

Toronto 2, April 11th, 1958.

Memorandum to
Mr. F. C. Brownridge,
Materials & Research Engineer,
Downsview, Ontario.

Re: BA 725 Thames River at Delaware,
- Highway #2, District #2.

Attached please find soil investigation report
BA 725 for your file.

Encl.
JCM*DW.

J.C. McALLISTER
FOR A. M. TOYE
BRIDGE ENGINEER.

UNIVERSAL
GEOTECHNIQUE

LIMITED



BA 725-A

COPY

2924 BLOOR STREET WEST • TORONTO 18, ONTARIO, CANADA

22nd April, 1958.

M. M. Dillon & Company Limited,
141 Maple Street,
London, Ontario.

Attention: Mr. J. Mitchell

DELAWARE BRIDGE, THAMES RIVER

W.P. 7-57 - Highway N° 2

WP 7-57

Gentlemen:

We refer to the writer's discussion with you in London on the 17th of April during which you raised certain questions and we offer the following comments.

In relation to the abutments you raised the question as to whether Franki piles could be driven to derive support from the till or the sands and gravels overlying the till. We would state that the sand and gravel stratum is of limited thickness and therefore the load from piles terminating in this stratum would inevitably be transferred to the till. Thus piles would generally derive support from the till and because of the characteristics of this particular material we would not anticipate that adequate load bearing capacity could be obtained from piles terminating close to the surface of such till. It would, therefore, appear that friction piles driven some distance into the till would be the more appropriate solution if piles were to be used.

The foregoing comments apply to the Southwest abutment which we now understand would be located at station 225 + 00.

Referring to the possible necessity of excavating the alluvial deposits in the vicinity of boreholes BH.7, 8, 9 and 10, if piles were used to support the structure in these localities, we would confirm our previous opinion that only the loam need be removed prior to driving piles as the underlying loose deposits will be compacted by the action of pile driving.

Regarding your further question concerning an appropriate value to use for the skin friction of piles driven through the clayey silt encountered in borehole BH.A, we would state that an initial value of 500 lbs./sq.ft. could be used and that after consolidation this value could be assessed as 1000 lbs./sq.ft. The value of skin friction which can be used for estimating the lengths of piles in the underlying till can be estimated as 1500 lbs./sq.ft.

?

Precise recommendations with regard to foundation design are not, of course, a simple function of the soil conditions but must take into account the general arrangement of the proposed structure and because the fill underlying the proposed site is not of a hard consistency, the foundation design for this particular project warrants careful consideration. It was remarked to the writer during our discussion that the allowable bearing capacity of 2 tons/sq.ft. which we had suggested in our Report was perhaps conservative but your assumption that this fill would be of similar consistency to the material on which you have founded other bridges in London is certainly not justified and we would state that softer tills such as that which exists at Delaware are often encountered in Southwestern Ontario.

The decision as to whether spread footings can be used or whether pile foundations should be adopted is dependent on the sensitivity of the structure to settlement.

We understand from our discussion that an abutment will be located at station 225 and that the overall length of the bridge will be 470 feet and that in all probability there will be five equal spans of 94 feet. The location of the Southwest abutment at station 225 makes any appreciable excavation at this point difficult due to the very close proximity of the existing Highway N° 2 and undoubtedly the additional 30 feet of fill for the approaches will cause appreciable consolidation of the clayey silt which was encountered in borehole BH.A and merely from an appraisal of the soil profile we would not be surprised if long term settlement under the weight of the fill was in the region of 6 inches. (It will be readily appreciated that a programme of consolidation testing and settlement analysis is normally only carried out after tentative designs for the structure are available and only then if the design requires such an investigation.)

It is now understood that the loading on the piers will amount to 25 tons per foot run, and again from an appraisal of the soil profile we would conclude that long term settlement of piers, founded on spread footings located at elevation 658 and designed for a bearing pressure of 2 tons/sq.ft., could amount to about 3 to 4 inches with differential settlement of up to 50% of the maximum settlement. If such spread footings were adopted piers numbers 1, 2 and 3 measured from the Southwestern abutment could be located at elevation 658 and pier N° 4 could be at elevation 660.

Reverting to the questions raised concerning the negative friction which may develop if a relatively shallow abutment is supported on pile foundations, we would state that for the loading conditions due to the height of fill material we consider that for 30 tons working load per pile such piles should be driven to an ultimate resistance of 80 tons in the underlying till.

We have already referred to possible long term settlement in the region of 6 inches due to consolidation of the clayey silt under the additional load imposed by 30 feet of fill adjacent to the Southwest abutment and if this abutment was not supported on piles and transferred its load at elevation 695 the amount of settlement would likely be increased by 1 or 2 inches. Thus the anticipated total long term settlement of this abutment should be considered in the region of 6 inches if it is not supported on piles.

A further important consideration with regard to the Southwest abutment is the general stability of the fill against a circular slip in the underlying clayey silt or slow lateral movement of the fill towards the river due to relatively high shear stress in the clayey silt stratum. As the soft strata is alluvial we consider an inadequate factor of safety would quite likely obtain and consequently if any further consideration is to be given to supporting a shallow abutment on the fill we feel that removal of the clayey silt for the full width of the bridge and for a minimum distance of 15 feet on either side of station 225 is essential. In any event, if the removal of the clayey silt is possible without resorting to the expense of a braced excavation, such a procedure would be desirable even if bearing piles were used as negative friction on the piles would be reduced to a negligible amount and slope instability and creep would be eliminated. We shall later refer to alternative suggestions for avoiding the dangers of slope instability and creep due to plastic yield in the clayey silt.

We would now like to offer some suggestions that may be appropriate but it will be realized that these are made without the advantage of any tentative design from which to work. Considering a bridge of 470 foot overall length and consisting of five spans of 94 feet and bearing in mind the soil conditions and the close proximity of the Southwest abutment to the existing Highway, we would suggest two main possibilities and variations thereof:

(a) The foundations to the piers could be supported on spread footings and the abutments on piles and the structure designed as a series of simply supported spans assuming that the approximate anticipated long term settlements from a judgement of the soil profile were tolerable and in this respect it will be observed that the abutments are a more serious consideration than the foundations to the piers due to the additional loading from the fill to the approaches and the clayey silt stratum which occurs under the Southwestern abutment.

(b) Friction pile foundations could be used to support the four main piers and the three internal spans could be designed as a continuous structure with overhanging cantilevers, the end spans being simply supported. The abutments could be supported on piles but the presence of the clayey silt stratum means that such piles would have to support load transferred by negative friction and such piles may be subjected to an indeterminate lateral pressure due to the shearing stresses which would develop along potential circular slip planes passing through the clayey silt. The foregoing comments refer to the sketch of the tentative design seen in your office whereby a small abutment will be supported on vertical and raking piles with the fill sloping from the abutment down to the existing grade near the first pier.

It occurs to us that considerably greater stability could be obtained by installing a pattern of vertical sand drains beneath and to the rear of this abutment. Such sand drains could be installed from the existing grade and would have the advantage of allowing a considerable amount of the consolidation of the clayey silt to take place under the imposition of the load from the approach fill prior to the erection of the two end spans of the bridge and such sand drains could be used in combination with a small abutment supported on bearing piles and such an arrangement would obviously reduce the negative friction on the bearing piles to a relatively small amount.

✓ The foregoing suggestion appears to have merit as the difficulties of substantial long term settlement of the clayey silt would be avoided and furthermore this stratum would be considerably strengthened and thereby avoid any appreciable lateral force being imposed on the bearing piles and obviate any danger of slope instability.

The Northeastern abutment would be situated close to borehole BH.9 which disclosed a buried channel filled with sandy silt and the danger of disturbing such material by excavation for foundations has already been referred to in our Report. However, the bearing capacity in an undisturbed state can be taken as 2 tons/sq.ft. and long term settlement is likely to be negligible compared with the settlement occurring during construction. Thus in our view the most critical condition applies to the Southwestern abutment but we would favour adopting similar foundations to both abutments.

✓ Finally, a further alternative in connection with these abutments perhaps deserves consideration and that is that the abutment could consist of a vertical line of interlocking steel sheet piling which could, if desirable, be returned into the banks to form wing walls and such sheet piling could be designed not only to resist any lateral earth pressure that would develop if scow removed the slope between the abutment and the first pier but also to support the vertical load. The effective life of such sheet piling could certainly be in excess of 100 years.

We trust that the foregoing comments will prove helpful and we would reiterate our desire to give every assistance. Undoubtedly it will be fully appreciated that the normal procedure for soil investigation is to carry out subsurface exploration and develop soil profiles which should be considered in relation to tentative designs in order to consider whether more detailed study of the soil at certain locations on the site is necessary, otherwise considerable time and money could be expended on consolidation tests and settlement analysis for conditions whose applicability might be merely fortuitous. It is, therefore, our opinion that the costs of soil investigation and foundation analysis can be considerably reduced and their value increased, provided the Soils Consultant is given the general arrangement of the tentatively proposed design so that he may effectively plan the subsurface exploration and any necessary laboratory tests.

If we can elaborate any further on the soil conditions please do not hesitate to inform us.

Yours truly,

Universal GEOTECHNIQUE Limited

jcl/sq

J. Owen Lake.

- 4 -

cc: Ontario Department of Highways, Att: Mr. J. C. McAllister

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REPORT

on

SUBSURFACE EXPLORATION

for

PROPOSED BRIDGE

THAMES RIVER AT DELAWARE

ONTARIO

INTRODUCTION

The Highways Department of the Province of Ontario are planning a proposed crossing of the Thames River at Delaware to carry Highway N° 2 just North of the existing crossing.

To determine the subsurface conditions for purposes of engineering design, the DHO authorized Universal GEOTECHNIQUE Limited to proceed with subsurface exploration of the proposed site and this Report gives the results of the investigation.

AVAILABLE INFORMATION

DHO plan E-3326-1 indicated tentatively chosen locations for some of the boreholes and a memorandum indicated that the stability conditions for the approach fill should be considered.

THE SITE

The site of the proposed bridge and approaches is situated just to the Northwest of the existing Highway N° 2.

The site lies entirely within the Flood Plain of the Thames River. The land on the Eastern side of the river is grass covered and includes some marshy areas which are concentrated mainly in a shallow abandoned channel which, at the present time, serves to carry flood waters of the river. This area adjacent to the Eastern bank of the river exhibits a fairly level topography with a slight depression that indicates the existence of the aforementioned abandoned channel.

Land adjacent to the Western bank of the river consists of pasture and shows a fairly pronounced grade towards the river.

A restricted marshy area exists from about chainage 213 + 50 to 214 + 75.

SUBSURFACE EXPLORATION

Subsurface exploration was carried out during the period 5th February to 19th March, 1958, and comprised a total of 20 exploratory boreholes located in positions as shown on the plans accompanying this Report. The proposed locations of the boreholes were staked and the ground surface elevations for boreholes located on land were obtained by a DHO Survey Crew but subsequently the positions of certain boreholes were slightly revised in accordance with particulars given in this Report. The field investigation was hampered and delayed by a period of particularly bad weather with heavy snowfalls.

