

#

63-F-208

W.P. #279-62

HWY. #401 &

LARVE CREEK

CROSSING

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

Attention: Mr. S. McCombie

Mr. A. G. Stermac,  
Principal Foundation Engr.,  
Foundation Section,  
Materials & Research Division.  
August 7, 1963.

FOUNDATION INVESTIGATION REPORT BY -  
H. Q. Golder & Associates, Limited -  
Probings to Define Bedrock Surface -  
Proposed Crossing Near La Rue Mills,  
Hwy. 401 - Line 'G', Gananoque, Ont.  
W.P. 279-62 -- District #8

We have reviewed the above-mentioned report and are  
in agreement with the discussion and recommendations contained  
therein.

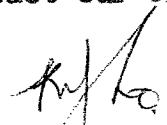
We also believe that the recommendations are self-  
explanatory and adequate for your future design work.

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  
E. A. Cash  
J. E. Gruspier  
A. Watt

Foundations Office  
Gen. Files

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

**H. Q. GOLDER & ASSOCIATES LTD.**

**CONSULTING CIVIL ENGINEERS**

H. Q. GOLDER  
V. MILLIGAN  
L. G. SODERMAN

2444 BLOOR STREET WEST  
TORONTO 9, ONTARIO  
767-9201  
763-4103

**REPORT**

**TO**

**DEPARTMENT OF HIGHWAYS, ONTARIO**

**ON**

**PROBINGS TO DEFINE BEDROCK SURFACE**

**PROPOSED CROSSING NEAR LA RUE MILLS  
HIGHWAY 401 - LINE G  
WP 279-62**

**GANANOQUE**

**ONTARIO**

**Distribution:**

11 copies - Department of Highways, Ontario  
Toronto, Ontario

2 copies - H.Q. Golder & Associates Ltd.  
Toronto, Ontario

July, 1963

6364

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ABSTRACT

The results of an investigation to determine the elevation of the surface of bedrock at the proposed pier and abutment locations for two adjacent bridge structures on the proposed revision of Highway 401, Line G, near Gananoque, Ontario, are reported.

A previous investigation at the site is reported in our report 6266, dated December, 1962, and includes recommendations for the foundation design of the proposed structures.

## INTRODUCTION

H. Q. Golder & Associates Ltd. have been retained by the Department of Highways, Ontario, by letter dated June 21, 1963, to carry out an investigation at a proposed creek crossing on Highway 401, Line G, near Gananoque, Ontario.

The purpose of the investigation was to determine the elevation of the surface of bedrock at the proposed pier and abutment locations for two adjacent bridge structures at the crossing.

A previous investigation at the site is reported in our report 6266, dated December, 1962, and includes details of the subsoil at the site and recommendations for the foundation design of the proposed structures.

## PROCEDURE

The fieldwork for the present investigation was carried out between June 26 and July 10, 1963. During this period 28 wash probings and 49 dynamic cone penetration tests or hand borings were put down to determine the elevation of bedrock at the proposed pier and abutment locations. In addition, 6 borings, numbered 101 to 106, were put down to

core bedrock in AXT size. The borings and probings were put down by means of a skid or raft mounted machine drillrig supplied and operated by the F. E. Johnston Drilling Co. Ltd.

The locations of all the borings and probings were determined by Golder & Associates Ltd. with respect to the centrelines of the bearings for the abutments and piers of the proposed structures. These centrelines were set out in the field by the Department of Highways, Ontario.

The locations of the borings and probings put down during the present investigation are shown on Figure 1. Detailed logs for boreholes 101 to 106 are given on the Records of Boreholes.

The elevations used in this report are referred to a bench mark located in the north root of a 2.5 feet oak tree 221 feet right of station 280 + 49 on proposed Highway 401, Line G. The elevation of this bench mark is given as 279.87, Geodetic, on Department of Highways, Ontario Plan E-4136-1, dated August, 1962.

#### SITE TOPOGRAPHY AND GEOLOGY

The proposed creek crossing is situated approximately 0.4 miles west of La Rue Mills, which is about 16 miles north-east of Gananoque, Ontario. This area lies within the physiographic region known as the "Leeds Knobs and Flats" (Chapman and Putnam, 1951) and consists primarily of scattered knobs of rock between which lie clay deposits laid down by the Champlain sea. The clay plains are typically gently undulating farmed land. The creek to be crossed meanders through one of these plains.

Bedrock in this area consists of various types of altered sedimentary rocks, crystalline limestones and dolomites, gneisses and quartzites of the Grenville series of Precambrian Age, which are intruded, metamorphosed and deformed by bodies of granite, syenite and other igneous rocks (Wilson, 1946). The surface elevation of bedrock can vary appreciably within small areas.

#### SUBSOIL CONDITIONS

No samples were taken of the soil overlying bedrock at the proposed crossing during the present investigation. Details of the overburden are given in our report 6266, dated December, 1962.



Bedrock was cored in AXT size (approximately 1 1/8 inches diameter) for about 10 feet in boreholes 101 to 106, inclusive. The rock was found to be a hard grey or pink coloured fine and medium textured crystalline rock. Some cracks or fissures were noted in the core recovered, particularly in the upper 3 to 4 feet.

It should be noted that the elevation of bedrock in the borings where it was cored was generally within a few inches of the bedrock surface elevation inferred from adjacent probings.

  
L.N. McCammon, P. Eng.

  
V. Milligan, P. Eng.

NMcC/rs  
6364  
July, 1963

REFERENCES

- CHAPMAN, L.J., and PUTNAM, D.F., "The Physiography of Southern Ontario", University of Toronto Press, 1951.
- WILSON, A.E., "Geology of the Ottawa - St. Lawrence Lowland, Ontario and Quebec", Geological Survey Memoir No. 241, Canada Department of Mines and Resources, Ottawa, 1946.

