

**Submitted To AECOM Canada Ltd.
189 Wyld Street Suite 103, North Bay, Ontario P1B 1Z2
On Behalf of the Ontario Ministry of Transportation**

**Dewatering System
Crooked Creek Culvert
Site No. 47-003
GWP 5131-08-00**

**Highway 66
8.0 km West of Highway 11**

FINAL DEWATERING SYSTEM REPORT

Date: December 6, 2013
Ref. N^o: 13/05/13073-F9

Geocres No. 42A-97

LVM | MERLEX

**Submitted To AECOM Canada Ltd.
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Crooked Creek Culvert
Site No. 47-003
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Final Dewatering System Report

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Client:

AECOM Canada Ltd.
 189 Wyld Street, Suite 103
 North Bay, Ontario
 P1B 1Z2
 Attention: **Mr. Al Rose**

| REVISION AND PUBLICATION REGISTER | | |
|-----------------------------------|------------|---|
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| 1 hard copy | File |

1 INTRODUCTION

LVM | MERLEX has been retained by AECOM Canada Ltd., on behalf of the Ministry of Transportation of Ontario (MTO), to provide design information for a potential dewatering system required for rehabilitation of an existing culvert. This culvert is located at Crooked Creek, on Highway 66, some 8.0 km West of Highway 11, in the Township of Eby, Site No. 47-003.

The project was specified by the MTO in the RFP/TPM documentation Agreement No. 5012-E-0025. The terms of reference for the scope of work are outlined in LVM | MERLEX's Proposal P-13-022, dated February, 2013. The factual information for this site was provided in the Foundation Investigation Report (FIR) prepared in 2008 by Shaheen & Peaker Limited (S&P), Geocres No. 42A-71. This report on dewatering system is to be read in conjunction with the Foundation Investigation and Design Report (FIDR) for this project.

2 HISTORICAL SUBSURFACE INFORMATION

A foundation investigation was carried out for the Crooked Creek Culvert in 2007, by Shaheen & Peaker Limited (S&P). The factual information from this investigation was provided in the FIR, Geocres No. 42A-71. Based on the information provided, the surficial geology of the area consists of glaciolacustrine fine grained deposits (i.e. silt, clay, and varved clay). The topography of the Site is generally flat.

The highway embankment centreline elevation varies from elevation 301.2 to 301.5m in the area of the culvert. Based upon the above referenced FIR, the subsurface conditions consist of a pavement structure overlying granular embankment fill described as sand to sandy gravel, in a loose to dense level of compactness. A 1.2 m thick layer of rock fill was encountered in the lower part of the embankment fills at Borehole No. S1. The embankment fills were some 3.5 to 4.3 m in height above original grade, at the culvert location. The boreholes advanced at the culvert ends, in the area of the required dewatering system, indicate the subsurface conditions consisted of a granular (sand) fill, some 1.4 to 1.6 m thick, underlain by a relatively thin (0.7 to 1.0 m thick) stratum of clayey silt to silty clay. This stratum was underlain by a relatively deep deposit of silt. The silt deposit was described as generally loose silt containing occasional firm to stiff cohesive (i.e. clayey) seams and zones. The silt deposit was encountered to depths of 14.2 to 18.3 m, elevation 285.8 to 283.0 m respectively. The silt deposit is underlain by a soft to stiff clayey silt deposit which is in turn underlain by rock fragments overlying bedrock at depths of 23.7 to 31.7 m (elevation 275.7 to 269.6 m respectively). For reference purposes, the historical borehole logs and borehole plan, by S&P have been included in Appendix 2.

2.1 GROUNDWATER DATA

Based on the historical information provided in the FIR, the groundwater level was recorded at elevations 296 to 298 m. A site review was carried out by LVM | Merlex, during preparation of

this report, and the water level in the creek was recorded at approximately elevation 298.2 m. During the site review, a beaver dam was observed upstream of the culvert. It appears that this dam retains approximately a 1 metre head of water.

3 DISCUSSION AND RECOMMENDATIONS

3.1 GENERAL

The culvert at this location is a 6.3x3.9 m Structural Plate Corrugated Steel Pipe Arch (SPCSPA), some 26.2 m in length. Flow through the culvert is from left to right (i.e. north to south) (see Photo Essay, Appendix 1). Based on the borehole data from the S&P foundation investigation, the soils at the inlet and outlet consist of some 150 mm of organics underlain by some 1.5 to 1.7 m of sand fill overlying the native soils which consist of a generally loose to compact silt stratum overlying very soft to soft clayey silts and sands overlying bedrock at depth.

It is understood that, based on the December 2007 Structural Evaluation Report, the pipe arch is structurally adequate to carry all loads as per the CHBDC. However the lower zone of the arch, at and below normal water line, has experienced some section loss due to corrosion. Present plans propose a culvert rehabilitation consisting of installing a concrete liner (lower half of pipe) and constructing cut-off walls, which will likely consist of steel sheet piling attached to the concrete liner.

In order to carry out this work geotechnical information for a dewatering system is required.

It should be noted that the Crooked Creek Culvert location is posted as a fish sanctuary.

3.2 DEWATERING

The culvert must be maintained in a dewatered condition during culvert rehabilitation. The groundwater level, in the fall of 2007, was recorded at approximately elevations 296 to 298 m during the field investigation carried out by S&P. The water level at the culvert was recorded at 298.2 m during our site review in July 2013. Dewatering, in accordance with OPSS 517 and 518, will be required during rehabilitation activities.

A slow flow was observed through the culvert at the time of the current site review. The water level in the creek was some 1.9 m above the culvert invert, at the outlet end. A relatively long beaver dam is present at a distance of some 20 m upstream of the culvert site. It appeared that the beaver dam was retaining a 1 m head of water. It is imperative that the integrity of the beaver dam be maintained during construction.

In order to dewater the culvert location a cofferdam will be required at the inlet and outlet. It is understood that in consideration of the 6.3 m width of the arch it would be possible to construct a cofferdam along the centre of the culvert allowing work in the dry on one side and permit bypass flow along the other side. Since the existing culvert is a closed SPCSPA, a gravity type cofferdam (i.e. sand bag or other sufficiently narrow gravity cofferdam system) could be used

along the center of the culvert to control flow to one side. Considering the corrugated cross section of the existing culvert, a seal (i.e. bentonite seal) would likely be required between the gravity cofferdam and existing culvert, for the dam to effectively contain water. A sheet pile wall fixed to the interior of the existing culvert could also be considered. Another option would be to use a small diameter bypass culvert/pipe inside, and located to one side, to allow bypass pumping through one half of the existing culvert while work is carried out on the opposite side.

As previously noted, a beaver dam is present a short distance upstream of the culvert. Due to safety concerns, associated with a breach in the beaver dam at the time of construction, a complete cofferdam at the inlet and outlet with bypass pumping through a temporary bypass pipe installed through the existing embankment is the preferred method of bypassing flow.

Considering the hydrostatic pressure associated with a 2 m head of water, a temporary gravity type or sheet pile type cofferdam would be appropriate at this location. To resist the 2 m hydrostatic pressure, a circular sheet pile wall will attain structural stability from its geometry and depth of penetration of the sheets, therefore may require minimal interior bracing. To minimize seepage below the cofferdam, the sheets should extend to a depth below the inside base equal to the depth of water above the base. It is likely that the depth of sheet penetration will be controlled by structural considerations and not seepage.

If a gravity type cofferdam (earth fill with a low permeable core) is considered, environmental constraints will control, specifically since this is a fish sanctuary. As such, a sand bag/metre bag or auquadam type dam may have to be used to minimize the risk of earth fines increasing the turbidity of the natural water course. Depending upon the base width of the cofferdam seepage may develop below the temporary sand bag wall, specifically close to the existing embankment slope where a sand deposit, some 1.5 m deep, was present overlying the lower permeable silt stratum. This may require pumping from filtered sumps within the dewater area.

Conceptual cofferdam sketches have been included in Appendix 3.

As noted above the beaver dam, located some 20 m upstream is holding back some 1 m head of water. Whichever type of cofferdam system is constructed, the cofferdam capacity must be sufficient to accommodate an increased sudden flow should the beaver dam be breached.

