

Vermont Dam Safety Workshop
Association of State Dam Safety Officials (ASDSO)
in partnership with the
Department of Environmental Conservation – Dam Safety Program



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Session 1: Introductions



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WELCOME

Dam Safety Workshop

- ASDSO retained by the Vermont Dam Safety Program
- Funded through a Dam Safety Program Grant from FEMA
- Interactive Workshop
- Workshop Manual for participants.
- Online download also available

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What is Vermont Dam Safety Program?

- Located in the Water Investment Division (WID) of the DEC
- Full time staff of two engineers, summer intern, and 200 hours+/- of a WID technician
- Mission different than most divisions within ANR/DEC. Primary focus is on Public Safety.
- Administer 10 V.S.A Chapter 43: Dams
 - Non-federal, non-power dams
- Act as Dam owners, regulators, and engineers

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What is Vermont Dam Safety Program? (Cont.)

- **Vermont Dam Inventory**
 - ~1,100 records (active and historic sites)
- **Registration Program**
 - Annual fee for Owners of Dams capable of impounding >500,000 cf
- **Inspection Program**
 - Visual inspections and reporting by Program Staff
- **Dam Orders (permits)**
 - Review applications, Public Good Process, develop Order conditions
- **Unsafe Dam Proceedings**
 - Quasi-judicial process to require Unsafe dams be repaired/removed to make them safe.

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What is Vermont Dam Safety Program? (Cont.)

- **DEC Owned Dams, 14 in total**
 - 3 Winooski River Flood Control Dams
 - 11 other dams
- **Own/Operate/Maintain/Emergency Planning/Capitol Planning**



Waterbury Dam



Wrightsville Dam



East Barre Dam

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What is ASDSO?

- **Association of State Dam Safety Officials**
 - **National non-profit association dedicated to improvement of dam safety through research, education, and communication**
 - **Established in 1984 by representatives of state agencies responsible for regulating thousands of non-federal dams in the U.S.**

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What is ASDSO? (Cont.)

- **Now serves as the premier professional organization for individuals committed to ensuring the safety of dams in the U.S.**
- **Provides professional development and educational opportunities for all persons interested or working in the field of dam safety**

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What is ASDSO? (Cont.)

- **An opportunity for persons interested in the advancement of dam safety in the U.S. to participate in that advancement on a regional and national level**

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ASDSO Membership:

- **Becoming a member of ASDSO is a way to join with others to work towards the safe design, operation, maintenance and upkeep of all dams, whether privately or publicly owned.**
- **Over the years, ASDSO has grown and benefited from the involvement of many types of members.**

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ASDSO Web Page

DamSafety.org

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What is the Role of FEMA in Dam Safety?

- **Administrator of the National Dam Safety Program**
- **Provides assistance grants to state dam safety programs**
- **Coordinates agencies involved in dam safety**
- **<http://www.fema.gov/national-dam-safety-program>**

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Workshop Facility Logistics

- Information Center
- Flow of Workshop
- Lunch & Break Plans
- **MAKE SURE LINK TO PRESENTATION EXISTS SOMEWHERE OR HERE**

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Instructor Information

Phil Moreschi, P.E., CFM
Professional Engineer: NY, MA, CT and RI

- BSCE – University of Connecticut, 1978
- Connecticut Dam Safety Program to 1987
- Founding Member of ASDSO
- President of New England Association for Dam Safety
- Inspected and worked on close to 1,000 dams
- Authored: “Connecticut Dam Operations and Maintenance Manual” and “Connecticut Dam Inspection Guidelines”
- FERC Independent Consultant



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Instructor Information

Phil Forzley, P.E.
Professional Engineer: CT and MA

- BS Civil Engineering – University of Connecticut, 1984
- MS Environmental Engineering – University of Connecticut, 1996
- Connecticut Dam Safety Program to 1986
- Inspected and worked on close to 250 dams in CT, MA, VT and NH
- New England Water & Environment Association - Watershed Management Committee Chair
- Emergency Action Plans in CT and MA



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Instructor Information

Andrea C. Judge, P.E.
Professional Engineer: MA

- Diploma of College Studies – Civil Engineering Technology – Dawson College 2004
- B.Eng. Civil Engineering – Concordia University, 2008
- Geotechnical and Dam Safety Engineer
- Inspected close to 150 dams in New England
- Experience in assessment, design of repairs, and construction administration



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Purpose of Workshop

To Teach participants about:

- **Dam Safety Laws and Upcoming Regulations**
- **Operation, Maintenance, and Inspection of Dams**
- **Issues of Public Safety, Dam Owner Liability, Responsibility, Emergency Planning, and Security**

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Purpose of Workshop (Cont.)

