Mactaquac Generating Station Brief

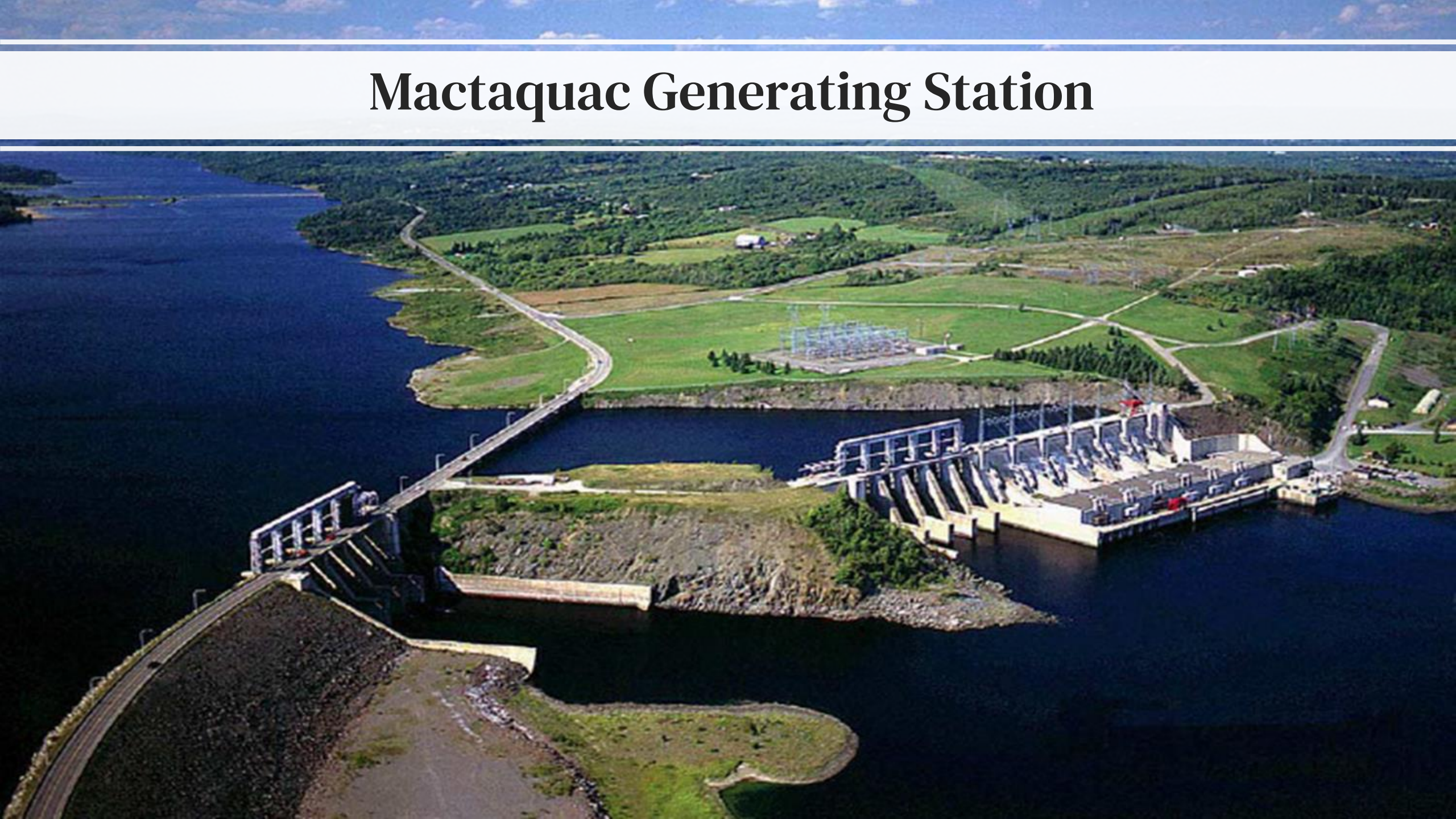
New Brunswick Emergency Measures Organization (NB EMO)

NBEMO New Brunswick Emergency Measures Organization
OMUNB Organisation des mesures d'urgence du Nouveau-Brunswick

