Bringing New York Dams into Compliance

May 3, 2019

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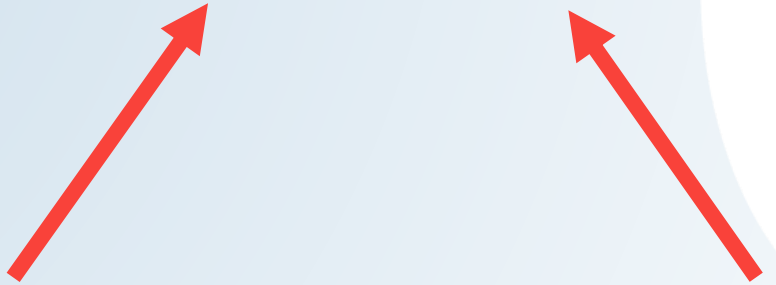
NYSDEC Dam Safety Regulations

6 NYCRR Part 673



Title 6 of the New York Codes, Rules, and Regulations (NYCRR)

Part 673: Dam Safety Regulations

Purpose: Administer Environmental Conservation Law Article 15 and regulate dam safety and dam safety programs

NYSDEC Dam Safety Regulations: Hazard Classification

Class A – Low Hazard Dam

Dam failure is **unlikely** to result in damage to anything more than isolated and unoccupied buildings and undeveloped lands.


Lake Katonah Dam

Class B – Intermediate Hazard Dam

Dam failure is **likely** to pose the threat of personal injury or result in substantial economic, environmental, or infrastructure loss.
Loss of human life is not expected.


Glass Lake Dam

Class C – High Hazard Dam

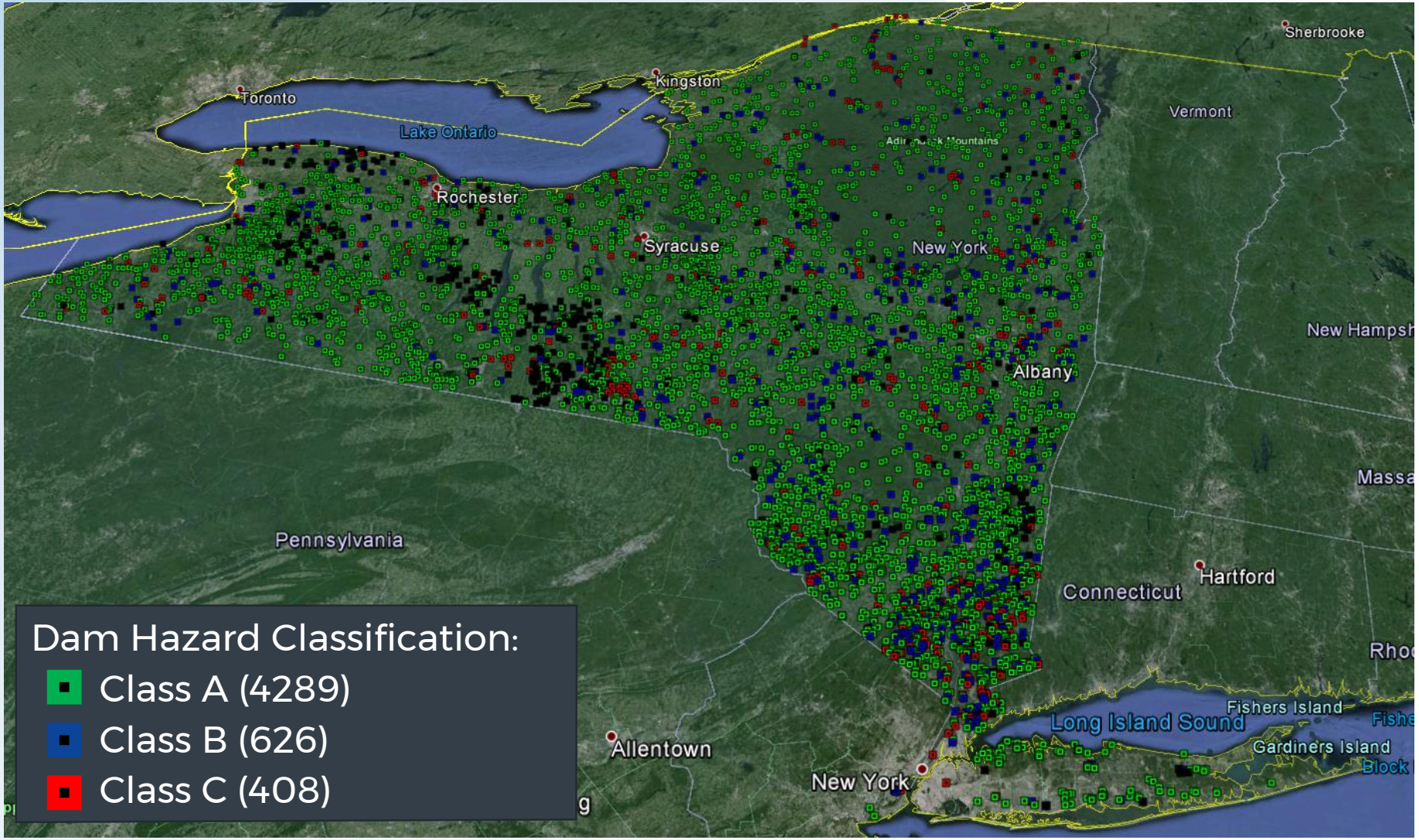
Dam failure is **likely** to result in widespread substantial economic, environmental, or infrastructure loss.
Loss of human life is likely.


