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Staff Report

Planning & Development Services – Engineering Division

Report To:	**Committee of the Whole**
Meeting Date:	June 26, 2017
Report Number:	PDS.17.66
Subject:	Peel Street Pumping Station Upgrades
Prepared by:	Brian Worsley, P.Eng., Manager of Development Engineering

A. Recommendations

THAT Council receive Staff Report PDS.17.66 entitled, "Peel Street Sanitary Sewage Pumping Station Upgrades";

AND THAT Council approve creating budget for upgrades to the Peel Street Sanitary Sewage Pumping Station and the Thornbury Water Treatment Plant in the amount of $275,000;

AND THAT Council approve funding $60,000 from the Water Asset Replacement Reserve Fund, $169,000 from the Wastewater Asset Replacement Reserve Fund, and $46,000 from the Lora Bay Sewer Development Charge Reserve Fund.

B. Overview

The Peel Street Sanitary Sewage Pumping Station (PSPS) is located in front of the Blue Mountains Water Treatment Plant (WTP) on Bay St. On three separate occasions the PSPS has not been able to keep up with the incoming sewage flows resulting in flooding of a nearby resident's basement with sewage.

During a recent review of the PSPS it was determined that:

- it is receiving higher than normal / anticipated sewage flows, and that at the inflow exceeds the stations (nominal) rated capacity. Examination of PSPS flow records showed that the incoming flows have gradually been increasing over the last five (5) years, with peaks values occurring spring and fall;
- CCTV inspection of the connected sewer system did not reveal an obvious inflow source, other than an unusual number of laterals flowing, indicating that household foundation drains may be connected to the system;
- flows from the adjacent Water Treatment Plant backwash tanks take up approximately 60% of PSPS capacity, but modifications to the (Water Treatment Plant) backwash tank pumps could reduce this to approximately 15% of PSPS capacity;

- preliminary analysis indicates that, (subject to confirmation) replacement of the existing twin 5 Horsepower pumps, with twin 10 to 15 Horsepower pumps, would increase Peel Street Sanitary Sewage Pumping Station capacity by approximately 50%, (from 15/18 l/s to 22/30 l/s).

Accordingly, modifications are required to the Peel Street Sanitary Sewage Pumping Station and the Blue Mountains Water Treatment Plant to ensure existing flows to the PSPS can be safely managed.

C. Background and Analysis

The existing PSPS receives flows from 57 homes, 24 condo units and one hotel, as well as backwash water from the WTP. The catchment area is delineated in red on Figure 1, overleaf. Existing sanitary sewers and civic address numbers are shown in green, and the PSPS is identified with a yellow "P" symbol.

