Submitted To Triton Engineering Services Limited
18 Robb Blvd Unit 8,
Orangeville, Ontario L9W 3L2
On Behalf of the Ontario Ministry of Transportation

Culvert Replacement – Site No. 46-374
Station 14+722 – Twp. of Dowling
GWP 5081-06-00

Highway 144 From 1.5 km South of Sudbury Municipal Road 8, Northerly 18.1 km to Cartier West Entrance (Centre Street)

FINAL FOUNDATION INVESTIGATION REPORT

Date: October 7, 2013
Ref. N^{o}: 11/11/11209-F1

Geocres No. 41I-295

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2-120 PROGRESS COURT, NORTH BAY (ONTARIO) CANADA P1A 0C2 – T 705.476.2550 | F 705.476.8882 – NORTHBAY@LVM.CA - WWW.LVM.CA

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Station 14+722 - TWP of Dowling
GWP 5081-06-00

Final Foundation Investigation Report

Prepared by:

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Property and Confidentiality

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5 hard copies, 1 electronic copy	MTO Project Manager
1 hard copy, 1 electronic copy	MTO Pavement & Foundations Section, Foundation Group

1 INTRODUCTION

LVM | MERLEX has been retained by Triton Engineering Services Limited, on behalf of the Ministry of Transportation of Ontario (MTO), to carry out a foundation investigation for the proposed replacement of existing twin culverts and design of a protection system. This culvert replacement is located on Highway 144, at Station 14+722, (some 350 m South of New Cobden Road), in the Township of Dowling.

The foundation investigation location was specified by the MTO in the RFP/TPM documentation Agreement No. 5010-E-0051. The terms of reference for the scope of work are outlined in LVM | Merlex's Proposal P-11-023, dated June, 2011. The purpose of this investigation was to determine the subsurface conditions in the area of the culvert in order to provide design recommendations. LVM | MERLEX investigated the foundation area by the drilling of boreholes, carrying out in-situ tests, and performing laboratory testing on select samples.

2 SITE DESCRIPTION

The foundation investigation for these twin Structural Plate Corrugated Steel Pipe Arch (SPCSPA) culverts is located at Station 14+722, Township of Dowling (Site No. 46-374). The topography at the site is a low wet land area with flooded organic terrain to the left (south) and right (north) of the embankment. The existing highway embankment currently supports three undivided lanes of highway, two in the northbound direction and one in the southbound direction. The existing highway, at the culvert locations, is constructed on a fill embankment some 3.6 m in height above the native subgrade, with centerline elevation of 272.0 m at the location of the twin culverts. The culverts at this location are twin 1.07x2.0 m SPCSPA culverts, 25.9 m in length. These dimensions could not be verified in the field since both culvert ends were essentially buried at the time of the investigation. Flow through the culvert would be from left (south) to right (north), based on culvert inverts, however the hydrology study has indicated that the flow is from right (north) to left (south). The left (south) end of the culverts was blocked with backfill, at the time of this investigation, as such there was no flow through the culverts (see Photo Essay, Appendix 4).

Infrastructure at the location of the twin culverts consists of overhead power and communication wires on the right (north) side of the highway.

2.1 SITE PHYSIOGRAPHY AND SURFICIAL GEOLOGY

This project is located in the Geomorphic Sub-province known as the Eastern Sandy Uplands. The topography on this section of Highway 144 is generally rolling. There are a few exposed bedrock ridges. At many locations, significant layers of earth overlay the bedrock. Organic terrain was also observed. Within the project area, overburden consists primarily of sands.

Bedrock in the area of the location of this culvert foundation investigation, as indicated on OGS Map 2506, comprises of Middle Precambrian Era sandstone, shale, argillite, iron formation, tuff, basalt, and limestone.

3 INVESTIGATION PROCEDURES

The field work for this investigation was carried out during the period of March 8th to 21st, during which five (5) sampled boreholes and DCPTs were advanced. For the purposes of foundation design for the culvert replacement, one borehole was advanced through the embankment slightly up chainage from the culverts, and one borehole was advanced at the inlet end and one at the outlet end of the culverts. Two boreholes were advanced through the embankment, one up and down chainage from the culverts, to provide subsurface data to support the design of a protection system.

The field investigation was carried out using both a Bombardier track mounted CME and a truck mounted CME drilling rigs equipped with hollow stem augers, standard augers, and routine geotechnical sampling equipment. Soil samples were obtained at the borehole locations at regular intervals of depth using the standard 50 mm O.D. split spoon sampler advanced in accordance with the Standard Penetration Test (SPT) procedures (ASTM D-1586). The SPT method involves advancing a 50 mm O.D. split spoon sampler with the force of a 63.5 kg hammer freely dropping 760 mm mounted in a trip (automatic) hammer. The number of blows per 300 mm penetration was recorded as the “N” value. At the boreholes, a Dynamic Cone Penetration Test (DCPT) was carried out to give a continuous plot of the soil resistance with depth. When cohesive deposits were encountered, the in-situ strength was measured using an “N” size field vane, vane collar, and calibrated torque meter. All samples taken during this investigation were stored in labeled airtight containers for transport to our North Bay laboratory for visual examination and select laboratory testing.

Groundwater conditions in the open boreholes were observed during the advancement of and immediately following, completion of the individual boreholes. All open boreholes were backfilled upon completion with compacted auger cuttings in the general order they were removed and, where necessary, bentonite pellet backfill was added to the boreholes to bring them up to grade. At the borehole(s) through the embankment, the upper portion of the hole, where necessary, was backfilled with an asphalt cold patch to seal the existing asphalt surface.

The field work for this investigation was under the full time direction of a senior member of our engineering staff, who was responsible for locating the boreholes, clearing the borehole locations of underground services, in-situ sampling and testing operations, logging of the boreholes, labeling and preparation of samples for transport to our North Bay laboratory, plus overall drill supervision. All samples received a visual confirmatory inspection in our laboratory. Laboratory testing of select samples included routine testing for natural moisture content determination and particle size analysis, as well as specific gravity testing. The results of the

laboratory testing are presented on the individual Record of Borehole Sheets (Appendix 2), with a summary of results presented on the laboratory sheets in Appendix C (Figures Nos. L-1 to L-4).

The location of the individual boreholes were determined in the field using highway chainage (established by others) and offset relative to highway centerline. The MTO co-ordinates, northing and easting, were then established for the boring locations. Elevations contained in this report are referenced to a geodetic datum.

4 SUBSURFACE CONDITIONS

Details of the subsurface conditions revealed by the investigation program are presented on the enclosed Record of Borehole Logs (Appendix 2) and on Figure No. 2 (Appendix 3). Please note that stratigraphic delineation presented on the borehole logs and soil strata plot are the results of non-continuous sampling, response to drilling progress, the results of SPT and Dynamic Cone Penetration Test (DCPT) plus field observations. Typically such boundaries represent transitions from one zone to another and are not an exact demarcation of specific geological unit. Additional consideration should be given to the fact that subsurface conditions may vary markedly between adjacent boreholes and beyond any specific boring location, and are shown on the drawings for illustration purposes only.

4.1 CULVERT STATION 14+722, TWP OF DOWLING

A plan and profile illustrating the borehole locations and stratigraphic sequences is shown on Figure No. 2, Appendix 3. During the course of the exploration program, five (5) sampled boreholes were put down at this site, with Borehole Nos. 1 and 2 advanced at opposite culvert ends. Boreholes No. 3 to 5 were advanced through the existing embankment. At the time of the subsurface investigation, the ground surface elevations at Boreholes Nos. 1 to 5 were recorded at 269.7, 269.9, 272.1, 271.6, and 272.2 m, respectively.

4.1.1 Surficial Layers

At existing grade at Borehole Nos. 1 and 2, a layer of snow 300 to 500 mm in thickness was encountered at the time of this investigation. At Borehole Nos. 3, 4, and 5, a pavement structure consisting of a layer of asphalt some 50 mm thick was penetrated, underlain by a layer of crushed gravel some 125 to 150 mm thick.

4.1.2 Embankment Fill

Underlying the pavement structure at Borehole Nos. 3, 4, and 5, and below the snow cover at Borehole No. 2, a deposit of granular fill consisting of brown sand some to with gravel trace to some silt was penetrated. The natural moisture content measured on samples from this deposit was in the order of 2 to 22%. Gradation analyses were carried out on seven (7) samples of this deposit, the results of which indicated 13 to 41% gravel size particles, 54 to 76% sand size particles, and 3 to 30% silt and clay size particles (Figure No. L-1, Appendix 3). Based on SPT

'N' values of 2 to 45 blows per 300 mm penetration, the compactness of this deposit was described as very loose to dense, generally compact. This deposit was encountered to depths of 1.7, 3.8, 2.9, and 3.2 m below grade at Borehole Nos. 2, 3, 4, and 5, respectively (elevations 268.2, 268.3, 268.7, and 269.0 m, respectively).

4.1.3 Silty Sand

Underlying the fill at Borehole No. 2, a deposit of grey silty sand was penetrated. The natural moisture content measured on a sample of this deposit was in the order of 17%. Based on SPT 'N' values of 4 blows per 300 mm penetration, the compactness of this deposit was described as loose. This deposit was encountered to a depth of 2.1 m below grade (elevation 267.8 m).

