



THURBER ENGINEERING LTD.



MEMORANDUM

To: Christopher Schueler, P.Eng.
AECOM

Date: March 9, 2017

From: Sydney Pang, P.Eng.
Alastair Gorman, P.Eng.
(Reviewed by P.K. Chatterji, P.Eng.)

File: 19-4406-20

PRELIMINARY FOUNDATION ASSESSMENT PIGEON RIVER BRIDGE (SITE 21-023) G.W.P. 4008-13-01 GEOCRES NO. 31D-669

1 INTRODUCTION

This memorandum presents a brief summary of a geotechnical assessment of the Pigeon River Bridge which carries Highway 7A over Pigeon River in the Municipality of Kawartha Lakes. It also presents preliminary geotechnical recommendations for use in assessment of the existing foundations at the site. Information from AECOM indicates that the proposed rehabilitation works include patching, waterproofing and paving concrete deck surface; patch repairing deck soffit, deck fascia, barrier walls and substructure; sealing the inside face of barrier walls; eliminating existing deck drains; and paving the existing approaches. AECOM also advises that the dead load on the foundations is expected to remain the same as a result of the rehabilitation works.

The recommendations provided in this memorandum are for planning, structure evaluation and preliminary design purposes only. Additional investigation and analysis may be required in any subsequent detail design phase of the project.

The following reference numbers apply to this site:

- Current W.P. 4008-13-01
- Site No. 21-023
- Historic GEOCRES No. Not Applicable
- Historic W.P. 56-81-01

2 SITE DESCRIPTION

The site is located on Highway 7A at approximately 1 km west of the intersection of Highways 7A and 35 in the Geographic Township of Manvers, Municipality of Kawartha Lakes. Based on the description in Section 6.3.3 of the RFP, the existing bridge, constructed in 1950, is a single span reinforced cast-in-place concrete rigid frame slab bridge with a clear span of 9.1 m. The overall

deck width is 11.8 m with an asphalt riding surface of 10.4 m carrying one lane of traffic in each direction of Highway 7A. The structure was last rehabilitated in 1988 which generally involved barrier wall replacement, deck patching, concrete overlay, waterproofing and paving.

The mapping in the Physiography of Southern Ontario by Chapman and Putnam shows that the site lies within the physiographic region known as the Peterborough Drumlin Field. As indicated by the name, this area is characterized by a large number of drumlins within a rolling till plain. The rolling nature of the terrain in the general vicinity of the site is consistent with this mapping.

3 SUBSURFACE CONDITIONS

No foundation information was found in the GEOCREST library for this bridge site. There is existing geotechnical information for the upper 1.5 m depth as part of a pavement investigation for the 1988 rehabilitation. This information indicates that the pavement structure overlies sands and silts. The sands and silts have been described as “stony” at some locations which could be interpreted as indicating a glacial till deposit.

4 SITE OBSERVATIONS

Foundation engineering staff from Thurber visited the site to observe conditions above the waterline related to the general geotechnical performance.

There were no obvious signs of settlement or distress at the foundation elements. Concrete spalling and cracking were observed on the abutment walls.

The approach slopes appeared to be stable with no obvious signs of instability. All slope faces appeared well vegetated, except for some erosion at the southeast approach slope near the creek water level. There was no visible settlement at the approach slabs although a slight bump was noticed at the west approach.

Photographs of the structure and the approaches are attached in Appendix A.

5 EXISTING FOUNDATIONS

A historic “General Drawing” dated May 1950 indicates that the original design involved a concrete rigid frame structure supported by strip footings of 3 ft. 6 ins. (1.07 m) in width. The wingwall at each of the four corners was designed to be 15 ft. 6 ins. (≈4.7 m) in length at the top reducing to 6 ft. (≈1.8 m) in length at the base. The rigid frame has an overall height of 14 ft. 8.5 ins. (≈4.5m) and an overall length (parallel to the highway) of 34 ft. (≈10.4 m).

According to this General Drawing, the strip footings supporting the bridge were designed to be founded at Elevation 82.0 ft (≈25.0 m), or approximately 4 ft. (≈1.2 m) below the riverbed at the time of the design.

There is no information from this drawing or other source available to us at this time that would indicate the design footing bearing pressure and founding stratum.

