



Exeter Reservoir Dam Feasibility Study

Project Update #2

September 19, 2024

Presented By

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Pare Project Manager & Senior Vice President





Town of Exeter Water Treatment Plant

Exeter Reservoir Dam

Portsmouth Ave

NH Route 202 W

Maxar

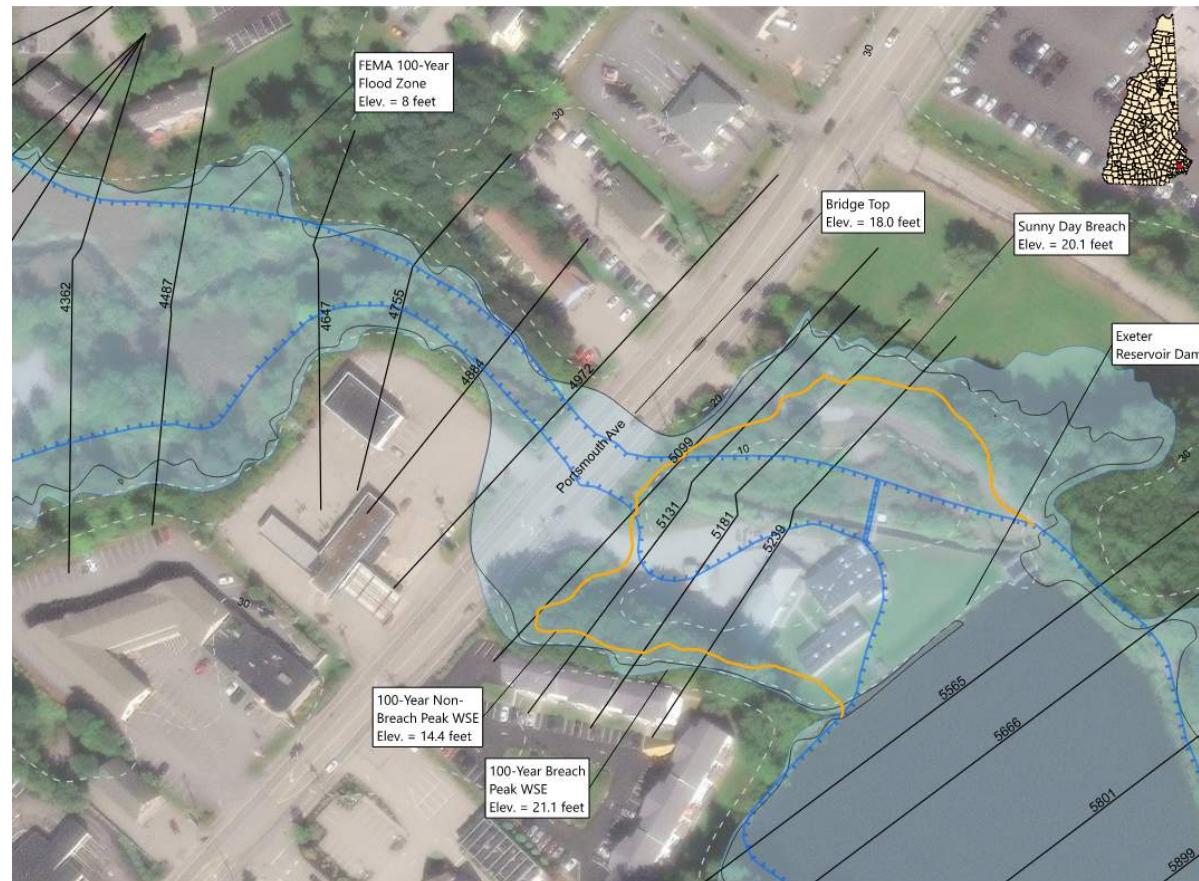
Exeter Reservoir Dam

- Commonly known as Water Works Dam
- Concrete face earth fill dam, 15' high and 248' long
- 49' long spillway that leads into 8' wide and 220' long sluiceway
- High Hazard & Poor Condition
- Impounds Dearborn Brook and water pumped from Exeter River
- Contributing area 1.75 square miles
- Provides drinking water to 4,500 customers
- WTP downstream of dam

