



Public Information Meeting

Review of Rehabilitation Alternatives
Brodhead Tributaries Watershed



PA-463 (Leavitt Branch Dam) & PA-464 (Goose Pond Dam)

Presented By

Robert Shusko | Mark Buckwalter

Online Meeting Logistics

- Instructions to Online Attendees
- Chat Function
- Attendees Online Muted and Unable to Speak

Introduction

Local Sponsor

Monroe County Commissioners

Robert Gress, Chief Clerk

- Owner
- Responsible for Land Rights

Monroe County Conservation District

Kristina Heaney, District Manager

- Responsible for permits
- Operation and maintenance
- Property access

Funding, Technical, & Contracting Support

USDA, NRCS

Mark Buckwalter, P.E.

- Primary Administrator of Project
- Conducts Final Review and Acceptance of Project Documents
- Coordinates with Public
- Provides Project Funding

Consulting Engineers

DDK Engineering

Robert Shusko, P.E.

Chuck Goodling, P.E.

- Field Reconnaissance and Background Data
- Engineering Analyses to Characterize Watersheds and Performance of the Dams
- Evaluates Potential Alternatives for Rehabilitation
- Prepares Final Project Documents

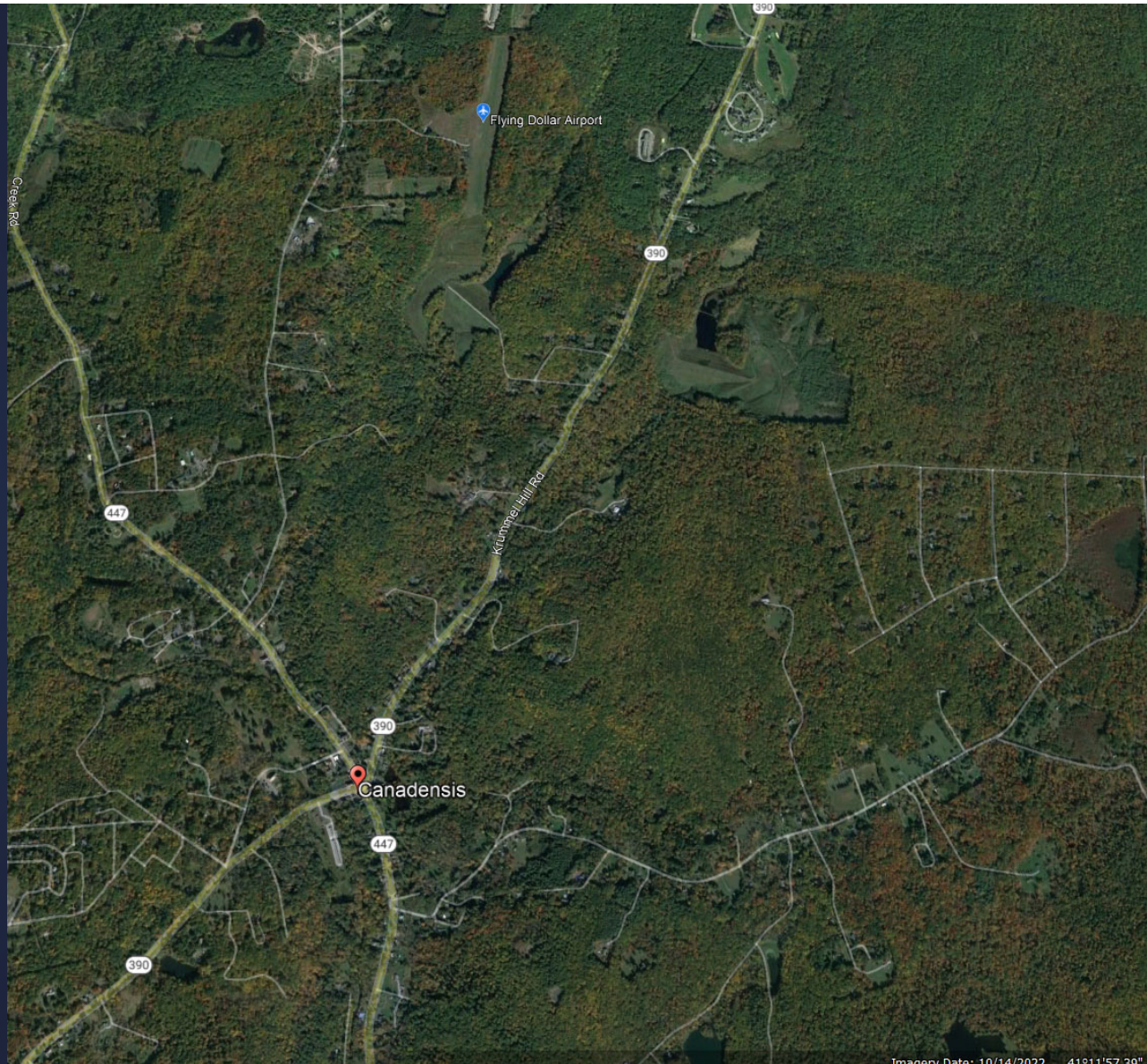
Meeting Objectives

- Purpose and Need/Background
- NRCS Rehabilitation Process
- Investigations and Analyses Performed to Date
- Dam Deficiencies
- Alternatives Formulation Process
- Present Alternatives
- Present Preferred Alternatives
- Collect Public Input



Background Behind the Dams...

- The Town of Canadensis has historically sustained flooding.
 - Flood of August 15, 1955
 - 7.3" in 8 hours
 - 1.1M in Damages
 - 9 lives lost
- Monroe County worked with NRCS (formally SCS) to develop a watershed work plan to address flooding.
 - Initial Plan completed in 1961
 - 2 supplementary watershed plans were completed thereafter.
- These planning studies resulted in the design and construction of 2 flood control dams to protect downstream residences.
 - Leavitt Branch Dam (PA463) - 1976
 - Goose Pond Dam (PA-464) - 1975



Purpose and Need

Purpose

Continue to provide flood protection to the watershed for the next 50- 100 years while minimizing environmental, economic, and social impacts.



Need

The existing dam structures do not meet current safety and performance standards.

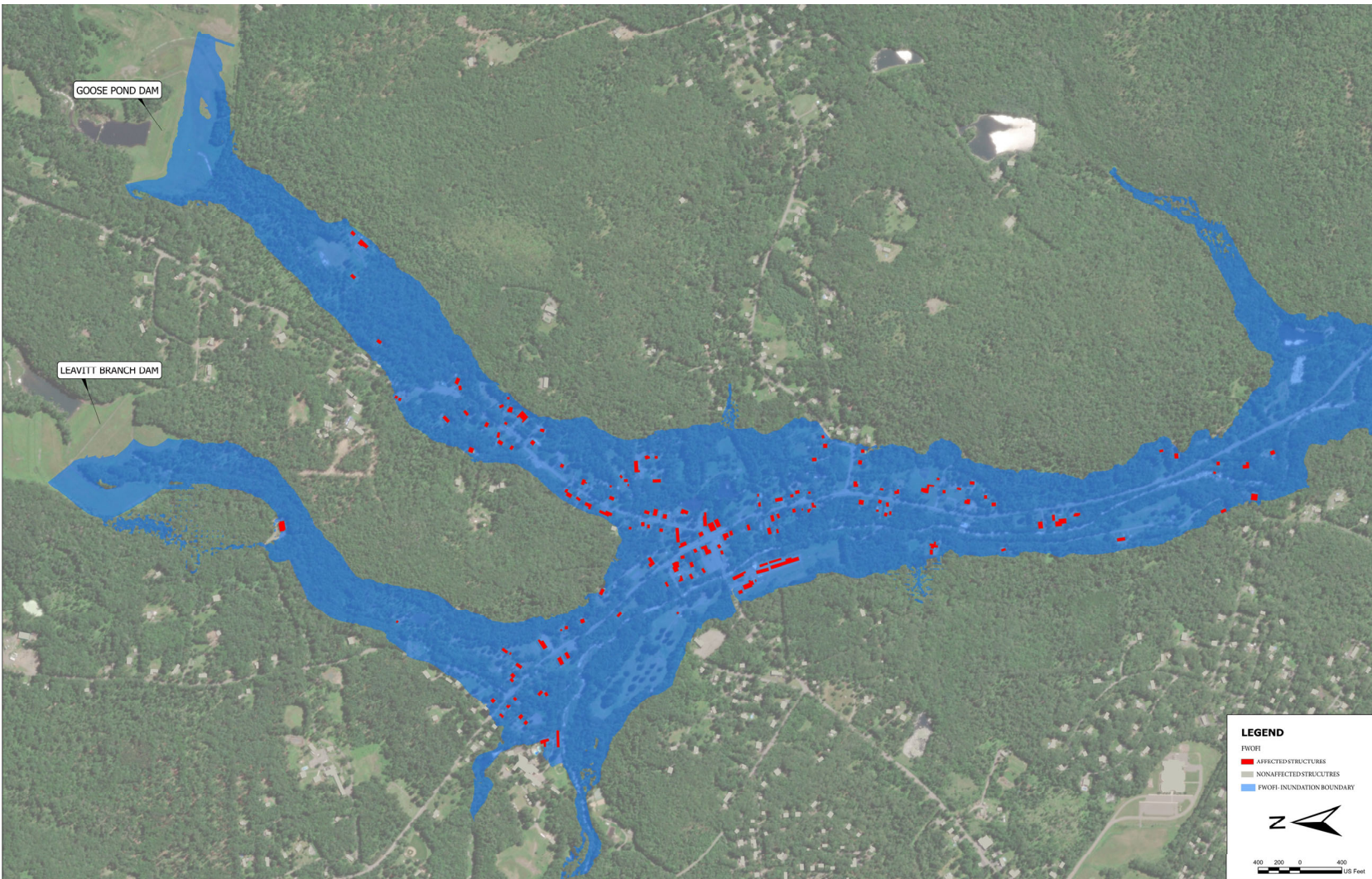
The dams are not less safe than the day they were built.

