



**FOUNDATION INVESTIGATION REPORT  
FOR PROPOSED  
NEW BUILDING LOCATED AT THE MINDEMOYA PATROL YARD  
AGREEMENT NO.: 5009-E-0062  
GEOCRES NO.: 41G-11  
WO 2010-11040**

**AUGUST 09, 2010  
GS-TB-011970**

**PREPARED FOR:  
MINISTRY OF TRANSPORTATION OF ONTARIO  
NORTHEASTERN REGION OFFICE  
447 MCKEOWN AVENUE, SUITE 301  
NORTH BAY, ON P1B 9S9**

3 Copies - Ministry of Transportation, North Bay, ON  
1 Copy - Ministry of Transportation, Downsview, ON  
1 Copy - DST Consulting Engineers Inc., Thunder Bay, ON

**DST CONSULTING ENGINEERS INC.  
605 Hewitson Street, Thunder Bay, Ontario P7B 5V5  
Phone: 1-807-623-2929 Fax: 1-807-623-1792**



## Table of Contents

1. INTRODUCTION .....	4
2. SITE DESCRIPTION .....	5
3. INVESTIGATION PROCEDURES AND LABORATORY TESTING.....	7
4. DESCRIPTION OF SUBSURFACE CONDITIONS .....	8
4.1 Subsurface Conditions – Proposed Building .....	8
4.1.1 Asphalt .....	8
4.1.2 Sand .....	8
4.1.3 Clay .....	8
4.1.4 Till.....	9
4.1.5 Bedrock .....	9
4.1.6 Groundwater .....	11
4.2 Subsurface Conditions – New Ditch .....	11
5. LIMITATIONS OF REPORT .....	13

### **APPENDICES**

LIMITATIONS OF REPORT .....	'A'
-----------------------------	-----

### **DRAWINGS**

BOREHOLE LOCATION PLAN .....	1
------------------------------	---

### **ENCLOSURES**

LOG OF BOREHOLES .....	1 - 31
GRAINSIZE ANALYSIS .....	32 - 34
ATTERBERG LIMITS TEST RESULTS .....	35

## List of Tables

Table 4.1	Elevation of boreholes and depth of bedrock .....	9
Table 4.2	Classification of rock mass using RQD index .....	10
Table 4.3	UCS of the bedrock predicted based of point load tests .....	11
Table 4.4	Strength classification of rock mass using UCS .....	11
Table 4.5	Elevation of hand auger boreholes and depth of bedrock .....	12

## List of Figures

Figure 2.1	Mindemoya patrol yard (facing north).....	5
Figure 2.2	Mindemoya patrol yard (facing north east).....	6
Figure 2.3	Mindemoya patrol yard location (facing south) .....	6

**FOUNDATION INVESTIGATION REPORT  
FOR PROPOSED  
NEW BUILDING LOCATED AT THE MINDEMOYA PATROL YARD  
AGREEMENT NO.: 5009-E-0062  
GEOCRES NO.: 41G-11  
WO 2010-11040**

**1. INTRODUCTION**

DST Consulting Engineers Inc. (DST) has been retained by the Ministry of Transportation, Northeastern Region, to conduct a foundation investigation for the proposed new building located at Mindemoya Patrol Yard that is located on Highway 542, on Lot 15, Concession 5, Township of Carnarvon in the Sudbury area, or the local address of 6702 Hwy 542, Mindemoya, Ontario, P0P 1S0. This work was carried out under the Agreement No. 5009-E-0062.

This report, the factual information, addresses the field investigation undertaken, laboratory test program performed and factual report on subsurface conditions encountered.

## 2. SITE DESCRIPTION

This site is mainly flat at the north end and slightly rises in elevation at the south end. Vegetation exists north and west of sides of the dome consisting of mainly grasses (Figure 2.1). A ditch (Figure 2.2) is located north, east and west of the existing dome and is at a distance of approximately 10 m from the dome.

The proposed structure has dimensions of 24.5 m × 42.5 m (80 ft × 140 ft) and will replace the existing Fitzpatrick Dome (Figure 2.3) that has been in-place for 37 years and has reached its life expectancy. The new structure will have a slightly larger foot print than the old dome and will be constructed in approximately same location as the old dome.

In this location, a geotechnical investigation was performed in 1959 for the construction of existing structure. According to that investigation, the generalized stratigraphy was identified as soil overlying bedrock varying in depth from a minimum of 0.2 m at the north end of the site to about 1.7 m at the south end. In addition, the overlying soil consisted of thick brown fine silty sandy followed by dry lighter brown fine silty sand usually with some gravel and small boulders above the bed rock. During the investigation, the water table was not detected above the bedrock and the bedrock was noted at shallow depth. It was recommended to lay the foundation directly on the bedrock.



Figure 2.1 Mindemoya patrol yard (facing north)



Figure 2.2 Mindemoya patrol yard (facing north east)



Figure 2.3 Mindemoya patrol yard location (facing south)

### **3. INVESTIGATION PROCEDURES AND LABORATORY TESTING**

Site work was carried out in the period between July 10 and July 14, 2010 utilizing a CME 750 drill rig mounted on an all terrain chassis with large floatation tires. Nine (9) boreholes were put down to depths ranging between 0.9 and 4.2 m. Seven (7) of the boreholes were drilled at the strategic locations of the building foundation and another two were drilled at the middle of the proposed building area (Drawing 1). Twenty-two (22) hand auger boreholes were put down at the north side of the proposed building, where the new ditch is expected to be excavated (Drawing 1). Boreholes were advanced with 83 mm inside diameter hollow stem augers. Advancement beyond auger refusal with diamond drilling techniques was performed in BH 2 and BH 4. Soil samples were obtained from the auger flights and from the split spoon sampler used for the standard penetration test (SPT) at intervals of 0.75 m. The rock coring was performed using 'B' size core barrels.

The soil samples were identified in the field, placed in labelled containers and transported to DST's laboratory in Thunder Bay for further analysis. The classification and index tests were subsequently performed in the laboratory on samples collected from the boreholes to aid in the selection of engineering properties. Laboratory tests included natural moisture contents, gradation and Atterberg limits on soil samples and point load tests were performed on rock cores. Laboratory test results are presented in the Borehole Logs (Enclosures 1 to 9) and in the graphical illustrations (Enclosures 32 to 34).

Ground surface elevations of boreholes and hand auger holes were surveyed by DST personnel. The elevations of the boreholes were estimated based on a field level survey based on the Bench Mark (BM) with the elevation of 213.26 m (Drawing 1). The benchmark elevation was provided by MTO.



#### **4. DESCRIPTION OF SUBSURFACE CONDITIONS**

The subsurface conditions are presented based on the information obtained during power auger drilling and hand auger drilling. The subsurface conditions are separately discussed for proposed building site and new ditch site.

##### **4.1 Subsurface Conditions – Proposed Building**

The subsurface conditions of the proposed building site are discussed based on field and laboratory testing. In this site, slightly varied stratigraphy can be found at different locations of boreholes. The generalized stratigraphy, based on the conditions at the boreholes close to the existing ditch (Boreholes 1, 2 & 6), consists of clay overlying the bedrock. However, the generalized stratigraphy, based on conditions at the other boreholes (Boreholes 3, 4, 5, 7, 8 & 9), consists of mainly sand and gravel, overlying the bedrock. It is indicated that there is a slight change in the overburden between north and south side of the site. The depth of bedrock is about 1 m, slightly uniform over the site ranging from 0.9 to 1.4 m below ground surface at the boreholes due to undulation of its surface. Details of the subsurface conditions of the site are given in the Borehole Logs (Enclosures 1 to 9). Each indentified stratigraphy is further discussed below.

