

# INDIAN LAKE DAM REHABILITATION PROJECT

Town of Indian Lake, New York  
Hamilton County



**Hudson River -  
Black River  
Regulating District**



**BERGMANN**

ARCHITECTS ENGINEERS PLANNERS

*Bergmann has joined Colliers Engineering & Design*

# Overview

## Agenda

- Site Overview
- Rehabilitation Design
  - Major work items
  - NYSDEC Compliance
- Cost Estimate
- Schedule



**Hudson River -  
Black River  
Regulating District**

# DAM & SITE OVERVIEW

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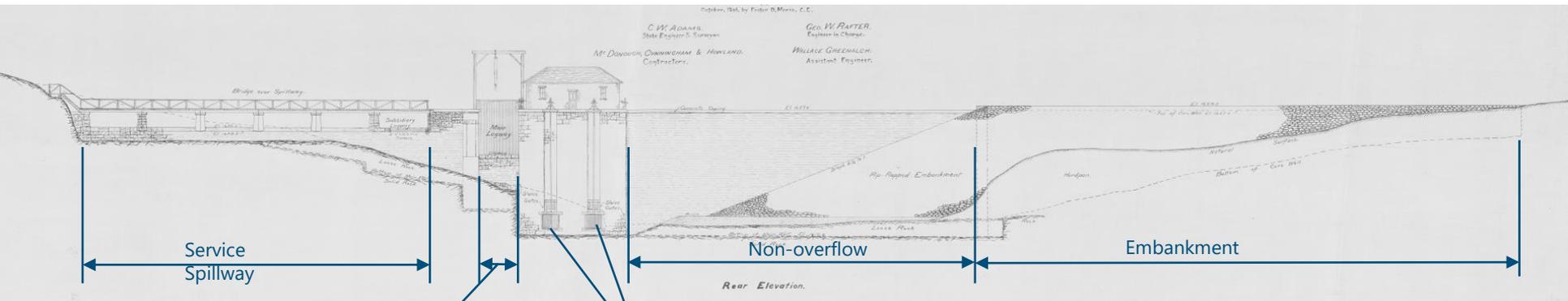
# INDIAN LAKE DAM

## Dam History

- Built 1898 by the Indian River Company
- 1987/1988 – Minor Rehabilitation including work on sluice gates and installation of toe drain
- 2009 – grouting and patching of joints on upstream face of dam

## Dam Data

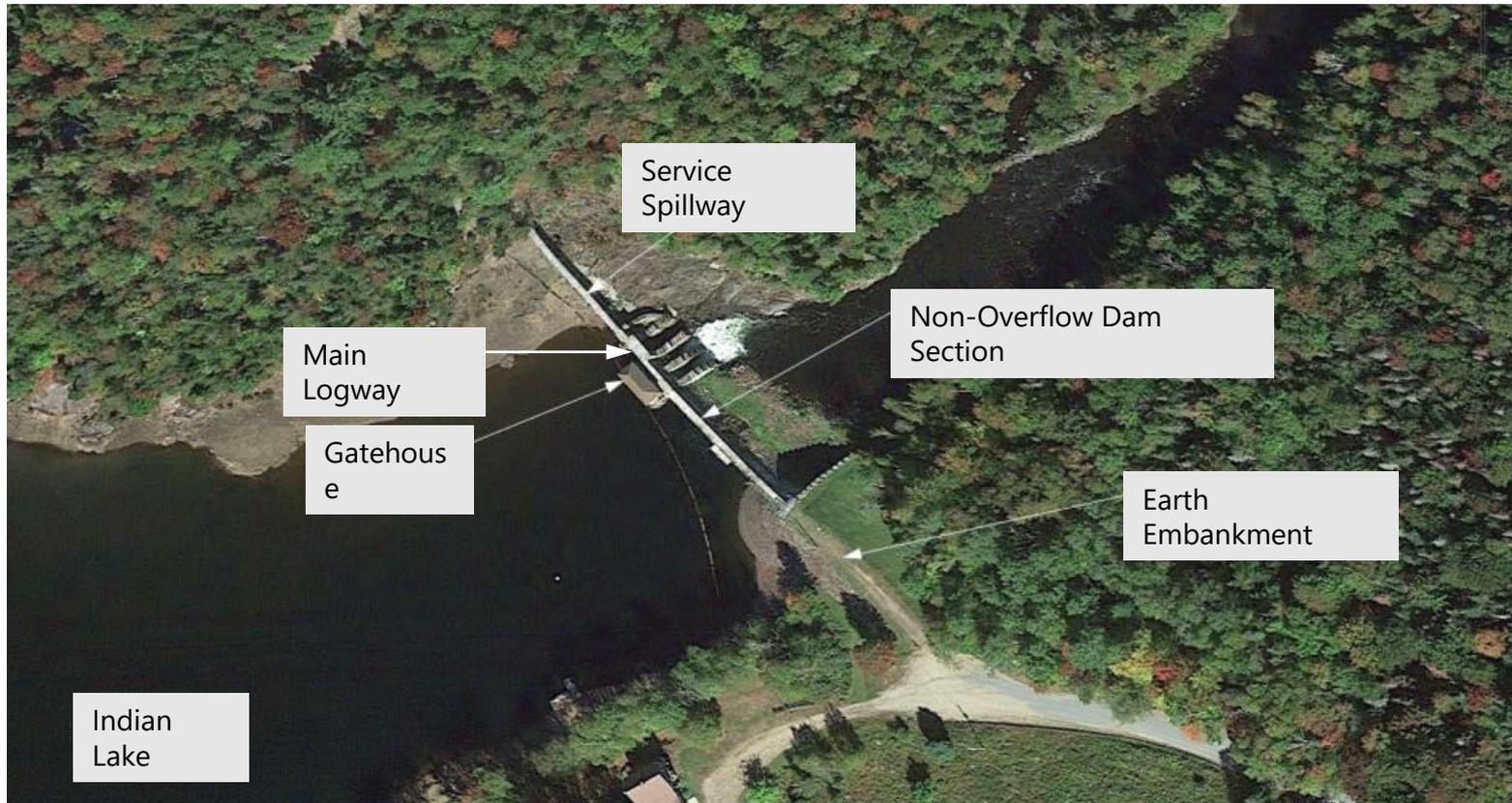
- High hazard structure per NYSDEC
- Dam Components:
  - 150-ft earth embankment
  - 151-ft non-overflow masonry section
  - 127-ft fixed crest service spillway
  - (2) 5-ft dia low-level outlet conduits used for regulation of reservoir height
  - 15-ft “main logway” currently blocked off with inoperable bulkhead



