

memorandum



To: Mr. M. Devata
Senior Foundations Engineer
Pavement and Foundation Design
Room 315, Central Building

Date: 83 07 20

FILE NO.: 3162-2-4-113

ATTN: Mr. M.D. MacLean

From: Soils & Aggregates Section
Engineering Materials Office
Room 311, Central Building

RE: STRUCTURES IN THE HAMLET OF MINDEMOYA, MANITOULIN ISLAND
W.P. 138-80-01, HIGHWAYS 542 and 551, DISTRICT 17, SUDBURY

As requested by your section, the abovementioned site was visited on July 5, 1983, in the company of Mr. O.E. Ramakko of the Structural Section, Northern Region. The project requires the replacement of two culverts on Highway 542 and the construction of a retaining wall adjacent to Highway 551, all within the hamlet of Mindemoya.

GENERAL GEOLOGY

The nature of the bedrock at all three sites is very similar. The sites are underlain by horizontally-bedded dolostone of the Amabel Formation. Bedrock where exposed is estimated to be of high strength, and is intersected by near-vertical, widely spaced joints (2 to 3 metre spacing). The rock is medium-bedded with slab thickness about 100 to 300 mm, and, in general, appears consistently sound.

GENERAL RECOMMENDATIONS

Excavation of the rock should preferably be undertaken using a smooth wall blasting technique in order to minimize damage to surrounding bedrock. Loose slabs of rock must be removed before placing concrete. The bedrock is capable of an allowable bearing pressure of at least 2.5 MPa. Where shear resistance is required below foundations e.g. in the case of the retaining wall, it is recommended that dowels be installed in preference to keying into bedrock. The latter would result in unnecessary damage to a competent rock mass. Fully grouted dowels should be installed to a depth of at least 1 metre into bedrock. In the vicinity of the structures, open joints in the bedrock should be filled with concrete to minimize the potential for uplift of slabs, for example, by hydrostatic or ice pressures.

SITE SPECIFIC CONCLUSIONS AND RECOMMENDATIONS

- 1) Mindemoya Creek Culvert on Highway 542; location - approximately 80 m east of Highway 551

The location of the proposed structure is shown on Fig. 1. Bedrock is exposed throughout the invert of the existing culvert, as well as upstream and downstream of the structure (see photographs, Fig. 2). Field observations confirm borehole results that bedrock surface is approximately 0.8 to 1.0 m below the roadway in the vicinity of this site. At the northern and southern extremities of the culvert, the invert is respectively approximately 2.35 and 1.83 m below ground surface.

- 2) Mindemoya Creek Culvert on Highway 542; location - approximately 840 m east of Highway 551

The location of the proposed structure is shown on Fig. 3. The rock at this site, although by definition generally medium-bedded, consists of beds that are more thinly bedded than the other two sites. Beds at this site are approximately 50 to 150 mm thick. Severe undermining of pier foundations is occurring, and appears to be a result of the more thinly bedded nature of strata, which is loosened by scouring and ice-jacking.

Below the entire area of the existing structure, bedrock occurs in the creek bed, which is about 1.5 m below road surface. No rock was observed in the river banks above this elevation. Boreholes closest to and on either side of the bridge indicate that bedrock is 0.4 m below road surface.

- 3) Retaining Wall on Highway 551; location - approximately 250 m north of Highway 542

The location of the proposed structure is shown on Fig. 4. Approximately half the length of the proposed retaining wall is underlain by rock and half by a variety of soil types. The estimated boundaries of the various foundation materials are shown on Fig. 4.

South of Station 10 + 283:

Bedrock is exposed in the creek bed under the entire length of this part of the proposed structure.

As described in the general recommendations, upper loose slabs of rock should be removed prior to placing concrete. These slabs will generally be about 100 to 200 mm thick along this part of the creek. The rock in the creek bed is naturally stepped down from south to north. The foundations to the retaining wall could most conveniently be stepped at the following stations:

10 + 243.5
10 + 265.5.

North of Station 10 + 283:

North of Station 10 + 283, the proposed retaining wall appears to be underlain by three soil types i.e. organic rich soils of an old river course, glacial till, and road embankment material. The distribution of these materials is shown on Fig. 4. The photograph, Fig. 5, shows the area in question.

Attempts to hand dig a test-pit on the line of the proposed structure were prevented by the presence of a high concentration of boulders in the road embankment fill. A metal pole was driven about 1.2 m into the organic soils of the marsh approximately 10 m west of the proposed retaining wall. No resistance to driving was encountered. Boreholes drilled along the roadway did not encounter bedrock. Therefore, north of Station 10 + 283, the depth of bedrock is unknown.

