

DOCUMENT NUMBER IDENTIFICATION

GEOCRES No. 41K-39

DIST 18 REGION NORTHWESTERN

W.P. No. 903-72-02

CONT. No. 76-59

W. O. No. _____

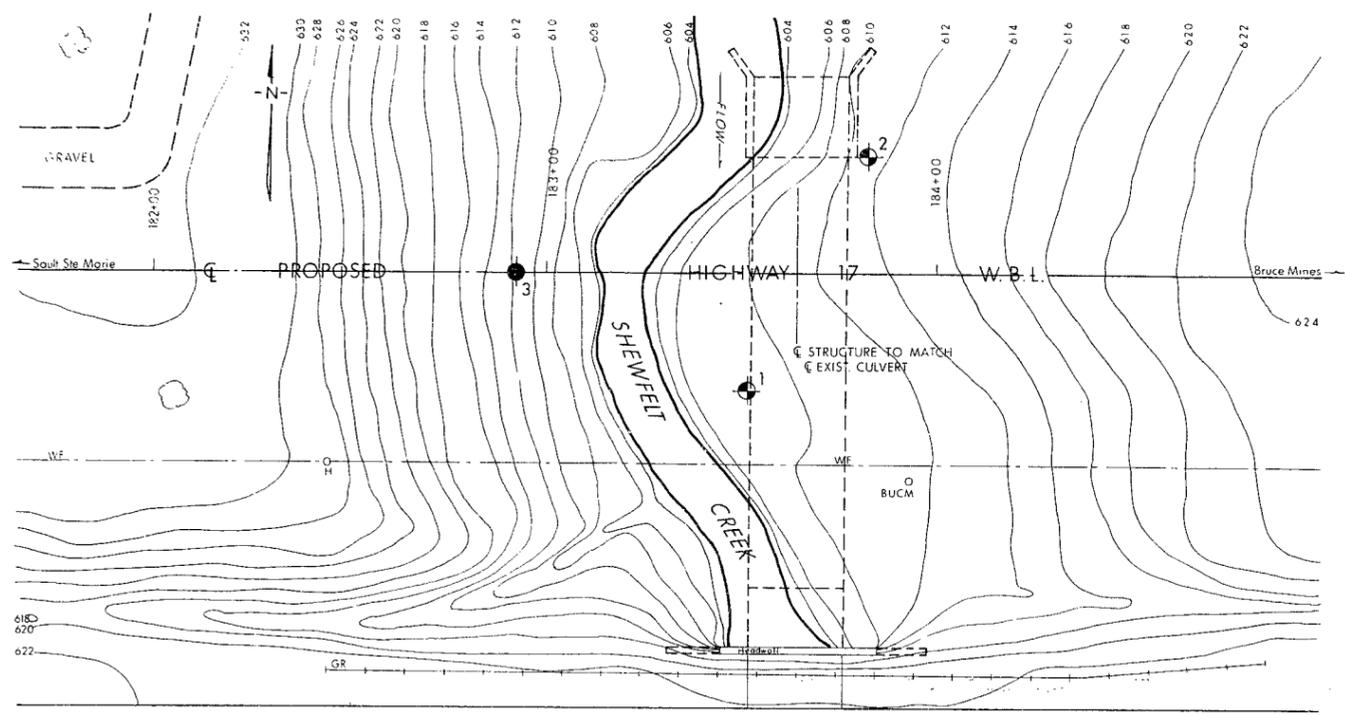
STR. SITE No. _____

HWY. No. 17

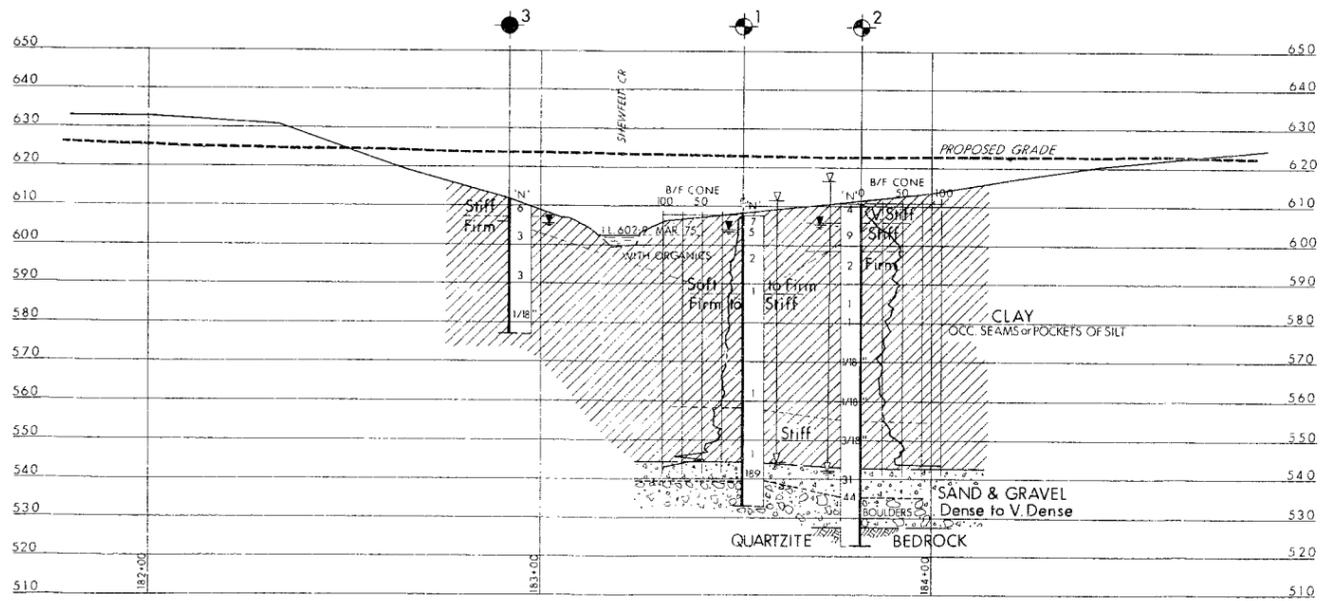
LOCATION Proposed Culvert North
of Rydall MILL Rd. and
HWY. 17.

OVERALL PROJECT COST IN THOUSANDS 3.

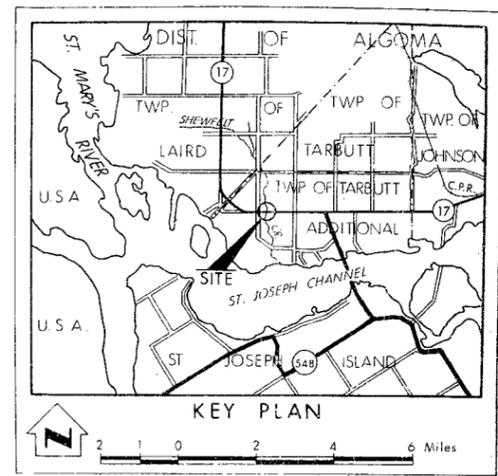
REMARKS _____



EXISTING HIGHWAY 17
PLAN
 SCALE 20 10 0 20 40 FT



Q PROFILE
 SCALE 20 10 0 20 40 FT



LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Resistance Test
- ⊕ Bore Hole & Cone Test
- ⊕ Water Levels established at time of field investigation MAR 1975
- ∇ Head ARTESIAN CONDITION
- ∇ Encountered

NO	ELEVATION	STATION	OFFSET
1	607.4	183+52	30' RT.
2	610.7	183+82	30' LT.
3	612.2	182+92	∅

NOTE
 The complete foundation file for this project may be examined at the Geotechnical Office, Downsview. Information in this file is specifically excluded in accordance with the conditions of subsection 102-2 of Form 100 as amended by the special provision "Contractor's Investigations" included with the contract documents.

