

INTER-OFFICE MEMORANDUM

TO: CHAIR AND MEMBERS
FINANCIAL MANAGEMENT COMMITTEE

DATE: 2016 JUNE 06

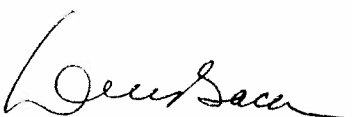
FROM: CITY CLERK

FILE: 38000-01

SUBJECT: EMERGENCY BACK-UP POWER FOR TRAFFIC SIGNALS
(ITEM NO. 6(02), MANAGER'S REPORTS, COUNCIL 2016 MAY 30)

Burnaby City Council, at the Open Council meeting held on 2016 May 30, received the above noted report and adopted the following recommendations contained therein:

1. **THAT** Council receive this report for information.
2. **THAT** the issue of emergency back-up power for traffic signals be referred to the Financial Management Committee for further review and consideration.



Dennis Back
City Clerk

DB:nv

TO: CITY MANAGER **DATE:** 2016 May 20

FROM: DIRECTOR ENGINEERING **FILE:** 38000 09

SUBJECT: EMERGENCY BACK-UP POWER FOR TRAFFIC SIGNALS

PURPOSE: To provide information regarding the resiliency of the City's traffic signals during a power outage.

RECOMMENDATION:

1. **THAT** Council receive this report for information.

REPORT**1.0 BACKGROUND**

There are approximately 240 traffic signals operated by the City which manage traffic flows at the busiest intersections to maintain a safe and efficient transportation network. These signals are expected to operate 24/7 and regular maintenance is carried out to ensure their optimum performance and minimize any disruptions. Even so, for a variety of reasons, power outages occur occasionally which disrupt their operation.

During a power outage, motorists approaching a dark traffic signal are expected to treat it as if it were controlled by stop signs. At larger and more complex intersections (like Kingsway and Willingdon), a 4-way stop operation is challenging. In recognition of this, the City has installed uninterrupted power supply systems (UPS) at 70 major intersections as shown on Figure 1. The UPS installed at each intersection provides back-up power for full operation for at least 4 hours, possibly longer, depending upon the age and type of batteries and the number of signals heads powered. After 4 hours, the traffic signal would operate in an all-way-red flash mode for up to 20 hours before going completely dark. When power is restored, the majority of traffic signals automatically resume normal operation without any other intervention.

A windstorm last year on August 29 caused power outages across many parts of the Lower Mainland. In some parts of Burnaby, the outage lasted up to 3 days and many traffic signals were reported to be out of order. Communication between some traffic signals and the City's central monitoring system was also impacted which necessitated field assessments during the recovery stage to confirm that all traffic signals were back to normal operations. Following the storm, a number of initiatives were undertaken to improve the City's response and recovery, including a review of the back-up power supply for traffic signals.

2.0 DISCUSSION

There are two main factors in determining the need for back-up power at a signalized intersection. First is the frequency and duration of the power outage. Weather related events are one of the more common causes of forced power outages within the Lower Mainland. Storm events can topple trees and disrupt overhead power lines. BC Hydro's ability to restore power - lines in a timely fashion is dependent on the scope and severity of the event relative to resources that are available to them for repairs. Over the past year (April 2015 to April 2016), there have been 463 individual power outages within Burnaby, almost a third of these are related to 4 large scale storm events. The average duration of forced power outages is about 8 hours including storm events. The average duration excluding storm events is about 4 hours.

The second factor is the traffic conditions at the intersection in terms of how well it operates as a default all-way stop control. The 70 intersections that currently have UPS were selected based on several factors including:

- high traffic and pedestrian volumes;
- multi-lane approaches;
- signalized left turns;
- high collision rates;
- higher posted speed limits;
- presence of advanced warning flashers or railroad pre-emptions, and
- unusual intersection operations or configurations.

