Long-Term Dewatering Filtration Plan
2243 and 2269 Fairview Street
and 864 Drury Lane
Burlington, Ontario

August 9, 2022

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1. Introduction

1.1. Background

Aquatech dewatering was requested by Brookfield Properties to design a long-term dewatering filtration system for the construction dewatering at 2243 and 2269 Fairview Street, and 864 Drury Lane, Burlington, Ontario. The hydrogeological investigation report prepared by Pinchin (Technical Addendum – Hydrogeological and Global Stability Characterization 2243 and 2269 Fairview Street and 864 Drury Lane, Burlington, Ontario Pinchin File: 225780.004 (Revised), May 20,2022) were used to identify the required design flow rate and groundwater contaminants exceeding the discharge limits for the conceptual design.

1.2. Description of The Proposed Treatment System

Aquatech has proposed a long-term dewatering filtration system to treat for exceedances found in borehole MW305 tested as mentioned in Table 1 below to meet the City of Burlington Storm Sewer Discharge By-Law 86-2002. Table 1 summarizes the various parameters that exceeded the discharge criteria as per the hydrogeological site assessment report and the recent water quality reports.

Table 1. Exceedance Summary Table as per the Hydrogeological Investigation and Technical Memo

Parameter	City of Burlington Storm Sewer Discharge Limits	Concentration for MW305
Total Suspended Solids (TSS), (mg/L)	15	84
Total Manganese (Mn), (µg/L)	50	120
Dissolved Manganese (Mn),(µg/L)	50	85

The proposed water treatment system consists of various components to treat for these exceedances identified above and the following are components of the system:

1. One (1) 1,550-Gallon Settling Tank
2. Two (2) 2” Submersible Pumps (Primary and Backup)
3. One (1) 2-POD Sand Filtration Unit
4. One (1) Chlorine Dosing Unit
5. One (1) 2-POD Greensand Filtration Unit
6. Three (3) 1000-Pounds Granular Activated Carbon Vessels
7. One (1) Remote Monitoring System
8. One (1) 1,550-Gallon Backwash Water Collection Tank

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9. One (1) 1,550-Gallon Clean Water Tank
10. One (1) 3" Submersible Pump in the Backwash Water Collection Tank
11. One (1) 2" Submersible Pump in the Clean Water Collection Tank
12. Two (2) 1000-Pounds Phosphorous Removal Vessels (Contingency)
13. One (1) 1000-Pounds Zinc Removal Vessel (Contingency)

The system is designed to treat long term discharge flow rate of **17 US GPM (94 m^3/day)** provided in the hydrogeological assessment report. Exceeding this capacity may cause permanent damage to the system and affect the reliability of the treatment. The process flow diagram of the proposed system is provided in Appendix A and a detailed description of the system components, and their performance objectives is provided in the following sections.

2. System Components

2.1. Primary Settling Tank

The water from the dewatering sump pump is first collected in a 1,550-gallon tank, which also serves as a primary settling tank and removes coarser/denser TSS particles. There are two submersible pumps in this tank (one primary and one backup), which pumps the water to the subsequent filtration systems. Considering the maximum flow rate of 21 US GPM, the calculated residence time of the incoming water is approximately 1 hr in the tank (considering a 30% of available free headspace).

2.2. Submersible Pumps

There are two submersible pumps (one primary and one backup) in the 1,550-gallon primary settling tank to transfer the water collected from the sump pit into the filtration systems and discharge pipes. Two 230V, 3 Phase, 5 HP electric submersible pumps with 2-inch discharge bore will be utilized for this purpose. The primary and backup submersible pumps in the primary holding tank are set to 'Automatic' mode in the control panel. This ensures that these pumps are operated on floats and are triggered depending on the water level in the primary holding tank. A high-water level in the primary settling tank will trigger the pump to turn on and start pumping until the water level reaches a set low level. The level sensor in the primary tank is connected to the remote monitoring system which can be accessed 24/7.

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A 3-inch-high head electric submersible pump (230 V, 2.5 HP) in the backwash collection tank can pump the backwash water/sludge to the ground level for subsequent disposal via vacuum trucks. Also, one 2-inch electric submersible pump in the clean water collection tank can transfer the clean water to any filtration vessel for backwash events or for media soaking.

