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Appendix G

Landfill Expansion - Geotechnical Report

Environment

City of Sault Ste. Marie

Landfill Expansion – Geotechnical Report

Prepared by:

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Project Number:

60117627 (402.19.1)

Date:

June, 2014

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June 19th, 2014

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Dear Ms. Taddo:

Project No: **60117627 (402.19.1)**

Regarding: **Sault Ste. Marie Landfill Expansion – Geotechnical Report**

AECOM Canada Ltd. (AECOM) is pleased to submit our report on the above referenced project. If you have any questions please do not hesitate to contact Zeyad Al-Hayazai, P.Eng. directly at 204 928 9221 or Rick Talvitie, P.Eng. at 705 942 2612.

Sincerely,
AECOM Canada Ltd.

Ron Typliski, P.Eng.
Vice President, Environment
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ZS:CM
Encl.
cc:

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Revision Log

Revision #	Revised By	Date	Issue / Revision Description
1	Z. Shukri	June 18, 2014	Final Report

AECOM Signatures

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1 Introduction

The City of Sault Ste. Marie (The City) retained AECOM to provide geotechnical engineering services for the proposed expansion of the existing landfill facility located north of Fifth Line and west of Highway 17 in the City of Sault Ste. Marie, Ontario. The existing landfill footprint covers an approximate area of 26 hectares. The capped waste embankment height is approximately 19.5 m above existing grade. Different side slope inclinations between 4H:1V and 20H:1V were used in the existing facility. The maximum thickness of the waste material in the existing landfill is estimated to be about 30 m thick.

The geotechnical scope of work for this project consisted of the following tasks:

- Review relevant information and published geotechnical data.
- Develop and complete a geotechnical field investigation program including utility locates, test hole drilling, soil sampling, instrumentation installation and laboratory testing.
- Complete geotechnical engineering studies including stability assessment for possible configurations during the service life of the facility and for the final configuration.
- Prepare a geotechnical report to document the geotechnical investigation, discuss geotechnical concerns and provide geotechnical recommendations related to the design and construction of the proposed expansion.

This report documents the 2013 geotechnical field investigation, discusses the geotechnical considerations and provides related geotechnical recommendations in support of the facility expansion. Environmental aspects and any potential impacts from the existing facility or the proposed work are beyond the scope of this report.

2 Site Description

The existing facility is located approximately 800 m northwest of the Fifth Line East and Highway 17 intersection. The proposed expansion is planned to take place on the north and west sides of the existing disposal footprint. Natural ground topography has been altered and the existing site topography varies from gently undulating to steep and hilly with isolated rock outcrops. The site is bordered by the Canon Creek on the north and east sides. Photos for general site view are presented in Appendix A (photos 1 and 2)

The Sault Ste. Marie area is at the southern boundary of the Superior Structural Province of the Canadian Shield and is characterized by bedrock of different geological settings. The physiography of the Sault Ste. Marie area is dictated primarily by the underlying bedrock structure and topography. The surficial soils in the area typically consist of sand and gravelly sand, of varying thickness. The landfill site is characterized by isolated bedrock outcrops, exposed conglomerate faces and sand as surficial material. Test holes drilled in the area confirmed the general surficial geology indicating the soil profile consists of sand, sand and gravel underlain by fine sand and some silt over bedrock.

A review of the existing site information indicates the groundwater flow is generally from north to south and from east to west. Groundwater conditions in the overburden deposits measured during the 2013 investigation support this observation.

2.1 Expansion Development Plan

To achieve the proposed end use development plan, the landfill expansion will be completed in a series of stages or cells involving both below grade and above grade refuse placement. Each cell or stage will be completed to or near final grade prior to moving forward with the next stage. This approach will reduce the extent of surface area exposed at any point in time and therefore reduce the net precipitation infiltration and overall leachate generation rate.

Each stage will generally include site preparation including topsoil stripping, cell excavation, exterior berm construction, compaction and lining of the cell's base soils. A leachate collection system will be installed as required by the design across the cell base. Once a below grade area has been completed, above grade development can then proceed in a series of lifts until the design grades for that area are achieved. Once the above grade area approaches final design grade in one cell, the next cell will be excavated and prepared to receive refuse. This sequence is repeated until all cells or stages have been developed and the final site topography has been reached.

The development stages of the proposed facility expansion are illustrated, in general, in Appendix B. The site has been divided into eight cells/stages to accommodate installation of a liner and leachate collection system across the base of the facility. A liner is also proposed in areas where waste from the expansion area will interface with the existing waste within the approved disposal footprint.

Development is planned to commence in the northeast corner of the site working towards the west along the north perimeter of the footprint and then to the south. Above grade exterior slopes should be formed through berm construction and final grading. Interior areas should be constructed as a series of benches with each bench extending outwards from the exterior berm as a terrace feature. The surface area of these terraces should be limited to prevent the formation of large plateaus with inadequate surface drainage. The terraces should be large enough, however, to allow for efficient landfilling operations.

In addition to the standard cell development, landfill mining is proposed in the southwest quadrant of the existing disposal footprint. Landfill mining involves the excavation of existing disposed waste and cover material, recovering the cover material, installing of a liner and leachate collection system along the original landfill base, and returning the waste to the disposal footprint.

Relevant information on ground profiles, landfill configurations and cross section were compiled to support geotechnical models across the site area. Landfill plan and cross sections used in the stability assessment are attached in Appendix B.

3 Geotechnical Investigation

3.1 Field Work

In the period from June 17th to 24th, 2013, AECOM completed a field based geotechnical investigation. The drilling was completed by TBT Engineering Consulting Group, using a tire mounted CME 750 drill rig equipped with 194 mm outside diameter hollow stem augers. The investigation included the drilling of sixteen (16) test holes (TH13-01 to TH12-09, TH13-10A, TH13-10B, TH13-10C, TH13-11A, TH13-11B, TH13-12 and TH13-13. Four (4) test holes were advanced into the existing landfill (TH 13-01, TH13-04, TH13-11A and TH 13-11B). The approximate locations of the test holes are shown on the test hole location plan in Appendix C.

Ten (10) test holes (TH13-01 to TH13-05, TH13-07 to TH13-09, TH13-11B and TH13-13) were advanced to a depth greater than 10 m. Six (6) test holes (TH13-06, TH13-10A, TH13-10B, TH13-10C, TH13-11A and TH13-12) encountered auger refusal and were terminated at depths between 2.5 to 6.1 m below existing ground surface. Standard Penetration Test (SPT) was completed at regular intervals. Disturbed soil samples were collected for further visual inspection and testing. Four (4) standpipe piezometers were installed at the location of TH13-07, TH13-08, TH13-10C and TH13-11B, to measure groundwater levels (GWL) in the foundation soil and in the municipal solid waste (MSW). Laboratory testing included: moisture content, gradation, and direct shear tests.

Logs have been prepared for each test hole to record the description and the relative position of the soil strata, location of samples obtained, field and laboratory test results, and other pertinent information. Test hole logs and laboratory test results are attached in Appendix D and E, respectively.

3.2 Subsurface Conditions

The existing grade elevations varied across the site from elevation 279.0m for the existing ground to 310.5m at the top of existing landfill. In descending order the soil profile generally consists of:

- Topsoil
- Fill
- Municipal Solid Waste (MSW)
- Upper Sand
- Sand and Gravel / Conglomerate
- Lower Sand
- Bedrock

Each of these units is described further below:

Topsoil

Topsoil was encountered at the ground surface in test holes TH13-06, TH13-08, TH13-09, TH13-10A, TH13-10B, TH13-10C, TH13-12, and TH13-13. The topsoil thickness ranges from 0.10 to 0.30 m. Generally, the topsoil is sandy, brown to dark brown, loose, moist to dry, organic and contains trace amounts of gravel, trace amounts of cobbles and trace amounts of clay.

Fill

Fill was encountered at ground surface in test holes TH13-01 and TH13-04. In test hole TH13-01, the fill is 1 m thick and mainly consists of sand, trace gravel, trace cobble, and trace organic. The fill is brown, loose, dry, and medium to coarse grained. The fill encountered in test hole 13-04 is 0.1 m thick and mainly consists of sand and gravel and trace organic.

Municipal Solid Waste (MSW)

MSW was encountered in test holes TH13-01, TH13-04, TH13-11A and TH13-11B where the drilling was advanced into the existing landfill. The MSW consists of paper, cloth, wood, rubber and other miscellaneous trash. Variable amounts of sand were observed in the MSW as shown in Photos 3 and 4, Appendix A. The MSW is dark brown to black in color and wet. SPT blow counts in the MSW range from 11 to 60.

Upper Sand

Sand 1.4 to 7.5 m thick was encountered below the top soil or at ground surface in TH13-03, TH13-08 to TH13-10C, TH13-12 and TH13-13. Generally, the sand contains trace amounts of gravel and trace amounts cobbles. The sand is brown, compact to dense, moist and medium to coarse grained. The moisture content from laboratory measurements ranges from 5 to 13 percent. SPT blow counts in the sand range from 12 to 49.

Sand and Gravel Deposit

Sand and gravel 1.5 to 10.5 m thick was encountered beneath the upper sand at the location of test holes TH13-03, TH13-08, TH13-09, TH13-10A, TH13-10B TH13-10C, TH13-12 and TH13-13. Sand and gravel was also observed at ground surface in test holes TH13-02, TH13-06 and TH13-07. Generally, the deposit contains some cobbles, and trace amounts of boulders. The deposit is brown, compact to dense, and moist. Generally, the sand is medium to coarse grained. The moisture content from laboratory measurements ranges from 2.5 to 11 percent. SPT blow counts range from 16 to refusal (i.e., three consecutive 50 blows/150 mm or 100 blows/300 mm). Sand and gravel matrix observed from exposed faces on site is dense to very dense. Laboratory measurement for moisture content ranges from 2.5 to 6 percent.

Observation of exposed faces of this unit revealed the strata as a conglomerate, as shown in Photo 05 and 06 in Appendix A. The unit consists of sub-rounded to rounded grains of variable sizes up to boulders size (i.e., > 200 mm). The observed matrix is poorly sorted and cemented.

Lower Sand

Sand 6.7 to 23.7 m thick was encountered below the conglomerate at the location of test holes TH13-03, TH13-07 to TH13-09, and TH13-13 and directly underneath the MSW in test holes TH13-01 and TH13-11B. Generally, the sand contains some fines and trace gravel. The sand is brown becoming pinkish brown with increasing depth, compact to dense, moist to wet, and medium to fine grained. The moisture content from laboratory measurements ranges from 5 to 13 percent. SPT blow counts in the sand range from 14 to refusal. Blow-up was observed in the sand below the groundwater table.

Bedrock

Auger refusal on suspected bedrock was encountered in test holes TH13-02, TH13-09, TH13-10B and TH13-10C at elevation 300, 265, 297 and 297 m, respectively.

Rock outcrops were observed at the northern boundary of the landfill extending towards the northwest. The observed outcrops were knobby with an irregular topography.

3.3 Groundwater Condition

Groundwater elevations from the four (4) standpipe piezometers installed at the Site are presented in Table 01. The piezometers were installed to monitor groundwater condition and assist in interpretation of groundwater flow direction and gradients within the overburden. The locations of the standpipe piezometers are shown on Figure 01 in Appendix C.

Monitoring results from TH/MW13-10C suggest a suspected perched groundwater at elevation 299.3 m in the sand and gravel conglomerate. Monitoring results from TH/MW13-11B indicate perched leachate level in MSW at elevation 285.4 m or 8.2 below the existing landfill grade. Groundwater levels may vary seasonally, annually or due to construction or landfilling activities and waste composition.

In normal conditions, leachate level in the MSW is maintained at low elevation within the landfill due to the (relatively) high permeability of the waste material and the performance of the leachate collection system; however, due to the natural non consistency of the material forming the MSW, local water entrapment can occur and cause perched water level in the landfill.

For the purpose of stability analysis, the groundwater elevation in the sand and in the MSW is generally assumed at elevation 280 and 290 m, respectively.

Table 01: Summary of GWL Monitoring

Standpipe ID	Location	Soil Unit Installed in	Ground Surface Elevation (m)	Date	Measured Groundwater Elevation (m)
MW13-01	TH13-07	Lower Sand	281.4	June 21, 2013 June 22, 2013 June 23, 2013 June 25, 2013	Installed 263.7 263.7 264.5
MW13-02	TH13-08	Lower Sand	291.7	June 22, 2013 June 22, 2013 June 25, 2013	Installed 261.3 262.9
MW13-03	TH13-10C	Sand & Gravel Conglomerate	302	June 23, 2013 June 23, 2013 June 25, 2013	Installed 299 298.4
MW13-04	TH13-11B	MSW	293.6	June 24, 2013 June 25, 2013	Installed 285.4*

*leachate level in the MSW

4 Geotechnical Assessment

4.1 Settlement

The rate and magnitude of landfill settlement is an important performance consideration. Generally, case histories suggest that waste has consolidation characteristics similar to peat, namely rapid initial consolidation followed by secondary consolidation. The rate and magnitude of waste settlement have been found to vary primarily with the unit weight and overburden pressure. Therefore settlement observed in deep landfills is larger than shallow landfills.

Over the long term, a typical waste fill might settle between 10 to 25 percent of its total thickness. Settlement in landfills is a result of different mechanisms: (a) distortion, bending, crushing and reorientation, (b) plastic creep, (c) raveling, (d) corrosion, oxidation and combustion, and (e) biochemical decay. The density achieved from compaction is the key factor influencing the magnitude of landfill settlement. Due to long term settlement, the initial side slopes should be expected to change; therefore, post closure maintenance may need to consider re-grading of slopes.

Settlement magnitude for landfills is difficult to estimate due to material variability within the waste fill; therefore, a typical settlement range of 10 to 25% of the landfill thickness, as mentioned above, should be expected within the lifetime of the landfill.

Differential settlement will occur between the perimeter road/berm fill and the waste within the disposal footprint and at the interface between the recently placed and existing MSW (as shown in section alignment 2A-2013 and section A-A in Appendix A). With the implementation of proper compaction technique, such settlements can be mitigated. Relative differential settlement between new and existing waste may adversely impact and cause internal tensile stresses in the liner systems. In this regard, it is recommended to install two (2) additional reinforcement layers of high strength geogrid such as Tensar UX1800HS or equivalent. The proposed geogrid layers will contribute to the required resistance to the tensile stress induced in the liner and protect the linear.

The final cover of the landfill should be monitored. A settlement monitoring program is proposed for the initial cells so that settlements are recorded. The monitoring results will be used to assess and verify the anticipated settlement and modify the design of the uncompleted cells, as required.

4.2 Bearing Capacity

An analysis was carried out to assess the bearing capacity of the foundation soil below the proposed waste fill embankment. The analysis was undertaken to assess the height to which the waste embankment can be constructed. Based on the provided geometry for the proposed landfill expansion, bearing capacity is not anticipated to be a concern for the design thickness of 33 m (i.e. Elevation 311 m).

4.3 Stability Assessment

Stability assessment was carried out to investigate the stability of the proposed landfill configurations, in terms of height and overall side slope that could be developed to maintain acceptable factors of safety against slope instability. An adequate Factor of Safety (FS) against slope instabilities must be achieved for the proposed waste embankment side slopes. In this regard, a design objective FS of 1.5 has been selected for the long term condition consistent with acceptable design practice. The granular nature of the foundation soils is favourable for stability as excess pore water pressure is not anticipated to develop in response to loading. Therefore, the short term, end of construction, condition was not considered in the stability assessment.

Stability assessment consisted of a limit equilibrium slope stability analysis using software developed by GeoStudio International. Both circular and non-circular failure surfaces were analyzed. Groundwater levels modelled in the analysis were based on a groundwater monitoring program installed during 2013 field work and based on a data collected from the existing monitoring wells around the landfill area.

4.3.1 Analysis Parameters

The soil strength parameters adopted in the analysis are summarized in **Table 02**. These parameters are derived based on correlation with index soil properties from laboratory test results and back analysis stability results. Since layers of daily cover soil are likely to be thin and irregular in comparison to the layers of refuse, no distinction was made between the two.

Back analysis was performed to establish and assign strength parameters to the waste material. The analysis was completed for the existing landfill geometry assuming a FS close to unity. Different scenarios were considered in the back analysis using different sections and piezometric levels.

Table 02: Strength Parameters for Stability Assessment

Material	Unit Weight, γ (kN/m^3)	Effective Stress Analysis		Groundwater Elev. (m)
		Cohesion, C' (kPa)	Friction Angle, ϕ' (°)	
Sand (upper)	16.5	0	30	265 - 280
Sand and Gravel	17.0	0	33	
Sand (lower)	16.7	0	30	
MSW	12.0	1	18	
Bedrock	Impenetrable			

4.3.2 Analysis Results

The proposed excavation configuration and construction staging plan were made available by Dillon Consulting and used to complete the stability assessment. Stability analyses were completed for two construction stages for each cell:

- Stage 1: side slope stability for excavations below existing ground and adjacent to the existing landfill,
- Stage 2: side slope stability for embankment at design height

The results of the analysis are presented graphically in Appendix F and are summarized in **Table 03**. The following recommendations are provided based on the findings of the stability analysis:

- Excavation side slope shall not be steeper than 3H:1V.
- Landfill slopes less than 10 m high can be constructed at side slopes of 4H:1V. Flatter slopes 5H:1V shall be used for fill height between 10 and 15m. For fill heights greater than 15 m side slope at 6H:1V or flatter is recommended.
- The piezometric condition associated with groundwater within the existing waste fill has a significant impact on the stability. The analyses were completed to investigate the maximum groundwater level at which the design objective FS=1.5 would be maintained. In this regard, the groundwater level should be controlled at or below elevation 290 m in the cells located at the west side (i.e., Cell 1A, 3, 4 and 6). Leachate level ranged from 290 m (at Cell 2 and Cell 5) to 294 m (at Cell 1 and Cell 7) can be tolerated.. Groundwater level variation in the order of 1 m could impact the calculated FS. Monitoring is recommended during and post cell development to observe and protect against development of higher groundwater levels.

  Generally, groundwater elevation in the lower sand has a limited impact on the stability analysis as the modelled groundwater level is relatively deep and below theoretical slip surfaces.
- Perimeter berms up to 3 m high and 6 m crest wide can be constructed at 3H:1V side slopes.

Table 03: Summary of Slope Stability Analysis

Cell #	Cross Section	Construction Stage	Critical Side Slope	Groundwater Elev. (m)	Leachate Level Elev. (m)	Critical FS	Figure #
Cell 1	1+400 - 2014	1	3H:1V	280	-	1.72	01
		2	4H:1V	280	298	1.59	02
	Alignment 3 - 2013	1	4H:1V	280	-	2.3	03
		2	4H:1V	280	292	1.64	04
Cell 1A	A - A - 2011	1	3H:1V	274	-	1.72	05
		2	4H:1V	274	290	1.53	06
	C – C - 2011	1	3H:1V	280	-	1.73	07
		2	4H:1V	280	290	1.65	08
Cell 2	Alignment 2A – 2013	1	5H:1V	280	290	1.7	09
		2	4H:1V	280	290	1.74	10
	Alignment 3 – 2013	1	5H:1V	280	292	1.76	11
		2	5H:1V	280	294	1.84	12
Cell 3	0+100 – 2014	1	3H:1V	270	-	1.73	13
		2	5H:1V	268	290	1.52	14
	B - B - 2011	1	3H:1V	280	-	1.65	15
		2	6H:1V	280	290	1.59	16
Cell 4	A - A - 2011	1	5H:1V	280	290	1.67	17
		2	6H:1V	280	290	1.67	18
	C - C - 2011	1	3H:1V	280	290	2.0	19
		2	4H:1V	280	290	1.56	20
Cell 5	Alignment 3 - 2013	1	5H:1V	280	294	1.85	21
		2	6H:1V	280	294	1.83	22
	B - B - 2011	1	4H:1V	265	290	1.52	23
Cell 6	0+400 - 2014	1	3H:1V	280	-	1.72	24
		2	6.2H:1V	280	290	1.74	25
	0+200 - 2014	1	3H:1V	280	-	1.73	26
		2	6.6H:1V	280	290	1.51	27
Cell 7	Alignment 3 - 2013	1	5H:1V	280	294	1.87	28
	0+700 – 2014	2	3H:1V	280	-	1.73	29
		1	4H:1V	280	294	1.67	30

4.4 Excavation

The means and methods of the excavation is the responsibility of the Contractor. All excavations shall be in accordance with applicable regulations of Ontario's Workplace Health and Safety. As per Ontario's Occupational Health and Safety Act, the excavated soil is generally classified as Type 2 soil. The Contractor shall prepare an excavation plan observing the recommendations provided in this report. Conventional mechanical/hydraulic excavation and earth moving equipment are expected to perform satisfactorily. Based on short term groundwater monitoring readings presented in Table 01 and the historical groundwater monitoring data around the landfill area, the GWL is anticipated below the planned excavation level between elevation 263 and 264 m. A perched GWL is suspected in a zone of moderate permeability cemented conglomerate. Provisions for construction dewatering and groundwater control should be allowed for in project schedule and cost where this unit is encountered in the excavation. Groundwater seepage could result in undermining and loss of toe support which could eventually adversely impact the stability of cut slopes. In these events, AECOM should be contacted to assess site conditions and review design recommendations, as required.

The engineering design recommendations presented within this report are based on the assumption that an adequate level of monitoring will be provided during construction. An adequate level of monitoring is considered to be full-time onsite supervision during the cell excavation.

4.5 Drainage

The importance of internal drainage within the landfill cannot be overstated. The potential for low permeability barriers within the waste may impede drainage and raise the piezometric level and adversely impact the stability of the fill. It is essential to incorporate an efficient leachate collection system in the design to promote downward migration and protect against mounding of liquid within the waste. Regular monitoring of the performance of the leachate collection system should be an integral part of the operating procedures.

The components of the drainage system buried within the landfill will be subjected to significant vertical and lateral strain. The leachate collection system design shall account for these conditions.

4.6 Excavated Material

Excavated material can be used to construct perimeter berms and roadway embankments (side slopes should not be steeper than 3H:1V). The excavated materials may also be used for soil cover. Soils for roadway embankment construction should exclude any organic or deleterious objects or materials. When an area is scheduled for excavation, the topsoil should first be removed and stockpiled for reuse and the excavated soil incorporated into roadway embankments or stockpiled in temporary berms for future use. Areas to be used for stockpiles should also be stripped of the topsoil prior to placing material in these areas. Stockpiles should be setback at safe distance not less than 5 m from open excavations.

As the site develops, space will be restricted and it may become more difficult to find suitable stockpile locations. In later years, material can be placed around the perimeter of the site. If material is placed in an area proposed for future landfill development, it is important that the stockpile is depleted prior to scheduling excavations in these areas.

4.7 Berms and Roadway Embankment

The construction of berms may be required to shield the landfill operations, to reduce noise and litter problems, and to provide an initial slope against which to place and compact refuse and facilitate the overall stability.

The above grade berms will be constructed as per final grading. The construction of perimeter berms is required to provide an initial slope against which to place and compact refuse and to direct surface water away from the active operations.

Sand berms can be constructed and lined with an appropriate geosynthetic liner to control seepage. Side slopes with a maximum height of 5m should not be steeper than 3H:1V, higher berms can be constructed with a side slope not steeper than 4H:1V. All construction activities should be subject to quality control testing.

The following recommendations are provided with respect to roadway construction on berms:

- All topsoil and deleterious material should be removed before placement of fill.
- Fill shall be placed in 300 mm lifts and compacted to 95% of Standard Proctor maximum dry density.
- Wet or soft subgrade areas should be excavated and replaced with suitable fill.
- Prior to placement of fill, the subgrade should be scarified to a depth of 200 mm and compacted to 95% of Standard Proctor maximum dry density.
- During construction all surfaces and construction areas should be adequately graded to facilitate drainage.

Based on a preliminary assessment of the anticipated use, the following preliminary pavement alternatives are provided. Further engineering input will be required to develop the final design pavement section:

Concrete surface:	150 mm concrete
	150 mm base crushed granular
	750 mm compacted fill
Asphalt surface:	130 mm asphalt
	150 mm base crushed granular
	150 mm subbase crushed granular
	750 mm compacted fill

5 Closure

The findings and recommendations of this report were based on the results of field and laboratory investigations, combined with an interpolation of soil and ground water conditions between the test hole locations. If conditions are encountered that appear to be different from those shown by the test holes drilled at this site and described in this report, or if assumptions stated herein are not in keeping with the design, this office should be notified in order that the recommendation can be reviewed and justified, if necessary.

Soil conditions, by their nature, can be highly variable across a site. The placement of waste fill and prior construction activities on a site can contribute to the variability especially near surface soil conditions. A contingency should be included in the construction budget to allow for possibility of variation in soil conditions, which may result in modifications of the design and construction procedures.

Appendix A
Photos

Photo 01: General site view, looking northeast

Photo 02: General site view, TH13-01, looking northeast

Photo 03: Waste material collected during drilling, TH13-01

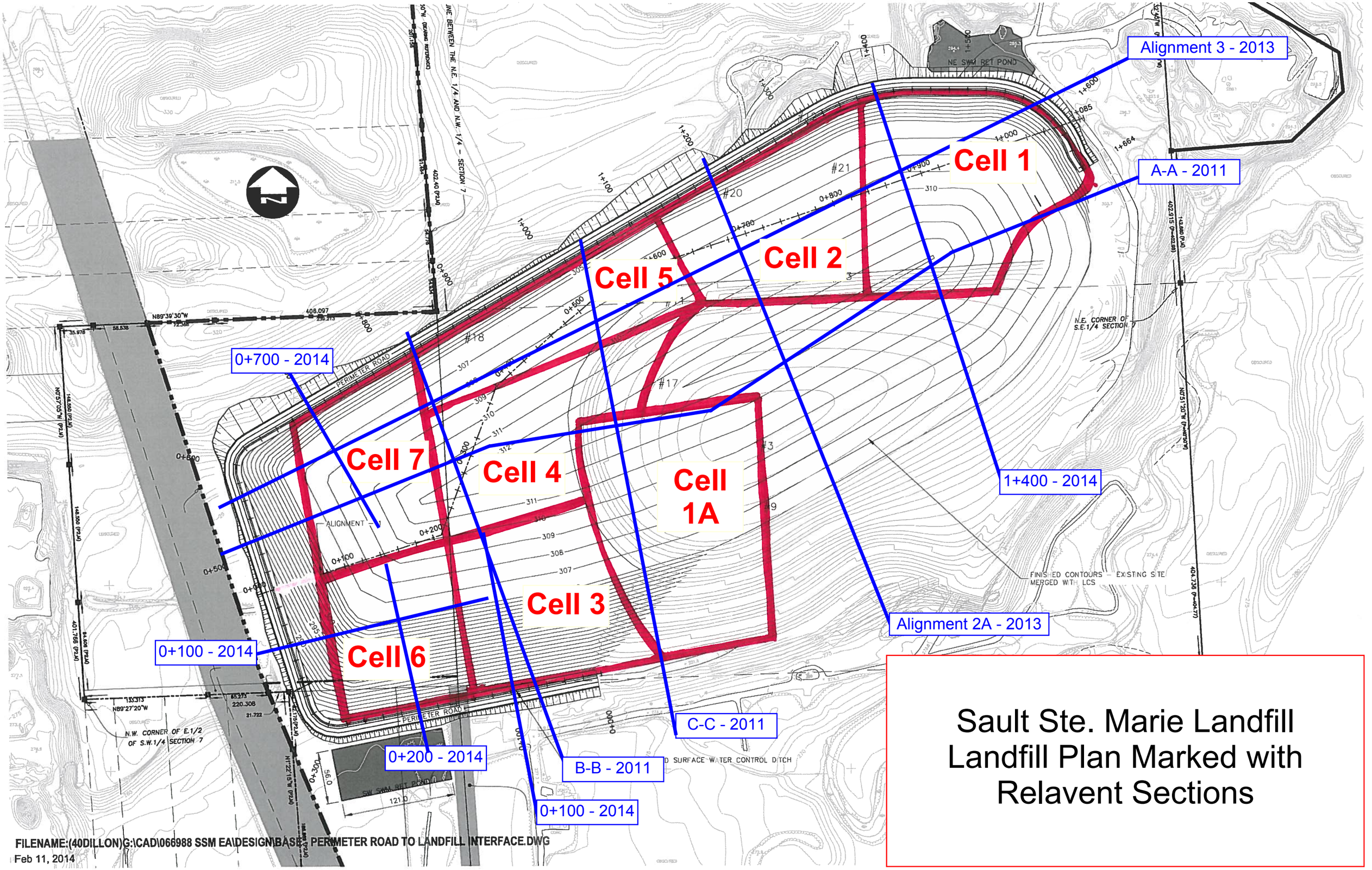
Photo 04: Waste material collected during drilling, TH13-01

Photo 05: Exposed Conglomerate unit, looking northwest from TH13-01.

Photo 06: Exposed Conglomerate unit, looking northwest from TH13-01.

Appendix B

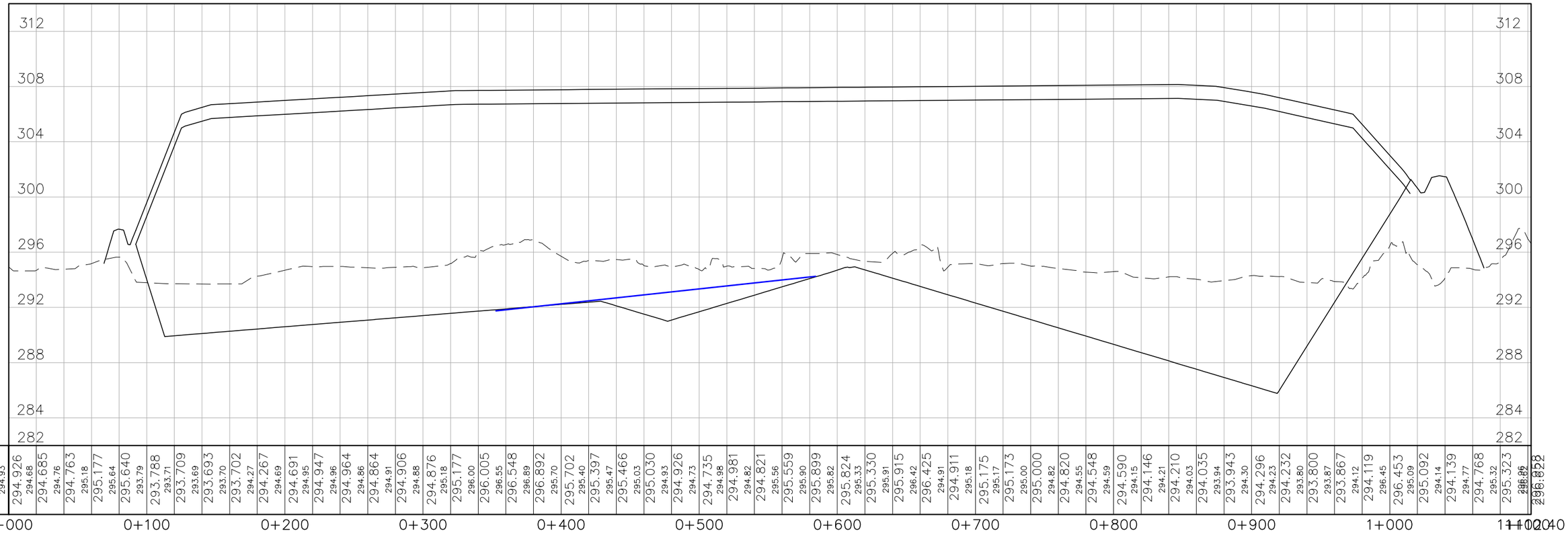
Landfill Plan and Sections



Sault Ste. Marie Landfill
Landfill Plan Marked with
Relavent Sections

FILENAME:(40DILLON)G:\CAD\066988 SSM EA\DESIGN\BASE - PERIMETER ROAD TO LANDFILL INTERFACE.DWG
Feb 11, 2014

Alignment – 3



Alignment 3 - 2013

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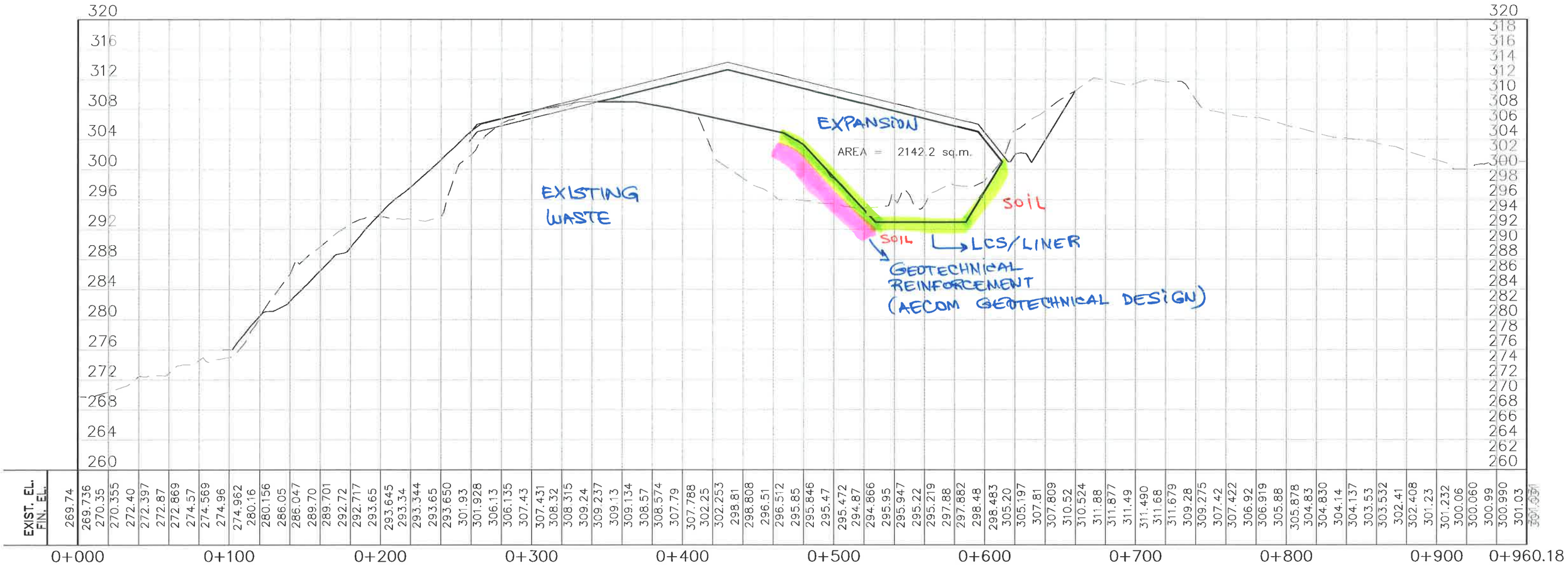
Sep 27, 2013

Alignment — 2 a



Alignment 2A - 2013

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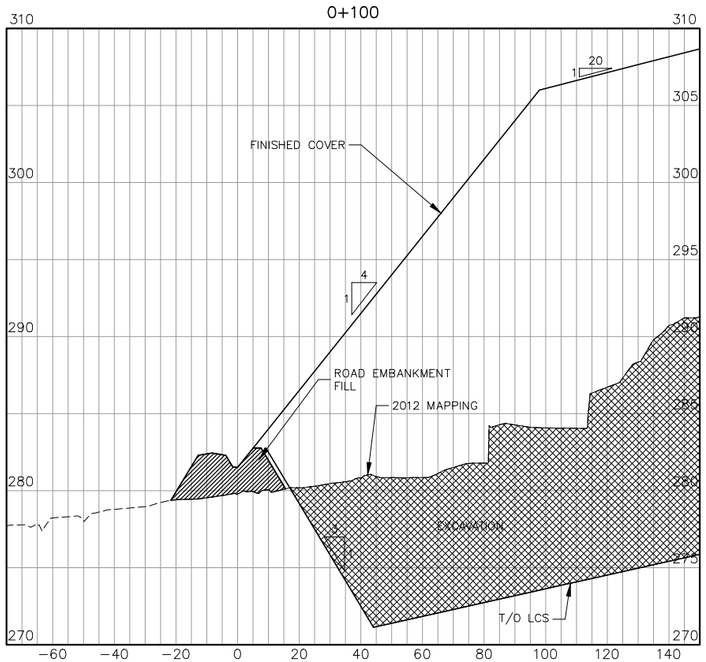
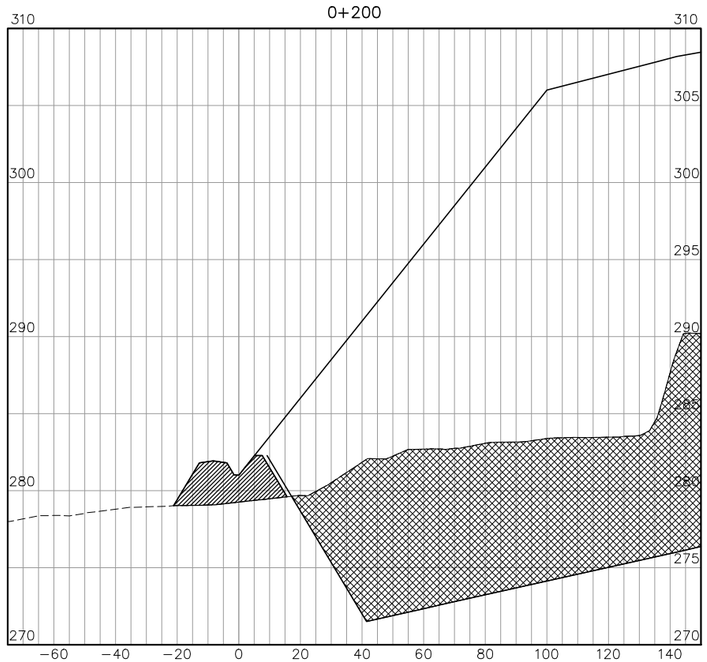
Dec 23, 2013





Cover area: 327,000 sq.m. (1 m thick)

LCS Area below 2012 Mapping:
FLOOR 97,200 sq.m., 0.75 m THICK
SIDE SLOPES 42,200 sq.m., 0.50 m THICK

LCS VOLUME: (97,200 x 0.75) + (42,200 X 0.5) = 94,000 cu. m.