NR Reservoir #1 Dam

NYSDEC Dam Safety Regulations: Requirements

NEW YORK STATE DAM SAFETY REGULATIONS				
REQUIREMENT	FREQUENCY	DAM HAZARD CLASSIFICATION		
		C HIGH	B INTERMEDIATE	A LOW
Inspection & Maintenance Plan	On-going	✓	✓	Varies
Annual Certification	Annually by Jan 31	✓	✓	N/A
Emergency Action Plan	Annual Review and Update	✓	✓	N/A
Dam Safety Inspection	2 Years for Class C 4 Years for Class B	✓	✓	N/A
Engineering Assessment	Every 10 Years	2022	2025	N/A
✓ - indicates requirement that must be fulfilled				

NYSDEC Dams Inventory



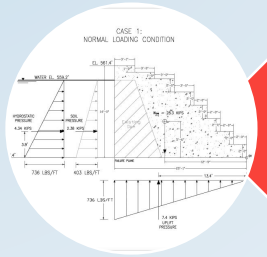
Engineering Assessment

Required every 10 years for Class B and C dams or if assigned Condition Rating of “unsafe” or “unsound”

- Safety Inspection
- Hydrologic and hydraulic analysis
- Spillway capacity determination
- Stability and structural analysis
- Hazard Classification
- Emergency Action Plan Review

Common Rehabilitation Issues

Insufficient Spillway Capacity



Inadequate Stability Factors of Safety

Insufficient Low Level Outlet Capacity

Dam Condition Issues

Spillway Capacity

Spillway Design Floods for Existing Dams

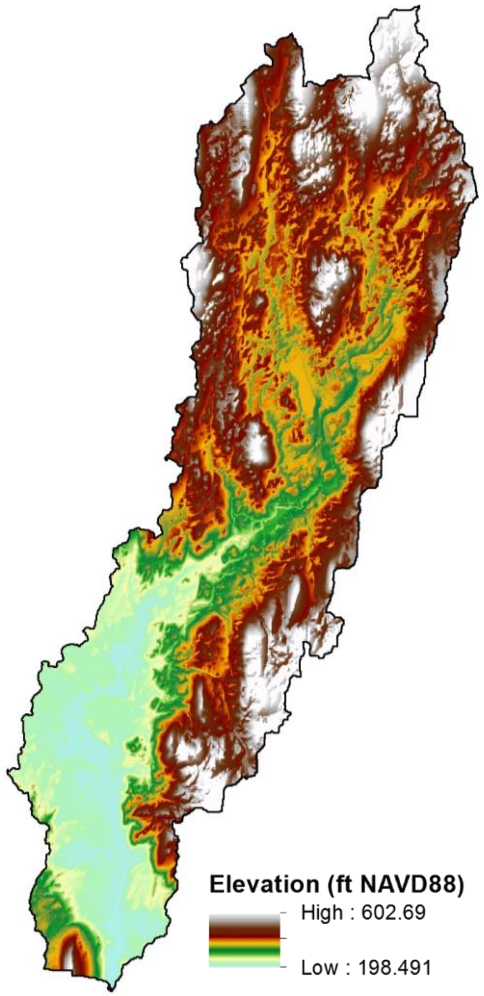
Hazard Classification	Spillway Design Flood (SDF)
A	100 year
B	150% of 100 year
C	50% of Probable Maximum Flood

Guidelines for the Design of Dams, 1989, NYSDEC Division of Water

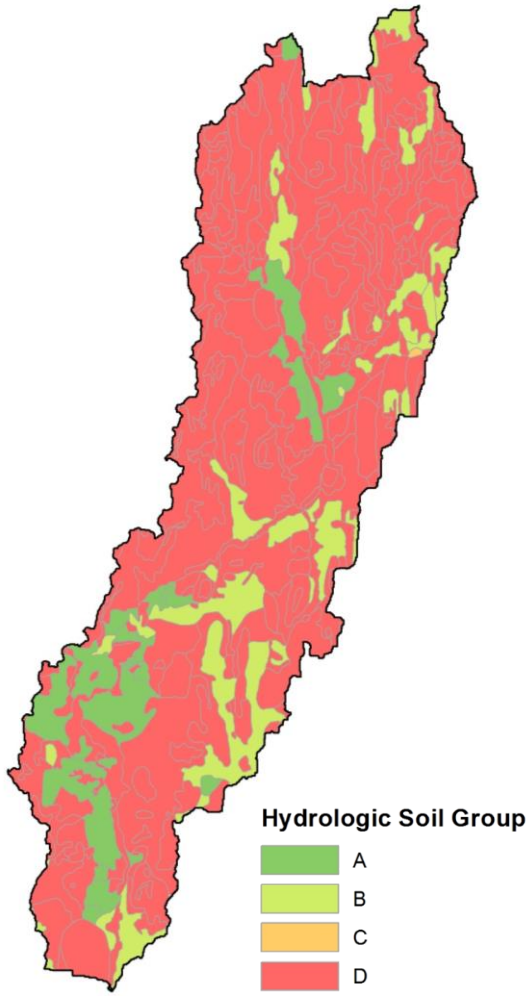
Mount Beacon Dam Spillway (Class C Dam)