Soil samples were obtained generally at intervals of about 5 feet but where noticeable changes of strata occurred the depths of such changes were recorded, and where necessary additional samples were obtained.

The state of compaction of essentially cohesionless soil and the consistency of cohesive soil were determined by the standard penetration test taken during the operation of soil sampling. (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).

Visual examination and classification of all samples was carried out in the laboratory and certain samples obtained with thin-walled sampling tubes were subjected to additional examination and testing. The descriptions of the soil obtained from the foregoing examination together with the results of the standard penetration tests are given on the borehole logs which, together with a location plan and borehole sections, 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

The site of the proposed bridge occupies an old glacial spillway that lies within the Caradoc Sand Plain and this spillway now serves as the Flood Plain of the Thames River.

A noteworthy feature disclosed by the subsurface exploration is a buried channel located in the vicinity of chainage 220 + 00. This channel, which is probably of glacial origin, is filled with interbedded sands, silts and clays which can most likely be attributed to the Maumee - Whittlesey periods. During the period of the aforementioned lakes the channel existed as a bay but later the Thames River built its delta into the waters of Lake Whittlesey and covered the buried channel with the Caradoc sands.

From the information obtained from the boreholes the strata down to the explored depths can be divided into the following categories:

(a) TOP SOIL

Brown sandy loam with varying amounts of organic matter covers the site with the exception, of course, of the river bed.

(b) ALLUVIAL SILTS & SANDS

These upper alluvial deposits of the Thames River vary generally from sandy silts to silty sands. They contain organic matter represented by decayed vegetation ranging from blades of grass and leaves to pieces of wood, and are in parts rich in calcareous matter existing in the form of small shells at certain horizons.

These upper alluvial deposits range from very soft to firm.

(c) ALLUVIAL SANDS & GRAVELS

These sands and gravels are generally found in lenses below the strata described as silts and sands and can be accepted as the lower alluvial deposits. They consist of sands and gravels containing in parts a little silty clay and shells and traces of organic matter.

(d) LACUSTRINE SANDS, SILTS & CLAYS

These lacustrine deposits were encountered in boreholes BH.9 and 10, thereby indicating a buried channel filled with deposits attributed to early Lake Whittlesey. The silts and sands exist in a dense state and the clays are of very stiff to hard consistency and it is to be noted that traces of organic matter are to be found in these deposits.

(e) CLAY TILL

Brownish-grey to greyish-brown sandy silty clay with fine to large subangular gravel underlies the site.

Gas was encountered in borehole BH.6 within this stratum.

(f) SANDY TILL

The sandy till consisting of sands and gravels and of clayey sands and gravels is essentially an integral part of the glacial till. This sandy pocket was encountered in boreholes BH.1, 3 and 6.

During the period of exploration the water table ranged from about elevation 677 to 678 in the East and in the vicinity of boreholes BH.7 and 8 near the river bank the water table was at 674, whilst in borehole BH.A on the Western bank of the river the elevation of free water was 673.

LABORATORY TESTS

In addition to visual examination of the soil samples in the laboratory certain samples were subjected to testing and the results of index property tests are given in table N° 1 and the results of shear strength tests are summarized in table N° 2 included in the appendix to this Report.

DISCUSSION

The results of the subsurface exploration have disclosed an absence of alluvial deposits in the main channel of the River Thames, such deposits having been eroded to uncover the underlying glacial till. However, on either side of the river channel in the Flood Plain the underlying glacial till is covered by alluvial deposits and in the vicinity of boreholes BH.9 and 10 a buried channel was encountered.

The alluvial deposits generally vary from sandy silts to silty sands and they contain varying amounts of organic matter and would be totally unsuitable for supporting the foundations of any structure. In some parts of the Flood Plain a relatively limited thickness of alluvial sands and gravels were encountered immediately beneath the silts and sands. The glacial till underlying the alluvial deposits can generally be described as being of a stiff to very stiff consistency and undoubtedly it exists in a preconsolidated state, it having been subjected to ice-loading during the period of glaciation and at a later stage overburden has been removed by erosion. At a subsequent stage deposition has occurred in the Flood Plain of the river.

Referring now to the proposed structure, we understand that piers will be located in the vicinity of boreholes BH.1, 3 and 5 and presumably abutments will be located in the vicinity of boreholes BH.4 and 7. It is further understood that there is the possibility of an abutment being located in the vicinity of BH.9 instead of BH.7 and we would draw attention to the fact that a buried channel exists in the vicinity of BH.9 and that this channel has been filled with lacustrine silts and clays. Whilst these silts and clays exist in a compact state in their undisturbed condition, any attempt to excavate in such material below the water table may cause disturbance and softening and consequently this possibility should receive consideration.

Generally it would appear that suitable foundations for the proposed structure can take the form of spread footings deriving support from the glacial till and unless the river conditions are appreciably altered it would not be anticipated that any serious lowering of the upper surface of the till would occur in the river channel due to scour. It is, therefore, suggested that the underside of pier foundations could be located at elevation 658. The glacial till existing below this elevation is fairly uniform in consistency but as it is not highly preconsolidated the safe bearing capacity cannot generally be considered to exceed 4,000 lbs./sq.ft. when considering the possibility of minor variations in consistency.

It is understood that the total load per foot run of pier will be about 35 tons and undoubtedly the imposition of this load at an intensity of pressure amounting to 4,000 lbs./sq.ft. on the soil

would result in some long term settlement which would, however, be quite tolerable for most types of structures. This aspect, therefore, need only be considered if the structure is particularly sensitive to settlement.

For the relatively heavy loading conditions in relation to the underlying strata, it would be natural to consider pile foundations driven to rock in lieu of spread footings but as the depth to bedrock in the vicinity of this site is likely to be considerable, this alternative does not appear to be practicable. Thus if pile foundations were to be adopted the piles would derive support essentially from friction rather than end bearing and with a loading of 35 tons per lineal foot of pier the pile cap would probably be almost as large as the required size of a spread footing. It would, therefore, appear that provided excavation for the pier foundations is carried out within vertical sided cofferdams and that any back filling around the pier up to the level of the river bed is of such a nature as to resist scour, then spread footings would provide adequate bearing capacity. Under no circumstances should back filling around pier foundations on this site be composed of sand or other easily eroded material as otherwise the first flood will remove such material and allow scouring action to attack the fill close to the underside of the footings.

Referring to the abutments it will be observed that these will have to resist the lateral earth pressure of the soft alluvial deposits if the latter material is not removed and it is suggested that it would be expedient to remove all such soft strata from the immediate vicinity of the rear of the abutments and replace with compacted material provided with suitable drainage and this will not only relieve the lateral earth pressure but also mitigate settlement of the fill approaches at the junction with the structure.

Referring now to the stability of the approach fill it will be observed in an earlier part of this Report that a restricted marshy area exists from about $213 + 50$ to $214 + 75$ but more importantly the subsurface exploration discloses that soft alluvial deposits exist on the line of the proposed road across the entire width of the Flood Plain. These soft alluvial deposits are primarily composed of silts and sands containing organic matter and will consolidate under the additional loading which will be imposed by the fill. Because these alluvial deposits consist primarily of silts and fine sands, consolidation will be relatively rapid and thus the removal of such deposits is not essential to achieve successful construction. However, these deposits at present have a high moisture content and very low cohesion and consequently they would not support the almost immediate application of the full loading which will ultimately be imposed by the fill. However, if the topsoil is removed and a layer of essentially cohesionless material is deposited on the surface of the alluvial deposits to act as a drainage layer there should be no instability develop because during the period when the approach fill is being constructed sufficient time should elapse for consolidation of the silts to take place with a correspondingly progressive increase in the shear strength of such material and by the time the approach fill reaches its design height the excess pore water pressure in the underlying alluvial deposits should have been virtually dissipated. It is to be noted that any drainage layer that is placed on the alluvial deposits beneath the fill approaches should not ultimately extend to the slopes of such approaches on the upstream side as otherwise, in times of flood, water would infiltrate beneath the fill and the possibility of piping and erosion would be a danger.

CONCLUSIONS

Subsurface exploration at the site of the proposed bridge has disclosed that below the riverbed and beneath soft alluvial deposits which cover the Flood Plain on either side of the river there exists stiff to very stiff clay till. Subject to the precautions mentioned in the previous section of this Report spread footings are suggested for the foundations to the piers and abutments. Such spread footings should not be located at a higher elevation than 658 and the intensity of pressure imposed on the soil should not exceed 2 tons/sq.ft. The level of the underside of footings to the abutments will also, of course, be dependent on the development of adequate passive resistance against the lateral earth pressure, allowing for complete removal by scour of the alluvial deposits overlying the till in front of the abutments.

Mention has been made in the Report to some long term consolidation of the clay till but this would only be of importance if the bridge structure is particularly sensitive to settlement.

With regard to the stability of the approach fill, it is concluded that whilst the immediate but obviously impossible application of the full load from the completed approaches would result in a failure, the predominantly silty and sandy composition of the alluvial deposits will enable dissipation of excess pore water pressure with resultant consolidation and increase of shear strength to be effected during the gradual heightening of the approach fill, and consequently no particular difficulties are foreseen in carrying out the construction.

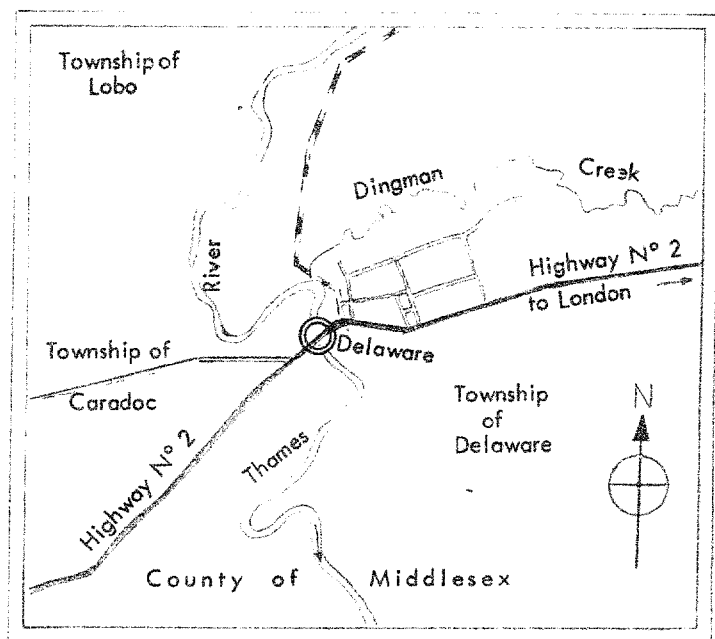
Universal GEOTECHNIQUE Limited,



L. Baskin, P.Eng.
Engineering Geologist.

Report N° T.289/58

April, 1958.