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

REVISIONS	DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO
 ENGINEERING SERVICES BRANCH—GEOTECHNICAL OFFICE—SOIL MECHANICS SECTION

SHEWELT CREEK

HIGHWAY NO 17 PROP. W.B.L. DIST. NO. 18
 DIST. OF ALGOMA
 TWP. TARBUTT ADDITIONAL LOT 8 CON 6

BORE HOLE LOCATIONS & SOIL STRATA

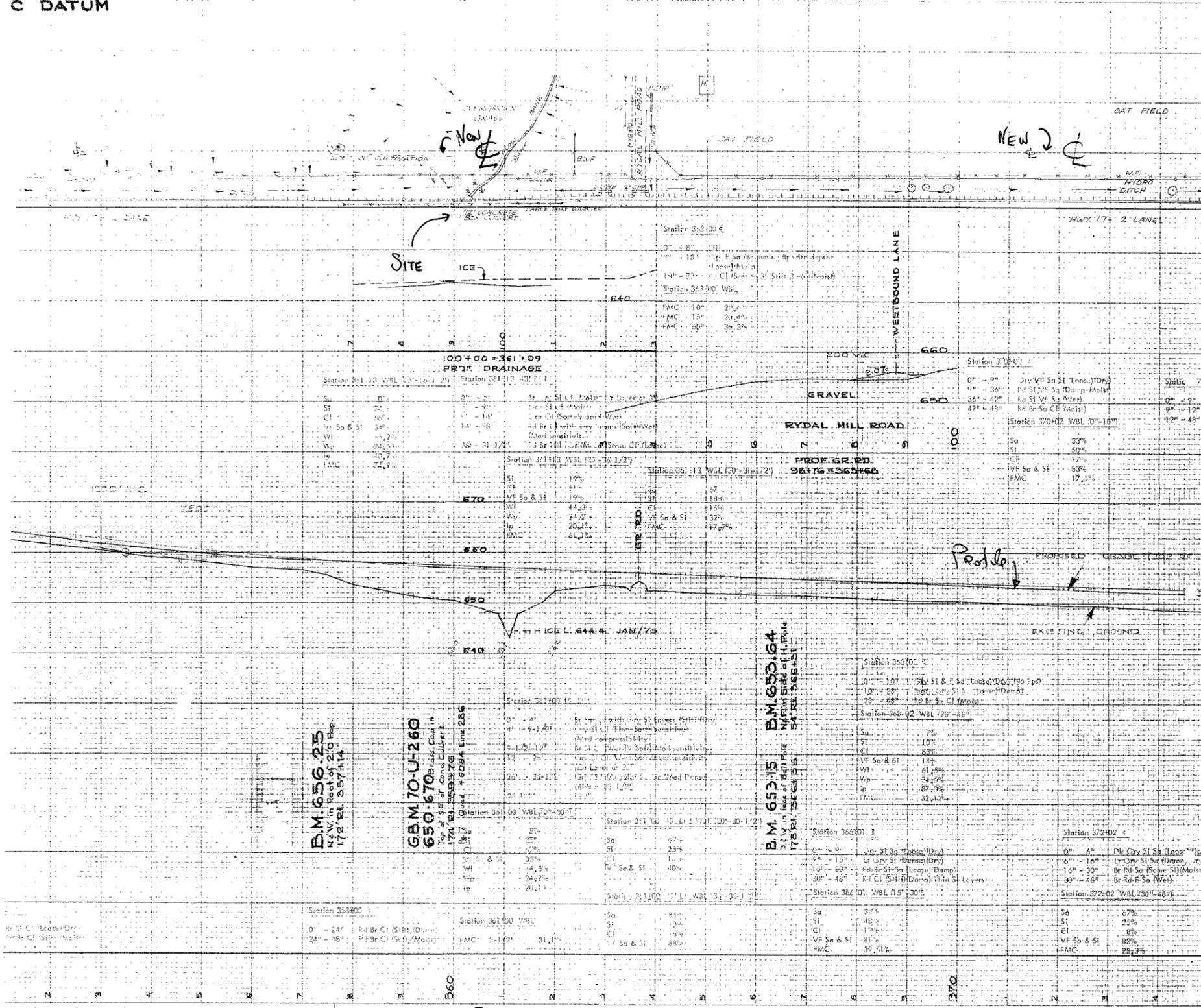
SUBMD H.S. CHECKED	WP NO 903-72-07	DRAWING NO.
DRAWN S.O. CHECKED	W.O. NO.	
DATE 9 APR 1975	SITE NO 385-285	BRIDGE DRAWING NO.
APPROVED	CONT NO 76-59	385-285-2

Twp# 341-285 2 B
 41K-39

B-602-17-2
C-602-17-2
C DATUM

Hwy 17.
Culvert w. Rydal
Mill Road.

W.P. 903-72-02



B.M. 656.25
W.V. in Box of 210
172' E. 95.7' N. 172'

B.M. 70-U-260
Top of 3" dia. Culvert
174' E. 33.3' N. 174'

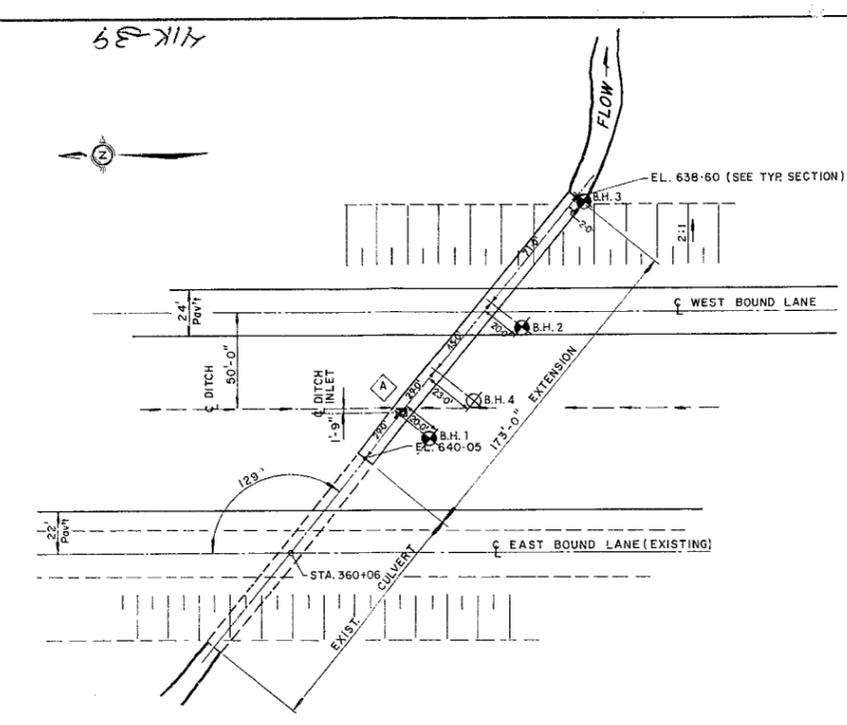
B.M. 653.15
W.V. in Box of 210
178' E. 36.4' N. 178'

B.M. 653.64
W.V. in Box of 210
184' E. 36.6' N. 184'