4.1.4 Peat

At existing grade at Borehole No. 1, and underlying the embankment fill at Boreholes Nos. 4 and 5, a deposit of dark brown silty peat trace fine fibres and inclusions was penetrated. A thin layer of the brown silty organics, some 150 mm thick, was encountered at the lower interface of the fill at Borehole No. 3. The natural moisture content measured on samples of this deposit was in the order of 54 to 87%. This deposit was encountered to depths of 2.0, 3.5, and 4.1 m below grade at Borehole Nos. 1, 4 and 5, respectively (elevations 267.7, 268.1, and 268.1 m, respectively).

4.1.5 Sand and Gravel

Underling the silty organics at Borehole Nos. 1, 3, 4, and 5, and underlying the silty sand at Borehole No. 2, a deposit of grey sand and gravel trace silt to sand some to with gravel trace to some silt was penetrated. The natural moisture content measured on samples of this deposit was in the order of 8 to 24%. Gradation analyses were carried out on four (4) samples of this deposit, the results of which indicated 15 to 51% gravel size particles, 42 to 81% sand size particles, and 4 to 17% silt and clay size particles (Figure No. L-2, Appendix 3). Based on SPT 'N' values of 20 to 74 blows per 300 mm penetration, the compactness of this deposit was described as compact to very dense, generally dense. This deposit was encountered to depths of 3.5, 3.7, 5.8, 5.2, and 6.1 m below grade at Borehole Nos. 1 to 5, respectively (elevations 266.2, 266.2, 266.3, 266.4, and 266.1 m, respectively).

4.1.6 Sand

Underlying the sand and gravel deposit at each borehole location, a deposit of grey sand trace to some silt trace gravel was penetrated. The natural moisture content measured on samples of this deposit was in the order of 18 to 28%. Gradation analyses were carried out on five (5) samples of this deposit, the results of which indicated 0 to 2% gravel size particles, 79 to 98% sand size particles, and 2 to 19% silt and clay size particles (Figure No. L-3, Appendix 3). Based on SPT 'N' values of 7 to 27 blows per 300 mm penetration, the compactness of this deposit was described as loose to compact. This deposit was encountered to depths of 10.1, 8.5, and 8.8 m below grade at Borehole Nos. 3, 4, and 5, respectively (elevations 262.0, 263.1,

and 263.4 m, respectively). Sampling was terminated in this deposit at depths of 9.6 m below grade at Borehole Nos. 1 and 2. (elevations 260.1 and 260.3 m, respectively).

4.1.7 Silty Sand

Underlying the sand deposit at Borehole Nos. 3, 4, and 5, a deposit of grey silty sand was penetrated. The natural moisture content measured on samples of this deposit was in the order of 21 to 25%. A gradation analysis was carried out on one (1) sample of this deposit, the results of which indicated 0% gravel size particles, 59% sand size particles, 39% silt size particles, and 2% clay size particles (Figure No. L-4, Appendix 3). Based on SPT 'N' values of 9 to 16 blows per 300 mm penetration, the compactness of this deposit was described as loose to compact. Sampling was terminated in this deposit at depths of 11.1 m below grade at Borehole Nos. 3 to 5 (elevations 261.0, 260.5, and 261.1 m, respectively).

4.1.8 DCPT

DCPTs were advanced from surface at each borehole. DCPT refusal was encountered at depths of 17.4, 17.1, 18.9, 20.8, and 19.2 m below grade at Borehole Nos. 1 to 5, respectively (elevations 252.3, 252.8, 253.2, 250.8, and 253.0 m, respectively).

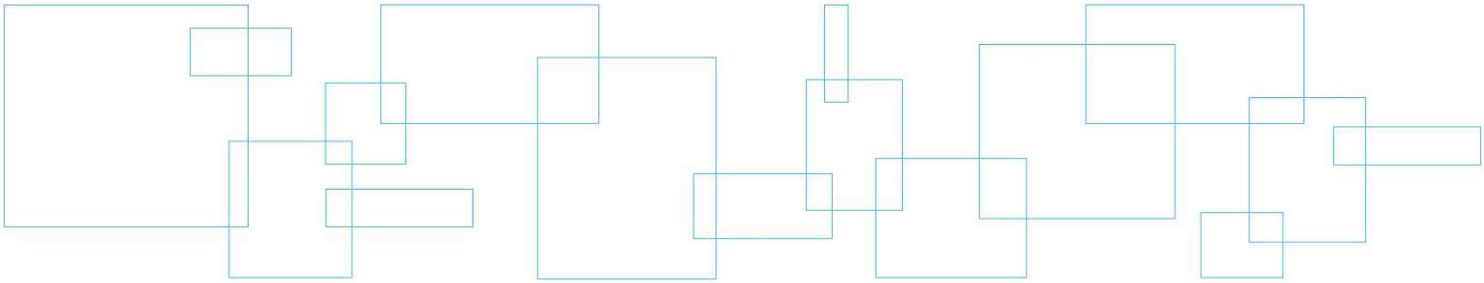
4.2 GROUNDWATER DATA

The water level at the culvert inlet was measured at an elevation of 269.9 m, at the time of this investigation. The left (south) ditch had been backfilled with sand fill which plugged the culvert to within some 150 mm of the obvert (see Photos 4 and 5, Appendix 4). There was no flow through the culvert at the time of this investigation. Measurements of the groundwater table and cave-in levels were undertaken, where possible, in the open boreholes during the advance of the individual borings and upon completion. These levels are recorded on the individual Record of Borehole Log Sheets (Appendix B). The water levels in the boreholes were measured at elevations of 269.3 to 270.3 m upon completion.

The groundwater and river water levels will fluctuate seasonally.

Appendix 1 Key Plan

Drawing No. 1 Key Plan



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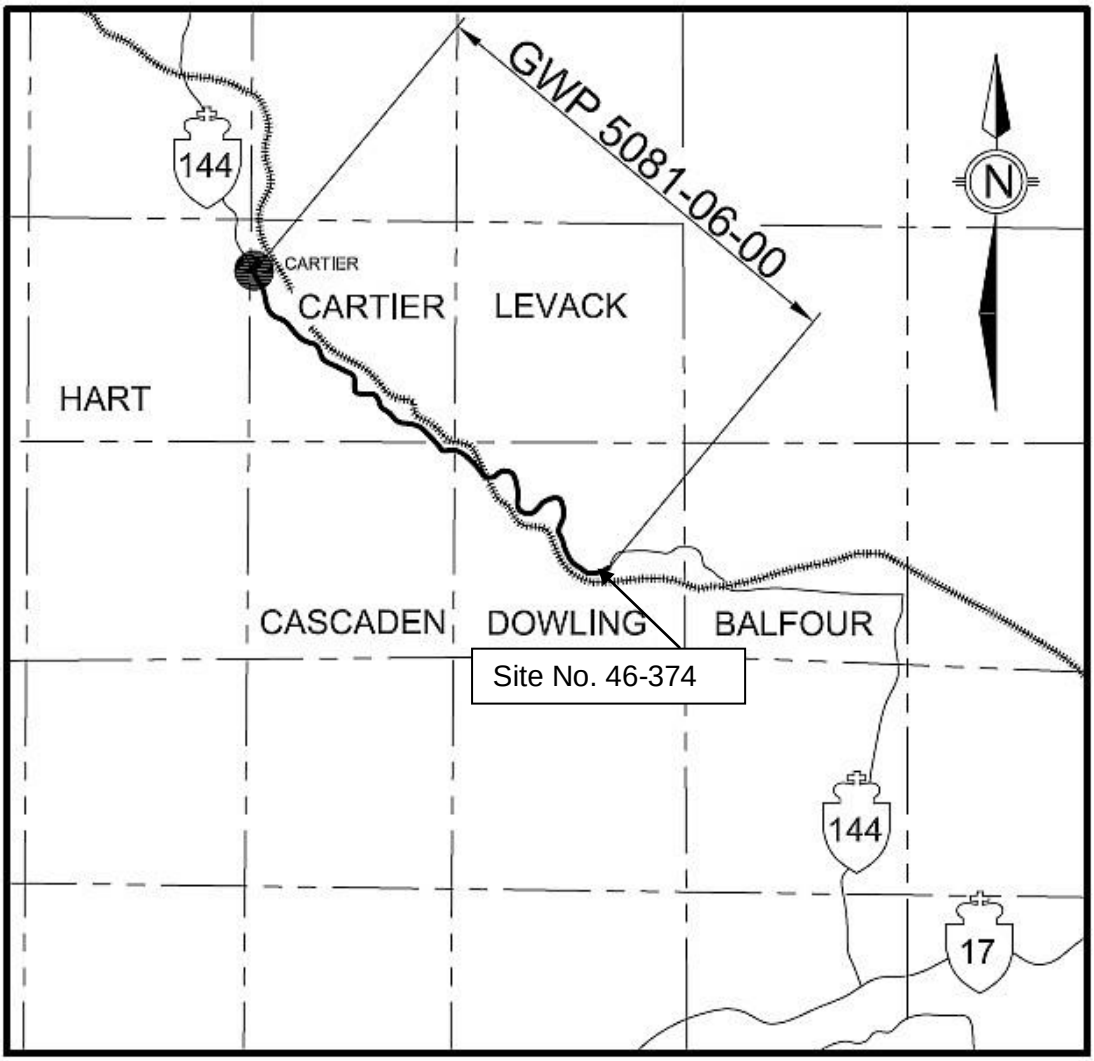
KEY PLAN Drawing No. 1

