Submitted To MMM GROUP
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Northbound Passing Lane – TWP of Taylor
Culvert Extension – Station 22+565
Embankment – Stations 22+450 to 22+590
GWP 5217-08-00
WP 5219-08-01

Highway 11 – Passing Lane No. 3
From 2.7 km North of the West Junction
of Highway 101, Southerly 2.4 km
New Liskeard Area

FINAL FOUNDATION INVESTIGATION AND DESIGN REPORT

Date: February 21, 2012
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Geocres No. 42A-89

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1.0 INTRODUCTION

LVM | MERLEX has been retained by MMM Group Ltd., on behalf of the Ministry of Transportation of Ontario (MTO), to carry out a foundation investigation for a proposed northbound passing lane. This passing lane work project (WP 5219-08-01 - Passing Lane No. 3) is located on Highway 11 and passes through part of the Township of Taylor. The location is described as: from 2.7 km north of the west junction of Highway 101 at Station 23+500 Taylor Township, southerly 2.4 km. The foundation investigation for this project involves the investigation for the widening of the existing highway embankment between Stations 22+450 and 22+590, Taylor Township, as well as an extension to a 3050 mm SPCSP culvert located within the proposed widening at Station 22+565. The highway embankment is generally 2 m higher than the surrounding grade, except at the culvert location (Station 22+565) where the height of fill locally increases to 7.5 m. The culvert at Station 22+565 is identified as Site No. 39E-223/C.

The foundation investigation location was specified by the MTO in the RFP/TPM documentation Agreement No. 5009-E-0044. The terms of reference for the scope of work are outlined in LVM | MERLEX's proposal P-10-006, dated January 27, 2010. The purpose of the investigation was to determine the subsurface conditions along select areas of the proposed passing lane. LVM | MERLEX investigated the foundation areas by the drilling of boreholes, carrying out in-situ tests, and performing laboratory testing on select samples.

2.0 SITE DESCRIPTION

The site of the foundation investigation is within the proposed northbound passing lane (Passing Lane No. 3), between Stations 22+450 and 22+590 in the Township of Taylor. The topography at the site is generally of moderate relief. The existing highway embankment currently supports two undivided lanes of highway.

The existing highway between Stations 22+450 to 22+590 is constructed on a fill embankment, with a centerline elevation ranging between 263.9 and 266.0 m. A fill widening will be required to construct the northbound passing lane within the above noted limits. An extension to the outlet of the existing 3050 mm SPCSP culvert at Station 22+565, Taylor Township, is required to accommodate the widening. The flow through the culvert is from west to east (right to left) with a 25 year design flow of 10.5 m^3/s.

Within the area of investigation there is an entrance on the left, within some 50 m of the culvert location. Infrastructure at this location consists of overhead power and communication wires on the left and right sides of the highway.

2.1 Site Physiography and Surficial Geology

This project is located in the Geomorphic Sub-province known as the Cochrane Clay Plain. The topography on this section of Highway 11 is generally slightly 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 clay, containing varying amounts of silt and sand.

Bedrock in the area, as indicated on OGS Map 2506, is of the Early Precambrian Era. At the location of the proposed Passing Lane No. 3, the bedrock comprises of Metasediments including: conglomerate, sandstone, mudstone, marble, chert, iron formation and related migmatites.

3.0 INVESTIGATION PROCEDURES

The field work for this investigation was carried out between September 27 and October 14, 2010, during which six (6) sampled boreholes were advanced for the embankment widening, and two (2) sampled boreholes were advanced for the culvert extension. Each borehole was advanced to the north (left) of the existing embankment along the toe of the embankment.

The field investigation was carried out using a Bombardier mounted CME 45B drilling rig 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 (37 mm inside diameter) 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. Between the borehole locations, Dynamic Cone Penetration Tests (DCPT) were 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. Relatively undisturbed samples of the clay deposits were retrieved using a 75 mm diameter Shelby Tube. 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.

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 testing for natural moisture content determination, Atterberg Limits, particle size analysis, specific gravity, and consolidation testing. The results of the laboratory testing are presented on the individual Record of Borehole Sheets (Appendix B), with a summary of results presented on the laboratory sheets in Appendix C (Figure Nos. L-1 to L-19).

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.

4.0 SUBSURFACE CONDITIONS

Details of the subsurface conditions revealed by the investigation program are presented on the enclosed Record of Borehole Logs (Appendix B) and on Figure Nos. F3-1 and F3-2 (Appendix C). 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 Russel Creek Culvert, Station 22+565, TWP of Taylor

Two (2) boreholes, Borehole Nos. A-1 and A-2 (Enclosure Nos. 2 and 3, Appendix B), were advanced to the west of the existing culvert at Station 22+565. The ground surface elevations at Borehole Nos. A-1 and A-2 were recorded at 258.0 and 259.2 m, respectively. A plan and profile showing the borehole locations and stratigraphic sequences is shown on Figure No. F3-1, Appendix C.

A thin layer of surficial organics some 50 mm in thickness was encountered at both boreholes.

4.1.1 Fill (Silt)

Underlying the surficial organics at Borehole No. A-1, a deposit of fill consisting of brown silt trace sand trace gravel trace wood was penetrated. The natural moisture content measured on a sample of this deposit was in the order of 23%. This deposit was encountered to a depth of 0.8 m below grade (elevation 257.2 m).

4.1.2 Fill (Clay)

Underlying the silt fill at Borehole No. A-1, and underlying the surficial organics at Borehole No. A-2, a heterogeneous fill deposit consisting of brown clay some sand to sandy with silt trace gravel was penetrated. The natural moisture content obtained from samples of this deposit was is the order of 15 to 59%. Hydrometer analyses were carried out on three (3) samples of this deposit, the results of which indicated 4 to 10% gravel size particles, 18 to 34% sand size particles, 23 to 27% silt size particles, and 36 to 58% clay size particles (Figure No. L-1, Appendix C). Atterberg Limits testing was carried out on three (3) samples of this deposit, the results of which indicated a Liquid Limit in the order of 38 to 59% and a Plastic Limit in the order of 17 to 22%. Based on the results of the Atterberg Limits testing, the fine grained portion of this deposit was classified under USCS as clay of high plasticity (CH) (Figure No. L-12, Appendix

C). Based on SPT 'N' values of 5 to 22 blows per 300 mm penetration, the consistency of this deposit was estimated as firm to very stiff. This deposit was encountered to depths of 2.1 and 3.0 m below grade at Borehole Nos. A-1 and A-2, respectively (elevations 255.9 and 254.6 m, respectively).

4.1.3 Clay

Underlying the heterogeneous fill deposit at Borehole Nos. A-1 and A-2, a deposit of grey clay trace sand was penetrated. The natural moisture content measured on samples of this deposit was in the order of 46 to 63%. Hydrometer analyses were carried out on four (4) samples of this deposit, the results of which indicated 0% gravel size particles, 0 to 1% sand size particles, 18 to 25% size silt particles, and 74 to 82% clay size particles (Figure No. L-12, Appendix C). Atterberg Limits testing was carried out on five (5) samples of this deposit, the results of which indicated a Liquid Limit in the order of 51 to 60% and a Plastic Limit in the order of 20 to 23%. Based on the results of the Atterberg Limits testing, the deposit was classified under USCS as clay of high plasticity (CH) (Figure No. L-13, Appendix C). Based on the in-situ field vane testing, which returned values of 28 to 44 kPa, the consistency of this deposit was described as firm (Figure No. L-17, Appendix C). The plasticity generally decreased with depth in this deposit as the silt content was observed to gradually increase, resulting in a gradual change to a silty clay. While the transition was gradual, it is considered the change to silty clay was encountered at depths of some 7.3 and 8.8 m at Borehole Nos. A-1 and A-2 respectively (elevations 250.7 and 250.4 m, respectively).

A single one-dimensional oedometer (consolidation) test was carried out on a sample of this deposit obtained from Borehole No. A-2 (see Figure Nos. L-18a to L-18c, Appendix C). The preconsolidation pressure was estimated to be in the order of 100 kPa and the over-consolidation ratio, which is the ratio of the preconsolidation pressure to the existing overburden

pressure, was in the order of 1.5. Based on the results of the oedometer (consolidation) tests, vane shear strength data, and the relationship of the moisture content to liquid limit, this deposit is considered to be slightly over-consolidated.

4.1.4 Silty Clay

Underlying the clay deposit at Borehole Nos. A-1 and A-2, a deposit of grey silty clay trace sand was penetrated. The natural moisture content obtained from samples of this deposit was in the order of 37 to 53%. Hydrometer analyses were carried out on three (3) samples of this deposit, the results of which indicated 0% gravel size particles, 0 to 1% sand size particles, 28 to 66% size silt particles, and 34 to 72% clay size particles (Figure No. L-2, Appendix C). Atterberg Limits testing was carried out on the three (3) samples of this deposit, the results of which indicated a Liquid Limit in the order of 36 to 48% and a Plastic Limit in the order of 19 to 20%. Based on the results of the Atterberg Limits testing, the deposit was classified under USCS as silty clay of medium plasticity (CI) (Figure No. L-15, Appendix C). Based on the in-situ field vane testing, which returned values of 46 to 66 kPa, the consistency of this deposit was described as firm to stiff (Figure No. L-17, Appendix C). The plasticity of this deposit generally decreases with depth in this deposit as the silt content continued to increase, becoming clayey silt at depth as observed at Borehole No. A-1. This deposit was encountered to a depth of 11.9 m at Borehole No. A-1 (elevation 246.1 m). Sampling was terminated in this deposit at a depth of 14.2 m below existing grade at Borehole No. A-2 (elevation 245.0 m).

4.1.5 Clayey Silt

At Borehole No. A-1, a gradual change to grey clayey silt occurred at depth. The natural moisture content from samples of this deposit was in the order of 29 to 46%. A hydrometer analysis was carried out on a single sample of this deposit, the results of which indicated 0% gravel size particles, 0% sand size particles, 86% silt size particles, and 14% clay size particles

(Figure No. L-3, Appendix C). Atterberg Limits testing was carried out on one (1) sample of this deposit, the results of which indicated a Liquid Limit in the order of 21% and a Plastic Limit in the order of 16%. Based on the results of the Atterberg Limits testing, the deposit was classified under USCS as clayey silt (ML-CL) (Figure No. L-16, Appendix C). Based on STP values, the consistency of this deposit was estimated as stiff. Sampling was terminated in this deposit at a depth of 14.2 m at Borehole No. A-1 (elevation 243.8 m).

Refusal was encountered on the DCPTs at depths of 17.9 and 15.8 m below existing grade at Borehole Nos. A-1 and A-2 respectively (elevations 240.1 and 243.4 m, respectively).

4.2 Passing Lane No. 3, Station 22+450 to 22+590, TWP of Taylor

A plan and profile showing the borehole locations and stratigraphic sequences is shown on Figure No. F3-1, Appendix C. During the course of the exploration program, six (6) sampled boreholes (Borehole Nos. 1 to 6, Enclosure Nos. 4 to 9, Appendix B), along with five DCPT (DCPT Nos. 1 to 5, Enclosure Nos. 10 to 14, Appendix B) were advanced to the east of the existing embankment. At the time of the subsurface investigation, the ground surface elevations at Boreholes Nos. 1 to 6 were recorded at 261.4, 261.7, 262.0, 263.6, 263.0, and 263.6 m, respectively. A plan and profile showing the borehole locations and stratigraphic sequences is shown on Figure No. F3-3, Appendix C.

A thin layer of surficial organics some 50 mm in thickness was generally encountered at each borehole.

4.2.1 Silty Clay

Underlying the surficial organics at Borehole No. 1, a deposit of brown silty clay trace to some sand was penetrated. The natural moisture content measured on samples of this deposit was in

the order of 20 to 30%. Hydrometer analyses were carried out on three (3) samples of this deposit, the results of which indicated 0% gravel size particles, 1 to 15% sand size particles, 32 to 41% silt size particles, and 53 to 64% clay size particles (Figure No. L-4, Appendix C). Atterberg Limits testing was carried out on the three (3) samples of this deposit, the results of which indicated a Liquid Limit in the order of 47 to 55% and a Plastic Limit in the order of 19 to 21%. Based on the results of the Atterberg Limits testing, the deposit was classified under USCS as silty clay of medium plasticity to clay of high plasticity (CI to CH) (Figure No. L-12, Appendix C). Based on STP 'N' values of 4 to 13 blows per 300 mm penetration, the consistency of this deposit was estimated as firm to stiff. This deposit was encountered to a depth of some 3.7 m below ground surface (elevation 257.7 m).

4.2.2 Sand

Underlying the silty clay at Borehole No. 1, a deposit of grey sand trace gravel trace silt was penetrated. The natural moisture content measured in a sample of this deposit was in the order of 15%. A gradation analysis was carried out on one sample of this deposit which was retained in the spilt spoon sampler (37 mm inside diameter), the results of which indicated 3% gravel size particles, 93% sand size particles, and 4% silt and clay size particles (Figure No. L-5, Appendix C). Based on SPT values of 2 blows per 300 mm penetration, the compactness of this deposit was described as very loose. This deposit was encountered to a depth of 4.6 m below ground surface (elevation 257.7 m).

4.2.3 Sandy Clay

Underlying the sand at Borehole No. 1, a deposit of sandy clay some silt was penetrated. The natural moisture content measured on samples of this deposit was in the order of 35 to 49%. A hydrometer analysis was carried out on one (1) sample of this deposit, the results of which indicated 0% gravel size particles, 40% sand size particles, 14% silt size particles, and 46% clay

size particles (Figure No. L-6, Appendix C). Atterberg Limits testing was carried out on one sample of this deposit, the results of which indicated a Liquid Limit in the order of 41% and a Plastic Limit in the order of 15%. Based on the results of the Atterberg Limits testing, the deposit was classified under USCS as silty clay of medium plasticity (CI) (Figure No. L-12, Appendix C). Based on STP 'N' values of 0 (static weight of hammer) to 8 blows per 300 mm penetration, the consistency of this deposit was estimated as very soft to firm. This deposit was encountered to a depth of 6.6 m below ground surface (elevation 254.8 m).

4.2.4 Clay

Underlying the sandy clay at Borehole No. 1, and underlying the surficial organics at Boreholes Nos. 2 to 6 inclusive, a deposit of brown to grey clay trace sand was penetrated. The upper 3 to 4 m of this deposit was observed to be desiccated, based upon color, a generally lower moisture content, and in consideration of the consistency (estimated as very stiff based on SPT 'N' values) relative to the remainder of the deposit at greater depths. The transition from desiccated to undesiccated clay occurs at elevations ranging from 261 to 259 m. The silt content generally increased with depth in this deposit. The natural moisture content measured on samples of this deposit was in the order of 24 to 74%. Hydrometer analyses were carried out on seventeen (17) samples of this deposit, the results of which indicated 0% gravel size particles, 0 to 2% sand size particles, 12 to 63% silt size particles, and 35 to 88% clay size particles (Figure Nos. L-7 to L-10, Appendix C). Atterberg Limits testing was carried out on the 17 samples of this deposit, the results of which indicated a Liquid Limit in the order of 52 to 82% and a Plastic Limit in the order of 19 to 24%. Based on the results of the Atterberg Limits testing, the deposit was classified under USCS as clay of high plasticity (CH) (Figure Nos. L-13 and L-14, Appendix C). Based on in-situ shear strengths of 22 to 58 kPa, which generally increased with depth, below elevation 260 m, the consistency of the undesiccated part of this deposit was described as soft to stiff, generally firm (Figure No. L-17, Appendix C). The

plasticity generally decreased with depth in this deposit as the silt content was observed to gradually increase, resulting in a gradual change to a silty clay. While the transition was gradual, the change to silty clay was generally encountered at depths of some 13.4, 11.9, 7.3, 10.4, 14.9, and 16.5 m below ground surface at Borehole Nos. 1 to 6 respectively (elevations 248.0, 249.8, 254.7, 253.2, 248.1, and 247.1 m, respectively).

A single one-dimensional oedometer (consolidation) test was carried out on a sample of this deposit obtained from Borehole No. 3, Sample No. 9 (see Figure Nos. L-19a to L-19c, Appendix C). The preconsolidation pressure was estimated to be in the order of 70 kPa and the over-consolidation ratio, which is the ratio of the preconsolidation pressure to the existing overburden pressure, was in the order of 1.0. Based on the results of the oedometer (consolidation) tests, vane shear strength data, and the relationship of the moisture content to liquid limit, this deposit is considered to be normally consolidated.

4.2.5 Silty Clay

A gradual transition from clay to a deposit of grey silty clay trace sand was observed at Borehole Nos. 1 to 6. The natural moisture content obtained from samples of this lower region of the fine grained deposit was in the order of 28 to 61%. Hydrometer analyses were carried out on ten (10) samples of this deposit, the results of which indicated 0% gravel size particles, 0 to 3% sand size particles, 27 to 73% silt size particles, and 27 to 72% clay size particles (Figure Nos. L-7 to L-10, Appendix C). Atterberg Limits testing was carried out on the ten (10) samples of this deposit, the results of which indicated a Liquid Limit in the order of 33 to 56% and a Plastic Limit in the order of 17 to 21%. Based on the results of the Atterberg Limits testing, the deposit was classified under USCS as silty clay of medium to low plasticity (CI to CL) (Figure No. L-15, Appendix C). The plasticity generally decreased with depth in this deposit as the silt content continued to increase, becoming clayey silt at depth as observed at Borehole No. 2.

Based on in-situ shear strengths of 26 to 74 kPa, the consistency of this deposit was described as firm to stiff (Figure No. L-17, Appendix C). This deposit was encountered to a depth of 14.9 m below grade at Borehole No. 2 (elevation 246.8 m). Sampling was terminated in this deposit at Borehole Nos. 1, 3, 4, 5, and 6 at depths of some 18.8, 18.8, 19.1, 19.1, and 19.1 m below ground surface respectively (elevations 242.6, 243.2, 244.5, 243.9, and 244.5 m, respectively).

4.2.6 Clayey Silt

Underlying the silty clay at Borehole No. 2, a deposit of grey silty clay trace sand was penetrated. The natural moisture content measured on samples of this deposit was in the order of 37 to 42%. A hydrometer analysis was carried out on one (1) sample of this deposit, the results of which indicated 0% gravel size particles, 0% sand size particles, 70% silt size particles, and 30% clay size particles (Figure Nos. L-7, Appendix C). Atterberg Limits testing was carried out on the one (1) sample of this deposit, the results of which indicated a Liquid Limit in the order of 24% and a Plastic Limit in the order of 17%. Based on the results of the Atterberg Limits testing, the deposit was classified under USCS as clayey silt of low plasticity (CL) (Figure No. L-16, Appendix C). The consistency of this deposit was estimated as very stiff (Figure No. L-17, Appendix C). This deposit was encountered to a depth of 17.7 m below grade at Borehole No. 2 (elevation 244.0 m).

4.2.7 Sand

Underlying the clayey silt at Borehole No. 2, a deposit of grey sand with silt trace clay was penetrated. The natural moisture content measured on a sample of this deposit was in the order of 22%. A gradation analysis was carried out on one sample of this deposit which was retained in the spilt spoon sampler, the results of which indicated 0% gravel size particles, 64% sand size particles, 28% silt size particles, and 8% clay size particles (Figure No. L-11, Appendix C). Based on SPT values of 7 blows per 300 mm penetration, the compactness of this deposit was

described as loose. Sampling was terminated in this deposit at a depth of 18.8 m below ground surface (elevation 242.9 m).

Refusal was encountered on the DCPTs at depths of 22.5, 18.1, 18.8, 22.5, 22.2, and 21.8 m below existing grade at Borehole No. 1 and DCPT Nos. 1 to 5, respectively (elevations 238.9, 243.3, 241.1, 239.3, 239.5, and 241.2 m, respectively).

4.3 Groundwater Conditions

Measurement 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. Artesian pressure was identified in Borehole No. A-1 when the hole was advanced below 12.8 m depth and silt/fine sand content increased. Groundwater levels were not recorded in Borehole Nos. A-1 and A-2, due to the artesian pressure and the need to immediately seal the boreholes. This artesian pressure was measured in Borehole No. 1, with a piezometer installed to an 18 m depth. The water level rose, over a two day period, to some 325 mm above existing grade at the borehole (elevation 261.7 m). This piezometer was decommissioned and sealed with bentonite before leaving the site. Based on the brown/grey interface in the soils, the groundwater table, at the borehole locations, is estimated to be between elevations 259.3 to 260.3 m in the area of the widening. The water level in the stream was measured at elevation 256.8 m at the time of this investigation. The groundwater levels will fluctuate seasonally.

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5.0 DESIGN COMMENTS AND RECOMMENDATIONS

5.1 General

A northbound passing lane, WP 5219-08-01 - Passing Lane No. 3, is proposed in the Township of Taylor. The section located between Stations 22+450 and 22+590 was identified as requiring a foundation investigation in the RFP, along with an investigation for an extension to a 3050 mm diameter SPCSP culvert, located within this area, at Station 22+565.

The proposed passing lane will be 3.5 m wide for its entire length (Station 22+450 to 22+590) with a 3.5 m shoulder. The proposed passing lane will extend from the edge of pavement of the existing northbound lane, 3.5 m left (center line of the passing lane will be 5.4 m left of the highway centerline). The embankment will therefore be widened some 4.4 m to accommodate the new passing lane and shoulder (see Figure Nos. F3-3 and F3-4). The extension to the culvert at Station 22+565 will be some 8 m.

Details on the pavement design are contained in the Pavement Design Report prepared by LVM | MERLEX – Reference No. 10/07/10131-P3, dated May 2011. As detailed in the highway geotechnical report prepared by LVM | MERLEX, to construct the passing lane the embankment will be widened to match the existing embankment height, using earth fill or SSM, with a 1.0 to 1.5 m pavement structure (subbase (thickness varies to match subbase on existing lanes), base, and asphalt).

The culvert (Station 22+565) was reported by others to be in good condition and therefore does not require replacement or lining at this time. An extension to the culvert is required to allow for the passing lane to be constructed. It is anticipated that the culvert extension will be constructed of Structural Plate Corrugated Steel Pipe, 3050 mm diameter, to accommodate the flow as per the hydrology report (prepared by MMM Group).

Based on data obtained during this foundation investigation, supplemented with the data obtained from the geotechnical investigation for this section of highway (Enclosure No. 17, Appendix D), which was also carried out by LVM | MERLEX, the embankment supporting the existing pavement structure at these sites has been constructed using granular materials (pavement structure) over earth fills. The native soils to the left (north) of the embankment consist generally of stiff to firm clays/silty clays from surface (elevations 261.4 to 263.6 m, at Borehole Nos. 1 to 6) down to elevations 242.6 to 244.5 m.

At the culvert location, a visual review indicated no signs of embankment instability. The culvert outlet invert was recorded at elevation 256.0 m. The founding native soils, beyond the toe of slope, based on Borehole Nos. A-1 and A-2, comprise of a deposit of clay fill to elevations 255.9 and 254.6 m, respectively, underlain by a generally firm decreasing to soft clay to approximately elevation 251.0 m, underlain by generally stiff silty clay. Based on a review of the existing embankment and culvert, and on the native soils at this location, the founding materials are considered reasonable for culvert support.

5.2 Foundation Considerations

The foundation area is located along proposed Passing Lane No. 3, in the Township of Taylor, between Stations 22+450 to 22+590. This section of the existing highway embankment is constructed using granular fill (pavement structure) overlying earth fill and the new passing lane will be constructed in a similar manner. The relationship between the existing highway centerline profile relative to the existing grade at the boreholes is shown on Figure No. F3-2, Appendix C. The height of the existing embankment along this section of the proposed passing lane varies from some 1.2 m at Station 22+470 to, locally, approximately 7.5 m above existing grade at Station 22+565 (i.e. at the Russel Creek Culvert).

In order to construct the passing lane, as indicated in the geotechnical report, excavations, to depths of 1.2 to 1.5 m below the existing left edge of pavement (varying between elevation 263.9 m at Station 22+550 to elevation 265.5 m at Station 22+450), will be carried out starting at points ranging from 4.0 to 5.5 m left of centreline, to the left, as required to widen the embankment. Considering the proposed excavations and the existing 2H:1V foreslope along the proposed passing lane alignment, the new embankment plus pavement structure will range in height from 1.2 to locally 7.5 m (directly adjacent to the culvert extension) above existing grade. This height of construction over the existing embankment 2H:1V foreslope will result in an additional pressure on the clays ranging from less than 10 kPa up to approximately 50 kPa, with the greater pressure increase occurring to the sides of the Russell Creek Culvert (Station 22+565), see Figure Nos. F3-3 and F3-4, Appendix E.

The upper 2 to 3 m of the native clay deposit between Stations 22+450 and 22+590 was found to be very stiff, with shear strength values greater than 100 kPa, based on SPT “N” values of 1 to 18 returned at Borehole Nos. 1 to 6 and ‘N’ values of 2 and 3 at Borehole Nos. A-1 and A-2. Below this upper crust of clay, the average shear strength was in the order of 30 to 40 kPa, increasing with depth (see Figure No. L-17). Based on the soil conditions present, including the stiff clay crust, the response of the existing embankment, and a foundation elevation for the extension similar to that of the existing culvert outlet (elevation 256.0 m), and assuming the extension will be constructed at a similar slope as the existing culvert (some 1.5%) for a new outlet elevation of 255.8 m, a factored bearing resistance at ULS of 100 kPa for the native silty clay soil can be used for flexible or rigid pipe. A geotechnical resistance at SLS of 50 kPa is associated with a 50 mm total settlement (see Section 5.2.1 Settlements).

5.2.1 Settlements

The new embankment fill for the widening will be placed over the existing embankment foreslope. The widening will extend from the edge of the existing shoulder, out some 4.4 m to the new shoulder rounding, and then will be sloped down at an angle of 2H:1V to original grade. The “wedge” of fill will be thinnest adjacent the existing highway, becoming thicker progressing to the left (i.e. transversely). As such, the new load will also be minimal adjacent the existing highway, increasing progressing to the left as the fill becomes thicker. The greatest thickness of new fill being added to the embankment for the widening, except in the area of the culvert (Station 22+565), will be in the order of 2.3 m (see Figure No. F3-3, Appendix E). The net vertical pressure increase associated with the addition of the generally 0.9 m of embankment fill is some 15 kPa, except at Station 22+550 where the net vertical pressure is some 40 kPa.

