

FURTHER TO AUTHORITY MEETING #6/13
To Be Held July 26, 2013

FURTHER TO:

AUTH4. DELEGATIONS

AUTH4.1 A delegation by Ms. Sabina Vaivada of 10 Northover Street, Toronto, speaking in regard to July 8th storm damage to the rear of homes on Northover Street.

AUTH7. SECTION I - ITEMS FOR AUTHORITY ACTION

LISTED AS REPORT TO FOLLOW, ITEM HAS BEEN WITHDRAWN

AUTH7.6 ALBION HILLS FIELD CENTRE PHASE 5 RETROFIT PROJECT
Tender PMO13-06

**AUTH7.7 FLOOD MANAGEMENT FOR THE JULY 8TH SEVERE WEATHER
EVENT**

Preparedness, Response, Recovery and Mitigation Actions 55

**AUTH7.8 EROSION MANAGEMENT FOR THE JULY 8TH SEVERE WEATHER
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Item AUTH7.7

TO: Chair and Members of the Authority
Meeting #6/13, July 26, 2013

FROM: Deborah Martin-Downs, Director, Ecology

RE: **FLOOD MANAGEMENT FOR THE JULY 8TH SEVERE WEATHER EVENT**
Prevention and Mitigation, Preparedness, Response and Recovery Actions

KEY ISSUE

A review of the July 8th Severe Weather Event in the Greater Toronto Area, TRCA's response during and after the event, and how major cities prepare for floods across Canada and abroad (including Calgary, Alberta).

RECOMMENDATION

THAT a formal comprehensive assessment of the July 8th, 2013 event be undertaken by Toronto and Region Conservation Authority (TRCA) staff;

THAT a formal public outreach project be initiated to improve access to information relating to flood risk;

THAT opportunities to accelerate flood mitigation projects, as per the TRCA Flood Protection Strategy (2012), and upgrades to flood control infrastructure, as per the Flood Control Infrastructure State of Repair (2013) report be investigated;

THAT local and regional municipalities be encouraged to develop a fund dedicated to the management of storm runoff to be able to respond to and mitigate flood risks;

AND FURTHER THAT the local and regional municipalities be so advised by the CEO's Office.

BACKGROUND

Could Toronto be the next Calgary? London? or Manhattan?

In order to understand the flood risk in the Greater Toronto Area (GTA), it is necessary to understand four important factors that establish risk:

- 1. Climate** - how prone is the area to severe weather; what type of weather can we expect?
- 2. Geology** - how is our landscape shaped; how do our watersheds store and release water?
- 3. Policy** - what is our tolerance for living near water? who regulates development?
- 4. Warnings** - do we have effective methods to manage the risks that exist?

By definition, risk is the "exposure to the chance of injury or loss". Over the past few years we have seen an increasing number of severe weather events and their devastating impact on urban areas. Most provinces within Canada have experienced significant flooding and major economic losses within the past decade; the most recent being in the cities of Calgary, Winnipeg and Halifax. In British Columbia \$20 million was paid in compensation after five homes were destroyed by a dam breach in 2010. That same year, in Saskatchewan, a washout of a section of the Trans-Canada Highway occurred after a record flood. There are numerous other examples in Canada. Worldwide the story is no better, with hurricane activity originating in the Caribbean Sea and the Gulf of Mexico, decimating the eastern seaboard of the United States (New York and New Jersey after Tropical Storm Sandy, October 2012) and the southern states (New Orleans, Louisiana in 2005), respectively. Weather is a natural phenomenon with inherent risks, however these risks become multiplied exponentially in urban areas.

The communities within the GTA are fortunate, in some respects, to be well positioned within each of the four factors of risk listed above.

Climate, very simply put, describes the prevailing weather conditions of a region. On a macro scale, climate is driven by the rotation and angle of the earth, along with energy inputs from the sun and outputs of energy from the surface. These factors create air masses - with different geographic locations subjected to different air mass types. They are either considered to be dry (continental) or moist (maritime), and warm (tropical) or cold (polar) or extremely cold (arctic). Five basic types of air masses determine the Canadian weather. They can bring anything from scorching heat to bone-chilling cold depending on the type of air mass. The most violent weather usually occurs when the coldest airmass meets the warmest along a "Front". Weather at the surface of the earth is highly dependent on the location of the front.

In the GTA we have historically received weather (that could lead to flooding) in four ways:

1. during the spring melting of the winter snowpack;
2. rain falling on snow events during the winter;
3. severe thunderstorm activity in the summer bringing short intense bursts of rain in localized areas; or
4. large volumes of precipitation brought by hurricane activity over a longer period of time than thunderstorms.

We do not have the same level of climate risk as some other cities. For example, we are not as directly exposed to hurricanes as Halifax or New York.

Geology, influences the ability of watersheds to convey precipitation through the river systems to the lake after a rain or snow event. Geographical features, such as the Rocky Mountains in the west, can have significant impacts on weather at a local scale. In the GTA, Lake Ontario protects our region from receiving the majority of severe weather coming up from the south, and the Niagara Escarpment tends to push some systems north of the area (e.g., snow squalls tend to hit Buffalo but skirt around the GTA before falling in Barrie). Geology also dictates the soil type and the ability of the ground to absorb and store water. This can significantly impact the timing of flood waters. In addition, the size of the watershed can play a significant role in determining flood risks. Calgary sits in the lower portion of a 25,000 sq. km watershed with mountains storing snow at its upper end and wide flat river valleys at the lower end. By comparison, TRCA's largest watershed, the Humber River watershed, is less than 1,000 sq. km and has well defined, steep valleys that convey water relatively quickly to the lake. That is why we do not see flood waters sit on the land for days on end waiting to drain, as we see in other cities.

