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55-F-202C

Hwy # 86

LITTLE MAITLAND

RIVER.

B.A. 503

RACEY, MACCALLUM AND ASSOCIATES LIMITED

Directors:

W. C. MACCALLUM, B. ENG., M.E.I.C., P. ENG.
R. JOHN RACEY, B. SC., M.E.I.C., P. ENG.
JOHN S. LOCHHEAD, B. ENG., M.E.I.C., P. ENG.
JOHN A. NORLIN, B.A., M. SC.
ROBERT H. QUINTAL, M.A. SC., M.E.I.C., P. ENG.
A. ERIC RANKINE, B. SC., A.M.I.E.E., M.E.I.C., P. ENG.
J. B. CHALLIES, B. ENG., LL.D., M.E.I.C., P. ENG.

A COMPANY OWNED, DIRECTED AND OPERATED BY

Consulting Engineers
AND ASSOCIATED STAFF



MONTREAL: 4123 SHERBROOKE STREET WEST, FITZROY 5261
TORONTO: 33 BLOOR STREET EAST, WALNUT 2-9071

Affiliations:

THE E. B. ALLEN INSPECTION COMPANY
ISOTOPE PRODUCTS LIMITED,
RADIOGRAPHERS
IRVING P. KRICK, PH.D.,
METEOROLOGIST
JACQUES POULIN,
QUEBEC LAND SURVEYOR
THE VIBRATION ENGINEERING COMPANY

REPORT NO. S-500-501/55/T-88-1

Toronto, Ontario,
May 27th, 1955.

Ontario Department of Highways,
c/o Messrs. Lazarides, Lount and Partners,
79 Scollard Street,
TORONTO, Ontario.

RE: FOUNDATION INVESTIGATION -
PROPOSED HYSLOPS BRIDGE OVER
LITTLE MAITLAND RIVER ON
HIGHWAY NO. 86

Dear Sirs:

In accordance with your instructions we carried out the drilling of four (4) boreholes at the above site, and we wish to report on our findings as follows.

LOCATION OF THE SITE AND OF THE BOREHOLES

The bridge site is located between Wingham and Listowel, Ontario, on Highway No. 86 crossing the Little Maitland River.

The location of the boreholes is shown on the sketch plan on an attached sheet. Two boreholes, Nos. 1 and 3, were located on the western embankment, and two boreholes, Nos. 2 and 4, on the eastern embankment of the river, the latter being situated in the water at the edge of the present river bed. The location of the boreholes, as proposed by the client, was partly revised with regard to the accessibility with the drillers' equipment.

The elevations of the boreholes were determined by levelling referring to the M.S.L. elevation of the existing bridge roadway.

REPORT NO. S-500-501/55/T-88-1 Cont'dTHE DRILLING WORK

The drilling equipment was sent to the site for the first time on April 14th, 1955. Drilling for borehole No. 1 was finished on April 16th. The equipment was moved across the bridge, and borehole No. 2 was drilled from April 16th to April 19th. The equipment was moved to borehole No. 3 on April 19th and borehole No. 3 completed on April 20th. The equipment was moved back to Toronto the same day. The programme, as originally ordered, comprising the drilling of the mentioned three boreholes was supplemented at a later date by a fourth borehole on account of the study of the secured soil samples for a more favourable foundation design. The drilling equipment was brought back to the site, therefore, on April 30th, and borehole No. 4 completed on May 3rd, on which day the driller's equipment was also moved from the site and returned to Toronto.

Drilling was performed with standard diamond core drills, manufactured by Longyear & Boyles Bros. respectively, operating with AXT-size drill rods. The soil was penetrated with 2-1/2" and 3" extra-heavy-duty drive pipe with a 250 pound drive-hammer, dropped 30" and a 350 pound drive-hammer dropped 20" respectively. Soil sampling was carried out by driving a standard 2" split barrel sampler at generally 2.5 foot intervals with the drive-hammer producing an energy equal to 4200 in. lbs. The number of blows necessary to drive the sampler one foot into the soil was counted. These figures as well as the penetration values for the drive pipe are shown in a diagram, for each borehole separately, on the attached Engineering Data Sheets.

REPORT NO. S-500-501/55/T-88-1 Cont'dDISCUSSION OF THE RESULTS (See attached Engineering Data Sheets)

A top layer of loose recent river deposits with organic matter occurs to a depth of 4 to 6 feet in boreholes Nos. 1, 2 and 3 and to only 1 foot depth below the river bed in hole No. 4. The soils as encountered below the topmost layer of recent deposits in boreholes Nos. 1, 2 and 4 represent predominantly gravel and sand alternating in composition from sandy gravel to gravelly sand in a compact to dense state as shown on the attached Data Sheets.