6 ASSESSMENT OF EXISTING FOUNDATIONS

There is no site-specific foundation information on which to base an assessment of the bridge foundations. Shallow pavement boreholes advanced in 1988 reveal the presence of sand and silt deposits immediately below the pavement structure. However, there is no information on the density of these soils. Soft or loose organic and alluvial deposits may have existed over the site prior to bridge construction.

Structural inspection was carried out by others in 2012 as part of the Ontario Bridge Management System (OBMS). Results documented on inspection forms indicate some leached cracks, honeycombing and severe scaling on both abutments above waterline. Other forms of concrete deterioration were also noted on the wingwalls. These records are generally consistent with Thurber's observations during our recent site visit.

There is no documented record of the foundations having experienced any movement and the approach embankments appear to be performing well. Accordingly, it can be surmised that the existing bridge foundations were appropriately designed and can safely carry the imposed loads to date. It is considered that the observed erosion at the southeast approach slope is a localized condition that is not anticipated to significantly alter the future performance of the structure. In order to avoid the propagation of distress, it is recommended that the affected area be reinstated as part of the rehabilitation works.

Based on the rehabilitation works outlined earlier in this memo and the fact that the dead load on the foundations is expected to remain the same after rehabilitation, it can be assumed that the bridge foundations will continue to perform satisfactorily provided that all structural requirements are met.

7 EXCAVATION AND ROADWAY PROTECTION

If the selected rehabilitation strategy requires excavations adjacent to the bridge, it is recommended that site investigation and field testing be carried out through the approach embankments in order to characterize the soils and to select parameters for geotechnical design, including roadway protection.

8 CLOSURE

Factual subsurface information for foundation purposes is not available for this site. Visual observations during our recent site visit, structure inspection records from 2012 and pavement investigation information from 1988 have been used in preparation of this memorandum.



60 YEARS

This memorandum was prepared by Messrs. Sydney Pang, P.Eng. and Alastair Gorman, P.Eng. and was reviewed by Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

Thurber Engineering Ltd.



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Associate, Senior Foundation Engineer



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Senior Associate, Senior Foundation Engineer



