Technical Memorandum

To:	Amber Saltarelli	**From:**	Amanda Malatesta, Nick Schmidt
Company:	Gannett Fleming		**SLR Consulting (Canada) Ltd.**
cc:			
		Project No.	243.V24414.00000
		Revision	0

RE: Hydrogeological Assessment – Ontario Northland Northeastern Passenger Rail Service: New Timmins Station, Timmins, Ontario

1.0 Introduction

Palmer (part of SLR) was retained by Gannett Fleming on behalf of Ontario Northland Transportation Commission (ONTC) to undertake a desktop hydrogeological assessment in support of the design of the Timmins-Porcupine Station Project located in Timmins, Ontario (the Site).

The objective of the desktop hydrogeological assessment is to review existing information and studies to provide a description of existing local groundwater conditions in the Study Area (i.e. 500 m radius from the Site) and a high-level summary of potential impacts and mitigation measures as they relate to the proposed development.

2.0 Existing Conditions

2.1 Proposed Development

The proposed Timmins-Porcupine Station property is approximately one (1) hectare and is located along Falcon Street, between Gervais Street North and Duke Street East in Timmins, Ontario. The Site is bounded to the southeast by the existing railway line. The Whitney Multipurpose Court and a baseball diamond are located west of the Site, with residential neighbourhoods extending further east and west. The Timmins-Porcupine Station Project will involve the construction of a new passenger rail station as a terminus station situated along the Northlander route (**Figure 1**).

2.2 Regional Setting

2.2.1 Topography and Drainage

The Study Area is generally flat with a slope from the northeast to the southwest. Based on regional topography mapping, a topographic high of 288 metres above sea level (masl) is located towards the northeast area of the Site, decreasing approximately 1 to 2 m towards the southwest area of the Site (**Figure 2**).

The Study Area is located within the Porcupine River Watershed (PRW), which is under the jurisdiction of the Mattagami Region Conservation Authority. The Porcupine River drains into Night Hawk Lake to the west and ultimately to the Frederick House River System.

There is one provincially significant wetland within 500 m of the Site, Porcupine Lake Wetland lies approximately 450 m to the northeast of the Site. The closest water body is Bob's Lake, which is situated approximately 450 m southeast of the Site. Shallow Lake is approximately 750 m to the northwest of the Site.

2.2.2 Geology and Physiography

A review of available Ontario quaternary geology mapping indicated that the surficial soils at the Site are mainly comprised of clay and silt glaciolacustrine and glaciomarine deep water deposits (Ontario Geological Survey, 2010) (**Figure 3**). Bedrock geology mapping indicated that the Site is underlain by Metasedimentary bedrock bounded to the north and south by fault lines that converge to the northeast (Ontario Geological Survey, 2011) (**Figure 4**). Immediately east of the Site is a felsic to intermediate metavolcanic rock deposit which is separated from the bedrock underlying the Site by the southwest to northeast trending fault line.

2.3 Site Conditions

2.3.1 Site Geology

Palmer (2024) conducted a geotechnical investigation field investigation in 2023 at the Site. During the drilling program, twenty-one (21) boreholes (H23-NT-1 to BH23-NT-21) were advanced (**Figure 1**). Five (5) additional boreholes (BH24-NT-101 to BH24-NT-105) were drilled between June 11 and 14, 2024 as part of the 2024 geotechnical field investigation. The locations of boreholes are shown on the Site Plan (**Figure 1**). Boreholes were drilled to depths ranging from 3.1 to 16.2 m below existing ground surface (mbgs) (284.4 to 270.2 masl). Cross sections of the study area are presented in **Figures 5** to **7**.

Based on the results of the drilling program, the study area was comprised of a thin layer of topsoil which was underlain by silty clay / clayey silt, sandy silt / silty sand, sand, sand and gravel, and gravelly sand Fill materials. The Fill generally ranged from 0.7 to 3.8 mbgs (286.9 to 283.5 masl).

The Fill material was underlain by varying thicknesses of silty clay to clayey silt deposits which generally extended between 3.0 to 11.7 mbgs (284.2 to 275.5 masl). A silt to sandy silt layer was encountered beneath the silty clay to clayey silt deposits, at varying depths across the Site and varied thicknesses (1.6 to 3.1 m where measurable). This was further underlain by a silty sand till unit that was generally encountered between 13.8 to 16.2 mbgs (274.1 to 270.6 masl). A single instance of a sandy gravel layer was encountered at BH23-NT-12 and extended to a depth of 14.3 mbgs (272.7 masl).

Bedrock was not encountered during the drilling program.

2.3.2 Groundwater Elevation

As part of the geotechnical Investigation conducted by Palmer (2024), ten (10) monitoring wells were installed at the Site and stabilized groundwater measurements were obtained on August 30, 2023. The groundwater measurements are presented in Table 1 below.

Table 1: Groundwater Elevations

Monitoring Well ID	Screened Interval (mbgs)	Water Level Depth (mbgs) / Water Level Elevation (masl)
BH23-NT-1	3.1 - 6.1	3.9 / 284.8
BH23-NT-3	3.1 - 6.1	3.7 / 284.7
BH23-NT-4	12.2 – 15.2	5.1 / 283.1
BH23-NT-7	3.1 - 6.1	3.4 / 284.7
BH23-NT-9	10.1 – 13.1	4.8 / 283.1
BH23-NT-12	3.1 - 6.1	1.5 / 285.5
BH23-NT-13	3.1 - 6.1	0.6 / 286.5
BH23-NT-17	3.1 - 6.1	1.2 / 285.9
BH23-NT-18	3.1 - 6.1	1.5 / 286.2
BH23-NT-21	3.1 - 6.1	1.3 / 285.9
*mbgs = meter below ground surface		

Shallow groundwater was generally found to range 0.6 to 3.9 mbgs (286.5 to 284.8 masl) across the Site and is generally found within the upper silty clay deposits.

2.3.3 Hydrogeology

Hydrostratigraphic units can be subdivided into two distinct groups based on their ability to allow groundwater movement: an aquifer and an aquitard. An aquifer is defined as a layer of soil that is permeable enough to permit a usable supply of water to be extracted. An aquitard is a layer of soil that inhibits groundwater movement due to its low permeability.

The soils at the Site would generally be considered an aquitard which would limit groundwater flow both through the soils horizontally but also limit downward flow from the ground surface (infiltration).

2.4 Source Protection

The City of Timmins obtains its drinking water from the Mattagami River which is located within the Mattagami Region Source Protection Area. A Source Protection Plan (SPP) for the Mattagami Region Source Protection Area was developed for the sole municipal drinking water source (MRCA, 2019). The closest intake protection zone (IPZ) is located approximately 14 km west of the Site. The Site is located outside of all vulnerable areas as described in the SPP.

The SPP outlines the prescribed threats and areas of vulnerability to source water within the Mattagami Source Protection Region and the policies to address them. These policies may impact development types, locations, operations, materials, applications and the need for additional risk management, assessments, plans and/or studies. Furthermore, the MECP has developed the document Best Practices for Source Water Protection (Updated November 2, 2023) for water sources and drinking water systems that are not included in a SPP or are not regulated by the Clean Water Act. Every effort will be made to protect source water in accordance with the MECP guidelines, local regulations and the Clean Water Act.

3.0 Construction Dewatering

Construction activities associated with the construction of the Timmins-Porcupine Station that will resulting in ground disturbance and below grade works may include:

- Installation of new or modification of existing site servicing including, watermains, storm and sanitary sewers, gas services, power/hydro, and telecommunications;
- Culvert installations for stormwater management;
- Site grading;
- Excavations for building foundations;

At this time, a detailed construction plan is unavailable to assess the dimensions of proposed excavations required for the above construction activities. Depending on the depth of excavations, dewatering may be required below the groundwater level to complete the construction works in the dry.

Water takings of more than 50,000 L/day are regulated by the Ontario Ministry of Environment, Conservation and Parks (MECP). The MECP requires an Environmental Activity and Sector Registry (EASR) to be registered for any construction dewatering that is between 50,000 L/day and 400,000 L/day, or a Permit to Take Water (PTTW) to be obtained for any construction dewatering that is greater than 400,000 L/day.

It is noted that hydraulic conductivity estimates were not obtained from the monitoring wells on Site. Hydraulic conductivity estimates would need to be obtained to provide accurate dewatering estimates as part of detailed design. The range of hydraulic conductivities for clay and silt glaciolacustrine deposits can range between 10^{-6} m/s to 10^{-12} m/s (Freeze and Cherry, 1979).

. A hydrogeological assessment will be undertaken as part of detailed design to evaluate hydraulic conductivity and dewatering rates to establish an accurate dewatering estimate and permitting recommendation.

3.1 Water Taking Report and Discharge Report

Depending on whether an EASR or a PTTW is required for the construction dewatering works, different reporting will be required to support water taking permitting. Should an EASR be recommended, a Water Taking Report and Discharge Report will need to be prepared. Should a PTTW be recommended, a stand-alone hydrogeological report compliant with the MOE document “Technical Guidance Document for Hydrogeological Studies In Support of Category 3 Applications for Permit to Take Water” will need to be prepared.

If it is determined that water takings will be in excess of 50,000 L/day but less than 400,000 L/day, and a EASR registration is required, a Water taking Report and a Discharge Report will need to be developed by a qualified professional (QP) as defined by Ontario Regulation 63/16 prior to registering the EASR.

The Water Taking Report, as stipulated by the MECP, must include at minimum:

- A description of the construction site and construction project;
- A summary of the qualifications and experience of the person who prepared the water taking report;
- A description of the water taking activity, including the rate or volume at which the water will be taken;

- A calculated Zone of Influence expected for each dewatered work areas within the construction site;
- A ground settlement assessment conducted by a qualified engineer (P.Eng.) to the potential impact of the soil settlement that would occur as a result of the proposed water taking, including an assessment of the impact of the soil settlement on the integrity of infrastructure located in the expected area of influence for each dewatered work area;
- An analysis of the potential impact of the proposed water taking on other water users and on the natural functions of the ecosystem in the expected area(s) of influence;
- A contingency plan that includes measures to address the potential impact of the proposed water taking on other water users, a description of potential site-specific impacts and a description of a shutdown protocol if the QP assesses that such a protocol is required;
- A protocol for providing written notice to other water users who have the potential to be impacted and the applicable local ministry district office at least 48 hours prior to the initial commencement of the water taking activity; and,
- An analysis to determine whether a water monitoring plan would be needed and, if needed, a description of the plan and the circumstances in which it would be needed.

The Discharge Report, as stipulated by the MECP, must include at minimum:

- A summary of the qualifications and experience of the person who prepared the discharge report;
- An assessment of the quality and quantity of the ground water and storm water that is expected to be discharged;
- The location of the discharge;
- A recommendation of one or more of the methods of transfer or discharge;
- If the recommended method of discharge is to a surface land or to a storm sewer, a statement that the discharge will not cause an adverse effect to the environment;
- If the recommended method of discharge is to a surface land or to a storm sewer, identification of any treatment or control measures required to minimize erosion, flooding, scouring and sedimentation and a statement that addresses the quality of the discharge to ensure that it will not cause an adverse effect on the environment;
- An analysis to determine whether a monitoring plan would be needed to monitor the potential impacts of the discharge and, if needed, a description of the plan and the circumstances in which it would be needed; and,
- A contingency plan that includes measures to address: potential impacts related to the quality and quantity of the discharge, any failures of recommended treatment or control measures and other site-specific impacts such as flooding. A description of a shutdown protocol should be included if the QP assesses that such a protocol is required.

A requirement of the EASR is to record the daily water taking volumes and report them annually. Therefore, it is required that the dewatering contractor provide measurement controls suitable to measure and record the daily volume of water discharged (e.g., totalizer) and flow rate (e.g., flow meter) to confirm that discharge rates remain below the maximum permitted discharge rate.

Furthermore, any monitoring specified in either the Water Taking Report or the Discharge Report will need to be followed by the contractor completing the construction dewatering.

4.0 Impact Assessment

The following sections provide a preliminary assessment of the potential impacts of dewatering to surrounding receptors including impacts to groundwater resources, surrounding surface water, potable water sources and groundwater quality. At this time a radius of influence from dewatering has not been determined, therefore a summary of features within 500m was used for the assessment.

4.1 Water Supply

Well records from the MECP WWR database were reviewed to assess the stratigraphy and water use of wells located within a 500 m radius of the Study Area. The locations of the wells are shown in **Figure 8**, and a summary is provided below.

Five (5) MECP wells were identified within 500 m of the property. Four (4) of those wells were observation/monitoring wells or test holes and one (1) well was without a noted water use. There were no noted water supply wells. None of the available water well records provided static water level measurements.

Given that the City of Timmins obtains its drinking water from the Mattagami River, there are no anticipated impacts to drinking water supply.

Well ID	Completion Date	Depth (mbgs)	Well Use	Geology
7424776	7/24/2022	NA	NA	NA
7442959	3/7/2023	4.7	Monitoring/Observation	Brown Fill (0 - 1.52m), Brown Silt Sand (1.52 - 4.72 m)
7442960	3/7/2023	4.7	Monitoring/Observation	Brown Fill (0 - 1.52m), Brown Silt Sand (1.52 - 4.72 m)
7442961	3/7/2023	4.7	Monitoring/Observation	Brown Fill (0 - 1.52m), Brown Silt Sand (1.52 - 4.72 m)
7442962	3/7/2023	4.7	Monitoring/Observation	Brown Fill (0 - 1.52m), Brown Silt Sand (1.52 - 4.72 m)

4.2 Natural Heritage Features

Based on a review of existing mapping, two surface water features were identified within 500 m of the Site. Porcupine Lake Wetland PSW, approximately 450 m to the northeast of the Site and Bob's Lake, approximately 430 m east of the Site. Neither surface water feature is expected to have impacts from construction related activities on the Site.

4.3 Discharge Water Quality

A Preliminary Soil and Groundwater Characterization Report (SGCR) was issued by Gannett Fleming to ONTC in March 2024. Groundwater samples were obtained from the existing monitoring wells on Site, and the analytical results were compared to MECP Table 2 SCS. A summary of the exceedances are provided below:

- Chloride in groundwater sample BH23-NT-1 (1,530,000 µg/L) exceeded the MECP Table 2 SCS (790,000 µg/L).
- Benzo(a)pyrene in groundwater sample BH23-NT-7 (0.0179 µg/L) exceeded the MECP Table 2 SCS (0.01 µg/L). The RDL for benzo(a)pyrene in groundwater sample BH23-NT-1 (<0.0135) also exceeded the MECP Table 2 SCS (0.01 µg/L).

Depending on the intended point of discharge of construction dewatering volumes, water quality should be assessed in comparison with the regulations of the receiving environment (i.e. Sewer use bylaws, PWQO, or other MECP guidelines). Groundwater quality should meet the appropriate regulations, and if not, should undergo treatment prior to discharge. Should treatment of groundwater be necessary to discharge to an accepted receiver, a mobile Environmental Compliance Approval (ECA) may be necessary to permit this treatment. A treatment specialist should be consulted if treatment is expected to be necessary.

For the management of excess groundwater or dewatering during construction, all relevant approvals for water taking (PTTW or EASR) and discharge (discharge permit / approval where required) shall be obtained prior to construction.

If discharge water is to be directed overland as deemed appropriate by the QP, discharge should be dispersed through existing vegetation and be minimum distance of 30 m away from any surface water body, as stipulated by the MECP. Due to the high potential for sediment during construction dewatering, it is recommended that discharge water be directed through a sediment filtration bag, before being discharge overland.

Proper erosion and sedimentation control measures should also be in place and stipulated in the construction plans. The measures should be installed, used, operated, and maintained in accordance with recommendations provided by the manufacturers of the control measures.

In the event that a hydrocarbon film or sheen be observed, dewatering shall cease until the source of the impact is identified, and or the discharge is sufficiently treated based on the criteria of the receiver.

5.0 References

Chapman, L.J. and Putnam, D.F. 1984. Physiography of southern Ontario; Ontario Geological Survey.

Freeze, A.R., Cherry, J.A. 1979. Groundwater. Prentice-Hall Inc., Englewood Cliffs, New Jersey.

Mattagami Region Conservation Authority (MRCA), 2019. Mattagami Region Source Protection Plan. December 3, 2019.

Ontario Geological Survey 2010. Surficial geology of southern Ontario; Ontario Geological Survey, Miscellaneous Release— Data 128 – Revised.

Ontario Geological Survey 2011. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release---Data 126-Revision 1.

Palmer, 2024. Geotechnical Investigation – Ontario Northland Northeastern Passenger Rail Service: New Timmins Station, Timmins, Ontario. Draft Rev. 3. August 9, 2024.

6.0 Statement of Limitations

This report has been prepared by SLR Consulting (Canada) Ltd. (SLR) for Gannett Fleming (Client) in accordance with the scope of work and all other terms and conditions of the agreement between such parties. SLR acknowledges and agrees that the Client may provide this report to government agencies, interest holders, and/or Indigenous communities as part of project planning or regulatory approval processes. Copying or distribution of this report, in whole or in part, for any other purpose other than as aforementioned is not permitted without the prior written consent of SLR.

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7.0 Closure

We trust that this report provides the information requested for your present requirements. Please do not hesitate to contact the undersigned should there be any questions.

Regards,

SLR Consulting (Canada) Ltd.

Amanda Malatesta, M.Sc., P.Geo
Hydrogeologist

Nick Schmidt, B.Sc., P.Geo
Senior Hydrogeologist

Attachments:

Figure 1: Site Plan

Figure 2: Site Topography and Drainage

Figure 3: Quaternary Geology

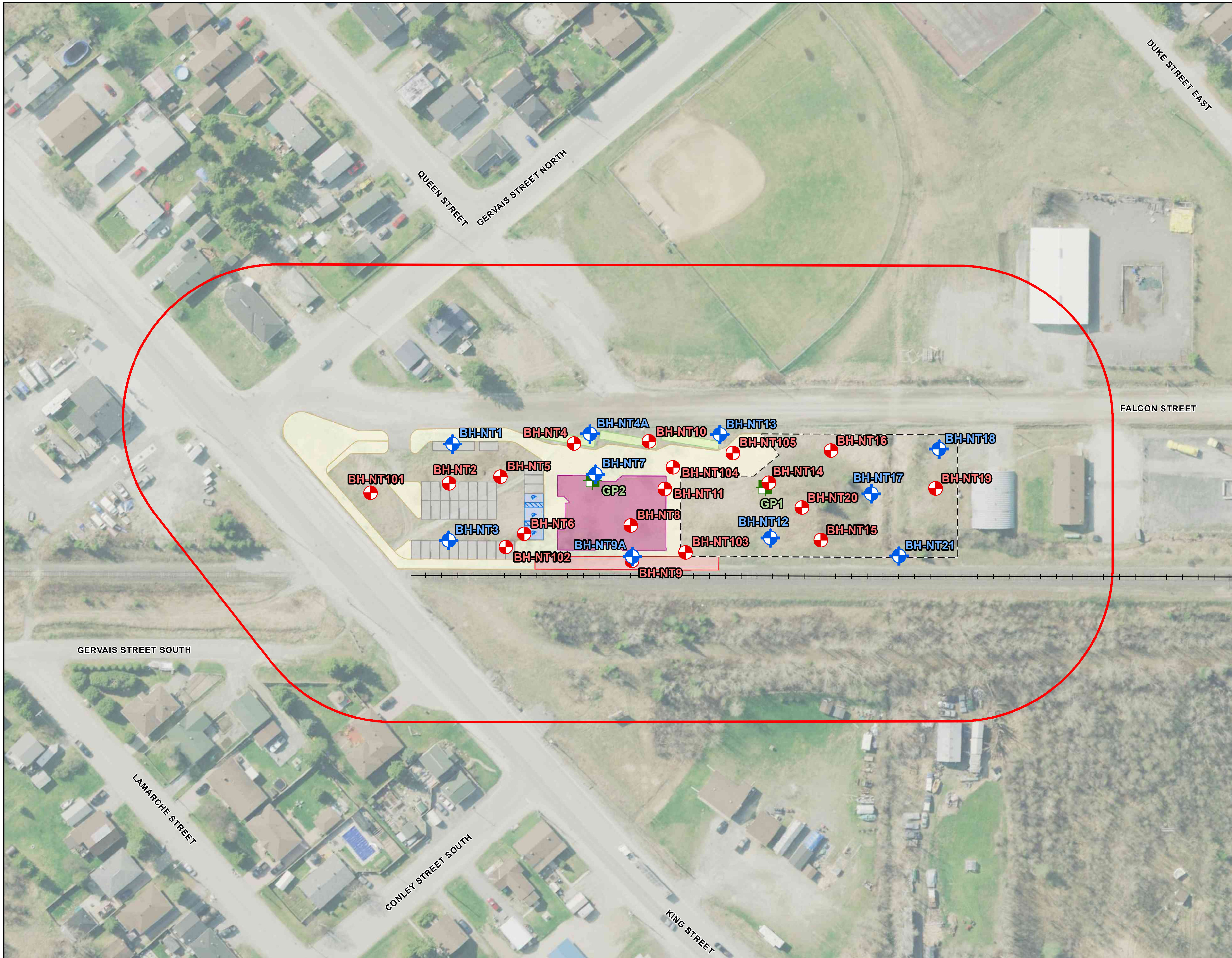
Figure 4: Bedrock Geology

Figure 5: Cross Section 1

Figure 6: Cross Section 2

Figure 7: Cross Section 3

Figure 8: MECP Water Well Records within 500m of Study Area



KEY MAP

LEGEND

- Borehole/Monitoring Well Location
- Borehole Location
- Test Pit Location
- Existing Mainline Rail Track
- Study Area
- Proposed Platform
- Proposed Station Building
- Proposed Bus Stop
- Proposed Parking
- Proposed Barrier-Free Parking
- Proposed Curbline
- Future Bus Storage and Maintenance Facility

0 10 20 30 40 50
METRE SCALE

North American Datum 1983
Universal Transverse Mercator Projection Zone 17

Scale: 1:1,200
Page Size: Tabloid (11 x 17 inches)

Drawn: CV
Checked: AM
Date: Sep 9, 2024

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NORTH

CLIENT
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PROJECT
Hydrogeological Assessment -
New Timmins Station, Ontario Northland
Northeastern Passenger Rail Project

TITLE
Site Plan

Palmer. PART OF SLR

REF. NO. 243.V2414.0000-1-2

Figure 1

LEGEND

- Surface Elevation Contour (2m)
- Watercourse[1]
- Waterbody[1]
- Wetland[1]
- Wetland - Evaluated - Provincial[1]
- Study Area

1. LIO/MNRF

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METRE SCALE

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Universal Transverse Mercator Projection Zone 17

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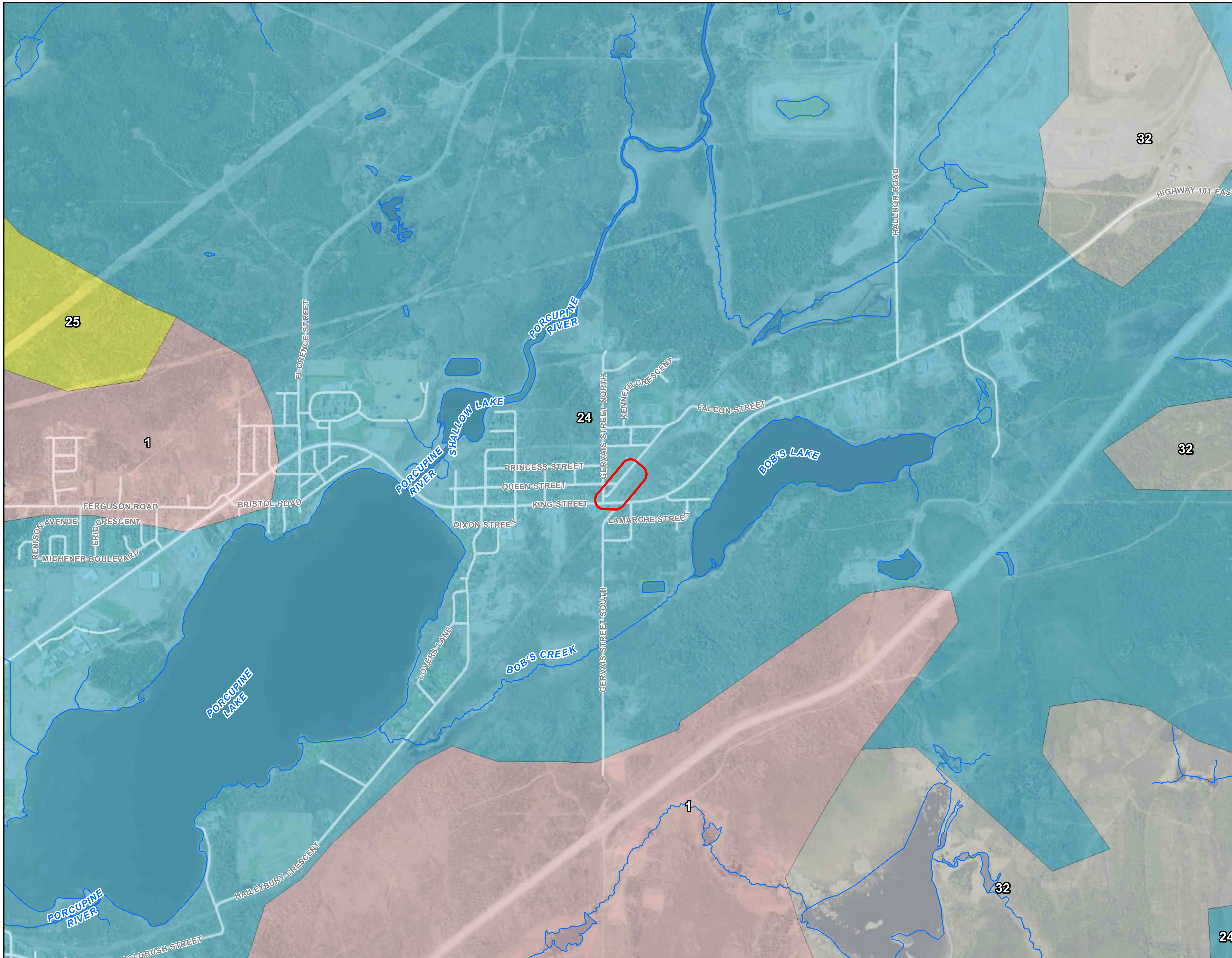
PROJECT
Hydrogeological Assessment -
New Timmins Station, Ontario Northland
Northeastern Passenger Rail Project

TITLE
Site Topography and Drainage

Palmer. PART OF SLR

REF. NO. 243.V24414.00000

Figure 2



LEGEND

Watercourse[1]

Study Area

Quaternary Geology[2]

Phanerozoic / Cenozoic / Quaternary / Recent

32: Organic deposits: *peat, muck and marl*

Phanerozoic / Cenozoic / Quaternary / Pleistocene

25: Glaciomarine deposits: *sand, gravelly sand and gravel nearshore and beach deposits*

24: Glaciomarine deposits: *silt and clay, minor sand basin and quiet water deposits*

Precambrian

1: Bedrock: *undifferentiated igneous and metamorphic rock, exposed at surface or covered by a discontinuous, thin layer of drift*

1. LIO/MNRF
2. Ontario Geological Survey, 2017. *Quaternary geology, seamless coverage of the province of Ontario*: Ontario Geological Survey, Data Set 14

0 200 400 600 800 1,000

METRE SCALE

North American Datum 1983
Universal Transverse Mercator Projection Zone 17

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Page Size: Tabloid (11 x 17 inches)

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NORTH

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Hydrogeological Assessment -
New Timmins Station, Ontario Northland
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TITLE

Quaternary Geology

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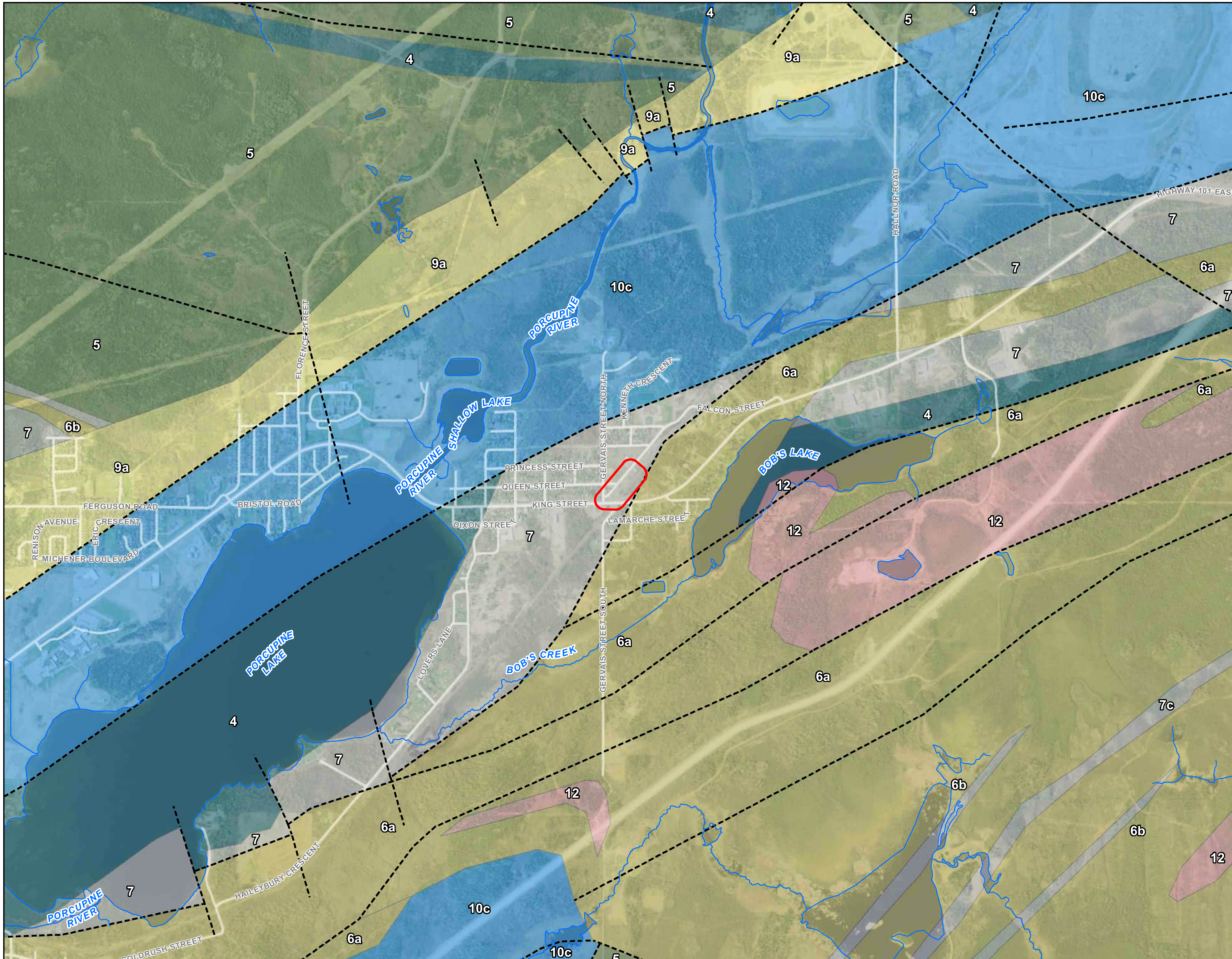
Figure 3



LEGEND

Watercourse[1]

Study Area

Bedrock Geology[2]

- 12: Foliated tonalite suite: tonalite to granodiorite - foliated to massive
- 10c: Mafic and ultramafic rocks: ultramafic rocks
- 9a: Coarse clastic metasedimentary rocks: Metasedimentary rocks: conglomerate, arkose, arenite, wacke, sandstone, siltstone, argillite
- 7: Metasedimentary rocks
- 7c Metasedimentary rocks: Marble, chert, iron formation, minor metavolcanic rocks
- 6a: Felsic to intermediate metavolcanic rocks: Dacitic and andesitic flows, tuffs and breccias
- 6b: Felsic to intermediate metavolcanic rocks: Rhyolitic, rhyodacitic flows, tuffs and breccias
- 5: Mafic to intermediate metavolcanic rocks
- 4: Mafic to ultramafic metavolcanic rocks

Fault Line

1. LIO/MNRF
2. Ontario Geological Survey 2011. *1:250 000 scale bedrock geology of Ontario*; Ontario Geological Survey, Miscellaneous Release–Data 126 - Revision 1

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Universal Transverse Mercator Projection Zone 17

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Hydrogeological Assessment - New Timmins Station, Ontario Northland Northeastern Passenger Rail Project

TITLE
Bedrock Geology

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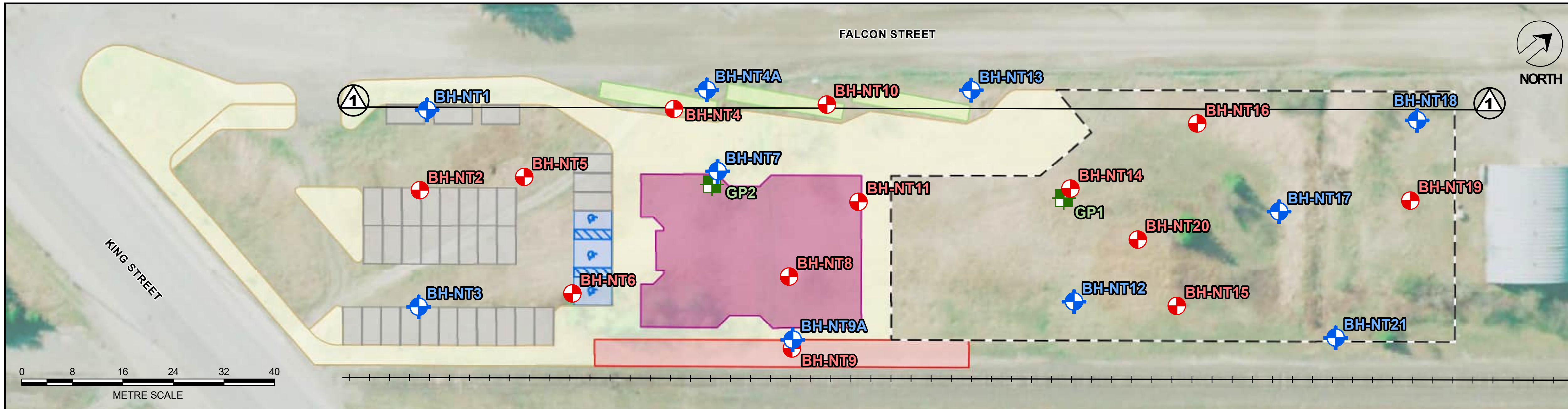
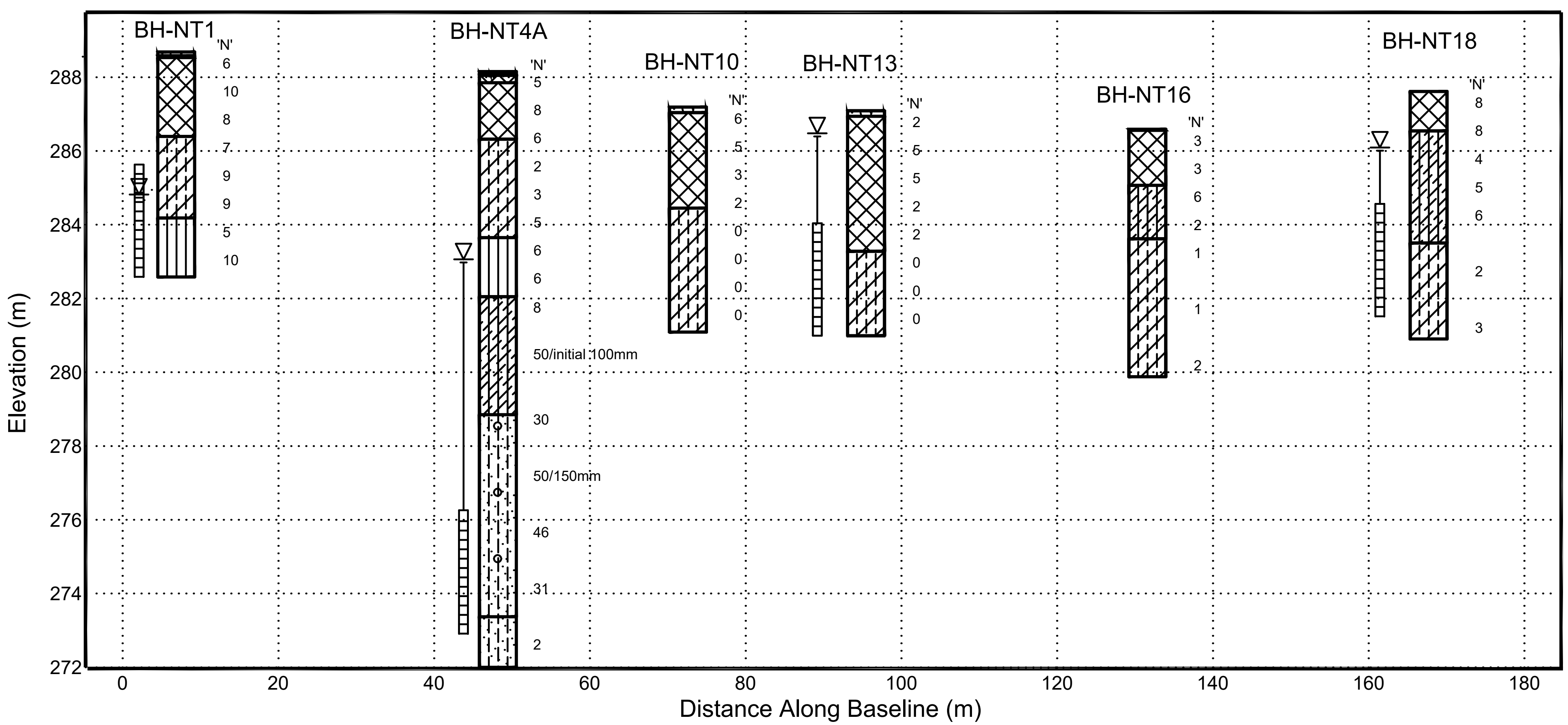
REF. NO. 243.V24414.00000

Figure 4



MAP LEGEND

- Borehole/Monitoring Well Location
- Borehole Location
- Test Pit Location
- Existing Mainline Rail Track
- Proposed Platform
- Proposed Station Building
- Proposed Bus Stop
- Proposed Parking
- Proposed Barrier-Free Parking
- Proposed Curbline
- Future Bus Storage and Maintenance Facility
- Cross-Section Location



SECTION LEGEND

- Topsoil
- Fill
- Silty Clay
- Silt
- Clayey Silt
- Silty Sand Till
- Silty Sand

Map Scale: 1:750
Section Scale: As Shown

Page Size: Tabloid (11 x 17 inches)

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TITLE
Cross Section 1

Palmer PART OF SLR

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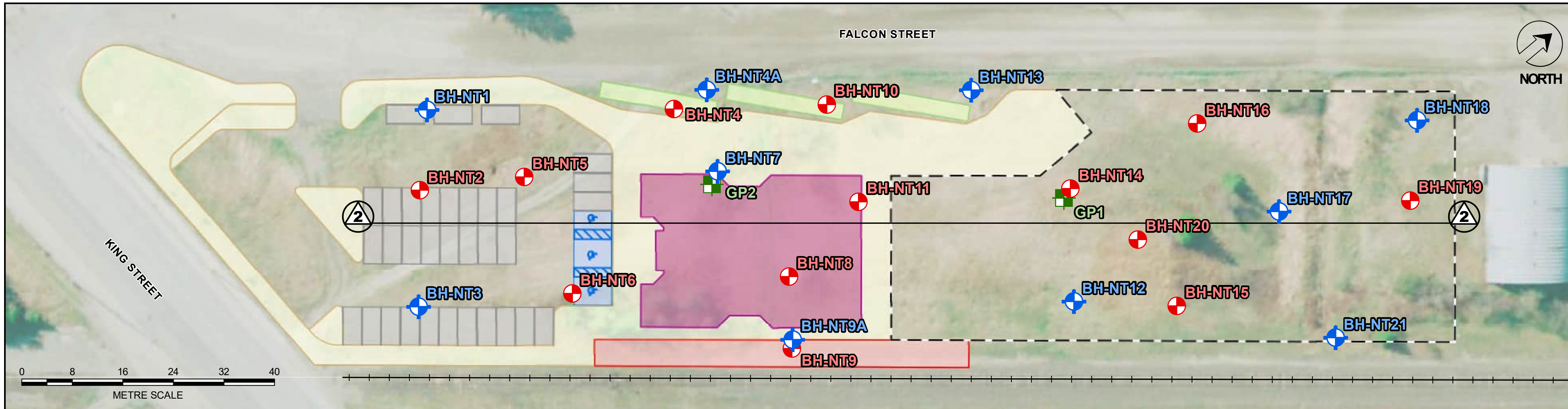
Figure 5



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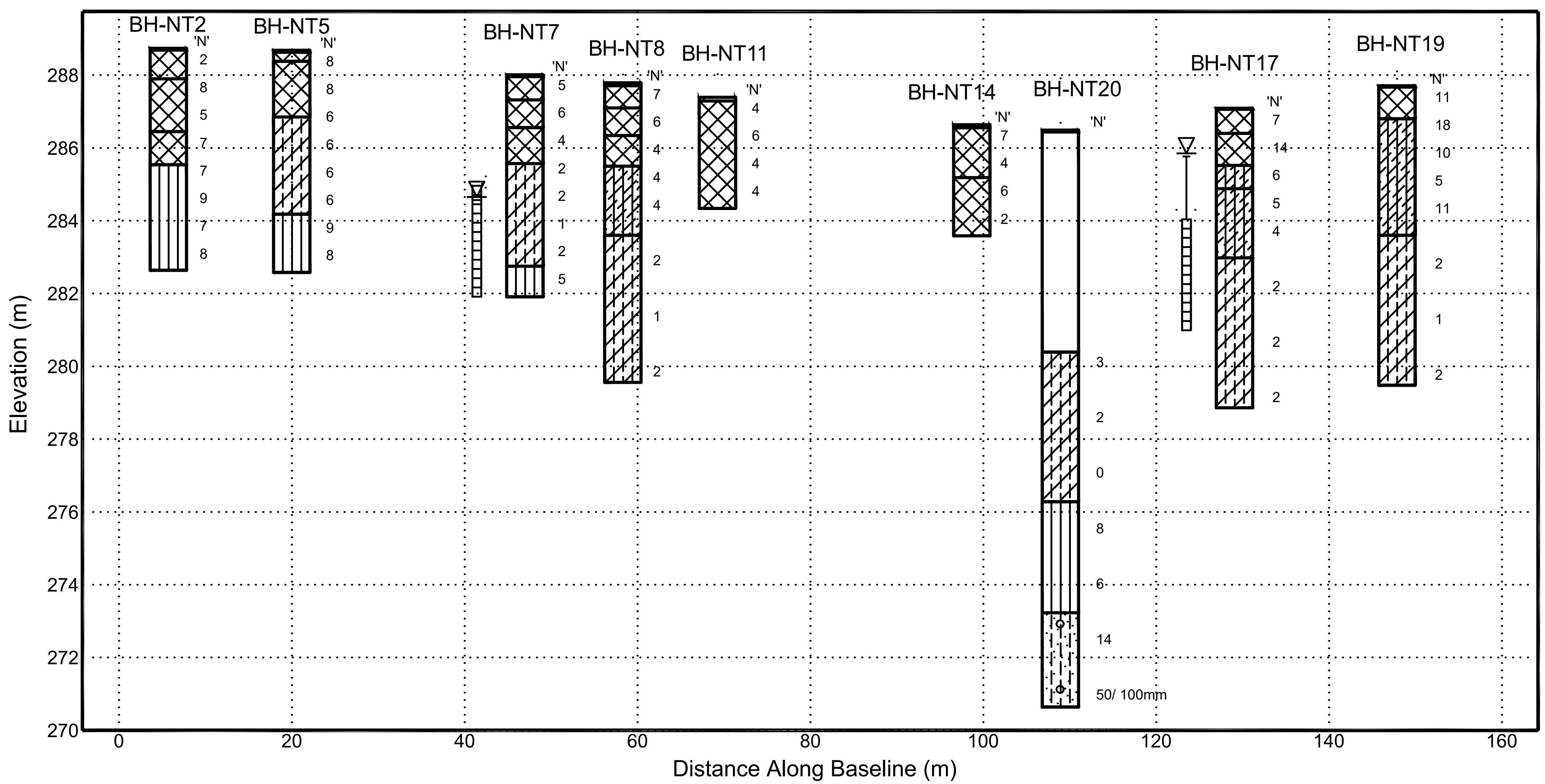

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Cross Section 2

Palmer. PART OF SLR

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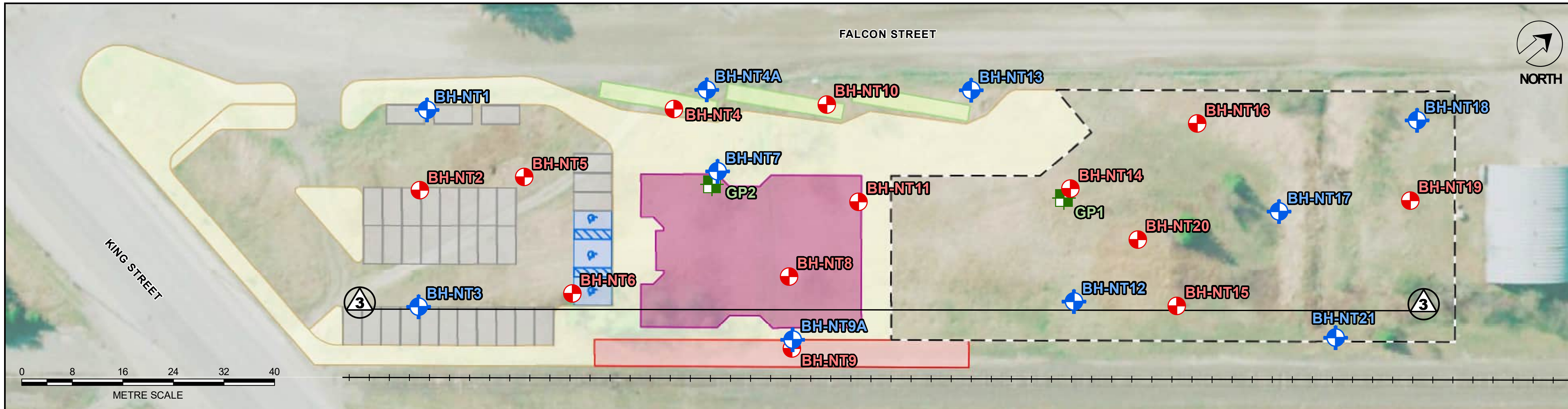
Figure 6



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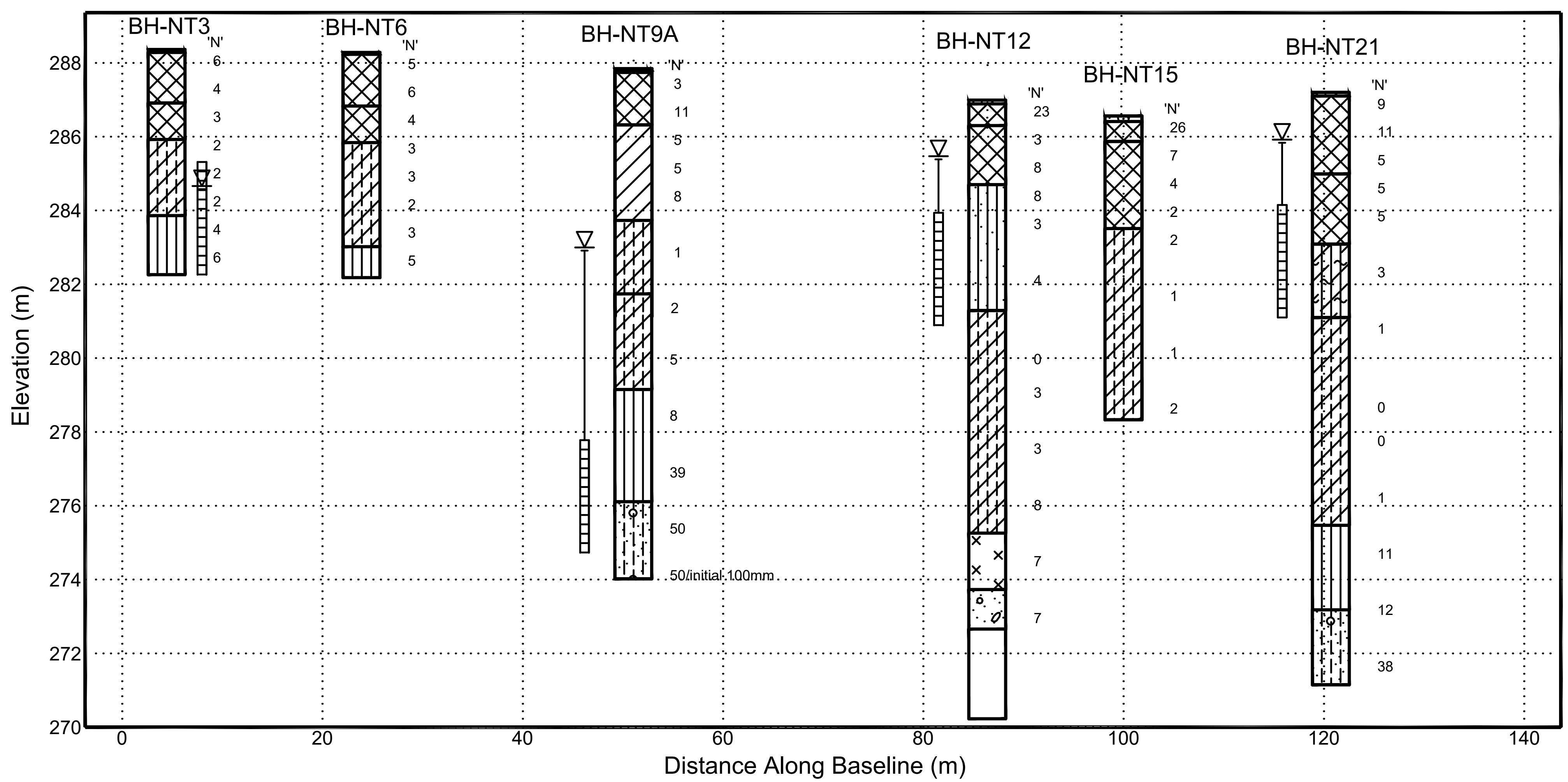
- Future Bus Storage and Maintenance Facility
- Cross-Section Location



SECTION LEGEND

- Topsoil
- Fill
- Sandy Silt
- Silty Clay
- BSI Silt
- Sand and Gravel + Boulders
- Organic Clayey Silt
- Silt
- Silty Sand Till
- Silt and Clay

Map Scale: 1:750
Section Scale: As Shown

Page Size: Tabloid (11 x 17 inches)

Drawn: TO/CV
Checked: AM
Date: Jul 25, 2024

Source Notes:
Imagery (2016, COOP) provided by Land Information Ontario map service.
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CLIENT
Gannett Fleming

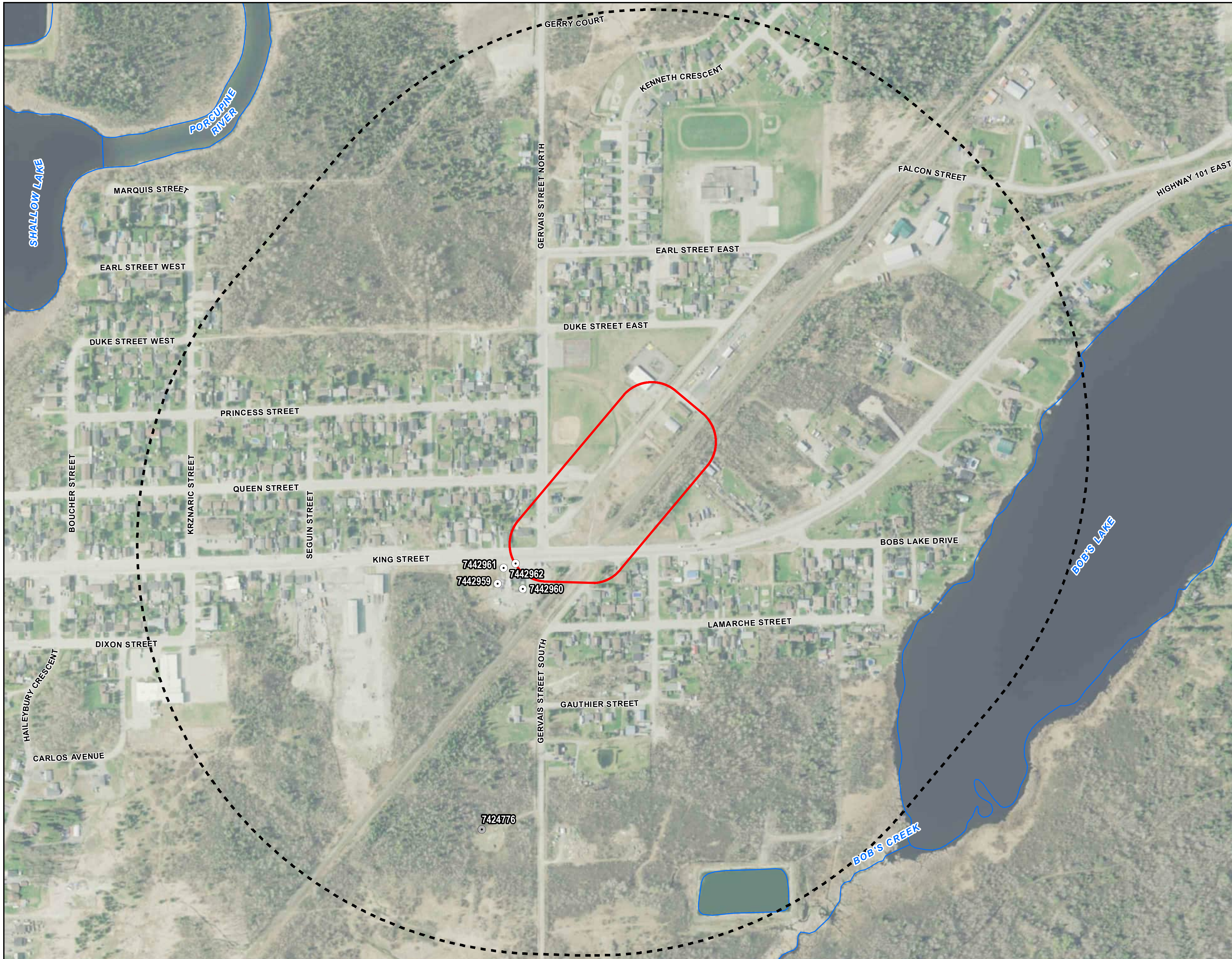
PROJECT
Hydrogeological Assessment -
New Timmins Station, Ontario Northland
Northeastern Passenger Rail Project

TITLE
Cross Section 3

Palmer PART OF SLR

REF. NO. 243.V24414.00000

Figure 7



LEGEND

Watercourse[1]

Study Area

500m Study Area Buffer

Water Well Record within 500m[2]

by Well Use

Test Well/Monitoring Well

N/A

1. LIO/MNRF
2. MECP

0 50 100 150 200 250

METRE SCALE

North American Datum 1983
Universal Transverse Mercator Projection Zone 17

Scale: 1:5,000
Page Size: Tabloid (11 x 17 inches)

Drawn: CV
Checked: AM
Date: Jul 24, 2024

Source Notes:
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NORTH

CLIENT

Gannett Fleming

PROJECT

Hydrogeological Assessment -
New Timmins Station, Ontario Northland
Northeastern Passenger Rail Project

TITLE

MECP Water Well Records within 500m of Study Area

Palmer PART OF SLR

REF. NO. 243.V24414.00000

Figure 8

Appendix A

Geotechnical Report

871 Equestrian Court, Unit 1, Oakville, ON L6L 6L7
Tel: 647-795-8153 | www.pecg.ca

Geotechnical Investigation – Ontario Northland Northeastern Passenger Rail Service: New Timmins Station, Timmins, Ontario (Draft Rev 3)

Palmer Project #

[illegible]

Prepared For

[illegible]

A[illegible]

[illegible]

[illegible]

Dear [illegible]:

Re: Geotechnical Investigation – Ontario [illegible]orthland [illegible]ortheastern [illegible]assenger Rail Service [illegible]e[illegible] Ti[illegible]ins Station [illegible] Ti[illegible]ins Ontario [illegible] Dra[illegible]t Rev [illegible]

[illegible]ro[illegible]ect [illegible]

[illegible] the subject site (“the Site”) [illegible].

