Hydrogeological Study Report

Wallace Point Road Subdivision

3491 Wallace Point Road
Otonabee-South Monaghan,
Peterborough, Ontario

D.M. Wills Project Number 21-85162

D.M. Wills Associates Limited
Partners in Engineering, Planning and
Environmental Services
Peterborough

May 2023

Prepared for:
Nirvana Homes c/o Rubal Kundra

Submissions Summary

Submission No.	Submission Title	Date of Release	Submissions Summary
1	Final Hydrogeological Study Report	May 25, 2023	Final Submission to Client

This report has been formatted considering the requirements of the Accessibility for Ontarians with Disabilities Act.

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1.0 Introduction

D.M. Wills Associates Limited (Wills) was retained by Nirvana Homes c/o Rubal Kundra (Client) to complete a Hydrogeological Study (Study) for the property identified as 3491 Wallace Point Road in Otonabee-South Monaghan, Ontario (Subject Property). The Subject Property is approximately 24.5 hectares (ha) and currently consists of agricultural fields with a residential building and barn located in the northwestern portion along Wallace Point Road. The Subject Property is shown on **Figure 1**.

Wills understands that the Client wishes to develop the Subject Property to include 50 residential lots and a commercial center (Proposed Development). Domestic water supply for the Proposed Development will be provided by the Stewart Hall municipal water system. Wills' Study was conducted to confirm the sewage servicing capacity and to provide subsurface design requirements for proposed Low Impact Development (LID) features on the Subject Property.

This Study was conducted in conjunction with the Functional Servicing Report (FSR) and Geotechnical Report, submitted under separate cover.

2.0 Scope of Work

Wills' approved Scope of Work for the Study included the following:

- Public and private utility service locates were obtained prior to initiating field investigations.
- A Site-Specific Health and Safety Plan and Fieldwork Plan were prepared.
- An excavation contractor, Steenburgh Sand and Gravel (Steenburgh) was retained to excavate 10 test pits to a depth of 3.0 mbg on the Subject Property on June 20, 2022.
- Four single ring infiltrometers were installed in shallow auger holes to determine representative infiltration rates for LID design on the Subject Property on June 20, 2022. Infiltration tests were conducted on June 21, 2022. Water levels in the infiltrometers were monitored manually using a Solinst Water Level Meter.
- A licensed drilling contractor, Canadian Environmental Drilling and Contractors Inc. (Canadian Environmental) was retained to advance 12 boreholes on the Subject Property from July 11 to July 13, 2022. Boreholes were advanced to an approximate depth of 6.55 metres below ground (mbg) or until practical refusal. Four boreholes were completed as monitor wells.
- Standard Penetration Tests (SPT) and split spoon sampling was used to collect soil samples at 0.75 m intervals for the top 3.0 m, and 1.5 m intervals below 3.0 m to refusal or borehole termination depth.
- Retained soil samples were submitted to WSP Canada (WSP), a Canadian Certified Independent Laboratory (CCIL) for analysis of Natural Moisture Content, Particle Size Distribution, and percolation testing.

- Three groundwater samples were submitted to SGS Canada (SGS), a Canadian Association for Laboratory Accreditation Inc. (CALA) accredited laboratory for nitrate analysis to support the Groundwater Impact Assessment.
- The findings of Wills' field investigation were summarized in this Hydrogeological Study Report.

3.0 Subsurface Investigation

Borehole, monitor well, test pit and infiltration test locations are shown on **Figure 2.**

Representative soil samples collected by Wills staff during the field program were classified based on grain size, stratigraphy, and relative soil compactness. Select soil samples were submitted to WSP for analysis of Natural Moisture Content, Particle Size Distribution (including sieve and hydrometer analysis), and percolation testing. Laboratory testing results were compared to the Ministry of Municipal Affairs and Housing, Building and Development Branch (MMAH) Supplementary Standard SB-6 – Percolation Time and Soil Descriptions Table 2 and Table 3 values (Ontario Building Code [OBC], 2012) (OBC Table 2/3).

Borehole and test pit logs detailing the encountered subsurface conditions and monitor well construction details are included in **Appendix A**. The auger holes advanced to facilitate the infiltration tests (INF-1 to INF-4) were situated adjacent to existing test pits and were not logged or sampled.

3.1 Soil Profile Summary

3.1.1 Ontario Geological Survey Mapping

Physiographic Region	The Peterborough Drumlin Field.
Surficial Geology	Older alluvial deposits consisting of clay, silt, sand, gravel, and potential organic remains.
Bedrock Geology	Limestone, dolostone, shale, arkose and sandstone from the Shadow Lake Formation.

OGS mapping of the Subject Property is included in **Appendix B**.

3.1.2 Overburden description

The results of the drilling and test pit programs indicate the overburden is generally aligned with the complex alluvial deposition environment suggested by the OGS mapping.

The subsurface profile consists of a surficial layer of silty sand topsoil that is generally underlain by silty sand to sandy silt material. This layer is variably interbedded with silt that includes with varying amounts of sand and clay. A basal layer of sand and gravel material was encountered in BH22-06, BH22-11 and BH22-12. Occasional cobbles were

generally observed towards the bottom of the boreholes and were encountered in both the sand and silt dominated strata. The subsurface stratigraphy is detailed on the test pit and boreholes logs included in **Appendix A**.

Seven laboratory particle size distribution analyses were completed on the collected soil samples. The analytical results are summarized in **Table 1** on the basis of the Unified Soil Classification System (USCS). Certificates of Analysis for the physical soil analysis are included in **Appendix C**.

Table 1 – Summary of Particle Size Distribution

Location ID	Sample No.	Soil Unit	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH22-04	SS5	silty sand	14	47	24	15
BH22-06	SS6	silt	8	16	71	
BH22-10	SS7	sand	0	90	10	
BH22-11	SS7	sandy gravel	66	28	6	
TP22-02	GS2	silty sand	0	64	24	12
TP22-03	GS3	sandy silt	2	29	49	20
TP22-06	GS2	sand and silt	16	36	35	13

3.1.3 Bedrock

Bedrock was not encountered at any of the borehole or test pit locations. Although bedrock classification was beyond the scope of the Study, OGS Mapping (2007) indicates the local underlying bedrock geology includes limestone, dolostone, shale, arkose, and/or sandstone from the Shadow Lake Formation.

3.2 Groundwater

Static groundwater water levels were measured in the four monitor wells on July 28, 2022. Well construction details and groundwater observations are provided on the borehole logs in **Appendix A**. **Table 2** summarizes the static groundwater levels and corresponding elevations. Groundwater elevations were inferred using topographic survey data collected by Wills in November 2021.

Table 2 – Groundwater Level Summary

Monitor Well ID	Stick-Up (mag)	Date	Static Water Level (mbg)	Groundwater Elevation (masl)
BH22-01 (MW22-01)	0.82	07/28/2023	5.93	199.58
BH22-02 (MW22-02)	0.92	07/28/2023	0.72 mag artesian conditions	194.91
BH22-03 (MW22-03)	0.92	07/28/2023	3.55	194.02
BH22-04 (MW22-04)	0.86	07/28/2023	2.77	194.77

*mag – metres above ground. masl – metres above sea level

A summary of groundwater levels and seepage in the open boreholes and test pits is included in **Table 3.** Note that boreholes and test pits were backfilled shortly after completion, and water levels in the open test holes may underestimate static conditions (i.e., static water levels may be at higher elevations).

Table 3 – Groundwater Observations in Open Test Holes

Borehole/Test Pit ID	Date	Water Level (mbg)	Groundwater Elevation (masl)
BH22-05	07/12/2023	3.70	195.98
BH22-06	07/11/2023	3.65	192.53
BH22-07	07/11/2023	2.45	192.79
BH22-08	07/13/2023	5.00	193.32
BH22-09	07/12/2023	Saturated soil at 6.2, no standing water	Saturated soil at 192.34
BH22-10	07/12/2023	2.20	198.49
BH22-11	07/11/2023	0.00 artesian conditions	195.56
BH22-12	07/12/2023	Wet soil at 4.55, borehole caved to 2.4	Wet soil at 199.20
TP22-01	06/20/2023	Groundwater seepage at 1.0	Groundwater seepage at 196.54

TP22-02	06/20/2023	Groundwater seepage at 2.2	Groundwater seepage at 199.69
TP22-03	06/20/2023	-	-
TP22-04	06/20/2023	Groundwater seepage at 2.1	Groundwater seepage at 199.06
TP22-05	06/20/2023	Groundwater seepage at 1.4	Groundwater seepage at 194.30
TP22-06	06/20/2023	Groundwater seepage at 1.1	Groundwater seepage at 193.89
TP22-07	06/20/2023	-	-
TP22-08	06/20/2023	-	-
TP22-09	06/20/2023	-	-
TP22-10	06/20/2023	-	-

Artesian conditions were observed at MW22-02 and BH22-11 in the northern portion of the Subject Property. A confined aquifer was interpreted to be represented by a saturated sand to sandy gravel layer in BH22-11, at a depth of 3.10 mbg (192.22 masl). An obvious confined aquifer was not identified in MW20-22, however, may be associated with soil saturation and increased gravel content at a depth of 4.8 mbg (190.11 masl).

It should also be noted that during Wills' test pit and borehole investigation, wet to saturated sand lenses were observed throughout the investigated depths. The lenses contributed to minor groundwater seepage in the test pits between approximately 1.0 – 2.5 mbg. It is likely that these sand lenses are discontinuous and may preferentially store infiltrating water as it migrates downwards through the surrounding lower K-value materials.

3.2.1 Hydraulic Gradient

Horizontal hydraulic gradient, including magnitude and direction, was calculated for the Subject Property using the United States Environmental Protection Agency (EPA) *On-Line Tools for Site Assessment Calculation – Hydraulic Gradient – Magnitude and Direction*.

The hydraulic gradient was calculated using Wills' field measurements collected on July 28, 2022, and monitor well elevations inferred from Wills' topographic survey. The inputs and outputs of the EPA's model are summarized in **Table 4**.

Table 4 – July 28, 2022, Hydraulic Gradients

Monitor Well	UTM Easting (m)	UTM Northing (m)	Groundwater Elevation (masl)
MW22-01	714171	4900635	199.58
MW22-02	714306	4901128	194.91
MW22-03	714010	4900799	194.02
MW22-04	714425	4901049	194.77
Hydraulic Gradient Magnitude			**0.0174**
Flow Direction from North (positive y axis)			**321.2**
Coefficient of Determination (R^2)			**0.77**

Based on the 2022 static groundwater level measurements, the horizontal hydraulic gradient was calculated to be 0.0174 with an approximately northwest flow direction (321.2° azimuth). The inferred groundwater flow direction is shown on **Figure 2**.

4.0 In-Situ Infiltration Testing

In-situ Infiltration tests were conducted at select locations on the Subject Property to determine representative shallow infiltration rates for stormwater management and sewage disposal system design. Infiltration test locations are shown on **Figure 2** and were conducted at depths ranging from 0.9 to 1.4 mbg.

Water levels within the single-ring infiltrometer casings were manually monitored using a Solinst water level tape at each location. The infiltration tests were conducted for a maximum of 105 minutes, with water levels measured at 30 second intervals for the first 5 minutes and increasing intervals as the test progressed. Detailed calculations and supporting infiltration graphs are included in **Appendix D.**

4.1 Permeability and Percolation Time

Table 5 summarizes the permeability and percolation times of the tested soils on the basis of the in-situ testing and laboratory results compared to OBC Table 2 & Table 3.

Table 5 – Permeability and Percolation Time Summary

ID	Soil Description	Soil Envelope	Laboratory Estimated Percolation (T)	Percolation Range (OBC Table 2 & 3)	Permeability	In-situ Testing
INF-01	Silty sand	SM	T = 20 min/cm	T = 8 – 20min/cm or 30 – 75 mm/hr	Medium to low	T= 0.15 min/cm or 4125 mm/hr
		ML		T = 20 – 50 min/cm or 12 – 30 mm/hr		
INF-02	Sandy silt	SM	T = 40 min/cm	T = 8 – 20min/cm or 30 – 75 mm/hr	Medium to low	T= 7 min/cm or 86 mm/hr
		ML		T = 20 – 50 min/cm or 12 – 30 mm/hr		
INF-03	Silty sand	SM	NA	T = 8 – 20min/cm or 30 – 75 mm/hr	Medium to low	T= 900 min/cm or 1 mm/hr
		ML		T = 20 – 50 min/cm or 12 – 30 mm/hr		
INF-04	Sand and silt	SM	T = 30 min/cm	T = 8 – 20min/cm or 30 – 75 mm/hr	Medium to low	T= 0 min/cm or 0.00 mm/hr (No infiltration during test period)
		ML		T = 20 – 50 min/cm or 12 – 30 mm/hr		

Notes: 1. SM envelope –silty sands, sand-silt mixtures
ML envelope – Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, clayey silts, with slight plasticity

Wills provides the following with respect to the permeability and percolation of the encountered shallow subsurface soils.

- The shallow soils are anticipated to generally fall within the SM and ML envelopes based on the laboratory testing results.
    - Shallow subsurface strata generally included some amount of clay, which is expected to bias the infiltration rates towards that of the ML soil envelope.
- In-situ infiltration rates showed a very poor correlation to the laboratory estimates for the tested soils. The in-situ results suggested infiltration rates that were either drastically higher or lower than the laboratory estimates for similar materials.
    - Based on the disparity between the in-situ and laboratory estimates, Wills expects that testing deficiencies (e.g., seating of the infiltrometer casing or obstruction by coarse gravel/cobble at the testing depth) may have impacted the in-situ results.
- In view of the in-situ results, physical soils testing, and Wills' review of the encountered materials, Wills recommends using the laboratory T-time estimate of 40 min/cm (15 mm/hr) as input into the design of proposed stormwater management features and sewage disposal systems on the Subject Property.

5.0 Groundwater Impact Assessment

A Groundwater Impact Assessment was conducted on the basis of the Ministry of Environment Conservation and Parks (MECP) *Guideline D-5-4* to determine the feasibility and potential for impacts to down-gradient water resources arising from the proposed sewage disposal systems. For the purpose of the Groundwater Impact Assessment, the Subject Property was divided into two sections: the lands designated for commercial use, and those designated for residential use. Separate Groundwater Impact Assessments were conducted for each section. The Groundwater Impact Assessment considered the following:

- Based on Wills' FSR, the Proposed Development can support 50 residential lots and a 1.5 ha commercial lot. Wills' FSR provides the following infiltration system requirements to support the Proposed Development:
    - Each residential lot will require two infiltration systems – One will capture runoff generated from the roof of each dwelling in a subsurface system (minimum required volume of 6 m^3). The second infiltration system will capture the remainder of the lot's runoff in an aboveground system (minimum required volume of 20 m^3).
    - The commercial lot will require an aboveground infiltration facility with a volume of approximately 105 m^3.
    - Wills understands that each lot (50 residential and one commercial) is proposed to be serviced with a private on-site sewage disposal system.

- At the time of preparing this report, dwelling sizes and anticipated sewage flows were not available, however, 1,000 L/day is considered to be an acceptable sewage effluent loading rate for the residential lots.
- The sewage effluent loading rate from the commercial lot will not exceed 4,495 L/day.
- Nitrate was used to assess the impact of sewage effluent on the groundwater environment. *Guideline D-5-4* requires that the effluent plume at the boundary of the Subject Property cannot exceed the ODWQS limit of 10 mg/L for nitrate to prevent off-site groundwater impacts.
- Wills' inputs to the Groundwater Assessment mass balance equations considered a standard nitrate loading of 40 mg/lot/day (*Guideline D-5-*4) for a conventional sewage disposal system.
- A background nitrate concentration of 3.04 mg/L was used for the Groundwater Impact Assessments. The background concentration was taken as the average nitrate concentration of three groundwater samples collected from monitor wells MW22-01, MW22-02, and MW22-03. The Certificates of Analysis for the nitrate samples is included in **Appendix E.**
- Available post-development dilution/recharge water for the Subject Property was estimated through a water balance analysis. A summary of the water balance calculations, including the Groundwater Impact Assessments, are included in **Appendix F**. The water balance analysis considered the following elements:
    - Historical Daily Climate Data – Peterborough A (Climate ID 6166415).
    - The total monthly water surplus available for dilution was calculated - accounting for evapotranspiration using the Thornthwaite method.
    - Infiltration factors for topography, soils, and cover were applied based on the MOEE document, *Hydrogeological Technical Information Requirements For Land Development Applications*, April 1995.
- The mass balance equation used in Wills' Groundwater Impact Assessments is included in **Appendix G**.

5.1 Predictive Assessment

The results from the Predictive Assessments are summarized in **Table 6** and **Table 7**.

Table 6 – Residential Lots Predictive Assessment of Nitrate Concentration

Parameter	Value
Number of Lots	50
Volume of Effluent (Q_e)	50 lots x 1,000 L/day = 50,000 L/day

Parameter	Value
Effluent nitrate concentration (Ce)	40 mg/L
Available dilution water (Qi)	193,854 L/day
Dilution water nitrate concentration (Ci)	3.04 mg/L
Total Volume (Qt)	243,854 L/day
Total nitrate concentration at property boundary	**9.89 mg/L**

Table 7 – Commercial Lot Predictive Assessment of Nitrate Concentration

Parameter	Value
Number of Lots	1
Volume of Effluent (Q_e)	1 lots x 4,495 L/day = 4,495 L/day
Effluent nitrate concentration (Ce)	40 mg/L
Available dilution water (Qi)	14,661 L/day
Dilution water nitrate concentration (Ci)	3.04 mg/L
Total Volume (Qt)	19,156 L/day
Total nitrate concentration at property boundary (Ct)	**9.91 mg/L**

In view of the results presented in **Table 5** and **Table 6,** Wills concludes that the current configuration of the Proposed Development, including the proposed infiltration features (as detailed in the FSR) would result in acceptable levels of nitrate at the property boundary.

6.0 Conclusions and Recommendations

The following conclusions and recommendations are provided with respect to Wills' Study.

- The subsurface profile on the Subject Property is consistent alluvial deposition, and includes interbedded silty sand, silt, and coarser grained materials at depth. The encountered strata include varying proportions of sand, silt, and clay within the individual soil layers, and was observed to vary both horizontally and vertically across the Subject Property.
    - The variable/interbedded nature of the subsurface soils provides poor predictive capability at any specific location on the Subject Property.
- Four monitor wells were installed to a depth of 6.55 mbg on the Subject Property.
    - Static groundwater levels measured on July 28, 2022, ranged from 5.93 mbg (199.58 masl) at MW22-01 to 0.72 mag (195.63 masl) at MW22-02.
    - Artesian groundwater conditions were observed in the northern portion of the Subject Property, as indicated by field measurements at MW22-02 and BH22-11.
    - The confined aquifer at BH22-11 may be represented by saturated sandy gravel encountered at a depth of 3.35 mbg (192.22 masl). A discrete confined aquifer was not identified at MW22-02, however, saturated sandy silty with higher gravel content was encountered at approximately 4.8 mbg (190.1 masl).
    - Based on the 2022 static groundwater measurements, a horizontal hydraulic gradient of 0.0174 with an approximate northwest orientation (321.2º azimuth) was determined.
- Groundwater seepage was encountered in all test pits at an approximate depth between 1.0 mbg and 2.2 mbg, with the exception of TP22-03, TP22-07, TP22-08, TP22-09, and TP22-10, which were observed to be dry prior to backfilling.
    - Groundwater seepage was generally observed along thin discontinuous sand lenses/stringers, that may seasoning retain infiltrating groundwater.
- Three groundwater samples were submitted for nitrate analysis to support the Groundwater Impact Assessment.
- Seven laboratory particle size distribution analyses and laboratory percolation time estimates were completed on representative samples of the shallow subsurface soils.
- Four in-situ infiltration tests were conducted on the Subject Property. T-Times were calculated to range from 0 min/cm (no infiltration) to 0.15 min/cm, with an average of 227 min/cm across all four tests.
    - Wills believes that testing deficiencies may have contributed to the disparity between in-situ rates and laboratory estimates for similar materials.
- In view of the in-situ infiltration testing and physical soil testing results, Wills recommends using the high end of the laboratory T-time estimate, 40 min/cm (15 mm/hr) for LID and sewage disposal system design.

    - Infiltration rates and percolation times may vary across the Subject Property, as topography, moisture content, soil gradation and relative compactness will affect in-situ infiltration rates.

- Any proposed LID and sewage disposal system design should consider the shallow groundwater and artesian conditions present on the northeastern portion of the Subject Property.
- Wills recommends completing additional test pits and/or boreholes in the northern portion of the Subject Property to confirm the vertical and lateral position of the confined aquifer.
    - Additional testing may be required to inform dewatering activities for any proposed excavation, as well as input to geotechnical analysis of any subsurface structures or utilities.
- A Groundwater Impact Assessment was conducted by Wills to determine the suitability of the Subject Property to accommodate private on-site sewage disposal systems.
- The Groundwater Impact Assessments considered 50 residential lots with anticipated flows to the sewage disposal systems of 1,000 L/day, and one commercial lot with anticipated flows to the sewage disposal systems of 4,495 L/day. Nitrate loading of 40 mg/lot/day was used on the basis of *Guideline D-5-4*.
- The Groundwater Impact Assessment concludes that a groundwater nitrate concentration of 9.89 mg/L (residential lots) and 9.91 mg/L (commercial lot) can be achieved at the downgradient property boundary with the incorporation of aboveground and subsurface infiltration features (detailed in Wills' FSR).
    - Both downgradient nitrate concentrations for the residential and commercial lots satisfy the requirements of *Guideline D-5-4*.

We trust that the information contained in and attached to this report meets your needs at this time. The following Statement of Limitations should be read carefully and is an integral part of this report. Do not hesitate to contact the undersigned if you have any questions or concerns.

Respectfully submitted,

Prepared by: _____

Lynsey Tuters, B.A., Dipl Et., C. Tech
Environmental Project Technologist

Reviewed by: _____

Ian Ames, M.Sc., P.Geo.
Environmental Monitoring and Management Lead

LT/IA/mp

Statement of Limitations

This report is intended solely for Owen H. Investments c/o Hugh Owen (Client) for the Proposed Development 1408 County Road 10, Cavan-Monaghan, Ontario, and is prohibited for use by others without D.M. Wills Associates Limited's (Wills) prior written consent. This report is considered Wills' professional work product and shall remain the sole property of Wills. Any unauthorized reuse, redistribution of or reliance on this report shall be at the Client and recipient's sole risk, without liability to Wills. The Client shall defend, indemnify and hold Wills harmless from any liability arising from or related to the Client's unauthorized distribution of the report. No portion of this report may be used as a separate entity; it is to be read in its entirety and shall include supporting drawings and appendices.