While the addition of new fill for the widening will not overstress the founding soils to failure, the load of the new fill is expected to result in long-term settlement due to consolidation of the underlying clay and silty clay deposits. To establish estimates of the magnitude of settlement for this section of the highway, two (2) one dimensional consolidation tests were carried out by Golder Associates Ltd. on representative samples of the clay obtained from Borehole No. A-2, Sample 9 and Borehole No. 3, Sample 9. Results from the consolidation tests are shown on enclosed Figure Nos. L-18a to L-18c and Figure Nos. L-19a to L-19c (Appendix C) and plots the void ratio to increasing vertical pressure. The sample from Borehole No. A-2 was taken from the river valley (Stations 22+530 to 22+580), where some 5 m of material had been scoured out to create the stream channel. As such, the clay in the valley has been over consolidated, with an OCR of 1.5. The consolidation data from Borehole A-2 has been used in the settlement analysis in the valley area. The sample from Borehole No. 3 represents the deposit where the grade is some 3 m greater than at Borehole No. A-2. The test results indicated this material was normally consolidated with an OCR of 1.0.

To calculate estimates of total consolidation settlements due to new embankment loads, the computer software program Settle 3D (Rocscience, 2006) has been used. These estimates have been confirmed with hand calculations.

The soil parameters used to estimate the settlement due to consolidation are as follows:

Station	Initial void Ratio (e_0)	Compression Index (C_c)	Recompression Index (C_{cr})	OCR
22+450 to 22+530 and 22+580 to 22+590	1.456	0.49	0.05	1.0
22+530 to 22+580	1.584	0.68	0.02	1.5

In consideration of a maximum effective stress increase of 50 kPa acting over the culvert extension, a maximum total settlement of approximately 55 mm is anticipated. This estimate is based on having properly compacted bedding and, as such, no initial settlement. This total settlement will develop in the area of the connection between the existing and new extension, some 18 m left of centerline.

This settlement could be accommodated by installing the extension on a camber. However considering the magnitude of estimated settlement at some 55 mm relative to the size of the 3050 mm diameter SPCSP extension, installing on a camber may not be necessary since a flexible culvert can deflect 2% or more without cracking.

Settlements of the new embankment slope, at sections along the passing lane, have been estimated as follows:

Station	Offset from CL to Maximum Load (m)	Maximum increase in load (kPa)	Estimated Total Settlement (mm)
22+450	11 Lt	15	50
22+500	11 Lt	15	50
22+550	15 Lt	40	50
22+590	12 Lt	15	50

This magnitude of settlement, which will develop on the embankment slope, will not adversely affect the new passing lane.

Based on the coefficient of consolidation (c_v) of $6.99e^{-4}$ cm^2/s for the clay, it is estimated that 90% of this settlement will develop over a period of approximately 10 years, as shown on the time–settlement curve provided on Figure No. F3-5, Appendix E.

The depth of cover over the culvert exceeds the 2.5 m depth of frost penetration provided in the RFP. As such, the culvert will not be impacted by frost. Provided fill within the depth of frost penetration is SSM or better, quality frost heaving will not impact the passing lane or shoulder. Frost protection (tapers) recommendations are discussed in the LVM | MERLEX Pavement Design Report.

5.2.2 Embedment and Subgrade Preparation

The results of this investigation indicate that the native soils at the toe of slope to the left of the outlet (Borehole Nos. A-1 and A-2) consist of a clay fill, underlain by a stratum of generally firm clay/silty clay, underlain by a thin clayey silt deposit at Borehole No. A-1. The embankment fill consist of granular materials (sands and gravels). A review of the condition of the pavement surface, at the culvert location, revealed some longitudinal and transverse asphalt cracking, however no indication of excess differential settlement was observed, which indicates that the embankment fill has generally performed well. A thin layer of organics, some 50 mm thick, was encountered in the area of the culvert extension. The organic layer should be removed prior to subgrade preparation and placing the bedding material.

It is understood that the existing culvert will remain in place with an extension connected at the left end. The left end of the existing SPCSP culvert is cut back on a bevel and has a low

concrete wingwall, perpendicular to the outlet end. It is likely that the structural plates will be unbolted back from the top of the barrel to allow a positive connection of the extension.

Embedment material, for flexible pipes, can consist of Granular B Type I placed in accordance with OPSD 802.010, however in consideration of the anticipated small quantities required for this extension, it is recommended that a Granular A material be used for embedment. Bedding should be a minimum 150 mm thick, as per OPSD 802.010. It is imperative that the embedment material in the haunch area of the pipe be compacted to 100% Standard Proctor Dry Density. Additionally, the backfill for the culvert extension should consist of a Granular B Type I and the embankment foreslope should be constructed to a 2H:1V slope.

Lateral earth pressures should be computed in accordance with the Canadian Highway Bridge Design Code (CHBDC). The design parameters are as follows:

	Granular A	**Granular B Type I**	**SSM/Existing Embankment Fill**
Angle of Internal Friction (degrees)	35	30	30
Unit weight (KN/m^3)	21	19	17.5
Active earth pressure (Ka)	0.27	0.33	0.33
At-rest earth pressure (Ko)	0.43	0.50	0.50

For flexible structures, such as SPCSP culverts, deflection can occur, as such the “active” condition (Ka) applies.

5.2.3 Excavation, Dewatering, and Embankment Reconstruction

All excavations greater than 1.2 m in depth must be sloped or shored in accordance with the Occupational Health and Safety Act Regulations for Construction Projects. Excavation, to cut back the existing foreslope to connect the extension, will penetrate the existing embankment fills, which consist of sands trace gravel trace silt. Temporary open excavations will be stable above the groundwater table at an angle of 1H:1V, as the embankment soils are considered a Type 3 soil as defined in the Occupational Health and Safety Act and Regulations for Construction Projects.

Bedrock was not encountered within the anticipated depth of excavation, therefore bedrock excavation and/or blasting operations are not anticipated.

Excavations must be maintained in a dewatered condition during excavation and foundation construction and every reasonable effort must be made to prevent disturbing the founding subgrade. The groundwater level in the stream was measured at elevation 256.8 m at the location of the culvert end, at the time of this investigation. Groundwater control, in accordance with OPSS 517 and 518, will be required to maintain a stable subgrade during culvert installation. Local temporary sandbagging and dewatering pumping, combined with installation of filtered sumps and pumping from the base of the excavation will, at a minimum, be required to maintain the excavation in a dewatered condition during subgrade preparation. Temporary sheet pile type cofferdams can also be considered for controlling stream flow combined with diversion pumping. Ultimately, the method of dewatering and stream diversion will be the choice of the contractor; however the importance of maintaining the subgrade in a dewatered stable condition during excavation and foundation construction cannot be stressed enough.

5.2.3.1 Protection System

It is understood that excavations, some 1.0 to 1.5 m, in depth, will be required in order to construct the pavement structure for the proposed passing lane (offset 4.0 to 5.5 m left of centreline). Considering the limited depth of excavation required, it will be possible to temporarily reduce the traffic to a single lane with traffic control, where necessary, allowing for an open excavation to be carried out. As such, it is not anticipated that a sheet pile or other type of protection system will be required during construction operations along the proposed passing lane.

At the left (outlet) end of the existing 3050 mm SPCSP culvert, the embankment foreslope can be locally cut back on a 1H:1V slope in compliance with the Occupational Health and Safety Act to allow installation of the SPCSP extension. This temporary construction slope does not intersect the existing left shoulder, it is not anticipated that a protection system will be necessary at this location, provided the contractor carries out an efficient and timely operation. The contractor is not to leave the temporary slope unattended at any time or open for an extended period of time (i.e. greater than 1 working day). Generally, this operation of removing (unbolting) the SPCSP end pieces and attaching the extension can be undertaken within a period of one work day. If the above cannot be complied with than the contractor can select to install a sheet pile shoring system.

5.3 Extension Connection

It is understood that the existing end of the SPCSP is in good condition. As discussed above, the new extension can be bolted directly to the outlet end, after the beveled section is removed. Considering the permeable nature of the cohesionless backfill in the embankment, clay seals are not considered necessary. The permeability of the embankment soil is similar to the culvert

embedment material, as such, provided a cutoff wall similar to the existing is placed, a rip-rap size rock apron is not required from a foundations perspective.

5.4 Embankment Stability

The maximum height of fill for this embankment is some 7.5 m at the culvert location (Station 22+565). A stability analysis using the program Slope/W was carried out at this location with a standard embankment slope established at 2H:1V. The unit weights and friction angles used for the slope analysis are based on general representative values for soil types, based on lab testing, while shear strengths were based on field vane testing, and are included in the following table.

Soil	Elevations (m)	Unit weight (KN/m^3)	Angle of Internal Friction (degrees)	Shear Strength (kPa)
Granular Fill	264.0 – 263.0	19	30	-
SSM/Existing Embankment Fill/New Embankment Fill	263.0 – 256.0	17.5	30	-
Clay	256.0 – 252.0	16.5	-	40
Clay	252.0 – 250.5	16.5	-	30
Silty Clay (firm)	250.5 – 248.0	16.5	-	50
Silty Clay (stiff)	248.0 – 244.0	16.5	-	60

The results of the analysis indicated a factor of safety in the order of 1.50 for a deep seated rotational failure through the native silty clay subgrade with a water table at elevation 257.0 m (see Figure No. S-1, Appendix E). As, such the stability of the new embankment slope will not be an issue provided it is properly constructed as discussed in Section 5.1.

5.5 Construction Concerns

The water level in the culvert was recorded at elevation 258.6 m at the time of this investigation. The contractor must be prepared to control the creek flow and the groundwater water at the time of construction of the culvert extension.

6.0 CLOSURE

Information provided in this report is valid only at the locations described above. Any assumptions of continuity of soil stratigraphy between boreholes, as shown on the enclosed cross-sections, is intended as an aid for design purposes only and does not constitute a statement of existing conditions for contractual or construction purposes. Field investigation was carried out using a CME drill rig mounted on a Bombardier carrier owned by Chrisdamat Management Ltd. The report was prepared by Mr. J. R. Berghamer, P. Eng and reviewed by the firm's principal and MTO designate Mr. M. A. Merleau, P. Eng.

Details of the investigation, the material analysis and recommendation in this report are considered to be complete. However, should any questions arise, please do not hesitate to contact the undersigned.

LVM | MERLEX

M. A. Merleau, P. Eng.
Principal Engineer
MTO Designate

J. R. Berghamer, P. Eng.
Regional Manager

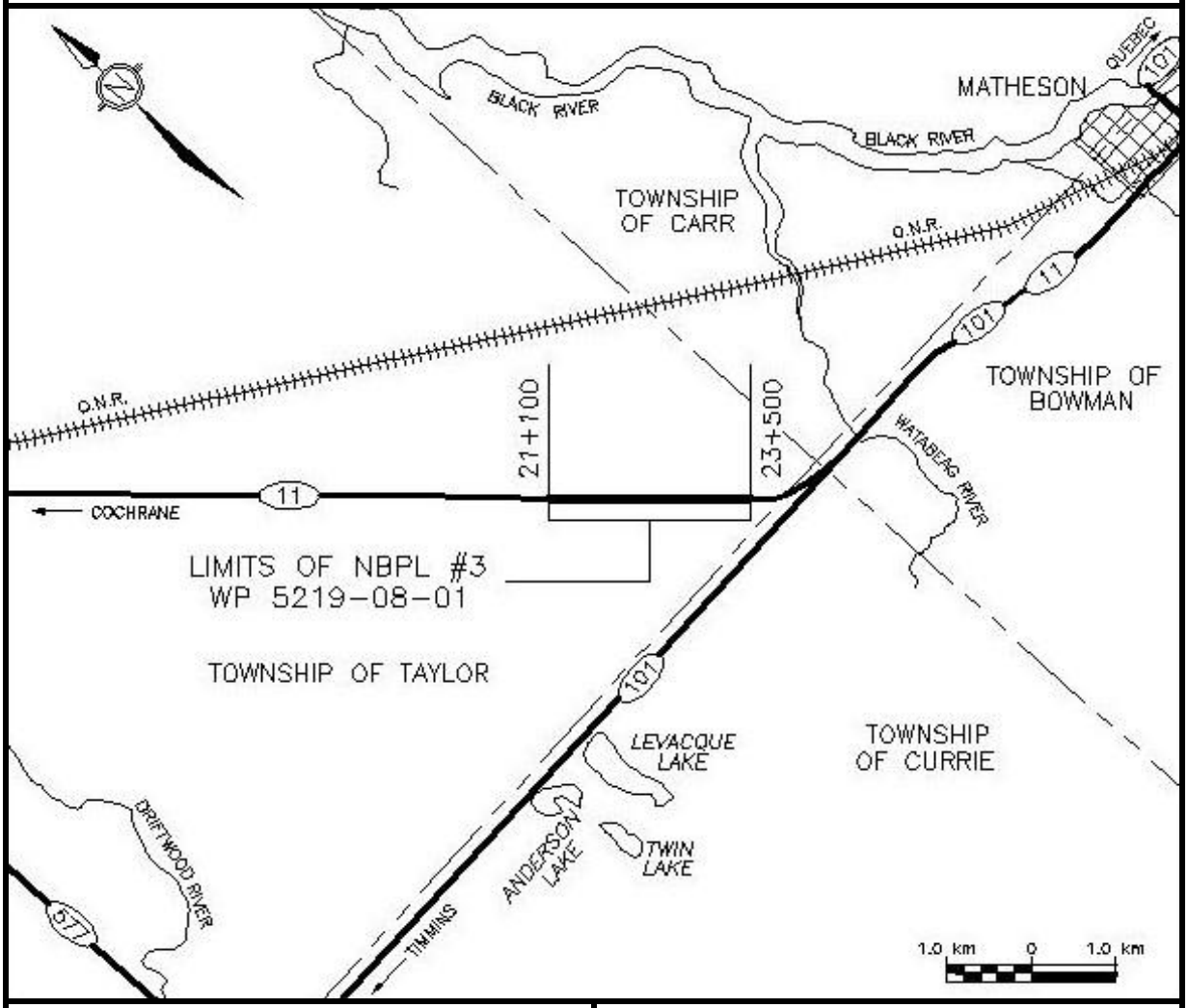
Appendix A Key Plan

Figure No. 1: Key Plan

KEY PLAN

Figure No. 1

NOT TO SCALE



FINAL
FOUNDATION INVESTIGATION
AND DESIGN REPORT
GWP 5217-08-00

WP 5219-08-01

Highway 11, Northbound Passing Lane
2.7 km North of Highway 101,
Southerly 2.4 km

Ref. No.: 10/07/10131-F3 February 2012

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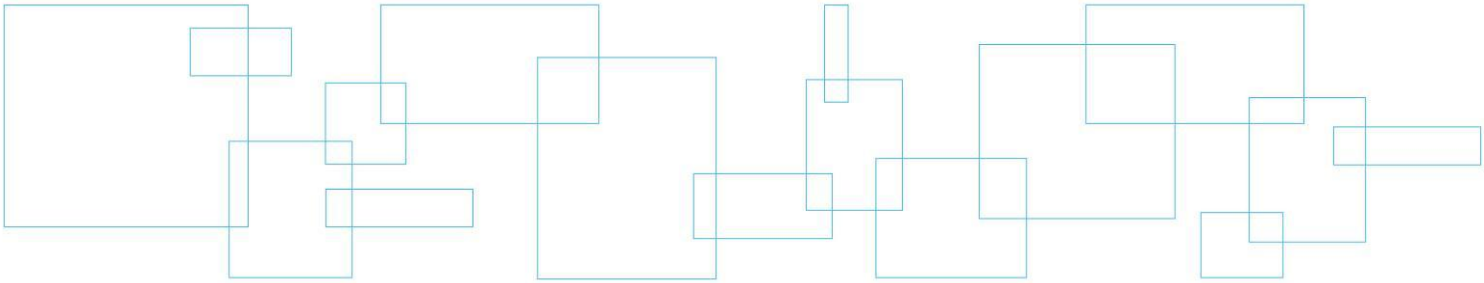
Appendix B Abbreviations
Record of Borehole Sheets

Enclosure No. 1: List of Abbreviations and Symbols
Enclosure Nos. 2 to 14: Record of Borehole Sheets



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LIST OF ABBREVIATIONS AND 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
NP Non Plastic
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

3. SOIL DESCRIPTION (Cont'd)

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

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%

5. LABORATORY TESTS

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

LIST OF ABBREVIATIONS AND DESCRIPTION OF TERMS

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. A-1

LVM | MERLEX

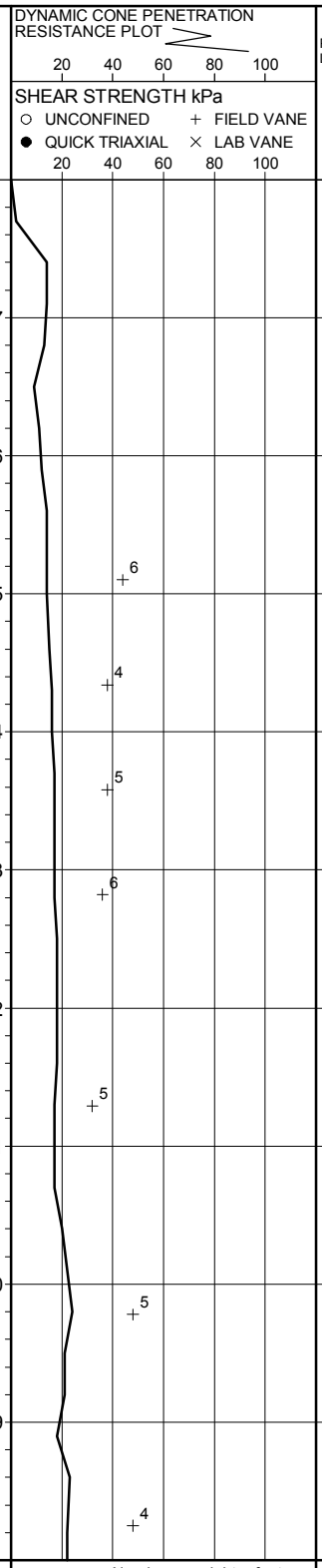
REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379070.8 E 336793.0 - Taylor Township - Russel Creek Culvert ORIGINATED BY JL

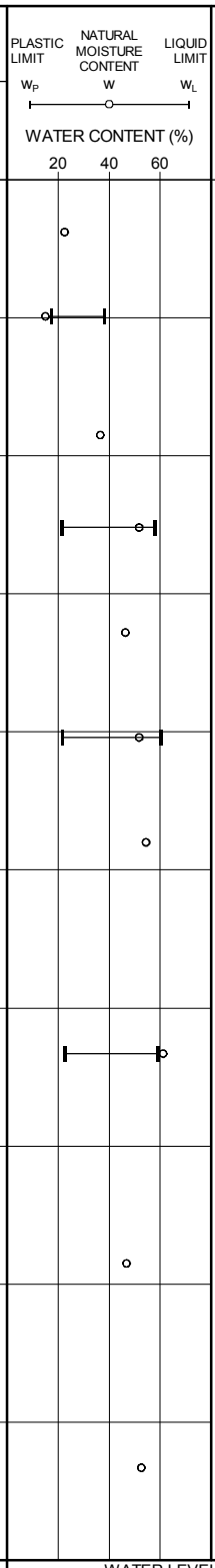
PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT MMM Group Ltd. DATE (Started) September 27, 2010 TIME (Completed) 3:00:00 PM CHECKED BY MAM

DATE (Completed) September 27, 2010

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS
258.0	Ground Surface					
0.0	50 mm surficial organics FILL - brown silt trace sand trace gravel trace wood		1	AS	N/A	
257.2						
0.8	FILL - brown clay with sand with silt trace gravel trace organics (firm/stiff)		2	SS	16	
			3	SS	5	
255.9						
2.1	CLAY - grey clay (high plasticity) (firm/stiff)		4	SS	2	
			5	SS	WH	
	Silt content increases with depth Plasticity decreases with depth		6	SS	WH	
			7	SS	PM	
250.7						
7.3	SILTY CLAY - grey silty clay trace sand (medium plasticity) (firm/stiff)		8	SS	PM	
			9	SS	PM	
			10	SS	PM	
	Continued Next Page					





UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
	10 30 23 37
	0 0 22 78
	0 0 18 82
	0 0 20 80

COMMENTS

Artesian groundwater pressure evident when borehole penetrated 12.8 m depth. Immediately plugged after 14 m sample by reverse augering to force cohesive cuttings down hole following which 6 bags of bentonite pellets used to seal hole.

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)	-	-
2)	-	-
3)	-	-

MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

LVM | MERLEX ENGINEERING LTD.

, Phone: Fax: Email:

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

METRIC

RECORD OF BOREHOLE NO. A-1

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379070.8 E 336793.0 - Taylor Township - Russel Creek Culvert ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT MMM Group Ltd. DATE (Started) September 27, 2010 TIME (Completed) 3:00:00 PM CHECKED BY MAM

DATE (Completed) September 27, 2010

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		
			11	SS	WH		247	+ 4	○		
246.1											
11.9	CLAYEY SILT - grey clayey silt										
	(stiff)		12	SS	10		246		H ○		0 0 86 14
							245				
			13	SS	10		244		○		
243.8											
14.2	End of Sampling Continuation of DCPT						243				
							242				
							241				
240.1											
17.9	DCPT Refusal End of Borehole										

MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

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, Phone: Fax: Email:

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

METRIC

RECORD OF BOREHOLE NO. A-2

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379076.7 E 336798.4 - Taylor Township - Russel Creek Culvert ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT MMM Group Ltd. DATE (Started) September 28, 2010 TIME (Completed) 11:05:00 AM CHECKED BY MAM

DATE (Completed) September 28, 2010

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS
259.2	Ground Surface					
0.0	50 mm surficial organics FILL - brown clay some sand to sandy with silt trace gravel trace organics (firm/stiff)		1	AS	N/A	
			2	SS	14	
			3	SS	21	
			4	SS	22	
			5	SS	14	
			6	SS	7	
254.6						
4.6	CLAY - grey clay trace sand (high plasticity) (firm)		7	SS	3	
			8	SS	WH	
			9	TO	PM	
250.4						
8.8	SILTY CLAY - grey silty clay trace sand (medium plasticity) (firm/stiff)		10	SS	PM	
	Continued Next Page					

ELEVATION SCALE: 259, 258, 257, 256, 255, 254, 253, 252, 251, 250

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)
	4	18	27	51
	4	34	26	36
	0	1	25	74
	0	0	28	72

COMMENTS
Borehole immediately backfilled upon completion. The water level in the adjacent creek measured at 256.8 m.

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)	-	-
2)	-	-
3)	-	-

MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

LVM | MERLEX ENGINEERING LTD.
, Phone: Fax: Email:

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

METRIC

RECORD OF BOREHOLE NO. A-2

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379076.7 E 336798.4 - Taylor Township - Russel Creek Culvert ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT MMM Group Ltd. DATE (Started) September 28, 2010 TIME (Completed) 11:05:00 AM CHECKED BY MAM

DATE (Completed) September 28, 2010

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										
	Silt content increases with depth Plasticity decreases with depth						249				
			11	SS	PM						0 1 41 58
							248	3			
							247				
			12	SS	WH			4			
							246				
245.0			13	SS	5						0 0 66 34
14.2	End of Sampling Continuation of DCPT						245				
							244				
243.4											
15.8	DCPT Refusal End of Borehole										

SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE

MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

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METRIC

RECORD OF BOREHOLE NO. 1

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379086.8 E 336778.7 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY MCM

CLIENT MMM Group Ltd. DATE (Started) September 30, 2010 TIME (Completed) 5:30:00 PM CHECKED BY MAM

DATE (Completed) September 30, 2010

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	"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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
261.4	Ground Surface										
0.0	50 mm surficial organics										
	SILTY CLAY - brown silty clay trace to some sand		1	AS	N/A		261				
	(medium to high plasticity)		2	SS	13						0 1 35 64
	(firm/stiff)		3	SS	9		260				
			4	SS	9		259				0 4 41 55
			5	SS	4		258				0 15 32 53
257.7						▽					
3.7	SAND - grey sand trace silt trace gravel		6	SS	2		257				3 93 (4)
	(very loose)										
256.8											
4.6	SANDY CLAY - grey sandy clay some silt trace organics		7	SS	8		256				
	(medium plasticity)										
	(very soft/ firm)										
254.8			8	SS	WH		255	6			0 40 14 46
6.6	CLAY - grey clay trace sand										
	(high plasticity)						254				
	(soft/stiff)		9	SS	PM						
	Silt content increases with depth Plasticity decreases with depth						253	18			
			10	SS	PM		252	15	82		0 1 19 80
	Continued Next Page										

COMMENTS

Peizometer installed to 18.3 m depth (elevation 243.1 m). Water level rose to 325 mm above ground surface, 14 days after installation. Piezometer decommissioned and plugged with bentonite.