SCALE

1" = 1 Mile

PROJECT W.P. 7-57 Hwy. No. 2 over Thames River at
TITLE Key Plan Delaware

DRG. NO. 1 ORDER NO. T.289/58

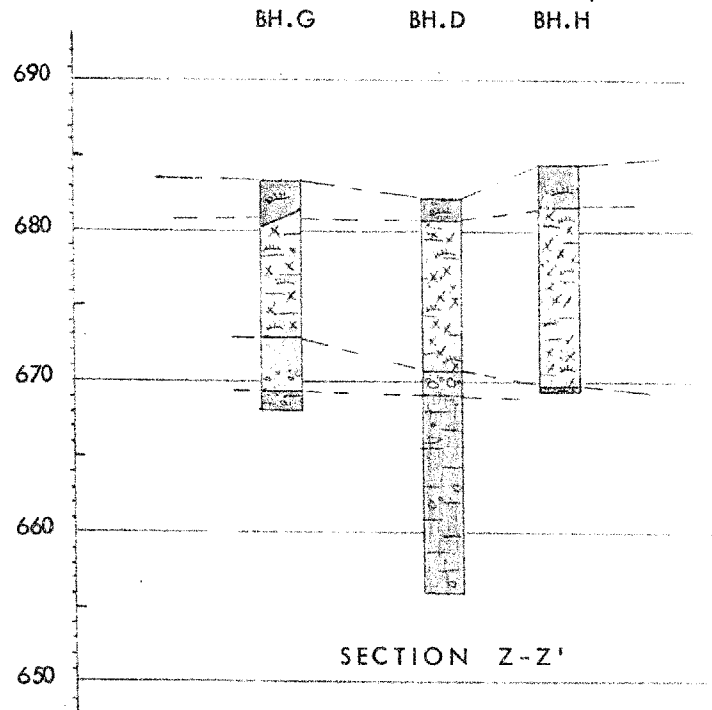
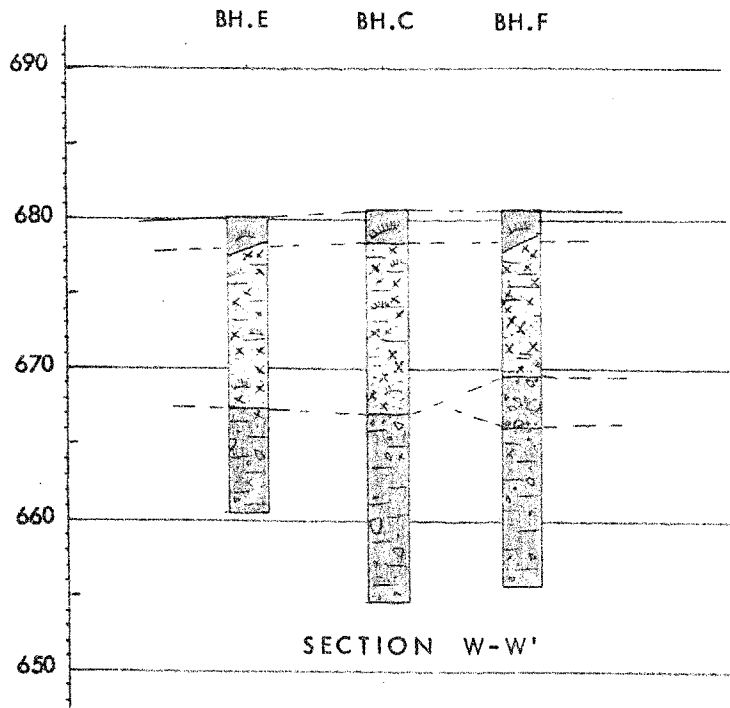


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PROJECT W.P. 7-57 Hwy. N°2 over Thames River at
TITLE Borehole Sections
DRG. NO. 7 ORDER NO. T. 289/58
Delaware



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LEGEND



TOP SOIL



SILTS & SANDS (ALLUVIAL)



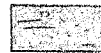
SANDS & GRAVELS (ALLUVIAL)



SILTS & CLAYS (LACUSTRINE)



CLAY TILL (GLACIAL)

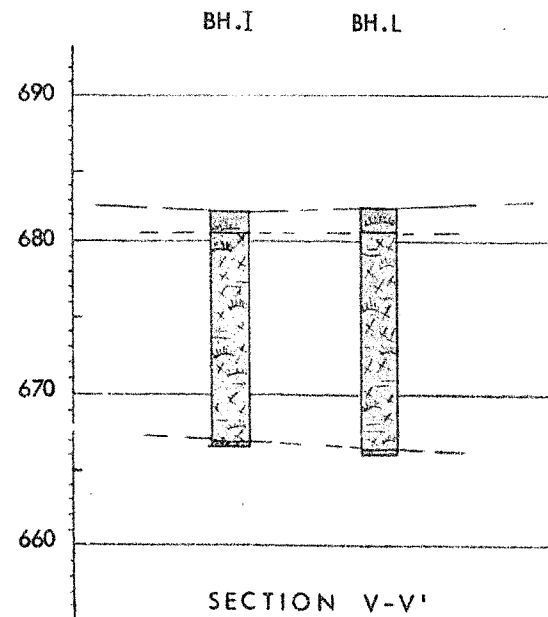
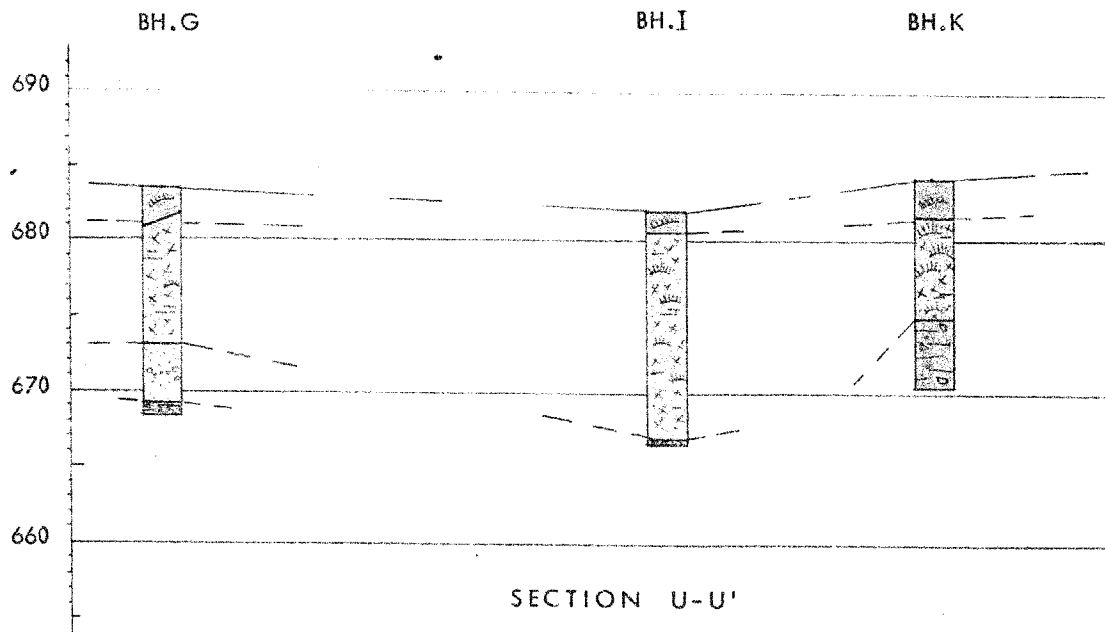


SANDY TILL (GLACIAL)

SCALE

Horizontal 1" = 50'-0"
Vertical 1" = 10'-0"

PROJECT W.P. 7-57 Hwy. No. 2 over Thames River at
TITLE Borehole Sections
DRG. NO. 8 ORDER NO. 1,289/58
Delaware



LEGEND



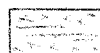
TOP SOIL



SILTS & SANDS (ALLUVIAL)



SANDS & GRAVELS (ALLUVIAL)



SILTS & CLAYS (LACUSTRINE)



CLAY TILL (GLACIAL)



SANDY TILL (GLACIAL)

SCALE

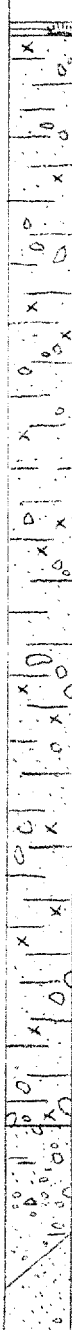
Horizontal 1" = 50'-0"
Vertical 1" = 10'-0"



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SOIL MECHANICS LABORATORY

BOREHOLE LOGPROJECT W.P. 7-57 Hwy. N° 2 over Thames River at Delaware ORDER NO. T.289/58CLIENT Ontario Department of HighwaysBOREHOLE NO. BH.1 DIAMETER 2-1/2" CASING 2-1/2"BOREHOLE LOCATION See Plan INCLINATION Vertical BEARING —

DESCRIPTION OF STRATA	ELEVATION	LEGEND	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Water				Zero			
Black organic CLAY. Very stiff grey sandy silty CLAY with fine to medium subangular gravel.	665.4		• 1	5'-6" 6'-0"		18	Damp High dry strength.
do			• 2			26	do
Very stiff to hard do			• 3			32	do
do			• 4			28	do
do			• 5			38	do
Very stiff do			• 6			27	do
do			• 7			27	do
Dense grey fine to coarse SAND with fine gravel, generally subangular. Little clay.			• 8	42'-6"		30	Wet No dry strength.
Dense clayey fine to coarse SAND with some gravel.			• 9	50'-0"		34	Moist

SCALE: 1" = 5'-0" • DISTURBED SAMPLE End of Borehole ■ UNDISTURBED SAMPLE

SOIL MECHANICS LABORATORY

BOREHOLE LOG

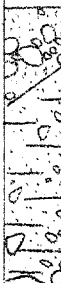
PROJECT W.P. 7-57 Hwy. N° 2 over Thames River at Delaware ORDER NO. T.289/58

CLIENT Ontario Department of Highways

BOREHOLE NO. BH.2 DIAMETER 2-1/2" CASING 2-1/2"

BOREHOLE LOCATION See Plan INCLINATION Vertical BEARING ---

FORM G-1A 800-0-53
UNIVERSAL LTD.