NOT TO SCALE



FINAL
FOUNDATION INVESTIGATION REPORT
GWP 5081-06-00

Highway 144 – Site No. 46-374

From 1.5 km South of Sudbury Municipal Road 8,
Northerly 18.1 km To Cartier West Entrance

MEL Ref. No.: 11/11/11209-F1 October 2013

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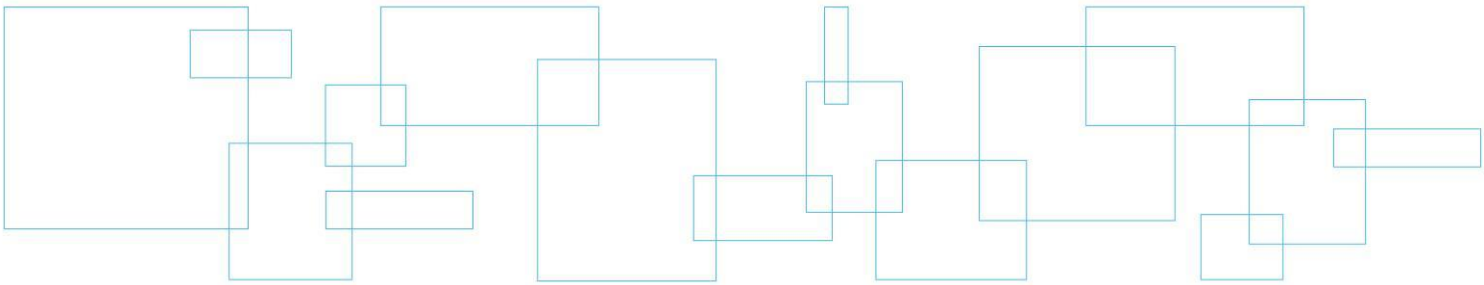
Appendix 2 Subsurface Data

Enclosure No. 1 List of Abbreviations and Symbols
Enclosure Nos. 2 to 6 Record of Borehole Sheet



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LIST OF ABBREVIATIONS & DESCRIPTION OF TERMS

The abbreviations and terms, used to describe retrieved samples and commonly employed on the borehole logs, on the figures and in the report are as follows:

1. ABBREVIATIONS

AS Auger Sample
CS Chunk Sample
DS Denison type sample
FS Foil Sample
NFP No Further Progress
PH Sampler advanced by hydraulic pressure
PM Sampler advanced by manual pressure
RC Rock core with size & percentage of recovery
SS Split Spoon
ST Slotted Tube
TO Thin-walled, open
TP Thin-walled, piston
WS Wash Sample

2. PENETRATION RESISTANCE/"N"

Dynamic Cone Penetration Test (DCPT):

A continuous profile showing the number of blows for each 300 mm of penetration of a 50 mm diameter 60° cone attached to AW rod driven by a 63 kg hammer falling 760 mm.

Plotted as —•—•—•—•

Standard Penetration Test (SPT) or "N" Values

The number of blows of a 63 kg hammer falling 760 mm required to advance a 50 mm O.D. drive open sampler 300 mm.

3. SOIL DESCRIPTION

a) *Cohesionless Soils:*

"N" (blows/0.3 m)	*Relative Density*
0 to 4	very loose
4 to 10	loose
10 to 30	compact
30 to 50	dense
over 50	very dense

b) *Cohesive Soils:*

Undrained Shear Strength (kPa)	*Consistency*
Less than 12	very soft
12 to 25	soft
25 to 50	firm
50 to 100	stiff
100 to 200	very stiff
over 200	hard

3. SOIL DESCRIPTION (Cont'd)

c) *Method of Determination of Undrained Shear Strength of Cohesive Soils:*

+ 3.2 - Field Vane test in borehole. The number denotes the sensitivity to remoulding.

D - Laboratory Vane Test

¨ - Compression test in laboratory

For a saturated cohesive soil the undrained shear strength is taken as one-half of the undrained compressive strength.

4. TERMINOLOGY

Terminology used for describing soil strata is based on the proportion of individual particle sizes present in the samples (please note that, with the exception of those samples subject to a grain-size analysis, all samples were classified visually and the accuracy of visual examination is not sufficient to determine exact grain sizing):

Trace, or occasional	Less than 10%
Some	10 to 20%
With	20 to 30%
Adjective (i.e. silty or sandy)	30 to 40%
And (i.e. sand and gravel)	40 to 60%

Terminology for cobbles and/or boulders frequency is an estimate based on drill response and field observations:

Occasional	Obstructions encountered in borehole, however advance is not severely impeded
Numerous	Obstructions appear essentially continuous over drilled length

5. LABORATORY TESTS

P Standard Proctor Test
A Atterberg Limit Test
GS Grain Size Analysis
H Hydrometer Analysis
C Consolidation

SAMPLE DESCRIPTION NOTES:

1. **FILL:** The term fill is used to designate all man-made deposits of natural soil and/or waste materials. The reader is cautioned that fill materials can be very heterogeneous in nature and variable in depth, density and degree of compaction. Fill materials can be expected to contain organics, waste materials, construction materials, shot rock, rip-rap, and/or larger obstructions such as boulders, concrete foundations, slabs, abandoned tanks, etc.; none of which may have been encountered in the borehole. The description of the material penetrated in the borehole therefore may not be applicable as a general description of the fill material on the site as boreholes cannot accurately define the nature of fill material. During the boring and sampling process, retrieved samples may have certain characteristics that identify them as 'fill'. Fill materials (or possible fill materials) will be designated on the Borehole Logs. If fill material is identified on the site, it is highly recommended that testpits be put down to delineate the nature of the fill material. However, even through the use of testpits defining the true nature and composition of the fill material cannot be guaranteed. Fill deposits often contain pockets or seams of organics, organically contaminated soils or other deleterious material that can cause settlement or result in the production of methane gas. It should be noted that the origins and history of fill material is frequently very vague or non-existent. Often fill material may be contaminated beyond environmental guidelines and the material will have to be disposed of at a designated site (i.e. registered landfill). Unless requested or stated otherwise in this report, fill material on this site has not been tested for contaminants however, environmental testing of the fill material can be carried out at your request. Detection of underground storage tanks cannot be determined with conventional geotechnical procedures.

2. **TILL:** The term till indicates a material that is an unstratified, glacial deposit, heterogeneous in nature and, as such, may consist of mixtures and pockets of clay, silt, sand, gravel, cobbles and/or boulders. These heterogeneous deposits originate from a geological process associated with glaciation. It must be noted that due to the highly heterogeneous nature of till deposits, the description of the deposit on the borehole log may only be applicable to a very limited area and therefore, caution must be exercised when dealing with a till deposit. When excavating in till, contractors may encounter cobbles/boulders or possibly bedrock even if they are not indicated on the borehole logs. It must be appreciated that conventional geotechnical sampling equipment does not identify the nature or size of any obstruction.

3. **BEDROCK:** Auger refusal may be due to the presence of bedrock, but possibly could also be due to the presence of very dense underlying deposits, boulders or other large obstructions. Auger refusal is defined as the point at which an auger can no longer be practically advanced. It must be appreciated that conventional geotechnical sampling equipment does not differentiate between nature and size of obstructions that prevent further penetration of the boring below grade. Bedrock indicated on the borehole logs will be labeled 'possibly' or 'probable' etc. based on the response of the boring and sampling equipment, surrounding topography, etc. Bedrock can be proven at individual borehole locations, at your request, by diamond core drilling operations or, possibly, by testpits. It must also be appreciated that bedrock surfaces can be, and most times are, very erratic in nature (i.e. sheer drops, isolated rock knobs, etc.) and caution must be used when interpreting subsurface conditions between boreholes. A bedrock profile can be more accurately estimated, at the clients' request, through a series of closely positioned unsampled auger probes combined with core drilling.

4. **GROUNDWATER:** Although the groundwater table may have been encountered during this investigation and the elevation noted in the report and/or on the record of boreholes, it must be appreciated that the elevation of the groundwater table will fluctuate based upon seasonal conditions, localized changes, erratic changes in the underlying soil profile between boreholes, underlying soil layers with highly variable permeabilities, etc. These conditions may affect the design and type and nature of dewatering procedures. Cave-in levels recorded in borings give a general indication of the groundwater level in cohesionless soils however, it must be noted that cave-in levels may also be due to the relative density of the deposit, drilling operations etc.

ENCLOSURE NO.:2 (Pg. 1 of 2)

METRIC

RECORD OF BOREHOLE NO. 1

LVM

REFERENCE 11/11/11209-F1 DATUM Geodetic LOCATION N 5159825.0 E 277008.6 - Dowling Township ORIGINATED BY JL

PROJECT GWP 5081-06-00, Highway 144, Site No. 46-374 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY MCM

CLIENT Triton Engineering Services Ltd. DATE (Started) 2012 March 8 TIME (Completed) 2:00:00 PM CHECKED BY MAM

DATE (Completed) 2012 March 8

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS
269.7	Ground Surface					
0.0	500 mm Snow cover PEAT - dark brown silty organics trace fine fibres		1	AS		▽▽
			2	SS	WH	
			3	SS	WH	
267.7						
2.0	GRAVEL and SAND - grey gravel and sand trace silt (dense)					
			4	SS	50	
			5	SS	42	
266.2						
3.5	SAND - grey sand some silt trace gravel (loose/compact)					
			6	SS	9	
			7	SS	10	
			8	SS	7	
			9	SS	11	
			10	SS	16	
260.1						
9.6	End of Sampling					

Continued Next Page

ELEVATION SCALE: 269, 268, 267, 266, 265, 264, 263, 262, 261, 260

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa 20 40 60 80 100
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%) 20 40 60

UNIT WEIGHT γ kN/m^3

REMARKS & GRAIN SIZE DISTRIBUTION (%)

GR SA (SI CL)

51 42 (7)

2 79 (19)

0 90 (10)

COMMENTS

The stratification lines represent approximate boundaries. The transition may be gradual.

