

July 19, 2011

Project No. 09-1111-6064

Ms. Janice Fay
Enbridge Gas Distribution Inc.
500 Consumers Road,
North York, ON M2J 1P8

**RESPONSES TO MTO REVIEW COMMENTS
INSTALLATION OF NPS16 GAS PIPELINE – PROPOSED HDD CROSSING OF HIGHWAY 400
KING TOWNSHIP, ONTARIO
MINISTRY OF TRANSPORTATION, ONTARIO
WO 2011-11007**

Dear Ms. Fay:

This letter provides our responses to the review comments made by Ministry of Transportation, Ontario (MTO) with respect to our Draft Subsurface Investigation and Design Report completed for Enbridge Gas Distribution (Enbridge) Inc., in regard to the Proposed Horizontal Directional Drilling (HDD) Crossing of Highway 400 in King Township, Ontario. MTO's comments, dated May 25, 2011, were forwarded to Golder Associates Ltd. (Golder) by email on June 8, 2011. In presenting our response, we have firstly repeated the MTO comments (in italics) followed by our response.

1. *MTO GEOCRES No. 31D-517 has been assigned to the Final Report and Foundation Drawings (BH Locations and Soil Strata).*

The GEOCRES number has been added to the Final Report and Foundation Drawings.

2. *There should be a reference in the report to MTO document "Guidelines for Foundation Engineering- Tunneling for Corridor Encroachment Permit Application".*

The text in the Final Report has been revised to indicate a reference to the MTO "Guidelines for Foundation Engineering- Tunneling for Corridor Encroachment Permit Application".

3. *Please confirm that the BH#2 and #9 extends beyond the elevation that is lower than 3 tunnel diameter below invert.*

In correspondence via email with Enbridge, pipeline depths at each borehole location were provided to Golder. It has also been indicated to Golder that the proposed pipeline diameter is 400 mm. Assuming a slightly larger tunnel diameter to accommodate the 400 mm diameter pipeline (for example 500 mm to 600 mm), three tunnel diameters would be about 1.5 m to 1.8 m.

In regard to Borehole 2, the pipeline depth was indicated to be about 10 m below existing grade at this location; the borehole was advanced to a depth of about 12.7 m, which is greater than three tunnel diameters as indicated above.



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In regard to Borehole 9, the pipeline depth was also indicated to be about 10 m below existing grade at this location; the borehole was advanced to a depth of about 13.6 m, which is greater than three tunnel diameters as indicated above.

4. *Please provide justification for using Hazen approach for soil types other than sands. Please also clarify how falling head tests resulted in same hydraulic conductivity values for sand in BH8 and Clayey silt till in BH6.*

The falling head test results did not necessarily produce the expected results and was the reason the test was completed a second time at BH6. It was decided to report the factual findings of the work authorized to be undertaken. As an alternate means to provide a general estimate of hydraulic conductivity, the Hazen method was used for soil types other than sands, despite the Hazen method being originally derived for sand soils. It is our opinion that regardless of the foregoing unexpected hydraulic conductivity testing results, based on our local experience with soils of this nature, the hydrogeological impact assessment presented in the report remains valid. The text of the report in Section 6.2 has been modified to include that this conclusion has also been based on our local experience.

5. *Please provide comments on drilling fluid properties such as fluid gel strength and viscosity, since these are critical input for cohesionless stretch of the alignment to avoid unintended enlargement of diameter. Please provide your recommendation on the low permeability filter cake and its application for the cohesionless soils to prevent the loss of the fluid.*

It is understood that HDD is the preferred methodology to install the pipeline based on the reasoning indicated in the Design Report. The drilling fluid properties, such as fluid gel strength and viscosity, must be selected in consideration of the overall drilling process, equipment and methodology, which is determined by the drilling contractor. Accordingly, it is Golder's opinion that the selection of the optimum fluid properties necessary to complete the utility installation should be the responsibility of the drilling contractor. Similarly the requirements for low permeability filter should also be the responsibility of the drilling contractor given the anticipated soil conditions outlined in the subsurface investigation and design report. The text of the report in Section 7.3 has been modified to indicate the importance in selecting the proper fluid mix designs and potential consequences of poor fluid mix utilization.

6. *Please comment on flow pressures and possible ground heave, if it exists.*

Similar to the comments provided for Item 5 noted above, the potential for ground heave is dependent on the flow pressures and mud pressure selected by the drilling contractor. Golder has provided geotechnical and subsurface information in the design report to aid the contractor in the selection of mud and flow pressures to mitigate the potential for ground heave. The text of the report in Section 7.3 has been modified to indicate the requirement for careful monitoring of flow pressures and ground heave.

7. *The estimated long term settlement (25mm) for the ramp exceeds our alert levels outlined in "Guidelines for Foundation Engineering- Tunneling for Corridor Encroachment Permit Application"*

As noted in the design report, the higher settlement values correspond to the pipeline locations at the ramp locations. The higher settlement values are primarily due to the lower amount of ground cover associated with the HDD at these locations (about 8 m to 9 m below the ramp locations). The settlement values indicated in the report have been calculated assuming that full volume loss occurs in the annulus of the borehole post-construction, and that the borehole is not grouted following the installation of the pipeline. It should be noted that full volume loss is not anticipated to occur in the borehole and the post-construction settlement value provided in the report is a conservative value. As recommended in the design report, to mitigate the potential for post-construction settlement, it is recommended to cement grout the annulus following the pipeline installation.

We trust that the above comments are sufficient for your purposes at this time. Please contact our office should you require further clarification.

Yours truly,

GOLDER ASSOCIATES LTD.



Nick La Posta, P.Eng.
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Ty Garde, P.Eng.
Principal, Designated MTO Contact