The recommendations made in this report are based on Wills' present understanding of the Project, the current and proposed site use, ground and subsurface conditions, and are based on the work scope approved by the Client and described in the report. The services were performed in a manner consistent with the level of care and skill ordinarily exercised by members of geoscience or engineering professions currently practicing under similar conditions in the same locality. No other representations, and no warranties or representations of any kind, either expressed or implied, are made. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the sole responsibility of such third parties.

The recommendations and comments made in this report are based on Wills' investigations and resulting understanding of the Project, as defined at the time of the assignment. Wills should be retained to review our recommendations when the final or any modified design drawings and specifications are complete. Without this review, Wills shall not be liable for any misunderstanding of our recommendations or their application and adaptation.

Soil, bedrock, and groundwater conditions between and beyond the test locations may differ both horizontally and vertically from those encountered at the test locations. Should any conditions at the Subject Property be encountered which differ from those found at the test locations, Wills must be notified immediately in order to permit a reassessment of our recommendations. If different conditions are identified, no matter how minor, the recommendations in this report shall be considered invalid until sufficient review and written assessment of said conditions by Wills is completed.

Figures

Source(s):
- Ontario Ministry of Natural Resources and Forestry, Make A Topographic Map

GRAPHIC SCALE
0 25 50 100 150 m

Legend

Subject Property Limits

Subject Property Plan

3491 Wallace Point Road
Otonabee-South Monaghan

WILLS

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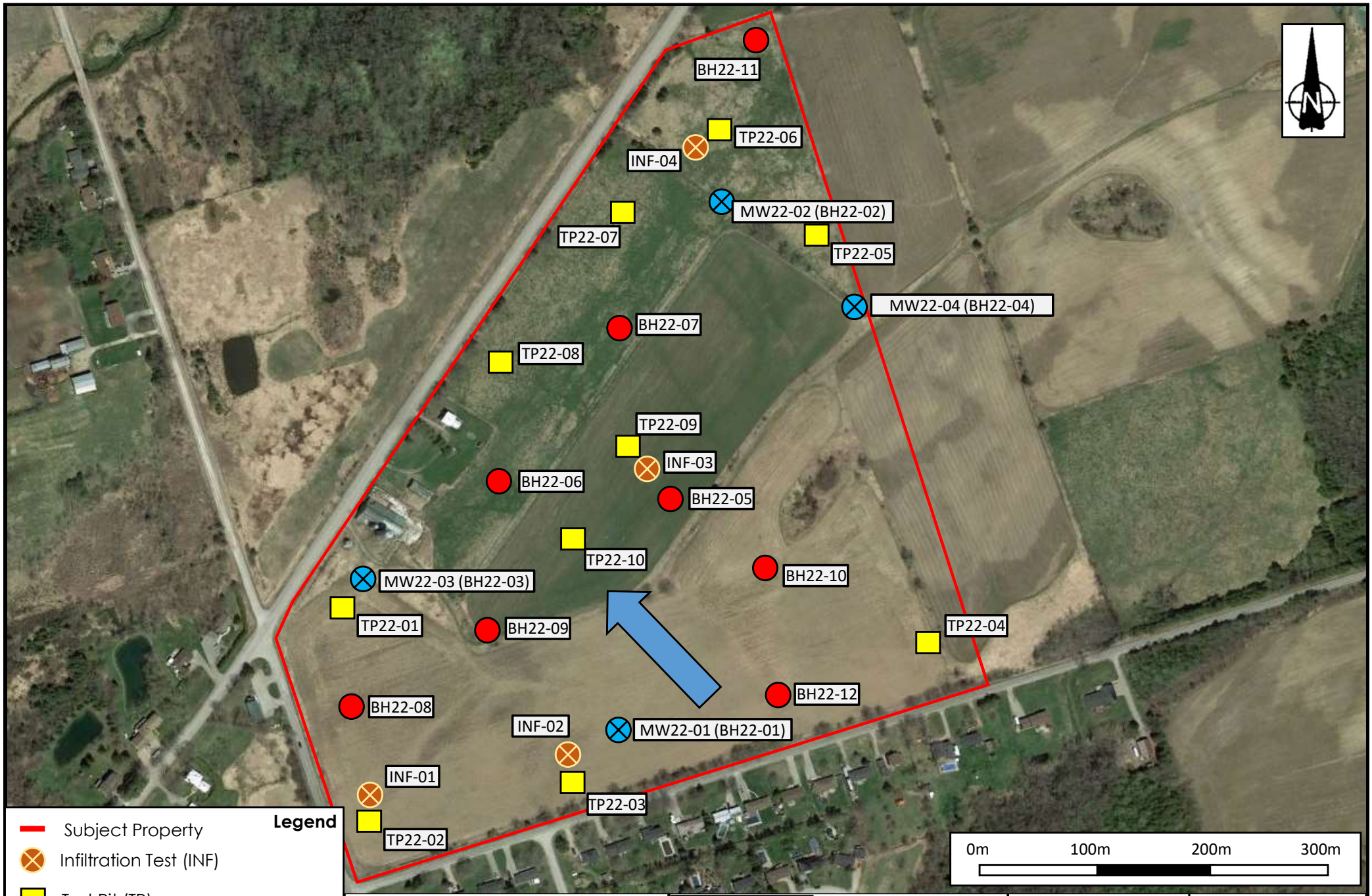
Drawn by: L. Tuters	**Scale:** 1:5 000 on 8.5"x11" (US Letter)
Checked: I. Ames	**Date:** April 13, 2023
Project No.: 21-85162	**Drawing file No.:** Figure 1



Subsurface Investigation Plan

3491 Wallace Point Road,
Township of Otonabee-South
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Project No.: 21 - 85162	Drawing File No.: Figure 2

Appendix A

Borehole and Test Pit Logs

Project Number: 21-85261
Project Location: 3491 Wallace Point Road, Otonabee-South Monaghan
Project Name: Wallace Point Subdivision
Client: Nirvana Homes

Test Pit – TP22-01

Excavation Date: June 20, 2022	Elevation: 197.540 masl	UTM: 17T 713994 m E, 4800777 m N

Depth (mbg)	Soil Description
0.0 – 0.9	Brown sandy silt topsoil, trace clay, moist
0.9 - 1.4	Light brown sandy silt, some clay, moist
1.4 – 2.9	Grey to light brown silty sand, some clay, trace gravel, occasional cobble, orange-brown mottling, moist to wet below 1.0 mbg

Groundwater

- Minor groundwater seepage at 1.0 mbg

Additional Notes

- Test pit terminated at 2.9 mbg
- 0.1 m of pooling water in test pit upon completion
- Test pit backfilled and nominally compacted using excavator following completion of stratigraphic logging and sampling

Test Pit Photos

Project Number: 21-85261
Project Location: 3491 Wallace Point Road, Otonabee-South Monaghan
Project Name: Wallace Point Subdivision
Client: Nirvana Homes

Test Pit – TP22-02

Date Completed: June 20, 2022	Elevation: 201.889 masl	UTM: 17T 714016 m E, 4900575 m N

Depth (mbg)	Soil Description
0.0 – 1.1	Brown sandy silt topsoil, trace clay, moist
1.1 – 2.9	Light brown silty sand, some clay, trace gravel, occasional cobble below 2.3 mbg, moist to wet below 1.8 m
Grab Sample Summary	
GS-02 collected at approximately 1.2 mbg	GS2 GSA: 0% Gravel 64% Sand 24% Silt 12% Clay

Groundwater

- Groundwater seepage at 2.2 mbg

Additional Notes

- Test pit terminated at 2.9 mbg
- Test pit walls sloughing below 2.2 mbg
- 0.2 m of pooling water in test pit upon completion
- Test pit backfilled and nominally compacted using excavator following completion of stratigraphic logging and sampling

Test Pit Photos

Project Number: 21-85261
Project Location: 3491 Wallace Point Road, Otonabee-South Monaghan
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Client: Nirvana Homes

Test Pit – TP22-03

Date Completed: June 20, 2022	Elevation: 206.581masl	UTM: 17T 714172 m E, 4900605 m N

Depth (mbg)	Soil Description
0.0 – 0.2	Brown sandy silt topsoil, trace clay, moist
0.2 – 0.6	Light brown sandy silt, some clay, moist
0.6 – 2.7	Light grey-brown sandy silt, some clay, trace gravel, occasional cobble/boulder, moist

Grab Sample Summary

GS-03 collected at approximately 1.2 mbg	GS3 GSA: 2% Gravel 29% Sand 49% Silt 20% Clay

Groundwater

- Groundwater not encountered

Additional Notes

- Test pit terminated at 2.7 mbg
- Test pit backfilled and nominally compacted using excavator following completion of stratigraphic logging and sampling

Test Pit Photos

Project Number: 21-85261
Project Location: 3491 Wallace Point Road, Otonabee-South Monaghan
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Client: Nirvana Homes

Test Pit – TP22-04

Date Completed: June 20, 2022	Elevation: 201.163 masl	UTM: 17T 714478 m E, 4900745 m N

Depth (mbg)	Soil Description
0.0 – 0.5	Brown sandy silt topsoil, trace clay, moist
0.5 – 2.9	Light orange-brown to light grey-brown sandy silt, some clay, trace to some gravel, moist to wet below 2.1 mbg

Groundwater

- Groundwater encountered at 2.1 mbg

Additional Notes

- Test pit terminated at 2.9 mbg
- 0.1 m of pooling water in test pit upon completion
- Test pit backfilled and nominally compacted using excavator following completion of stratigraphic logging and sampling

Test Pit Photos

Project Number: 21-85261
Project Location: 3491 Wallace Point Road, Otonabee-South Monaghan
Project Name: Wallace Point Subdivision
Client: Nirvana Homes

Test Pit – TP22-05

Date Completed: June 20, 2022	Elevation: 195.699 masl	UTM: 17T 714363 m E, 4901125 m N

Depth (mbg)	Soil Description
0.0 – 0.3	Brown sandy silt topsoil, trace clay, moist
0.3 - 1.4	Light brown to grey clayey silt, trace sand, some gravel, occasional cobble, drier than plastic limit
1.4 – 2.7	Grey sandy silt, some clay, increasing cobble content with depth, wet

Groundwater

- Groundwater seepage at 1.4 mbg

Additional Notes

- Test pit terminated at 2.7 mbg
- Test pit backfilled and nominally compacted using excavator following completion of stratigraphic logging and sampling

Test Pit Photos

Project Number: 21-85261
Project Location: 3491 Wallace Point Road, Otonabee-South Monaghan
Project Name: Wallace Point Subdivision
Client: Nirvana Homes

Test Pit – TP22-06

Date Completed: June 20, 2022	Elevation: 194.991masl	UTM: 17T 714306 m E, 4901184 m N

Depth (mbg)	Soil Description
0.0 – 0.3	Brown sandy silt topsoil, trace clay, some gravel, moist
0.3 – 2.7	Grey to orange-brown sand and silt, some clay, some gravel, occasional cobble below 1.8 m, moist to wet below 1.1 mbg

Grab Sample Summary

GS-02 - collected at approximately 0.9 mbg	GS2 GSA: 16% Gravel 36% Sand 35% Silt 13% Clay

Groundwater

- Groundwater seepage at 1.1 mbg

Additional Notes

- Test pit terminated at 2.7 mbg
- Test pit backfilled and nominally compacted using excavator following completion of stratigraphic logging and sampling

Test Pit Photos

Project Number: 21-85261
Project Location: 3491 Wallace Point Road, Otonabee-South Monaghan
Project Name: Wallace Point Subdivision
Client: Nirvana Homes

Test Pit – TP22-07

Date Completed: June 20, 2022	Elevation: 195.670 masl	UTM: 17T 714246 m E, 4901136 m N

Depth (mbg)	Soil Description
0.0 – 0.5	Brown sandy silt topsoil, trace clay, moist
0.5 - 1.8	Light brown to grey sandy silt to sand and silt, some clay, trace gravel, occasional cobble, moist

Groundwater

- Groundwater not encountered

Additional Notes

- Test pit terminated at 1.8 mbg
- Test pit backfilled and nominally compacted using excavator following completion of stratigraphic logging and sampling

Test Pit Photos

Project Number: 21-85261
Project Location: 3491 Wallace Point Road, Otonabee-South Monaghan
Project Name: Wallace Point Subdivision
Client: Nirvana Homes

Test Pit – TP22-08

Date Completed: June 20, 2022	Elevation: 196.848 masl	UTM: 17T 714110 m E, 4900977 m N

Depth (mbg)	Soil Description
0.0 – 0.5	Brown sandy silt topsoil, trace clay, moist.
0.5 – 2.7	Grey to light orange-brown, sandy clayey silt, trace to some gravel, occasional cobble, moist

Groundwater

- Groundwater not encountered

Additional Notes

- Test pit terminated at 2.7 mbg
- Test pit backfilled and nominally compacted using excavator following completion of stratigraphic logging and sampling

Test Pit Photos

Project Number: 21-85261
Project Location: 3491 Wallace Point Road, Otonabee-South Monaghan
Project Name: Wallace Point Subdivision
Client: Nirvana Homes

Test Pit – TP22-09

Date Completed: June 20, 2022	Elevation: 196.924 masl	UTM: 17T 714216 m E, 4900901 m N

Depth (mbg)	Soil Description
0.0 – 0.3	Brown sandy silt topsoil, trace clay, moist.
0.3 – 2.4	Light grey-brown to orange-brown sandy silt, some clay to clayey, trace gravel, occasional cobble below 1.2 mbg, moist.

Groundwater

- Groundwater not encountered

Additional Notes

- Test pit terminated at 2.4 mbg
- Walls collapsing below 1.1 mbg upon test pit completion
- Test pit backfilled and nominally compacted using excavator following completion of stratigraphic logging and sampling

Test Pit Photos

Project Number: 21-85261
Project Location: 3491 Wallace Point Road, Otonabee-South Monaghan
Project Name: Wallace Point Subdivision
Client: Nirvana Homes

Test Pit – TP22-10

Date Completed: June 20, 2022	Elevation: 197.349 masl	UTM: 17T 714175 m E, 4900837 m N

Depth (mbg)	Soil Description
0.0 – 0.3	Brown sandy silt topsoil, some clay, moist
0.3 - 1.2	Light brown to grey sandy silt, some clay, trace gravel, moist
1.4 – 2.9	Grey to light brown clayey silt, drier than plastic limit

Groundwater

- Groundwater not encountered

Additional Notes

- Test pit terminated at 2.9 mbg
- Test pit backfilled and nominally compacted using excavator following completion of stratigraphic logging and sampling

Test Pit Photos

D. M. Wills Associates Limited
150 Jameson Drive
Peterborough, Ontario K9J 0B9

WELL NUMBER MW22-01

CLIENT Nirvana Homes
PROJECT NAME Geotechnical and Hydrogeological Investigation
PROJECT NUMBER 21-85162
PROJECT LOCATION 3491 Wallace Point Rd, Township of Otonabee
DATE STARTED 7/13/22 **COMPLETED** 7/13/22
UTM EASTING 714171 **NORTHING** 4900635
DRILLING CONTRACTOR Canadian Environmental Drilling & Contractors Inc.
GROUND ELEVATION 205.512 masl
DRILLING METHOD 6" Solid Stem Auger with Split Spoons
GROUNDWATER LEVELS:
LOGGED BY LT **CHECKED BY** IA
AT END OF DRILLING No measurable groundwater
NOTES BH22-01
AFTER DRILLING 5.93 m / Elev 199.58 m

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	REMARKS	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
							Casing Top Elev: 0.82 (m) Casing Type: Monument
	SS 1	23	3-3-4-7 (7)	MC: 11 %		0.20 205.31 TOPSOIL: Brown silty sand topsoil, trace clay, moist, loose SILTY SAND: Brown silty sand to sand and silt, trace clay, trace gravel, occasional cobble, moist, compact	
1	SS 2	33	7-7-10 (17)	MC: 9 %			
	SS 3	87	5-10-8 (18)	MC: 9 %			← Bentonite seal from 0 to 2.75 mbg.
2							
	SS 4	98	12-25-15 (40)	MC: 9 %		- dense	
3							
	SS 5	54	8-7-9 (16)	MC: 7 %		- compact	
4							
	SS 6	109	27-50-50 (100)	MC: 8 %		4.65 200.86 -wet cm-scale sand stringer SILT: Light brown silt, some sand, trace clay, trace gravel, moist, very dense	← Quartz sand pack filter from 2.75 to 6.10 mbg. Point 10 slotted screen from 3.05 to 6.10 mbg.
5							
6				WL July 28/22: 5.93 mbg		6.10 199.41	
	SS 7	65	6-25-30 (55)	MC: 12 %		SILTY SAND: Grey silty sand, trace clay, trace gravel, wet, very dense 6.55 198.96	
						Borehole terminated in silty sand at 6.55 mbg.	

BH LOGS WITH TERMINATION NOTES 85162 BOREHOLE LOGS.GPJ USETHISONEOVERBURDENBHLOGNVALUE.GDT 4/19/23

D. M. Wills Associates Limited
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Peterborough, Ontario K9J 0B9

WELL NUMBER MW22-02

CLIENT Nirvana Homes
PROJECT NAME Geotechnical and Hydrogeological Investigation
PROJECT NUMBER 21-85162
PROJECT LOCATION 3491 Wallace Point Rd, Township of Otonabee
DATE STARTED 7/11/22 **COMPLETED** 7/11/22
UTM EASTING 714306 **NORTHING** 4901128
DRILLING CONTRACTOR Canadian Environmental Drilling & Contractors Inc.
GROUND ELEVATION 194.905 masl
DRILLING METHOD 6" Solid Stem Auger with Split Spoons
GROUNDWATER LEVELS:
LOGGED BY LT **CHECKED BY** IA
AT END OF DRILLING Groundwater at surface
NOTES BH22-02
AFTER DRILLING -0.72 m / Elev 195.63 m

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	REMARKS	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	SS 1	4	1-1-1-2 (2)	MC: 21 %		0.30 / 194.61 TOPSOIL: Brown silty sand topsoil, trace clay, rootlets, moist, loose	Casing Top Elev: 0.92 (m) Casing Type: Monument
1	SS 2	100	4-2-4 (6)	MC: 24 %		SILTY SAND: Brown-grey silty sand, some clay, moist, loose	Bentonite seal from 0 to 2.75 mbg.
2	SS 3	100	2-6-8 (14)	MC: 10 %		- compact	
						2.30 / 192.61	
	SS 4	65	10-12-11 (23)	MC: 8 %		SANDY SILT: Grey sandy silt, trace clay, trace gravel, occasional cobble, moist, compact	
3	SS 5	61	10-9-10 (19)	MC: 9 %		-wet	
4							Quartz sand pack filter from 2.75 to 6.10 mbg. Point 10 slotted screen from 3.05 to 6.10 mbg.
5	SS 6	65	8-9-13 (22)	MC: 6 %		-some gravel, saturated	
6							
	SS 7	65	10-26-22 (48)	MC: 17 %		- cm scale sand stringer, dense	
						6.55 / 188.36	

Borehole terminated in sandy silt at 6.55 mbg. Artesian conditions encounterered. Piezometric level at 0.72 meters above grade on July 28, 2022.

BH LOGS WITH TERMINATION NOTES 85162 BOREHOLE LOGS.GPJ USETHISONEOVERBURDENBHLOGNVALUE.GDT 4/19/23

D. M. Wills Associates Limited
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Peterborough, Ontario K9J 0B9

WELL NUMBER MW22-03

CLIENT Nirvana Homes
PROJECT NAME Geotechnical and Hydrogeological Investigation
PROJECT NUMBER 21-85162
PROJECT LOCATION 3491 Wallace Point Rd, Township of Otonabee
DATE STARTED 7/11/22 **COMPLETED** 7/11/22
UTM EASTING 714010 **NORTHING** 4900799
DRILLING CONTRACTOR Canadian Environmental Drilling & Contractors Inc. **GROUND ELEVATION** 197.573 masl
DRILLING METHOD 6" Solid Stem Auger with Split Spoons
GROUNDWATER LEVELS:
LOGGED BY LT **CHECKED BY** IA
AT END OF DRILLING 4.55 m / Elev 193.02 m
NOTES BH22-03
AFTER DRILLING 3.55 m / Elev 194.02 m

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	REMARKS	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	SS 1	25	3-4-6-8 (10)	MC: 20 %		TOPSOIL: Brown silty sand topsoil, trace clay, moist, loose	Casing Top Elev: 0.9 (m) Casing Type: Monument
						0.60 196.97	
1	SS 2	89	2-3-3 (6)	MC: 19 %		SILTY SAND: Brown silty sand to sand and silt, some clay, trace gravel, moist, loose - orange-brown mottling	
	SS 3	65	6-5-3 (8)	MC: 10 %			Bentonite seal from 0 to 2.75 mbg.
2							
	SS 4	100	5-5-5 (10)	MC: 13 %		- compact	
3							
	SS 5	100	5-4-6 (10)	MC: 11 %			
				WL July 28/22:3.55 mbg			
4							
				WL in open borehole July 11th, 2022		4.55 193.02	Quartz sand pack filter from 2.75 to 6.10 mbg. Point 10 slotted screen from 3.05 to 6.10 mbg.
	SS 6	65	40-18-15 (33)	MC: 18 %		SILT: Grey silt, some sand, trace clay, trace gravel, occasional cobble, saturated, dense	
5							
6							
	SS 7	65	10-18-24 (42)	MC: 15 %		6.55 191.02	
						Borehole terminated in silt at 6.55 mbg.	

