Bullough's Pond Dam Q & A

1. Why are we focusing on Bullough's Pond Dam now? Was this on Newton's radar before the Office of Safety wrote to us? When did the Office of Dam Safety inspect the dam?

The condition of Bullough's Pond Dam has been on Newton's radar for years; for example, it was identified in the City's Hazard Mitigation and Climate Vulnerability Plan in early 2018 as a potential flooding risk.

According to the ODS, the dam is classified as a "significant hazard potential structure," meaning its failure could result in loss of life and substantial property damage. Flood modeling indicates a dam breach or overtopping could inundate large areas of Newtonville, including:

- Newton North High School
- Over 450 homes
- Sections of Mass Pike
- Cabot Park
- Nearby commercial districts

Following inspections in May 2017 and June 2018, the ODS deemed the dam to be structurally deficient and in poor condition, identifying several safety concerns, including:

- Inadequate height above the recorded high-water mark of the dam during the Spillway Design Flood and the potential for embankment overtopping
- Unwanted vegetation and large trees on the downstream slope of the dam which weaken the structure and is in violation of state rules
- Scarping and exposed, erosion-prone soils along the upstream and downstream slopes
- Deterioration and potential instability of the dam at the downstream end of the low-level outlet, with concerns that continued erosion could compromise the integrity of the downstream slope
- Missing mortar in some joints of the spillway

As a result, the State issued a Dam Safety Order in July 2018 requiring rehabilitation to bring the dam into compliance with safety regulations. "Significant Hazard Potential" means that failure could cause property damage and potential risk to public safety downstream. The City is acting to comply with state law and to protect residents and property.

2. Where is Bullough's Pond Dam and what kind of dam is it?

Bullough's Pond Dam is located at the north end of Bullough's Pond at Dexter Road, which is near Commonwealth Avenue and Walnut Street. It's an earthen embankment dam with a

concrete spillway structure. Earthen embankment dams use compacted soil as the structural water retaining barrier to hold back water and are vulnerable to issues like seepage, erosion, and vegetation growth. The concrete spillway provides a way to pass water from the reservoir to the downstream side of the dam.

3. Why does the Office of Dam Safety require removal of trees from dams? Are they right? What do best practices say?

Trees on dams are not allowed by state law for quite a few reasons.

- Root System Damage
    - Tree roots can penetrate deeply into the embankment, creating pathways for seepage (water moving through the dam).
    - When roots decay after the tree dies or is removed, they leave voids and channels, which increase the risk of internal erosion and potential dam failure.
- Increased Risk of Instability
    - Large trees add weight and wind load to the embankment. During strong winds or storms, uprooting can pull out large sections of soil, compromising the dam's structural integrity, increasing the erosion of the slope and creating a public safety hazard.
    - Root growth can disturb the compacted soil layers, reducing the embankment's strength.
    - Uprooted trees increased risk of flooding with the potential to block spillway channel
- Inspection and Maintenance Challenges
    - Trees and dense vegetation obscure visual inspections by dam safety personnel, making it difficult to detect:
        - Seepage areas
        - Cracks in the slope indicating slope instability
        - Animal burrows
        - Surface erosion
        - Vegetation can interfere with surveying equipment and maintenance machinery.
- Increased Animal Activity

    - Tree roots create habitat for burrowing animals like muskrats and groundhogs, which further weaken the dam by creating internal tunnels.

- Regulatory Guidance
    - The FEMA Federal Guidelines for Dam Safety and USACE (U.S. Army Corps of Engineers) guidelines explicitly prohibit trees and woody vegetation on embankment dams for the reasons above. Link: for FEMA Dam Owner's Guide To Plant Impact on Earthen Dams Link for USACE ETL 1110-2-583 - Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures
    - State dam safety programs (including Massachusetts and each New England state, New York, Nebraska, Washington, Wisconsin, California, Oregon, etc.) require embankments to be covered only with mowed grass or low groundcover to ensure visibility and stability. Links: MA Office of Dam Safety Policy for Trees on Dams, New York Department of Environmental Conservation Information for Dam Owners, Nebraska – Problems with Trees on Dams, New Hampshire – Environmental Fact Sheet – Tree Growth on and Adjacent to Dams

4. If we have to make changes to the dam, what are our options?

The City commissioned GEI Consultants, professional engineers specializing in dam design and safety, and they developed 9 initial concepts, later narrowed to 3 feasible alternatives based on effectiveness, environmental impact, impact to residents, and cost. These experts are licensed Professional Engineers (PEs) with deep experience in dam rehabilitation and regulatory compliance.

