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CONSULTING GEOTECHNICAL ENGINEERS

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SUBSURFACE INVESTIGATION
PROPOSED DYKING
DUFFIN CREEK
PICKERING, ONTARIO

Ref. No. G-85.0706
August 1985

Prepared for:

The Metropolitan Toronto Region Conservation Authority
c/o Simcoe Engineering Limited
Consulting Engineers
345 Kingston Road
Pickering, Ontario
L1V 1A1

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August 30, 1985

Ref. No. G-85.0706

The Metropolitan Toronto Region
Conservation Authority
c/o Simcoe Engineering Limited
Consulting Engineers
345 Kingston Road
Pickering, Ontario
L1V 1A1

Attention: Mr. L. Smith, P.Eng.

Re: Subsurface Investigation
Proposed Dyking
Duffin Creek
Pickering, Ontario

Dear Sirs:

Further to your verbal request, we have investigated the subsurface and foundation conditions at the site of the proposed dyke, to be constructed on the south side of Duffin Creek, between Brock Road and Highway 2, in Pickering, Ontario.

Under cover of this letter, we are pleased to submit to you our report describing the findings together with recommendations for design.

Should you have any questions in connection with this project, we shall be pleased to discuss them with you.

Yours very truly,

GEO-CANADA LTD.

Ivan P. Lieszkowszky, P.Eng.

IPL:esp

EXECUTIVE SUMMARY

Seven exploratory boreholes drilled along the proposed alignment of the approximately 1 km long dyke to be built on the south side of Duffin Creek, between Brock Road and Highway 2 in Pickering, revealed a variable sequence of fine sand, silt, and sand and gravel deposits, which in places is underlain by silty clay till or is interbedded with a layer of organic silt.

Our analysis of the stability of the dyke indicates that under a 3 m high dyke constructed with 2:1 side slopes the safety factor against general foundation failure is greater than 2, which is considered to be adequate. Settlements are estimated to be of the order of 0.1 m.

Although the theoretical safety factor against "piping" (subsurface erosion) and uplift on the downstream or dry side of the dyke is less than unity, due to the short duration that the flood water is expected to be at its peak and the time lag required for critical "piping" and uplift conditions to develop, in our opinion design measures to prevent these conditions to occur may not be required. It is, however, suggested that the area behind the dyke be observed during flood conditions to determine if and where remedial measures to prevent piping or uplift are necessary.

Consequently, the dyke can be constructed as proposed with the provision of possible future remedial measures.

Ref. No. G-85.0706

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REPORT

ON

SUBSURFACE INVESTIGATION

PROPOSED DYKING

DUFFIN CREEK

PICKERING, ONTARIO

1.0 INTRODUCTION

The Metropolitan Toronto Region Conservation Authority has retained through their Consulting Engineers, Simcoe Engineering Limited, the services of Geo-Canada Ltd. to investigate the subsurface and foundation conditions at the site of a proposed flood control dyke for a section of Duffin Creek, extending from Brock Road to Highway 2 in the Town of Pickering, Ontario. Verbal authorization to carry out the investigation was received from Mr. L. Smith, P.Eng., on July 17, 1985, and the terms of reference and the scope of the work were discussed with the Consulting Engineers during a site visit on June 7, 1985.

Accordingly, the purpose of the geotechnical investigation and study was to establish the subsurface conditions at seven points along the dyke; to evaluate the foundation conditions and the stability of the dyke; to assess the seepage

.../...

conditions under the dyke; to recommend design cross sections for the dyke; and to make suggestions for the geotechnical related aspects of the contract specifications.

Presented in this report are the results and findings of the subsurface investigation together with our interpretation of the data and recommendations for the items indicated above.

The work in the field was carried out on July 22, 1985, under the supervision of a geotechnical engineer. The borings were put down with a power auger machine and soil samples were recovered and standard penetration tests (SPT) were performed at frequent intervals of depth. Furthermore, field vane tests were performed in the cohesive strata. The locations of the boreholes are shown on the attached Borehole Location Plan (Enclosure 1).

The recovered soil samples were visually identified in the field and were forwarded to our laboratory for further examination and testing. The testing programme consisted of grain size analyses (sieve and hydrometer tests) and the determination of the natural moisture contents. The results of the field and laboratory tests are presented on the borehole logs and on Figures 1, 2, 3 and 4.

.../...

Elevations at the borehole locations were established by the Consulting Engineers. The elevations in metres, are referred to the geodetic datum.

2.0 THE PROJECT

We understand that the purpose of the dyke is to reduce the frequency and the risk of flooding in a low lying area on the south side of Duffin Creek, which extends from just east of Brock Road to Highway 2. The dyke will be about 1 km long and the crest elevation of the dyke will vary between Elevations 84.4 and 83.0 m approximately. The high water level during design flood levels will be 0.3 m below the top of the dyke. It is anticipated that the crest of the dyke will be 4 m wide and, tentatively, 2:1 (horizontal to vertical) side slopes are proposed by the Consultants. It is understood that the duration of the flood water levels will be short and will not exceed twelve hours and possibly will be much shorter. The recommendations made in this report will be based on this information.

3.0 SUBSURFACE CONDITIONS

Reference to the borehole logs, presented on Enclosures 2 to 8 inclusive, indicates that the subsurface conditions, as

.../...

revealed by the borings, are somewhat variable over the length of the site.

In addition to surface fills, the borings identified the four main natural substrata listed below.

