THE MILLER GROUP

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Committed to Leadership in Our Industry

July 25, 2014

Manitoba Conservation and Water Stewardship
Environmental Approvals
2nd Floor, 123 Main St.
Winnipeg, MB R3C 1A5

Attn: Tracey Braun, M. Sc. – Director Environmental Approvals Branch

Dear Ms. Braun:

RE: Repository Cell – Dangerous Goods Handling & Transportation Act Licence No. 58 HW S2 RRR

Please accept this as Miller Environmental Corporation's ("Miller") proposal for the addition of a repository cell to Miller's southern processing facility. This proposal is provided as per clause 14 of Dangerous Goods Handling and Transportation Act ("DGHTA") operating licence No. 58HW S2 RRR ("licence"), wherein *"The Licencee shall notify the Director of any intended alteration of process at the facility, which is likely to cause a significant environmental effect, prior to implementing the alteration."*

The purpose of this proposal is to amend Miller's current facility operating licence to include a repository cell as per the submitted "Licence Application and Environmental Impact Assessment" document dated March 5, 1992. This document was submitted by the Manitoba Hazardous Waste Management Corporation ("MHWMC") in support of a DGHTA Licence application for an integrated hazardous waste management facility in the Rural Municipality of Montcalm.

Preliminary Design

AECOM has performed a geotechnical investigation to provide Miller with the necessary design and procedures to construct the repository cell to current standards. Please refer to the following attachments for these details:

1. L-RPT-2014-07-24-Miller Environmental- Repository Storage Cell Construction REVB (Appendix A)
2. C-0001, C-0002, C-0003 (Appendix B)

Construction and Operating Considerations

Stabilization/Solidification Process Facilitated on Miller's Site

Miller currently processes approximately 980 tonnes of bulk solid material per month with this volume steadily increasing from year to year. The stabilization process occurs in the mixer in process building 5

("PB5"). Stabilization begins with heavy metal bearing wastes (such as fly ash) and wastewaters (potentially from customer waste, filter press processing, etc.) mixed together. Once the slurry has reached desired consistency, acid reagents and necessary pH buffering agents are added. There is potential for heat and smoke to be generated during this process. Smoke and vapors are captured through the ventilation equipment and put through an automated wet inorganic scrubber. The scrubber monitors pH levels through an online pH probe. pH adjustments are done automatically throughout the scrubbing process to ensure emissions stay neutral. The temperature is monitored closely with an infrared thermometer temperature gun. If the temperature exceeds 90^{o} C, the process is stopped and allowed to cool. Processing resumes once the temperature has lowered. A sample of the slurry is tested by Miller's internal lab. If the sample does not meet the requirements set by the lab (desired pH levels, etc.), additional reagents are added to reach desired requirements. Solidification begins after the lab confirms the stabilized slurry has passed. Depending on the suspected components in the slurry, a sufficient amount of reagent(s) is added to the bin as coordinated by the lab. Samples are taken once again to confirm the lab requirements for the solidification mixture. Batch sheets are completed throughout the stabilization process to track all reagents and waste products put into the mixture. Once the solidification process is complete, the stabilized product is transferred into a container. Once the transfer has been completed, a sample is taken and sent to an external accredited lab for landfill requirement testing. If the stabilized product parameters do not meet the landfill criteria, the stabilization process is repeated. Samples are taken once again to confirm the lab requirements. Once the internal lab parameters have met the deficiencies from the external lab results, a sample is taken and sent to an external accredited lab again. If all parameters meet landfill criteria, the stabilized product will be placed into the repository cell.

Leachate Management and Dust Control

The proposed repository cell is lined with a clay liner and contains a leachate collection system. The repository is constructed with weeping tile pipe within the base of the cell sloping towards a vertical collection conduit. The conduit is capped with a lid which will give access to a sump pump at the bottom of the conduit to extract and monitor leachate collected from the repository cell. Leachate is monitored for potential contaminants. The leachate monitoring process consists of leachate being sampled and internally analyzed. Leachate is collected and applied to the top of the processed material to reduce the potential escape of material due to wind. When leachate levels are low, water is applied to the top of the processed material to mitigate escape of material due to wind. When required, leachate is pumped and treated appropriately depending on contaminants found.

Capping Process

Once the repository is full, capping will consist of covering the processed material with 1 meter of clay and allowing the indigenous vegetation to grow over it. The capping layer will provide a low permeability/sealing layer to further prevent the infiltration of precipitation into the repository cell to control leachate generation. The leachate collection system will continue to be operational to sample leachate when required and to determine whether there are any permeability issues once the repository is capped.

Secure Repository

- The active area of the facility is fenced by a 40" high security fence (6" x 8" mesh wire with wooden posts) as a means of minimizing the potential for vandalism and/or theft, as well as unauthorized entry. Swing gates are locked at both entrances at the end of each day.
- A chain link fencing with a lockable gate surrounds the tank farm.
- Building security consists of fire, hydrocarbon emission, and unauthorized building entry alarm. All buildings are secured by means of an alarm system tied into 24 hour security monitoring. Alarm monitoring system immediately contacts appropriate personnel should any trigger occur.
- Daily checking of the facility takes place each weekend.

Agreement letters from MHWMC Board and Community Liaison Committee

Agreement letters from the MHWMC board and Community Liaison Committee ("CLC") are included as Appendix C.

Environmental Monitoring Program

Miller's operational strategy focuses on ensuring that the processes conducted within the specific buildings on the plant's site effectively eliminate environmental impacts to our property and in particular our neighbors. State of the art emission controls are incorporated specifically with this purpose in mind. It is Miller's position that future installations would incorporate best available technologies for this purpose. It is Miller's position that when possible, environmental impacts can be effectively mitigated at source before external issues become evident. Miller has, from its inception, provided a comprehensive annual environmental report to key stakeholders including Conservation. This report focuses on the internal control measures mitigating potential external environmental impacts. This data can be provided along with any additional information requested by Conservation as part of the new licencing requirements for the repository cell. To support the implemented changes in the environmental monitoring program from the last licence revision in April 2013, Miller initiated a third party peer review of the past 12 years of monitoring data (Refer to Appendix G in "Dangerous Goods Handling and Transportation Act – Licence Revision" facility proposal submitted March 22, 2013).

The parameters selected for monitoring, the media monitored, and the locations of the monitoring stations were all based on data obtained and used to estimate potential facility emissions for the risk assessment process. An integral component of the risk assessment was the assumption that strict emission controls and process monitoring would be utilized to reduce potential contaminants at source. The risk assessment process evaluated the health and environmental risks posed by the operation of a fully developed physical/chemical treatment facility operating at full capacity.

The monitoring program emphasizes process emission control monitoring of the concentrated process emissions as being the most common sense approach of addressing emissions at their source and as they occur, as opposed to after the fact discovery.

In May of 2010, Miller contracted Pinchin Environmental Ltd. ("Pinchin") to do an Environmental Peer Review ("EPR") of Annual Monitoring Reports ("AMR"). Environmental monitoring is conducted each year and an AMR is prepared as part of the requirements of Miller's licence. The purpose of the EPR was to evaluate the environmental performance monitoring data conducted as part of the licence to operate the facility. Review of the reporting requirement monitoring included air, soil, biological indicator and water data. Twelve years of data (1997 to 2008) were reviewed and include a review of the AMR reports outlined in Section 1.1 of the EPR. Monitoring in Miller's licence is combined into the following 4 sections: Respecting Ambient Air Monitoring, Respecting Soil Monitoring, Respecting Groundwater Monitoring, and Respecting Surface Water Monitoring.

Respecting Ambient Air Monitoring

Emissions of particulate matter ("PM") are assessed at point sources and beyond the property line for opacity and PM concentration. Ambient air monitoring for PM and specific metals is done at 2 locations at and beyond the property line with high and low volume sampling equipment. The 2 locations are identified as "A1-Southeast Corner" and "A2-Northeast Centre". Samples are collected and analyzed on alternating months from May to October. Determined by Pinchin's EPR, over the 12 year period, there were no instances where the maximum off-property metals concentrations exceeded the corresponding limit criteria listed in the DGHTA Licence. As mentioned above, Miller believes the most common sense approach of addressing emissions at their source and as they occur, as opposed to after the fact discovery.

Respecting Soil Monitoring

Soil samples are obtained from the top 10 cm of soil to measure the impact of any surface deposition. The soil monitoring program has satisfied the requirements and has been generally well below the criteria identified by the DGHTA Licence the last 12 years as per Pinchin's EPR. The processing buildings on Miller's site all have mitigation measures in place for things such as containment of liquids, berming around tanks, buildings and pads, blind sumps in buildings and tanker pads, etc. With these measures in place, there is confidence in environmental protection outside of the facility operations. Any incident involving an external spill is immediately addressed with impacted soils being removed, reported and processed.

Respecting Groundwater Monitoring

Miller collects groundwater samples annually from five monitoring wells as per Miller's DGHTA Licence (refer to Appendix D). The location of the five wells are the northwest side of PB2 (OMW1), southwest side of PB2 (OMW2), southeast side of PB2 (OMW3) and two located south of the administration building (OMW4 & OMW5). Miller has focused on these five wells because of their proximity to the processing buildings. Groundwater flows from the northwest corner to the southeast corner of the facility property. Based on the groundwater flow and Pinchin's EPR, Miller proposes to keep the annual

groundwater monitoring requirements at the five monitoring wells that are currently being used with the addition of the repository cell. Due to the warm summer months being the most appropriate time to collect groundwater samples, Miller will continue this annual practice of taking one sample from each active monitoring well (OMW1, OMW2, OMW3, OMW4, OMW5) in July.

Respecting Surface Water Monitoring

Miller monitors surface water in the retention pond located North of the facility. Discharging of the retention pond beyond the boundaries of the facility (due to concerns of the retention pond overfilling) requires testing of surface water to meet parameters set in Schedule A of Miller's DGHTA Licence. A control structure is in place at the discharge location of the retention pond such that uncontrolled or accidental discharge is prevented. Based on Pinchin's EPR and data meeting the required parameters in Miller's DGHTA Licence, Miller monitors on an as required basis prior to discharging. Miller does not discharge water from the retention pond beyond the boundaries of the facility unless water samples meet the parameters identified in the DGHTA Licence and written approval from Conservation has been received.

Miller will not discharge any wastewater to the large retention ponds at the north boundary of the facility. A control structure at the discharge location of the retention ponds is in place such that uncontrolled or accidental discharge is prevented. Miller will direct all wastewater generated as a result of any activity at the facility, other than the treatment of hazardous waste, to a blind sump or sumps properly designed to contain such liquids. Miller will ensure that all liquids collected in sumps are managed in a manner approved by the Director.

Any precipitation collected in the repository cell will be collected in the leachate collection system.

All sanitary wastes are directed to one of four holding tanks properly designed to contain sanitary wastes. The external disposal of these wastes is managed by a third party sanitary waste hauler.

Maintenance Plan

The maintenance plan for the repository cell consists of regular physical checks to ensure the stability of the floor liner and perimeter berms. Any required repairs are internally reported and completed immediately. Physical checks of all aspects of the leachate collection system (i.e.: pumps, conduits, weeping tile, etc.) are also performed to ensure the proper collection of leachate within the repository cell. Once the closure of the repository has been completed, regular physical checks to the cap will be performed to ensure the prevention of the infiltration of precipitation into the repository cell to control leachate generation. Upon closure, the leachate collection system will also continue to be monitored to ensure its functionality along with monitoring any permeability issues.

As per my phone conversation with Raj Rathanamo on Wednesday, July 16th, Miller will have the opportunity to begin the construction work with the submission of the repository cell proposal to Manitoba Conservation and Water Stewardship.

If you have any questions, please feel free to contact me at 204-925-9604 or by email at daveh@millerenvironmental.mb.ca.

Sincerely yours,
Miller Environmental Corporation

Dave Howes
Technical Services Coordinator

CC: Raj Rathanamo - Manitoba Conservation and Water Stewardship
Bruce Webb - Manitoba Conservation and Water Stewardship
Vaughn Bullough – Vice President & General Manager, Miller Environmental Corporation
Todd Normandeau – Projects Coordinator, Miller Environmental Corporation

Appendix A

AECOM Geotechnical Investigation Report

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Technical Memorandum

To	Todd Normandeau	Page	1
CC	Keith Fitchett		
Subject	Miller Environmental-Repository Cell Geotechnical Assessment		
From	Jared Baldwin/Alex Hill		
Date	July 28, 2014	Project Number	60320105 (400)

1. Introduction

This Technical Memorandum summarises the results of the geotechnical investigation performed at the proposed location of the Repository Cell situated within the existing Miller Environmental waste management facility, approximately 7.0 km northwest of Letellier, Manitoba.

It is our understanding that the proposed Repository Cell will measure an approximate 100 m x 100 m for the intended use as a hazardous waste site. The results and recommendations contained within this Technical Memorandum are only to be considered applicable to design associated with the proposed Repository Cell.

2. Geotechnical Investigation

2.1 General

Twelve (12) test holes (TH14-01 to TH14-12) were drilled on May 15, 2014 within the footprint of the proposed cell at the locations shown on Figure 01. The test holes were advanced to depth between 6.4 and 12.5 m below existing grade. Drilling was completed by Maple Leaf Drilling Ltd, using a track mounted Acker MP-5 drill rig equipped with 125 mm solid stem augers (SSA).

Disturbed and relatively undisturbed soil samples (via Shelby tubes) were collected at regular intervals from select test holes, as shown within the enclosed Test Hole Logs. A total of nine (9) Shelby tube samples were collected during the investigation, and are listed in Table 01 below. All soils observed during drilling were logged and visually classified on site by AECOM personnel. Soil samples recovered and transported to AECOM's Material Testing Laboratory in Winnipeg for further visual examination.

Laboratory testing included the determination of moisture contents, Atterberg Limits, grain size analysis via hydrometer method, and flexible wall permeability. A detailed test hole log has been prepared for each test hole to record the description and the relative position of the various soil strata, location of samples obtained, field and laboratory test results and other pertinent information, and are

provided in Appendix A of this Technical Memorandum. Results of the geotechnical laboratory analysis are presented in Appendix B.

2.2 Visual Inspection

Following completion of fieldwork, undisturbed samples not selected for testing were extruded and visually inspected by AECOM Geotechnical Engineer with Miller Environmental personnel in attendance. A summary of undisturbed samples taken during the fieldwork are presented in Table 01 below, with corresponding photographs included as Appendix C of this Technical Memorandum.

Table 01: Summary of Undisturbed Samples

Sample Identifier	Depth Range (m)	Soil Unit	Comments
TH14-02: T7	1.50- 2.10	Silt and Clay	
TH14-03: T24	4.50- 5.10	Silty Clay	Flexible Wall Permeability test
TH14-04: T29	6.10- 6.70	Silty Clay	
TH14-05: T31	3.00- 3.60	Silty Clay	
TH14-06: T36	4.50- 5.10	Silty Clay	
TH14-07: T42	1.50- 2.10	Silt and Clay	Flexible Wall Permeability test
TH14-08: T47	3.00- 3.60	Silt and Clay	
TH14-09: T52	4.50- 5.10	Silty Clay	
TH14-10: T57	6.10- 6.70	Silty Clay	

3. Subsurface Conditions

3.1 Soil Profile

The general soil profile in descending order is as follows;

- Topsoil/Organics;
- Silt and Clay; and
- Silty Clay.

These soil units are described separately below.

3.1.1 Topsoil/Organics

A layer of topsoil was encountered at ground surface in all test holes (TH14-01 to TH14-12). The thickness of the topsoil was noted at between 0.2 and 0.4 m.

3.1.2 Silt and Clay

The silt and clay was noted, in all test holes, directly below the layer of topsoil/organics to a depth of between 1.6 to 4.65 m, or an elevation of 232.1 to 235.1 m.

The silt and clay layer generally is yellowish brown, stiff and dry. Grain distribution analysis indicate high silt (>50 percent) content, with a corresponding clay content of between 35 to 40 percent and trace amounts of fine to medium grained sand (<10 percent).

Moisture content values varied between 20 and 35 percent. The plastic limit varied between 19 and 21 percent, with a corresponding liquid limit between 47 and 50 percent. Based on laboratory analysis and field observations, the silt and clay is of intermediate plasticity. Based on laboratory analysis, undrained shear strength values were measured between 34 and 126 kPa. However, based upon field observations, an average undrained shear strength value of 50 kPa would be more characteristic of the deposit. The bulk saturated unit weight of the silt and clay range from 18.6 to 19.8 kN/m^3. A flexible wall permeability test performed on the silt and clay resulted in an average permeability of 1.36x10-10 m/sec.

3.1.3 Silty Clay

The silty clay was encountered directly below the silt and clay layer in all test holes. The thickness or base of the deposit was not proven; however the silty clay was still present at a depth of 12.5 m below grade in one test hole (TH14-06). The silty clay was noted as a brownish grey, stiff, moist, and of high plasticity.

Grain distribution analysis indicate high clay (>75 percent) content, with a corresponding silt content of between 20 to 25percent, and trace amounts of sand (<5 percent).

Moisture content values varied between 31 and 54 percent. The plastic limit ranged between 29 and 31 percent, with a corresponding liquid limit between 56 and 57 percent. Based on laboratory analysis and field observations, the silt and clay has a high plasticity index. Based on laboratory analysis, undrained shear strength of the silty clay deposit ranged from 20 to 49 kPa. The bulk saturated unit weight ranged from 16.5 and 17.4 kN/m^3. A flexible wall permeability test performed on the silt and clay resulted in an average permeability of 7.78x10-10 m/sec.

4. Geotechnical Assessment

Based on the design brief submitted to this office, the following information has been integrated into our assessment;

- The construction and operation of the waste management facility will be conducted in three separate phases. Each phase of operation will consist of the excavation and deposition of waste materials in approximately one third of the total facility floor area. It is understood that each phase of operation will commence when the total allowable area for each one third of floor area has been filled with waste materials.
- It is understood that the time duration between each phase of operation is currently estimated at 1 year.
- The height of the perimeter dyke/ berms will measure 2.5 m above existing ground surface, whilst a 3.5 m excavation below the ground surface at the same slope inclination will extend the total interior repository depth to a maximum of 6.0 m.

- Following the completion of all three filling phases, a clay cap will be constructed across the repository cell facility.

4.1 Slope Stability

Preliminary slope stability analysis has been performed to investigate the short and long term stability. Assessment of short term conditions is associated with slope stability during and directly following construction whilst the cell is not operational (i.e., absence of waste materials). Assessment of long term stability relates to the stability under normal operating conditions (i.e., deposition of waste materials). Industry accepted factors of safety for temporary and long term slopes are 1.3 and 1.5, respectively. Settlement analysis has not been undertaken as part of this investigation; however settlement within the foundation soils should be expected.

Short term scenarios are difficult to quantify in terms of duration; however, they are generally considered very short lived, rare or temporary scenarios. It is understood that all cell phases of this repository will be fully backfilled up to existing ground level within a year of excavation. Providing this remains true, targeting a short term factor of safety for the interior of the facility is considered appropriate.

The following general cases have been the subject of the preliminary slope stability assessment:

- Short term stability of interior of perimeter slopes;
- Short term stability of temporary interior slopes; and
- Long term stability of exterior of perimeter berm.

The following assumptions have been made to facilitate the preliminary stability analysis:

- Typical soil strength parameters based on local experience have been assumed;
- The prairie groundwater levels were assumed to be up to 1.0 m below ground surface (KGS, 1992).
- The maximum excavation depth is 3.5 m below prairie level and the maximum perimeter berm height is 2.5 m.

The interior and exterior slopes of 3H:1V and 4H:1V, respectively, is the Client's preferred geometry and was provided to us for analysis. Slope stability was determined to be very sensitive on the prairie groundwater level.

The following is required in order to achieve a factor of safety of 1.3 for the short term scenarios noted previously:

1) A series of subdrains within the base of the facility at least 1.0 m deep and up to a maximum of 1.0 m away from the toe of the base of the excavation must be incorporated and operational immediately after excavation and remain functional during operation and closure of the facility.

2) During construction and operation, the vertical height between the base of the excavation or waste materials and the top of the perimeter slope (including the berm) should not exceed 4.5 m at any time during construction or operation of the facility.

3) During construction and operation, the vertical height between the base of the excavation or waste materials and the top of the temporary interior slope should not exceed 3.5 m at any time during construction or operation of the facility.

4) Excavated slopes should be flatted with the hazardous waste as soon as possible after excavation.

It should be noted that analysis of the short term scenarios associated with weight of construction equipment and foundation destabilization by way of adding lifts of soil above existing grade have not been evaluated. Additional discussion and general recommendations are provided below.

5. Discussion and General Recommendations

5.1 General

The License (Licence Number 58 HW S2 RRR) granted by Manitoba Conservation includes the following requirements concerning natural clay liners:

- The natural liner should be a minimum of 1 m in thickness at the thinnest point.
- The liner should have a hydraulic conductivity of 1 x 10-7 cm/sec or less.

The liner for the repository should comprise of naturally occurring galciolacustrine soils and/or reworked galciolacustrine soils (engineered clay fill). Engineered clay fill for use as liner material should be a minimum of 1 m thick, compacted to a minimum of 95 percent SPMDD at moisture content of +2 percent above the optimum moisture content. The measured hydraulic conductivity values, reported in Section 3.0, meet and exceed the Licence requirements.

Clay liner placement and compaction should be avoided during winter conditions. The efficiency of the clay liner is impaired if it is allowed to dry out during placement. Desiccation of the clay during construction may result in cracking which may reduce the liner efficiency.

The following sections discuss the main components of the facility: floor, perimeter slopes, temporary interior slopes, and perimeter berms.

5.2 Floor of the Proposed Facility

Based on the field investigation, the natural liner thickness below the planned cell floor (i.e., 3.5 m below existing grade) will be in excess of the required 1 m. On this basis, it is considered that the existing cohesive soils will act as a natural clay liner for the facility floor.

The following recommendations are provided to prepare the base of the cell:

- Re-work and compact at least the top 300 mm of the cell floor to a minimum of 95 percent of Standard Proctor Maximum Dry Density (SPMDD).

- Any soft, sandy or wet zones encountered at excavation grade of the facility floor should be removed and replaced with suitable cohesive soil of equivalent hydraulic conductivity characteristics and composition (i.e., clay soil). Replacement of up to 1 m thickness of soft/sandy soils with acceptable clay liner soil is deemed appropriate.
- The design should incorporate a series of subdrains at least 1.0 m below excavation grade and maximum of 1.0 m away from the toe of the 3H:1V perimeter slopes. This is needed to draw groundwater below the base of the excavation during construction and during operation of the facility. It will also serve as leachate collection during operation and closure of the facility.

5.3 Perimeter Slopes

Based on the field investigation, the naturally occurring glaciolacustrine clays are considered suitable as a natural clay liner for the perimeter slopes below existing ground level.

The following recommendations are provided to prepare the perimeter slopes:

- Excavation and shaping of the perimeter slopes should be at least 3H:1V.
- The relief between the base and top of the excavation and/or berms along the perimeter slopes should not exceed 4.5 m at any time during construction or operation of the facility.
- Any soft, sandy or wet zones encountered along the perimeter slopes should be removed and replaced with suitable cohesive soil of equivalent hydraulic conductivity characteristics and composition (i.e., clay soil). Replacement of up to 1 m thickness of soft/sandy soils with acceptable clay liner soil is deemed appropriate.

5.4 Temporary Interior Slopes

Based on the field investigation, the naturally occurring glaciolacustrine clays are considered suitable as a natural clay liner for the temporary interior slopes below existing ground level.

The following recommendations are provided to prepare the perimeter slopes:

- Excavation and shaping of the temporary interior slopes should be at least 2H:1V.
- The relief between the base and top of the excavation and/or berms along the temporary interior slopes should not exceed 3.5 m at any time during construction or operation of the facility.
- Any soft, sandy or wet zones encountered along the perimeter slopes should be removed and replaced with suitable cohesive soil of equivalent hydraulic conductivity characteristics and composition (i.e., clay soil). Replacement of a minimum of 3.0 m horizontal thickness of soft/sandy soils with acceptable clay liner soil is deemed appropriate.
- Longitudinal haul roads should be constructed at minimum 3.0 m from the crest of the interior slope.
- Flattening of the temporary interior slope linearly along slope by way of hazardous waste placement should take place as soon as possible after construction.