[illegible]

[illegible]

[illegible]

Draft

[illegible]

August 9, 2024

Table of Contents

Drawings

Appendix A

[illegible]

Appendix B

[illegible]

Appendix C

[illegible]

Appendix D

[illegible]

1. Introduction

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] and their designers. Use of this report by third party without Palmer's consent is [illegible]

2. Site and Regional Geology

[illegible]

[illegible]

[illegible]

3. Field and Laboratory Work

[illegible] **Dra[illegible]ing** [illegible]

[illegible] mm depth into the soil (SPT 'N' values) gives an indication of the compactness [illegible]dition or consistency of the sampled soil material. The SPT 'N' values are indicated on the borehole [illegible] **A[illegible]endi[illegible] A**. [illegible]

[illegible] **Table** [illegible]

[illegible]

[illegible]

[illegible]

4. Subsurface Conditions

[illegible] General notes on soil sample description are presented on the “Explanation of Terms Used in the record of borehole” sheet in [illegible] A. [illegible]

4.1 Soil Conditions

Topsoil

[illegible]

Fill Materials

[illegible] ‘N’ values ranging from [illegible]

[illegible]

[illegible] **Appendix B**. [illegible]

Silty Clay

[illegible] The standard penetration 'N' values ranging from [illegible]

[illegible] **Appendix B** [illegible]

[illegible]

[illegible] **Appendix B**. [illegible]

Clayey Silt

[illegible]). The standard penetration 'N' values ranging from [illegible]

[illegible]

[illegible] Appendix B [illegible]

[illegible]

[illegible] Appendix B [illegible]

Silt / Sandy Silt

[illegible] ‘N’ values ranging from [illegible]

[illegible] Appendix B [illegible]

[illegible]

Silty Sand (Till)

[illegible] The standard penetration 'N' values ranging [illegible]

[illegible] **A[illegible]endi[illegible] B** [illegible]

[illegible]

Sandy Gravel

[illegible] 'N' value [illegible]

4.2 Groundwater Conditions

[illegible] **Table** [illegible]

Table [illegible] Monitoring [illegible]ell Details and [illegible]ater Levels

Monitoring Well ID	Screen Interval (mBGS)	Water Level Depth (mBGS)/ Water Level Elevation (m)
		August 30, 2023
BH23-NT-1	3.1 ~ 6.1	3.9/284.8
BH23-NT-3	3.1 ~ 6.1	3.7/284.7

Monitoring Well ID	Screen Interval (mBGS)	Water Level Depth (mBGS)/ Water Level Elevation (m)
		August 30, 2023
BH23-NT-4	12.2 ~ 15.2	5.1/283.1
BH23-NT-7	3.1 ~ 6.1	3.4/284.7
BH23-NT-9	10.1 ~ 13.1	4.8/283.1
BH23-NT-12	3.1 ~ 6.1	1.5/285.5
BH23-NT-13	3.1 ~ 6.1	0.6/286.5
BH23-NT-17	3.1 ~ 6.1	1.2/285.9
BH23-NT-18	3.1 ~ 6.1	1.5/286.2
BH23-NT-21	3.1 ~ 6.1	1.3/285.9

[illegible]

[illegible]

4.3 In-Situ Infiltration Testing

[illegible]

[illegible]

$$K = (6 \times 10^{-11}) I^{3.7363}$$

Where:

K = [illegible]dr[illegible]d[illegible]

I [illegible]r[illegible]r[illegible]

T[illegible]r[illegible]r[illegible]r [illegible]d [illegible]r [illegible]d [illegible]. C[illegible]d[illegible]r [illegible]r [illegible]O[illegible]r[illegible]r [illegible]r T[illegible] [illegible]d [illegible]r[illegible] r[illegible]r [illegible]r[illegible]r[illegible]d [illegible] **Table** [illegible]d r[illegible]r[illegible]r[illegible]d[illegible]d [illegible] **A[illegible]endi[illegible] C**.

Table [illegible]sti[illegible]ated In[illegible]iltration Rates

Soil Descri[illegible]tion	[illegible]ercolation Test Location	De[illegible]th o[illegible] Auger Hole [illegible] bgs[illegible]	H [illegible]	[illegible]ield Saturated Hydraulic Conductivity [illegible]K_s[illegible] s[illegible]	Calculated In[illegible]iltration Rate [illegible]hr[illegible]	In[illegible]iltration Rate [illegible]ith [illegible] [illegible]OS
C[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mean Value				[illegible]	[illegible]	[illegible]

5. Recommended Design Parameters

[illegible]d [illegible]r [illegible]r [illegible]r[illegible]d[illegible]r [illegible]r[illegible]d [illegible]r [illegible]r[illegible]d [illegible] **Table** [illegible]. T[illegible]r[illegible]d[illegible]d [illegible]r [illegible]r[illegible]r [illegible]d [illegible]T N[illegible]r[illegible]r [illegible]r[illegible]d [illegible]d [illegible]d [illegible]d [illegible]d r[illegible]r[illegible].

Table [illegible]Reco[illegible]ended Soil [illegible]ara[illegible]eters [illegible]or Design

SOIL TY[illegible]	NEW GRANULAR FILL		EXISTING FILL	[illegible]O[illegible]COH[illegible]SIV[illegible] [illegible]ATIV[illegible] SOILS – SA[illegible]D A[illegible]D GRAV[illegible]L TO SA[illegible]DY SILT [illegible]TILL[illegible]					COH[illegible]SIV[illegible] [illegible]ATIV[illegible] SOIL – SILTY CLAY [illegible]TILL[illegible]					
SPT 'N'	'A'	'B'	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]–[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]nit [illegible]eight [illegible]k[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

SOIL TY[illegible]	NEW GRANULAR FILL		EXISTING FILL	[illegible]O[illegible]COH[illegible]SIV[illegible] [illegible]ATIV[illegible] SOILS – SA[illegible]D A[illegible]D GRAV[illegible]L TO SA[illegible]DY SILT [illegible]TILL[illegible]						COH[illegible]SIV[illegible] [illegible]ATIV[illegible] SOIL – SILTY CLAY [illegible]TILL[illegible]				
SPT 'N'	'A'	'B'	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]ective angle o[illegible] internal [illegible]riction [illegible]°[illegible]ϕ'	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]ective cohesion, c' [illegible]k[illegible]a[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]ndrained shear strength [illegible]k[illegible]a[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Coe[illegible]icient o[illegible] lateral earth [illegible]ressure														
Active K_a	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
At rest K_o	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]assive K[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]lastic [illegible]odulus [illegible]M[illegible]a[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Poission's ratio	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Modulus o[illegible] subgrade reaction k [illegible]M[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Lateral [illegible]odulus o[illegible] subgrade reaction K_h [illegible]M[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

6. Discussion and Recommendations

6.1 Foundation Design Considerations

[illegible]

Settle[illegible]ent

[illegible]

[illegible] **A[illegible]endi[illegible] B**. [illegible]

[illegible]

[illegible]:

- [illegible]
- [illegible]
- [illegible]

[illegible]:

- [illegible]

6.1.1.1 Station Building Shallow Foundations

6.1.1.2 Parking Lot

[illegible]

6.1.1.3 Bus Loop

[illegible]

[illegible] **Section** [illegible]

[illegible]

6.1.1.4 Train Platform

[illegible]

6.1.1.5 Preloading

[illegible]

[illegible]

[illegible] Dee[illegible] [illegible]oundations

6.1.2.1 Helical Piles

[illegible]

[illegible]

[illegible]

Table [illegible]

Table [illegible] Chance Helical [illegible]ile [illegible]actored Geotechnical Resistances

"N" value Cohesionless Soil	"N" value Cohesive Soil	Pile Type (size)	Compression Capacity		Tension Capacity	
			SLS (kN)	ULS (kN)	SLS (kN)	ULS (kN)
25-30	[illegible]	SS5 (38 mm)	200	270	60	80
30-35	[illegible]	SS175 (44 mm)	370	500	115	150
40-50	[illegible]	SS200 (51 mm)	500	670	205	270

[illegible]

- [illegible]
- [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

6.1.2.2 Micropiles

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

6.1.2.3 Lateral Resistances of Piles

[illegible]

[illegible] Ground Improvement

[illegible]

[illegible]

[illegible] to safely control both total and differential settlements. The structure's loads are transferred between the [illegible] CMC [illegible]

[illegible]

6.2 Excavations, Backfill and Groundwater Control

[illegible]

[illegible]

[illegible]

[illegible] **Section** [illegible]

[illegible]

[illegible]

imported granular fill such as OPSS Granular "B" should be used. Imported granular fill, which can be [illegible]

[illegible]

[illegible] thickness and extent of these soils, the prevailing groundwater level at the time of construction, "a[illegible] advance" dewatering measure using well points/eductors may be required to maintain the stability of the base and side slopes of the excavations in these areas. These 'active dewatering' measures would have [illegible]

[illegible]

6.3 Floor Slab / Slab Drainage

[illegible]

[illegible] **Section** [illegible]

[illegible]

6.4 Seismic Considerations

[illegible]

[illegible] than 30 m and based on general knowledge of the local geology and physiography. In this regard, Palmer's [illegible] showing average standard penetration 'N' values less tha[illegible]

[illegible]

6.5 Frost Protection

[illegible] MTO H[illegible]

[illegible]

6.6 Monitoring and Instrumentation

[illegible] Section [illegible]

Ground Move[illegible]ent Monitoring [illegible]rogra[illegible]

[illegible]

- [illegible]
- [illegible]
- [illegible]
- [illegible]

[illegible]

[illegible]

[illegible]

Vibration Monitoring Program

[illegible]

[illegible]

1. [illegible]

2. [illegible]

3. [illegible]

4. [illegible]

[illegible]

Level [illegible]:

"[illegible]ARNIN[illegible]" [illegible]

Level [illegible]:

"CRITICA[illegible]" [illegible]

The “Warning” and “Critical” alarm levels at specific monitoring points should be provided based on the [illegible]

[illegible] [illegible]recondition Construction Survey

[illegible]

6.7 Pavement Design

[illegible] **Tables [illegible] and** [illegible]

[illegible]

Table [illegible]: Recommended Pavement Structure Thickness

Pavement Layer	Compaction Requirements	Light Duty Pavement [illegible]Parking for Cars[illegible]	Heavy Duty Pavement [illegible]Access Road[illegible]ire Routes[illegible]Buses and Delivery Trucks[illegible]
Asphaltic Concrete	93% Maximum Relative Density (MRD)	40 mm HL 3 50 mm HL 8	40 mm HL 3 HS 100 mm HL 8 HS
OPSS Granular “A” Base (or 20mm Crusher Run Limestone)	100% SPMDD*	150 mm	150 mm
OPSS Granular “B” (or 50mm Crusher Run Limestone)	100% SPMDD	1050 mm	1760 mm

Table [illegible]: Recommended Rigid Pavement Structure Thickness

Pavement Layer	Compaction Requirements	Heavy Duty Pavement [illegible]Access Road[illegible]ire Routes[illegible]Buses and Delivery Trucks[illegible]
Concrete	-	300 mm
OPSS Granular “A” Base (or 20mm Crusher Run Limestone)	100% SPMDD*	150 mm
OPSS Granular “B” (or 50mm Crusher Run Limestone)	100% SPMDD	1760 mm

[illegible]

[illegible]

[illegible]

Add[illegible]

- [illegible] MDD.
- [illegible]

[illegible]

6.8 Geotechnical Quality of Excavated Soils

[illegible]

- **Grou**[illegible]

[illegible] MDD. T[illegible] d[illegible] [illegible]

- **Grou**[illegible] y be dusty and “flour” like while at moisture contents ±1% higher than optimum, the soil will be “spongy” and will “pump”.

- **Grou**[illegible] site or should be used only in “soft” landscaping [illegible]

A[illegible] MDD [illegible] ar “A” or “B” material, and the top 1.5m of subgrade backfill [illegible] MDD

6.9 Concrete Exposed to Sulphate Attack

T[illegible] **Table** [illegible] **A**[illegible]**endi**[illegible] **D**.

Table [illegible] Summary of Sulphate Concentration Test

Sample ID	Soil Depth (mBGS)	Soil Type	Sulphate Concentration (%)
BH23NT-21 SS5	3.0 – 3.6	Fill	0.0022
BH23NT-19 SS4	2.3 – 2.9	Clayey Silt	<0.0020
BH23NT-17 SS2	0.8 – 1.4	Fill	<0.0020
BH23NT-17 SS3	1.5 – 2.1	Clayey Silt	<0.0020
BH23NT-17 SS4	2.3 – 2.9	Clayey Silt	<0.0020

Sample ID	Soil Depth (mBGS)	Soil Type	Sulphate Concentration (%)
BH23NT-9 SS3	1.5 – 2.1	Clayey Silt	<0.0020
BH3NT-6 SS2	0.8 – 1.4	Fill	<0.0020
BH23NT-3 SS4	1.5 – 2.1	Fill/Silty Clay	0.0030
BH23NT-4A SS3	9.1 – 9.7	Clayey Silt/Silty Sand Till	0.0051
BH23NT-1 SS3	1.5 – 2.1	Fill	0.0024

N[illegible]: [illegible]

The category of severity of attack is “negligible” based on CSA Standard CAN/CSA A[illegible] M[illegible] [illegible]

6.10 Corrosivity Potential

T[illegible] **Table** [illegible] AN[illegible] [illegible] A[illegible] **A[illegible]endi[illegible] D**.

Table [illegible] Summary of Corrosivity Potential of Soils

Sample ID	Depth (mBGS)	Soil Type	Parameter (Score)					
			pH	Resistivity (ohm.cm)	Sulphide (mg/kg)	Redox potential (mV)	Moisture content (%)	Total Points
BH23NT-21 SS5	3.0 – 3.6	Fill	7.77 (0)	4850 (0)	0.29 (2)	258 (0)	31.1 (2)	3
BH23NT-19 SS4	2.3 – 2.9	Clayey Silt	7.72 (0)	6670 (0)	<0.24 (2)	275 (0)	18.5 (1)	3
BH23NT-17 SS2	0.8 – 1.4	Fill	7.78 (0)	5080 (0)	<0.24 (2)	283 (0)	17.0 (1)	3
BH23NT-17 SS3	1.5 – 2.1	Clayey Silt	7.73 (0)	7140 (0)	<0.24 (2)	293 (0)	18.0 (1)	3
BH23NT-17 SS4	2.3 – 2.9	Clayey Silt	7.68 (0)	4720 (0)	<0.24 (2)	271 (0)	17.0 (1)	3
BH23NT-9 SS3	1.5 – 2.1	Clayey Silt	7.71 (0)	9520 (0)	<0.23 (2)	292 (0)	16.1 (1)	3
BH3NT-6 SS2	0.8 – 1.4	Fill	7.61 (0)	6170 (0)	<0.23 (2)	304 (0)	14.8 (1)	3
BH23NT-3 SS4	1.5 – 2.1	Fill/Silty Clay	7.73 (0)	3150 (0)	<0.28 (2)	300 (0)	29.0 (1)	3
BH23NT-4A SS3	9.1 – 9.7	Clayey Silt/Silty Sand Till	8.09 (0)	4900 (0)	<0.22 (2)	279 (0)	10.4 (1)	3
BH23NT-1 SS3	1.5 – 2.1	Fill	7.73 (0)	2420 (0)	<0.26 (2)	296 (0)	26.0 (1)	3

[illegible]

[illegible]

[illegible]

[illegible]

7. Certification

[illegible]

[illegible]

Prepared By: [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Revie[illegible]ed By: Dr[illegible]

M[illegible] D. [illegible] D[illegible].[illegible].E[illegible].
T[illegible] d[illegible] E[illegible] r[illegible]

Dr[illegible]

C[illegible] C[illegible] D[illegible] T[illegible] M.[illegible].[illegible].E[illegible].
r[illegible] E[illegible] r

Dr[illegible]

N[illegible] d.[illegible].[illegible].[illegible].[illegible].
[illegible] r H[illegible] dr[illegible]

August 9, 2024

8. References

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

General Comments and Limitations of Report

[illegible]

[illegible]

[illegible]

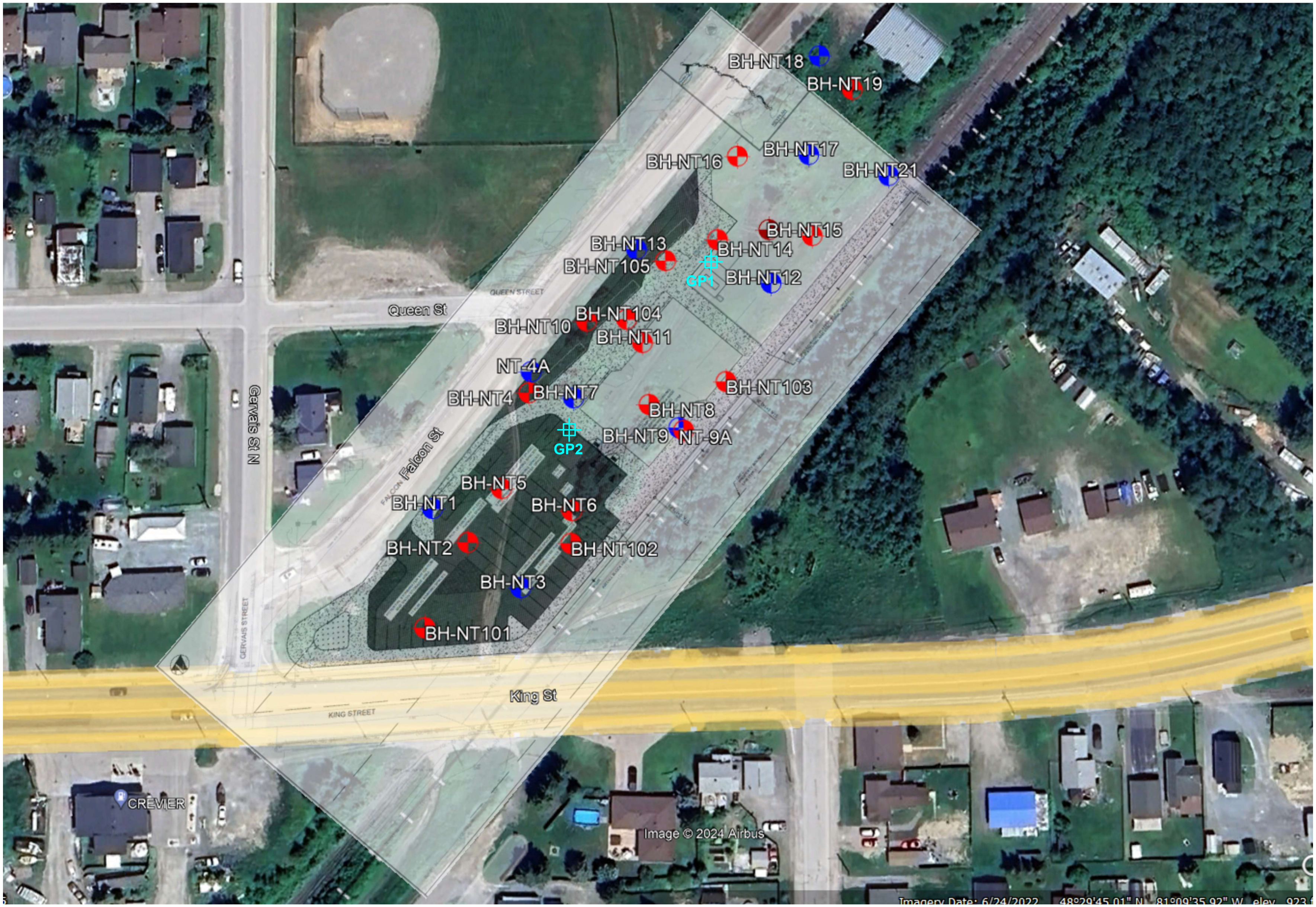
[illegible]

[illegible]

[illegible]

Palmer™

Drawings



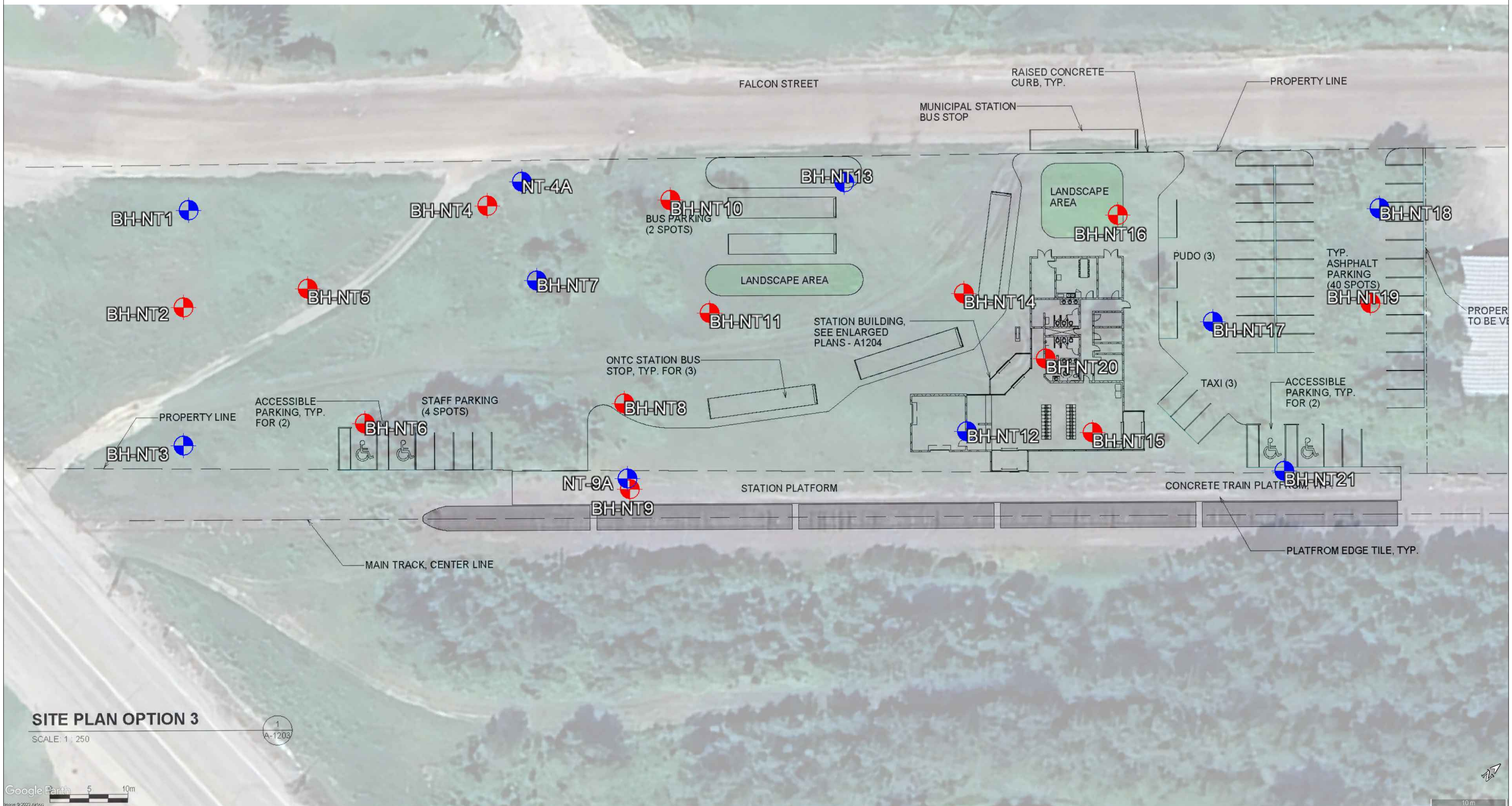
LEGEND

Borehole Location

Borehole/Monitoring Well Location

Test Pit Location

Client: **Ontario Northland Transportation Commission**		Project No.: **2304202**	Drawing No.: **1**
Drawn: **SL**	Approved: **AR**	Title: **Borehole/Monitoring Wells and Test Pits Layout Plan**	
Date: **August 2024**	Scale: **As Shown**	Project: **Ontario Northland Northeastern Passenger Rail - New Timmins 2024**	
Original Size: **Letter**	Rev: **N/A**	Palmer PART OF SLR	871 Equestrian Ct, Oakville, ON L6L 6L7

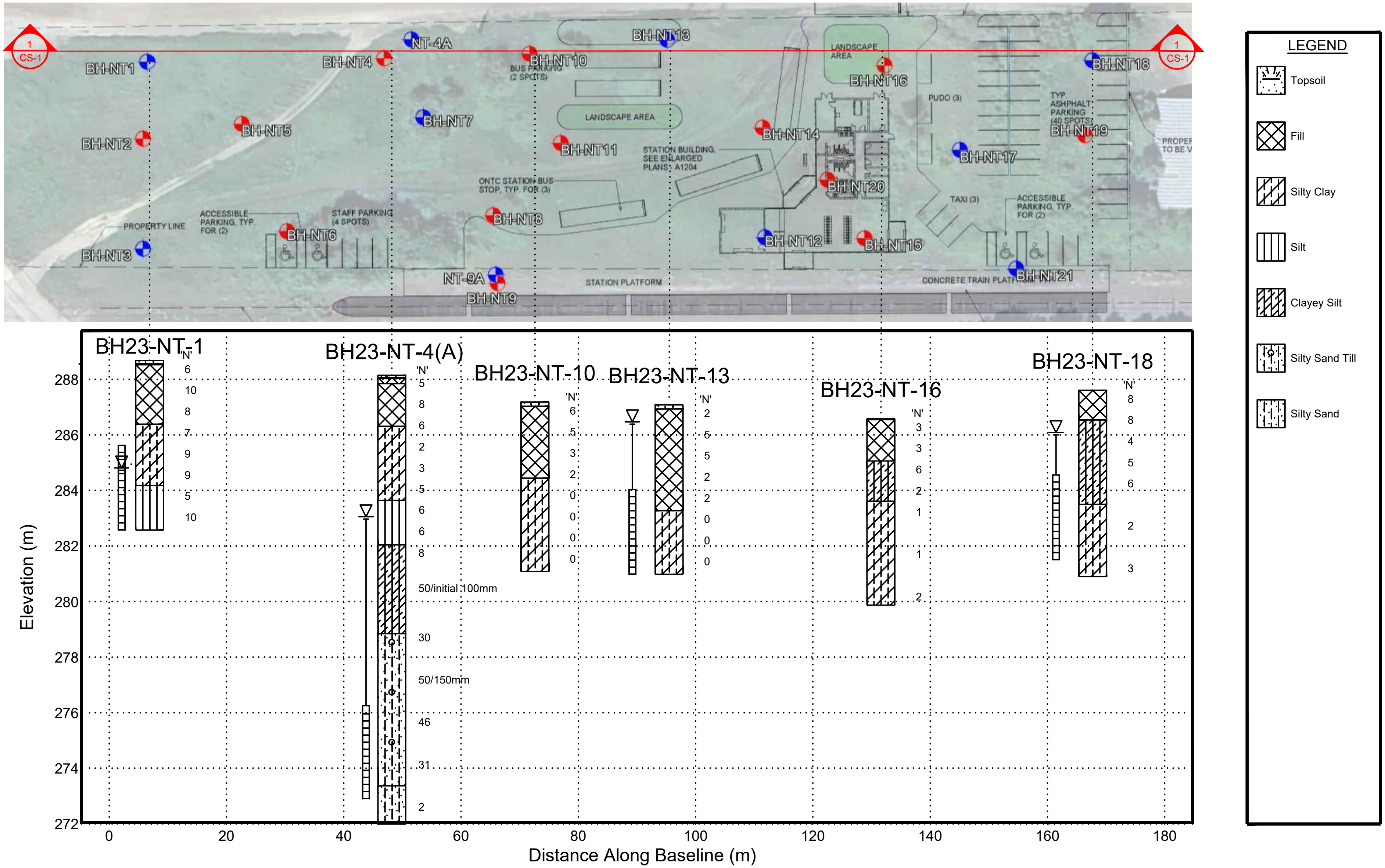


LEGEND

Borehole/Monitoring Well Location

Borehole Location

Client:	Gannett Fleming	Project No.: 2304202	Drawing No.: 1
Drawn: IB	Approved: AR	Title: New Timmins Station: Borehole/Monitoring Well Location Plan	
Date: November, 2023	Scale: As Shown	Project: Geotechnical Investigation Ontario Northland Northeastern Passenger Rail, ON	
Original Size: Letter	Rev: N/A	Palmer	871 Equestrian Court Oakville, Ontario L6L 6L7



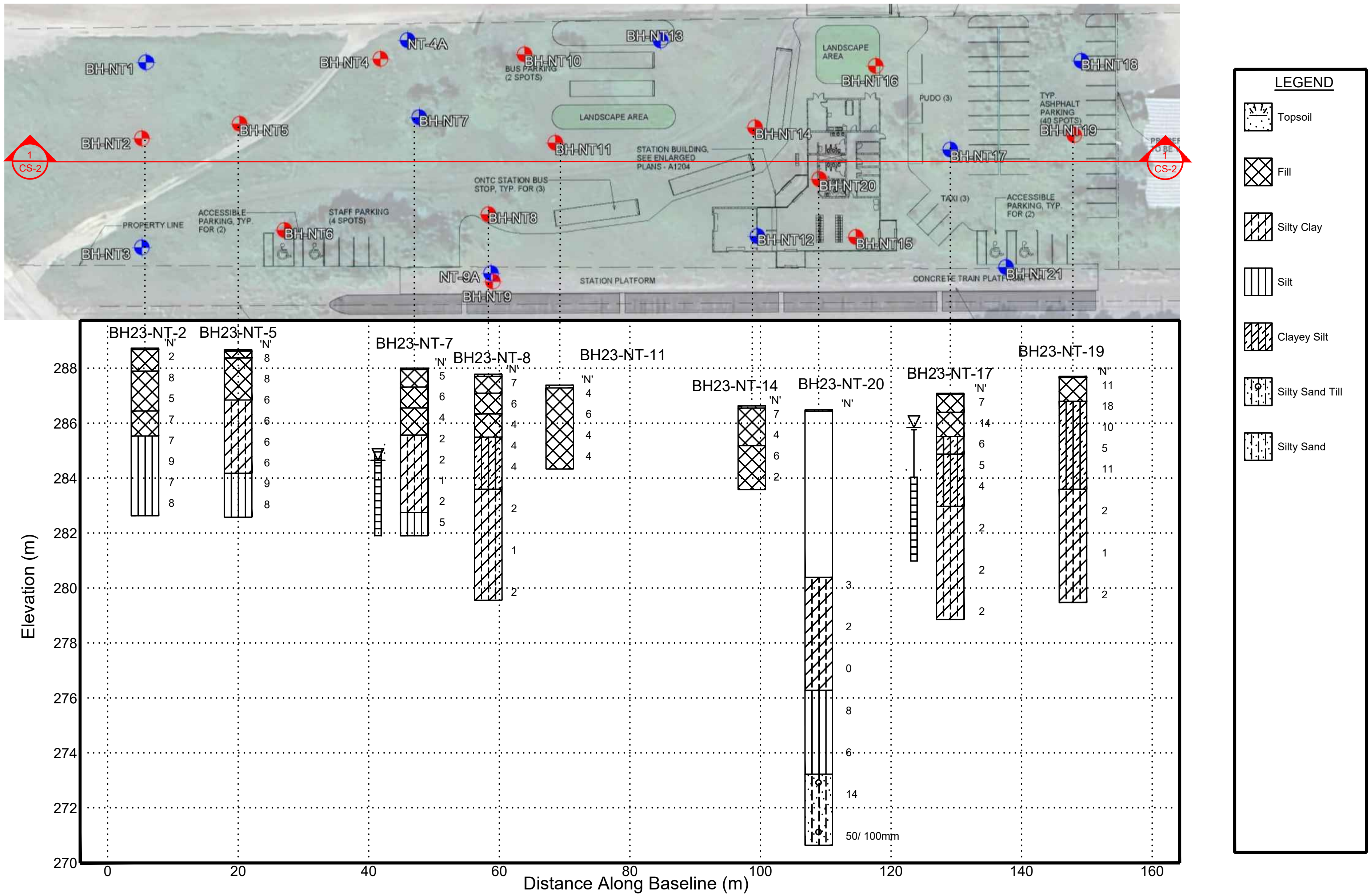
LEGEND

Borehole

Borehole with monitoring well

Cross section location

Client: GANNETT FLEMING		Project No.: **2304202**	Drawing No.:
Drawn: **TO**	Approved: **MDS**	Title: **Subsurface Profile**	
Date: **October, 2023**	Scale: **As Shown**	Project: **Geotechnical Investigation - New Timmins Station Ontario Northland Northeastern Passenger Rail, Timmins, ON**	
Original Size: **Letter**	Rev: **N/A**	Palmer	871 Equestrian Ct, Unit 1 Oakville, Ontario L6L 6L7



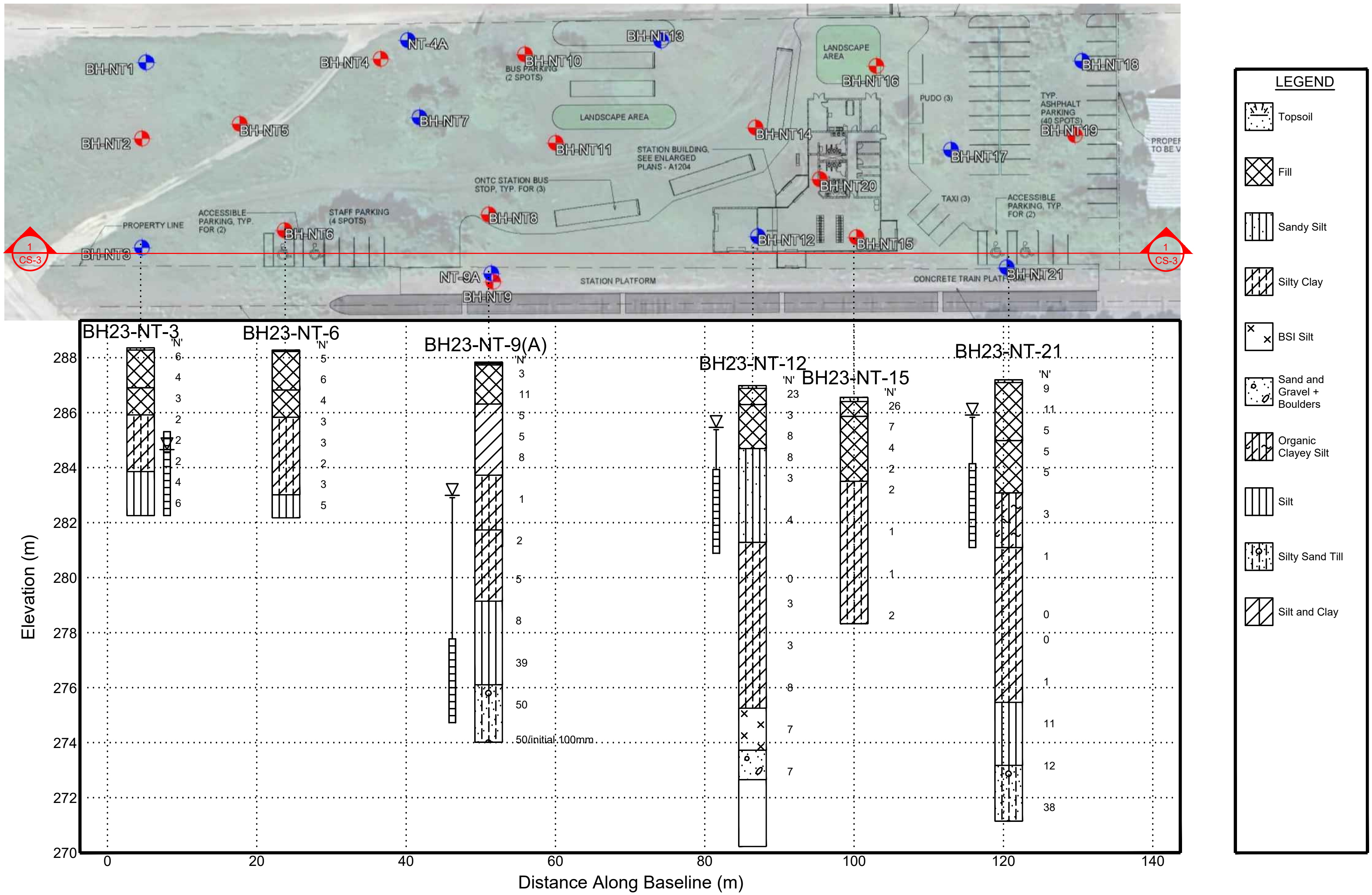
LEGEND

Borehole

Borehole with monitoring well

Cross section location

Client:	GANNETT FLEMING	Project No.: 2304202	Drawing No.:
Drawn: TO	Approved: MDS	Title:	Subsurface Profile
Date: October, 2023	Scale: As Shown	Project:	Geotechnical Investigation - New Timmins Station Ontario Northland Northeastern Passenger Rail, Timmins, ON
Original Size: Letter	Rev: N/A	Palmer™	871 Equestrian Ct, Unit 1 Oakville, Ontario L6L 6L7



LEGEND

Borehole

Borehole with monitoring well

Cross section location

Client: **GANNETT FLEMING**		Project No.: **2304202**	Drawing No.:
Drawn: **TO**	Approved: **MDS**	Title: **Subsurface Profile**	
Date: **October, 2023**	Scale: **As Shown**	Project: **Geotechnical Investigation - New Timmins Station Ontario Northland Northeastern Passenger Rail, Timmins, ON**	
Original Size: **Letter**	Rev: **N/A**	Palmer	871 Equestrian Ct, Unit 1 Oakville, Ontario L6L 6L7

Appendix A

Borehole Logs

Notes On Sample Descriptions

□. All sample descriptions included in this report generally follow the Unified Soil Classification. Laboratory grain size analyses provided by PECG also follow the same system. Different classification systems may be used by others, such as the system by the International Society for Soil Mechanics and Foundation Engineering (ISSMFE). Please note that, with the exception of those samples where a grain size analysis and/or Atterberg Limits testing have been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

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□. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional preliminary geotechnical site investigation.

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

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Explanation of Terms Used in the Record of Borehole

Sample Type

AS	Auger sample
BS	Block sample
CS	Chunk sample
DO	Drive open
DS	Dimension type sample
FS	Foil sample
RC	Rock core
SC	Soil core
SS	Spoon sample
ST	Slotted tube
TW	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

Penetration Resistance

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in) required to drive a 50 mm (2 in) drive open sampler for a distance of 300 mm (12 in).

Dynamic Cone Penetration Resistance, N_d:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in) to drive uncased a 50 mm (2 in) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in).

Textural Classification of Soils

Classification	Particle Size
Boulders	>300 mm
Cobbles	75 mm-300 mm
Gravel (Gr)	4.75 mm-75 mm
Sand (Sa)	0.075 mm-4.75 mm
Silt (Si)	0.002 mm-0.075 mm
Clay (Cl)	<0.002 mm

Coarse Grain Soil Description (50% greater than 0.075 mm)

Terminology	Proportion
Trace	0-10%
Some	10-20%
Adjective (e.g. silty or sandy)	20-35%
And (e.g. sand and gravel)	>35%

Soil Description

a) Cohesive Soils

Consistency	Undrained Shear Strength (kPa)	SPT "N" Value
Very soft	<12	0-2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very stiff	100-200	15-30
Hard	>200	>30

b) Cohesionless Soils

Density Index (Relative Density)	SPT "N" Value
Very loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

Soil Tests

w	Water content
w_p	Plastic limit
w_l	Liquid limit
C	Consolidation (oedometer) test
CID	Consolidated isotropically drained triaxial test
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement
D_R	Relative density (specific gravity, Gs)
DS	Direct shear test
ENV	Environmental/ chemical analysis
M	Sieve analysis for particle size
MH	Combined sieve and hydrometer (H) analysis
MPC	Modified proctor compaction test
SPC	Standard proctor compaction test
OC	Organic content test
V	Field vane (LV-laboratory vane test)
γ	Unit weight

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LOG OF BOREHOLE BH23-NT-1

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service

CLIENT: Gannett Fleming | Method: Hollow Stem Augers | TECHNICIAN: T.O

PROJECT LOCATION: Timmins, Ontario | Diameter: 200mm | REF. NO.: 2304202

DATUM: Geodetic | Date: Jul 5, 2023 | ENCL NO.: 1

BH LOCATION: See Borehole Location Plan N 5371307.41 E 488124.54

ELEV (m) / DEPTH	CLASSIFICATION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	WATER CONTENT (%)
288.8	Ground Surface						
288.7 / 0.1	**TOPSOIL:** 100mm				Concrete		
288.6 / 0.2	**FILL:** silty sand, trace gravel, trace organics, grey, moist, loose.	1	SS	6	Sand		~9
	FILL: silty clay, trace sand, trace organics, brown, moist, firm to stiff.					288	
	------------ contains silt seams	2	SS	10			~19
					Bentonite		
		3	SS	8		287	~16
286.5 / 2.3	**SILTY CLAY:** interval with silt seams/layers, trace sand, brown, moist to wet, firm to stiff.	4	SS	7		286	~19
					Sand		
		5	SS	9	Screen		~21
	contains dilatant silt layers, grey	6	SS	9	W. L. 284.8 m	285	~19
284.3 / 4.5	**SILT:** trace to some clay, trace sand, dilatant, grey, wet, loose.	7	SS	5	Screen	284	~18
		8	SS	10		283	~22
282.7 / 6.1	**END OF BOREHOLE**						

Note:
1) 50mm diameter monitoring well was installed upon completion in the borehole.

Water Level Readings:

Date	W. L. Depth (mBGS)
2023-08-30	3.94

Column headings also include: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100); SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × TORVANE (20, 40, 60, 80, 100); PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L (10, 20, 30); POCKET PEN. (Cu) (kPa); NATURAL UNIT WT (kN/m^3); REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ 8=3% Strain at Failure

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service

CLIENT: Gannett Fleming | Method: Hollow Stem Augers | TECHNICIAN: T.O□

PROJECT LOCATION: Timmins, Ontario | Diameter: 200mm | REF. NO.: 2304202

DATUM: Geodetic | Date: Jul 5, 2023 | ENCL NO.: 2

BH LOCATION: See Borehole Location Plan N 5371298.6 E 488133.83

ELEV (m) / DEPTH	CLASSIFICATION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION / SHEAR STRENGTH (kPa)	WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m^3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
288.8	Ground Surface											
288.7 / 0.1	**TOPSOIL:** 50mm											
	FILL: silty sand, trace clay, trace rootlets, brown, moist, very loose to loose.		1	SS	2							
287.9 / 0.8	**FILL:** silty clay, some sand, trace gravel, brown, moist, firm.		2	SS	8		288					
	trace organics, brownish grey		3	SS	5		287					
286.5 / 2.3	**FILL:** silt, some clay, trace sand, trace gravel, brown, moist, firm.		4	SS	7		286					
285.6 / 3.2	**SILT:** interval with silty clay seams/layers, trace sand, oxidized, dilatant, brown, wet, loose.		5	SS	7		285					
			6	SS	9							0 1 85 14
	------------ grey		7	SS	7		284					
			8	SS	8		283					
282.7 / 6.1	**END OF BOREHOLE**											

Dynamic cone penetration resistance plot scale: 20 40 60 80 100
Shear strength legend: ○ UNCONFINED; + FIELD VANE & Sensitivity; ● QUICK TRIAXIAL; × TORVANE
Water content: PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; scale 10 20 30

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

Palmer™

LOG OF BOREHOLE BH23-NT-3

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service

CLIENT: Gannett Fleming | Method: Hollow Stem Augers | TECHNICIAN: T.O□

PROJECT LOCATION: Timmins, Ontario | Diameter: 200mm | REF. NO.: 2304202

DATUM: Geodetic | Date: Jul 5, 2023 | ENCL NO.: 3

BH LOCATION: See Borehole Location Plan N 5371286.76 E 488147.72

ELEV (m) / DEPTH	CLASSIFICATION (SOIL PROFILE)	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS / ELEVATION	SHEAR STRENGTH (kPa)	WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
288.4	Ground Surface									
288.3 / 0.1	**TOPSOIL:**75mm				Concrete					
	FILL: clayey silt, trace to some sand, trace gravel, trace organics, dark brown to brown, moist to wet, firm to soft.	1	SS	6	Sand; 288		○			
	contains silt seams, brown	2	SS	4			○			
286.9 / 1.5	**FILL:** silty clay, trace sand, contains silt seams/layers, brown, moist, soft to very soft.	3	SS	3	287; Bentonite		○			
285.9 / 2.4	**SILTY CLAY:** interval with silt seams/layers, trace sand, brown, moist to wet, very soft.	4	SS	2	286; Sand	×	○	25		
	greyish brown	5	SS	2	285; W. L. 284.7 m	×	○	0		
	grey	6	SS	2		×	○	25		
283.9 / 4.5	**SILT:** interval with silty clay seams/layers, dilatant, grey, wet, very loose to loose.	7	SS	4	284; Screen		○			0 1 81 18
		8	SS	6	283		○			
282.3 / 6.1	**END OF BOREHOLE**									

Note:
1) 50mm diameter monitoring well was installed upon completion in the borehole.

Water Level Readings:

Date	W. L. Depth (mBGS)
2023-08-30	3.7

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED; + FIELD VANE & Sensitivity; ● QUICK TRIAXIAL; × TORVANE; 20 40 60 80 100

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ 3 =3% Strain at Failure

LOG OF BOREHOLE BH23-NT-4

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service

CLIENT: Gannett Fleming | Method: Hollow Stem Augers | TECHNICIAN: T.O□

PROJECT LOCATION: Timmins, Ontario | Diameter: 200mm | REF. NO.: 2304202

DATUM: Geodetic | Date: Jul 6, 2023 | ENCL NO.: 4

BH LOCATION: See Borehole Location Plan N 5371334.45 E 488150.78

ELEV (m) / DEPTH	CLASSIFICATION (SOIL PROFILE)	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	ELEVATION	SHEAR STRENGTH (kPa)	WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	REMARKS
288.2	Ground Surface								
288.0 / 0.1	**TOPSOIL:** 75mm				288				
287.9 / 0.3	**FILL:** sandy silt, trace organics, greyish brown, moist, loose.	1	SS	5			~19		
	FILL: silty clay, trace sand, contains silt seams, brown, moist, firm	2	SS	8	287		~17		
286.4 / 1.8	**SILTY CLAY:** interval with silt seams, trace sand, oxidized, brown, moist to wet, firm to very soft	3	SS	6			~18		
		4	SS	2	286	Torvane ~105	~17	98	
	------------ grey	5	SS	3	285	Torvane ~60	~22	98	
		6	SS	5	284		~23		
283.7 / 4.5	**SILT:** some clay, trace sand, dilatant, grey, wet, moist, loose	7	SS	6	283		~20		
		8	SS	6			~26		
282.1 / 6.1	**END OF BOREHOLE**								

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED; + FIELD VANE & Sensitivity; ● QUICK TRIAXIAL; × TORVANE

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ 8=3% Strain at Failure

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service
CLIENT: Gannett Fleming
PROJECT LOCATION: Timmins, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan N 5371336.72 E 488150.24

Method: Hollow Stem Augers
Diameter: 200mm
Date: Jul 17, 2023

TECHNICIAN: T.O
REF. NO.: 2304202
ENCL NO.: 5

ELEV (m) / DEPTH	SOIL PROFILE – CLASSIFICATION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	SHEAR STRENGTH (kPa)	WATER CONTENT (%)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
288.2	Ground Surface								
288.0 / 0.1	**TOPSOIL:** 100mm **Auger directed to 4.5m without samples**				Concrete; Sand				
						287			
						286			
						285			
						284			
					W. L. 283.1 m				
282.1 / 6.1	**CLAYEY SILT:** trace sand, trace cobbles/boulders, contains wet silty sand pockets, brownish grey, moist to wet, stiff to hard.				Bentonite				
		1	SS	8				○	Auger grinding
						281			
			VANE				+69.4 (2.7)		
		2	SS/NR	50/ initial 100mm					Auger grinding
						280			
						279			
278.9 / 9.3	grey **SILTY SAND TILL:** trace to some gravel, trace clay, trace cobbles, grey, wet, compact to very dense.								
		3	SS	30				○	

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH (kPa): ○ UNCONFINED; + FIELD VANE & Sensitivity; ● QUICK TRIAXIAL; × TORVANE — 20 40 60 80 100
PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30
POCKET PEN. (Cu) (kPa); NATURAL UNIT WT (kN/m³); GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ^{8}=3% Strain at Failure

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service

CLIENT: Gannett Fleming | Method: Hollow Stem Augers | TECHNICIAN: T.O

PROJECT LOCATION: Timmins, Ontario | Diameter: 200mm | REF. NO.: 2304202

DATUM: Geodetic | Date: Jul 17, 2023 | ENCL NO.: 5

BH LOCATION: See Borehole Location Plan N 5371336.72 E 488150.24

ELEV (m) / DEPTH	CLASSIFICATION (Continued)	SAMPLE NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	WATER CONTENT (%)	GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	SILTY SAND TILL: trace to some gravel, trace clay, trace cobbles, grey, wet, compact to very dense.(Continued)					278		
11	contains clayey silt pockets	4	SS	50/ 150mm		277	~20	
12		5	SS	46	Sand	276	~17	5 57 34 4
13						275		
14	contains dilatant silt layers	6	SS	31	Screen	274	~20	
273.4 / 14.8	**SILTY SAND:** trace gravel, trace clay, contains dilatant silt pockets, grey, wet, very loose.					273		
15–16		7	SS	2	Sand / Bentonite		~17	
272.0 / 16.2	**END OF BOREHOLE**					272		

Notes:
1) Refer to NT-4 borehole log from 0.1m to 4.5m.
2) 50mm diameter monitoring well was installed upon completion in the borehole.

Water Level Readings:

Date	W. L. Depth (mBGS)
2023-08-30	5.09

Plot headings: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × TORVANE (20 40 60 80 100); PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30; POCKET PEN. (Cu) (kPa); NATURAL UNIT WT (kN/m³); REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ 8=3% Strain at Failure

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LOG OF BOREHOLE BH23-NT-5

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service

CLIENT: Gannett Fleming	Method: Hollow Stem Augers	TECHNICIAN: T.O
PROJECT LOCATION: Timmins, Ontario	Diameter: 200mm	REF. NO.: 2304202
DATUM: Geodetic	Date: Jul 6, 2023	ENCL NO.: 6

BH LOCATION: See Borehole Location Plan N 5371307.16 E 488142.54

SOIL PROFILE

(m) ELEV / DEPTH	CLASSIFICATION
288.7	Ground Surface
288.6 / 0.1	**TOPSOIL:** 50mm
288.4 / 0.3	**FILL:** clayey silt, sandy, trace topsoil, dark brown, moist, firm.
	FILL: silty clay, some sand, trace gravel, trace organics, brown, moist, firm. contains sandy silt pockets
286.9 / 1.8	**SILTY CLAY:** interval with sandy silt and silt seams, trace sand, brown, moist, firm. brown to grey; contains dilatant silt layers
284.2 / 4.5	**SILT:** interval with silty clay seams/layers, trace sand, dilatant, grey, wet, loose.
282.6 / 6.1	**END OF BOREHOLE**

SAMPLES

NUMBER	TYPE	"N" BLOWS / 0.3 m
1	SS	8
2	SS	8
3	SS	6
4	SS	6
5	SS	6
6	SS	6
7	SS	9
8	SS	8

GROUND WATER CONDITIONS

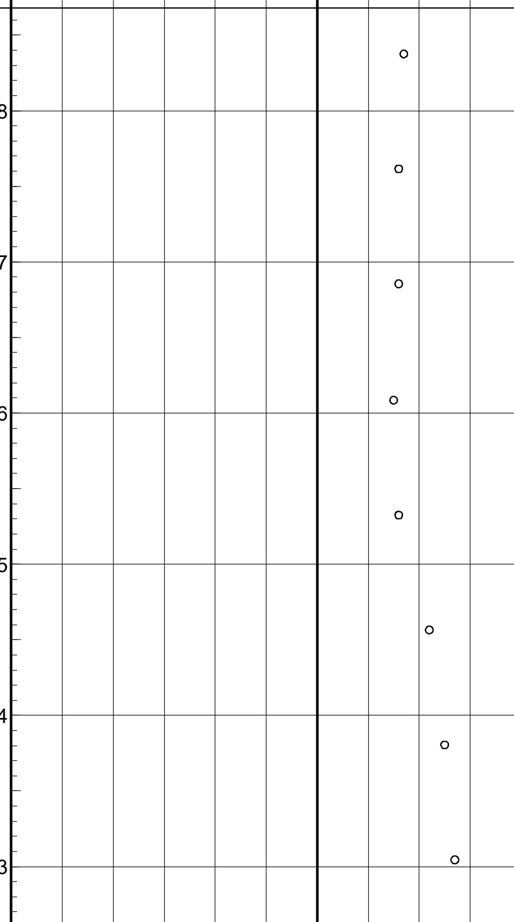
ELEVATION: 288, 287, 286, 285, 284, 283

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED; + FIELD VANE & Sensitivity; ● QUICK TRIAXIAL; × TORVANE — 20 40 60 80 100

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

WATER CONTENT (%): 10 20 30



POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

GROUNDWATER ELEVATIONS

Measurement: 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ 8=3% Strain at Failure

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LOG OF BOREHOLE BH23-NT-6

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service

CLIENT: Gannett Fleming | Method: Hollow Stem Augers | TECHNICIAN: T.O□

PROJECT LOCATION: Timmins, Ontario | Diameter: 200mm | REF. NO.: 2304202

DATUM: Geodetic | Date: Jul 6, 2023 | ENCL NO.: 7

BH LOCATION: See Borehole Location Plan N 5371309.11 E 488159.65

ELEV (m) / DEPTH	CLASSIFICATION (SOIL PROFILE)	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	ELEVATION	TORVANE SHEAR STRENGTH (kPa)	NATURAL MOISTURE CONTENT (%)	POCKET PEN. (Cu) (kPa)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
288.3	Ground Surface								
288.2 / 0.1	**TOPSOIL:** 50mm								
	FILL: clayey silt, contains sandy silt pockets/layers, trace sand, trace organics, brown, moist, firm.	1	SS	5	288		~16		
286.8 / 1.5		2	SS	6	287		~18		
	FILL: silty clay, trace sand, contains silt seams/layers, brown, moist, firm to soft.	3	SS	4			~17		
285.8 / 2.4	**SILTY CLAY:** interval with silt seams/layers, trace sand, brown, moist, soft to very soft.	4	SS	3	286	~80	~17	25	
		5	SS	3	285	~60	~20	50	
		6	SS	2	284	~27	~26	0	
283.0 / 5.3		7	SS	3		~54	~29	25	
	SILT: interval with silty clay layers, trace sand, dilatant, grey, wet, loose.	8	SS	5	283		~28		0 1 85 14
282.2 / 6.1	**END OF BOREHOLE**								

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × TORVANE; 20 40 60 80 100

PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30

NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ 8=3% Strain at Failure

LOG OF BOREHOLE BH23-NT-7

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service
CLIENT: Gannett Fleming | Method: Hollow Stem Augers | TECHNICIAN: T.O
PROJECT LOCATION: Timmins, Ontario | Diameter: 200mm | REF. NO.: 2304202
DATUM: Geodetic | Date: Jul 6, 2023 | ENCL NO.: 8
BH LOCATION: See Borehole Location Plan N 5371328.07 E 488161.35

ELEV (m)	DEPTH (m)	SOIL PROFILE – CLASSIFICATION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	SHEAR STRENGTH (kPa) TORVANE	WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	REMARKS
288.1		Ground Surface								
288.0	0.1	**TOPSOIL:** 50mm				Concrete				
		FILL: sandy silt, trace clay, trace, trace rootlets, brown, moist, loose.	1	SS	5	Sand		~19		
287.4	0.7	**FILL:** clayey silt, trace sand,brown, moist to wet, firm.	2	SS	6			~20		
286.6	1.5	**FILL:** silty clay, trace sand, contains silt seams, trace organics, brown, moist, firm to soft.	3	SS	4	Bentonite		~20		
285.6	2.4	**SILTY CLAY:** trace sand, oxidized, brown, moist, very soft.	4	SS	2		~80	~19	50	
		-------- grey	5	SS	2	Sand; W. L. 284.7 m	~60	~19	50	
			6	SS	1		~27	~21	0	
		contains silt seams	7	SS	2	Screen	~53	~23	25	
282.8	5.3	**SILT:** interval with silty clay seams, trace sand, dilatant, grey, wet, loose.	8	SS	5			~24		
282.0	6.1	**END OF BOREHOLE**								

Note:
1) 50mm diameter monitoring well was installed upon completion in the borehole.
Water Level Readings:

Date	W. L. Depth (mBGS)
2023-08-30	3.36

Legend: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100); SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × TORVANE; PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) 10, 20, 30; NATURAL UNIT WT (kN/m³); REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL; STRATA PLOT; ELEVATION.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: + 3, × 3 : Numbers refer to Sensitivity; ○ 8=3% Strain at Failure

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service

CLIENT: Gannett Fleming | Method: Hollow Stem Augers | TECHNICIAN: T.O□

PROJECT LOCATION: Timmins, Ontario | Diameter: 200mm | REF. NO.: 2304202

DATUM: Geodetic | Date: Jul 8, 2023 | ENCL NO.: 9

BH LOCATION: See Borehole Location Plan N 5371334.22 E 488190.18

ELEV (m) / DEPTH	CLASSIFICATION (SOIL PROFILE)	NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	WATER CONTENT (%)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
287.8	Ground Surface							
287.8 / 0.1	**TOPSOIL:** 75mm							
	FILL: sand mix with topsoil, trace gravel, dark brown, moist, loose.	1	SS	7			~29	
287.1 / 0.7	**FILL:** sandy silt, trace gravel, greyish brown, moist, loose.	2	SS	6		287	~10	
286.3 / 1.5	**FILL:** silt, trace to some clay, trace gravel, trace straw, brown, moist, loose.	3	SS	4		286	~6	
285.5 / 2.3	**CLAYEY SILT:** trace sand, contain dilatant sandy silt and silt seams, brown, wet, soft.	4	SS	4		285	~22 (Wp ~18, WL ~25)	0 3 73 24
	contains dilatant silt layers	5	SS	4		284	~23	
283.6 / 4.2	**SILTY CLAY:** trace sand, contain dilatant silt seams, grey, wet, very soft.	6	SS	2		283	~31	
		7	SS	1		282, 281	~34	
		8	SS	2		280	~40	
279.6 / 8.2	**END OF BOREHOLE**							

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × TORVANE; 20 40 60 80 100

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30

POCKET PEN. (Cu) (kPa) | NATURAL UNIT WT (kN/m^3)

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ^{8}=3% Strain at Failure

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LOG OF BOREHOLE BH23-NT-9

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service
CLIENT: Gannett Fleming
PROJECT LOCATION: Timmins, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan N 5371327.66 E 488190.31

Method: Hollow Stem Augers
Diameter: 200mm
Date: Jul 9, 2023

TECHNICIAN: T.O□
REF. NO.: 2304202
ENCL NO.: 10

ELEV (m) / DEPTH	CLASSIFICATION	NUMBER	TYPE	"N" BLOWS / 0.3 m	ELEVATION	Natural Moisture Content (%) (approx.)
287.9	Ground Surface					
287.8 / 0.1	**TOPSOIL:** 50mm					
	FILL: sand, some gravel, trace silt, trace rootlets, grey, moist, loose to compact.	1	SS	3		~5
	gravelly, contains wood pieces, wet	2	SS	11	287	
286.4 / 1.5	**CLAYEY SILT:** trace sand, contains dilatant silt seams, brown, wet, firm.	3	SS	5	286	~19
		4	SS	5		~23
		5	SS	8	285	~18
283.8 / 4.1	**SILTY CLAY:** trace sand, contains silt seams, grey, wet, very soft.				284	
		6	SS	1	283	~27
		7	SS	2	282	
281.2 / 6.7	**END OF BOREHOLE** Note: 1) water level was at 4.6m BGS upon completion of drilling.					