Logway

Outlet Conduits

# INDIAN LAKE DAM SITE PLAN



# NON-COMPLIANT FEATURES AND ITEMS FOR REHABILITATION

## Major Regulatory Requirements (NYSDEC)

- Insufficient Spillway Capacity to pass Design Flood without Overtopping
- Downstream Slope of Dam Embankment Steeper than 1V:2H
- Dam Structure does not meet Stability Requirements – particularly Ice and Flood Cases

## Maintenance and Operation Issues

- Seepage and Leakage at Dam (Main Non-Overflow, Spillway, & Retaining Wall)
- Exterior Gates at Gate House are Manual Crank, Deteriorated, and Some Inoperable
- Safe Access with Improved Walkways/Bridge, Railings, and Fencing to Current Codes
- Main Logway Stoplogs are Not Operable



# REHABILITATION DESIGN

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# REHABILITATION DESIGN

## MAJOR WORK ITEMS

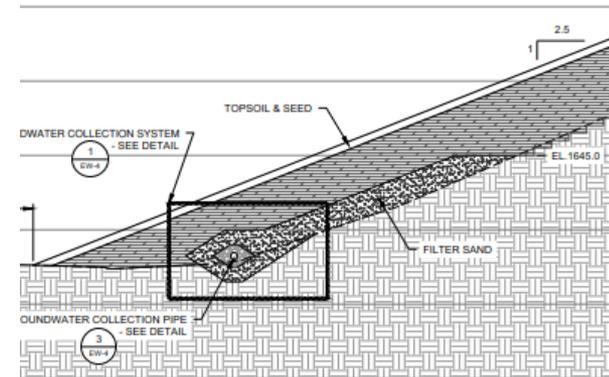
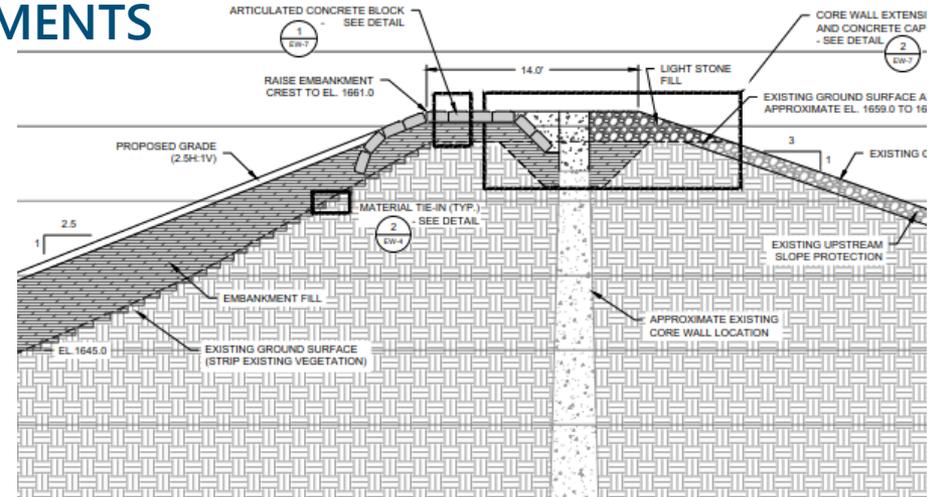
- Embankment Stability Improvements – Raising & Flattening Embankment, Retaining Wall Retrofit
- Structural Stability Improvements – Post-tensioned Anchoring
- Leakage Improvements – Consolidation Grouting, Masonry Repointing and Sealing
- Operations Improvements – Upstream Gate Replacement and New Operating Platform
- Operable Main Logway Bulkhead Gate
- Spillway Bridge Replacement
- Debris Boom Replacement
- Site Access and Safety Improvements
- Lake Access Trail Construction (by NYSDEC Request)