Excavation: 1,151,000 cu.m.

Daily and Int. Cover: (−800,0000 cu.m.)

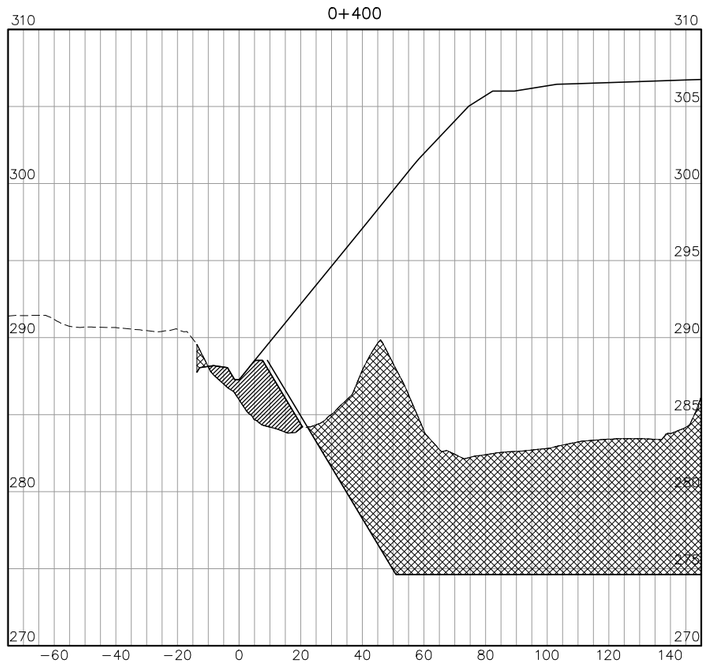
Road Embankment: (−54,000 cu.m.)

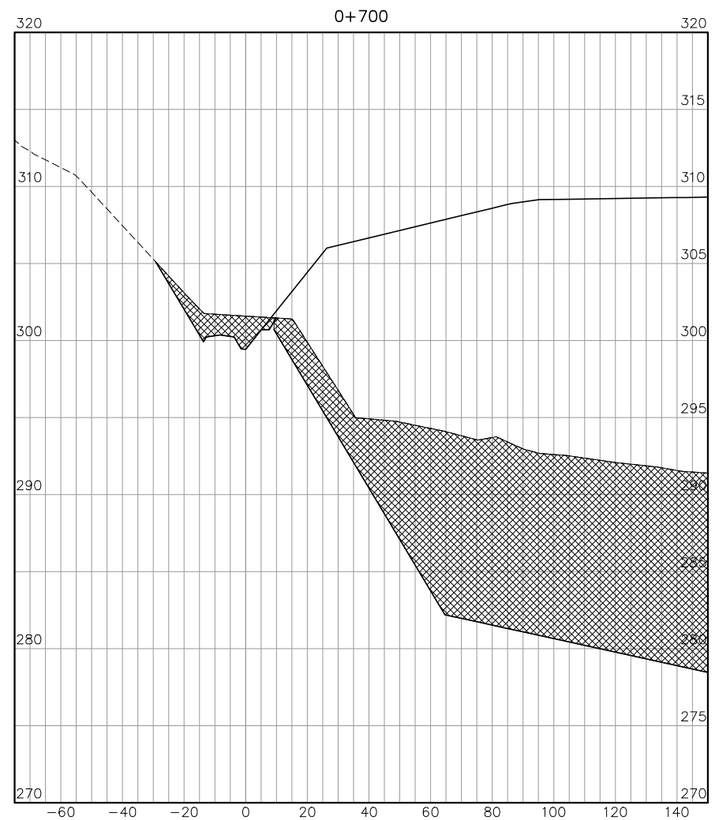
Soils: 1,151,000 + 94,000 − 800,000 − 327,000 − 54,000 = 64,700u.m.

0+100 and 0+200 - 2014

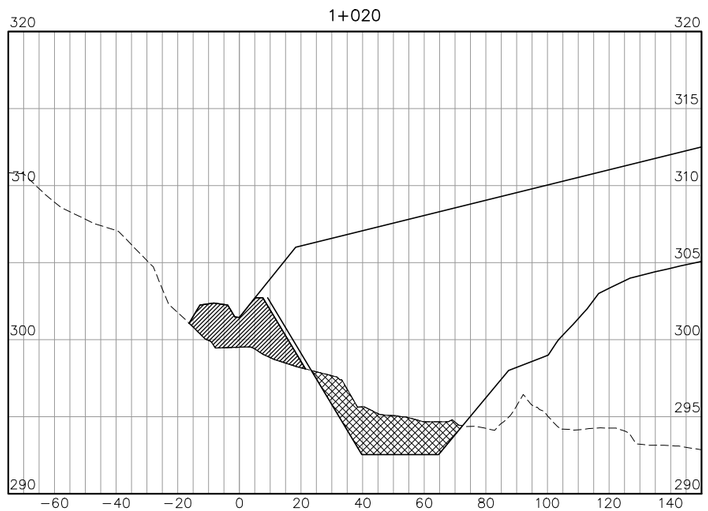
FILENAME:(40DILLON)G:\CAD\066988 SSM EA\DESIGN\BASE - PERIMETER ROAD TO LANDFILL INTERFACE.DWG

Feb 11, 2014





0+400 and 0+700 - 2014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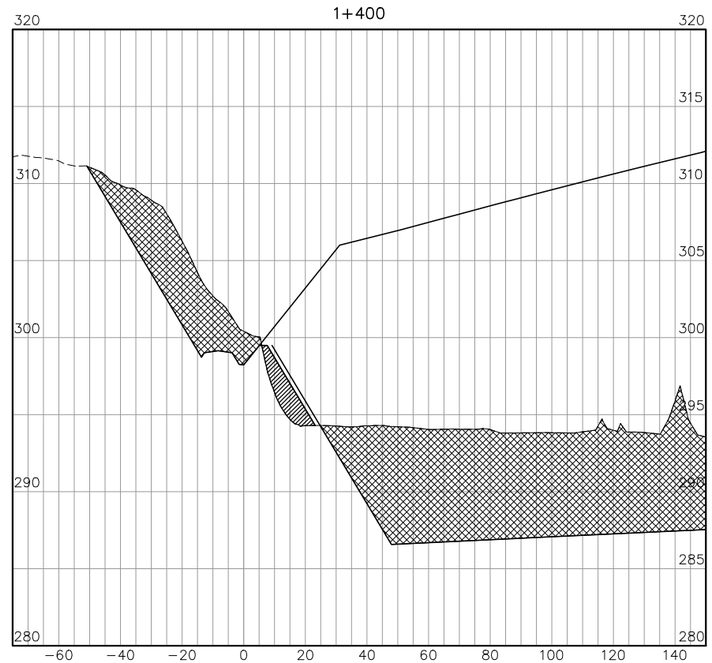
140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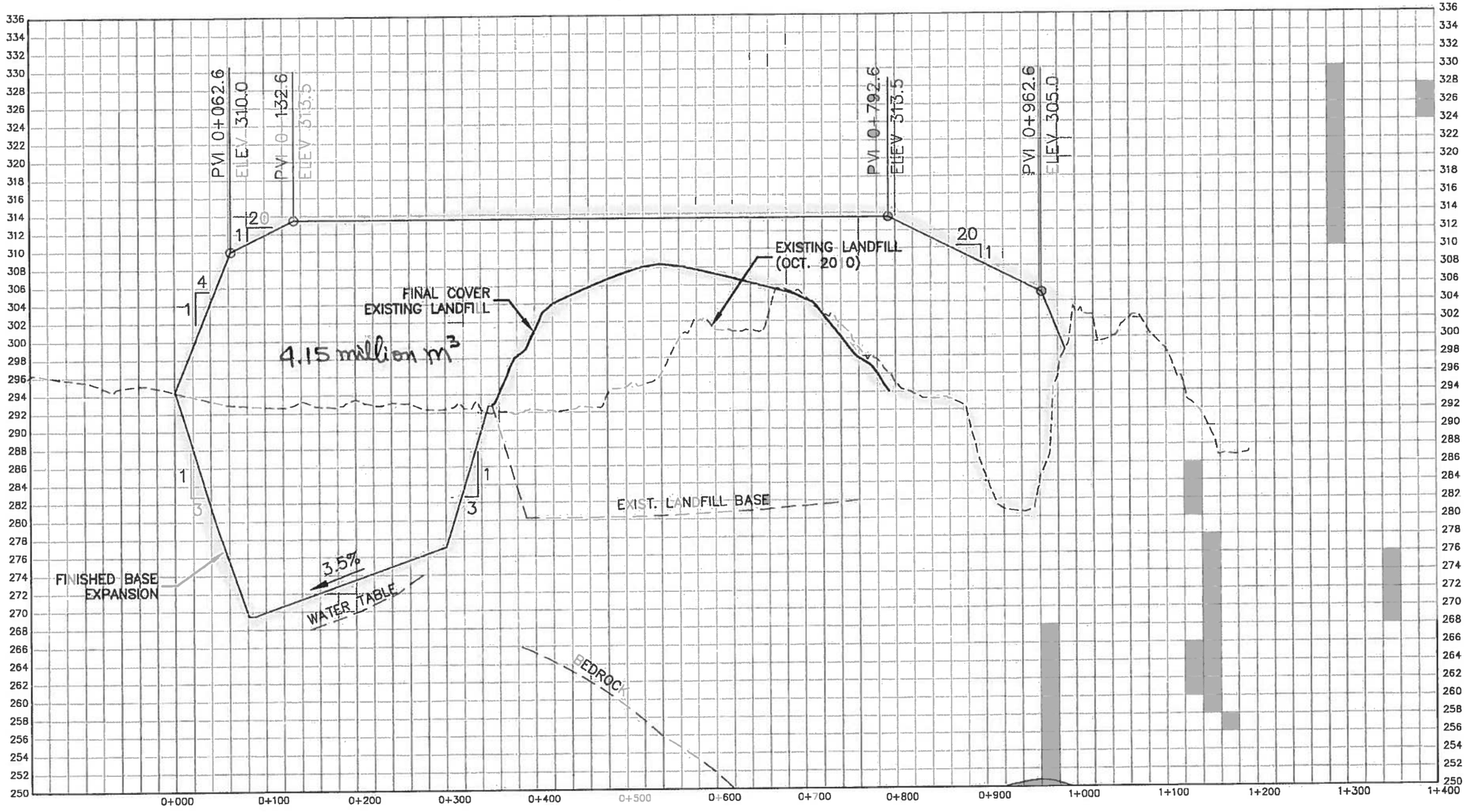
140

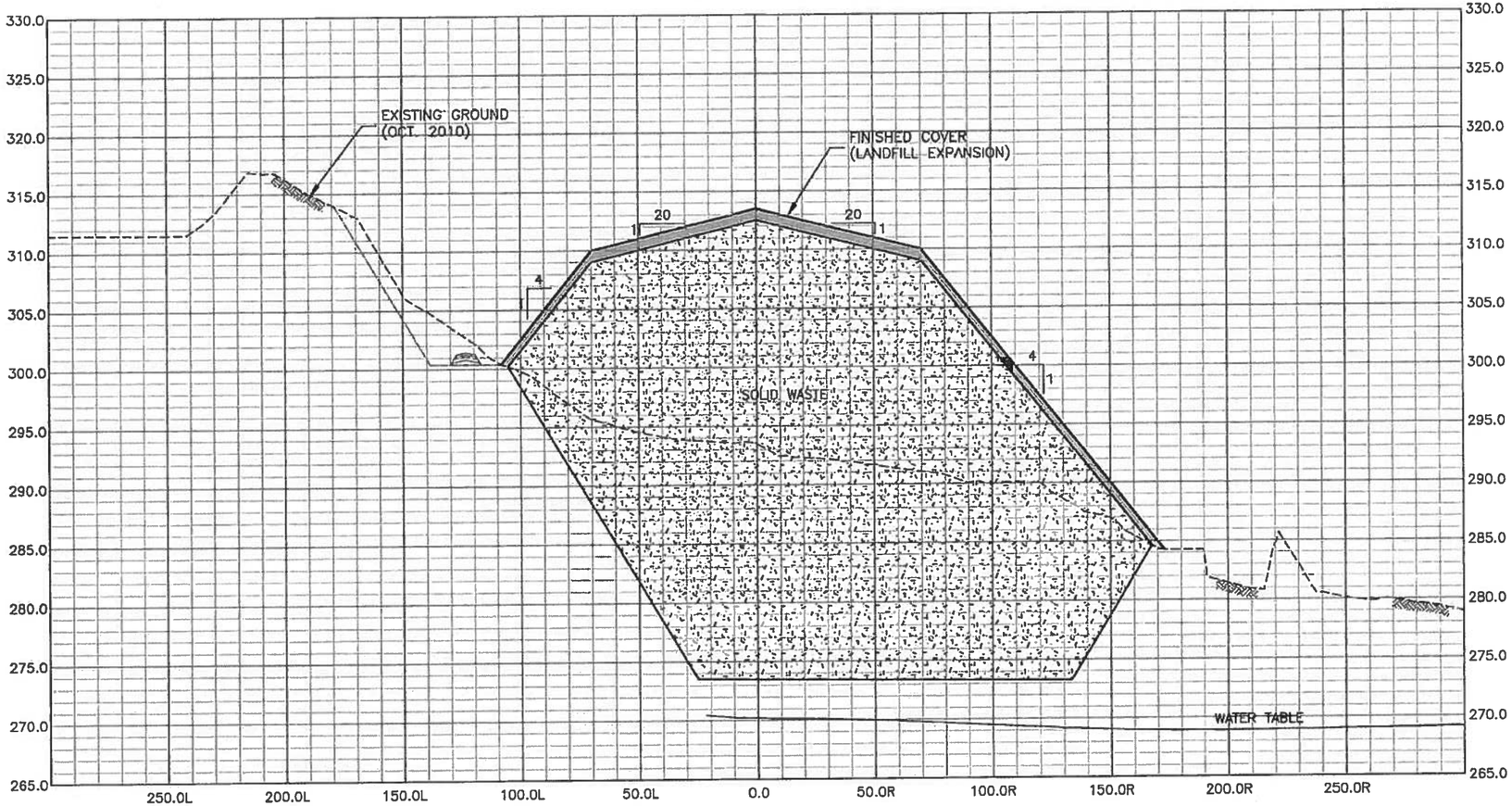
1+400 - 2014



SECTION A–A
(0+200)

DRAFT
Jun 13, 2011

A - A - 2011

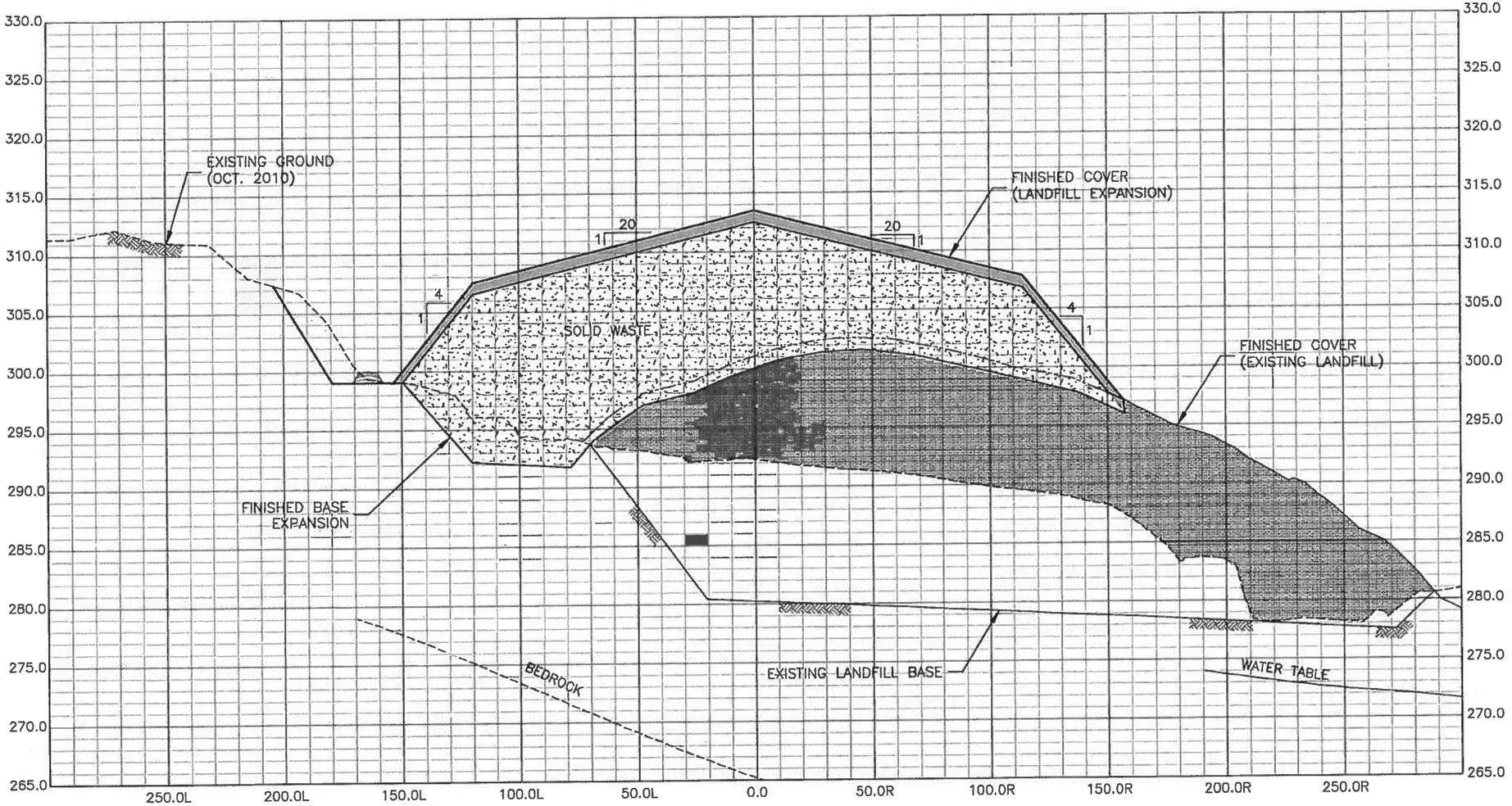


SECTION B–B
(0+200)

DRAFT
Jun 13, 2011

B - B - 2011

M:\EA\EXPANSION OPTIONS MAY 2011\FIGURES\CURRENT\OPTION-3.DWG 06/13/11



SECTION C–C
(0+400)

DRAFT
Jun 13, 2011

NISKN OPTIONS MAY 2011\FIGURES\CURRENT\OPTION4-3.DWG 06/13/11

C - C - 2011

Appendix C

Test Hole Location Plan

AECOM

Figure: 01

Test Hole and Monitoring Well Location Plan

Sault Ste. Marie Landfill Expansion

City of Sault Ste. Marie

ANSI B 279.4mm x 431.8mm

Project Management Initials: Designer: Checked: Approved:

Last saved by: CLOUSTONC (2013-06-28) Last Plotted: 2013-06-28
Filename: P:\60117627\900-CAD-GIS\920 GIS-GRAPHICS\B\MXD\G001_60117627_01V1_THPLAN.MXD

Appendix D

Test Hole Logs

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-01**
LOCATION: 16 T Easting: 705070 Northing: 5163139 UTM N 0.0 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 296.70

SAMPLE TYPE ■ GRAB ▯ SHELBY TUBE ⊠ SPLIT SPOON ▬ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION
0		SAND (FILL) - organic, trace gravel, trace cobble - brown, loose, dry - medium to coarse grained					296
1		MUNICIPAL SOLID WASTE (MSW)	⊠	S01	43	SPT 5, 5, 38 blows/150 mm SPT Recovery 6%	295
2							294
3		- moist below 3.1 m	⊠	S02	8	SPT 7, 5, 3 blows/150 mm SPT Recovery 11%	
4			■	G03			293
5		- dark brown to black, wet, some cobbles below 4.6 m	⊠	S04	10	SPT 12, 8, 2 blows/150 mm SPT Recovery 8%	292
6							291
7			⊠	S05	16	SPT 8, 10, 6 blows/150 mm SPT Recovery 11%	
			■	G06			290
8			⊠	S07	51/ 51mm	SPT 51 blows/51 mm SPT Recovery 0%	289
9							288
		- moist to dry below 9.1 m	⊠	S08	59/ 152mm	SPT 59 blows/152 mm SPT Recovery 0%	
			■	G09			287
10		SAND (Lower) - trace gravel - brown, compact, moist - medium to coarse grained	⊠	S10	21	SPT 12, 11, 10 blows/150 mm SPT Recovery 71%	
11							286
12							285
13			⊠	S11	26	SPT 8, 11, 15 blows/150 mm SPT Recovery 67%	284
14		- dense below 13.7 m	⊠	S12	38	SPT 18, 19, 19 blows/150 mm SPT Recovery 83%	283
15							282

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 20.42 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/18/13
PROJECT ENGINEER: Rick Talvitie	Page 1 of 2

AECOM

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-01**
LOCATION: 16 T Easting: 705070 Northing: 5163139 UTM N 0.0 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 296.70

SAMPLE TYPE ■ GRAB ▯ SHELBY TUBE ⊠ SPLIT SPOON ▬ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
15		- trace silt, pinkish brown, fine to medium grained below 15.2 m - Gravel: 0%, Sand: 91.0%, Fines: 9.0%	⊠	S13	30		SPT 8, 14, 16 blows/150 mm SPT Recovery 96%	281
16								
17		- wet below 16.8 m	⊠	S14	31		SPT 4, 13, 18 blows/150 mm SPT Recovery 46%	280
18								279
19		- trace cobbles, trace oxidation below 18.3 m	⊠	S15	72		SPT 8, 34, 38 blows/150 mm SPT Recovery 58%	278
20			⊠	S16	30		SPT 10, 14, 16 blows/150 mm SPT Recovery 63%	277
21		END OF TEST HOLE AT 20.4 m IN SAND. NOTES: 1. Seepage was observed at 16.8 m below ground surface. 2. Sand blowup observed at 16.8 m below ground surface. 3. Test hole open to 19.4 m below ground surface upon completion. 4. Test hole backfilled with with auger cuttings after drilling.						276
22								275
23								274
24								273
25								272
26								271
27								270
28								269
29								268
30								267

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100; ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 20.42 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/18/13
PROJECT ENGINEER: Rick Talvitie	Page 2 of 2

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-02**
LOCATION: 16 T Easting: 704829 Northing: 5163258 UTM N 1.5 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 310.50

SAMPLE TYPE ■ GRAB ▯ SHELBY TUBE ☒ SPLIT SPOON ▬ BULK ▨ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
0		SAND and GRAVEL - trace organics, trace to some cobbles, trace boulders - brown, compact, moist - medium to coarse grained						310
1								
2			☒	S17	27		SPT 14, 13, 14 blows/150 mm SPT Recovery 33%	309
3		- trace clay to 3.7 m below ground surface	☒	S18	19		SPT 7, 9, 10 blows/150 mm SPT Recovery 17%	308
4								307
5		- very dense at 4.8 m below ground surface	☒	S19	56		SPT 18, 24, 32 blows/150 mm SPT Recovery 4%	306
6								305
7			☒	S20	27		SPT 9, 12, 15 blows/150 mm SPT Recovery 67%	304
8		- silt lens (76 mm thick), wet, low plasticity	☒	S21	16		SPT 6, 7, 9 blows/150 mm SPT Recovery 83%	303
9								302
10		- moist, fine grained below 9.4 m	☒	S22	30		SPT 3, 12, 18 blows/150 mm SPT Recovery 83%	301
11		END OF TEST HOLE AT 10.5 m ON SUSPECTED BEDROCK. NOTES: 1. Power auger refusal at 10.5 m below ground surface in SAND and GRAVEL. 2. No seepage observed upon completion of drilling. 3. Test hole open to 10.5 m below ground surface upon completion. 4. Test hole backfilled with auger cuttings after drilling.						300
12								299
13								298
14								297
15								296

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 10.52 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/18/13
PROJECT ENGINEER: Rick Talvitie	Page 1 of 1

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-03**
LOCATION: 16 T Easting: 704869 Northing: 5163123 UTM N 3.0 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 294.50

SAMPLE TYPE ■ GRAB ▯ SHELBY TUBE ☒ SPLIT SPOON ▬ BULK ▨ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200	COMMENTS	ELEVATION
0		SAND (Upper) - trace gravel, trace silt, trace cobble - brown, compact to dense, dry to moist - medium to coarse grained							294
1									
2			☒	S24	49	● ◆		SPT 3, 10, 39 blows/150 mm SPT Recovery 63%	293
3		- moist, cobbly below 3 m	☒	S25	31	◆		SPT 9, 15, 16 blows/150 mm SPT Recovery 25%	292
4									291
5		- fine grained below 4.6 m - Gravel: 6.3%, Sand: 90.4%, Fines: 3.3%	☒	S26	12	● ◆		SPT 3, 5, 7 blows/150 mm SPT Recovery 75%	290
6		- dense below 6 m	☒	S27	44	◆		SPT 6, 15, 29 blows/150 mm SPT Recovery 54%	289
7									288
8		SAND and GRAVEL - some cobbles, trace silt, trace boulders - brown, dense, moist - medium to coarse grained	☒	S28	37	● ◆		SPT 11, 17, 20 blows/150 mm SPT Recovery 92%	287
9									286
10		- trace oxidation - Gravel: 44.7%, Sand: 46.9%, Fines: 8.4%	☒	S29	48	● ◆		SPT 12, 25, 23 blows/150 mm SPT Recovery 71%	285
11			☒	S30	37	◆		SPT 11, 16, 21 blows/150 mm SPT Recovery 46%	284
12		- very dense below 12 m							283
13			☒	S31	92	● ◆		SPT 23, 47, 45 blows/150 mm SPT Recovery 75%	282
14		SAND (Lower) - trace cobble, trace silt - brown, very dense, moist - fine to medium grained	☒	S32	85	● ◆		SPT 10, 25, 60 blows/150 mm SPT Recovery 100%	281
15									280

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 20.42 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/18/13
PROJECT ENGINEER: Rick Talvitie	Page 1 of 2

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-03**
LOCATION: 16 T Easting: 704869 Northing: 5163123 UTM N 3.0 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 294.50

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ▨ SPLIT SPOON ▬ BULK ▨ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
15								279
		- wet, below 15.6 m	▨	S33	76		SPT 11, 25, 51 blows/150 mm SPT Recovery 63%	
16								278
17		- trace oxidation, some gravel, some silt below 16.8 m - Gravel: 19.0%, Sand: 69.1%, Fines: 11.9%	▨	S34	31		SPT 9, 12, 19 blows/150 mm SPT Recovery 50%	277
18								
		- pinkish brown, very dense, medium grained below 18.3 m	▨	S35	76		SPT 10, 34, 42 blows/150 mm SPT Recovery 92%	276
19		- fine grained sand, trace cobble, trace clay below 18.9 m						275
20			▨	S36	65		SPT 6, 22, 43 blows/150 mm SPT Recovery 79%	274
21		END OF TEST HOLE AT 20.4 m IN SAND. NOTES: 1. Seepage observed at 15.6m below ground surface. 2. Sand blowup observed at 16.8 m below ground surface. 3. Test hole open to 19.7 m below ground surface upon completion. 4. Test hole backfilled with auger cuttings after drilling.						273
22								272
23								
24								271
25								270
26								269
27								268
28								267
29								266
30								265

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100; ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 20.42 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/18/13
PROJECT ENGINEER: Rick Talvitie	Page 2 of 2

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-04**
LOCATION: 16 T Easting: 704709 Northing: 5162845 UTM N 4.6 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 307.70

SAMPLE TYPE ■ GRAB ▯ SHELBY TUBE ☒ SPLIT SPOON ▬ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
0		SAND and GRAVEL (FILL) - trace organic - brown, loose, dry to moist - medium to coarse grained						307
1		MUNICIPAL SOLID WASTE (MSW) - black, wet						
2								306
3								305
4								304
5								303
6			☒	S37	27	◆	SPT 12, 20, 7 blows/150 mm SPT Recovery 54%	302
7								301
8								300
9								299
10								298
11		- trace sand, brown, moist	☒	S38	60	◆	SPT 44, 45, 15 blows/150 mm SPT Recovery 17%	297
12								296
13								295
14		- trace to some sand, trace cobbles, dry below 13.7 m	☒	S39	30	◆	SPT 13, 16, 14 blows/150 mm SPT Recovery 21%	294
15								293

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 20.42 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/19/13
PROJECT ENGINEER: Rick Talvitie	Page 1 of 2

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-04**
LOCATION: 16 T Easting: 704709 Northing: 5162845 UTM N 4.6 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 307.70

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION
15							292
16							
17				S40	67	SPT 32, 17, 50 blows/150 mm SPT Recovery 43%	291
18							290
19							289
20		- some sand, moist below 19.8 m		S41	72	SPT 7, 24, 48 blows/150 mm SPT Recovery 58%	288
21		END OF TEST HOLE AT 20.4 m IN MSW. NOTES: 1. Seepage observed at 1.5 m below surface. 2. Test hole sloughed in with garbage upon completion.					287
22							286
23							285
24							284
25							283
26							282
27							281
28							280
29							279
30							278

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 20.42 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/19/13
PROJECT ENGINEER: Rick Talvitie	Page 2 of 2

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-05**
LOCATION: 16 T Easting: 704486 Northing: 5162490 UTM N 6.1 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 279.00

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ▨ SPLIT SPOON ▤ BULK ▨ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200	COMMENTS	ELEVATION
0		SAND (Lower) - trace gravel, trace silt, trace cobble - brown, loose to dense, moist - fine to medium grained							
1									278
2		- moist to dry, trace cobble below 2.0 m	▨	S42	4	◆		SPT 2, 2, 2 blows/150 mm SPT Recovery 21%	277
3			▨	S43	98	◆		SPT 16, 50, 48 blows/150 mm SPT Recovery 25%	276
4									275
5		- pinkish brown, dense to very dense, moist, fine grained below 4.6 m	▨	S44	57	● ◆		SPT 9, 23, 34 blows/150 mm SPT Recovery 86%	274
6									273
7			▨	S45	44	● ◆		SPT 5, 20, 24 blows/150 mm SPT Recovery 96%	272
8			▨	S46	53	● ◆		SPT 7, 25, 28 blows/150 mm SPT Recovery 100%	271
9									270
10		- wet, medium to coarse grained below 9.6 m	▨	S47	36	● ◆		SPT 8, 15, 21 blows/150 mm SPT Recovery 100%	269
11		- fine grained, trace oxidation	▨	S48	38	● ◆		SPT 5, 15, 23 blows/150 mm SPT Recovery 79%	268
12									267
13									266
14		- very dense below 14 m	▨	S49	105	●	>> ◆	SPT 30, 54, 51 blows/150 mm SPT Recovery 100%	265
15									

AECOM

LOGGED BY: Sam Oshati | COMPLETION DEPTH: 20.12 m
REVIEWED BY: Zeyad Shukri | COMPLETION DATE: 6/19/13
PROJECT ENGINEER: Rick Talvitie

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-05**
LOCATION: 16 T Easting: 704486 Northing: 5162490 UTM N 6.1 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 279.00

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ▤ BULK ▨ NO RECOVERY ◧ CORE

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION
15							
16							263
17		- silty, trace clay below 17.0 m - Gravel: 0.0%, Sand: 56.8%, Fines: 43.2%	☒	S50	60/ 102mm	SPT 33, 60 blows/150 mm SPT Recovery 100%	262
18							261
19							260
20			☒	S51	71/ 102mm	SPT 40, 71 blows/150 mm SPT Recovery 100%	259
21		END OF TEST HOLE AT 20.1 m IN SAND. NOTES: 1. Seepage observed at 9.6m below ground surface. 2. Sand blowup observed at 13.7 m below ground surface. 3. Test hole open to 18.6 m below ground surface upon completion. 4. Test hole backfilled with auger cuttings after drilling.					258
22							257
23							256
24							255
25							254
26							253
27							252
28							251
29							250
30							

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 20.12 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/19/13
PROJECT ENGINEER: Rick Talvitie	Page 2 of 2

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-06**
LOCATION: 16 T Easting: 5163073 Northing: 704604 UTM N 7.6 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 309.50

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ▨ SPLIT SPOON ▤ BULK ▨ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
0		TOPSOIL - rootlets, some sand, some gravel, trace cobble - dark brown to brown, loose, moist						309
1		SAND and GRAVEL - some cobbles, trace silt, trace boulders - brown, very dense, moist - medium to coarse grained						
			▨	S52	50/ 102mm		SPT 50 blows/102 mm SPT Recovery 25%	308
2			■	S53				
		- moist to wet below 1.8 m						307
3			▨	S54	50/ 76mm		SPT 50 blows/76 mm SPT Recovery 17%	
		- cobbly below 3.0 m						306
4								
			▨	S55	52/ 102mm		SPT 10, 52 blows/150 mm SPT Recovery 82%	305
5			■	G56				
		END OF TEST HOLE AT 5.2 m IN SAND and GRAVEL.						304
6		NOTES: 1. Power auger refusal at 5.2 m below ground surface in SAND and GRAVEL. 2. No seepage was observed during drilling. 3. Test hole open to 3.6 m below ground surface upon completion. 4. Test hole backfilled with auger cuttings after drilling.						303
7								302
8								301
9								300
10								299
11								298
12								297
13								296
14								295
15								

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 5.18 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/20/13
PROJECT ENGINEER: Rick Talvitie	Page 1 of 1

AECOM

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-07**
LOCATION: 16 T Easting: 704240 Northing: 5162548 UTM N 9.1 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 281.40

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	WELL INSTALLATION	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
0			SAND and GRAVEL - some cobbles, trace silt - brown, very dense, moist - medium to coarse grained						281
1									
2			- Gravel: 48.5%, Sand: 43.1%, Fines: 8.4%		S57	95		SPT 13, 45, 50 blows/150 mm SPT Recovery 100%	280
3					S58	50/ 76mm		SPT 25, 50 blows/150 mm SPT Recovery 100%	279
4									278
5					S59	52/ 102mm		SPT 28, 52 blows/150 mm SPT Recovery 100%	277
6			SAND (Lower) - trace to some silt, trace gravel - brown, very dense, moist - fine grained		S60	76		SPT 12, 30, 46 blows/150 mm SPT Recovery 96%	276
7									275
8			- pinkish brown, fine to medium grained below 7.6 m		S61	66		SPT 13, 30, 36 blows/150 mm SPT Recovery 96%	274
9									273
10					S62	69		SPT 12, 29, 40 blows/150 mm SPT Recovery 86%	272
11			- dense below 10.7 m		S63	42		SPT 10, 19, 23 blows/150 mm SPT Recovery 92%	271
12									270
13					S64	40		SPT 8, 19, 21 blows/150 mm SPT Recovery 86%	269
14									268
15									267

