

**Foundation Investigation Report
Highway Platform Widening, Highway 11
Station 12+700 to Station 12+800,
Township of Chamberlain
W.P. 109-98-00
MTO District 53, New Liskeard**

Prepared for:

**MINISTRY OF TRANSPORTATION
447 McKeown Avenue, Suite 301
NORTH BAY, Ontario
P1B 9S9**

and

**D.F. Elliott Consulting Engineers Ltd.
36 Lakeshore Road, Box 2525
NEW LISKEARD, Ontario
P0J 1P0**

Trow Consulting Engineers Ltd.

Geocres No. 31M-61
1074 Webbwood Drive
Sudbury, Ontario P3C 3B7
Telephone: (705) 674-9681
Facsimile: (705) 674-8271

S08131G/L1
February 19, 2002

TABLE OF CONTENTS

PART 1 – FOUNDATION INVESTIGATION

1.0	INTRODUCTION.....	1
1.1	Site Description	1
1.2	Geological Setting.....	2
1.3	Investigative Procedures	2
1.3.1	Previous Investigation	2
1.3.2	Current Investigation	3
1.3.3	Laboratory Program	4
1.4	Subsurface Conditions.....	4
1.4.1	Fill (Sand and Gravel)	5
1.4.2	Fill (Silt)	5
1.4.3	Alluvial Silty Clay	5
1.4.4	Alluvial Silty Sand.....	5
1.4.5	Silty Clay.....	5
1.5	Groundwater Conditions	6
2.0	CLOSING COMMENTS	10

APPENDICES

LIMITATIONS	Appendix I
DRAWINGS AND PHOTOGRAPHS	Appendix II
BOREHOLE LOGS	Appendix III
LABORATORY TEST RESULTS	Appendix IV

Part 1 - Foundation Investigation

1.0 INTRODUCTION

This report addresses the results of a geotechnical foundation investigation conducted by Trow Consulting Engineers Ltd. ("Trow") for a proposed highway platform widening and a subsequent grade raise of approximately 200 mm. Originally, a North bound passing lane was proposed on Highway 11 between Station 10+220 and 13+290 (Chamberlain Township). Adding the passing lane would have required the embankment to be widened and the existing culvert to be extended at approximately Station 12+750, Chamberlain Township, MTO District 53 (New Liskeard). Since the commencement of the project, the limits for the North Bound passing lane were altered, beginning at Station 10+800 (Dack Township) and ending at Station 11+200 (Chamberlain Township). Although the entire length will no longer be fully widened to accommodate a passing lane, the area will be widened to bring the existing shoulders and roundings to current design specifications. The following investigation was completed to assess the design parameters required for widening the embankments between Station 12+700 and Station 12+800 (Chamberlain Township).

1.1 SITE DESCRIPTION

This site is located in the Township of Chamberlain (District of Timiskaming) on Highway 11, approximately 4.75 km north of the junction of Highways 11 and 560 (near the Town of Englehart). The approximate stationing of this site is from Station 12+700 to 12+800 (Chamberlain Township).

The centre of a small creek is situated near Station 12+750 as indicated on the Site Plan, Drawing 1 in Appendix II. The creek approaches the embankment from the west about 50 m south of the culvert, and flows parallel to the toe of the embankment before crossing underneath the roadway. On the east side of the highway the creek flows towards the north. The creek has a depth of about 250 mm under normal flow conditions.

The overall terrain in the vicinity of the site is generally flat and relatively level on either side of the stream bed. The creek bed has steep walls with grasses and shrubs as the primary vegetative cover. The surrounding area contains mature deciduous and coniferous trees. Single family dwellings, along with various farm buildings, are found on the northeast, southwest, and southeast quadrants of the site, approximately 150 to 200 m from the existing centreline culvert. Photographs of the site are shown in Appendix II.

The embankment on the right (east) side of the highway has a slope of about 2H:1V to about 2.4H:1V, with a maximum height of approximately 8 m. The embankment on the left (west) side of the highway has a slope of about 2H:1V to about 3H:1V, also with a height of about 8 m. Cross-sections of the embankment are shown in Drawings 2 and 3 in Appendix II.

A concrete box culvert approximately 6100 mm wide by 1500 mm high was located about 7.5 m north of the current culvert prior to 1996. As a result of centerline cracking, a 4200 mm diameter structural plate pipe was installed in 1996 by tunneling into the side of the embankment. After installing the structural plate pipe culvert, the concrete box culvert was filled with non-shrink grout, and abandoned in place. A portion of the plan view supplied with the contract drawings for culvert replacement (Contract 50-96-1041) was copied and included as Drawing 4 (Appendix II).

The highway crosses the creek via a granular/earth fill embankment, with the culvert located in the centre of the creek bed. The construction date of the embankment is unknown, however, the highway at this location has been on the current alignment for at least the last 50 years. The side slopes of the existing embankment are covered with grasses and small shrubs. As part of the culvert replacement work in 1996, rip rap protection was added to the lower portion of the side slope in the vicinity of the new pipe culvert on both the left side and the right side of the highway. Road side ditches that flow along both sides of the highway empty into the creek. Rip rap was also added to these ditches as a part of the 1996 work.

1.2 GEOLOGICAL SETTING

According to OGS Map 2555, the bedrock beneath the site is a foliated tonalite suite ranging in composition from tonalite to granodiorite (foliated to massive) that is Neo to Mesoarchean in age. The overburden soils are mainly glaciolacustrine deposits (OGS Map 2543) comprised of silt and clay with minor amounts of sand. Soil deposition occurred in a low energy environment, such as a basin or in quiet water. Rhythmically bedded silt and clay (varved clay) are common in this area.

1.3 INVESTIGATIVE PROCEDURES

1.3.1 *Previous Investigation*

Trow completed a geotechnical investigation at this site (Trow report S07015G, dated July 29, 1996) for the MTO regarding the replacement of the original concrete box culvert with the existing steel plate culvert. As part of this previous investigation, two boreholes (BH-3 and BH-4) were advanced at the culvert location on July 11, 1996. The feasibility of tunneling through the embankment was assessed by advancing the two boreholes from the top of the embankment, through the embankment, and into the underlying native soil.

The previous boreholes were advanced using a track-mounted CME-55 drill rig, equipped with solid and hollow stem augers, supplied by Master Soils Investigations. Soil samples were obtained by using a 51 mm OD split spoon sampler, in conjunction with standard penetration tests at approximately 1.5 m intervals. The standard penetration test 'N' values were recorded during advancement of the boreholes.

Two undisturbed thin walled "Shelby" tube samples (50 mm diameter) were obtained in the cohesive underlying deposit. The in-situ undrained shear strength of the cohesive soils was determined by field vane testing completed in both boreholes. The field vane had dimensions of

152 mm long by 70 mm diameter, not including the 45° point. Torque measurements were made using two calibrated scales on a calibrated lever arm threaded to the drill rods. Following completion of the boreholes, water level measurements were obtained in the open boreholes. The boreholes were subsequently backfilled in accordance with the Ministry of Transportation guidelines.

Details of the soil strata and groundwater conditions encountered in the boreholes BH-3 and BH-4 are included in Appendix III, and plotted on the profile on Drawing 1 and 2 in Appendix II. Further information on soil descriptions and classification are contained on Figure 1.

All of the recovered soil samples were sealed in the field to prevent moisture loss, and transported to Trow's Sudbury laboratory for detailed visual examination, routine moisture content determination, and classification.

The locations of the previous boreholes are presented on the Site Plan (Drawing 1), located in Appendix II. The boreholes were originally referenced to the guard rail posts, and no stations or UTM coordinates were obtained. The boreholes were then situated on the current site plan with respect to the guard rail post locations supplied with the current survey information. UTM coordinates were estimated assuming the locations of the guard rail post were unchanged during the two site investigations. The borehole depths were referenced assuming an elevation of 100.0 m at the centerline of the highway above the centerline of the culvert. This datum was assigned in the original report. The current centreline profile and cross sections shown on Drawings 1 and 2 assume that this datum has not varied appreciably between the two investigations. The borehole elevations were also correlated utilizing the survey information supplied by the prime consultant D.F. Elliott Consulting Engineers Ltd. ("D.F. Elliott").