- **Dam Failure Modes**
- **Developing and Implementing Emergency Action Plans**
- **Repair and or Removal Projects – Costs, Funding, and Hiring a Consultant**

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Participant Introductions

Each Participant Please Briefly Introduce Yourself to the Workshop Group

- **Name**
- **Location and Type of Dam**
- **Describe your job responsibility in relation to dams**

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Workshop Agenda

Registration Sign-In/Breakfast

Session 1: Introduction

**Session 2: State Dam Safety Laws
and Draft Administrative Regulations**

MORNING BREAK

**Session 3: Dam Failures Modes & Case
Histories**

**Session 4: Dam Operation,
Maintenance, and Inspection**

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Workshop Agenda (Cont.)

LUNCH

Session 5: Emergency Action Plans

AFTERNOON BREAK

**Session 6: Public Safety, Security and
Dam Owner Liability**

Session 7: Dam Repair/Removal Projects

Wrap-Up & Workshop Evaluation

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Located on ASDSO Website

- A listing of website links for dam owners
- State Dam Safety Laws and Draft Regulations
- ASDSO Dam Ownership Brochures. 1) *Dam Ownership: Responsibility and Liability*, 2) *Dam Ownership: Internal Erosion of Earth Dams*, 3) *Dam Ownership: Procuring the Services of a Professional Engineer*
- Dam Seepage Monitoring Software Fact Sheet and Software Ordering Information
- Sample Emergency Action Plan and Template
- National Cost of Dam Rehabilitation: Summary of Cost Methodology and Information Brochure on the Need for a National Dam Rehabilitation Program

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Materials located on Website (cont.)

- *Technical Manual: Conduits Through Embankment Dams*, Federal Emergency Management Agency 484CD/September 2005 (Go to “Conduit” folder and click on “Install”)
- Brochure on *Conduits through Embankment Dams: Best Practices for Design, Construction, Problem Identification and Evaluation, Inspection Maintenance, Renovation, and Repair*. FEMA L-266, September 2005.
- *Dam Safety: An Owners Guidance Manual*, FEMA 145, August 1987.
- *Technical Manual for Dam Owners: Animal Impacts on Dams*, FEMA 473, September 2005.
- *Technical Manual for Dam Owners: Impacts of Plants on Earthen Dams*, FEMA 534, September 2005.

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Materials located on Website (cont.)

- *Dam Owner's Guide to Plant Impacts on Earthen Dams, FEMA L-263, September 2005*
- *Dam Owner's Guide to Animal Impacts on Earthen Dams, FEMA L-264, September 2005*
- Dam Safety Fact Sheets(Ohio Division of Water)
- *Operation, Maintenance and Inspection Manual for Dams, Dikes and Levees, by George E. Mills, Ohio Division of Water*
- *1) Evaluating Facility Emergency Preparedness, 2) Inspection of Spillways, Outlet Works and Mechanical Equipment, 3) Inspection of Embankment Dams, by Chris Veesaert, US Bureau of Reclamation.*
- *Dams Sector Security Awareness Guide, A Guide for Owners and Operators, Department of Homeland Security, 2007.*

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State Dam Safety Resources

- **Website:**
 - <https://dec.vermont.gov/facilities-engineering/dam-safety>
- **Information on State specific Dam Safety topics:**
 - Annual Dam Registration
 - Dam Ownership
 - Inspection Program
 - Unsafe Dams
 - Dam Orders
 - State Dam Safety Laws and Draft Regulations
- **Additional Information as developed – Stay Tuned!**

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Additional Dam Safety Resources

- **U.S. Department of Agriculture,
Natural Resources Conservation Service
(USDA/NRCS)**
<http://www.nrcs.usda.gov/programs/WSRehab/>
- **U.S. Department of Agriculture, Local Soil and
Water Conservation District (USDA/LSWCD)**