The use of UPS to maintain the entire traffic signal system would not be practical or cost effective. Many simpler signalized intersections can and do operate safely under an all-way stop procedure if necessary. In light of all the above considerations, steps for improving the reliability and safety of signalized intersections during a power outage are discussed below:

2.1 Install Additional UPS

Using the same criteria for installing UPS at existing locations, additional UPS can be installed at the next highest ranking intersections. This includes intersections such as Austin Ave and Gatineau Pl, Marine Way and Nelson Ave, Kingsway and 10th Ave, and Royal Oak and Deer Lake Parkway. An additional 16 locations are recommended at a cost of about \$160,000. This would also incur an additional cost of \$9,600 per year (\$600 for each unit) for annual maintenance and full replacement cost in about 15 years. All these additional locations have been reviewed with the RCMP and are also shown in Figure 1. With the additions, approximately one-third of all traffic signals in Burnaby would be equipped with UPS.

To: City Manager
From: Director Engineering
Re: EMERGENCY BACK-UP POWER FOR TRAFFIC
SIGNALS
2016 May 20 Page 3

Traffic signals along Boundary Road are managed by the City of Vancouver. Only four intersections along Boundary Road have a UPS system. Because of high traffic volumes, a request will be made to Vancouver for the installation of a UPS system at Boundary/Hastings, Boundary/Kingsway, Boundary/Imperial (49th Ave) and Boundary/Marine Way.

2.2 Install Longer Lasting UPS

There is an option to install UPS capable of providing up to 24 hours of battery back-up power for full signal operation, but this would require the installation of an additional cabinet in close proximity to the existing traffic control cabinet. Space constraints at some intersections may limit the use of this option. The cost of this larger UPS is approximately \$20,000 each plus an additional annual operating cost of \$750 to maintain. The high cost, potential space constraints, and low probability of power outages lasting 24 hours make this option unattractive. If back up power is required for 24 hours or more, the best option is to provide a gas powered generator that would be manually deployed and maintained. However, this would only be practical for an isolated power outage at one or two intersections. Isolated power outages affecting traffic signals have occurred in the past from time to time (up to 6 times a year) and contractors have been used to obtain the necessary back-up generator. To ensure the availability of a back-up generator specifically for traffic signal outages, one is being purchased this year through existing budgets.

2.3 Improve Response Procedures

Based on a review of last year's windstorm, procedural adjustments to traffic signal operations have been made to improve the recovery time. While most traffic signals automatically revert back to normal operation when power is restored, there are occasions when a manual reboot is required. This can usually be detected through the central monitoring system at City Hall; however, if radio communication lines are blocked or if communication equipment is damaged, the problem would not be detected unless reported by the public. To mitigate this, traffic staff will now be dispatched as required to field investigate traffic signals during the recovery stage of an event to verify their condition and try to get them back into operation as quickly as possible. The ongoing expansion of the City's underground fibre optic network will also help improve the reliability of the City's communication system.


To provide an additional redundancy, a third person has also been added to receive automated emails from the central monitoring system to notify of any abnormal traffic signal operations. This ensures better staff coverage, particularly outside of regular office hours. For day to day issues, procedures are currently in place for our maintenance contractor to respond to a traffic signal malfunction within one hour of dispatch. This continues to work well.

To: City Manager
From: Director Engineering
Re: EMERGENCY BACK-UP POWER FOR TRAFFIC
SIGNALS

2016 May 20..... Page 4

3.0 CONCLUSIONS

Following the windstorm in August 2015 that caused a lengthy power outage in many parts of Burnaby, a review was completed regarding the resiliency of the City's traffic signals. Currently 70 major intersections are equipped with an uninterrupted power supply (UPS) system that provides battery back-up power for at least 4 hours of full operation followed by up to 20 hours of all-way-red flash operation. To further enhance safety during a power outage, an additional 16 high priority signalized locations are recommended to be equipped at an estimated cost of \$160,000. This enhancement will be funded from 2016 Capital Contingency with installations beginning later this year and completed in 2017. The provision of longer lasting battery back-up power is not recommended because of high costs and limited benefits due the infrequent occurrence of long duration power outages. Additional measures taken to maintain traffic signal operations include the purchase of a portable generator to be used for longer duration power outages at isolated locations and some procedural changes to help decrease recovery times and provide additional monitoring redundancies.



