SURREY
CITY OF PARKS

Corporate Report

NO.: R067

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REGULAR COUNCIL

TO: **Mayor & Council** DATE: July 14, 2010

FROM: **Fire Chief** **FILE:**
General Manager, Engineering
General Manager, Parks, Recreation and Culture

SUBJECT: **Fraser River Freshet Flood Threat and Related Actions**

RECOMMENDATION

It is recommended that Council receive this report as information.

INTENT

The purpose of this report is to provide Council with information about the planning and mitigation actions being taken by staff in preparation for the 2007 Fraser River freshet.

BACKGROUND

The largest Fraser River flood on record occurred in May of 1894 when rapid snowmelt caused river levels to rise dramatically, triggering flooding from Harrison to Richmond. The flood was massive; however, property damage was limited because settlement was sparse. The next largest Fraser River flood of record occurred in 1948. Due to increased development and population growth within the floodplain, the impacts were much greater than in 1894, including:

- Evacuation of 16,000 people
- Damage to or complete destruction of 2300 homes
- 1500 residents left homeless
- Costs of about $150 million in relation to recovery after the flood (current values)

Since 1948 the Fraser River has not had a flood of this magnitude, although there have been a few freshets that were close to the same level such as the one that occurred in 1972.

In 2005, the Fraser Basin Council retained Northwest Hydraulic Consultants Ltd and generated an up-to-date design flood profile for the lower Fraser River based on the following two scenarios:

- The 1894 Fraser River Freshet flood combined with spring high tide conditions (Fraser Freshet Profile)
- The 1 in 200-year winter storm surge flood with winter high tide conditions combined with a Fraser River winter flow (the Winter Storm Surge profile)

The Winter Storm Surge profile exceeds the Freshet profile in the lower 28 km of the river, or downstream from a point 1.4 km downstream of the Alex Fraser Bridge. Upstream of that point, the Fraser River Freshet Flood profile is the dominant flood hazard.

Dyke design levels for Bridgeview, South Westminster and Barnston Island were initially established in 1969 (estimated flood water level plus 0.6 m freeboard), based on high water marks from the1894 and 1948 floods plus some limited computer modelling. The new predictions for floodwater elevations are higher than the 1969 estimates, and many sections of the diking network along the Fraser River require substantial upgrades. The areas most impacted by these new flood elevations are upstream of Port Mann and there are only minor changes for the dyked areas of Bridgeview and South Westminster. The Provincial standard for dykes is to meet the floodwater level profile plus 0.6 meters (2 feet) of additional freeboard.

DISCUSSION

Current Flood Threat Conditions:

The winter snow accumulation season is largely over. As of April 1st, very substantial snow packs have accumulated over large portions of the province. The Fraser River basin Snow Index is 134% of normal. This is amongst the most significant Fraser River snow packs measured since 1953, when detailed snow measurements were first taken in the Fraser River catchment. The current years' snow is similar to that of 1972, and only slightly below that of the peak snow years of 1974 and 1999. As a result of the widespread heavy snow conditions, the River Forecast Centre is forecasting well above normal spring runoff in most river basins, including all the major Interior basins. The potential for major flooding along the Fraser is at its greatest risk since 1948, and will be dependent largely on the weather during snowmelt season, which predominantly occurs through May and June. During 1999 when high snow accumulations also occurred, the weather patterns allowed for a gradual snow melt and, though water levels were very high in the Fraser, major flooding was avoided. The flood threat of 1999 was mostly confined to the Lower and middle Fraser basins due to relatively low snow pack levels in the interior of BC. The Freshet Flood threat of 2007 is impacting most of the Province.

The Fraser River flood threat is compounded by the effects of the Pine Beetle epidemic in the B.C. Interior. The Forest Practices Board warned on March 19 that 60% of the Fraser Rivers' drainage area is subject to beetle attack. In much of that area, trees have died and lost their needles, exposing the snow to sunlight rather than shading. As such, snow melt may occur more rapidly than has occurred in previous high snow pack years. A creek study that was undertaken indicates that where trees have died within a creek catchment area there can be a 60% increase in spring runoff flows due to accelerated snow melt in comparison to when the trees were alive and shading the snow on the ground.

Challenges:

The Surrey floodplain (i.e., those areas that are below the 10 metre elevation) includes South

Westminster from the Delta border, Bridgeview, Thornton yards to Port Mann Bridge, and east to the Langley Border. There are an estimated 1000 homes, 2800 residents, and the workplaces of 8,100 employees in the effected floodplain.