Hydrologic Analysis

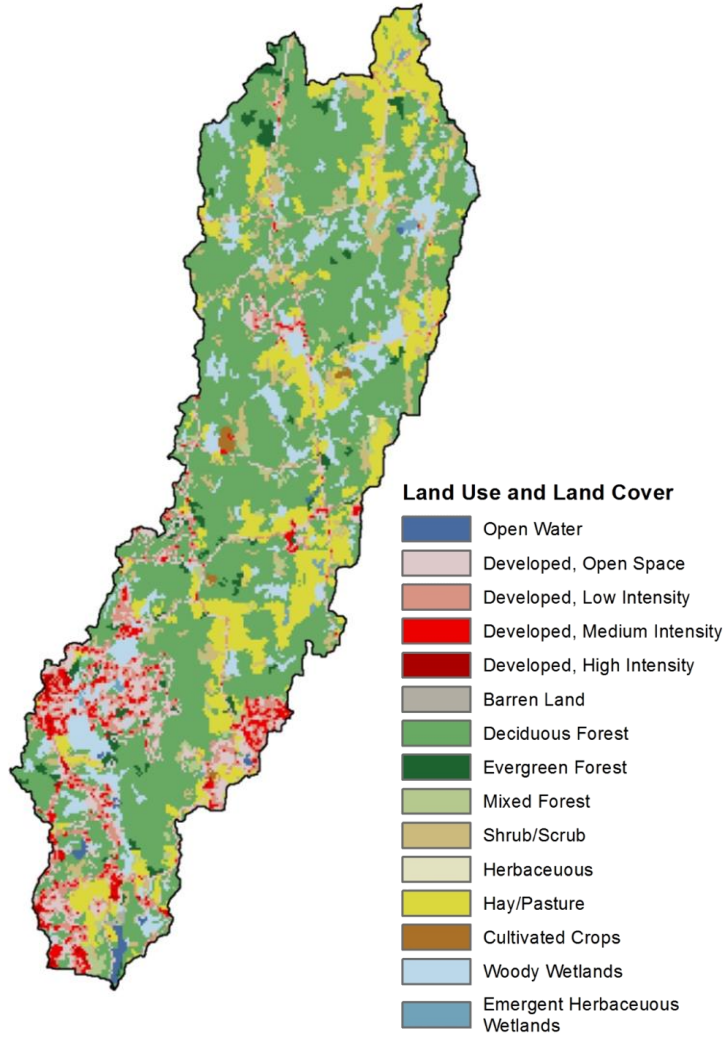
Digital Elevation Model



Hydrologic Soil Group



Land Use and Land Cover

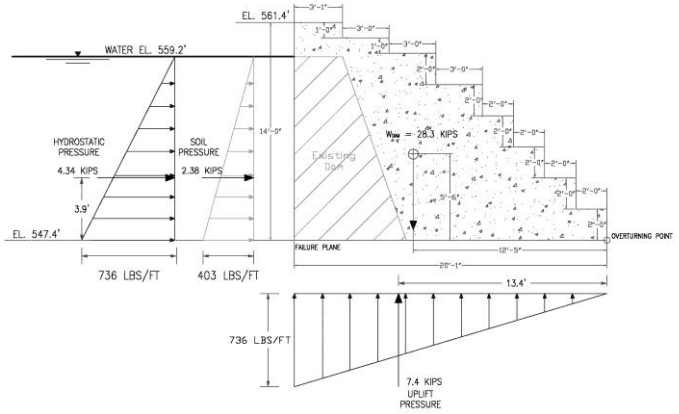


Stability Analysis: Gravity Dam Guidelines

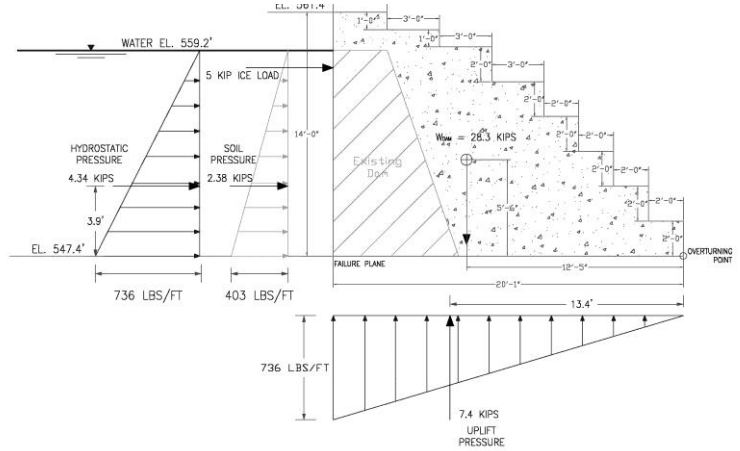
Load Case	Load Condition	Minimum Required Factor of Safety
Case 1	Normal	1.5
Case 2	Ice	1.25
Case 3	Spillway Design Flood (SDF)	1.25
Case 4	Seismic	1.0