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) 9/30/10 5:30:00 PM	3.7	-
2) 10/1/10 7:30:00 AM	10.4	-
3) 10/14/10 7:30:00 AM	-0.325	-

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METRIC

RECORD OF BOREHOLE NO. 1

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379086.8 E 336778.7 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY MCM

CLIENT MMM Group Ltd. DATE (Started) September 30, 2010 TIME (Completed) 5:30:00 PM CHECKED BY MAM

DATE (Completed) September 30, 2010

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										
	(soft/stiff)		11	SS	PM		251				
							250				
			12	SS	PM		249				0 0 37 63
248.0											
13.4	SILTY CLAY - grey silty clay						248				
	(medium plasticity)										
	(stiff)		13	SS	PM		247				
			14	SS	PM		246				
	silt content increasing with depth						245				
			15	SS	3		244				0 0 73 27
							243				
242.6			16	SS	4						
18.8	End of Sampling Continutation of DCPT						242				
							241				
	Continued Next Page										

MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

METRIC

RECORD OF BOREHOLE NO. 1

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379086.8 E 336778.7 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY MCM

CLIENT MMM Group Ltd. DATE (Started) September 30, 2010 TIME (Completed) 5:30:00 PM CHECKED BY MAM

DATE (Completed) September 30, 2010

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										
238.9							240				
							239				
22.5	DCPT Refusal End of Borehole										

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)

MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

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

METRIC

RECORD OF BOREHOLE NO. 2

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379033.4 E 336823.7 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY MCM

CLIENT MMM Group Ltd. DATE (Started) October 6, 2010 TIME (Completed) 5:25:00 PM CHECKED BY MAM

DATE (Completed) October 6, 2010

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS
261.7	Ground Surface					
0.0	50 mm surficial organics					
	CLAY - brown clay		1	AS	N/A	
	(high plasticity)					
			2	SS	11	
			3	SS	2	
	grey at 2.7 m		4	SS	WH	
			5	SS	PM	
	(firm/stiff)		6	SS	PM	
	Silt content increases with depth Plasticity decreases with depth		7	SS	PM	
			8	SS	PM	
			9	SS	PM	
			10	SS	PM	
	Continued Next Page					

ELEVATION SCALE: 261, 260, 259, 258, 257, 256, 255, 254, 253, 252

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)
	0	0	29	71
	0	0	14	86
	0	0	16	84
	0	0	16	84

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) 10/6/10 5:25:00 PM	-	1.9
2)	-	-
3)	-	-

MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

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

METRIC

RECORD OF BOREHOLE NO. 2

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379033.4 E 336823.7 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY MCM

CLIENT MMM Group Ltd. DATE (Started) October 6, 2010 TIME (Completed) 5:25:00 PM CHECKED BY MAM

DATE (Completed) October 6, 2010

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										
			11	SS	PM		251	4			
249.8							250				
11.9	SILTY CLAY - grey silty clay (medium plasticity) (firm/stiff)		12	SS	PM		249	4			0 0 40 60
			13	SS	PM		248	3			
246.8							247				
14.9	CLAYEY SILT - grey clayey silty (low plasticity)		14	SS	WH		246				0 0 70 30
			15	SS	5		245				
244.0							244				
17.7	SAND - grey sand with silt trace clay (loose)		16	SS	7		243				0 64 28 8
242.9											
18.8	End of Sampling End of Borehole										

MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

METRIC

RECORD OF BOREHOLE NO. 3

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379108.2 E 336759.9 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY MCM

CLIENT MMM Group Ltd. DATE (Started) October 7, 2010 TIME (Completed) 4:45:00 PM CHECKED BY MAM

DATE (Completed) October 7, 2010

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	"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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
262.0	Ground Surface							20 40 60 80 100	20 40 60		
0.0	50 mm surficial organics										
	CLAY - brown clay some silt trace sand		1	AS	N/A						
	(high plasticity)		2	SS	18		261				0 2 63 35
	grey at 2.0 m		3	SS	11		260				
			4	SS	4		259				
	(firm)		5	SS	1						
			6	SS	PM		258	+3	81		0 0 12 88
			7	SS	PM		257	+4			
			8	SS	PM		256	+5			0 0 16 84
254.7							255				
7.3	SILTY CLAY - grey silty clay trace sand		9	SS	PM		254	+7			0 1 27 72
	(medium to high plasticity)										
	(firm/stiff)						253				
	Silt content increases with depth Plasticity decreases with depth		10	SS	PM						0 3 39 58
	Continued Next Page										

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) 10/7/10 4:45:00 PM	Dry	2.7
2)	-	-
3)	-	-

MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

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

METRIC

RECORD OF BOREHOLE NO. 3

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379108.2 E 336759.9 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY MCM

CLIENT MMM Group Ltd. DATE (Started) October 7, 2010 TIME (Completed) 4:45:00 PM CHECKED BY MAM

DATE (Completed) October 7, 2010

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							20 40 60 80 100	20 40 60		
			11	SS	PM		251	4			0 0 32 68
			12	SS	PM		250	3			
			13	SS	PM		249	4			
			14	SS	PM		248	4			
			15	SS	PM		247				0 0 50 50
			16	SS	2		246				
243.2							245				
18.8	End of Sampling End of Borehole						244				

MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

ENCLOSURE NO.:7 (Pg. 1 of 2)

METRIC

RECORD OF BOREHOLE NO. 4

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379118.7 E 336741.0 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY MCM

CLIENT MMM Group Ltd. DATE (Started) October 12, 2010 TIME (Completed) 4:55:00 PM CHECKED BY MAM

DATE (Completed) October 12, 2010

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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
263.6	Ground Surface										
0.0	50 mm surficial organics										
	CLAY - brown clay trace sand		1	AS	N/A		263				
	(high plasticity)		2	SS	12						0 2 34 64
			3	SS	7		262				
			4	SS	4		261				
			5	SS	WH						0 0 23 77
	grey at 4.3 m						260	4			
			6	SS	PM						
	(firm/stiff)							5			
			7	SS	PM		259				
								8			
							258				
			8	SS	PM						
							257	5			
			9	SS	PM		256				0 0 16 84
								8			
							255				
			10	SS	PM						
							254	7			
	Continued Next Page										

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)	-	-
2)	-	-
3)	-	-

MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

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ENCLOSURE NO.:7 (Pg. 2 of 2)

METRIC

RECORD OF BOREHOLE NO. 4

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379118.7 E 336741.0 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY MCM

CLIENT MMM Group Ltd. DATE (Started) October 12, 2010 TIME (Completed) 4:55:00 PM CHECKED BY MAM

DATE (Completed) October 12, 2010

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)
253.2	Continued from Previous Page										
10.4	SILTY CLAY - grey silty clay (medium plasticity) (firm/stiff) Silt content increases with depth Plasticity decreases with depth		11	SS	PM		253				
			12	SS	WH		252				
			13	SS	WH		251				
			14	SS	WH		250				0 0 40 60
			15	SS	1		249				
			16	SS	2		248				0 0 48 52
244.5							247				
19.1	End of Sampling End of Borehole						246				
							245				

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ENCLOSURE NO.:8 (Pg. 1 of 2)

METRIC

RECORD OF BOREHOLE NO. 5

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379139.6 E 336727.8 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY MCM

CLIENT MMM Group Ltd. DATE (Started) October 13, 2010 TIME (Completed) 1:00:00 PM CHECKED BY MAM

DATE (Completed) October 13, 2010

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/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
263.0	Ground Surface										
0.0	50 mm surficial organics										
	CLAY - brown clay trace sand		1	AS	N/A						
	(high plasticity)										
			2	SS	9		262				0 0 28 72
			3	SS	4		261				
	grey at 2.7 m										
			4	SS	WH						
	Silt content increases with depth Plasticity decreases with depth						260				
			5	SS	WH						
	(firm)										
			6	SS	PM		259				0 1 35 64
			7	SS	PM		258				
			8	SS	PM		257				
			9	SS	PM		256				
			10	SS	PM		255				
	Continued Next Page						254				

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)	-	-
2)	-	-
3)	-	-

MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

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ENCLOSURE NO.:8 (Pg. 2 of 2)

METRIC

RECORD OF BOREHOLE NO. 5

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379139.6 E 336727.8 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY MCM

CLIENT MMM Group Ltd. DATE (Started) October 13, 2010 TIME (Completed) 1:00:00 PM CHECKED BY MAM

DATE (Completed) October 13, 2010

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							20 40 60 80 100	20 40 60		
			11	SS	PM		252	4			
			12	SS	PM		251	5			
			13	SS	WH		250	3			
248.1							249				
14.9	SILTY CLAY - grey silty clay (medium plasticity) Silt content increases with depth Plasticity decreases with depth (firm/stiff)		14	SS	WH		248	3			0 0 45 55
			15	SS	WH		247	3			
			16	SS	2		246	4			
243.9							245				
19.1	End of Sampling End of Borehole						244				

MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

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ENCLOSURE NO.:9 (Pg. 1 of 2)

METRIC

RECORD OF BOREHOLE NO. 6

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379161.9 E 336708.2 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY MCM

CLIENT MMM Group Ltd. DATE (Started) October 13, 2010 TIME (Completed) 9:45:00 AM CHECKED BY MAM

DATE (Completed) October 14, 2010

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)
263.6	Ground Surface										
0.0	50 mm surficial organics										
	CLAY - brown clay		1	AS	N/A		263				
	(firm/stiff)		2	SS	7						
			3	SS	2		262				0 0 30 70
			4	SS	WH		261				
	grey at 3.4 m										
	Silt content increases with depth Plasticity decreases with depth		5	SS	PM		260				
			6	SS	PM		259				
			7	SS	PM		258				
			8	SS	PM		257				0 2 15 83
			9	SS	PM		256				
			10	SS	PM		255				
	Continued Next Page						254				

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)	-	-
2)	-	-
3)	-	-

MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

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ENCLOSURE NO.:9 (Pg. 2 of 2)

METRIC

RECORD OF BOREHOLE NO. 6

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379161.9 E 336708.2 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY MCM

CLIENT MMM Group Ltd. DATE (Started) October 13, 2010 TIME (Completed) 9:45:00 AM CHECKED BY MAM

DATE (Completed) October 14, 2010

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							20 40 60 80 100	20 40 60		
			11	SS	PM		253				
								4			
							252				
			12	SS	PM						
							251	3			
							250				
			13	SS	PM			3			0 0 30 70
							249				
			14	SS	PM						
247.1							248	3			
16.5	SILTY CLAY - grey silty clay (low plasticity) (stiff)						247				
			15	SS	PM			3			
							246				
			16	SS	PM		245				0 0 55 45
244.5								4			
19.1	End of Sampling End of Borehole										

MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

ENCLOSURE NO.:10 (Pg. 1 of 2)

METRIC

RECORD OF DCPT NO. 1

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379083.5 E 336791.5 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT MMM Group Ltd. DATE (Started) October 1, 2010 TIME (Completed) CHECKED BY MAM

DATE (Completed) October 1, 2010

SOIL PROFILE			SAMPLES			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 / NATURAL MOISTURE CONTENT / LIQUID LIMIT w_P w w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES						
261.4 0.0	Ground Surface						261 260 259 258 257 256 255 254 253 252				
	Continued Next Page										

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)	-	-
2)	-	-
3)	-	-

MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

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ENCLOSURE NO.:10 (Pg. 2 of 2)

METRIC

RECORD OF DCPT NO. 1

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379083.5 E 336791.5 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT MMM Group Ltd. DATE (Started) October 1, 2010 TIME (Completed) CHECKED BY MAM

DATE (Completed) October 1, 2010

SOIL PROFILE			SAMPLES			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)
ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES						
	Continued from Previous Page						251 250 249 248 247 246 245 244				
243.3 18.1	DCPT Refusal End of Borehole										

MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

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ENCLOSURE NO.:11 (Pg. 1 of 2)

METRIC

RECORD OF DCPT NO. 2

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379051.9 E 336814.8 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT MMM Group Ltd. DATE (Started) October 6, 2010 TIME (Completed) CHECKED BY MAM

DATE (Completed) October 6, 2010

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	w_P w w_L WATER CONTENT (%)	γ kN/m^3	GR SA (SI CL)
259.9	Ground Surface							20 40 60 80 100	20 40 60		
0.0							259				
							258				
							257				
							256				
							255				
							254				
							253				
							252				
							251				
	Continued Next Page						250				

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)	-	-
2)	-	-
3)	-	-

MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

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ENCLOSURE NO.:11 (Pg. 2 of 2)

METRIC

RECORD OF DCPT NO. 2

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379051.9 E 336814.8 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT MMM Group Ltd. DATE (Started) October 6, 2010 TIME (Completed) CHECKED BY MAM

DATE (Completed) October 6, 2010

SOIL PROFILE			SAMPLES			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)
ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES						
	Continued from Previous Page										
							249				
							248				
							247				
							246				
							245				
							244				
							243				
							242				
241.1											
18.8	DCPT Refusal End of Borehole										

MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

METRIC

RECORD OF DCPT NO. 3

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379116.5 E 336753.5 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT MMM Group Ltd. DATE (Started) October 6, 2010 TIME (Completed) 1:00:00 PM CHECKED BY MAM

DATE (Completed) October 6, 2010

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)
261.8	Ground Surface										
0.0							261				
							260				
							259				
							258				
							257				
							256				
							255				
							254				
							253				
	Continued Next Page						252				

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)

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)	-	-
2)	-	-
3)	-	-

MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

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METRIC

RECORD OF DCPT NO. 3

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379116.5 E 336753.5 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT MMM Group Ltd. DATE (Started) October 6, 2010 TIME (Completed) 1:00:00 PM CHECKED BY MAM

DATE (Completed) October 6, 2010

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										
	Continued Next Page										

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

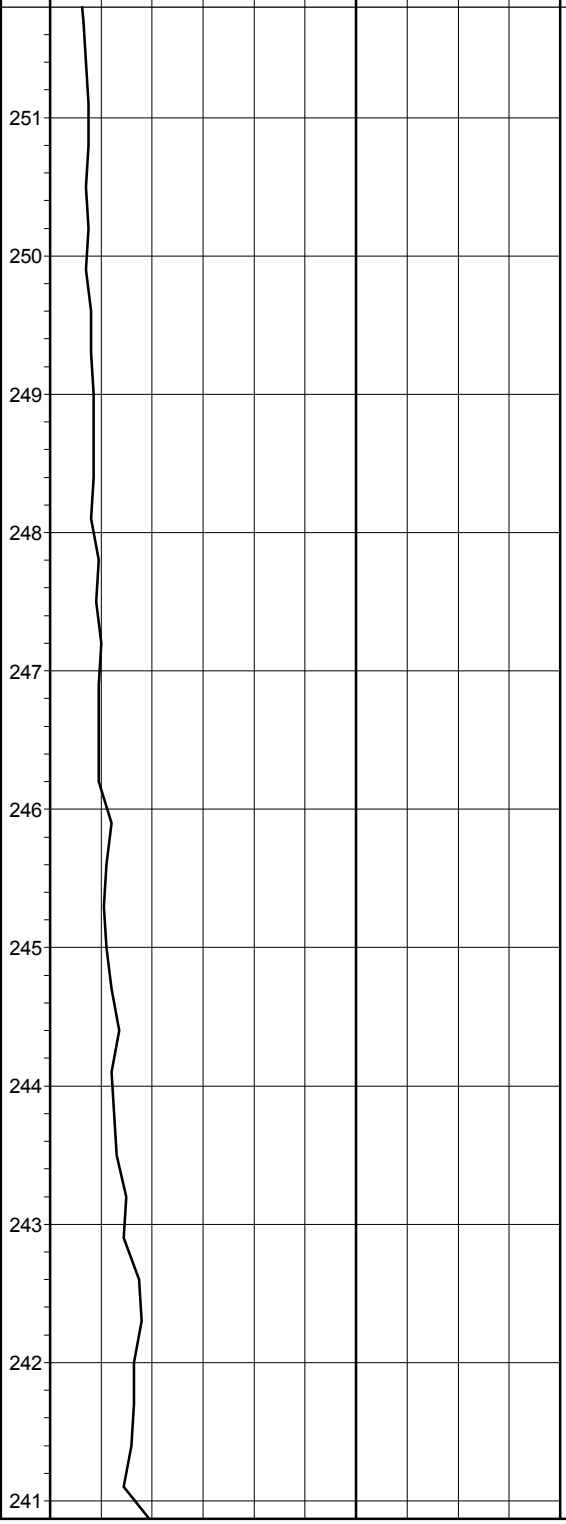
SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L

WATER CONTENT (%): 20 40 60

UNIT WEIGHT γ kN/m^3

REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)



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METRIC

RECORD OF DCPT NO. 3

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379116.5 E 336753.5 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT MMM Group Ltd. DATE (Started) October 6, 2010 TIME (Completed) 1:00:00 PM CHECKED BY MAM

DATE (Completed) October 6, 2010

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		
							240				
239.3											
22.5	DCPT Refusal End of Borehole										

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METRIC

RECORD OF DCPT NO. 4

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379133.7 E 336736.8 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT MMM Group Ltd. DATE (Started) October 8, 2010 TIME (Completed) CHECKED BY MAM

DATE (Completed) October 8, 2010

SOIL PROFILE			SAMPLES							
ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"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)
261.7	Ground Surface										
0.0							261				
							260				
							259				
							258				
							257				
							256				
							255				
							254				
							253				
							252				
	Continued Next Page										

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)	-	-
2)	-	-
3)	-	-

MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

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METRIC

RECORD OF DCPT NO. 4

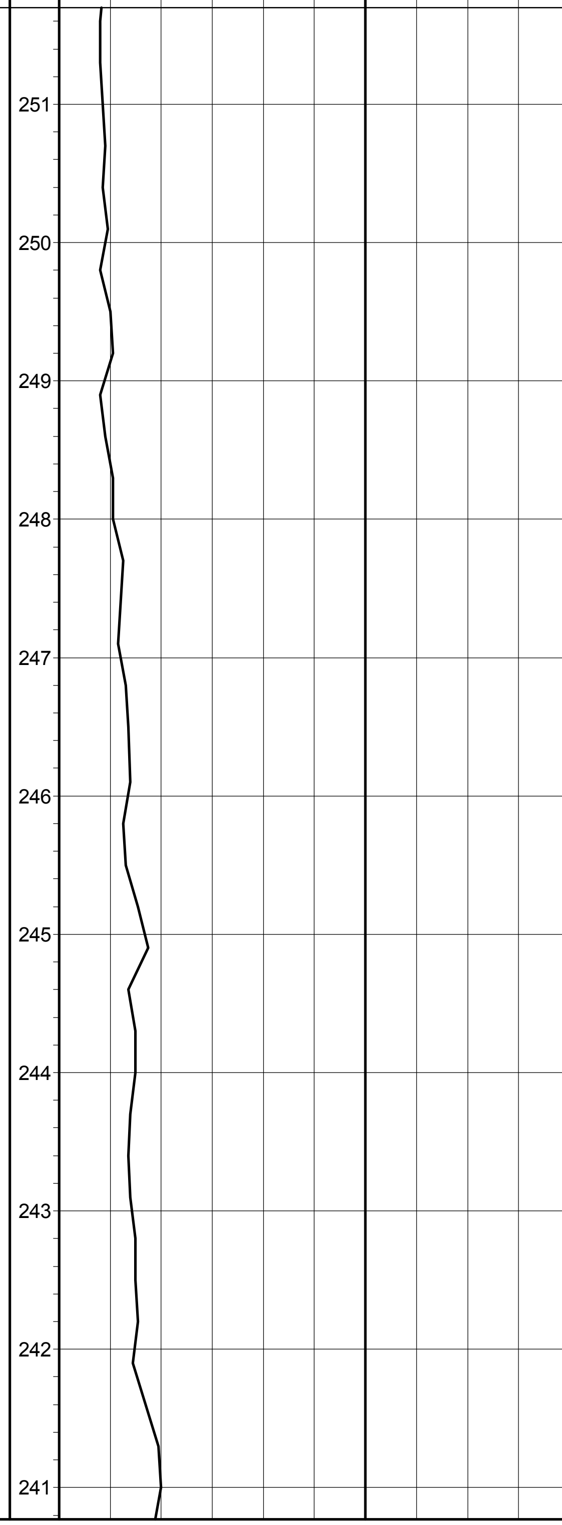
LVM | MERLEX

REFERENCE	10/07/10131-F3	DATUM	Geodetic	LOCATION	N 5379133.7 E 336736.8 - Taylor Township
PROJECT	GWP 5217-08-00, Hwy 11, Passing Lane 3			BOREHOLE TYPE	Track Mounted CME 45B - Hollow Stem Augers
CLIENT	MMM Group Ltd.			DATE (Started)	October 8, 2010
				DATE (Completed)	October 8, 2010

TIME (Completed)

ORIGINATED BY JL
COMPILED BY RG
CHECKED BY MAM

SOIL PROFILE			SAMPLES			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)
ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES						
	Continued from Previous Page										
	Continued Next Page										



METRIC

RECORD OF DCPT NO. 4

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379133.7 E 336736.8 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT MMM Group Ltd. DATE (Started) October 8, 2010 TIME (Completed) CHECKED BY MAM

DATE (Completed) October 8, 2010

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										
239.5							240				
22.2	DCPT Refusal End of Borehole										

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)

MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

METRIC

RECORD OF DCPT NO. 5

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379152.8 E 336719.2 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT MMM Group Ltd. DATE (Started) October 8, 2010 TIME (Completed) CHECKED BY MAM

DATE (Completed) October 8, 2010

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)
263.0	Ground Surface										
0.0											
							262				
							261				
							260				
							259				
							258				
							257				
							256				
							255				
							254				
	Continued Next 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

WATER CONTENT (%): 20 40 60

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)		-	-
2)		-	-
3)		-	-

MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

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METRIC

RECORD OF DCPT NO. 5

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379152.8 E 336719.2 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT MMM Group Ltd. DATE (Started) October 8, 2010 TIME (Completed) CHECKED BY MAM

DATE (Completed) October 8, 2010

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										

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)

252
251
250
249
248
247
246
245
244
243

Continued Next Page

MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

ENCLOSURE NO.:14 (Pg. 3 of 3)

METRIC

RECORD OF DCPT NO. 5

LVM | MERLEX

REFERENCE 10/07/10131-F3 DATUM Geodetic LOCATION N 5379152.8 E 336719.2 - Taylor Township ORIGINATED BY JL

PROJECT GWP 5217-08-00, Hwy 11, Passing Lane 3 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT MMM Group Ltd. DATE (Started) October 8, 2010 TIME (Completed) CHECKED BY MAM

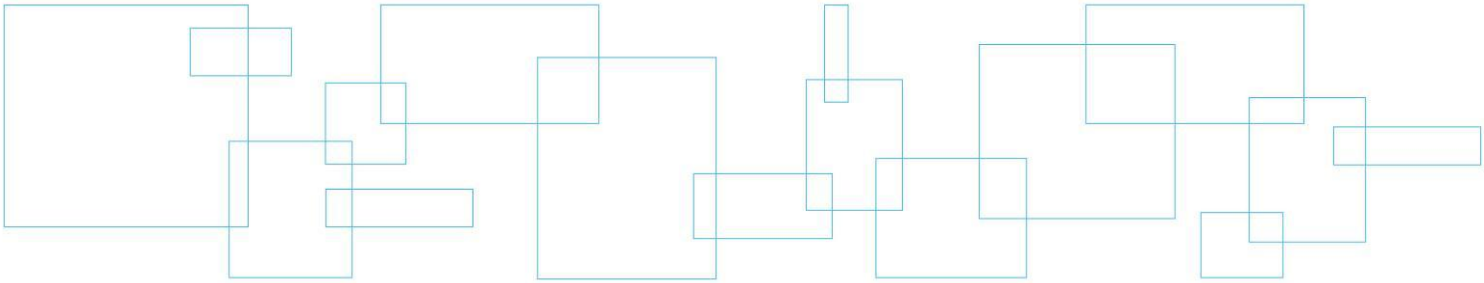
DATE (Completed) October 8, 2010

SOIL PROFILE			SAMPLES			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)
ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES						
	Continued from Previous Page						242				
241.2											
21.8	DCPT Refusal End of Borehole										

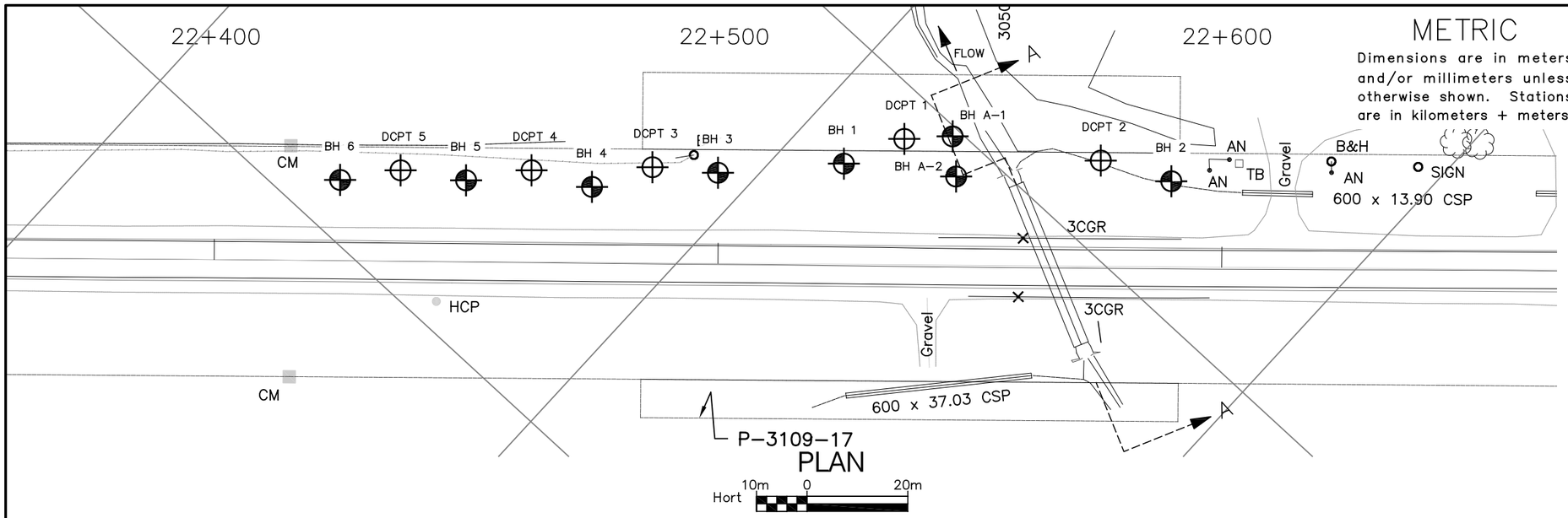
MEL-GEO 10131 - AREA 13 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 2/22/12

