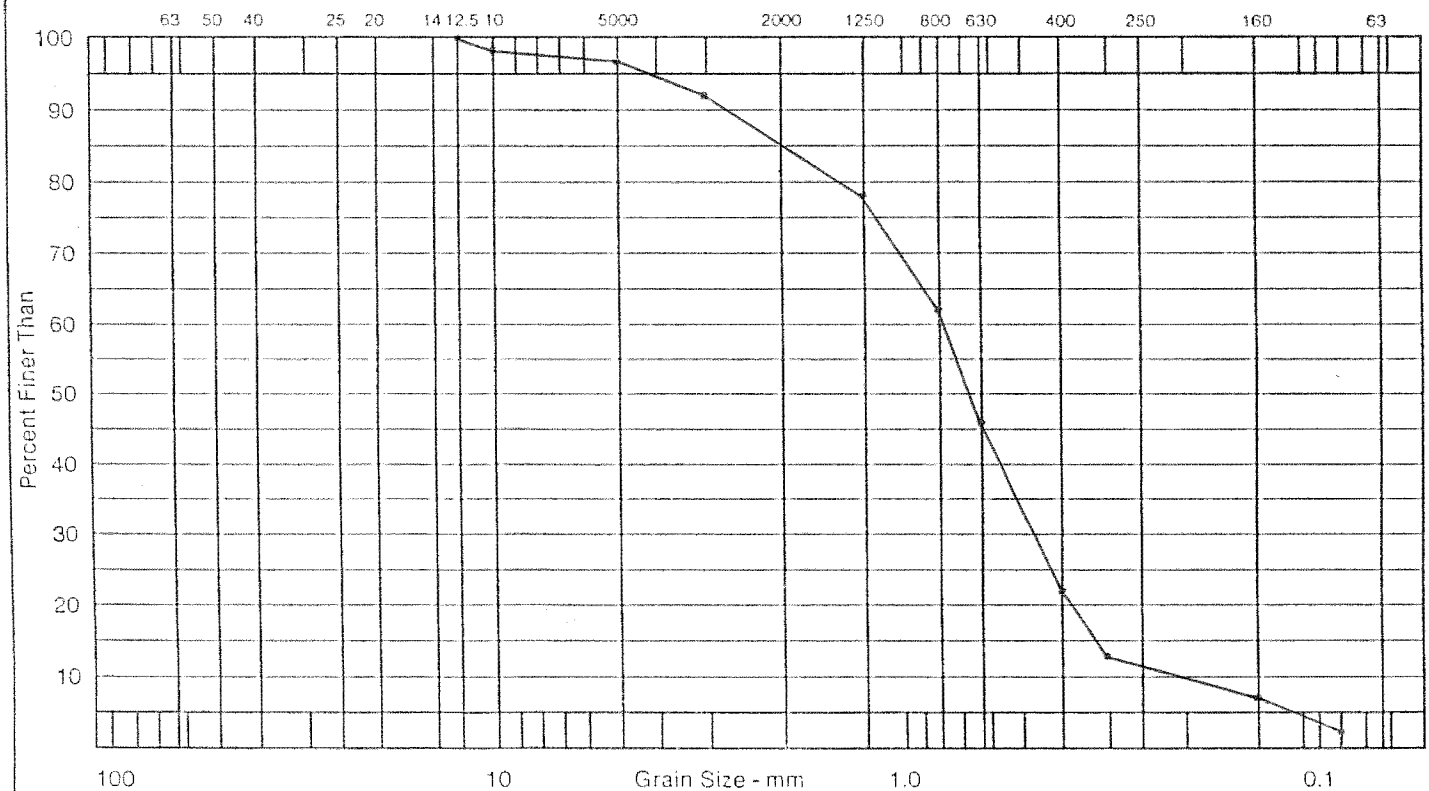
Remarks:

Moisture: 21.6 %

Gravel: 3.7 %

Sand: 93.4 %

Silt: 2.9 %



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3051 Parsons Road, Edmonton, Alberta T6N 1C8

SCREEN ANALYSIS

Client: YTG, Transportation Engineering
Project: Freegold Road Access Routes
Sample: 149 Depth:
Location: TH # 36-94
Made by: MB/RK Job No.: 8002-232
Ck'd by: Date: 1994/10/31 & 11/04

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					
25,000	25.0					
20,000	20.0					100.0
12,500	12.5					97.1
10,000	10.0					94.9
5,000	5.0					88.7
2500	2.5					83.7
1,250	1.25					73.2
800	0.800					59.0
630	0.630					46.3
400	0.400					25.8
315	0.315					16.9
160	0.160					10.4
80	0.080					5.8

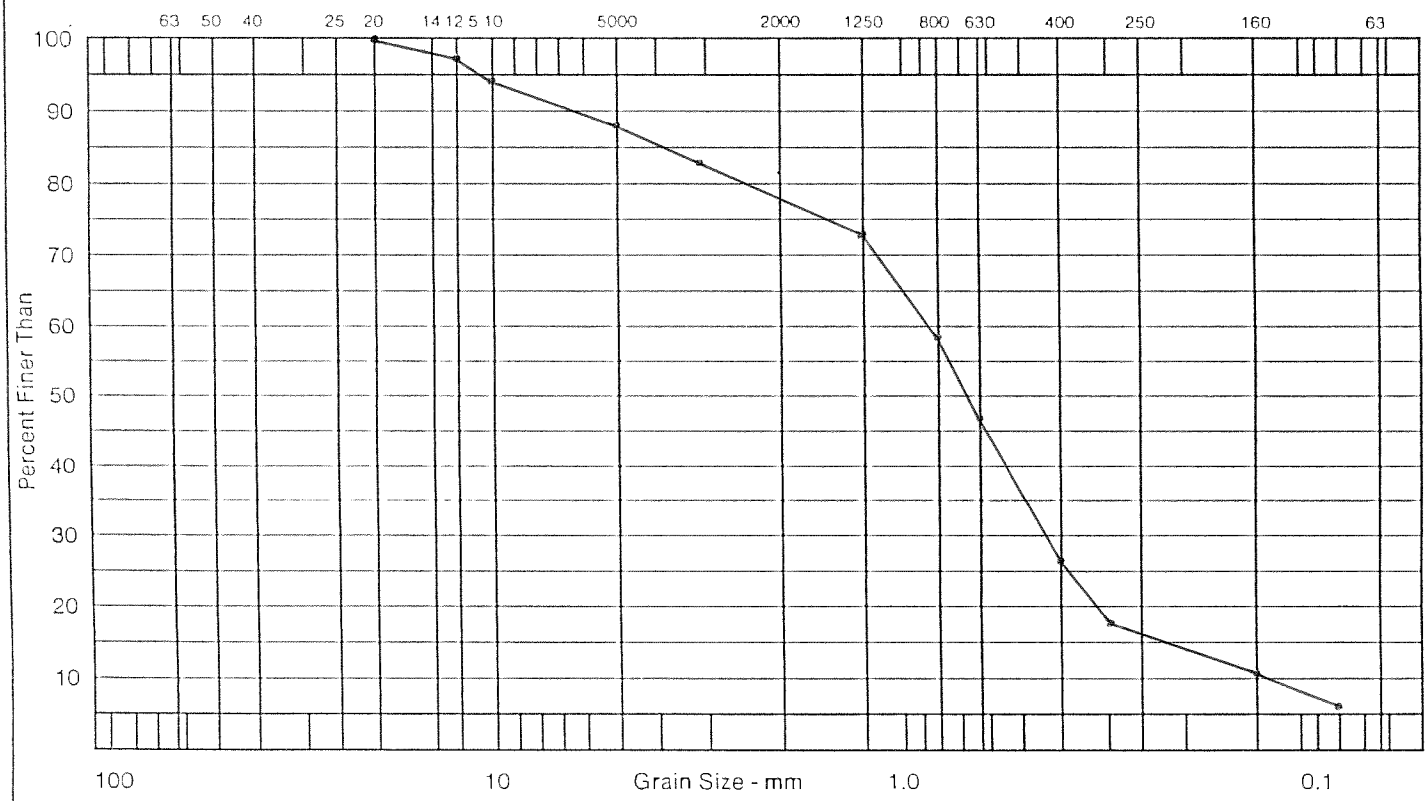
Description of Sample: Sand, some gravel, trace of silt, SW

Time of Sieving: Min. 15

Method of Preparation: Dry: Washed: X

Remarks:

Moisture: 17.7 %
Gravel: 11.3 %
Sand: 83.9 %
Silt: 5.8 %



HOGGAN ENGINEERING & TESTING (1980) LTD.

