Report To: Chair and Members of the Planning and Public Works Committee

From: Jim Harnum, Commissioner, Public Works

Date: March 25, 2015

Report No. - Re: PW-11-15 - Region Wide Basement Flooding Mitigation Study Update - Phase 1 - Wastewater Collection System Enhancements in Priority Areas

RECOMMENDATION

1. THAT Council authorize the allocation of funding to an upset limit of $3.2 million (excluding applicable taxes), from project S3042A for the design, construction and contract administration of improvements to further reduce the potential for future basement flooding from sanitary sewer backup in the high risk areas as set out in Attachment #2 to Report No. PW-11-15, re: “Region Wide Basement Flooding Mitigation Study Update – Phase 1 – Wastewater Collection System Enhancements in Priority Areas”.

2. THAT Council authorize the allocation of funding in the amount of $1.65 million (excluding applicable taxes), from project S3042A for the development and implementation of a voluntary Downspout Disconnection Program, to disconnect downspouts from the sanitary and storm sewer systems as set out in Report No. PW-11-15.

3. THAT Council authorize the Manager of Purchasing Services to prepare the procurement documents required to meet the modified procurement process as outlined in Report No. PW-11-15, subject to the approval of the Commissioner of Finance and Regional Treasurer.

REPORT

Executive Summary

- On August 4, 2014, a major storm event led to significant flooding in the City of Burlington. Several thousand homes were affected by the storm event which resulted in both surface flooding and basement flooding from surcharged storm sewers, sanitary sewers and watercourses.
- As previously outlined in Report PW-46-14, approved by Council on November 19, 2014, Halton Region initiated several actions intended to provide enhanced services for homeowners affected by basement flooding from sanitary sewer
surcharging including providing ex-gratia grants and subsidies for downspout and weeping tile disconnection and installation of backwater valves and sump pumps.

- Report PW-46-14, directed staff to hire a consultant with significant expertise in the areas of basement flooding and wastewater collection systems. GM BluePlan Engineering Limited was retained to review the public and private side wastewater infrastructure in areas deemed to be at higher risk of basement flooding and to identify opportunities to reduce risk of future flooding.

- The City of Burlington has hired consulting firm AMEC Foster Wheeler to analyze the August 4, 2014 storm and its impact on the City of Burlington’s storm water system. The report from this work is expected in summer 2015 and Halton Region will review these findings as it relates to the Region Wide Basement Flooding Mitigation Study.

- As discussed in Report PW-46-14, the Region Wide Basement Flooding Mitigation Study was to be developed in two phases. Report PW-11-15 outlines the results of Phase 1 of the study, a comprehensive review of the infrastructure in the areas identified as higher risk in the City of Burlington.

- A number of specific infrastructure projects have been identified by the consultant that would enhance and optimize the wastewater collection system in the higher risk areas in the City of Burlington and reduce the risk of future basement flooding from storm events, at an estimated cost of $3.2 million.

- Based on the consultant’s analysis, there were no deficiencies found in the wastewater system that could be deemed to have caused basement flooding under typical rainfall events in any of the areas studied.

- The consultant has also recommended that a Downspout Disconnection Program be developed to mitigate the risk to basement flooding in the future by reducing rainwater inflow to the sanitary and stormwater system at an estimated cost of $1.65 million.

- Staff are seeking Council approval for authority for the Commissioner of Public Works to undertake the work identified for optimization, in the most expeditious manner possible and authority to undertake the development and implementation of a Downspout Disconnection Program in the priority areas as outlined in Report PW-11-15 and any other areas that would have an immediate and dramatic impact on reducing inflow of rainwater into the sanitary sewer system in collaboration with the City of Burlington.

- In Phase 2 of the study, the comprehensive analysis for Region wide infrastructure will be completed. Specific infrastructure projects will be identified by the consultant to enhance and optimize the wastewater collection system in other areas of Halton Region that may similarly be at higher risk to basement flooding from sanitary sewer backup.