- Fine Sand with Silt
- Loose to Very Loose Organic Silt
- Sand and Gravel
- Clayey Silt

The distribution of these four main substrata vary over the length of the site in that the loose to very loose organic silts were found only under the downstream portion of the site as represented by Boreholes 1 to 4, while the clayey silt was observed in Boreholes 4 to 6, i.e. under the upstream part of the site.

The thickness and surface elevations of the individual strata vary considerably, particularly in the downstream section of the site.

Since details of the subsurface conditions are shown on the individual borehole logs, the following paragraphs are

.../...

intended only to summarize briefly the main characteristics of the various soils strata.

3.1 Fill and Topsoil

Boreholes 1 and 2 encountered fill extending to depths of 1.8 and 0.5 m respectively. The fill consists predominantly of brown silty sand with some gravel. At Borehole 1, the surface was covered by a 0.3 m thick surficial layer of topsoil, whereas at Borehole 2 the fill was underlain by a 50 mm thick layer of topsoil, which probably represents the original ground surface. At Borehole 3, a surficial layer of topsoil had been partially stripped.

3.2 Fine Sand with Silt

Below the surficial fill and topsoil or the ground surface in Boreholes 2 to 7, a layer of fine sand containing varying amounts of silt was encountered. This material is layered and was found at various depths within the horizon explored by the boreholes. Only Borehole 1 failed to encounter the stratum. An upper sand layer was fairly continuous throughout Boreholes 2 to 7, extending to depths between 0.9 and 2.1 m. A deeper layer was encountered at depths of 1.4 to 2.9 m in Boreholes 3 and 7. The results of grain size

.../...

distribution tests are presented on Figures 1 and 2, showing 0 to 4% gravel, 48 to 85% sand, and 15 to 50% silt. The natural moisture contents of these layers vary considerably, from 13 to over 20%. Standard penetration tests yielded "N"-values ranging from 5 to 24 blows per 0.3 m, and averaging about 10. From these values, the relative density of the sand is inferred to be loose to compact. The coefficient of permeability of the sandy layers is estimated to be in the order of 10^{-3} cm/second, while the more silty layers have an estimated coefficient of permeability of 10^{-5} cm/second.

3.3 Organic Silt

Underlying the fill in Borehole 1 and the silty fine sand in Boreholes 2, 3 and 4, the subsoil is a dark brown or black coloured organic silt. This layer was contacted at depths between 0.9 and 2.1 m, and extends to depths of 1.4 to 2.6 m. Shells, decaying wood and other organic matter were embedded in the matrix of the soil. Standard penetration resistances ("N"-values) in this material range from 3 to 6 blows per 0.3 m, indicating a very loose to loose relative density. The natural moisture content is over 20%. The undrained shear strength of the material, as indicated by in-situ vane tests, ranges from about 43 to 67 KPa (900 to 1400 psf), however,

.../...

due to the sandy nature of the organic silt, the field vane tests may yield values which greater than the actual shear strength of the soil mass.

3.4 Sand and Gravel

At greater depth, generally underlying either the silty fine sand layers or the organic silt layers, each of the boreholes contacted a layer of brown sand and gravel containing traces of silt. In Boreholes 1, 2 and 3, the upper surface of this deposit was found at depths of about 2.5 to 3.2 m, however, since these boreholes were terminated in this deposit, the overall thickness of the stratum is not known. At Boreholes 4 to 7 inclusive, however, the boreholes penetrated through the deposit and the base of the sand and gravel stratum was recorded at depths of 2.6 to 3.4 m. The results of grain size analyses performed on representative samples are shown on Figures 3 and 4, indicating that the material consists of 10 to 65% gravel, 30 to 85% sand and less than 5% silt. The natural moisture content varies from about 11 to 17%. Standard penetration tests gave "N"-values ranging from 13 to over 40 blows per 0.3 m, and averaging approximately 23 blows, indicating tha the deposit is compact to dense. From these results, it is inferred that the sands and gravels are compact to dense. The permeability of the material is

.../...

estimated to be in the order of 10^{-2} cm/second.

3.5 Clayey Silt

Underlying the sand and gravel, at depths between 2.6 and 3.4 m, Boreholes 4, 5 and 6 encountered the surface of a clayey silt. The full thickness of the deposit was not determined. The material has the matrix and characteristics of a glacial till and contains traces of sand and gravel. Based on "N"-values of 30 blows per 0.3 m, the material encountered in Boreholes 4 and 6 is said to have a hard consistency, while in Borehole 5 the clay is soft ("N"=4). The undrained shear strength of the soft clay in Borehole 5 was measured by field vane tests. The values range between approximately 19 and 45 KPa and average about 32 KPa (700 psf). The permeability of the silty clay is estimated to be very low.

3.6 Groundwater Conditions

At the time of the investigation, the groundwater level was found to be between Elevation 81.5 m at Borehole 7 and about 79 m at Boreholes 1 and 2. This indicates a slight gradient along the course of the stream from north to south.

.../...

4.0 DISCUSSION OF THE RESULTS

4.1 General

The investigation has indicated that the line of the proposed dyke is underlain by two somewhat different soil stratigraphies. In the downstream portion of the site, where the dyke alignment is further removed from the creek (Boreholes 1 to 4), the subsoil comprises a variable sequence of fine sand, organic silt, and sand and gravel layers extending mostly to the full depth of the boreholes.