4 STATEMENT OF LIMITATIONS

The design recommendations given in this geotechnical report are applicable only to the project described in the text and only if constructed substantially in accordance with details of alignment and elevations stated in the report. Since all details of the design may not be known, in our analysis certain assumptions had to be made. The actual conditions may however, vary from those assumed, in which case changes and modifications may be required to our geotechnical recommendations. We recommend, therefore, that we be retained and provided the opportunity during the design stage to review the design drawings, site survey information, proposed elevations, etc. to verify that they are consistent with our recommendations or the assumptions made in our analysis. It is further recommended that we be retained to review the final design drawings and specifications relative to the geotechnical recommendations.

If, during construction, conditions in the field vary from those assumed at the design stage, an engineer from this office must be notified immediately.

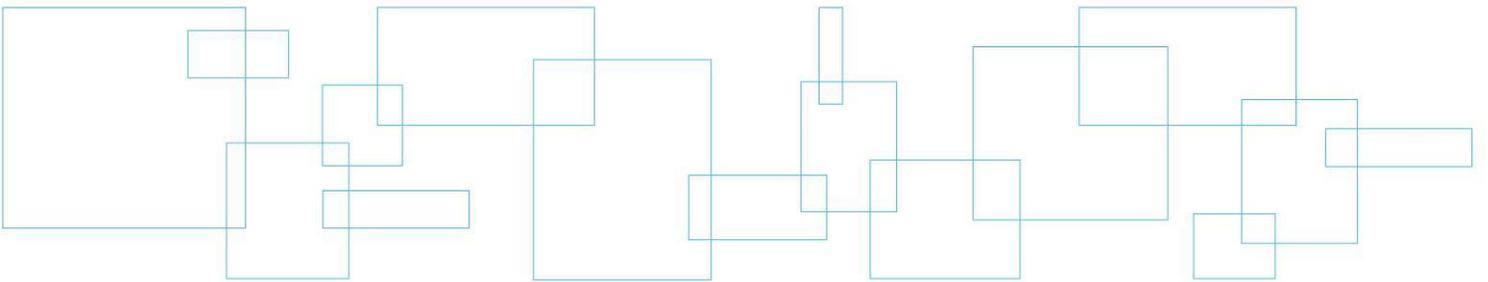
Proper subgrade preparation, groundwater control, compaction, etc. are all critical aspects of the bearing capacity of native soils. It must be noted that different aspects of the geotechnical design are based on the assumption that LVM | MERLEX will be retained during site preparation and construction of the proposed works to ensure that both the geotechnical site characteristics and the construction operations/techniques are consistent with our recommendations. Should LVM | MERLEX not be involved during the full construction phase, our liability is strictly limited to the factual information contained herein only.

Section 3 of this reported is intended for the use of the client and the design team only and is not intended to be included in the tender documents. Inclusion of the factual information (Sections 1 to 5 inclusive) in the tender documents is furnished merely for the general information of bidders and is not in any way warranted or guaranteed by or on behalf of the owner or the owner's consultants and its subconsultants or the consultants' or subconsultants' employees, and neither the owner nor its consultants or its employees shall be liable for any representations negligent or otherwise contained in the documents.

Appendix 1 Photo Essay

Enclosure No. 1:

Photo Essay



Culvert Inlet – Looking North

Photo: 1



Culvert Outlet – Looking South

Photo: 2



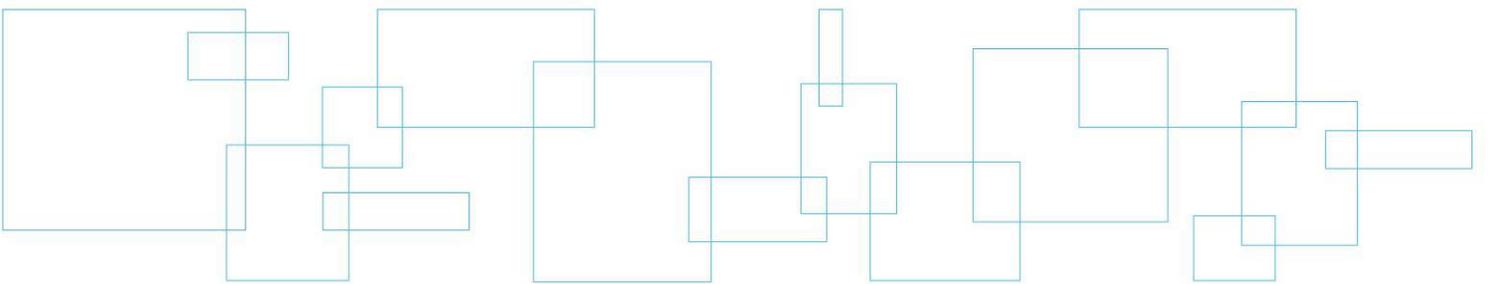
Project: Hwy 66 – Crooked Creek Culvert

Photos Provided By: LVM

Date: July 2013

Appendix 2 Historic Data

Shaheen and Peaker 2007 Borehole Data and Location Plan



NOTES:
FOR DETAILED SUBSURFACE CONDITIONS
REFER TO RECORD OF BOREHOLE SHEETS.

METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN. STATIONS
ARE IN KILOMETRES + METRES.

CONT No.
GWP: 448-98-00
Hwy 66- Crooked Creek Culvert
Town of Eby, ON
BOREHOLE LOCATIONS



SHEET

SHAHEEN & PEAKER LIMITED



KEY PLAN
N.T.S

LEGEND

Borehole

| No. | ELEV. | CO-ORDINATES | |
|-----|-------|--------------|----------|
| | | NORTH | EAST |
| C1 | 299.4 | 5322594.0 | 361406.8 |
| C2 | 300.0 | 5322554.7 | 361411.1 |
| C3 | 301.3 | 5322580.7 | 361412.3 |
| D1 | 300.0 | 5322690.4 | 361499.9 |
| D2 | 300.1 | 5322657.2 | 361469.5 |
| D3 | 299.9 | 5322621.6 | 361434.2 |
| D4 | 298.9 | 5322542.8 | 361362.0 |
| D5 | 299.8 | 5322507.4 | 361329.5 |
| S1 | 301.5 | 5322556.3 | 361390.2 |
| S2 | 301.2 | 5322600.8 | 361434.9 |