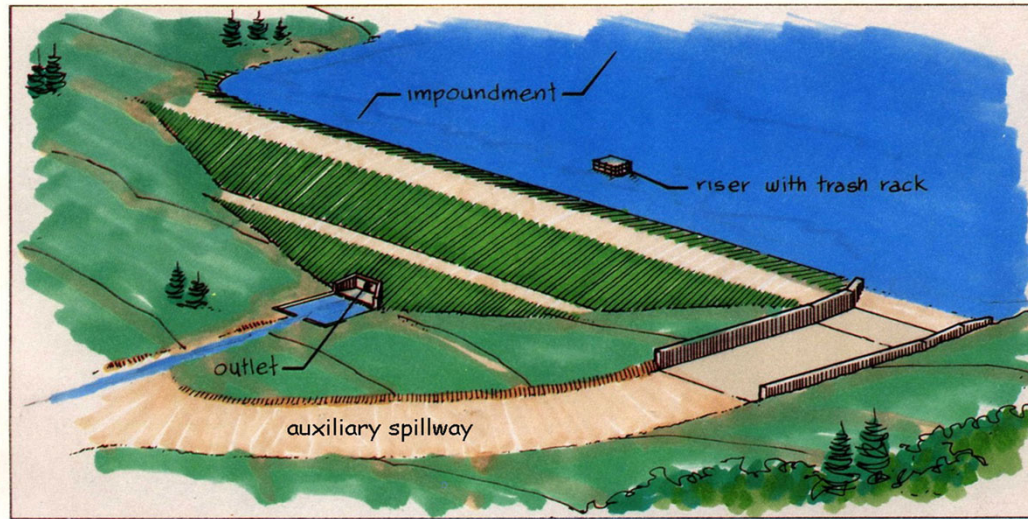
- Inspected annually by Monroe County and PADEP-Dam Safety
- No imminent dam safety hazards identified
- The dams are aging gracefully

The County is taking a proactive approach by pursuing rehabilitation of these dams.

FWOFI Alternative Inundation Map (No Action)

- Leavitt Dam Fails at 10.31 inches of Rain During 24-Hour Storm Duration
- Goose Dam Fails at 13.21 inches of Rain During 6-Hour Storm Duration
- Approximately 150 Affected Structures
- Approximately 48,100 linear Feet of Public Roadways are Affected





Typical Earth Dam

- Impoundment
- Embankment (Dam)
- Riser with trash rack
- Outlet
- Auxiliary spillway



Brodhead Tributaries Watershed Dams

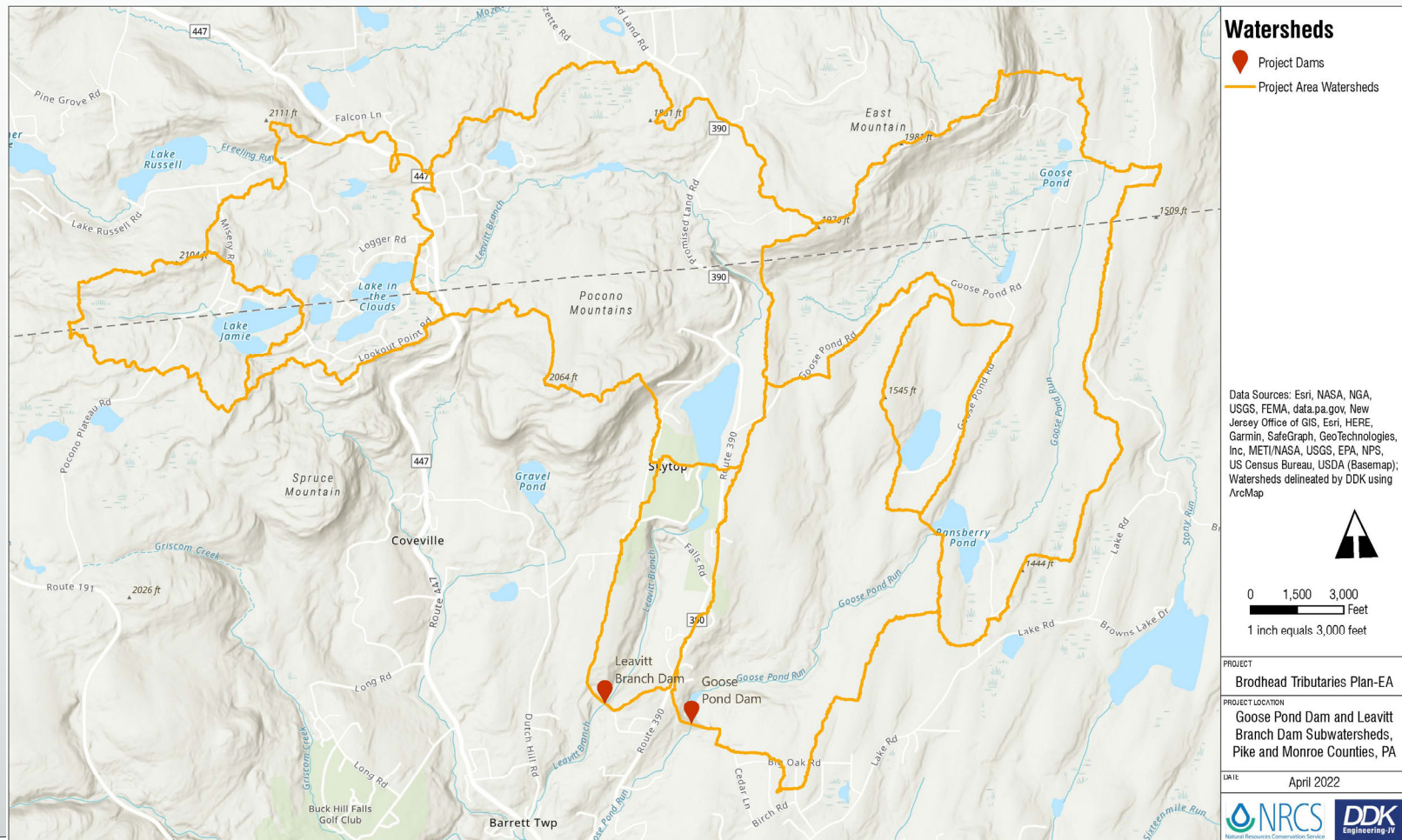
Leavitt Branch Dam

- 6.5 Sq. Mile Watershed
- 2 Acres of Reservoir Water Surface (Designed As a Dry Dam)
- 96 Feet High
- 886 Feet Long
- High Hazard Potential

Goose Pond Dam

- 6.9 Sq. Mile Watershed
- 4 Acres of Reservoir Water Surface
- 101 Feet High
- 1286 Feet Long
- High Hazard Potential

Leavitt Branch and Goose Pond Watershed Map



Analyses & Investigations

- Inspections of Structural and Earthen Components
- Detailed Surveys Including Topographic
- Bathymetry and Sediment
- Internal Pipe Inspections
- Geotechnical Investigations
- Structural and Geotechnical Analyses
- Hydrology and Hydraulic Analyses
- Environmental Investigations
- Cultural Resources Investigations



Geotechnical Investigation

Borings Completed:

- 9 Borings at Leavitt Branch Dam
- 11 Borings at Goose Pond Dam

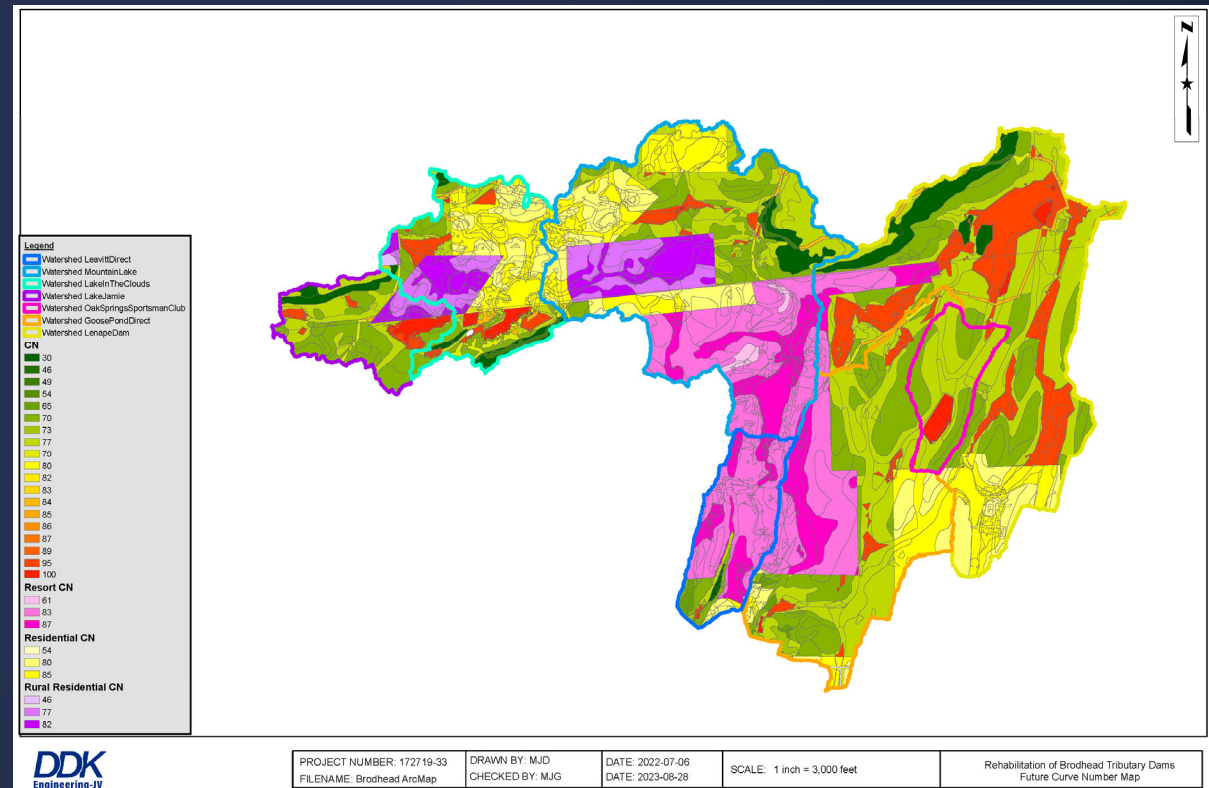
72719-33 NRCS - Brodhead Tributaries 10/29/21
Boring: GP-21-214 Box: 2 of 2 From: 26.0' - 34.0'

Run	Depth (ft)	Rec (ft)	Rec (%)	RQD (ft)	RQD (%)
R-4	26.0' - 31.0'	5.0'	100%	3.4'	68%
R-5	31.0' - 34.0'	3.0'	100%	0'	0%
R-6	34.0' - 39.0'	5.0'	100%	3.5'	72%



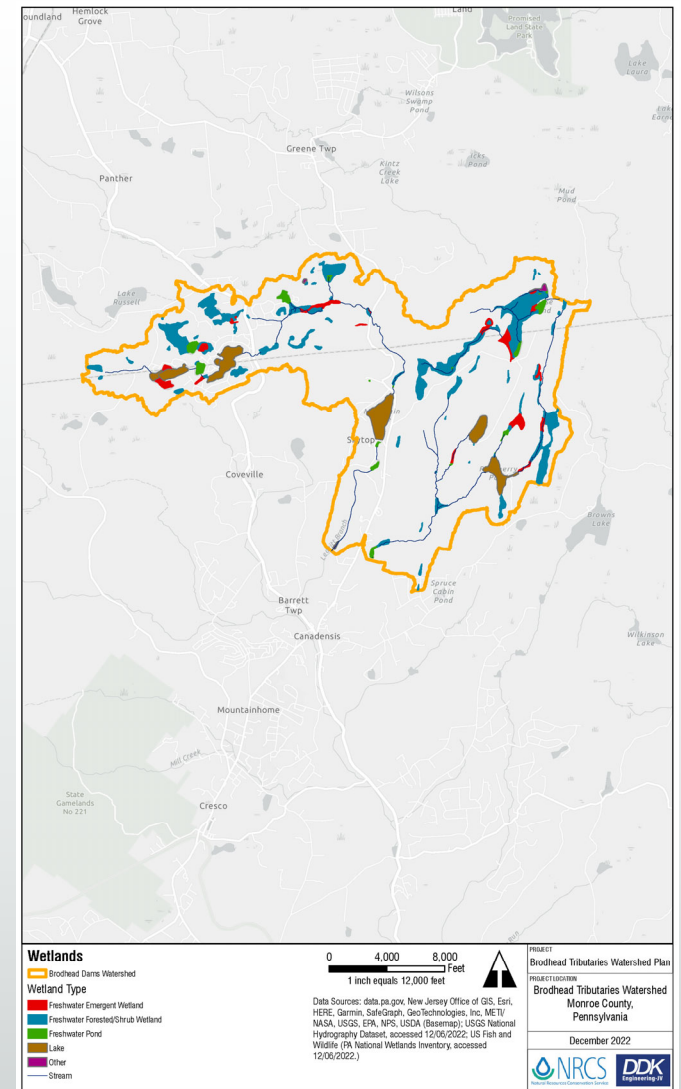
Hydrology & Hydraulic Analyses

- Characterize Watersheds
- Evaluate Impacts From Upstream Dams
- Flood Routings of Existing Conditions
- Breach Analyses
- Prepare Inundation Mapping
- Analyze Proposed Alternatives

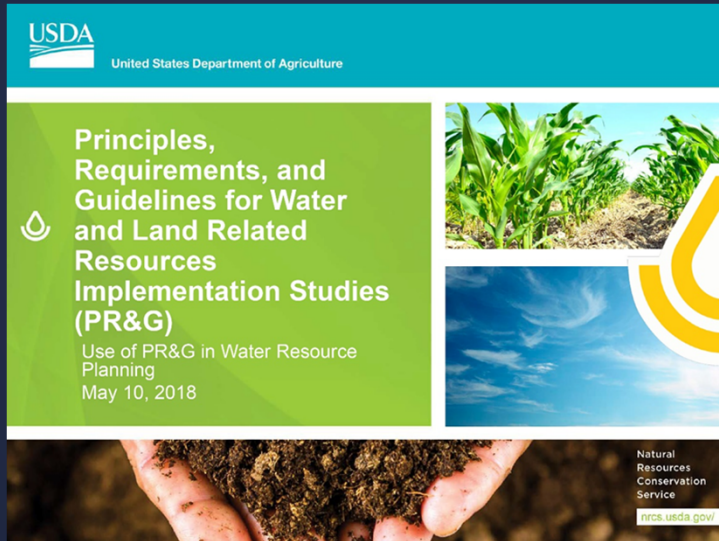


Environmental Investigation

- Wetland Delineation
- Land Cover and Soils Mapping
- Air and Water Quality
- PNDI Inquiry (Threatened and Endangered Species)
 - 2 Endangered Species
 - Northern Long Ear Bat
 - Indiana Bat
 - Tricolored Bat (Pending)
 - 4 Unnamed Sensitive Species
 - 3 Special Concern Species
 - Mud Sedge
 - Horned Bladderwort
 - Eastern Buckmoth
 - 2 Special Concern Resources
 - Red Spruce – Mixed Hardwood Palustrine Forest
 - Indian Ladder Falls



NRCS Dam Rehabilitation Process



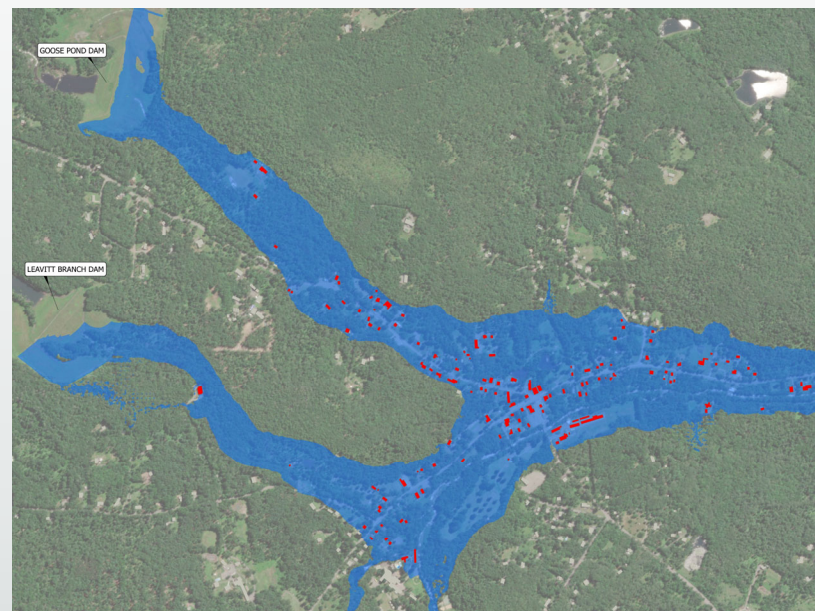
- Begins between Sponsor and NRCS
 - Identify deficiencies, problems and need for action
 - Detailed engineering analysis
 - Identify Resource concerns
 - Develop alternatives in conjunction with NRCS guidelines
-
- **Programmatic Alternatives** (required under PR&G)
 - Future Without Federal Investment (FWOFI) | No Federal Action
 - Decommissioning the Dam (Dam Removal)
 - Non-structural Alternatives (elevate, relocate, zoning, etc.)
 - Structural Rehabilitation to PA Dam Safety and NRCS Design Criteria
 - Locally Preferred (Sponsor's) Alternative
 - National Economic Efficiency (NEE)
 - **Alternative Formulation and Evaluation under PR&G**
 - Public benefits of alternative are compared to costs
 - Performance against guiding principals
 - Performance against formulation criteria
 - Must evaluate ecosystem services (Resource Concerns)