Other factors, such as the amount of wetlands, forest cover and slope of the land, contribute to the behaviour of stormwater runoff across a watershed. Anthropogenic factors, such as clearing the forest cover, paving surfaces or building stormwater management ponds also have an effect on the behaviour and timing of water across the watershed.

Wide, flat landscapes will allow flood water to spill out much further than narrow, deep valley systems. In Australia, some floodplains are up to 10 km wide and as a result of agriculture and irrigation practices, flooding in Australia can be extremely widespread and cause significant disruption to large amounts of the population. In the GTA the valleys are predominantly narrow and steep, and can contain the river's flood waters in a relatively localized area.

The amount of water that needs to be conveyed through the watershed is dependent on how much precipitation falls during an event, how much of that rain infiltrates into the ground (to become groundwater), how much is evaporated, how much is stored in the watershed (in depressions or trapped by leaves), and how much becomes runoff. It is the runoff (or stormwater) that can lead to flooding.

We do not have the same level of geological risk as some other cities. For example, we are not subjected to the massive amount of snow melt that Calgary is subjected to from the Rockies. We have smaller, more narrow watersheds than areas that experience long drawn out flooding events allowing for us to enter recovery mode much more quickly than others.

Policy in Ontario is very different than policies in other areas of Canada, and indeed, throughout the world. In London, England, for example, development in the floodplain is acceptable and there is a heavy reliance on "flood protection schemes" or flood controls that need to be erected before a flood to provide temporary protection. In the United States, the Federal Emergency Management Agency (FEMA) regulates development within the floodplain and landowners are allowed to develop within certain flood prone areas if they can provide proof of flood insurance. Across the Canadian provinces development rules vary, however it is common for development within the 100 year floodplain to be allowed.

Ontario's approach in the aftermath of Hurricane Hazel, was to restrict development within the Regulatory floodplain, which is delineated by applying the precipitation from the Hazel event over each watershed and calculating where the flood waters would have reached had the storm been centered over that particular watershed. This is often challenged as an overly conservative approach to managing development, however it has served extremely well in limiting the loss of life and property due to flood risk as seen by our most recent example of the July 8th storm.

The draft Living City Policies uphold the philosophy of limiting the exposure to natural hazards to reduce the risk to life and property. In this way, through provincial policy and regulations (O. Reg. 166/06) TRCA has functionally and effectively decreased risks compared to other regions without such policies.

Warnings serve to reduce flood risk for people that currently live or work within a floodplain (due to development that pre-dates existing regulations). The flood forecasting and warning program at TRCA is a key component of the Flood Management Service (FMS), and it follows the guidelines laid out by the Province of Ontario to operate an effective program. Most major cities operate effective programs also, and the state of the science is constantly improving to develop effective forecasting tools and communications systems.

Unfortunately, the ability to warn about flood risks is limited to the ability to predict the weather. In areas where watersheds respond slowly there is more time to assess flood risks (e.g., on the Mississippi River a flood may occur days after rainfall). However, in the GTA the quick response of watersheds does not afford us a lot of lead time for warning. This is more pronounced during the summer when thunderstorms pop up unexpectedly and are scattered throughout the jurisdiction. This is less of an issue when hurricane activity in the fall effects the TRCA's jurisdiction as it has a longer lead time and is typically more widespread.

The Alberta Provincial Flood Mitigation Report, which was released after Calgary experienced major flooding in 2005, highlighted 18 recommendations to decrease risks due to flooding. These recommendations and how TRCA's program has addressed the same issues in our work are provided in detail in Attachment 1. As mentioned, most major cities operate excellent flood forecasting and warning systems and there are many lessons that TRCA has learned by studying various flood management programs. Staff continue to interact with our counterparts in urban centres to glean insights from their most recent experiences and to share TRCA's experiences and lessons learned with them.

Calgary Floods in 2005 and 2013

The climate and geology in Alberta are significantly different than what we experience at home in Ontario. The most recent flooding in Calgary on June 21, 2013 was a result of a number of factors that unfortunately came together at the same time and produced the "perfect" conditions for massive flooding. The Bow River begins in the Rocky Mountains and travels south through the City of Canmore and joins up with the smaller Elbow River near the City of Calgary. From there the Bow continues south and joins the South Saskatchewan River near Medicine Hat before flowing into the Province of Saskatchewan. The watershed is massive, covering 25,000 sq. km with relatively wide shallow floodplains and flat slopes through Canmore and Calgary.

Rainfall began falling off and on, 12 days before the flood. During the heaviest rainfall on June 20th, up to 200 mm of rain was recorded over 16 hours (exceeding the monthly average rainfall amounts). The region also experienced a later than normal snow melt meaning that the ground was still saturated in many areas (not as much rainfall could infiltrate into the ground and therefore rain became stormwater runoff). Add to that the fact that snow was still present in the mountains producing a "rain on snow" event in the upper portions of the watershed causing water to run off of the mountains and adding to the stormwater in the low lying areas. The water levels in the rivers responded by rising quite dramatically and flow rates on the Bow River spiked to eight times its normal flow rate. This was three times the flow during the 2005 event.

During the event 26 communities were evacuated and more than 110,000 Calgarians were affected. The City received over 100,000 calls to 311 and more than 1.8 million web visits. By June 22nd the rivers in Calgary began to recede and some evacuated residents started to return home. The Alberta government has announced a \$1 billion fund to rebuild from the floods, which according to Premier Alison Redford, have changed the Province forever. The storms of 2005 and 2013 are not the only major floods of record (several major floods occurred in the late 1800's/early 1900's). Meteorologists with the Weather Network predict that there is an almost 30% chance that this type of storm will occur again by 2050 based on historical data.