BH LOGS WITH TERMINATION NOTES 85162 BOREHOLE LOGS.GPJ USETHISONEOVERBURDENBHLOGNVALUE.GDT 4/19/23

D. M. Wills Associates Limited
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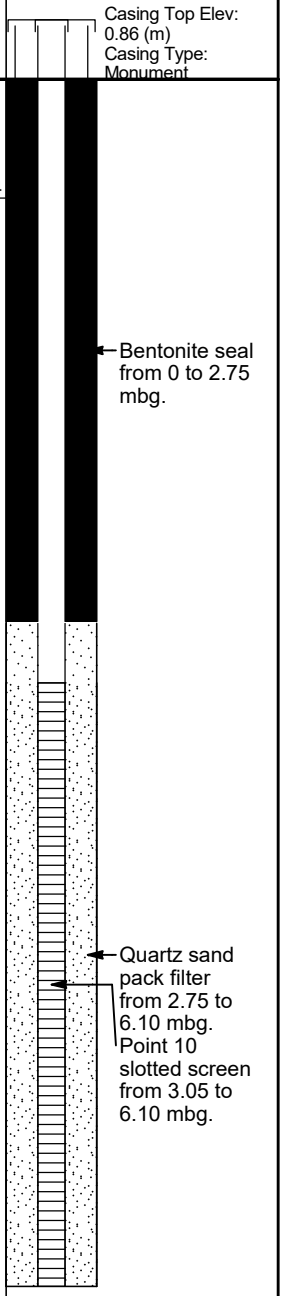
WELL NUMBER MW22-04

CLIENT Nirvana Homes
PROJECT NAME Geotechnical and Hydrogeological Investigation
PROJECT NUMBER 21-85162
PROJECT LOCATION 3491 Wallace Point Rd, Township of Otonabee
DATE STARTED 7/12/22 **COMPLETED** 7/12/22
UTM EASTING 714425 **NORTHING** 4901049
DRILLING CONTRACTOR Canadian Environmental Drilling & Contractors Inc. **GROUND ELEVATION** 197.536 masl
DRILLING METHOD 6" Solid Stem Auger with Split Spoons
GROUNDWATER LEVELS:
LOGGED BY LT **CHECKED BY** IA
AT END OF DRILLING 5.80 m / Elev 191.74 m
NOTES BH22-04
AFTER DRILLING 2.77 m / Elev 194.77 m

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	REMARKS	MATERIAL DESCRIPTION
	SS 1	41	1-3-1-4 (4)	MC: 14 %	TOPSOIL: Brown silty sand topsoil, trace clay, moist, loose
					0.60 / 196.94
1	SS 2	65	4-5-6 (11)	MCt: 10 %	SILTY SAND: Brown silty sand, trace to some clay, trace gravel, moist to wet, compact
2	SS 3	65	7-6-6 (12)	MC: 10 %	
3	SS 4	91	4-14-7 (21)	MC: 8 %	
				WL July 28/22: 2.77 mbg	
	SS 5	100	6-8-12 (20)	MC: 8 % GSA SS-5: Gravel 14% Sand 47% Silt 24% Clay 15%	-some clay, some gravel
4					-grey-brown
5	SS 6	65	8-13-16 (29)	MC: 7 %	
6				WL in open borehole July 12th, 2022	
	SS 7	65	11-13-13 (26)	MC: 7 %	
					6.55 / 190.99
					Borehole terminated in silty sand at 6.55 mbg.

WELL DIAGRAM



BH LOGS WITH TERMINATION NOTES 85162 BOREHOLE LOGS.GPJ USETHISONEOVERBURDENBHLOGNVALUE.GDT 4/19/23

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BORING NUMBER BH22-05

CLIENT Nirvana Homes
PROJECT NAME Geotechnical and Hydrogeological Investigation
PROJECT NUMBER 21-85162
PROJECT LOCATION 3491 Wallace Point Rd, Township of Otonabee
DATE STARTED 7/12/22 **COMPLETED** 7/12/22
UTM EASTING 714262 **NORTHING** 4900865
DRILLING CONTRACTOR Canadian Environmental Drilling & Contractors Inc. **GROUND ELEVATION** 199.679 masl
DRILLING METHOD 6" Solid Stem Auger with Split Spoons **GROUNDWATER LEVELS:**
LOGGED BY LT **CHECKED BY** IA **AT END OF DRILLING** 3.65 m / Elev 196.03 m
NOTES **AFTER DRILLING** ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	REMARKS	GRAPHIC LOG	MATERIAL DESCRIPTION
	SS 1	30	1-2-6-13 (8)	MC: 14 %		TOPSOIL: Brown silty sand topsoil, trace clay, moist, loose
						0.55 199.13
1	SS 2	65	9-8-7 (15)	MC: 8 %		SILTY SAND: Brown-grey silty sand to sandy silt, some clay, trace to some gravel, moist, compact
2	SS 3	100	5-6-7 (13)	MC: 9 %		
3	SS 4	111	6-5-7 (12)	MC: 9 %		-cm-scale sand stringer, wet
4	SS 5	115	7-9-13 (22)	MC: 12 % WL in open borehole July 12th, 2022		▼
						4.55 195.13
5	SS 6	115	6-12-19 (31)	MC: 17 %		SILT: Grey silt, some sand to sandy, trace silt, wet, dense -cm-scale coarse sand stringer
6						
	SS 7	100	8-15-16 (31)	MC: 18 %		-trace gravel
						Borehole terminated in silt at 6.55 mbg. Borehole caved to 5.1 mbg following completion.

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Peterborough, Ontario K9J 0B9

BORING NUMBER BH22-06

CLIENT Nirvana Homes
PROJECT NAME Geotechnical and Hydrogeological Investigation
PROJECT NUMBER 21-85162
PROJECT LOCATION 3491 Wallace Point Rd, Township of Otonabee
DATE STARTED 7/11/22 **COMPLETED** 7/11/22
UTM EASTING 714120 **NORTHING** 4900877
DRILLING CONTRACTOR Canadian Environmental Drilling & Contractors Inc. **GROUND ELEVATION** 196.176 masl
DRILLING METHOD 6" Solid Stem Auger with Split Spoons
GROUNDWATER LEVELS:
LOGGED BY LT **CHECKED BY** IA
AT END OF DRILLING 3.65 m / Elev 192.53 m
NOTES
AFTER DRILLING ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	REMARKS	GRAPHIC LOG	MATERIAL DESCRIPTION
	SS 1	25	1-1-2-5 (3)	MC: 12 %		TOPSOIL: Brown silty sand topsoil, trace clay, moist, very loose
						0.60 195.58
1	SS 2	65	3-2-4 (6)	MC: 11 %		SILTY SAND: Brown-grey silty sand, some clay, trace to some gravel, moist to wet, loose - orange-brown mottling
2	SS 3	78	2-1-2 (3)	MC: 11 %		- very loose
3	SS 4	100	5-7-13 (20)	MC: 8 %		- moist, compact
4	SS 5	72	10-19-25 (44)	MC: 6 % WL in open borehole July 11th, 2022		- dense
						4.55 191.63
5	SS 6	78	8-18-32 (50)	MC: 13 % GSA SS-6: Gravel 8% Sand 16% Silt 71% Clay 5%		SILT: Grey silt, some sand, trace clay, trace gravel, occasional cobble, wet, dense
6						6.10 190.08
	SS 7	43	16-20-29 (49)	MC: 8 %		SAND AND GRAVEL: Grey sand and gravel, some silt, wet, dense
						6.55 189.63
						Borehole terminated in sand and gravel at 6.55 mbg. Borehole caved to 4.9 mbg following completion.

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BORING NUMBER BH22-07

CLIENT Nirvana Homes
PROJECT NAME Geotechnical and Hydrogeological Investigation
PROJECT NUMBER 21-85162
PROJECT LOCATION 3491 Wallace Point Rd, Township of Otonabee
DATE STARTED 7/11/22 **COMPLETED** 7/11/22
UTM EASTING 714216 **NORTHING** 4901018
DRILLING CONTRACTOR Canadian Environmental Drilling & Contractors Inc.
GROUND ELEVATION 195.24 masl
DRILLING METHOD 6" Solid Stem Auger with Split Spoons
GROUNDWATER LEVELS:
LOGGED BY LT **CHECKED BY** IA
AT END OF DRILLING 2.45 m / Elev 192.79 m
NOTES
AFTER DRILLING ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	REMARKS	GRAPHIC LOG	MATERIAL DESCRIPTION	
	SS 1	0	1-2-4-4 (6)			TOPSOIL: Loose, no recovery	
						0.45	194.79
1	SS 2	100	4-4-5 (9)	MC: 28 %		SILTY SAND: Brown-grey silty sand to sand and silt, some clay, trace to some gravel, moist, loose	
2	SS 3	65	2-3-2 (5)	MC: 14 %		- wet	
3	SS 4	65	7-7-10 (17)	WL in open borehole July 11th, 2022 MC: 12 %		▼ - compact	
						3.00	192.24
4	SS 5	65	5-8-10 (18)	MC: 17 %		SILT: Grey silt, some sand, trace gravel, trace clay, wet, compact	
						4.55	190.69
5	SS 6	100	25-40-50 (90)	MC: 9 %		SILTY SAND: Grey silty sand, trace gravel, trace clay, occasional cobble, wet, very dense	
6	SS 7	100	25-49-50 (99)	MC: 12 %			
						6.55	188.69
						Borehole terminated in silty sand at 6.55 mbg. Borehole caved to 4.6 mbg following completion.	

BH LOGS WITH TERMINATION NOTES 85162 BOREHOLE LOGS.GPJ USETHISONEOVERBURDENBHLOGNVALUE.GDT 4/19/23

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BORING NUMBER BH22-08

CLIENT Nirvana Homes
PROJECT NAME Geotechnical and Hydrogeological Investigation
PROJECT NUMBER 21-85162
PROJECT LOCATION 3491 Wallace Point Rd, Township of Otonabee
DATE STARTED 7/13/22 **COMPLETED** 7/13/22
UTM EASTING 714005 **NORTHING** 4900686
DRILLING CONTRACTOR Canadian Environmental Drilling & Contractors Inc. **GROUND ELEVATION** 198.316 masl
DRILLING METHOD 6" Solid Stem Auger with Split Spoons
GROUNDWATER LEVELS:
LOGGED BY LT **CHECKED BY** IA
AT END OF DRILLING 5.00 m / Elev 193.32 m
NOTES
AFTER DRILLING ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	REMARKS	GRAPHIC LOG	MATERIAL DESCRIPTION	
	SS 1	23	1-2-3-4 (5)	MC: 20 %		TOPSOIL: Brown sandy silt topsoil, trace clay, moist, loose	
						0.60	197.72
1	SS 2	33	4-3-5 (8)			SILTY SAND: Brown silty sand, some clay, moist to wet, loose	
2	SS 3	87	2-2-3 (5)				
3	SS 4	98	4-10-23 (33)			- dense	
4	SS 5	54	10-20-20 (40)				
						4.55	193.77
5	SS 6	109	25-21-21 (42)	WL in open borehole July 13th, 2022		SAND: Brown sand, trace silt, trace clay, trace gravel, occasional cobble, wet, dense - wet	
6						6.10	192.22
						Borehole terminated in sand material at 6.10 mbg due to refusal on presumed cobble/boulder.	

BH LOGS WITH TERMINATION NOTES 85162 BOREHOLE LOGS.GPJ USETHISONEOVERBURDENBHLOGNVALUE.GDT 4/19/23

D. M. Wills Associates Limited
150 Jameson Drive
Peterborough, Ontario K9J 0B9

BORING NUMBER BH22-09

CLIENT Nirvana Homes
PROJECT NAME Geotechnical and Hydrogeological Investigation
PROJECT NUMBER 21-85162
PROJECT LOCATION 3491 Wallace Point Rd, Township of Otonabee
DATE STARTED 7/12/22 **COMPLETED** 7/12/22
UTM EASTING 714120 **NORTHING** 4900755
DRILLING CONTRACTOR Canadian Environmental Drilling & Contractors Inc.
GROUND ELEVATION 198.543 masl
DRILLING METHOD 6" Solid Stem Auger with Split Spoons
GROUNDWATER LEVELS:
LOGGED BY LT **CHECKED BY** IA
AT END OF DRILLING No measurable groundwater
NOTES
AFTER DRILLING ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	REMARKS	GRAPHIC LOG	MATERIAL DESCRIPTION	
	SS 1	30	1-3-5-6 (8)	MC: 13 %		TOPSOIL: Brown silty sand topsoil, trace clay, moist, loose	
						0.60	197.94
1	SS 2	22	5-8-5 (13)	MC: 10 %		SILTY SAND: Brown silty sand to sand and silt, trace clay, trace gravel, moist, compact	
	SS 3	89	2-14-14 (28)	MC: 18 %		1.75	196.79
2						SILT: Grey-brown silt, some sand, trace gravel, trace clay, wet, compact	
	SS 4	89	16-14-10 (24)	MC: 20 %			
3						3.20	195.34
	SS 5	72	15-9-16 (25)	MC: 11 %		SILTY SAND: Grey silty sand, some clay, trace clay, wet, compact	
4						4.57	193.97
	SS 6	100	12-15-8 (23)	MC: 15 %		SILT: Grey silt, some sand, trace gravel, trace clay, wet, compact	
5							
6						- saturated	
	SS 7	100	4-4-13 (17)	MC: 14 %		6.55	191.99
						Borehole terminated in sand and silt at 6.55 mbg. Borehole caved to 2.4 mbg following completion.	

BH LOGS WITH TERMINATION NOTES 85162 BOREHOLE LOGS.GPJ USETHISONEOVERBURDENBHLOGNVALUE.GDT 4/19/23

D. M. Wills Associates Limited
150 Jameson Drive
Peterborough, Ontario K9J 0B9

BORING NUMBER BH22-10

CLIENT Nirvana Homes
PROJECT NAME Geotechnical and Hydrogeological Investigation
PROJECT NUMBER 21-85162
PROJECT LOCATION 3491 Wallace Point Rd, Township of Otonabee
DATE STARTED 7/12/22 **COMPLETED** 7/12/22
UTM EASTING 714334 **NORTHING** 4900807
DRILLING CONTRACTOR Canadian Environmental Drilling & Contractors Inc. **GROUND ELEVATION** 200.694 masl
DRILLING METHOD 6" Solid Stem Auger with Split Spoons
GROUNDWATER LEVELS:
LOGGED BY LT **CHECKED BY** IA
AT END OF DRILLING 2.15 m / Elev 198.54 m
NOTES
AFTER DRILLING ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	REMARKS	GRAPHIC LOG	MATERIAL DESCRIPTION	
	SS 1	41	2-1-2-3 (3)	MC: 17 %		TOPSOIL: Brown silty sand topsoil, some clay, moist, very loose	
						0.50	200.19
						SILTY SAND: Brown silty sand to sandy silt, trace to some clay, trace gravel, moist, compact	
1	SS 2	65	6-6-7 (13)	MC: 10 %			
	SS 3	65	14-9-12 (21)	MC: 9 %			
2				WL in open borehole July 12th, 2022		2.30	198.39
	SS 4	54	8-21-37 (58)	MC: 6 %		SAND: brown sand, some silt, trace gravel, trace clay, moist, very dense	
3						3.00	197.69
	SS 5	93	24-24-32 (56)	MC: 10 %		SANDY SILT: Grey sandy silt, trace gravel, trace clay, wet, dense	
						3.50	197.19
4						SAND: Brown sand, trace silt, trace clay, wet, dense	
5	SS 6	43	3-4-17 (21)	MC: 15 %		-compact	
6				GSA SS-7: Sand 90% Silt & Clay 10%		-dense	
	SS 7	65	18-23-20 (43)	MC: 15 %		6.55	194.14
						Borehole terminated in sand at 6.55 mbg. Borehole caved to 4.6 mbg following completion.	

BH LOGS WITH TERMINATION NOTES 85162 BOREHOLE LOGS.GPJ USETHISONEOVERBURDENBHLOGNVALUE.GDT 4/19/23

D. M. Wills Associates Limited
150 Jameson Drive
Peterborough, Ontario K9J 0B9

BORING NUMBER BH22-11

CLIENT Nirvana Homes
PROJECT NAME Geotechnical and Hydrogeological Investigation
PROJECT NUMBER 21-85162
PROJECT LOCATION 3491 Wallace Point Rd, Township of Otonabee
DATE STARTED 7/11/22 **COMPLETED** 7/11/22
UTM EASTING 714320 **NORTHING** 4901258
DRILLING CONTRACTOR Canadian Environmental Drilling & Contractors Inc.
GROUND ELEVATION 195.565 masl
DRILLING METHOD 6" Solid Stem Auger with Split Spoons
GROUNDWATER LEVELS:
LOGGED BY LT **CHECKED BY** IA
AT END OF DRILLING 0.00 m / Elev 195.57 m
NOTES
AFTER DRILLING ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	REMARKS	GRAPHIC LOG	MATERIAL DESCRIPTION	
	SS 1	0	2-2-0-3 (2)			TOPSOIL: Brown silty sand topsoil, moist, very loose	
						0.60	194.97
1	SS 2	8	1-1-2-4 (3)	MC: 31 %		CLAYEY SILT: Grey-brown clayey silt, trace to some sand, trace gravel, moist, very loose	
						1.50	194.07
2	SS 3	75	4-5-6-4 (11)	MC: 10 %		SILTY SAND: Brown silty sand, some clay, trace gravel, orange brown mottling, moist, compact	
	SS 4	75	2-3-4-4 (7)	MC: 9 %		- grey, moist to wet, loose	
3						3.10	192.47
	SS 5	43	2-2-3 (5)	MC: 11 %		3.35 SAND: Grey sand, trace silt, trace clay, trace gravel, occasional cobble, saturated, compact	192.22
4						SANDY GRAVEL: Grey sandy gravel, trace silt, trace clay, occasional cobble, saturated, very dense	
5	SS 6	43	24-18-25 (43)	MC: 5 %		- dense	
	SS 7	75	20-30-27-19 (57)	MC: 9 % GSA SS-7: Gravel 66% Sand 28% Silt and Clay 6%		5.65	189.92
						Borehole terminated in sand material at 5.65 mbg due to refusal on presumed cobble/boulder. Borehole caved to 4.0 mbg following completion. Artesian conditions encountered at SS-5 (groundwater flowing out of borehole) - borehole sealed with bentonite.	

D. M. Wills Associates Limited
150 Jameson Drive
Peterborough, Ontario K9J 0B9

BORING NUMBER BH22-12

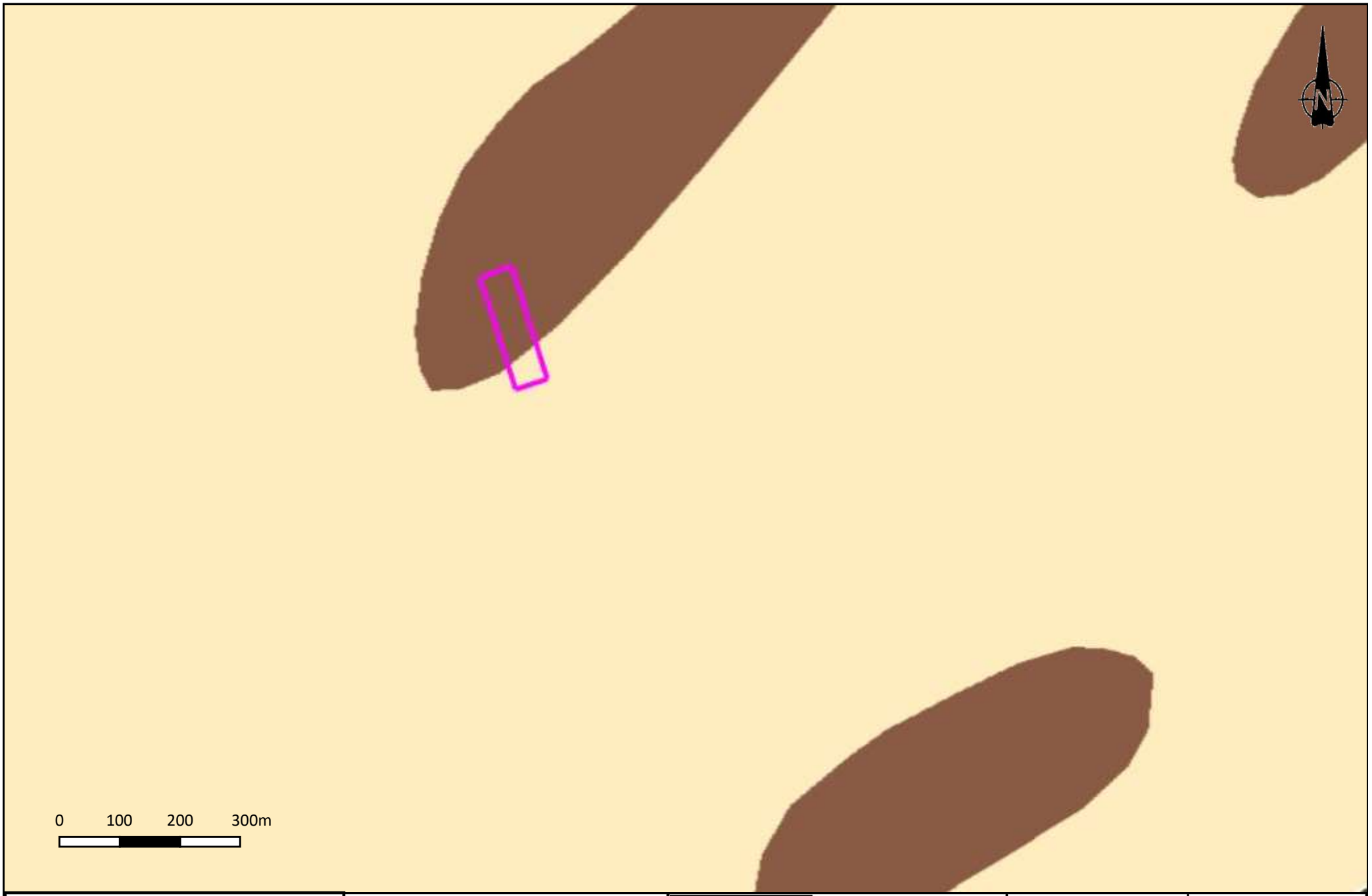
CLIENT Nirvana Homes
PROJECT NAME Geotechnical and Hydrogeological Investigation
PROJECT NUMBER 21-85162
PROJECT LOCATION 3491 Wallace Point Rd, Township of Otonabee
DATE STARTED 7/12/22 **COMPLETED** 7/12/22
UTM EASTING 714364 **NORTHING** 4900698
DRILLING CONTRACTOR Canadian Environmental Drilling & Contractors Inc.
GROUND ELEVATION 203.745 masl
DRILLING METHOD 6" Solid Stem Auger with Split Spoons
GROUNDWATER LEVELS:
LOGGED BY LT **CHECKED BY** IA
AT END OF DRILLING No measurable groundwater
NOTES
AFTER DRILLING ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	REMARKS	GRAPHIC LOG	MATERIAL DESCRIPTION	
	SS 1	49	1-2-3-4 (5)	MC: 17 %		TOPSOIL: Brown silty sand topsoil, trace clay, moist, loose	
						0.60	203.15
1	SS 2	0	2-4-5 (9)			SAND: Brown sand, trace silt, trace gravel, occasional cobble, moist, loose	
						-dense	
2	SS 3	33	6-15-25 (40)	MC: 6 %			
	SS 4	72	13-21-45 (66)	MC: 8 %		- very dense	
3							
	SS 5	70	17-36-42 (78)	MC: 3 %			
4							
						4.55	199.20
	SS 6	65	27-25-31 (56)	MC: 9 %		SANDY GRAVEL: Brown sandy gravel, trace silt, trace clay, occasional cobble, wet, very dense	
5							
6						6.10	197.65
						Borehole terminated in sandy gravel material at 6.1 mbg. Borehole caved to 2.4 mbg following completion.	