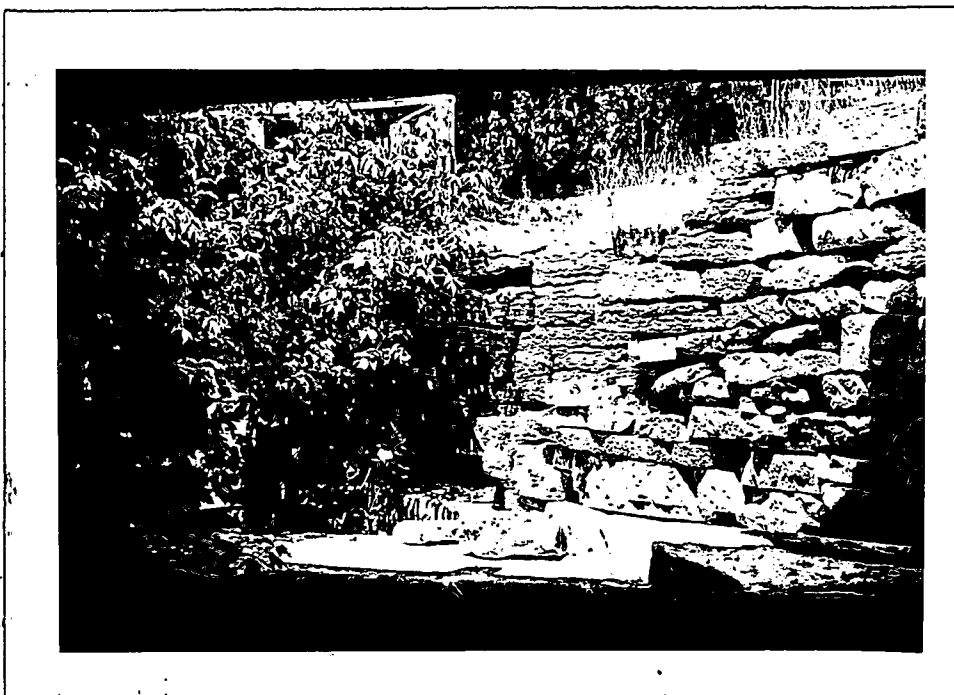
It is recommended that three boreholes be drilled to investigate foundation conditions along this portion of the proposed retaining wall. Proposed borehole locations are shown on Fig. 4. Bedrock should be cored to a depth of at least 1.5 m. A track mounted drilling machine will be necessary at this site due to the steep nature of the road embankment. Access is possible at approximately Station 10 + 350.

If you have any questions, do not hesitate to contact me.

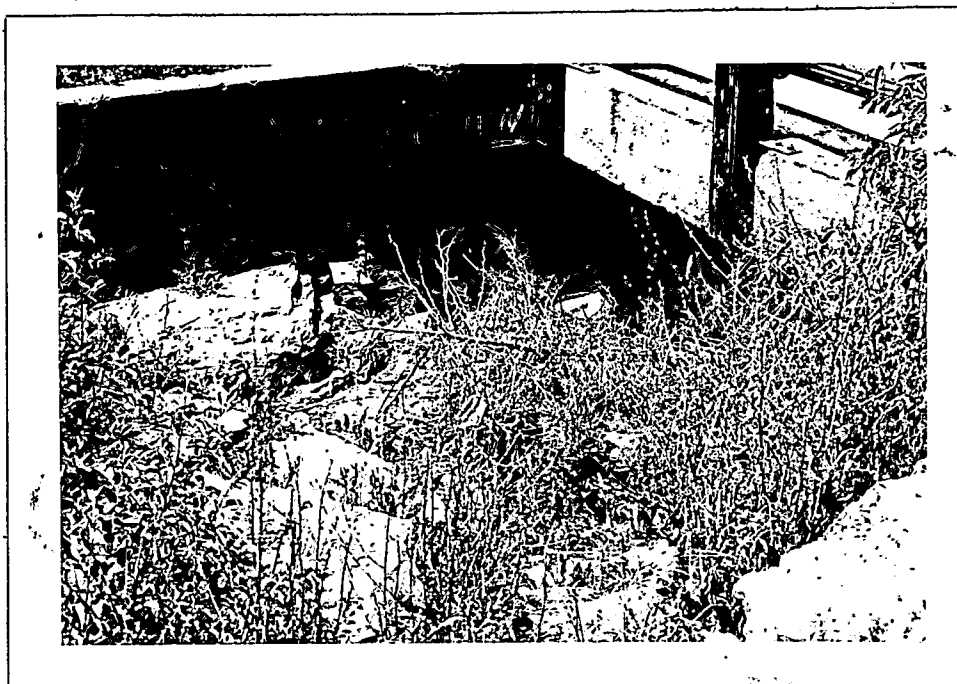


E.R. Magni,
Geologist.