- Inspections by qualified personnel of performance of the temporary interior slopes for cracking, toppling, or any other form of degradation of slope should be conducted regularly. Cracking, toppling, or any other form of degradation of the slope should be repaired immediately.

5.5 Perimeter Berms

The subsurface conditions encountered at the site are anticipated to provide suitable foundation for construction of berms for the proposed repository cell facility, subject to subgrade treatment.

The recommended subgrade treatment includes clearing and stripping all organics and topsoil. The top 300 mm of the exposed subgrade if found suitable, should be scarified and re-compacted to at least 95 percent SPMDD. If organic matter, soft or weak zones are encountered, it should be excavated and replaced with engineered suitable fill.

6. Closing

The analysis and recommendations presented in this memorandum are based on the data obtained from test hole drilled at discrete locations. This memorandum does not reflect any variations which may occur between the test hole locations. In the performance on subsurface explorations, specific information is obtained at specific locations at specific times. However, it is well known that variations in soil, bedrock and groundwater conditions exist on most sites between test hole locations. The nature and extent of variations may not become evident until the course of construction. If variations are then evident, it will be necessary for a re-evaluation of the recommendations presented in this memorandum after performing on-site observations during the construction period and noting the characteristics on any variations. A qualified geotechnical engineer should be retained to provide inspection services during construction.

Please contact the undersigned if you have any questions regarding any of the information or recommendations contained within this Technical Memorandum.

Sincerely,

AECOM Canada Ltd.

Prepared By:

PROVINCE OF MANITOBA J.R. BALDWIN Member 30340 REGISTERED PROFESSIONAL ENGINEER

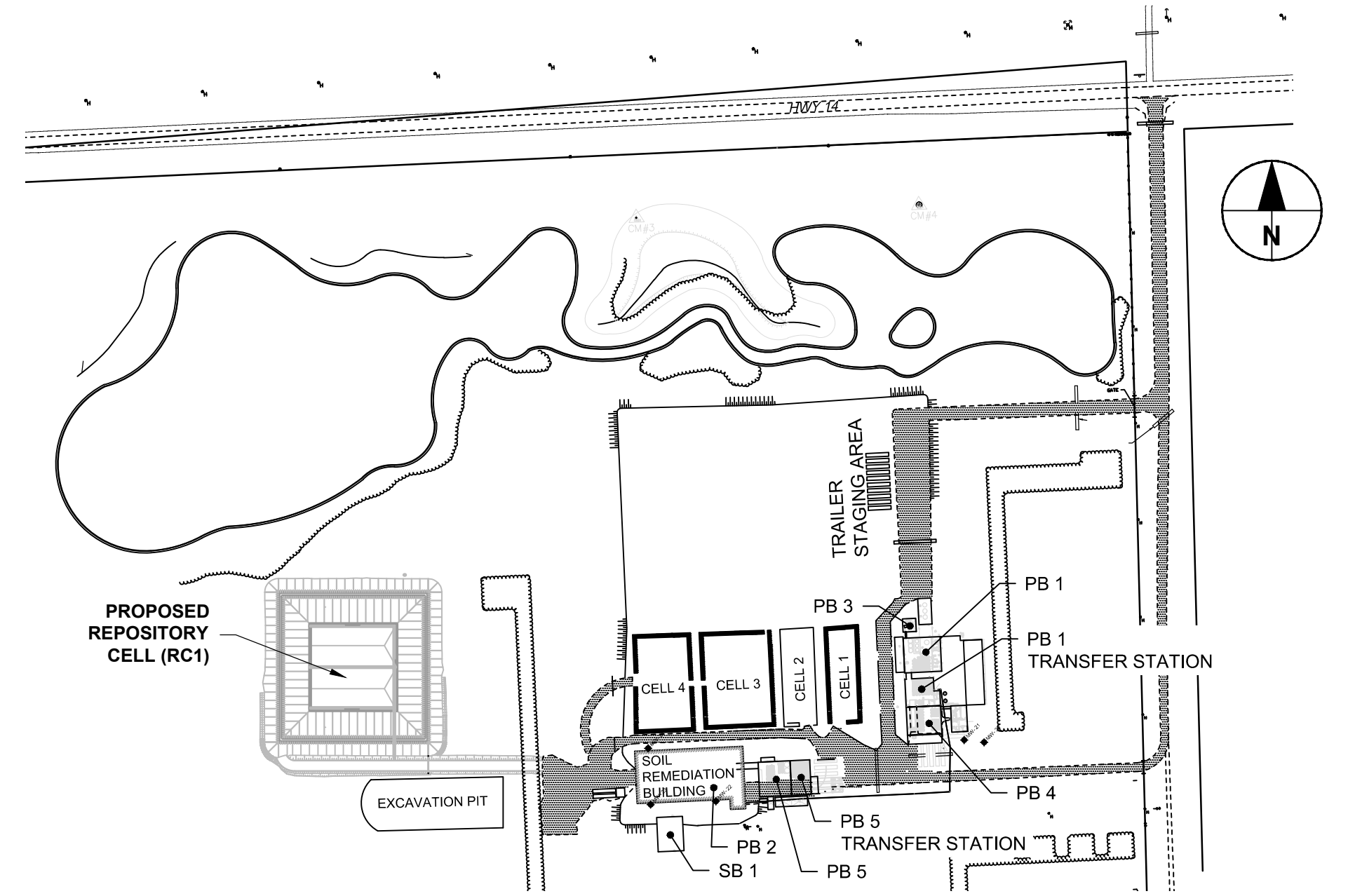
Jared Baldwin, M.Sc., P.Eng.
Geotechnical Engineer

Reviewed By:

for Faris Khalil, P.Eng., PMP, M.Sc
Manager, Geotechnical Engineering

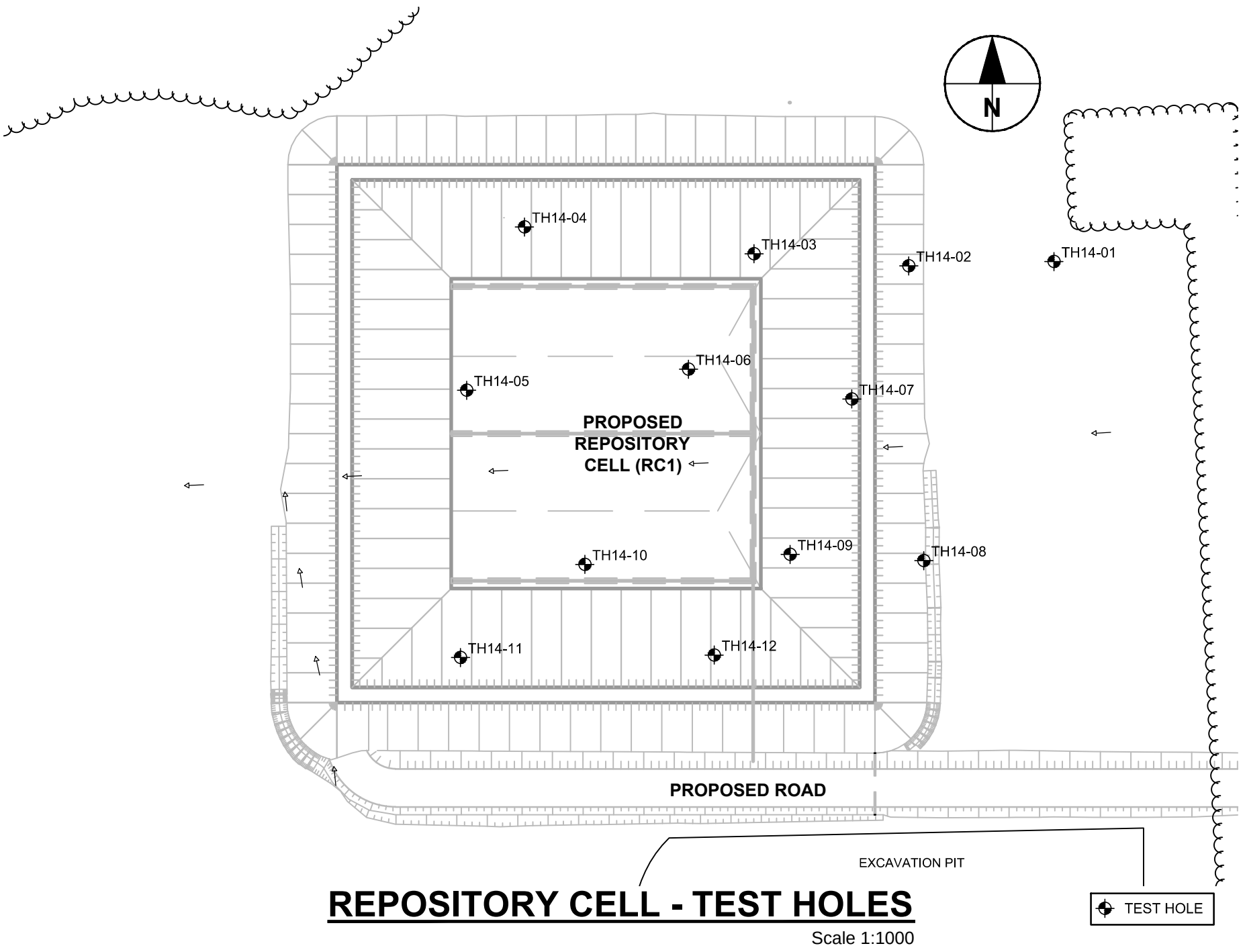
Figures

Test Hole Location Plan



SITE PLAN

Scale 1:3750



REPOSITORY CELL - TEST HOLES

Scale 1:1000

TEST HOLE LOCATION PLAN
REPOSITORY CELL
MILLER ENVIRONMENTAL CORPORATION, MANITOBA
Project No: 60320105

AECOM

Appendix A

Test Hole Logs

AECOM Canada Ltd.

GENERAL STATEMENT

NORMAL VARIABILITY OF SUBSURFACE CONDITIONS

The scope of the investigation presented herein is limited to an investigation of the subsurface conditions as to suitability for the proposed project. This report has been prepared to aid in the evaluation of the site and to assist the engineer in the design of the facilities. Our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of earth work, foundations and similar. In the event of any changes in the basic design or location of the structures as outlined in this report or plan, we should be given the opportunity to review the changes and to modify or reaffirm in writing the conclusions and recommendations of this report.

The analysis and recommendations presented in this report are based on the data obtained from the borings and test pit excavations made at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere are not significantly different from those disclosed by the borings and excavations. However, variations in soil conditions may exist between the excavations and, also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions differ from those encountered in the exploratory borings and excavations, are observed or encountered during construction, or appear to be present beneath or beyond excavations, we should be advised at once so that we can observe and review these conditions and reconsider our recommendations where necessary.

Since it is possible for conditions to vary from those assumed in the analysis and upon which our conclusions and recommendations are based, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

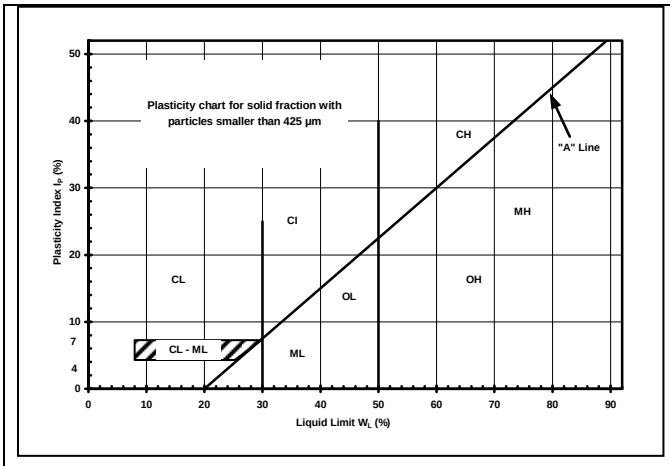
In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earth work and the foundations be observed by an experienced soils engineer. We can be retained to provide these services for you during construction. In addition, we can be retained to review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in our report.

EXPLANATION OF FIELD & LABORATORY TEST DATA

Description				UMA Log Symbols	USCS Classification	Laboratory Classification Criteria			
						Fines (%)	Grading	Plasticity	Notes
COARSE GRAINED SOILS	GRAVELS (More than 50% of coarse fraction of gravel size)	CLEAN GRAVELS (Little or no fines)	Well graded gravels, sandy gravels, with little or no fines		GW	0-5	$C_U > 4$ $1 < C_C < 3$		Dual symbols if 5-12% fines. Dual symbols if above "A" line and $4<W_P<7$ $C_U = \frac{D_{60}}{D_{10}}$ $C_C = \frac{(D_{30})^2}{D_{10} x D_{60}}$
			Poorly graded gravels, sandy gravels, with little or no fines		GP	0-5	Not satisfying GW requirements		
		DIRTY GRAVELS (With some fines)	Silty gravels, silty sandy gravels		GM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey gravels, clayey sandy gravels		GC	> 12		Atterberg limits above "A" line or $W_P<7$	
	SANDS (More than 50% of coarse fraction of sand size)	CLEAN SANDS (Little or no fines)	Well graded sands, gravelly sands, with little or no fines		SW	0-5	$C_U > 6$ $1 < C_C < 3$		
			Poorly graded sands, gravelly sands, with little or no fines		SP	0-5	Not satisfying SW requirements		
		DIRTY SANDS (With some fines)	Silty sands, sand-silt mixtures		SM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey sands, sand-clay mixtures		SC	> 12		Atterberg limits above "A" line or $W_P<7$	
FINE GRAINED SOILS	SILTS (Below 'A' line negligible organic content)	$W_L<50$	Inorganic silts, silty or clayey fine sands, with slight plasticity		ML			Classification is Based upon Plasticity Chart	
		$W_L>50$	Inorganic silts of high plasticity		MH				
	CLAYS (Above 'A' line negligible organic content)	$W_L<30$	Inorganic clays, silty clays, sandy clays of low plasticity, lean clays		CL				
		$30<W_L<50$	Inorganic clays and silty clays of medium plasticity		CI				
		$W_L>50$	Inorganic clays of high plasticity, fat clays		CH				
	ORGANIC SILTS & CLAYS (Below 'A' line)	$W_L<50$	Organic silts and organic silty clays of low plasticity		OL				
		$W_L>50$	Organic clays of high plasticity		OH				
HIGHLY ORGAINIC SOILS			Peat and other highly organic soils		Pt	Von Post Classification Limit		Strong colour or odour, and often fibrous texture	

	Asphalt		Till		
	Concrete		Bedrock (Undifferentiated)		AECOM
	Fill		Bedrock (Limestone)		

When the above classification terms are used in this report or test hole logs, the designated fractions may be visually estimated and not measured.



FRACTION		SEIVE SIZE (mm)		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
		Passing	Retained	Percent	Identifier
Gravel	Coarse	76	19	35-50	and
	Fine	19	4.75		
Sand	Coarse	4.75	2.00	20-35	"y" or "ey" *
	Medium	2.00	0.425		
	Fine	0.425	0.075	10-20	some
Silt (non-plastic) or Clay (plastic)		< 0.075 mm		1-10	trace

* for example: gravelly, sandy clayey, silty

Definition of Oversize Material

COBBLES: 76mm to 300mm diameter
BOULDERS: >300mm diameter

LEGEND OF SYMBOLS

Laboratory and field tests are identified as follows:

- q_u - undrained shear strength (kPa) derived from unconfined compression testing.
- T_v - undrained shear strength (kPa) measured using a torvane
- pp - undrained shear strength (kPa) measured using a pocket penetrometer.
- L_v - undrained shear strength (kPa) measured using a lab vane.
- F_v - undrained shear strength (kPa) measured using a field vane.
- γ - bulk unit weight (kN/m^3).
- SPT - Standard Penetration Test. Recorded as number of blows (N) from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 51 mm O.D. Raymond type sampler 0.30 m into the soil.
- DPPT - Drive Point Pentrometer Test. Recorded as number of blows from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 50 mm drive point 0.30 m into the soil.
- w - moisture content (W_L, W_P)

The undrained shear strength (Su) of a cohesive soil can be related to its consistency as follows:

Su (kPa)	**CONSISTENCY**
<12	very soft
12 – 25	soft
25 – 50	medium or firm
50 – 100	stiff
100 – 200	very stiff
200	hard

The resistance (N) of a non-cohesive soil can be related to compactness condition as follows

N – BLOWS/0.30 m	**COMPACTNESS**
0 - 4	very loose
4 - 10	loose
10 - 30	compact
30 - 50	dense
50	very dense

PROJECT: Repository Cell Construction- Letellier	CLIENT: Miller Environmental Corporation	TESTHOLE NO: **TH14-01**
LOCATION: Within Footprint of Proposed Repository Cell; UTM 14U 0620010 E/5449743 N		PROJECT NO.: 60320105
CONTRACTOR: Maple Leaf Drilling	METHOD: RM 30 Track Mounted - 125mm SSA	ELEVATION (m): 236.86

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

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

DEPTH (m)	SOIL SYMBOL	BACKFILL DETAILS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / Total Unit Wt (kN/m³) / Plastic MC Liquid	UNDRAINED SHEAR STRENGTH (kPa)	COMMENTS	ELEVATION
0			TOPSOIL/ORGANICS- rootlets							
			SILT and CLAY- trace sand - yellowish brown, stiff, dry, - intermediate to high plasticity							
1										236
					G1					
2										235
3			CLAY- silty - brownish grey, firm to stiff, moist - high plasticity		G2					234
4										233
			- becoming soft below 4.50 m		G3					
5										232
6										231
					G4					
			END OF TEST HOLE AT 6.40 m in CLAY							
7			NOTES: 1. Seepage observed below 0.60 m. 2. No Sloughing observed. 3. Test hole backfilled with bentonite upon completion.							230
8										229
9										228
10										227

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/2 × □ Lab Vane □ △ Pocket Pen. △ ✣ Field Vane ✣ (kPa) 50 100 150 200

AECOM

LOGGED BY: Alex Hill	COMPLETION DEPTH: 6.40 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 5/15/14
PROJECT ENGINEER: Keith Fitchett	Page 1 of 1

LOG OF TEST HOLE 60320105- TEST HOLE LOGS DRAFT.GPJ UMA WINN.GDT 7/8/14

PROJECT: Repository Cell Construction- Letellier	CLIENT: Miller Environmental Corporation	TESTHOLE NO: **TH14-02**
LOCATION: Within Footprint of Proposed Repository Cell; UTM 14U 0619983 E/5449744 N		PROJECT NO.: 60320105
CONTRACTOR: Maple Leaf Drilling	METHOD: RM 30 Track Mounted - 125mm SSA	ELEVATION (m): 236.77

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

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

DEPTH (m)	SOIL SYMBOL	BACKFILL DETAILS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
0			TOPSOIL/ORGANICS- rootlets						
			SILT and CLAY- trace sand - yellowish brown, stiff, dry, - intermediate plasticity						236
1					G6				
					T7			Gravel: 0.0%, Sand: 4.6%, Silt: 57.9%, Clay: 68.7%	235
2			- dark brown, stiff and moist from 2.15 m						
									234
3					G8				
									233
4									
			- becoming soft below 4.50 m		G9				232
5			CLAY- silty - brownish grey, firm to stiff, moist - high plasticity						
									231
6					G10				
			END OF TEST HOLE AT 6.40 m in CLAY						
			NOTES: 1. Seepage observed below 0.60 m. 2. No Sloughing observed. 3. Test hole backfilled with bentonite upon completion.						230
7									
									229
8									
									228
9									
									227
10									

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/2 × | □ Lab Vane □ | △ Pocket Pen. △ | ✠ Field Vane ✠ (kPa) 50 100 150 200

LOGGED BY: Alex Hill	COMPLETION DEPTH: 6.40 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 5/15/14
PROJECT ENGINEER: Keith Fitchett	Page 1 of 1

AECOM

LOG OF TEST HOLE 60320105- TEST HOLE LOGS DRAFT.GPJ UMA WINN.GDT 7/8/14

PROJECT: Repository Cell Construction- Letellier	CLIENT: Miller Environmental Corporation	TESTHOLE NO: **TH14-03**
LOCATION: Within Footprint of Proposed Repository Cell; UTM 14U 0619951.1 E/5449744 N		PROJECT NO.: 60320105
CONTRACTOR: Maple Leaf Drilling	METHOD: RM 30 Track Mounted - 125mm SSA	ELEVATION (m): 236.83

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

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

DEPTH (m)	SOIL SYMBOL	BACKFILL DETAILS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
0			TOPSOIL/ORGANICS- rootlets						
			SILT and CLAY- trace sand - yellowish brown, stiff, dry, - low to intermediate plasticity						236
1					G21				
2			- dark brown, stiff and moist from 2.30 m						235
3			CLAY- silty - brownish grey, firm to stiff, moist - high plasticity		G22				234
4					G23				233
5					T24			Gravel: 0.0%, Sand: 0.0%, Silt: 20.7%, Clay: 79.3%	232
6			- becoming soft below 5.80 m		G25				231
7			END OF TEST HOLE AT 6.40 m in CLAY NOTES: 1. Seepage observed below 0.60 m. 2. No Sloughing observed. 3. Test hole backfilled with bentonite upon completion.						230
8									229
9									228
10									227

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/2 × □ Lab Vane □ △ Pocket Pen. △ ⛢ Field Vane ⛢ (kPa) 50 100 150 200

LOG OF TEST HOLE 60320105- TEST HOLE LOGS DRAFT.GPJ UMA WINN.GDT 7/8/14

AECOM

LOGGED BY: Alex Hill	COMPLETION DEPTH: 6.40 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 5/15/14
PROJECT ENGINEER: Keith Fitchett	Page 1 of 1

PROJECT: Repository Cell Construction- Letellier	CLIENT: Miller Environmental Corporation	TESTHOLE NO: **TH14-04**
LOCATION: Within Footprint of Proposed Repository Cell; UTM 14U 0619905.86 E/5449749.5 N		PROJECT NO.: 60320105
CONTRACTOR: Maple Leaf Drilling	METHOD: RM 30 Track Mounted - 125mm SSA	ELEVATION (m): 236.86

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

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

DEPTH (m)	SOIL SYMBOL	BACKFILL DETAILS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
0			TOPSOIL/ORGANICS- rootlets						
1			SILT and CLAY- trace - yellowish brown, stiff, dry, - low to intermediate plasticity						236
					G26				
2									235
3			- dark brown, stiff and moist from 2.70 m						234
			CLAY- silty - brownish grey, firm to stiff, moist - high plasticity		G27				
4									233
					G28				
5									232
6			- becoming soft below 5.80 m						231
					T29				
			END OF TEST HOLE AT 6.40 m in CLAY						
7			NOTES: 1. Seepage observed below 0.60 m. 2. No Sloughing observed. 3. Test hole backfilled with bentonite upon completion.						230
8									229
9									228
10									227

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/2 × □ Lab Vane □ △ Pocket Pen. △ ✣ Field Vane ✣ (kPa) 50 100 150 200

AECOM

LOGGED BY: Alex Hill	COMPLETION DEPTH: 6.40 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 5/15/14
PROJECT ENGINEER: Keith Fitchett	Page 1 of 1

LOG OF TEST HOLE 60320105- TEST HOLE LOGS DRAFT.GPJ UMA WINN.GDT 7/8/14

PROJECT: Repository Cell Construction- Letellier	CLIENT: Miller Environmental Corporation	TESTHOLE NO: **TH14-05**
LOCATION: Within Footprint of Proposed Repository Cell; UTM 14U 0619894.5 E/5449717 N		PROJECT NO.: 60320105
CONTRACTOR: Maple Leaf Drilling	METHOD: RM 30 Track Mounted - 125mm SSA	ELEVATION (m): 236.91