BH LOGS WITH TERMINATION NOTES 85162 BOREHOLE LOGS.GPJ USETHISONEOVERBURDENBHLOGNVALUE.GDT 4/19/23

Appendix B

OGS Mapping



Legend

- Till Plains (Drumlinized)
- Drumlins
- Subject Property Boundary

Regional Physiography Map

Hydrogeological Study
949 Eighth Line, Lakefield, Township of Selwyn, Ontario

WILLS

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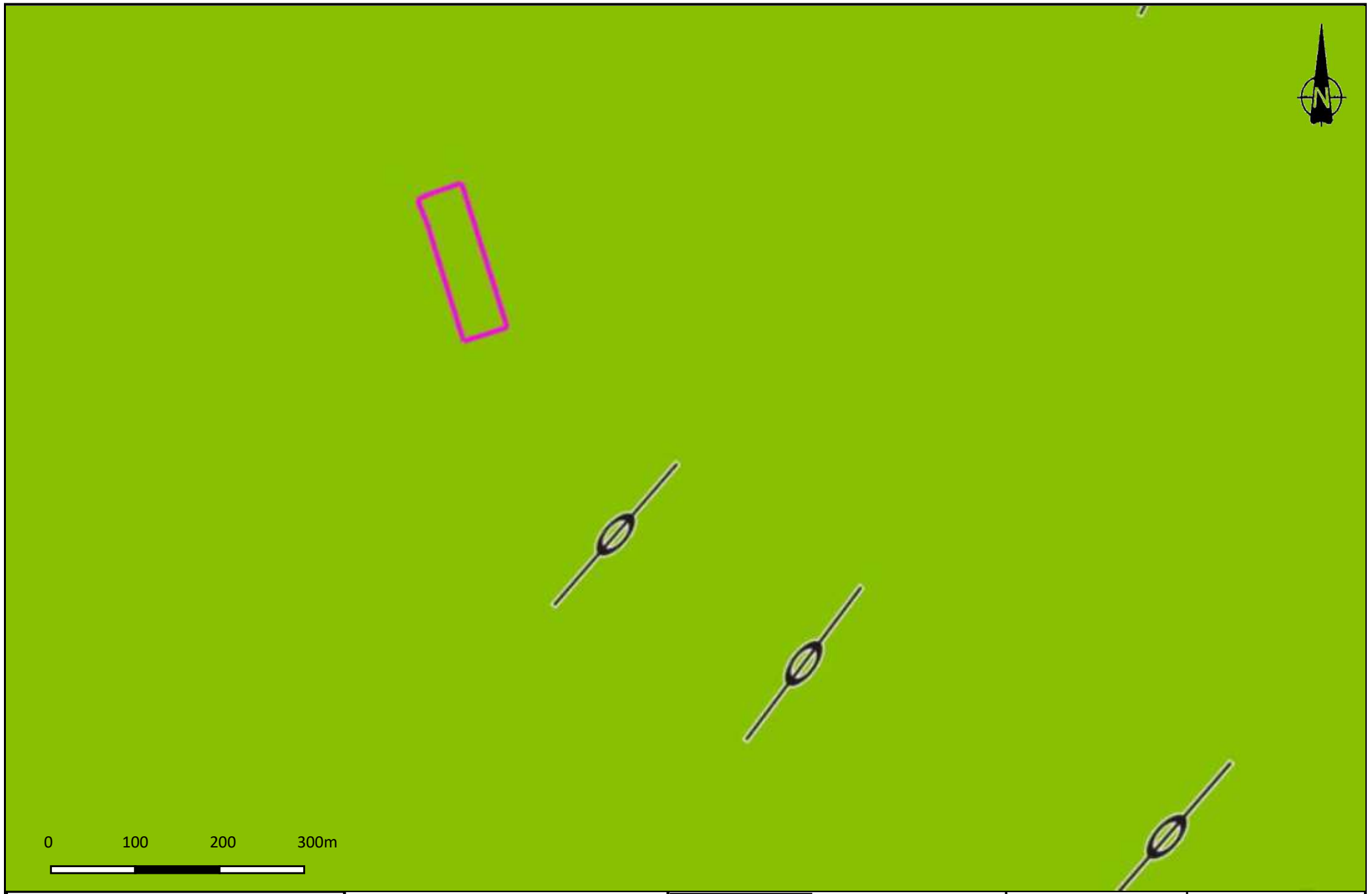
E. wills@dmwills.com

Drawn By	LT	Scale	See Scale Bar
Checked	IA	Date	March 2022
Project No.	22-85260	Drawing File No.	APP-B1



Legend

- Stone-poor, sandy silt to silty sand-textured
- Drumlin, Drumlinoid Ridges
- Subject Property Boundary

Regional Surficial Geology Map

Hydrogeological Study
949 Eighth Line, Lakefield, Township of Selwyn, Ontario

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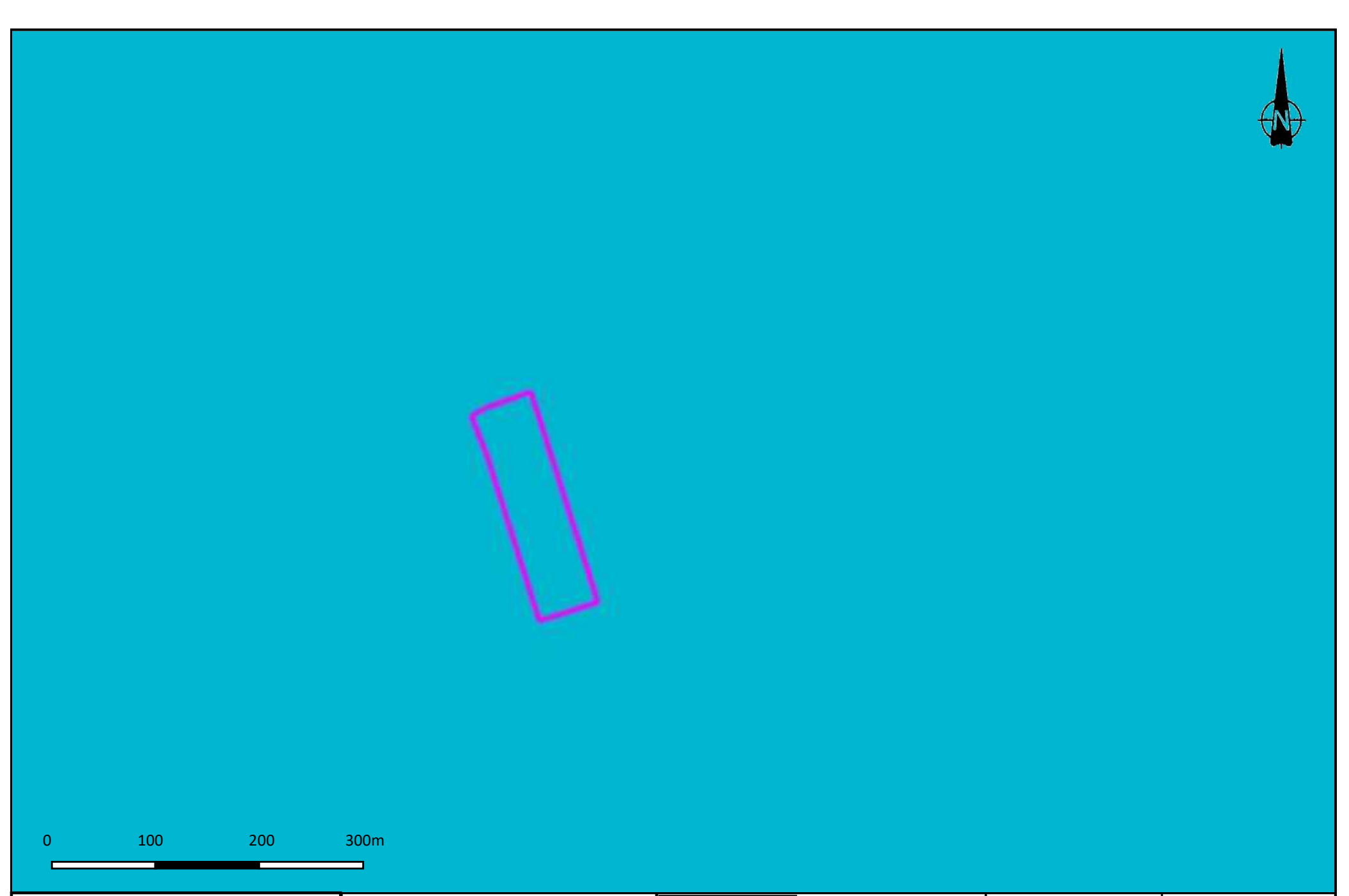
Drawn By	LT	Scale	See Scale Bar
Checked	IA	Date	March 2022
Project No.	22-85260	Drawing File No.	APP-B2



Legend

- Clastic Metasedimentary Rocks
- Subject Property

Regional Bedrock Geology Map

Hydrogeological Study
949 Eighth Line, Lakefield, Township of Selwyn, Ontario

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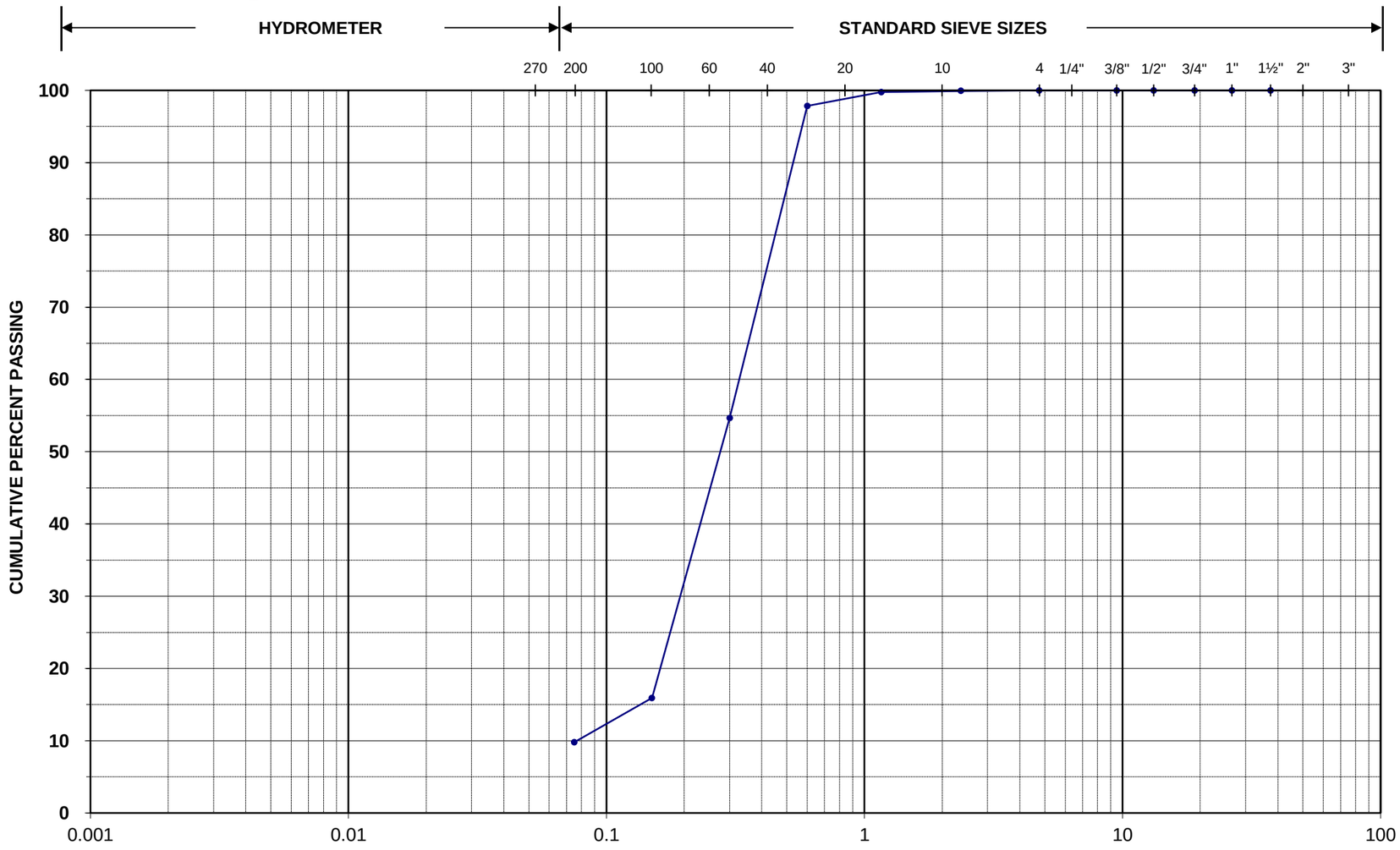
Drawn By	LT	Scale	See Scale Bar
Checked	IA	Date	March 2022
Project No.	22-85260	Drawing File No.	APP-B3

Appendix C

Certificates of Analysis – Physical Soil Testing

PARTICLE SIZE DISTRIBUTION



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

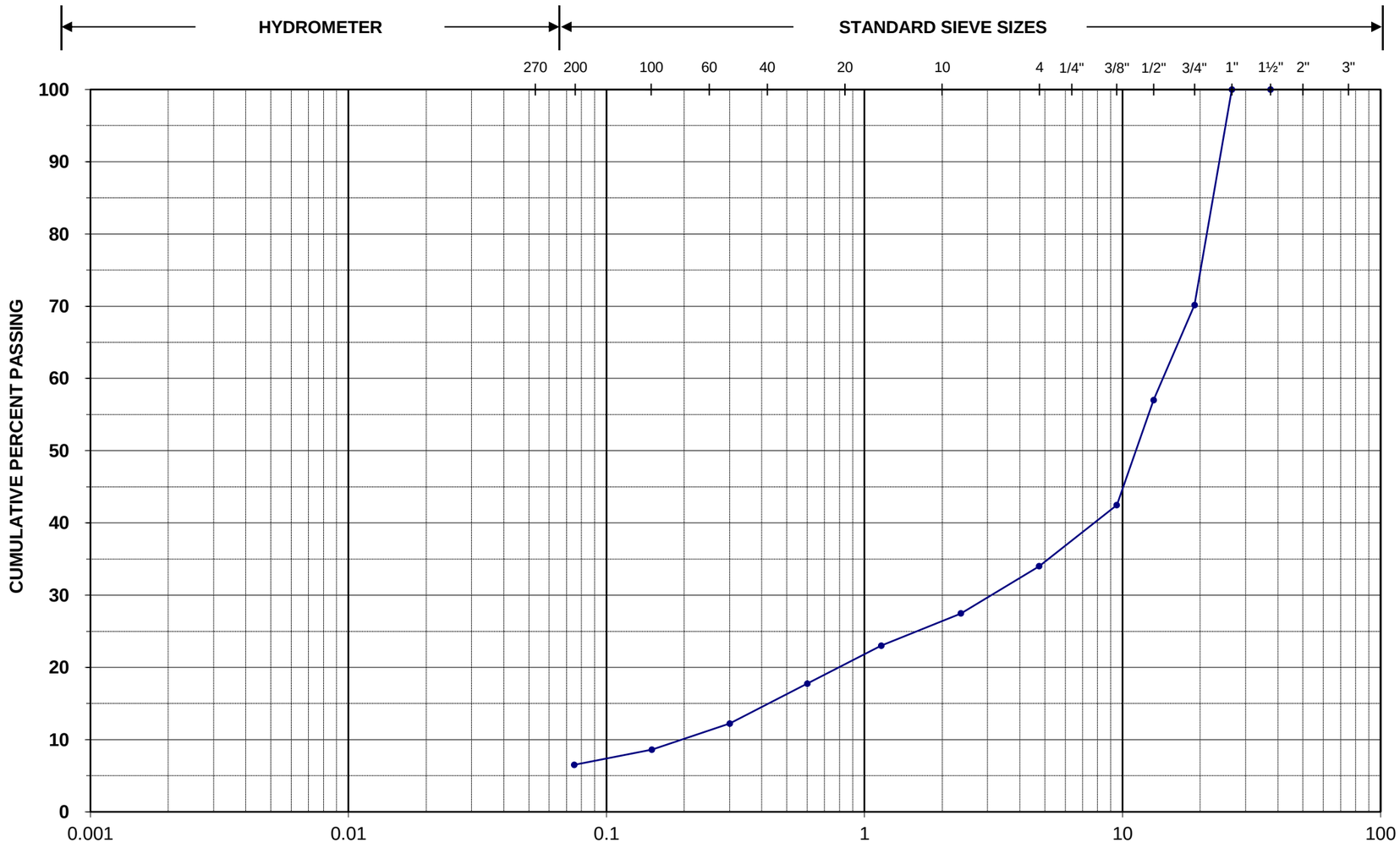
Project Name: DM Wills - 85162 **Project No.:** 201-07253-00

Location ID.: BH22-10 **Sample No./Depth:** SS-7

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine
37.5 mm	100.0	**2.36 mm**	99.9
26.5 mm	100.0	**1.16 mm**	99.8
19.0 mm	100.0	**0.60 mm**	97.9
13.2 mm	100.0	**0.30 mm**	54.7
9.5 mm	100.0	**0.15 mm**	15.9
4.75 mm	100.0	**0.075 mm**	9.8

Note: More information is available upon request. Tested by: WGH Reviewed by: Date: 17-Aug-22

PARTICLE SIZE DISTRIBUTION



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

Project Name: DM Wills - 85162 **Project No.:** 201-07253-00

Location ID.: BH22-11 **Sample No./Depth:** SS-7

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine
37.5 mm	100.0	**2.36 mm**	27.5
26.5 mm	100.0	**1.16 mm**	23.0
19.0 mm	70.2	**0.60 mm**	17.8
13.2 mm	57.0	**0.30 mm**	12.2
9.5 mm	42.5	**0.15 mm**	8.6
4.75 mm	34.0	**0.075 mm**	6.5

Note: More information is available upon request. Tested by: WGH Reviewed by: _____ Date: 17-Aug-22

MOISTURE CONTENTS

Project Location: DM Wills - 85162 **Tech:** JG
File No.: 201-07253-00 **Date:** 16-Aug-22

TIN NO.	FR11	SSM40	X15	I5	DM5
BOREHOLE NO.	BH22-01	BH22-01	BH22-01	BH22-01	BH22-01
SAMPLE & DEPTH	-	-	-	-	-
WT of TIN & WET SOIL (g)	115.0	110.9	139.4	122.9	150.0
WT of TIN & DRY SOIL (g)	107.1	101.0	129.5	111.3	139.2
WT of WATER (g)	8.0	9.9	9.8	11.6	10.7
TARE WT (g)	16.8	14.3	15.2	15.4	14.7
WT of DRY SOIL (g)	90.3	86.7	114.3	95.9	124.6
MOISTURE CONTENT	8.8%	11.4%	8.6%	12.1%	8.6%

TIN NO.	7F	BD13	AT53	LD1	BD9
BOREHOLE NO.	BH22-01	BH22-01	BH22-02	BH22-02	BH22-02
SAMPLE & DEPTH	-	-	-	-	-
WT of TIN & WET SOIL (g)	154.9	118.3	121.5	88.8	114.5
WT of TIN & DRY SOIL (g)	146.3	111.1	106.0	76.1	95.5
WT of WATER (g)	8.6	7.2	15.4	12.7	19.0
TARE WT (g)	16.9	16.3	14.8	14.6	16.7
WT of DRY SOIL (g)	129.5	94.9	91.2	61.5	78.7
MOISTURE CONTENT	6.6%	7.6%	16.9%	20.7%	24.1%

TIN NO.	HL01	BD5	SMS	BHWT6	LB8
BOREHOLE NO.	BH22-02	BH22-02	BH22-02	BH22-02	BH22-03
SAMPLE & DEPTH	-	-	-	-	-
WT of TIN & WET SOIL (g)	118.1	129.5	99.3	128.3	152.7
WT of TIN & DRY SOIL (g)	108.8	120.6	94.7	120.1	135.0
WT of WATER (g)	9.4	8.9	4.7	8.3	17.6
TARE WT (g)	16.3	16.1	14.9	15.3	15.6
WT of DRY SOIL (g)	92.4	104.5	79.8	104.8	119.5
MOISTURE CONTENT	10.1%	8.6%	5.8%	7.9%	14.7%

TIN NO.	BR18	J6	ALT	BB2	TP4
BOREHOLE NO.	BH22-03	BH22-03	BH22-03	BH22-03	BH22-03
SAMPLE & DEPTH	-	-	-	-	-
WT of TIN & WET SOIL (g)	105.6	169.3	138.3	153.8	134.1
WT of TIN & DRY SOIL (g)	90.4	154.3	127.0	132.6	115.3
WT of WATER (g)	15.2	15.0	11.2	21.2	18.9
TARE WT (g)	14.9	15.3	16.3	15.5	14.8
WT of DRY SOIL (g)	75.5	139.0	110.7	117.0	100.5
MOISTURE CONTENT	20.1%	10.8%	10.2%	18.1%	18.8%

TIN NO.	DF2	B2	E14	7AR	2E
BOREHOLE NO.	BH22-03	BH22-04	BH22-04	BH22-04	BH22-04
SAMPLE & DEPTH	-	-	-	-	-
WT of TIN & WET SOIL (g)	158.1	149.0	161.0	148.4	149.1
WT of TIN & DRY SOIL (g)	141.8	140.0	148.0	140.2	139.2
WT of WATER (g)	16.3	9.0	13.0	8.2	9.8
TARE WT (g)	15.4	15.4	15.5	15.0	14.8
WT of DRY SOIL (g)	126.5	124.6	132.5	125.2	124.4
MOISTURE CONTENT	12.9%	7.2%	9.8%	6.5%	7.9%

MOISTURE CONTENTS

Project Location: DM Wills - 85162 **Tech:** JG
File No.: 201-07253-00 **Date:** 16-Aug-22

TIN NO.	LF2	V127	X27	FR9	WK4
BOREHOLE NO.	BH22-04	BH22-04	BH22-04	BH22-05	BH22-05
SAMPLE & DEPTH	-	-	-	-	-
WT of TIN & WET SOIL (g)	88.5	161.7	158.4	129.2	167.3
WT of TIN & DRY SOIL (g)	79.4	147.9	147.6	112.1	145.5
WT of WATER (g)	9.1	13.8	10.8	17.1	21.8
TARE WT (g)	15.3	15.6	15.2	16.7	15.7
WT of DRY SOIL (g)	64.1	132.2	132.3	95.4	129.8
MOISTURE CONTENT	14.1%	10.4%	8.2%	17.9%	16.8%

TIN NO.	AB7	BR2	FR17	W4	BL3
BOREHOLE NO.	BH22-05	BH22-05	BH22-05	BH22-05	BH22-05
SAMPLE & DEPTH	-	-	-	-	-
WT of TIN & WET SOIL (g)	139.5	145.7	149.6	136.8	95.9
WT of TIN & DRY SOIL (g)	125.9	135.9	138.3	126.3	86.2
WT of WATER (g)	13.6	9.8	11.3	10.5	9.6
TARE WT (g)	15.4	15.3	16.7	14.7	15.3
WT of DRY SOIL (g)	110.6	120.6	121.6	111.6	70.9
MOISTURE CONTENT	12.3%	8.1%	9.3%	9.4%	13.6%