Column headings: SOIL PROFILE; SAMPLES; GROUND WATER CONDITIONS; ELEVATION; DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100); SHEAR STRENGTH (kPa): O UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × TORVANE (20, 40, 60, 80, 100); PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) (10, 20, 30); POCKET PEN. (Cu) (kPa); NATURAL UNIT WT (kN/m^3); REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; O ^{8}=3% Strain at Failure

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LOG OF BOREHOLE BH23-NT-9A

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service

CLIENT: Gannett Fleming | Method: Hollow Stem Augers | TECHNICIAN: T.O□

PROJECT LOCATION: Timmins, Ontario | Diameter: 200mm | REF. NO.: 2304202

DATUM: Geodetic | Date: Jul 18, 2023 | ENCL NO.: 11

BH LOCATION: See Borehole Location Plan N 5371328.33 E 488189.04

ELEV (m) / DEPTH	SOIL PROFILE – CLASSIFICATION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	SHEAR STRENGTH (kPa)	WATER CONTENT (%)
287.9	Ground Surface							
287.8 / 0.1	**TOPSOIL:** 100mm **Auger directed to 4.5m without samples**				Concrete Sand Bentonite	287 / 286 / 285 / 284		
					W. L. 283.1 m	282		
281.8 / 6.1	**SILTY CLAY:** trace sand, contains dilatant silt seams/pocktes, grey, wet, firm.	1	SS	2				○ (~21)
			VANE			281	+ 2.4 (~35 kPa)	
	contains dilatant silt layers	2	SS	5		280		○ (~21)
279.2 / 8.7	**SILT:** trace to some clay, dilatant, grey, wet, firm to hard.					279		
		3	SS	8	Sand			○ (~21)

Chart headings: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100); SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × TORVANE (20, 40, 60, 80, 100); PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) (10, 20, 30); POCKET PEN. (Cu) (kPa); NATURAL UNIT WT (kN/m^3); REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL; STRATA PLOT.

Continued Next Page

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: + 3, × 3 : Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service

CLIENT: Gannett Fleming | Method: Hollow Stem Augers | TECHNICIAN: T.O

PROJECT LOCATION: Timmins, Ontario | Diameter: 200mm | REF. NO.: 2304202

DATUM: Geodetic | Date: Jul 18, 2023 | ENCL NO.: 11

BH LOCATION: See Borehole Location Plan N 5371328.33 E 488189.04

(m) ELEV DEPTH	SOIL PROFILE - CLASSIFICATION (Continued)	SAMPLES NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	NATURAL MOISTURE CONTENT	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	SILT: trace to some clay, dilatant, grey, wet, firm to hard.(Continued)							Auger grinding
11	trace cobbles/boulders	4	SS	39		277	o	
					Screen			
276.2 / 11.7	**SILTY SAND TILL:** trace to some clay, trace gravel, trace cobbles, grey, wet, dense to very dense.					276		
12		5	SS	50			o	5 43 45 7
13						275		
					Sand			
274.1 / 13.8	**END OF BOREHOLE**	6	SS	50/ initial 100mm				

Note:
1) Refer to NT-9 borehole log from 0.1m to 6.1m.
2) 50mm diameter monitoring well was installed upon completion in the borehole.
Water Level Readings:

Date	W. L. Depth (mBGS)
2023-08-30	4.84

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × TORVANE; 20 40 60 80 100

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30

POCKET PEN. (Cu) (kPa) | NATURAL UNIT WT (kN/m^3)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ 8=3% Strain at Failure

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LOG OF BOREHOLE BH23-NT-10

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service

CLIENT: Gannett Fleming	Method: Solid Stem Augers	TECHNICIAN: T.O
PROJECT LOCATION: Timmins, Ontario	Diameter: 150 mm	REF. NO.: 2304202
DATUM: Geodetic	Date: Jul 7, 2023	ENCL NO.: 12

BH LOCATION: See Borehole Location Plan N 5371356.37 E 488164.81

ELEV (m) / DEPTH	CLASSIFICATION	NUMBER	TYPE	"N" BLOWS/0.3 m	Shear Strength (kPa)	Water Content (%)	Pocket Pen. (Cu) (kPa)
287.2	Ground Surface						
287.0 / 0.0	**TOPSOIL:** 150mm						
0.2	**FILL:** clayey silt, trace sand, trace organics, brown, moist to wet, firm to soft.	1	SS	6		~17	
		2	SS	5		~20	
	trace organics	3	SS	3		~21	
284.5		4	SS	2		~23	
2.7	**SILTY CLAY:** trace sand, contains dilatant silt seams, grey, wet, very soft.	5	SS	0	Torvane ~21	~24	0
		6	SS	0	Torvane ~25	~22	0
		7	SS	0	Torvane ~27	~23	0
281.1		8	SS	0	Torvane ~31	~21	0
6.1	**END OF BOREHOLE**						

Column headings: SOIL PROFILE; STRATA PLOT; SAMPLES; GROUND WATER CONDITIONS; ELEVATION (287, 286, 285, 284, 283, 282); DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × TORVANE (20 40 60 80 100); PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) (10 20 30); POCKET PEN. (Cu) (kPa); NATURAL UNIT WT (kN/m³); REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ 8=3% Strain at Failure

Palmer

LOG OF BOREHOLE BH23-NT-11

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service

CLIENT: Gannett Fleming | Method: Solid Stem Augers | TECHNICIAN: T.O□

PROJECT LOCATION: Timmins, Ontario | Diameter: 150 mm | REF. NO.: 2304202

DATUM: Geodetic | Date: Jul 7, 2023 | ENCL NO.: 13

BH LOCATION: See Borehole Location Plan N 5371350.73 E 488179.48

ELEV (m) / DEPTH	CLASSIFICATION	NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	WATER CONTENT (%)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
287.4	Ground Surface							
287.3 / 0.1	**TOPSOIL:** 100mm							
	FILL: sandy silt, trace to some clay, trace gravel, trace organics, greyish brown, wet, loose.	1	SS	4		287	~13	
		2	SS	6			~11	
		3	SS	4		286	~21	
		4	SS	4		285	~22	
284.4 / 3.1	**END OF BOREHOLE**							

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED; + FIELD VANE & Sensitivity; ● QUICK TRIAXIAL; × TORVANE — 20 40 60 80 100

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30

POCKET PEN. (Cu) (kPa) | NATURAL UNIT WT (kN/m^3)

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ^{8}=3% Strain at Failure

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service

CLIENT: Gannett Fleming | Method: Hollow Stem Augers | TECHNICIAN: T.O

PROJECT LOCATION: Timmins, Ontario | Diameter: 200mm | REF. NO.: 2304202

DATUM: Geodetic | Date: Jul 18, 2023 | ENCL NO.: 14

BH LOCATION: See Borehole Location Plan N 5371365.84 E 488214.96

SOIL PROFILE

ELEV (m)	DEPTH (m)	CLASSIFICATION
287.0		Ground Surface
286.9	0.1	**TOPSOIL:** 100mm
		FILL: sandy gravel, trace silt and clay, brownish grey, moist, compact.
286.3	0.7	**FILL:** sandy silt, trace to some clay, trace gravel, trace organics, brownish grey, wet, very loose to loose. trace granite
284.7	2.3	**SANDY SILT:** trace to some clay, dilatant, greyish brown, wet, loose to very loose.
281.3	5.7	**SILTY CLAY:** trace sand, contains dilatant silt seams, grey, wet, very soft to soft.

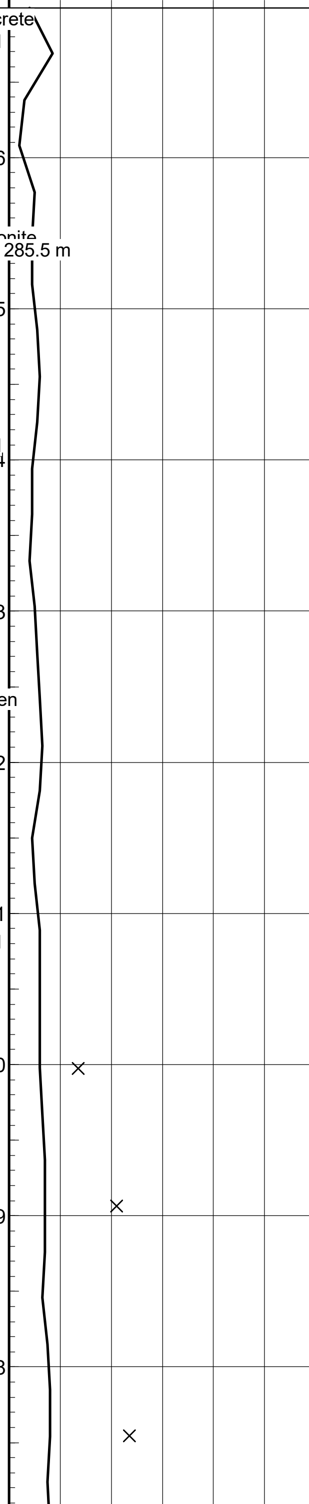
SAMPLES

NUMBER	TYPE	"N" BLOWS/0.3 m	Natural moisture content (%)	Pocket Pen. (Cu) (kPa)	Remarks / Grain size distribution (%) GR SA SI CL
1	SS	23			
2	SS	3			
3	SS	8			
4	SS	8			
5	SS	3			0 20 71 9
6	SS	4			
	TW				
7	SS	0		0	
8	SS	3		0	
9	SS	3		25	

GROUND WATER CONDITIONS: Concrete; Sand; Bentonite; W. L. 285.5 m; Sand; Screen; Sand

ELEVATION: 286, 285, 284, 283, 282, 281, 280, 279, 278

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa): ○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × TORVANE (20 40 60 80 100)



PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30

POCKET PEN. (Cu) (kPa) | NATURAL UNIT WT (kN/m³) | REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ 8=3% Strain at Failure

LOG OF BOREHOLE BH23-NT-12

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service

CLIENT: Gannett Fleming | Method: Hollow Stem Augers | TECHNICIAN: T.O

PROJECT LOCATION: Timmins, Ontario | Diameter: 200mm | REF. NO.: 2304202

DATUM: Geodetic | Date: Jul 18, 2023 | ENCL NO.: 14

BH LOCATION: See Borehole Location Plan N 5371365.84 E 488214.96

ELEV (m) / DEPTH	SOIL PROFILE – CLASSIFICATION (Continued)	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION
	SILTY CLAY: trace sand, contains dilatant silt seams, grey, wet, very soft to soft.(Continued)					
	contains dilatant silt layers	10	SS	8		276
					Bentonite	
275.3 / 11.7	**SILT:** some clay to clayey, dilatant, grey, wet, loose.					275
		11	SS	7		
						274
273.7 / 13.3	**SANDY GRAVEL:** trace to some silt, trace clay, grey, wet to saturated, loose.					
		12	SS	7		273
272.7 / 14.3	**Dynamic cone without samples**					272
						271
270.2 / 16.8	**END OF BOREHOLE** Note: 1) 50mm diameter monitoring well was installed upon completion in the borehole. Water Level Readings: Date W. L. Depth (mBGS) 2023-08-30 1.52					

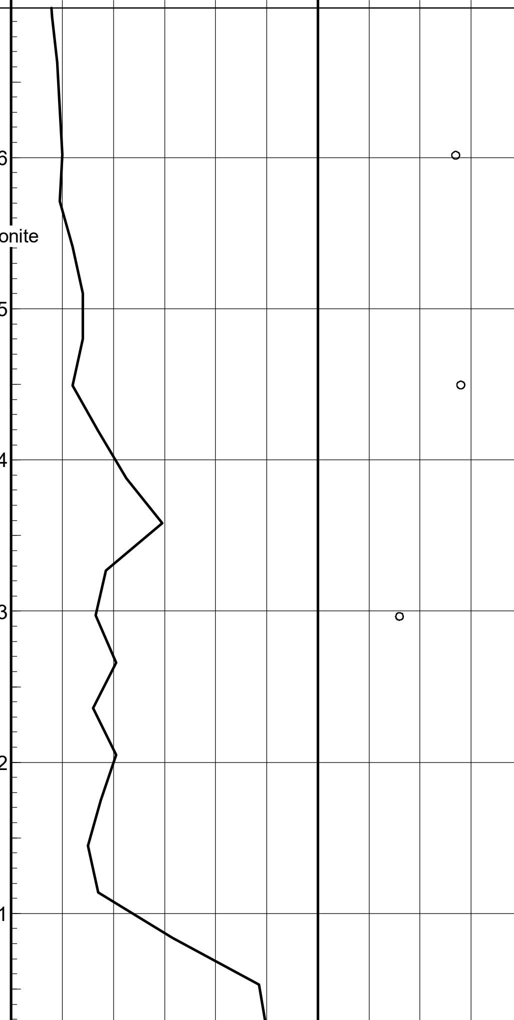
Depth scale: 11, 12, 13, 14, 15, 16

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100)

SHEAR STRENGTH (kPa): ○ UNCONFINED; + FIELD VANE & Sensitivity; ● QUICK TRIAXIAL; × TORVANE (20, 40, 60, 80, 100)

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT W_L; WATER CONTENT (%) (10, 20, 30)

POCKET PEN. (Cu) (kPa) | NATURAL UNIT WT (kN/m³) | REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL



GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

Palmer™

LOG OF BOREHOLE BH23-NT-13

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service

CLIENT: Gannett Fleming | Method: Solid Stem Augers | TECHNICIAN: T.O

PROJECT LOCATION: Timmins, Ontario | Diameter: 150 mm | REF. NO.: 2304202

DATUM: Geodetic | Date: Jul 7, 2023 | ENCL NO.: 15

BH LOCATION: See Borehole Location Plan N 5371375.25 E 488177.92

SOIL PROFILE

(m) ELEV / DEPTH	CLASSIFICATION
287.1	Ground Surface
286.9 / 0.0	**TOPSOIL:** 150mm
0.2	**FILL:** clayey silt, sandy, trace gravel, grey, wet, very soft to firm.
	greyish brown
	trace straw, contains sandy silt seams
	grey
283.3 / 3.8	**SILTY CLAY:** trace sand, contains dilatant sandy silt pocket,grey, wet, very soft.
	------------ contains silt seams
281.0 / 6.1	**END OF BOREHOLE** Note: 1) 50mm diameter monitoring well was installed upon completion in the borehole. Water Level Readings: Date W. L. Depth (mBGS) 2023-08-30 0.61

SAMPLES

NUMBER	TYPE	"N" BLOWS / 0.3 m	TORVANE (kPa)	NATURAL MOISTURE CONTENT (%)	POCKET PEN. (Cu) (kPa)
1	SS	2		~23	
2	SS	5		~21	
3	SS	5		~21	
4	SS	2		~27	
5	SS	2		~22	
6	SS	0	~22	~28	0
7	SS	0	~18	~29	0
8	SS	0	~22	~31	0

GROUND WATER CONDITIONS (monitoring well): Concrete; Sand; W. L. 286.5 m; Bentonite; Sand; Screen

ELEVATION: 286, 285, 284, 283, 282, 281

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × TORVANE — 20 40 60 80 100

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30

NATURAL UNIT WT (kN/m^3)

REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ 8=3% Strain at Failure

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service

CLIENT: Gannett Fleming | Method: Solid Stem Augers | TECHNICIAN: T.O□

PROJECT LOCATION: Timmins, Ontario | Diameter: 150 mm | REF. NO.: 2304202

DATUM: Geodetic | Date: Jul 7, 2023 | ENCL NO.: 16

BH LOCATION: See Borehole Location Plan N 5371377.85 E 488199.29

(m) ELEV DEPTH	CLASSIFICATION	SAMPLE NUMBER	TYPE	"N" BLOWS / 0.3 m	WATER CONTENT (%)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
286.7	Ground Surface					
286.6 / 0.1	**TOPSOIL:** 75mm					
	FILL: silty sand, some gravel, trace clay, greyish brown, moist to wet, loose to very loose.	1	SS	7		
		2	SS	4		
285.2 / 1.5	**FILL:** clayey silt, trace sand, trace organics, brown, wet, firm to soft.	3	SS	6		
		4	SS	2		
283.6 / 3.1	**END OF BOREHOLE**					

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED; + FIELD VANE & Sensitivity; ● QUICK TRIAXIAL; × TORVANE — 20 40 60 80 100

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30

POCKET PEN. (Cu) (kPa) | NATURAL UNIT WT (kN/m³) | GR SA SI CL

Elevation scale: 286, 285, 284

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH23-NT-15

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service

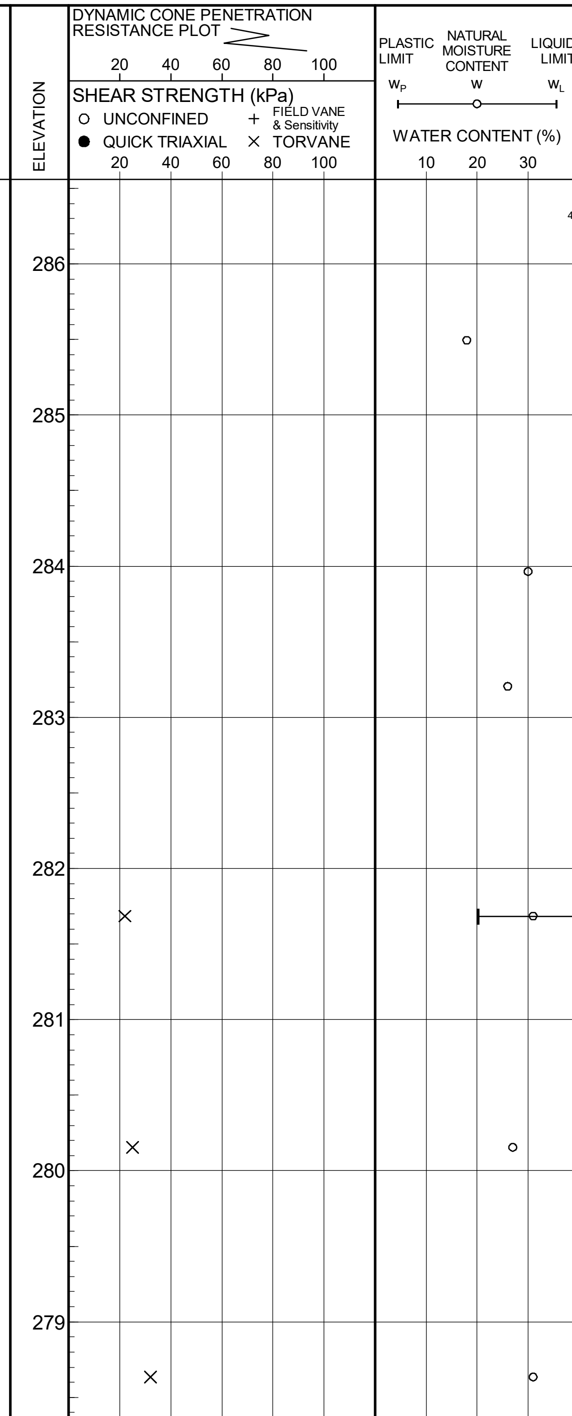
CLIENT: Gannett Fleming | Method: Hollow Stem Augers | TECHNICIAN: T.O

PROJECT LOCATION: Timmins, Ontario | Diameter: 200mm | REF. NO.: 2304202

DATUM: Geodetic | Date: Jul 8, 2023 | ENCL NO.: 17

BH LOCATION: See Borehole Location Plan N 5371375.65 E 488225.86

ELEV (m) / DEPTH	SOIL PROFILE – CLASSIFICATION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	POCKET PEN. (Cu) (kPa)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
286.6	Ground Surface					
286.4 / 0.0	**TOPSOIL:** 150mm					
0.2	**FILL:** sand and gravel mix with topsoil, trace silt and clay, dark brown, wet, compact.	1	SS	26		
285.9 / 0.7	**FILL:** clayey silt, trace sand, grey, moist to wet, firm to very soft.	2	SS	7		
		3	SS	4		
	trace straw, contains wet silt seams/layers	4	SS	2		
283.5 / 3.1	**SILTY CLAY:** trace sand, contains silt seams, grey, wet, very soft.	5	SS	2		
	contains dilatant silt layers	6	SS	1	0	0 1 55 44
		7	SS	1	0	
		8	SS	2	0	
278.3 / 8.2	**END OF BOREHOLE**					



GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ 8=3% Strain at Failure

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service
CLIENT: Gannett Fleming | Method: Hollow Stem Augers | TECHNICIAN: T.O
PROJECT LOCATION: Timmins, Ontario | Diameter: 200mm | REF. NO.: 2304202
DATUM: Geodetic | Date: Jul 8, 2023 | ENCL NO.: 18
BH LOCATION: See Borehole Location Plan N 5371399.91 E 488204.61

ELEV (m) / DEPTH	CLASSIFICATION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	SHEAR STRENGTH (kPa)	WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
286.7	Ground Surface							
286.7 / 0.0	**TOPSOIL:** 25mm							
	FILL: organic clayey silt, sandy, trace wood pieces, dark brown, moist, soft.	1	SS	3		o		
		2	SS	3		o		
285.2 / 1.5	**CLAYEY SILT:** trace sand, contains wet sand seams, brown, moist to wet, firm to soft.	3	SS	6		o		
	brown to grey	4	SS	2		├o┤		0 3 73 24
283.7 / 3.0	**SILTY CLAY:** trace sand, contains dilatant silt seams, grey, wet, very soft.	5	SS	1	× (Torvane)	o	0	
		6	SS	1		o		
		7	SS	2	× (Torvane)	o	0	
280.0 / 6.7	**END OF BOREHOLE**							

Legend: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100); SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × TORVANE (20, 40, 60, 80, 100); PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) (10, 20, 30); NATURAL UNIT WT (kN/m^3); REMARKS AND GRAIN SIZE DISTRIBUTION (%). Elevation scale: 286, 285, 284, 283, 282, 281, 280.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service
CLIENT: Gannett Fleming
PROJECT LOCATION: Timmins, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan N 5371400.3 E 488223.47

Method: Hollow Stem Augers
Diameter: 200mm
Date: Jul 8, 2023

TECHNICIAN: T.O
REF. NO.: 2304202
ENCL NO.: 19

ELEV (m) / DEPTH	CLASSIFICATION (SOIL PROFILE)	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	Natural Moisture Content w (%)	Shear Strength (kPa)	Pocket Pen. (Cu) (kPa)
287.1	Ground Surface							
287.0 / 0.0	**TOPSOIL:** 25mm				Concrete			
	FILL: sandy silt, some organics, trace rootlets, trace wood pieces, dark brown, moist, loose.	1	SS	7	Sand	~22		
286.4 / 0.7	**FILL:** clayey silt, some organics, trace sand, dark brown, wet, stiff.	2	SS	14	W. L. 285.9 m; Bentonite	~38		
285.5 / 1.6	**CLAYEY SILT:** trace sand, contains sandy silt pockets/layers, brown, wet, firm.	3	SS	6		~25		
284.9 / 2.2	**CLAYEY SILT:** trace sand, brown, wet, firm to soft.	4	SS	5				
		5	SS	4	Sand	~32		
283.0 / 4.1	**SILTY CLAY:** trace sand, contains dilatant silt seams/layers, grey, wet, soft.	6	SS	2	Screen	~31		
		7	SS	2	Bentonite	~44	Torvane ~18	0
		8	SS	2		~46	Torvane ~20	0
278.9 / 8.2	**END OF BOREHOLE**							

1) 50mm diameter monitoring well was installed upon completion in the borehole.
Water Level Readings:

Date	W. L. Depth (mBGS)
2023-08-30	1.24

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ 8=3% Strain at Failure

Palmer

LOG OF BOREHOLE BH23-NT-18

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service

CLIENT: Gannett Fleming | Method: Hollow Stem Augers | TECHNICIAN: T.O

PROJECT LOCATION: Timmins, Ontario | Diameter: 200mm | REF. NO.: 2304202

DATUM: Geodetic | Date: Jul 9, 2023 | ENCL NO.: 20

BH LOCATION: See Borehole Location Plan N 5371429.19 E 488229.58

ELEV (m) / DEPTH	SOIL PROFILE – CLASSIFICATION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	DCPT / SHEAR STRENGTH (kPa)	NATURAL MOISTURE CONTENT	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
287.7	Ground Surface										
0.0	**FILL:** sandy silt, trace to some clay, trace organics, brownish grey, moist, loose.	1	SS	8	Concrete, Sand			~10			
		2	SS	8	Bentonite	287		~18			
286.6 / 1.1	**CLAYEY SILT:** trace sand, contains dilatant silt seams, brown, wet, firm to soft.	3	SS	4	W. L. 286.2 m	286		~21			
		4	SS	5	Sand	285		~20			
	contains dilatant sandy silt layers	5	SS	6		284		~20			
283.6 / 4.1	**SILTY CLAY:** trace sand, contains dilatant silt seams, grey, wet, very soft to soft.	6	SS	2	Screen	283	Torvane ~15	~30	0		
		7	SS	3	Sand, Bentonite	282		~30			
281.0 / 6.7	**END OF BOREHOLE**					281					

Note:
1) 50mm diameter monitoring well was installed upon completion in the borehole.
Water Level Readings:

Date	W. L. Depth (mBGS)
2023-08-30	1.52

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ 8=3% Strain at Failure

LOG OF BOREHOLE BH23-NT-19

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service
CLIENT: Gannett Fleming
PROJECT LOCATION: Timmins, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan N 5371418.48 E 488234.04

Method: Hollow Stem Augers
Diameter: 200mm
Date: Jul 9, 2023

TECHNICIAN: T.O
REF. NO.: 2304202
ENCL NO.: 21

ELEV (m) / DEPTH	CLASSIFICATION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	NATURAL MOISTURE CONTENT	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
287.7	Ground Surface					
287.7 / 0.0	**TOPSOIL:** 40mm					
	FILL: sandy silt mix with topsoil, trace gravel, dark brown, moist, compact.	1	SS	11		
286.8 / 0.9	**CLAYEY SILT:** trace sand, contains silt seams, brown, wet, very stiff to firm.	2	SS	18		
		3	SS	10		
		4	SS	5		
		5	SS	11		
283.6 / 4.1	**SILTY CLAY:** trace sand, contains silt seams, grey, wet, very soft.	6	SS	2		
		7	SS	1	43 (liquid limit)	0 1 41 58
		8	SS	2		
279.5 / 8.2	**END OF BOREHOLE**					

Chart columns: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100); SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × TORVANE (20, 40, 60, 80, 100); PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) (10, 20, 30); POCKET PEN. (Cu) (kPa); NATURAL UNIT WT (kN/m³); STRATA PLOT; GROUND WATER CONDITIONS; ELEVATION (287, 286, 285, 284, 283, 282, 281, 280).

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ 8=3% Strain at Failure

Palmer™

LOG OF BOREHOLE BH23-NT-20

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service

CLIENT: Gannett Fleming | Method: Hollow Stem Augers | TECHNICIAN: T.O□

PROJECT LOCATION: Timmins, Ontario | Diameter: 200mm | REF. NO.: 2304202

DATUM: Geodetic | Date: Jul 19, 2023 | ENCL NO.: 22

BH LOCATION: See Borehole Location Plan N 5371380.42 E 488212.84

ELEV (m) / DEPTH	SOIL PROFILE – CLASSIFICATION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa)	PLASTIC LIMIT W_P / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L – WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m^3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
286.5	Ground Surface										
286.4 / 0.1	**TOPSOIL:** 50mm **Auger directed to 6.1m without samples**					286					
						285					
						284					
						283					
						282					
						281					
280.4 / 6.1	**SILTY CLAY:** trace sand, trace gravel, grey, wet, soft to very soft.	1	SS	3		280		o			
						279					
		2	SS	2		278		o			
		3	SS	0		277		o			

Continued Next Page

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ^{8}=3% Strain at Failure

SHEAR STRENGTH legend: ○ UNCONFINED; + FIELD VANE & Sensitivity; ● QUICK TRIAXIAL; × TORVANE

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service

CLIENT: Gannett Fleming | Method: Hollow Stem Augers | TECHNICIAN: T.O□

PROJECT LOCATION: Timmins, Ontario | Diameter: 200mm | REF. NO.: 2304202

DATUM: Geodetic | Date: Jul 19, 2023 | ENCL NO.: 22

BH LOCATION: See Borehole Location Plan N 5371380.42 E 488212.84

ELEV (m) / DEPTH	CLASSIFICATION (Continued)	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	ELEVATION	WATER CONTENT (%)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
276.3 / 10.2	**SILT:** trace to some clay, contains silty clay seams, dilatant, grey, wet, loose.				276		
		4	SS	8		~23	
					275		
		5	SS	6	274	~21	
273.2 / 13.3	**SILTY SAND TILL:** trace to some clay, trace gravel, grey, wet, compact, to very dense.				273		
		6	SS	14		~13	6 56 34 4
					272		
		7	SS	50/100mm	271	~13	
270.6 / 15.9	**END OF BOREHOLE**						

Column headings also include: STRATA PLOT; GROUND WATER CONDITIONS; DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH (kPa) ○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × TORVANE (20 40 60 80 100); PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30; POCKET PEN. (Cu) (kPa); NATURAL UNIT WT (kN/m³).

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

Palmer

LOG OF BOREHOLE BH23-NT-21

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service

CLIENT: Gannett Fleming | Method: Hollow Stem Augers | TECHNICIAN: T.O

PROJECT LOCATION: Timmins, Ontario | Diameter: 200mm | REF. NO.: 2304202

DATUM: Geodetic | Date: Jul 19, 2023 | ENCL NO.: 23

BH LOCATION: See Borehole Location Plan N 5371385.94 E 488239.75

(m) ELEV / DEPTH	SOIL PROFILE – CLASSIFICATION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	SHEAR STRENGTH (kPa)	WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
287.2	Ground Surface									
287.0 / 0.1	**TOPSOIL:** 100mm				Concrete					
	FILL: gravelly sand, trace organics, dark grey, wet, loose to compact.	1	SS	9	Sand					
		2	SS	11		286		o		
					W. L. 285.9 m; Bentonite					
	contains wood pieces	3	SS	5				o		
285.0 / 2.2	**FILL:** sandy silt, trace to some clay, dilatant, brown, wet, loose.					285				
		4	SS	5				o		
					Sand					
	contains clayey silt pockets	5	SS	5		284		o		
283.1 / 4.1	**ORGANIC CLAYEY SILT:** trace sand, brownish grey, wet, soft. possible fill					283				
					Screen					
		6	SS	3				o		
						282				
281.1 / 6.1	**SILTY CLAY:** trace sand, contains silt seams, grey, wet, very soft.				Sand					
		7	SS	1			× (Torvane)	o	0	
						280				
			VANE				+ 1.4 / 19.8			
						279				
		8	SS	0				49 (Wp–w)	0	0 1 35 64
						278				
		9	SS	0			× (Torvane)	o	0	

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × TORVANE; 20 40 60 80 100

PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30

NATURAL UNIT WT (kN/m^3)

Continued Next Page

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: + 3 , × 3 : Numbers refer to Sensitivity; ○ 8 =3% Strain at Failure

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service
CLIENT: Gannett Fleming | Method: Hollow Stem Augers | TECHNICIAN: T.O
PROJECT LOCATION: Timmins, Ontario | Diameter: 200mm | REF. NO.: 2304202
DATUM: Geodetic | Date: Jul 19, 2023 | ENCL NO.: 23
BH LOCATION: See Borehole Location Plan N 5371385.94 E 488239.75

ELEV (m) DEPTH	CLASSIFICATION (Continued)	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	SHEAR STRENGTH (kPa)	WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	SILTY CLAY: trace sand, contains silt seams, grey, wet, very soft.(Continued)				Bentonite				
	contains silt layers	10	SS	1		Torvane ~40	~34	0	
275.5 / 11.7	**SILT:** some clay, contains clayey silt seams, dilatant, grey, wet, compact.	11	SS	11			~28		
273.2 / 14.0	**SILTY SAND TILL:** trace to some clay, trace gravel, grey, wet, compact to dense.	12	SS	12			~22		
		13	SS	38			~16		
271.2 / 16.1	**END OF BOREHOLE**								

Note:
1) 50mm diameter monitoring well was installed upon completion in the borehole.
Water Level Readings:

Date	W. L. Depth (mBGS)
2023-08-30	1.28

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ 8=3% Strain at Failure

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail - Timmins 2024
CLIENT: Gannett Fleming
PROJECT LOCATION: Timmins, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan N 5371275.6 E 488119.38

Method: Hollow Stem Augers
Diameter: 200mm
Date: Jun 11, 2024

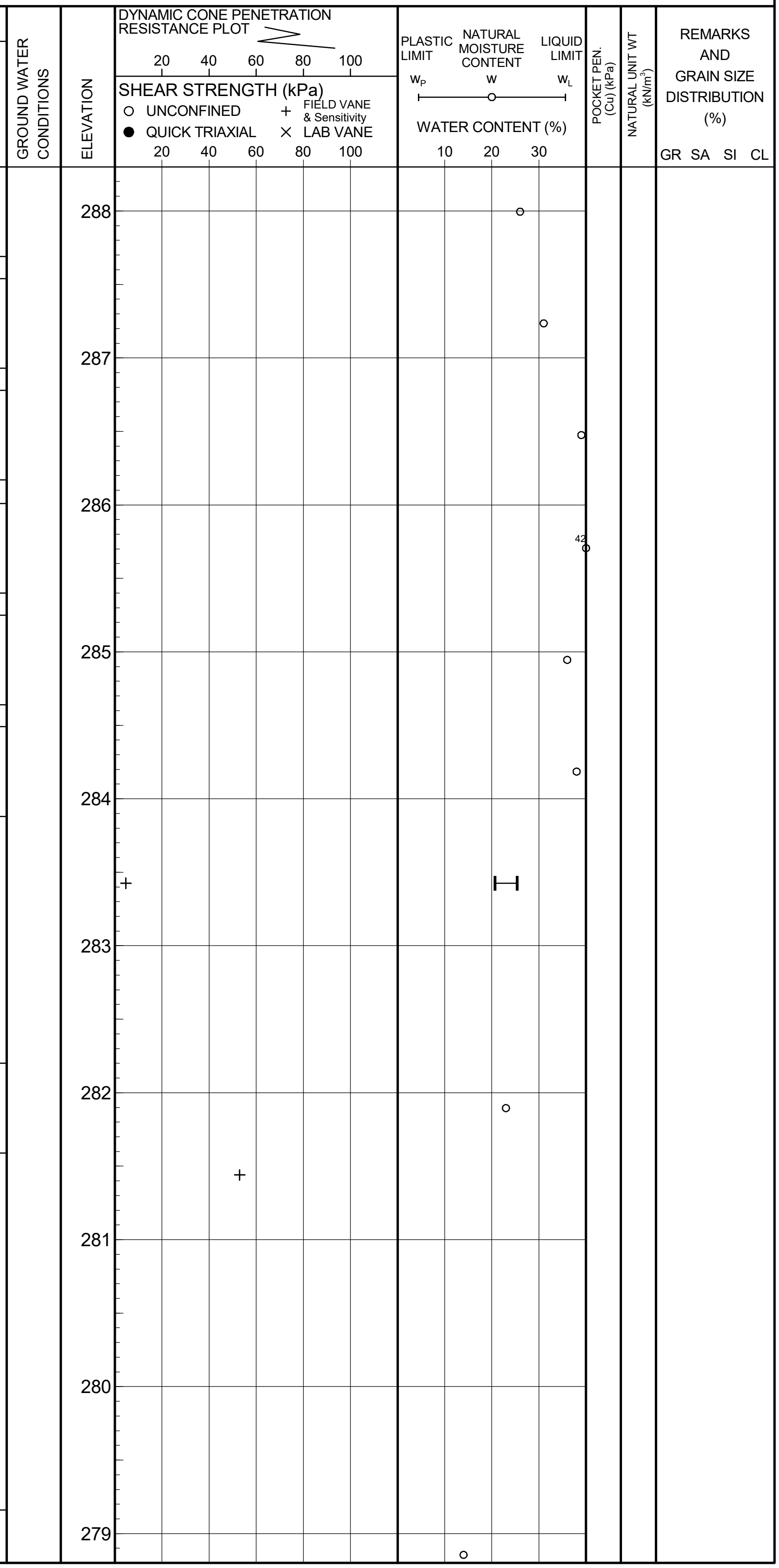
REF. NO.: 2304202
ENCL NO.: 1

SOIL PROFILE

ELEV (m)	DEPTH (m)	CLASSIFICATION
288.3		Ground Surface
288.2	0.0 / 0.1	**TOPSOIL:** 100mm
	0.1	**FILL:** clayey silt, trace sand, trace gravel, trace organics, brown, wet, firm.
286.1	2.2	**FILL:** silty clay, trace sand, brown, wet, firm.
285.3	3.1	**SILTY CLAY:** trace sand, greyish brown, wet, soft to firm. grey below 6.1m; contains clayey silt layers
279.6	8.7	**SILTY SAND TILL:** trace clay, trace gravel, grey, wet, dense. contains silt layers

SAMPLES

NUMBER	TYPE	"N" BLOWS/0.3 m
1	SS	8
2	SS	7
3	SS	5
4	SS	5
5	SS	4
6	SS	4
	TW	
7	SS	7
	VANE	
	TW	
8	SS	40



Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

Palmer™

LOG OF BOREHOLE BH24-NT101

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail - Timmins 2024

CLIENT: Gannett Fleming | Method: Hollow Stem Augers

PROJECT LOCATION: Timmins, Ontario | Diameter: 200mm | REF. NO.: 2304202

DATUM: Geodetic | Date: Jun 11, 2024 | ENCL NO.: 1

BH LOCATION: See Borehole Location Plan N 5371275.6 E 488119.38

(m) ELEV / DEPTH	SOIL PROFILE – CLASSIFICATION (Continued)	SAMPLE NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	SILTY SAND TILL: trace clay, trace gravel, grey, wet, dense.(Continued)					278	
		9	SS	35		277	wet spoon below
276.6 / 11.7	**SANDY SILT TO SILTY SAND:** trace clay, trace gravel, grey, wet to saturated, very dense.						
		10	SS	50/ 75mm		276	
						275	
		11	SS	50/ initial 125mm		274	
272.8 / 15.5	contains sand layers	12	SS	50/ 100mm		273	

END OF BOREHOLE
1) Water level was at 7.71mBGS upon completion of drilling.
2. Borehole was open upon completion of drilling.

Depth scale (m): 10, 11, 12, 13, 14, 15

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × LAB VANE: 20 40 60 80 100

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L; WATER CONTENT (%): 10 20 30

POCKET PEN. (Cu) (kPa) | NATURAL UNIT WT (kN/m^3)

0_SOIL-ROCK-APRIP 5-2022_PM_ROCK_HYDROG FORM_NEW LOGO.GLB
PALMER SOIL - 2018 1DIG 2024 TIMMINS -20240808.GPJ 24-8-8

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH24-NT102

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail - Timmins 2024

CLIENT: Gannett Fleming | Method: Hollow Stem Augers

PROJECT LOCATION: Timmins, Ontario | Diameter: 200mm | REF. NO.: 2304202

DATUM: Geodetic | Date: Jun 12, 2024 | ENCL NO.: 2

BH LOCATION: See Borehole Location Plan N 5371297.74 E 488160.8

ELEV (m) / DEPTH	SOIL PROFILE – CLASSIFICATION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	REMARKS
288.3	Ground Surface						
288.2 / 0.0	**TOPSOIL:** 150mm						
0.2	**FILL:** clayey silt, trace sand, trace gravel, trace organics, brown, moist, firm.	1	SS	5		288	
		2	SS	8		287	
		3	SS	5			
286.0 / 2.3	**SILTY CLAY:** trace sand, greyish brown, wet, very soft.	4	SS	3		286	
	grey below 3.1m	5	SS	2		285	
		6	SS	0		284	
			TW			283	
	contains grey wet clayey silt layers		TW			282	
281.1 / 7.2	**SANDY SILT:** trace to some clay, grey, wet to saturated, compact.					281	
		7	SS	11		280	
278.9						279	

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × LAB VANE — 20 40 60 80 100

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L; WATER CONTENT (%): 10 20 30 (off-scale values printed: 41 at sample 4, 45 at sample 5)

POCKET PEN. (Cu) (kPa) | NATURAL UNIT WT (kN/m^3) | REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail - Timmins 2024
CLIENT: Gannett Fleming
Method: Hollow Stem Augers
PROJECT LOCATION: Timmins, Ontario
Diameter: 200mm
REF. NO.: 2304202
DATUM: Geodetic
Date: Jun 12, 2024
ENCL NO.: 2
BH LOCATION: See Borehole Location Plan N 5371297.74 E 488160.8

(m) ELEV DEPTH	CLASSIFICATION (Continued)	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	NATURAL MOISTURE CONTENT w (%)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
9.5	**SILTY SAND TILL:** trace clay, trace gravel, grey, moist to wet, very dense to dense.(Continued)								
							278		
	contains clayey silt layers		8	SS	76			~7	
							277		
							276		
	saturated below 13m		9	SS	17		275	~24	Auger grinding
							274		
							273		
			10	SS	40			~15	
272.5 15.9	**END OF BOREHOLE** 1) Water level was at 6.24mBGS upon completion of drilling. 2. Borehole was open upon completion of drilling.								

Column headings also include: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × LAB VANE (20 40 60 80 100); PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L, WATER CONTENT (%) (10 20 30); POCKET PEN. (Cu) (kPa); NATURAL UNIT WT (kN/m^3).

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

Palmer

LOG OF BOREHOLE BH24-NT103

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail - Timmins 2024

CLIENT: Gannett Fleming

PROJECT LOCATION: Timmins, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan N 5371341.01 E 488199.31

Method: Hollow Stem Augers

Diameter: 200mm

Date: Jun 12, 2024

REF. NO.: 2304202

ENCL NO.: 3

SOIL PROFILE

(m) ELEV / DEPTH	CLASSIFICATION
287.2	Ground Surface
287.0 / 0.0	**TOPSOIL:** 125mm
0.1	**FILL:** silty sand, trace clay, trace gravel, contains cobbles, brown, moist, loose to very loose. some clay below 1.5m
284.2 / 3.1	**SILTY CLAY:** trace sand, brown, moist, soft.
282.7 / 4.5	**SILTY CLAY:** trace sand, grey, moist to wet, very soft.

SAMPLES

NUMBER	TYPE	"N" BLOWS / 0.3 m
1	SS	5
2	SS	8
3	SS	6
4	SS	3
5	SS	3
6	SS	3
7	SS	0
	TW	
8	SS	0
9	SS	0

GROUND WATER CONDITIONS

ELEVATION: 287, 286, 285, 284, 283, 282, 281, 280, 279, 278

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

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

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

WATER CONTENT (%): 10 20 30

Annotations: 60.4 (TW sample); 46 (Sample 8)

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

Palmer

LOG OF BOREHOLE BH24-NT103

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail - Timmins 2024

CLIENT: Gannett Fleming | Method: Hollow Stem Augers

PROJECT LOCATION: Timmins, Ontario | Diameter: 200mm | REF. NO.: 2304202

DATUM: Geodetic | Date: Jun 12, 2024 | ENCL NO.: 3

BH LOCATION: See Borehole Location Plan N 5371341.01 E 488199.31

(m) ELEV / DEPTH	SOIL PROFILE – CLASSIFICATION (Continued)	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	NATURAL MOISTURE CONTENT (%)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	SILTY CLAY: trace sand, grey, moist to wet, very soft.(Continued)					277		
276.2 / 11.0	**CLAYEY SILT:** trace to some gravel, trace sand, contains cobbles, grey, wet, very soft.	10	SS	2		276, 275, 274	~19	
273.2 / 14.0	**SILTY SAND TILL:** trace clay, trace gravel, grey, moist, very dense.	11	SS	82/250mm		273, 272	~10	Auger grinding
271.6 / 15.7	**END OF BOREHOLE** 1) Water level was at 8.71mBGS upon completion of drilling. 2. Borehole was open upon completion of drilling.							

Column legend: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100); SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × LAB VANE (20, 40, 60, 80, 100); PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) (10, 20, 30); POCKET PEN. (Cu) (kPa); NATURAL UNIT WT (kN/m^3); STRATA PLOT.

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH24-NT104

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail - Timmins 2024
CLIENT: Gannett Fleming
Method: Hollow Stem Augers
PROJECT LOCATION: Timmins, Ontario
Diameter: 200mm
REF. NO.: 2304202
DATUM: Geodetic
Date: Jun 13, 2024
ENCL NO.: 4
BH LOCATION: See Borehole Location Plan N 5371355.51 E 488175.7

(m) ELEV / DEPTH	CLASSIFICATION (SOIL PROFILE)	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS
287.4	Ground Surface					
0.0	**Auger directed to 2.3m without samples**					
285.1 / 2.3	**FILL:** silty clay to clayey silt, trace sand, greyish brown, moist to wet, very soft.		1	SS	1	
284.4 / 3.1	**SILTY CLAY:** trace sand, contains clayey silt layers, greyish brown, wet, very soft.		2	SS	1	
	grey below 3.8m		3	SS	0	
				TW		
				TW		
			4	SS	0	

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

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

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30

POCKET PEN. (Cu) (kPa) | NATURAL UNIT WT (kN/m³) | REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

ELEVATION: 287, 286, 285, 284, 283, 282, 281, 280, 279, 278

Natural moisture content plotted: Sample 1 ≈ 21%; Sample 2 ≈ 20%; Sample 3: 44; Sample 4 ≈ 34%.

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail - Timmins 2024

CLIENT: Gannett Fleming | Method: Hollow Stem Augers

PROJECT LOCATION: Timmins, Ontario | Diameter: 200mm | REF. NO.: 2304202

DATUM: Geodetic | Date: Jun 13, 2024 | ENCL NO.: 4

BH LOCATION: See Borehole Location Plan N 5371355.51 E 488175.7

(m) ELEV / DEPTH	SOIL PROFILE – CLASSIFICATION (Continued)	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa)	WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m^3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	SILTY CLAY: trace sand, contains clayey silt layers, greyish brown, wet, very soft.(Continued)					277, 276					
275.8 / 11.6	**SILTY SAND TILL:** trace clay, trace gravel, contains cobbles, grey, wet to saturated, compact to very dense.	5	SS	22		275, 274		○ (~25)			
	moist to wet	6	SS	89/ 275mm		273		○ (~13)			
272.7 / 14.7	**SAND:** trace clay, trace silt, grey, moist to wet, dense.	7	SS	38		272		○ (~13)			
271.6 / 15.9	**END OF BOREHOLE** 1) Water level was at 7.74mBGS upon completion of drilling. 2. Borehole was open upon completion of drilling.										

Shear strength legend: ○ UNCONFINED; + FIELD VANE & Sensitivity; ● QUICK TRIAXIAL; × LAB VANE

Water content legend: PLASTIC LIMIT W_P; NATURAL MOISTURE CONTENT W; LIQUID LIMIT W_L

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH24-NT105

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail - Timmins 2024

CLIENT: Gannett Fleming

Method: Hollow Stem Augers

PROJECT LOCATION: Timmins, Ontario

Diameter: 200mm

REF. NO.: 2304202

DATUM: Geodetic

Date: Jun 14, 2024

ENCL NO.: 5

BH LOCATION: See Borehole Location Plan N 5371373.28 E 488184.6

(m) ELEV / DEPTH	SOIL PROFILE – CLASSIFICATION	STRATA PLOT	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION / SHEAR STRENGTH (kPa)	WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
286.9	Ground Surface											
0.0	**Auger directed to 3.1m without samples**						286, 285, 284					
283.9 / 3.1	**SILTY CLAY:** trace sand, trace gravel, grey, wet, soft to very soft.	hatched	1	SS	3		283		○			
		hatched		TW			282	+ (field vane)	├──┤ 43			
	contains silty sand layers	hatched	2	SS	1		281, 280		46 ○			
		hatched	3	SS	1		279, 278		46 ○			

Continued Next Page

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail - Timmins 2024
CLIENT: Gannett Fleming
PROJECT LOCATION: Timmins, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan N 5371373.28 E 488184.6

Method: Hollow Stem Augers
Diameter: 200mm
Date: Jun 14, 2024

REF. NO.: 2304202
ENCL NO.: 5

(m) ELEV DEPTH	SOIL PROFILE – CLASSIFICATION (Continued)	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	ELEVATION	WATER CONTENT (%)
	SILTY CLAY: trace sand, trace gravel, grey, wet, soft to very soft.(Continued)				277, 276, 275	
		4	SS	0	274	~31
273.0 / 13.9	**SILTY SAND TILL:** trace to some clay, trace gravel, contains cobbles, grey, moist to wet, compact to dense.	5	SS	15	273, 272	~18
	contains 330mm sand and gravel pockets, trace silt, grey, wet	6	SS	47		~9
271.1 / 15.8	**END OF BOREHOLE** 1) Water level was at 4.04mBGS upon completion of drilling. 2. Borehole was open upon completion of drilling.					

