# Operation & Maintenance of Dams & Spillways

Presented By: Johnny Cosgrove, PE

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## Dam Owner per §299.2

- Holds legal possession or ownership;
- Is the fee simple owner;
- Is the sponsoring local organization of NRCS assisted project dams; or
- Has a lease or easement



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# 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.
- "Owners, not the state, are responsible for the safety of the dam including making any additional dam safety evaluations and repairs." *Spencer Dam Failure Investigation Report*



# 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.

# Inspection Frequency

- Owner should conduct detailed inspections at least once a year, more often if possible
- TCEQ aims to conduct inspections at least every 5 years for high and significant hazard dams
- Owner can have engineering inspections more frequently



# Inspection Frequency

For significant rainfall events:

- Pre-storm (per weather forecasts) – inspect dam and spillways prior to expected rainfall:
  - ensure no hydraulic issues, including anything that could reduce conveyance such as debris, beaver dens, clogged fish fence, etc., from BOTH inlets and outlets
  - ensure no structural issues, including any slides (especially high on dam near crest) or anything that would justify pre-emptively lowering the reservoir level

# Inspection Frequency

For significant rainfall events:

- Post-storm – inspect dam and spillways for issues/damage:
  - Erosion damage, including any advancement of prior head-cutting erosion in spillway discharge channels
  - Changes in seepage locations, condition/flowrate, sediment, etc.
  - Presence of (or pre-cursors to) embankment slides, especially after long dry-spells



# Operation & Maintenance Plans

The owners of **all** dams shall develop and implement a written 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

# Operation & Maintenance Plans

A good maintenance program:

- Will protect against deterioration and will prolong life
- Will protect the owner, as well as the public
- Will have a small cost compared to costs of major repairs, loss of life and property, and litigation



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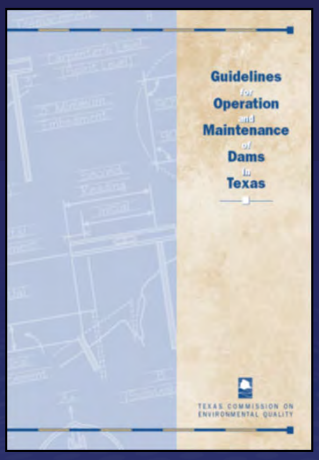
# Operation & Maintenance Plans

Reference Material (Rules/Regulations & Manuals) can be downloaded from TCEQ Dam Safety's website:

https://www.tceq.texas.gov/compliance/investigation/damsafetyprog.html



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# Operation & Maintenance Plans

Owner Responsibilities - Should Have a File / Binder with:

- Inspection reports & related correspondence
- Record of flooding events: dates, max. pool elevation, whether emergency spillway engaged (& to what depth)
- Site plans, geotechnical reports, & all current analyses/studies conducted for the dam
- Instrumentation readings over the years (if applicable)
- Records of any modifications to the dam
- Records should be transferred to new owner when property sold



# Aging of Dams

- In Texas, over 91% of the Inventory size dams are 25 years old or older.
- Almost half are 50 years old or older.

# Aging of Dams

Aging can contribute to incidents or failures through:

- Piping/seepage
- Concrete deterioration
- Settlement
- Gate deterioration
- Geotextile deterioration



# Dam Failures

Failures occur from the following:

- 34% from overtopping
- 30% from foundation defects and slope instability
- 20% from piping or seepage

# Dam Failures

Dam Failures from 1975 – 2001:

- Nearly 70% due to overtopping
- 15% from seepage or piping



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# Dam Failures Resulting in Fatalities

- 86% of the fatalities resulted from dams between 20 and 49 feet in height.
- 47% of the fatalities resulted from dams with drainage area less than 2 sq. mi.
- 75% of the fatalities resulted from dams with drainage area less than 10 sq. mi. (this would include 90% of Texas watershed dams and 80% of all dams)
- 7 dams had less than 300 ac-ft of water released during the failure.



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# Liability

Who is responsible for safety and liability?