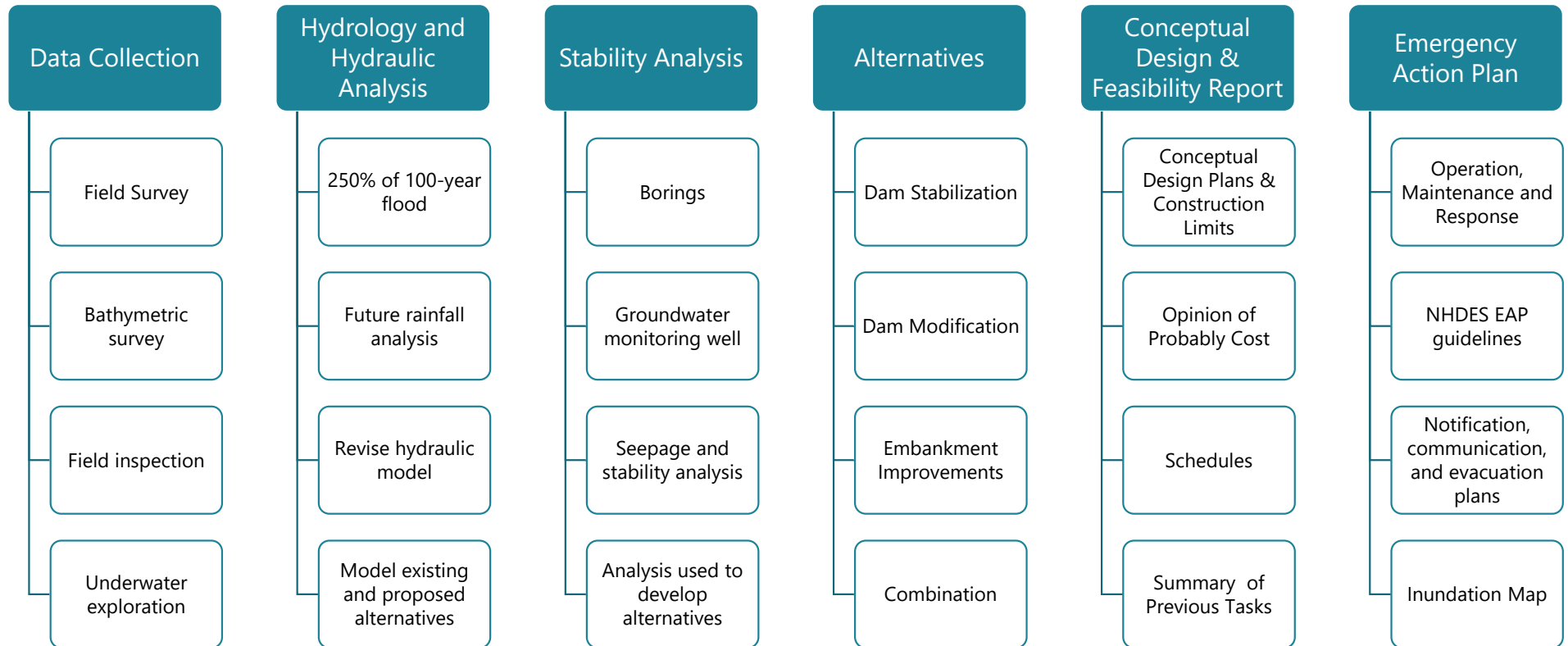


Background

- Pickpocket Dam Letter of Deficiency requesting Breach Analysis
 - Exeter Reservoir only had simplified Breach Analysis
- Breach Analysis confirmed High-Hazard Classification
 - Overtops Portsmouth Avenue
 - Flood heights greater than 1' on 1st floor of 3 structures - water treatment plant (4,500 customers) and 21 Webster Ave
- Feasibility Study to evaluate alternatives to bring dam into compliance



Scope of Work



Hydrologic Analysis

- Revised watershed boundaries in 2016 hydrologic HEC-HMS model
- Incorporated future rainfall analysis

STEP 6 TABLE. APPROACH FOR CALCULATING PROJECTED EXTREME PRECIPITATION ESTIMATES BASED ON TOLERANCE FOR FLOOD RISK.

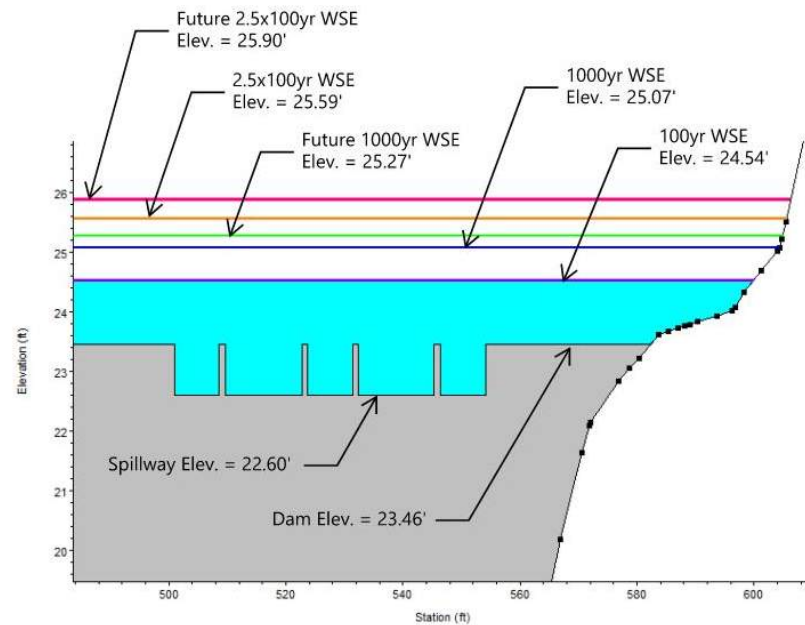
	HIGH TOLERANCE FOR FLOOD RISK	MEDIUM TOLERANCE FOR FLOOD RISK	LOW TOLERANCE FOR FLOOD RISK	VERY LOW TOLERANCE FOR FLOOD RISK
PROJECTED EXTREME PRECIPITATION ESTIMATE =	(Best available precipitation data) x (1.15)		(Best available precipitation data) x (>1.15)	

