APPENDIX V

Emergency Preparedness Plan

February, 2016

LONG POND WEIR

Emergency Preparedness Plan

Submitted to:
Greg Sheppard, P.Eng.
CBCL Limited
187 Kenmount Road
St. John's, NL
A1B 3P9

REPORT

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Distribution:

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1.0 EMERGENCY PREPAREDNESS PLAN

1.1 Introduction

Emergency preparedness refers to the extent of which an organization is prepared ahead of time with a plan of action to use when an unusual or hazardous situation arises. An Emergency Preparedness Plan (EPP) is a document that defines who does what, when, where, and how during an emergency.

This EPP is a guide to assist personnel with the City of St. John's and external emergency agencies to develop individual response plans for a potential or actual flooding and/or weir breach event at the Long Pond Weir. This EPP includes specific information to allow timely reactions to potential and imminent flooding events.

This EPP is designed to help ensure, the public will receive and understand official information related to an evacuation requirements, and that the public will act in its own interest and evacuate areas at risk when officially advised to do so.

The EPP is not a response document, but it does contain the essential information required for local authorities to develop their rescue plans for an emergency situation related to the Long Pond Weir. It is imperative that each local authority has developed their own flood emergency response plans and that these plans are current and functional.

1.2 Purpose

The EPP's intended purpose is to help responsible parties successfully navigate through a potential or imminent weir emergency. It guides the City of St. John's personnel in identifying, monitoring, responding to and mitigating problems that might arise with the Long Pond Weir.

This EPP describes initial observations and required actions to be taken in the event of a potential weir emergency, personnel to be notified, notification protocol, potential remedial or mitigation actions to be completed, and resources available.

The Long Pond EPP identifies two levels of emergency where the EPP would require activation. These levels are potential weir emergency and imminent/ actual weir emergency. If an emergency were to develop the responders are to contact the appropriate individuals as per the Notification Flow Chart in **APPENDIX A**. As well to assist the emergency responders, this document contains information on the following:

- inundation mapping;
- key contact personnel as per the Notification Flow Chart;
- notification procedures; and,
- what key responders should be doing.

The basic operations of the Long Pond Weir are outlines in the Operations Maintenance and Surveillance (OMS) Manual. Emergency responders should be familiar with this document as well as the Emergency Response Plan (ERP) and the EPP.

1.3 Weir Location

The Long Pond Weir is located at the outlet of Long Pond into Rennies River, adjacent to the Allendale Road Bridge. Long Pond is part of the Rennies River water catchment which is located in St. John's, NL (Figure 1). The catchment is approximately 32 km^2 and discharges into Quidi Vidi Lake. Other water bodies in this catchment include Yellow Marsh Stream, Ken Brook, Leary's Brook, and Rennies River. Significant rainfall events in previous years have caused flooding along Rennies River, downstream from Long Pond. A study on Rennies River Catchment Stormwater Management Plan was completed by CBCL Ltd. for the City of St. John's to determine the best way forward to manage flooding issues. The preferred solution was to build a weir structure at the outlet of Long Pond to increase the holding capacity of Long Pond and control the rate of flow into Rennies River during precipitation events.

The weir is approximately 30m long, 5m in height, and 3m wide at the crest. It is an earth filled dam structure with a 6m wide pre-cast concrete opening to maintain flow to Rennies River and there are also two (2) 2m wide flood gates that are pre-cast concrete openings on either side of the opening to allow additional flow downstream if Long Pond water levels get about 55.7m. These gates are manually operated.

1.4 Responsibilities

The Long Pond Weir is owned and operated by the City of St. John's (the City). The Water & Wastewater Distribution division within the Department of Public Works will be responsible for completing routine inspections and maintenance on the weir. It is the responsibility of the Department of Public Works to initiate the ERP and EPP when necessary.

Since the weir is owned by the City, the City's Emergency Management Plan would be implemented in the event of a potential or imminent emergency. Therefore, it is the responsibility of the Emergency Operations Manager with the City of St. John's to notify the appropriate responding authorities in the event of an emergency.

1.5 Reporting

The Long Pond Weir is located in a highly trafficked area of St. John's and can be observed and accessed by the general public. The general public can report any unusual or potentially hazardous conditions along the weir by calling the City of St. John's Access line at 311 or submit the observation on the Access 311 St. John's app. These observations will be reported to the Operations Supervisor Water & Wastewater Distribution who will investigate the observation and activate the ERP for hazardous conditions, if necessary.

Routine inspections are completed by the Foreperson Water & Wastewater Distribution. The reports are reviewed and filed within the Department of Public Works. Any anomalies observed along the weir during the inspections will be identified within the reports. If applicable the ERP and EPP response protocols will be activated.

2.0 EFFECTS OF INUNDATION

The following is a brief overview and the general nature, timing, and hazardous conditions that are likely to develop at various downstream reaches should the Long Pond Weir fail.

Possible weir failures can be broadly classified in two of the following categories:

- Failures caused by excessive rainfall, runoff, or snowmelt during a heavy rainfall or freshet which may result in overtopping of the weir. The weir was designed to withstand a 1 in 100 year flood plus 30%. When operated under normal conditions, the Long Pond Weir should have sufficient capacity to manage high inflow events up to the design inflow flood of 55.7m water elevation.
- Weir failures, which may include unexpected movement of the weir, water leaking through the dam leading to piping failures, foundation movement, and severe erosion under non-flood conditions or non-flooding conditions.

Long Pond Weir is part of the Rennies River catchment in St. John's. Rennies River flows through the east end of St. John's and there is residential and recreational infrastructure along the river banks as well as bridges and roads along the river. As part of the weir studies, a classification for the weir had to be completed based on the CDA guidelines. The classification is based on three broad consequence categories which are (1) potential loss of life, (2) environmental and cultural losses, and (3) infrastructure and economic losses. The overall dam classification is determined by the highest potential consequence. The Long Pond Weir is classified as significant because the highest potential consequence for incremental losses between dam safe and dam failure scenarios was within the infrastructure category. Road, bridges, and houses would be damaged in a flooding event. However, only minor damages would occur to bridges and roads in the incremental difference and 3 houses in 100 year flooding and 7 houses in 1000 year flooding incremental scenarios would be damaged (Golder, 2015). For further information regarding the inundation effects refer to the Long Pond Weir Classification Canadian Dam Association prepared by Golder Associates.

3.0 OVERVIEW OF EMERGENCY RESPONSE PROCEDURES

If the Long Pond Weir experiences a hazardous condition, potential, imminent, or actual emergency, the Water and Wastewater Distribution staff are trained to activate the Long Pond Weir Emergency Response Plan (please refer to the ERP document). Activation of the plan facilitates a standard incident response system which will establish a site command post. Depending on the severity of the situation, the response team will activate the City's EMP which includes an emergency operation centre (EOC).

The EOC will be established at the third floor of the St. John's Fire Station on Parade Street. If this location is not available the backup location is in the Mount Pearl Fire Station on Olympic Drive. The EOC will be headed by the City appointed Emergency Operations Manager (EOM). The EOM is responsible for activating the City's EMP. The EOM is also responsible for directing and controlling all emergency operations and for providing the necessary personnel and resources. For more information regarding the City of St. John's Emergency Management Plan refer to the City's website.

4.0 POTENTIAL WEIR EMERGENCY

4.1 Definitions

A potential weir emergency is any situation that poses an immediate threat to the safety of the weir and the downstream personnel and infrastructure. This condition is currently not an emergency but can become one if weather conditions change or there is further deterioration along the weir. These conditions can be weakening of the weir itself or foundations or it could be the reduction in freeboard.

4.2 Operating Personnel Response

For a potential weir emergency, Water & Wastewater Distribution personnel; Foreperson, Operations Supervisor, and Manager, will complete an inspection to determine the severity of the situation. The Manager will then notify the Deputy City Manager who will activate the potential weir emergency portion of the Long Pond Weir ERP. The ERP will direct the Deputy City Manager to:

- establish a Site Command Post (SCP);
- complete special site inspection;
- carry out emergency actions; and,
- begin notifications as per the notification procedures (**APPENDIX A**) which includes contacting the EOM who will activate Standby conditions for the EMP.

4.3 External Agencies Response

External agencies will be notified of the standby conditions for a potential emergency by the EOM with the City. They will continue to be notified with updates to the status of the emergency by the EOM as per the notification procedures in the EMP. If necessary, external agencies will activate their own internal emergency plan for “Potential Weir Emergency” scenario.

5.0 IMMINENT/ ACTUAL WEIR EMERGENCY

5.1 Definition

An imminent/ actual weir emergency is any condition that will, or likely will, cause the weir to fail and or produce significant and or sudden increases in flow in Rennies River downstream of the weir. Imminent weir emergency protocol would be used for the suspected or actual overtopping of the weir, or failure of the weir is suspected.

5.2 Operating Personnel Response

Upon initial indication of an imminent weir emergency for the Long Pond Weir, Deputy City Manager will immediately activate the imminent/ actual emergency portion of the Long Pond Weir ERP that will direct them to do the following, if not already completed during a potential weir emergency:

- establish SCP at the weir;
- complete a special site inspection; and,
- complete notifications as per the notification protocols (**APPENDIX A**) which include activating Phase 2 EPP/ERP Evacuation procedures as per the City's EMP.

As part of the notification protocols, the EOM will be contacted and they will activate the City's emergency procedures.

5.3 External Agencies Response

External agencies will be notified of the emergency conditions for an imminent or actual emergency by the EOM with the City. They will continue to be notified with updates to the status of the emergency by the EOM as per the notification procedures in the EMP. If necessary, external agencies will activate their own internal emergency plan for "Imminent or Actual Weir Emergency" scenario.

6.0 COMMUNICATION SYSTEMS

Effective communication and quick response to implement mitigation efforts are essential when dealing with potential or actual emergency situations.

6.1 Communications

General

Notification procedures for the various emergency scenarios with key personnel, and contact information are given on the Notification flow chart in **APPENDIX A**.

A comprehensive listing of agencies, who have a registered copy of the EPP is given in the Communications Directory in **APPENDIX E.**

Communications

There is no direct access to a landline at the Long Pond Weir. Individuals assessing the weir should have a fully charged cell phone on them to be able to report back to the Operations Supervisor, Manager or Deputy City Manager depending on the scenario.

In the event cell phone service is unavailable due to an outage, communications can be established from the weir by using satellite phones or radios on the City's UHF radio system.

7.0 INUNDATION MAPPING

Inundation mapping was completed for four (4) scenarios which were:

- 1 in 100 year flood weir safe (Sunny Day flood weir safe);
- 1 in 100 year flood weir breach (Sunny Day flood weir breach);
- 1 in 1000 year flood weir safe; and,
- 1 in 1000 year flood weir breach.

In all scenarios the flooding begins at the Allendale Road Bridge and follows Rennies River ending in Quidi Vidi Lake. The majority of the flooding occurs along the river banks however, the river spreads out over the banks in the following areas:

- Carpasian Road Bridge area;
- Portugal Cove Road Bridge area;
- Area between Rennies River Trail and Winter Avenue;
- Dominion Parking Lot; and,
- Carnel, Clancey Avenues and Lake Avenue intersection.

The maps are shown in **APPENDIX B** for all four (4) scenarios. It should be noted that these maps are hypothetical and many assumptions had to be made when modelling these scenarios. The intent of the maps are to show the estimated maximum extents of flooding, flood depths, peak flow values for planning and evacuation purposes. However, the maps may be subject to considerable error due to model uncertainties and assumptions. They are to be used as a guide, and judgements regarding evacuation should be made referring to the maps but also taking into account actual conditions in these areas.

The flood zones are located within 2 km of the weir and therefore the peak flood wave can be expected to occur within 30 minutes of a breach of the weir. During an emergency flood event the crossings along the flood path should be secured from traffic.

8.0 UPDATING THE EMERGENCY PREPAREDNESS PLAN

The City of St. John's staff will be responsible for updating the EPP and ERP. Both of these documents will be incorporated into the City's EMP. The documents will be reviewed annually. Any necessary updates that are required will be identified in the review and will be completed. Revisions will be circulated to all affected agencies identified in the Distribution List in **APPENDIX E** of the City of St. John's Emergency Management Plan.

Any revisions and or comments to the Long Pond Weir EPP should be forwarded to the City of St. John's Emergency Plan Review Committee. All revisions will be recorded on the Record of Revisions sheet included in **APPENDIX C**.

9.0 TRAINING

City of St. John's employees, associated with the Long Pond Weir and those identified as part of the Municipal Control Group are to be familiar with all aspects of the Emergency Preparedness and Response Plans for the Long Pond Weir.

Individuals involved with the response for the Long Pond Weir EPP and ERP will undergo individual training, team training, combined training with various departments and agencies, and full scale exercises as per the City's EMP training guidelines.

A record with be kept in the Emergency Preparedness records which specifies the date and names of individuals who were trained on the EPP.

10.0 TESTING

Testing is an important component of an emergency preparedness plan. Testing provides confirmation that the document is complete and the personnel are competent with their abilities to deal with an emergency. Testing will also determine if there are any anomalies with the current plan and whether a revision is necessary.

Testing of the EPP will be completed as per the City's EMP and will include tabletop exercises, functional exercises, and full scale exercises. All personnel who may be involved in a response at the weir should participate in the testing of the EPP. Testing exercises will be documented and filed on a form similar to the one found in **APPENDIX D**.

It should be noted that functional checking of the existing flood gates is part of routine maintenance and safety review.

11.0 OUTSIDE AGENCIES

This EPP is a controlled document. Copies of this document have been sent to applicable personnel and agencies that have involvement in the emergency response. A distribution list of the EPP is included in **APPENDIX E**. Each agency has been asked to indicate that they understand their role as outlines in the EPP by sending a "Letter of Understanding" to the City of St. John's similar to the letter that is found in **APPENDIX F**. The Deputy City Manager Public Works will keep track of all agencies returning this letter by entering the date the letter was received and any additional remarks in an electronic database. This file will be copied and forwarded to all registered EPP holders along with the next set of revisions when they are completed.

By making this agreement, the City endeavors to secure each agency's commitment to fulfill its designated responsibilities, encourage active involvement in reviewing, updating and testing the plan and reduce misunderstanding of any provision detailed in this EPP.

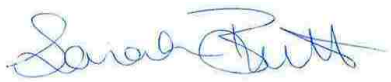
Agencies are expected to participate in the maintenance of the EPP by reviewing its contents for adequacy and forwarding any comments or suggestions to the Deputy City Manager Public Works, using a form similar to that in **APPENDIX G**.

Agencies involved in the notification procedure for potential weir emergency are expected to participate in the communications and operational test, complete the appropriate forms as explained in the ERP and submit the completed forms to the Deputy City Manager, Public Works.

City of St. John's Department of Public Works personnel will not be responsible for giving or carrying out evacuation orders. The MCG will declare an emergency situation and recommend an evacuation order however; it is the responsibility of external agencies to officially give and carry out evacuation orders. The City of St. John's personnel are required to notify local authorities of the emergency conditions as appropriate and in accordance with this EPP.

Report Signature Page

GOLDER ASSOCIATES LTD.



Sarah Butt, P.Eng
Intermediate Geotechnical Engineer

Shiu Kam, P.Eng (Ontario)
Principal

SB/SK/kl

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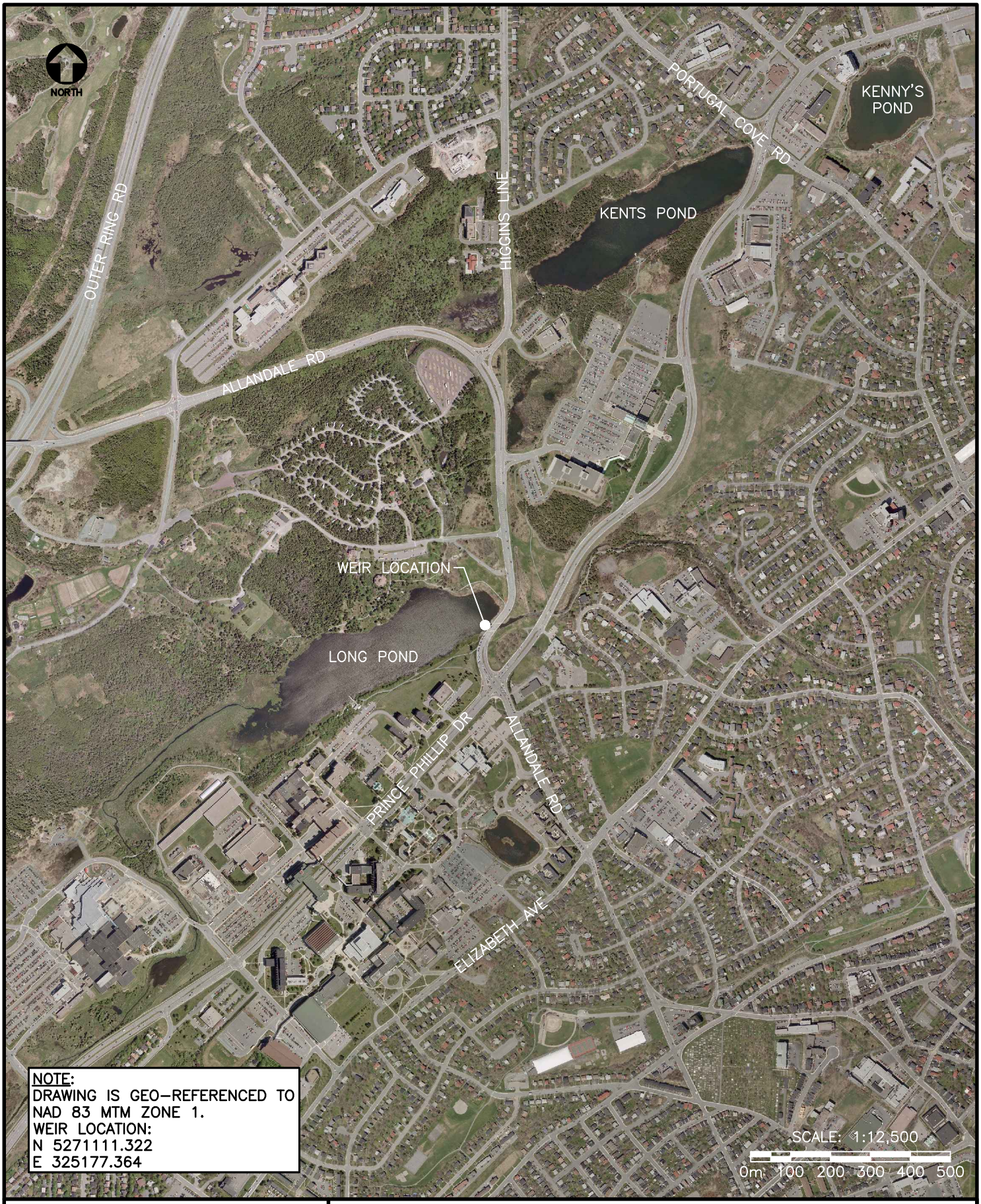
Shear Diamonds Ltd. 2011. Emergency Preparedness and Emergency Response Plan For Dam Emergencies at the Jericho Project, Nunavut. Accessed on January 12, 2016 at ftp://ftp.nirb.ca/03-MONITORING/00MN059-JERICHO%20DIAMOND%20MINE/02-MONITORING%20AND%20MANAGEMENT%20PLANS/Spill%20&%20Emergency%20Response/110601-00MN059-Emergency%20Preparedness%20and%20Response%20Plan%20for%20Dam%20Emergencies.pdf