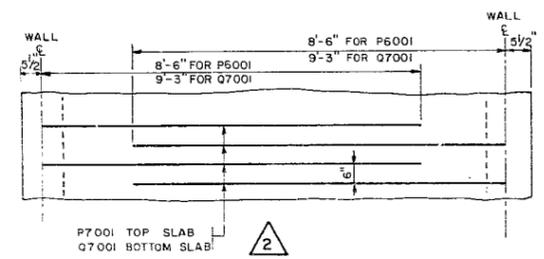
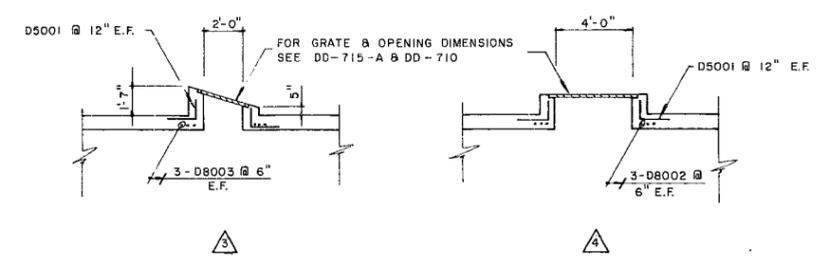
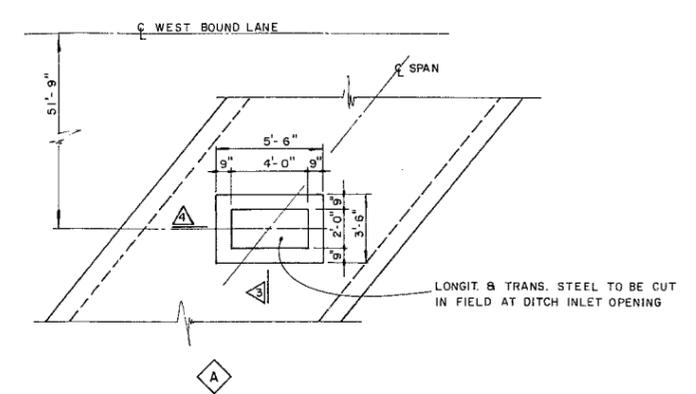
41K-39

1. The soil data shown on this plan view is for the soil in the culvert. It is not to be used for any other purpose.

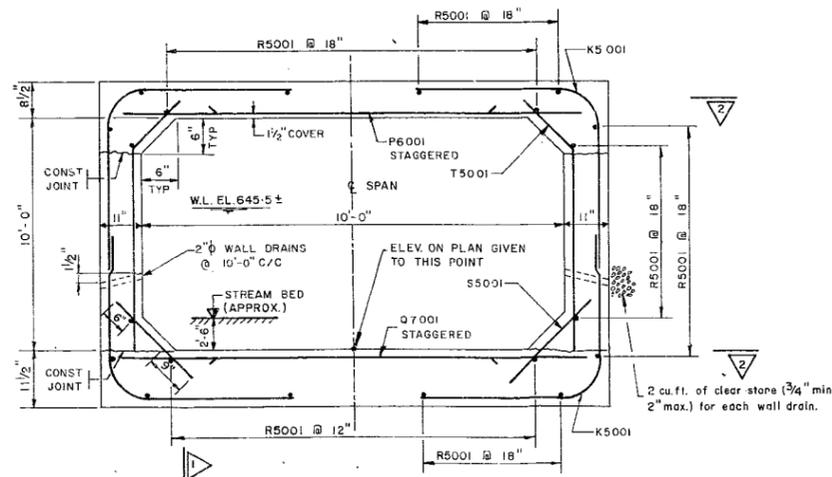
CONT No WP No	
CULVERT STATION	SHEET



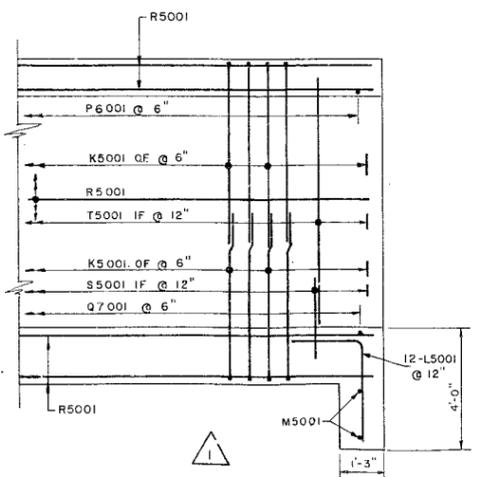
PLAN



2



TYPICAL CULVERT SECTION
SYMMETRICAL ABOUT & SPAN



1

* VERTICAL DIMENSIONS

MARK	No REQ'D	C/C	LENGTH	DETAILS	REMARKS
P6001	346	6"	8'-6"	STRAIGHT	BOTTOM OF TOP SLAB STAGGERED
Q7001	346	6"	9'-3"	STRAIGHT	TOP OF BOTTOM SLAB STAGGERED
K5001	1384	6"	11'-0 1/2"		OUTSIDE FACE TOP & BOTTOM
R5001	567	SEE SECTION	20'-6"	STRAIGHT 63 PER LINE	LONGITUDINAL (MIN. LAP 1'-6")
S5001	346	12"	2'-3"	STRAIGHT	INSIDE FACE OF WALLS (AT BOTTOM HAUNCH)
T5001	346	12"	10'-10 1/2"		INSIDE FACE OF WALLS
M5001	2	18"	11'-4"	STRAIGHT	APRON
L5001	12	12"	5'-8"		APRON
D5001	16	12"	2'-4"		DITCH INLET
D8002	6	6"	7'-0"	STRAIGHT	DITCH INLET
D8003	6	6"	9'-6"	STRAIGHT	DITCH INLET

GENERAL NOTES

- CLASS OF CONCRETE 3000 PSI
- CLEAR COVER TO REINFORCING STEEL 3" EXCEPT AS NOTED
- ALL EXPOSED CORNERS TO BE CHAMFERED 3/4"
- NO CONCRETE SHALL BE PLACED IN BOTTOM SLAB UNTIL THE DEPTH OF THE EXCAVATION AND CHARACTER OF THE FOUNDATION MATERIAL HAVE BEEN APPROVED BY THE ENGINEER
- FILL SHALL BE PLACED AT BOTH SIDES OF CULVERT SIMULTANEOUSLY
- CULVERT AND RETAINING WALLS (WHERE APPLICABLE) SHALL BE BUILT IN ACCORDANCE WITH MTC FORM 9
- REINFORCING STEEL SHALL BE HARD GRADE
- STEEL FOR EACH CULVERT (INCLUDING RETAINING WALL WHERE APPLICABLE) SHALL BE BUNDLED SEPARATELY AND MARKED WITH STATION NUMBER
- WALL DRAIN OPENINGS TO BE FORMED USING NON-METALLIC MATERIAL
- VERTICAL LOCATION OF WALL DRAINS SHALL BE DETERMINED IN FIELD BY THE ENGINEER
- IF DENOTES INSIDE FACE
- OF DENOTES OUTSIDE FACE
- E.F. DENOTES EACH FACE



DRAWING NOT TO SCALE

QUANTITIES			
ITEM	WALLS & SLABS	RETAINING WALL	TOTAL
WT OF REINF STL tons	22.08	-	22.08
VOL OF CONCRETE cu yd	249	-	249

CO				
TWP				
LOT		CON		
HWY		DIST		
DESIGN	DRAWN	CHECK	HWY	DATE
J.W.T.	B.J.A.	J.W.T.	17	FEB./76

DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 41K-39

DIST. 18 REGION Northwestern

W.P. No. 903-72-02

CONT. No. 76-59

W. O. No. _____

STR. SITE No. _____

HWY. No. 17

LOCATION Proposed Culvert North of Rydall Mill Rd. and Hwy. 17

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. ~~3~~ 3

REMARKS: documents to be unfolded before microfilming

memorandum

Indirect 76-59
WR 403-22-0



To: Pavement and Foundation
Design Section
Central Building
1201 Wilson Avenue
Downsview

Date: September 10, 1982

From: Property Office
5th Floor, 3501 Dufferin St.
Downsview

Re: Paat Property
Hwy. 17
- Arbitration

We gave a number of undertakings on discovery held in the above-referenced arbitration. Enclosed is a copy of the memo from Mr. G. L. Gardiner of District 18 indicating that the requisite engineering reports and test borings might be available at your office.

