

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. A. M. Toye,  
Bridge Engineer,  
Bridge Division.

FROM: Foundation Section,  
Materials & Research Div.,  
Room 107, Lab. Bldg.

Attention: Mr. S. McCombie

DATE: March 12, 1964.

OUR FILE REF.

IN REPLY TO

SUBJECT:

FOUNDATION INVESTIGATION REPORT BY:  
Gecco Limited, Consulting Engineers.  
W.P. 27-63, Hwy. 62, York River Bridge,  
District No. 10, Bancroft, Ontario.

The above report with its addendum, submitted by the Consultant, has been reviewed and we agree with the recommendations made.

For calculation of lateral earth pressure, however, a coefficient of 0.3 may be used for the case of spread footings on sand and gravel, and 0.4 for the case of pile foundation or foundation resting on bedrock.

Adequate drainage has to be provided for the backfill material as in standard practice.

We trust that you will find the information contained in this report adequate for your design requirements. Should there be any queries in connection with this project, please do not hesitate to contact our Office.

KYL/MdeF  
Attach.

cc: Messrs. A. M. Toye (2)  
H. A. Tregaskes  
H. D. McMillan  
J. Ford  
J. E. Callaghan  
J. E. Gruspier  
A. Watt

Foundations Office  
Gen. Files

*KYL*  
K. Y. Lo,  
SUPERVISING FOUNDATION ENGR.  
For:  
A. G. Stermac,  
PRINCIPAL FOUNDATION ENGR.

BA 1782  
SITE 11-21

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420 MICHEL JASMIN, DORVAL, QUEBEC Rexdale, Ontario.  
TELEPHONE 631-9827 March 5th, 1964.

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Department of Highways, Ontario,  
Materials and Research Division,  
Downsview, Ontario.

Attention: Mr. A. G. Stermac, P. Eng.,  
Principal Foundation Engineer.

Re: Soil Conditions and Foundations,  
Proposed York River Bridge,  
Bancroft, Ontario.

*Submitted  
March 12-64*

W.P. 27-63

Dear Sirs:

This letter accompanies our report on the above investigation. The results of one borehole, which is still outstanding, will be presented as an addendum in the near future, which will then complete this report.

We find that at the proposed abutment locations there is about 10 feet of fill and sandy silt at the surface. Below this is dense to very dense sand and gravel with boulders, then bedrock.

It is considered that the bridge may be carried on spread footings at the proposed elevation of 1062, as discussed in the report. The actual foundation treatment however, will depend on the method of scour protection as discussed.

We believe that this report in conjunction with the addendum covers the requirements of this investigation. Should you require further information or wish to discuss any aspect of this report please give us a call.

Yours very truly,

GEOCON LTD

*M. A. J. Matich per D.B.O.*

MAJM/reb  
T7590

M. A. J. Matich, P. Eng.,  
Vice-President and Chief Engineer.

T7590  
REPORT  
TO  
DEPARTMENT OF HIGHWAYS, ONTARIO  
ON  
SOIL CONDITIONS AND FOUNDATIONS  
PROPOSED YORK RIVER BRIDGE  
BANCROFT ONTARIO

Distribution:

- 10 copies - Department of Highways, Ontario,  
Downsview, Ontario.
- 3 copies - Geocon Ltd,  
Rexdale, Ontario.

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## INTRODUCTION

Geocon Ltd has been retained by the Department of Highways, Ontario by letter dated February 18th, 1964 to carry out a foundation investigation at the Bridge Street bridge over the York River in Bancroft.

The purpose of the investigation was to determine the soil conditions at the bridge site as required for the design of the replacement structure.

One additional borehole is being carried out at the site, and the results will be reported shortly as an addendum to this report.

## SUMMARIZED SOIL CONDITIONS

The boreholes were put down through the approach embankments and encountered up to 8.5 feet of loose to compact sand and gravel fill. The upper 6 feet of the fill at borehole 2 contained cinders. At the location of borehole 1 the surface of the embankment is covered by rock fill which is also reported to have been used in the construction of parts of the approach embankments. Underlying the sand and gravel fill, at borehole 1, is a stratum of loose to compact organic sandy silt. The sand and gravel fill and the sandy silt stratum are underlain by a stratum of dense to very dense sand and gravel with some boulders. The measured thickness ranged from 11.5 feet to 64 feet. The surface of this stratum in the river is strewn with boulder sizes.

The sand and gravel stratum directly overlies bedrock.

General

It is understood that the existing Bridge Street bridge over the York River in Bancroft, Ontario, is to be replaced by a wider structure of the same length. The existing bridge is an old single span concrete arch structure. It is 18 feet wide and 90 feet in length and has a deck at about elevation 1079. Adjacent to the north side of the bridge there is a 4.5 foot wide sidewalk and 8 inch water main. The latter is supported by three groups of timber piles founded in rockfilled timber cribs.

No data concerning the foundations of the existing bridge was available at the time of this investigation. The bridge appears to have performed satisfactorily and there are no obvious signs of settlement or lateral movement of the abutments. However there is some cracking visible on the surface of the south side of the arch near the west abutment which is believed due to deterioration of the concrete.

The proposed bridge is 41 feet wide and consists of 28 feet of pavement with two sidewalks 6.5 feet in width. As tentatively proposed, the bridge will be a simply supported single span structure with the deck slab at about elevation 1079 and supported by five precast concrete girders. Roadway grade will therefore be essentially the same as existing grade. The deck slab will be of reinforced concrete construction. At the north-east corner of the bridge, retaining walls will be provided to accommodate steps giving access from the sidewalk to the river bank. At the other three corners of the bridge, concrete wing walls parallel to the

General (continued)

roadway will be constructed and supported by the abutment footings. As shown on Department of Highways, Ontario, Drawing B63179 SK1, presently proposed footing elevation is about 1062.

Foundations

The result of the investigation indicates that a dense to very dense sand and gravel stratum exists below the elevation of river level and extends to bedrock. Above river level there is generally organic sandy silt or sand and gravel fill.

The fill and the organic silt are not considered suitable as foundation materials in this instance. Foundations, therefore, will have to be carried down to the dense sand and gravel stratum. All of the overburden is frost susceptible and therefore it is recommended that foundations be provided with at least 5 feet of earth cover for frost protection.

Based on the observed relative density of the sand and gravel stratum it is considered that the abutments for the proposed bridge may be carried on spread footings within this stratum. The foundation elevation however will depend on whether or not protection is provided against possible undermining by scour. One possibility would be to provide rip-rap cover of suitable size stone on the banks and river bed adjacent to each abutment. If this is done the abutment footings could be carried at elevation 1062, as proposed, where they would generally be just within the dense to very dense sand and gravel stratum.

Foundations (continued)

However, extrapolation between observed bedrock elevation at borehole 1 and an outcrop at elevation 1072 approximately 50 feet to the north of the existing east abutment, gives a bedrock elevation at the north side of the existing east abutment which is higher than elevation 1062. An additional borehole is being carried out to check on actual bedrock elevation at this point. The results will be reported separately.

The minimum measured standard penetration resistance or "N" value in this material is 41, and in several cases "N" values greater than 100 were obtained. It is appreciated that the "N" values were influenced by the presence of large gravel sizes. However, other factors such as the resistance to driving casing, the pressure on the bit during drilling, the lack of water loss and the fact that the hole did not cave when left uncased for 10 feet below the water table, confirm that this material is in a dense to very dense state. It is considered therefore that an allowable bearing value of 3 tons per square foot may be used in the design of the spread footings for the abutments and for the retaining walls. With precautions during construction, as discussed below, the total settlement of the abutment under this allowable bearing value should not be more than 1/2 inch. With a foundation elevation at 1062, the north end of the east abutment will probably be carried on bedrock. Therefore the anticipated total settlement may also be the differential settlement of this abutment. Settlement will, for practical purposes, take place concurrently with application of load and will therefore be largely completed at the end of construction.



Foundations (continued)

Depending on the results of the additional hole, the footings for the east abutment and retaining walls may be in part carried directly on bedrock. In this event, the recommended allowable bearing value for the bedrock is 20 tons per square foot.

The alternative to using rip-rap protection, as discussed, would be to found the abutments below the possible depth of scour. In view of the dense nature of the sand and gravel, and the presence of boulders in the river bed at this location and the lack of significant constriction, this location does not appear to be particularly scour susceptible. However, the possible depth of scour should be checked. The latter is dependent on a number of factors including the hydraulics of the river channel, the maximum variation in water level and the nature of the material in the stream bed. At this particular site there is the further consideration that special conditions of flow might arise in the event that the dam immediately downstream of the bridge should be emptied rapidly. In view of these considerations, it is not possible to determine the depth of scour on the basis of information, obtained during this investigation.

At the east abutment, bedrock occurs within a depth of about 10 feet below footing level and by taking the whole foundation down to bedrock the danger of scour would be eliminated. At the west abutment, however, bedrock was encountered about 50 feet below proposed footing excavation. Depending on the anticipated depth of scour,

Foundations (continued)

this abutment might be founded on bearing piles extended below the scour zone, or the foundation might be protected against undermining by a steel sheet pile surround. A variety of pile types would be suitable for the bearing piles. The dense nature of the sand and gravel stratum and the presence of boulders would cause a high penetration resistance to any type of driven pile and jetting would probably be necessary. Jetting to assist driving is recommended for any steel sheet piling that might be involved.

From a purely soil mechanics standpoint the most suitable foundation type would be the alternative using spread footings with rip-rap protection. However, the final choice is also dependent on considerations of economics which are beyond the scope of this report.

Approach Embankments

It is understood that the grade of the approach embankments will remain the same as the existing grade. If spread footings are used and adequate rip-rap protection provided, as discussed above, the overall stability of either approach embankment should be adequate. On the other hand, if scour is permitted in front of the abutments the overall stability of the end of the embankment at the abutment should be checked using the soils properties given in the report.

It is recommended that the backfill to the abutments and retaining walls consist of well compacted free draining non-frost susceptible granular material. It is

Approach Embankments (continued)

further recommended that adequate provision be made for drainage of the backfill behind the abutment. With backfill as above a coefficient of lateral earth pressure of 0.4 is recommended for the case of spread footings on sand and gravel, and 0.5 for the case of a pile foundation or foundation directly on bedrock. The abutment should have a factor of safety of at least 1.5 against lateral sliding.