NOTE:
DRAWING IS GEO-REFERENCED TO NAD 83 MTM ZONE 1.
WEIR LOCATION:
N 5271111.322
E 325177.364

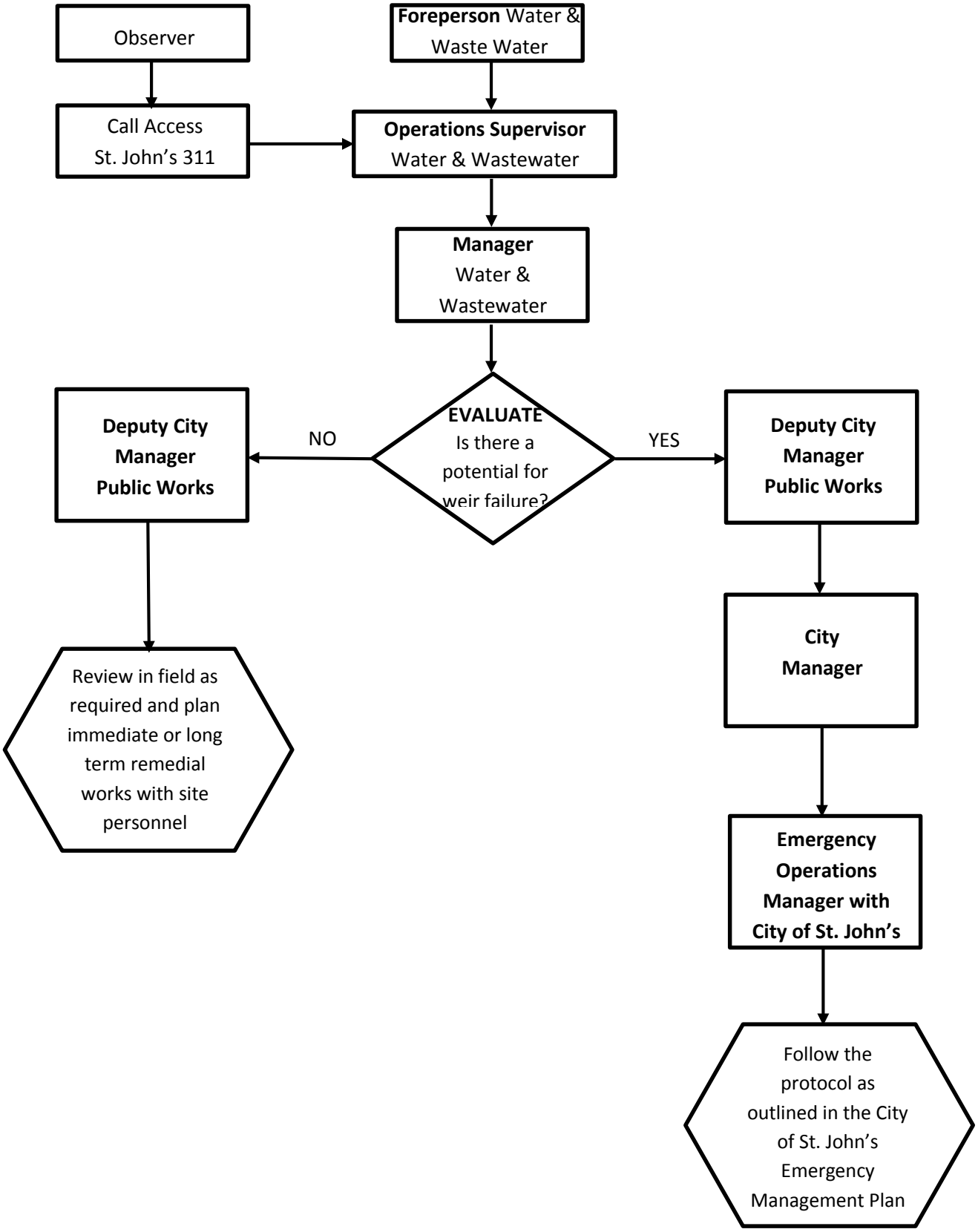
CBCL LIMITED
Consulting Engineers
187 KENMOUNT ROAD
ST. JOHN'S, NL, A1B 3P9
Phone: (709) 364-8623
Fax: (709) 364-8627

PROPOSED LONG POND WEIR

LOCATION PLAN

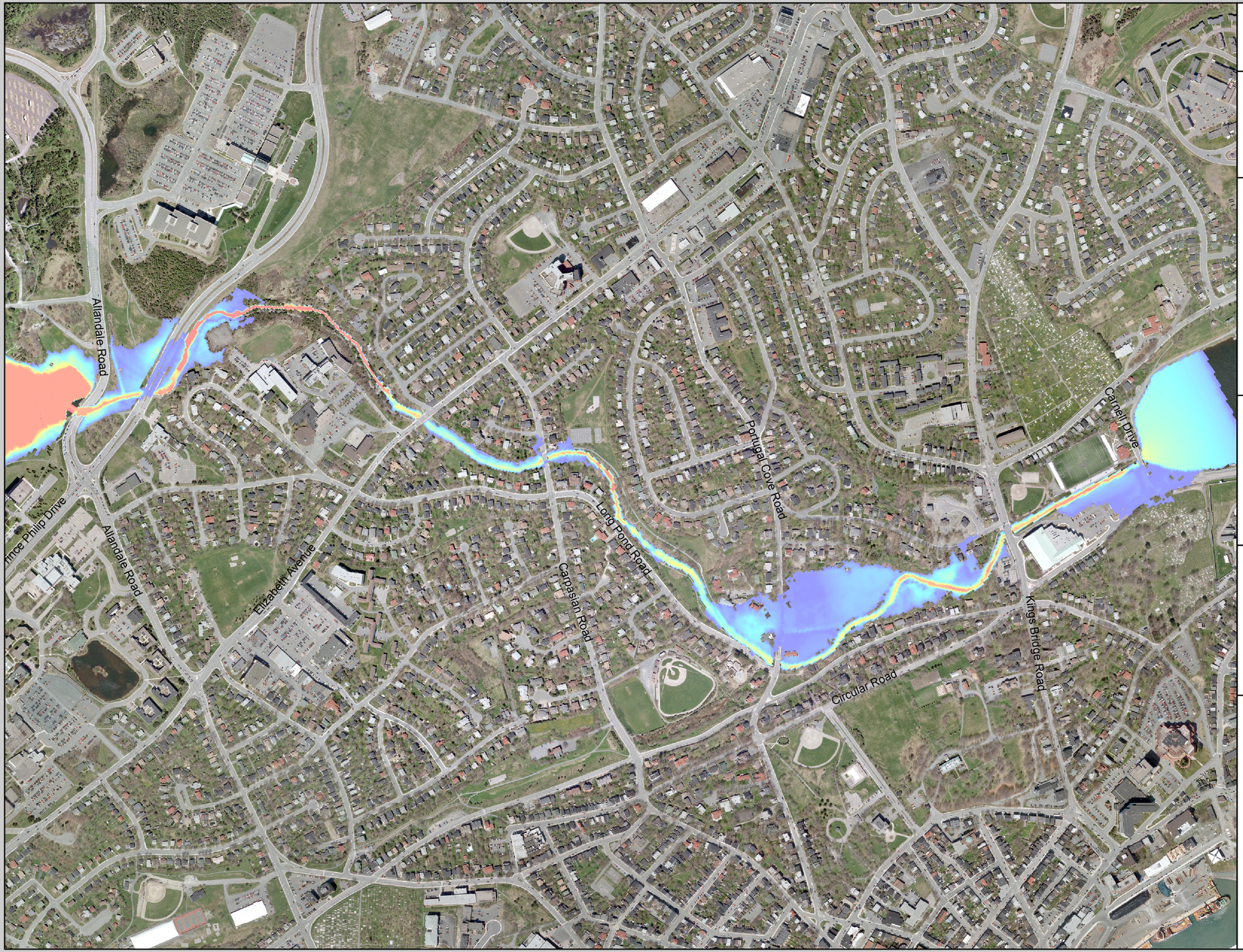
APPENDIX A

Notification Chart


Observer
Foreperson Water & Waste Water
Call Access St. John's 311
Operations Supervisor Water & Wastewater
Manager Water & Wastewater
EVALUATE Is there a potential for weir failure?
NO
YES
Deputy City Manager Public Works
Deputy City Manager Public Works
Review in field as required and plan immediate or long term remedial works with site personnel
City Manager
Emergency Operations Manager with City of St. John's
Follow the protocol as outlined in the City of St. John's Emergency Management Plan

APPENDIX B

Inundation Mapping



ST. JOHN'S
DEPARTMENT OF CORPORATE SERVICES

Long Pond Weir
Environmental Preview Report

Legend

Piping Failure Depth (m)

High : 5.63

Low : 0

Drawing Title:

Weir Breach Assessment
Piping Failure
Depth Map

CBCL LIMITED
Consulting Engineers

Coordinate System:
NAD_1983_MTM_1
Units:Metre
Scale:1:7,500

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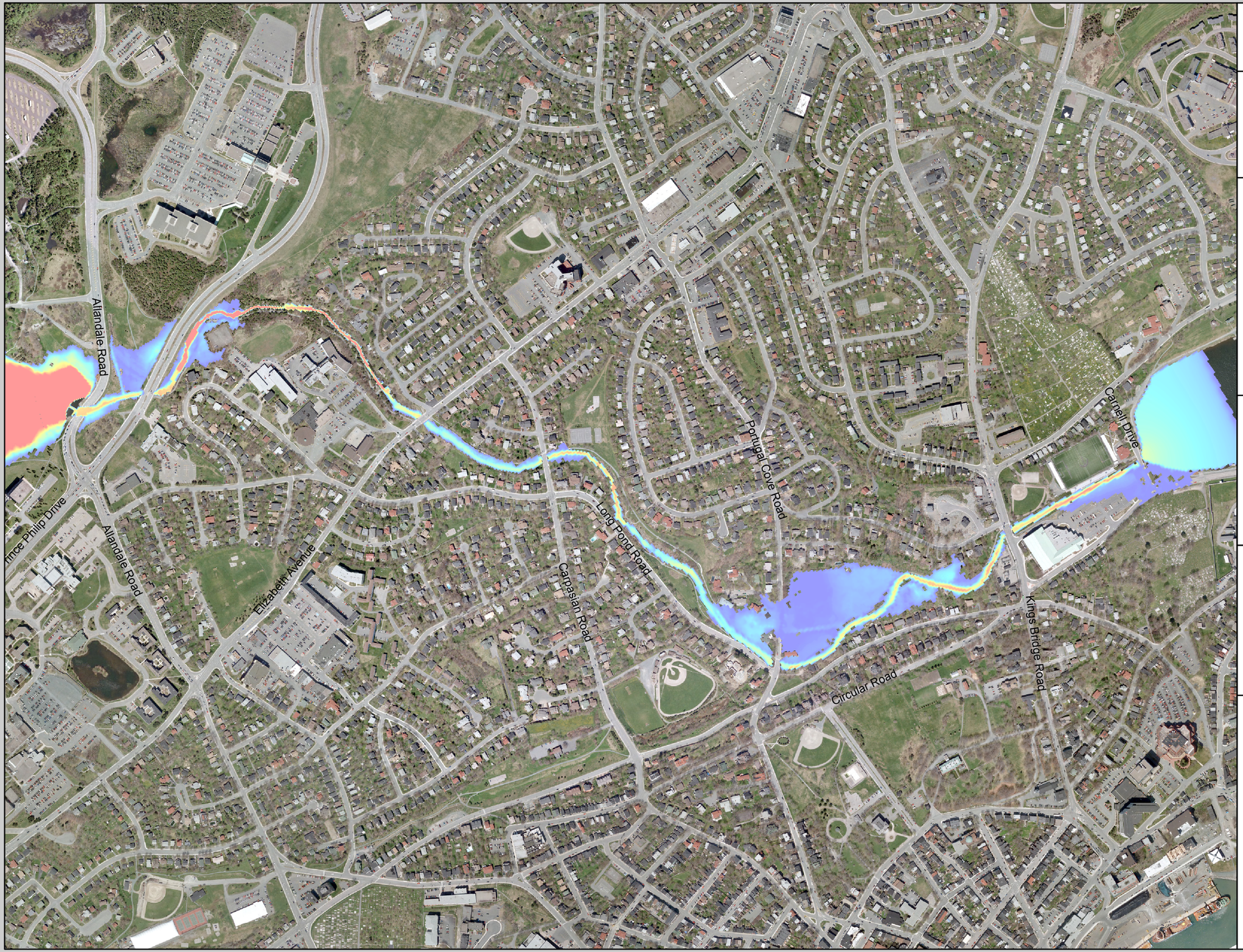

ST. JOHN'S
DEPARTMENT OF CORPORATE SERVICES

Long Pond Weir Environmental Preview Report

Legend

No Piping Failure Depth (m)

High : 5.28

Low : 0

Drawing Title:

Weir Breach Assessment
No Piping Failure
Depth Map

CBCL LIMITED
Consulting Engineers

Coordinate System:
NAD_1983_MTM_1
Units:Metre
Scale:1:7,500

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W
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S

ST. JOHN'S
DEPARTMENT OF CORPORATE SERVICES

Long Pond Weir
Environmental Preview Report

Legend

Overtopping Failure Depth (m)

High : 7.2

Low : 0

Drawing Title:

Weir Breach Assessment
Overtopping Failure
Depth Map

CBCL LIMITED
Consulting Engineers

Coordinate System:
NAD_1983_MTM_1
Units:Metre
Scale:1:7,500

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ST. JOHN'S
DEPARTMENT OF CORPORATE SERVICES

Long Pond Weir
Environmental Preview Report

Legend

No Overtopping Breach Depth (m)

High : 11.1

Low : 0

Drawing Title:

Weir Breach Assessment
No Overtopping Failure
Depth Map

CBCL LIMITED
Consulting Engineers

Coordinate System:
NAD_1983_MTM_1
Units:Metre
Scale:1:7,500

N
W
E
S

APPENDIX C

Record of Revision

APPENDIX W

Emergency Response Plan

February, 2016

LONG POND WEIR

Emergency Response Plan

Submitted to:
Greg Sheppard, P.Eng.
CBCL Limited
187 Kenmount Road
St.John's NL
A1B 3P9

REPORT

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TABLES

FIGURES FOLLOWING THE REPORT

APPENDICES

1.0 INTRODUCTION

The City of St. John's currently owns and operates a flood control weir at the outlet of Long Pond (Figure 1). The approximately 30 m long weir, with approximately 3 m wide crest and up to 5 m in height retains a head of up to 2 m under normal operating condition. The weir has a 6m pre-cast concrete opening to maintain water flow to Rennie's River. On either side of the opening there are also two (2) 2m wide manually operated flood gates set in pre-cast concrete channels.

The ability of the City of St. John's to effectively manage an emergency situation arising from a breach of the weir depends on their planning and preparedness. A key part to this preparedness is establishing a clear emergency response structure that is understood by all responders. This structure is presented in an Emergency Response Plan (ERP). An ERP is an internal document outlining actions to be taken by city staff during an emergency with the weir. An emergency preparedness plan (EPP) is prepared for external communication with the purpose of defining the hazards posed by the weir, the roles and responsibilities of all parties and notifications to be made. Emergency preparedness is an integral component of a dam safety management program to reduce the potential consequences of dam failure (CDA 2007).

This ERP outlines the procedures that operations personnel shall follow in the event of an emergency or unusual operation at the weir. The key emergency response roles and responsibilities, in order of priority, as well as the necessary notifications and contact information are also outlined in the ERP.

It is the intent that this ERP will be incorporated into the existing Emergency Management Plan (EMP) for the City and will undergo the scheduled review, testing, and updating as per the City's EMP maintenance plan.

2.0 EMERGENCY RESPONSE PLAN

2.1 Purpose

An ERP has been developed for the Long Pond Weir to assist the dam owner, the City, in determining the seriousness of identified hazardous conditions and to implement the appropriate responses to protect public safety.

Three typical levels of response have been outlined by the CDA as follows:

- *hazardous condition or incident* - does not pose immediate danger but could develop into one;
- *potential dam emergency* - downstream affected areas may need to take steps to mitigate damage or prepare for evacuation; and,
- *imminent or actual dam emergency* - widespread evacuation of the downstream population is required.

These three scenarios and appropriate actions for the Long Pond Weir are described in the following sections. Check sheets have been developed for each of the individuals responding to emergencies to prompt the appropriate actions in the field. These forms are in APPENDIX D and will be used during actual responses and kept on file for review.

2.2 Hazardous Conditions

2.2.1 Definition

A hazardous condition is classified as any condition resulting in the Long Pond Weir not operating as designed. These conditions are often warning signs for more serious issues that could result in weir failure. If they are caught in time, corrective actions or mitigation measures can be implemented to prevent a more serious event. It should be noted that hazardous conditions are not associated with routine maintenance activities such as vegetation control and corrosion of gates.

Some of the conditions to look for are as follows:

- leakages or seepage along the weir face;
- erosion along the face;
- boils or bulges along the face;
- deformation, slumping or sliding of the slope;
- cracking of the weir along the crest or face;
- reduction of freeboard along the weir, i.e. rising water levels beyond the safe operating range;
- blockage or restriction at the weir opening;
- turbid seepage water;
- whirlpools close to the weir; and,
- water bubbling before or after the weir.

These conditions can be identified during routine inspections carried out by the Water & Wastewater Distribution division within the Department of Public Works. The Department of Public Works will complete the following response.

2.2.2 Response Steps

2.2.2.1 Initial Report and Verification

If these conditions are observed, it is to be immediately reported to the Operations Supervisor for Water & Wastewater Distribution in the Department of Public Works. The following information will be ascertained if possible:

- name and position, if applicable, of person reporting the condition;
- description of the problem with photographic records;
- location and extent of the problem;
- likelihood of further deterioration;
- effects on surrounding infrastructure;
- long Pond elevation, i.e. higher or lower than usual;
- outlet (Rennies River) elevation, i.e. more or less flow than usual; and,
- note any other facts or observations provided by the observer.

The Operations Supervisor will immediately contact the Manager who will advise the Deputy City Manager Public Works of the current situation. The Operations Supervisor will go and inspect the weir with the Manager to assess and verify the extent of the hazardous conditions. The Operations Supervisor will fill out a special inspection form as shown in APPENDIX A.

2.2.2.2 Response Actions

The Operations Supervisor will complete the following:

- Update the Manager Water & Wastewater Distribution of the results of the special inspection, who will inform the Director of the current situation.
- Arrange for increased surveillance of the weir by individuals trained in dam safety procedures until the Operations Supervisor has re-evaluated the condition in the field and gives the “All Clear” if appropriate.
- Assess the condition of the weir in the field in collaboration with the Manager, the consulting engineer(s) and when necessary the Deputy City Manager Public Works.
- Determine and implement immediate actions in collaboration with the Manager that can mitigate or eliminate the problem, such as
  - Placement of sandbags;
  - Placement of rip rap along the face; and,
  - Removal of any obstructions in the weir opening or channel.
- Monitor the situation until an “All Clear” is acceptable or if the situation deteriorates elevate to a “Potential Dam Emergency” and follow the applicable response actions.

2.2.3 Notifications

Immediate notifications of the situation are to be made by the Manager and are limited to the Deputy City Manager, Public Works. The Manager and the Deputy City Manager may specify additional personnel or agencies that should be contacted depending on the situation. Refer to the Communications Directory in APPENDIX G for a complete list of personnel, and agencies. Outside consultants shall be contacted by the Deputy City Manager, if required.

At this stage, the situation is considered a hazard and therefore activation of the EPP is not required. All notifications are within the Department of Public Works. However, the notifications are such that if the conditions deteriorate into a potential hazard, the next notification would be to activate the standby conditions of the EPP.

When the situation passes without escalating, the Operations Supervisor is to complete and distribute a Notification of Hazardous Conditions (APPENDIX E). This will be sent to the Deputy City Manager and kept on file to be reviewed during the engineering inspections and the Dam Safety Review.

2.2.4 Evacuation

Since this is a hazardous condition and no immediate danger is posed, evacuation is not necessary at this time.

2.2.5 Media Contacts

As this situation does not pose immediate danger to the general public, media communication would not be necessary. However, if the media does become involved, all communications will be handled by the Public Information Officer of the Municipal Control Group (MCG) as per the City's EMP.

2.3 Potential Weir Emergency

2.3.1 Definition

A potential weir emergency is any situation that poses an immediate threat to the safety of the weir and downstream personnel and infrastructure. It may be necessary for affected areas to take steps to mitigate damage or prepare for evacuation. This can include but not limited to weakening foundations or abutments that could result in the failure of the weir and cause large or rapidly increasing uncontrolled release of water into Rennies River. It can also be the reduction in freeboard of the weir which would cause water to uncontrollably overtop the weir into Rennies River. Some examples of potential dam emergencies are as follows:

- loss of freeboard either by rising water or sinking of weir;
- extreme weather event forecast, i.e. heavy rains or warm temperatures that would melt snowpack quickly;
- excessive amounts of seepages/leaks;
- settlement on one side of a longitudinal crack;
- severe blockage of weir opening;
- existence of deep transverse cracks from Long Pond to Rennies River; and,
- severe erosion of weir material (external and internal).

These conditions can be identified during routine inspections carried out by the Water & Wastewater Distribution division within the Department of Public Works In potential dam emergencies, these events occur with little warning and require quick implementation of mitigating actions to stop it from becoming an actual dam emergency. The following response steps will be completed in such a situation.

2.3.2 Response Steps

2.3.2.1 Initial Report and Verification

If any of these conditions are observed, it is to be immediately reported to the Foreperson for Water & Wastewater Distribution in the Department of Public Works. The following information will be ascertained if possible:

- name and position, if applicable, of person reporting the condition;
- description of the problem with photographic records;
- location and extent of the problem;
- likelihood of further deterioration;
- effects on surrounding infrastructure;
- prevailing weather conditions;
- Long Pond elevation, i.e. higher or lower than usual;
- outlet (Rennies River) elevation, i.e. more or less flow than usual; and,
- note any other facts or observations provided by the observer.

If the initial observation was made by the Technician responsible for the routine inspections, the Operations Supervisor will ask the Foreperson to remain in the vicinity of the weir, if it is safe to do so; to monitor the conditions until further assessment can be made.

The Operations Supervisor will immediately contact the Manager who will advise the Deputy City Manager Public Works, and City Manager of the potential emergency situation. The Operations Supervisor and Manager and the consulting engineer will meet with the Foreperson to further inspect the weir and assess the potential of a dam emergency and develop an immediate action plan. The Operations Supervisor will fill out a special inspection form as shown in APPENDIX A and the Manager will update the Deputy City Manager of the situation.