New Nouveau Brunswick

Unclassified

Mactaquac Generating Station



Caveat

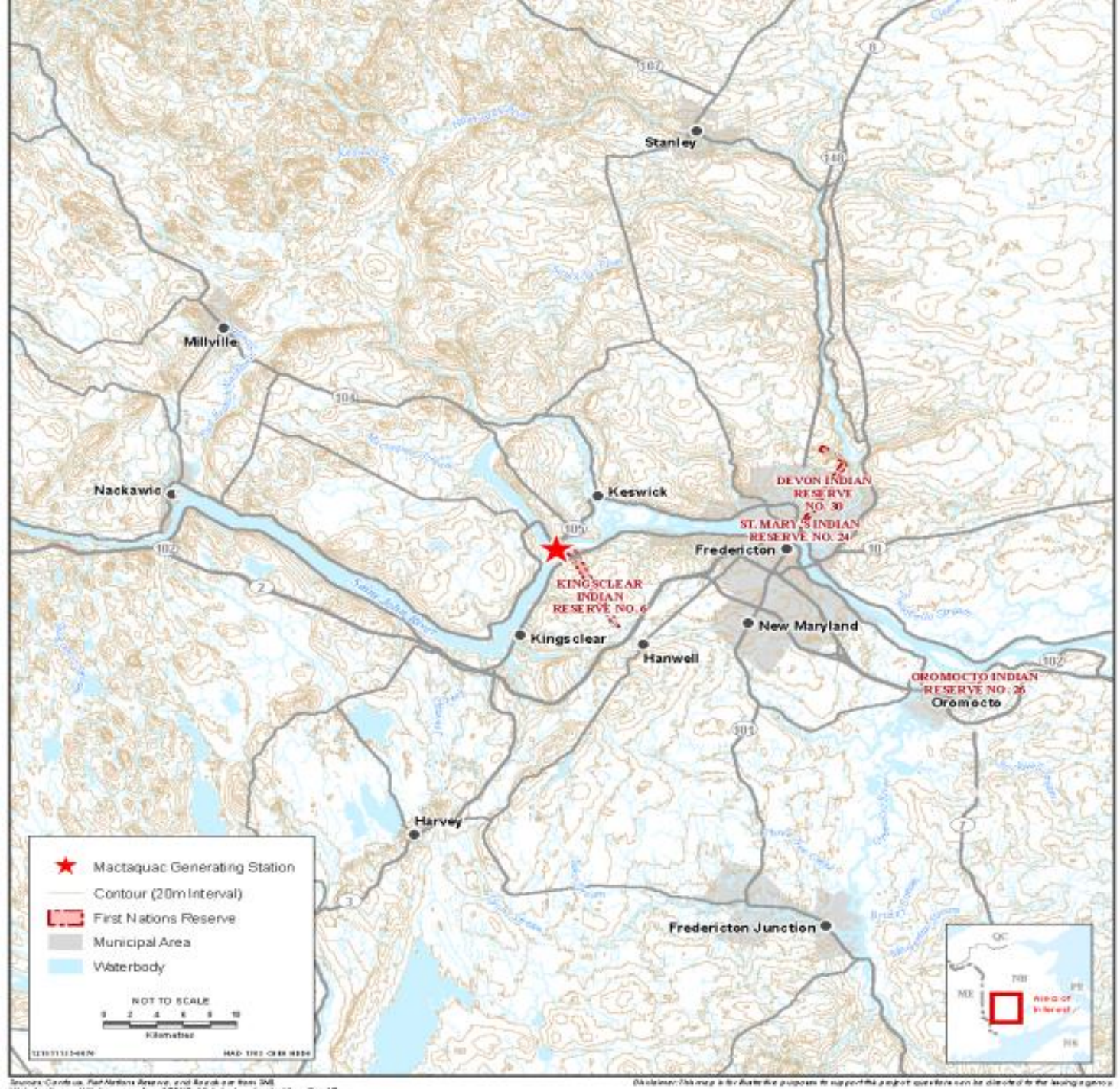
The delivery of this briefing on the planning by NB Power and NB EMO is in no way tied to any ongoing safety concerns at the Mactaquac Generating Station.

These briefings are to provide details on the current plans prepared by NB Power and NB EMO.

NB EMO and other government departments have been focused on COVID 19 over the past couple of years therefore NB EMO wanted to provide updated briefings to new members as well as seasoned veterans on the current plans.

Outline

1. Location
2. Mactaquac Generating Station Overview
3. Plans
4. Mactaquac Generating Station Emergency Preparedness Plan
5. Site Description / Major Components
6 Mactaquac Generating Station Emergency Measures Plan
7. Flood 1973, 2018, and 2019
8. Conclusion / Questions



Mactaquac Generating Station Location

The Mactaquac Generating Station (MGS) is located on the St. John River about 20 km west of Fredericton, New Brunswick.

With a generating capacity of approximately 670 MW, the MGS supplies approximately 18% of New Brunswick's power requirements.

The MGS is a run-of-the-river dam; flows into the head pond are typically equal to the flows through the dam. There is, however, some daily and seasonal storage of water in the head pond. This storage allows NB power to fluctuate power generation to respond to variations in energy markets and operational requirements.

