COMMITTEE OF THE WHOLE – JUNE 2, 2009

CITY-WIDE DRAINAGE & STORM WATER MANAGEMENT CRITERIA STUDY AUGUST 19, 2005 RAINSTORM UPDATE

Recommendations

The Commissioner of Engineering and Public Works, in consultation with the Manager of Emergency Planning and the Director of Legal Services recommends:

1. That the conclusions and recommendations of the City-Wide Drainage and Storm Water Management Criteria Study be used to enhance and inform all applicable City Emergency Plans and Procedures, and the Engineering Standards Design Criteria;

2. That public educational material outlining the importance of keeping catch basin grates free and clear of visible debris or other potential obstructions to drainage be included in the next regular publication of the Public Works Newsletter and Waste Collection Schedule, and on the City's website; and

3. That a copy of this report be forwarded to the Toronto and Region Conservation Authority for information purposes.

Economic Impact

There are no immediate economic impacts resulting from the adoption of this report. Capital Project No. 1599-0-06 for the City-Wide Drainage and Storm Water Management Criteria Study was approved as part of the 2006 Capital Budget, with combined funding from taxation and development charges. Capital Project No. DT-7026-09, Phase 2 of the City-Wide Drainage Study has been approved in conjunction with the 2009 Capital Budget deliberations. The Phase 2 Study will serve as a follow-up and include additional detailed analysis of key areas of interest throughout the City. Funding approval for subsequent studies and/or remedial works may be considered as part of future Capital Budget deliberations.

Communications Plan

This report recommends that the Public Works Newsletter, the Waste Collection Schedule and the City website be used to inform the public on the overall benefits of keeping catch basin grates free and clear of visible debris or other potential obstructions to drainage.

Purpose

The purpose of this report is to inform Council of the conclusions and recommendations of the City-Wide Drainage and Storm Water Management Criteria Study, and to serve as a follow-up to the August 19, 2005 Rainstorm report, being Item 8, Report No. 5, of the Committee of the Whole, which was adopted without amendment by Council at its meeting of February 13, 2006. Council, at the same meeting resolved as follows:

a. *"That Staff provide a report outlining options to address emergency situations using existing resources."*

b. *"That Staff continue to explore and subsequently report back to Council on funding alternatives and approaches to secure future sustainable funding for:*

    i. *Unexpected storm damage to roads and infrastructure as a result of flooding or other types of severe natural weather occurrences.*

ii. *An enhanced level of cleaning and maintenance of the City's storm water management pond facilities and catch basins."*

c. *"That consideration be given to the development of a Flood Emergency Response Plan in close cooperation with the City's Manager of Emergency Planning."*

This report will address items *a, b(ii)* and *c* above. It is anticipated that item *b(i)* will be addressed in a future report in consultation with the Finance Department.

Background – Analysis and Options

On August 19th, 2005, the City of Vaughan and surrounding municipalities from Stratford to Pickering experienced a rainstorm event that caused considerable flooding resulting in significant damage to both private and public property.

A review and subsequent analysis of the precipitation intensities and total rainfall data recorded by various rain gauge stations in the field and operational during this rainstorm, was completed for the City by the engineering consulting firm Clarifica Inc. This analysis concluded that approximately 85% of the City experienced 100-year return period storm conditions or worse (based on statistical analysis, the intensity of the rainfall event was equal to, or in excess of a rainfall event expected to occur at least once during a 100 year period).

The City's storm sewer system (minor system) and overland flow routes (major system) are designed to accommodate rainstorm flows from 5-year and 100-year return period storm events respectively. This is a commonly accepted design standard within the Province of Ontario. As a result of the high rainfall intensities over a short duration period, as experienced on August 19th, 2005, a significant amount of overland flow within City streets and overall system flooding would be expected and did occur at various locations throughout the City.