###### **4.1.1 Asphalt**

A thickness of 80 mm asphalt was encountered in Borehole 3.

###### **4.1.2 Sand**

Sand with varying amount of gravel and silt was encountered in Boreholes 3, 4, 5, 7, 8 and 9. This layer varies in thickness between 0.2 and 1.2 m. SPT values are between 3 and 31 blows per 0.3 m indicating a state of variable compactness from very loose to compact. Gradation analyses conducted on samples collected at the boreholes indicate gravel, sand and fines contents of 7 to 37%, 42 to 83% and 10 to 38%, respectively. Grain size distributions are reported on the Borehole Logs (Enclosures 1 to 9) and are plotted in Enclosures 32 and 34. The moisture contents of samples range from 4 to 13%.

###### **4.1.3 Clay**

A clay material varying thickness between 0.9 and 1.2 m was encountered in Boreholes 1, 2, and 6. This clay consists of traceable amount of sand and gravel. The Atterberg limit tests were conducted

on samples from Boreholes 1, 2, 6 and 7 and are plotted in Enclosure 35. Laboratory tests on samples indicate that the clay has a liquid limit between 23 and 43% with a plasticity index between 7 and 29%, indicating low to high plasticity. SPT results between 1 and 10 blows over 0.3 m penetration. The moisture contents of samples range from 17 to 37%. Based on the moisture content and SPT results, the clay identified appears to be firm to stiff.

#### 4.1.4 Till

Till was encountered in Boreholes 4, 7, 8 and 9. The till consists of sand, gravel and fine material and it overlies immediately above the bedrock with thickness ranging from 0.2 to 0.6 m. SPT values for this till are between 10 and 31 blows per 0.3 m indicating a state of variable compactness from loose to compact. The moisture contents of the samples range from 7% to 10%.

#### 4.1.5 Bedrock

All boreholes encountered bedrock at depths varying between 0.9 and 1.4 m below existing grade. In Boreholes 2 and 4, rock coring was performed to a depth of 3 m below the rock surface. The depths of the bedrock below ground surface are provided in Table 4.1. It is expected that depth of the bedrock will vary slightly over the site due to undulation. According to the visual identification, the rock may was smooth and many fractures were noted and identified as sedimentary rock.

Table 4.1 Elevation of boreholes and depth of bedrock

Borehole I.D.	Ground elevation (m)	Bedrock depth (m)
BH 1	214.75	1.40
BH 2	214.28	1.00
BH 3	214.42	1.20
BH 4	214.33	1.20
BH 5	214.29	1.20
BH 6	214.25	0.90
BH 7	214.63	1.40
BH 8	214.42	1.30
BH 9	214.26	1.10

The rock cored was qualitatively identified in the laboratory. The Rock Quality Designation (RQD) is a qualitative estimate of rock mass quality from drill core logs. The RQD is expressed as given in Equation 4.1 (Deere et al., 1967) and Table 4.2 shows the ranges of RQD and strength classifications.

$$RQD = \frac{\sum \text{Length of core pieces} > 10 \text{ cm length}}{\text{Total length of core run}} \quad \text{Equation 4.1}$$

Table 4.2 Classification of rock mass using RQD index

RQD (%)	Rock quality
0 - 25	Very Poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

The measured RQDs of bedrock based on the Boreholes 2 and 4 are in the range between 33 and 45% and these values indicate a “poor” quality of rock quality underneath the proposed building.

In order to classify the bedrock with respect to strength, two point load tests were conducted on selected core samples. Estimated Uniaxial Compressive Strengths (UCS) from point load tests at Boreholes 2 and 4 are given in Table 4.3. In the estimation of UCS, the conversion factor of 16 was taken in the calculation (Smith, 1997). The bedrock is classified as “Medium” strength using strength classification given in Table 4.4.

Table 4.3 UCS of the bedrock predicted based of point load tests

Borehole I.D	Load (kN)	Corrected point load strength index, $I_{50}$ (MPa)	Estimated Uniaxial Compressive Strength, UCS (MPa)
2	11.3	4.5	70
4	8.4	3.4	55

Table 4.4 Strength classification of rock mass using UCS

UCS (MPa)	Strength classification
1-5	Very Low
5-25	Low Strength
25-50	Moderate
50-100	Medium
100-250	High
250-700	Very High

#### 4.1.6 Groundwater

At the time of the field investigation, the groundwater was not encountered in any of the boreholes. However, groundwater levels can be expected to vary with season and precipitation events. It is likely that a water table above the bedrock surface will occur at times, potentially as high as close to ground surface.

#### 4.2 Subsurface Conditions – New Ditch

The general stratigraphy consists of clay, organics or fills overlying variable strata of clay that in turn are underlain by bedrock. The depths to refusal at each hand auger borehole are tabulated in Table 4.5. This may represent cobbles, boulders or bedrock. Enclosures 10 to 31 show the subsurface condition based on hand auger boreholes.

Table 4.5 Elevation of hand auger boreholes and depth of bedrock

Hand borehole I.D.	Ground elevation (m)	Refusal depth (m)
HA 1	214.93	1.40
HA 2	214.70	1.20
HA 3	214.63	1.10
HA 4	214.47	1.20
HA 5	214.84	1.40
HA 6	214.69	1.30
HA 7	214.62	1.20
HA 8	214.50	1.00
HA 9	214.37	1.10
HA 10	214.27	0.70
HA 11	214.87	1.10
HA 12	214.59	1.10
HA 13	214.46	0.90
HA 14	214.38	0.90
HA 15	214.28	1.00
HA 16	214.26	1.00
HA 17	214.91	1.50
HA 18	215.10	1.70
HA 19	214.08	0.90
HA 20	214.15	0.60
HA 21	215.39	1.50
HA 22	214.15	1.00

## 5. LIMITATIONS OF REPORT

A description of limitations which are inherent in carrying out site investigation studies is given in Appendix 'A', and this forms an integral part of this report.

For DST CONSULTING ENGINEERS INC.

Prepared by:



Loges Paramaguru  
Geotechnical Specialist

Prepared by:

Kerrie Fabius, P.Eng  
Project Engineer



Reviewed by:



Dr. M W Bo, PhD. P. Eng P.Geo C.Geol, C. Eng, Eur Geol, Eur Eng,  
Director (GeoServices)



Mike Fabius, P. Eng.  
Principal

**APPENDIX 'A'**  
**LIMITATIONS OF REPORT**

# **LIMITATIONS OF REPORT**

## **GEOTECHNICAL STUDIES**

The data, conclusions and recommendations which are presented in this report, and the quality thereof, are based on a scope of work authorized by the Client. Note that no scope of work, no matter how exhaustive, can identify all conditions below ground. Subsurface and groundwater conditions between and beyond the testholes may differ from those encountered at the specific locations tested, and conditions may become apparent during construction which were not detected and could not be anticipated at the time of the site investigation. Conditions can also change with time. It is recommended practice that DST Consulting Engineers be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the testholes. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the testhole locations and should not be used for other purposes, such as grading, excavation, planning, development, etc.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with details stated in this report. Since all details of the design may not be known, we recommend that we be retained during the final stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid.