$+^3$, $\times^3$: Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 120 kPa

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 12/3/8 1:50:00 PM	0.5 ▽	1.9 ▨
2) 12/3/9 7:20:00 AM	0.5 ▽	-
3) 12/3/21 12:30:00 PM	0 ▼	-

MEL-GEO 11209 - AREA 1 - BOREHOL LOGS.GPJ MEL-GEO.GDT 13/10/4

L|V|M
120 Progress Court, North Bay, On P1A 0C2 Phone: (705)476-2550 Fax: (705)476-8882 Email: northbay@lvm.ca

METRIC

RECORD OF BOREHOLE NO. 1

L|V|M

REFERENCE 11/11/11209-F1 DATUM Geodetic LOCATION N 5159825.0 E 277008.6 - Dowling Township ORIGINATED BY JL

PROJECT GWP 5081-06-00, Highway 144, Site No. 46-374 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY MCM

CLIENT Triton Engineering Services Ltd. DATE (Started) 2012 March 8 TIME (Completed) 2:00:00 PM CHECKED BY MAM

DATE (Completed) 2012 March 8

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
	Continued from Previous Page						259	DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100 SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE: 20 40 60 80 100	PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L WATER CONTENT (%): 20 40 60		
							258				
							257				
							256				
							255				
							254				
252.3							253				
17.4	DCPT Refusal End of Borehole										

MEL-GEO 11209 - AREA 1 - BOREHOL LOGS.GPJ MEL-GEO.GDT 13/10/4

L|V|M
120 Progress Court, North Bay, On P1A 0C2 Phone: (705)476-2550 Fax: (705)476-8882 Email: northbay@lvm.ca

ENCLOSURE NO.:3 (Pg. 1 of 2)

METRIC

RECORD OF BOREHOLE NO. 2

REFERENCE 11/11/11209-F1 DATUM Geodetic LOCATION N 5159796.5 E 277007.1 - Dowling Township ORIGINATED BY JL

PROJECT GWP 5081-06-00, Highway 144, Site No. 46-374 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY MCM

CLIENT Triton Engineering Services Ltd. DATE (Started) 2012 March 9 TIME (Completed) 11:18:00 AM CHECKED BY MAM

DATE (Completed) 2012 March 9

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS
269.9	Ground Surface					
0.0	300 mm Snow cover FILL - brown sand with gravel trace silt (loose)		1	AS		
			2	SS	8	
268.2			3	SS	4	
1.7	SILTY SAND - grey silty sand (loose)					
267.8						
2.1	SAND - grey sand some to with gravel trace silt (dense)		4	SS	40	
			5	SS	33	
266.2						
3.7	SAND - grey sand trace silt (loose/compact)		6	SS	9	
			7	SS	11	
			8	SS	10	
			9	SS	18	
			10	SS	9	
260.3						
9.6	End of Sampling					

Continued Next Page

ELEVATION SCALE: 269, 268, 267, 266, 265, 264, 263, 262, 261, 260

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa 20 40 60 80 100
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) 20 40 60

UNIT WEIGHT γ kN/m^3

REMARKS & GRAIN SIZE DISTRIBUTION (%)

	GR	SA	(SI CL)
2	21	76	(3)
4	15	80	(5)
8	0	98	(2)

COMMENTS

The stratification lines represent approximate boundaries. The transition may be gradual.

+ 3, × 3 : Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 120 kPa

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 12/3/9 11:05:00 AM	0.6	2.5
2) 12/3/21 12:30:00 PM	0.6	-
3) 12/3/21 2:30:00 PM	0.6	-

MEL-GEO 11209 - AREA 1 - BOREHOL LOGS.GPJ MEL-GEO.GDT 13/10/4

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METRIC

RECORD OF BOREHOLE NO. 2

REFERENCE 11/11/11209-F1 DATUM Geodetic LOCATION N 5159796.5 E 277007.1 - Dowling Township ORIGINATED BY JL

PROJECT GWP 5081-06-00, Highway 144, Site No. 46-374 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY MCM

CLIENT Triton Engineering Services Ltd. DATE (Started) 2012 March 9 TIME (Completed) 11:18:00 AM CHECKED BY MAM

DATE (Completed) 2012 March 9

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
	Continued from Previous Page						259, 258, 257, 256, 255, 254, 253	20 40 60 80 100	20 40 60		
252.8 / 17.1	DCPT Refusal End of Borehole										

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ENCLOSURE NO.:4 (Pg. 1 of 2)

METRIC

RECORD OF BOREHOLE NO. 3

LVM

REFERENCE 11/11/11209-F1 DATUM Geodetic LOCATION N 5159802.7 E 277003.9 - Dowling Township ORIGINATED BY JL

PROJECT GWP 5081-06-00, Highway 144, Site No. 46-374 BOREHOLE TYPE Truck Mounted CME 45B - Hollow Stem Augers COMPILED BY MCM

CLIENT Triton Engineering Services Ltd. DATE (Started) 2012 March 22 TIME (Completed) 2:30:00 PM CHECKED BY MAM

DATE (Completed) 2012 March 22

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
272.1	Ground Surface										
0.0	50 mm Asphalt 150 mm Crushed gravel FILL - brown sand with gravel trace silt (very loose/compact)		1	AS			272				
			2	SS	26						37 55 (8)
			3	SS	7	▽	271				
			4	SS	3		270				24 70 (6)
			5	SS	15		269				
268.3											
3.8	150 mm dark brown silty organics SAND - grey sand with gravel some silt (compact/dense)		6	SS	40		268				22 61 (17)
			7	SS	28		267				
266.3											
5.8	SAND - grey sand trace silt (loose/compact)		8	SS	11		266				
			9	SS	21		265				0 95 (5)
			10	SS	27		264				
262.0							263				
10.1	SILTY SAND - grey silty sand Continued Next Page						262				

COMMENTS

The stratification lines represent approximate boundaries. The transition may be gradual.

+ 3, × 3 : Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 120 kPa

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 12/3/22 2:20:00 PM	1.8 ▽	1.9 ▨
2)	- ▽	-
3)	- ▼	-

MEL-GEO 11209 - AREA 1 - BOREHOL LOGS.GPJ MEL-GEO.GDT 13/10/4

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ENCLOSURE NO.:4 (Pg. 2 of 2)

METRIC

RECORD OF BOREHOLE NO. 3

REFERENCE 11/11/11209-F1 DATUM Geodetic LOCATION N 5159802.7 E 277003.9 - Dowling Township ORIGINATED BY JL

PROJECT GWP 5081-06-00, Highway 144, Site No. 46-374 BOREHOLE TYPE Truck Mounted CME 45B - Hollow Stem Augers COMPILED BY MCM

CLIENT Triton Engineering Services Ltd. DATE (Started) 2012 March 22 TIME (Completed) 2:30:00 PM CHECKED BY MAM

DATE (Completed) 2012 March 22

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
	Continued from Previous Page										
	SILTY SAND - grey silty sand										
261.0	(compact)		11	SS	16		261				
11.1	End of Sampling										
							260				
							259				
							258				
							257				
							256				
							255				
253.2							254				
18.9	DCPT Refusal End of Borehole										

MEL-GEO 11209 - AREA 1 - BOREHOL LOGS.GPJ MEL-GEO.GDT 13/10/4

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ENCLOSURE NO.:5 (Pg. 1 of 2)

METRIC

RECORD OF BOREHOLE NO. 4

L|V|M

REFERENCE 11/11/11209-F1 DATUM Geodetic LOCATION N 5159821.1 E 277027.7 - Dowling Township ORIGINATED BY JL

PROJECT GWP 5081-06-00, Highway 144, Site No. 46-374 BOREHOLE TYPE Truck Mounted CME 45B - Hollow Stem Augers COMPILED BY MCM

CLIENT Triton Engineering Services Ltd. DATE (Started) 2012 March 21 TIME (Completed) 1:55:00 PM CHECKED BY MAM

DATE (Completed) 2012 March 21

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
271.6	Ground Surface										
0.0	50 mm Asphalt 125 mm Crushed Gravel FILL - brown sand with gravel to gravelly trace to some silt (compact)		1	AS			271				
			2	SS	12						22 63 (15)
			3	SS	12	▽	270				41 54 (5)
			4	SS	12		269				
268.7						▽					
2.9	PEAT - dark brown silty organics trace inclusions		5	SS	2					87	
268.1							268				
3.5	SAND - grey sand with gravel some silt (dense)		6	SS	74	▨					
			7	SS	54		267				
266.4											
5.2	SAND - grey sand trace to some silt (loose/compact)		8	SS	11		266				
			9	SS	9		265				0 83 (17)
263.1							264				
8.5	SILTY SAND - grey silty sand (loose/compact)		10	SS	9		263				
							262				
	Continued Next Page										

COMMENTS

The stratification lines represent approximate boundaries. The transition may be gradual.