TIN NO.	LM20	BE87	F32	FR38	BR9
BOREHOLE NO.	BH22-06	BH22-06	BH22-06	BH22-06	BH22-06
SAMPLE & DEPTH	-	-	-	-	-
WT of TIN & WET SOIL (g)	147.3	79.7	167.1	120.8	170.6
WT of TIN & DRY SOIL (g)	137.3	72.8	152.4	114.6	152.4
WT of WATER (g)	10.0	6.8	14.7	6.2	18.3
TARE WT (g)	16.9	14.3	15.9	16.8	15.0
WT of DRY SOIL (g)	120.4	58.5	136.5	97.9	137.4
MOISTURE CONTENT	8.3%	11.7%	10.7%	6.3%	13.3%

TIN NO.	IU	OS16	LW4	LG4	X10
BOREHOLE NO.	BH22-06	BH22-06	BH22-07	BH22-07	BH22-07
SAMPLE & DEPTH	-	-	-	-	-
WT of TIN & WET SOIL (g)	134.3	157.6	88.7	154.6	157.8
WT of TIN & DRY SOIL (g)	126.0	143.4	80.8	134.8	142.1
WT of WATER (g)	8.4	14.2	7.9	19.9	15.7
TARE WT (g)	16.3	14.9	15.6	15.1	15.7
WT of DRY SOIL (g)	109.6	128.5	65.2	119.7	126.4
MOISTURE CONTENT	7.6%	11.1%	12.1%	16.6%	12.4%

TIN NO.	KR91	T1	BR16	6C	FR18
BOREHOLE NO.	BH22-07	BH22-07	BH22-07	BH22-08	BH22-08
SAMPLE & DEPTH	-	-	-	-	-
WT of TIN & WET SOIL (g)	155.2	104.3	175.0	130.0	105.5
WT of TIN & DRY SOIL (g)	143.7	84.9	155.4	122.2	90.5
WT of WATER (g)	11.6	19.5	19.6	7.8	15.0
TARE WT (g)	15.2	15.7	15.1	15.8	15.0
WT of DRY SOIL (g)	128.5	69.2	140.4	106.4	75.6
MOISTURE CONTENT	9.0%	28.1%	13.9%	7.3%	19.8%

MOISTURE CONTENTS

Project Location: DM Wills - 85162 **Tech:** JG
File No.: 201-07253-00 **Date:** 16-Aug-22

TIN NO.	HE	M	NLI	NL2	TP8
BOREHOLE NO.	BH22-08	BH22-08	-	-	BH22-09
SAMPLE & DEPTH	-	-	-	-	-
WT of TIN & WET SOIL (g)	176.4	183.7	133.6	167.5	166.0
WT of TIN & DRY SOIL (g)	162.1	166.3	125.6	153.9	150.6
WT of WATER (g)	14.3	17.3	8.1	13.6	15.4
TARE WT (g)	16.8	15.7	15.5	15.5	15.6
WT of DRY SOIL (g)	145.3	150.7	110.1	138.5	135.0
MOISTURE CONTENT	9.9%	11.5%	7.3%	9.8%	11.4%

TIN NO.	BS3	MVD5	LAB	BE43	BR19
BOREHOLE NO.	BH22-09	BH22-09	BH22-09	BH22-09	BH22-09
SAMPLE & DEPTH	-	-	-	-	-
WT of TIN & WET SOIL (g)	162.5	142.9	162.6	81.4	141.8
WT of TIN & DRY SOIL (g)	143.2	122.2	144.8	74.0	122.9
WT of WATER (g)	19.3	20.7	17.8	7.4	18.9
TARE WT (g)	15.6	15.8	15.1	15.0	15.0
WT of DRY SOIL (g)	127.6	106.5	129.7	59.1	107.9
MOISTURE CONTENT	15.1%	19.5%	13.7%	12.5%	17.5%

TIN NO.	AT57	BV9	BR10	X34	WC3
BOREHOLE NO.	BH22-09	BH22-10	BH22-10	BH22-10	BH22-10
SAMPLE & DEPTH	-	-	-	-	-
WT of TIN & WET SOIL (g)	147.4	147.2	133.1	136.5	148.9
WT of TIN & DRY SOIL (g)	135.3	136.1	126.1	125.5	131.5
WT of WATER (g)	12.1	11.0	7.0	11.0	17.4
TARE WT (g)	15.4	15.4	15.0	15.7	15.6
WT of DRY SOIL (g)	119.9	120.7	111.1	109.7	115.9
MOISTURE CONTENT	10.1%	9.1%	6.3%	10.0%	15.0%

TIN NO.	FR28	L24	BD1	TQ12	MVD6
BOREHOLE NO.	BH22-10	BH22-10	BH22-10	BH22-11	BH22-11
SAMPLE & DEPTH	-	-	-	-	-
WT of TIN & WET SOIL (g)	119.8	117.2	139.8	163.8	161.9
WT of TIN & DRY SOIL (g)	105.8	102.1	128.5	151.8	148.7
WT of WATER (g)	13.9	15.0	11.3	12.1	13.2
TARE WT (g)	15.0	14.7	16.9	17.1	15.1
WT of DRY SOIL (g)	90.8	87.5	111.6	134.7	133.6
MOISTURE CONTENT	15.3%	17.2%	10.1%	9.0%	9.9%

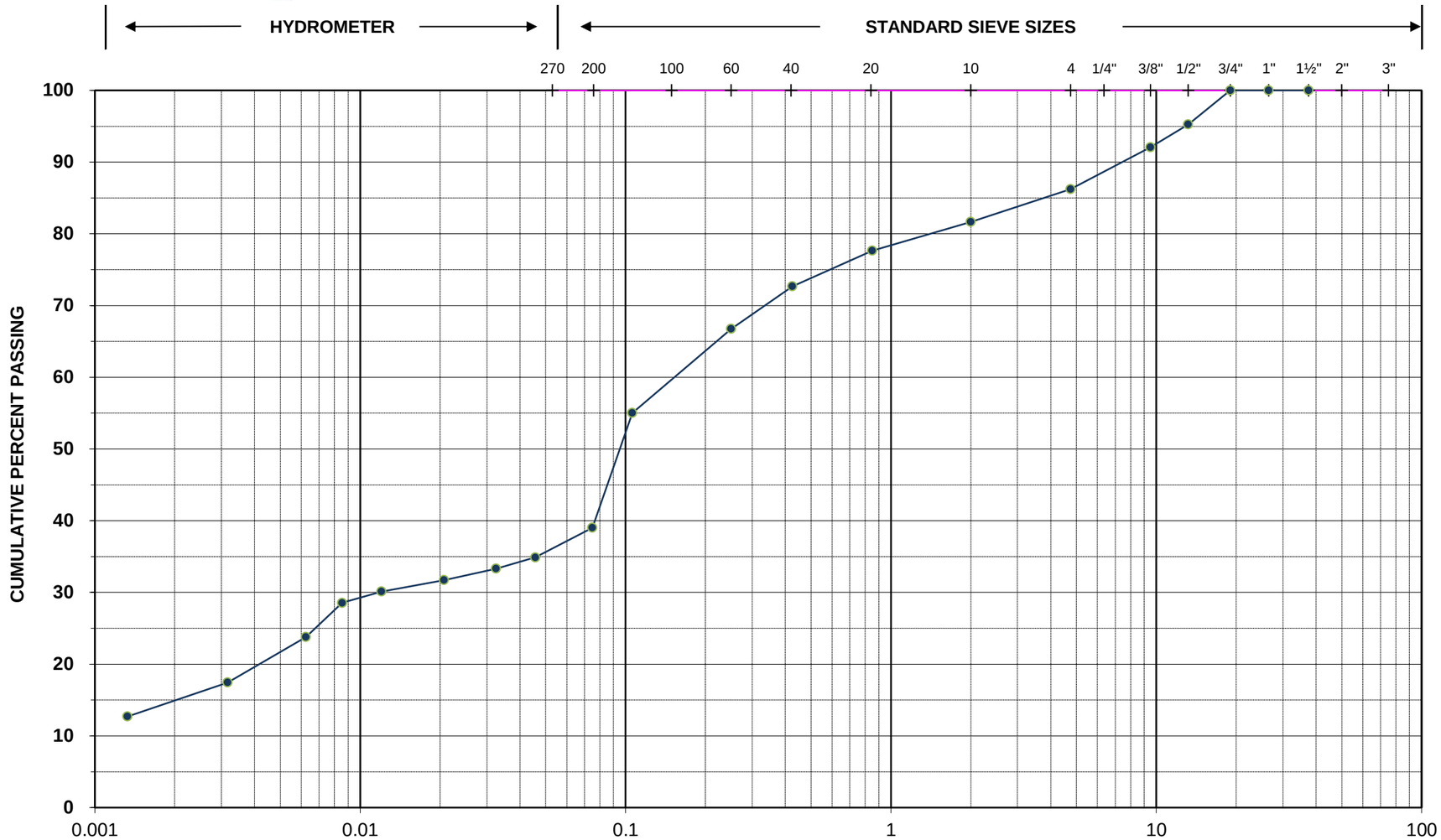
TIN NO.	D16	BR4	IL-42	12e	HN2
BOREHOLE NO.	BH22-11	BH22-11	BH22-11	BH22-11	BH22-12
SAMPLE & DEPTH	-	-	-	-	-
WT of TIN & WET SOIL (g)	162.3	167.0	107.3	82.4	109.2
WT of TIN & DRY SOIL (g)	150.0	152.0	103.1	66.6	95.7
WT of WATER (g)	12.2	14.9	4.3	15.8	13.6
TARE WT (g)	15.8	15.2	16.1	15.1	15.5
WT of DRY SOIL (g)	134.2	136.8	87.0	51.6	80.2
MOISTURE CONTENT	9.1%	10.9%	4.9%	30.7%	16.9%

MOISTURE CONTENTS

Project Location: DM Wills - 85162 **Tech:** JG
File No.: 201-07253-00 **Date:** 16-Aug-22

TIN NO.	BL8	4KR	MVD3	KZK	
BOREHOLE NO.	BH22-12	BH22-12	BH22-12	BH22-12	
SAMPLE & DEPTH	-	-	-	-	
WT of TIN & WET SOIL (g)	149.7	107.5	131.8	115.0	
WT of TIN & DRY SOIL (g)	139.6	102.2	122.4	111.8	
WT of WATER (g)	10.0	5.3	9.4	3.2	
TARE WT (g)	15.7	14.9	15.3	15.3	
WT of DRY SOIL (g)	123.9	87.3	107.1	96.5	
MOISTURE CONTENT	8.1%	6.1%	8.7%	3.3%	
TIN NO.					
BOREHOLE NO.					
SAMPLE & DEPTH					
WT of TIN & WET SOIL (g)					
WT of TIN & DRY SOIL (g)					
WT of WATER (g)					
TARE WT (g)					
WT of DRY SOIL (g)					
MOISTURE CONTENT					
TIN NO.					
BOREHOLE NO.					
SAMPLE & DEPTH					
WT of TIN & WET SOIL (g)					
WT of TIN & DRY SOIL (g)					
WT of WATER (g)					
TARE WT (g)					
WT of DRY SOIL (g)					
MOISTURE CONTENT					
TIN NO.					
BOREHOLE NO.					
SAMPLE & DEPTH					
WT of TIN & WET SOIL (g)					
WT of TIN & DRY SOIL (g)					
WT of WATER (g)					
TARE WT (g)					
WT of DRY SOIL (g)					
MOISTURE CONTENT					
TIN NO.					
BOREHOLE NO.					
SAMPLE & DEPTH					
WT of TIN & WET SOIL (g)					
WT of TIN & DRY SOIL (g)					
WT of WATER (g)					
TARE WT (g)					
WT of DRY SOIL (g)					
MOISTURE CONTENT					

PARTICLE SIZE DISTRIBUTION LS702/ASTM D422



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

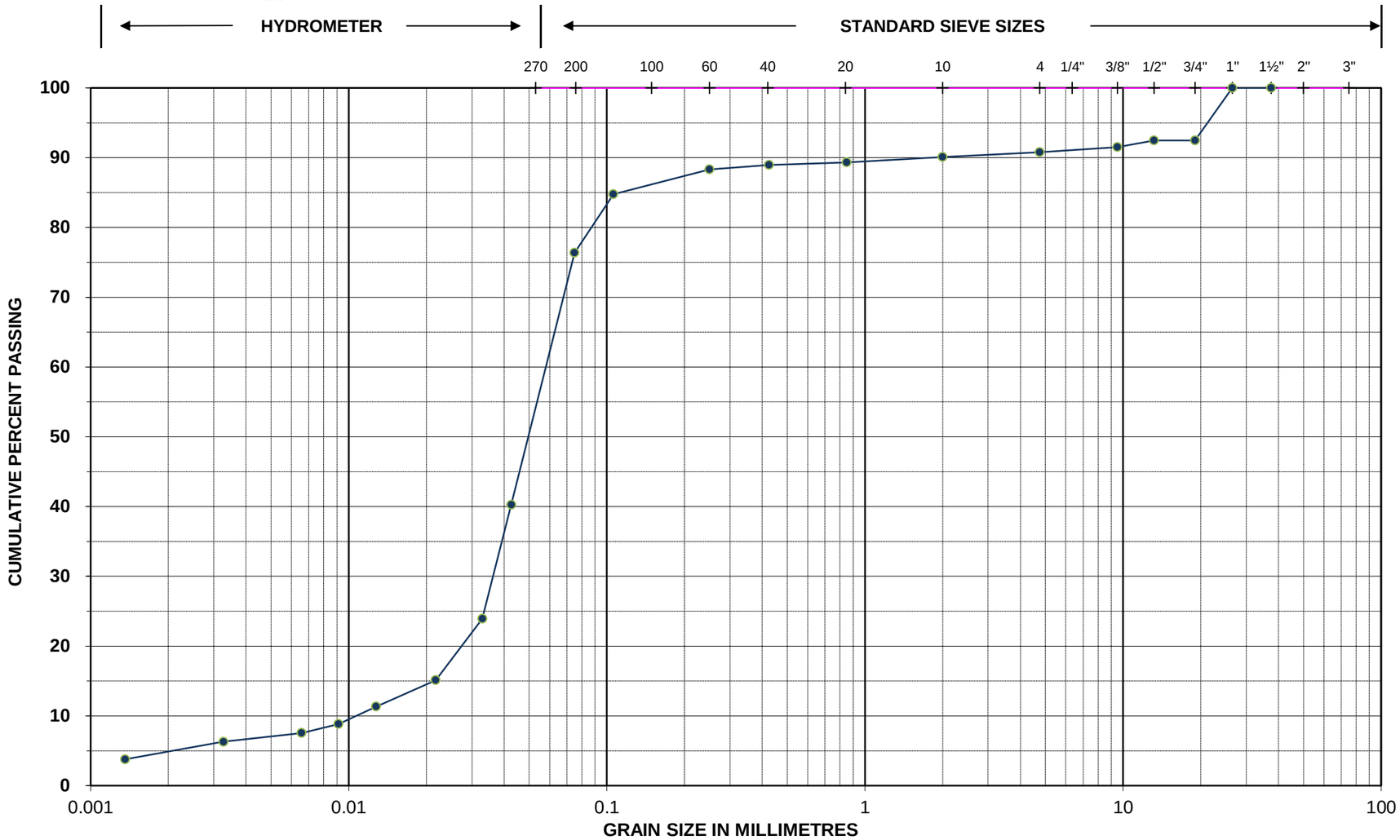
Project Name: DM Wills - 85162 **Project No.:** 201-07253-00

Location ID.: BH22-04 **Sample No./Depth:** SS-5

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine	Hydrometer (mm)	% Passing
37.5 mm	100.0	**2.00 mm**	81.7	**0.046**	34.9
26.5 mm	100.0	**0.850 mm**	77.6	**0.021**	31.7
19.0 mm	100.0	**0.425 mm**	72.7	**0.009**	28.5
13.2 mm	95.2	**0.250 mm**	66.7	**0.003**	17.4
9.50 mm	92.0	**0.106 mm**	55.0	**0.001**	12.7
4.75 mm	86.2	**0.075 mm**	39.0		

Note: More information is available upon request. Tested by: NLO Reviewed by: Date: 17-Aug-22

PARTICLE SIZE DISTRIBUTION LS702/ASTM D422



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

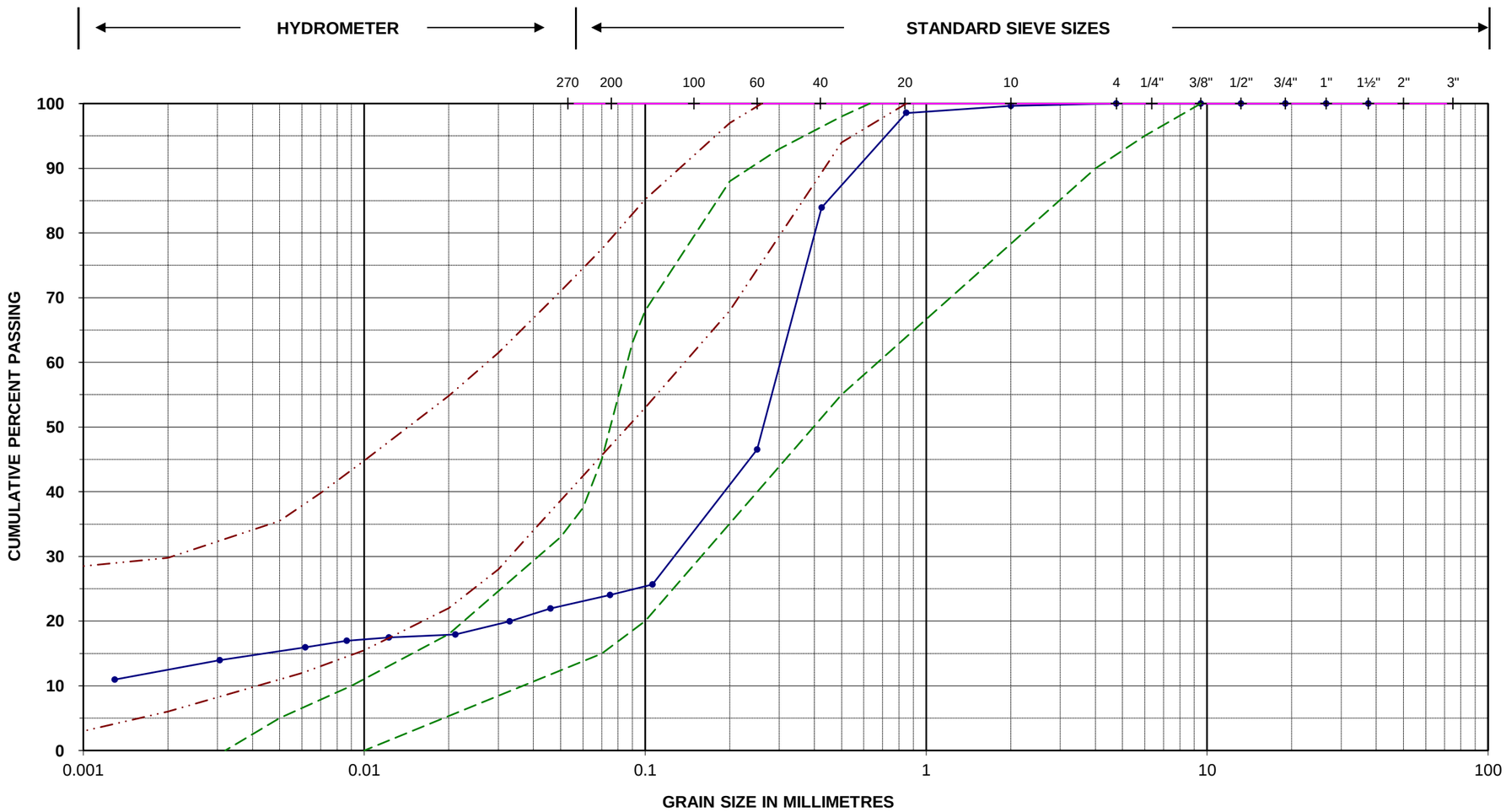
Project Name: DM Wills - 85162 **Project No.:** 201-07253-00

Location ID.: BH22-06 **Sample No./Depth:** SS-6

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine	Hydrometer (mm)	% Passing
37.5 mm	100.0	**2.00 mm**	90.1	**0.043**	40.3
26.5 mm	100.0	**0.850 mm**	89.3	**0.022**	15.1
19.0 mm	92.5	**0.425 mm**	89.0	**0.009**	8.8
13.2 mm	92.5	**0.250 mm**	88.3	**0.003**	6.3
9.50 mm	91.5	**0.106 mm**	84.8	**0.001**	3.8
4.75 mm	90.8	**0.075 mm**	76.4		

Note: More information is available upon request. Tested by: NLO Reviewed by: Date: 17-Aug-22

PARTICLE SIZE DISTRIBUTION LS702/ASTM D422



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

GRAVEL	0	%
SAND	64	%
SILT	24	%
CLAY	12	%

---------- sm envelope T = 8 - 20 min/cm

— - - — - - — - - — ml envelope T = 20 - 50 min/cm

Estimated T = 20 min/cm

Project Name: DM Wills - 85162 **Project No.:** 201-07253-00

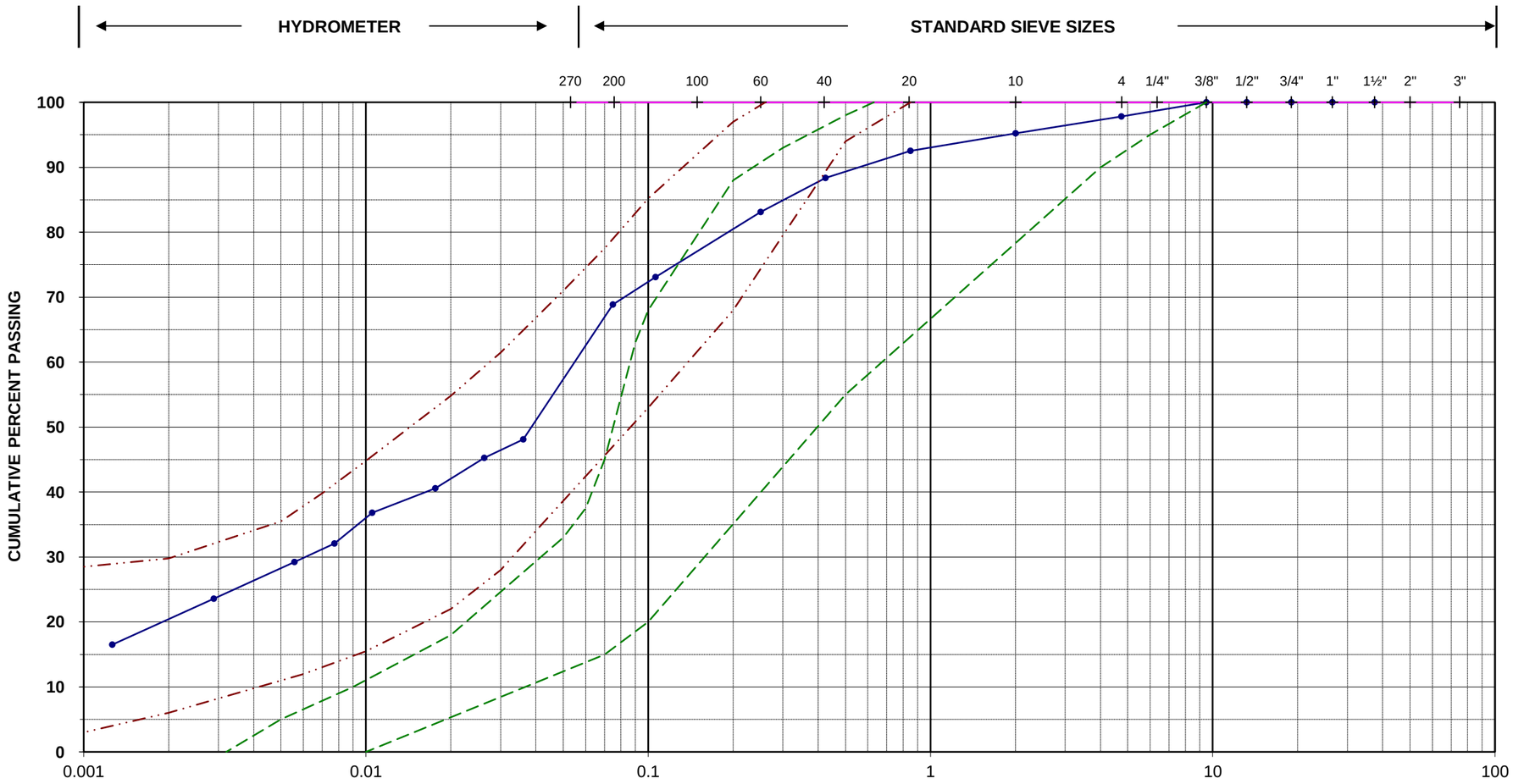
Location ID.: TP22-02 **Sample No./Depth:** GS2

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine	Hydrometer (mm)	% Passing
37.5 mm	100.0	**2.00 mm**	99.66	**0.046**	21.9
26.5 mm	100.0	**0.850 mm**	98.5	**0.021**	17.9
19.0 mm	100.0	**0.425 mm**	83.9	**0.009**	17.0
13.2 mm	100.0	**0.250 mm**	46.5	**0.003**	14.0
9.50 mm	100.0	**0.106 mm**	25.6	**0.001**	11.0
4.75 mm	100.0	**0.075 mm**	24.0		

Note: More information is available upon request.