PENETRATION TESTS: ✳ Becker ✳ | ◇ Dynamic Cone ◇ | ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + | × QU × | □ Lab Vane □ | △ Pocket Pen. △ | ✤ Field Vane ✤ (kPa) 50 100 150 200

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 24.99 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/21/13
PROJECT ENGINEER: Rick Talvitie	Page 1 of 2

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-07**
LOCATION: 16 T Easting: 704240 Northing: 5162548 UTM N 9.1 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 281.40

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	WELL INSTALLATION	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
15			- trace to some cobbles, very dense at 15.4 m		S65	57/ 76mm		SPT 19, 57 blows/150 mm SPT Recovery 100%	266
16									
17									265
18			- dense, wet, medium to coarse grained below 18.3 m		S66	39		SPT 8, 18, 21 blows/150 mm SPT Recovery 75%	264
19									263
20									
21			- fine to medium grained below 21.3 m		S67	44		SPT 6, 16, 28 blows/150 mm SPT Recovery 92%	262
22									
23									261
24									260
25			- Gravel: 0.1%, Sand: 86.6%, Fines: 13.3%		S68	43		SPT 12, 20, 23 blows/150 mm SPT Recovery 50%	259
26			END OF TEST HOLE AT 25 m IN SAND. NOTES: 1. Seepage observed at 18.3 m below ground surface. 2. Sand blowup observed at 21.3 m below ground surface. 3. Installed 25 mm diameter monitoring well (MW13-01) with 4.6 m screen from 21 to 25.6 m below ground surface and 0.8 m stick-up. 4. Above ground protective casing installed. 5. Test hole blown-up with native sand to 17.7 m, backfilled with well gravel to 17.4 m, sealed with bentonite to 14 m followed by auger cuttings to 7.9 m, then sealed to 7.3 m followed by auger cuttings to 2.7 m, sealed to 0.10 m and concreted to ground surface. 6. Ground water monitoring: - June 22, 2013 at 18.34 m (Elev. 263.7) - June 23, 2013 at 18.33 m (Elev. 263.7) - June 25, 2013 at 17.47 m (Elev. 264.5)					258
27									257
28									256
29									255
30									254
									253
									252

PENETRATION TESTS: ✳ Becker ✳ | ◇ Dynamic Cone ◇ | ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + | × QU × | □ Lab Vane □ | △ Pocket Pen. △ | ✤ Field Vane ✤ (kPa) 50 100 150 200

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 24.99 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/21/13
PROJECT ENGINEER: Rick Talvitie	Page 2 of 2

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-08**
LOCATION: 16 T Easting: 704086 Northing: 5162515 UTM N 10.7 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 291.70

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	WELL INSTALLATION	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
0			TOPSOIL - rootlets, some sand, some gravel, trace cobble, trace clay - dark brown to brown, moist						291
1			SAND (Upper) - trace gravel, trace silt, trace cobble - brown, compact, moist - medium to coarse grained						
2					S69	13		SPT 2, 6, 7 blows/150 mm SPT Recovery 63%	290
3			SAND and GRAVEL - some cobbles - brown, dense to very dense, moist - medium to coarse grained		S70	50/ 76mm		SPT 13, 50 blows/150 mm SPT Recovery 44%	289
4									288
5			SAND (Seam) - trace silt - brown, very dense, moist - fine to medium grained - trace oxidation - Gravel: 0.0%, Sand: 90.3%, Fines: 9.7%		S71	80		SPT 16, 30, 50 blows/150 mm SPT Recovery 82%	287
6			SAND and GRAVEL - some cobbles, trace silt, trace boulders - brown, very dense, moist - medium to coarse grained		S72	52/ 102mm		SPT 33, 52 blows/150 mm SPT Recovery 100%	286
7									285
8					S73	50/ 102mm		SPT 50 blows/102 mm SPT Recovery 100%	284
9			- coarse grained below 9.1 m		S74	66		SPT 19, 32, 34 blows/150 mm SPT Recovery 92%	283
10									282
11					S75	79		SPT 23, 37, 42 blows/150 mm SPT Recovery 92%	281
12									280
13			SAND (Lower) - trace gravel, trace silt - pinkish brown, dense, moist - fine to medium grained		S76	38		SPT 12, 19, 19 blows/150 mm SPT Recovery 86%	279
14									278
15									277

PENETRATION TESTS: ✳ Becker ✳ | ◇ Dynamic Cone ◇ | ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + | × QU × | □ Lab Vane □ | △ Pocket Pen. △ | ✤ Field Vane ✤ (kPa) 50 100 150 200

AECOM	LOGGED BY: Sam Oshati	COMPLETION DEPTH: 33.53 m
	REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/22/13
	PROJECT ENGINEER: Rick Talvitie	Page 1 of 3

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-08**
LOCATION: 16 T Easting: 704086 Northing: 5162515 UTM N 10.7 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 291.70

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	WELL INSTALLATION	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION
15			- very dense below 15 m					
					S77	55	SPT 13, 26, 29 blows/150 mm SPT Recovery 86%	
16								276
17								275
18								274
					S78	49	SPT 8, 19, 30 blows/150 mm SPT Recovery 92%	
19			- trace cobble below 18.6 m					273
20								272
21								271
					S79	99	SPT 22, 48, 51 blows/150 mm SPT Recovery 100%	
22			- trace to some gravel, coarse grained, brown below 21.3 m					270
23								269
24								268
25			- fine to medium grained below 24.4 m					267
26			- dense below 25.9 m		S80	35	SPT 10, 17, 18 blows/150 mm SPT Recovery 96%	266
27								265
28								264
29								263
30								262

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 33.53 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/22/13
PROJECT ENGINEER: Rick Talvitie	Page 2 of 3

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-08**
LOCATION: 16 T Easting: 704086 Northing: 5162515 UTM N 10.7 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 291.70

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	WELL INSTALLATION	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS: Becker; Dynamic Cone; SPT (Standard Pen Test) (Blows/300mm) 0 20 40 60 80 100; Total Unit Wt (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH: Torvane; QU; Lab Vane; Pocket Pen.; Field Vane (kPa) 50 100 150 200	COMMENTS	ELEVATION
30			- trace gravel, very dense, wet						261
31					S81	69	● ◆		SPT 9, 27, 42 blows/150 mm SPT Recovery 92%	
32										260
33										259
34			END OF TEST HOLE AT 33.5 m IN SAND. NOTES: 1. Seepage observed at 30.5 m below ground surface. 2. Sand blowup observed at 30.5 m below ground surface. 3. Installed 25 mm monitoring well (MW13-02) with 3.0 m screen from 30.5 to 33.5 m below ground surface and 0.90 m stick-up. 4. Above ground protective casing installed. 5. Test hole blown-up with native sand to 33.2 m, backfilled with well gravel to 29.7 m, sealed with bentonite to 28.8 m followed by auger cuttings to 18.3 m, then sealed with bentonite to 17.7 m followed by auger cuttings to 9.4 m, sealed with bentonite to 8.8 m, followed by auger cuttings to 1.1 m, then sealed with bentonite to 0.10 m and concreted to ground surface. 6. Ground water monitoring: - June 22, 2013 at 29.68 m (Elev. 261.3) - June 25, 2013 at 28.76 m (Elev. 262.9)						258
35										257
36										256
37										255
38										254
39										253
40										252
41										251
42										250
43										249
44										248
45										247

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 33.53 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/22/13
PROJECT ENGINEER: Rick Talvitie	Page 3 of 3

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-09**
LOCATION: 16 T Easting: 704174 Northing: 5162703 UTM N 12.2 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 293.50

SAMPLE TYPE ■ GRAB ▯ SHELBY TUBE ☒ SPLIT SPOON ▬ BULK ▨ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
0		TOPSOIL - rootlets, some sand, some gravel, trace cobble, trace clay - dark brown to brown, moist						293
1		SAND (Upper) - some gravel, trace silt - brown, compact, moist - medium to coarse grained						
2		- Gravel: 13.1%, Sand: 82.6%, Fines: 4.3%	☒	S82	22	● ◆	SPT 3, 11, 11 blows/150 mm SPT Recovery 71%	292
3		SAND and GRAVEL - some cobbles, trace silt, trace boulders - brown, compact to dense, moist - medium to coarse grained	☒	S83	47	◆	SPT 6, 18, 29 blows/150 mm SPT Recovery 43%	291
4								290
5		SAND (Lower) - trace gravel, trace silt - pinkish brown, dense, moist - fine to medium grained	☒	S84	48	● ◆	SPT 10, 19, 29 blows/150 mm SPT Recovery 75%	289
6								288
7		- trace gravel, trace cobble, very dense below 6.4 m	☒	S85	58	● ◆	SPT 19, 23, 35 blows/150 mm SPT Recovery 83%	287
8			☒	S86	68	● ◆	SPT 66, 34, 34 blows/150 mm SPT Recovery 85%	286
9								285
10			☒	S87	55	● ◆	SPT 30, 25, 30 blows/150 mm SPT Recovery 83%	284
11			☒	S88	64	● ◆	SPT 13, 26, 38 blows/150 mm SPT Recovery 92%	283
12								282
13								281
14		- some gravel, medium to coarse grained sand below 13.7 m	☒	S89	51/ 76mm	◆	SPT 44, 51 blows/150 mm SPT Recovery 89%	280
15								279

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200

AECOM	LOGGED BY: Sam Oshati	COMPLETION DEPTH: 27.99 m
	REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/23/13
	PROJECT ENGINEER: Rick Talvitie	Page 1 of 2

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-09**
LOCATION: 16 T Easting: 704174 Northing: 5162703 UTM N 12.2 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 293.50

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ⊠ SPLIT SPOON ▤ BULK ⊘ NO RECOVERY ◧ CORE

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION
15							278
16							277
17			⊠	S90	51/ 127mm	SPT 51 blows/127 mm SPT Recovery 100%	276
18							275
19							274
20			⊠	S91	53/ 127mm	SPT 53 blows/127 mm SPT Recovery 100%	273
21							272
22							271
23							270
24		- fine grained below 24.4 m	⊠	S92	51/ 76mm	SPT 33, 51 blows/150 mm SPT Recovery 100%	269
25							268
26							267
27		- silty, some gravel, greyish brown, moist below 27.4 m					266
28		END OF TEST HOLE AT 28 m ON SUSPECTED BEDROCK.	⊠	S93	53/ 102mm	SPT 53 blows/102 mm SPT Recovery 63%	265
29		NOTES: 1. Power auger refusal at 28 m below ground surface in SAND. 2. No seepage observed during drilling. 3. Test hole open to 17.1 m below ground surface upon completion. 4. Test hole backfilled with auger cuttings after drilling.					264
30							

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 27.99 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/23/13
PROJECT ENGINEER: Rick Talvitie	Page 2 of 2

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-10A**
LOCATION: 16 T Easting: 704292 Northing: 5162874 UTM N 13.7 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 302.00

SAMPLE TYPE ■ GRAB ▯ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200	COMMENTS	ELEVATION
0		TOPSOIL - rootlets, some sand, some gravel, trace cobble, trace clay - dark brown to brown, moist, soft							302
1		SAND (Upper) - trace gravel, trace silt - brown, compact, moist - medium to coarse grained							301
2									300
3		SAND and GRAVEL - some cobbles - greyish brown, dense, moist - medium to coarse grained							299
4		END OF TEST HOLE AT 2.47 m IN SAND and GRAVEL. NOTES: 1. Power auger refusal at 2.5 m below ground surface in SAND and GRAVEL. 2. No seepage observed during drilling. 3. Test hole open to 2.5 m below ground surface upon completion. 4. Test hole backfilled with auger cuttings after drilling.							298
5									297
6									296
7									295
8									294
9									293
10									292
11									291
12									290
13									289
14									288
15									

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 2.47 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/23/13
PROJECT ENGINEER: Rick Talvitie	Page 1 of 1

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-10B**
LOCATION: 16 T Easting: 704292 Northing: 5162874 UTM N 15.2 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 302.00

SAMPLE TYPE ■ GRAB ▯ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION
0		TOPSOIL - rootlets, some sand, some gravel, trace cobble, trace clay - dark brown to brown, moist, soft					
1		SAND (Upper) - trace gravel, trace silt - brown, compact, moist - medium to coarse grained					301
2			☒	S94	23	SPT 2, 9, 14 blows/150 mm SPT Recovery 71%	300
3		SAND and GRAVEL - some cobbles, trace silt - greyish brown, dense, moist - medium to coarse grained	☒	S95	51/ 102mm	SPT 30, 51 blows/150 mm SPT Recovery 0%	299
4							298
5		- pinkish brown below 4.3 m - silty, fine grained sand, low plasticity, moist to wet below 4.6 m	☒	S96	61	SPT 7, 11, 50 blows/150 mm SPT Recovery 67%	297
6		END OF TEST HOLE AT 5.2 m ON SUSPECTED BEDROCK. NOTES: 1. Power auger refusal at 5.2 m below ground surface in SAND and GRAVEL. 2. Seepage observed at 4.6 m below ground surface. 3. Test hole open to 4.6 m below ground surface upon completion. 4. Test hole backfilled with auger cuttings after drilling.					296
7							295
8							294
9							293
10							292
11							291
12							290
13							289
14							288
15							

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 5.18 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/23/13
PROJECT ENGINEER: Rick Talvitie	Page 1 of 1

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-10C**
LOCATION: 16 T Easting: 704292 Northing: 5162874 UTM N 16.8 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 302.00

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	WELL INSTALLATION	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100; ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200	COMMENTS	ELEVATION
0			TOPSOIL - rootlets, some sand, some gravel, trace cobble, trace clay - dark brown to brown, soft, moist							302
1			SAND - trace gravel, trace silt - brown, compact, moist - medium to coarse grained							301
2										300
3			SAND and GRAVEL - some cobbles, trace silt - greyish brown, dense, moist - medium to coarse grained							299
4			- silty, fine grained sand, pinkish brown, low plasticity, moist to wet below 3.7 m							298
5			END OF TEST HOLE AT 5.0 m ON SUSPECTED BEDROCK.		G97					297
6			NOTES: 1. Power auger refusal at 5.0 m below ground surface in SAND and GRAVEL. 2. Seepage observed at 4.6 m below ground surface. 3. Installed 25 mm diameter monitoring well (MW13-03) with 3.0 m screen from 1.9 to 4.97 m below ground surface and 0.85 m stick-up. 4. Above ground protective casing installed. 5. Test hole backfilled with well gravel to 1.5 m, sealed with bentonite to 0.10 m and concreted to ground surface. 6. Ground water monitoring: - June 23, 2013 at 4.03 m (Elev. 299) - June 25, 2013 at 3.65 m (Elev. 298.4)							296
7										295
8										294
9										293
10										292
11										291
12										290
13										289
14										288
15										

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 4.97 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/23/13
PROJECT ENGINEER: Rick Talvitie	Page 1 of 1

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-11A**
LOCATION: 16 T Easting: 704586 Northing: 5162868 UTM N 18.3 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 293.60

SAMPLE TYPE ■ GRAB ▯ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
0		MUNICIPAL SOLID WASTE (MSW) - black, wet						293
1								292
2								291
3								290
4								289
5								288
6		END OF TEST HOLE AT 6.1 m IN MSW. NOTES: 1. Seepage observed at 2.4 m below ground surface. 2. Test hole sloughed in with garbage upon completion and sealed with betonite at ground surface.						287
7								286
8								285
9								284
10								283
11								282
12								281
13								280
14								279
15								

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × ☐ Lab Vane ☐ △ Pocket Pen. △ ☘ Field Vane ☘ (kPa) 50 100 150 200

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 6.10 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/23/13
PROJECT ENGINEER: Rick Talvitie	Page 1 of 1

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-11B**
LOCATION: 16 T Easting: 704581 Northing: 5162870 UTM N 19.8 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 293.60

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	WELL INSTALLATION	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS: Becker ✳ / Dynamic Cone ◇ / SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100; Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH: + Torvane + / × QU × / □ Lab Vane □ / △ Pocket Pen. △ / Field Vane (kPa) 50 100 150 200	COMMENTS	ELEVATION
0			MUNICIPAL SOLID WASTE (MSW) - trace sand - black, moist to wet						293
1			- trace cobbles at 0.9 m						292
2									291
3									290
4			- wet below 3.7 m						289
5									288
6									287
7									286
8									285
9					S97	32	◆		SPT 7, 21, 11 blows/150 mm SPT Recovery 17%
10			- trace sand at 9.4 m						284
11									283
12					S98	18	◆		SPT 10, 8, 10 blows/150 mm SPT Recovery 17%
13									282
14									281
15									280
									279

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 24.99 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/24/13
PROJECT ENGINEER: Rick Talvitie	Page 1 of 2

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-11B**
LOCATION: 16 T Easting: 704581 Northing: 5162870 UTM N 19.8 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 293.60

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	WELL INSTALLATION	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
15									278
16			SAND (Lower) - trace debris - brown to pinkish brown, dense, moist - fine to medium grained						277
17					S99	44		SPT 10, 19, 25 blows/150 mm SPT Recovery 63%	
18			- pinkish brown, medium grained below 17.4 m						276
19			- wet below 18.9 m		S100	35		SPT 11, 18, 17 blows/150 mm SPT Recovery 63%	275
20									274
21									273
22			- compact, fine grained below 21.3 m		S101	15		SPT 3, 6, 9 blows/150 mm SPT Recovery 100%	272
23									271
24									270
25					S102	14		SPT 1, 5, 9 blows/150 mm SPT Recovery 75%	269
26			END OF TEST HOLE AT 24.99 m IN SAND. NOTES: 1. Seepage observed at 18.9 m below ground surface in sand. 2. Sand blowup observed at 21.3 m below ground surface. 3. Methane effervescence observed during drilling. 4. Installed 25 mm diameter monitoring well (MW13-04) with 10.7 m screen from 3.0 to 13.7 m below ground surface and 0.90 m stick-up. 5. Above ground protective casing installed. 6. Test hole sloughed at 19.2 m below ground surface, sealed with bentonite to 13.7 m, backfilled with well gravel to 2.7 m, sealed with bentonite to 0.10 m and concreted to ground surface. 7. Leachate level monitoring: - June 25, 2013 at 8.2 m (Elev. 285.4)					268
27									267
28									266
29									265
30									264

PENETRATION TESTS: ✳ Becker ✳ | ◇ Dynamic Cone ◇ | ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + | × QU × | □ Lab Vane □ | △ Pocket Pen. △ | ✤ Field Vane ✤ (kPa) 50 100 150 200

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 24.99 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/24/13
PROJECT ENGINEER: Rick Talvitie	Page 2 of 2

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-12**
LOCATION: 16 T Easting: 704338 Northing: 5162831 UTM N 21.3 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 295.50

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ▨ SPLIT SPOON ▬ BULK ▨ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200	COMMENTS	ELEVATION
0		TOPSOIL - rootlets, some sand, trace gravel, trace cobble, trace clay - dark brown to brown, soft, moist							295
1		SAND (Upper) - some gravel, trace cobble, trace silt - brown, compact, moist - medium to coarse grained							294
2		SAND and GRAVEL - some cobbles, trace silt, trace boulders - brown, very dense, moist - medium to coarse grained							293
3									292
4		END OF TEST HOLE AT 3.5 m IN SAND and GRAVEL. NOTES: 1. Power auger refusal at 3.5 m below ground surface in SAND and GRAVEL. 2. No seepage observed during drilling. 3. Test hole open to 3.5 m below ground surface upon completion. 4. Test hole backfilled wih auger cuttings after drilling.							291
5									290
6									289
7									288
8									287
9									286
10									285
11									284
12									283
13									282
14									281
15									

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 3.51 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/24/13
PROJECT ENGINEER: Rick Talvitie	Page 1 of 1

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-13**
LOCATION: 16 T Easting: 704336 Northing: 5162743 UTM N 22.9 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 292.50

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ▩ SPLIT SPOON ▬ BULK ▨ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200	COMMENTS	ELEVATION
0		TOPSOIL - rootlets, some sand, trace gravel, trace cobble, trace clay - dark brown to brown, moist, soft							292
1		SAND (Upper) - trace gravel, trace silt, trace cobble - brown, moist, compact - medium to coarse grained							291
2									
3		SAND and GRAVEL - some cobbles, trace silt, trace boulders - brown, dense, moist - medium to coarse grained							290
4									289
5		SAND (Lower) - trace gravel, trace silt - pinkish brown, compact, moist - medium to coarse grained							288
6									287
7									286
8									285
9									284
10									283
11									282
12									281
13									280
14									279
15									278

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 15.39 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/25/13
PROJECT ENGINEER: Rick Talvitie	Page 1 of 2

PROJECT: Sault St. Marie - Landfill Expansion	CLIENT: City Of Sault Ste. Marie	TESTHOLE NO: **TH13-13**
LOCATION: 16 T Easting: 704336 Northing: 5162743 UTM N 22.9 E 0.3		PROJECT NO.: 60117627
CONTRACTOR: TBT Engineering Consulting Group	METHOD: Tire Mounted CME 750, HSA 194 mm	ELEVATION (m): 292.50

SAMPLE TYPE ■ GRAB ▯ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ⧄ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200	COMMENTS	ELEVATION
15									277
		END OF TEST HOLE AT 15.39 m IN SAND. NOTES: 1. No seepage observed during drilling. 2. Test hole open to 13.7 m below ground surface upon completion. 3. Test hole backfilled with auger cuttings after drilling.							
16									276
17									275
18									274
19									273
20									272
21									271
22									270
23									269
24									268
25									267
26									266
27									265
28									264
29									263
30									

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 15.39 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 6/25/13
PROJECT ENGINEER: Rick Talvitie	Page 2 of 2

LOG OF TEST HOLE TH LOGS-SSM FINAL.GPJ UMA WINN.GDT 4/18/14

Appendix E

Laboratory Test Results

MOISTURE CONTENT

JOB No.: 60117627
CLIENT: City of SSM
PROJECT: SSM Landfill Expansion

DATE: July 16, 2013

HOLE NO.	TH13 - 01	-	-	-	-	-
SAMPLE NO.	G3	G6	G9	S11	S13	S14
DEPTH (FT)	12 - 13	21.5 - 22.5	31.5	40 - 41.5	50 - 51.5	55 - 56.5
MOISTURE CONTENT %	41.8	18.9	4.8	2.9	5.6	19.0

HOLE NO.	TH13 - 01	-	TH13 - 02	-	-	TH13 - 03
SAMPLE NO.	S15	S16	S20	S21	S22	S24
DEPTH (FT)	60 - 61.5	65 - 66.5	20.0	25.0	30.0	5.0
MOISTURE CONTENT %	10.1	12.7	4.5	10.9	7.3	4.8

HOLE NO.	TH13 - 03	-	-	-	-	-
SAMPLE NO.	S26	S28	S29	S31	S32	S33
DEPTH (FT)	15.0	25.0	30.0	40.0	45.0	50.0
MOISTURE CONTENT %	5.6	3.8	6.2	3.1	5.3	8.7

HOLE NO.	TH13 - 03	-	-	TH13 - 05	-	-
SAMPLE NO.	S34	S35	S36	S44	S45	S46
DEPTH (FT)	55.0	60.0	65.0	15.0	20.0	25.0
MOISTURE CONTENT %	17.5	14.2	15.0	7.3	8.6	11.6

NOTES:

AECOM

MATERIALS LABORATORY
AECOM
99 Commerce Drive, Winnipeg, MB R3P 0Y7 Canada
tel (204) 477-5381 **fax** (204) 284-2040

MOISTURE CONTENT

JOB No.: 60117627
CLIENT: City of SSM
PROJECT: SSM Landfill Expansion

DATE: July 16, 2013

HOLE NO.	TH13 - 05	-	-	-	-	TH13 - 06
SAMPLE NO.	S47	S48	S49	S50	S51	S54
DEPTH (FT)	30.0	35.0	45.0	55.0	65.0	5.5
MOISTURE CONTENT %	16.1	19.9	17.4	17.8	17.6	4.9

HOLE NO.	TH13 - 06	-	TH13 - 07	-	-	-
SAMPLE NO.	S55	G56	S57	S58	S59	S60
DEPTH (FT)	15.0	16.0	5.0	10.0	15.0	20.0
MOISTURE CONTENT %	3.8	4.4	4.5	5.3	3.2	3.0

HOLE NO.	TH13 - 07	-	-	-	-	-
SAMPLE NO.	S61	S62	S63	S64	S65	S66
DEPTH (FT)	25.0	30.0	35.0	40.0	50.0	60.0
MOISTURE CONTENT %	4.2	4.6	5.9	11.5	5.7	17.7

HOLE NO.	TH13 - 07	-	TH13 - 08	-	-	-
SAMPLE NO.	S67	G68	S69	S71	S72	S74
DEPTH (FT)	70.0	80.0	5.0	15.0	20.0	30.0
MOISTURE CONTENT %	18.7	18.8	5.3	12.6	2.5	2.6

NOTES:

AECOM

MATERIALS LABORATORY
AECOM
99 Commerce Drive, Winnipeg, MB R3P 0Y7 Canada
tel (204) 477-5381 **fax** (204) 284-2040

MOISTURE CONTENT

JOB No.: 60117627
CLIENT: City of SSM
PROJECT: SSM Landfill Expansion

DATE: July 16, 2013

HOLE NO.	TH13 - 08	-	-	-	-	-
SAMPLE NO.	S75	S76	S77	S78	S79	S80
DEPTH (FT)	35.0	40.0	50.0	60.0	70.0	85.0
MOISTURE CONTENT %	3.5	7.4	6.2	5.3	2.4	6.4

HOLE NO.	TH13 - 08	TH13 - 09	-	-	-	-
SAMPLE NO.	S81	S82	S84	S85	S86	S87
DEPTH (FT)	100.0	5.0	15.0	20.0	25.0	30.0
MOISTURE CONTENT %	20.1	6.3	6.7	4.5	4.8	4.6

HOLE NO.	TH13 - 09	TH13 - 10B	TH13 - 11B	-	-	-
SAMPLE NO.	S88	S94	S99	S100	S101	S102
DEPTH (FT)	35.0	5.0	55.0	60.0	70.0	80.0
MOISTURE CONTENT %	4	6.7	5.1	9.9	21.7	20.8

HOLE NO.						
SAMPLE NO.						
DEPTH (FT)						
MOISTURE CONTENT %						

NOTES:

AECOM

MATERIALS LABORATORY
AECOM
99 Commerce Drive, Winnipeg, MB R3P 0Y7 Canada
tel (204) 477-5381 **fax** (204) 284-2040

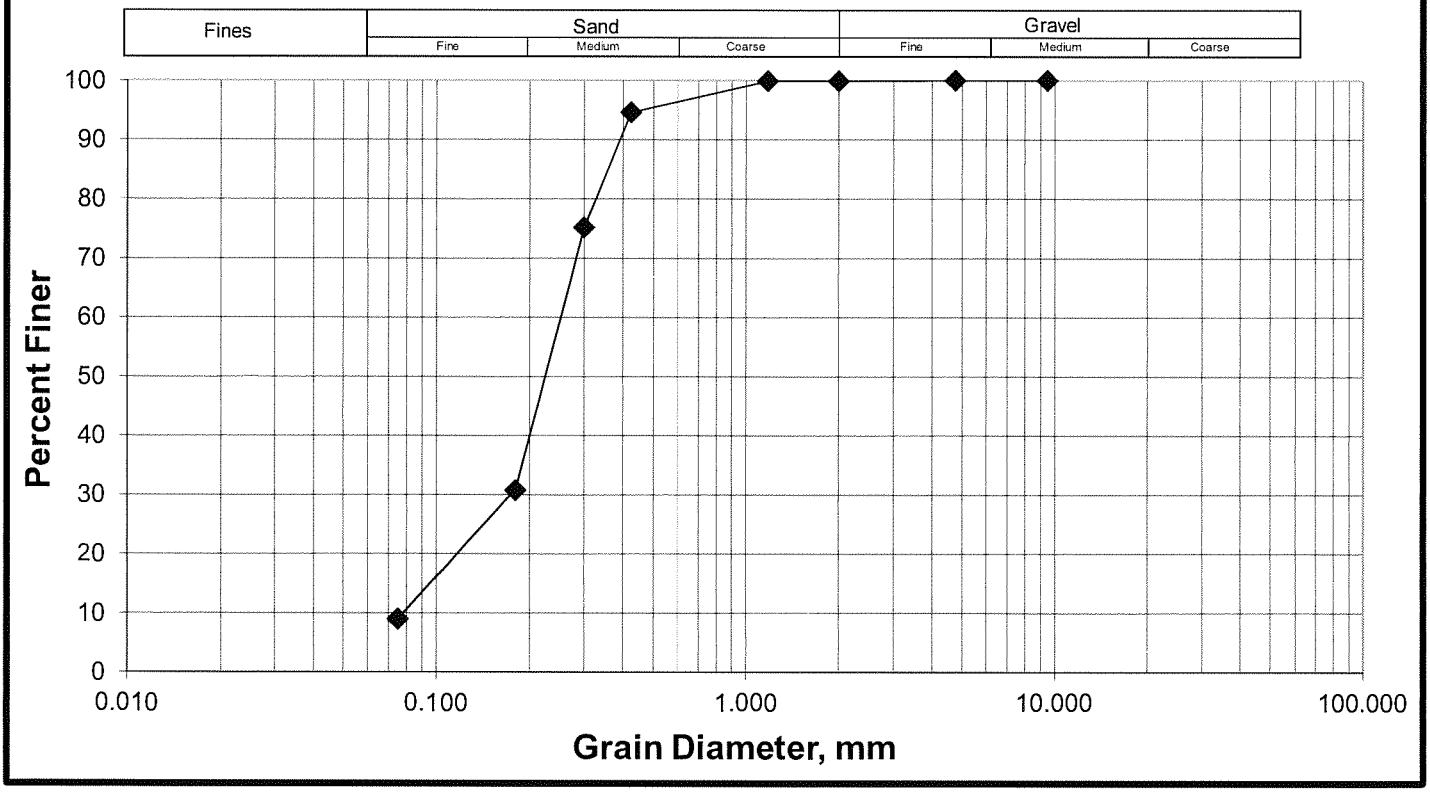
GRAIN SIZE DISTRIBUTION
(ASTM C136-06)

MATERIALS LABORATORY
AECOM
99 Commerce Dr., Winnipeg, MB R3P 0Y7 Canada
tel (204) 477-5381 **fax** (204) 284-2040

Client:	City of SSM	Sample No.:	S13
Project:	SSM Landfill Expansion	Test Hole No.:	TH13 - 01
Job No:	60117627	Depth:	50 - 51.5'
Date :	15-Jul-13	Sample Description:	Sand

Sieve (mm.)	Sieve No.	Total Percent Passing	Specification (min - max)
150.0	6"		
100.0	4"		
75.0	3"		
50.0	2"		
37.5	1.5"		
25.0	1"		
19.0	3/4"		
16.0	5/8"		
12.5	1/2"		
9.5	3/8"		
4.75	No. 4	100.0	
2.00	No. 10	100.0	
1.18	No. 16	99.9	
0.425	No. 40	94.6	
0.300	No. 50	75.1	
0.180	No. 80	30.8	
0.075	No. 200	9.0	

GRAIN SIZE DISTRIBUTION CURVE

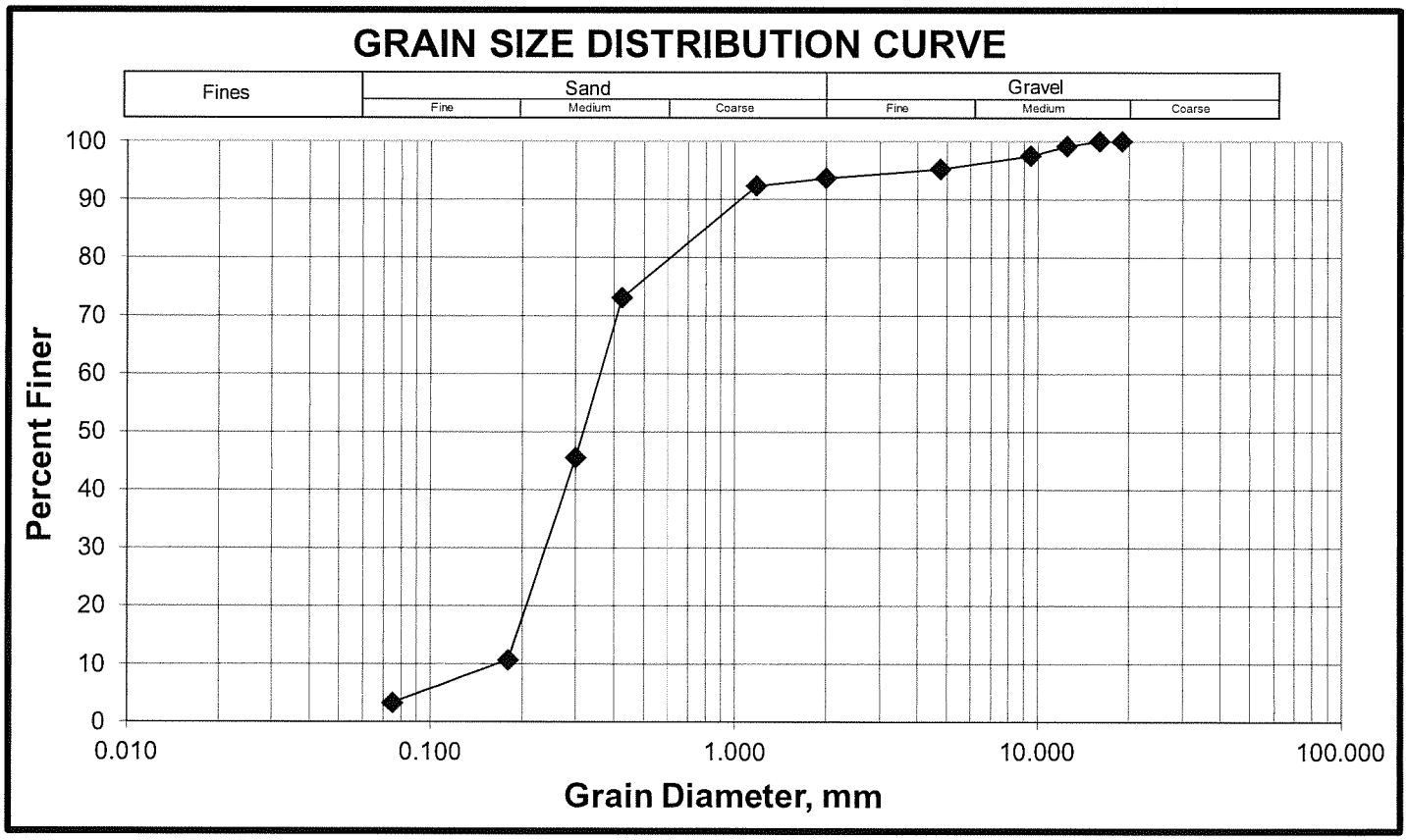


GRAIN SIZE DISTRIBUTION
(ASTM C136-06)

MATERIALS LABORATORY
AECOM
99 Commerce Dr., Winnipeg, MB R3P 0Y7 Canada
tel (204) 477-5381 **fax** (204) 284-2040

Client:	City of SSM	Sample No.:	S26
Project:	SSM Landfill Expansion	Test Hole No.:	TH13 - 03
Job No:	60117627	Depth:	15'
Date :	15-Jul-13	Sample Description:	Sand

Sieve (mm.)	Sieve No.	Total Percent Passing	Specification (min - max)
150.0	6"		
100.0	4"		
75.0	3"		
50.0	2"		
37.5	1.5"		
25.0	1"		
19.0	3/4"		
16.0	5/8"	100.0	
12.5	1/2"	99.2	
9.5	3/8"	97.5	
4.75	No. 4	95.3	
2.00	No. 10	93.7	
1.18	No. 16	92.3	
0.425	No. 40	73.1	
0.300	No. 50	45.5	
0.180	No. 80	10.7	
0.075	No. 200	3.3	