Location: approx. 80 m east of Hwy. 551
(based on Drawing 659-542 and 551/18-0)



Hwy. 542, Mindemoya Creek Culvert, approx.
80 m east of Hwy. 551, North Side
Photograph looking south



Hwy. 542, Mindemoya Creek Culvert, approx.
80 m east of Hwy. 551, South Side
Photograph looking south-east

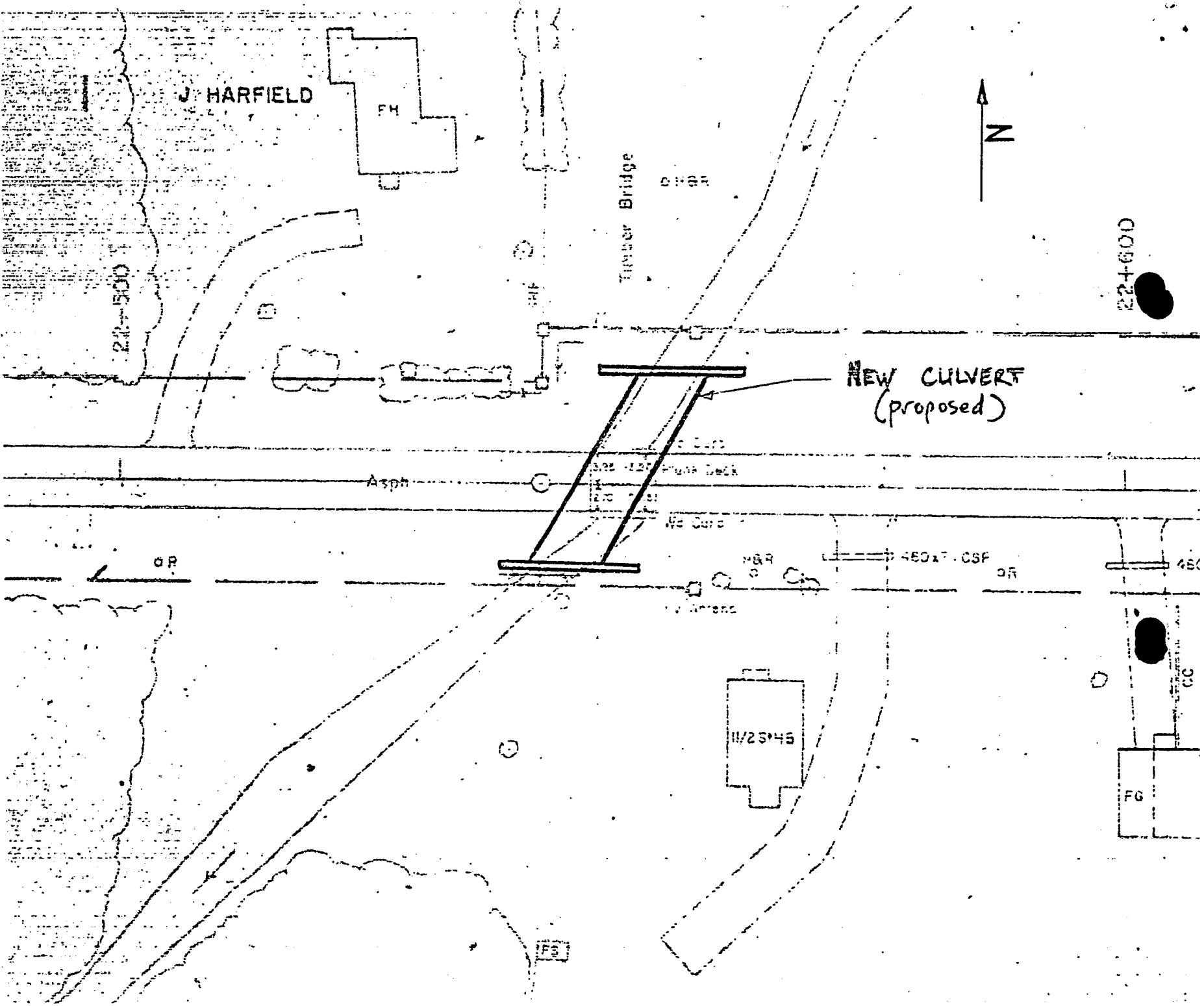


FIGURE 3: Proposed Mindemoya Creek Culvert
Highway 542

Location: approx. 840 m east of Hwy. 551
(based on Drawing 659-542 and 551/9-0)