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3051 Parsons Road, Edmonton, Alberta T6N 1C8

SCREEN ANALYSIS

Client: YTG, Transportation Engineering
Project: Freegold Road Access Routes
Sample: 150 Depth:
Location: TH # 96-94
Made by: MB/RK Job No.: 8002-232
Ck'd by: Date: 1994/10/31 & 11/04

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					
25,000	25.0					
20,000	20.0					
12,500	12.5					
10,000	10.0					
5,000	5.0					100.0
2500	2.5					99.6
1,250	1.25					96.8
800	0.800					87.5
630	0.630					75.0
400	0.400					42.0
315	0.315					28.1
160	0.160					13.5
80	0.080					7.5

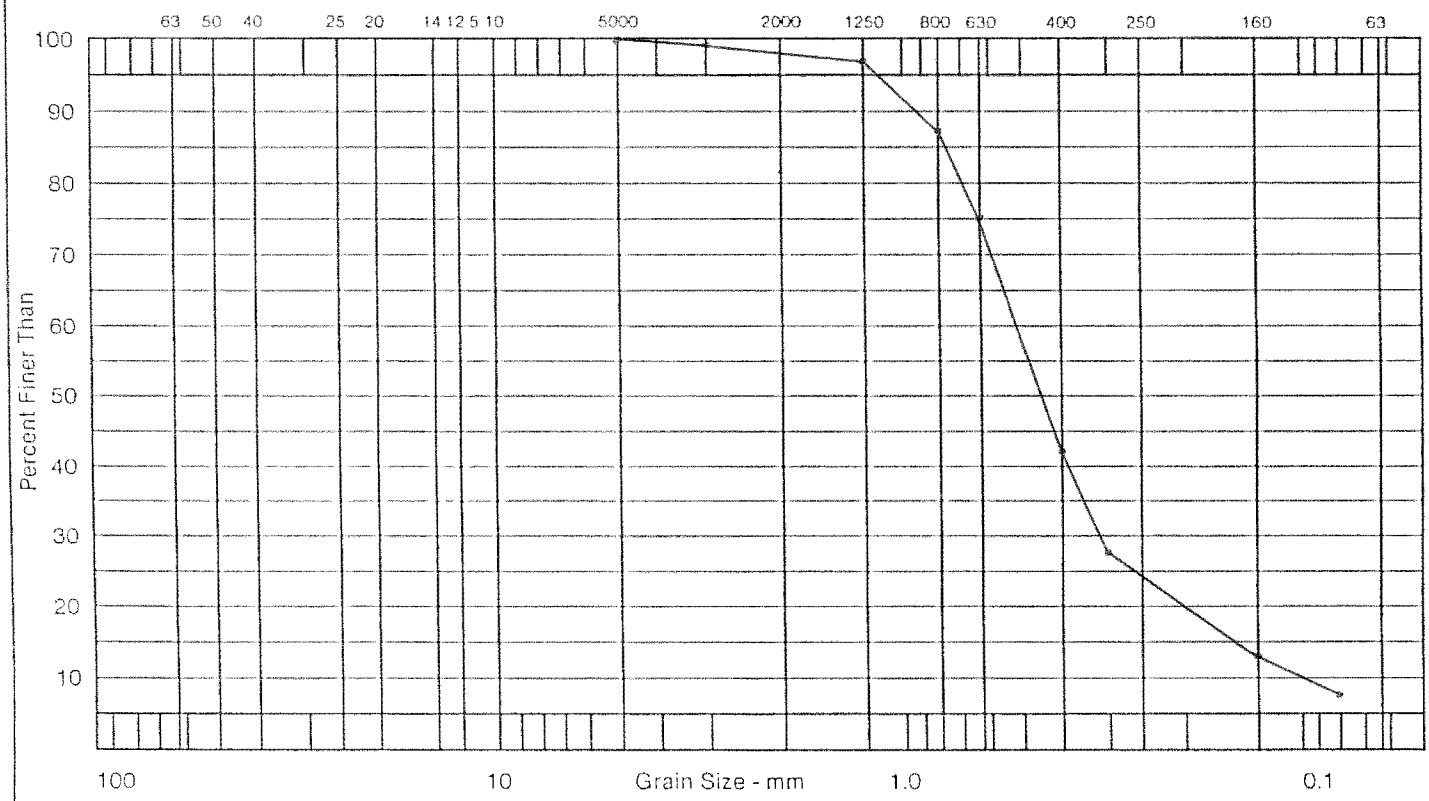
Description of Sample: Sand, Trace of Silt, SP

Method of Preparation: Dry: Washed: X

Remarks:

Moisture: 20.2 %
Gravel: 0.0 %
Sand: 92.5 %
Silt: 7.5 %

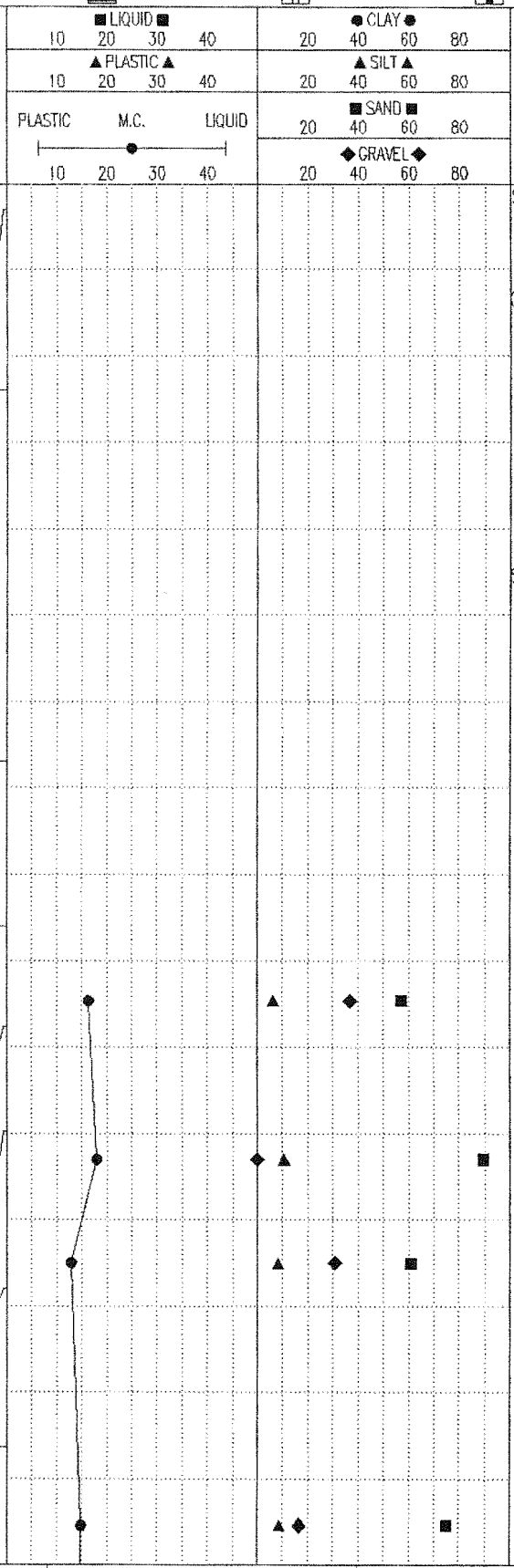
Time of Sieving: Min. 15



YTG, Transportation Engineering Branch	Freegold Road Access Routes	BOREHOLE No: TH#38-94
Ibex Contracting Ltd., CME 75 rig using	Nordenskiold Bridge area - see site	Project No: 8002-232
both hollow stem and solid stem augers	sketch for location of TH#38-94	ELEVATION: 0.000 (m)

