

56-F-213C

Hwy 401 : 27

DISTRICT # 6

UNIVERSAL
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DEC. 1956

56-F-213 C

REPORT

on

SUBSURFACE EXPLORATION

for

INTERCHANGE SITE

of

HIGHWAYS 401 AND 27

DISTRICT N° 6, ONTARIO

2924 Bloor Street West,
Toronto 18, Ontario.

REPORT

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SUBSURFACE EXPLORATION

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INTERCHANGE SITE

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HIGHWAYS 401 AND 27DISTRICT N° 6, ONTARIOINTRODUCTION

The Highways Department of the Province of Ontario are planning a widening of Highway 27 and a relocation of Highway 401 at their interchange in Toronto Gore Township south of Dixon Road.

This highway widening and relocation necessitates further crossings of Mimico Creek, Highway 27 and the access road to Highway 401 East already being carried over the creek by reinforced concrete culverts.

In order to evaluate the properties of the overburden and determine the depth to the underlying rock, the Department authorized subsurface exploration at the locations of the proposed culverts. Soil boring and diamond core drilling was accordingly carried out between the 16th November and the 7th December, 1956.

The extent of the exploration conformed to the information indicated on drawings N°E-3084-1, N°E-3086-1 and N° 3085-1. As work proceeded, an additional borehole BH.3, and slight re-locations of boreholes BH.4, 5, 6 and 7 were requested by D.H.O. Furthermore, in order to expedite the work, the locations of BH.5 and BH.6 were moved a few feet to more accessible positions as agreed with the D.H.O. Field Engineer.

PHYSIOGRAPHIC FEATURES

The Mimico Creek upstream and downstream of the explored site exhibits a narrow flood plain bordered by comparatively steep banks of the surrounding Till plain. Occasional small streams flowing from the Till plain into the Mimico Creek create miniature hanging valleys indicating relatively poor permeability of the Till. Within the explored area some diversion of the original creek bed is noticeable.

SUBSURFACE EXPLORATION

Subsurface exploration comprised a total of seven exploratory boreholes located substantially in the positions requested by D.H.O. and now shown on drawings 2, 4 and 6 accompanying this Report.

The positions of the boreholes were staked by the Staff of D.H.O. whilst the levelling was done by a field crew of Universal GEOTECHNIQUE.

All levels were referred to the water level of Mimico Creek as it was on the afternoon of the 7th December, 1956, this datum being assumed as 100.0 feet.

All boreholes were taken to rock and thereafter drilling was continued to various depths to ascertain the formation and determine its condition.

Penetration through the overburden was sometimes difficult due to the frequency of boulders and the high percentage of broken shale fragments that were chipped from the parent rock by the glacier and transported for a short distance.

Whenever possible split barrel samples were taken in the overburden and the state of compaction and consistency were determined by standard penetration tests taken at intervals of 5 feet or more frequently where it was considered necessary. (The standard penetration test, as referred to in this Report, involves the recording of the number of blows (N) of a 140 lb. hammer falling 30 inches that are required to drive a 2 inch diameter split barrel sampler 1 foot into the soil at the bottom of the borehole, after an initial penetration of 6 inches).

Diamond core drilling in the rock was carried out with AXT bits but due to the structure of this sedimentary formation, core recovery was sometimes difficult.

Free water was encountered in all boreholes at approximately the same elevation as the water level of the Mimico Creek.

Details of the strata as shown on the borehole logs together with soil and rock profiles, form part of this Report.

Subsurface conditions given in this Report are those indicated by material encountered in the boreholes. The accuracy of extrapolation to obtain the soil profile should be associated directly with the geological conditions and inversely with the spacing of the boreholes.

GEOLOGICAL FEATURES

From the information disclosed by the investigation the strata underlying the proposed site can be divided into the following categories:

(a) FILL

The presence of Fill on this site does not mean a completely foreign material that might have been brought from afar; the material under this heading seems to be of local excavation which was dumped in order to correct the channel bed of the Mimico Creek, while some of it might have been unintentionally dumped during the construction of the existing Highways 27 and 401.

It is generally composed of local Till with an occasional admixture of decaying wood in the form of branches and broken fragments of tree trunks.

(b) TILL

Under this heading, what seems to be a fairly complex mixture of Till, reworked Till and some glaciofluvial deposits have been brought together. In spite of the comparative thinness of these deposits we suspect two layers of Till belonging to different periods, probably the result of local recession and advance of the final glacial substage.

The Till varies from sandy to clayey material and contains a fairly high percentage of gravel and boulders, particularly the lower system.

(c) ALLUVIAL DEPOSITS

These deposits are represented in borehole BH.5 by a bedded sand which is most likely of interglacial origin, and by the thin layers and lenses of sand and some waterworn gravels deposited by the Mimico Creek.

(d) ROCK

The bedrock consists of dark grey shale with bands or lenses of calcareous shales and limestones belonging to the Dundas formation. These shales, to the explored depth, are generally weathered and broken and in some cases a fairly well developed jointing could be observed.