- In order to meet the timelines of the work to be completed, a competitive process will be followed where three to five companies will be invited to submit proposals. This is a modification to the Purchasing By-Law No. 65-10 where advertising to the open market for the value of this work is required. An invited list approach maintains a competitive process in an expeditious manner but still meets the purposes, goals and objectives of the Purchasing By-Law.
A final report, including findings from Phase 2 of the study, will be provided to Council in the summer of 2015

Background

On August 4, 2014, a major storm event led to widespread flooding in the City of Burlington. A significant number of homes were affected due to surface flooding as well as flooding from rainwater entering the storm and sanitary sewers.

The experience of municipalities across Canada support the conclusion that basement flooding is a complex problem which is further complicated by and impacted by changing weather patterns. In addition, the design and construction of private side storm and sanitary drainage systems and site grading often vary significantly from lot to lot. It is well understood that although sanitary sewers are designed to accommodate a certain amount of rainwater and groundwater infiltration and inflow, direct private side connections such as weeping tiles and downspouts can quickly and severely overwhelm properly designed, well maintained and operated wastewater collection systems. These extraneous flows can result in surcharged sanitary sewers and potentially lead to basement flooding. In older systems, these direct connections are more prevalent than in newer systems, where such connections, as per the Ontario Building Code, are no longer permitted.

Report PW-46-14, approved by Council on November 19, 2014, outlined the impacts to homeowners as a result of the storm and it also detailed both active and planned Regional activities in response to the flooding in several areas in the City of Burlington. Areas in the City of Burlington were identified as having a history of basement flooding during severe storm events and deemed to be higher risk of future flooding. In order to assist homeowners who had experienced multiple basement floods the Basement Flooding Prevention Subsidy Program was expanded for these higher risk homes to allow for the immediate disconnection of sources of stormwater and the installation of backwater prevention devices at no cost to the homeowner. To date, 134 homes have been provided with this additional assistance.

As of February 20, 2015, an additional 182 Basement Flooding Prevention Subsidy application forms for the 50 per cent rebate have been processed to disconnect downspouts, weeping tiles and install backwater valves and sump pumps. There are also over 80 additional applications currently pending and hundreds more anticipated as Halton Region has been advised by City of Burlington staff that significantly more building permits have been taken out for the basement flooding prevention works.

The City of Burlington has hired consulting firm AMEC Foster Wheeler to analyze the August 4, 2014 storm and its impact on the City of Burlington’s storm water system. The report from this work, expected in summer 2015, will recommend future actions to assist the City in dealing with the effects of climate change and mitigate future flooding risks throughout the City of Burlington. Halton Region will continue to work with the City of
Burlington to review AMEC Foster Wheeler’s findings as it relates to the Region Wide Basement Flooding Mitigation Study.

GM BluePlan Engineering Limited was retained to undertake the Region Wide Basement Flooding Mitigation Study as recommended in Report PW-46-14. The study is progressing on time and on budget and as requested by Council, memorandums providing ongoing updates have been reported to Council on a monthly cycle.

The Region Wide Basement Flooding Mitigation Study was initiated to review all areas across Halton that have experienced basement flooding and to identify system improvement opportunities that can mitigate the risk of future basement flooding during severe rain events.

As previously identified, the municipal sanitary sewer system is a Regional responsibility with the stormwater system being within the responsibility of each local municipality. Therefore due to the direct link between stormwater inflow and sanitary sewer surcharging, addressing basement flooding and mitigating the risk of future flooding will require a collaborative approach between the Region and each local municipality.

Although the Halton wide system review continues, the initial Phase 1 review has been focused on the areas in the City of Burlington that were identified at higher risk and have experienced multiple flooding events. Report PW-11-15 provides a summary of the work undertaken by the Region’s consultant and staff over the past several months and resulting recommendations.

**Discussion**

**Review of the Priority Areas in the City of Burlington**

Preliminary analysis completed by the consultant focused on areas that have experienced multiple flooding during severe rain events and that were deemed higher risk areas, which have identified five priority wastewater areas that drain into pumping stations and two other areas that experienced repeat flooding for a total of seven priority areas. The seven priority areas are identified in Attachment #1.

The consultant focused their attention on reviewing these areas, as directed by Council in Report PW-46-14, as a number of homeowners in all seven priority areas have experienced multiple flooding occurrences over numerous years and varying degrees of rainfall events.