2.3.2.2 Response Actions

Upon notification of the situation, the Deputy City Manager Public Works shall complete the following:

- arrange for a site command post (SCP) to be established at or near the weir, if it is safe to do so;
- arrange for constant 24-hour surveillance of the area by qualified individuals trained in dam safety procedures;
- monitor climatic conditions;
- assess the situation at the weir in collaboration with the Manager, Operations Supervisor, City Manager, and external consultants;
- mobilize resources necessary to implement immediate actions plan;
- activate the standby portion of the EPP;

- determine whether it is an imminent emergency and if so activate the evacuation portion of the EPP by notifying personnel in Phase 2 of the notification chart (APPENDIX B) or if still potential emergency, maintain surveillance and implement mitigation actions;
- determine and implement immediate actions in collaboration with the Operations Supervisor, and external consultants that can mitigate or eliminate the problem, such as:
  - placement of sandbags;
  - dump fill at leakage location;
  - placement of rip rap along the face;
  - removal of excess water;
  - removal of any obstructions in the weir opening or channel; and,
- monitor situation until the potential emergency has been eliminated and give the “All Clear” or if situation deteriorates to become an imminent emergency activate the evacuation portion of the EPP by notifying personnel in the Phase 2 of the notification chart (APPENDIX B); make contacts directly, do not leave messages.

2.3.3 Notifications

The immediate notifications are to be made are shown in APPENDIX B. The Deputy City Manager Public Works is the key individual in coordinating evaluation of the potential emergency, remedial measures, impact reduction, etc.

The Deputy City Manager will activate the EPP and immediately notify the City Manager of the situation. Since emergency crews may be required and residents may need to be evacuated, the City’s MCG will have to be on stand by and possibly activated. The City Manager will contact the Emergency Operations Manager (EOM) who will then activate the standby stage of the EMP as per the City’s protocol.

If any individual responsible for making further notifications cannot be reached the alternate listed should be contacted. **DO NOT LEAVE MESSAGES.** Timely communication of the emergency is vital to successfully handle the situation. If neither the primary nor the alternate can be reached, it is the responsibility of the initiating caller to make the further notifications.

The Deputy City Manager or others may specify additional personnel or agencies that should be notified and initiate actions to reduce the downstream flooding hazard. Refer to the Communications Directory in APPENDIX G.

When the emergency situation is resolved, the Manager is to complete and distribute a Notification of Emergency Response (APPENDIX F). This will be sent to the Deputy City Manager and kept on file to be reviewed during the engineering inspections and the Dam Safety Review.

2.3.4 Evacuation

A potential weir emergency could create flooding downstream. Mitigation measures should be completed downstream by residents and responsible agencies. The City’s MCG will notify the personnel downstream of any preparations that are necessary as per the EMP protocols. Evacuation of the residents in the flood plain, as shown in the inundation maps APPENDIX C, may also be necessary. The evacuation stand by and/ or order will be made by the MCG as per the City’s EMP protocols.

2.3.5 Media Contacts

All official communications will be handled by the Public Information Officer of the MCG as per the City's EMP. Emergency announcements will be through local media and will follow the communications protocol in the City's EMP.

2.4 Imminent or Actual Weir Emergency

2.4.1 Definition

An imminent or actual weir emergency is any situation that will or likely will create a threat to residents and agencies downstream of the Long Pond Weir by the significant and or sudden increase of water flow in Rennies River. Evacuation downstream is necessary. In this scenario, the safety of the weir is in question. It is either about to fail, failing or has failed and flooding downstream is imminent or occurring. Little to nothing can be done to prevent or mitigate the situation with the weir. Some examples of imminent dam emergencies are as follows:

- complete loss of freeboard either by rising water or sinking of weir;
- extreme weather event forecast, i.e. heavy rains or warm temperatures that would melt snowpack quickly and exceed the safe conveyance capacity of the weir;
- piping through weir;
- foundation failure;
- significant settlement on one side of a longitudinal crack, i.e. sinking to at or below the water level;
- severe to complete blockage of weir opening;
- large slide or sloughing of material on the face of the weir reducing the thickness and or the stability; and,
- severe erosion of weir material creating thinning of the weir and creating a weak zone that could or has failed.

These conditions can be identified during inspections carried out by the Foreperson Water & Wastewater Distribution division within the Department of Public Works or by the general public observations. The public can report such observations by calling 311 or submitting an Access St. John's request via the mobile app or email. However, in imminent or actual weir emergencies, these events occur with little warning and require quick implementation of mitigating actions to reduce the amount of damage caused by the flooding and to activate the evacuation portion of the EPP. Little to nothing can be done to eliminate or slow down the emergency. The following response steps will be completed in such a situation.

2.4.2 Response Steps

2.4.2.1 Initial Report and Verification

If any of these conditions are observed, it is to be immediately reported to the Operations Supervisor Water & Wastewater Distribution in the Public Works Department. The following information will be ascertained if possible:

- name and position, if applicable, of person reporting the condition;
- description of the problem with photographic records;
- location and extent of the problem;

- likelihood of further deterioration;
- effects on surrounding infrastructure;
- prevailing weather conditions;
- long Pond elevation, i.e. higher or lower than usual;
- outlet (Rennies River) elevation, i.e. more or less flow than usual; and,
- note any other facts or observations provided by the observer.

If the initial observation was made by the Foreperson responsible for the routine inspections, the Operations Supervisor will ask them to remain in the vicinity of the weir, if it is safe to do so; to monitor the conditions until further assessment can be made.

The Operations Supervisor will immediately contact the Manager Water & Wastewater Distribution who will advise the Deputy City Manager Public Works, and City Manager. The Operations Supervisor and the Manager will meet with the Foreperson to further inspect the weir and assess whether it is an imminent or actual weir emergency. The Operations Supervisor will fill out a special inspection form as shown in APPENDIX A and the Manager will update the Deputy City Manager on the situation.

If the situation has already gone from a potential weir emergency to an imminent emergency, the Deputy City Manager is to notify the City Manager to initiate the evacuation portion of the EPP as per the City's EMP.

2.4.2.2 Response Actions

Upon notification of the situation, the Deputy City Manager Public Works shall complete the following:

- arrange for a SCP to be established at or near the weir, if it is safe to do so;
- arrange for constant 24-hour surveillance of the area by qualified individuals trained in dam safety procedures;
- assess the situation at the weir in collaboration with the Operations Supervisor, , Manager, City Manager, and external consultants; and,
- activate Phase 2, evacuation portion of the EPP.

2.4.3 Notifications

The immediate notifications to be made are shown in APPENDIX B, Phase 2 notifications will be followed since the situation has already gone past hazard.

The Deputy City Manager will immediately notify the City Manager of the situation. Emergency crews are required and residents need to be evacuated, the City's MCG will be activated. The City Manager will contact the EOM who will then activate the EMP as per the City's protocol.

If any individual responsible for making further notifications cannot be reached the alternate listed should be contacted. **DO NOT LEAVE MESSAGES.** Timely communication of the emergency is vital to successfully handle the situation. If neither the primary nor the alternate can be reached, it is the responsibility of the initiating caller to make the further notifications.

The Manager or others may specify additional personnel or agencies that should be notified and initiate actions to reduce the downstream flooding hazard. Refer to the Communications Directory in APPENDIX G.

When the emergency situation is resolved, the Deputy City Manager is to complete and distribute a Notification of Emergency Response (APPENDIX F). This will be sent to the City Manager and kept on file to be reviewed during the engineering inspections and the Dam Safety Review.

2.4.4 Evacuation

An imminent or actual weir emergency will create flooding downstream. Evacuation of residents in the flood plain, as shown in the inundation maps Appendix C, will be required until the situation has been resolved and it is safe to return. The evacuation order will be made by the EOM with the MCG as per the City of St. John's EMP protocols. Traffic on downstream roads that may be flooded should be immediately curtained.

2.4.5 Media Contacts

All official communications will be handled by the Public Information Officer of the MCG as per the City's EMP. Emergency announcements will be through local media and will follow the communications protocol in the City's EMP.

3.0 PREVENTATIVE ACTIONS

The following remedial measures can be taken in an attempt to reduce or eliminate an emergency weir situation.

Loss of freeboard or dam cross section due to erosion

In the case of loss or reduction of freeboard or weir cross-section due to erosion and or increased water in Long Pond, the following measures can be implemented:

- lower the water level in Long Pond, if possible, by maximizing discharge, water diversion, pumping or upstream retention, if possible;
- place additional rip rap, materials or sand bags in damaged areas to prevent further erosion, if safe to do so;
- restore freeboard using earth and fill if safe access by equipment is available, if not use sand bags along the rest of the weir.

Slides on the upstream or downstream slope

Slides on the upstream or downstream slope dictate that the following measures be taken:

- stabilize slides by placing a weighting toe berm in the area using soil, rock, gravel or sand bags; and,
- repair the slide area using soil, rock, or gravel to re-establish the slope cross section.

Erosion flows through the weir, foundation, or abutments

When erosion flows occur through or around the weir the following measures can be taken:

- attempt to reduce the flow through by placing material or sand bags in Long Pond at the location of the problem;
- if it is possible, lower the water in Long Pond until the flow is reduced or stops completely; and,
- place a reverse filter berm over the exit point, if possible, this will allow seepage through but stop the erosion of fine material.

Blockage of weir opening

When material or objects are blocking the weir opening and restricting the flow, the following measures can be taken:

- using appropriate equipment, remove obstruction;
- open the flood gates to lower water levels; and,
- if necessary increase the freeboard by placing material or sand bags along the crest of the weir.

Excessive seepage and high level saturation of the weir

If excessive seepage or a high level of saturation in the weir is observed, the following measures can be taken:

- if it is possible, lower the water level in Long Pond below the seepage or saturation area;
- place material or sand bags along the weir slopes to slow down the seepage; and,
- continue frequent monitoring for signs of slides, cracking or concentrated seepage along the weir faces.

Excessive settlement of the weir

If excessive settlement of portions of or the entire weir occurs, the following measures can be completed:

- if possible reduce the water level in Long Pond to below the settlement area; and
- restore the level of the freeboard by placing material or sand bags in the affected area.

Mass movement of weir on its foundation- spreading or mass sliding failure

If a mass movement of the weir occurs, it should be dealt with as follows:

- lower the water level in Long Pond by opening flood gates until the movement stops;
- plug leak location with sand and gravel to prevent weir erosion;
- place material, boulders, or sand bags along the toe of the movement to stabilize the toe, if it is safe to do so; and,
- continue lowering water until a safe level has been reached and permanent repairs can be completed on the weir.

4.0 SITE ACCESS

The primary and secondary routes to access the weir are provided in this section. It is important to have these routes specified prior to an emergency event so response teams can be efficient arriving on the scene. Areas that would be affected by flooding are shown in APPENDIX C Inundation Mapping.

4.1 Road Access

The Long Pond Weir is constructed adjacent to the Allendale Road Bridge. Access to the site is by Allendale Road, which is a public road through St. John's.

4.2 Foot Access

The Long Pond Walking Trail runs along Long Pond and adjacent to the Long Pond Weir. Personnel can gain access to the weir from the walking trail if necessary. Access of some construction equipment can be made with the trail.

4.3 Air Access

If necessary, air access to the Long Pond Weir is available by helicopter. There are a number of locations that a helicopter can land in the area, such as a large field north of the weir that is part of Pippy Park, and grassy areas south west of the weir behind the Leslie Harris Centre on the MUN campus. Both of these areas do not have overhead lines or trees.

4.4 Effect of Weir Breach

In the event of a weir breach, or a large flood, access to the site will be affected as follows:

- The Allendale Road in the area of the bridge will be flooded but not the entire road therefore partial access can be gained to the weir.
- Portions of the walking trail will be flooded therefore not safe to use this access method.
- Portion of the Pippy Park field will be flooded however, helicopters could still land in the northern portion of the field and the area behind the Leslie Harris Centre is unaffected and can be used as a landing area for helicopters.

4.5 Response during Periods of Darkness

Response to potential or actual emergency conditions during periods of darkness is to be conducted in a similar manner as responses during daylight periods. Please refer to the details outlined in Section 2.

Personal safety hazards are present when responding to any hazardous or emergency situation. However, when responding to these situations during darkness, creates additional safety hazards due to limited visibility. The following additional precautions should be taken when responding to a potential or actual emergency during darkness:

- ensure adequate lighting for the assessment; i.e. vehicle head lights directed towards the weir, headlamp, flashlights with extra batteries and/or flood lamp;
- a generator should be mobilized for ECP;
- all emergency actions to be carried out with adequate lighting; and,

- assessments should be done in groups, however if it is unavoidable to investigate alone, use a call in safety system i.e. calling or texting Operations Supervisor every half hour with status to ensure personal safety.

It should be noted that response times during periods of darkness can be significantly increased because of reduced visibility and it is outside of normal office/operating hours.

Overall, personal safety is of the utmost importance, DO NOT TAKE RISKS when assessing the situation.

4.6 Response during Adverse Weather

Weather conditions play a major role in potential and actual emergency events. Heavy precipitation, high winds, and heavy snow and ice conditions can create flooding and/or damage to the weir. Therefore, if any of these conditions are forecast the following measures should be completed:

- increase the monitoring of the weir until adverse weather passes; and,
- immediately report any storm damage to the Operations Supervisor, who will notify the Manager Water & Wastewater Distribution, who shall determine if it is necessary to initiate the Potential Weir Emergency response procedures.

During adverse weather conditions, access to the weir could become difficult. In order to conduct a visual assessment of the dam, personnel may have to gain access by foot, helicopter, or arrange for snow clearing to the site. As a result, response times will be significantly longer.

5.0 COMMUNICATION SYSTEMS, EQUIPMENT, AND MATERIALS

Effective communication and quick response to implement mitigation efforts are essential when dealing with potential or actual emergency situations.

5.1 Communications

General

Notification procedures for the various emergency scenarios with key personnel are given in the Notification flow chart in APPENDIX B.

A comprehensive listing of names, agencies, and telephone numbers is given in the Communications Directory in APPENDIX G.

Communications

There is no direct access to a landline at the Long Pond Weir. Individuals assessing the weir should have a fully charged cell phone on them to be able to report back to the Operations Supervisor, Manager, or Deputy City Manager depending on the scenario.

In the event cell phone service is unavailable due to an outage, communications can be established from the weir to supervisors by radios.

5.2 Equipment and Materials

Civil Equipment and Material

The City of St. John's has various pieces of heavy equipment that are available for use when needed. To organize equipment use, contact the Operations Supervisor Water & Wastewater Distribution.

If the City does not have the necessary pieces of equipment there are various contracting companies in and around St. John's that have the required equipment and could help in the situation. These companies are listed below:

Table 1: Construction Companies in St. John's Area

Company Name	Phone Number
Pyramid Construction Ltd	709-576-8802
H.J. O'Connell Construction Ltd	709-726-9095
Pennecon Ltd	709-782-3404
J3 Consulting & Excavation Ltd	709-682-1750
Dexter Construction Company Ltd	709-726-5246
Weir's Construction Ltd	709-368-4081
Trident Construction	709-368-8835
RJG Construction Ltd.	709-753-5229

There are a number of quarries in and around St. John's where material can be obtained to fill sand bags or place along the weir to prevent further deterioration. Most of these quarries are owned by the construction companies listed above and acquisition of material can be made through them.

5.3 Helicopter Services

In the extreme cases when road and foot access is not available to the weir then helicopters have to be used; the following companies can be contacted:

Table 2: Helicopter Services in the St. John's Area

Company	Phone Number
3D Helicopters	709-738-6295
Cougar Helicopters Inc	709-758-4800
Universal Helicopters Newfoundland Ltd	709-576-4611

6.0 INUNDATION MAPPING

Inundation mapping was completed for four (4) scenarios which were:

- 1 in 100 year flood weir safe (Sunny Day flood weir safe);
- 1 in 100 year flood weir breach (Sunny Day flood weir breach);
- 1 in 1000 year flood weir safe; and,
- 1 in 1000 year flood weir breach.

In all scenarios the flooding begins at the Allendale Road Bridge and follows Rennies River ending in Quidi Vidi Lake. The majority of the flooding occurs along the river banks however, the river spreads out over the banks in the following areas:

- Carpasian Road Bridge area;
- Portugal Cove Road Bridge area;
- Area between Rennies River Trail and Winter Avenue;
- Dominion Parking Lot; and,
- Carnel, Clancey Avenues and Lake Avenue intersection.

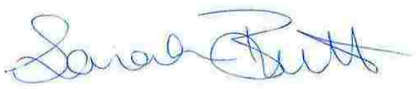
The maps are shown in APPENDIX C for all four (4) scenarios. It should be noted that these maps are hypothetical and many assumptions had to be made when modelling these scenarios. The intent of the maps are to show the estimated maximum extents of flooding, flood depths, peak flow values for planning and evacuation purposes. However, the maps may be subject to considerable error due to model uncertainties and assumptions. They are to be used as a guide, and judgements regarding evacuation should be made referring to the maps but also taking into account actual conditions in these areas.

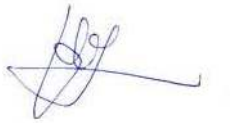
7.0 WARNING SYSTEM

There are no warning systems installed to notify downstream residents or agencies of potential or imminent flooding. Since warnings will only be required during potential, imminent or actual emergencies, all warnings will be activated by the City through the MCG as per their emergency management protocols.

Report Signature Page

GOLDER ASSOCIATES LTD.





Sarah Butt, P.Eng.
Intermediate Geotechnical Engineer

Shiu Kam, P.Eng. (Ontario)
Principal

SB/SK/kl

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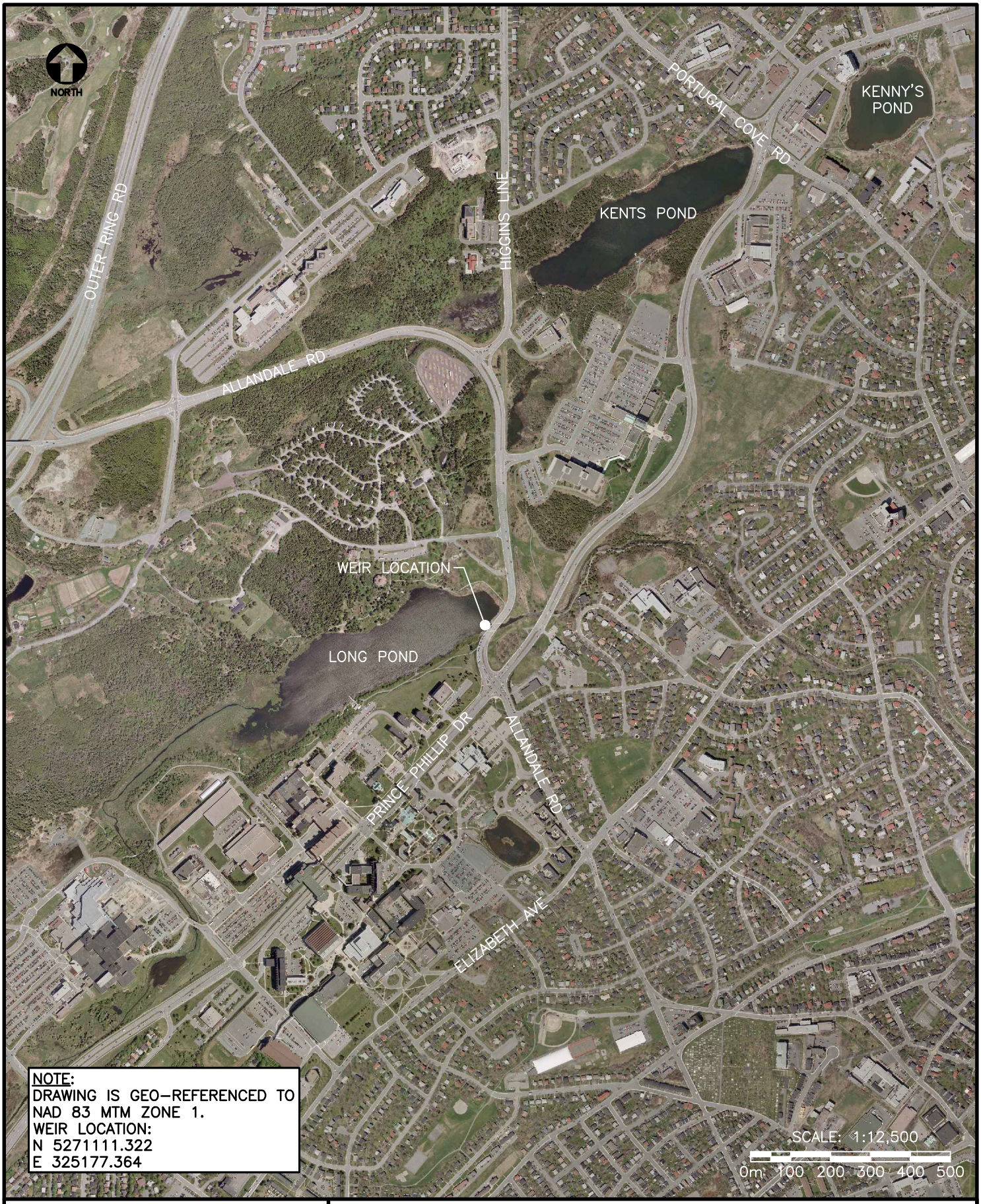
REFERENCES

Canadian Dam Association (CDA) 2007, Dam Safety Guidelines 2007.

City of St. John's, 2013. City of St. John's Emergency Management Plan. Accessed online January 12, 2016. http://www.stjohns.ca/sites/default/files/files/publication/Emergency%20Management%20Plan.pdf

Newfoundland and Labrador Hydro, 2002. Dam Safety Emergency Preparedness Plan Bay D'Espoir Hydroelectric Development Victoria Dam. Registered Copy # 27.