Stability Analysis: Typical Gravity Section

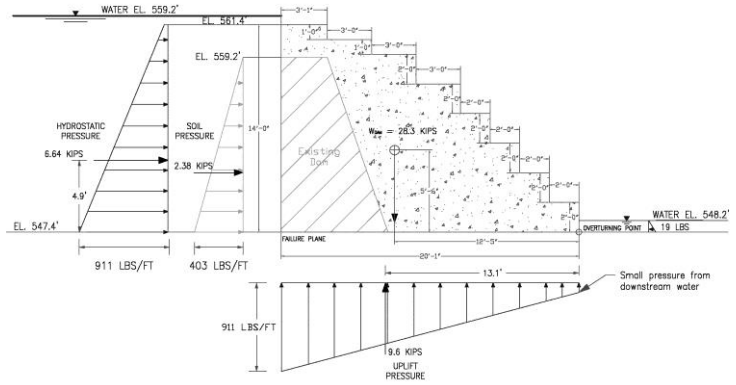
Normal



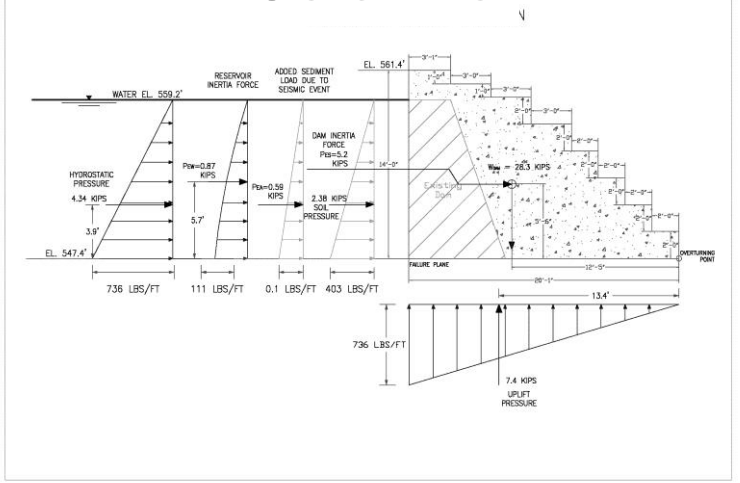
Ice



Extreme (SDF)



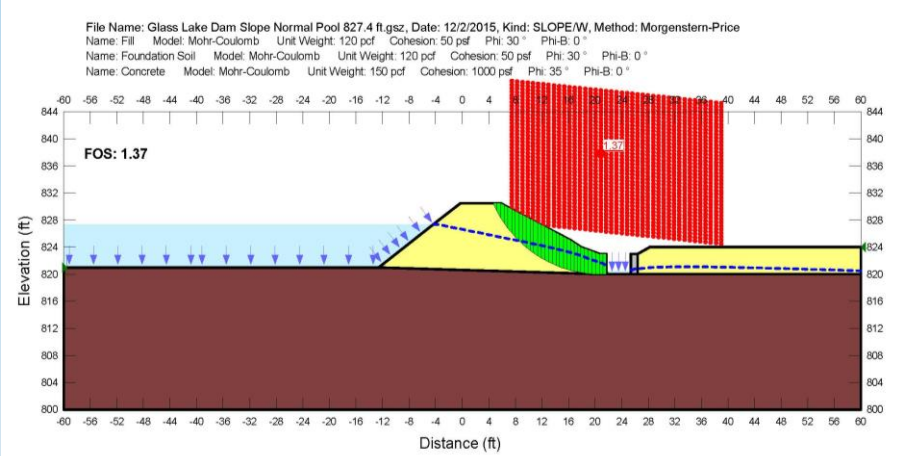
Seismic



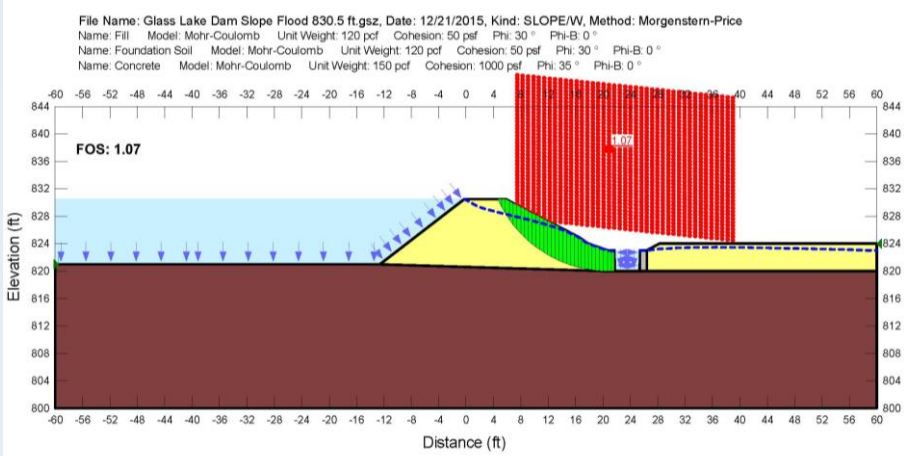
Stability Analysis: Embankment Dam Guidelines

Loading Condition	Slope to be Analyzed	Minimum Required Factor of Safety
Steady Seepage with Normal Loading Conditions	Downstream	1.5
Steady Seepage with Design Loading Conditions (SDF)	Downstream	1.4
Seismic Loading Conditions	Downstream	1
	Upstream	1
Rapid Drawdown with Normal Loading Conditions	Downstream	1.1
	Upstream	1.1
Rapid Drawdown with Design Loading Conditions (SDF)	Downstream	1.3