1.3.2 Current Investigation

The current field investigation was completed on April 27, 2000, and September 19, 2000. The investigation consisted of three (3) boreholes advanced through the overburden soils at the toe of the existing embankment. Borehole BH-18A, drilled on April 27, 2000, was advanced using a Bombardier mounted CME-55 drill rig, equipped with solid and hollow stem augers. The drill rig was supplied by an MTO approved soils drilling contractor, Colbar Resources. Borehole BH-19, also drilled on April 27, 2000, was advanced using a tripod mounted Winki drill, also supplied by Colbar Resources. Borehole BH-18B was advanced on September 19, 2000 next to BH-18A utilizing a CME-55 drill, supplied by Marathon Drilling Ltd. Soil samples were obtained in Boreholes BH-18A and BH-19 using a 51 mm OD split-spoon sampler. Standard penetration tests were performed at approximately 750 mm and 1.5 m intervals. The standard penetration resistance 'N' values together with the blows from dynamic cone penetration tests were recorded to assess relative soil density. Water levels were measured following the completion of the boreholes and backfilled with auger cuttings in accordance with the Ministry of Transportation guidelines. The locations of boreholes BH-18A, BH-18B and BH-19 are presented on Drawing 1 (Appendix II). The locations and surface elevations of the boreholes were established by survey crews from D.F. Elliott.

One (1) undisturbed, 50 mm diameter, thin walled “Shelby” tube sample was obtained in the cohesive soil deposit from Borehole BH-18A, and three (3), 70 mm diameter thin walled “Shelby” tube samples from Borehole BH-18B. Field vane tests were made in both boreholes throughout the cohesive soil stratum to measure the in-situ undrained shear strength of the cohesive soils. The field vane had dimensions of 152 mm long by 70 mm diameter, not including the 45° point. Torque was measured using two calibrated scales on a calibrated lever arm threaded to the drill rods. A dynamic cone penetration test was completed beneath the sampled portion of Borehole BH-18A down to refusal.

All of the recovered soil samples were logged, then sealed in the field to prevent moisture loss, and transported to Trow’s Sudbury laboratory for detailed visual examination. Routine moisture contents and soil classification were completed at Trow’s Sudbury laboratory. Borehole logs containing the details of the soil and groundwater conditions are shown in Appendix III. The standard data sheet, given in Figure 1, provides additional details on soil descriptions for classification purposes.

1.3.3 Laboratory Program

The laboratory testing program for the selected soil samples consisted of the following:

- Natural moisture content determinations (LS 701);
- Grain size distribution analyses (LS 702);
- Atterberg limits (LS 703 and LS 704);
- 1-dimensional consolidation test;
- Laboratory vane tests.

Results from laboratory measurements are summarized on the borehole logs in Appendix III and Figures 2 to 6 in Appendix IV.

1.4 SUBSURFACE CONDITIONS

Soil sections, longitudinal, as well as at the centreline of the valley, are plotted on Drawings 1 and 2. Drawing 2 also contains cross sections of the highway embankment at Stations 12+700, 50 m south of the centreline of the valley and 12+800, approximately 50 m north of the centreline of the creek bed. Drawing 3 contains sections at Stations 12+725, 12+750, and 12+775 showing the existing highway configuration and the existing embankment.

In general, the following different soil layers were encountered with increasing depth:

- Fill (Sand and Gravel);
- Fill (Silt);
- Alluvial Silty Clay;
- Alluvial Silty Sand/Alluvial Sand;
- Silty Clay .

The above soil strata encountered in the boreholes are summarized below.

1.4.1 Fill (Sand & Gravel)

From the surface of the pavement (at about elevation 215 m) to a depth of 6.1 m, the embankment fill material was composed of a mixture of gravel and sand layers. This unit was encountered in Boreholes BH-3 and BH-4, which were advanced from on top of the existing embankment, along the shoulders of the roadway. Standard penetration resistance “N” values ranged between 4 and 20, with the relative density decreasing with increasing depth.

1.4.2 Fill (Silt)

The upper granular fill was underlain by a silt fill, that was encountered in Boreholes BH-3 and BH-4. The silt fill had a brownish-grey colour and was in a moist to wet state. The standard penetration resistance “N” values were between 4 and 6. The silt fill extended from an elevation of approximately 209 m to about 207 m. Samples recovered from the boreholes indicated that the silt was previously disturbed and included traces of organics.

1.4.3 Alluvial Silty Clay

Borehole BH-19 encountered grey silty clay extending to a depth of 1.2 m (elevation ~207 m). This deposit contained a trace organics and occasional wood fibres. This soil was very soft with standard penetration resistance “N” values of about 2. Moisture contents were between 20% and 30%.

1.4.4 Alluvial Silty Sand

A grey alluvial silty sand deposit extended from an elevation of 208 m to 206 m at Borehole BH-3 and from an elevation of about 206 m to 204 m in Boreholes BH-4 and BH-19. This layer contained trace organics and wood particles. Moisture contents were between 20% and 30%. Measured standard penetration resistance “N” values were between 1 and 8, indicating a very loose to loose condition.

1.4.5 Silty Clay

The base unit for all boreholes was a moist grey silty clay. This silty clay had thin silt layers (varved clay) below an elevation that varied from 204 m to 212 m. The individual layers or varves had a thickness of approximately 5 to 25 mm.

The moisture contents were generally between 40% to 66%, with a few samples containing around 35% water. Moisture contents were dependent on the silt content and consistency of the individual sample. Three Atterberg limit tests were completed. Results from one shallow sample in borehole BH-19 (elevation ~205 m) had a Liquid Limit of about 37%, a Plastic Limit of 19%, and a Plasticity Index of 18%. The two samples obtained from borehole BH-18A (elevation ~207 m and ~195 m) had consistent results, where the Liquid Limit was about 49%, the Plastic Limit

was about 20%, and a resulting Plasticity Index at 29%. These results indicated that this clay can be classified as a medium plasticity (CI) silty clay.

Standard penetration resistance “N” values were between 0 to 5 in the silty clay. In-situ field vane and laboratory shear vane testing, as well as the SPT values, indicated that the silty clay had a uniform soft/firm consistency, with undrained shear strengths of about 24 kPa to 36 kPa. Results from comparing the peak shear strength to remoulded strength (sensitivity) were between 4 and 5, indicating that the clay was moderately sensitive. The undrained shear strength profile, which includes shear strength data from all boreholes, is shown on Figure 4 (Appendix IV). Shear strength values did not vary significantly between measurements made beneath the existing roadway and measurements made adjacent to the roadway.

Borehole BH-19 was terminated within this clay unit at a depth of 5.5 m (elevation of ~202 m). Sampling in Boreholes BH-18A and BH-18B terminated at depths of 22 m and 24 m (elevations of ~190 m and ~188 m), respectively within the clay unit. At the location of Borehole BH-18A, a dynamic cone was pushed hydraulically with little to no resistance to a depth of about 30 m below existing grade (elevation of ~182 m). The test was terminated at a dynamic cone penetration resistance value of +53 blows/300 mm. The silty clay stratum likely extended to the full depth of the dynamic cone test.

A one-dimensional consolidation test was performed on a sample of silty clay extruded from a thin walled Shelby tube. The sample was obtained from Borehole BH-18A at a depth of approximately 6 m (elevation ~208 m). Consolidation test results are presented on Figures 5 and 6 (Appendix IV). The silty clay material is overconsolidated with a preconsolidation stress of about 150 kPa and an overburden stress of approximately 26 kPa. At loadings between 10 and 100 kPa, the coefficient of volume compressibility (m_v) is 0.08 MPa^{-1} . The coefficient of consolidation (c_v) shown in Figure 6 decreases with increasing stress and is about $2.5 \times 10^{-7} \text{ m}^2/\text{s}$ at a 50 kPa loading.

1.5 GROUNDWATER CONDITIONS

Groundwater levels were measured in the open boreholes prior to backfilling and are included on the borehole logs in Appendix III. In borehole BH-19, the groundwater level was about 50 mm below existing grade. The groundwater level was about 400 mm below grade in BH-18A and no water was observed in BH-18B on completion of drilling. The groundwater levels were consistent with the water level observed in the creek, (i.e. virtually at grade). Seasonal variations of the water table should be expected, with higher water levels occurring during the wet periods of the year (such as spring and fall), and lower levels during drier periods.

2.0 CLOSING COMMENTS

The recommendations in this report are subject to the limitations provided in Appendix I and should be considered as part of this report.