The majority of private property damage and flooding complaints received by the City as a result of the August 19th, 2005 rainstorm were in the older residential neighbourhoods of Woodbridge and Thornhill where existing storm drainage systems pre-date the City's current design criteria. Public Works Dispatch and the Fire Department received and responded to numerous flooding related calls. The majority of complaints were related to basement flooding due to sewer back-ups, and were deferred to the residents' home insurance company.

The typical types of flooding damage sustained to public property included:

- Erosion to watercourse banks causing collapse, fencing damage, terrafix block and gabion basket damage and rip rap washouts,
- Roadway pavement structure washouts,
- Broken storm sewer inlet grates, and
- Damaged manholes.

It is important to note, that as a result of the August 19th, 2005 rainstorm, similar types of flooding complaints and damages were received by many other neighbouring municipalities.

In order to substantiate and ultimately mitigate future instances of flooding and related concerns received by residents, Clarifica Inc. was retained by the City (in accordance with the City's procurement policy and in consultation with the Purchasing Services Department) to undertake a City-Wide Drainage and Storm Water Management Criteria Study. This Study was envisioned to be the first phase of a comprehensive investigation of existing drainage conditions throughout the

City that would ultimately lead to recommendations on site specific mitigation measures that will address potential future drainage and flooding issues.

City-Wide Drainage & Storm Water Management Criteria Study

The first phase of the City-Wide Drainage & Storm Water Management Criteria Study has now been completed. It includes a comprehensive mapping and evaluation of the City's existing drainage and storm water management systems. The information gathered and all associated analysis will allow the City to;

- Better understand the storm sewer system design parameters and level of flood protection within existing urbanized areas, in particular the older areas of the City,
- Assess impacts of future urbanization from infill development and urban boundary expansion,
- Make decisions regarding infrastructure needs and priorities for construction, and
- Assess operation and maintenance / remediation requirements.

Although more detailed analysis will be required during future phases of the Study, the ultimate goal is to provide and maintain acceptable storm drainage systems and flood protection throughout the City. The key tasks completed and deliverables provided during the first phase of the Study include:

1. Collection and analysis of all geographic information systems data related to existing storm sewers and appurtenances, surface topography, land use information and applicable hydraulic models,
2. Identification of additional data needs and gaps that will lead to an enhanced drainage evaluation for use in future flood remediation and studies,
3. Identification and mapping of major (overland flow) and minor system networks and drainage areas throughout the City including preliminary development of lumped hydrologic models,
4. A preliminary assessment of potential flood locations and severity of flooding along major river valleys, on table land areas and at road crossings,
5. A review of flooding sites identified during the August 19, 2005 rainstorm event to determine potential causes of flooding and develop recommendations for further evaluation and/or retrofit,
6. A review of the City's current storm drainage and storm water management design criteria by comparing with other municipalities,
7. A review of the Rainbow Creek Master Drainage Plan document, and
8. The preparation of recommendations for future analysis, studies and phases.

The main components of the City-Wide Drainage and Storm Water Management Criteria Study, and all associated conclusions and recommendations have been summarized below.

Drainage Base Mapping:

Preliminary flood maps have been prepared for valley and stream corridors. Affected properties have been classified with respect to extent of flooding predicted under various return period storm events including 10-year, 25-year, 50-year, 100-year and the regional storm event. A classification system has been developed and is referred to as the Flood Emergency Response Index (FERI). This index or ranking system, prioritizes sites using depth of flooding and land use information. Flood vulnerable structures (FVS) and flood vulnerable roads (FVR) have been identified for each of the return period storm events. For flood vulnerable structures, the FERI equations consider the type of building and land use; while for flood vulnerable roads the FERI equations consider individual roadway classification.

The index system and associated mapping will be used to inform and enhance emergency flood response planning, and will assist in prioritizing the City's storm drainage system inspection and maintenance program.

Future study phases will be required to expand the drainage system databases, address data gaps and work towards the creation of refined data sets that can be used in site specific more detailed evaluation.

In addition, coordination with existing Toronto and Region Conservation Authority floodplain mapping will be required to ensure consistency and accuracy of all resulting detailed analysis work.