The July 8th, 2013 Storm in the GTA

On Monday, July 8th, 2013, a weather system developed in the GTA producing a series of severe thunderstorms that released significant amounts of precipitation in a very short time period. This section of the report to the Authority will provide a high level analysis of the event from a weather perspective and the Flood Management Service's response during the event. A separate report to the Authority will address damages related to the storm. A separate comprehensive technical report on the storm event will be produced in the near future which will be made available to the public.

It has been widely reported in the media that this storm was "bigger than Hazel" and that it was the most rainfall that the City of Toronto has ever seen. It is easy to understand how this mis-conception came about. In fact, the total amount of rainfall recorded on July 8th by Water Survey Canada at its Pearson International Airport gauge did exceed the daily total amount of rainfall recorded at the same gauge during the Hurricane Hazel event in 1954. However, that only tells one part of the story. Hurricane Hazel as a whole produced much more rain (285 mm) across TRCAs jurisdiction than the July 8th storm and the period of rain was much longer (48 hours). By comparison, the July 8th storm lasted only a few hours and dropped between 50 to 100 mm of rain as recorded at TRCA's precipitation gauges. The data released by Water Survey Canada (of 126 mm of rainfall in one hour at Pearson) correlates with TRCA gauge readings in the same vicinity (of 110 mm of rainfall during the same time period), however this amount and intensity of rainfall was very localized and did not produce "Hazel-type" flood damages. Simply put, the volume of water during Hazel and the extent of area impacted during Hazel far exceeded that of the July 8th storm.

Having said that, the July 8th storm was an extreme weather event, causing significant damages. The storm developed just west of TRCA's jurisdiction and caused significant damage in the Credit Valley Conservation Authority's jurisdiction (particularly in Mississauga). It continued across the top of the City of Toronto, across the Etobicoke, Mimico and Humber watersheds (dropping a significant amount of precipitation on the Black Creek subwatershed) and tracked southward down the Don River watershed. Areas to the north and east of TRCA's jurisdiction recorded nominal amounts of precipitation (Lake Simcoe Region Conservation Authority and Central Lake Ontario Conservation Authority recorded less than 20 mm of precipitation each).

The July 8th event can be characterized as a storm that primarily produced urban flooding issues by overwhelming stormwater sewer systems and flooding low lying areas on roadways and in underpasses. Basement flooding was widely reported across the City, particularly in the Black Creek watershed. Rivers did not escape either. Extremely high water levels were recorded in all of the major watercourses and riverine flooding occurred on several watercourses, including the Don River which overtopped its banks, and utilized its floodplain to convey stormwater to Lake Ontario. In doing so, portions of the Don Valley Parkway and CN Rail line were flooded. The shear force of the water travelling down the valleys caused erosion to river banks and valley walls in areas where the centre of the storm travelled.

On the afternoon of July 8th, Environment Canada issued Special Weather Statements between 1-3pm indicating the potential for thunderstorm activity in the GTA. These messages were upgraded to a Severe Thunderstorm Warning at 5:42pm. Thunderstorms are very common during the summer months of July and August and they are very difficult to predict accurately. Climate dictates that thunderstorms occur in the late afternoon and early evening (when the earth's surface has warmed enough from the summer sun to cause hot air to rise, creating instability in the atmosphere). However, during the morning and early afternoon hours there is limited ability to predict the location and severity of the thunderstorms, and they tend to "pop up" quickly on radar screens, seemingly out of nowhere. The July 8th storm was typical in this fashion as the early predictions did not show significant cause for concern in the GTA, although there was a potential for thunderstorms. By way of context, in the summer of 2011, Environment Canada issued 18 Severe Thunderstorm Warnings for the City of Toronto but we did not have any riverine flooding in the TRCA jurisdiction.

FMS Response During the Event

In terms of the response actions for the July 8th event, TRCA issued a series of flood messages, including a Watershed Conditions Statement (on July 7th), a Flood Watch (July 8th at 5:00pm) and a Flood Warning (July 8th at 7:20pm). Other operations included:

- monitoring weather and communicating with Environment Canada;
- communication before and during the event with our municipal partners (Toronto Transportation, Toronto Office of Emergency Management, Toronto Police etc);
- monitoring and operations of major flood control structures (G. Ross Lord Dam, Claireville Dam);
- conducting media interviews;
- monitoring social media; and
- managing staff resources.

Post event activities included:

- conducting media interviews with all major media outlets;
- collecting hydrometrics data and inspecting gauging stations;
- inspecting flood control facilities and continued operations of two major dams;
- data management and event analysis;
- conducting high water level assessments to document the storm and to calibrate hydrology models;
- attending public meetings;
- event documentation; and
- conducting an analysis of FMS systems and processes.

The Flood Infrastructure State of Repair Report (2013) highlighted several key areas where deficiencies in TRCA's infrastructure need to be addressed, both in the short term and long term. The need to undertake improvements to G. Ross Lord Dam (for the generator and gates) became even more evident during this event. Plans are already underway to carry out these two projects however their completion is critical to the future operations of the dam and these projects must be completed as soon as possible. Other control structures, such as the Black Creek Flood Control channel, that were slated for improvements next year, have now become critical and will require more immediate attention.

TRCA's Flood Management Service Program Overview

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. As with all emergencies, municipalities have the primary responsibility for the welfare of residents, and should incorporate flood emergency response into municipal emergency planning. The Ministry of Natural Resources and conservation authorities are primarily responsible for operating a forecasting and warning system, and the Province may coordinate a response in support of municipal action.

