

APPENDIX B

Geotechnical Investigation (KGS Group 2019)

TORONTO AND REGION CONSERVATION
AUTHORITY


Conservation Ontario Class EA Rehab -
Pickering & Ajax Flood Control Dykes –
2019 Geotechnical Investigation Report

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Prepared by:


Chris Robak, P. Eng.
Geotechnical Engineer

Approved by:


Shan Gnanasunthar, P. Eng.
Senior Geotechnical Engineer



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STATEMENT OF LIMITATIONS AND CONDITIONS

Limitations

This report has been prepared for Toronto and Region Conservation Authority “[TRCA]” in accordance with the agreement between KGS Group and TRCA (the “Agreement”). This report represents KGS Group’s professional judgment and exercising due care consistent with the preparation of similar reports. The information, data, recommendations and conclusions in this report are subject to the constraints and limitations in the Agreement and the qualifications in this report. This report must be read as a whole, and sections or parts should not be read out of context.

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Third Party Use of Report

Any use a third party makes of this report or any reliance on or decisions made based on it, are the responsibility of such third parties. KGS Group accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions undertaken based on this report.

Geo-Environmental Statement of Limitations

KGS Group prepared the geo-environmental conclusions and recommendations for this report in a professional manner using the degree of skill and care exercised for similar projects under similar conditions by reputable and competent environmental consultants. The information contained in this report is based on the information that was made available to KGS Group during the investigation and upon the services described, which were performed within the time and budgetary requirements of Toronto and Region Conservation Authority. As this report is based on the available information, some of its conclusions could be different if the information upon which it is based is determined to be false, inaccurate or contradicted by additional information. KGS Group makes no representation concerning the legal significance of its findings or the value of the property investigated.

Geotechnical Investigation Statement of Limitations

The geotechnical investigation findings and recommendations of this report were prepared in accordance with generally accepted professional engineering principles and practice. The findings and recommendations are based on the results of field and laboratory investigations, combined with an interpolation of soil and groundwater conditions found at and within the depth of the test holes drilled by KGS Group at the site at the time of drilling. If conditions encountered during construction appear to be different from those shown by the test holes drilled by KGS Group or if the assumptions stated herein are not in keeping with the design, KGS Group should be notified in order that the recommendations can be reviewed and modified if necessary.

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1.0 INTRODUCTION

KGS Group was retained by Toronto and Region Conservation Authority (TRCA) to undertake a geotechnical investigation in support of a *Conservation Ontario Class Environmental Assessment for Remedial Flood and Erosion Control Projects* (Conservation Ontario 2002, amended 2013) to rehabilitate the Pickering and Ajax Dykes. The goal of the rehabilitation is to ensure that the dykes meet current engineering standards while maintaining, at minimum, the existing flood protection levels.

The purposes of the geotechnical investigation, specifically, were to:

- confirm dyke and foundation conditions,
- expand upon the existing geotechnical information,
- determine if the dykes are comprised of any impacted soils warranting special handling or disposal considerations

This report summarizes previous geotechnical information and the results of the geotechnical investigations completed as part of this assignment.

2.0 BACKGROUND

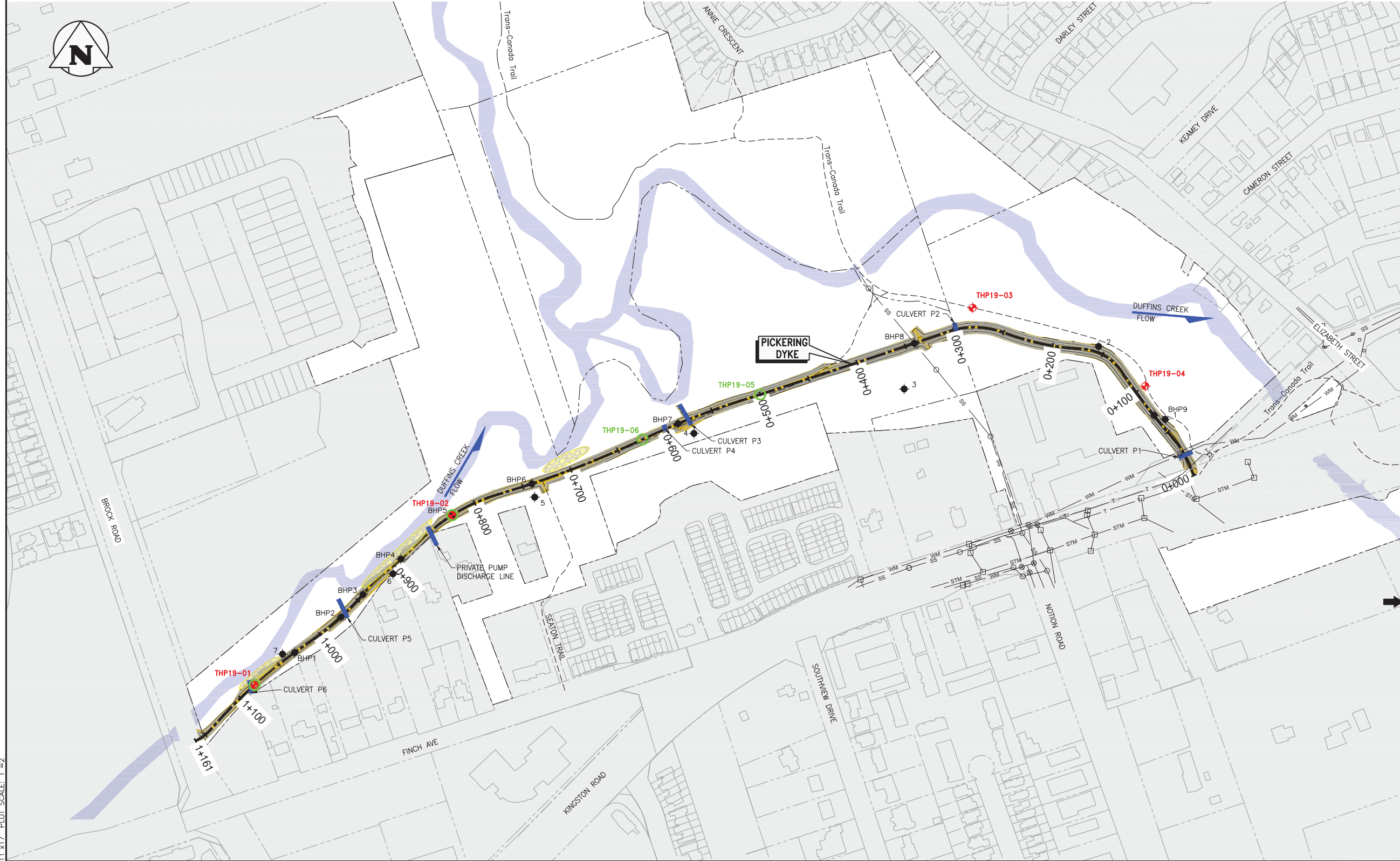
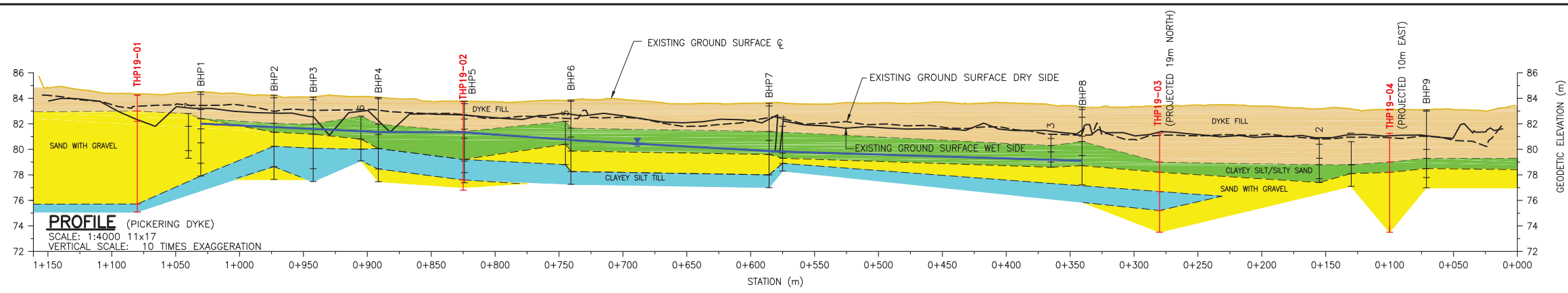
The Pickering Dyke is located in the City of Pickering and the Town of Ajax approximately 950 m north of Highway 401 as illustrated in Figure GR-01. This dyke is approximately 1,150 m long and traverses TRCA controlled property behind residences along Finch Ave and Kingston Road West from Brock Road, approximately 70 m north of the Finch Ave intersection, to Kingston Road West, approximately 150 m east of the Notion Road intersection.

The Ajax Dyke is located within the Town of Ajax, approximately 170 m north of Highway 401 as illustrated in Figure GR-02. This dyke is approximately 340 m long and extends from Church Street at the Mill Street intersection to the southwest corner of the private property located at 92 Church Street (the location of a commercial/residential development known as Village Garden).

Scaled-down copies of the construction drawings for the dykes are included in Appendix A. In general, the dykes were constructed to have a minimum 3 m crest width and 2H:1V side slopes but localized areas exist along the Pickering Dyke where the minimum dyke crest width was relaxed to 2 m.

The Pickering Dyke was intended to have a top of dyke crest elevation that varied from 84.6 m to 82.9 m and the Ajax Dyke was intended to have a consistent top of dyke crest elevation of 81.2 m once the datum conversion to the CGVD 28 - 78 is applied.

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- LEGEND:**
- ⊗ CONTROL VALVE
 - SANITARY/STORM MANHOLE
 - ⊕ HYDRANT
 - CATCH BASIN
 - SS — SANITARY/SEWER SERVICE
 - STM — STORM SEWER
 - WM — WATERMAIN/WATER SERVICE
 - WM — WATERMAIN/WATER SERVICE (ASSUMED ABANDONED)
 - T — CABLE
 - TRCA PROPERTY
 - - - TRAIL
 - EXISTING CULVERT/DRAINAGE FEATURE
 - EXISTING DYKE
 - DYKE CENTRE LINE STATIONING
 - ▭ PROPERTY NOT CONTROLLED BY TRCA
 - ▨ EXISTING RIPRAP (APPROXIMATE LIMIT)
 - 2 TESTHOLE (GEO-CANADA LTD., 1985)
 - BHP2 TESTHOLE (GEOPRO CONSULTING, 2017)
 - THP19-01 TEST HOLE (KGS GROUP, 2019)
 - THP19-06 TEST HOLE (KGS GROUP, 2019)
 - DYKE FILL ENVIRONMENTAL SAMPLING LOCATION (KGS GROUP, 2019)
 - GROUNDWATER LEVEL (SEE NOTE 2)

- NOTES:**
- TOP OF DYKE PROFILE AND DYKE FOOTPRINT BASED ON 2017 SURVEY DATA FROM TRCA.
 - GROUNDWATER LEVELS AS MEASURED IN MONITORING WELLS ON AUGUST 22, 2019.

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0	19/09/30	ISSUED WITH GEOTECHNICAL INVESTIGATION REPORT	CMR	SG

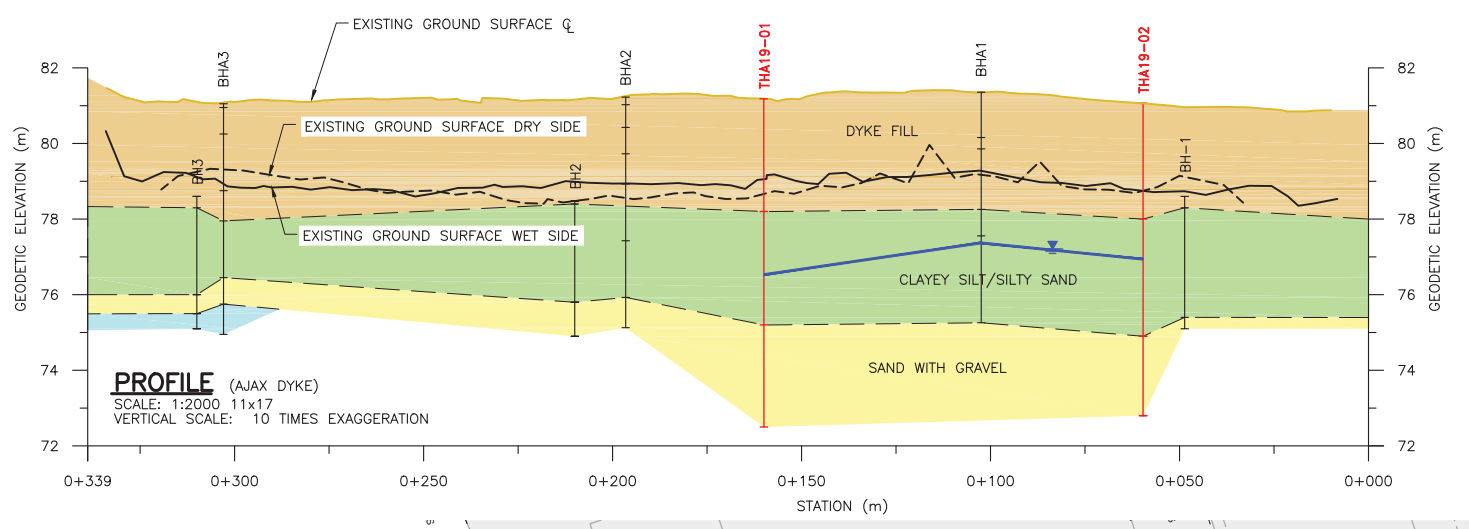
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Conservation Authority

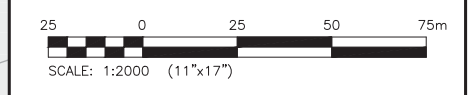
GEOTECHNICAL INVESTIGATION FOR PICKERING AND AJAX DYKES

PICKERING DYKE TEST HOLE LOCATION PLAN AND PROFILE



- LEGEND:**
- ⊗ CONTROL VALVE
 - SANITARY/STORM MANHOLE
 - ⊕ HYDRANT
 - ss — SANITARY/SEWER SERVICE
 - wm — WATERMAIN/WATER SERVICE
 - wm — WATERMAIN/WATER SERVICE (ABANDONED)
 - g — GAS LINE
 - TRCA PROPERTY
 - TRAIL
 - EXISTING CULVERT
 - EXISTING DIKE
 - DYKE CENTRE LINE STATIONING
 - PROPERTY NOT CONTROLLED BY TRCA
 - BH2 TESTHOLE (GEO-CANADA LTD., 1984)
 - BHA2 TESTHOLE (GEOPRO CONSULTING, 2017)
 - THA19-01 TEST HOLE (KGS GROUP, 2019)
 - DYKE FILL ENVIRONMENTAL SAMPLING LOCATION (KGS GROUP, 2019)
 - GROUNDWATER LEVEL (SEE NOTE 2)

- NOTES:**
- TOP OF DYKE PROFILE AND DYKE FOOTPRINT BASED ON 2017 SURVEY DATA FROM TRCA.
 - GROUNDWATER LEVELS AS MEASURED IN MONITORING WELLS BETWEEN AUG 19- AND 22, 2019.



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GEOTECHNICAL INVESTIGATION FOR THE PICKERING AND AJAX DYKES

AJAX DYKE TEST HOLE LOCATION PLAN AND PROFILE

2.1 Previous Geotechnical Investigations

There have been three (3) geotechnical investigations along the alignments of the Pickering and Ajax Dykes:

- A 1984 investigation completed by Geo-Canada Ltd. in support of construction of the Ajax Dyke.
- A 1985 investigation completed by Geo-Canada Ltd. in support construction of the Pickering Dyke.
- A 2017 investigation completed by GeoPro consulting in support of Valdor Engineering Inc's Dyke Level of Service and Rehabilitation Report for the Pickering and Ajax SPA's.

The results of these investigations are summarized below.

2.1.1 1984 AJAX DYKE INVESTIGATION

Geo-Canada Ltd. advanced three (3) test holes (BH1 to BH3) through the foundation soils of the Ajax Dyke in 1984 prior to construction of the dyke. The locations of these test holes are illustrated on Figure GR-02 and the test hole logs and supporting laboratory soil index tests have been compiled in Appendix B.

It was determined that the foundation conditions for the Ajax Dyke consisted of four general soil units including the following in order of descending elevation:

1. Topsoil
2. Silt (Low Plasticity, contained pieces of wood and shells)
3. Silty Sand and Gravel
4. Sandy Silt Till (BH3 only)

The proposed Ajax dyke location was underlain by a 0.3 m thick topsoil at surface, followed by a silt layer to a depth of 2.6 m to 3.2 m overlying compact silty sand and gravel. Dense/Hard sandy silt till was encountered only in test hole BH3 at a depth of 3.1 m (El. 75.5 m) below the existing ground and the permeability of the till is estimated to be very low.

Groundwater elevations at the time of the investigations varied from 76.4 m to 77.0 m which corresponds to depths of 1.5 m to 2.1 m below the original ground surface prior to construction of the dyke.

2.1.2 1985 PICKERING DYKE INVESTIGATION

Geo-Canada Ltd. advanced six (6) test holes (BH1 to BH6) through the foundation soils of the Pickering Dyke in 1985, prior to construction of the dyke. The locations of these test holes are illustrated on Figure GR-01 and the test hole logs and supporting a laboratory soil index tests have been compiled in Appendix C.

It was determined that the foundation conditions for the Pickering Dyke were somewhat variable, though distinct trends were apparent with five general soil units including the following in order of descending elevation:

1. Fill (Silty Sand with some gravel fill) (BH1 and BH2 only)
2. Fine Sand with Silt
3. Silt (Contained shells and decaying wood) (BH1 to BH4 only)
4. Sand and Gravel
5. Clayey Silt with trace gravel (BH5 only)
6. Clayey Silt Till (Well cemented, Hard) (BH4 and BH6 only)

Groundwater elevations at the time of the investigations varied from 78.7 m to 81.4 m which correspond to depths of 1.3 m to 2.1 m below the original ground surface prior to construction of the dyke.

2.1.3 2017 PICKERING AND AJAX DYKE INVESTIGATION

GeoPro Consulting Ltd. advanced nine (9) test holes (BHP1 to BHP9) through the Pickering Dyke and three (3) test holes (BHA1 to BHA3) through the Ajax Dyke in 2017. The locations of these test holes are illustrated on Figures GR-01 and GR-02 for the Pickering and Ajax Dykes, respectively. Test hole logs and supporting laboratory soil index tests have been compiled in Appendix D.

GeoPro summarized the general site stratigraphy at both sites with nine distinct soil units:

1. Topsoil
2. Granular Fill
3. Fill Materials
4. Probable Fill Material
5. Gravelly Sand, Sand and Gravel and Sandy Gravel
6. Upper (Fine) Sand, Silty (Fine) Sandy Silt and (Fine) Sand and Silt
7. Lower (Fine) Sand, Silty Sand, (Fine) Sand and Silt, Sandy Silt and Silt
8. Sand and Silt Till and Sandy Silt till
9. Organic Silty Sand to Organic Sand and Silt and Organic Silt

As part of this investigation, six (6) groundwater monitoring wells were installed in the Pickering Dyke foundations, two (2) groundwater monitoring wells were installed in the Pickering Dyke fill, and three (3) groundwater monitoring wells were installed in the foundation soils of the Ajax Dyke. These wells were read at least once between October 10 and October 19, 2017. Groundwater elevations in the dyke foundation soils at the time of the readings varied from 78.6 m to 82 m for the Pickering Dyke and from 76.8 m to 77.5 m for the Ajax Dyke with a distinct decrease in the observed elevations from the upstream to downstream ends of the sites. The two groundwater monitoring wells installed in the Pickering Dyke Fill were dry at the time of the readings.

3.0 2019 INVESTIGATION PROGRAM

KGS group completed geotechnical investigations of the Ajax and Pickering Dykes between June 18 and August 22, 2019. These investigations included:

- Utility locates in advance of the drilling program both to update the inventory buried infrastructure beneath the dykes and avoid conflicts with buried utilities during the drilling program,
- A drilling and sampling program to characterize the existing dyke fill material for disposal and also to supplement existing geotechnical information,
- Assessment of the foundation conditions at the dykes,
- Installation of standpipe piezometers to measure the groundwater conditions within the dyke fill and the foundation soils,
- Falling head tests on new and existing standpipe piezometers to better understand the range of potential seepage behaviour of the in-situ soils.

3.1 Drilling and Sampling Program

KGS Group completed a drilling and soil sampling program from July 6th to 7th, 2019. A total of six (6) test holes were drilled between the Ajax and Pickering Dyke sites and an additional two dyke samples were obtained (THP19-05 and THP19-06) outside of the four test hole locations at the Pickering Dyke for purposes of O.Reg 558 TCLP - Metals and Inorganics analyses.

Four (4) test holes (THP19-01 to THP19-04) were drilled at Pickering Dyke site with two (2) of the test holes (THP19-01 and THP19-02) drilled through the crest of the dyke and the other two (2) drilled at the wet side toe of dyke (THP19-03 and THP19-04), as illustrated in Figure GR-01. Two (2) test holes (THA19-01 and THA19-02) were drilled at the Ajax Dyke site with both test holes drilled through the crest of the dyke, as illustrated in Figure GR-02. The test holes were advanced to depths ranging from 6.7 m to 9.8 m below grade, depending on whether the test hole was advanced from the crest of the dyke or from beyond the wet side toe of the dyke. A summary of the 2019 drilling program is presented on Table 1. The approximate locations of the test holes and additional dyke fill sampling locations are shown on Figures GR-01 and GR-02.

TABLE 1: SUMMARY OF 2019 DRILLING PROGRAM

Location	Test Hole #	Northing (M)	Easting (M)	Total Depth Drilled (Approx.)	Fill Thickness (M)	Foundation Soil Thickness Explored (M)
				(M)		
Pickering Dyke Crest (Sta. 0+1080)	THP19-01	4857133	654730	9.1	1.5	7.6
Pickering Dyke Crest	THP19-02	4857299	654924	6.7	4.4	2.3

Location	Test Hole #	Northing (M)	Easting (M)	Total Depth Drilled (Approx.)	Fill Thickness (M)	Foundation Soil Thickness Explored (M)
				(M)		
(Sta. 0+0825)						
Pickering Dyke Wet Side Toe (Sta. 0+0280)	THP19-03	4857503	655435	7.8	2.2	5.6
Pickering Dyke Wet Side Toe (Sta. 0+0100)	THP19-04	4857426	655604	7.8	2.2	5.6
Pickering Dyke Crest (Sta. 0+0500)	THP19-05	4857418	655226	1.5	O.Reg 558 TCLP Sample	
Pickering Dyke Crest (Sta. 0+0625)	THP19-06	4857374	655111	1.5	O.Reg 558 TCLP Sample	
Ajax Dyke Crest (Sta. 0+160)	THA19-01	4856906	656349	9.8	3.0	6.8
Ajax Dyke Crest (Sta. 0+060)	THA19-02	4856892	656446	8.2	3.0	5.2

A drilling and sampling program was completed by Landshark Drilling of Brantford, Ontario, using a track mounted Mobile B57 drill rig equipped with 200 mm diameter hollow stem augers and an automatic hammer. The drilling and sampling program was supervised by a KGS Group geotechnical engineer.

Typically soil samples from the dyke were collected using a split spoon sampler with Standard Penetration Tests (SPT) completed at intervals ranging from nearly continuous to 1.5 m. All samples were visually classified in the field according to the Unified Soil Classification System (USCS).

Photographs of samples from the geotechnical investigations are included in Appendix E and detailed test hole logs are included in Appendix F.

3.2 Laboratory Testing

A laboratory testing program was performed on select soil samples to:

- characterize soil for disposal purposes; and
- determine the relevant engineering properties of the dyke fill and foundation soils for use in the stability assessment.

The testing included: six (6) O.Reg 558 Toxicity Characterization Leachate Procedure (TCLP) for Metals and Inorganics analyses, thirty-one (31) moisture content analyses, four (4) Atterberg limit tests, ten (10) grain size analyses, and one (1) organic content test.

(CALA). O.Reg 558 TCLP - Metals and Inorganics analyses test results are compiled in Appendix G. REG 558 Metal and Inorganics (TCLP) laboratory testing was completed at AGAT Laboratories in Mississauga, Ontario. AGAT is an environmental soil testing laboratory accredited by the Canadian Association for Laboratory Accreditation Inc.

Soil index test results are compiled in Appendix H. The laboratory testing for soil index tests was completed at the Golder Associates Ltd. Soil Laboratory in Mississauga, Ontario with the following American Society for Testing and Materials (ASTM) Standards used for the soil testing:

- ASTM D422 - Standard Test Method for Particle-Size Analysis of Soils;
- ASTM D1140 - Test Method for Amount of Material in Soils Finer than the No. 200 Sieve;
- ASTM D2216 - Standard Test Method for Laboratory Determination of Water (Moisture); and
- ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit and Plasticity.

3.3 Groundwater Monitoring Instrumentation

Four (4) standpipe piezometers were installed in six of the test holes advanced as part of the drilling and sampling program. Two (2) of the four standpipe piezometers were installed in the foundations of the Ajax Dyke (one in test hole THA19-01 and the other in test hole THA19-02). The other two standpipe piezometers were installed in the foundations of the Pickering Dyke (one in test hole THP19-02 and the other in test hole THP19-03).

Falling head tests were completed on all four standpipe piezometers that were installed as part of the drilling and sampling program after allowing the instruments time to stabilize. Falling head tests were also performed on five of the nine standpipe piezometers previously installed by GeoPro Consulting Ltd. In 2017 (BHA1, BHP1, BHP4, BHP6, and BHP7). The five standpipe piezometers selected for falling head tests from previous geotechnical investigations were those where the initial water levels measured in the standpipes would completely submerge the well screen.

4.0 INVESTIGATION RESULTS

4.1 Stratigraphy

The subsurface conditions at the test hole locations of the sites were inferred from the information obtained from the exploratory test holes, laboratory test data and our understanding of the site geology. The stratigraphy and engineering properties of the subsurface soils are described in this section. A summary of the drilling program is presented in Table 1. The approximate locations of the test holes are shown in Figures GR-01 and GR-02 with detailed test hole logs included in Appendix F. Table 2 and Table 3 summarize all available soil index laboratory test results at the Pickering Dyke and Ajax Dyke site, respectively.

4.1.1 PICKERING DYKE

4.1.1.1 Dyke Fill

Topsoil was encountered in all four test holes to a depth of approximately 0.1 m±. The topsoil was generally dark brown and damp.

The fill material encountered within the dyke generally consisted of clayey silt till fill. The clayey silt till fill material was encountered below the topsoil. The dyke fill extended to depths that varied between 1.4 m and 4.4 m at the test hole locations. The clayey silt till fill was generally brown in colour, moist, firm to stiff, of low plasticity, and contained varying amounts of sand and trace organics. The moisture content of the fill material varied from 11% to 33%. An Atterberg Limits test on a sample of the fine fraction indicated that the clayey silt till fill was of low plasticity with a measured Liquid Limit of 21%, Plastic Limit of 12% and Plasticity Index of 9%. Grain size analyses on one (1) sample indicated that the dyke fill consisted of 5% gravel, 38% sand, and 57% fines. Generally, the uncorrected SPT N-values in the dyke fill varied from 9 to 30.

4.1.1.2 Foundation Soils

The foundation soils encountered at the Pickering dyke consisted of Silty Sand, Clayey Silt, Sand with Gravel and Clayey Silt Till within the investigated depth.

Silty Sand – A layer of silty sand, measuring 0.8 m, was observed beneath the dyke fill in test hole THP19-01. The silty sand was generally brown in colour, fine grained, moist, loose, poorly graded and contained trace to some fines. Uncorrected SPT N-values in the silty sand was 7.

Clayey Silt – A layer of clayey silt, measuring 0.7 m thick, was observed beneath the fill in test holes THP19-03 and THP19-04. The clayey silt was generally brown and grey in colour, moist, soft, of low plasticity and contained trace sand with organics. Moisture contents in the clayey silt varied from 25% to 31%. Uncorrected SPT N-values in the clayey silt varied from 2 to 3.

Sand with Gravel – A layer of sand with gravel was encountered below the silty sand in test hole THP19-01 and below the clayey silt in test holes THP19-03 and THP19-04. Layers of sand with gravel were also encountered between the clayey silt and underlying clayey silt till in THP19-03 and beneath the underlying clayey silt till in THP19-02. The sand with gravel was generally grey in colour, wet, compact to very dense, contained fine to coarse grained sand, fine to coarse grained gravel, and trace to some fines. The moisture content ranged from 5.4% to 24.5%. Grain size analyses on three (3) samples indicated that the sand with

gravel consisted of 17% to 36% gravel, 51% to 72% sand, and 9% to 25% fines. Uncorrected SPT N-values in the sand with gravel generally varied from 10 to 61 with higher SPT values encountered at depth.

Clayey Silt Till – Clayey silt till was encountered in test holes THP19-01, THP19-02 and THP19-03. In THP19-01, the clayey silt till was grey in colour, wet, very hard, of low plasticity and contained varying amounts of sand. Very hard augering was observed in this layer in THP19-01 and pieces of shale fragments were recovered before test hole refusal. In THP19-02 and THP19-03, the clayey silt till was brown to grey in colour, moist, firm to hard, of low plasticity and contained varying amounts of sand. Grain size analyses on one (1) sample indicated that the clayey silt till was comprised of 11% gravel, 38% sand, and 51% fines. Uncorrected SPT N-values in the clayey silt till varied from 16 to over 130 blows (partial penetration of 125 mm).