$+^3$, $\times^3$: Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 120 kPa

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 12/3/21 1:45:00 PM	2.8 ▽	3.8 ▨
2) 12/3/21 4:45:00 PM	1.8 ▽	-
3)	- ▽	-

MEL-GEO 11209 - AREA 1 - BOREHOL LOGS.GPJ MEL-GEO.GDT 13/10/4

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ENCLOSURE NO.:5 (Pg. 2 of 2)

METRIC

RECORD OF BOREHOLE NO. 4

L|V|M

REFERENCE 11/11/11209-F1 DATUM Geodetic LOCATION N 5159821.1 E 277027.7 - Dowling Township ORIGINATED BY JL

PROJECT GWP 5081-06-00, Highway 144, Site No. 46-374 BOREHOLE TYPE Truck Mounted CME 45B - Hollow Stem Augers COMPILED BY MCM

CLIENT Triton Engineering Services Ltd. DATE (Started) 2012 March 21 TIME (Completed) 1:55:00 PM CHECKED BY MAM

DATE (Completed) 2012 March 21

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES						
	Continued from Previous Page							20 40 60 80 100	20 40 60		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	W_P W W_L	γ kN/m^3	GR SA (SI CL)
260.5			11	SS	11		261				
11.1	End of Sampling						260				
							259				
							258				
							257				
							256				
							255				
							254				
							253				
							252				
250.8							251				
20.8	DCPT Refusal End of Borehole										

MEL-GEO 11209 - AREA 1 - BOREHOL LOGS.GPJ MEL-GEO.GDT 13/10/4

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ENCLOSURE NO.:6 (Pg. 1 of 2)

METRIC

RECORD OF BOREHOLE NO. 5

L|V|M

REFERENCE 11/11/11209-F1 DATUM Geodetic LOCATION N 5159827.3 E 277059.4 - Dowling Township ORIGINATED BY JL

PROJECT GWP 5081-06-00, Highway 144, Site No. 46-374 BOREHOLE TYPE Truck Mounted CME 45B - Hollow Stem Augers COMPILED BY MCM

CLIENT Triton Engineering Services Ltd. DATE (Started) 2012 March 21 TIME (Completed) 5:05:00 PM CHECKED BY MAM

DATE (Completed) 2012 March 21

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
272.2	Ground Surface						
0.0	50 mm Asphalt 125 mm Crushed Gravel FILL - brown sand some to with gravel some to with silt (very loose/dense)		1	AS			
			2	SS	45		30 60 (10)
			3	SS	10		
			4	SS	2	▽	13 57 (30)
269.0			5	SS	WH		
3.2	PEAT - dark brown silty organics trace inclusions		6	SS	21		
268.1							
4.1	GRAVEL and SAND - grey gravel and sand trace silt (compact)		7	SS	20	▨	49 47 (4)
266.1							
6.1	SAND - grey sand trace to some silt (compact)		8	SS	11		
			9	SS	19		
263.4							
8.8	SILTY SAND - grey silty sand (loose)		10	SS	11		0 59 39 2
	Continued Next Page						

ELEVATION SCALE: 272, 271, 270, 269, 268, 267, 266, 265, 264, 263, 262

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%): 20 40 60

UNIT WEIGHT γ kN/m³: 85

COMMENTS

The stratification lines represent approximate boundaries. The transition may be gradual.

+ 3, × 3 : Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 120 kPa

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 12/3/21 4:50:00 PM	2.5 ▽	4.3 ▨
2)	- ▽	-
3)	- ▼	-

MEL-GEO 11209 - AREA 1 - BOREHOL LOGS.GPJ MEL-GEO.GDT 13/10/4

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ENCLOSURE NO.:6 (Pg. 2 of 2)

METRIC

RECORD OF BOREHOLE NO. 5

REFERENCE 11/11/11209-F1 DATUM Geodetic LOCATION N 5159827.3 E 277059.4 - Dowling Township ORIGINATED BY JL

PROJECT GWP 5081-06-00, Highway 144, Site No. 46-374 BOREHOLE TYPE Truck Mounted CME 45B - Hollow Stem Augers COMPILED BY MCM

CLIENT Triton Engineering Services Ltd. DATE (Started) 2012 March 21 TIME (Completed) 5:05:00 PM CHECKED BY MAM

DATE (Completed) 2012 March 21

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
	Continued from Previous Page							DYNAMIC CONE PENETRATION RESISTANCE PLOT; 20 40 60 80 100; SHEAR STRENGTH kPa; ○ UNCONFINED + FIELD VANE; ● QUICK TRIAXIAL × LAB VANE; 20 40 60 80 100	PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L; WATER CONTENT (%); 20 40 60		
261.1			11	SS	9						
11.1	End of Sampling						261				
							260				
							259				
							258				
							257				
							256				
							255				
							254				
253.0							253				
19.2	DCPT Refusal End of Borehole										

MEL-GEO 11209 - AREA 1 - BOREHOL LOGS.GPJ MEL-GEO.GDT 13/10/4

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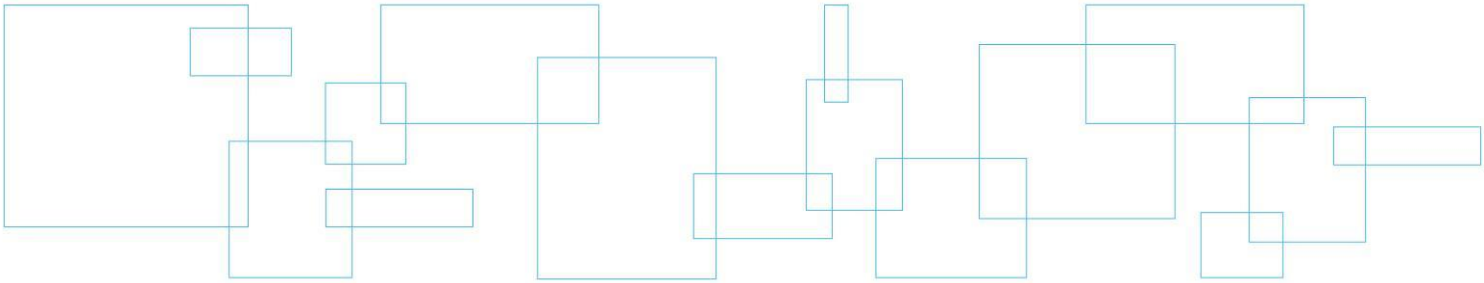
Appendix 3 Lab Data

Drawing No. 2: Borehole Location and Soil Strata
Figure Nos. L-1 to L-4: Grain Size Distribution Curves
Figure No. L-5: Lab Test Summary Sheet



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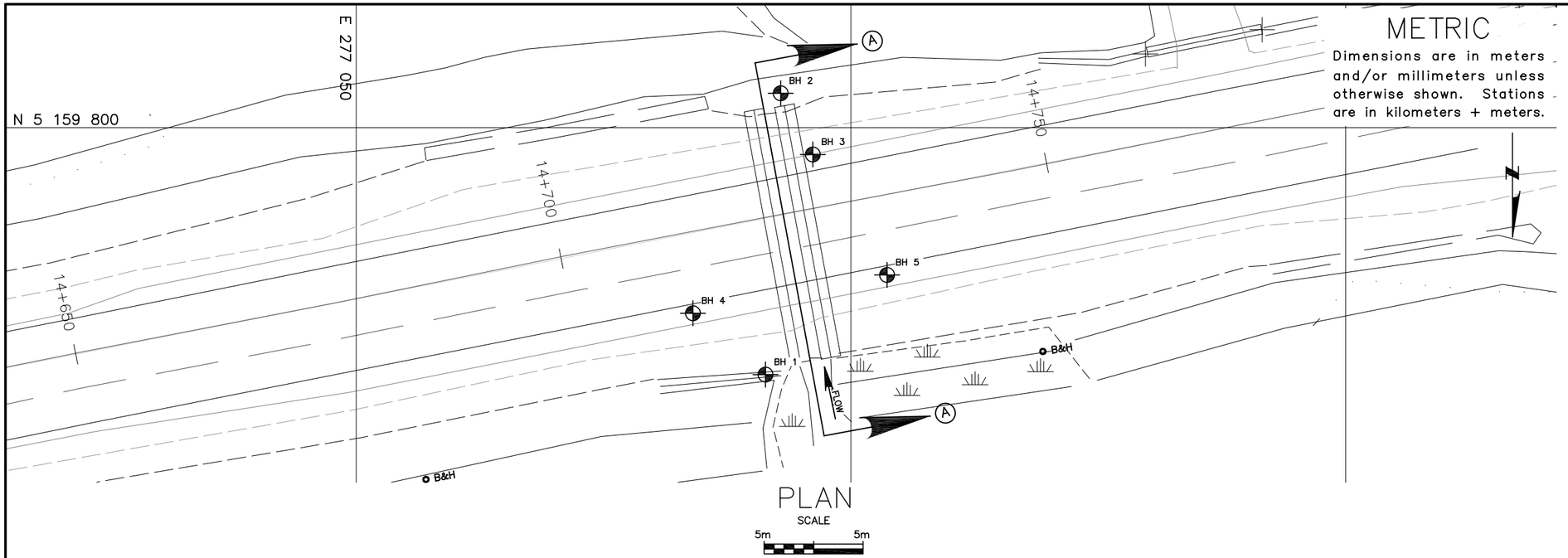
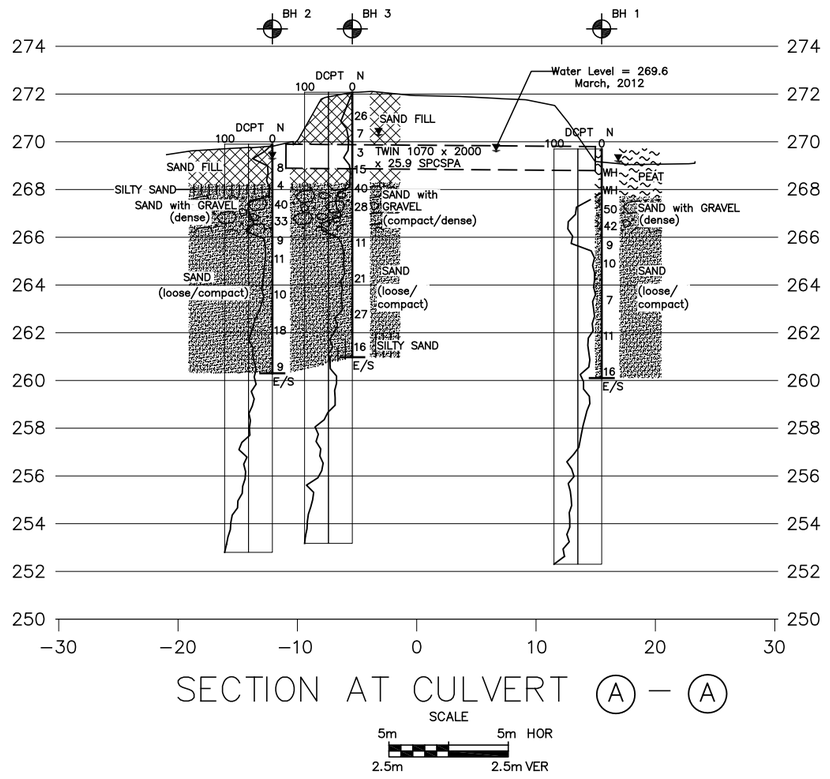


