

This document can be made available in other accessible formats as soon as practicable and upon request



# Staff Report

## Infrastructure & Public Works

---

**Report To:** Committee of The Whole  
**Meeting Date:** January 29, 2018  
**Report Number:** CSPW.18.003  
**Subject:** Status Update - 10<sup>th</sup> Line Water Booster Station and Electrical Risk Assessment of Critical Water and Wastewater Infrastructure  
**Prepared by:** Allison Kershaw, Manager of Water and Wastewater Services

---

### A. Recommendations

---

THAT Council receive Staff Report CSPW.18.003 entitled, “Status Update – 10<sup>th</sup> Line Water Booster Station”;

AND THAT Council approve creating a project budget to complete an Electrical Risk Assessment at the water treatment plant, four (4) booster stations and three (3) water reservoirs in the amount of \$15,000 to be funded from the Water Asset Replacement Reserve Fund;

AND THAT Council approve creating a project budget to complete an Electrical Risk Assessment at the two (2) wastewater treatment plants and six (6) sewage pumping stations in the amount of \$15,000 to be funded from the Wastewater Asset Replacement Reserve Fund.

### B. Overview

---

This report provides a status update on the emergency purchase of Variable Frequency Drives for the 10<sup>th</sup> Line Water Booster Station.

Further, this report requests \$30,000 for completing an Electrical Risk Assessment of the critical water and wastewater infrastructure to evaluate the current status of the surge protection equipment in the Town’s critical water and wastewater stations.

### C. Background

---

On Tuesday, December 5, 2017 the Town experienced a power outage and an extremely high wind event. During that time, Town Water Operators became aware that the pumps at the 10<sup>th</sup> Line Water Booster Station (WBS) were not operating. Upon investigation, it was determined that while the pump units were unaffected, the fuses and Variable Frequency Drives (VFDs) that operate the pumps had been damaged. This left the Lora Bay Pressure Zone with flow through pressure only and on rural fire protection.

Notification was provided to the Director of Infrastructure and Public Works who in turn, confirmed that the incident was classified as an emergency and directed repairs in accordance with the Town's Purchasing Policy. Subsequent notice of the WBS VFD failure was provided to members of Council, Senior Management Team and the Town's Fire Department.

The Purchasing Policy states in situations where an emergency purchase is necessary,

"The User Division shall submit a memorandum to Council outlining the purchase and the conditions that constituted an emergency together with a source of funding, prior to the end of the quarter in which the emergency procurement took place".

Final costs will be reported on as soon as they are known.

Fuses and VFDs were acquired on December 6, 2017. Mike Elder Electric was retained by the Town to perform the electrical installation work required and provide a full assessment of the damage to the WBS.

In Mike Elder's Assessment Report, provided as Attachment #1, he catalogues the damage to the WBS including the VFDs and the transfer switch. This switch is used to transfer operations automatically from utility power to the backup generator in the event of a power interruption. A technician from Total Power was onsite December 15, 2017 to assess the transfer switch and ensure that the new switch is integrated successfully. Total Power is relied on for the company's expertise in repairing transfer switches.

NLS Engineering, the Town's SCADA integrator, was required to complete some programming work on two of the replacement VFDs to ensure adequate equipment communication.

By Friday, December 8, 2017 the replacement VFDs were installed and operational. The Lora Bay area was restored to normal pressure levels including fire protection. The transfer switch remained inoperable. This means that if power is lost from the grid, an electrician will need to attend the site and manually transfer the operations from the grid power supply to the back-up generator supply and back again to the grid. The damaged parts of the transfer switch have been identified and have been ordered, however there is an eight to twelve week delivery time for the parts. Staff investigated replacing the entire switch, however the current panel could not accommodate a new transfer switch. The best option was to replace the damaged parts of the current transfer switch. The Town has received a quotation from Total Power to repair the transfer switch for approximately 5,500. It is anticipated that final costs associated with repairs to the 10<sup>th</sup> Line WBS will total approximately \$21,000 but this will be confirmed once the transfer switch is delivered and installed.

## **D. Analysis**

---

The Mike Elder report provides an opinion of possible cause for the issues experienced at the WBS. The report infers that an accidental spike in voltage was delivered to the WBS, possibly related to the power outage or high wind condition experienced December 5, 2017.