- Owners of dams
- Those entities responsible for O&M at the dams



# Basic Legal Premise

- Lawsuits will claim extensive liability on the part of everyone involved in the dam failure incident.
- We live in a litigious society – there will likely be an attempt to sue any/all of the following:
  - Owners
  - Operators
  - Engineers
  - Designers
  - Contractors
  - Inspectors
  - Employees
  - Regulators

# Basic Legal Premise

- Overriding purpose of modern tort law is to compensate innocent victims for injuries caused by wrongdoers.
- Perception can mean more than facts.



# Will TCEQ Enforce?

- TCEQ will not require the dam owner to breach the dam or drain the lake simply because they do not meet all of the requirements.
- TCEQ will execute our enforcement powers if the dam presents an **unacceptable threat to public safety** and dam owner is making no attempt to alleviate the threat - Failure to Act.

# Avoiding TCEQ Enforcement

- Best way to avoid enforcement is being proactive & not reactive
- Proactive means **routine O&M** so owners don't find themselves 'too far gone' & unable to afford 'rescuing' their dam due to years of neglect



# O&M Duties Neglected

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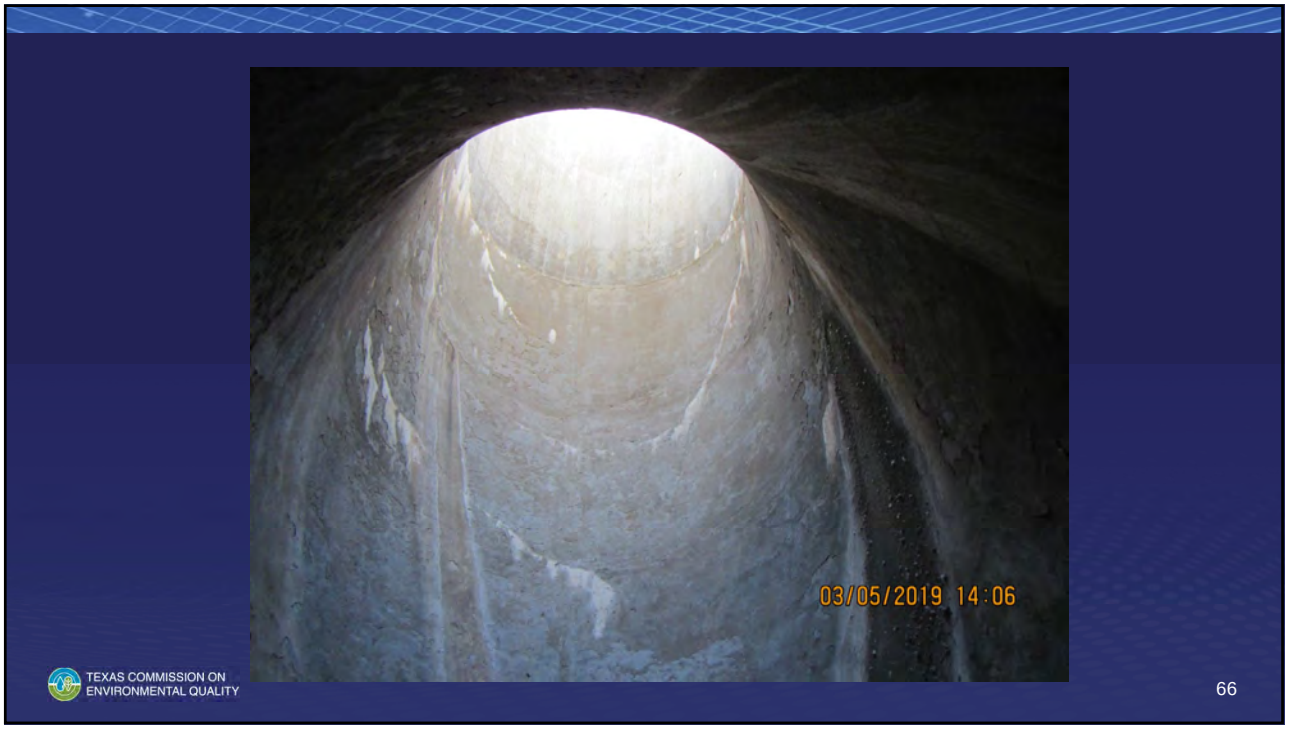
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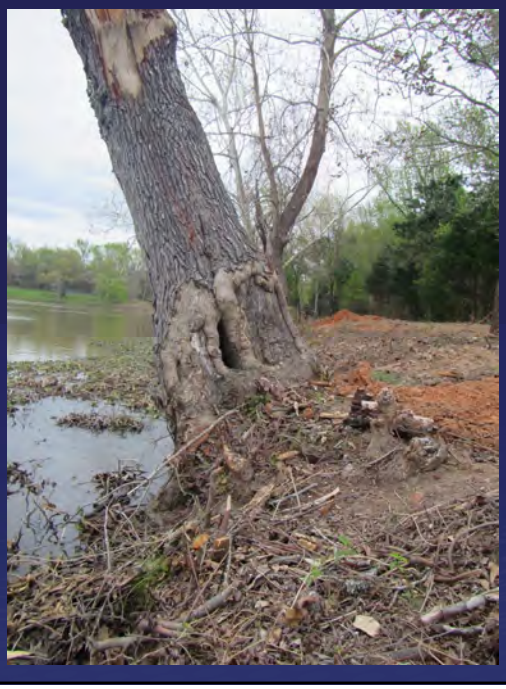