Would you have the matter researched and forward the materials to us accordingly.

Thank you for your attention to this matter.

E. Villaluz
Ernesto Villaluz (3213)
Arbitrations Clerk

For: John R. Hare
Senior Arbitrations Officer

EV/ic
Encl.

P.S. → Hand delivered ^{copy of} foundation report
and related material on 92 0920.
JRD
92-09-20



memorandum



To: Property Office
5th Floor
3501 Dufferin Street
Downsview, Ontario

Date: 1982 09 07

Attention: E. Villaluz
Arbitrations Clerk

Re: Paat Property Hwy. 17
Arbitration



I have completed a review of the diaries and files for Contract 76-59 as they exist as of this date. With the exception of six correspondence files and a copy of the daily equipment diaries, all other data (field books, supervisor's diaries, miscellaneous files, etc.) appear to have been destroyed.

As best I can with so little information, I will comment on Mr. T. C. Marshall's list of inquiries and undertakings.

- 1) See my letter of May 27, 1977 on your file.
- 2) See equipment diaries submitted - a list of the contractors equipment was presented at the time of construction however this has since been destroyed.
- 3) I believe the discovery of the artisan well as described in my 'Project Supervisor's Diary' - now destroyed. Also refer to my letter of May 27, 1977.
- 4) This paragraph is answered in my letter of May 27, 1977. The equipment diaries for the Shewfelt Creek structure have been isolated and marked as such in the box of diaries submitted to you under separate cover.
- 5) It states that Mr. Marshall requires engineering reports, test borings, etc. Any information of this nature that might be available would be found with the Geotechnical Office, Downsview, as noted on Sheet No. 131 (Soils Information) of the Contract Drawings for Contract 76-59.

I am not aware of any investigations that may have been made by the Ministry of the Environment related to the Paat property.

In reference to the last paragraph, Mr. Marshall should be advised that 'H' piling was performed in the area of the structure footings. These piles were driven to withstand an approximate load of 70 tons per pile. This was achieved by driving the piles to a depth in the range of 60 - 65 feet below the footing elevation. The sequence of pile-driving in relation to the artisan discovery is covered in my letter of May 27, 1977.

.....2

- 6) See soils profile and logs, Sheet No. 131 of the Contract Drawings Contract 76-59.
- 7) I can only assume that this has been done by the Structure Office Hydrology staff.
- 8) The diaries pertaining to the Shewfelt Creek Structure have been isolated and marked as such. These records as well as all other equipment diaries have been submitted as noted.

All references in the diaries to work other than the structure in the vicinity of the Paat property are intermingled throughout the other diaries and would take weeks to isolate. Such work was of such superficial nature that I doubt if it could have any bearing on this investigation.

- 9) The assumption that the sheet piling was simply driven down into the clay is correct. The piling was hoisted into vertical place with a $\frac{3}{4}$ cubic yard crane and driven using an air hammer and compressor. The depth to which the sheet piling was driven was determined by the contractor (approximately 17 feet from top of footing) which he felt was sufficient to withstand external pressures as the footing was excavated. This depth was approved by the Structural Office prior to start of this operation.
- 10) My letter of May 27, 1977, advises of the location and date on which the artisan well was encountered.

I realize that more detailed information may be required, however, the records now appear to be somewhat diminished and I hesitate to rely on memory for details after a time lapse of six years.

I trust this may be of some help and if I can be of further assistance, feel free to contact me at the District Office, Sault Ste. Marie.


G. L. Gardiner
District Services Supvr.
18-Sault Ste. Marie



Ontario

Ministry of the
Attorney
General

Crown Law Office
Civil Law

416/965-9592

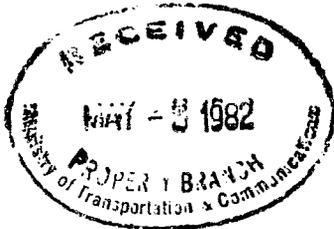
17th Floor
18 King Street East
Toronto, Ontario
M5C 1C5

Please Refer to File

No.

April 29, 1982

MEMORANDUM TO:



J. R. Hare,
Senior Arbitrations Officer,
Ministry of Transportation
and Communications,
Property Branch,
5th Floor,
3501 Dufferin Street,
Downsview, Ontario.
M3K 1N6

FROM:

T. C. Marshall
Counsel

RE:

Ministry of Transportation
and Communications ats Paat

We gave a number of undertakings on your Discovery in this matter conducted in Sault Ste. Marie on April 27, 1982. I list them below. In addition to the undertakings we gave, I have some inquiries that should be made as well and they are listed without differentiating as between undertakings and inquiries.

- (1) Was there any blasting required in the general locale of the Paat farm at all?
- (2) Can we obtain a list and description of the equipment used for the purposes of the road construction?
bridge
- (3) Where is the discovery of the artesian well described? Is there an entry in diaries to do with this or did Mr. Gardiner or other Ministry personnel personally observe the occurrence? I want to have some statement as to the amount of water that seemed to have emerged, a characterization of the pressure it was under and the duration?

J. R. Hare
April 29, 1982

(4) I want to know as well whether this occurred in an area where the stream was diverted. That is, did it occur in an area where there had not been water before? Indeed I think we should have a description in some detail of the operation at the bridge site on a step by step basis to indicate quite clearly what activities were carried out and when. This is all information that can perhaps be obtained from the job diaries.

(5) Can you in fact obtain for me the engineering reports that were prepared with respect to the soil conditions. If there were test borings done then I would like to have copies of the logs of those tests. Was any testing done at all on the Paat property? I would like to have some little exploration made as to the precise nature of the information given to the Minister of the Environment that would lead it to express the opinion that it did. I think I have to deal with whether or not it is reasonable to assume that there was the same stratum extending the 1300 feet between the well and the bridge site. We undertook in any event to review the engineering reports.

There is some reference in the material to an "H" pile that went down some very considerable distance. Can I be informed as to the purpose of this and when it was put down and how the timing of that related to the notice of the artesian well.

- (6) When we have the logs of the test borings we should also have a clear record of the location of those test bore holes.
- (7) Can we make some inquiry of perhaps the Ministry of the Environment or the Ministry of Agriculture and Food to determine whether this particular area is an area that is known to be underlain by "pools" of water or has a somewhat unique aquafer configuration. I can perhaps refine this question in discussion with you.

J. R. Hare
April 29, 1982

- (8) Mr. Gardiner will review all of the job diaries and will pull out everything that relates to construction in front of the Paat property and on the structures themselves. I think copies should be made of that material and I would like to have a copy of it.
- (9) Can we have a description as to how the sheet piling is put in. Is it simply driven down through the clay? How is the depth to which it is driven determined?
- (10) If there is no entry in the diaries about the artesian well being encountered do we have some way of identifying the exact date on which that event occurred?