The WBS and other facilities are surge protected, and surge protection remains operational at the WBS despite the equipment failure. If the incident was caused by a momentary voltage spike, it must have been less than the 2,000 volt value of the surge protection.

Staff have contacted Hydro One to determine if any further details on the power interruption can be provided and whether additional mitigating measures should be put in place. Hydro One is reluctant to provide input until the Town submits a formal claim against them.

It is anticipated that final costs for the repair of approximately \$21,000 are known given the firm quote by Total Power, but this will be confirmed in a future Staff Report once parts for the transfer switch are received and installed.

To avoid the risk of a similar incident happening again Staff are requesting that \$15,000 from the Water Reserve and \$15,000 from the Wastewater Reserve be allocated to perform an electrical risk assessment of the following water and wastewater facilities:

#### Water Facilities

- Water Treatment Plant
- Water Tower
- 10<sup>th</sup> Line WBS
- Thornbury Reservoir
- Camperdown Reservoir
- Arrowhead Road WBS
- Happy Valley Road WBS
- Mountain Road WBS

#### Wastewater Facilities

- Craigleith Wastewater Treatment Plant
- Thornbury Wastewater Treatment Plant
- Craigleith Main Sewage Lift Station
- Lake Shore Sewage Lift Station
- Delphi Sewage Lift Station
- Mill Street Sewage Lift Station
- Peel Street Sewage Lift Station
- Sunset Boulevard Sewage Lift Station

The proposed budget of \$30,000 to complete the electrical risk assessments is based on discussions with electrical engineers and Staff experience.

Subsequent to Council approval, Staff will present to Council the results of the Electrical Risk Assessments of critical water and wastewater infrastructure conducted by a Consultant specializing in electrical engineering. This assessment will evaluate the current status of the equipment protecting water and wastewater electrical systems as compared to industry standards for similar operations. If the protection of the electrical systems are found to be

vulnerable, Staff will present to Council the options for providing adequate protection to critical electrical systems to prevent any further damage related to electrical failures or surges.

Staff request that Council approve creating a project budget of \$30,000 to complete an Electrical Risk Assessment various water and wastewater facilities to be funded from Water and Wastewater Reserves.

## E. The Blue Mountains Strategic Plan

---

Goal #4: Promote a Culture of Organizational & Operational Excellence

Goal #5: Ensure Our Infrastructure is Sustainable

## F. Environmental Impacts

---

N/A

## G. Financial Impact

---

A summary of the repair costs known to date is available below:

Summary of Costs to Date – 10 <sup>th</sup> Line WBS Repair		
Vendor	Equipment or Purchased Service	Subtotal
Benshaw Advanced Controls & Drives	Variable Frequency Drives & Display Kits	\$10,007.00
	Variable Frequency Drive Cards for PLC Compatibility	\$1,750.00
Mike Elder Electrical	Electrical Work	\$3,447.79
Total Power	Transfer Switch Power Supply	\$5,499.31
Miscellaneous	Materials	\$100.00
	<b>Subtotal</b>	<b>\$20,804.10</b>

At this time, the subtotal for expenditures is approximately \$20,804. A report detailing final costs will be brought forward to Council once full costs are known. In addition, once the full costs are known a funding source will be recommended to Council.

Subsequent to Council approval, the proposed \$30,000 budget for the electrical assessment will be financed from the Water Asset Replacement Reserve Fund and the Wastewater Asset Replacement Reserve Fund.

## **H. In consultation with**

---

Darren Shilvock, Water Supervisor

Maurice Dempster, Wastewater Supervisor

Serena Wilgress, Manager of Purchasing & Risk Management

Sam Dinsmore, Deputy Treasurer/Manager of Accounting & Budgets

## **I. Attached**

---

1. Mike Elder Electric Report – 10<sup>th</sup> Line Booster Station – Electrical Equipment Damage, dated December 12, 2017

Respectfully submitted,

---

**Allison Kershaw**

Manager of Water and Wastewater Services

---

**Reg Russwurm**, MBA, P.Eng

Director of Infrastructure and Public Works

For more information, please contact:

Allison Kershaw

[ipwinfo@thebluemountains.ca](mailto:ipwinfo@thebluemountains.ca)

519-599-3131 extension 226

# Mike Elder Electric

861 4<sup>TH</sup> Ave E, Owen Sound  
519-270-6339

December 12, 2017

Attn: Town of Blue Mountains

## **10<sup>TH</sup> LINE BOOSTER STATION – ELECTRICAL EQUIPMENT DAMAGE**

The following outlines electrical equipment damages found at the 10<sup>th</sup> Line Booster Station, necessary repairs, and possible cause of the damage.