New Brunswick / Nouveau-Brunswick

NBEMO
New Brunswick Emergency Measures Organization

OMUNB
Organisation des mesures d'urgence du Nouveau-Brunswick

Mactaquac Generating Station Plans

There are two:

NB Power

NBEMO

NB Power	Emergency Preparedness Plan (EPP) for Dam Safety Mactaquac Generating Station
NBEMO	Mactaquac Generating Station Emergency Measures Plan

New Nouveau Brunswick

NBEMO New Brunswick Emergency Measures Organization

OMUNB Organisation des mesures d'urgence du Nouveau-Brunswick

Emergency Preparedness Plan

The EPP for Dam Safety
Mactaquac Generating Station

This Emergency Preparedness Plan (EPP) was prepared by NB Power for use by external agencies and is intended to facilitate effective emergency response in cases where a failure or breach of any of the water-retaining structures at Mactaquac Generating Station (MGS) could be expected to result in serious flooding and potential loss of life.

The development of this EPP does not, in any way, reflect upon the structural integrity and safe operation of the MGS.

New Nouveau Brunswick

NBEMO
New Brunswick
Emergency Measures
Organization

OMUNB
Organisation des
mesures d'urgence du
Nouveau-Brunswick

Emergency Preparedness Plan

This EPP is consistent with the Canadian Dam Association's (CDA) Dam Safety Guidelines, which is the industry standard for dam safety in Canada. There are no legislative requirements for NB Power to implement this type of plan.

New Brunswick Nouveau Brunswick

NBEMO New Brunswick Emergency Measures Organization

OMUNB Organisation des mesures d'urgence du Nouveau-Brunswick

Emergency Preparedness Plan

This Emergency Preparedness Plan (EPP) for Dam Safety is one of four (4) primary dam safety documents applicable to NB Power's dams.

New Nouveau Brunswick

1. An Operations, Maintenance, and Surveillance (OMS) Manual for Dam Safety—Mactaquac Generating Station, which describes how day-to-day tasks related to dam safety at MGS are performed, and by whom. The OMS manual contains In-Plant Procedures (IPPs) applicable to normal conditions, flood situations, dam safety alerts, and/or dam safety emergencies;

2. An Emergency Preparedness Plan (EPP) for Dam Safety—Mactaquac Generating Station, which contains inundation maps and other information applicable to MGS that is required by downstream responders to update their own emergency plans;

NBEMO New Brunswick Emergency Measures Organization

OMUNB Organisation des mesures d'urgence du Nouveau-Brunswick

Emergency Preparedness Plan

This Emergency Preparedness Plan (EPP) for Dam Safety is one of four (4) primary dam safety documents applicable to NB Power's dams, i.e.:

3.An Emergency Response Plan (ERP) for Dam Safety—Mactaquac Generating Station, which describes how NB Power will respond to a dam safety emergency at MGS; and

4. An Executive Emergency Response Plan and Emergency Response Procedure (EERP), which describes how NB Power executives will respond to various types of emergencies.

New Brunswick Nouveau Brunswick

NBEMO New Brunswick Emergency Measures Organization

OMUNB Organisation des mesures d'urgence du Nouveau-Brunswick

Emergency Preparedness Plan

Emergency Classification and Notifications

This EPP identifies five (5) activation levels that can occur at MGS and may require a response-by-response personnel and other organizations in addition to NB Power.