## LIST OF STANDARD ABBREVIATIONS

The standard abbreviations commonly employed on each "Record of Borehole", on the figures, and in the text of the report are as follows:

### SAMPLE TYPES

A.S. - Auger Sample	R.C. - Rock Core
C.S. - Chunk Sample	S.T. - Slotted Tube
D.O. - Drive Open	T.O. - Thin-walled, Open
D.S. - Denison Type Sample	T.P. - Thin-walled, Piston
F.S. - Foil Sample	W.S. - Wash Sample

### PENETRATION RESISTANCES

Dynamic Penetration Resistance - The energy required to drive a 2 inch diameter, 60 degree cone attached to the end of the drilling rods into the ground: expressed in blows per foot, where each blow represents 4,200 inch-pounds of energy.

Standard Penetration Resistance, N - The number of blows by a 140 pound hammer dropped 30 inches required to drive a 2 inch drive open sampler one foot into the ground.

Sampler advanced by static weight	- weight, hammer	- Wh
Sampler advanced by pressure	- pressure, hydraulic	- Ph
Sampler advanced by pressure	- pressure, manual	- Pm

### SOIL DESCRIPTION

The standard terminology for the descriptions of the relative density of cohesionless soils and the consistency of cohesive soils is as follows:

<u>Relative Density</u>	<u>N, Blows/ft.</u>	<u>Consistency</u>	<u>c, lb/sq. ft.</u>
Very Loose	0 to 4	Very Soft	Less than 250
Loose	4 to 10	Soft	250 to 500
Compact	10 to 30	Firm	500 to 1,000
Dense	30 to 50	Stiff	1,000 to 2,000
Very Dense	over 50	Very Stiff	2,000 to 4,000
		Hard	over 4,000

### SOIL TESTS

C - Consolidation Test	Q - Undrained Triaxial
H - Hydrometer Analysis	Qc - Consolidated Undrained Triaxial
M - Sieve Analysis	S - Drained Triaxial
MH - Combined Analysis, Sieve and Hydrometer	U - Unconfined Compression
	V - Field Vane Test

Note: Undrained triaxial tests in which pore pressures are measured are shown as Q<sup>p</sup> or Q<sup>p</sup>c.

### SOIL PROPERTIES

$\gamma$ - Total Unit Weight	K - Coefficient of Permeability
$\gamma_d$ - Dry Unit Weight	c - Undrained Shear Strength
$\gamma_b$ - Submerged Unit Weight	( $\frac{1}{2}$ Compressive Strength)
L <sub>L</sub> - Liquid Limit	St - Sensitivity
P <sub>L</sub> - Plastic Limit	$\phi'$ - Effective Angle of Shearing Resistance
W - Natural Water Content	c' - Effective Cohesion Intercept
G - Specific Gravity	Cc - Compression Index
e - Void Ratio	Cv - Coefficient of Consolidation

## RECORD OF BOREHOLE S 101 &amp; 102

LOCATION SEE FIGURE 1

BORING DATE JULY 4-8, 1963

DATUM GEODETIC

BOREHOLE TYPE WASH BORING

BOREHOLE DIAMETER BX &amp; AX CASING

SAMPLER HAMMER WEIGHT - LB. DROP - INCHES

PEN. TEST HAMMER WEIGHT - LB. DROP - INCHES

SOIL PROFILE			SAMPLES			ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					COEFFICIENT OF PERMEABILITY K, CM. / SEC.			
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FT.		SHEAR STRENGTH C. LB. / SQ. FT.					WATER CONTENT, PERCENT P <sub>L</sub> — W — L <sub>L</sub>			
269.5	GROUND LEVEL					270	101/								
0.0	COMPACT GREY SILTY SAND														
266.8															
2.7			1	AXT RC	-	265									
	HARD GREY WITH SOME PINK BANDS (1" TO 3" IN THICKNESS TYPICALLY) FINE AND MEDIUM TEXTURED CRYSTALLINE ROCK WITH SOME FRACTURES (BEDROCK)		2	"	-										
			3	"	-										
			4	"	-	260									
257.3															
12.2	END OF HOLE					255									
270.3	GROUND LEVEL					270	102/								
0.0	BROWN SANDY TOPSOIL														
0.8			1	AXT RC	-										
	HARD PINK AND GREY FINE AND MEDIUM TEXTURED CRYSTALLINE ROCK WITH SOME FRACTURES (BEDROCK)		2	"	-	265									
			3	"	-										
258.5						260									
11.8	END OF HOLE					255									

## RECORD OF BOREHOLE 103

LOCATION SEE FIGURE 1

BORING DATE JULY 10, 1963

DATUM                      GEODETIC

**BOREHOLE TYPE**

WASH BGRING

BOREHOLE DIAMETER      AX CASING .

**SAMPLER HAMMER WEIGHT - LB. DROP - INCHES**

PEN. TEST HAMMER WEIGHT - LB. DROP - INCHES

[illegible]

VERTICAL SCALE  
1 INCH TO 5'-0"

**GOLDER & ASSOCIATES**

DRAWN *m.w.*  
CHECKED *r. n/cb.*

## RECORD OF BOREHOLE 104

LOCATION SEE FIGURE 1

BORING DATE JUNE 27-28, 1963

DATUM GEODETIC

BOREHOLE TYPE

WASH BORING

BOREHOLE DIAMETER

8X 8 AX CASING

SAMPLER HAMMER WEIGHT — LB. DROP — INCHES

PEN. TEST HAMMER WEIGHT — LB. DROP — INCHES

SOIL PROFILE			SAMPLES			ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					COEFFICIENT OF PERMEABILITY K, CM. / SEC.			
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FT.		SHEAR STRENGTH C, LB. / SQ. FT.					WATER CONTENT, PERCENT			
264.4	GROUND LEVEL					265									
						260									
						255									
						250									
246.9						245									
17.5						240									
						235									
237.4															
27.0	END OF HOLE														

VERTICAL SCALE  
1 INCH TO 5' - 0"

GOLDER &amp; ASSOCIATES

DRAWN M. W.  
CHECKED H. A. B.