You indicated that the Ministry had a policy of going in and testing wells close to the right-of-way. You mentioned that there was a quality test and presumably a flow test also conducted. Are there written policies with respect to this kind of activity? If so, can I have copies of whatever it is that set out those policies and some indication as to the reason for these policies being established?

- (11) You were going to inquire of the Insurance and Claims Sections concerning other well complaints and you were going to locate opinions expressed by the Ministry of the Environment that might be contrary to the opinion expressed in this case. It may be that the insurers for Bot Construction who may have had to investigate some of these complaints would have files that would be of assistance to us as you suggest.

J.R. Hare
April 29, 1982

- (12) I think I would like to look at the Ministry files as they relate to McQuarrie and what was done to remedy this problem.
- (13) Did we carry out any testing anywhere in connection with these well complaints after they were first made to determine underground conditions? Did the Ministry of the Environment do any testing themselves. It does not seem so.

A number of undertakings were given to us. They were as follows:

- (1) Produce the receipts for water hauling. This should tend to give us some idea of the date on which the well dried up.
- (2) The date Furkey deepened the well and a copy of the well record kept by him.
- (3) Any records that he kept with respect to pumping tests and quality tests on the deepening of the old well.
- (4) Quota details and cattle sales records.
- (5) A direction from her to get records from the Milk Marketing Board.
- (6) The date of the first notice to M.T.C. re loss on cattle.
- (7) The exact date that the water ran out.
- (8) Provide any information re loss of water that we don't have.
- (9) Provide a general sketch of home farm, house, highway, driveway, creek touching property, bridge structure and house and position of the two wells.

FOUNDATION INVESTIGATION REPORT

For

The Proposed Culvert North of
Rydal Mill Rd. and Hwy 17 (W.B.L.)
Hwy. 17, District 18, S.S.M.
W.P. 903-72-02

1. INTRODUCTION

It is proposed to improve the existing Hwy. 17, southeast of Sault Ste. Marie, to a four lane divided highway. Two new lanes, parallel to and east of the existing Hwy 17, are to be constructed to accommodate the west bound lanes at the above mentioned location. Approximately 350 ft. north of Rydal Mill Rd., a culvert extension in a southeasterly direction is proposed where the creek crosses the west bound lanes. Originally, a concrete box structure similar to the existing culvert was proposed. During a preliminary soils investigation at the site, personnel from the Northwestern Regional Materials and Testing Section found poor subsoil conditions at the proposed location. As a result, the Soil Mechanics Section was requested to carry out a detailed foundation investigation at the site to determine the subsoil conditions and make recommendations pertaining to the type and placement of the culvert and the associated stability and settlement considerations of the proposed embankment.

2. SITE DESCRIPTION

The site is located 8 miles south of the town of Echo Bay, immediately east of existing Hwy. 17 approximately 350 ft. north of Rydal Mill Rd. The eastward flowing creek at this location travels through a shallow valley approximately 10 ft. wide. During the course of the field investigation, the site was blanketed by a 4 ft. cover of powdery snow drifting to 6 ft. heights east of the existing 10 x 10 concrete box culvert. This snow cover limited the definition of the creek boundaries, however, from the profile submitted by the Northwestern Region, the maximum depth of the creek valley is 5 ft., with steep side slopes. The overall north and south river banks have slopes of 2 horizontal to 1 vertical. An ice

level in the creek was established at 644.4, January, 1975.

The surrounding terrain is flat to gently undulating in relief between elevation 650 and 658 favoring crop farming and grazing. Numerous gullies are evident in the vicinity of the site.

3. FIELD AND LABORATORY WORK

Snow conditions together with accessibility problems during the time of the field investigation, limited the investigation to the south bank of the creek. Three sampled boreholes accompanied by dynamic cone penetration tests were carried out by means of a bombardier mounted hollow stem auger machine. One additional dynamic cone penetration test was carried out to provide complementary field data.

Samples of the overburden were obtained at required depths by means of a 2 in. O.D. split-spoon sampler, the sampling carried out according to the specifications for the Standard Penetration Test. The same method was used to advance the dynamic cone penetration tests. Where cohesive deposits were encountered, 2 in. O.D. Shelby tube samplers were pushed manually or hydraulically into the soil. In addition, field vane tests were carried out, where possible, to determine the in-situ undrained shear strength of the soil.

All samples were subjected to a careful inspection and classification, both in the field and in the laboratory. Following this examination, various laboratory tests were effected on representative soil samples, to determine the physical properties of the overburden, namely:

- Natural Moisture Contents
- Atterberg Limits
- Grain Size Distributions
- Undrained Shear Strengths
- Consolidation Characteristics

Surveying of the borehole locations was carried out by personnel from the Sault Ste. Marie District Office. (See Fig. 1).

Groundwater levels were established by taking readings in the open boreholes

during the period of the foundation investigation.

4. SUBSOIL CONDITIONS

4.1 General

A cohesive deposit of reddish-brown to grey, soft to firm, silty clay to clay extends to a depth of 25 ft. below the ground surface. The upper 2.5 to 6.5 ft. of the stratum consists of silty clay with sand and organics. Beneath this stratum, a granular deposit of silty sand was encountered.

4.2 Silty Clay with Organics to Clay

The cohesive deposit at the site consists of a reddish-brown to grey silty clay to clay. The upper 2.5 to 6.5 ft. of this deposit is a silty clay with sand and organics extending to elev. 642. The organic content by weight in this portion of the deposit ranged between 2.6 and 5.5 percent. The organics within this material are believed to be the former stream bed. Below elev. 642, the deposit changes to a clay and extends to elev. 621. The overall thickness of the cohesive stratum measures 25 ft.

The physical properties of the cohesive stratum are as follows:

		<u>Silty Clay with Organics</u>	<u>Clay</u>
Liquid Limit	%	29 - 51	50 - 80
Plastic Limit	%	16 - 30	22 - 31
Moisture Content	%	23 - 77	50 - 82
Bulk Density PCF	%	-	95 - 103

Undrained shear strength testing for the cohesive stratum gave the following values:

	<u>RANGE (PSF)</u>
In-situ field vane	440 - 760
Laboratory vane	515 - 770

The above data reveals that the soil below the silty clay with organics is a soft to firm inorganic clay of high plasticity displaying a medium

sensitivity. (See Fig. 2) A 1.0 ft. thick localized surficial deposit of gravel with sand was found in one isolated location at the site.

4.3 Silty Sand

At a depth of 25.0 ft. below the ground surface (approx. elev. 621), a layer of silty sand some gravel was encountered. The relative density of this granular deposit in general, increases with depth from loose to very dense. The 'N' values vary from 1 blow/ft. in the upper portion increasing to 71 blows/ft in the lower portion of the deposit. The stratum was proven to a maximum depth 41.5 ft.