SAMPLE TYPE ■ TUBE ⊘ LOST ⊠ AUGER ▤ BULK ▥ SPT ▮ CORE

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	SPT(N)	SOILS DESCRIPTION	USC	SOIL SYMBOL	DEPTH (m)
0.0				SAND -fine grained, trace of silt, damp	SP-SM		0.0
				0.15m SANDY GRAVEL -some silt, fine to medium grained sand sizes, medium dense, damp, light brown	GW-GM		
1.0							1.0
				1.2m SILTY GRAVELLY SAND -fine to medium grained sand sizes, clean, coarse grained sand lenses damp			
2.0					SW-SM		2.0
3.0							3.0
				COBBLE AND BOULDER STRATUM -cobbles and boulders make drilling very difficult between 3.3 and 4.3 metres	GP		
4.0				4.3m			4.0
		152	38	SILTY GRAVELLY SAND -fine to medium grained sand sizes, clean, wet (water table occurs at 4.3m)	SW		
5.0				4.9m GRAVEL -poorly graded, auger action indicates possible cobble presence, wet	GP		5.0
		153		5.5m			
6.0		154	31	GRAVELLY SAND -trace silt, very dense, coarse grained sand, wet, oxidation throughout, rusty brown in colour	SW		6.0
				6.4m COBBLE LAYER -difficult drilling	GP		
7.0							7.0
				7.3m			
		155	31	GRAVELLY SAND -trace silt, coarse grained sand, moist to wet, very dense, oxidation, rounded	SW		
8.0							8.0



J. R. PAINE & ASSOCIATES Edmonton, Alberta	LOGGED BY: MB	COMPLETION DEPTH: 9.4 m
	REVIEWED BY: WCK	COMPLETE: 94/10/21
	Fig. No:	Page 1 of 2

YTG, Transportation Engineering Branch	Freegold Road Access Routes	BOREHOLE No: TH#38-94
Ibex Contracting Ltd., CME 75 rig using	Nordenskiold Bridge area - see site	Project No: 8002-232
both hollow stem and solid stem augers	sketch for location of TH#38-94	ELEVATION: 0.000 (m)

SAMPLE TYPE: TUBE | LOST | AUGER | BULK | SPT | CORE

SOILS DESCRIPTION

LIQUID 10 20 30 40 | CLAY 20 40 60 80
PLASTIC 10 20 30 40 | SILT 20 40 60 80
PLASTIC M.C. LIQUID | SAND 20 40 60 80
10 20 30 40 | GRAVEL 20 40 60 80

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	SPT(N)	USC	SOIL SYMBOL	DEPTH (m)
8.0						8.0
				SW		
				GP		
9.0				GW-SW		9.0
		156	41			
10.0						10.0
11.0						11.0
12.0						12.0
13.0						13.0
14.0						14.0
15.0						15.0
16.0						16.0

gravel, quartz-like sand particles

8.2m

COBBLE LAYER
-difficult drilling

8.5m

SANDY GRAVEL to GRAVELLY SAND
-trace silt, wet, well graded, oxidation throughout, very dense

9.45m

REFUSAL @ 9.45 m POSSIBLY DUE TO DENSE COBBLE AND BOULDER LAYER

NOTE: -TH#37-94 drilled 3 m west of TH#38-94 with refusal at 2.13 m
-once the cobble and boulder stratum was penetrated, hollow stem augers were employed
-TH#38-94 located 1 metre east of TH# 2-94

J. R. PAINE & ASSOCIATES
Edmonton, Alberta

LOGGED BY: MB	COMPLETION DEPTH: 9.4 m
REVIEWED BY: WCK	COMPLETE: 94/10/21
Fig. No:	Page 2 of 2

HOGGAN ENGINEERING & TESTING (1980) LTD.

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3051 Parsons Road, Edmonton, Alberta T6N 1C8

SCREEN ANALYSIS

Client: YTG, Transportation Engineering

Sample: 152 Depth: Project: Freegold Road Access Routes

Location: TH # 38-94 Made by: MB/RK Job No.: 8002-232

Ck'd by: Date: 1994/10/31 & 11/04

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					100.0
25,000	25.0					99.4
20,000	20.0					86.9
12,500	12.5					77.3
10,000	10.0					72.1
5,000	5.0					63.2
2500	2.5					49.4
1,250	1.25					35.5
800	0.800					29.3
630	0.630					26.3
400	0.400					20.5
315	0.315					17.4
160	0.160					11.3
80	0.080					6.1

Description of Sample: Gravelly Sand, Trace of Silt, SW

Time of Sieving: Min. 15

Method of Preparation: Dry Washed X

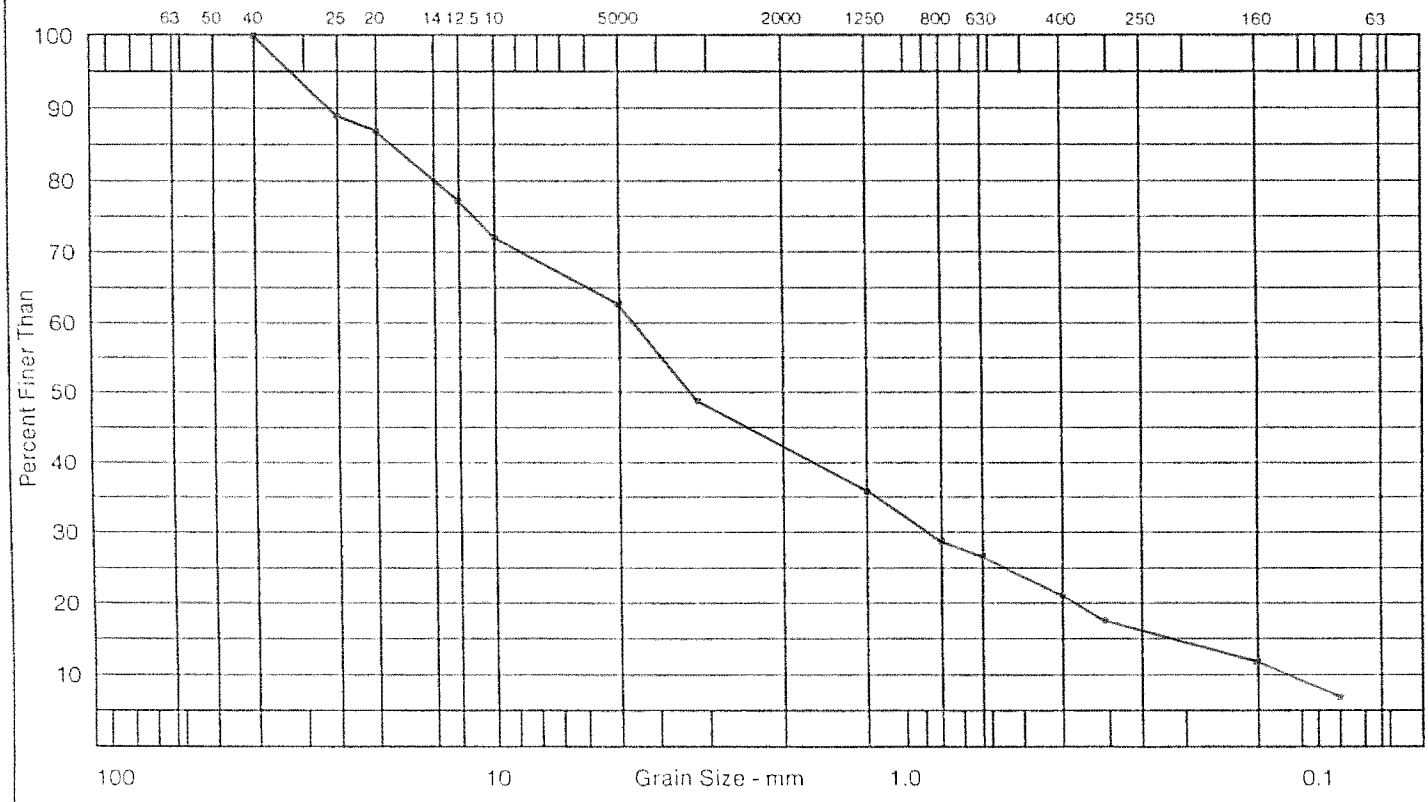
Remarks:

Moisture: 16.4 %

Gravel: 36.9 %

Sand: 57.1 %

Silt: 6.1 %



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SCREEN ANALYSIS

Client: YTG, Transportation Engineering
Project: Freegold Road Access Routes
Sample: 153 Depth:
Location: TH # 38-94
Made by: MB/RK Job No.: 8002-232
Ck'd by: Date: 1994/10/31 & 11/04

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					
25,000	25.0					
20,000	20.0					
12,500	12.5					
10,000	10.0					100.0
5,000	5.0					99.9
2500	2.5					90.2
1,250	1.25					66.0
800	0.800					52.3
630	0.630					44.7
400	0.400					30.7
315	0.315					24.9
160	0.160					15.4
80	0.080					10.3

