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Totten Sims Hubicki Associates
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Attention: Mr. Mike Delsey, P.Eng.

RE: GEOTECHNICAL OVERVIEW FOR PROPOSED NEW NORTH OAKVILLE TRANPORTATION CORRIDOR CLASS ENVIRONMENTAL ASSESSMENT NEW BURNHAMTHORPE ROAD OVER SIXTEEN MILE CREEK HALTON, ONTARIO

Dear Sirs:

This letter provides a summary of the general subsurface information and foundation considerations for the class environmental assessment of the proposed new North Oakville Transportation Corridor crossing over the Sixteen Mile Creek as part of the new North Oakville Transportation Corridor project in Halton, Ontario.

The study area is located in north Oakville and is bounded by Bronte Road on the west, Highway 407 on the north, Dundas Street on the south and 9th Line on the east. Based on information provided by Totten Sims Hubicki Associates (TSH), numerous route alternatives and creek crossing locations were developed and evaluated based on a comprehensive range of environmental and technical factors and criteria. The recommended route was selected with input from government agencies, the Town of Oakville, Conservation Halton and the public. In particular, the location for the proposed new Sixteen Mile Creek Bridge was selected after consideration of natural environmental features, geomorphology and accessibility to the valley from already disturbed areas.

As requested by TSH on May 8, 2008, Golder has undertaken a desktop study with the intent of providing comments on geotechnical foundation considerations for the bridge crossing the Sixteen Mile Creek. The following literature and reports prepared within the study area were used in the review:

- The Physiography of Southern Ontario, Chapman, L.J. and Putnam, D.F. Ontario Geological Survey, Special Volume 2, Third Edition, 1984

- "Structural Design Report for Highway 403, 16 Mile Creek Bridges, Site No. 10-490, District 4, Burlington, GWP 406-85-00, Highway 403 Trafalgar Road to 16 Mile Creek, WP 406-85-01, 16 Mile Creek Bridge (WBL), WP 406-85-02, 16 Mile Creek Bridge (EBL)", Ministry of Transportation, Ontario, 1993

- Report of "Hydrogeological Assessment of Proposed New North Oakville Transportation Corridor", prepared for TSH by Gartner Lee Limited, May in 2008

REGIONAL GEOLOGY

Physiographically, the study area is located within the geological domain known as the "South Slope". The South Slope is the southern slope of the Oak Ridges Moraine including a strip south of the Peel Plain and is predominantly a moraine till plain which, in the study area, is known as the Halton Ground Moraine till plain (Halton Till Plain) generally represented by the topographic low area in the study area. The moraine till plain was formed following the retreat of the Wisconsinan ice sheet which covered the area during the Pleistocene Epoch. After deglaciation and during the draining of the glacial lakes north of the Trafalgar Moraine, several deep river valleys were formed by erosion of the overburden and bedrock.

The Halton Till Plain is characterized by a surficial clayey silt till. This plain is transected by the Trafalgar End Moraine till ridge on which is generally represented by the topographic high area in the north part of the study area. Based on the hydrogeological assessment report as noted above, the southern limit of the Trafalgar Moraine appears to be located on the north side of the present Burnhamthorpe Road between Bronte Road and Neyagawa Boulevard. The Trafalgar Moraine mainly consists of clayey silt till overlying shale bedrock of the Queenston Formation which consists of red-brown shale containing limestone/siltstone interbeds.

SUBSURFACE CONDITIONS

The overburden in the overall study area consists generally of unsorted, unstratified heterogeneous mixtures of clayey silts, sands and gravels of glacial till origin. The till is generally classified as a clayey silt of low to medium plasticity and forms the matrix for the sands and gravels which are variable in proportion. The overburden varies in thickness at different areas but is typically less than a few metres except at some locations within/adjacent to the Sixteen Mile Creek valley.

The following summarizes the subsurface conditions encountered during investigations at the existing bridge crossing locations of the Sixteen Mile Creek valley; specifically Highway 407 and Dundas Street West.