Programmatic Alternatives Required to be Considered

- Future Without Federal Investment (FWOFI) | No Federal Action
- Decommissioning the Dam
- Non-structural Alternatives
- Structural Rehabilitation

Future Without Federal Investment (FWOFI)

- No Rehabilitation
- Eventual Dam Failure
 - By Deterioration
 - Storm Event Breach



- Risks
 - Loss of Life
 - Loss of homes and business in inundation zone (approximately 150 structures)



Programmatic Alternatives Required to be Considered

- Future Without Federal Investment (FWOFI) | No Federal Action
- Decommissioning the Dam
- Non-structural Alternatives
- Structural Rehabilitation

Decommissioning The Dam

- Remove Dam
- Restore and stabilize pre-existing streambed
- Flood Protection to structures/infrastructure downstream
 - Flood-proofing of buildings (explained in later slide)
 - Acquisition of structures
 - Relocation/ Removal of structures
 - Infrastructure upgrades
 - Modifying zoning regulations to address future floodplain development
- Risks
 - Greater depth of water in floodplain than non-structural alternative
 - Floodplain is still at risk
 - Road crossings will still be flooded
 - Homes and structures will need to be removed or relocated

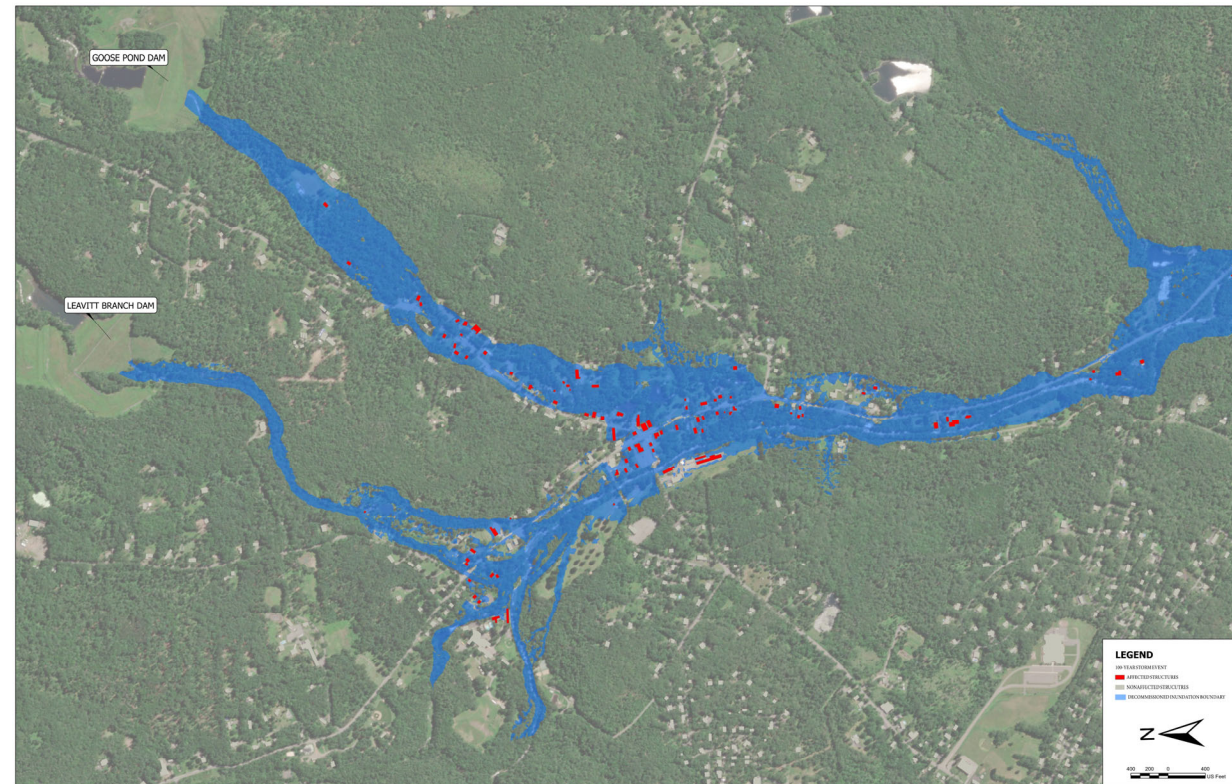


Programmatic Alternatives Required to be Considered

- Future Without Federal Investment (FWOFI) | No Federal Action
- Decommissioning the Dam
- Non-structural Alternatives
- Structural Rehabilitation

Decommission The Dams

100-Year Storm Event – 7.60 inches of Rain During 24-hour Storm Duration

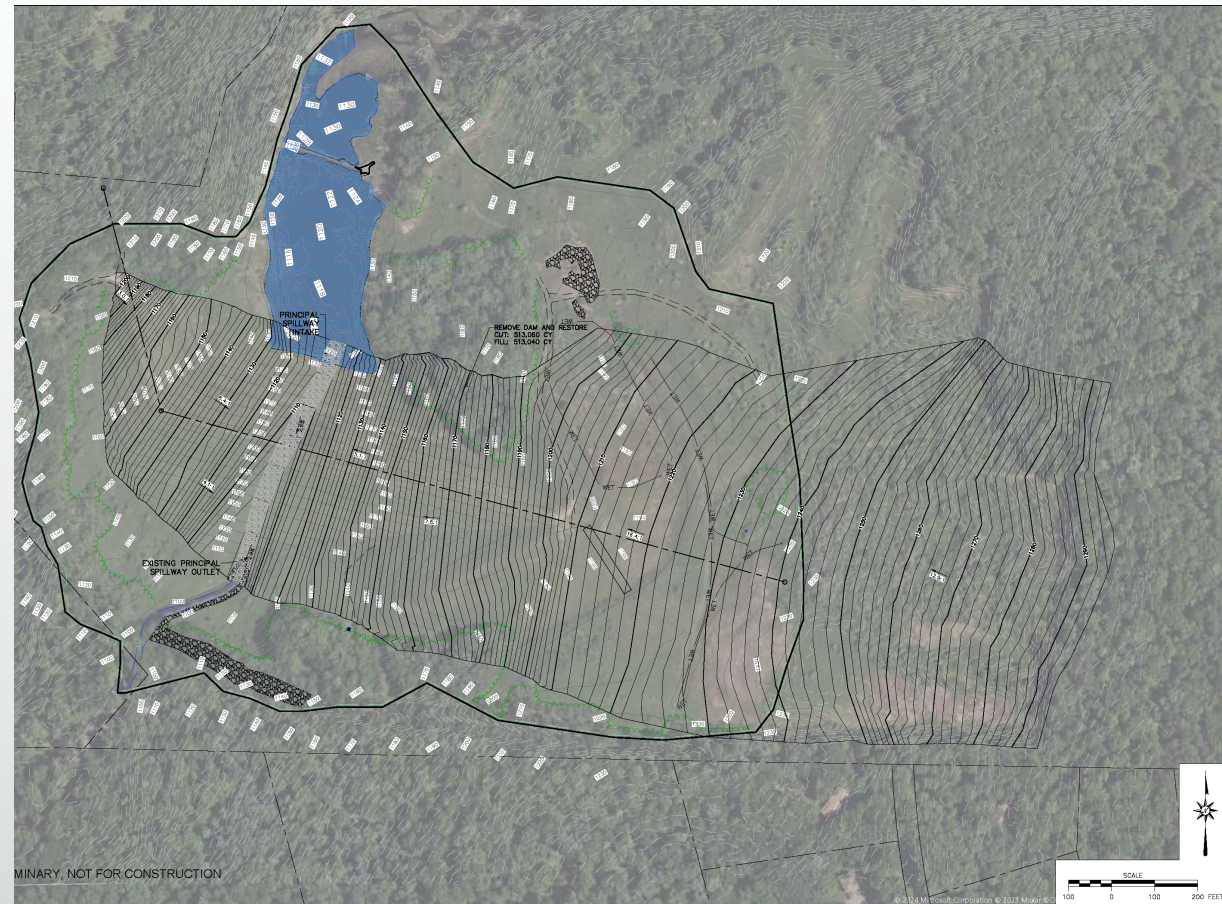


Approximate Affected Structures: 110
Public Roads Inundated: 25,250 Linear Feet

Programmatic Alternatives Required to be Considered

- Future Without Federal Investment (FWOFI) | No Federal Action
- Decommissioning the Dam
- Non-structural Alternatives
- Structural Rehabilitation