New Nouveau Brunswick

NBEMO
New Brunswick Emergency Measures Organization

OMUNB
Organisation des mesures d'urgence du Nouveau-Brunswick

Level	Condition		Action
	Hydrologic Event	**Other Events**	
NORMAL CONDITION (Green)	River conditions are normal, in that no flood warning is appropriate or necessary.	n/a	• Follow procedures outlined in the dam-specific *OMS Manual for Dam Safety* for normal conditions.
FLOOD SITUATION (Blue) Out-of-bank water levels	A 'Flood Warning' has been issued by regulatory authority or municipality, or NB Power, but situation is not threatening dam integrity.	Not applicable. *<u>Note</u>: NB Power has discretion to declare a 'Level Blue' for any other abnormal flows.*	• Follow procedures outlined in the dam-specific *OMS Manual for Dam Safety*. • EOC (MGS) may be activated at discretion of NB Power to coordinate internal activities. • NB Power is available to support NB EMO on request.
DAM ALERT (Yellow) Abnormal condition poses a threat	a) Inflow exceeds 50% of the maximum discharge capacity (710,000 cfs), i.e. 355,000 cfs. b) The maximum operating water level (MOL) of the headpond (133 ft) is expected to be exceeded.	Abnormal condition that may affect dam performance has been identified, e.g.: • Signs of potential internal erosion; • Earthquake occurrence; • Increased leakage; • Minor structural deformation or deterioration.	• Initiate internal notifications, but do not activate the ERP. • Follow procedures outlined in the dam-specific *OMS Manual for Dam Safety* to mitigate abnormal condition. • Activate EOC (MGS) at discretion of NB Power. • Increased on-site monitoring. • Continue to evaluate as required. • Determine need to issue targeted external notification
DAM EMERGENCY (Orange) Potential dam failure is developing	a) Inflow exceeds the maximum discharge capacity, i.e. 710,000 cfs. b) The maximum operating level (MOL) of the headpond (133 ft) has been exceeded. c) The headpond level is expected to exceed the top of the embankment core (138 ft).	Inflows are indicative of potential dam failure. Abnormal condition creates threat to dam safety, requiring immediate attention. If implemented, remediation is expected to be effective.	• Activate the ERP. • Activate the EOC. • Initiate external and internal notifications. • Provide situational briefings. • Discuss time available for evacuation with NB EMO and external stakeholders. • Implement mitigation actions. • Carry out on-site monitoring. • Prepare for plant shutdown.
DAM FAILURE (Red) Dam failure is imminent or has occurred	a) Inflow exceeds the maximum discharge capacity, i.e. 710,000 cfs. b) Dam overtopping is occurring or imminent.	Upstream water level is decreasing rapidly, indicative of dam failure. Failure of dam is occurring or imminent.	• Perform all actions listed for DAM EMERGENCY (level 'Orange'), **plus**: • Initiate plant shutdown procedures; • Evacuate NB Power staff to safety.

OPERATION LEVELS

This EPP identifies five (5) Operation Levels that can exist at MQGS and may require a response by external response agencies and other organizations in addition to NB Power.

New Nouveau Brunswick

NORMAL CONDITION (GREEN)

- **A NORMAL CONDITION is the default operation level at MQGS and is associated with normal river conditions.**
- **During a normal condition, NB Power will follow the operating procedures contained in their OMS Manual for Dam Safety.**

OPERATION LEVELS

This EPP identifies five (5) Operation Levels that can exist at MQGS and may require a response by external response agencies and other organizations in addition to NB Power.

FLOOD SITUATION (BLUE)

- **A FLOOD SITUATION is not a dam safety emergency (i.e., it does not threaten the dam's integrity). However, it is associated with higher-than-normal river flows and may constitute an emergency for stakeholders downstream of MQGS.**
- **Upon classification of a Flood Situation, NB Power will follow the operating procedures contained in their OMS Manual for Dam Safety.**

OPERATION LEVELS

This EPP identifies five (5) Operation Levels that can exist at MQGS and may require a response by external response agencies and other organizations in addition to NB Power.

DAM ALERT (YELLOW)

- **A DAM ALERT is not a dam safety emergency; it is an abnormal condition that could develop into a dam emergency if ignored or if mitigative actions are unsuccessful.**
- **Upon classification of a Dam Alert, NB Power will follow the procedures outlined in their OMS Manual for Dam Safety.**

OPERATION LEVELS

This EPP identifies five (5) Operation Levels that can exist at MQGS and may require a response by external response agencies and other organizations in addition to NB Power.

DAM EMERGENCY (ORANGE)

- **A DAM EMERGENCY indicates that a potential dam failure is developing. However, it is believed that mitigative actions can be performed in time to prevent a dam failure.**
- **NB Power's primary management objective during a Dam Emergency is to save the dam.**

OPERATION LEVELS

This EPidentifies five (5) Operation Levels that can exist at MQGS and may require a response by external response agencies and other organizations in addition to NB Power.

DAM FAILURE (RED)

- **A DAM FAILURE indicates that a dam failure is imminent or has already occurred. It is believed that mitigative actions cannot be performed in time to prevent a dam failure. NB Power's primary management objective during a Dam Failure is to save lives.**
- **Upon classification of a Dam Emergency or Dam Failure, NB Power's Hydro IM will issue the following notification to NB EMO**
- **(A courtesy notification may also be provided upon classification of a Dam Alert, at the discretion of the Hydro IM.**

Notifications

The most important objective of a notification system is to warn stakeholders of a dam failure before the occurrence of significant flood impacts.