# EMBANKMENT STABILITY IMPROVEMENTS

## RAISING & FLATTENING EMBANKMENT, RETAINING WALL RETROFIT

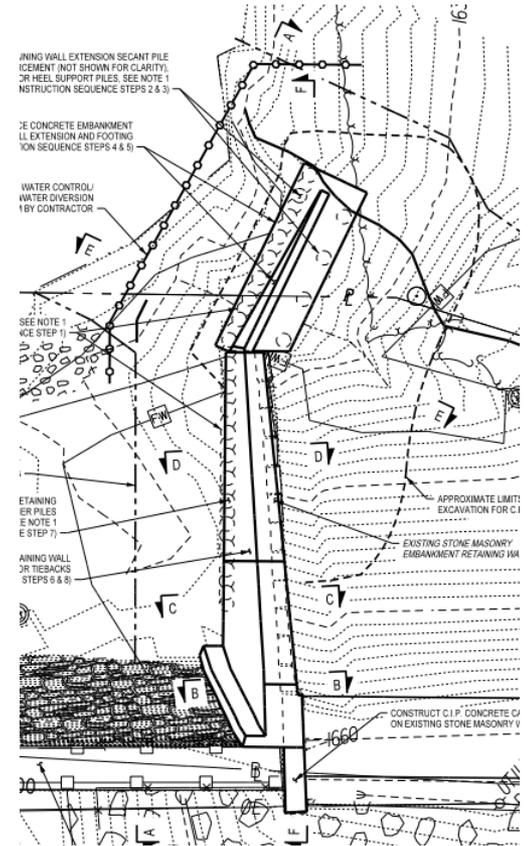
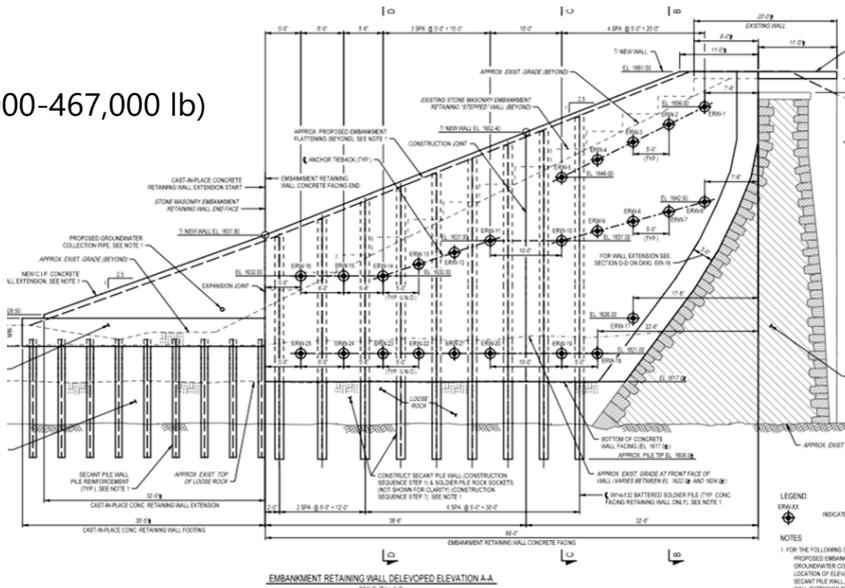
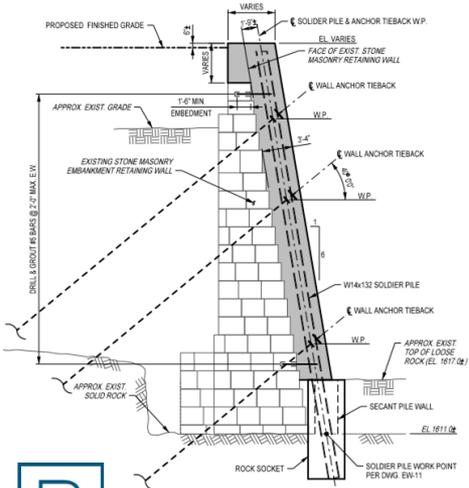
- Must pass the Spillway Design Flood (SDF) without overtopping
- SDF peak water elevation EL. 1660.3 (1/2 PMF)
- Existing - The lowest point on the existing embankment is 1659.6 (0.7 feet below the SDF).
- Proposed 1-foot raise - Embankment crest will be raised to EL. 1661.0
  - SDF is passed without overtopping (proposed crest is 0.7 feet above the SDF elevation).
- Embankment improvements:
  - Raising the crest
  - Flattening the downstream slope
  - Granular drainage blanket & drain at toe
  - Armoring for Overtopping Protection (flood exceeding 1/2 PMF)
  - Improved Toe Drain System
  - Piezometer Extensions
  - Drivable Crest for Maintenance Access



# EMBANKMENT STABILITY IMPROVEMENTS

## RAISING & FLATTENING EMBANKMENT, RETAINING WALL MODIFICATIONS

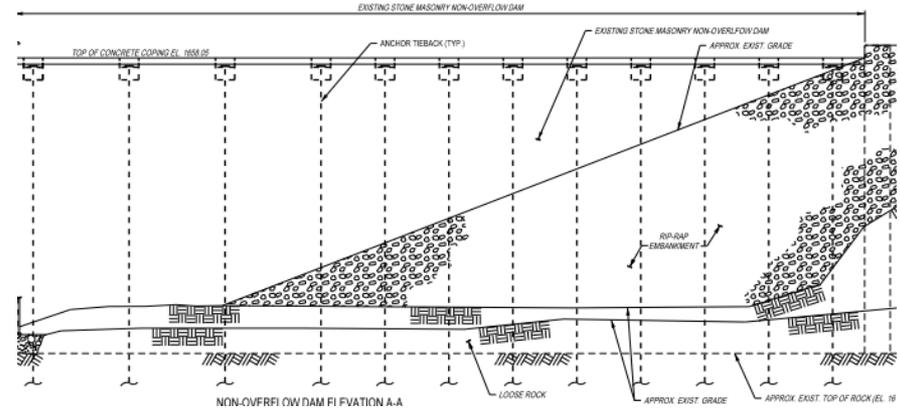
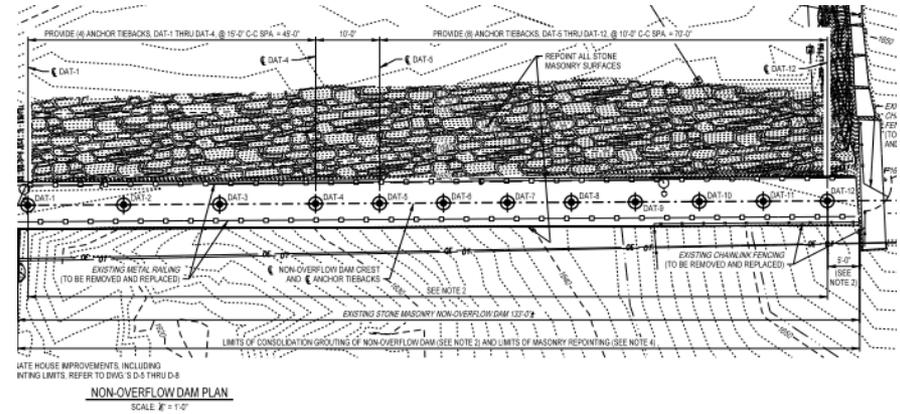
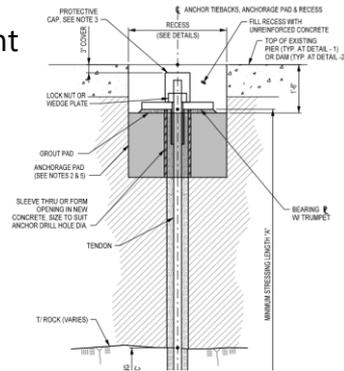
- Embankment Retaining Wall Improvements
  - Extending and Raising Wall to Support Embankment Raise
  - Concrete Facing
  - Secant Wall
  - Anchoring (142,000-467,000 lb)