Further upstream, Boreholes 5, 6 and 7, which are situated closer to the present stream course, did not encounter the organic silt and the sequence of silty fine sand, sand and gravel and a further layer of sand is underlain by soft to hard silty clay.

For the purposes of analysis, the site may be divided in two parts extending upstream and downstream from Borehole 4. Upstream from Borehole 4, the controlling soil deposit for the purpose of stability analysis is the soft silty clay. This stratum has a relatively low shear strength, is compressible, and has a low permeability. The following parameters may be assumed for design.

.../...

Unit weight of clay - 16 kN per cubic metre

Average shear strength - 28 kN per square metre (600 psf)

Coefficient of permeability - 10^{-8} cm/second

Downstream, the loose organic silt deposit is the significant stratum, and for the purpose of design, the following parameters are suggested.

Unit weight of silt - 17.5 kN per cubic metre

Angle of shearing resistance - 27 degrees

Coefficient of permeability - 10^{-5} cm/second

Since the borrow material for the dyke can originate from any one of several excavation sites within the Town, the analysis has been based on the assumption that the material will comprise a select, well graded glacial till ranging from sand to clay size particles. It is assumed from previous experience that the permeability of the borrow material will be of the order of 10^{-5} cm/second.

4.2 Foundations

The bearing capacity of the subsoil to carry the weight of a 3 m high dyke constructed with 2:1 side slopes has been analyzed at various locations along the dyke and it has been

.../...

found that the foundation stratum will provide a factor of safety greater than 2.0 against the possibility of general shear failure of the foundation. This is considered to be adequate.

4.3 Settlement

Based on analysis, it is estimated that the settlement under a 3 m high embankment will be about 0.1 m. It is, therefore, recommended that the crest elevation of the dyke be raised by 0.1 m above the proposed design elevations to allow for this settlement. The settlement will be time dependent, but the majority of the settlement should be completed by the end of the first year.

4.4 Subsurface Erosion

Assuming that the high water level on the upstream side of the dyke is maintained at an elevation 0.3 m below the top of the dyke for a sufficiently long period of time, it is possible that the dyke could fail by "piping" (i.e. by subsurface erosion) through the silty fine sand foundation material. However, in order to develop a steady seepage condition, it is estimated that the high water level must be maintained for a period in excess of a week. Since it is

.../...

understood that the flood waters will rise, peak and drop again within a period of a few hours, it is our opinion that there is an adequate safety factor against the possibility of a failure due to piping through the silty fine sand stratum. The underlying sand and gravel stratum, however, is much more pervious than the silty fine sand, and it is expected that steady seepage conditions in this stratum could develop in a much shorter time, in approximately one day. This condition could be aggrevated by the fact that in the area represented by Boreholes 4, 5, 6 and 7, the alignment of the dyke is considerably closer to the creek and the base of the dyke narrower, thus further reducing any time lag for this condition to develop. It would be prudent to carefully observe the conditions at the site immediately following the first few floods after the dyke is constructed to determine if any material is being eroded. If any "boiling" is noted, this office should be consulted for further recommendations.

4.5 Uplift

The ground on the downstream side of the dyke could theoretically be threatened by uplift due to the water pressure in the sand and gravel stratum underlying the less pervious organic silt and fill layers in Boreholes 1 to 4 inclusive. Assuming that the sand and gravel stratum is

.../...

hydraulically connected to the creek, during flood conditions the head of water in the sand and gravel stratum could be as much as 2.9 m above the ground surface. As the overlying silt and fill are considerably less pervious, this pressure cannot be relieved by seepage through the silt or fill, consequently, the pressure would tend to lift up the overlying silt strata. This uplift pressure is resisted only by the weight of the overlying strata. Assuming that at Borehole 3 the thickness of the overlying strata is a minimum of 1.4 m and that the bulk unit weight of the silt and overlying sand averages about 17.5 kN per cubic metre, the maximum resisting force that could be mobilized at this location is 24.5 kN per square metre. The maximum uplift pressure at the interface of the silt and the underlying sandy gravel is equal to 4.3 m of water head (i.e. about 43 kN per square metre). The safety factor against uplift is, therefore, only 0.6. The critical head for a factor of safety of 1 is elevation approximately 81.7 m.

However, the water pressure in the sand and gravel deposit will not rise immediately with the water level in the creek. The time lag between the increase in pressure and the rise in the water level will be a function of the distance from the creek and the dyke. Between Boreholes 1 to 4, where this

.../...

phenomena could occur, the most critical location is Borehole 4, which is about 50 m from the creek, therefore, assuming that the minimum distance between the dyke and the creek is 50 m, and that the dyke at its base is 15 m wide, it is estimated that at this distance the time lag required for the water pressure to respond will be of the order of one to two days. As the duration of the flood level is expected to be considerably shorter, a blow-out condition on the dry side of the dyke is unlikely to develop. It would, however, be prudent to carefully observe the ground conditions for signs of an imminent blow-out (i.e. boils, tension cracks, etc.) during the first few floods following the construction of the dyke.

In view of the low probability of a blow-out occurring and that the consequences of blow-out would not be too serious, we do not consider it necessary at this time to incorporate in the design remedial measures to prevent uplift.

In the area represented by Boreholes 5, 6 and 7, where the dyke alignment is much closer to the stream course, it is expected that a rapid blow-out will not occur as the overlying silty fine sand is sufficiently pervious to allow for the upward seepage of the excess water pressure. As

.../...

[illegible]

indicated in the previous sub-section, however, this area should be observed for signs of "piping" following the first few floods after the completion of the dyke.