Unless otherwise noted, the information contained herein in no way reflects on environmental aspects of either the site or the subsurface conditions.

The comments given in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of testholes may not be sufficient to determine all the factors that may affect construction methods and costs, e.g. the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusion as to how the subsurface conditions may affect their work.

Any results from an analytical laboratory or other subcontractor reported herein have been carried out by others, and DST Consulting Engineers Inc. cannot warranty their accuracy. Similarly, DST cannot warranty the accuracy of information supplied by the client.



# **DRAWINGS**

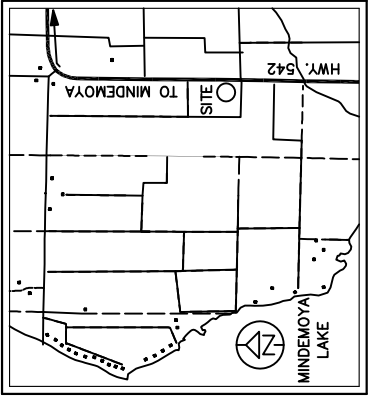
PLATE No  
659-542/31-0  
DRAWING NO.  
06590542031  
CONT No  
5009-0062  
WO No  
2002-50-008

Mindemoya Patrol Yard  
STA 23+020 TO STA 23+120  
Survey 2002/05 Revised

SHEET

METRIC  
DIMENSIONS ARE IN METRES  
AND / OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

KEY PLAN

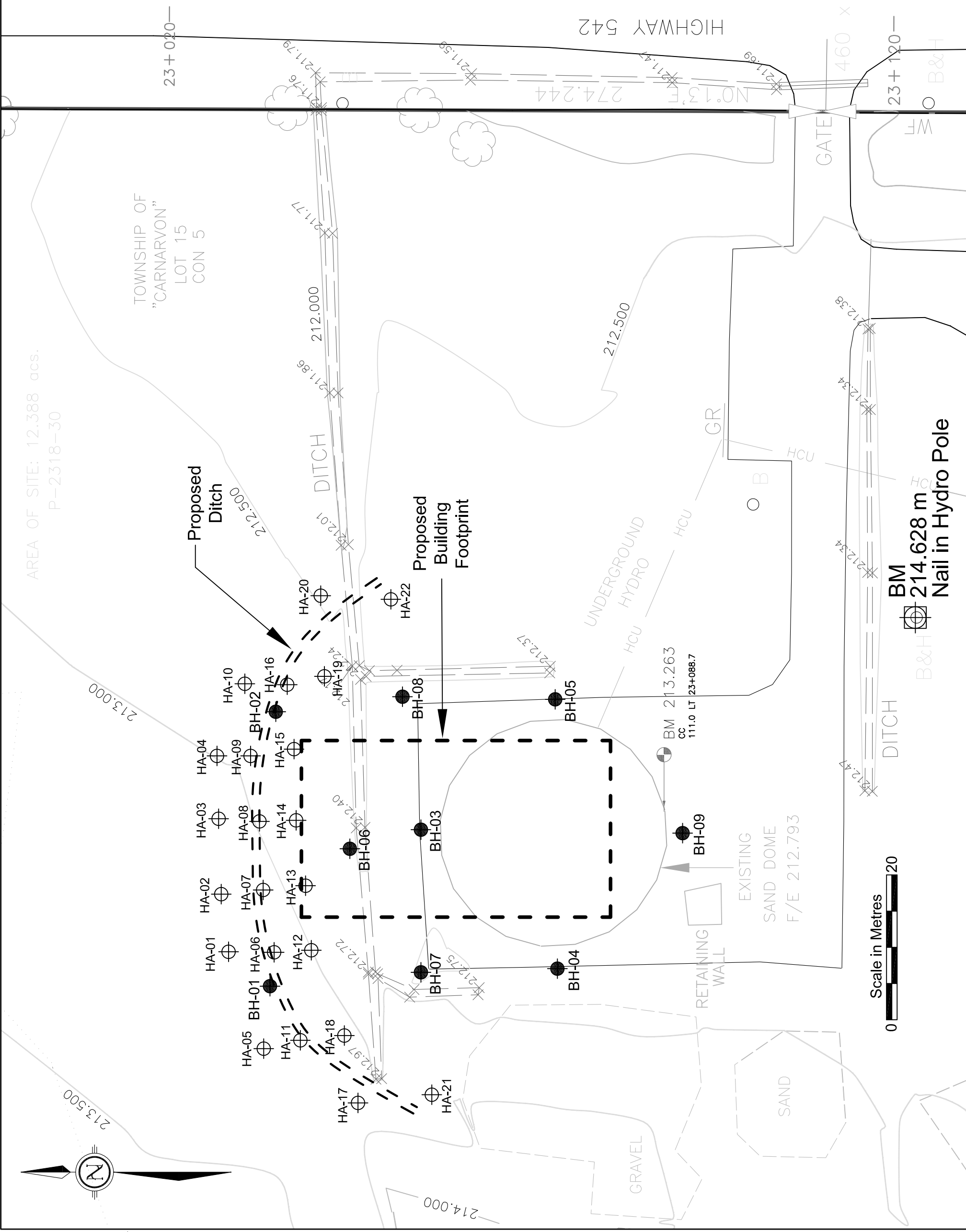


LEGEND			
	Borehole - Deep		Northing
	Borehole - Shallow		Easting
	Borehole with CPT		
	Rock Probe		
	Blows/0.3m (Std. Pen Test, 475 J/Blow)		
	Water level at time of Investigation.		

No.	Elevation	Northing	Easting
BH-01	214.753	5064100	407003
BH-02	214.233	5064099	407004
BH-03	214.333	5064098	407005
BH-04	214.333	5064060	407005
BH-05	214.293	5064060	407042
BH-06	214.253	5064088	407022
BH-07	214.633	5064079	407005
BH-08	214.633	5064081	407005
BH-09	214.263	5064081	407023
HA-01	214.933	5064106	407088
HA-02	214.698	5064106	407016
HA-03	214.633	5064106	407027
HA-04	214.473	5064107	407035
HA-05	214.633	5064106	407035
HA-06	214.633	5064106	407035
HA-07	214.618	5064100	407017
HA-08	214.503	5064101	407026
HA-09	214.373	5064102	407035
HA-10	214.273	5064103	407040
HA-11	214.586	5064096	407036
HA-12	214.588	5064095	407036
HA-13	214.463	5064095	407018
HA-14	214.378	5064096	407026
HA-15	214.283	5064096	407036
HA-16	214.263	5064097	407045
HA-17	214.586	5064096	407036
HA-18	215.088	5064096	406996
HA-19	214.083	5064092	407046
HA-20	214.053	5064092	407057
HA-21	215.393	5064088	406988
HA-22	214.153	5064082	407056

NOTE:  
The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed by interpolation and may not represent actual conditions.

