



Dam Safety Maintenance Program

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Agenda

- Dam owner responsibilities
- Inspections
- Maintenance plans
- Maintenance recommendations and photos

Dam owner responsibilities

Dam owner responsibilities

- Owner shall be responsible for operating and maintaining the dam and spillways in a safe manner regardless if the TCEQ Dam Safety Program makes an inspection.
- Owner shall be responsible for addressing all maintenance and safety concerns identified during any inspection.
- Owner shall ensure that necessary maintenance, repairs, alterations are initiated and completed in a timely manner following any inspection.
- “It was the overall system for financing, designing, constructing, operating, evaluating, and upgrading the four dams in the series, involving many parties during the nearly 100 years of project history, which fell short in ensuring a safe dam at the Edenville site. Collectively, they were operating within a system that had conflicting interests and goals, resulting in the system having non-cooperative relationships.” *Final Report, Investigation of Failures of Edenville and Sanford Dams*

Dam inspections

Inspections

- Owner shall inspect the dam and spillways on a regular basis, following significant rainfall events, and during emergency events.
- Owner shall notify TCEQ Dam Safety in writing within 5 working days after becoming aware of any problems or damage that pose a significant threat to the dam.
- Owner shall submit a copy of all engineering inspection reports prepared by the owner's professional engineer to TCEQ Dam Safety for review.

Inspections

- Dam inspection frequency
 - Owner detailed inspections at least once a year, more often if possible.
 - TCEQ inspections at least every 5 years for high and significant hazard dams
 - Owner can have engineering inspections more frequently

Maintenance plans

Maintenance plans

- The owners of **all** dams shall develop and implement an operation and maintenance plan, even if TCEQ Dam Safety has not recently performed an inspection. The plan should include:
 - The schedules for engineering and maintenance inspections
 - Any restrictions imposed by the engineer's design.
 - A list of maintenance items and a schedule for addressing each item

Maintenance photos and recommendations

Maintenance photos

- The following are photos of maintenance items that need to be addressed.
- Some items may require a consulting engineer to develop plans for repair.
- Names of the dams shown in the photos will not be given.



Recommendations

- Desiccation cracks:
 - are usually associated with drying due to lack of rain
 - can result in saturation of the dam when rains occur, which could result in slides
- Structural cracking:
 - is usually associated with movement of the dam
 - could indicate a problem with the dam that needs the attention of an engineer

Recommendations

- Desiccation cracks
 - Cover cracks with topsoil and re-vegetate area
- Structural cracking (for ex., Longitudinal and Transverse)
 - If significant cracking, an engineer may need to be retained to determine the cause of the cracking and to make recommendations for correction









Recommendations

- All small trees (less than 4 inches in diameter), brush, vines, briars, and bamboo should be cut and removed from the dam at least yearly (fall or winter)
- Mow the grass on the dam, if possible, at least two times a year.

Recommendations

- Remove all trees and brush from earth-cut spillways
- Remove vegetation from around inlets.
- Remove trees and brush from around concrete structures and pipes.
- Care should be taken to avoid damage to the concrete during removal.





Recommendations

- Drain any standing water from the crest of the dam
- Regrade and re-compact fill
- Slope crest to upstream slope
- Periodically regrade
- Keep traffic off the dam when wet









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Recommendations

- Burrowing animals can endanger the structural integrity of the dam
- The burrows and tunnels weaken the embankment and serve as pathways for seepage
- Hogs destroy the protective vegetative cover
- Livestock trails can promote severe erosion
- Livestock can overgraze the vegetative cover

Recommendations

- Take measures to eliminate the burrowing animals; i.e., beavers, nutria, badgers, weasels, or gophers and feral hogs
- Cattle should be set on a rotation to allow the grass to grow

Recommendations

- For burrows/dens, excavate, backfill, compact, and seed. Also, you can fill hole with grout, cover with soil, and seed or re-vegetate
- For livestock trails, fill with soil and compact and then re-vegetate
- For hog damage, re-vegetate the damaged area after repairs