DISCUSSION

It is understood that tentative designs for the culverts envisage the use of spread footings located at a depth of about 6 feet below the present water level in the creek, and that a bearing capacity of 3 tons/sq. ft. has been used for preliminary design purposes.

In all the boreholes, with the exception of BH.4, the soil at the specified depth could normally be expected to have a safe bearing capacity of 3 tons/sq. ft. However, for reasons discussed later in this Report, a somewhat lower figure may be preferable.

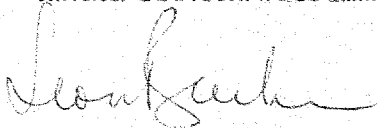
In borehole BH.4 the material was a sandy clay with gravel and the safe bearing capacity was assessed as 1-1/2 tons/sq. ft. However, this softer material may be only local, and at 9 feet below the water level of the creek the safe bearing capacity for normal concentric loading increased to 3 tons/sq. ft. and a few feet lower bedrock was encountered.

Due to the heterogeneous nature of the deposits overlying the bedrock at this locality the ultimate bearing capacity will obviously be variable at any given level: To determine the degree of such variability in detail would entail a probably unjustifiable amount of exploration.

Therefore, taking into account the foregoing fact, and the necessity to assess the bearing capacity at any given level from two drillholes in heterogeneous deposits on each site, and the ratio of dead to live load in this type of structure, it appears expedient to limit the safe bearing capacity for concentric loading to 2 tons/sq. ft.

If it is anticipated that a substantial proportion of the flood capacity of the existing culverts may be required, the question of scour adjacent to spread footings should receive consideration as the creek bed material is certainly susceptible to scour under flood conditions. In this connection it should be observed that the figures for bearing capacity quoted in this Report assume that spread footings will always have a minimum surcharge of 2 feet of undisturbed material.

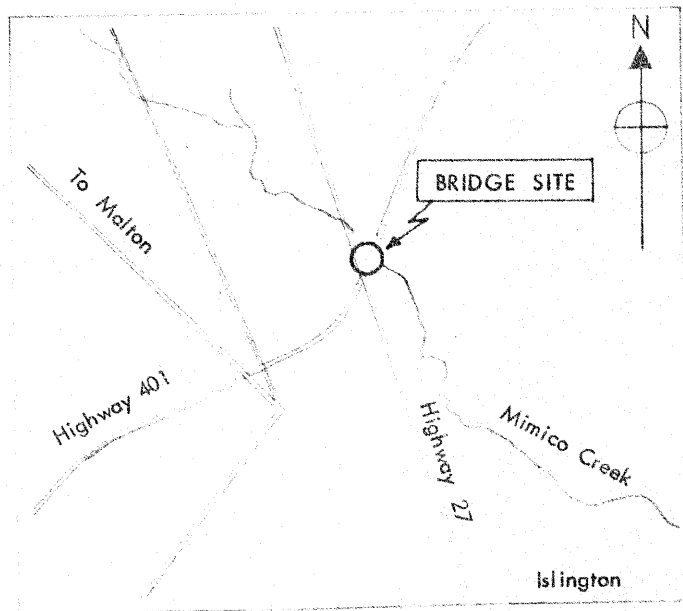
Universal GEOTECHNIQUE Limited,



L. Baskin, P.Eng.
Engineering Geologist.

Report N° T. 178/56

December, 1956.