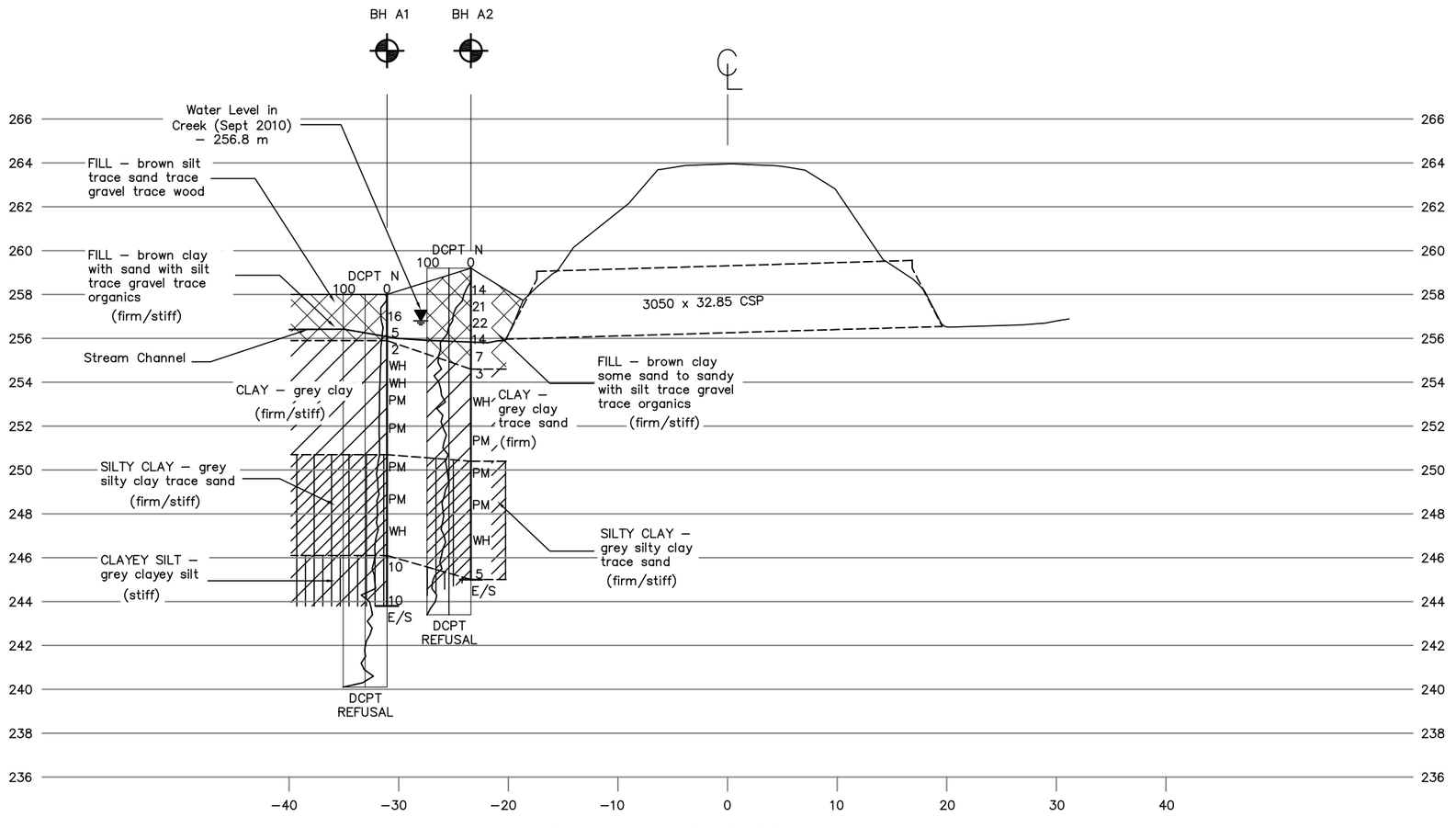
Appendix C Borehole Location Plan Labwork

Figure No. F3-1 and F3-2: Borehole Location and Soil Strata
Figure Nos. L-1 to L-11: Summary Grain Size Analysis Graph
Figure Nos. L-12 and L-16: Plasticity Chart
Figure No. L-17: Shear Strength Chart
Figure Nos. L-18 and L-19: Consolidation Test Results



LVM | MERLEX





CULVERT SECTION A - A

Hort 5m 0 10m
Vert 2.5m 0 5m

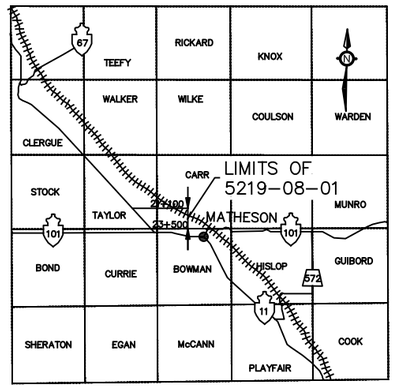
CONT No
WP No 5219-08-01
Geocres No 42A-89

N

HWY NO. 11 – Township of Taylor
Passing Lane No. 3 – Site No. 39E-223/C
Russel Creek Culvert Extension – Station 22+565
BOREHOLE LOCATIONS & SOIL STRATA

Figure F3-1

LVM | MERLEX



KEY PLAN – NOT TO SCALE

LEGEND

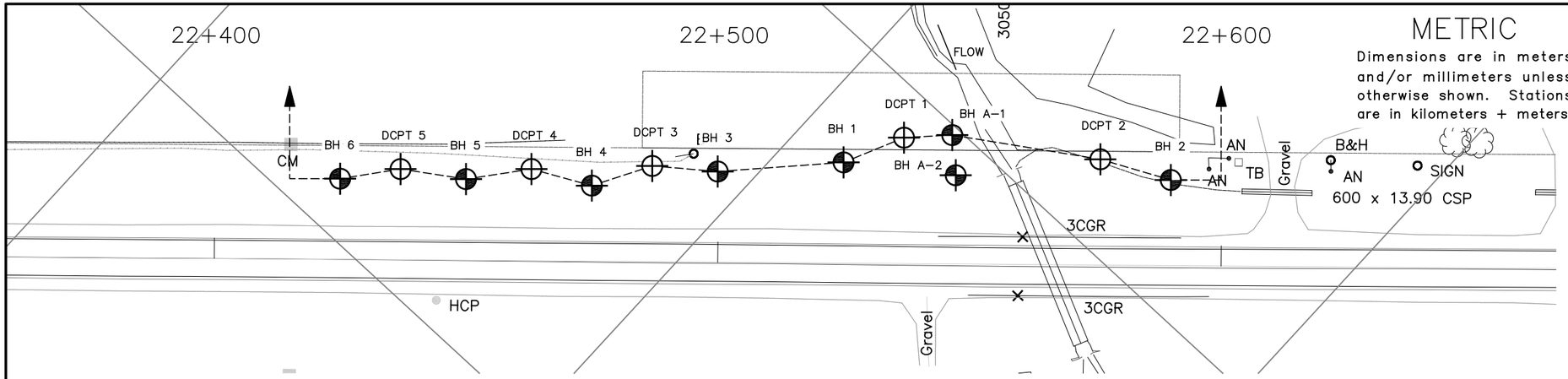
- Borehole
- Dynamic Cone Penetration Test
- "N" Blows/0.3 m (Std Pen Test, 475 J/blow)
- DCPT Blows/0.3 m (60° Cone, 475 J/blow)
- Water Level at Time of Investigation
- A/R Auger Refusal at Elevation
- E/S End of Sampling

Borehole No.	Elev.	O/S	Co-ordinates	
			Northerly	Easterly
Borehole No. A-1	258.0	27m Lt	5379076.7	336798.4
Borehole No. A-2	259.2	18m Lt	5379070.8	336793.0

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.

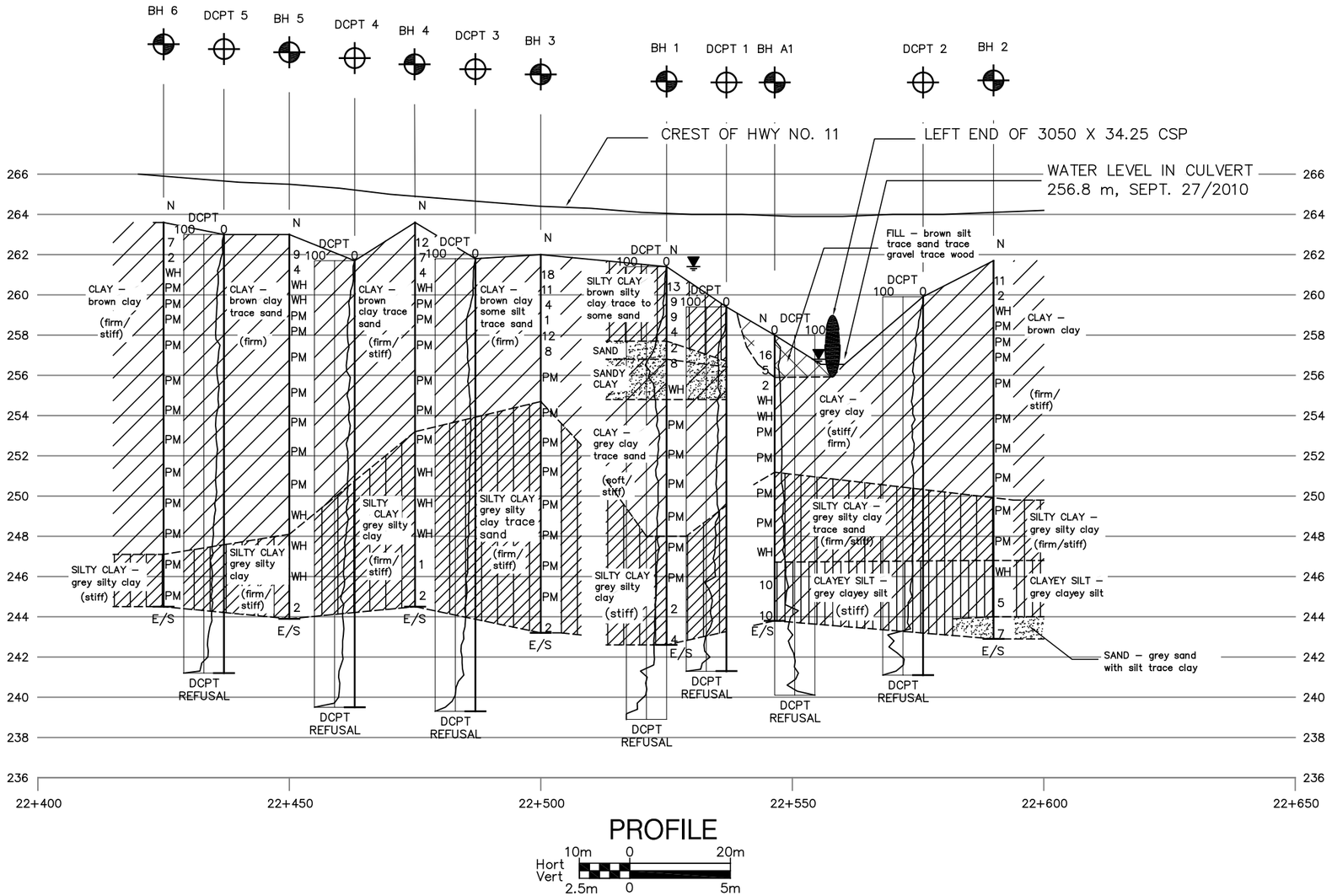
REVISIONS	DATE	BY	DESCRIPTION
	Feb 2012	MCM	FINAL

HWY No. 11 – Station 22+565 – Taylor Twp			REF: 10131-F3
SUBM'D			Passing Lane 3
DRAWN RG	CHK MAM	DATE December 2010	FIG F3-1



METRIC

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



PROFILE

Hort 10m 0 20m
Vert 2.5m 0 5m

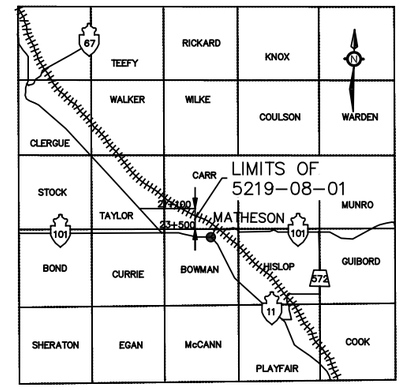
CONT No
WP No 5219–08–01
Geocres No 42A–89

N

HWY NO. 11 – Township of Taylor
Passing Lane No. 3
Embankment Widening – 22+450 to 22+590
BOREHOLE LOCATIONS & SOIL STRATA

Figure F3–2

L|V|M | MERLEX



KEY PLAN – NOT TO SCALE

LEGEND

- Borehole
- Dynamic Cone Penetration Test
- "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	Co–ordinates Easterly
Borehole No. 1	261.4	20m Lt	5379086.8	336778.7
Borehole No. 2	261.7	17m Lt	5379033.4	336823.7
Borehole No. 3	262.0	18m Lt	5379108.2	336759.9
Borehole No. 4	263.6	15m Lt	5379118.7	336741.0
Borehole No. 5	263.0	16m Lt	5379139.6	336727.8
Borehole No. 6	263.6	16m Lt	5379161.9	336708.2
Borehole No. A–1	258.0	27m Lt	5379076.7	336798.4
Borehole No. A–2	259.2	18m Lt	5379070.8	336793.0
DCPT No. 1	259.4	25m Lt	5379083.5	336791.6
DCPT No. 2	259.9	21m Lt	5379051.8	336814.8
DCPT No. 3	261.8	19m Lt	5379116.5	336753.5
DCPT No. 4	261.7	18m Lt	5379133.7	336736.8
DCPT No. 5	263.0	18m Lt	5379152.8	336719.2

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.

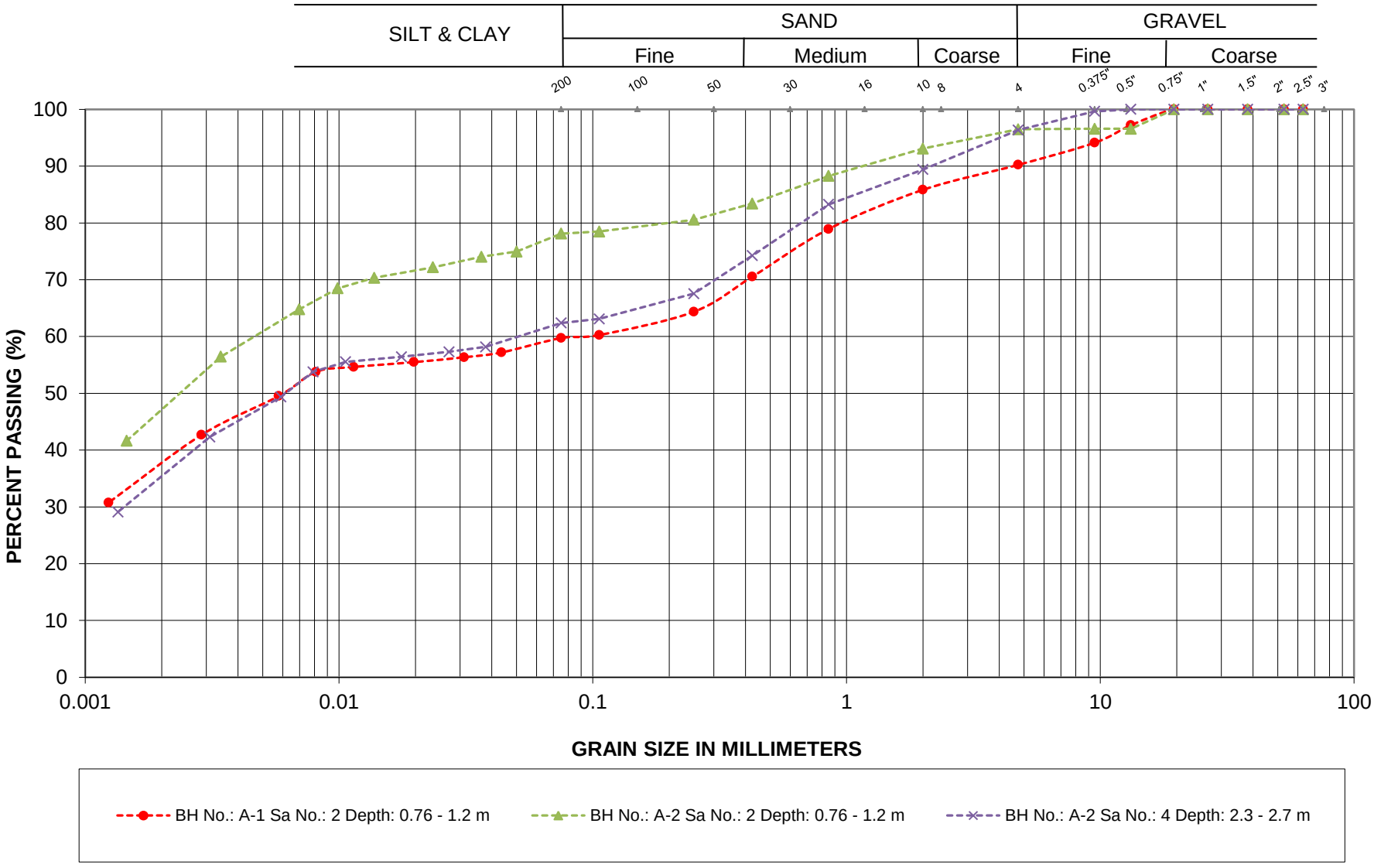
REVISIONS

DATE	BY	DESCRIPTION
Feb 2012	MCM	FINAL

HWY No. 11 – Sta. 22+450–22+590 – Taylor Twp			REF: 10131–F3
SUBM'D			Passing Lane 3
DRAWN RG	CHK MAM	DATE December 2010	FIG F3–2