The conservation authorities of the Greater Toronto Area (GTA) have developed a Flood Forecasting and Warning Service for the municipalities and residents within their collective watersheds and 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 agencies and the public with notice, information and advice so that they can respond to potential flooding and flood emergencies. Roles and responsibilities during a flood event are outlined in a Flood Contingency Plan, which is intended for all public officials and agency staff likely to play a role in the: 1) prevention and mitigation, 2) preparedness, 3) response and 4) recovery pertaining to flood events. The four categories form the principles of risk management which are widely adopted by Emergency Management Professionals within the Province, including Emergency Management Ontario (provincial), Offices of Emergency Management and First Responders (municipal). TRCAs Flood Management Service is structured to follow the Emergency Management Continuum outlined in Attachment 2.

The following briefly lists how each of the principles are addressed within TRCA's Flood Management Service:

Prevention & Mitigation

1. Understanding our risks: climate, geology, watershed response and potential for climate change.
2. Documenting our risks: floodplain mapping, flood vulnerable area database.
3. Limiting exposure to risk: Planning and Development policies.
4. Preparedness: establishing a flood forecasting and warning program.
5. Reducing risk: creating a flood protection strategy for vulnerable areas and implementing remedial works projects.
6. Reducing risk: constructing and maintaining flood control infrastructure.

Preparedness (there are six pillars of preparedness in emergency management)

1. Emergency Plans
2. Emergency Operations Centre
3. Training
4. Exercises
5. Emergency Information/Communication Plans
6. Public Education

Response (during an event)

1. Flood forecasting (includes issuing flood messages).
2. Flood Infrastructure and Hydrometrics operations (operating flood control infrastructure, e.g., G. Ross Lord Dam).
3. Communications: providing information and advice to response agencies.
4. Data management: preliminary storm analysis, flood event documentation.
5. River watch: providing staff in the field to collect information pertaining to flooding.
6. Human resources: manage staff resources, ensure staff safety.

Recovery (after the event)

1. Risk management: event debrief and lessons learned.
2. Data management: final storm analysis, continue flood event documentation, model calibration.
3. Hydrometrics - gauge maintenance, gauge network upgrades.
4. Flood control infrastructure - infrastructure inspections, documentation, repairs and upgrades.

The Flood Management Service Self-Assessment Based on the Provincial Flood Mitigation Report for Alberta (2006)

Alberta experienced a catastrophic flood in June 2005, resulting in the deaths of three people and over \$165 million dollars in disaster service payments. In an effort to identify potential mitigative measures to flooding in Alberta, a ministerial task force was struck in 2005 and a flood mitigation committee was created. A Provincial Flood Mitigation Strategy (2006) was developed with 18 recommendations, organized into three key target areas. The resources required to implement all of the recommendations were estimated at \$306 million (one time investment to be stated over a period of years) and a \$1.2 million increase in government operational budgets.

Target #1: Making resources available to make informed decisions about flood risks.

TRCA's level of execution: we have addressed 66% of the target goals in this area.

Target #2: Providing support to municipalities to encourage appropriate developments in flood prone areas.

TRCA's level of execution: we have addressed 80% of the target goals in this area.

Target #3: Provide technical expertise to municipalities for river and lake related flooding.

TRCA's level of execution: we have addressed 100% of the target goals in this area.

Attachment 1 lists each of the report recommendations within the three target areas and provides details on how TRCA's Flood Management Services addresses each recommendation. Overall, the guidelines for flood forecasting and warning within Ontario (which were created by the GTA Flood Group and later adopted by the Ministry of Natural Resources) have provided good direction for program development. There are some areas where we have addressed the recommendations but we could be doing more. In particular, under Target #1, TRCA has one of the best floodplain mapping programs in the Province, but we must continue to maintain the quality of the data by committing to a rigid schedule for updates based on new Official Plans for each municipality. Plans for future flood mitigation projects will not prove to be useful without quality floodline mapping as a foundation. Under the same target area, one of the recommendations is to make historic flood information available to the public in an accessible manner (i.e., via websites), including flood risk reports and flood photography. While TRCA has begun work toward this goal through the development of a flood event documentation database and improved web presence there is still much work to do to achieve success in this area.

CONCLUSIONS AND RECOMMENDATIONS

Recent flooding events within Canada and in other countries have reinforced the need to maintain the highest standard of flood management within TRCA's jurisdiction. Although we have many factors in our favour (climate, geology, policy and warnings) there is still quite a high level of risk due to flooding in the TRCA jurisdiction due to development that occurred before TRCA had effective regulations for floodplain management in place. It is important to note that TRCA's responsibility for flood management is limited to riverine flooding and does not include "urban flooding" which is characterized by sewer backups, slow drainage in low lying areas and roads, and basement flooding. However, TRCA can play an important role in assisting our municipal partners in addressing urban flooding issues.

Although the FMS program is well positioned to manage flood risks and emergency management during flood events, there are several areas of improvement that can be realized. These include the implementation of the Flood Protection Strategy (2012) at an accelerated pace, and the implementation of Flood Control Infrastructure maintenance and upgrades as per the State of Repair Report (2013). When comparing TRCA's FMS program to the recommendations from the Alberta Provincial Flood Mitigation Report, it is evident that support of TRCA's floodline mapping program should continue and plans to enable FMS to provide flood risk information to the public using web-based tools should be accelerated.