DST Consulting Engineers Inc.  
605 Hewitson Street  
Thunder Bay, ON P7B 5V5  
Ph: (807) 623-2929  
Fx: (807) 623-1792  
Email: thunderbay@dstgroup.com




# **ENCLOSURES**

# RECORD OF BOREHOLE No BH-01

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064100 m N, 407003 m E) ORIGINATED BY KS  
 DIST                      HWY 542 BOREHOLE TYPE Hollow Stem Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 10 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
						20 40 60 80 100 ○ UNCONFINED    ✕ FIELD VANE □ QUICK TRIAXIAL    ★ LAB VANE					20 40 60 WATER CONTENT (%)						
214.8	GROUND SURFACE																
	CLAY - Silty, some organics, brown, firm		SS1	SS	7												
	----- - layered silty clay and clayey silt, brown/grey		SS2	SS	7												
213.4			SS3	SS	28												
1.4	End of Borehole at 1.35 m Auger Refusal																28 blows for 120 mm (Blow counts stopped. Auger Bouncing)

✕<sup>3</sup>, ★<sup>3</sup>: Numbers refer to Sensitivity    ○ 3% STRAIN AT FAILURE

ENCLOSURE 1

ON\_MOT\_CS-TB-011970 - MTO COCHRANE - 5009-0062 #4 - MINDEMOYA PATROL YARD.GPJ DST\_MIN.GDT 9/8/10

# RECORD OF BOREHOLE No BH-02

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064099 m N, 407041 m E) ORIGINATED BY KS  
 DIST HWY 542 BOREHOLE TYPE Hollow Stem Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 12 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT  w <sub>p</sub>	NATURAL MOISTURE CONTENT  w	LIQUID LIMIT  w <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)	
								○ UNCONFINED □ QUICK TRIAXIAL	✕ FIELD VANE ★ LAB VANE							
214.3	GROUND SURFACE							20 40 60 80 100								
	CLAY - Silty, layered, trace sand and gravel, brown, very soft		AS1	AS										Borehole Dry on Completion		
			SS2	SS	1											
213.3																
1.0	BEDROCK															
	RC1 TCR 1.53 m - 100% RQD 1.45 m - 33%		RC1	RC												

ON\_MOT\_CS-TB-011970 - MTO COCHRANE - 5009-0062 #4 - MINDEMOYA PATROL YARD.GPJ DST\_MIN.GDT 9/8/10

✕<sup>3</sup>, ★<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE



ENCLOSURE 2

**RECORD OF BOREHOLE No BH-03**

1 OF 1

**METRIC**

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064077 m N, 407023 m E) ORIGINATED BY KS  
DIST                      HWY 542 BOREHOLE TYPE Hollow Stem Auger COMPILED BY ML  
DATUM Geodetic DATE 2010 07 12 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
						20 40 60 80 100 ○ UNCONFINED    ✕ FIELD VANE □ QUICK TRIAXIAL    ★ LAB VANE					WATER CONTENT (%)						
						20 40 60 80 100					20 40 60						
214.4	GROUND SURFACE																
214.3	ASPHALT - 80 mm																
0.1	SAND & GRAVEL - Silty, brown, loose to compact		SS1	SS	8												
	----- - trace clay		SS2	SS	28												
213.2	End of Borehole at 1.24 m Auger Refusal															18 blows for 100 mm (Blow counts stopped. Auger Bouncing)	

✕<sup>3</sup>, ★<sup>3</sup>: Numbers refer to Sensitivity    ○ 3% STRAIN AT FAILURE

**ENCLOSURE 3**

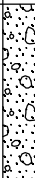


ON\_MOT\_CS-TB-011970 - MTO COCHRANE - 5009-0062 #4 - MINDEMOYA PATROL YARD.GPJ DST\_MIN.GDT 9/8/10

# RECORD OF BOREHOLE No BH-04

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064060 m N, 407005 m E) ORIGINATED BY KS  
 DIST HWY 542 BOREHOLE TYPE Hollow Stem Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 12 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								20 40 60 80 100										20 40 60		
214.3	GROUND SURFACE																GR SA SI CL			
	SAND & GRAVEL - Silty, brown, compact		SS1	SS	16		214										Borehole Dry on Completion			
213.7	- Silty Clay, some sand and gravel - 50 mm		SS2	SS	31												6 57 (37)			
0.6	TILL - Sand, gravelly, silty, trace clay, brown, compact																			
213.1	BEDROCK						213										17 blows for 100 mm (Blow counts stopped. Auger Bouncing)			
1.2	RC1 TCR 1.5 m - 100% RQD 1.45 m - 43%		RC1	RC																
	RC1 TCR 1.53 m - 100% RQD 1.45 m - 43%						212													
							211													
210.1	End of Borehole at 4.2 m																			
4.2																				

✕<sup>3</sup>, ★<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

**RECORD OF BOREHOLE No BH-05**

1 OF 1

**METRIC**

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064060 m N, 407042 m E) ORIGINATED BY KS  
 DIST                      HWY 542 BOREHOLE TYPE Hollow Stem Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 12 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	20	40	60			
214.3	GROUND SURFACE																
	SAND- Silty, trace gravel, loose		SS1	SS	10												
	----- - trace clay, occasional cobbles		SS2	SS	10												
213.0			SS3	SS	7												
1.3	End of Borehole at 1.25 m Auger Refusal															7 blows for 50 mm (Blow counts stopped. Auger Bouncing)	

ON\_MOT\_CS-TB-011970 - MTO COCHRANE - 5009-0062 #4 - MINDEMOYA PATROL YARD.GPJ DST\_MIN.GDT 9/8/10

$\times^3, \star^3$ : Numbers refer to Sensitivity  $\bigcirc$  3% STRAIN AT FAILURE



**RECORD OF BOREHOLE No BH-06**

1 OF 1

**METRIC**

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064088 m N, 407022 m E) ORIGINATED BY KS  
 DIST                      HWY 542 BOREHOLE TYPE Hollow Stem Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 12 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
						20 40 60 80 100 ○ UNCONFINED    ✕ FIELD VANE □ QUICK TRIAXIAL    ★ LAB VANE					WATER CONTENT (%)						
						20 40 60 80 100					20	40	60				
214.3	GROUND SURFACE																
	CLAY & SILT - trace sand, layered, varved, brown/grey, stiff		SS1	SS	10												
			SS2	SS	10												
213.4																	
0.9	End of Borehole at 0.85 m Auger Refusal															10 blows for 120 mm (Blow counts stopped. Auger Bouncing)	

✕<sup>3</sup>, ★<sup>3</sup>: Numbers refer to Sensitivity    ○ 3% STRAIN AT FAILURE

**RECORD OF BOREHOLE No BH-07**

1 OF 1

**METRIC**

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064079 m N, 407005 m E) ORIGINATED BY KS  
DIST                      HWY 542 BOREHOLE TYPE Hollow Stem Auger COMPILED BY ML  
DATUM Geodetic DATE 2010 07 12 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
214.6	GROUND SURFACE													
214.5	SAND & GRAVEL - Silty, brown													Borehole Dry on Completion
0.2	SAND - some gravel, brown/grey, loose		SS1	SS	8		214							6 83 (11)
213.9	CLAY & SILT - stiff		SS2	SS	14									
213.4	TILL - Sand, gravelly, silty, trace clay, brown		SS3	SS	30									14 44 (42)
1.2														
213.2														
1.4	End of Borehole at 1.4 m Auger Refusal													30 blows for 50 mm (Blow counts stopped. Auger Bouncing)

$\times^3, \star^3$ : Numbers refer to Sensitivity  $\bigcirc$  3% STRAIN AT FAILURE