The notification flow chart shows that the stakeholders affected by a dam failure at MQGS are accounted for in this EPP and identifies the following responsibilities:

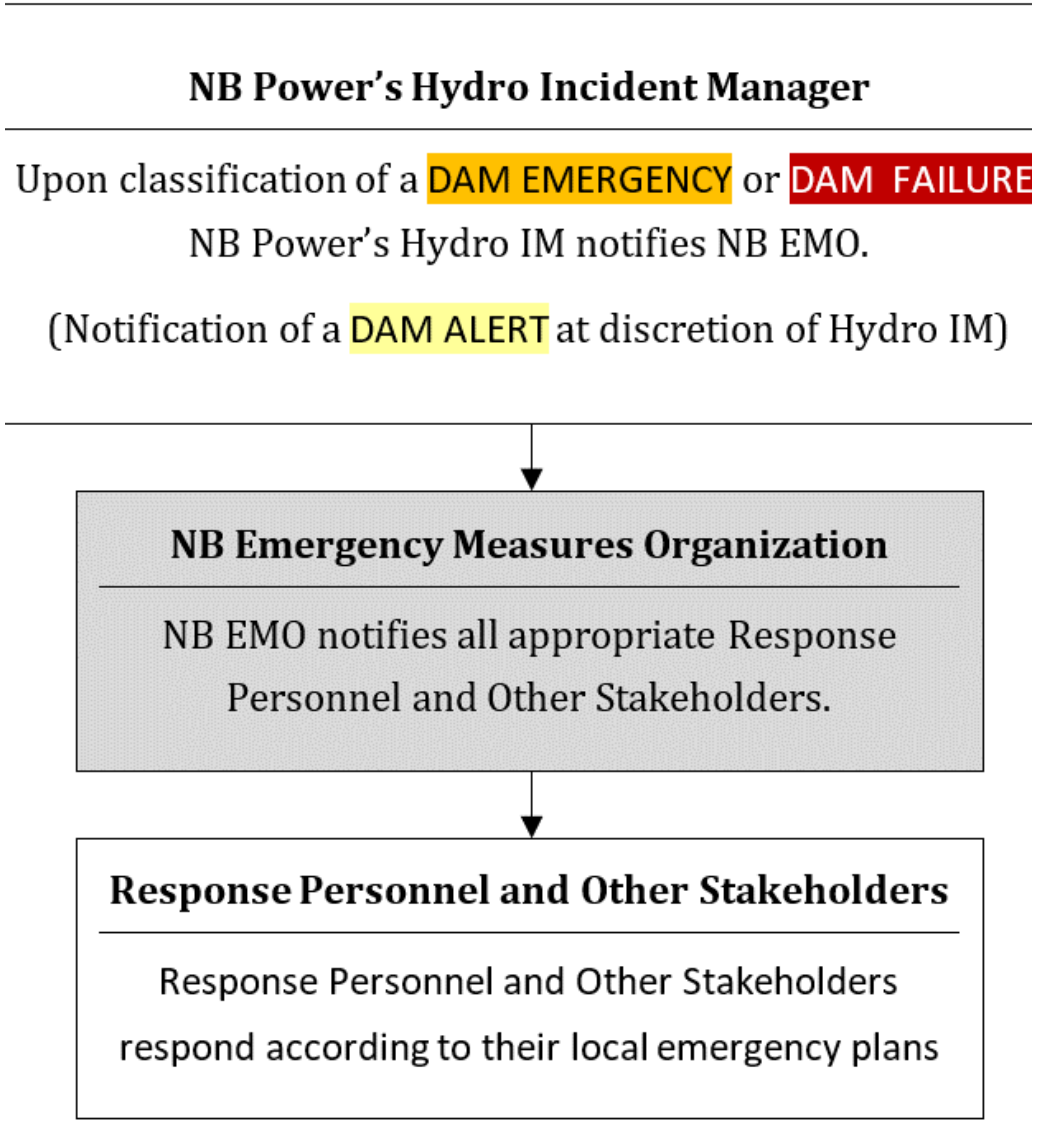
New Nouveau Brunswick

NB Power's Hydro Incident Manager (Hydro IM) notifies NB EMO

NB EMO notifies all appropriate Response Personnel and Other Stakeholders

NBEMO Mactaquac Generating Station Emergency Measures Plan (Annex B)

Emergency Preparedness Plan for Dam Safety Mactaquac Generating Station



NBEMO New Brunswick Emergency Measures Organization
OMUNB Organisation des mesures d'urgence du Nouveau-Brunswick

New Nouveau Brunswick

Site Description

The main structures comprising MGS are pictured on the next slide:

- Main Dam Embankment;
- Diversion Sluiceway;
- Main Spillway;
- Intake Structure; and
- Powerhouse

New Nouveau Brunswick

NBEMO New Brunswick Emergency Measures Organization

OMUNB Organisation des mesures d'urgence du Nouveau-Brunswick


Diversion
Sluiceway
Main
Spillway
Intake
Structure
Main Dam Embankment
Rock Island
Power House