The field investigation was performed by Mr. S. McAuliffe, senior field technician, and supervised by Mr. E.A. Gonneau, MBA, P.Eng., Project Manager. The report was written by Mr. A. Zerwer, Ph.D. and reviewed by Mr. A.J. Schell, M.Sc., P.Eng., Branch Manager/Senior Geotechnical Engineer, of Trow's Sudbury office. An independent review of the report was conducted by Mr. S.E. Gonsalves, M.Eng., P.Eng., Principal Geotechnical Engineer (Trow's MTO designated foundation contact) of Trow's Brampton office.

We trust this report is satisfactory for your purposes. Should you have any questions, please do not hesitate to contact us.

Yours truly,

Trow Consulting Engineers Ltd.

A. Zerwer, Ph.D.
Geotechnical Specialist

A.J. Schell, M.Sc., P. Eng.
Branch Manager/Sr. Geotechnical Engineer

S.E Gonsalves, M.Eng., P.Eng.
Principal Engineer
MTO Designated Foundation Contact

APPENDIX I

LIMITATIONS

LIMITATIONS

The recommendations presented in this report are in accordance with our present understanding of the project and are provided solely for the use of D.F. Elliott Consulting Engineers Ltd., the MTO and their design team for the design of the highway embankment platform widening at Station 12+700 to 12+800, Chamberlain Township. We request that we be retained to review the design and our recommendations as the design proceeds, to ensure that the final design is in general agreement with our recommendations and that our recommendations have been interpreted as intended.

A subsurface investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those reported at the test locations, we require that we be notified immediately in order to allow reassessment of our recommendations. It may then be necessary to carry out additional field work and analyses.

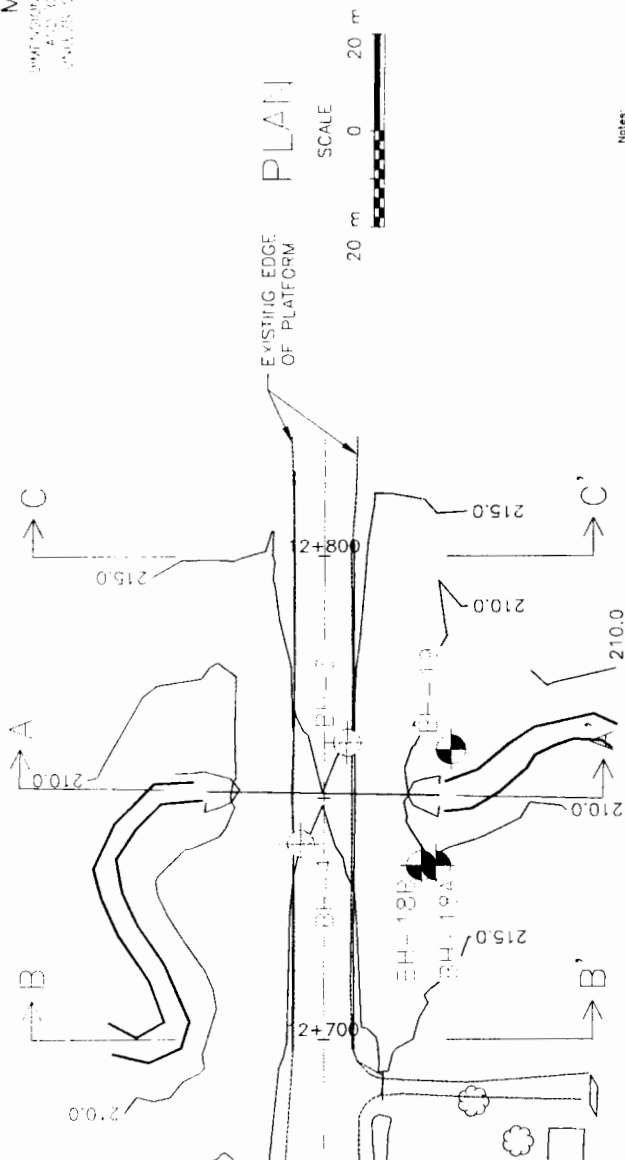
Contractors bidding on or undertaking the works should, relative to the subsurface conditions, decide on their own investigations, if deemed necessary, as well as their own interpretations of the factual results provided herein, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

The information presented in this report is based upon an investigation designed to provide information to support an overall assessment of the current geotechnical conditions as the site of the proposed highway embankment platform widening, Station 12+700 to 12+800 at the Township of Chamberlain, District of Temiskaming. The conclusions presented in this report reflect the site conditions existing at the time of the investigation. It is noted that the soil boundaries indicated on the logs are inferred from discontinuous sampling and observations during drilling. These boundaries are intended to reflect transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change.

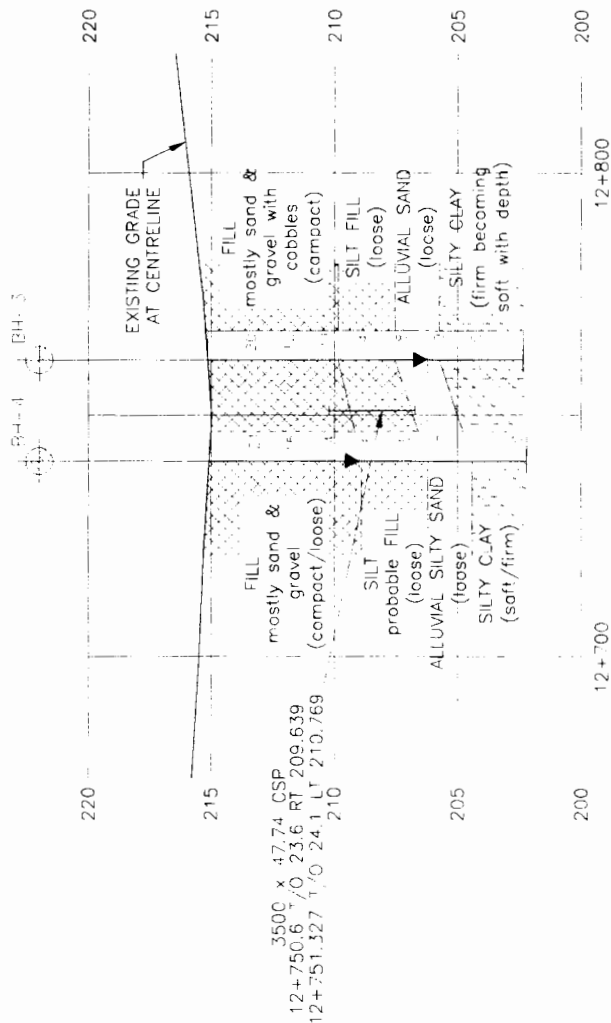
APPENDIX II

DRAWINGS AND PHOTOGRAPHS

THE UNIVERSITY OF CHICAGO



- 1) Drawing produced by referencing drawings provided by D.F. Elliott Consulting Engineers Ltd
- 2) Elevations of previous boreholes (July 1996), interpolated from previous foundation investigation data. All new borehole elevations were provided by D.F. Elliott Consulting Engineers Ltd.