### **Booster Pumps:**

On the morning of December 5, 2017, (0930), an on-site investigation was conducted to find out why all 5 Variable Frequency Drives (VFDs, drives) that run and control the water booster pumps had failed and could not be reset.

The utility power to the building was out and the on-site stand-by generator was running.

It was immediately found that all 5 VFDs had apparently experienced the same failure as none of the drives had any display on the control screens, even though all the disconnect switches were on and there was generator power to the entire building.

Upon further investigation, it was found that 14 of the 15 fuses that supply 600Volt power to the drives (3 fuses per VFD) had blown. These fuses were rated at 80Amps.

It was then discovered that the input circuits of all 5 VFDs had been fatally damaged. The conclusion of the investigation was to replace the drives with new Benshaw Rsi Series VFDs.

### **Transfer Switch:**

On the afternoon of December 5, 2017, it was found that the stand-by generator was still running even though the utility power to the building had been restored. The user display of the automatic power transfer switch (responsible for monitoring utility power and starting/stopping the generator as necessary) was displaying a 0 Volt condition of incoming utility power.

Upon further investigation it was found that the 400Amp main utility service entrance breaker had been tripped. When this main breaker was reset, there was then utility power available at the transfer switch. However, during voltage checks it was noticed that there were 2 areas of black electrical arc marks inside the transfer switch cabinet.

Due to these visible electrical faults the transfer switch was operated manually out of caution to minimize risk of more extensive damage. Utility power was then restored to the building and the generator was shut-down manually.

The 2 areas of arcing inside the transfer switch cabinet were: 1) resulting from the phase A voltage tap connector blowing apart and away from the source, creating black marks all around the phase A utility power lug, and 2) all around the utility power SCR, a semi-conductor that delivers a power source to the control system of the transfer system.

#### **Other Equipment:**

During the installation of the new drives on December 7<sup>th</sup> and 8<sup>th</sup>, and upon further investigation of other building equipment on December 11<sup>th</sup>, it was found that the electrical damage seems to have been restricted to the input circuits of the VFDs and to the transfer switch control power source SCR.

It was found that the on-site Surge Protection device is still operational as the service lights are all on and indicating the system is still OK.

#### **Repairs:**

The faulted VFDs have been replaced with new drives and tested for performance and compatibility with the pumps and the SCADA system. There are 2 drives that require the installation of output cards in order to supply a proper feed-back signal to the SCADA system. However, these 2 mentioned drives are still serviceable in the event of a high-flow situation. These cards are due to be installed within 4 days.

The transfer switch will be repaired ASAP, as the replacement SCR is on order. It may be the only damaged component but this will not be known until the damaged device is replaced. The transfer switch can still be operated manually to run the pumps from the generator during power outages.

#### **Possible Cause:**

Please consider the following an opinion only of what may have happened to cause damages to the electrical equipment at the 10<sup>th</sup> Line Booster Station.

Since the only apparent damage to the building happened to semi-conductor solid state devices, it may be possible that there was a very fast accidental voltage spike delivered to the building. Perhaps this spike could have been related to the power outage or high wind condition on December 5<sup>th</sup>.

This increase in voltage could have been large enough to break down the semiconductor devices creating dead short circuits between phases. This dead short condition would be powerful enough to blow the 80amp fuses feeding the drives, and also blow apart the small gauge voltage tap wire of the transfer switch control power source.

These damages may have happened in the amount of time it would take for the upstream main 400Amp breaker to trip. This time frame could be just fractions of a second.

The surge suppressor is rated at 2000Volts between phases. If a voltage spike were less than this value perhaps it could be uninterrupted by the surge protector, allowing it to pass into other devices.

For instance, the 3 phase bridge rectifier semi-conductor devices that were blown in all VFDs have a rating of 1600V. Perhaps a voltage spike of 1800V would be enough to damage these components, but not enough to activate the surge suppressor devices.

Regards,

Mike Elder

MIKE ELDER ELECTRIC  
519-270-6339