## RECORD OF BOREHOLE 105

LOCATION SEE FIGURE 1

BORING DATE JULY 3-4, 1963

DATUM GEOMETRIC

BOREHOLE TYPE

WASH BORING

BOREHOLE DIAMETER

BX &amp; AX CASING

SAMPLER HAMMER WEIGHT — LB. DROP — INCHES

PEN. TEST HAMMER WEIGHT — LB. DROP — INCHES

SOIL PROFILE		SAMPLES			ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					COEFFICIENT OF PERMEABILITY K, CM. / SEC.			
ELEV. DEPTH	DESCRIPTION	STRAT. PLT.	NUMBER	TYPE		SHEAR STRENGTH C, LB. / SQ. FT.					WATER CONTENT, PERCENT			
263.3	GROUND LEVEL				265									
					260									
					255									
250.0					250									
13.3					245									
					240									
240.4														
22.9	END OF HOLE													

VERTICAL SCALE  
1 INCH TO 5' - 0"

GOLDER &amp; ASSOCIATES

DRAWN M.W.  
CHECKED v. m. g.

# RECORD OF BOREHOLE 106

LOCATION SEE FIGURE 1

BORING DATE JULY 9, 1963

DATUM GEODETIC

BOREHOLE TYPE

WASH BORING

BOREHOLE DIAMETER

BX &amp; AX CASING

SAMPLER HAMMER WEIGHT - LB. DROP - INCHES

PEN. TEST HAMMER WEIGHT - LB. DROP - INCHES

SOIL PROFILE		SAMPLES			ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					COEFFICIENT OF PERMEABILITY K, CM. / SEC.			
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		SHEAR STRENGTH C, LB./SQ. FT.					WATER CONTENT, PERCENT P <sub>L</sub> W      L <sub>L</sub>			
					265									
262.3 0.0	RIVER LEVEL													
259.8 2.5	RIVER BOTTOM				260									
	NO SAMPLES TAKEN. BORING ONLY PUT DOWN TO DETERMINE BEDROCK SURFACE				255									
253.0 9.3														
	HARD GREY FINE AND MEDIUM TEXTURED CRYSTALLINE ROCK WITH A FEW FRACTURES (BEDROCK)		1	AXT RC	250									
			2	"										
			3	"	245									
242.5 19.8			4	"										
	END OF HOLE				240									

VERTICAL SCALE  
1 INCH TO 5' - 0"

GOLDER & ASSOCIATES

DRAWN m.w.  
CHECKED h.w.



# BORING PLAN SHOWING INFERRED ROCK ELEVATIONS

FIGURE 1

## LEGEND

PREVIOUS INVESTIGATION (OUR REPORT 6266, DATED DEC./62.)

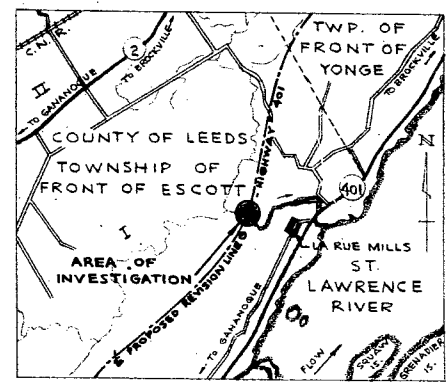
- 3 BOREHOLE IN PLAN
- 13 PENETRATION TEST IN PLAN

## PRESENT INVESTIGATION

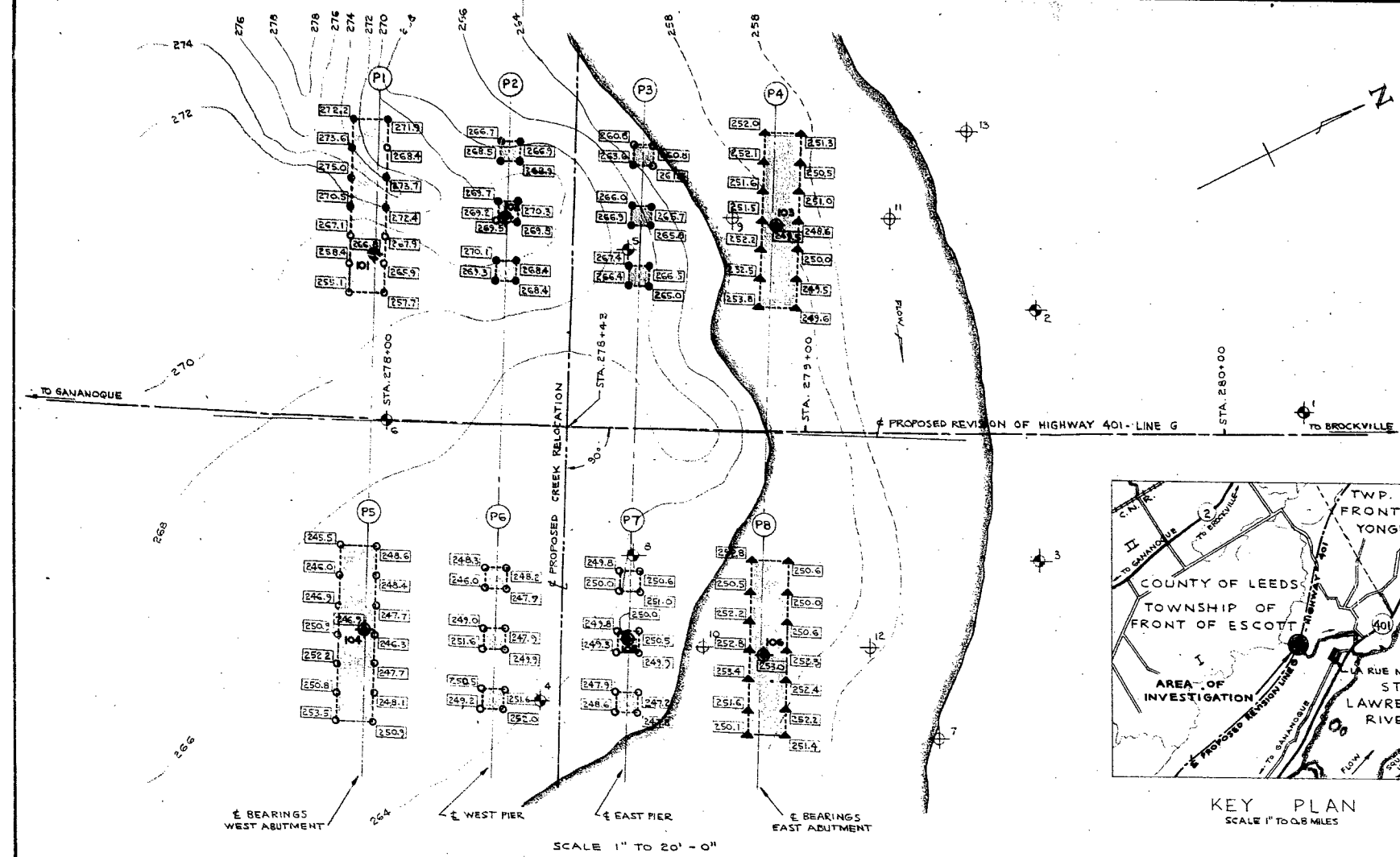
- 103 BOREHOLE IN PLAN
- CONE PENETRATION TEST OR HAND PROBING
- ▲ WASH PROBING
- ROCK OUTCROP AT GROUND SURFACE