# STRUCTURAL STABILITY IMPROVEMENTS

## POST-TENSIONED ANCHORING & GROUTING

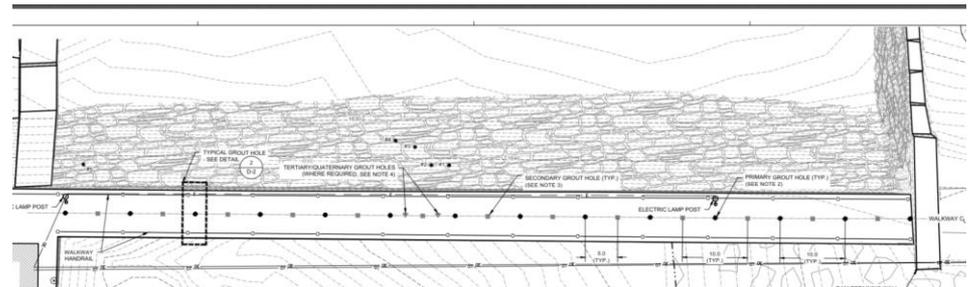
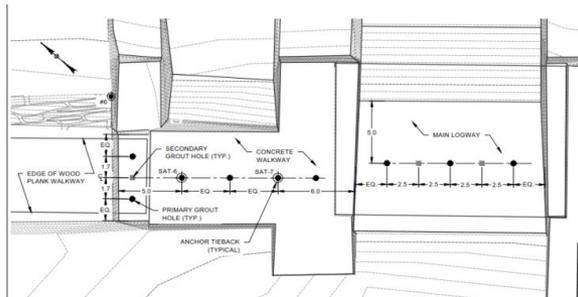
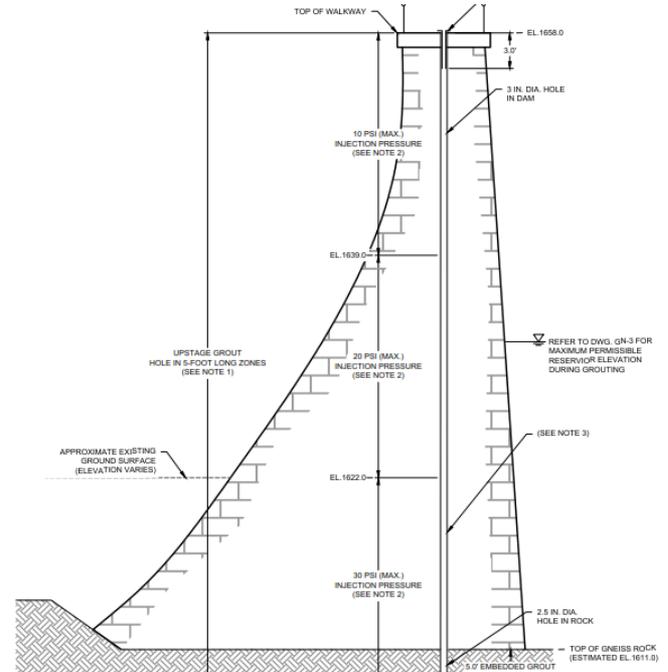
- Post-tensioned anchors (PTAs) required to meet required sliding & overturning stability criteria
  - Main concern in Ice and Flood cases
  - Anchor heads recessed into reinforced concrete anchorage pad with protective cap
  - Anchor forces range from 142,000-528,000 lb
- PTA Locations:
  - Embankment Retaining Wall
  - Non-Overflow
  - Spillway Right Abutment
  - Spillway Piers



# LEAKAGE IMPROVEMENTS

CONSOLIDATION GROUTING, MASONRY REPOINTING AND SEALING

- Leakage causing increased deterioration of the stone masonry & cyclopean concrete. Notable leakage locations:
  - Non-overflow
  - Embankment retaining wall
  - Spillway right end
- Consolidation Grouting
  - Use of cement grout with admixtures
  - Complete with reservoir lowered
  - Locations: Non-overflow, Spillway right end, Main logway



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# LEAKAGE IMPROVEMENTS

CONSOLIDATION GROUTING, MASONRY REPOINTING AND SEALING

- Gate House and Dam Masonry Repointing and Sealing
  - Missing and damaged mortar throughout
  - Repointing to decrease future water seepage and prevent against potential erosion.
  - All deteriorated upstream and downstream joints, which includes the non-overflow dam, gate house structure and the main spillway and bridge piers.
  - Includes removal of vegetation from joints, removal of older damaged mortar, and the replacement with new mortar
  - Repointing with an epoxy or cementitious mortar intended for underwater installation is feasible.



Approx. elevation	Type	Dimension			Direction of void	t
		Length	Width	Note		
1640	Missing mortar	12"	1"		Vertical	1
1633	Missing mortar	9"	2"		Horizontal	1
12/2						
Above gate	Hole	9"	7"			1
1638	Missing mortar	21"	1"		Horizontal	1
#2 guide	Hole	8"	8"			1
#2 guide	Missing mortar	5"	2"		Vertical	1
#2 guide	Missing mortar	8"	2"		Horizontal	1
1637	Missing mortar	8"	2"		Horizontal	1
1641	Hole	3"	3"			1
#2 guide	Missing mortar	12"			Timber tie in	1
1636	Missing mortar	12"	1"		Vertical	1
1636	Missing mortar	12"	1"		Horizontal	1
1639	Missing mortar	2"	1"		Horizontal	1
Top of gate	Missing mortar	24"	2"		Horizontal	1
1628	Missing mortar	6"	1"		Horizontal	1
1635	Missing mortar	7"	1"		Horizontal	1
1635	Missing mortar	7"	1"		Vertical	1
1630	Missing mortar	18"	2"		Horizontal	1
1638	Missing mortar	Full course		intermittent	Horizontal	1
1638	Hole	4"	4"			1
1642	Missing mortar	12"	2"		Vertical	1
1643	Hole	4"	4"			1
1643	Hole	4"	4"			1
1643	Hole	1"	1"			1
1639	Missing mortar	9"	3"		Horizontal	1