Appendix A

Site Description

Characteristics of MGS Structures and Reservoir

Reservoir

Reservoir		
Normal Headpond Elevation		133 ft (40.5 m)
Tailrace Elevation at Full Load		21 ft (6.4 m)
Normal Headpond Surface Area		21,800 acres (8,822 ha)
Useful Storage Capacity		202,700 acre-ft (250 million m^3)
Normal Operating Range	Max	133 ft (40.5 m)
	Min	128 ft (39.0 m)

New Nouveau Brunswick

NBEMO New Brunswick Emergency Measures Organization

OMUNB Organisation des mesures d'urgence du Nouveau-Brunswick

Appendix A

Site Description

Characteristics of MGS Structures and Reservoir

Main Dan Embankment

Main Dam Embankment		
Type of Structure		Rockfill with central impervious core
Length of Crest		1,800 ft (549 m)
Width at Crest		40 ft (12.2 m)
Minimum Crest Elevation		139 ft (42.4 m)
Minimum Core Elevation		138 ft (42.1 m)
Maximum Height		180 ft (54.9 m)
Upstream Slope	Upper Slope	1.8H:1V
	Lower Slope	Upstream cofferdam incorporated as toe berm (EL. 70 ft)
Downstream Slope	Upper Slope	1.7H:1V
	Lower Slope	Downstream cofferdam incorporated as toe berm (EL. 35 ft)
Right Abutment		Original ground (bedrock)
Left Abutment		South End Pier of Diversion Sluiceway

New Brunswick Nouveau Brunswick

NBEMO New Brunswick Emergency Measures Organization

OMUNB Organisation des mesures d'urgence du Nouveau-Brunswick

Appendix A

Site Description

Characteristics of MGS Structures and Reservoir

Diversion Sluiceway

Diversion Sluiceway		
Type of Structure		Concrete gravity overflow
Control Gates		5 vertical lift gates
Size of Gates		45 ft-wide x 53 ft-high (13.7 m x 16.2 m)
Gate Sill Elevation		80 ft (24.4 m)
Length of Structure	Gated Structure	273 ft (83.2 m)
	Stoplog Storage	83 ft (25.3 m)
	North Bulkhead Wall	240 ft (73.2 m)
Right Abutment		Main Dam Embankment
Left Abutment		Rock Island

New Nouveau Brunswick

NBEMO New Brunswick Emergency Measures Organization

OMUNB Organisation des mesures d'urgence du Nouveau-Brunswick

Appendix A

Site Description

Characteristics of MGS Structures and Reservoir

Main Spillway

Main Spillway		
Type of Structure		Concrete gravity overflow
Control Gates		5 vertical lift gates
Size of Gates		45 ft-wide x 53 ft-high (13.7 m x 16.2 m)
Gate Sill Elevation		80 ft (24.4 m)
Length of Structure	Stoplog Storage	78 ft (23.8 m)
	Gated Structure	273 ft (83.2 m)
Right Abutment		Rock Island
Left Abutment		Intake Structure
Total Discharge Capacity of Spillway Structures (Diversion Sluiceway + Main Spillway)		680,000 cfs (19,255 cms)

New Brunswick Nouveau Brunswick

NBEMO New Brunswick Emergency Measures Organization

OMUNB Organisation des mesures d'urgence du Nouveau-Brunswick

Appendix A

Site Description

Characteristics of MGS Structures and Reservoir

Powerhouse

Powerhouse		
Installed Capacity		672 MW
Number of Units		6
Type of Turbine		Kaplan
Plant Discharge Capacity		81,000 cfs (2,300 cms)
In-Service Dates (Year)	Units 1, 2, and 3	1968
	Unit 4	1972
	Unit 5	1979
	Unit 6	1980

New Nouveau Brunswick

NBEMO New Brunswick Emergency Measures Organization

OMUNB Organisation des mesures d'urgence du Nouveau-Brunswick

Appendix A

Site Description

Characteristics of MGS Structures and Reservoir

Intake Structure

INTAKE STRUCTURE		
Type of Structure		Concrete gravity
Control Gates		2 per unit, vertical hydraulic lift
Size of Gates (Clear Opening)		16 ft-high x (34 ft + 4.5 in)-wide
Sill Elevation		60 ft (18.3 m)
Structure Length		522 ft (159.1 m)
Penstocks	Type	6 steel-lined
	Internal Diameter	29 ft (8.8 m)
	Length	178 ft (54.3 m)
Right Abutment		Intake structure
Left Abutment		Original ground (bedrock)