- Evaluated 1000-year event for NHDES rulemaking for Env-Wr 100-700

Design Storm	Peak Discharge (cfs)
50-year, 24-hr	1,000
100-year, 24-hr	1,200
200-year, 24-hr	2,050
1000-year, 24-hr	2,100
Future 100-year, 24-hr	1,450
Future 1000-year, 24-hr	2,400
250% of 100-year, 24-hr	3,000
250% of Future 100-year, 24-hr	3,650

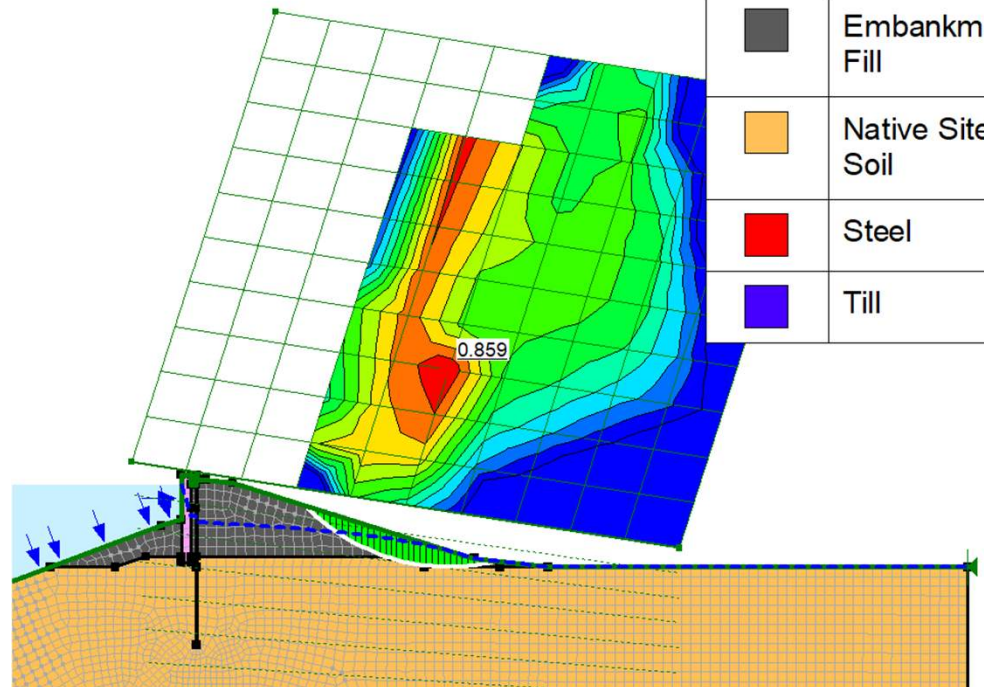
Hydraulic Analysis

- Incorporated topographic and bathymetric survey data into HEC-RAS hydraulic model
- Tide elevation of 3.29 as downstream tailwater condition
- Current Spillway Capacity (top): 135 cfs
- Required Spillway Capacity: 3,000 cfs
- Current Sluiceway Capacity: 1,000 cfs
- Required Sluiceway Capacity: Undefined