DESCRIPTION OF STRATA	ELEVATION	LEGEND	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Water				Zero			
	667.6			3'-3"		12	Wet
Firm brown fine to coarse SAND and fine to medium GRAVEL, subangular to subrounded.			• 1				
			• 2			20	No recovery
Stiff grey CLAY with fine to large subangular gravel.			• 3	12'-6"		-	Moist High dry strength. Refusal Condition Pressured Boulder
				End of Borehole			

SOIL MECHANICS LABORATORY

BOREHOLE LOGPROJECT W.P. 7-57 Hwy. N° 2 over Thames River at Delaware ORDER No. I.289/58CLIENT Ontario Department of HighwaysBOREHOLE NO. BH.3 DIAMETER 2-1/2" CASING 2-1/2"BOREHOLE LOCATION See Plan INCLINATION Vertical BEARING

DESCRIPTION OF STRATA	ELEVATION	LEGEND	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Water				Zero			
	665.8		• 1	5'-6"		8	Damp High dry strength.
Firm grey sandy CLAY with fine to medium subangular to subrounded gravel. Some iron staining.			• 2			25	do
Very stiff grey sandy silty CLAY with fine subangular gravel.			• 3			33	do
Very stiff to hard do			• 4			26	do
Very stiff do			• 5			18	do
Stiff do			• 6			25	do
Very stiff do			• 7			27	do
do			• 8	40'-6"		32	Moist
Dense clayey fine to coarse SAND and fine GRAVEL. Gravel generally subangular			• 9			35	do
Dense fine to coarse SAND and fine GRAVEL. Little clay.			• 10	48'-0"		31	Damp High dry strength.
Very stiff grey sandy CLAY with fine subangular gravel.				50'-0"			

SCALE: 1" = 5'-0" * DISTURBED SAMPLE End of Borehole ■ UNDISTURBED SAMPLE

SOIL MECHANICS LABORATORY

BOREHOLE LOGPROJECT W.P. 7-57 Hwy. N° 2 over Thames River at Delaware ORDER NO. T.289/58CLIENT Ontario Department of HighwaysBOREHOLE NO. BH.5 DIAMETER 2-1/2" CASING 2-1/2"BOREHOLE LOCATION See Plan INCLINATION Vertical BEARING —

DESCRIPTION OF STRATA	ELEVATION	LOG	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Water				Zero			
	666.9			3'-0"			
Loose fine to coarse SAND and fine to medium GRAVEL.			• 1	6'-6"		6	Wet
Stiff grey sandy silty CLAY with fine to medium subangular gravel.			• 2			19	Damp High dry strength.
Very stiff do			• 3			24	do
do			• 4			24	do
Very stiff to hard do			• 5			31	do
Very stiff do			• 6			25	do
do			• 7			31	do
do			• 8	40'-0"		33	do
				End of Borehole			

FORM G-1-A 500
UNIVERSITY OF TORONTO

SCALE: 1" = 5'-0" • DISTURBED SAMPLE

■ UNDISTURBED SAMPLE

SOIL MECHANICS LABORATORY

BOREHOLE LOG

PROJECT W.P. 7-57 Hwy. N° 2 over Thames River at Delaware ORDER NO. T.289/58

CLIENT Ontario Department of Highways

BOREHOLE NO. BH.6 DIAMETER 2-1/2" CASING 2-1/2"

BOREHOLE LOCATION See Plan INCLINATION Vertical BEARING

DESCRIPTION OF STRATA	ELEVATION	LEGEND	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Water				Zero			
	666.6			4'-0"			
		• 1				11	No recovery
Stiff grey sandy silty CLAY with fine to medium subangular gravel.		• 2				19	Damp High dry strength.
do		T1					
		• 3				20	do
Very stiff do		• 4				32	do
		T2					
do		• 5				25	do
		T3					
Stiff do		• 6				19	do
do		• 7				20	do
do		• 8				20	Gas encountered at 38'-6" do
do		• 9		44'-6"		29	do
Dense grey clayey fine to coarse SAND and fine to medium GRAVEL, generally subangular.		• 10				37	Wet
do				49'-0"			do
				End of Borehole			

SCALE: 1" = 5'-0" • DISTURBED SAMPLE

■ UNDISTURBED SAMPLE

SOIL MECHANICS LABORATORY

BOREHOLE LOG

PROJECT W.P. 7-57 Hwy. No. 2 over Thames River at Delaware ORDER NO. T.289/58CLIENT Ontario Department of HighwaysBOREHOLE NO. BH. 7 DIAMETER 2-1/2" CASING 2-1/2"BOREHOLE LOCATION See plan INCLINATION Vertical BEARING

DESCRIPTION OF STRATA	ELEVATION	LEGEND	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Firm brown loam with organic matter.	685.17			Zero			
Very loose brown generally fine SAND.			1	1'8"		2	Damp. Medium dry strength.
Loose brown fine SAND with lenses of fine to medium sand.			2			3	Damp. Low to medium dry strength.
Very loose. do			3			2	do
Loose. do			4	Free Water		3	do
With occasional shell fragments.			5			6	Wet. Low dry strength.
Loose brown fine to coarse SAND with shells.			6	13'9"		21	Wet. Sand: Low dry strength. Clay: High dry strength.
Firm brown fine to coarse SAND and fine gravel with lenses of grey sandy clay and shell fragments. Gravel subangular to subrounded.			7	17'6"		42	Damp. High dry strength.
do			8			38	do
No dessication. Contains seams of brownish sandy silt.			9			36	do
do			10			23	do
Stiff brownish grey sandy silty CLAY with fine to medium gravel.			11			22	do
do			12			28	Moist. High dry strength.
Stiff brownish grey sandy silty CLAY with fine to medium gravel.			13	50'0"		25	do
do							
Stiff to very stiff.							

SCALE: 1" = 5'0" • DISTURBED SAMPLE End of Borehole ■ UNDISTURBED SAMPLE

SOIL MECHANICS LABORATORY

BOREHOLE LOG

PROJECT W.P. 7-57 Hwy. No. 2 over Thames River at Delaware ORDER NO. T.239/58CLIENT Ontario Department of HighwaysBOREHOLE NO. BH. 8 DIAMETER 2-1/2" CASING 2-1/2"BOREHOLE LOCATION See plan INCLINATION Vertical BEARING _____

DESCRIPTION OF STRATA	ELEVATION	LEGEND	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Firm dark brown to brown loam with organic matter.	684.65			Zero			
Very loose brown fine silty SAND. Occasional shells.			• 1	1'6"		2	Damp. Low to medium dr; strength.
Loose brown fine to medium SAND.			• 2	4'9"		4	Damp. Low dry strength.
do			• 3			4	do
Loose brown fine to coarse SAND with little clay and shell fragments.			• 4	9'6"	Free Water	4	Wet. Medium dry strength.
Firm brown SAND and gravel.			• 5	12'6"		30(9')	No recovery.
Firm greyish brown fine to coarse SAND with lenses of grey sandy clay and of fine to medium gravel.			• 6	16'4"		13	Wet. Clay: High dry strength.
Very stiff grey sandy silty CLAY with fine to medium subangular gravel and occasional thin seams of light grey sandy silt.			• 7			24	Damp. High dry strength.
do			• 8			53(9')	do High N due to gravel.
do			• 9			20	Damp. High dry strength.
do			• 10	36'9"		18	do
End of Borehole							

SOIL MECHANICS LABORATORY

BOREHOLE LOG

PROJECT W.P. 7-57 Hwy. No. 2 over Thames River at Delaware ORDER NO. I.289/58CLIENT Ontario Department of HighwaysBOREHOLE NO. BH. 9 DIAMETER 2-1/2" CASING 2-1/2"BOREHOLE LOCATION See plan INCLINATION Vertical BEARING _____

DESCRIPTION OF STRATA	ELEVATION	LEGEND	SAMPLE	DEPTH	THICKNESS	N	REMARKS
	683.41			Zero			
Loose brown sandy LOAM with some organic matter.			• 1			5	Damp. Low to medium dry strength.
Loose brown fine to medium somewhat silty SAND with traces of organic matter.			• 2	4'3"		5	do
Very loose brown fine to medium SAND with some shell fragments.			• 3	7'9"		3	Wet. Low dry strength.
Loose. do With seams of brown sandy clay.			• 4			8	do
Firm brown fine to coarse SAND and fine to medium GRAVEL containing little silt and clay.			• 5	12'3"		18	Wet.
Gravel subangular to subrounded. do			• 6			23	do
				17'6"			
Dense grey sandy SILT with traces of organic matter.			• 7			42	Wet. Low to medium dry strength.
Very dense grey somewhat sandy SILT Interbedded with fine grey silty sand. Occasional paper thin seams of clay.			• 8			55(9')	do
Dense grey somewhat sandy SILT Interbedded with very stiff grey silty clay.			• 9			30(6')	do
Hard grey sandy silty CLAY with fine subangular gravel.			• 10	34'9" 35'6"		32(6')	Damp. High dry strength.
			End of Borehole				

SOIL MECHANICS LABORATORY

BOREHOLE LOGPROJECT W.P. 7-57 Hwy. No. 2 over Thames River at DelawareORDER NO. T.289/58CLIENT Ontario Department of HighwaysBOREHOLE NO. BH. 10DIAMETER 2-1/2"CASING 2-1/2"BOREHOLE LOCATION See planINCLINATION Vertical

BEARING

DESCRIPTION OF STRATA	ELEVATION	LEGEND	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Loose brown sandy loam with organic matter.	684.60			Zero			
Loose brown clayey SAND with organic matter.			• 1	2'5"		4	Damp. Medium dry strength.
Very loose brown clayey SAND. Traces of organic matter.			• 2			3	do
Very loose brown fine to medium SAND, exhibits bedding.			• 3	7'0"		2	Wet. Low to medium dry strength.
do				Free Water			
Loose brown fine to coarse SAND and fine GRAVEL. Gravel subangular to subrounded.			• 4	11'6"		4	do Wet. Low dry strength.
Firm brown fine to coarse SAND and fine to large gravel with little silt.			• 5			38	Wet. High N due to large gravel.
				17'10"			
Dense brownish grey fine slightly silty SAND.			• 6			36(9)	Wet. Low dry strength.
Dense brownish grey fine silty SAND interbedded with very stiff silty clay.			• 7	25'6"		33(9)	Wet. Sand: Low dry strength. Clay: High dry strength.
do			• 8			25(6)	do
Very dense brownish grey sandy SILT.			• 9			35(6)	Wet. Low to medium dry strength.
Hard brownish grey sandy silty CLAY with generally fine subangular gravel.			• 10	39'0"		37(10)	Damp. High dry strength.
do			• 11			38	do
do			• 12	50'0"		38	do

SCALE: 1" = 5'0"

• DISTURBED SAMPLE End of Borehole

■ UNDISTURBED SAMPLE

BOREHOLE LOG

ORDER NO. T.289/58

BOREHOLE LOCATION See plan INCLINATION Vertical BEARING _____

DESCRIPTION OF STRATA	ELEVATION	LEGEND	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Dark brown loam with organic matter.	681.5			Zero			
Firm dark brown sandy CLAY with organic matter.			• 1	2'6"		8	Damp. High dry strength.
Firm brown clayey SILT with some organic matter and shell fragments.			• 2	4'9"		7	Moist. Medium to high dry strength.
do			• 3	Free Water		5	do
Some iron staining.			• 4	10'6"		6	do
Firm grey clayey silty SAND with shell fragments and organic matter. Iron stained.			• 5	13'0"		12	Wet. Medium dry strength.
Firm fine to coarse SAND with fine to medium gravel. Gravel subangular to subrounded.			• 6			28	Wet. No dry strength.
do				18'3"			do
Stiff brownish grey silty sandy CLAY with generally fine subangular gravel.			• 7			24	Damp. High dry strength.
do			• 8			26	do
Stiff to very stiff.				26'0"			
				End of Borehole			

SCALE: 1" = 5'0" • DISTURBED SAMPLE

UNDISTURBED SAMPLE

SOIL MECHANICS LABORATORY

BOREHOLE LOGPROJECT W.P. 7-57 Hwy. No. 2 over Thames River at Delaware ORDER NO. T.289/58CLIENT Ontario Department of HighwaysBOREHOLE NO. BH. B DIAMETER 2-1/2" CASING 2-1/2"BOREHOLE LOCATION See plan INCLINATION Vertical BEARING