PLAN

SCALE

5m 5m

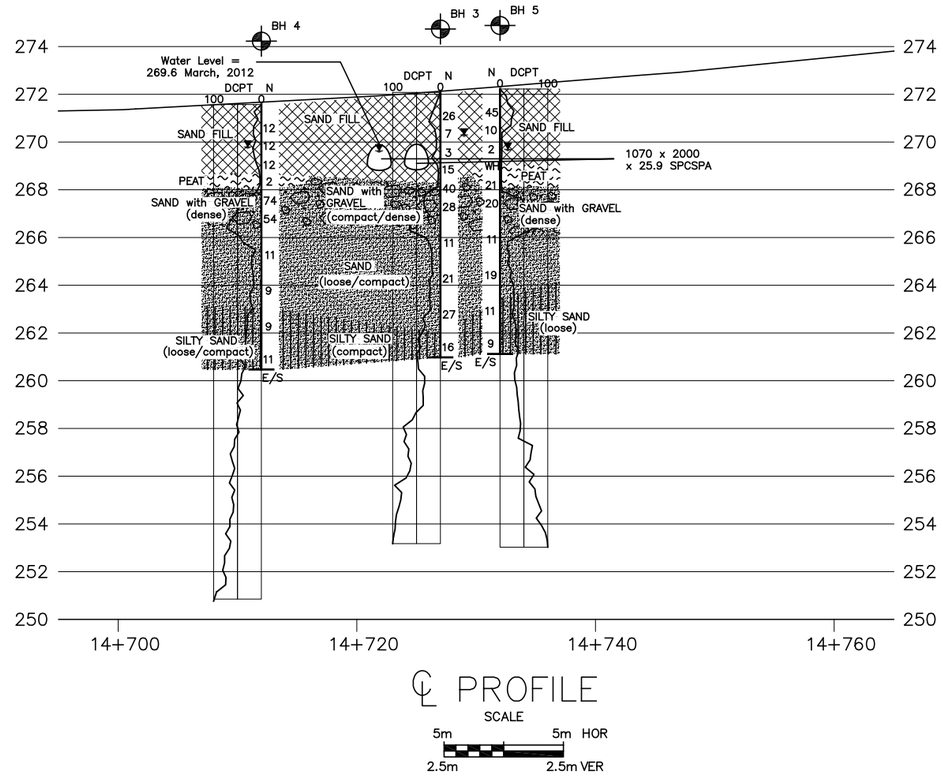


SECTION AT CULVERT (A) – (A)

SCALE

5m 5m HOR

2.5m 2.5m VER



℄ PROFILE

SCALE

5m 5m HOR

2.5m 2.5m VER

This drawing is for subsurface information only. Surface details and features are for conceptual illustration. The proposed structure location is shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contract Documents.

METRIC

Dimensions are in meters and/or millimeters unless otherwise shown. Stations are in kilometers + meters.

CONT No

GWP No 5081–06–00

N

HWY NO. 144 – Township of Dowling

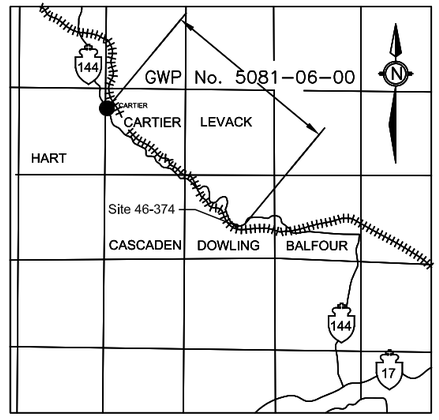
SITE NO. 46–374

Culvert at Station 14+722

BOREHOLE LOCATIONS & SOIL STRATA

Drawing 2

L|V|M | MERLEX



KEY PLAN – NOT TO SCALE

LEGEND

- Borehole
- Dynamic Cone Penetration Test (DCPT)
- Borehole and DCPT
- N — Blows/0.3 m (Std Pen Test, 475 J/blow)
- DCPT — Blows/0.3 m (60° Cone, 475 J/blow)
- Water Level at Time of Investigation
- A/R — Auger Refusal at Elevation
- E/S — End of Sampling

Borehole No.	Elev.	O/S	Co–ordinates	
			Northerly	Easterly
Borehole No. 1	269.7	15.5m Rt	5159825.0	277008.6
Borehole No. 2	269.9	12.1m Lt	5159796.5	277007.1
Borehole No. 3	272.1	5.0m Lt	5159802.7	277003.9
Borehole No. 4	271.6	8.5m Rt	5159821.1	277027.7
Borehole No. 5	272.2	8.5m Rt	5159827.3	277059.4

NOTE 1:

The boundaries between soil strata have been established at the borehole locations only. The boundaries illustrated and stratigraphy between boreholes on this drawing are assumed based on borehole data and may vary. They are intended for design only.

REVISIONS

DATE	BY	DESCRIPTION
Sept 2012	RG	DRAFT
Oct 2013	RG	FINAL

HWY No. 144 – Dowling Twp – Culvert at Sta. 14+722			REF 11209–F1
SUBM'D		GEOCRES 41I–295	SITE 46–374
DRAWN RG	CHK MAM	DATE Sept 2012	FIG 2

Reference No.: 11/11/11209-F1
Date: October 2013

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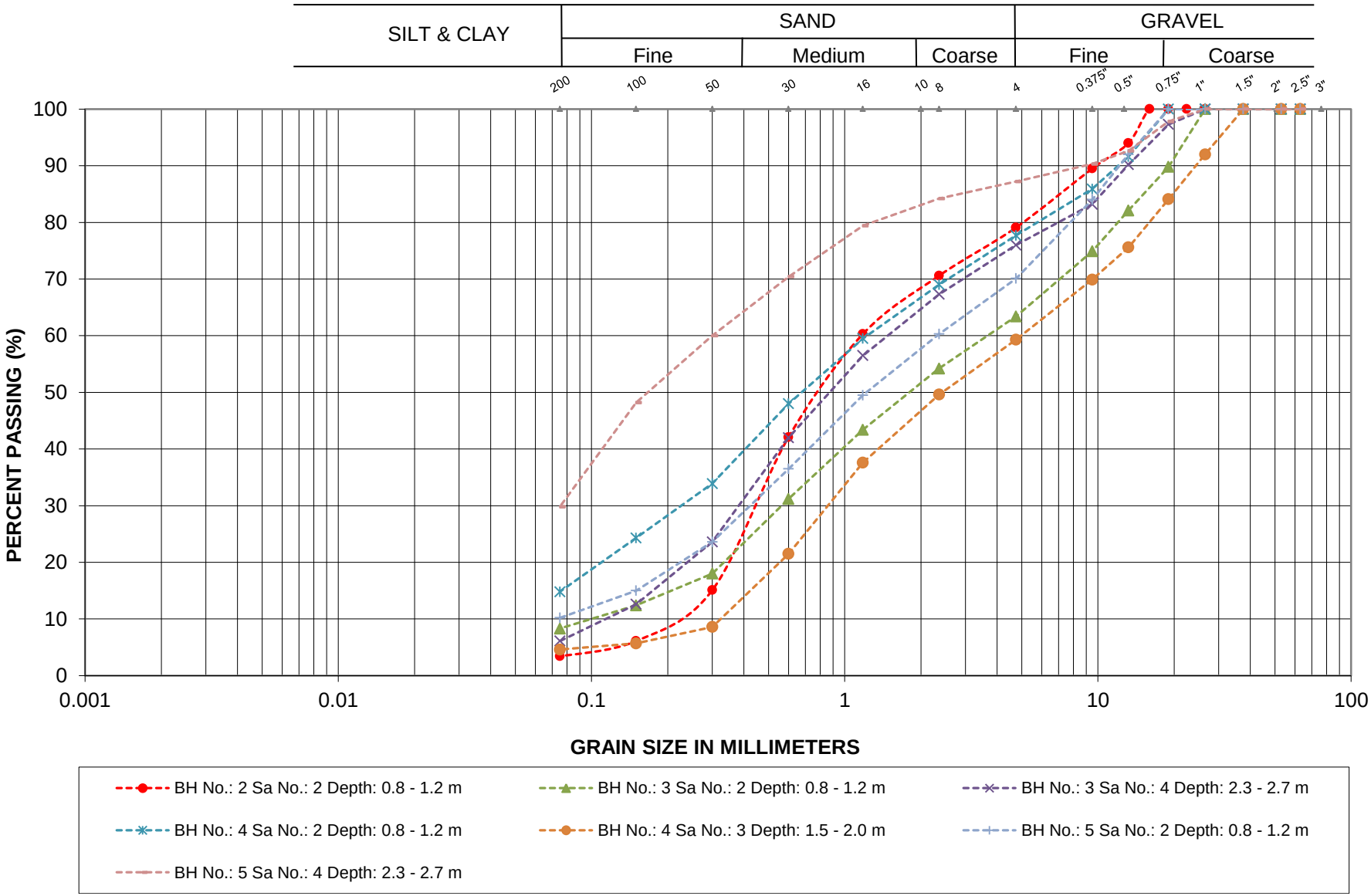
GRAIN SIZE ANALYSIS