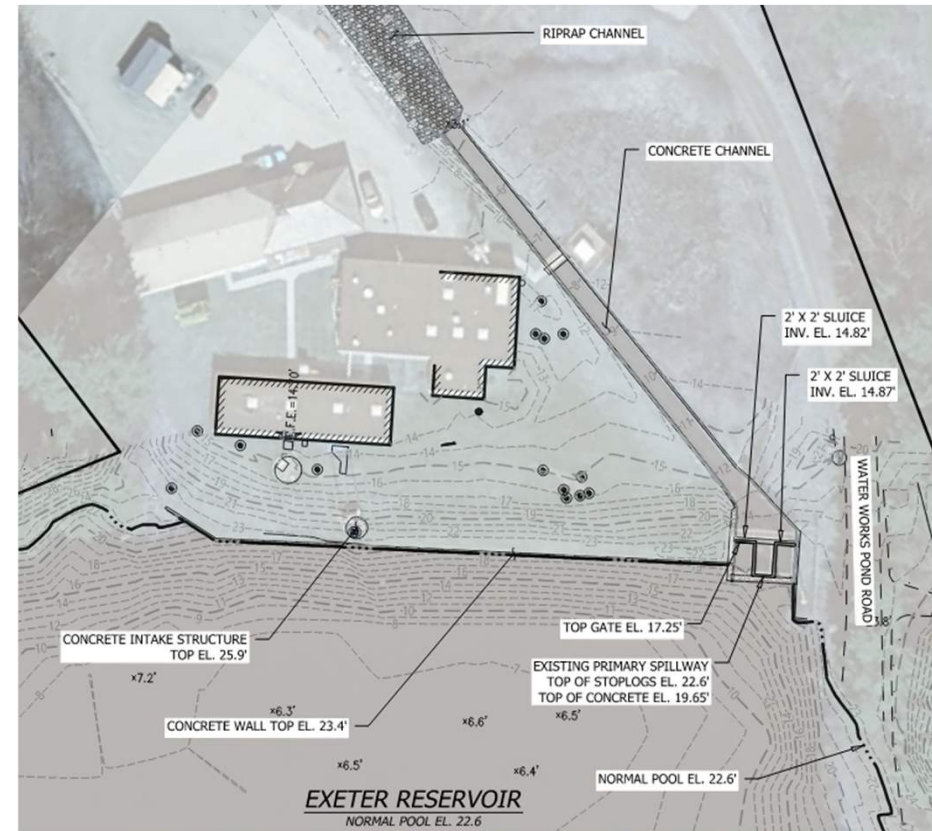
Results of Stability Analysis

- Subsurface investigation completed November 2023 & June 2024
 - Embankment Fill: 0' ~ 7' below crest, loose to medium dense sand with some silt
 - Native Soil: 7' ~ 35' below crest, medium to stiff clay
 - Glacial Till: > 41' below crest, very dense sand with little gravel
- Embedment depth of steel sheet pile cutoff wall is sufficient
- Upstream concrete wall is stable
- Seepage and slope stability factors of safety are acceptable other than downstream slope stability during SDF and seismic loading conditions



Rehabilitation Design Constraints

- NH ENV-Wr 100-800 – Dam Regulations:
 - Pass 1,000-year storm flows with 1 foot of freeboard and no operations
 - Slope stability meeting NRCS Technical Release 210-60 guidance
- Surface Water Treatment Plant (SWTP) located at the toe of the downstream slope
- Water Works Pond Road passing through the right abutment
- No seepage drain present