NOTE

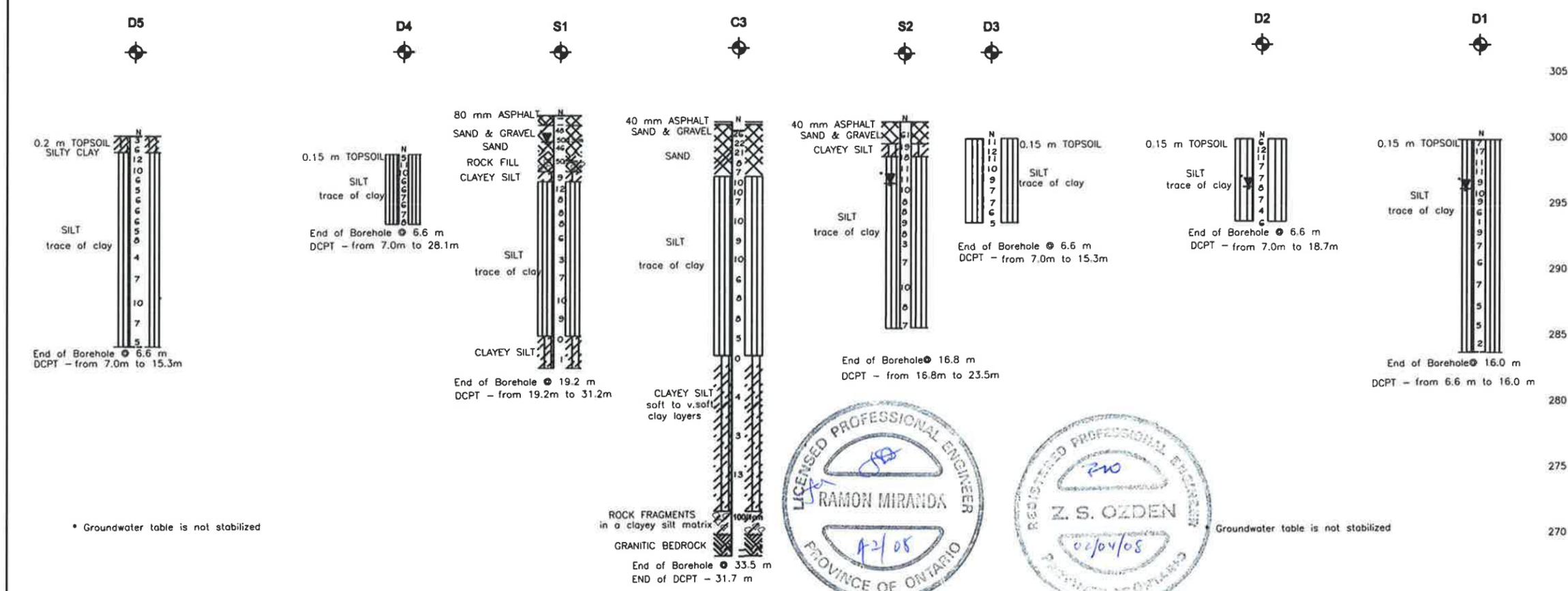
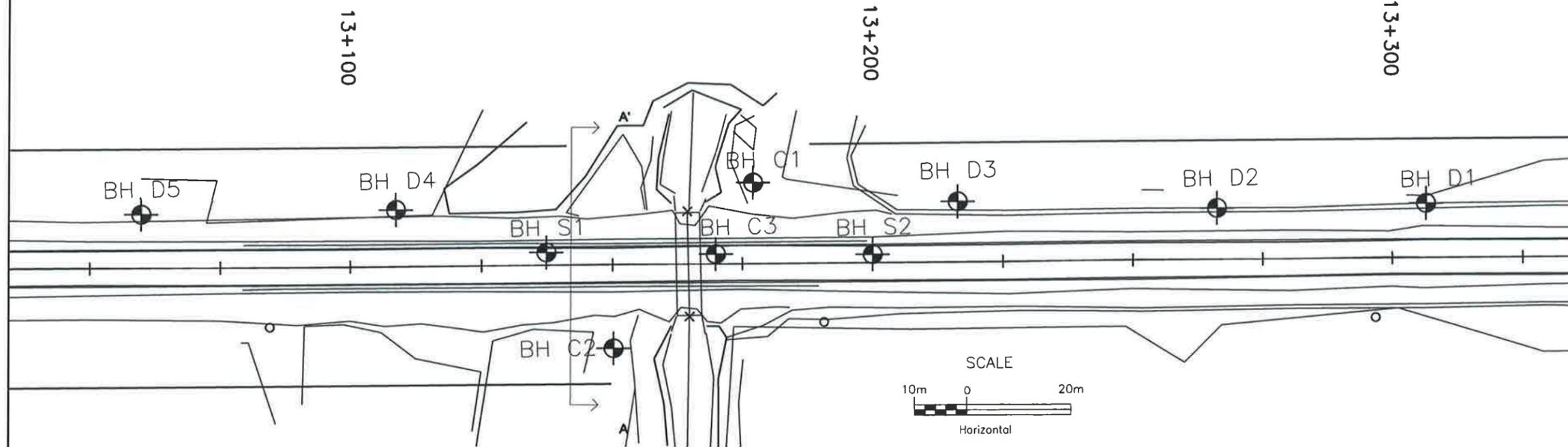
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in this report and related documents are specifically excluded in accordance with the conditions of Section GC 2.01 of OPS Gen. Cond.

| REV. | DATE | BY | DESCRIPTION |
|------|------|----|-------------|
| | | | |

Geocres No. 42A - 71

| SPT 1201 | | | DIST |
|----------|------------|----------------|-------|
| SUBM'D | CHECKED | DATE Jan, 2008 | SITE |
| DRAWN GR | CHECKED RM | APPROVED ZO | DWG 2 |



* Groundwater table is not stabilized

Groundwater table is not stabilized



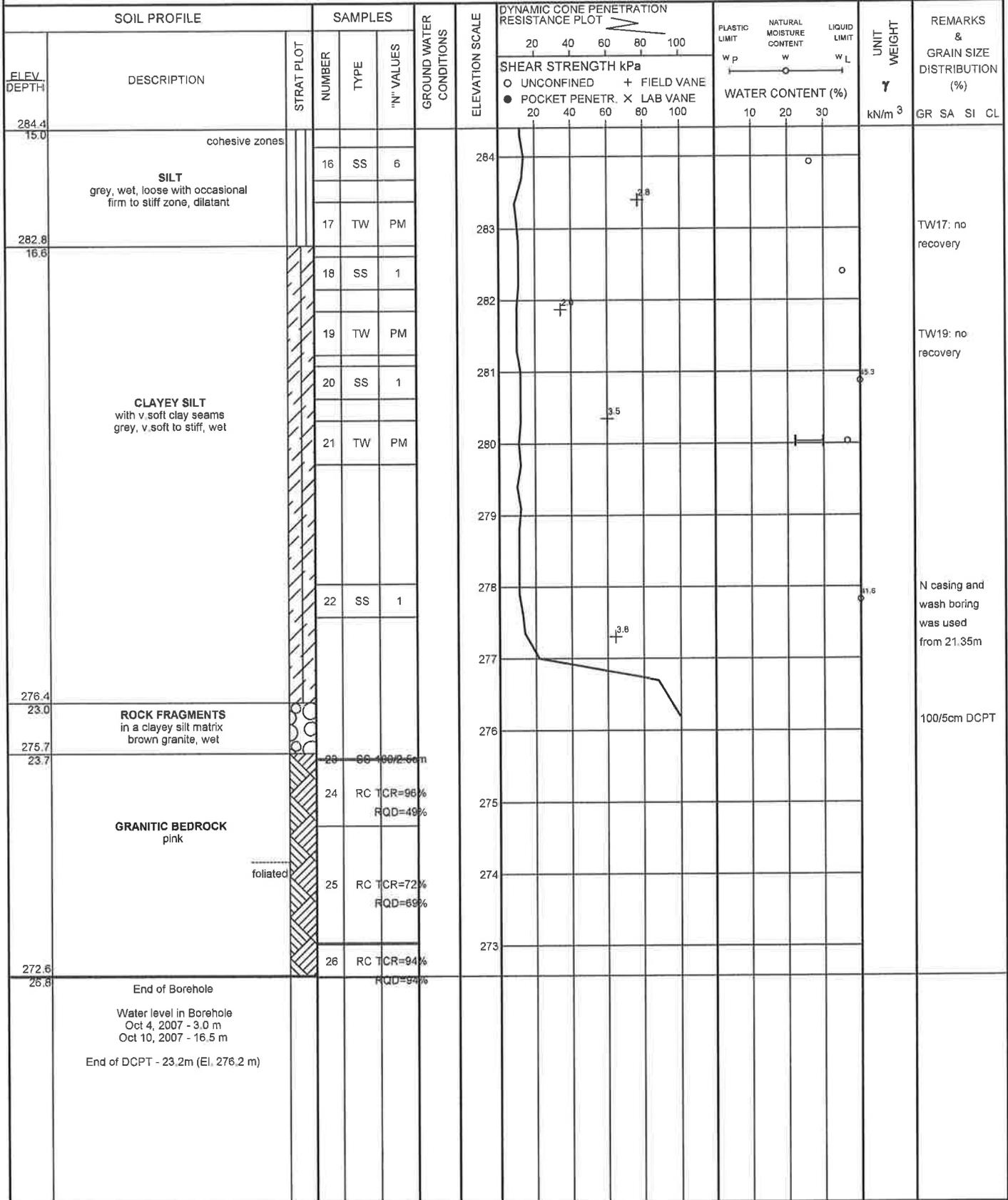
SPT 1201

RECORD OF BOREHOLE No C1

2 OF 2

METRIC

GWP 448-98-00 LOCATION Crooked Creek Culvert - Sta. 13+176 14.5 m Lt C/L ORIGINATED BY ZI
 DIST HWY 66 BOREHOLE TYPE Hollow Stem Auger & N-type Wash Boring & NQ Coring COMPILED BY GR
 DATUM Geodetic DATE 10/3/2007 10/11/2007 CHECKED BY ZO