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

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

DEPTH (m)	SOIL SYMBOL	BACKFILL DETAILS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION
0			TOPSOIL/ORGANICS- rootlets					
			SILT and CLAY- some silt to silty, trace to some sand - yellowish brown, stiff, dry, - low to intermediate plasticity					
1								236
					G30			
2								235
			- trace sand, dark brown, stiff and moist from 2.30 m					
3								234
					T31			
4								233
			CLAY- silty - brownish grey, stiff, moist - high plasticity					
					G32			
5			- becoming firm from 4.85 m					232
6			- becoming soft below 5.80 m					231
					G33			
			END OF TEST HOLE AT 6.40 m in CLAY					
7			NOTES: 1. Seepage observed below 0.60 m. 2. No Sloughing observed. 3. Test hole backfilled with bentonite upon completion.					230
8								229
9								228
10								227

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/2 × | □ Lab Vane □ | △ Pocket Pen. △ | ✠ Field Vane ✠ (kPa) 50 100 150 200

LOGGED BY: Alex Hill	COMPLETION DEPTH: 6.40 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 5/15/14
PROJECT ENGINEER: Keith Fitchett	Page 1 of 1

AECOM

LOG OF TEST HOLE 60320105- TEST HOLE LOGS DRAFT.GPJ UMA WINN.GDT 7/8/14

PROJECT: Repository Cell Construction- Letellier	CLIENT: Miller Environmental Corporation	TESTHOLE NO: **TH14-06**
LOCATION: Within Footprint of Proposed Repository Cell; UTM 14U 0619938.2 E/5449721 N		PROJECT NO.: 60320105
CONTRACTOR: Maple Leaf Drilling	METHOD: RM 30 Track Mounted - 125mm SSA	ELEVATION (m): 236.91

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

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

DEPTH (m)	SOIL SYMBOL	BACKFILL DETAILS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
0			TOPSOIL/ORGANICS- rootlets						
1			SILT and CLAY- trace to some sand - yellowish brown, stiff, dry, - intermediate plasticity						236
					G34				
2									235
			- dark brown, stiff and moist from 2.30 m						
3									234
					G35				
4									233
			CLAY- silty - brownish grey, firm to stiff, moist - high plasticity		T36			Gravel: 0.0%, Sand: 2.1%, Silt: 22.0%, Clay: 75.9%	
5									232
6									231
					G37				
			- becoming soft and wet below 6.40 m						
7									230
			- trace sand and firm below 7.60 m						
					G38				
8									229
9									228
					G39				
10									227

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/2 × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200

AECOM

LOGGED BY: Alex Hill	COMPLETION DEPTH: 12.50 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 5/15/14
PROJECT ENGINEER: Keith Fitchett	Page 1 of 2

LOG OF TEST HOLE 60320105- TEST HOLE LOGS DRAFT.GPJ UMA WINN.GDT 7/8/14

PROJECT: Repository Cell Construction- Letellier	CLIENT: Miller Environmental Corporation	TESTHOLE NO: **TH14-06**
LOCATION: Within Footprint of Proposed Repository Cell; UTM 14U 0619938.2 E/5449721 N		PROJECT NO.: 60320105
CONTRACTOR: Maple Leaf Drilling	METHOD: RM 30 Track Mounted - 125mm SSA	ELEVATION (m): 236.91

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

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

DEPTH (m)	SOIL SYMBOL	BACKFILL DETAILS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
10									
11									226
12					G40				225
13			END OF TEST HOLE AT 12.50 m in CLAY NOTES: 1. Seepage observed below 0.60 m. 2. No Sloughing observed. 3. Test hole backfilled with bentonite upon completion.						224
14									223
15									222
16									221
17									220
18									219
19									218
20									217

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/2 × | □ Lab Vane □ | △ Pocket Pen. △ | ✤ Field Vane ✤ (kPa) 50 100 150 200

LOG OF TEST HOLE 60320105- TEST HOLE LOGS DRAFT.GPJ UMA WINN.GDT 7/8/14

AECOM

LOGGED BY: Alex Hill	COMPLETION DEPTH: 12.50 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 5/15/14
PROJECT ENGINEER: Keith Fitchett	Page 2 of 2

PROJECT: Repository Cell Construction- Letellier	CLIENT: Miller Environmental Corporation	TESTHOLE NO: **TH14-07**
LOCATION: Within Footprint of Proposed Repository Cell; UTM 14U 0619970.4 E/5449716 N		PROJECT NO.: 60320105
CONTRACTOR: Maple Leaf Drilling	METHOD: RM 30 Track Mounted - 125mm SSA	ELEVATION (m): 236.79

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

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

DEPTH (m)	SOIL SYMBOL	BACKFILL DETAILS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
0			TOPSOIL/ORGANICS- rootlets						
			SILT and CLAY- trace to some sand - yellowish brown, stiff, dry, - low to intermediate plasticity						236
1					G41				
					T42			Gravel: 0.0%, Sand: 4.6%, Silt: 56.1%, Clay: 39.4%	235
2			- trace sand, dark brown, stiff and moist from 2.30 m						
									234
3					G43				
			CLAY- silty - brownish grey, stiff, moist - high plasticity						233
4									
					G44				232
5									
			- becoming firm and grey from 5.50 m						231
6					G45				
			END OF TEST HOLE AT 6.40 m in CLAY						
7			NOTES: 1. Seepage observed below 0.60 m. 2. No Sloughing observed. 3. Test hole backfilled with bentonite upon completion.						230
									229
8									
									228
9									
									227
10									

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/2 × □ Lab Vane □ △ Pocket Pen. △ ⛢ Field Vane ⛢ (kPa) 50 100 150 200

AECOM

LOGGED BY: Alex Hill	COMPLETION DEPTH: 6.40 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 5/15/14
PROJECT ENGINEER: Keith Fitchett	Page 1 of 1

LOG OF TEST HOLE 60320105- TEST HOLE LOGS DRAFT.GPJ UMA WINN.GDT 7/8/14

PROJECT: Repository Cell Construction- Letellier	CLIENT: Miller Environmental Corporation	TESTHOLE NO: **TH14-08**
LOCATION: Within Footprint of Proposed Repository Cell; UTM 14U 619984.54 E/5449683.77 N		PROJECT NO.: 60320105
CONTRACTOR: Maple Leaf Drilling	METHOD: RM 30 Track Mounted - 125mm SSA	ELEVATION (m): 236.73

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

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

DEPTH (m)	SOIL SYMBOL	BACKFILL DETAILS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION
0			TOPSOIL/ORGANICS- rootlets					
			SILT and CLAY- trace to some sand - yellowish brown, stiff, dry, - intermediate plasticity					236
1								
					G46			235
2								
								234
3			- trace sand, dark brown, stiff and moist from 3.00 m		T47		Gravel: 0.0%, Sand: 6.4%, Silt: 57.7%, Clay: 35.9%	
			CLAY- silty - brownish grey, stiff, moist - high plasticity					233
4								
					G48			232
5								
			- becoming firm and grey from 5.50 m					231
6								
					G49			230
			END OF TEST HOLE AT 6.40 m in CLAY					
7			NOTES: 1. Seepage observed below 0.60 m. 2. No Sloughing observed. 3. Test hole backfilled with bentonite upon completion.					229
8								
								228
9								
								227
10								

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/2 × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200

AECOM

LOGGED BY: Alex Hill	COMPLETION DEPTH: 6.40 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 5/15/14
PROJECT ENGINEER: Keith Fitchett	Page 1 of 1

LOG OF TEST HOLE 60320105- TEST HOLE LOGS DRAFT.GPJ UMA WINN.GDT 7/8/14

PROJECT: Repository Cell Construction- Letellier	CLIENT: Miller Environmental Corporation	TESTHOLE NO: **TH14-09**
LOCATION: Within Footprint of Proposed Repository Cell; UTM 14U 0619958.2E/5449685 N		PROJECT NO.: 60320105
CONTRACTOR: Maple Leaf Drilling	METHOD: RM 30 Track Mounted - 125mm SSA	ELEVATION (m): 236.72

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

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

DEPTH (m)	SOIL SYMBOL	BACKFILL DETAILS	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/2 × □ Lab Vane □ △ Pocket Pen. △ ⛢ Field Vane ⛢ (kPa) 50 100 150 200	COMMENTS	ELEVATION
0			TOPSOIL/ORGANICS- rootlets						236
			SILT and CLAY- trace to some sand - yellowish brown, stiff, dry, - low to intermediate plasticity						
1									
					G50		●		235
2									
			- trace sand, dark brown, stiff and moist from 2.40 m						234
3					G51		●		
			CLAY- silty - brownish grey, stiff, moist - high plasticity						233
4									
					T52		●	+△	232
5									
			- becoming firm and dark grey from 5.50 m						231
6					G53		●		
			END OF TEST HOLE AT 6.40 m in CLAY						230
7			NOTES: 1. Seepage observed below 0.60 m. 2. No Sloughing observed. 3. Test hole backfilled with bentonite upon completion.						
8									229
9									228
10									227

AECOM

LOGGED BY: Alex Hill	COMPLETION DEPTH: 6.40 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 5/15/14
PROJECT ENGINEER: Keith Fitchett	Page 1 of 1

LOG OF TEST HOLE 60320105- TEST HOLE LOGS DRAFT.GPJ UMA WINN.GDT 7/8/14

PROJECT: Repository Cell Construction- Letellier	CLIENT: Miller Environmental Corporation	TESTHOLE NO: **TH14-10**
LOCATION: Within Footprint of Proposed Repository Cell; UTM 14U 0619917.75E/5449683 N		PROJECT NO.: 60320105
CONTRACTOR: Maple Leaf Drilling	METHOD: RM 30 Track Mounted - 125mm SSA	ELEVATION (m): 236.76

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

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

DEPTH (m)	SOIL SYMBOL	BACKFILL DETAILS	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/2 × □ Lab Vane □ △ Pocket Pen. △ ⛢ Field Vane ⛢ (kPa) 50 100 150 200	COMMENTS	ELEVATION
0			TOPSOIL/ORGANICS- rootlets						236
1			SILT and CLAY- some silt to silty, trace to some sand - yellowish brown, stiff, dry, - low to intermediate plasticity						
					G54		●		
2									235
			- trace sand, dark brown, stiff and moist from 2.00 m						
3									234
					G55		●		
4			CLAY- silty - brownish grey, stiff, moist - high plasticity						233
					G56		●		232
5									
			- becoming firm and dark grey from 5.30 m						231
6					T57		●	△	
			END OF TEST HOLE AT 6.40 m in CLAY						230
7			NOTES: 1. Seepage observed below 0.60 m. 2. No Sloughing observed. 3. Test hole backfilled with bentonite upon completion.						
8									229
9									228
10									227

AECOM

LOGGED BY: Alex Hill | COMPLETION DEPTH: 6.40 m

REVIEWED BY: Faris Khalil | COMPLETION DATE: 5/15/14

PROJECT ENGINEER: Keith Fitchett | Page 1 of 1

LOG OF TEST HOLE 60320105- TEST HOLE LOGS DRAFT.GPJ UMA WINN.GDT 7/8/14

PROJECT: Repository Cell Construction- Letellier	CLIENT: Miller Environmental Corporation	TESTHOLE NO: **TH14-11**
LOCATION: Within Footprint of Proposed Repository Cell; UTM 14U 0619893.25 E/5449664.67 N		PROJECT NO.: 60320105
CONTRACTOR: Maple Leaf Drilling	METHOD: RM 30 Track Mounted - 125mm SSA	ELEVATION (m): 236.81

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

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

DEPTH (m)	SOIL SYMBOL	BACKFILL DETAILS	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/2 × ☐ Lab Vane ☐ △ Pocket Pen. △ ⛢ Field Vane ⛢ (kPa) 50 100 150 200	COMMENTS	ELEVATION
0			TOPSOIL/ORGANICS- rootlets							
			SILT and CLAY- some silt to silty, trace to some sand - yellowish brown, stiff, dry, - low to intermediate plasticity							
1										236
2										235
			- trace sand, dark brown, stiff and moist from 2.30 m							
3										234
			CLAY- silty - brownish grey, stiff, moist - high plasticity							
4										233
5			- becoming firm and dark grey from 4.85 m							232
6										231
			END OF TEST HOLE AT 6.40 m in CLAY							
			NOTES: 1. Seepage observed below 0.60 m. 2. No Sloughing observed. 3. Test hole backfilled with bentonite upon completion.							
7										230
8										229
9										228
10										227

AECOM

LOGGED BY: Alex Hill	COMPLETION DEPTH: 6.40 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 5/15/14
PROJECT ENGINEER: Keith Fitchett	Page 1 of 1

LOG OF TEST HOLE 60320105- TEST HOLE LOGS DRAFT.GPJ UMA WINN.GDT 7/8/14

PROJECT: Repository Cell Construction- Letellier	CLIENT: Miller Environmental Corporation	TESTHOLE NO: **TH14-12**
LOCATION: Within Footprint of Proposed Repository Cell; UTM 14U 0619943.2 E/5449665 N		PROJECT NO.: 60320105
CONTRACTOR: Maple Leaf Drilling	METHOD: RM 30 Track Mounted - 125mm SSA	ELEVATION (m): 236.82

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

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

DEPTH (m)	SOIL SYMBOL	BACKFILL DETAILS	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/2 × □ Lab Vane □ △ Pocket Pen. △ ⛢ Field Vane ⛢ (kPa) 50 100 150 200	COMMENTS	ELEVATION
0			TOPSOIL/ORGANICS- rootlets							
			SILT and CLAY- trace to some sand - yellowish brown, stiff, dry, - intermediate plasticity							236
1										
2										235
			- trace sand, dark brown, stiff and moist from 2.40 m							
3										234
			CLAY- silty - brownish grey, stiff, moist - high plasticity							
4										233
5			- becoming firm and dark grey from 5.00 m							232
6			END OF TEST HOLE AT 6.40 m in CLAY							231
			NOTES: 1. Seepage observed below 0.60 m. 2. No Sloughing observed. 3. Test hole backfilled with bentonite upon completion.							
7										230
8										229
9										228
10										227

LOG OF TEST HOLE 60320105- TEST HOLE LOGS DRAFT.GPJ UMA WINN.GDT 7/8/14

AECOM

LOGGED BY: Alex Hill	COMPLETION DEPTH: 6.40 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 5/15/14
PROJECT ENGINEER: Keith Fitchett	Page 1 of 1

Appendix B

Geotechnical Laboratory Reports

AECOM
99 Commerce Drive
Winnipeg, MB, Canada R3P 0Y7
www.aecom.com

204 477 5381 tel
204 284 2040 fax

Memorandum

To	Alex Hill	Page	1
CC			
Subject	Miller Environmental – Repository Cell Construction – Lettelier		
From	Jared Baldwin		
Date	June 17, 2014	Project Number	60320105

Please find attached the following material test result(s) on sample(s) submitted to the Winnipeg Geotechnical Laboratory:

- Thirty-seven (37) Moisture Content tests.
- Five (5) Atterberg Limits (3 points) tests.
- Five (5) Grain Size Distribution (hydrometer method) tests.
- Nine (9) Torvane, Pocket Penetrometer, Moisture Content, Bulk Density and Visual Description without Unconfined Compressive Strength, on a Shelby tube sample.
- Two (2) Flexible Wall Permeability tests.

If you have any questions, please contact the undersigned.

Sincerely,

Jared Baldwin, M.Sc., P.Eng.
Geotechnical Engineer

Att.

AECOM Canada Ltd.
Winnipeg Geotechnical Laboratory
99 Commerce Drive
Winnipeg, Manitoba
R3P 0Y7
Phone: 204 477 5381 Fax: 204 284 2040

Project Name:	Repository Cell Construction	Supplier:	AECOM
Project Number:	60320105	Specification:	N/A
Client:	Miller Environmental	Field Technician:	AHill
Sample Location:	Varies	Sample Date:	May 15, 2014
Sample Depth:	Varies	Lab Technician:	MLotecki
Sample Number:	Varies	Date Tested:	May 27, 2014

Moisture Content (ASTM D2216-10)

Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Location	Sample	Depth (m)	Moisture Content (%)
TH14-01	G1	1.45 - 1.6 m	20.8
-	G2	2.97 - 3.12 m	39.3
-	G3	4.5 - 4.65 m	52.2
-	G4	6.02 - 6.17 m	51.7
TH14-02	G6	0.69 - 0.84 m	20.9
-	G8	2.97 - 3.12 m	26.1
-	G9	4.5 - 4.65 m	31.8
-	G10	6.02 - 6.17 m	48.0
TH14-03	G21	1.45 - 1.6 m	26.1
-	G22	2.97 - 3.12 m	49.7
-	G23	3.66 - 4.27 m	51.5
-	G25	6.02 - 6.17 m	49.5
TH14-04	G26	1.45 - 1.6 m	34.3
-	G27	2.97 - 3.12 m	47.8
-	G28	4.5 - 4.65 m	45.2
TH14-05	G30	1.45 - 1.6 m	21.4
-	G32	4.5 - 4.65 m	49.4
-	G33	6.02 - 6.17 m	50.3
TH14-06	G34	1.45 - 1.6 m	25.5
-	G35	2.97 - 3.12 m	46.3
-	G37	6.02 - 6.17 m	51.4
-	G38	7.54 - 7.7 m	49.8
-	G39	9.07 - 9.22 m	52.8
-	G40	12.12 - 12.27 m	52.3
TH14-07	G41	0.69 - 0.84 m	26.4
-	G43	2.97 - 3.12 m	48.6
-	G44	4.5 - 4.65 m	53.5
-	G45	6.02 - 6.17 m	51.1
14-08	G46	1.45 - 1.6 m	27.3
-	G48	4.5 - 4.65 m	51.4
-	G49	6.02 - 6.17 m	46.2
TH14-09	G50	1.45 - 1.6 m	27.5
-	G51	2.97 - 3.12 m	30.5
-	G53	6.02 - 6.17 m	49.4
TH14-10	G54	1.45 - 1.6 m	33.4
-	G55	2.97 - 3.12 m	49.5
-	G56	4.5 - 4.65 m	52.8

Location	Sample	Depth (m)	Moisture Content (%)

AECOM Canada Ltd.
Winnipeg Geotechnical Laboratory
99 Commerce Drive
Winnipeg, Manitoba
R3P 0Y7
Phone: 204 477 5381 Fax: 204 284 2040

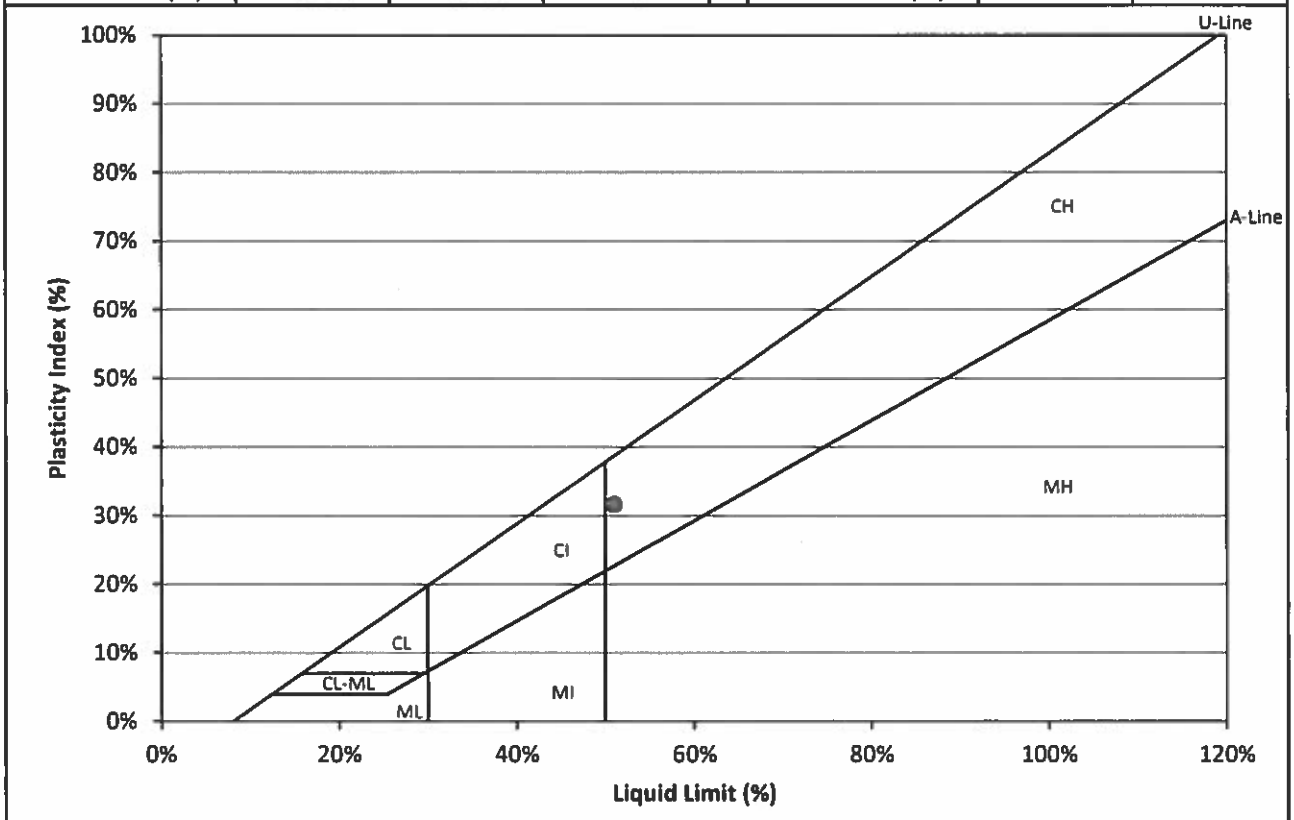
Project Name:	Repository Cell Construction	Supplier:	N/a
Project Number:	60320105	Specification:	N/a
Client:	Miller Environmental	Field Technician:	AHill
Sample Location:	TH14-03	Sample Date:	May 15, 2014
Sample Depth:	0.38 - 0.53 m	Lab Technician:	ALarionov
Sample Number:	T07	Date Tested:	June 3, 2014

Atterberg Limits

ASTM D4318: Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

Liquid Limit			
Blows	19	22	30
Wet Sample (g)	8.9	8.5	8.0
Dry Sample (g)	5.9	5.6	5.3
Water Content (%)	52.0%	51.7%	49.9%

Plastic Limit		
Trial	1	2
Wet Sample (g)	6.8	5.7
Dry Sample (g)	5.7	4.8
Water Content (%)	19.0%	19.8%



Liquid Limit (%): 51.0%	Plastic Limit (%): 19.4%	Plasticity Index (%): 31.6%

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Winnipeg Geotechnical Laboratory
99 Commerce Drive
Winnipeg, Manitoba
R3P 0Y7
Phone: 204 477 5381 Fax: 204 284 2040