Storm Drainage and Storm Water Management Criteria Review:

The City's current storm drainage and storm water management criteria has been reviewed and compared with other municipalities' criteria to determine where improvements could be made to help the City better manage storm water. The criteria comparison included the municipalities of Brampton, Mississauga, Richmond Hill and Bradford-West Gwillimbury.

Various aspects of the criteria were reviewed including, minor and major system design parameters, storm water management criteria, roadway and grading design parameters, Intensity Duration Frequency curves (IDF), inlet and outlet structures and grates, and operational and maintenance procedures.

The results of the review confirmed that the City's design standards are consistent with other municipalities and good engineering practice. In addition, improvements to the storm system design and analysis approach are suggested to better understand the ultimate functioning of these systems and to reflect current information on climate change. Standards pertaining to inlet grates should be revised to allow for over-sizing thereby decreasing the likelihood of clogging due to debris build-up.

With respect to updating system design parameters to reflect the impacts of climate change, the Toronto and Region Conservation Authority is currently working with Environment Canada and other partners on updating synthetic design storm data (Intensity Duration Frequency curves) for all Golden Horseshoe municipalities within Southern Ontario. The City has committed a $5,000 financial contribution to this project.

The above noted recommendations and initiatives will prove to be very useful and will be incorporated into the City's comprehensive Design Criteria Review Study to be undertaken in 2009.

Reported Flooding Locations Related to August 2005:

A preliminary assessment was conducted for a number of flood locations reported during the

August 2005 storm event. The focus of the assessment was to identify the extent of potential concerns and to recommend further detailed analysis that will lead to recommendations on remedial options.

Reported flood locations were assessed individually by reviewing flood reports, available design drawings and reports, and conducting site visits. Based on this information, a preliminary assessment of major and minor system conditions in the area was completed. The potential causes of flooding have been identified, these typically include:

- drainage systems that were constructed in relatively old areas of the City where sewer capacities are not in accordance with current standards;
- roadside ditches, culverts, catch basins and other sewer inlets that are susceptible to clogging;
- altered grades on private property surrounding homes;
- reverse slope driveways; and
- overland flow routes on private lands that have been altered or blocked.

It is important to note that this analysis is at a very high level and preliminary in nature. Additional detailed analysis will be required at these locations before more specific recommendations can be made on remedial options. Further analysis work of this nature is referred to as a dual system micro drainage analysis that can be used to evaluate the existing drainage infrastructure to determine the existing system design parameters and level of protection for each reported flooding location. Phase 2 funding for this analysis has been approved in the 2009 Capital Budget deliberations and the consultant procurement process will commence soon.

Rainbow Creek Watershed Master Plan Review:

The existing condition in the Rainbow Creek Watershed has been reviewed and compared against the December 1989 Master Plan conclusions and recommendations. This work focused on a comparison of the level of controls recommended in the 1989 Master Plan and the existing storm water management facilities in place.

The review concluded that significant urbanization has occurred in the watershed since 1989. The impacts of uncontrolled flow from older developments and the overall increase in imperviousness in the Rainbow Creek watershed requires a Master Plan update involving detailed site-specific field investigation to update watershed inventories, and to conduct updated hydrologic and hydraulic assessment. The update should analyze impacts on peak flow, flooding frequencies and erosion potential.

It is anticipated that this work will be completed as part of the Storm Drainage and Storm Water Management Master Plan Study in conjunction with the City's Growth Management Strategy.

<u>Emergency Planning Program</u>

The *Emergency Management and Civil Protection Act* became law on April 15, 2003. The *Act* identifies the mandatory requirements of an Emergency Planning Program for all municipalities across the province. Accordingly, on December 6, 2004 Council adopted the City's Emergency Planning Program and related Emergency Plan. This program includes:

- Regular training and exercises for staff and other persons with respect to the provision of necessary services and the procedures to be followed in emergency response and recovery activities;

- Public education on risks to public safety and on public emergency preparedness;

- The identification and assessment of the various hazards and risks to public safety that could give rise to an emergency; and

- The identification of facilities and infrastructure that are at risk of being affected by emergencies included those related to severe weather occurrences.