4.6 Dyke Cross Section

Making the previous assumptions regarding the nature of the borehole material, our analysis indicates that the following minimum dyke cross section should be adopted. The crest elevation should be raised 0.1 m above the proposed crest elevation to allow for settlement; crest width 4 m, side slopes 2:1 (horizontal to vertical), are acceptable.

4.7 Construction

We recommend that any topsoil encountered be stripped throughout the full width of the dyke. The topsoil could be stockpiled and re-used after construction for the top dressing of the dyke.

The surface of the natural subgrade soil should be left rough so that the first lift of the fill material blends in and forms a homogeneous mixture with the subgrade. Depending on the dyke material used, other methods may be required to achieve this desired effect. Furthermore, at the beginning

.../...

of each day's work, the surface of the fill in the embankment should be inspected to ensure that it has not dried out or that it is not uniformly smooth. Should the surface become exceptionally dry, it is recommended that water be applied and that the surface be roughened before the next lift of material is placed. Alternatively, if a crust has formed on the surface of the fill, the hardened layer should be scraped off in order to expose a more workable underlying material.

The material used for dyke construction should be placed in uniform lifts throughout the full width of the dyke, the maximum thickness of a lift should not exceed 200 mm, and each lift should be compacted to not less than 95% of its standard Proctor maximum dry density. The degree of compaction should be checked with frequent in-situ density tests.

5.0 STATEMENT OF LIMITATION

The Statement of Limitation, as quoted in Appendix "A", is an integral part of this report.

GEO-CANADA LTD.

Ivan P. Lieszkowszky, P.Eng.

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A P P E N D I X

APPENDIX
"A"
Statement of Limitation

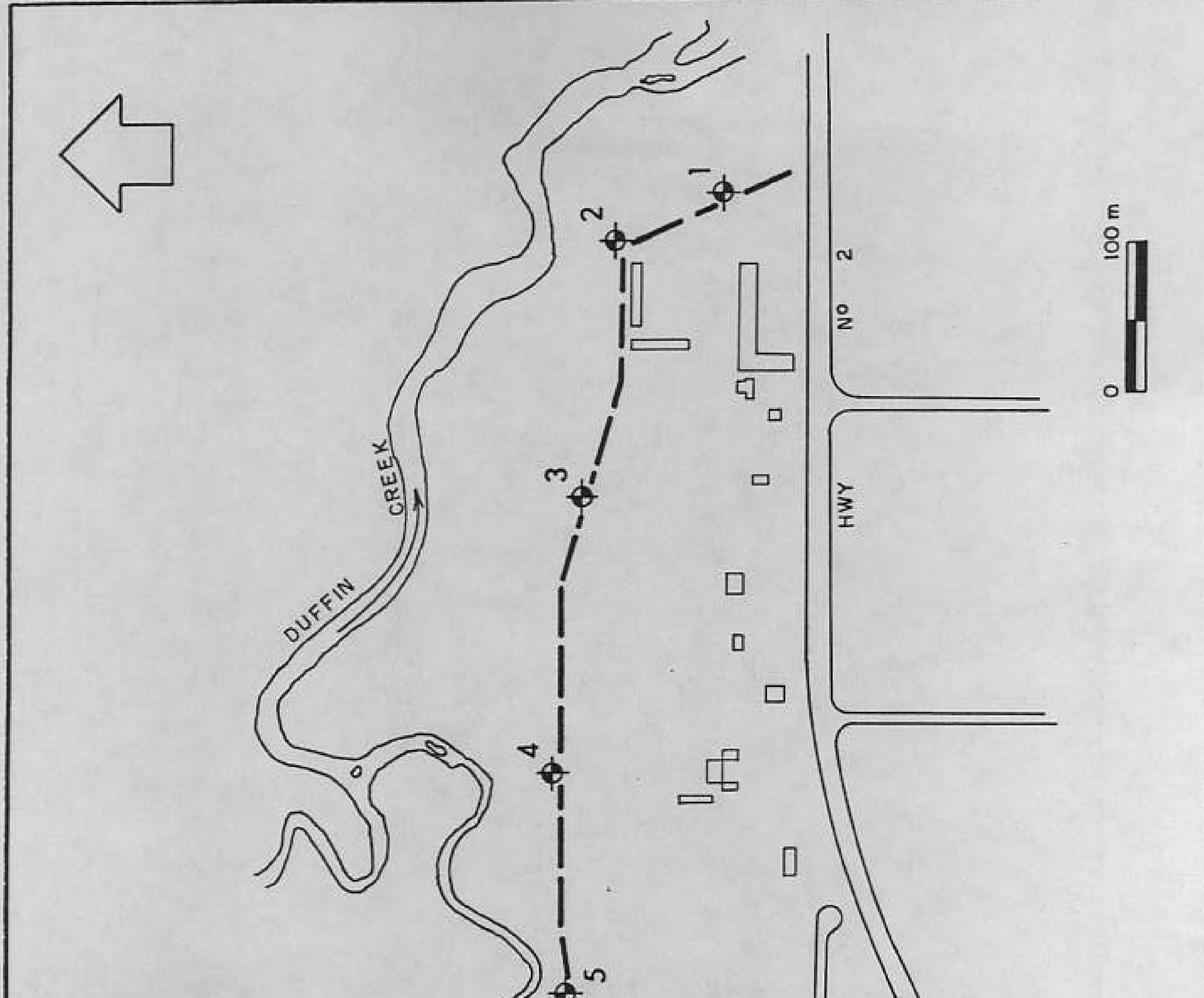
The conclusions and recommendations in this report are based on information determined at the borehole locations. Soil and groundwater conditions between and beyond the boreholes may differ from those encountered at the borehole locations, and conditions may become apparent during construction which could not be detected or anticipated at the time of the soil investigation.

