

July 13, 2007

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Mr. Mike Shallhorn, P.Eng.
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Dear Mr. Shallhorn

Foundation Engineering Comments
Scour Modelling, MTO Ferry Docks
GWP 3029-05-00
District 31, Chatham

We are pleased to provide our comments on the laboratory work conducted to model the depth of scour at the Ferry Docks.

Site Conditions

Details concerning the design dredge level, design level for top of scour protection and the composition of the soil within this zone revealed in boreholes drilled over water at these sites is summarized in the following table:

Ferry Dock	Design Dredge Level (Elevation (m))	Design Top of Scour Protection (Elevation (m))	Tip Elevation of Steel Sheet Piling (m)	Composition of Soil ¹ Between Elevation 169.0 and 166.0
Kingsville	169.0	166.9	165.0	Silt/silty fine sand and sandy silt (to elevation 165.0 overlying sandy/clayey silt till)
Leamington	169.0	166.9	162.3	Sand/silty sand/sandy silt (to elevation 165.5 overlying silty clay/clayey silt)
Pelee Island	169.0	166.9	164.5	Silty clay (to elevation 166.0 overlying clayey silt till)

1. Soil profile is documented in the following Geocres reports:
Kingsville Dock, Geocres 40J2-67
Leamington Dock, Geocres 40J2-66
Pelee Island Dock, Geocres 40G15-2

Physical Model

We understand HCCL Coastal and River Engineering (HCCL) used a cohesionless material to conduct laboratory tests to model the scour potential at the Kingsville and Leamington Docks and published empirical data correlated to specific properties of the clayey soils at the Pelee Island Dock. The empirical relationships for clayey soils were also used at Leamington to evaluate the potential scour of the cohesive material that underlies the cohesionless material at Leamington.



We also understand the 'fall' velocity of the individual soil particles is the primary indicator of the scour potential of cohesionless soils subjected to the shear and suction forces induced by propellers. The most significant indicator of 'fall' velocity is the diameter of the individual soil particles.

Sandy material with a D_{50} of 0.1 mm was employed during the laboratory tests to model scour of the cohesionless soil at the Kingsville and Leamington Dock.

Foundation Engineering Comments

Use of cohesionless soil to model the scour at Kingsville and Leamington is considered to be appropriate; a cohesive soil model is suitable at Pelee Island and the material below the cohesionless soil at Leamington.

Additional engineering comments for each dock are provided. It is important to note that our assessment of the D_{50} of the soil employed during the scour modelling is based on the physical property of the soil and does not take the 'scale effects' into consideration that are required for laboratory modelling.

Kingsville Dock

Borehole data is available at both ends and near the centre of this dock. The lake bottom elevation is near elevation 169.1 and 167.6 near the north and south ends of the dock respectively and 167.4 near the centre. It appears that some 1.4 m of scour sediment may exist near the north end of the pier, 500 mm at the centre, and less than 200 mm at the south end.

The near surface soil is described as loose to compact silt, some sand in the borehole at the south end of the pier and compact silty fine sand/sandy silt with clayey silt seams in the other two holes. This material is judged to be cohesionless.

The D_{50} of the soil, deduced from the grain size distribution tests conducted on samples of the soil from this site was about 0.05 mm. Consequently, subject to scale effects, the D_{50} of 0.1 mm may be overestimated for modelling purposes.

Leamington Dock

Borehole data is available at the north end and centre of this dock. The lake bottom elevation at these two locations was near 168.6 and 167.3, respectively. A 900 mm thick layer of very loose silt (possible sediment) was penetrated in the hole located near the north end of the dock; very loose sand/silty sand/sandy silt was identified below the silt (possible sediment) and at the surface in the other hole. The material is judged to be cohesionless.

Samples of these soils were not subjected to grain size distribution analyses. Based on the description of the soil and the gradation analysis conducted at the Kingsville dock, the D_{50} of this soil is expected to be near 0.1 mm and therefore, subject to scale effects, appears to be reasonable for modelling purposes.



The engineering properties of the clayey soil at the Leamington Dock interpreted from the borehole and laboratory test data are:

Surface Elevation	Slight variation along the dock – 165.7 near the north end, 165.4 near centre
Bottom Elevation	163.0 near north end, 163.2 near centre
Thickness	2.7 m near north end and 2.2 m near centre
Liquid Limit	32 to 38
Plastic Limit	15 to 22
Plasticity Index	16 to 18
Water Content	20 to 28
Shear Strength based on Vane Shear Tests and deduced from SPT test values of 6	65 kPa, sensitivity 3 to 4
Unconfined Compressive Strength	130 kPa
Effective Friction Angle	29° and cohesion intercept of 5 kPa in consolidated undrained test
Clay Content (based on description, no gradation data available)	At least 40%
Consolidation Pressure (deduced from published information concerning correlation of liquidity index with sensitivity of clayey soils; Navfac DM-7.1, May 1982)	100 kPa

Pelee Island

The soil between the design dredge level and the top of scour protection elevation consists of stiff silty clay with a trace of sand and gravel.

The silty clay forms the lake bottom in two of the three boreholes drilled at this site and is below a 300 mm thick silty fine sand unit in the other.



The engineering properties of the clayey soil at the Pelee Island Dock interpreted from the borehole and laboratory test data are:

Surface Elevation	Ranges along the face of the dock from about 168.9 at the north to 168.2 at the south
Bottom Elevation	165.8 at north end, 166.6 at centre and 166.4 at south end
Thickness	3.1 m north end and 1.5 m at centre and south end of dock face
Liquid Limit	32 to 35
Plastic Limit	15 to 18
Plasticity Index	16 to 20
Water Content of Samples taken near Elevation 167.8	24 to 26
Shear Strength based on Vane Shear Tests and deduced from SPT test values of 4 to 7	70 kPa, sensitivity 2 to 4
Unconfined Compressive Strength	140 kPa
Effective Friction Angle	32° and effective cohesion of zero in consolidated undrained triaxial test
Clay Content (based on description, no gradation data available)	At least 40%
Consolidation Pressure (deduced from published information concerning correlation of liquidity index with sensitivity of clayey soils; Navfac DM-7.1, May 1982)	100 to 125 kPa

We trust this will be sufficient and look forward to any questions you may have.

Sincerely

Peto MacCallum Ltd.

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MTO Designated Contact

DWK:lad

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