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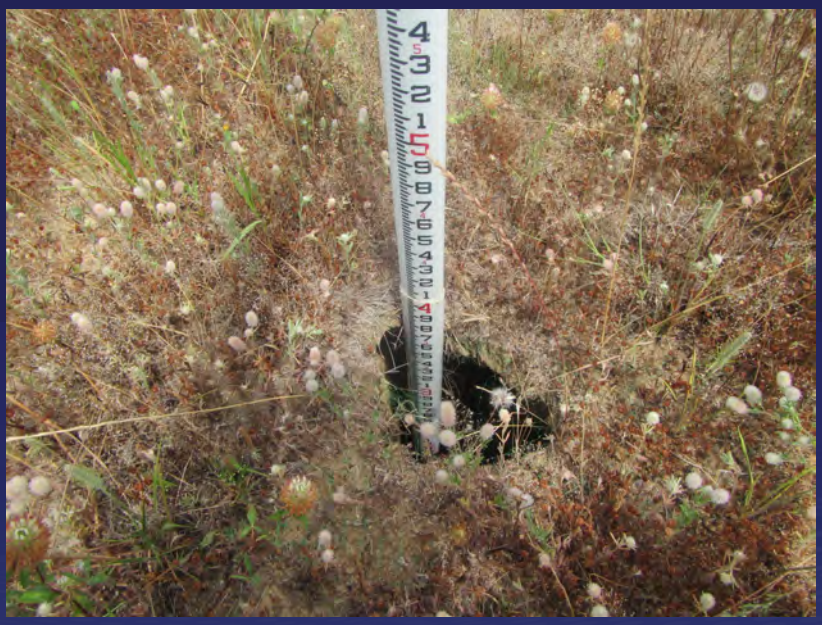

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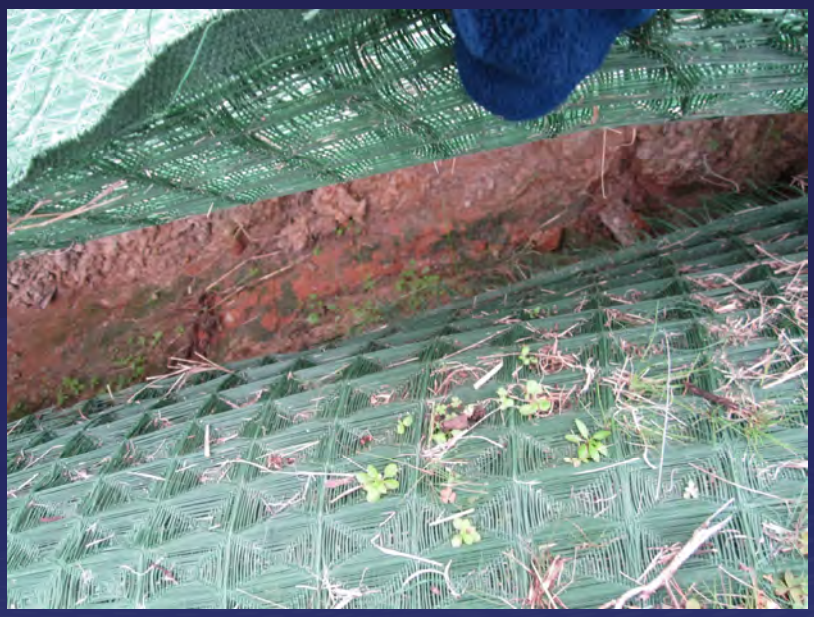