Municipalities seek to balance the needs for water and sewer infrastructure with that of storm infrastructure. In the face of risks to continued service, storm systems frequently lack the funding and resourcing required to tackle the issues of inadequately sized infrastructure, combined sewers, erosion and retrofits to manage stormwater. Some municipalities are implementing stormwater rates to provide a source of dedicated funding to the management of rain water and we encourage more of the municipalities to follow suit to ensure that funds are available to respond to runoff events and mitigate the potential effects.

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Date: June 24, 2013

Attachments: 1

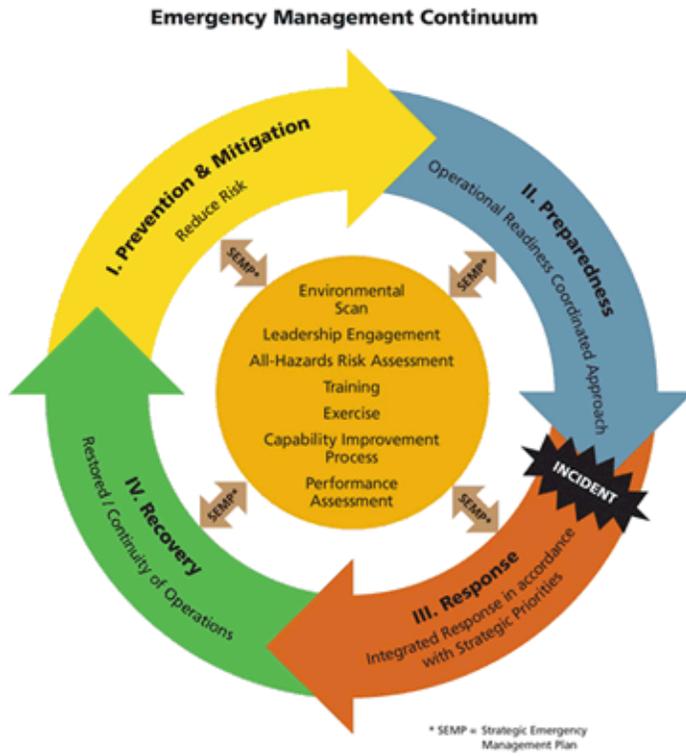
Attachment 1

Alberta Provincial Flood Mitigation Report Consultation and Recommendations November 10, 2006 – comparison to TRCA’s jurisdiction

Report Recommendations		TRCA’s Jurisdiction	
Target #1: Alberta has the resources available to make informed decisions about flood risks.			
1	Coordinate the completion of flood risk maps for the identified urban flood risk areas in the province.		<ul style="list-style-type: none"> • Up to date floodplain mapping for entire jurisdiction • SPA areas clearly mapped • FVA’s and FVR’s mapped for jurisdiction
2	Develop a map maintenance program to ensure that the flood risk maps are updated when appropriate.		<ul style="list-style-type: none"> • Ongoing updates • Future plan for updates in advance, work with municipalities to coordinate updates with planning initiatives
3	Identify priority rural flood risk areas that require flood risk mapping and develop a program to prepare the maps.		<ul style="list-style-type: none"> • Floodplain mapping exists for all of TRCA’s jurisdiction, with the exception of headwater areas
4	Co-ordinate the determination of the 1:100 year still water lake elevation for all gauged lakes in the province.		<ul style="list-style-type: none"> • TRCA monitors watersheds to assess risks: reservoir levels associated with all dams, as well as identified areas where critical WL should be monitored, real-time gauging for all critical locations
5	Continue to collect high-water elevation, aerial photography and other appropriate data whenever a significant flood occurs and share this information with local authorities. Alberta Environment should continue to explore and evaluate other methods of collecting flood data such as satellite imagery.		<ul style="list-style-type: none"> • Photographs and data collected after each event • Flood event documentation database currently in development
6	Make historic flood information available to the public on its web site. Suitable information would include historic high-water elevations, flood risk reports, and flood photography.		<ul style="list-style-type: none"> • Historic data available by request, information and data available on TRCA website and others (Hurricane Hazel, municipalities, media)
Target #2: Alberta municipalities have the support they need through additional education, guidelines, regulations and programs to encourage appropriate future developments in flood prone areas.			
7	The Minister of Environment designate a flood risk area after the responsible local authority has had an opportunity to review the maps and provide comments on the technical elements. The recommended time period for designation is within six months of receiving the maps.		<ul style="list-style-type: none"> • Development is restricted/regulated in the floodplain • SPA’s are designated in Ontario • Updates to SPA boundaries a collaboration between municipalities, TRCA, province (MNR, MMAH)
8	A notification system be established that will inform any potential buyer that the property is located within a designated flood risk area.		<ul style="list-style-type: none"> • This is lacking in Ontario, this information is not on title • Information should be more accessible to the public • TRCA has a dedicated staff person to respond to property and legal inquires; and we continue to work on public web-based tool for identification of flood risk areas based on addresses
9	Alberta Municipal Affairs, in consultation with Alberta Environment prepare an information bulletin on the subject of planning for flood-prone lands to be circulated to municipalities.		<ul style="list-style-type: none"> • TRCA’s P&D and FMS staff are dedicated to ensuring our municipal partners have access to our floodplain, FVA, regulation mapping and keeping the lines of communication open whenever there is new data available