P.K. Chatterji, P.Eng.
Review Principal, Designated MTO Contact

Attachment



Appendix A
Archived Drawings

METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

PLATE No
CONT No 88-77
WP No 56-81-01



KEY PLAN
TO STA
Survey _____ Revised _____

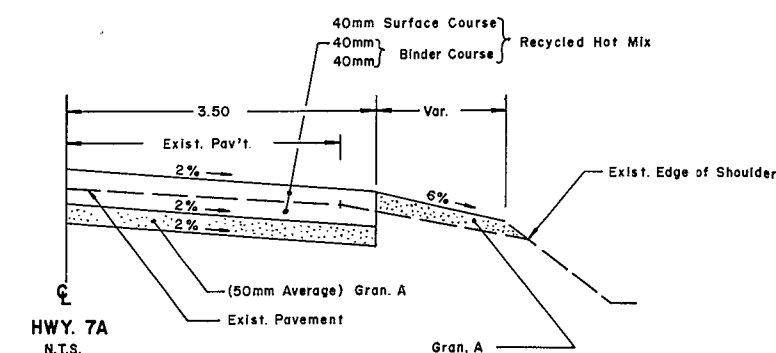
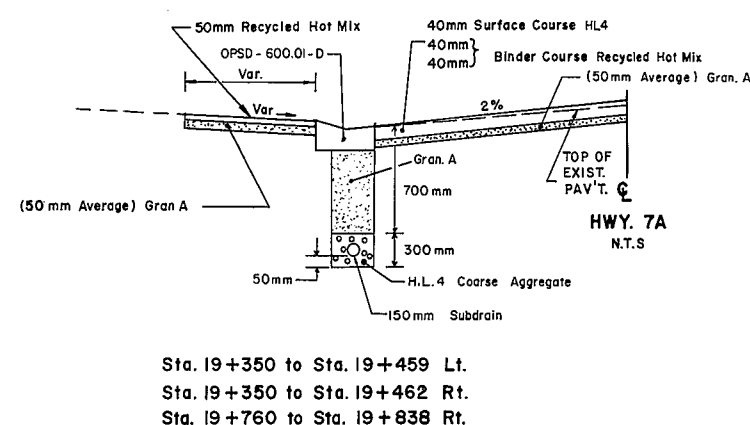
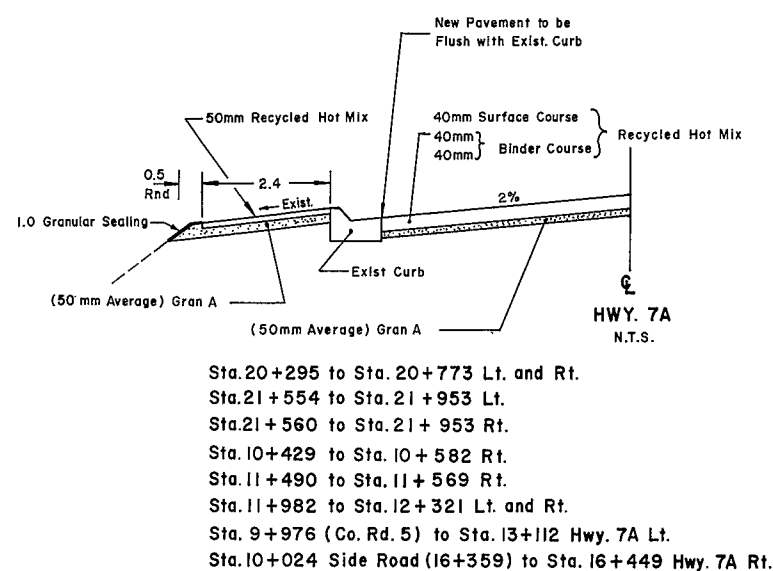
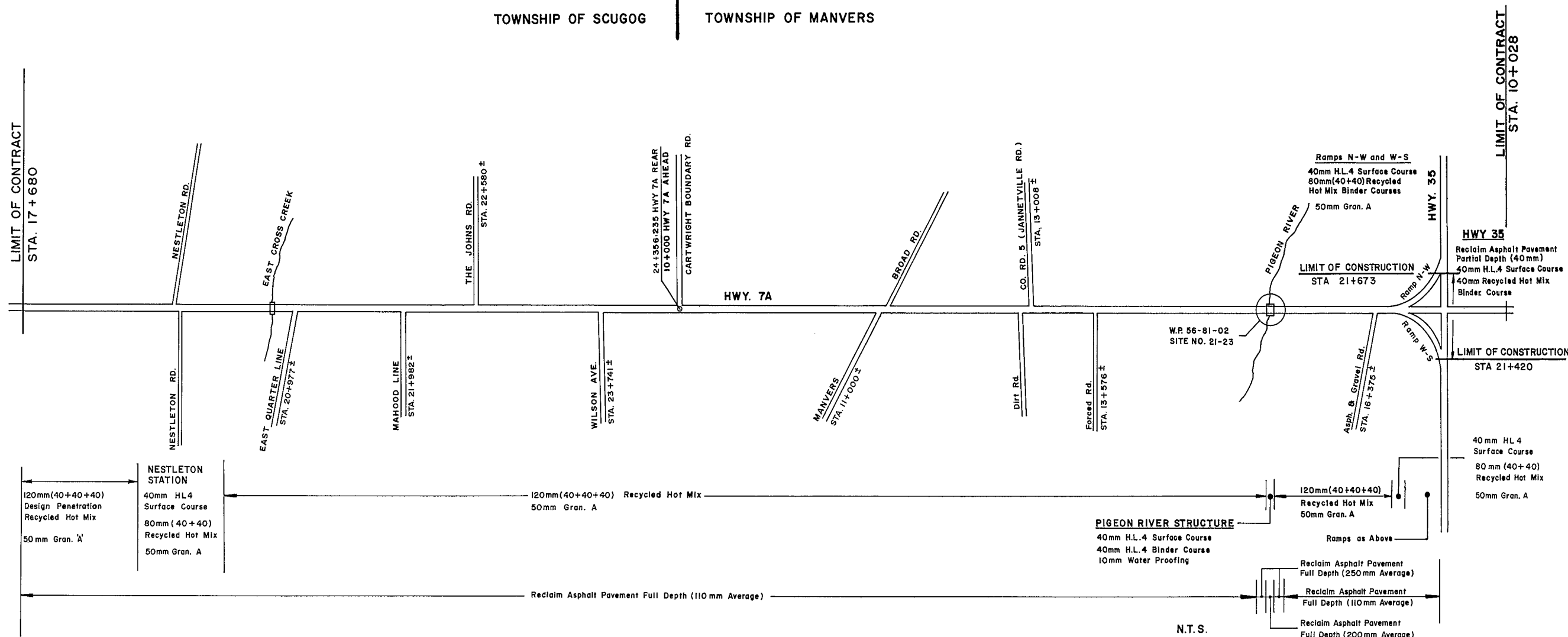
SHEET
I