G.W.P.: 5081-06-00
LOCATION: Hwy 144

EMBANKMENT FILL

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FIGURE L-1

Reference No.: 11/11/11209-F1
Date: October 2013

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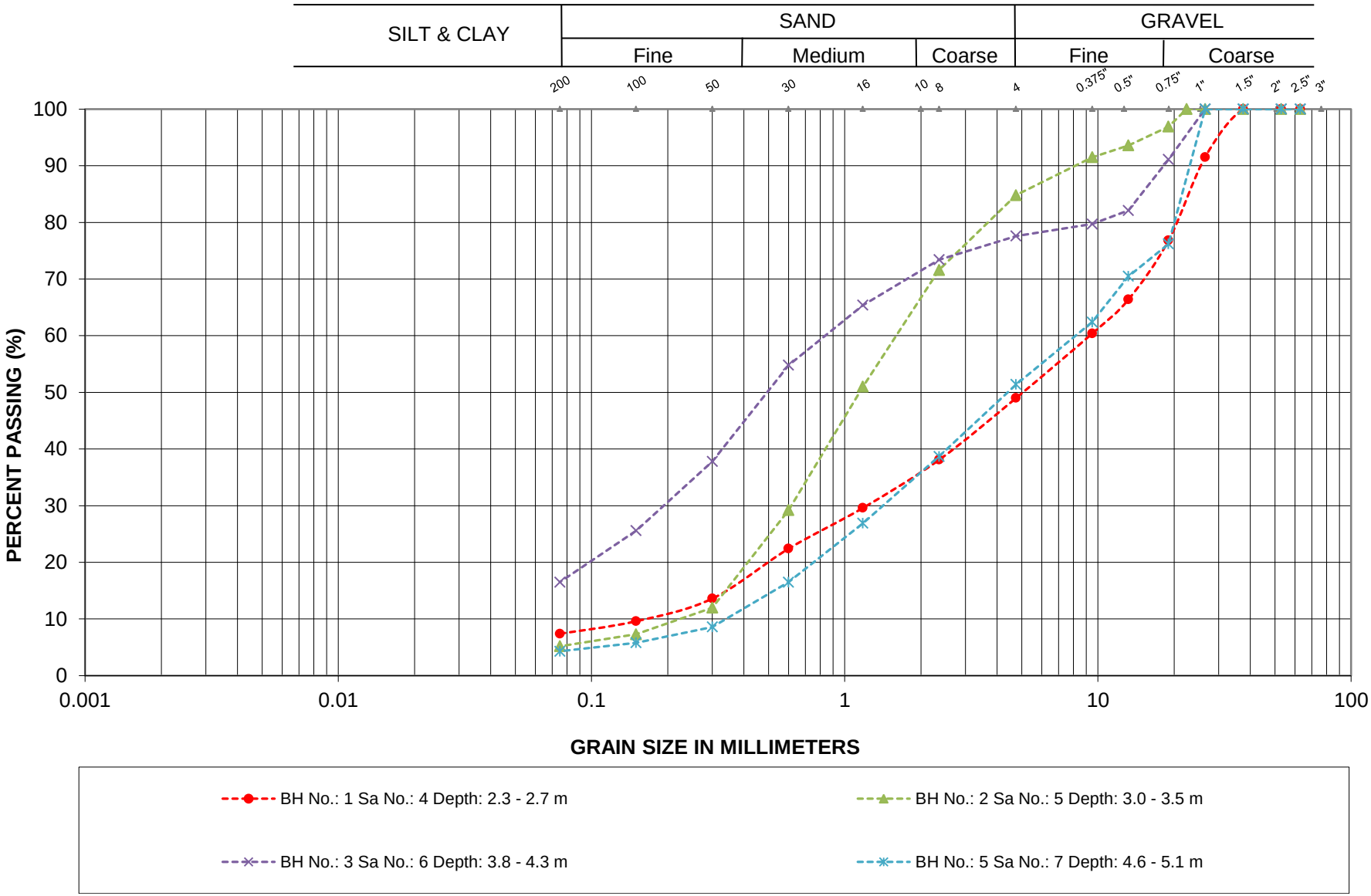
GRAIN SIZE ANALYSIS



G.W.P.: 5081-06-00
LOCATION: Hwy 144

SAND AND GRAVEL

LVM | MERLEX

FIGURE L-2

Reference No.: 11/11/11209-F1
Date: October 2013

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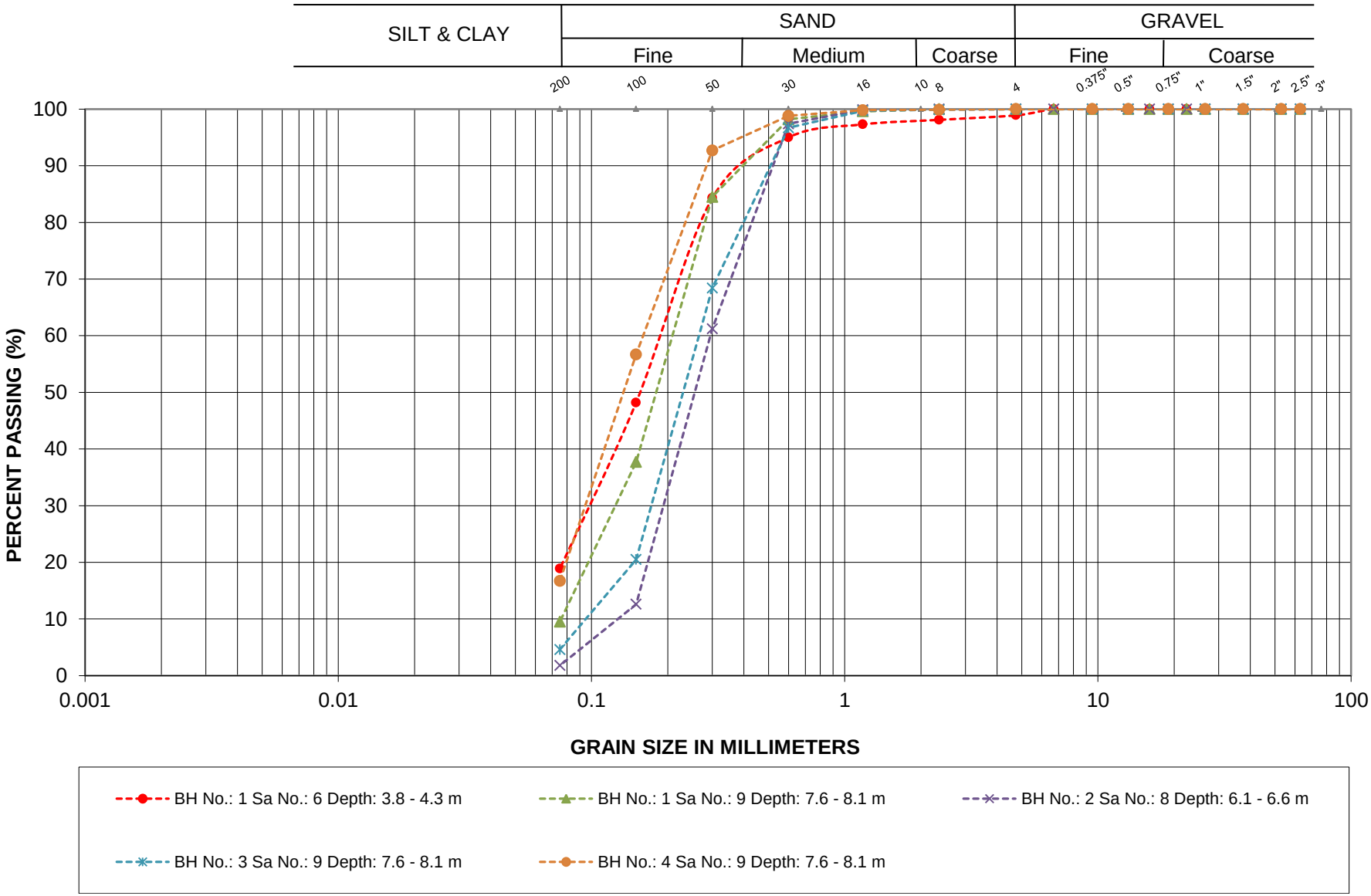
GRAIN SIZE ANALYSIS