Report Recommendations		TRCA's Jurisdiction
10	The flood mitigation strategy include a cessation of the sale of crown lands in known flood risk areas.	 <ul style="list-style-type: none"> Province & TRCA do not sell land within the floodplain
11	The "Flood Risk Management Guidelines for Location of New Facilities Funded By Alberta Infrastructure" be followed when province constructs or contributes funding towards new facilities.	 <ul style="list-style-type: none"> Limited ability to restrict this type of development through the EA process, in many cases municipal/public infrastructure is permitted within our regulated areas
12	The provincial government develop programs to cost-share flood mitigation measures to protect existing development in urban and rural areas. The costs should be shared among the federal, provincial, and local governments. In the case of individuals, they could cost-share directly with the federal government.	 <ul style="list-style-type: none"> TRCA recently completed prioritization of all FVA in our jurisdiction as part of our Flood Protection and Remedial Capital Works Strategy Implementation of the strategy will require significant funding and collaboration with our municipal partners
13	Disaster Recovery Regulations be amended to prohibit disaster recovery payments for new inappropriate development in flood risk areas.	 <ul style="list-style-type: none"> New development in the floodplain in Ontario is very rare Ontario Disaster Relief Assistance Program (ODRAP) exists, with very specific qualification requirements
14	The provincial government continue to pursue amendments to the federal disaster financial assistance arrangements to allow federal funding for disaster recovery compensation for damages to appropriate development in flood risk areas.	 <ul style="list-style-type: none"> Broader discussion...though maybe in SPA's? No commitment from Federal Government for compensation funds at this time
15	The provincial flood mitigation strategy not include provincially operated or funded flood insurance.	 <ul style="list-style-type: none"> TRCA agrees with this approach, no FEMA model.
16	The provincial government continue to support local authorities to educate their citizens on the flood risks to their communities.	 <ul style="list-style-type: none"> TRCA's FMS continues to develop our public outreach program i.e., community events, social media, web presence, etc. Future...educational videos on youtube etc.
Target #3: Alberta government continues to provide technical expertise to municipalities for river related flooding.		
17	Expand its forecasting network to provide an appropriate level of warning for all local authorities exposed to a flood risk.	 <ul style="list-style-type: none"> Collaboration with municipal partners continues to increase. Influx of support to the Flood Management Service from Peel, York and Toronto in recent years. TRCA continues to provide a state of the art FFWP within our jurisdiction. New technologies are helping to better predict when/where flooding is occurring. Reaching TRCA's target audience is constantly evolving i.e., workshops, public events, email, text messages, social media
18	Explore the potential for extending the provincial flood risk mapping program to an emergency mapping program	 <ul style="list-style-type: none"> TRCA has completed flood risk mapping, and has provided this to municipal partners. FMS has ongoing involvement in municipal emergency exercises and collaboration on emergency communication systems.

Attachment 2



Item AUTH7.8

TO: Chair and Members of the Authority
Meeting #6/13, July 26, 2013

FROM: Nick Saccone, Director, Restoration Services

RE: **EROSION MANAGEMENT FOR THE JULY 8TH SEVERE WEATHER EVENT**

KEY ISSUE

Staff report on the management of erosion and slope instability hazards resulting from the severe weather event on July 8th, 2013.

RECOMMENDATION

WHEREAS the significant rainfall event of July 8, 2013 caused very high flows and resulting erosion damages along a number of river systems, creating new sites where existing development and infrastructure is endangered, particularly within the City of Toronto;

AND WHEREAS the costs of completing these repairs are far in excess of existing Toronto and Region Conservation Authority (TRCA) funding allocations;

AND WHEREAS the City of Toronto will be pursuing financial assistance from the provincial and federal governments to address storm related damages;

AND WHEREAS TRCA had previously requested additional funding support from the City of Toronto to address erosion and flood control concerns prior to the July 8 event;

THEREFORE LET IT BE RESOLVED THAT TRCA staff be authorized to undertake geotechnical investigations and undertake interim erosion control and/or slope stabilization works at critical and high priority sites through the reallocation of \$200,000.00 as may be required through the reallocation of funds from the Erosion Infrastructure Major Maintenance, Valley and Shoreline Monitoring and Minor Maintenance and other erosion and hazard related funding that may be available from the City of Toronto;

THAT staff be directed to report to the City Manager at the City of Toronto on the July 8, 2013 severe weather event related to physical and financial impacts of river and valley erosion, and to request the City of Toronto for additional funds in 2013-2014 to undertake remedial design and works for critical and high priority sites;

THAT staff be directed to request long-term enhanced funding commencing in 2014 to implement stabilization for critical and high priority sites and initiate valley segment-based planning in cooperation with City of Toronto staff to proactively identify and address erosion and slope instability hazards and that the preliminary estimates submitted to Toronto in May 2013 for 2014-2023 be amended as required;

THAT staff be authorized to develop a formal communication strategy with City of Toronto staff and local Councillors to disseminate consistent messaging to affected constituents;

THAT staff include in the 2014-2023 capital budget estimates identification of additional funding requirements and that a follow up report on the status of enhanced funding requests and progress of work be provided to the Authority in approximately six months;

AND FURTHER THAT a copy of this report be provided to the City of Toronto, including Finance Department, City Manager's Office and Toronto Water.

BACKGROUND

In the early evening hours of July 8th, 2013 a severe thunderstorm activity rolled through the Toronto area, bringing large amounts of rainfall over the span of a few hours to the west end and downtown areas of the city. This intense (downpour of) precipitation not only resulted in extensive flooding of major roadways and transit infrastructure, but also caused significant damage to the river and valley systems, the park amenities found within them, the water infrastructure buried beneath them and many of the older neighbourhoods that border them.

Beginning on the morning of July 9th, 2013 TRCA staff began receiving emails and telephone calls from private landowners, park users and City of Toronto staff about various types of damage sustained during the storm event. These calls ranged from reports of minor damage to asphalt park paths, to debris blockages, to “landslides” and backyards “collapsing”. Calls were vetted through senior Restoration Services staff and prioritized for inspection based on information at hand, then added to a storm damage inventory list in TRCA's existing erosion management database before inspectors were dispatched to complete preliminary site assessments. Staff were also preparing to inspect known areas of erosion currently ranking high in the current list of known sites.