REGIONAL MUNICIPALITY OF DURHAM

COUNTY OF VICTORIA

TOWNSHIP OF SCUGOG

TOWNSHIP OF MANVERS



METRIC

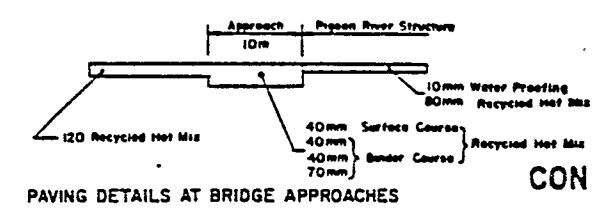
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AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

PLATE No 275-7A
CONT No 88-77
WP No 56-81-01

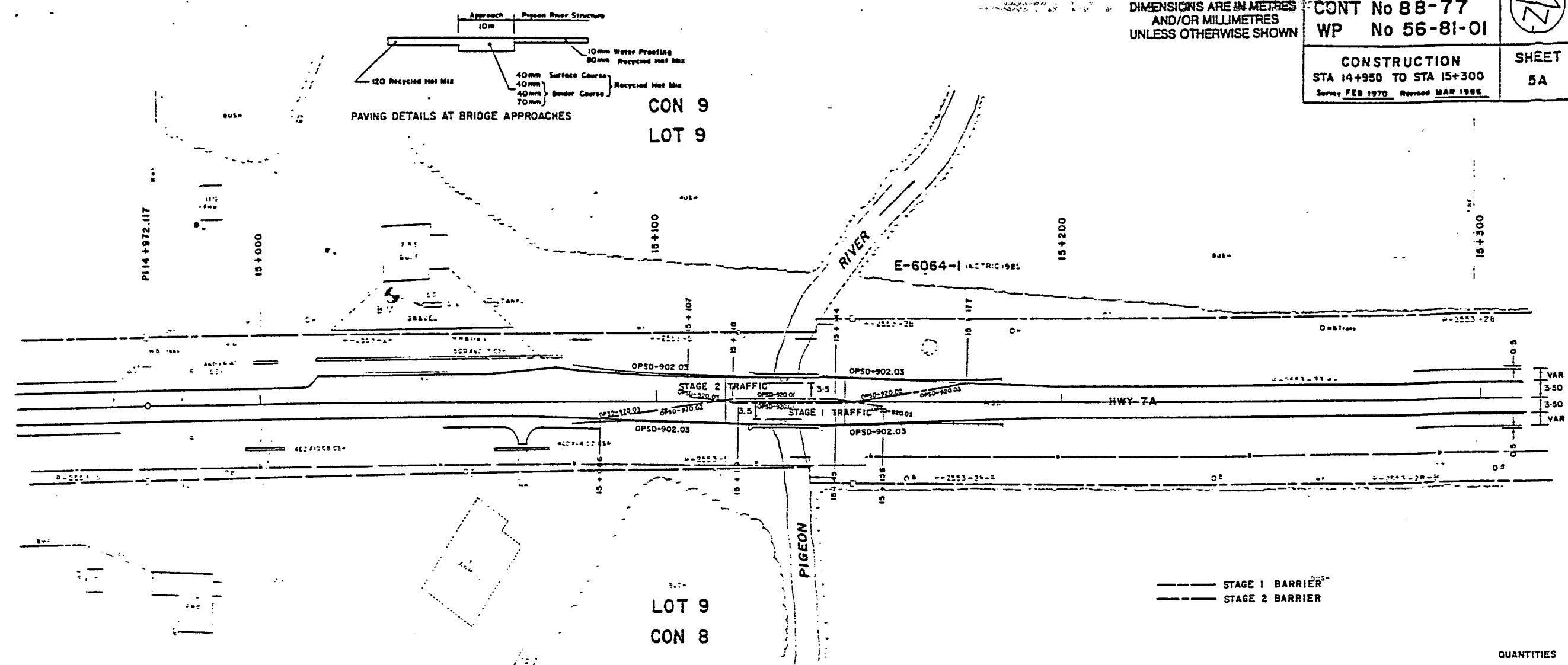


CONSTRUCTION
STA 14+950 TO STA 15+300
Survey FEB 1970 Revised MAR 1986

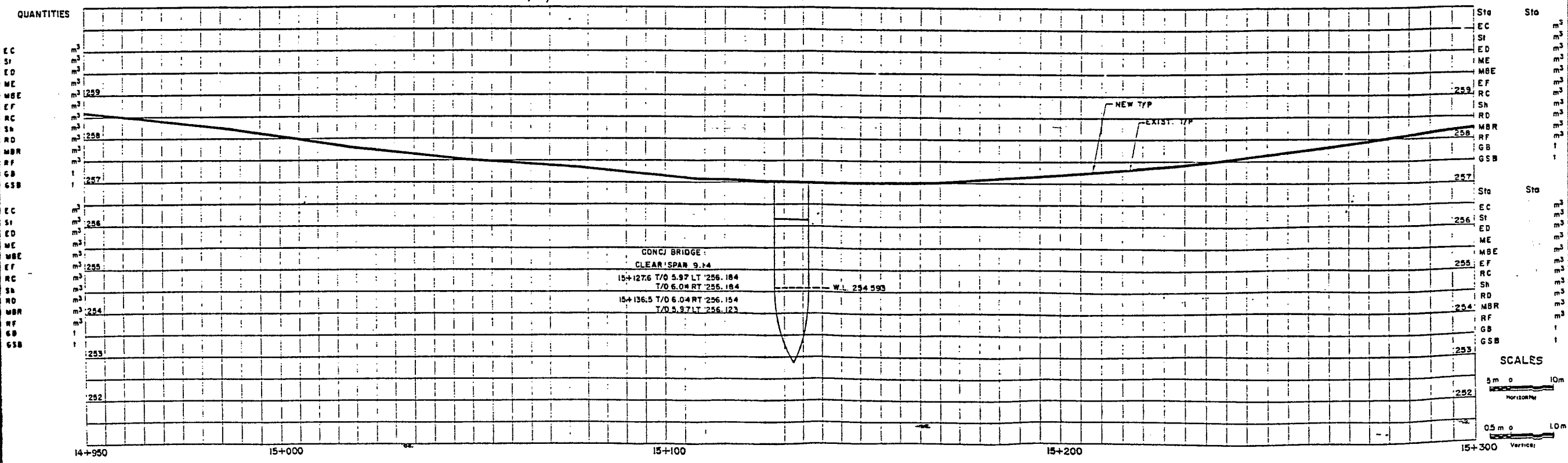
SHEET
5A



CON 9
LOT 9



STAGE 1 BARRIER
STAGE 2 BARRIER

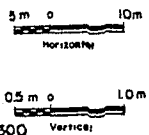


CONC. BRIDGE
CLEAR SPAN 9.14
15+127.6 T/O 5.97 LT 256.184
T/O 6.04 RT 256.184
15+136.5 T/O 6.04 RT 256.154
T/O 5.97 LT 256.123

QUANTITIES

Sta

SCALES



METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

PLATE No

CONT No 88-77
WP No 56-81-01

