

G.I.-30 SEPT. 1976

GEOCRES No. 42 D-14DIST. 18 REGION W.P. No. 194-87-01
(formerly 295-85-01)CONT. No. W. O. No. STR. SITE No. 48 E-47HWY. No. 17LOCATION Hwy 17 & Ripple CreekNo of PAGES -OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:



Ministry
of
Transportation

FILE

FOUNDATION DESIGN SECTION

**foundation
investigation and
design report**

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP 194-87-01 DIST 19
HWY 17 STR SITE 48E-47

Ripple Creek Culvert at Highway 17

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FOUNDATION INVESTIGATION REPORT
For
Ripple Creek Culvert at Highway 17
W.P. 194-87-01, Site No. 48E-47
District 19, Thunder Bay

INTRODUCTION

This report summarizes the results of a foundation investigation conducted for the proposed replacement for Ripple Creek Culvert at Highway 17. The replacement culvert will be at approximately the same location as the existing.

SITE DESCRIPTION

The site is located on Highway 17 adjacent to C.P.R.'s Ripple Station, approximately 32.1 km east of Terrace Bay in the Township of Walsh, District of Thunder Bay. The existing culvert is about 4 m wide by 2 m high and a major portion of it is a tie crib with bracing. The culvert has shown signs of distress in places.

The embankment slopes are rockfill and presently stand at a gradient of 1.5H:1V. The height of the embankment is about 6 m at culvert location. The width of the creek is less than 2 m and water flows in a southerly direction.

According to the Geological Map S265 in Ontario Geological Survey Report GR164, the site consists largely of deposits of varved or massive clay and silt and bare bedrock.

INVESTIGATION PROCEDURES

The field investigation for this project was conducted on 90 08 23 and 90 08 24, and comprised of five (5) boreholes and one (1) test pit. A continuous flight track mounted drilling machine equipped with solid and hollow stem augers was used to auger the boreholes. The test pit was excavated with a 230 backhoe.

Four (4) of the five (5) boreholes were drilled on the existing embankment and terminated within the rock fill stratum at a maximum depth of 2.3 m. The remaining borehole (BH 1) was augered to the south of the embankment, to a depth

of 5.3 m. Soil samples were taken generally at regular intervals in conjunction with standard penetration tests using split spoon samplers. Field vane tests and dynamic cone penetration tests were also carried out in BH 1 to determine the strength of the native soils at various depths. The test pit (BH 6) was dug to the north of the embankment to a depth of 1.7 m where bedrock was encountered.

The following laboratory tests were carried out on representative samples to identify and determine the physical properties of the overburden.

- Grain Size Distribution Analysis
- Natural Moisture Content Determinations
- Atterberg Limits Determinations

The results of the laboratory testing are plotted on the Record of Borehole sheets.

SUBSURFACE CONDITIONS

The Record of Borehole sheets in the Appendix illustrate the subsurface conditions at the five boreholes (BH 1 to 5) and one test pit (BH 6) locations. The locations and elevations of the boreholes, along with stratigraphical profiles based on the borehole data are shown on Drawing No. 1948701-A.

The subsurface stratigraphy typically comprises rock/granular fill overlying native overburden of silty clay, then bedrock.

Fill

The highway embankment consists of 6± m of cobbles and boulders with sand. At BH 1 and the test pit at the south and north ends of the embankment, respectively, this layer of non-cohesive fill extended below grade to depths of 1.9 m and 0.5 m respectively. The material was generally a silty sand with frequent cobbles and boulders, and was in a loose state with Standard Penetration 'N' value of 4.

Silty Clay

This cohesive deposit underlies the fill stratum. It has been described as a silty clay with trace of sand. The consistency of the material was very soft to firm but became very stiff below elevation 195 m in BH 1 with occasional sand and gravel.

The results of the two sets of laboratory testing carried out on the samples retrieved from BH 1 are summarized as follows:

Property

Natural Moisture Content (w%)	31	and	12.5
Liquid Limit (w _L %)	29.5	and	15.5
Plastic Limit (w _p %)	17.5	and	12.5
Grain Size Distribution (%)			
- Gravel	0		16
- Sand	1		42
- Silt	64		35
- Clay	35		7

Field vane tests carried out on the silty clay material indicated undrained shear strengths of 20 to 30 kPa.