- P2 PIER OR ABUTMENT NUMBER
- PROBINGS NUMBERED CONSECUTIVELY, CLOCKWISE.  
(Eg: P2-1, P2-2, P2-3 ..... P2-12.)
- PROPOSED FOOTING LOCATIONS
- ELEVATION OF TOP OF BEDROCK (INFERRED)

REFERENCE: DAMAS AND SMITH LIMITED, CONSULTING ENGINEERS DRWG.  
CREEK CROSSING - WP 273-62, HWY. 401, DIST. NO. 3  
3.3 MILES FROM TOWNSHIP ROAD TO ROCKPORT.

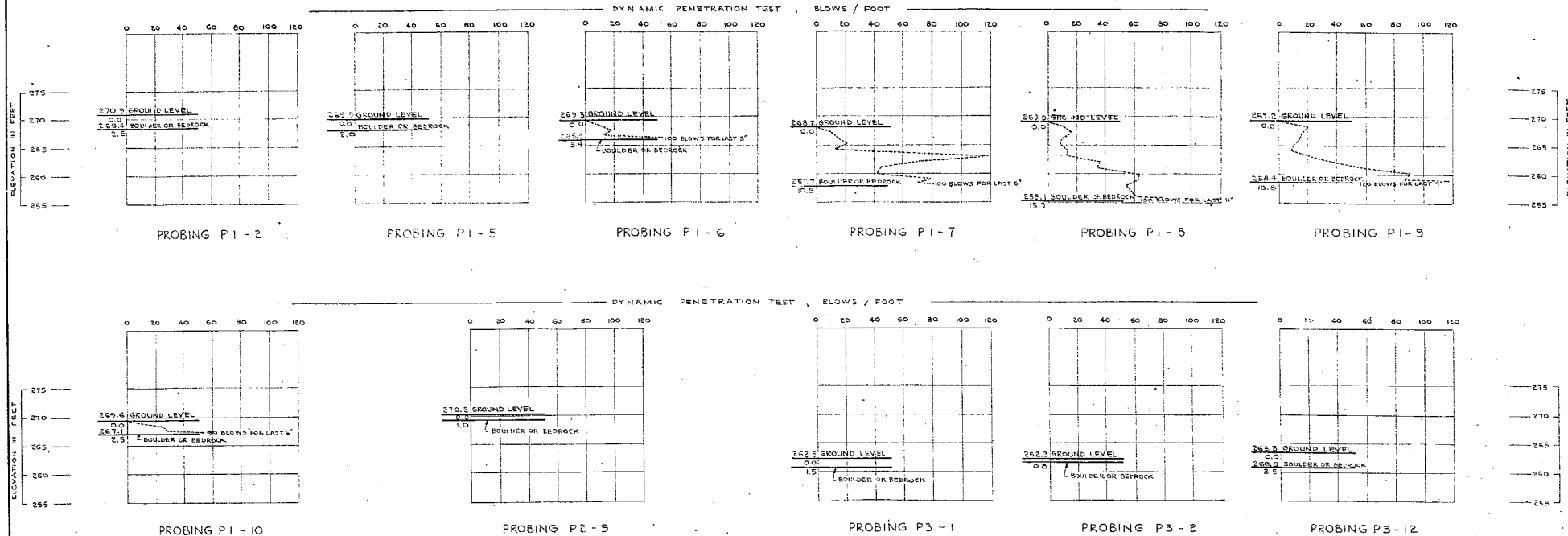


KEY PLAN  
SCALE 1" TO 0.6 MILES



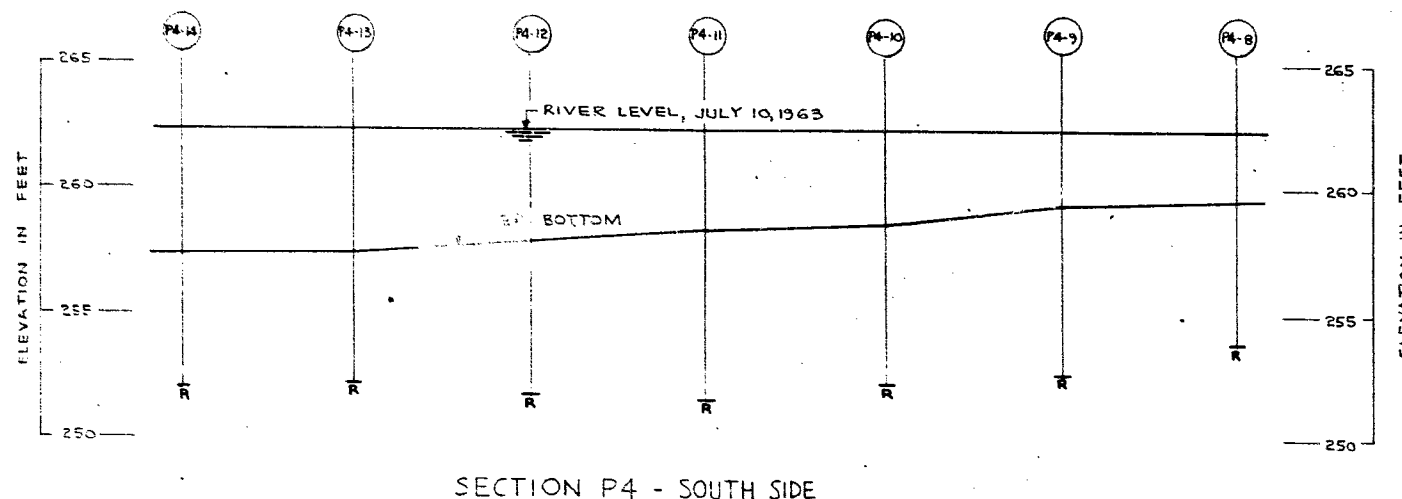
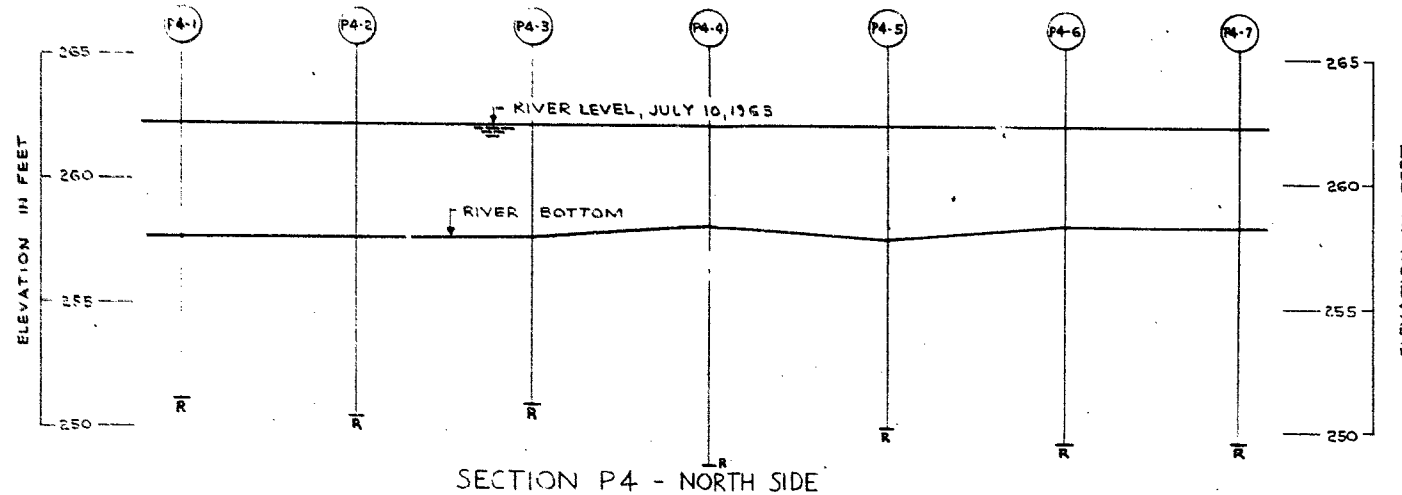
GOLDER & ASSOCIATES