TABLE 2: PICKERING DYKE: SUMMARY OF SOIL INDEX CHARACTERISTICS

Test Hole #	Sample Depth (M) / Sample No.	Moisture Content (%)	Plasticity (%)				Grain Size Distribution				
			LL	PL	PI	Gravel	Sand				Silt and Clay (<0.075 mm)
							Coarse (<4.75 to 2.0 mm)	Medium (<2.0 TO 0.425 MM)	Fine (<0.425 TO 0.075 MM)	Sand Total	
THP19-01	0.76 (S2)	48.2									
	1.52 (s3)	18.8									
	3.05 (S5)	5.4									
	6.10 (S7)	11.5									
	7.62 (S9)	14.0				17.5	9	19	43.5	71.5	
THP19-02	0.76 (S2)	11.8									
	1.52 (S3)	10.9	20.6	12.1	8.5	5	5	7	26	38	57
	2.29 (S4)	24.5									
	3.05 (S5)	14.1									
	4.57 (S6)	10.1	18.5	11.9	6.6	11	7	10	21.5	38.5	50.5
	6.10 (S7)	15.4				21	10	20	24	54	25
THP19-03	0.67 (S2)	33.7									
	1.52 (S3)	19.3									
	2.29 (S4)	37.1									
	3.05 (S5)	15.3									

Test Hole #	Sample Depth (M) / Sample No.	Moisture Content (%)	Plasticity (%)				Grain Size Distribution				
			LL	PL	PI	Gravel	Sand				Silt and Clay (<0.075 mm)
							Coarse (<4.75 to 2.0 mm)	Medium (<2.0 TO 0.425 MM)	Fine (<0.425 TO 0.075 MM)	Sand Total	
	4.57 (S6)	8.7									
	6.10 (S7)	9.2				36	18	22	11	51	13
THP19-04	0.61 (S2)	24.4									
	2.29 (S4)	24.6									
	4.57 (S6)	11.6				25	17	30	19	66	9

4.1.2 AJAX DYKE

4.1.2.1 Dyke Fill

Trail topping (quarry dust) was encountered in both test holes to a depth of approximately 75 mm±.

The fill material encountered within the dyke generally consisted of a clayey silt till fill. The clayey silt till fill material was encountered below the trail topping. The dyke fill extended to a depth of 3.0 m at both test hole locations from the crest of the dyke. The clayey silt till fill was generally brown in colour, moist, firm to stiff, of low plasticity, and contained varying amounts of sand and trace organics. The moisture content of the fill material varied from 10% to 18%. An Atterberg Limits test on a sample of the fine fraction indicated that the clayey silt till fill was of low plasticity with a measured Liquid Limit of 25%, Plastic Limit of 14% and Plasticity Index of 12%. Grain size analyses on one (1) sample indicated that the dyke fill consisted of 6% gravel, 33% sand, and 61% fines. Generally, the uncorrected SPT N-values in the dyke fill varied from 13 to 26.

4.1.2.2 Foundation Soils

The foundation soils encountered at the Ajax dyke consisted of Clayey Silt, Sand and Sand with Gravel within the investigated depth.

Clayey Silt – A layer of clayey silt, measuring 3.0 m± thick, was observed beneath the fill in both test holes. The clayey silt was generally brown to greenish brown, moist, soft to stiff and contained trace to some sand and trace gravel with organics. Moisture contents in the clayey silt varied from 11% to 29%. Atterberg Limits tests on two (2) samples of the fine fraction indicated that the clayey silt till fill was of low plasticity with a measured Liquid Limit between 21% and 24%, Plastic Limit between 18% and 20% and Plasticity Index of 3% to 4%. Grain size analyses on two (2) samples indicated that the clayey silt consisted of 1% gravel, 23% to 48% sand, and 52% to 76% fines. Uncorrected SPT N-values in the clayey silt varied from 2 to 14 with lower SPT values located near the east tie-in. One sample of silt was also submitted for organic content testing. It was found to have 2.8% organic content.

Sand – Sand was encountered below the clayey silt at test hole THA19-01. The sand was generally grey in colour, fine to coarse grained, wet, loose to very dense and contained trace fine to coarse sub-angular to angular gravel and trace to some fines. Moisture contents in the sand varied from 9% to 14%. Uncorrected SPT N-values in the sand varied from 3 to 90 with higher SPT values encountered at depth.

Sand with Gravel – Sand with gravel was encountered below the clayey silt at test hole THA19-02. The sand with gravel was generally grey in colour, fine to coarse grained, wet, very dense and contained trace fine to coarse sub-angular to angular gravel and trace to some fines. One (1) moisture content test in the sand with gravel indicated 9% moisture. Uncorrected SPT N-values in the sand varied from 50 to 70 with higher SPT values encountered at depth.

TABLE 3: AJAX DYKE: SUMMARY OF SOIL INDEX CHARACTERISTICS

Test Hole #	Sample Depth (M) / Sample No.	Moisture Content (%)	Plasticity (%)				Grain Size Distribution				
			LL	PL	PI	Gravel	Sand				Silt and Clay (<0.075 mm)
							Coarse (<4.75 to 2.0 mm)	Medium (<2.0 TO 0.425 MM)	Fine (<0.425 TO 0.075 MM)	Sand Total	
THA19-01	0.76 (S1)	9.4									
	1.52 (S2)	14.4									
	3.05 (S4)	16.2									
	4.57 (S5)	13.5	24	20.3	3.7	1	1	2	20	23	76
	7.62 (S7)	9.1				4	6	19	54	79	17
THA19-02	0.76 (S1)	13.8									
	1.52 (S2)	10.7									
	3.05 (S3)	18.1	25.5	13.9	11.6	6	8	5	20	33	61
	4.57 (S4)	23.8				0	0	0	48	48	52
	6.10 (S5)	27.7	9.6	21.3	18.3	3.0					

4.2 Groundwater Conditions

The four (4) standpipe piezometers installed as part of this geotechnical investigation as well as five (5) of the GeoPro Consulting Ltd. standpipe piezometers installed in 2017 were read at least once as part of this assignment between August 6th, 2019 and August 22nd, 2019. Table 4 summarizes the groundwater monitoring results.

Groundwater monitoring results for the Pickering Dyke varied from elevation 79.1 to 82.0 with a gradient that is assumed to closely follow the hydraulic gradient of Duffin's Creek (i.e. in a north to south direction).

Groundwater monitoring results for the Ajax Dyke varied from elevation 76.5 to 77.5. No clear groundwater gradient is apparent in the recent readings due to an anomalously higher reading in BHA1, located between TH19A-01 and TH19A-02.

4.2.1 FALLING HEAD PERMEABILITY TEST RESULTS

Falling head tests were completed on the following monitoring wells:

- THA19-01 (Ajax Dyke)
- BHA1 (Ajax Dyke)
- THA19-02 (Ajax Dyke)
- BHP1 (Pickering Dyke)
- BHP4 (Pickering Dyke)
- THP19-02 (Pickering Dyke)
- BHP6 (Pickering Dyke)
- BHP7 (Pickering Dyke)
- THP19-03 (Pickering Dyke)

The falling head tests were completed according to the Hvorslev Slug-Test method. The standpipe piezometers selected for the falling head tests were chosen specifically because the screened length of the standpipe was completely saturated prior to the tests. The results of the falling head tests (i.e. the estimated saturated hydraulic conductivity – K_{sat}) are summarized in Table 5 and detailed test results are included in Appendix I.

The estimated K_{sat} value of one of the falling head tests (BHP4) could not be determined because the monitoring well could not be filled without immediately dissipating the excess head pressure. K_{sat} values for preliminary design are summarized along with the material properties for general soil units in the Section 4.4. The high permeability in the underlying sand and gravel layers for the Pickering Dyke is based on the free draining conditions observed in BHP4.

TABLE 4: PIEZOMETRIC MONITORING RESULTS

Dyke Name:	Ajax Dyke			Pickering Dyke					
Test Hole:	THA19-01	BHA1	THA19-02	BHP1	BHP4	THP19-02	BHP6	BHP7	THP19-03
Approximate Station:	0+160	0+100	0+060	1+030	0+890	0+825	0+745	0+585	0+280
Ground Elevation ⁽²⁾ (m):	81.00	81.25	81.00	84.50	84.00	83.75	83.75	83.50	81.25
Tip Elevation (m):	71.90	75.15	73.40	79.90	79.40	77.65	79.15	77.40	73.55
Monitoring Zone:	Sand	Sandy Silt / Clayey Silt	Sand with Gravel	Sand and Gravel	Silty Sand / Silt Till	Clayey Silt Till	Sand and Gravel	Sand and Gravel	Sand with Gravel
Date									
06-Aug-19				82.02	81.22		80.75	79.86	
07-Aug-19		77.45		82.00	81.25		80.75	80.00	
19-Aug-19	76.53		76.94						
22-Aug-19		77.37		82.02	81.35	81.33	80.73	79.86	79.10

Notes:

1. Standpipe piezometer at test hole BHA1, BHP1, BHP4, BHP6, BHP7 were installed by GeoProConsulting in 2017.
2. The ground elevations at all test holes are approximate and based on interpretation of the available topography survey (2017) and LiDAR (2015) provided by TRCA.

TABLE 5: FALLING HEAD TEST RESULTS AND EXPECTED PERMEABILITY COMPARISONS

DYKE	TEST HOLE ID (Monitoring Zone)	Station	Screen Depth Range (m)	Static Water Level Depth (m)	Falling Head Test K_{SAT} (cm/s)	Notes
Ajax Dyke	THA19-01 (Sand)	0+160	7.6 - 9.1	3.43	3.8E-04	
	BHA1 (Sandy Silt / Clayey Silt)	0+100	4.6 - 6.1	3.65	2.0E-06	
	THA19-02 (Sand with Gravel)	0+060	4.6 - 6.1	3.84	7.7E-04	
Pickering Dyke	BHP1 (Sand and Gravel)	1+030	3.1 - 4.6	2.33	3.8E-03	
	BHP4 (Silty Sand / Silt Till)	0+890	3.1 - 4.6	2.49	N/A	1
	THP19-02	0+825	4.6 - 6.1	2.21	5.5E-04	
		0+745	3.1 - 4.6	2.94	2.7E-03	
		0+585	4.6 - 6.1	3.47	4.8E-04	
	BHP4	0+280	6.1 - 7.6	1.99	2.8E-03	

Notes:

1. Excess head pressure dissipated too quickly. Open conditions.

5.0 GEOTECHNICAL ENGINEERING ASSESSMENT

5.1 General Stratigraphic Profiles

Figures GR-01 and GR-02 illustrate general stratigraphic profiles that consider the results of all four geotechnical site investigations completed at the sites of the Ajax and Pickering Dykes. In general, the stratigraphic profiles consist of four distinct soil layers, as described in Section 2.3.

Representative estimated shear strength and permeability parameters for the four primary soil layers at the sites of the Ajax and Pickering Dykes are presented on Table 6. The soil strength parameters were estimated from Standard Penetration Tests (SPT), laboratory index testing using empirical correlations, as well as previous experience with similar soil materials. It should be noted that advanced laboratory tests were not completed on the dyke fill and foundation soils as part of this scope of work.

TABLE 6: EFFECTIVE SHEAR STRENGTH AND HYDRAULIC CONDUCTIVITY PARAMETERS

Material (USCS Soil Types)	Saturated Hydraulic Conductivity, K_{SAT} (cm/s)	UNIT WEIGHT, γ (kN/m ³)	Effective Friction Angle Φ'	UNIT Cohesion C' (kPa)
Dyke Fill (Clayey Silt Till Fill)	1×10^{-5}	19.5	30°	0
Clayey Silt / Silty Sand	1×10^{-3} – Pickering 1×10^{-5} - Ajax	18.0	30°	0
Sand with Gravel	1×10^{-1} – Pickering 1×10^{-3} - Ajax	21.0	34°	0
Clayey Silt Till	1×10^{-5}	21.5	35	0

*may contain cobbles and boulders

The recommended hydraulic conductivity values consider the results of the falling head tests as follows:

- 1) No falling head tests were completed in dyke fill material. The recommended K_{sat} of 1×10^{-5} cm/s is a reasonable estimate considering the typical permeability for a clayey silt till fill (firm to stiff).
- 2) No hydraulic conductivity test was available in the upper Clayey Silt / Silty Sand of the Pickering Dyke. The recommended K_{sat} (1×10^{-3} cm/s) for the upper Clayey Silt / Silty Sand is a reasonable estimate based on the range of soil gradation test results in this upper material.
- 3) A single falling head test result was obtained from a piezometer installed in the upper Clayey Silt of BHA1 at the Ajax Dyke. The estimated K_{sat} from the falling head test was 2×10^{-6} cm/s. The recommended permeability ($K_{sat} = 1 \times 10^{-5}$ cm/s) is conservative and rounded up to the next highest order of magnitude relative to the applicable test results. The permeability is consistent with that recommended for the overlying dyke fill.

- 4) The results of falling head tests that could successfully be completed in the sand and gravel layer at the Pickering Dyke varied from a K_{sat} of 4.8×10^{-4} cm/s to 3.8×10^{-3} cm/s. The recommended permeability primarily considers the result in BHP4 in which the standpipe piezometer could not be filled quickly enough to maintain excess head. The recommended K_{sat} of 1×10^{-1} cm/s would be consistent with a test that could be successfully completed in less than 1 second.
- 5) The results of falling head test results that were completed in the sand and gravel layer at the Ajax Dyke varied from a K_{sat} of 3.8×10^{-4} cm/s to 7.7×10^{-4} cm/s. The recommended permeability ($K_{sat} = 1 \times 10^{-3}$ cm/s) is conservative and rounded up to the next highest order of magnitude relative to the applicable test results.
- 6) The recommended K_{sat} (1×10^{-5} cm/s) for the Clayey Silt Till is a reasonable estimate based on the range of soil gradation test results.

6.0 CHEMICAL TESTING AND ANALYSIS

Composite soil samples were collected from test holes THP19-01, THP19-02, THP19-05 and THP19-06 on the Pickering Dyke and test holes THA-01 and THA-02 on the Ajax Dyke. Test hole locations are shown on Figures GR-01 and GR-02. Observations made at the time of drilling are provided on the stratigraphic logs provided in Appendix F, and show no visual (hydrocarbon staining) or olfactory (hydrocarbon odour) evidence of soil contamination. Representative soil samples were submitted under chain of custody to AGAT Laboratory in Mississauga for toxicity characteristic leaching procedure (TCLP) analysis, specifically for inorganic and metal parameters as per Ontario Regulation (O.Reg) 558. It is recommended that additional soil samples be collected from the dykes and submitted for analysis of O.Reg. 153/04 parameters at the detailed design stage as part of the planning and development of the Excess Soil Management Plan (described at the end of this section).

Table 7 provides a summary of the results as compared to O.Reg 558 Schedule 4 Leachate Quality Criteria. A copy of the laboratory certificate of analysis is provided in Appendix G.

TABLE 7: TCLP RESULTS-SOIL

Leachate Parameter	Laboratory Results (mg/L)						O. Reg. 558 - Schedule 4 Leachate Quality Criteria
	THA-01	THA-02	THP-01	THP-02	THP-05	HPP-06	
Arsenic	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	2.5
Barium	0.74	0.688	0.623	0.611	0.0675	0.688	100
Boron	0.053	<0.05	0.059	0.05	0.06	0.067	500
Cadmium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.5
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	5
Lead	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	5
Mercury	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.1
Selenium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	5
Uranium	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	10
Fluoride	0.21	0.21	0.13	0.17	0.09	0.16	150
Cyanide	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	20
Nitrate+Nitrite as N	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	1000

TCLP is a chemical analysis process used to determine whether there are hazardous elements present in a material, in this case soil. The test involves a simulation of leaching through a landfill and can provide a rating that can prove if the soil is leachate toxic. Leachate toxic means producing leachate containing any of the contaminants listed in Schedule 4 of O.Reg 588 at a concentration equal to or in excess of the concentration specified for that contaminant in Schedule 4 using the TCLP Method 1311 that appears in the United States Environmental Protection Agency Publication SW-846 entitled “Test Methods for Evaluating Solid Waste, Physical/Chemical Methods”, as amended from time to time, or an equivalent test method approved by the Ministry of Environment Conservation and Parks.

All TCLP results were below their respective O.Reg 588 Schedule 4 criteria, with most below reported detection limits, indicating that soils sampled from the Pickering and Ajax are not leachate toxic, and can be disposed of at any solid non-hazardous landfill. Additional tests would be required during development of the Excess Soil Management Plan (discussed below) to dispose of these soils at other willingly receiving sites, such as construction sites.

During the detailed design phase an Excess Soil Management Plan will need to be developed in compliance with Ontario’s new On-Site and Excess Soil Regulation (O.Reg. 406/19) detailing how soil removed from the site will be managed. On December 4, 2019 the Government of Ontario announced that it had finalized and is implementing O.Reg.406/19 under the *Environmental Protection Act (EPA)*. The new regulatory framework provides clarification on the responsibilities for both generators and receivers of excess soil in Ontario. The regulation defines excess soil as soil that has been excavated that must be removed from the project area (including any sediment). The Regulation will hold proponents responsible for the proper management of excess soil generated by their project. Non-compliance could lead to fines and orders issued under the EPA.

The new regulation is being phased in as follows:

- July 1, 2020: reuse rules, including risk-based standards, waste designation and approvals
- January 1, 2022: testing, tracking and registration
- January 1, 2025: restrictions on landfilling soils
- grandfathering provisions - applicable from January 1, 2021 to January 1, 2026, to recognize where work to be done is already stipulated in a contract.

The main components of excess soil management as defined under O.Reg 406/19 include the following:

- **Assessment of Past Uses Report** – this report includes the following:
 - a) Records Review;
 - b) Interviews with persons familiar with the site;
 - c) Site Reconnaissance;
 - d) A review and evaluation of information gathered;
 - e) Determine areas of actual or potential environmental concern and chemicals of concern; and
 - f) Preparation of an Assessment of Past Uses Report.
- **Sampling and Analysis Plan**
 - a) Determine number of samples (this depends on volume to be removed from the site - minimum of 3 samples for < 600 m³ – with additional samples per additional volume);

- b) Develop laboratory program based on the standard parameter list provided in O.Reg. 409/19 and potential chemicals of concern identified in the Assessment of Past Uses Report.
- c) Collect and analyze samples, with number of samples dependent on the volume of soil to be removed from the site.
- **Preparation of Characterization Report Including Review and Evaluation**
 - a) Includes data assessment and comparison to excess soil quality guidelines, cross sections, figures, tables and narrative description.
- **Excess Soil Destination Report**
 - a) Report detailing the logistics of soil removal (dates, final depths, volumes, destination etc.)
- **Tracking System Development**
 - a) Plan on how each load leaving the site will be tracked.

Ultimately the purpose of the new regulation is to promote the on-site re-use of soils where appropriate. The Excess Soil Management Plan need to determine and plan for a beneficial end of soil removed from the site.

7.0 CLOSURE

1. A geotechnical investigation program was undertaken in 2019 at the sites of the Ajax and Pickering Dykes to confirm dyke and foundation conditions, expand upon the existing geotechnical information, and determine if the dykes are comprised of any impacted soils warranting special handling or disposal considerations.
2. Four (4) test holes were advanced at the site of the Pickering Dyke and two (2) test holes were advanced at the site of the Ajax Dyke. An additional two (2) dyke samples of the Pickering Dyke were also obtained as part of four (4) samples submitted for O.Reg 558 Metals and Inorganics analyses.
3. The dyke fill materials encountered at both dykes consisted of clayey silt till fill. In general, the clayey silt till fill was brown in colour, moist, firm to stiff, of low plasticity, and contained varying amounts of sand and trace organics.
4. The foundation soils encountered at the Pickering Dyke consisted of Silty Sand, Clayey Silt, Sand with Gravel and Clayey Silt Till. In THP19-01, very hard augering was observed in the Clayey Silt Till layer (9 m depth) and pieces of shale fragments were recovered before test hole refusal.
5. The foundation soils encountered at the Ajax Dyke consisted of Clayey Silt, Sand and Sand with Gravel.
6. Piezometric data revealed that the groundwater levels beneath the dykes varied from elevation 76.5 m to 82.0 m between August 19 and 22, 2019. The variation is assumed to closely follow the hydraulic gradient of Duffin's Creek. Falling head tests were also completed on new and previously installed monitoring wells.
7. Based on the chemical testing and analysis, the soil sampled from the Pickering and Ajax Dykes was not leachate toxic. Observations made at the time of drilling indicated no potential contamination of soil.
8. The recommended soil strength and hydraulic conductivity parameters for the dyke fill and foundation soils to be used in the analyses as part of the dykes' rehabilitation were estimated based on the SPT testing, laboratory testing results with empirical correlations, falling head testing and previous experience with similar materials.

8.0 REFERENCES

1. Geo-Canada, *Geotechnical Investigation Proposed Dyking Duffin Creek Pickering, Ontario*, August 1984
2. Geo-Canada, *Subsurface Investigation Proposed Dyking Duffin Creek Pickering, Ontario*, August 1985
3. Valdor Engineering, *Dyke Level of Service and Rehabilitation Report Pickering / Ajax SPA's*, March 2018

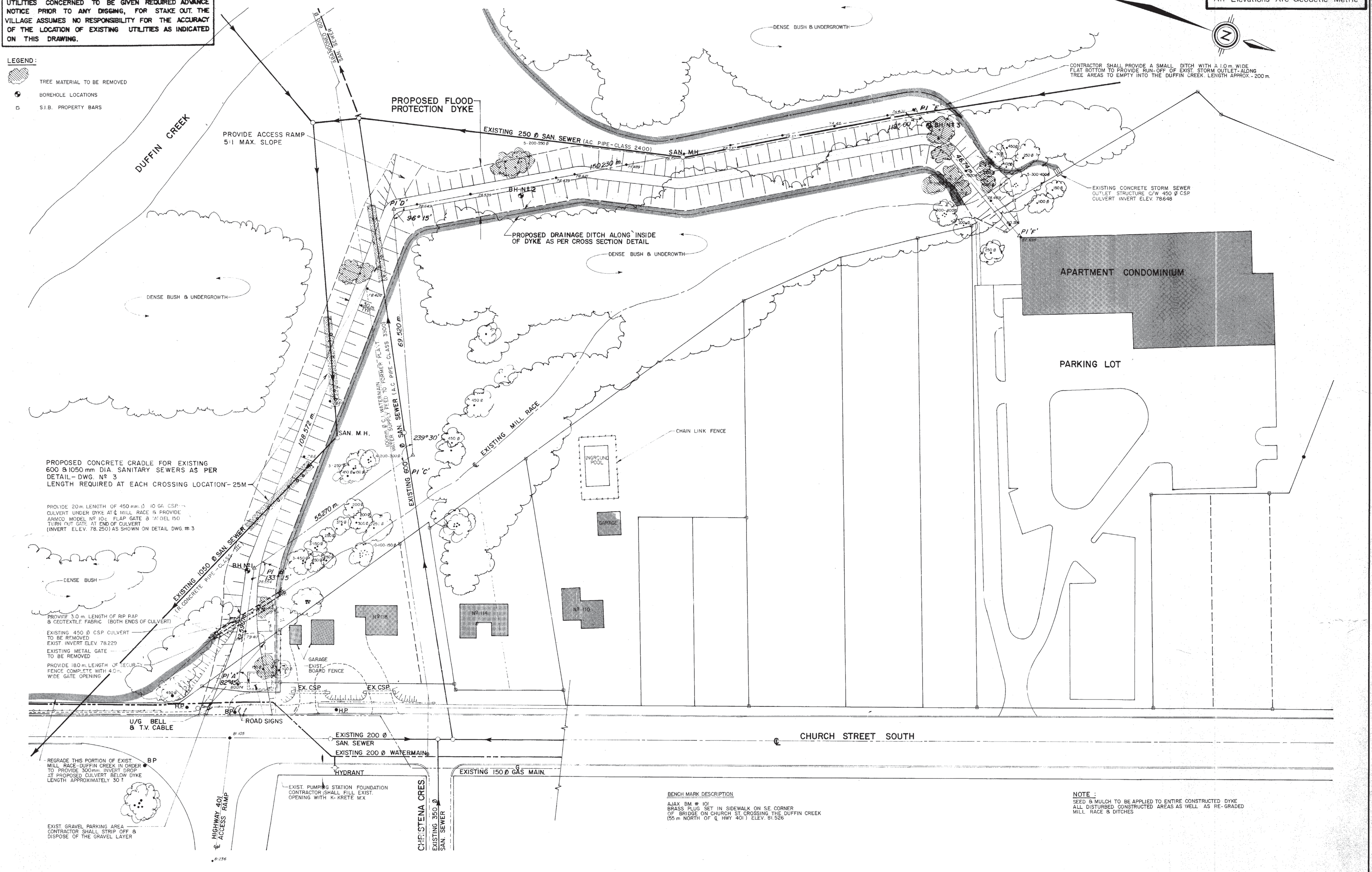
APPENDIX A

Construction Drawings for the Ajax and Pickering
Dykes

CONTRACTOR TO BE RESPONSIBLE FOR LOCATION OF ALL EXISTING U/G & OVERHEAD UTILITIES. VARIOUS UTILITIES CONCERNED TO BE GIVEN REQUIRED ADVANCE NOTICE PRIOR TO ANY DIGGING, FOR STAKE OUT. THE VILLAGE ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OF THE LOCATION OF EXISTING UTILITIES AS INDICATED ON THIS DRAWING.

All Dimensions Are In Millimetres
All Elevations Are Geodetic Metric

- LEGEND:**
- TREE MATERIAL TO BE REMOVED
 - BOREHOLE LOCATIONS
 - S.I.B. PROPERTY BARS



PROPOSED CONCRETE CRADLE FOR EXISTING 600 & 1050 mm DIA. SANITARY SEWERS AS PER DETAIL-DWG. N° 3
LENGTH REQUIRED AT EACH CROSSING LOCATION-25M

PROVIDE 20 m LENGTH OF 450 mm Ø 10 GA. CSP. CULVERT UNDER DYKE AT MILL RACE & PROVIDE ARMCO MODEL N° 10 C. FLAP GATE & MODEL 150 TURN PUT GATE AT END OF CULVERT (INVERT ELEV. 78.250) AS SHOWN ON DETAIL DWG. # 3

PROVIDE 3.0 m LENGTH OF RIP RAP & GEOTEXTILE FABRIC (BOTH ENDS OF CULVERT)
EXISTING 450 Ø CSP CULVERT TO BE REMOVED
EXIST INVERT ELEV 78.229
EXISTING METAL GATE TO BE REMOVED

PROVIDE 180 m LENGTH OF SECURITY FENCE COMPLETE WITH 4.0 m WIDE GATE OPENING

REGRADE THIS PORTION OF EXIST. MILL RACE-DUFFIN CREEK IN ORDER TO PROVIDE 300 mm INVERT DROP AT PROPOSED CULVERT BELOW DYKE LENGTH APPROXIMATELY 30.1

EXIST GRAVEL PARKING AREA-CONTRACTOR SHALL STRIP OFF & DISPOSE OF THE GRAVEL LAYER

BENCH MARK DESCRIPTION
AJAX BM # 101
BRASS PLUG SET IN SIDEWALK ON S.E. CORNER OF BRIDGE ON CHURCH ST. CROSSING THE DUFFIN CREEK (55 m NORTH OF Q. HWY 401) ELEV. 91.526

NOTE:
SEED & MULCH TO BE APPLIED TO ENTIRE CONSTRUCTED DYKE
ALL DISTURBED CONSTRUCTED AREAS AS WELL AS RE-GRADED MILL RACE & DITCHES

Date	Revisions

the metropolitan toronto and region conservation authority
5 Shoreham Drive, Downsview, Ontario
M3N 1S4

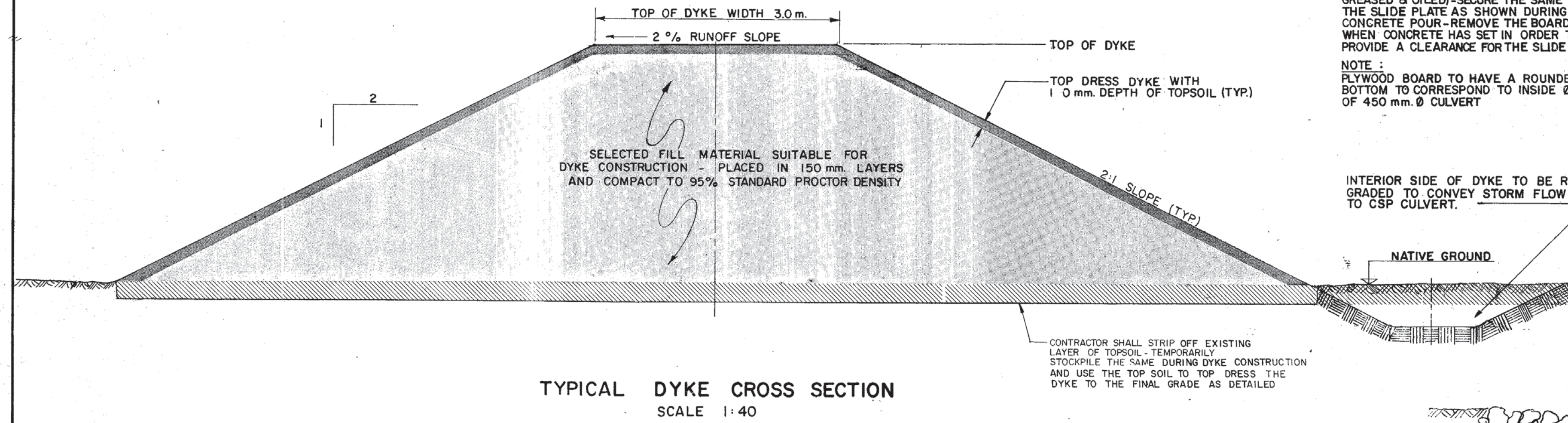
DUFFIN CREEK
AJAX FLOOD PROTECTION DYKE PLAN

Simcoe
Simcoe Engineering Group Limited • Consulting Engineers

Design B.K.	Scale Horiz. 1:500	Drawing No. 2
Drawn B.K.	Date AUGUST 1984	
Checked R.L.S.		