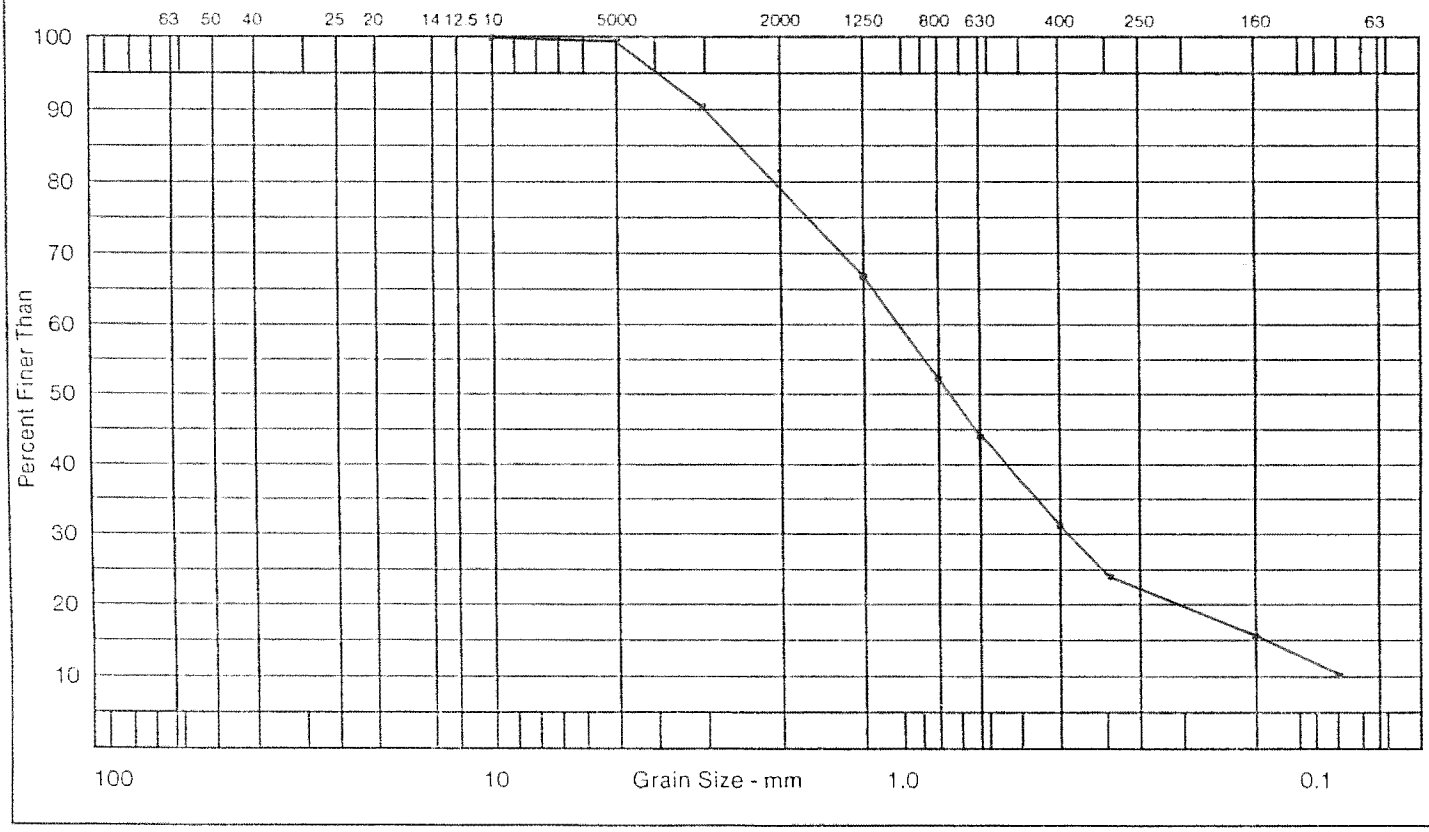
Description of Sample: Sand, some silt, SW

Time of Sieving: Min. 15

Method of Preparation: Dry: Washed: X

Remarks:

Moisture: 16.0 %
Gravel: 0.1 %
Sand: 89.6 %
Silt: 10.3 %



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SCREEN ANALYSIS

Client: YTG, Transportation Engineering
Project: Freegold Road Access Routes
Sample: 154 Depth:
Location: TH # 38-94
Made by: MB/RK Job No.: 8002-232
Ck'd by: Date: 1994/10/31 & 11/04

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					100.0
25,000	25.0					94.1
20,000	20.0					94.1
12,500	12.5					86.8
10,000	10.0					83.9
5,000	5.0					69.1
2500	2.5					55.3
1,250	1.25					47.3
800	0.800					39.2
630	0.630					34.7
400	0.400					24.8
315	0.315					19.9
160	0.160					12.5
80	0.080					8.1

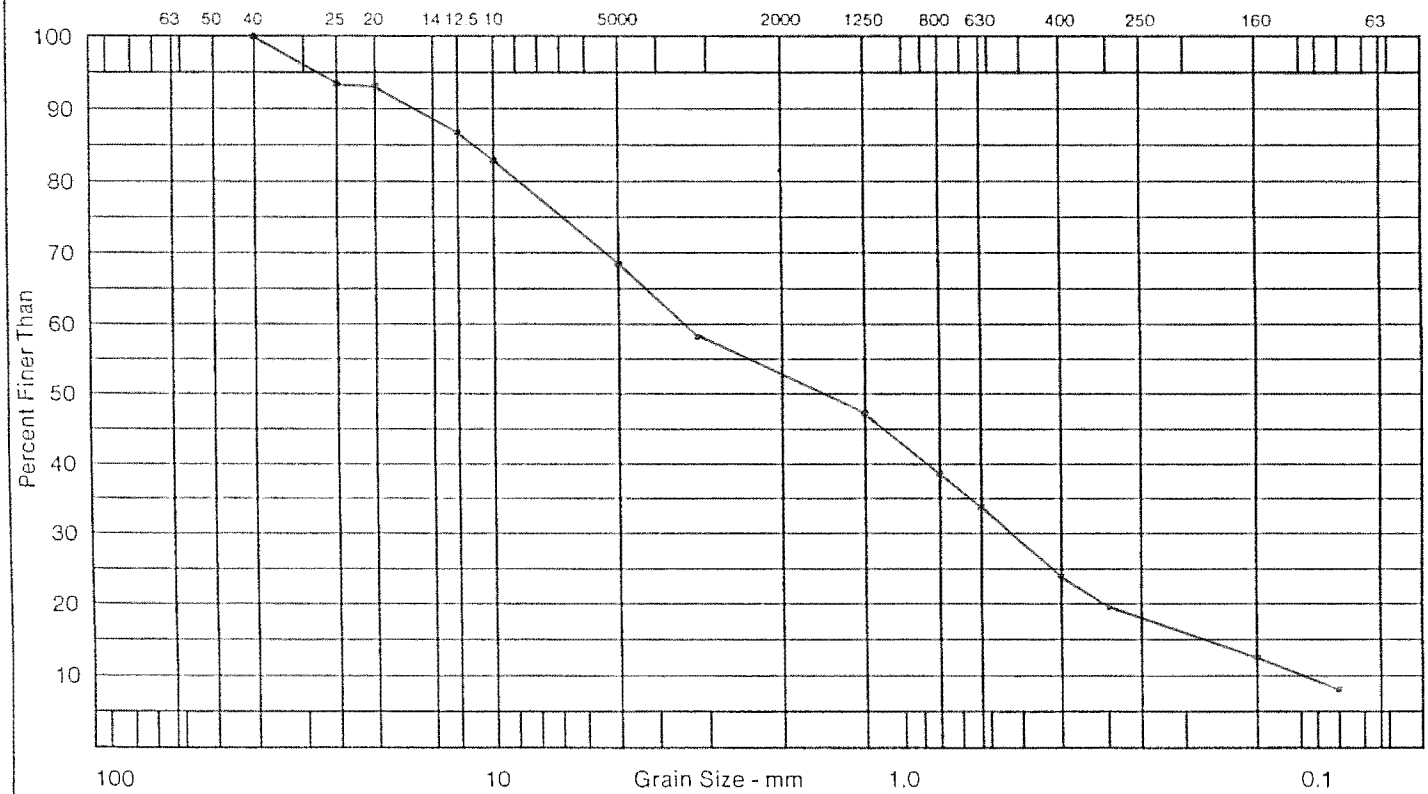
Description of Sample: Gravelly Sand, Trace of Silt, SW