- **Who developed the options?** A team of civil and geotechnical engineers from GEI , under guidance from the State's Office of Dam Safety requirements and in consultation with Newton's Public Works Department. The approved option will be submitted to the State's Office of Dam Safety for approval under a Chapter 253 Dam Safety Permit to repair the dam.

Alternatives Considered for Bullough's Pond Dam Rehabilitation:

- The following 9 alternatives were evaluated to address deficiencies at Bullough's Pond Dam. Each alternative was assessed for feasibility, ability to meet spillway safety requirements, and potential impacts.

Alternative	Feasible Option & Addresses Spillway Safety Requirements	Pros	Cons
No Action	No	No immediate cost.	Does not correct deficiencies; remains a public safety hazard; violates state regulations.
Dam Removal	Yes	Eliminates dam safety liability; restores natural stream flow.	Significant environmental and cultural impacts; loss of pond; loss of beloved landmark; loss of Dexter Rd or significant new bridge required to replace removed embankment; expensive sediment disposal; community opposition likely.
Dredge Reservoir Sediments	No	Increases volume of water in reservoir and may improve water quality.	Water remains at current weir crest elevation so does not provide increased volume storage during a flood event. Fails to address structural or hydraulic deficiencies; significant risk of overtopping/breach in a 100-year storm event remains; high cost and disposal challenges.
Modify Low-Level Outlet Operations – Mechanical Pumps or Manual Release of Reservoir	No	Low-cost operational adjustment.	Cannot correct spillway capacity or seepage issues; Office of Dam Safety does not allow this solution; minimal impact on overall safety.
Add Auxiliary Spillway	No	Provides additional discharge path during floods.	Site constraints, property takings, high cost, and environmental permitting challenges make this impractical.
Modify Primary Spillway – Piano or Labyrinth Weir	Yes	Improves hydraulic capacity to meet safety standards.	Not effective passing the volume of water in the design flood where opening in Dexter Street will

			become a restriction. Construction complexity; site constraints, high cost, requires temporary road closure and traffic disruption.
Install Sheet Pile Wall	Yes	Enhances seepage control and dam stability. Allows a portion of the downstream slope to erode but stops full breach of dam in an overtopping event.	Does not increase hydraulic capacity of spillway – allows overtopping; Slope downstream of the sheet pile wall erodes in overtopping of dam; Uncertainty in developing connection between sheet pile and bedrock; High construction cost; utility relocation, requires temporary road closure and traffic disruption, potential vibration impacts to surrounding area;
Modify Core Wall	Yes	Adds internal structural component for added stability; long-term seepage protection. Allows a portion of the downstream slope to erode but stops full breach of dam in an overtopping event.	Does not increase hydraulic capacity of spillway – allows overtopping; Slope downstream of the core wall erodes in overtopping of dam; Existing core wall is a seepage barrier, not a structural wall; Risk that core wall cannot serve as structural wall due to condition would result in significant construction cost increase. Requires excavation along full alignment of the dam; utility relocation, requires temporary road closure and traffic disruption, potential vibration impacts to surrounding area costly and time intensive. downstream slope erodes in overtopping of dam

Downstream Erosion Protection	Yes	Prevents slope erosion during high flows. Maintains downstream slope during an overtopping event. Provides a backup seepage control system to the dam in the event the core wall degrades over time.	Does not increase hydraulic capacity of spillway – allows overtopping; additional cost to integrate with other measures.

5. What are the final 3 options presented to the City Council's Public Facilities Committee and what are the pros and cons of each?