DETAILS

NOTE:
SEED & MULCH SHALL BE APPLIED TO THE COMPLETE DYKE INCLUDING AREAS DISTURBED DURING CONSTRUCTION



TYPICAL DYKE CROSS SECTION
SCALE 1:40

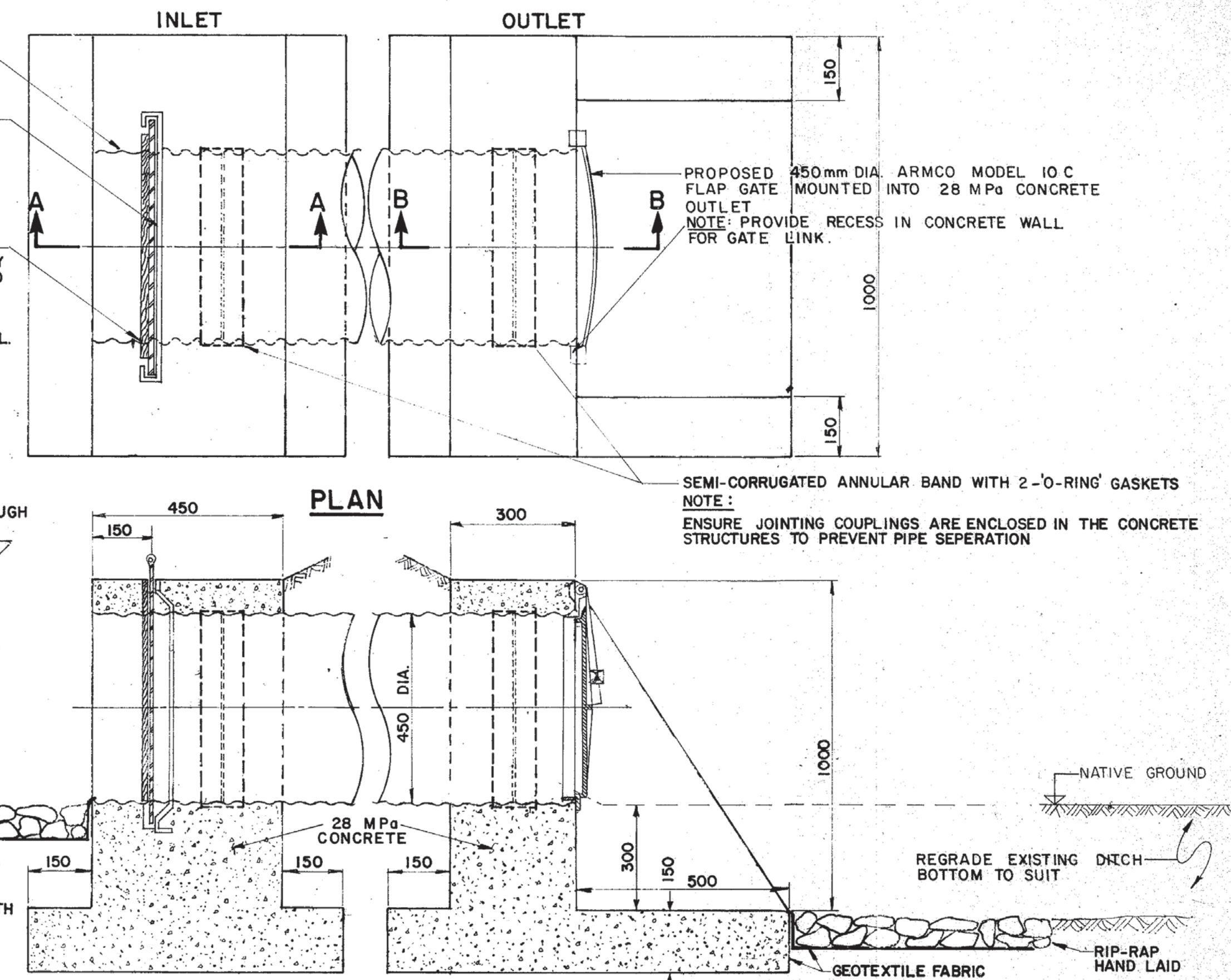
PROPOSED 450mm Ø - 10 GA. C.S.P. CULVERT-LAY @ 0.00% GRADE

PROPOSED 450mm Ø ARMCO MODEL 150 TURN OUT GATE PROVIDE HOLES IN FRAME & SLIDE PLATE IN OPEN & CLOSED POSITIONS (BOTH SIDES) FOR PADLOCKS TO PREVENT SLIDE PLATE FROM BEING REMOVED

CONTRACTOR TO PROVIDE A PIECE OF 19mm THICK PLYWOOD BOARD (HEAVILY GREASED & OILED)-SECURE THE SAME TO THE SLIDE PLATE AS SHOWN DURING CONCRETE POUR-REMOVE THE BOARD WHEN CONCRETE HAS SET IN ORDER TO PROVIDE A CLEARANCE FOR THE SLIDE PL. NOTE: PLYWOOD BOARD TO HAVE A ROUNDED BOTTOM TO CORRESPOND TO INSIDE Ø OF 450mm Ø CULVERT

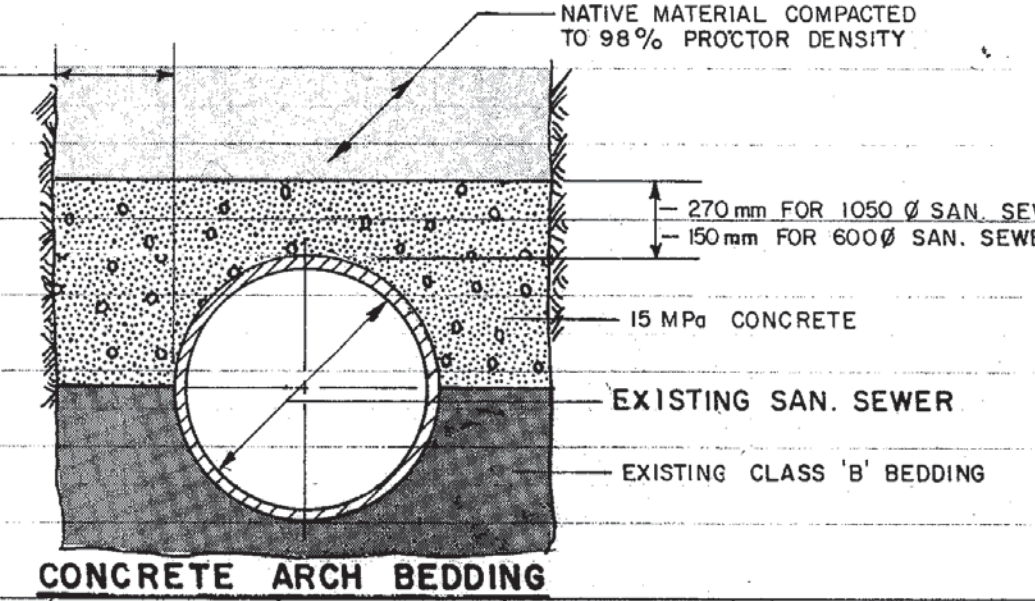
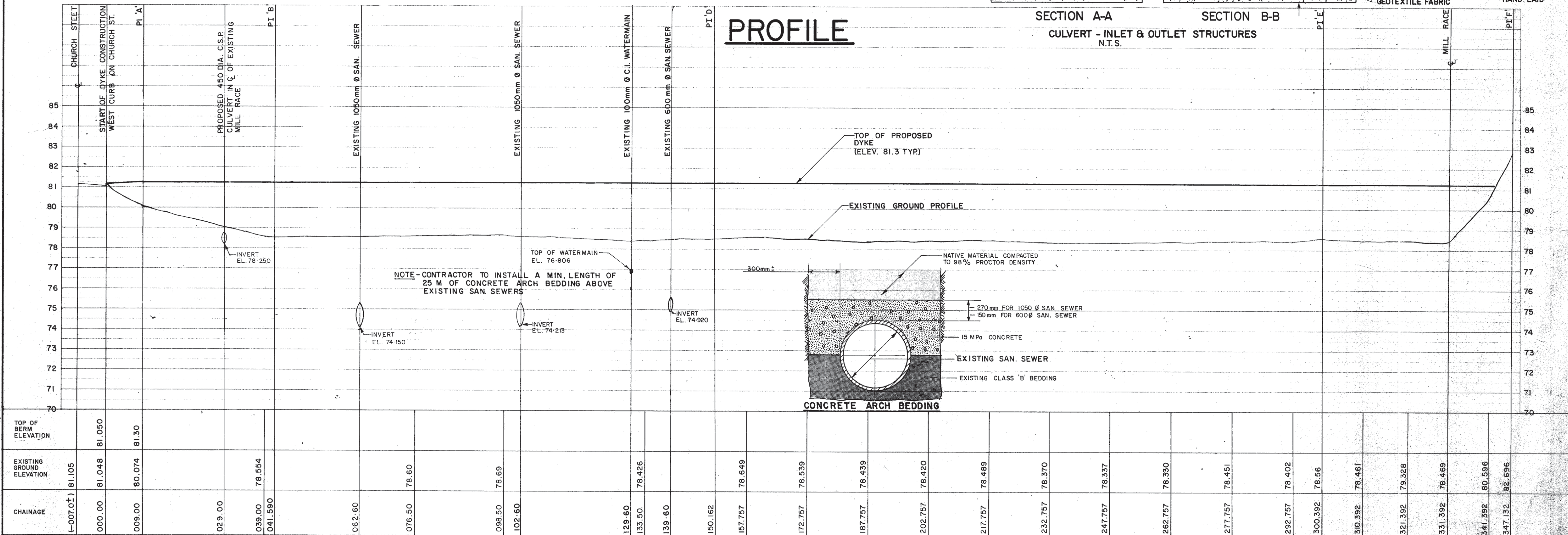
INTERIOR SIDE OF DYKE TO BE ROUGH GRADED TO CONVEY STORM FLOW TO CSP CULVERT.

NOTE: CONTRACTOR SHALL INSTALL RIP-RAP AT ENDS OF CULVERT DIMENSIONS - 3.0m LENGTH x FULL WIDTH OF DITCH



SECTION A-A SECTION B-B
CULVERT - INLET & OUTLET STRUCTURES
N.T.S.

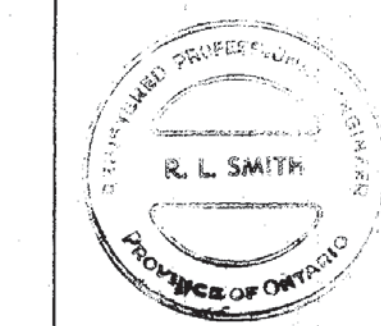
PROFILE



Date	Revisions	TOP OF BERM ELEVATION	EXISTING GROUND ELEVATION	CHAINAGE
		81.050	81.105	0+00
		81.30	80.074	0+09
			78.554	0+39
				0+41
				0+62
				0+76
				0+98
				1+02
				1+29
				1+35
				1+39
				1+50
				1+57
				1+72
				1+77
				2+02
				2+17
				2+32
				2+47
				2+62
				2+77
				2+92
				3+00
				3+10
				3+21
				3+31
				3+41
				3+47

the metropolitan toronto and region conservation authority
5 Shoreham Drive, Downsview, Ontario
M3N 1S4

DUFFIN CREEK
AJAX - FLOOD PROTECTION DYKE
PROFILE / DETAILS



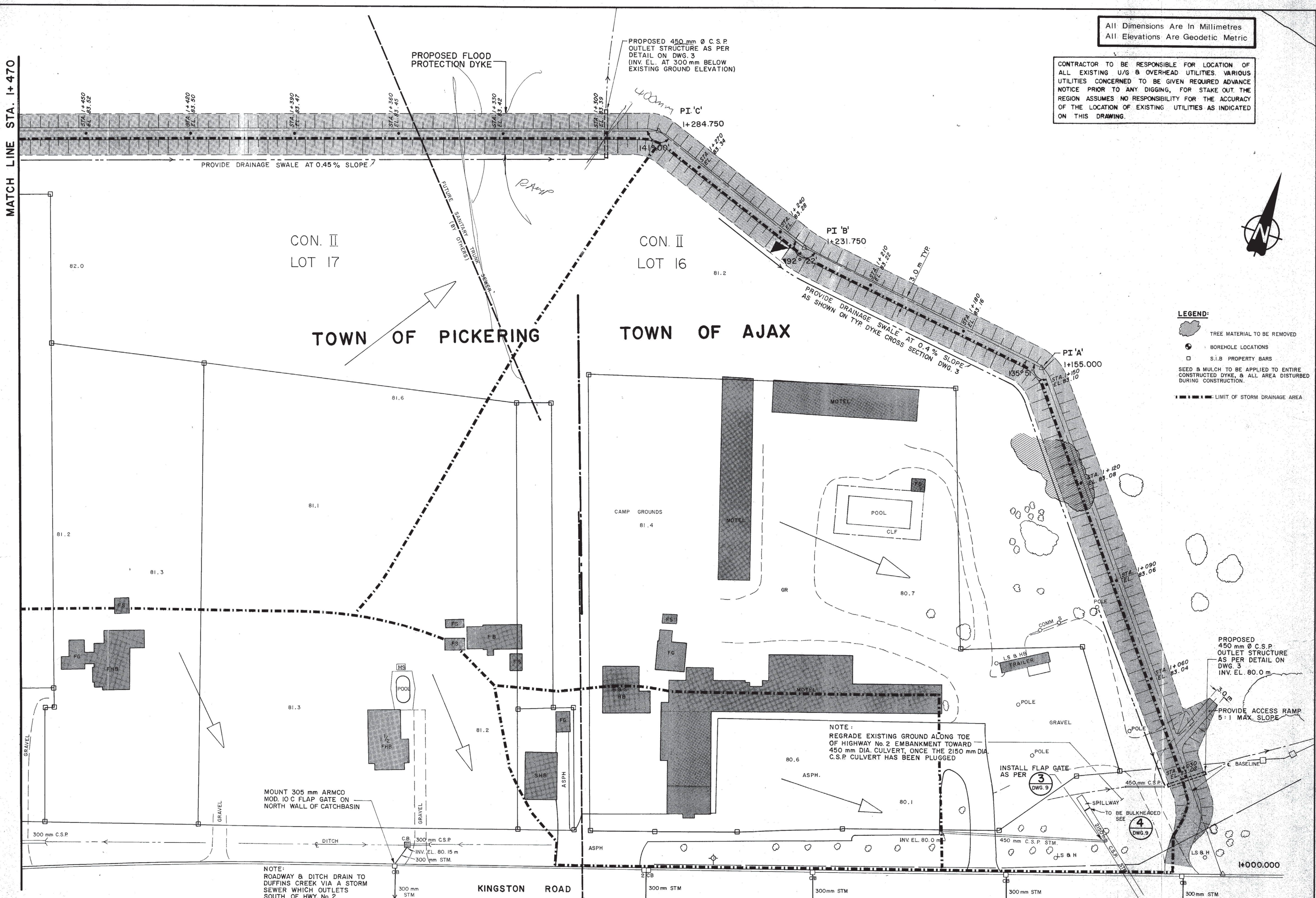
Simcoe
Simcoe Engineering Group Limited • Consulting Engineers
Design B.K. Scale Horiz. 1" = 500'
Drawn R.S. Vert. 1" = 100'
Checked R.L.S. Date AUGUST 1984
Drawing No. **3**

All Dimensions Are In Millimetres
All Elevations Are Geodetic Metric

CONTRACTOR TO BE RESPONSIBLE FOR LOCATION OF ALL EXISTING U/G & OVERHEAD UTILITIES. VARIOUS UTILITIES CONCERNED TO BE GIVEN REQUIRED ADVANCE NOTICE PRIOR TO ANY DIGGING, FOR STAKE OUT THE REGION ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OF THE LOCATION OF EXISTING UTILITIES AS INDICATED ON THIS DRAWING.



- LEGEND:**
- TREE MATERIAL TO BE REMOVED
 - BOREHOLE LOCATIONS
 - S.I.B. PROPERTY BARS
 - SEED & MULCH TO BE APPLIED TO ENTIRE CONSTRUCTED DYKE, & ALL AREA DISTURBED DURING CONSTRUCTION.
 - LIMIT OF STORM DRAINAGE AREA



Date	Revisions

the metropolitan toronto and region conservation authority
5 Shoreham Drive, Downsview, Ontario
M3N 1S4

**DUFFIN CREEK
PICKERING FLOOD PROTECTION DYKE
PLAN
STA. 1+000 TO STA. 1+470**

Simcoe
Simcoe Engineering Group Limited • Consulting Engineers
Design RLS, JM Scale Horiz. 1:500 Drawing No. **4**
Drawn JH Date JULY 1985
Checked BK

INSTALL HAND PLACED RANDOM RIP-RAP STONE SIZE 300 TO 600 mm WITH TERRAFIX TYPE 270 R FILTER MAT (LENGTH APPROX-25 m x FULL CREEK EMBANKMENT) NOTE-REGRADE CREEK BANK TO SUIT

PROPOSED FLOOD PROTECTION DYKE

PROPOSED 600 mm Ø C.S.P. OUTLET STRUCTURE AS PER DETAIL ON DWG. N° 3 (INV. EL. 300 mm BELOW EXISTING GROUND EL.)

LEGEND:

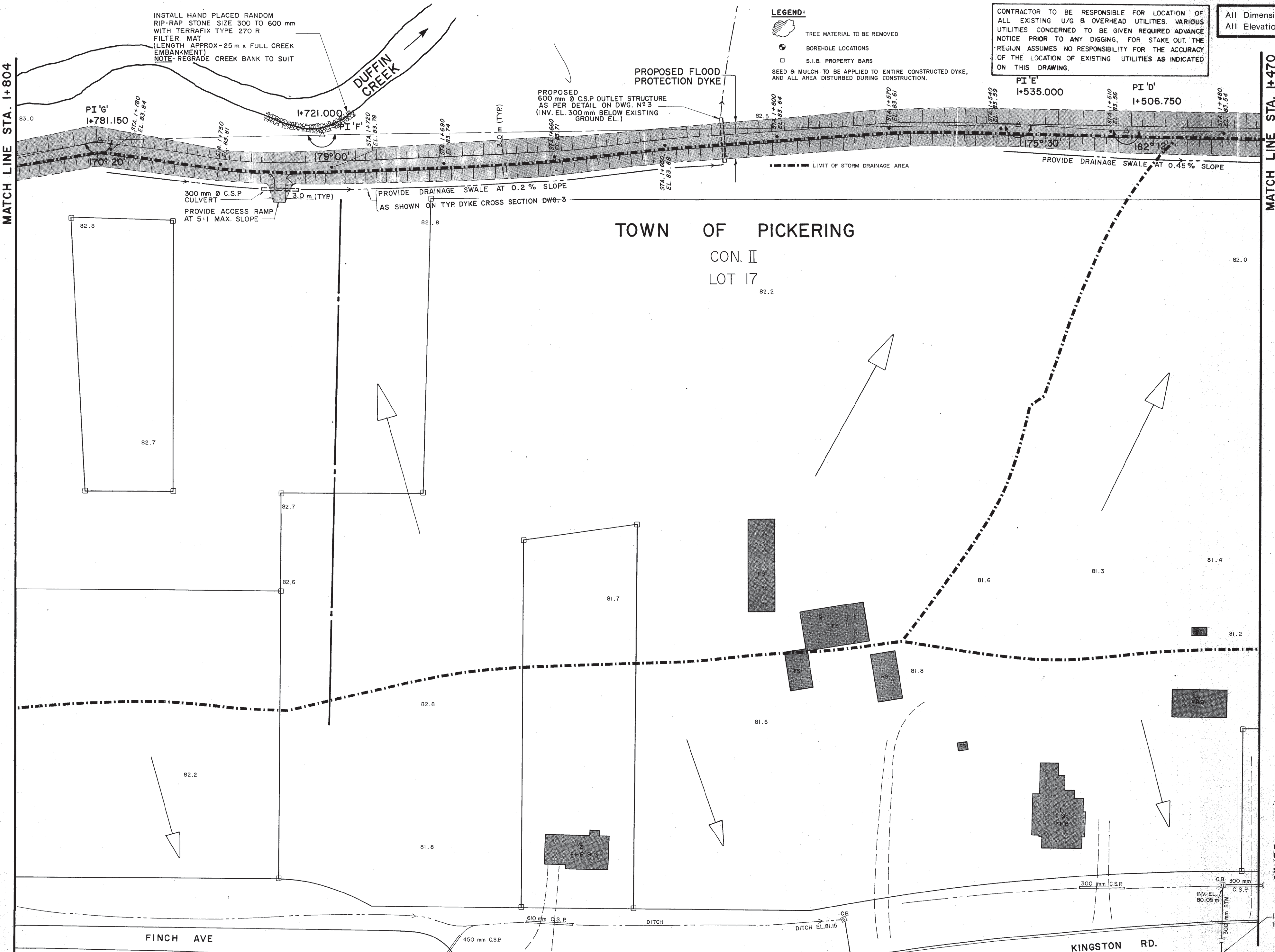
- TREE MATERIAL TO BE REMOVED
- BOREHOLE LOCATIONS
- S.I.B. PROPERTY BARS
- SEED & MULCH TO BE APPLIED TO ENTIRE CONSTRUCTED DYKE, AND ALL AREA DISTURBED DURING CONSTRUCTION.

CONTRACTOR TO BE RESPONSIBLE FOR LOCATION OF ALL EXISTING U/G & OVERHEAD UTILITIES. VARIOUS UTILITIES CONCERNED TO BE GIVEN REQUIRED ADVANCE NOTICE PRIOR TO ANY DIGGING, FOR STAKE OUT THE REJUN ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OF THE LOCATION OF EXISTING UTILITIES AS INDICATED ON THIS DRAWING.

All Dimensions Are In Millimetres
All Elevations Are Geodetic Metric

MATCH LINE STA. I+804

MATCH LINE STA. I+470



FINCH AVE

KINGSTON RD.

NOTE: ROADWAY & DITCH DRAIN TO DUFFIN CREEK VIA STORM SEWER WHICH OUTLETS SOUTH OF HWY. No. 2

INSTALL FLAP GATE AS PER DETAIL

5
DWG. 9

Date	Revisions

the metropolitan toronto and region conservation authority
5 Shoreham Drive, Downsview, Ontario
M3N 1S4

DUFFIN CREEK
PICKERING FLOOD PROTECTION DYKE
PLAN
STA. I+470 TO STA. I+804

Simcoe
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Design RLS, JM Scale Horiz. 1:500 Drawing No. **5**
Drawn JH
Checked BK Date JULY 1985

BENCH MARK DESCRIPTION

GOEDETIC B.M. 67-U-002

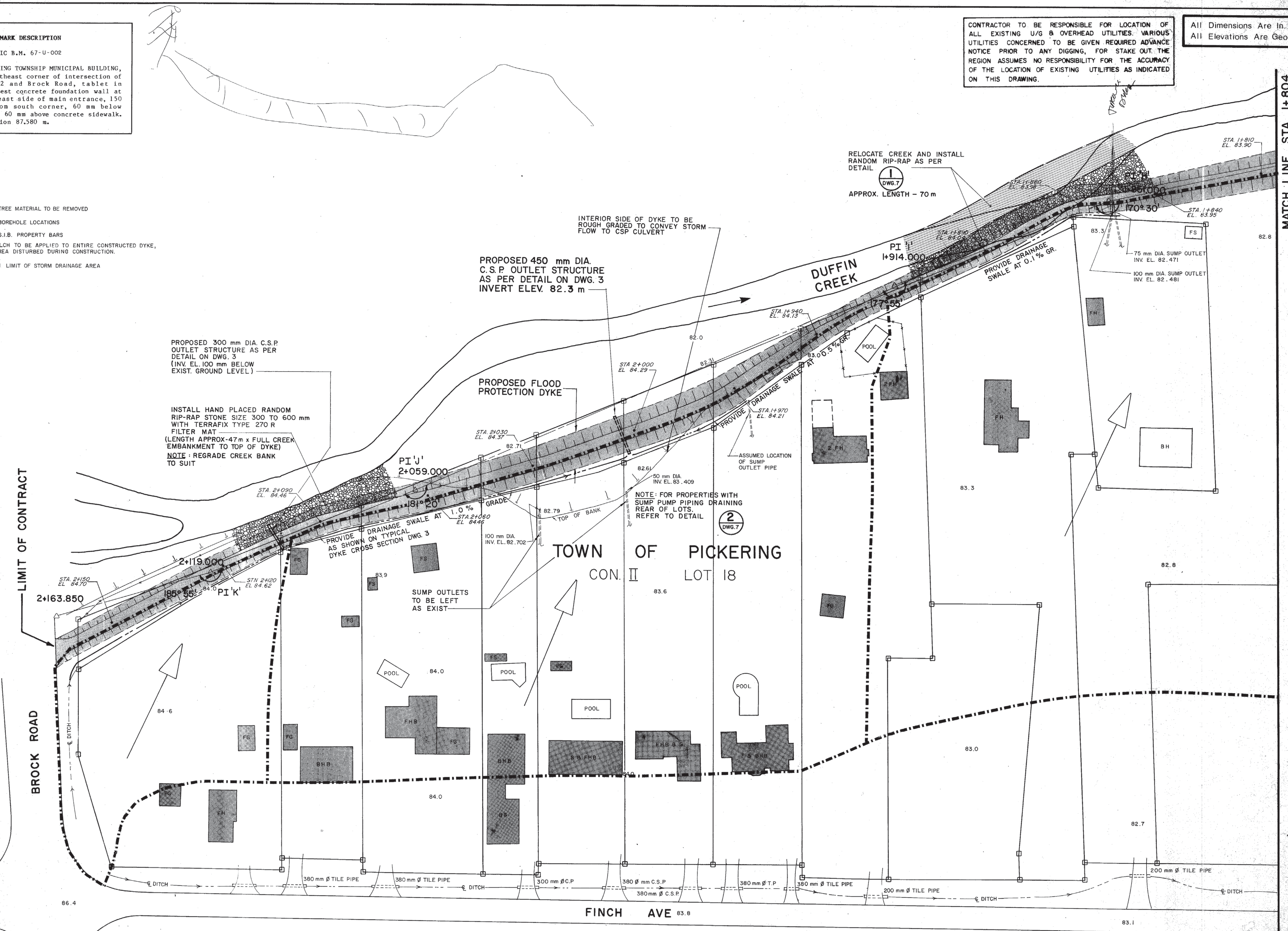
PICKERING TOWNSHIP MUNICIPAL BUILDING, at northeast corner of intersection of HWY #2 and Brock Road, tablet in southwest concrete foundation wall at northeast side of main entrance, 150 mm from south corner, 60 mm below brick, 60 mm above concrete sidewalk. Elevation 87.580 m.

LEGEND:

- TREE MATERIAL TO BE REMOVED
- BOREHOLE LOCATIONS
- S.I.B. PROPERTY BARS
- SEED & MULCH TO BE APPLIED TO ENTIRE CONSTRUCTED DYKE, AND ALL AREA DISTURBED DURING CONSTRUCTION.
- LIMIT OF STORM DRAINAGE AREA

CONTRACTOR TO BE RESPONSIBLE FOR LOCATION OF ALL EXISTING U/G & OVERHEAD UTILITIES. VARIOUS UTILITIES CONCERNED TO BE GIVEN REQUIRED ADVANCE NOTICE PRIOR TO ANY DIGGING, FOR STAKE OUT. THE REGION ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OF THE LOCATION OF EXISTING UTILITIES AS INDICATED ON THIS DRAWING.