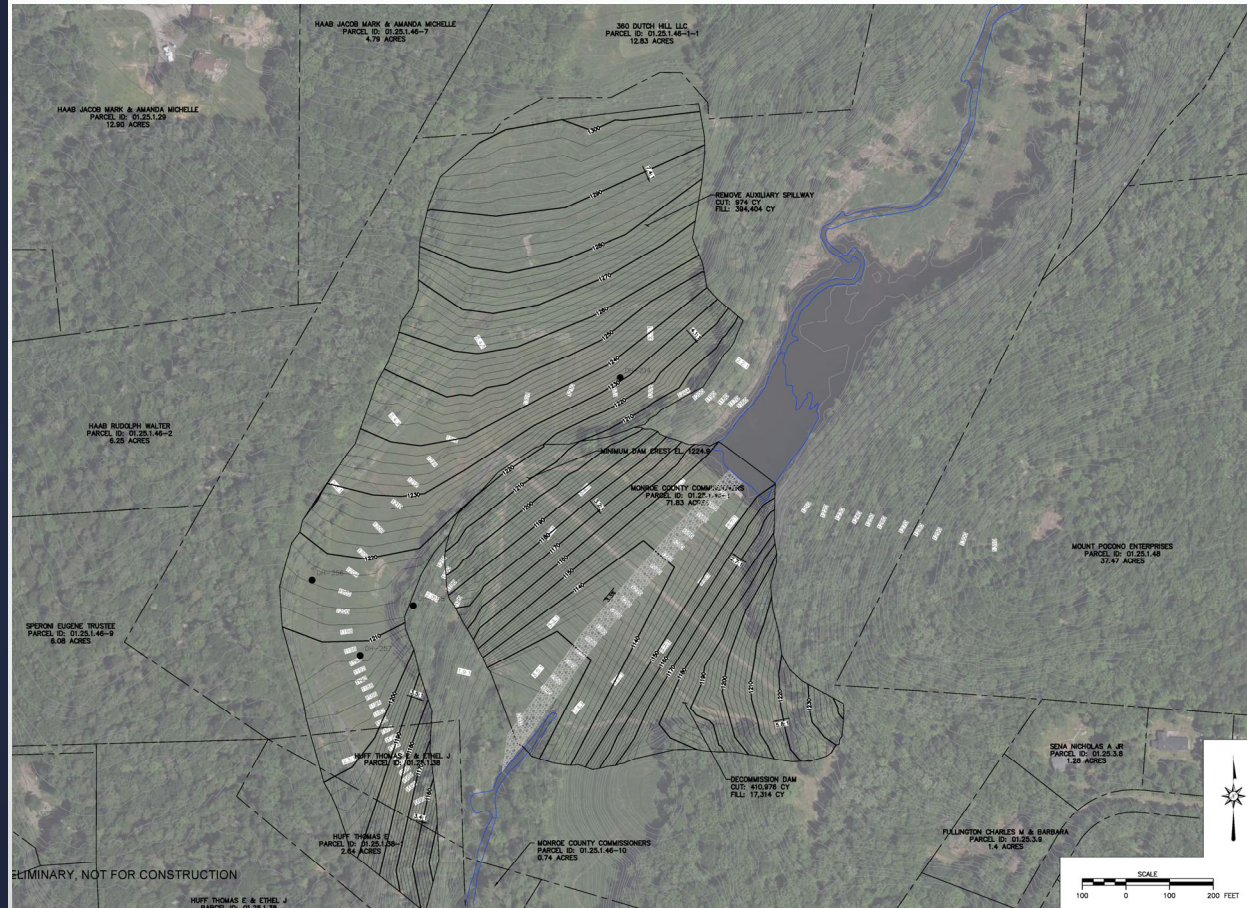
Decommission Goose Pond Dam



Programmatic Alternatives Required to be Considered

- Future Without Federal Investment (FWOFI) | No Federal Action
- Decommissioning the Dam
- Non-structural Alternatives
- Structural Rehabilitation

Decommission Leavitt Branch Dam



Programmatic Alternatives Required to be Considered

- Future Without Federal Investment (FWOFI) | No Federal Action
- Decommissioning the Dam
- Non-structural Alternatives
- Structural Rehabilitation

Non-Structural Alternatives

- Flood Protection in floodplain to lower hazard classification
- Flood Protection to structures/infrastructure downstream
 - Flood-proofing of buildings
 - Acquisition of structures
 - Relocation/ Removal of structures
 - Infrastructure upgrades
 - Modifying zoning regulations to address future floodplain development
- Risks
 - Floodplain is still at risk
 - Road crossings will still be flooded
 - Homes and structures will need to be removed or relocated



Programmatic Alternatives Required to be Considered

- Future Without Federal Investment (FWOFI) | No Federal Action
- Decommissioning the Dam
- Non-structural Alternatives
- Structural Rehabilitation

Non-Structural Alternatives

Flood Proofing Buildings

Elevate Structure or Abandoning Lower Floor

Raise Structures Above Predicted Flood Levels



Photo courtesy of NRCS

Programmatic Alternatives Required to be Considered

- Future Without Federal Investment (FWOFI) | No Federal Action
- Decommissioning the Dam
- Non-structural Alternatives
- Structural Rehabilitation

Non-Structural Alternatives Flood Proofing Buildings

Floodproofing (Dry and Wet

Dry - Structure is Retrofitted to Prevent Floodwater From Entering

Wet – Structure is Retrofitted to Prevent Floodwater from Entering Living Area

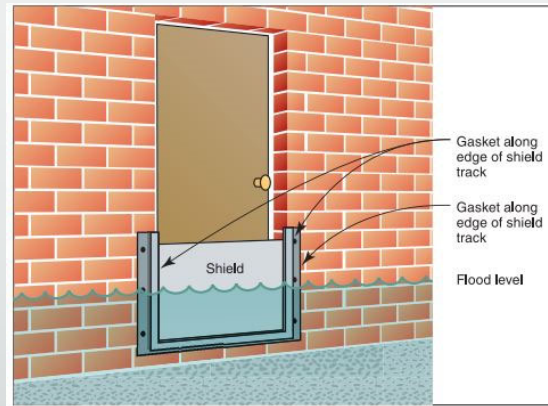


Photo courtesy of FEMA P-312: Homeowner's Guide to Retrofitting

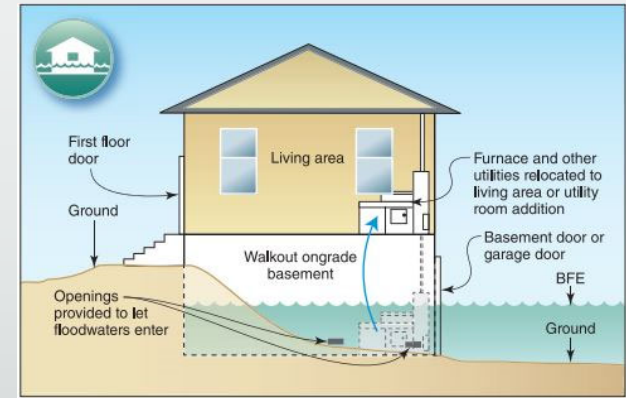


Photo courtesy of FEMA P-312: Homeowner's Guide to Retrofitting

Programmatic Alternatives Required to be Considered

- Future Without Federal Investment (FWOFI) | No Federal Action
- Decommissioning the Dam
- Non-structural Alternatives
- Structural Rehabilitation

Structural Alternatives

- Correct Deficiencies that do not meet PA Dam Safety Standards and NRCS Criteria
- Safely pass the required storm flood flow without overtopping dam



- Risks
 - Very Little Safety Risks





Leavitt Branch Dam Notable Deficiencies

- Does Not Store PSH Event (close to 200-year) Without Activating Auxiliary Spillway
- Auxiliary Spillway Breaches at the 380-year event (10.31 inches of Rain During 24-Hour Storm Duration)
- Dam Overtops During FBH Event (22.77 inches of Rain During 6-Hour Storm Duration)
- Minor Repairs Required to Concrete Structures

Goose Pond Dam

Notable Deficiencies

- Does Not Store PSH Event (close to 200-year) Without Activating Auxiliary Spillway
- Dam Overtops During FBH Event (22.77 inches of Rain During 6-Hour Storm Duration)
- Minor Repairs Required to Concrete Structures
- Internal Drainage System Requires Upgrade



Alternatives Summary

HIGHEST RISK LOWEST RISK	Large Amount of Structures in Floodplain affected	FWOFI	Eliminated due to amount of risk to the public and amount of damages
		DECOMMISSION	Eliminated due to overall cost of floodproofing and dam removal, significant adverse impacts to downstream resources
	Smaller Amount of structures in Floodplain affected	NON-STRUCTURAL	Eliminated due to overall cost of floodproofing, significant adverse impacts to downstream resources, does not correct deficiencies at dam sites
		STRUCTURAL REHABILITATION	Carried forward into detailed study

Types of Improvements to the Auxiliary Spillways

- Change / Improve Weir Crest
- Reinforce Downstream Channel Lining
- Downstream Channel Energy Dissipation

Change / Improve Weir Crest

- **Broad-crested Weir (Existing)** - A flat rectangular section of weir perpendicular to flow and no downstream shape control
- **Ogee Weir**- Control weir is S- shaped in profile
- **Labyrinth** - Weir wall is constructed in a zigzag manner



Types of Improvements to the Auxiliary Spillways

- Change / Improve Weir Crest
- Reinforce Downstream Channel Lining
- Downstream Channel Energy Dissipation