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Additional Dam Safety Resources

- **US. Bureau of Reclamation: www.usbr.gov**
- **Corps of Engineers:
<http://itl.erdc.usace.army.mil/library/publications.html>**
- **Federal Energy Regulatory Commission:
www.ferc.gov/industries/hydropower/safety.asp**
- **Local consulting firms**

For quick links to resources go to
DamSafety.org
Resources Center

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Introduction to Dams

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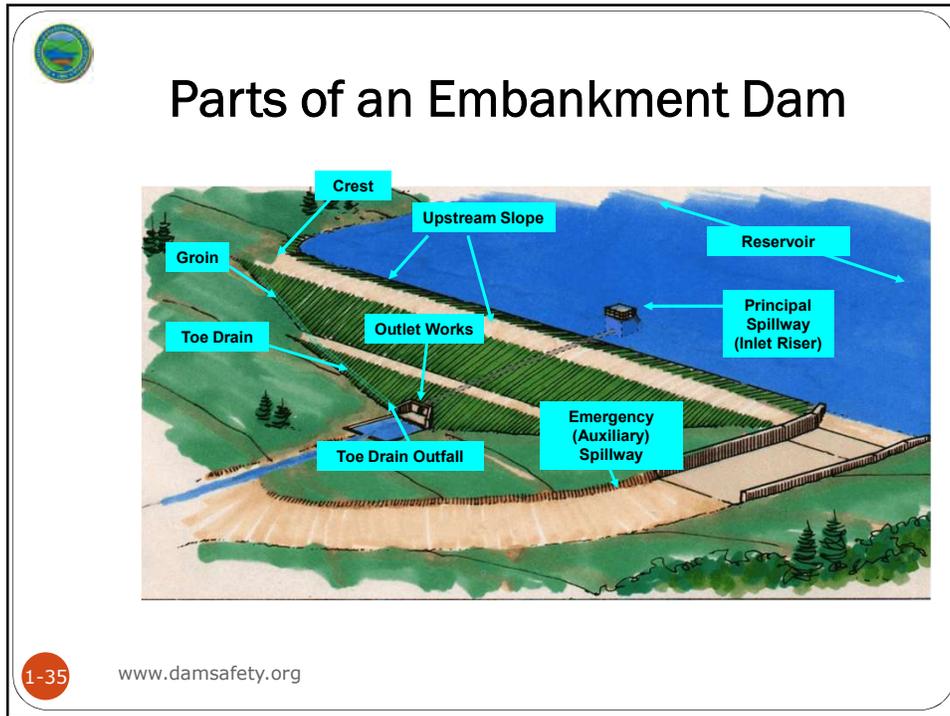
Introduction to Dams

We will cover:

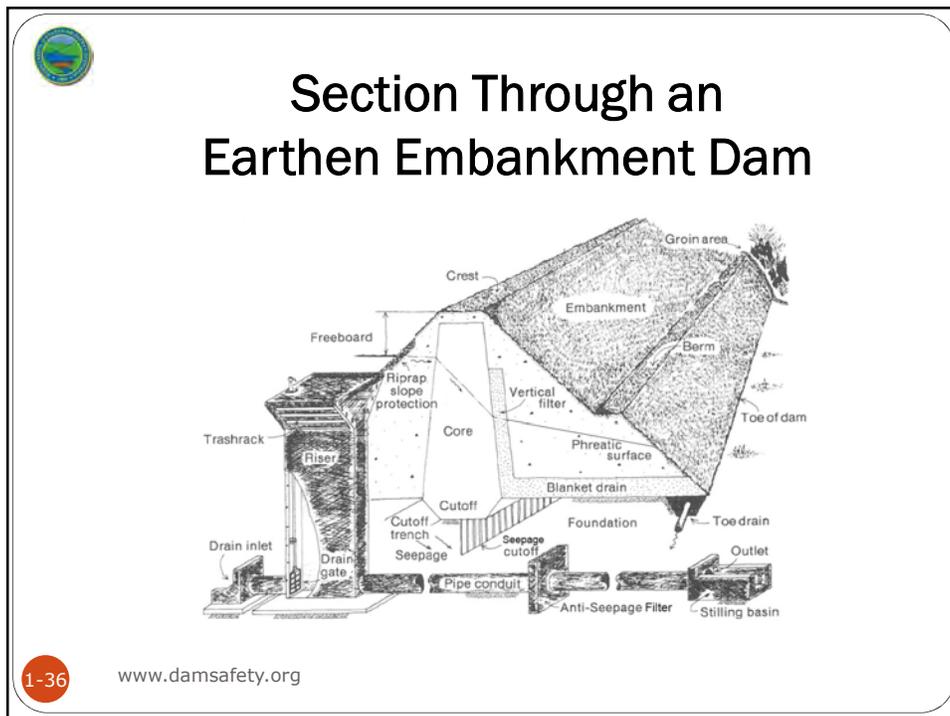
- **Dam Parts**
- **Dam Types**
- **Types of spillways**
- **Functions of dams**
- **Terminology**