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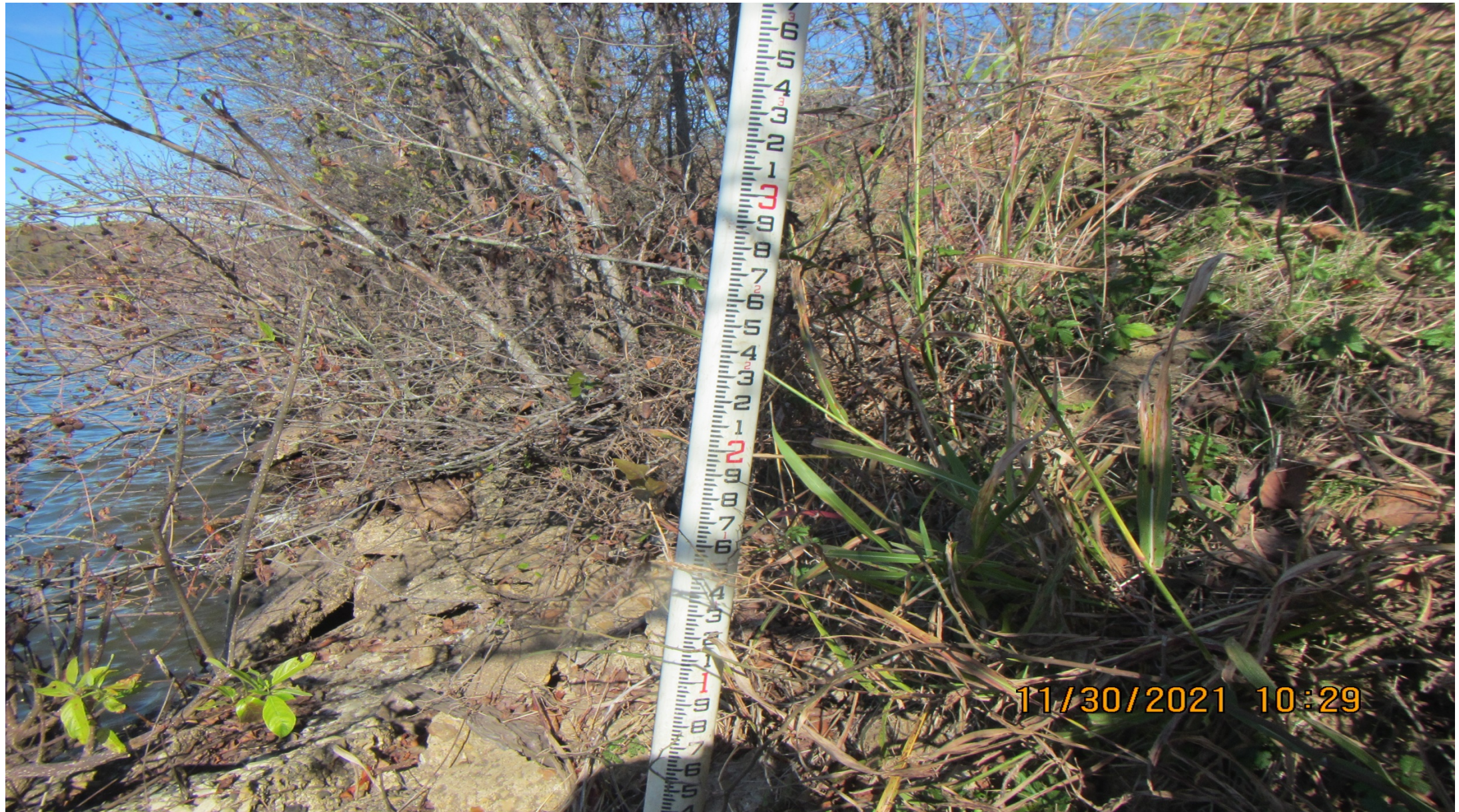


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Recommendations

- The cause of the erosion will have a direct bearing on the type of repairs (evaluate - may be more cost effective to truly fix the cause rather than periodically repair/band-aid the symptom).
- Repair erosion channels or gullies as soon as possible (and determine cause if unknown or if new occurrence).
- Use good compacted fill and protect from a reoccurrence – for ex., cover with rock riprap or a high-performance turf reinforcement mat.
- Establish a good grass cover in repaired areas.
- Erosion around inlets and along conduits will require an engineer to determine the problem and recommend a correction.

Recommendations

- Reestablish slope protection including bedding material. An engineer may be required to design the slope material.
- Extensive damage may require flattening the slope before replacement of the slope protection.