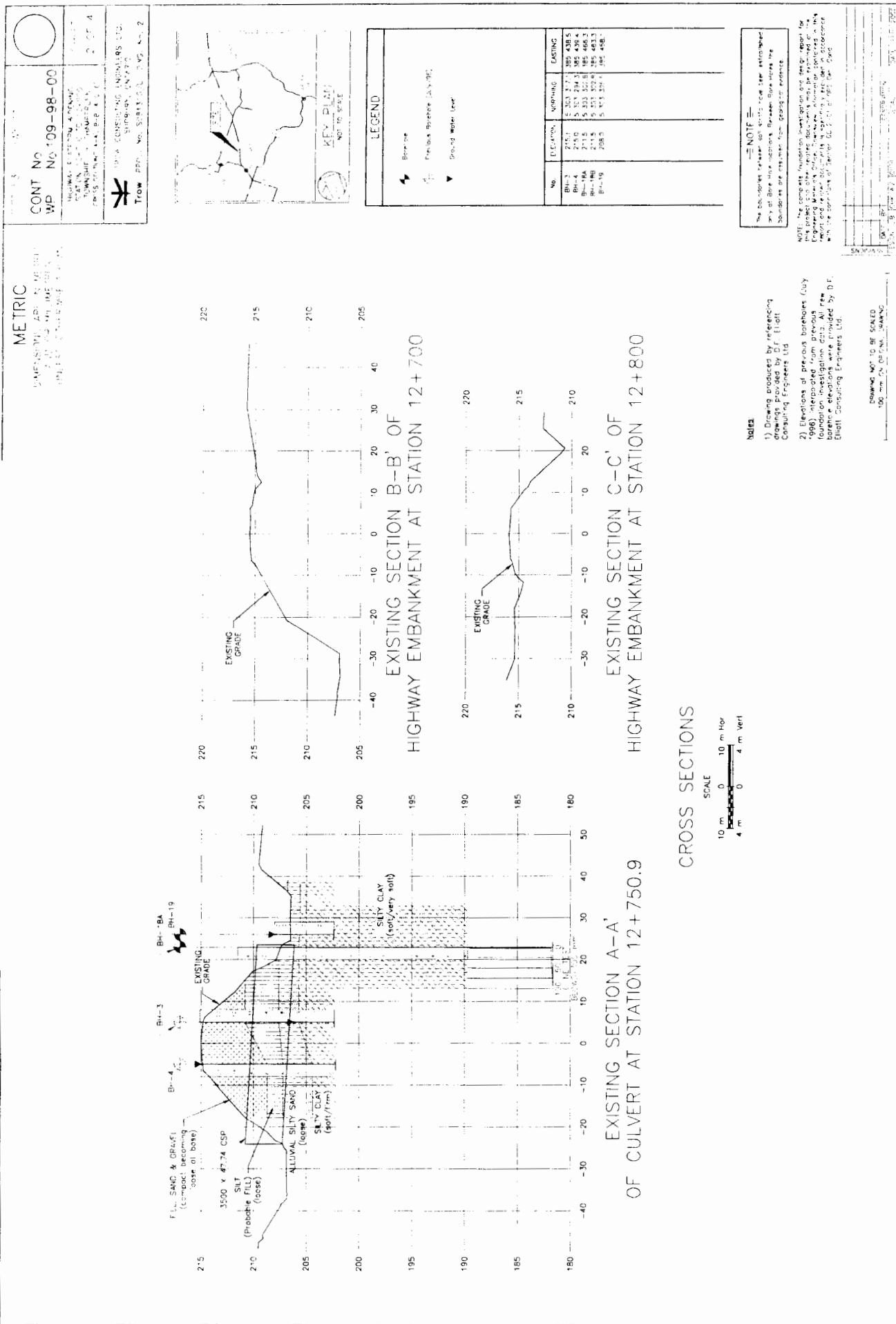
EXISTING
CENTRELINE PROFILE

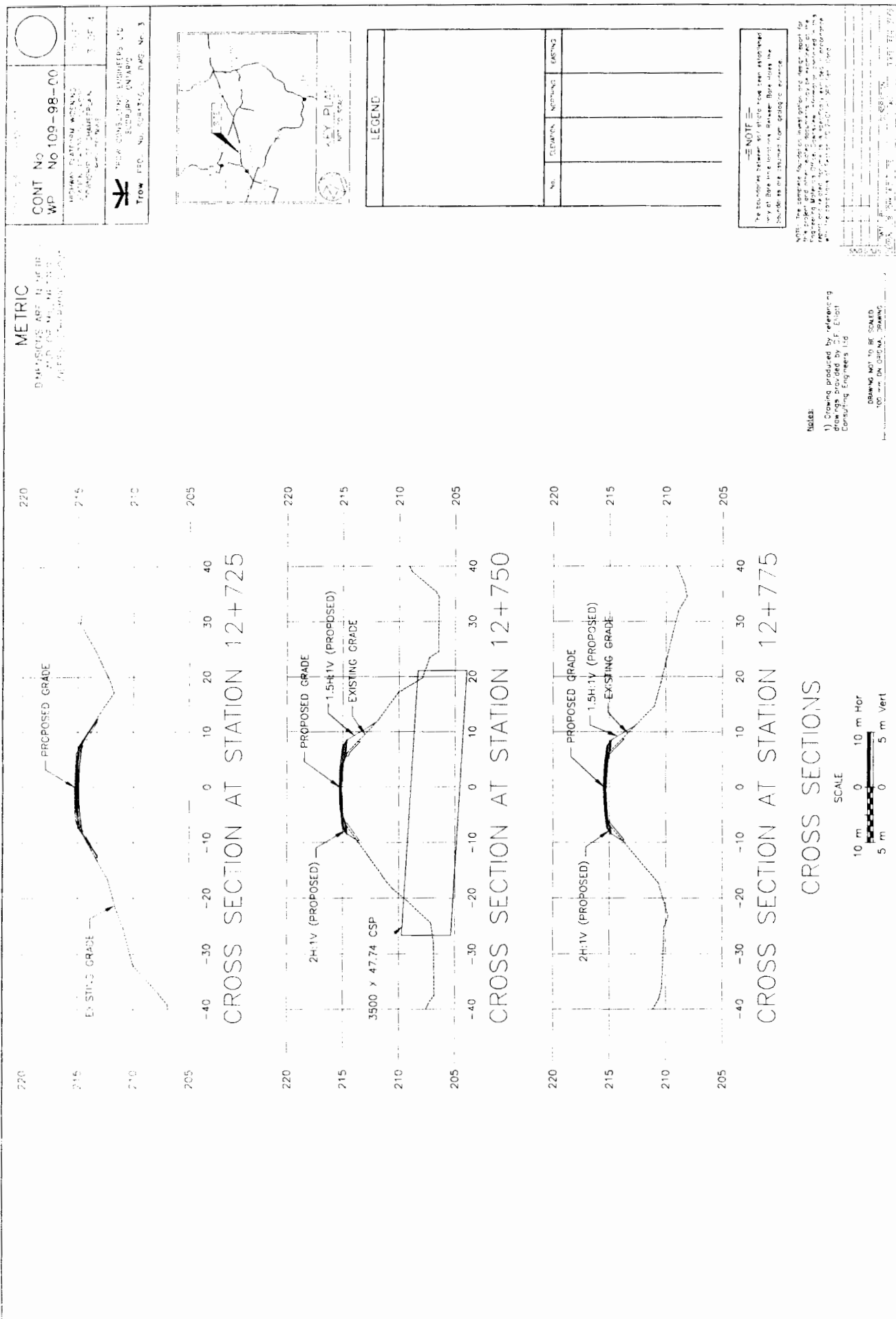
Year	TECHNICAL	MANAGEMENT	LEADERSHIP
1991-3	216.4	15,323.17	189,428.6
1991-4	215.0	15,307.29	189,459.4
1991-5	214.5	15,291.41	189,490.2
1991-6	214.0	15,275.53	189,521.0
1991-7	213.5	15,259.65	189,551.8
1991-8	213.0	15,243.77	189,582.6
1991-9	212.5	15,227.89	189,613.4
1991-10	212.0	15,212.01	189,644.2
1991-11	211.5	15,196.13	189,675.0
1991-12	211.0	15,180.25	189,705.8
1992-1	210.5	15,164.37	189,736.6
1992-2	210.0	15,148.49	189,767.4
1992-3	209.5	15,132.61	189,798.2
1992-4	209.0	15,116.73	189,829.0
1992-5	208.5	15,100.85	189,859.8
1992-6	208.0	15,084.97	189,890.6
1992-7	207.5	15,069.09	189,921.4
1992-8	207.0	15,053.21	189,952.2
1992-9	206.5	15,037.33	189,983.0
1992-10	206.0	15,021.45	190,013.8
1992-11	205.5	15,005.57	190,044.6
1992-12	205.0	14,989.69	190,075.4
1993-1	204.5	14,973.81	190,106.2
1993-2	204.0	14,957.93	190,137.0
1993-3	203.5	14,942.05	190,167.8
1993-4	203.0	14,926.17	190,198.6
1993-5	202.5	14,910.29	190,229.4
1993-6	202.0	14,894.41	190,260.2
1993-7	201.5	14,878.53	190,291.0
1993-8	201.0	14,862.65	190,321.8
1993-9	200.5	14,846.77	190,352.6
1993-10	200.0	14,830.89	190,383.4
1993-11	199.5	14,815.01	190,414.2
1993-12	199.0	14,799.13	190,445.0
1994-1	198.5	14,783.25	190,475.8
1994-2	198.0	14,767.37	190,506.6
1994-3	197.5	14,751.49	190,537.4
1994-4	197.0	14,735.61	190,568.2
1994-5	196.5	14,719.73	190,599.0
1994-6	196.0	14,703.85	190,629.8
1994-7	195.5	14,687.97	190,660.6
1994-8	195.0	14,672.09	190,691.4
1994-9	194.5	14,656.21	190,722.2
1994-10	194.0	14,640.33	190,753.0
1994-11	193.5	14,624.45	190,783.8
1994-12	193.0	14,608.57	190,814.6
1995-1	192.5	14,592.69	190,845.4
1995-2	192.0	14,576.81	190,876.2
1995-3	191.5	14,560.93	190,907.0
1995-4	191.0	14,545.05	190,937.8
1995-5	190.5	14,529.17	190,968.6
1995-6	190.0	14,513.29	190,999.4
1995-7	189.5	14,497.41	191,030.2
1995-8	189.0	14,481.53	191,061.0
1995-9	188.5	14,465.65	191,091.8
1995-10	188.0	14,449.77	191,122.6
1995-11	187.5	14,433.89	191,153.4
1995-12	187.0	14,418.01	191,184.2
1996-1	186.5	14,402.13	191,215.0
1996-2	186.0	14,386.25	191,245.8
1996-3	185.5	14,370.37	191,276.6
1996-4	185.0	14,354.49	191,307.4
1996-5	184.5	14,338.61	191,338.2
1996-6	184.0	14,322.73	191,369.0
1996-7	183.5	14,306.85	191,400.2
1996-8	183.0	14,290.97	191,431.0
1996-9	182.5	14,275.09	191,461.8
1996-10	182.0	14,259.21	191,492.6
1996-11	181.5	14,243.33	191,523.4
1996-12	181.0	14,227.45	191,554.2
1997-1	180.5	14,211.57	191,585.0
1997-2	180.0	14,195.69	191,615.8
1997-3	179.5	14,179.81	191,646.6
1997-4	179.0	14,163.93	191,677.4
1997-5	178.5	14,148.05	191,708.2
1997-6	178.0	14,132.17	191,739.0
1997-7	177.5	14,116.29	191,769.8
1997-8	177.0	14,100.41	191,800.6
1997-9	176.5	14,084.53	191,831.4
1997-10	176.0	14,068.65	191,862.2
1997-11	175.5	14,052.77	191,893.0
1997-12	175.0	14,036.89	191,923.8
1998-1	174.5	14,021.01	191,954.6
1998-2	174.0	14,005.13	191,985.4
1998-3	173.5	13,989.25	192,016.2
1998-4	173.0	13,973.37	192,047.0
1998-5	172.5	13,957.49	192,077.8
1998-6	172.0	13,941.61	192,108.6
1998-7	171.5	13,925.73	192,139.4
1998-8	171.0	13,909.85	192,170.2
1998-9	170.5	13,893.97	192,201.0
1998-10	170.0	13,878.09	192,231.8
1998-11	169.5	13,862.21	192,262.6
1998-12	169.0	13,846.33	192,293.4
1999-1	168.5	13,830.45	192,324.2
1999-2	168.0	13,814.57	192,355.0
1999-3	167.5	13,798.69	192,385.8
1999-4	167.0	13,782.81	192,416.6
1999-5	166.5	13,766.93	192,447.4
1999-6	166.0	13,751.05	192,478.2
1999-7	165.5	13,735.17	192,509.0
1999-8	165.0	13,719.29	192,539.8
1999-9	164.5	13,703.41	192,570.6
1999-10	164.0	13,687.53	192,601.4
1999-11	163.5	13,671.65	192,632.2
1999-12	163.0	13,655.77	192,663.0
2000-1	162.5	13,639.89	192,693.8
2000-2	162.0	13,624.01	192,724.6
2000-3	161.5	13,608.13	192,755.4
2000-4	161.0	13,592.25	192,786.2
2000-5	160.5	13,576.37	192,817.0
2000-6	160.0	13,560.49	192,847.8
2000-7	159.5	13,544.61	192,878.6
2000-8	159.0	13,528.73	192,909.4