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Common Terminology

- **Upstream & Downstream Slopes**
- **Abutments (Right & Left)**
- **Groin**
- **Spillways**
- **Outlet Works**
- **Drains**
- **Rip Rap**
- **Freeboard**

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Common Terminology (cont.)

- **Instrumentation**
 - **Survey Monuments**
 - **Piezometers**
 - **Seepage Weir**

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Downstream Slope



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Abutment/Groin



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Spillway



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Rip-Rap Stilling Basin



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Trashracks



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Rip Rap - Upstream Slope

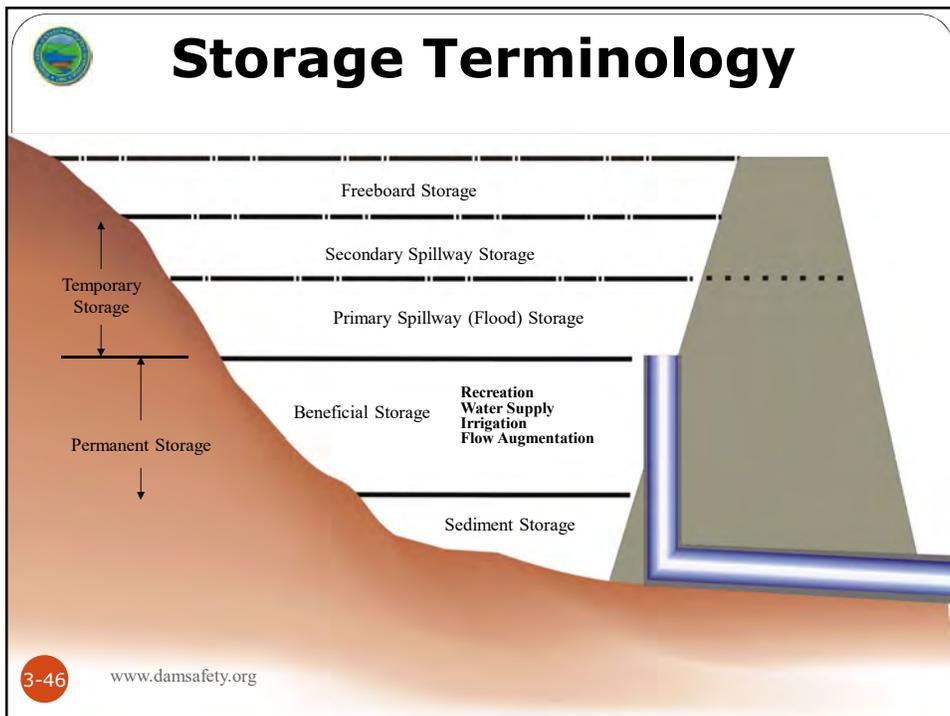


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Cross Section Terminology

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Instrumentation

Monitoring Well

Seepage Weir

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Types of Dams

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Types of Dams

- Earthen and Rockfill Embankment Dams (Comprise about 90 Percent of the Dams in the United States)
- Concrete and Rock Masonry Dams
 - Gravity dams
 - Arch dams
 - Buttress dams

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Types of Dams (Cont.)