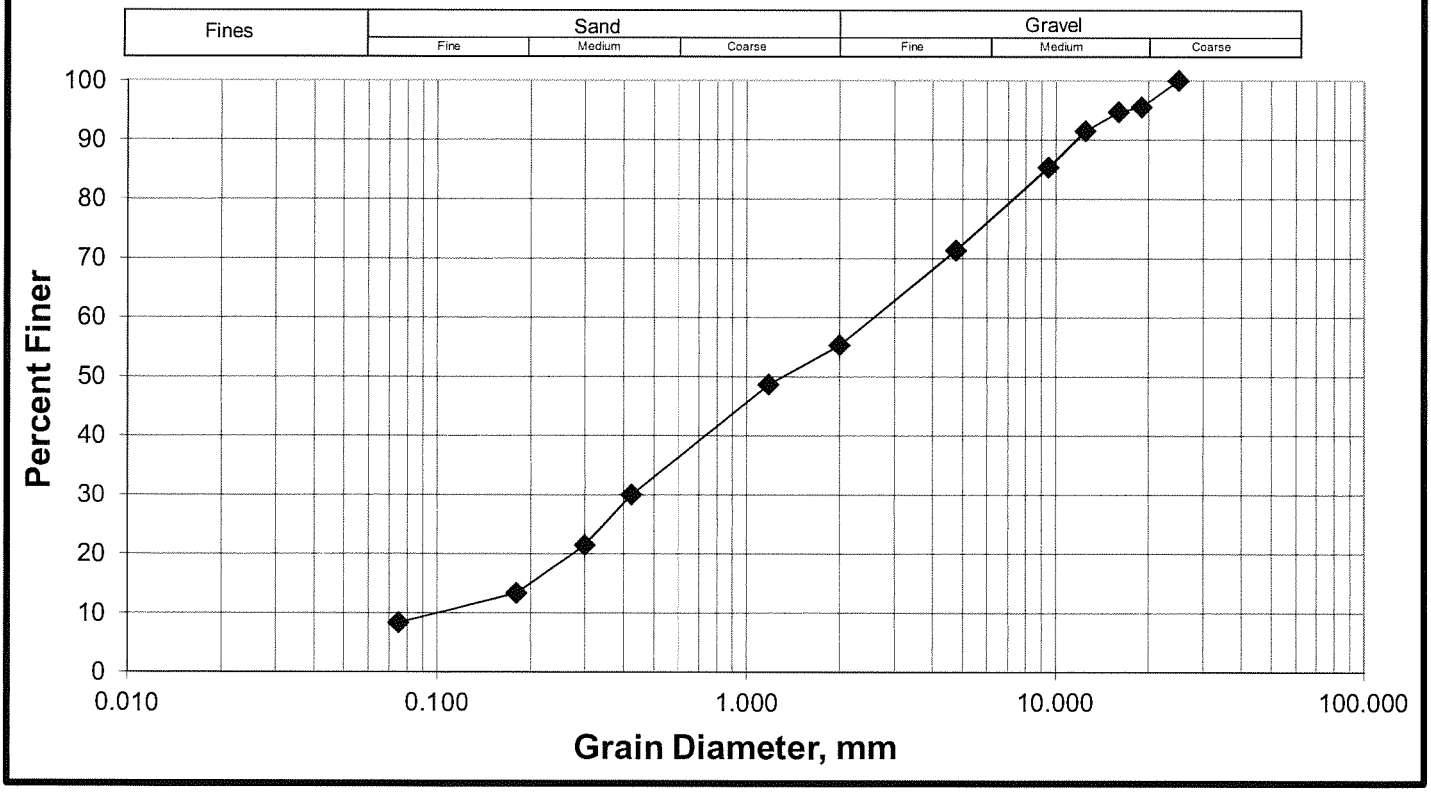
GRAIN SIZE DISTRIBUTION
(ASTM C136-06)

MATERIALS LABORATORY
AECOM
99 Commerce Dr., Winnipeg, MB R3P 0Y7 Canada
tel (204) 477-5381 fax (204) 284-2040

Client:	City of SSM	Sample No.:	S29
Project:	SSM Landfill Expansion	Test Hole No.:	TH13 - 03
Job No:	60117627	Depth:	30'
Date :	15-Jul-13	Sample Description:	Sand

Sieve (mm.)	Sieve No.	Total Percent Passing	Specification (min - max)
150.0	6"		
100.0	4"		
75.0	3"		
50.0	2"		
37.5	1.5"		
25.0	1"	100.0	
19.0	3/4"	95.6	
16.0	5/8"	94.7	
12.5	1/2"	91.5	
9.5	3/8"	85.3	
4.75	No. 4	71.3	
2.00	No. 10	55.3	
1.18	No. 16	48.6	
0.425	No. 40	30.0	
0.300	No. 50	21.5	
0.180	No. 80	13.3	
0.075	No. 200	8.4	

GRAIN SIZE DISTRIBUTION CURVE

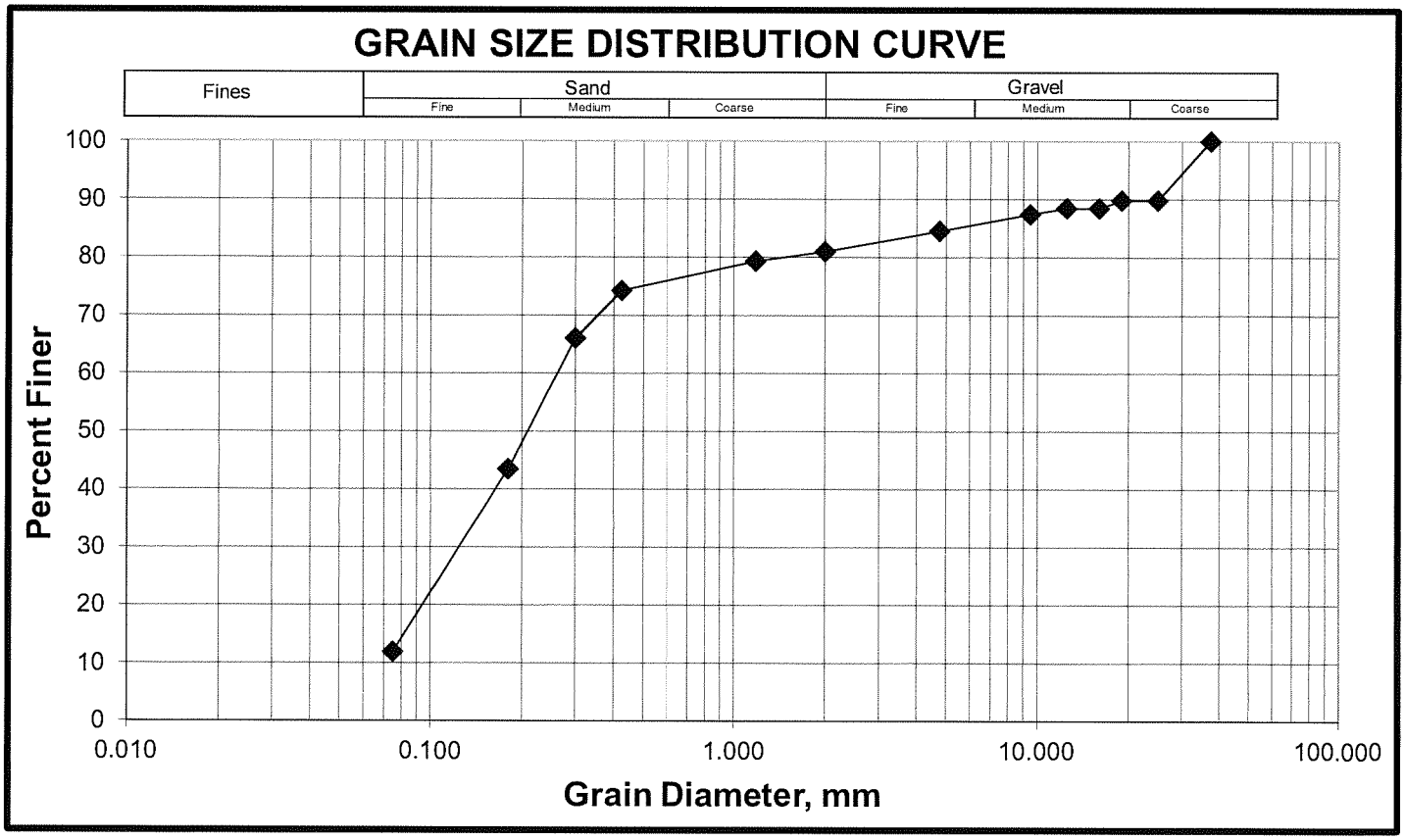


GRAIN SIZE DISTRIBUTION
(ASTM C136-06)

MATERIALS LABORATORY
AECOM
99 Commerce Dr., Winnipeg, MB R3P 0Y7 Canada
tel (204) 477-5381 **fax** (204) 284-2040

Client:	City of SSM	Sample No.:	S34
Project:	SSM Landfill Expansion	Test Hole No.:	TH13 - 03
Job No:	60117627	Depth:	55'
Date :	15-Jul-13	Sample Description:	Sand

Sieve (mm.)	Sieve No.	Total Percent Passing	Specification (min - max)
150.0	6"		
100.0	4"		
75.0	3"		
50.0	2"		
37.5	1.5"	100.0	
25.0	1"	89.9	
19.0	3/4"	89.9	
16.0	5/8"	88.5	
12.5	1/2"	88.5	
9.5	3/8"	87.4	
4.75	No. 4	84.5	
2.00	No. 10	81.0	
1.18	No. 16	79.4	
0.425	No. 40	74.2	
0.300	No. 50	66.0	
0.180	No. 80	43.4	
0.075	No. 200	11.9	



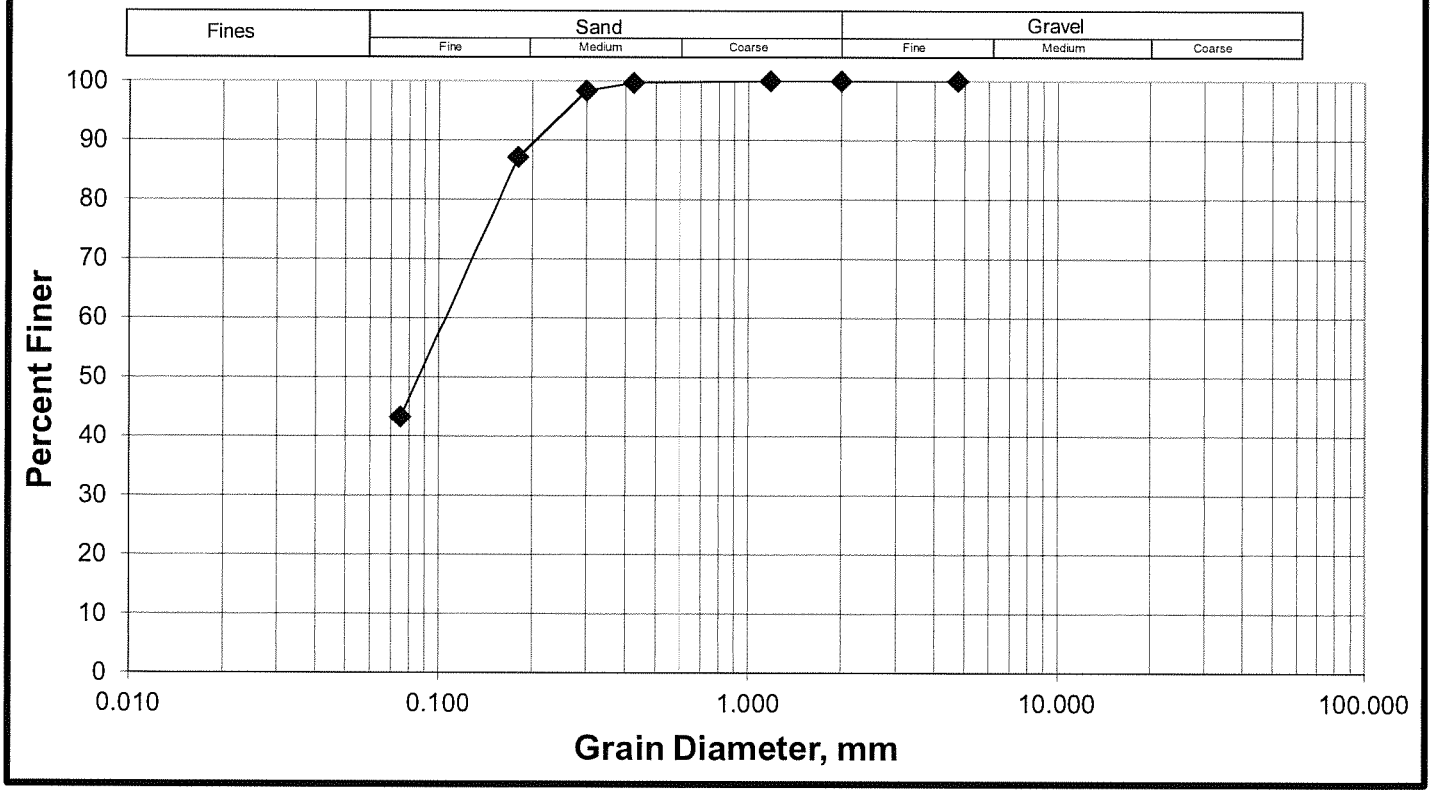
GRAIN SIZE DISTRIBUTION
(ASTM C136-06)

MATERIALS LABORATORY
AECOM
99 Commerce Dr., Winnipeg, MB R3P 0Y7 Canada
tel (204) 477-5381 **fax** (204) 284-2040

Client:	City of SSM	Sample No.	S50
Project:	SSM Landfill Expansion	Test Hole No.:	TH13 - 05
Job No:	60117627	Depth:	55'
Date :	15-Jul-13	Sample Description:	Sand

Sieve (mm.)	Sieve No.	Total Percent Passing	Specification (min - max)
150.0	6"		
100.0	4"		
75.0	3"		
50.0	2"		
37.5	1.5"		
25.0	1"		
19.0	3/4"		
16.0	5/8"		
12.5	1/2"		
9.5	3/8"		
4.75	No. 4		
2.00	No. 10	100.0	
1.18	No. 16	100.0	
0.425	No. 40	99.7	
0.300	No. 50	98.4	
0.180	No. 80	87.2	
0.075	No. 200	43.2	

GRAIN SIZE DISTRIBUTION CURVE

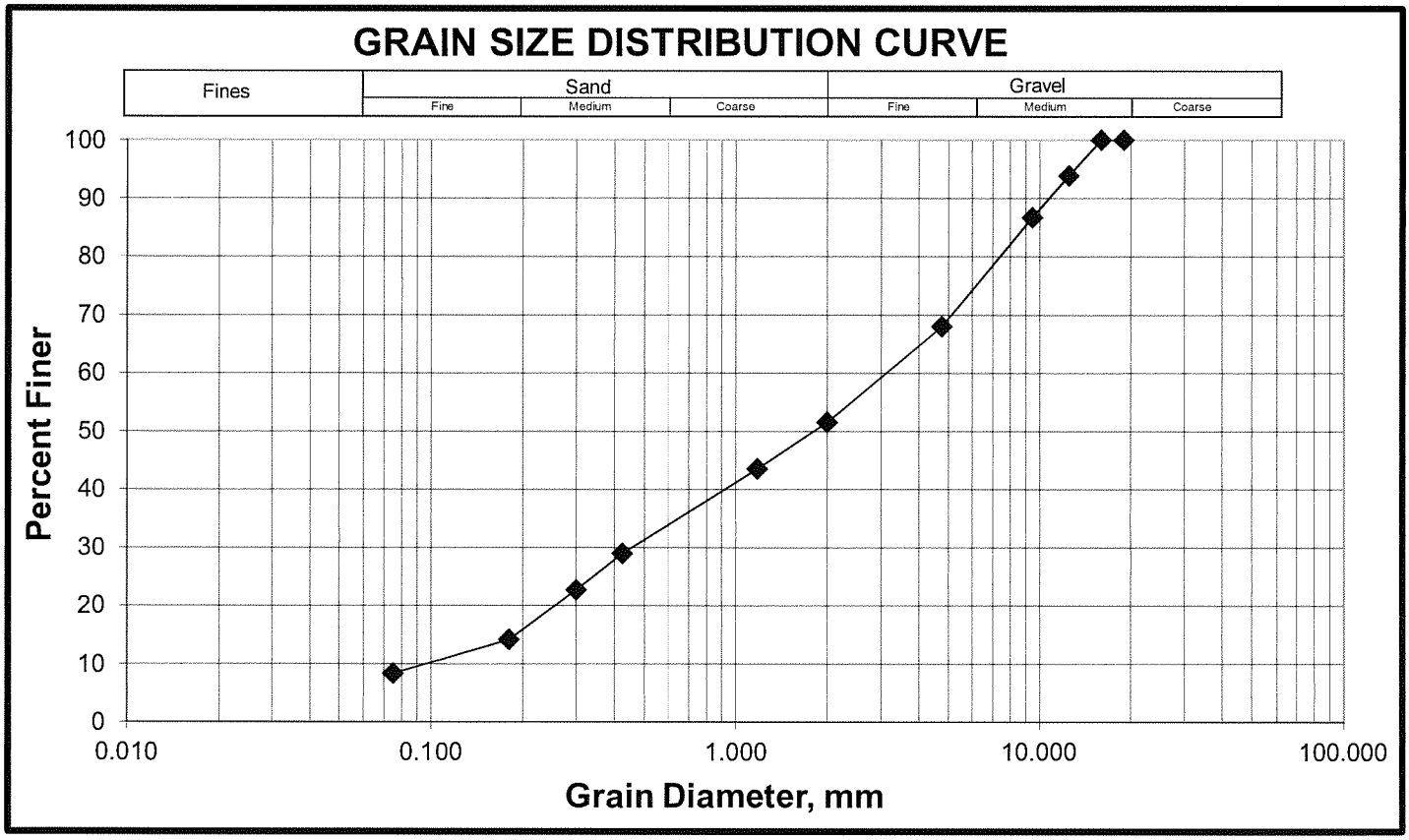


GRAIN SIZE DISTRIBUTION
(ASTM C136-06)

MATERIALS LABORATORY
AECOM
99 Commerce Dr., Winnipeg, MB R3P 0Y7 Canada
tel (204) 477-5381 **fax** (204) 284-2040

Client:	City of SSM	Sample No.:	S57
Project:	SSM Landfill Expansion	Test Hole No.:	TH13 - 07
Job No:	60117627	Depth:	5'
Date :	15-Jul-13	Sample Description:	Sand

Sieve (mm.)	Sieve No.	Total Percent Passing	Specification (min - max)
150.0	6"		
100.0	4"		
75.0	3"		
50.0	2"		
37.5	1.5"		
25.0	1"		
19.0	3/4"		
16.0	5/8"	100.0	
12.5	1/2"	93.9	
9.5	3/8"	86.7	
4.75	No. 4	67.9	
2.00	No. 10	51.5	
1.18	No. 16	43.5	
0.425	No. 40	29.0	
0.300	No. 50	22.7	
0.180	No. 80	14.2	
0.075	No. 200	8.4	



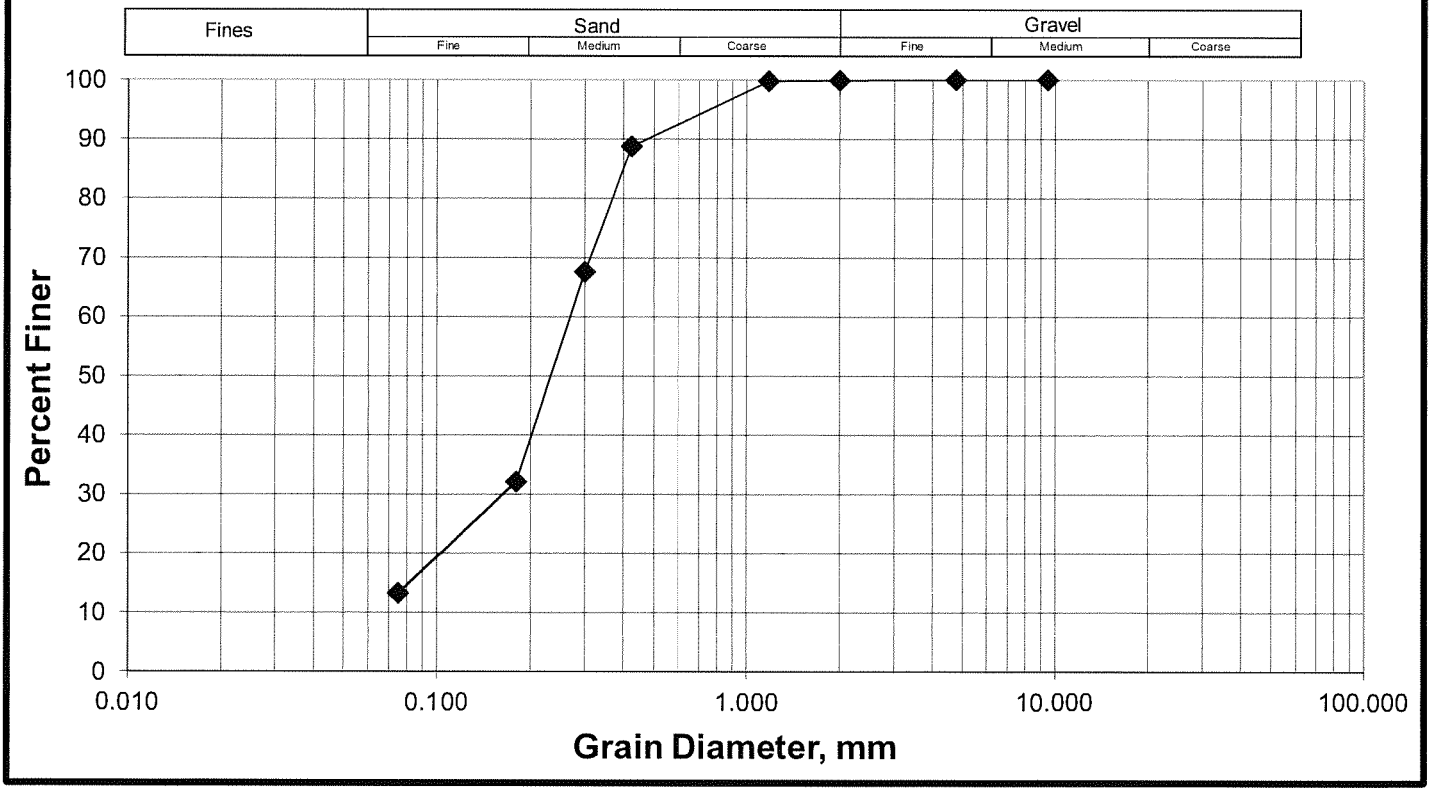
GRAIN SIZE DISTRIBUTION
(ASTM C136-06)

MATERIALS LABORATORY
AECOM
99 Commerce Dr., Winnipeg, MB R3P 0Y7 Canada
tel (204) 477-5381 **fax** (204) 284-2040

Client:	City of SSM	Sample No.:	S68
Project:	SSM Landfill Expansion	Test Hole No.:	TH13 - 07
Job No:	60117627	Depth:	80'
Date :	15-Jul-13	Sample Description:	Sand

Sieve (mm.)	Sieve No.	Total Percent Passing	Specification (min - max)
150.0	6"		
100.0	4"		
75.0	3"		
50.0	2"		
37.5	1.5"		
25.0	1"		
19.0	3/4"		
16.0	5/8"		
12.5	1/2"		
9.5	3/8"		
4.75	No. 4	100.0	
2.00	No. 10	99.9	
1.18	No. 16	99.8	
0.425	No. 40	88.8	
0.300	No. 50	67.6	
0.180	No. 80	32.0	
0.075	No. 200	13.3	

GRAIN SIZE DISTRIBUTION CURVE



GRAIN SIZE DISTRIBUTION
(ASTM C136-06)

MATERIALS LABORATORY
AECOM
99 Commerce Dr., Winnipeg, MB R3P 0Y7 Canada
tel (204) 477-5381 **fax** (204) 284-2040

Client:	City of SSM	Sample No.:	S71
Project:	SSM Landfill Expansion	Test Hole No.:	TH13 - 08
Job No:	60117627	Depth:	15'
Date :	15-Jul-13	Sample Description:	Sand

Sieve (mm.)	Sieve No.	Total Percent Passing	Specification (min - max)
150.0	6"		
100.0	4"		
75.0	3"		
50.0	2"		
37.5	1.5"		
25.0	1"		
19.0	3/4"		
16.0	5/8"		
12.5	1/2"		
9.5	3/8"		
4.75	No. 4	100.0	
2.00	No. 10	100.0	
1.18	No. 16	99.6	
0.425	No. 40	89.0	
0.300	No. 50	71.3	
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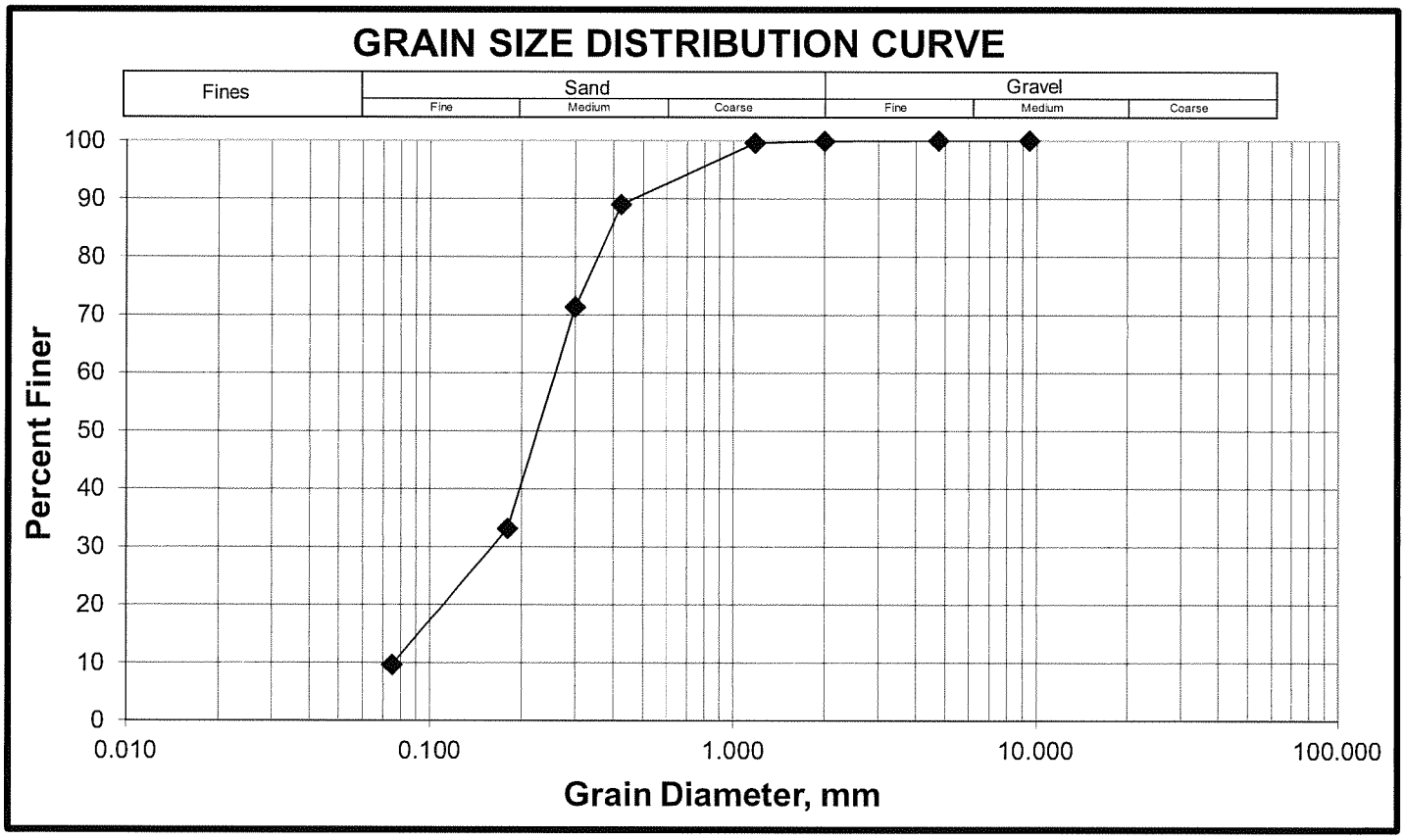
0.075	No. 200	9.7	



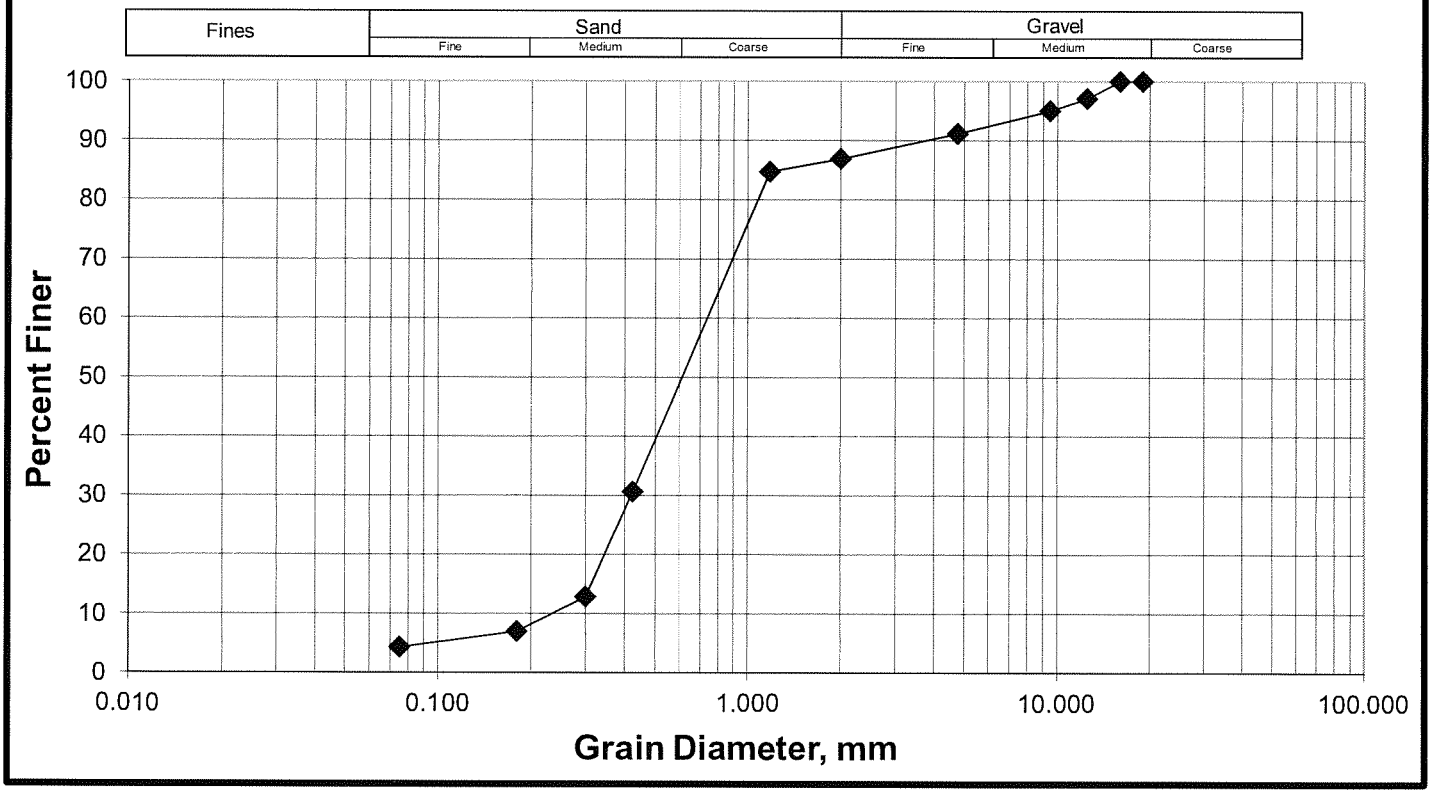
GRAIN SIZE DISTRIBUTION
(ASTM C136-06)

MATERIALS LABORATORY
AECOM
99 Commerce Dr., Winnipeg, MB R3P 0Y7 Canada
tel (204) 477-5381 **fax** (204) 284-2040

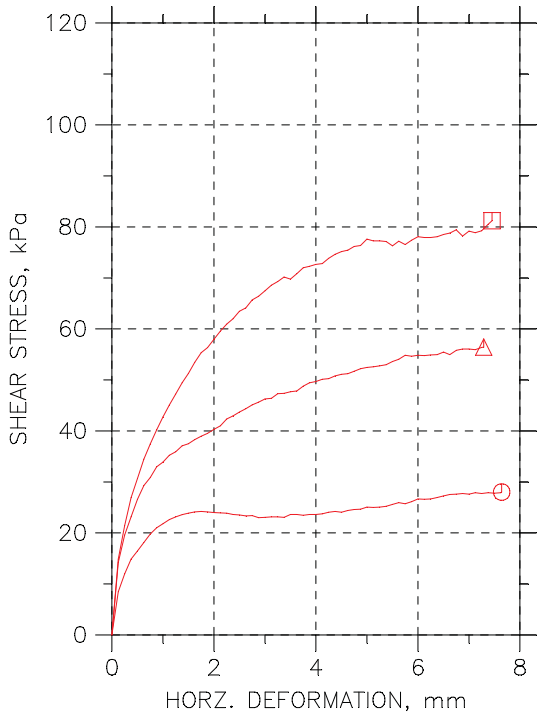
Client:	City of SSM	Sample No.:	S82
Project:	SSM Landfill Expansion	Test Hole No.:	TH13 - 09
Job No:	60117627	Depth:	5'
Date :	15-Jul-13	Sample Description:	Sand

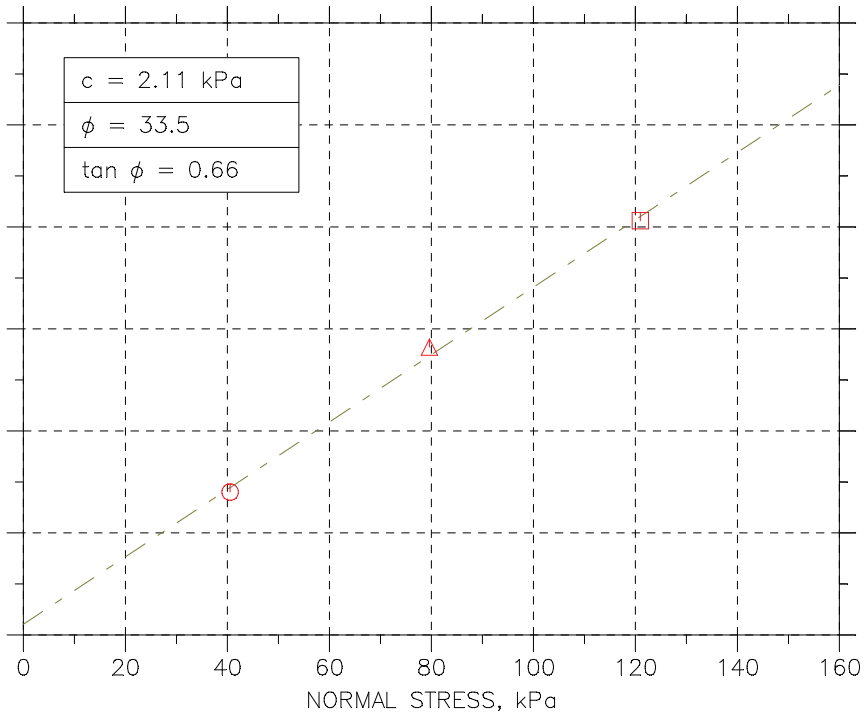
Sieve (mm.)	Sieve No.	Total Percent Passing	Specification (min - max)
150.0	6"		
100.0	4"		
75.0	3"		
50.0	2"		
37.5	1.5"		
25.0	1"		
19.0	3/4"		
16.0	5/8"	100.0	
12.5	1/2"	97.1	
9.5	3/8"	95.0	
4.75	No. 4	91.1	
2.00	No. 10	86.9	
1.18	No. 16	84.8	
0.425	No. 40	30.6	
0.300	No. 50	12.8	
0.180	No. 80	7.0	
0.075	No. 200	4.3	