KEY PLAN

Scale: 1" = 1 Mile

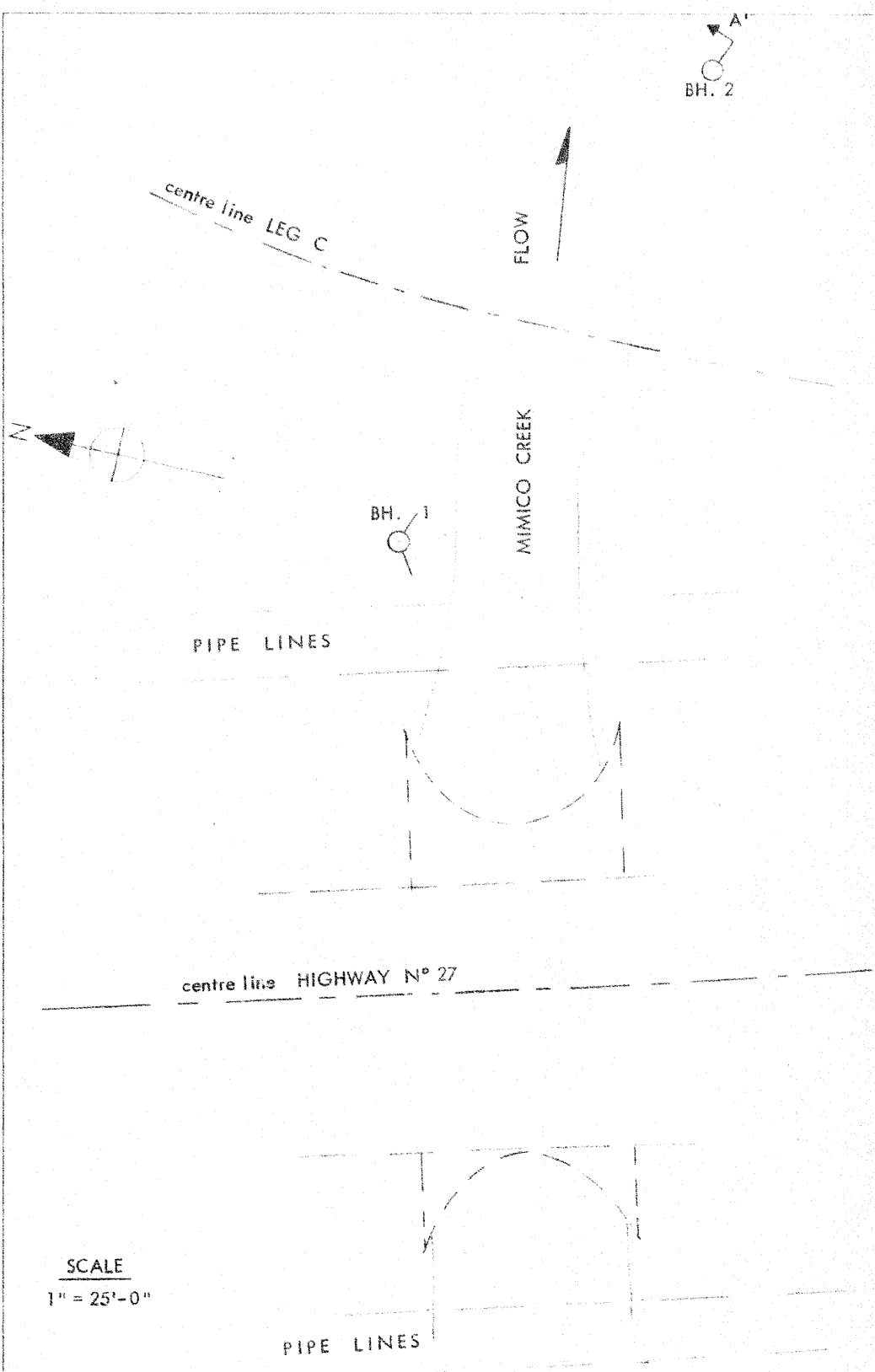
PROJECT Interchange Highway 401 & 27

TITLE Key Plan

DRG. NO. 1 ORDER NO. T.179/56



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This Drawing is an approximate copy of a section of Plan
 D.M. 4215 B supplied by the Department of Highways, Ontario.