+³, X³: Numbers refer to Sensitivity
 20
 15
 10
 (%) STRAIN AT FAILURE

SPT 1201

RECORD OF BOREHOLE No C2

1 OF 3

METRIC

GWP 448-98-00 LOCATION Crooked Creek Culvert - Sta. 13+150 15 m Rt C/L ORIGINATED BY ZI
 DIST HWY 66 BOREHOLE TYPE Hollow Stem Auger & N-type Wash Boring & NQ Coring COMPILED BY GR
 DATUM Geodetic DATE 10/25/2007 10/28/2007 CHECKED BY ZO

| SOIL PROFILE | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | PLASTIC LIMIT W _P | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|--------------|---|---------|------|------------|-------------------------|-----------------|--|----|---------------------------------|-------------------------------|--------------------------------|------------------|---------------------------------------|
| FLEV DEPTH | DESCRIPTION | NUMBER | TYPE | "N" VALUES | | | 20 | 40 | | | | | |
| 300.0 | GROUND SURFACE | | | | | | | | | | | | |
| 0.0 | 0.15 m TOPSOIL | 1 | SS | 6 | | | | | | | | | |
| | FILL: sand with some gravel grey to brown, moist | 2 | SS | 10 | | | | | | | | | |
| 298.4 | | 3 | SS | 12 | | | | | | | | | spoon wet |
| 1.6 | | 4 | SS | 13 | | | | | | | | | |
| | | 5 | SS | 9 | | | | | | | | | |
| | tr. organics | 6 | SS | 7 | | | | | | | | | |
| | | 7 | SS | 11 | | | | | | | | | |
| | SILT grey, tr. clay, wet, v. loose to loose with occasional firm to stiff zones, dilatant | 8 | SS | 8 | | | | | | | | | 0 0 92 8 |
| | | 9 | SS | 6 | | | | | | | | | |
| | | 10 | SS | 8 | | | | | | | | | |
| | | 11 | SS | 5 | | | | | | | | | 0 0 93 7 Non-Plastic |
| | | 12 | SS | 2 | | | | | | | | | |
| | with some clay zones | 13 | TW | PM | | | | | | | | | |
| | slightly more clay contents | 14 | SS | 8 | | | | | | | | | |
| | | 15 | SS | 9 | | | | | | | | | |
| 285.8 | | 16 | SS | 5 | | | | | | | | | |
| 14.2 | CLAYEY SILT grey, wet, with v. soft clay seams v. soft to stiff | | | | | | | | | | | | |
| 285.0 | | | | | | | | | | | | | |

Continued Next Page

+³ . X³ : Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

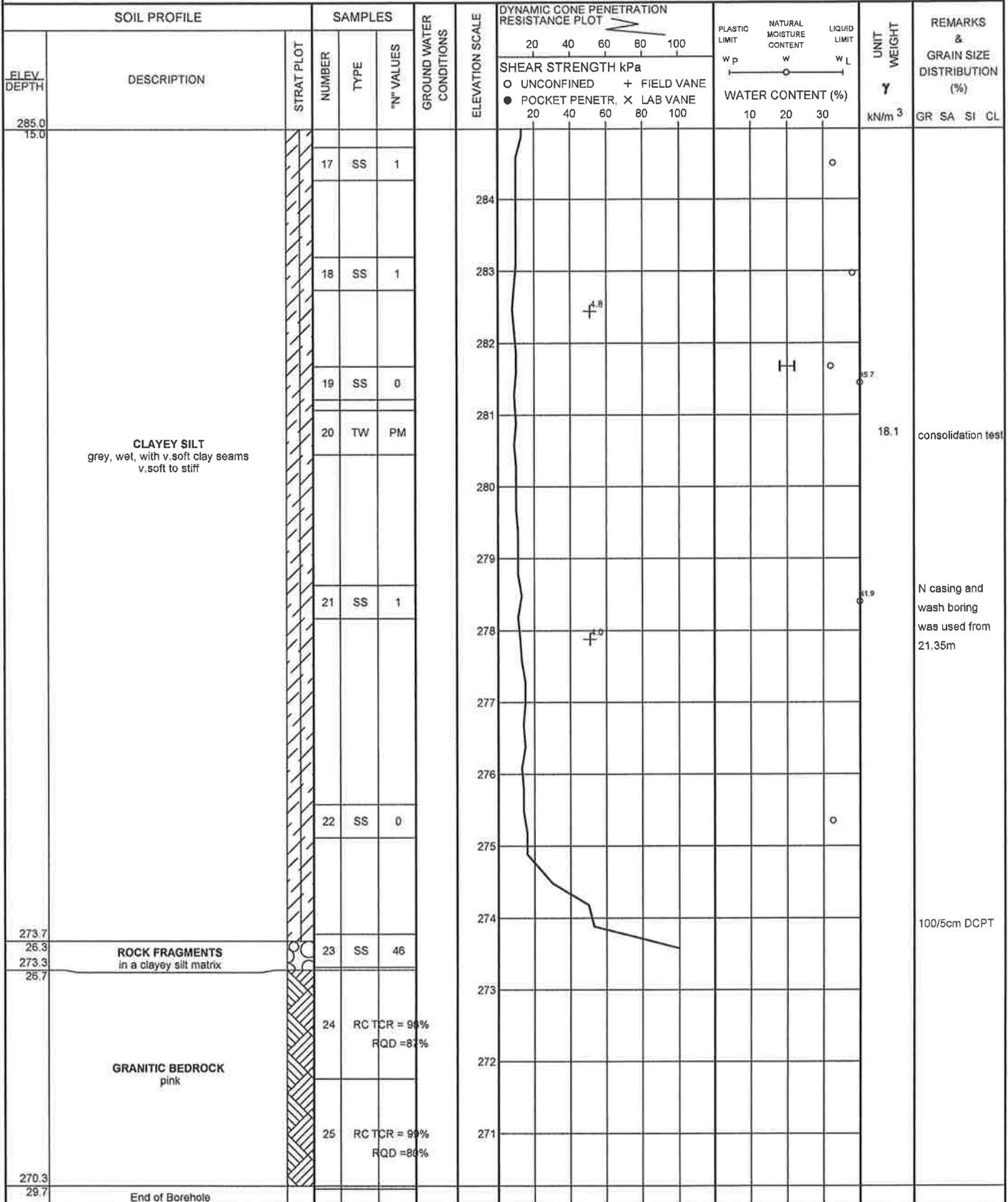
SPT 1201

RECORD OF BOREHOLE No C2

2 OF 3

METRIC

GWP 448-98-00 LOCATION Crooked Creek Culvert - Sta. 13+150 15 m Rt CL ORIGINATED BY ZI
 DIST HWY 86 BOREHOLE TYPE Hollow Stem Auger & N-type Wash Boring & NQ Coring COMPILED BY GR
 DATUM Geodetic DATE 10/25/2007 10/28/2007 CHECKED BY ZO



Continued Next Page

+³ X³: Numbers refer to Sensitivity 20
15 5
10 (%) STRAIN AT FAILURE

SPT 1201

RECORD OF BOREHOLE No C2

3 OF 3

METRIC

GWP 448-98-00 LOCATION Crooked Creek Culvert - Sta. 13+150 15 m Rt C/L ORIGINATED BY ZI
 DIST _____ HWY 66 BOREHOLE TYPE Hollow Stem Auger & N-type Wash Boring & NQ Coring COMPILED BY GR
 DATUM Geodetic DATE 10/25/2007 10/28/2007 CHECKED BY ZO

| SOIL PROFILE | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL | | | | |
|----------------|---|------------|--------|------|----------------------------|-----------------|---|--------------------|----|-----|----|------------------------------------|-------------------------------------|-----------------------------------|--|--|-------------------|----|--|--|
| ELEV. DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | | | "N" VALUES | SHEAR STRENGTH kPa | | | | | | | | | WATER CONTENT (%) | | | |
| | | | | | | 20 | 40 | 60 | 80 | 100 | 20 | 40 | 60 | 80 | 100 | 10 | 20 | 30 | | |
| 270.0 | Water level in Borehole Oct 25, 2007 - 15.2 m Oct 26, 2007 - 14.6 m End of DCPT-26.4 m (El. 273.6 m) | | | | | | | | | | | | | | | | | | | |

+³, X³: Numbers refer to Sensitivity
 20
 15 5
 10 (%) STRAIN AT FAILURE

SPT 1201

RECORD OF BOREHOLE No C3

1 OF 3

METRIC

GWP 448-98-00 LOCATION Crooked Creek Culvert - Sta. 13+170 1.5 m Lt C/L ORIGINATED BY _____
 DIST _____ HWY 66 BOREHOLE TYPE Hollow Stem Auger & NQ Coring COMPILED BY _____
 DATUM Geodetic DATE 10/11/2007 10/14/2007 CHECKED BY _____