Reinforce Downstream Channel Lining

- ACB



- RCC

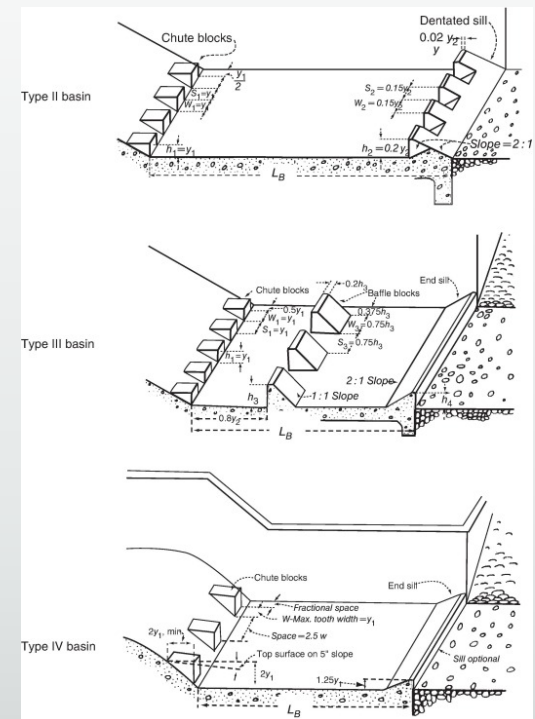


Types of Improvements to the Auxiliary Spillways

- Change / Improve Weir Crest
- Reinforce Downstream Channel Lining
- Downstream Channel Energy Dissipation

Downstream Channel Energy Dissipation

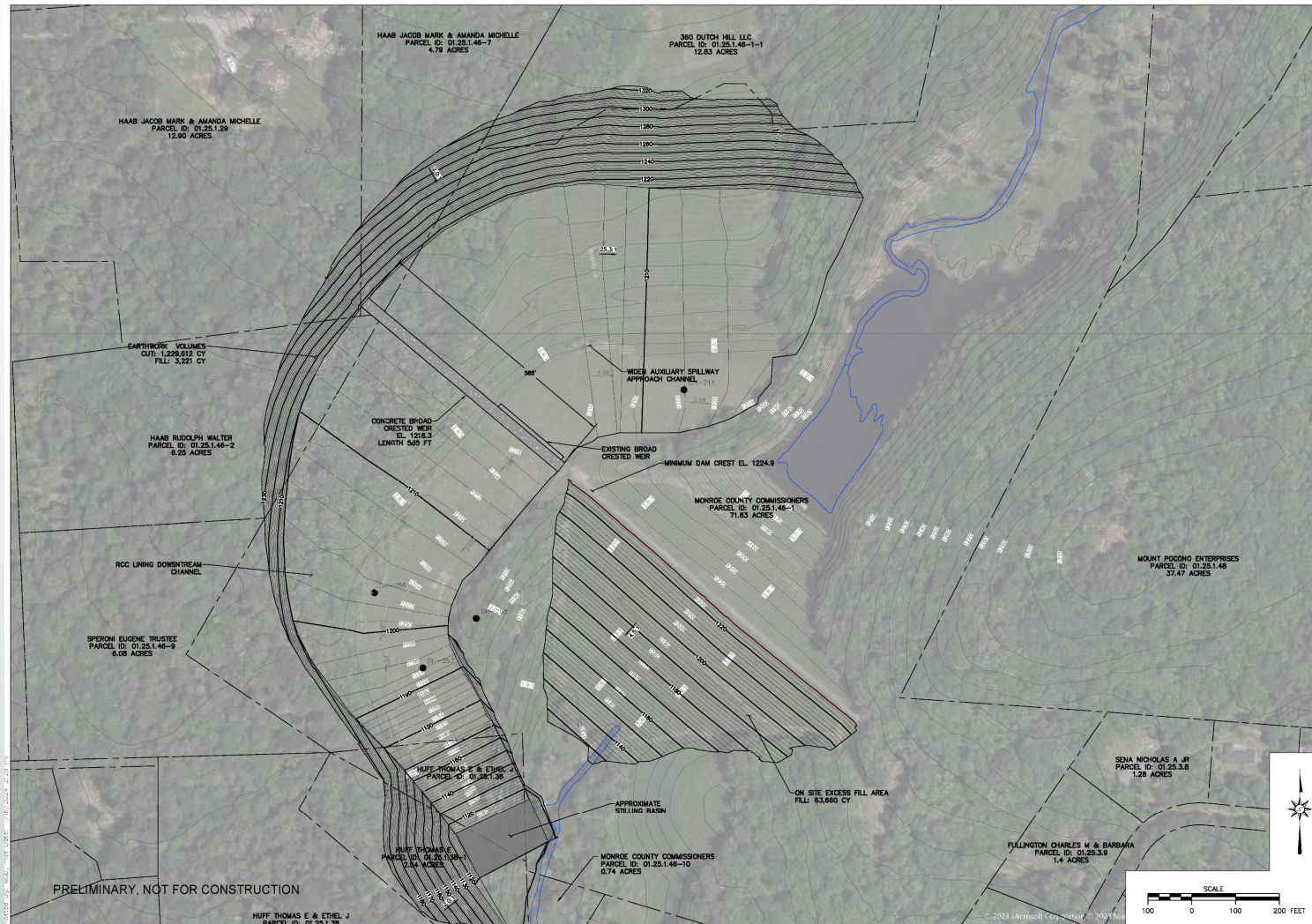
- Stilling Basin – Dissipates energy and velocity before entering stream and prevents downstream erosion



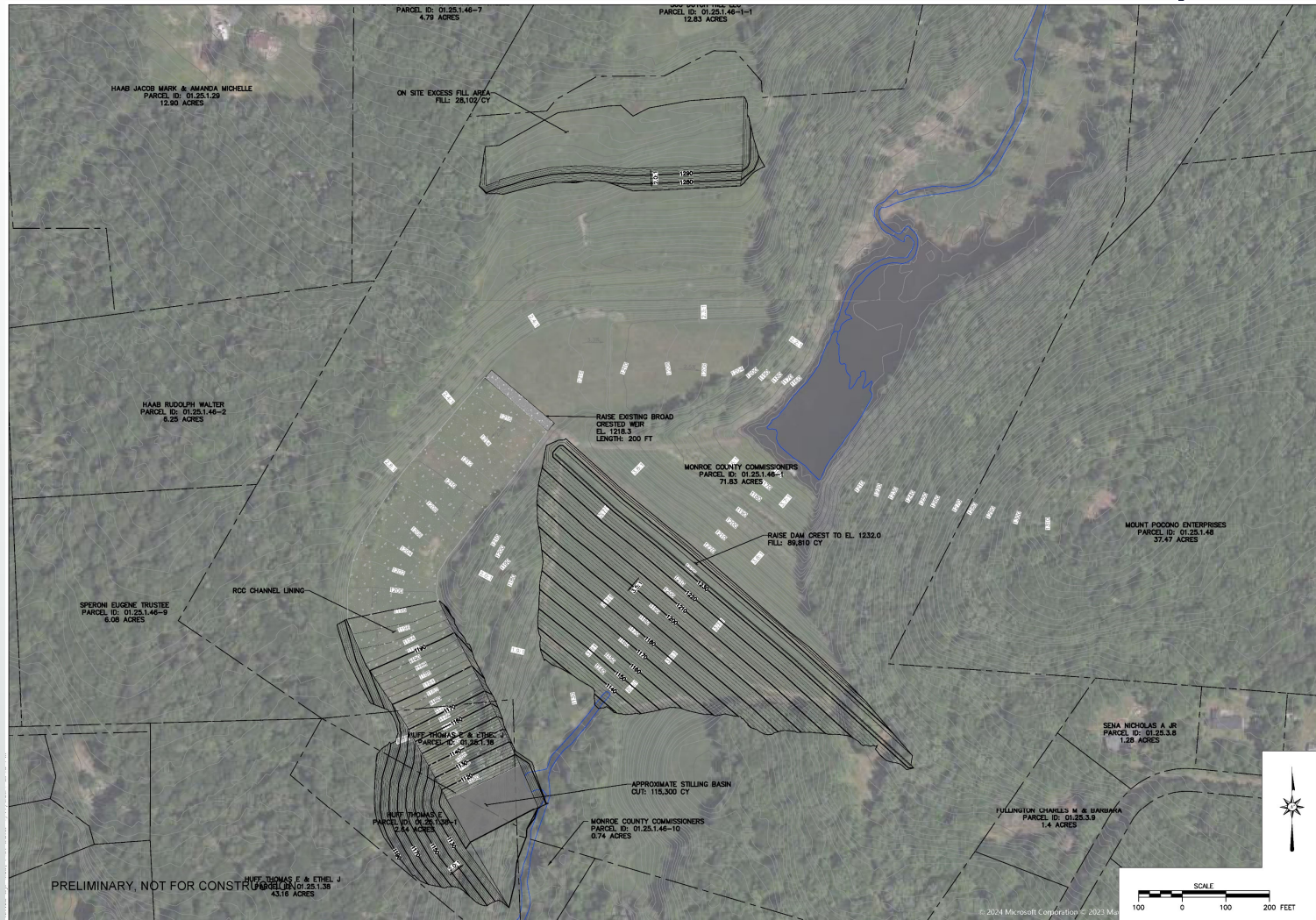
Structural Alternatives- Leavitt Branch Dam