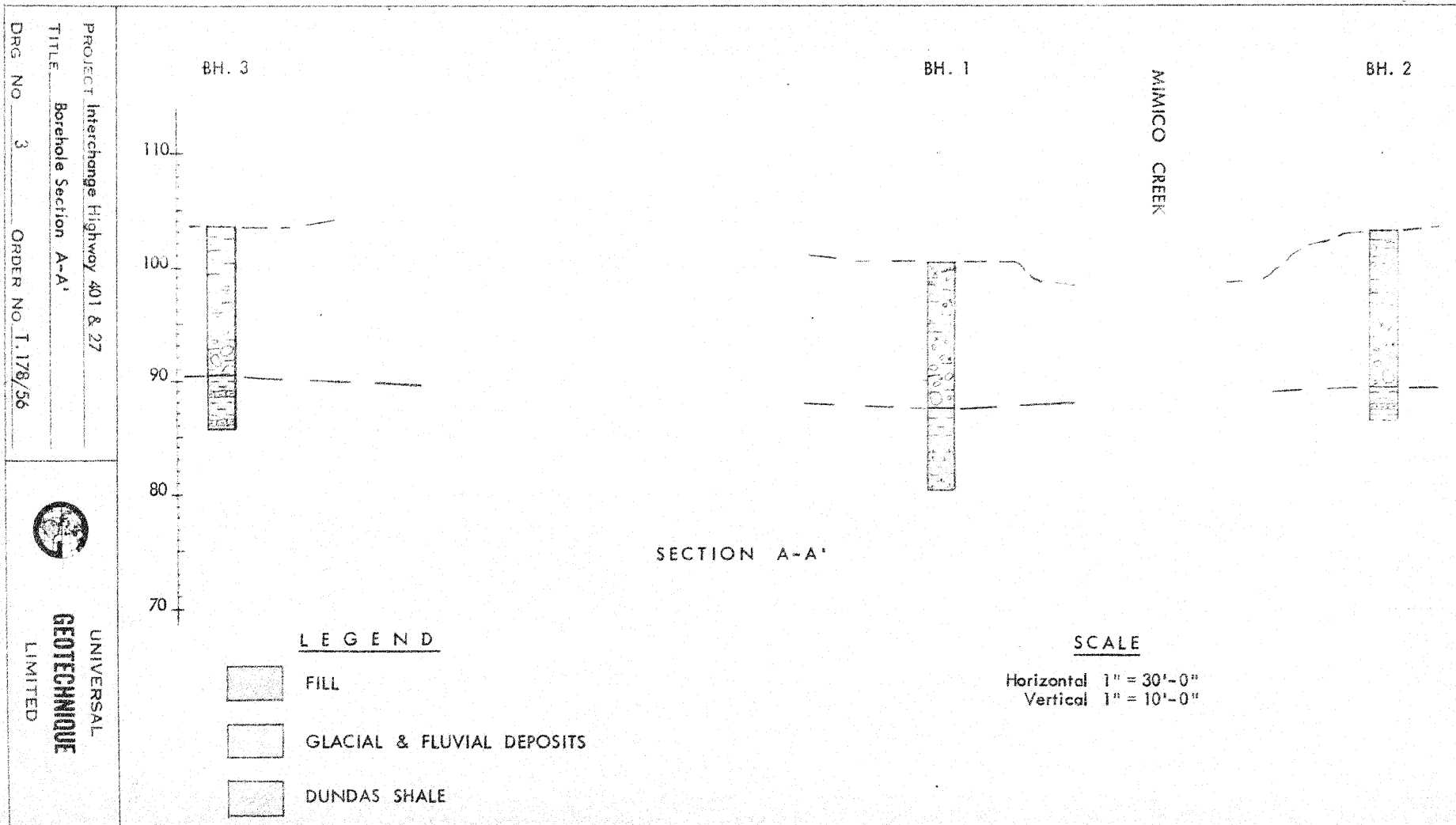
PROJECT Interchange Highway 401 & 27

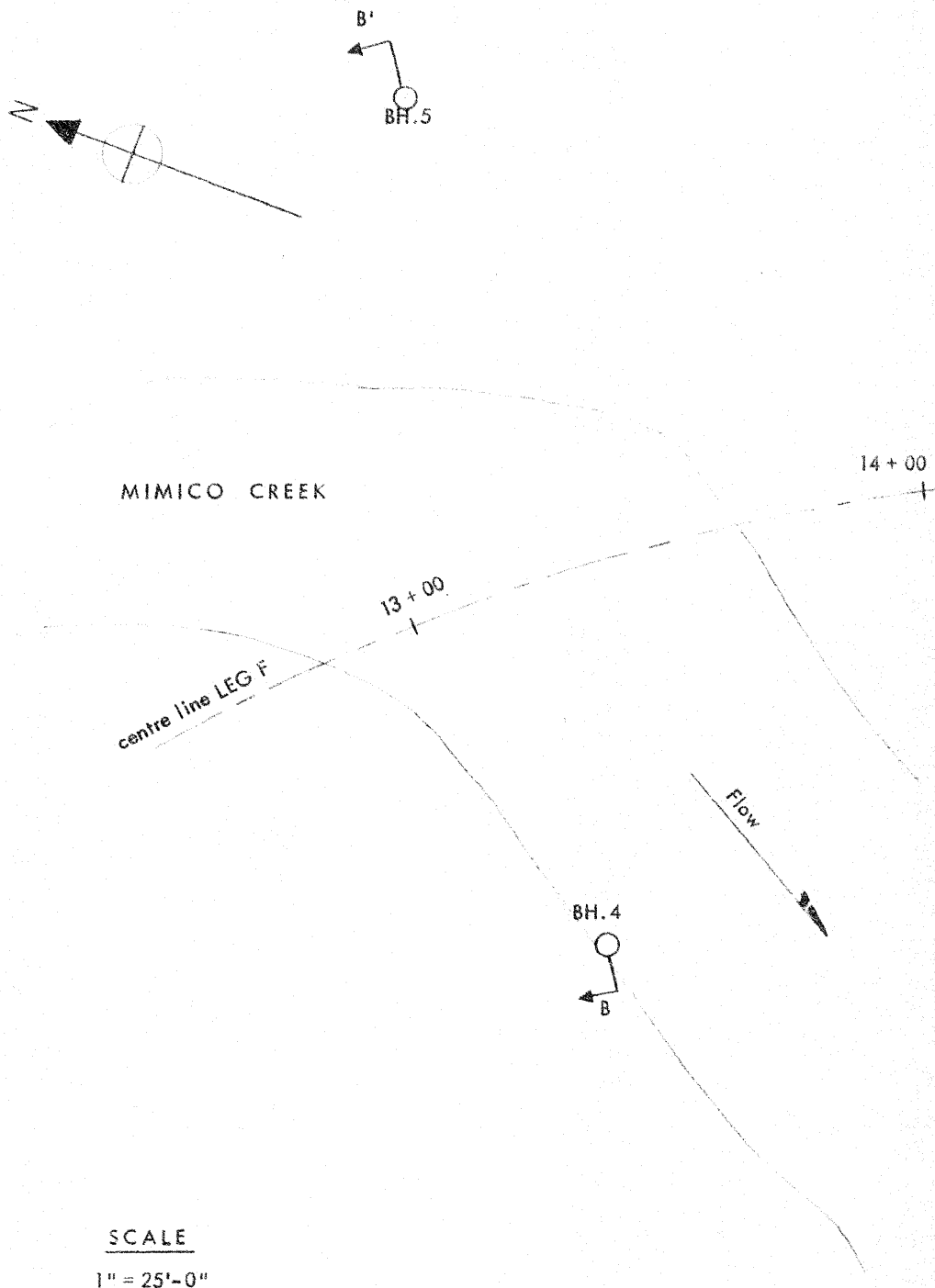
TITLE Borehole Plan: BH.1, BH.2 & BH.3

DRG No. 2 ORDER No. T.178/56



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SCALE
1" = 25'-0"

This Drawing is an approximate copy of a section of Plan D.M. 4215 B
supplied by the Department of Highways, Ontario.