NOTE:
DRAWING IS GEO-REFERENCED TO NAD 83 MTM ZONE 1.
WEIR LOCATION:
N 5271111.322
E 325177.364

CBCL LIMITED
Consulting Engineers
187 KENMOUNT ROAD
ST. JOHN'S, NL, A1B 3P9
Phone: (709) 364-8623
Fax: (709) 364-8627

PROPOSED LONG POND WEIR

LOCATION PLAN

APPENDIX A

Special Inspection Form

SPECIAL INSPECTION FORM

Date: _____ **Time:** _____

Person Inspecting: _____ **Weather Conditions:** _____

Area of Concern: _____

Issue Reported By: _____

Reported Issue (Check all that apply)

Seepage	☐	Cracking	☐	Slumping of Material	☐
Settlement of Crest	☐	Loss of Freeboard	☐	Clogged Opening	☐
Erosion	☐	Piping	☐	Movement of Weir	☐
Whirlpool in Water	☐	Bubbling of Water	☐	Turbid Water	☐
Formation of Boils or Bulges	☐	Other (specify)	☐	_____	

Description of Issue

Size/Volume of issue (If safe measure dimensions): _____

Is this a pre-existing issue? Was it identified in routine inspection: ☐ Yes ☐ No

If yes: When was condition first identified? _____

Has condition gotten worse? ☐ Yes ☐ No

Have remedial actions been completed on this previously? ☐ Yes ☐ No

If No: When was the last inspection? _____

Are conditions deteriorating quickly? (i.e. issue hasn't changed since first identified or issue significantly changed since coming on site) ☐ Yes ☐ No

Weather Related Issues

Is there significant rain or drastic temperature change casing snowmelt in the forecast? ☐ Yes ☐ No

How high is the current pond level? _____

Would opening the flood gates assist the situation? ☐ Yes ☐ No

Are there high winds in the forecast? ☐ Yes ☐ No

Are current waves overtopping the weir? ☐ Yes ☐ No

Condition of Weir and Flow

Is the outlet of the weir unobstructed? ☐ Yes ☐ No

Is the water flowing out clear? ☐ Yes ☐ No

Is flow higher or lower than normal? ☐ Higher ☐ Lower

Are there any additional issues, i.e. cracks, erosion etc., with the weir? ☐ Yes ☐ No

Mitigation/Recommendations

Can the issue be remedied / mitigated quickly? ☐ Yes ☐ No

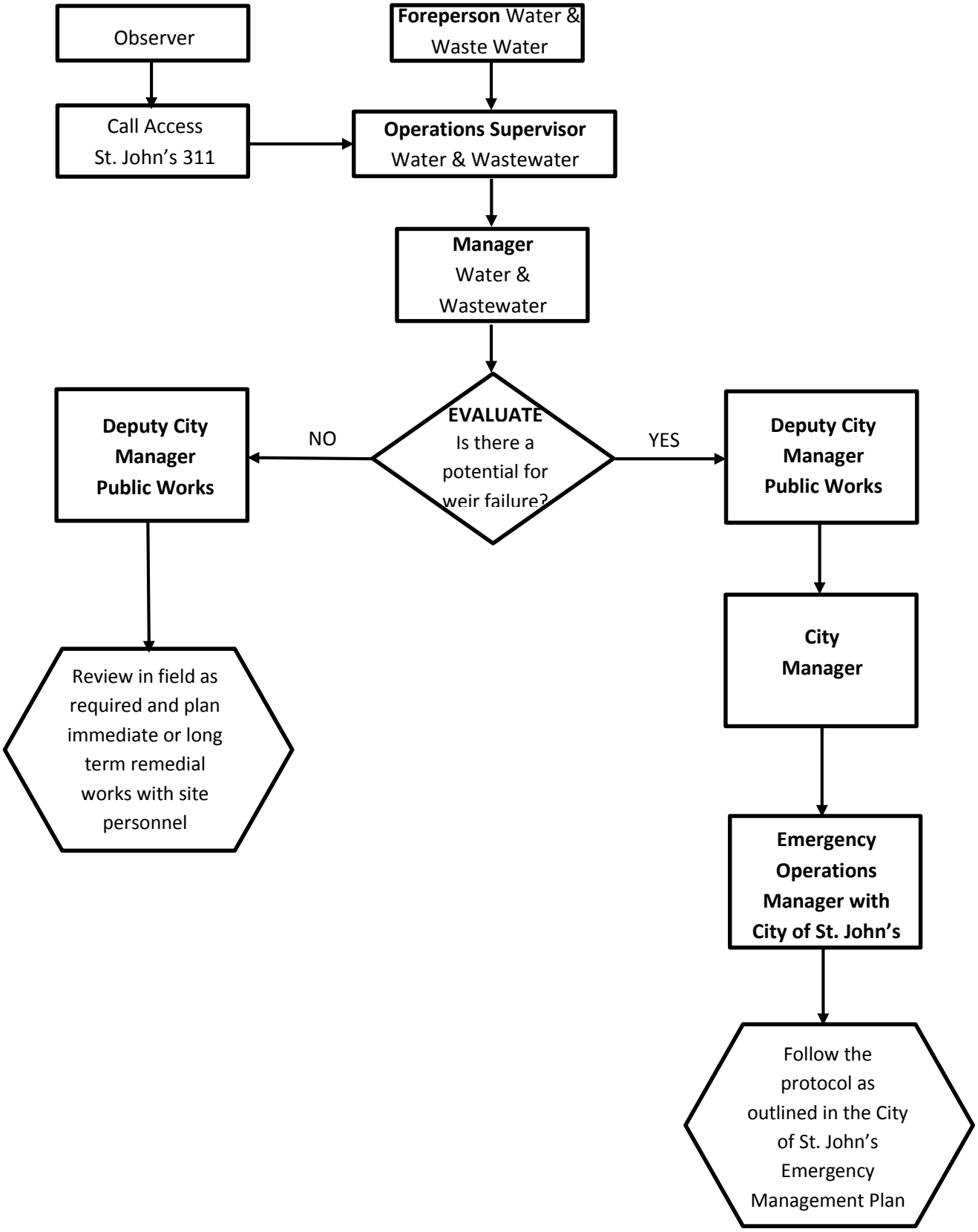
Will this issue cause a potential or imminent emergency? ☐ Yes ☐ No

Suggested emergency ranking: ☐ Hazard ☐ Potential Emergency ☐ Imminent/actual Emergency

Recommendations for immediate actions	Sketch / Notes

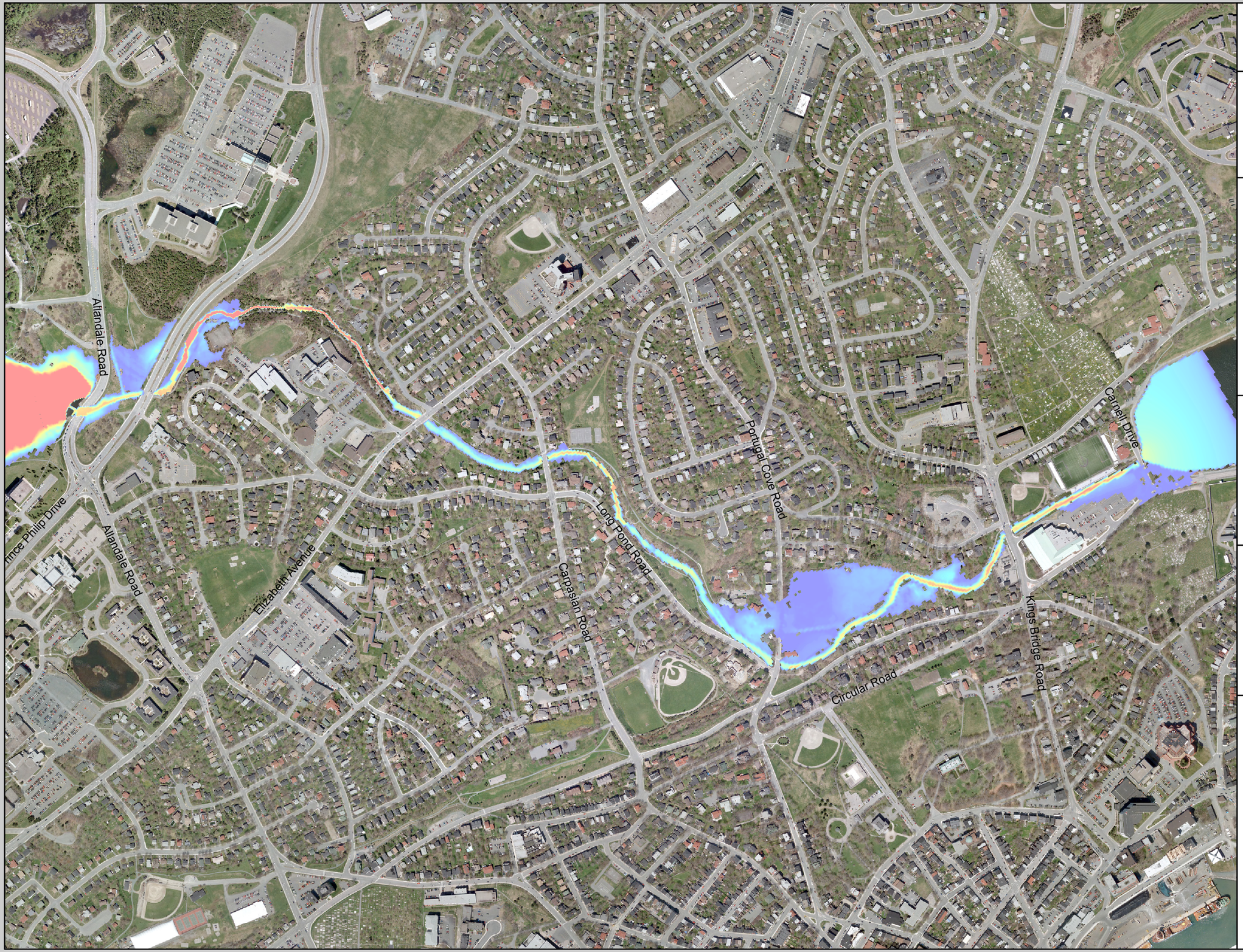
APPENDIX B

Notification Chart


Observer
Foreperson Water & Waste Water
Call Access St. John's 311
Operations Supervisor Water & Wastewater
Manager Water & Wastewater
EVALUATE Is there a potential for weir failure?
NO
YES
Deputy City Manager Public Works
Deputy City Manager Public Works
Review in field as required and plan immediate or long term remedial works with site personnel
City Manager
Emergency Operations Manager with City of St. John's
Follow the protocol as outlined in the City of St. John's Emergency Management Plan

APPENDIX C

Inundation Mapping



ST. JOHN'S
DEPARTMENT OF CORPORATE SERVICES

Long Pond Weir Environmental Preview Report

Legend

No Piping Failure Depth (m)

High : 5.28

Low : 0

Drawing Title:

Weir Breach Assessment
No Piping Failure
Depth Map

CBCL LIMITED
Consulting Engineers

Coordinate System:
NAD_1983_MTM_1
Units:Metre
Scale:1:7,500

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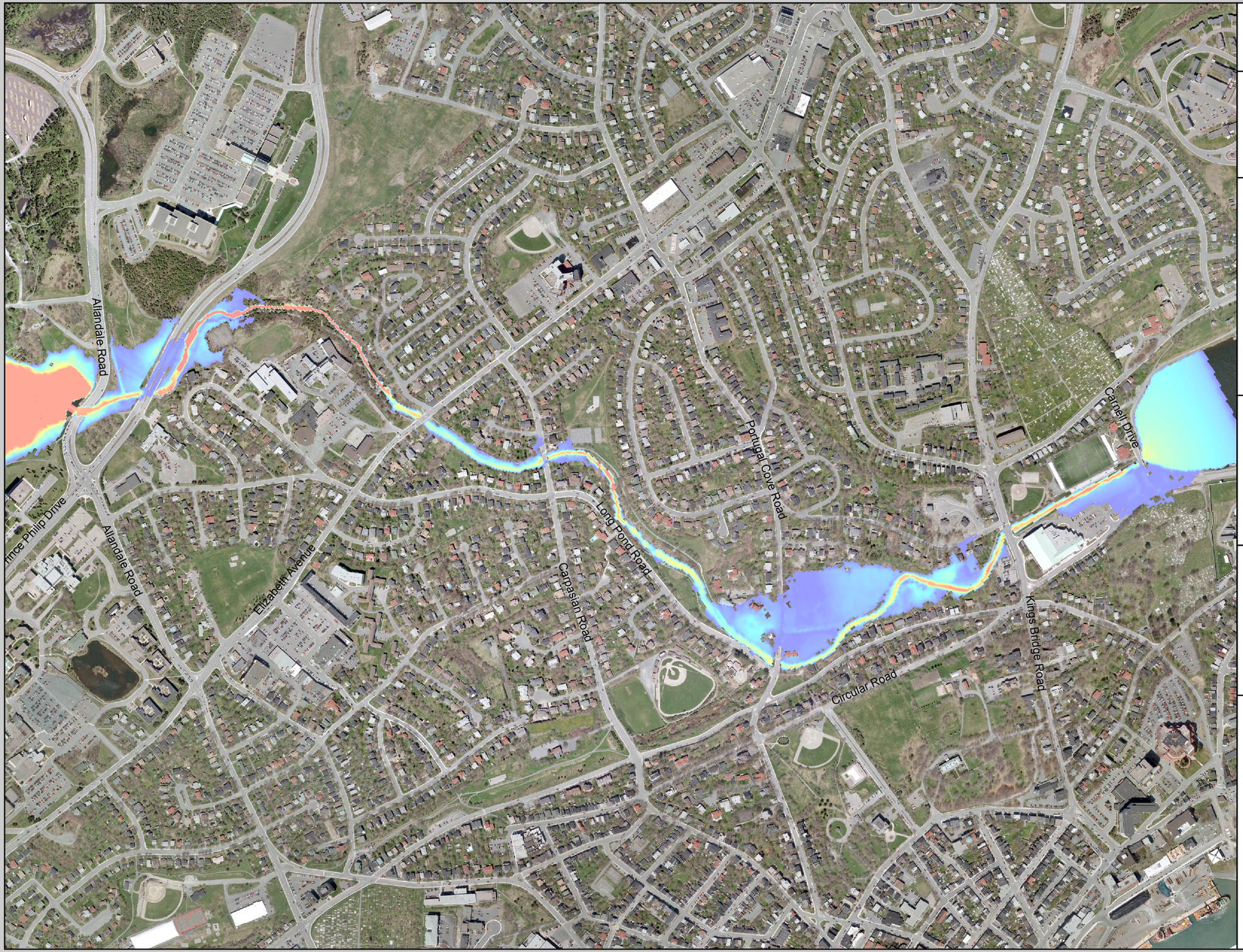

ST. JOHN'S
DEPARTMENT OF CORPORATE SERVICES

Long Pond Weir
Environmental Preview Report

Legend

Piping Failure Depth (m)

High : 5.63

Low : 0

Drawing Title:

Weir Breach Assessment
Piping Failure
Depth Map

CBCL LIMITED
Consulting Engineers

Coordinate System:
NAD_1983_MTM_1
Units:Metre
Scale:1:7,500

N
W E
S

ST. JOHN'S
DEPARTMENT OF CORPORATE SERVICES

Long Pond Weir
Environmental Preview Report

Legend

No Overtopping Breach Depth (m)

High : 11.1

Low : 0

Drawing Title:

Weir Breach Assessment
No Overtopping Failure
Depth Map

CBCL LIMITED
Consulting Engineers

Coordinate System:
NAD_1983_MTM_1
Units:Metre
Scale:1:7,500

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S

ST. JOHN'S
DEPARTMENT OF CORPORATE SERVICES

Long Pond Weir
Environmental Preview Report

Legend

Overtopping Failure Depth (m)

High : 7.2

Low : 0

Drawing Title:

Weir Breach Assessment
Overtopping Failure
Depth Map

CBCL LIMITED
Consulting Engineers

Coordinate System:
NAD_1983_MTM_1
Units:Metre
Scale:1:7,500

N
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E
S

APPENDIX D

Summary Response Check Sheets

OBSERVER/ FOREPERSON

Action Required	Completed? (Circle One)	Date/Time
Immediately report the issue or concern to the Operations Supervisor Water & Wastewater Distribution?	Yes/No	
Provided the following information: • Name and Location • Description of issue • Rate of deterioration • Effects on surrounding area • Water elevation in Long Pond • Water elevation in Rennies River • Weather Conditions • Estimated Time of occurrence	 Yes/No Yes/No Yes/No Yes/No Yes/No Yes/No Yes/No Yes/No	
Remain on site on standby as directed if it is safe to do so	Yes/No	

ACCESS ST. JOHN'S OPERATOR

Action Required	Completed (Circle One)	Date/Time
Record all information provided by observer	Yes/No	
Contact the Operations Supervisor Water & Wastewater Distribution	Yes/No	
Keep in contact with the observer if possible	Yes/No	

OPERATIONS SUPERVISOR WATER & WASTEWATER DISTRIBUTION

Action Required	Completed (Circle One)	Date/Time
Notify Manager of the current situation at the weir	Yes/No	
Verify report is genuine	Yes/No	
Go to site and discuss the issue with observer or technician	Yes/No	
Complete special inspection form	Yes/No	
Discuss the situation and inspection with the Manager Water & Wastewater Distribution	Yes/No	
Discuss potential mitigation measures with personnel at site	Yes/No	
Provide recommendations for immediate remedial actions	Yes/No	
Arrange for equipment and material to implement actions	Yes/No	
Supervise crews while work is being done	Yes/No	
Report to Manager when the work is completed	Yes/No	
Stay on site as directed if it is safe to do so	Yes/No	

MANAGER WATER & WASTEWATER DISTRIBUTION

Action Required	Completed (Circle One)	Date/Time
Received update of situation at the weir	Yes/No	
Notified the Deputy City Manager Public Works of current situation	Yes/No	
Inspected the weir condition with the Operations Supervisor	Yes/No	
Updated Deputy City Manager on situation	Yes/No	
Arrange surveillance of the area for the hazardous condition	Yes/No	
Assess the situation with the Deputy City Manager, Operations Supervisor, and City Manager in the field	Yes/No	
Discuss and implement immediate actions to be completed by operations	Yes/No	
Review and notify Deputy City Manager when remedial work is completed	Yes/No	
Monitor situation and give all clear or escalate to potential emergency	Yes/No	
Complete hazardous situation report for the weir	Yes/No	

DEPUTY CITY MANAGER PUBLIC WORKS

Action Required	Completed (Circle One)	Date/Time
Received full update with situation status by Manager Water & Wastewater	Yes/No	
Notify City Manager of situation at the weir	Yes/No	
Call External Consultants	Yes/No	
Arrange for site command post (SCP) to be established at the weir	Yes/No	
Arrange for qualified personnel to provide 24 hour surveillance	Yes/No	
Go to site to assess the situation with the Operations Supervisor, Manager and consultants	Yes/No	
Activate EPP standby	Yes/No	
Provide regular updates to City Manager of situation	Yes/No	
Determine any actions to be implemented with Operations Supervisor and consultants	Yes/No	
Monitor situation either escalate to imminent emergency or give all clear	Yes/No	
Notify City Manager of status change	Yes/No	
Activate EPP Phase 2 Evacuation	Yes/No	
Completed Notification of Emergency Response Form	Yes/No	

CITY MANAGER

Action Required	Completed (Circle One)	Date/Time
Received full debrief of situation from the Deputy City Manager	Yes/No	
Notify the Emergency Operations Manager with City of St. John's of potential emergency	Yes/No	
Went to site to assess the situation	Yes/No	
Activate EPP standby if necessary	Yes/No	
Receive regular updates from Deputy City Manager with status	Yes/No	
Notify/Update Emergency Operations Manager of status activate emergency if told to do so	Yes/No	

EMERGENCY OPERATIONS MANAGER

Actions Required	Completed (Circle One)	Date/Time
Discuss with City Manager the current situation	Yes/No	
Activate Standby procedures as per the City of St. John's Emergency Management Plan	Yes/No	
Keep in close contact with the City Manager	Yes/No	
Activate Emergency as per the EMP if told to do so	Yes/No	
Call off standby or emergency situation if told to do so	Yes/No	

APPENDIX E

Notification of Hazardous Conditions

LONG POND WEIR HAZARDOUS CONDITION RESPONSE FORM

(To be issued within 24 hour of any hazardous condition observation/response)

To: Deputy City Manager Water & Wastewater Date:_____

From: Manager Water & Wastewater Distribution File #: _____

CC:

Operations Supervisor Water & Wastewater Distribution

Date of Hazard: _____

Description of hazard: _____

Hazard Reported by: _____

Persons Notified: _____

Actions Taken: _____

Comments: (Lessons learned, improvement suggestions, etc.) _____

APPENDIX F

Notification of Emergency Response Form

LONG POND WEIR NOTIFICATION OF EMERGENCY RESPONSE FORM

(To be issued within 24 hours of any potential or imminent emergency response)

To: City Manager Public Works Date:_____

From: Deputy City Manager Water & Wastewater Distribution File #: _____

CC: Manager Water & Wastewater

Operations Supervisor Water & Wastewater Distribution

Date of Incident: _____

Description of Incident: _____

Persons Notified: _____

Actions Taken: _____

Comments (lessons learned, improvement suggestions, etc.) _____

APPENDIX G

Communication Directory

Table 3: Other Personnel and Agencies to Assist in Emergencies

	Agency or Personnel
1	Emergency Operations Manager
2	Deputy City Manager- Public Works
3	Deputy City Manager- Planning, Development and Engineering
4	Director of Regional Fire Services (Fire Chief)
5	Director of Engineering
6	Public Information Officer, City of St. John's
7	Senior Police Official with the Royal Newfoundland Constabulary
8	Senior Official Health Care Corporation
9	Manager Water & Wastewater Distribution
10	Infrastructure Engineer Water & Wastewater Distribution
11	Project Engineer Water & Wastewater Distribution
12	Foreperson Water & Wastewater Distribution
13	Operations Supervisor Water & Wastewater Distribution
14	Municipal Affairs Fire and Emergency Services
15	NL Power

Table 4: Consulting Engineers to Assist in Emergencies

Consulting Engineers	Phone Number
Golder Associates Ltd.	709 722 2695
CBCL Consulting Engineers	709 364 8623
Stantec Inc.	709 576 1458
Amec Foster Wheeler	709 724 1900

Table 5: Contracting Companies

Company Name	Phone Number
Pyramid Construction Ltd	709-576-8802
H.J. O'Connell Construction Ltd	709-726-9095
Pennecon Ltd	709-782-3404
J3 Consulting & Excavation Ltd	709-682-1750
Dexter Construction Company Ltd	709-726-5246
Weir's Construction Ltd	709-368-4081
Trident Construction	709-368-8835
RJG Construction Ltd.	709-753-5229

As a global, employee-owned organisation with over 50 years of experience, Golder Associates is driven by our purpose to engineer earth's development while preserving earth's integrity. We deliver solutions that help our clients achieve their sustainable development goals by providing a wide range of independent consulting, design and construction services in our specialist areas of earth, environment and energy.