BOREHOLE DATA

STA TO STA

Survey Revised

SHEET

9

17+765 3.3 m Rt. ϵ
0 - 70 mm asph.
70 - 330 cr.gr.
330 - 430 br.cl.si.
430 - 560 cr.gr.
560 - 1.5 m br.si.sa.stny. moist

18+001 3.4 m Rt. ϵ
0 - 180 mm asph.
180 - 280 cr.gr.
280 - 600 br.sa. (SP)
600 - 1.5 m br.stny.si.sa. (1.3-1.5 m wet)

18+173 3.4 m Rt. ϵ
0 - 130 mm asph.
130 - 240 cr.gr.
240 - 800 br.stny.si.sa.
800 - 1.2 m br.cl.si.
1.2 - 1.5 br.stny.si.sa. moist

18+405 3.4 m Rt. ϵ
0 - 80 mm asph.
80 - 300 cr.gr.
300 - 1.2 m br.stny.si.sa.
1.2 - 1.5 dk.br.si.sa.tps.
1.5 - 1.7 br.cl.si. moist

18+679 3.4 m Rt. ϵ
0 - 100 mm asph.
100 - 270 cr.gr.
270 - 1.4 m br.stny.si.sa.
1.4 - 1.6 br.cl.si. moist

18+954 3.4 m Rt. ϵ
0 - 90 mm asph.
90 - 250 cr.gr.
250 - 1.0 m br.si.sa.stny.
1.0 - 1.5 dk.br.si.sa.tps.
1.5 - 1.8 br.si.sa. moist