11 S PYETTE

PROPOSED
RETAINING
WALL

Proposed Borehole Locations

GLACIAL
TILL

MARSH
(old river course)

ROAD EMBANKMENT MATERIAL

~~(YONGE ST)~~

Gravel

Boundaries between material types

Z

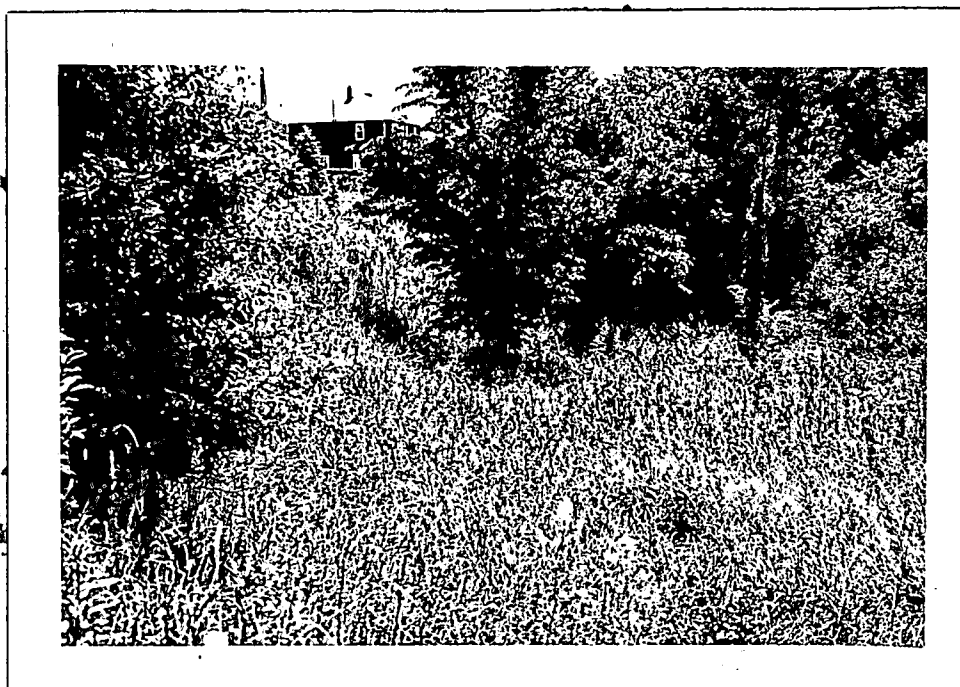


FIGURE 5: Hwy. 551, Site of Proposed Retaining Wall, photograph looking south showing marsh area

memorandum



To: Mr. O. E. Ramakko
Senior Structural Engineer
Structural Section
Northern Region
North Bay

Date: 83 07 29

From: Pavement & Foundation Design
Room 315, Central Building
Downsview

Re: Structures in the Hamlet of Mindemoya
W.P. 138-80-01, Highways 542 and 551
District 17, Sudbury

In response to your request of 83 07 12 for a review of the foundation requirements at the above noted sites, we requested Mr. E. Magni (Geologist, Soils and Aggregates Section) to ascertain the extent and condition of the exposed bedrock. His findings and recommendations are contained in the attached memorandum (E. Magni to M. Devata, dated 83 07 20), and are self-explanatory. In addition to Mr. Magni's assessment, the following comments are provided.

1. For culverts and retaining walls founded on limestone bedrock, a factored bearing capacity at Ultimate Limit States of 3000 kPa can be used for design purposes. Bearing capacity at Serviceability Limit States, Type II, will not govern since the founding strata is unyielding. Dowelling and filling of open joints should be carried out as described in the attached memorandum.
2. Backfill to retaining walls and culverts should consist of free draining granular backfill. Earth pressures on structures can be calculated as outlined in O.H.B.D.C. Section 6.6.1.2.
3. In view of the expense associated with retaining wall construction in the area along Hwy 551 north of Station 10+283, it is suggested that the fills be widened at this location. The Regional Geotechnical Office should be consulted for the appropriate recommendations for widening. In order to provide for a stream channel at the transition between fill slopes and the retaining wall (founded on bedrock), consideration should be given to a) steepening fill slopes by means of rock fill and possibly gabion baskets; b) diverting the stream channel to the west; or c) relocating the retaining wall to the east.

Should you require any further comments, please do not hesitate to call this office.

M. MacLean

M. MacLean, P. Eng.
Foundations Engineer

MM:gm
Encl.