Recommendations

- Large truck traffic should not be allowed on the dam unless the dam was designed for truck traffic.
- The only traffic that should be allowed on the dam is for maintenance purposes.



Recommendations

- Check for leaning utility poles, guard rails, sprinkler heads, and slumps on slope
- If a slide is located, an engineer needs to be retained



Recommendations

- Engineer should evaluate cause of slide and recommend correction
- May require lowering the lake level
- May require slide area to be stabilized with lime
- Over-excavation of slide area and proper benching of existing embankment critical for proper bonding of new fill











Recommendations

- Monitor seepage regularly to determine if flow is increasing or if soil material is being carried in the flow.
- If quantity of flow is increasing or the flow becomes muddy, an engineer should be retained to evaluate the condition and make recommendations for further action
- May require lowering the lake level

Recommendations

- Monitor any flow from under a concrete spillway and any flow from any drainage system
- If flow increases or there is soil material in the flow, contact your engineer for recommendations on corrective action; do not confuse IRON OCHRE with suspended soil material
- If flow increases rapidly or the amount of soil increases, the reservoir may need to be lowered under the direction of your engineer (& may require notification under your emergency action plan)



Recommendations

- If a boil develops along the downstream toe, an engineer needs to be retained as soon as possible
- Repairs may include a dike of sandbags or earth around the boil to control the water flow
- May require lowering the lake level



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Recommendations

- Clear vegetation around toe drain and well outlets
- Measure and monitor flow from outlets
- Keep outlet clear of algae, especially those with flap gates
- Have engineer evaluate data from drains and wells





Recommendations

- Undermining or undercutting of concrete or outlet structures can cause collapse of the structure and will require an engineer to determine the most appropriate method of repair
- May require construction of a cutoff wall, properly placed compacted fill, and some type of erosion protection such as rock riprap
- An undermined structure may have to be replaced under supervision of an engineer.







Recommendations

- For spalling or disintegration, will require an engineer to make recommendations for correction, especially if reinforcing steel is visible
- Small spalls can be monitored, without repair, to determine if movement is occurring and what is causing the spalls



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Recommendations

- Remove beaver dams from entrances to spillways
- Remove debris from inlets and trash guards
- Remove fences from spillway channels. If one is required due to stocking with grass carp, the fence needs to be a distance away from the spillway crest to allow unobstructed flow

Recommendations

- Remove all obstacles from spillway channels
- Don't allow construction in the spillway channel



Recommendations

- If you decide to replace a gate or valve under water, the work should be done only by an expert in the field and done with consideration of all safety measures
- If the lake is lowered for some reason, maintenance of the gate or valve should be performed at that time, including painting

Recommendations

- Low flow outlets, siphon systems, control gates, flashboards, and other outlet control works must be operated at least annually.
- If the systems are deteriorated and have not been operated in many years, they should not be operated until they are inspected by a qualified professional engineer.







Recommendations

- Pipe deterioration is very often associated with corrugated metal pipe (CMP)
- Deterioration usually requires replacement of the pipe, especially if there are voids beneath the pipe, or slip-lining the pipe with a smaller pipe and grouting between the pipes
- If the pipe is replaced, do not replace with another CMP, as CMPs should not be used in dams
- This will require an engineer and should be undertaken as soon as possible to avoid erosion of the dam









Recommendations

- Areas to inspect on spillway gates
 - Main framing members
 - Lifting & supporting assemblies
 - Lifting connections, chains, cables
 - Fractures, cracks, welds
 - Normal waterline, abrasion areas, crevices
 - Trunnions
 - Seal plates
 - Lubrication