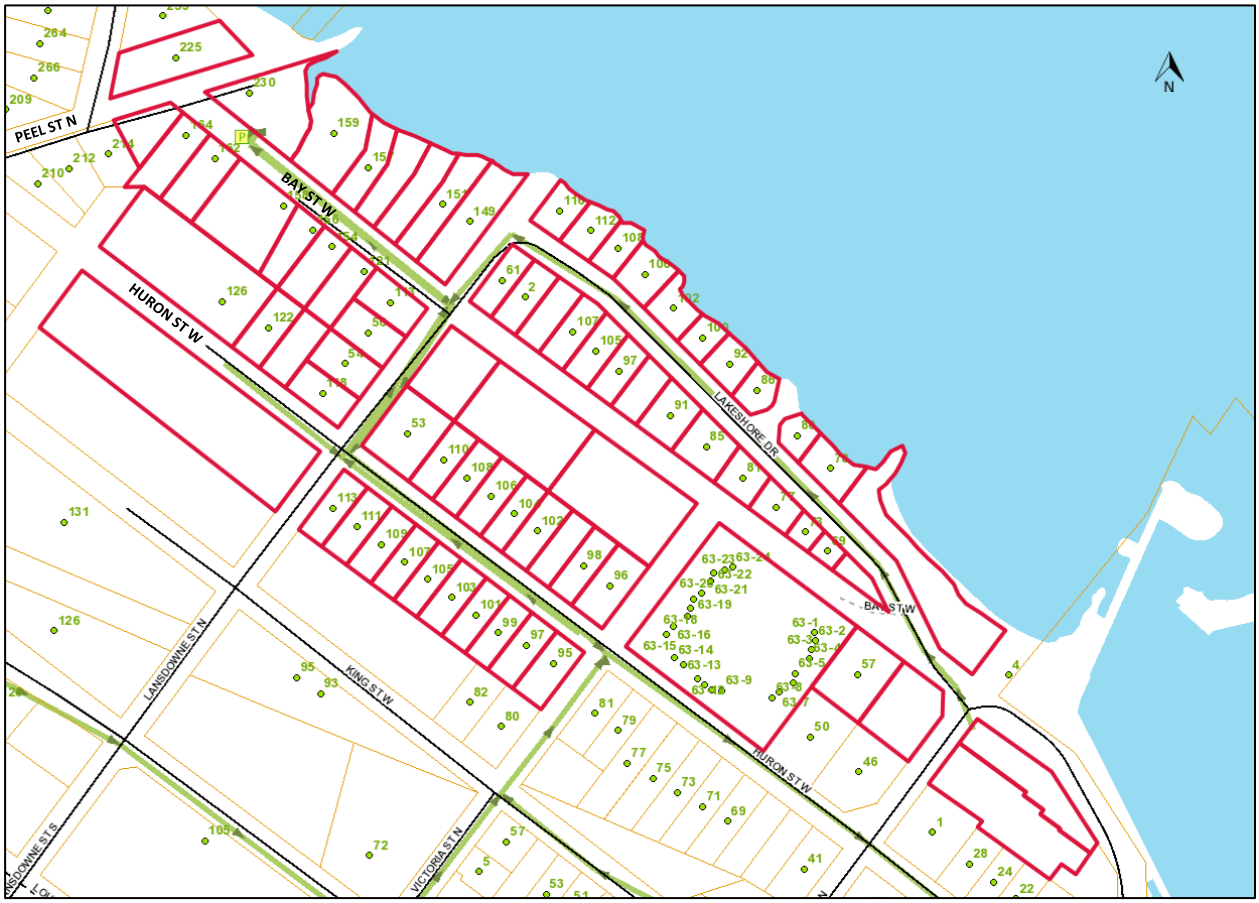

Figure 1 – PSPS Sanitary Drainage Catchment Area

The PSPS currently does not have a Certificate of Authorization (CofA) or Environmental Compliance Approval (ECA) from the Ministry of the Environment and Climate Change (MOECC).

Staff have completed preliminary investigations of the following PSPS aspects:

1. Inflow and Infiltration (within the PSPS collection system);
2. Backwash Water Inflow Rate (from the adjacent WTP);
3. PSPS Pumping Capacity;
4. PSPS Pump Controls;
5. PSPS Forcemain Capacity & Surge Protection;
6. Hotel Sewage Flows;
7. Future Development Flows; and
8. PSPS Capacity Review

Inflow and Infiltration

Based on PSPS pump run data, the high flows experienced at the PSPS have seasonal variability, indicating inflow and infiltration (I/I) may be a significant factor. The three sanitary flooding problems occurred at one location on Lakeshore Drive. One was during wet weather, and the other two were due to pump malfunctions.

To address these issues, additional PSPS alarms have been installed (within the last two months) to allow Staff more notification to react, and implement mitigating measures, such that a sewage haul and vacuum truck can be called in an emergency flooding event.

Staff directed Pipe Vision to undertake a CCTV video of the public sanitary collection system that discharges into the PSPS to determine if there is are visible sources of inflow and infiltration into the mainline sewer. If there are significant leaks it may be possible to complete internal repairs to help to reduce the flows, however, typically it is very difficult to significantly reduce I/I, particularly when foundation drains may be connected.