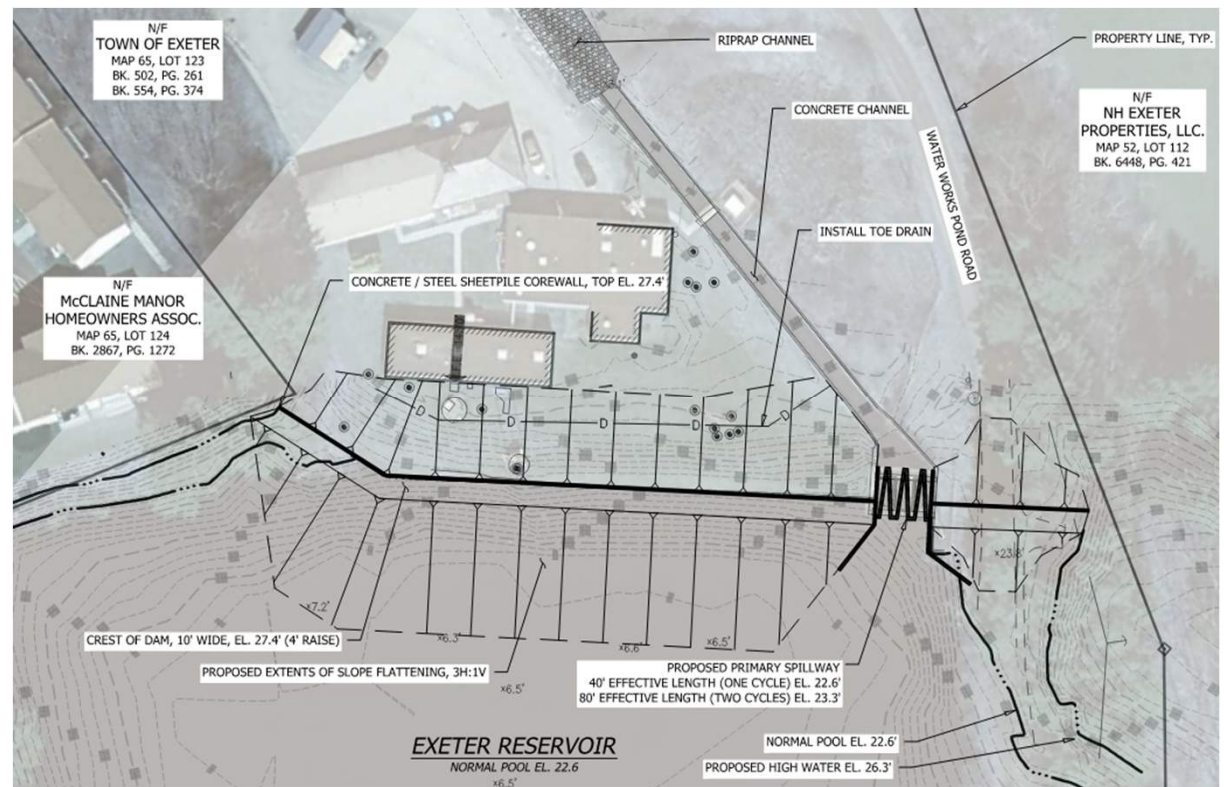
Initial Alternatives

- Goals: Increase freeboard and spillway capacity, improve slope stability factors of safety, add seepage drain
- Options to increase freeboard (raise top of dam):
 - Install earthen fill
 - Install floodwall (extend steel sheet piles)
- Options to increase spillway capacity:
 - Raise top of dam (increase maximum flow over existing spillway)
 - Replace existing spillway with larger spillway (labyrinth weir)
 - Add auxiliary discharge capacity (overtopping protection)

Dam Raise Vs. L_{eff} to Pass Future 1,000 Year Storm with 1 Foot of Freeboard		
TOD Elevation	TOD Raise (ft)	Reqd L_{eff} (ft)
23.4	0	Impossible
23.9	0.5	5000
24.4	1	1100
24.9	1.5	550
25.4	2	300
25.9	2.5	210
26.4	3	150
26.9	3.5	120
27.4	4	100
27.9	4.5	80
28.4	5	70
28.9	5.5	60
29.4	6	50
29.9	6.5	40
30.4	7	21

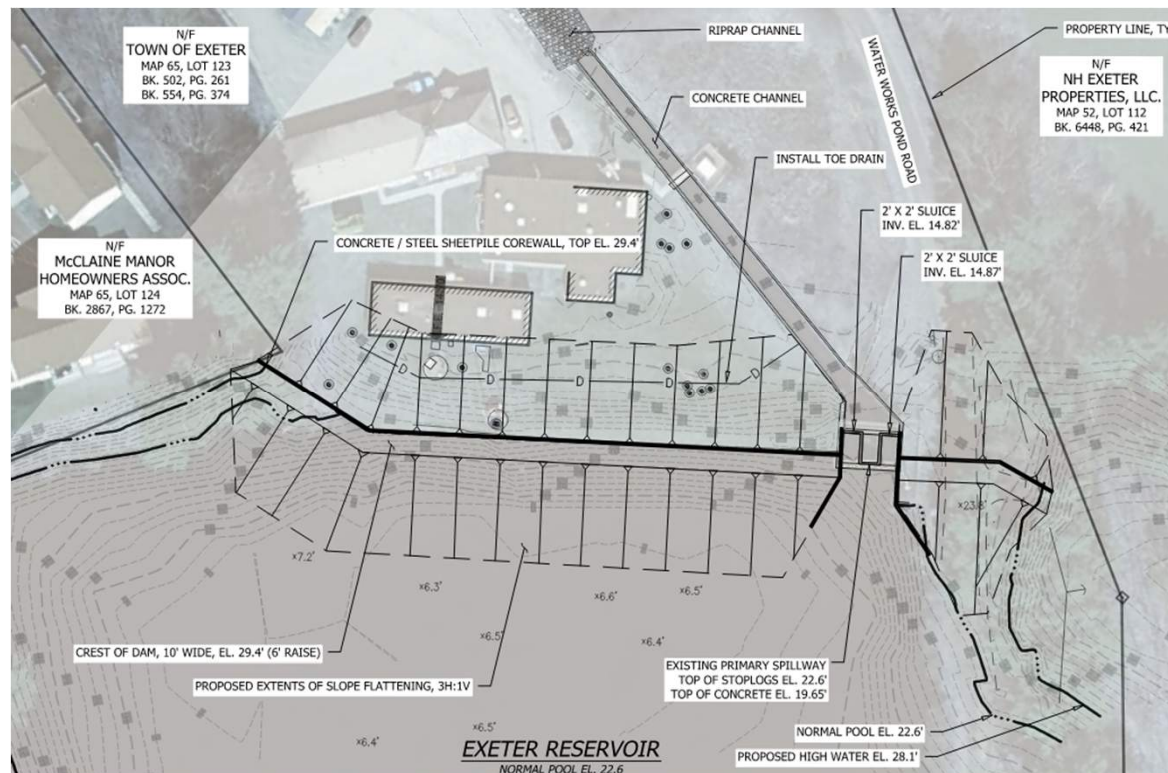
Alternative 1:

- Raise top of dam 4 feet (earthen fill), replace spillway with labyrinth weir having 120-foot effective length
 - Option for multi-stage labyrinth weir
 - Approximate cost of \$4,256,000