Highway 407 Bridges Crossing Sixteen Mile Creek

Based on the available boreholes information contained in the 1993 Ministry of Transportation report mentioned above, the overburden encountered in boreholes put down on the tableland near the crest of the Sixteen Mile Creek valley at Highway 407 consisted of about 7 m of hard clayey silt till in the area of the west abutments, and about 9 m to 13 m of very stiff to hard clayey silt till at the east abutments. The overburden was underlain by red-brown shale bedrock with interbedded siltstone. The shale bedrock was encountered at about Elevation 164 m in the vicinity of the west abutments and at approximate Elevations between 156 m and 160 m in the vicinity of the east abutments of the bridges. The bedrock was generally highly weathered within the top 1 m to 3 m of the formation at most locations; occasionally as much as 5 m was noted as being weathered and fractured.

Shale bedrock is generally exposed on the floodplain and at the toe of the west valley slope. About 2 m to 5 m of stiff to hard clayey silt till was encountered below ground surface in boreholes put down on the floodplain between the east river bank and the toe of east valley slope. The shale bedrock was encountered at approximate Elevations 134 m to 136 m in the flood plain area. The bedrock was generally highly to completely weathered within the upper 2 m to 3 m at most locations.

The measured natural water contents of the clayey silt till ranged from about 7 percent to 18 percent. Atterberg limit tests carried out on selected samples of the deposit measured liquid limits ranging from about 13 percent to 20 percent and plasticity indices ranging from about 8 percent to 15 percent indicating medium to high plasticity.

Groundwater levels in the boreholes on the tableland behind the valley slopes were measured in 1992 between Elevations 162 m and 164 m; groundwater levels in the boreholes in the floodplain area were encountered between Elevations 133 m and 137 m in 1992.

Dundas Street Bridge Crossing Sixteen Mile Creek

Based on the cross section B-B’ along Dundas Street as shown in the hydrogeological assessment report mentioned above, relatively shallow (less than 3 m) overburden overlies the shale bedrock at both crests of the Sixteen Mile Creek valley slopes. Shale bedrock is typically exposed on the creek valley slopes and it is understood that there is up to about 3 m of soft clayey soils present overlying the shale bedrock in the floodplain area/under the valley floor. It is further understood that there is poor quality highly weathered shale bedrock to depths of at least 6 m below ground surface.

FOUNDATION CONSIDERATIONS FOR THE PROPOSED BURNHAMTHORPE BRIDGE

It is understood that the preferred road alignment crosses the Sixteen Mile Creek in the southern portion of the study area and is about 0.5 km north of Dundas Street West. Based on the available subsurface information at the Dundas Street West bridge crossing of the Sixteen Mile Creek as discussed above, spread footings seated on the shale bedrock and/or pile foundations extended into the bedrock would be suitable options for support of the new North Oakville Transportation Corridor over the Sixteen Mile Creek. Depending on the thickness of the overburden at the crest of the valley slopes at the abutment locations, spread footings could be feasible for the abutment support. It is noted that the configuration of the valley slope at the abutment locations should be reviewed and an assessment made with respect to where the abutment footings need to be located to maintain them beyond the geotechnical long term stable slope line.

For the pier footings in the creek valley, depending on the condition of the upper portions of the bedrock and on the thickness of the overburden, it may be preferable to use caissons socketted into the bedrock. If the upper portions of the bedrock are classified as poor quality (which infers that the rock is closely fractured) and highly weathered, then the caissons would have to be extended to sufficient depth to ensure that they are within the underlying less weathered good quality rock. The general concern with this type of construction is that there is potential for significant inflow of groundwater to the caisson excavation. This then precludes inspection of the caisson and requires the use of tremie concrete. The alternative would be to use spread footings founded on or within the shale bedrock. The design will be governed by the quality of the upper portions of the bedrock. Depending on the thickness of overburden in the valley floor, groundwater control measures may be required to maintain a dry excavation.

As noted, this summary is based on available subsurface information which is remote from the proposed bridge crossing site and site specific information must be obtained as part of any additional studies for this project (i.e. detail design).

We trust that this letter is sufficient for your present requirements. If you have any questions please call us.

Yours truly,

GOLDER ASSOCIATES LTD.

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Anne S. Poschmann, P.Eng.
Principal

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