**Comprehensive Review and Analysis of the Existing System**

The GM BluePlan Engineering Limited analysis in the high priority areas, involved the review, distillation and aggregation of all existing information and data relevant to the performance of the sanitary sewer system. A “no stone unturned” approach was taken to review this information and develop an accurate understanding of the existing sanitary
sewer system in order to identify opportunities to further mitigate the risk of basement flooding from sewer surcharging.

**Reviewing Previous Recommendations**

Previously published studies and reports were examined and recommendations reviewed. Any recommended actions from previous reports were reviewed with staff to ensure that they had been completed. The consultant found that the majority of previously identified work had been addressed, those areas not addressed were minor in nature and would have no impact on the potential for future flooding.

**Assessment of the Sewer System**

Staff and the consultant team examined all information sources to ensure that a complete and accurate assessment of the existing sewer system was in place to form the basis of analysis moving forward. This information included:

1. Sanitary sewer system Geographic Information System
2. InfoSewer sanitary sewer system model
3. Close Circuit Television (CCTV) inspection records of the system.

These three information sources, in conjunction with a considerable field inspection effort, provided a comprehensive review of the location, size, hydraulic capacity and age of each of the sanitary sewer pipes within the priority area. The resulting geospatial information and data provided a sound analysis platform upon which to layer additional findings related to the performance and condition of each section of pipe.

**Analysis for Optimization Projects**

One of the consultant’s main objectives was to identify opportunities for system improvement and optimization. These improvements are intended to further mitigate the risk of future sanitary sewer surcharging and basement flooding by reducing inflow and infiltration and optimizing the conveyance of sewage away from the local neighborhoods. In order to identify these opportunities, the consultant focused on the examination of the two primary contributors to sewer surcharging and basement flooding. These factors are conveyance capacity and extraneous inflow and infiltration into the sanitary sewer system. In addition, the consultant conducted hydraulic modeling and analysis to ensure that any of the projects recommended would not negatively impact downstream areas.

**Conveyance Capacity**

This analysis examined all sewer sections in the priority areas through the review of detailed CCTV inspection data for each sewer section to identify: sewers that would be improved by upsizing, collapses, reverse grade sewers, misaligned/deflected sewers, root intrusions, accumulated debris and any other issue that could restrict flow in the system during normal or wet weather conditions. The review looked for obvious
structural or maintenance issues that might be optimized to improve conveyance capacity.

Identification of these issues was confined to those downstream of repeatedly flooded areas.

Potential contributing issues were then separated into two classes of improvements:
- Those requiring the excavation and replacement of the entire sewer section,
- Those requiring the excavation and replacement of a section of the sewer length only.

These projects are outlined in Attachment #2 as the first priority projects in Phase 1 given the lead time and approvals required for open cut excavation.

**Extraneous Inflow and Infiltration**

As outlined in this Report, analysis also involved the examination of detailed CCTV inspection information to identify any sewer sections within the priority areas with active infiltration as a result of groundwater. The severity, low/medium/high, and the extent, number of active leaks, were determined and an appropriate method of sealing these pipes determined.

All areas of groundwater leaks were identified and recommended for sealing.

Areas of infiltration were then separated into three classes of improvements:
- Infiltration removed as a result of sewer replacements under the first set of projects noted above,
- Sections with multiple areas of infiltration which required relining of the entire section of sewer through trenchless rehabilitation,
- Those sections with a small number of areas of infiltration were identified for trenchless spot repairs.

Sections suitable for trenchless rehabilitation require shorter lead times, less coordination requirements and minimal disruptions to local roads and residents and are listed in Attachment #2.

The consultant found that although system improvements have been identified to optimize the wastewater system that none of the issues found were significant enough to have caused sanitary sewer surcharging in either dry weather or as a result of typical storm events and that carrying out these improvements would go over and above what would be considered normal maintenance or replacement practices.

**Procurement Process**

In order to meet the timelines of the Conveyance Capacity and Extraneous Inflow and Outflow Projects, a competitive process will be followed where three to five companies
will be invited to submit proposals. This is a modification to the Purchasing By-Law No. 65-10 where advertising to the open market for the value of this work is required. An invited list approach maintains a competitive process in an expeditious manner but still meets the purposes, goals and objectives of the Purchasing By-law.