Reference No.: 10/07/10131-F3
Date: February 2012

GRAIN SIZE ANALYSIS



PROJECT: W.P. 5219-08-01
LOCATION: Hwy 11 Passing Lane 3

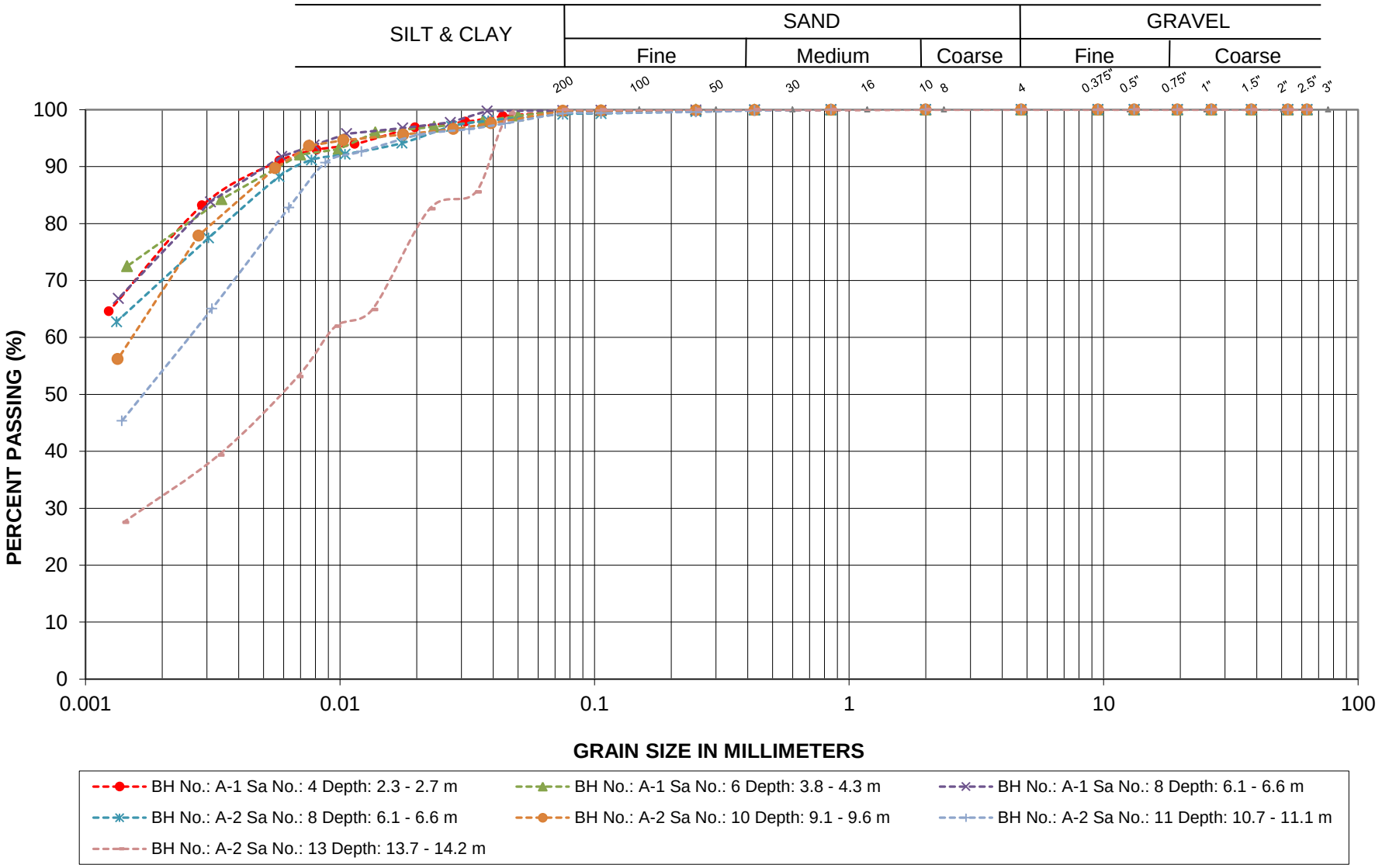
FILL

LVM | MERLEX

FIGURE L-1

Reference No.: 10/07/10131-F3
Date: February 2012

GRAIN SIZE ANALYSIS



PROJECT: W.P. 5219-08-01
LOCATION: Hwy 11 Passing Lane 3

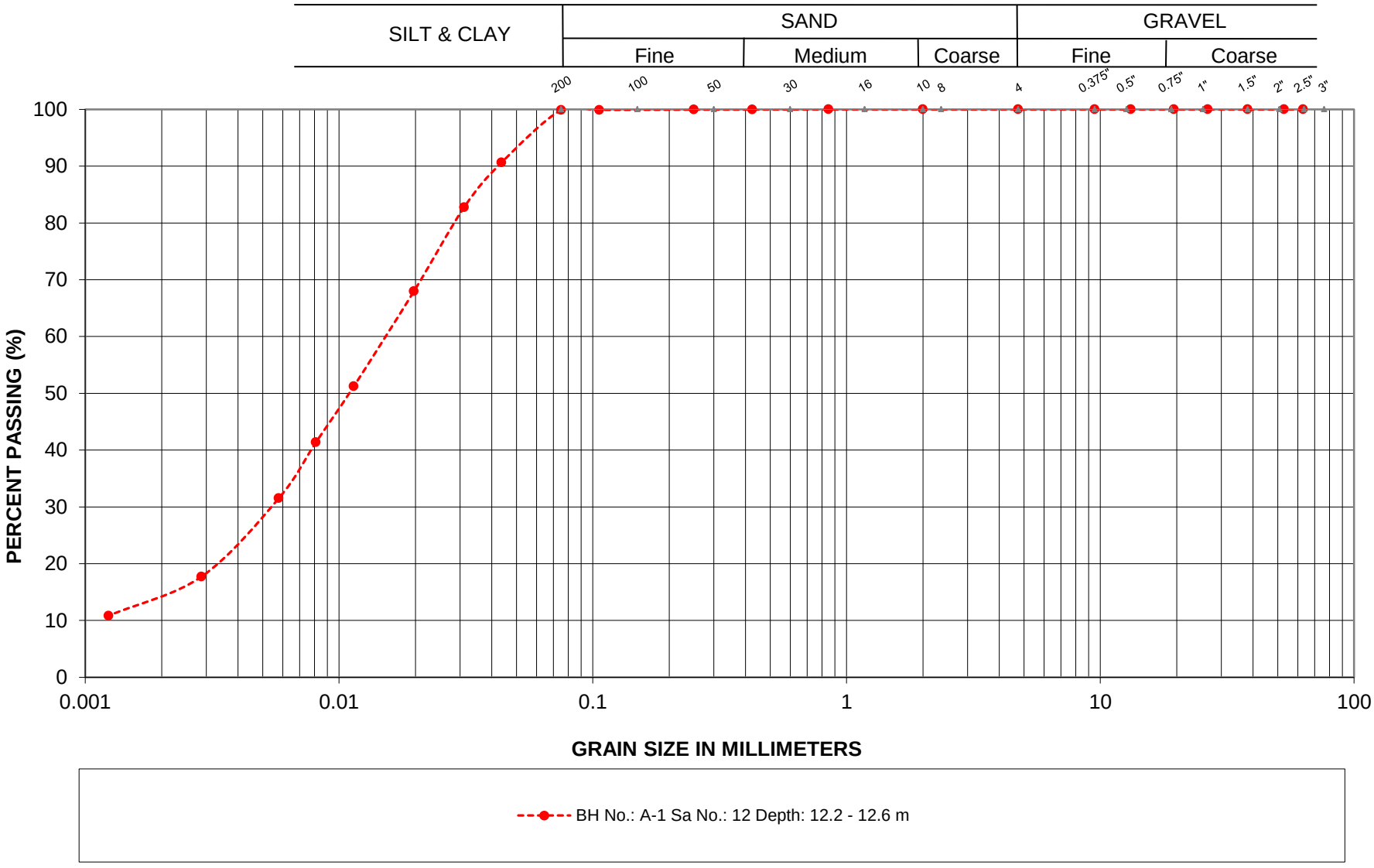
CLAY/SILTY CLAY

LVM | MERLEX

FIGURE L-2

Reference No.: 10/07/10131-F1
Date: February 2012

GRAIN SIZE ANALYSIS



PROJECT: W.P. 5219-08-01
LOCATION: Hwy 11 Passing Lane 3

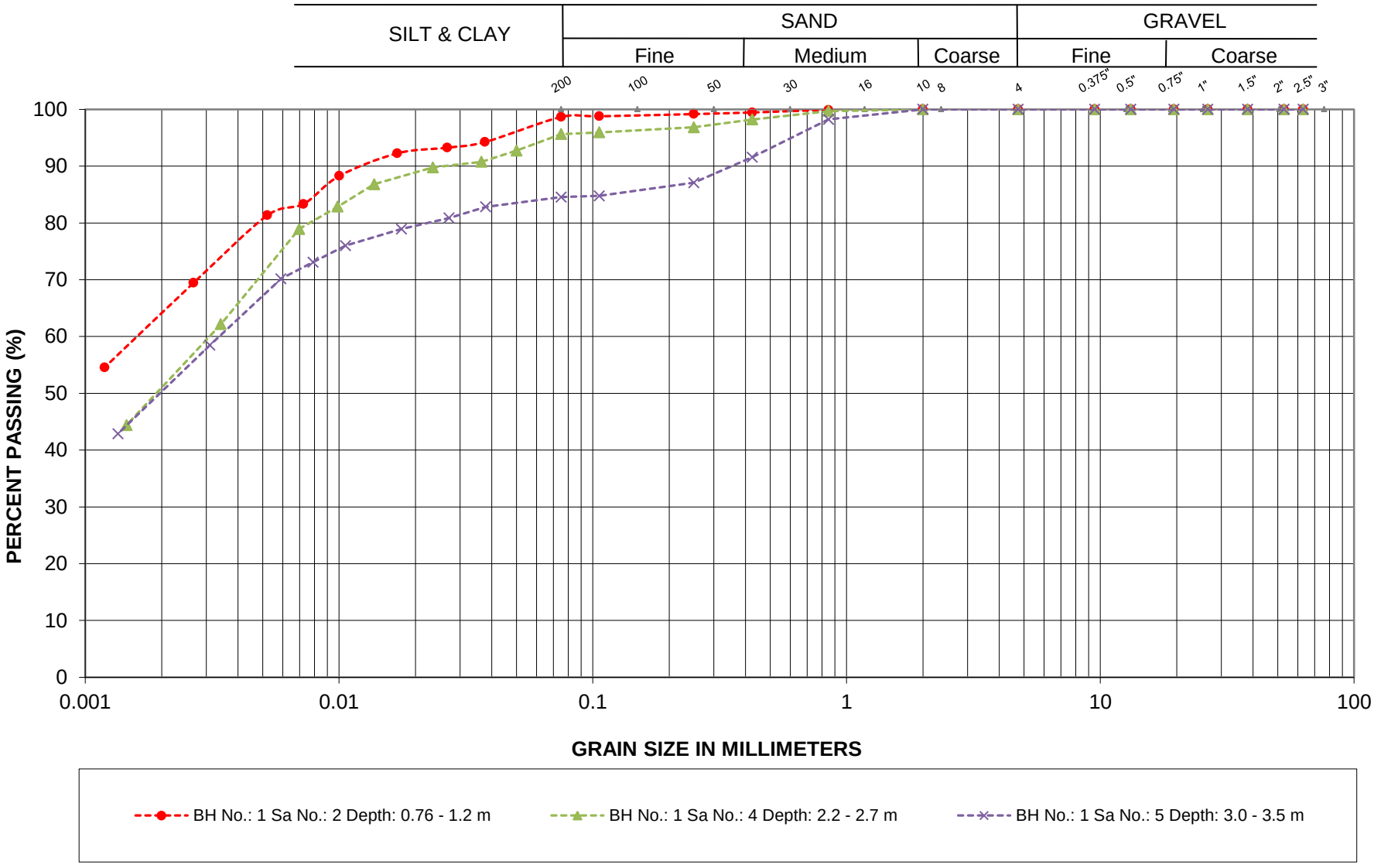
CLAYEY SILT

LVM | MERLEX

FIGURE L-3

Reference No.: 10/07/10131-F3
Date: February 2012

GRAIN SIZE ANALYSIS



PROJECT: W.P. 5219-08-01
LOCATION: Hwy 11 Passing Lane 3

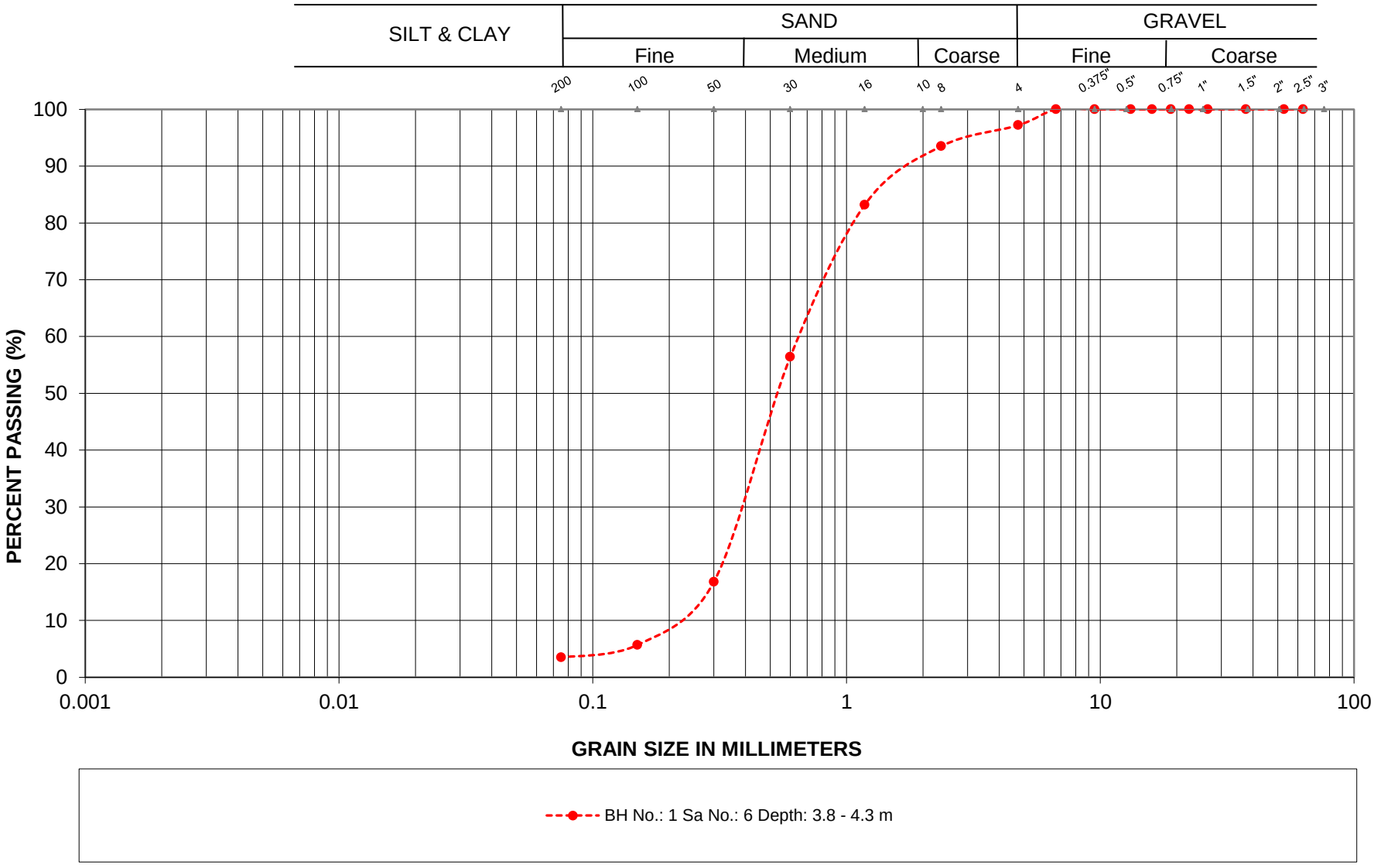
SILTY CLAY

LVM | MERLEX

FIGURE L-4

Reference No.: 10/07/10131-F3
Date: February 2012

GRAIN SIZE ANALYSIS



PROJECT: W.P. 5219-08-01
LOCATION: Hwy 11 Passing Lane 3

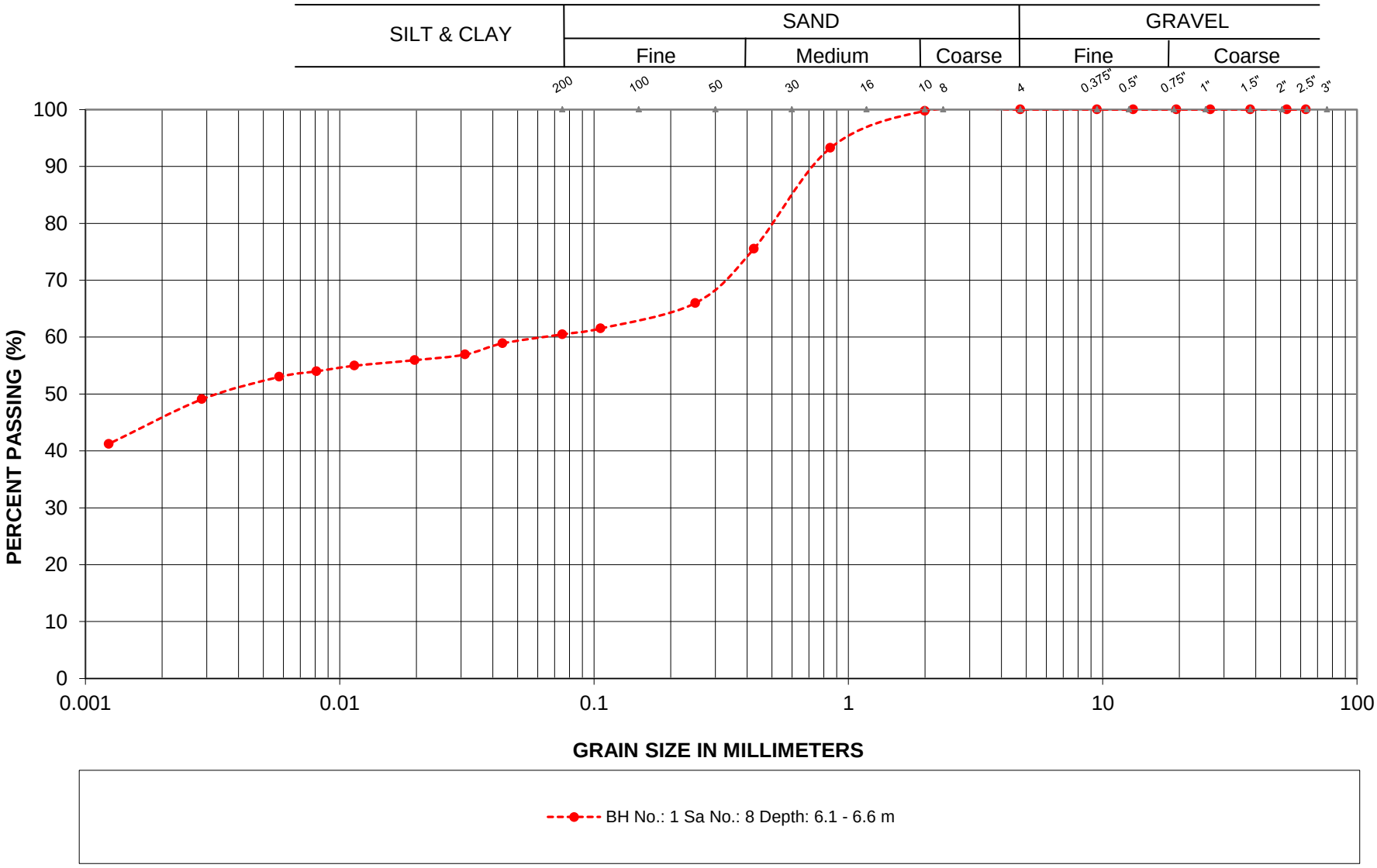
SAND

LVM | MERLEX

FIGURE L-5

Reference No.: 10/07/10131-F3
Date: February 2012

GRAIN SIZE ANALYSIS



PROJECT: W.P. 5219-08-01
LOCATION: Hwy 11 Passing Lane 3

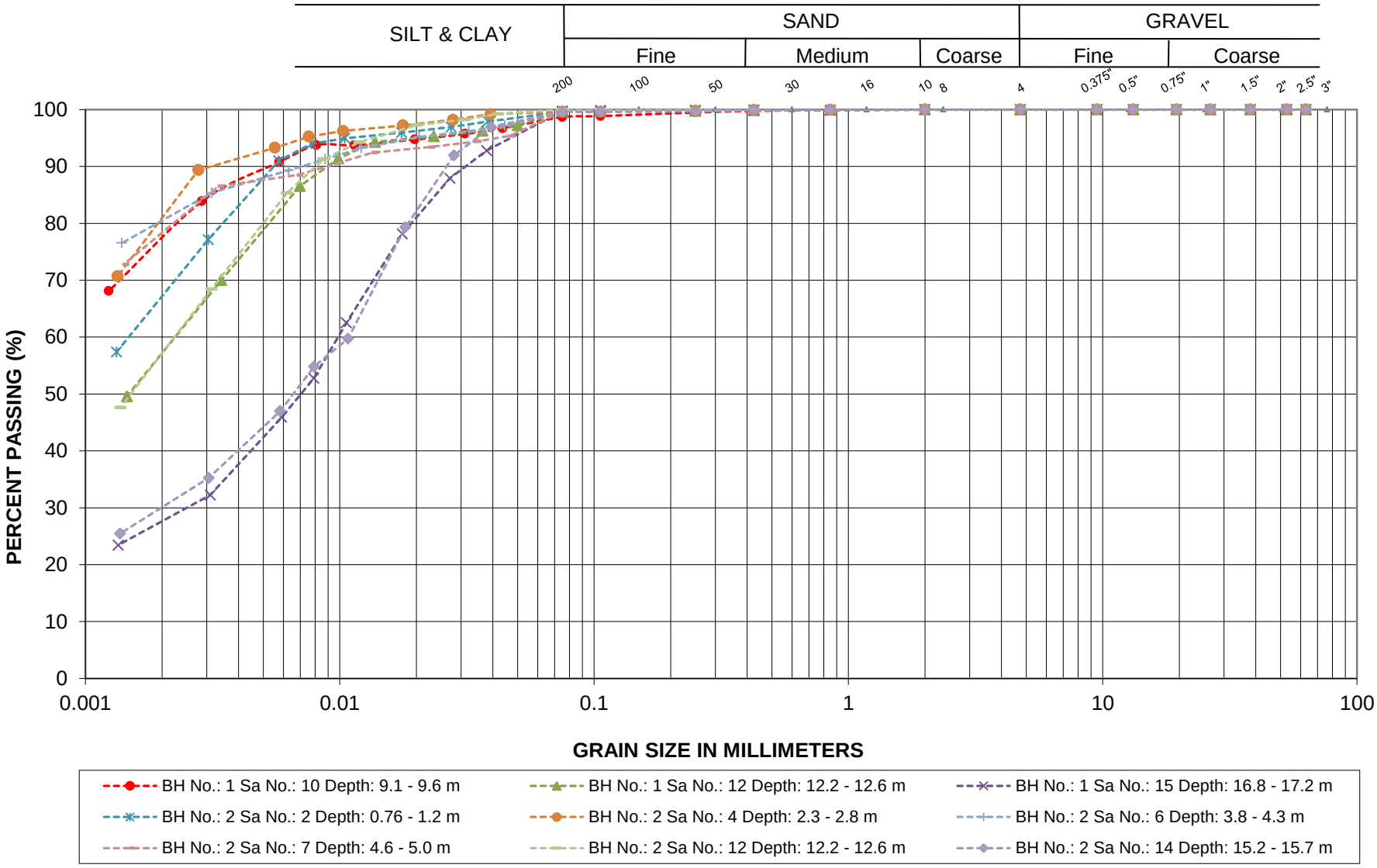
SANDY CLAY

LVM | MERLEX

FIGURE L-6

Reference No.: 10/07/10131-F3
Date: February 2012

GRAIN SIZE ANALYSIS



PROJECT: W.P. 5219-08-01
LOCATION: Hwy 11 Passing Lane 3

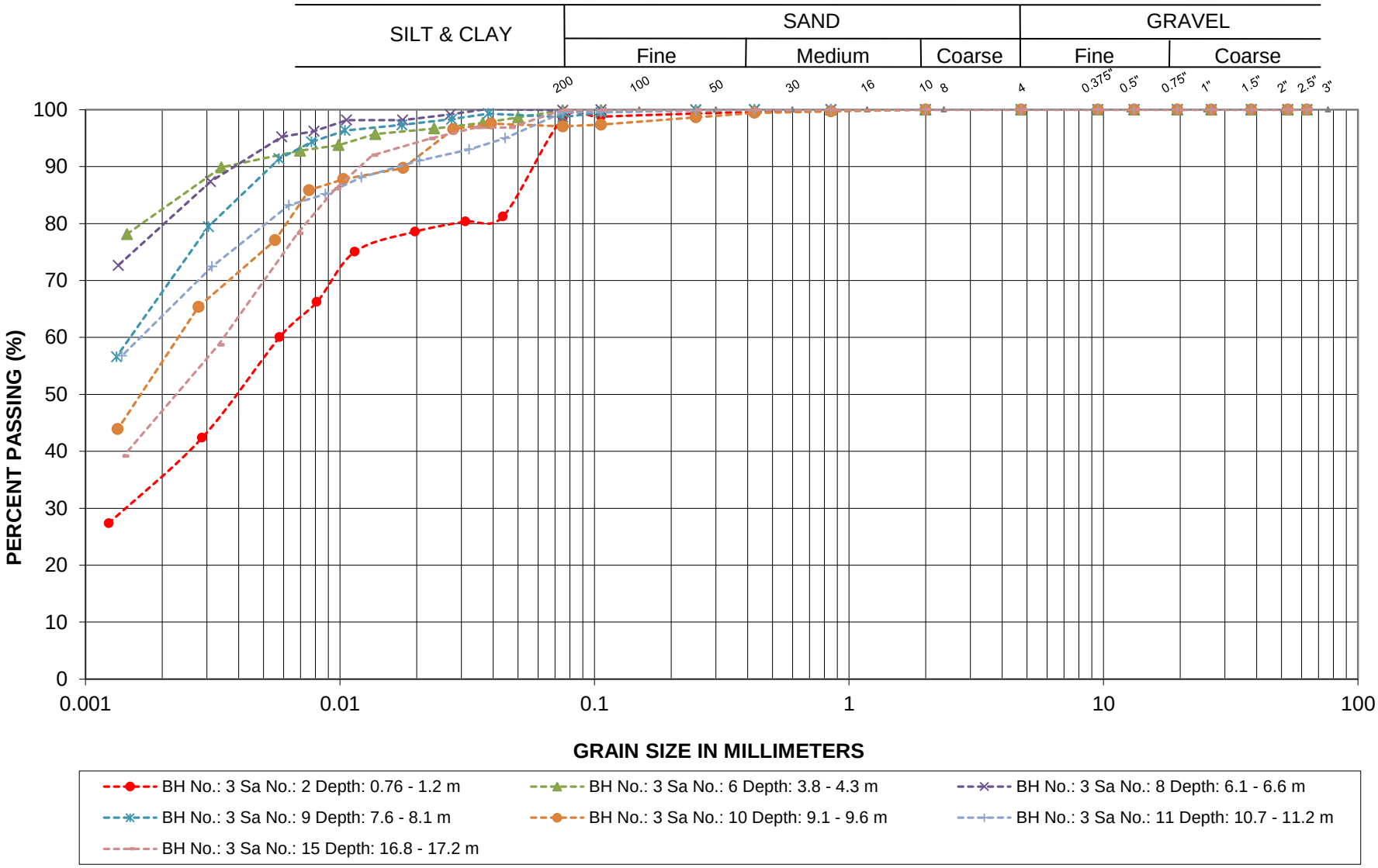
CLAY/SILTY CLAY

LVM | MERLEX

FIGURE L-7

Reference No.: 10/07/10131-F3
Date: February 2012

GRAIN SIZE ANALYSIS



PROJECT: W.P. 5219-08-01
LOCATION: Hwy 11 Passing Lane 3

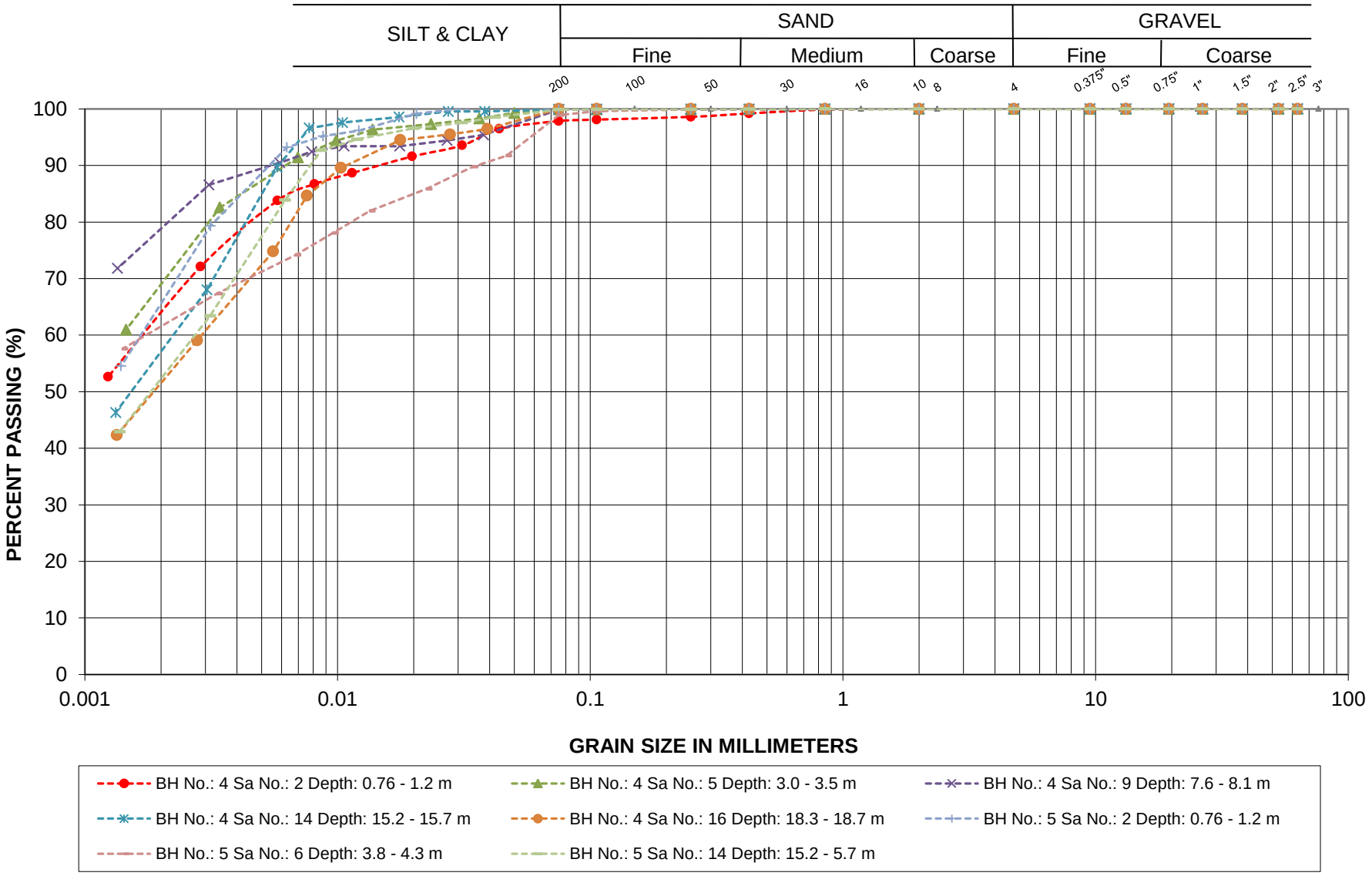
CLAY/SILTY CLAY

LVM | MERLEX

FIGURE L-8

Reference No.: 10/07/10131-F3
Date: February 2012

GRAIN SIZE ANALYSIS



PROJECT: W.P. 5219-08-01
LOCATION: Hwy 11 Passing Lane 3

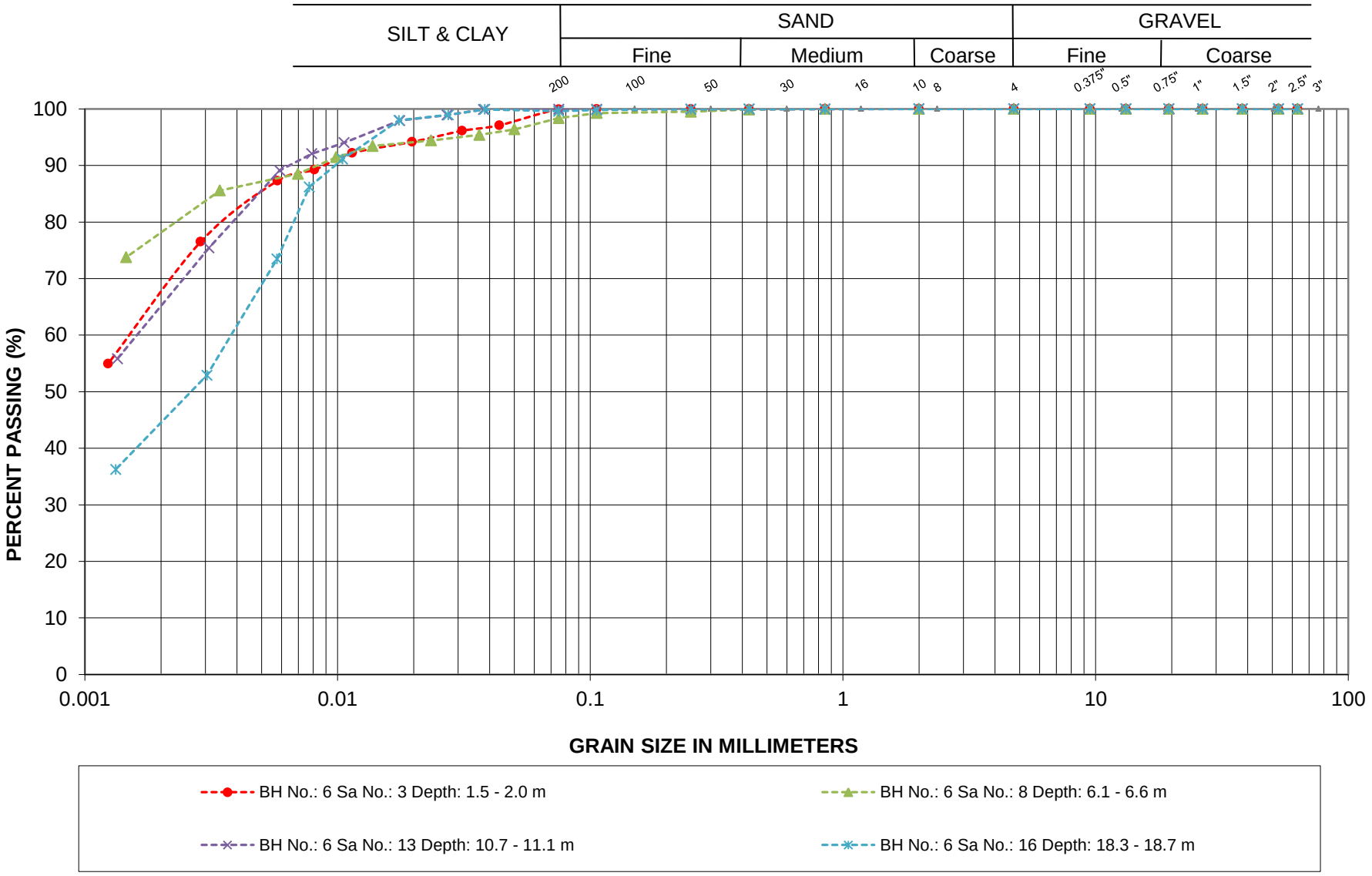
CLAY/SILTY CLAY

LVM | MERLEX

FIGURE L-9

Reference No.: 10/07/10131-F3
Date: February 2012

GRAIN SIZE ANALYSIS



CLAY/SILTY CLAY

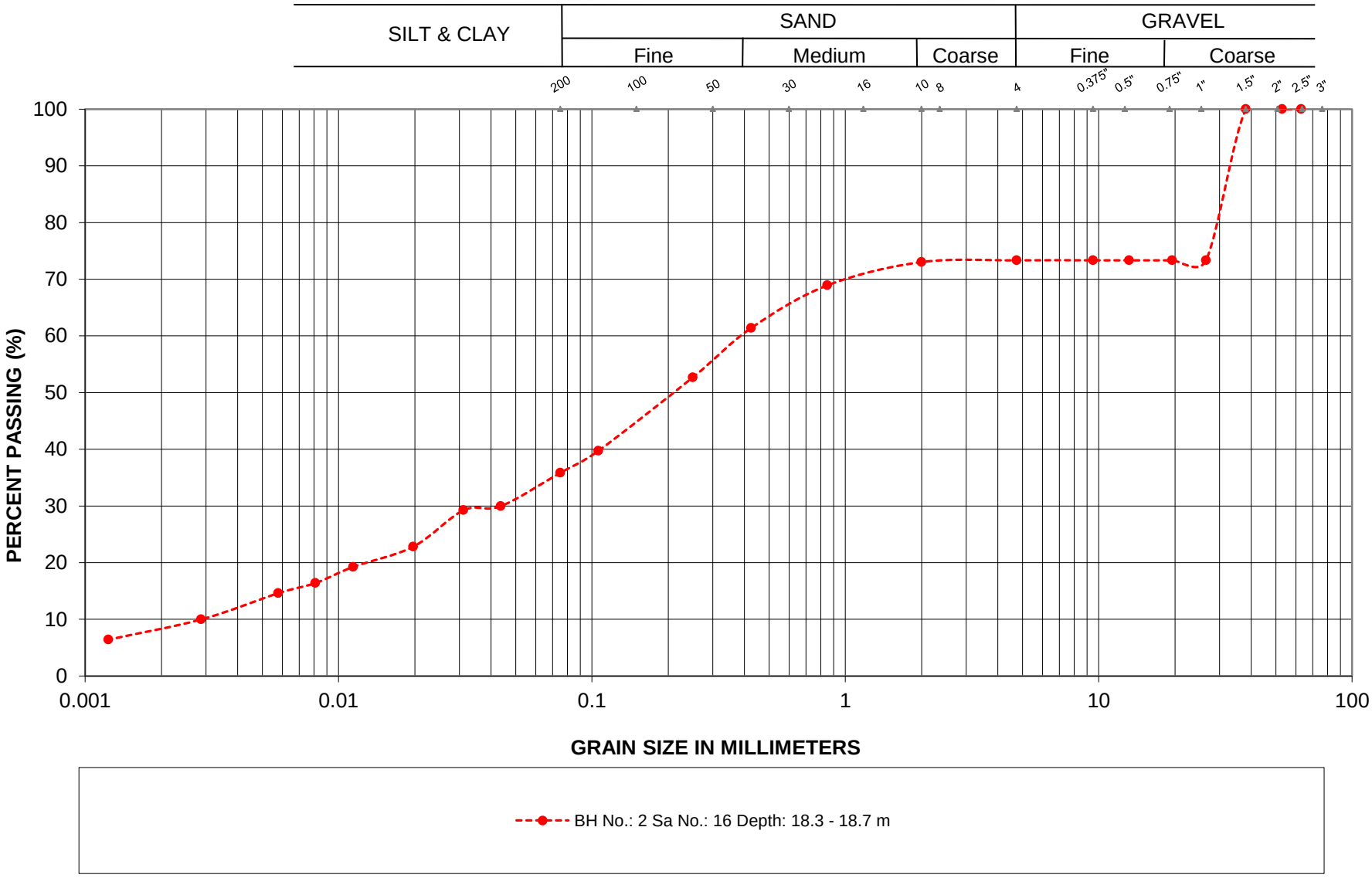
PROJECT: W.P. 5219-08-01
LOCATION: Hwy 11 Passing Lane 3

LVM | MERLEX

FIGURE L-10

Reference No.: 10/07/10131-F3
Date: February 2012

GRAIN SIZE ANALYSIS



SAND

PROJECT: W.P. 5219-08-01
LOCATION: Hwy 11 Passing Lane 3

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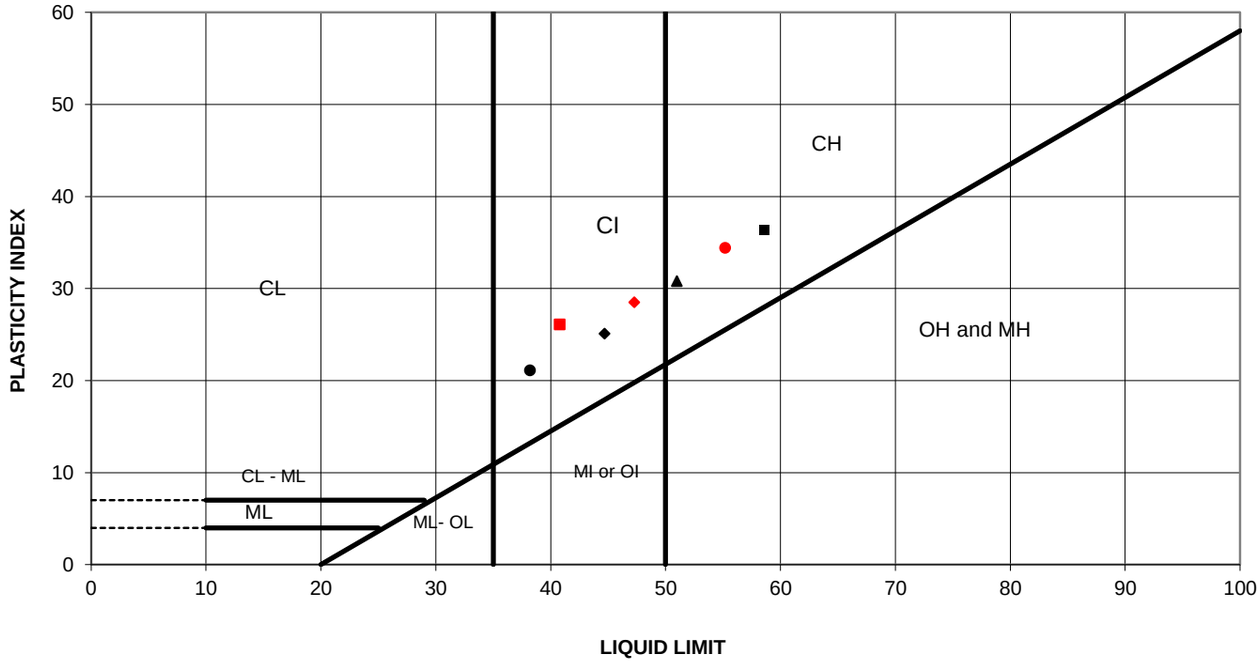
FIGURE L-11

ATTERBERG LIMITS TEST RESULTS

FIGURE L-12

ATTERBERG INDICES
Fill, Upper Silty Clay, Sandy Clay



SYMBOL	BH	Sa. No.	Depth(m)	Elev.(m)	Liquid Limit	Plastic Limit	Plasticity Index	NMC %
●	A-1	2	0.8	258.4	38.2	17.1	21.1	15.0
◆	A-2	2	0.8	257.2	44.7	19.6	25.1	24.1
■	A-2	4	2.3	255.7	58.6	22.2	36.4	19.6
▲	1	2	0.8	260.6	51.0	20.2	30.8	26.4
●	1	4	2.3	259.1	55.2	20.8	34.4	28.4
■	1	5	3.0	258.4	47.3	18.8	28.5	30.3
▲	1	8	6.1	255.3	40.8	14.7	26.1	49.2

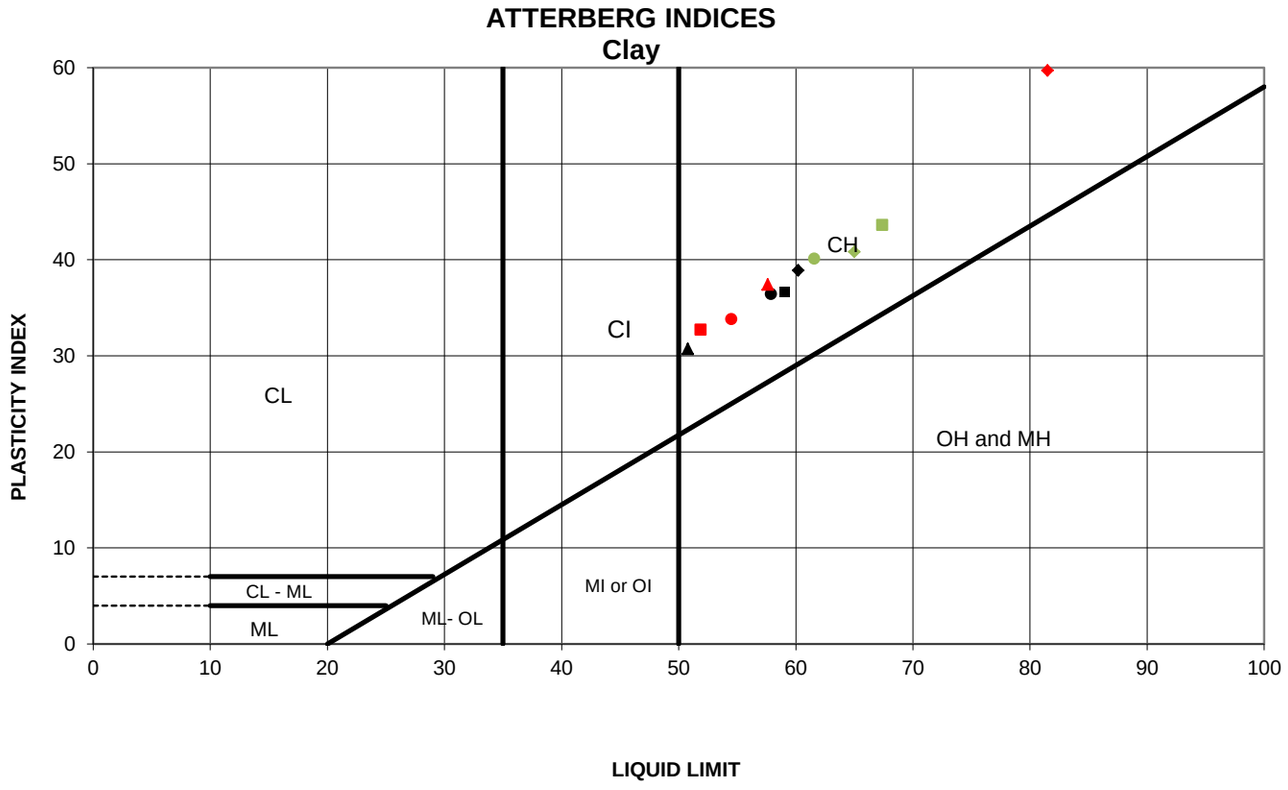