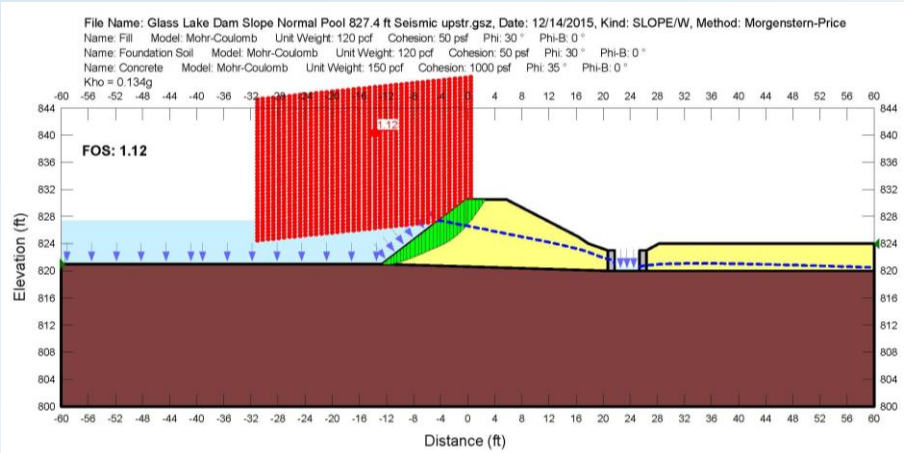
Stability Analysis: Embankment Section



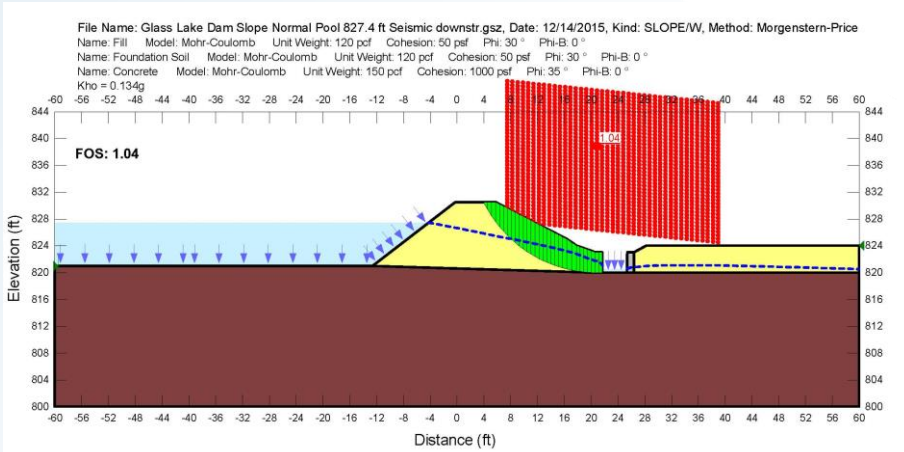
Normal Pool



Flood (SDF)