Bedrock

Assumed bedrock was encountered in BH 1 and the test pit at 5.3 m and 1.7 m depths respectively, indicating that the bedrock dips in a southerly direction.

Groundwater

Groundwater level was monitored at BH 1 and test pit locations during and after completion of the investigation. The groundwater table was found to be close to the existing native ground surface. Seasonal variation is expected.

DISCUSSION AND RECOMMENDATIONS

It is proposed to replace the existing timber box culvert with a new 2.5 m x 2.0 m x 42.0 m concrete box culvert about 9 m to the west of it. At the time of the field investigation, we were under the impression that the alignment of the proposed culvert would be the same as the existing alignment. Hence the boreholes were located in proximity to the existing culvert, some 8 m east of the proposed alignment and the subsurface conditions at the proposed alignment were extrapolated from these boreholes. The proposed invert elevation at the inlet is 199.68 m and 197.75 m at the outlet. The culvert will be overlain with varying amounts of fill up to about 6 m at the centreline of Highway 17. We understand that the culvert will be constructed in two stages with a detour to the north of the existing Highway 17.

Foundation

Based on the field investigation, it is apparent that the material at the culvert invert is the soft silty clay at one end and bedrock at the other end. In view of the anticipated differential settlements, we recommend that the silty clay be removed down to bedrock surface starting from the downstream end and the excavation be backfilled with engineered fill, consisting of either rock fill or granular 'A' materials. It is envisaged that the average depth of excavation be 1.5 m to 2 m below the invert elevations of the proposed culvert. Should excavation be required below El. 194 m to reach bedrock, this office should be notified for further assessment of the situation and recommendations.

The bearing capacities recommended as per the O.H.B.D.C. are as follows:

Compacted Granular 'A' or Rock Fill

Factored Bearing Capacities at U.L.S.	=	640 kPa
Bearing Capacity at S.L.S. type II	=	250 kPa

The bearing surface of the rockfill should be chinked with 150 mm low slump concrete to provide a working mat.

For culvert construction, excavation through the existing rock fill and silty clay can be carried out using a temporary cut slope gradient of 2H:1V. Dewatering may be carried out by sump pumping. To create a more gradual and smooth transition between the existing roadway and the new section above the culvert, the excavation should have a transition zone extending from the frost line and 2H:1V slope intersect to the road surface (see Figure 1). This transition zone should be formed at 10H:1V.

The minimum earth cover required for frost protection is 2.2 m, unless the box culvert is structurally designed to withstand frost pressures.

Backfill

Backfill to the culvert should consist of rockfill and granular material. Reference is made to OPSD 803 standards for details.

During backfilling with rockfill below the culvert invert and prior to culvert construction, it is recommended a surcharge be applied by placing an additional rockfill thickness of 2 m above final grade as a rolling surcharge that would be advanced as the concurrent subexcavation/backfill operation progressed as shown as Figure 2. This would enhance the compactness of the rockfill. If rockfill is used as backfill and bedding to the culvert, consideration should be given to specifying a 0.5 m cushion around the culvert consisting of well graded rock fill with particle sizes less than 300 mm.

Slope Stability

The slope of the embankment may be safely constructed with rock fill to a maximum height of 9 m with a 1.5H:1V gradient and 6 m with a 1.25H:1V gradient. Alternatively, nominal 1 m wide berms can be incorporated into the 1.25H:1V design at 6 m to a maximum height of 12 m or in the 1.5H:1V design at 9 m to a maximum height of 18 m to ensure surficial stability of the fill.

Culvert Treatment

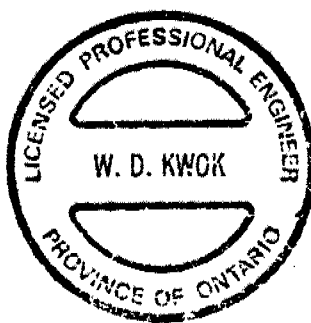
For granular backfill, a seal of cohesive material (CI-CH clay) with a minimum


thickness of 0.6 m should be constructed at the culvert inlet. The seal should extend a minimum of 5 m on each side of the culvert inlet, and from the high water level down to 1 m below the base of the culvert as a cutoff. The culvert inlet should be protected with 0.6 m of rock protection extending a minimum of 1 m beyond the clay seal. If the embankment will be rockfill, the seal and rock protection are not required at the inlet.