	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Ogee			✓	✓		
Broad Crest	✓	✓				✓
Labyrinth					✓	
Stilling Basin	✓	✓	✓	✓	✓	✓
Cutoff To Rock						
Raise Dam Crest		✓		✓		✓
Widen Spillway	✓	✓	✓	✓		
Narrow Spillway					✓	
Approach Channel Modification			✓	✓	✓	
Spillway Lining	✓	✓	✓	✓	✓	✓

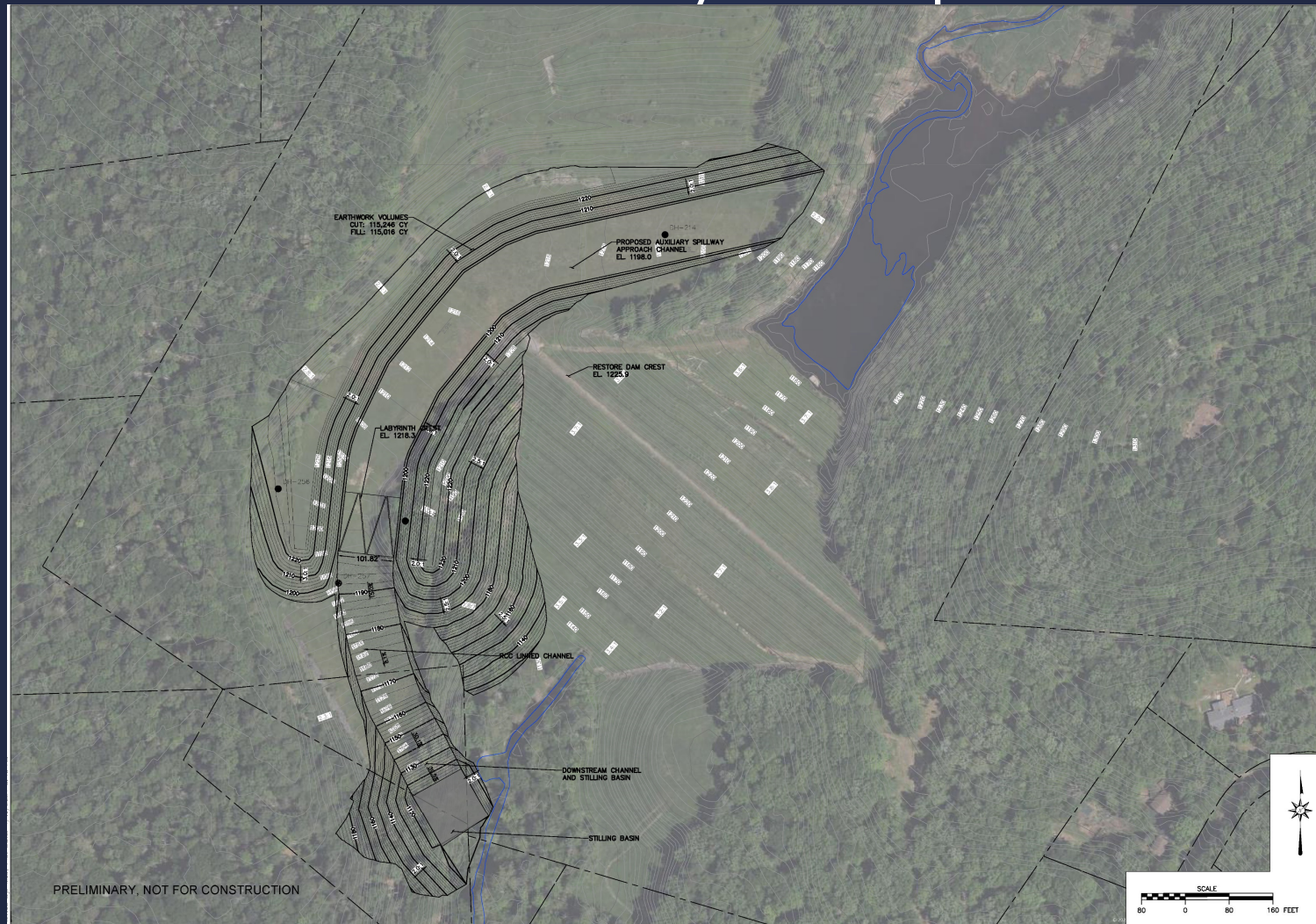
Leavitt Branch Dam Broad Crested Weir Option



Leavitt Branch Dam Raise Dam Crest Option



Leavitt Branch Dam Labyrinth Option - Preferred



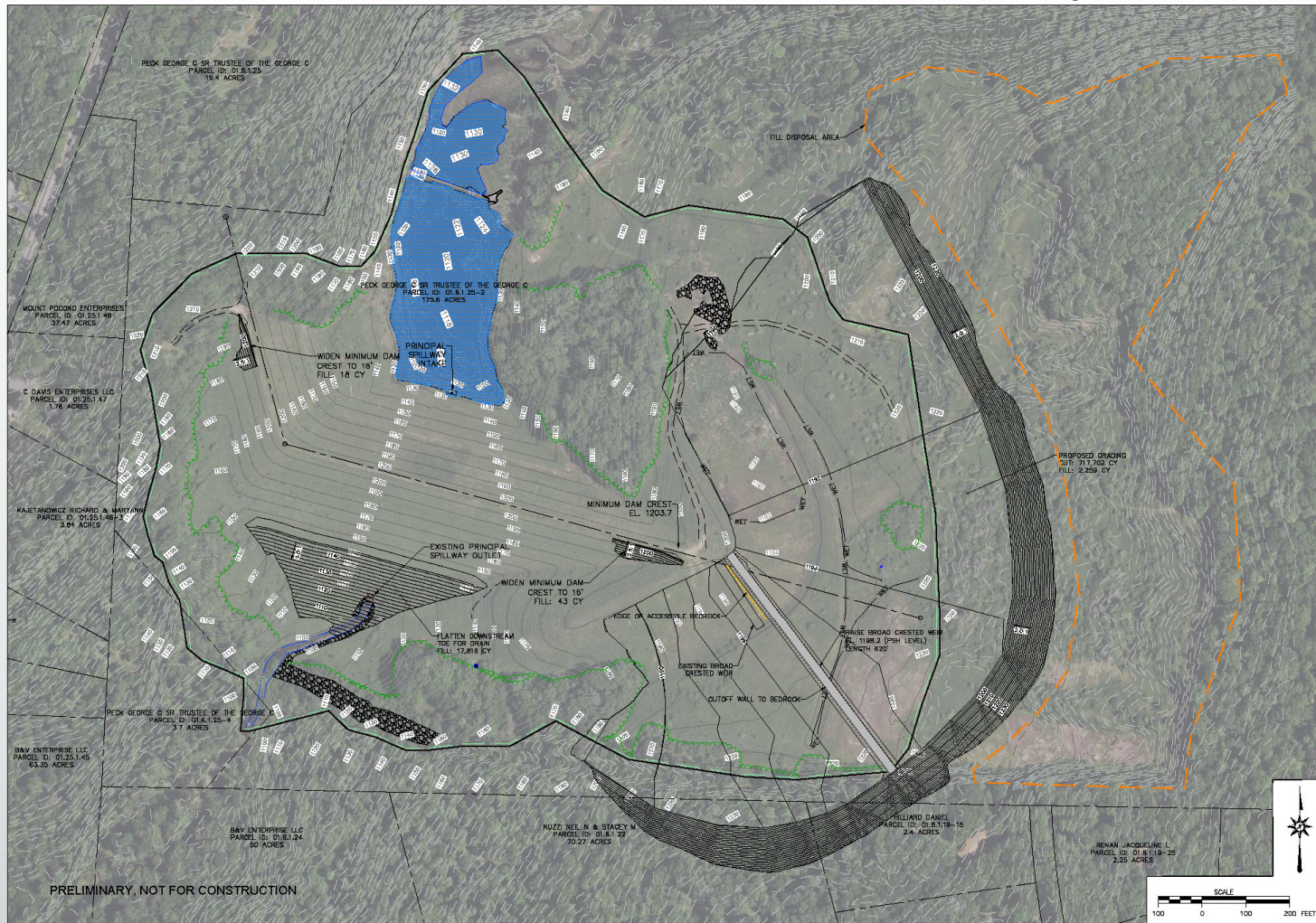
Leavitt Branch Dam – Deciding Factors

	Widen Existing Broad Crest Spillway	Replace with Ogee Weir Crest	Raise Dam Crest	Replace With Labyrinth Spillway
Balanced Earthwork	✗	✗	✓	✓
Limited Amount of Earthwork	✗	✗	✓	✓
Minimal Channel Stabilization	✗	✗	✓	✓
Limited Surrounding Land Rights	✗	✗	✗	✓
Cost Effective	✗	✗	✓	✓
Federally Preferred Alternative	✗	✗	✗	✓
Estimated Cost Range	\$45-140 Million	\$25-75 Million	\$24.5 Million	\$18.5-22 Million