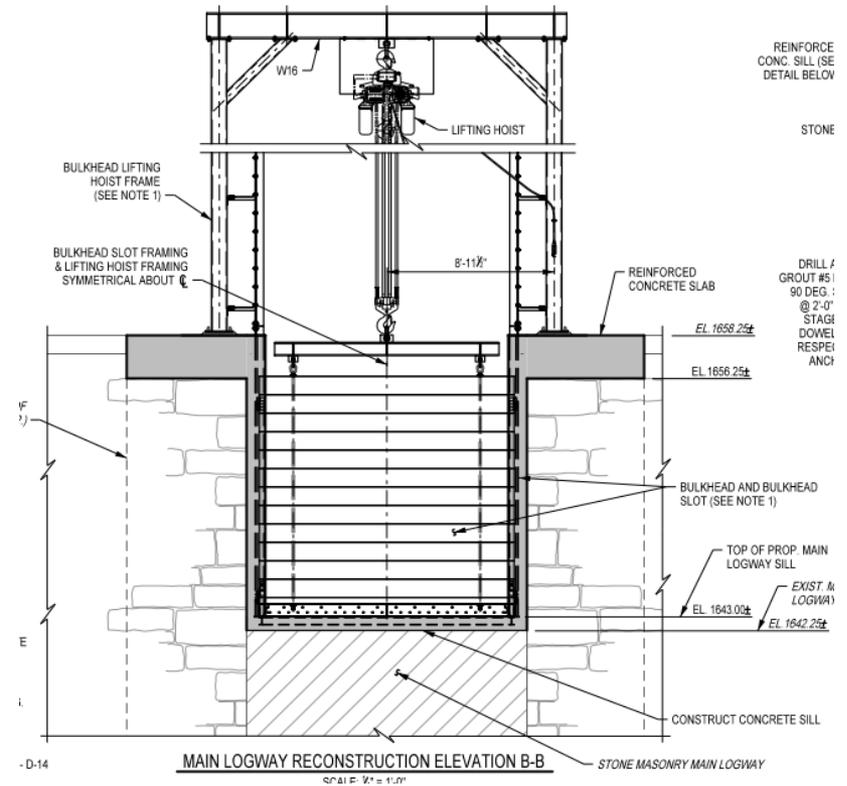


# MAIN LOGWAY BULKHEAD GATE

WATER CONTROL DURING CONSTRUCTION & FUTURE USE



Reservoir water release and water elevations anticipated to be consistent with normal reservoir operation throughout project construction.



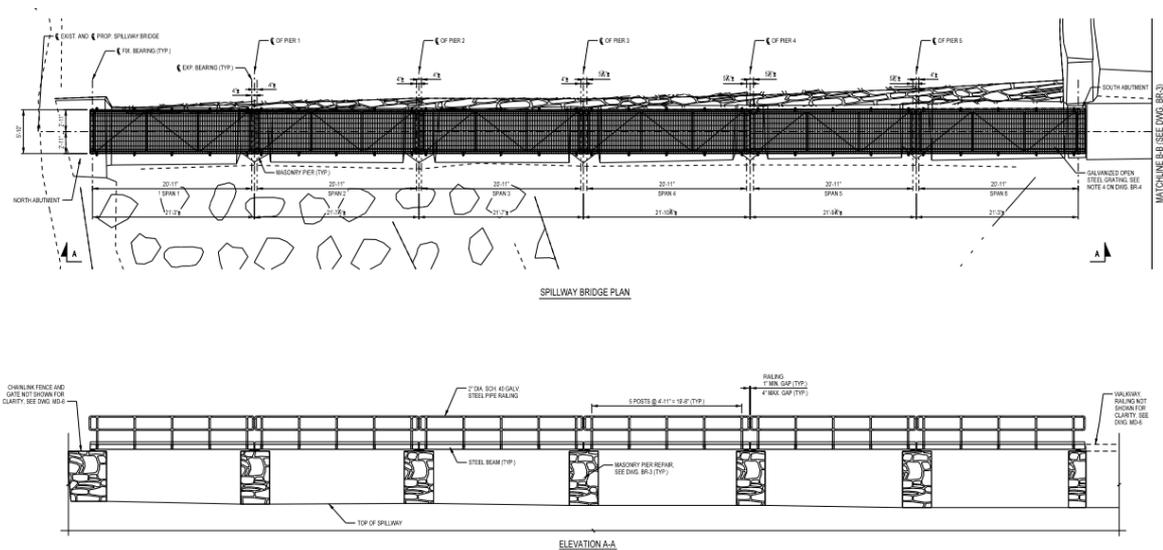
## SPILLWAY BRIDGE REPLACEMENT

- Existing bridge at end of service life (section loss, paint failure, surface rust, cracking timber deck)
- Installation of PTAs through spillway piers



# SPILLWAY BRIDGE REPLACEMENT

- Proposed Replacement bridge:
  - Galvanized steel rolled shapes and grating
  - Railing on both sides of bridge for adequate fall protection
  - Less costly than repairing existing bridge
  - Low maintenance (galvanized, not painted)

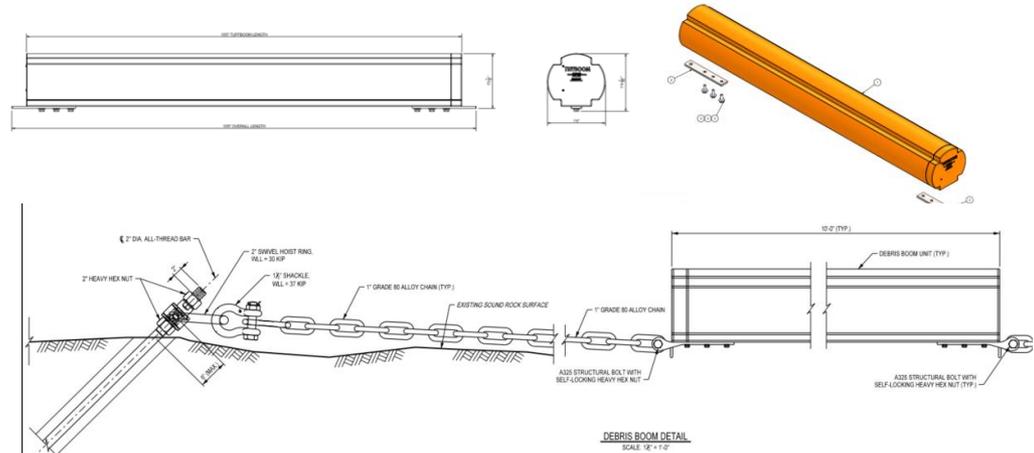
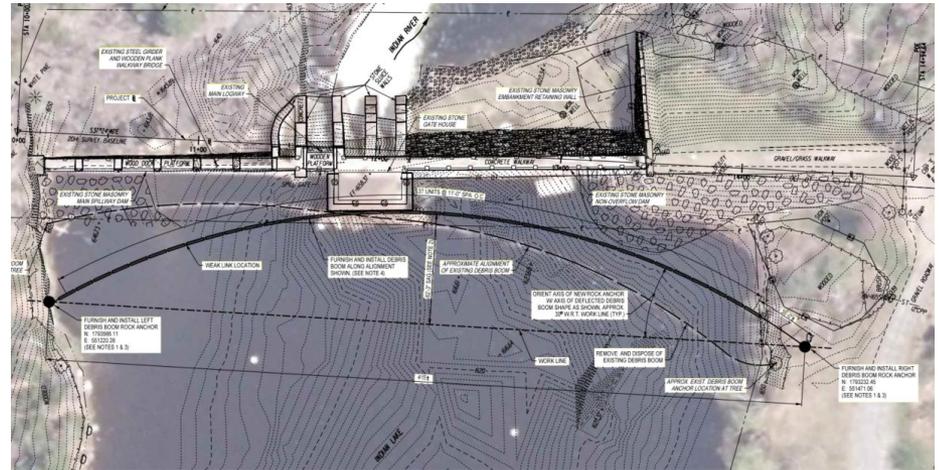