2000-9	158.5	13,512.85	192,940.2
2000-10	158.0	13,496.97	192,971.0
2000-11	157.5	13,481.09	193,001.8
2000-12	157.0	13,465.21	193,032.6
2001-1	156.5	13,449.33	193,063.4
2001-2	156.0	13,433.45	193,094.2
2001-3	155.5	13,417.57	193,125.0
2001-4	155.0	13,401.69	193,155.8
2001-5	154.5	13,385.81	193,186.6
2001-6	154.0	13,369.93	193,217.4
2001-7	153.5	13,354.05	193,248.2
2001-8	153.0	13,338.17	193,279.0
2001-9	152.5	13,322.29	193,309.8
2001-10	152.0	13,306.41	193,340.6
2001-11	151.5	13,290.53	193,371.4
2001-12	151.0	13,274.65	193,402.2
2002-1	150.5	13,258.77	193,433.0
2002-2	150.0	13,242.89	193,463.8
2002-3	149.5	13,227.01	193,494.6
2002-4	149.0	13,211.13	193,525.4
2002-5	148.5	13,195.25	193,556.2
2002-6	148.0	13,179.37	193,587.0
2002-7	147.5	13,163.49	193,617.8
2002-8	147.0	13,147.61	193,648.6
2002-9	146.5	13,131.73	193,679.4
2002-10	146.0	13,115.85	193,710.2
2002-11	145.5	13,100.00	193,741.0
2002-12	145.0	13,084.12	193,771.8
2003-1	144.5	13,068.24	193,802.6
2003-2	144.0	13,052.36	193,833.4
2003-3	143.5	13,036.48	193,864.2
2003-4	143.0	13,020.60	193,895.0
2003-5	142.5	13,004.72	193,925.8
2003-6	142.0	12,988.84	193,956.6
2003-7	141.5	12,972.96	193,987.4
2003-8	141.0	12,957.08	194,018.2
2003-9	140.5	12,941.20	194,049.0
2003-10	140.0	12,925.32	194,079.8
2003-11	139.5	12,909.44	194,110.6
2003-12	139.0	12,893.56	194,141.4
2004-1	138.5	12,877.68	194,172.2
2004-2	138.0	12,861.80	194,203.0
2004-3	137.5	12,845.92	194,233.8
2004-4	137.0	12,830.04	194,264.6
2004-5	136.5	12,814.16	194,295.4
2004-6	136.0	12,798.28	194,326.2
2004-7	135.5	12,782.40	194,357.0
2004-8	135.0	12,766.52	194,387.8
2004-9	134.5	12,750.64	194,418.6
2004-10	134.0	12,734.76	194,449.4
2004-11	133.5	12,718.88	194,480.2
2004-12	133.0	12,703.00	194,511.0
2005-1	132.5	12,687.12	194,541.8
2005-2	132.0	12,671.24	194,572.6
2005-3	131.5	12,655.36	194,603.4
2005-4	131.0	12,639.48	194,634.2
2005-5	130.5	12,623.60	194,665.0
2005-6	130.0	12,607.72	194,695.8
2005-7	129.5	12,591.84	194,726.6
2005-8	129.0	12,575.96	194,757.4
2005-9	128.5	12,560.08	194,788.2
2005-10	128.0	12,544.20	194,819.0
2005-11	127.5	12,528.32	194,849.8
2005-12	127.0	12,512.44	194,880.6
2006-1	126.5	12,496.56	194,911.4
2006-2	126.0	12,480.68	194,942.2
2006-3	125.5	12,464.80	194,973.0
2006-4	125.0	12,448.92	195,003.8
2006-5	124.5	12,433.04	195,034.6
2006-6	124.0	12,417.16	195,065.4
2006-7	123.5	12,401.28	195,096.2
2006-8	123.0	12,385.40	195,127.0
2006-9	122.5	12,369.52	195,157.8
2006-10	122.0	12,353.64	195,188.6
2006-11	121.5	12,337.76	195,219.4
2006-12	121.0	12,321.88	195,250.2
2007-1	120.5	12,306.00	195,281.0
2007-2	120.0	12,290.12	195,311.8
2007-3	119.5	12,274.24	195,342.6
2007-4	119.0	12,258.36	195,373.4
2007-5	118.5	12,242.48	195,404.2
2007-6	118.0	12,226.60	195,435.0
2007-7	117.5	12,210.72	195,465.8
2007-8	117.0	12,194.84	195,496.6
2007-9	116.5	12,178.96	195,527.4
2007-10	116.0	12,163.08	195,558.2
2007-11	115.5	12,147.20	195,589.0
2007-12	115.0	12,131.32	195,619.8
2008-1	114.5	12,115.44	195,650.6
2008-2	114.0	12,100.00	195,681.4
2008-3	113.5	12,084.12	195,712.2
2008-4	113.0	12,068.24	195,743.0
2008-5	112.5	12,052.36	195,773.8
2008-6	112.0	12,036.48	195,804.6
2008-7	111.5	12,020.60	195,835.4
2008-8	111.0	12,004.72	195,866.2
2008-9	110.5	11,988.84	195,897.0
2008-10	110.0	11,972.96	195,927.8
2008-11	109.5	11,957.08	195,958.6
2008-12	109.0	11,941.20	195,989.4
2009-1	108.5	11,925.32	196,020.2
2009-2	108.0	11,909.44	196,051.0
2009-3	107.5	11,893.56	196,081.8
2009-4	107.0	11,877.68	196,112.6
2009-5	106.5	11,861.80	196,143.4
2009-6	106.0	11,845.92	196,174.2
2009-7	105.5	11,830.04	196,205.0
2009-8	105.0	11,814.16	196,235.8
2009-9	104.5	11,798.28	196,266.6
2009-10	104.0	11,782.40	196,297.4
2009-11	103.5	11,766.52	196,328.2
2009-12	103.0	11,750.64	196,359.0
2010-1	102.5	11,734.76	196,389.8
2010-2	102.0	11,718.88	196,420.6
2010-3	101.5	11,702.96	196,451.4
2010-4	101.0	11,687.08	196,482.2
2010-5	100.5	11,671.20	196,513.0
2010-6	100.0	11,655.32	196,543.