The Severe Storms Emergency Sub-Plan is a component of the City's overall Emergency Plan. The purpose of this sub-plan is to support the City's Emergency Plan by providing the procedures to be followed in the event of warning and impacts of a severe storm emergency affecting the City. Severe storms may include tornadoes, hurricanes, severe thunderstorms, hail, blizzards, high winds, heavy snow, snow squalls, and heavy rain causing flooding.

The Manager of Emergency Planning in collaboration with the Emergency Planning Working Group is responsible for annually reviewing and revising all City Emergency Plans (including the Severe Storms Sub-Plan) and Procedures as necessary. The Emergency Management Program Committee is responsible for issuing final approval of all revisions to the City's Emergency Plans and Procedures. In addition, the Emergency Management Team is required to participate in annual Emergency Plans and Procedures exercises and training.

The preliminary findings of the Phase 1 Drainage Study will prove to be useful information for a number of applicable City Emergency Plans and Procedures, which more specifically deal with the following emergency related tasks:

- implementation of protective measures;
- issuing evacuation orders or precautionary information to staff and the public;
- identifying and blocking dangerous public travel routes; and
- identifying alternate travel routes.

Accordingly, it is recommended that the conclusions and recommendations of the City-Wide Drainage and Storm Water Management Criteria Study be used to enhance and inform all applicable City Emergency Plans and Procedures.

Other Applicable Programs & Initiatives

Staff will be participating in a Municipal Storm Water Management and Urban Flooding Survey as organized by the Ministry of the Environment. This survey will inform the following current provincial government initiatives:

- The Ministry of the Environment is undertaking a review of municipal storm water management in light of climate change; and

- The Ministries of Natural Resources & Municipal Affairs and Housing are currently undertaking a review of urban flooding in Ontario, the degree to which it is a problem, and what strategies might be put in place to better manage this risk.

It is anticipated that the outcome of the above noted provincial initiatives will assist all municipalities in the future.

Toronto and Region Conservation Authority Flood Contingency Plan:

The responsibility for dealing with flood contingency planning in Ontario is shared by municipalities, conservation authorities and the Ministry of Natural Resources on behalf of the province. Accordingly, the Toronto and Region Conservation Authority in cooperation with all Greater Toronto Area conservation authorities have developed a Flood Forecasting and Warning Service for municipalities and residents within their collective watersheds and along the

shorelines of Lake Ontario and Georgian Bay. The purpose of this service is to reduce risk to life and damage to property by providing local municipalities, agencies and the public with notice, information and advice so that they can respond to potential flooding and flood related emergencies. This service is accompanied with a Flood Contingency Plan which is intended for all public officials and agency staff likely to play a role in flood warning, mitigation, or emergency relief.

Municipalities carry the primary responsibility and authority for response to flooding and flood emergencies such that the welfare of residents and property is protected. In addition, conservation authorities maintain the following responsibilities related to flooding and flood emergencies:

- Monitor watershed and weather conditions;
- Operate a Flood Forecasting System to provide warning of anticipated or actual flood conditions;
- Issue High Water Safety, Flood Advisory and Flood Warning bulletins;
- Operate dams and flood control structures to reduce the effects of flooding;
- Provide advice to municipalities in preventing or reducing the effects of flooding; and
- Maintain communications with municipalities and the Ministry of Natural Resources during a flood emergency.

The City's Emergency Operations Centre is designed to accommodate external experts as required. If necessary, representatives from the Toronto and Region Conservation Authority or the Ministry of Natural Resources can be requested to mobilize such that on-site expertise is available within the City's Emergency Operations Centre.

York Region Police Community Alert Program:

York Regional Police currently run a Community Alert Program. Residents can easily sign up on-line for this service. The program allows York Regional Police to notify residents and businesses by telephone and email about community safety matters in their area. The system is also used to alert citizens in the event of an emergency, including flooding or flood related emergencies.