Construction

With foundations at elevation 1062, construction would involve excavation into the sand and gravel stratum for a distance of at least 5 feet below observed water level. Some means will therefore be required to control water inflow. For this purpose, a gravity well point system could be used or alternatively the excavation could be sheeted and dewatered by pumping from filter equipped sumps maintained below excavation level. Installation of well points would probably require the use of a hole puncher, and the construction of a low berm on the riverside of the excavation. As mentioned earlier, sheeting would require jetting to assist installation. Sheet piling, if used should be carried below excavation level a distance at least equal to the head differential. The base of excavation should be well compacted prior to footing construction.

CONCLUSIONS AND RECOMMENDATIONS

- 1) The approach embankments consist generally of up to 8.5 feet of loose to compact sand and gravel fill. Underlying the 5 feet of fill, at the east

- 1) (continued)  
embankment, is 4.5 feet of organic sandy silt. The surface of the east embankment is covered by rock fill. The embankments are founded on 11.5 to 64 feet of dense to very dense sand and gravel with some boulders. This stratum directly overlies granite gneiss bedrock. Numerous boulders were present in the river bed.
- 2) At the time of investigation the river level was at elevation 1067.4. No information was available on the maximum stream velocity or fluctuation of river level.
- 3) The dense to very dense sand and gravel stratum is a competent foundation stratum. The abutments of the bridge may be founded on spread footings at elevation 1062, as proposed, if suitable precautions are taken against frost and scour. A net allowable bearing value of 3 tons per square foot could be used in design, as discussed.
- 4) Consideration could be given to founding below scour level, as discussed, and the depth of possible scour would have to be checked in this event.
- 5) Recommendations covering lateral earth pressures and drainage to the abutments are given.
- 6) Construction of footings to the proposed elevation will involve excavation below river level and dewatering measures will be required. Several possibilities are discussed in the report.

PERSONNEL

9

The investigation was carried out under the supervision of Mr. D. B. Oates. This report was written by Mr. D. B. Oates and reviewed by Mr. M. A. J. Matich.

DBO/reb  
T7590

*D. B. Oates*

D. B. Oates, P. Eng.  
Senior Soils Engineer



APPENDIX I

PROCEDURE

SITE AND GEOLOGY

SOIL CONDITIONS

WATER CONDITIONS

OFFICE REPORTS ON SOIL EXPLORATION

GEOCON

## PROCEDURE

The field work for this investigation was carried out between February 19th and 26th, 1964. Two boreholes were put down using a standard skid-mounted diamond drill-rig. Because of the boulder content in the overburden, both boreholes had to be advanced by diamond drilling methods, using BX and AX size casing.

A complete log of each borehole is given on the Office Reports on Soil Exploration in this Appendix. The locations of the boreholes together with the inferred soil stratigraphy are shown on Drawing T7590-1, located in the pocket at the rear of this report.

The results of the laboratory testing are shown on the figure in Appendix II. All samples, remaining after testing will be stored until October 1st, 1964 at which time you will be contacted for instructions regarding their disposal.

All elevations are referred to Geodetic datum. The location of the bench mark used is shown on Department of Highway, Ontario, Drawing No. B 63179 SK1 and has a quoted elevation of 1072.63.

## SITE AND GEOLOGY

The bridge site is located in Bridge Street over the York River in the Town of Bancroft, Ontario. The deck of the existing bridge is about 13 feet above river level and the river banks adjacent to the bridge on the south side are steeply sloping.

## SITE AND GEOLOGY (continued)

II

Based on available geological evidence the overburden in the area consists generally of granular glacial drift directly overlying bedrock. Further, the surface of bedrock is highly irregular resulting in considerable variations in the thickness of the overburden.

### SOIL CONDITIONS

The principal soil conditions encountered in the investigation are as follows:

#### Loose to Compact Brown Sand and Gravel Fill

Both boreholes were put down through the bridge approach embankments and encountered a stratum of sand and gravel fill. The thickness varied from about 5 feet at borehole 1 to about 8.5 feet at borehole 2. At borehole 2 the upper 6 feet contained cinders. At the location of borehole 1 the surface of the embankment slope is covered by rock fill. The maximum size observed was about 6 feet. It is understood, from local information, that rock fill was used to construct parts of the approaches to the bridge. At the bridge location the river bed is strewn with rocks of boulders. The average size is about 12 inches.

A single standard penetration test carried out gave an "N" value of 11 blows per foot. Before advancing the casing by drilling an attempt was made to drive the casing. Based on the "N" value and an estimate of the driving resistance it is believed that the relative density of the fill ranges from loose to compact.



Loose to Compact Dark Brown Sandy Silt

Underlying the sand and gravel fill at borehole 1 is a stratum of dark brown sandy silt. The sandy silt contains finely dispersed organic material and occasional angular gravel. It has a thickness at the borehole, of about 4.5 feet

Based on a single "N" value of 7 blows per foot, and the resistance to advancing the casing, the relative density is believed to range from loose to compact.

Dense to Very Dense Brown to Grey Sand and Gravel with some Boulders

Underlying the sand and gravel fill and organic sandy silt stratum is a brown to grey stratum composed mainly of sand and gravel with some boulders and silt sizes. The maximum length of boulder core recovered during drilling was about 6 inches though it is believed possible that larger sizes exist within the overburden. The coarse gravel content is granite and generally angular in shape.

Mechanical analysis tests were carried out on three representative samples from this stratum and the results plotted on Fig. 1 in Appendix II. The results indicate that the gravel content increases slightly with depth. The upper part of this stratum contains generally 15 percent gravel sizes, 70 percent sand sizes and 15 percent silt and clay sizes.

## SOIL CONDITIONS (continued)

IV

### Dense to Very Dense Brown to Grey Sand and Gravel with some Boulders (continued)

The estimated coefficient of permeability of this stratum, as encountered in the boreholes, is  $1 \times 10^{-3}$  centimeters per second. However, during an investigation at a nearby site a high water loss, during drilling, was observed in an essentially similar material. No water loss was however observed in the boreholes put down at this site. It is believed therefore that a higher permeability than given above could exist locally in this stratum.

Standard penetration tests carried out in this stratum gave "N" values ranging from 41 to greater than 100 blows per foot. In this type of material the "N" values are affected by the coarse gravel content. However, based on the "N" values obtained and on the resistance observed during advancing the boreholes the relative density of this stratum is considered to range from dense to very dense and generally very dense.

For design purposes an angle of internal friction of 40 degrees could be used where applicable. The wet and submerged unit weights are estimated to be 135 and 75 pounds per cubic foot.

### Bedrock

The bedrock was cored in AXT size for depths of 10 and 13 feet. The surface of bedrock was encountered at depths below ground level of about 21 and 72.5 feet. Numerous outcrops were observed in the general area of the bridge. A bedrock outcrop was observed at about elevation 1072 along

## SOIL CONDITIONS (continued)

V

### Bedrock (continued)

the north side of the building adjacent to the north wing wall of the existing east abutment. Other outcrops were observed about 200 feet downstream of the bridge and to the south-west of the bridge. A borehole is presently being put down to check on actual bedrock elevation at the north side of the east abutment. The results will be submitted as an addendum.

Core recovery was high and the nature of the bedrock was sound. The core recovered was identified as hard granite gneiss, having a relatively high mica content.

## WATER CONDITIONS

Water level observations in the casing indicate that the elevation of the ground water level at the abutments is the same as river level. At the time of investigation the river level was at about elevation 1067. No information on the range between high and low water levels, and the maximum water velocity.

## EXPLANATION OF THE FORM "OFFICE REPORT ON SOIL EXPLORATION"

The object of this form is to enable a comprehensive study of the soil to be made by combining on one sheet all of the information obtained from the boring. An explanation of the various columns of the report follows.

### ELEVATION AND DEPTH

This column gives the elevation and depth of boundaries between the various soil strata. The elevation is referred to the datum shown in the general heading.

### WATER CONDITIONS

In this column the water level in the casing at the time of boring or the water table in the ground, determined by a series of observations in a piezometer or standpipe, is indicated to scale by a horizontal line with the symbol W.L. or W.T. above the line. A notation of any complicated groundwater conditions will be made in this column.

### DESCRIPTION

A description of the soil, using standard terminology, is contained in this column. The consistency of cohesive soils and the relative density of non-cohesive soils are described by the following terms:

| <u>Consistency</u> | <u>U-Strength<br/>Tons/sq. ft.</u> | <u>Relative Density</u> | <u>Standard Penetration<br/>Resistance. Blows/ft.</u> |
|--------------------|------------------------------------|-------------------------|---|
| Very soft          | 0.03 to 0.25                       | Very loose              | 0 to 4  |
| Soft               | 0.25 to 0.5                        | Loose                   | 4 to 10   |
| Firm               | 0.5 to 1.0                         | Compact                 | 10 to 30  |
| Stiff              | 1.0 to 2.0                         | Dense                   | 30 to 50  |
| Very stiff         | 2.0 to 4.0                         | Very dense              | over 50   |
| Hard               | over 4.0                           |                         |   |

### STRATIGRAPHIC PLOT

The stratigraphic plot follows the standard symbols of the National Research Council, Canada.

### ELEVATION SCALE

The information in all columns is plotted to a true elevation scale which is shown in this column.

### GRAPHS

The main body of the report forms a graph which is used to plot to correct elevation the important soil properties which are obtained through field and laboratory tests. The scales and symbols for the plotting are shown at the head of the column.

### OTHER TESTS

In this column are shown, by symbol, the other field or laboratory tests which have been performed on the soil and for which the results have not been plotted on the above graph.

### SAMPLES

The first three columns describe the condition, type and number of each sample obtained from the boring. The location and extent of each sample is plotted to scale.

In the last column is shown the penetration resistance in blows of 4200 inch-pounds required to drive one foot of the sampler into the ground. When a 2 inch Drive Sampler is used the result obtained is termed the "Standard Penetration Resistance".