G.W.P.: 5081-06-00
LOCATION: Hwy 144

SAND

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FIGURE L-3

Reference No.: 11/11/11209-F1
Date: October 2013

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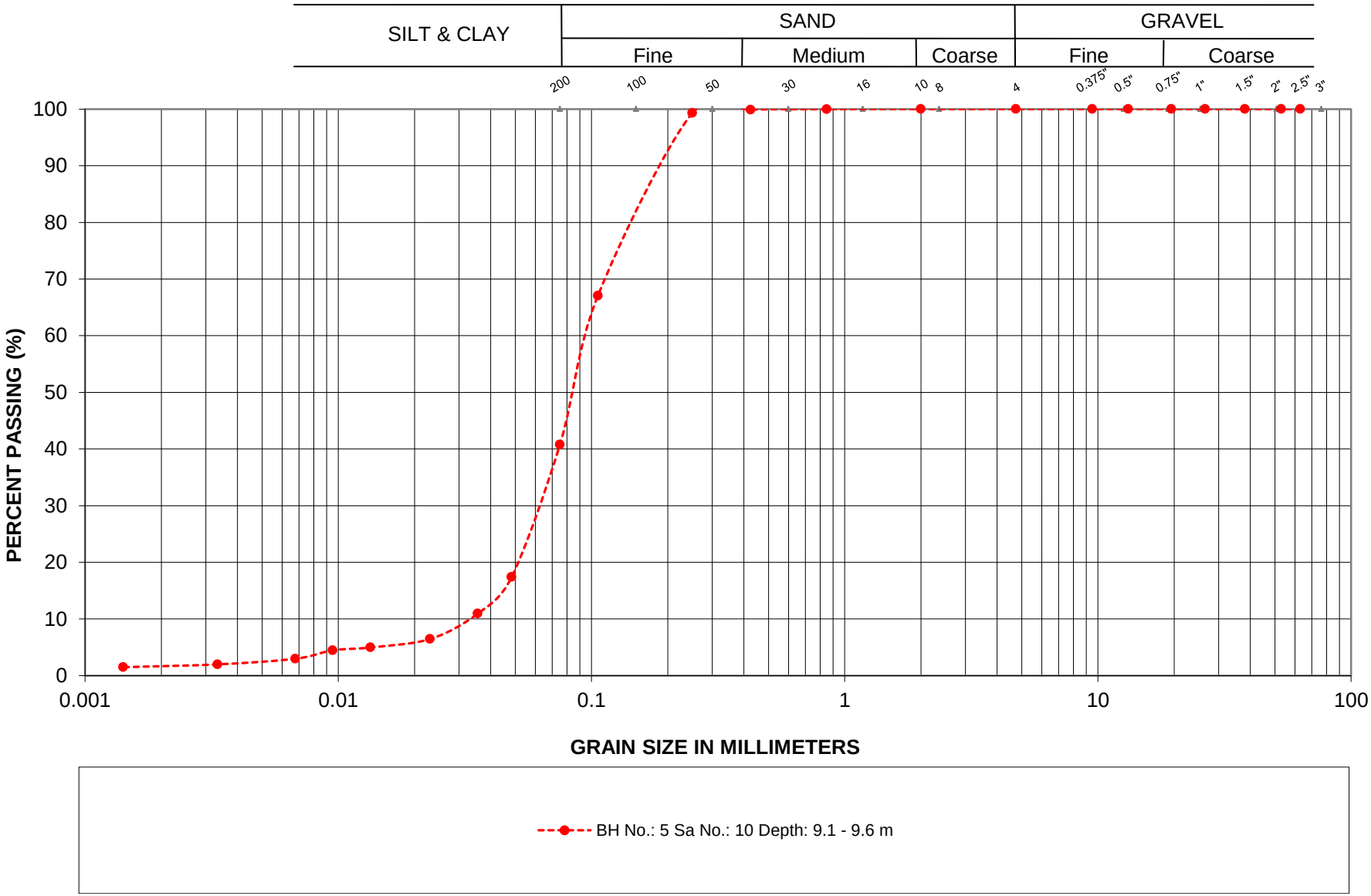
GRAIN SIZE ANALYSIS



G.W.P.: 5081-06-00
LOCATION: Hwy 144

SILTY SAND

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FIGURE L-4

LVM | MERLEX

Laboratory Tests - Summary Sheet

Borehole No.	Sample No.	Depth	Grain Size Analysis				NMC	Atterberg Limits			SPT 'N'	USCS	Unit Weight (kN/m3)	Remarks
			Gravel Size (%)	Sand Size (%)	Silt Size (%)	Clay Size (%)		LL (%)	PL (%)	IP (%)				
1	1	0.0					59.4				N/A			
	2	0.8					67.6				WH			
	3	1.5					71.5				WH			
	4	2.3	51	42	7		10.0				50			
	5	3.0					12.3				42			
	6	3.8	2	79	19		25.1				9			
	7	4.6					25.6				10			
	8	6.1					27.1				7			
	9	7.6	0	90	10		23.1				11			
	10	9.1					18.1				16			
2	1	0.0					18.1				N/A			
	2	0.8	21	76	3		20.8				8			
	3a	1.5					21.8				4			
	3b	1.5					17.1				4			
	4	2.3					9.7				40			
	5	3.0	15	80	5		13.8				33			
	6	3.8					25.0				9			
	7	4.6					22.8				11			
	8	6.1	0	98	2		22.6				10			
	9	7.6					27.8				18			
	10	9.1					25.3				9			
3	1	0.0					3.5				N/A			
	2	0.76	37	55	8		4.9				26			
	3	1.5					5.9				7			
	4	2.3	24	70	6		12.2				3			
	5	3.0					14.8				15			
	6	3.8	22	61	17		24.5				40			

LVM | MERLEX

Laboratory Tests - Summary Sheet

Borehole No.	Sample No.	Depth	Grain Size Analysis				NMC	Atterberg Limits			SPT 'N'	USCS	Unit Weight (kN/m3)	Remarks
			Gravel Size (%)	Sand Size (%)	Silt Size (%)	Clay Size (%)		LL (%)	PL (%)	IP (%)				
3	7	4.6					13.9				28			
	8	6.1					18.5				11			
	9	7.6	0	95	5		21.9				21			
	10	9.1					19.5				27			
	11	10.7					24.1				16			
4	1	0.0					2.2				N/A			
	2	0.8	22	63	15		7.5				12			
	3	1.5	41	54	5		9.2				12			
	4	2.3					12.7				12			
	5	3.0					87.3				2			
	6	3.8					18.2				74			
	7	4.6					7.8				54			
	8	6.1					17.9				11			
	9	7.6	0	83	17		25.7				9			
	10	9.1					25.48				9			
	11	10.7					26				11			
5	1	0.0					3.32				N/A			
	2	0.8	30	60	10		4.31				45			
	3	1.5					7.34				10			
	4	2.3	13	57	30		19.86				2			
	5a	3.0					21.93				WH			
	5b	3.0					85.04				WH			
	6a	3.8					54.34				21			
	6b	3.8					12.19				21			
	7	4.6	49	47	4		14.56				20			
	8	6.1					22.85				11			
	9	7.6					25.81				19			

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Laboratory Tests - Summary Sheet

Borehole No.	Sample No.	Depth	Grain Size Analysis				NMC	Atterberg Limits			SPT 'N'	USCS	Unit Weight (kN/m3)	Remarks
			Gravel Size (%)	Sand Size (%)	Silt Size (%)	Clay Size (%)		LL (%)	PL (%)	IP (%)				
	10	9.1	0	59	39	2	25.13				11			
	11	10.7					21.41				9			

Appendix 4 Photo Essay

Enclosure No. 7: Photo Essay

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Existing Embankment – Existing Embankment, General Pavement Condition Looking West	Photo: 1

Existing Embankment and Culvert Inlet – Right (North) Side, Looking West	Photo: 2

Reference No. 11/11/11209-F1 Project: Hwy 144 – Station 14+722, Twp of Dowling	Photos Provided By: LVM Date: March 2012

Culvert Inlet – Looking North	Photo: 3

Existing Embankment and Culvert Outlet – Left (South) Side, Looking West	Photo: 4

Reference No. 11/11/11209-F1 Project: Hwy 144 – Station 14+722, Twp of Dowling	Photos Provided By: LVM Date: March 2012

Culvert Outlet – South End Looking North	Photo: 5

Culvert Outlet – Buried Culverts, South End	Photo: 6

Reference No. 11/11/11209-F1 Project: Hwy 144 – Station 14+722, Twp of Dowling	Photos Provided By: LVM Date: March 2012