Tested by: WGH Reviewed by: Date: 29-Jun-22

PARTICLE SIZE DISTRIBUTION LS702/ASTM D422



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

GRAVEL	**2**	**%**
SAND	**29**	**%**
SILT	**49**	**%**
CLAY	**20**	**%**

---------- sm envelope T = 8 - 20 min/cm

– – – — – – – — – – – — – ml envelope T = 20 - 50 min/cm

Estimated T = 40 min/cm

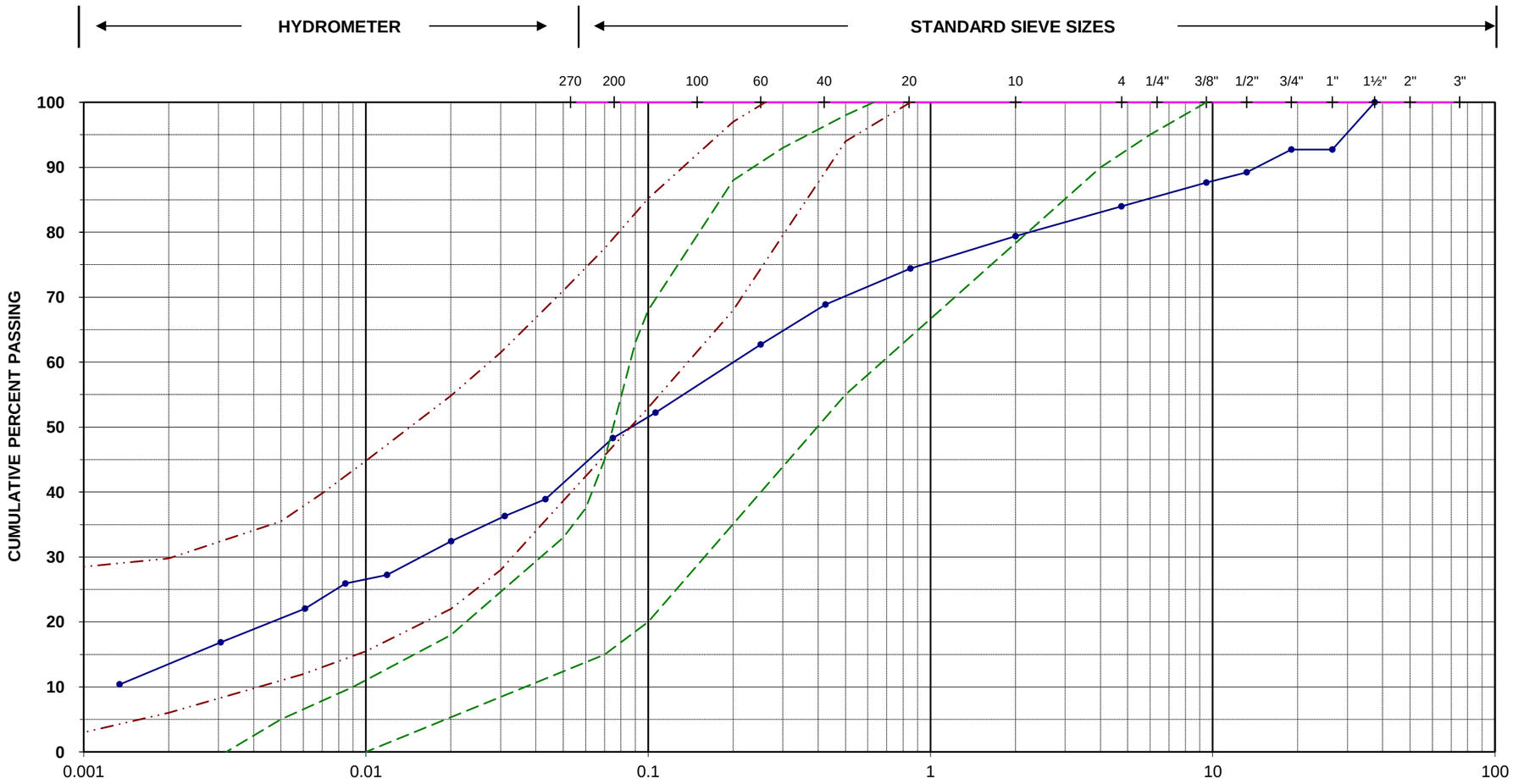
Project Name: DM Wills - 85162 **Project No.:** 201-0725-00

Location ID.: TP22-03 **Sample No./Depth:** GS3

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine	Hydrometer (mm)	% Passing
37.5 mm	100.0	**2.00 mm**	95.20	**0.036**	48.1
26.5 mm	100.0	**0.850 mm**	92.5	**0.018**	40.6
19.0 mm	100.0	**0.425 mm**	88.3	**0.008**	32.1
13.2 mm	100.0	**0.250 mm**	83.1	**0.003**	23.6
9.50 mm	100.0	**0.106 mm**	73.1	**0.001**	16.5
4.75 mm	97.8	**0.075 mm**	68.9		

Note: More information is available upon request. Tested by: WGH Reviewed by: Date: 30-Jun-22

PARTICLE SIZE DISTRIBUTION LS702/ASTM D422



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

GRAVEL	16	%
SAND	36	%
SILT	35	%
CLAY	13	%

---------- sm envelope T = 8 - 20 min/cm

– - - – - - – - - – - sm envelope T = 20 - 50 min/cm

Estimated T = 30 min/cm

Project Name: DM Wills - 85162 **Project No.:** 201-07253-00

Location ID.: TP22-06 **Sample No./Depth:** GS2

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine	Hydrometer (mm)	% Passing
37.5 mm	100.0	**2.00 mm**	79.37	**0.043**	38.9
26.5 mm	92.7	**0.850 mm**	74.4	**0.020**	32.4
19.0 mm	92.7	**0.425 mm**	68.9	**0.008**	25.9
13.2 mm	89.2	**0.250 mm**	62.7	**0.003**	16.9
9.50 mm	87.6	**0.106 mm**	52.2	**0.001**	10.4
4.75 mm	84.0	**0.075 mm**	48.3		

Note: More information is available upon request.

Tested by: WGH Reviewed by: Date: 30-Jun-22

Appendix D

Infiltration Graphs

IN-SITU INFILTRATION TEST

Project:	Wallace Point Road	**PROJECT NO.:**	85162
Site Location:	3491 Wallace Point Road	**Date:**	21-Jun-22
Test ID:	INF-01	**Start Time:**	
		Test No.	1

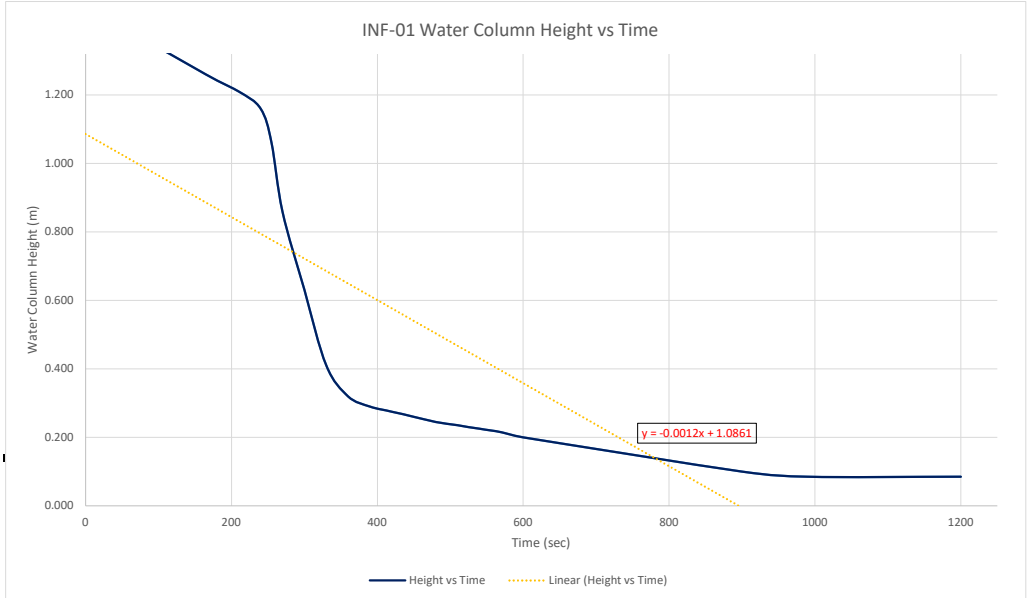
Depth of Test Pit (m):	0.91	**Pipe Stickup (m):**	0.37	**Total Pipe Length(m):**	1.46

Time* (Seconds)	Measurement Interval (sec)	Depth** (m)	Water Column Height (m)	Distance dropped per interval (m1)	Infilitration Rate per Interval (m/sec)	Cumulative Infiltration Rate (m/sec)
0	-	0.000	1.460	-	--	--
165	165	0.200	1.260	0.200	1.212E-03	1.212E-03
210	45	0.250	1.210	0.050	1.111E-03	1.190E-03
240	30	0.300	1.160	0.050	1.667E-03	1.250E-03
255	15	0.400	1.060	0.100	6.667E-03	1.569E-03
270	15	0.600	0.860	0.200	1.333E-02	2.222E-03
300	30	0.830	0.630	0.230	7.667E-03	2.767E-03
330	30	1.050	0.410	0.220	7.333E-03	3.182E-03
360	30	1.140	0.320	0.090	3.000E-03	3.167E-03
390	30	1.170	0.290	0.030	1.000E-03	3.000E-03
420	30	1.185	0.275	0.015	5.000E-04	2.821E-03
450	30	1.200	0.260	0.015	5.000E-04	2.667E-03
480	30	1.215	0.245	0.015	5.000E-04	2.531E-03
510	30	1.225	0.235	0.010	3.333E-04	2.402E-03
540	30	1.235	0.225	0.010	3.333E-04	2.287E-03
570	30	1.245	0.215	0.010	3.333E-04	2.184E-03
600	30	1.260	0.200	0.015	5.000E-04	2.100E-03
900	300	1.360	0.100	0.100	3.333E-04	1.511E-03
990	90	1.375	0.085			1.389E-03
1,200	870	1.375	0.085	0.015	1.724E-05	1.146E-03

** Depth at time 0 indicates measurement below top of measuring pipe at the start of the test.
Not used for statistical analysis

	(m/sec)	(mm/sec)	(mm/hour)
Maximum Infiltration Rate Between Sampling Intervals -	1.33E-02	1.33E+01	48000
Minimum Infiltration Rate Between Sampling Intervals -	1.72E-05	1.72E-02	62
Median Infiltration Rate Between Sampling Intervals -	7.50E-04	7.50E-01	2700
Average Infiltration Rate Between Sampling Intervals -	**2.57E-03**	**2.57E+00**	**9268**
Cumulative Infiltration Rate for Entire Data Set -	**1.15E-03**	**1.15E+00**	**4125**

In-situ Infiltration Rate Measured in the Field (mm/sec):	**1.15**
In-situ Infiltration Rate Measured in the Field (mm/hour):	**4125**
Calculated Percolation Time (T) based on field infiltration (min/cm):	**0.15**



	Test 1 - Observed
Test Duration (seconds)	**1,200**
Total Drop Distance (mm)	**1375**
Total Number of Measured Intervals	**20**
Infiltration Rate (mm/sec) - Test Average	**1.15**
Infiltration Rate (mm/hour) - Test Average	**4125**
Calculated Percolation Time (T) based on Field Infiltration (min/cm)	**0.15**

IN-SITU INFILTRATION TEST

Project:	Wallace Point Road	**PROJECT NO.:**	85162
Site Location:	3491 Wallace Point Road	**Date:**	21-Jun-22
Test ID:	INF-02	**Start Time:**	
		Test No.	1

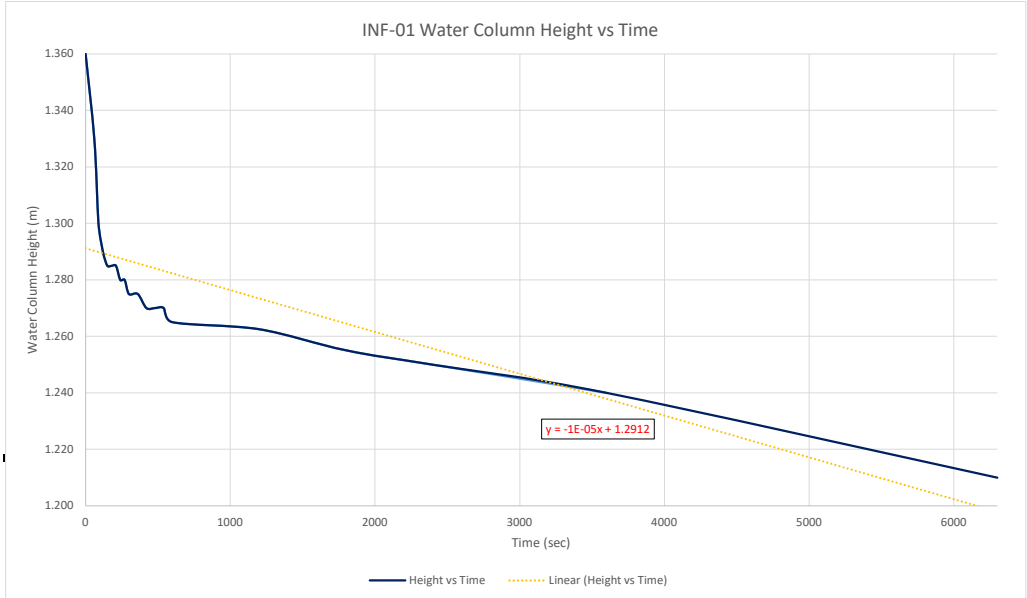
Depth of Test Pit (m):	0.91	**Pipe Stickup (m):**	0.26	**Total Pipe Length(m):**	1.36

Time* (Seconds)	Measurement Interval (sec)	Depth** (m)	Water Column Height (m)	Distance dropped per interval (m1)	Infilitration Rate per Interval (m/sec)	Cumulative Infiltration Rate (m/sec)
0	-	0.000	1.360	-	--	--
60	60	0.030	1.330	0.030	5.000E-04	5.000E-04
90	30	0.060	1.300	0.030	1.000E-03	6.667E-04
120	30	0.070	1.290	0.010	3.333E-04	5.833E-04
150	30	0.075	1.285	0.005	1.667E-04	5.000E-04
180	30	0.075	1.285	0.000	0.000E+00	4.167E-04
210	30	0.075	1.285	0.000	0.000E+00	3.571E-04
240	30	0.080	1.280	0.005	1.667E-04	3.333E-04
270	30	0.080	1.280	0.000	0.000E+00	2.963E-04
300	30	0.085	1.275	0.005	1.667E-04	2.833E-04
360	60	0.085	1.275	0.000	0.000E+00	2.361E-04
420	60	0.090	1.270	0.005	8.333E-05	2.143E-04
480	60	0.090	1.270	0.000	0.000E+00	1.875E-04
540	60	0.090	1.270	0.000	0.000E+00	1.667E-04
600	60	0.095	1.265	0.005	8.333E-05	1.583E-04
1,200	600	0.098	1.263	0.003	4.167E-06	8.125E-05
1,800	600	0.105	1.255	0.007	1.250E-05	5.833E-05
2,400	600	0.110	1.250	0.005	8.333E-06	4.583E-05
3,600	1200	0.120	1.240	0.010	8.333E-06	3.333E-05
6,300	2700	0.150	1.210	0.030	1.111E-05	2.381E-05

** Depth at time 0 indicates measurement below top of measuring pipe at the start of the test.
Not used for statistical analysis

	(m/sec)	(mm/sec)	(mm/hour)
Maximum Infiltration Rate Between Sampling Intervals -	1.00E-03	1.00E+00	3600
Minimum Infiltration Rate Between Sampling Intervals -	0.00E+00	0.00E+00	0
Median Infiltration Rate Between Sampling Intervals -	1.11E-05	1.11E-02	40
Average Infiltration Rate Between Sampling Intervals -	**1.34E-04**	**1.34E-01**	**482**
Cumulative Infiltration Rate for Entire Data Set -	**2.38E-05**	**2.38E-02**	**86**

In-situ Infiltration Rate Measured in the Field (mm/sec):	**0.02**
In-situ Infiltration Rate Measured in the Field (mm/hour):	**86**
Calculated Percolation Time (T) based on field infiltration (min/cm):	**7.00**



	Test 1 - Observed
Test Duration (seconds)	**6,300**
Total Drop Distance (mm)	**150**
Total Number of Measured Intervals	**20**
Infiltration Rate (mm/sec) - Test Average	**0.02**
Infiltration Rate (mm/hour) - Test Average	**86**
Calculated Percolation Time (T) based on Field Infiltration (min/cm)	**7.00**

IN-SITU INFILTRATION TEST

Project:	Wallace Point Road	**PROJECT NO.:**	85162
Site Location:	3491 Wallace Point Road	**Date:**	21-Jun-22
Test ID:	INF-03	**Start Time:**	1:11 PM
		Test No.	1

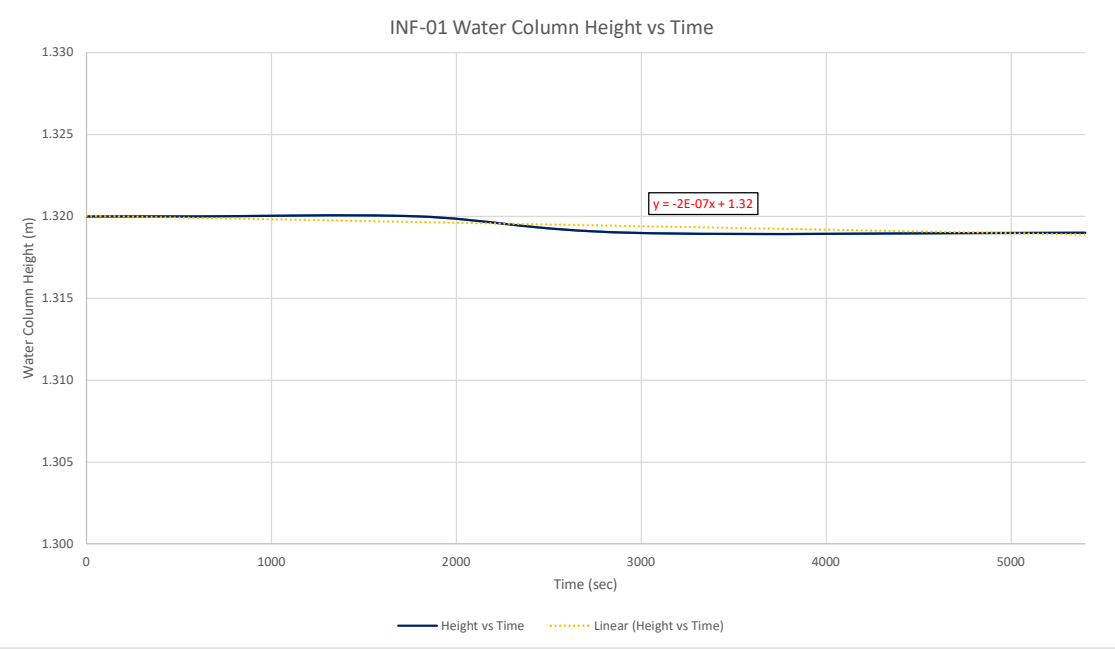
Depth of Test Pit (m):	0.91	**Pipe Stickup (m):**	0.15	**Total Pipe Length(m):**	1.32