4.4 Groundwater Conditions

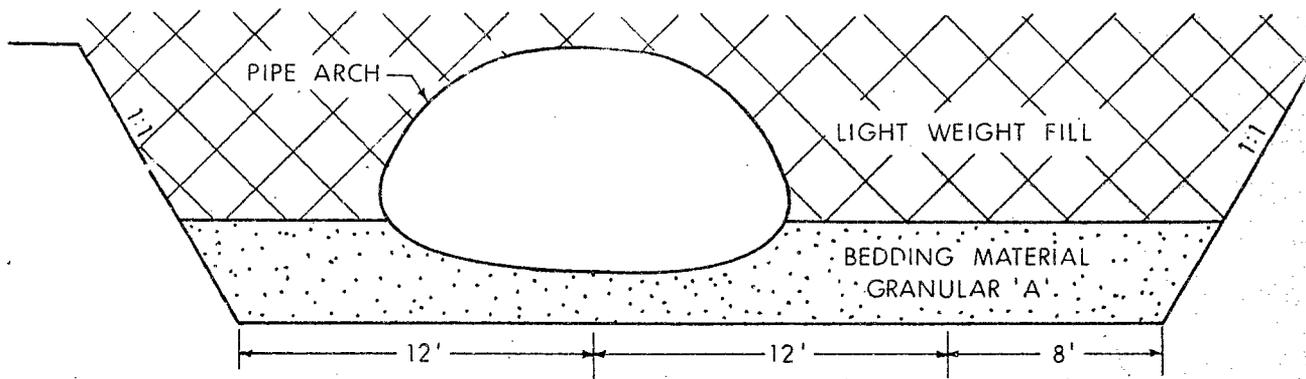
The stable groundwater table across the site was established at the ground surface. Groundwater was first noticeable when the boring operations penetrated through the cohesive stratum to the lower granular layer.

5. DISCUSSION AND RECOMMENDATIONS

Subsequent to the foundation investigation, this Office was in communication with the Consulting Engineering Firm of McCormick Rankin and Associates Ltd. Based on the poor subsoil conditions encountered at the site, it was agreed that a structural steel pipe arch is a more desirable structure type for the proposed culvert extension than the formerly planned rigid concrete box. It is now understood that the creek will be carried under the proposed Hwy. 17 west bound lanes, by a structural steel plate pipe arch culvert of dimensions 12'9" x 8'10", extending for a distance of 173 ft. southeast from the existing concrete box culvert. The invert elevation is to vary between 641.7 at the connection with the existing box and 640.5 at the east extreme of the culvert.

5.1 Design Recommendations

The bedding requirements for the proposed culvert should be according to MTC Standard No. DD 808-B, Type 5 with subexcavation as shown on the following page.



The structural steel plate pipe arch should be placed on a mat of granular material in order to distribute the critical corner bearing pressure so that the stress increase induced in the cohesive foundation subsoil will not exceed the allowable bearing capacity of this deposit.

During construction, should pockets of organic material be encountered below the limit of excavation such material should be excavated to its full depth and replaced with well-compacted granular material. The compaction of the material in the vicinity of the haunches is critical. The limits of subexcavation are indicated on the aforementioned figure, where slopes of 1:1 should be brought up to the frost line which is approximately 6 ft. below the ground surface. Lightweight backfill of Algoma Steel slag as shown above should be used to reduce the load on the foundation soil to minimize post-construction settlement.

The pipe arch will settle differentially due to the consolidation of the underlying cohesive stratum as a result of the imposed embankment loading. In order to allow for this settlement, it is recommended that the structure be cambered. A camber of 9.0 inches at the centreline of the proposed highway embankment should be incorporated in the culvert design in order to maintain the required hydraulic gradient through the culvert should the anticipated settlement take place.

The connection between the existing concrete box culvert and the structural steel plate pipe arch should be carried out according to MTC Standard

No. DD-810. In addition to this, the Consultants were provided with two structural drawings detailing the connections between the existing box culvert at Eighteen Mile Creek, District No. 4, and the proposed structural steel pipe arch extensions. (Drawing No's 138-45-1, 138-45-4) According to available information, this pipe arch culvert connected to the box culvert is performing satisfactorily without any signs of distress.

Stability analyses in terms of total stresses were carried out for the proposed embankment to determine the stability of the highway embankment. The maximum height of fill will be 15 ft., the vertical distance from the existing creek bed to the proposed profile grade of Hwy. 17W, elev. 657. The following soil parameters were used in the analysis:

Soil Type	Elevation	ϕ	Cu. (PSF)	γ (PCF)
Fill	657 - 642	30°	0	125
Clay	642 - 635	0	540	100
Clay	635 - 630	0	440	98
Clay	630 - 621	0	650	98
Silty sand	621 - 605	32°	0	115

Groundwater table - Ground Surface

The results showed that the proposed embankment is safe with respect to the stability in the transverse direction provided 2:1 side slopes are constructed and the suggested subexcavation and backfill methods are adhered to.

5.2 Construction Requirements

The stable groundwater table was established at the ground surface across the site. In order that the bedding for the structural steel pipe arch be placed in a relatively dry condition, a temporary dewatering scheme will be required. Two schemes are possible: the creek could be temporarily diverted, or a relatively impervious earth dike could be constructed and any infiltrated water in the cofferdam area could be pumped out by conventional means.

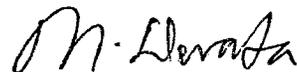
6. MISCELLANEOUS

The field work, performed during the period of March 4 to March 8, inclusive, 1976, was carried out under the immediate supervision of Mr. R.W. Barnes, Project Engineer.

The drilling equipment was owned and operated by Canadian Longyear Ltd., Sudbury.

This report was prepared by R.W. Barnes under the general supervision of Mr. M. Devata, Supervising Engineer, who also reviewed this report.


R.W. Barnes
Project Engineer


M. Devata
Supervising Engineer

MD/op
April, 1976



ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 1

WP 903-72-02 LOCATION See Figure 1 ORIGINATED BY RWB
 DIST 18 HWY 17 WBL BORING DATE March 4, 1976 COMPILED BY RWB
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger CHECKED BY _____

SOIL PROFILE		STRAT. PLOT	SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT				LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION		NUMBER	TYPE	N' VALUES		SHEAR STRENGTH PSF				WATER CONTENT %				
						200 400 600 800 1000				w_p w w_L			P.C.F. GR SA SI CL		
						O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				25 50 75					
645.0	Ground Level		1	SS	3										
	Silty clay with topsoil		2	TW	PM										4.9% Org.
	Reddish Brown to Grey Clay		3	TW	PM	640									0 1 38 61
			4	TW	PM										
	Soft to Firm		5	TW	PM	630									
			6	TW	PM										
620.0	Silty sand some gravel		7	TW	PM	620									15 47 32 6
25.0	Loose		8	SS	4										15 43 37 5
610.0	End of Borehole					610									
35.0	Borehole auger to 35.0 ft.					600									

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO
 ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 2

WP 903-72-02 LOCATION See Figure 1 ORIGINATED BY RWB
 DIST 18 HWY 17 WBL BORING DATE March 5, 1976 COMPILED BY RWB
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger CHECKED BY

SOIL PROFILE		STRAT. PLOT	SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS			
ELEV DEPTH	DESCRIPTION		NUMBER	TYPE	'N' VALUES		20	40	60	80	100	SHEAR STRENGTH PSF					P.C.F.	% GR SA SI CL	
						O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					WATER CONTENT %								
647.8	Ground Level																		
0.0	Gravel with sand	4.3	1	SS	15													56 38 (6)	
	Silty clay with sand, organics		2	SS	17													0 20 51 29	
	Reddish Brown to Grey Clay Soft to Firm		3	TW	PH													0 33 32 35	
			4	SS	1													0 25 30 45	
				5	TW	PM	640											98	
				6	TW	PM													98
				7	TW	PM	630												95
622.8	Silty sand, some gravel. Loose to Compact		8	TW	PM													0 44 49 7	
25.0			9	SS	8													14 57 23 6	
				10	SS	24												11 52 35 2	
608.8	End of Borehole					610												17 48 31 4	
39.0						600													

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 4

WP 903-72-02 LOCATION See Figure 1 ORIGINATED BY RWB
 DIST 18 HWY 17 WBL BORING DATE March 8, 1976 COMPILED BY RWB
 DATUM Geodetic BOREHOLE TYPE Dynamic Cone Penetration Test CHECKED BY _____