Other Dam Types

- Steel dam
- Inflatable Rubber dam
- Wood/Timber

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Earthen and Rockfill Embankment Dam



Waterbury Dam, Waterbury

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Earthen Embankment Dam



Wrightsville Dam, Montpelier/East Montpelier

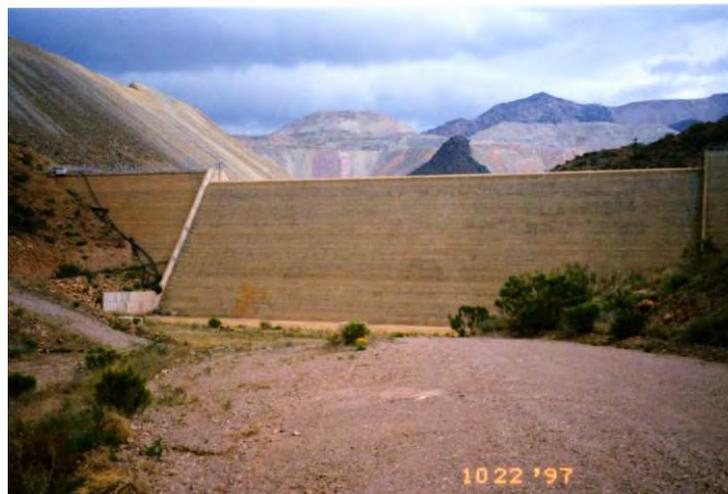
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Roller Compacted Concrete Gravity Dam



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Concrete Buttress Dam



Crystal Lake Dam, Barton

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Stone Masonry/Earth Fill Dam



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Stone Masonry Dam



Upstream Batter
Provides Increased
Stability

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Sweet Pond Dam, Guilford

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Concrete Gravity Dam



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Masonry Gravity Dam

Cyclopean Concrete Core



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Rubber Dam



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Timber Crib Dam



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Masonry Buttress Dam



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Concrete Gravity Dam

Ambursen
Dam



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Types of Spillways

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Types of Spillway Systems

- Conduit spillways
- Open channel spillways
- Weir Spillways

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Conduit Spillways

- Riser and conduit
- Drop box and conduit
- Morning glory riser and conduit
- Slanting conduit

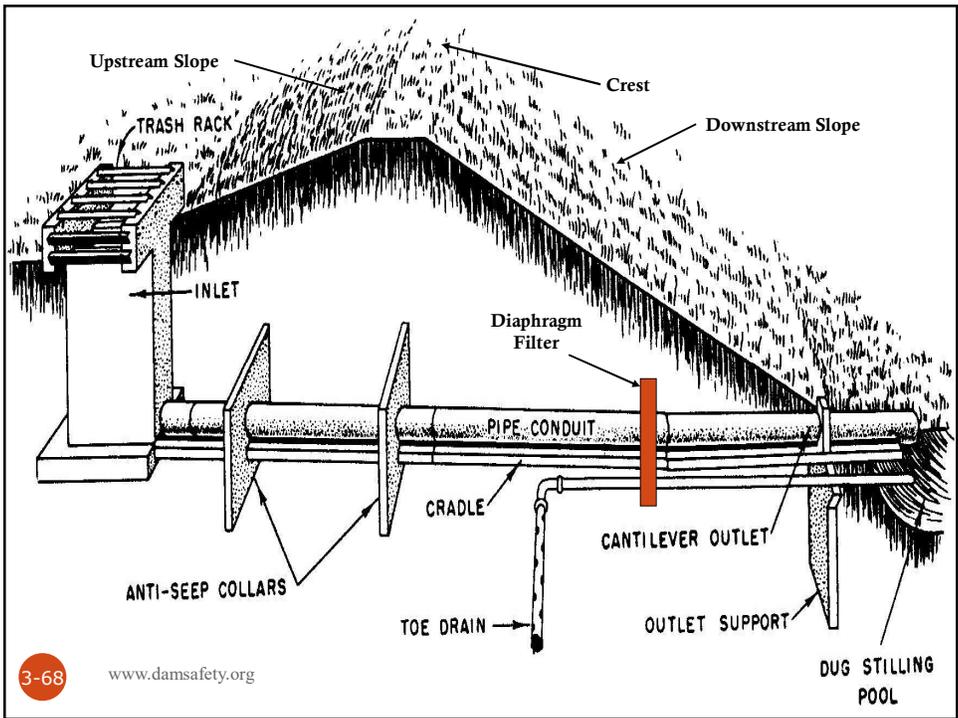
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Conduit Spillway