**Project Sequencing and Scheduling**

All identified optimization projects will need to consider the 2015 capital work planned by both the City of Burlington and Halton Region. Accordingly, planned capital works for each organization will be coordinated to the extent possible for cost and time efficiency, and to minimize the impact to residents. Discussions with the City of Burlington have been initiated to ensure that projects are coordinated wherever possible.

Costs for the initial project listing are currently estimated at approximately $3.2 million and dependent on weather and could be completed within six to eight months with an accelerated design and procurement process.

**Voluntary Fully Funded Downspout Disconnection and Education Program**

Although the infrastructure improvement projects will help to mitigate the risk of sanitary surcharging in future rainfall events, significant contributions of stormwater inflow and infiltration from private properties will continue to negatively impact the system's performance.

Depending on the duration, intensity and overall severity of the storm event studies have shown that as few as five to ten homes with direct downspout connections to the sanitary sewer can exceed the capacity of a local sanitary sewer during heavy rainfall events. For perspective there are thousands of homes in the identified priority areas that may be connected to the sanitary and/or storm system directly. In discussions with the City of Burlington it has been generally agreed that disconnections of downspouts from the sanitary or storm sewer can mitigate both stormwater and sanitary sewer flooding with the following benefits.

   a. A substantial reduction in extraneous to the sanitary sewer leading to a corresponding decrease in the risk of basement flooding,

   b. A substantial decrease in peak flow to the local storm system leading to reduced likelihood of surface flooding and storm sewer surcharging.

The benefits would be both sustainable and responsive to the ongoing impacts of climate change and resulting severe and changing weather patterns.

Accordingly, staff recommends that the Region initiate a voluntary Downspout Disconnection Program within the City of Burlington, initially targeted within the priority areas and any other areas that would have an immediate and dramatic impact on reducing inflow into the sanitary sewer system.
The Program would be voluntary and at no charge to participating homeowners. All costs will be borne by Halton Region. Homeowners would be required to sign a waiver to allow the Region of Halton to carry out this work on private property.

It is noted that situations where lot or area drainage is not conducive to downspout disconnection must be identified and in certain situations downspout disconnection may not be desirable or feasible.

Based on previous experience in other municipalities, GM BluePlan Engineering Limited has recommended that this Program involve face to face consultation and education of property owners to achieve participation especially in areas where residents do not have a history of flooding. Identifying the environmental and community benefits of this Program along with full funding of these retrofits will be the primary drivers to achieving voluntary participation. This face to face contact will also provide an opportunity to educate homeowners about the causes of basement flooding and prevention.

Due to the potential for site specific drainage issues each lot will have to be assessed by qualified personnel for suitability for downspout disconnection in order to avoid unintended negative drainage impacts.

This Program is ideally provided by a third party program manager in conjunction with qualified contractor(s) given the extent and complexity of the program and necessary site by site evaluations.

Although the actual number of homes that could be, and agree to be, disconnected may be difficult to definitively predict a conservative estimate would be approximately a third of homes would voluntarily participate with suitable site drainage characteristics. For the priority areas this would amount to approximately 4,000 homes. Based on the experience of other municipalities including the City of Toronto, it is predicted that the cost per disconnection may be in the order of $300 to $400 per residences and result in an overall program cost including consultation, education and administration of approximately $1.65 million.

**Procurement Process**

In order to meet the timelines of the Voluntary Downspout Disconnection and Education Program, a competitive process will be followed where three to five companies will be invited to submit proposals. This is a modification to the Purchasing By-Law No. 65-10 where advertising to the open market for the value of this work is required. An invited list approach maintains a competitive process in an expeditious manner but still meets the purposes, goals and objectives of the Purchasing By-Law.
Overall Reduced Risk of Basement Flooding

The basement flooding mitigation initiatives as recommended initially within the priority areas will result in a reduced risk of basement flooding through improvements to the wastewater system and protection within homes that have installed a backwater prevention valve and disconnected their downspouts and weeping tiles. The risk of flooding will also be further reduced by addressing the sources of extraneous inflow to the sanitary sewer system through downspout disconnection.