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## GEOCON

## OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T7530 BORING # 1 DATUM GEODETIC CASING BX & AX  
 BORING DATE FEB. 19-21, 1964 REPORT DATE FEB. 26, 1964 COMPILED BY AEL. CHECKED BY DBG  
 SAMPLER HAMMER WT 140 LBS DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS ENERGY)

## SAMPLE CONDITION

☐ DISTURBED  
☐ FAIR  
☐ GOOD  
☐ LOST

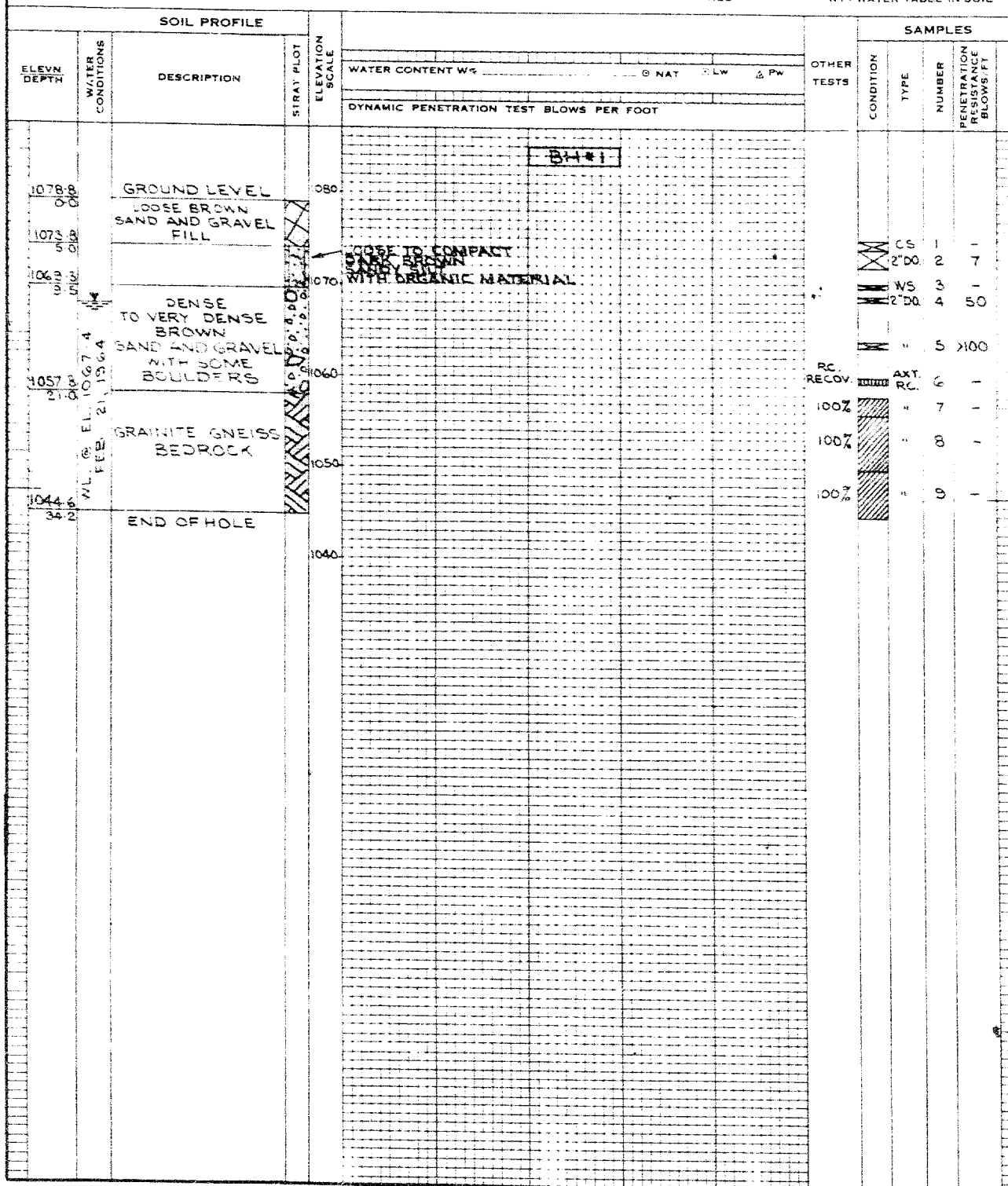
## SAMPLE TYPES

AS AUGER SAMPLE  
 ST SLOTTED TUBE  
 WS WASHED SAMPLE  
 DO DRIVE-OPEN  
 DF DRIVE-FOOT VALVE  
 CS CHUNK SAMPLE

FS FOIL SAMPLE  
 SO SLEEVE-OPEN  
 SF SLEEVE-FOOT VALVE  
 TO THIN WALLED OPEN  
 RC ROCK CORE

## ABBREVIATIONS

V IN-SITU VANE TEST  
 M MECHANICAL ANALYSIS  
 U UNCONFINED COMPRESSION  
 QC TRIAXIAL CONSOLIDATED UNDRAINED  
 Q TRIAXIAL UNDRAINED  
 S TRIAXIAL DRAINED  
 1 WET UNIT WEIGHT  
 K PERMEABILITY  
 C CONSOLIDATION  
 WL WATER LEVEL IN CASING  
 WT WATER TABLE IN SOIL



## GEOCON

## OFFICE REPORT ON SOIL EXPLORATION

CONTRACT 77530 BORING # 2 DATUM GEODETIC CASING BX & AX.  
 BORING DATE FEB. 21-23, 1964 REPORT DATE FEB. 26, 1964 COMPILED BY AEL. CHECKED BY DBO  
 SAMPLER HAMMER WT 140 LBS DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN. LBS ENERGY)

## SAMPLE CONDITION

☐ DISTURBED  
☐ FAIR  
☐ GOOD  
☐ LOST

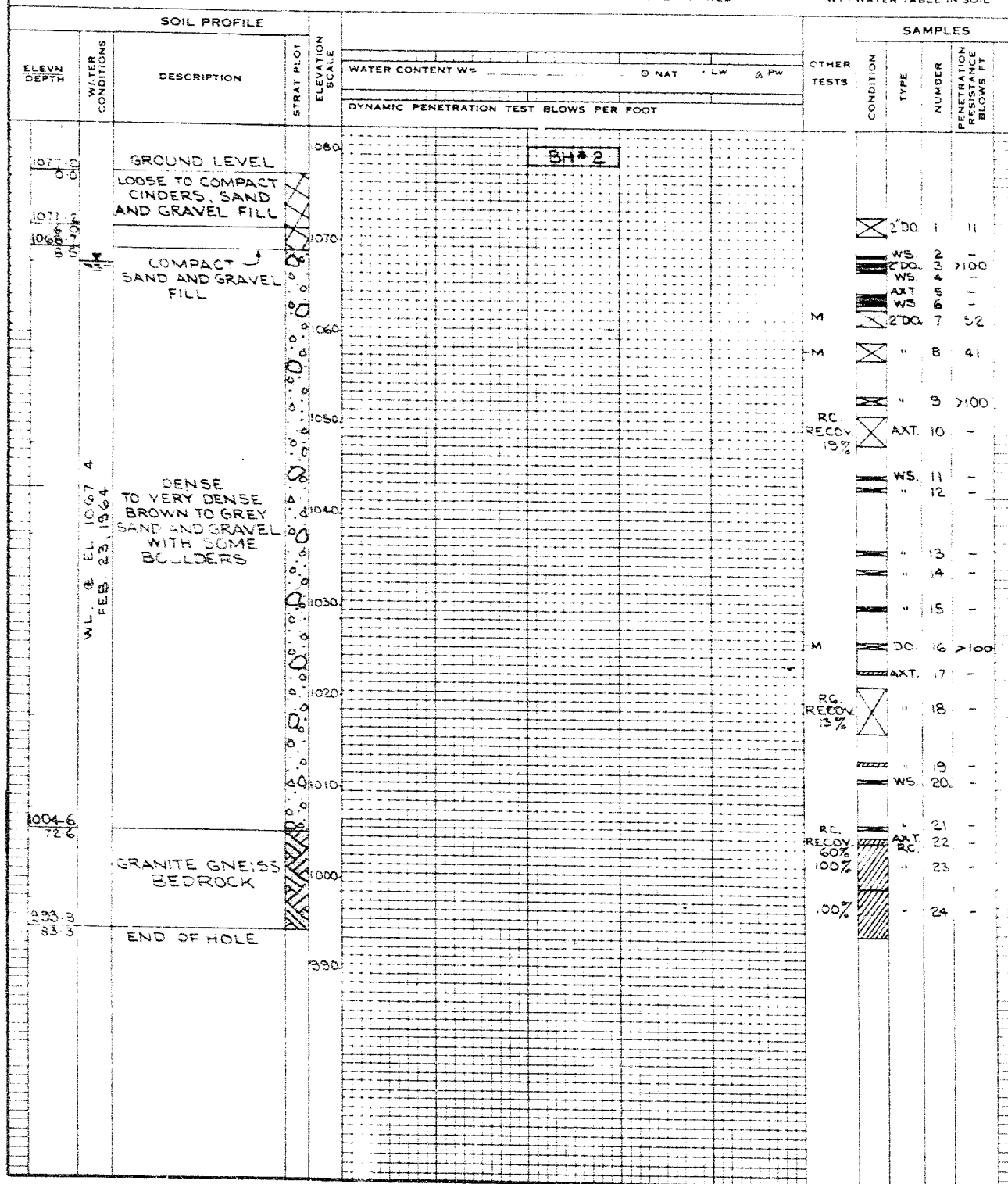
## SAMPLE TYPES

AS - AUGER SAMPLE  
 ST - SLOTTED TUBE  
 WS - WASHED SAMPLE  
 DO - DRIVE-OPEN  
 DF - DRIVE-FOOT VALVE  
 CS - CHUNK SAMPLE

FS - FOIL SAMPLE  
 SO - SLEEVE-OPEN  
 SF - SLEEVE-FOOT VALVE  
 TO - THIN WALLED OPEN  
 RC - ROCK CORE

## ABBREVIATIONS

V - IN-SITU VANE TEST  
 M - MECHANICAL ANALYSIS  
 U - UNCONFINED COMPRESSION  
 QC - TRIAXIAL CONSOLIDATED UNDRAINED  
 Q - TRIAXIAL UNDRAINED  
 S - TRIAXIAL DRAINED  
 W - WET UNIT WEIGHT  
 K - PERMEABILITY  
 C - CONSOLIDATION  
 WL - WATER LEVEL IN CASING  
 WT - WATER TABLE IN SOIL