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | PLASTIC LIMIT w _p | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|--------------|---|------------|---------|------|------------|-------------------------|-----------------|--|-------------------|---------------------------------|-------------------------------|--------------------------------|------------------|---------------------------------------|
| ELEV. DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | WATER CONTENT (%) | | | | | |
| 301.3 | GROUND SURFACE | | | | | | | | | | | | | |
| 0.0 | 40 mm ASPHALT | | 1 | AS | | | | | | | | | | |
| | 0.18 m SAND & GRAVEL | | 2 | AS | | | | | | | | | | |
| 300.5 | grey to brown, moist | | | | | | | | | | | | | |
| 0.8 | 0.57 m SAND | | 3 | SS | 26 | | | | | | | | | |
| | grey to brown, moist | | | | | | | | | | | | | |
| | tr. gravel | | 4 | SS | 22 | | | | | | | | | |
| | some gravel | | | | | | | | | | | | | |
| | FILL: sand | | 5 | SS | 21 | | | | | | | | | |
| | brown, moist | | | | | | | | | | | | | |
| | compact | | 6 | SS | 8 | | | | | | | | | |
| | loose | | | | | | | | | | | | | |
| 297.0 | | | 7 | SS | 7 | | | | | | | | | |
| 4.3 | | | | | | | | | | | | | | |
| | | | 8 | SS | 10 | | | | | | | | | 0 3 90 7 |
| | | | | | | | | | | | | | | |
| | | | 9 | SS | 10 | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | 10 | SS | 7 | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | 11 | SS | 10 | | | | | | | | | |
| | SILT | | | | | | | | | | | | | |
| | grey, trace of clay, wet, dilatant | | | | | | | | | | | | | |
| | loose with occasional firm to stiff zones | | | | | | | | | | | | | |
| | | | 12 | SS | 9 | | | | | | | | | 0 0 94 6 |
| | | | | | | | | | | | | | | Non-Plastic |
| | | | 13 | TW | PM | | | | | | | | | |
| | slightly more clay contents | | | | | | | | | | | | | |
| | | | 14 | SS | 10 | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | 15 | SS | 6 | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | 16 | SS | 8 | | | | | | | | | |
| | with occ. clay zones | | | | | | | | | | | | | |
| 286.3 | | | | | | | | | | | | | | |

Continued Next Page

+³, X³: Numbers refer to Sensitivity
 20
 15 5
 10 (%) STRAIN AT FAILURE

SPT 1201

RECORD OF BOREHOLE No C3

2 OF 3

METRIC

GWP 448-98-00 LOCATION Crooked Creek Culvert - Sta. 13+170 1.5 m Lt C/L ORIGINATED BY _____
 DIST _____ HWY 66 BOREHOLE TYPE Hollow Stem Auger & NQ Coring COMPILED BY _____
 DATUM Geodetic DATE 10/11/2007 10/14/2007 CHECKED BY _____

| SOIL PROFILE | | SAMPLES | | | GROUND WATER CONDITIONS | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | WATER CONTENT (%) | | | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) | |
|---------------|---|------------|--------|------|-------------------------|--|-----------------|---------------------------------|------------------------------|--------------------------------|--|---------------------------------------|---|
| ELEV. DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | | "N" VALUES | 20 40 60 80 100 | PLASTIC LIMIT (w _p) | NATURAL MOISTURE CONTENT (w) | LIQUID LIMIT (w _L) | | | |
| 286.3 15.0 | SILT grey, trace of clay, wet, dilatant loose with occasional firm to stiff zones with occ. clay zones | | 17 | SS | 8 | | | | | | | | |
| | | | | 18 | SS | 5 | | | | | | | |
| 283.0 18.3 | CLAYEY SILT grey, wet, with soft to v. soft clay layers v. soft to stiff with soft to v. soft clay layers with occ. clay zones | | 19 | SS | 0 | | | | | | | | |
| | | | | 20 | TW | PM | | | | | | 18.3 | consolidation test |
| | | | | 21 | SS | 4 | | | | | | | N casing and wash boring was used from 21.35m |
| | | | | 22 | SS | 3 | | | | | | | |
| | | | 23 | SS | 13 | | | | | | | | |
| 271.3 | | | | | | | | | | | | | |

Continued Next Page

+³ X³: Numbers refer to Sensitivity $\frac{20}{15} \times \frac{5}{10}$ (%) STRAIN AT FAILURE

SPT 1201

RECORD OF BOREHOLE No C3

3 OF 3

METRIC

GWP 448-98-00 LOCATION Crooked Creek Culvert - Sta. 13+170 1.5 m Lt C/L ORIGINATED BY _____
 DIST _____ HWY 66 BOREHOLE TYPE Hollow Stem Auger & NQ Coring COMPILED BY _____
 DATUM Geodetic DATE 10/11/2007 10/14/2007 CHECKED BY _____

| SOIL PROFILE | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|--------------|--------|------|----------------------------|-----------------|---|--------------------|---------------------------------|---|---|--|
| ELEV. DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | | | "N" VALUES | SHEAR STRENGTH kPa | | | | |
| | | | | | | 20 40 60 80 100 | 20 40 60 80 100 | 10 20 30 | W _p W W _L | | | |
| 271.3 30.0 | CLAYEY SILT grey, wet | | 24 | CC | 100/100 | | | | | | | |
| 270.8 30.5 | | | 25 | RC | TCR=32% RQD=0% | | | | | | | |
| 269.6 31.7 | ROCK FRAGMENTS in a clayey silt matrix | | 26 | RC | TCR=48% RQD=0% | | | | | | | |
| 267.8 33.5 | GRANITIC BEDROCK pink | foliated | 27 | RCT | TCR = 100% RQD = 100% | | | | | | 100/7.6cm DCPT | |
| End of Borehole Water level in Borehole Oct 12, 2007 - 13.1 m Oct 15, 2007 - 4.0 m End of DCPT - 31.7 m (El. 269.6 m) | | | | | | | | | | | | |

+³, X³: Numbers refer to Sensitivity $\frac{20}{15} \times \frac{5}{10}$ (%) STRAIN AT FAILURE

SPT 1201

RECORD OF BOREHOLE No D1

2 OF 2

METRIC

GWP 448-98-00 LOCATION Crooked Creek Culvert - Sta. 13+310 11 m Lt C/L / Sta 13+308 14 m Lt C/L ORIGINATED BY ZI
 DIST HWY 66 BOREHOLE TYPE Hollow Stem Auger COMPILED BY GR
 DATUM Geodetic DATE 10/15/2007 10/29/2007 CHECKED BY ZO

| SOIL PROFILE | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---------------|---|------------|--------|------|-------------------------|-----------------|--|--------------------|---|--|--|
| ELEV. DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | | | "N" VALUES | SHEAR STRENGTH kPa | | | |
| 285.0 15.0 | occ. clay seams SILT wet, dilatant | | 16 | SS | 2 | | | | | 45.8 | |
| 284.0 16.0 | End of Borehole @ 6.6 m on Oct 16, 2007 Water level in borehole - 3.7m upon completion Borehole was moved and redrilled to 15.7 m on Oct 29, 2007 | | | | | | 4.0 | | | | |

+³, X³: Numbers refer to Sensitivity
 20
 15
 10
 5
 (%) STRAIN AT FAILURE

SPT 1201

RECORD OF BOREHOLE No D2

1 OF 2

METRIC

GWP 448-98-00 LOCATION Crooked Creek Culvert - Sta. 13+265 11 m Lt C/L ORIGINATED BY ZI
 DIST HWY 66 BOREHOLE TYPE Hollow Stem Auger COMPILED BY GR
 DATUM Geodetic DATE 10/16/2007 CHECKED BY ZO

| SOIL PROFILE | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|--------------|--|------------|--------|------|-------------------------|-----------------|--|--------------------|---------------------------------|-------------------------------|--------------------------------|------------------|---------------------------------------|
| ELEV. DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | | | "N" VALUES | SHEAR STRENGTH kPa | | | | | |
| | | | | | | 20 40 60 80 100 | ○ UNCONFINED + FIELD VANE | 10 20 30 | | | | | |
| 300.1 0.0 | GROUND SURFACE | | | | | | | | | | | | |
| | 0.15 m TOPSOIL | | 1 | SS | 6 | | | | | | | | |
| | | | 2 | SS | 12 | | | | | | | | |
| | grey to brown grey | | 3 | SS | 11 | | | | | | | 0 1 92 7 | |
| | SILT wet, dilatant, loose to compact | | 4 | SS | 7 | | | | | | | | |
| | tr. organics | | 5 | SS | 7 | | 3.1 | | | | | | |
| | tr. organics | | 6 | SS | 8 | | 3.3 | | | | | | |
| | tr. clay | | 7 | SS | 7 | | 3.4 | | | | | | |
| | | | 8 | SS | 4 | | 2.6 | | | | | | |
| | | | 9 | SS | 6 | | 2.5 | | | | | | |
| 293.5 6.6 | End of Borehole @ 6.6m | | | | | | 2.6 | | | | | | |