Date: Feb-12
Project: Northbound Passing Lane 3
W.P: 5219-08-01

Prep'd: AT
Chkd: RG
Ref. No.: 10/07/10131-F3

LVM | MERLEX

ATTERBERG LIMITS TEST RESULTS

FIGURE L-13



SYMBOL	BH	Sa. No.	Depth(m)	Elev.(m)	Liquid Limit	Plastic Limit	Plasticity Index	NMC %
●	A-1	4	2.3	256.9	57.9	21.5	36.4	51.7
◆	A-1	6	3.8	255.4	60.2	21.3	38.9	51.7
■	A-1	8	6.1	253.1	59.1	22.5	36.6	61.1
▲	A-2	8	6.1	251.9	50.8	20.1	30.7	59.1
●	A-2	9	7.6	250.4	54.5	20.7	33.8	63.0
◆	1	10	9.1	252.3	81.5	21.8	59.7	63.0
■	1	12	12.2	249.2	51.9	19.2	32.7	50.9
▲	2	2	0.8	260.9	57.6	20.2	37.4	41.6
●	2	4	2.3	259.4	61.6	21.5	40.1	56.5
◆	2	6	3.8	257.9	65.0	24.2	40.8	66.4
■	2	7	4.6	257.1	67.4	23.8	43.6	66.2

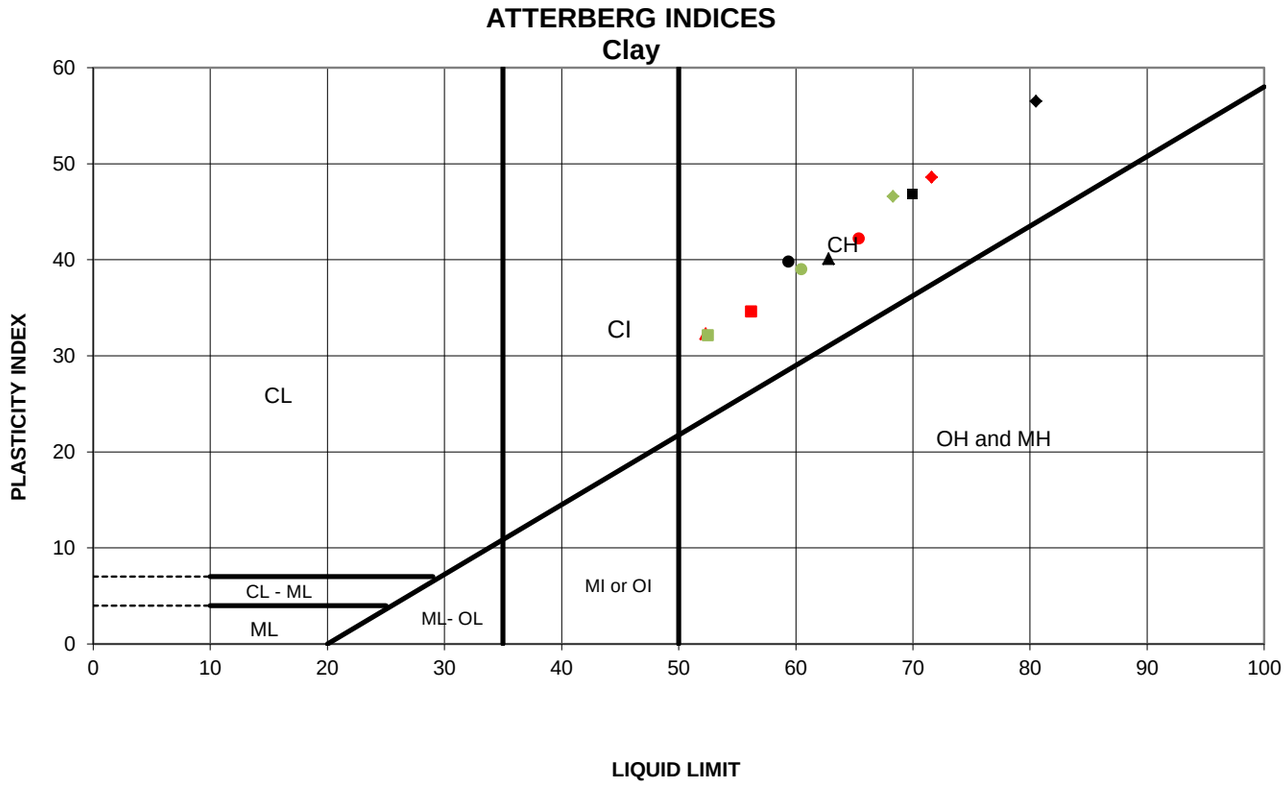
Date: Feb-12
Project: Northbound Passing Lane 3
W.P: 5219-08-01

Prep'd: AT
Chkd: RG
Ref. No.: 10/07/10131-F3

LVM | MERLEX

ATTERBERG LIMITS TEST RESULTS

FIGURE L-14



SYMBOL	BH	Sa. No.	Depth(m)	Elev.(m)	Liquid Limit	Plastic Limit	Plasticity Index	NMC %
●	3	2	0.8	261.2	59.4	19.6	39.8	23.7
◆	3	6	3.8	258.2	80.5	24.0	56.5	64.5
■	3	8	6.1	255.9	70.0	23.2	46.8	61.4
▲	4	2	0.8	262.8	62.8	22.7	40.1	32.4
●	4	5	3.0	260.6	65.4	23.2	42.2	52.6
◆	4	9	7.6	256.0	71.6	23.0	48.6	64.7
■	5	2	0.8	262.2	56.2	21.6	34.6	34.7
▲	5	6	3.8	259.2	52.3	20.0	32.3	62.0
●	6	3	1.5	262.1	60.5	21.5	39.0	38.3
◆	6	8	6.1	257.5	68.3	21.7	46.6	65.7
■	6	13	13.7	249.9	52.5	20.4	32.1	57.9

Date: Feb-12
Project: Northbound Passing Lane 3
W.P: 5219-08-01

Prep'd: AT
Chkd: RG
Ref. No.: 10/07/10131-F3

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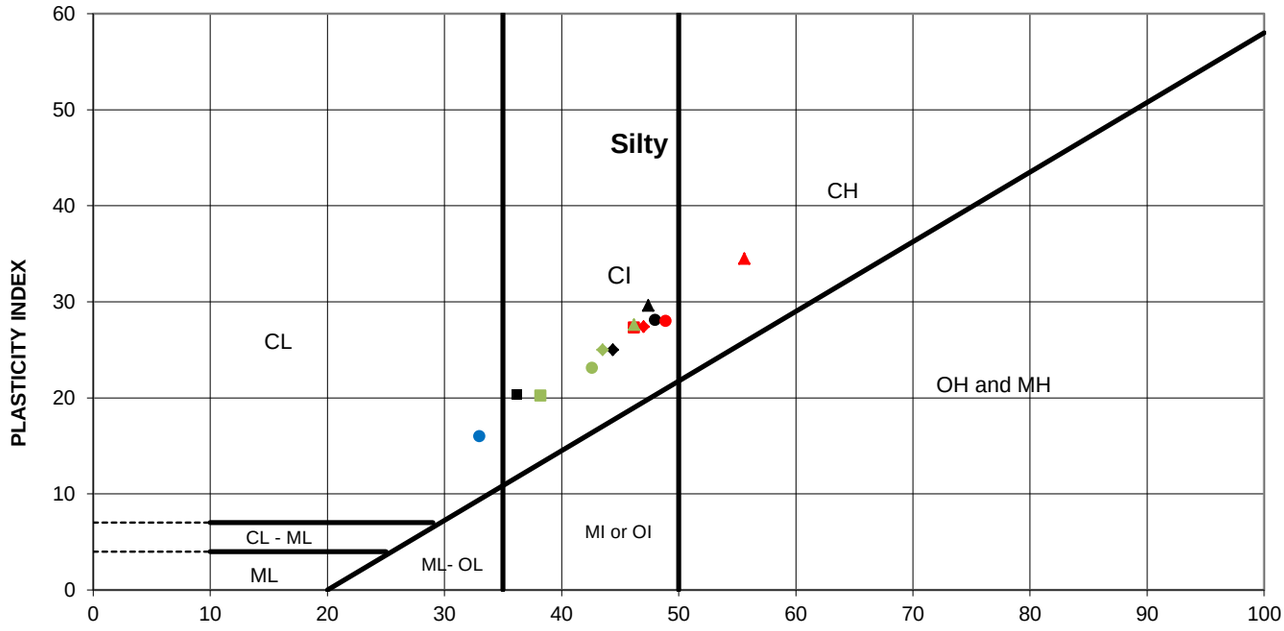
ATTERBERG LIMITS TEST RESULTS

FIGURE L-15

ATTERBERG INDICES



SYMBOL	BH	Sa. No.	Depth(m)	Elev.(m)	Liquid Limit	Plastic Limit	Plasticity Index	NMC %
●	A-2	10	9.1	248.9	48.0	19.9	28.1	50.0
◆	A-2	11	10.7	247.3	44.4	19.4	25.0	47.7
■	A-2	13	13.7	244.3	36.2	15.9	20.3	36.7
▲	1	15	16.8	244.6	47.4	17.8	29.6	28.0
●	2	12	12.2	249.5	48.9	20.9	28.0	40.6
◆	3	9	7.6	254.4	47.0	19.6	27.4	51.3
■	3	10	9.1	252.9	46.2	18.9	27.3	47.6
▲	3	11	10.7	251.3	55.6	21.1	34.5	59.1
●	3	15	16.8	245.2	42.6	19.5	23.1	61.5
◆	4	14	15.2	248.4	43.5	18.5	25.0	37.9
■	4	16	18.3	245.3	38.2	18.0	20.2	38.7
▲	5	14	15.2	247.8	46.2	18.6	27.6	44.1
●	6	16	18.3	245.3	33.0	17.0	16.0	31.1

Date: Feb-12
Project: Northbound Passing Lane 3
W.P: 5219-08-01

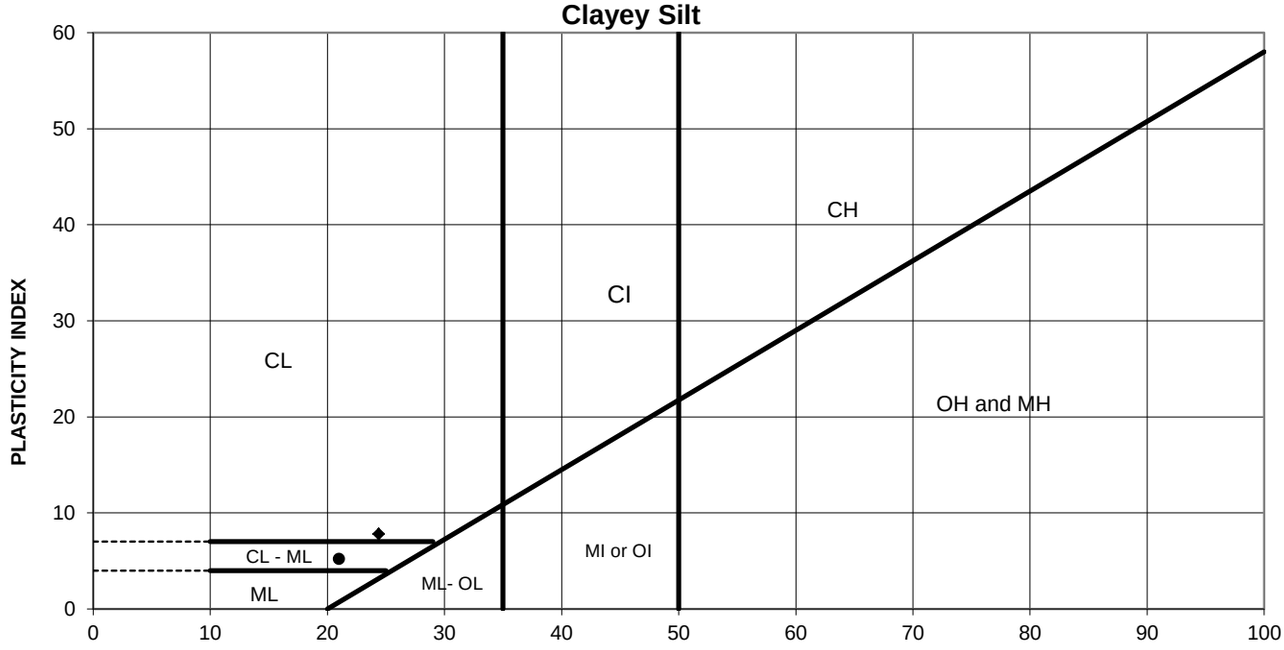
Prep'd: AT
Chkd: RG
Ref. No.: 10/07/10131-F3

LVM | MERLEX

ATTERBERG LIMITS TEST RESULTS

FIGURE L-16

ATTERBERG INDICES
Clayey Silt



SYMBOL	BH	Sa. No.	Depth(m)	Elev.(m)	Liquid Limit	Plastic Limit	Plasticity Index	NMC %
●	A-1	12	12.2	247.0	21.0	15.8	5.2	46.6
◆	2	14	15.2	246.5	24.4	16.6	7.8	36.5

Date: Feb-12
Project: Northbound Passing Lane 3
W.P: 5219-08-01

Prep'd: AT
Chkd: RG
Ref. No.: 10/07/10131-F3

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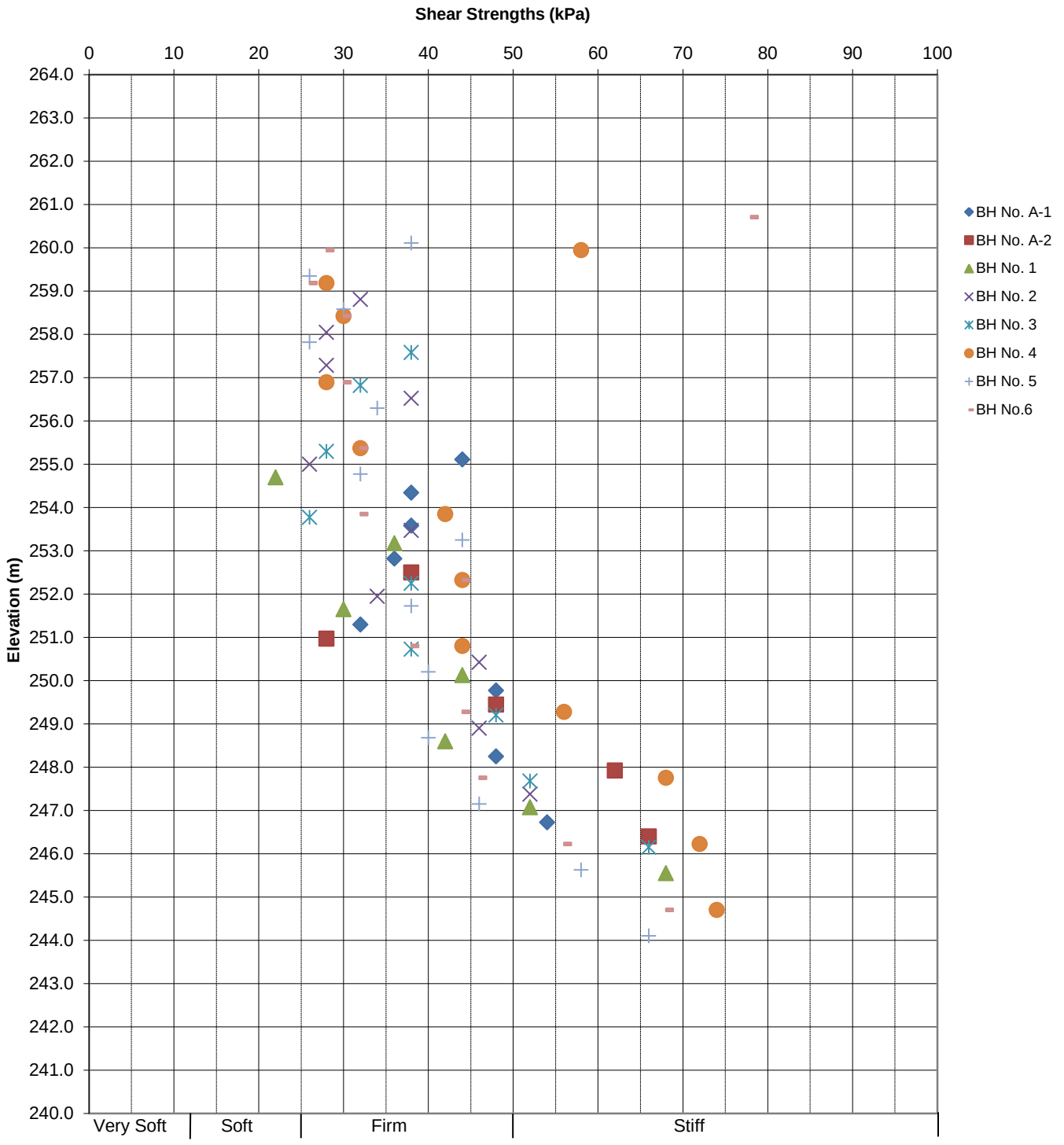
IN-SITU SHEAR STRENGTHS	Figure No. L-17