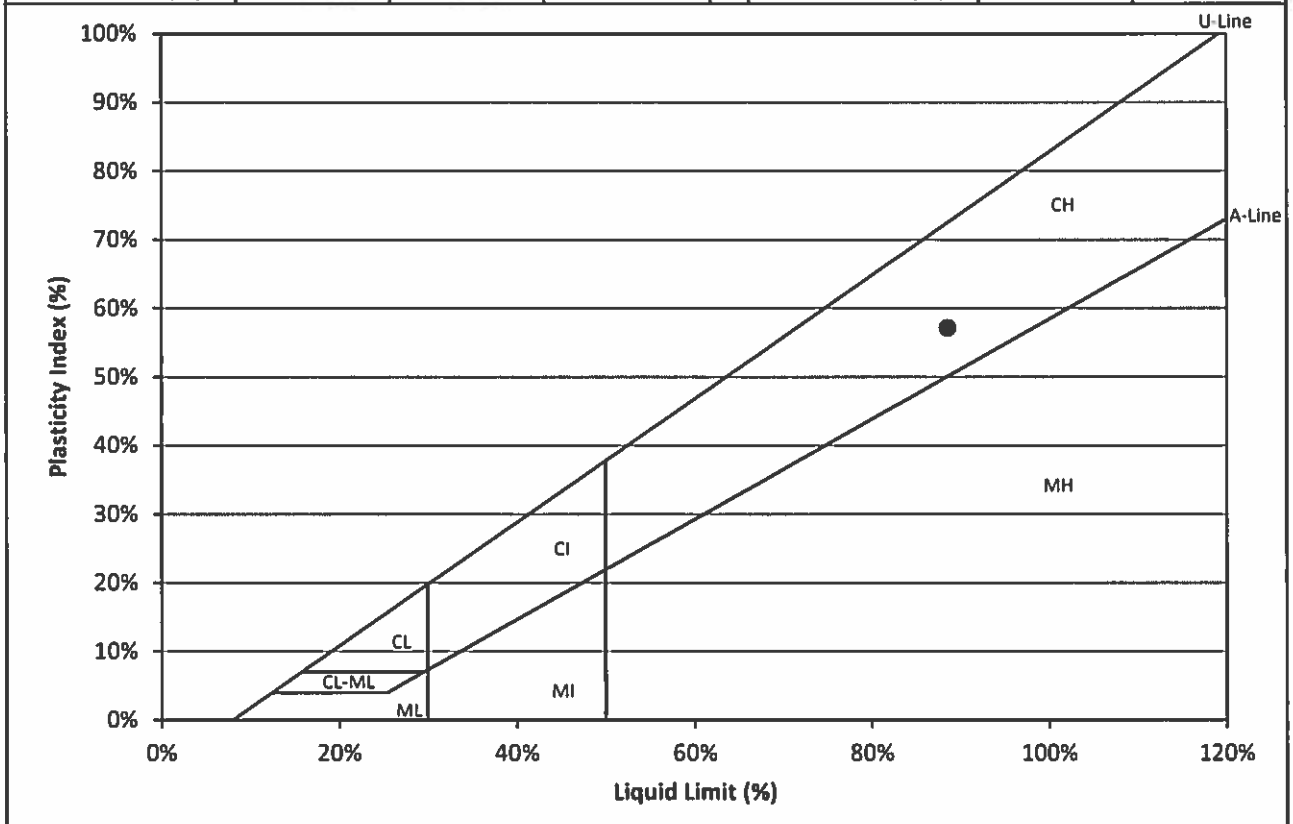
Project Name:	Repository Cell Construction	Supplier:	N/a
Project Number:	60320105	Specification:	N/a
Client:	Miller Environmental	Field Technician:	AHill
Sample Location:	TH14-03	Sample Date:	May 15, 2014
Sample Depth:	4.50 - 4.65 m	Lab Technician:	ALarionov
Sample Number:	T24	Date Tested:	June 3, 2014

Atterberg Limits

ASTM D4318: Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

Liquid Limit			
Blows	23	27	35
Wet Sample (g)	6.6	6.8	7.4
Dry Sample (g)	3.5	3.6	4.0
Water Content (%)	88.9%	88.1%	85.4%

Plastic Limit		
Trial	1	2
Wet Sample (g)	5.6	5.8
Dry Sample (g)	4.3	4.4
Water Content (%)	31.5%	31.4%



Liquid Limit (%): 88.5%	Plastic Limit (%): 31.4%	Plasticity Index (%): 57.1%

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Winnipeg Geotechnical Laboratory
99 Commerce Drive
Winnipeg, Manitoba
R3P 0Y7
Phone: 204 477 5381 Fax: 204 284 2040

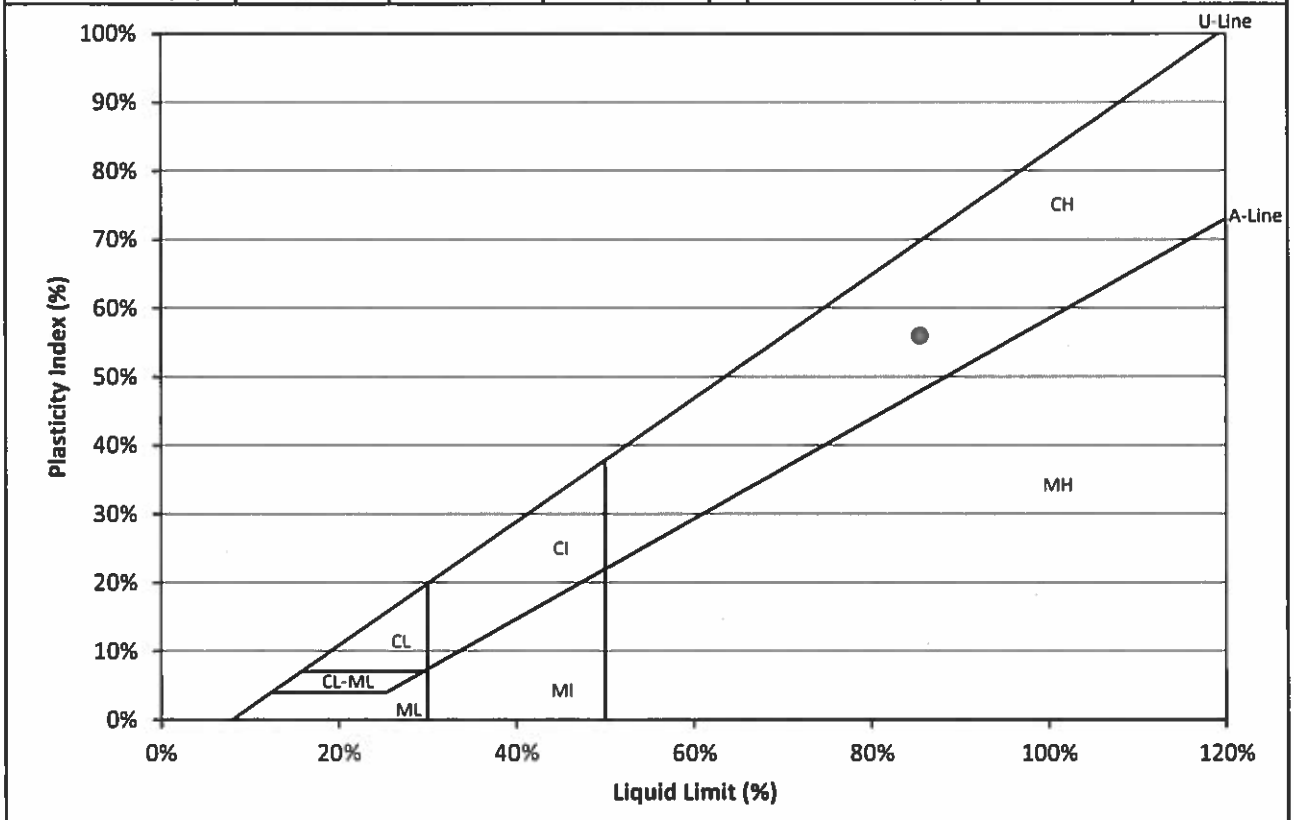
Project Name:	Repository Cell Construction	Supplier:	N/a
Project Number:	60320105	Specification:	N/a
Client:	Miller Environmental	Field Technician:	AHill
Sample Location:	TH14-06	Sample Date:	May 15, 2014
Sample Depth:	4.50 - 4.65 m	Lab Technician:	ALarionov
Sample Number:	T36	Date Tested:	June 3, 2014

Atterberg Limits

ASTM D4318: Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

Liquid Limit			
Blows	18	21	25
Wet Sample (g)	7.7	7.9	8.3
Dry Sample (g)	4.1	4.2	4.5
Water Content (%)	85.7%	85.6%	85.5%

Plastic Limit		
Trial	1	2
Wet Sample (g)	6.5	6.5
Dry Sample (g)	5.0	5.1
Water Content (%)	29.7%	29.5%



Liquid Limit (%): 85.5%	Plastic Limit (%): 29.6%	Plasticity Index (%): 55.9%

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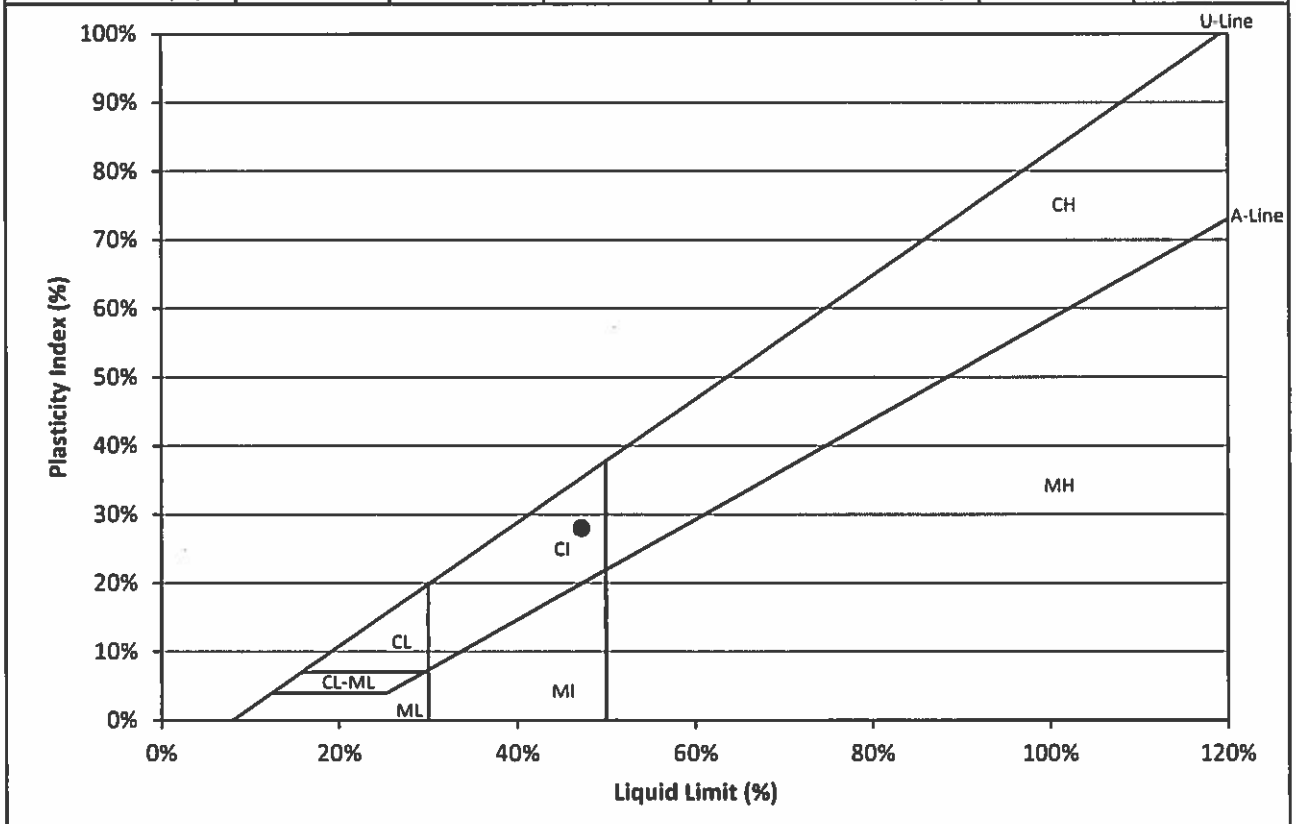
Project Name:	Repository Cell Construction	Supplier:	N/a
Project Number:	60320105	Specification:	N/a
Client:	Miller Environmental	Field Technician:	AHill
Sample Location:	TH14-07	Sample Date:	May 15, 2014
Sample Depth:	1.45 - 1.60 m	Lab Technician:	ALarionov
Sample Number:	T42	Date Tested:	June 3, 2014

Atterberg Limits

ASTM D4318: Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

Liquid Limit			
Blows	16	24	32
Wet Sample (g)	9.1	8.3	8.3
Dry Sample (g)	6.0	5.6	5.8
Water Content (%)	50.8%	47.7%	45.1%

Plastic Limit		
Trial	1	2
Wet Sample (g)	5.6	6.8
Dry Sample (g)	4.7	5.7
Water Content (%)	19.2%	19.3%



Liquid Limit (%): 47.2%	Plastic Limit (%): 19.2%	Plasticity Index (%): 28.0%

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99 Commerce Drive
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Phone: 204 477 5381 Fax: 204 284 2040

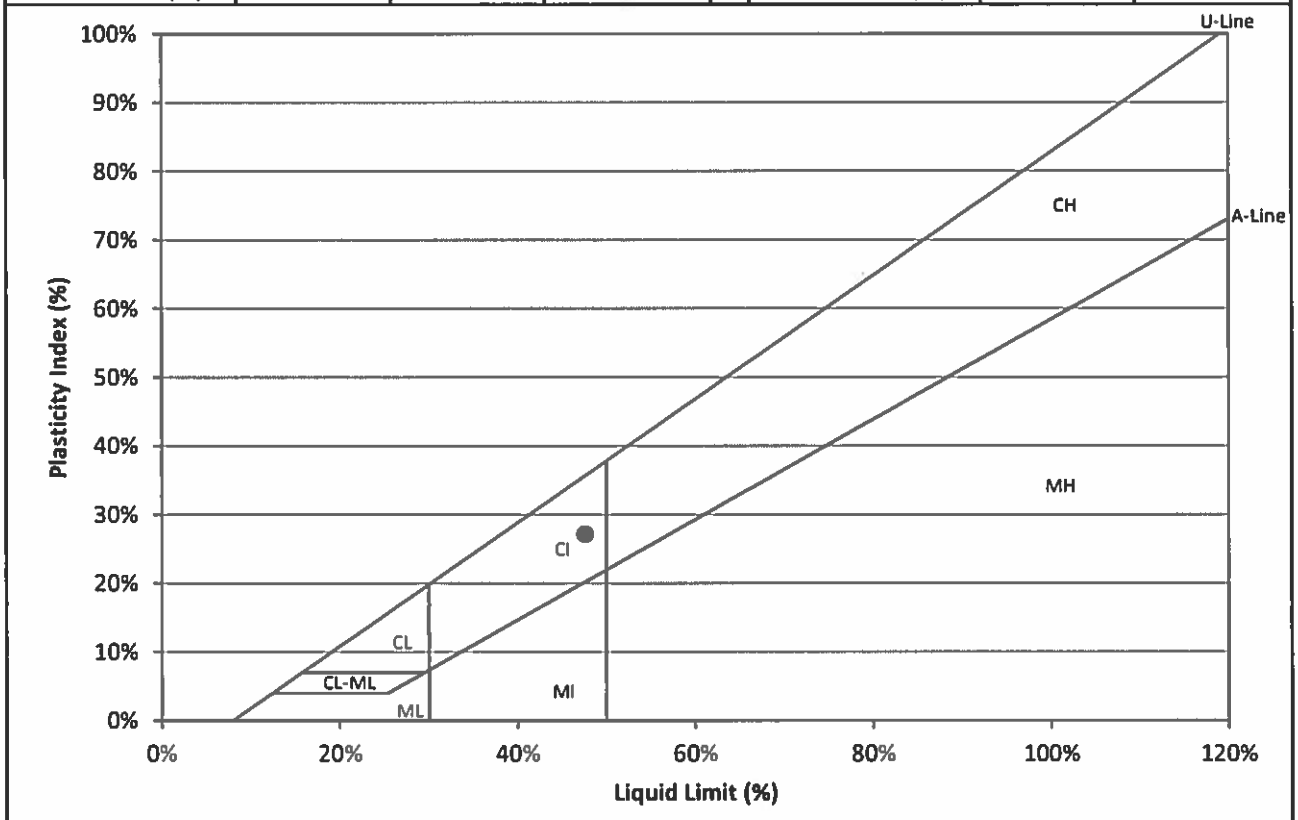
Project Name:	Repository Cell Construction	Supplier:	N/a
Project Number:	60320105	Specification:	N/a
Client:	Miller Environmental	Field Technician:	AHill
Sample Location:	TH14-08	Sample Date:	May 15, 2014
Sample Depth:	2.97 - 3.12 m	Lab Technician:	ALarionov
Sample Number:	T47	Date Tested:	June 3, 2014

Atterberg Limits

ASTM D4318: Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

Liquid Limit			
Blows	18	23	30
Wet Sample (g)	7.9	8.8	8.9
Dry Sample (g)	5.3	5.9	6.1
Water Content (%)	49.3%	48.3%	46.2%

Plastic Limit		
Trial	1	2
Wet Sample (g)	5.6	7.9
Dry Sample (g)	4.7	6.5
Water Content (%)	20.5%	20.5%



Liquid Limit (%): 47.6%	Plastic Limit (%): 20.5%	Plasticity Index (%): 27.1%

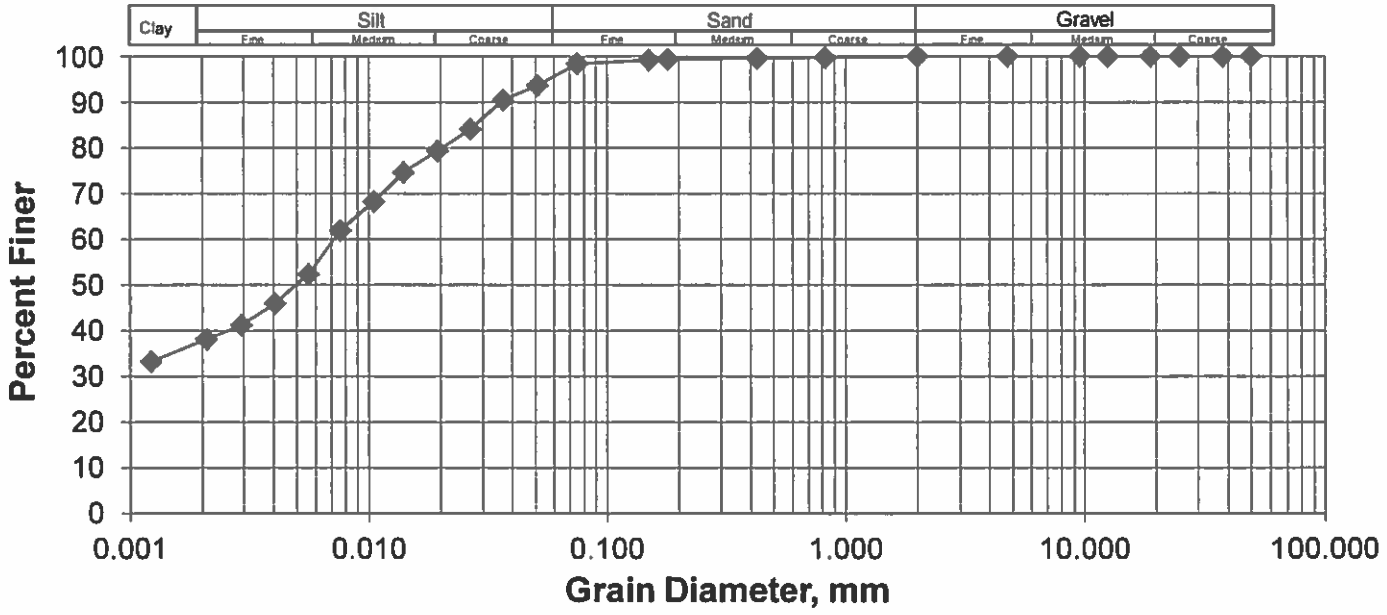
GRAIN SIZE DISTRIBUTION
(ASTM D422-63)

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

Job No.:	60320105	Hole No.:	TH14-03
Client:	Miller Environmental	Sample No.:	T7
Project :	Repository Cell Replacement	Depth:	1.45 - 1.60 m
Date Tested:	2-Jun-14	Date Sampled:	15-May-14
Tested By:	ALarionov	Sampled By:	AECOM (AHill)

GRAVEL SIZES		SAND SIZES		FINES	
Grain Size (mm.)	Total Percent Passing	Grain Size (mm.)	Total Percent Passing	Grain Size (mm.)	Total Percent Passing
50.0	100.0	2.00	100.0	0.0750	98.4
38.0	100.0	0.83	99.8	0.0510	93.6
25.0	100.0	0.43	99.6	0.0367	90.5
19.0	100.0	0.18	99.4	0.0268	84.1
12.5	100.0	0.15	99.2	0.0194	79.3
9.5	100.0	0.075	98.4	0.0140	74.6
4.75	100.0			0.0105	68.2
2.00	100.0			0.0076	61.9
				0.0056	52.3
				0.0041	46.0
				0.0029	41.2
				0.0021	38.1
				0.0012	33.3

GRAIN SIZE DISTRIBUTION CURVE



Gravel	**0.0%**	**Silt**	**57.9%**
Sand	**4.6%**	**Clay**	**37.6%**

** Note: Soil Classification based on Grain Size from Canadian Foundation Engineering Manual, 3rd edition (1992).

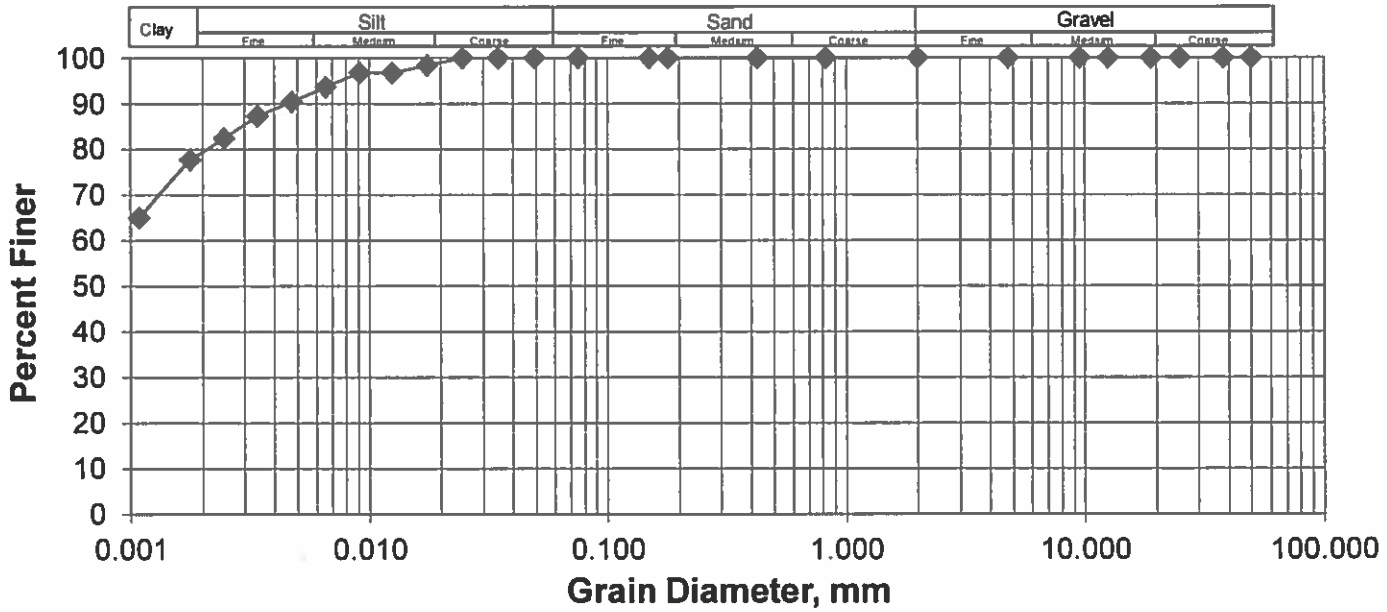
GRAIN SIZE DISTRIBUTION
(ASTM D422-63)

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

Job No.:	60320105	Hole No.:	TH14-03
Client:	Miller Environmental	Sample No.:	T24
Project :	Repository Cell Replacement	Depth:	4.50 - 4.65 m
Date Tested:	2-Jun-14	Date Sampled:	15-May-14
Tested By:	ALarionov	Sampled By:	AECOM (AHill)