2.3. Sand Media Filtration Unit

Following the settling tank is a 2-pod sand filter unit that can remove particles larger than 20 micron-size. The sand filtration unit consists of a 2-POD vessel system with backwash capability and connections for influent, effluent, and backwash. The filtration vessels are filled with silica sand media and gravel media as support. The sand media is a naturally occurring, graded and washed sand that is high in silica and low in calcium. The gravel media is highly spherical-shaped media that promotes even distribution of water in support beds. As the water passes through the filtration media, the particulates are trapped and retained within the media bed resulting in clean process water flowing out through the outlet.

The filtration mode will continue until a sufficient amount of solids have been collected to create a 10 psi pressure drop across the filter bed. At this time, the filters will be automatically shifted to backwash mode, and during the backwash cycle, clean filtered water from the other pod is then processed in the opposite flow direction creating the backwash condition. Routine backwashing is automatically performed to clean the sand media to avoid any particulate build-up. The frequency of backwashing is determined by regularly monitoring the system for pressure differential. The backwash water from the 2-pod sand filter is pumped into the 1,550-gallon backwash tank.

2.4. Chlorine Dosing Unit

Greensand media filtration is used to remove the manganese content present in the groundwater and chlorination is required to oxidize the manganese and to regenerate this greensand media continuously. Chlorine dose depends on the concentration variation of manganese and other contaminants consuming the chlorine such as iron, hydrogen sulfide and ammonia. Chlorination aids in oxidizing these contaminants and some other organics in addition to manganese in the water that can be subsequently filtered out. For this purpose, 12% sodium hypochlorite solution is used, and the proper dose depends on the concentration of all the contaminants exerting chlorine demand.

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The system incorporates a high-quality chemical metering pump to provide accurate and consistent metering. The chlorination system includes a chlorine holding tank, a flow meter, an injection pump, a tubing, and an injection port. Sodium hypochlorite is injected inline and the piping length and convolutions between the chlorine dosing unit and Greensand filtration unit are designed in such a way to provide a contact time of a minimum of 10 seconds after chlorine injection prior to manganese filtration by Greensand. Chemically treated groundwater will flow through the 2-POD GreenSand filtration unit. Also, the chlorine dosing should be maintained at a rate so that chlorine residual after the Greensand filtration unit is in the range of 0.5 to 1.5 ppm.

2.5. Greensand Filtration Unit

The greensand filtration unit consists of a 2-POD vessel system with backwash capability and total of three connections for influent, effluent, and backwash. The vessels are filled with microporous silica sand-based oxidation catalyst media designed for the removal of exceeding manganese. The maximum working pressure of the system is 100 psi. Filtration media operates with continuous injection of sodium hypochlorite to continuously regenerate the media. The media is stable at a pH range of 5.8-8.6 and is not consumed in the treatment process. This filter removes contaminants by providing contact time between water and the high-affinity media. Routine backwashing is automatically performed to clean the media to avoid particulate build-up. The frequency of backwashing is determined by regularly monitoring the system for pressure differential. Backwash mode will be automatically triggered once the pressure differential reaches 10 psi. During the backwash mode of operation, clean filtered water from the other pod is then processed in the opposite flow direction creating the backwash condition.

2.6. Granular Activated Carbon Filtration Unit

Downstream of the greensand filtration unit are three 1000 lbs granular activated carbon (GAC) vessel with a total of two connections for influent and effluent, which will be installed in series configuration. GAC vessels are used to remove any generated organic by-products formed during chlorination (such as chloroform) through the process of adsorption, whereby pollutant particles are trapped in the pores of the carbon granules. The maximum working pressure of the system is 75 psig and the calculated contact time of the vessel is 10 min. GAC vessels do not generally require backwash, however the pressure differential across the vessels should be monitored closely to ensure the system is performing well. The filter requires replacement when

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there is contaminant exceedance or when the pressure differential of 10 psi is observed before and after each vessel. If there is no exceedance is observed for the chlorinated organic by-products from the effluent of GAC vessels, while there is a pressure differential across the vessels, backwash may help to bring the pressure differential back to its operational values for continuous performance.