All Dimensions Are In Millimetres
All Elevations Are Geodetic Metric



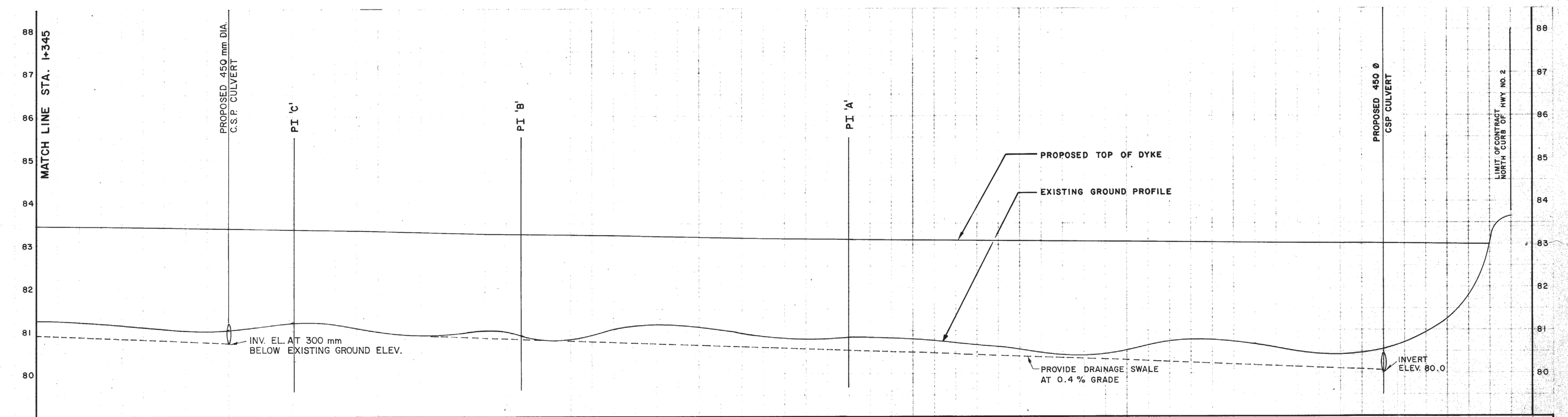
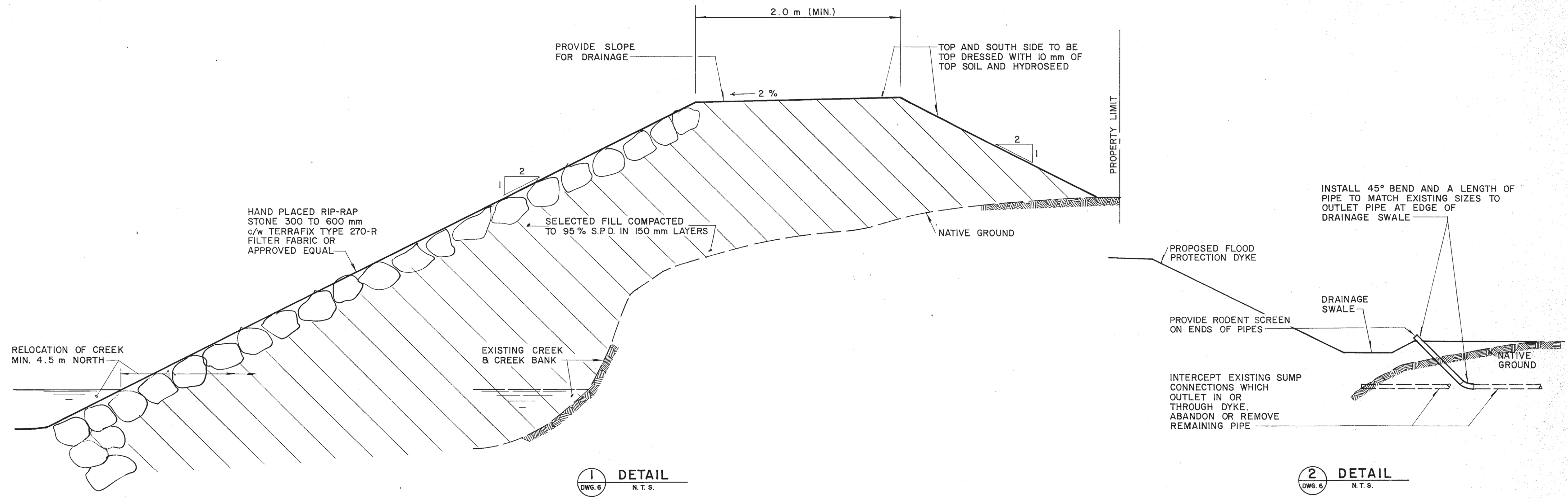
Date	Revisions

the metropolitan toronto and region conservation authority
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M3N 1S4

**DUFFIN CREEK
PICKERING FLOOD PROTECTION DYKE
PLAN
STA. 1+804 TO LIMIT OF CONTRACT**

Simcoe
Simcoe Engineering Group Limited • Consulting Engineers

Design RLS, JM	Scale Horiz. 1:500	Drawing No. 6
Drawn JH	Date JULY 1985	
Checked BK		



TOP OF DYKE ELEVATION	83.42	83.39	83.37	83.34	83.28	83.26	83.22	83.16	83.11	83.10	83.08	83.06	83.04	83.02	83.00
EXISTING GROUND ELEVATION	81.27	81.02	81.20	81.08	81.01	80.90	81.01	80.95	80.87	80.85	80.62	80.55	80.70	80.55	80.64
CHAINAGE	1+330	1+300	1+284.75	1+270	1+240	1+231.75	1+210	1+180	1+155	1+150	1+120	1+090	1+060	1+030	1+000

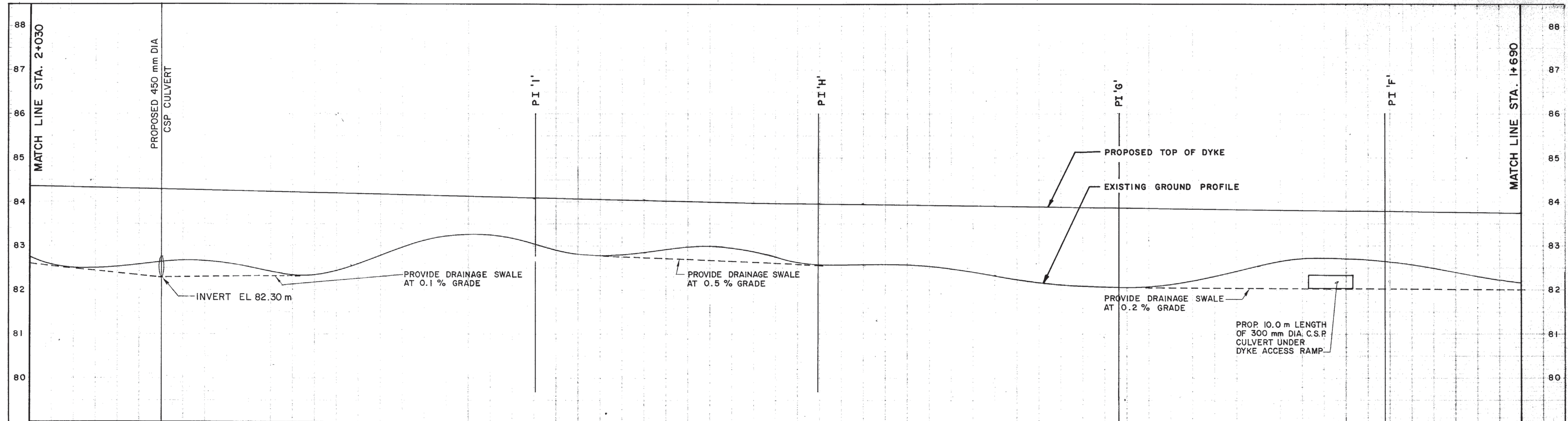
Date	Revisions

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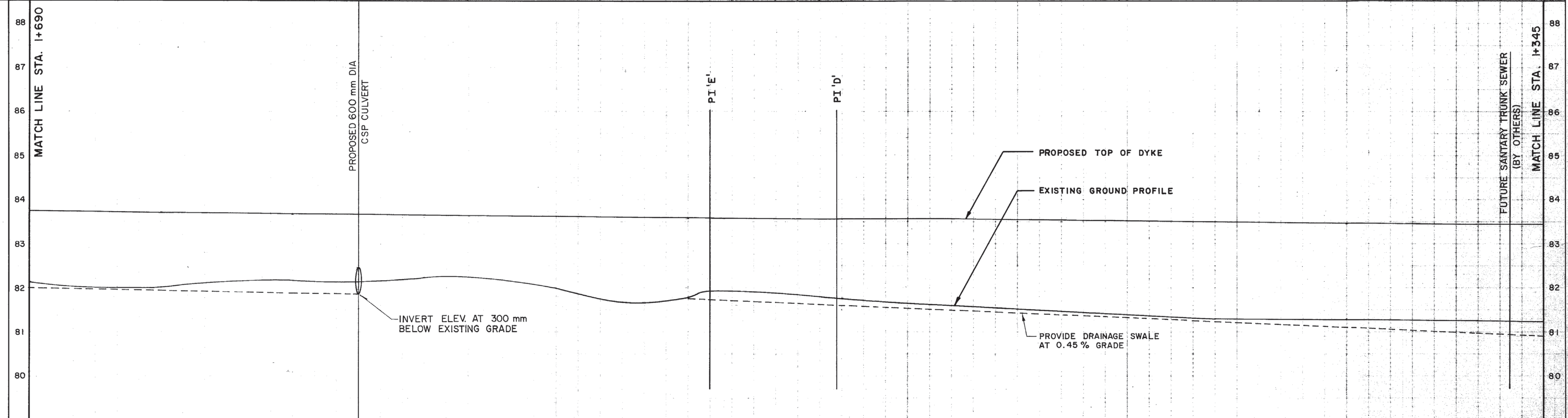
DUFFIN CREEK
PICKERING FLOOD PROTECTION DYKE
PROFILE (STA. 1+000 TO STA. 1+345)

Simcoe
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Design RLS, JM	Scale Horiz. 1:500 Vert. 1:50	Drawing No. 7
Drawn JH	Date JULY 1985	
Checked BK		



TOP OF DYKE ELEVATION	84.37	84.29	84.21	84.13	84.08	84.04	83.98	83.97	83.95	83.90	83.84	83.81	83.78	83.74
EXISTING GROUND ELEVATION	82.75	82.65	82.31	83.11	83.04	82.86	82.74	82.55	82.56	82.31	82.08	82.51	82.62	82.16
BASELINE CHAINAGE	2+030	2+000	1+970	1+940	1+914	1+890	1+860	1+851	1+840	1+810	1+781.15	1+750	1+721	1+690



TOP OF DYKE ELEVATION	83.74	83.71	83.68	83.64	83.61	83.59	83.58	83.56	83.54	83.52	83.50	83.47	83.45
EXISTING GROUND ELEVATION	82.16	82.00	82.18	82.23	81.97	81.78	81.95	81.78	81.60	81.46	81.31	81.30	81.27
BASELINE CHAINAGE	1+690	1+660	1+630	1+600	1+570	1+540	1+535	1+506.75	1+480	1+450	1+420	1+390	1+360

Date	Revisions

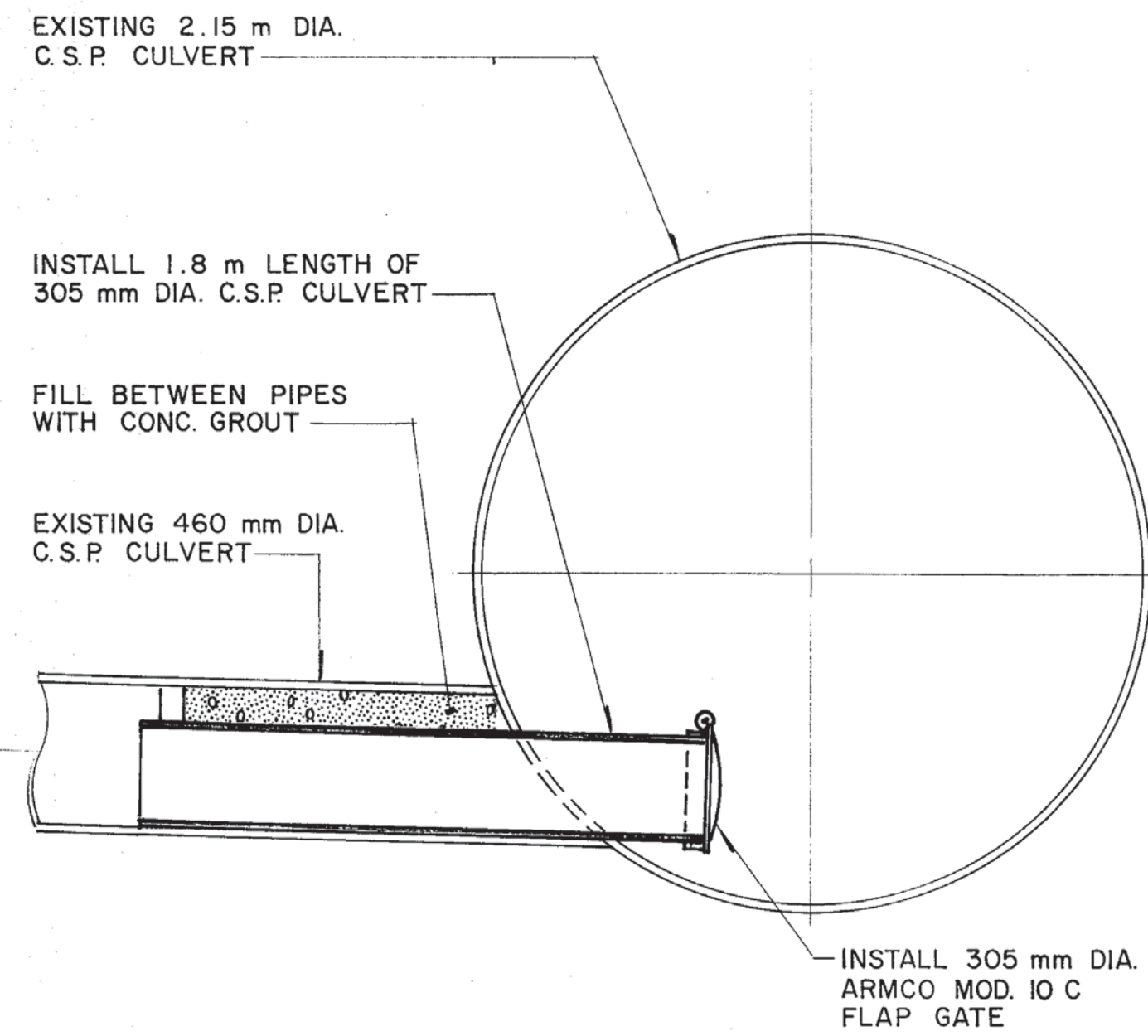


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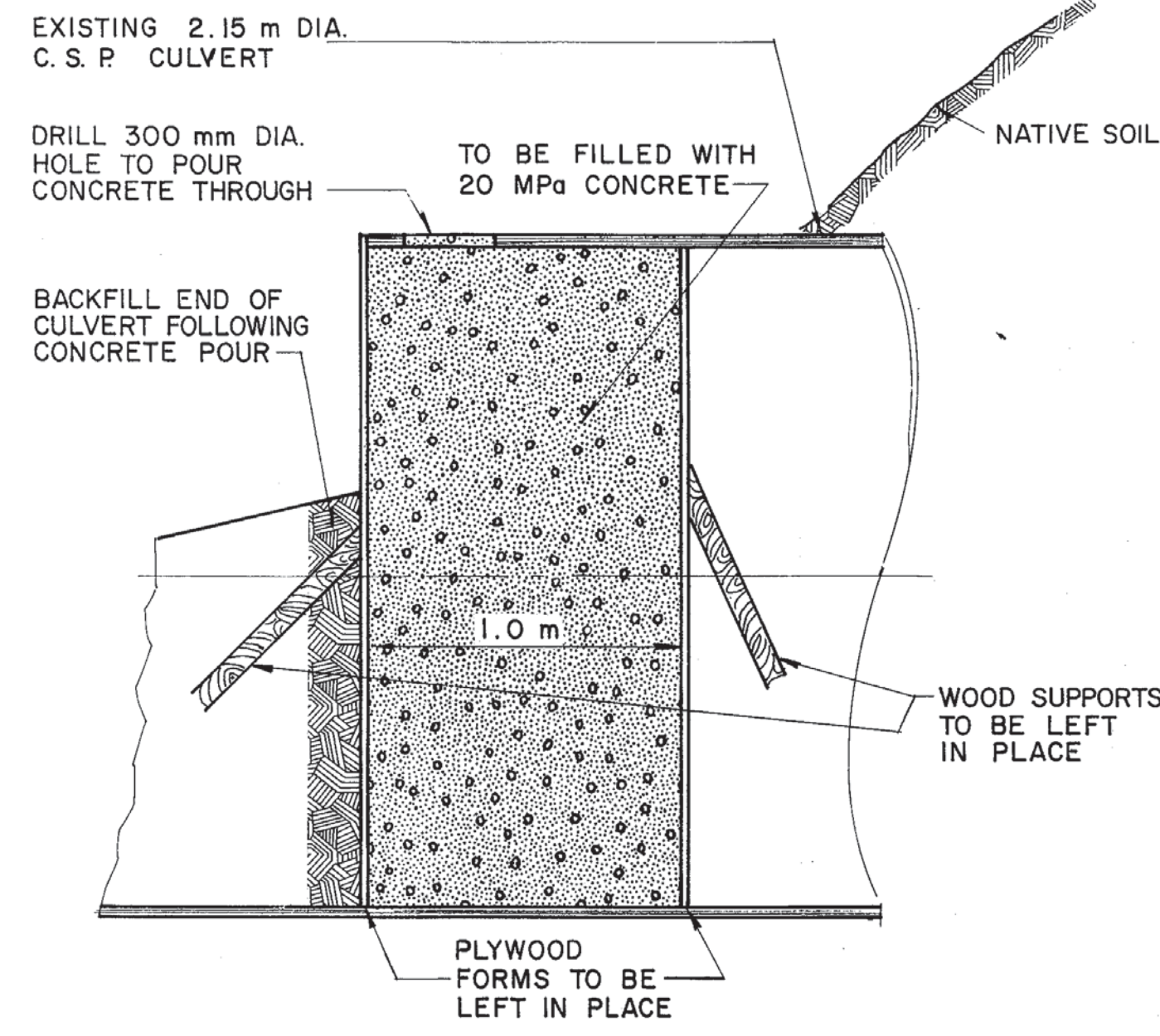
DUFFIN CREEK
PICKERING FLOOD PROTECTION DYKE
PROFILE (STA. 1+345 TO STA. 1+690)
& (STA. 1+690 TO STA. 2+030)

Simcoe

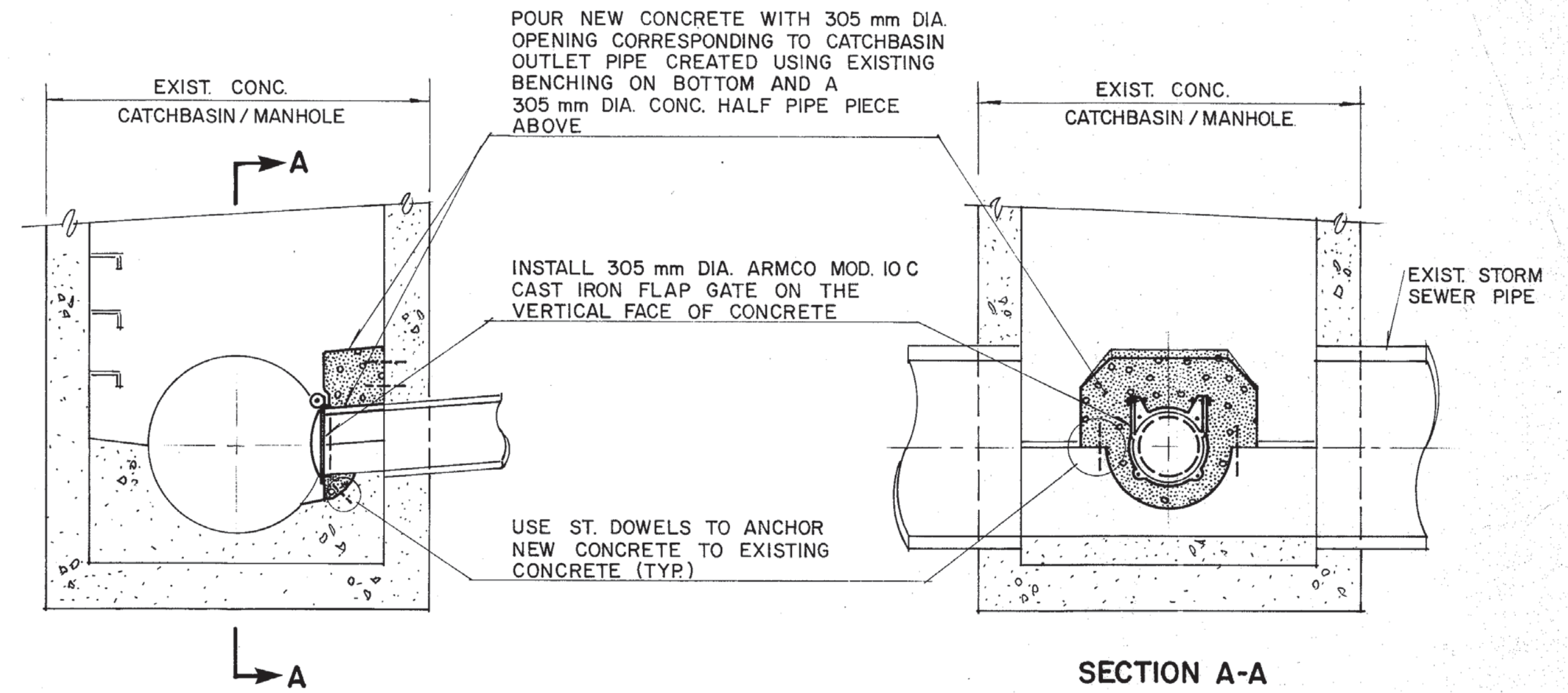
Simcoe Engineering Group Limited • Consulting Engineers
Design RLS, JM
Drawn JH
Checked BK
Scale Horiz 1:500
Vert 1:50
Date JULY 1985
Drawing No. **8**



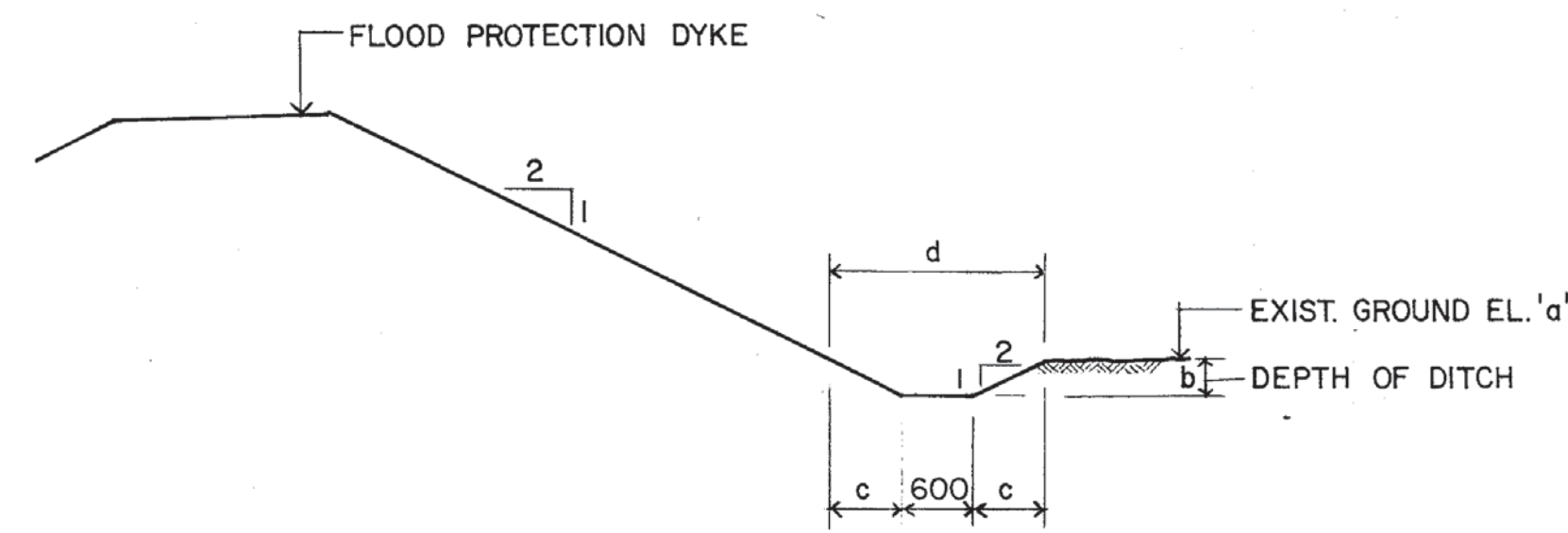
3 DETAIL
DWG.4 SCALE 1:20



4 DETAIL
DWG.4 SCALE 1:20



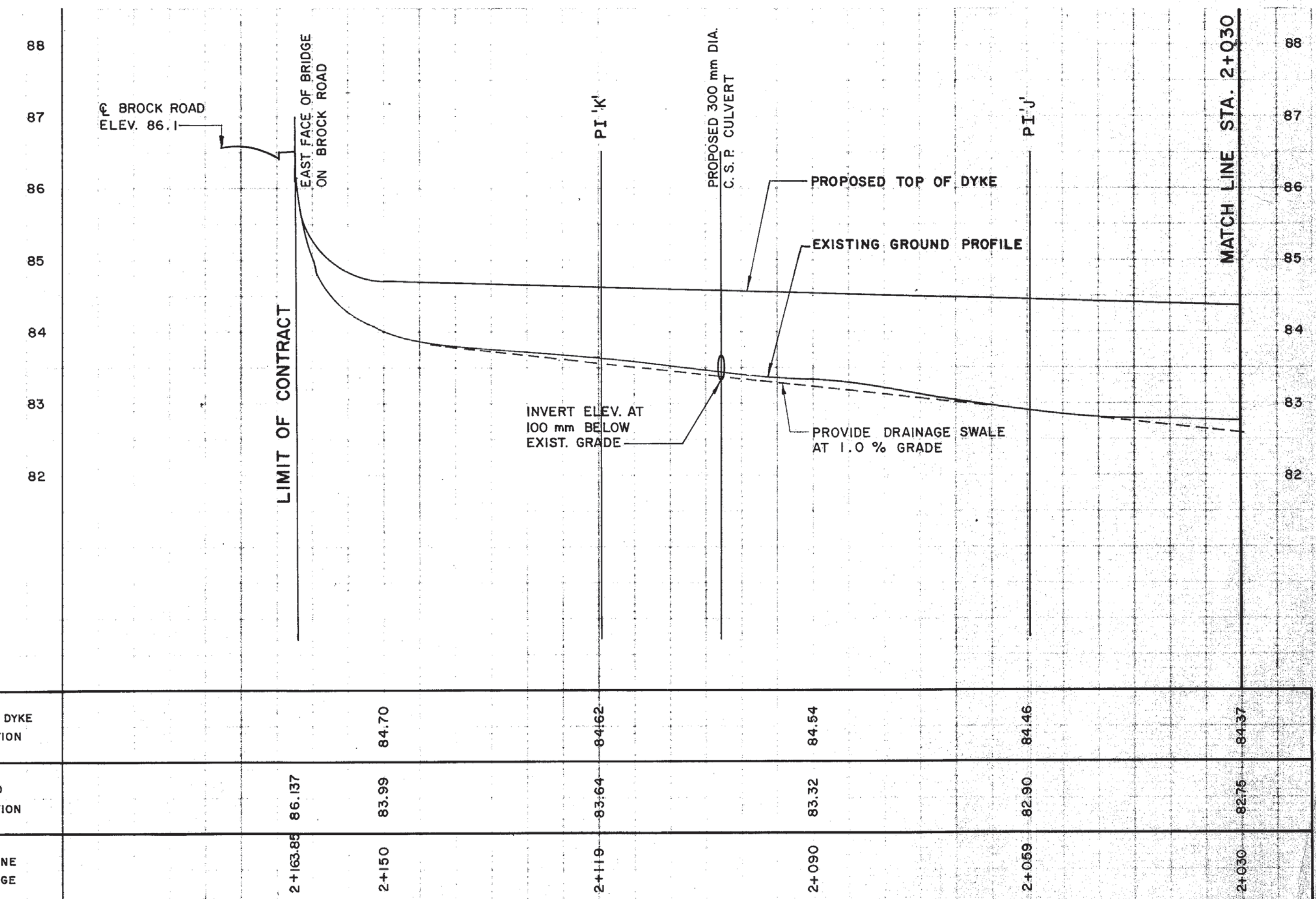
5 DETAIL
DWG.5 SCALE 1:25



TYPICAL DITCH SECTION
N.T.S.