APPENDIX II

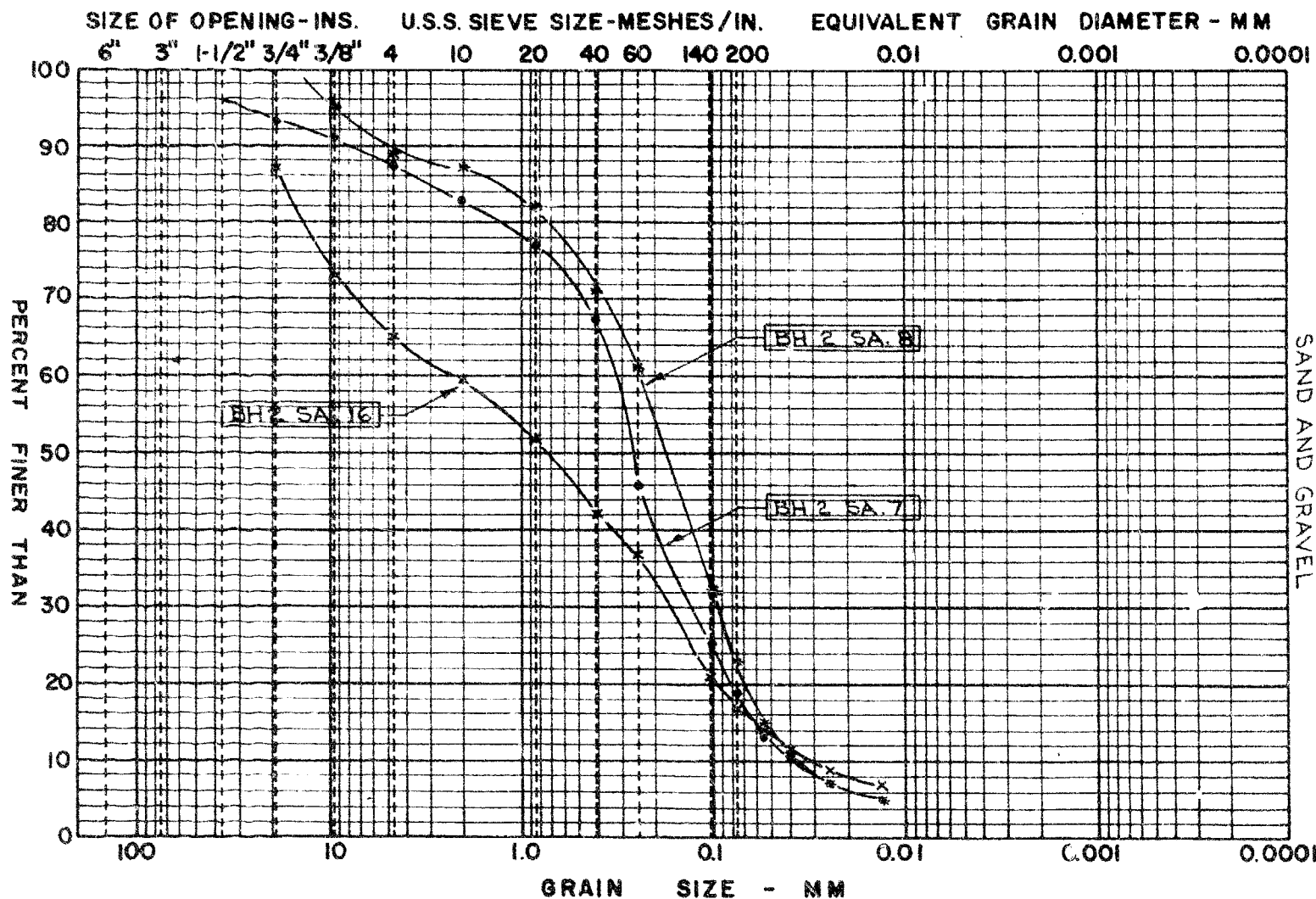
Figures - Laboratory Testing

GEOCON

# GRAIN SIZE DISTRIBUTION

APPENDIX II  
FIGURE 1  
PROJECT T7590

| COBBLE | GRAVEL SIZE |        |      | SAND SIZE |        |      | FINE GRAINED |             |
|--------|-------------|--------|------|-----------|--------|------|--------------|-------------|
| ← SIZE | COARSE      | MEDIUM | FINE | COARSE    | MEDIUM | FINE | SILT SIZE    | CLAY SIZE → |





Materials and Research Division

February 18, 1964

Geeson, Limited,  
Consulting Engineers,  
14 Haas Road,  
Bordale, Ontario.

Attention: Mr. F. J. Hefferman

Re: W.P. 27-63, Hwy. 62, York River in Bancroft,  
District #10, Bancroft, Ontario.

Dear Sir:

Please consider this your authority to carry out a foundation investigation at the above site. Plans and profiles were provided to your representative on February 17, 1964.

It is understood that a qualified Soils Engineer will be in charge of the field work at all times.

Ten copies of the completed foundation report, with one additional copy of each subsoil profile, should be submitted to the Foundation Section prior to March 30, 1964. Previous requirements as to preliminary borehole information and laboratory testing program, should be followed.

Because the drawings accompanying the foundation reports, showing the location of borings, the inferred subsoil conditions, etc., are to become contract drawings, you are requested to prepare them in accordance with the D.M.C. standards. To enable you to do this, we are supplying you with sample drawings with all the necessary explanations, together with linen sheets for your drawings. You are also requested to provide the D.M.C. with Crenaflex copies of the drawings.

Charges for the work performed will be in accordance with your Schedule of Rates, dated February 17, 1959, and invoice to be addressed to the attention of the undersigned.

EDS/MSL

Yours very truly,

cc: Messrs: S. McCombie  
J. E. Callaghan  
J. Ford  
J. E. Crispier  
M. D. Smith (2) M. Konings  
Foundations Office Gen. Files (2)

*A. R. Kitch*  
A. R. Kitch,  
MATERIALS & RESEARCH ENGINEER

Mr. A. M. Teye,  
Bridge Engineer,  
Bridge Division.

Foundation Section,  
Materials & Research Div.,  
Room 107, Lab. Bldg.

Attention: Mr. S. McCombie

March 12, 1964.

FOUNDATION INVESTIGATION REPORT BY:  
Geocon Limited, Consulting Engineers.  
W.P. 27-63, Hwy. 62, York River Bridge,  
District No. 10, Bancroft, Ontario.

The above report with its addendum, submitted by the Consultant, has been reviewed and we agree with the recommendations made.

For calculation of lateral earth pressure, however, a coefficient of 0.3 may be used for the case of spread footings on sand and gravel, and 0.4 for the case of pile foundation or foundation resting on bedrock.

Adequate drainage has to be provided for the backfill material as in standard practice.

We trust that you will find the information contained in this report adequate for your design requirements. Should there be any queries in connection with this project, please do not hesitate to contact our Office.

XYL/mief  
Attach.

cc: Messrs. A. M. Teye (2)  
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J. Ford  
J. E. Callaghan  
J. E. Graspier  
A. Watt

Foundations Office  
Gen. Files

*Wyle*  
K. Y. Lo,  
SUPERVISING FOUNDATION ENGR.  
For:  
A. G. Sternac,  
PRINCIPAL FOUNDATION ENGR.

## MEMORANDUM

TO: Mr. A. Rutka,  
Materials & Research Section,  
Department of Highways,  
DOWNSVIEW, ONTARIO.

FROM: Mr. J.A. McKillop,  
District Construction Eng.

Bancroft, Ontario,  
March 24th, 1964.

Att'n: Mr. A.G. Stermac.

DATE:

OUR FILE REF.

IN REPLY TO

## SUBJECT:

Re: Village of Bancroft.

Proctor and Redfern, Consulting Engineers, Toronto, are presently carrying out the design for the reconstruction of Highways 28, 62 and 500 in the Village of Bancroft under a proposed connecting link agreement. They have requested a copy of the foundation report for the York River Bridge recently completed by Geocon Limited. WP. 27-63

We would appreciate if they could be supplied with a copy of this report.

JAMcK:mp

  
J.E. Callaghan,  
District Engineer.

# GEOCON LTD

## HEAD OFFICE

420 MICHEL JASMIN, DORVAL, QUEBEC  
TELEPHONE 631-9827

## DISTRICT OFFICES

14 HAAS ROAD  
REXDALE, TORONTO, ONT.  
TEL. 244-6476

1425 WEST PENDER ST.  
VANCOUVER 5, B.C.  
TEL. MU. 1-8926

Rexdale, Ontario.  
March 5th, 1964.

Department of Highways, Ontario,  
Materials and Research Division,  
Downsview, Ontario.

Attention: Mr. A. G. Stermac, P. Eng.,  
Principal Foundation Engineer.

Re: York River Bridge  
Bancroft, Ontario.

Dear Sirs:

Please find attached some photographs of the existing bridge over the York River, in Bancroft, Ontario. These photographs were taken during the recent investigation and it is hoped that they will be of some interest to you.

Yours very truly,

GEOCON LTD

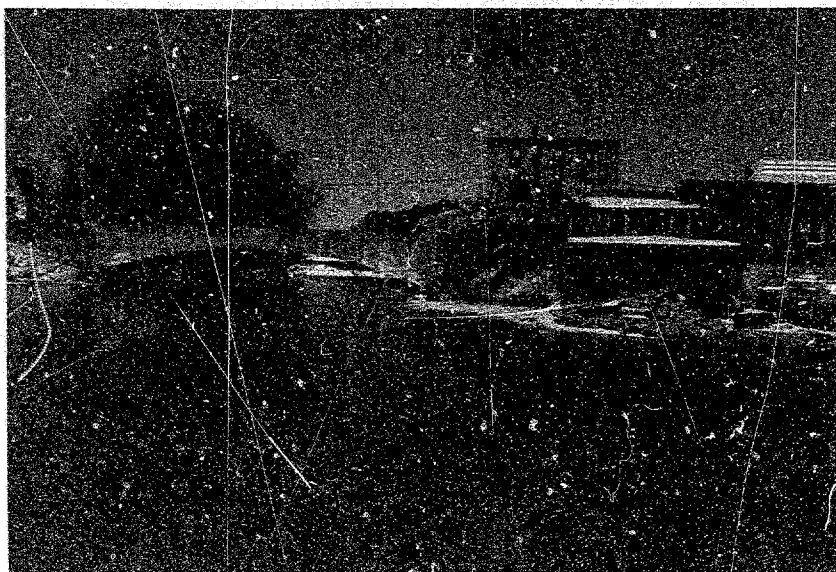
*D. B. Oates*

DBO/reb  
T7590  
Enc.

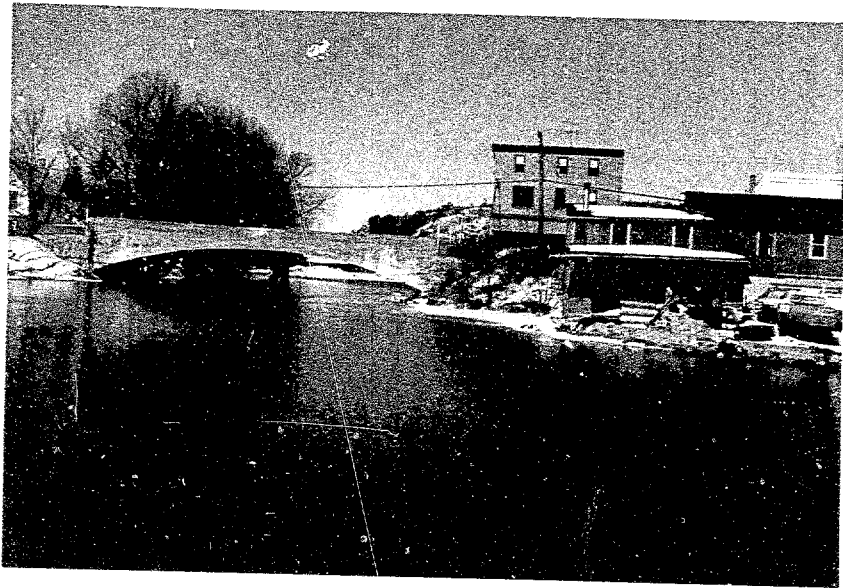
D. B. Oates, P. Eng.,  
Senior Soils Engineer.

