

re: **Groundwater Infiltration Review**
Proposed Residential Development
Brazeau Pit and Drummonds Pit- Borrisokane Road - Ottawa

to: Caivan Communities - **Mr. Andrew Finnson** - afinnson@caivan.com

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Paterson Group (Paterson) has prepared the current memorandum report to provide a review of the hydrogeological characteristics in support of groundwater infiltration recommendations for the aforementioned site.

Background Information

It is currently understood that the proposed residential development consists of a mixture of single family and townhouse style residential dwellings. It is also understood that the development will be serviced by municipal infrastructure that outlets to a stormwater management pond.

The field program for the geotechnical investigation at the Brazeau Pit was completed between November 16, 2018 and April 10, 2019. At that time, a total of 12 boreholes and 15 test pits were advanced to a maximum depth of 5.9 m below existing grade. The results of the investigation indicated that, in general, the subsurface profile consisted of a thin layer of fill material overlying a deposit of silty sand/sand with varying amounts of gravel and cobbles. A thick layer of fill material was encountered within the southeast portion of the subject site and primarily consisted of silty sand with varying amounts of clay, gravel, cobbles, organics and construction debris. This was typically underlain by a till deposit composed of a silty sand matrix with gravel, cobbles and boulders. A very stiff to stiff silty clay layer was noted between the silty sand/sand and till deposits at select boreholes within the western portion of the property. A DCPT test was completed at one borehole location and encountered practical refusal at a depth of 23.5 m. However, bedrock was not conclusively encountered as part of the geotechnical investigations for the proposed development.

The field program for the geotechnical investigation at the Drummonds Pit was completed between July 22 and July 26, 2019. At that time, a total of 8 boreholes and 14 test pits were advanced to a maximum depth of 11.3 m below existing grade. The results of the investigation indicated that, in general, the subsurface profile consisted of a fill material comprised of silty sand to sand and/or silty clay with varying amounts of gravel, cobbles and boulders. Depending on the depth of excavation during the extraction of the aggregate material, the above noted fill material is underlain by either silty sand/sand with varying amounts of gravel, cobbles and boulders or a glacial till deposit composed of a silty sand to silty clay matrix with varying amounts of gravel, cobbles and boulders. A very stiff to stiff silty clay layer was noted underlying the silty sand/sand or fill material at select test holes. A DCPT test was completed at one borehole location and encountered practical refusal at a depth of 11.6 m.

Bedrock was not conclusively encountered as part of the geotechnical investigations for the proposed development. However, based on available mapping, the site is located in an area where bedrock consists of dolomite of the Oxford formation, with overburden thickness ranging from 15 to 25 m.

Hydrogeological Setting

The subject site is located primarily within the Jock Downstream Reach subwatershed of the Jock watershed, with a negligible percentage of the property being located within the Mud Creek subwatershed of the Lower Rideau watershed.

Hydraulic Conductivity and Infiltration Values

Hydraulic conductivity testing was not completed as part of the geotechnical investigations for the proposed development. However, testing completed directly south of the subject site as part of the Community Development Plan (CDP) determined that the hydraulic conductivity of the silty sand/sand deposit ranged from 3.0×10^{-6} to 4.8×10^{-4} m/sec. The hydraulic conductivity values obtained from within the till deposit were slightly lower, and ranged from 5.0×10^{-7} to 7.6×10^{-5} m/sec. The values obtained from the field testing to the south are consistent with published values, and are considered applicable to the materials encountered at the subject site. With regards to the silty clay layer noted underlying the silty sand/sand deposit, hydraulic conductivity values were anticipated to range from 1.0×10^{-9} to 1.0×10^{-7} m/sec, and were based on published values. Due to the variability in the fill material noted on site, hydraulic conductivity values are anticipated to range from 1.0×10^{-7} to 1.0×10^{-4} m/sec and is dependant on the ratio of silty sand/sand to silty clay within the material. **For infiltration system design purposes, it is recommended to use an infiltration rate of 75 mm/hr for the Brazeau Pit site and an infiltration rate of 50 mm/hr for the Drummond Pit site.**

Based on discussions with David Schaeffer Engineering Ltd., it is understood that a version of the Etobicoke exfiltration system is being proposed for the development in order to ensure infiltration volumes to the underlying aquifer systems be maintained. The exfiltration system is proposed to be installed below the curb lines of the development and placed over native silty sand/sand, free-draining sand material 1.5 m in thickness or a silty sand/sand to silty clay fill material. **It is understood that the subject area is required to meet post-development infiltration levels of 40% of the area precipitation. It is further understood that the annual precipitation for the area is 844 mm, so a post-development infiltration level of 40% would require that a minimum infiltration of 338 mm be achieved for the subject site.**

Water Levels and Flow Directions

Water levels obtained at the time of the geotechnical investigations ranged from 0 to 9.1 m depth below existing grade. Based on the recovered water levels, it is expected that the local groundwater flow direction trends to the north towards the Jock River, located approximately 1.4 km north from the north property boundary of the Drummonds Pit. This is corroborated by the groundwater divide separating the Jock Downstream Reach subwatershed and the Mud Creek subwatershed located at the southern boundary of the Brazeau Pit. Its location at the southern edge of the property would suggest that groundwater flows north, away from the divide.

Groundwater Recharge and Discharge

The presence of overburden soils with moderate to high hydraulic conductivity overlying the bedrock aquifer units are considered to provide the potential for significant groundwater recharge within the study area. The Kars esker is considered to transmit large quantities of water that are recharged through the infiltration of precipitation within the non-cohesive material comprising the original overburden materials in the area. The subject site represents a small portion of the existing zone identified by the Mississippi-Rideau Source Protection Region (MRSPR) as a zone of significant groundwater recharge.

Recommendations

As previously discussed, existing conditions at the subject site currently allow for significant volumes of recharge to occur. As such, it is recommended that measures be taken as part of the proposed development to ensure that infiltration volumes to the underlying aquifer systems be maintained. In accomplishing this, the following are some of the potential measures that could be implemented at the subject site:

- Transport the water using a modified version of the Etobicoke exfiltration system for the development with a minimum 1 m vertical separation between the base of the system and the seasonally high water table to allow for adequate infiltration.
- Allocate land for City parks, providing opportunities to allow clean water to infiltrate into the overburden aquifer system.
- Promote infiltration of clean water from rooftops by directing stormwater to grassed areas as opposed to driveways and/or municipal infrastructure.
- Implement Low Impact Development (LID) measures in conjunction with BMP for stormwater quality and quantity control to assist in infiltrating clean water, treating salt impacted water where required or redirecting salt impacted water away from infiltration locations.

It is important to note that not all of the above may necessarily need to be employed at the subject site, and that the measures required to maintain existing infiltration will be dependant on the final design of the proposed development.

We trust that this information satisfies your requirements.

Best Regards,

Paterson Group Inc.



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