The CCTV assessment of Lakeshore Drive did not identify an obvious source of extraneous infiltration. Pipe Vision reputably indicated there were a high number of service laterals flowing, which could be indicative of foundation drain connections (a past practice). Pipe Vision also indicated that leaking was observed in some maintenance holes, which could have been from defects in the concrete or ponding on the surface resulting in inflow through the cover holes. The CCTV assessment of Bay, Landsdowne and Huron Streets within the sanitary catchment area is currently on-going and may provide additional information on infiltration sources.

Additional field work would be required to verify these finding, devise solutions and rectify deficiencies.

Backwash Water

An analysis of the WTP backwash water was conducted to determine when discharge was occurring to the PSPS, and also what volume of water was being discharged to the PSPS. During periods of high raw water turbidity, approximately 95 m^3 of backwash water (equivalent to sanitary flow from approximately 1000 people) is discharged daily (1.1% of 2016 maximum day demand) to the PSPS by an underflow pump at approximately 10 to 11 L/s.

As a temporary solution to help alleviate high wet weather flows to the PSPS, a lockout was installed on the WTP underflow pumps. The lockout stops the pumps from discharging to the PSPS when both pumps in the PSPS are already running and the PSPS is struggling to keep up with incoming sewage flows. It also triggers an alarm and notifies the WTP Operators.

As an additional temporary measure, the WTP SCADA system could be programmed to pump backwash water to the PSPS during the early hours of the morning (1am-3am) to ensure its discharge does not occur during residential peak sewage flow times. Currently the backwash water automatically discharges to the PSPS soon after it's generated or the pumps are manually activate by the WTP Operators (during daylight hours).

As a permanent solution, variable frequency drives (VFDs) could be installed on the WTP underflow pumps to enable the pumps to pump at a lower flow rate to the PSPS. The pumps could currently be reduced to as low as 2.2 L/s, which includes safety factor of 2, without causing backwash water discharge problems at the WTP. When the WTP is operating at its rated capacity of 15,140 m3/d, the underflow pumps could pump at 4.0 L/s, which includes a safety factor of 2.

Another permanent solution, could include diverting some of the backwash water that currently goes to the Waste Tanks and PSPS instead to Little Beaver Creek. Based on conversations with the Water Operators, the WTP is permitted to discharge to this creek as long as the annual average TSS concentration does not exceed 25 mg/L. The current discharge has an average TSS concentration of about 1 mg/L, and therefore there is some capacity to operationally increase the loading rate.

However, either of the above alterations to the WTP will require an amendment to the Plant's Ministry of the Environment and Climate Change Environmental Compliance Approval.

Peel Street Sanitary Pumping Station Pumping Capacity

Drawdown testing was conducted at the PSPS and confirmed that each pump discharges approximately 15 L/s when operating alone and a total of 18 L/s when both pumps operate together.

Based on the rate of rise observed in the PSPS during the testing, average and peak incoming sewage flows (excluding backwash water) are estimated at approximately 1.2 L/s and 3.5 L/s, respectively. We calculated theoretical average and peak sewage flow estimates at 1.1 L/s and 4.1 L/s, respectively. Of the calculated 4.1 L/s peak flow, 3.3 L/s is peak sewage flow and 0.8 L/s is an I/I allowance. The observed and theoretical average sewage flows are comparable,

but the observed peak sewage flow is less than expected. This is because the drawdown testing occurred on a dry weather day, and we believe the peak incoming sewage flows could have been significantly higher during wet weather.

Knowing that the PSPS pumps are not able to keep up during wet weather periods when the backwash water is discharging, we estimate I/I is contributing *at a minimum* of 5 L/s during wet weather. According to the MOECC, this rate is at the high end of the I/I range theoretically anticipated and suggests the PSPS is dealing with more I/I than normal.

We note that pump impellers were changed to a cutter type of impeller to address clogging from cleaning products (Swiffer cloths). This was a successful change, in that it reduced calls regarding this pump station, and will need to be considered for future upgrades.