# DEBRIS BOOM REPLACEMENT



Debris boom chain anchoring to tree  
Bergmann

Indian Lake Dam  
12 May 2022, 10:16:29



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# LAKE ACCESS TRAIL & PORTAGE

Indian Lake Dam Water Access Site – Proposed Parking Area



Indian Lake Dam Water Access Site – Lake Access Trail



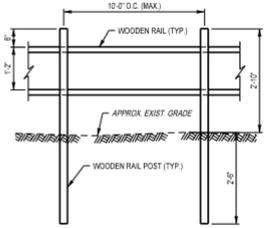
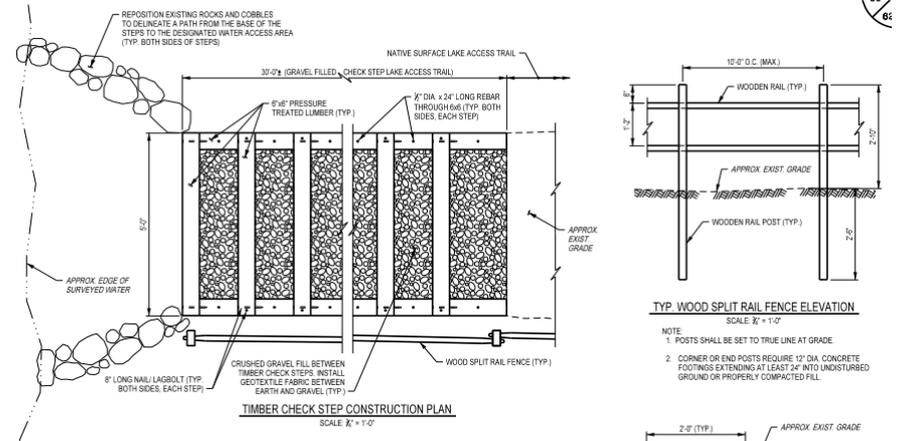
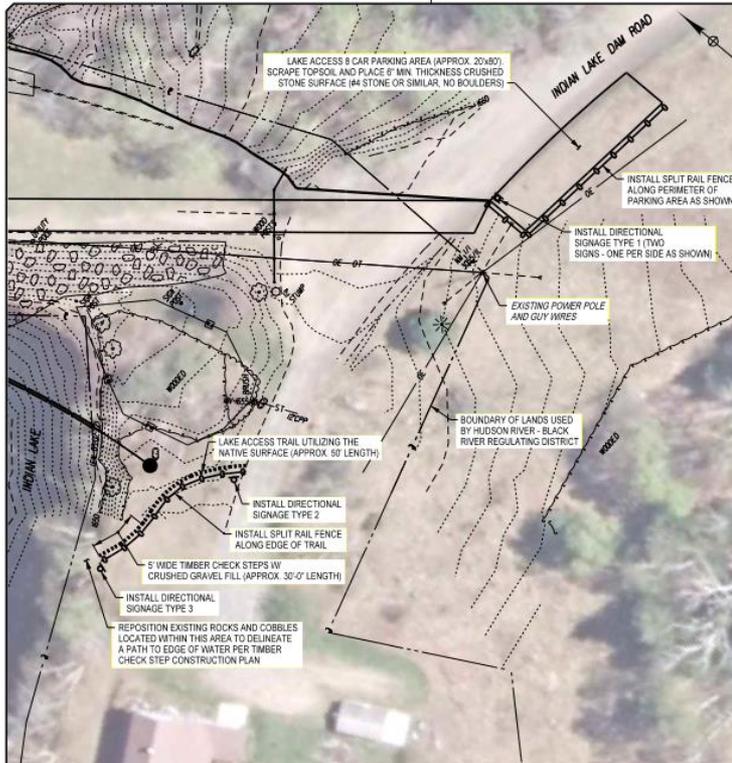
Indian Lake Dam Water Access Site – Launch Site



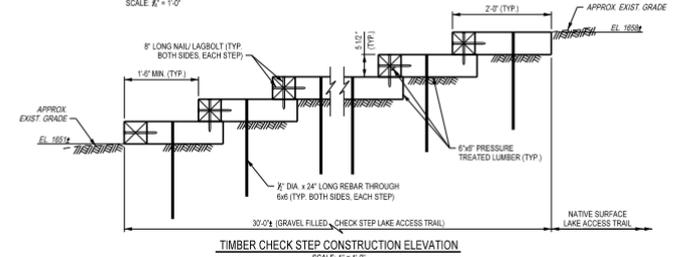
Indian Lake Dam Water Access Site - Shoreline Path



# LAKE ACCESS TRAIL & PORTAGE



NOTE:  
1. POSTS SHALL BE SET TO TRUE LINE AT GRADE.  
2. CORNER OR END POSTS REQUIRE 12" DIA. CONCRETE FOOTINGS EXTENDING AT LEAST 24" INTO UNDISTURBED GROUND OR PROPERLY COMPACTED FILL.