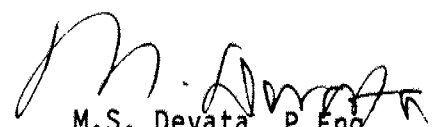
If the embankment is not rockfill, the culvert outlet should be provided with 0.6 m rock protection as per OPSD 810.01 Type 'A'. If the embankment is rockfill, this treatment will not be necessary. However, in any case, the outlet channel should be armoured with 0.6 m of rock protection for 15 m along the channel to prevent undercutting of the bed.

MISCELLANEOUS

The fieldwork for this investigation was carried out by B. Lane, Engineering Trainee. The drilling equipment was owned and operated by Dominion Soil Investigation Ltd. The report was prepared by Mr. D. Kwok, Project Foundation Engineer, under the general supervision of Mr. D. Dundas, Senior Foundation Engineer. The report was reviewed by Mr. D. Dundas and approved by Mr. M. Devata, Chief Foundation Engineer.




D. Kwok, P.Eng.
Project Foundation Engineer


M.S. Devata, P.Eng.
Chief Foundation Engineer

APPENDIX

EXPLANATION OF TERMS USED IN REPORT

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 1" 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_f	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

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	e_{max}	1, %	VOID RATIO IN LOOSEST STATE	j	kN/m ³	SEEPAGE FORCE
γ'	kN/m ³	UNIT WEIGHT OF SUBMERGED SOIL						

RECORD OF BOREHOLE No 1

1 OF 1

METRIC

W.P. 194-87-01 LOCATION Sta. 12 + 256.0, 28.4 RT. Hwy. 17
 DIST 18 HWY 17 BOREHOLE TYPE Cone Test, Hollow-Stem Auger
 DATUM Geodetic DATE 90 08 23
 ORIGINATED BY BL
 COMPILED BY BL
 CHECKED BY DD

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
199.2	Ground Surface		1	CS	•											
0.0	Frequent Cobbles And Boulders															
197.3	Silty Sand With Gravel Loose		1	SS	4											
1.9	Silty Clay		2	TW	PH											
	Trace Sand															
	Soft to Firm		3	SS	1											
	Occ. Sand And Gravel Hard		4	SS	17											
193.8	End of Borehole															
5.3	Probable Bedrock															
	• Grab sample taken by backhoe															

RECORD OF BOREHOLE No 2

1 OF 1

METRIC

W.P. 194-87-01 LOCATION Sta. 12 + 238.0, 6.6 RT. Hwy 17 ORIGINATED BY BL
DIST 18 HWY 17 BOREHOLE TYPE Solid-Stem Auger COMPILED BY DD
DATUM Geodetic DATE 90 08 24 CHECKED BY DD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT 7 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	W _p	W	W _L		
207.7	Ground Surface																
0.0	Cobbles And Boulders With Sand (Rock Fill)					DRY *											
205.4																	
2.3	End of Borehole * 90 08 24																

RECORD OF BOREHOLE No 3

1 OF 1

METRIC

W.P. 194-87-01 LOCATION Sta. 12 + 252.0, 6.8 RT. Hwy 17 ORIGINATED BY BL
DIST 18 HWY 17 BOREHOLE TYPE Solid-Stem Auger COMPILED BY OD
DATUM Geodetic DATE 90 08 24 CHECKED BY OD

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT			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	w _p	w		
207.7	Ground Surface															
0.0	Cobbles And Boulders With Sand (Rock Fill)				DRY *											
206.3																
1.4	End of Borehole • 90 08 24															

RECORD OF BOREHOLE No 4

1 OF 1

METRIC

W.P. 194-87-01 LOCATION Sta. 12 + 259.6, 6.8 LT. Hwy 17
 DIST 18 HWY 17 BOREHOLE TYPE Solid-Stem Auger
 DATUM Geodetic DATE 90 08 24
 ORIGINATED BY BL
 COMPILED BY DD
 CHECKED BY DD

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					
207.7	Ground Surface																
0.0	Cobbles And Boulders With Sand (Rock Fill)					DRY *											
206.0																	
1.7	End of Borehole • 90 08 24																