This type of soil extends downwards in these boreholes as follows:-

In Borehole No. 1 to Elevation 1082 M.S.L.

In Borehole No. 2 to Elevation 1096 M.S.L.

In Borehole No. 4 to Elevation 1093 M.S.L.

The soil condition in borehole No. 3 differs considerably from the above mentioned ones, comprising predominantly fine to medium sand with some silty layers and being in a loose to compact state of compaction downwards to elevation 1088 M.S.L.

Below the mentioned elevations the soil composition changes to a material that appears to be a glacial till consisting of a calcareous mixture of very dense to extremely dense silt, sand and angular gravel with some very stiff clay noticed only in Borehole No. 4.

CONCLUSIONS FOR THE PROPOSED STRUCTURE

For a foundation on the soil at a depth of 10 feet or at approximately elevation 1100 the permissible load on the soil would have to be based on the soil conditions in borehole No. 3 and would be as low as about 1.1 t/sq. ft. to keep differential settlement in the order of one-half inch. This value was obtained by plotting the penetration values for borehole No. 3, considering the submerged state of the soil.

REPORT NO. S-500-501/55/T-88-1 Cont'dCONCLUSIONS OF THE PROPOSED STRUCTURE Cont'd

As the dimensions of the footings at about elevation 1100 were considered to become excessive for the proposed structure, a deeper foundation capable of carrying a load of 4 to 5 tons/sq. ft. with a possible differential settlement in the order of 1/2 inch was required. This soils pressure can be considered allowable at or near to the glacial till encountered at the elevations given above. It will be noticed that the extremely dense glacial till was met at a lower level on the western embankment than on the eastern bank of the river. It may, therefore, be recommendable to place the base of the foundation for the western abutment at a level several feet lower than at the eastern one. This does not mean that the depth has to be chosen to be as low as elevation 1082. However, the average between the elevations of glacial till in boreholes Nos. 1 and 3, being 1085, is considered satisfactory for the foundation of the western abutment. The influence of a relatively thin layer of sand of lower density between the foundation base and the glacial till will not cause any noticeable differential settlement.

For the eastern abutment the respective foundation base could be placed at an average between the elevations of glacial till for boreholes Nos. 2 and 4, being about elevation 1095.

Moreover, sheet piling prior to the construction of the abutments will improve the state of compaction of the soil to some extent.

We trust that this information is satisfactory and shall be pleased to consult further with you if it is deemed desirable.