TABLE OF DIMENSIONS

STA.	GROUND ELEV. a (m)	b (m)	c (m)	d (m)
1+030	80.55	0.550	1.10	2.80
1+060	80.70	0.380	1.16	2.92
1+090	80.55	0.310	0.62	1.84
1+120	80.62	0.260	0.52	1.64
1+150	80.85	0.370	0.74	2.08
1+180	80.95	0.390	0.70	2.00
1+210	81.01	0.290	0.58	1.76
1+240	81.01	0.170	0.34	1.28
1+300	81.02	0.320	0.64	1.88
1+330	81.27	0.435	0.87	2.34
1+360	81.27	0.300	0.60	1.80
1+390	81.30	0.195	0.39	1.38
1+420	81.31	0.070	0.14	0.88
1+450	81.46	0.085	0.17	0.94
1+480	81.60	0.090	0.18	0.96
1+510	81.78	0.135	0.27	1.14
1+540	81.78	-	-	-
1+630	82.18	0.350	0.70	2.00
1+660	82.00	0.110	0.22	1.04
1+690	82.16	0.210	0.42	1.44
1+720	82.62	0.610	1.22	3.04
1+750	82.51	0.440	0.88	2.36
1+780	82.08	-	-	-
1+860	82.74	0.145	0.29	1.18
1+890	82.86	0.115	0.23	1.06
1+970	82.31	-	-	-
2+000	82.65	0.350	0.70	2.00
2+030	82.75	0.150	0.30	1.20
2+060	82.90	-	-	-
2+090	83.32	0.120	0.24	1.08
2+120	83.64	0.140	0.28	1.16
2+150	83.99	0.190	0.38	1.36



Date	Revisions

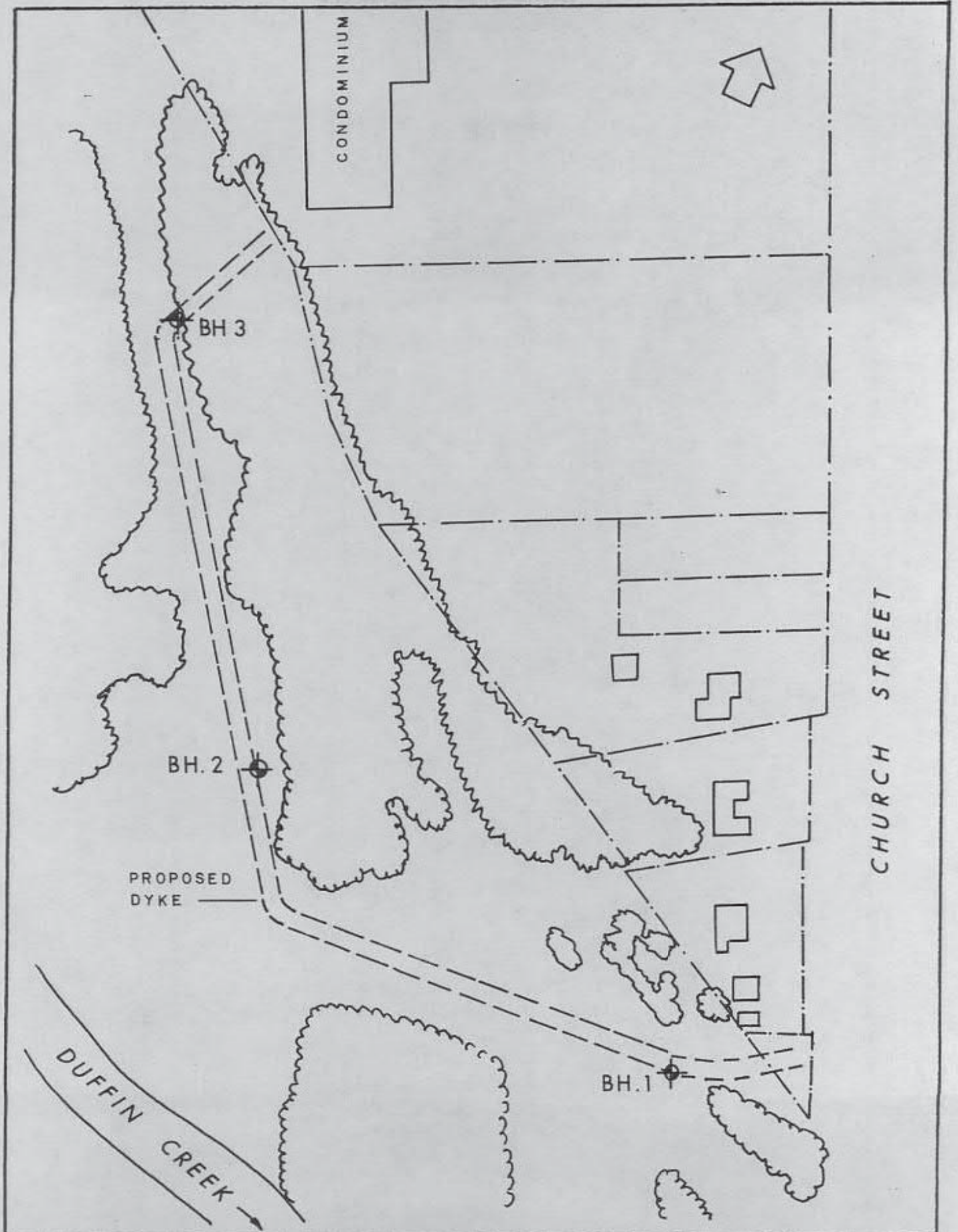
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DUFFIN CREEK
PICKERING FLOOD PROTECTION DYKE
PROFILE (STA. 2+030 TO LIMIT OF CONTRACT)
DETAIL NO 2

Simcoe
Simcoe Engineering Group Limited • Consulting Engineers
Design RLS, JM
Drawn JH
Checked BK
Scale Horiz. 1:500
Vert. 1:50
Date JULY 1985
Drawing No. **9**
319.03-A1-1945

APPENDIX B

1984 Ajax Dyke Geotechnical Investigation Logs



BOREHOLE LOCATION PLAN

G-84.0709

ENCL. 1

LOG OF BOREHOLE ..1.....

Our Reference No. C-84,0709

Enclosure No. 2

CLIENT: SIMCOE ENGINEERING LTD.
 PROJECT: DUFFIN CREEK DYKE
 LOCATION: PICKERING, ONTARIO
 DATUM ELEVATION: GEODETIC

DRILLING DATA

Method: AUGERING
 Diameter: 125 mm
 Date: August 3, 1984

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _l	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
		STRAT. PLOT	NUMBER	TYPE			'N' VALUES	20	40	60	80					
78.6	Ground Surface															
0.0	TOPSOIL															
78.3			1	SS	24											
0.3	SILT Organic Some Sand, Shells, Very Slightly Plastic Very Loose to Loose															
			2	SS	7											
		Moist ----- Wet		3	SS	4										
		Brown ----- Grey		4	SS	3										
	Sandy															
75.4	Wood															
3.2	Silty SAND & GRAVEL		5	SS	25											
75.1	Compact															
3.5	END OF BOREHOLE															

LOG OF BOREHOLE ..2.....

Our Reference No. G-84.0709

Enclosure No. 3

CLIENT: SIMCOE ENGINEERING LTD.
 PROJECT: DUFFIN CREEK DYKE
 LOCATION: PICKERING, ONTARIO
 DATUM ELEVATION: GEODETIC

DRILLING DATA

Method: AUGERING
 Diameter: 125 mm
 Date: August 3, 1984

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH m	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20	40	60	80	100	W _p	W		
78.4	Ground Surface															
0.0	TOPSOIL															
78.1			1	SS	4											
0.3	Brown SILT Organic Some Sand, Shells	Moist Wet														
			2	SS	8											
	Slightly Plastic Loose		3	SS	5	H										
75.8			4	SS	6											
2.6	Grey Silty SAND & GRAVEL Some Organic Matter Compact	Wet														
			5	SS	16											
74.9																
3.5	END OF BOREHOLE															

LOG OF BOREHOLE ..3.....

Our Reference No. G-84.0709

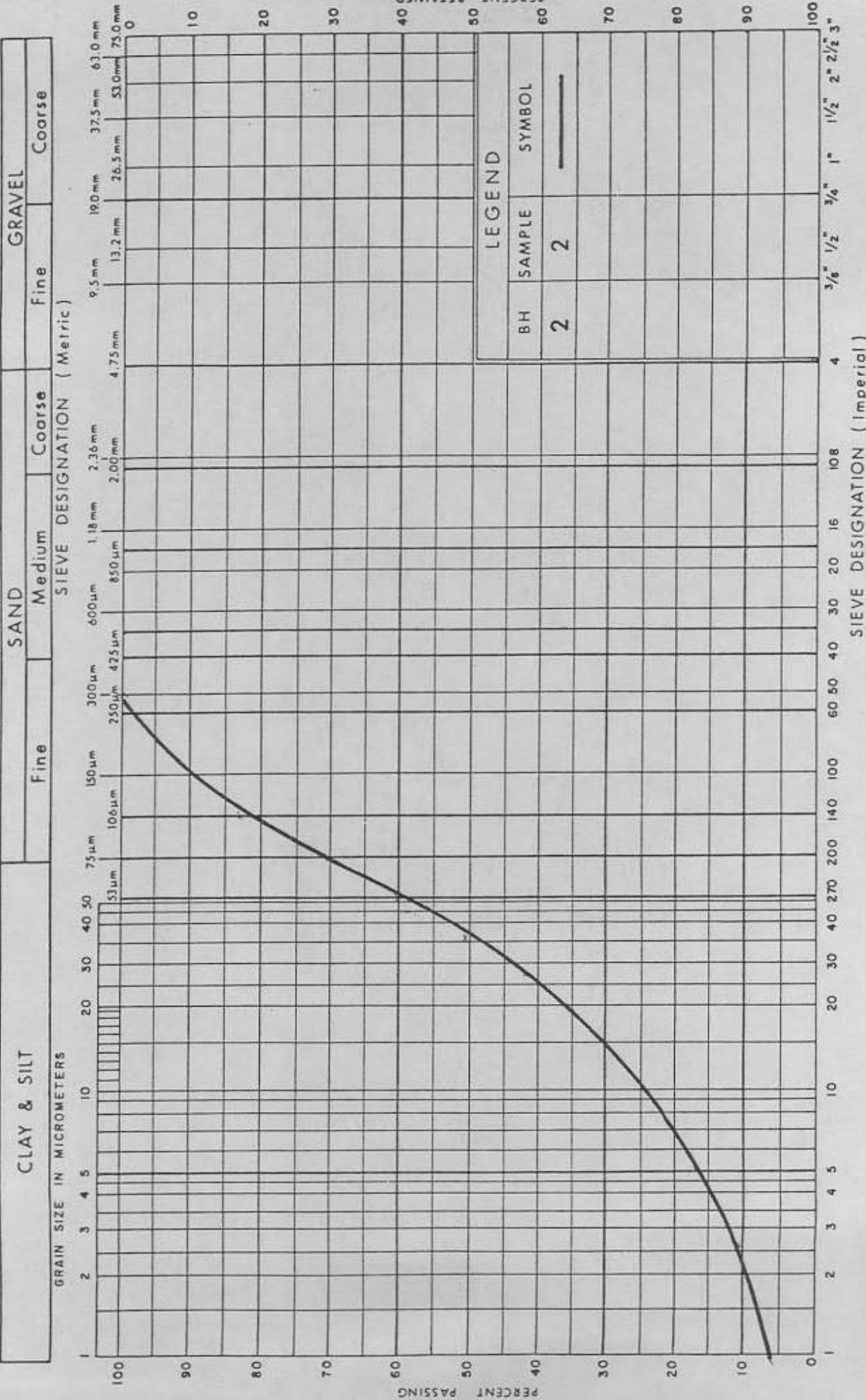
Enclosure No. 4

CLIENT: SIMCOE ENGINEERING LTD.
 PROJECT: DUFFIN CREEK DYKE
 LOCATION: PICKERING, ONTARIO
 DATUM ELEVATION: GEODETIC

DRILLING DATA
 Method: AUGERING
 Diameter: 125 mm
 Date: August 3, 1984

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH m	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20	40	60	80	100	W _p		
78.6	Ground Surface														
0.0	TOPSOIL		1	SS	7										
78.3															
0.3	Brown SILT Organic Some Sand, Shells Slightly Plastic Loose		2	SS	7										
76.0			4	SS	15										
2.6	Grey, Compact wet Silty SAND & GRAVEL														
75.5															
3.1	Grey, Dense Sandy Silt TILL		5	SS	30										
75.1															
3.5	END OF BOREHOLE														

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

SILT, sandy, organic

GEO-CANADA

FIG No 1

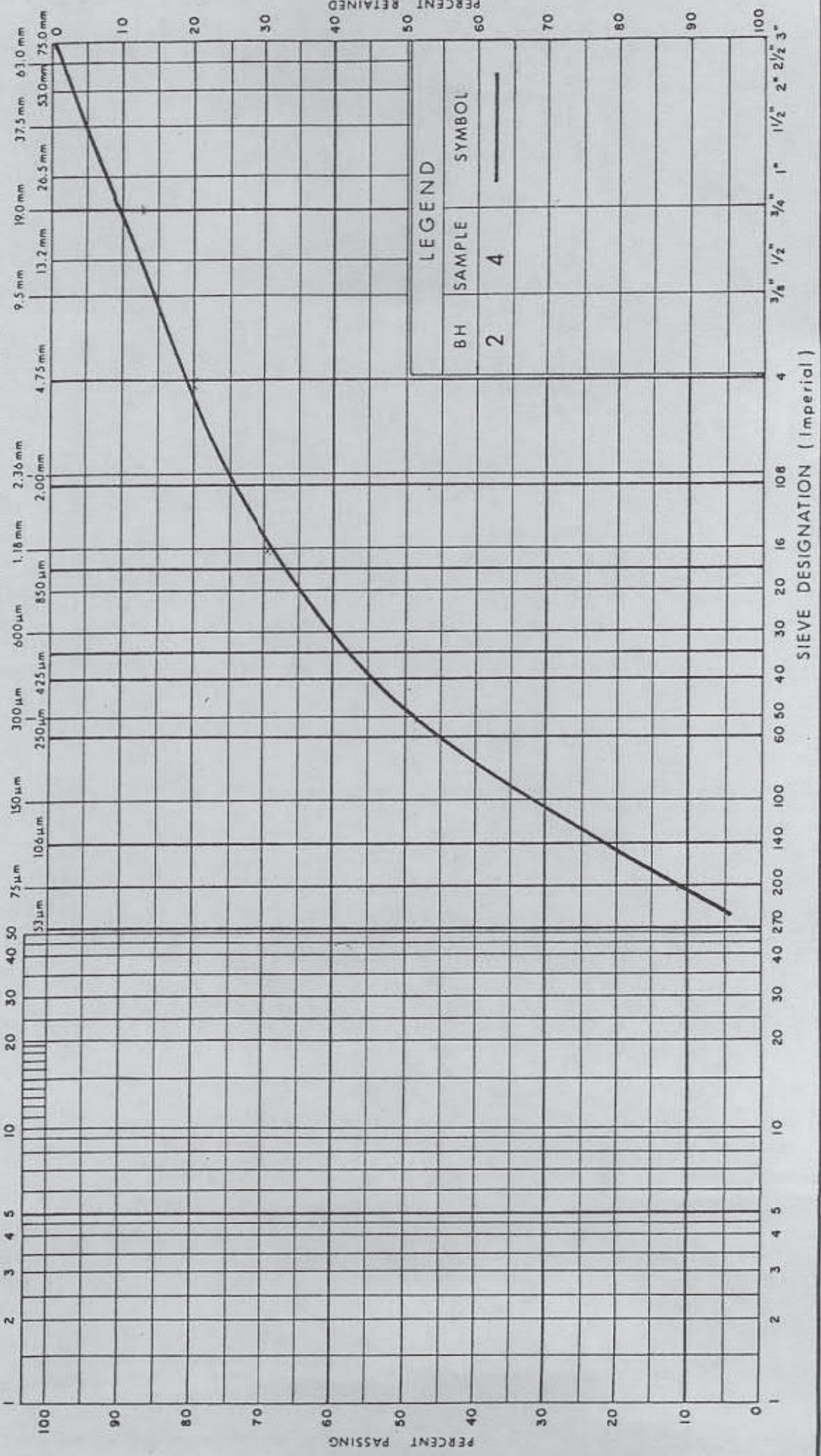
REF. No G-84.0709

DATE AUG. 1984

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT		SAND			GRAVEL	
Fine		Medium	Coarse	Fine	Coarse	

SIEVE DESIGNATION (Metric)



GRAIN SIZE DISTRIBUTION
SILTY SAND & GRAVEL

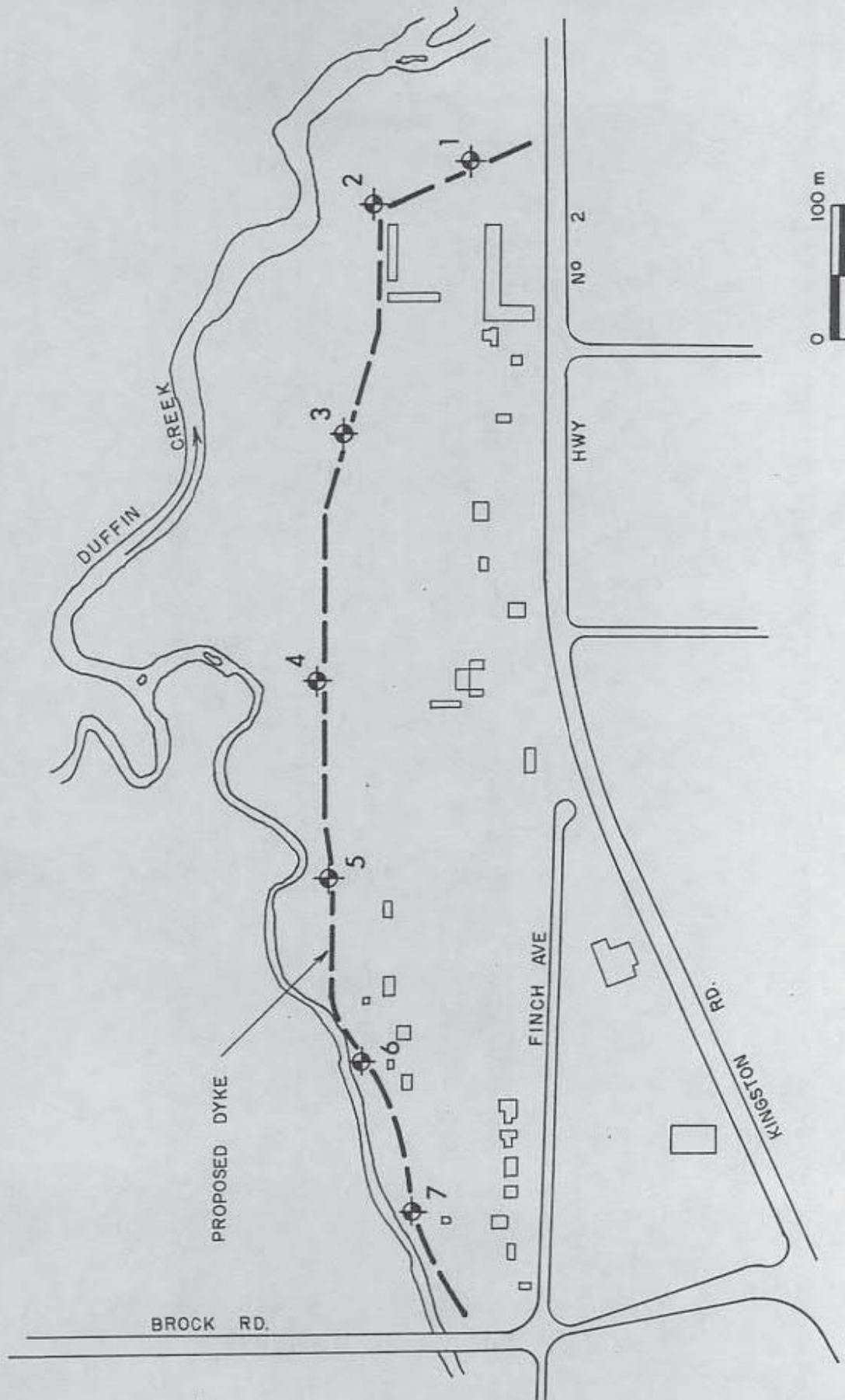
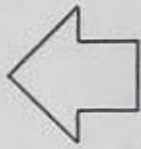
FIG No 2

REF. No G-84.0709

DATE AUG. 1984

APPENDIX C

1985 Pickering Dyke Geotechnical Investigation Logs



BOREHOLE LOCATION PLAN

G-85.0706

ENCL. 1

PROJECT No. G-85.0706 LOG OF BOREHOLE.....1.....

CLIENT: M.T.R.C.A. c/o Simcoe Engineering

PROJECT: Duffin Creek Dyke

LOCATION: Pickering, Ontario

DATUM ELEVATION: Geodetic

DRILLING DATA

Method: Augering

Diameter: 100 mm

Date: July 22, 1985

m ELEV. DEPTH.	SOIL PROFILE		SAMPLE			GROUND WATER	REMARKS (%)	
	DESCRIPTION	SYMBOL	NUMBER	TYPE	N' BLS / 0.3			
80.6	Ground Surface							
0.0	300 mm Topsoil		1	SS	47	 W.L. 79.1 m	GR. SA. SI. CL. w	
	FILL silty sand, some gravel brown dense to compact							
	<u>damp</u> moist							
78.8			2	SS	18			
1.8	Organic SANDY SILT trace gravel grey, black mottled wet, loose							
78.1			3	SS	7			
2.5	SAND AND GRAVEL trace silt grey, saturated compact							
77.1			4	SS	25			
			5	SS	27		65 30 5 0 17	
3.5	END OF BOREHOLE							

PROJECT No. G-85.0706 LOG OF BOREHOLE.....2.....

CLIENT: M.T.R.C.A. c/o Simcoe Engineering
 PROJECT: Duffin Creek Dyke
 LOCATION: Pickering, Ontario
 DATUM ELEVATION: Geodetic

DRILLING DATA

Method: Augering
 Diameter: 100 mm
 Date: July 22, 1985

m	SOIL PROFILE		SAMPLE			GROUND WATER	REMARKS
	ELEV. DEPTH.	DESCRIPTION	SYMBOL	NUMBER	TYPE		
80.9	Ground Surface						%
0.0	FILL		[Handwritten symbol]				GR. SA. SI. CL. w
80.4	brown silty sand, some gravel						
0.5	50 mm Topsoil		[Handwritten symbol]	1	SS	24	
	brown SILTY SAND						
	compact to dry		[Handwritten symbol]	2	SS	7	1 49 50 0 24
79.3	loose to moist SANDY SILT						
1.6	ORGANIC SILT		[Handwritten symbol]				
	with fine sand						
	dark brown		[Handwritten symbol]	3	SS	3	
78.3	wet very loose						W.L. 78.8 m
2.6	SAND		[Handwritten symbol]				
	fine to medium, trace shells						
77.7	grey, wet, loose		[Handwritten symbol]	4	SS	8	
3.2	SAND AND GRAVEL						
79.4	wet, loose		[Handwritten symbol]				
3.5	END OF BOREHOLE						

PROJECT No. G-85.0706 LOG OF BOREHOLE...3.....

CLIENT: M.T.R.C.A. c/o Simcoe Engineering

PROJECT: Duffin Creek Dyke

LOCATION: Pickering, Ontario

DATUM ELEVATION: Geodetic

DRILLING DATA

Method: Augering

Diameter: 100 mm

Date: July 22, 1985

m ELEV. DEPTH.	SOIL PROFILE		SAMPLE			GROUND WATER	REMARKS				
	DESCRIPTION	SYMBOL	NUMBER	TYPE	N' BLS / 0.3		%				
81.2	Ground Surface										
0.0	Topsoil VERY FINE SAND brown, damp loose		1	SS	10		GR.	SA.	SI.	CL.	w
80.3											
0.9	ORGANIC SILT sandy brown, loose		2	SS	6		2	48	50	0	13
79.8											
1.4	SAND fine to medium some silt, shells brown, moist, compact		3	SS	16		4	76	20	0	19
79.0											
2.2	SILT brown, wet, loose		4	SS	8						
78.6											
2.6	SAND AND GRAVEL trace of silt brown wet very dense		5	SS	52		60	35	5	0	15
77.7											
2.5	END OF BOREHOLE										

▽
W.L.
79.3 m

PROJECT No. G-85.0706 .. LOG OF BOREHOLE ... 4

CLIENT: M.T.R.C.A. c/o Simcoe Engineering
 PROJECT: Duffin Creek Dyke
 LOCATION: Pickering, Ontario
 DATUM ELEVATION: Geodetic

DRILLING DATA

Method: Augering
 Diameter: 100 mm
 Date: July 22, 1985

m ELEV. DEPTH.	SOIL PROFILE		SAMPLE			GROUND WATER	REMARKS
	DESCRIPTION	SYMBOL	NUMBER	TYPE	N' BLS / 0.3		
81.8	Ground Surface						
0.0	FINE SAND damp to moist loose to compact	· · · · ·	1	SS	7	▽	
		· · · · ·	2	SS	11		
		· · · · ·					
	shells	· · · · ·	A				
79.7	brown grey	· · · · ·	3 B	SS	10		
12.1	ORGANIC SILT	⌈ ⌋	A				
79.3	black, wet, loose	⌈ ⌋	4	SS	38		
2.5	SAND AND GRAVEL	· · · · ·	B				
78.9	grey, wet, dense	· · · · ·					
2.9	CLAYEY SILT TILL	⌈ ⌋					
78.3	grey well cemented, hard	⌈ ⌋	5	SS	36		
3.5	END OF BOREHOLE						

PROJECT No. G-85.0706 LOG OF BOREHOLE...5.....

CLIENT: M.T.R.C.A. c/o Simcoe Engineering
 PROJECT: Duffin Creek Dyke
 LOCATION: Pickering, Ontario
 DATUM ELEVATION: Geodetic

DRILLING DATA
 Method: Augering
 Diameter: 100 mm
 Date: July 22, 1985

m ELEV. DEPTH.	SOIL PROFILE		SAMPLE			GROUND WATER	REMARKS	
	DESCRIPTION	SYMBOL	NUMBER	TYPE	N' BLS / 0.3			
82.2	Ground Surface							
0.0	FINE SAND trace silt brown, dry loose	}	1	SS	3	80.2 m		
				2	SS			8
80.4	shells		3	SS	14			
1.8	SAND AND GRAVEL trace silt, shells grey, wet compact	o						
				4	SS			13
78.8			5	SS	3			
3.4	CLAYEY SILT trace sand, gravel grey soft	/				C _u = 19 KPa		
				6	SS	4	C _u = 36 KPa	
				7	SS	4	C _u = 45 KPa	
				8	SS	4	C _u = 28 KPa	
75.3								
6.9	END OF BOREHOLE							

PROJECT No. G-85.0706 LOG OF BOREHOLE...6.....

CLIENT: M.T.R.C.A. c/o Simcoe Engineering
 PROJECT: Duffin Creek Dyke
 LOCATION: Pickering, Ontario
 DATUM ELEVATION: Geodetic

DRILLING DATA
 Method: Augering
 Diameter: 100 mm
 Date: July 22, 1985

m ELEV. DEPTH.	SOIL PROFILE		SAMPLE			GROUND WATER	REMARKS
	DESCRIPTION	SYMBOL	NUMBER	TYPE	'N' BLS / 0.3		
82.6	Ground Surface						%
0.0	FINE SAND some silt brown dry to wet loose	.	1	SS	5	W.L. 81.1 m	GR. SA. SI. CL. w
							0 70 30 0 16
80.8			A	3	SS		18
1.8	SAND AND GRAVEL with some silt brown, wet compact	o	B				
80.0				4	SS	41	
2.6	CLAYEY SILT TILL grey well cemented hard	/ /					
79.1				5	SS	100	
3.5	END OF BOREHOLE						

PROJECT No. G-85.0706 LOG OF BOREHOLE 7

CLIENT: M.T.R.C.A. c/o Simcoe Engineering

PROJECT: Duffin Creek Dyke

LOCATION: Pickering, Ontario


DATUM ELEVATION: Geodetic

DRILLING DATA

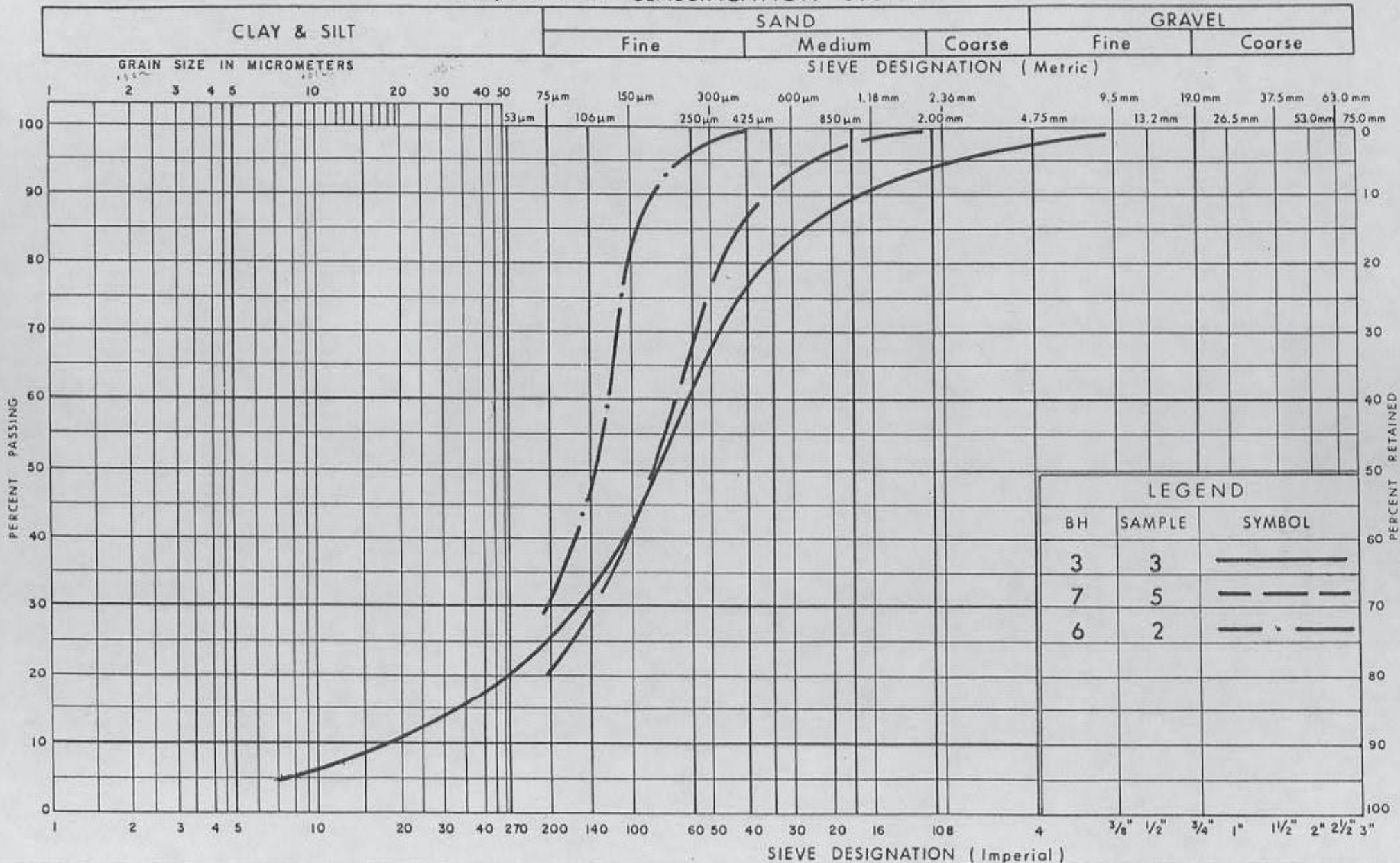
Method: Augering

Diameter: 100 mm

Date: July 22, 1985

m ELEV. DEPTH.	SOIL PROFILE		SAMPLE			GROUND WATER	REMARKS				
	DESCRIPTION	SYMBOL	NUMBER	TYPE	'N' BLS / 0.3		%				
82.8	Ground Surface										
0.0	FINE SAND trace silt brown dry loose	.	1	SS	5	 W.L. 81.5 m	GR.	SA.	SI.	CL.	w
81.8		.	2	SS	17						
1.0	SAND AND GRAVEL with some silt brown moist to wet compact	o	3	SS	24		45	50	5	0	11
79.9		o	4	SS	18						11
2.9	FINE SAND with some silt grey, saturated, compact	.	5	SS	11		0	85	15	0	
79.3		.									
3.5	END OF BOREHOLE										

