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PROJECT NO.: SM 190167-G April 12, 2019

URBANTECH CONSULTING
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Attention: Scott Reimer, P.Eng.
Project Engineer

SUPPLEMENTAL SWM POND CONSIDERATIONS
ORANGEVILLE HIGHLANDS-PHASE II SUBDIVISION
ORANGEVILLE, ONTARIO

Dear Mr. Reimer,

Further to your request, SOIL-MAT ENGINEERS has prepared the following comments with respect to the construction of the stormwater management (SWM) pond within the proposed Orangeview Highlands development in Orangeville, Ontario. This letter report should be read in conjunction with our initial geotechnical investigation report SM 165031-G, dated August 1, 2013.

We understand that the proposed development will include the construction of a SWM pond in the southeast corner of the development. Based on the proposed cross-section drawings provided to our office, the SWM pond will have a permanent pool elevation of 421.00 metres, and a bottom of pond elevation ranging from 418.50 to 420.00 metres. Where the permanent pool elevation is below the static groundwater elevation, it will be necessary to provide a low permeability layer over the base of the pond to resist the infiltration of natural groundwater, and of sufficient weight to resist the hydrostatic uplift pressures. This could be accomplished through the use of a compacted clay liner, or with a weighed down proprietary liner system, etc. The weight of the liner system would have to exceed the uplift pressure of the ground water during the most severe periods of the year, likely when maximum storage is required. In approximate terms for example, one metre of clay liner, or equivalent, would be required for about every two meters of water storage below static ground water level, i.e., when the water level in the pond is 2 metres below the static ground water table, the clay liner would have to be at least one metre thick; if 3 metres below the static level, then 1.5 metres thick, etc.

An impermeable compacted clay liner would consist of a sufficiently plastic clay soil, with a recommended minimum clay content of 20 per cent and plasticity index of 7. The fine-grained sand to silty sand soils encountered during our geotechnical investigation would not be considered suitable for use in construction a compacted clay liner. A suitable off-site source could be located for importation to the site, and the clay liner should be placed in nominal lifts of 300 millimetres, sufficiently worked to destroy any natural layering or soil structure, and compacted to 95 per cent of its standard Proctor maximum dry density [SPMDD].

Alternatively, weighed down proprietary liners could be considered, however the material suppliers of such materials (such as Layfield, Terrafix, Suprema) would have to be consulted for recommendations on the appropriate product and installation methods for the site conditions. Such artificial liners would not require compaction efforts and could be weighed down with practically any available soil or granular material.

The provided drawings indicate interior pond slopes beneath the permanent pond elevation of 4 to 5 horizontal to 1 vertical, with interior slopes above permanent pond elevation and exterior slopes no steeper than 3 horizontal to 1 vertical. It is understood that the use of coarse 'rip rap' and filter cloth will be provided for some interior slopes under water to maintain stability of some of the submerged slopes. In general, it is recommended that all interior pond slopes be provide with at least some form of stabilisation/protection.

The proposed pond slopes would be considered to remain stable at the proposed inclinations of between 3 to 5 horizontal to 1 vertical, provided the material utilised is free of significant organic deposits, construction debris, or any other deleterious materials which would affect stability of the pond slopes. Our office should be retained to review any imported material to the site, as well as to provide quality control services during construction.

Additional stabilization efforts such as biaxial geogrid layers within the fill mass may also be considered. The product supplier [such as Terrafix or Maccaferri] should be consulted on the most appropriate products and design details, given the proposed slope and soil conditions. Such reinforced earth embankments should also incorporate suitable drainage, such as 'wick drains', or layers of granular material encased in heavy geofabric, in order to prevent excess pore water pressure, which would impact the stability of the constructed slope.

We trust that this information meets with your requirements. Should you have any queries or require additional information, please do not hesitate to contact the undersigned.

Yours very truly,
SOIL-MAT ENGINEERS & CONSULTANTS LTD.

Kyle Richardson, P.Eng.
Project Engineer

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