Time of Sieving: Min. 15

Method of Preparation: Dry Washed X

Remarks:

Moisture: 12.9%
Gravel: 30.9%
Sand: 61.0%
Silt: 8.1%



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3051 Parsons Road, Edmonton, Alberta T6N 1C8

SCREEN ANALYSIS

Client: YTG, Transportation Engineering
Project: Freegold Road Access Routes
Sample: 155 Depth:
Location:
Made by: MB/RK Job No.: 8002-232
TH # 38-94 Ck'd by: Date: 1994/10/31 & 11/04

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					100.0
25,000	25.0					89.9
20,000	20.0					89.9
12,500	12.5					89.9
10,000	10.0					88.8
5,000	5.0					83.6
2500	2.5					69.6
1,250	1.25					47.7
800	0.800					35.3
630	0.630					29.6
400	0.400					21.0
315	0.315					17.7
160	0.160					8.6
80	0.080					8.6

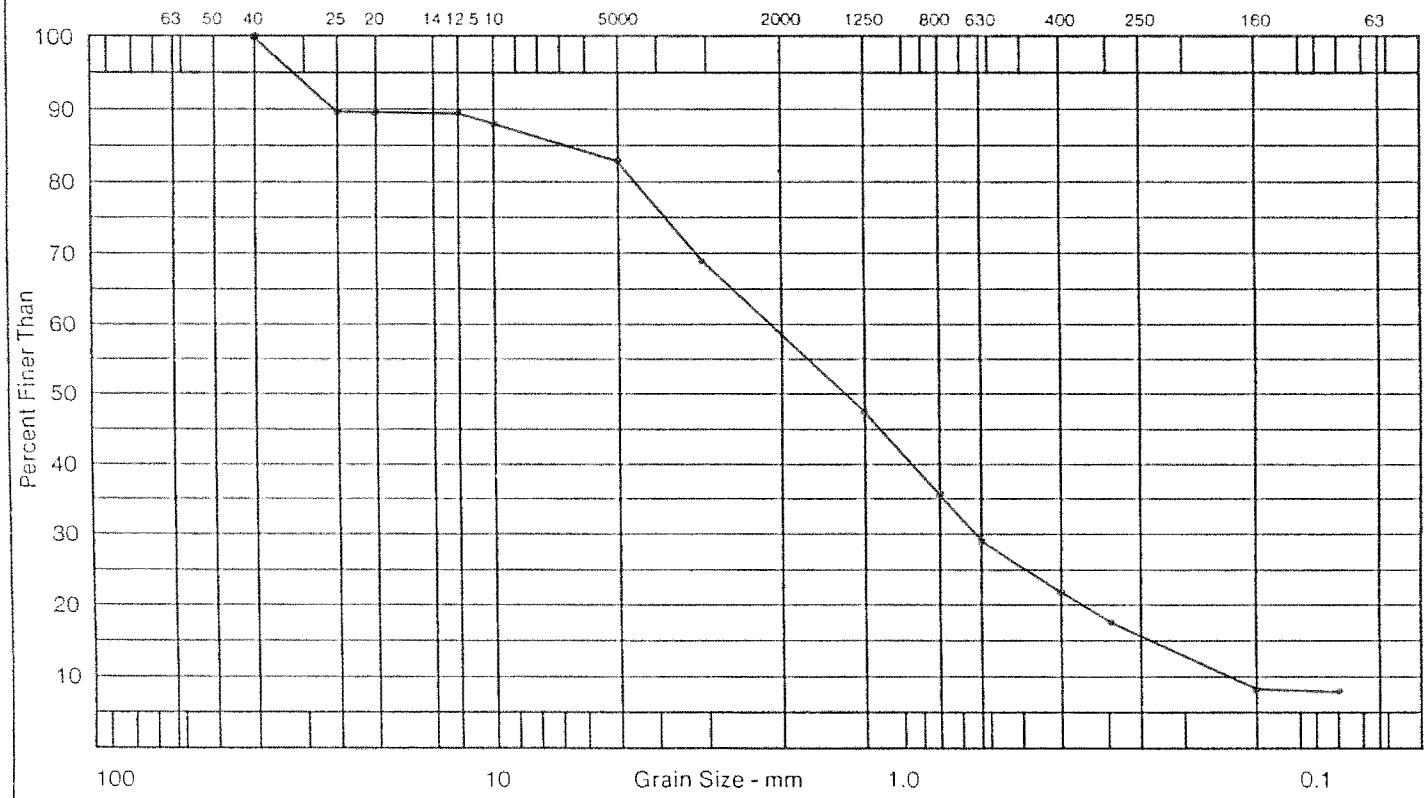
Description of Sample: Gravelly Sand, Trace of Silt, SW

Method of Preparation: Dry ____ Washed X

Remarks:

Moisture: 14.9 %
Gravel: 16.4 %
Sand: 75.0 %
Silt: 8.6 %

Time of Sieving ____ Min. 15



HOGGAN ENGINEERING & TESTING (1980) LTD.

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3051 Parsons Road, Edmonton, Alberta T6N 1C8

SCREEN ANALYSIS

Client: YTG, Transportation Engineering
Project: Freegold Road Access Routes
Sample: 156 Depth:
Location: TH # 38-94
Made by: MB/RK Job No.: 8002-232
Ck'd by: Date: 1994/10/31 & 11/04

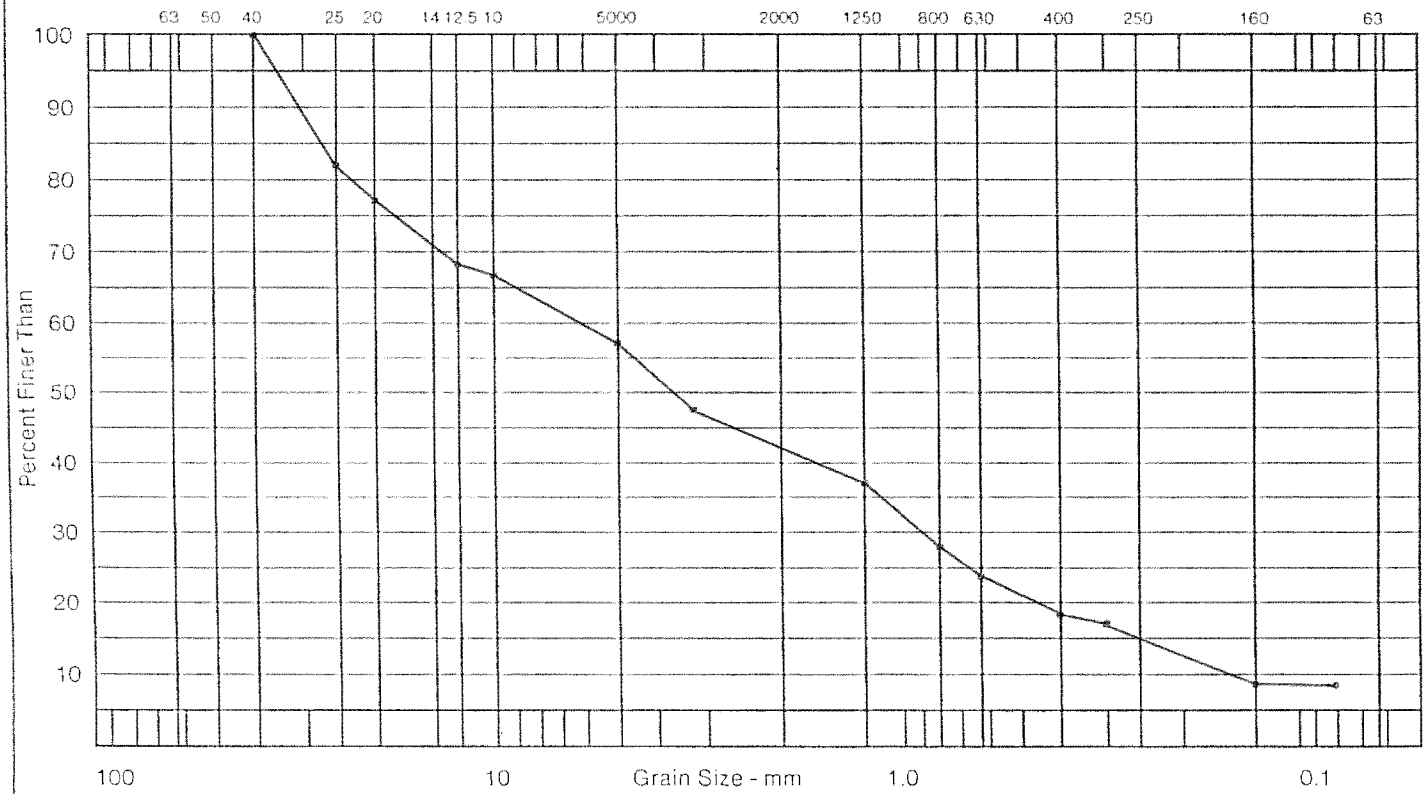
Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					100.0
25,000	25.0					81.3
20,000	20.0					76.6
12,500	12.5					68.6
10,000	10.0					66.1
5,000	5.0					56.9
2500	2.5					47.5
1,250	1.25					36.4
800	0.800					28.2
630	0.630					24.2
400	0.400					19.8
315	0.315					16.5
160	0.160					9.1
80	0.080					9.1