Emergency Preparedness Plan

The EPP for Dam Safety
Mactaquac Generating Station

This Emergency Preparedness Plan has Appendix A Site Description

Appendix B Inundation Maps –Sunny Day Failure

Appendix C Inundation Maps –PMF Failure

Appendix D Peak Water Levels–Flood Timings

Appendix E EPP Plan Holders–PMF Failure

Appendix F Definitions

New Brunswick Nouveau Brunswick

NBEMO New Brunswick Emergency Measures Organization

OMUNB Organisation des mesures d'urgence du Nouveau-Brunswick

Emergency Preparedness Plan

The EPP for Dam Safety
Mactaquac Generating Station

New Nouveau Brunswick

Are there any questions on the Emergency Preparedness Plan for Dam Safety Mactaquac Generating Station?

NBEMO
New Brunswick Emergency Measures Organization

OMUNB
Organisation des mesures d'urgence du Nouveau-Brunswick

Mactaquac Generating Station Emergency Measures Plan

New Brunswick / Nouveau-Brunswick

NBEMO

Mactaquac Generating Station Emergency Measures Plan

NBEMO
New Brunswick Emergency Measures Organization

OMUNB
Organisation des mesures d'urgence du Nouveau-Brunswick

Mactaquac Generating Station Emergency Measures Plan

CSA Z-1600:17 (R2022) Standard

Table of Contents / Introduction / Distribution

Part 1 - General Information

Part 2 - Hazard, History, Vulnerability and Maximum Threat with Response Actions

Part 3 - Provincial Department / Agencies Roles and Responsibilities

Annexes A to F

New Nouveau Brunswick

NBEMO
New Brunswick Emergency Measures Organization

OMUNB
Organisation des mesures d'urgence du Nouveau-Brunswick

Mactaquac Generating Station Emergency Measures Plan

CSA Z-1600:17 Standard

Regional Plan

Provincial Plans

Foreword

Table of Contents

New Nouveau Brunswick

NBEMO New Brunswick Emergency Measures Organization

OMUNB Organisation des mesures d'urgence du Nouveau-Brunswick

Mactaquac Generating Station Emergency Measures Plan

- Introduction
- Distribution List
- List of Amendments

New Nouveau Brunswick

NBEMO New Brunswick Emergency Measures Organization

OMUNB Organisation des mesures d'urgence du Nouveau-Brunswick

Mactaquac Generating Station Emergency Measures Plan

- Part 1 - General Information
  - 1.1 Background to 1.21 Definitions

  - Phases of an Emergency
  - Graduated Response
  - Levels of Response
  - Authority Minister of Public Safety
  - States of Emergency
  - PEAC
  - PEOC
  - MGS Site Description
  - Emergency Communications
  - Definitions

New Nouveau Brunswick

NBEMO New Brunswick Emergency Measures Organization

OMUNB Organisation des mesures d'urgence du Nouveau-Brunswick

Mactaquac Generating Station Emergency Measures Plan

- Part 2 - Hazard, History, Vulnerability and Maximum Threat with Response Actions
  - 2.1 Hazard to 2.6 Hazard Summary
  - MGS Classifications
  - Notification Procedures
  - Response Guidelines

New Brunswick / Nouveau-Brunswick

NBEMO New Brunswick Emergency Measures Organization

OMUNB Organisation des mesures d'urgence du Nouveau-Brunswick

Mactaquac Generating Station Emergency Measures Plan

- Part 3 - Provincial Department / Agencies Roles and Responsibilities
  - 3.1 New Brunswick Regulation 84-7 and The Emergency Measures Act to 3.2.16 NB Power
  - Listing of Provincial Department / Agencies Roles and Responsibilities

New Brunswick / Nouveau-Brunswick

NBEMO New Brunswick Emergency Measures Organization

OMUNB Organisation des mesures d'urgence du Nouveau-Brunswick

Mactaquac Generating Station Emergency Measures Plan

- Annexes
  - Annex A - Contact List for Provincial Departments / Organizations / Agencies (PEAC)
  - Annex B - List of Local Governments, Rural Districts, Regional District Managers (RDM's), Regional Emergency Management Coordinators (REMCs), and First Nation Contacts Downstream from the Mactaquac Generating Station

New Brunswick Nouveau Brunswick

NBEMO New Brunswick Emergency Measures Organization

OMUNB Organisation des mesures d'urgence du Nouveau-Brunswick

Mactaquac Generating Station Emergency Measures Plan

- Annexes
  - Annex C - Mactaquac Generating Station Staff Contact List
  - Annex D - Critical Infrastructure Classifications

New Brunswick Nouveau Brunswick

NBEMO New Brunswick Emergency Measures Organization

OMUNB Organisation des mesures d'urgence du Nouveau-Brunswick

Mactaquac Generating Station Emergency Measures Plan

- Annexes
  - Annex E - Provincial Activation Timeline
  - Annex F – Inundation Mapping Summary (Sunny Day Failure)

Mactaquac Generating Station Emergency Measures Plan

Any Questions on the NBEMO Mactaquac Generating Station Emergency Measures Plan?