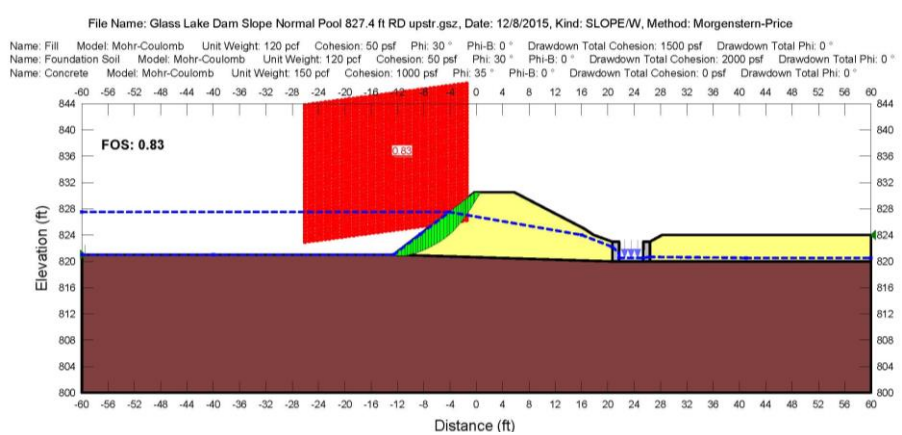


Seismic Upstream

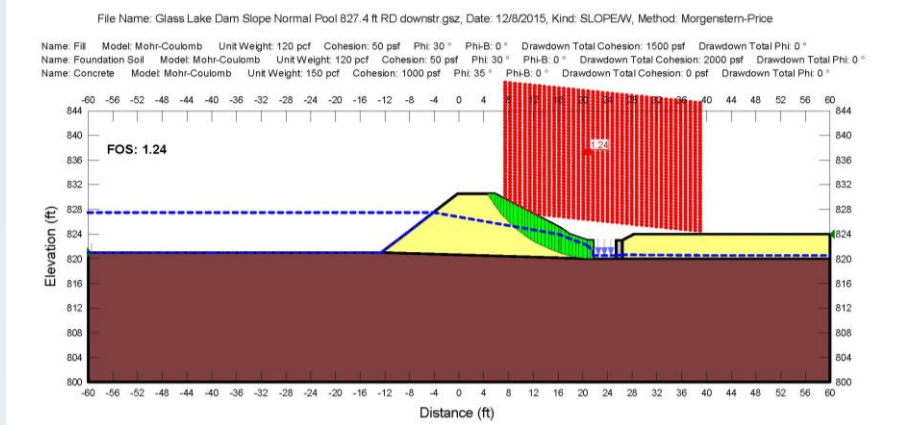


Seismic Downstream

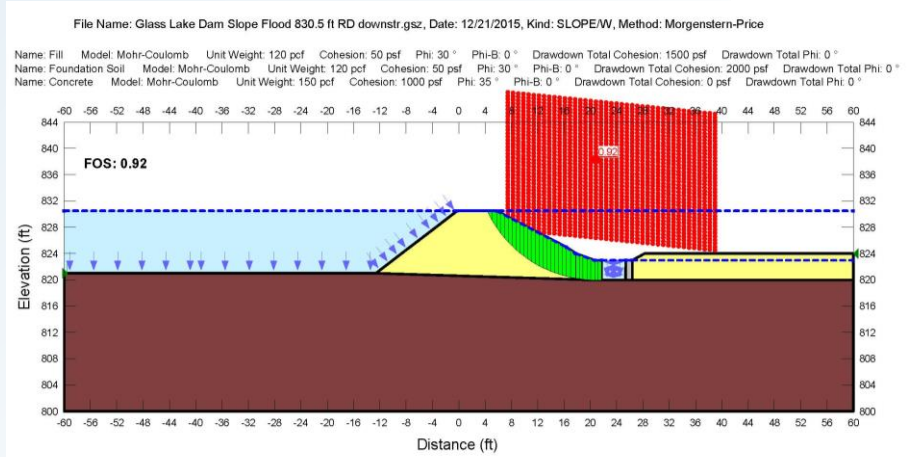
Stability Analysis: Embankment Section



Normal Pool - Rapid Drawdown Upstream



Normal Pool - Rapid Drawdown Downstream



Flood (SDF) - Rapid Drawdown Downstream

Low Level Outlet

Mount Beacon Reservoir Dam

Pocket Dam

The low level drain is required to have sufficient capacity to discharge 90% of the storage below the lowest spillway crest within 14 days, assuming no inflow into the reservoir.

Guidelines for the Design of Dams, 1989
NYSDEC Division of Water

General Conditions

- Undesirable vegetation
- Deteriorating concrete
- Irregular dam crest
- Potential piping
- Wet embankments