**SIGN TYPE 1**  
SCALE: NONE



**SIGN TYPE 2**  
SCALE: NONE



**SIGN TYPE 3**  
SCALE: NONE



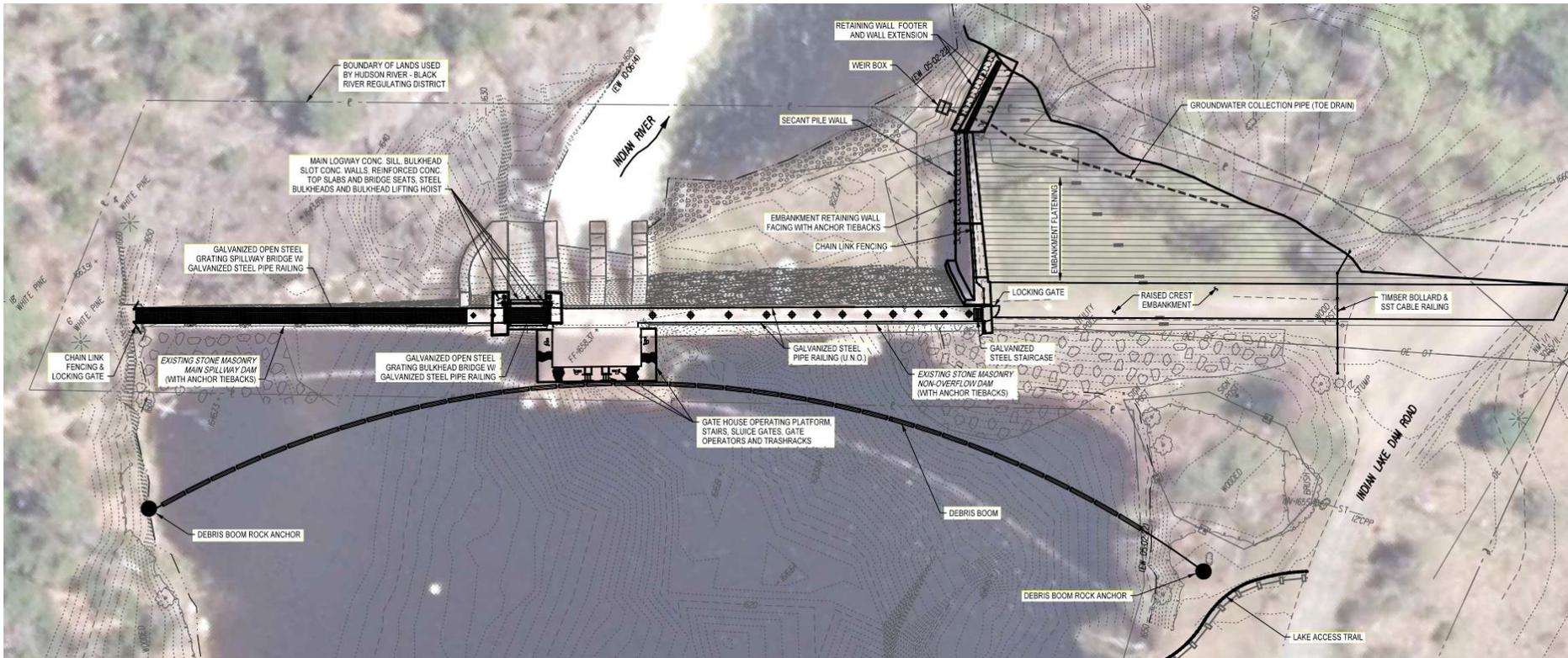
# NYSDEC COMPLIANCE

PER NYSDEC GUIDELINES DESIGN OF DAMS

NYSDEC Criterion	Proposed Feature Condition
<b>Sections 5.3 and 6.5.4 require that existing dams have adequate spillway capacity to pass the SDF without overtopping.</b>	Proposed embankment raise brings into compliance
<b>Section 6.5.5 requires that the auxiliary spillway – service spillway combination have sufficient capacity to evacuate the storage between the maximum design high water and auxiliary spillway crest within 12 hours.</b>	Judged acceptable with logway closed. Proposed operable main logway bulkhead being open brings into compliance.
<b>Section 9.1.1 requires downstream slopes to be no steeper than 1V:2H for earth dams with seepage control.</b>	Embankment will be flattened to 1V:2.5H slope and seepage control (drainage blanket) will be installed.
<b>Section 9.2 requires that earth dams be analyzed for slope stability and compared with the factors of safety indicated in EM 1110-2-1902 (USACE, 2003).</b>	Flattened embankment meets the required factors of safety.
<b>Section 10.7.2 presents requirements on the location of the resultant force from overturning analyses.</b>	Structures will be anchored with post-tensioned rock anchors to meet requirement.
<b>Section 10.7.4 presents minimum safety factors against sliding.</b>	Structures will be anchored with post-tensioned rock anchors to meet required factors of safety.
<b>Section 13.0 requires that all dams with toe drains have weirs on the downstream end of the drains. It also requires that the flow be measured and correlated with reservoir elevation.</b>	The proposed embankment modifications include a toe drain that extends along the full length of the groin of the embankment and will include a monitoring weir to allow for flow measurement.



# FINAL CONDITIONS SITE PLAN



# COST ESTIMATE

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## CONSTRUCTION COST SUMMARY

Major Features of Construction Work Estimate	Bid Construction Cost
Retaining Wall Foundations, Concrete, Anchoring	\$2,400,000
Non-Overflow Dam Grouting and Anchoring	\$900,000
Embankment Raising, Drainage, Grading and Armoring	\$1,000,000
Spillway Grouting, Anchoring, and Bridge	\$1,200,000
Logway Operable Gate, Concrete, and Bridge	\$800,000
Gate House Valves, Trash Racks, Platform, Operators	\$1,600,000
Repointing Stone Masonry	\$800,000
Miscellany – Mobilization, Site Prep, Fencing, Railing, Electrical, Debris Boom	\$2,300,000
<b>Total</b>	<b>\$11,000,000</b>

*Numbers above are as bid for construction, exclusive of construction administration and inspection and engineering.*



# SCHEDULE

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# PROJECT SCHEDULE

## PRE-CONSTRUCTION

### Current Activities Q3-Q4 2023

- Finalizing Permit Approvals with Agencies
- Finalizing Award of Bid Selection
- Establishing Construction Administration
- Construction Work Start:
  - Contracting Ready – Sept
  - Mobilization – Oct
  - Major Activities – Oct/Nov and on