Time* (Seconds)	Measurement Interval (sec)	Depth** (m)	Water Column Height (m)	Distance dropped per interval (m1)	Infilitration Rate per Interval (m/sec)	Cumulative Infiltration Rate (m/sec)
0	-	0.000	1.320	-	--	--
30	30	0.000	1.320	0.000	0.000E+00	0.000E+00
60	30	0.000	1.320	0.000	0.000E+00	0.000E+00
90	30	0.000	1.320	0.000	0.000E+00	0.000E+00
120	30	0.000	1.320	0.000	0.000E+00	0.000E+00
150	30	0.000	1.320	0.000	0.000E+00	0.000E+00
180	30	0.000	1.320	0.000	0.000E+00	0.000E+00
300	120	0.000	1.320	0.000	0.000E+00	0.000E+00
600	300	0.000	1.320	0.000	0.000E+00	0.000E+00
1,800	1200	0.000	1.320	0.000	0.000E+00	0.000E+00
2,940	1140	0.001	1.319	0.001	8.772E-07	3.401E-07
5,400	2460	0.001	1.319	0.000	0.000E+00	1.852E-07

** Depth at time 0 indicates measurement below top of measuring pipe at the start of the test.
Not used for statistical analysis

	(m/sec)	(mm/sec)	(mm/hour)
Maximum Infiltration Rate Between Sampling Intervals -	8.77E-07	8.77E-04	3
Minimum Infiltration Rate Between Sampling Intervals -	0.00E+00	0.00E+00	0
Median Infiltration Rate Between Sampling Intervals -	0.00E+00	0.00E+00	0
Average Infiltration Rate Between Sampling Intervals -	**7.97E-08**	**7.97E-05**	**0**
Cumulative Infiltration Rate for Entire Data Set -	**1.85E-07**	**1.85E-04**	**1**

In-situ Infiltration Rate Measured in the Field (mm/sec):	**0.00**
In-situ Infiltration Rate Measured in the Field (mm/hour):	**1**
Calculated Percolation Time (T) based on field infiltration (min/cm):	**900.00**



		Test 1 - Observed
Test Duration (seconds)		**5,400**
Total Drop Distance (mm)		**1**
Total Number of Measured Intervals		**12**
Infiltration Rate (mm/sec) - Test Average		**0.000185**
Infiltration Rate (mm/hour) - Test Average		**1**
Calculated Percolation Time (T) based on Field Infiltration (min/cm)		**900.00**

IN-SITU INFILTRATION TEST

Project:	Wallace Point Road	**PROJECT NO.:**	85162
Site Location:	3491 Wallace Point Road	**Date:**	21-Jun-22
Test ID:	INF-04	**Start Time:**	2:20 PM
		Test No.	1

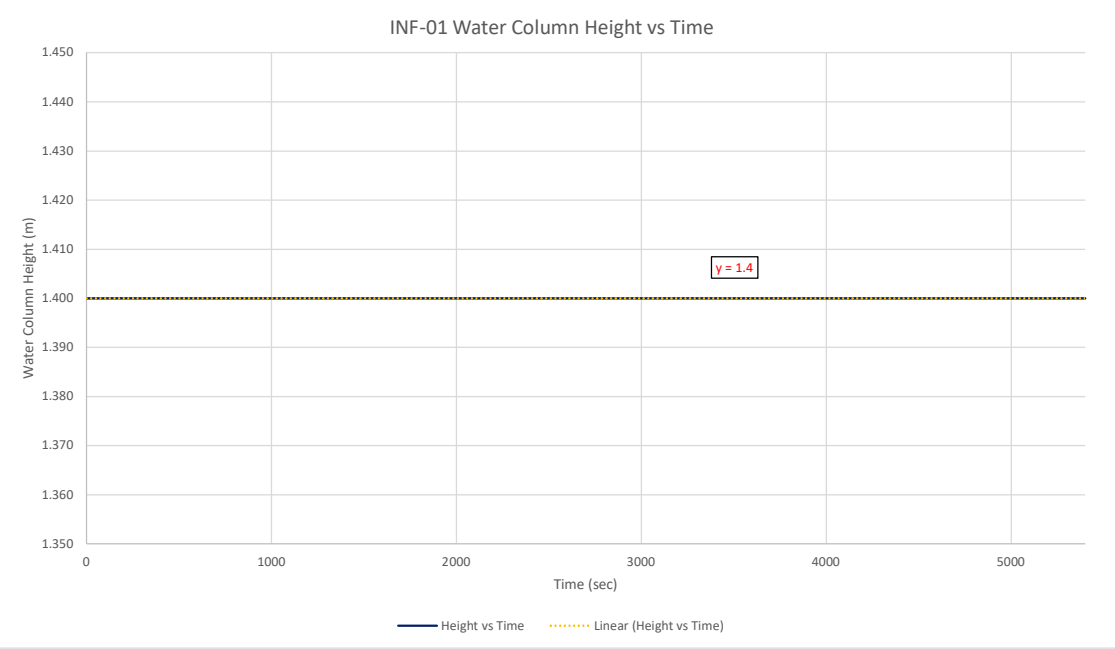
Depth of Test Pit (m):	0.91	**Pipe Stickup (m):**	0.2	**Total Pipe Length(m):**	1.40

Time* (Seconds)	Measurement Interval (sec)	Depth** (m)	Water Column Height (m)	Distance dropped per interval (m1)	Infilitration Rate per Interval (m/sec)	Cumulative Infiltration Rate (m/sec)
0	-	0.000	1.400	-	--	--
30	30	0.000	1.400	0.000	0.000E+00	0.000E+00
60	30	0.000	1.400	0.000	0.000E+00	0.000E+00
90	30	0.000	1.400	0.000	0.000E+00	0.000E+00
120	30	0.000	1.400	0.000	0.000E+00	0.000E+00
150	30	0.000	1.400	0.000	0.000E+00	0.000E+00
180	30	0.000	1.400	0.000	0.000E+00	0.000E+00
300	120	0.000	1.400	0.000	0.000E+00	0.000E+00
600	300	0.000	1.400	0.000	0.000E+00	0.000E+00
1,800	1200	0.000	1.400	0.000	0.000E+00	0.000E+00
2,940	1140	0.000	1.400	0.000	0.000E+00	0.000E+00
5,400	2460	0.000	1.400	0.000	0.000E+00	0.000E+00

** Depth at time 0 indicates measurement below top of measuring pipe at the start of the test.
Not used for statistical analysis

	(m/sec)	(mm/sec)	(mm/hour)
Maximum Infiltration Rate Between Sampling Intervals -	0.00E+00	0.00E+00	0
Minimum Infiltration Rate Between Sampling Intervals -	0.00E+00	0.00E+00	0
Median Infiltration Rate Between Sampling Intervals -	0.00E+00	0.00E+00	0
Average Infiltration Rate Between Sampling Intervals -	**0.00E+00**	**0.00E+00**	**0**
Cumulative Infiltration Rate for Entire Data Set -	**0.00E+00**	**0.00E+00**	**0**

In-situ Infiltration Rate Measured in the Field (mm/sec):	**0.00**
In-situ Infiltration Rate Measured in the Field (mm/hour):	**0**
Calculated Percolation Time (T) based on field infiltration (min/cm):	**0.00**



		Test 1 - Observed
Test Duration (seconds)		**5,400**
Total Drop Distance (mm)		**0**
Total Number of Measured Intervals		**12**
Infiltration Rate (mm/sec) - Test Average		**0.00**
Infiltration Rate (mm/hour) - Test Average		**0**
Calculated Percolation Time (T) based on Field Infiltration (min/cm)		**0.00**

Appendix E

Certificate of Analysis – Groundwater Nitrates

FINAL REPORT

CA15000-AUG22 R1

85162

Prepared for

D.M. Wills -Peterborough

FINAL REPORT

CA15000-AUG22 R1

First Page

CLIENT DETAILS

Client	D.M. Wills -Peterborough
Address	150 Jameson Drive Peterborough, ON K9J 0B9. Canada
Contact	Lynsey Tuters
Telephone	289-385-6230
Facsimile	705-741-3568
Email	ltuters@dmwills.com
Project	85162
Order Number	
Samples	Ground Water (3)

LABORATORY DETAILS

Project Specialist	Maarit Wolfe, Hon.B.Sc
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	705-652-2000
Facsimile	705-652-6365
Email	Maarit.Wolfe@sgs.com
SGS Reference	CA15000-AUG22
Received	08/02/2022
Approved	08/09/2022
Report Number	CA15000-AUG22 R1
Date Reported	08/09/2022

COMMENTS

MAC - Maximum Acceptable Concentration
MDL - SGS Method Detection Limit

Temperature of Sample upon Receipt: 6 degrees C
Cooling Agent Present: No
Custody Seal Present: Yes

SIGNATORIES

Maarit Wolfe, Hon.B.Sc

TABLE OF CONTENTS

Client: D.M. Wills -Peterborough
Project: 85162
Project Manager: Lynsey Tuters
Samplers: Lynsey Tuters

MATRIX: WATER

L1 = ODWS_MAC / WATER / - - Table 1,2 and 3 - Drinking Water - Reg O.169_03

Sample Number				7	8	9
Sample Name				85162-MW22-01	85162-MW22-03	85162-MW22-02
Sample Matrix				Ground Water	Ground Water	Ground Water
Sample Date				28/07/2022	28/07/2022	28/07/2022
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**	**Result**
Metals and Inorganics						
Nitrite (as N)	as N mg/L	0.03	1	< 0.03	< 0.03	0.46
Nitrate (as N)	as N mg/L	0.06	10	2.24	1.17	5.70
Nitrate + Nitrite (as N)	as N mg/L	0.06		2.24	1.17	6.16

EXCEEDANCE SUMMARY

No exceedances are present above the regulatory limit(s) indicated

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-[ENVIIC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Nitrate + Nitrite (as N)	DIO0011-AUG22	mg/L	0.06	<0.06	NA		NA			NA		
Nitrite (as N)	DIO0011-AUG22	mg/L	0.03	<0.03	ND	20	98	90	110	104	75	125
Nitrate (as N)	DIO0011-AUG22	mg/L	0.06	<0.06	1	20	98	90	110	98	75	125

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Results relate only to the sample tested.
Data reported represent the sample as submitted to SGS. Solid samples expressed on a dry weight basis.
"Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.
Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the "Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act and Excess Soil Quality" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated.

SGS Canada Inc. statement of conformity decision rule does not consider uncertainty when analytical results are compared to a specified standard or regulation.

This report supersedes all previous versions.

-- End of Analytical Report --

Request for Laboratory Services and CHAIN OF CUSTODY

SGS Environmental Services - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Toll Free: 877-747-7658 Fax: 705-652-6365
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361 Web: www.ca.sgs.com

No:

Page ____ of ____

Laboratory Information Section - Lab use only

Received By: Naumeet Kaur
Received Date (mm/dd/yyyy): AUG 0 2 2022 (mm\dd\yy)
Received Time: ___ : ___
Received By (signature): ____
Custody Seal Present: ☑
Custody Seal Intact: ☑
Cooling Agent Present: ☑ NO
Temperature Upon Receipt (°C) 6x3
LAB LIMS #: CA15000-AUG22

REPORT INFORMATION

Company: D.M. Wills
Contact: Lynsey Tulers
Address: 150 Jameson Dr.
Peterborough
Phone: 289-385-6230
Fax:
Email: ltulers@dmwills.com

INVOICE INFORMATION

☑ (same as Report Information)
Company:
Contact:
Address:
Phone:
Email: accounted@mwills.com

PROJECT INFORMATION

Quotation #:
P.O. #: 85162
Project #: 85162
Site Location/ID:

TURNAROUND TIME (TAT) REQUIRED

☑ Regular TAT (5-7days)
TAT's are quoted in business days (exclude statutory holidays & weekends).
Samples received after 3pm or on weekends : TAT begins the next business day

RUSH TAT (Additional Charges May Apply) ☐ 1 Day ☐ 2 Days ☐ 3-4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date: Rush Confirmation ID:

REGULATIONS

Regulation 153 (2011):
☐ Table 1 ☐ Res/Park Soil Texture:
☐ Table 2 ☐ Ind/Com ☐ Coarse
☐ Table 3 ☐ Agri/Other ☐ Medium
☐ Table ____ ☐ Fine

Other Regulations:
☐ Reg 347/558 (3 Day min TAT)
☐ PWQO ☐ MMER
☐ CCME ☐ Other:
☐ MISA ODWQS

Sewer By-Law:
☐ Sanitary
☐ Storm
Municipality:

DRINKING WATER SAMPLES (POTABLE WATER FOR HUMAN CONSUMPTION) MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	PHC F1-F4 BTEX	O.Reg153 Metals (ICP & hydride metals)	☐Hg ☐B-HWS ☐Cr(VI)	O.Reg 153 VOCs	☑ Nitrates								COMMENTS: Field Filtered (F) Preserved (P)
1	~~MW~~ 85162-MW22-01	July 28/22	AM	1	GW					✓								
2	85162-MW22-03	"	"	1	GW					✓								
3	85162-MW22-02	"	"	1	GW					✓								
4																		
5																		
6																		
7																		
8																		
9																		
10																		

Observations/Comments/Special Instructions

Sampled By (NAME): L Tulers	**Signature:** L Tulers	Date: 08/01/22 (mm/dd/yy)	Pink Copy - Client
Relinquished by (NAME): L Tulers	**Signature:** L Tulers	Date: 08/01/22 (mm/dd/yy)	Yellow & White Copy - SGS

Revision #: 1.0
Date of Issue: 01 June, 2014

Appendix F

Groundwater Impact Assessments

Infiltration Factor Calculations for PR-106

Sheet 1 of 1

Project No: 85162
Project Name: 3491 Wallace Point Road
Designed/Checked By: NN / MJH
Date: 13-Apr-23

Topography	
Average Slope	1.20%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	B	Total
Soil Type	Bondhead Loam	
Area (ha)	1.50	1.50
Soil Infiltration Factor	0.30	**0.30**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture Range Grass Woods Wetland Bare Earth (>70% Rock)	0.75	0.10
Impervious	0.75	
Total[3]	0.75	**0.10**

MOE Infiltration Factor	**0.65**
Actual Infiltration Factor	**0.65**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Features for PR-106

Sheet 2 of 2

Project No: 85162
Project Name: 3491 Wallace Point Road
Designed/Checked By: NN / MJH
Date: 13-Apr-23

Infiltration Features Summary		
Total Storage Volume[1]	0.0	m^3
Contributing Area[2]	15000	m^2
Pervious Area	7500	m^2
Impervious Area	7500	m^2
Maximum Drawdown	48	hrs
Average Infiltration Volume[3]	**4152**	**m^3/yr**
	276.8	**mm/yr**

Notes:

1. Total Storage Volume from all Infiltration Features in the catchment
2. The entire catchment contributes flow to the Infiltration Features

3. Average Infiltration Volume has been estimated

Monthly Water Budget Calculations

WILLS

Project No: 85162
Project Name: 3491 Wallace Point Road
Designed/Checked By: NN / MJH
Date: 13-Apr-23

'PETERBOROUGH A' DAILY CLIMATE DATA (1981-2010)

Station ID = 48952
Latitude = 44.23
Longitude = -78.36

First Year of Data Used = 1981
Last Year of Data Used = 2010
Total Years of Data Used = 30

Thornthwaite (1948) Inputs				Monthly Water Budget Analysis				
Month	Mean Temperature (°C)[1]	Total Precipitation (mm)[1]	Heat Index	PET (mm)	Daylight Correction Factor	Adjusted PET (mm)	Surplus (mm)	Deficit (mm)
January	-8.3	56.1	0.00	0.0	0.78	0.0	56.1	0.0
February	-7.0	50.4	0.00	0.0	0.87	0.0	50.4	0.0
March	-1.7	57.0	0.00	0.0	1.00	0.0	57.0	0.0
April	6.1	67.6	1.35	29.6	1.12	33.3	38.0	0.0
May	12.1	82.9	3.82	62.3	1.23	76.8	20.6	0.0
June	17.1	82.9	6.43	85.9	1.29	110.6	0.0	27.8
July	19.6	73.2	7.88	102.0	1.26	128.5	0.0	55.3
August	18.4	78.7	7.18	95.7	1.16	111.4	0.0	32.7
September	14.0	81.6	4.74	69.8	1.04	72.7	11.8	0.0
October	7.6	72.0	1.87	38.2	0.91	35.0	33.8	0.0
November	2.0	83.6	0.24	9.3	0.80	7.4	74.3	0.0
December	-4.6	66.9	0.00	0.0	0.74	0.0	66.9	0.0
Totals		**852.9**	33.51			**575.8**	**408.8**	**115.8**
	Thornthwaite Coefficient (α)		**1.032**			Total Water Surplus (mm)		**277.1**

Notes:

1. Temperature and Precipitation data are calculated using daily climate data from 1981-2010
2. Water budget adjusted for latitude and length of daylight
3. Potential Evapotranspiration (PET) is calculated based on the Thornthwaite 1948 equation
4. Total Water Surplus (Thornthwaite, 1948) is calculated as total precipitation minus adjusted evapotranspiration

Water Balance Calculations for Existing Conditions

WILLS

Project No: 85162
Project Name: 3491 Wallace Point Road
Designed/Checked By: NN / MJH
Date: 13-Apr-23

Catchment Parameters	EX-100										**Total**
Drainage Area (m^2)	247800										**247800**
Pervious Area (m^2)	246984										**246984**
Impervious Area (m^2)	816										**816**
Evapotranspiration Factors											
Pervious PET Ratio											
Impervious Evapotranspiration[3]											
Infiltration Factors											
Topography Infiltration Factor											
Soil Infiltration Factor											
Land Cover Infiltration Factor											
MOE Infiltration Factor											
Actual Infiltration Factor											
Run-Off Coefficient											
Runoff from Impervious Surfaces											
Inputs (mm/yr)											
Precipitation	852.8										**852.8**
Run-On	0.0										**0.0**
Other Inputs	0.0										**0.0**
Total Inputs	852.8										**852.8**
Outputs (mm/yr)	**0.45**										
Precipitation Surplus											**0.0**
Net Surplus											**0.0**
Evapotranspiration	357.5										**357.5**
Infiltration	220.7										**220.7**
Infiltration Features[4]	0.0										**0.0**
Total Infiltration	**220.7**										**220.7**
Runoff Pervious Areas											**0.0**
Runoff Impervious Areas											**0.0**
Total Unadjusted Runoff	271.1										**271.1**
Total Adjusted Runoff[5]	**271.1**										**271.1**
Total Outputs	**849.3**										**849.3**
Inputs (m^3/yr)											
Precipitation	211,316										**211,316**
Run-On	0										**0**
Other Inputs	0										**0**
Total Inputs	**211,316**										**211,316**
Outputs (m^3/yr)											
Precipitation Surplus	0										**0**
Net Surplus	0										**0**
Evapotranspiration	88,579										**88,579**
Infiltration	54,699										**54,699**
Infiltration Features[4]	0										**0**
Total Infiltration	54,699										**54,699**
Runoff Pervious Areas	0										**0**
Runoff Impervious Areas	0										**0**
Total Unadjusted Runoff	67,177										**67,177**
Total Adjusted Runoff[5]	67,177										**67,177**
Total Outputs	**210,455**										**210,455**

Notes:

1. Water Balance Calculations area in based on methodology described in the Conservation Authority Guidelines for Hydrogeological Assessments (June 2013)
2. Precipitation and Evapotranspiration values were provided.
3. Evaporation from impervious areas was assumed to be 20% of Precipitation
4. Infiltration Features are calculated using daily Precipitation data and averaged over the number of years of available data. The entire Catchment is assumed to contribute with no infiltration occuring during months with a negative average temperature.
5. Total Adjusted Runoff is calculated as (Pervious Runoff + Impervious Runoff) - (Infiltration Features)

Water Balance Calculations for Proposed Conditions

WILLS

Project No: 85162
Project Name: 3491 Wallace Point Road
Designed/Checked By: NN / MJH
Date: 13-Apr-23

Catchment Parameters	PR-106										**Total**
Drainage Area (m^2)	15000										**15000**
Pervious Area (m^2)	7500										**7500**
Impervious Area (m^2)	7500										**7500**
Evapotranspiration Factors											
Pervious PET Ratio											
Impervious Evapotranspiration[3]											
Infiltration Factors											
Topography Infiltration Factor											
Soil Infiltration Factor											
Land Cover Infiltration Factor											
MOE Infiltration Factor											
Actual Infiltration Factor											
Run-Off Coefficient											
Runoff from Impervious Surfaces											
Inputs (mm/yr)											
Precipitation	852.8										**852.8**
Run-On	0.0										**0.0**
Other Inputs	0.0										**0.0**
Total Inputs	852.8										**852.8**
Outputs (mm/yr)											
Precipitation Surplus											**0.0**
Net Surplus											**0.0**
Evapotranspiration	207.2										**207.2**
Infiltration	79.9										**79.9**
Infiltration Features[4]	276.8										**276.8**
Total Infiltration	**356.7**										**356.7**
Runoff Pervious Areas											**0.0**
Runoff Impervious Areas											**0.0**
Total Unadjusted Runoff	562.9										**562.9**
Total Adjusted Runoff[5]	286.1										**286.1**
Total Outputs	**850.1**										**850.1**
Inputs (m^3/yr)											
Precipitation	12,791										**12,791**
Run-On	0										**0**
Other Inputs	0										**0**
Total Inputs	**12,791**										**12,791**
Outputs (m^3/yr)											
Precipitation Surplus	0										**0**
Net Surplus	0										**0**
Evapotranspiration	3,108										**3,108**
Infiltration	1,199										**1,199**
Infiltration Features[4]	4,152										**4,152**
Total Infiltration	5,351										**5,351**
Runoff Pervious Areas	0										**0**
Runoff Impervious Areas	0										**0**
Total Unadjusted Runoff	8,443										**8,443**
Total Adjusted Runoff[5]	4,291										**4,291**
Total Outputs	**12,751**										**12,751**

Notes:

1. Water Balance Calculations area in based on methodology described in the Conservation Authority Guidelines for Hydrogeological Assessments (June 2013)
2. Precipitation and Evapotranspiration values were provided.
3. Evaporation from impervious areas was assumed to be 20% of Precipitation
4. Infiltration Features are calculated using daily Precipitation data and averaged over the number of years of available data. The entire Catchment is assumed to contribute with no infiltration occuring during months with a negative average temperature.
5. Total Adjusted Runoff is calculated as (Pervious Runoff + Impervious Runoff) - (Infiltration Features)

Water Balance Assessment

WILLS

Project No: 85162
Project Name: 3491 Wallace Point Road
Designed/Checked By: NN / MJH
Date: 13-Apr-23

Characteristic	Existing	Proposed No Mitigation	Change	Proposed With Mitigation	Change
Inputs (m^3/yr)					
Precipitation	211,316	12,791	-93.9%	12,791	-93.9%
Run-On	0	0	0.0%	0	0.0%
Other Inputs	0	0	0.0%	0	0.0%
Total Inputs	211,316	12,791	-93.9%	12,791	-93.9%
Outputs (m^3/yr)					
Precipitation Surplus	0	0	0.0%	0	0.0%
Net Surplus	0	0	0.0%	0	0.0%
Evapotranspiration	88,579	3,108	-96.5%	3,108	-96.5%
Infiltration	54,699	1,199	-97.8%	1,199	-97.8%
Infiltration Features	0	0	0.0%	4,152	0.0%
Total Infiltration	**54,699**	**1,199**	**-97.8%**	**5,351**	**-90.2%**
Runoff Pervious Areas	0	0	0.0%	0	0.0%
Runoff Impervious Areas	0	0	0.0%	0	0.0%
Total Runoff	**67,177**	**8,443**	**-87.4%**	**4,291**	**-93.6%**
Total Outputs	210,455	12,751	-93.9%	12,751	-93.9%