Spillway Capacity: St. Joseph's Lake Dam

Increase capacity by raising non-overflow section and adding auxiliary spillway

Before

After

Spillway Capacity: St. Joseph's Lake Dam - After

Embankment

Spillway

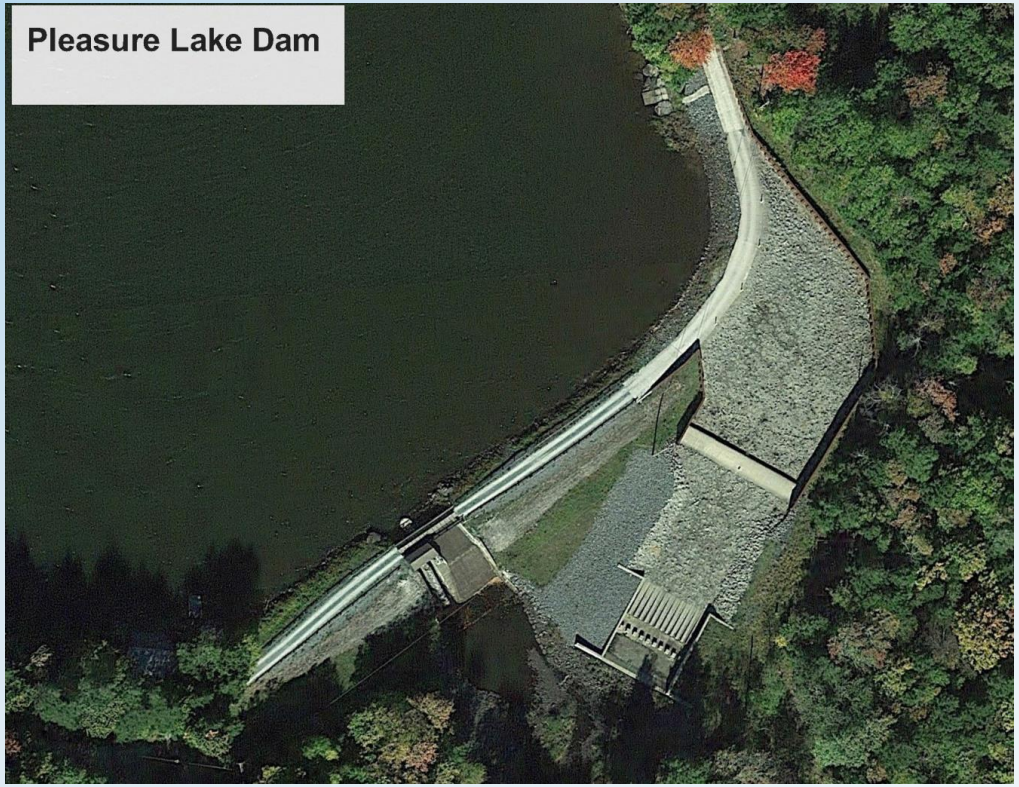
Spillway Enhancement: Browns Dam

Increase capacity by raising non-overflow section

Before

After

Spillway Enhancement: Pleasure Lake Dam



New emergency spillway

Spillway Enhancement: Lake Louise Marie

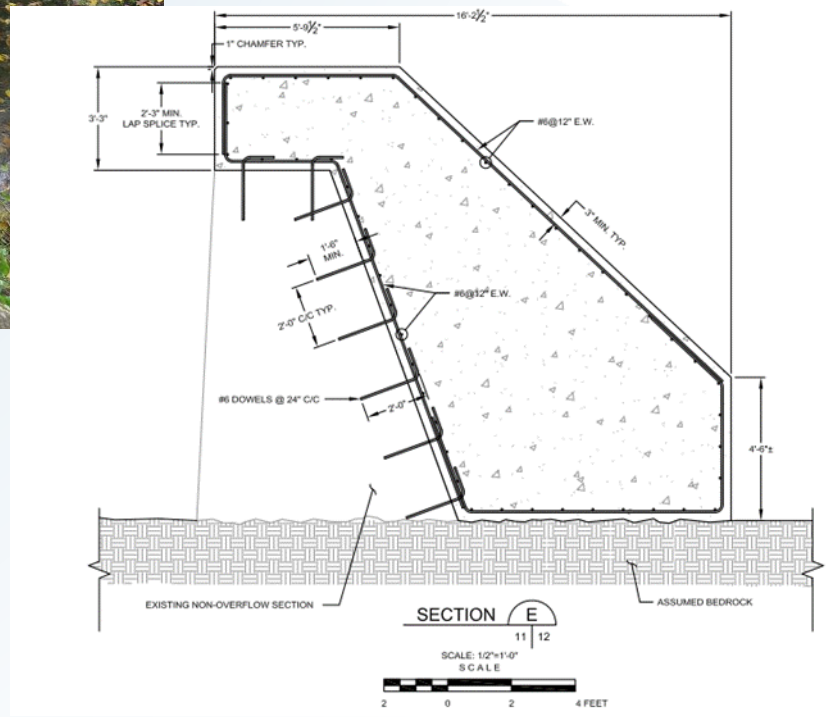
New auxiliary spillway

Stability Improvements: St. Joseph's Dam

Concrete Dam - Anchoring

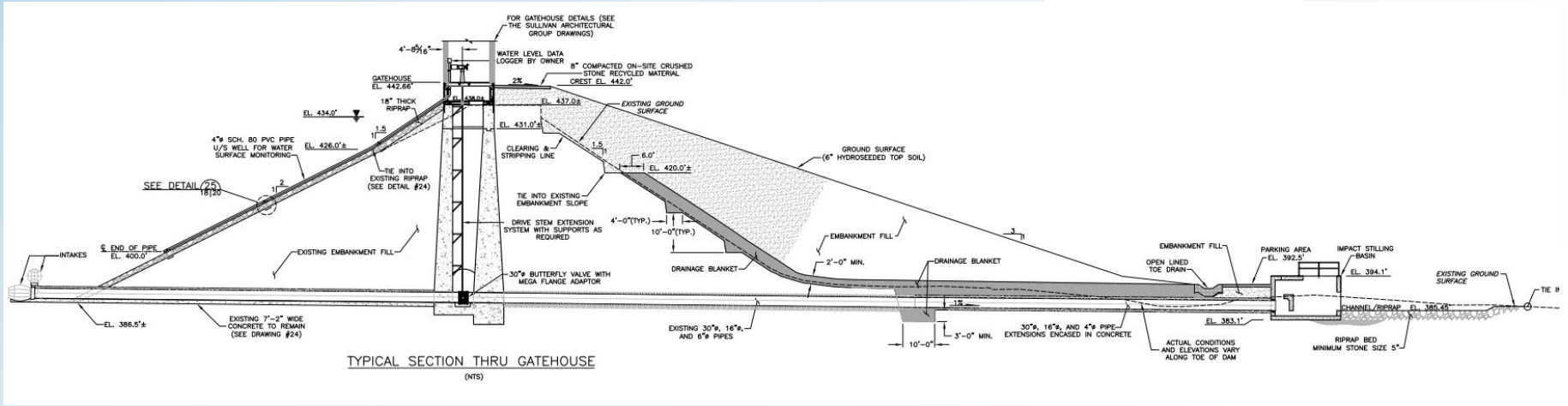
Stability Improvements: Chiselhurst Dam

Concrete Dam – adding mass



Stability Browns Dam Embankment Remediation

Embankment Dam – flatten downstream slope and seepage blanket



Before

After

Low Level Outlet Repair: St. Joseph's Dam

Low Level Outlet

Temporary Valve

Construction

Low Level Outlet: Lake Louise Marie

New LLO drains 40% of Lake

Pumping to assist and drain remainder

Low Level Outlet Alternative Approach

Installing new LLO's in existing dams can be risky and expensive