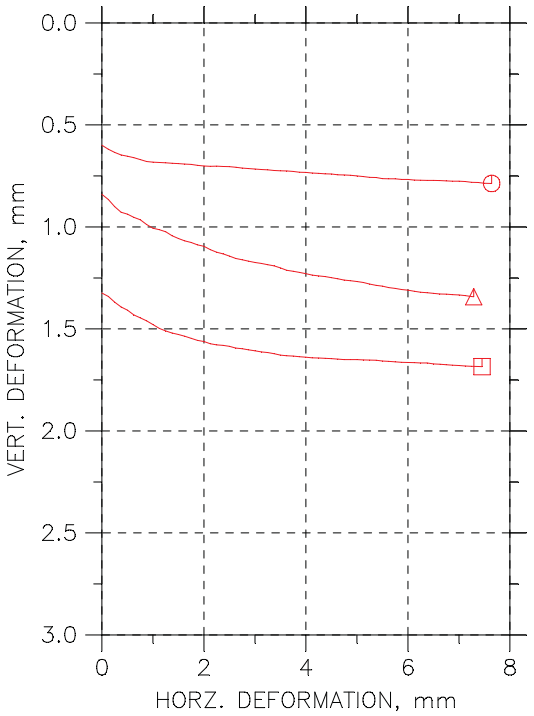
GRAIN SIZE DISTRIBUTION CURVE



DIRECT SHEAR TEST REPORT







Symbol		⏲	△	⊡	
Test No.		40 kPa	80 kPa	120 kPa	
Sample No.		G56	G56	G56	
Shape		Circular	Circular	Circular	
Initial	Dimension, mm	62.95	63.55	63.92	
	Area, cm^2	31.123	31.719	32.09	
	Height, mm	29.05	29.23	29.43	
	Water Content, %	8.32	6.10	5.11	
	Dry Density, kN/m^3	15.95	15.979	16.03	
	Saturation, %	35.05	25.82	21.78	
	Void Ratio	0.62932	0.62638	0.62123	
Consol. Height, mm		28.6	28.536	28.256	
Consol. Void Ratio		0.60406	0.58777	0.55654	
Final	Water Content, %	22.40	19.80	19.30	
	Dry Density, kN/m^3	16.394	16.748	17.003	
	Saturation, %	101.44	95.11	96.79	
	Void Ratio	0.58518	0.5517	0.5284	
Normal Stress, kPa		40.534	79.621	120.97	
Max. Shear Stress, kPa		28.013	56.424	81.21	
Ult. Shear Stress, kPa		28.013	56.424	81.21	
Time to Failure, min		76.474	74.949	76.283	
Disp. Rate, mm/min		0.1	0.1	0.1	
Estimated Specific Gravity		2.65	2.65	2.65	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	
Plasticity Index		---	---	---	

Project: SAULT STE MARIE LANDFILL	
Location: WINNEPEG, MB CA	
Project No.: 60117627	
Boring No.: 13-06 G56	
Sample Type: REMOLDED	
Description: F-C SAND TRACE F-C GRAVEL TRACE SILT - BROWN SP	
Remarks: TEST PERFORMED AS PER ASTM D 3080 SPECIMEN REMOLDED TO APPROX.16.0 kN/m3	

Fri, 02-AUG-2013 15:22:03

DIRECT SHEAR TEST DATA

Project: SAULT STE MARIE LANDFILL
Boring No.: 13-06 G56
Sample No.: G56
Test No.: 40 kPa

Location: WINNEPEG, MB CA
Tested By: BCM
Test Date: 8/1/13
Sample Type: REMOLDED

Project No.: 60117627
Checked By: WPQ
Depth: 16.0'
Elevation: -----

Soil Description: F-C SAND TRACE F-C GRAVEL TRACE SILT - BROWN SP
Remarks: TEST PERFORMED AS PER ASTM D 3080 SPECIMEN REMOLDED TO APPROX.16.0 kN/m3

	Elapsed Time min	Vertical Stress kPa	Vertical Displacement mm	Horizontal Stress kPa	Horizontal Displacement mm
1	0.00	40.53	0.599	0	0
2	3.40	40.38	0.6187	8.469	0.1255
3	4.68	40.3	0.635	11.96	0.251
4	6.08	40.38	0.6473	14.87	0.3753
5	7.07	40.38	0.6538	16.46	0.5008
6	8.36	40.38	0.6603	18.12	0.6251
7	9.62	40.46	0.6701	19.78	0.7507
8	10.90	40.53	0.6791	21.02	0.8762
9	12.01	40.53	0.6824	21.79	1
10	13.24	40.61	0.684	22.62	1.126
11	14.57	40.53	0.6857	23.16	1.25
12	15.61	40.53	0.6881	23.57	1.376
13	16.94	40.53	0.6898	23.87	1.5
14	18.16	40.61	0.6922	24.1	1.626
15	19.38	40.61	0.6938	24.22	1.751
16	20.38	40.53	0.6979	24.1	1.875
17	21.74	40.53	0.7012	23.99	2.001
18	22.94	40.53	0.7028	23.93	2.125
19	24.01	40.61	0.702	23.87	2.251
20	25.31	40.46	0.7036	23.63	2.375
21	26.66	40.53	0.7045	23.51	2.501
22	27.85	40.53	0.7077	23.33	2.627
23	28.93	40.53	0.7118	23.39	2.75
24	30.37	40.53	0.7143	22.98	2.876
25	31.42	40.53	0.7159	23.04	3
26	32.68	40.53	0.7184	23.16	3.126
27	33.98	40.53	0.72	23.16	3.251
28	35.18	40.46	0.7233	23.04	3.376
29	36.38	40.61	0.7249	23.63	3.501
30	37.55	40.61	0.7257	23.63	3.625
31	38.67	40.53	0.7282	23.45	3.751
32	39.98	40.46	0.7322	23.63	3.875
33	41.06	40.61	0.7331	23.63	4.001
34	42.46	40.53	0.7355	23.75	4.126
35	43.59	40.61	0.7372	24.05	4.25
36	44.77	40.53	0.7396	24.22	4.376
37	46.10	40.53	0.7404	24.05	4.5
38	47.35	40.61	0.7445	24.4	4.626
39	48.47	40.53	0.7453	24.58	4.75
40	49.62	40.61	0.747	24.64	4.876
41	50.95	40.61	0.7502	25.05	5.001
42	52.08	40.53	0.7535	24.99	5.125
43	53.30	40.53	0.7568	25.05	5.251
44	54.46	40.53	0.7576	25.23	5.375
45	55.68	40.53	0.7633	25.59	5.501
46	56.97	40.53	0.7641	25.94	5.625
47	58.19	40.46	0.7641	25.7	5.751
48	59.36	40.53	0.7674	26.12	5.876
49	60.59	40.61	0.7674	26.65	6
50	61.68	40.61	0.7707	26.59	6.126
51	63.01	40.53	0.7715	26.65	6.25
52	64.35	40.61	0.7723	26.95	6.376
53	65.59	40.53	0.7723	27.24	6.501
54	66.60	40.46	0.7731	27.54	6.626
55	67.85	40.53	0.7739	27.6	6.751
56	68.87	40.53	0.7756	27.72	6.875
57	70.05	40.53	0.7756	27.6	7.001
58	71.45	40.61	0.7772	27.89	7.125
59	72.68	40.61	0.7813	27.72	7.251
60	73.87	40.53	0.7821	27.89	7.376
61	75.15	40.61	0.7862	27.78	7.5
62	76.24	40.23	0.787	27.89	7.626
63	76.47	40.53	0.787	28.01	7.643

DIRECT SHEAR TEST DATA

Project: SAULT STE MARIE LANDFILL
Boring No.: 13-06 G56
Sample No.: G56
Test No.: 80 kPa

Location: WINNEPEG, MB CA
Tested By: BCM
Test Date: 8/1/13
Sample Type: REMOLDED

Project No.: 60117627
Checked By: WPQ
Depth: 16.0'
Elevation: -----

Soil Description: F-C SAND TRACE F-C GRAVEL TRACE SILT - BROWN SP
Remarks: TEST PERFORMED AS PER ASTM D 3080 SPECIMEN REMOLDED TO APPROX.16.0 kN/m3

	Elapsed Time min	Vertical Stress kPa	Vertical Displacement mm	Horizontal Stress kPa	Horizontal Displacement mm
1	0.00	79.54	0.8402	0	0
2	5.32	79.32	0.8651	14.21	0.1255
3	6.59	79.54	0.9003	19.6	0.251
4	7.80	79.09	0.9283	23.16	0.3753
5	8.98	79.32	0.9377	26.59	0.5008
6	10.28	79.54	0.9532	29.28	0.6251
7	11.35	79.47	0.9646	30.88	0.7507
8	12.78	79.62	0.9885	32.96	0.8762
9	13.90	79.47	1.006	33.88	1
10	15.17	79.54	1.013	35.23	1.126
11	16.21	79.32	1.024	35.9	1.25
12	17.53	79.54	1.043	37.06	1.376
13	18.72	79.47	1.057	37.49	1.5
14	19.95	79.62	1.068	38.29	1.626
15	21.14	79.54	1.077	38.96	1.751
16	22.42	79.47	1.088	39.52	1.875
17	23.62	79.47	1.095	40.31	2.001
18	24.78	79.54	1.112	40.99	2.125
19	26.17	79.54	1.124	42.33	2.251
20	27.22	79.54	1.132	42.95	2.375
21	28.49	79.62	1.143	43.68	2.501
22	29.76	79.62	1.154	44.36	2.626
23	31.00	79.62	1.161	45.09	2.75
24	32.24	79.54	1.168	45.64	2.876
25	33.43	79.54	1.174	46.25	3
26	34.48	79.62	1.179	46.38	3.126
27	35.86	79.62	1.186	47.3	3.251
28	36.99	79.62	1.191	47.36	3.376
29	38.32	79.62	1.201	47.66	3.501
30	39.43	79.54	1.213	47.85	3.625
31	40.61	79.62	1.218	48.77	3.751
32	41.92	79.62	1.223	49.44	3.875
33	43.17	79.62	1.229	49.69	4.001
34	44.31	79.62	1.236	50.11	4.126
35	45.51	79.62	1.241	50.24	4.25
36	46.81	79.62	1.244	50.79	4.376
37	47.94	79.62	1.249	51.09	4.5
38	49.14	79.54	1.254	51.22	4.627
39	50.35	79.62	1.26	51.71	4.75
40	51.54	79.62	1.263	52.2	4.876
41	52.85	79.62	1.268	52.44	5.001
42	54.04	79.62	1.273	52.56	5.125
43	55.30	79.54	1.28	52.75	5.251
44	56.53	79.62	1.286	52.99	5.375
45	57.53	79.62	1.29	53.61	5.501
46	58.87	79.54	1.298	54.04	5.625
47	60.24	79.62	1.302	54.83	5.751
48	61.43	79.62	1.307	54.65	5.876
49	62.49	79.62	1.31	54.83	6
50	63.75	79.62	1.315	54.77	6.126
51	64.73	79.7	1.32	54.89	6.25
52	65.99	79.62	1.322	54.95	6.376
53	67.30	79.62	1.326	55.44	6.501
54	68.52	79.62	1.329	54.95	6.626
55	69.72	79.62	1.33	55.81	6.752
56	71.02	79.62	1.332	56.06	6.875
57	72.17	79.62	1.334	56.06	7.001
58	73.39	79.54	1.337	55.93	7.125
59	74.62	79.62	1.341	56.36	7.251
60	74.95	79.62	1.342	56.42	7.29

DIRECT SHEAR TEST DATA

Project: SAULT STE MARIE LANDFILL
Boring No.: 13-06 G56
Sample No.: G56
Test No.: 120 kPa

Location: WINNEPEG, MB CA
Tested By: BCM
Test Date: 8/1/13
Sample Type: REMOLDED

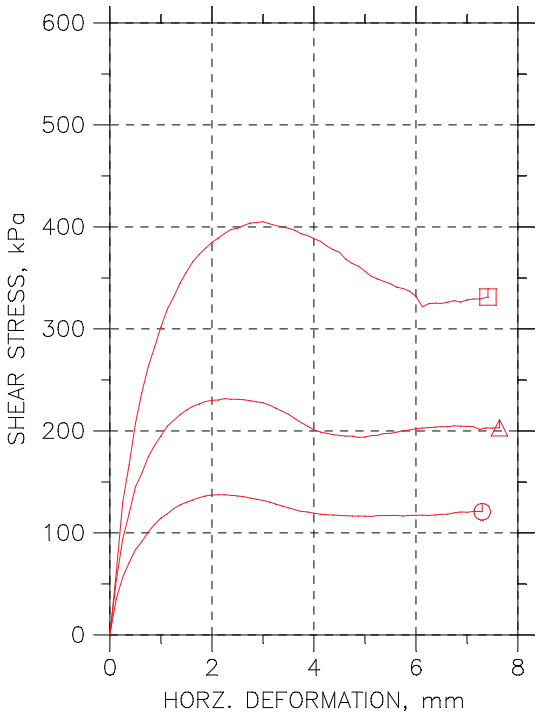
Project No.: 60117627
Checked By: WPQ
Depth: 16.0'
Elevation: -----

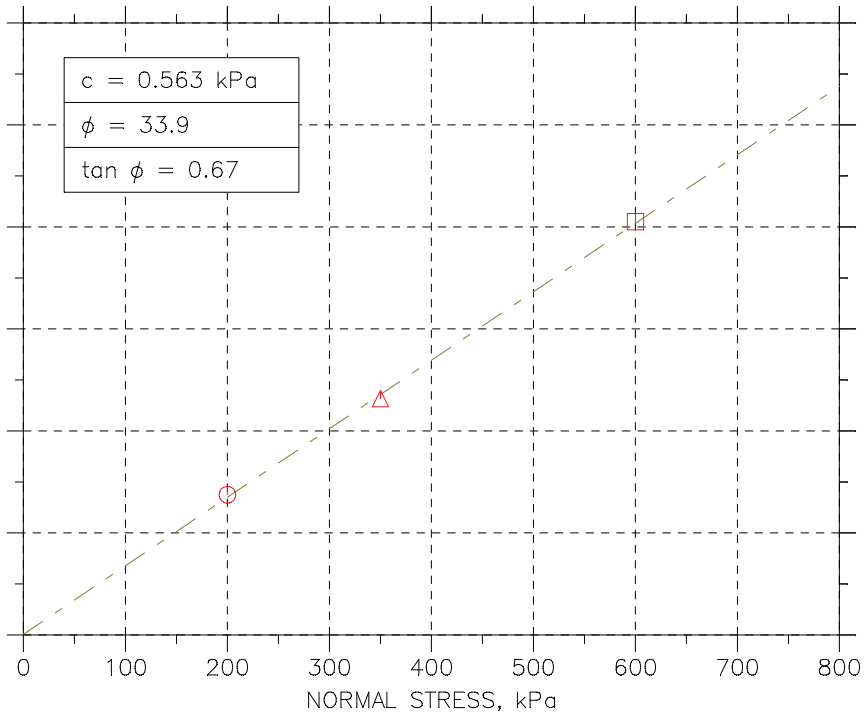
Soil Description: F-C SAND TRACE F-C GRAVEL TRACE SILT - BROWN SP
Remarks: TEST PERFORMED AS PER ASTM D 3080 SPECIMEN REMOLDED TO APPROX.16.0 kN/m3

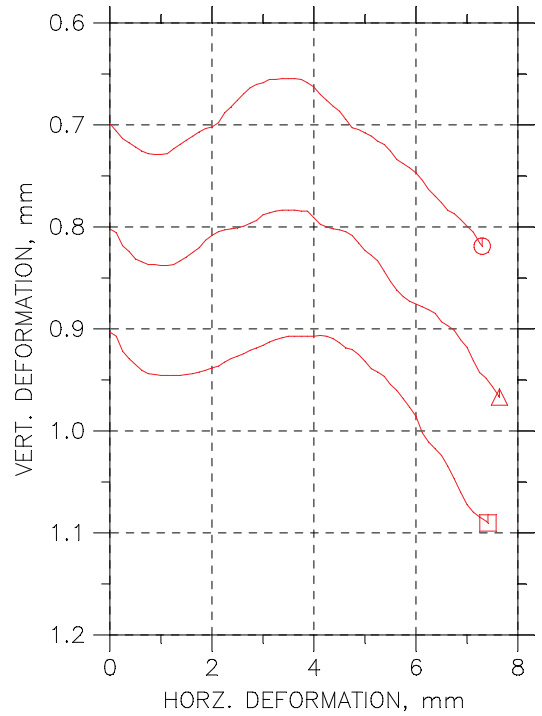
	Elapsed Time min	Vertical Stress kPa	Vertical Displacement mm	Horizontal Stress kPa	Horizontal Displacement mm
1	0.00	120.9	1.324	0	0
2	4.71	120.9	1.34	14.86	0.1255
3	6.06	120.6	1.369	21.46	0.251
4	7.40	120.5	1.393	26.91	0.3753
5	8.57	120.9	1.408	30.69	0.5008
6	9.82	121	1.432	34.46	0.6251
7	11.01	120.8	1.446	37.46	0.7507
8	12.20	120.7	1.46	40.22	0.8762
9	13.39	120.9	1.478	42.73	1
10	14.70	120.7	1.497	45.07	1.126
11	15.94	120.7	1.51	47.23	1.25
12	17.17	120.8	1.52	49.45	1.376
13	18.40	121	1.527	51.24	1.5
14	19.60	121	1.536	53.46	1.626
15	20.90	120.9	1.546	55.32	1.751
16	22.00	121	1.556	56.34	1.875
17	23.16	120.9	1.562	57.96	2.001
18	24.40	121	1.572	59.57	2.125
19	25.65	120.8	1.578	60.95	2.251
20	26.81	120.9	1.581	61.97	2.375
21	28.04	120.9	1.585	63.47	2.501
22	29.34	120.9	1.594	64.13	2.626
23	30.44	121	1.597	65.69	2.75
24	31.75	121	1.603	66.41	2.876
25	33.09	121	1.608	67.49	3
26	34.30	120.9	1.612	68.56	3.126
27	35.38	121	1.616	69.28	3.251
28	36.69	120.9	1.621	70.18	3.376
29	37.72	120.9	1.629	69.76	3.501
30	39.08	120.9	1.631	70.84	3.625
31	40.33	121	1.633	71.98	3.751
32	41.53	121	1.636	72.28	3.875
33	42.78	121	1.639	72.64	4.001
34	43.85	121	1.642	72.82	4.126
35	45.16	121	1.643	73.84	4.25
36	46.28	121	1.644	74.62	4.376
37	47.53	120.7	1.646	75.16	4.5
38	48.74	121	1.648	75.46	4.626
39	49.98	121	1.65	76.18	4.75
40	51.19	121	1.65	76.36	4.876
41	52.50	121	1.65	77.61	5.001
42	53.68	121	1.652	77.25	5.125
43	54.79	121	1.652	77.25	5.251
44	56.00	121	1.653	77.13	5.375
45	57.41	121	1.657	76.3	5.501
46	58.39	121	1.659	77.19	5.625
47	59.53	121	1.661	76.54	5.751
48	60.95	121.1	1.664	77.37	5.876
49	62.19	121	1.665	78.09	6
50	63.48	121	1.666	77.91	6.126
51	64.70	121	1.667	77.91	6.25
52	65.75	121	1.667	78.09	6.376
53	66.99	121	1.671	78.51	6.501
54	68.19	121	1.673	78.81	6.627
55	69.56	121	1.675	79.41	6.751
56	70.76	121	1.678	78.21	6.875
57	72.10	120.9	1.679	79.17	7.001
58	73.11	120.9	1.682	78.87	7.125
59	74.33	121	1.684	79.23	7.251
60	75.40	121	1.684	80.49	7.376
61	76.28	121	1.685	81.21	7.454

DIRECT SHEAR TEST REPORT

AECOM







Symbol		⏲	△	⊡	
Test No.		200 kPa	350 kPa	600 kPa	
Sample No.		S67	S67	S67	
Shape		Circular	Circular	Circular	
Initial	Dimension, mm	63.44	63.43	63.45	
	Area, cm^2	31.609	31.599	31.619	
	Height, mm	29.27	29.24	29.28	
	Water Content, %	17.80	17.60	17.50	
	Dry Density, kN/m^3	16.746	16.802	16.781	
	Saturation, %	85.47	85.32	84.53	
	Void Ratio	0.55189	0.54669	0.54862	
Consol. Height, mm		28.66	28.527	28.468	
Consol. Void Ratio		0.51952	0.50899	0.5057	
Final	Water Content, %	19.30	18.70	18.10	
	Dry Density, kN/m^3	17.228	17.377	17.43	
	Saturation, %	100.59	100.00	97.70	
	Void Ratio	0.50847	0.49555	0.49096	
Normal Stress, kPa		200.01	350.12	600.06	
Max. Shear Stress, kPa		137.44	231.65	405.12	
Ult. Shear Stress, kPa		120.77	203.1	331.24	
Time to Failure, min		24.519	26.373	30.66	
Disp. Rate, mm/min		0.1	0.1	0.1	
Estimated Specific Gravity		2.65	2.65	2.65	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	
Plasticity Index		---	---	---	

Project: SAULT STE MARIE LANDFILL

Location: WINNEPEG, MB CA

Project No.: 60117627

Boring No.: 13-07 S67

Sample Type: REMOLDED

Description: F-C SAND TRACE SILT - BROWN SP

Remarks: TEST PERFORMED AS PER ASTM D 3080 SPECIMEN REMOLDED TO APPROX.16.5 kN/m3

Fri, 02-AUG-2013 15:33:02

DIRECT SHEAR TEST DATA

Project: SAULT STE MARIE LANDFILL
Boring No.: 13-07 S67
Sample No.: S67
Test No.: 200 kPa

Location: WINNEPEG, MB CA
Tested By: BCM
Test Date: 8/1/13
Sample Type: REMOLDED

Project No.: 60117627
Checked By: WPQ
Depth: 70.0'
Elevation: -----

Soil Description: F-C SAND TRACE SILT - BROWN SP
Remarks: TEST PERFORMED AS PER ASTM D 3080 SPECIMEN REMOLDED TO APPROX.16.5 kN/m3

	Elapsed Time min	Vertical Stress kPa	Vertical Displacement mm	Horizontal Stress kPa	Horizontal Displacement mm
1	0.00	199.9	0.6987	0	0
2	4.70	199.6	0.7061	35.21	0.1255
3	6.13	199.9	0.7135	56.46	0.251
4	7.36	199.8	0.7175	70.65	0.3753
5	8.71	199.9	0.7216	83.51	0.5008
6	9.72	199.9	0.7257	91.61	0.6251
7	11.08	199.9	0.7282	101	0.7507
8	12.33	199.9	0.729	108.5	0.8762
9	13.60	200	0.729	114.7	1
10	14.67	199.9	0.7282	118.8	1.126
11	15.99	200	0.7233	123.7	1.25
12	17.19	200	0.7192	127.5	1.376
13	18.35	200.1	0.7151	130.1	1.5
14	19.68	200.1	0.711	132.4	1.627
15	21.06	200	0.7069	134.6	1.751
16	22.18	200.1	0.7036	136.4	1.875
17	23.54	200.1	0.702	137.2	2.001
18	24.52	200	0.6979	137.4	2.125
19	25.76	200	0.6881	137.4	2.251
20	26.89	200	0.6824	137	2.375
21	28.28	200	0.6759	136.4	2.501
22	29.50	200.1	0.6693	135.6	2.626
23	30.67	200	0.6636	134.2	2.75
24	31.91	200	0.6603	133	2.876
25	33.15	200	0.6587	131.9	3
26	34.14	200	0.6554	130.4	3.126
27	35.45	199.6	0.6554	128.2	3.251
28	36.73	199.9	0.6546	126.4	3.376
29	37.89	199.9	0.6546	124.6	3.501
30	39.11	199.9	0.6546	122.8	3.625
31	40.26	199.8	0.6554	121.1	3.751
32	41.46	199.9	0.6587	120.6	3.875
33	42.66	199.8	0.6628	119.3	4.001
34	44.04	199.9	0.6701	118.4	4.126
35	45.18	199.8	0.6759	117.8	4.25
36	46.30	199.9	0.6816	117.6	4.376
37	47.53	199.8	0.6865	117.2	4.5
38	48.72	199.9	0.6947	116.8	4.626
39	50.05	199.9	0.7028	116.7	4.75
40	51.20	199.8	0.7045	116.5	4.876
41	52.47	199.8	0.7077	116.5	5.001
42	53.48	199.8	0.711	116.2	5.125
43	54.87	199.8	0.7159	117	5.251
44	55.90	199.8	0.7192	117	5.375
45	57.20	199.9	0.7257	117.2	5.501
46	58.26	199.9	0.7339	117.1	5.625
47	59.54	199.8	0.738	116.7	5.751
48	60.78	199.8	0.7421	117.2	5.876
49	62.04	199.8	0.747	117.3	6
50	63.14	199.8	0.7543	117.5	6.126
51	64.47	199.7	0.7633	117.1	6.25
52	65.50	199.9	0.7698	117.6	6.376
53	66.80	199.8	0.7764	118.3	6.501
54	68.10	199.9	0.7837	118.4	6.626
55	69.30	199.8	0.787	119.6	6.751
56	70.42	199.8	0.7927	120.5	6.875
57	71.57	199.8	0.7993	120.3	7.001
58	72.89	199.9	0.805	121.1	7.125
59	74.19	199.8	0.8156	121.1	7.251
60	74.59	199.9	0.8189	120.8	7.299

DIRECT SHEAR TEST DATA

Project: SAULT STE MARIE LANDFILL
Boring No.: 13-07 S67
Sample No.: S67
Test No.: 350 kPa

Location: WINNEPEG, MB CA
Tested By: BCM
Test Date: 8/1/13
Sample Type: REMOLDED

Project No.: 60117627
Checked By: WPQ
Depth: 70.0'
Elevation: -----

Soil Description: F-C SAND TRACE SILT - BROWN SP
Remarks: TEST PERFORMED AS PER ASTM D 3080 SPECIMEN REMOLDED TO APPROX.16.5 kN/m3

	Elapsed Time min	Vertical Stress kPa	Vertical Displacement mm	Horizontal Stress kPa	Horizontal Displacement mm
1	0.00	349.9	0.802	0	0
2	5.17	349.7	0.8056	53.29	0.1255
3	6.60	349.7	0.8185	93.58	0.251
4	7.76	349.8	0.824	118.7	0.3753
5	9.31	349.9	0.8314	145.2	0.5008
6	10.29	349.9	0.8342	158.6	0.6251
7	11.68	349.9	0.8369	174.7	0.7507
8	12.92	350.1	0.8369	185.8	0.8762
9	14.09	350	0.8379	195.1	1
10	15.49	350	0.8379	204.6	1.126
11	16.49	350	0.8369	210.4	1.251
12	17.81	350.1	0.8333	216	1.376
13	19.00	350.1	0.8296	220.3	1.5
14	20.37	350.1	0.825	224.2	1.626
15	21.49	350	0.8204	226.5	1.751
16	22.70	350	0.813	228.8	1.875
17	23.86	350	0.8084	230	2.001
18	25.03	350	0.8047	230.5	2.125
19	26.37	350.1	0.8029	231.7	2.251
20	27.52	350.1	0.802	231.1	2.375
21	28.73	350.1	0.801	231.1	2.501
22	29.90	350	0.7992	230.5	2.626
23	31.09	350.1	0.7964	229.6	2.75
24	32.33	350	0.7937	228.5	2.876
25	33.64	350	0.7881	227.5	3
26	34.74	350	0.7863	225.3	3.126
27	36.04	350	0.7845	222.4	3.251
28	37.27	350	0.7835	219.5	3.376
29	38.40	349.9	0.7835	216.3	3.501
30	39.69	349.9	0.7835	212.1	3.625
31	40.82	349.9	0.7845	208.2	3.751
32	41.85	349.9	0.7845	204.9	3.875
33	43.30	349.9	0.7909	200.8	4.001
34	44.40	349.8	0.7973	199.1	4.126
35	45.68	349.9	0.8001	197.6	4.25
36	46.77	349.9	0.802	196.4	4.376
37	47.95	349.9	0.8029	195.6	4.5
38	49.19	349.8	0.8047	194.9	4.627
39	50.47	349.9	0.8084	194.9	4.75
40	51.75	349.8	0.8158	193.7	4.876
41	52.92	349.9	0.8231	194	5.001
42	54.08	349.8	0.8277	195.4	5.125
43	55.32	349.9	0.8333	195.8	5.251
44	56.55	349.8	0.8434	197.4	5.375
45	57.72	349.9	0.8535	197.6	5.501
46	58.90	349.9	0.8618	198.9	5.625
47	60.14	349.9	0.8682	200.1	5.751
48	61.35	349.8	0.8728	200.8	5.876
49	62.66	349.9	0.8756	202.1	6
50	63.82	349.8	0.8784	202.8	6.126
51	64.86	349.7	0.8811	203.2	6.25
52	66.14	349.9	0.8848	203.7	6.376
53	67.54	349.8	0.8931	204.2	6.501
54	68.69	349.9	0.8968	204	6.626
55	69.75	349.8	0.9014	204.9	6.751
56	71.10	349.8	0.9106	204.7	6.875
57	72.07	349.8	0.918	204.3	7.001
58	73.29	349.9	0.9309	204.2	7.125
59	74.62	349.9	0.9428	201.5	7.251
60	75.80	349.9	0.9483	203	7.376
61	76.94	349.9	0.9566	202.8	7.5
62	78.24	349.9	0.9658	203.2	7.626
63	78.33	349.9	0.9668	203.1	7.639

DIRECT SHEAR TEST DATA

Project: SAULT STE MARIE LANDFILL
Boring No.: 13-07 S67
Sample No.: S67
Test No.: 600 kPa

Location: WINNEPEG, MB CA
Tested By: BCM
Test Date: 8/1/13
Sample Type: REMOLDED

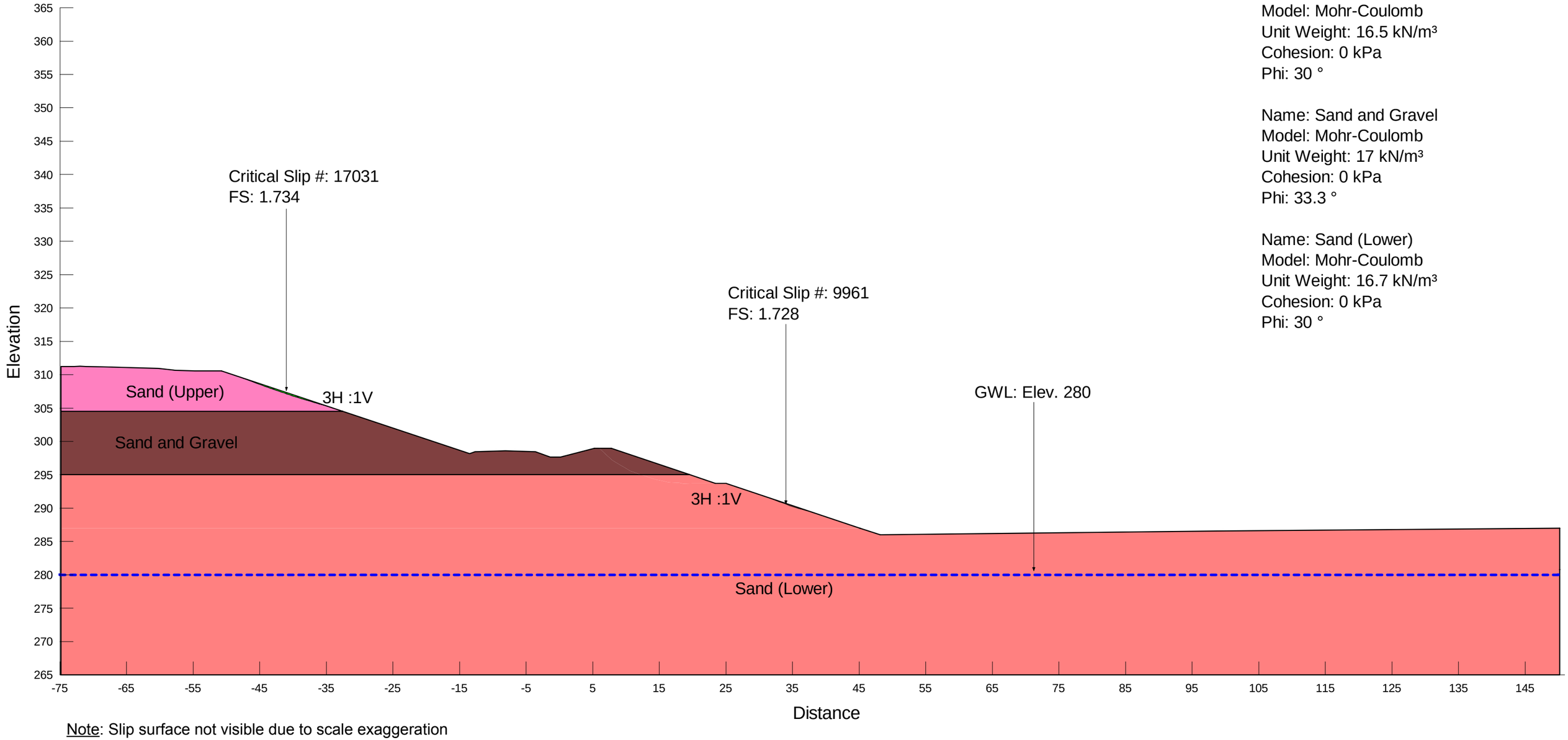
Project No.: 60117627
Checked By: WPQ
Depth: 70.0'
Elevation: -----

Soil Description: F-C SAND TRACE SILT - BROWN SP
Remarks: TEST PERFORMED AS PER ASTM D 3080 SPECIMEN REMOLDED TO APPROX.16.5 kN/m3

	Elapsed Time min	Vertical Stress kPa	Vertical Displacement mm	Horizontal Stress kPa	Horizontal Displacement mm
1	0.00	599.9	0.9031	0	0
2	1.82	599.8	0.9071	61.11	0.1255
3	3.44	599.7	0.9218	129.9	0.251
4	4.51	599.9	0.9292	166.5	0.3753
5	5.92	599.8	0.9349	207.4	0.5008
6	7.21	599.9	0.9406	237.8	0.6251
7	8.47	599.9	0.9439	263	0.7507
8	9.62	599.9	0.9447	282.5	0.8762
9	10.88	599.9	0.9455	301.9	1
10	12.20	600.1	0.9455	319.3	1.126
11	13.28	600	0.9455	331.3	1.25
12	14.68	600.1	0.9455	345.1	1.376
13	15.88	600.1	0.9447	355.8	1.5
14	17.13	600.1	0.9439	365.7	1.626
15	18.22	600.1	0.9423	372.9	1.751
16	19.59	600.1	0.9406	379.1	1.875
17	20.80	600.1	0.9382	384.8	2.001
18	21.97	600.1	0.9366	389.1	2.125
19	23.24	600.1	0.9325	393.6	2.251
20	24.54	600.1	0.9292	397.4	2.375
21	25.74	600.1	0.9268	398.6	2.501
22	26.91	600.1	0.9243	401.4	2.626
23	28.30	600.1	0.921	403.9	2.75
24	29.39	600.1	0.9186	404.3	2.876
25	30.66	600.1	0.9161	405.1	3
26	31.91	600.1	0.9129	403.1	3.126
27	33.13	600	0.9104	401.4	3.251
28	34.42	600.1	0.9088	399.8	3.376
29	35.59	600	0.9071	398.8	3.501
30	36.60	599.9	0.9071	396.7	3.625
31	38.05	600	0.9071	393.1	3.751
32	39.13	600	0.9071	391.7	3.875
33	40.53	599.9	0.9071	388.5	4.001
34	41.63	600	0.9063	385.9	4.126
35	42.81	599.9	0.9071	381.5	4.25
36	44.01	599.9	0.9096	377.7	4.376
37	45.30	599.9	0.9137	375.2	4.5
38	46.61	599.9	0.9186	368.2	4.626
39	47.78	599.9	0.9202	364.1	4.75
40	48.82	599.9	0.9251	361.5	4.876
41	50.06	599.8	0.9317	356.6	5.001
42	51.34	599.9	0.939	351.5	5.125
43	52.48	599.9	0.9423	349	5.251
44	53.68	599.8	0.9464	346.5	5.375
45	54.83	599.9	0.9545	344.2	5.501
46	56.10	599.8	0.9603	341	5.625
47	57.38	599.8	0.9684	339.5	5.751
48	58.64	599.9	0.9766	337.1	5.876
49	59.67	599.8	0.9856	331.9	6
50	60.94	599.7	1.002	321.6	6.126
51	62.25	599.9	1.011	324.6	6.25
52	63.42	599.8	1.017	325.2	6.376
53	64.51	599.7	1.024	325	6.501
54	65.91	599.9	1.035	326.2	6.626
55	66.96	599.8	1.047	327.6	6.751
56	68.21	599.7	1.06	326.4	6.875
57	69.53	599.9	1.072	328.4	7.001
58	70.62	599.8	1.08	329.4	7.125
59	71.88	599.8	1.084	329.4	7.251
60	73.12	599.8	1.089	330.8	7.377
61	73.46	599.8	1.09	331.2	7.414