DESCRIPTION OF STRATA	ELEVATION	LEGEND	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Loose brown silty loam with organic matter.	682.15			Zero			
Loose brown clayey sandy SILT with traces of organic matter.			• 1	2'3"		5	Damp. Medium dry strength.
Firm brown clayey sandy SILT with some shell fragments. Iron stained.			• 2	4'6"		7	do
Very soft brown clayey SILT. Iron stained.			• 3	7'0"	Free Water	1	Wet. Medium dry strength.
Soft to firm brown sandy silty CLAY with organic matter. Iron stained.			• 4	9'0"		3	Moist. Medium to high dry strength.
Grey. do			• 5	12'6"		8	Moist.
Loose grey fine to coarse SAND and generally fine GRAVEL.			• 6	14'6"		20	Damp. High dry strength.
Stiff brownish grey sandy CLAY with fine subangular gravel.			• 7			12	do
do			• 8			24	do
Very stiff. do			• 9			28	do
do				31'0"			do
				End of Borehole			

FORM G-1A 500
UNIVERSITY OF TORONTO

SOIL MECHANICS LABORATORY

BOREHOLE LOG

PROJECT W.P. 7-57 Hwy. No. 2 over Thames River at Delaware ORDER NO. T.289/58

CLIENT Ontario Department of Highways

BOREHOLE NO. BH. C DIAMETER 2-1/2" CASING 2-1/2"

BOREHOLE LOCATION See plan INCLINATION Vertical BEARING _____

FORM G-1A 906
UNIVERSITY OF TORONTO

DESCRIPTION OF STRATA	ELEVATION	LEGEND	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Firm brown loam with organic matter.	680.62			Zero			
Firm brown sandy CLAY with some organic matter. Iron stained.			• 1	2'3"	Free Water 4	4	Moist High dry strength.
Soft to firm brown sandy clayey SILT. Iron stained.			• 2	4'6"		3	Wet. Medium dry strength.
Soft grey sandy clayey SILT with organic matter.			• 3	7'6"		1	Wet. Medium to high dry strength.
Loose grey fine to coarse SAND with shell fragments.			• 4	9'10"		5	Wet. Low dry strength.
Very stiff brownish grey CLAY with fine to medium subangular gravel.			• 5	13'6"		21	Damp. High dry strength.
do			• 6			21	do
do			• 7	26'0"		21	do
				End of Borehole			

SOIL MECHANICS LABORATORY







BOREHOLE LOGPROJECT W.P. 7-57 Hwy. No. 2 over Thames River at Delaware ORDER NO. T.289/58CLIENT Ontario Department of HighwaysBOREHOLE NO. BH. D DIAMETER 2-1/2" CASING 2-1/2"BOREHOLE LOCATION See plan INCLINATION Vertical BEARING _____

FORM G-14 (REV. 1-1-58)

DESCRIPTION OF STRATA	ELEVATION	LEGEND	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Firm brown organic loam with some organic matter.	682.05			Zero			
Soft brown sandy CLAY with organic matter. Some iron staining.			• 1	1'6"		2	Moist. High dry strength.
Soft brown sandy clayey SILT with some organic matter and iron staining.			• 2	Free Water		2	Wet. Medium dry strength.
do			• 3			2	do
do			• 4			2	do
Firm fine to coarse SAND and GRAVEL.			• 5	11'6"		11	do
Stiff brownish grey sandy CLAY with fine to medium subangular gravel.			• 6	13'0"		22	Damp. High dry strength.
Stiff, do			• 7			23	do
Stiff to very stiff.			• 8			23	do
do				26'0"			do
				End of Borehole			

SOIL MECHANICS LABORATORY

BOREHOLE LOGPROJECT W.P. 7-57 Hwy. N° 2 over Thames River at Delaware ORDER NO. T.289/58CLIENT Ontario Department of HighwaysBOREHOLE NO. BH.E DIAMETER 2-1/2" CASING 2-1/2"BOREHOLE LOCATION See Plan INCLINATION Vertical BEARING FORM G-1A 800
UNIVERSAL STATIONERY CO.

DESCRIPTION OF STRATA	ELEVATION	LEGEND	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Soft brown loam with organic matter.	680.1		• 1	Zero		3	Damp.
Soft brown clayey sandy SILT with some organic matter.			T1 • 2		Free Water 	2	Moist. Medium dry strength.
Very loose grey silty SAND with organic matter.			T2 • 3	9'-0"		2	No recovery.
Very stiff greyish brown sandy silty CLAY with fine subangular gravel.			T3 • 4	12'-6"		21	Damp. High dry strength.
do			T4 T5 • 5	19'-6"		23	No recovery No recovery Damp. High dry strength.
				End of Borehole			

SCALE: 1" = 5'-0" • DISTURBED SAMPLE

■ UNDISTURBED SAMPLE

SOIL MECHANICS LABORATORY

BOREHOLE LOGPROJECT W.P. 7-57 Hwy. No. 2 over Thames River at Delaware ORDER NO. T.289/58CLIENT Ontario Department of HighwaysBOREHOLE NO. BH. F DIAMETER 2-1/2" CASING 2-1/2"BOREHOLE LOCATION See plan INCLINATION Vertical BEARING _____

DESCRIPTION OF STRATA	ELEVATION	LEGEND	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Soft brown loam with organic matter.	680.6		• 1	Zero		3	Damp.
Soft to firm brown sandy clayey SILT. Some iron staining.			T1 • 2	Free Water		4	Wet. Medium to high dry strength.
Very loose brown fine to coarse SAND.			T2 • 3	8'3" 9'3"		3	Wet. Clayey silt. Medium dry strength
Very loose slightly clayey sandy SILT with some gravel.			• 4	11'0"		4	Wet. Low dry strength.
Very loose brownish grey fine to coarse SAND and fine to medium GRAVEL, subangular to subrounded.			T3 • 5	14'6"		26	Damp. High dry strength.
Very stiff greyish brown sandy silty CLAY with fine subangular gravel.			T4 • 6	25'0"		26	do
do				End of Borehole			

SCALE: 1" = 5'0" • DISTURBED SAMPLE

■ UNDISTURBED SAMPLE

SOIL MECHANICS LABORATORY

BOREHOLE LOG

PROJECT W.P. 7-57 Hwy. N° 2 over Thames River at DelawareORDER NO. T.289/58CLIENT Ontario Department of HighwaysBOREHOLE NO. BH.GDIAMETER 2-1/2"CASING 2-1/2"BOREHOLE LOCATION See PlanINCLINATION VerticalBEARING FORM G-1A 500
UNIFIED STATIONERY CO.


DESCRIPTION OF STRATA	ELEVATION	LEGEND	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Soft to firm brown sandy loam with organic matter.	683.4		• 1	Zero		10	Wet
			T1				No recovery
			T2		Free Water		
Soft to firm clayey SILT with little organic matter.			• 2			4	Wet. Medium to high dry strength.
			T3				
Soft do			• 3	10'-6"		16	do
Firm grey fine to coarse SAND with generally fine subangular to subrounded gravel.			T4	13'-10"			Sand: Low to medium dry strength.
Very stiff grey silty sandy CLAY with fine subangular gravel.			• 4	15'-0"		27	No recovery
			End of Borehole				

SCALE: 1" = 5'-0" • DISTURBED SAMPLE

■ UNDISTURBED SAMPLE

SOIL MECHANICS LABORATORY

BOREHOLE LOGPROJECT W.P. 7-57 Hwy. No. 2 over Thames River at Delaware ORDER NO. T.289/58CLIENT Ontario Department of HighwaysBOREHOLE NO. BH. H DIAMETER 2-1/2" CASING 2-1/2"BOREHOLE LOCATION See plan INCLINATION Vertical BEARING _____FORM G-1A 500
UNIVERSAL GEOTECHNIQUE LTD.

DESCRIPTION OF STRATA	ELEVATION	LEGEND	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Soft brown sandy loam with traces of organic matter.	684.5		1	Zero		3	Damp.
Soft to firm brown clayey sandy SILT with some organic matter. Iron stained.			T1 2			3	Wet. Medium dry strength.
Very soft. do Occasional shell fragments.			T2 3			Zero	do
Soft grey sandy CLAY with organic matter.			T3 4			22	Wet. Clay: Medium to high dry strength.
Firm to dense grey coarse SAND with some fine gravel, subangular to subrounded.				14'9" 15'0"			
End of Borehole							

SCALE: 1" = 5'0" * DISTURBED SAMPLE

■ UNDISTURBED SAMPLE

SOIL MECHANICS LABORATORY

BOREHOLE LOG

PROJECT W.P. 7-57 Hwy. No. 2 over Thames River at Delaware ORDER No. I.289/58

CLIENT Ontario Department of Highways

BOREHOLE No. BH. I DIAMETER 2-1/2" CASING 2-1/2"

BOREHOLE LOCATION See plan INCLINATION Vertical BEARING _____

FORM G-1A 500
UNIFIED STATION 85/11

DESCRIPTION OF STRATA	ELEVATION	LEGEND	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Brown silty loam with organic matter. Iron stained.	682.0			Zero	Free Water		Moist.
Very loose brown sandy clayey SILT with organic matter and shell fragments.			• 1	1'6"		2	Wet. Medium dry strength
do			• 2			1	do
do			• 3			1	do
do			• 4			1	do
Very loose grey brown sandy clayey SILT. Some organic matter and shell fragments.			• 5	12'6"		1	do
Firm to dense grey fine to coarse SAND and fine to medium GRAVEL subangular to subrounded.			• 6	15'3" 15'7"		13	Wet. Low dry strength.
			End of Borehole				

SCALE :

• DISTURBED SAMPLE

■ UNDISTURBED SAMPLE

SOIL MECHANICS LABORATORY

BOREHOLE LOGPROJECT W.P. 7-57 Hwy. No. 2 over Thames River at Delaware ORDER NO. T.289/58CLIENT Ontario Department of HighwaysBOREHOLE NO. BH. K DIAMETER 2-1/2" CASING 2-1/2"BOREHOLE LOCATION See plan INCLINATION Vertical BEARING _____

DESCRIPTION OF STRATA	ELEVATION	LEGEND	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Dark brown organic loam.	684.1			Zero			Damp.
Very loose dark brown to black organic clayey SILT.			• 1	2'6"		2	Wet. Medium dry strength.
do			• 2			2	do
Loose grey to brown sandy clayey SILT with organic matter.			• 3	7'0"		4	do
Firm to stiff grey sandy CLAY with subangular gravel.			• 4	9'3"		14	Moist. High dry strength.
Stiff. do			• 5			14	do
				14'0"			
				End of Borehole			

FORM G-1A 500
UNIVERSAL GEOTECHNICAL

SOIL MECHANICS LABORATORY

BOREHOLE LOGPROJECT W.P. 7-57 Hwy. No. 2 over Thames River at Delaware ORDER NO. T.289/58CLIENT Ontario Department of HighwaysBOREHOLE NO. BH. L DIAMETER 2-1/2" CASING 2-1/2"BOREHOLE LOCATION See plan INCLINATION Vertical BEARING _____