**ENCLOSURE 7**

ON\_MOT\_CS-TB-011970 - MTO COCHRANE - 5009-0062 #4 - MINDEMOYA PATROL YARD.GPJ DST\_MIN.GDT 9/8/10

# RECORD OF BOREHOLE No BH-08

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064081 m N, 407043 m E) ORIGINATED BY KS  
 DIST HWY 542 BOREHOLE TYPE Hollow Stem Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 12 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT  w <sub>p</sub>	NATURAL MOISTURE CONTENT  w	LIQUID LIMIT  w <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED      ✕ FIELD VANE □ QUICK TRIAXIAL    ★ LAB VANE									
214.4	GROUND SURFACE						20	40	60	80	100						Borehole Dry on Completion
214.3	SAND & GRAVEL - Silty, some organics and asphalt, brown																
0.2	SILT & CLAY - layered, brown, stiff		SS1	SS	10												
213.8																	15 57 (28)
0.6	TILL - Sand, silty, some gravel, trace clay, brown, compact		SS2	SS	12												
213.2																	7 45 (48)
1.3	End of Borehole at 1.25 m Auger Refusal		SS3	SS	4												4 blows for 40 mm (Blow counts stopped. Auger Bouncing)

✕<sup>3</sup>, ★<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

**RECORD OF BOREHOLE No BH-09**

1 OF 1

**METRIC**

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064044 m N, 407023 m E) ORIGINATED BY KS  
 DIST                      HWY 542 BOREHOLE TYPE Hollow Stem Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 12 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								20	40	60	80	100					

$\times^3, \star^3$ : Numbers refer to Sensitivity  $\bigcirc$  3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No HA-01

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064106 m N, 407008 m E) ORIGINATED BY KS  
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	20	40	60			
214.9	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, occasional cobbles, brown CLAY - Silty, trace sand and gravel, occasional cobbles, brown																
214.8 0.1																	
213.6 1.4	End of Borehole at 1.35 m Auger Refusal on Bedrock																


$\times^3, \star^3$ : Numbers refer to Sensitivity  $\bigcirc$  3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No HA-02

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064106 m N, 407016 m E) ORIGINATED BY KS  
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT  w <sub>p</sub>	NATURAL MOISTURE CONTENT  w	LIQUID LIMIT  w <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa													
214.7	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, brown  CLAY - Silty, trace sand and gravel, brown						214	20	40	60	80	100									
214.6																					
0.1																					
213.5	End of Borehole at 1.20 m Auger Refusal on Bedrock																				
1.2																					

ON\_MOT\_CS-TB-011970 - MTO COCHRANE - 5009-0062 #4 - MINDEMOYA PATROL YARD.GPJ DST\_MIN.GDT 3/8/10

✕<sup>3</sup>, ★<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

**RECORD OF BOREHOLE No HA-03**

1 OF 1

**METRIC**

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064106 m N, 407027 m E) ORIGINATED BY KS  
DIST                      HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML  
DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>			
214.6																	
214.5	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, brown																
0.1	CLAY - Silty, trace sand and gravel, brown																
213.5																	
1.1	End of Borehole at 1.10 m Auger Refusal on Bedrock																

$\times^3, \star^3$ : Numbers refer to Sensitivity       $\bigcirc$  3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No HA-04

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064107 m N, 407035 m E) ORIGINATED BY KS  
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>			
214.5	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, brown CLAY - Silty, trace sand and gravel, brown																
214.4 0.1																	
213.3 1.2	End of Borehole at 1.15 m Auger Refusal on Bedrock																

ON\_MOT\_CS-TB-011970 - MTO COCHRANE - 5009-0062 #4 - MINDEMOYA PATROL YARD.GPJ DST\_MIN.GDT 3/8/10

$\times^3, \star^3$ : Numbers refer to Sensitivity  $\bigcirc$  3% STRAIN AT FAILURE



**RECORD OF BOREHOLE No HA-05**

1 OF 1

**METRIC**

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064100 m N, 406995 m E) ORIGINATED BY KS  
 DIST            HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>			
214.8																	
214.7	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, brown																
0.1	CLAY - Silty, trace sand and gravel, brown																
213.4																	
1.4	End of Borehole at 1.40 m Auger Refusal on Bedrock																


$\times^3, \star^3$ : Numbers refer to Sensitivity       $\bigcirc$  3% STRAIN AT FAILURE

**RECORD OF BOREHOLE No HA-06**

1 OF 1

**METRIC**

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064099 m N, 407008 m E) ORIGINATED BY KS  
 DIST            HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>			
214.7	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, brown CLAY - Silty, trace sand and gravel, occasional cobbles, brown																
214.6 0.1																	
213.4 1.3	End of Borehole at 1.30 m Auger Refusal on Bedrock																

$\times^3, \star^3$ : Numbers refer to Sensitivity       $\bigcirc$  3% STRAIN AT FAILURE

**RECORD OF BOREHOLE No HA-07**

1 OF 1

**METRIC**

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064100 m N, 407017 m E) ORIGINATED BY KS  
DIST            HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML  
DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
						20	40	60	80	100							
214.6																	
214.5	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, brown																
0.1	CLAY - Silty, trace sand and gravel, brown																
213.5																	
1.2	End of Borehole at 1.15 m Auger Refusal on Bedrock																

✕<sup>3</sup>, ★<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

**RECORD OF BOREHOLE No HA-08**

1 OF 1

**METRIC**

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064101 m N, 407026 m E) ORIGINATED BY KS  
 DIST                      HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>			
214.5																	
214.4	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, brown																
0.1	CLAY - Silty, trace sand and gravel, brown																
213.5																	
1.0	End of Borehole at 1.00 m Auger Refusal on Bedrock																

$\times^3, \star^3$ : Numbers refer to Sensitivity       $\bigcirc$  3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No HA-09

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064102 m N, 407035 m E) ORIGINATED BY KS  
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>			
214.4																	
214.3	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, brown																
0.1	CLAY - Silty, trace sand and gravel, brown																
213.3																	
1.1	End of Borehole at 1.05 m Auger Refusal on Bedrock																

ON\_MOT\_CS-TB-011970 - MTO COCHRANE - 5009-0062 #4 - MINDEMOYA PATROL YARD.GPJ DST\_MIN.GDT 3/8/10


$\times^3, \star^3$ : Numbers refer to Sensitivity  $\bigcirc$  3% STRAIN AT FAILURE

**RECORD OF BOREHOLE No HA-10**

1 OF 1

**METRIC**

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064103 m N, 407040 m E) ORIGINATED BY KS  
 DIST                      HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
						20	40	60	80	100						
214.3																
214.2	TOPSOIL - CLAY - Silty, with organics, some sand and gravel, brown															
0.1	CLAY - Silty, some sand and gravel, brown															
213.6	End of Borehole at 0.70 m Auger Refusal on Bedrock															
0.7																

$\times^3, \star^3$ : Numbers refer to Sensitivity  $\bigcirc$  3% STRAIN AT FAILURE

**RECORD OF BOREHOLE No HA-11**

1 OF 1

**METRIC**

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064096 m N, 406996 m E) ORIGINATED BY KS  
 DIST                      HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W <sub>p</sub>	W	W <sub>L</sub>		
							20	40	60	80	100						
214.9																	
214.8	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, brown																
0.1	CLAY - Silty, trace sand and gravel, brown																
213.8																	
1.1	End of Borehole at 1.10 m Auger Refusal on Bedrock																