19+044 3.4 m Rt. ϵ
0 - 130 mm asph.
130 - 250 cr.gr.
250 - 480 br.sa. (SP)
480 - 670 dk.br.si.sa.tps.
670 - 1.5 m br.si.sa. moist

19+228 3.4 m Rt. ϵ
0 - 120 mm asph.
120 - 300 cr.gr.
300 - 1.5 m br.si.sa.stny. moist

19+341 3.4 m Rt. ϵ
0 - 90 mm asph.
90 - 250 cr.gr.
250 - 1.5 m br.si.sa.stny. moist

19+862 3.4 m Rt. ϵ
0 - 80 mm asph.
80 - 280 cr.gr.
280 - 850 br.gr. GP
850 - 1.5 m br.sa.cl. MP (wet 850 mm - 1.2 m)

20+039 3.4 m Rt. ϵ
0 - 110 mm asph.
110 - 350 cr.gr.
350 - 1.5 m br.stny.si.sa. moist

20+264 3.4 m Rt. ϵ
0 - 140 mm asph.
140 - 300 cr.gr.
300 - 1.5 m br.stny.si.sa. (300 - 500 mm moist-wet)

20+737 4.1 m Rt. ϵ
0 - 260 mm conc. (curb & gutter)
260 - 440 cr.gr.
440 - 650 br.si.gr.
650 - 870 dk.br.si.sa.tps.
870 - 1.5 m br.si.sa.stny.

20+828 3.4 m Rt. ϵ
0 - 170mm asph.
170 - 450 cr.gr.
450 - 760 br.gr. (GP)
760 - 1.5m br.si.sa.stny.

20+920 4.3m Rt. ϵ
0 - 130mm asph.
130 - 340 cr.gr.
340 - 900 br.gr. (GP)
900 - 1.5m br.si.sa.stny. (900 - 1.1m wet)

21+102 3.4m Rt. ϵ
0 - 100mm asph.
100 - 340 cr.gr.
340 - 1.5m br.si.sa.stny., moist

21+282 3.4m Rt. ϵ
0 - 90mm asph.
90 - 170 cr.gr.
170 - 700 br.si.sa.
700 - 1.3m dk.br.si.sa.tps.
1.3 - 1.9 br.si.sa.moist

21+328 3.4m Rt. ϵ
0 - 100mm asph.
100 - 300 cr.gr.
300 - 650 br.sa.si.
650 - 1.5m br.si.sa.moist

21+560 3.4m Rt. ϵ
0 - 120mm asph.
120 - 260 cr.gr.
260 - 650 br.sa.si.
650 - 1.5m br.si.sa.stny., moist

NOTE: Sta.21+880-21+886, bank erosion 12m Lt. ϵ

21+983 4.6 m Rt. ϵ

0 - 100 mm asph.
100 - 200 cr.gr.
200 - 1.5 m br.si.sa.stny.moist

22+099 3.4 m Rt. ϵ
0 - 110 mm asph.
110 - 290 cr.gr.
290 - 1.5 m br.si.sa.stny.moist

22+337 3.4 m Rt. ϵ
0 - 100 mm asph.
100 - 280 cr.gr.
280 - 1.5 m br.si.sa.stny.moist

22+631 3.4 m Rt. ϵ
0 - 140 mm asph.
140 - 330 cr.gr.
330 - 1.1 m br.stny.si.sa.
1.1 - 1.5 dk.br.si.sa.tps.
1.5 - 1.8 gry.stny.si.sa.moist

22+886 3.4 m Rt. ϵ
0 - 80 mm asph.
80 - 300 cr.gr.
300 - 1.5 m br.si.sa.stny. moist

23+105 3.4 m Rt. ϵ
0 - 100 mm asph.
100 - 350 cr.gr.
350 - 650 br.stny.si.sa.
650 - 850 dk.br.si.sa.tps.
850 - 1.5 m gry.si.sa.stny. moist-wet

23+297 3.4 m Rt. ϵ

0 - 90 mm asph.
90 - 160 cr.gr.
160 - 1.5 m br.si.sa.stny. moist

23+480 3.4 m Rt. ϵ
0 - 100 mm asph.
100 - 300 cr.gr.
300 - 900 br.si.sa.stny.
900 - 1.5 m br.si.cl. (MP) moist

23+800 3.4 m Rt. ϵ
0 - 120 mm asph.
120 - 300 cr.gr.
300 - 1.5 m br.si.sa.stny. moist