The design recommendations given in this report are applicable only to the project described in the text, and then only if constructed substantially in accordance with details of alignment and elevations stated in the report. Since all details of the design may not be known to us, in our analysis certain assumptions had to be made. The actual conditions may, however, vary from those assumed, in which case changes and modifications may be required to our recommendations.

We recommend, therefore, that we be retained during the final design stage to review the design drawings and to verify that they are consistent with our recommendations or the assumptions made in our analysis. We recommend also that we be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the boreholes. In cases where these recommendations are not followed, the company's responsibility is limited to interpreting accurately the information encountered at the boreholes.

The comments given in this report on potential construction problems and possible methods are intended only for the guidance of the design engineer. The number of boreholes may not be sufficient to determine all the factors that may affect construction methods and costs. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work.

E N C L O S U R E S



BOREHOLE LOCATION PLAN

G-85.0706

ENCL. 1

GEO-CANADA LTD.

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

LOG OF BOREHOLE 2

PROJECT No. G-85.0706

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 DESCRIPTION	SYMBOL	SAMPLE NUMBER	SAMPLE TYPE	'N' BLS/0.3	GROUND WATER	REMARKS % GR.	SA.	SI.	CL.	w
80.9	Ground Surface										
0.0 / 80.4	FILL brown silty sand, some gravel										
0.5 / 79.3	50 mm Topsoil brown SILTY SAND compact to loose, dry to moist SANDY SILT		1	SS	24						
			2	SS	7		1	49	50	0	24
1.6 / 78.3	ORGANIC SILT with fine sand dark brown wet very loose		3	SS	3	W.L. 78.8 m					
2.6 / 77.7	SAND fine to medium, trace shells grey, wet, loose		4	SS	8						
3.2 / 79.4	SAND AND GRAVEL wet, loose										
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 DESCRIPTION	SYMBOL	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE 'N' BLS/0.3	GROUND WATER	REMARKS % GR.	SA.	SI.	CL.	w
81.2	Ground Surface										
0.0 80.3	Topsoil VERY FINE SAND brown, damp loose		1	SS	10						
0.9 79.8	ORGANIC SILT sandy brown, loose		2	SS	6		2	48	50	0	13
1.4 79.0	SAND fine to medium some silt, shells brown, moist, compact		3	SS	16	W.L. 79.3 m	4	76	20	0	19
2.2 78.6	SILT brown, wet, loose		4	SS	8						
2.6 77.7	SAND AND GRAVEL trace of silt brown wet very dense		5	SS	52		60	35	5	0	15
2.5	END OF BOREHOLE										

LOG OF BOREHOLE 4

PROJECT No. G-85.0706

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: DESCRIPTION	SYMBOL	SAMPLE: NUMBER	SAMPLE: TYPE	SAMPLE: 'N' BLS/0.3	GROUND WATER	REMARKS
81.8	Ground Surface						
0.0	FINE SAND damp to moist loose to compact		1	SS	7		
			2	SS	11		
	shells brown / grey		3 A / 3 B	SS	10	▽	
79.7 / 12.1	ORGANIC SILT black, wet, loose		4 A	SS	38		
79.3 / 2.5	SAND AND GRAVEL grey, wet, dense		4 B				
78.9 / 2.9	CLAYEY SILT TILL grey well cemented, hard		5	SS	36		
78.3 / 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 DESCRIPTION	SYMBOL	SAMPLE NUMBER	TYPE	'N' BLS/0.3	GROUND WATER	REMARKS
82.2	Ground Surface						
0.0	FINE SAND trace silt brown, dry loose		1	SS	3		
			2	SS	8		
80.4	shells		3	SS	14	80.2 m	
1.8	SAND AND GRAVEL trace silt, shells grey, wet compact		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						

LOG OF BOREHOLE 6

PROJECT No. G-85.0706

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 DESCRIPTION	SYMBOL	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE 'N' BLS/0.3	GROUND WATER	REMARKS % GR.	SA.	SI.	CL.	w
82.6	Ground Surface										
0.0	FINE SAND some silt brown dry to wet loose		1	SS	5						
			2	SS	7		0	70	30	0	16
80.8			3 A/B	SS	18	W.L. 81.1 m	10	85	5	0	13
1.8 / 80.0	SAND AND GRAVEL with some silt brown, wet compact		4	SS	41						
2.6 / 79.1	CLAYEY SILT TILL grey well cemented hard		5	SS	100						
3.5	END OF BOREHOLE										

LOG OF BOREHOLE ....7.............

