Brief History of Vermont Dams and Dam Safety

1876 - 1st Dam Safety Law in US Passed in VT

1852 - Failure of Dam in Bennington

1923 - Harriman Dam Built

1927 Flood - Numerous Dams Failed

1929 - VT Dam Permit Program enacted

1930s - Winooski River Flood Dam Built

1947 - East Pittsford Dam Failed

1950s-60s - CT River Flood Dam Built

1981/82 - Chapter 43: Dams Enacted and amended to include inspections

2011 TS Irene - Some Small Dams Failed

2018 - Act 161 Passed, dam safety rule authority

2020 - Admin Rules

2025 - Standard Rules

July 2023 Flood - 5 failed/breached, >50 topped

Legend
Red = Major Incidents/failures
Blue = Legislation
Black = Major Dam building
Brief Program Overview

• Located in the Water Investment Division (WID) within VTDEC

• "The mission of the Vermont Dam Safety Program is to reduce risks to life, property, and the environment from dam incidents and dam failure through effective communication, education, regulation, and dam ownership"

• RESPONSIBILITIES:
  ➢ dam regulation
  ➢ dam ownership
  ➢ lands management

• CURRENT STAFFING:
  ➢ (2) licensed engineer
  ➢ (2) staff engineers
  ➢ (1) program administrator/analyst
  ➢ Summer Temporary (pending funding)

• STATUTE/RULES:
  ➢ 10 V.S.A Chapter 43: Dams, Non-federal, non-power dams (Rules in development)

• DAM OWNERSHIP: 14 dams including the (3) Winooski River Flood Control Dams.
Hazard Potential Classifications

• Potential for loss of life, property losses, lifeline losses, or environmental losses due to a dam failure or incident.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Direct Loss of Life</th>
<th>Property Losses</th>
<th>Lifeline Losses</th>
<th>Environmental Losses</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH</td>
<td>Probable or Certain (one or more) (extensive downstream residential, commercial, or industrial development)</td>
<td>Not considered for this classification</td>
<td>Not considered for this classification</td>
<td>Not considered for this classification</td>
</tr>
<tr>
<td>SIGNIFICANT</td>
<td>None expected</td>
<td>Major or extensive public and private facilities</td>
<td>Disruption of essential or critical facilities and access</td>
<td>Major or extensive mitigation required or impossible to mitigate</td>
</tr>
<tr>
<td>LOW</td>
<td>None expected</td>
<td>Private agricultural lands, equipment and isolated non-occupied buildings, non-major roads.</td>
<td>No disruption of services – repairs are cosmetic or rapidly repairable damage</td>
<td>Minimal incremental damage</td>
</tr>
<tr>
<td>MINIMAL</td>
<td>Same as LOW hazard, above</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Categories are based on overall dam performance and do not apply to appurtenances.

• Independent of condition rating of the dam.
Vermont Dam Inventory / Natural Resources Atlas

- Contains ~1,119 records (active and historic sites)

  - ~992 under jurisdiction of VTDEC (Non-Power, Non-Federal)
    - **44 HIGH**, **133 SIGNIFICANT**, **252 LOW**, **563 MINIMAL or not rated**

  - ~21 PUC (Hydropower pre-1935)
    - **4 HIGH**, **4 SIGNIFICANT**, **13 LOW**, **1 not rated**

  - ~82 FERC (Power post-1935)
    - **15 HIGH**, **7 SIGNIFICANT**, **46 LOW**, **14 MINIMAL or not rated**

  - ~24 other dams are under jurisdiction of Federal Government (USACE, National Park Service, US Forest Service, etc.)
Vermont Dam Inventory / Natural Resources Atlas Continued

VT Dams - Purposes

VT Dams - Hazard Potential Classification

VT Dams - Age

VT Dams - Ownership Type
Regulatory – Key Initiative
Rulemaking – Act 161 of 2018

- Phase I, Administrative Rules adopted
- Phase II, Standards Rules in development
  - Siting, design, construction, alteration
  - Operation & Maintenance
  - Inspection, monitoring, record keeping, reporting
  - Repair or removal
  - Application for authorization
  - EAP requirements and guidance
- Extension to July 1, 2025 being pursued
Dam Ownership – Key Initiative

**Waterbury Dam - Spillway Replacement Project**

- In 2000s Radial Arm Flood Gate jamming, leading to Flood load restrictions on gates
- Section 1177, WIIN 2016 Funding, $70-100M Project, US Army Corps New England
- General Assembly has allocated match needed for up to $60M in Federal Funds
- Improvements to gates, concrete spillways, bridge, lifting equipment, discharge channel
- Mod. Study ~2023/2024, Design ~2025/2026, Construction ~2027/2028
Overview of July 2023 Flood Event on Vermont’s Dams