Yours very truly,

RACEY, MACCALLUM AND ASSOCIATES LIMITED

K. Tubbesing
K. Tubbesing, P. Eng.

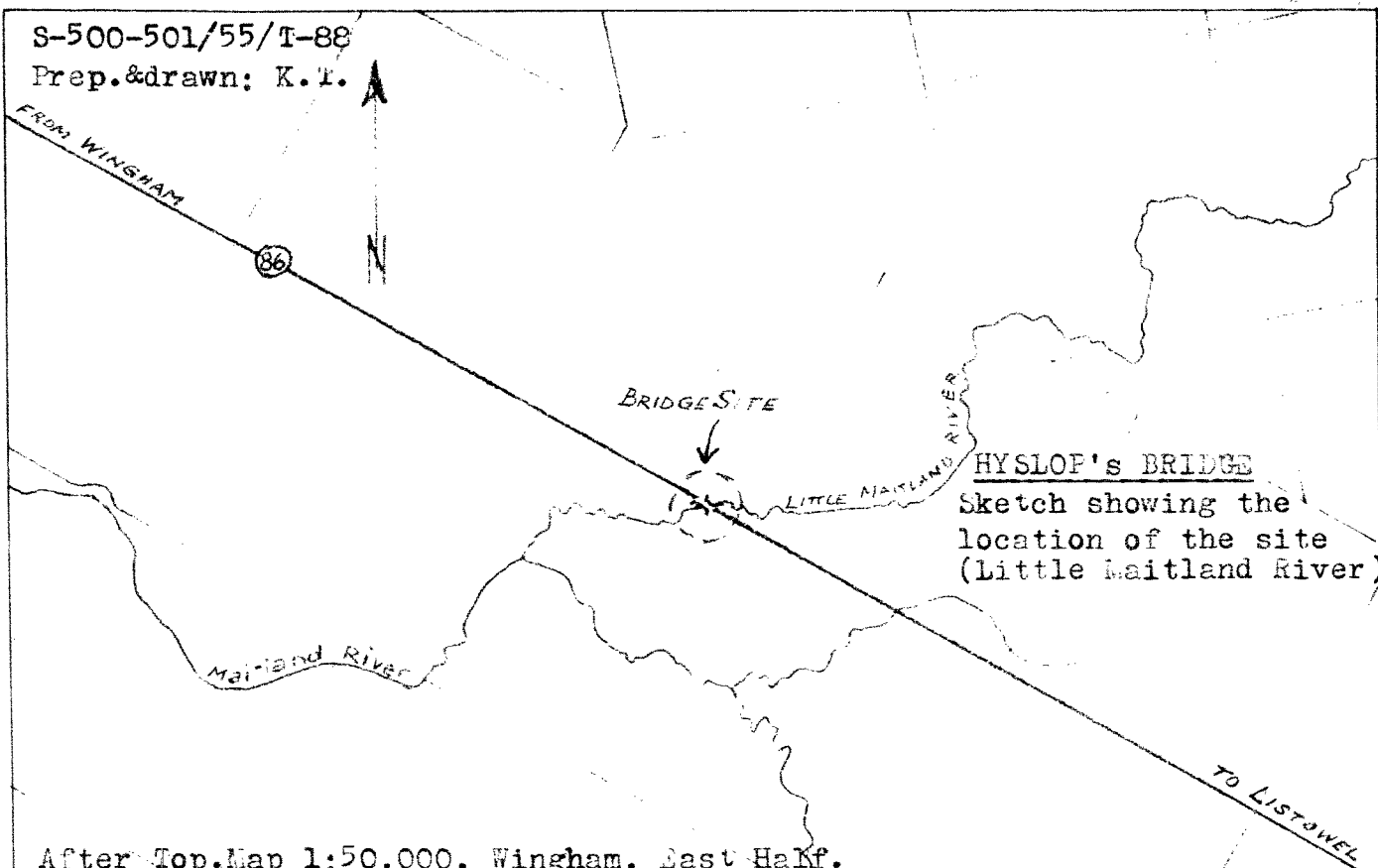
KT/PW

Original and two copies - Messrs. Lazarides, Lount and Partners,
Toronto, Ontario.

c.c.'s: 2 - Racey, MacCallum and Associates Limited, Montreal, P. Q.
2 - K. Tubbesing, Soils Engineer

S-500-501/55/T-88

Prep.&drawn: K.T.



HYSLOP'S BRIDGE (HWY. No. 86)
crossing Little Maitland
River.

Sketch showing the location
of the boreholes

RACEY, MacCALLUM & ASSOCIATES, Ltd.