Continued Next Page

+³, X³: Numbers refer to Sensitivity 20
15 5
10 (%) STRAIN AT FAILURE

SPT 1201

RECORD OF BOREHOLE No D2

2 OF 2

METRIC

GWP 448-98-00 LOCATION Crooked Creek Culvert - Sta. 13+285.11 m Lt C/L ORIGINATED BY ZI
 DIST HWY 66 BOREHOLE TYPE Hollow Stem Auger COMPILED BY GR
 DATUM Geodetic DATE 10/16/2007 CHECKED BY ZO

| SOIL PROFILE | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|--------------|--|-------------------|------|------------|-------------------------|-----------------|--|-----------------|---------------------------------|-------------------------------|--------------------------------|------------------|--|
| ELEV. DEPTH | DESCRIPTION | STRAT PLOT NUMBER | TYPE | "N" VALUES | | | 20 40 60 80 100 | 20 40 60 80 100 | | | | | |
| 285.1 | | | | | | | | | | | | | |
| 281.4 | | | | | | | | | | | | | |
| 18.7 | End of Borehole@ 6.6m Water level in borehole - 3.7m upon completion DCPT was performed from 7.0 m to 18.7 m | | | | | | | | | | | | 100/5cm DCPT |

+³, X³: Numbers refer to Sensitivity 20 15 10 (% STRAIN AT FAILURE

SPT 1201

RECORD OF BOREHOLE No D3

1 OF 2

METRIC

GWP 448-98-00 LOCATION Crooked Creek Culvert - Sta. 13+215 13 m Lt C/L ORIGINATED BY ZI
 DIST HWY 66 BOREHOLE TYPE Hollow Stem Auger COMPILED BY GR
 DATUM Geodetic DATE 10/16/2007 CHECKED BY ZO

| SOIL PROFILE | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL | |
|--------------|------------------------------------|------------|--------|------|-------------------------|-----------------|--|--------------------|---------------------------------|-------------------------------|--------------------------------|------------------|--|-------------------|
| ELEV. DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | | | "N" VALUES | SHEAR STRENGTH kPa | | | | | | WATER CONTENT (%) |
| | | | | | | 20 | 40 | 60 | 80 | 100 | 10 | 20 | 30 | |
| 299.9 0.0 | GROUND SURFACE | | | | | | | | | | | | | |
| | 0.15 m TOPSOIL | | 1 | SS | 11 | | | | | | | | | |
| | moist / brown wet / grey | | 2 | SS | 12 | 299 | | | | | | | | |
| | | | 3 | SS | 11 | 298 | | | | | | | | |
| | | | 4 | SS | 10 | | | | | | | | | |
| | SILT dilatant, loose to compact | | 5 | SS | 9 | 297 | | | | | | | | |
| | | | 6 | SS | 7 | 296 | | | | | | | | |
| | | | 7 | SS | 7 | 295 | | | | | | | | |
| | | | 8 | SS | 6 | 294 | | | | | | | | |
| | | | 9 | SS | 5 | 293 | | | | | | | | |
| 293.3 6.6 | End of Borehole @6.6m | | | | | | | | | | | | | |

Continued Next Page

+³, X³: Numbers refer to Sensitivity 20
15 5
10 (%) STRAIN AT FAILURE

SPT 1201

RECORD OF BOREHOLE No D3

2 OF 2

METRIC

GWP 448-98-00 LOCATION Crooked Creek Culvert - Sta. 13+215 13 m LI C/L ORIGINATED BY ZI
 DIST _____ HWY 66 BOREHOLE TYPE Hollow Stem Auger COMPILED BY GR
 DATUM Geodetic DATE 10/16/2007 CHECKED BY ZO

| SOIL PROFILE | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | | | PLASTIC LIMIT W _P | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|----------------|---|----------------------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---|--|
| ELEV. DEPTH | DESCRIPTION | STRAT PLOT NUMBER | TYPE | "N" VALUES | | | 20 | 40 | 60 | 80 | 100 | | | | | |
| 284.9 | | | | | | | | | | | | | | | | |
| 284.6 | | | | | | | | | | | | | | | | |
| 15.3 | End of Borehole @6.6m Borehole dry upon completion (not stabilized) DCPT was performed from 7.0 m to 15.3 m | | | | | 284 | | | | | | | | | | |

SPT 1201

RECORD OF BOREHOLE No D4

1 OF 2

METRIC

GWP 448-98-00 LOCATION Crooked Creek Culvert - Sta. 13+108 13 m Lt C/L ORIGINATED BY ZI
 DIST HWY 66 BOREHOLE TYPE Hollow Stem Auger COMPILED BY GR
 DATUM Geodetic DATE 10/17/2007 CHECKED BY ZO

| SOIL PROFILE | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---------------|--------------------------------------|---------------|--------|------|----------------------------|-----------------|---|--------------------|---------------------------------|-------------------------------------|-----------------------------------|--|--|
| FLEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | | | "N" VALUES | SHEAR STRENGTH kPa | | | | | |
| 298.9 0.0 | GROUND SURFACE | | | | | | | | | | | | |
| | 0.15 m TOPSOIL | | 1 | SS | 5 | | | | | | | | |
| | | | 2 | SS | 11 | 298 | | | | | | 0 2 91 7 | |
| | | brown grey | 3 | SS | 10 | 297 | | | | | | | |
| | | | 4 | SS | 6 | 296 | | | | | | 0 2 92 6 | |
| | SILT trace of clay, wet, dilatant | | 5 | SS | 6 | 296 | 3.3 | | | | | no recovery | |
| | | | 6 | SS | 7 | 295 | 3.0 | | | | | | |
| | | | 7 | SS | 6 | 294 | 3.0 | | | | | | |
| | | | 8 | SS | 7 | 293 | 2.9 | | | | | | |
| | | | 9 | SS | 8 | 292 | 3.0 | | | | | no recovery | |
| 292.3 6.6 | End of Borehole @6.6m | | | | | 292 | 2.9 | | | | | | |
| | | | | | | 291 | | | | | | | |
| | | | | | | 290 | | | | | | | |
| | | | | | | 289 | | | | | | | |
| | | | | | | 288 | | | | | | | |
| | | | | | | 287 | | | | | | | |
| | | | | | | 286 | | | | | | | |
| | | | | | | 285 | | | | | | | |
| | | | | | | 284 | | | | | | | |

Continued Next Page

+ 3 . X 3 : Numbers refer to Sensitivity 20 15 5 10 (%) STRAIN AT FAILURE

SPT 1201

RECORD OF BOREHOLE No D4

2 OF 2

METRIC

GWP 448-98-00 LOCATION Crooked Creek Culvert - Sta. 13+108 13 m Lt C/L ORIGINATED BY ZI
 DIST _____ HWY 66 BOREHOLE TYPE Hollow Stem Auger COMPILED BY GR
 DATUM Geodetic DATE 10/17/2007 CHECKED BY ZO

| SOIL PROFILE | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---------------|--|------------|--------|------|----------------------------|--------------------|---|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | | | | | | | | |
| 283.9 | | | | | | | | | | | | |
| 270.4 28.5 | End of Borehole @6.6m DCPT was performed from 7.0 m to 28.1 m | | | | | | | | | | | 100/6cm DCPT |

+³, X³: Numbers refer to Sensitivity
 20
 15 ⊕ 5
 10 (%) STRAIN AT FAILURE

SPT 1201

RECORD OF BOREHOLE No D5

1 OF 2

METRIC

GWP 448-98-00 LOCATION Crooked Creek Culvert - Sta 13+060 13 m Lt C/L / Sta 13+062 13 m Lt C/L ORIGINATED BY ZI
 DIST _____ HWY 66 BOREHOLE TYPE Hollow Stem Auger COMPILED BY GR
 DATUM Geodetic DATE 10/16/2007 10/29/2007 CHECKED BY ZO

| SOIL PROFILE | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | PLASTIC LIMIT W _P | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|--------------|--|---------|------|------------|-------------------------|-----------------|--|-------------------|---------------------------------|-------------------------------|--------------------------------|------------------|---------------------------------------|
| ELEV. DEPTH | DESCRIPTION | NUMBER | TYPE | "N" VALUES | | | 20 40 60 80 100 | 40 80 120 160 200 | | | | | |
| 299.8 0.0 | GROUND SURFACE | | | | | | | | | | | | |
| | 0.2 m TOPSOIL | 1 | SS | 3 | | | | | | | | | |
| | SILTY CLAY brown, moist, soft to firm | 2 | SS | 6 | | | | | | | | | |
| 298.6 1.2 | | 3 | SS | 12 | | | | | | | | | |
| | | 4 | SS | 10 | | | | | | | | | |
| | | 5 | SS | 6 | | | | | | | | | |
| | | 6 | SS | 5 | | | | | | | | | |
| | | 7 | SS | 6 | | | | | | | | | |
| | | 8 | SS | 6 | | | | | | | | | |
| | | 9 | SS | 6 | | | | | | | | | |
| | | 10 | SS | 5 | | | | | | | | | |
| | SILT trace of clay, wet loose to compact, dilatent | 11 | SS | 8 | | | | | | | | | |
| | | 12 | SS | 4 | | | | | | | | | |
| | | 13 | SS | 7 | | | | | | | | | |
| | | 14 | SS | 10 | | | | | | | | | |
| | | 15 | SS | 7 | | | | | | | | | |
| 284.8 | | | | | | | | | | | | | |