The City is working with The Ministry of Environment in providing real time forecasting and hydraulic predictions setup for the 2007 Freshet. The Province, through their consultant, will be using information from the City's river level gauge network established in 1999, to look at the river profile during the freshet period. They will be providing bi-weekly updates and forecasts. Water levels collected through the City system will help with forecasting and enable a more efficient warning system for communities along the river. Information gathered will also assist in future model calibration and in determining where further channel works may be necessary.

Since the freshet area also includes the Interior of BC, early warning notice is possible for the lower mainland. If flooding occurs in the Prince George region, there is a window of about 5 to 7 days before the floodwaters reach Mission.

Assisting residents and businesses in the floodplain in preparing for a potential flood will greatly assist in the event an evacuation becomes necessary. Early warning, correct information, and participation of residents to plan and provide for themselves as much as possible are critical to the effective management of any emergency. If an evacuation is necessary, there will be challenges in relation to accommodating people and animals. Security during an evacuation is a major undertaking, especially when access and debris are an issue.

Preventing the flood waters from further damaging infrastructure beyond the floodplain will be a challenge. Engineering staff has been working with Fraser Port Authority and Gateway Teams on flood coordination for 2007 and beyond.

During the 2007 freshet as in previous high water level years, the water levels and peak flow rates in the Fraser River will remain high for an estimated period of 4 to 6 weeks. The possibility of dyke seepage and erosion will be very high during this period and may require a voluntary evacuation if there are concerns regarding the ability of the dykes to withstand the water pressure over the extended period during which they will be under stress. The Engineering Department is developing a work plans in relation to isolating the utilities and services in blocks to provide a systematic shut down of such utilities and services if a shut down becomes necessary.

The Provincial government provided the City of Surrey with a grant of $1,065,682 to address 16 areas of concern in relation to the dykes along the Fraser River. A condition of the Provincial grant was that only external contractors could be retained to complete the works. Since the grant was received, the City has held discussions with representatives from the Province to remove this restriction and allow for the City's own construction crews to be utilized. This was an important consideration because it is very difficult in the current economy to retain contractors on short notice to undertake projects.

The Fraser River contains large volumes of debris such as uprooted and fallen trees, which can pose significant hazards to commercial and recreational navigation and the safety and maintenance of infrastructure such as docks, bridges, dykes and underwater lines. Situated near the town of Hope, the Fraser River Debris Trap annually collects up to 100,000 cubic metres of material, which is swept downstream from the interior during the annual Fraser River Spring Freshet. There is a problem of ownership and funding for the Debris Trap, and

concern for its continued operation prior to and during the Freshet.

In addition to the flood impact on residential, commercial and industrial sectors of the floodplain, there will be disruption of major transportation corridors including Patullo Bridge, King George Highway, South Fraser Way, Scott Road, Skytrain, CNR, BNR, and Fraser Port.

Should the high waters breach the dyke, extensive recovery and remediation will be required to bring services back to large areas. Heavily flooded areas could be shut down for extended periods of time. Group lodging may be necessary for these extended periods of time.

Planning (Pre-Event, Flood Event, Recovery):

All City Departments are playing a role in planning for the 2007 Fraser River freshet. Fire Service Department is taking the lead role in planning and coordination of the local and provincial response in Surrey. The Engineering Department has the largest task in relation to constructing mitigation works to dykes, and City infrastructure. The Parks, Recreation and Culture Department is tasked with preparing residents for a possible evacuation and a possible lengthy stay away from home. The RCMP is planning for a systematic, orderly evacuation, if necessary, and will be responsible for security of the evacuated area.

The Fire Services Department is in regular liaison with City departments, Provincial authorities (PEP, MOE, Fraser Health, BC Hydro) as well as Teresan Gas, Fraser Port Authority, RCMP, and neighbouring community Emergency Planners. Bi-weekly freshet planning meetings have been taking place to better coordinate and brief stakeholders on mitigation efforts of City Departments and the Province. In early May, a process for providing information to property owners and residents whose property and place of residence may potentially be directly affected by the freshet will take place. This will involve the distribution by Fire Services and RCMP personnel of an updated Residential Flood Preparedness Guide to property owners and residents in the flood prone areas and an evening community meeting during which information about the potential flood and roles and responsibilities will be provided. An emergency resource acquisition list is being updated for use during a flood event. Staff is in discussions with those neighbouring municipalities that will not be affected by the freshet about possible assistance during the freshet period should such assistance become necessary.