Order No.: S-500-501/55/T-88 RACEY, MacCALLUM AND ASSOCIATES

Dated Limited

F. LUSK

Driller

Day Month Year

Foundation Engineering Division

Hole Begun 14/4/55

W. LINTON

Hole Ended 16/4/55

Engineering Data Sheet for Borehole: 1

Helper

Job Name: HYSLOPS BRIDGE, HWY. NO. 86, LITTLE MAITLAND RIVER

K. TUBBESING

Job Located: BRIDGE AT HWY. # 86, CROSSING LITTLE MAITLAND RIVER, 9 MILES ESE. OF

Checked by

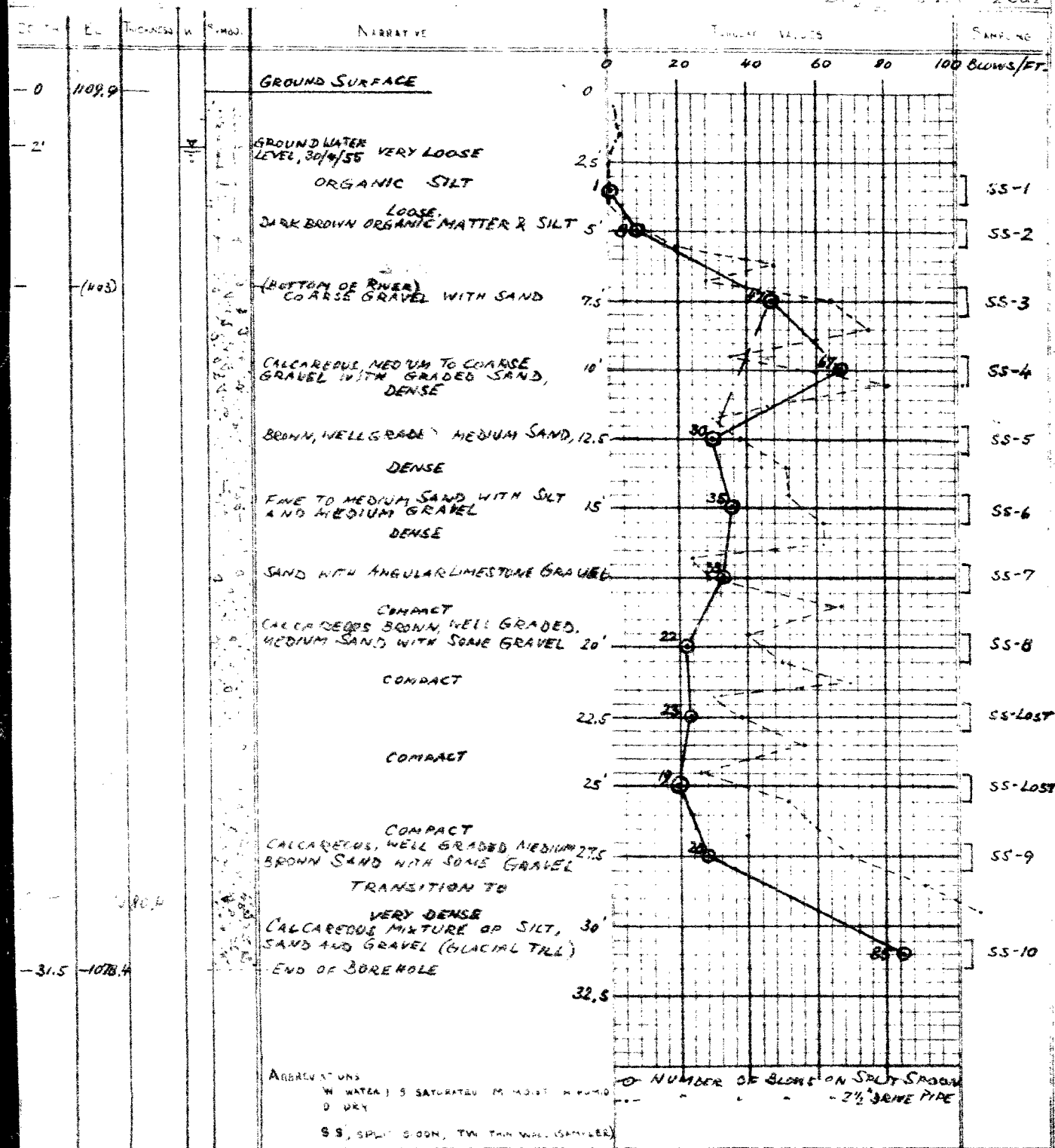
Hole Located: AS SHOWN ON ATTACHED SKETCH PLAN.

WINGHAM, ONT.

Hole Elevation: 1109.9 Datum: M.S.L.

18/4/55

Dry Month Year



0 1109.5
 -1.5
 GROUND SURFACE
 GROUND WATER LEVEL, 30/4/55.
 SOFT MIXTURE OF SILTCLAY, SAND 5' AND GRAVEL
 COMPACT, BROWNISH-GREY SILT 7.5' WITH LIMESTONE GRAVEL
 DENSE, BROWNISH-GREY COARSE, 10' SILT WITH FINE SAND AND SOME MEDIUM GRAVEL
 VERY DENSE, COARSE SILT WITH 12.5' FINE SAND AND FINE TO MEDIUM ANGULAR GRAVEL
 VERY DENSE MIXTURE OF 15' SILT, SAND AND ANGULAR LIMESTONE GRAVEL (GLACIAL TILL)
 DENSE, DITTO.
 DITTO
 EXTREMELY DENSE GLACIAL TILL
 DITTO.
 -25.5 -1184.0
 END OF BOREHOLE

0 20 40 60 80
 0
 2.5
 5
 7.5
 10
 12.5
 15
 17.5
 20
 22.5
 25
 27.5
 30

SS-1
 SS-2
 SS-3
 SS-4
 SS-5
 SS-6
 SS-7
 SS-8
 SS-9

13
 20
 38
 60
 45
 44

136
 133
 128
 124
 185
 185
 160
 160
 150

219 SS-8
 319 SS-9

NUMBER OF BLOWS ON 2" SPIKE SPOON
 IN WATER SATURATED SOIL
 2" SPIKE SPOON

Date 19/4/55

Date 20/4/55

Engineering Data Sheet for No. 3

HYSLOP'S BRIDGE, HWY. NO. 86, LITTLE MAITLAND RIVER

K. TUBBESING

BRIDGE AT HWY. #86, CROSSING LITTLE MAITLAND RIVER, 9 MILES E.S.E. OF WINGHAM, ONT.