Made *M.W.*  
Chkd. *M.W.*  
Appd. *[Signature]*





**NOTES**

- I) FOR LOCATION OF PROBINGS SEE FIGURE 1.
- II) ALL ELEVATIONS ARE TO GEODETIC DATUM.
- III) DYNAMIC PENETRATION TESTS CARRIED OUT USING 140 LB. HAMMER WITH 56 IN. DROP.



SCALE 1" TO 5'-0"

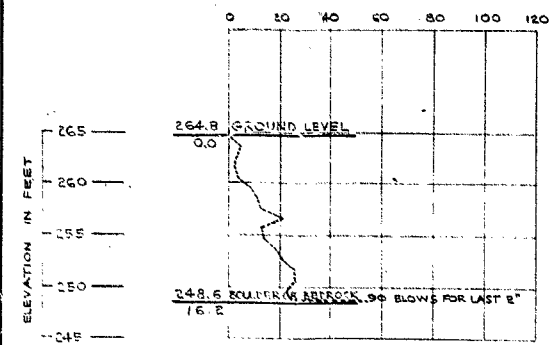
LEGEND

-  WASH PROBING IN ELEVATION
-  REFUSAL, BOULDER OR BEDROCK

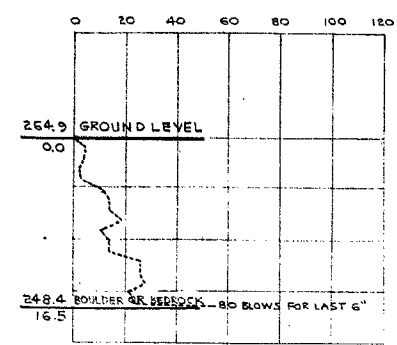
NOTES

- I) FOR LOCATIONS OF PROBINGS SEE FIGURE 1
- II) ALL ELEVATIONS ARE TO GEODETIC DATUM.