- Wide ranging rainfall of 3 to 9 inches
- Highest rainfall total in Calais, Vermont (9.2 inches) and 4 to 8 common along the Green Mountains
- July 9, Declared State of Emergency
- July 14, Federal Declaration of Major Disaster
Overview of July 2023 Flood Event on ANR-owned dams

Winooski River Flood Control Dam Performance

• Wrightsville, P-El. 684.15 (10” below aux., ~50’ above normal), \textcolor{blue}{1^{st} Pool-of-Record}
• East Barre, P-El. 1,153.3 (11.7’ below aux., ~28’ above normal), \textcolor{blue}{1^{st} Pool-of-Record}
• Waterbury, P-El. 604.33 (6.5’ below action, ~15’ above normal), \textcolor{blue}{4^{th} Pool-of-Record}

• Continual Storm Monitoring
• On-the-fly inundation mapping and emergency coordination
• Post-Event Inspections, August 2 Inspections with USACE
• Post –Event Tunnel Inspections at Wrightsville & East Barre
• Request for USACE Support for Study of Wrightsville and East Barre
• Waterbury Dam Interim Risk Reduction
Overview of July 2023 Flood Event on ANR-owned dams

**Wrightsville Dam Performance**

- Wrightsville, P-El. 684.15 (10” below aux., ~50’ above normal), 1st Pool-of-Record

- 50’ flood storage pool nearly full.
- 30’ freeboard, full flood pool to dam crest.
- At risk of activating aux. spillway, flooding along North Branch to the Winooski River.
- Request for USACE Support to evaluate feasibility of improved operational flexibility
Overview of July 2023 Flood Event on ANR-owned dams

Other DEC, FPR, and F&W Dam Performance

- DEC-Owned (3 of 14)
  - Minor erosion near spillway at Noyes Pond Dam
  - Waterbury Dam – center gate and bridge (pre-existing but flood control related)
  - Wrightsville Dam
    - Right spillway wall mortar damage/stone missing.
    - Minor scouring of concrete tunnel at upstream end.
    - Operational Flexibility Feasibility Study.

- FPR-Owned (5 of 15)
  - Minor erosion, leakage, and debris issues.

- F&W Owned (17 of 76):
  - Gale Meadows Dam, major Aux. Spillway erosion
  - Others minor erosion, leakage, debris issues.
Overview of July 2023 Flood Event on Regulated Dams

DSP Actions:

RAPID INSPECTIONS
• Rapid Inspection of 390 Non-Power, Non-Federal Dams
• Emergency Management Assistance Compact (EMAC) supported with staff from NY Power Authority, NY Dam Safety, and MA Office of Dam Safety

FOLLOWUP INSPECTIONS
• Inspection of 65 Non-Power, Non-Federal Dams flagged as part of Rapid Inspection.
• 5 FAILED/BREACHED DAMS (2 SIGN, 3 LOW HAZARD POTENTIAL)

Hands Mill Dam, Washington, SIGN Hazard
South Woodbury Pond Dam, Woodbury, SIGN Hazard
Overview of July 2023 Flood Event on Regulated Dams

DSP Actions Continued:

Quinn Lower Dam, Wallingford, LOW Hazard

Lyons Pond Dam, Peru, LOW Hazard

Clarks Sawmill Dam, Cabot, LOW Hazard

Dow Pond Dam, Middlebury, SIGN Hazard
Overview of July 2023 Flood Event on Regulated Dams

DSP Actions Continued:

ONGOING REGULATORY WORK
- 5 FAILED/BREACHED DAMS (2 SIGN, 3 LOW)
- <50 dams with notable damage
- ~57 dams were overtopped
- Working through ~50 dams with storm damage
- Emergency Action Plans, Temporary Repairs, increased monitoring, Risk reduction measures at ~8 dams and counting.

CURSORY COST ESTIMATES OF DAMAGES
- Est. costs of maintenance, temp. stabilization, & compliance (not necessarily storm damage).
- Storm Maintenance, ~$600k
- Temporary Stabilization, ~$1M
- Compliance Costs, ~$60 M
Thank you!
Questions?

Ben Green, PE
Dam Safety Engineer
VTDEC Dam Safety Program
802-622-4093
Benjamin.Green@vermont.gov