PROJECT Interchange Highway 401 & 27
TITLE Borehole Plan: BH.4 & BH.5
DRG NO 4 ORDER NO T.178/56

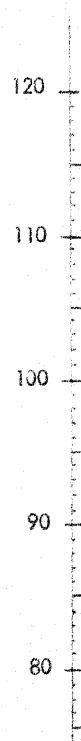


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PROJECT Interchange Highway 401 & 27
 TITLE Borehole Section B-B'
 DRG NO. 5 ORDER NO. 1.178/56






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BH.4

MIMICO CREEK

LEGEND

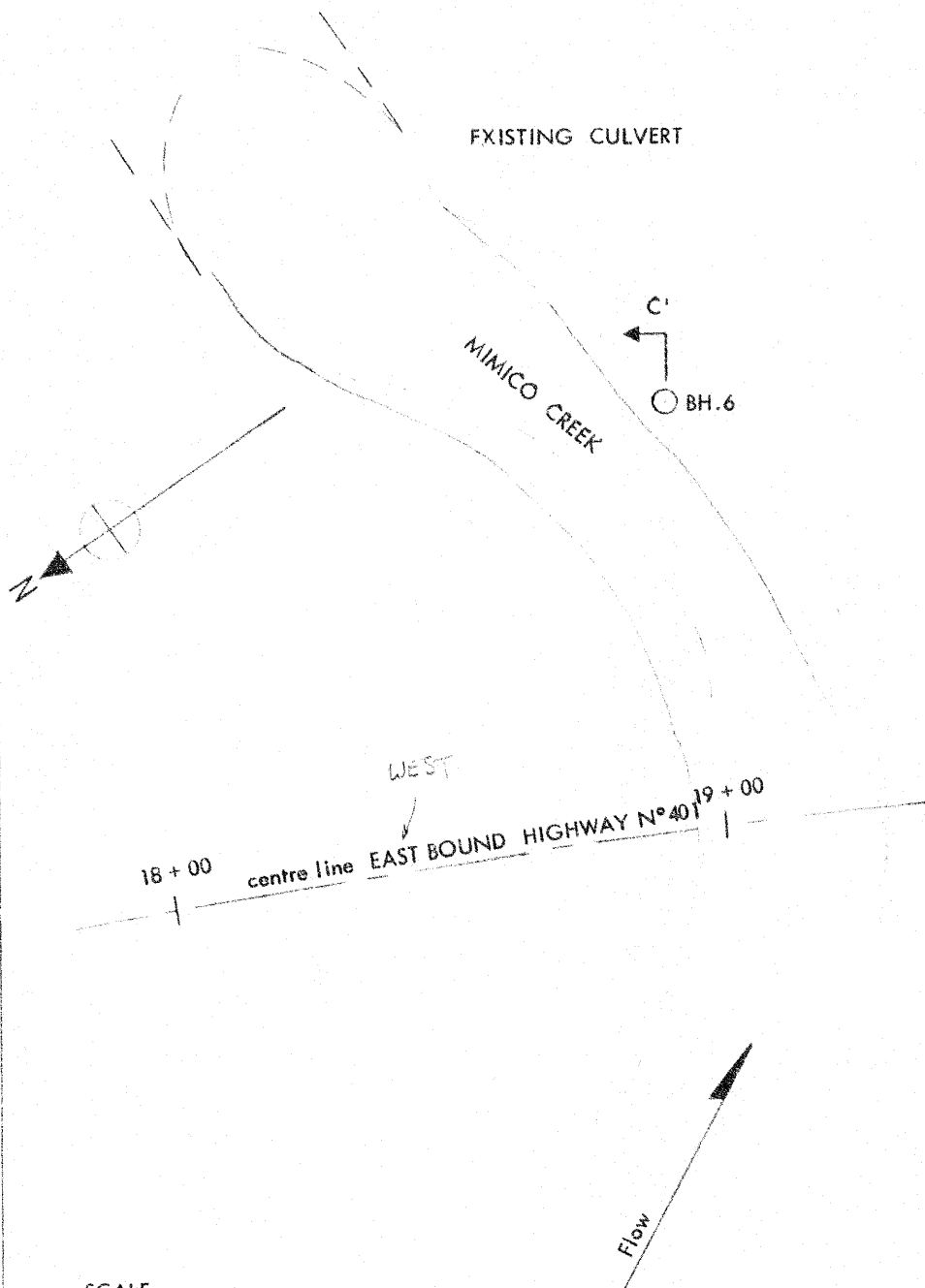
-  FILL
-  GLACIAL & FLUVIAL DEPOSITS
-  DUNDAS SHALE

BH.5

SECTION B-B'

SCALE

Horizontal 1" = 30'-0"
 Vertical 1" = 10'-0"



SCALE
1" = 25'-0"

This Drawing is an approximate copy of a section of Plan D.M. 4215 B supplied by the Department of Highways, Ontario.