- Excavation Risk
- Cofferdam Risk
- Seepage Path in Embankment Dams

Pumping Alternatives

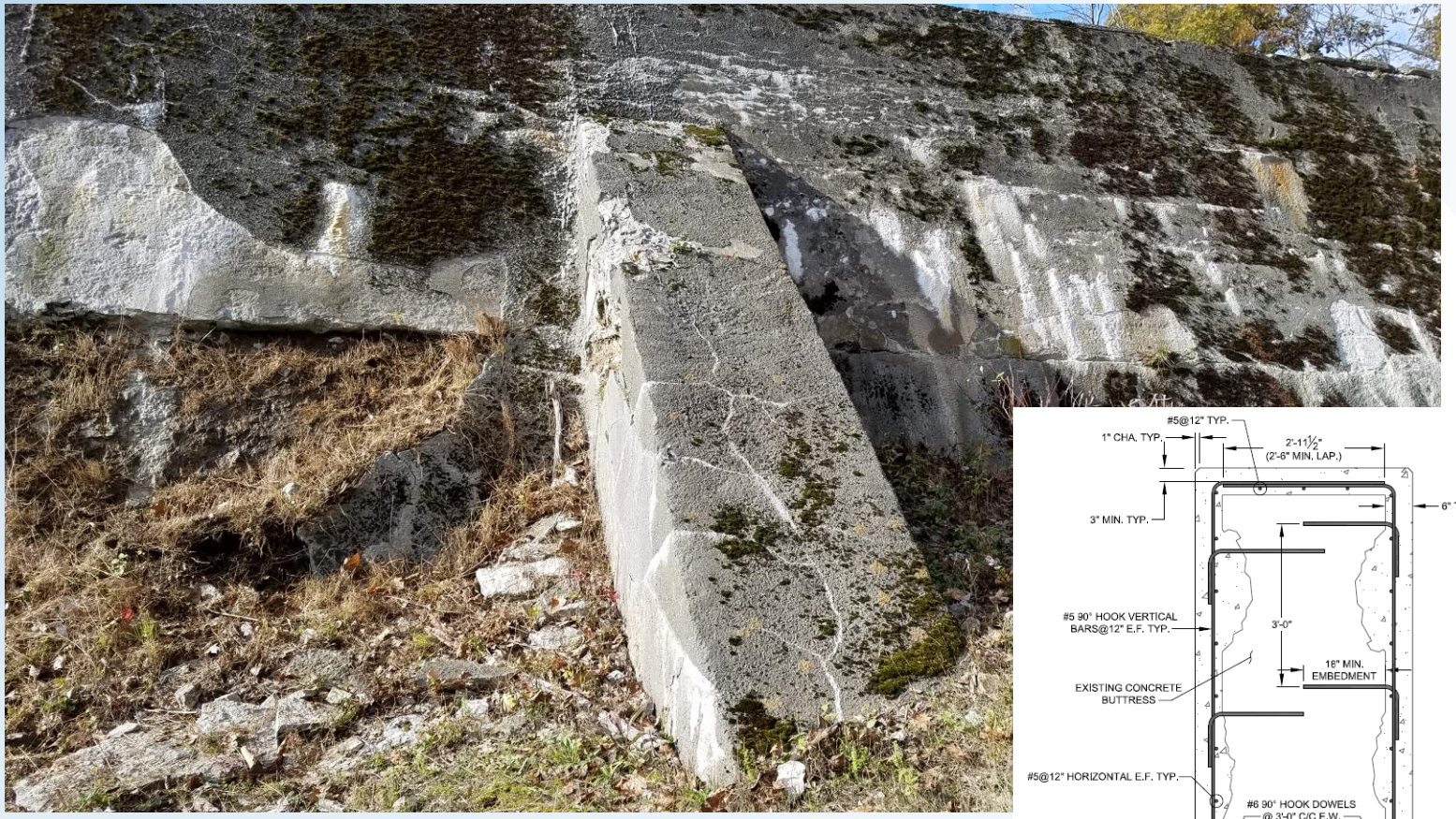
- Pumps as supplement (Lake Louise Marie and Wolf Lake)
- Pumps Only (Pleasure Lake)
- Pump sizes must be reasonable and readily available
- Develop a documented plan, get DEC approval, and include in EAP

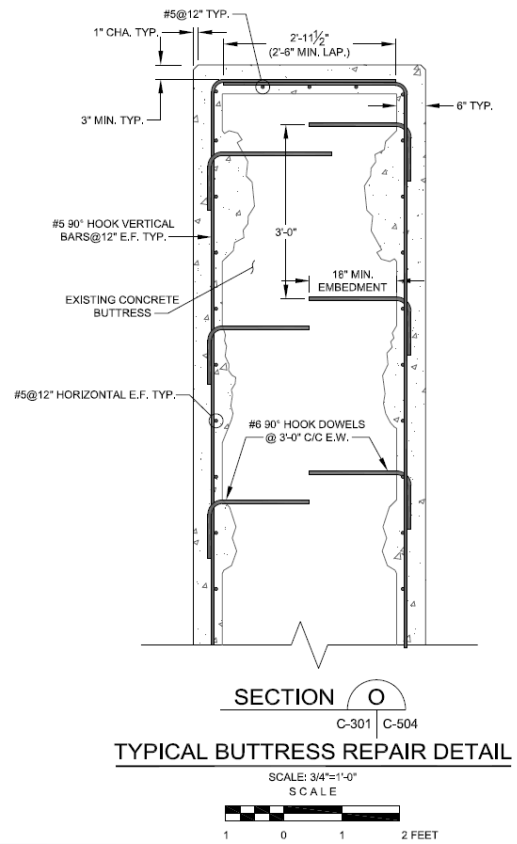
Undesirable Vegetation

Issues:

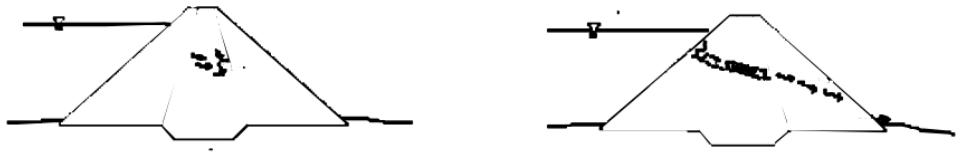
- Difficult to inspect – hides problems
- Attracts borrowing rodents
- Tree roots create seepage paths

Deteriorating Concrete





Potential Piping



INITIATION	CONTINUATION	PROGRESSION	BREACH/FAILURE
Leakage exits on d/s side of core and backward erosion initiates	Continuation of erosion	Backward erosion progresses back to the reservoir	Breach mechanism forms

(a) Backward erosion piping in the embankment

Swinging Bridge

Financing Strategies

- Bank Loans
- Homeowner Assessment (HOA)
- Project Phasing
- Available Grants through Consolidated Funding Application (CFA)

Thank you!

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