2.7. Phosphorus Removal Filtration Unit (Contingency)

The most recent water quality report (November 2021) indicated dissolved phosphorus concentration was below the City of Burlington Storm Sewer discharge limits. However, phosphorus was shown as an exceedance in the previous water quality samples collected form the same monitoring well (June and August 2021). Phosphorus removal system is considered as contingency in case there is any exceedances observed in the concentration of phosphorus in the influent water. This system, if required, should be installed downstream of the GAC filtration units consisting of two 1000 lbs vessels installed in series (lead and lag configuration) with a total of two connections for influent and effluent that are used to decrease the concentration of phosphorous through the process of adsorption. The maximum working pressure of the system is 75 psig and the calculated contact time between the groundwater and the media is 5 min. The vessels are filled with a specialty iron oxide-based media that removes the contaminants through adsorption. Routine backwashing is required to clean the media to avoid particulate build-up. The frequency of backwashing is determined by regularly monitoring the system for pressure differential and when the pressure differential reaches 10 psi across the vessels, the media requires backwash. Clean treated water collected in the clean water tank should be used for this purpose to avoid consuming the adsorption capacity of the media during the backwash event. The filter requires replacement when there is contaminant exceedance in the effluent treated water.

2.8. Zinc Removal Filtration Unit (Contingency)

The most recent water quality report (November 2021) indicated dissolved zinc concentration was below the City of Burlington Storm Sewer discharge limits. However, zinc was shown as an exceedance in the previous water quality samples collected form the same monitoring well (June 2021). Zinc removal system is considered as contingency in case there is any exceedance observed in the concentration of zinc in the influent water. This system, if required, should be installed downstream of the GAC filtration units (or downstream of phosphorus removal

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system if implemented) consisting of one 1000 lbs vessel with a total of two connections for influent and effluent that are used to decrease the concentration of zinc through the process of adsorption. The maximum working pressure of the system is 75 psig and the calculated contact time between the groundwater and the media is 3.5 min. The vessels are filled with a specialty iron oxide-based media that removes the contaminants through adsorption. Routine backwashing is required to clean the media to avoid particulate build-up. The frequency of backwashing is determined by regularly monitoring the system for pressure differential and when the pressure differential reaches 10 psi across the vessels, the media requires backwash. Clean treated water collected in the clean water tank should be used for this purpose to avoid consuming the adsorption capacity of the media during the backwash event. The filter requires replacement when there is contaminant exceedance in the effluent treated water.

2.9. Remote Monitoring System

A remote monitoring system that can provide information on the critical parameters essential to understand the effective operations of the system has to be installed. The remote monitoring system installed by Aquatech consists of sensors that can measure parameters such as flow rate, total flow, water level in the primary tank, velocity, pressure, pH, temperature, and turbidity on a real-time basis. This data can also be accessed 24/7, and the event notifications can be received when the data loggers are connected to a data collection software platform such as DataLinks.

2.10. Backwash Water Collection Tank

The backwash water collection tank would be a 1,550-gallon tank, and all the backwash water generated from the sand media, greensand filtration units, phosphorous and zinc removal media (if installed), and GAC filtration units (if backwash required) are collected in this tank. The backwash water tank requires regular cleaning. The backwash water collection tank is equipped with a level sensor connected to a remote monitoring system that can provide notifications when the tank is full and needs to be vacuumed and cleaned.

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2.11. Clean Water Tank

A 1,550-gallon clean water tank is also included in the filtration system train. The primary purpose of this tank is to serve as a holding tank for clean treated water/city water that is required during the backwash of GAC vessels (if required), and phosphorous and zinc removal vessels. The treated water from the effluent or city water will be collected in this tank whenever backwash is needed. The treated water/clean water will be pumped through the vessels to perform the backwash. This tank will be also used during the commissioning phase when clean water is required to be collected for media soaking and initial backwash.

3. Appendix

Following section provides document pertaining to process flow diagram of all the system components of the proposed water treatment system for the long-term filtration system (including main and continency phosphorus and zinc removal systems).

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This filtration plan provides the design of the proposed water treatment based on the water quality result and pertaining information provided in the hydrogeological investigation report. Additional samples might be needed on the project site prior to the installation and mobilization of the treatment system. The equipment specifications may change at the time of procurement and installation.

We trust that the above is self-explanatory, but should you require any additional information please do not hesitate to contact the writer for same.

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