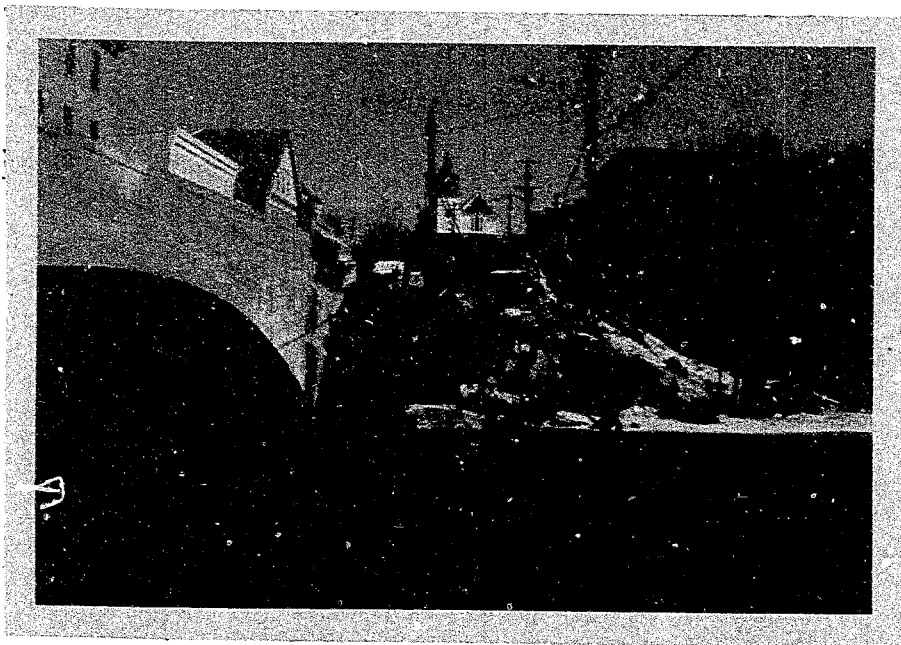


WEST ABUTMENT - SOUTH SIDE



SOUTH SIDE OF BRIDGE





EAST ABUTMENT - SOUTH SIDE



EAST ABUTMENT - SOUTH SIDE



VIEW OF STREET - LOOKING EAST



VIEW OF STREET - LOOKING EAST



T7590

## ADDENDUM REPORT

70

DEPARTMENT OF HIGHWAYS, ONTARIO

ON

## SOIL CONDITIONS AND FOUNDATIONS

# PROPOSED YORK RIVER BRIDGE

**BANCROFT**

ONTARIO

**Distribution:**

10 copies - Department of Highways, Ontario,  
Downsview, Ontario.

3 copies - Geocon Ltd,  
Rexdale, Ontario.

March 11th, 1964

# GEOCON

# GEOCON LTD

HEAD OFFICE

420 MICHEL JASMIN, DORVAL, QUEBEC  
TELEPHONE 631-9827

Rexdale, Ontario.  
March 11th, 1964.

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14 HAAS ROAD  
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TEL. 244-6476

1425 WEST PENDER ST.  
VANCOUVER 5, B.C.  
TEL. MU. 1-8926

Department of Highways, Ontario,  
Materials and Research Division,  
Downsview, Ontario.

Attention: Mr. A. G. Stermac, P. Eng.,  
Principal Foundation Engineer.

Re: Addendum to Report T7590  
Soil Conditions and Foundations  
Proposed York River Bridge  
Bancroft, Ontario.

Dear Sirs:

This letter reports the results of the additional borehole put down at the north side of the east abutment of the bridge. The results are presented in the form of a borehole log.

The additional borehole was put down at the east end of the existing north-east retaining wall and encountered bedrock at about elevation 1058. The bedrock was found to be overlain by a stratum of very dense sand and gravel with boulders. The surface of this stratum was encountered at elevation 1072. The footing as presently proposed would be founded at elevation 1062, this is, within the sand and gravel stratum and about 4 feet above the bedrock at the borehole location.

Included in this addendum with the log of borehole 3 are the revised logs of boreholes 1 and 2 together with a revised Drawing T7590-1-1 showing the locations of the boreholes and the inferred soil stratigraphy. A cronaflex copy of the

Department of Highways, Ontario,  
March 11th, 1964,  
Page 2.

revised Drawing T7590-1-<sup>A</sup>~~1~~ has been supplied with this addendum. The description of the bedrock as given in our report, dated March 5th, 1964, has been changed on the attached borehole logs and Drawing. The bedrock is identified as recrystallized limestone. The bearing pressure for bedrock, as given in our report, would however remain the same at 20 tons per square foot.

We believe that this addendum completes the information required from this investigation. Should you require further information or wish to discuss any aspect of this addendum or our previous report please give us a call.

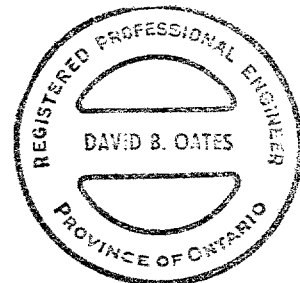
Yours very truly,

GEOCON LTD

*D. B. Oates*

D. B. Oates, P. Eng.,  
Senior Soils Engineer.

DBO/reb  
T7590



GEOCON

## EXPLANATION OF THE FORM "OFFICE REPORT ON SOIL EXPLORATION"

The object of this form, is to enable a comprehensive study of the soil to be made by combining on one sheet all of the information obtained from the boring. An explanation of the various columns of the report follows.

### ELEVATION AND DEPTH

This column gives the elevation and depth of boundaries between the various soil strata. The elevation is referred to the datum shown in the general heading.

### WATER CONDITIONS

In this column the water level in the casing at the time of boring or the water table in the ground, determined by a series of observations in a piezometer or standpipe, is indicated to scale by a horizontal line with the symbol W.L. or W.T. above the line. A notation of any complicated groundwater conditions will be made in this column.

### DESCRIPTION

A description of the soil, using standard terminology, is contained in this column. The consistency of cohesive soils and the relative density of non-cohesive soils are described by the following terms:

| Consistency | U-Strength<br>Tons/sq. ft. | Relative Density | Standard Penetration<br>Resistance. Blows/ft. |
|-------------|----------------------------|------------------|---|
| Very soft   | 0.03 to 0.25               | Very loose       | 0 to 4  |
| Soft        | 0.25 to 0.5                | Loose            | 4 to 10                                       |
| Firm        | 0.5 to 1.0                 | Compact          | 10 to 30                                      |
| Stiff       | 1.0 to 2.0                 | Dense            | 30 to 50                                      |
| Very stiff  | 2.0 to 4.0                 | Very dense       | over 50                                       |
| Hard        | over 4.0                   |                  |   |

### STRATIGRAPHIC PLOT

The stratigraphic plot follows the standard symbols of the National Research Council, Canada.

### ELEVATION SCALE

The information in all columns is plotted to a true elevation scale which is shown in this column.

### GRAPHS

The main body of the report forms a graph which is used to plot to correct elevation the important soil properties which are obtained through field and laboratory tests. The scales and symbols for the plotting are shown at the head of the column.

### OTHER TESTS

In this column are shown, by symbol, the other field or laboratory tests which have been performed on the soil and for which the results have not been plotted on the above graph.

### SAMPLES

The first three columns describe the condition, type and number of each sample obtained from the boring. The location and extent of each sample is plotted to scale.

In the last column is shown the penetration resistance in blows of 4200 inch-pounds required to drive one foot of the sampler into the ground. When a 2 inch Drive Sampler is used the result obtained is termed the "Standard Penetration Resistance".

**GEOCON**

## GEOCON

## OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T7590 BORING # 1 DATUM GEODETIC CASING BX & AX  
 BORING DATE FEB. 19-21, 1964 REPORT DATE FEB. 26, 1964 COMPILED BY AEL. CHECKED BY DBO  
 SAMPLER HAMMER WT 140 LBS DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN. LBS ENERGY)