GRAVEL SIZES		SAND SIZES		FINES	
Grain Size (mm.)	Total Percent Passing	Grain Size (mm.)	Total Percent Passing	Grain Size (mm.)	Total Percent Passing
50.0	100.0	2.00	100.0	0.0750	100.0
38.0	100.0	0.83	100.0	0.0491	100.0
25.0	100.0	0.43	100.0	0.0347	100.0
19.0	100.0	0.18	100.0	0.0246	100.0
12.5	100.0	0.15	100.0	0.0175	98.4
9.5	100.0	0.075	100.0	0.0125	96.8
4.75	100.0			0.0091	96.8
2.00	100.0			0.0066	93.6
				0.0047	90.5
				0.0034	87.3
				0.0025	82.5
				0.0018	77.8
				0.0011	65.1

GRAIN SIZE DISTRIBUTION CURVE



Gravel	**0.0%**	**Silt**	**20.7%**
Sand	**0.0%**	**Clay**	**79.3%**

** Note: Soil Classification based on Grain Size from Canadian Foundation Engineering Manual, 3rd edition (1992).

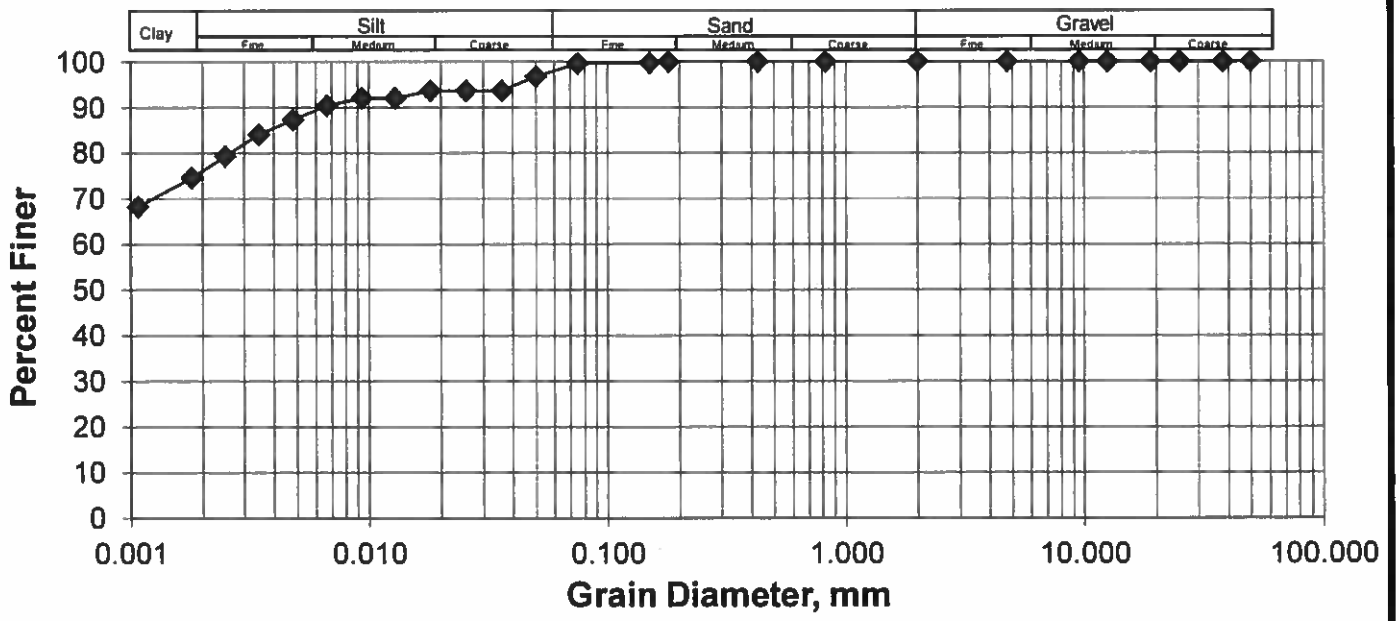
GRAIN SIZE DISTRIBUTION
(ASTM D422-63)

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

Job No.:	60320105	Hole No.:	TH14-06
Client:	Miller Environmental	Sample No.:	T36
Project :	Repository Cell Replacement	Depth:	4.50 - 4.65 m
Date Tested:	2-Jun-14	Date Sampled:	15-May-14
Tested By:	ALarionov	Sampled By:	AECOM (AHill)

GRAVEL SIZES		SAND SIZES		FINES	
Grain Size (mm.)	Total Percent Passing	Grain Size (mm.)	Total Percent Passing	Grain Size (mm.)	Total Percent Passing
50.0	100.0	2.00	100.0	0.0750	99.6
38.0	100.0	0.83	100.0	0.0500	96.8
25.0	100.0	0.43	100.0	0.0360	93.6
19.0	100.0	0.18	100.0	0.0255	93.6
12.5	100.0	0.15	99.8	0.0180	93.6
9.5	100.0	0.075	99.6	0.0128	92.1
4.75	100.0			0.0094	92.1
2.00	100.0			0.0067	90.5
				0.0048	87.3
				0.0035	84.1
				0.0025	79.3
				0.0018	74.6
				0.0011	68.2

GRAIN SIZE DISTRIBUTION CURVE



Gravel	**0.0%**	**Silt**	**22.0%**
Sand	**2.1%**	**Clay**	**75.9%**

** Note: Soil Classification based on Grain Size from Canadian Foundation Engineering Manual, 3rd edition (1992).

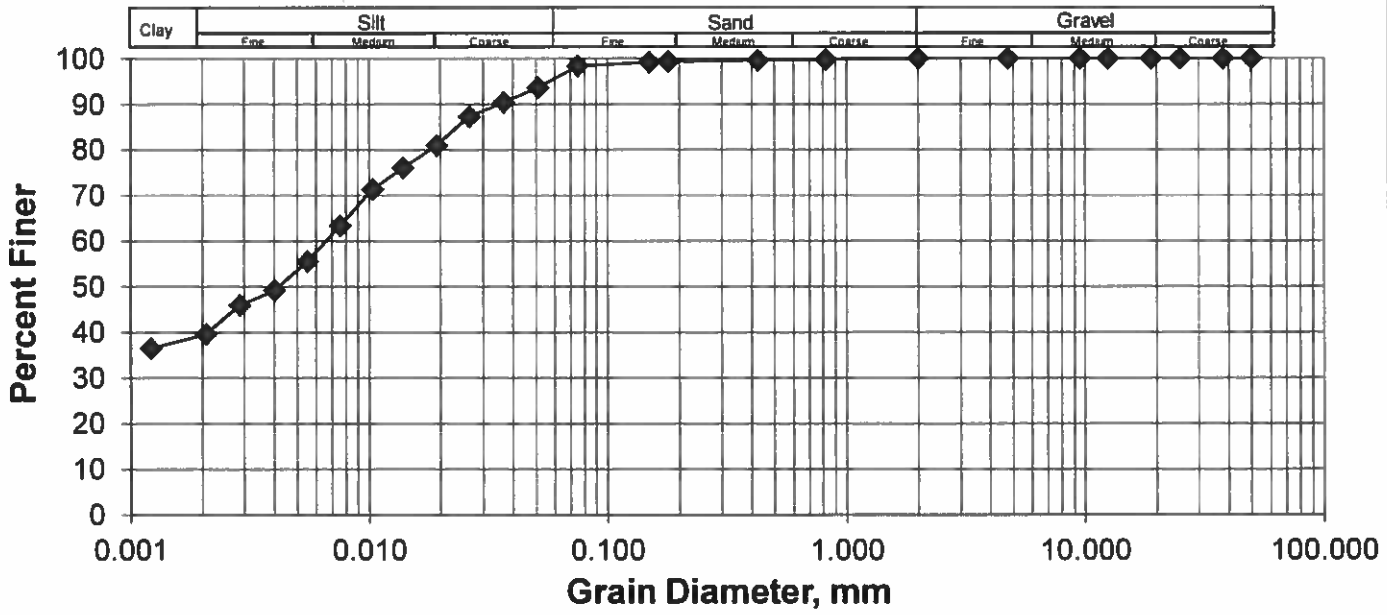
GRAIN SIZE DISTRIBUTION
(ASTM D422-63)

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

Job No.:	60320105	Hole No.:	TH14-07
Client:	Miller Environmental	Sample No.:	T42
Project :	Repository Cell Replacement	Depth:	1.45 - 1.60 m
Date Tested:	2-Jun-14	Date Sampled:	15-May-14
Tested By:	ALarionov	Sampled By:	AECOM (AHill)

GRAVEL SIZES		SAND SIZES		FINES	
Grain Size (mm.)	Total Percent Passing	Grain Size (mm.)	Total Percent Passing	Grain Size (mm.)	Total Percent Passing
50.0	100.0	2.00	100.0	0.0750	98.4
38.0	100.0	0.83	99.8	0.0510	93.6
25.0	100.0	0.43	99.6	0.0367	90.5
19.0	100.0	0.18	99.4	0.0264	87.3
12.5	100.0	0.15	99.2	0.0192	80.9
9.5	100.0	0.075	98.4	0.0139	76.2
4.75	100.0			0.0104	71.4
2.00	100.0			0.0076	63.5
				0.0055	55.5
				0.0040	49.2
				0.0029	46.0
				0.0021	39.6
				0.0012	36.5

GRAIN SIZE DISTRIBUTION CURVE



Gravel	**0.0%**	**Silt**	**56.1%**
Sand	**4.6%**	**Clay**	**39.4%**

** Note: Soil Classification based on Grain Size from Canadian Foundation Engineering Manual, 3rd edition (1992).

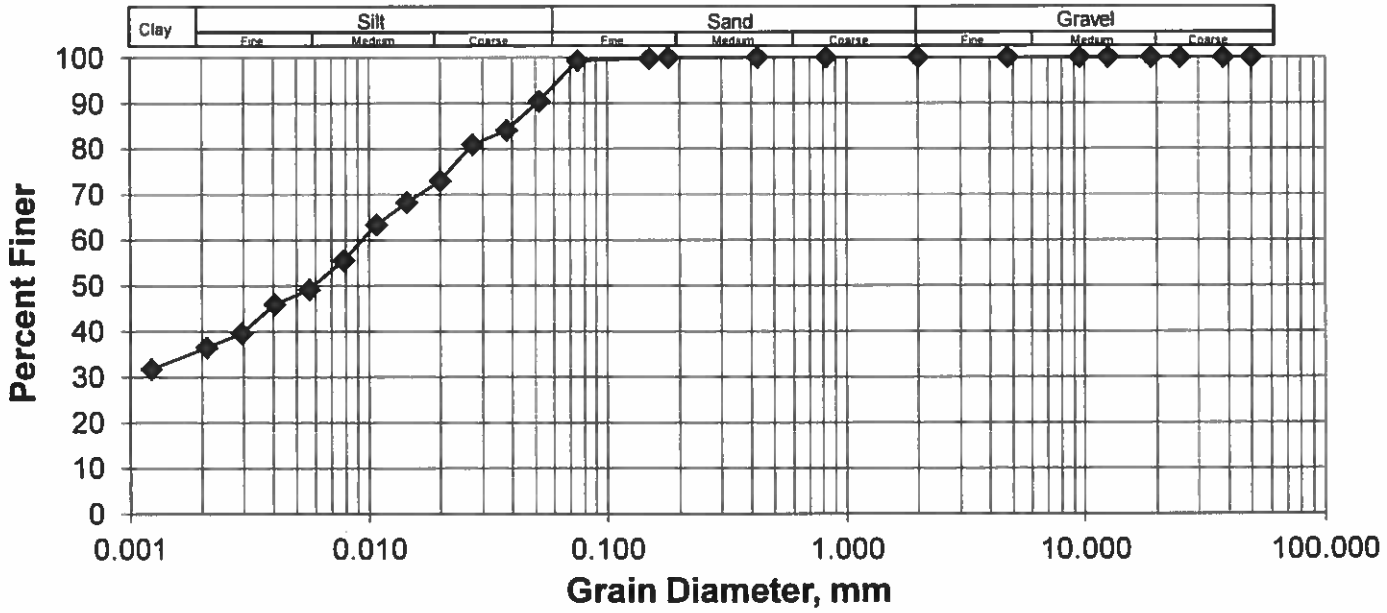
GRAIN SIZE DISTRIBUTION
(ASTM D422-63)

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

Job No.:	60320105	Hole No.:	TH14-08
Client:	Miller Environmental	Sample No.:	T47
Project :	Repository Cell Replacement	Depth:	2.97 - 3.12 m
Date Tested:	2-Jun-14	Date Sampled:	15-May-14
Tested By:	ALarionov	Sampled By:	AECOM (AHill)

GRAVEL SIZES		SAND SIZES		FINES	
Grain Size (mm.)	Total Percent Passing	Grain Size (mm.)	Total Percent Passing	Grain Size (mm.)	Total Percent Passing
50.0	100.0	2.00	100.0	0.0750	99.4
38.0	100.0	0.83	100.0	0.0518	90.5
25.0	100.0	0.43	100.0	0.0379	84.1
19.0	100.0	0.18	100.0	0.0272	80.9
12.5	100.0	0.15	99.8	0.0200	73.0
9.5	100.0	0.075	99.4	0.0144	68.2
4.75	100.0			0.0107	63.5
2.00	100.0			0.0078	55.5
				0.0057	49.2
				0.0041	46.0
				0.0029	39.6
				0.0021	36.5
				0.0012	31.7

GRAIN SIZE DISTRIBUTION CURVE



Gravel	**0.0%**	**Silt**	**57.7%**
Sand	**6.4%**	**Clay**	**35.9%**

** Note: Soil Classification based on Grain Size from Canadian Foundation Engineering Manual, 3rd edition (1992).

AECOM - SOILS LABORATORY
SHEAR STRENGTH, MOISTURE CONTENT & DENSITY CALCULATIONS

AECOM

CLIENT: Miller Environmental
PROJECT: Repository Cell Construction
JOB NO.: 60320105

TEST HOLE NO.:	**TH14-03**
SAMPLE NO.:	**T7**
SAMPLE DEPTH:	1.45 - 1.60 m
DATE TESTED:	23-May-14
SHEAR STRENGTH TESTS	
TORVANE	
Reading	0.70
Vane Size (S, M, L)	m
Undrained Shear Strength (kPa)	**68.7**
Undrained Shear Strength (ksf)	1.43
POCKET PENETROMETER	
Reading - Qu (tsf)	2.50
Undrained Shear Strength (kPa)	**119.7**
Reading - Qu (tsf)	2.40
Undrained Shear Strength (kPa)	**114.9**
Reading - Qu (tsf)	3.00
Undrained Shear Strength (kPa)	**143.6**
UNCONFINED COMPRESSIVE STRENGTH TEST	
Unconfined compressive strength (kPa)	**N/a**
Unconfined compressive strength (ksf)	**N/a**
Undrained Shear Strength (kPa)	**N/a**
Undrained Shear Strength (ksf)	**N/a**
MOISTURE CONTENT	
Tare Number	SG36
Wt. Sample wet + tare (g)	2020.0
Wt. Sample dry + tare (g)	1721.5
Wt. Tare (g)	581.7
Moisture Content %	**26.2**
BULK DENSITY	
Sample Wt. (g)	1438.4
Diameter 1 (cm)	7.21
Diameter 2 (cm)	7.20
Diameter 3 (cm)	7.21
Avg. Diameter (cm)	**7.21**
Length 1 (cm)	18.60
Length 2 (cm)	18.52
Length 3 (cm)	18.54
Avg. Length (cm)	**18.55**
Volume (cm^3)	756.8
Moisture content (%)	26.2
Bulk Density (g/cm^3)	1.901
Bulk Density (kN/m^3)	**18.6**
Bulk Density (pcf)	**118.7**
Dry Density (kN/m^3)	**14.77**

AECOM - SOILS LABORATORY
UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS (ASTM D2166)

AECOM

CLIENT:	Miller Environmental
PROJECT:	Repository Cell Construction
JOB NO.:	60320105

TEST HOLE NO.:	TH14-03
SAMPLE NO.:	T7
SAMPLE DEPTH:	1.45 - 1.60 m
SAMPLE DATE:	15-May-14
TEST DATE:	23-May-14

SOIL DESCRIPTION:	
CLAY; silty, trace oxidation, brown, moist, very stiff, intermediate plasticity, laminated.	
MOISTURE CONTENT:	26.2

FAILURE SKETCH

SAMPLE DIAM.(Do):	72.07	(mm)	INITIAL AREA, Ao:	4079.0	(mm^2)
SAMPLE LENGTH, (Lo):	185.53	(mm)	PISTON RATE:	0.051	(inches / minute)
L / D RATIO:	2.57	(2 < L/D < 2.5)	AXIAL STRAIN RATE, R:	0.70	(0.5<R<2 % / minute)

TEST DATA - DIAL READINGS							
AXIAL COMPRESSION	PROVING RING	TOTAL AXIAL STRAIN, E_1	AVERAGE CROSS-SECTIONAL AREA, A	APPLIED AXIAL LOAD, P	COMPRESSIVE STRESS, σ_c		
(inches)	(inches)	(%)	(inches2)	(lbs)	(psi)	(ksf)	(kPa)

UNCONFINED COMPRESSIVE STRENGTH, q_u:	0.00	kPa
(based on maximum q_u value)	0.000	ksf
UNDRAINED SHEAR STRENGTH, S_u:	0.00	kPa
(based on maximum q_u value)	0.000	ksf

NOTES:

AECOM - SOILS LABORATORY
SHEAR STRENGTH, MOISTURE CONTENT & DENSITY CALCULATIONS

AECOM

CLIENT: Miller Environmental
PROJECT: Repository Cell Construction
JOB NO.: 60320105

TEST HOLE NO.:	**TH14-03**
SAMPLE NO.:	**T24**
SAMPLE DEPTH:	4.50 - 4.65 m
DATE TESTED:	23-May-14
SHEAR STRENGTH TESTS	
TORVANE	
Reading	0.50
Vane Size (S, M, L)	m
Undrained Shear Strength (kPa)	**49.0**
Undrained Shear Strength (ksf)	1.02
POCKET PENETROMETER	
Reading - Qu (tsf)	0.75
Undrained Shear Strength (kPa)	**35.9**
Reading - Qu (tsf)	0.75
Undrained Shear Strength (kPa)	**35.9**
Reading - Qu (tsf)	0.75
Undrained Shear Strength (kPa)	**35.9**
UNCONFINED COMPRESSIVE STRENGTH TEST	
Unconfined compressive strength (kPa)	**N/a**
Unconfined compressive strength (ksf)	**N/a**
Undrained Shear Strength (kPa)	**N/a**
Undrained Shear Strength (ksf)	**N/a**
MOISTURE CONTENT	
Tare Number	SG36
Wt. Sample wet + tare (g)	**N/a**
Wt. Sample dry + tare (g)	**N/a**
Wt. Tare (g)	**N/a**
Moisture Content %	**N/a**
BULK DENSITY	
Sample Wt. (g)	**N/a**
Diameter 1 (cm)	**N/a**
Diameter 2 (cm)	**N/a**
Diameter 3 (cm)	**N/a**
Avg. Diameter (cm)	**N/a**
Length 1 (cm)	**N/a**
Length 2 (cm)	**N/a**
Length 3 (cm)	**N/a**
Avg. Length (cm)	**N/a**
Volume (cm^3)	**N/a**
Moisture content (%)	**N/a**
Bulk Density (g/cm^3)	**N/a**
Bulk Density (kN/m^3)	**N/a**
Bulk Density (pcf)	**N/a**
Dry Density (kN/m^3)	**N/a**

AECOM - SOILS LABORATORY
UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS (ASTM D2166)

AECOM

CLIENT:	Miller Environmental
PROJECT:	Repository Cell Construction
JOB NO.:	60320105

TEST HOLE NO.:	TH14-03
SAMPLE NO.:	T7
SAMPLE DEPTH:	4.50 - 4.65 m
SAMPLE DATE:	15-May-14
TEST DATE:	23-May-14

SOIL DESCRIPTION:
CLAY: trace silt, trace oxidation, sulphate inclusions, brown, moist, firm, high plasticity
MOISTURE CONTENT: N/a

FAILURE SKETCH

SAMPLE DIAM.(Do):	#VALUE!	(mm)	INITIAL AREA, Ao:	#VALUE!	(mm^2)
SAMPLE LENGTH, (Lo):	#VALUE!	(mm)	PISTON RATE:	0.051	(inches / minute)
L / D RATIO:	#VALUE!	(2 < L/D < 2.5)	AXIAL STRAIN RATE, R:	#VALUE!	(0.5<R<2 % / minute)

TEST DATA - DIAL READINGS							
AXIAL COMPRESSION	PROVING RING	TOTAL AXIAL STRAIN, ε_1	AVERAGE CROSS-SECTIONAL AREA, A	APPLIED AXIAL LOAD, P	COMPRESSIVE STRESS, σ_c		
(inches)	(inches)	(%)	($inches^2$)	(lbs)	(psf)	(ksf)	(kPa)

UNCONFINED COMPRESSIVE STRENGTH q_u:	0.00	kPa
(based on maximum q_u value)	0.000	ksf
UNDRAINED SHEAR STRENGTH, S_u:	0.00	kPa
(based on maximum q_u value)	0.000	ksf

NOTES:

AECOM - SOILS LABORATORY
SHEAR STRENGTH, MOISTURE CONTENT & DENSITY CALCULATIONS

AECOM

CLIENT: Miller Environmental
PROJECT: Repository Cell Construction
JOB NO.: 60320105

TEST HOLE NO.:	**TH14-04**
SAMPLE NO.:	**T29**
SAMPLE DEPTH:	6.02 - 6.17 m
DATE TESTED:	23-May-14
SHEAR STRENGTH TESTS	
TORVANE	
Reading	0.50
Vane Size (S, M, L)	m
Undrained Shear Strength (kPa)	**49.0**
Undrained Shear Strength (ksf)	1.02
POCKET PENETROMETER	
Reading - Qu (tsf)	0.75
Undrained Shear Strength (kPa)	**35.9**
Reading - Qu (tsf)	0.50
Undrained Shear Strength (kPa)	**23.9**
Reading - Qu (tsf)	0.50
Undrained Shear Strength (kPa)	**23.9**
UNCONFINED COMPRESSIVE STRENGTH TEST	
Unconfined compressive strength (kPa)	**N/a**
Unconfined compressive strength (ksf)	**N/a**
Undrained Shear Strength (kPa)	N/a
Undrained Shear Strength (ksf)	N/a
MOISTURE CONTENT	
Tare Number	SG36
Wt. Sample wet + tare (g)	1715.8
Wt. Sample dry + tare (g)	1207.7
Wt. Tare (g)	243.3
Moisture Content %	**52.7**
BULK DENSITY	
Sample Wt. (g)	**N/a**
Diameter 1 (cm)	**N/a**
Diameter 2 (cm)	**N/a**
Diameter 3 (cm)	**N/a**
Avg. Diameter (cm)	**N/a**
Length 1 (cm)	N/a
Length 2 (cm)	N/a
Length 3 (cm)	N/a
Avg. Length (cm)	N/a
Volume (cm^3)	N/a
Moisture content (%)	52.7
Bulk Density (g/cm^3)	N/a
Bulk Density (kN/m^3)	N/a
Bulk Density (pcf)	N/a
Dry Density (kN/m^3)	N/a

AECOM - SOILS LABORATORY
UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS (ASTM D2166)

AECOM

CLIENT:	Miller Environmental
PROJECT:	Repository Cell Construction
JOB NO.:	60320105

TEST HOLE NO.:	TH14-03
SAMPLE NO.:	T7
SAMPLE DEPTH:	6.02 - 6.17 m
SAMPLE DATE:	15-May-14
TEST DATE:	23-May-14

SOIL DESCRIPTION:	
CLAY, trace silt, trace sulphate, trace oxidation, grey, moist, firm, high plasticity, laminated.	
MOISTURE CONTENT:	52.7