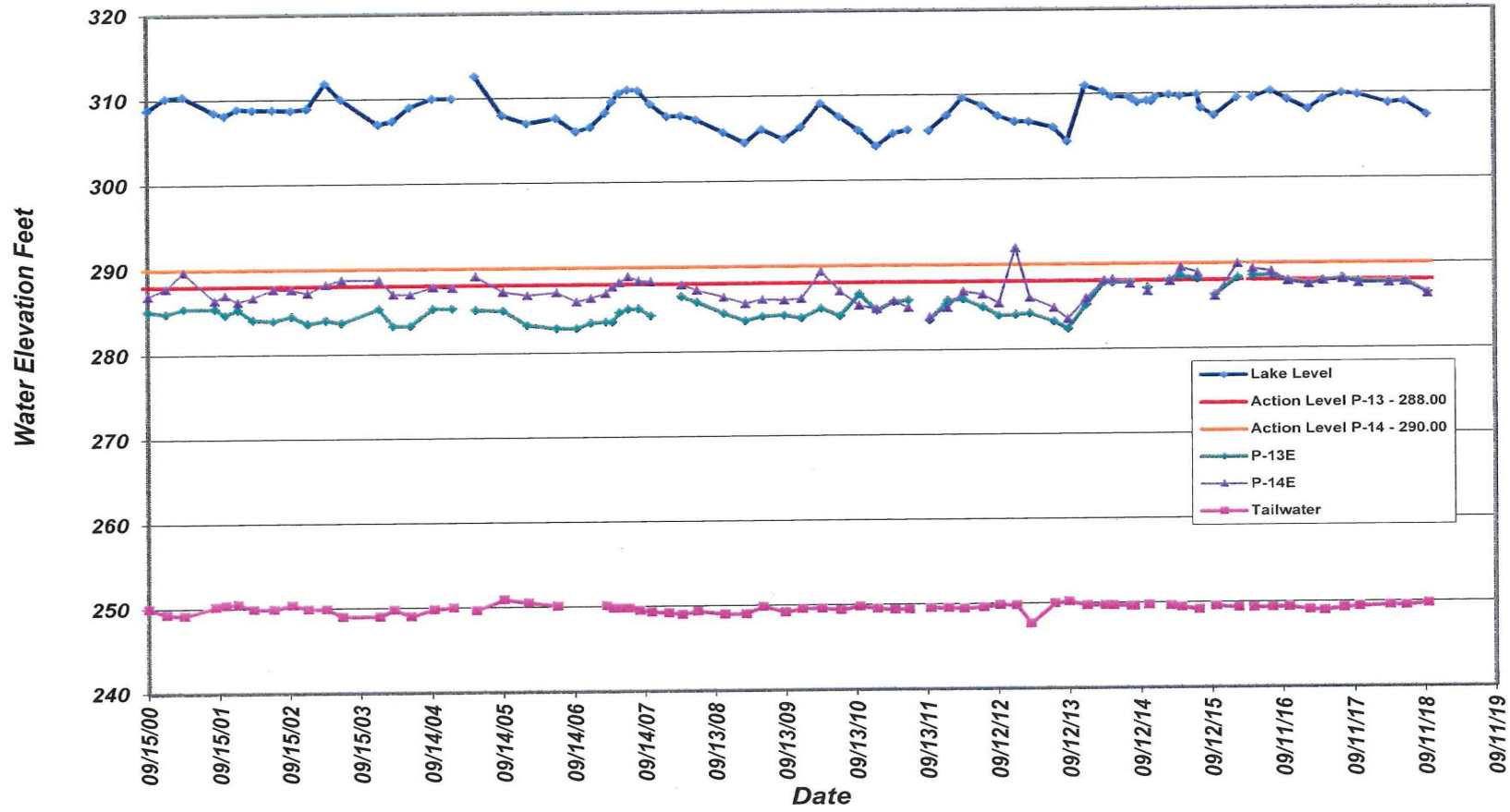
Recommendations

- Operation
 - Operate gates through full cycle at least once a year, preferably under full load, coordinating releases with Emergency Management Coordinators
 - Check noise levels when opening gates
 - Check all mechanical parts for wear
 - Checks all bolts for tightness
 - Check side seals









Instrumentation

- Collect data on schedule provided by your engineer
- Protect instrumentation from damage during maintenance activities
- Have engineer evaluate instrumentation data (especially if unusual reading or new trend); frequency depends on condition

Summary

- The dams in Texas are getting older, which could mean that more issues could be developing over time.
- There have been a number of large rainfall events over the last few years, putting stress on the dams and spillways.
- It is essential that owners have an updated operation and maintenance plan and emergency action plan.
- The owners should be performing maintenance on a regular basis, even if TCEQ Dam Safety has not performed a recent inspection.

Contact Information

- TCEQ Dam Safety Website:
https://www.tceq.texas.gov/compliance/investigation/dam_safetyprog.html
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Questions??