## SAMPLE CONDITION

— DISTURBED  
 — FAIR  
 — GOOD  
 — LOST

## SAMPLE TYPES

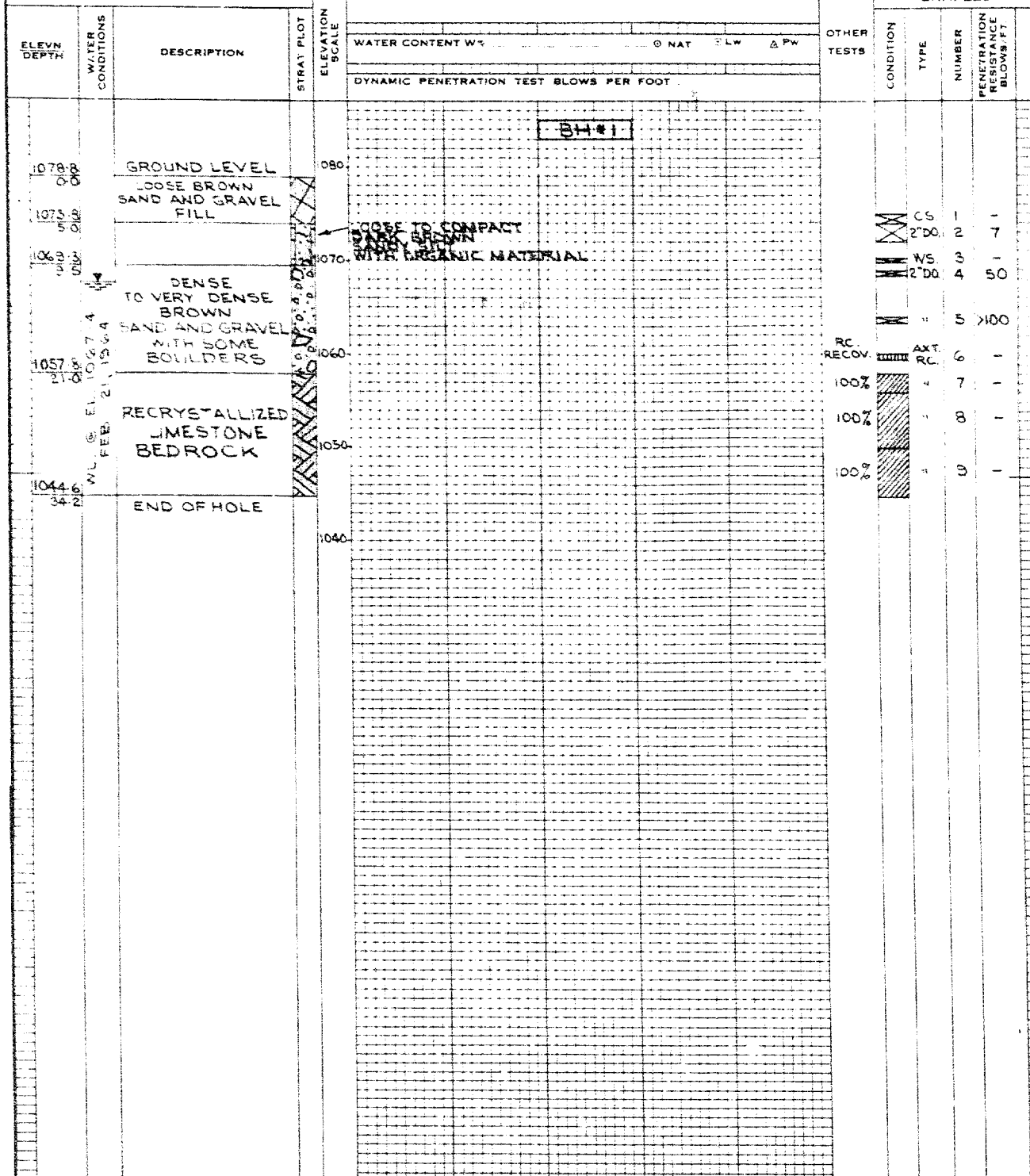
AS AUGER SAMPLE FS FOIL SAMPLE  
 ST SLOTTED TUBE SO SLEEVE OPEN  
 WS WASHED SAMPLE SF SLEEVE FOOT VALVE  
 DO DRIVE-OPEN TO THIN WALLED OPEN  
 DF DRIVE-FOOT VALVE RC ROCK CORE  
 CS CHUNK SAMPLE

## ABBREVIATIONS

V IN-SITU VANE TEST W WET UNIT WEIGHT  
 M MECHANICAL ANALYSIS K PERMEABILITY  
 U UNCONFINED COMPRESSION C CONSOLIDATION  
 QC TRIAXIAL CONSOLIDATED UNDRAINED  
 Q UNCONFINED COMPRESSION  
 S TRIAXIAL DRAINED WL WATER LEVEL IN CASING  
 WT WATER TABLE IN SOIL

## SOIL PROFILE

## SAMPLES



## GEOCON

## OFFICE REPORT ON SOIL EXPLORATION

CONTRACT 77530 BORING # 2 DATUM GEODETIC CASING BX & AX.  
 BORING DATE FEB. 2-23, 1964 REPORT DATE FEB. 26, 1964 COMPILED BY AEL. CHECKED BY DBO  
 SAMPLER HAMMER WT 140 LBS DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN LBS ENERGY)

## SAMPLE CONDITION

☐ DISTURBED  
☐ FAIR  
☐ GOOD  
☐ LOST

AS AUGER SAMPLE  
 ST SLOTTED TUBE  
 WS WASHED SAMPLE  
 DO DRIVE-OPEN  
 DF DRIVE-FOOT VALVE  
 CS CHUNK SAMPLE

## SAMPLE TYPES

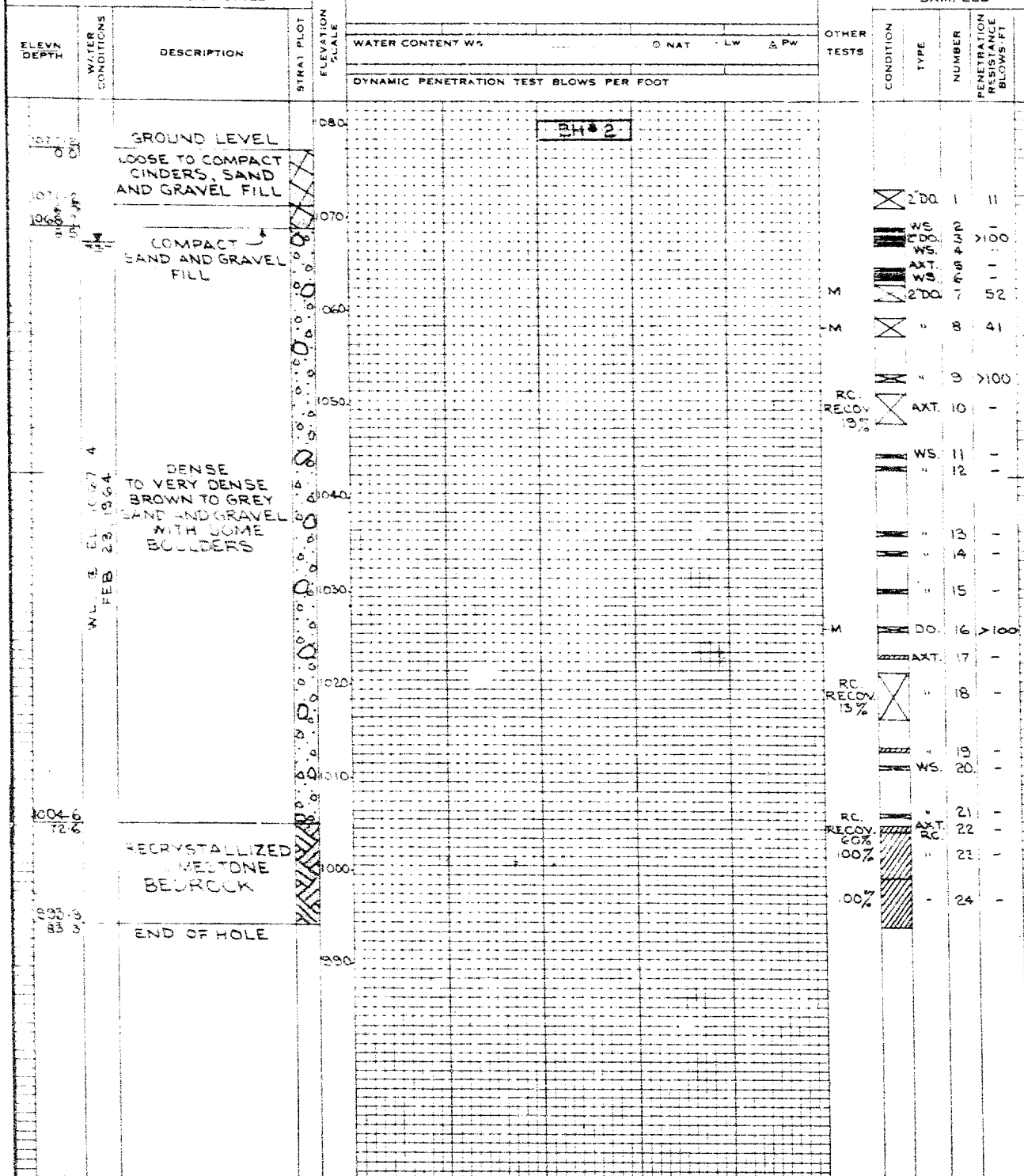
FS FOIL SAMPLE  
 SO SLEEVE-OPEN  
 SF SLEEVE-FOOT VALVE  
 TO THIN WALLED OPEN  
 RC ROCK CORE

## ABBREVIATIONS

V IN SITU VANE TEST  
 M MECHANICAL ANALYSIS  
 U UNCONFINED COMPRESSION  
 CC TRIAXIAL CONSOLIDATED UNDRAINED  
 CU TRIAXIAL UNDRAINED  
 S TRIAXIAL DRAINED  
 1 WET UNIT WEIGHT  
 K PERMEABILITY  
 C CONSOLIDATION  
 WL WATER LEVEL IN CASING  
 WT WATER TABLE IN SOIL

## SOIL PROFILE

## SAMPLES



## GEOCON

## OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T7530 BORING # 3 DATUM GEODETIC CASING AX & BX.  
 BORING DATE MAR. 5, 1964 REPORT DATE MAR. 10, 1964 COMPILED BY AEL. CHECKED BY DBO.  
 SAMPLER HAMMER WT 140 LBS DROP 30 INCHES PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN. LBS ENERGY