24+024 3.4 m Rt. ϵ
0 - 100 mm asph.
100 - 300 cr.gr.
300 - 500 br.sa. (SP)
500 - 900 gry.sa.si. w/s cl. wet
900 - 1.5 m gry.sa.si.stny. moist

24+093 3.4 m Rt. ϵ
0 - 130 mm asph.
130 - 260 cr.gr.
260 - 530 br.sa. SP
530 - 900 br.si.sa. moist-wet
900 - 1.5 m br.si.sa. w/s cl. wet

24+236 3.4 m Rt. ϵ
0 - 140 mm asph.
140 - 350 cr.gr.
350 - 700 br.sa. (SP)
700 - 1.5 m br.si.sa. occ. stn., moist

10+023 3.4 m Rt. ϵ
0 - 100 mm asph.
100 - 340 cr.gr.
340 - 640 br.sa. (SP)
640 - 1.5 m br.si.sa.stny. moist

10+176 3.4 m Rt. ϵ
0 - 120 mm asph.
120 - 340 cr.gr.
340 - 730 br.sa. (SP)
730 - 1.5 m br.si.sa. - sa.si.stny. wet

10+231 3.4 m Rt. ϵ
0 - 130 mm asph.
130 - 360 cr.gr.
360 - 700 br.sa. (SP)
700 - 1.5 m br.si.sa. wet

10+370 3.4 m Rt. ϵ
0 - 100 mm asph.
100 - 350 cr.gr.
350 - 580 br.sa. (SP)
580 - 1.5 m br.si.sa. - sa.si.stny. moist

10+664 3.4 m Rt. ϵ
0 - 80 mm asph.
80 - 280 cr.gr.
280 - 700 br.sa. (SP)
700 - 1.5 m br.si.sa.stny. moist

10+873 3.4 m Rt. ϵ
0 - 100 mm asph.
100 - 270 cr.gr.
270 - 660 br.sa. (SP)
660 - 1.5 m br.si.sa. moist

11+146 3.4 m Rt. ϵ
0 - 110 mm asph.
110 - 250 cr.gr.
250 - 510 br.sa. (SP)
510 - 770 br.sa.si. w/s cl. wet
770 - 1.5 m br.si.sa. moist-wet

11+376 3.4 m Rt. ϵ
0 - 50 mm asph.
50 - 230 cr.gr.
230 - 580 br.sa. (SP)
580 - 1.5 m br.si.sa.stny. moist

11+481 3.4 m Rt. ϵ
0 - 100 mm asph.
100 - 300 cr.gr.
300 - 750 br.sa. (SP)
750 - 1.5 m br.si.sa.stny. moist

11+699 4.8 m Rt. ϵ
0 - 110 mm asph.
110 - 280 cr.gr.
280 - 650 br.sa. (SP)
650 - 1.5 m br.stny.si.sa. moist

11+877 3.4 m Rt. ϵ
0 - 50 mm asph.
50 - 200 cr.gr.
200 - 630 br.sa. (SP)
630 - 1.5 m br.stny.si.sa. moist

11+931 3.4 m Rt. ϵ
0 - 100 mm asph.
100 - 280 cr.gr.
280 - 660 br.sa. (SP)
660 - 1.5 m br.stny.si.sa. moist

12+347 3.4 m Rt. ϵ
0 - 120 mm asph.
120 - 230 cr.gr.
230 - 550 br.sa. (SP)
550 - 1.1 m br.si.sa. - sa.si.stny. wet
1.1 - 1.4 dk.br.si.sa.tps. moist
1.4 - 1.8 br.stny.si.sa. moist

12+563 3.4 m Rt. ϵ
0 - 100 mm asph.
100 - 230 cr.gr.
230 - 530 br.sa. (SP)
530 - 1.5 m gry.br.si.sa.stny. moist

12+746 3.4 m Rt. ϵ
0 - 80 mm asph.
80 - 260 cr.gr.
260 - 570 br.sa. (SP)
570 - 1.0 m br.si.sa.stny. (wet 900 - 1.0 m)
1.0 - 1.5 gry.sa.si. w/s cl. wet

12+947 4.5 m Rt. ϵ
0 - 100 mm asph.
100 - 240 cr.gr.
240 - 550 br.sa. (SP)
550 - 1.2 m br.si.sa.
1.2 - 1.5 dk.br.si.sa.tps.
1.5 - 1.8 br.stny.si.sa. moist