SAMPLE DIAM.(Do):	#VALUE!	(mm)	INITIAL AREA, Ao:	#VALUE!	(mm^2)
SAMPLE LENGTH, (Lo):	#VALUE!	(mm)	PISTON RATE:	0.051	(inches / minute)
L / D RATIO:	#VALUE!	(2 < L/D < 2.5)	AXIAL STRAIN RATE, R:	#VALUE!	(0.5<R<2 % / minute)

FAILURE SKETCH

TEST DATA - DIAL READINGS							
AXIAL COMPRESSION	PROVING RING	TOTAL AXIAL STRAIN, E_t	AVERAGE CROSS-SECTIONAL AREA, A	APPLIED AXIAL LOAD, P	COMPRESSIVE STRESS, σ_c		
(inches)	(inches)	(%)	(inches2)	(lbs)	(psi)	(ksf)	(kPa)

UNCONFINED COMPRESSIVE STRENGTH, q_u:	0.00	kPa
(based on maximum q_u value)	0.000	ksf
UNDRAINED SHEAR STRENGTH, S_u:	0.00	kPa
(based on maximum q_u value)	0.000	ksf

NOTES:

AECOM - SOILS LABORATORY
SHEAR STRENGTH, MOISTURE CONTENT & DENSITY CALCULATIONS

AECOM

CLIENT: Miller Environmental
PROJECT: Repository Cell Construction
JOB NO.: 60320105

TEST HOLE NO.:	**TH14-05**
SAMPLE NO.:	**T31**
SAMPLE DEPTH:	2.97 - 3.12 m
DATE TESTED:	23-May-14
SHEAR STRENGTH TESTS	
TORVANE	
Reading	0.50
Vane Size (S, M, L)	m
Undrained Shear Strength (kPa)	**49.0**
Undrained Shear Strength (ksf)	1.02
POCKET PENETROMETER	
Reading - Qu (tsf)	0.75
Undrained Shear Strength (kPa)	**35.9**
Reading - Qu (tsf)	0.75
Undrained Shear Strength (kPa)	**35.9**
Reading - Qu (tsf)	1.25
Undrained Shear Strength (kPa)	**59.9**
UNCONFINED COMPRESSIVE STRENGTH TEST	
Unconfined compressive strength (kPa)	**N/a**
Unconfined compressive strength (ksf)	**N/a**
Undrained Shear Strength (kPa)	**N/a**
Undrained Shear Strength (ksf)	**N/a**
MOISTURE CONTENT	
Tare Number	SG36
Wt. Sample wet + tare (g)	1555.7
Wt. Sample dry + tare (g)	1264.6
Wt. Tare (g)	409.3
Moisture Content %	**34.0**
BULK DENSITY	
Sample Wt. (g)	N/a
Diameter 1 (cm)	N/a
Diameter 2 (cm)	N/a
Diameter 3 (cm)	N/a
Avg. Diameter (cm)	**N/a**
Length 1 (cm)	N/a
Length 2 (cm)	N/a
Length 3 (cm)	N/a
Avg. Length (cm)	**N/a**
Volume (cm^3)	N/a
Moisture content (%)	34.0
Bulk Density (g/cm^3)	N/a
Bulk Density (kN/m^3)	**N/a**
Bulk Density (pcf)	**N/a**
Dry Density (kN/m^3)	**N/a**

AECOM - SOILS LABORATORY

UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS (ASTM D2166)

AECOM

CLIENT:	Miller Environmental
PROJECT:	Repository Cell Construction
JOB NO.:	60320105

TEST HOLE NO.:	TH14-03
SAMPLE NO.:	T7
SAMPLE DEPTH:	2.97 - 3.12 m
SAMPLE DATE:	15-May-14
TEST DATE:	23-May-14

SOIL DESCRIPTION:	
CLAY; silty to some silt, trace sulphate inclusions, trace oxidation, trace organics, light brown to brown, moist, firm, intermediate to high plasticity, laminated.	
MOISTURE CONTENT:	34.0

SAMPLE DIAM.(Do):	#VALUE!	(mm)	INITIAL AREA, Ao:	#VALUE!	(mm^2)
SAMPLE LENGTH, (Lo):	#VALUE!	(mm)	PISTON RATE:	0.051	(inches / minute)
L / D RATIO:	#VALUE!	(2 < L/D < 2.5)	AXIAL STRAIN RATE, R:	#VALUE!	(0.5<R<2 % / minute)

FAILURE SKETCH

TEST DATA - DIAL READINGS							
AXIAL COMPRESSION	PROVING RING	TOTAL AXIAL STRAIN, E_1	AVERAGE CROSS-SECTIONAL AREA, A	APPLIED AXIAL LOAD, P	COMPRESSIVE STRESS, σ_c		
(inches)	(inches)	(%)	(inches2)	(lbs)	(psi)	(ksf)	(kPa)

UNCONFINED COMPRESSIVE STRENGTH, q_u:	0.00	kPa
(based on maximum q_u value)	0.000	ksf
UNDRAINED SHEAR STRENGTH, S_u:	0.00	kPa
(based on maximum q_u value)	0.000	ksf

NOTES:

AECOM - SOILS LABORATORY
SHEAR STRENGTH, MOISTURE CONTENT & DENSITY CALCULATIONS

AECOM

CLIENT: Miller Environmental
PROJECT: Repository Cell Construction
JOB NO.: 60320105

TEST HOLE NO.:	**TH14-06**
SAMPLE NO.:	**T36**
SAMPLE DEPTH:	4.50 - 4.60 m
DATE TESTED:	23-May-14
SHEAR STRENGTH TESTS	
TORVANE	
Reading	0.38
Vane Size (S, M, L)	m
Undrained Shear Strength (kPa)	**37.3**
Undrained Shear Strength (ksf)	0.78
POCKET PENETROMETER	
Reading - Qu (tsf)	0.40
Undrained Shear Strength (kPa)	**19.2**
Reading - Qu (tsf)	0.60
Undrained Shear Strength (kPa)	**28.7**
Reading - Qu (tsf)	0.50
Undrained Shear Strength (kPa)	**23.9**
UNCONFINED COMPRESSIVE STRENGTH TEST	
Unconfined compressive strength (kPa)	**N/a**
Unconfined compressive strength (ksf)	**N/a**
Undrained Shear Strength (kPa)	**N/a**
Undrained Shear Strength (ksf)	**N/a**
MOISTURE CONTENT	
Tare Number	SG36
Wt. Sample wet + tare (g)	1855.6
Wt. Sample dry + tare (g)	1431.5
Wt. Tare (g)	579.1
Moisture Content %	**49.8**
BULK DENSITY	
Sample Wt. (g)	1276.6
Diameter 1 (cm)	7.22
Diameter 2 (cm)	7.21
Diameter 3 (cm)	7.20
Avg. Diameter (cm)	**7.21**
Length 1 (cm)	18.55
Length 2 (cm)	18.60
Length 3 (cm)	18.53
Avg. Length (cm)	**18.56**
Volume (cm^3)	757.8
Moisture content (%)	49.8
Bulk Density (g/cm^3)	1.685
Bulk Density (kN/m^3)	**16.5**
Bulk Density (pcf)	**105.2**
Dry Density (kN/m^3)	**11.03**

AECOM - SOILS LABORATORY
UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS (ASTM D2166)

AECOM

CLIENT:	Miller Environmental
PROJECT:	Repository Cell Construction
JOB NO.:	60320105

TEST HOLE NO.:	TH14-03
SAMPLE NO.:	T7
SAMPLE DEPTH:	4.50 - 4.60 m
SAMPLE DATE:	15-May-14
TEST DATE:	23-May-14

SOIL DESCRIPTION:	
CLAY, trace silt, trace gypsum inclusions (3mm thick), grey, moist, soft, high plasticity.	
MOISTURE CONTENT:	49.8

FAILURE SKETCH

SAMPLE DIAM.(Do):	72.10	(mm)	INITIAL AREA, Ao:	4082.8	(mm^2)
SAMPLE LENGTH, (Lo):	185.60	(mm)	PISTON RATE:	0.051	(inches / minute)
L / D RATIO:	2.57	(2 < L/D < 2.5)	AXIAL STRAIN RATE, R:	0.70	(0.5<R<2 % / minute)

TEST DATA - DIAL READINGS							
AXIAL COMPRESSION	PROVING RING	TOTAL AXIAL STRAIN, E_1	AVERAGE CROSS-SECTIONAL AREA, A	APPLIED AXIAL LOAD, P	COMPRESSIVE STRESS, σ_c		
(inches)	(inches)	(%)	(inches2)	(lbs)	(psi)	(ksf)	(kPa)

UNCONFINED COMPRESSIVE STRENGTH, q_u:	0.00	kPa
(based on maximum q_u value)	0.000	ksf
UNDRAINED SHEAR STRENGTH, S_u:	0.00	kPa
(based on maximum q_u value)	0.000	ksf

NOTES:

AECOM - SOILS LABORATORY
SHEAR STRENGTH, MOISTURE CONTENT & DENSITY CALCULATIONS

AECOM

CLIENT: Miller Environmental
PROJECT: Repository Cell Construction
JOB NO.: 60320105

TEST HOLE NO.:	TH14-07
SAMPLE NO.:	T42
SAMPLE DEPTH:	1.45 - 1.60 m
DATE TESTED:	23-May-14
SHEAR STRENGTH TESTS	
TORVANE	
Reading	0.70
Vane Size (S, M, L)	m
Undrained Shear Strength (kPa)	68.7
Undrained Shear Strength (ksf)	1.43
POCKET PENETROMETER	
Reading - Qu (tsf)	1.75
Undrained Shear Strength (kPa)	83.8
Reading - Qu (tsf)	1.75
Undrained Shear Strength (kPa)	83.8
Reading - Qu (tsf)	2.00
Undrained Shear Strength (kPa)	95.8
UNCONFINED COMPRESSIVE STRENGTH TEST	
Unconfined compressive strength (kPa)	N/a
Unconfined compressive strength (ksf)	N/a
Undrained Shear Strength (kPa)	N/a
Undrained Shear Strength (ksf)	N/a
MOISTURE CONTENT	
Tare Number	SG36
Wt. Sample wet + tare (g)	N/a
Wt. Sample dry + tare (g)	N/a
Wt. Tare (g)	N/a
Moisture Content %	N/a
BULK DENSITY	
Sample Wt. (g)	N/a
Diameter 1 (cm)	N/a
Diameter 2 (cm)	N/a
Diameter 3 (cm)	N/a
Avg. Diameter (cm)	N/a
Length 1 (cm)	N/a
Length 2 (cm)	N/a
Length 3 (cm)	N/a
Avg. Length (cm)	N/a
Volume (cm^3)	N/a
Moisture content (%)	N/a
Bulk Density (g/cm^3)	N/a
Bulk Density (kN/m^3)	N/a
Bulk Density (pcf)	N/a
Dry Density (kN/m^3)	N/a

AECOM - SOILS LABORATORY
UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS (ASTM D2166)

AECOM

CLIENT:	Miller Environmental
PROJECT:	Repository Cell Construction
JOB NO.:	60320105

TEST HOLE NO.:	TH14-03
SAMPLE NO.:	T7
SAMPLE DEPTH:	1.45 - 1.60 m
SAMPLE DATE:	15-May-14
TEST DATE:	23-May-14

SOIL DESCRIPTION:
SILT and CLAY, trace oxidation, brown, moist, stiff, low to intermediate plasticity, laminated
MOISTURE CONTENT: N/a

FAILURE SKETCH

SAMPLE DIAM.(Do):	#VALUE!	(mm)	INITIAL AREA, Ao:	#VALUE!	(mm^2)
SAMPLE LENGTH, (Lo):	#VALUE!	(mm)	PISTON RATE:	0.051	(inches / minute)
L / D RATIO:	#VALUE!	(2 < L/D < 2.5)	AXIAL STRAIN RATE, R:	#VALUE!	(0.5<R<2 % / minute)

TEST DATA - DIAL READINGS							
AXIAL COMPRESSION	PROVING RING	TOTAL AXIAL STRAIN, E_1	AVERAGE CROSS-SECTIONAL AREA, A	APPLIED AXIAL LOAD, P	COMPRESSIVE STRESS, σ_c		
(inches)	(inches)	(%)	(inches2)	(lbs)	(psi)	(ksf)	(kPa)

UNCONFINED COMPRESSIVE STRENGTH, q_u:	0.00	kPa
(based on maximum q_u value)	0.000	ksf
UNDRAINED SHEAR STRENGTH, S_u:	0.00	kPa
(based on maximum q_u value)	0.000	ksf

NOTES:

AECOM - SOILS LABORATORY
SHEAR STRENGTH, MOISTURE CONTENT & DENSITY CALCULATIONS

AECOM

CLIENT: Miller Environmental
PROJECT: Repository Cell Construction
JOB NO.: 60320105

TEST HOLE NO.:	TH14-08
SAMPLE NO.:	T47
SAMPLE DEPTH:	2.97 - 3.12 m
DATE TESTED:	23-May-14
SHEAR STRENGTH TESTS	
TORVANE	
Reading	0.35
Vane Size (S, M, L)	m
Undrained Shear Strength (kPa)	34.3
Undrained Shear Strength (ksf)	0.72
POCKET PENETROMETER	
Reading - Qu (tsf)	1.50
Undrained Shear Strength (kPa)	71.8
Reading - Qu (tsf)	2.00
Undrained Shear Strength (kPa)	95.8
Reading - Qu (tsf)	1.00
Undrained Shear Strength (kPa)	47.9
UNCONFINED COMPRESSIVE STRENGTH TEST	
Unconfined compressive strength (kPa)	N/a
Unconfined compressive strength (ksf)	N/a
Undrained Shear Strength (kPa)	N/a
Undrained Shear Strength (ksf)	N/a
MOISTURE CONTENT	
Tare Number	SG36
Wt. Sample wet + tare (g)	1331.1
Wt. Sample dry + tare (g)	1126.1
Wt. Tare (g)	543.7
Moisture Content %	35.2
BULK DENSITY	
Sample Wt. (g)	787.7
Diameter 1 (cm)	7.20
Diameter 2 (cm)	7.20
Diameter 3 (cm)	7.21
Avg. Diameter (cm)	7.20
Length 1 (cm)	10.08
Length 2 (cm)	10.06
Length 3 (cm)	10.07
Avg. Length (cm)	10.07
Volume (cm^3)	410.4
Moisture content (%)	35.2
Bulk Density (g/cm^3)	1.919
Bulk Density (kN/m^3)	18.8
Bulk Density (pcf)	119.8
Dry Density (kN/m^3)	13.92

AECOM - SOILS LABORATORY
UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS (ASTM D2166)

AECOM

CLIENT:	Miller Environmental
PROJECT:	Repository Cell Construction
JOB NO.:	60320105

TEST HOLE NO.:	TH14-03
SAMPLE NO.:	T7
SAMPLE DEPTH:	2.97 - 3.12 m
SAMPLE DATE:	15-May-14
TEST DATE:	23-May-14

SOIL DESCRIPTION:	
CLAY; some silt, trace oxidation, brown with grey, moist, stiff, intermediate plasticity, laminated.	
MOISTURE CONTENT:	35.2

FAILURE SKETCH

SAMPLE DIAM.(Do):	72.03	(mm)	INITIAL AREA, Ao:	4075.3	(mm^2)
SAMPLE LENGTH, (Lo):	100.70	(mm)	PISTON RATE:	0.051	(inches / minute)
L / D RATIO:	1.40	(2 < L/D < 2.5)	AXIAL STRAIN RATE, R:	1.29	(0.5<R<2 % / minute)

TEST DATA - DIAL READINGS							
AXIAL COMPRESSION	PROVING RING	TOTAL AXIAL STRAIN, E_1	AVERAGE CROSS-SECTIONAL AREA, A	APPLIED AXIAL LOAD, P	COMPRESSIVE STRESS, σ_c		
(inches)	(inches)	(%)	($inches^2$)	(lbs)	(psi)	(ksf)	(kPa)

UNCONFINED COMPRESSIVE STRENGTH, q_u:	0.00	kPa
(based on maximum q_u value)	0.000	ksf
UNDRAINED SHEAR STRENGTH, S_u:	0.00	kPa
(based on maximum q_u value)	0.000	ksf

NOTES:

AECOM

AECOM - SOILS LABORATORY
SHEAR STRENGTH, MOISTURE CONTENT & DENSITY CALCULATIONS

CLIENT: Miller Environmental
PROJECT: Repository Cell Construction
JOB NO.: 60320105

TEST HOLE NO.:	TH14-09
SAMPLE NO.:	T52
SAMPLE DEPTH:	4.50 - 4.65 m
DATE TESTED:	23-May-14
SHEAR STRENGTH TESTS	
TORVANE	
Reading	0.20
Vane Size (S, M, L)	m
Undrained Shear Strength (kPa)	19.6
Undrained Shear Strength (ksf)	0.41
POCKET PENETROMETER	
Reading - Qu (tsf)	0.50
Undrained Shear Strength (kPa)	23.9
Reading - Qu (tsf)	0.75
Undrained Shear Strength (kPa)	35.9
Reading - Qu (tsf)	0.75
Undrained Shear Strength (kPa)	35.9
UNCONFINED COMPRESSIVE STRENGTH TEST	
Unconfined compressive strength (kPa)	N/a
Unconfined compressive strength (ksf)	N/a
Undrained Shear Strength (kPa)	N/a
Undrained Shear Strength (ksf)	N/a
MOISTURE CONTENT	
Tare Number	SG36
Wt. Sample wet + tare (g)	1072.5
Wt. Sample dry + tare (g)	830.2
Wt. Tare (g)	242.1
Moisture Content %	41.2
BULK DENSITY	
Sample Wt. (g)	N/a
Diameter 1 (cm)	N/a
Diameter 2 (cm)	N/a
Diameter 3 (cm)	N/a
Avg. Diameter (cm)	N/a
Length 1 (cm)	N/a
Length 2 (cm)	N/a
Length 3 (cm)	N/a
Avg. Length (cm)	N/a
Volume (cm^3)	N/a
Moisture content (%)	41.2
Bulk Density (g/cm^3)	N/a
Bulk Density (kN/m^3)	N/a
Bulk Density (pcf)	N/a
Dry Density (kN/m^3)	N/a

AECOM - SOILS LABORATORY
UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS (ASTM D2166)

AECOM

CLIENT:	Miller Environmental
PROJECT:	Repository Cell Construction
JOB NO.:	60320105

TEST HOLE NO.:	TH14-03
SAMPLE NO.:	T7
SAMPLE DEPTH:	4.50 - 4.65 m
SAMPLE DATE:	15-May-14
TEST DATE:	23-May-14

SOIL DESCRIPTION:	
CLAY; trace silt, trace oxidation, greyish brown, moist, firm, high plasticity	
MOISTURE CONTENT:	41.2

FAILURE SKETCH

SAMPLE DIAM.(Do):	#VALUE!	(mm)	INITIAL AREA, Ao:	#VALUE!	(mm^2)
SAMPLE LENGTH, (Lo):	#VALUE!	(mm)	PISTON RATE:	0.051	(inches / minute)
L / D RATIO:	#VALUE!	(2 < L/D < 2.5)	AXIAL STRAIN RATE, R:	#VALUE!	(0.5<R<2 % / minute)

TEST DATA - DIAL READINGS							
AXIAL COMPRESSION	PROVING RING	TOTAL AXIAL STRAIN, ε_1	AVERAGE CROSS-SECTIONAL AREA, A	APPLIED AXIAL LOAD, P	COMPRESSIVE STRESS, σ_c		
(inches)	(inches)	(%)	(inches2)	(lb_s)	(psi)	(ksf)	(kPa)

UNCONFINED COMPRESSIVE STRENGTH, q_u:	0.00	kPa
(based on maximum q_u value)	0.000	ksf
UNDRAINED SHEAR STRENGTH, S_u:	0.00	kPa
(based on maximum q_u value)	0.000	ksf

NOTES:

AECOM - SOILS LABORATORY
SHEAR STRENGTH, MOISTURE CONTENT & DENSITY CALCULATIONS

AECOM

CLIENT: Miller Environmental
PROJECT: Repository Cell Construction
JOB NO.: 60320105

TEST HOLE NO.:	**TH14-10**
SAMPLE NO.:	**T57**
SAMPLE DEPTH:	6.02 - 6.17 m
DATE TESTED:	23-May-14
SHEAR STRENGTH TESTS	
TORVANE	
Reading	0.55
Vane Size (S, M, L)	m
Undrained Shear Strength (kPa)	53.9
Undrained Shear Strength (ksf)	1.13
POCKET PENETROMETER	
Reading - Qu (tsf)	1.25
Undrained Shear Strength (kPa)	59.9
Reading - Qu (tsf)	1.00
Undrained Shear Strength (kPa)	47.9
Reading - Qu (tsf)	1.00
Undrained Shear Strength (kPa)	47.9
UNCONFINED COMPRESSIVE STRENGTH TEST	
Unconfined compressive strength (kPa)	N/a
Unconfined compressive strength (ksf)	N/a
Undrained Shear Strength (kPa)	N/a
Undrained Shear Strength (ksf)	N/a
MOISTURE CONTENT	
Tare Number	SG36
Wt. Sample wet + tare (g)	2020.1
Wt. Sample dry + tare (g)	1423.6
Wt. Tare (g)	205.9
Moisture Content %	49.0
BULK DENSITY	
Sample Wt. (g)	N/a
Diameter 1 (cm)	N/a
Diameter 2 (cm)	N/a
Diameter 3 (cm)	N/a
Avg. Diameter (cm)	N/a
Length 1 (cm)	N/a
Length 2 (cm)	N/a
Length 3 (cm)	N/a
Avg. Length (cm)	N/a
Volume (cm^3)	N/a
Moisture content (%)	49 0
Bulk Density (g/cm^3)	N/a
Bulk Density (kN/m^3)	N/a
Bulk Density (pcf)	N/a
Dry Density (kN/m^3)	N/a

AECOM - SOILS LABORATORY
UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS (ASTM D2166)

AECOM

CLIENT:	Miller Environmental
PROJECT:	Repository Cell Construction
JOB NO.:	60320105

TEST HOLE NO.:	TH14-03
SAMPLE NO.:	T7
SAMPLE DEPTH:	6.02 - 6.17 m
SAMPLE DATE:	15-May-14
TEST DATE:	23-May-14

SOIL DESCRIPTION:	
CLAY, some silt, trace oxidation, brown with grey, moist, stiff, intermediate plasticity, laminated.	
MOISTURE CONTENT:	49.0

FAILURE SKETCH

SAMPLE DIAM.(Do):	#VALUE!	(mm)	INITIAL AREA, Ao:	#VALUE!	(mm^2)
SAMPLE LENGTH, (Lo):	#VALUE!	(mm)	PISTON RATE:	0.051	(inches / minute)
L / D RATIO:	#VALUE!	(2 < L/D < 2.5)	AXIAL STRAIN RATE, R:	#VALUE!	(0.5<R<2 % / minute)

TEST DATA - DIAL READINGS							
AXIAL COMPRESSION	PROVING RING	TOTAL AXIAL STRAIN, E_1	AVERAGE CROSS-SECTIONAL AREA, A	APPLIED AXIAL LOAD, P	COMPRESSIVE STRESS, σ_c		
(inches)	(inches)	(%)	(inches2)	(lbs)	(psi)	(ksf)	(kPa)

UNCONFINED COMPRESSIVE STRENGTH, q_u:	0.00	kPa
(based on maximum q_u value)	0.000	ksf
UNDRAINED SHEAR STRENGTH, S_u:	0.00	kPa
(based on maximum q_u value)	0.000	ksf

NOTES:

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Project Name:	Repository Cell Construction	Supplier:	AECOM
Project Number:	60320105	Specification:	N/A
Client:	Miller Environmental	Field Technician:	AHill
Sample Location:	TH14-03	Sample Date:	May 15, 2014
Sample Depth:	4.50 - 4.65 m	Lab Technician:	MLotecki
Sample Number:	T24	Date Tested:	June 4, 2014

Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

Material and Test Description

Material Description:
CLAY - brown, firm, high plasticity, homogeneous.