Chart columns: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100); SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × LAB VANE (20, 40, 60, 80, 100); PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) (10, 20, 30); POCKET PEN. (Cu) (kPa); NATURAL UNIT WT (kN/m^3); REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Depth scale: 10, 11, 12, 13, 14, 15

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

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Appendix B

Geotechnical Laboratory Tesing Results

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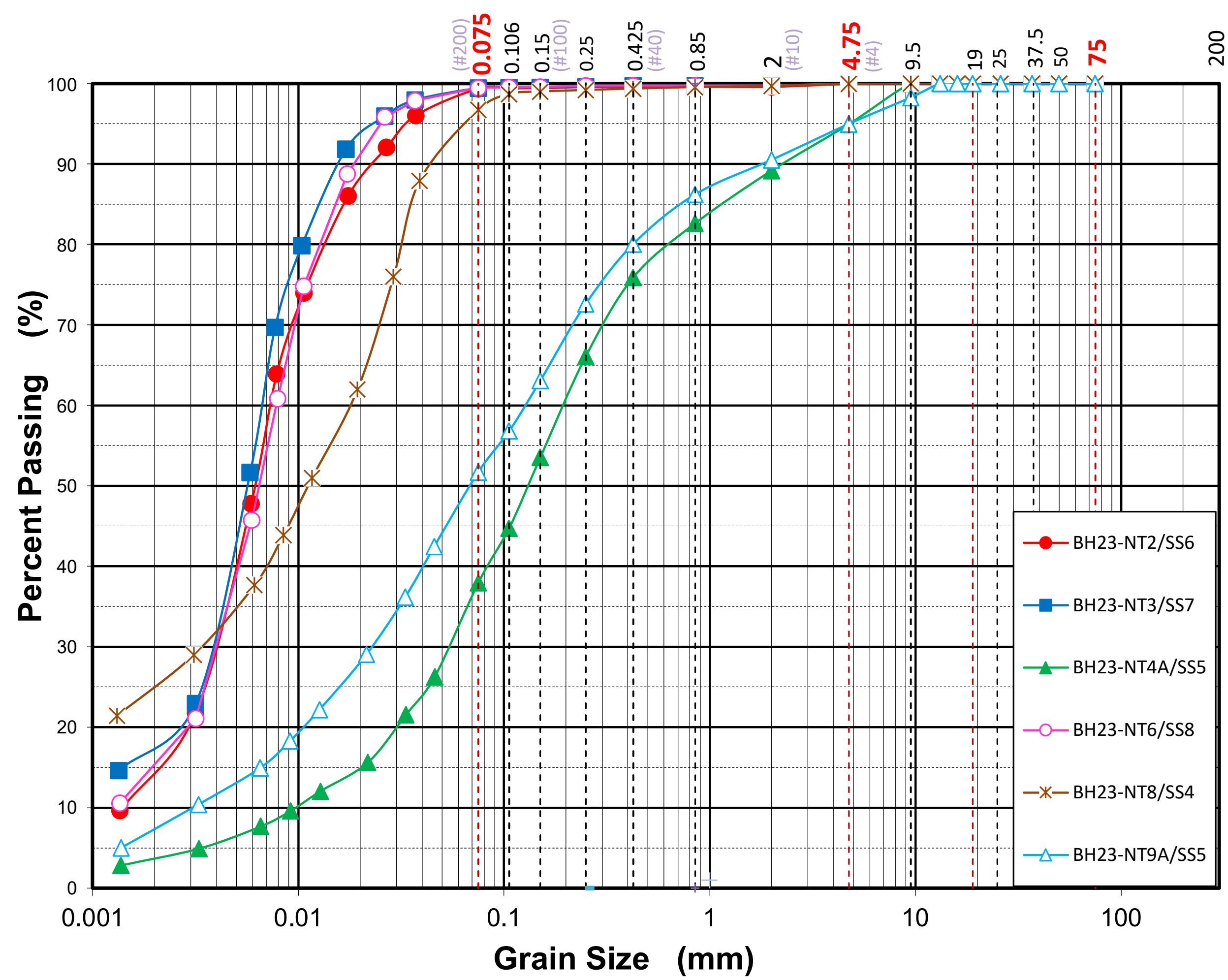
Oakville, ON L6L 6L7

Particle Size Distribution Report

Project No.:	2304202	Lab No.:	R23-001_1
Project Name:	Ontario Northland Northeastern Passenger Rail Service	Tested By:	BW
Client:	Gannett Fleming	Checked By:	TO
Location:	Timmins, Ontario	Date:	10/11/2023

Test Results

Test No.	Sample No.	Clay	Silt	Sand			Gravel		Cobble+	Remarks
				Fine	Medium	Coarse	Fine	Coarse		
1	BH23-NT2/SS6	14	85	1						
2	BH23-NT3/SS7	18	81	1						
3	BH23-NT4A/SS5	4	34	57			5			
4	BH23-NT6/SS8	14	85	1						
5	BH23-NT8/SS4	24	73	3						
6	BH23-NT9A/SS5	7	45	43			5			
7										
8										



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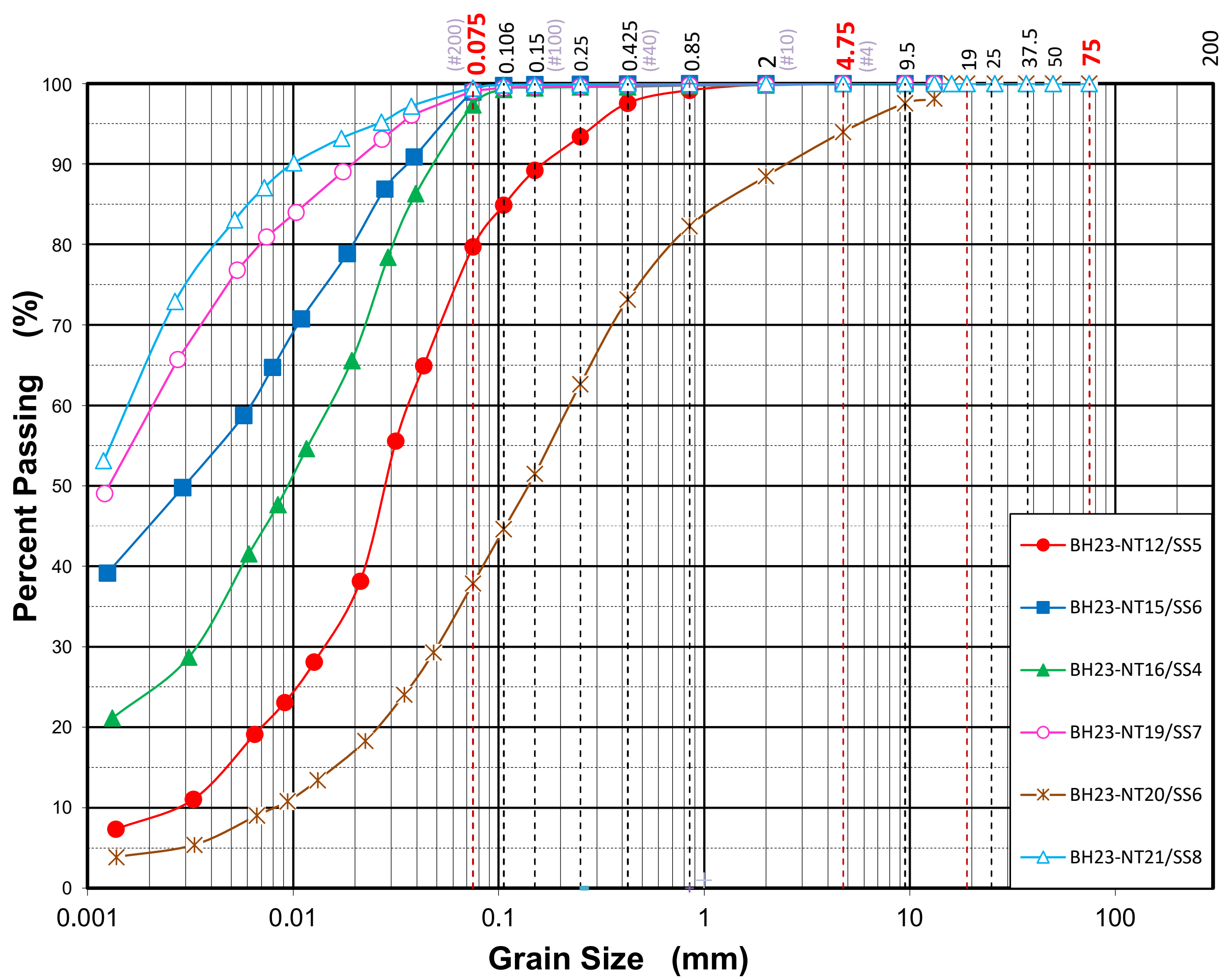
Oakville, ON L6L 6L7

Particle Size Distribution Report

Project No.:	2304202	Lab No.:	R23-001_2
Project Name:	Ontario Northland Northeastern Passenger Rail Service	Tested By:	BW
Client:	Gannett Fleming	Checked By:	TO
Location:	Timmins, Ontario	Date:	10/11/2023

Test Results

Test No.	Sample No.	Clay	Silt	Sand			Gravel		Cobble+	Remarks
				Fine	Medium	Coarse	Fine	Coarse		
1	BH23-NT12/SS5	9	71	20						
2	BH23-NT15/SS6	44	55	1						
3	BH23-NT16/SS4	24	73	3						
4	BH23-NT19/SS7	58	41	1						
5	BH23-NT20/SS6	4	34	56			6			
6	BH23-NT21/SS8	64	35	1						
7										
8										



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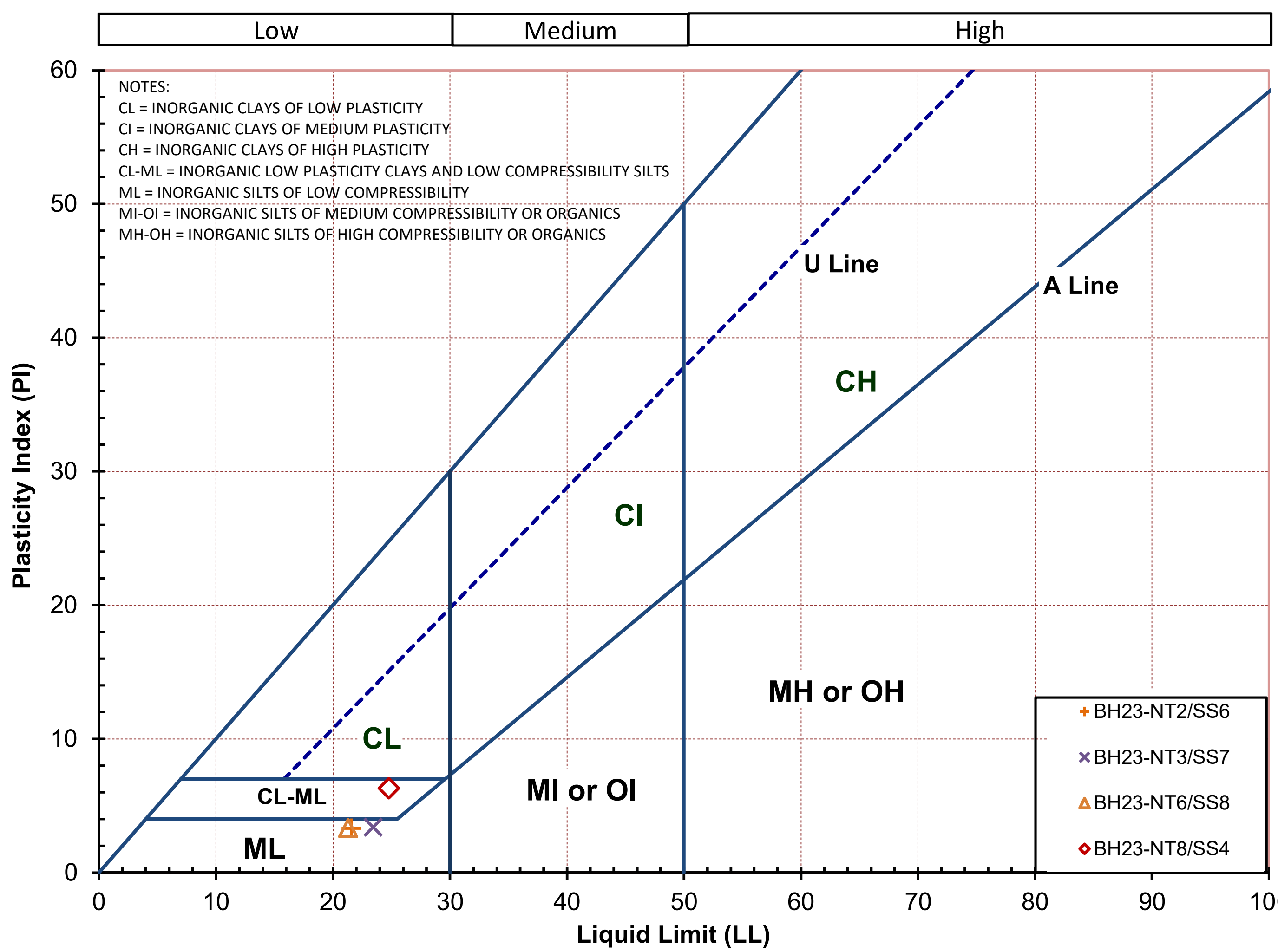
871 Equestrain Ct, Unit 1
Oakville, ON L6L 6L7

Plasticity Chart

Project No.	2304202	Lab No.	R23-001_1
Project Name	Ontario Northland Northeastern Passenger Rail Service	Tested By	BW
Client	Gannett Fleming	Checked By	OT
Location	Timmins, ON	Date	10/11/2023

Test Results

Test No	Sample No	LL	PL	PI	Fines	W%	Description	USCS
1	BH23-NT2/SS6	22	18	3				ML
2	BH23-NT3/SS7	23	20	3				ML
3	BH23-NT4A/SS5						Not Plastic	
4	BH23-NT6/SS8	21	18	3				ML
5	BH23-NT8/SS4	25	18	6				CL-ML
6	BH23-NT9A/SS5						Not Plastic	
7								
8								



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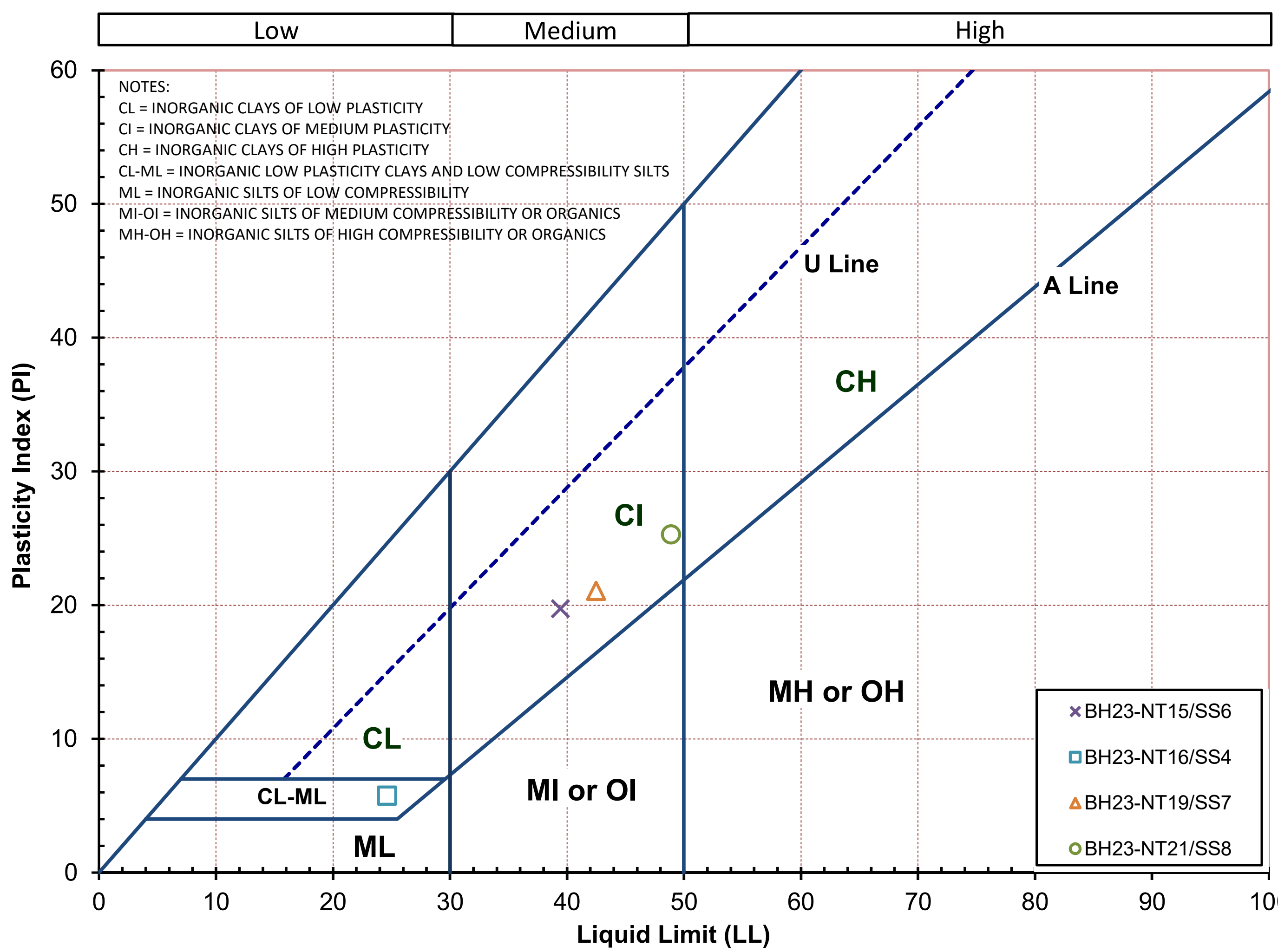
Plasticity Chart

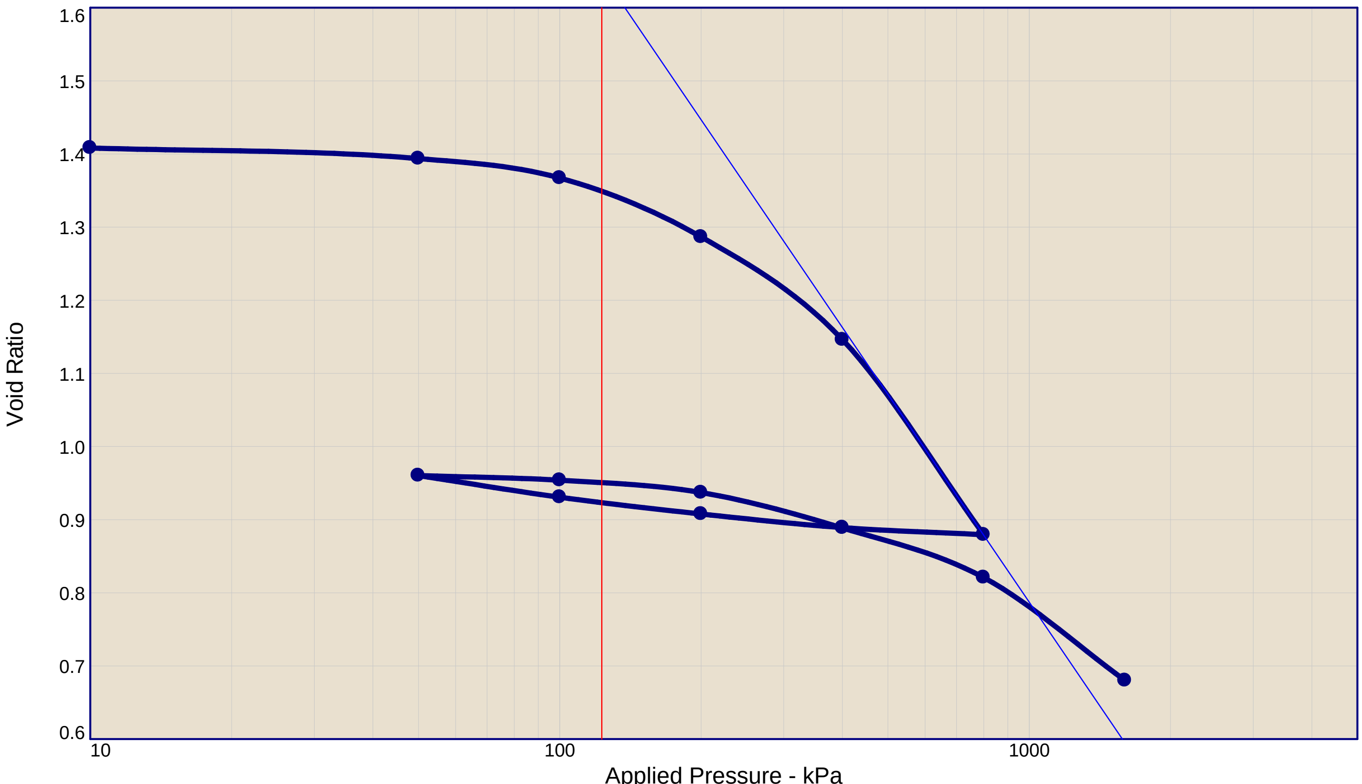
Project No.	2304202	Lab No.	R23-001_2
Project Name	Ontario Northland Northeastern Passenger Rail Service	Tested By	BW
Client	Gannett Fleming	Checked By	OT
Location	Timmins, ON	Date	10/11/2023

Test Results

Test No	Sample No	LL	PL	PI	Fines	W%	Description	USCS
1	BH23-NT12/SS5						Not Plastic	
2	BH23-NT15/SS6	39	20	20				CI
3	BH23-NT16/SS4	25	19	6				CL-ML
4	BH23-NT19/SS7	43	21	21				CL
5	BH23-NT20/SS6						Not Plastic	
6	BH23-NT21/SS8	49	24	25				CI
7								
8								



CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation

No.	Load (kPa)	C_v (cm.2/day)	C_α	No.	Load (kPa)	C_v (cm.2/day)	C_α	No.	Load (kPa)	C_v (cm.2/day)	C_α
1	10.0	70.39		8	200.0	42.48		15	1600.0	22.18	
2	50.0	67.29		9	100.0	68.45					
3	100.0	63.91		10	50.0	18.55					
4	200.0	36.30		11	100.0	205.68					
5	400.0	49.44		12	200.0	323.35					
6	800.0	31.75		13	400.0	279.98					
7	400.0	222.78		14	800.0	198.18					

Natural Saturation	Natural Moisture	Dry Dens. (kg/m3)	LL	PI	Sp. Gr.	P_c (kPa)	C_c	Initial Void Ratio
94.9 %	48.6 %	1141	57.0	35.2	2.75	283	0.94	1.409

MATERIAL DESCRIPTION	USCS	AASHTO
SILTY CLAY grey		

Project No. CA19009.23.18 **Client:** Palmer

Project: PECG PRJ # 2304202 ONTC Additional testing

Location: New Timmins **Depth:** 20' - 22' **Sample Number:** BH23-NT12

Remarks:
Tested on 2 Nov 2023
Assumed Sp. Gravity 2.75

Terrapex

Toronto, Ontario

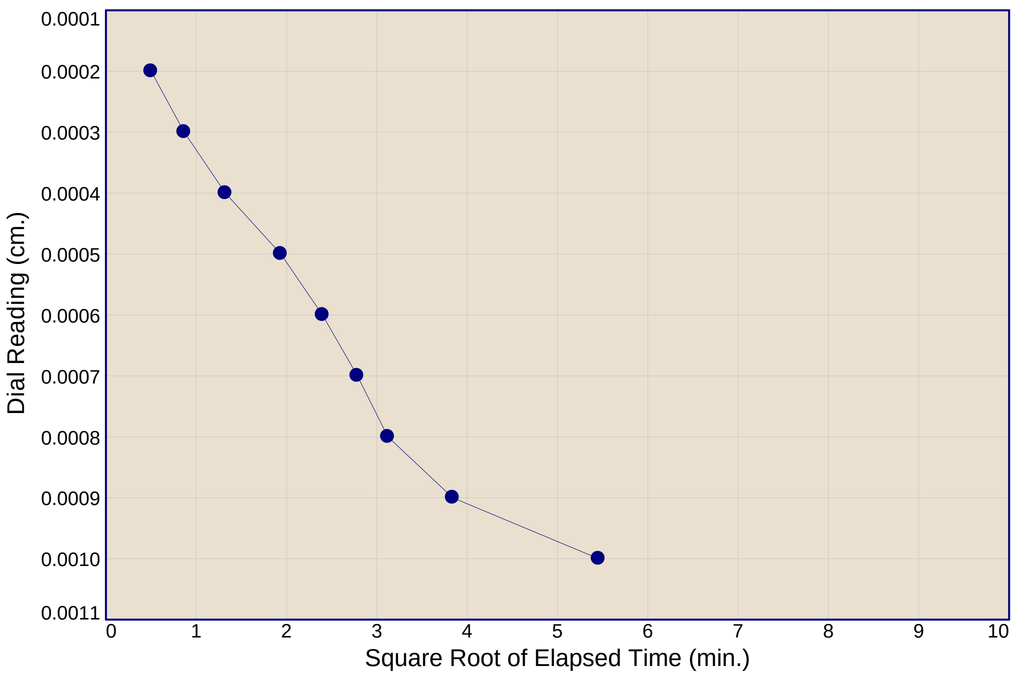
Figure

Tested By: RJ

Dial Reading vs. Time

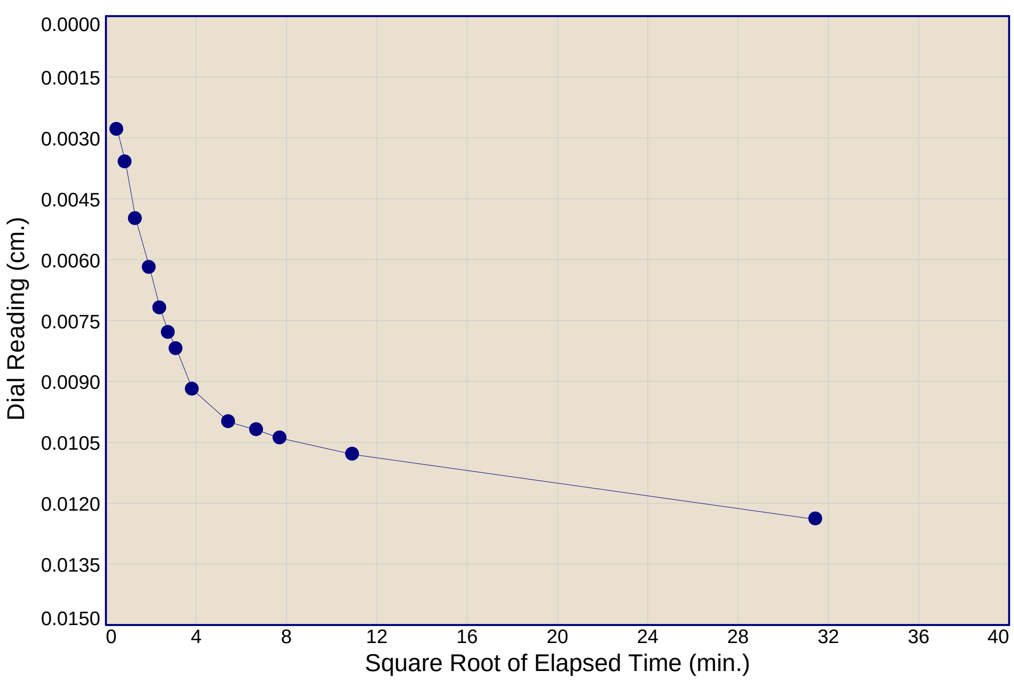
Project No.: CA19009.23.18
Project: PECG PRJ # 2304202 ONTC Additional testing

Location: New Timmins   Depth: 20' - 22'   Sample Number: BH23-NT12



Load No.= 1
Load= 10.0 kPa
D_0 = 0.0001
D_{90} = 0.0009
D_{100} = 0.0010
T_{90} = 15.49 min.

C_v @ T_{90}
70.39 $cm.^2$/day



Load No.= 2
Load= 50.0 kPa
D_0 = 0.0019
D_{90} = 0.0093
D_{100} = 0.0101
T_{90} = 16.08 min.

C_v @ T_{90}
67.29 $cm.^2$/day

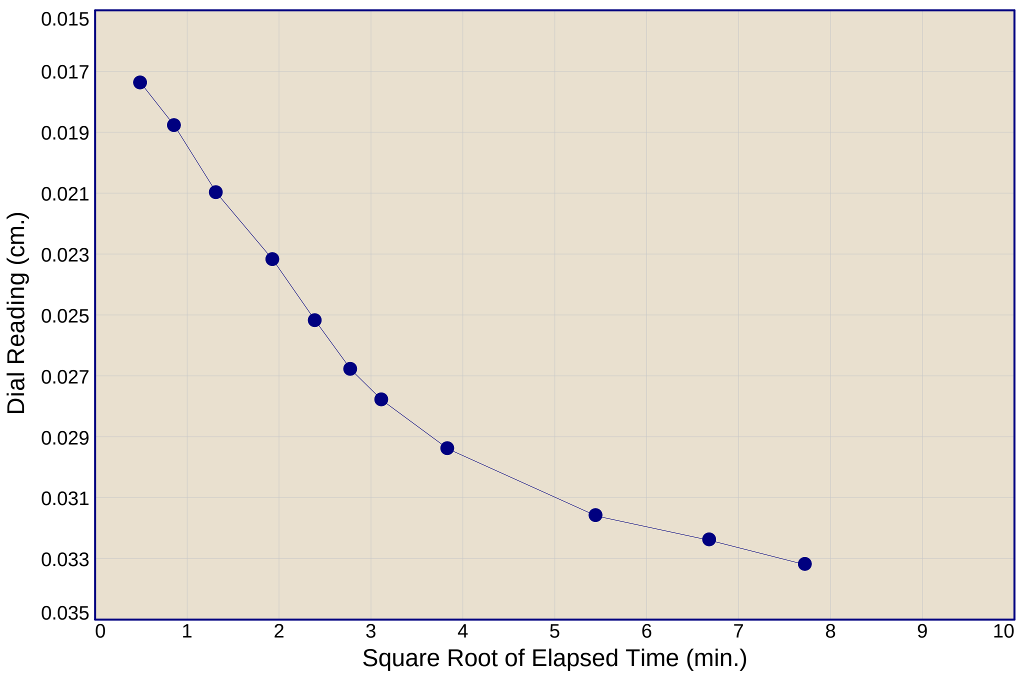
Figure

Terrapex

Dial Reading vs. Time

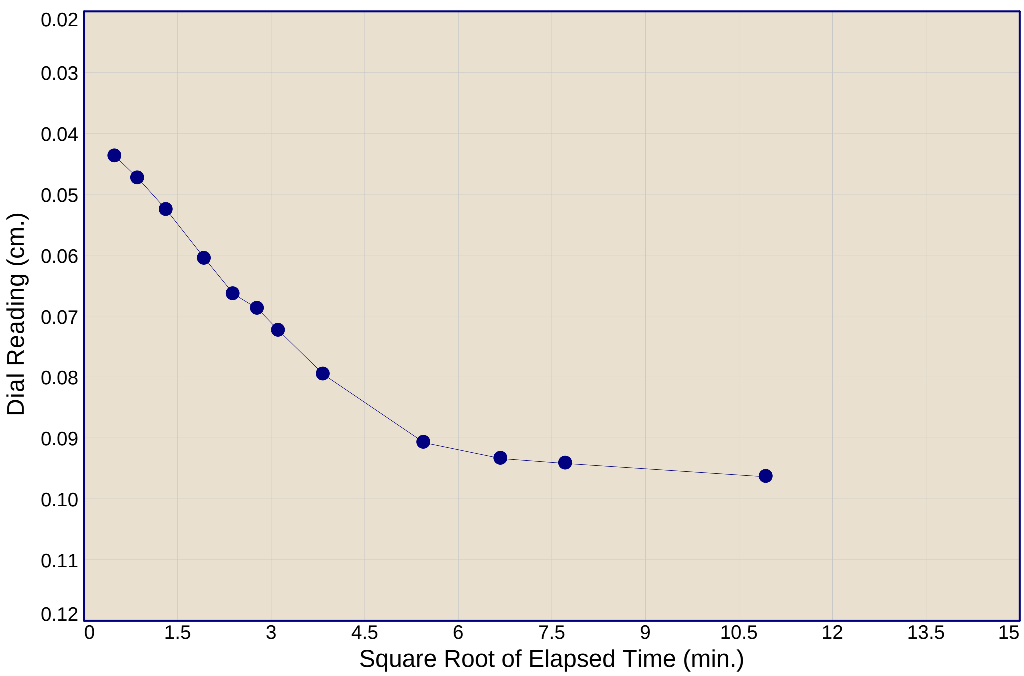
Project No.: CA19009.23.18
Project: PECG PRJ # 2304202 ONTC Additional testing

Location: New Timmins Depth: 20' - 22' Sample Number: BH23-NT12



Load No.= 3
Load= 100.0 kPa
D_0 = 0.0154
D_{90} = 0.0297
D_{100} = 0.0313
T_{90} = 16.62 min.

C_v @ T_{90}
63.91 cm.^{2}/day



Load No.= 4
Load= 200.0 kPa
D_0 = 0.0382
D_{90} = 0.0896
D_{100} = 0.0953
T_{90} = 27.90 min.

C_v @ T_{90}
36.30 cm.^{2}/day

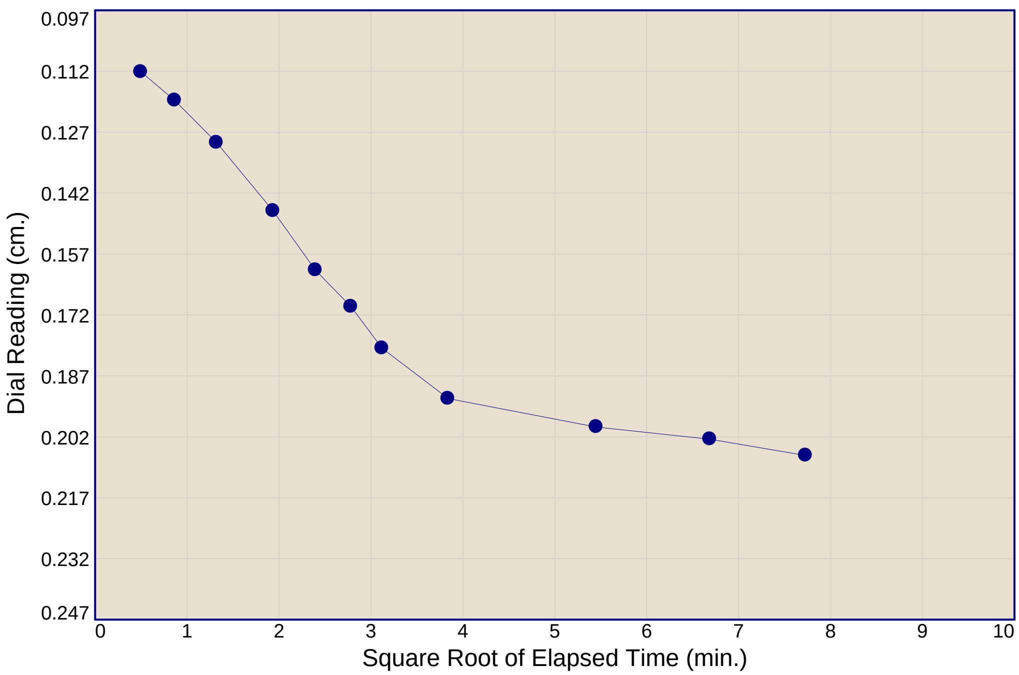
Figure

Terrapex

Dial Reading vs. Time

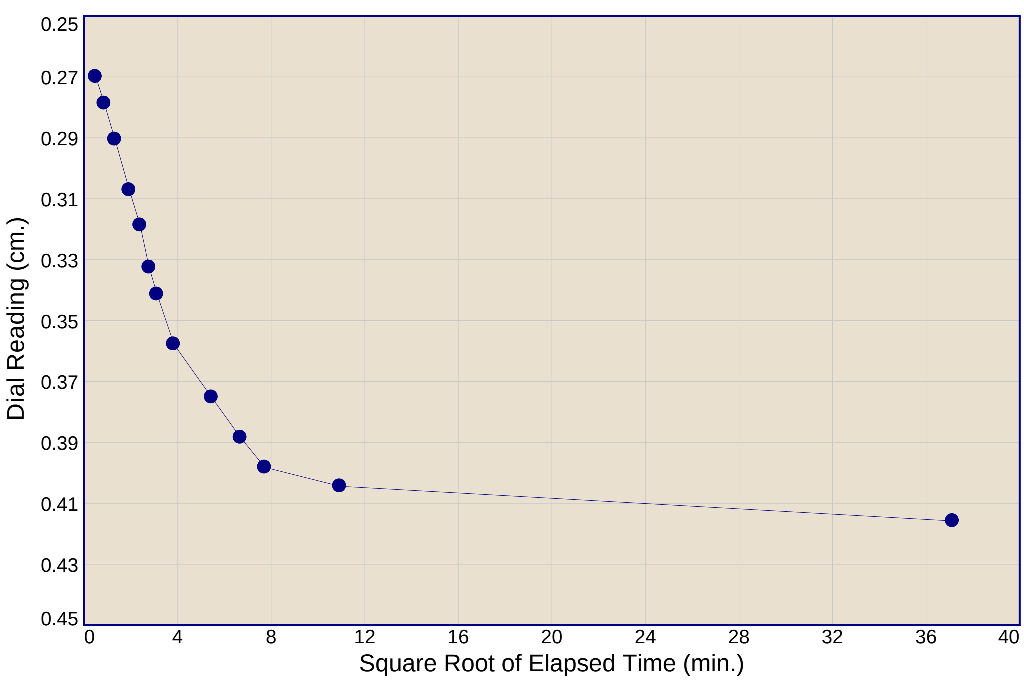
Project No.: CA19009.23.18
Project: PECG PRJ # 2304202 ONTC Additional testing

Location: New Timmins   Depth: 20' - 22'   Sample Number: BH23-NT12



Load No.= 5
Load= 400.0 kPa
D_0 = 0.0972
D_{90} = 0.1946
D_{100} = 0.2054
T_{90} = 18.56 min.

C_v @ T_{90}
49.44 $cm.^2$/day



Load No.= 6
Load= 800.0 kPa
D_0 = 0.2557
D_{90} = 0.3682
D_{100} = 0.3807
T_{90} = 23.10 min.

C_v @ T_{90}
31.75 $cm.^2$/day

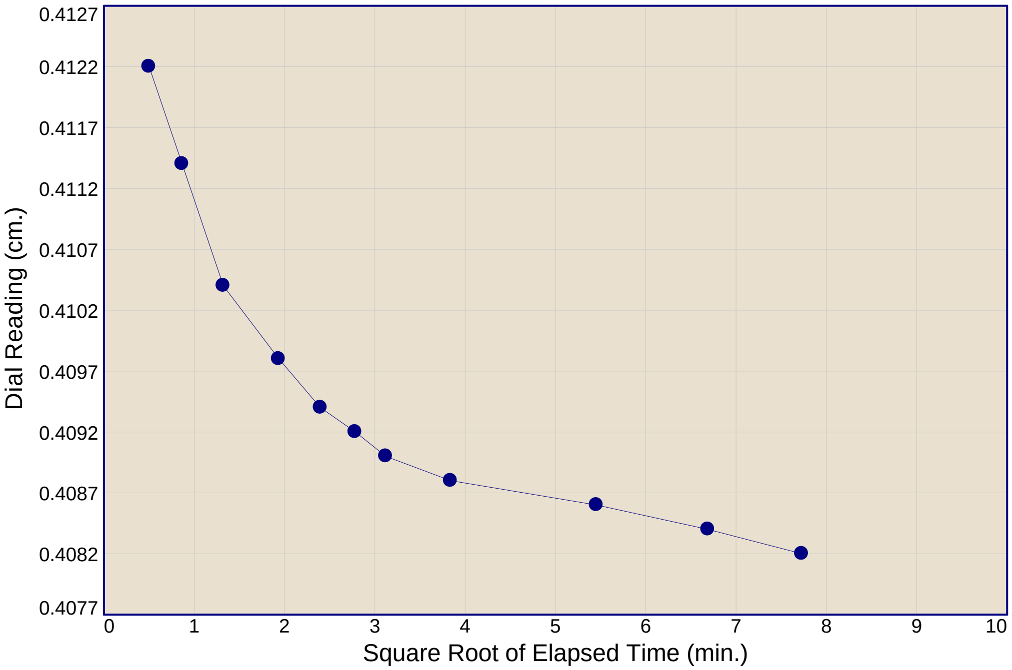
Figure

Terrapex

Dial Reading vs. Time

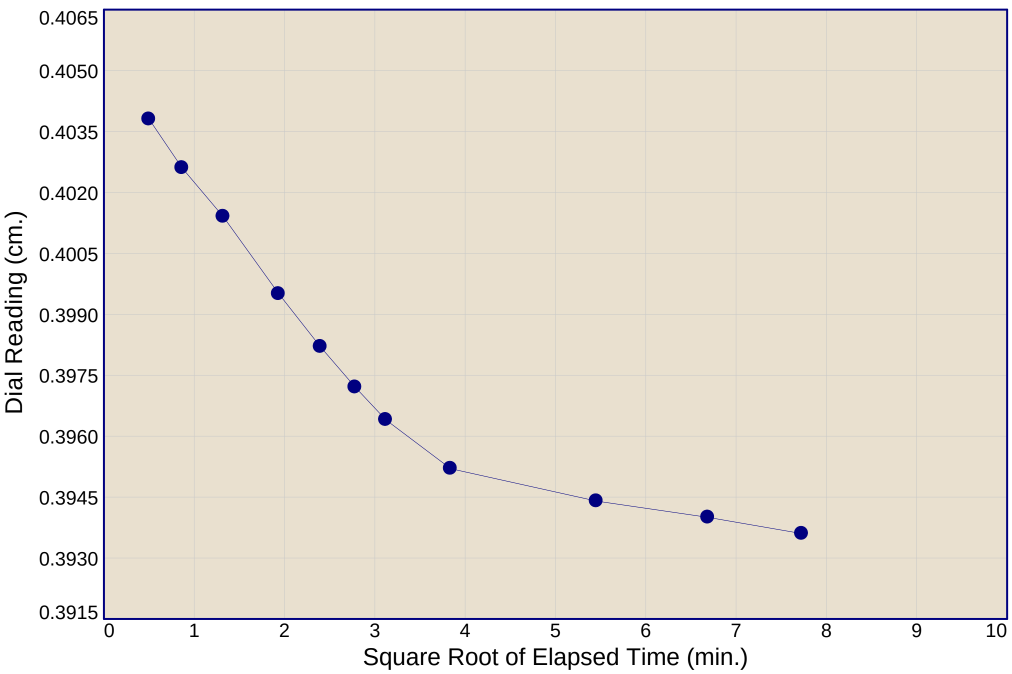
Project No.: CA19009.23.18
Project: PECG PRJ # 2304202 ONTC Additional testing

Location: New Timmins Depth: 20' - 22' Sample Number: BH23-NT12



Load No.= 7
Load= 400.0 kPa
D_0 = 0.4133
D_{90} = 0.4100
D_{100} = 0.4096
T_{90} = 3.00 min.

C_v @ T_{90}
222.78 cm.^{2}/day



Load No.= 8
Load= 200.0 kPa
D_0 = 0.4052
D_{90} = 0.3951
D_{100} = 0.3940
T_{90} = 15.97 min.

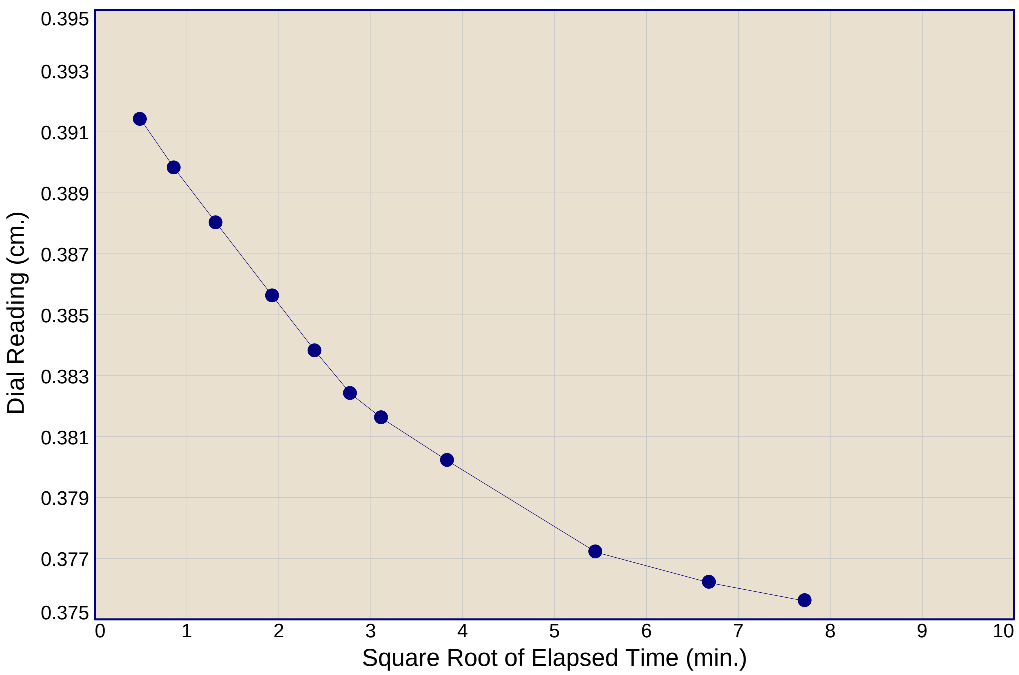
C_v @ T_{90}
42.48 cm.^{2}/day

Terrapex

Dial Reading vs. Time

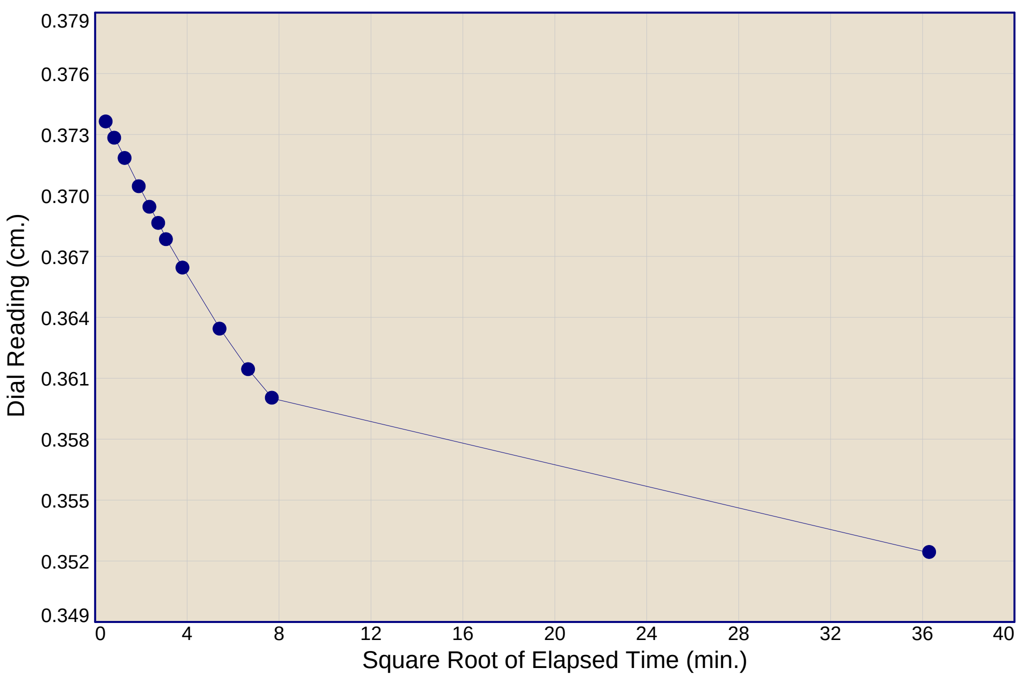
Project No.: CA19009.23.18
Project: PECG PRJ # 2304202 ONTC Additional testing

Location: New Timmins   Depth: 20' - 22'   Sample Number: BH23-NT12



Load No.= 9
Load= 100.0 kPa
D_0 = 0.3937
D_{90} = 0.3815
D_{100} = 0.3801
T_{90} = 10.12 min.

C_v @ T_{90}
68.45 $cm.^2$/day



Load No.= 10
Load= 50.0 kPa
D_0 = 0.3749
D_{90} = 0.3622
D_{100} = 0.3608
T_{90} = 38.37 min.

C_v @ T_{90}
18.55 $cm.^2$/day

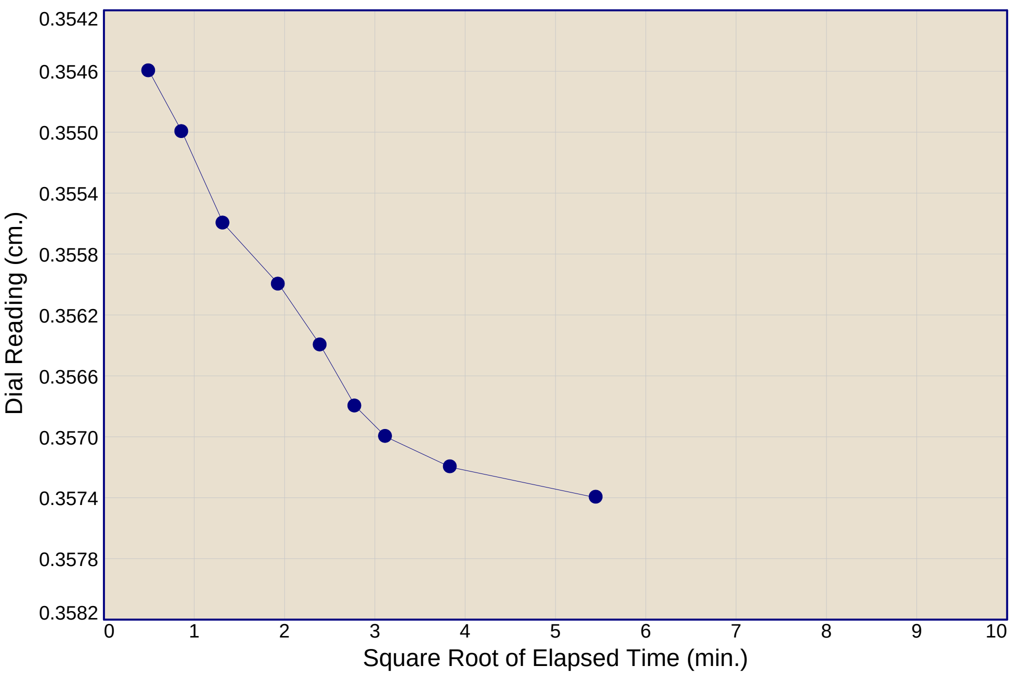
Figure

Terrapex

Dial Reading vs. Time

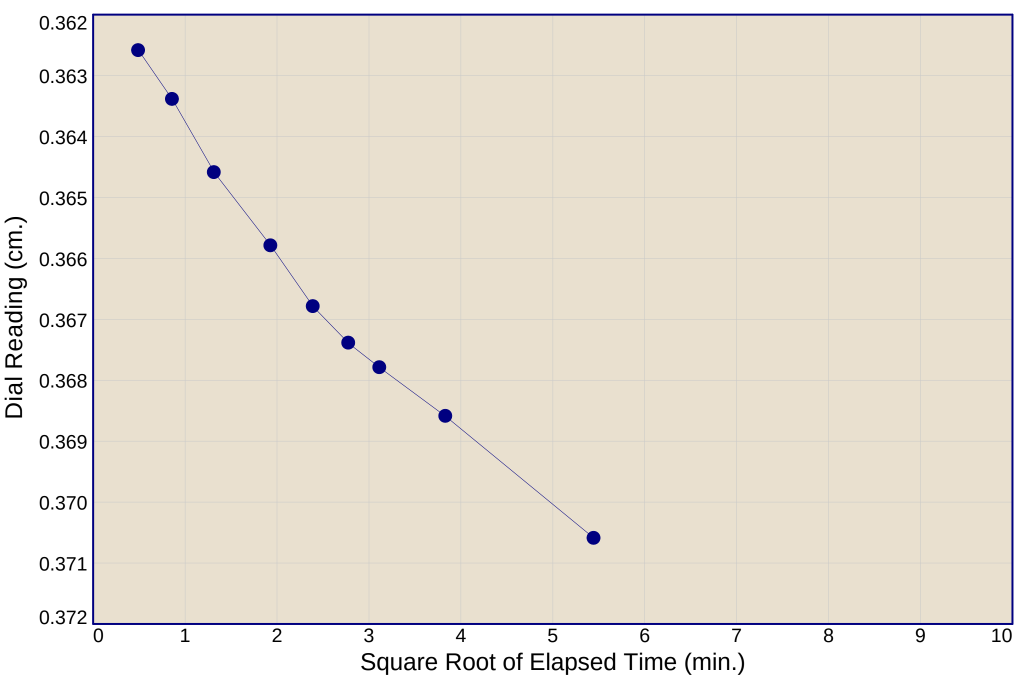
Project No.: CA19009.23.18
Project: PECG PRJ # 2304202 ONTC Additional testing

Location: New Timmins Depth: 20' - 22' Sample Number: BH23-NT12



Load No.= 11
Load= 100.0 kPa
D_0 = 0.3540
D_{90} = 0.3560
D_{100} = 0.3562
T_{90} = 3.49 min.

C_v @ T_{90}
205.68 $cm.^2$/day



Load No.= 12
Load= 200.0 kPa
D_0 = 0.3608
D_{90} = 0.3649
D_{100} = 0.3654
T_{90} = 2.20 min.

C_v @ T_{90}
323.35 $cm.^2$/day

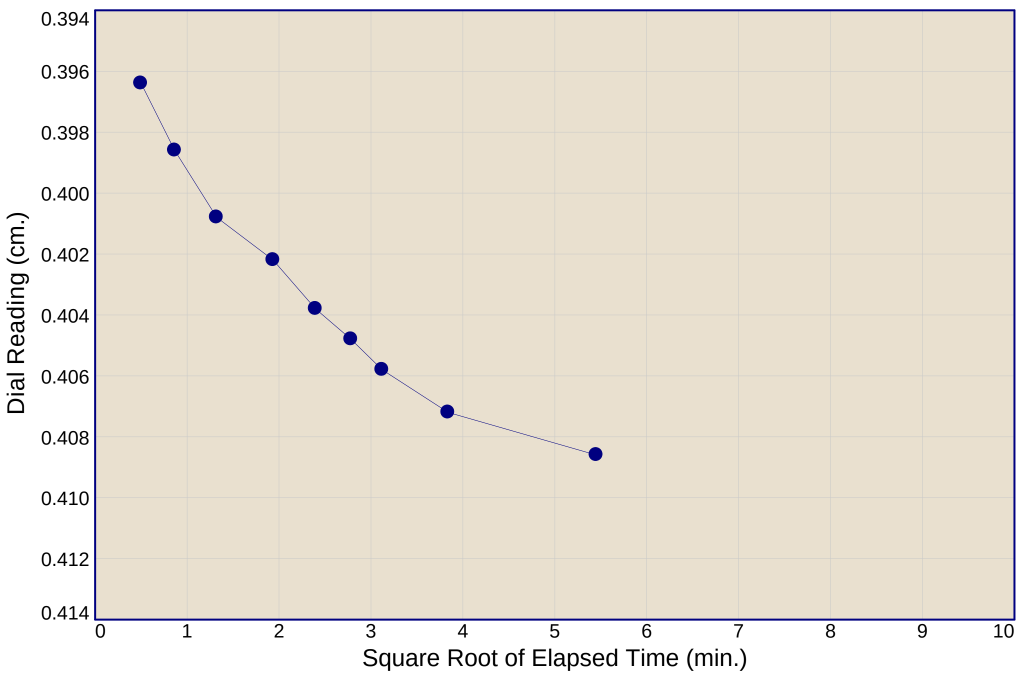
Figure

Terrapex

Dial Reading vs. Time

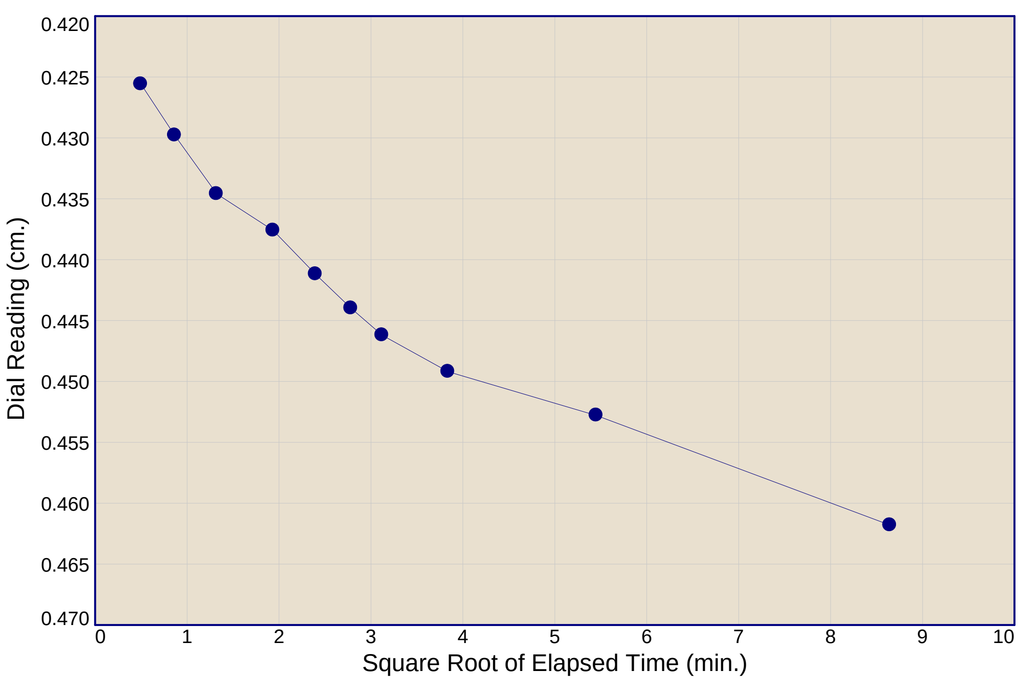
Project No.: CA19009.23.18
Project: PECG PRJ # 2304202 ONTC Additional testing

Location: New Timmins   Depth: 20' - 22'   Sample Number: BH23-NT12



Load No.= 13
Load= 400.0 kPa
D_0 = 0.3933
D_{90} = 0.4014
D_{100} = 0.4022
T_{90} = 2.45 min.

C_v @ T_{90}
279.98 $cm.^2$/day



Load No.= 14
Load= 800.0 kPa
D_0 = 0.4198
D_{90} = 0.4369
D_{100} = 0.4388
T_{90} = 3.23 min.

C_v @ T_{90}
198.18 $cm.^2$/day

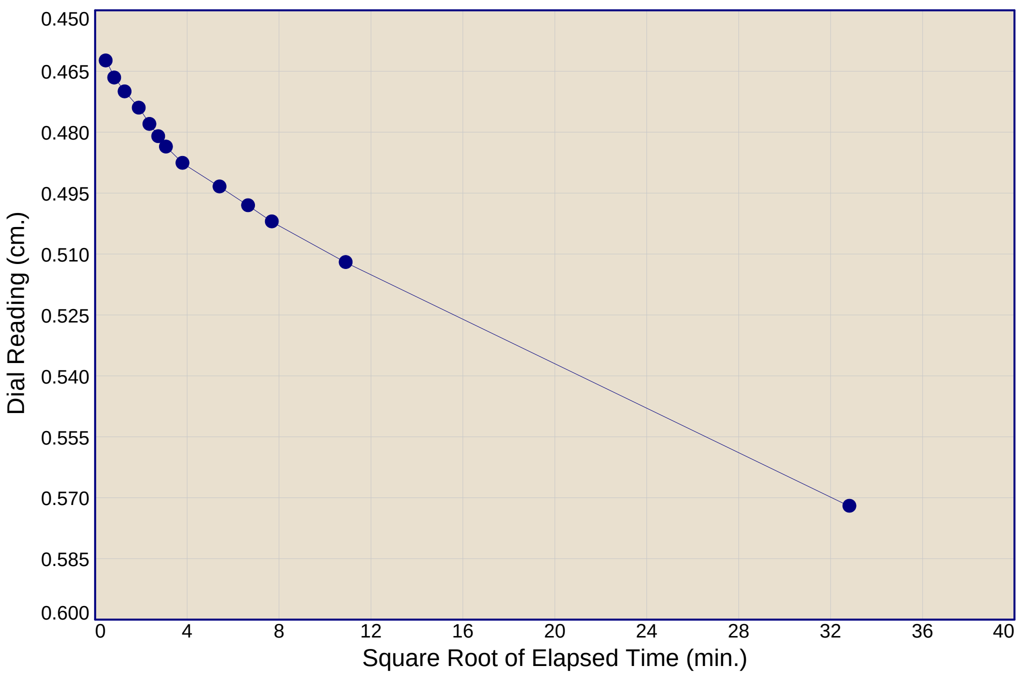
Figure

Terrapex

Dial Reading vs. Time

Project No.: CA19009.23.18
Project: PECG PRJ # 2304202 ONTC Additional testing

Location: New Timmins Depth: 20' - 22' Sample Number: BH23-NT12



Load No.= 15
Load= 1600.0 kPa
D_0 = 0.4585
D_{90} = 0.4923
D_{100} = 0.4961
T_{90} = 25.95 min.

C_v @ T_{90}
22.18 cm.^{2}/day

Figure

Terrapex

CONSOLIDATION TEST DATA

2023-11-06

Client: Palmer
Project: PECG PRJ # 2304202 ONTC Additional testing
Project Number: CA19009.23.18
Location: New Timmins
Depth: 20' - 22' **Sample Number:** BH23-NT12
Material Description: SILTY CLAY grey
Liquid Limit: 57.0 **Plasticity Index:** 35.2
Testing Remarks: Tested on 2 Nov 2023
Assumed Sp. Gravity 2.75
Tested by: RJ

Test Specimen Data

NATURAL MOISTURE		VOID RATIO		AFTER TEST	
Wet w+t =	130.88 g.	**Spec. Gr.**	= 2.75	**Wet w+t** =	88.64 g.
Dry w+t =	101.90 g.	**Est. Ht. Solids**	= 0.784 cm.	**Dry w+t** =	77.13 g.
Tare Wt. =	42.32 g.	**Init. V.R.**	= 1.409	**Tare Wt.** =	42.32 g.
Moisture =	48.6 %	**Init. Sat.**	= 94.9 %	**Moisture** =	33.1 %

UNIT WEIGHT		TEST START			
				Dry Wt. =	34.81 g.
Height =	1.890 cm.	**Height**	= 1.890 cm.		
Diameter =	5.010 cm.	**Diameter**	= 5.010 cm.		
Weight =	63.21 g.				
Dry Dens. =	1141 kg/m^3				

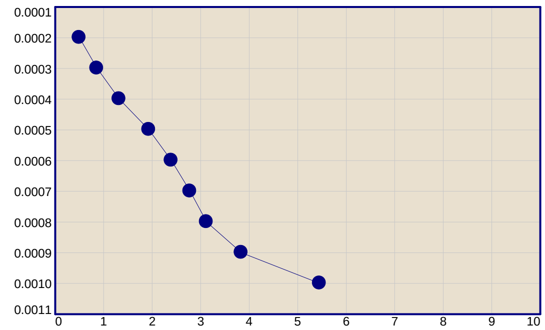
End-Of-Load Summary

Pressure (kPa)	Final Dial (cm.)	Deformation (cm.)	C_v ($cm.^2$/day)	C_α	Void Ratio	% Strain
start	0.00010	0.00000			1.409	
10.0	0.00100	0.00090	70.39		1.408	0.0 Comprs.
50.0	0.01240	0.01230	67.29		1.394	0.7 Comprs.
100.0	0.03320	0.03310	63.91		1.367	1.8 Comprs.
200.0	0.09640	0.09630	36.30		1.287	5.1 Comprs.
400.0	0.20660	0.20650	49.44		1.146	10.9 Comprs.
800.0	0.41580	0.41570	31.75		0.879	22.0 Comprs.
400.0	0.40820	0.40810	222.78		0.889	21.6 Comprs.
200.0	0.39360	0.39350	42.48		0.908	20.8 Comprs.
100.0	0.37560	0.37550	68.45		0.931	19.9 Comprs.
50.0	0.35240	0.35230	18.55		0.960	18.6 Comprs.
100.0	0.35740	0.35730	205.68		0.954	18.9 Comprs.
200.0	0.37060	0.37050	323.35		0.937	19.6 Comprs.
400.0	0.40860	0.40850	279.98		0.889	21.6 Comprs.
800.0	0.46180	0.46170	198.18		0.821	24.4 Comprs.
1600.0	0.57220	0.57210	22.18		0.680	30.3 Comprs.