DESCRIPTION OF STRATA	ELEVATION	LEGEND	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Firm brown loam with organic matter.	682.25			Zero	Free Water		Moist.
Loose brown clayey SILT with organic matter.			1	1'6"		6	Wet. Medium dry strength.
Loose grey brown slightly clayey SILT with organic matter and shell fragments.			T1				Poor recovery
			2			2	Moist. Low to medium dry strength.
			T2				
Loose brown clayey SILT with organic matter and shell fragments.			3			4	Wet. Medium dry strength.
Firm to dense grey fine to coarse SAND with fine to medium gravel subangular to subrounded.			4	16'0" 16'3"		13	Wet.
			End of Borehole				

SCALE: 1" = 5'0" * DISTURBED SAMPLE

■ UNDISTURBED SAMPLE

SOIL MECHANICS LABORATORY INDEX PROPERTIES

 REPORT NO. T.289/58

 TABLE NO. 1

 SHEET NO. 1

BORE-HOLE NO.	SAMPLE NO.	DEPTH		NATURAL DENSITY LB/FT ³	NATURAL MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	PLASTICITY INDEX	TYPE OF SAMPLE U - UNDISTURBED D - DISTURBED
		FROM	TO						
BH.6	T.1	12'-0"	13'-0"	136	16.3				
	T.2	21'-6"	22'-6"	136	18.3				
					18.7				
	T.3	26'-0"	27'-0"	132	22.2				
					21.4				
BH.E	T.1	3'-0"	4'-6"		41.4	54	27	27	
					40.8				
	T.2	7'-0"	8'-6"	120	30.1				
					35.2				
	T.3	10'-0"	11'-6"	119	30.2				
					27.5				
BH.F	T.1	3'-0"	4'-6"	114	29.8				
					32.8				
	T.2	7'-0"	8'-6"	124	25.9				
					27.7				
	T.3	16'-0"	17'-0"	137	20.5				
					15.9				
BH.G	T.4	21'-0"	22'-6"	133	16.2				
					17.8				
	T.1	5'-0"	6'-6"	120	31.5				
					30.2				
	T.2	8'-6"	9'-0"	115	32.4				
					30.8				
BH.H		9'-0"	9'-6"	118	34.5				
					38.8				
	T.3	12'-6"	14'-6"	138	15.6				
					13.4				
	T.2	7'-0"	8'-6"	123	26.1	31	21	10	
					27.8				
	T.3	11'-0"	12'-6"	111	40.0	39	25	14	
					42.6				

 PROJECT Delaware Bridge, Ontario

TITLE _____

 ORDER NO. T.289/58


**UNIVERSAL
GEOTECHNIQUE
LIMITED**

TABLE N° 2

BOREHOLE N°	SAMPLE N°	ELEVATION	UNCONFINED COMPRESSION STRENGTH lbs./sq. ft.
BH.6	T.1	658	3600 *
	T.2	648	5200 *
	T.3	644	2900 *
BH.8	7	664	6500 *
	8	658	4400 *
BH.E	T.1	677	1100
		to	600
		676	700
BH.F	T.1	677	1100
	T.2	673	600
	T.3	664	4600 *
	T.4	659	4400 *
BH.G	T.2	678	1400
	T.3	675	600 *
		674	750
	T.4	670	3000
BH.H	T.2	677	900 *
	T.3	673	750 *
BH.L	T.2	672	550 *

PROJECT Delaware Bridge, Ontario.

TITLE Shear Strength Tests

DRG. NO. _____ ORDER NO. T.289/58



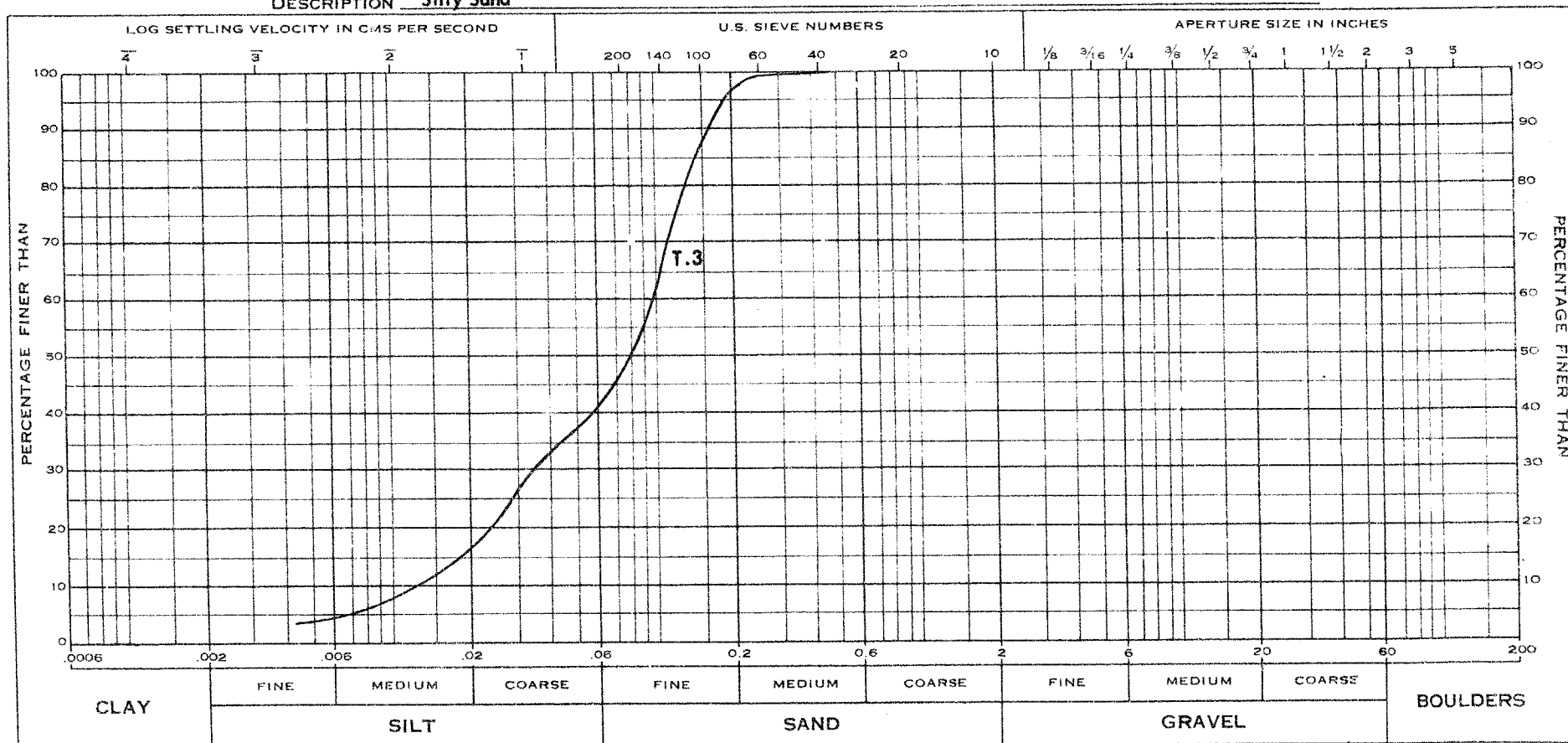
UNIVERSAL
GEOTECHNIQUE
LIMITED

SOIL MECHANICS LABORATORY MECHANICAL ANALYSIS

T.289/58

PROJECT W.P. 7-57 Hwy. N° 2 over Thames River at Delaware BORING NO. BH.E SAMPLE NO. T.3 DATE OF TEST 28th March, 1958.

DESCRIPTION Silty Sand



PARTICLE SIZE IN MM



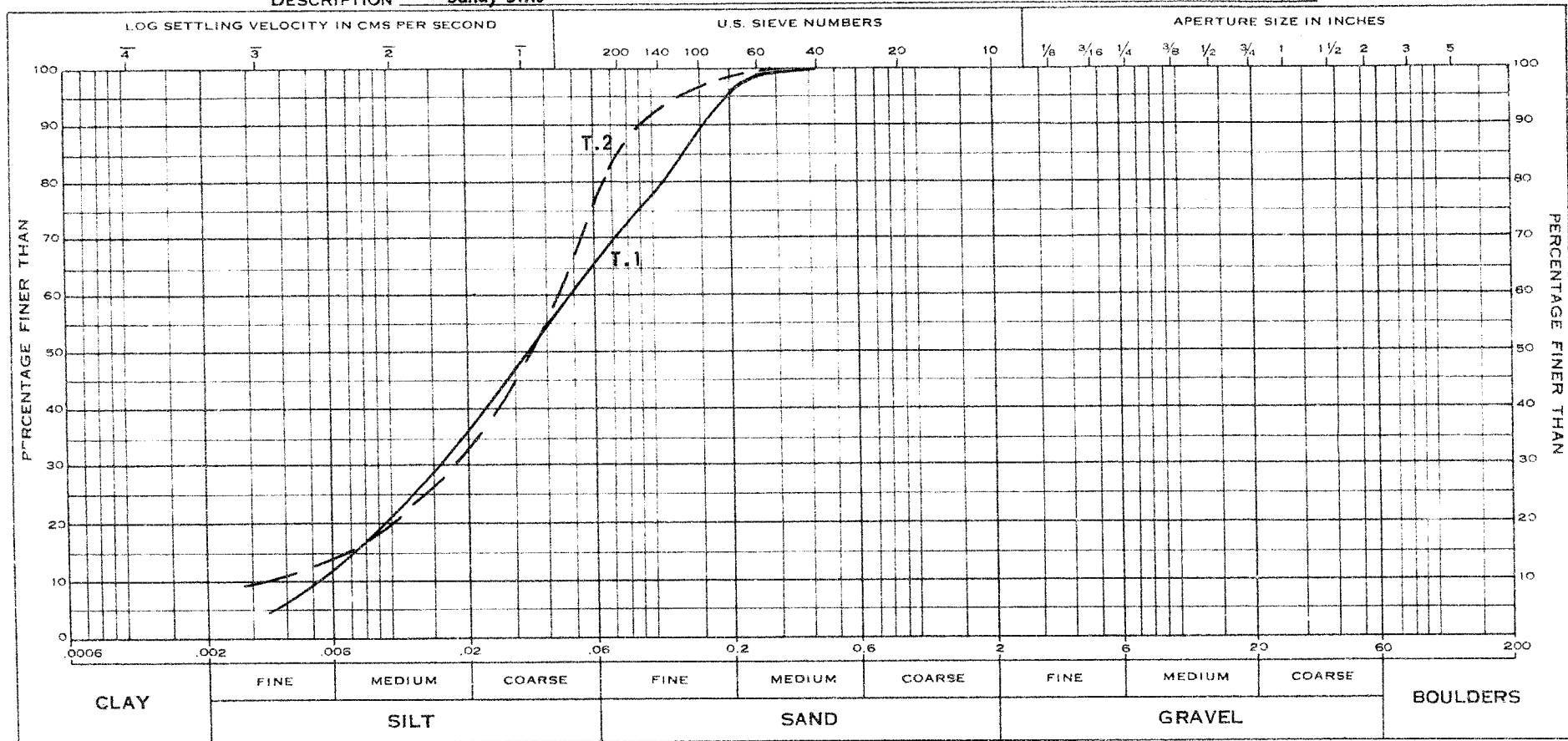
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SOIL MECHANICS LABORATORY MECHANICAL ANALYSIS

T.289/58

PROJECT W.P. 7-57 Hwy. N° 2 over Thames River at Delaware BORING NO. BH.F SAMPLE NO. T.1 & T.2 DATE OF TEST 28th March, 1958.