Test Type:	Constant Head
Mould Size:	Flexible Wall
Sample Source:	Shelby Tube Sample
Fluid Used:	Deaired Water
Fluid Reservoir:	Burrettes

Remoulding Details	
Max Dry Density (kg/m^3):	N/A
Proctor ID:	N/A
Percent Max (%):	N/A
Target Dry Density (kg/m^3):	N/A

Initial Sample Characteristics

Water Content	
Wet + Tare (g):	453.3
Dry + Tare (g):	299.7
Tare (g):	8.3
Water Content (%):	52.7%

Sample Size					
Trial	1	2	3	4	Average
Diameter (mm):	72.1	72.3	72.2	72.2	72.2
Length (mm):	63.1	63.2	63.1	63.3	63.2
Weight (g)	450.5				

Area (cm^2):	40.9	Specific Gravity (Note 2):	2.71
Volume (cm^3):	258.6	Void Ratio:	137.2%
Wet Density (kg/m^3):	1,741.7	Saturation:	103.9%
Dry Density (kg/m^3):	1,140.6	Porosity:	57.8%

Final Sample Characteristics

Water Content	
Wet + Tare (g):	455.8
Dry + Tare (g):	299.9
Tare (g):	8.4
Water Content (%):	53.5%

Sample Size					
Trial	1	2	3	4	Average
Diameter (mm):	72.8	72.6	72.4	71.9	72.4
Length (mm):	64.1	64.2	64.2	63.9	64.1
Weight (g)	448.0				

Area (cm^2):	41.2	Specific Gravity (Note 1):	2.71
Volume (cm^3):	264.1	Void Ratio:	144.7%
Wet Density (kg/m^3):	1,696.5	Saturation:	100.0%
Dry Density (kg/m^3):	1,105.3	Porosity:	59.1%

Note 1: Specific gravity for final sample characteristics calculation adjusted to result in 100.0% saturation.
Note 2: Specific gravity for initial sample characteristics calculation set equal to that of the final.

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Project Name:	Repository Cell Construction	Supplier:	AECOM
Project Number:	60320105	Specification:	N/A
Client:	Miller Environmental	Field Technician:	AHill
Sample Location:	TH14-03	Sample Date:	May 15, 2014
Sample Depth:	4.50 - 4.65 m	Lab Technician:	MLotecki
Sample Number:	T24	Date Tested:	June 4, 2014

Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

Consolidation Data

Cell Pressure (kPa):	172.4	Top Pressure (kPa):	137.9
Bottom Pressure (kPa):	137.9	Pressure Difference (kPa):	-

Date & Time	Elapsed Time (Days)	Room Temp (°C)	Top Burret (mL)	Bottom Burret (mL)	Cell (mL)	Total Vol. Change (mL)	Volume Strain (%)
5/25/14 14:00	0.00	24.3	2.34	2.14	22.00	0.00	0.00%
5/25/14 15:30	0.06	24.0	2.74	2.50	21.50	-0.26	-0.10%
5/26/14 8:45	0.78	23.8	4.26	3.96	19.50	-1.24	-0.48%
5/26/14 17:50	1.16	24.3	4.44	4.14	19.40	-1.50	-0.58%
5/27/14 8:20	1.76	24.4	4.56	4.26	19.40	-1.74	-0.67%
5/28/14 9:10	2.80	24.4	4.63	4.38	19.70	-2.23	-0.86%
5/29/14 8:45	3.78	24.2	4.66	4.42	19.80	-2.40	-0.93%
5/30/14 7:05	4.71	25.6	4.60	4.40	19.70	-2.22	-0.86%
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
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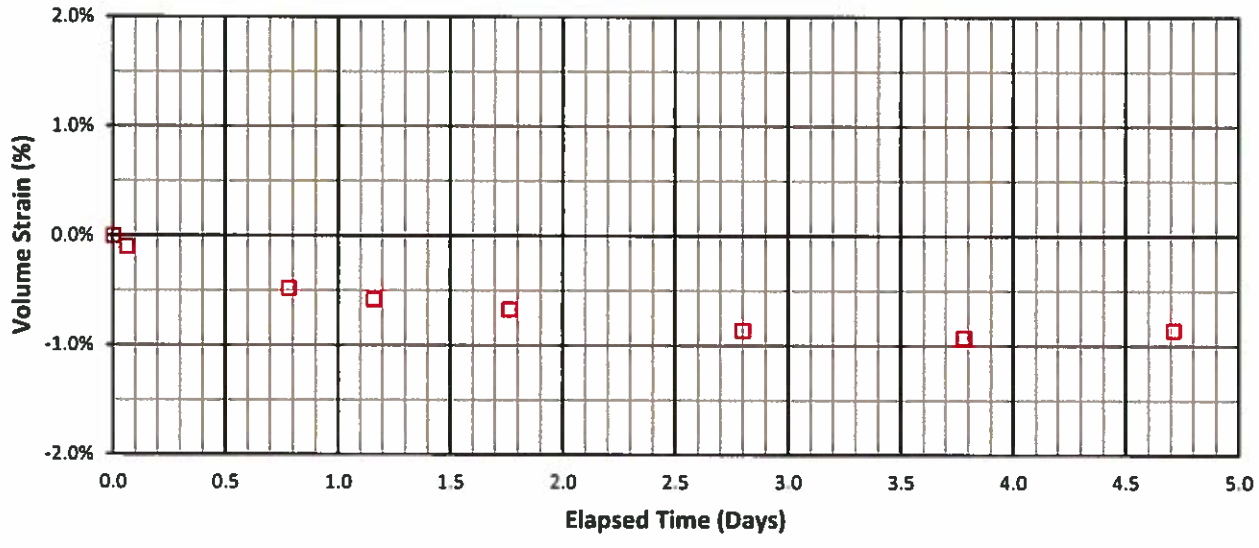

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Project Name:	Repository Cell Construction	Supplier:	AECOM
Project Number:	60320105	Specification:	N/A
Client:	Miller Environmental	Field Technician:	AHill
Sample Location:	TH14-03	Sample Date:	May 15, 2014
Sample Depth:	4.50 - 4.65 m	Lab Technician:	MLotecki
Sample Number:	T24	Date Tested:	June 4, 2014

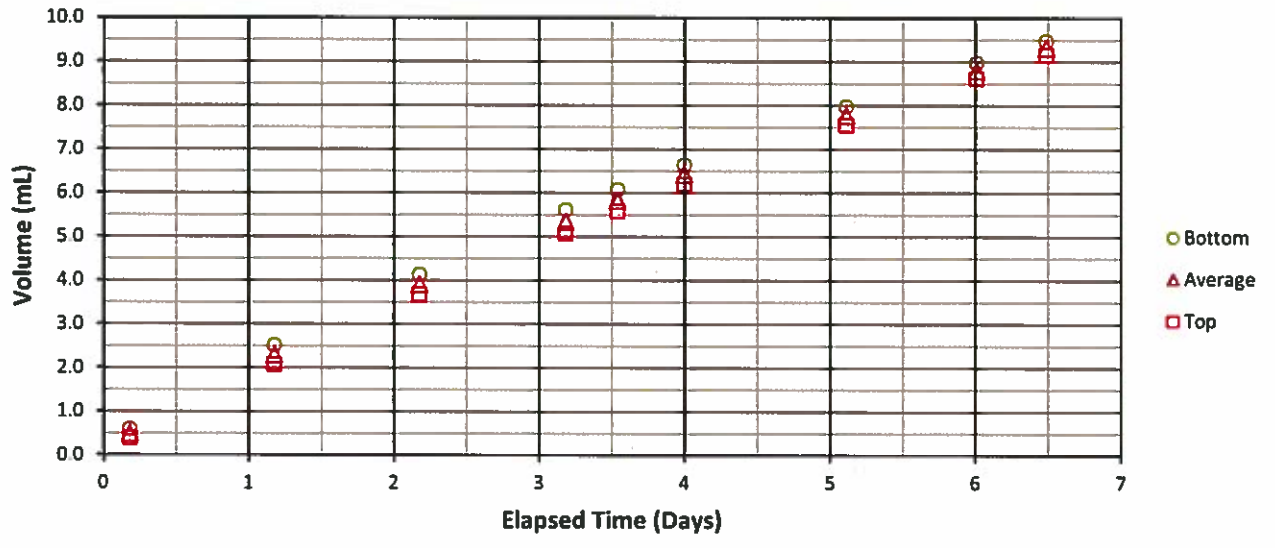
Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

Permeation Data

Cell Pressure (kPa):	172.4	Top Pressure (kPa):	124.1
Bottom Pressure (kPa):	151.7	Pressure Difference (kPa):	27.6

Date & Time	Elapsed Time (Days)	Room Temp (°C)	Top Burret (mL)	Bottom Burret (mL)	Top Vol. Change (mL)	Bottom Vol. Change (mL)	Average Vol. Change (mL)
5/30/14 7:20	0.000	25.6	9.88	0.26	0.00	0.00	0.00
5/30/14 11:40	0.181	25.6	9.48	0.86	0.40	0.60	0.50
5/31/14 11:30	1.174	25.5	7.80	2.78	2.08	2.52	2.30
6/1/14 11:30	2.174	25.5	6.20	4.40	3.68	4.14	3.91
6/2/14 11:40	3.181	25.0	4.80	5.88	5.08	5.62	5.35
6/2/14 20:15	3.538	25.2	4.30	6.34	5.58	6.08	5.83
6/3/14 7:15	3.997	25.0	3.68	6.91	6.20	6.65	6.43
6/4/14 9:55	5.108	25.0	2.32	8.24	7.56	7.98	7.77
6/5/14 7:30	6.007	25.4	1.26	9.24	8.62	8.98	8.80
6/5/14 19:00	6.486	26.1	0.72	9.74	9.16	9.48	9.32
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-



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Project Name:	Repository Cell Construction	Supplier:	AECOM
Project Number:	60320105	Specification:	N/A
Client:	Miller Environmental	Field Technician:	AHill
Sample Location:	TH14-03	Sample Date:	May 15, 2014
Sample Depth:	4.50 - 4.65 m	Lab Technician:	MLotecki
Sample Number:	T24	Date Tested:	June 4, 2014

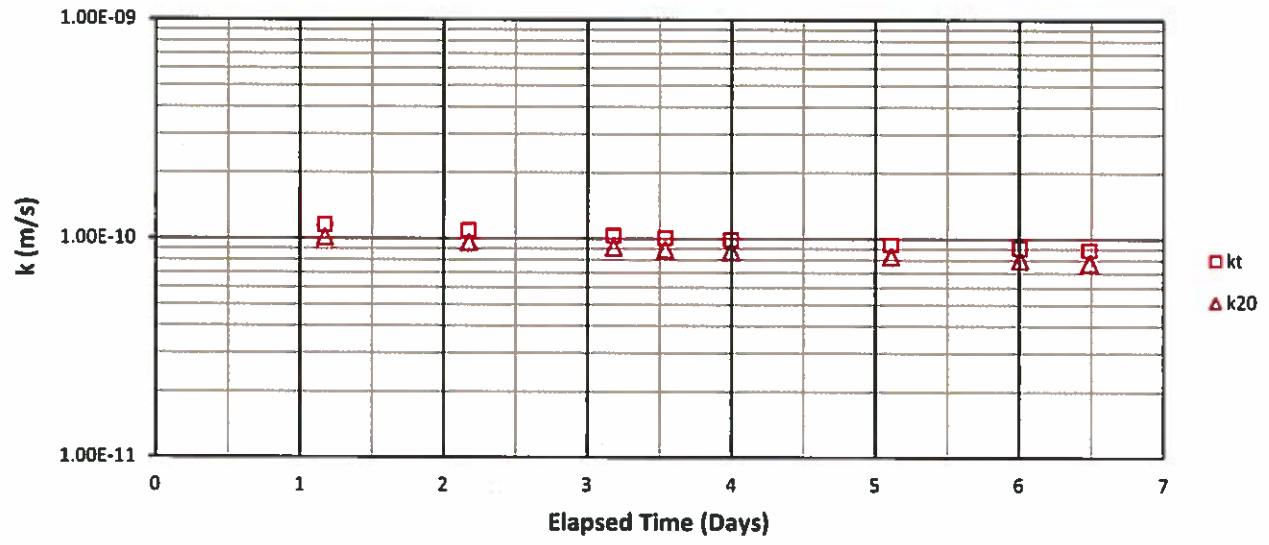
Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

Permeation Data

Head Difference (m):	2.8	Area of Sample (m^2)	4.107E-03
Length of Sample (m):	6.364E-02	Gradient, i	4.418E+01

Elapsed Time (Days)	Average Volume Change (mL)	Average Temperature (°C)	k_t (m/s)	R_T	k_{20} (m/s)
1	2.30	25.6	1.156E-10	0.878	1.015E-10
2	3.91	25.6	1.091E-10	0.878	9.583E-11
3	5.35	25.3	1.031E-10	0.883	9.107E-11
4	5.83	25.4	1.013E-10	0.881	8.922E-11
4	6.43	25.3	9.905E-11	0.883	8.746E-11
5	7.77	25.3	9.413E-11	0.883	8.311E-11
6	8.80	25.5	9.088E-11	0.879	7.988E-11
6	9.32	25.9	8.923E-11	0.872	7.781E-11
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-



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Project Name:	Repository Cell Construction	Supplier:	AECOM
Project Number:	60320105	Specification:	N/A
Client:	Miller Environmental	Field Technician:	AHill
Sample Location:	TH14-07	Sample Date:	May 15, 2014
Sample Depth:	1.45 - 1.60 m	Lab Technician:	MLotecki
Sample Number:	T42	Date Tested:	June 4, 2014

Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

Material and Test Description

Material Description:
CLAY and SILT - brown, trace oxidation, firm, lensed.

Test Type:	Constant Head
Mould Size:	Flexible Wall
Sample Source:	Shelby Tube Sample
Fluid Used:	Deaired Water
Fluid Reservoir:	Burrettes

Remoulding Details	
Max Dry Density (kg/m^3):	N/A
Proctor ID:	N/A
Percent Max (%):	N/A
Target Dry Density (kg/m^3):	N/A

Initial Sample Characteristics

Water Content	
Wet + Tare (g):	495.5
Dry + Tare (g):	392.1
Tare (g):	8.3
Water Content (%):	26.9%

Sample Size					
Trial	1	2	3	4	Average
Diameter (mm):	71.9	72	72	72.1	72.0
Length (mm):	61.4	61.5	62	62.1	61.8
Weight (g)	498.3				

Area (cm^2):	40.7	Specific Gravity (Note 2):	2.74
Volume (cm^3):	251.4	Void Ratio:	75.7%
Wet Density (kg/m^3):	1,982.0	Saturation:	97.6%
Dry Density (kg/m^3):	1,561.3	Porosity:	43.1%

Final Sample Characteristics

Water Content	
Wet + Tare (g):	512.7
Dry + Tare (g):	398.4
Tare (g):	8.6
Water Content (%):	29.3%

Sample Size					
Trial	1	2	3	4	Average
Diameter (mm):	72.6	72.4	72.5	72.4	72.5
Length (mm):	62.6	61.7	62.2	62.7	62.3
Weight (g)	505.2				

Area (cm^2):	41.3	Specific Gravity (Note 1):	2.74
Volume (cm^3):	257.0	Void Ratio:	80.5%
Wet Density (kg/m^3):	1,965.7	Saturation:	100.0%
Dry Density (kg/m^3):	1,520.0	Porosity:	44.6%

Note 1: Specific gravity for final sample characteristics calculation adjusted to result in 100.0% saturation.
Note 2: Specific gravity for initial sample characteristics calculation set equal to that of the final.

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99 Commerce Drive
Winnipeg, Manitoba
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Phone: 204 477 5381 Fax: 204 284 2040

Project Name:	Repository Cell Construction	Supplier:	AECOM
Project Number:	60320105	Specification:	N/A
Client:	Miller Environmental	Field Technician:	AHill
Sample Location:	TH14-07	Sample Date:	May 15, 2014
Sample Depth:	1.45 - 1.60 m	Lab Technician:	MLotecki
Sample Number:	T42	Date Tested:	June 4, 2014

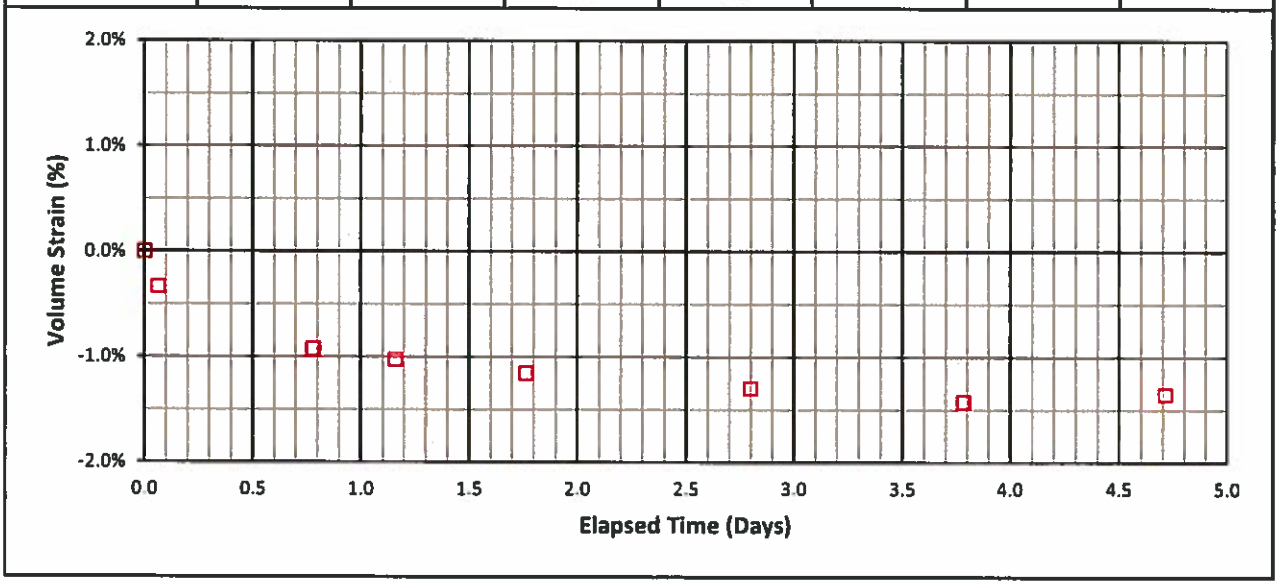
Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

Consolidation Data

Cell Pressure (kPa):	172.4	Top Pressure (kPa):	137.9
Bottom Pressure (kPa):	137.9	Pressure Difference (kPa):	-

Date & Time	Elapsed Time (Days)	Room Temp (°C)	Top Burret (mL)	Bottom Burret (mL)	Cell (mL)	Total Vol. Change (mL)	Volume Strain (%)
5/25/14 14:00	0.00	24.3	2.06	2.18	21.30	0.00	0.00%
5/25/14 15:30	0.06	24.0	2.92	2.86	20.60	-0.84	-0.33%
5/26/14 8:45	0.78	23.8	4.26	4.10	19.50	-2.32	-0.92%
5/26/14 17:50	1.16	24.3	4.34	4.18	19.60	-2.58	-1.03%
5/27/14 8:20	1.76	24.4	4.40	4.24	19.80	-2.90	-1.15%
5/28/14 9:10	2.80	24.4	4.42	4.28	20.10	-3.26	-1.30%
5/29/14 8:45	3.78	24.2	4.42	4.30	20.40	-3.58	-1.42%
5/30/14 7:05	4.71	25.6	4.38	4.26	20.30	-3.40	-1.35%
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-



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Sample Number:	T42	Date Tested:	June 4, 2014

Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

Permeation Data

Cell Pressure (kPa):	172.4	Top Pressure (kPa):	124.1
Bottom Pressure (kPa):	151.7	Pressure Difference (kPa):	27.6

Date & Time	Elapsed Time (Days)	Room Temp (°C)	Top Burret (mL)	Bottom Burret (mL)	Top Vol. Change (mL)	Bottom Vol. Change (mL)	Average Vol. Change (mL)
5/30/14 7:20	0.000	25.6	9.72	0.30	0.00	0.00	0.00
5/30/14 11:40	0.181	25.6	9.10	0.94	0.62	0.64	0.63
5/31/14 11:30	1.174	25.5	6.28	3.88	3.44	3.58	3.51
6/1/14 11:30	2.174	25.5	3.76	6.28	5.96	5.98	5.97
6/2/14 11:40	3.181	25.0	1.54	8.50	8.18	8.20	8.19
6/2/14 20:15	3.538	25.2	0.78	9.22	8.94	8.92	8.93
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
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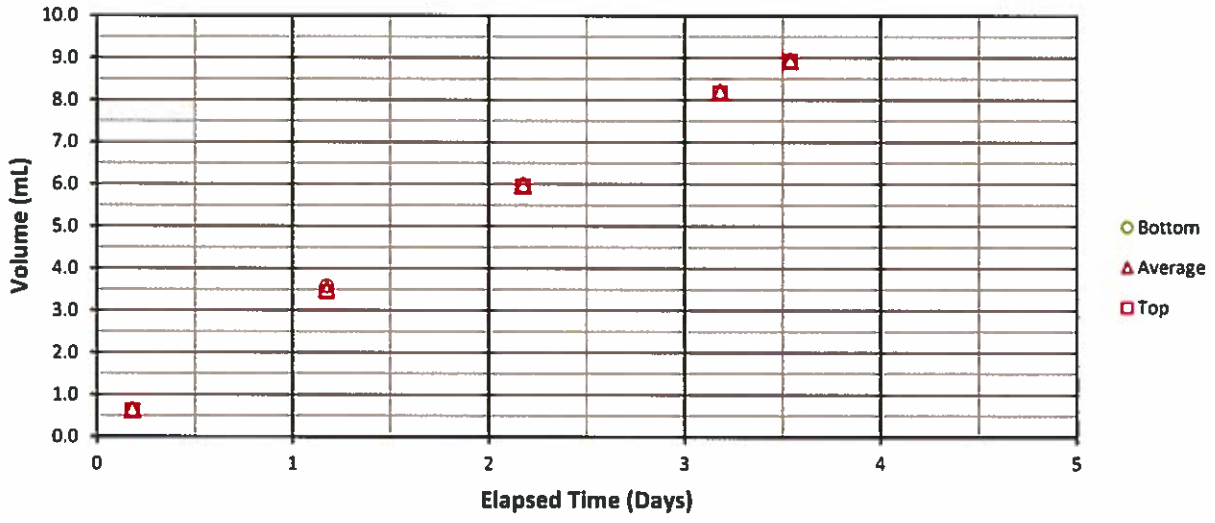

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Project Number:	60320105	Specification:	N/A
Client:	Miller Environmental	Field Technician:	AHill
Sample Location:	TH14-07	Sample Date:	May 15, 2014
Sample Depth:	1.45 - 1.60 m	Lab Technician:	MLotecki
Sample Number:	T42	Date Tested:	June 4, 2014

Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

Permeation Data

Head Difference (m):	2.8	Area of Sample (m^2)	4.098E-03
Length of Sample (m):	6.203E-02	Gradient, i	4.533E+01