Pump Controls

The PSPS pumps currently operate as lead/lag pumps, where both pumps occasionally run together to try and keep up during high flow periods. Up until recently, the flows discharged by the PSPS have been unknown since the pump run hour data was only available for each pump and the hours when both pumps ran together could not be quantified (and draw down test data was not available to correlate hours with flows).

To remedy this, a third hour meter was recently installed at the PSPS to track pump run hours when both pumps are operating. Going forward, the flows at the PSPS will be able to be calculated.

To provide full redundancy and protection from sewage spills, the pumps in the PSPS should operate as duty/standby pumps where only one runs at a time. It should also be noted that MOECC regulation, and custom & practice require that a twin pump station's capacity, be based on just one pump operating.

Forcemain Capacity and Surge Protection

According to For Record Ontario MOE PWWP 5-0062-67 drawings by Ainley and Associates, the PSPS discharges through a 485 m long, 150 mm nominal diameter PVC Series 160 (SDR 26) forcemain.

The forcemain exits the PSPS to the east and crosses beneath the Little Beaver River. From there it continues east along Bay St W, then south on Lansdowne St N, and finally east on Huron St W where it connects to a maintenance hole east of address 96 Huron St W, at the Victoria St N road allowance.

We estimate the PSPS overcomes approximately 8.6 m of static lift, and 2.9 m of dynamic headlosses with one pump running (15 L/s) or 3.9 m of dynamic headlosses with two pumps running (18 L/s).

Based on a rough surge analysis, we estimate surge pressures from when one pump is on and fails or both pumps running fail simultaneously (flows of 15 and 19 l/s respectively) of

approximately 65 psi and 95 psi, respectively. These pressures are less than the pressure ratings (according to IPEX catalogue) for new PVC SDR 26 piping (short term 205 psi, long term 160 psi). which suggest a maximum allowable flow of approximately 30 l/s.

A detailed surge analysis investigation should be completed if PSPS upgrades are proposed that increase the PSPS discharge flow rates.

Hotel Sewage Flows

The Royal Harbour Resort is a significant sewage contributor to the PSPS. Staff have been in contact with this hotel and confirmed it consists of 43 rooms, a lounge, pool and fitness facilities. It is usually fully occupied year-round. The hotel stated sump pumps and pool water are not being discharged to the sanitary sewer.

Based on design flows specified by the MOECC, we estimate a hotel of this size to have average sewage flows of approximately 29 m^3/d. Their water records indicate they use 19 m^3/d water. Therefore, the hotel does not appear to be a culprit with respect to the PSPS capacity issues.

Future Development Flows

Future, imminent sewage flows from the third phase of the Trailwoods development are anticipated to come online in 2018. The development has received approval and is currently in construction. The sewage discharge for the majority of the units (Timber Lane and Plum Ridge Circle) will be through a newly constructed sanitary sewer on Peel St. that discharges to the existing PSPS. We estimate average and peak sewage flows to the PSPS for the Trailwoods development of approximately 0.5 L/s and 1.7 L/s, respectively.

The new sanitary sewer is being constructed at the expense of the developer with some credit for future development charges. The developer is not required to contribute to upgrades required at the PSPS since it was never included in their original agreements, and as the land has been zoned for development for several years, it is the Municipality's responsibility to be able to serve the development.

Additionally, there are currently 9 vacant lots on Bay St. W, Huron St. W. and Lakeshore Drive, and, at some future date, flows from Cameron Street (estimated 36 lots east of Tennis Club) may have to be included. Their future buildout and sewage flows should be considered for any upgrades/modifications for the PSPS. We estimate average and peak sewage flows for these vacant lots of approximately 0.2 L/s and 0.8 L/s, respectively, and from Cameron Street of 0.3 L/s and 1.2 L/s, respectively.