Continued Next Page

+³, X³: Numbers refer to Sensitivity
 20
 15
 10 (%) STRAIN AT FAILURE

SPT 1201

RECORD OF BOREHOLE No S1

1 OF 3

METRIC

GWP 448-98-00 LOCATION Crooked Creek Culvert - Sta. 13+137 1.4 m Lt C/L ORIGINATED BY ZI
 DIST HWY 66 BOREHOLE TYPE Hollow Stem Auger & N-type Wash Boring COMPILED BY GR
 DATUM Geodetic DATE 10/2/2007 10/4/2007 CHECKED BY ZO

| SOIL PROFILE | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | PLASTIC LIMIT w _p | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|--------------|---------------------------------------|------------|--------|------|-------------------------|-----------------|--|--------------------|---------------------------------|-------------------------------|--------------------------------|------------------|---------------------------------------|
| ELEV. DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | | | "N" VALUES | SHEAR STRENGTH kPa | | | | | |
| | | | | | | 20 40 60 80 100 | 40 80 120 160 200 | 10 20 30 | | | KN/m ³ | GR SA SI CL | |
| 301.5 | GROUND SURFACE | | | | | | | | | | | | |
| 0.0 | 80mm ASPHALT | | 1 | AS | --- | | | | | | | | |
| | 0.19 m SAND & GRAVEL | | 2 | AS | --- | | | | | | | | |
| 300.8 | brown, moist | | | | | | | | | | | | |
| 0.8 | 0.48 m SAND | | 3 | SS | 48 | | | | | | | | |
| | brown to grey, trace of gravel, moist | | | | | | | | | | | | |
| | FILL:sand | | 4 | SS | 50/13cm | | | | | | | | |
| | brown, trace of gravel | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| 298.8 | | | 5 | SS | 46 | | | | | | | | |
| 2.8 | FILL:sandy gravel | | | | | | | | | | | | |
| 298.4 | brown, wet | | 6 | SS | 60/3cm | | | | | | | | |
| 3.1 | | | | | | | | | | | | | |
| | FILL:rock | | 7 | RC | | | | | | | | | |
| | granite, with some sand & gravel | | | | | | | | | | | | |
| 297.2 | | | | | | | | | | | | | |
| 4.3 | CLAYEY SILT | | 8 | SS | 9 | | | | | | | | |
| | with some peat, trace of rootlets | | | | | | | | | | | | |
| 296.5 | trace of sand, with some gravel, wet | | | | | | | | | | | | |
| 5.0 | | | | | | | | | | | | | |
| | | | 9 | SS | 12 | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | 10 | SS | 8 | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | 11 | SS | 8 | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | 12 | SS | 8 | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | 13 | SS | 6 | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | 14 | SS | 3 | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | 15 | SS | 7 | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | 16 | SS | 10 | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| 286.5 | | | | | | | | | | | | | |

Continued Next Page

+³, X³: Numbers refer to Sensitivity
 20
 15 5
 10 (%) STRAIN AT FAILURE

SPT 1201

RECORD OF BOREHOLE No S1

2 OF 3

METRIC

GWP 448-98-00 LOCATION Crooked Creek Culvert - Sta. 13+137 1.4 m Lt C/L ORIGINATED BY ZI
 DIST HWY 66 BOREHOLE TYPE Hollow Stem Auger & N-type Wash Boring COMPILED BY GR
 DATUM Geodetic DATE 10/2/2007 10/4/2007 CHECKED BY ZO

| SOIL PROFILE | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | PLASTIC LIMIT w _p | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w _L | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|----------------|--|------------|--------|------|----------------------------|-----------------|---|--------------------|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV. DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | | | "N" VALUES | SHEAR STRENGTH kPa | | | | | |
| 286.5 15.0 | SILT grey, trace of clay, wet, dilatant loose with occasional firm to stiff zones | | 17 | SS | 9 | | | | | | | | |
| 284.7 16.8 | | | | 18 | SS | 0 | | | | | | | |
| 282.3 19.2 | CLAYEY SILT with v. soft clay layers | | | 19 | SS | 1 | | | | | | | |
| | | | | | | | | | | | | | |

+ 3 . X 3³ Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

Continued Next Page

Dynamic cone penetration blows are 0 blows/feet from 19.2 to 23.2 m.

SPT 1201

RECORD OF BOREHOLE No S1

3 OF 3

METRIC

GWP 448-98-00 LOCATION Crooked Creek Culvert - Sta. 13+137 1.4 m Lt C/L ORIGINATED BY ZI
 DIST _____ HWY 66 BOREHOLE TYPE Hollow Stem Auger & N-type Wash Boring COMPILED BY GR
 DATUM Geodetic DATE 10/2/2007 10/4/2007 CHECKED BY ZO

| SOIL PROFILE | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|----------------|---|----------------------|------|------------|----------------------------|-----------------|---|-----------------|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV. DEPTH | DESCRIPTION | STRAT PLOT NUMBER | TYPE | "N" VALUES | | | 20 40 60 80 100 | 20 40 60 80 100 | | | | | |
| 271.5 | | | | | | | | | | | | | |
| 270.3 | | | | | | | | | | | | | |
| 31.2 | End of Borehole @ 19.2 m DCPT was performed from 19.2 m to 31.2 m Water level in Borehole Oct 02, 2007 - 3.2 m Oct 03, 2007 - 1.8 m | | | | | | | | | | | 100/5cm DCPT | |

+³, X³: Numbers refer to Sensitivity 20
15
10 (5) STRAIN AT FAILURE

SPT 1201

RECORD OF BOREHOLE No S2

2 OF 2

METRIC

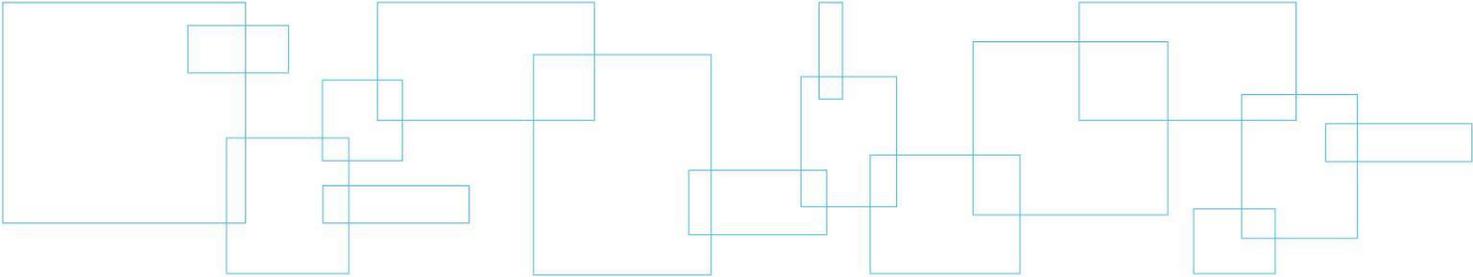
GWP 446-98-00 LOCATION Crooked Creek Culvert - Sta. 13+200 1.5 m Lt C/L ORIGINATED BY ZI
 DIST HWY 66 BOREHOLE TYPE Hollow Stem Auger COMPILED BY GR
 DATUM Geodetic DATE 10/14/2007 CHECKED BY ZO

| SOIL PROFILE | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---------------|--|------------|--------|------|-------------------------|-----------------|--|--------------------|---------------------------------|-------------------------------|--------------------------------|---------------------------------------|--|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | | | "N" VALUES | SHEAR STRENGTH kPa | | | | | |
| 286.2 15.0 | SILT trace of clay, wet, dilatant loose to compact with occasional firm to stiff zones | | 15 | SS | 7 | | 20 | 40 | 60 | 80 | 100 | | |
| 285.5 15.7 | | | | | | | | | | | | | |
| 277.7 23.5 | End of Borehole @ 16.8 m DCPT was performed from 16.8 m to 23.5 m * Water level @ 4.3 m upon completion (not stabilized) | | | | | | | | | | | 100/2.5cm DCPT | |