Appendix F
Slope Stability Analysis

Figure 01: Cell 1 Excavation - Section 1+400 - 2014



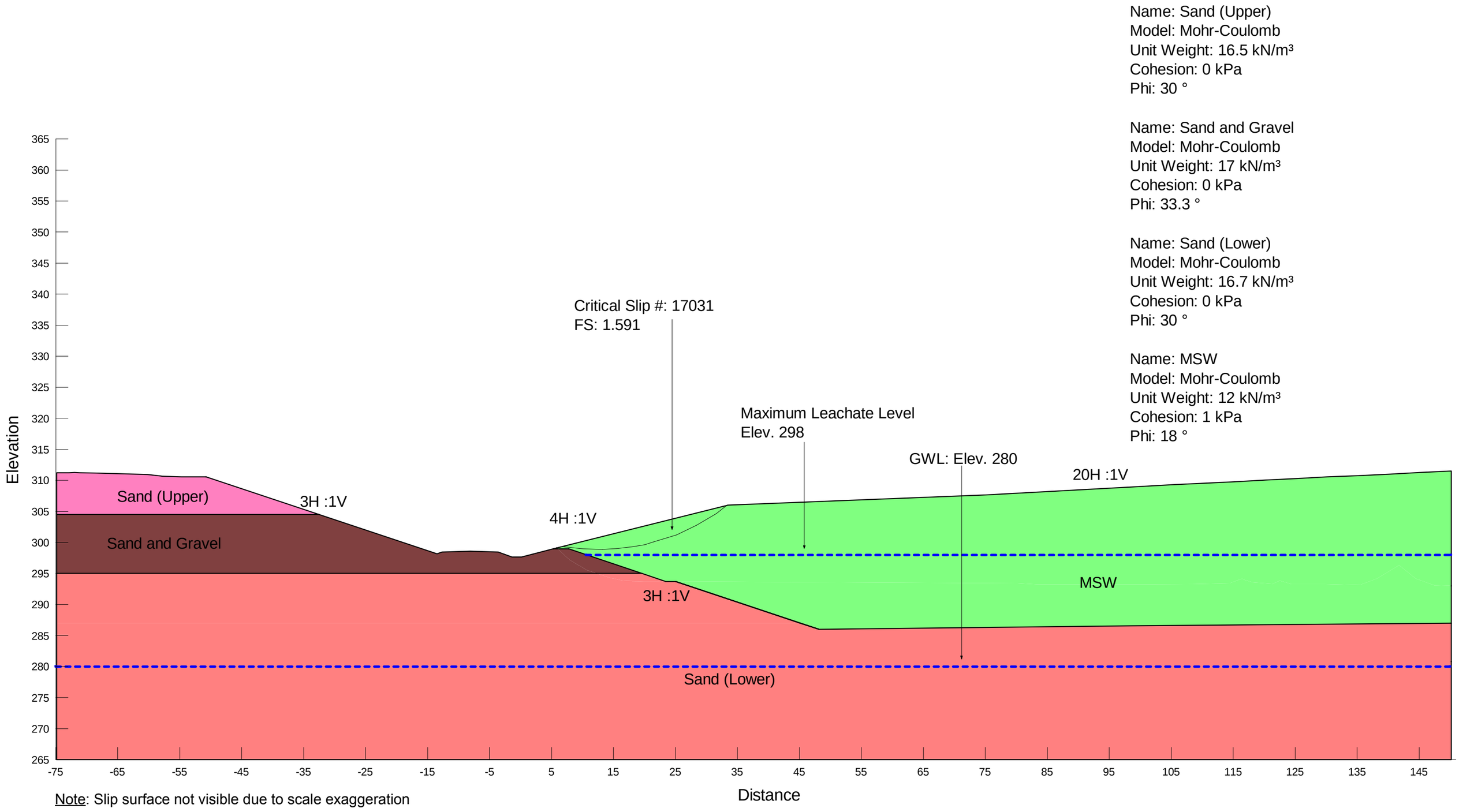
Name: Sand (Upper)
Model: Mohr-Coulomb
Unit Weight: 16.5 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Sand and Gravel
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 0 kPa
Phi: 33.3 °

Name: Sand (Lower)
Model: Mohr-Coulomb
Unit Weight: 16.7 kN/m³
Cohesion: 0 kPa
Phi: 30 °

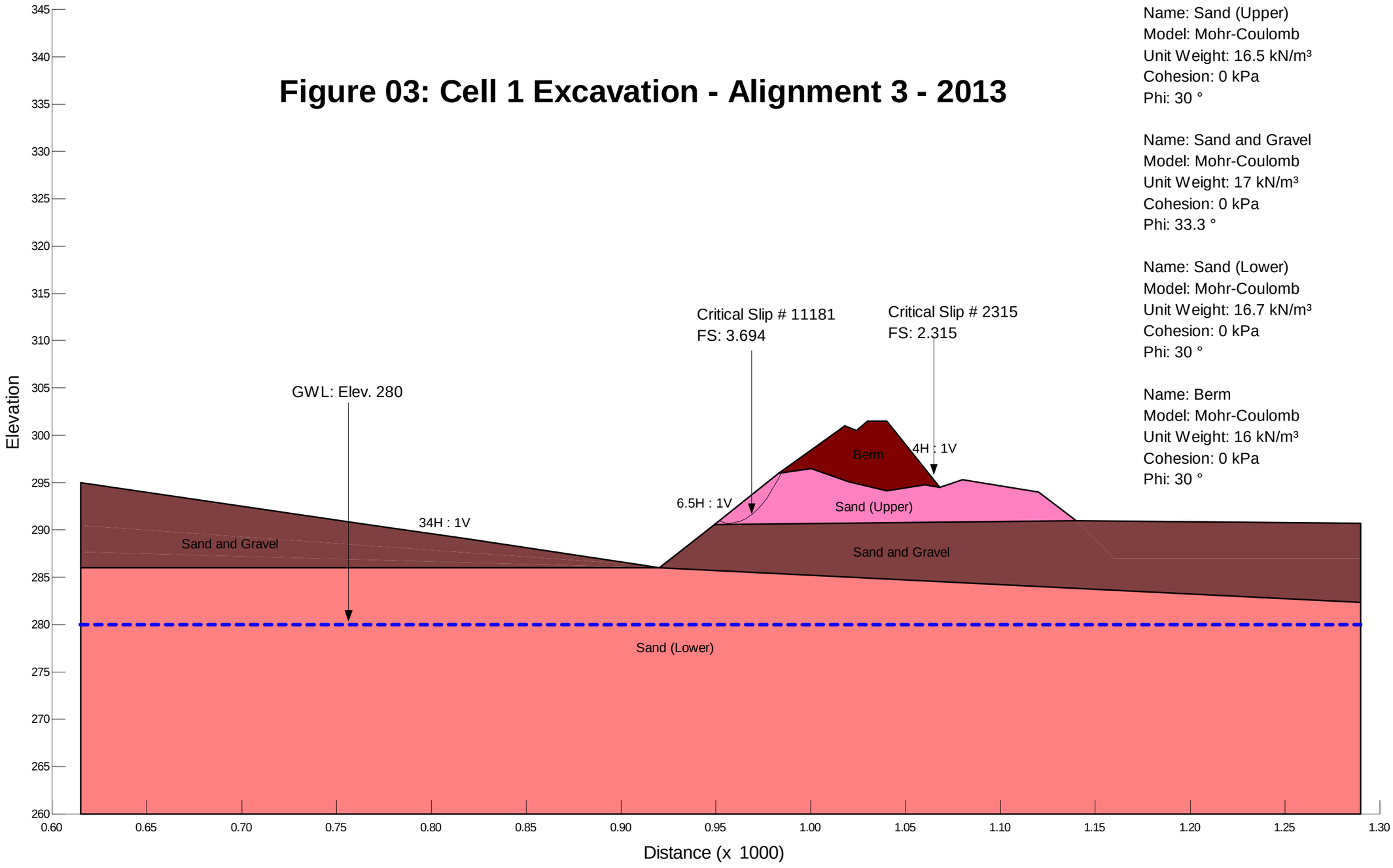
Note: Slip surface not visible due to scale exaggeration

Figure 02: Cell 1 Final Cover - Section 1+400 - 2014



Note: Slip surface not visible due to scale exaggeration

Figure 03: Cell 1 Excavation - Alignment 3 - 2013



Name: Sand (Upper)
Model: Mohr-Coulomb
Unit Weight: 16.5 kN/m³
Cohesion: 0 kPa
Phi: 30 °

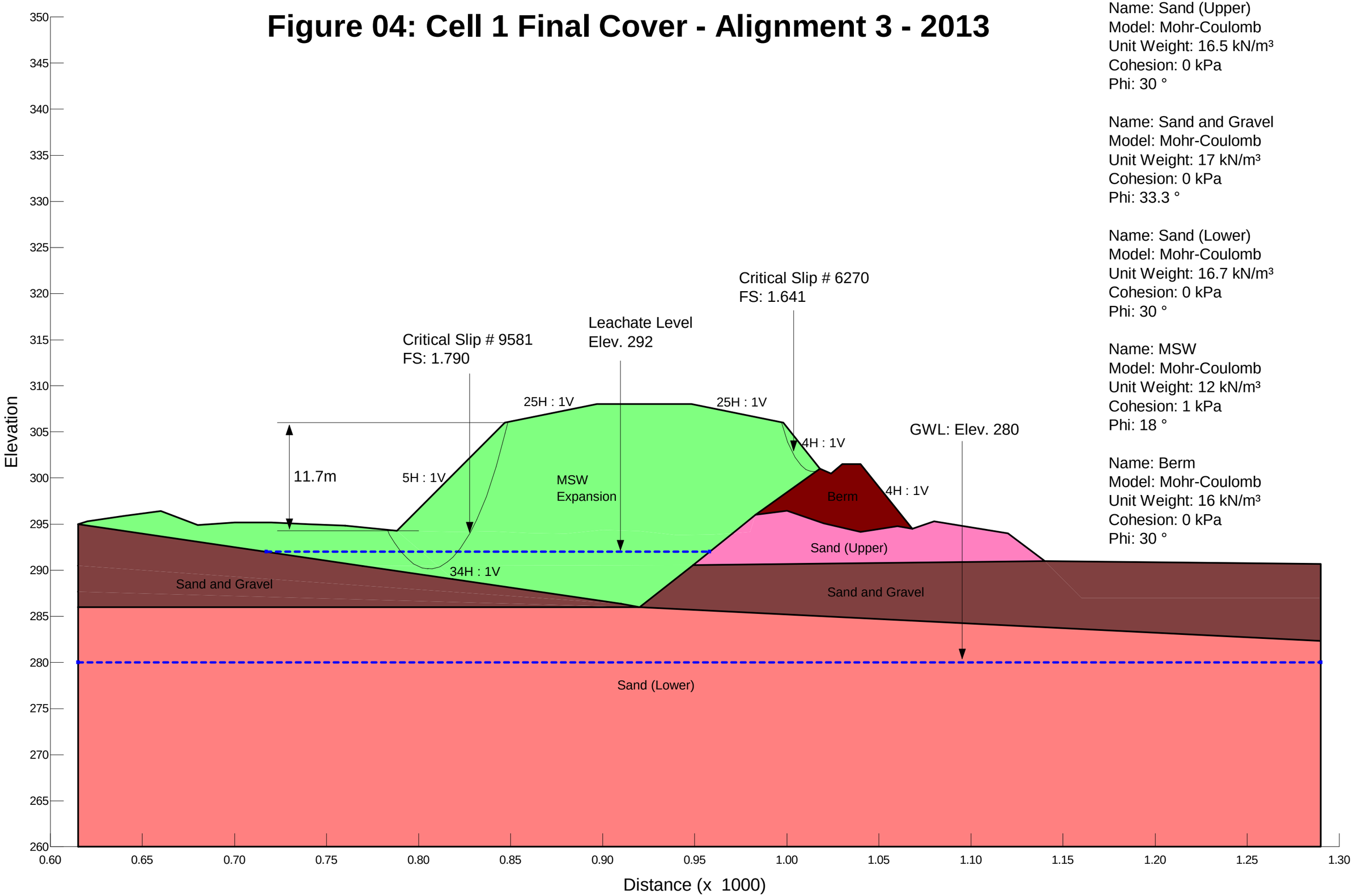
Name: Sand and Gravel
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 0 kPa
Phi: 33.3 °

Name: Sand (Lower)
Model: Mohr-Coulomb
Unit Weight: 16.7 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Berm
Model: Mohr-Coulomb
Unit Weight: 16 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Note: Berm slip surface not visible due to scale exaggeration

Figure 04: Cell 1 Final Cover - Alignment 3 - 2013



Name: Sand (Upper)
Model: Mohr-Coulomb
Unit Weight: 16.5 kN/m³
Cohesion: 0 kPa
Phi: 30 °

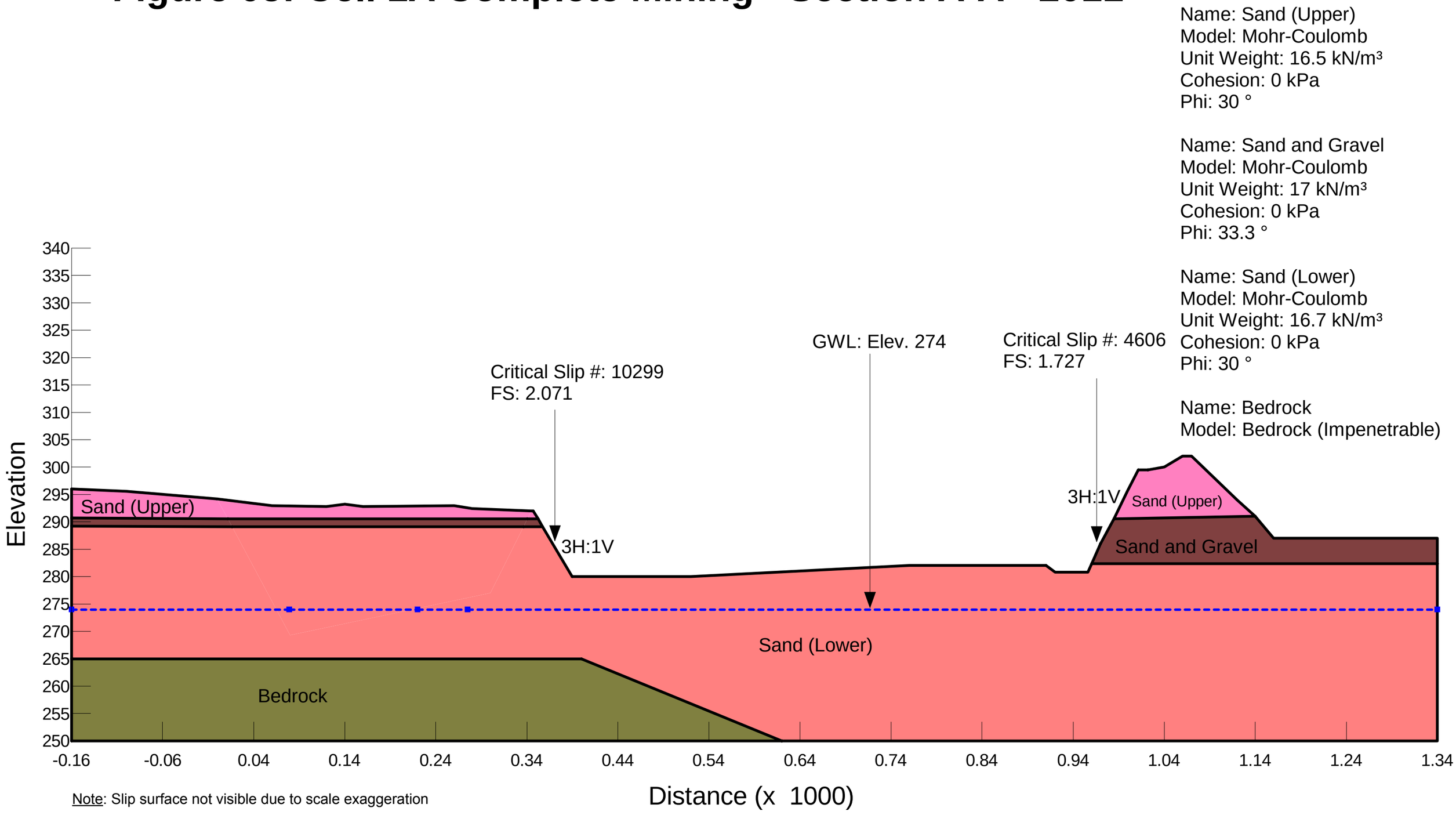
Name: Sand and Gravel
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 0 kPa
Phi: 33.3 °

Name: Sand (Lower)
Model: Mohr-Coulomb
Unit Weight: 16.7 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: MSW
Model: Mohr-Coulomb
Unit Weight: 12 kN/m³
Cohesion: 1 kPa
Phi: 18 °

Name: Berm
Model: Mohr-Coulomb
Unit Weight: 16 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Figure 05: Cell 1A Complete Mining - Section A-A - 2011



Note: Slip surface not visible due to scale exaggeration

Figure 06: Cell 1A Final Cover - Section A-A - 2011

Name: Sand (Upper)
Model: Mohr-Coulomb
Unit Weight: 16.5 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Sand and Gravel
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 0 kPa
Phi: 33.3 °

Name: Sand (Lower)
Model: Mohr-Coulomb
Unit Weight: 16.7 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Bedrock
Model: Bedrock (Impenetrable)

Name: MSW
Model: Mohr-Coulomb
Unit Weight: 12 kN/m³
Cohesion: 1 kPa
Phi: 18 °

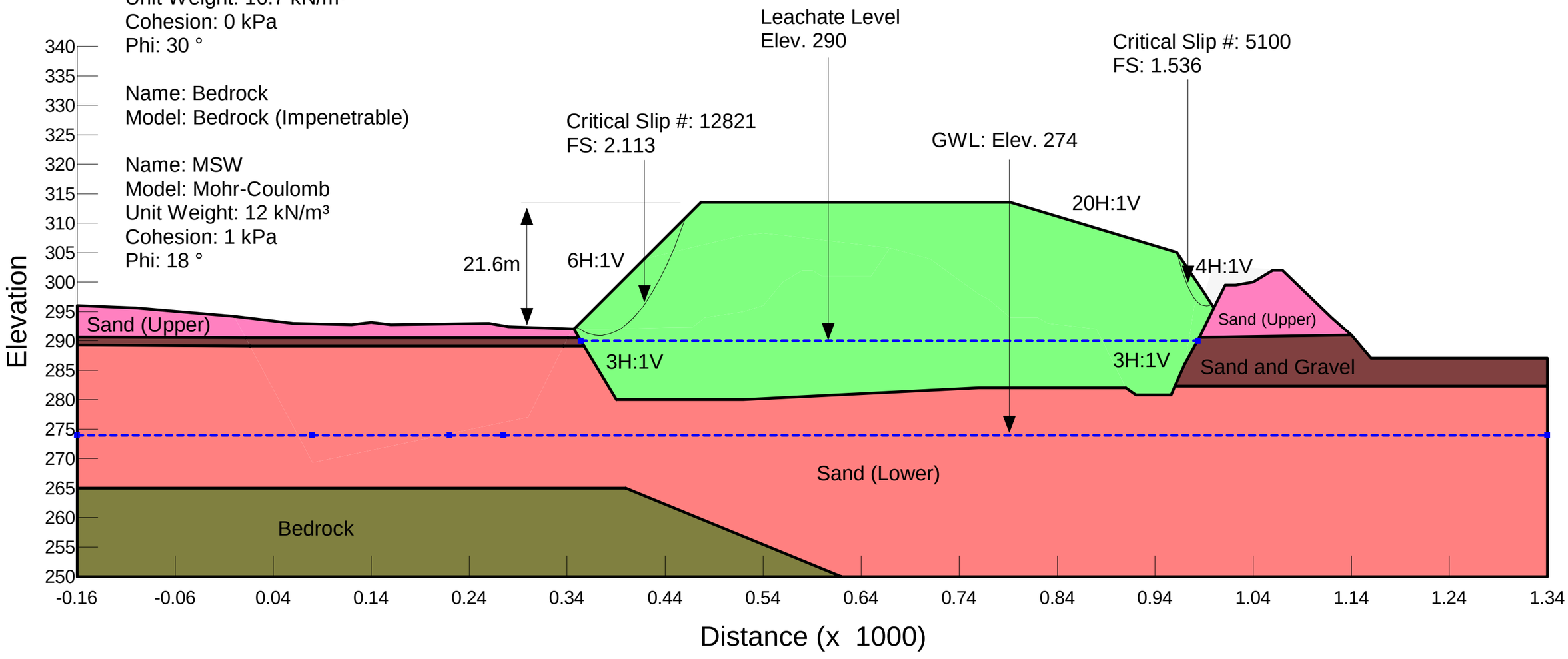
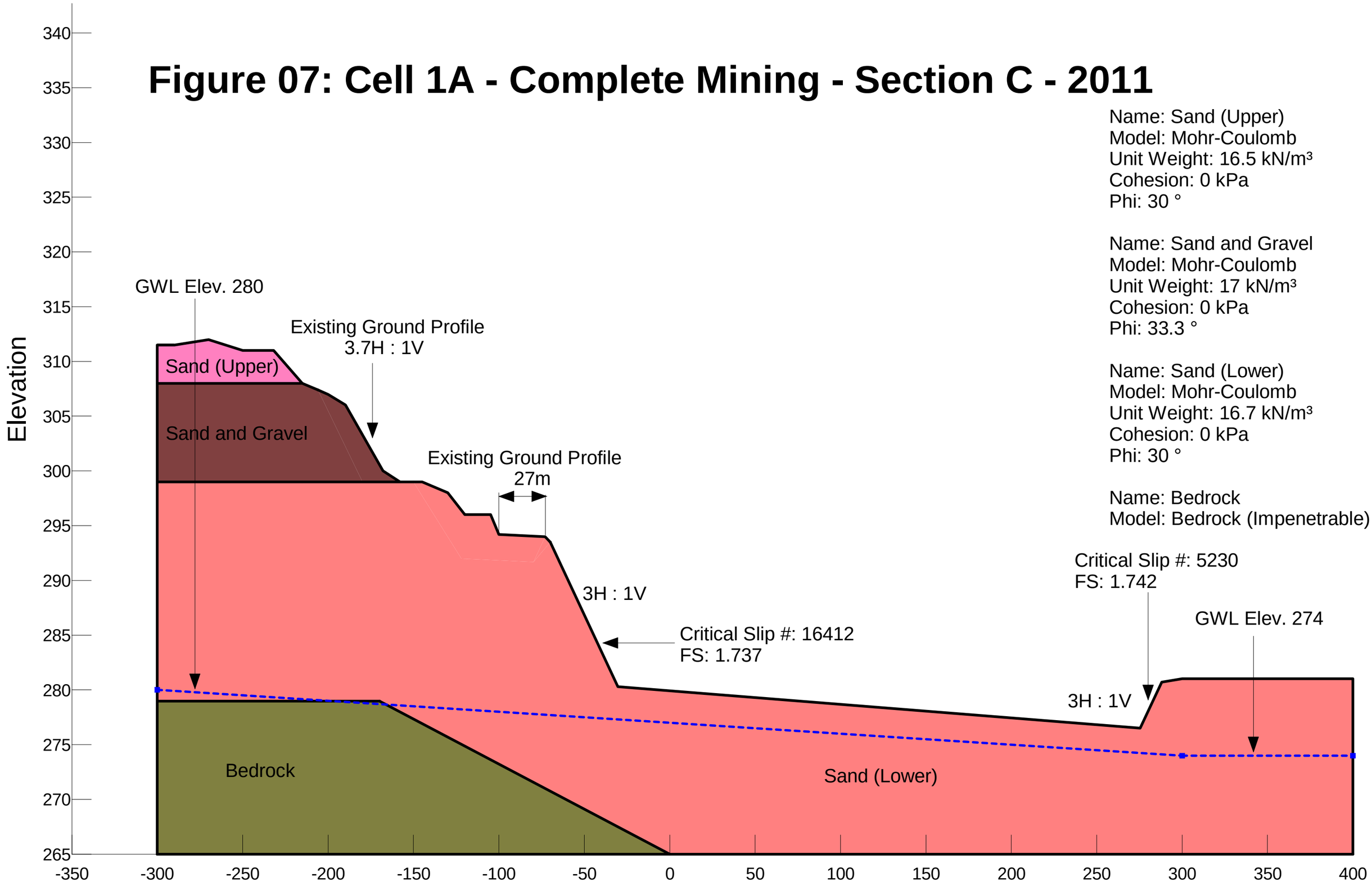


Figure 07: Cell 1A - Complete Mining - Section C - 2011



Name: Sand (Upper)
Model: Mohr-Coulomb
Unit Weight: 16.5 kN/m³
Cohesion: 0 kPa
Phi: 30 °

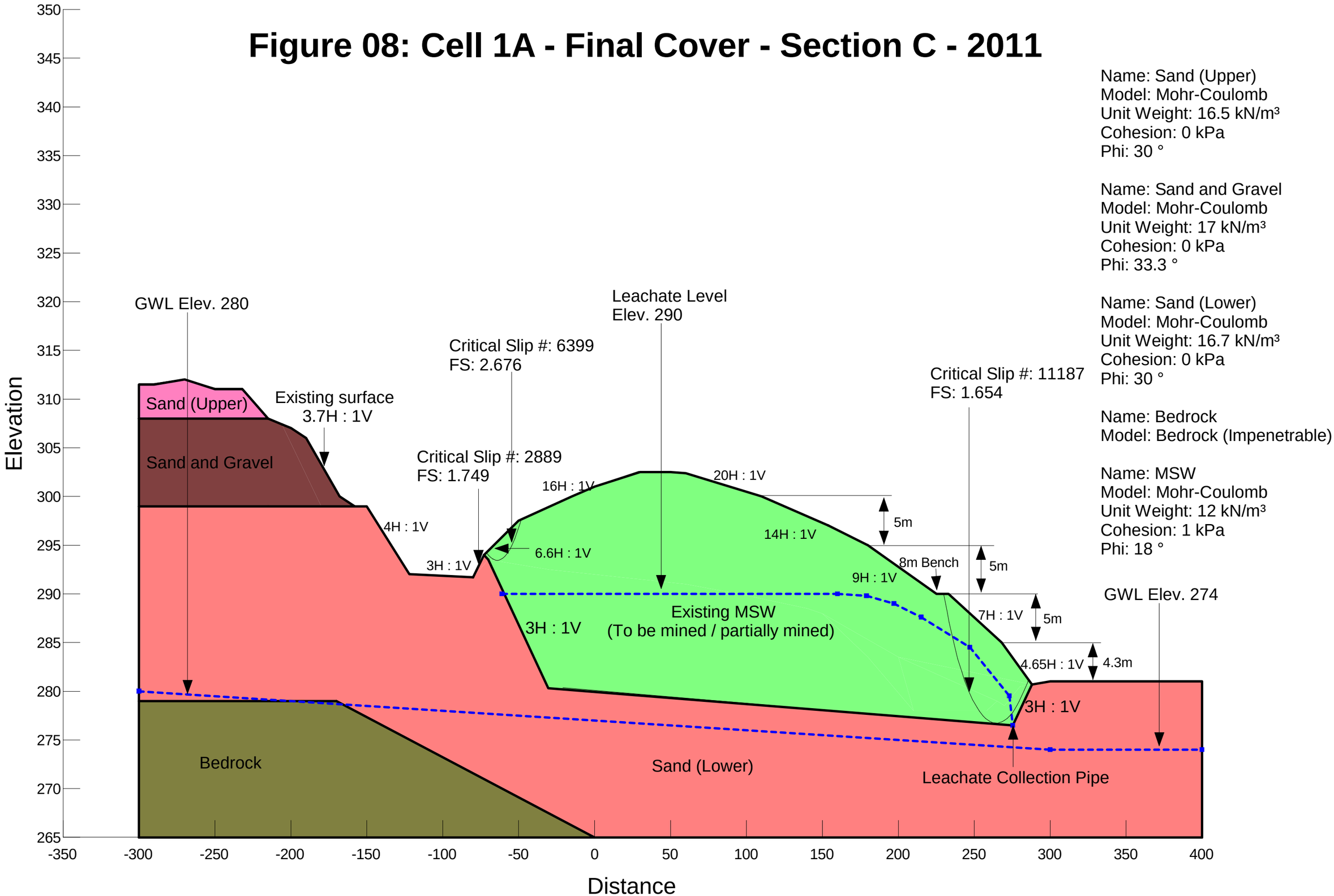
Name: Sand and Gravel
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 0 kPa
Phi: 33.3 °

Name: Sand (Lower)
Model: Mohr-Coulomb
Unit Weight: 16.7 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Bedrock
Model: Bedrock (Impenetrable)

Note: Slip surface not visible due to scale exaggeration

Figure 08: Cell 1A - Final Cover - Section C - 2011



Name: Sand (Upper)
Model: Mohr-Coulomb
Unit Weight: 16.5 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Sand and Gravel
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 0 kPa
Phi: 33.3 °

Name: Sand (Lower)
Model: Mohr-Coulomb
Unit Weight: 16.7 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Bedrock
Model: Bedrock (Impenetrable)

Name: MSW
Model: Mohr-Coulomb
Unit Weight: 12 kN/m³
Cohesion: 1 kPa
Phi: 18 °

Figure 09: Cell 2 Excavation - Alignment 2A - 2013

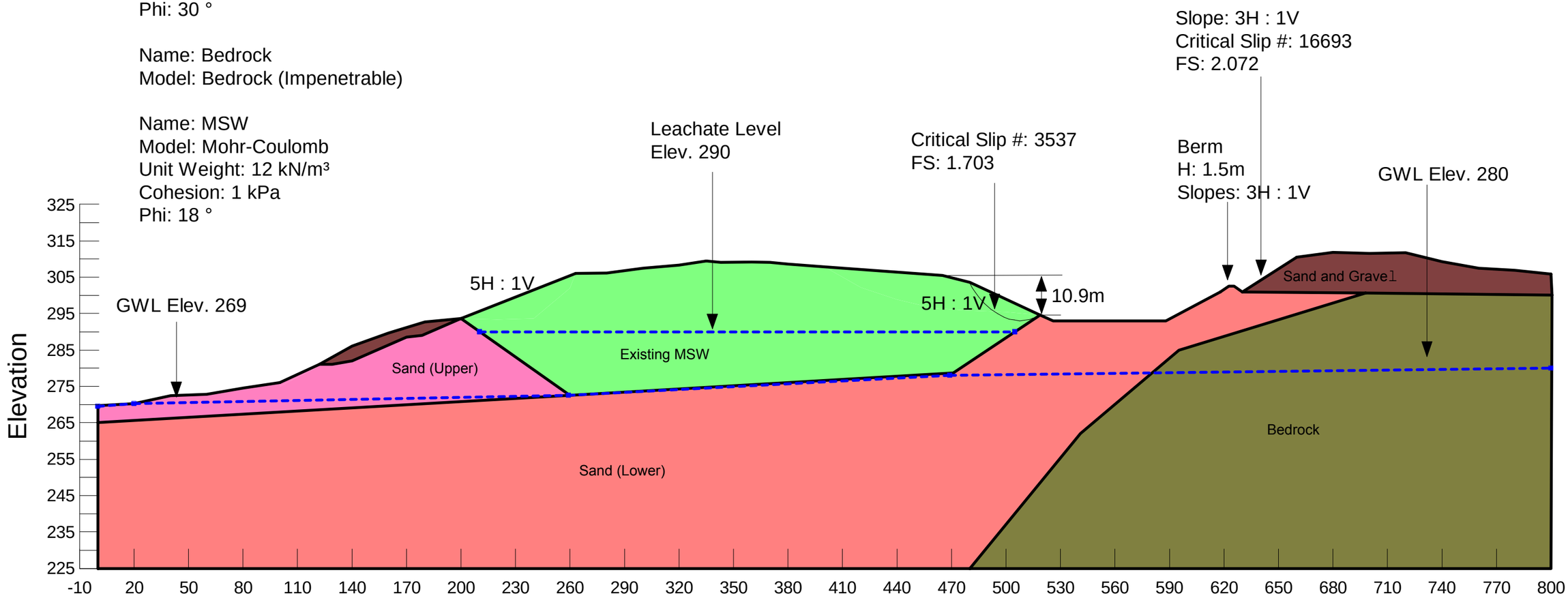
Name: Sand (upper)
Model: Mohr-Coulomb
Unit Weight: 16.5 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Sand and Gravel
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 0 kPa
Phi: 33.3 °

Name: Sand (lower)
Model: Mohr-Coulomb
Unit Weight: 16.7 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Bedrock
Model: Bedrock (Impenetrable)

Name: MSW
Model: Mohr-Coulomb
Unit Weight: 12 kN/m³
Cohesion: 1 kPa
Phi: 18 °



Note: Slip surface in sand and gravel unit not visible due to scale exaggeration

Figure 10: Cell 2 - Final Cover - Alignment 2A - 2013

Name: Sand (Upper)
Model: Mohr-Coulomb
Unit Weight: 16.5 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Sand and Gravel
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 0 kPa
Phi: 33.3 °

Name: Sand (Lower)
Model: Mohr-Coulomb
Unit Weight: 16.7 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Bedrock
Model: Bedrock (Impenetrable)

Name: MSW
Model: Mohr-Coulomb
Unit Weight: 12 kN/m³
Cohesion: 1 kPa
Phi: 18 °

Name: Berm
Model: Mohr-Coulomb
Unit Weight: 16 kN/m³
Cohesion: 0 kPa
Phi: 30 °

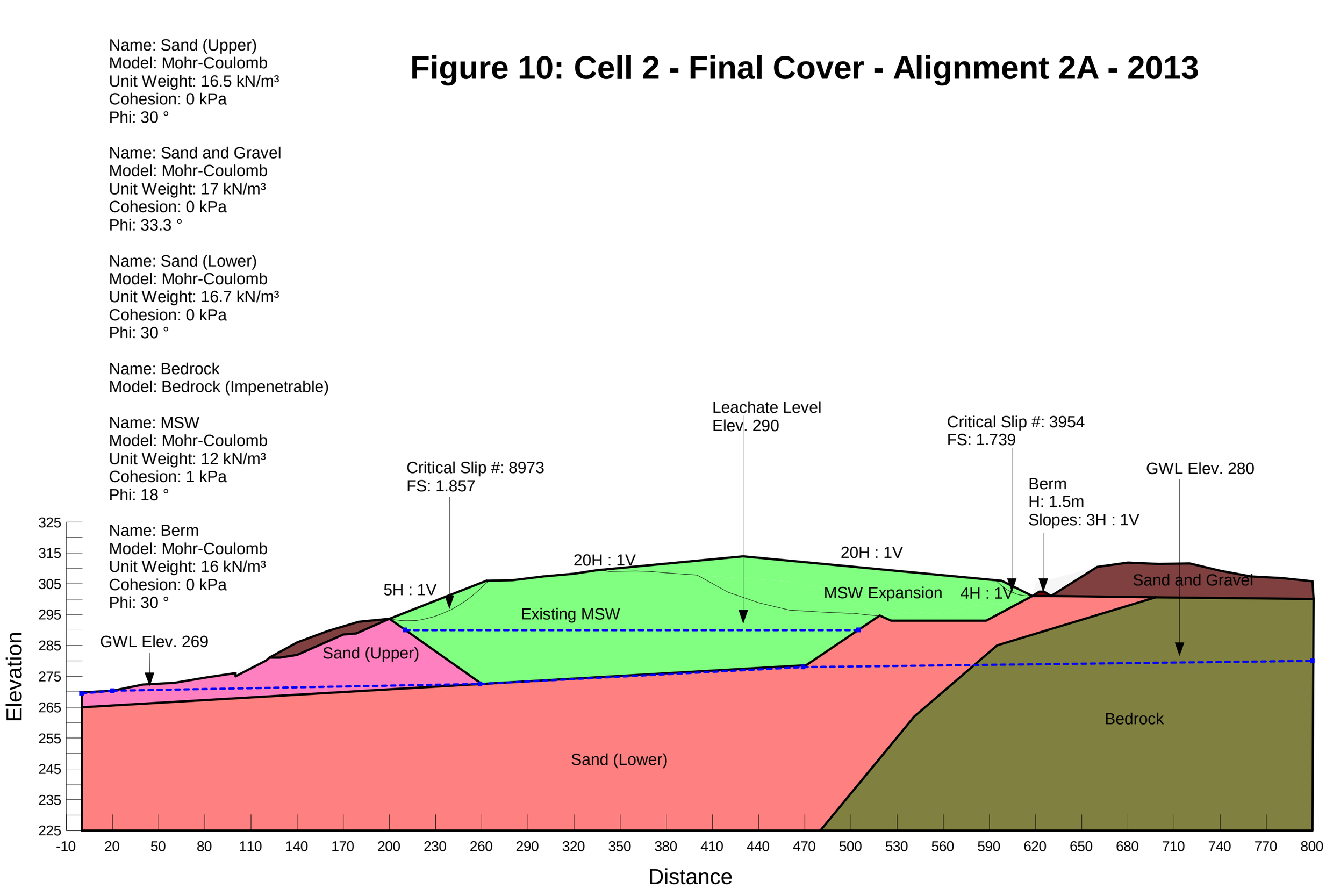


Figure 11 - Cell 2 Excavation - Alignment 3 - 2013

Name: Sand (upper)
Model: Mohr-Coulomb
Unit Weight: 16.5 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Sand and Gravel
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 0 kPa
Phi: 33.3 °