Routine Operation & Maintenance of The Storm Drainage System

Based on a recent analysis of the available geographic information systems database, the City's current inventory of storm sewers and related infrastructure includes approximately:

- 900 kilometers of storm sewers;
- 1,800 kilometers of roadways (inclusive of Regional Roads);
- 12,300 storm sewer maintenance holes;
- 19,300 catch basins
- 33,000 storm sewer pipe segments (between maintenance holes);
- 72 assumed storm water management ponds, with approximately 50 additional new ponds to be constructed and/or assumed in the near future; and
- Numerous other drainage facilities such as culverts and engineered and natural channels.

In order to ensure the City's existing storm drainage system continues to operate as designed and as efficiently as possible, the Public Works Department's annual storm sewer and storm water management pond maintenance program includes the following routine activities:

- Catch basin cleaning;
- Street cleaning along the curb line and gutters of municipal roadways to remove excess debris and reduce the probability of clogging of catch basin grates;

- Inspection and cleaning of storm water management pond inlet and outlet structures;
- Replacement of broken catch basin grates with newer shaped units less susceptible to clogging; and
- Sewer inspection.

The current level of funding does not allow the City to clean all catch basins on an annual basis. In order to achieve this, allocation of additional funding is required in future Operating Budgets to provide for a higher level of catch basin maintenance.

Ensuring catch basin grates are kept free and clear of miscellaneous debris along City streets and within rear yards (in the case of rear yard catch basins), is very important in reducing the amount of overland flow and potential for excessive water ponding on streets and within rear yards during heavy rainstorm events. There are simple steps which can be taken by homeowners in support of this cause both within local roadways and rear yards.

Generally, rear yard catch basins are the responsibility of the individual land owner, accordingly the City does not secure easements for operation and maintenance of these storm drainage system features. The grading of residential lots surrounding a rear yard catch basin is also critical in ensuring the overall drainage system functions as designed. Rear yard drainage swales leading to catch basins are often inadvertently obstructed or altered by homeowners.

Accordingly, it is recommended that educational material on the importance of keeping catch basin grates free and clear of debris or other potential obstructions be included in the next regular publication of the Public Works Newsletter and Waste Collection Schedule, and on the City's website.

Relationship to Vaughan Vision 2020

In consideration of the strategic priorities related to Vaughan Vision 2020, the recommendations of this report will assist in:

- Enhancing and ensuring Community Safety, Health and Wellness;
- The pursuance of excellence in service delivery;
- Demonstrating leadership initiatives, promoting environmental and financial sustainability;
- Effective governance;
- Enhancing productivity, cost effectiveness and innovation;
- Maintaining assets and infrastructure; and
- Planning and managing growth, and economic vitality.

More specifically, Strategic Initiative No. 17 provides the following mandate:

"A review of the Engineering Department's design criteria and strategy for storm drainage and storm water management facilities to reflect climate changes, emerging legislation, and protection from significant flooding."

The conclusions and recommendations of the City-Wide Drainage and Storm Water Management Criteria Study, in association with other related on-going initiatives and Capital Studies as described within this report, will ensure the successful completion of this initiative.

This report is therefore consistent with the priorities previously set by Council.

Regional Implications

There are no immediate Regional implications resulting from the adoption of this report.

Conclusion

City-wide storm drainage system mapping and preliminary flooding analysis data has now been compiled with the completion of the first phase of the City-Wide Drainage and Storm Water Management Criteria Study. This study will inform and enhance the City's Emergency Plans and Procedures, the Engineering Standards Design Criteria and other on-going related Capital Studies.

Future study phases will be required to expand the drainage system databases, address data gaps and work towards the creation of refined data sets that can be used in site specific and more detailed evaluation. Funding for the second phase of the City-Wide Drainage Study has been approved in the 2009 Capital Budget. This Study will expand upon the Phase 1 work and include additional detailed analysis of key interest areas throughout the City.

Attachments

N/A

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