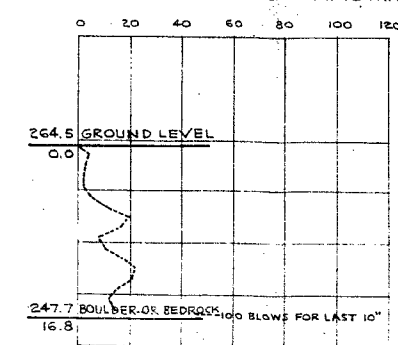
DYNAMIC PENETRATION TESTS , BLOWS / FOOT



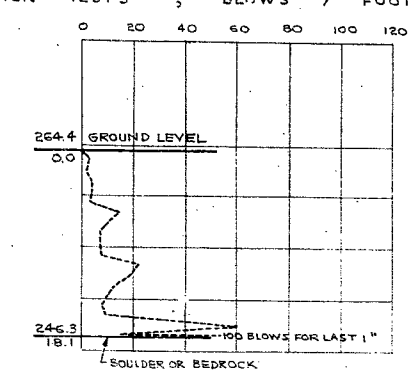
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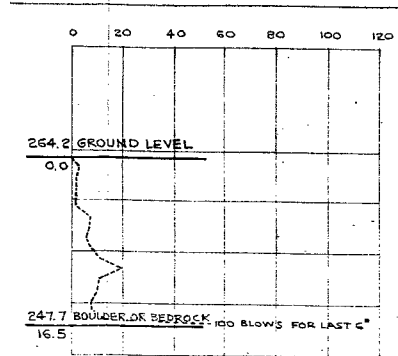
PROBING P5-2



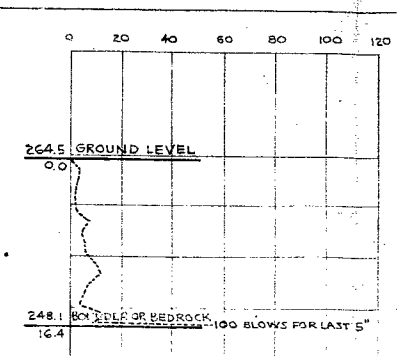
PROBING P5-3



PROBING P5-4

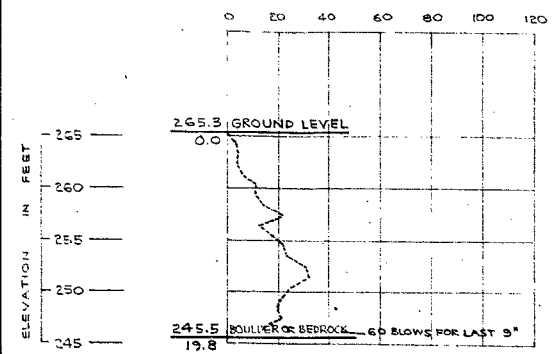


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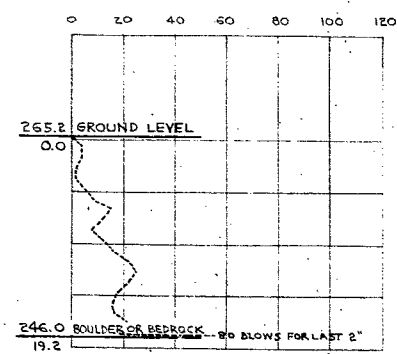


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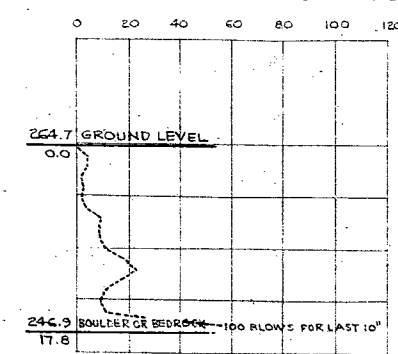
DYNAMIC PENETRATION TESTS , BLOWS / FOOT



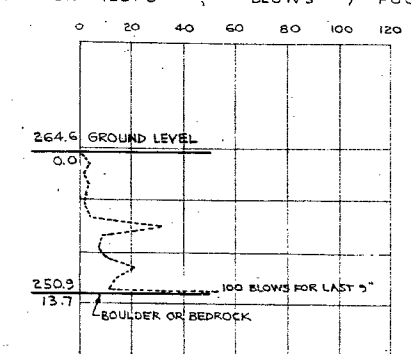
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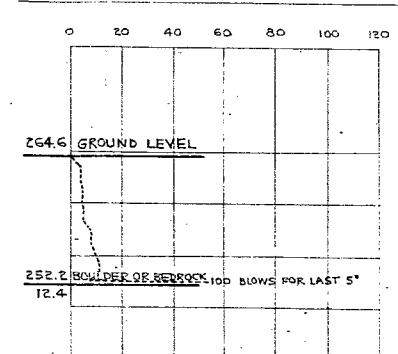
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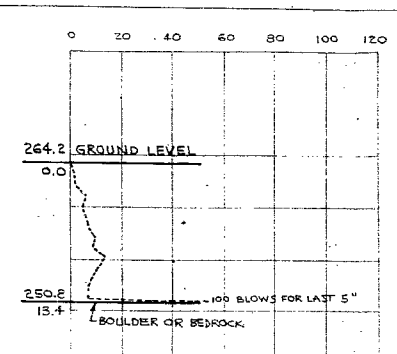
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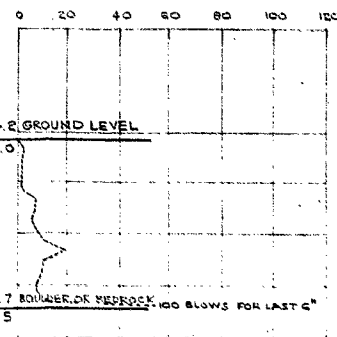
PROBING P5-11