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w		UNIT WEIGHT γ	REMARKS % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w		
648.0	Ground Level														
0.0															
607.0															
41.0	End of Cone Test														

20
15 \diamond 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

PLAN VIEW

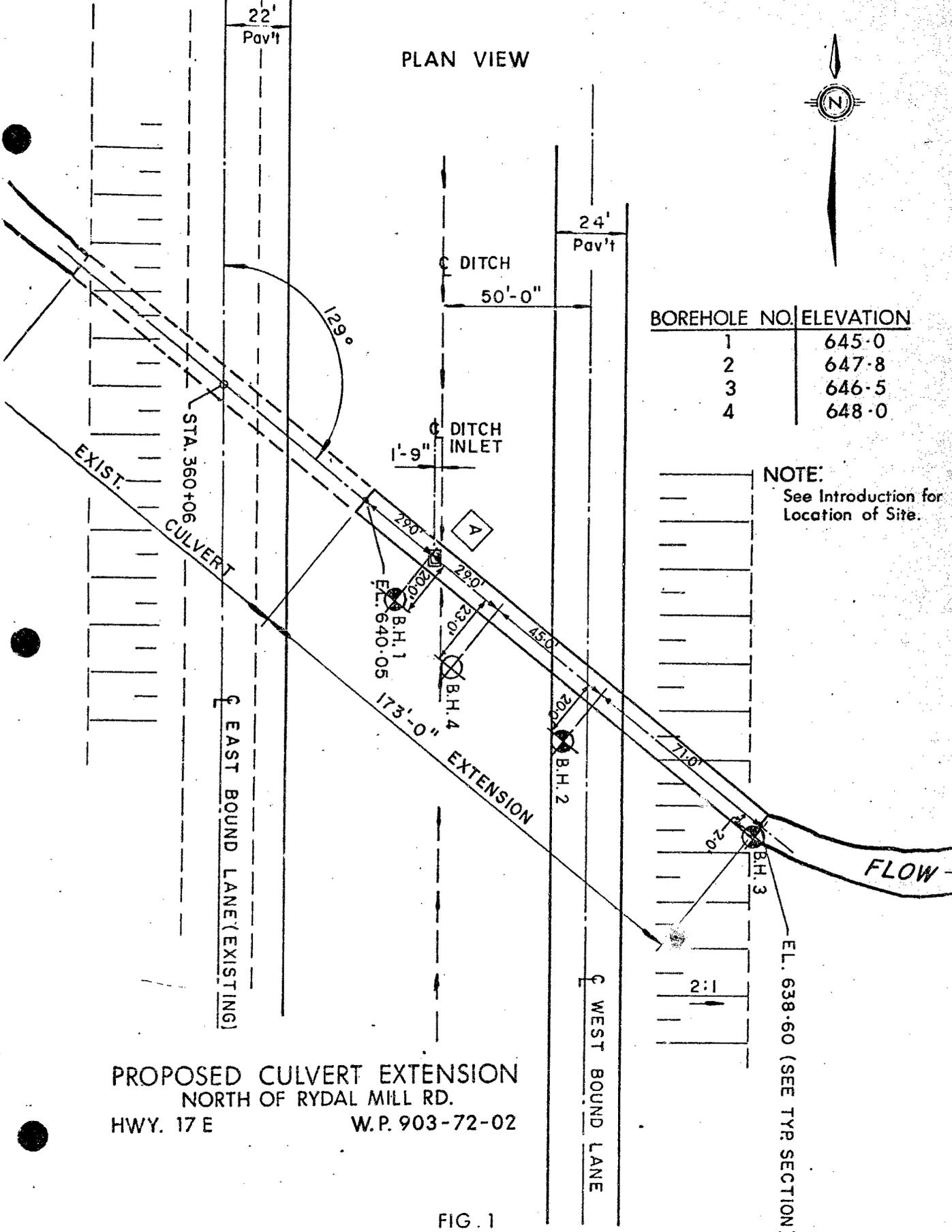


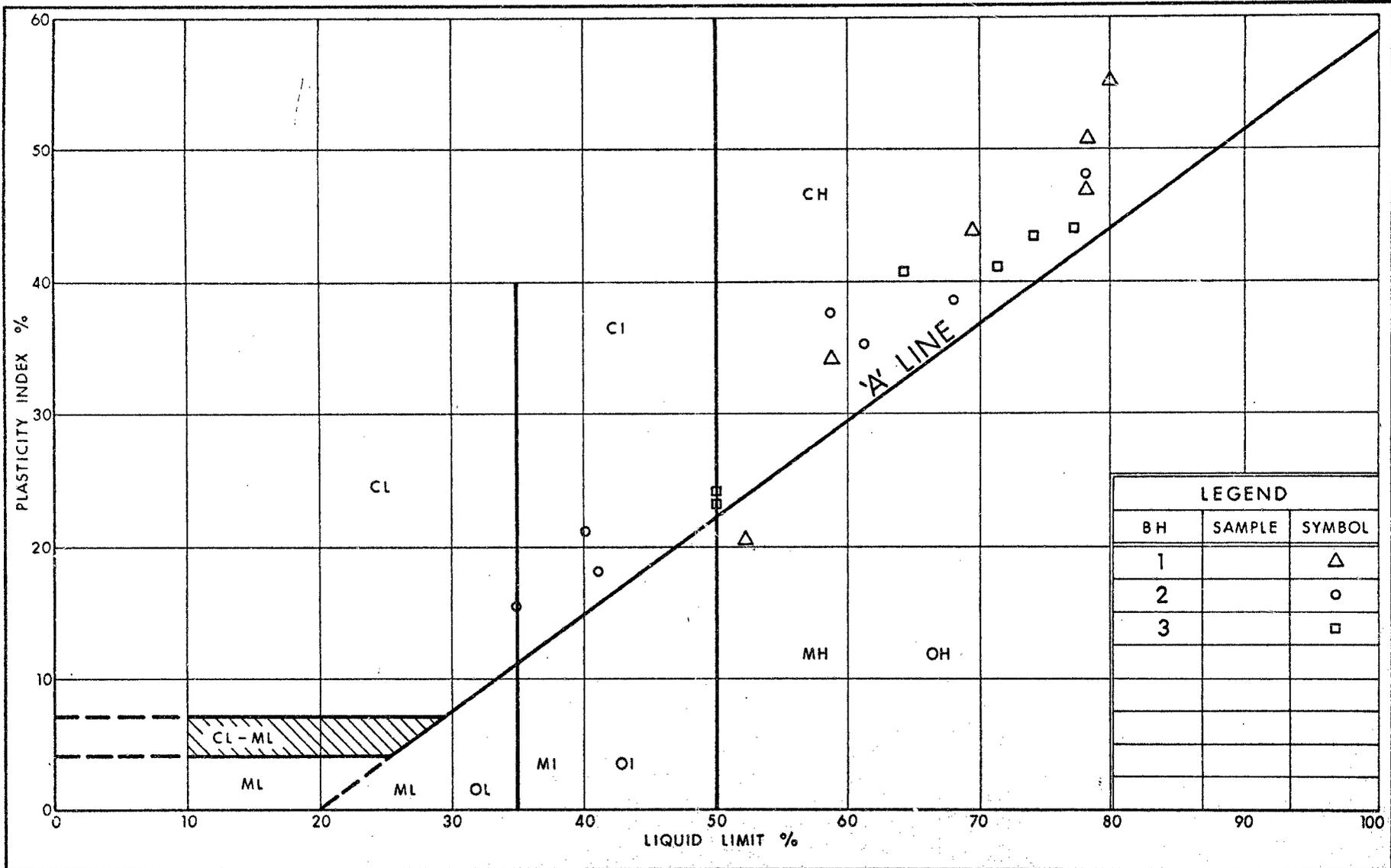
BOREHOLE NO.	ELEVATION
1	645.0
2	647.8
3	646.5
4	648.0

NOTE:
See Introduction for
Location of Site.