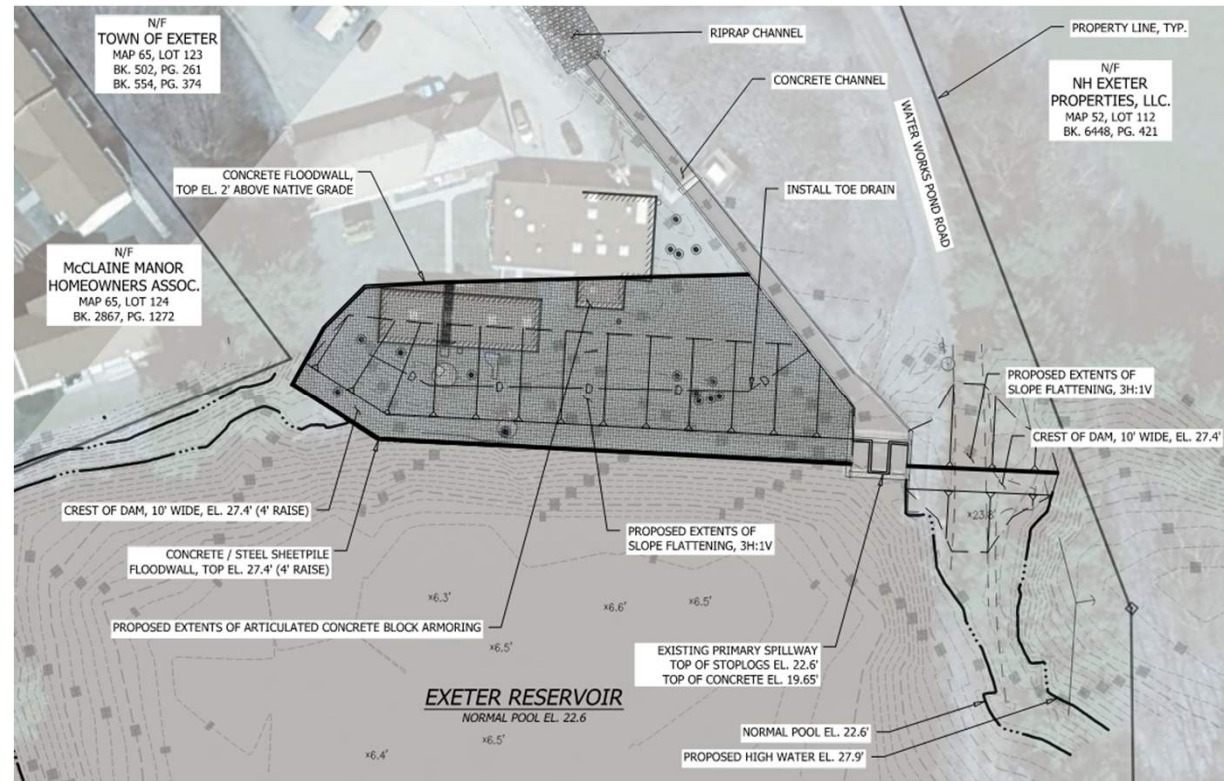
Alternative 2

- Raise top of dam 6 feet (earthen fill), keep existing spillway
 - Approximate cost of \$2,749,000
 - May require purchasing land at the left abutment