TRCA has a long-standing Erosion Management Program funded by its municipal partners to monitor erosion and instability-prone areas, and implement stabilization works on a priority basis to the limit of availability of funding each year. While the majority of funding is applied towards the maintenance of existing erosion control structures that protect the park systems and municipal infrastructure, this program is extended to private properties in extreme cases where homes have been deemed as at risk by erosion or instability.

The foundation of the Erosion Management Program and the remedial erosion control works that TRCA has implemented at over 500 locations across its jurisdiction over the last 40+ years is staff's expertise in the identification, assessment, tracking and prioritization of erosion hazards, and TRCA's relational web-based database which allows sites to be added and modified in real-time as new hazards are identified and priorities must be re-evaluated. These monitoring sites include erosion hazards on private property at the request of private landowners, existing erosion control structures on TRCA and City-owned lands to protect valuable greenspace, and select municipal infrastructure (sanitary sewer crossings, retaining walls, park trails, etc.) in cooperation with TRCA's municipal partners such as Toronto Water and Toronto Parks, Forestry & Recreation (PF&R).

Recognizing that TRCA has considerable experience and the necessary tools and protocols in place to assess and track erosion and slope instability hazards through its existing Erosion Management Program, by July 10th 2013 Toronto Water, PF&R and 311, who were also receiving numerous reports of storm-related damage, agreed that all initial reports of erosion and slope instability be referred to TRCA for preliminary inspection and addition to the damage inventory. This cross-divisional and cross-organizational cooperation allowed staff to respond to the public's concerns in a timely fashion and disseminate pertinent information to the appropriate City staff following initial inspection, while building and maintaining a comprehensive database of City-wide damage.

The following provides an overview of TRCA's management of erosion and slope instability hazards in the days after the July 8th severe weather event to provide, at a preliminary level, an assessment of the types and extent of damage sustained to private property, public lands and municipal infrastructure. It is noted that the inventory and assessment process outlined was carried out in compliance with the standards and practices of TRCA's existing Erosion Management Program.

General sequence of inventory and assessment process:

1. Calls are vetted through senior staff and prioritized for inspection based on available information.
2. A new database record is created and populated with available information (municipal address, watershed/watercourse, GPS coordinates, landowner information and other information).
3. An inspection is completed by trained TRCA staff documenting the type and visible extent of the hazard, structure(s) potentially at risk, as well as the existing conditions of natural features such as slope/bank height and inclination, type and extent of vegetation cover, and other evaluation criteria to assist the inspectors with the assignment of a priority ranking for potential remedial or major maintenance works based on perceived risk to life and/or property.
4. The preliminary priority rankings are categorized as "critical", "high", "medium", "low" or "none", using the general criteria outlined in Attachment 1 as a guideline for decision-making.
5. A new "point" is generated in Geographic Information Systems (GIS) based mapping to visually display the results of the preliminary priority ranking, linked to an attribute table where high level information about the site is easily viewed and shared with internal and external partners to promote efficiency, collaboration and reduce duplication of effort.
6. Information is shared with the appropriate internal and external partners depending on the nature of the damage/hazard, for example Toronto Water where hazards to storm outfalls or water/wastewater crossings have been identified, PF&R where hazard to park amenities or City-owned valley slopes has been identified, and Ravines & Watercourses where debris jams have been identified.

By the end of the first week of inspections on July 12th 2013, six properties were flagged as critical priority, 20 were flagged as high priority, 33 were flagged as medium priority, 66 as low priority and 16 sites with a priority of "none", the latter being primarily recently completed TRCA erosion control sites where no appreciable damage was observed following the storm event, including those sites located in the areas where the highest amounts of rainfall were recorded, such as the Mechanically Stabilized Earth (MSE) retaining wall system constructed along Black Creek at the rear of Troutbrooke Drive in 2012, and TRCA's natural channel restoration sites near the Toronto Pearson International Airport.

It is noted that the positive inspections of TRCA's recent erosion control and river restoration sites is a testament to the high standards of TRCA's design criteria which are upheld to withstand the type of event that occurred on July 8th and which are anticipated to occur more frequently in the face of a changing climate. It is staff's opinion, based on years of post-storm monitoring, that the inclusion of vegetation and other principles of natural channel design are a key factor in resilient stabilization works.

Senior TRCA staff subsequently inspected all sites flagged critical or high priority sites on Monday, July 15th to confirm the preliminary priority ranking and review conditions first-hand to determine the appropriate course of action. Staff found that an overwhelming number of slope failures had occurred in Wards 2 and 9, either entirely or partially on private properties situated at the top of valley slopes. It is noted that both of these wards, Etobicoke North and York Centre, respectively, are located in areas generally developed during the mid 1950's to 1970's, prior to preventive development controls being fully implemented with respect to setbacks from areas prone to natural hazards such as erosion and slope instability.

In many cases there were existing retaining structures in place that had failed or were failing, some of which appear to have been constructed over the natural top of bank to create/retain useable rear yard space. No permit information was reviewed as part of this preliminary assessment process, however it is likely that many of these structures were not designed by an engineer based on visual observation of the material types and construction methods. To a lesser degree, at some sites with no existing retaining structures only the upper slope failed, likely due to the movement of unengineered fill placed during the development of the property (i.e., no significant alterations by the previous or current homeowners). In limited cases, slope failures occurred along the entire height of the valley slope – at these locations the river was generally coincident with the base of the valley slope and toe erosion is believed to have triggered the failure.