Nitrate Dilution Calculations

Total Dilution Area	1.50	ha
No. of Lots	1	
Sewage Flow per Lot	4495	L/day
Total Daily Sewage Loading	4,495	L/day
Nitrate in Septic Effluent	40	mg/L
Background Nitrates	3.04	mg/L
Stormwater Effluent Nitrates	0	mg/L
Infiltration Rates		
Infiltration Rate (Clean Water)	79.9	mm/year
Infiltration Rate (Clean Water)	3,286	L/day
Infiltration Rate (Stormwater)	276.8	mm/year
Infiltration Rate (Stormwater)	11,375	L/day
Nitrate Concentrations		
Nitrate Loading - Development	179,800	mg/day
Nitrate Loading - Rainfall	9,988	mg/day
Nitrate Loading - Runoff	0	mg/day
Total Nitrate Loading	189,788	mg/day
Dilution - Development	4,495	L/day
Dilution - Groundwater Recharge	14,661	L/day
Total Dilution	19,156	L/day
Boundary Nitrate Concentration	**9.91**	**mg/L**

Monthly Water Budget Calculations

Project No: 85162
Project Name: 3491 Wallace Point Road
Designed/Checked By: NN / MJH
Date: 12-Apr-23

'PETERBOROUGH A' DAILY CLIMATE DATA (1981-2010)

Station ID = 48952
Latitude = 44.23
Longitude = -78.36

First Year of Data Used = 1981
Last Year of Data Used = 2010
Total Years of Data Used = 30

Thornthwaite (1948) Inputs				Monthly Water Budget Analysis				
Month	Mean Temperature (°C)[1]	Total Precipitation (mm)[1]	Heat Index	PET (mm)	Daylight Correction Factor	Adjusted PET (mm)	Surplus (mm)	Deficit (mm)
January	-8.3	56.1	0.00	0.0	0.78	0.0	56.1	0.0
February	-7.0	50.4	0.00	0.0	0.87	0.0	50.4	0.0
March	-1.7	57.0	0.00	0.0	1.00	0.0	57.0	0.0
April	6.1	67.6	1.35	29.6	1.12	33.3	38.0	0.0
May	12.1	82.9	3.82	62.3	1.23	76.8	20.6	0.0
June	17.1	82.9	6.43	85.9	1.29	110.6	0.0	27.8
July	19.6	73.2	7.88	102.0	1.26	128.5	0.0	55.3
August	18.4	78.7	7.18	95.7	1.16	111.4	0.0	32.7
September	14.0	81.6	4.74	69.8	1.04	72.7	11.8	0.0
October	7.6	72.0	1.87	38.2	0.91	35.0	33.8	0.0
November	2.0	83.6	0.24	9.3	0.80	7.4	74.3	0.0
December	-4.6	66.9	0.00	0.0	0.74	0.0	66.9	0.0
Totals		**852.9**	33.51			**575.8**	**408.8**	**115.8**
	Thornthwaite Coefficient (α)		**1.032**			Total Water Surplus (mm)		**277.1**

Notes:

1. Temperature and Precipitation data are calculated using daily climate data from 1981-2010
2. Water budget adjusted for latitude and length of daylight
3. Potential Evapotranspiration (PET) is calculated based on the Thornthwaite 1948 equation
4. Total Water Surplus (Thornthwaite, 1948) is calculated as total precipitation minus adjusted evapotranspiration

Water Balance Calculations for Existing Conditions

Project No: 85162
Project Name: 3491 Wallace Point Road
Designed/Checked By: NN / MJH
Date: 12-Apr-23

Catchment Parameters	EX-100										**Total**
Drainage Area (m^2)	247800										**247800**
Pervious Area (m^2)	246984										**246984**
Impervious Area (m^2)	816										**816**
Evapotranspiration Factors											
Pervious PET Ratio											
Impervious Evapotranspiration[3]											
Infiltration Factors											
Topography Infiltration Factor											
Soil Infiltration Factor											
Land Cover Infiltration Factor											
MOE Infiltration Factor											
Actual Infiltration Factor											
Run-Off Coefficient											
Runoff from Impervious Surfaces											
Inputs (mm/yr)											
Precipitation	852.8										**852.8**
Run-On	0.0										**0.0**
Other Inputs	0.0										**0.0**
Total Inputs	852.8										**852.8**
Outputs (mm/yr)	**0.45**										
Precipitation Surplus											**0.0**
Net Surplus											**0.0**
Evapotranspiration	357.5										**357.5**
Infiltration	220.7										**220.7**
Infiltration Features[4]	0.0										**0.0**
Total Infiltration	**220.7**										**220.7**
Runoff Pervious Areas											**0.0**
Runoff Impervious Areas											**0.0**
Total Unadjusted Runoff	271.1										**271.1**
Total Adjusted Runoff[5]	**271.1**										**271.1**
Total Outputs	**849.3**										**849.3**
Inputs (m^3/yr)											
Precipitation	211,316										**211,316**
Run-On	0										**0**
Other Inputs	0										**0**
Total Inputs	**211,316**										**211,316**
Outputs (m^3/yr)											
Precipitation Surplus	0										**0**
Net Surplus	0										**0**
Evapotranspiration	88,579										**88,579**
Infiltration	54,699										**54,699**
Infiltration Features[4]	0										**0**
Total Infiltration	54,699										**54,699**
Runoff Pervious Areas	0										**0**
Runoff Impervious Areas	0										**0**
Total Unadjusted Runoff	67,177										**67,177**
Total Adjusted Runoff[5]	67,177										**67,177**
Total Outputs	**210,455**										**210,455**

Notes:

1. Water Balance Calculations area in based on methodology described in the Conservation Authority Guidelines for Hydrogeological Assessments (June 2013)
2. Precipitation and Evapotranspiration values were provided.
3. Evaporation from impervious areas was assumed to be 20% of Precipitation
4. Infiltration Features are calculated using daily Precipitation data and averaged over the number of years of available data. The entire Catchment is assumed to contribute with no infiltration occuring during months with a negative average temperature.
5. Total Adjusted Runoff is calculated as (Pervious Runoff + Impervious Runoff) - (Infiltration Features)

Water Balance Calculations for Proposed Conditions

WILLS

Project No: 85162
Project Name: 3491 Wallace Point Road
Designed/Checked By: NN / MJH
Date: 12-Apr-23

Catchment Parameters	PR-101	PR-102	PR-103	PR-104	PR-105		PR-107	PR-108			Total
Drainage Area (m^2)	15200	38700	35500	34700	59500		34700	14500			**232800**
Pervious Area (m^2)	12920	32895	30175	29495	50570		17350	14500			**187905**
Impervious Area (m^2)	2280	5805.0	5325	5205	8930		17350	0			**44895**
Evapotranspiration Factors											
Pervious PET Ratio											
Impervious Evapotranspiration[3]											
Infiltration Factors											
Topography Infiltration Factor											
Soil Infiltration Factor											
Land Cover Infiltration Factor											
MOE Infiltration Factor											
Actual Infiltration Factor											
Run-Off Coefficient											
Runoff from Impervious Surfaces											
Inputs (mm/yr)											
Precipitation	852.8	852.8	852.8	852.8	852.8		852.8	852.8			**852.8**
Run-On	0.0	0.0	0.0	0.0	0.0		0.0	0.0			**0.0**
Other Inputs	0.0	0.0	0.0	0.0	0.0		0.0	0.0			**0.0**
Total Inputs	852.8	852.8	852.8	852.8	852.8		852.8	852.8			**852.8**
Outputs (mm/yr)	**0.52**	**0.52**	**0.52**	**0.52**	**0.52**	**#DIV/0!**	**0.12**	**0.56**			
Precipitation Surplus											**0.0**
Net Surplus											**0.0**
Evapotranspiration	352.4	349.0	354.7	350.5	351.8		207.2	373.2			**331.4**
Infiltration	234.4	232.3	234.7	233.0	233.6		79.9	263.3			**212.5**
Infiltration Features[4]	113.5	125.7	103.3	120.4	115.4		0.0	0.0			**91.5**
Total Infiltration	**347.9**	**358.0**	**338.0**	**353.4**	**349.0**		**79.9**	**263.3**			**303.9**
Runoff Pervious Areas											**0.0**
Runoff Impervious Areas											**0.0**
Total Unadjusted Runoff	216.0	213.7	219.9	215.2	216.6		562.9	209.4			**267.5**
Total Adjusted Runoff[5]	102.5	88.0	116.6	94.8	101.2		562.9	209.4			**176.0**
Total Outputs	**802.8**	**794.9**	**809.3**	**798.7**	**801.9**		**850.1**	**845.9**			**811.4**
Inputs (m^3/yr)											
Precipitation	12,962	33,002	30,273	29,591	50,740		29,591	12,365			**198,524**
Run-On	0	0	0	0	0		0	0			**0**
Other Inputs	0	0	0	0	0		0	0			**0**
Total Inputs	**12,962**	**33,002**	**30,273**	**29,591**	**50,740**		**29,591**	**12,365**			**198,524**
Outputs (m^3/yr)											
Precipitation Surplus	0	0	0	0	0		0	0			**0**
Net Surplus	0	0	0	0	0		0	0			**0**
Evapotranspiration	5,356	13,506	12,591	12,163	20,931		7,191	5,411			**77,148**
Infiltration	3,563	8,990	8,331	8,086	13,897		2,774	3,817			**49,460**
Infiltration Features[4]	1,725	4,863	3,667	4,176	6,866		0	0			**21,297**
Total Infiltration	5,289	13,853	11,998	12,263	20,763		2,774	3,817			**70,757**
Runoff Pervious Areas	0	0	0	0	0		0	0			**0**
Runoff Impervious Areas	0	0	0	0	0		0	0			**0**
Total Unadjusted Runoff	3,283	8,269	7,807	7,466	12,885		19,532	3,037			**62,279**
Total Adjusted Runoff[5]	1,558	3,406	4,140	3,290	6,020		19,532	3,037			**40,982**
Total Outputs	**12,203**	**30,764**	**28,729**	**27,715**	**47,713**		**29,497**	**12,265**			**188,887**

Notes:

1. Water Balance Calculations area in based on methodology described in the Conservation Authority Guidelines for Hydrogeological Assessments (June 2013)
2. Precipitation and Evapotranspiration values were provided.
3. Evaporation from impervious areas was assumed to be 20% of Precipitation
4. Infiltration Features are calculated using daily Precipitation data and averaged over the number of years of available data. The entire Catchment is assumed to contribute with no infiltration occuring during months with a negative average temperature.
5. Total Adjusted Runoff is calculated as (Pervious Runoff + Impervious Runoff) - (Infiltration Features)

Water Balance Assessment

WILLS

Project No: 85162
Project Name: 3491 Wallace Point Road
Designed/Checked By: NN / MJH
Date: 12-Apr-23

Characteristic	Existing	Proposed No Mitigation	Change	Proposed With Mitigation	Change
Inputs (m^3/yr)					
Precipitation	211,316	198,524	-6.1%	198,524	-6.1%
Run-On	0	0	0.0%	0	0.0%
Other Inputs	0	0	0.0%	0	0.0%
Total Inputs	211,316	198,524	-6.1%	198,524	-6.1%
Outputs (m^3/yr)					
Precipitation Surplus	0	0	0.0%	0	0.0%
Net Surplus	0	0	0.0%	0	0.0%
Evapotranspiration	88,579	77,148	-12.9%	77,148	-12.9%
Infiltration	54,699	49,460	-9.6%	49,460	-9.6%
Infiltration Features	0	0	0.0%	21,297	0.0%
Total Infiltration	**54,699**	**49,460**	**-9.6%**	**70,757**	**29.4%**
Runoff Pervious Areas	0	0	0.0%	0	0.0%
Runoff Impervious Areas	0	0	0.0%	0	0.0%
Total Runoff	**67,177**	**62,279**	**-7.3%**	**40,982**	**-39.0%**
Total Outputs	210,455	188,887	-10.2%	188,887	-10.2%

Nitrate Dilution Calculations

Total Dilution Area	23.28	ha			
No. of Lots	50				
Sewage Flow per Lot	1000	L/day			
Total Daily Sewage Loading	50,000	L/day			
Nitrate in Septic Effluent	40	mg/L			
Background Nitrates	3.04	mg/L			
Stormwater Effluent Nitrates	0	mg/L			
Infiltration Rates					
Infiltration Rate (Clean Water)	212.5	mm/year			
Infiltration Rate (Clean Water)	135,506	L/day			
Infiltration Rate (Stormwater)	91.5	mm/year			
Infiltration Rate (Stormwater)	58,349	L/day			
Nitrate Concentrations	**22915.75985**		**0.39**	**(0.11)**	**10**
Nitrate Loading - Development	2,000,000	mg/day			
Nitrate Loading - Rainfall	411,937	mg/day			
Nitrate Loading - Runoff	0	mg/day			
Total Nitrate Loading	2,411,937	mg/day			
Dilution - Development	50,000	L/day			
Dilution - Groundwater Recharge	193,854	L/day			
Total Dilution	243,854	L/day			
Boundary Nitrate Concentration	**9.89**	**mg/L**			

Infiltration Factor Calculations for PR-101

Sheet 1 of 1

Project No: 85162
Project Name: 3491 Wallace Point Road
Designed/Checked By: NN / MJH
Date: 12-Apr-23

Topography	
Average Slope	6.25%
Slope Description	Rolling/Hilly Land
Topography Infiltration Factor	**0.15**

Soils		
Hydrologic Soil Group[2]	B	Total
Soil Type	Bondhead Loam	
Area (ha)	1.52	1.52
Soil Infiltration Factor	0.30	**0.30**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture Range Grass Woods Wetland Bare Earth (>70% Rock)	1.29	0.10
Impervious	0.23	
Total[3]	1.29	**0.10**

MOE Infiltration Factor	**0.55**
Actual Infiltration Factor	**0.55**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Features for PR-101

Sheet 2 of 2

Project No: 85162
Project Name: 3491 Wallace Point Road
Designed/Checked By: NN / MJH
Date: 12-Apr-23

Infiltration Features Summary		
Total Storage Volume[1]	0.0	m^3
Contributing Area[2]	15200	m^2
Pervious Area	12920	m^2
Impervious Area	2280	m^2
Maximum Drawdown	48	hrs
Average Infiltration Volume[3]	**1725**	**m^3/yr**
	113.5	**mm/yr**

Notes:

1. Total Storage Volume from all Infiltration Features in the catchment
2. The entire catchment contributes flow to the Infiltration Features

3. Average Infiltration Volume has been estimated

Infiltration Factor Calculations for PR-102

Sheet 1 of 1

Project No: 85162
Project Name: 3491 Wallace Point Road
Designed/Checked By: NN / MJH
Date: 12-Apr-23

Topography	
Average Slope	5.50%
Slope Description	Rolling/Hilly Land
Topography Infiltration Factor	**0.15**

Soils		
Hydrologic Soil Group[2]	B	Total
Soil Type	Bondhead Loam	
Area (ha)	3.87	3.87
Soil Infiltration Factor	0.30	**0.30**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture Range Grass Woods Wetland Bare Earth (>70% Rock)	3.29	0.10
Impervious	0.58	
Total[3]	3.29	**0.10**

MOE Infiltration Factor	**0.55**
Actual Infiltration Factor	**0.55**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Features for PR-102

Sheet 2 of 2

Project No: 85162
Project Name: 3491 Wallace Point Road
Designed/Checked By: NN / MJH
Date: 12-Apr-23

Infiltration Features Summary		
Total Storage Volume[1]	0.0	m^3
Contributing Area[2]	38700	m^2
Pervious Area	32895	m^2
Impervious Area	5805	m^2
Maximum Drawdown	48	hrs
Average Infiltration Volume[3]	**4863**	**m^3/yr**
	125.7	**mm/yr**

Notes:

1. Total Storage Volume from all Infiltration Features in the catchment
2. The entire catchment contributes flow to the Infiltration Features

3. Average Infiltration Volume has been estimated

Infiltration Factor Calculations for PR-103

Sheet 1 of 1

Project No: 85162
Project Name: 3491 Wallace Point Road
Designed/Checked By: NN / MJH
Date: 12-Apr-23

Topography	
Average Slope	3.07%
Slope Description	Rolling Land
Topography Infiltration Factor	**0.20**

Soils		
Hydrologic Soil Group[2]	B	Total
Soil Type	Bondhead Loam	
Area (ha)	3.55	3.55
Soil Infiltration Factor	0.30	**0.30**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture Range Grass Woods Wetland Bare Earth (>70% Rock)	3.02	0.10
Impervious	0.53	
Total[3]	3.02	**0.10**

MOE Infiltration Factor	**0.60**
Actual Infiltration Factor	**0.60**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Features for PR-103

Sheet 2 of 2

Project No: 85162
Project Name: 3491 Wallace Point Road
Designed/Checked By: NN / MJH
Date: 12-Apr-23

Infiltration Features Summary		
Total Storage Volume[1]	0.0	m^3
Contributing Area[2]	35500	m^2
Pervious Area	30175	m^2
Impervious Area	5325	m^2
Maximum Drawdown	48	hrs
Average Infiltration Volume[3]	**3667**	**m^3/yr**
	103.3	**mm/yr**

Notes:

1. Total Storage Volume from all Infiltration Features in the catchment
2. The entire catchment contributes flow to the Infiltration Features

3. Average Infiltration Volume has been estimated

Infiltration Factor Calculations for PR-104

Sheet 1 of 1

Project No: 85162
Project Name: 3491 Wallace Point Road
Designed/Checked By: NN / MJH
Date: 12-Apr-23

Topography	
Average Slope	1.09%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	B	Total
Soil Type	Bondhead Loam	
Area (ha)	3.47	3.47
Soil Infiltration Factor	0.30	**0.30**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture Range Grass Woods Wetland Bare Earth (>70% Rock)	2.95	0.10
Impervious	0.52	
Total[3]	2.95	**0.10**

MOE Infiltration Factor	**0.65**
Actual Infiltration Factor	**0.65**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Features for PR-104

Sheet 2 of 2

Project No: 85162
Project Name: 3491 Wallace Point Road
Designed/Checked By: NN / MJH
Date: 12-Apr-23

Infiltration Features Summary		
Total Storage Volume[1]	0.0	m^3
Contributing Area[2]	34700	m^2
Pervious Area	29495	m^2
Impervious Area	5205	m^2
Maximum Drawdown	48	hrs
Average Infiltration Volume[3]	**4176**	**m^3/yr**
	120.4	**mm/yr**

Notes:

1. Total Storage Volume from all Infiltration Features in the catchment
2. The entire catchment contributes flow to the Infiltration Features

3. Average Infiltration Volume has been estimated

Infiltration Factor Calculations for PR-105

Sheet 1 of 1

Project No: 85162
Project Name: 3491 Wallace Point Road
Designed/Checked By: NN / MJH
Date: 12-Apr-23

Topography	
Average Slope	2.29%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	B	Total
Soil Type	Bondhead Loam	
Area (ha)	5.95	5.95
Soil Infiltration Factor	0.30	**0.30**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture Range Grass Woods Wetland Bare Earth (>70% Rock)	5.06	0.10
Impervious	0.89	
Total[3]	5.06	**0.10**

MOE Infiltration Factor	**0.65**
Actual Infiltration Factor	**0.65**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Features for PR-105

Sheet 2 of 2

Project No: 85162
Project Name: 3491 Wallace Point Road
Designed/Checked By: NN / MJH
Date: 12-Apr-23

Infiltration Features Summary		
Total Storage Volume[1]	0.0	m^3
Contributing Area[2]	59500	m^2
Pervious Area	50570	m^2
Impervious Area	8930	m^2
Maximum Drawdown	48	hrs
Average Infiltration Volume[3]	**6866**	**m^3/yr**
	115.4	**mm/yr**

Notes:

1. Total Storage Volume from all Infiltration Features in the catchment
2. The entire catchment contributes flow to the Infiltration Features

3. Average Infiltration Volume has been estimated

Infiltration Factor Calculations for PR-107

Sheet 1 of 1

Project No: 85162
Project Name: 3491 Wallace Point Road
Designed/Checked By: NN / MJH
Date: 12-Apr-23

Topography	
Average Slope	1.82%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	B	Total
Soil Type	Bondhead Loam	
Area (ha)	3.47	3.47
Soil Infiltration Factor	0.30	**0.30**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture Range Grass Woods Wetland Bare Earth (>70% Rock)	1.74	0.10
Impervious	1.74	
Total[3]	1.74	**0.10**

MOE Infiltration Factor	**0.65**
Actual Infiltration Factor	**0.65**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Factor Calculations for PR-108

Sheet 1 of 1

Project No: 85162
Project Name: 3491 Wallace Point Road
Designed/Checked By: NN / MJH
Date: 12-Apr-23

Topography	
Average Slope	1.29%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	B	Total
Soil Type	Bondhead Loam	
Area (ha)	1.45	1.45
Soil Infiltration Factor	0.30	**0.30**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture Range Grass Woods Wetland Bare Earth (>70% Rock) Impervious	1.45	0.10
Total[3]	1.45	**0.10**

MOE Infiltration Factor	**0.65**
Actual Infiltration Factor	**0.65**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Catchment	Req. Storage (m^3)	Number of Lots	Storage per Lot (m^3)
PR-101	161	4	41
PR-102	410	11	38
PR-103	342	8	43
PR-104	318	10	32
PR-105	602	15	41
PR-106	171	Comm Block	171
PR-107	348	ROW	348
PR-108	76	SWM Block	76

Appendix G

Mass Balance Equation

WILLS

Appendix G– D-5-4 Groundwater Impact Assessment: Mass Balance Equation

$$\mathbf{Q_t C_t = Q_e C_e + Q_i C_i}$$

Where Q_t = Total Volume (Q_e + Q_i)

Note: As per the requirements of D-5-4, the maximum volume of effluent allowed to be used as dilution water is 1000L/day/lot.

C_t = Total Concetration of nitrate at property boundary

Q_e = volume of septic effluent

C_e = Concentration of nitrate in effluent (40 mg/L)

Q_i = Volume of available dilution water

C_i = Concentration of nitrate in dilution water

In order to determine the concertation of the nitrate at the property boundary (C_t), the mass balance equation is rearranged to the following:

$$\boldsymbol{Ct = \frac{QeCe + QiCi}{Qt}}$$