Compression index (C_c), kPa = 0.94 **Preconsolidation pressure (P_p), kPa =** 283 **Void ratio at P_p (e_m) =** 1.231
Overburden (σ_{vo}), kPa = 200 **Void ratio at σ_{vo} (e_o) =** 1.287 **Recompression index (C_r) =** 0.14

Pressure: 10.0 kPa	TEST READINGS	Load No. 1

No.	Clock Time	Dial Reading
1	+0 00:00:15	0.00010
2	+0 00:00:30	0.00020
3	+0 00:01:00	0.00030
4	+0 00:02:00	0.00040
5	+0 00:04:00	0.00050
6	+0 00:06:00	0.00060
7	+0 00:08:00	0.00070
8	+0 00:10:00	0.00080
9	+0 00:15:00	0.00090
10	+0 00:30:00	0.00100

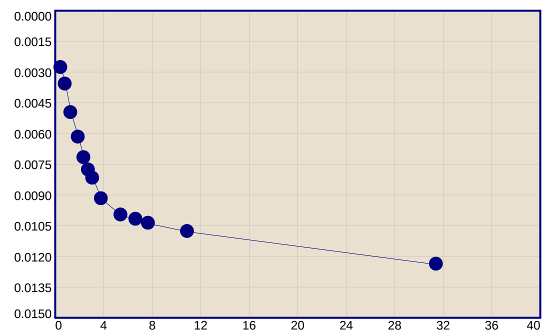


Void Ratio = 1.408 **Compression =** 0.0%

D_0 = 0.0001 D_{90} = 0.0009 D_{100} = 0.0010 C_v **at 15.49 min. =** 70.39 cm.^{2}/day

Pressure: 50.0 kPa	TEST READINGS	Load No. 2

No.	Clock Time	Dial Reading	No.	Clock Time	Dial Reading
1	+0 00:30:15	0.00180	11	+0 01:15:00	0.01020
2	+0 00:30:30	0.00280	12	+0 01:30:00	0.01040
3	+0 00:31:00	0.00360	13	+0 02:30:00	0.01080
4	+0 00:32:00	0.00500	14	+0 17:00:00	0.01240
5	+0 00:34:00	0.00620			
6	+0 00:36:00	0.00720			
7	+0 00:38:00	0.00780			
8	+0 00:40:00	0.00820			
9	+0 00:45:00	0.00920			
10	+0 01:00:00	0.01000			

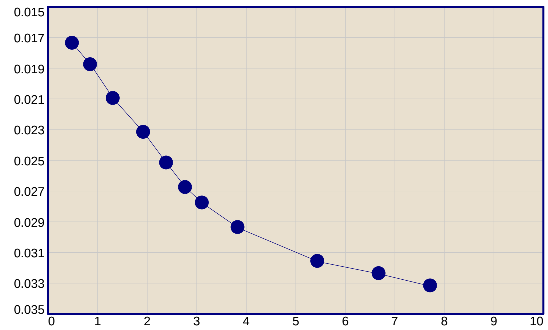


Void Ratio = 1.394 **Compression =** 0.7%

D_0 = 0.0019 D_{90} = 0.0093 D_{100} = 0.0101 C_v **at 16.08 min. =** 67.29 cm.^{2}/day

Pressure: 100.0 kPa	TEST READINGS	Load No. 3

No.	Clock Time	Dial Reading	No.	Clock Time	Dial Reading
1	+0 17:00:15	0.01620	11	+0 17:45:00	0.03240
2	+0 17:00:30	0.01740	12	+0 18:00:00	0.03320
3	+0 17:01:00	0.01880			
4	+0 17:02:00	0.02100			
5	+0 17:04:00	0.02320			
6	+0 17:06:00	0.02520			
7	+0 17:08:00	0.02680			
8	+0 17:10:00	0.02780			
9	+0 17:15:00	0.02940			
10	+0 17:30:00	0.03160			

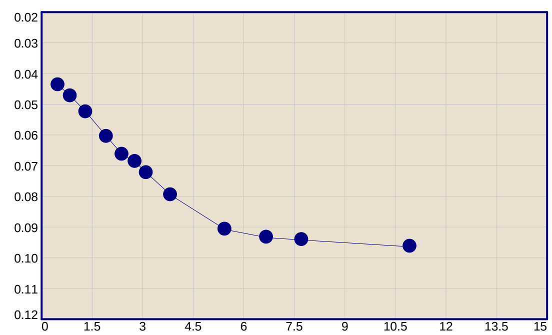


Void Ratio = 1.367 **Compression =** 1.8%

D_0 = 0.0154 D_{90} = 0.0297 D_{100} = 0.0313 C_v **at 16.62 min. =** 63.91 $cm.^2$/day

Pressure: 200.0 kPa	TEST READINGS	Load No. 4

No.	Clock Time	Dial Reading	No.	Clock Time	Dial Reading
1	+0 18:00:15	0.04120	11	+0 18:45:00	0.09340
2	+0 18:00:30	0.04380	12	+0 19:00:00	0.09420
3	+0 18:01:00	0.04740	13	+0 20:00:00	0.09640
4	+0 18:02:00	0.05260			
5	+0 18:04:00	0.06060			
6	+0 18:06:00	0.06640			
7	+0 18:08:00	0.06880			
8	+0 18:10:00	0.07240			
9	+0 18:15:00	0.07960			
10	+0 18:30:00	0.09080			

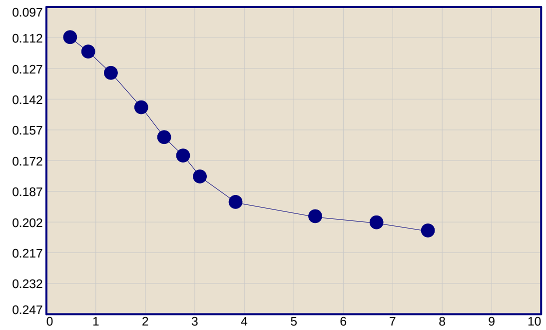


Void Ratio = 1.287 **Compression =** 5.1%

D_0 = 0.0382 D_{90} = 0.0896 D_{100} = 0.0953 C_v **at 27.90 min. =** 36.30 $cm.^2$/day

Pressure: 400.0 kPa	TEST READINGS	Load No. 5

No.	Clock Time	Dial Reading	No.	Clock Time	Dial Reading
1	+0 20:00:15	0.10640	11	+0 20:45:00	0.20260
2	+0 20:00:30	0.11220	12	+0 21:00:00	0.20660
3	+0 20:01:00	0.11920			
4	+0 20:02:00	0.12960			
5	+0 20:04:00	0.14640			
6	+0 20:06:00	0.16100			
7	+0 20:08:00	0.17000			
8	+0 20:10:00	0.18020			
9	+0 20:15:00	0.19260			
10	+0 20:30:00	0.19960			

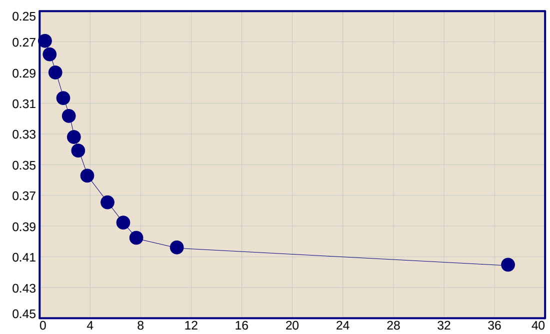


Void Ratio = 1.146 **Compression =** 10.9%

D_0 = 0.0972 D_{90} = 0.1946 D_{100} = 0.2054 C_v **at 18.56 min. =** 49.44 cm.^{2}/day

Pressure: 800.0 kPa	TEST READINGS	Load No. 6

No.	Clock Time	Dial Reading	No.	Clock Time	Dial Reading
1	+0 21:00:15	0.26440	11	+0 21:45:00	0.38840
2	+0 21:00:30	0.27000	12	+0 22:00:00	0.39820
3	+0 21:01:00	0.27880	13	+0 23:00:00	0.40440
4	+0 21:02:00	0.29060	14	+1 20:00:00	0.41580
5	+0 21:04:00	0.30720			
6	+0 21:06:00	0.31880			
7	+0 21:08:00	0.33260			
8	+0 21:10:00	0.34140			
9	+0 21:15:00	0.35780			
10	+0 21:30:00	0.37520			

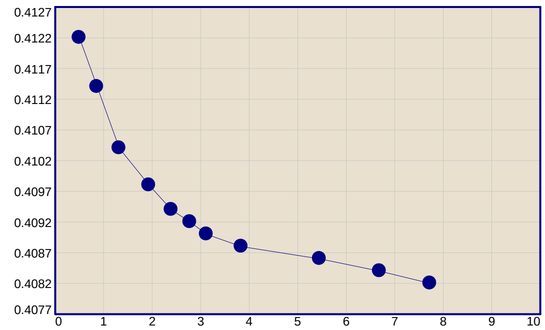


Void Ratio = 0.879 **Compression =** 22.0%

D_0 = 0.2557 D_{90} = 0.3682 D_{100} = 0.3807 C_v **at 23.10 min. =** 31.75 cm.^{2}/day

Pressure: 400.0 kPa	TEST READINGS	Load No. 7

No.	Clock Time	Dial Reading	No.	Clock Time	Dial Reading
1	+1 20:00:15	0.41280	11	+1 20:45:00	0.40840
2	+1 20:00:30	0.41220	12	+1 21:00:00	0.40820
3	+1 20:01:00	0.41140			
4	+1 20:02:00	0.41040			
5	+1 20:04:00	0.40980			
6	+1 20:06:00	0.40940			
7	+1 20:08:00	0.40920			
8	+1 20:10:00	0.40900			
9	+1 20:15:00	0.40880			
10	+1 20:30:00	0.40860			

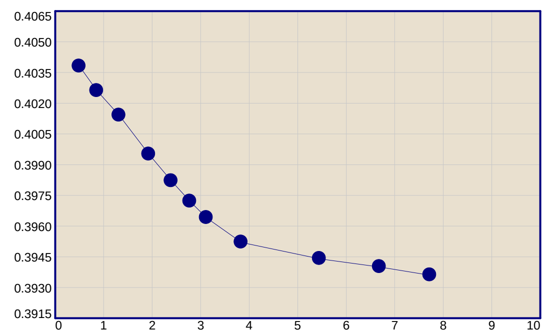


Void Ratio = 0.889 **Compression =** 21.6%

$\mathbf{D_0}$ **=** 0.4133 $\mathbf{D_{90}}$ **=** 0.4100 $\mathbf{D_{100}}$ **=** 0.4096 $\mathbf{C_v}$ **at 3.00 min. =** 222.78 $cm.^2$/day

Pressure: 200.0 kPa	TEST READINGS	Load No. 8

No.	Clock Time	Dial Reading	No.	Clock Time	Dial Reading
1	+1 21:00:15	0.40500	11	+1 21:45:00	0.39400
2	+1 21:00:30	0.40380	12	+1 22:00:00	0.39360
3	+1 21:01:00	0.40260			
4	+1 21:02:00	0.40140			
5	+1 21:04:00	0.39950			
6	+1 21:06:00	0.39820			
7	+1 21:08:00	0.39720			
8	+1 21:10:00	0.39640			
9	+1 21:15:00	0.39520			
10	+1 21:30:00	0.39440			

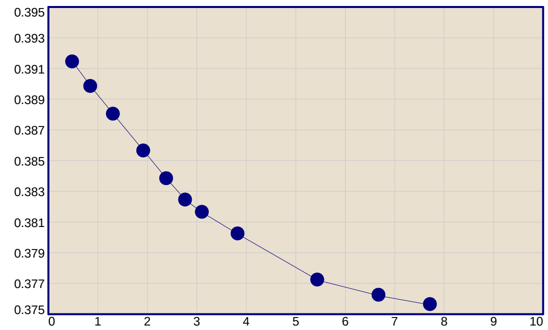


Void Ratio = 0.908 **Compression =** 20.8%

$\mathbf{D_0}$ **=** 0.4052 $\mathbf{D_{90}}$ **=** 0.3951 $\mathbf{D_{100}}$ **=** 0.3940 $\mathbf{C_v}$ **at 15.97 min. =** 42.48 $cm.^2$/day

Pressure: 100.0 kPa	TEST READINGS	Load No. 9

No.	Clock Time	Dial Reading	No.	Clock Time	Dial Reading
1	+1 22:00:15	0.39180	11	+1 22:45:00	0.37620
2	+1 22:00:30	0.39140	12	+1 23:00:00	0.37560
3	+1 22:01:00	0.38980			
4	+1 22:02:00	0.38800			
5	+1 22:04:00	0.38560			
6	+1 22:06:00	0.38380			
7	+1 22:08:00	0.38240			
8	+1 22:10:00	0.38160			
9	+1 22:15:00	0.38020			
10	+1 22:30:00	0.37720			

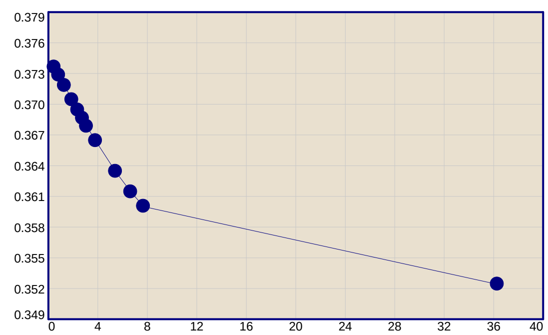


Void Ratio = 0.931 **Compression =** 19.9%

D_0 = 0.3937 D_{90} = 0.3815 D_{100} = 0.3801 C_v **at 10.12 min. =** 68.45 cm.^{2}/day

Pressure: 50.0 kPa	TEST READINGS	Load No. 10

No.	Clock Time	Dial Reading	No.	Clock Time	Dial Reading
1	+1 23:00:15	0.37420	11	+1 23:45:00	0.36140
2	+1 23:00:30	0.37360	12	+2 00:00:00	0.36000
3	+1 23:01:00	0.37280	13	+2 21:00:00	0.35240
4	+1 23:02:00	0.37180			
5	+1 23:04:00	0.37040			
6	+1 23:06:00	0.36940			
7	+1 23:08:00	0.36860			
8	+1 23:10:00	0.36780			
9	+1 23:15:00	0.36640			
10	+1 23:30:00	0.36340			

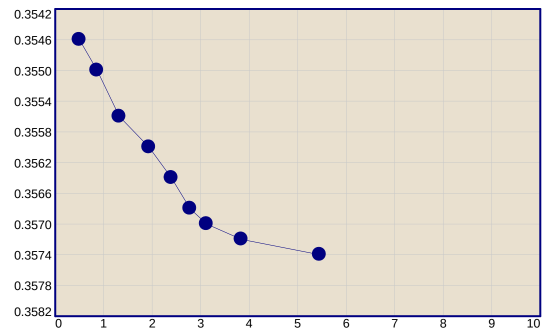


Void Ratio = 0.960 **Compression =** 18.6%

D_0 = 0.3749 D_{90} = 0.3622 D_{100} = 0.3608 C_v **at 38.37 min. =** 18.55 cm.^{2}/day

Pressure: 100.0 kPa	TEST READINGS	Load No. 11

No.	Clock Time	Dial Reading
1	+2 21:00:15	0.35420
2	+2 21:00:30	0.35460
3	+2 21:01:00	0.35500
4	+2 21:02:00	0.35560
5	+2 21:04:00	0.35600
6	+2 21:06:00	0.35640
7	+2 21:08:00	0.35680
8	+2 21:10:00	0.35700
9	+2 21:15:00	0.35720
10	+2 21:30:00	0.35740

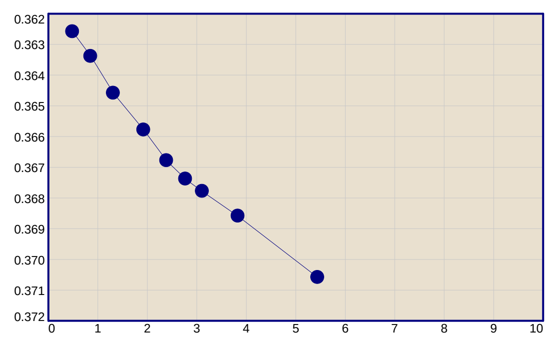


Void Ratio = 0.954 **Compression =** 18.9%

D_0 = 0.3540 D_{90} = 0.3560 D_{100} = 0.3562 C_V **at 3.49 min. =** 205.68 $cm.^2$/day

Pressure: 200.0 kPa	TEST READINGS	Load No. 12

No.	Clock Time	Dial Reading
1	+2 21:30:15	0.35880
2	+2 21:30:30	0.36260
3	+2 21:31:00	0.36340
4	+2 21:32:00	0.36460
5	+2 21:34:00	0.36580
6	+2 21:36:00	0.36680
7	+2 21:38:00	0.36740
8	+2 21:40:00	0.36780
9	+2 21:45:00	0.36860
10	+2 22:00:00	0.37060

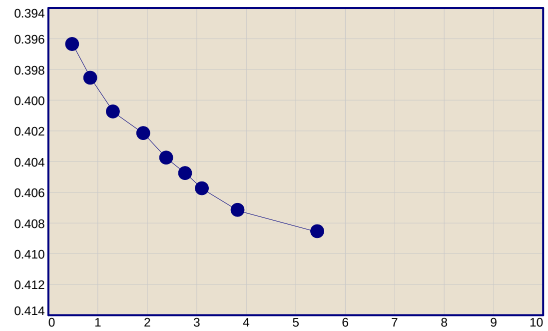


Void Ratio = 0.937 **Compression =** 19.6%

D_0 = 0.3608 D_{90} = 0.3649 D_{100} = 0.3654 C_V **at 2.20 min. =** 323.35 $cm.^2$/day

Pressure: 400.0 kPa	TEST READINGS	Load No. 13

No.	Clock Time	Dial Reading
1	+2 22:00:15	0.37060
2	+2 22:00:30	0.39640
3	+2 22:01:00	0.39860
4	+2 22:02:00	0.40080
5	+2 22:04:00	0.40220
6	+2 22:06:00	0.40380
7	+2 22:08:00	0.40480
8	+2 22:10:00	0.40580
9	+2 22:15:00	0.40720
10	+2 22:30:00	0.40860

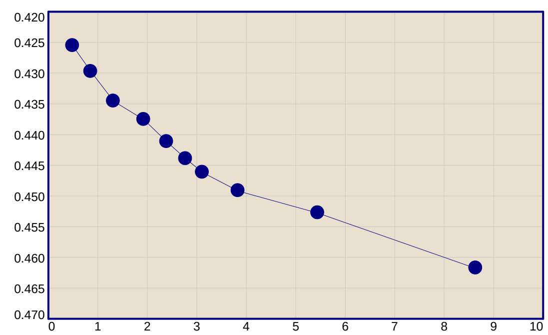


Void Ratio = 0.889 **Compression =** 21.6%

D_0 = 0.3933 **D_{90} =** 0.4014 **D_{100} =** 0.4022 **C_v at 2.45 min. =** 279.98 cm.^{2}/day

Pressure: 800.0 kPa	TEST READINGS	Load No. 14

No.	Clock Time	Dial Reading	No.	Clock Time	Dial Reading
1	+2 22:30:15	0.42080	11	+2 23:45:00	0.46180
2	+2 22:30:30	0.42560			
3	+2 22:31:00	0.42980			
4	+2 22:32:00	0.43460			
5	+2 22:34:00	0.43760			
6	+2 22:36:00	0.44120			
7	+2 22:38:00	0.44400			
8	+2 22:40:00	0.44620			
9	+2 22:45:00	0.44920			
10	+2 23:00:00	0.45280			

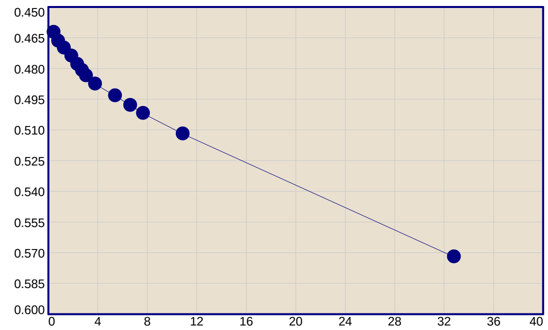


Void Ratio = 0.821 **Compression =** 24.4%

D_0 = 0.4198 **D_{90} =** 0.4369 **D_{100} =** 0.4388 **C_v at 3.23 min. =** 198.18 cm.^{2}/day

Pressure: 1600.0 kPa			TEST READINGS			Load No. 15

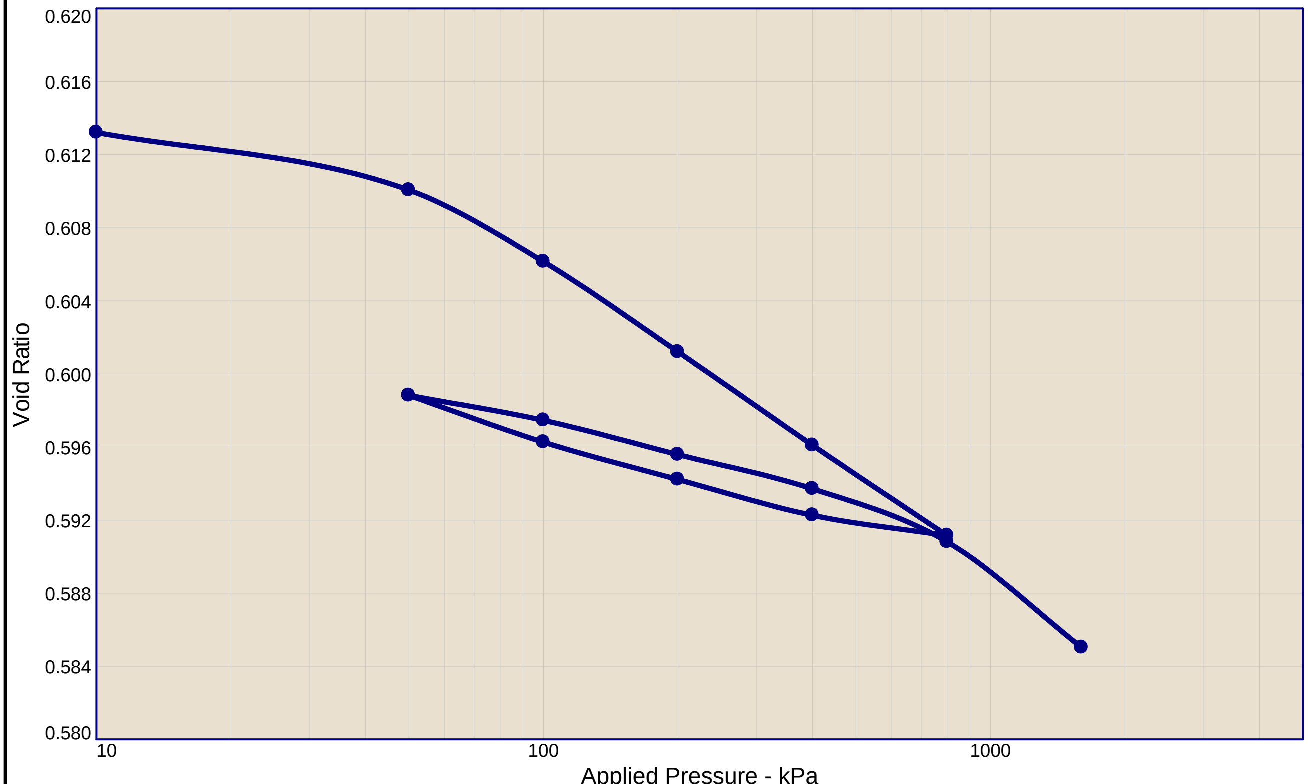
No.	Clock Time	Dial Reading	No.	Clock Time	Dial Reading
1	+3 00:00:15	0.46180	11	+3 00:45:00	0.49820
2	+3 00:00:30	0.46260	12	+3 01:00:00	0.50220
3	+3 00:01:00	0.46680	13	+3 02:00:00	0.51220
4	+3 00:02:00	0.47020	14	+3 18:00:00	0.57220
5	+3 00:04:00	0.47420			
6	+3 00:06:00	0.47820			
7	+3 00:08:00	0.48120			
8	+3 00:10:00	0.48380			
9	+3 00:15:00	0.48780			
10	+3 00:30:00	0.49360			



Void Ratio = 0.680 **Compression =** 30.3%

D_0 = 0.4585 **D_{90} =** 0.4923 **D_{100} =** 0.4961 **C_V at 25.95 min. =** 22.18 cm.^{2}/day

CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation											
No.	Load (kPa)	C_v (cm.^{2}/day)	C_α	No.	Load (kPa)	C_v (cm.^{2}/day)	C_α	No.	Load (kPa)	C_v (cm.^{2}/day)	C_α
1	10.0	54.68		8	200.0	168.39		15	1600.0	100.13	
2	50.0	36.85		9	100.0	91.55					
3	100.0	923.74		10	50.0	371.84					
4	200.0	16.46		11	100.0	40.94					
5	400.0	255.14		12	200.0	28.93					
6	800.0	53.95		13	400.0	11.68					
7	400.0	37.14		14	800.0	37.97					

Natural		Dry Dens. (kg/m3)	LL	PI	Sp. Gr.	Overburden (kPa)	P_c (kPa)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
89.6 %	20.3 %	1683	25.3	4.7	2.72	85	116	0.02	0.01	0.617

MATERIAL DESCRIPTION	USCS	AASHTO
CLAYEY SILT grey wet	CL-ML	

Project No. CA19009.24.03 **Client:** PECG
Project: PECG Project No. 2304202 Lab Testing

Location: NT101 **Depth:** 15'-17'6" **Sample Number:** NT101

Terrapex

Toronto, Ontario

Remarks:
Tested on 17 July 2024
Sp. Gravity 2.72 (assumed)

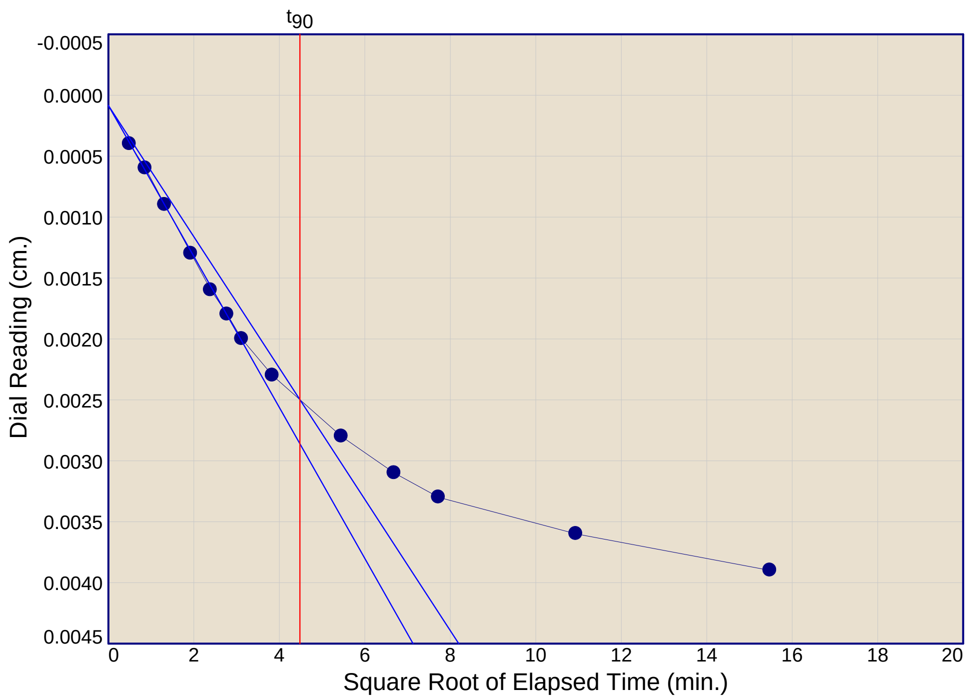
Figure

Tested By: John Ramachandran **Checked By:** Demetra Matthews

Dial Reading vs. Time

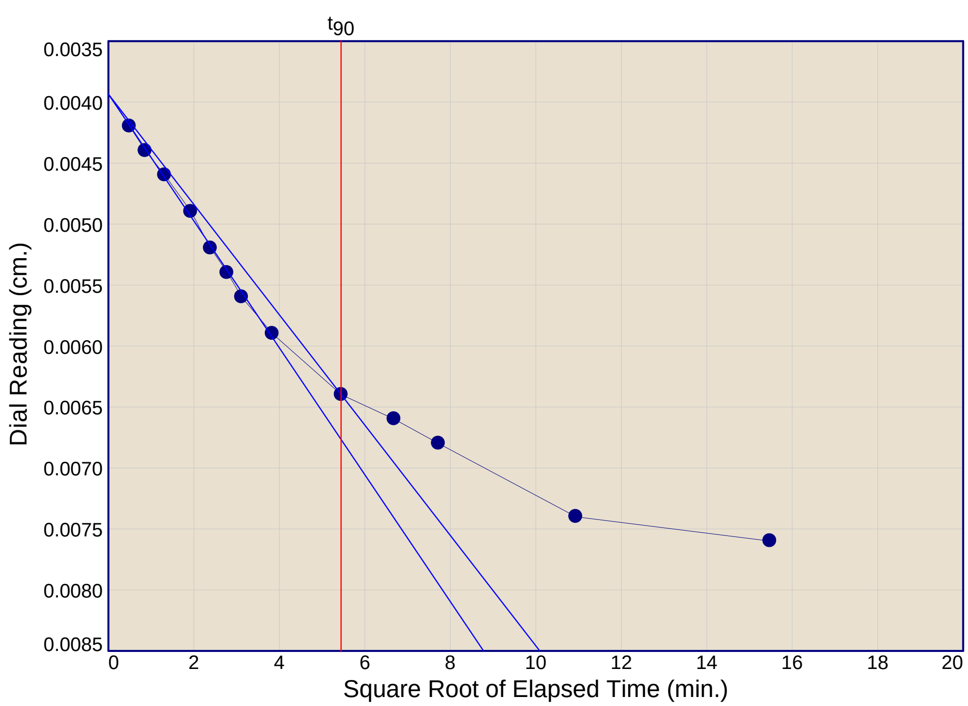
Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT101 Depth: 15'-17'6" Sample Number: NT101



Load No.= 1
Load= 10.0 kPa
D_0 = 0.0001
D_{90} = 0.0025
D_{100} = 0.0028
T_{90} = 20.07 min.

C_v @ T_{90}
54.68 $cm.^2$/day



Load No.= 2
Load= 50.0 kPa
D_0 = 0.0039
D_{90} = 0.0064
D_{100} = 0.0067
T_{90} = 29.66 min.

C_v @ T_{90}
36.85 $cm.^2$/day

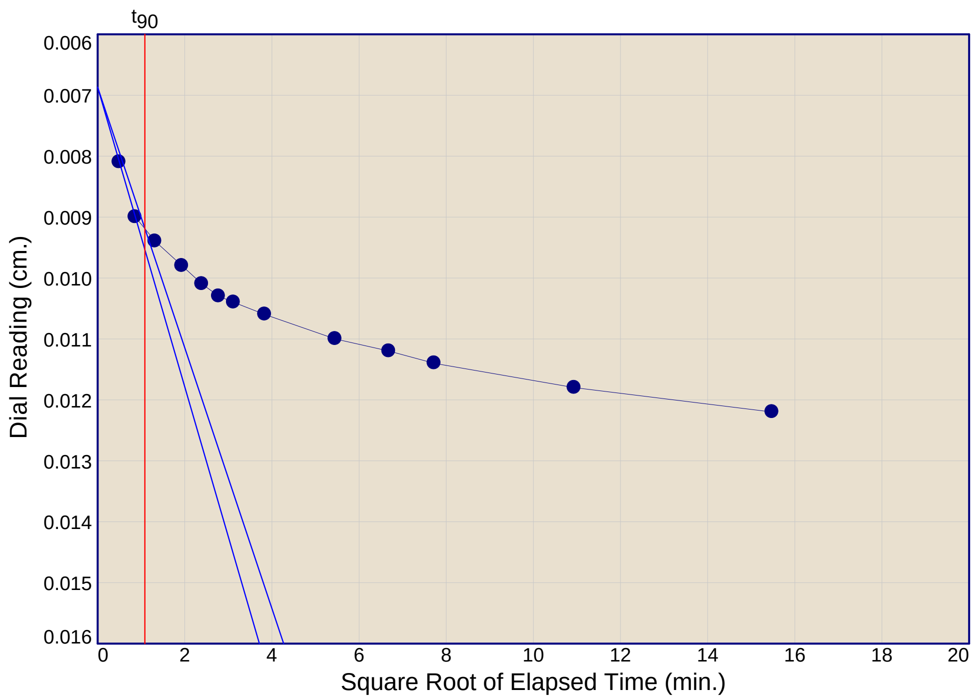
Figure

Terrapex

Dial Reading vs. Time

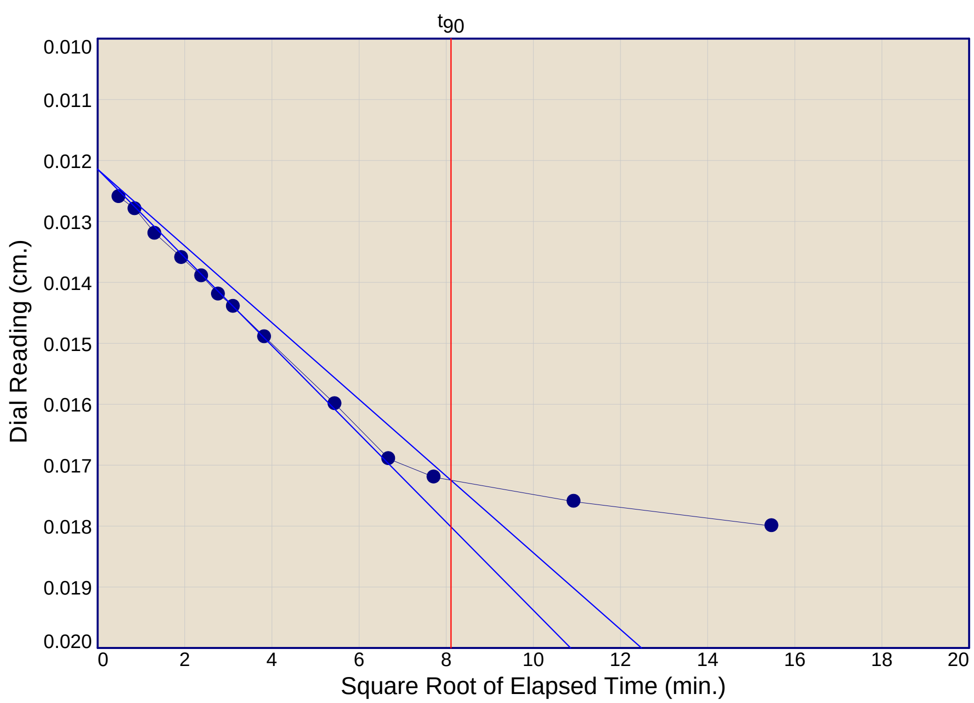
Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT101 Depth: 15'-17'6" Sample Number: NT101



Load No.= 3
Load= 100.0 kPa
D_0 = 0.0069
D_{90} = 0.0092
D_{100} = 0.0094
T_{90} = 1.18 min.

C_v @ T_{90}
923.74 cm.^{2}/day



Load No.= 4
Load= 200.0 kPa
D_0 = 0.0121
D_{90} = 0.0172
D_{100} = 0.0178
T_{90} = 65.76 min.

C_v @ T_{90}
16.46 cm.^{2}/day

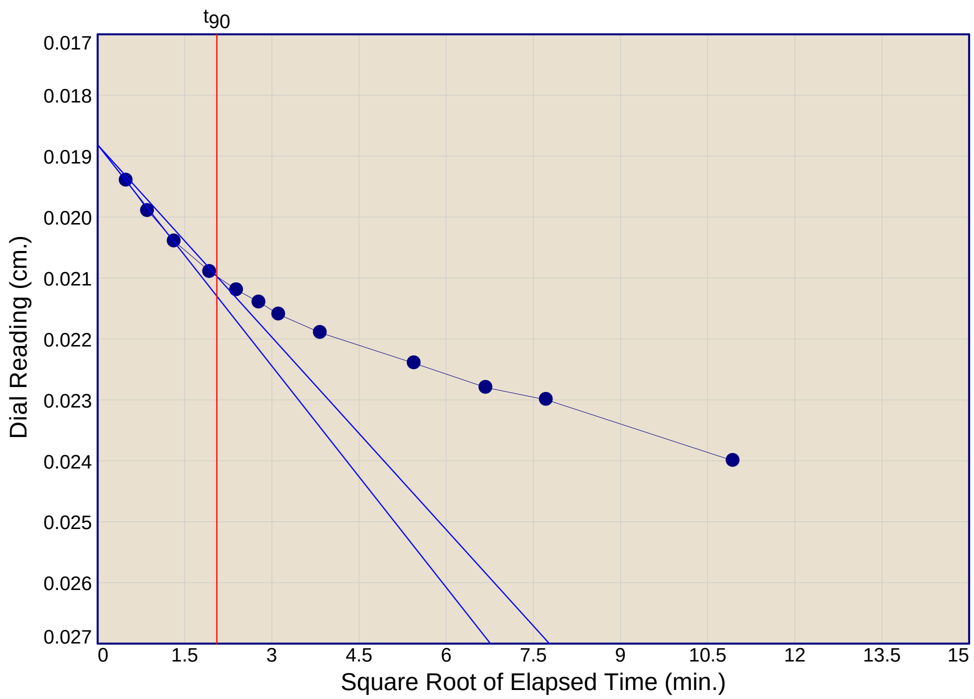
Figure

Terrapex

Dial Reading vs. Time

Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT101 Depth: 15'-17'6" Sample Number: NT101



Load No.= 5

Load= 400.0 kPa

D_0 = 0.0188

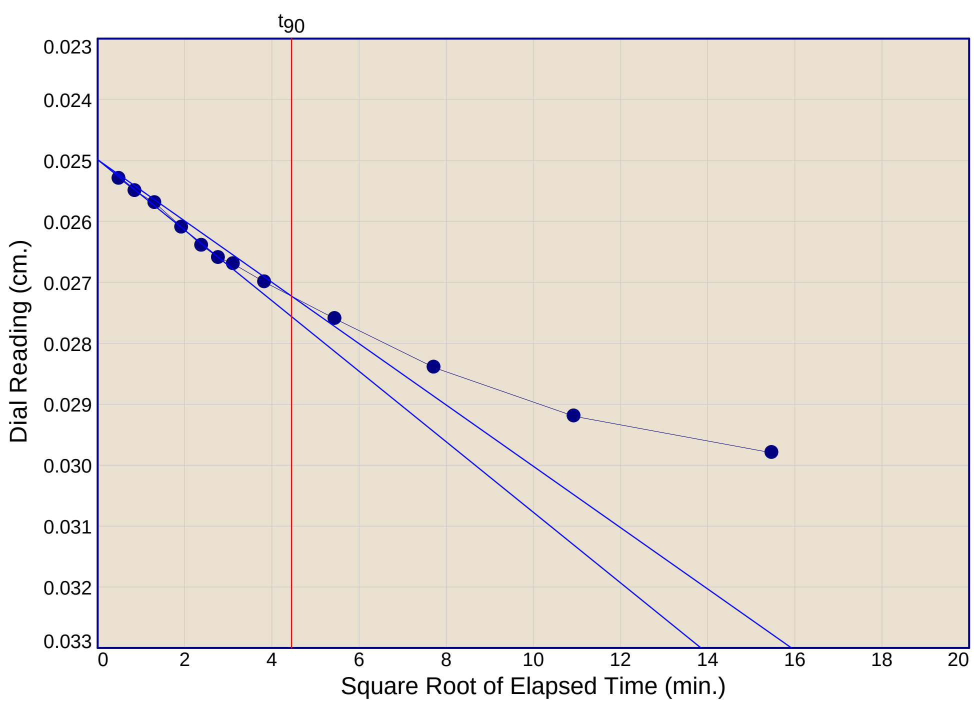
D_{90} = 0.0210

D_{100} = 0.0212

T_{90} = 4.21 min.

C_v @ T_{90}

255.14 cm.^{2}/day



Load No.= 6

Load= 800.0 kPa

D_0 = 0.0250

D_{90} = 0.0272

D_{100} = 0.0275

T_{90} = 19.81 min.

C_v @ T_{90}

53.95 cm.^{2}/day

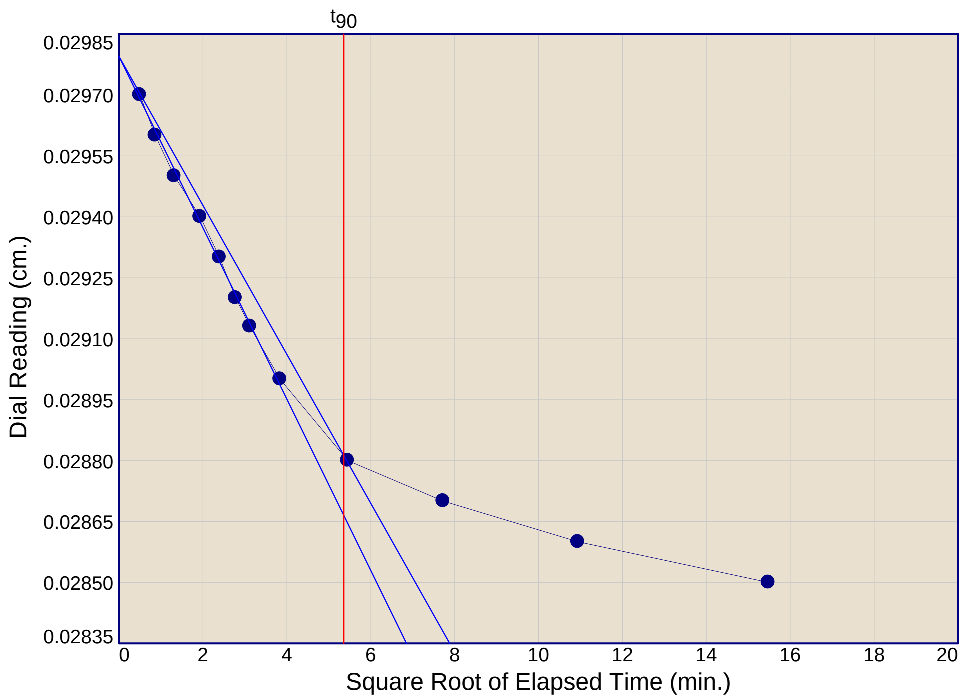
Figure

Terrapex

Dial Reading vs. Time

Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT101 Depth: 15'-17'6" Sample Number: NT101



Load No.= 7

Load= 400.0 kPa

D_0 = 0.0298

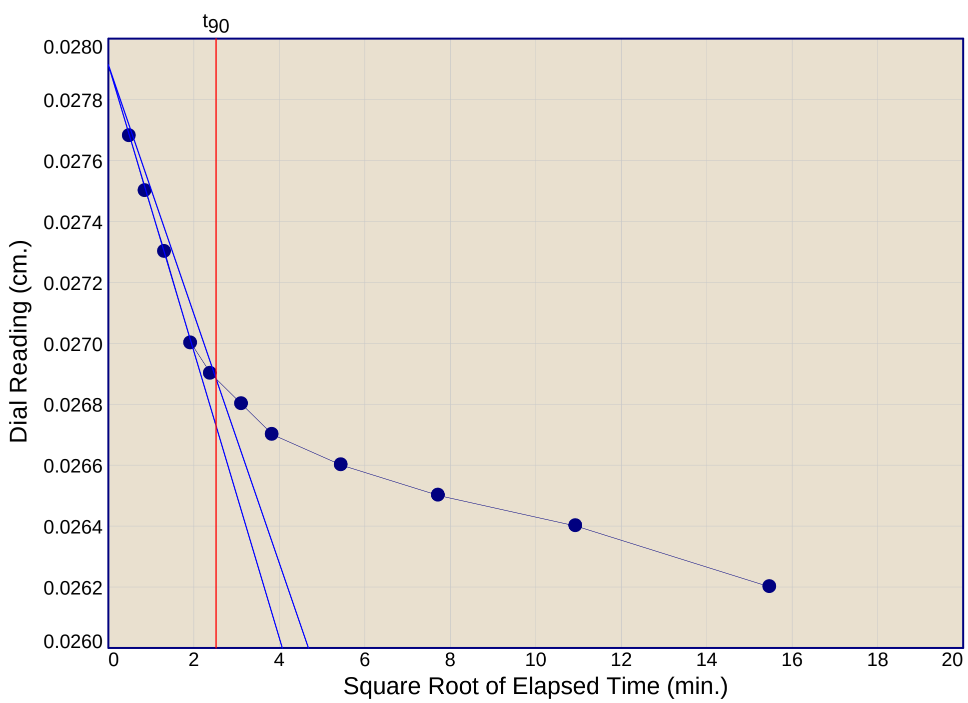
D_{90} = 0.0288

D_{100} = 0.0287

T_{90} = 28.71 min.

C_v @ T_{90}

37.14 cm.^{2}/day



Load No.= 8

Load= 200.0 kPa

D_0 = 0.0279

D_{90} = 0.0269

D_{100} = 0.0268

T_{90} = 6.35 min.

C_v @ T_{90}

168.39 cm.^{2}/day

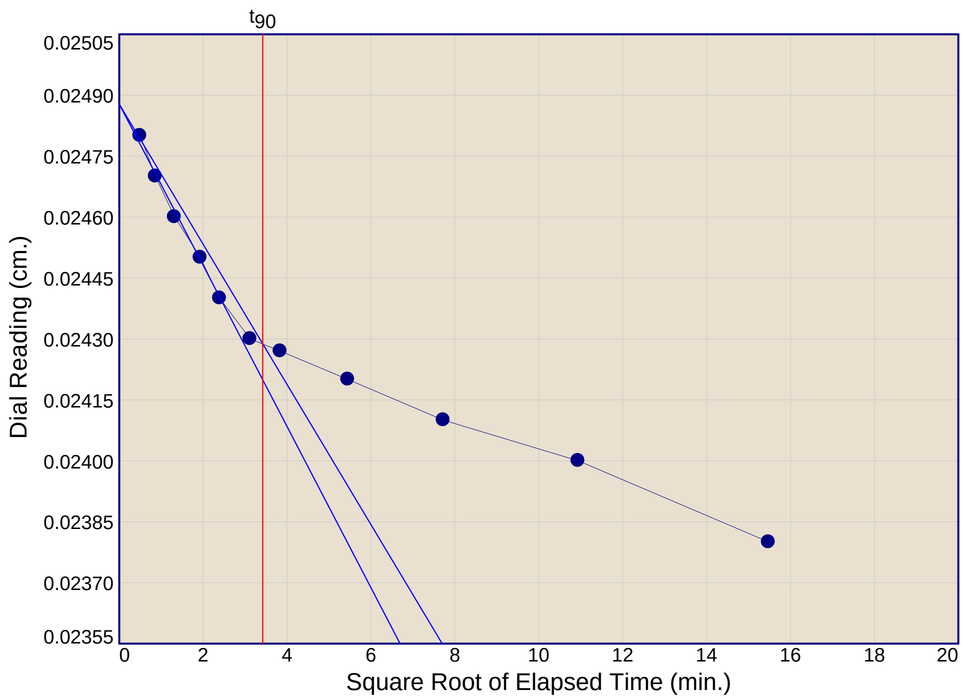
Figure

Terrapex

Dial Reading vs. Time

Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT101 Depth: 15'-17'6" Sample Number: NT101



Load No.= 9

Load= 100.0 kPa

D_0 = 0.0249

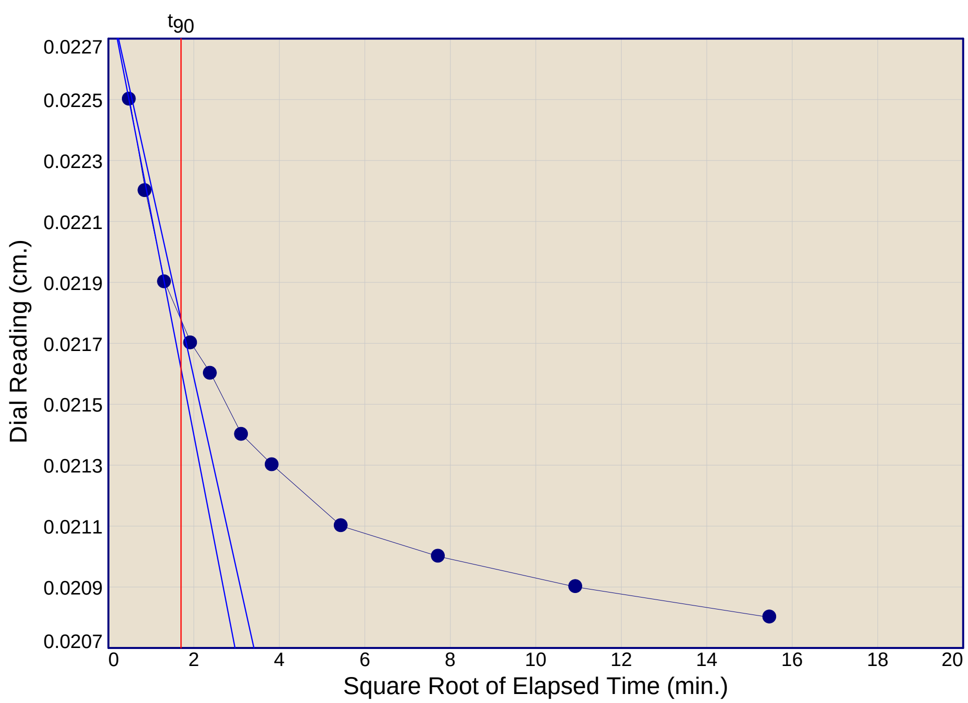
D_{90} = 0.0243

D_{100} = 0.0242

T_{90} = 11.71 min.

C_v @ T_{90}

91.55 cm.^{2}/day



Load No.= 10

Load= 50.0 kPa

D_0 = 0.0229

D_{90} = 0.0218

D_{100} = 0.0217

T_{90} = 2.89 min.

C_v @ T_{90}

371.84 cm.^{2}/day

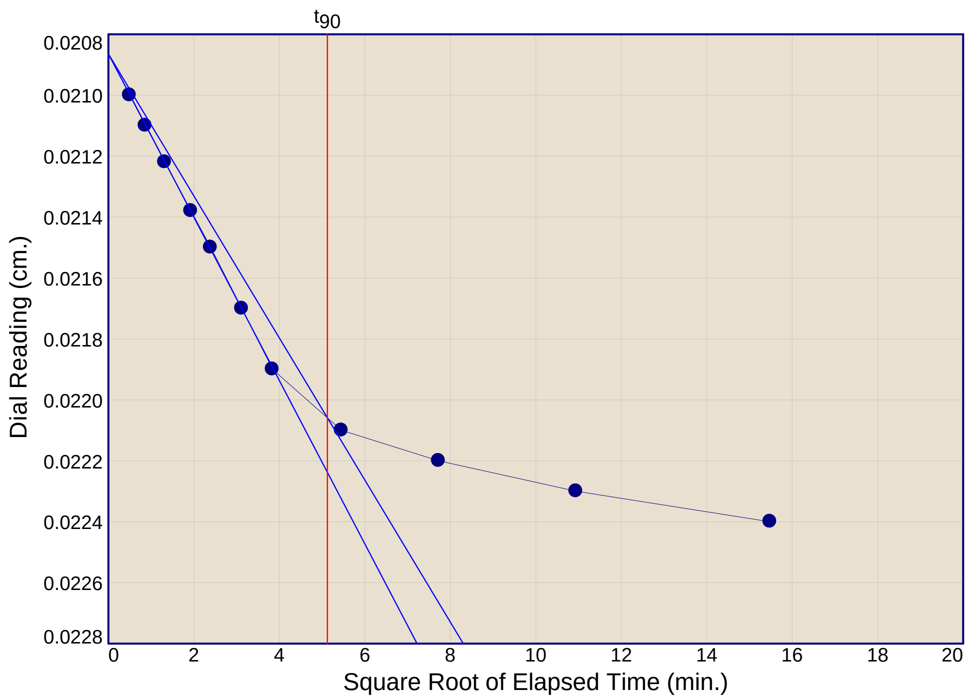
Figure

Terrapex

Dial Reading vs. Time

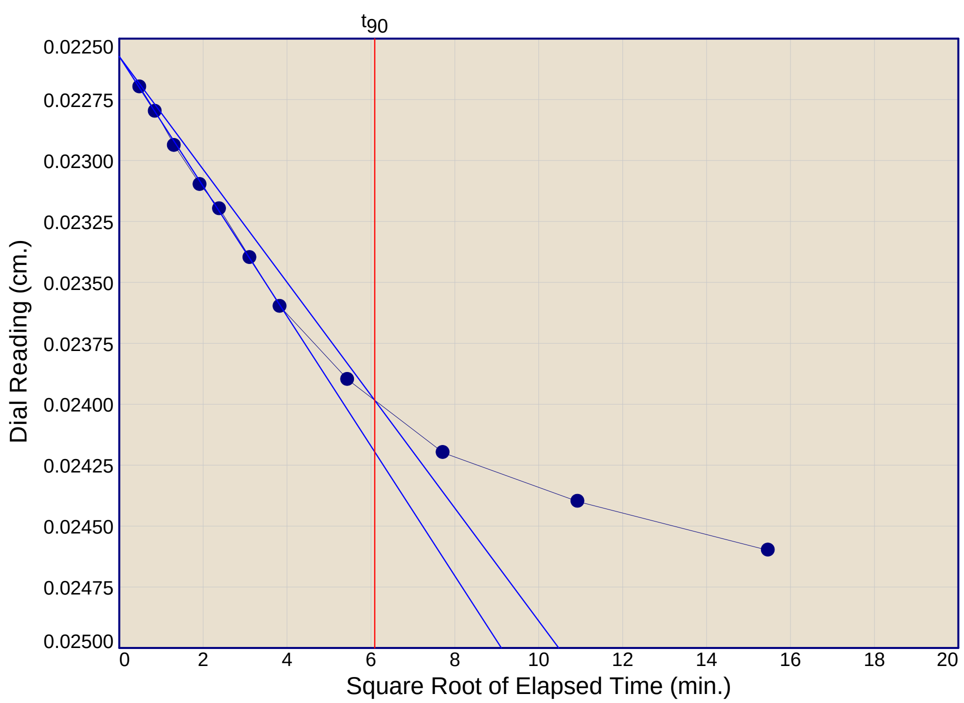
Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT101 Depth: 15'-17'6" Sample Number: NT101



Load No.= 11
Load= 100.0 kPa
D_0 = 0.0209
D_{90} = 0.0221
D_{100} = 0.0222
T_{90} = 26.25 min.

C_v @ T_{90}
40.94 cm.^{2}/day



Load No.= 12
Load= 200.0 kPa
D_0 = 0.0226
D_{90} = 0.0240
D_{100} = 0.0241
T_{90} = 37.08 min.

C_v @ T_{90}
28.93 cm.^{2}/day

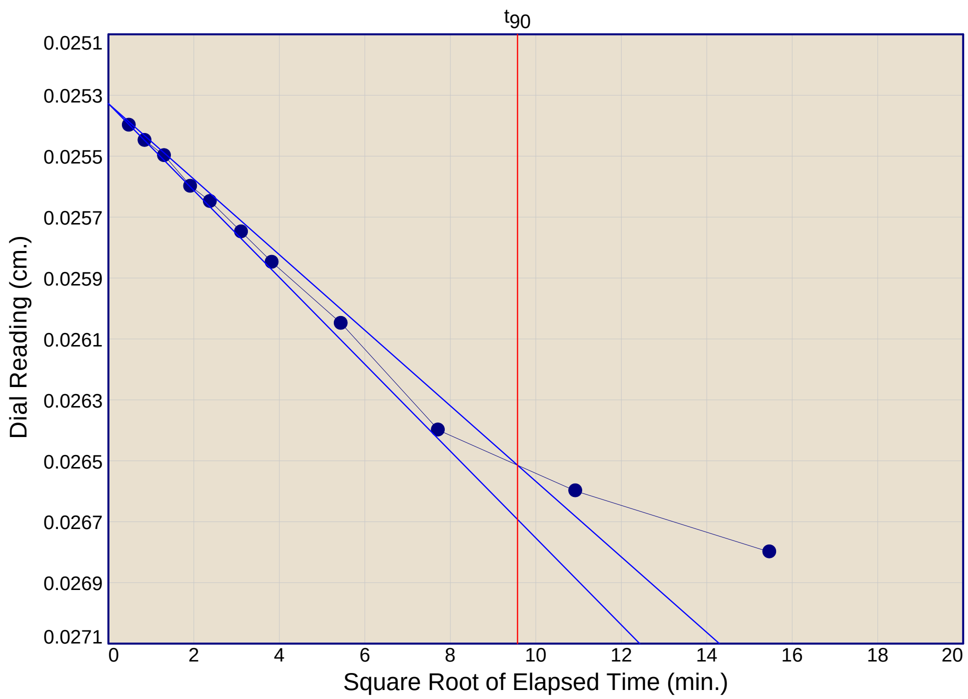
Figure

Terrapex

Dial Reading vs. Time

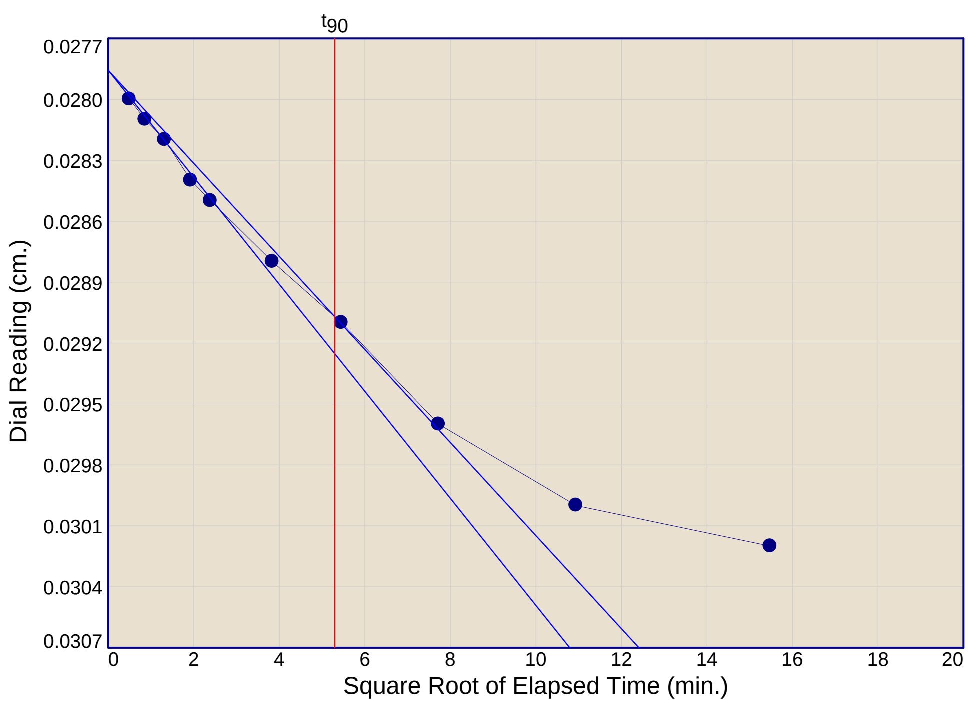
Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT101 Depth: 15'-17'6" Sample Number: NT101



Load No.= 13
Load= 400.0 kPa
D_0 = 0.0253
D_{90} = 0.0265
D_{100} = 0.0266
T_{90} = 91.63 min.