Due to the close proximity of the erosion and/or slope instability to essential structures ranked as critical or high priority and other observations made by staff during these initial inspections, TRCA retained the geotechnical engineering firm Terraprobe Inc. on July 16th to inspect these sites and assess:

- type of failure/instability observed;
- potential cause(s) of the failure/instability;
- extent and degree of risk; and
- potential stabilization options and magnitude of associated costs.

Terraprobe completed the required field work between July 17th – 19th 2013 and is scheduled to provide a final report outlining their findings and recommendations on July 25th 2013. Staff will be prepared to discuss the findings and recommendations at the Authority Meeting on July 26th 2013.

Also of note is the damage reported and observed along the lower reaches of Mimico Creek, which although has, in most cases, been ranked as medium to low priority from a risk perspective, is quite extensive in terms of structural damage to existing retaining walls and cost to private landowners to repair and replace these structures. As more than 50 properties were reported as being damaged within the first few days following the July 8th storm event, inspectors were directed by senior TRCA staff to complete a “walk-through” of Mimico Creek from approximately Eglinton Avenue and Highway 427 south to the mouth of Mimico Creek, to compile a comprehensive inventory of storm damage to this watercourse and the properties and structures impacted. Staff is currently preparing a separate report on this assessment, detailing the locations of erosion and slope instability in proximity to homes, park amenities, water infrastructure and other structures, as well as other storm-related issues such as debris jams to share with the City of Toronto upon completion as part of TRCA’s post-storm management efforts.

At the time this report was prepared, TRCA had inspected more than 240 sites since July 9th 2013. TRCA staff continue to receive reports of damage and is continuing to inspect all areas of concern to update the damage inventory list and disseminate information to Toronto Water, Parks, Forestry & Recreation staff, and other City departments on a regular basis. Coarse estimates to repair damaged areas were provided to the City Manager’s Office on July 16th, and are continuing to be refined and updated as more information becomes available, however the current total estimate is in the order of \$28 million with critical sites representing \$5.7 million of the total.

RATIONALE

In light of TRCA’s specialized experience in the assessment and remediation of erosion and slope instability through its Erosion Management Program, staff, subject to authorization, propose to initiate detailed geotechnical investigations and undertake interim erosion control and/or slope stabilization works as required at high priority sites using reallocated 2013 erosion capital funds. Staff also request authorization to submit a request to the City of Toronto for special funds in 2013-2014 to remediate critical priority sites and commence with the detailed designs for high priority sites; and authorization to request long-term enhanced funding commencing in 2014 to implement needed stabilization and repair works commencing in 2014 and initiate valley segment-based planning to proactively identify and address erosion and slope instability hazards before they become critical priority sites as a result of severe weather events.

To ensure the ongoing communication and coordination of efforts with the City of Toronto, staff recommend a follow up report to the Authority on the status of the proposed funding requests and progress of work in approximately six months from the date of this report. Staff also recommend developing a formal communication strategy with local Councillors, with updates proposed to be provided bi-weekly initially, transitioning to monthly as the post-storm efforts evolve from inspections and assessments to detailed designs and restoration works.

FINANCIAL DETAILS

Current expenditures related to TRCA's response to the severe weather event on July 8th are estimated at approximately \$100,000 and represent: staff wages and travel costs to inspect and inventory damage reported; materials and supplies for site securement (fencing, signage, clean up activities); and consulting engineering services to assess critical and high priority sites and provide recommendations and estimated costs for potential stabilization works. An additional \$250,000 is estimated to be required to complete detailed geotechnical investigations for critical and high priority sites only, the results of which are necessary for detailed designs of potential future remedial and major maintenance works. Finally, an additional \$28 million is estimated to be needed for state of good repair works, which is assumed to include the cost of the detailed design work and all necessary approvals required for construction. TRCA is prepared to reallocate approximately \$200,000 from 2013 erosion capital to offset the costs already incurred and additional costs to initiate interim emergency works and/or detailed studies at outlined above.

Costs for future detailed investigations, detailed designs and construction were coarsely estimated using past similar works for reference, with a 50% contingency allowance applied in light of the absence of detailed information. Costs are subject to change as new sites are identified and more information becomes available.

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Date: July 15, 2013

Attachments: 1

Attachment 1

General Criteria Used to Assign Preliminary Priority Rankings

PRELIMINARY RANKING	CRITERIA
Critical	Hazard may be posing imminent risk to an essential structure (e.g., house, municipal infrastructure) or human life. Site recommended for immediate follow up by qualified engineer to assess risk and confirm priority ranking. Emergency works may be required to mitigate risk.
High	Hazard may be posing risk to an essential structure (e.g., house, municipal infrastructure) or human life over the short term. Site recommended for immediate follow up by qualified engineer to assess risk and confirm priority ranking. Stabilization works may be required in the near future (1 – 5 years) to mitigate risk.
Medium	Hazard may be posing risk to an essential structure (e.g., house, municipal infrastructure) or human life over the medium to long term. Site recommended for follow up by a qualified engineer after high priority sites have been assessed. Stabilization works may be required in the future (5 – 25 years) to mitigate risk.
Low	Hazard may be posing risk to an essential structure (e.g., house, municipal infrastructure) or human life over the long term. Site recommended for follow up by qualified engineer as funding becomes available, however sites should be re-assessed at least every 5 years to confirm priority. Stabilization works may be required in the future (25+ years) to mitigate risk.
None	No perceived risk to an essential structure (e.g., house, municipal infrastructure). Damage is believed to be isolated to a defined area (gardens, existing retaining structures) or not related to erosion or slope instability (e.g., basement flooding)