PROPOSED CULVERT EXTENSION
NORTH OF RYDAL MILL RD.
HWY. 17 E W.P. 903-72-02

FIG. 1







Memorandum

To: Mr. D. Jarvis, Head
Planning & Design Section
Northwestern Region, Thunder Bay

From: Soil Mechanics Section
Engineering Materials Office
3rd Floor, Central Building

Attention:

Date: 78 03 22

Our File Ref.

In Reply to

Subject: Re: W.P. 903-72-00
Hwy 17, Echo River Crossing
Four Lane Alignment Revision
District 18, Sault Ste. Marie

903-72-02

As per your request, we have completed a preliminary foundation investigation for the feasibility study of an alternative crossing of new Hwy. 17 at Echo River. The new alignment is some 800 feet south of Line "D" and the new crossing is approximately 1800 feet south of the existing Bailey bridge on Lakeshore Drive over Echo River. This memorandum summarizes the results of our findings, together with the pertinent recommendations for the structure foundations and the approaches. It should be noted that the recommendations given herein are of a preliminary nature. A final foundation investigation will be necessary when the preliminary design is completed. This memorandum should be appended to our previous foundation report under W.P. 903-72-00.

1. Subsurface Conditions

Subsoil at the new alternative crossing consists of a deep deposit of soft to stiff clay to silty clay which extends to at least 120 feet below the ground surface. No attempt has been made to determine the lower boundary of this cohesive deposit because of the great depth. The undrained shear strength of the clay to silty clay, as determined by field vane tests, gradually increases with depth. In the upper 30 feet, the undrained shear strength varies from 300 psf. to 750 psf. From 30 feet to 60 feet below the ground surface the undrained shear strength remains more or less constant with depth, with an average value of about 950 psf. Below this depth, the undrained shear strength again increases with depth from 1250 psf. to 1600 psf, at a rate of 16 psf per foot. The groundwater level was found to be at approximately elevation 580.0 which is about the same elevation as the ice level in the river.

2. Recommendations

The following preliminary recommendations are provided for feasibility study purposes.

cont'd.....

2.1 Structure Foundations

The most suitable type of foundations, in our opinion, will be friction timber piles. For #14 class A timber piles driven at least 40 feet in the original ground, an allowable load of 15 tons per pile may be assumed for design purposes.

2.2 Approach Embankments

2.2.1 Stability Consideration

The depth of water at the revised crossing is about 6 feet to 8 feet. The height of the approach fills in the forward direction, therefore, should be measured from the riverbed. The following recommendations are provided for the design of fills of various heights with side slopes and forward slopes of 2:1.

- Fills up to 9 feet in height in the transverse direction will be stable.
- Approach fills in the longitudinal direction up to 12 feet in height (measured from riverbed) will be stable.
- Mid-height berm will be required if fills are higher than 9 feet in the transverse direction or 12 feet in the longitudinal direction. The berm should be 8 feet long for every 1 foot height in excess of the above safe heights.
- Fills higher than 15 feet in the transverse direction or 18 feet in the longitudinal direction will require multiple berms.

2.2.2 Settlement Consideration

The cohesive subsoil will consolidate under the weight of the approach fills. For fills of 9 feet in height, the induced settlement is estimated to be 8 inches over a period of 4 years and a total of 14 inches over a period of 15 years. In view of the anticipated large settlement, it would be advantageous to preload the site for as long a period as possible, or apply a surcharge to the embankments, prior to constructing the structure. However, should the method of surcharge be contemplated, stability of the new fill configuration should be investigated.

2.3 Conclusion

The revised alignment is closer to Lake George and is located in a low lying swampy terrain. From a soil mechanics' point of view, the new alignment is less

cont'd.....

favorable than the previous alignments originally proposed by the Region and investigated by this Section. The fill heights can be increased and the settlement problems can be minimized if light-weight material is used to construct the embankments. Should this be contemplated, this Section will provide specific recommendations.

B. Ly

B. Ly
Senior Engineer

For: M. Devata
Supervising Engineer

BL/ig

cc: E. Van Beilen
C.M. Smith
G. Wrong
W. Kulmatickas
Files ✓

HEAD OFFICE REVIEW SUMMARY

BOARD OOMS E-1 and E-2
DOWNSVIEW M3M 1J8, Ontario

DATE: April 9, 1976

W.P. 903-72-02

CONTRACT 76-59

HIGHWAY 17 & 638

TYPE OF WORK Grading, Drainage, Granular Base, Hot Mix Paving and Structures

LOCATION Bar River Road to Range Light Road 10 mi East of Hwy 548 and Hwy 638
from Hwy 17, Echo Bay E'ly .8 mi

DISTRICT 18

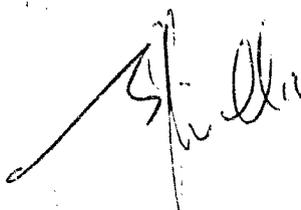
ADVERTISING DATE May 12, 1976

ATTENDANCE

J. R. Wear	M. Devata	W. Berkis	P. McWatt
E. J. Willis	F. G. Allen	W. Bennett	D. Mieh
McCormick & Rankin	J. E. Callaghan	G. Wrong	J. Crannie
W. Katarynczuk	J. Davidson	S. Kryzevicius	N. Zoltay
D. Fossum			

POINTS OF DISCUSSION

1. Status of Utilities - Bell overhead and buried cable will be relocated during life time of contract so qualifying Special to be added.
2. Due to scattered nature of rock it was decided to leave compaction items as designed.
3. Hwy 548 intersection - agreed to remove rock in median for visibility from initial stop.



E. J. Willis
Supervisor
Contract Documentation

for:

J. R. Wear
Head
Contract Review Section

c.c.	W.D. Neillpovitz	H.J. Heffernan
	W.L. Lees	G. Wrong
	J.R. Morgenroth	C. Mirza ✓
	G.E. French	B. Giroux
	G.M. Jordan	J. Crannie
	McCormick & Rankin	E. J. Willis
	M. Stoyanoff	C. Grebski
	W. R. Bennett	R. S. Pillar
	P. McWatt	



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: File

FROM: Soil Mechanics Section
West Bldg.

ATTENTION:

DATE: April 7, 1976

OUR FILE REF.

IN REPLY TO

SUBJECT:

Proposed Culvert
North of Rydal Mill Rd and Hwy 17(WBL)
W.P. 903-72-02 District 18

Field Work

In order to mobilize the bombardier mounted boring machine to the creek bank area, a D7 bulldozer was employed to clear snow on both the north and south creek banks. Borings were put down only on the south side of the creek for three reasons:

1. the cleared area on the south bank was generally within 20 ft. of the proposed culvert ℓ , as opposed to 30 to 40 ft. on the north side where the dozer had more trouble operating
2. a safe access to the south bank was afforded via Rydal Mill Rd. whereas access to the north bank would have required unloading of equipment on the narrow Hwy 17E shoulder which was obstructed by plowed snow.
3. subsequent drifting after the initial clearing of the north bank necessitated considerable re-clearing to move the bombardier on site.

R. Barnes

R. Barnes
Project Engineer

RB/bp
cc: File
Record Services