RECORD OF BOREHOLE No 5

1 OF 1

METRIC

W.P. 194-87-01 LOCATION Sta. 12 + 244.0, 6.8 LT. Hwy 17 ORIGINATED BY BL
 DIST 18 HWY 17 BOREHOLE TYPE Solid-Stem Auger COMPILED BY DD
 DATUM Geodetic DATE 90 08 24 CHECKED BY DD

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					
207.7	Ground Surface																
0.0	Cobbles And Boulders With Sand (Rock Fill)					DRY											
207.0																	
0.7	End of Borehole • 90 08 24																

RECORD OF BOREHOLE No 6

1 OF 1

METRIC

W.P. 194-87-01 LOCATION Sta. 12 + 256.0, 20.4 LT. Hwy. 17
 DIST 18 HWY 17 BOREHOLE TYPE Test Pit
 DATUM Geodetic DATE 90 08 24
 ORIGINATED BY BL
 COMPILED BY BL
 CHECKED BY DD

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			20	40	60	80	100					
203.5	Ground Surface																
0.0	Silty Sand		1	CS	*												
203.0	Frequent Cobbles And Boulders																
0.5	Silty Clay		2	CS	*		203										
201.8			3	CS	*		202										
1.7	End of Borehole Probable Bedrock																
	* Grab sample taken by backhoe																