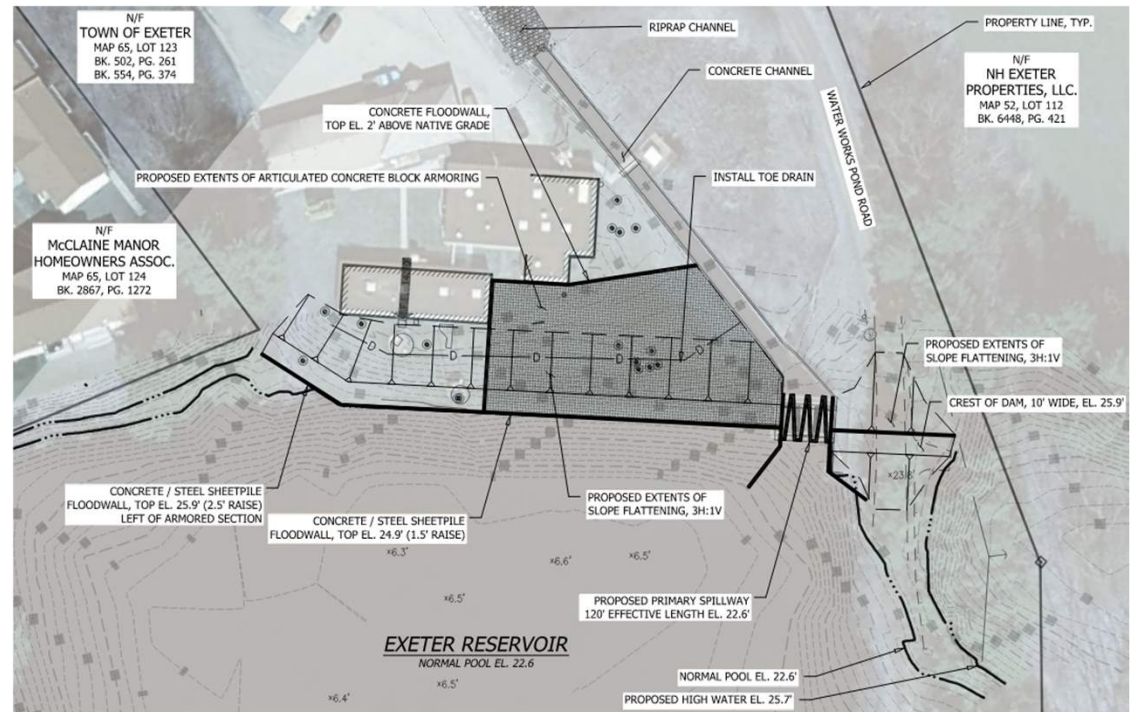
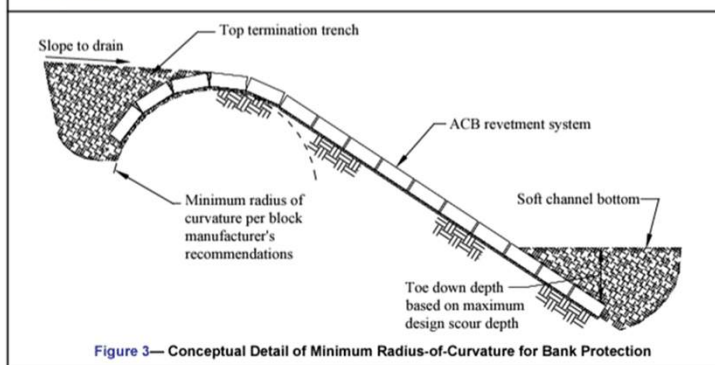
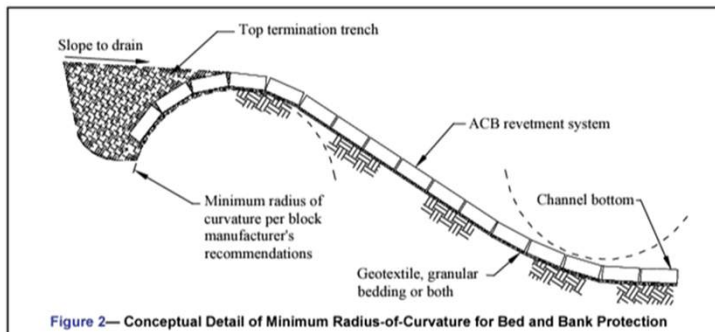
Alternative 3

- Raise top of dam 4 feet (earthen fill), keep existing spillway, install overtopping protection
 - Approximate cost of \$2,276,000
 - Would require removal / reconfiguration of the SWTP