Engineering has updated the Business Flood Preparedness Guide and are compiling a list of businesses both inside and outside of the dyke system that may be affected by flood waters during the freshet. Engineering staff will notify these businesses of their flood risks and will be working with them on flood protection where possible. Businesses outside the dykes will be shown projected flood elevations and advised to move inventory and equipment to higher ground.

Engineering operations staff is compiling inventories of equipment and resources for use during the event and is taking action to ensure that all equipment needed for dyke closure areas is in good working order. Area isolation plans (i.e., utility protection) related to potential dyke breaches are being developed. Area recovery planning is also underway.

Since receiving the Provincial Grant money, the City has retained Associated Engineering to provide design and contract administration services for the dyke upgrading work. Site investigations of the project area have been completed and Associated Engineering has initiated the design process. Upon completion of the preliminary design drawings, the Engineering Department will be meeting with the Province's grant administrator to review

the proposed works prior to detailed design. This meeting is tentatively scheduled for the week of April 16th. Upon Provincial approval, detailed design will be completed over the following two weeks, with construction scheduled to start the week of April 30th, and completed by early June.

Engineering has resurveyed the entire Fraser River dyke system looking for areas where settlement has occurred or where holes exist. This information will be used for the temporary and permanent construction required for the protection of the floodplain.

Engineering Department dyke patrols and inspections will continue, in order to monitor the performance of the flood control works and to initiate any corrective actions that need to be taken. The following provides a listing of the approach that is taken to dyke inspection activities:

STAGE I **MISSION GAUGE 6.0 m (2.5 m Dyke Freeboard at Mission)**
At this stage the river is generally bank-full and patrols will be mobilized if the river level continues to rise. Local conditions may require more frequent inspections of the riverbank adjacent to dykes to monitor for erosion.

STAGE II **MISSION GAUGE 6.5 m (2.0 m Dyke Freeboard at Mission)**
An inspection of the full dyke system once each day will be undertaken at this stage.

STAGE III **MISSION GAUGE 7.0 m (1.5 m Dyke Freeboard at Mission)**
The dykes will be patrolled on a 24-hour a day basis until the water levels start to recede.

Due to the possibility of road closures during a flood event, including the King George Highway in South Westminster and the closure of the Patullo Bridge, Transporation Engineering staff is developing a traffic control plan with the Fire Services Department and the RCMP.

The City webpage will include a link to Fraser River Freshet to allow the public to remain informed of mitigation and planning for the Freshet. Engineering Department staff has also set up a Flood Information Hotline at 604-598-5738, which is informational mailbox but does not accept a message.

The Parks, Recreation and Culture Department, which is responsible for Emergency Social Services (ESS), has been meeting with staff and volunteers to plan for ESS roll out, if necessary, during the Freshet. North Surrey ESS Reception Centre managers have been briefed; additional registration and referral forms ordered, and training for administration of registration and referral of persons in need will be conducted in the next month. Volunteers associated with ESS in North Surrey / Bridgeview area are on alert. City staff will also participate in a Provincial Emergency Program-sponsored workshop dealing with large-scale evacuations, mutual aid, mass care, and transition into recovery.

The PRC Department is also exploring the possibility of pre-registering potential evacuees in advance of a full-scale evacuation. Group lodging opportunities in Surrey and neighbouring communities is also being investigated.

An exercise will be held in early May to distribute Flood Preparedness Guides to residents in

the floodplain, and a community meeting held to update and field questions from the public. Emphasis will be on awareness, early warning, and self help to prepare the public for the possible flood and recovery.

The City Emergency Operation Centre (EOC) located at Fire Station #1 has undergone renovations and will be fully operational and available for use should a significant flood occur.

CONCLUSION

The 2007 Fraser River Freshet is definite cause for concern and early preparation is important. Factors influencing the Freshet include snow pack, weather, Pine Beetle impacts, Debris Trap, dyke stability, Flood Preparedness at a personal level, local government preparedness and provincial government preparedness. Factors that can be controlled are receiving immediate attention and others are being monitored to ensure that actions are initiated when warranted in relation to the flood threat.

Data related to snow packs and from hydraulic modelling indicate that subject to warm weather conditions in May and June, the potential for major flooding along the Fraser is at its highest since the flood of 1948.

Department managers and other staff are preparing for the Fraser River freshet and will continue to meet on a regular basis to strategize and plan mitigative works to lessen the impact of a freshet flood, should one occur, and to deal with the impacts of a flood on the community. Snow pack and runoff forecasts provided by the Ministry of Environment will continue to be closely monitored.

Len Garis Fire Chief	Paul Ham General Manager, Engineering	Laurie Cavan General Manager, Parks, Recreation & Culture