PROJECT Interchange Highway 401 & 27

TITLE Borehole Plan: BH.6 & BH.7

DRG. NO. 6 ORDER NO. T.178/56

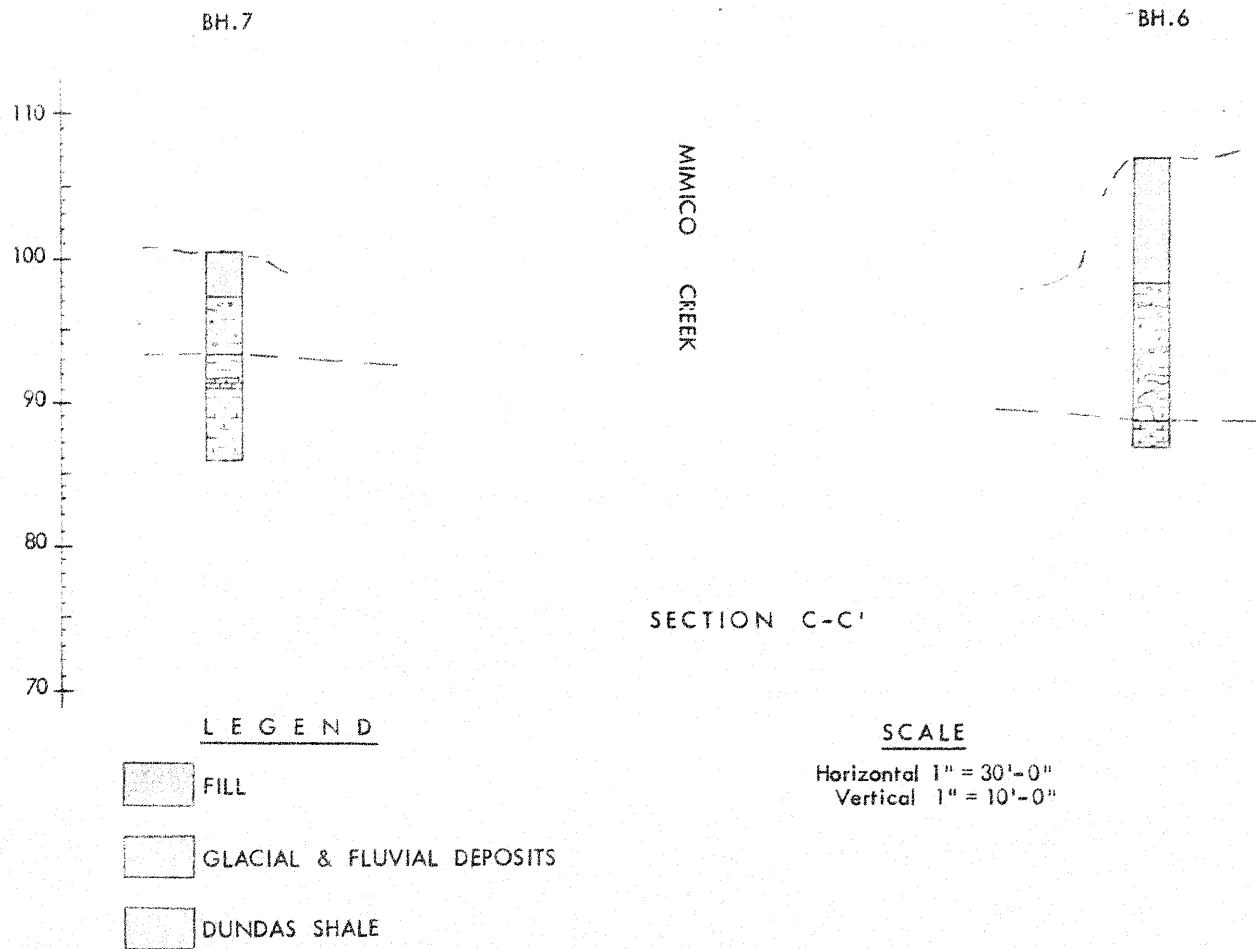


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PROJECT Interchange Highway 401 & 27
TITLE Borehole Section C-C'
DRG. NO. 7 ORDER NO. T.1/8/56



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SOIL MECHANICS LABORATORY

BOREHOLE LOG

PROJECT Interchange Highway 401 & 27, District 6, Ontario.ORDER NO. T. 178/56CLIENT Department of Highways, Ontario.BOREHOLE NO. BH. 1DIAMETER 2-1/2" & AXCASING 2-1/2" & BXBOREHOLE LOCATION See PlanINCLINATION VerticalBEARING