Structural Alternatives- Goose Pond Dam

	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Option 9	Option 10	Option 11	Option 12
Ogee					✓	✓	✓					
Broad Crest	✓	✓	✓	✓								✓
Labyrinth								✓	✓	✓	✓	
Stilling Basin or Apron					✓	✓	✓	✓	✓	✓	✓	
Cutoff To Rock	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Raise Dam Crest			✓	✓			✓		✓		✓	✓
Widen Spillway	✓	✓	✓	✓	✓	✓	✓	✓		✓		
Narrow Spillway									✓		✓	
Contains 100-Year	✓		✓		✓					✓	✓	✓
Contains PSH		✓		✓		✓	✓	✓	✓			
Approach Channel Modification					✓	✓	✓	✓	✓	✓	✓	
Spillway Lining												

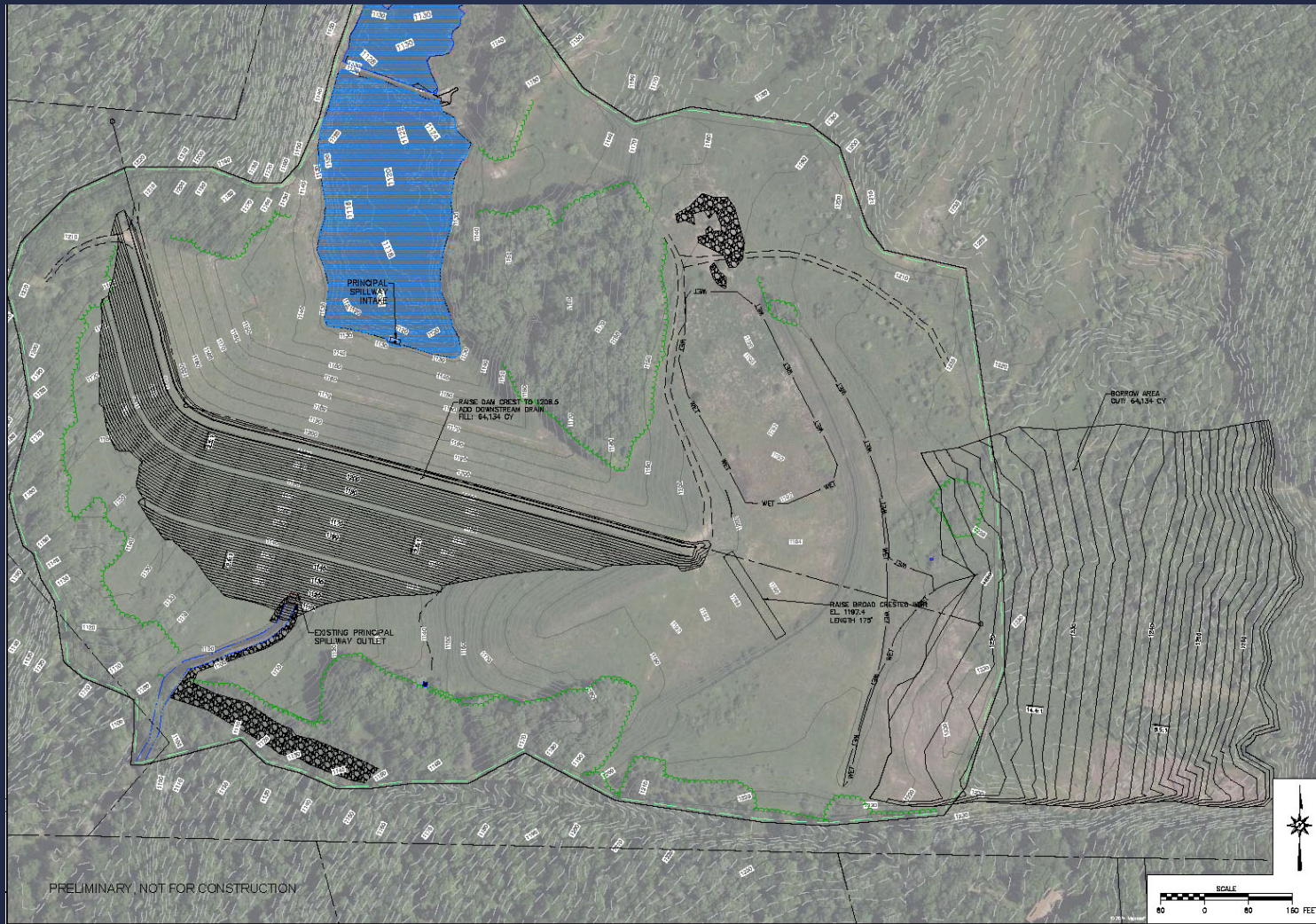
Goose Pond Dam Broad Crested Weir Option



Goose Pond Dam Labyrinth Option



Goose Pond Dam Raise Dam Crest Option



Goose Pond Dam – Deciding Factors

	Widen Existing Broad Crest Spillway	Replace with Ogee Wier Crest	Raise Dam Crest	Replace With Labyrinth Spillway
Balanced Earthwork	✗	✗	✓	✓
Limited Amount of Earthwork	✗	✗	✓	✓
Limited Surrounding Land Rights	✗	✗	✗	✓
Cost Effective	✗	✗	✓	✓
Federally Preferred Alternative	✗	✗	✓	✓
Estimated Cost Range	\$12-33 Million	\$19-33 Million	\$7.5 Million	\$9.5-12 Million

Federal / Local Cost-Share

- **NRCS Cost-Share**

- 100% of Planning costs
- 100% of Design costs
- 100% of Construction Engineering and QA
- 65% of Construction costs

- **Local Sponsor Cost-Share**

- 35% of Construction Costs (Cash or In-Kind Credit)
- 100% of Permit Costs
- 100% of Land / Easement Acquisition Costs

- **FWOFI (No Federal Action)**

- 0% Federal
- 100% Local



Dam Rehabilitation Estimated Construction Cost Summary

	Recommended Alternatives	
	Leavitt Branch Structural Rehabilitation	Goose Pond Structural Rehabilitation
Construction Cost	\$18.5-22 Million	\$7.5-12 Million
Monroe County Cost-Share	\$6.5-7.7 Million (35 %)	\$2.6-4.2 Million (35 %)
	TOTAL \$9.3-11.9 Million	

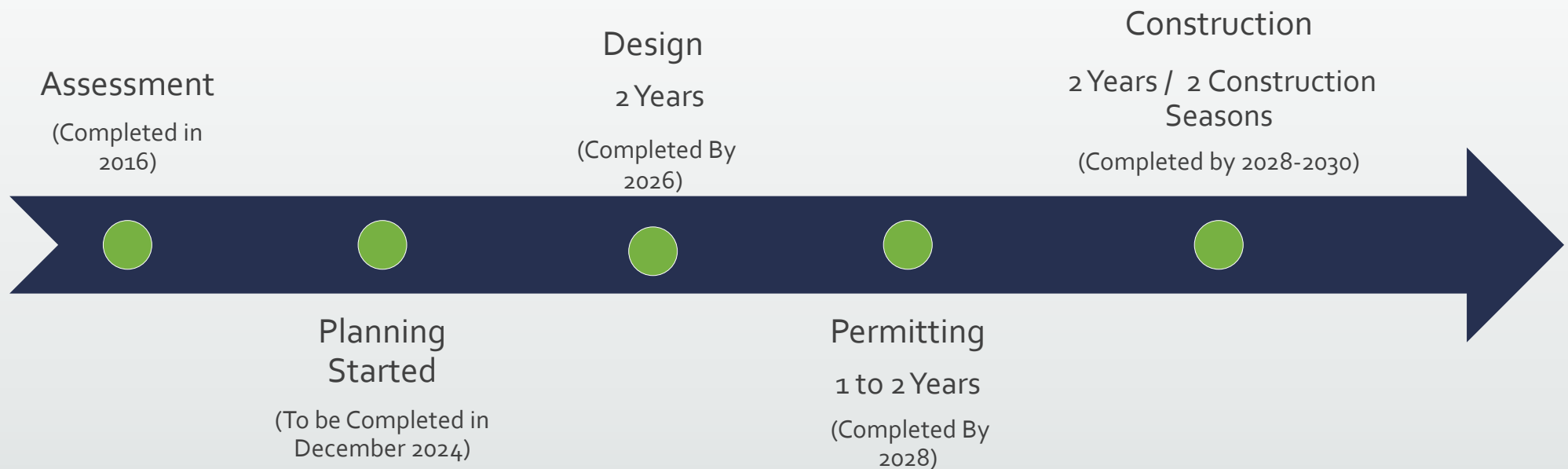


Plan-ED Project Schedule

- Collection and Analysis of Data - **September 2021**
- First Public Meeting - **April 2022**
- Formulation and Evaluation of Alternatives - **April 2023**
- Second Public Meeting – **February 2024**
- Preferred Alternative Selected – **Early Spring 2024**
- Draft Plan-ED completed – **June 2024**
- Final Plan-ED completed – **December 2024**



Anticipated Timeline



Public Discussion And Questions

Summary Of Alternatives	
FWOFI	No Rehabilitation and Eventual Dam Failure
Decommissioning	Remove Dam to Pre-existing Conditions and Provide Flood Protection to Structures Downstream
Non-structural Alternatives	Provide Flood Protection to Downstream Structures and Infrastructures
Structural Rehabilitation	Correct the Deficiencies and Safely Pass the Required Storm Event

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More Information about Dam Rehabilitation

NRCS dam rehabilitation website is:

<https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/wr/>

Points of Contact

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THANK YOU

We appreciate your participation today and your input and assistance during the development of this Plan-ED.