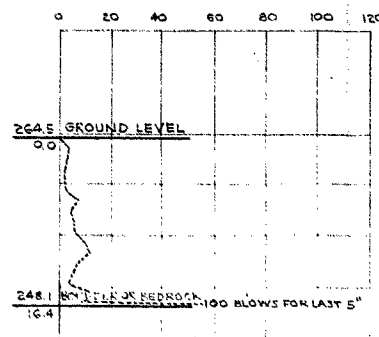
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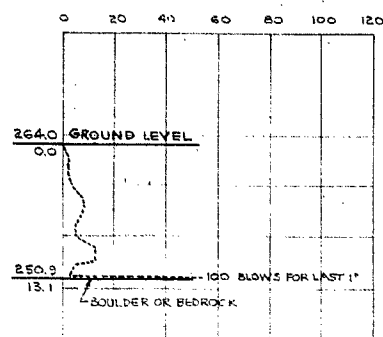
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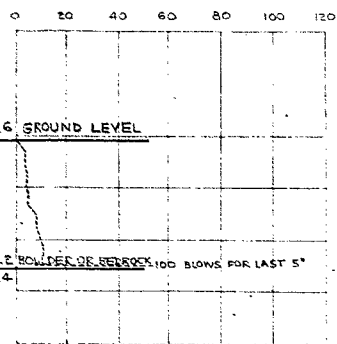
PROBING P5-5



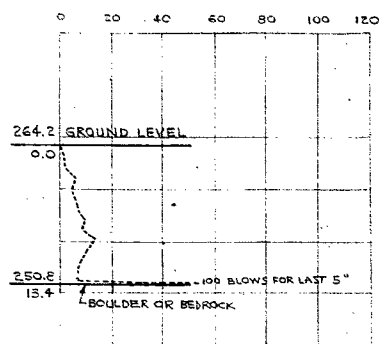
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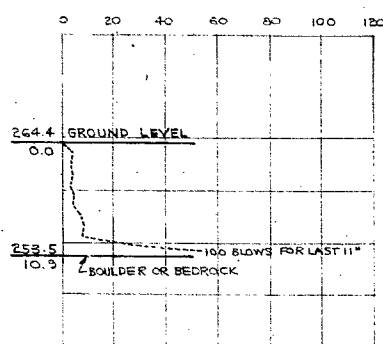
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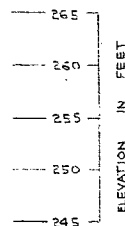
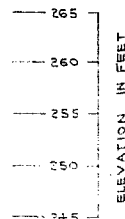
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PROBING P5-9