For more information, visit golder.com

Africa	+ 27 11 254 4800
Asia	+ 86 21 6258 5522
Australasia	+ 61 3 8862 3500
Europe	+ 44 1628 851851
North America	+ 1 800 275 3281
South America	+ 56 2 2616 2000

solutions@golder.com
www.golder.com

Golder Associates Ltd.
62 Pippy Place - Suite 204
St. John's, Newfoundland, A1B 4H7
Canada
T: +1 (709) 722 2695

Golder Associates

APPENDIX X

Operation, Maintenance and Surveillance Manual

February 2016

LONG POND WEIR

Operation, Maintenance and Surveillance Manual

Submitted to:
Greg Sheppard, P.Eng.
CBCL Limited
187 Kenmount Road
St. John's, NL, Canada
A1B 3P9

REPORT

Report Number: 1535695-06-Rev 0

Distribution:

1 ecopy - CBCL Limited
1 copy - Golder Associates Limited

Golder Associates

Table of Contents

FIGURES FOLLOWING THE REPORT

APPENDICES

1.0 INTRODUCTION

1.1 Purpose of Operation, Maintenance, and Surveillance Manual

The Operation, Maintenance, and Surveillance Manual (OMS Manual) is a requirement of the Canadian Dam Association Dam Safety Guidelines (CDA 2013) to ensure all operational activities and constraints are defined for a particular dam and that the dam is managed with the appropriate level of regard for safety.

The OMS Manual provides both experienced and new staff with the required information needed to support a safe operation of the dam.

The OMS is a living document in the fact that is must be reviewed and updated accordingly. Documentation should be prepared during the construction phase and updated when major changes to the structures, equipment, or operating conditions. This document should also be reviewed regularly to ensure that the practices and other documentation are current. It is suggested that this would occur as a minimum during the periodic Dam Safety Review.

1.2 Project Description

The site selected for the construction of the weir is located at the east end of Long Pond at its outlet and the beginning of Rennies River, upstream of the Allandale Road Bridge in St. John's, NL (Figure 1). This location is within Pippy Park. The site is underlain by overburden consisting of clayey silt, gravelly clay, or sand, sandy gravel till and bedrock as determined from geotechnical investigations.

Long Pond is a part of the Rennies River Catchment, which is approximately 32 km^2, within the City of St. John's. In the past, this catchment has experienced flooding during significant rainfall events and has resulted in major public and private property damage. The City of St. John's commissioned the Rennies River Catchment Stormwater Management Plan study to determine and prioritize flood protection infrastructure improvements. From this study, it was found that the most significant flood protection improvement would be the construction of a weir located in the east end of Long Pond.

Long Pond Weir is a flood retention structure designed to attenuate the flow into the downstream area. The main purpose of the weir is to increase the holding capacity of Long Pond during a storm event, which in turn will decrease the flow going downstream and reduce the probability of flooding. The weir is approximately 30m long, 3m wide at the crest, and approximately 5m high. There is a 6m wide pre-cast concrete channel to maintain flows from Long Pond to the rest of Rennies River. There are also two (2) 2m wide flood gates on either side of the opening that are constructed in pre-cast concrete channels.

1.3 Site Access

The Long Pond Weir can be easily accessed by vehicle using Allandale Road. It can also be accessed via foot by using the Long Pond Walking Trail that encompasses both sides of the pond. If all other access routes are not accessible, the area can be accessed using helicopter. There are two grassy fields north, and southwest of the weir that are clear of power lines and trees that can be used as a helipad.

1.4 Construction Details

The construction of the weir and appurtenant structures will be detailed in an as built report which will be contained in Appendix C when it is completed. The weir is an embankment dam with 1.8H:1.0V upstream and downstream slopes.

The weir will be founded on competent glacial till which is approximately at 49m elevation based on previous geotechnical investigations. The weir will be constructed with 4 inch minus angular (blast rock) rock fill. The weir will have two layers of 600mm angular rip rap on the upstream and downstream slopes. There is a 6m wide pre-cast concrete channel for flow conveyance and fish passage. There are also two (2) 2m wide pre-cast concrete openings with hand operated gates on either side of the flow channel for flood control. These gates will be opened when the water elevation in Long Pond reaches 55.7m.

The weir is approximately 30m long and 3m wide at the top. The crest elevation of the weir is at approximately 56.3m. Approximately 600mm of rip-rap protection has been placed on the upstream and downstream sides of the weir opening to provide erosion protection over the long term operation of the weir.

A water level monitoring station has been constructed and installed on the side of Long Pond in close proximity to the weir. This station consists of a hut that houses the water level sensors, communications equipment i.e. antenna, modem and logger, and power source. The water level data can be accessed through the Provincial and Federal Government websites where it will update every two (2) hours, display trending data and save data for 12 months.

1.5 Dam Classification

The hazard classification of a dam is based on the incremental consequences of failure measures in the potential for loss of life, economic, social, and environmental losses. In other words, the classification is based on the incremental changes of flooding between the dam still operating and with the dam failing. Guidelines for assessing dam failure impacts are provided in CDA (2013). Appropriate engineering standards and care during operations are based on the consequence classification of the dam.

Based on the applicable CDA guidelines the Long Pond Weir is classified as a Significant Risk dam class (Golder 2015). This classification is characterized by having the following incremental changes:

- *Population at Risk:* Temporary only;
- *Loss of Life:* Unspecified;
- *Environmental and Cultural Values Incremental Losses:* No significant loss or deterioration of fish or wildlife habitat. Loss of marginal habitat only. Restoration or compensation in kind highly possible; and,
- *Infrastructure and Economics Incremental Losses:* Losses to recreational facilities, seasonal workplaces, and transportation routes.

1.6 Roles and Responsibilities

The Long Pond Weir is owned, operated, and maintained by the City of St. John's, Department of Public Works, Water and Wastewater Distribution division.

Inspections will be completed by the Foreperson within the Water & Wastewater Distribution division. The Operations Supervisor within the same division will review the inspection reports and notify the Manager or Deputy City Manager Public Works of any potential or imminent hazards. The Operations Supervisor will also arrange to have any necessary maintenance completed by the Operations group within the Water & Wastewater Distribution division.

The Deputy City Manager Public Works has the responsibility to maintain the OMS document, suggest any necessary changes, ensure the document is up to date, and ensure the applicable groups have and following the newest document.

For the purpose of the OMS Manual the following individuals have been identified:

Role	Name	Office Phone Number	Cell Phone Number
Operations Supervisor, Department of Public Works, Water and Wastewater Distribution division			
Manager, Water & Wastewater Distribution			
Deputy City Manager			

Note Due to privacy concerns, the names and numbers of the above positions have been omitted from this document. When the City of St. John's takes ownership of the weir, this information will be populated.*

1.7 Distribution and Revision of OMS

The OMS Manual will be distributed to the following people/groups:

- Water & Wastewater Distribution Personnel;
  - Foreperson;
  - Operations Supervisor;
  - Manager;
- Deputy City Manager Public Works; and,
- City Manager.

Reviews of the OMS Manual will occur whenever there is a change in structure, equipment, or operating condition and also during the Dam Safety Review. Any revisions that are deemed necessary to make will be made to the document by the Manager Water & Wastewater Distribution and then redistributed to the applicable parties.

2.0 OPERATIONS

2.1 General description of Operations

The Long Pond Weir will temporarily store water in Long Pond during storm events and spring freshet. The water will then be naturally released through the opening in the weir at a lower rate than it would naturally flow out of Long Pond.

There will be two (2) 2m metal flood gates installed in the weir. These gates are opened manually and do not have electrical components. The gates will be opened when the water levels in Long Pond reach 55.7m as determined from water level monitoring. The gates are made of quality material that is corrosion resistant, require virtually no maintenance and remain easily operable after long periods of inactivity. Regular testing of the gates will be carried out.

There will be a water level monitoring station on the banks of Long Pond which can be monitored remotely through provincial and federal government websites. The threshold water level for operating the gates will be marked in the wet well for easy reference.

2.2 Operations during extreme weather events (flooding and dry)

The main purpose of the Long Pond Weir is to moderate the downstream stream during extreme weather events. As a result of flow restriction the water level in the pond will increase from 53m to 55.7m maximum with an overall capacity increase of 160,000m^3 during a high flow event. The weir is designed to have a freeboard that can withstand the 1 in 100 year flooding event plus 30%. Due to elevations of nearby infrastructure i.e. Allendale Road Bridge, the weir will not be able to hold the precipitation from the 1 in 1000 year flood, and significant flood to the downstream infrastructure will occur. The weir is equipped with two flood gates which are manually operated. The gates are to be opened when the water levels in Long Pond reach 55.7m.

During dry season no water will be impounded upstream of the weir.

The Operations Supervisor will monitor weather conditions during critical flow periods (freshshet and storms) and schedule additional surveillance visits as necessary.

2.3 Flow Equipment and Systems

A water level monitoring station will be installed on the bank of Long Pond in close proximity to the weir. The water levels will be uploaded to the provincial and federal government websites and can be accessed by the general public. The websites will display the data every two hours, daily summaries and monthly summaries. Manual water level measurement can also be taken with a staff gauge or within the wet well inside the monitoring station.

2.4 Documentation and Reporting

There are no electrical or mechanical operating parts or procedures associated with the Long Pond Weir. Therefore documentation and reporting will be minimal. The only operating parts of the wear are the manually operated flood gates and the water level monitoring station. Documentation is required for the following activities:

- dam safety training records of personnel;
- routine inspections reports;
- engineering inspections reports;

- special inspection reports including equipment testing records;
- maintenance requests and completed reports; and,
- dam safety review reports.

Findings of routine inspections are to be reported to the Operations Supervisor Water & Wastewater Distribution. Depending on the severity of the findings, they will be further reported to the Manager, Deputy City Manager etc as per the reporting guidelines in the Emergency Preparedness Plan (EPP) and Emergency Response Plan (ERP).

Maintenance requests are to be reported to the Operations Supervisor who will then report it to the Manager and the Operations Supervisor to get it scheduled in to get completed.

2.5 References to EPP/ERP

The EPP and ERP for the Long Pond Weir describe the required steps to address hazardous operational conditions, potential dam emergency, and imminent or actual dam emergency. In all scenarios, the observer of the conditions must report it to the Operations Supervisor, who will report it to the Manager. Both will go to the site to assess the situation and decide the level of emergency and whether activation of the EPP is required or not.

The full EPP and ERP are available at the City of St. John's and should be reviewed and the responses should be well known to everyone working with the weir.

3.0 MAINTENANCE

3.1 General requirements of Maintenance

Regular maintenance will be required on the Long Pond Weir throughout its life. This will be the responsibility of the City of St. John's, Public Works Department. The routine maintenance is similar to that of other hydraulic structures mainly ensuring the opening is clear of debris and the flow is not inhibited.

Other such maintenance issues associated with embankment dams are:

- clearing of debris and vegetation from flow passage way and gate inlets;
- removing and mowing vegetation, if applicable;
- establishing desirable vegetation cover, if applicable;
- controlling burrowing animals;
- replacing deteriorated riprap;
- restoring settled crest and freeboard;
- repairing seepage-induced slumping; and,
- controlling and repairing surface erosion features.

3.2 Maintenance Planning and Frequency

Routine maintenance such as clearing the opening of debris and establishing desirable vegetation cover; should be completed on a regular basis, typically on a bi-weekly schedule depending on the season.

Other maintenance items such as controlling burrowing animals, repairing damage and controlling surface erosion will be carried out on an as required basis. Such need will be determined during routine surveillance or maintenance of the weir.

All maintenance requirements and requests are to be identified during the routine inspections. The requests are to be reported to the Operations Supervisor who will then work with the Manager to get the requested maintenance in the schedule and completed in a timely manner. Once the request has been completed, the Operations Supervisor will notify the Manager so the work can be documented and tracked.

3.3 Triggers to Maintenance

Regular maintenance is to be expected for the life of the Long Pond Weir; however, maintenance outside of the routine and periodic is also to be expected. This other maintenance will be determined during routine surveillance, annual dam safety reviews, or hazardous or potential emergency observations. Other types of maintenance or remediation could include but are not limited to the following:

- cracking along the crest or in the weir;
- seepage along the weir;
- settlement in the weir;
- cracking of the pre-cast concrete channels; and,
- slumping along the weir.

Anything that is changed from the previous surveillance record should be further inspected to determine if it is natural or if it is an indication of incipient failure. Both instances would require maintenance. The extent and timing of this maintenance would differ depending on the seriousness of the deficiency.

3.4 Maintenance and Testing of Flow Control Equipment

Flow control equipment at the Long Pond Weir consists of two (2) 2m wide flood gates. These flood gates are opened only when the water levels reach 55.7m in Long Pond; therefore it is not anticipated to operate them frequently. However it is important to ensure that they are in working order in the unlikely event they have to be used. The manufacturer of the gates state the “gates are made with high quality materials, such as 304/304L or 316/316L grade stainless steel and virgin UHMWPE, ensuring the best corrosion resistance for a long life in the toughest environments with virtually no maintenance required” (ISEaquanox, 2013). The manufacturer also states “the gates will also remain easily operable even after very long periods of inactivity” (ISEaquanox, 2013).

The flood gates are to be inspected along with the rest of the weir during the routine inspections and any requirements for maintenance are to be noted and planned as per the rest of the weir maintenance requirements. As part of the routine inspection, the flood gates are to be tested to ensure they are in working order. To test the gates, the inspector should open each gate just enough to allow water through the bottom of the weir. Annual full function testing of the gates should be carried out in the fall of each year.

4.0 SURVEILLANCE

4.1 General Requirements

Surveillance programs are a requirement for dams because failures are often preceded by warning signs that are may be detected from field observation. The main purpose of surveillance is to identify changes in the performance conditions early on so that the appropriate corrective actions and/or risk mitigation measures can be implemented prior to more adverse consequences such as failure occur.

4.2 Surveillance Program

The surveillance program consists of visual observations by trained staff and qualified professional engineers. The frequency of inspections and monitoring activities depend on regulatory requirements, hazard classification of dam, dam condition and past performance, time of development of expected failure modes, and seasonal or other access constraints.

Surveillance will include routine inspections, engineering inspections and special inspections. A dam safety inspection by an engineer is carried out as part of the dam safety review. The requirements for inspections are discussed further in the following subsections.

Surveillance inspections will be compared to a baseline condition inspection which would be completed shortly after construction as part of the as-built record. The visual inspection is to detect changing conditions which may be a concern for dam safety and operability. It is important to review previous inspections before conducting the current inspection, so the inspector is familiar with the pre-existing conditions and can make comments regarding the change in non-conformities or the development of new ones. By reviewing the previous inspections, it is less likely that non-conformities will be over looked.

4.2.1 Routine Inspections

Routine inspections are completed on a semi-monthly frequency by the Foreperson with the Water & Wastewater Distribution division of the Public Works Department with the City of St. John's. The Foreperson is to be adequately trained to be able to identify issues with the weir. The main purpose of these inspections is to identify any conditions that may change the weir performance and would require follow-up. The following occurrences should be noted:

- new or changes in leakages;
- erosion;
- sinkholes;
- boils;
- seepage;
- slope slumping or sliding;
- settlement;
- displacements or cracking of crest;
- cracking in the pre-cast concrete channels;
- clogging of weir opening;
- monitoring equipment is working properly; and,
- flood gates are operating properly.

Inspection observations are to be documented on an inspection form (Appendix A). These forms are reviewed by the Operations Supervisor and Manager who are responsible for the weir, distributed to the applicable parties within the Public Works Department and filed. From these reports, it will be determined if maintenance activities are required, or an additional more in depth inspection is required to define the scope of maintenance.

4.2.2 Engineering Inspections

Engineering inspections are more detailed than the routine inspections. These occur on an annual basis, however based on the condition of the weir; the frequency may increase to bi-annually or decrease to semi-annually inspections. These inspections are conducted by a professional engineer registered in the province or their designate who are not involved with the day to day operation or monthly surveillance of the weir. It would normally be completed by a third party consultant hired by the City of St. John's.

The engineering inspection is a more detailed routine visual inspection of the weir and the associated monitoring equipment, if any. The main purpose of these inspections is to highlight significant changes from previous inspections, assessment of the severity of observed issues and provide recommendations for maintenance, repairs, investigations or additional monitoring. These observations would be documented by the inspector, reviewed with the Operations Supervisor and the Manager who is responsible for the weir, distributed to applicable parties, and filed. The recommendations are be discussed and an action plan developed to address the observed concerns.

4.2.3 Special Inspections

Special inspections are not planned at a pre-determined frequency. These inspections would occur based on extreme weather events and observations of hazardous, potential or imminent/actual emergency conditions. It is recommended that an inspection would occur during an extreme weather event, if it is safe to do so, to observe and determine how the weir operates when it is stressed. If this is not possible, an inspection must be completed after the weather event to determine if there was any damage to and any necessary repairs to the weir. Some extreme weather events that would warrant this special inspection include but not limited to:

- heavy rainfall;
- flooding;
- windstorms;
- severe icing;
- rapid snowmelt;
- earthquakes;
- exceedance of maximum operating water level; and,
- hurricanes or tropical storms.

These special inspections will be completed by the Operations Supervisor and/ or Manager when hazardous, potential and/or imminent/actual emergency conditions have been observed, as per the protocols in the EPP and ERP. Safety is of the utmost importance; therefore if it is unsafe to complete these inspections they will not be completed. A sample of a special inspection form is in APPENDIX B.

4.2.4 Dam Safety Reviews

Dam safety reviews are a requirement of the CDA Dam Safety Guidelines (CDA 2013) and the Government of Newfoundland and Labrador Department of Environment and Conservation. The frequency of these reviews is dependent on the hazard classification of the dam. For the Long Pond Weir, the classification is Significant Risk Hazard and the frequency of the dam safety reviews is every 10 years. Notwithstanding more frequent Dam Safety Reviews should be conducted when there is material change in the weir.

These reviews will be conducted by a third party engineering consultant who is registered and licensed to practice in the province. The dam safety review will include a systematic evaluation of the safety of the weir, assessment of the performance of the weir, and review to ensure that the construction meets current standards.

The reviews will be documented and reviewed with the Operations Supervisor, Manager Water & Wastewater Distribution and Deputy City Manager Public Works. The reviews will then be distributed to the necessary parties within the Public Works Department, mitigation plans for any findings will be developed and implemented by the Manager and Operations Supervisor and the report will be filed with the other reviews in document control.

4.3 Procedures for Surveillance

Surveillance activities should be completed in a methodical manner. It is important when arriving on site to have all the necessary equipment to complete the inspection. These items include:

- inspection form which includes drawings of the weir;
- camera;
- fully charged cell phone, or other means of communication, i.e. sat phone or radios;
- field note book;
- GPS, if one is available;
- tape measure, ruler, or something similar to use as a scale;
- bucket or graduated container and a stop watch for measuring any seepages; and,
- flagging tape, and/or spray paint for marking potentially hazardous conditions for monitoring purposes.

Before starting the inspection, the inspector, weather conditions, date and time must be documented on the inspection form. During the inspection, it is very important to take good notes and pictures to describe what is being observed. These inspections document the first indication of performance issues and they prompt maintenance work. They are also used to assess progression of identified non-conformities. These inspections reports go to other people, many of whom will not have been to site but still require knowing exactly what you have seen.

Upon approach, the condition of the weir should be noted and pictures taken from a distance. This will identify any slumps, bulges, or leakages along the face that may not be evident up close. This should be completed for both sides of the weir, if safe to do so. Mark any changes to the faces of the weir on the map that is provided on the inspection sheet.