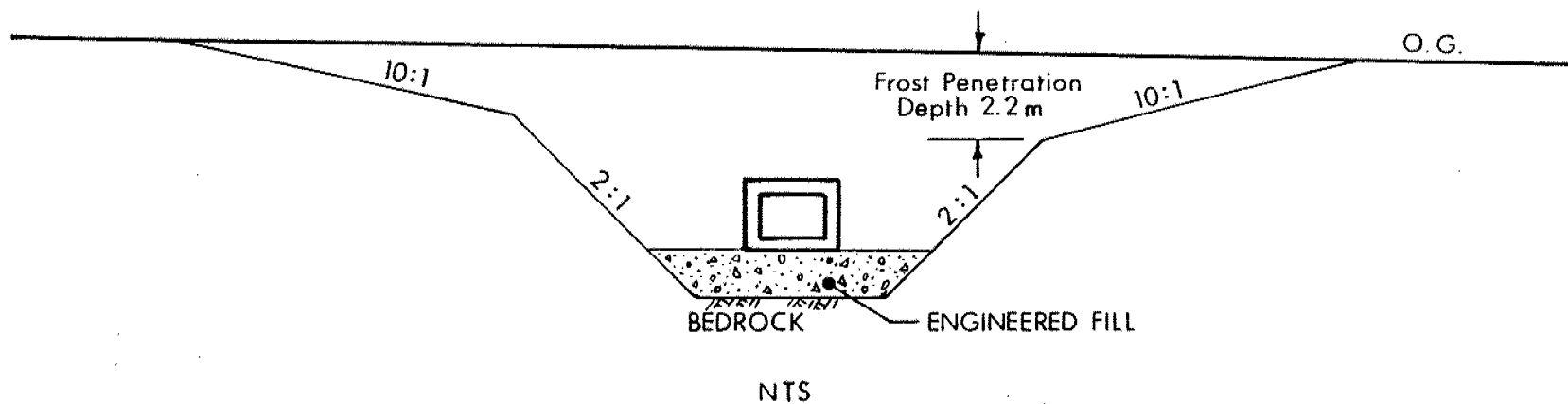


FIG 1 - SCHEMATIC SECTION SHOWING THE TEMPORARY CUT PROFILES

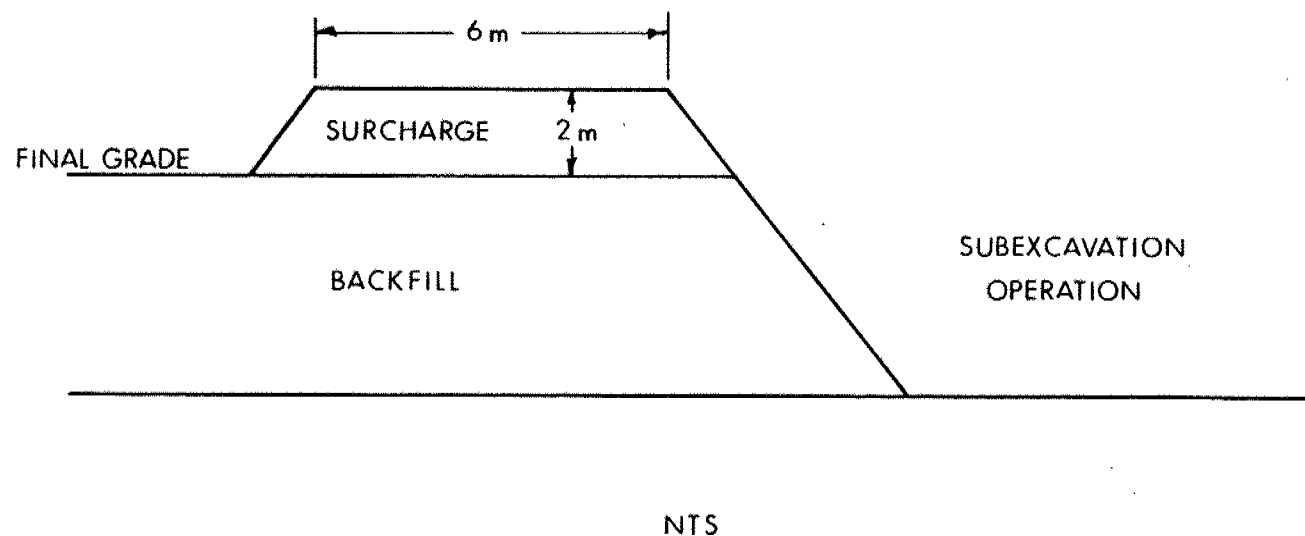