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Morning Glory Spillway



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Open Channel Spillways

- Earthen/vegetated
- Concrete-lined
- Rock-cut

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Earthen Vegetated Spillway



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Open Channel Spillway



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Open Channel Spillway -- Rock Cut Channel



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Weir Spillways

- Drop box inlet
- Broad crested
- Labyrinth
- Sharp crested
- Gated

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Weir Spillway - Drop Box Inlet



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 **Weir Spillway - Ogee Crest**



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 **Labyrinth Spillway**



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Weir Spillway - Broad Crest



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Weir Spillway - Sharp Crest



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Gated Spillway Systems



Waterbury Dam, Waterbury

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The image shows a large concrete dam with a spillway. The spillway has several gates, and the water is flowing through them. The dam is situated in a wooded area with trees showing autumn foliage. The foreground shows a rocky bank with some moss and small plants.

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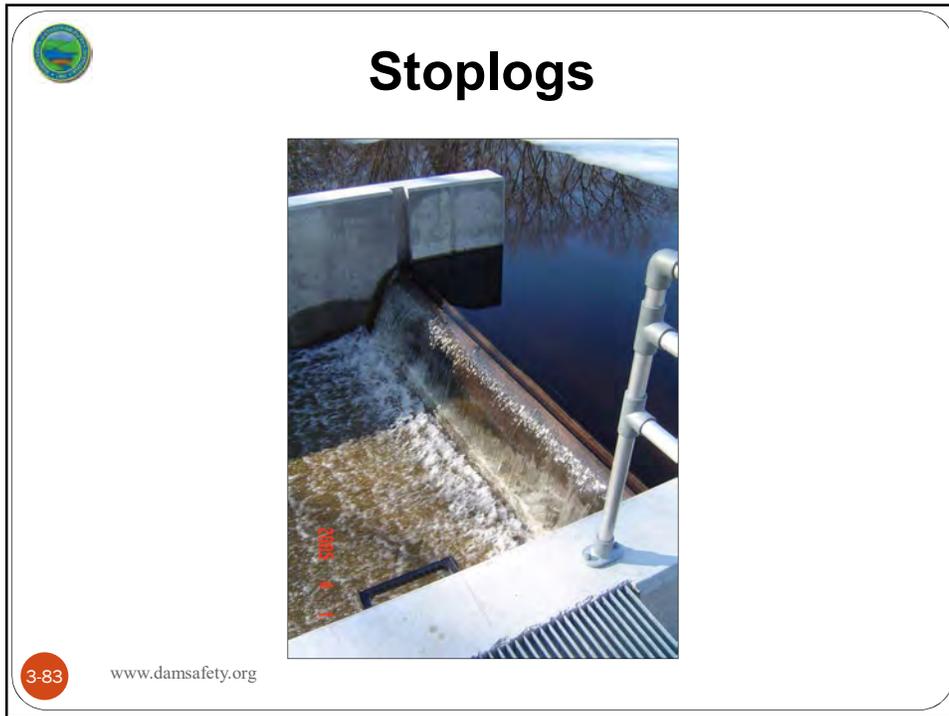
Stoplog Slots