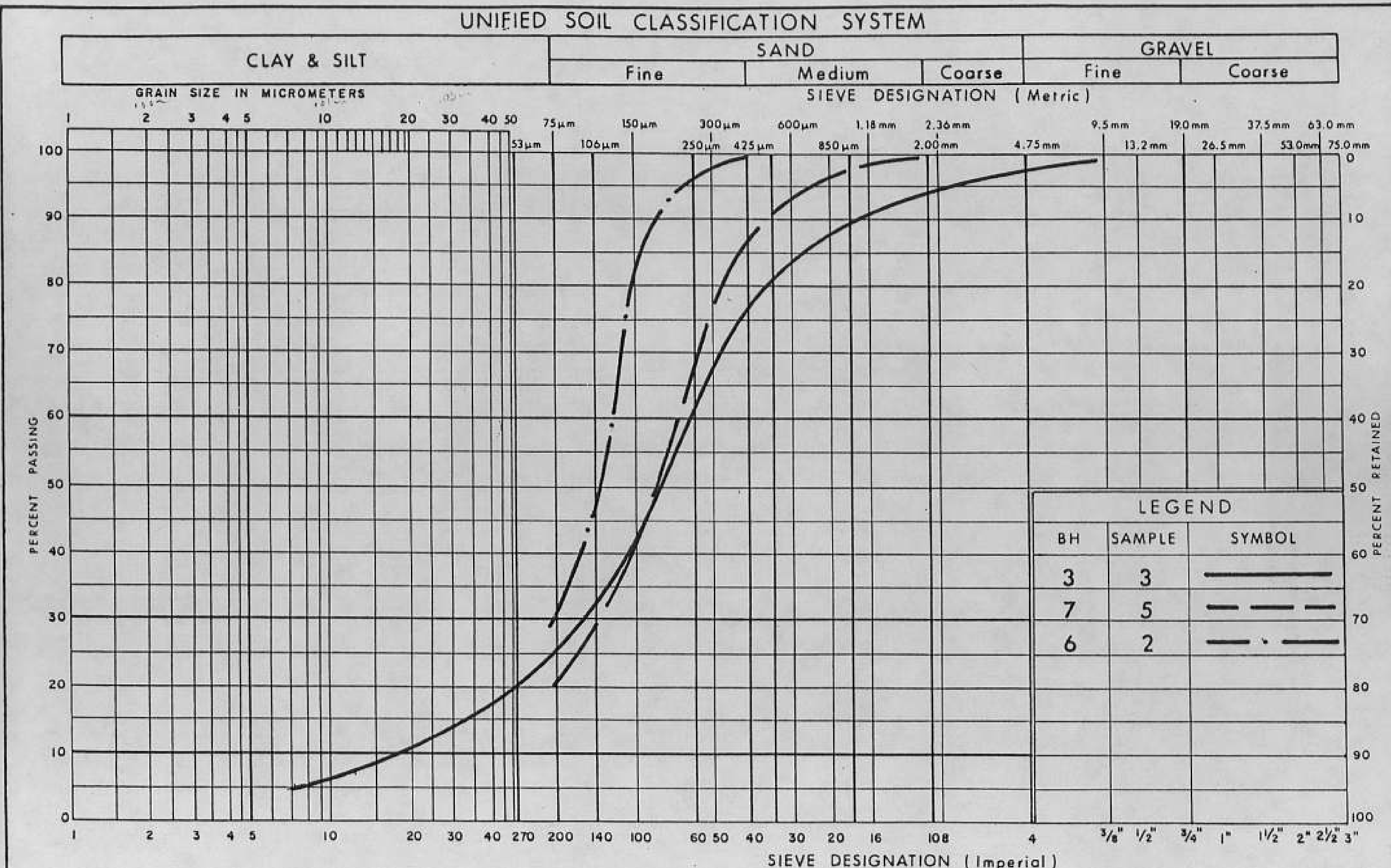
PROJECT No. G-85.0706

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

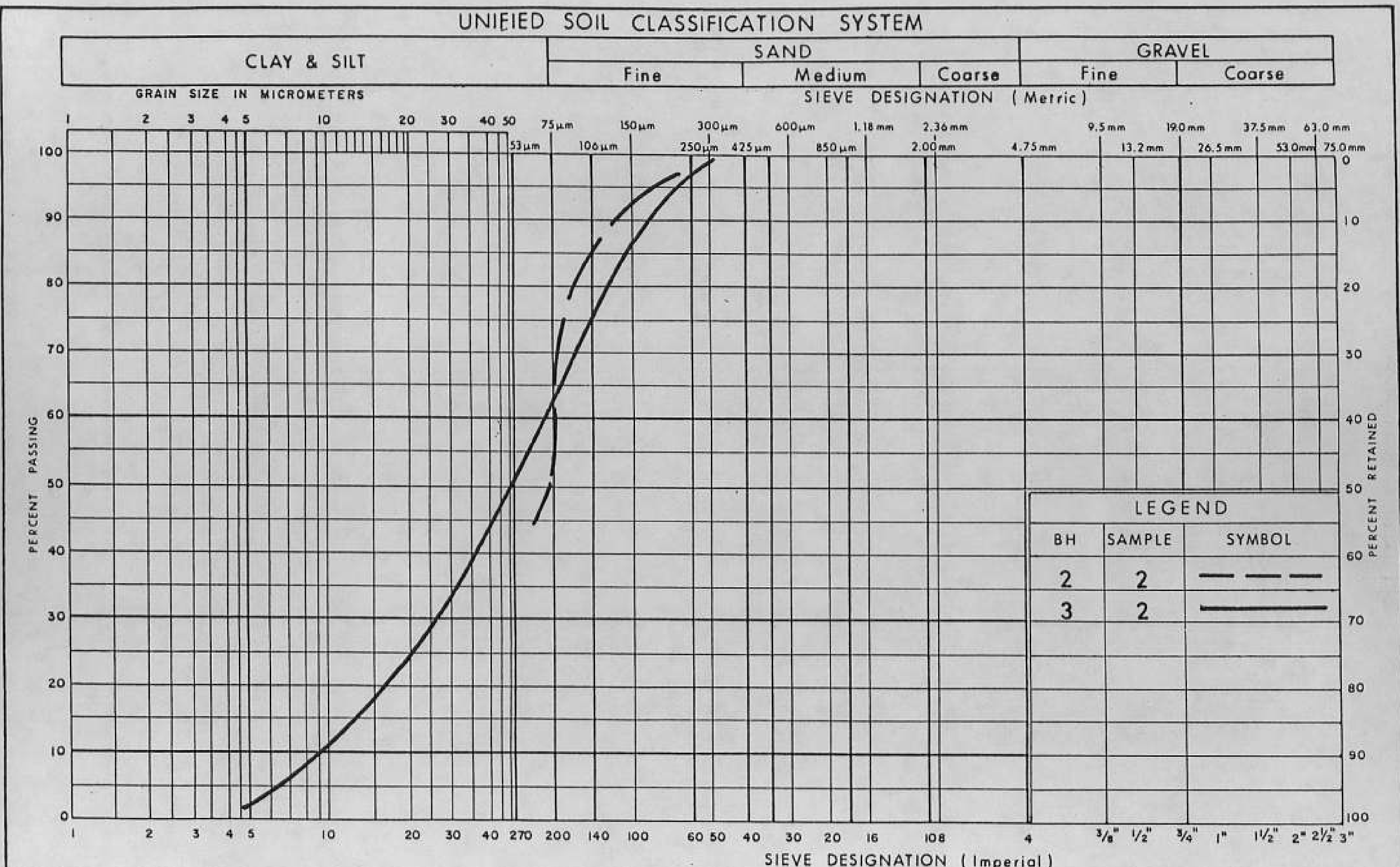
DRILLING DATA

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

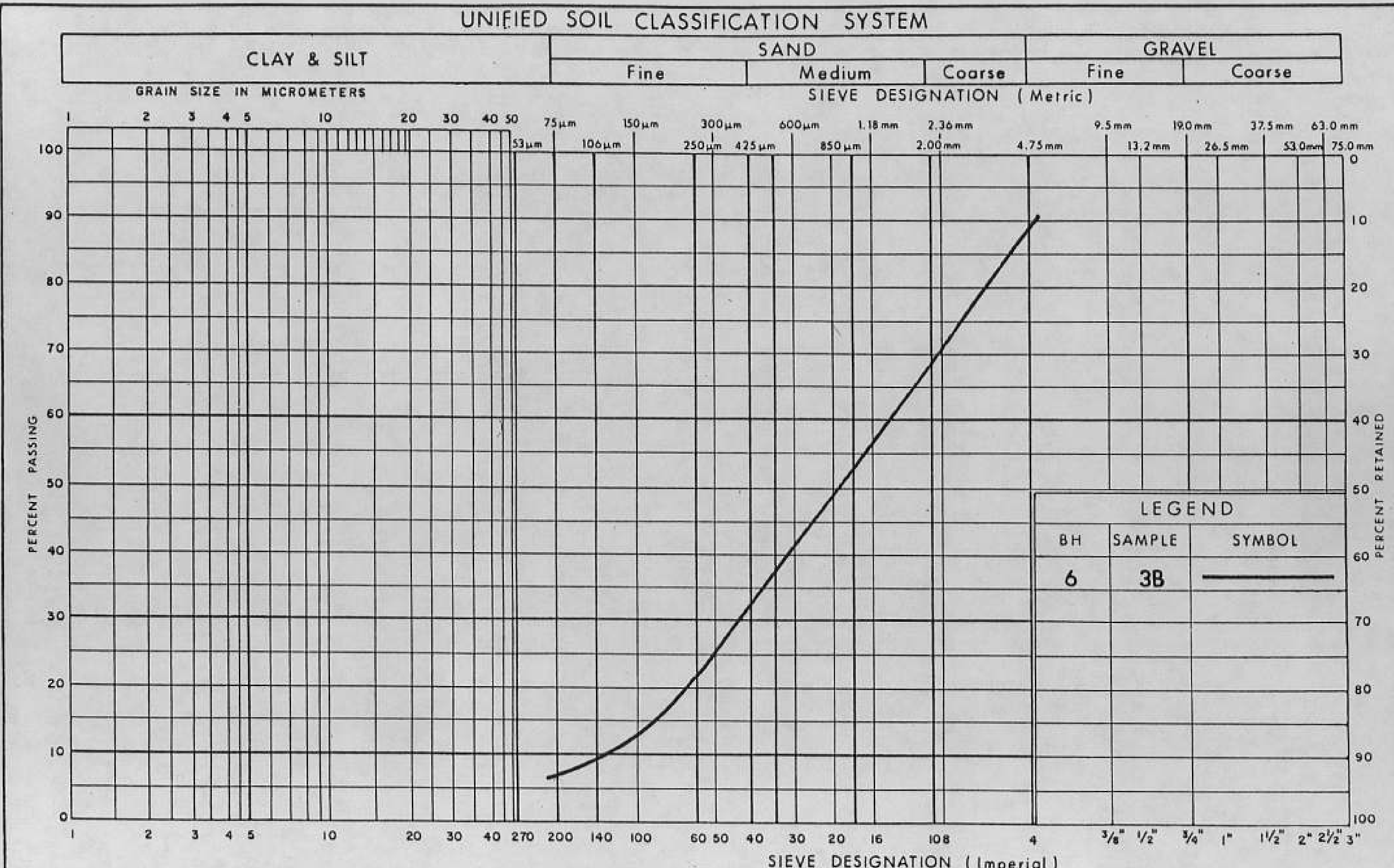
m ELEV. / DEPTH.	SOIL PROFILE DESCRIPTION	SYMBOL	SAMPLE NUMBER	SAMPLE TYPE	'N' BLS/0.3	GROUND WATER	REMARKS % GR.	SA.	SI.	CL.	w
82.8	Ground Surface										
0.0	FINE SAND trace silt brown dry loose		1	SS	5						
81.8			2	SS	17						
1.0	SAND AND GRAVEL with some silt brown moist to wet compact					W.L.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