## SAMPLE CONDITION

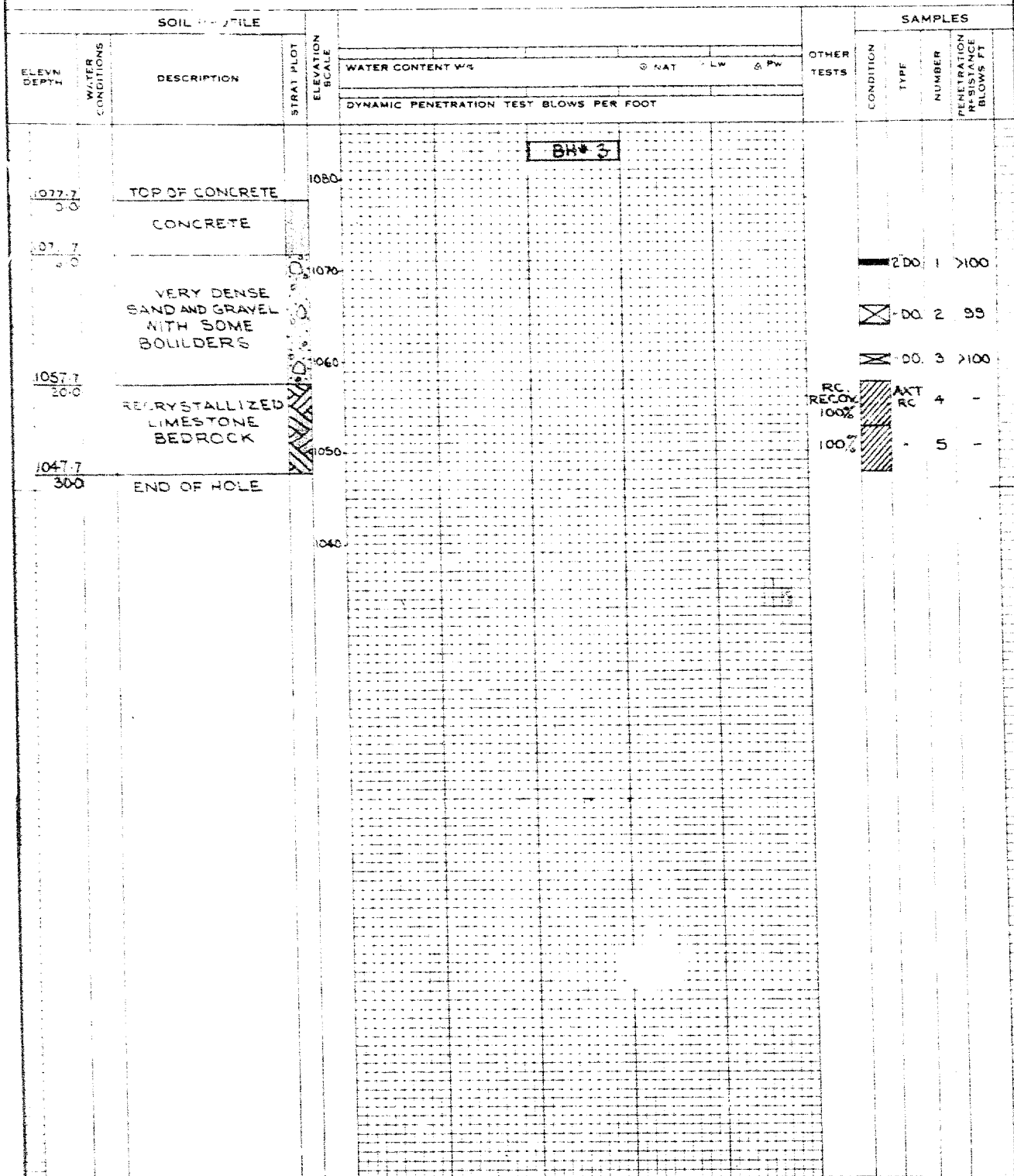
☐ DISTURBED  
☐ FAIR  
☐ GOOD  
☐ LOST

## SAMPLE TYPES

AS AUGER SAMPLE  
 ST SLOTTED TUBE  
 WS WASHED SAMPLE  
 DO DRILL-OPEN  
 DF DRILL-FOOT VALVE  
 CH CHURN SAMPLE  
 FS FOIL SAMPLE  
 SO SLEEVE-OPEN  
 SF SLEEVE-FOOT VALVE  
 TO THIN WALLED OPEN  
 RC ROCK CORE

## ABBREVIATIONS

V IN-SITU VANE TEST  
 M MECHANICAL ANALYSIS  
 U UNCONFINED COMPRESSION  
 DC TRIAXIAL CONSOLIDATED UNDRAINED  
 D TRIAXIAL UNDRAINED  
 S TRIAXIAL DRAINED  
 γ WET UNIT WEIGHT  
 K PERMEABILITY  
 C CONSOLIDATION  
 WL WATER LEVEL IN CASING  
 WT WATER TABLE IN SOIL



#64-F-213-C

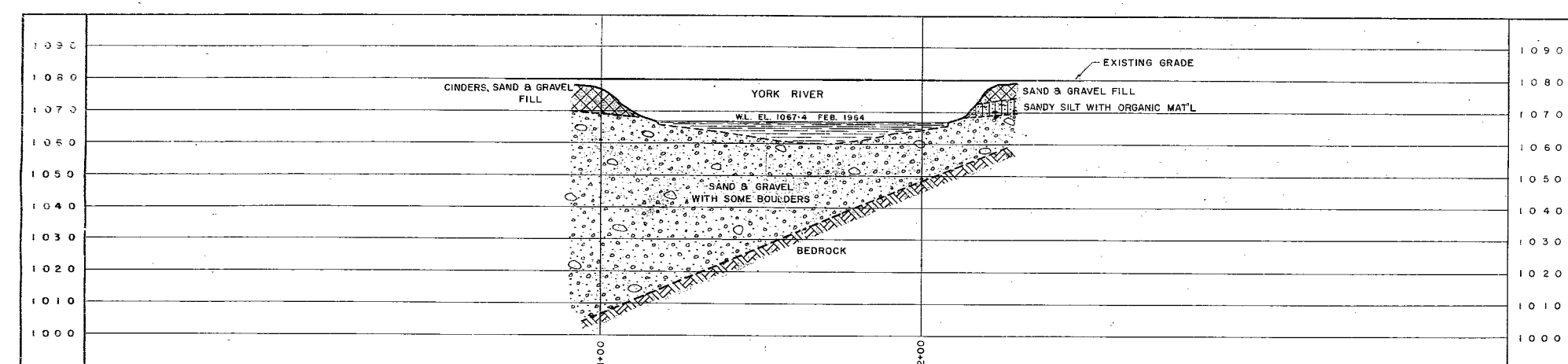
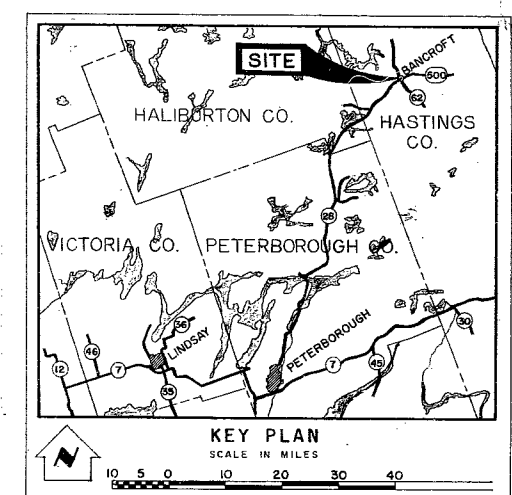
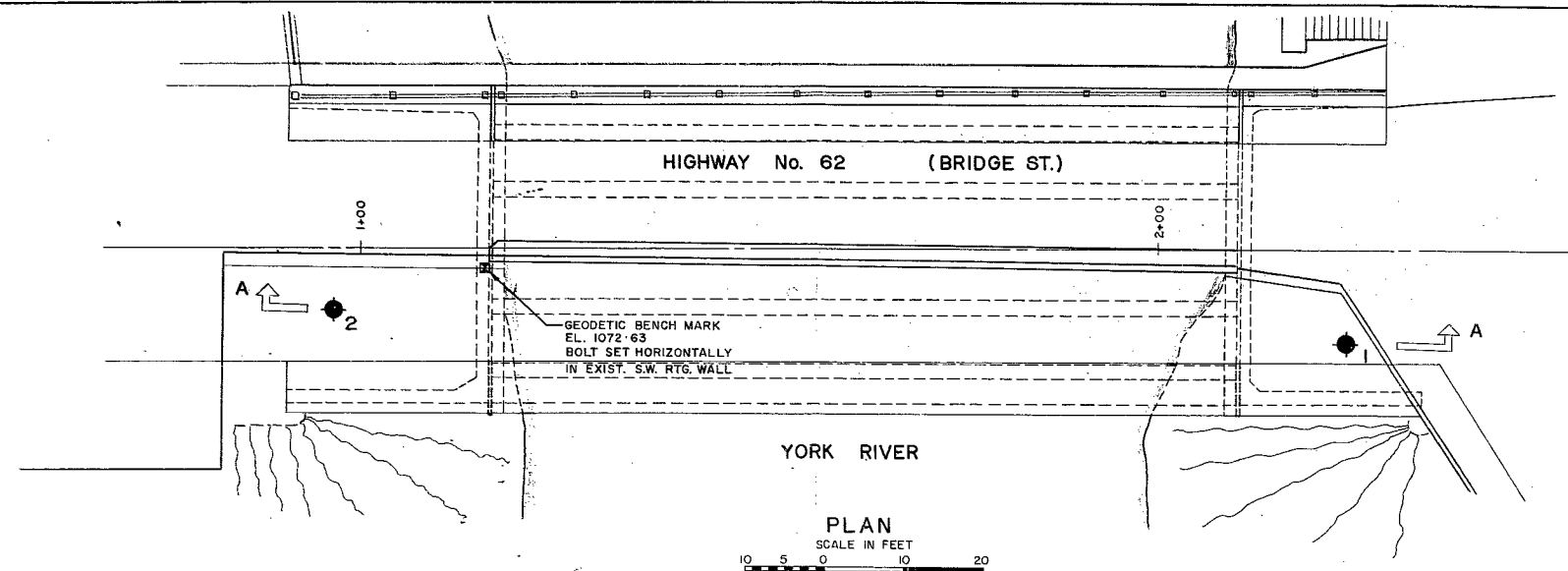
W.P. #27-63

Hwy. # 62

YORK RIVER

BANCROFT

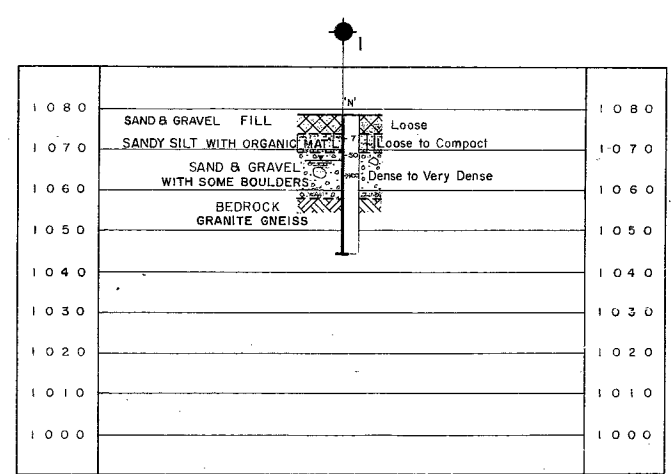
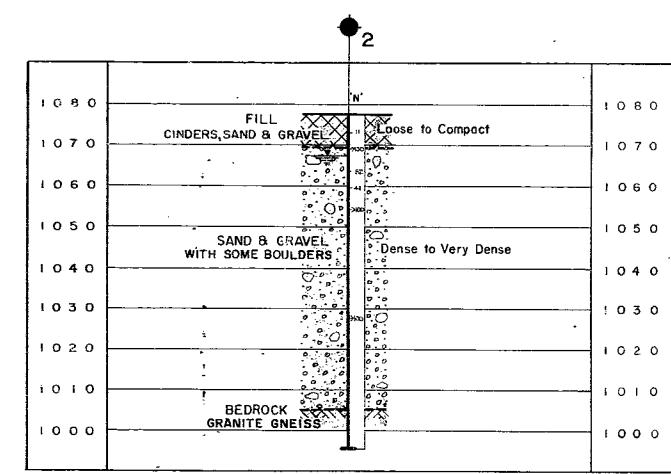




| LEGEND |  |         |        |
|--------|--|---------|--------|
|        | Bore Hole  |         |        |
|        | Cone Penetration Hole  |         |        |
|        | Bore & Cone Penetration Hole                                       |         |        |
|        | Water Levels established at time of field investigation, FEB. 1964 |         |        |
|        | Bench Mark   |         |        |
| NO.    | ELEVATION  | STATION | OFFSET |
| 1      | 1078.8   | 2+23.7  | 12 LT  |
| 2      | 1078.6   | 0+96.5  | 8 LT   |