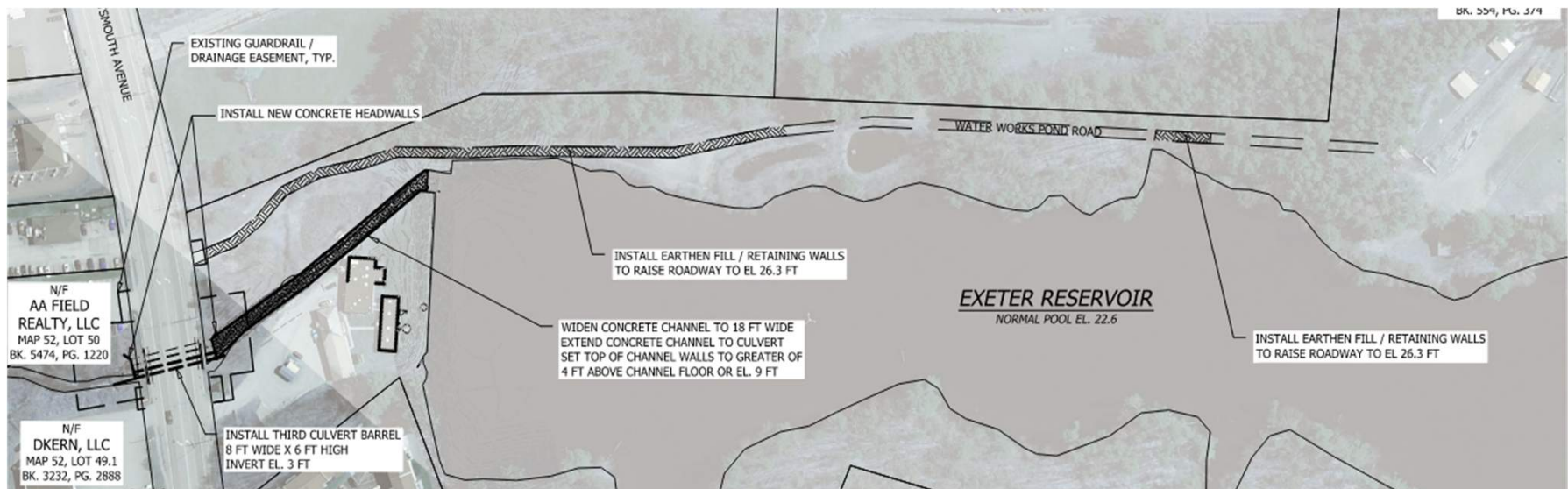
Alternative 4

- Raise top of dam 1.5/2.5 feet (earthen fill or floodwall), replace spillway with labyrinth weir having 120-foot effective length, install overtopping protection over 150 feet of dam
 - Approximate cost of \$3,193,000
 - May require floodproofing of Surface Water Treatment Plant



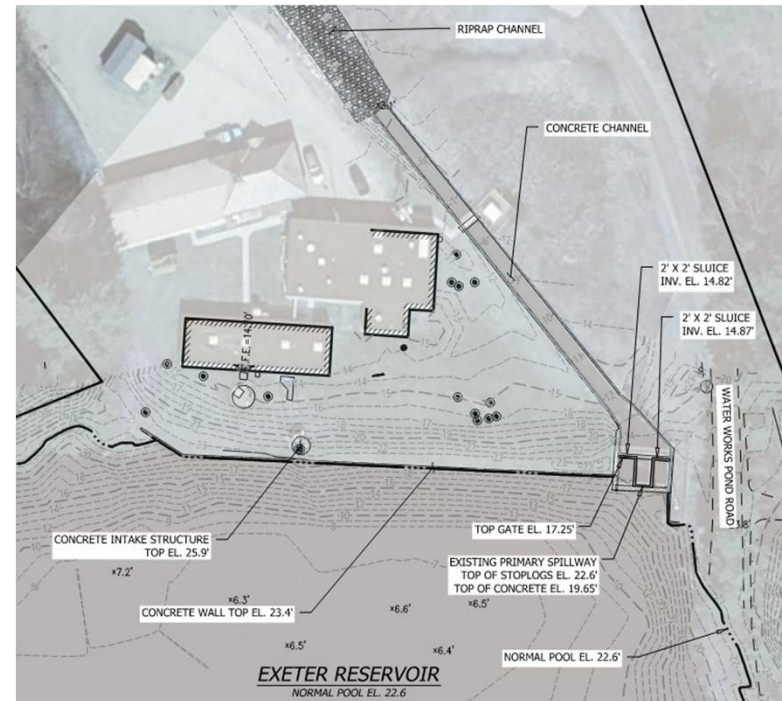
Additional Considerations

- Current sluiceway (1,000 cfs capacity):
 - Concrete from spillway to downstream side of SWTP – 8 feet wide, 4 feet deep
 - Riprap downstream of SWTP – 10 feet wide (minimum), 4 feet deep
 - Widen to 18 feet, extend concrete, raise height at culverts: \$1,250,000
- Portsmouth Avenue Culverts (2X1,000 cfs Capacity):
 - Two parallel culverts, each 8 feet wide, 6 feet high
 - Add third culvert or replace with bridge: Price unknown
- Water Works Pond Road:
 - Flood during overtopping or if impoundment levels are raised
 - Raise impacted portions of roadway 2 feet: \$150,000



	Description	Notes	Cost
Existing	Existing Dam & SPWY		
Alternative 1	Raise TOD 4', replace spillway with Labyrinth having 120' effective length, 40' @ el. 22.6, 80' @ el. 23.3		\$4,256,000
Alternative 2	Raise TOD 6', original spillway	May require purchasing land at left abutment.	\$2,749,000
Alternative 3	Install ACB Overtopping Protection at Dam, raise dam 4'	Requires D/S building removal or reconfiguration.	\$2,276,000
Alternative 4	Install 150' ACB Overtopping Protection, raise dam 1.5' / 2.5', replace spillway with Labyrinth having 120' effective length	Requires floodproofing D/S buildings.	\$3,193,000

Design Storm	Peak Discharge (cfs)
50-year, 24-hr	1,000
100-year, 24-hr	1,200
200-year, 24-hr	2,050
1000-year, 24-hr	2,100
Future 100-year, 24-hr	1,450
Future 1000-year, 24-hr	2,400
250% of 100-year, 24-hr	3,000
250% of Future 100-year, 24-hr	3,650



Schedule

Date	Action
Thursday, September 26th	DRAFT EAP AND OMR to Town for Review
Thursday, October 10th	Submit Draft EAP to NHDES
Monday, November 4th	Draft Study to Town and NHDES for Review
Saturday, November 9th	Last day to receive NHDES EAP Comments (30-day review period)
Monday, November 18th	Receive Study Comments from Town and NHDES
Thursday, November 21st	RAC Meeting to present Study
Tuesday, November 26th	Submit Final Study, EAP and OMR

Questions?