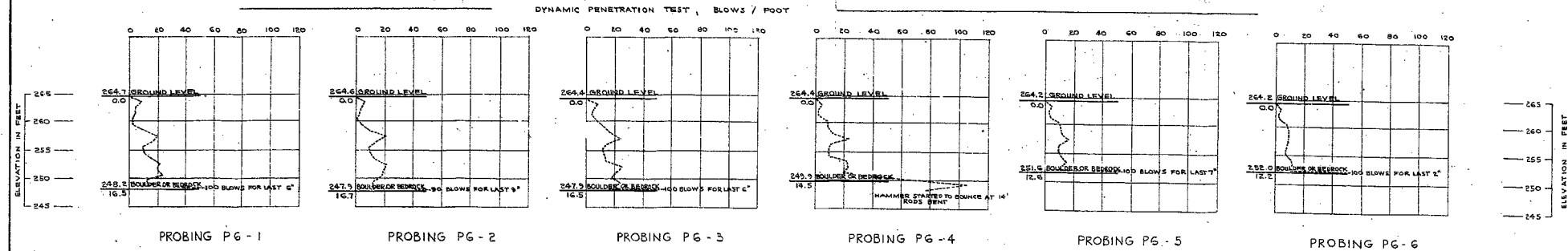


PROBING P5-8



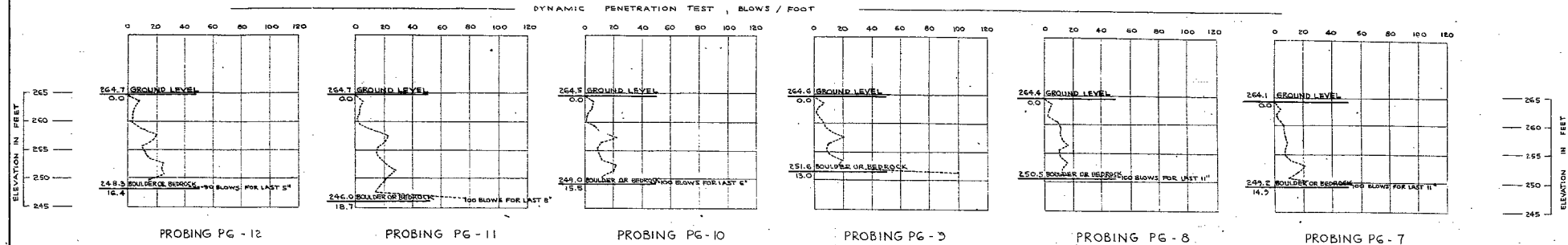
NOTES

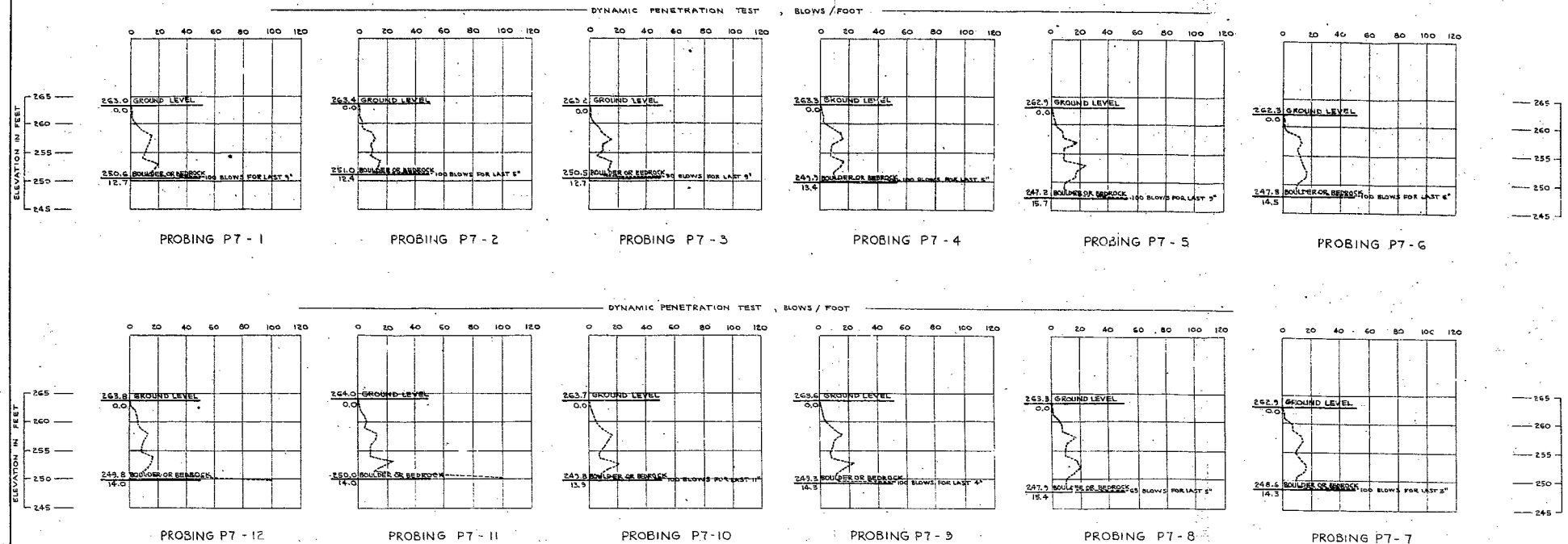
- i) FOR LOCATIONS OF PROBINGS SEE FIGURE 1.
- ii) ALL ELEVATIONS ARE TO GEODETIC DATUM.
- iii) DYNAMIC PENETRATION TESTS CARRIED OUT USING 140 LB. HAMMER WITH 30 IN. DROP.



NOTES

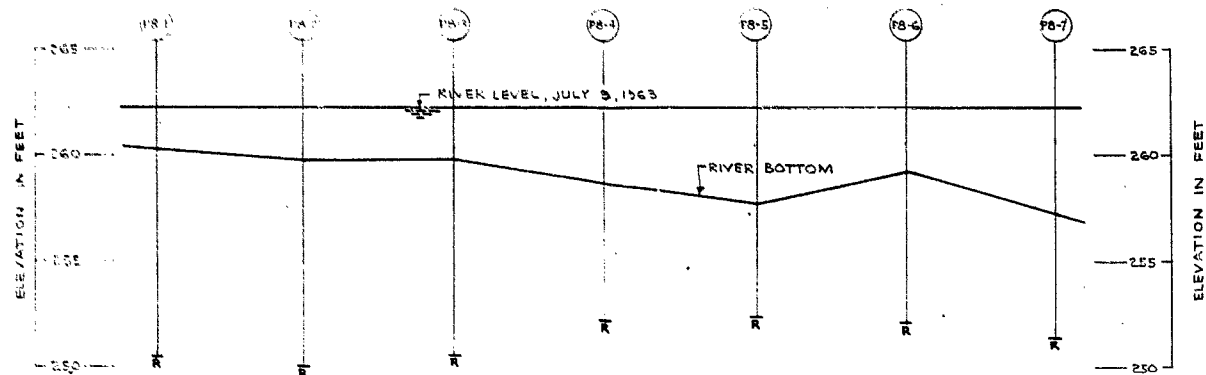
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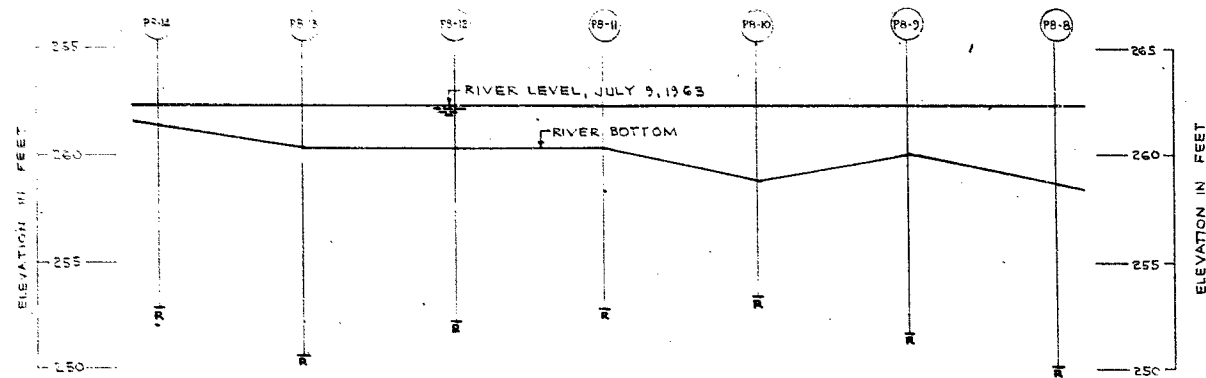


NOTES

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- III) DYNAMIC PENETRATION TESTS CARRIED OUT USING 140 LB. HAMMER WITH 30 IN. DROP.



SECTION P8 - NORTH SIDE



SECTION P8 - SOUTH SIDE

SCALE 1" TO 5'-0"

LEGEND

- (PS-1) WASH PROBING IN ELEVATION
- ⊥ REFUSAL, BOULDER, OR BEDROCK

NOTES

- i) FOR LOCATIONS OF PROBINGS SEE FIGURE 1.
- ii) ALL ELEVATION ARE TO GEODETIC DATUM.