All of these measures in combination will reduce the risk of future flooding and in part form a strategic response to the impact of climate change and severe weather events that can significantly impact Halton residents.

It should be understood that the risk of basement flooding cannot be fully eliminated.

Next steps and Additional Analysis as part of the Phase 2

Additional Field Inspection / Public Side Analysis

In order to quantify the potential beneficial impact of continuing downspout and weeping tile disconnection, GM BluePlan Engineering Limited must ascertain the prevalence of existing connections to the system. This will involve the selective inspection of homes, based on year of construction, to determine a relationship of between age of home and the sources of extraneous flow. This sample group will then be applied to a statistical model to generate an approximation of the number and impact of these connections.

This task will proceed when weather conditions permit.

Communications and Outreach Activities

A well planned communications strategy is paramount to the success of the Region Wide Basement Flooding Mitigation Study. Hellingman Communications, a specialist in the field of public engagement for municipal projects, was sub-contracted by GM BluePlan Engineering Limited and is part of the project communications team to ensure appropriate coordination of information to and from the general public is achieved. Several meetings between the project communications team and Halton’s Corporate Communications staff have been held to discuss options to optimize current information available as well as to ensure consistency with Halton Region’s Communications Framework. A communication plan has been developed, outlining the methods and material for basement flooding education as well as delivery of the message through Public Information Centres including existing documents such as:

- A Guide to Flooding Prevention and Recovery,
- Current post flood pamphlet and web site material,
- Region of Halton Basement Flooding Subsidy Program web site material and homeowner forms,
- Region of Halton Basement Flooding Frequently Asked Questions (FAQs).
Enhanced and expanded customer facing materials for basement flooding in general will be further developed, which may include:

- Development of a stakeholder database with an emphasis on repeatedly flooded areas and advocacy groups,
- Development of a draft e-newsletter,
- Development of 311 operator and Halton staff consistent messaging,
- Organize Public Information Centres to provide residents and other interested parties the opportunity to receive project construction information,
- Development of non-technical material, key messages, which outline the overall intent of the Region Wide Basement Flooding Study and possible outcomes,

Region Wide Assessment and Program Development

Throughout the next several months the consultant will continue to review and refine the hydraulic models and findings from additional analysis and field verification as well as capital works will commence in the priority areas.

These findings and methodology used to identify system improvements within the priority areas will be applied across the Region and prioritized actions will be developed for a Region Wide Program. The rationale and analysis tools developed under the priority area analysis will also be used to support the Region Wide program development.

This Program will consist of both public and private property works and will provide short, medium and long term strategies for the reduction of extraneous flow to the sanitary sewer. The consultant will also be developing a list of key performance indicators that will allow staff to determine and report on the beneficial impacts of their extraneous flow reduction measures in the long term.

The results of the consultant’s review of sanitary drainage sheds across Halton Region and recommendations for system optimization projects in addition to the results of the additional analysis as outlined above will be the subject of a further report to Council this summer.

FINANCIAL/PROGRAM IMPLICATIONS

The funding related to the grants and subsidies provided under the Basement Flood Prevention Program are provided in the approved 2015 Wastewater Operating Budget. The costs for the additional subsidy applications and the enhanced/expanded customer facing program as discussed above will be funded from the wastewater operating budget. If the demand for services is significant, the resulting budget variance will be addressed in the budget variance report.

In addition, the approved 2015 Capital Budget includes $5.0 million in capital project S3042A (capital upgrades to address basement flooding) to assist in the implementation of any potential recommendations resulting from the Region Wide Basement Flooding
Mitigation Study. Accordingly, the $3.2 million for the implementation of the optimization work, including the third party project management resources, as well as the $1.65 million for voluntary downspout disconnection program will be funded from project S3042A.

Respectfully submitted,

[Signature]

Kiyoshi Oka P. Eng.
Director, Water and Wastewater System Services

Jim Harnum
Commissioner, Public Works

Approved by

[Signature]

Jane MacCaskill
Chief Administrative Officer

If you have any questions on the content of this report, please contact:

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Attachments:  Attachment #1 – Map of Priority Areas
              Attachment #2 – Phase 1 Wastewater System Enhancement Projects