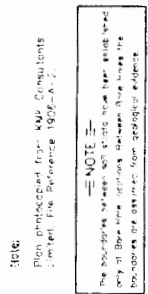
The boundary between the two has been established
— N O T —

[illegible]

DRAWING NOT TO BE SCALED







Второй шаг — это введение в эксплуатацию системы автоматического контроля качества. В настоящее время в большинстве случаев контроль качества осуществляется вручную, что приводит к ошибкам и задержкам. Автоматизация процесса контроля качества позволит повысить его эффективность и снизить затраты.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING



**Photograph 1: ~ Station 12+750 – Looking north east at the existing eastern embankment slope.
(Note: The culvert outlet at the toe of the slope.)**



**Photograph 2: ~Station 12+750 – Looking south east at the existing eastern embankment slope.
(Note: The culvert outlet at the toe of the slope.)**



Photograph 3: ~ Station 12+750 – Looking south west from the top of the creek's north side slope at the culvert outlet and the creek's south side slope.



Photograph 4: ~ Station 12+750 – Looking west towards existing culvert outlet and embankment from the creek gully.

APPENDIX III

BOREHOLE LOGS

EXPLANATION OF TERMS USED IN REPORT

Fig. 1

N VALUE: THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D. SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS \bar{N}

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON "A" SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH (C_u) AS FOLLOWS:

C_u (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	> 200
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

N (BLOWS/0.3m)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND/OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), FOR MODIFIED RECOVERY, IS:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

JOINTING AND BEDDING:

SPACING	50mm	50 - 300mm	0.3m - 1m	1m - 3m	> 3m
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

S S	SPLIT SPOON	T P	THINWALL PISTON
W S	WASH SAMPLE	O S	OSTERBERG SAMPLE
S T	SLOTTED TUBE SAMPLE	R C	ROCK CORE
B S	BLOCK SAMPLE	P H	T W ADVANCED HYDRAULICALLY
C S	CHUNK SAMPLE	P M	T W ADVANCED MANUALLY
T W	THINWALL OPEN	F S	FOIL SAMPLE

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

m_v	kPa ⁻¹	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
C_v	m ² /s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{v0}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	-°	APPARENT ANGLE OF INTERNAL FRICTION
τ_r	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_r	1	SENSITIVITY = $\frac{C_u}{T_r}$

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m ³	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	e_{min}	1, %	VOID RATIO IN DENSEST STATE
γ_s	kN/m ³	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
ρ_w	kg/m ³	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	kN/m ³	UNIT WEIGHT OF WATER	S_r	%	DEGREE OF SATURATION	D_n	mm	n PERCENT - DIAMETER
ρ	kg/m ³	DENSITY OF SOIL	w_L	%	LIQUID LIMIT	C_u	1	UNIFORMITY COEFFICIENT
γ	kN/m ³	UNIT WEIGHT OF SOIL	w_p	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
ρ_d	kg/m ³	DENSITY OF DRY SOIL	w_s	%	SHRINKAGE LIMIT	q	m ³ /s	RATE OF DISCHARGE
γ_d	kN/m ³	UNIT WEIGHT OF DRY SOIL	I_p	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
ρ_{sat}	kg/m ³	DENSITY OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
γ_{sat}	kN/m ³	UNIT WEIGHT OF SATURATED SOIL	I_c	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m ³	DENSITY OF SUBMERGED SOIL				i	kN/m ²	SEEPAGE FORCE

RECORD OF BOREHOLE BH-3

1 OF 1

METRIC

G.W.P. 109-98-00

LOCATION 5 303 317.1 N. 385 438.5 E

ORIGINATED BY S.M.

DIST 53 HWY 11

BOREHOLE TYPE Hollow stem augers / CME-55

COMPILED BY M.D.

DATUM Geodetic

DATE July 11, 1996

CHECKED BY L.B.

SOIL PROFILE			SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) CONE PENETRATION TEST		PLASTIC LIMIT wp	NATURAL MOISTURE CONTENT w	LIQUID LIMIT wl	UNIT WEIGHT kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER TYPE	BLOWS/0.3m			20	40					
215.1	GROUND SURFACE					215							
0.0	FILL, mostly SAND & GRAVEL with some COBBLES, brown, moist (compact)					214							
			1	SS	20								
			2	SS	12								
209.8			3	SS	11								
5.3	SILT FILL, brown & grey, trace of ORGANICS, moist to wet. (loose)		4	SS	4								
207.6			5	SS	8								
7.5	ALLUVIAL SAND, with ORGANICS & WOOD PARTICLES, wet. (loose)		6	SS	9								
205.7			7	SS	0								
9.4	SILTY CLAY, stratified with wet SILT seams, grey/brown, saturated. (firm becoming soft with depth)		8	TW									
202.3	END OF BOREHOLE												
12.8	Notes: 1) This borehole forms part of Highway 11, Highway Platform Widening, station ~12+700 to ~12+800 2) Borehole located at station ~12+761, offset ~5 m right of centreline as referenced to Highway 11 3) Water level was at ~8.9 m & hole was open to ~11.1 m depth on completion												



RECORD OF BOREHOLE BH-4

1 OF 1

METRIC

G.W.P. 109-98-00

LOCATION 5 303 294.3 N, 385 439.4 E

ORIGINATED BY S.M.

DIST 53 HWY 11

BOREHOLE TYPE Hollow stem augers / CME-55

COMPILED BY M.D.

DATUM Geodetic

DATE July 11, 1996

CHECKED BY L.B.

SOIL PROFILE			SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) CONE PENETRATION TEST		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE			20	40					
215.0	GROUND SURFACE					215							
0.0	FILL, mostly SAND & GRAVEL, brown, moist. (compact with loose section at base of unit)		1	SS	21								
			2	SS	15								
			3	SS	4								
208.9	SILT, (probable FILL), light brown then grey below ~7.5 m depth, wet. (loose)		4	SS	6								
6.1			5	SS	5								
206.2	ALLUVIAL SILTY SAND, with ORGANICS & WOOD PARTICLES, wet. (loose)		6	SS	7								
8.8			7	TW									
204.4	SILTY CLAY, grey, stratified with wet silt seams, saturated. (soft/firm)		8	SS	0								
10.6													
202.2	END OF BOREHOLE												
12.8	Notes: 1) This borehole forms part of Highway 11, Highway Platform Widening, station ~12+700 to ~12+800. 2) Borehole located at station ~12+741, offset ~5 m left of centreline as referenced to Highway 11. 3) Water level was at ~8.7 m & hole was open to ~10.7 m depth on completion												