If it is safe to do so, walk along the crest of the weir on both sides of the opening, looking at the condition of the crest and the faces, making note of any cracks, settlement, or seepages that are observed. Walk around any identified non-conformities.

Seeing the non-conformity from different perspectives can reveal additional important aspects that may have been over looked. Take pictures along the length of the weir to show the general condition. Take specific pictures of any abnormalities seen, if possible with a scale to determine size. Take GPS location of the end points of the abnormality, if it is safe to do so. Also mark these changes on the graphic of the weir that is on the inspection form. If seepages are identified, obtain a flow measurement if it is safe to do so. If it is not safe, attempt to estimate the flow as best as possible, take a video with the camera, and mark the location on the map provided.

Make note of the condition of the weir flow channel and how the water is flowing through it, i.e., unimpeded flow, some obstructions, flow opening is blocked and requires cleaning. Take pictures to document the condition. Make note of the condition of the flood gates and associated flow channels. Test opening the flood gates slightly to make sure the components are in working order.

Record the water level in Long Pond to determine if the water is close to its high flow or low flow conditions. It is also important to document what additional activities are occurring in the area at the time of the inspection, such as road construction, bridge maintenance, trail maintenance, snow clearing or anything else that could affect the weir performance and the water level in Long Pond.

Observe the water on both sides to the weir for water quality. Does the water seem cloudy; is there a lot of debris in the water? Take pictures of these observations. Also make observations regarding the flow of the water before and after the weir. Are there any whirlpools; bubbling up of water, or reduction of flow? These could indicate serious issues that will need to be dealt with immediately. Take pictures or videos and notify the appropriate people right away.

Before concluding the inspection, check the water monitoring systems to ensure they are functioning properly. If there are displays on the equipment, record their measurements and the time they were recorded.

4.4 Personnel for Surveillance

Routine surveillance activities can be completed by any member of the Public Works Department with the City of St. John's. However, these people will have to be trained by a professional who is familiar with failure modes of embankment dams. This would include an overview of the potential issues, images of what these issues look like in the field, and a walk through of the inspection in the field. It is recommended that the personnel selected to complete the surveillance would have refresher training on an annual basis.

The Engineering Inspections must be completed by a professional engineer registered and licensed to practice in the province of Newfoundland and Labrador. This engineer must be fluent in dams and dam failures and is usually a third party consultant that is not involved in the day to day operation of the weir.

The Special Inspections can be done by both Public Works personnel and a professional engineer. These inspections should be completed by at least two people, as per the ERP guidelines. Depending on the severity of the weather event or observed condition, the EPP may be triggered which would include consultation with a third party engineer.

Dam Safety Reviews must be completed by someone who is very familiar with the CDA guidelines for dam safety. This is most likely a third party engineer licensed to practice in the province that was hired by the City of St. John's to complete this task.

4.5 Inspection Report and Distribution

The inspection form would have been completed in the field. A formal report will be completed. This will be a high level report summary of what observations were made in the field including any photos or videos taken during the inspection. Any recommendations, such as the weir opening requires cleaning, should be included in the report. The inspection form will be attached to the report. This will be sent to the engineers and manager in the Water & Wastewater Distribution division and once they review, they will distribute to the necessary personnel within the Department of Public Works. The inspection reports will be kept on file and observations loaded into a database. These reports will be reviewed periodically to see the progression or development of non-conformities and monitor the weir's performance.

Report Signature Page

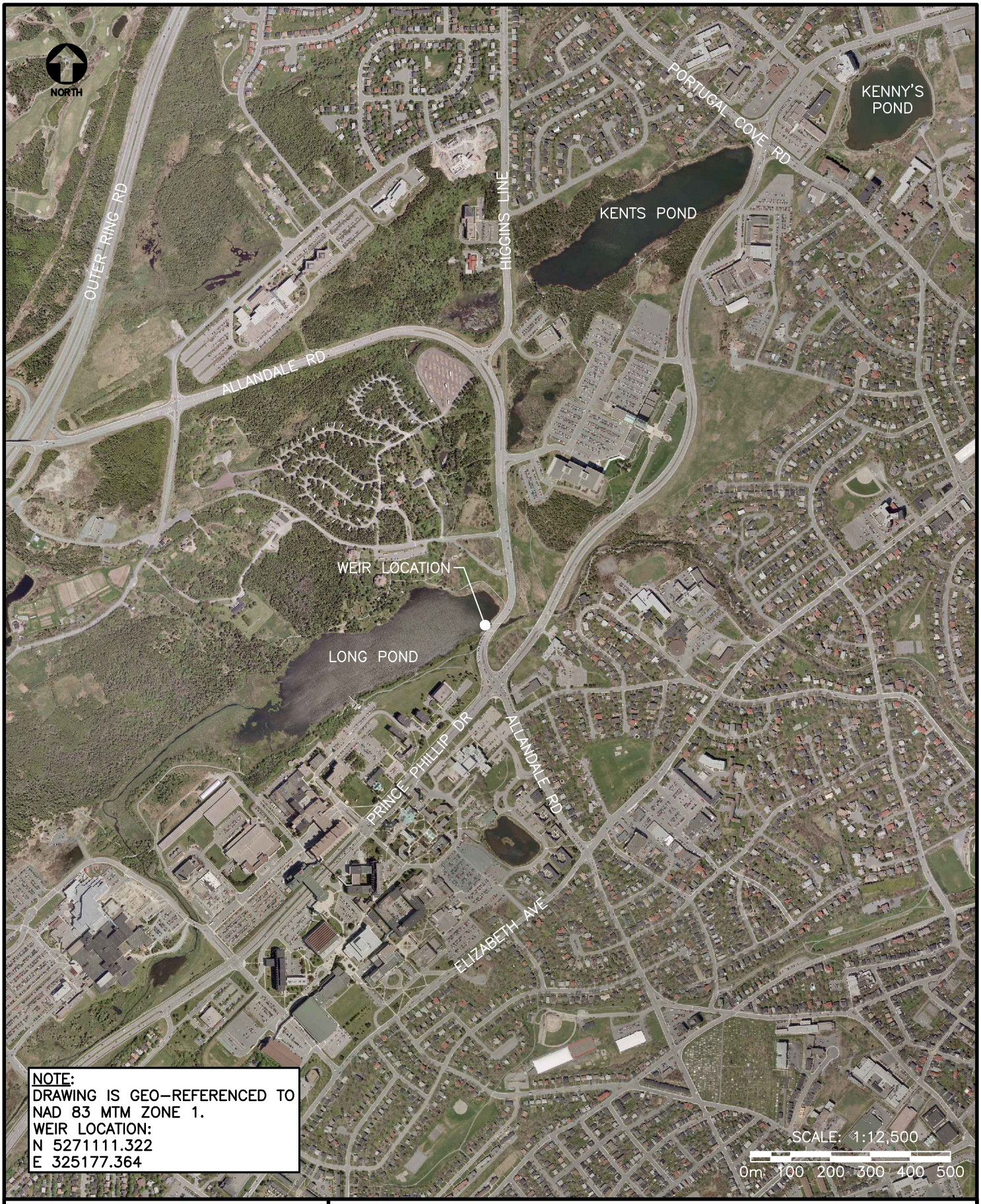
GOLDER ASSOCIATES LTD.

Sarah Butt, P.Eng
Intermediate Geotechnical Engineer

Shiu Kam, P.Eng. (Ontario)
Principal

SB/SK/kl

\\golder.gds\gal\montreal\actif\2015\3 proj\1535695 cbcl long pond weir investigation nl\5 preparation of deliverables\001 short title\rev0\06 oms\1535695-06-r-rev 0- long pond weir oms.docx



NOTE:
DRAWING IS GEO-REFERENCED TO NAD 83 MTM ZONE 1.
WEIR LOCATION:
N 5271111.322
E 325177.364

CBCL LIMITED
Consulting Engineers
187 KENMOUNT ROAD
ST. JOHN'S, NL, A1B 3P9
Phone: (709) 364-8623
Fax: (709) 364-8627

PROPOSED LONG POND WEIR

LOCATION PLAN

APPENDIX A

Inspection Form

LONG POND WEIR SEMI-MONTHLY INSPECTION

Monthly Inspection by:_____. Date: _____.

Weather:_____. Time of Inspection: _____.

Weir Inspection Upon Approach	
Any evidence of seepage or leakages along the face of the weir?	
Any evidence of slumps or slides along the face of the weir?	
Any evidence of bulges along the face of the weir?	
Is there excess vegetation that requires maintenance along the face of the weir?	
If you answered "yes" to any of these questions, mark locations on attached map, take photos, estimate extent of non-conformity and contact the Operations Supervisor Water & Wastewater Distribution.	
General condition of weir upon approach. Any noticeable changes from last inspection?	

Weir Inspection

Any evidence of cracking along the crest of the weir?	
Any evidence of settlement along the crest of the weir?	
Any evidence of seepages along the face of the weir?	
Any evidence of erosion or formation of erosional gullies along the crest or down the face of the weir?	
Any evidence of cracking in the pre-cast concrete channels?	
Are the flood gates in good operating condition? *(Test opening both gates slightly)*	
If you answered "yes" to any of these questions, mark locations on attached map, take photos, estimate extent of non-conformity and contact the Operations Supervisor Water & Wastewater Distribution.	
General condition of the weir. Any noticeable changes from the last inspection?	

Water Quality	
What is the appearance of the water quality upstream of the weir?	
What is the appearance of the water quality downstream of the weir?	
Is there debris in the water?	
Are there any obstructions in the opening of the weir impeding water flow?	
Are there any whirlpools, bubbling, or flow reductions in the water before or after the weir?	
What is the water level in the channel? Is it in low flow or high flow conditions?	

General Conditions and Comments	
Are there any activities occurring in the weir area: • Trail Maintenance; • Road Maintenance; • Bridge Maintenance; • Snow clearing; or • Other activity?	
What is the overall condition of the area?	
What maintenance is required or recommended, if any, to keep the weir in good condition?	

APPENDIX B

Special Inspection Form

SPECIAL INSPECTION FORM

Date: _____ **Time:** _____

Person Inspecting: _____ **Weather Conditions:** _____

Area of Concern: _____

Issue Reported By: _____

Reported Issue (Check all that apply)

Seepage	☐	Cracking	☐	Slumping of Material	☐
Settlement of Crest	☐	Loss of Freeboard	☐	Clogged Opening	☐
Erosion	☐	Piping	☐	Movement of Weir	☐
Whirlpool in Water	☐	Bubbling of Water	☐	Turbid Water	☐
Formation of Boils or Bulges	☐	Other (specify)	☐	_____	

Description of Issue

Size/Volume of issue (If safe measure dimensions): _____

Is this a pre-existing issue? Was it identified in routine inspection: ☐ Yes ☐ No

If yes: When was condition first identified? _____

Has condition gotten worse? ☐ Yes ☐ No

Have remedial actions been completed on this previously? ☐ Yes ☐ No

If No: When was the last inspection? _____

Are conditions deteriorating quickly? (i.e. issue hasn't changed since first identified or issue significantly changed since coming on site) ☐ Yes ☐ No

Weather Related Issues

Is there significant rain or drastic temperature change casing snowmelt in the forecast? ☐ Yes ☐ No

How high is the current pond level? _____

Would opening the flood gates assist the situation? ☐ Yes ☐ No

Are there high winds in the forecast? ☐ Yes ☐ No

Are current waves overtopping the weir? ☐ Yes ☐ No

Condition of Weir and Flow

Is the outlet of the weir unobstructed? ☐ Yes ☐ No

Is the water flowing out clear? ☐ Yes ☐ No

Is flow higher or lower than normal? ☐ Higher ☐ Lower

Are there any additional issues, i.e. cracks, erosion etc., with the weir? ☐ Yes ☐ No

Mitigation/Recommendations

Can the issue be remedied / mitigated quickly? ☐ Yes ☐ No

Will this issue cause a potential or imminent emergency? ☐ Yes ☐ No

Suggested emergency ranking: ☐ Hazard ☐ Potential Emergency ☐ Imminent/actual Emergency

Recommendations for immediate actions	Sketch / Notes

APPENDIX C

As-Built Report

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Asia	+ 86 21 6258 5522
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Europe	+ 44 1628 851851
North America	+ 1 800 275 3281
South America	+ 56 2 2616 2000

solutions@golder.com
www.golder.com

Golder Associates Ltd.
62 Pippy Place - Suite 204
St. John's, Newfoundland, A1B 4H7
Canada
T: +1 (709) 722 2695

Golder Associates

APPENDIX Y

Hazard Identification and Risk Assessment

February 25, 2016

LONG POND WEIR

Hazard Identification and Risk Assessment

Submitted to:
Greg Sheppard, P.Eng.
CBCL Limited
187 Kenmount Road
St. John's, NL
A1B 3P9

REPORT

Report Number: 1535695-07-Rev 0

Distribution:

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1.0 INTRODUCTION

A Hazard Identification & Risk Assessment (HIRA) is an emergency management tool that identifies the hazards and their associated risks in a certain area. It helps emergency professionals to determine what hazards exist, how severe their impact can be on the community, infrastructure, property and environment, and which hazards pose the greatest threat to the public. With this information, the emergency professionals can better improve public safety and to protect against property and infrastructure damage. The purpose of a HIRA is to identify which hazards should be the focus of emergency management programs at a given point in time. It is intended that a HIRA is an ongoing process such that when hazards are identified as having a high level of risk, emergency management programs should attempt to minimize the risk through prevention, preparedness, mitigation, response and recovery measures. If these measures are successful, then the risk of the hazard will decrease. The ongoing HIRA process will eventually address all of the identified hazards since as the risk of a particular hazard decreases, it will score lower in the HIRA ranking during the revision, allowing another set of hazards to be focused on.

1.1 Purpose

Emergency planning is a requirement for any dam structure where lives are at risk as per the Canadian Dam Association Dam Safety Guidelines, 2007. It is also specified as a requirement in the Environmental Preview Report that was issued by the provincial government for the Long Pond Weir.

Hazard identification and risk assessments are an ongoing, ever evolving process. The purpose of this HIRA is to anticipate future emergency situations at the weir and to identify which hazards should be considered a priority at particular point of time by emergency management programs. It should be noted that new hazards may emerge or evolve over time and that the current emergency management tools my not be affective in the new conditions therefore the management tools and processes may alter the hazards' priority in subsequent revisions.

1.2 Scope

The goal of this document is to identify the hazards associated with the Long Pond Weir that have the potential to impact the weir and downstream residents and infrastructure in the City of St. John's.

1.2.1 Background

Long Pond is located in the City of St. John's and is part of Rennies River watershed which discharges to Quidi Vidi Lake. The Rennies River watershed has flooded numerous times throughout the past with the most recent flood occurring in 2010. There are significant residential areas, main roads and recreational areas within the flood plain of Rennies River. A study was commissioned by the City of St. John's in 2014 to develop a storm water management plan for Rennies River. This study was completed by CBCL Limited. It was found that the best solution for minimizing flooding is the construction of a weir at the outlet of Long Pond. This weir would act as a dam and create a storm water retention area which would increase the storage capacity in Long Pond to 160, 000 m^3.

The weir will be approximately 30m long, 5m high, and 3m wide at crest. The weir will have a 6m wide pre-cast concrete channel which will maintain flow through Rennies River. On either side of the opening, there will be a 2m wide manually operated flood gate that will be constructed in a pre-cast concrete channel. The gates will be opened when the water level in Long Pond reaches 55.7m elevation. The water level will be monitored by a real-time water monitoring station that will be constructed on the banks of Long Pond and can be monitored on the Provincial and Federal government's websites.

1.3 HIRA Structure

A HIRA can be broken down in four separate categories. These categories are also used as steps in developing and maintaining the HIRA. These four categories or steps are: Hazard Identification, Risk Assessment, Risk Analysis, and Monitor and Review. Each of these four categories are explained in the following section.

Hazard Identification

This step in the HIRA process, as the name suggests, aims to identify the hazards that are relevant for the area to be included in the risk assessment. This requires a systematic review of the potential hazards associated with a dam failure in order to determine whether they may pose a threat to the area. The main categories that will be used to classify and identify the various hazards include:

- health and safety of the public;
- health and safety of the response personnel;
- continuity of operations;
- property, facilities, and infrastructure;
- delivery of services; and,
- the environment.

Risk Assessment

During this step of the HIRA process, the level of risk for each hazard is examined. This may involve the examination of past occurrences, possible scenarios and an examination of the current vulnerability of the infrastructure, services, operations, properties, public/community, and environment within an area exposed to the hazard. The likelihood of the hazard occurring at an intensity that could result in damage, the potential impacts of the hazard on people, property, the environment, services, operations, and critical infrastructure should be examined. It is important to be as through as possible since the information gathered at this step will be critical in assisting decision makers in identifying which risks will not be considered tolerable.

Risk Analysis

The information collected in the risk assessment step will be examined. The desired outcome of the risk analysis is the identification of which hazards should be considered a priority for emergency management programs at that particular point in time based on their likelihood and potential consequences.

Monitor and Review

It is important to remember that a HIRA is an ongoing process and hazards and their associated risks must be monitored and reviewed regularly. A HIRA provides information on which hazards should be considered a priority for emergency management programs at a particular point in time. Changes in hazard frequency or mitigation practices etc. may reduce the risk of a particular hazard in subsequent revisions and refocus efforts on another hazard. Over time with subsequent revisions, as the various hazards are identified as priorities for emergency management programs and actions are taken to alter and minimize their risk, all hazards will eventually be cycled through and examined.

2.0 LONG POND WEIR HIRA

2.1 Hazard Identification

The following is a list of hazards associated with the Long Pond Weir that may negatively impact the health and safety of the public and response personnel, the operations and delivery of services within the City of St. John's, property, facilities, and infrastructure, and the environment.

- erosion of the banks and weir creating turbid (muddy) water downstream;
- during dry season, reduction of flow through Rennies River affecting fish habitat;
- structural issues with the weir, i.e. cracking, bulges, settlement, that could inadvertently injure someone if they came upon it;
- loss of containment during a flood event due to slope failure ;
- weir failure due to waves and water levels overtopping the weir, creating flood conditions downstream;
- sudden foundation failure of the weir, creating in rush of water into Rennies River and flooding downstream;
- weir failure, i.e. portion eroded away or piping through the weir, creating increase water into Rennies River, flooding downstream including properties and roads;
- inability to operate the control gates leading to dam overtopping, and
- ice or debris bridging the weir opening causing water to backup and overtop the weir.

2.2 Risk Assessment

Summarized below are the risks associated with the hazards that were previously identified. To determine the risks past occurrences and possible scenarios were examined along with current vulnerability of the infrastructure, services, operations, properties, public/community, and environment downstream of the weir.

Hazard	Assessment	Consequence
Erosion of the banks and weir creating turbid (muddy) water downstream	Erosion and turbid water is a natural occurrence and occurs seasonally. The addition of a weir at the outlet of Long Pond should not have much if any effect on the erosion potential downstream along the river banks. Rennies River is a well-established river with mature and stable banks that has low potential for erosion. The weir itself will have rip rap covering that would prevent erosion. Turbid water will not have any effect on infrastructure, services, operations, or properties downstream. It will have an aesthetic impact on the community, the water will look dirty. It also may impact fish in the river.	This is considered a low consequence event because it is a natural, regularly occurring event and condition. It does not impact the health or safety of the public and has no impact on infrastructure. It does have an impact on the environment. It could negatively impact the fish in the river. This process would happen regardless if the weir was in place or not.

Hazard	Assessment	Consequence
During dry season, reduction of flow through Rennies River affecting fish populations	Again, this is naturally and seasonally occurring event. There is always a flow through Rennies River. The weir is constructed to always allow flow into the river. The weir is designed to allow flow through as long as the weir channel is not blocked. This only impacts to fish in the river. Maintenance will be provided to ensure serviceability of the weir.	This is considered low consequence because it is a natural, seasonal event. This would occur with or without the weir.
Structural issues with the weir, i.e. cracking, bulges, settlement that could inadvertently injure someone if they came upon it.	Structural issues, if not marked in the field, could cause operations personnel, responders, or the general public to trip causing cuts or bruises, roll an ankle or knee causing sprains, torn ligaments and even broken bones, or fall off the weir into Long Pond or Rennies River and drown. Weir has been designed to acceptable safety standards. As part of the operation of the weir there are regular inspections where all safety hazards would be identified and mitigated on a timely manner. Until the issue is resolve access to the weir can be curtained. The responders to the weir will be familiar with the weir and dam safety. It is not recommended that public be allowed to access the dam crest because of its narrow width.	The consequence of injury is moderate.
Loss of containment during a flood event due to slope failure	Slope failure during a flood event can reduce the freeboard and cause a breach of the dam. The dam is washed out and the downstream communities flooded. The extent of flooding from dam breach could be higher than conditions before weir construction. Flood protection is lost from such failure. During construction all the unsuitable materials below the dam footprint will be removed and the dam fill will be placed according to specification. Potentially unsafe condition of the weir would be identified in the routine inspections and if identified would be fixed quickly.	This is very high consequence event.
Weir failure due to waves and water levels overtopping the weir, creating flood conditions downstream	Overtopping can result from a larger than design event. The weir is designed to be higher than waves during the 1:100 year storm + 30%. The existing trigger level for opening of the auxiliary flood gates is 55.7 m, which is 0.3m	The consequences of losing the weir are very high. The resulting flooding from overtopping could exceed historic conditions both in the magnitude of flood and rate of flooding.