UNIFIED SOIL CLASSIFICATION SYSTEM

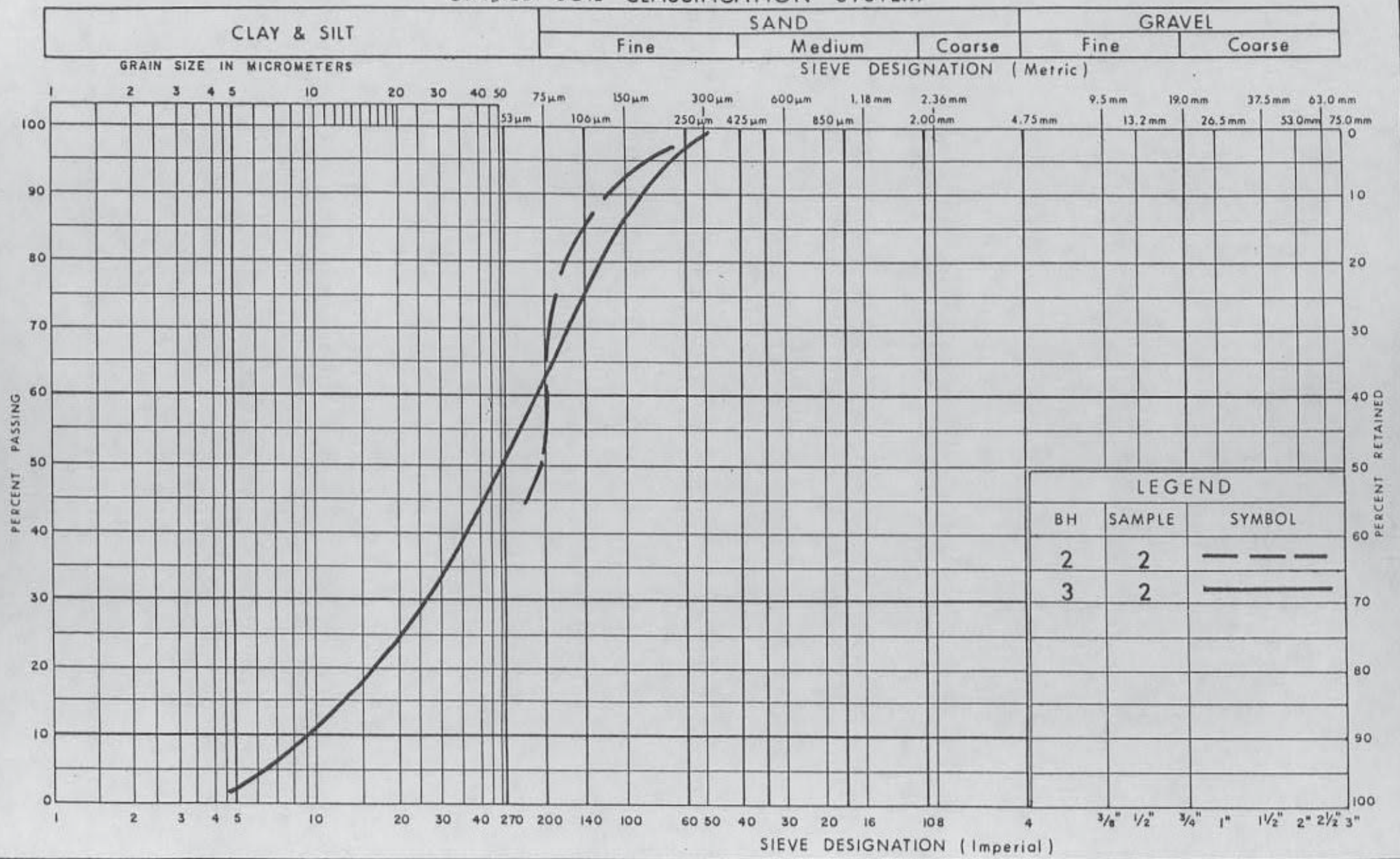


GEO-CANADA

GRAIN SIZE DISTRIBUTION
FINE SAND
some silt

FIG No 1
REF. No G-85.0706
DATE AUGUST 1985

UNIFIED SOIL CLASSIFICATION SYSTEM



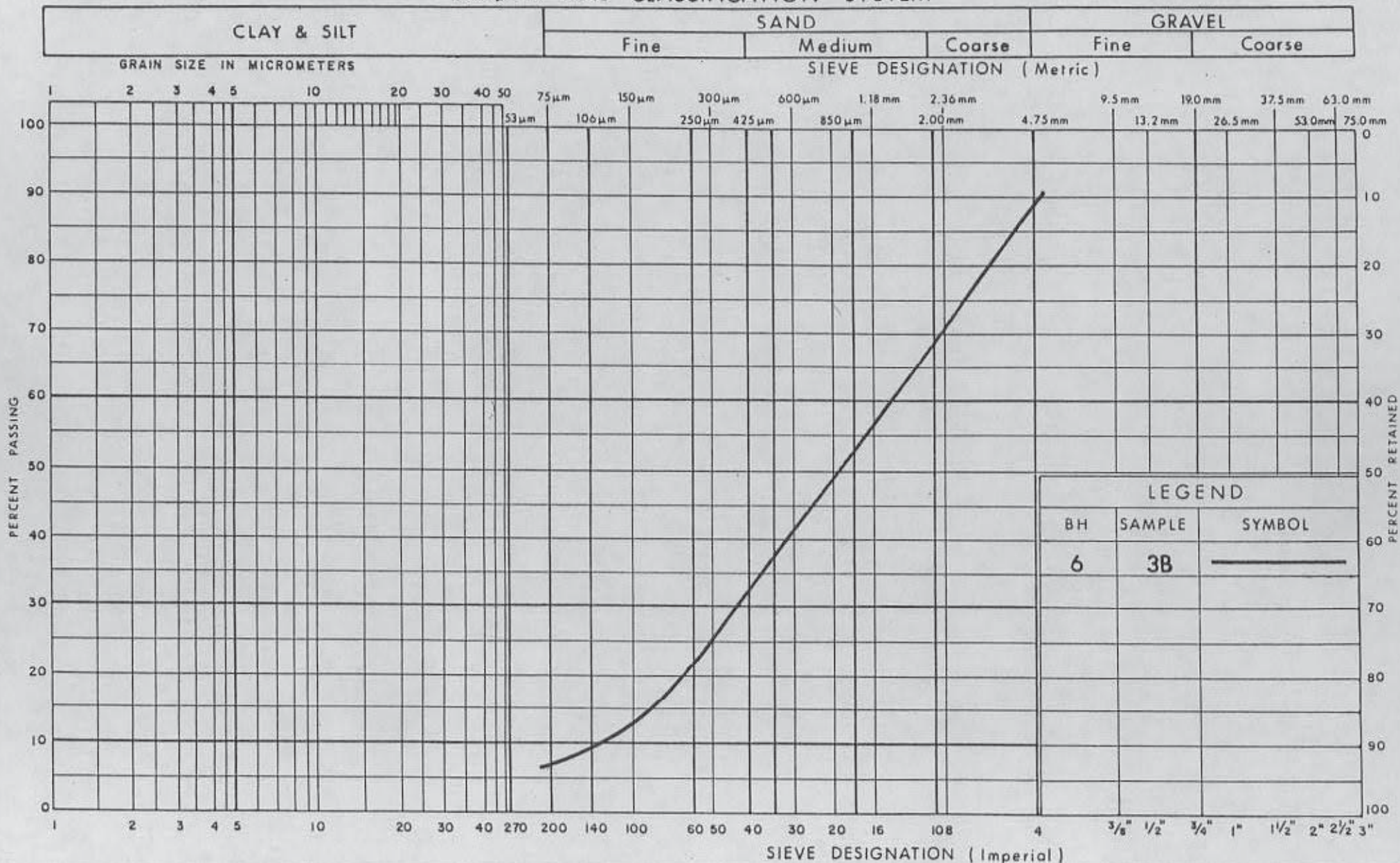
LEGEND		
BH	SAMPLE	SYMBOL
2	2	- - - - -
3	2	—————

GEO-CANADA

GRAIN SIZE DISTRIBUTION
 SILT
 with fine sand

FIG No 2
 REF. No G-85.0706
 DATE AUGUST 1985

UNIFIED SOIL CLASSIFICATION SYSTEM

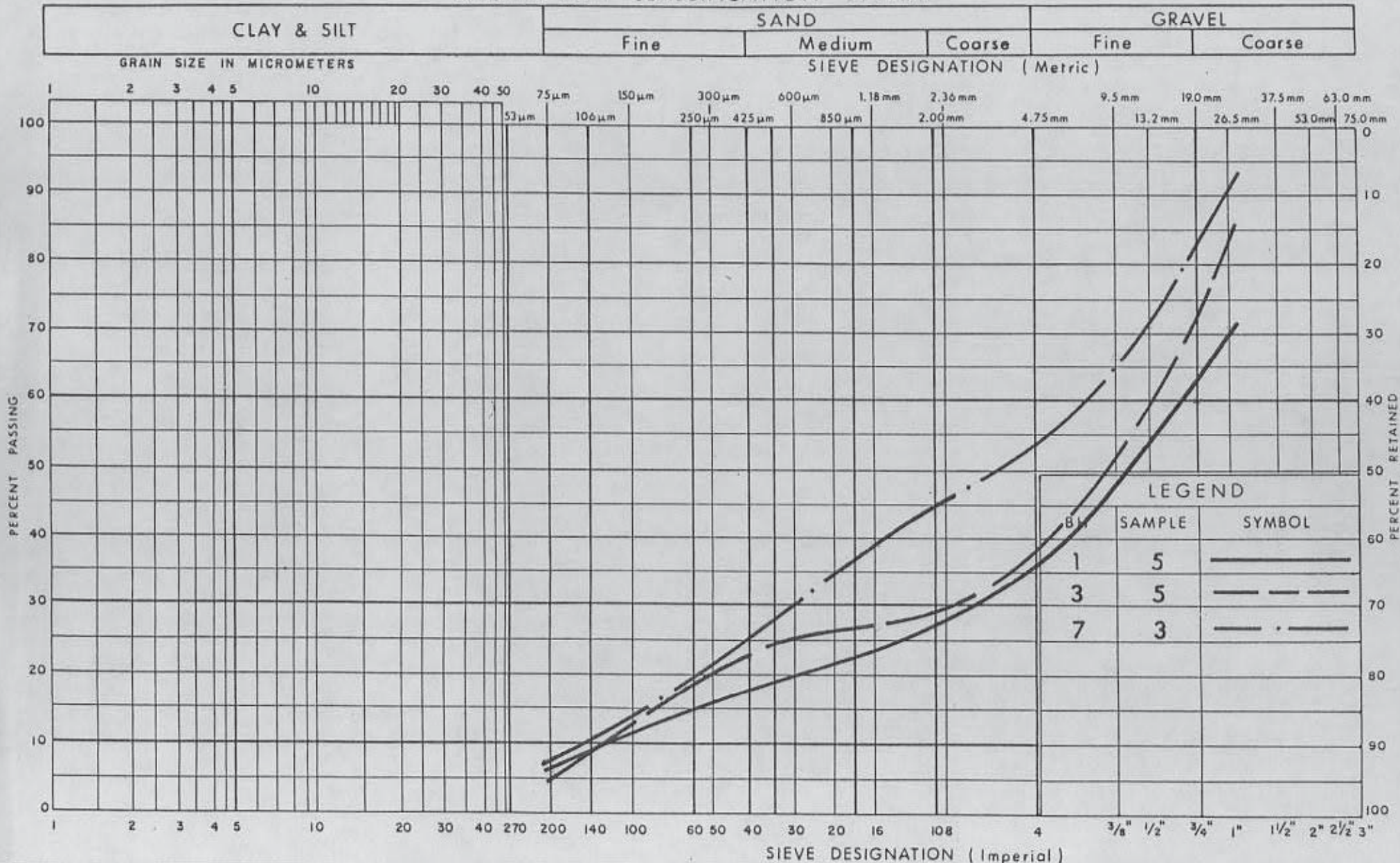


GEO-CANADA

GRAIN SIZE DISTRIBUTION
SAND
 trace gravel, silt

FIG No 3
REF. No G-85.0706
DATE AUGUST 1985

UNIFIED SOIL CLASSIFICATION SYSTEM



GEO-CANADA

GRAIN SIZE DISTRIBUTION
SAND and GRAVEL
trace silt

FIG No 4
REF. No G-85.0706
DATE AUGUST 1985

APPENDIX D

2017 Ajax and Pickering Dyke Geotechnical
Investigation Logs



Enclosure 1A: Notes on Sample Descriptions

1. Each soil stratum is described according to the *Modified Unified Soil Classification System*. The compactness condition of cohesionless soils (SPT) and the consistency of cohesive soils (undrained shear strength) are defined according to Canadian Foundation Engineering Manual, 4th Edition. Different soil classification systems may be used by others. Please note that a description of the soil strata is based on visual and tactile examination of the samples augmented with field and laboratory test results, such as a grain size analysis and/or Atterberg Limits testing. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.
2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional preliminary geotechnical site investigation.
3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.



Enclosure 1B: Explanation of Terms Used in the Record of Boreholes

Sample Type

AS	Auger sample
BS	Block sample
CS	Chunk sample
DO	Drive open
DS	Dimension type sample
FS	Foil sample
NR	No recovery
RC	Rock core
SC	Soil core
SS	Spoon sample
SH	Shelby tube Sample
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

Penetration Resistance

Standard Penetration Resistance (SPT), N:

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

PM – Samples advanced by manual pressure

WR – Samples advanced by weight of sampler and rod

WH – Samples advanced by static weight of hammer

Dynamic Cone Penetration Resistance, N_d :

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

Piezo-Cone Penetration Test (CPT):

An electronic cone penetrometer with a 60 degree conical tip and a projected end area of 10 cm² pushed through ground at a penetration rate of 2 cm/s. Measurement of tip resistance (Q_t), porewater pressure (PWP) and friction along a sleeve are recorded electronically at 25 mm penetration intervals.

Textural Classification of Soils (ASTM D2487)

Classification	Particle Size
Boulders	> 300 mm
Cobbles	75 mm - 300 mm
Gravel	4.75 mm - 75 mm
Sand	0.075 mm – 4.75 mm
Silt	0.002 mm-0.075 mm
Clay	<0.002 mm(*)

(*) Canadian Foundation Engineering Manual (4th Edition)

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

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

Soil Description

a) Cohesive Soils(*)

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

(*) Hierarchy of Shear Strength prediction

1. Lab triaxial test
2. Field vane shear test
3. Lab. vane shear test
4. SPT “N” value
5. Pocket penetrometer

b) Cohesionless Soils

Compactness Condition (Formerly Relative Density)	SPT “N” Value
Very loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

Soil Tests





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

PROJECT: Geotechnical Investigation for Duffins Creek Dyke Rehabilitation		DRILLING DATA	
CLIENT: Valdor Engineering Inc.	METHOD: Continuous Split Spoon	DIAMETER: 51 mm	
PROJECT LOCATION: Pickering & Ajax, ON	FIELD ENGINEER: CS	DATE: 2017-09-12	
DATUM: N/A	SAMPLE REVIEW: DX	REF. NO.: 17-1967G	
BH LOCATION: See Borehole Location Plan	CHECKED: DL	ENCL. NO.: 11	

ELEV. DEPTH (m)	SOIL PROFILE DESCRIPTION	STRATA PLOT	SAMPLES			GROUND WATER	ELEVATION	DYNAMIC PENETRATION TEST				Plastic Limit w _p	Natural Moisture Content w	Liquid Limit w _L	WATER CONTENT (%)	UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
			NUMBER	TYPE	"N" BLOWS/0.3m			○ SPT	≧ Cone	blows/0.3m	blows/0.3m						
0.0	TOPSOIL: (40 mm) FILL: sandy silt, trace clay, trace gravel, trace rootlets, layers of silty sand, pockets of sand, brown, moist, compact		1	SS	12	Concrete											
1.0			2A	SS	20												
1.2	FILL: clayey silt, sandy, trace gravel, trace organics, layers of sandy silt, dark brown, moist, very stiff		2B	SS													
1.5	FILL: sandy silt, some clay, trace gravel, some organics, layers of clayey silt, containing wood fragments, dark grey, moist, loose to compact		3	SS	16	Bentonite											
2.0			4	SS	10												
3.0	FILL: silty sand, trace gravel, layers of organic clayey silt, brown, moist, compact		5	SS	23												8 47 35 10
3.8	FILL: sandy silt, trace to some clay, trace gravel, some organics, trace rootlets, zones of clayey silt, greyish brown to dark brown, moist, compact		6	SS	14	4.5 mBGL Oct 10											
4.5			7	SS	17	Sand											
5.0			8	SS	17	Screen											
6.0	—containing wood pieces																
6.1	END OF BOREHOLE Notes: 1) Water encountered at a depth of 5.8 m below ground surface (mBGS) during drilling. 2) Borehole was open and dry upon completion of drilling. 3) 38 mm dia. monitoring well was installed in borehole upon completion of drilling. Water Level Readings Date W. L. Depth (mBGS) Oct. 10, 2017 4.45 Oct. 19, 2017 4.48																

01 - GEOPRO SOIL LOG - GEOPRO 17-1967GT BH LOG PROJECT DATA 20171020 - EW - JY.GPJ - 2017-10-25 09:18

GROUNDWATER ELEVATIONS

Measurement    

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

PROJECT: Geotechnical Investigation for Duffins Creek Dyke Rehabilitation		DRILLING DATA	
CLIENT: Valdor Engineering Inc.	METHOD: Continuous Split Spoon	DIAMETER: 51 mm	
PROJECT LOCATION: Pickering & Ajax, ON	FIELD ENGINEER: CS	DATE: 2017-09-15	
DATUM: N/A	SAMPLE REVIEW: DX	REF. NO.: 17-1967G	
BH LOCATION: See Borehole Location Plan	CHECKED: DL	ENCL. NO.: 12	

ELEV. DEPTH (m)	SOIL PROFILE DESCRIPTION	STRATA PLOT	SAMPLES			GROUND WATER	ELEVATION	DYNAMIC PENETRATION TEST				Plastic Limit w _p	Natural Moisture Content w	Liquid Limit w _L	UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)	
			NUMBER	TYPE	"N" BLOWS/0.3m			20	40	60	80						20
0.0	TOPSOIL: (200 mm)																
0.2	FILL: sandy silt to sand and silt, trace clay, trace gravel, trace organics, trace rootlets, brown, moist, loose to compact		1	SS	10												
0.8	FILL: silty sand, trace gravel, layers of sand and silt, brown, moist, compact		2	SS	17												
1.5	FILL: clayey silt, some sand to sandy, trace gravel, trace organics, layers of sandy silt, pockets of sand, brown, moist, stiff		3	SS	12												
2.3	FILL: sandy silt to sand and silt, trace to some organics, layers of clayey silt, layers of silty sand, dark brown, moist, compact		4	SS	18												
			5	SS	19												
3.8	ORGANIC SILT: trace to some clay, trace to some sand, layers of silty sand, greenish brown, wet, compact		6	SS	12												
4.6	SAND AND SILT TO SILTY SAND: trace clay, trace gravel, some organics, zones of organic silt, greyish brown, wet, loose		7	SS	5											3 39 46 12	
5.3	FINE SAND: some silt, trace clay, trace gravel, greyish brown, wet, loose		8A	SS												3 79 13 5	
5.6	SAND AND GRAVEL: trace to some silt, greyish brown, wet, loose		8B	SS													
6.1	END OF BOREHOLE Notes: 1) Water encountered at a depth of 2.0 m below ground surface (mBGS) during drilling. 2) Water was at a depth of 5.3 mBGS upon completion of drilling. 3) Borehole caved at a depth of 5.3 mBGS upon completion of drilling. 4) 38 mm dia. monitoring well was installed in borehole upon completion of drilling. Water Level Readings Date W. L. Depth (mBGS) Oct. 10, 2017 4.21 Oct. 19, 2017 4.15																

01 - GEOPRO SOIL LOG - GEOPRO 17-1967GT BH LOG PROJECT DATA 20171020 - EW - JY.GPJ - 2017-10-25 09:18

GROUNDWATER ELEVATIONS
 Measurement 1st 2nd 3rd 4th

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

PROJECT: Geotechnical Investigation for Duffins Creek Dyke Rehabilitation		DRILLING DATA	
CLIENT: Valdor Engineering Inc.	METHOD: Continuous Split Spoon	DIAMETER: 51 mm	
PROJECT LOCATION: Pickering & Ajax, ON	FIELD ENGINEER: CS	DATE: 2017-09-12	
DATUM: N/A	SAMPLE REVIEW: DX	REF. NO.: 17-1967G	
BH LOCATION: See Borehole Location Plan	CHECKED: DL	ENCL. NO.: 13	

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION TEST				WATER CONTENT (%)			REMARKS AND GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3m	GROUND WATER	SHEAR STRENGTH (kPa)				W _p	w		W _L
							Unconfined	Field Vane & Sensitivity	Quick Triaxial	Penetrometer			Lab Vane	
0.0	TOPSOIL: (90 mm)													
0.1	FILL: sandy silt to sand and silt, trace clay, trace gravel, trace organics, trace rootlets, brown, moist, compact		1	SS	29	Concrete								
0.8	FILL: sandy silt to silty sand, trace gravel, layers of clayey silt, brown, moist, compact to dense		2	SS	25									
			3	SS	43	Bentonite								
2.3	FILL: sandy silt, trace to some clay, trace gravel, layers of organic silt, brown to greyish brown, moist, compact		4	SS	27									
3.1	ORGANIC SILT: some clay, trace to some sand, trace rootlets, dark brown, wet, loose		5	SS	9	3.5 mBGL Oct 19								
	—layers of sandy silt —layers of silty sand		6	SS	5									
4.6	SAND TO SILTY SAND: trace to some silt, trace to some organics, layers of organic silt, layers of peats, greyish brown to dark brown, wet, very loose to loose		7	SS	4	Sand								
						Screen								
5.3	SANDY SILT: trace clay, trace gravel, layers of silty sand, containing cobbles and boulders, grey, wet, compact		8	SS	20									
6.1	END OF BOREHOLE Notes: 1) Water encountered at a depth of 5.2 m below ground surface (mBGS) during drilling. 2) 38 mm dia. monitoring well was installed in borehole upon completion of drilling. Water Level Readings Date W. L. Depth (mBGS) Oct. 19, 2017 3.54													

01 - GEOPRO SOIL LOG - GEOPRO 17-1967GT BH LOG PROJECT DATA 20171020 - EW - JY.GPJ - 2017-10-25 09:18

GROUNDWATER ELEVATIONS
 Measurement: 1st, 2nd, 3rd, 4th
GRAPH NOTES + 3, x 3: Numbers refer to Sensitivity ▲ = 3% Strain at Failure

PROJECT: Geotechnical Investigation for Duffins Creek Dyke Rehabilitation		DRILLING DATA	
CLIENT: Valdor Engineering Inc.	METHOD: Continuous Flight Auger - Auto Hammer	DIAMETER: 205 mm	
PROJECT LOCATION: Pickering & Ajax, ON	FIELD ENGINEER: GH	DATE: 2017-09-07	
DATUM: N/A	SAMPLE REVIEW: DX	REF. NO.: 17-1967G	
BH LOCATION: See Borehole Location Plan	CHECKED: DL	ENCL. NO.: 2	







ELEV. DEPTH (m)	SOIL PROFILE DESCRIPTION	STRATA PLOT	SAMPLES			GROUND WATER	ELEVATION	DYNAMIC PENETRATION TEST				Plastic Limit W _p	Natural Moisture Content w	Liquid Limit W _L	UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
			NUMBER	TYPE	"N" BLOWS/0.3m			SPT	Cone	blows/0.3m	blows/0.3m					
0.0	TOPSOIL: (205 mm)															
0.2	FILL: sandy silt, trace to some clay, trace gravel, trace to some organics, trace rootlets, containing wood fragments, dark brown to brown, moist, loose to compact		1	SS	10											
1.4	FILL: silty sand, trace organics, trace rootlets, layers of organic silt, dark brown to brown, moist, loose		2	SS	14											
2.1	GRAVELLY SAND: trace silt, containing cobbles and boulders, brown, wet, compact		3	SS	9											
2.9	SAND AND GRAVEL: trace silt, containing cobbles and boulders, brown, wet, compact		4	SS	13	2.5 mBGL Oct 10										20 74 7
4.0	GRAVELLY SAND: trace silt, containing cobbles and boulders, grey, wet, compact		5	SS	15											
5.6	SAND: some gravel, trace to some silt, layers of gravelly sand, grey, wet, dense — layers of silty sand		6	SS	28											
6.6	END OF BOREHOLE Notes: 1) Water encountered at a depth of 2.3 m below ground surface (mBGS) during drilling. 2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling. Water Level Readings Date: Oct. 10, 2017 W. L. Depth (mBGS): 2.53		7	SS	31											

01 - GEOPRO SOIL LOG GEOPRO 17-1967GT BH LOG PROJECT DATA 20171020 - E.W. - JY.GPJ 2017-10-25 09:18





GROUNDWATER ELEVATIONS
 Measurement: 1st, 2nd, 3rd, 4th

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

PROJECT: Geotechnical Investigation for Duffins Creek Dyke Rehabilitation CLIENT: Valdor Engineering Inc. PROJECT LOCATION: Pickering & Ajax, ON DATUM: N/A BH LOCATION: See Borehole Location Plan	DRILLING DATA METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm FIELD ENGINEER: GH DATE: 2017-09-07 SAMPLE REVIEW: DX REF. NO.: 17-1967G CHECKED: DL ENCL. NO.: 3
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SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC PENETRATION TEST				WATER CONTENT (%)				REMARKS AND GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3m		ELEVATION	SPT	Cone	blows/0.3m	Plastic Limit	Natural Moisture Content	Liquid Limit	UNIT WT (kN/m ³)	
							20	40	60	80	W _p	w	W _L	GR SA SI CL	
0.0	TOPSOIL: (150 mm)														
0.2	FILL: sandy silt, trace to some clay, trace gravel, trace to some organics, trace rootlets, containing wood fragments, layers of clayey silt, layers/zones of silty sand, dark brown to brown, moist, loose to compact		1	SS	10										
			2	SS	6										
			3	SS	22										
2.2	ORGANIC SILTY SAND TO ORGANIC SAND AND SILT: trace clay, trace rootlets, trace gravel, brown to grey, wet, very loose		4	SS	3										
2.9	SANDY GRAVEL: trace to some silt, greyish brown, saturated, compact		5	SS	17									54 34 12	
4.0	SAND AND SILT TILL: trace clay, trace gravel, layers of silty sand, containing cobbles and boulders, grey, moist to wet, compact		6	SS	22										
5.6	SAND AND GRAVEL: trace silt, greyish brown, saturated, compact		7	SS	22										
6.6	END OF BOREHOLE Notes: 1) Water encountered at a depth of 3.0 m below ground surface (mBGS) during drilling. 2) Water was at a depth of 2.7 mBGS upon completion of drilling. 3) Borehole caved at a depth of 3.5 mBGS upon completion of drilling.														





01 - GEOPRO SOIL LOG GEOPRO 17-1967GT BH LOG PROJECT DATA 20171020 - EIW - JY.GPJ 2017-10-25 09:18

GROUNDWATER ELEVATIONS
 Measurement    
GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ▲ = 3% Strain at Failure

PROJECT: Geotechnical Investigation for Duffins Creek Dyke Rehabilitation CLIENT: Valdor Engineering Inc. PROJECT LOCATION: Pickering & Ajax, ON DATUM: N/A BH LOCATION: See Borehole Location Plan	DRILLING DATA METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm FIELD ENGINEER: GH DATE: 2017-09-07 SAMPLE REVIEW: DX REF. NO.: 17-1967G CHECKED: DL ENCL. NO.: 4
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SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC PENETRATION TEST				Plastic Limit w _p	Natural Moisture Content w	Liquid Limit w _L	UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3m		ELEVATION	SPT 20	Cone 40	blows/0.3m 60					
0.0	TOPSOIL: (150 mm)														
0.2	FILL: sandy silt, trace to some clay, trace gravel, trace organics, trace rootlets, pockets of organics, containing wood fragments, brown to greyish brown, moist, loose to dense		1	SS	7		○					○			
1															
	— containing rock fragments		2	SS	10		○					○			
2															
			3	SS	35			○				○			
2.1	SILTY SAND: trace clay, trace organics, trace rootlets, layers of sandy silt, brown, moist, compact		4	SS	23			○				○			
3															
			5	SS	38				○			○			
3	SAND AND GRAVEL: some silt to silty, trace clay, trace rootlets, layers of sandy silt, containing cobbles and boulders, brown, wet, dense														
4															
			6	SS	3		○					○			
4.0	SANDY SILT: some clay, trace gravel, grey, wet, very loose														
5															
			7	SS	78 / 280 mm										
5.6	SAND AND SILT TILL: trace clay, trace gravel, containing cobbles and boulders, grey, moist to wet, very dense														
6															
6.6	END OF BOREHOLE														
	Notes: 1) Water encountered at a depth of 3.0 m below ground surface (mBGS) during drilling. 2) Water was at a depth of 2.6 mBGS upon completion of drilling. 3) Borehole was caved in 4.0 mBGS upon completion of drilling.														