Description of Sample
Gravelly Sand to Sandy Gravel, Trace of Silt, SW-GW

Time of Sieving Min. 15

Method of Preparation Dry Washed X

Remarks
Moisture: 14.1 %
Gravel: 43.1 %
Sand: 47.8 %
Silt: 9.1 %



YTG, Transportation Engineering Branch	Freegold Road Access Routes	BOREHOLE No: TH#39-94
Ibex Contracting Ltd., CME 75 Truck	Nordenskiold Bridge area – see site	Project No: 8002-232
mounted rig utilizing solid stem augers	sketch for location of TH#39-94	ELEVATION: 0.000 (m)

SAMPLE TYPE ■ TUBE ⊘ LOST ⊠ AUGER ▤ BULK ▥ SPT ▮ CORE

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	SPT(N)	SOILS DESCRIPTION	USC	SOIL SYMBOL	DEPTH (m)
0.0				SILTY SAND –rich in organics, wet (precip.) 0.2m	SM		0.0
				SILTY SAND –medium grained sand, dry, brown, medium dense, trace oxidation 0.76m	SM		
1.0					SW		1.0
				GRAVELLY SAND –trace silt, medium grained sand, dry, rounded gravel, dense, oxidation 1.52m			
2.0					GP		2.0
				COBBLE AND BOULDER STRATUM –boulders present making drilling very difficult 2.74m			
3.0				SAND –coarse grained, oxidized throughout, damp, rusty brown in colour, medium dense, easy drilling, poorly graded			3.0
4.0							4.0
5.0 ▼				NOTE: free water is noted at 5.18 metres			5.0 ▼
6.0							6.0
					SW		
7.0							7.0
				–sand, some gravel			
8.0							8.0
9.0				–sand, trace silt, medium to fine grained			9.0
10.0							10.0

LIQUID 10 20 30 40 ■ | PLASTIC 10 20 30 40 ▲ | PLASTIC M.C. LIQUID 10 20 30 40 ⊢●⊣ | CLAY 20 40 60 80 ● | SILT 20 40 60 80 ▲ | SAND 20 40 60 80 ■ | GRAVEL 20 40 60 80 ◆

J. R. PAINE & ASSOCIATES
Edmonton, Alberta

LOGGED BY: MB	COMPLETION DEPTH: 16.8 m
REVIEWED BY: WCK	COMPLETE: 94/10/22
Fig. No:	Page 1 of 2

YTG, Transportation Engineering Branch	Freegold Road Access Routes	BOREHOLE No: TH#39-94
Ibex Contracting Ltd., CME 75 Truck	Nordenskiold Bridge area – see site	Project No: 8002-232
mounted rig utilizing solid stem augers	sketch for location of TH#39-94	ELEVATION: 0.000 (m)

SAMPLE TYPE ■ TUBE ⊘ LOST ⊠ AUGER ▤ BULK ▥ SPT ▮ CORE

SOILS DESCRIPTION

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	SPT(N)	SOILS DESCRIPTION
10.0				
	⊠	157		–sand, clean
11.0				
12.0	⊠	158		
13.0				
	⊠	159		
14.0				
15.0	⊠	160		–slightly more fine grained sands
16.0				
	⊠	161		
				16.8m
17.0				END OF HOLE @ 16.8 m
18.0				NOTE: –TH#39-94 in same location as TH#36-94, samples retrieved with depths greater than 10 m
19.0				
20.0				

■ LIQUID ■ 10 20 30 40
▲ PLASTIC ▲ 10 20 30 40
PLASTIC M.C. LIQUID 10 20 30 40
● CLAY ● 20 40 60 80
▲ SILT ▲ 20 40 60 80
■ SAND ■ 20 40 60 80
◆ GRAVEL ◆ 20 40 60 80

USC: SW

SOIL SYMBOL

DEPTH (m) 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0

J. R. PAINE & ASSOCIATES Edmonton, Alberta	LOGGED BY: MB	COMPLETION DEPTH: 16.8 m
	REVIEWED BY: WCK	COMPLETE: 94/10/22
	Fig. No:	Page 2 of 2

HOGGAN ENGINEERING & TESTING (1980) LTD.

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3051 Parsons Road, Edmonton, Alberta T6N 1C8

SCREEN ANALYSIS

Client: YTG, Transportation Engineering
Project: Freegold Road Access Routes
Sample: 157 Depth:
Location: TH # 39-94
Made by: MB/RK Job No.: 8002-232
Ck'd by: Date: 1994/10/31 & 11/04

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					
25,000	25.0					
20,000	20.0					
12,500	12.5					100.0
10,000	10.0					99.2
5,000	5.0					96.0
2500	2.5					86.1
1,250	1.25					69.1
800	0.800					50.3
630	0.630					36.9
400	0.400					15.1
315	0.315					9.2
160	0.160					4.0
80	0.080					2.4