Hazard	Assessment	Consequence
	higher than the water level that occurred during Hurricane Igor in 2010. Therefore, if the weir were to fail, the damages and inrush of water would be similar to the flooding and damages experienced during Hurricane Igor in 2010. There is also a possibility that the auxillary gates not operating either due to mechanical problems or human errors.	
Sudden foundation failure of the weir, creating inrush of water into Rennies River and flooding downstream	As above. The soft materials that would cause a foundation failure will be removed and the weir will be constructed on solid foundation.	This is a high consequence event.
Weir failure, i.e. portion eroded away or piping through the weir, creating increase water into Rennies River, flooding downstream including properties and roads	A weir failure would increase the water through the river and could create flooding and infrastructure damage downstream. This type of failure could have early warning signs that would be detected during routine inspections. Residents can also alert City of incipient conditions of large leakage.	The consequences are high.
Inability to operate the control gates leading to dam overtopping	Gate failure due to mechanical problems or human errors	The event can have a high consequence rating if the weir is overtopped.
Ice or debris bridging the weir opening causing water backing up and overtopping the weir.	With the changing weather conditions in the winter it is possible for ice to form then break up and block the weir opening. Natural debris and litter from the nearby roads and trails could also block the weir opening and interfere with the water flow and cause overtopping at the weir. This type of risk would be able to be identified early during routine inspections and from observations by the general public. It can also be remedied fairly easily be by removing the obstructions with appropriate equipment. The frequency of inspection is increased during the critical high flow period to ensure flow is not impeded. The gates can also be opened to increase flow capacity.	This is a moderate consequence event.

2.3 Risk Analysis

The information that was collected in the previous section will be further examined to determine which hazards should be considered a priority for emergency management programs based on their likelihood and potential consequences.

The City of St. John's (the City) has a Hazard Analysis document that was based on the HIRA format for all hazards identified in the Emergency Management Plan. They have an established risk analysis ranking system which will be used for the risk analysis for the Long Pond Weir hazards. This ranking system is in Table 1 below.

Table 1: Risk Analysis Ranking System

Rank	Probability	Rank	Impact & Vulnerability
6	Frequent or Very Likely	6	Very High
5	Moderate or Likely	5	High
4	Occasional, Slight Chance	4	Moderate
3	Unlikely, Improbable	3	Low to Moderate
2	Highly Unlikely (Rare Event)	2	Low
1	Very Rare Event	1	Very Low

After all the hazards are ranked for probability and Impact & Vulnerability, they are then determined if they are threats of consequence to the City, which are hazards that ranked with a probability of 4 or greater **AND** an impact & vulnerability ranking of 4 or greater. The City has identified flooding in the Hazard Analysis document and ranked this hazard as a 3 (Unlikely, Improbable) and 3 (Low to Moderate).

The hazards identified for the Long Pond Weir will be ranked using the above criteria.

Table 2: HIRA Ranking of Hazards

Hazard	Probability	Impact	Overall Ranking
Erosion	3	2	Low
Low Flow	3	2	Low
Structural Issues	2	3	Low
Slumping Material	2	5	Low
Overtopping by Waves and Water Level	3	5	Moderate
Foundation Failure	2	5	Low- Moderate
Weir Failure	2	5	Low- Moderate
Gate Failure	3	4	Low-Moderate
Flow Obstruction	3	3	Low- Moderate

Based on hazard ranking the ones that should be the focus of emergency management professionals are:

- flooding downstream caused by waves and/or water levels overtopping the weir;
- foundation Failure of weir;
- weir failure; and,
- flow obstruction.

2.4 Monitor and Review

As stated previously, this HIRA is an ongoing process. Hazards and their associated risks must be monitored and reviewed regularly because hazards are constantly changing and new hazards and risks are developing. This HIRA provides information on which hazards should be considered a priority for emergency management programs. Changes in the hazard frequency or the mitigation practices may reduce the risk of a particular hazard in subsequent revisions and therefore efforts will have to refocus on another hazard. Over time with subsequent revisions, as the various hazards are identified as priorities for emergency management programs and actions are taken that change and minimize their risk, all hazards will eventually be cycled through and examined.

The HIRA should at least be reviewed and updated annually. In the event of an emergency, the HIRA should be reviewed after the fact to determine if the hazard was identified and if the appropriate focus and mitigation practices were put in place.

Report Signature Page

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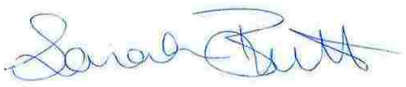

Sarah Butt, P.Eng.
Intermediate Geotechnical Engineer

Shiu Kam, P.Eng. (Ontario)
Principal

SB/SK/kl

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Asia	+ 86 21 6258 5522
Australasia	+ 61 3 8862 3500
Europe	+ 44 1628 851851
North America	+ 1 800 275 3281
South America	+ 56 2 2616 2000

solutions@golder.com
www.golder.com

Golder Associates Ltd.
62 Pippy Place - Suite 204
St. John's, Newfoundland, A1B 4H7
Canada
T: +1 (709) 722 2695

Golder Associates

APPENDIX Z

Self-Assessment Tool

February 25, 2016

LONG POND WEIR

Self-Assessment Tool

Submitted to:
Greg Sheppard, P.Eng.
CBCL Limited
187 Kenmount Road
St. John's, NL
A1B 3P9

REPORT

Report Number: 1535695-8-Rev 0

Distribution:

1 copy - CBCL Limited
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1.0 INTRODUCTION

Effective emergency response and preparedness planning is key to ensure the safety of the residents of St. John's when an emergency situation arises. This is established in well-documented site specific emergency response plans and an all-encompassing emergency management plan. The site specific plans being addressed in this document is for the Long Pond Weir. All developed emergency plans are living documents such that they are regularly tested and evaluated.

2.0 PURPOSE

This document is a self-assessment tool to determine the state of readiness of the Long Pond Weir owner's (the City of St. John's) with respect to a hazardous condition, potential or actual weir failure. These tools are effective means to determine the extent to which the emergency management system, and site specific emergency preparedness and response plans have been developed.

3.0 INSTRUCTIONS

The self-assessment tool is straight forward and asks various questions regarding keys areas of the emergency plans for the Long Pond Weir. The questions are yes or no questions and require checking either Yes, No, or Unknown boxes as a response. This document is intended to be used by the City of St. John's Emergency Services and Public Works Department to identify any gaps in the emergency plans.

4.0 SELF-ASSESSMENT TOOL

Table 1: Self-Assessment Tool for Long Pond Weir

Emergency Program Management

1)	Has a coordinator or manager been appointed and assigned responsibility for development, implementation, and updating the Long Pond Weir Emergency Plans?	☐ Yes ☐No ☐ Unknown
2)	Has the coordinator/manager name been communicated to all applicable parties?	☐ Yes ☐No ☐ Unknown
3)	Has an Emergency Plan Committee been established to oversee the development, implementation, and maintenance of the Long Pond Weir Emergency Plans?	☐ Yes ☐No ☐ Unknown
4)	Does the Emergency Plan Committee have senior management support?	☐ Yes ☐No ☐ Unknown
5)	Is there a defined record management system and person responsible, both electronic and hard copy, for Long Pond Weir documentation?	☐ Yes ☐No ☐ Unknown

Emergency Plan Development

6)	Have the Long Pond Weir emergency plans take an "all-hazards" approach?	☐ Yes ☐No ☐ Unknown

7)	Have the Long Pond Weir emergency plans have sufficient integration with prevention, mitigation, emergency operations/response, communications, and crisis management plans?	☐ Yes ☐ No ☐ Unknown
8)	Is there a process in place to involve interested stakeholders where appropriate?	☐ Yes ☐ No ☐ Unknown
9)	Is there a systematic and documented process for assessing risks to residents, property, operations, infrastructure, and the environment associated with the Long Pond Weir?	☐ Yes ☐ No ☐ Unknown
10)	Does the risk assessment process include hazard identification, vulnerability assessment, and impact analysis?	☐ Yes ☐ No ☐ Unknown
11)	Has the risk assessment/ HIRA been reviewed within the past 12 months?	☐ Yes ☐ No ☐ Unknown
12)	Is the risk assessment/HIRA documented and communicated to the emergency plan committee, coordinator, and management?	☐ Yes ☐ No ☐ Unknown
13)	Have additional controls identified in the risk assessment been implemented?	☐ Yes ☐ No ☐ Unknown
14)	Have the resources needed to develop, implement, and maintain the Long Pond Weir emergency and operation plans been identified and documented?	☐ Yes ☐ No ☐ Unknown
15)	Is there a strategy to address any gaps between required resources and available resources?	☐ Yes ☐ No ☐ Unknown
16)	Is an inventory of resources maintained and kept up to date?	☐ Yes ☐ No ☐ Unknown

Implementation of Long Pond Weir Plans

17)	Are objectives clearly stated in all plans?	☐ Yes ☐ No ☐ Unknown
18)	Are assumptions documented in each plan?	☐ Yes ☐ No ☐ Unknown
19)	Are functional roles and responsibilities of internal and external agencies identified in each plan?	☐ Yes ☐ No ☐ Unknown
20)	Are lines of authority clearly defined?	☐ Yes ☐ No ☐ Unknown
21)	Are notification succession processes clearly defined?	☐ Yes ☐ No ☐ Unknown

22)	Are communications to external agencies clearly defined?	☐ Yes ☐No ☐ Unknown
23)	Are resource and logistical requirements clearly defined in the plans?	☐ Yes ☐No ☐ Unknown
24)	Are plans accessible during emergencies?	☐ Yes ☐No ☐ Unknown
25)	Does each plan specify when and who has authority to activate the emergency plan?	☐ Yes ☐No ☐ Unknown
26)	Are there clearly defined thresholds to guide the notification and escalation protocols for emergency response?	☐ Yes ☐No ☐ Unknown
27)	Are procedures established for communicating information and coordinating decision making between senior management, emergency response teams and operational personnel who may get involved in an incident at the weir?	☐ Yes ☐No ☐ Unknown
28)	Have plans been distributed to or do those with defined responsibilities have access to the applicable plans?	☐ Yes ☐No ☐ Unknown
29)	Have prevention strategies been developed to prevent incidents occurring at the weir?	☐ Yes ☐No ☐ Unknown
30)	Is there an ongoing process of monitoring and analysis of developing issues with the weir to keep prevention strategies current?	☐ Yes ☐No ☐ Unknown
31)	Is there a process to monitor identified hazards and adjust the level of preventive measures based on the risk?	☐ Yes ☐No ☐ Unknown
32)	Are prevention strategies based on the results of hazard identification?	☐ Yes ☐No ☐ Unknown
33)	Have mitigation strategies been documented in a plan that includes measures to limit or control the hazards at Long Pond weir?	☐ Yes ☐No ☐ Unknown
34)	Do mitigation strategies include interim and long term actions to reduce hazards?	☐ Yes ☐No ☐ Unknown
35)	Do mitigation strategies incorporate:	
	a. Use of applicable standards	
	b. Hazard avoidance through land-use practices	
	c. Removal or elimination of the hazard	
	d. Reduction or limitation of the size of the hazard	
	e. Modification of the hazard characteristics	☐ Yes ☐No ☐ Unknown

f. Control of the rate of release of the hazard

g. Establishment of hazard warning and communication procedures.

36) Is there an emergency communication plan and procedures to disseminate information internally and externally to those involved in the response at the weir? ☐ Yes ☐No ☐ Unknown

37) Is there an emergency communication plan and procedures for communicating with media? ☐ Yes ☐No ☐ Unknown

38) Do emergency operations/response procedures include procedures for warning residents downstream that would be impacted due to the hazard? ☐ Yes ☐No ☐ Unknown

39) Have communication protocols and procedures been established and tested? ☐ Yes ☐No ☐ Unknown

40) Are the names, telephone numbers, and emergency contact instructions for management, emergency response teams, public agencies, contractors, and other who support the emergency plans compiled, immediately accessible and up to date? ☐ Yes ☐No ☐ Unknown

41) Does the emergency operations/response plans adequately address the staffing, equipment, training and response procedures for the Long Pond Weir? ☐ Yes ☐No ☐ Unknown

42) Do emergency procedures address the safety of first responders? ☐ Yes ☐No ☐ Unknown

43) Does the emergency operations/response plans define what constitutes as emergency and when the plan should be activated? ☐ Yes ☐No ☐ Unknown

Training & Education

44) Has a training and educational curriculum been established to support all roles associated with Long Pond Weir? ☐ Yes ☐No ☐ Unknown

45) Have the scope of the training and the frequency of instruction been identified? ☐ Yes ☐No ☐ Unknown

46) Is training provided for all employees upon hire to the public works team who will be working with the Long Pond Weir? ☐ Yes ☐No ☐ Unknown

47) Is training provided for emergency response teams upon assignment? ☐ Yes ☐No ☐ Unknown

48) Is training provided when the plan or procedures are changed or when a person's responsibilities change? ☐ Yes ☐No ☐ Unknown

49) Are records of training kept and maintained? ☐ Yes ☐No ☐ Unknown

50) Has a public education program been implemented to communicate the potential hazards and preparedness information to residents downstream of Long Pond Weir? ☐ Yes ☐ No ☐ Unknown

51) Are Long Pond Weir plans, procedures, and training evaluated through periodic exercises and tests? ☐ Yes ☐ No ☐ Unknown

52) Do members of the emergency response team participate in drills and exercises? ☐ Yes ☐ No ☐ Unknown

53) Are post hazard response critiques conducted promptly after an emergency response has been terminated? ☐ Yes ☐ No ☐ Unknown

54) Are lessons learned or after action reports from others collected and assessed? ☐ Yes ☐ No ☐ Unknown

55) Are exercises and tests documented? ☐ Yes ☐ No ☐ Unknown

56) Are there different levels of exercises such as individual training, workshops, tabletop exercises, functional exercises, and full-scale exercises? ☐ Yes ☐ No ☐ Unknown

57) Are exercises and plans designed to evaluate the plans, identify procedural deficiencies, validate recently changed procedures, clarify roles and responsibilities, obtain feedback and practice the deployment of teams and resources to manage emergencies at Long Pond Weir? ☐ Yes ☐ No ☐ Unknown

Plan Maintenance & Improvement

58) Are the Long Pond Weir plans and procedures evaluated through periodic reviews? ☐ Yes ☐ No ☐ Unknown

59) Are evaluations conducted on a regularly scheduled basis? ☐ Yes ☐ No ☐ Unknown

60) Is there a documented corrective action process for identified deficiencies? ☐ Yes ☐ No ☐ Unknown

61) Are the identified deficiencies prioritized? ☐ Yes ☐ No ☐ Unknown

62) Is there a continuous improvement or change management process that would trigger program reviews and corrective actions? ☐ Yes ☐ No ☐ Unknown

Report Signature Page

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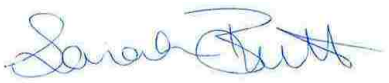

Sarah Butt, P.Eng
Intermediate Geotechnical Engineer

Shui Kam, P.Eng (Ontario)
Prinicpal

SB/SK/kl

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Africa	+ 27 11 254 4800
Asia	+ 86 21 6258 5522
Australasia	+ 61 3 8862 3500
Europe	+ 44 1628 851851
North America	+ 1 800 275 3281
South America	+ 56 2 2616 2000

solutions@golder.com
www.golder.com

Golder Associates Ltd.
62 Pippy Place - Suite 204
St. John's, Newfoundland, A1B 4H7
Canada
T: +1 (709) 722 2695

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APPENDIX AA

Public Information Session Presentation

CBCL LIMITED

Consulting Engineers

LONG POND WEIR
Information Session

November 18, 2015

Meeting Agenda

- Project Background
- Design
- Environmental Preview Report: Alternatives
- Questions

Background

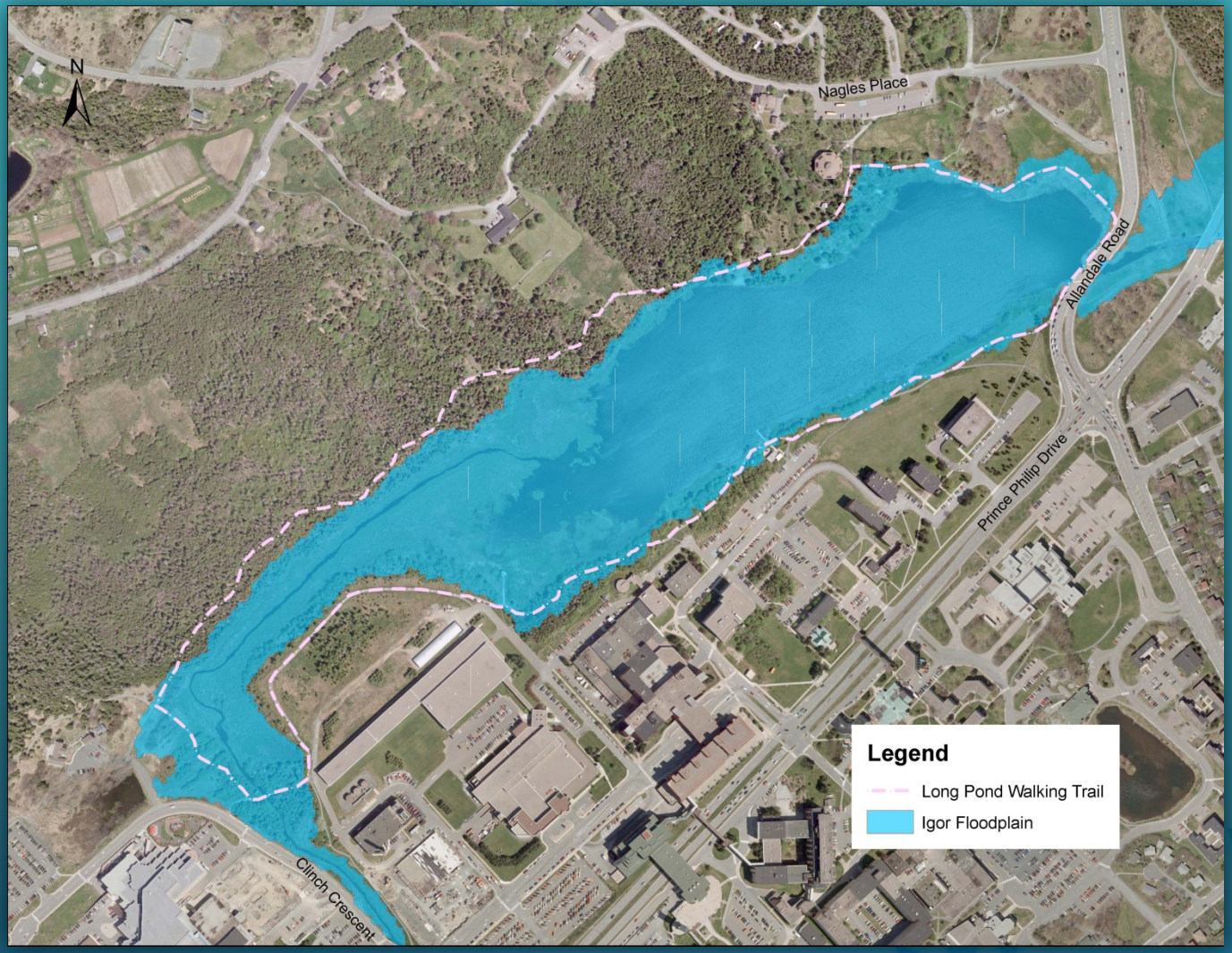
- Rennies River Catchment Stormwater Management Study
  - Historical flooding – Hurricane Igor (Sept. 2010)
  - Study completed – April, 2014
  - Prioritized list of improvements
  - Long Pond Weir identified as Priority 1

- Long Pond Weir Project
  - Design commenced – June, 2014
  - Provincial Environmental Assessment completed
  - Preparation of Provincial Environmental Preview Report ongoing
  - Anticipated construction – Summer 2016 *(subject to approvals)*

Background


N
Nagles Place
Allendale Road
Prince Philip Drive
Clinch Crescent
Legend
Long Pond Walking Trail