DESCRIPTION OF STRATA	ELEVATION	DEPTH	DIAMETER	INCLINATION	BEARING	REMARKS
Stiff dark grey brown calcareous very sandy CLAY with fine to coarse gravel. Some organic matter.	100.5'	Zero				Moist High Dry Strength
Firm grey to black silty sandy CLAY, somewhat organic with fine to coarse gravel.						Moist: Medium to High Dry Strength
Medium density grey silty clayey fine SAND, with fine to coarse gravel.		6'-0"				Moist: Low to Medium Dry Strength
Clay, Sand, Gravel & Boulders		7'-6"				7'-6" - 10'-0" core recovery 8%
		12'-9"				10'-0" - 12'-9" core recovery 30%
						12'-9" - 14'-6" core recovery 95%
Grey to dark grey laminated fairly soft shale with somewhat calcareous bands.						14'-6" - 17'-4" core recovery 44%
		20'-0"				17'-4" - 20'-0" core recovery 99%
		End of Borehole				

SCALE: 1" = 5'-0" • DISTURBED SAMPLE

■ UNDISTURBED SAMPLE

SOIL MECHANICS LABORATORY

BOREHOLE LOG

PROJECT Interchange Highway 401 & 27, District 6, Ontario. ORDER NO. T.178/56

CLIENT Department of Highways, Ontario.

BOREHOLE NO. BH.2 DIAMETER 2-1/2" & AX CASING 2-1/2" & BX

BOREHOLE LOCATION See Plan INCLINATION Vertical BEARING _____

DESCRIPTION OF STRATA	ELEVATION	TEST NO.	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Stiff dark brown calcareous very sandy CLAY with fine to medium gravel. Some organic matter.	103.1'		● 1	Zero		16	Damp High Dry Strength
Stiff greyish brown calcareous very sandy CLAY, with fine gravel and traces of organic matter. Iron stained.			● 2	2'-6"	Free Water	13	Damp: Medium to High Dry Strength
Firm grey clayey silty fine SAND. Some iron staining.			● 3	7'-0"			Wet: Low to Medium Dry Strength
Dense grey clay, silt, sand and gravel. Some gravel waterworn.			● 4	9'-9"		64(9')	Clayey Matrix Exhibits Medium Dry Strength
Clay, Sand, Gravel & Boulders.				13'-6"			9'-9" - 13'-6" core recovery 54%
Dark grey broken shale with bands of grey argillaceous limestone.				16'-6"			13'-6" - 16'-6" core recovery 42%
				End of Borehole			

SCALE: 1" = 5'-0" • DISTURBED SAMPLE

■ UNDISTURBED SAMPLE

SOIL MECHANICS LABORATORY

BOREHOLE LOG

PROJECT Interchange Highway 401 & 27, District 6, Ontario.

ORDER NO T.178/56

CLIENT Department of Highways, Ontario.

BOREHOLE NO BH.3

DIAMETER 2-1/2" & AX

CASING 2-1/2" & BX

BOREHOLE LOCATION See Plan

INCLINATION Vertical

BEARING

DESCRIPTION OF STRATA	ELEVATION	DEPTH	DEPTH	DEPTH	DEPTH	DEPTH
Stiff brown calcareous sandy CLAY with little organic matter	103.7'	Zero				
Changing To		Free Water				
Firm brown fine to coarse SAND with clayey pockets; slightly organic with small fragments of partly decayed wood.						
Very dense grey to brown clay, sand and generally subangular fine to medium GRAVEL.		9'-6"				
Clay, sand, gravel and boulders.		13'-0"				
Dark grey laminated shale with bands of grey argillaceous limestone.		18'-0"				
		End of Borehole				

SCALE: 1" = 5'-0" • DISTURBED SAMPLE

■ UNDISTURBED SAMPLE

SOIL MECHANICS LABORATORY

BOREHOLE LOG

PROJECT Interchange Highway 401 & 27, District 6, Ontario.

ORDER NO. T.178/56

CLIENT Department of Highways, Ontario.

BOREHOLE NO. BH.4 DIAMETER 2-1/2" & AX CASING 2-1/2" & BX

BOREHOLE LOCATION See Plan INCLINATION Vertical BEARING _____

DESCRIPTION OF STRATA	ELEVATION	DEPTH	THICKNESS	NO.	REMARKS
Loose brown subrounded generally medium sand. Probably FILL.	103.1'	Zero		3	Moist
		Free Water			
Firm light brown calcareous silty fine SAND.		3'-9"		14	Damp Low Dry Strength
Stiff grey calcareous sandy CLAY with fine to medium subangular to rounded gravel.		9'-6"		17	Damp High Dry Strength
Very stiff grey calcareous sandy CLAY with fine to medium subangular to rounded gravel. Some broken shale.				36	do
Stiff grey CLAY with broken dark grey shale. Clay, gravel & shale fragments. Broken soft shale.		17'-6"		43 (6")	do
Broken dark grey shale with bands of limestone.		22'-0"			16'-6" - 17'-6" core recovery 10% 17'-6" - 18' core recovery 83% 18' - 20' core recovery 21% 20' - 22' core recovery 15%
do		End of Borehole			

SCALE: 1" = 5'-0" • DISTURBED SAMPLE

■ UNDISTURBED SAMPLE

SOIL MECHANICS LABORATORY









BOREHOLE LOG

PROJECT Interchange Highway 401 & 27, District 6, Ontario. ORDER NO T.178/56

CLIENT Department of Highways, Ontario.