$\times^3, \star^3$ : Numbers refer to Sensitivity       $\bigcirc$  3% STRAIN AT FAILURE

**RECORD OF BOREHOLE No HA-12**

1 OF 1

**METRIC**

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064094 m N, 407008 m E) ORIGINATED BY KS  
 DIST                      HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>			
214.6																	
214.5	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, brown																
0.1	CLAY - Silty, trace sand and gravel, occasional cobbles, brown																
213.5																	
1.1	End of Borehole at 1.05 m Auger Refusal on Bedrock																

$\times^3, \star^3$ : Numbers refer to Sensitivity       $\bigcirc$  3% STRAIN AT FAILURE



# RECORD OF BOREHOLE No HA-13

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064095 m N, 407018 m E) ORIGINATED BY KS  
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	20	40	60			
214.5	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, occasional cobbles, brown CLAY - Silty, trace sand and gravel, brown																Wet at 0.80 m
214.4 0.1																	
213.6 0.9	End of Borehole at 0.90 m Auger Refusal on Bedrock																

$\times^3, \star^3$ : Numbers refer to Sensitivity  $\bigcirc$  3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No HA-14

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064096 m N, 407026 m E) ORIGINATED BY KS  
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>			
214.4	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, occasional cobbles, brown CLAY - Silty, trace sand and gravel, brown																
214.3 0.1																	
213.5 0.9	End of Borehole at 0.90 m Auger Refusal on Bedrock																

✕<sup>3</sup>, ★<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

**RECORD OF BOREHOLE No HA-15**

1 OF 1

**METRIC**

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064096 m N, 407036 m E) ORIGINATED BY KS  
 DIST                      HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>			
214.3																	
214.2	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, occasional cobbles, brown																
0.1	CLAY - Silty, trace sand and gravel, brown																
213.3																	
1.0	End of Borehole at 1.00 m Auger Refusal on Bedrock																

ON\_MOT\_CS-TB-011970 - MTO COCHRANE - 5009-0062 #4 - MINDEMOYA PATROL YARD.GPJ DST\_MIN.GDT 3/8/10

$\times^3, \star^3$ : Numbers refer to Sensitivity  $\bigcirc$  3% STRAIN AT FAILURE

**RECORD OF BOREHOLE No HA-16**

1 OF 1

**METRIC**

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064097 m N, 407045 m E) ORIGINATED BY KS  
 DIST                      HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>			
214.3	TOPSOIL - CLAY - Silty, with organics, some sand and gravel, occasional cobbles, brown CLAY - Silty, some sand and gravel, brown																
214.2 0.1																	
213.3 1.0	End of Borehole at 0.95 m Auger Refusal on Bedrock																

$\times^3, \star^3$ : Numbers refer to Sensitivity       $\bigcirc$  3% STRAIN AT FAILURE



# RECORD OF BOREHOLE No HA-18

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064090 m N, 406996 m E) ORIGINATED BY KS  
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>		
215.1	SAND & GRAVEL - Silty, some organics, occasional cobbles, brown						215									Wet at 0.85 m	
214.7	CLAY - Silty, some to trace organics, trace sand and gravel, brown																
213.4	End of Borehole at 1.70 m Auger Refusal on Cobbles																

✕<sup>3</sup>, ★<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No HA-19

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064092 m N, 407046 m E) ORIGINATED BY KS  
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
						20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>			
214.1	TOPSOIL - CLAY - Silty, with organics, some sand and gravel, brown CLAY - Silty, brown					214										
214.0 0.1																
213.2 0.9	End of Borehole at 0.85 m Auger Refusal on Bedrock															

✕<sup>3</sup>, ★<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No HA-20

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064092 m N, 407057 m E) ORIGINATED BY KS  
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
						20	40	60	80	100	20	40	60			
214.1																
214.0	TOPSOIL - CLAY - Silty, with organics, some sand and gravel, brown															
0.1	CLAY - Silty, brown															
213.5																
0.6	End of Borehole at 0.6 m Auger Refusal on Bedrock															

ON\_MOT\_CS-TB-011970 - MTO COCHRANE - 5009-0062 #4 - MINDEMOYA PATROL YARD.GPJ DST\_MIN.GDT 3/8/10

$\times^3, \star^3$ : Numbers refer to Sensitivity  $\bigcirc$  3% STRAIN AT FAILURE



# RECORD OF BOREHOLE No HA-21

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064088 m N, 406988 m E) ORIGINATED BY KS  
DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML  
DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	20	40	60			
215.4	SAND & GRAVEL - Silty, with asphalt debris, occasional cobbles and boulders, brown																
214.8	CLAY - Silty, trace sand and gravel, brown																
213.9	End of Borehole at 1.45 m Auger Refusal on Bedrock																

$\times^3, \star^3$ : Numbers refer to Sensitivity  $\bigcirc$  3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No HA-22

1 OF 1

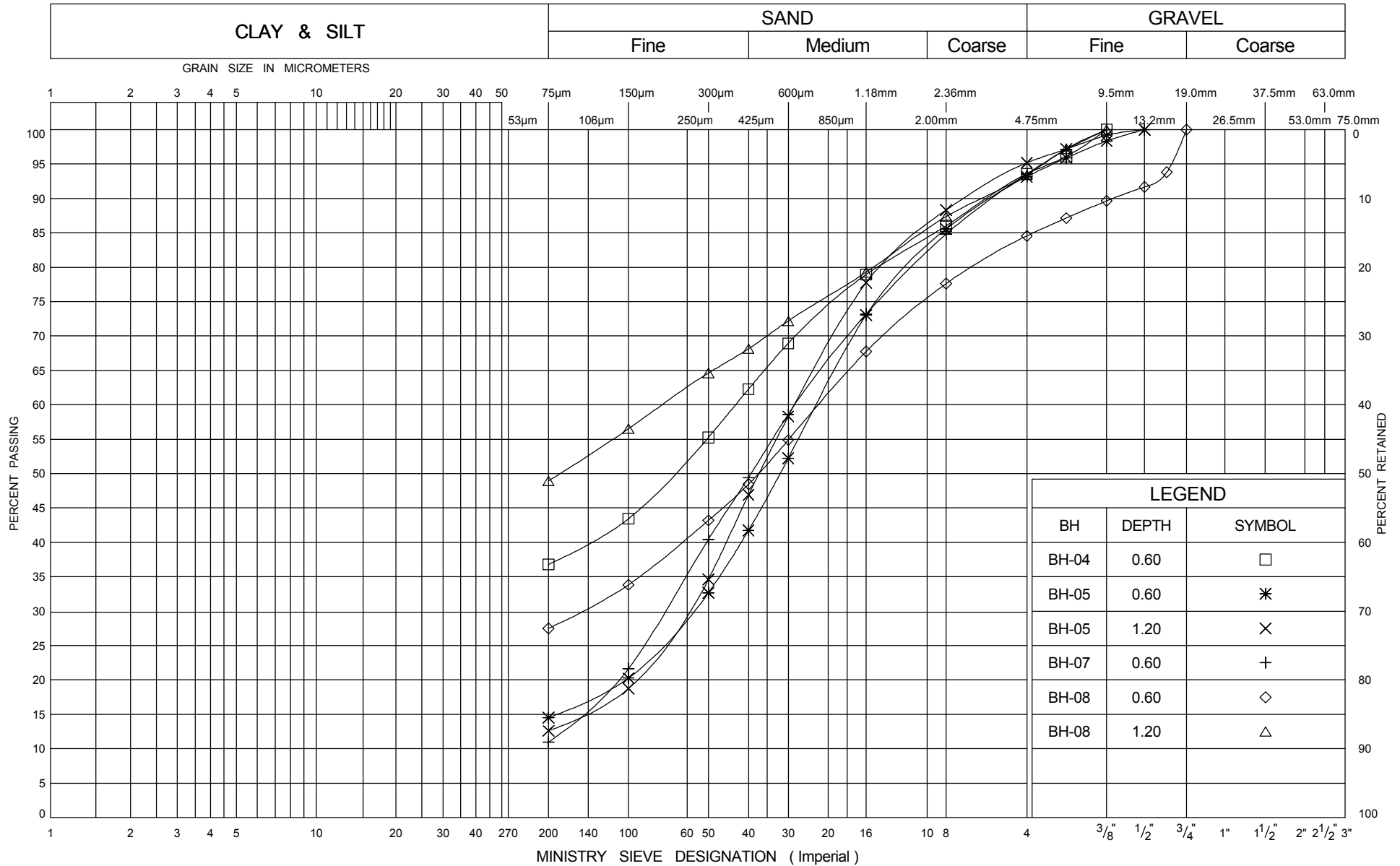
METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064082 m N, 407056 m E) ORIGINATED BY KS  
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML  
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
						20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>			
214.2	TOPSOIL - CLAY - Silty, with organics, some sand and gravel, brown CLAY - Silty, brown					214										
214.1 0.1																
213.2 1.0	End of Borehole at 0.95 m Auger Refusal on Bedrock															