C_v @ T_{90}
11.68 cm.^{2}/day



Load No.= 14
Load= 800.0 kPa
D_0 = 0.0279
D_{90} = 0.0291
D_{100} = 0.0292
T_{90} = 28.08 min.

C_v @ T_{90}
37.97 cm.^{2}/day

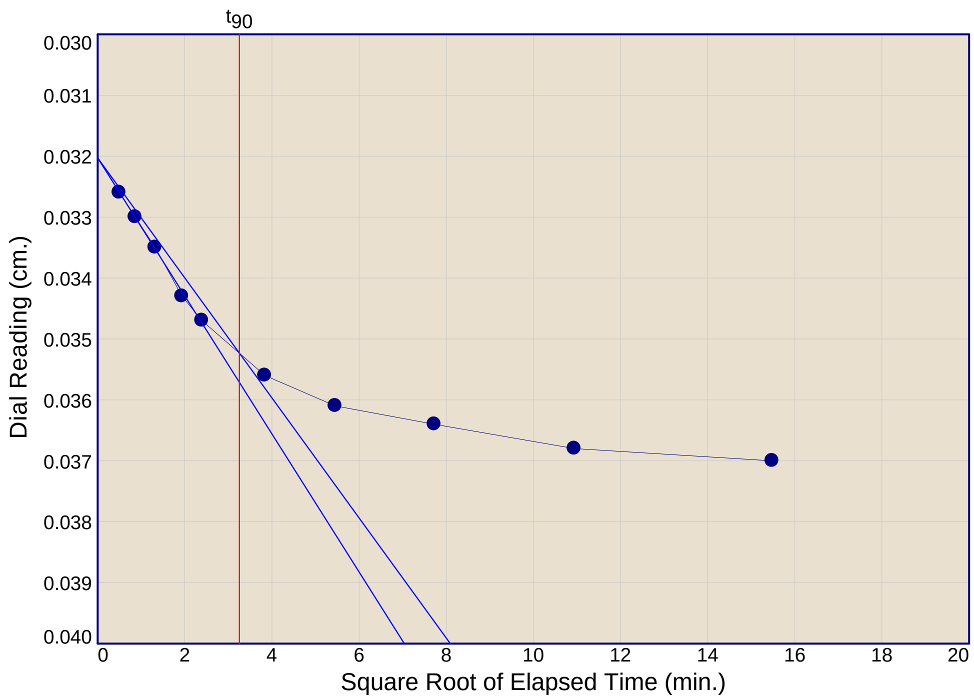
Figure

Terrapex

Dial Reading vs. Time

Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT101 Depth: 15'-17'6" Sample Number: NT101



Load No.= 15

Load= 1600.0 kPa

D_0 = 0.0320

D_{90} = 0.0352

D_{100} = 0.0356

T_{90} = 10.59 min.

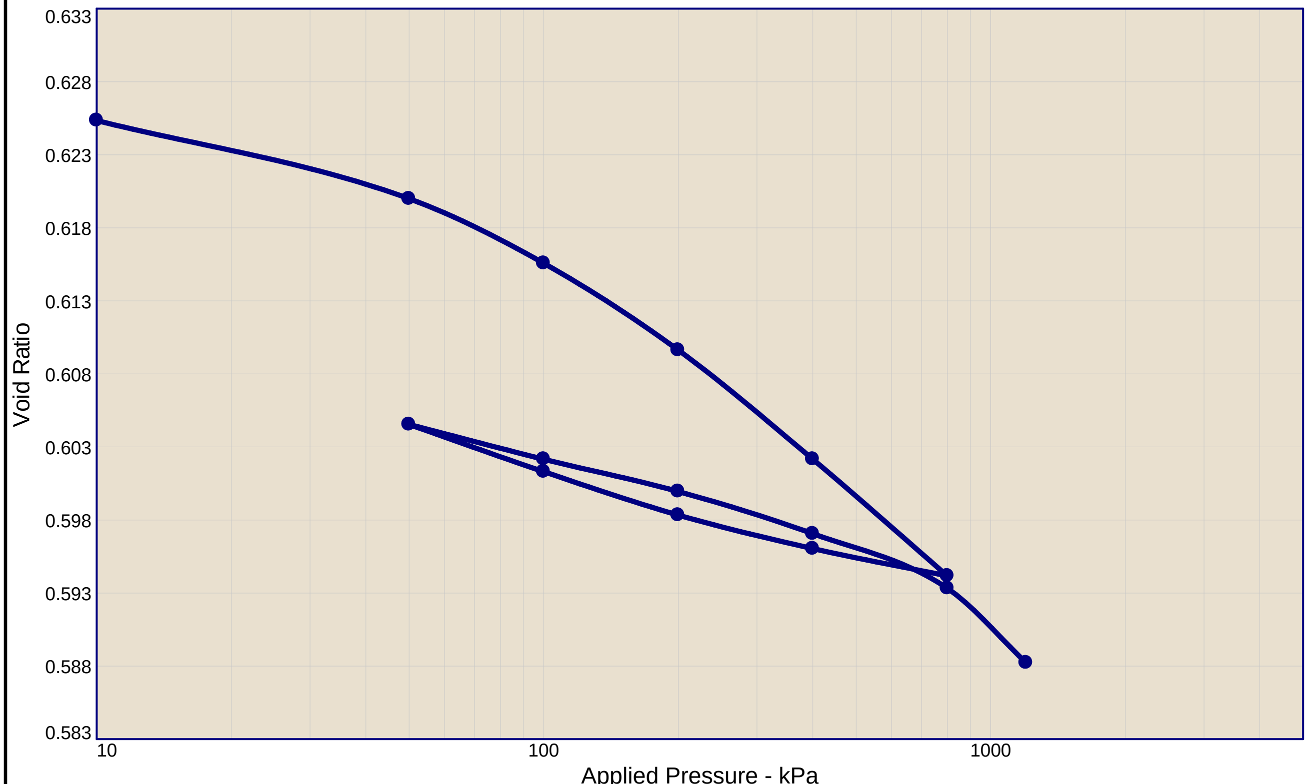
C_v @ T_{90}

100.13 cm.^{2}/day

Figure

Terrapex

CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation

No.	Load (kPa)	C_v (cm.²/day)	C_α	No.	Load (kPa)	C_v (cm.²/day)	C_α	No.	Load (kPa)	C_v (cm.²/day)	C_α
1	10.0	122.05		8	200.0	63.54		15	1200.0	111.73	
2	50.0	938.70		9	100.0	22.50					
3	100.0	170.67		10	50.0	16.43					
4	200.0	53.51		11	100.0	29.86					
5	400.0	25.57		12	200.0	39.23					
6	800.0	411.46		13	400.0	335.49					
7	400.0	102.98		14	800.0	34.53					

Natural Saturation	Natural Moisture	Dry Dens. (kg/m3)	LL	PI	Sp. Gr.	Overburden (kPa)	P_c (kPa)	C_c	C_r	Initial Void Ratio
102.5 %	23.6 %	1672	23.7	4.4	2.72	115	128	0.03	0.01	0.626

MATERIAL DESCRIPTION	USCS	AASHTO
CLAYEY SILT grey wet	CL-ML	

Project No. CA19009.24.03 **Client:** PECG

Project: PECG Project No. 2304202 Lab Testing

Location: NT102 **Depth:** 20'-22' **Sample Number:** NT102

Terrapex

Toronto, Ontario

Remarks:
Tested 25 July 2024
Sp. Gravity 2.72 (assumed)

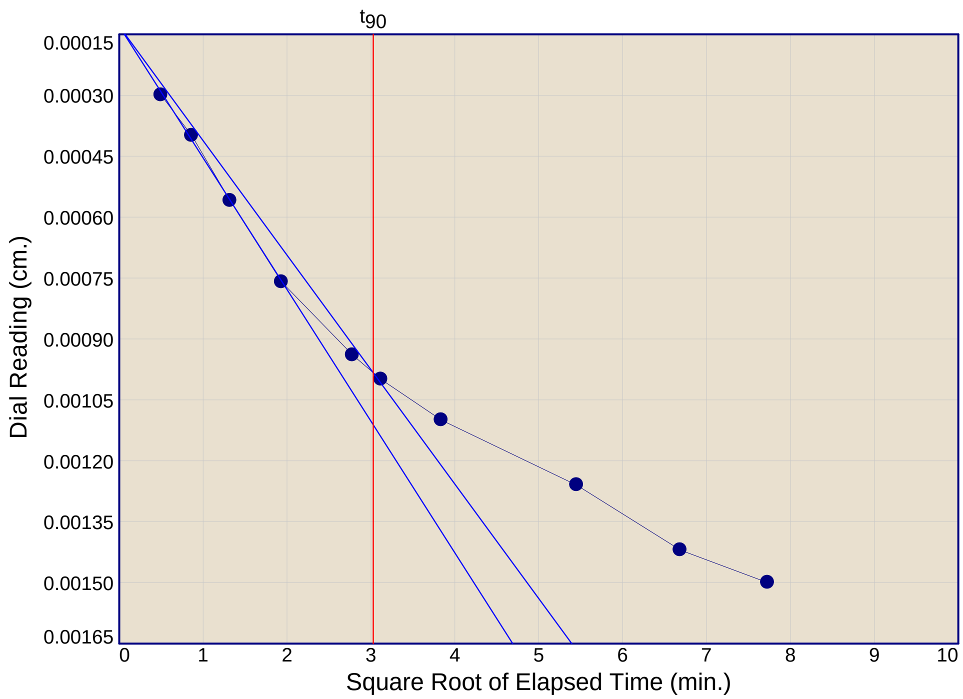
Figure

Tested By: John Ramachandran **Checked By:** Demetra Matthews

Dial Reading vs. Time

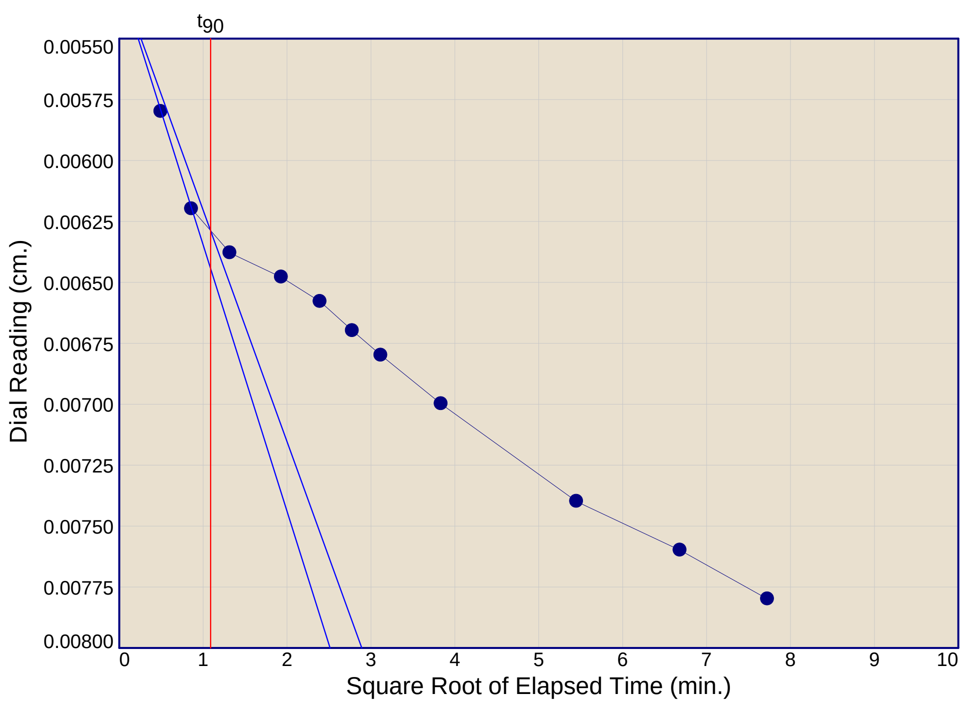
Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT102 Depth: 20'-22' Sample Number: NT102



Load No.= 1
Load= 10.0 kPa
D_0 = 0.0001
D_{90} = 0.0010
D_{100} = 0.0011
T_{90} = 9.17 min.

C_v @ T_{90}
122.05 cm.^{2}/day



Load No.= 2
Load= 50.0 kPa
D_0 = 0.0053
D_{90} = 0.0063
D_{100} = 0.0064
T_{90} = 1.19 min.

C_v @ T_{90}
938.70 cm.^{2}/day

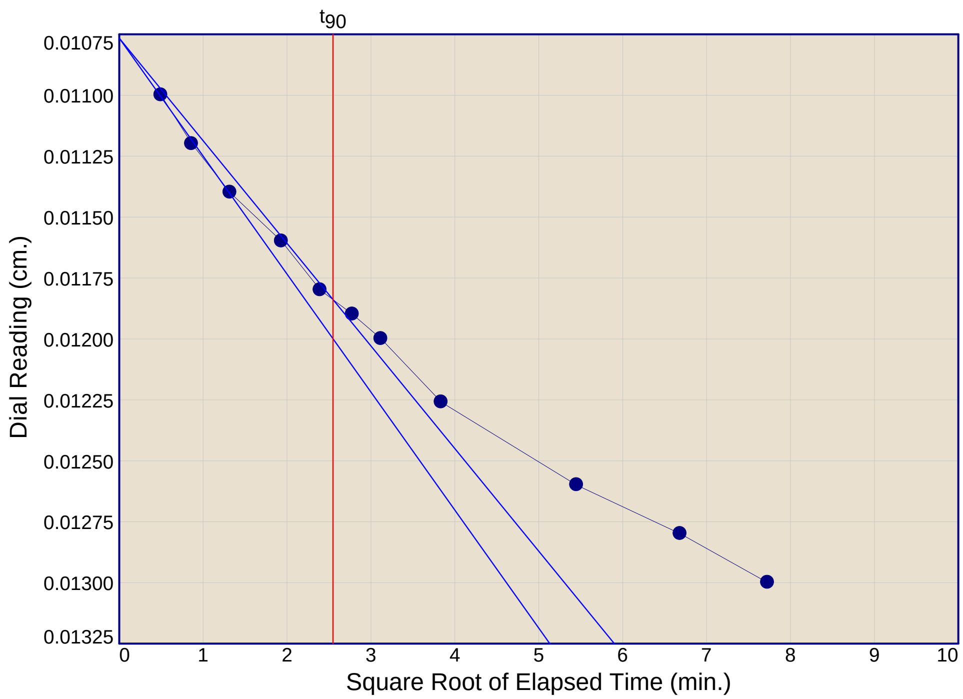
Figure

Terrapex

Dial Reading vs. Time

Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT102 Depth: 20'-22' Sample Number: NT102



Load No.= 3

Load= 100.0 kPa

D_0 = 0.0108

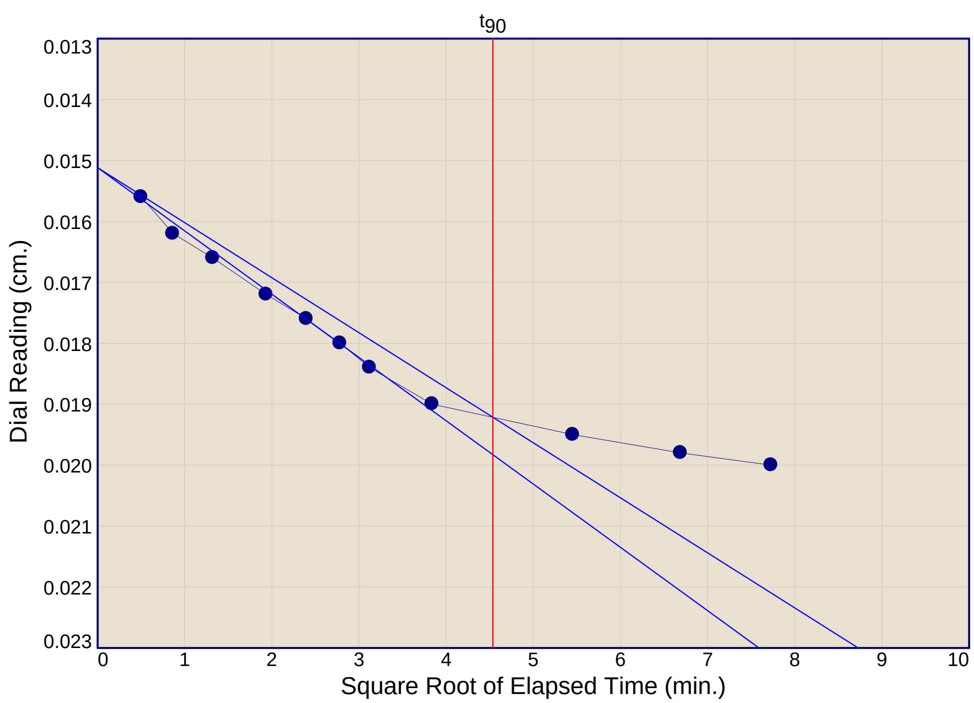
D_{90} = 0.0118

D_{100} = 0.0120

T_{90} = 6.49 min.

C_v @ T_{90}

170.67 cm.^{2}/day



Load No.= 4

Load= 200.0 kPa

D_0 = 0.0151

D_{90} = 0.0192

D_{100} = 0.0197

T_{90} = 20.57 min.

C_v @ T_{90}

53.51 cm.^{2}/day

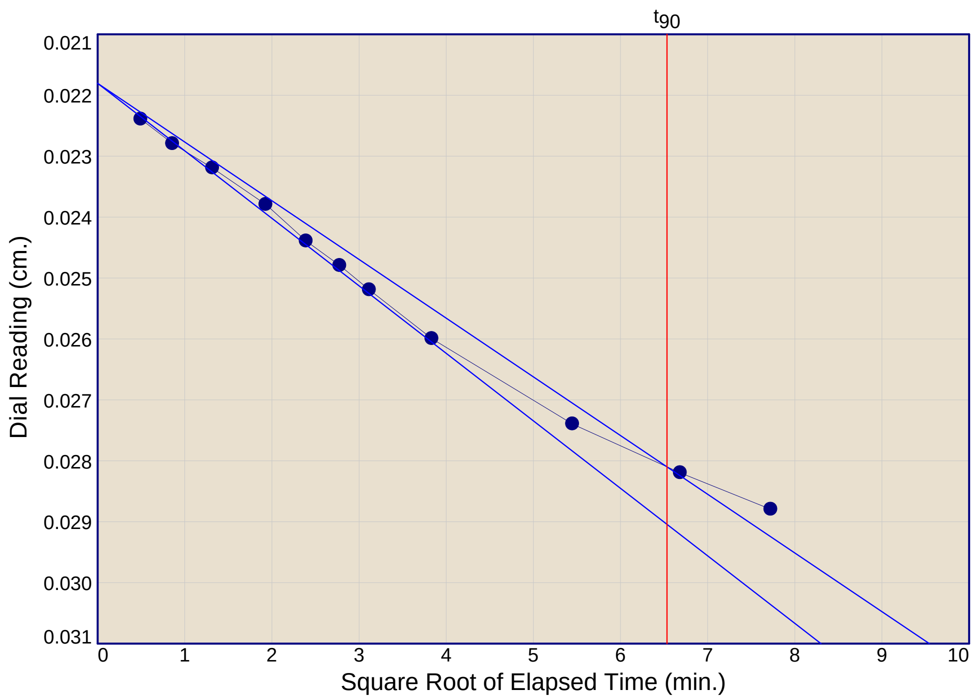
Figure

Terrapex

Dial Reading vs. Time

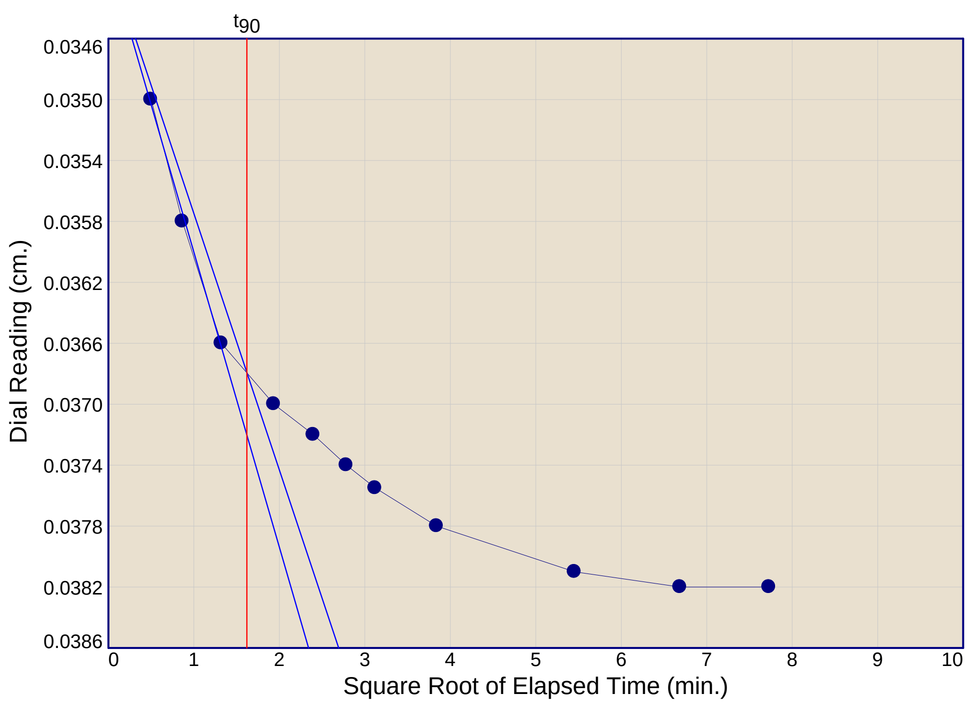
Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT102 Depth: 20'-22' Sample Number: NT102



Load No.= 5
Load= 400.0 kPa
D_0 = 0.0218
D_{90} = 0.0281
D_{100} = 0.0288
T_{90} = 42.68 min.

C_v @ T_{90}
25.57 cm.^{2}/day



Load No.= 6
Load= 800.0 kPa
D_0 = 0.0341
D_{90} = 0.0368
D_{100} = 0.0371
T_{90} = 2.63 min.

C_v @ T_{90}
411.46 cm.^{2}/day

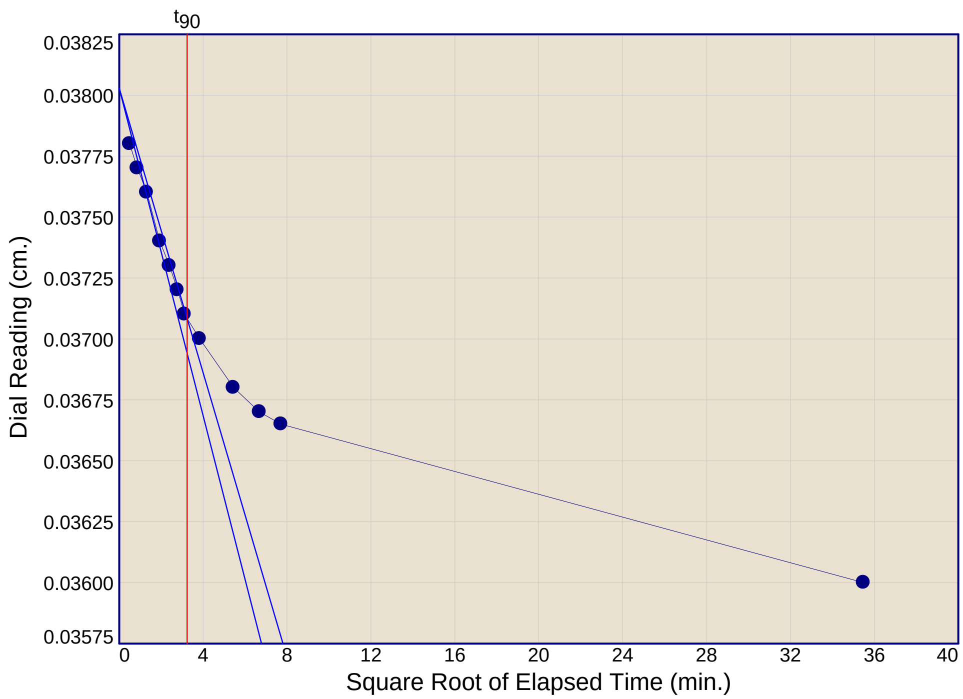
Figure

Terrapex

Dial Reading vs. Time

Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT102 Depth: 20'-22' Sample Number: NT102



Load No.= 7

Load= 400.0 kPa

D_0 = 0.0380

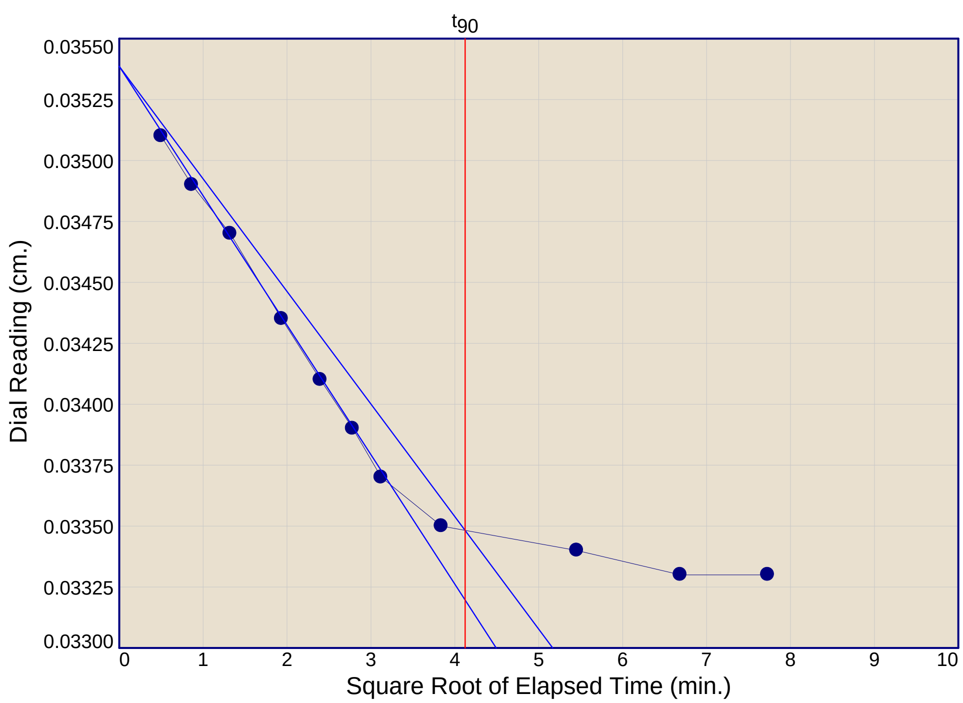
D_{90} = 0.0371

D_{100} = 0.0370

T_{90} = 10.46 min.

C_v @ T_{90}

102.98 cm.^{2}/day



Load No.= 8

Load= 200.0 kPa

D_0 = 0.0354

D_{90} = 0.0335

D_{100} = 0.0333

T_{90} = 16.99 min.

C_v @ T_{90}

63.54 cm.^{2}/day

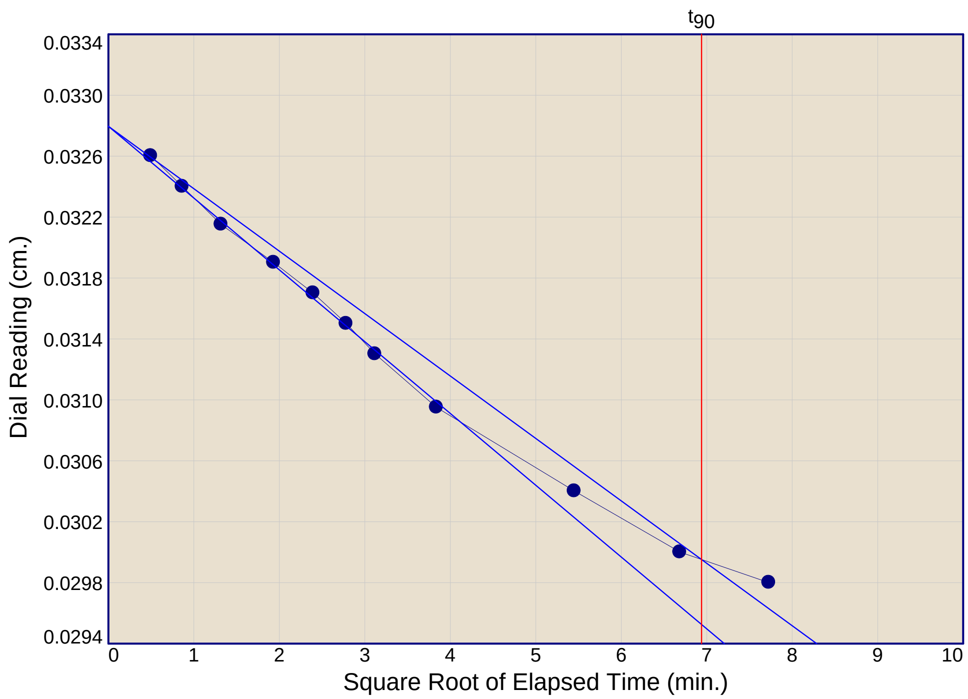
Figure

Terrapex

Dial Reading vs. Time

Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT102 Depth: 20'-22' Sample Number: NT102



Load No.= 9

Load= 100.0 kPa

D_0 = 0.0328

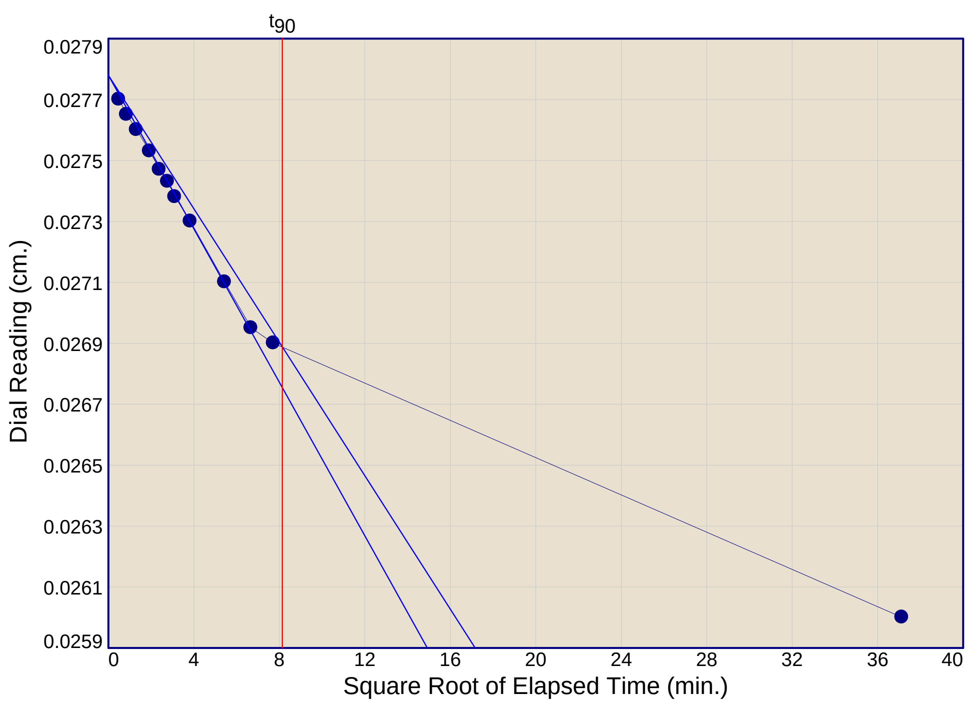
D_{90} = 0.0300

D_{100} = 0.0296

T_{90} = 48.15 min.

C_v @ T_{90}

22.50 cm.^{2}/day



Load No.= 10

Load= 50.0 kPa

D_0 = 0.0278

D_{90} = 0.0269

D_{100} = 0.0268

T_{90} = 66.27 min.

C_v @ T_{90}

16.43 cm.^{2}/day

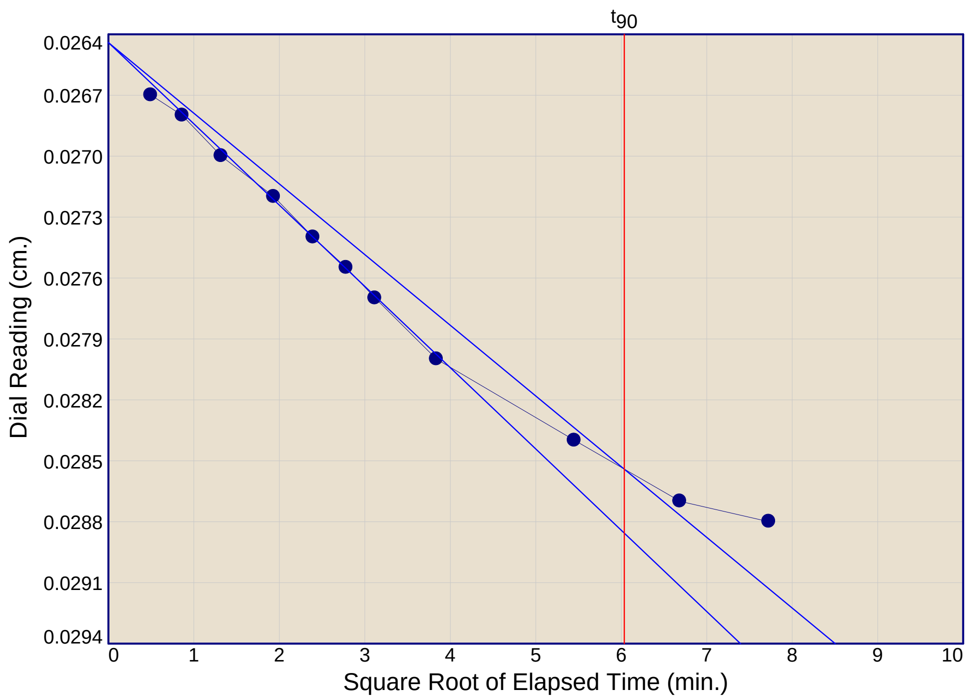
Figure

Terrapex

Dial Reading vs. Time

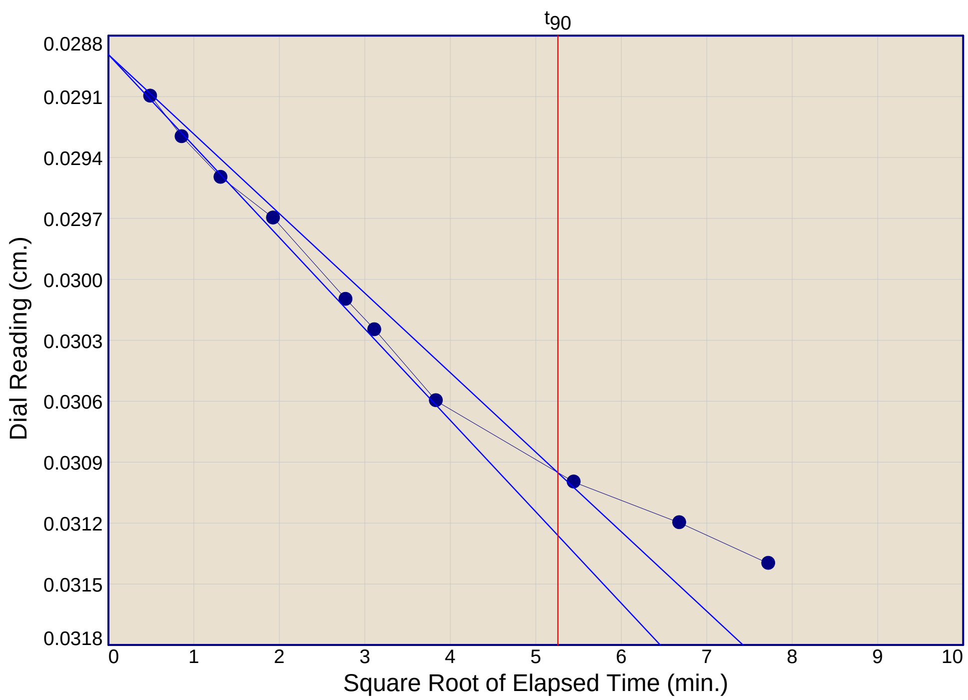
Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT102 Depth: 20'-22' Sample Number: NT102



Load No.= 11
Load= 100.0 kPa
D_0 = 0.0264
D_{90} = 0.0285
D_{100} = 0.0288
T_{90} = 36.43 min.

C_V @ T_{90}
29.86 cm.^{2}/day



Load No.= 12
Load= 200.0 kPa
D_0 = 0.0289
D_{90} = 0.0310
D_{100} = 0.0312
T_{90} = 27.65 min.

C_V @ T_{90}
39.23 cm.^{2}/day

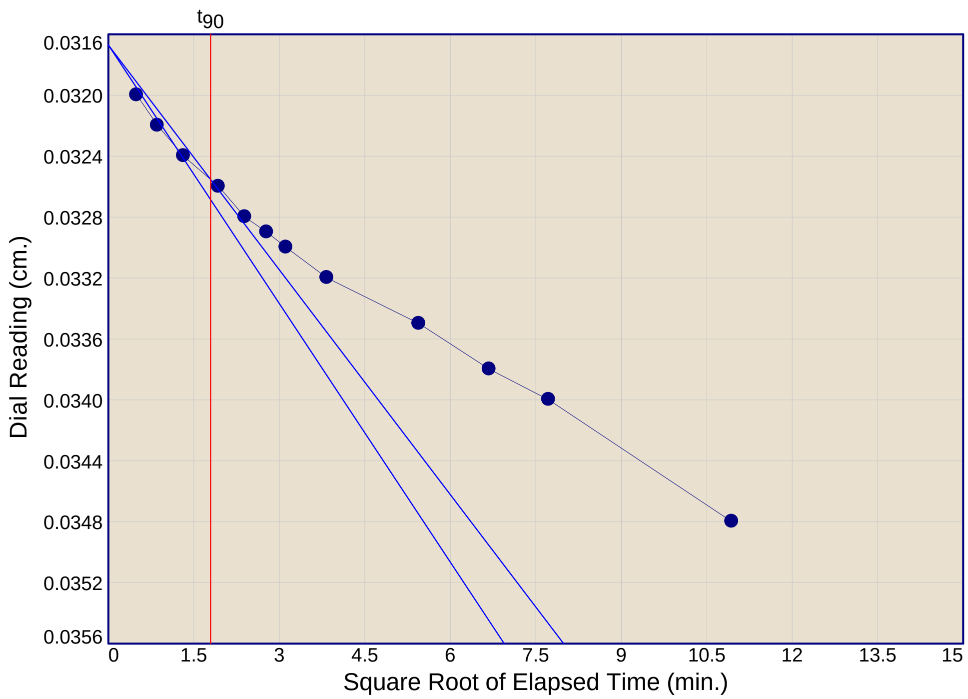
Figure

Terrapex

Dial Reading vs. Time

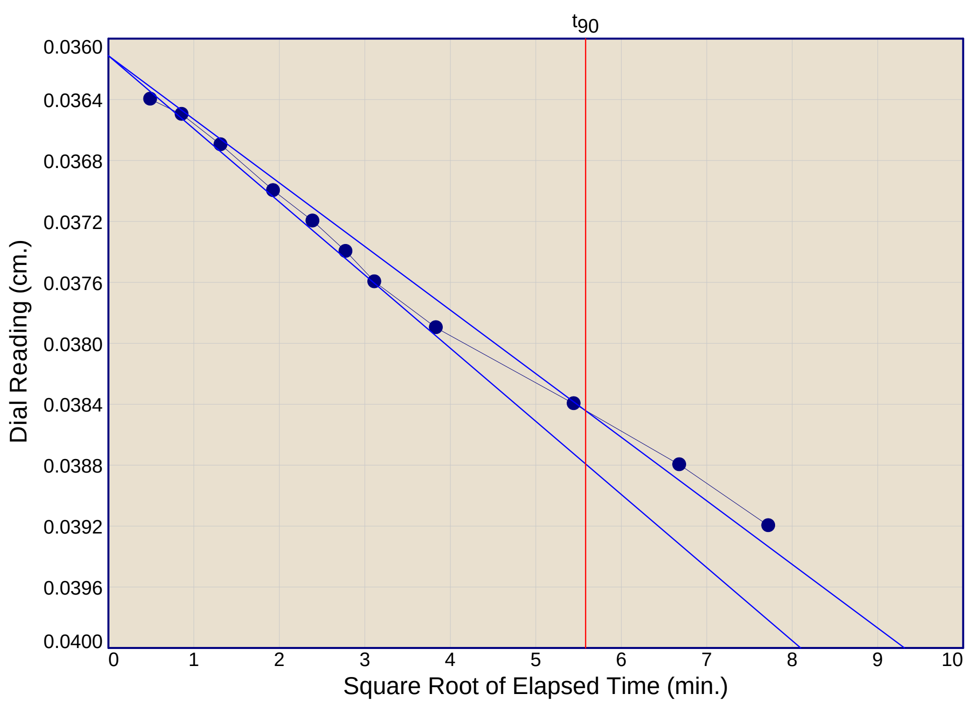
Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT102 Depth: 20'-22' Sample Number: NT102



Load No.= 13
Load= 400.0 kPa
D_0 = 0.0317
D_{90} = 0.0326
D_{100} = 0.0327
T_{90} = 3.22 min.

C_V @ T_{90}
335.49 cm.^{2}/day



Load No.= 14
Load= 800.0 kPa
D_0 = 0.0361
D_{90} = 0.0384
D_{100} = 0.0387
T_{90} = 31.18 min.

C_V @ T_{90}
34.53 cm.^{2}/day

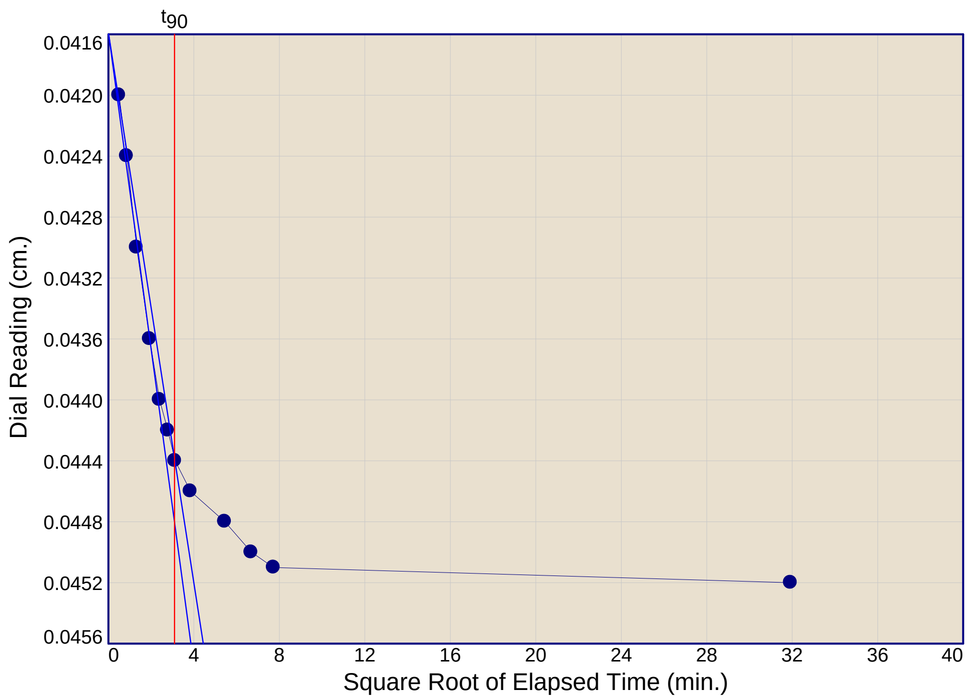
Figure

Terrapex

Dial Reading vs. Time

Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT102 Depth: 20'-22' Sample Number: NT102



Load No.= 15

Load= 1200.0 kPa

D_0 = 0.0416

D_{90} = 0.0444

D_{100} = 0.0447

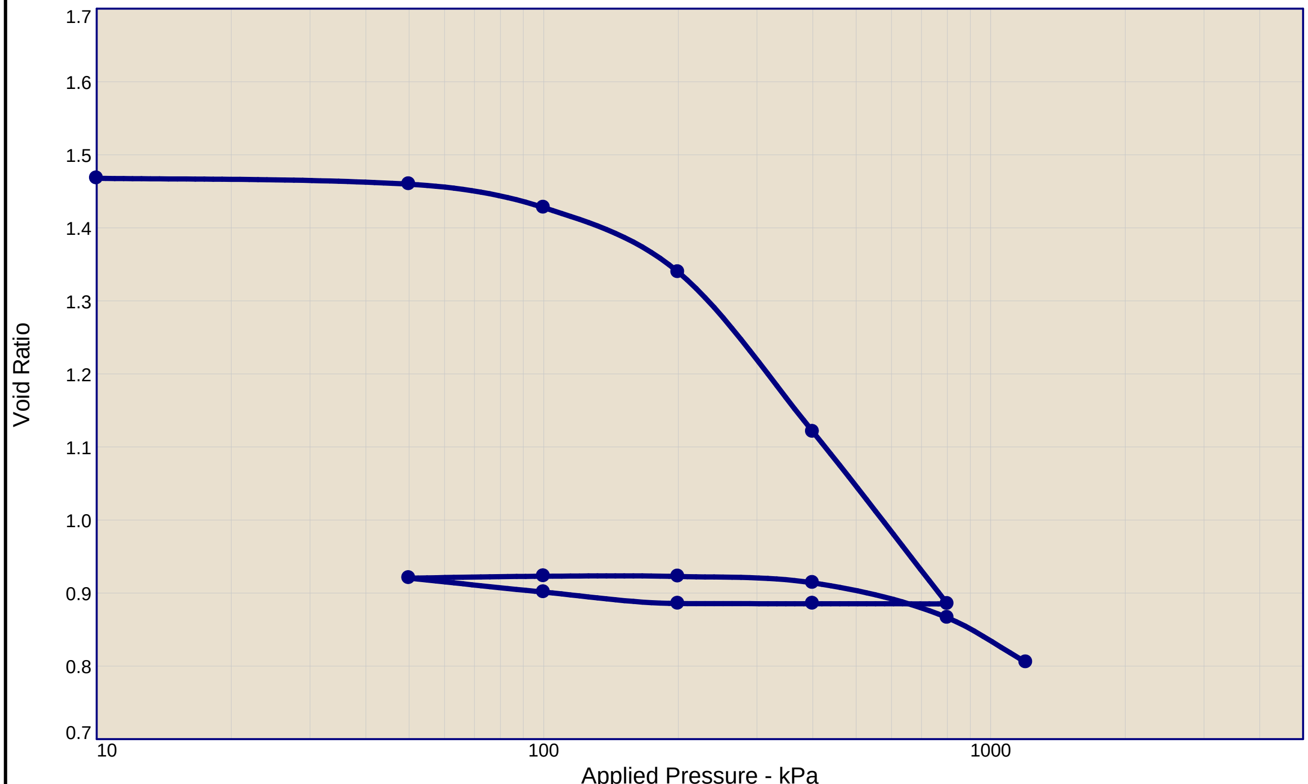
T_{90} = 9.59 min.

C_v @ T_{90}
111.73 cm.^{2}/day

Terrapex

Figure

CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation

No.	Load (kPa)	C_v (cm.^{2}/day)	C_α	No.	Load (kPa)	C_v (cm.^{2}/day)	C_α	No.	Load (kPa)	C_v (cm.^{2}/day)	C_α
1	10.0	65.10		8	200.0	40.34		15	1200.0	29.42	
2	50.0	57.75		9	100.0	19.32					
3	100.0	41.93		10	50.0	32.78					
4	200.0	43.96		11	100.0	45.96					
5	400.0	18.90		12	200.0	39.44					
6	800.0	12.78		13	400.0	17.93					
7	400.0	11.77		14	800.0	78.15					

Natural Saturation	Natural Moisture	Dry Dens. (kg/m3)	LL	PI	Sp. Gr.	Overburden (kPa)	P_c (kPa)	C_c	C_r	Initial Void Ratio
91.7 %	49.6 %	1101	60.4	36.4	2.72	115	173	0.78	0.00	1.471

MATERIAL DESCRIPTION	USCS	AASHTO
SILTY CLAY grey moist	CH or OH	

Project No. CA19009.24.03 **Client:** PECG

Project: PECG Project No. 2304202 Lab Testing

Location: NT103 **Depth:** 20'-22' **Sample Number:** NT103

Terrapex

Toronto, Ontario

Remarks:
Tested on 29 July 2024
Sp. Gravity 2.72 (assumed)

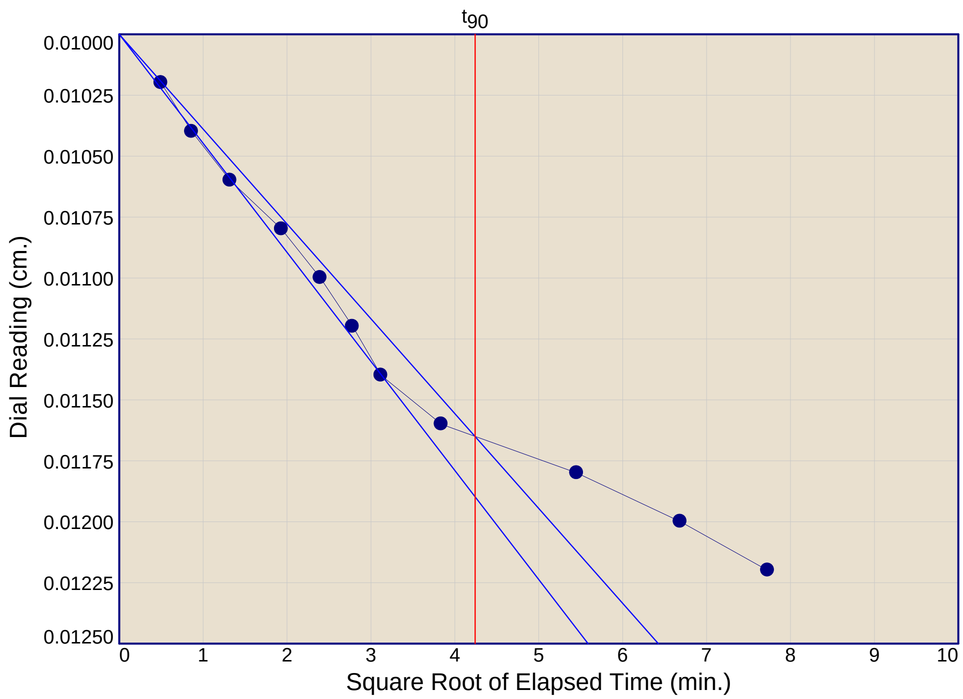
Figure

Tested By: John R & Anna M **Checked By:** Demetra Matthews

Dial Reading vs. Time

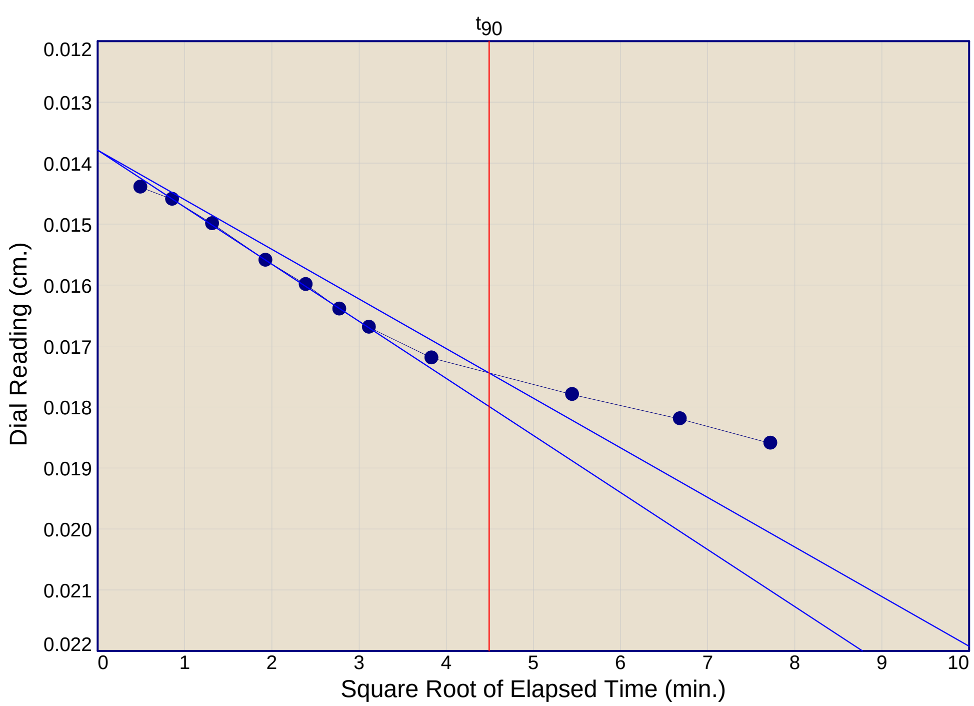
Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT103 Depth: 20'-22' Sample Number: NT103



Load No.= 1
Load= 10.0 kPa
D_0 = 0.0100
D_{90} = 0.0116
D_{100} = 0.0118
T_{90} = 17.99 min.

C_v @ T_{90}
65.10 $cm.^2$/day



Load No.= 2
Load= 50.0 kPa
D_0 = 0.0138
D_{90} = 0.0174
D_{100} = 0.0178
T_{90} = 20.18 min.

C_v @ T_{90}
57.75 $cm.^2$/day

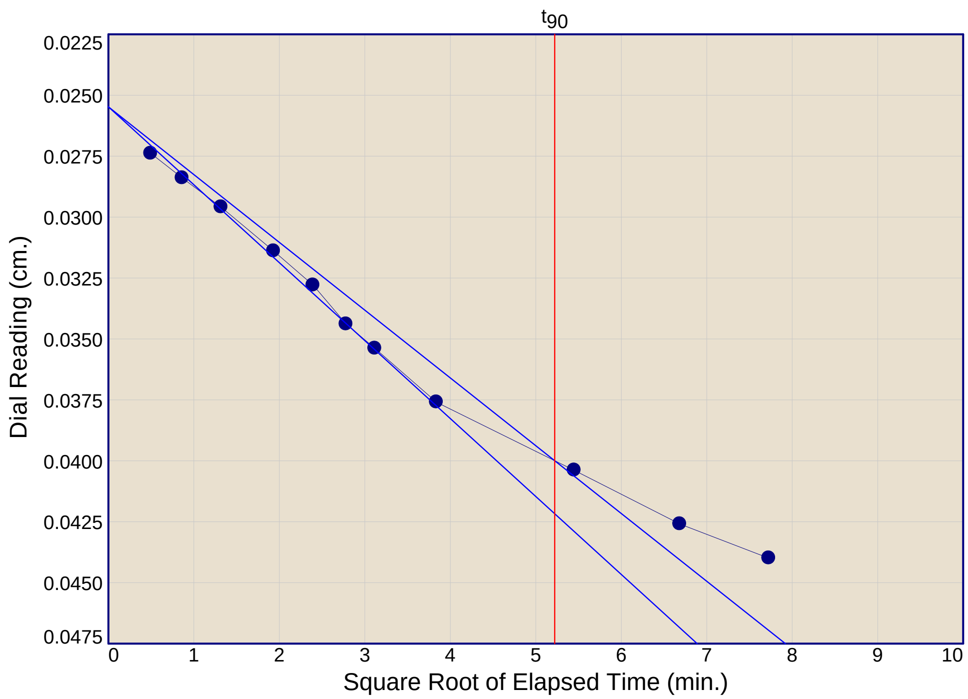
Figure

Terrapex

Dial Reading vs. Time

Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT103 Depth: 20'-22' Sample Number: NT103



Load No.= 3

Load= 100.0 kPa

D_0 = 0.0255

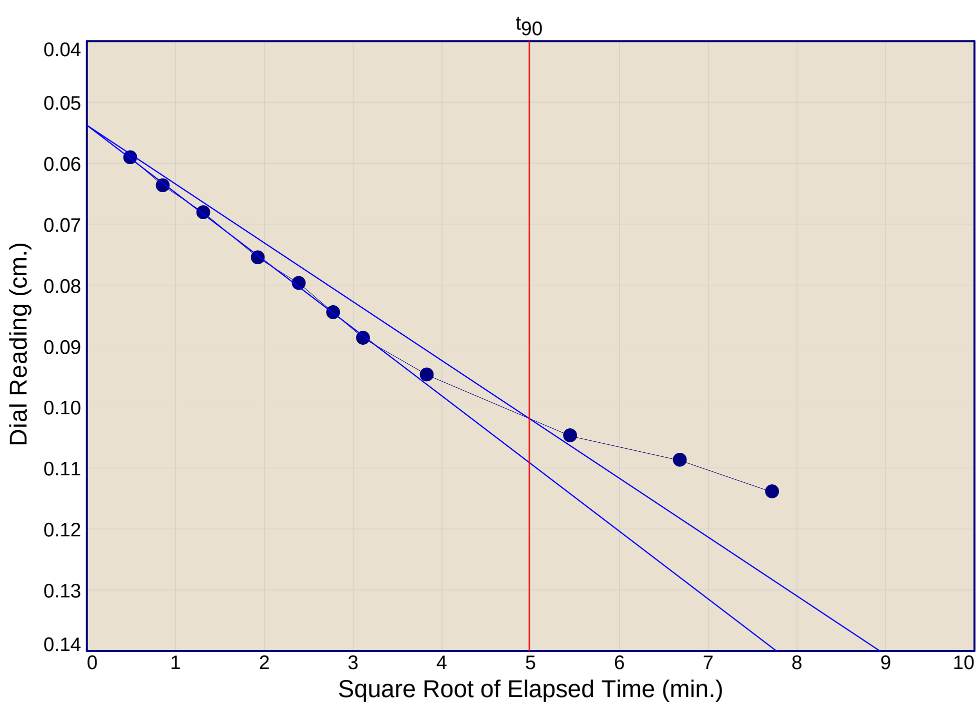
D_{90} = 0.0400

D_{100} = 0.0416

T_{90} = 27.27 min.