BOREHOLE NO. BH.5 DIAMETER 2-1/2" & AX CASING 2-1/2" & BX

BOREHOLE LOCATION See Plan INCLINATION Vertical BEARING

DESCRIPTION OF STRATA	ELEVATION	LEGEND	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Stiff brown very sandy CLAY with fine gravel and little organic matter.	116.3'		1	Zero		8	Moist Medium to High Dry Strength
Stiff brown sandy silty CLAY with fine to medium gravel.			2	3'-6"		11	Moist High Dry Strength
Firm brown fine silty SAND. Exhibits bedding.			3	7'-0"		14	Damp Low to Medium Dry Strength
Very dense grey brown clayey SAND with high percentage of fine to medium gravel.			4	13'-9"		44(3")	Damp Low to Medium Dry Strength
Very stiff grey silty CLAY with fine to medium gravel.			5		Free Water	17(6")	Moist: Medium to High Dry Strength
Stiff grey calcareous sandy silty CLAY with rounded gravel and fragments of shale. Broken soft grey shale.			6	21'-6"		37(6")	Moist 20' - 23' core recovery 30%
Dark grey broken shale, harder calcareous bands.							23' - 24' core recovery 33%
Dark grey to black shale with grey calcareous bands. Broken and jointed. Joints at 30° and parallel to core length.				26'-6"			24' - 26'-6" core recovery 56%
				End of Borehole			






SCALE: 1" = 5'-0"

• DISTURBED SAMPLE

■ UNDISTURBED SAMPLE

SOIL MECHANICS LABORATORY

BOREHOLE LOGPROJECT Interchange Highway 401 & 27, District 6, Ontario.ORDER NO T.178/56CLIENT Department of Highways, Ontario.BOREHOLE NO BH.6 DIAMETER 2-1/2" & AX CASING 2-1/2" & BXBOREHOLE LOCATION See Plan INCLINATION Vertical BEARING _____

DESCRIPTION OF STRATA	ELEVATION	LEGEND	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Loose brown calcareous clayey sand with fine to medium gravel. Probably FILL.	107.3'		• 1	Zero		5	Moist Medium Dry Strength
Loose brown calcareous sandy silty clay and concentrations of brown medium to coarse sand with fine gravel. Probably FILL.			• 2	Free	Water	7	Moist Clay: Medium to High Dry Strength Sand: Low to Medium Dry Strength
Firm darkish grey sandy silty CLAY with traces of organic matter and fine to medium gravel.			• 3	8'-6"		47	Wet: High Dry Strength 10' - 15' core recovery 11%
Clay, Sand, Gravel and Boulders.							15' - 18' core recovery 6%
do							18' - 20' core recovery 29%
Grey broken calcareous shale. Joints at 30° and parallel to core length.				18'-0"			
				20'-0"			
				End of Borehole			

SCALE: 1" = 5'-0" • DISTURBED SAMPLE

■ UNDISTURBED SAMPLE

SOIL MECHANICS LABORATORY

BOREHOLE LOGPROJECT Interchange Highway 401 & 27, District 6, Ontario.ORDER NO. T.178/56CLIENT Department of Highways, Ontario.BOREHOLE NO. BH.7DIAMETER 2-1/2" & AXCASING 2-1/2" & BXBOREHOLE LOCATION See PlanINCLINATION VerticalBEARING

DESCRIPTION OF STRATA	ELEVATION	LEGEND	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Loose mixture of clay, sand, gravel and fragments of wood, sand and gravel. Probably FILL.	100.6'			Zero	Free Water		
			● 1			4	Wet
Dense grey silty clayey SAND with fine to medium angular to subrounded gravel.			● 2	3'-0"		54	Moist: Medium Dry Strength
Very stiff grey very sandy CLAY with subangular fine to medium gravel.			● 3	7'-0"		67	Moist: Medium to High Dry Strength
Broken soft shale with bands of limestone.							7'-9' core recovery 21%
do							9'-10'-6" core recovery 28%
Broken dark grey shale with calcareous layers.							10'-6" - 12'-6" core recovery 33%
Darkish grey calcareous broken shale. Exhibits vertical joints.							12'-6" - 14'-6" core recovery 83%
				14'-6"			
				End of Borehole			

SCALE: 1" = 5' - 0" ● DISTURBED SAMPLE

■ UNDISTURBED SAMPLE