



Subject: Public Safety Notice Regarding Overtopping of Dams

Dear Dam Owner:

The Department of Conservation and Recreation (DCR) Office of Dam Safety (ODS) is contacting you to share information pertaining to the impact of overtopping on the stability of dams. Overtopping is a serious dam safety concern as this can lead to dam failure, which can cause damage to downstream interests, including, but not limited to, loss of life and damage to homes, industrial or commercial facilities, and public infrastructure.

Overtopping should be considered an emergency situation. Overtopping for even a short period of time can cause damage to a dam embankment and possible failure of the dam. If overtopping occurs, appropriate emergency actions should be taken in accordance with developed Emergency Action Plans and guidance from your chosen engineering consultant, and in coordination with emergency management personnel.

The Association of State Dam Safety Officials (ASDSO) has compiled many resources regarding various topics pertaining to dam safety. One such resource titled "Dam Ownership Fact Sheet" which can be viewed in entirety at the following link: <https://www.damsafety.org/dam-owners>, describes that "overtopping failures result from the erosive action of water on the embankment. Erosion is due to uncontrolled flow of water over, around, and adjacent to the dam. Earth embankments are not designed to be overtopped and therefore are particularly susceptible to erosion. Once erosion has begun during overtopping, it is almost impossible to stop." The ASDSO has also created a helpful video to explain this phenomenon, which is available for viewing at the following link: <https://www.youtube.com/watch?v=VRGtKcV3sU&list=PLt9aDt7bNpdyASEPeH7juGk--ZJ6oCUDu&index=7>. ASDSO captioned this video with the following statements: "Overtopping of a dam is often a precursor of dam failure. National statistics show that overtopping due to inadequate spillway design, debris blockage of spillways, or settlement of the dam crest account for approximately 34% of all U.S. dam failures."

There are multiple factors that can lead to overtopping. Common factors include reduced discharge capacity due to debris or vegetation blockages in spillways; structural damage to spillways and any outlet works; and/or rainfall events that exceed and overwhelm the capacity of a spillway and any outlet works. Scenarios such as these can create higher than normal pool levels. The combination of these factors can dramatically reduce the discharge and storage capacity of a dam which increases the likelihood that the dam will be overtopped during a severe storm event. Other factors that can lead to overtopping include, but are not limited to, presence of low spots or ruts on the crest, crest settlement, formation of "ice dams", high winds causing wave run up, and seismic activity.

Appropriate actions should be taken to prevent overtopping from occurring. The Federal Emergency Management Agency (FEMA) has drafted several technical publications, including a publication numbered FEMA 145, titled "Dam Safety: An Owner's Guidance Manual" and a publication titled "Emergency Operations Planning: Dam Incident Planning Guide" both of which can be viewed online at the following link: <https://www.damsafety.org/resourcecenter/national-dam-safety-program-guidelines-flyers-and-other-tools>.



These resources indicate that some actions that may be taken in preparation of significant rainfall to prevent overtopping or in response to an overtopping event may include, but not be limited to, the following:

- Removing debris or other obstructions from spillways and other outlet works as well as from downstream channels, culverts, and anywhere else where flows may be obstructed;
- Conducting controlled releases of water through the spillway(s), where applicable and appropriate, including opening of any outlet works to a safe capacity, ensuring controlled releases will not cause damages downstream;
- Placing sandbags along the crest to increase freeboard to attempt to move more water through the spillway and outlet works;
- Providing erosion-resistant protection to the downstream slope by placing plastic sheets or other materials over eroding areas;
- Diverting flood waters around the reservoir basin, if possible, which can sometimes require coordination with other dam owners/operators in the watershed;
- Creating additional spillway capacity by making a controlled breach in a low embankment or dike section where the foundation materials are erosion resistant;
- Evacuation of downstream populations at risk.

Decisions to employ any of the above-described response actions must be made in coordination with your chosen engineering consultant and emergency response personnel, and in accordance with applicable local, state, and/or federal regulations.

According to another FEMA publication numbered FEMA P-1015, titled "Technical Manual: Overtopping Protection for Dams", thousands of dams throughout North America have been determined to have inadequate spillway capacity and have the potential to experience overtopping. To address this situation, new design approaches have been developed that may allow for a dam to be safely overtopped through the employment of overtopping protection. A dam owner deciding to pursue overtopping protection for an existing dam must give strong consideration to the potential risk of failure of the protection system, which could quickly lead to a full breach of the dam. This is especially true for embankment dams as a small defect or design flaw could lead to catastrophic failure once the embankment is exposed to the overtopping flow. Overtopping protection should generally be reserved for situations with some combination of very low annual probability of occurrence, physical or environmental constraints on constructing other methods of flood conveyance, and prohibitive cost of other alternatives, or where downstream consequences of dam failure are demonstrated to be low. A careful analysis of all potential failure modes for a dam and appurtenant features must be performed for both the existing conditions and for the proposed modified conditions.

As a dam owner, you are responsible for maintaining and operating your dam in a manner that is protective of public safety. Per 302 CMR 10.13 (1), you are reminded that a dam "owner shall be responsible and liable for damage to property of others or injury to persons, including but not limited to, loss of life resulting from the operation, failure of or mis-operation of a dam." You are therefore responsible for any adverse consequences that may occur downstream of your dam as a result of damage that occurs to your dam during an extreme rainfall event. It is recommended that you maintain the operability of your spillway and outlet works and always ensure they are free and clear of debris and obstructions to flow, especially during periods of significant rainfall and runoff events.

You are reminded that it is the obligation of the dam owner to contact and notify all applicable local, state, and federal permitting agencies prior to conducting any work at a dam including manipulation of water levels.

If you have any questions, please contact Office of Dam Safety at dam.safety@mass.gov or 617-620-8583. Thank you for your attention to this important public safety concern and for your anticipated cooperation.

Sincerely,

A handwritten signature in black ink, appearing to read "William C. Salomaa". The signature is fluid and cursive, with the first name "William" and last name "Salomaa" clearly distinguishable.

William C. Salomaa, Director
Office of Dam Safety