✕<sup>3</sup>, ★<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

# UNIFIED SOIL CLASSIFICATION SYSTEM



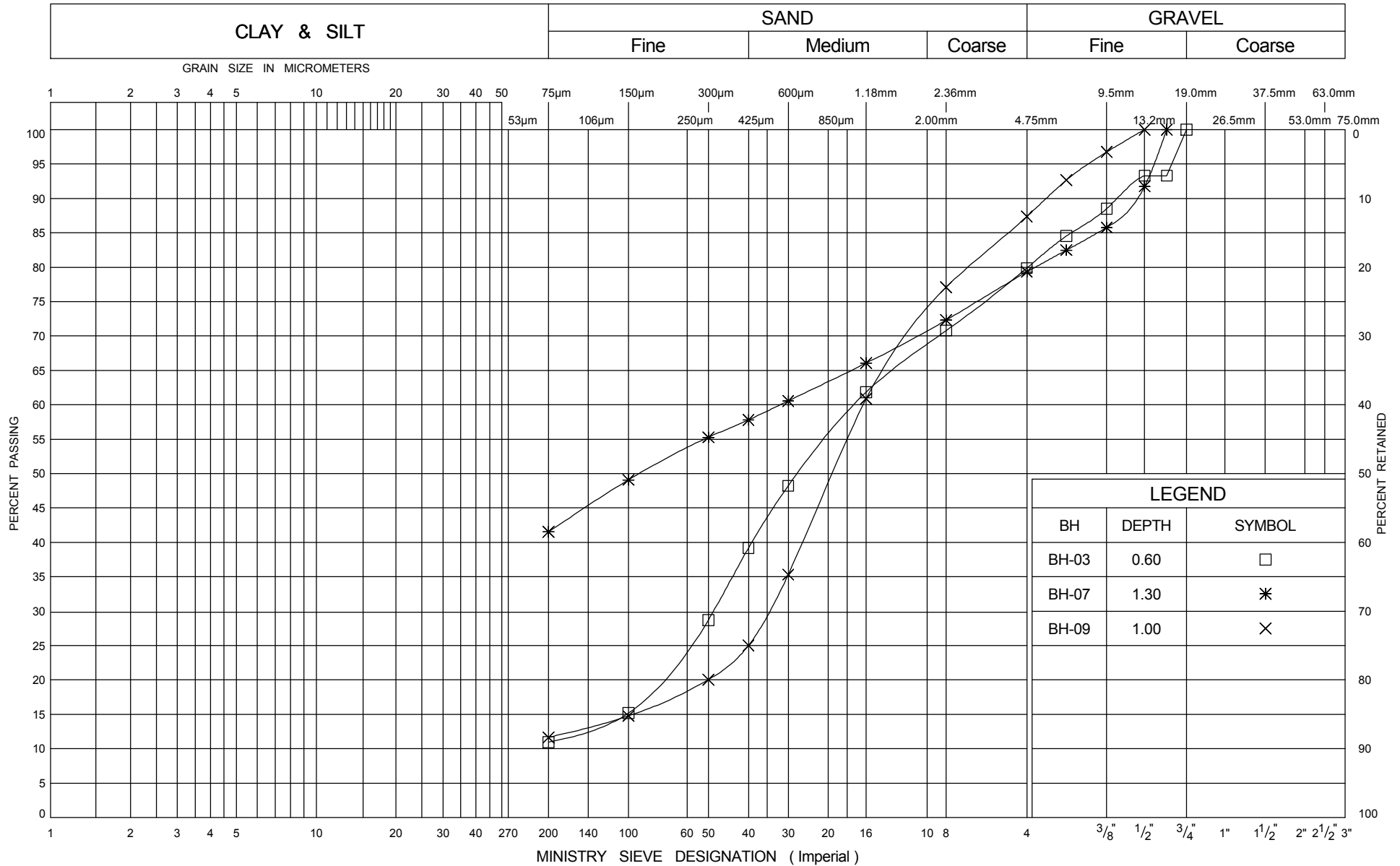
GRAIN SIZE DISTRIBUTION  
SAND, TRACE GRAVEL

ENCLOSURE 32

5009-0062 Assignment #4

HIGHWAY 542

# UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION  
SAND, SOME GRAVEL

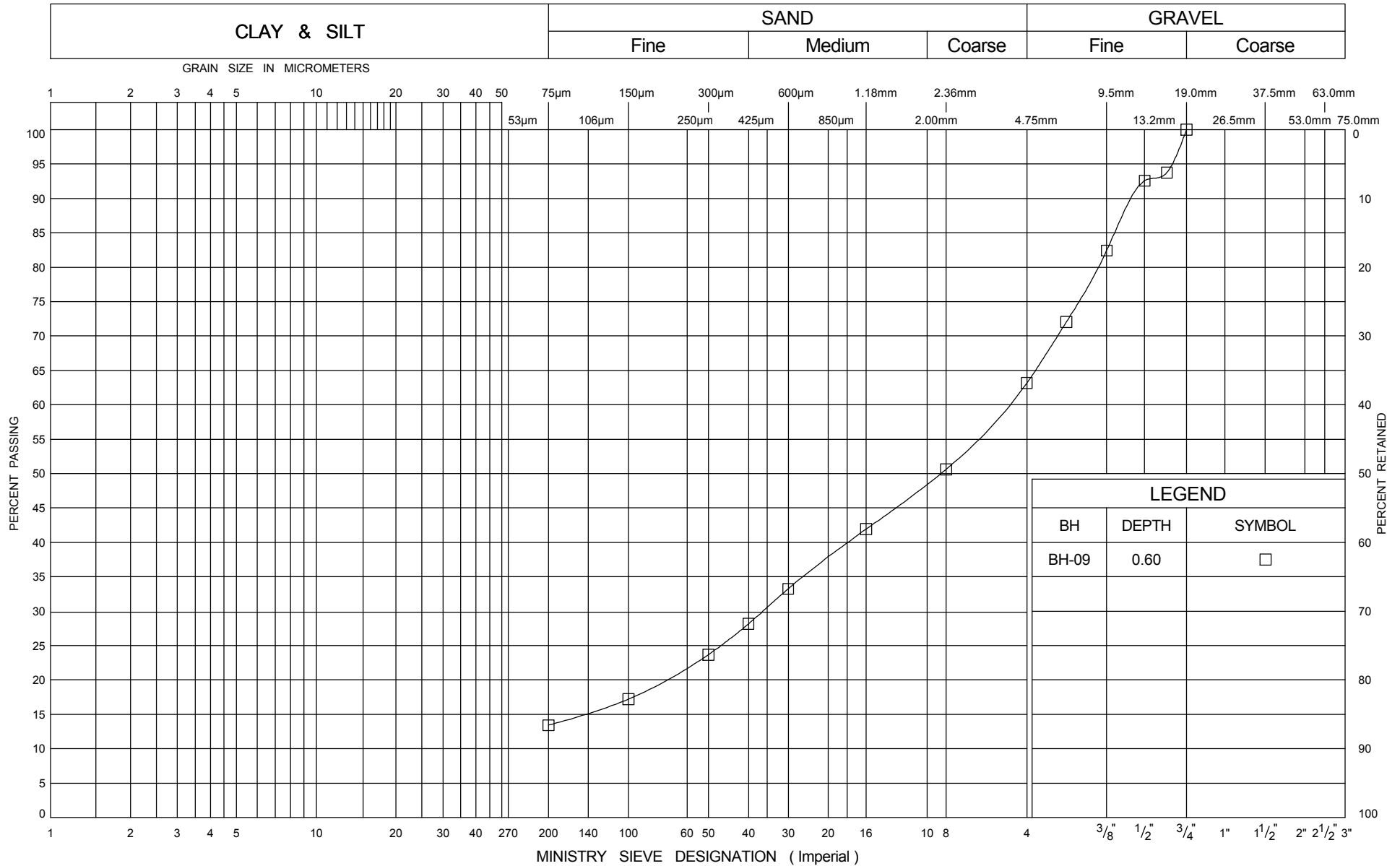
ENCLOSURE 33

5009-0062 Assignment #4

HIGHWAY 542

ONTARIO MOT GRAIN SIZE GS-TB-011970 - MTO COCHRANE - 5009-0062 #4 - MINDEMOYA PATROL YARD.GPJ DST\_MIN.GDT 9/8/10