RECORD OF BOREHOLE BH-18A 1 OF 1

METRIC

G.W.P. 109-98-00 LOCATION 5 303 302.8 N, 385 466.3 E ORIGINATED BY S.M.
 DIST 53 HWY 11 BOREHOLE TYPE Hollow stem augers / CME-55 COMPILED BY M.D.
 DATUM Geodetic DATE April 27, 2000 CHECKED BY L.B.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) CONE PENETRATION TEST		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION	
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS/0.3m			20	40				60
211.5	GROUND SURFACE												
0.0	SURFICIAL BOULDERS, rounded, ~300 mm over SILTY CLAY, laminated with silt, becoming heavily varved below ~4.6 m depth, brown becoming grey below ~2.3 m depth, moist to wet. (alternating soft & very soft zones)		1	SS	4		211						
			2	SS	2		210						
			3	SS	2		209						
			4	TW			208						
			5	SS	2		207						
			6	SS	3		206						
			7	SS	2		205						
			8	SS	2		204						
			9	SS	3		203						
			10	SS	2		202						
			11	SS	3		201						
			12	SS	2		200						
			13	SS	4		199						
			14	SS	4		198						
			15	SS	5		197						
			16	SS	4		196						
189.7	END OF SAMPLING						195						
21.8							194						
							193						
							192						
							191						
							190						
181.6	END OF CONE TEST						189						
29.9							188						
							187						
							186						
							185						
							184						
							183						
							182						

Notes:
 1) This borehole forms part of Highway 11, Highway Platform Widening, station ~12+700 to ~12+800.
 2) Borehole located at station ~12+736, ~23 m right of centreline as referenced to Highway 11.
 3) Water level was at ~0.4 m & hole was open to ~14.4 m depth on completion.
 4) Dynamic cone pushed with little resistance to ~29.9 m depth. Dynamic cone penetration test value at ~29.6 m depth was 53 blows for ~0.3 m.



RECORD OF BOREHOLE BH-18B 1 OF 1

METRIC

G.W.P. 109-98-00 LOCATION 5 303 302.8 N, 385 463.3 E ORIGINATED BY S.M.
 DIST 53 HWY 11 BOREHOLE TYPE Hollow stem augers / CME-55 COMPILED BY M.D.
 DATUM Geodetic DATE September 19, 2000 CHECKED BY L.B.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) × CONE PENETRATION TEST		PLASTIC LIMIT w _p ——— w ——— w _L	NATURAL MOISTURE CONTENT w	LIQUID LIMIT	UNIT WEIGHT kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS/0.3m			20 40 60 80	20 40 60 80					
211.5	GROUND SURFACE													
0.0	SILTY CLAY, laminated with silt, grey, moist to wet. (firm becoming soft with increasing depth)						211							
							210							
							209							
							208	+S=4						
							207							
							206							
							205	+S=4						
			1	TW			204							
							203							
							202	+S=5						
							201							
							200							
			2	TW			199							
							198							
							197							
							196	+S=4						
							195							
							194							
							193							
							192							
							191							
							190							
							189							
187.6 23.9	END OF BOREHOLE		3	TW			188	+S=4						
Notes: 1) This borehole forms part of Highway 11, Highway Platform Widening, station ~12+700 to ~12+800. 2) Borehole located at station ~12+736, ~20 m right of centreline as referenced to Highway 11. 3) Borehole was open & dry to ~15.6 m depth on completion.														



RECORD OF BOREHOLE BH-19

1 OF 1

METRIC

G.W.P. 109-98-00

LOCATION 5 303 325.5 N. 385 458.1 E

ORIGINATED BY S.M.

DIST 53 HWY 11

BOREHOLE TYPE Tripod sampling / Power hand auger

COMPILED BY M.D.

DATUM Geodetic

DATE April 27, 2000

CHECKED BY L.B.

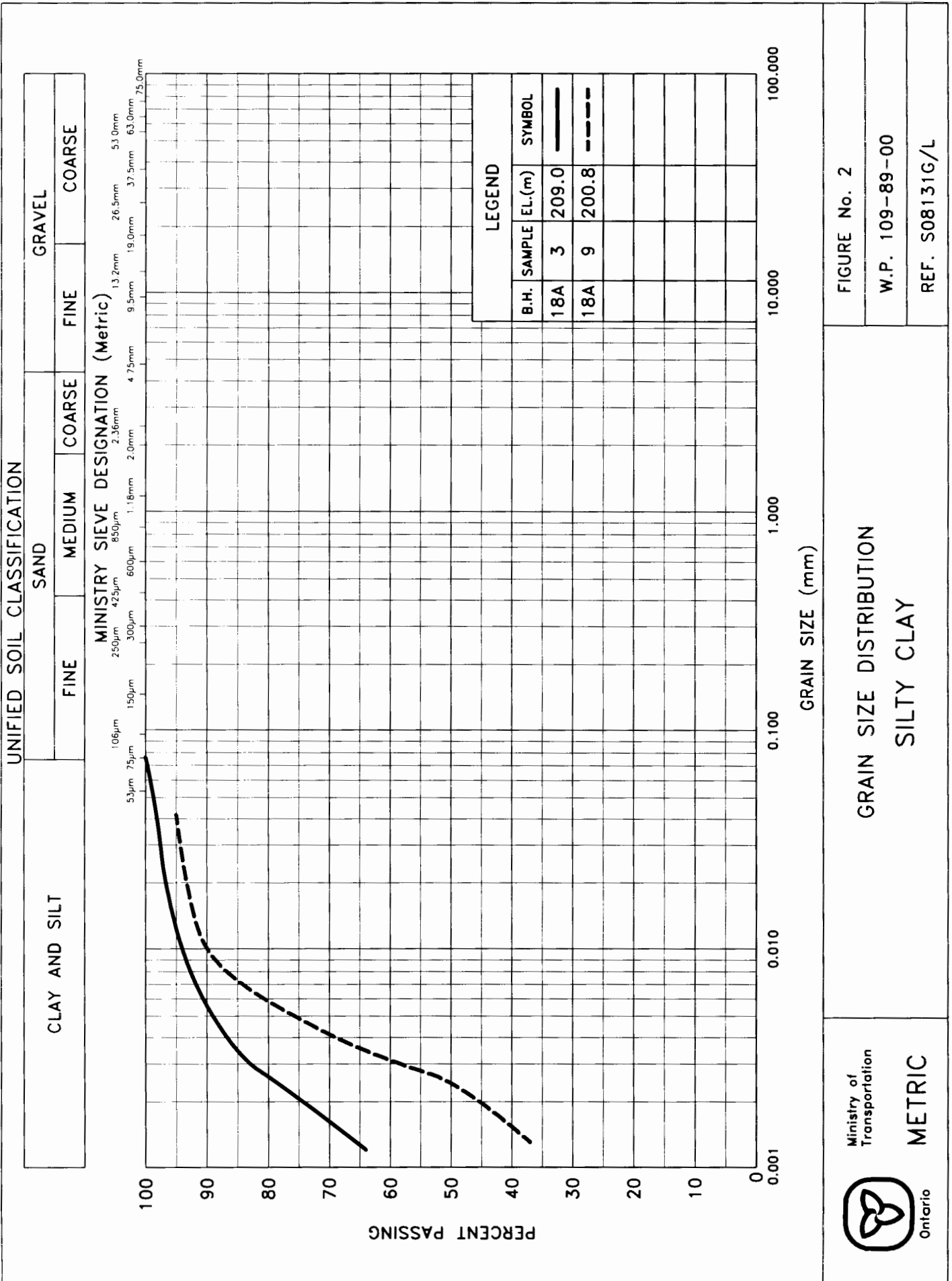
SOIL PROFILE			SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) CONE PENETRATION TEST		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE			BLOWS/0.3m	20					
208.0	GROUND SURFACE												
0.0	TOPSOIL, ~75 mm over		1	SS	2								
206.8	ALLUVIAL SILTY CLAY, with a		2	SS	2								
1.2	trace of organics & occasional wood		3	SS	2								
205.6	fibres, grey, moist, trace of sand &		4	SS	1								
2.4	gravel at ~0.6 m depth.		5	SS	2								
	(soft)												
	ALLUVIAL SILTY SAND, trace of												
	organics, trace of clay at ~1.8 m												
	depth, grey, wet.												
	(very loose)												
	SILTY CLAY, varved with silt, grey,		6	SS	2								
	wet.												
	(soft)												
202.4	END OF BOREHOLE												
5.6	Notes:												
	1) This borehole forms part of												
	Highway 11, Highway Platform												
	Widening, station ~12+700 to												
	~12+800.												
	2) Borehole located at station												
	~12+760, ~26 m right of centreline as												
	referenced to Highway 11.												
	3) Water level was at ~0.05 m & hole												
	was open to ~0.9 m depth on												
	completion.												