Final 3 Dam Improvement Alternatives

Alternative	Feasible	Benefits	Drawbacks	Trees Impacted	Estimated Cost
Install Sheet Pile Wall	Yes	Enhances seepage control and dam stability.	Does not increase hydraulic capacity of spillway (allows overtopping) Bedrock is not deep so for wall stability the sheet pile needs to key into bedrock which may not be possible. Downstream slope of dam erodes during overtopping and sends material downstream in an overtopping event. Significant reconstruction will be required after overtopping event. Utility relocation, temporary road closure,	172	$3.7 million

Alternative	Feasible	Benefits	Drawbacks	Trees Impacted	Estimated Cost
			traffic disruption, vibration impacts, higher cost,		
Modify Core Wall	Yes	Adds internal structural component (creates a structural wall vs core wall) increases stability of the upstream component of the dam long-term and provides additional seepage protection	Does not increase hydraulic capacity of spillway (allows overtopping) Requires excavation through dam; utility relocation, temporary road closure, traffic disruption, vibration impacts; risk existing wall is inadequate; potential cost escalation. Downstream slope of dam erodes during overtopping and sends material downstream in an overtopping event. Significant reconstruction will be required after overtopping event.	172	$4.3M (up to $12.3M if new wall needed)
Downstream Erosion Protection	Yes	Prevents downstream slope erosion; resists erosion; protects safety; minimal construction impact; likely ODS approval. Minimal reconstruction after overtopping event.	Does not increase hydraulic capacity of spillway (allows overtopping)	199	$2.6 million

6. What is a "core wall" in a dam, and how is it different from a building core wall? Do we need to further inspect the core wall?

A core wall in a dam is a low-permeability barrier inside the dam that restricts water from seeping through. It's usually made of clay, concrete, or asphaltic concrete. It is not a structural element of the dam.

A core wall is entirely different from a building core wall. A core wall in a building provides structural stability and contains utilities and thus is completely different in function and design than a dam's core wall.

The dam safety team has inspected the dam for seepage (which would be evidence of the core wall failing). No seepage was observed, so the core wall is operating as designed.

There is a potential risk associated with modifying the core wall by adding height to make it a structural component of the dam. The existing core wall serves as a seepage barrier and may not be designed to support additional structural loads. If it cannot bear the added weight, replacing the core wall will be necessary. This would involve fully opening Dexter Road and excavating to bedrock at the base of the dam—a process that would be very disruptive to the neighborhood, time-consuming, and costly.

7. Is a piano key or labyrinth key a viable solution?

A piano key or labyrinth weir are effective at passing more flow over a spillway at relatively low water level (height of water over the spillway). They provide a longer weir length which is able to pass more water at low water levels than a straight-line weir, however once the level of water over the labyrinth exceeds several feet, the flow is then governed by the straight-line distance across the spillway. We considered modifying the primary spillway as Alternative 6 in the Alternatives Report. Improving the primary spillway was not considered feasible for several reasons:

- Dexter Street Bridge – During high flow events the Dexter St bridge acts as a bottleneck limiting how quickly water can pass through the dam. Because of this bottleneck, the water levels upstream of the dam will still rise during floods, regardless of changes to the weir since the bridge is causing a "traffic jam" of water. Increasing the weir length or using a labyrinth weir will not increase discharges during high water stages, which are estimated from the design flood. In order to increase discharge and lower pond elevations during flood events the bottleneck needs to be removed by increasing the size of the Dexter St bridge.

- Walnut Street Culvert – If we were to widen the Dexter Street Bridge, the culvert at Walnut Street would become the hydraulic constraint, ponding water between Walnut Street and Dexter Road. As a result, Walnut Street could become a dam structure, for which it was not designed. Failure of the Walnut Street embankment due to overtopping or embankment failure because of the increased flow would not be acceptable. Therefore, the size of the Walnut Street Culvert would also need to be increased to be able to handle the increased discharge.
- Costs –Increasing the primary spillway discharge would likely have significant costs and likely require:
    - Widening the Dexter Road Bridge.
    - Rock excavation under the Dexter Road Bridge.
    - Constructing a significant concrete structure into the pond to provide a longer weir length to pass water at peak inflows.
    - Increasing the size of the Walnut Street Culvert.
    - Changes the aesthetic of Bullough's Pond

8. Why is Overtopping and Breaching a Concern?

Overtopping occurs when water flows over the crest of the dam rather than through the designed spillway. For earthen embankment dams, this is the leading cause of failure. When water overtops the dam, it quickly erodes the embankment material, which can result in a complete structural breach. Once the dam is breached, not only is the overtopping water being sent downstream, but all the water in the reservoir is also released at the same time. Such a failure could release a sudden, uncontrolled flood downstream, endangering lives, property, and critical infrastructure.