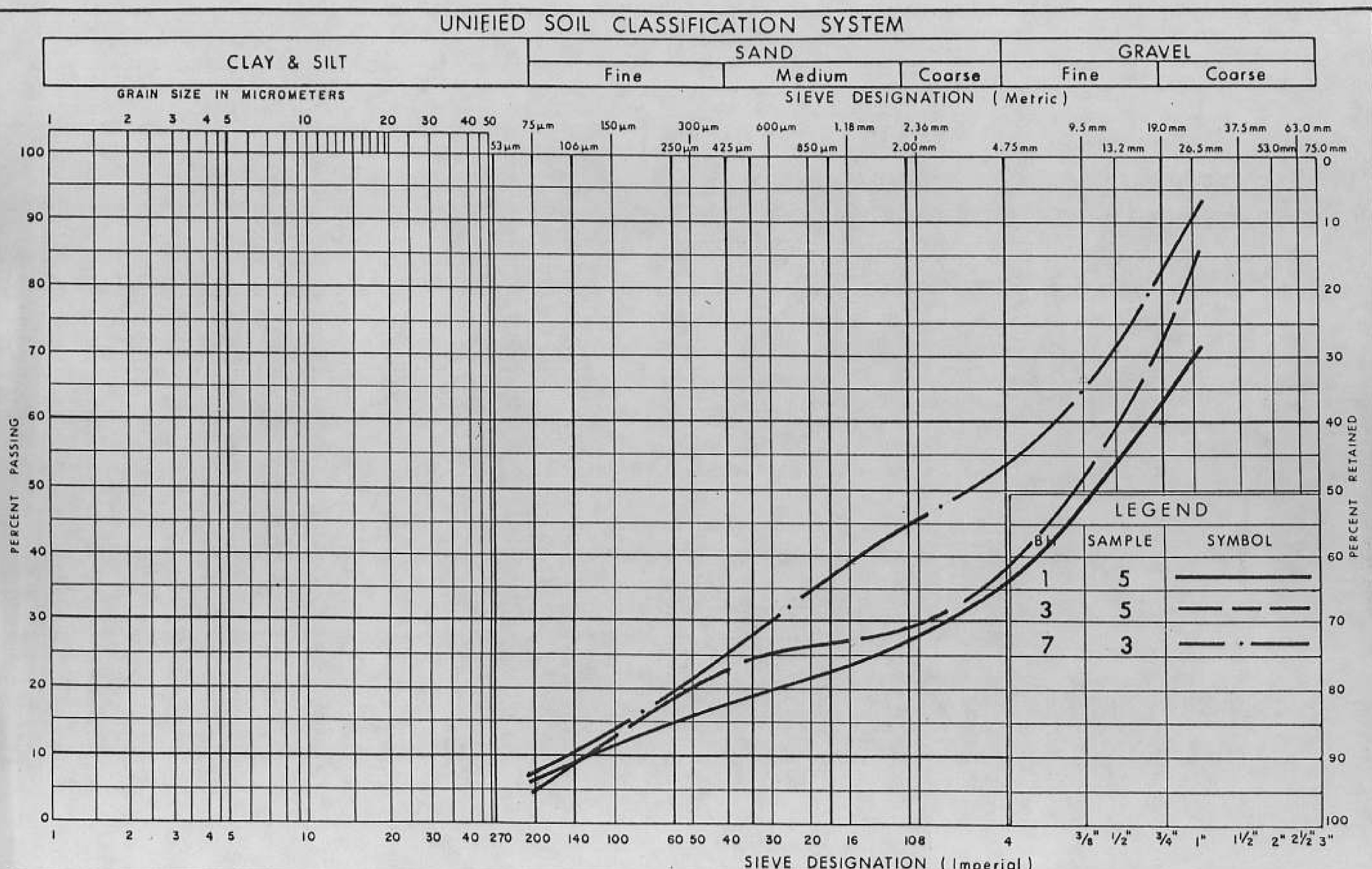
GEO-CANADA	GRAIN SIZE DISTRIBUTION FINE SAND some silt	FIG No 1 REF. No G-85.0706 DATE AUGUST 1985



GEO-CANADA	GRAIN SIZE DISTRIBUTION SILT with fine sand	FIG No 2 REF. No G-85.0706 DATE AUGUST 1985



GEO-CANADA	GRAIN SIZE DISTRIBUTION SAND trace gravel, silt	FIG No 3 REF. No G-85.0706 DATE AUGUST 1985



GEO-CANADA	GRAIN SIZE DISTRIBUTION SAND and GRAVEL trace silt	FIG No 4 REF. No G-85.0706 DATE AUGUST 1985