APPENDIX IV

LABORATORY TEST RESULTS

PLOTTED: 2002/02/25 - 10:53



PLOTTED: 2002/02/24 - 11:02

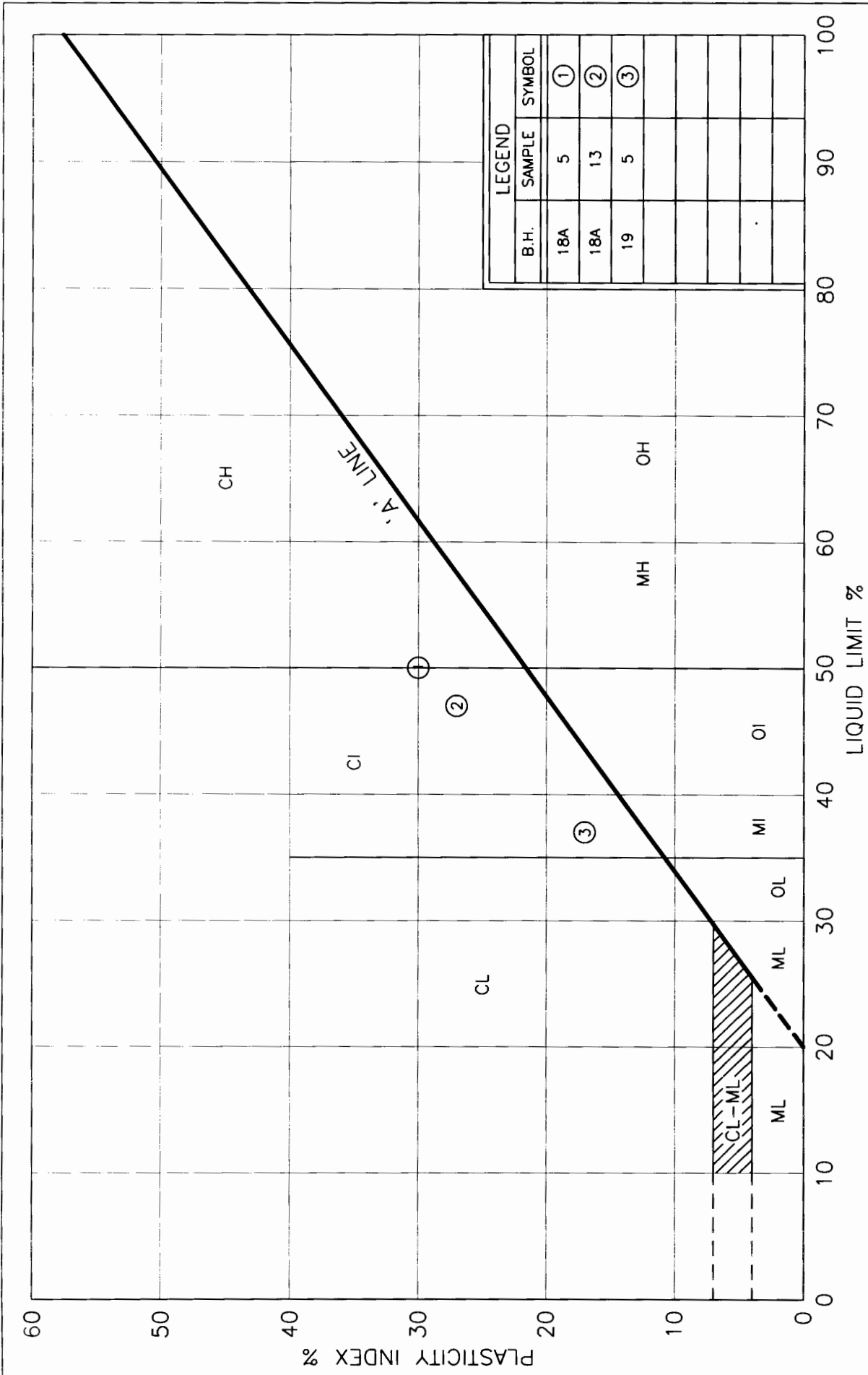


FIGURE No. 3

PLASTICITY CHART
SILTY CLAY

Ministry of
Transportation



METRIC

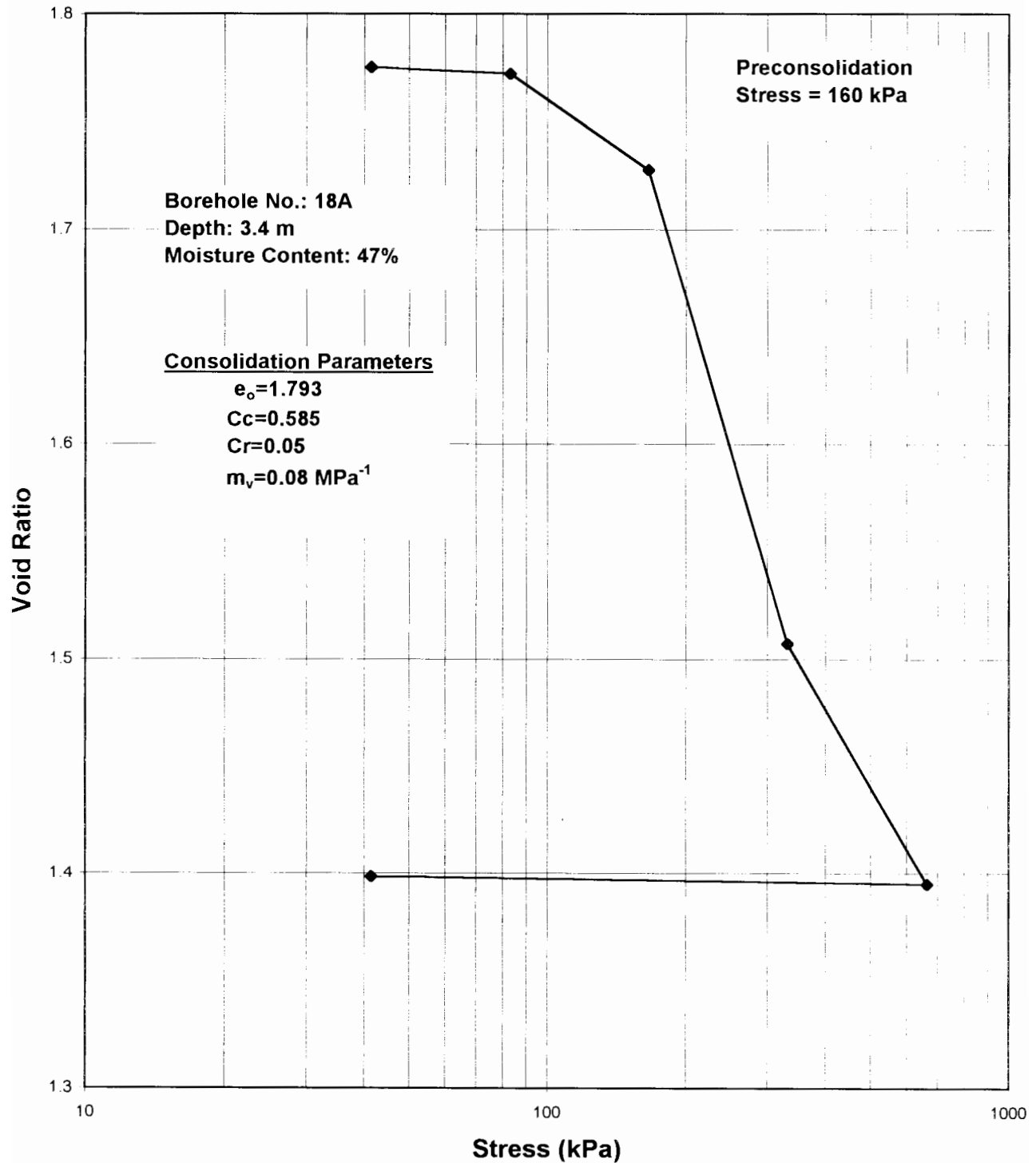
W.P. 109-98-00

REF. S08131G/L

WP No 109-98-00
PROJ. No SO8131G/L

Consolidation Test Results BH-18A

Figure 5



WP No 109-98-00
PROJ. No SO8131G/L

Coefficient of Consolidation BH-18A

Figure 6