01 - GEOPRO SOIL LOG - GEOPRO 17-1967GT BH LOG PROJECT DATA 20171020 - EIW - JY.GPJ - 2017-10-25 09:18

GROUNDWATER ELEVATIONS
 Measurement    
GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ▲ = 3% Strain at Failure

PROJECT: Geotechnical Investigation for Duffins Creek Dyke Rehabilitation		DRILLING DATA	
CLIENT: Valdor Engineering Inc.	METHOD: Continuous Flight Auger - Auto Hammer	DIAMETER: 205 mm	
PROJECT LOCATION: Pickering & Ajax, ON	FIELD ENGINEER: GH	DATE: 2017-09-07	
DATUM: N/A	SAMPLE REVIEW: DX	REF. NO.: 17-1967G	
BH LOCATION: See Borehole Location Plan	CHECKED: DL	ENCL. NO.: 5	







SOIL PROFILE			SAMPLES		GROUND WATER	DYNAMIC PENETRATION TEST				Plastic Limit W _p	Natural Moisture Content w	Liquid Limit W _L	UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)					
ELEV. DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE		"N" BLOWS/0.3m	20	40	60						80	20	40	60	80
0.0	TOPSOIL: (125 mm)																		
0.1	FILL: sandy silt, trace to some clay, trace gravel, trace organics, trace rootlets, pockets of organics, dark brown to greyish brown, moist, compact		1	SS	14														
			2	SS	20														
			3	SS	23													3 37 40 20	
2.1	FINE SAND AND SILT: trace clay, trace organics, layers of fine sandy silt, brown, moist, compact		4	SS	11													0 26 69 5	
2.9	SILTY SAND: some gravel, trace clay, some organics, trace rootlets, layers of sand and silt, layers of gravelly sand, grey, wet, compact		5	SS	16														
4.0	SAND AND SILT TILL: trace to some clay, trace gravel, layers of sand, containing cobbles and boulders, grey, moist, dense — auger grinding		6	SS	38														
5.6	SAND: trace to some silt, trace gravel, grey, wet, compact		7	SS	25														
6.6	END OF BOREHOLE Notes: 1) Water encountered at a depth of 3.0 m below ground surface (mBGS) during drilling. 2) 51 mm dia. monitoring well (deep) was installed in borehole upon completion of drilling. 3) 19 mm dia. piezometer (shallow) was installed in borehole upon completion of drilling. Water Level Readings Deep Well Date W. L. Depth (mBGS) Oct. 10, 2017 2.77 Shallow Well Date W. L. Depth (mBGS) Oct. 10, 2017 Dry																		

01 - GEOPRO SOIL LOG GEOPRO 17-1967GT BH LOG PROJECT DATA 20171020 - EIV - JY.GPJ 2017-10-25 09:18





GROUNDWATER ELEVATIONS
 Measurement 1st 2nd 3rd 4th

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

PROJECT: Geotechnical Investigation for Duffins Creek Dyke Rehabilitation CLIENT: Valdor Engineering Inc. PROJECT LOCATION: Pickering & Ajax, ON DATUM: N/A BH LOCATION: See Borehole Location Plan	DRILLING DATA METHOD: Continuous Flight Auger - Auto Hammer DIAMETER: 155 mm FIELD ENGINEER: GH DATE: 2017-09-08 SAMPLE REVIEW: DX REF. NO.: 17-1967G CHECKED: DL ENCL. NO.: 6
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SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC PENETRATION TEST				Plastic Limit Natural Moisture Content Liquid Limit	WATER CONTENT (%) w _p w w _L	UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3m		ELEVATION	SPT 20	Cone 40	blows/0.3m 60				
0.0	TOPSOIL: (180 mm)													
0.2	FILL: sandy silt, trace to some clay, trace gravel, trace to some organics, trace rootlets, seams of sand, containing shale fragments, containing wood fragments, brown to dark brown, moist, compact		1	SS	15		○					○		
1			2	SS	13		○						○	
1.4	FILL: silty fine sand, trace clay, trace organics, trace rootlets, layers of fine sandy silt, brown, moist, compact		3	SS	21		○					○		
2.2	SAND: trace clay, trace to some silt, trace to some gravel, trace rootlets, layers of coarse sand, layers of organic silt, brown to grey, wet, loose		4	SS	9		○					○		
2.9	GRAVELLY SAND: trace to some silt, brown to grey, saturated, compact to very dense		5	SS	17		○					○		28 63 9
3			6A	SS									○	
4.7	SANDY SILT TILL: some clay, trace gravel, zones of silty fine sand, containing cobbles and boulders, grey, moist to wet, very dense		6B	SS	60							○		
5													○	
5.6	SILT: some clay, trace to some sand, grey, moist to wet, very dense		7	SS	50 / 150							○		
6													○	
6.4	END OF BOREHOLE Notes: 1) Water encountered at a depth of 2.3 m below ground surface (mBGS) during drilling. 2) Water was at 2.7 mBGS upon completion of drilling. 3) Borehole caved at a depth of 3.0 mBGS upon completion of drilling.													

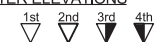
01 - GEOPRO SOIL LOG - GEOPRO 17-1967GT BH LOG PROJECT DATA 20171020 - EW - JY.GPJ - 2017-10-25 09:18

GROUNDWATER ELEVATIONS
 Measurement    
GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ▲ = 3% Strain at Failure

PROJECT: Geotechnical Investigation for Duffins Creek Dyke Rehabilitation		DRILLING DATA	
CLIENT: Valdor Engineering Inc.	METHOD: Continuous Flight Auger - Auto Hammer	DIAMETER: 205 mm	
PROJECT LOCATION: Pickering & Ajax, ON	FIELD ENGINEER: GH	DATE: 2017-09-08	
DATUM: N/A	SAMPLE REVIEW: DX	REF. NO.: 17-1967G	
BH LOCATION: See Borehole Location Plan	CHECKED: DL	ENCL. NO.: 7	

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION TEST				WATER CONTENT (%)				REMARKS AND GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3m	GROUND WATER	SHEAR STRENGTH (kPa)				WATER CONTENT (%)				
							SHEAR STRENGTH (kPa)				WATER CONTENT (%)				
						○ SPT ≧ Cone blows/0.3m 20 40 60 80				Plastic Limit Natural Moisture Content Liquid Limit W _p w W _L				UNIT WT (kN/m ³)	
						⊕ Unconfined × Field Vane & Sensitivity ▲ Quick Triaxial ⊠ Penetrometer + Lab Vane									GR SA SI CL
0.0	TOPSOIL: (125 mm)														
0.1	FILL: sandy silt, some clay, trace gravel, trace to some organics, trace rootlets, containing wood pieces, dark brown to brown, moist, compact		1	SS	12	← Concrete									
			2	SS	11										
	— layers of silty sand, layers of clayey silt		3	SS	17	← Bentonite									
2.2	SILTY FINE SAND TO FINE SAND AND SILT: trace clay, trace organics, trace rootlets, brown, moist, loose		4	SS	7										
2.9	SAND: trace to some silt, trace gravel, containing shell fragments, brown, wet, very loose to loose		5	SS	4	3.2 mBGL Oct 10 ← Sand ← Screen									
4.0	SAND AND GRAVEL: some silt to silty, trace clay, layers of clayey silt, grey, wet, compact		6	SS	16										
5.6	SAND AND SILT TILL: some clay, trace gravel, layers/zones of sandy silt, containing cobbles and boulders, grey, moist to wet, very dense		7	SS	59	← Natural pack								4	36 45 15
6.6	END OF BOREHOLE														
Notes: 1) Water encountered at a depth of 3.0 m below ground surface (mBGS) during drilling. 2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling. Water Level Readings Date W. L. Depth (mBGS) Oct. 10, 2017 3.23															

01 - GEOPRO SOIL LOG GEOPRO 17-1967GT BH LOG PROJECT DATA 20171020 - E.W. - JY.GPJ 2017-10-25 09:18

GROUNDWATER ELEVATIONS
 Measurement 1st 2nd 3rd 4th


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

PROJECT: Geotechnical Investigation for Duffins Creek Dyke Rehabilitation		DRILLING DATA	
CLIENT: Valdor Engineering Inc.	METHOD: Continuous Flight Auger - Auto Hammer	DIAMETER: 205 mm	
PROJECT LOCATION: Pickering & Ajax, ON	FIELD ENGINEER: GH	DATE: 2017-09-08	
DATUM: N/A	SAMPLE REVIEW: DX	REF. NO.: 17-1967G	
BH LOCATION: See Borehole Location Plan	CHECKED: DL	ENCL. NO.: 8	

SOIL PROFILE			SAMPLES		GROUND WATER	DYNAMIC PENETRATION TEST				Plastic Limit W _p	Natural Moisture Content w	Liquid Limit W _L	UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)				
ELEV. DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE		"N" BLOWS/0.3m	SPT 20	Cone 40	blows/0.3m 60						80	WATER CONTENT (%)		
0.0	GRANULAR FILL: (205 mm)	[Cross-hatch pattern]	1A	SS														
0.2	FILL: silty sand, trace gravel, trace organics, layers of organic sandy silt, brown, moist, compact	[Diagonal hatch pattern]	1B	SS	16													
1			2	SS	12										9	58	24	9
2	— layers of organic silt, zones of sandy silt	[Diagonal hatch pattern]	3	SS	19													
2.2	FINE SAND: some silt, trace organics, layers of sand and silt, brown, moist, loose	[Dotted pattern]	4	SS	9										0	79	18	3
2.9	SAND: some gravel, trace to some silt, brown, moist, loose to compact	[Dotted pattern]	5	SS	10													
4																		
4.0	SAND AND GRAVEL: trace to some silt, brown, wet, loose	[Bubbles pattern]	6	SS	7													
5.6	FINE SAND AND SILT: trace clay, layers of sandy silt, grey, saturated, dense	[Vertical lines pattern]	7	SS	33													
6.6	END OF BOREHOLE																	

01 - GEOPRO SOIL LOG GEOPRO 17-1967GT BH LOG PROJECT DATA 20171020 - EIW - JY.GPJ 2017-10-25 09:18

GROUNDWATER ELEVATIONS
 Measurement 1st 2nd 3rd 4th

GRAPH NOTES + 3, x 3: Numbers refer to Sensitivity ▲ = 3% Strain at Failure

PROJECT: Geotechnical Investigation for Duffins Creek Dyke Rehabilitation		DRILLING DATA	
CLIENT: Valdor Engineering Inc.	METHOD: Continuous Split Spoon	DIAMETER: 51 mm	
PROJECT LOCATION: Pickering & Ajax, ON	FIELD ENGINEER: GH	DATE: 2017-09-11	
DATUM: N/A	SAMPLE REVIEW: DX	REF. NO.: 17-1967G	
BH LOCATION: See Borehole Location Plan	CHECKED: DL	ENCL. NO.: 9	

ELEV. DEPTH (m)	SOIL PROFILE DESCRIPTION	STRATA PLOT	SAMPLES			GROUND WATER	ELEVATION	DYNAMIC PENETRATION TEST				Plastic Limit w _p	Natural Moisture Content w	Liquid Limit w _L	UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
			NUMBER	TYPE	"N" BLOWS/0.3m			SPT	Cone	blows/0.3m						
0.0	TOPSOIL: (180 mm)															GR SA SI CL
0.2	FILL: sandy silt, trace to some clay, trace gravel, trace to some organics, trace rootlets, containing shale fragments, dark brown to brown, moist, compact		1	SS	11											
0.8	FILL: sand and silt to silty sand, trace clay, trace gravel, brown to grey, moist, dense		2	SS	34											
2.3	FILL: sandy silt, trace clay, trace gravel, trace to some organics, layers of silty sand, dark brown to brown, moist, compact		4A	SS	22											
2.7	SILTY FINE SAND: layers/zones of organic silt, layers of sandy silt, brown, moist, compact		4B	SS												
3.8	SAND: some silt to silty, some gravel, layers of sandy silt, brown, wet, compact		5	SS	15											
4.6	SAND AND GRAVEL: trace to some silt, layers of sandy silt, brown, wet, compact		6	SS	13											
			7	SS	21											54 36 10
			8	SS	29											
6.1	END OF BOREHOLE Notes: 1) Water encountered at a depth of 4.6 m below ground surface (mBGS) during drilling. 2) 38 mm dia. monitoring well was installed in borehole upon completion of drilling. Water Level Readings Date W. L. Depth (mBGS) Oct. 10, 2017 4.42															

01 - GEOPRO SOIL LOG - GEOPRO 17-1967GT BH LOG PROJECT DATA 20171020 - EW - JY.GPJ - 2017-10-25 09:18

GROUNDWATER ELEVATIONS
 Measurement 1st 2nd 3rd 4th
 Measurement ∇ ∇ ∇ ∇

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

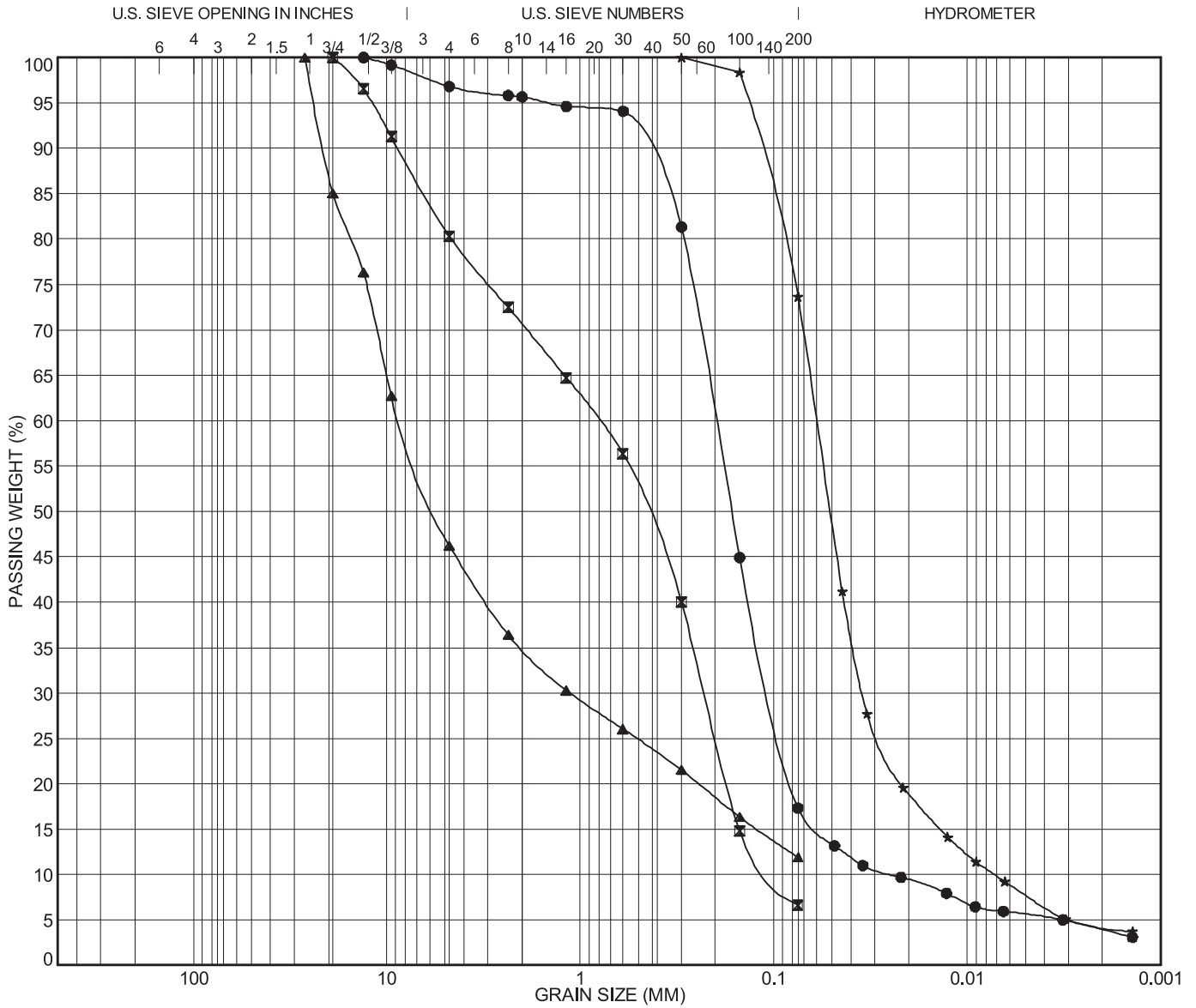
PROJECT: Geotechnical Investigation for Duffins Creek Dyke Rehabilitation		DRILLING DATA	
CLIENT: Valdor Engineering Inc.	METHOD: Continuous Split Spoon	DIAMETER: 51 mm	
PROJECT LOCATION: Pickering & Ajax, ON	FIELD ENGINEER: GH	DATE: 2017-09-11	
DATUM: N/A	SAMPLE REVIEW: DX	REF. NO.: 17-1967G	
BH LOCATION: See Borehole Location Plan	CHECKED: DL	ENCL. NO.: 10	

ELEV. DEPTH (m)	SOIL PROFILE DESCRIPTION	STRATA PLOT	SAMPLES			GROUND WATER	ELEVATION	DYNAMIC PENETRATION TEST				Plastic Limit w _p	Natural Moisture Content w	Liquid Limit w _L	UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)		
			NUMBER	TYPE	"N" BLOWS/0.3m			SPT	Cone	blows/0.3m	blows/0.3m						blows/0.3m	
0.0	TOPSOIL: (125 mm)																	
0.1	FILL: sandy silt to sand and silt, trace clay, trace gravel, trace organics, trace rootlets, layers of clayey silt, zones of silty sand, containing shale fragments, dark brown to brown, moist, very loose to dense		1	SS	4													
			2	SS	31												6 39 45 10	
			3	SS	37													
			4	SS	31													
3.1	PROBABLE FILL: silty fine sand, trace clay, trace organics, trace rootlets, layers of organic silt, dark brown to brown, moist, compact		5	SS	21													
3.8	SILTY SAND TO SANDY SILT: trace clay, trace to some organics, layers of organic silt, brown to dark brown, moist, loose		6	SS	8													
4.6	GRAVELLY SAND: trace clay, trace to some organics, zones of silty sand, greenish brown, wet, compact		7	SS	11													
5.3	SAND AND GRAVEL: trace silt, greyish brown, saturated, compact		8	SS	12													
6.1	END OF BOREHOLE Notes: 1) Water encountered at a depth of 4.6 m below ground surface (mBGS) during drilling. 2) 38 mm dia. monitoring well was installed in borehole upon completion of drilling. Water Level Readings Date W. L. Depth (mBGS) Oct. 10, 2017 4.36																	

01 - GEOPRO SOIL LOG - GEOPRO 17-1967GT BH LOG PROJECT DATA 20171020 - EW - JY.GPJ - 2017-10-25 09:18

GROUNDWATER ELEVATIONS
 Measurement 1st 2nd 3rd 4th

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



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

Specimen Identification			Classification				LL	PL	PI	Cc	Cu
●	BHA2	SS8A 5.33								2.17	8.16
■	BHP1	SS4 2.29								0.65	8.07
▲	BHP2	SS5 3.05								2.69	152.12
★	BHP4	SS4 2.29								2.78	8.34

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BHA2	SS8A 5.33	13.2	0.2	0.103	0.024	3.2	79.5	13.4	3.9
■	BHP1	SS4 2.29	19	0.804	0.228	0.1	19.7	73.6	6.7	
▲	BHP2	SS5 3.05	26.5	8.483	1.128		53.8	34.3	11.9	
★	BHP4	SS4 2.29	0.3	0.06	0.035	0.007	0.0	26.3	69.3	4.3

11-GEOPRO_GRAIN_SIZE GEOPRO-17-1967GT:BH LOG PROJECT DATA 20171012-IC.GPJ 2017-10-13 15:39



Unit 57, 40 Vogell Road, Richmond Hill, Ontario L4B 3N6
 Tel: 905-237-8336 Fax: 905-248-3699
 office@geoproconsulting.ca www.geoproconsulting.ca

GRAIN SIZE DISTRIBUTION

PROJECT: Geotechnical Investigation for Duffins Creek Dyke Rehabilitation

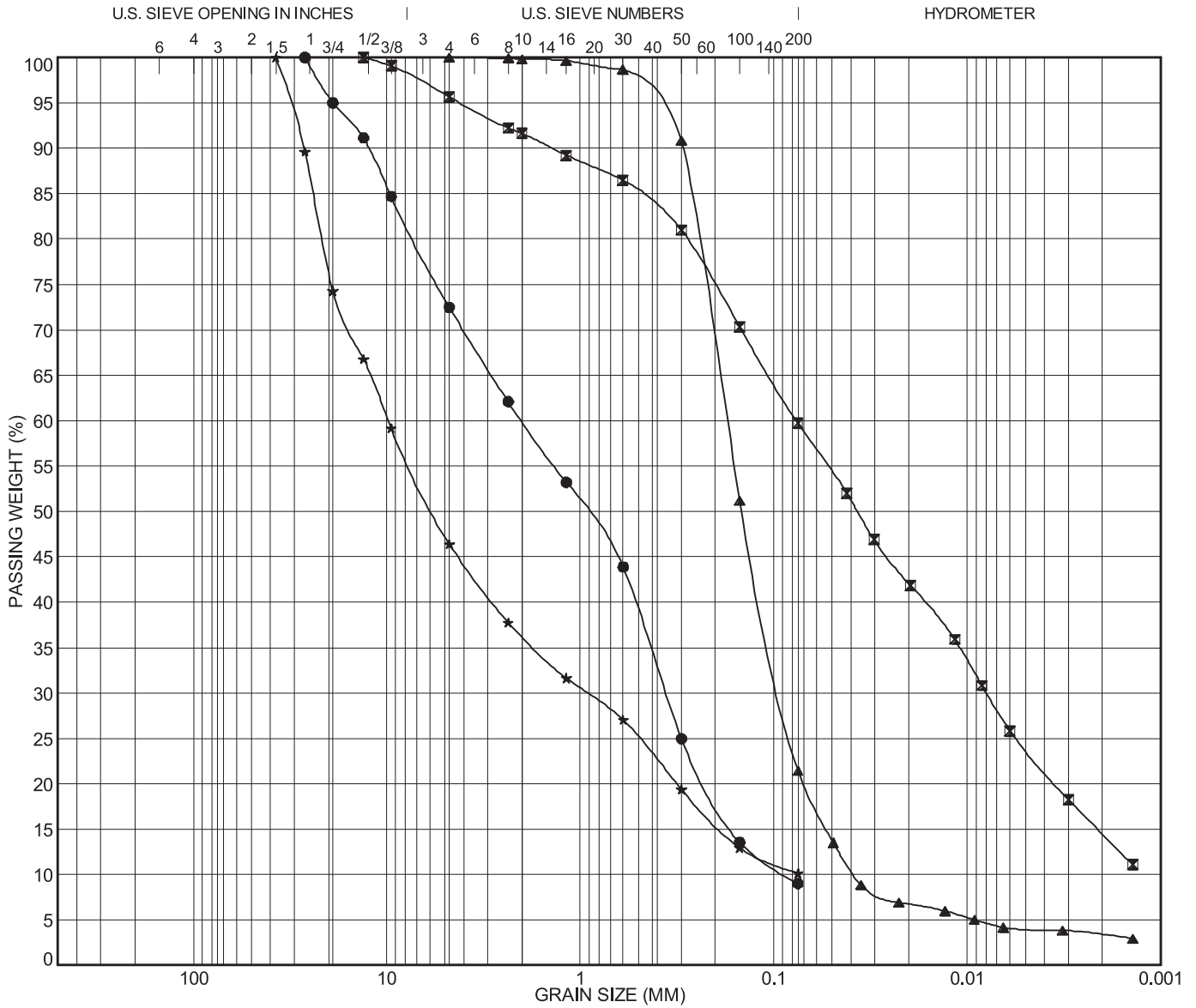
LOCATION: Pickering & Ajax, Toronto, ON

PROJECT NO.: 17-1967G

SAMPLED ON: 2017-09-07

FIGURE NO.: 1

TESTED ON: 2017-10-09



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

Specimen Identification			Classification				LL	PL	PI	Cc	Cu
●	BHP5	SS5	3.05							0.75	23.03
■	BHP6	SS7	6.10								
▲	BHP7	SS4	2.29							1.25	4.55
★	BHP8	SS7	4.57							1.20	136.09
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
●	BHP5	SS5	3.05	26.5	2.005	0.361	0.087	27.5	63.4	9.0	
■	BHP6	SS7	6.10	13.2	0.076	0.008		4.3	35.9	45.2	14.5
▲	BHP7	SS4	2.29	4.75	0.175	0.092	0.038	0.0	78.6	18.1	3.3
★	BHP8	SS7	4.57	37.5	9.847	0.926		53.6	36.2	10.1	

GRAIN SIZE DISTRIBUTION

PROJECT: Geotechnical Investigation for Duffins Creek Dyke Rehabilitation

LOCATION: Pickering & Ajax, Toronto, ON

PROJECT NO.: 17-1967G

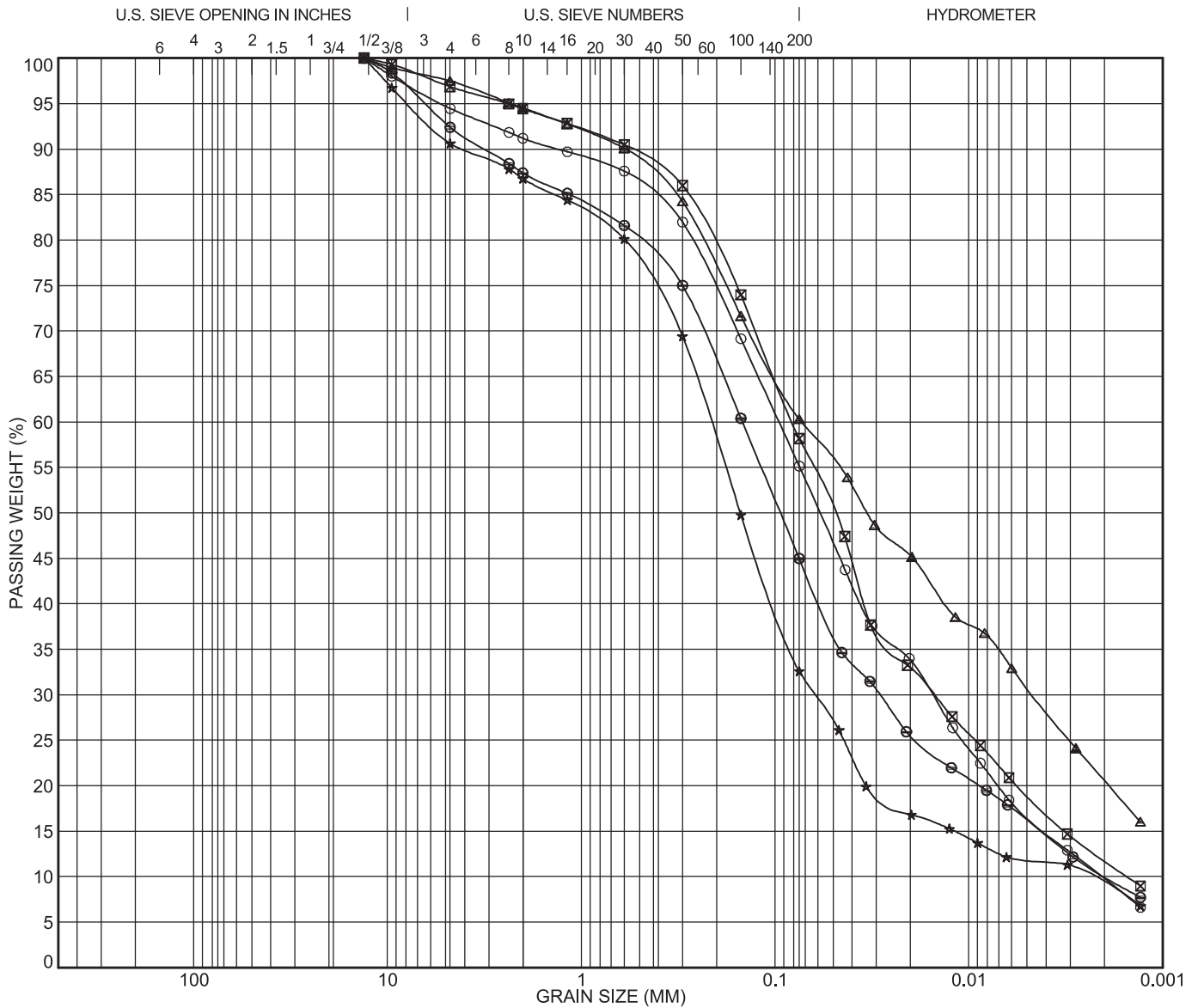
SAMPLED ON: 2017-09-11

FIGURE NO.: 2

TESTED ON: 2017-10-09



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COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

Specimen Identification			Classification				LL	PL	PI	Cc	Cu
⊖	BHA1	SS5 3.05							2.88	75.05	
⊗	BHA2	SS4 2.29							1.89	53.46	
△	BHP4	SS3 1.52									
★	BHP7	SS2 0.76							7.43	89.31	
○	BHP9	SS2 0.76							1.21	45.92	
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
⊖	BHA1	SS5 3.05	13.2	0.147	0.029	0.002	7.6	47.4	34.9	10.1	
⊗	BHA2	SS4 2.29	13.2	0.081	0.015	0.002	3.1	38.7	46.4	11.8	
△	BHP4	SS3 1.52	13.2	0.073	0.005		2.5	37.2	39.7	20.6	
★	BHP7	SS2 0.76	13.2	0.215	0.062	0.002	9.4	58.0	23.6	9.0	
○	BHP9	SS2 0.76	13.2	0.095	0.015	0.002	5.5	39.3	45.4	9.7	

GRAIN SIZE DISTRIBUTION

PROJECT: Geotechnical Investigation for Duffins Creek Dyke Rehabilitation

LOCATION: Pickering & Ajax, ON

PROJECT NO.: 17-1967G

SAMPLED ON: 2017-09-11

FIGURE NO.: 3

TESTED ON:



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 Tel: 905-237-8336 Fax: 905-248-3699
 office@geoproconsulting.ca www.geoproconsulting.ca

APPENDIX E

Photographs of 2019 Geotechnical Investigation Soil
Samples



THA19-01 Sample 1 (2'6"-4'6")
Recovery 1'6"



THA19-01 Sample 2 (5'-7')
Recovery 1'6"



THA19-01 Sample 3 (7'6"-9'6")
Recovery 1'6"



THA19-01 Sample 4 (10'-12')
Recovery 1'6"



THA19-01 Sample 5 (15'-17')
Recovery 2'



THA19-01 Sample 6 (20'-22')
Recovery 4"



THA19-01 Sample 7 (25' – 27')
Recovery 1'



THA19-01 Sample 8 (30' - 32')
Recovery 2'



THA19-02 Sample 1 (2'6" - 4'6")
Recovery 2'



THA19-02 Sample 2 (5' - 7')
Recovery 2'



THA19-02 Sample 3 (10' - 12')
Recovery 2'



THA19-02 Sample 4 (15' - 17')
Recovery 2'



THA19-02 Sample 5 (20'-22')
Recovery 1'



THA19-02 Sample 6 (25'-27')
Recovery 6"



THP19-01 Sample 1 (0'-2')
Recovery 1'



THP19-01 Sample 2 (2'6''-4'6'')
Recovery 1'



THP19-01 Sample 3 (5'-7')
Recovery 1'6"



THP19-01 Sample 4 (7'6''-9'6'')
Recovery 8"



THP19-01 Sample 5 (10'-12')
Recovery 6"



THP19-01 Sample 6 (12'6"-14'6")
Recovery 3"



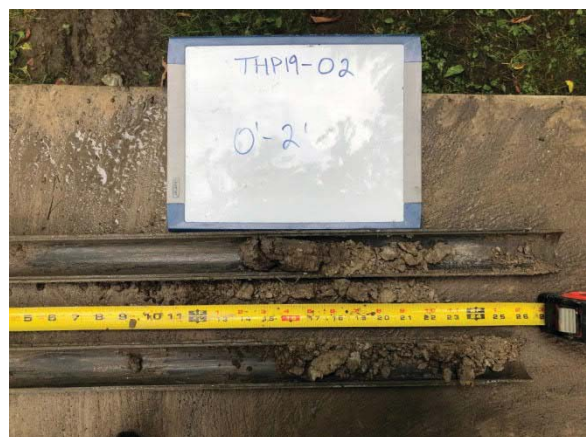
THP19-01 Sample 7 (15'-17')
Recovery 2"



THP19-01 Sample 8 (20'-22')
Recovery 1'6"



THP19-01 Sample 9 (25'-27')
Recovery 2'



THP19-02 Sample 1 (0'-2')
Recovery 1'



THP19-02 Sample 2 (2'6"-4'6")
Recovery 1'6"



THP19-02 Sample 3 (5'-7')
Recovery 1'9"



THP19-02 Sample 4 (7'6"-9'6")
Recovery 1'6"



THP19-02 Sample 5 (10'-12')
Recovery 4"



THP19-02 Sample 6 (15'-17')
Recovery 1'



THP19-02 Sample 7 (20'-22')
Recovery 1'



THP19-03 Sample 1 (0'-2')
Recovery 1'3"



THP19-03 Sample 2 (2'-4')
Recovery 1'6"



THP19-03 Sample 3 (5'-7')
Recovery 1'3"



THP19-03 Sample 4 (7'6\"-9'6\")
Recovery 1'3"



THP19-03 Sample 5 (10'-12')
Recovery 1'



THP19-03 Sample 6 (15'-17')
Recovery 1'3"



THP19-03 Sample 7 (20'-22')
Recovery 1'6"



THP19-03 Sample 8 (25'-27')
Recovery 1'6"



THP19-04 Sample 1 (0'-2')
Recovery 1'



THP19-04 Sample 2 (2'-4')
Recovery 1'6"



THP19-04 Sample 3 (5'-7')
Recovery 2'



THP19-04 Sample 4 (7'6\"/>



THP19-04 Sample 5 (10'-12')
Recovery 1'6"



THP19-04 Sample 6 (15'-17')
Recovery 2'



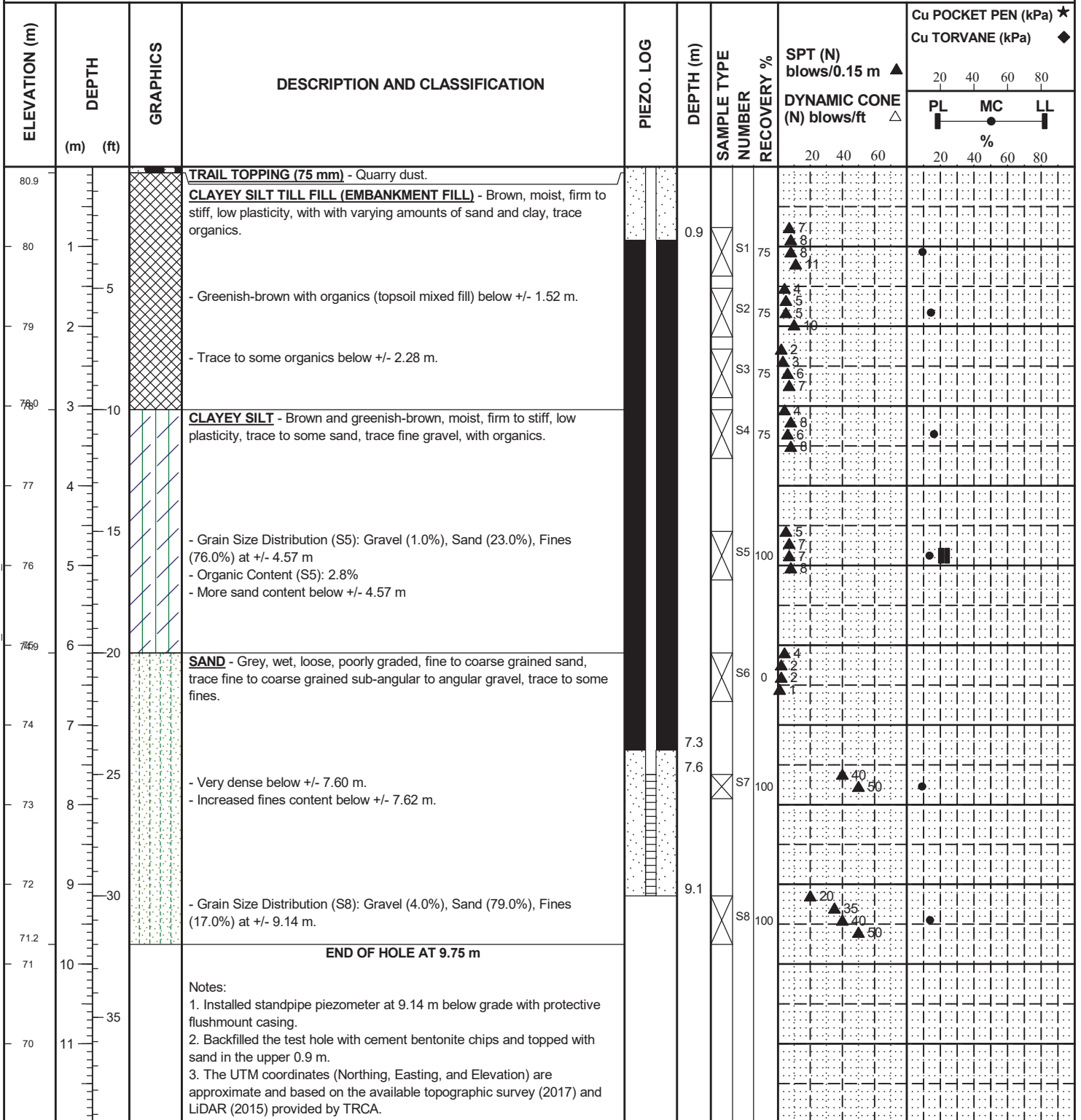
THP19-04 Sample 7 (20'-22')
Recovery 2'

APPENDIX F

2019 Ajax and Pickering Dyke Geotechnical
Investigation Logs

CLIENT TORONTO & REGION CONSERVATION AUTHORITY
PROJECT Pickering and Ajax Dykes Environmental Assessment
SITE Ajax Dyke
LOCATION Sta. 0+160 on Dyke Crest
DRILLING METHOD 100 mm ø Hollow Stem Auger, Mobile B57 Track Mounted, Trip Hammer

JOB NO. 19-2939-003
GROUND ELEV. 81.00 m
TOP OF CASING ELEV. 81.00 m
WATER ELEV.
DATE DRILLED 7/8/2019
UTM (m) N
 E



SAMPLE TYPE Split Spoon

CONTRACTOR
Landshark Drilling

INSPECTOR
D.D.

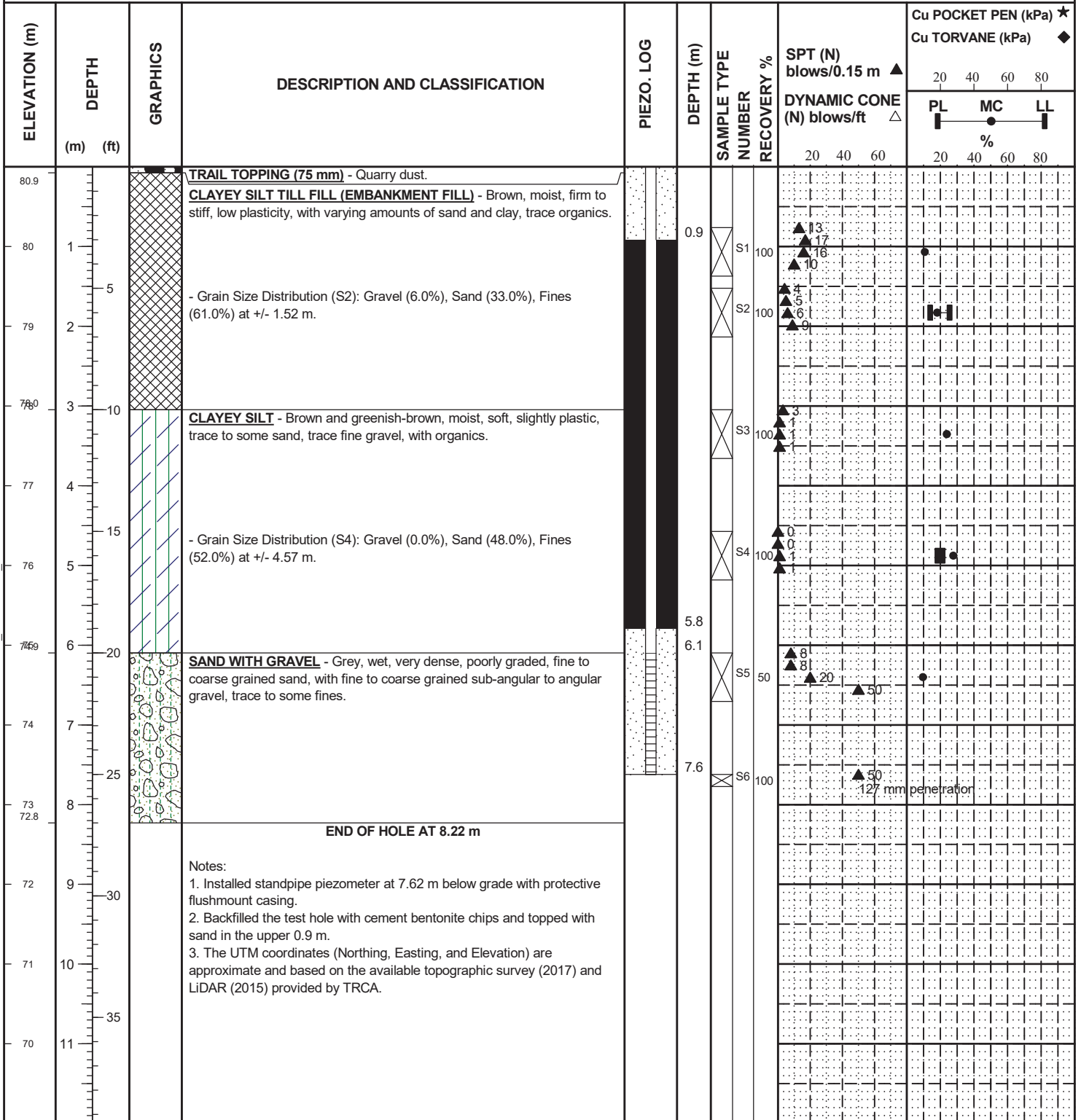
APPROVED
SG

DATE
12/3/19

GEO\TECHNICAL-SOIL LOG C:\USERS\DDUBEAU\DESKTOP\19-2939-003 PICKERING AND AJAX DYKES_03DEC2019_DD.GPJ

CLIENT TORONTO & REGION CONSERVATION AUTHORITY
PROJECT Pickering and Ajax Dykes Environmental Assessment
SITE Ajax Dyke
LOCATION Sta. 0+060 on Dyke Crest
DRILLING METHOD 100 mm ø Hollow Stem Auger, Mobile B57 Track Mounted, Trip Hammer

JOB NO. 19-2939-003
GROUND ELEV. 81.00 m
TOP OF CASING ELEV. 81.00 m
WATER ELEV.
DATE DRILLED 7/8/2019
UTM (m) N
 E



SAMPLE TYPE Split Spoon

CONTRACTOR **Landshark Drilling**

INSPECTOR **D.D.**

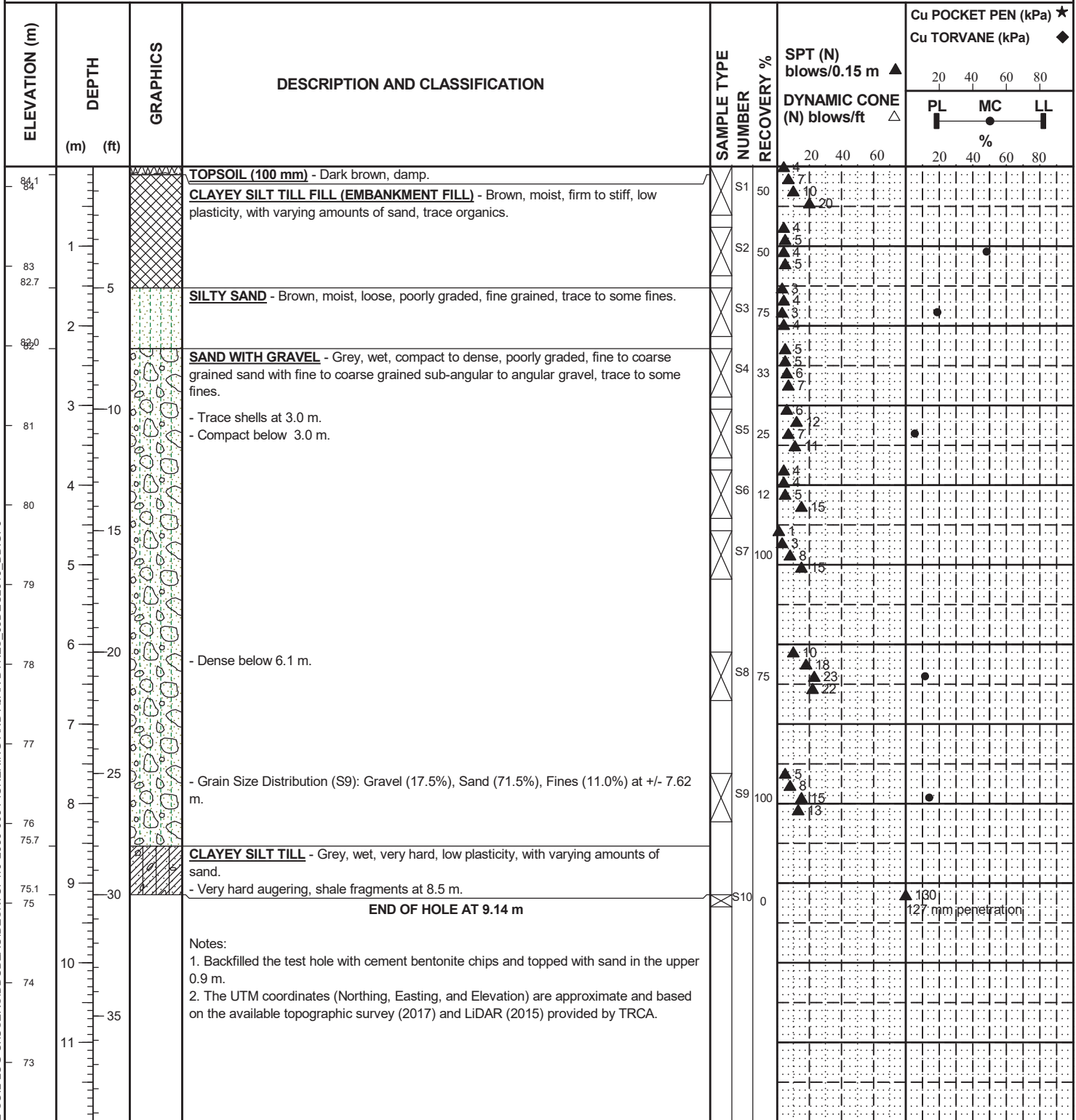
APPROVED **SG**

DATE **12/3/19**

GEO-TECHNICAL-SOIL LOG C:\USERS\DDUBEAU\DESKTOP\19-2939-003 PICKERING AND AJAX DYKES_03DEC2019_DD.GPJ

CLIENT TORONTO & REGION CONSERVATION AUTHORITY
PROJECT Pickering and Ajax Dykes Environmental Assessment
SITE Pickering Dyke
LOCATION Sta. 1+080 on Dyke Crest
DRILLING METHOD 100 mm ø Hollow Stem Auger, Mobile B57 Track Mounted, Trip Hammer

JOB NO. 19-2939-003
GROUND ELEV. 84.25 m
TOP OF CASING ELEV.
WATER ELEV.
DATE DRILLED 6/8/2019
UTM (m) N
 E



SAMPLE TYPE Split Spoon

CONTRACTOR **Landshark Drilling**

INSPECTOR **D.D.**

APPROVED **SG**

DATE **12/3/19**

CLIENT TORONTO & REGION CONSERVATION AUTHORITY
PROJECT Pickering and Ajax Dykes Environmental Assessment
SITE Pickering Dyke
LOCATION Sta. 0+825 on Dyke Crest
DRILLING METHOD 100 mm ø Hollow Stem Auger, Mobile B57 Track Mounted, Trip Hammer

JOB NO. 19-2939-003
GROUND ELEV. 83.73 m
TOP OF CASING ELEV. 83.73 m
WATER ELEV.
DATE DRILLED 6/8/2019
UTM (m) N E

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	PIEZO LOG	DEPTH (m)	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★		Cu TORVANE (kPa) ◆	
	(m)	(ft)										PL	MC	LL	PL
83.6				TOPSOIL (100 mm) - Dark brown, damp.											
83	1	5		CLAYEY SILT TILL FILL (EMBANKMENT FILL) - Brown, moist, firm to stiff, low plasticity, with varying amounts of sand, trace organics.		0.9									
82	2	10		- Grain Size Distribution (S3): Gravel (5.0%), Sand (38.0%), Fines (57.0%) at 1.5 m. - Organics (topsoil mixed fill, rootlets) below 2.4 m. - More sand content below 3.0 m.											
81	3	15													
80	4	20													
79.2	5	25		CLAYEY SILT TILL - Brown, moist, firm to stiff, low plasticity, with varying amounts of sand, trace organics.		4.6									
79				- Grain Size Distribution (S6): Gravel (11.0%), Sand (38.5%), Fines (50.5%) at 4.6 m.											
78	6	30													
77.6	7	35		SAND WITH GRAVEL - Grey, wet, compact, poorly graded, fine to coarse grained sand, with fine to coarse grained sub-angular to angular gravel, trace to some fines.		6.1									
77.0				- Grain Size Distribution (S7): Gravel (21.0%), Sand (54.0%), Fines (25.0%) at 6.1 m.											
77				END OF HOLE AT 6.70 m											
76	8	40		Notes: 1. Installed standpipe piezometer at 6.09 m below grade with protective flushmount casing. 2. Backfilled the test hole with cement bentonite chips and topped with sand in the upper 0.9 m. 3. The UTM coordinates (Northing, Easting, and Elevation) are approximate and based on the available topographic survey (2017) and LiDAR (2015) provided by TRCA.											
75	9	45													
74	10	50													
73	11	55													
72															

SAMPLE TYPE Split Spoon

CONTRACTOR **Landshark Drilling**

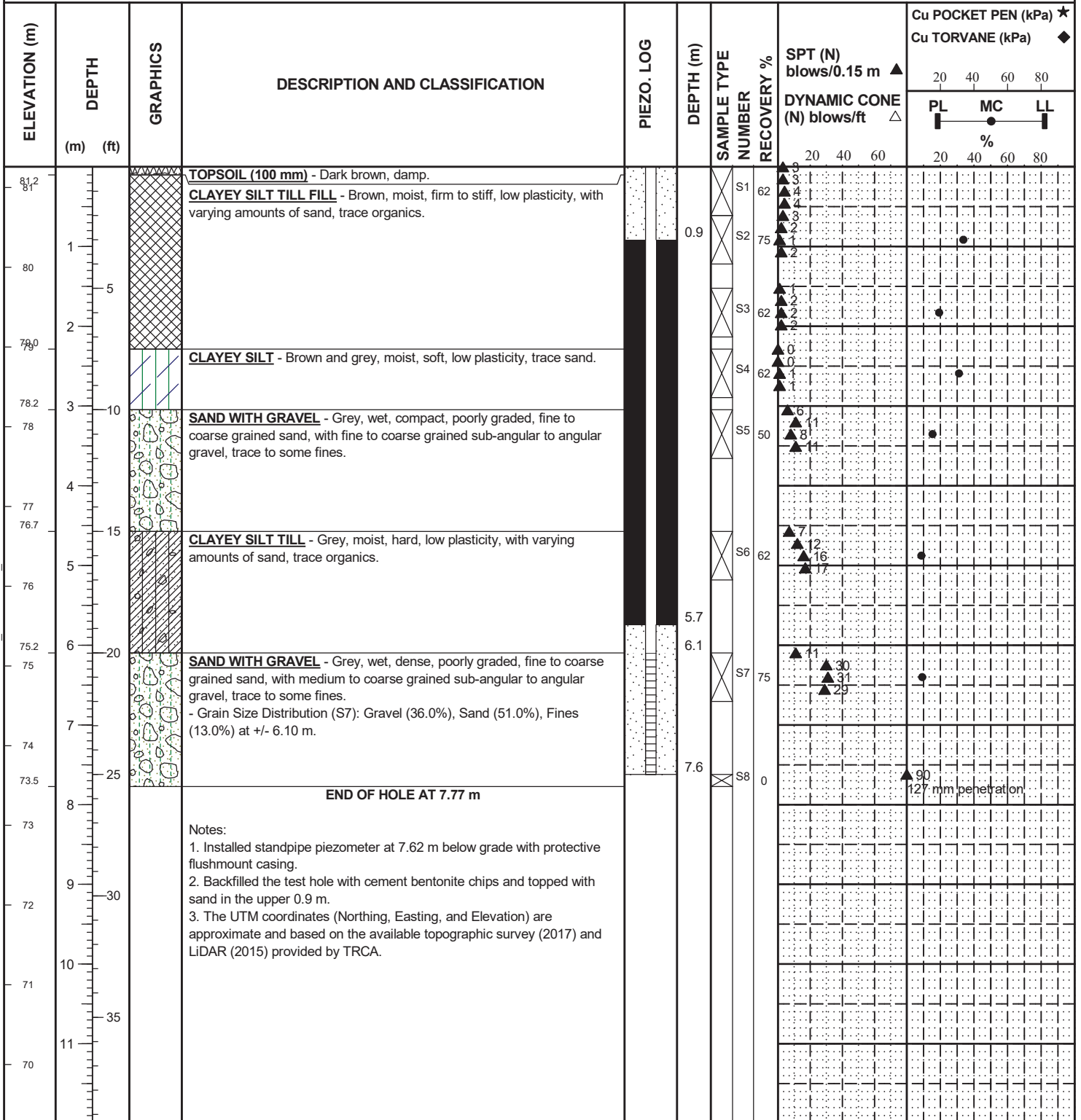
INSPECTOR **D.D.**

APPROVED **SG**

DATE **12/3/19**

CLIENT TORONTO & REGION CONSERVATION AUTHORITY
PROJECT Pickering and Ajax Dykes Environmental Assessment
SITE Pickering Dyke
LOCATION Sta. 0+280 on Wet Side of Dyke, 19 m Offset from Dyke Centerline
DRILLING METHOD 100 mm ø Hollow Stem Auger, Mobile B57 Track Mounted, Trip Hammer

JOB NO. 19-2939-003
GROUND ELEV. 81.26 m
TOP OF CASING ELEV. 81.26 m
WATER ELEV.
DATE DRILLED 7/8/2019
UTM (m) N E



SAMPLE TYPE Split Spoon

CONTRACTOR **Landshark Drilling**

INSPECTOR **D.D.**

APPROVED **SG**

DATE **12/3/19**

CLIENT TORONTO & REGION CONSERVATION AUTHORITY
PROJECT Pickering and Ajax Dykes Environmental Assessment
SITE Pickering Dyke
LOCATION Sta. 0+100 on Wet Side of Dyke, 10 m Offset from Dyke Centerline
DRILLING METHOD 100 mm ø Hollow Stem Auger, Mobile B57 Track Mounted, Trip Hammer

JOB NO. 19-2939-003
GROUND ELEV. 81.26 m
TOP OF CASING ELEV.
WATER ELEV.
DATE DRILLED 7/8/2019
UTM (m) N
 E

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★			Cu TORVANE (kPa) ◆		
	(m)	(ft)								20	40	60	80	20	40
81.2				TOPSOIL (100 mm) - Dark brown, damp.											
				CLAYEY SILT TILL FILL - Brown, moist, firm to stiff, low plasticity, with varying amounts of sand, trace organics.											
80	1	5				S1	4								
						S2	4								
79.0	2	10		CLAYEY SILT - Brown and grey, moist, soft, low plasticity, trace sand, with organics. - Grey below 2.4 m. - Grey below +/- 2.44 m.											
						S3	1								
78.2	3	15		SAND WITH GRAVEL - Grey, wet, very dense, poorly graded, fine to coarse grained sand, with fine to coarse grained sub-angular to angular gravel, trace to some fines.											
						S4	1								
78	4	20				S5	5								
							14								
							11								
							10								
77	5	25		- Grain Size Distribution (S6): Gravel (25.0%), Sand (66.0%), Fines (9.0%) at 6.1 m.											
						S6	7								
							10								
							18								
							25								
76	6	30				S7	0								
							17								
							23								
							45								
75	7	35				S8	0								
							100								
							127 mm penetration								
73.5	8			END OF HOLE AT 7.77 m											
73	9			Notes: 1. Backfilled the test hole with cement bentonite chips and topped with sand in the upper 0.9 m. 2. The UTM coordinates (Northing, Easting, and Elevation) are approximate and based on the available topographic survey (2017) and LiDAR (2015) provided by TRCA.											
72	10														
71	11														
70															

SAMPLE TYPE Split Spoon

CONTRACTOR **Landshark Drilling**

INSPECTOR **D.D.**

APPROVED **SG**

DATE **12/3/19**

APPENDIX G

O.Reg 558 TCLP – Metals and Inorganics Analyses
Test Results

**CLIENT NAME: KGS GROUP
SUITE 402, 4310 SHERWOODTOWNE BLVD
MISSISSAUGA, ON L4Z4C4
(905) 848-2473**

ATTENTION TO: S.Gnanasunthar

PROJECT: Pickering/Ajax Dykes 19-2939-003

AGAT WORK ORDER: 19T508259

SOIL ANALYSIS REVIEWED BY: Parvathi Malemath, Data Reviewer

DATE REPORTED: Sep 03, 2019

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.



Certificate of Analysis

AGAT WORK ORDER: 19T508259

PROJECT: Pickering/Ajax Dykes 19-2939-003

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
<http://www.agatlabs.com>

CLIENT NAME: KGS GROUP

SAMPLING SITE: Pickering + Ajax, On

ATTENTION TO: S.Gnanasunthar

SAMPLED BY: D. D.

O. Reg. 558 Metals and Inorganics

DATE RECEIVED: 2019-08-22

DATE REPORTED: 2019-09-03

Parameter	Unit	SAMPLE DESCRIPTION:		TPA19-01	TPA19-02	TPP19-01	TPP19-02	TPP19-05	TPP19-06
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2019-08-07	2019-08-07	2019-08-06	2019-08-06	2019-08-07	2019-08-07
		G / S	RDL	461448	461453	461454	461455	461458	461459
Arsenic Leachate	mg/L	2.5	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Barium Leachate	mg/L	100	0.100	0.740	0.688	0.623	0.611	0.675	0.688
Boron Leachate	mg/L	500	0.050	0.053	<0.050	0.059	<0.050	0.060	0.067
Cadmium Leachate	mg/L	0.5	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Chromium Leachate	mg/L	5	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead Leachate	mg/L	5	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Mercury Leachate	mg/L	0.1	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Selenium Leachate	mg/L	1	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Silver Leachate	mg/L	5	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium Leachate	mg/L	10	0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Fluoride Leachate	mg/L	150	0.05	0.21	0.21	0.13	0.17	0.09	0.16
Cyanide Leachate	mg/L	20	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
(Nitrate + Nitrite) as N Leachate	mg/L	1000	0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to O. Reg. 558 - Schedule IV Leachate Quality Criteria
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.
Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