DESCRIPTION Sandy Silts

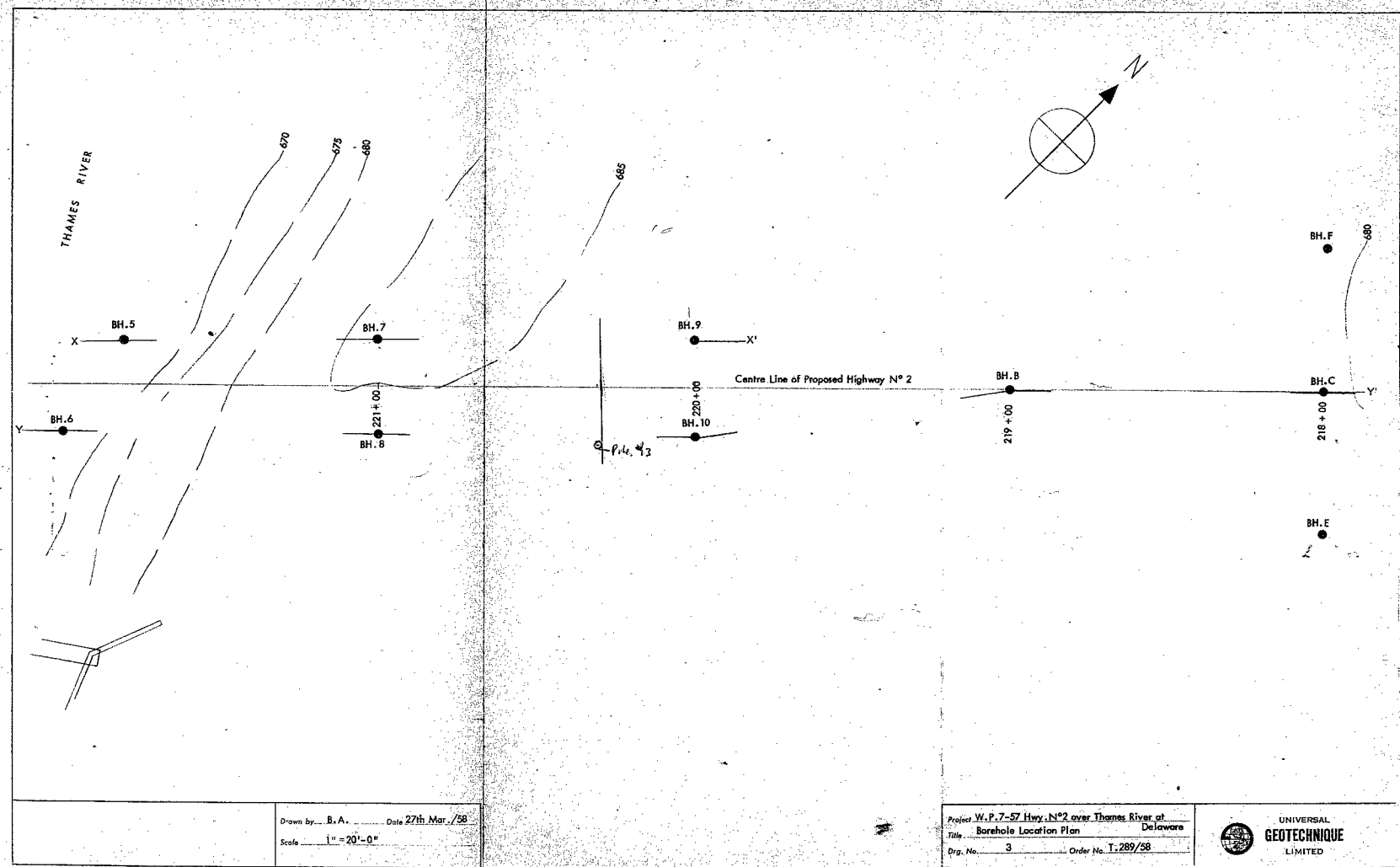
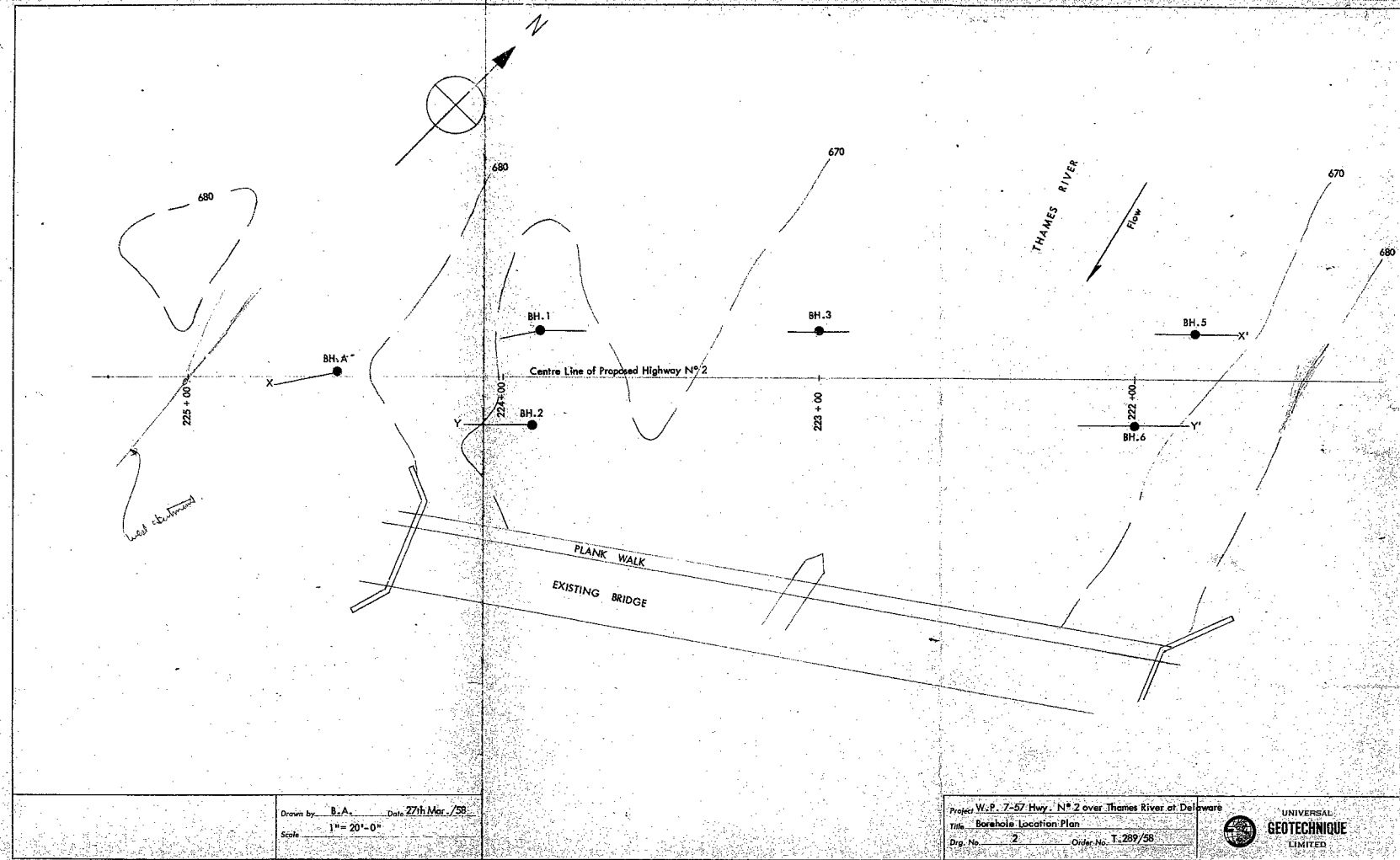