Elapsed Time (Days)	Average Volume Change (mL)	Average Temperature (°C)	k_t (m/s)	R_T	k_{20} (m/s)
1.174	3.51	25.6	1.807E-10	0.878	1.586E-10
2.174	5.97	25.6	1.669E-10	0.878	1.466E-10
3.181	8.19	25.3	1.570E-10	0.883	1.386E-10
3.538	8.93	25.4	1.540E-10	0.881	1.357E-10
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
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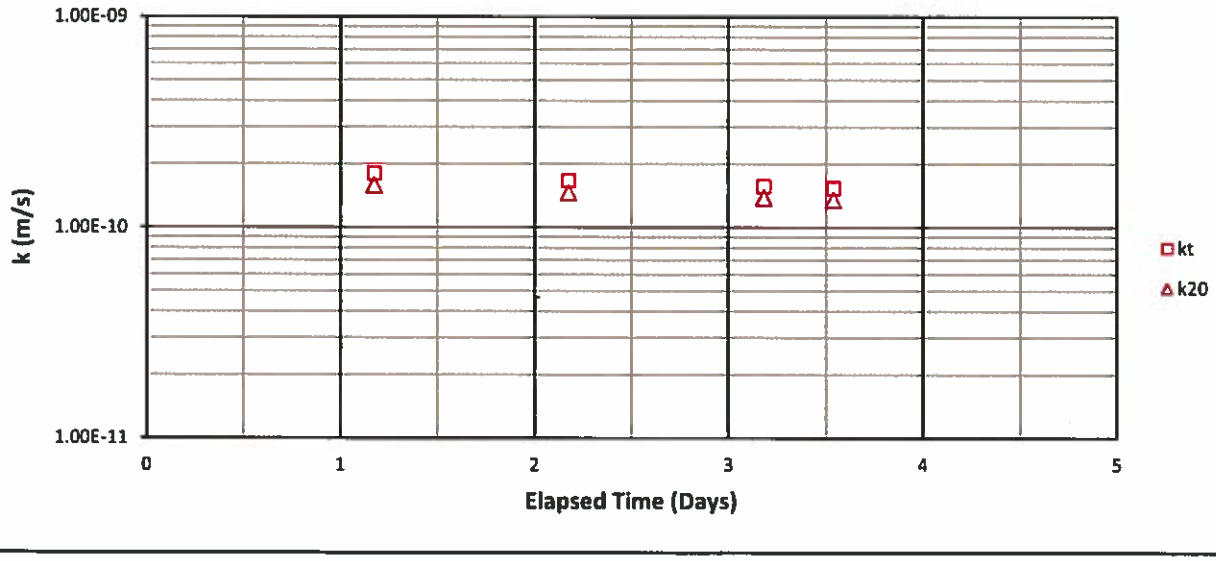
-	-	-	-	-	-
-	-	-	-	-	-



Appendix C

Photographs

TH14-03- 4.5 m

TH14-04- 6.0 m

TH14-06- 4.5 m

TH14-07- 1.5 m

TH14-08- 3.0 m

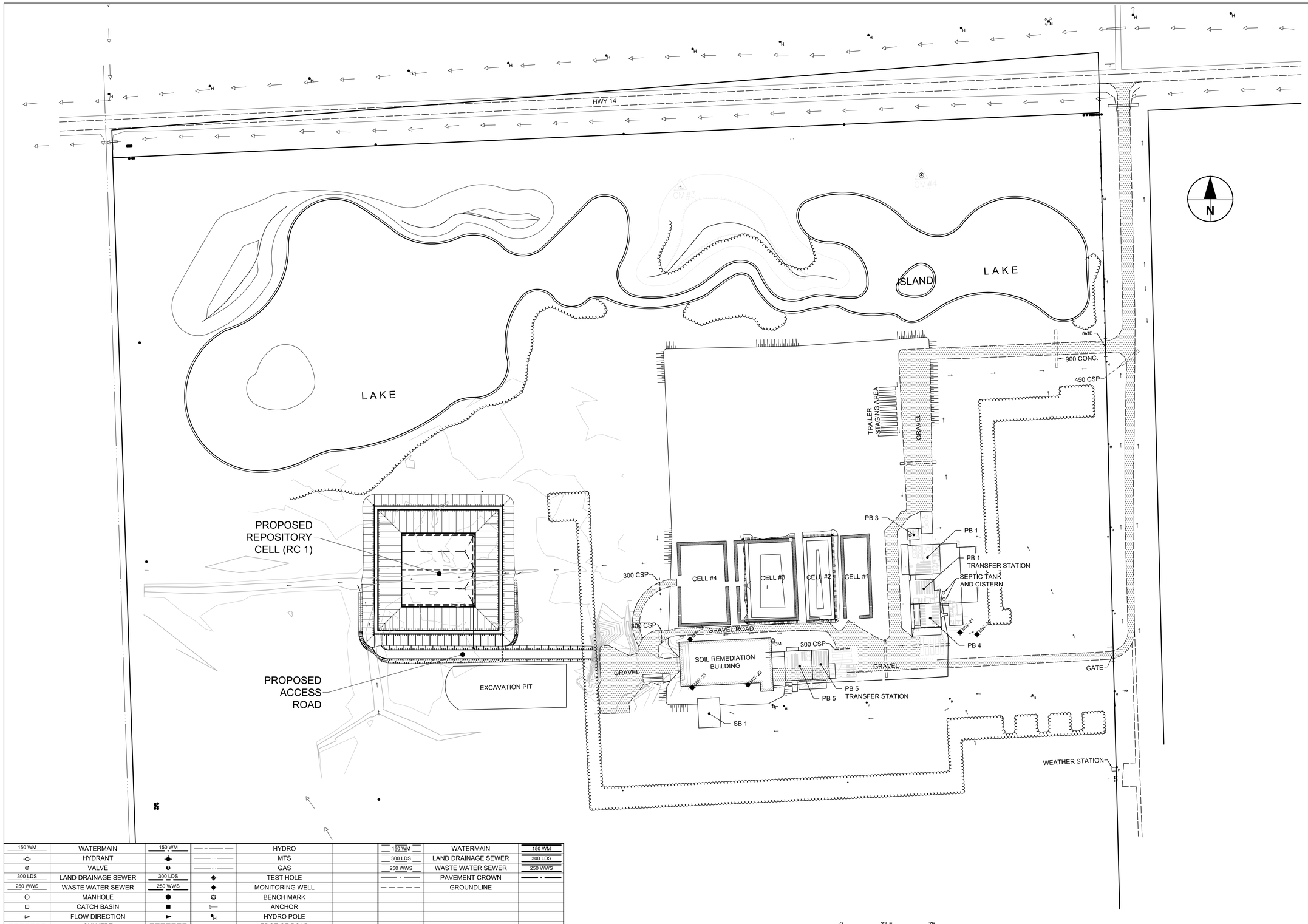
TH14-09- 3.0 m

TH14-09- 4.5 m

TH14-10- 6.0 m

Appendix B

AECOM Repository Design – C-0001, C-0002, C-0003



150 WM	WATERMAIN	150 WM		HYDRO		150 WM	WATERMAIN	150 WM
	HYDRANT			MTS		300 LDS	LAND DRAINAGE SEWER	300 LDS
	VALVE			GAS		250 WWS	WASTE WATER SEWER	250 WWS
300 LDS	LAND DRAINAGE SEWER	300 LDS		TEST HOLE			PAVEMENT CROWN	
250 WWS	WASTE WATER SEWER	250 WWS		MONITORING WELL			GROUNDLINE	
	MANHOLE			BENCH MARK				
	CATCH BASIN			ANCHOR				
	FLOW DIRECTION			HYDRO POLE				
	CULVERT			EDGE OF ROAD				
	TREE			DRAINAGE				
	SURVEY BAR			TREE LINE				
EXISTING	LEGEND - PLAN	NEW	EXISTING	LEGEND - PLAN	NEW	EXISTING	LEGEND - PROFILE	NEW

AECOM

PROJECT

Repository Cell

CLIENT

Miller Environmental Corporation
Manitoba

CONSULTANT

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99 Commerce Drive
Winnipeg, Manitoba R3P 0Y7
204.477.5381 tel 204.284.2040 fax
www.aecom.com

REGISTRATION

PROVINCE OF MANITOBA
K.W. FITCHETT
July 24/14
REGISTERED PROFESSIONAL ENGINEER

APEGM
Certificate of Authorization
AECOM Canada Ltd.
No. 4671 Date: July 24/14

ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	2014/07/24	ISSUED FOR ENVIRONMENTAL APPROVAL

KEY PLAN

PROJECT NUMBER

60216914

SHEET TITLE

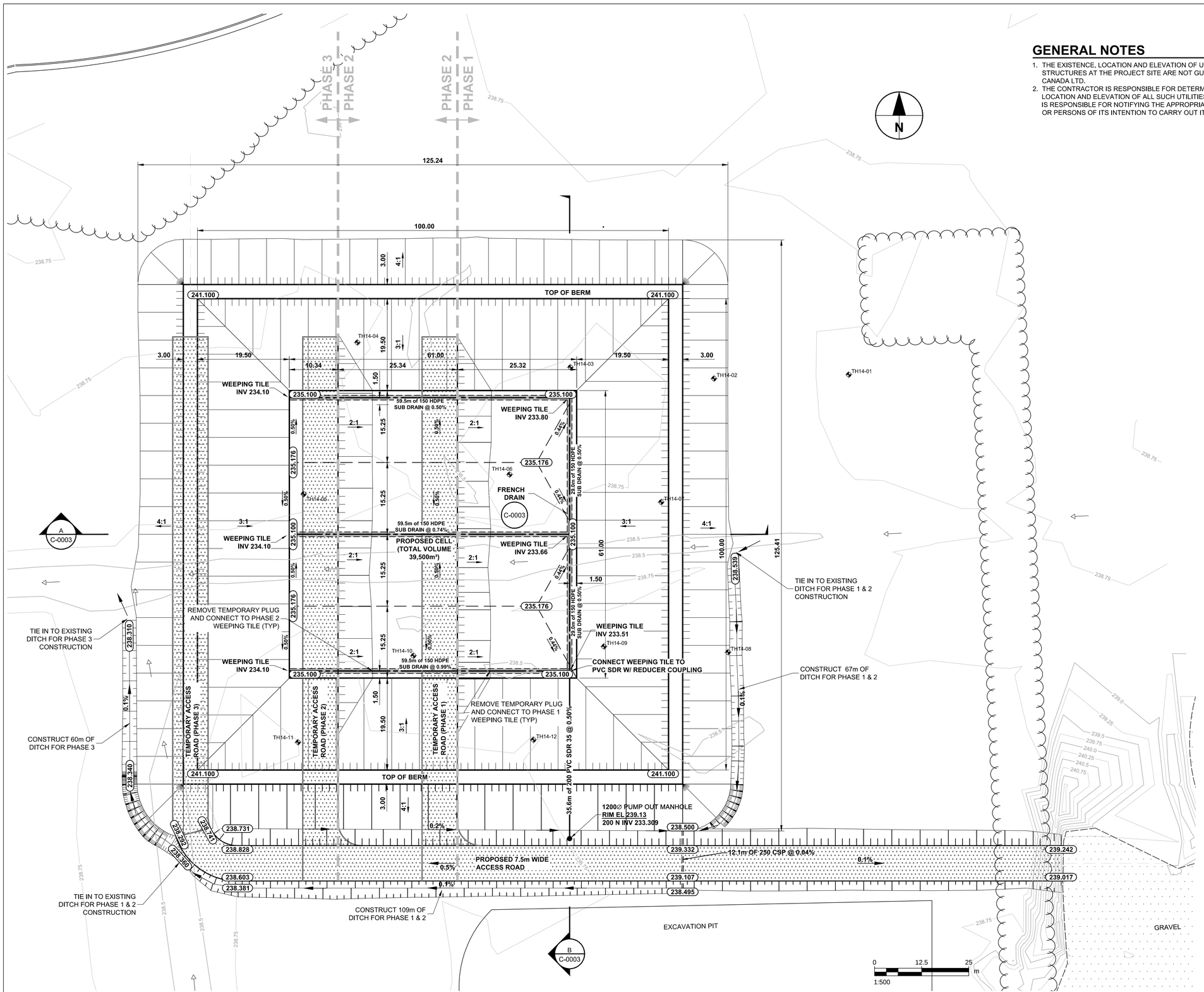
REPOSITORY CELL
OVERALL SITE PLAN

SHEET NUMBER

C-0001

GENERAL NOTES

1. THE EXISTENCE, LOCATION AND ELEVATION OF UTILITIES AND/OR CONCEALED STRUCTURES AT THE PROJECT SITE ARE NOT GUARANTEED BY AECOM CANADA LTD.
2. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE EXISTENCE, LOCATION AND ELEVATION OF ALL SUCH UTILITIES AND/OR STRUCTURES AND IS RESPONSIBLE FOR NOTIFYING THE APPROPRIATE COMPANY, DEPARTMENT OR PERSONS OF ITS INTENTION TO CARRY OUT ITS OPERATIONS.



AECOM

PROJECT

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KEY PLAN

PROJECT NUMBER

60216914

SHEET TITLE

REPOSITORY CELL
CELL PHASING, ACCESS ROAD AND SITE GRADING

SHEET NUMBER

C-0002

Last saved by: PEDERSENJ(2014-07-24) Last Plotted: 2014-07-24
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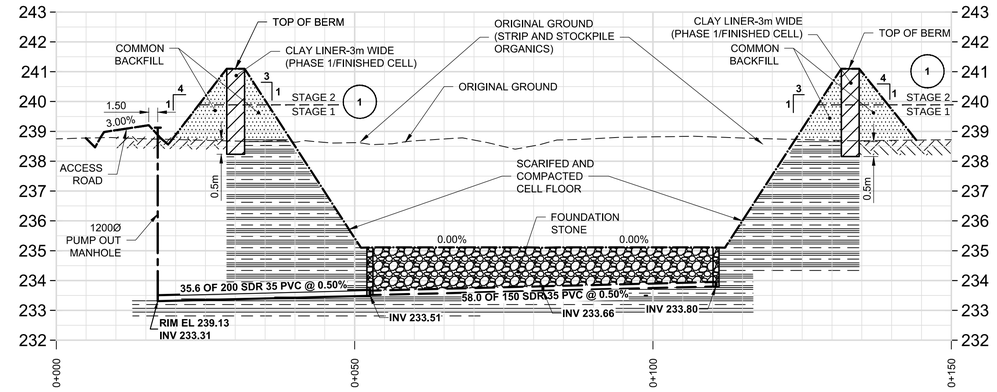
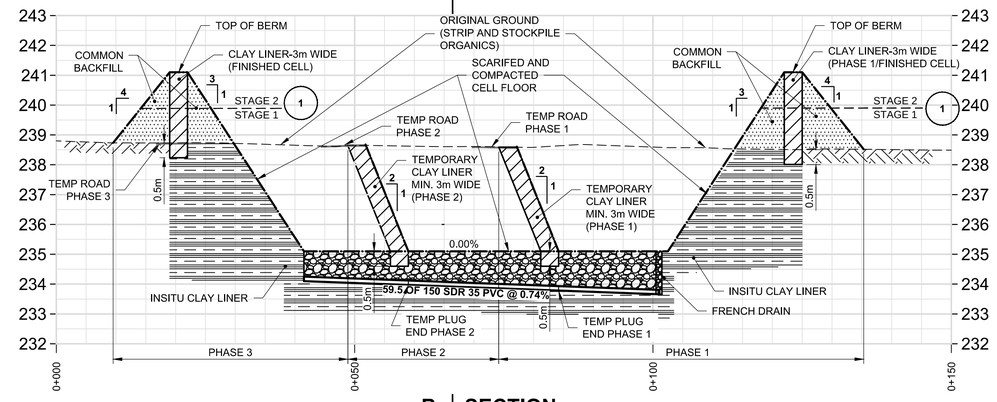


A | SECTION
C-0002



B | SECTION
C-0002

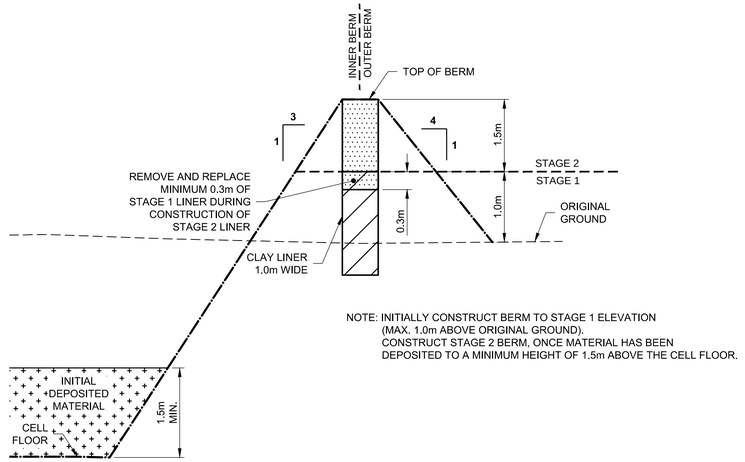
0 12.5 25 m H=1:500
0 0.5 1 V=1:50

CONSTRUCTION NOTES:

1. ADVISE ENGINEER SUFFICIENTLY IN ADVANCE OF EXCAVATION OPERATIONS FOR INITIAL CROSS-SECTIONS TO BE TAKEN.
2. STRIPPING OR REMOVAL OF TOPSOIL IS REQUIRED FOR THE AREA OF THE CELL(S) FLOOR AND AS DIRECTED ONSITE BY THE ENGINEER.
3. EXCAVATE CELL AREA TO LINES AND GRADES INDICATED. SLOPE THE CELL FLOOR AT THE END OF WORK EACH DAY TO ENSURE THERE IS A SUMP AREA FOR DRAINAGE IN THE EVENT OF A RAINFALL.
4. THE ENGINEER WILL DETERMINE IF THE VISIBLE CELL FLOOR BOTTOM IS THE TOP SURFACE OF THE LINER OR THE LINER TOP SURFACE IS BELOW THE CELL FLOOR. COMPLETE THE FOLLOWING WORKS TO CELL FLOOR WHERE IT IS THE TOP SURFACE OF THE LINER AS A MINIMUM AS DETERMINED BY ENGINEER.
   4.1 ENGINEER SHALL DETERMINE IF CELL BOTTOM IS SUITABLE AS CLAY LINER MATERIAL
   4.2 IF DIRECTED BY ENGINEER REMOVE UNSUITABLE MATERIAL AND REPLACE WITH CLAY TYPE SOIL TO LATERAL LIMITS AND DEPTHS DIRECTED. PLACE AND COMPACT IN ACCORDANCE WITH EMBANKMENT CONSTRUCTION
   4.3 UNSUITABLE MATERIALS EXCAVATED TO BE DISPOSED OF AS DIRECTED BY ENGINEER, EITHER STOCKPILED, PLACED IN WINDROWS OR PLACED ON OUTSIDE OF DIKE EMBANKMENT.
5. SCARIFY ENTIRE FLOOR TO 300mm AND COMPACT TO 95% STANDARD PROCTOR DENSITY.
6. COMPACT EMBANKMENT AND CONSTRUCTED LINERS TO 95% STANDARD PROCTOR DENSITY. LINER TO BE CONSTRUCTED OF MEDIUM PLASTIC CLAY WITH PERMEABILITY OF LESS THAN $1x\ 10^{-7}$.
7. DO NOT COMPLETE SCARIFYING AND COMPACTION OF CELL FLOOR UNTIL ALL EXCAVATION FOR EMBANKMENT AND LINER CONSTRUCTION HAS BEEN COMPLETED.
8. CONSTRUCT DITCHES TO DEPTHS AND WIDTHS INDICATED OR AS DIRECTED BY ENGINEER.

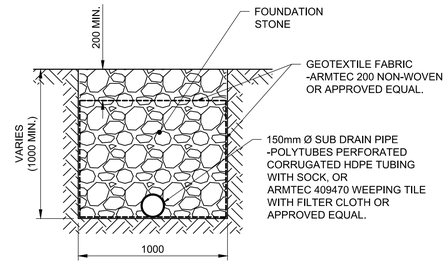
CONSTRUCTION NOTES (con't):

9. MAINTAIN AND KEEP DITCHES OPEN AND FREE FROM DEBRIS.
10. REMOVE SOFT AND OTHER UNSTABLE MATERIAL THAT WILL NOT COMPACT PROPERLY AND FILL RESULTIN DEPRESSIONS WITH APPROVED MATERIAL. REMOVE ROCKS OR STONES IN EXCESS OF 75mm FROM SURFACE.
11. SHAPE AND COMPACT ENTIRE BOTTOM OF CELL TO WITHIN 50mm OF DESIGN ELEVATIONS BUT NOT UNIFORMLY HIGH OR LOW.
12. FINISH TOP AND SIDE SLOPES OF DIKES OR BERMS TO WITHIN 50mm OF DESIGN ELEVATIONS
    11.1 REMOVE BOULDERS WITHIN 300mm OF EXPOSED SURFACE AND FILL RESULTING CAVITIES
    11.2 HAND FINISH SLOPES THAT CANNOT BE FINISHED SATISFACTORILY BY MACHINE
13. DISPOSE OF SURPLUS MATERIAL NOT REQUIRED FOR FINE GRADING AND LANDSCAPING OR EMBANKMENT CONSTRUCTION AS DIRECTED BY ENGINEER.
14. TRIM AND SHAPE ALL SURPLUS MATERIAL IN THE PILE AFTER CONSTRUCTION IS COMPLETE. IN GENERAL THE STOCKPILE MUST BE ABLE TO BE MAINTAINED BY MOWING EQUIPMENT. OBTAIN ENGINEER'S APPROVAL OF FINAL SHAPE.
15. TOPSOIL & SEED EXISTING DIKE TOPS & SIDESLOPES. RE-USE EXISTING TOPSOIL FROM THE SITE. SEED MIXTURE RATIO TO BE APPROVED BY THE ENGINEER.
16. SEE GEOTECHNICAL REPORT FOR TEST HOLE LOGS AND ANALYSIS.



NOTE: INITIALLY CONSTRUCT BERM TO STAGE 1 ELEVATION (MAX. 1.0m ABOVE ORIGINAL GROUND). CONSTRUCT STAGE 2 BERM, ONCE MATERIAL HAS BEEN DEPOSITED TO A MINIMUM HEIGHT OF 1.5m ABOVE THE CELL FLOOR.

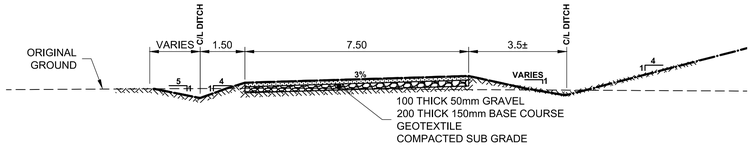
1 | BERM STAGING DETAIL
C-0003
Scale NTS



NOTE: FOUNDATION STONE SHALL BE NATURAL OR MANUFACTURED, CLEAN, ANGULAR, OPEN GRADED, GRANULAR MATERIAL WITH THE FOLLOWING GRADATION:

19mm SEIVE	100% PASSING
12.5mm SEIVE	0% - 5% PASSING

SUMP PIT DETAIL
Scale NTS



ACCESS ROAD SECTION
N.T.S.

AECOM

PROJECT

Repository Cell

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KEY PLAN

PROJECT NUMBER

60216914

SHEET TITLE

REPOSITORY CELL
CROSS SECTIONS
AND DETAILS

SHEET NUMBER

C-0003

Appendix C

MHWMC & CLC Approval Letters

Appendix D

Facility Map/Monitoring Well Locations

Miller Environmental Corporation
Facility Map
(Active Area)

N

Trailer
Staging Area

Cell
4

Inactive

Cell
3

Active

Cell
2

Active

Cell
1

Active

PB3

Tank 10
Tank 9
Tank 8
Tank 13
Tank 12
Tank 17
Tank 18
Tank 19
Tank 6
Tank 5
Tank 4
Tank 7
Compressor
Room
PB1
Parking lot
PB1
Transfer
Station
PB4
Main
Office

1
OMW

2
OMW

3
OMW

4
OMW

5
OMW

Container washing Facility

PB2

Ramp to PB2

Process Building 5
(PB5)

16
Tank

15
Tank

Mixer
1

Tank 3
Tank 2
Tank 1

Reagent
Silo 1

Reagent
Silo 2

Dust
Collector

Trailer Staging
Area

Trailer Staging
Area

Trailer
Ramp

Trailer
Staging Area

Bulk unloading & loading pad

SB1

Storage Building
SB1

△ Monitoring Wells 1 - 5

0 ft 48 ft 80 ft 160 ft