Background

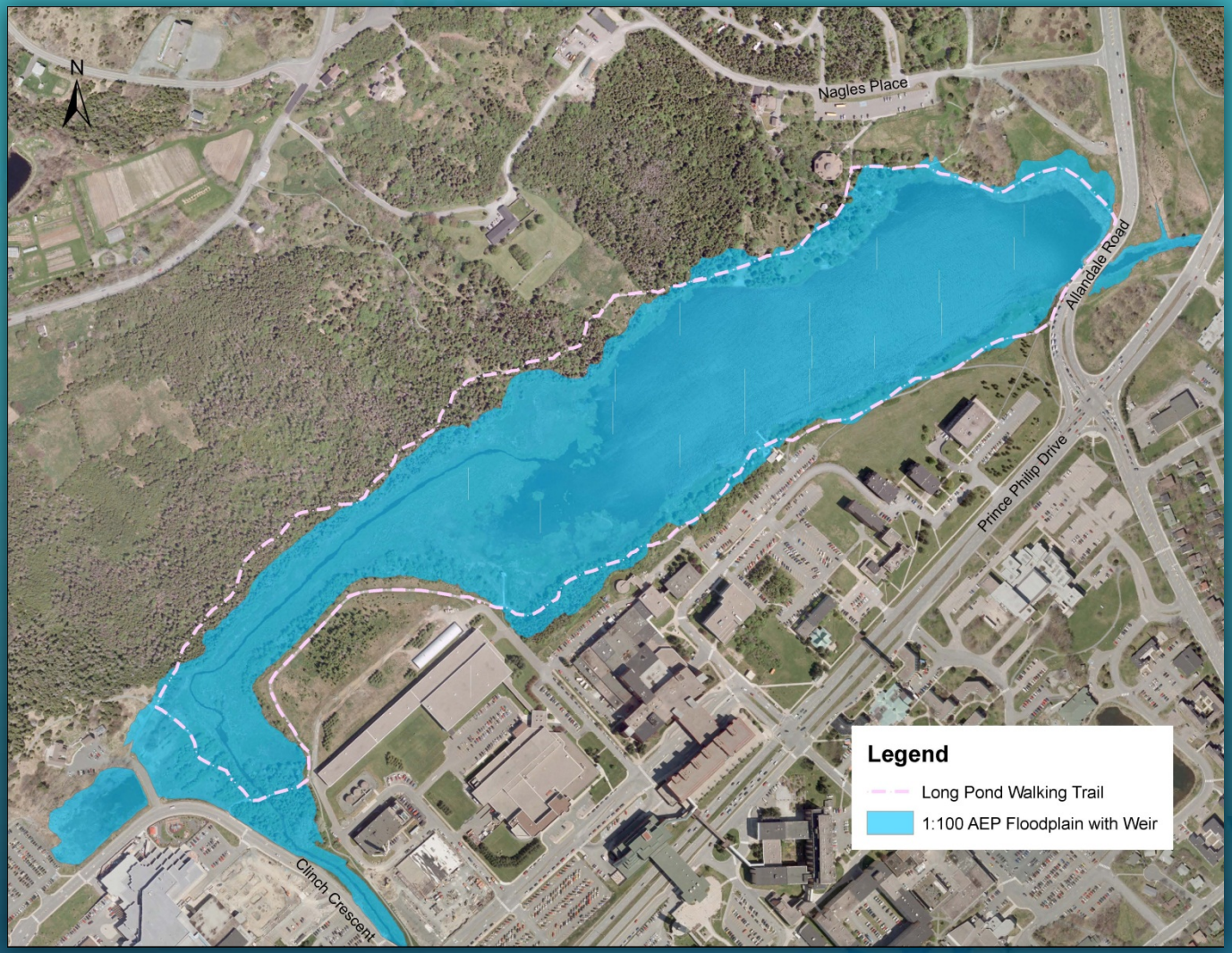

N
Nagles Place
Allandale Road
Prince Philip Drive
Clinch Crescent
Legend
Long Pond Walking Trail
Igor Floodplain

Design

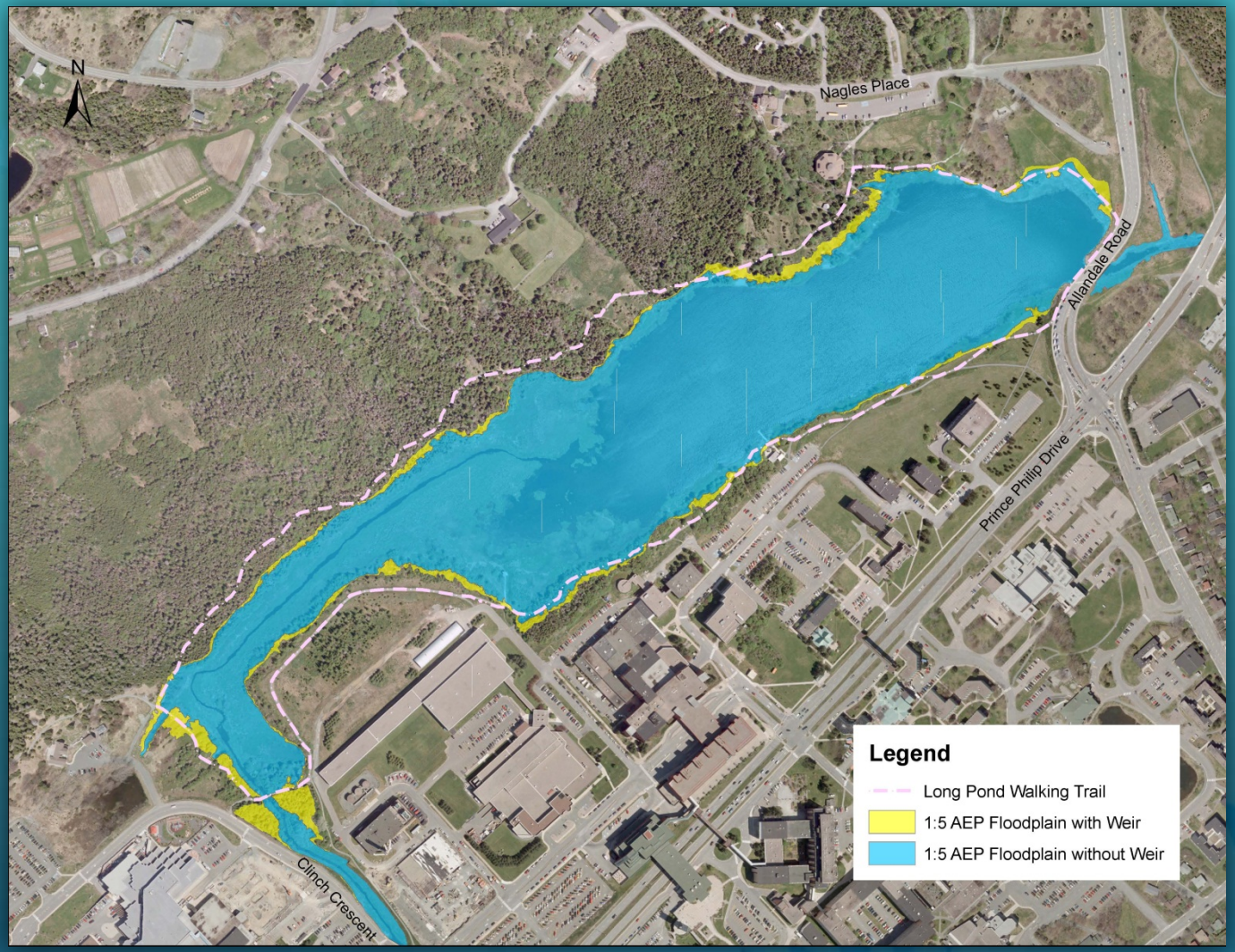
- Design considerations
  - Restrict flow at Long Pond to mitigate downstream flooding *(assuming that the downstream improvements are in place)*
  - Pond water level at its maximum for a short period during extreme rainfall events
  - Allow fish passage during low flows

- Design features
  - Opening in structure to bottom of pond
  - Pond top water level: 55.7 metres
  - Pond normal water level: ~53.0 metres
  - *Pond water level during Igor: 55.4 metres*

Design


N
Nagles Place
Allandale Road
Prince Philip Drive
Clinch Crescent
Legend
Long Pond Walking Trail
1:100 AEP Floodplain with Weir

Design


N
Nagles Place
Allandale Road
Prince Philip Drive
Clinch Crescent
Legend
Long Pond Walking Trail
1:5 AEP Floodplain with Weir
1:5 AEP Floodplain without Weir

EPR: Alternatives

- Section 9.0 of the “Guidelines for an Environmental Preview Report for the Long Pond Weir” states that a public information session must be held to present the information gathered to fulfil the requirements of Section 5 of the Guidelines.
- Section 5.0 of the Guidelines notes that the EPR must describe alternative means for carrying out the Project. Under this section, five steps (or topics) are presented for addressing the alternatives.
- The next five slides will address each step.

EPR: Alternatives

- *Identify alternative means, designs and locations to carry out the Project, and provide reasons for the rejection of alternatives.*

- Alternatives:
  - Conveyance capacity upgrades: Culvert/bridge upgrades; Berms; channel widening and deepening.
  - Storage to reduce flows: Increase Storage in existing water bodies; Storm water detention facilities.
  - Infiltration to reduce runoff: Disconnection of roof downspouts; Perforated pipes installed in clear stone bedding; Rain gardens.

EPR: Alternatives

- *Describe the advantages and disadvantages of constructing the dam using earthen materials versus concrete and demonstrate the rationale for the selected materials of construction.*

- Due to the EPR requirements, the selection of the materials of construction have been re-visited. An earthen structure will be acceptable if overtopping (i.e. spillway) is not part of the design. If a spillway is required, concrete will be selected.

- The main advantage of using earthen materials over concrete is cost. Also, construction duration could theoretically be shorter (important from an environmental perspective).

EPR: Alternatives

- *Explain why the installation of a dam at the outlet of Long Pond was selected as the first priority amongst a number of flood protection improvements that were recommended as part of a related study, Rennies River Catchment Stormwater Management Plan (CBCL, 2014).*

- Design of downstream improvements are based on the weir being in place. Protection of the areas downstream of Long Pond is a priority for the City.

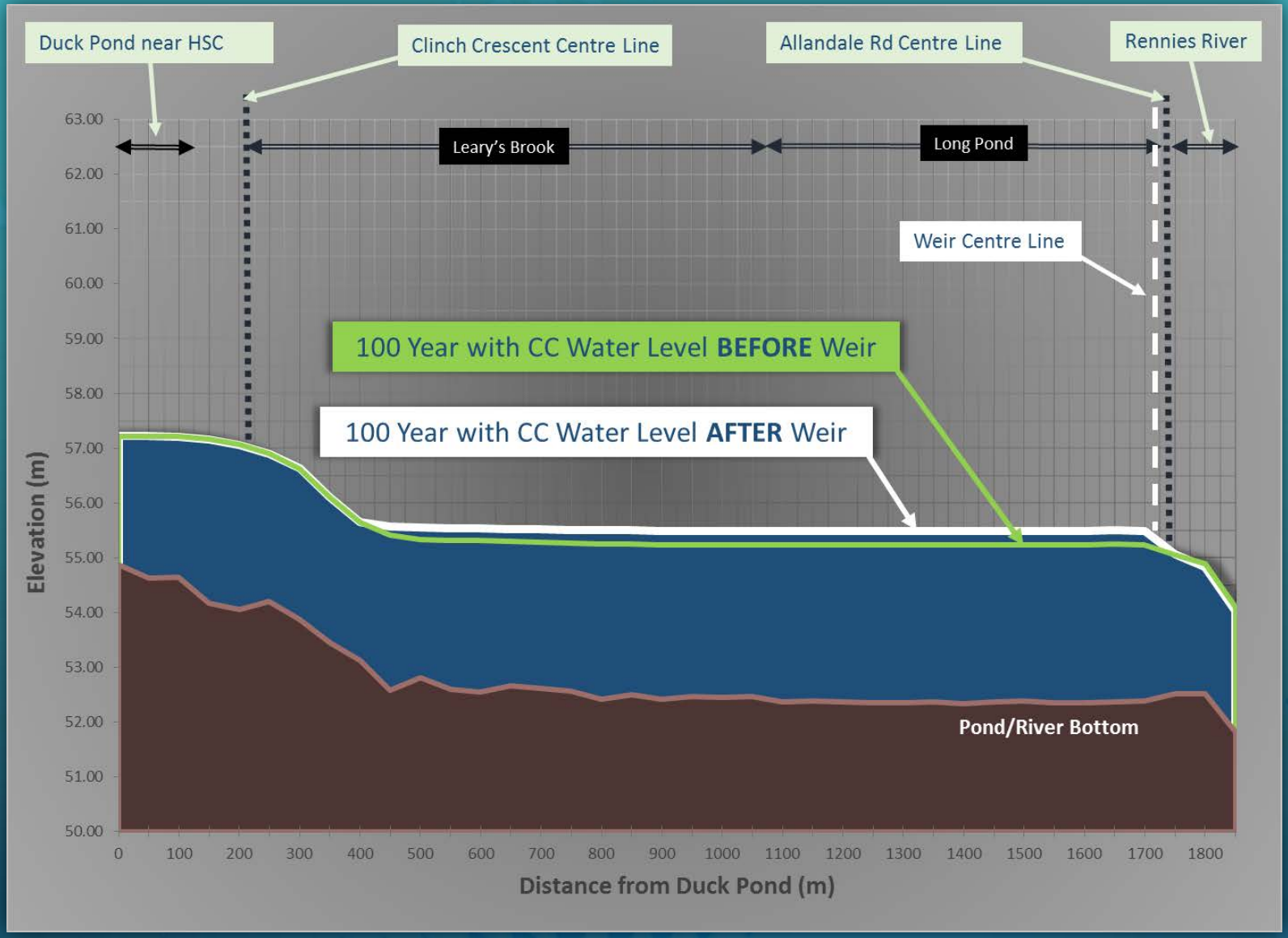
- The installation of the weir at Long Pond **will not** result in increased flooding upstream.

EPR: Alternatives

- *Explain why earth berms and concrete walls, recommended in the above-noted study, are not being constructed in the vicinity of Clinch Crescent East to Clinch Crescent West prior to the installation of the dam to manage the potential backwater effects.*

- There will be **no backwater effects** in the vicinity of Clinch Crescent East to Clinch Crescent West resulting from the installation of a flood control structure (dam) at outlet of Long Pond. The elevation difference between the underside of Clinch Crescent East Bridge and the brook invert at the inlet to Long Pond is over 1 metre.

EPR: Alternatives



EPR: Alternatives

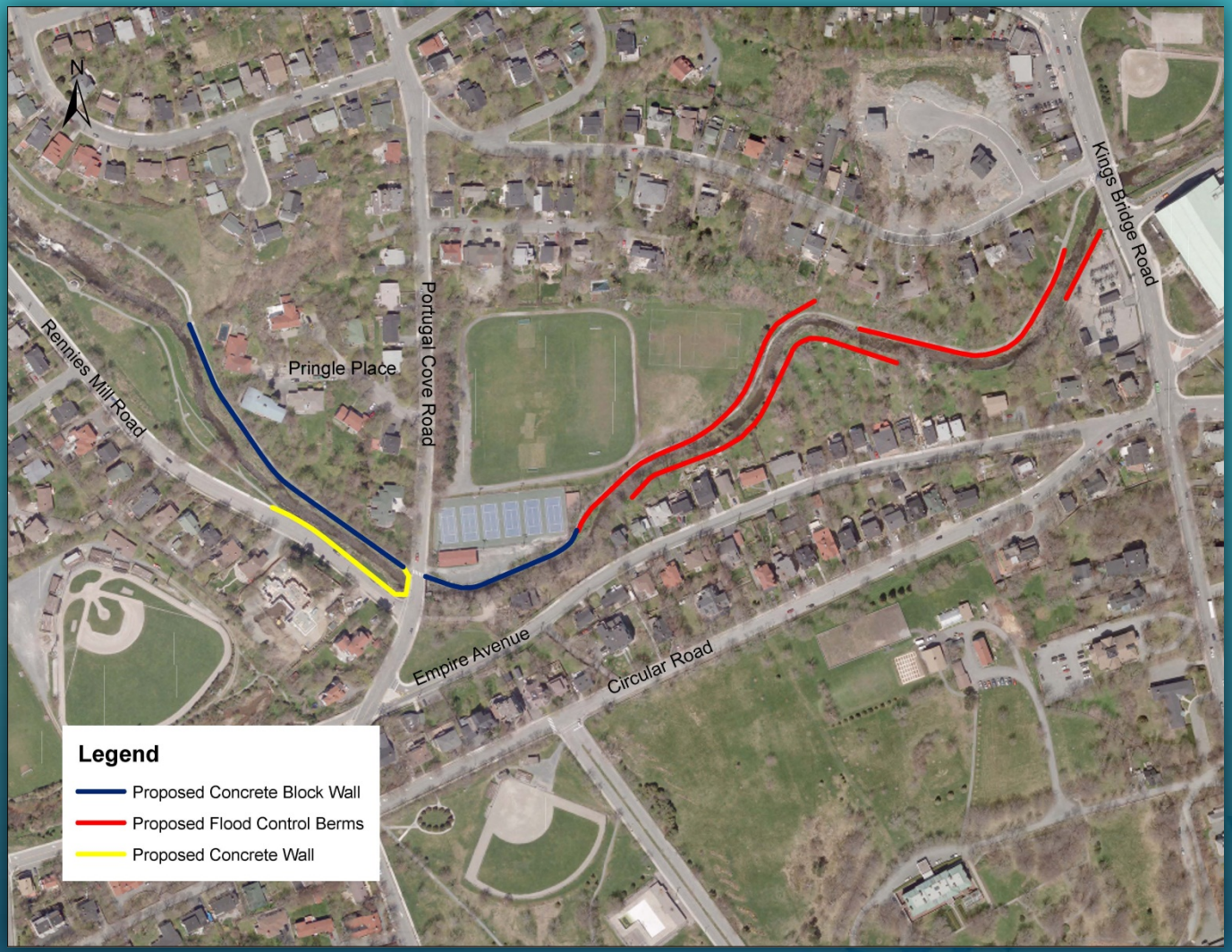
- *Explain why a fixed flow control structure is preferred, as opposed to a structure with operable parts, that may be used to manage the release of water out of Long Pond.*

- A fixed flow structure is preferred because, during a storm event, would require the attention of maintenance personnel to open a gate (or some similar structure) or a gate would be opened by some automatic means. In any event, the passive approach (fixed flow structure) is more reliable.

Questions…

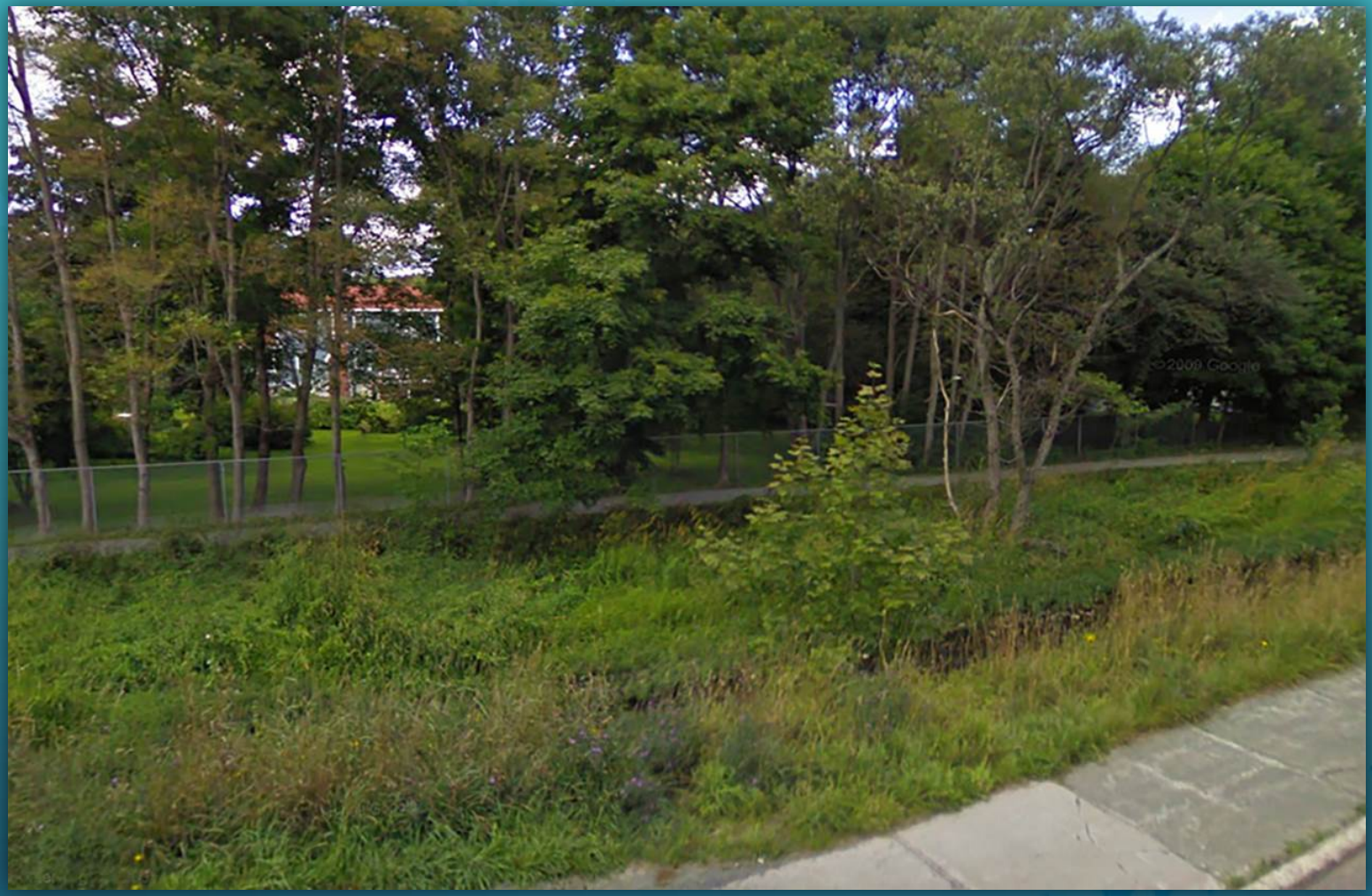
Downstream Improvements

Downstream Improvements



Downstream Improvements

Downstream Improvements



Downstream Improvements