PSPS Capacity Review

Based on our preliminary analysis, inflows to the PSPS are (in periods of wet weather) currently exceeding its current ("rated") capacity of 15 L/s (one pump running). The addition of future development and infill buildout, will exacerbate the situation; in approximately a year's time (summer 2018), flows from Trailwoods will be added. Additional flows should also be allowed for Cameron St.

See table below.

PSPS Input	Existing (L/s)	Future (L/s)
WTP Backwash	11	4 (WTP at rated capacity)
Existing residential and hotel peak flow (excl I/I)	3.3	3.3
I/I peak flow	5+	5+ (if not remediated)
Future peak flow – Trailwoods Phase 3	-	1.7
Future peak flow – Infill and build out of 9 vacant lots	-	0.8
Future peak flow – Cameron St (36 lots)	-	1.2
TOTAL	**19.3+**	**16+** *(23.0 w/o WTP alteration)*

D. Conclusion

From our preliminary analysis, we conclude the following:

1. **The PSPS is currently overloaded**. It requires both pumps on to handle the incoming peak flow it is experiencing. Occasionally both pumps running is not sufficient and a sewage haul truck is required.
2. **Inflow and infiltration appears to be contributing flows higher than normal**. A video inspection has been undertaken and foundations drains may be connected to the system.
3. The WTP backwash sequencing and operation has been modified and can be further modified to reduce its impact on the PSPS.
4. The available PSPS pump run data has limited usability to determine flow rates pumped by the PSPS. A third hour-meter has been installed to more accurately determine PSPS flow rates.
5. **Formalization of the work outlined in this report, (to facilitate works at the PSPS and the WTP) is needed immediately, since only temporary backwash sequencing alterations have been implemented to date and future development flows are imminent.**
6. The PSPS pumps currently operate as lead/lag pumps, but should operate as duty/standby pumps to provide full redundancy and protection from sewage spills. *(Normal practice for a two-pump station, such as the PSPS, is with one pump alone able to manage the peak flow to the station. The other pump is provided in case the first fails)*.

E. Recommendations

We recommend budget be created to fund the following; (it should be noted that the following assumes the wet well, forcemain and standby power supply are adequate. If they require upgrades, so will this estimated budget.):

1. Re-program the WTP SCADA system to pump backwash water to the PSPS during the early hours of the morning, operationally consider increasing backwash discharge to Little Beaver Creek, and purchase and install VFDs on both WTP underflow pumps ($60,000).
2. Complete additional field work to verify inflow and infiltration to the PSPS, devise solutions and rectify deficiencies ($15,000).
3. Hire a consultant to formalize & verify the work outlined in this report, and apply for an ECA ($25,000).
4. Provide an allowance for an Environmental Assessment to facilitate PSPS upgrades are required ($25,000).
5. Provide an allowance to replace both pumps and install VFD's and ultrasonic controls, at the PSPS ($150,000).

F. Financial Impact

The financial impact of these upgrades will be funded from two different funding sources; for replacements costs current users will fund these and growth related costs will be funded from Development Charges. As per the capacity chart 3.7L/s (1.7 + .08 + 1.2) are growth related capacity and the remaining 12.3L/s is for current users, this represents a 23% and 77% cost sharing.

From the list of 5 recommends numbers 1 and 2 are current users only and therefore the full $60,000 for the WTP SCADA will be funded from the Water Asset Replacement Reserve Fund. Similarly the additional field work for the inflow and infiltration will be funded 100% by current users and will be funded from the Wastewater Asset Replacement Reserve Fund. Items 3 to 5 totaling $200,000 will be funded using the 23/77% split as outlined in the paragraph above. The 77% or $154,000 will be funded from the Wastewater Asset Replacement Reserve Fund and the remaining $46,000 will be funded from the Lora Bay Sewer Development Charges Reserve Fund.

G. In Consultation With

John Caswell - Manager of Water and Wastewater Services, Ruth Prince – Director of Finance and IT Services/Treasurer, Sam Dinsmore – Deputy Treasurer/Manager of Accounting and Budgets and Senior Management Team (SMT)

Respectfully submitted,

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