# UNIFIED SOIL CLASSIFICATION SYSTEM



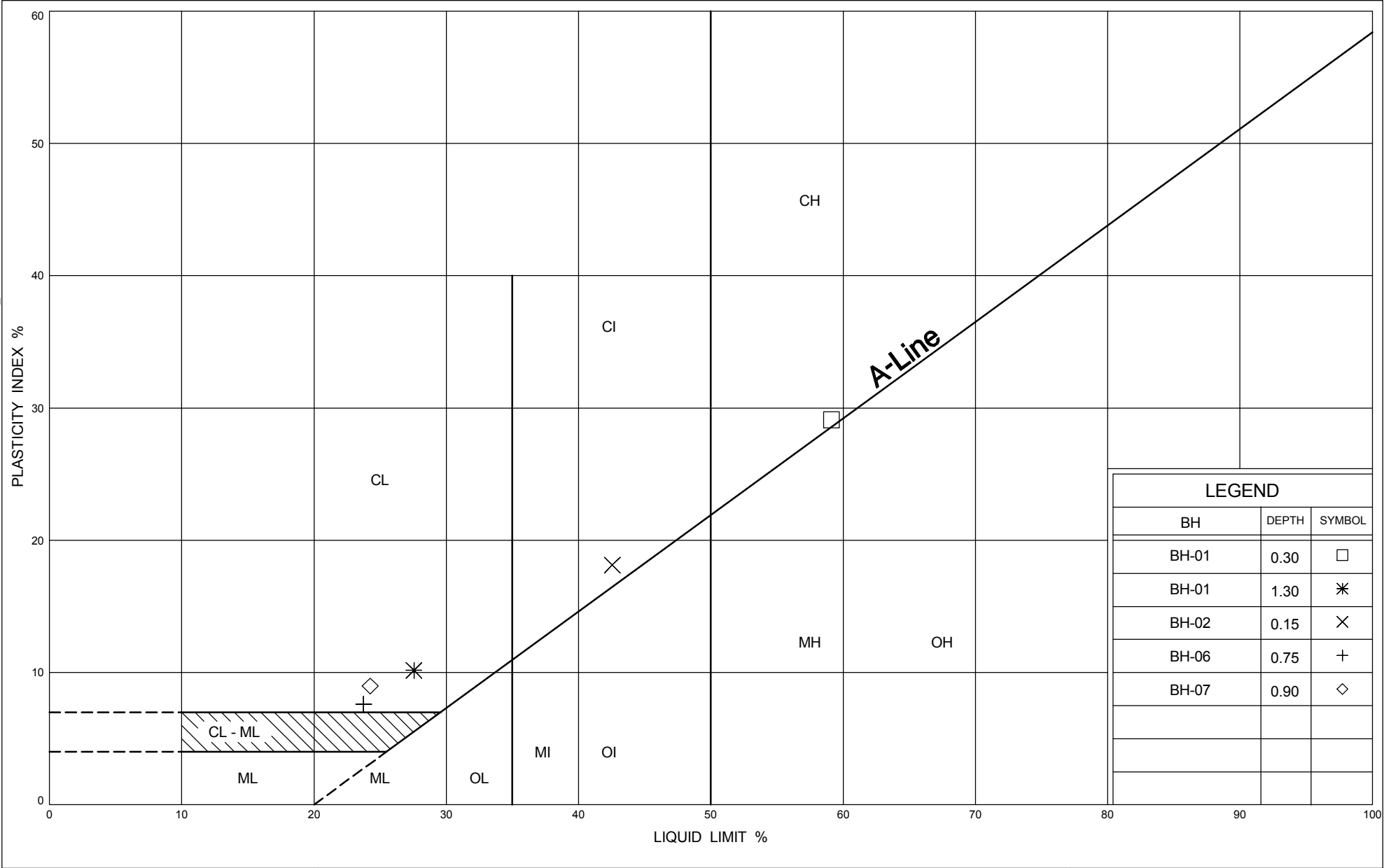
## GRAIN SIZE DISTRIBUTION SAND AND GRAVEL

ENCLOSURE 34

5009-0062 Assignment #4

HIGHWAY 542

ONTARIO MOT PLASTICITY CHART GS-TB-011970 - MTO COCHRANE - 5009-0062 #4 - MINDEMOYA PATROL YARD.GPJ DST\_MIN.GDT 5/8/10



LEGEND		
BH	DEPTH	SYMBOL
BH-01	0.30	□
BH-01	1.30	*
BH-02	0.15	×
BH-06	0.75	+
BH-07	0.90	◇



PLASTICITY CHART

ENCLOSURE 35  
5009-0062 Assignment #4  
HIGHWAY 542