C_v @ T_{90}

41.93 cm.^{2}/day



Load No.= 4

Load= 200.0 kPa

D_0 = 0.0538

D_{90} = 0.1019

D_{100} = 0.1072

T_{90} = 24.83 min.

C_v @ T_{90}

43.96 cm.^{2}/day

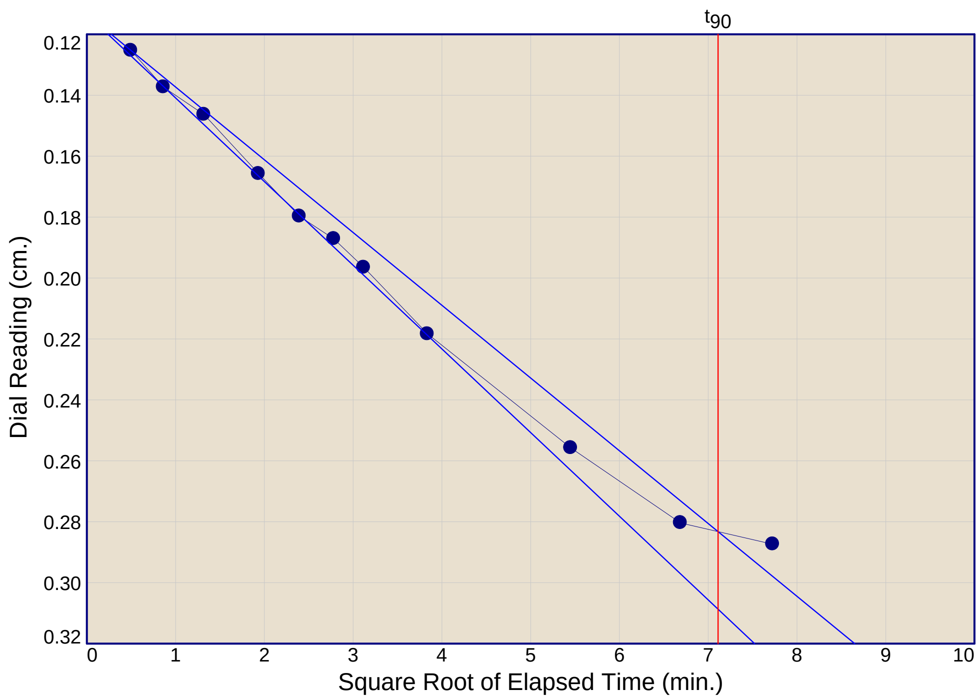
Figure

Terrapex

Dial Reading vs. Time

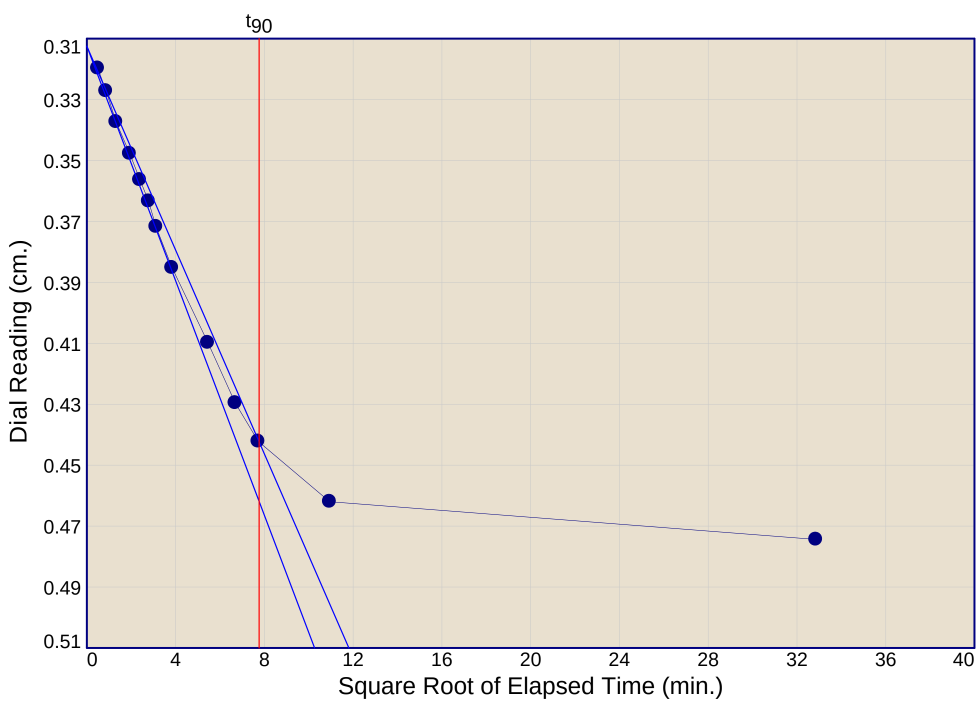
Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT103 Depth: 20'-22' Sample Number: NT103



Load No.= 5
Load= 400.0 kPa
D_0 = 0.1134
D_{90} = 0.2832
D_{100} = 0.3021
T_{90} = 50.57 min.

C_v @ T_{90}
18.90 cm.^{2}/day



Load No.= 6
Load= 800.0 kPa
D_0 = 0.3125
D_{90} = 0.4424
D_{100} = 0.4569
T_{90} = 60.32 min.

C_v @ T_{90}
12.78 cm.^{2}/day

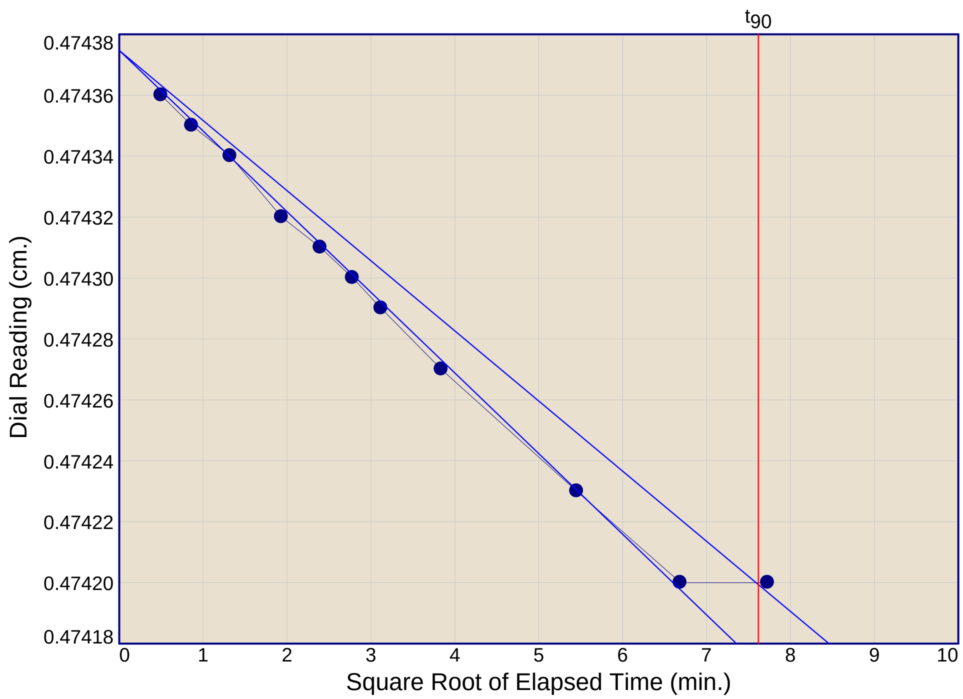
Figure

Terrapex

Dial Reading vs. Time

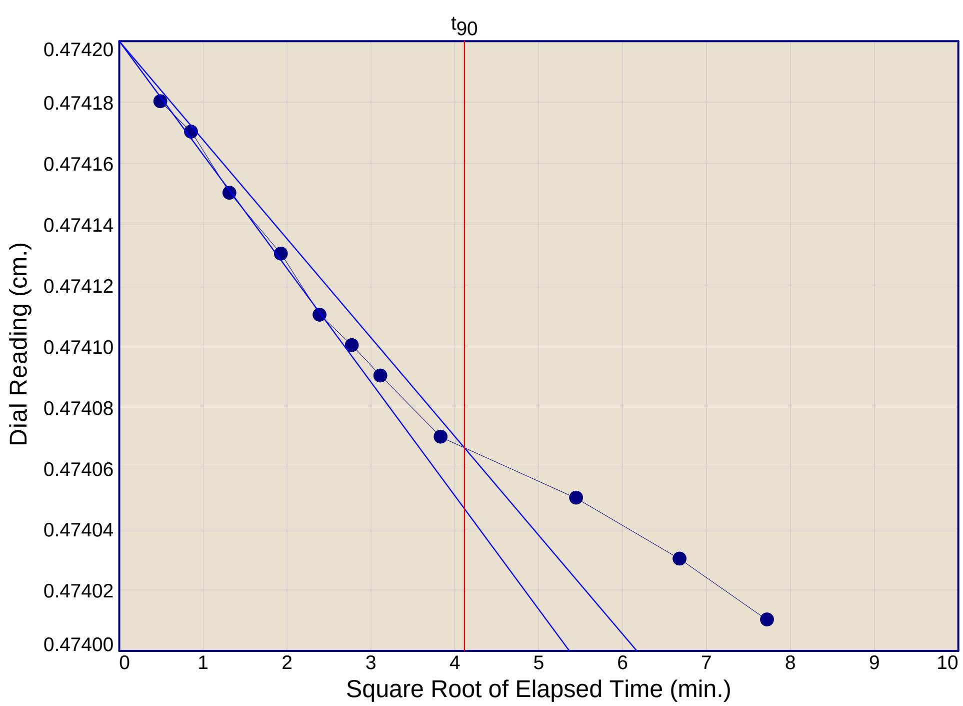
Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT103 Depth: 20'-22' Sample Number: NT103



Load No.= 7
Load= 400.0 kPa
D_0 = 0.4744
D_{90} = 0.4742
D_{100} = 0.4742
T_{90} = 58.02 min.

C_v @ T_{90}
11.77 $cm.^2$/day



Load No.= 8
Load= 200.0 kPa
D_0 = 0.4742
D_{90} = 0.4741
D_{100} = 0.4741
T_{90} = 16.93 min.

C_v @ T_{90}
40.34 $cm.^2$/day

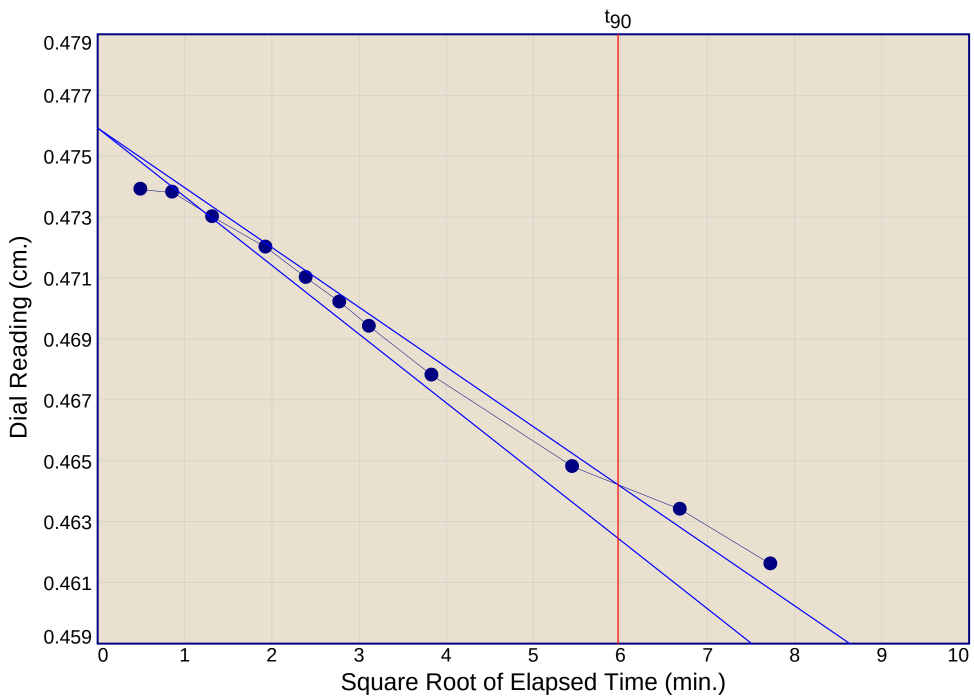
Figure

Terrapex

Dial Reading vs. Time

Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT103 Depth: 20'-22' Sample Number: NT103



Load No.= 9

Load= 100.0 kPa

D_0 = 0.4759

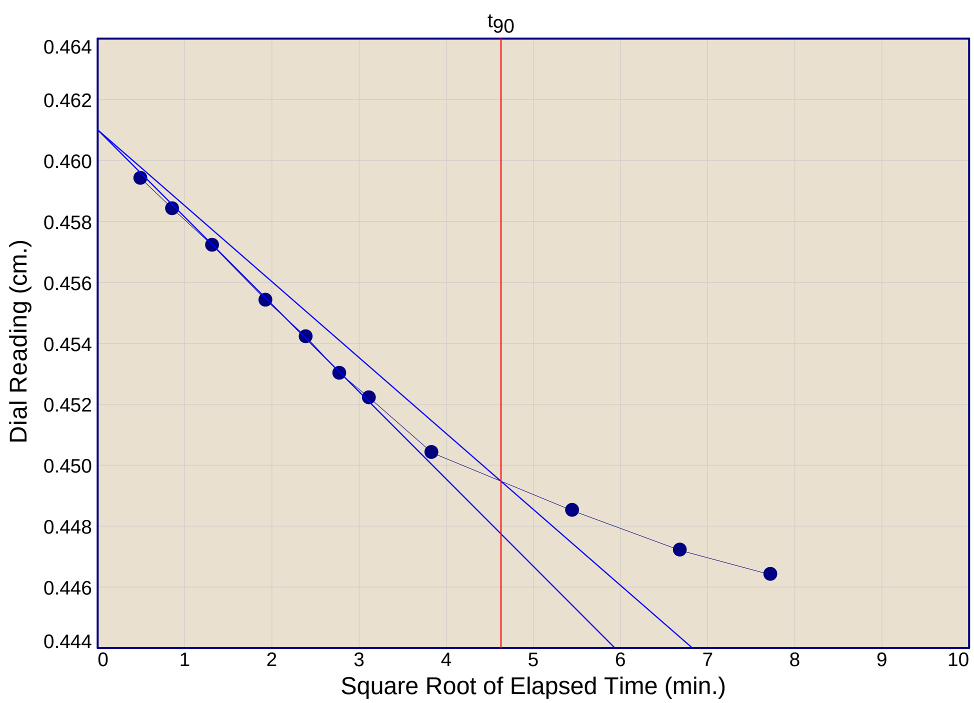
D_{90} = 0.4642

D_{100} = 0.4629

T_{90} = 35.66 min.

C_v @ T_{90}

19.32 cm.^{2}/day



Load No.= 10

Load= 50.0 kPa

D_0 = 0.4610

D_{90} = 0.4495

D_{100} = 0.4482

T_{90} = 21.42 min.

C_v @ T_{90}

32.78 cm.^{2}/day

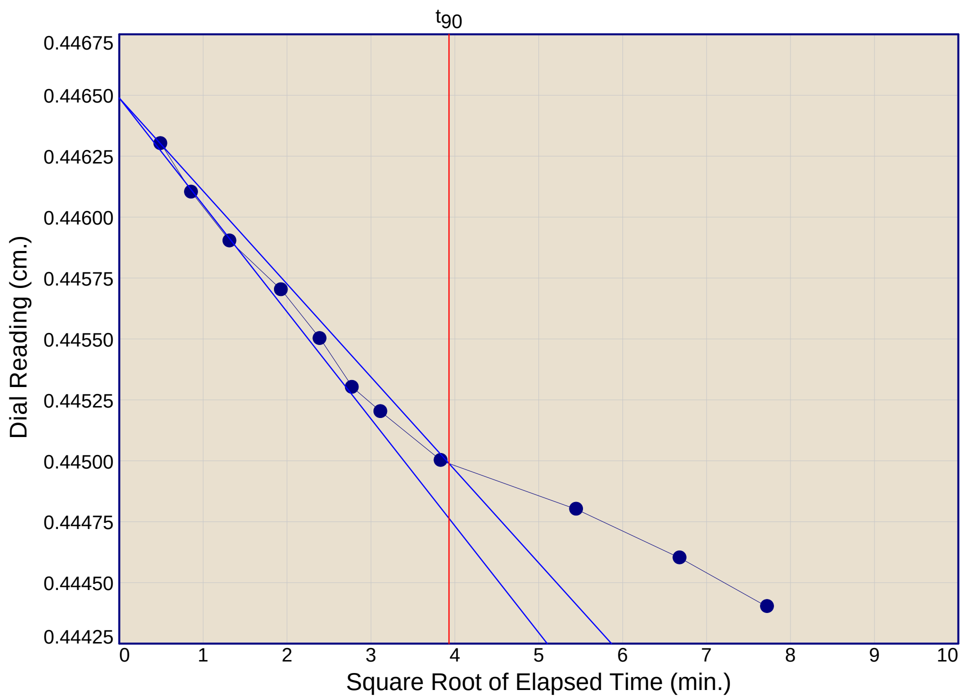
Figure

Terrapex

Dial Reading vs. Time

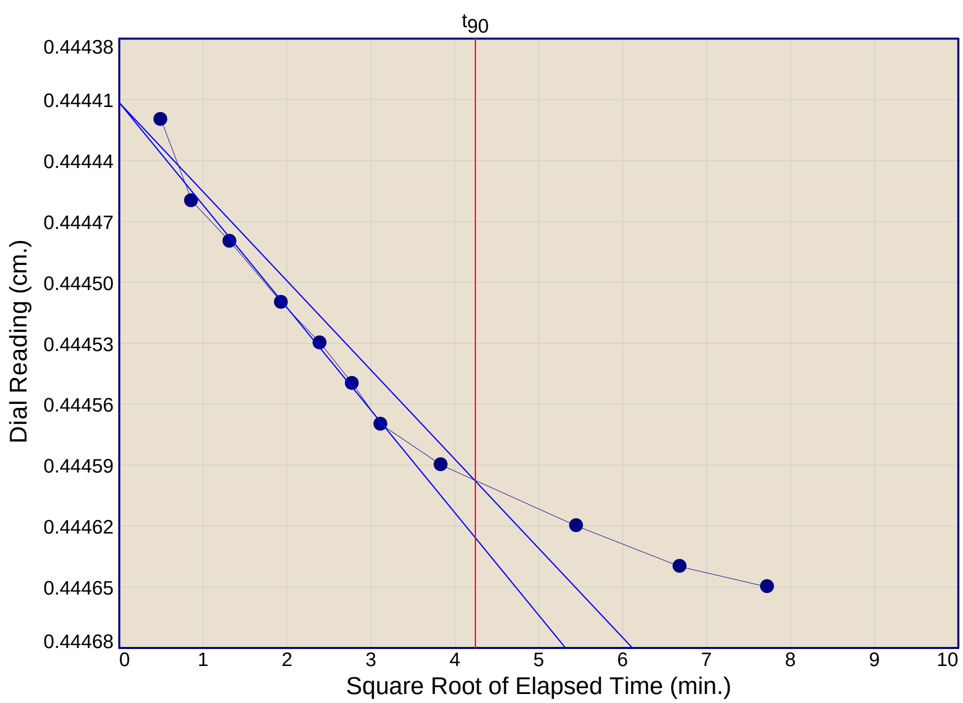
Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT103 Depth: 20'-22' Sample Number: NT103



Load No.= 11
Load= 100.0 kPa
D_0 = 0.4465
D_{90} = 0.4450
D_{100} = 0.4448
T_{90} = 15.44 min.

C_v @ T_{90}
45.96 cm.^{2}/day



Load No.= 12
Load= 200.0 kPa
D_0 = 0.4444
D_{90} = 0.4446
D_{100} = 0.4446
T_{90} = 18.01 min.

C_v @ T_{90}
39.44 cm.^{2}/day

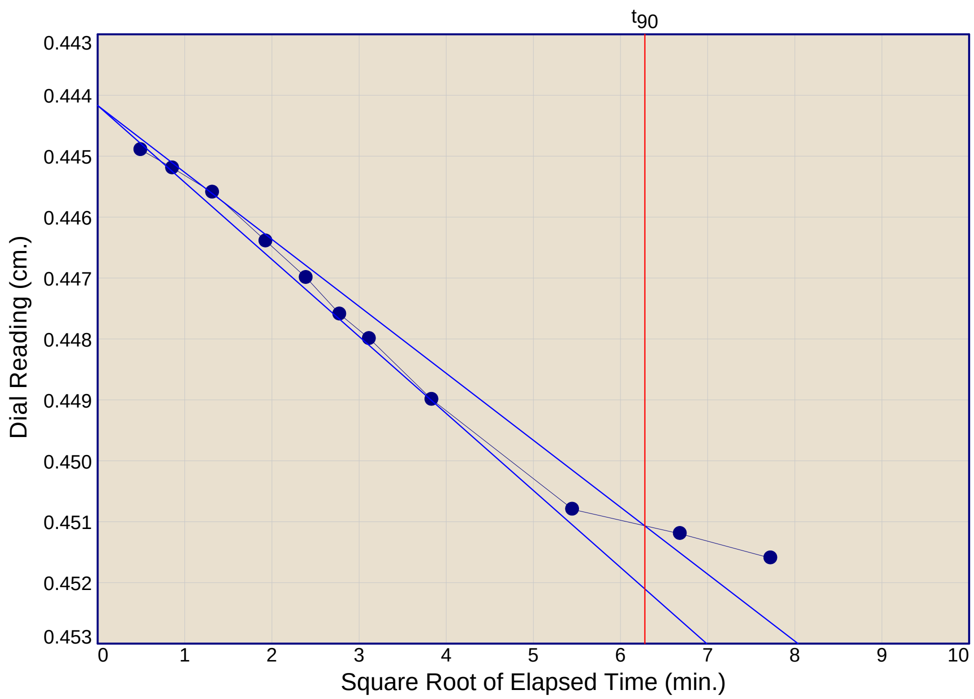
Figure

Terrapex

Dial Reading vs. Time

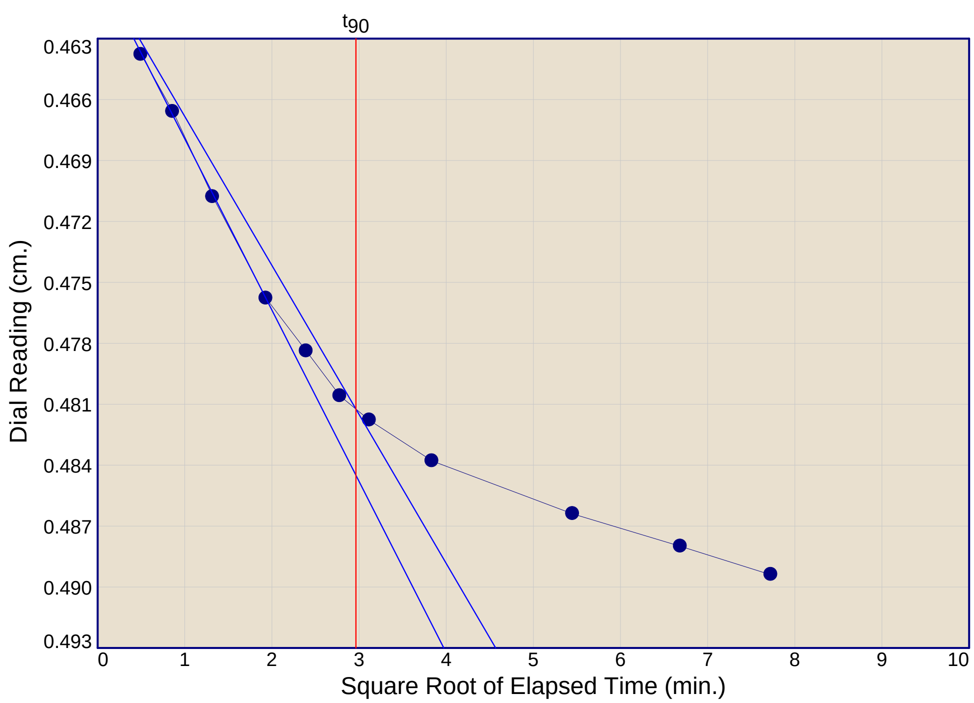
Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT103 Depth: 20'-22' Sample Number: NT103



Load No.= 13
Load= 400.0 kPa
D_0 = 0.4442
D_{90} = 0.4511
D_{100} = 0.4518
T_{90} = 39.42 min.

C_v @ T_{90}
17.93 cm.^{2}/day



Load No.= 14
Load= 800.0 kPa
D_0 = 0.4595
D_{90} = 0.4812
D_{100} = 0.4837
T_{90} = 8.78 min.

C_v @ T_{90}
78.15 cm.^{2}/day

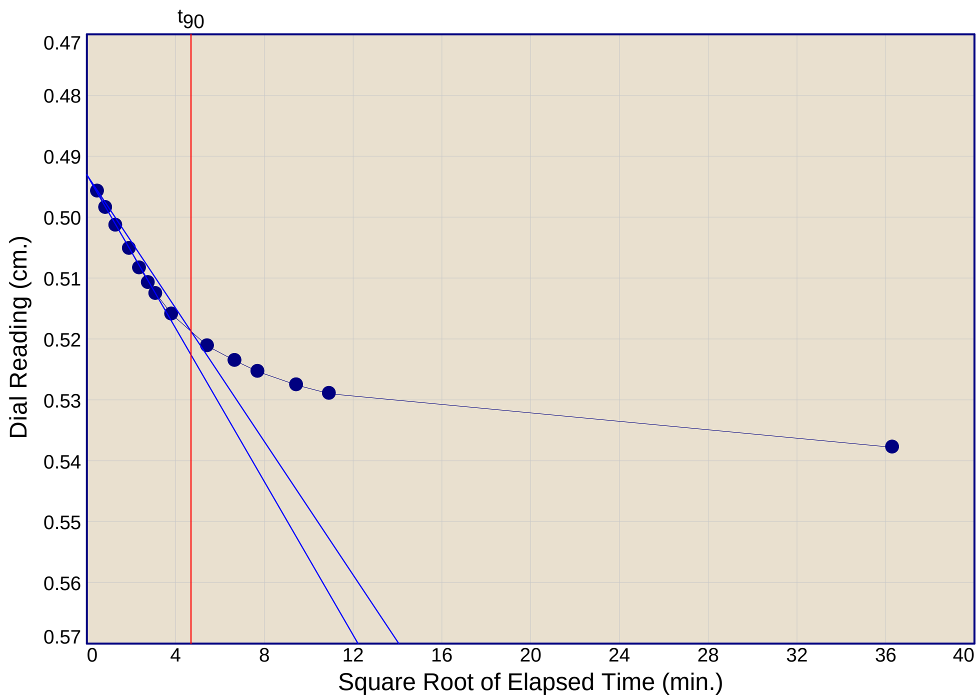
Figure

Terrapex

Dial Reading vs. Time

Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT103 Depth: 20'-22' Sample Number: NT103



Load No.= 15

Load= 1200.0 kPa

D_0 = 0.4931

D_{90} = 0.5187

D_{100} = 0.5216

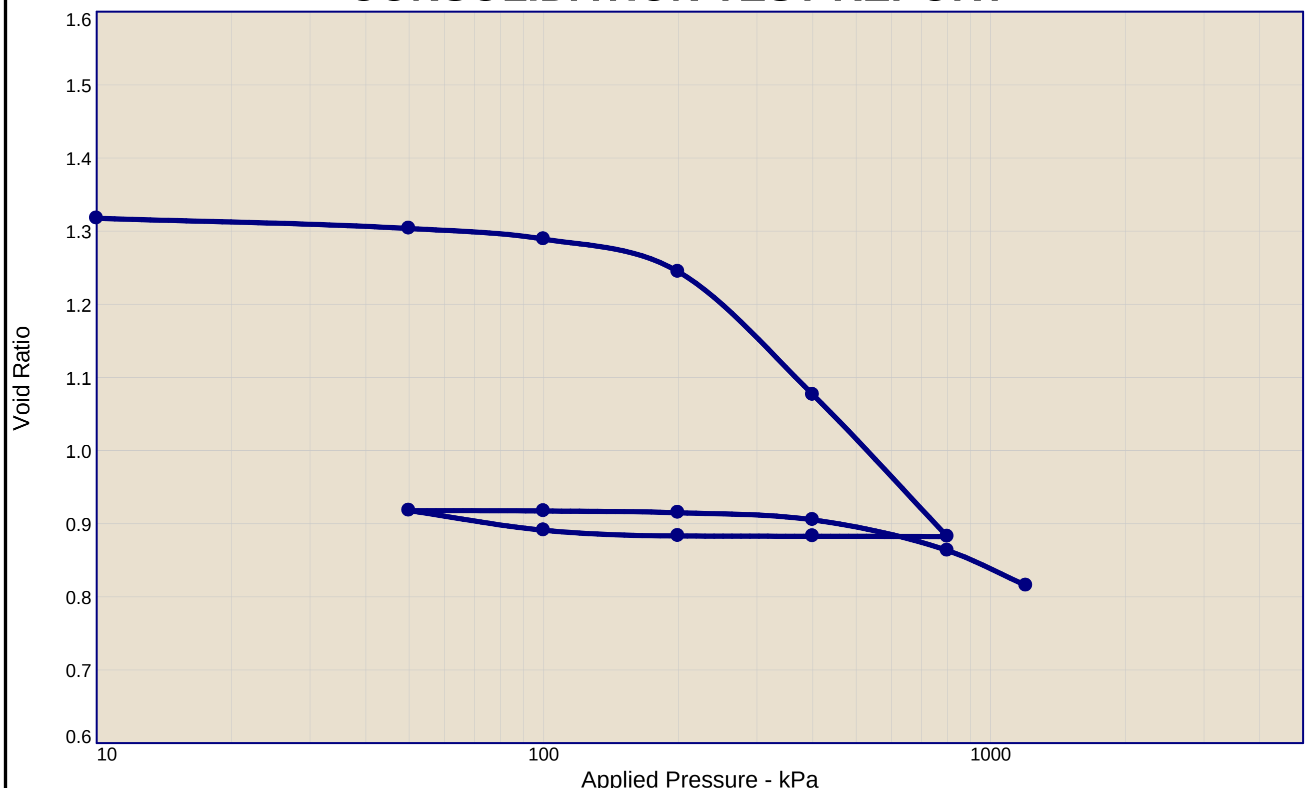
T_{90} = 22.01 min.

C_v @ T_{90}

29.42 $cm.^2$/day

Figure

CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation

No.	Load (kPa)	C_v (cm.^{2}/day)	C_α	No.	Load (kPa)	C_v (cm.^{2}/day)	C_α	No.	Load (kPa)	C_v (cm.^{2}/day)	C_α
1	10.0	164.70		8	200.0	38.47		15	1200.0	44.18	
2	50.0	76.10		9	100.0	18.20					
3	100.0	100.52		10	50.0	30.27					
4	200.0	36.88		11	100.0	44.39					
5	400.0	41.83		12	200.0	50.17					
6	800.0	42.54		13	400.0	35.57					
7	400.0	36.53		14	800.0	91.21					

Natural		Dry Dens. (kg/m3)	LL	PI	Sp. Gr.	Overburden (kPa)	P_c (kPa)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
85.5 %	41.7 %	1170	43.0	24.1	2.72	85	235	0.65	0.01	1.326

MATERIAL DESCRIPTION	USCS	AASHTO
SILTY CLAY grey moist	CL or OL	

Project No. CA19009.24.03 **Client:** PECG

Project: PECG Project No. 2304202 Lab Testing

Location: NT105 **Depth:** 15' - 17'1" **Sample Number:** NT105

Terrapex

Toronto, Ontario

Remarks:

Tested on 30 July 2024
Sp. Gravity 2.72 (assumed)

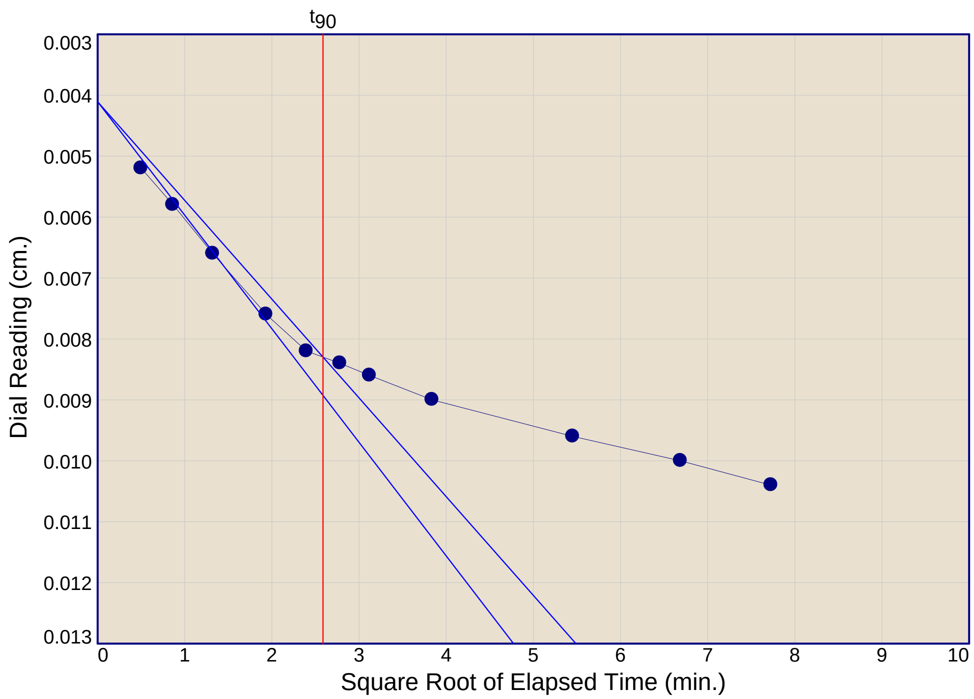
Figure

Tested By: John Ramachandran **Checked By:** Demetra Matthews

Dial Reading vs. Time

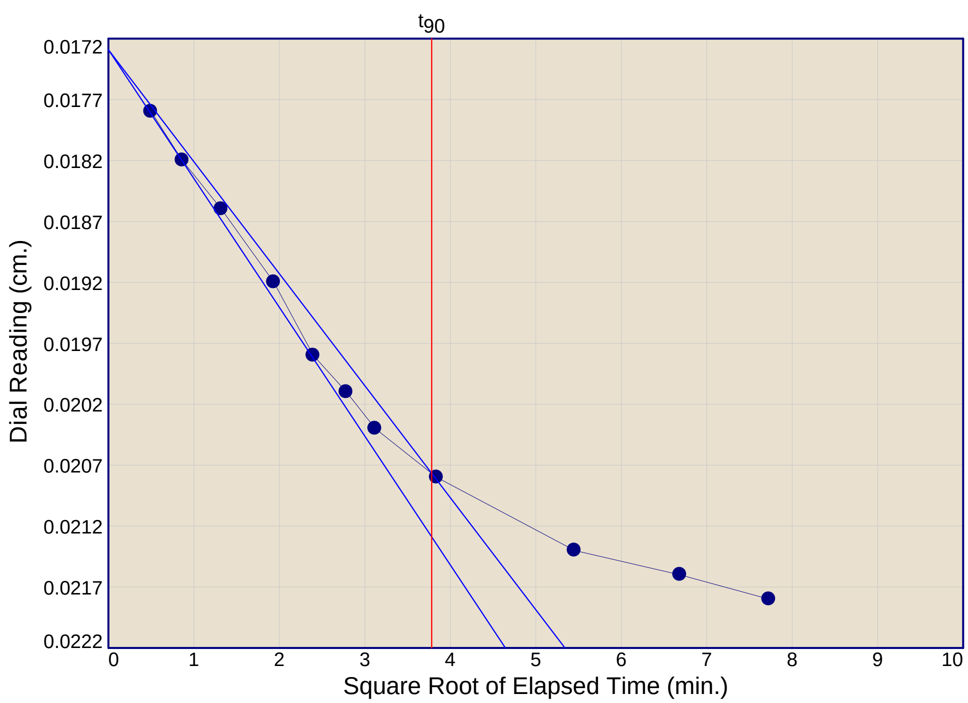
Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT105 Depth: 15' - 17'1" Sample Number: NT105



Load No.= 1
Load= 10.0 kPa
D_0 = 0.0041
D_{90} = 0.0083
D_{100} = 0.0088
T_{90} = 6.69 min.

C_v @ T_{90}
164.70 cm.^{2}/day



Load No.= 2
Load= 50.0 kPa
D_0 = 0.0173
D_{90} = 0.0208
D_{100} = 0.0212
T_{90} = 14.31 min.

C_v @ T_{90}
76.10 cm.^{2}/day

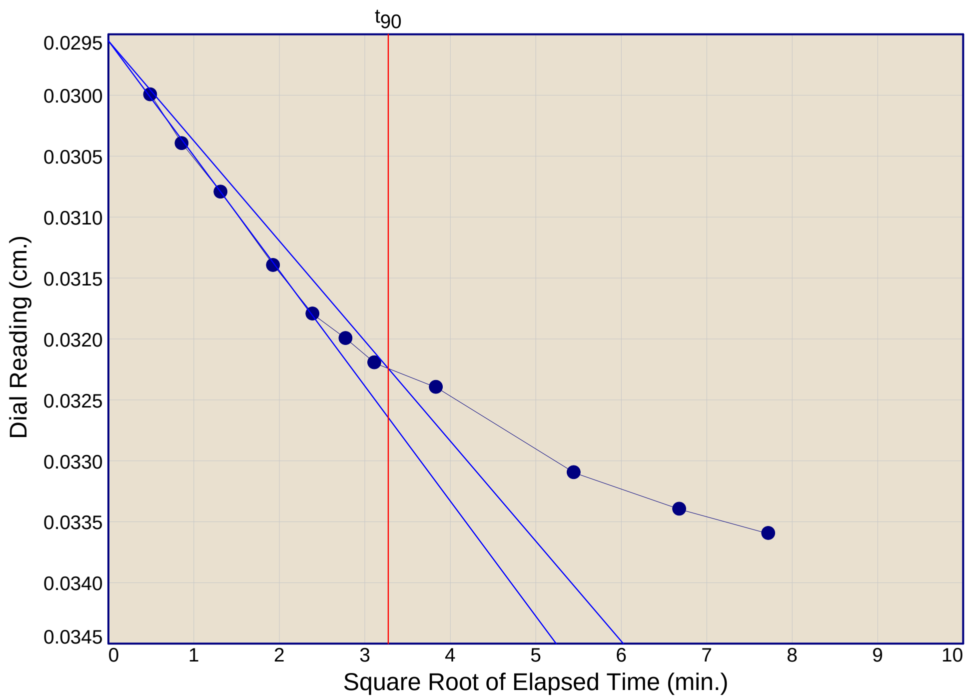
Figure

Terrapex

Dial Reading vs. Time

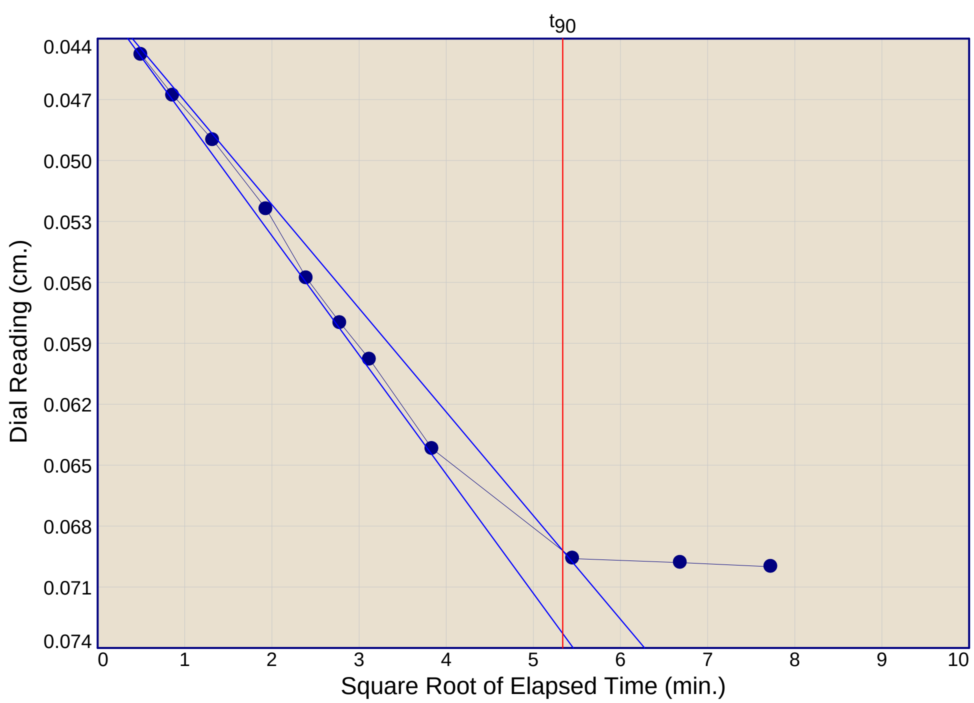
Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT105 Depth: 15' - 17'1" Sample Number: NT105



Load No.= 3
Load= 100.0 kPa
D_0 = 0.0296
D_{90} = 0.0322
D_{100} = 0.0325
T_{90} = 10.72 min.

C_v @ T_{90}
100.52 $cm.^2$/day



Load No.= 4
Load= 200.0 kPa
D_0 = 0.0420
D_{90} = 0.0692
D_{100} = 0.0722
T_{90} = 28.49 min.

C_v @ T_{90}
36.88 $cm.^2$/day

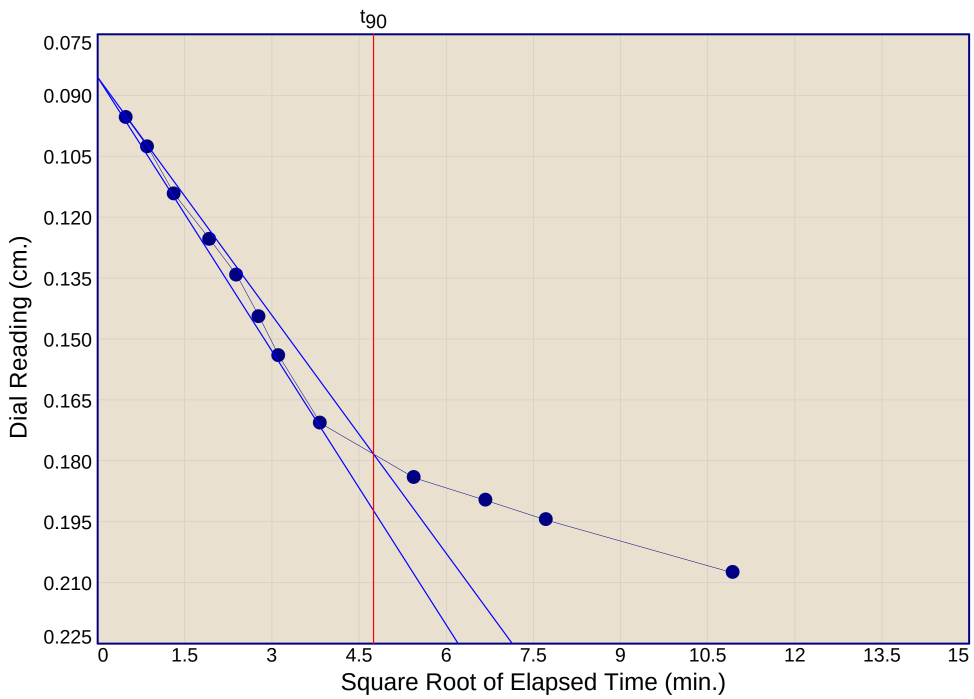
Figure

Terrapex

Dial Reading vs. Time

Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT105 Depth: 15' - 17'1" Sample Number: NT105



Load No.= 5

Load= 400.0 kPa

D_0 = 0.0856

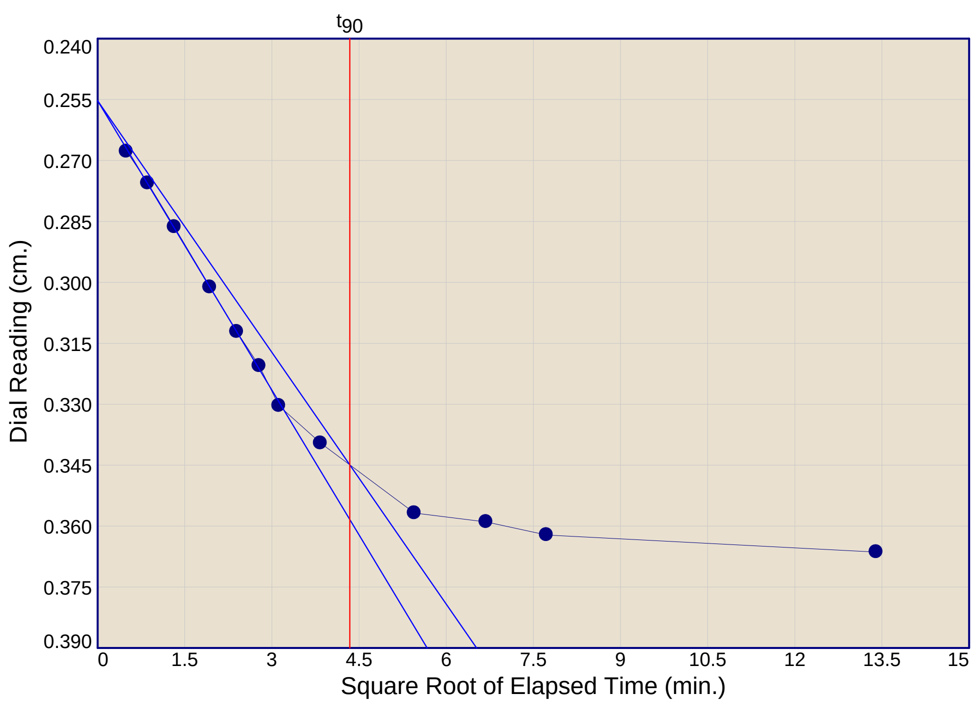
D_{90} = 0.1783

D_{100} = 0.1887

T_{90} = 22.56 min.

C_v @ T_{90}

41.83 cm.^{2}/day



Load No.= 6

Load= 800.0 kPa

D_0 = 0.2553

D_{90} = 0.3449

D_{100} = 0.3549

T_{90} = 18.83 min.

C_v @ T_{90}

42.54 cm.^{2}/day

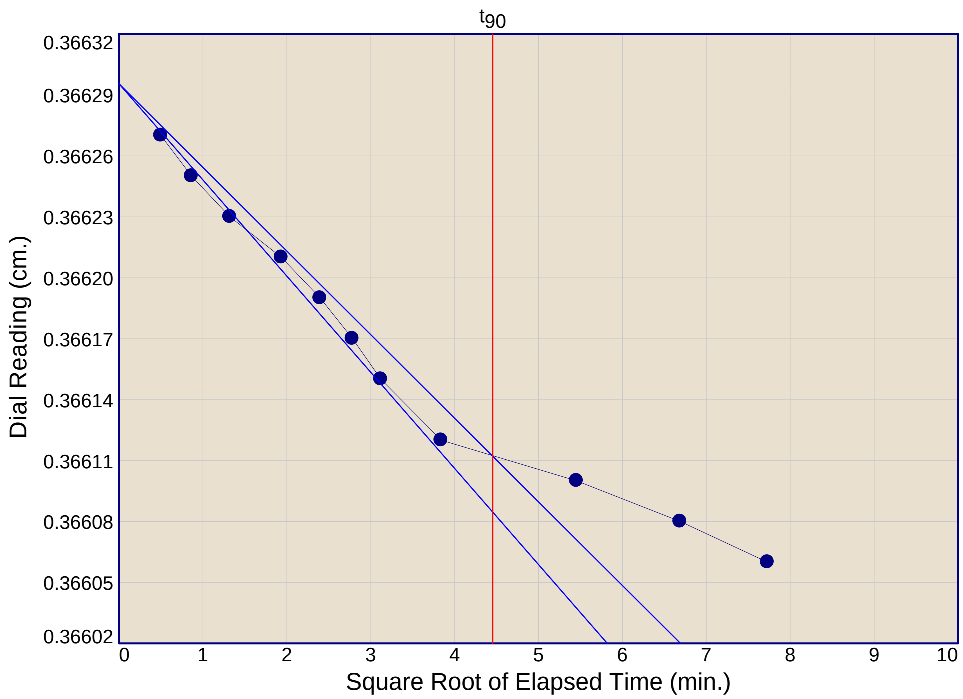
Figure

Terrapex

Dial Reading vs. Time

Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT105 Depth: 15' - 17'1" Sample Number: NT105



Load No.= 7

Load= 400.0 kPa

D_0 = 0.3663

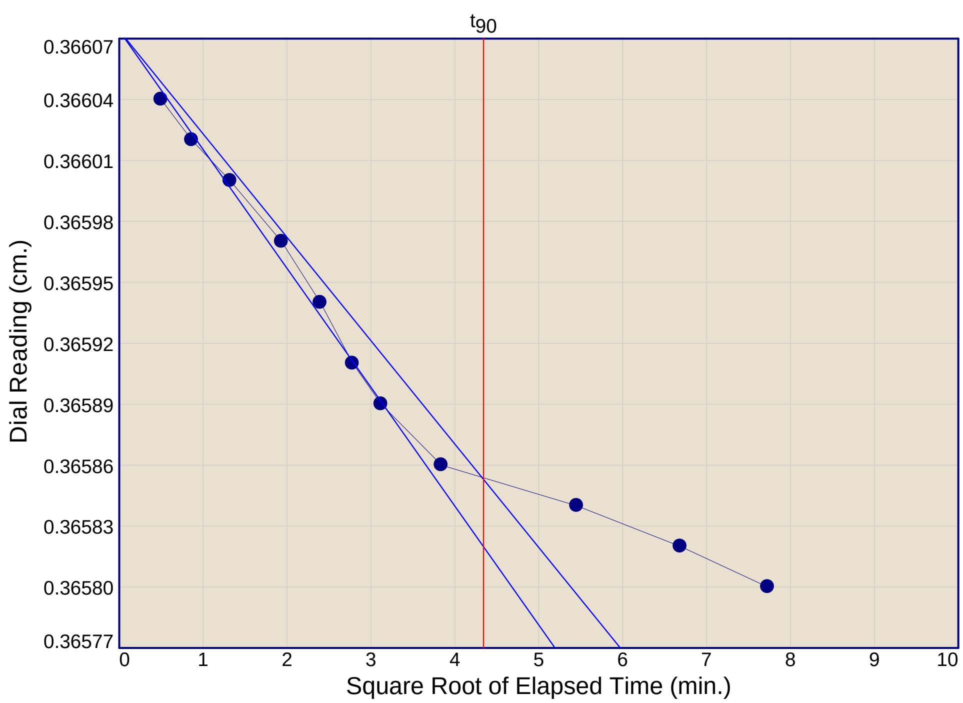
D_{90} = 0.3661

D_{100} = 0.3661

T_{90} = 19.84 min.

C_v @ T_{90}

36.53 cm.^{2}/day



Load No.= 8

Load= 200.0 kPa

D_0 = 0.3661

D_{90} = 0.3659

D_{100} = 0.3658

T_{90} = 18.84 min.

C_v @ T_{90}

38.47 cm.^{2}/day

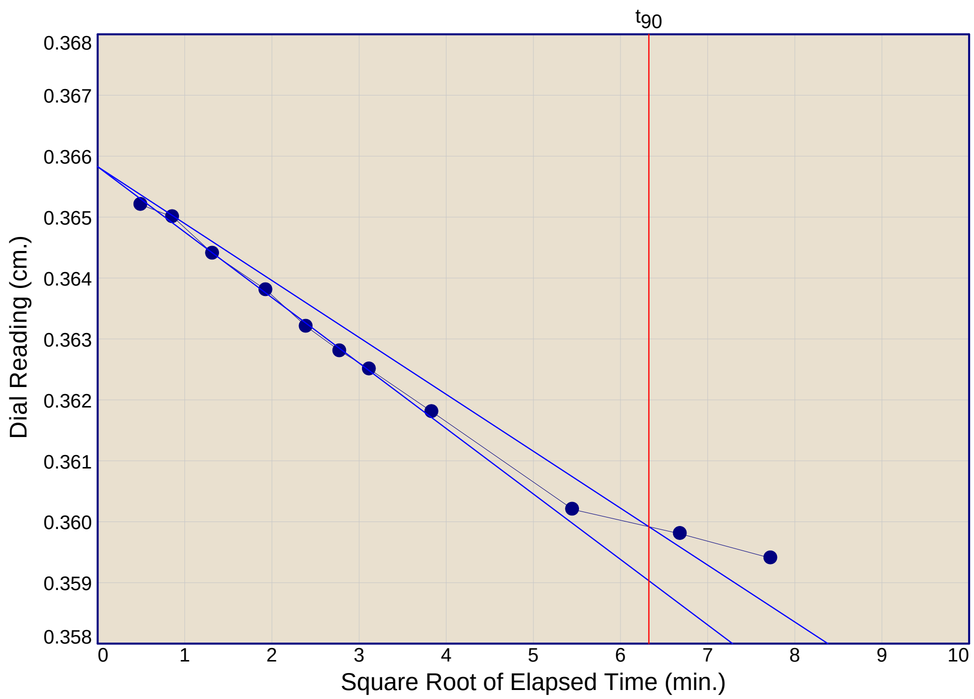
Figure

Terrapex

Dial Reading vs. Time

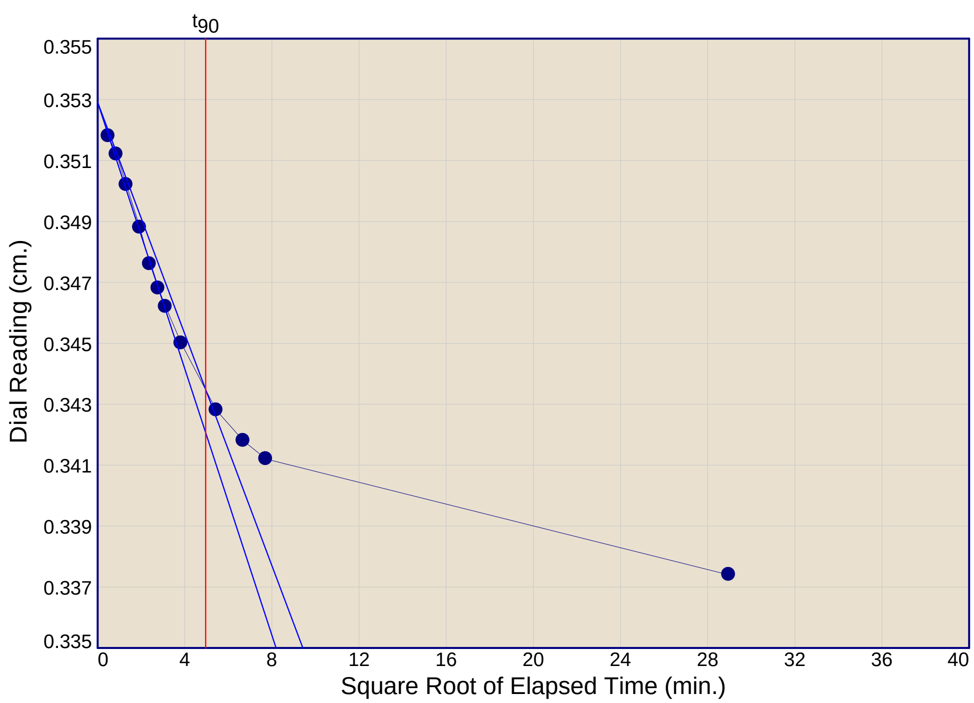
Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT105 Depth: 15' - 17'1" Sample Number: NT105



Load No.= 9
Load= 100.0 kPa
D_0 = 0.3658
D_{90} = 0.3599
D_{100} = 0.3593
T_{90} = 40.00 min.

C_v @ T_{90}
18.20 cm.^{2}/day



Load No.= 10
Load= 50.0 kPa
D_0 = 0.3529
D_{90} = 0.3435
D_{100} = 0.3424
T_{90} = 24.60 min.