### Long-Lead & Critical Sequencing Items

- Logway Gate Fabrication
- Gate house valves, trash racks, and platform procurement.
- Non-Overflow Dam Grouting & PT Anchoring
- Retaining Wall Raise Prior to Embankment Raise
  - (Winter Start proposed)
- PT Anchoring Spillway with Bridge Replacement
- Lower Reservoir Levels (Typ. Sept-April) for:
  - Embankment Stump Removals & Drains Installation
  - Retaining Wall Foundations & Anchoring
  - Consolidation Grouting
  - Post-Tensioned (Rock) Anchor Installation
- Tree cutting after Nov 1 (bat habitat)



# PROJECT SCHEDULE

## CONSTRUCTION – 2 SUMMER SEASONS

### Long-Lead Items for Priority Procurement

- Logway gate fabrication
- Post-tensioned anchors
- Gate house sluice gates, trash racks, and platform

### Late Summer / Fall / Winter 2023

- Mobilization, site prep, staging area, E&S controls.
- \*Construct retaining wall foundations.
- \*Concrete work for logway bulkhead operable gate.
- \*Remove trees from embankment toe (after Nov 1 for protected bats roosting).

\* Work must be completed during normal lower winter reservoir elevation.

### Spring-Summer-Fall 2024

- Install cofferdam / dive protections and E&S controls.
- Install gate house improvements including new sluice gates, trash racks, platform, and repointing.
- Retaining wall stem and facing construction with cased anchors installation.
- \*Regrade embankment section, install toe drain and seepage blanket.
- Final embankment and site improvements; stone/ACB mats, fencing, railing, drive areas, final electrical, DEC access trail.

### 2023 or 2024

- \*Consolidation grouting and anchoring in non-overflow and spillway sections of dam.
- Dam masonry repointing.
- Pedestrian bridge replacement (in coordination with spillway grouting and anchoring).
- Installation of logway operable gate (prior to gate house sluice gate and repointing work).
- Debris boom installation.





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ARCHITECTS ENGINEERS PLANNERS

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For additional information or questions:

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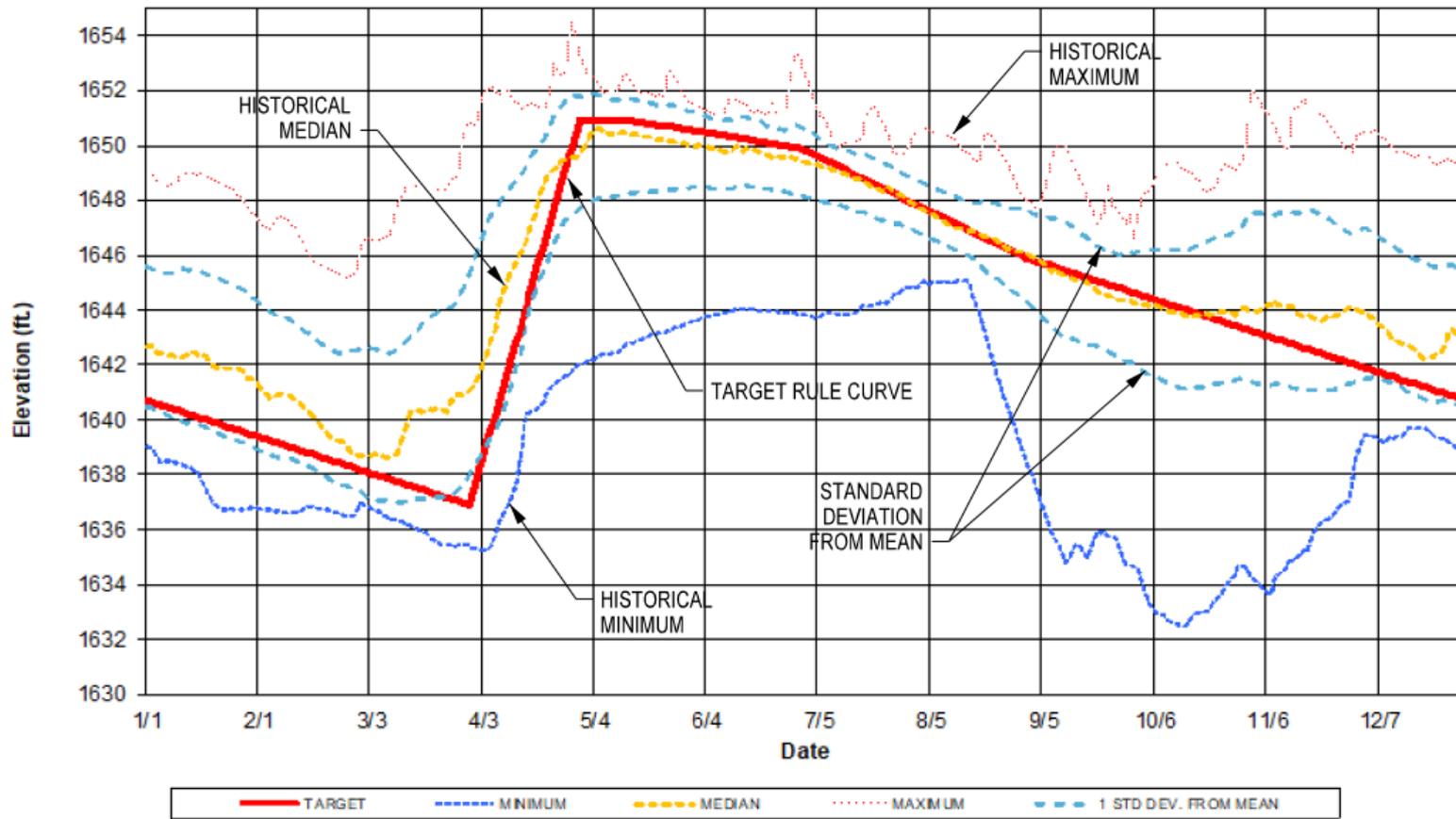
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### HISTORICAL RESERVOIR WATER LEVELS (1985 - 2021)

NOTE: REFER TO WATER CONTROL NOTE 1 FOR INFORMATION REGARDING THIS CHART.