New Nouveau Brunswick

NBEMO New Brunswick Emergency Measures Organization

OMUNB Organisation des mesures d'urgence du Nouveau-Brunswick

OPEN DISCUSSION

Flood History Fredericton NB

1973 8.61 meters

2019 8.37 meters

2008 8.36 meters

2018 8.31 meters

Fredericton Flood 1973

The 1973 Saint John River flood in late April 1973 was the most significant flood ever recorded on the Saint John River.

"Flooding occurred in several places along the Saint John that spring—among them, Edmundston, Grand Falls, Perth-Andover, Hartland, Woodstock and parts of Maine.

By far the most dramatic effects were in the lower valley. In Fredericton, the river level reached 8.6m, or 6.9m above its normal summer level (1.7m). Water spilled into older residential areas, lapped against newer subdivisions, and welled up around public buildings.

Fredericton Flood 1973

The flood inundated many parts of the city of Fredericton, New Brunswick and its surrounding farmlands killing at least one person and causing nearly 12 million dollars (78 million adjusted to 2008 dollars) in damages.

The flood was created by a combination of heavy rain in the watershed and snow melt.

Fredericton Flood 1973

Orange Pumpkin Flood 2019

Grand Lake Flood 2019

NBEMO
New Brunswick
Emergency Measures
Organization

OMUNB
Organisation des
mesures d'urgence du
Nouveau-Brunswick

New Nouveau
Brunswick

North Burton Bridge Flood 2019

NBEMO
New Brunswick
Emergency Measures
Organization

OMUNB
Organisation des
mesures d'urgence du
Nouveau-Brunswick

New Nouveau
Brunswick

Burton Bridge Flood 2019

NBEMO
New Brunswick
Emergency Measures
Organization

OMUNB
Organisation des
mesures d'urgence du
Nouveau-Brunswick

New Nouveau
Brunswick

Jemseg Flood 2018

NBEMO
New Brunswick
Emergency Measures
Organization

OMUNB
Organisation des
mesures d'urgence du
Nouveau-Brunswick

New Nouveau
Brunswick

Maugerville Flood 2018

NBEMO
New Brunswick
Emergency Measures
Organization

OMUNB
Organisation des
mesures d'urgence du
Nouveau-Brunswick

New Nouveau
Brunswick

Fredericton Flood 2018

NBEMO
New Brunswick
Emergency Measures
Organization

OMUNB
Organisation des
mesures d'urgence du
Nouveau-Brunswick

New Nouveau
Brunswick

Millidgeville Flood 2018

Mactaquac Generating Station Dam Breach

Dam Breach Analysis

New Nouveau Brunswick

Dam Breach

NBEMO
New Brunswick Emergency Measures Organization

OMUNB
Organisation des mesures d'urgence du Nouveau-Brunswick

Mactaquac Generating Station Dam Breach

Dam Breach Analysis

The analysis was carried out for normal low flow / full head pond water level conditions called “Sunny Day Scenario” and not the extreme high flow condition called “Probable Maximum Flood (PMF) Scenario” .

Mactaquac Generating Station Dam Breach

Dam Breach Analysis

Considering the spillway capacity and the availability of more than six feet of freeboard above the maximum design water level at the dam, analysis shows that overtopping of the Mactaquac embankment dam is not a realistic scenario to consider.

Therefore, for the purpose of preparing the Mactaquac Generating Station Emergency Measures Plan, only a breach caused by piping was investigated.

OPEN DISCUSSION

Notifications (to the public)

Emergency Services (Police, Fire, Ambulance)

Evacuations

Reception Centers

NBEMO
New Brunswick Emergency Measures Organization

OMUNB
Organisation des mesures d'urgence du Nouveau-Brunswick

OPEN DISCUSSION

Power Outages

Impacts (Before, During and After)

Returning Home

Planning

NBEMO New Brunswick Emergency Measures Organization

OMUNB Organisation des mesures d'urgence du Nouveau-Brunswick

Contact Information

Roger.Shepard@gnb.ca

506-478-2496

Visit

http://www.mactaquac.ca

NBEMO New Brunswick Emergency Measures Organization
OMUNB Organisation des mesures d'urgence du Nouveau-Brunswick

New Brunswick Nouveau Brunswick