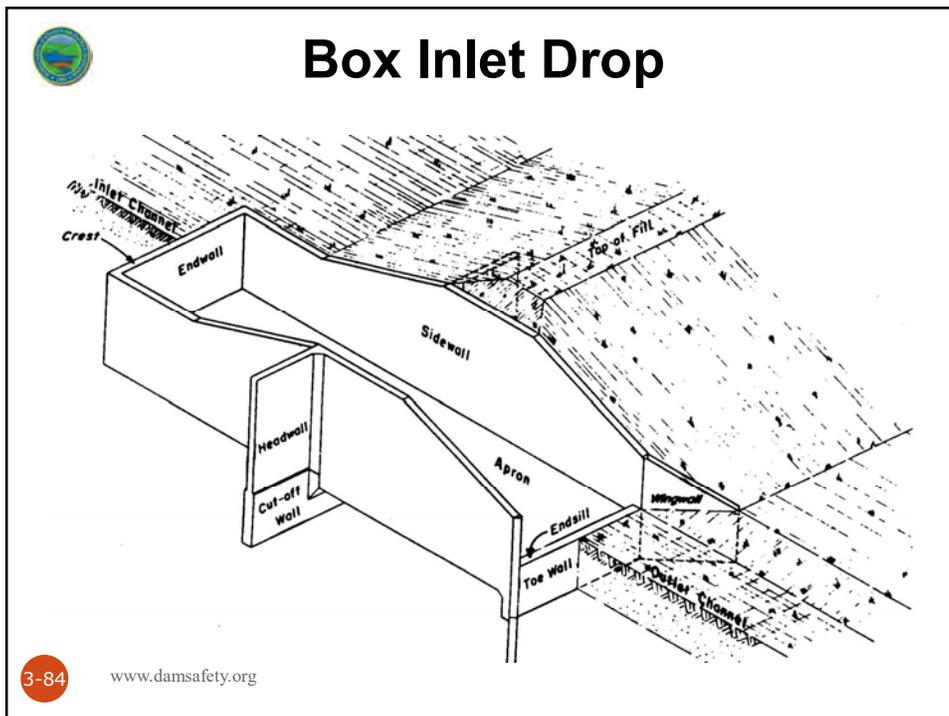
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The image shows a concrete structure with a slot. A metal frame is positioned over the slot, and a stoplog is visible. The structure is surrounded by a bed of gravel. The background shows trees and a clear sky.

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Box Inlet Drop



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Regardless of the type of dam, all dams must be properly operated, maintained, and inspected by owners.

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Functions of Dams

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Functions of Dams

- Flood control
- Water supply
- Power supply
- Waste impoundment
- Wastewater impoundment
- Irrigation
- Navigation
- Recreation

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Flood Control



Waterbury Dam, Waterbury



East Barre Dam, Barre Town



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Water Supply



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Hydropower



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Waste Impoundment



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Waste Impoundment/Tailings



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Wastewater Treatment

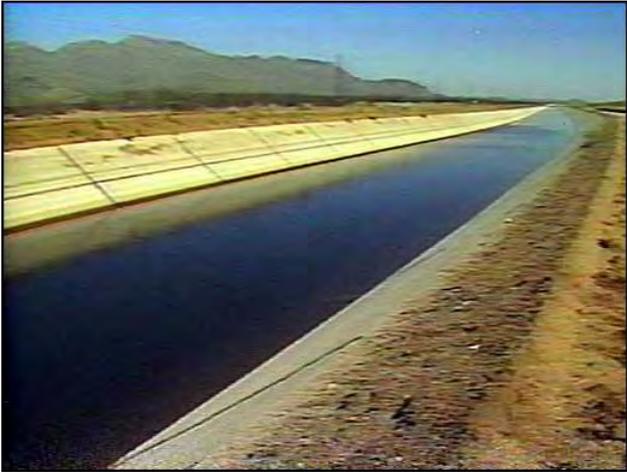


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Irrigation



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Navigation



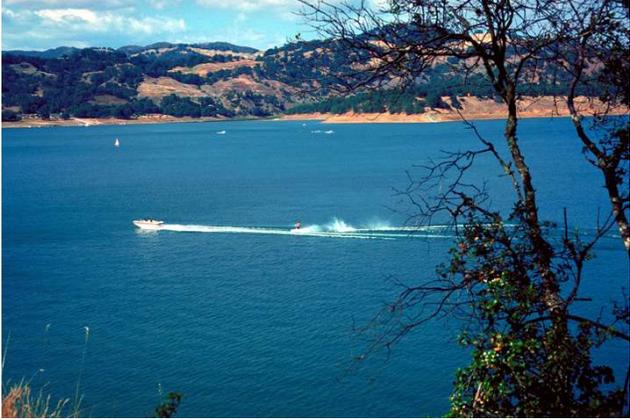
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Recreation



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KNOW YOUR DAM TERMINOLOGY!

Refer to Your **Glossary** the Rest of the Day.

Review Manuals located on the Website for more information.

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