Name: Sand (lower)
Model: Mohr-Coulomb
Unit Weight: 16.7 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Bedrock
Model: Bedrock (Impenetrable)

Name: MSW
Model: Mohr-Coulomb
Unit Weight: 12 kN/m³
Cohesion: 1 kPa
Phi: 18 °

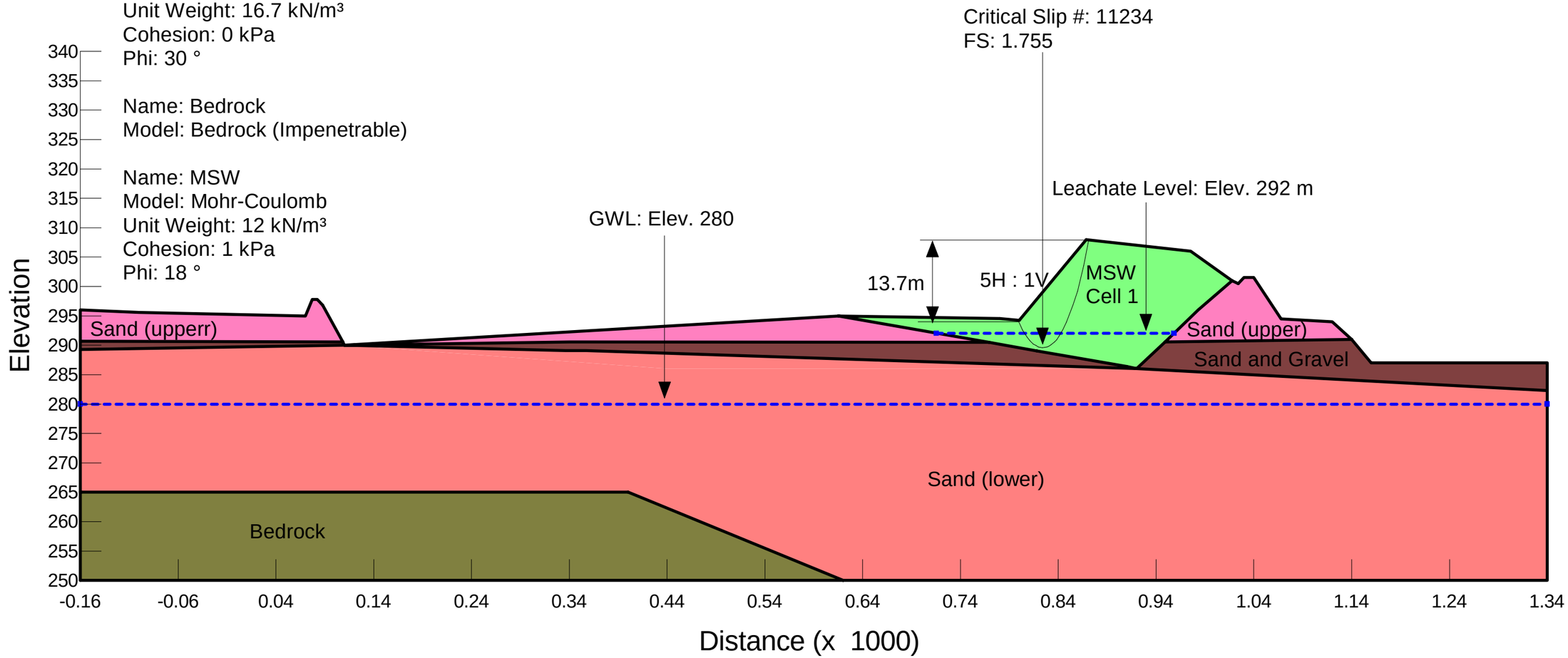


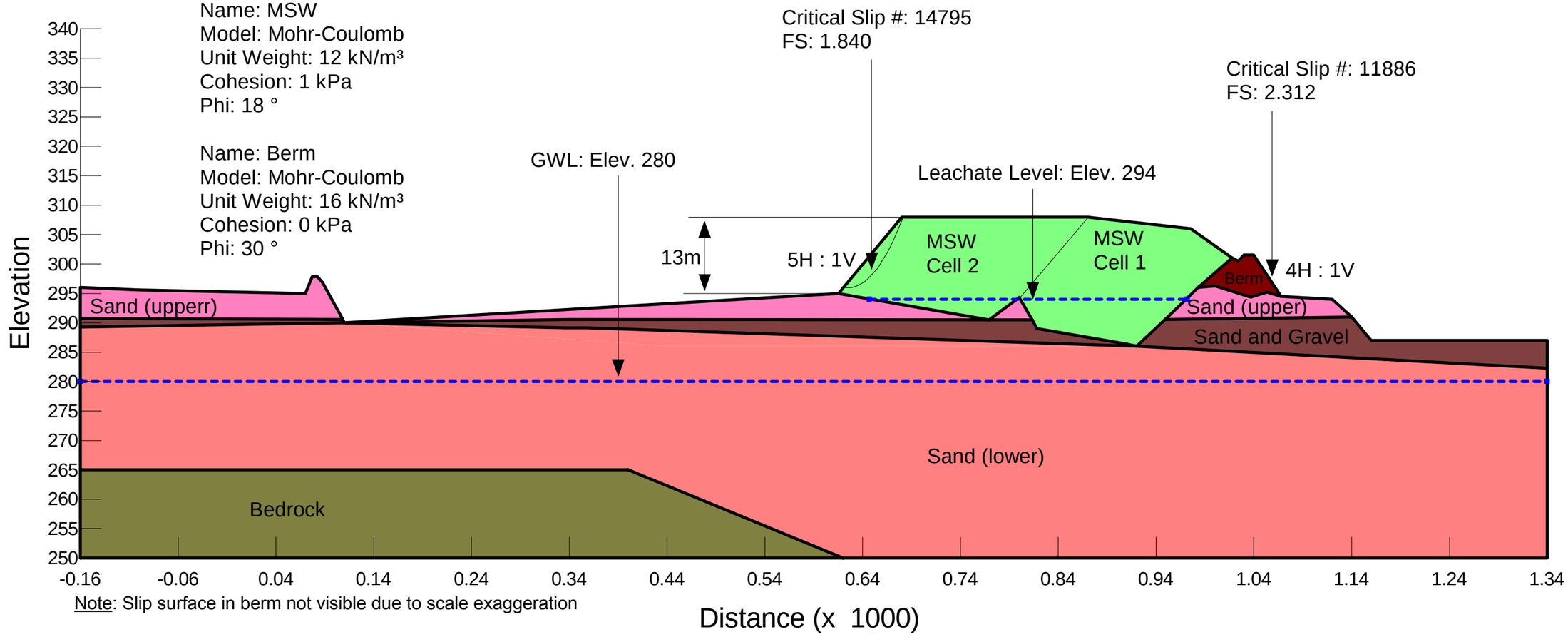
Figure 12: Cell 2 Final Cover - Alignment 3 - 2013

Name: Sand (upper)
Model: Mohr-Coulomb
Unit Weight: 16.5 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Sand and Gravel
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 0 kPa
Phi: 33.3 °

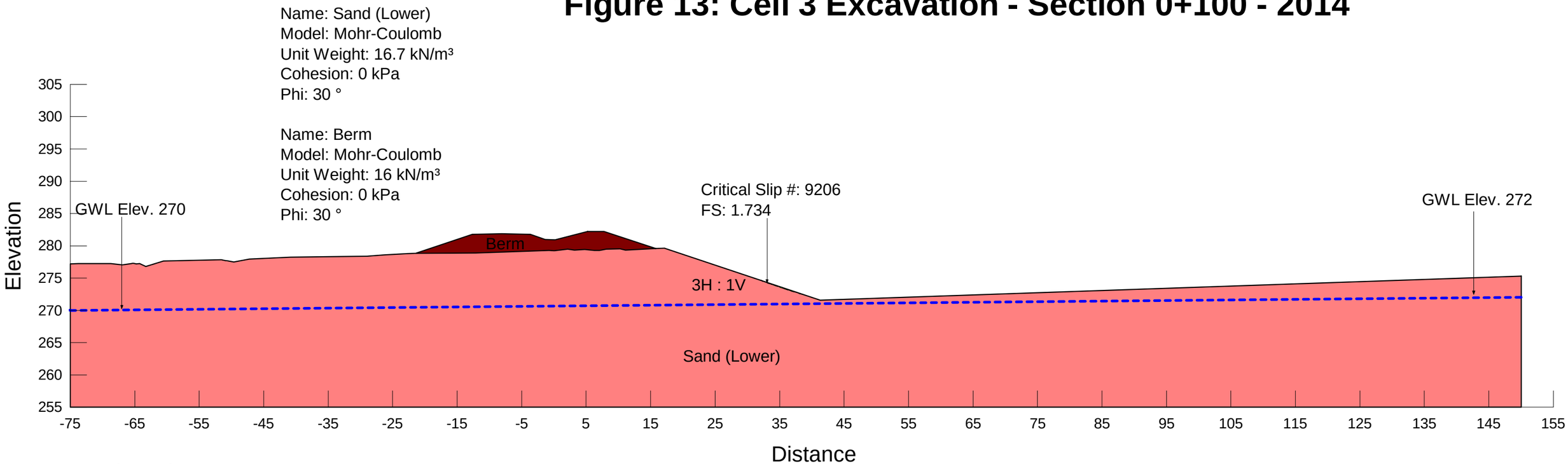
Name: Sand (lower)
Model: Mohr-Coulomb
Unit Weight: 16.7 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Bedrock
Model: Bedrock (Impenetrable)



Note: Slip surface in berm not visible due to scale exaggeration

Figure 13: Cell 3 Excavation - Section 0+100 - 2014



Note: Slip surface not visible due to scale exaggeration

Figure 14: Cell 3 Final Cover - Section 0+100 - 2014

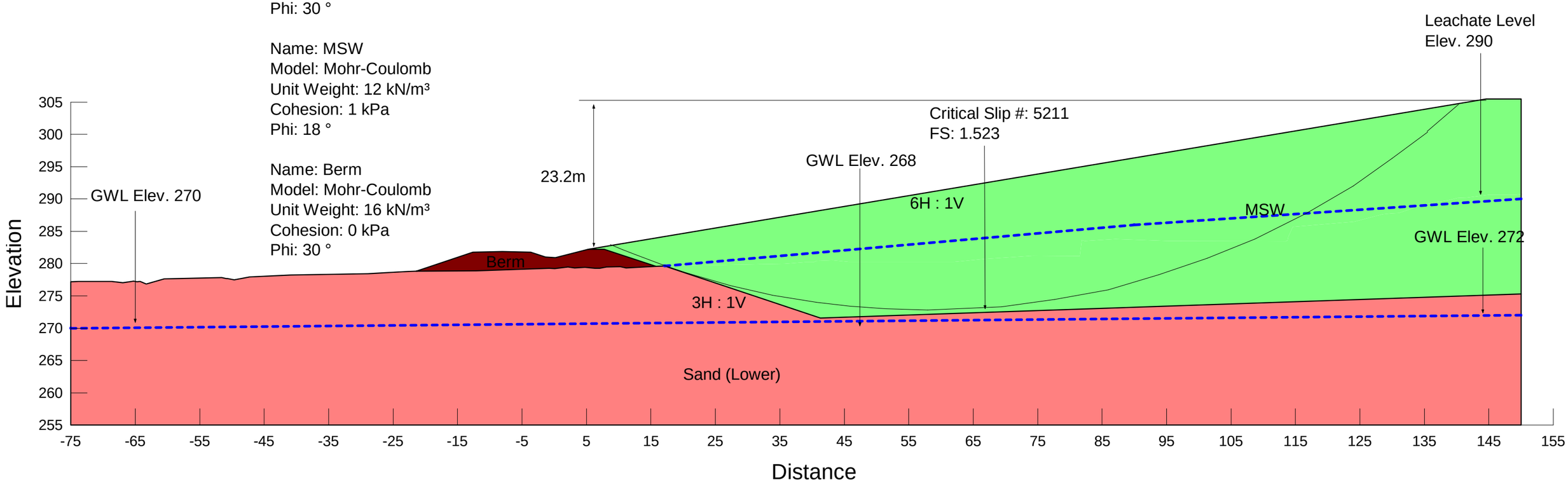
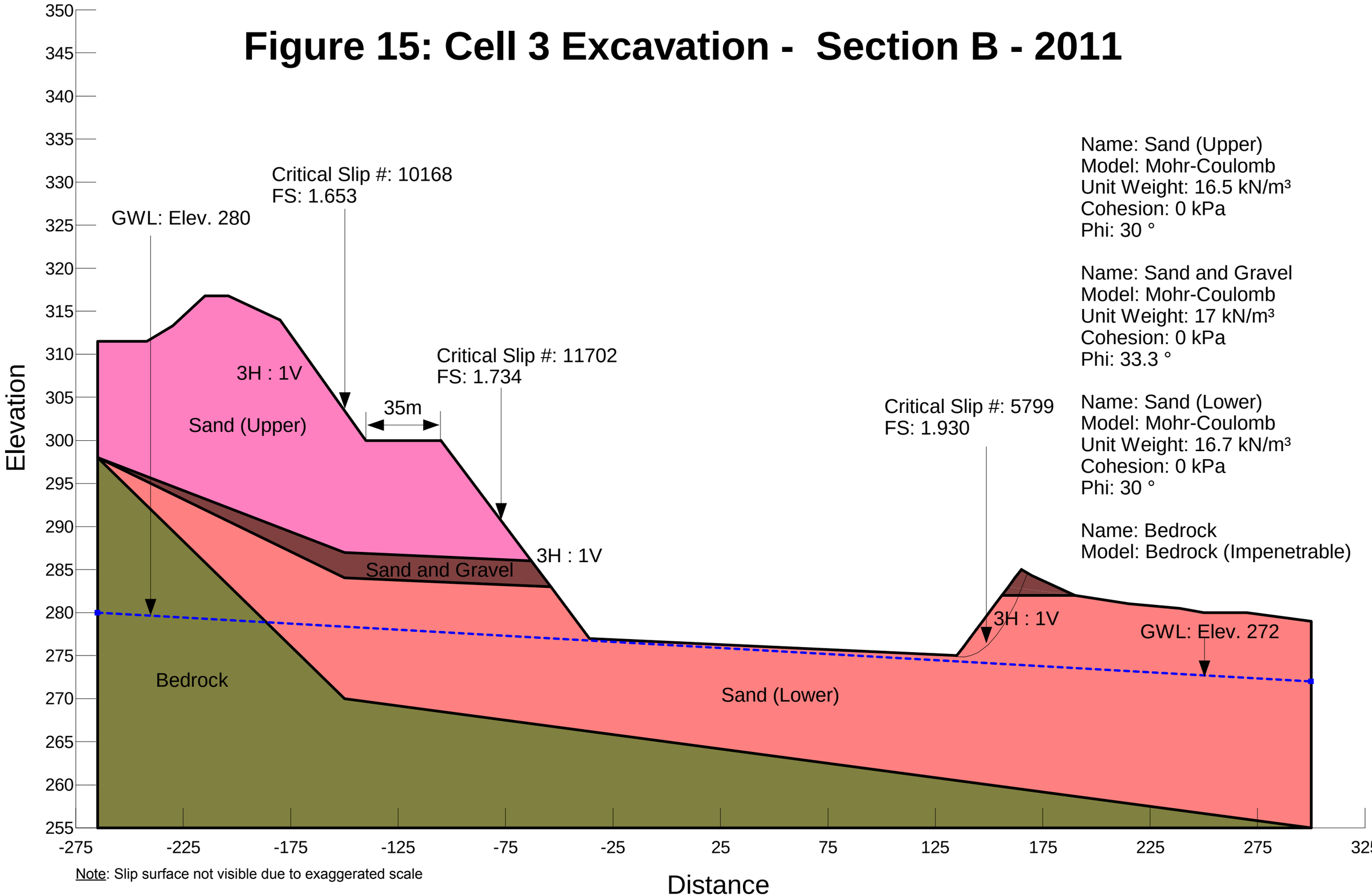
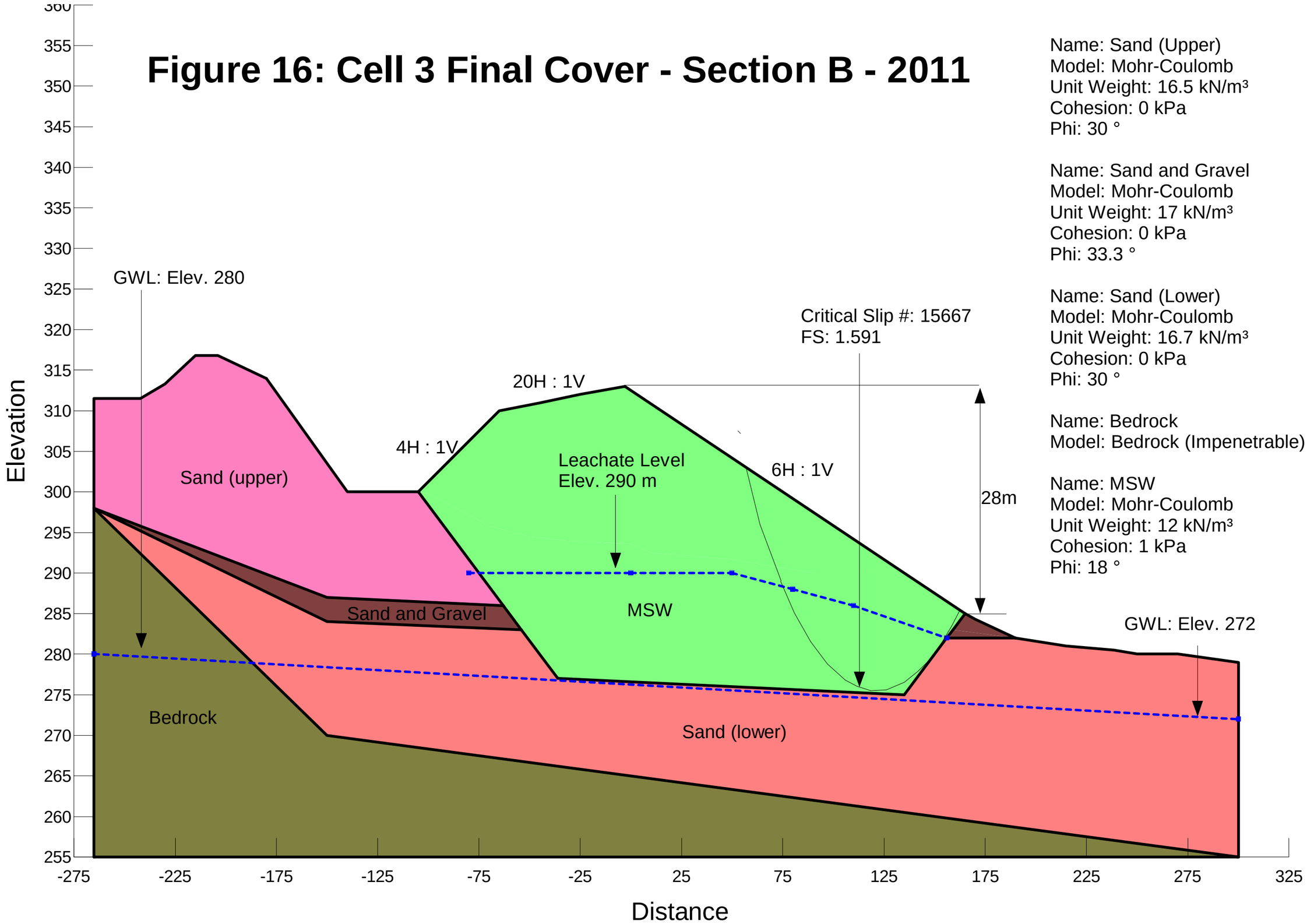


Figure 15: Cell 3 Excavation - Section B - 2011



Note: Slip surface not visible due to exaggerated scale

Figure 16: Cell 3 Final Cover - Section B - 2011



Name: Sand (Upper)
Model: Mohr-Coulomb
Unit Weight: 16.5 kN/m³
Cohesion: 0 kPa
Phi: 30 °

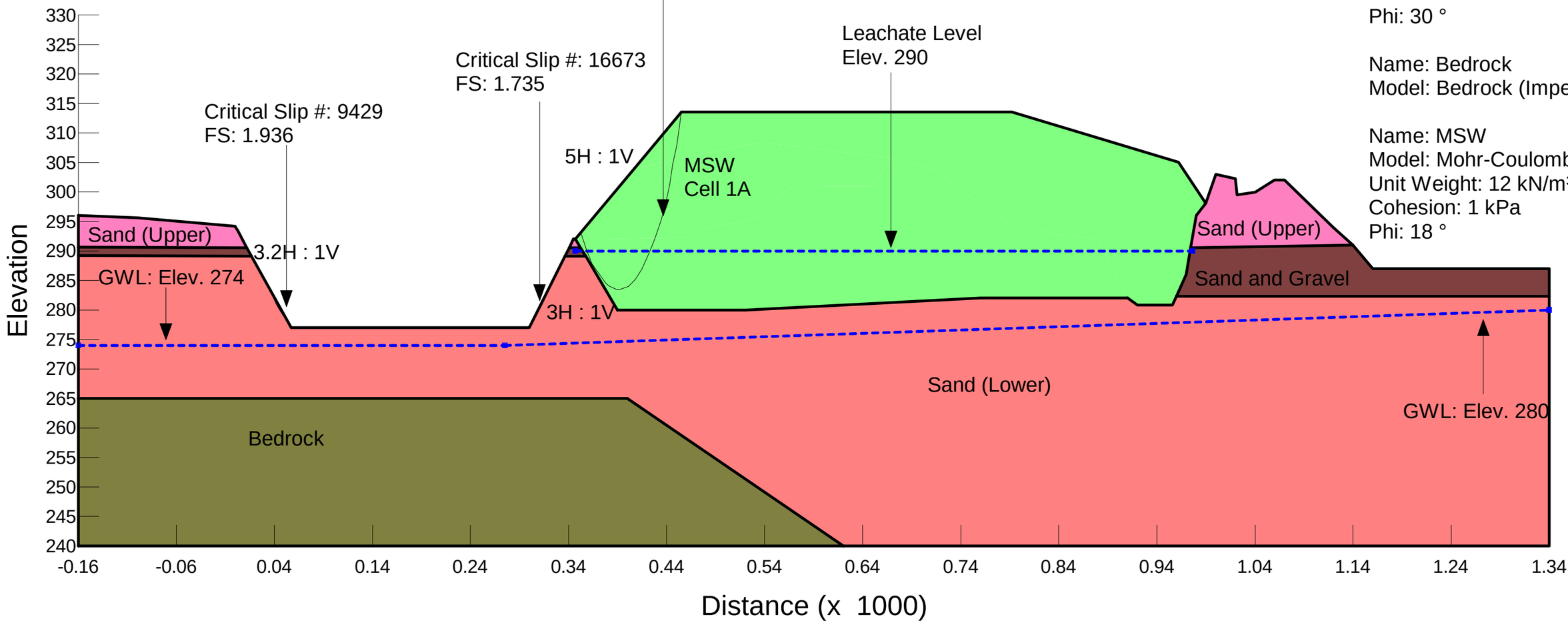
Name: Sand and Gravel
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 0 kPa
Phi: 33.3 °

Name: Sand (Lower)
Model: Mohr-Coulomb
Unit Weight: 16.7 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Bedrock
Model: Bedrock (Impenetrable)

Name: MSW
Model: Mohr-Coulomb
Unit Weight: 12 kN/m³
Cohesion: 1 kPa
Phi: 18 °

Figure 17: Cell 4 Excation - Section A-A - 2011



Name: Sand (Upper)
Model: Mohr-Coulomb
Unit Weight: 16.5 kN/m³
Cohesion: 0 kPa
Phi: 30 °

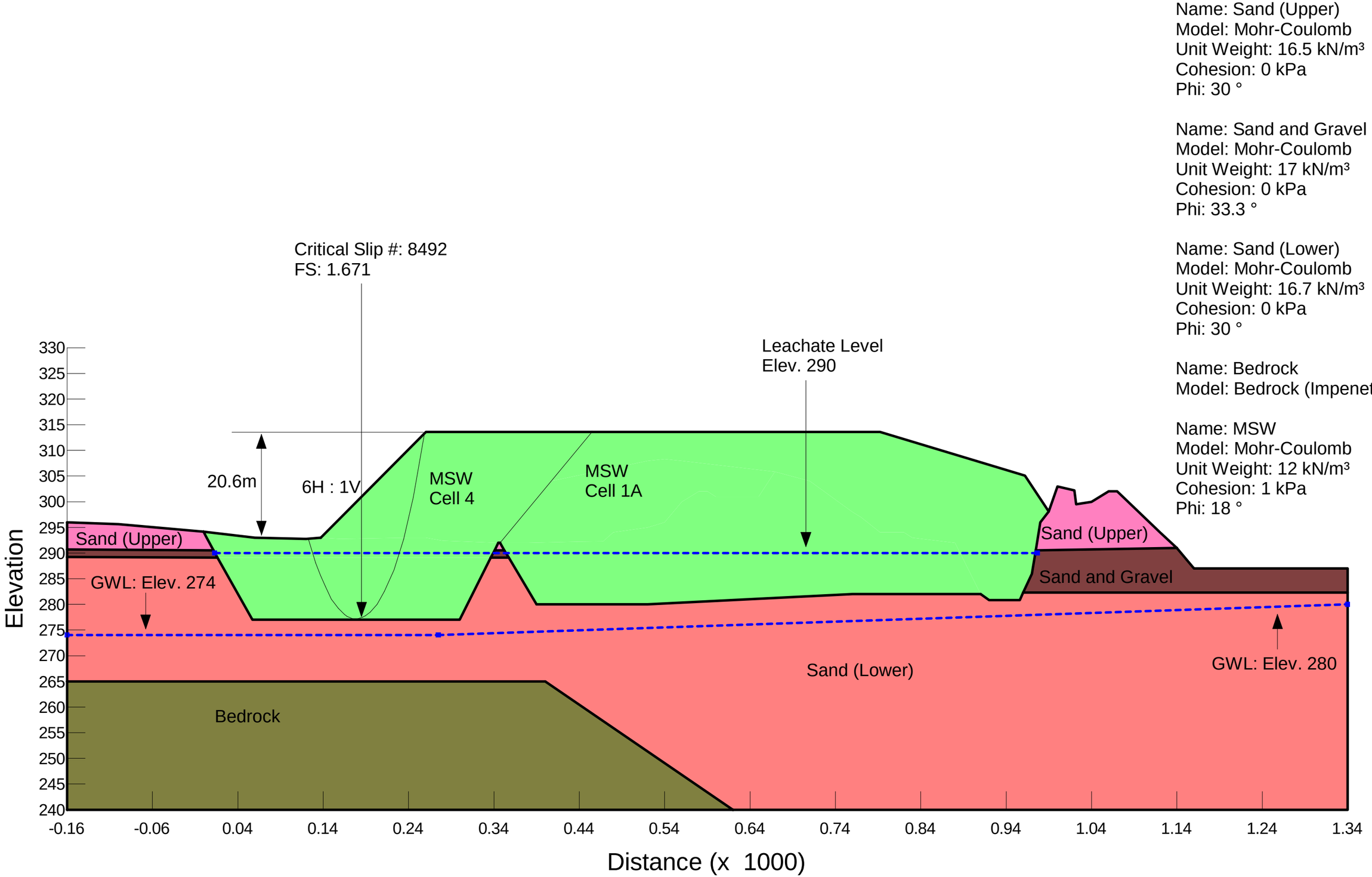
Name: Sand and Gravel
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 0 kPa
Phi: 33.3 °

Name: Sand (Lower)
Model: Mohr-Coulomb
Unit Weight: 16.7 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Bedrock
Model: Bedrock (Impenetrable)

Name: MSW
Model: Mohr-Coulomb
Unit Weight: 12 kN/m³
Cohesion: 1 kPa
Phi: 18 °

Figure 18: Cell 4 Final Cover - Section A-A - 2011



Name: Sand (Upper)
Model: Mohr-Coulomb
Unit Weight: 16.5 kN/m³
Cohesion: 0 kPa
Phi: 30 °

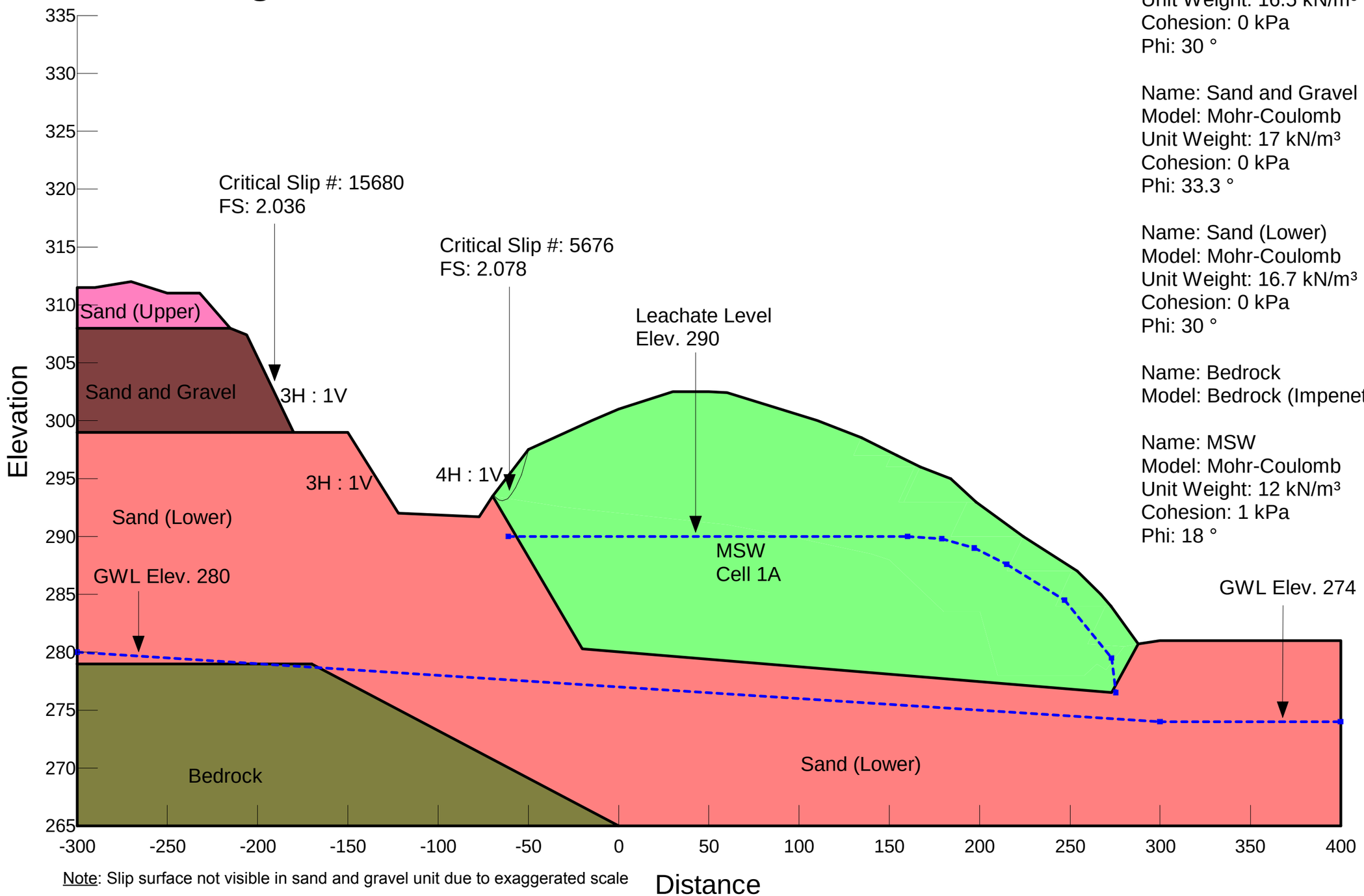
Name: Sand and Gravel
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 0 kPa
Phi: 33.3 °

Name: Sand (Lower)
Model: Mohr-Coulomb
Unit Weight: 16.7 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Bedrock
Model: Bedrock (Impenetrable)

Name: MSW
Model: Mohr-Coulomb
Unit Weight: 12 kN/m³
Cohesion: 1 kPa
Phi: 18 °

Figure 19: Cell 4 Excavtion - Section C - 2011



Note: Slip surface not visible in sand and gravel unit due to exaggerated scale

Name: Sand (Upper)
Model: Mohr-Coulomb
Unit Weight: 16.5 kN/m³
Cohesion: 0 kPa
Phi: 30 °