Leon A. Goss, P. Eng., MBA
DIRECTOR ENGINEERING

DL/ac

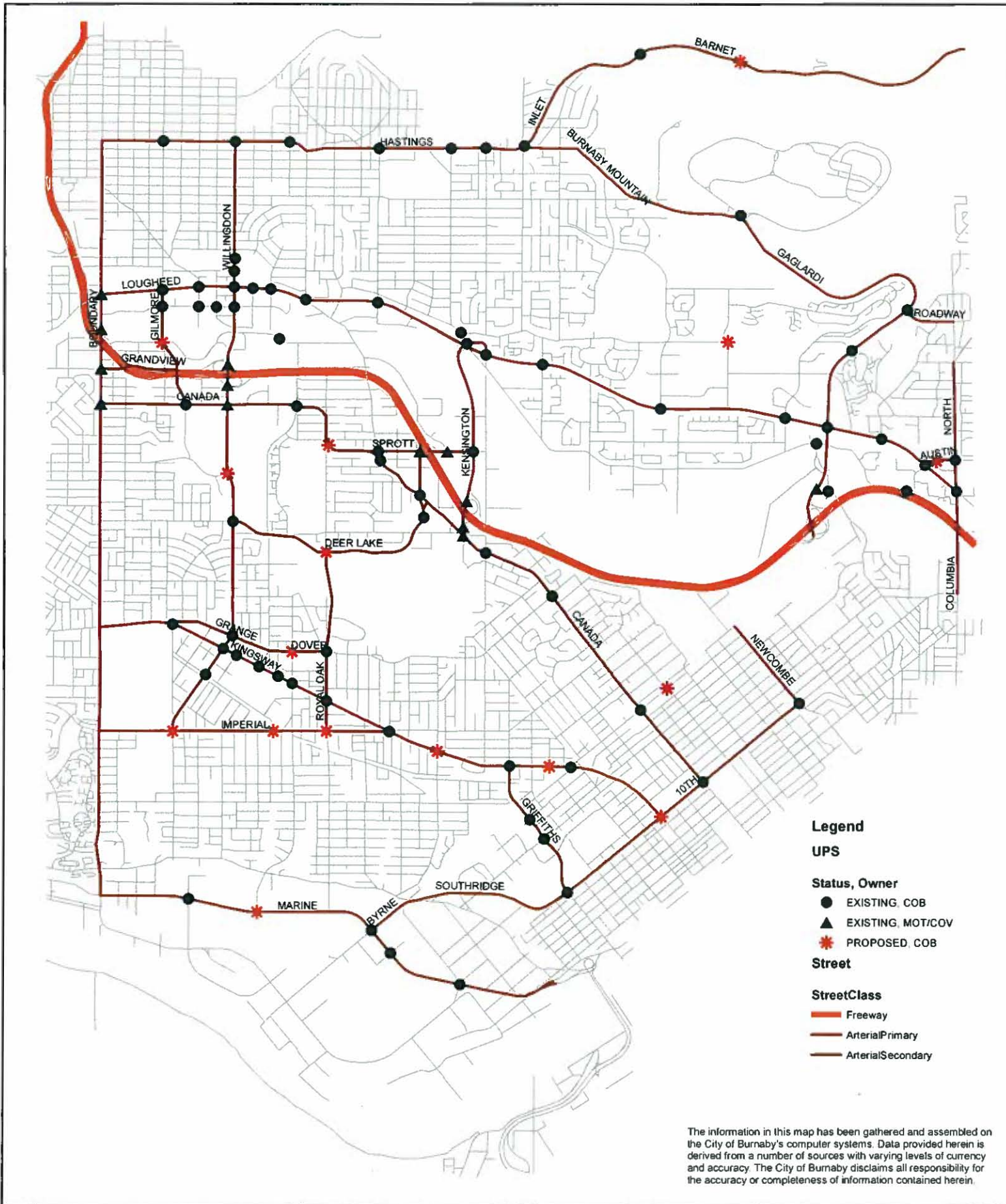
Attachment

Copied to: City Manager
Director Finance
Emergency Program Coordinator – Charmaine Pflugrath
RCMP – OIC Burnaby Detachment Chief Supt. Dave Critchley
Deputy Fire Chief – Dave Samson



Figure 1 - Intersections with Uninterrupted Power Supply System

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The information in this map has been gathered and assembled on the City of Burnaby's computer systems. Data provided herein is derived from a number of sources with varying levels of currency and accuracy. The City of Burnaby disclaims all responsibility for the accuracy or completeness of information contained herein.