In-Situ Shear Strengths vs. Depth



Date: February 2012
Project: 10/07/10131-F3
WP: 5219-08-01

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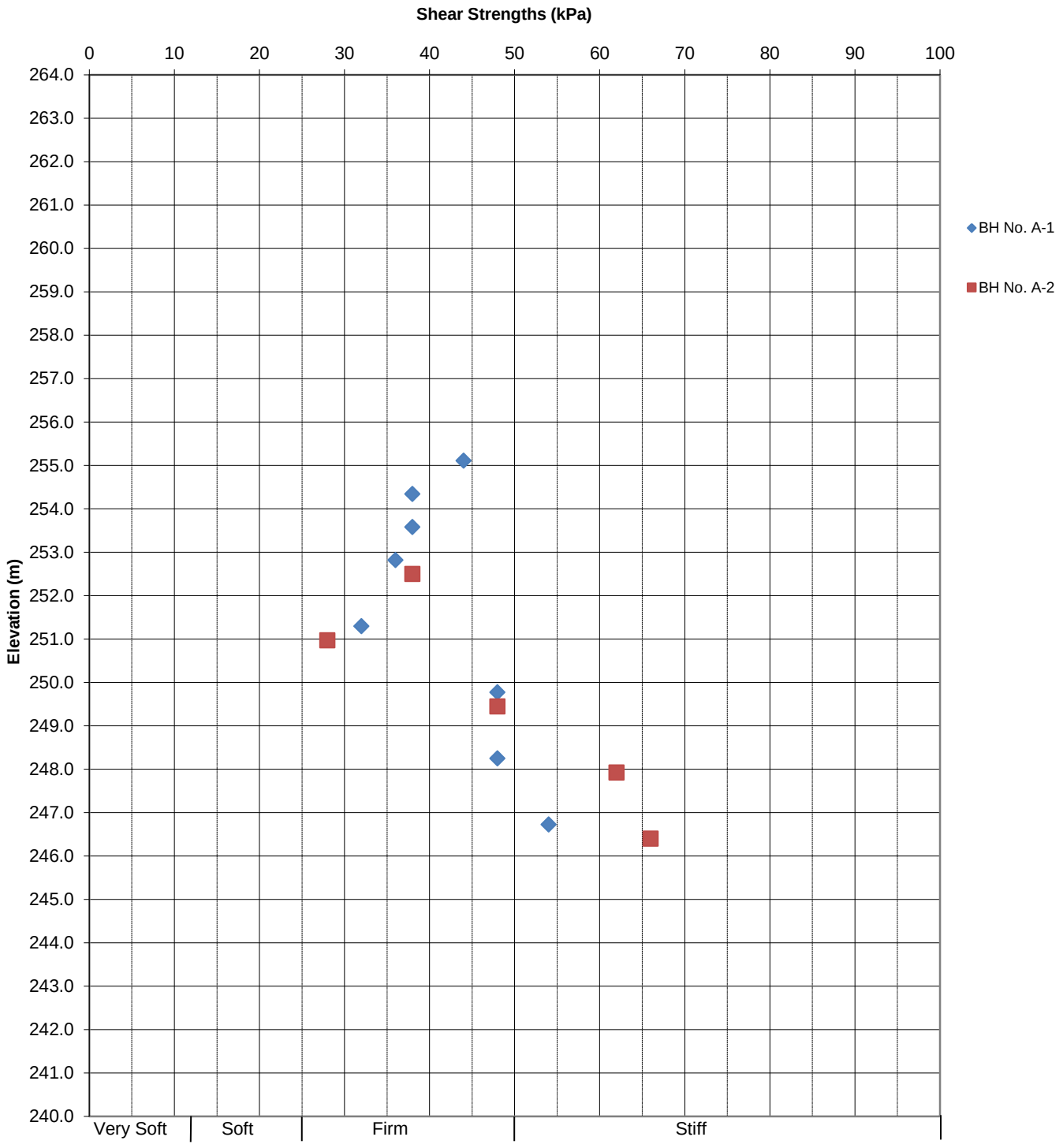
Checked:MAM

IN-SITU SHEAR STRENGTHS	Figure No. L-17a

In-Situ Shear Strengths vs. Depth



Date: February 2012
Project: 10/07/10131-F3
WP: 5219-08-01

LVM | MERLEX

Checked:MAM

CONSOLIDATION TEST SUMMARY

FIGURE L-18a

SAMPLE IDENTIFICATION

Project Number	10-1183-0107	Sample Number	9
Borehole Number	A-2	Sample Depth, m	7.6

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	4		
Date Started	12/3/2010		
Date Completed	12/20/2010		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	2.54	Unit Weight, kN/m^3	16.55
Sample Diameter, cm	6.30	Dry Unit Weight, kN/m^3	10.36
Area, cm^2	31.19	Specific Gravity, measured	2.73
Volume, cm^3	79.17	Solids Height, cm	0.982
Water Content, %	59.70	Volume of Solids, cm^3	30.64
Wet Mass, g	133.59	Volume of Voids, cm^3	48.52
Dry Mass, g	83.65	Degree of Saturation, %	102.9

TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t_{90} sec	c_v cm^2/s	m_v m^2/kN	k cm/s
0.00	2.538	1.584	2.538				
5.00	2.537	1.583	2.538	5	2.73E-01	7.88E-05	2.11E-06
9.99	2.535	1.581	2.536	73	1.87E-02	1.66E-04	3.03E-07
20.00	2.524	1.569	2.529	595	2.28E-03	4.33E-04	9.67E-08
40.03	2.497	1.542	2.510	759	1.76E-03	5.31E-04	9.16E-08
79.79	2.444	1.488	2.470	1852	6.99E-04	5.26E-04	3.60E-08
160.00	2.320	1.361	2.382	2269	5.30E-04	6.10E-04	3.17E-08
320.00	2.083	1.120	2.201	4133	2.49E-04	5.83E-04	1.42E-08
640.00	1.916	0.950	1.999	2306	3.67E-04	2.06E-04	7.41E-09
1280.00	1.784	0.816	1.850	1185	6.12E-04	8.12E-05	4.87E-09
2557.23	1.670	0.700	1.727	735	8.60E-04	3.52E-05	2.96E-09
1280.00	1.682	0.712	1.676				
320.00	1.727	0.758	1.704				
79.79	1.787	0.819	1.757				
20.00	1.845	0.878	1.816				
5.00	1.896	0.930	1.871				

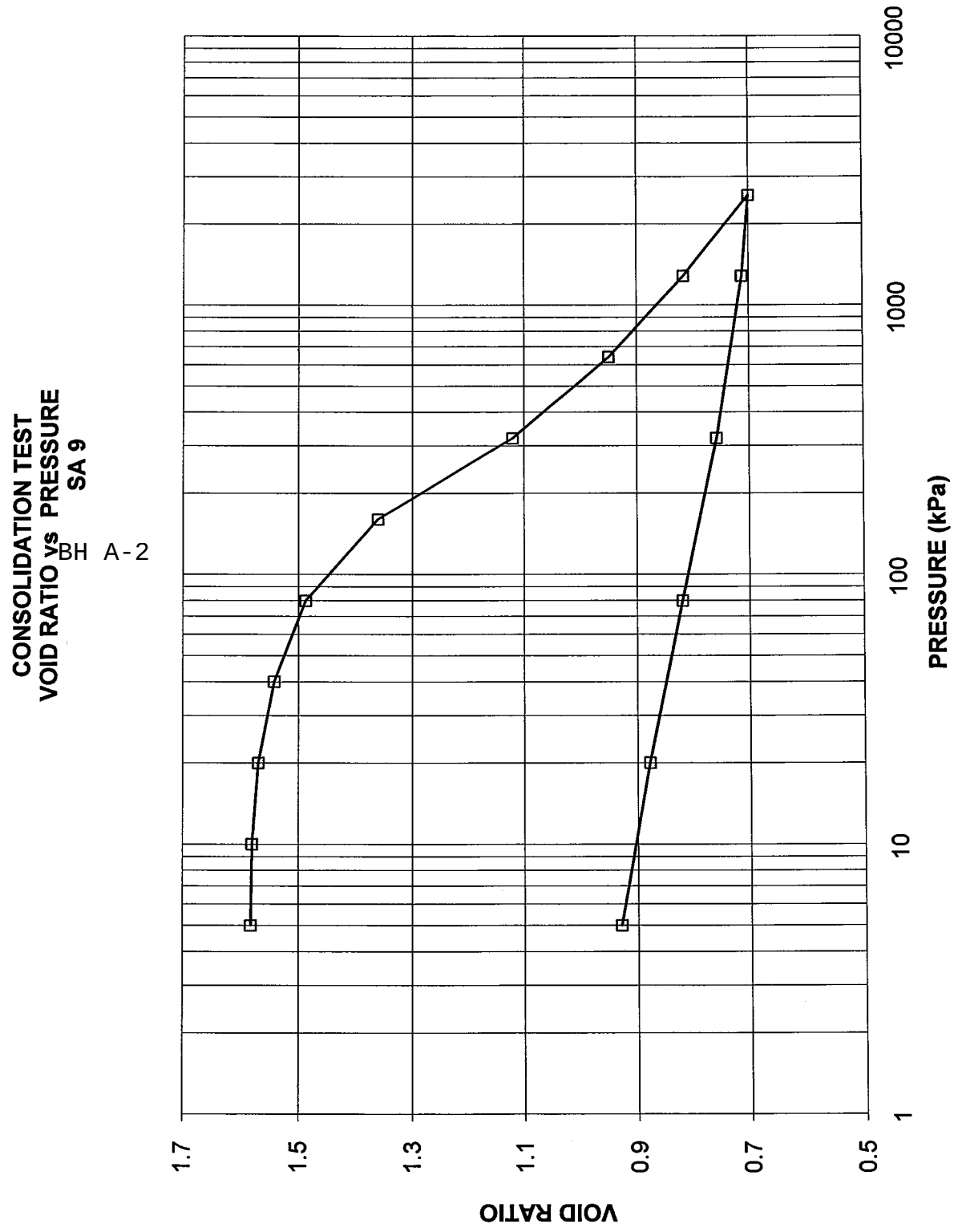
Note:
k calculated using cv based on t_{90} values.

SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	1.90	Unit Weight, kN/m^3	18.93
Sample Diameter, cm	6.30	Dry Unit Weight, kN/m^3	13.87
Area, cm^2	31.19	Specific Gravity, measured	2.73
Volume, cm^3	59.14	Solids Height, cm	0.982
Water Content, %	36.50	Volume of Solids, cm^3	30.64
Wet Mass, g	114.18	Volume of Voids, cm^3	28.50
Dry Mass, g	83.65		

CONSOLIDATION TEST
VOID RATIO VS LOG PRESSURE

FIGURE L-18b



Project No. 10-1183-0107

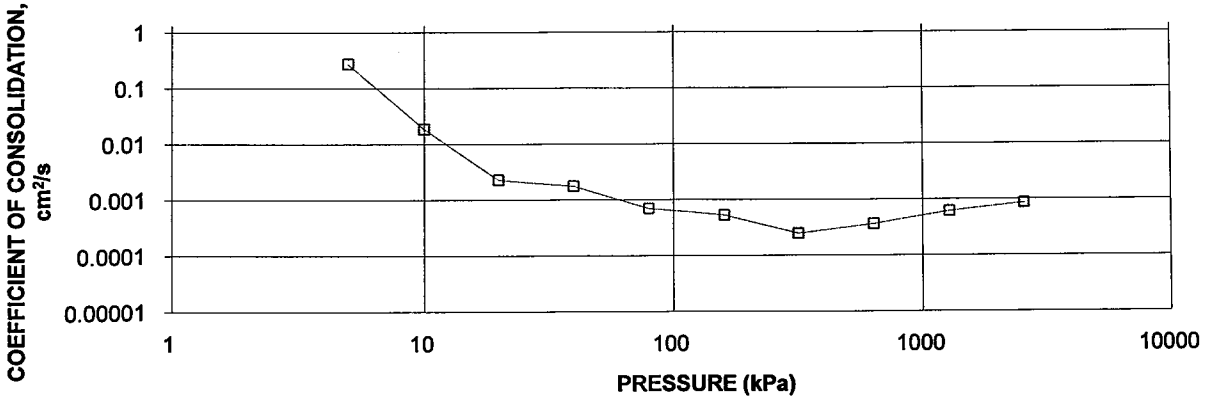
Prepared By: LFG

Golder Associates

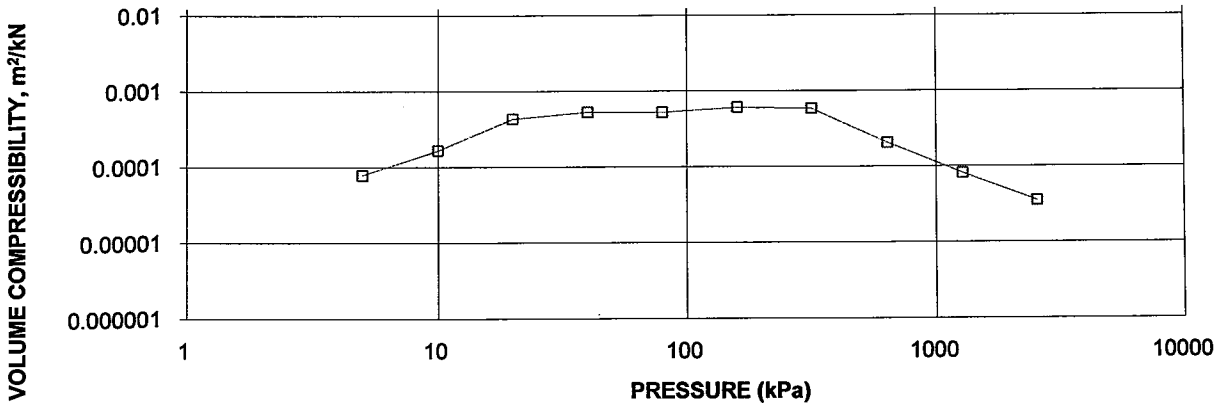
Checked By:

CONSOLIDATION TEST SUMMARY	FIGURE L-18c

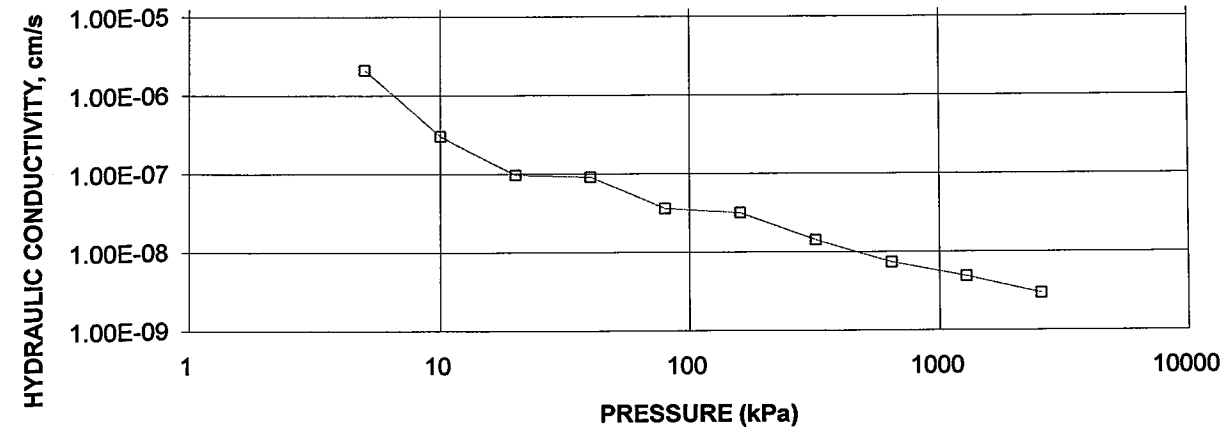
CONSOLIDATION TEST
C_V cm²/s VS PRESSURE (kPa)
BH A-2 **SA 9**



CONSOLIDATION TEST
M_V m²/kN vs PRESSURE (kPa)
BH A-2 **SA 9**



CONSOLIDATION TEST
HYDRAULIC CONDUCTIVITY vs PRESSURE
BH A-2 **SA 9**



Project No. 10-1183-0107
Prepared By: LFG

Golder Associates

Checked By:

CONSOLIDATION TEST SUMMARY

FIGURE L-19a

SAMPLE IDENTIFICATION

Project Number	10-1183-0107	Sample Number	9
Borehole Number	BH 3	Sample Depth, m	7.6

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	12		
Date Started	12/3/2010		
Date Completed	12/21/2010		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	2.55	Unit Weight, kN/m^3	16.85
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m^3	11.02
Area, cm^2	31.58	Specific Gravity, measured	2.76
Volume, cm^3	80.46	Solids Height, cm	1.038
Water Content, %	52.83	Volume of Solids, cm^3	32.77
Wet Mass, g	138.22	Volume of Voids, cm^3	47.70
Dry Mass, g	90.44	Degree of Saturation, %	100.2

TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t_{90} sec	c_v cm^2/s	m_v m^2/kN	k cm/s
0.00	2.548	1.456	2.548				
5.03	2.540	1.448	2.544	1215	1.13E-03	6.32E-04	6.99E-08
10.00	2.530	1.438	2.535	1949	6.99E-04	8.13E-04	5.57E-08
20.00	2.507	1.416	2.518	2614	5.14E-04	9.07E-04	4.57E-08
40.00	2.459	1.370	2.483	2323	5.62E-04	9.36E-04	5.16E-08
80.00	2.389	1.303	2.424	1882	6.62E-04	6.82E-04	4.42E-08
160.00	2.249	1.167	2.319	3286	3.47E-04	6.91E-04	2.35E-08
320.00	2.074	0.999	2.161	3025	3.27E-04	4.29E-04	1.37E-08
640.00	1.942	0.872	2.008	1815	4.71E-04	1.61E-04	7.44E-09
1280.00	1.826	0.759	1.884	984	7.65E-04	7.16E-05	5.36E-09
2556.39	1.720	0.658	1.773	735	9.07E-04	3.25E-05	2.88E-09
1280.00	1.726	0.663	1.723				
320.00	1.777	0.712	1.751				
80.00	1.829	0.762	1.803				
20.00	1.880	0.812	1.854				
5.03	1.924	0.854	1.902				

Note:
k calculated using cv based on t_{90} values.

SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	1.92	Unit Weight, kN/m^3	19.43
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m^3	14.60
Area, cm^2	31.58	Specific Gravity, measured	2.76
Volume, cm^3	60.75	Solids Height, cm	1.038
Water Content, %	33.06	Volume of Solids, cm^3	32.77
Wet Mass, g	120.34	Volume of Voids, cm^3	27.98
Dry Mass, g	90.44		

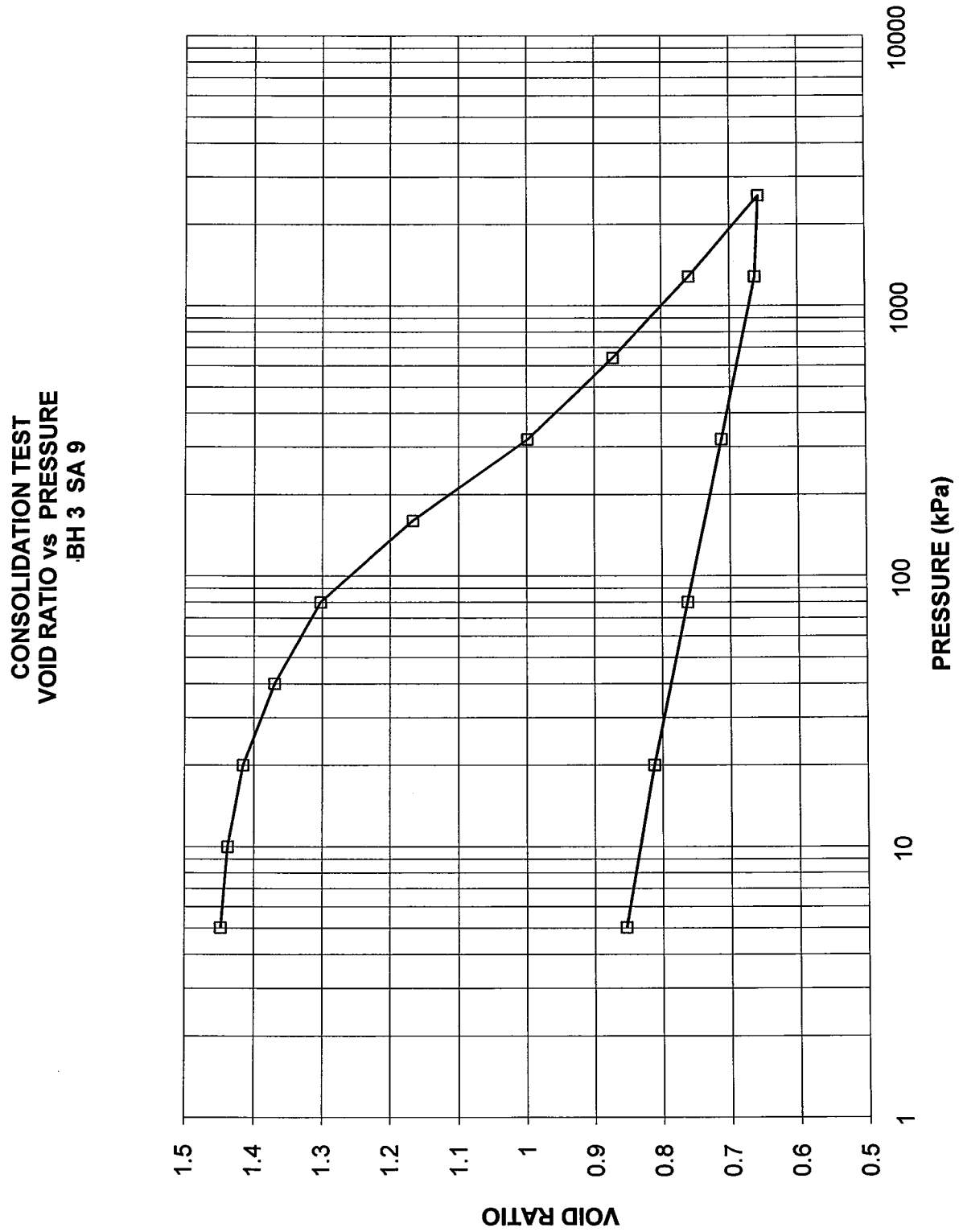
Prepared By: LFG

Golder Associates

Checked By:

CONSOLIDATION TEST
VOID RATIO VS LOG PRESSURE

FIGURE L-19b



Project No. 10-1183-0107

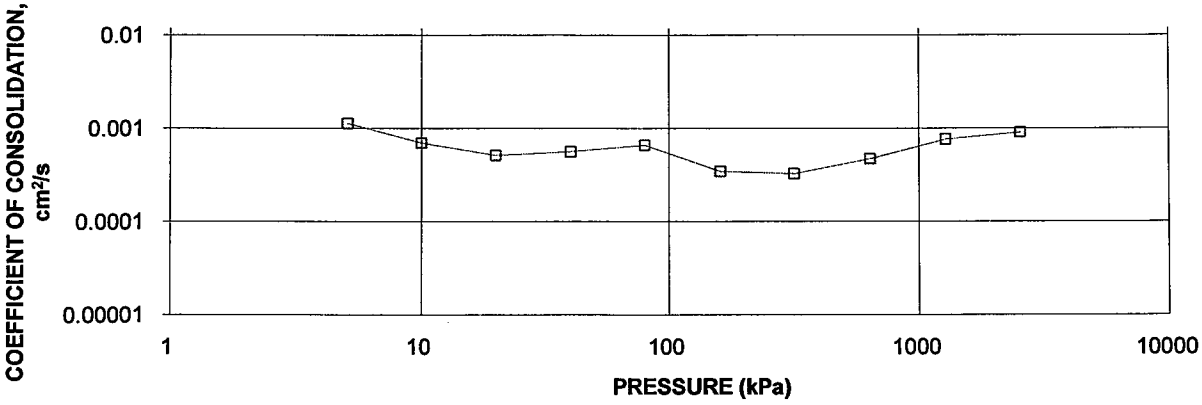
Prepared By: LFG

Golder Associates

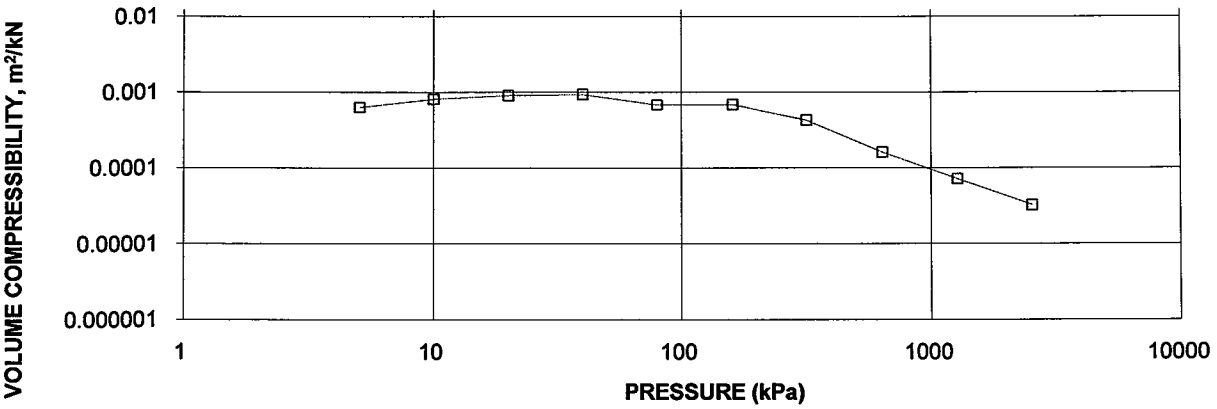
Checked By:

CONSOLIDATION TEST SUMMARY	FIGURE L-19c

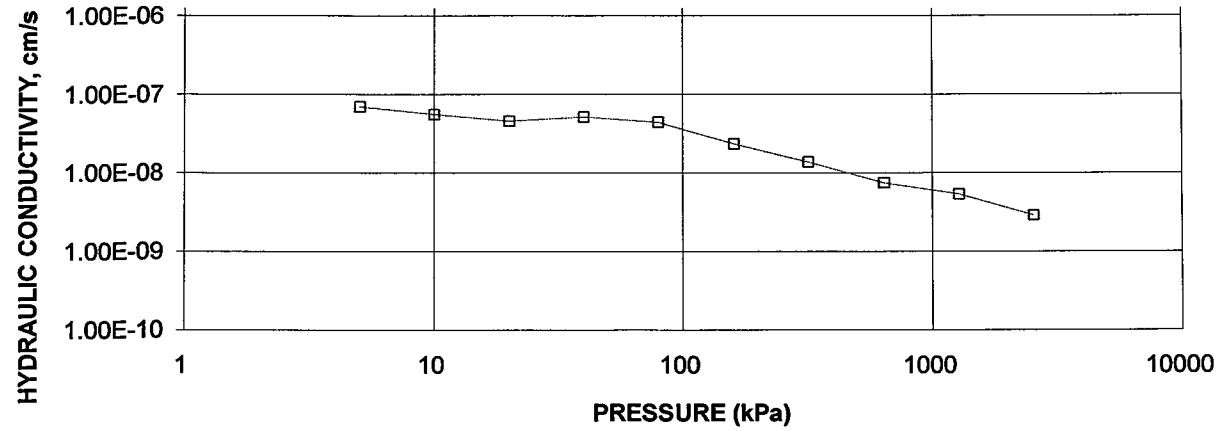
CONSOLIDATION TEST
C_V cm²/s VS PRESSURE (kPa)
BH 3 SA 9



CONSOLIDATION TEST
M_V m²/kN vs PRESSURE (kPa)
BH 3 SA 9



CONSOLIDATION TEST
HYDRAULIC CONDUCTIVITY vs PRESSURE
BH 2 SA 9



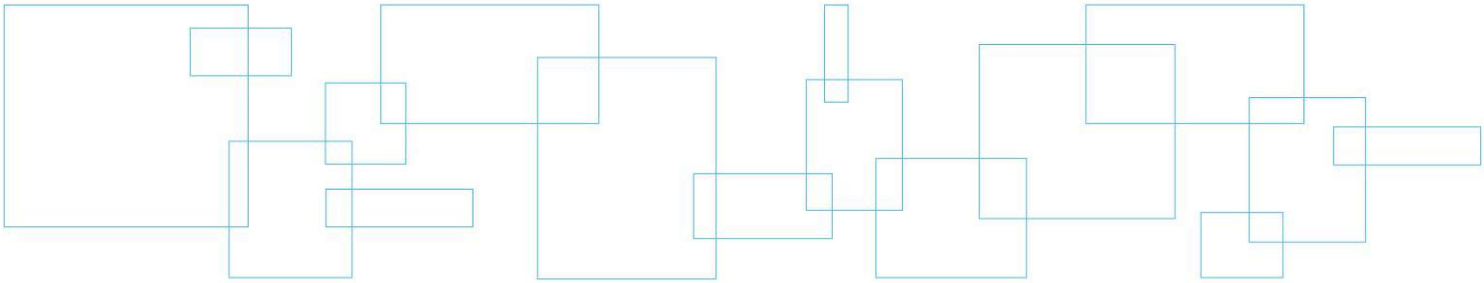
Project No. 10-1183-0107
Prepared By: LFG

Golder Associates

Checked By:

Appendix D Photo Essay

Enclosure Nos. 15: Photo Essay
Enclosure No. 16: List of Abbreviation for Geotechnical Borehole Logs
Enclosure No. 17: Geotechnical Borehole Logs



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Culvert Outlet - Looking South-West	Photo: 1

Drilling Boreholes for Culvert Extension – Looking East	Photo: 2

Reference No.: 10/07/10131-F3 Project: Hwy 11 – Township of Taylor, Culvert Station 22+565	Originated By: JL Date: September, 2010

LIST OF ABBREVIATIONS

Accep	Acceptable	**Hi**	Highly	**RSS**	Remoulded Shear Strength
Agg	Aggregate	**HP**	High Plasticity	**RF**	Rock Fill
Amor	Amorphous	**HM**	Hot Mix	**Sa**	Sand
Asph	Asphalt	**Ip**	Plasticity Index	**Sat**	Saturated
AP	Auger Probe	**L**	Loose	**SH**	Shale
BR	Bedrock	**Lt**	Light or Left	**Sh Rk**	Shot Rock
Blk	Black	**Liq**	Liquid	**Si (y)**	Silt (y)
Bl	Blue	**Lo**	Loam	**Sl (y)**	Slight (ly)
BH	Borehole	**Matl**	Material	**(L,M,H)SFH**	Susceptibility to Frost Heave (L – Low, M – Med, H – High)
Bld (y)	Boulder (y)	**Max**	Maximum		
Blds	Boulders	**Med**	Medium		
Br	Brown	**Mod**	Moderate	**SP**	Slight Plasticity
CF	Channel Face	**Mott**	Mottled	**SSM**	Select Subgrade Material
Cl	Clay	**Mrl**	Marl	**St**	Sensitivity
Co	Coarse	**Mul**	Mulch	**Stn (y)**	Stoney
Cob	Cobbles	**Num**	Numerous	**Stks**	Streaks
Comp	Compact	**MDD**	Maximum Dry Density	**Surf**	Surface
Conc	Concrete	**MWD**	Maximum Wet Density	**Temp**	Temperature
Contam	Contaminated	**MP**	Medium Plasticity	**TH**	Test Hole
Cr	Crushed	**NFP**	No Further Progress	**TP**	Test Pit
Dk	Dark	**NFP (Blds)**	No Further Progress (Boulders)	**Tps**	Topsoil
Decomp	Decomposed	**NMC**	Natural Moisture Content	**Tr**	Trace
D	Dense	**OCC**	Occasional	**USS**	Undisturbed Shear Strength
D_R	Relative Density	**Ora**	Orange	**Unreinf**	Unreinforced
E	Earth	**Org**	Organic	**Varv**	Varved
Fib	Fibrous	**Org M**	Organic Matter	**VF**	Very Fine
F	Fine	**Ob**	Overburden	**WT**	Water Table
Fr Wat	Free Water	**Pavt**	Pavement	**Weath**	Weathered
FB	Frost Boil	**Pedo**	Pedological	**W**	With
FH	Frost Heave	**Pen Mac**	Penetration Macadam	**w**	Field Moisture Content
Gran	Granular	**Psty**	Polystyrene	**Wd (y)**	Wood (y)
Gr	Gravel (ly)	**Poss**	Possible	**Wopt**	Optimum Moisture Content
Grn	Green	**PST**	Prime & Surface Treated	**Wp**	Plastic Limit
Gry	Grey	**Quant**	Quantity	**W_L**	Liquid Limit
H	Heavy	**Reinf**	Reinforced	**Yel**	Yellow

Example of an Abbreviated Borehole

10+000		On C/L	
0	- 300	Rooty Peat Fr Wat @ 200	
300	- 800	Br F Sa Tr Gr Tr Si NOT Accep Granular 'B' Type I 21% PASSING 75 µm Accep SSM	**20ELS107**
800	- 4.0	Gry Si F Sa Tr Gr w @ 3.6 = 20.0 % % Passing 2.00 mm = 91 425 µm = 80 75 µm = 34	**20ELS108** LSFH
4.0		NFP Bld or BR	

Station	Offset from Centerline (C/L) (Rt – Right; Lt – Left)
Depth below Grade*	Abbreviated Soil Description Groundwater Data (where encountered) Abbreviated Lab Data (where applicable) - Sample No., Type of Test(s) and Test Results - Relation to Ontario Provincial Standards and Specifications (OPSS) included (i.e. pass or fail; reason) where applicable

* Depths are measured in millimeters from 0 up to 1 meter and in meters for depths equal to greater than 1 meter

22+450 6.7 Lt C/L

0 - 300 Cr Gr
300 - 650 F-Med Sa W Gr Occ Cob
650 - 2.7 Si W Cl Tr F Sa

22+450 4.1 Lt C/L

0 - 80 Asph
80 - 280 Cr Gr
280 - 700 F-Med Sa W Gr Occ Cob
700 - 2.7 Si W Cl Tr F Sa

22+500 5.7 Lt C/L

0 - 350 Cr Gr
350 - 1.7 F-Med Sa W Gr Occ Cob
1.7 - 2.7 Si W Cl Tr F Sa

22+500 4.2 Lt C/L

0 - 70 Asph
70 - 290 Cr Gr
290 - 1.6 F-Med Sa W Gr Occ Cob
1.6 - 2.7 Si W Cl Tr F Sa

22+500 1.6 Lt C/L

0 - 260 Asph
260 - 450 Cr Gr
450 - 1.8 F-Med Sa W Gr
Accep Granular B Type I
1.8 - 2.7 Si W Cl Tr F Sa

22+550 5.7 Lt C/L

0 - 250 Cr Gr
250 - 2.0 F-Med Sa W Gr Occ Cob
2.0 - 2.7 Si W Cl Tr F Sa

22+550 4.2 Lt C/L

0 - 70 Asph
70 - 300 Cr Gr
300 - 1.7 F-Med Sa W Gr Occ Cob
1.7 - 2.7 Si W Cl Tr F Sa

Appendix E Design Data

Figure Nos. F3-3 and F3-4: Half Sections
Figure No. S-1: Stability Analysis
Figure No. F3-5: Settlement Chart

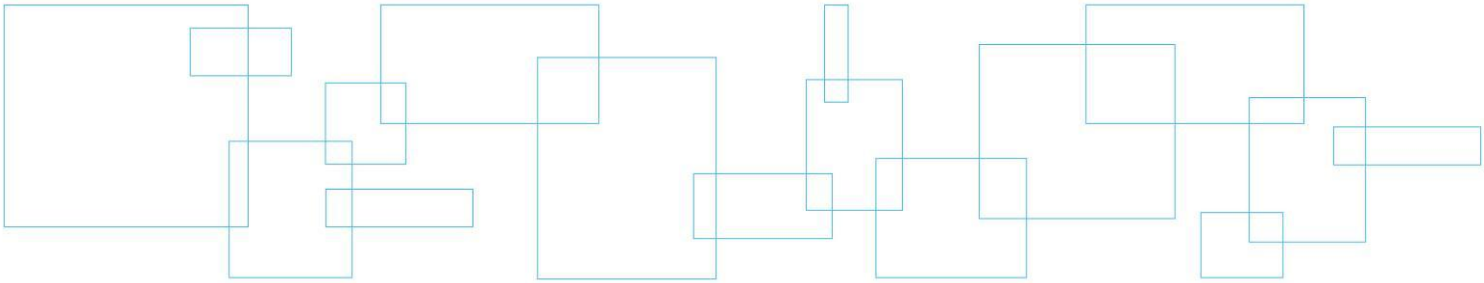

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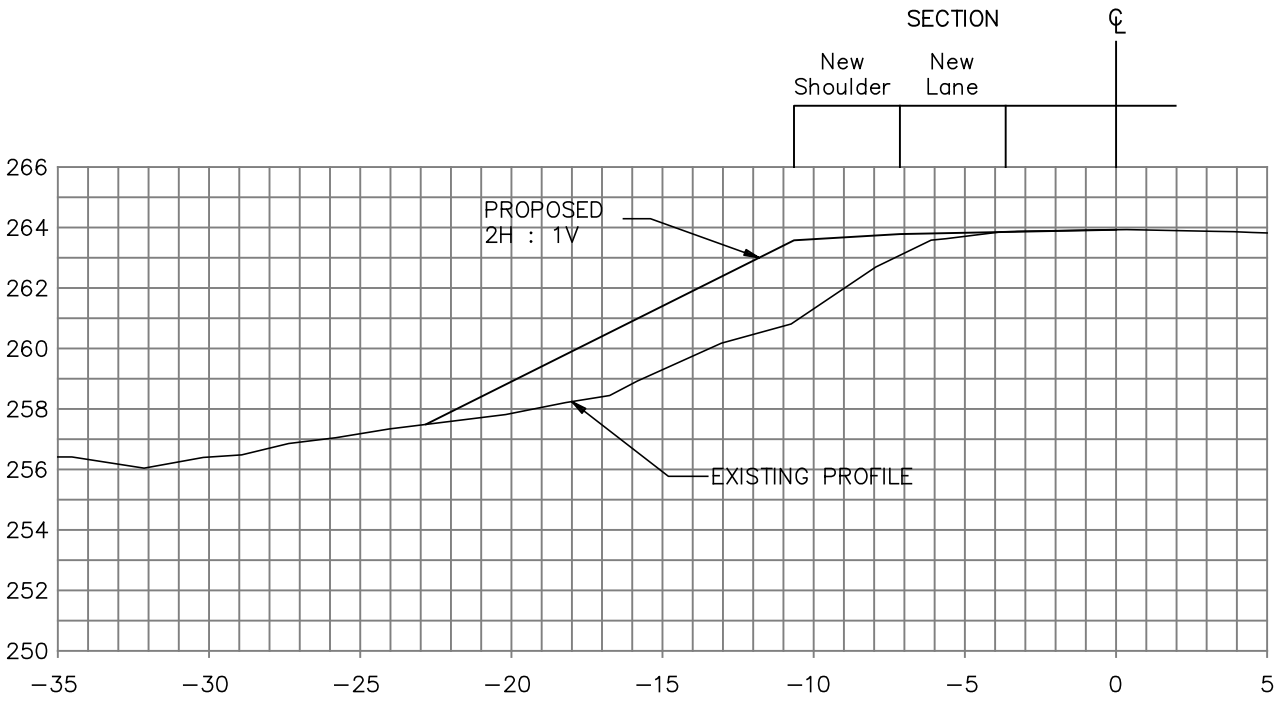
FIGURE No. F3–3



HALF SECTION STA. 22+550

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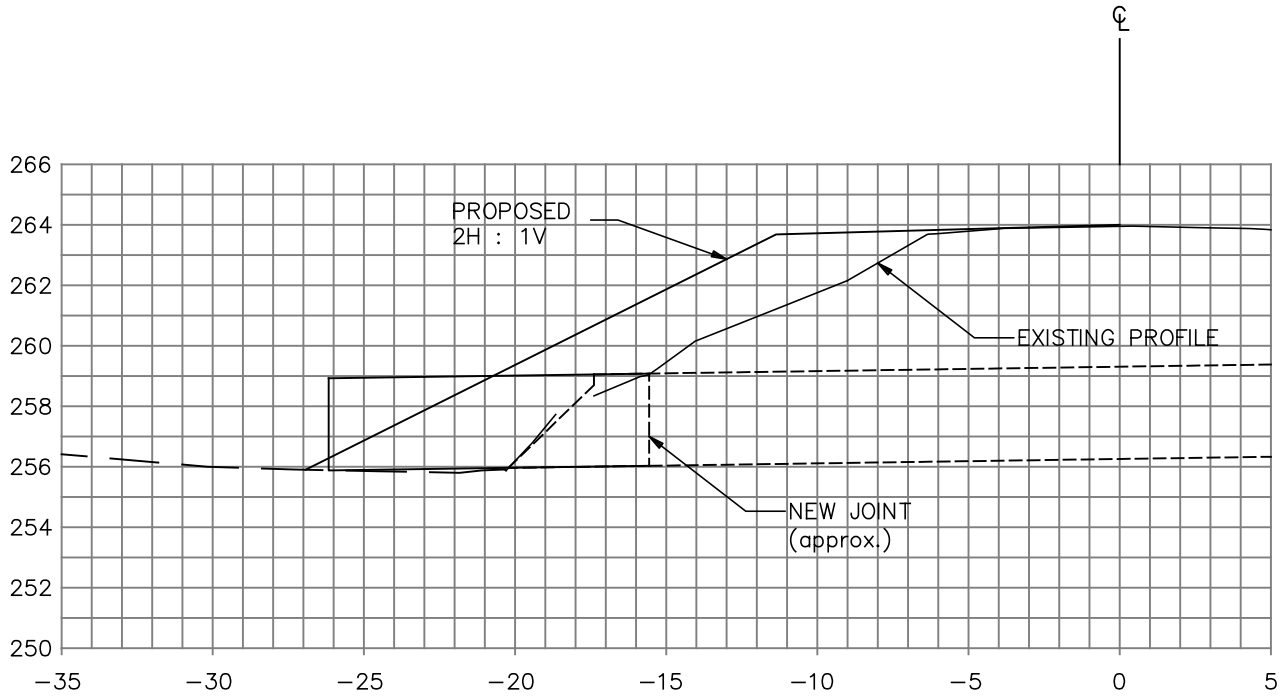
2-120 Progress Court,
North Bay Ontario, P1B 8G4
TEL: (705) 476 2550
FAX: (705) 476 8882

HWY NO. 11 – TWP. OF TAYLOR
Passing Lane No. 3
Culvert Replacement & Embankment Widening
Sta. 22+450 to 22+590

WP No.:	5219–08–01
Date:	Feb 2012
Scale:	1:250
Ref.:	10/07/10131–F3
Drawn By:	RG

FIGURE No. F3–4



HALF SECTION STA. 22+565

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2-120 Progress Court,
North Bay Ontario, P1B 8G4
TEL: (705) 476 2550
FAX: (705) 476 8882

HWY NO. 11 – TWP. OF TAYLOR

Passing Lane No. 3
Russel Creek Extension
Station 22+565

WP No.:	5219–08–01
Date:	Feb 2012
Scale:	1: 250
Ref.:	10/07/10131–F3
Drawn By:	RG

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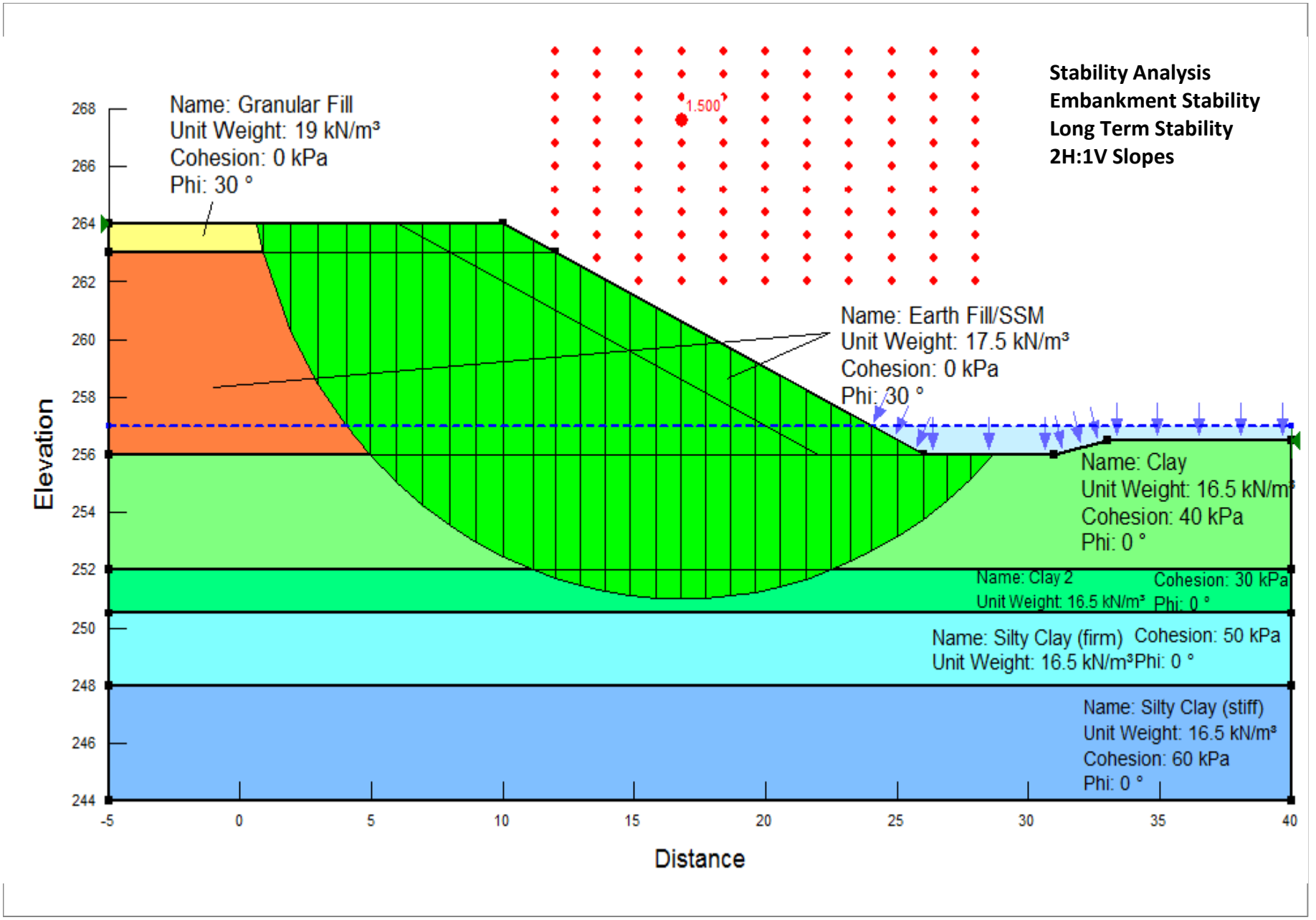

Stability Analysis
Station 22+565
2H:1V

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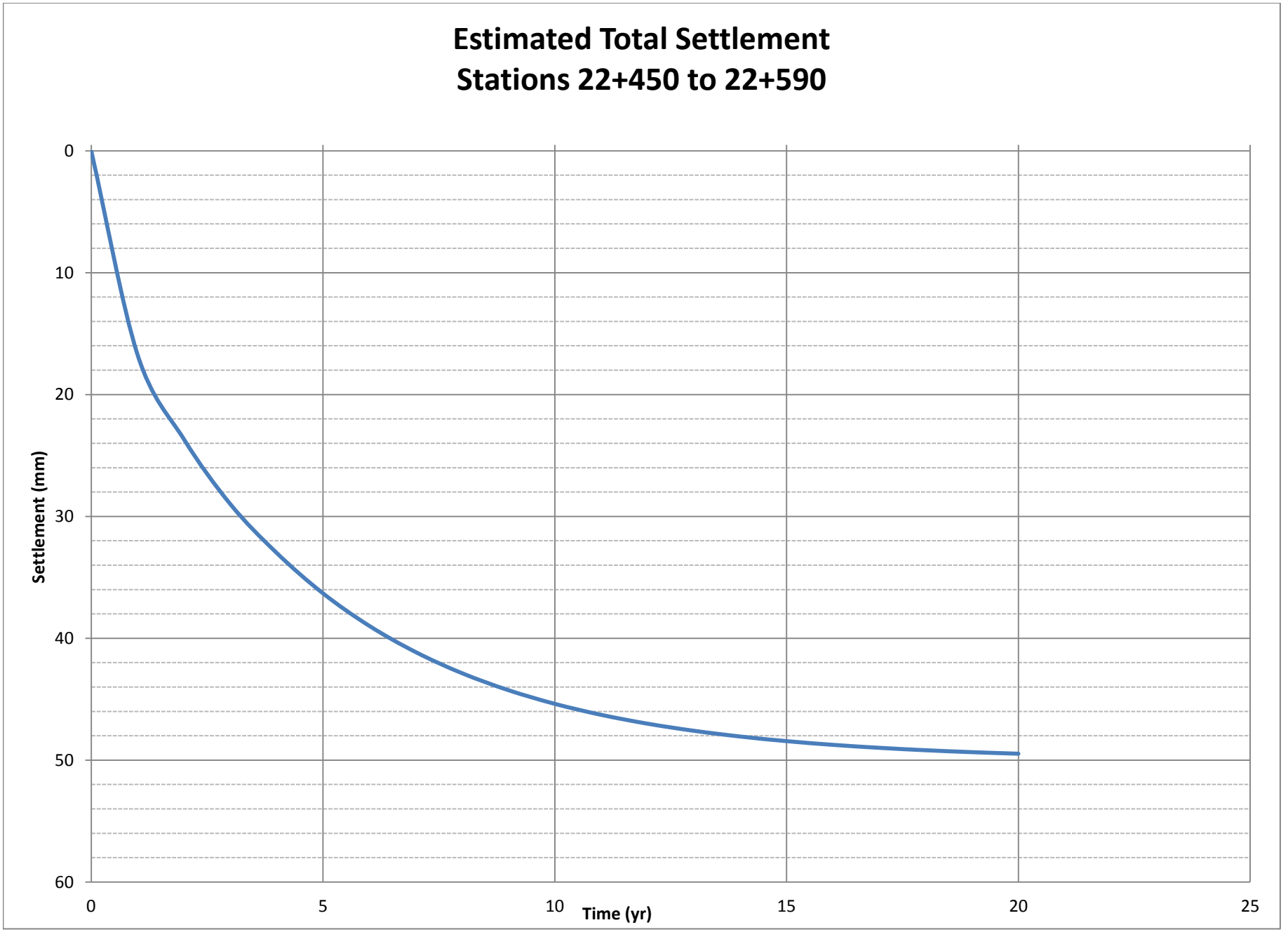

Project: G.W.P 5217-08-00
Location: Hwy 11, Passing Lane 3

Settlement
Stations 22+450 to 22+590, TWP of Taylor

Figure No. F3-5