**- NOTE -**  
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

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DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION - FOUNDATION SECTION

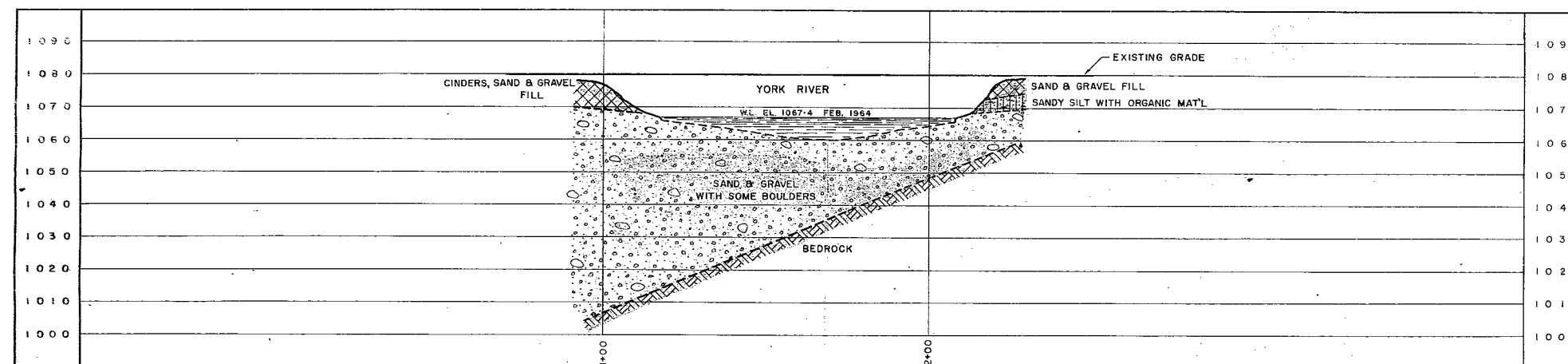
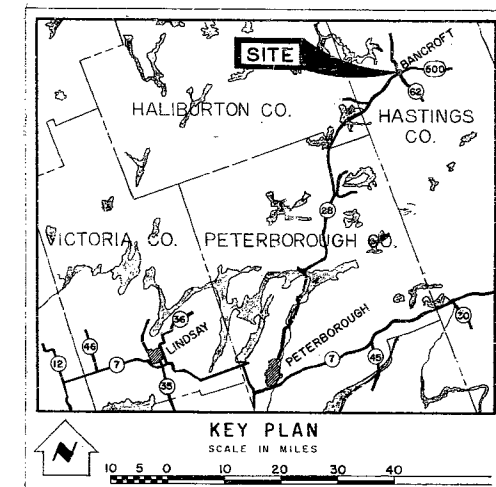
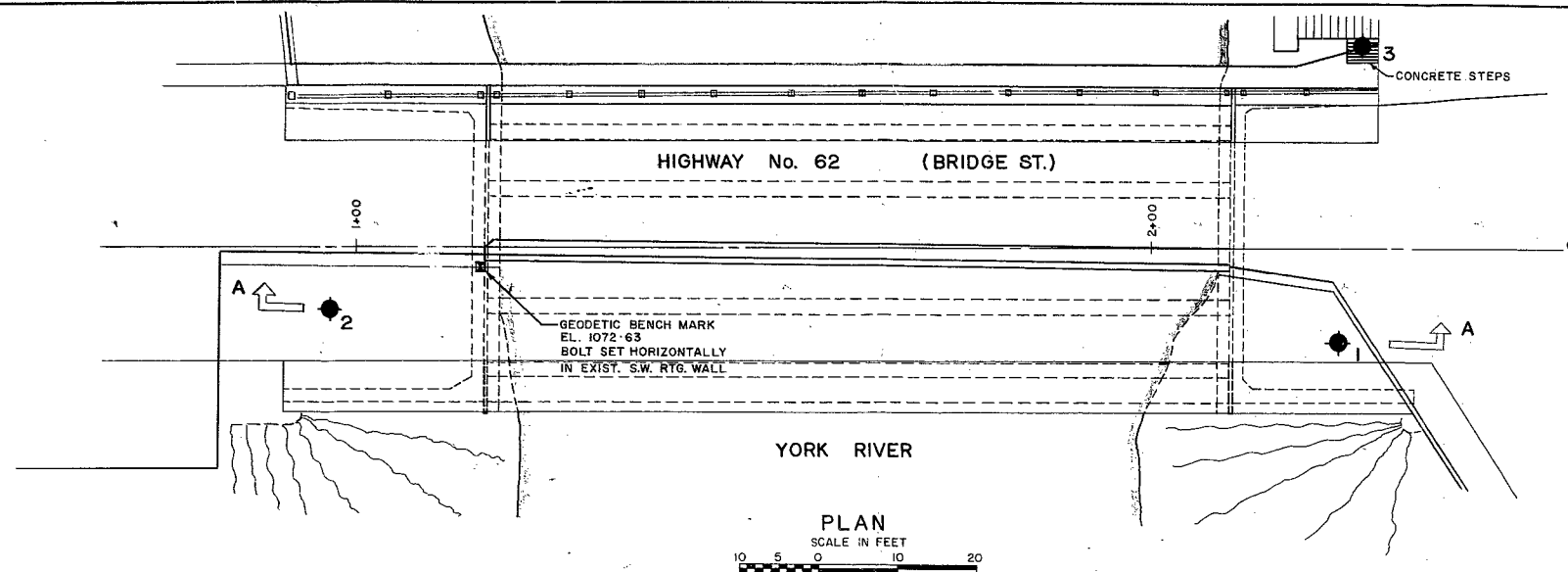
**YORK RIVER**

KING'S HIGHWAY NO. 62 DIST. NO. 10  
CO. HASTINGS TOWN OF BANCROFT  
TWP. FARADAY LOT 72 & 173 CON. 1

BORE HOLE LOCATIONS & SOIL STRATA

|                   |                |                  |                    |
|-------------------|----------------|------------------|--------------------|
| SUBM'D D.F.O.     | CHECKED F.J.H. | W.P. NO. 27 - 63 | M.B.R. DRAWING NO. |
| DRAWN A.E.L.      | CHECKED D.B.O. | JOB NO.          | BRIDGE DRAWING NO. |
| DATE MAR. 4, 1964 | SITE NO.       | CONT. NO.        |                    |

GEOCON LTD  
DRAWING No. T 7590-1

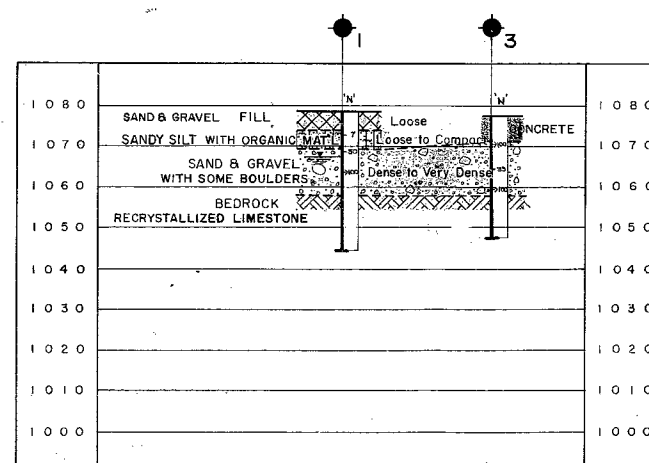
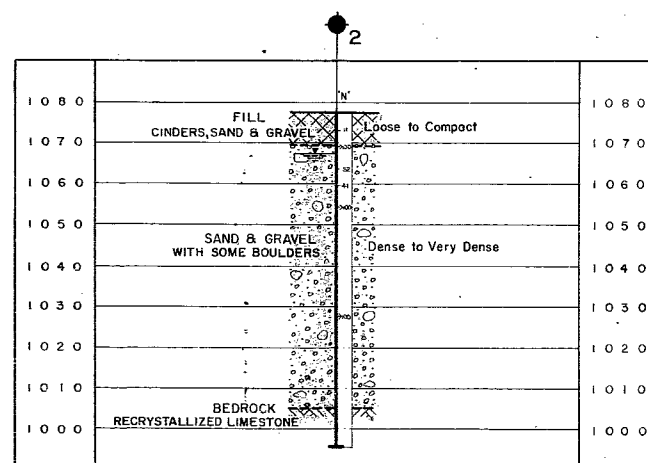


| LEGEND |  |  |  |
|--------|--|--|--|
|        | Bore Hole  |  |  |
|        | Cone Penetration Hole  |  |  |
|        | Bore & Cone Penetration Hole                                       |  |  |
|        | Water Levels established at time of field investigation, FEB. 1964 |  |  |
|        | Bench Mark   |  |  |

| NO. | ELEVATION | STATION | OFFSET  |
|-----|-----------|---------|---------|
| 1   | 1078.8    | 2+23.7  | 12 RT   |
| 2   | 1078.8    | 0+96.5  | 8 RT    |
| 3   | 1077.7    | 2+26.5  | 25.5 LT |

**- NOTE -**  
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

| PRINT RECORD |     |      |
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| REVISIONS | DATE | BY | DESCRIPTION |
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|           |      |    |             |

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION - FOUNDATION SECTION

**YORK RIVER**

KING'S HIGHWAY NO. 62 DIST. NO. 10  
CO. HASTINGS TOWN OF BANCROFT  
TWP. FARADAY LOT 172 & 173 CON. 1

**BORE HOLE LOCATIONS & SOIL STRATA**

|                             |                |                  |                    |
|-----------------------------|----------------|------------------|--------------------|
| SURM'D. D.B.O.              | CHECKED R.J.H. | W.P. NO. 27 - 63 | M.B.R. DRAWING NO. |
| DRAWN A.E.L.                | CHECKED D.B.O. | JOB NO.          |                    |
| DATE <u>MAR. 4, 1964</u>    | SITE NO.       |                  | BRIDGE DRAWING NO. |
| APPROVED <u>[Signature]</u> | CONT. NO.      |                  |                    |

GEOCON LTD  
DRAWING NO.  
T 7590-1.