C_v @ T_{90}
30.27 cm.^{2}/day

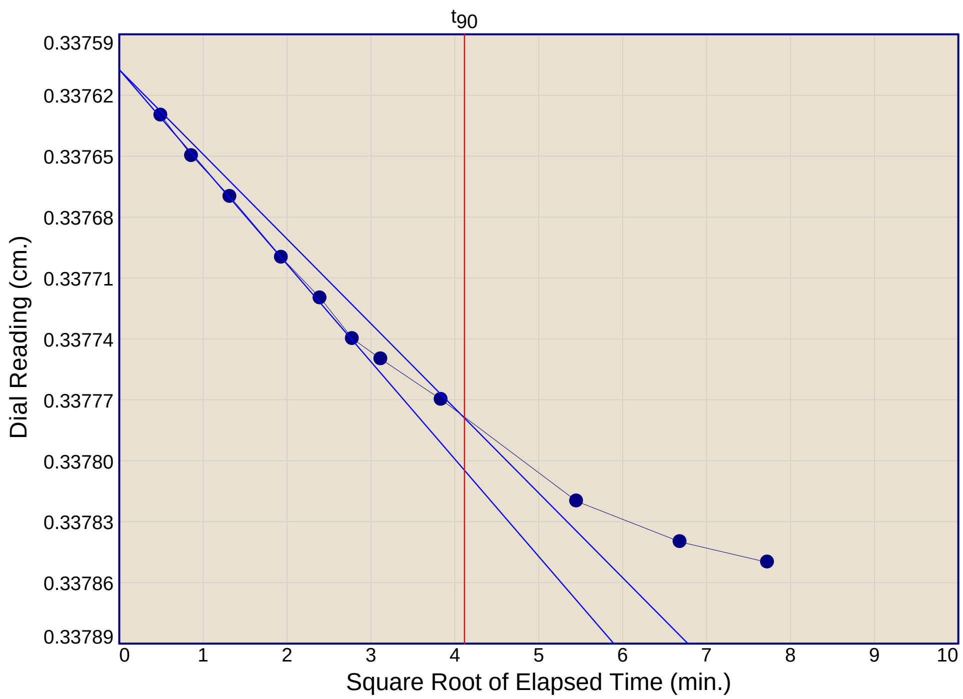
Figure

Terrapex

Dial Reading vs. Time

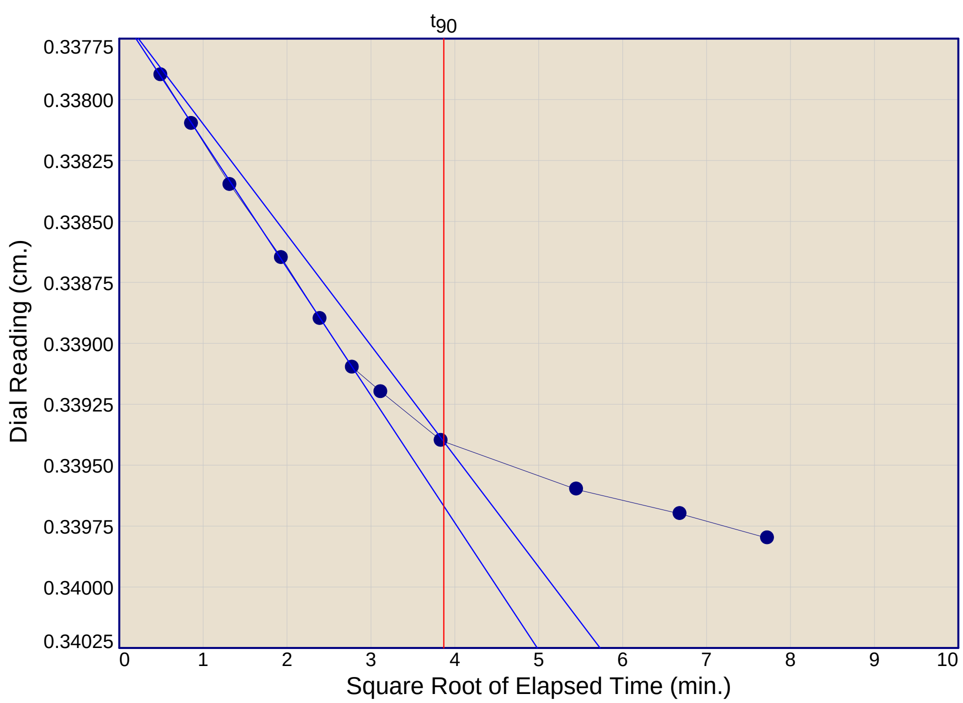
Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT105 Depth: 15' - 17'1" Sample Number: NT105



Load No.= 11
Load= 100.0 kPa
D_0 = 0.3376
D_{90} = 0.3378
D_{100} = 0.3378
T_{90} = 16.93 min.

C_v @ T_{90}
44.39 cm.^{2}/day



Load No.= 12
Load= 200.0 kPa
D_0 = 0.3376
D_{90} = 0.3394
D_{100} = 0.3396
T_{90} = 14.96 min.

C_v @ T_{90}
50.17 cm.^{2}/day

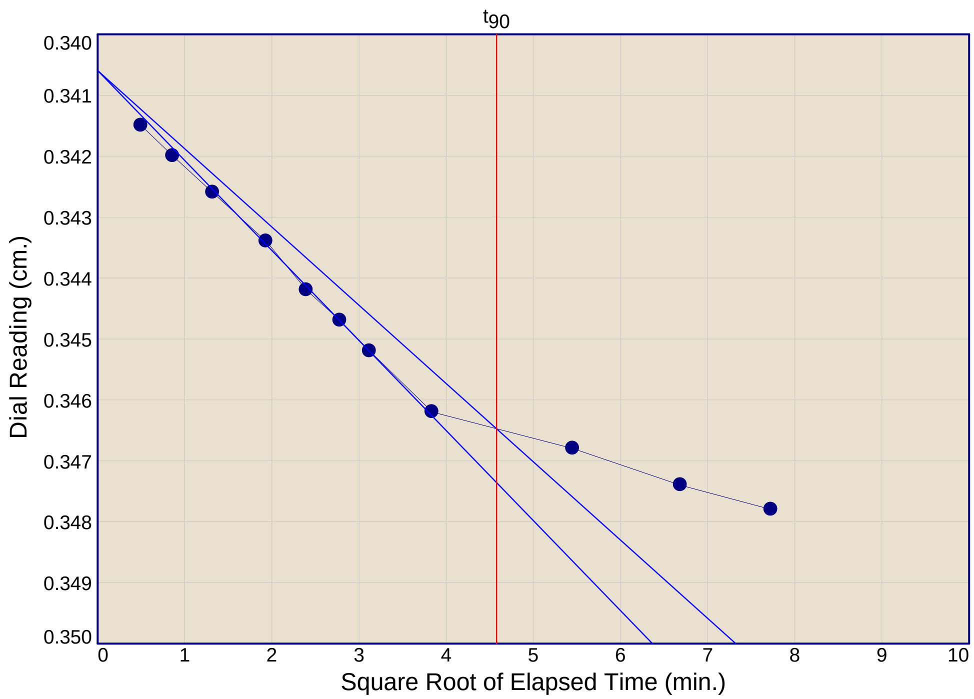
Figure

Terrapex

Dial Reading vs. Time

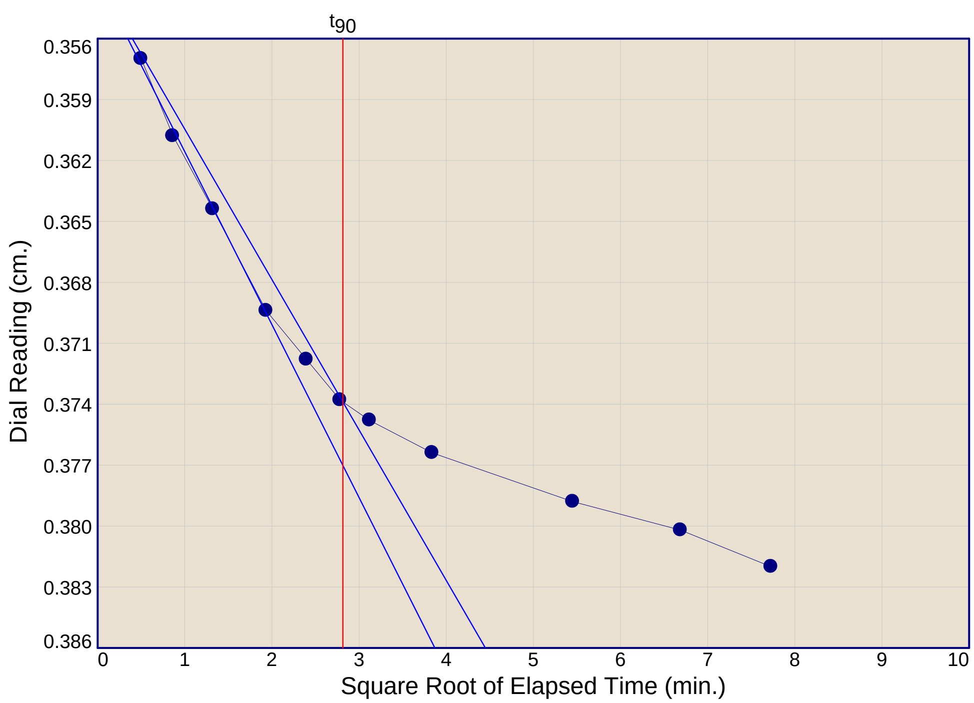
Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT105 Depth: 15' - 17'1" Sample Number: NT105



Load No.= 13
Load= 400.0 kPa
D_0 = 0.3406
D_{90} = 0.3465
D_{100} = 0.3471
T_{90} = 20.95 min.

C_v @ T_{90}
35.57 cm.^{2}/day



Load No.= 14
Load= 800.0 kPa
D_0 = 0.3531
D_{90} = 0.3739
D_{100} = 0.3762
T_{90} = 7.92 min.

C_v @ T_{90}
91.21 cm.^{2}/day

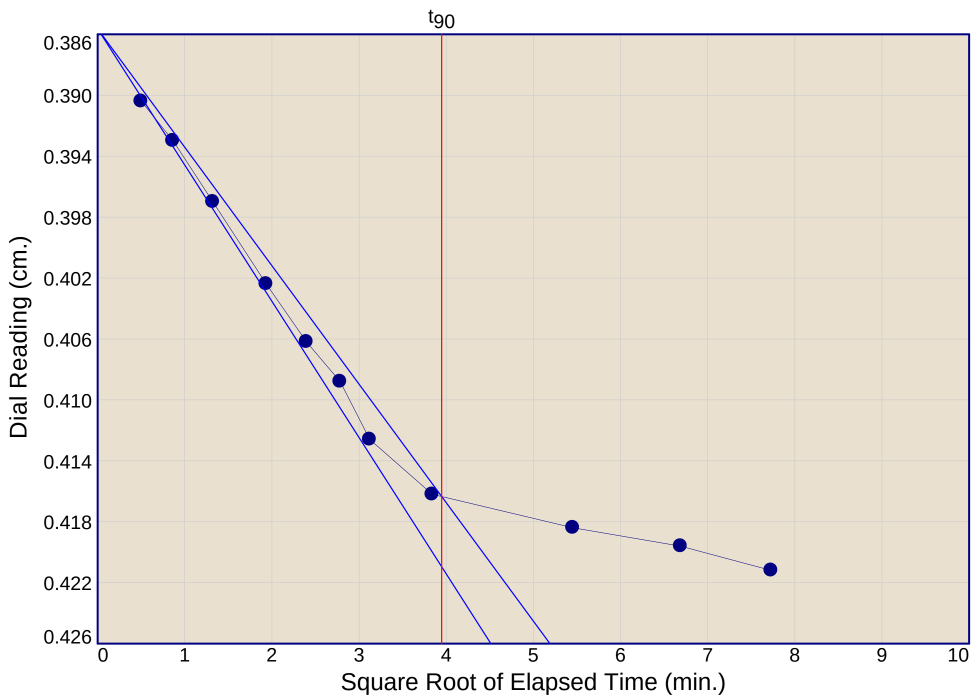
Figure

Terrapex

Dial Reading vs. Time

Project No.: CA19009.24.03
Project: PECG Project No. 2304202 Lab Testing

Location: NT105 Depth: 15' - 17'1" Sample Number: NT105



Load No.= 15

Load= 1200.0 kPa

D_0 = 0.3856

D_{90} = 0.4163

D_{100} = 0.4198

T_{90} = 15.59 min.

C_v @ T_{90}

44.18 cm.^{2}/day

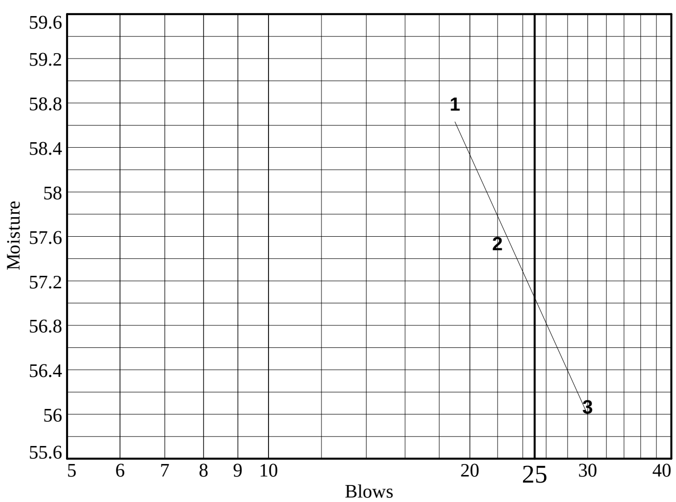
LIQUID AND PLASTIC LIMIT TEST DATA

2023-10-30

Client: Palmer
Project: PECG PRJ # 2304202 ONTC Additional testing
Project Number: CA19009.23.18
Location: New Timmins
Depth: 20' - 22' **Sample Number:** BH23-NT12
Material Description: SILTY CLAY grey
Testing Remarks: Test Date: October 23, 2023
Tested by: AM

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	20.97	20.83	20.01			
Dry+Tare	18.43	18.35	17.84			
Tare	14.11	14.04	13.97			
# Blows	19	22	30			
Moisture	58.8	57.5	56.1			



Liquid Limit= 57.0
Plastic Limit= 21.8
Plasticity Index= 35.2

Plastic Limit Data

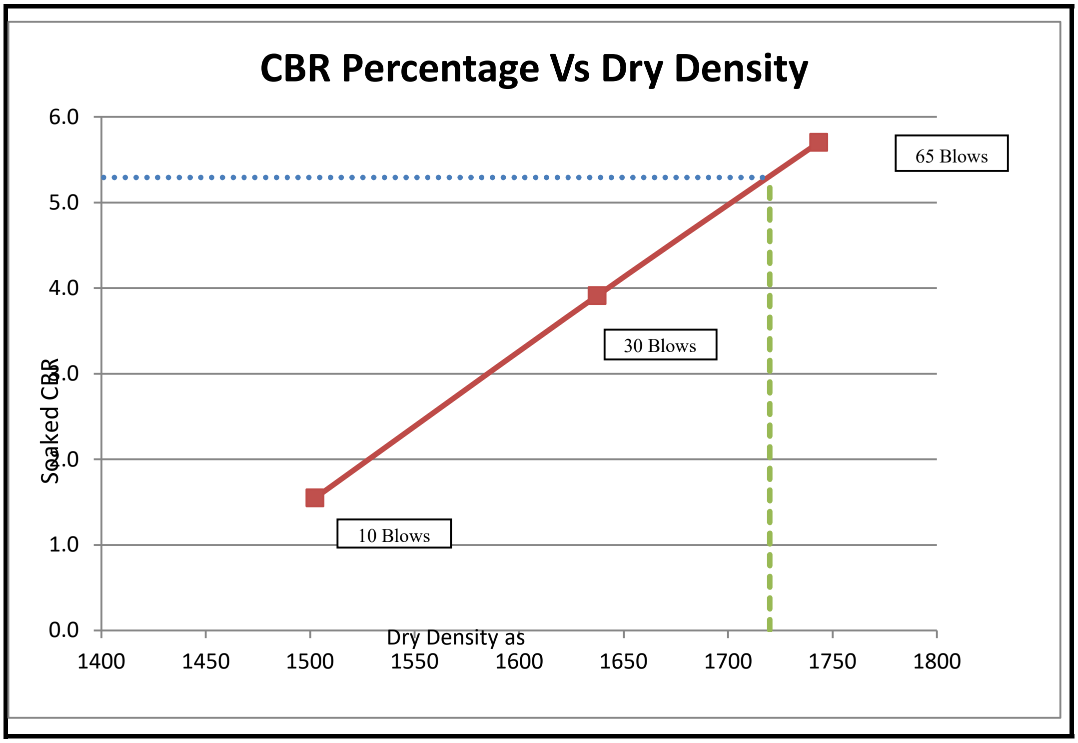
Run No.	1	2	3	4	
Wet+Tare	26.96	27.54			
Dry+Tare	25.87	26.40			
Tare	20.80	21.22			
Moisture	21.5	22.0			

PNJ ENGINEERING INC.
Pavement · Materials · Geo-Environmental · Engineering
70 Galaxy Blv
Toronto, Ontari
Tel: 905 597 8383 • Fax: 9

CBR (California Bearing Ratio) Testing of Subsoils
ASTM D 1883-14

Date: **October 6, 2023**

Proejct:	23-1060-08	**Client: :**	Palmer
PNJ Lab:	9932	**Location:**	Timmins
Sample Type:	Native	**Date Sammpled:**	N/A



Reported CBR Value @ penetration of 2.54mm (%)	**5.29**
Dry Unit Weight of Soil (KG/m³)	**1720**
Soaking Duration (Hour)	**96**
Maximum Swell (%)	**24.5**
Surcharge Weights used (g)	

Tested By KR

Reviewed By Prabhdeep Lubana, P.Eng.

70 Galaxy Blvd
Toronto, Ontario
Tel: 905 597 8383 • Fax: 9

CBR (California Bearing Ratio) Testing of Subsoils
ASTM D 1883-14

Project:	23-1060-08	Client: :	Palmer
PNJ Lab:	9932	Location:	Timmins
Sample Type:	Native	Date Sammpled:	N/A

10 Blows

Penetration, mm	Standard Stress, Mpa	Observed Stress, Mpa	CBR, %	Moisture Content, %		Dry Density (kg/m³)
				Molded	11.8	
				After Soaking	27.1	1502
2.54	6.89	0.107	1.5			87.3%
5.08	10.34	0.143	1.4	**Swell %**		
7.62	13.10	0.167	1.3	7.1		

30 Blows

Penetration, mm	Standard Stress, Mpa	Observed Stress, Mpa	CBR, %	Moisture Content, %		Dry Density (kg/m³)
				Molded	12.1	
				After Soaking	22.9	1637
2.54	6.89	0.270	3.9			95.2%
5.08	10.34	0.398	3.9	**Swell %**		
7.62	13.10	0.471	3.6	24.6		

65 Blows

Penetration, mm	Standard Stress, Mpa	Observed Stress, Mpa	CBR, %	Moisture Content, %		Dry Density (kg/m³)
				Molded	10.8	
				After Soaking	22.1	1743
2.54	6.89	0.393	5.7			101.4%
5.08	10.34	0.612	5.9	**Swell %**		
7.62	13.10	0.756	5.8	21.2		

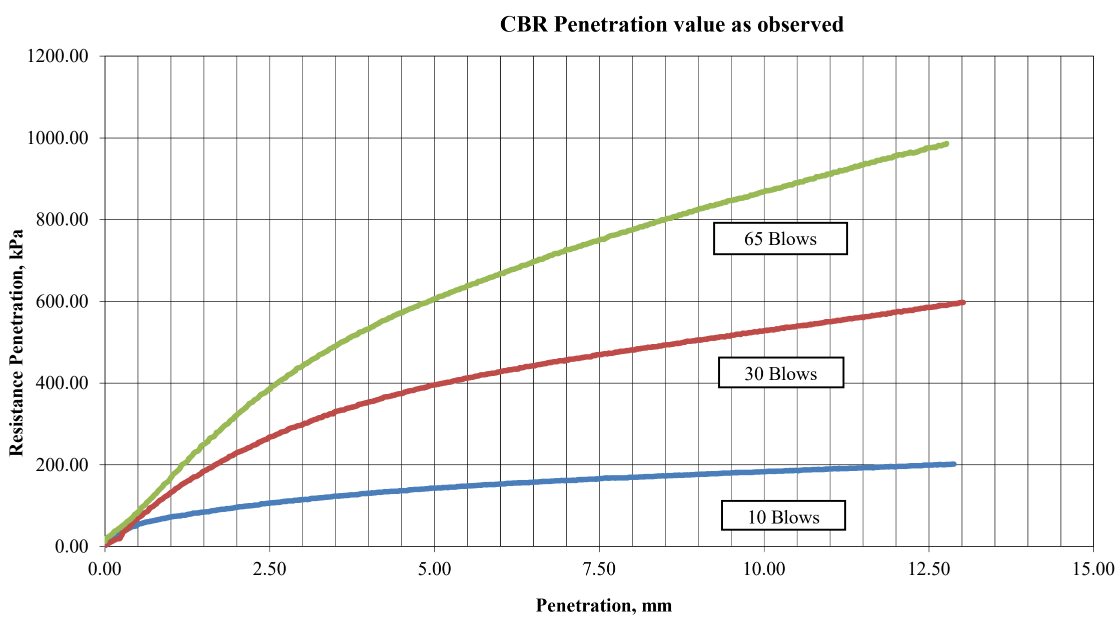
Tested By KR

Reviewed By [signature]
Prabhdeep Lubana, P.Eng.

PNJ ENGINEERING INC.
Pavement · Materials · Geo-Environmental · Engineering
70 Galaxy Blvd
Toronto, Ontario
Tel: 905 597 8383 • Fax: 9

CBR (California Bearing Ratio) Testing of Subsoils
ASTM D 1883-14

Project:	23-1060-08	Client: :	Palmer
PNJ Lab:	9932	Location:	Timmins
Sample Type:	Native	Date Sammpled:	N/A



Appendix C

Infiltration Testing Results

Guelph Permeameter Calculations - GP1

Input

Result

Support: ali@soilmoisture.com

Head #1

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir):	1
Enter water Head Height ("H" in cm):	20
Enter the Borehole Radius ("a" in cm):	3
Enter the soil texture-structure category (enter one of the below numbers):	2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.4000

Res Type	35.22
H	20
a	3
H/a	6.667
a*	0.04
C0.01	1.755
C0.04	1.903
C0.12	1.98
C0.36	1.98
C	1.903
R	0.400
Q	0.235
pi	3.142

$\alpha^* =$ 0.04 (cm^{-1})

$C =$ 1.903071156

$Q =$ 0.2348

$K_{fs} =$ 7.83E-05 cm/sec; 4.70E-03 cm/min; 7.83E-07 m/sec; 1.85E-03 inch/min; 3.08E-05 inch/sec

$\Phi_m =$ 1.96E-03 (cm^2/min)

Head #2

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir):	
Enter water Head Height ("H" in cm):	
Enter the Borehole Radius ("a" in cm):	
Enter the soil texture-structure category (enter one of the below numbers):	

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min):

Res Type	0
H	0
a	0
H/a	#DIV/0!
a*	0
C0.01	#DIV/0!
C0.04	#DIV/0!
C0.12	#DIV/0!
C0.36	#DIV/0!
C	0
R	0.000
Q	0
pi	3.1415

$\alpha^* =$ 0 (cm^{-1})

$C =$ 0

$Q =$ 0

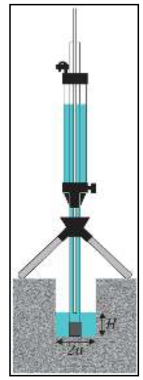
$K_{fs} =$ #DIV/0! cm/sec; #DIV/0! cm/min; #DIV/0! m/ses; #DIV/0! inch/min; #DIV/0! inch/sec

$\Phi_m =$ #DIV/0! (cm^2/min)

Average

$K_{fs} =$ #DIV/0! cm/sec; #DIV/0! cm/min; #DIV/0! m/s; #DIV/0! inch/min; #DIV/0! inch/sec

$\Phi_m =$ #DIV/0! (cm^2/min)



Two Head Method

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir):	
Enter the first water Head Height ("H1" in cm):	
Enter the second water Head Height ("H2" in cm):	
Enter the Borehole Radius ("a" in cm):	
Enter the soil texture-structure category (enter one of the below numbers):	

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

$\alpha^* =$ 0 (cm^{-1})

Steady State Rate of Water Level Change ("R1" in cm/min):

Steady State Rate of Water Level Change ("R2" in cm/min):

$Q_1 =$ 0

$Q_2 =$ 0

$C_1 =$ 0

$C_2 =$ 0

Res Type:	2.16
H1/a:	#DIV/0!
H2/a:	#DIV/0!
C1-0.01:	#DIV/0!
C2-0.01:	#DIV/0!
C1-0.04:	#DIV/0!
C2-0.04:	#DIV/0!
C1-0.12:	#DIV/0!
C2-0.12:	#DIV/0!
C1-0.36:	#DIV/0!
C2-0.36:	#DIV/0!

$G_1 =$ #DIV/0!

$G_2 =$ #DIV/0!

$G_3 =$ #DIV/0!

$G_4 =$ #DIV/0!

$K_{fs} =$ #DIV/0! cm/sec; #DIV/0! cm/min; #DIV/0! m/sec; #DIV/0! inch/min; #DIV/0! inch/sec

$\Phi_m =$ #DIV/0! (cm^2/min)

Calculation formulas related to [illegible] Where H_1 is the first water head height (cm), H_2 is the second water head height (cm), a is borehole radius (cm) and α^* is macroscopic capillary length [illegible] according to the soil texture-structure category. [illegible] C_1 [illegible] C_2 [illegible] (Zhang et al., 1998).

Soil Texture-Structure Category	$\alpha^*(cm^{-1})$	Shape Factor
Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01	$C_1 = \left(\frac{H_1/a}{2.102 + 0.118(H_1/a)}\right)^{0.655}$ $C_2 = \left(\frac{H_2/a}{2.102 + 0.118(H_2/a)}\right)^{0.655}$
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04	$C_1 = \left(\frac{H_1/a}{1.992 + 0.091(H_1/a)}\right)^{0.683}$ $C_2 = \left(\frac{H_2/a}{1.992 + 0.091(H_2/a)}\right)^{0.683}$
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$
Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macro pores, etc.	0.36	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$

Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s), K_{fs} is Soil saturated hydraulic conductivity (cm/s), Φ_m is Soil matric flux potential (cm²/s), α^* is Macroscopic capillary length parameter (from Table 2), a is Borehole radius (cm), H_1 is the first head of water established in borehole (cm), H_2 is the second head of water established in borehole (cm) and C is Shape factor (from Table 2).

One Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$	$K_{fs} = \frac{C_1 \times Q_1}{2\pi H_1^2 + \pi a^2 C_1 + 2\pi\left(\frac{H_1}{\alpha^*}\right)}$
One Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$	$\Phi_m = \frac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)\alpha^* + 2\pi H_1}$
Two Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$ $Q_2 = \bar{R}_2 \times 35.22$	$G_1 = \frac{H_2 C_1}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_2 = \frac{H_1 C_2}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $K_{fs} = G_2Q_2 - G_1Q_1$ $G_3 = \frac{(2H_2^2 + a^2C_2)C_1}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$
Two Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$ $Q_2 = \bar{R}_2 \times 2.16$	$G_4 = \frac{(2H_1^2 + a^2C_1)C_2}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $\Phi_m = G_3Q_1 - G_4Q_2$

Guelph Permeameter Calculations - GP2

Input

Result

Support: ali@soilmoisture.com

Head #1

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir):	1
Enter water Head Height ("H" in cm):	15
Enter the Borehole Radius ("a" in cm):	3
Enter the soil texture-structure category (enter one of the below numbers):	2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min):	0.4000

Res Type	35.22
H	15
a	3
H/a	5
a*	0.04
C0.01	1.518
C0.04	1.629
C0.12	1.667
C0.36	1.667
C	1.629
R	0.400
Q	0.235
pi	3.142

$\alpha^* =$ 0.04 (cm^{-1})

$C =$ 1.629144145

$Q =$ 0.2348

$K_{fs} =$	1.00E-04	cm/sec
	6.01E-03	cm/min
	1.00E-06	m/sec
	2.37E-03	inch/min
	3.95E-05	inch/sec

$\Phi_m =$ 2.51E-03 (cm^2/min)

Head #2

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir):	
Enter water Head Height ("H" in cm):	
Enter the Borehole Radius ("a" in cm):	
Enter the soil texture-structure category (enter one of the below numbers):	

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min):	

Res Type	0
H	0
a	0
H/a	#DIV/0!
a*	0
C0.01	#DIV/0!
C0.04	#DIV/0!
C0.12	#DIV/0!
C0.36	#DIV/0!
C	0
R	0.000
Q	0
pi	3.1415

$\alpha^* =$ 0 (cm^{-1})

$C =$ 0

$Q =$ 0

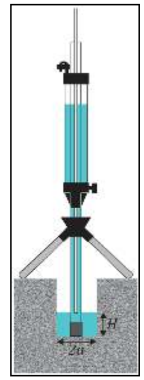
$K_{fs} =$	#DIV/0!	cm/sec
	#DIV/0!	cm/min
	#DIV/0!	m/ses
	#DIV/0!	inch/min
	#DIV/0!	inch/sec

$\Phi_m =$ #DIV/0! (cm^2/min)

Average

$K_{fs} =$	#DIV/0!	cm/sec
	#DIV/0!	cm/min
	#DIV/0!	m/s
	#DIV/0!	inch/min
	#DIV/0!	inch/sec

$\Phi_m =$ #DIV/0! (cm^2/min)



Two Head Method

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir):	
Enter the first water Head Height ("H1" in cm):	
Enter the second water Head Height ("H2" in cm):	
Enter the Borehole Radius ("a" in cm):	
Enter the soil texture-structure category (enter one of the below numbers):	

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

$\alpha^* =$ 0 (cm^{-1})

Steady State Rate of Water Level Change ("R1" in cm/min):	
Steady State Rate of Water Level Change ("R2" in cm/min):	

$Q_1 =$	0
$Q_2 =$	0
$C_1 =$	0
$C_2 =$	0
$G_1 =$	#DIV/0!
$G_2 =$	#DIV/0!
$G_3 =$	#DIV/0!
$G_4 =$	#DIV/0!

Res Type:	2.16
H1/a:	#DIV/0!
H2/a:	#DIV/0!
C1-0.01:	#DIV/0!
C2-0.01:	#DIV/0!
C1-0.04:	#DIV/0!
C2-0.04:	#DIV/0!
C1-0.12:	#DIV/0!
C2-0.12:	#DIV/0!
C1-0.36:	#DIV/0!
C2-0.36:	#DIV/0!

$K_{fs} =$	#DIV/0!	cm/sec
	#DIV/0!	cm/min
	#DIV/0!	m/sec
	#DIV/0!	inch/min
	#DIV/0!	inch/sec

$\Phi_m =$ #DIV/0! (cm^2/min)

[illegible]

Soil Texture-Structure Category	α^*(cm^{-1})	Shape Factor
Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01	$C_1 = \left(\frac{H_1/a}{2.102 + 0.118(H_1/a)}\right)^{0.655}$ $C_2 = \left(\frac{H_2/a}{2.102 + 0.118(H_2/a)}\right)^{0.655}$
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04	$C_1 = \left(\frac{H_1/a}{1.992 + 0.091(H_1/a)}\right)^{0.683}$ $C_2 = \left(\frac{H_2/a}{1.992 + 0.091(H_2/a)}\right)^{0.683}$
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$
Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macro pores, etc.	0.36	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$

Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s), K_{fs} is Soil saturated hydraulic conductivity (cm/s), Φ_m is Soil matric flux potential (cm^2/s), α^* is Macroscopic capillary length parameter (from Table 2), a is Borehole radius (cm), H_1 is the first head of water established in borehole (cm) , H_2 is the second head of water established in borehole (cm) and C is Shape factor (from Table 2).

One Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$	$K_{fs} = \frac{C_1 \times Q_1}{2\pi H_1^2 + \pi a^2 C_1 + 2\pi\left(\frac{H_1}{\alpha^*}\right)}$
One Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$	$\Phi_m = \frac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)\alpha^* + 2\pi H_1}$
Two Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$ $Q_2 = \bar{R}_2 \times 35.22$	$G_1 = \frac{H_2 C_1}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_2 = \frac{H_1 C_2}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $K_{fs} = G_2Q_2 - G_1Q_1$ $G_3 = \frac{(2H_2^2 + a^2C_2)C_1}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$
Two Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$ $Q_2 = \bar{R}_2 \times 2.16$	$G_4 = \frac{(2H_1^2 + a^2C_1)C_2}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $\Phi_m = G_3Q_1 - G_4Q_2$

Palmer™

Appendix D

Corrosivity Laboratory Results

ALS Canada Ltd.

right solutions.
right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **WT2326075**	Page	: 1 of 4
Client	: **Palmer Environmental Consulting Group Inc.**	Laboratory	: ALS Environmental - Waterloo
Contact	: Teddy Ou	Account Manager	: Andrew Martin
Address	: 74 Berkeley Street Toronto ON Canada M5V 1E3	Address	: 60 Northland Road, Unit 1 Waterloo ON Canada N2V 2B8
Telephone	: ----	Telephone	: +1 519 886 6910
Project	: 2304202	Date Samples Received	: 21-Aug-2023 15:30
PO	: ----	Date Analysis Commenced	: 22-Aug-2023
C-O-C number	: 20-1080778	Issue Date	: 01-Sep-2023 16:20
Sampler	: CLIENT		
Site	: ----		
Quote number	: (Q88296) PALMER 2023 STANDING OFFER		
No. of samples received	: 10		
No. of samples analysed	: 10		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Nik Perkio	Inorganics Analyst	Inorganics, Waterloo, Ontario
Niral Patel		Centralized Prep, Waterloo, Ontario

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
%	percent
µS/cm	microsiemens per centimetre
mg/kg	milligrams per kilogram
mV	millivolts
ohm cm	ohm centimetres (resistivity)
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical Results

Sub-Matrix: **Soil**

(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method/Lab	LOR	Unit	BH- NT-21/ SS5	BH- NT-19/ SS4	BH- NT-17/ SS4	BH- NT-12/ SS2	BH- NT-11/ SS3
				Client sampling date / time	18-Aug-2023 00:00	18-Aug-2023 00:00	18-Aug-2023 00:00	18-Aug-2023 00:00	18-Aug-2023 00:00
					WT2326075-001	WT2326075-002	WT2326075-003	WT2326075-004	WT2326075-005
					Result	Result	Result	Result	Result
Physical Tests									
Conductivity (1:2 leachate)	----	E100-L/WT	5.00	µS/cm	206	150	212	197	140
Moisture	----	E144/WT	0.25	%	31.1	18.5	17.0	18.0	17.0
Oxidation-reduction potential [ORP]	----	E125/WT	0.10	mV	258	275	271	283	293
pH (1:2 soil:CaCl2-aq)	----	E108A/WT	0.10	pH units	7.77	7.72	7.78	7.73	7.68
Resistivity	----	EC100R/WT	100	ohm cm	4850	6670	4720	5080	7140
Inorganics									
Sulfides, acid volatile	----	E396-L/WT	0.20	mg/kg	<0.29	<0.24	<0.24	<0.24	<0.24
Leachable Anions & Nutrients									
Chloride, soluble ion content	16887-00-6	E236.Cl/WT	5.0	mg/kg	6.2	22.7	75.5	64.9	20.6
Sulfate, soluble ion content	14808-79-8	E236.SO4/WT	20	mg/kg	22	<20	<20	<20	<20

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

Sub-Matrix: **Soil**

(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method/Lab	LOR	Unit	BH- NT-9/ SS3	BH- NT-6/ SS2	BH- NT-3/ SS4	BH- NT-4A/ SS3	BH- NT-1/ SS3
Client sampling date / time					18-Aug-2023 00:00	18-Aug-2023 00:00	18-Aug-2023 00:00	18-Aug-2023 00:00	18-Aug-2023 00:00
					WT2326075-006	WT2326075-007	WT2326075-008	WT2326075-009	WT2326075-010
					Result	Result	Result	Result	Result
Physical Tests									
Conductivity (1:2 leachate)	----	E100-L/WT	5.00	µS/cm	105	162	317	204	413
Moisture	----	E144/WT	0.25	%	16.1	14.8	29.0	10.4	26.0
Oxidation-reduction potential [ORP]	----	E125/WT	0.10	mV	292	304	300	279	296
pH (1:2 soil:CaCl2-aq)	----	E108A/WT	0.10	pH units	7.71	7.61	7.73	8.09	7.73
Resistivity	----	EC100R/WT	100	ohm cm	9520	6170	3150	4900	2420
Inorganics									
Sulfides, acid volatile	----	E396-L/WT	0.20	mg/kg	<0.23	<0.23	<0.28	<0.22	<0.26
Leachable Anions & Nutrients									
Chloride, soluble ion content	16887-00-6	E236.Cl/WT	5.0	mg/kg	14.9	14.6	91.7	31.4	132
Sulfate, soluble ion content	14808-79-8	E236.SO4/WT	20	mg/kg	<20	<20	30	51	24

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

ALS Canada Ltd.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **WT2326075**	Page	: 1 of 14
Client	: **Palmer Environmental Consulting Group Inc.**	Laboratory	: ALS Environmental - Waterloo
Contact	: Teddy Ou	Account Manager	: Andrew Martin
Address	: 74 Berkeley Street Toronto ON Canada M5V 1E3	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: ----	Telephone	: +1 519 886 6910
Project	: 2304202	Date Samples Received	: 21-Aug-2023 15:30
PO	: ----	Issue Date	: 01-Sep-2023 16:20
C-O-C number	: 20-1080778		
Sampler	: CLIENT		
Site	: ----		
Quote number	: (Q88296) PALMER 2023 STANDING OFFER		
No. of samples received	: 10		
No. of samples analysed	: 10		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-11/ SS3	E396-L	18-Aug-2023	24-Aug-2023	14 days	7 days	✓	24-Aug-2023	7 days	0 days	✓
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-12/ SS2	E396-L	18-Aug-2023	24-Aug-2023	14 days	7 days	✓	24-Aug-2023	7 days	0 days	✓
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-17/ SS4	E396-L	18-Aug-2023	24-Aug-2023	14 days	7 days	✓	24-Aug-2023	7 days	0 days	✓
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-19/ SS4	E396-L	18-Aug-2023	24-Aug-2023	14 days	7 days	✓	24-Aug-2023	7 days	0 days	✓
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-21/ SS5	E396-L	18-Aug-2023	24-Aug-2023	14 days	7 days	✓	24-Aug-2023	7 days	0 days	✓
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-1/ SS3	E396-L	18-Aug-2023	25-Aug-2023	14 days	8 days	✓	25-Aug-2023	7 days	0 days	✓
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-3/ SS4	E396-L	18-Aug-2023	25-Aug-2023	14 days	8 days	✓	25-Aug-2023	7 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-4A/ SS3	E396-L	18-Aug-2023	25-Aug-2023	14 days	8 days	✓	25-Aug-2023	7 days	0 days	✓
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-6/ SS2	E396-L	18-Aug-2023	25-Aug-2023	14 days	8 days	✓	25-Aug-2023	7 days	0 days	✓
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-9/ SS3	E396-L	18-Aug-2023	25-Aug-2023	14 days	8 days	✓	25-Aug-2023	7 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-1/ SS3	E236.Cl	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	24-Aug-2023	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-11/ SS3	E236.Cl	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	24-Aug-2023	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-12/ SS2	E236.Cl	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	24-Aug-2023	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-17/ SS4	E236.Cl	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	24-Aug-2023	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-19/ SS4	E236.Cl	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	24-Aug-2023	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-21/ SS5	E236.Cl	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	24-Aug-2023	28 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-3/ SS4	E236.Cl	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	24-Aug-2023	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-4A/ SS3	E236.Cl	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	24-Aug-2023	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-6/ SS2	E236.Cl	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	24-Aug-2023	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-9/ SS3	E236.Cl	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	24-Aug-2023	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-1/ SS3	E236.SO4	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	24-Aug-2023	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-11/ SS3	E236.SO4	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	24-Aug-2023	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-12/ SS2	E236.SO4	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	24-Aug-2023	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-17/ SS4	E236.SO4	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	24-Aug-2023	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-19/ SS4	E236.SO4	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	24-Aug-2023	28 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-21/ SS5	E236.SO4	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	24-Aug-2023	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-3/ SS4	E236.SO4	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	24-Aug-2023	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-4A/ SS3	E236.SO4	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	24-Aug-2023	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-6/ SS2	E236.SO4	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	24-Aug-2023	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-9/ SS3	E236.SO4	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	24-Aug-2023	28 days	0 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-1/ SS3	E100-L	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	25-Aug-2023	30 days	8 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-11/ SS3	E100-L	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	25-Aug-2023	30 days	8 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-12/ SS2	E100-L	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	25-Aug-2023	30 days	8 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-17/ SS4	E100-L	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	25-Aug-2023	30 days	8 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-19/ SS4	E100-L	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	25-Aug-2023	30 days	8 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-21/ SS5	E100-L	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	25-Aug-2023	30 days	8 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-3/ SS4	E100-L	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	25-Aug-2023	30 days	8 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-4A/ SS3	E100-L	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	25-Aug-2023	30 days	8 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-6/ SS2	E100-L	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	25-Aug-2023	30 days	8 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-9/ SS3	E100-L	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	25-Aug-2023	30 days	8 days	✓
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-1/ SS3	E144	18-Aug-2023	----	----	----		22-Aug-2023	----	5 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-11/ SS3	E144	18-Aug-2023	----	----	----		22-Aug-2023	----	5 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-12/ SS2	E144	18-Aug-2023	----	----	----		22-Aug-2023	----	5 days	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-17/ SS4	E144	18-Aug-2023	----	----	----		22-Aug-2023	----	5 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-19/ SS4	E144	18-Aug-2023	----	----	----		22-Aug-2023	----	5 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-21/ SS5	E144	18-Aug-2023	----	----	----		22-Aug-2023	----	5 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-3/ SS4	E144	18-Aug-2023	----	----	----		22-Aug-2023	----	5 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-4A/ SS3	E144	18-Aug-2023	----	----	----		22-Aug-2023	----	5 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-6/ SS2	E144	18-Aug-2023	----	----	----		22-Aug-2023	----	5 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-9/ SS3	E144	18-Aug-2023	----	----	----		22-Aug-2023	----	5 days	
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-1/ SS3	E125	18-Aug-2023	23-Aug-2023	180 days	6 days	✓	24-Aug-2023	180 days	7 days	✓
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-11/ SS3	E125	18-Aug-2023	23-Aug-2023	180 days	6 days	✓	24-Aug-2023	180 days	7 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-12/ SS2	E125	18-Aug-2023	23-Aug-2023	180 days	6 days	✓	24-Aug-2023	180 days	7 days	✓
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-17/ SS4	E125	18-Aug-2023	23-Aug-2023	180 days	6 days	✓	24-Aug-2023	180 days	7 days	✓
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-19/ SS4	E125	18-Aug-2023	23-Aug-2023	180 days	6 days	✓	24-Aug-2023	180 days	7 days	✓
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-21/ SS5	E125	18-Aug-2023	23-Aug-2023	180 days	6 days	✓	24-Aug-2023	180 days	7 days	✓
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-3/ SS4	E125	18-Aug-2023	23-Aug-2023	180 days	6 days	✓	24-Aug-2023	180 days	7 days	✓
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-4A/ SS3	E125	18-Aug-2023	23-Aug-2023	180 days	6 days	✓	24-Aug-2023	180 days	7 days	✓
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-6/ SS2	E125	18-Aug-2023	23-Aug-2023	180 days	6 days	✓	24-Aug-2023	180 days	7 days	✓
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-9/ SS3	E125	18-Aug-2023	23-Aug-2023	180 days	6 days	✓	24-Aug-2023	180 days	7 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-11/ SS3	E108A	18-Aug-2023	23-Aug-2023	30 days	5 days	✓	24-Aug-2023	30 days	7 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-12/ SS2	E108A	18-Aug-2023	23-Aug-2023	30 days	5 days	✓	24-Aug-2023	30 days	7 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-17/ SS4	E108A	18-Aug-2023	23-Aug-2023	30 days	5 days	✓	24-Aug-2023	30 days	7 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-19/ SS4	E108A	18-Aug-2023	23-Aug-2023	30 days	5 days	✓	24-Aug-2023	30 days	7 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-21/ SS5	E108A	18-Aug-2023	23-Aug-2023	30 days	5 days	✓	24-Aug-2023	30 days	7 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-1/ SS3	E108A	18-Aug-2023	23-Aug-2023	30 days	6 days	✓	25-Aug-2023	30 days	8 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-3/ SS4	E108A	18-Aug-2023	23-Aug-2023	30 days	6 days	✓	25-Aug-2023	30 days	8 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-4A/ SS3	E108A	18-Aug-2023	23-Aug-2023	30 days	6 days	✓	25-Aug-2023	30 days	8 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-6/ SS2	E108A	18-Aug-2023	23-Aug-2023	30 days	6 days	✓	25-Aug-2023	30 days	8 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-9/ SS3	E108A	18-Aug-2023	23-Aug-2023	30 days	6 days	✓	25-Aug-2023	30 days	8 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1103763	2	18	11.1	4.7	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1097635	1	19	5.2	5.0	✓
Moisture Content by Gravimetry	E144	1098416	2	33	6.0	5.0	✓
ORP by Electrode	E125	1099994	1	18	5.5	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A	1099425	2	40	5.0	5.0	✓
Water Extractable Chloride by IC	E236.Cl	1102290	1	15	6.6	5.0	✓
Water Extractable Sulfate by IC	E236.SO4	1102289	1	15	6.6	5.0	✓
Laboratory Control Samples (LCS)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1103763	2	18	11.1	4.7	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1097635	2	19	10.5	10.0	✓
Moisture Content by Gravimetry	E144	1098416	2	33	6.0	5.0	✓
ORP by Electrode	E125	1099994	1	18	5.5	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A	1099425	2	40	5.0	5.0	✓
Water Extractable Chloride by IC	E236.Cl	1102290	2	15	13.3	10.0	✓
Water Extractable Sulfate by IC	E236.SO4	1102289	2	15	13.3	10.0	✓
Method Blanks (MB)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1103763	2	18	11.1	4.7	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1097635	1	19	5.2	5.0	✓
Moisture Content by Gravimetry	E144	1098416	2	33	6.0	5.0	✓
Water Extractable Chloride by IC	E236.Cl	1102290	1	15	6.6	5.0	✓
Water Extractable Sulfate by IC	E236.SO4	1102289	1	15	6.6	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by “mod”).

Analytical Methods	*Method / Lab*	*Matrix*	*Method Reference*	*Method Descriptions*
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L ALS Environmental - Waterloo	Soil/Solid	CSSS Ch. 15 (mod)/APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Conductance is measured in the fluid that is observed in the upper layer.
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A ALS Environmental - Waterloo	Soil/Solid	MECP E3137A	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C) and is carried out in accordance with procedures described in the Analytical Protocol (prescriptive method). A minimum 10g portion of the sample, as received, is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling, or decanting and then analyzed using a pH meter and electrode.
ORP by Electrode	E125 ALS Environmental - Waterloo	Soil/Solid	APHA 2580 (mod)	Oxidation Redution Potential (ORP) is reported as the oxidation-reduction potential of the platinum metal-reference electrode employed in the analysis, measured in mV.
Moisture Content by Gravimetry	E144 ALS Environmental - Waterloo	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Water Extractable Chloride by IC	E236.Cl ALS Environmental - Waterloo	Soil/Solid	EPA 300.1	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection using a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Anions are measured in the fluid that is observed in the upper layer.
Water Extractable Sulfate by IC	E236.SO4 ALS Environmental - Waterloo	Soil/Solid	EPA 300.1	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection using a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Anions are measured in the fluid that is observed in the upper layer.
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L ALS Environmental - Waterloo	Soil/Solid	APHA 4500S2J	This analysis is carried out in accordance with the method described in APHA 4500 S2-J. After extraction the Acid Volatile Sulphide is determined colourimetrically.
Resistivity Calculation for Soil Using E100-L	EC100R ALS Environmental - Waterloo	Soil/Solid	APHA 2510 B	Soil Resistivity (calculated) is determined as the inverse of the conductivity of a 2:1 water:soil leachate (dry weight). This method is intended as a rapid approximation for Soil Resistivity. Where high accuracy results are required, direct measurement of Soil Resistivity by the Wenner Four-Electrode Method (ASTM G57) is recommended.

Preparation Methods	*Method / Lab*	*Matrix*	*Method Reference*	*Method Descriptions*

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH/EC	EP108 ALS Environmental - Waterloo	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.
Leach 1:2 Soil : 0.01CaCl2 - As Received for pH	EP108A ALS Environmental - Waterloo	Soil/Solid	MOEE E3137A	A minimum 10g portion of the sample, as received, is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling or decanting and then analyzed using a pH meter and electrode.
Preparation of ORP by Electrode	EP125 ALS Environmental - Waterloo	Soil/Solid	APHA 2580 (mod)	Field-moist sample is extracted in a 1:2 ratio with DI water and then analyzed by ORP meter.
Anions Leach 1:10 Soil:Water (Dry)	EP236 ALS Environmental - Waterloo	Soil/Solid	EPA 300.1	5 grams of dried soil is mixed with 50 grams of distilled water for a minimum of 30 minutes. The extract is filtered and analyzed by ion chromatography.
Distillation for Acid Volatile Sulfide in Soil	EP396-L ALS Environmental - Waterloo	Soil/Solid	APHA 4500S2J	Acid Volatile Sulfide is determined by colourimetric measurement on a sediment sample that has been treated with hydrochloric acid within a purge and trap system, where the evolved hydrogen sulfide gas is carried into a basic solution by argon gas for analysis.

QUALITY CONTROL REPORT

Work Order	: **WT2326075**		Page	: 1 of 6
Client	: Palmer Environmental Consulting Group Inc.		Laboratory	: ALS Environmental - Waterloo
Contact	: Teddy Ou		Account Manager	: Andrew Martin
Address	: 74 Berkeley Street Toronto ON Canada M5V 1E3		Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	:		Telephone	: +1 519 886 6910
Project	: 2304202		Date Samples Received	: 21-Aug-2023 15:30
PO	: ----		Date Analysis Commenced	: 22-Aug-2023
C-O-C number	: 20-1080778		Issue Date	: 01-Sep-2023 16:27
Sampler	: CLIENT ----			
Site	: ----			
Quote number	: (Q88296) PALMER 2023 STANDING OFFER			
No. of samples received	: 10			
No. of samples analysed	: 10			

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Nik Perkio	Inorganics Analyst	Waterloo Inorganics, Waterloo, Ontario
Niral Patel		Waterloo Centralized Prep, Waterloo, Ontario

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 1097635)											
WT2326061-002	Anonymous	Conductivity (1:2 leachate)	----	E100-L	5.00	µS/cm	0.278 mS/cm	273	1.81%	20%	----
Physical Tests (QC Lot: 1098386)											
EO2307467-001	Anonymous	pH (1:2 soil:CaCl2-aq)	----	E108A	0.10	pH units	7.70	7.80	1.29%	5%	----
Physical Tests (QC Lot: 1098388)											
HA2300549-003	Anonymous	Moisture	----	E144	0.25	%	25.6	27.1	5.75%	20%	----
Physical Tests (QC Lot: 1098416)											
WT2325790-006	Anonymous	Moisture	----	E144	0.25	%	8.41	8.32	1.15%	20%	----
Physical Tests (QC Lot: 1099425)											
WT2326032-003	Anonymous	pH (1:2 soil:CaCl2-aq)	----	E108A	0.10	pH units	7.08	7.23	2.10%	5%	----
Physical Tests (QC Lot: 1099994)											
WT2325868-001	Anonymous	Oxidation-reduction potential [ORP]	----	E125	0.10	mV	276	295	6.65%	25%	----
Inorganics (QC Lot: 1102211)											
WT2325833-004	Anonymous	Sulfides, acid volatile	----	E396-L	0.23	mg/kg	<0.23	<0.23	0.0002	Diff <2x LOR	----
Inorganics (QC Lot: 1103763)											
WT2326054-001	Anonymous	Sulfides, acid volatile	----	E396-L	0.22	mg/kg	1.14	0.98	14.2%	45%	----
Leachable Anions & Nutrients (QC Lot: 1102289)											
WT2326054-001	Anonymous	Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	189	196	3.21%	30%	----
Leachable Anions & Nutrients (QC Lot: 1102290)											
WT2326054-001	Anonymous	Chloride, soluble ion content	16887-00-6	E236.Cl	5.0	mg/kg	779	804	3.15%	30%	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 1097635)						
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	<5.00	----
Physical Tests (QCLot: 1098388)						
Moisture	----	E144	0.25	%	<0.25	----
Physical Tests (QCLot: 1098416)						
Moisture	----	E144	0.25	%	<0.25	----
Inorganics (QCLot: 1102211)						
Sulfides, acid volatile	----	E396-L	0.2	mg/kg	<0.20	----
Inorganics (QCLot: 1103763)						
Sulfides, acid volatile	----	E396-L	0.2	mg/kg	<0.20	----
Leachable Anions & Nutrients (QCLot: 1102289)						
Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	<20	----
Leachable Anions & Nutrients (QCLot: 1102290)						
Chloride, soluble ion content	16887-00-6	E236.Cl	5	mg/kg	<5.0	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 1097635)									
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	1409 µS/cm	99.3	90.0	110	----
Physical Tests (QCLot: 1098386)									
pH (1:2 soil:CaCl2-aq)	----	E108A	----	pH units	7 pH units	100	98.0	102	----
Physical Tests (QCLot: 1098388)									
Moisture	----	E144	0.25	%	50 %	99.2	90.0	110	----
Physical Tests (QCLot: 1098416)									
Moisture	----	E144	0.25	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 1099425)									
pH (1:2 soil:CaCl2-aq)	----	E108A	----	pH units	7 pH units	100	98.0	102	----
Inorganics (QCLot: 1102211)									
Sulfides, acid volatile	----	E396-L	0.2	mg/kg	2.196 mg/kg	90.2	70.0	130	----
Inorganics (QCLot: 1103763)									
Sulfides, acid volatile	----	E396-L	0.2	mg/kg	2.196 mg/kg	87.4	70.0	130	----
Leachable Anions & Nutrients (QCLot: 1102289)									
Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	5000 mg/kg	98.2	80.0	120	----
Leachable Anions & Nutrients (QCLot: 1102290)									
Chloride, soluble ion content	16887-00-6	E236.Cl	5	mg/kg	5000 mg/kg	97.9	80.0	120	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Physical Tests (QCLot: 1097635)									
	RM	Conductivity (1:2 leachate)	----	E100-L	1725.6 µS/cm	105	70.0	130	----
Physical Tests (QCLot: 1099994)									
	RM	Oxidation-reduction potential [ORP]	----	E125	475 mV	98.5	90.0	110	----
Leachable Anions & Nutrients (QCLot: 1102289)									
	RM	Sulfate, soluble ion content	14808-79-8	E236.SO4	1070 mg/kg	99.1	70.0	130	----
Leachable Anions & Nutrients (QCLot: 1102290)									
	RM	Chloride, soluble ion content	16887-00-6	E236.Cl	432 mg/kg	97.6	70.0	130	----

SDL-180

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

COC Number: 20 - 1080778

Page

ALS www.alsglobal.com

Environmental Division
Waterloo
Work Order Reference
WT2326075

Telephone : + 1 519 886 6910

Palmer Environmental Consulting Group Inc.

Report To	Contact and company name below will appear on the final report
Company:	Palmer Environmental Consulting Group Inc.
Contact:	Ted Ou
Phone:	647-280-6355
	Company address below will appear on the final report
Street:	871 Equestrian Court, Unit 1
City/Province:	Oakville / ON
Postal Code:	
Invoice To	Same as Report To ☒ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☒ NO
Company:	
Contact:	

Reports / Recipients

Select Report Format: ☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)

Merge QC/QCI Reports with COA ☒ YES ☐ NO ☐ N/A

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☐ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: Ted.Ou@pecg.ca

Email 2: Ted.Pan@pecg.ca

Email 3:

Invoice Recipients

Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax:

Email 2:

Turnaround Time (TAT) Requested

☒ Routine [R] if received by 3pm M-F - no surcharges apply

☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minim

☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minir

☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minii

☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minii

☐ Same day [E2] if received by 10am M-S - 200% rush surcharge. A may apply to rush requests on weekends, statutory holidays and nc

Date and Time Required for all E&P TATs:

For all tests with rush TATs requested, plea

Project Information

ALS Account # / Quote #:	
Job #:	2304202
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (ALS use only):

ALS Contact:

Sampler:

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Corrosivity Package (corrosivity + pH + Sulphate)	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
	BH-NT-21 / SS5	18/08/23	AM	Soil	1	X			
	BH-NT-19 / SS4	↓	↓	↓	1	X			
	BH-NT-17 / SS4				1	X			
	BH-NT-12 / SS2				1	X			
	BH-NT-11 / SS3				1	X			
	BH-NT-9 / SS3				1	X			
	BH-NT-6 / SS2				1	X			
	BH-NT-3 / SS4				1	X			
	BH-NT-4A / SS3				1	X			
	BH-NT-1 / SS3				1	X			

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human consumption/ use? ☐ YES ☐ NO

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

SAMPLE RECEIPT DETAILS (ALS use only)

Cooling Method: ☐ NONE ☒ ICE ☐ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C:

FINAL COOLER TEMPERATURES °C: 9.6

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (ALS use only)			FINAL SHIPMENT RECEPTION (ALS use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by: CM	Date: Aug 21/23	Time: 15:30

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

AUG 2020 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.