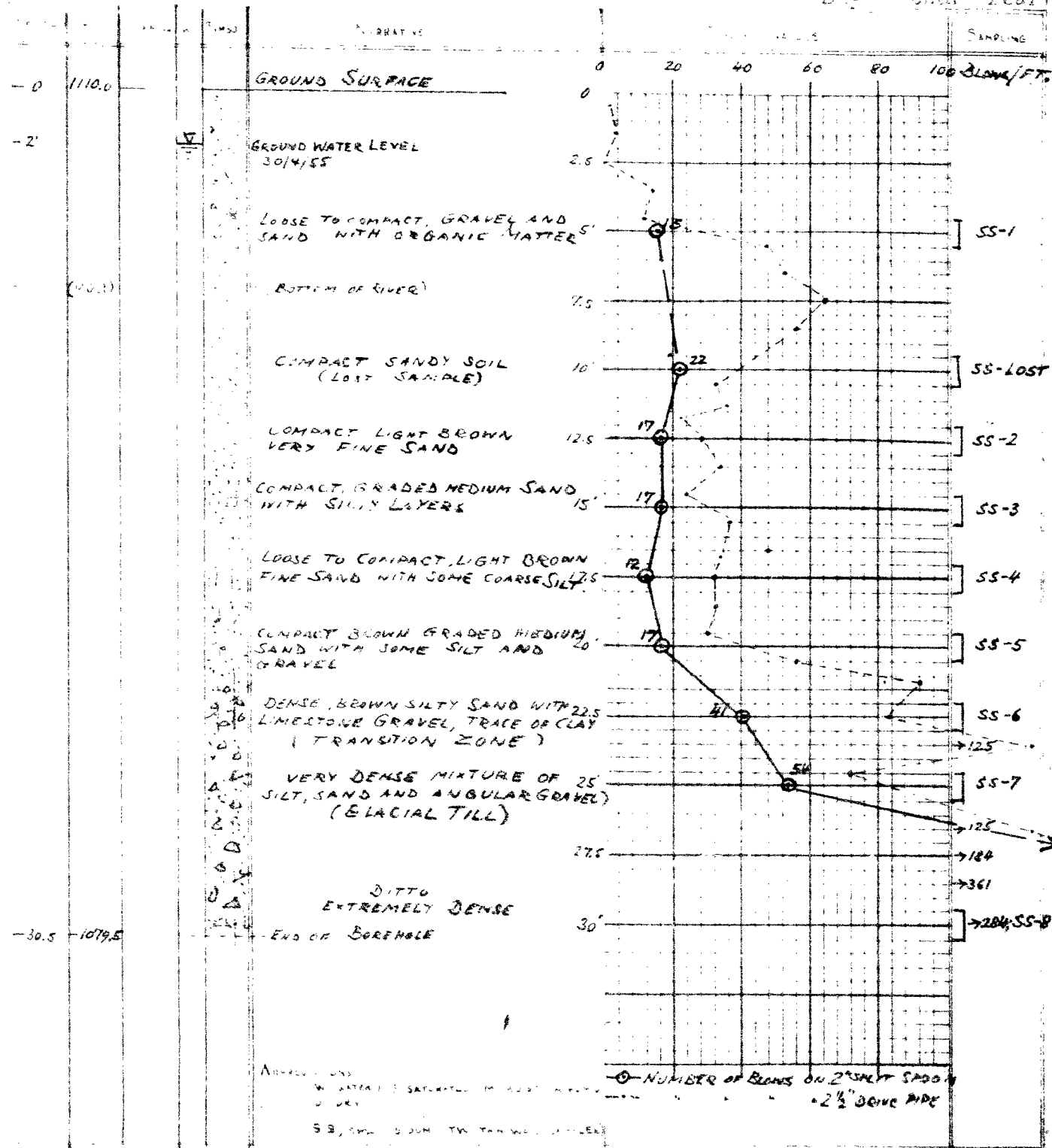
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AS SHOWN ON ATTACHED SKETCH

1110.0 Datum: M.S.L.

22/4/55

Date Month Year



Dated

Limited

Driller

Day Month Year

Foundation Engineering Division

Hole Began 30/4/55

Hole Ended 2/5/55

Engineering Data Sheet for Borehole: 4

Helper

Job Name: HYSLOP'S BRIDGE, HWY. NO. 86, LITTLE MAITLAND RIVER

K. TUBBERING

Job Located: BRIDGE AT HWY. #86, CROSSING LITTLE MAITLAND RIVER, 9 MILES E.S.E. OF WINGHAM, ONT.

Checked by

Data Located: AS SHOWN ON ATTACHED SKETCH PLAN.

Hole ID: 1108.2 (FW) Datum: M.S.L.