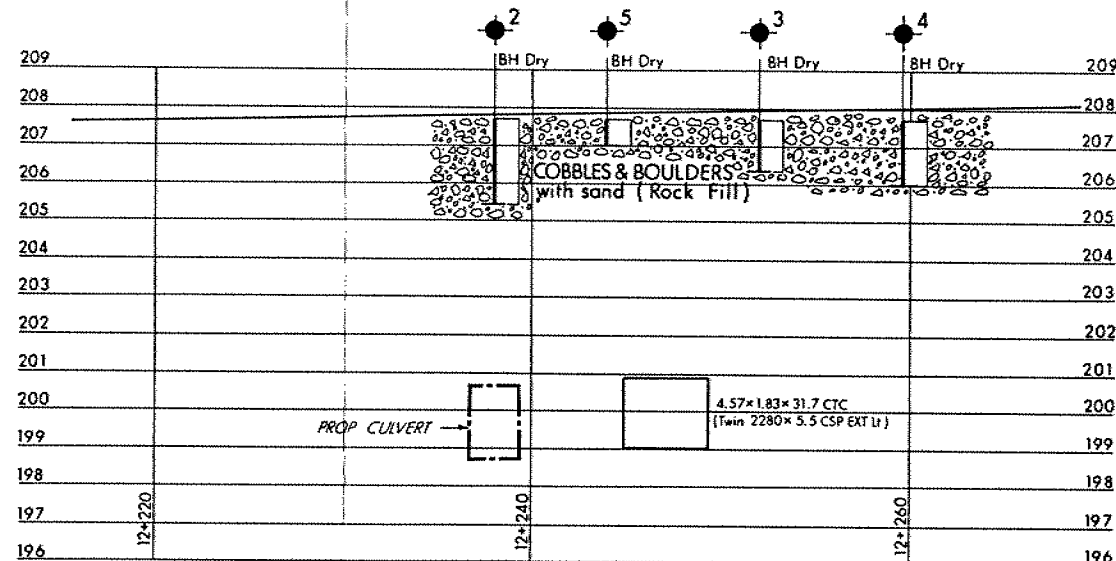
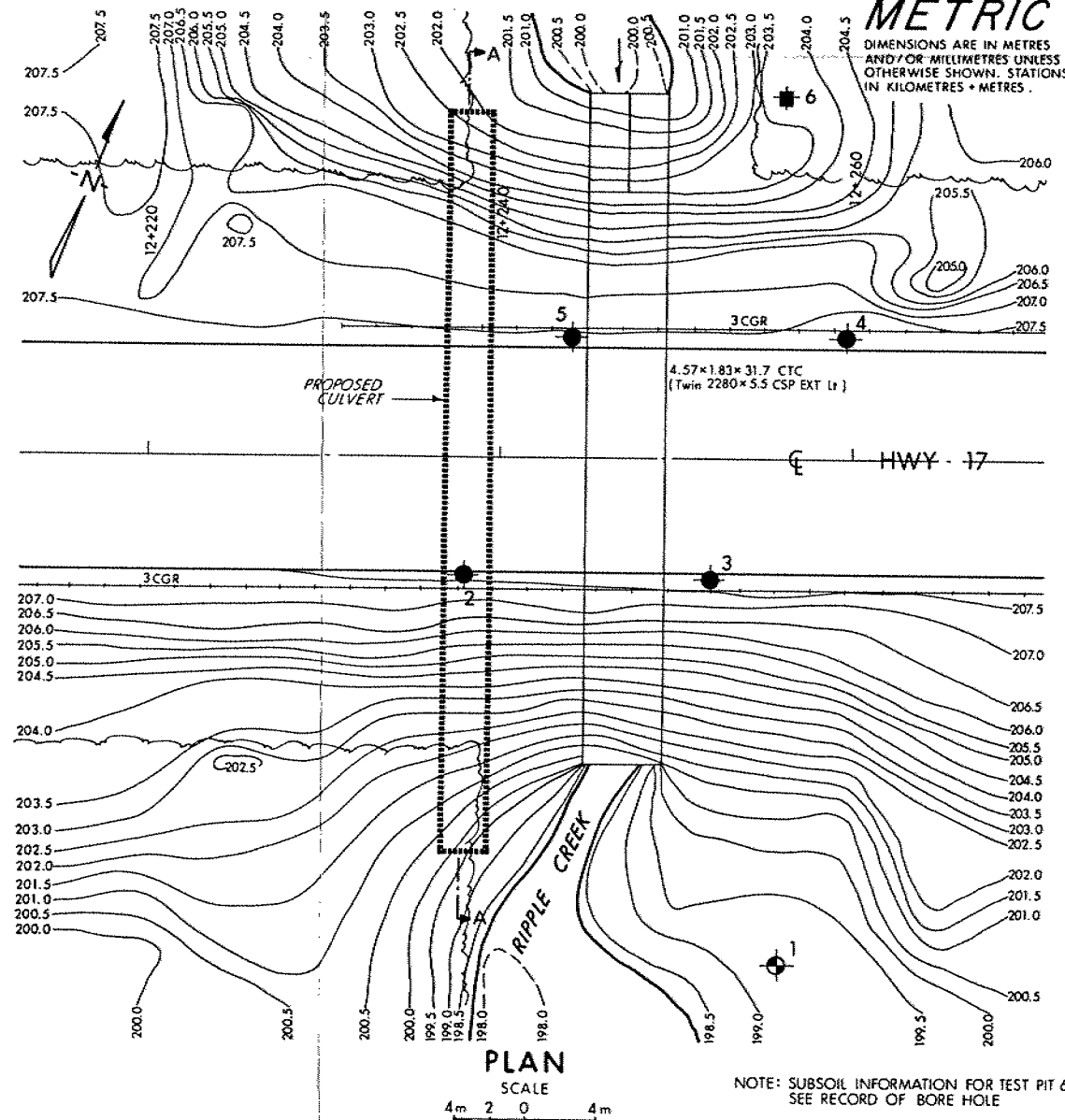
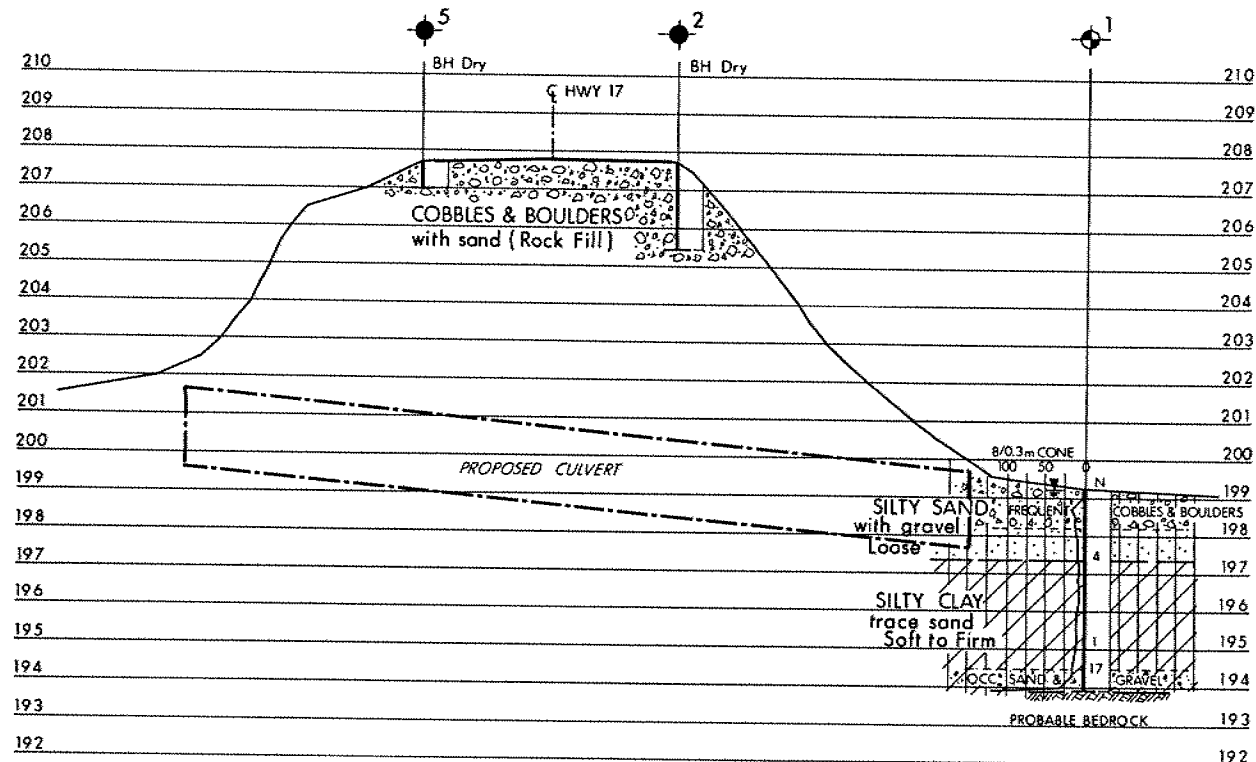