+³, X³: Numbers refer to Sensitivity
 20
 15 5
 10 (%) STRAIN AT FAILURE

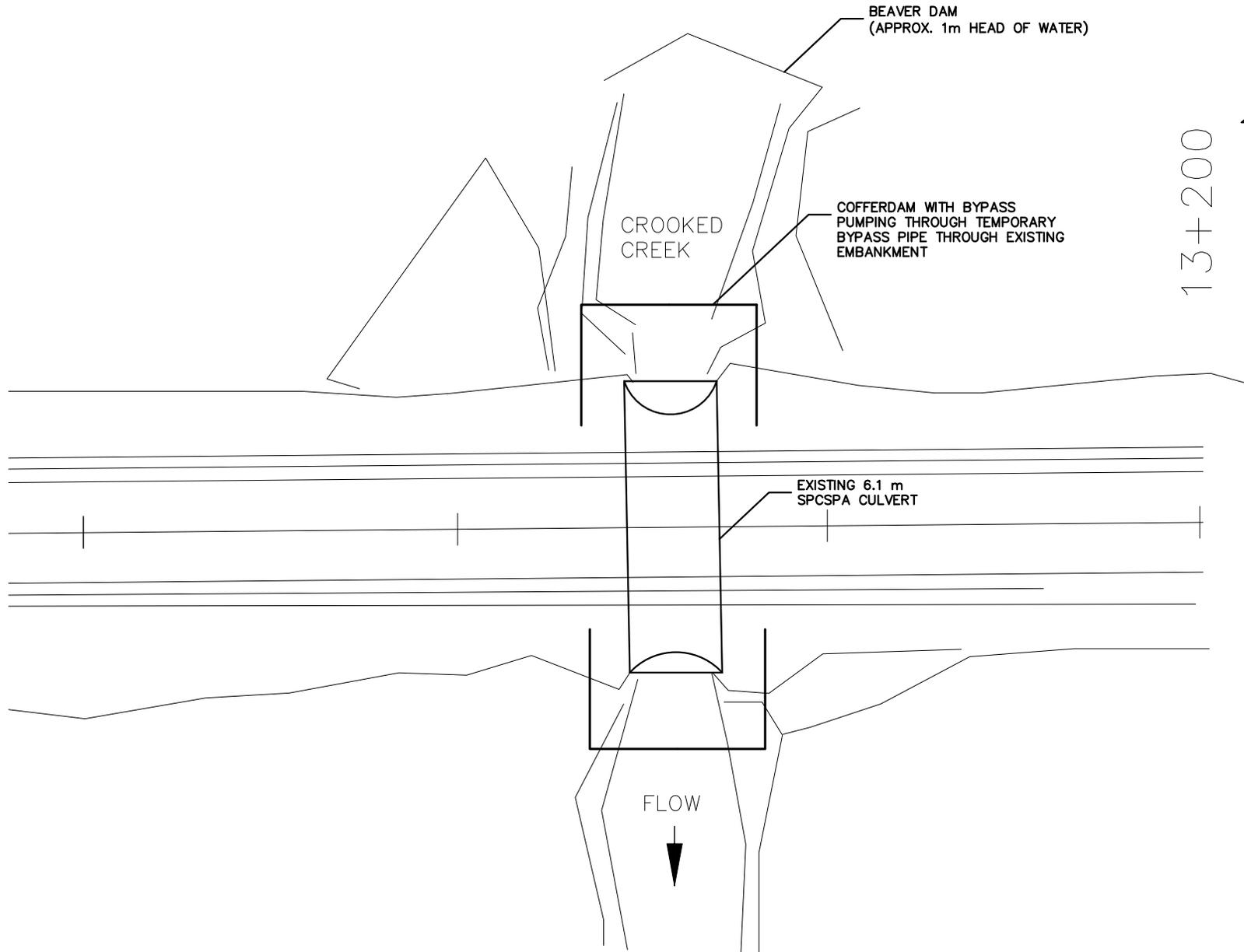
Appendix 3 Design Data

Sketch Nos. 1 and 2: Conceptual Cofferdam Sketch





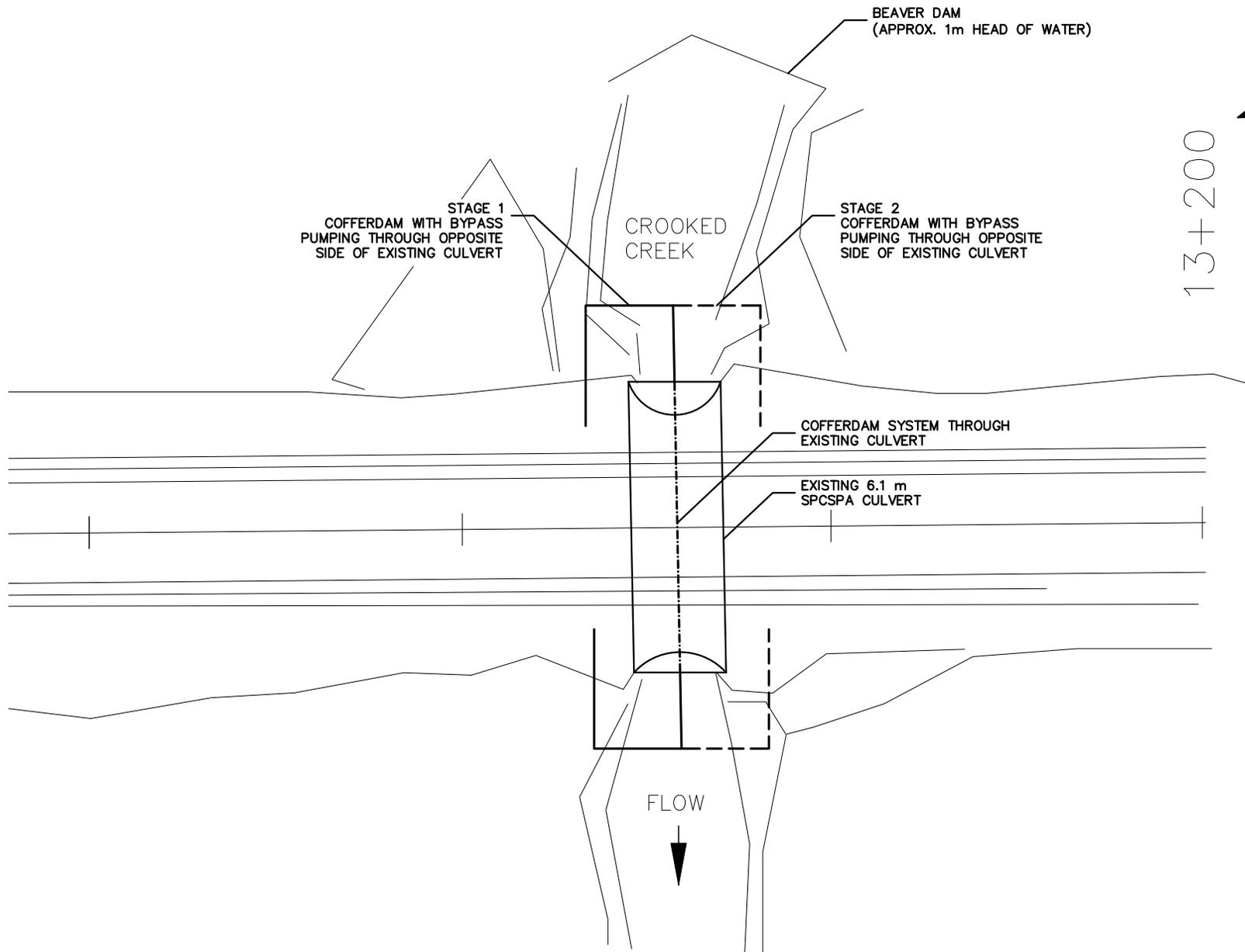
13+200



Not to Scale



13+200



Not to Scale