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# Owner Responsibilities

## When do I need an Engineer?

- All dams deteriorate with time
- In spite of periodic inspections and proper maintenance, occasional repairs and rehabilitation become necessary that go beyond normal O&M
- Downstream development may result in hazard classification change and need to upgrade the dam
- Engineer provides the expertise to perform this work



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# Professional Engineer Requirements per §299.4

- Prepare plans and specifications for any proposed improvements/modifications (**beyond O&M duties**)
- Prepare evaluations, analyses, or reports
- Conduct engineering inspections
- Observe the progress and quality of construction



# Professional Engineer Requirements per §299.21

Requirement to submit construction or modification plans for review also/further applies if:

- Water right permit required;
- Edwards Aquifer protection plan required;
- Modification of a NRCS assisted project dam without NRCS assistance; or
- Small, high or significant hazard dam exempt from water rights permit.

# Professional Engineer Requirements per §299.16

Professional Engineer report required when there is a proposal to:

- Dredge the reservoir within 200 feet of the dam;
- Install a utility line or pipeline in the dam;
- Construct a road across the dam or spillways or within 200 feet of the dam;
- Drill oil or gas wells or oil or gas exploration within 500 feet of the dam; or
- Blast within ½ mile of the dam.



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# Owner Responsibilities

## How to go about retaining an Engineer?

- Request options, if possible, for addressing the problem(s):
  - More than one way to 'skin-a-cat'
  - Can things be done in phases?
  - What should be prioritized (when have multiple problems/issues)?
- For example:
  - Possibly better to make structural upgrades, and correct serious deficiencies from maintenance neglect over the years …
  - Instead of hiring an engineer to perform a hydrologic and hydraulic analysis, which could result in an expensive study and costly modifications, especially if the dam already passes more than 50% of the PMF



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# Owner Responsibilities

Emergency repairs (per §299.45):

- Undertaken under supervision of a P.E.
- May start without E.D. approval.
- Notify E.D. within 12 hours after emergency discovered and evaluated.
- P.E. prepared plans for permanent repairs after emergency. Must be approved.



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# Owner Responsibilities

Consider Dam Removal if Cannot Maintain

- New Dam Removal Guidelines (not yet published)
- 'Hydraulically Adequate Breach' will not ultimately remove from TCEQ Dam Safety oversight
- Remove the entire dam to its natural channel; or,
- Remove enough of the dam embankment so that it no longer provides detention – typically no more than 1-ft of differential (between depth of water upstream and downstream of dam) during normal conditions and passage of design storm



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# Owner Resources

https://damsafety.org/dam-owners

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# Dam Owner Resource

https://damsafety.org/dam-owners

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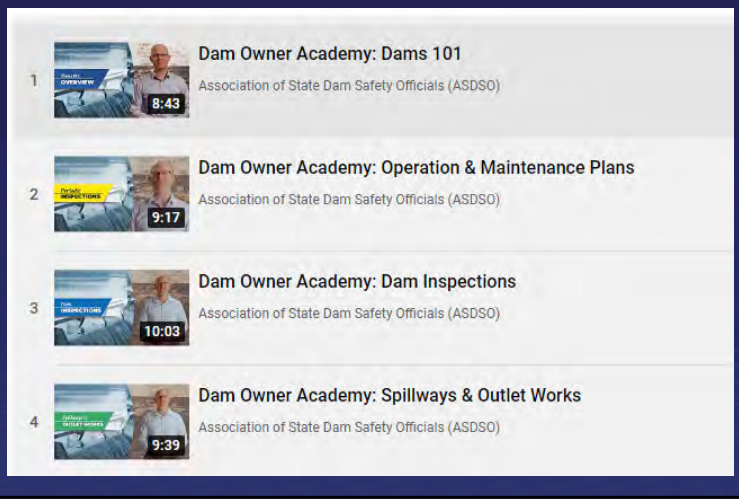
# Dam Owner Resource

https://damsafety.org/dam-owners

ASDSO Dam Owner Academy on YouTube

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# QUESTIONS?

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