FIG 2 - SUBEXCAVATION AND SURCHARGE OPERATION



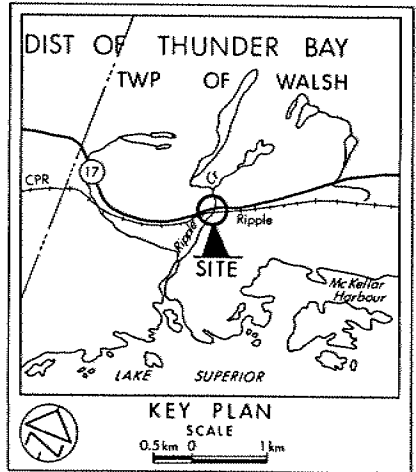
CONT No
WP No 194-87-01

RIFFLE CREEK

BORE HOLE LOCATIONS & SOIL STRATA



SHEET



LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- Wt at time of investigation 90 08
- ★ Test Pit

No	ELEVATION	STATION	OFFSET
1	199.2	12+256.0	28.4 m RT
2	207.7	12+238.0	6.6 m RT
3	207.7	12+252.0	6.8 m RT
4	207.7	12+259.6	6.8 m LT
5	207.7	12+244.0	6.8 m LT
6	203.5	12+256.0	20.4 m LT

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 Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

REV	DATE	BY	DESCRIPTION
1	1990 12 28	1	DATE 1990 12 28
2	1990 12 28	1	DATE 1990 12 28
3	1990 12 28	1	DATE 1990 12 28
4	1990 12 28	1	DATE 1990 12 28
5	1990 12 28	1	DATE 1990 12 28
6	1990 12 28	1	DATE 1990 12 28
7	1990 12 28	1	DATE 1990 12 28
8	1990 12 28	1	DATE 1990 12 28
9	1990 12 28	1	DATE 1990 12 28
10	1990 12 28	1	DATE 1990 12 28

Geocres No 42D-14	HWY No 17	SUBMD DK	CHECKED	DATE 1990 12 28	SITE 48E-47
		DRAWN SO	CHECKED	APPROVED	DWG 1948701-A