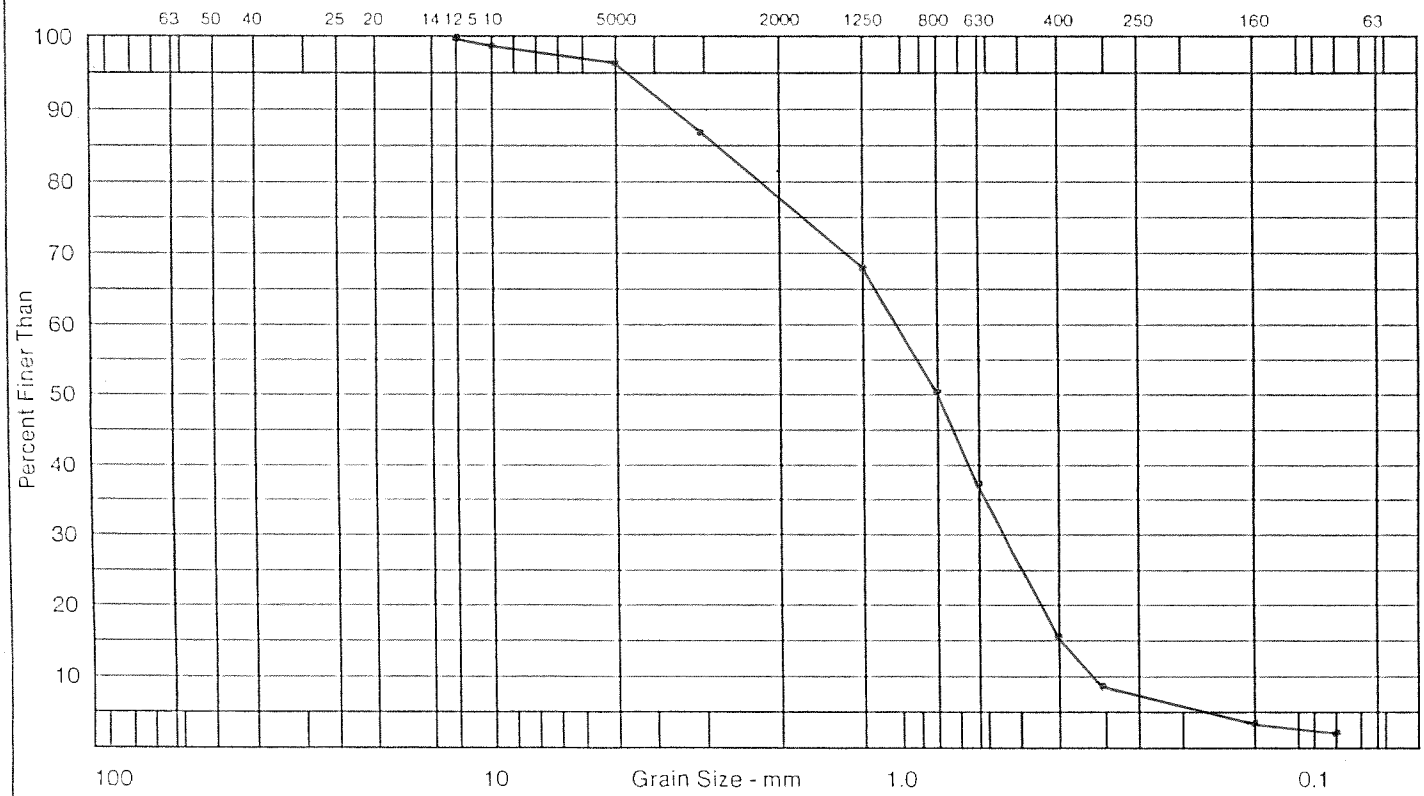
Description of Sample: Sand, SP

Time of Sieving: Min. 15

Method of Preparation: Dry: Washed: X

Remarks:

Moisture: 16.4 %
Gravel: 4.0 %
Sand: 93.6 %
Silt: 2.4 %



HOGGAN ENGINEERING & TESTING (1980) LTD.

An Affiliate of J. R. Paine & Associates Ltd.

3051 Parsons Road, Edmonton, Alberta T6N 1C8

SCREEN ANALYSIS

Client: YTG, Transportation Engineering
Project: Freegold Road Access Routes
Sample: 159 Depth:
Location: TH # 39-94
Made by: MB/RK Job No.: 8002-232
Ck'd by: Date: 1994/10/31 & 11/04

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					
25,000	25.0					
20,000	20.0					
12,500	12.5					100.0
10,000	10.0					99.8
5,000	5.0					99.8
2500	2.5					94.8
1,250	1.25					89.4
800	0.800					80.1
630	0.630					68.5
400	0.400					35.2
315	0.315					22.0
160	0.160					8.2
80	0.080					4.3

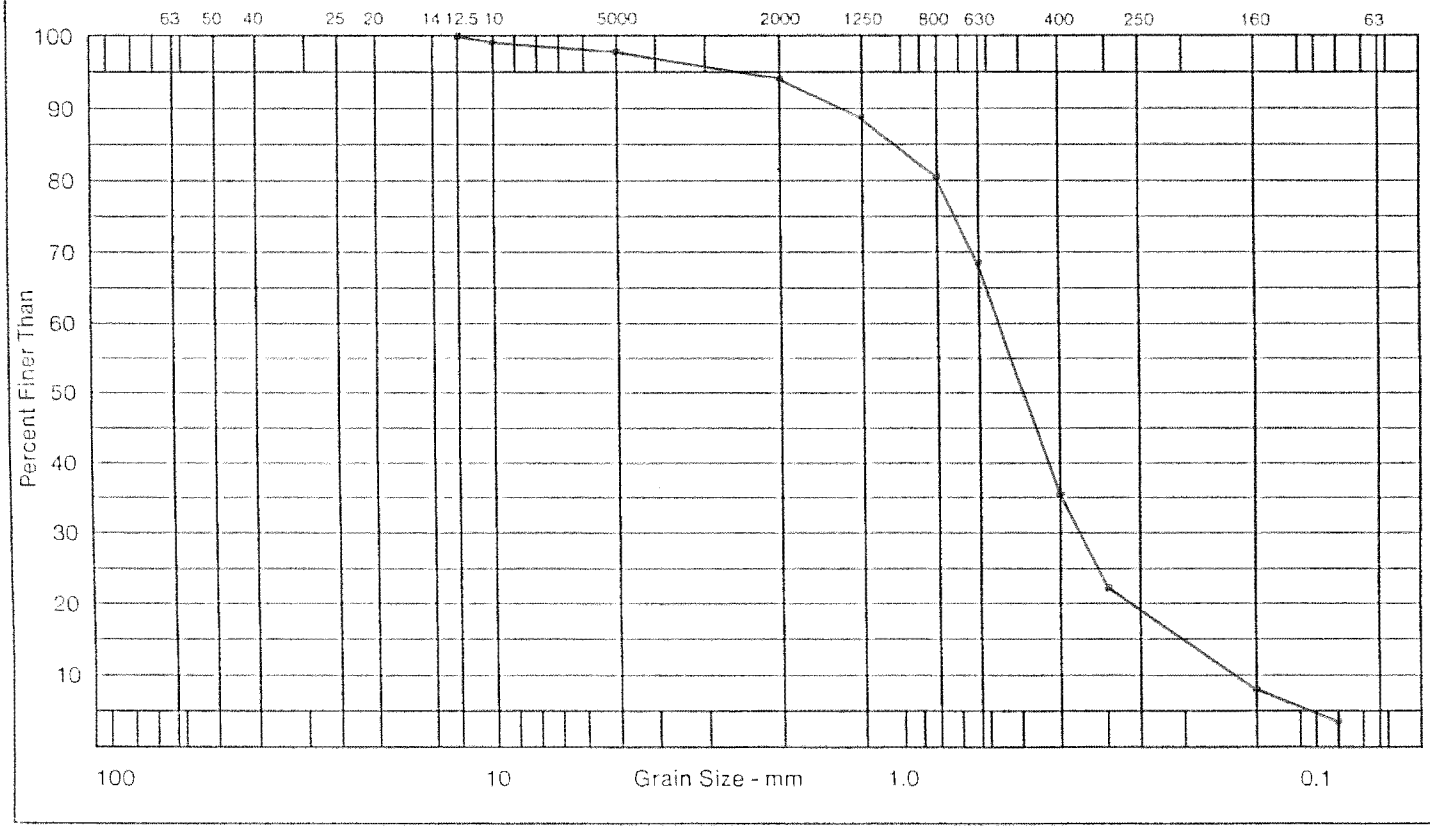
Description of Sample: Sand, SP

Time of Sieving: Min. 15

Method of Preparation: Dry: Washed: X

Remarks:

Moisture: 20.0 %
Gravel: 1.2 %
Sand: 94.5 %
Silt: 4.3 %



HOGGAN ENGINEERING & TESTING (1980) LTD.

An Affiliate of J. R. Paine & Associates Ltd.

3051 Parsons Road, Edmonton, Alberta T6N 1C8

SCREEN ANALYSIS

Client: YTG, Transportation Engineering

Sample: 159 Depth:

Project: Freegold Road Access Routes

Location: TH # 94-94

Made by: MB/RK Job No.: 8002-232

Ck'd by: Date: 1994/10/31 & 11/04

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					
25,000	25.0					
20,000	20.0					
12,500	12.5					
10,000	10.0					100.0
5,000	5.0					99.0
2500	2.5					97.6
1,250	1.25					94.9
800	0.800					56.6
630	0.630					75.5
400	0.400					45.5
315	0.315					31.4
160	0.160					14.4
80	0.080					9.7

Description of Sample: Sand, Trace of Silt, SP

Method of Preparation: Dry: Washed: X

Remarks:

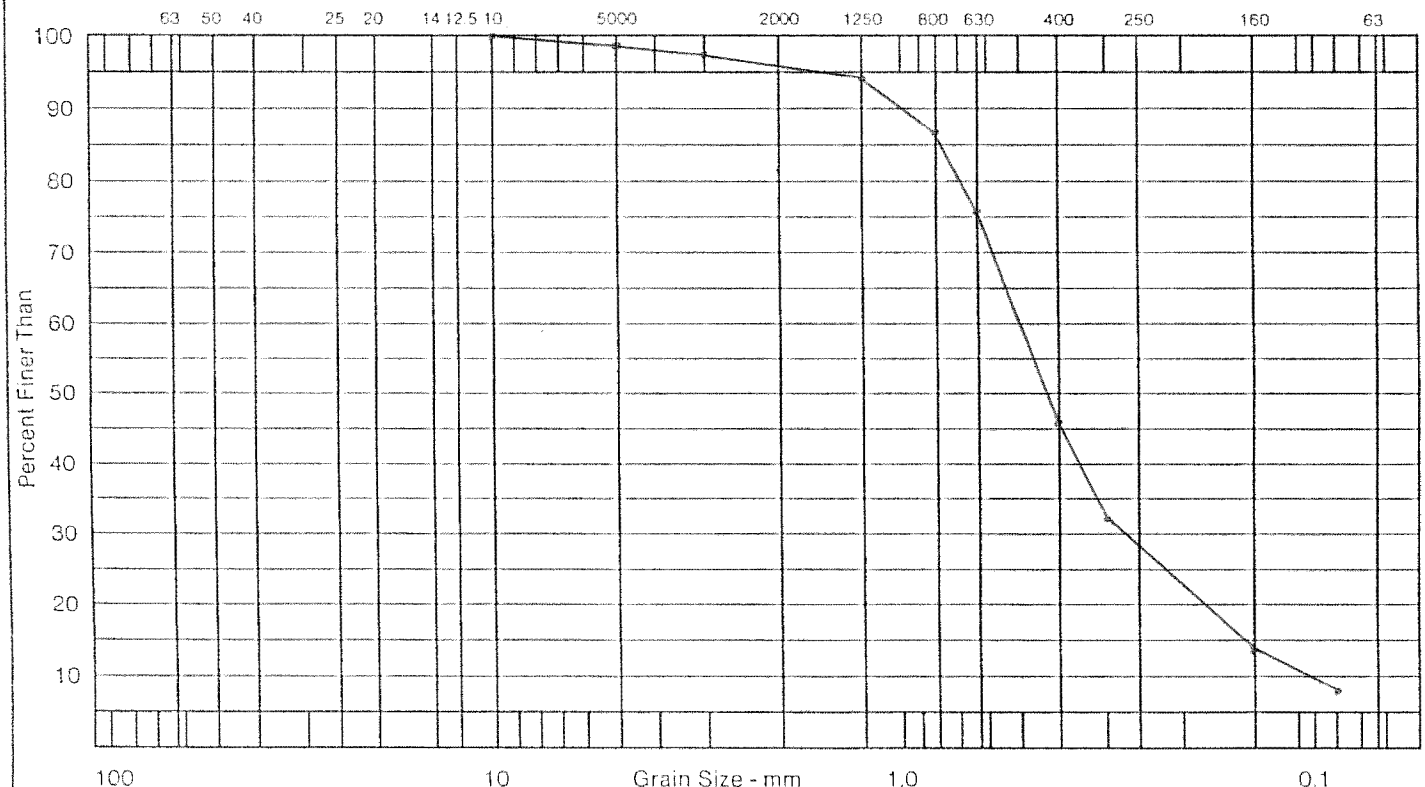
Moisture: 17.5%

Gravel: 1.0%

Sand: 90.3%

Silt: 9.7%

Time of Sieving: Min. 15



HOGGAN ENGINEERING & TESTING (1980) LTD.

An Affiliate of J. R. Paine & Associates Ltd.

3051 Parsons Road, Edmonton, Alberta T6N 1C8

SCREEN ANALYSIS

Client: YTG, Transportation Engineering

Project: Freegold Road Access Routes

Sample: 160 Depth:

Location: TH # 94-94

Made by: MB/RK Job No.: 8002-232

Ck'd by: Date: 1994/10/31 & 11/04

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					
25,000	25.0					
20,000	20.0					
12,500	12.5					100.0
10,000	10.0					99.5
5,000	5.0					99.2
2500	2.5					96.6
1,250	1.25					93.6
800	0.800					88.9
630	0.630					70.2
400	0.400					36.9
315	0.315					23.7
160	0.160					10.2
80	0.080					6.1

Description of Sample: Sand, Trace of Silt, SP

Time of Sieving Min. 15

Method of Preparation Dry Washed X

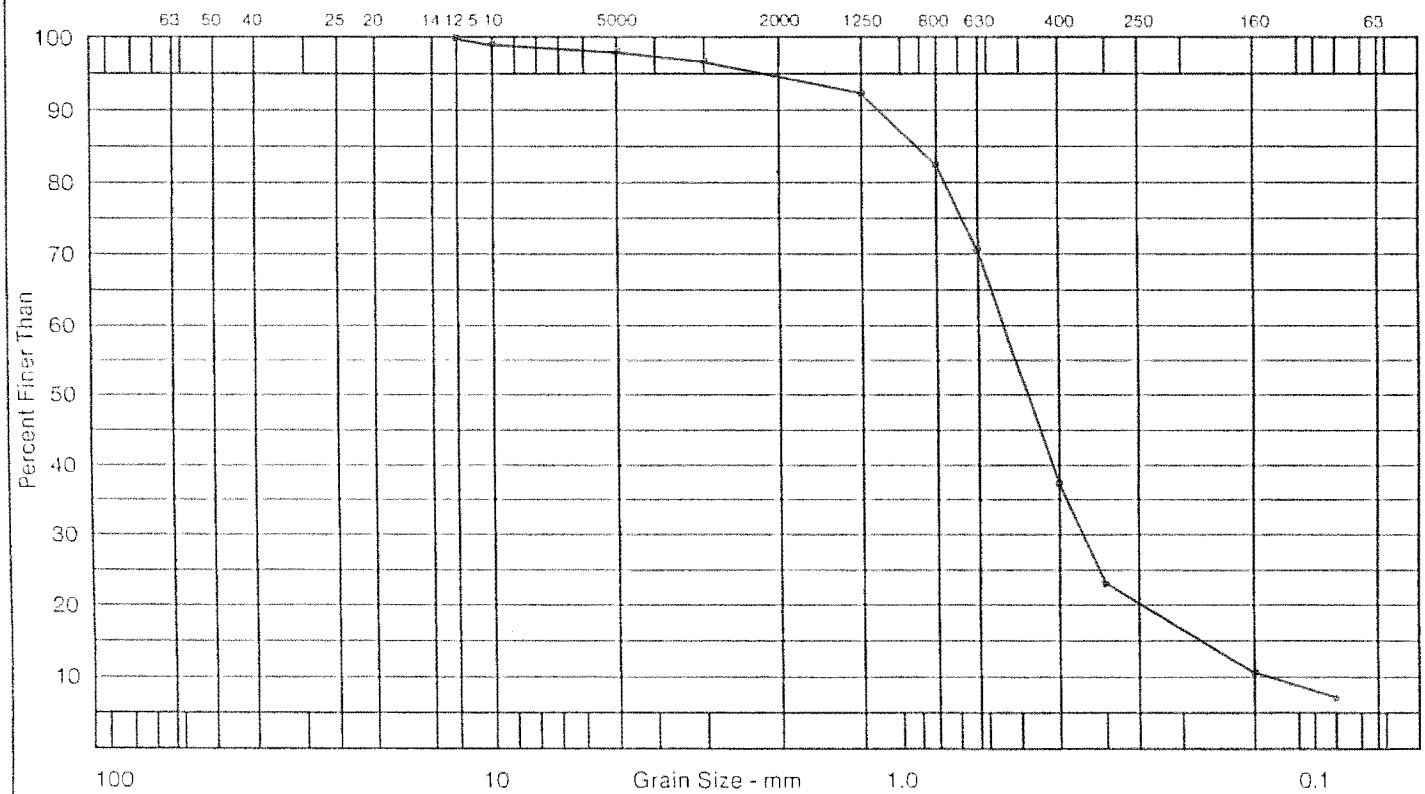
Remarks

Moisture:

Gravel:

Sand:

Silt:



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3051 Parsons Road, Edmonton, Alberta T6N 1C8

SCREEN ANALYSIS

Client: YTG, Transportation Engineering
Project: Freegold Road Access Routes
Sample: 161 Depth:
Location: TH # 39-94
Made by: MB/RK Job No.: 8002-232
Ck'd by: Date: 1994/10/31 & 11/04

Sieve No.	Size of Opening MM		Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
63,000	63.0					
50,000	50.0					
40,000	40.0					
25,000	25.0					
20,000	20.0					100.0
12,500	12.5					98.9
10,000	10.0					98.9
5,000	5.0					95.6
2500	2.5					92.8
1,250	1.25					85.8
800	0.800					74.5
630	0.630					63.6
400	0.400					34.6
315	0.315					25.1
160	0.160					10.8
80	0.080					6.1

Description of Sample: Sand, Trace of Silt, SP

Time of Sieving: Min. 15

Method of Preparation: Dry: Washed: X

Remarks:

Moisture: 18.2 %
Gravel: 4.4 %
Sand: 89.5 %
Silt: 6.1 %