9. If flooding occurs downstream in a 100-year storm anyway, why fix the dam?

Even if downstream flooding occurs, an intact dam still reduces peak flows and slows the flooding. A breach of the dam would make flooding far worse, with a sudden surge of water (all of the water stored in the reservoir) that could damage homes, infrastructure, and pose safety risks.

10. Can we lessen the flooding impact in Newtonville?

In parallel with the dam repairs, Newton is taking comprehensive steps to reduce flooding and improve water quality in Newtonville and across the City through its Stormwater Infrastructure Improvement Plan, which includes:

- Upgrading stormwater infrastructure
- Cleaning and maintaining catch basins, culverts, and streams

- Identifying and eliminating illegal stormwater connections
- Reviewing and updating floodplain and stormwater regulations
- Enhancing phosphorus control to protect local waterways
- Adding Green infrastructure (rain gardens, permeable surfaces).

These efforts are critical to building Newton's long-term resilience to climate change and protecting public health and safety.

These measures, however, complement not replace dam safety improvements.

11. If we remove trees, will the City be obligated to plant new trees or pay into a fund? Where might they be planted?

Newton's Tree Preservation Ordinance applies to the City's removal of trees on the dam. The city would need to:

- Replant equivalent caliper inches of trees or
- Contribute to the City's tree replacement fund.

As part of the proposed dam repair, the City will replace the trees removed from the dam and improve Bullough's Pond park area. The Bullough's Pond Dam project will fund a substantial program of tree plantings and pond improvements that include:

- 25-35 new trees around the pond
- 250-300 new street trees in the surrounding neighborhood.

Additional details on tree replacement and improvements will be included in the presentation on September 2, 2025.

12. While we are fixing the dam, can we improve the surrounding area for passive recreation?

Yes, we plan to add and/or improve:

- Benches, walking paths, interpretive signage
- Habitat restoration

We will coordinate with Parks & Recreation & Culture Department and the Conservation Commission.

13. What is the Bullough's Pond Association?

The Bullough's Pond Association (BPA) is a local nonprofit advocating for:

- Preservation of Bullough's Pond as a community and ecological resource
- Maintenance of water quality
- Aesthetic and historical value
  See Bullough's Pond Association for details.

14. Areas of Newtonville around the dam flooded three times in the 1990s. Does the pond need dredging to prevent flooding? What has been done since 1993?

Flooding in the 1990s highlighted sedimentation issues and blocked storm grates. Improvements since 1993 include:

- Dredging Bullough's Pond Dam and City Hall Ponds
- Storm drain upgrades
- Storm grates monitored and cleared during high intensity storms
- Additional routine maintenance

While not intuitively easily understood, dredging does not prevent the overtopping of the dam in high intensity rainstorms as the water level is always at the very top of the reservoir. In addition, the City recently dredged the City Hall Ponds and installed a forebay barrier to minimize sediment passing into the City Hall Ponds and Bullough's Pond. This forebay will be monitored and cleaned as needed. We will continue to monitor Bullough's Pond to determine when and if we need to dredge it.

15. Ahead of a major storm, can we lower the amount of water in the pond to reduce potential flooding? Could pumps or manual/mechanical systems be utilized at Bullough's Pond, perhaps in place of repairing the dam?

Due to the flow characteristics, the pond would need to be significantly drawn down in advance of any storm, to the point that it would be nearly emptied, making this not a very practical solution. Also, in discussions with the State's Office of Dam Safety, they have indicated that they would not likely approve a solution that would require manual operation to meet the dam safety requirement. The problem with a mechanical system solution is that it relies on electricity and equipment parts that can fail. In addition, manual intervention is prone to operational failure as it relies on a properly operating system that requires human intervention.