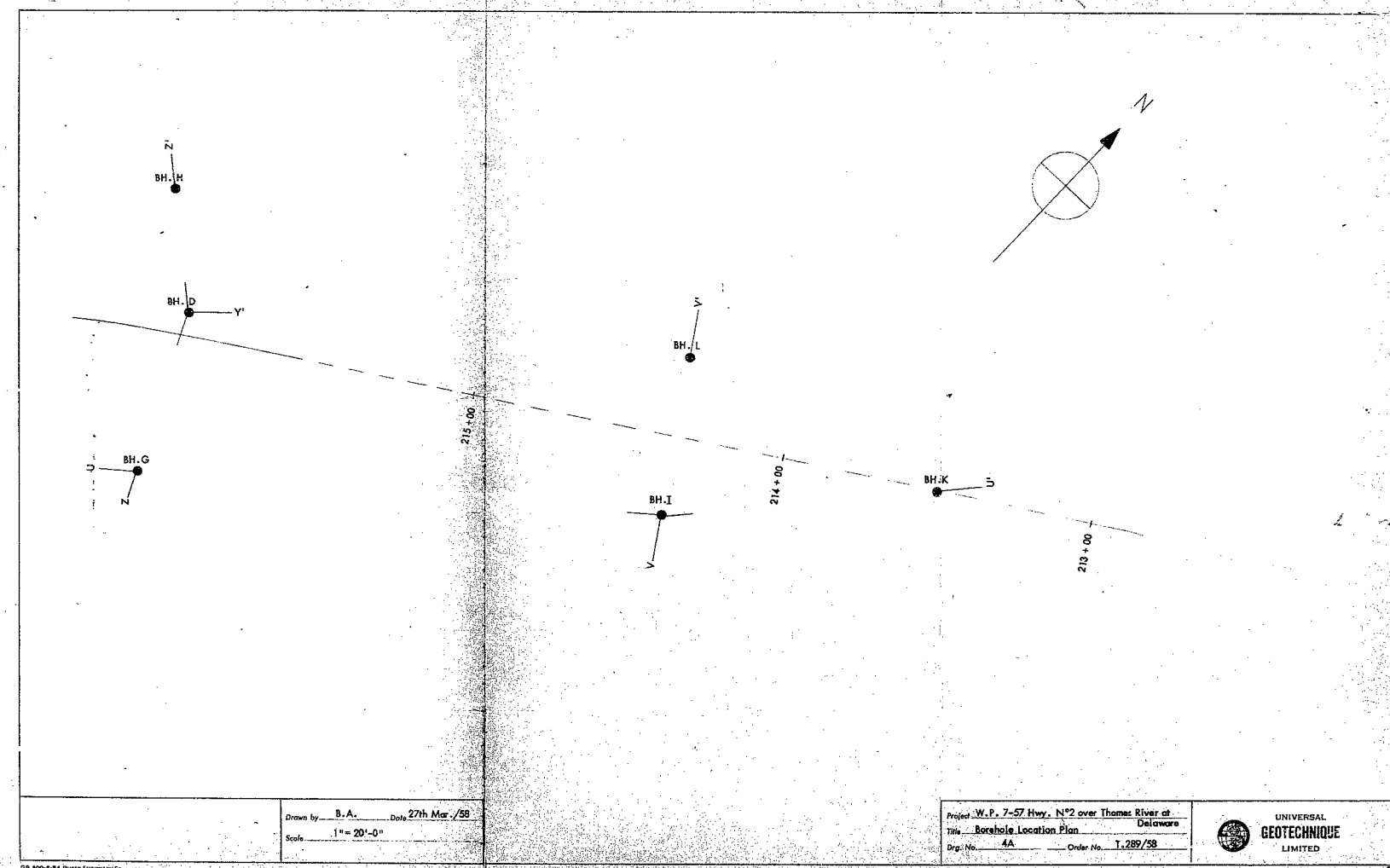
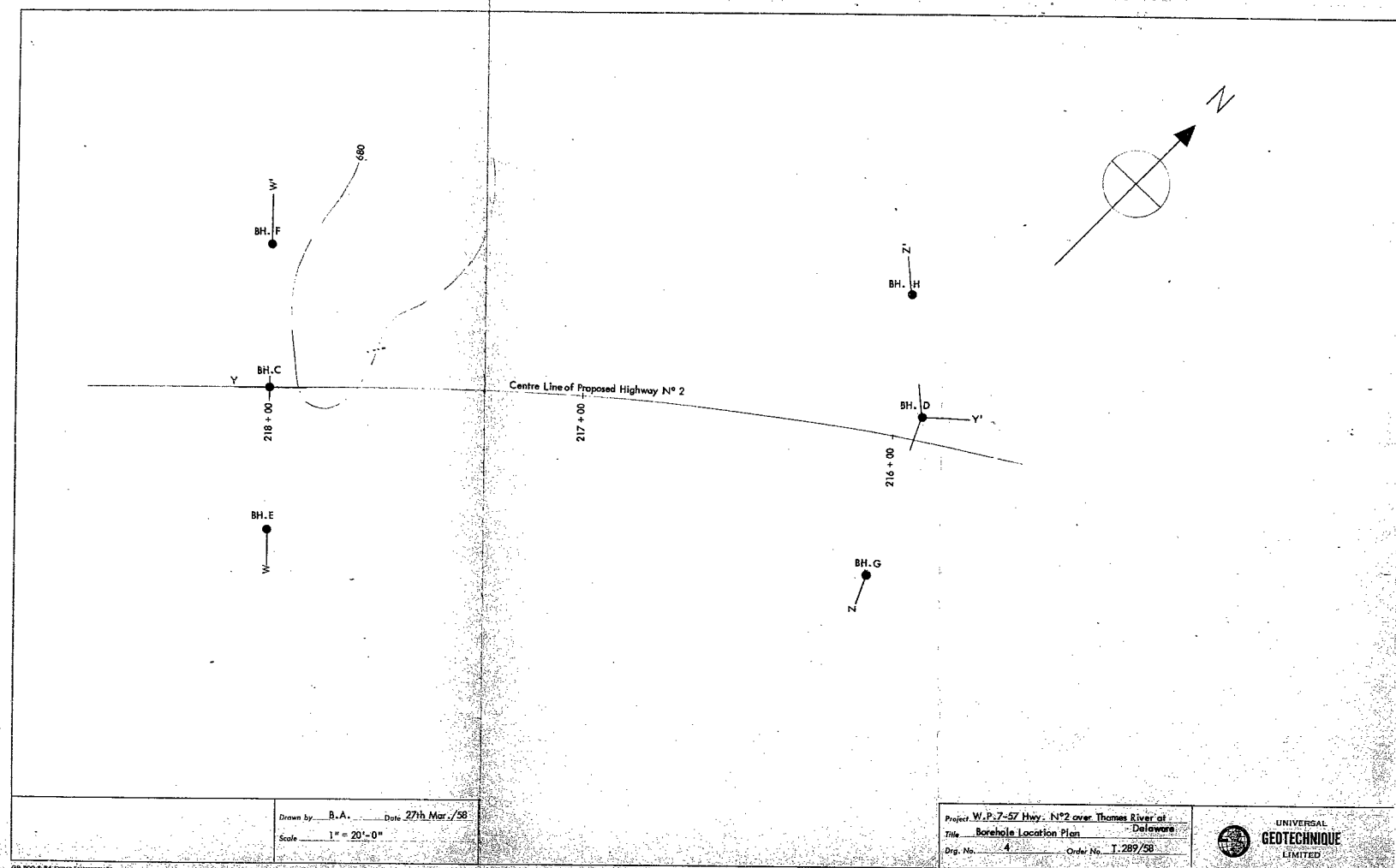
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W.P. 7-57

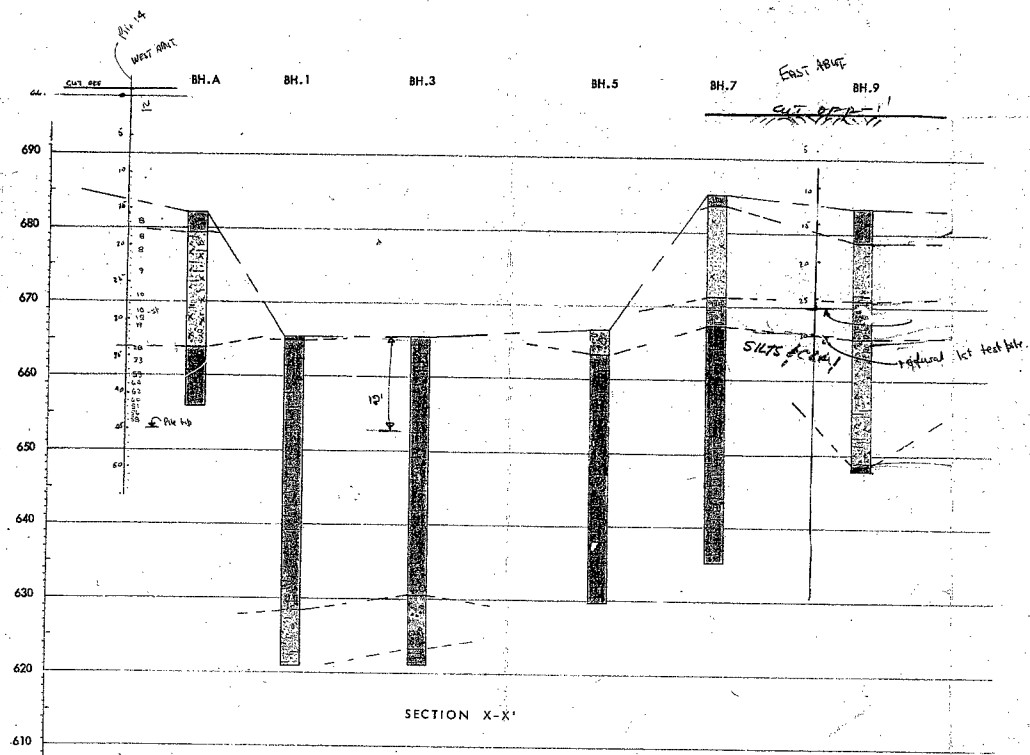
HWY. #2

THAMES RIVER
DELAWARE





- LEGEND**
- TOP SOIL
 - SILTS & SANDS (ALLUVIAL)
 - SANDS & GRAVELS (ALLUVIAL)
 - SILTS & CLAYS (LACUSTRINE)
 - CLAY TILL (GLACIAL)
 - SANDY TILL (GLACIAL)

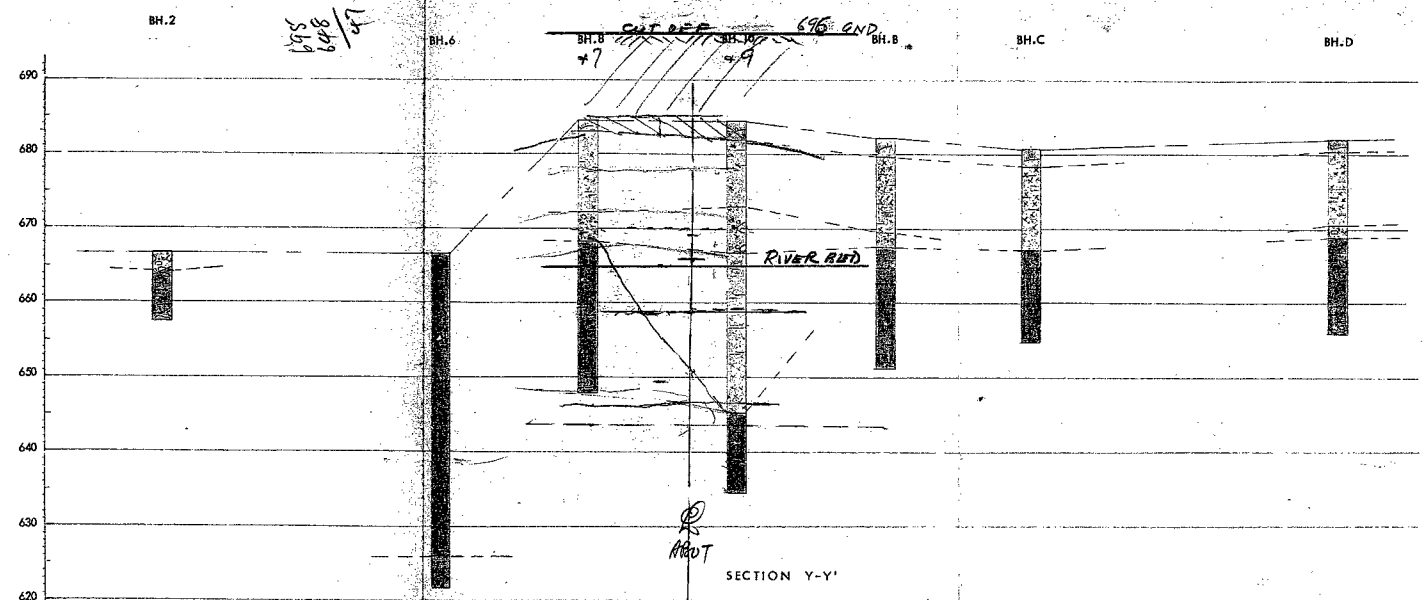


698.56
2.5
696
666
30

Drawn by: B.A. Date: 27th Mar./58
Scale: Horizontal 1" = 50'-0"
Vertical 1" = 10'-0"

Project: W.P. 7-57 Hwy. N°2 over Thomas River at Delaware
Title: Borehole Section
Drg. No. 5 Order No. T.289/58

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- LEGEND**
- TOP SOIL
 - SILTS & SANDS (ALLUVIAL)
 - SANDS & GRAVELS (ALLUVIAL)
 - SILTS & CLAYS (LACUSTRINE)
 - CLAY TILL (GLACIAL)
 - SANDY TILL (GLACIAL)

220+30.13
19.86

Drawn by: B.A. Date: 27th Mar./58
Scale: Horizontal 1" = 50'-0"
Vertical 1" = 10'-0"

Project: W.P. 7-57 Hwy. N°2 over Thomas River at Delaware
Title: Borehole Section
Drg. No. 6 Order No. T.289/58

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