13+086 3.4 m Rt. ϵ
0 - 100 mm asph.
100 - 260 cr.gr.
260 - 1.5 m br.si.sa. moist

13+249 3.4 m Rt. ϵ
0 - 80 mm asph.
80 - 270 cr.gr.
270 - 600 br.sa. (SP)
600 - 1.2 m br.si.sa.
1.2 - 1.5 dk.br.org.
1.5 - 1.8 br.si.sa. moist

13+477 3.4 m Rt. ϵ
0 - 80 mm asph.
80 - 300 cr.gr.
300 - 1.5 m br.si.sa. moist

13+706 3.4 m Rt. ϵ
0 - 70 mm asph.
70 - 250 cr.gr.
250 - 640 br.sa. (SP)
640 - 800 dk.br.si.sa.tps.
800 - 1.5 m br.si.sa.

13+980 3.4 m Rt. ϵ
0 - 80 mm asph.
80 - 200 cr.gr.
200 - 1.5m br.si.sa. moist

14+255 3.4 m Rt. ϵ
0 - 70 mm asph.
70 - 200 cr.gr.
200 - 1.5 m br.si.sa. moist

14+529 3.4 m Rt. ϵ
0 - 80 mm asph.
80 - 300 cr.gr.
300 - 700 br.si.sa.
700 - 1.0 m dk.br.si.sa.tps.
1.0 - 1.5 br.si.sa. moist

14+803 3.4 m Rt. ϵ
0 - 90 mm asph.
90 - 230 cr.gr.
230 - 1.5 m br.si.sa. moist

14+991 3.4 m Rt. ϵ
0 - 80 mm asph.
80 - 280 cr.gr.
280 - 900 br.si.sa.
900 - 1.5 m br.sa. (SP)

15+078 3.8 m Rt. ϵ
0 - 80 mm asph.
80 - 260 cr.gr.
260 - 1.5 m br.si.sa. moist

15+169 4.4 m Rt. ϵ
0 - 130 mm asph.
130 - 400 cr.gr.
400 - 2.2 m br.si.sa.stny. (wet 1.7-2.0 m)

15+215 3.3 m Rt. ϵ
0 - 120 mm asph.
120 - 300 cr.gr.
300 - 1.5 m br.stny.si.sa. moist

15+489 3.4 m Rt. ϵ
0 - 50 mm asph.
50 - 280 cr.gr.
280 - 600 br.sa. (SP)
600 - 800 dk.br.si.sa.tps.
800 - 1.4 m br.stny.si.sa.
1.4 - 1.8 dk.br.si.sa.tps.
1.8 - 2.1 br.si.sa.stny. moist

15+745 3.4 m Rt. ϵ
0 - 100 mm asph.
100 - 270 cr.gr.
270 - 2.0 m br.si.sa. (stny. 1.5 - 2.0 m)

15+859 3.4 m Rt. ϵ
0 - 120 mm asph.
120 - 200 cr.gr.
200 - 850 br.si.sa.
850 - 1.5 m gry.sa.si.stny. moist

16+106 3.4 m Rt. ϵ
0 - 100 mm asph.
100 - 200 cr.gr.
200 - 1.5 m br.si.sa.stny. moist

16+236 3.4 m Rt. ϵ
0 - 130 mm asph.
130 - 230 cr.gr.
230 - 600 br.si.sa.
600 - 900 br.si.sa.
900 - 1.5 m br.si.sa. moist

16+399 3.7 m Rt. ϵ
0 - 40 mm asph.
40 - 300 cr.gr.
300 - 1.7 m br.stny.si.sa. (1.0 - 1.7 m wet)

SOILS SURVEY DATA

DATE OF SURVEY	TYPE OF SURVEY
OCTOBER 1984	POWER AND HAND AUGER

NOTES

1. THE MOISTURE AND SURFACE CONDITIONS APPLY ONLY TO THE TIME OF THE SURVEY.
2. THE BOUNDARIES BETWEEN SOIL STRATA AND ALSO THE EARTH-ROCK CONTACT HAVE BEEN ESTABLISHED ONLY AT BORE HOLE LOCATIONS. BETWEEN BORE HOLES THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE AND MAY BE SUBJECT TO ERROR.

SCALE





Appendix B
Site Photographs



Photo 1 North Elevation of Pigeon River bridge Looking East



Photo 2 Looking West Over Pigeon River Bridge