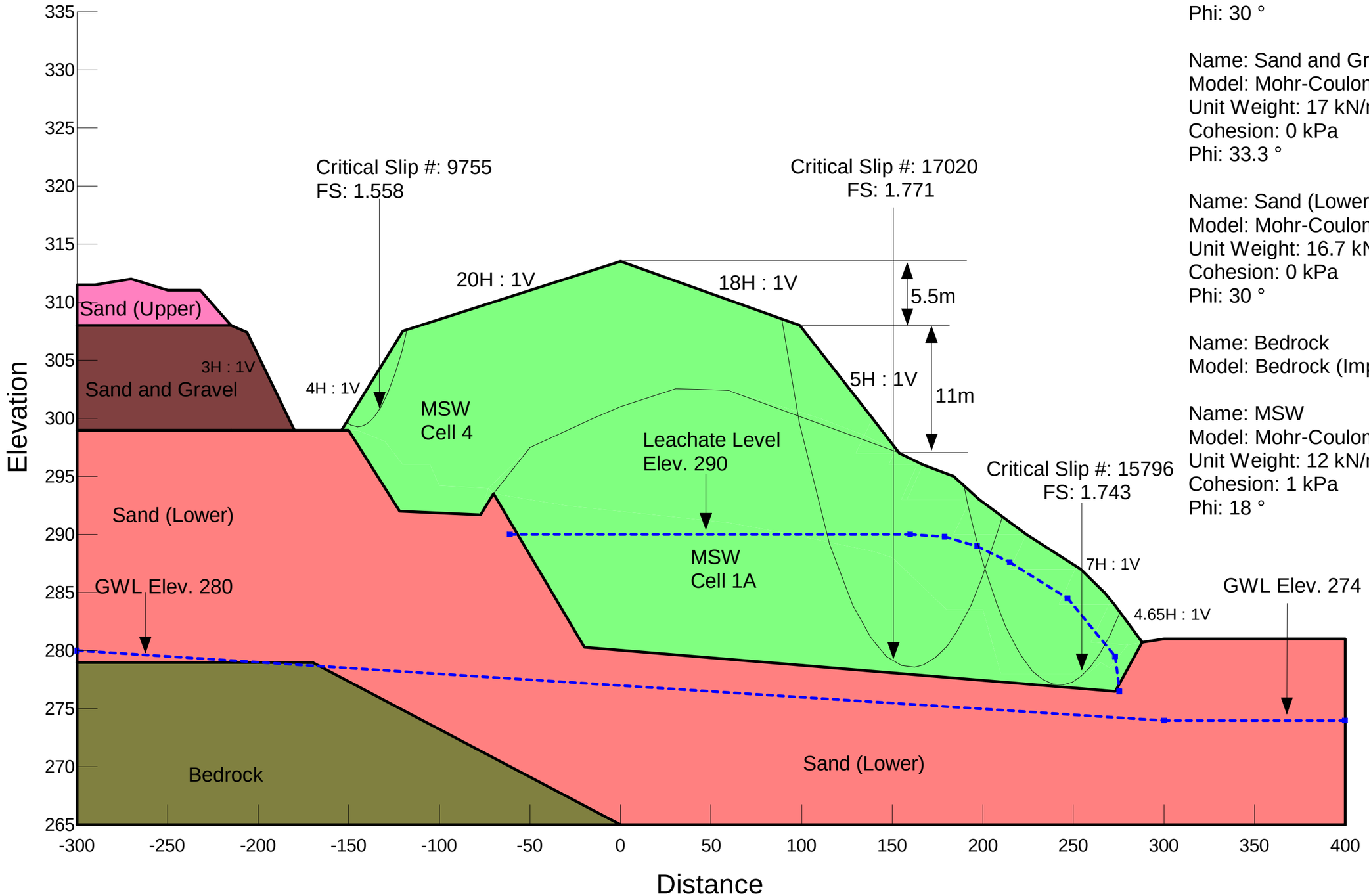
Name: Sand and Gravel
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 0 kPa
Phi: 33.3 °

Name: Sand (Lower)
Model: Mohr-Coulomb
Unit Weight: 16.7 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Bedrock
Model: Bedrock (Impenetrable)

Name: MSW
Model: Mohr-Coulomb
Unit Weight: 12 kN/m³
Cohesion: 1 kPa
Phi: 18 °

Figure 20: Cell 4 Final Cover - Section C - 2011



Name: Sand (Upper)
Model: Mohr-Coulomb
Unit Weight: 16.5 kN/m³
Cohesion: 0 kPa
Phi: 30 °

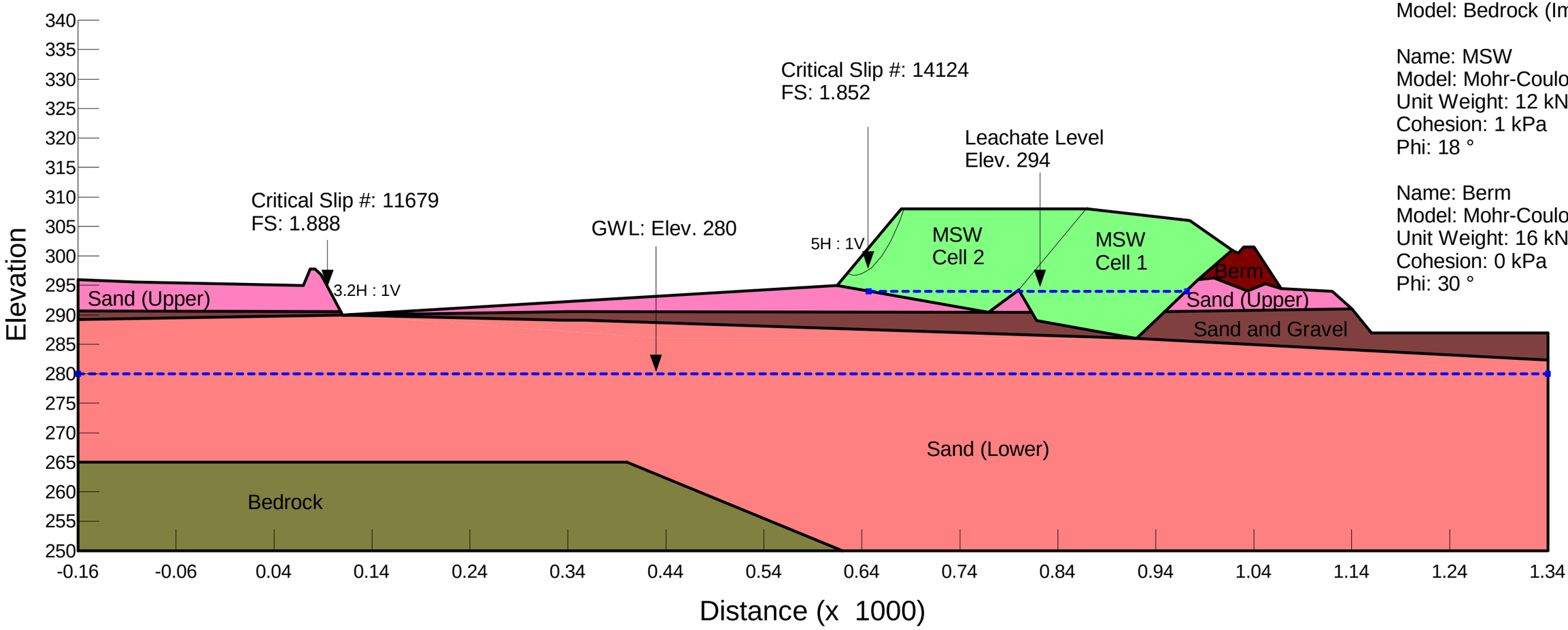
Name: Sand and Gravel
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 0 kPa
Phi: 33.3 °

Name: Sand (Lower)
Model: Mohr-Coulomb
Unit Weight: 16.7 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Bedrock
Model: Bedrock (Impenetrable)

Name: MSW
Model: Mohr-Coulomb
Unit Weight: 12 kN/m³
Cohesion: 1 kPa
Phi: 18 °

Figure 21: Cell 5 Excavation - Alignment 3 - 2013



Name: Sand (Upper)
Model: Mohr-Coulomb
Unit Weight: 16.5 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Sand and Gravel
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 0 kPa
Phi: 33.3 °

Name: Sand (Lower)
Model: Mohr-Coulomb
Unit Weight: 16.7 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Bedrock
Model: Bedrock (Impenetrable)

Name: MSW
Model: Mohr-Coulomb
Unit Weight: 12 kN/m³
Cohesion: 1 kPa
Phi: 18 °

Name: Berm
Model: Mohr-Coulomb
Unit Weight: 16 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Figure 22: Cell 5 Final Cover - Alignment 3 - 2013

Name: Sand (Upper)
Model: Mohr-Coulomb
Unit Weight: 16.5 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Sand and Gravel
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 0 kPa
Phi: 33.3 °

Name: Sand (Lower)
Model: Mohr-Coulomb
Unit Weight: 16.7 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Bedrock
Model: Bedrock (Impenetrable)

Name: MSW
Model: Mohr-Coulomb
Unit Weight: 12 kN/m³
Cohesion: 1 kPa
Phi: 18 °

Name: Berm
Model: Mohr-Coulomb
Unit Weight: 16 kN/m³
Cohesion: 0 kPa
Phi: 30 °

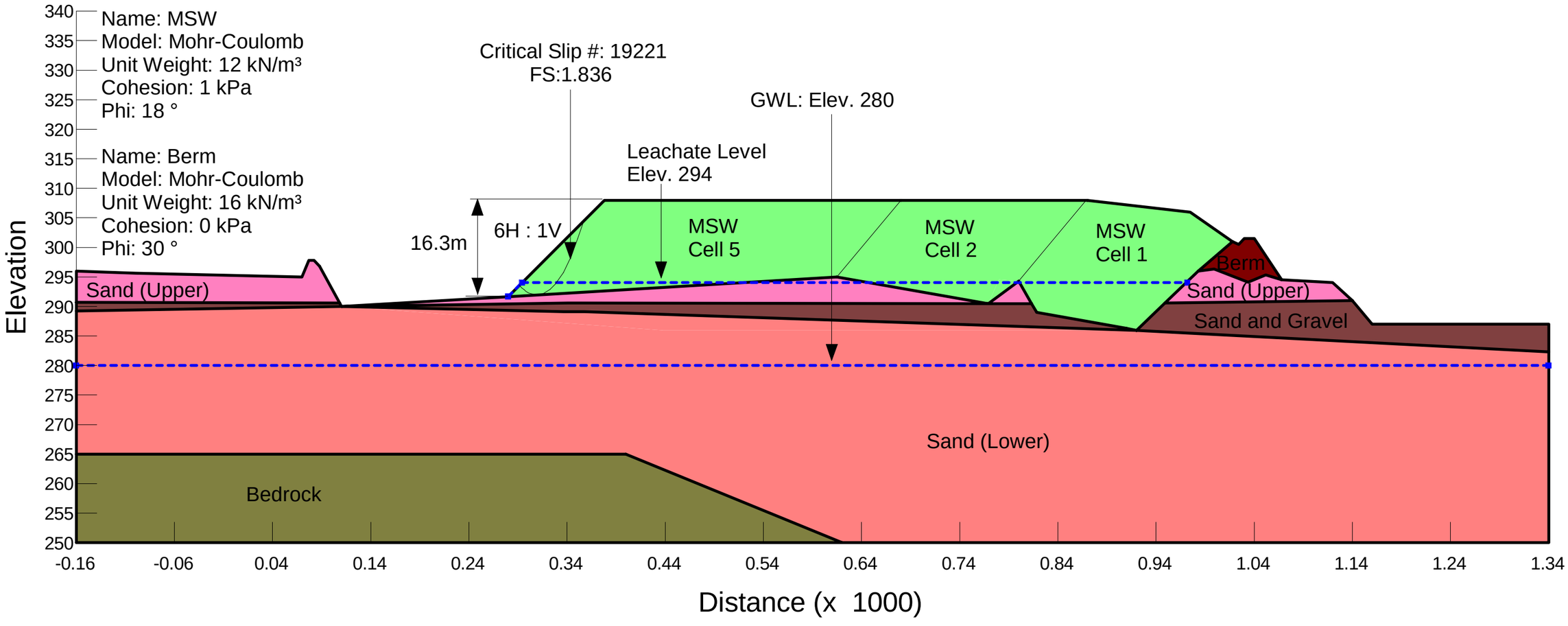
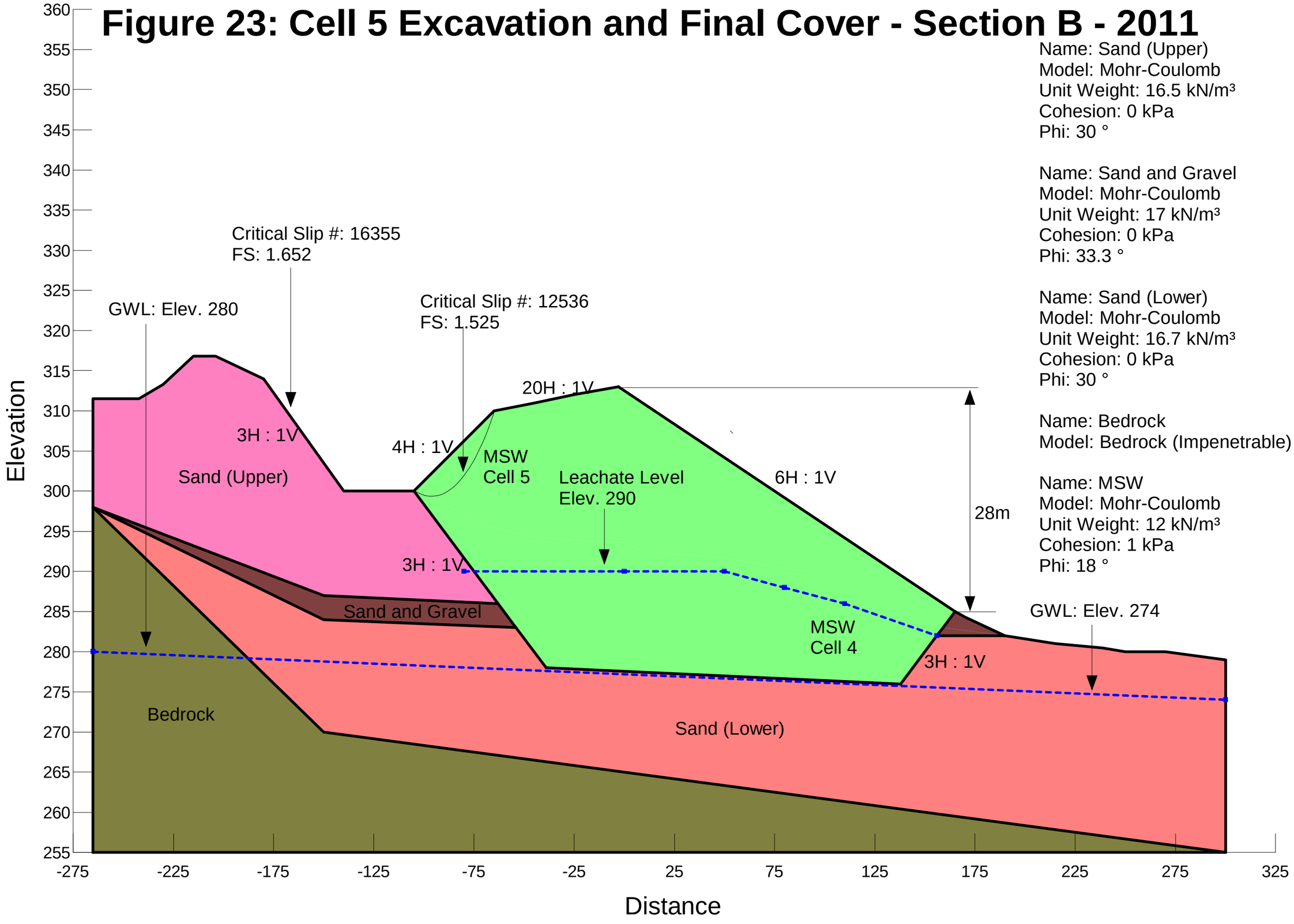


Figure 23: Cell 5 Excavation and Final Cover - Section B - 2011



Name: Sand (Upper)
Model: Mohr-Coulomb
Unit Weight: 16.5 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Sand and Gravel
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 0 kPa
Phi: 33.3 °

Name: Sand (Lower)
Model: Mohr-Coulomb
Unit Weight: 16.7 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Bedrock
Model: Bedrock (Impenetrable)

Name: MSW
Model: Mohr-Coulomb
Unit Weight: 12 kN/m³
Cohesion: 1 kPa
Phi: 18 °

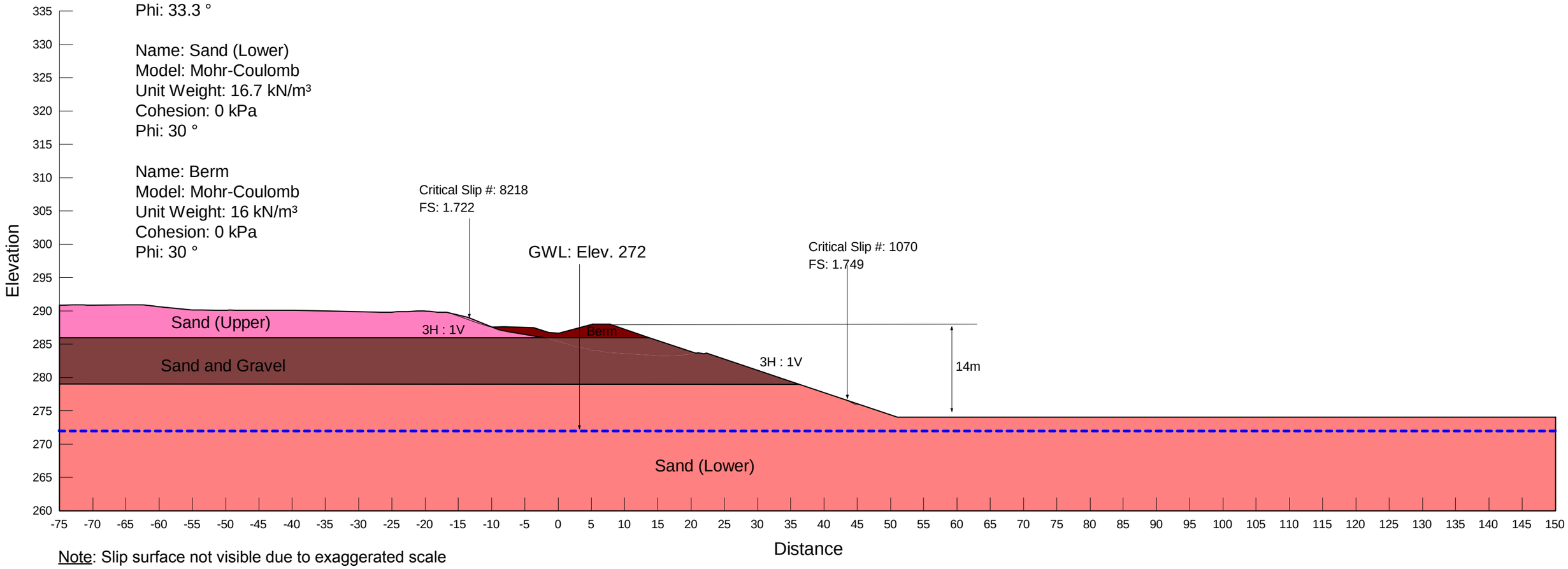
Figure 24: Cell 6 Excavation - Section 0+400 - 2014

Name: Sand (Upper)
Model: Mohr-Coulomb
Unit Weight: 16.5 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Sand and Gravel
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 0 kPa
Phi: 33.3 °

Name: Sand (Lower)
Model: Mohr-Coulomb
Unit Weight: 16.7 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Berm
Model: Mohr-Coulomb
Unit Weight: 16 kN/m³
Cohesion: 0 kPa
Phi: 30 °



Note: Slip surface not visible due to exaggerated scale

Figure 25: Cell 6 Final Cover - Section 0+400 - 2014

Name: Sand (Upper)
Model: Mohr-Coulomb
Unit Weight: 16.5 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Sand and Gravel
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 0 kPa
Phi: 33.3 °

Name: Sand (Lower)
Model: Mohr-Coulomb
Unit Weight: 16.7 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: MSW
Model: Mohr-Coulomb
Unit Weight: 12 kN/m³
Cohesion: 1 kPa
Phi: 18 °

Name: Berm
Model: Mohr-Coulomb
Unit Weight: 16 kN/m³
Cohesion: 0 kPa
Phi: 30 °

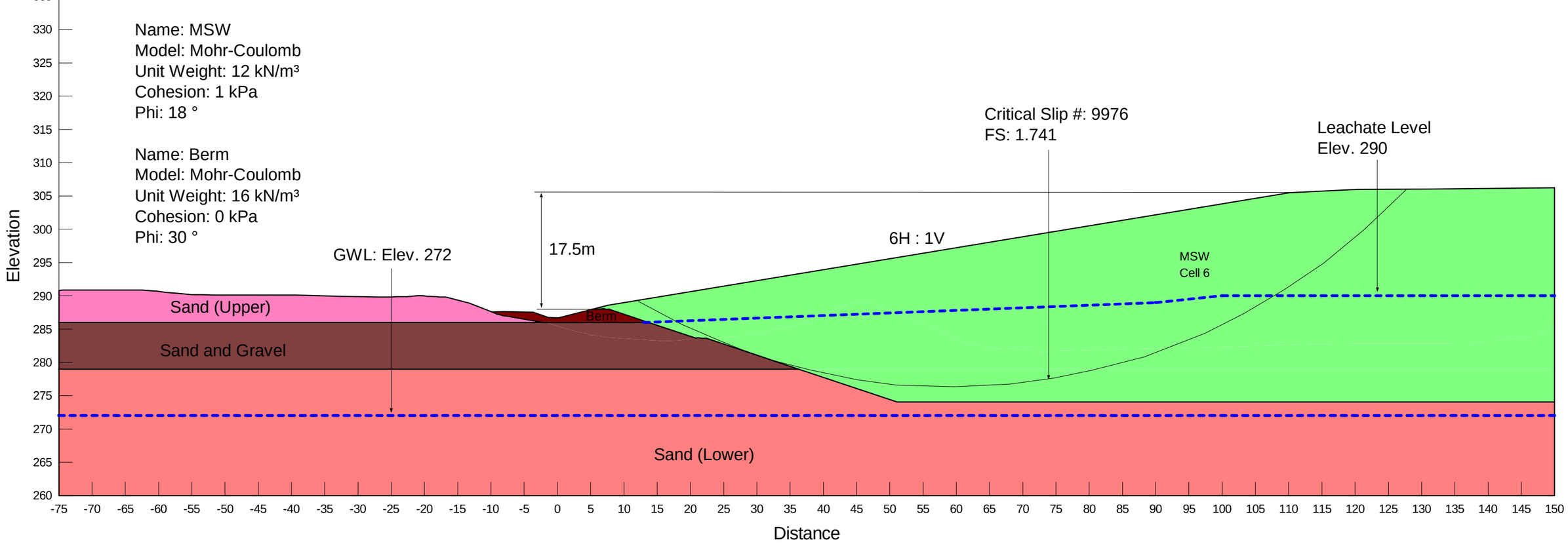
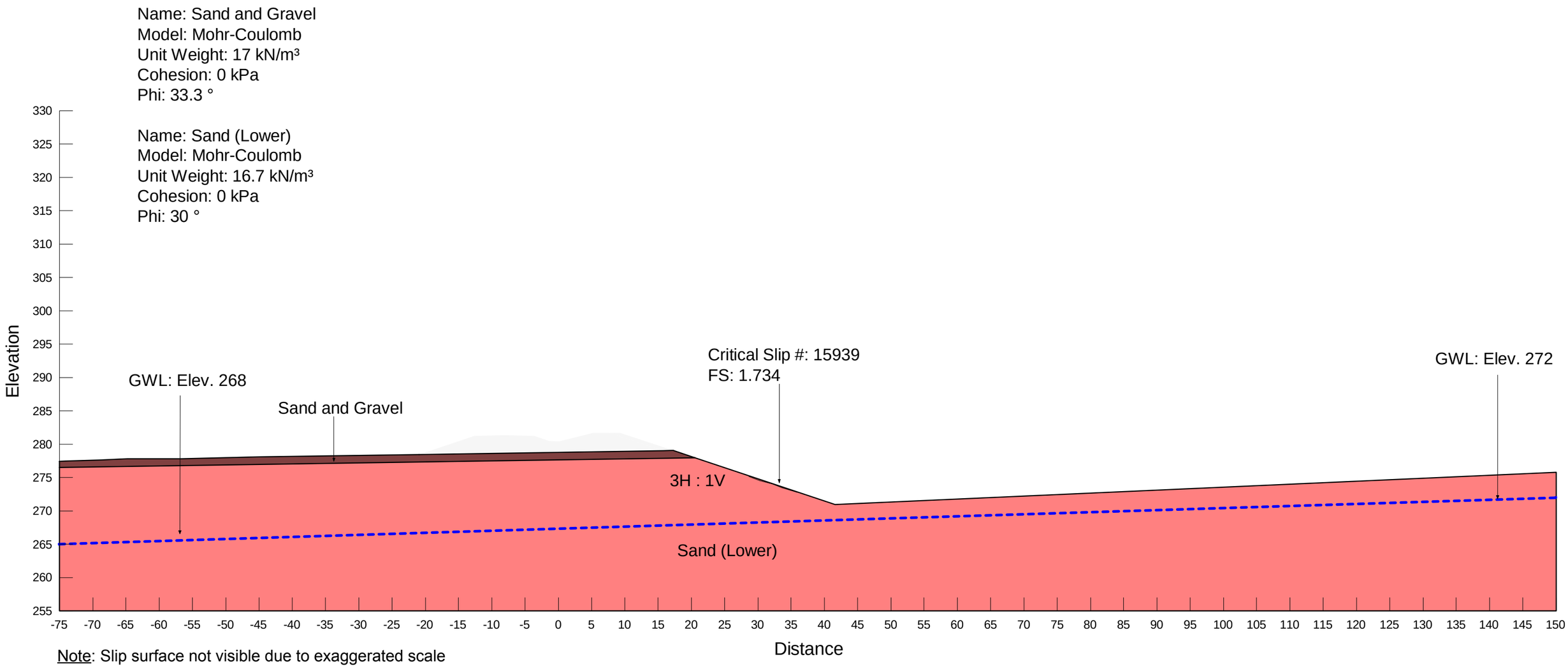


Figure 26: Cell 6 Excavtion - Section 0+200 - 2014



Note: Slip surface not visible due to exaggerated scale

Figure 27: Cell 6 Final Cover - Section 0+200 - 2014

Name: Sand and Gravel
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 0 kPa
Phi: 33.3 °

Name: Sand (Lower)
Model: Mohr-Coulomb
Unit Weight: 16.7 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: MSW
Model: Mohr-Coulomb
Unit Weight: 12 kN/m³
Cohesion: 1 kPa
Phi: 18 °

Name: Berm
Model: Mohr-Coulomb
Unit Weight: 16 kN/m³
Cohesion: 0 kPa
Phi: 30 °

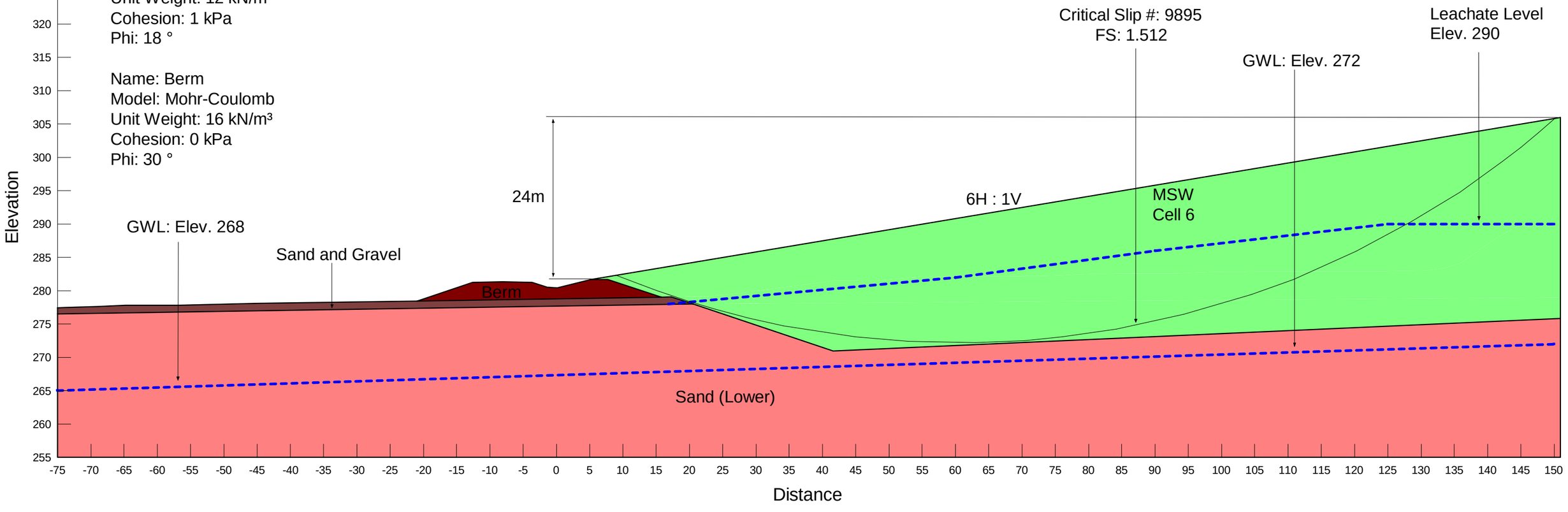
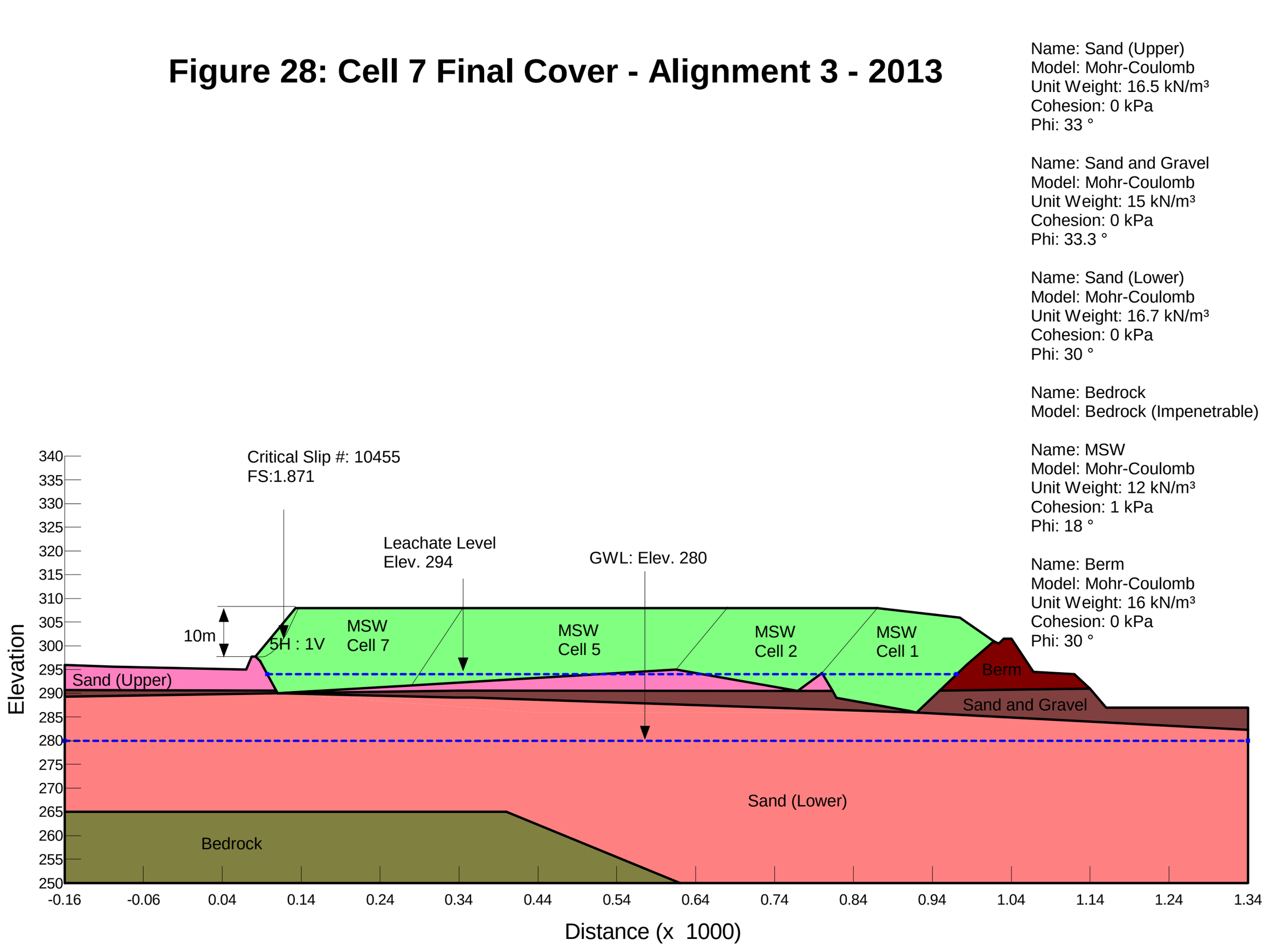


Figure 28: Cell 7 Final Cover - Alignment 3 - 2013



Name: Sand (Upper)
Model: Mohr-Coulomb
Unit Weight: 16.5 kN/m³
Cohesion: 0 kPa
Phi: 33 °

Name: Sand and Gravel
Model: Mohr-Coulomb
Unit Weight: 15 kN/m³
Cohesion: 0 kPa
Phi: 33.3 °

Name: Sand (Lower)
Model: Mohr-Coulomb
Unit Weight: 16.7 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Bedrock
Model: Bedrock (Impenetrable)

Name: MSW
Model: Mohr-Coulomb
Unit Weight: 12 kN/m³
Cohesion: 1 kPa
Phi: 18 °

Name: Berm
Model: Mohr-Coulomb
Unit Weight: 16 kN/m³
Cohesion: 0 kPa
Phi: 30 °

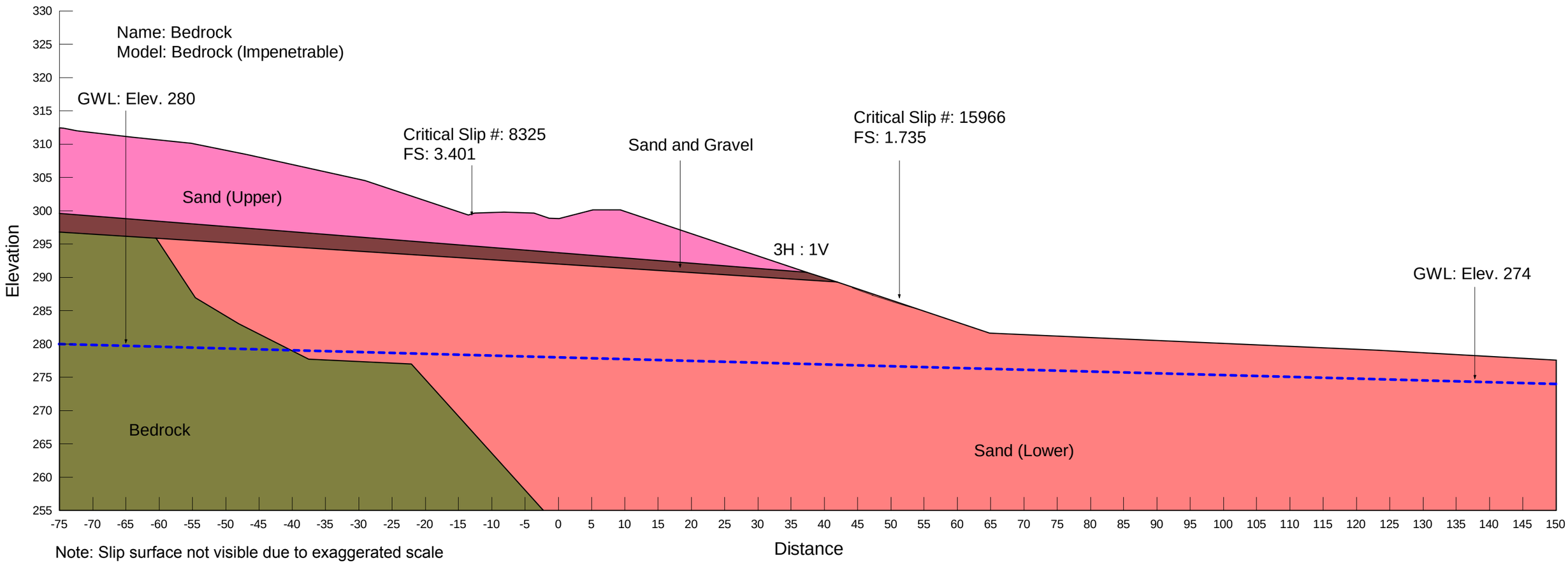
Figure 29: Cell 7 Excavation - Section 0+700 - 2014

Name: Sand (Upper)
Model: Mohr-Coulomb
Unit Weight: 16.5 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Sand and Gravel
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 0 kPa
Phi: 33.3 °

Name: Sand (Lower)
Model: Mohr-Coulomb
Unit Weight: 16.7 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Bedrock
Model: Bedrock (Impenetrable)



Note: Slip surface not visible due to exaggerated scale

Figure 30: Cell 7 Final Cover - Section 0+700 - 2014

Name: Sand (Upper)
Model: Mohr-Coulomb
Unit Weight: 16.5 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Sand and Gravel
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 0 kPa
Phi: 33.3 °

Name: Sand (Lower)
Model: Mohr-Coulomb
Unit Weight: 16.7 kN/m³
Cohesion: 0 kPa
Phi: 30 °

Name: Bedrock
Model: Bedrock (Impenetrable)

Name: MSW
Model: Mohr-Coulomb
Unit Weight: 12 kN/m³
Cohesion: 1 kPa
Phi: 18 °