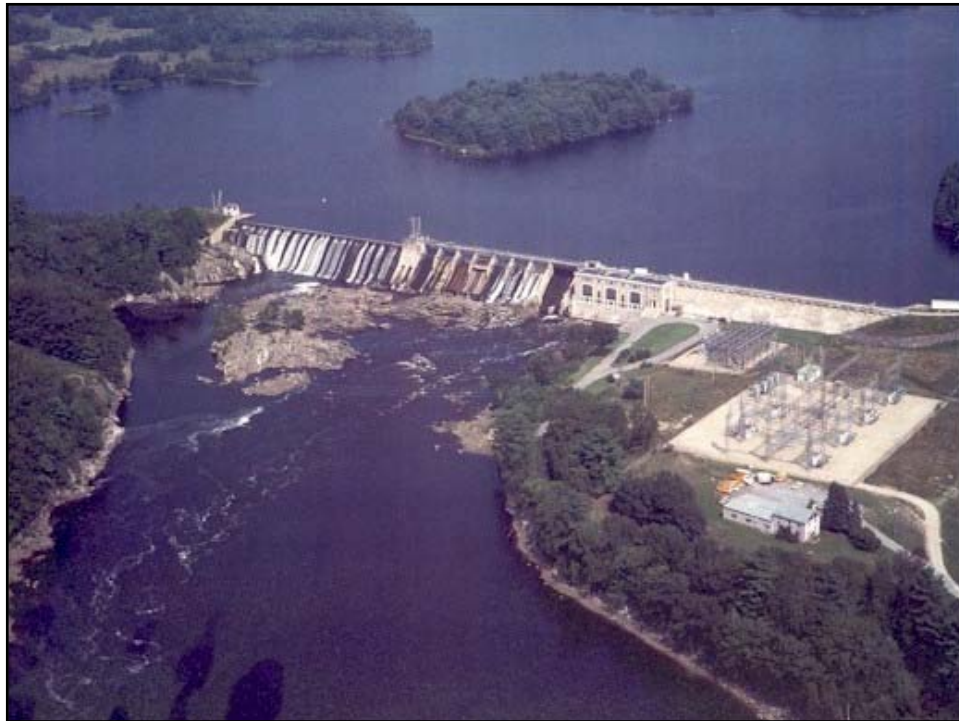


AN OVERVIEW OF DAM SAFETY IN MAINE

March 20, 2008



DAM HISTORY

- ☑ Waterpower has been harnessed since the mid 1700s
- ☑ The first dams provided waterpower for sawmills and grist mills.
- ☑ Hydro-mechanical power was later utilized at tanneries, textile mills and pulp and paper mills.
- ☑ Starting in the early 1900s dams built for Hydro-electric power generation, to regulate river flows, and to hold drinking water.
- ☑ Many new projects 1920s - 30s and 1980s - 90s
- ☑ Maine currently has over 1,000 dams, 111 with hydro generation





Timeline

- ☑ 1774 - Water Powered Sawmill built in Bethel
- ☑ 1790 - 1800 Six Sawmills built in Lisbon
- ☑ 1837 - Edwards Dam constructed
- ☑ 1850 - 1853 Lewiston Canal System Built
- ☑ 1867 - Maine Legislature studies "Water Power of Maine"
- ☑ 1880 - Beginning of hydroelectric generation in US – Grand Rapids, MI
- ☑ 1899 - Walter Wyman & Harvey Eaton buy 12 year old hydro at Oakland Maine – beginnings of Central Maine Power
- ☑ **1907 15% of US generation is hydropower**

Timeline Continued

- ☑ 1913 Electric Generation at Edwards Dam
- ☑ 1916 Construction starts on Ripogenus Dam
- ☑ 1920 Weston Station – Skowhegan
- ☑ 1930 Wyman Dam – Bingham
- ☑ **1940 40% of US generation is hydropower**
- ☑ 1949 Long Falls Dam (Flagstaff Lake) constructed
- ☑ 1980s – 90s Many new hydros built in Maine
- ☑ 1999 Deregulation of the Electric Industry –
Maine's Three utilities sell hydros to private sector
- ☑ 1999 Edwards Dam removed. (For the first time ever, the federal government ruled that the benefits of a free-flowing river outweighed the benefits of the dam and ordered its removal.)
- ☑ **2005 7% of US generation is hydropower**

RESOURCES

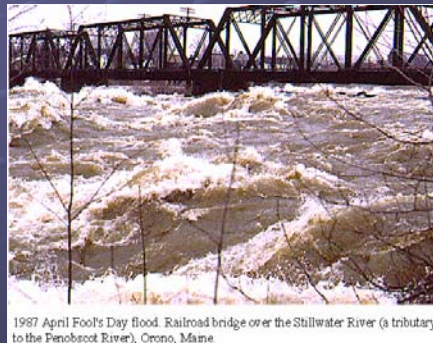


1867 – Maine Legislature commissions study of Water Power in Maine

- ☑ Maine's natural resources favor hydropower
- ☑ Average elevation drop in major rivers from headwaters to head of tide is over 600 feet
- ☑ More than 5,100 rivers & streams
- ☑ More than 1,600 lakes (> 2,300 square miles)
- ☑ Headwaters of Androscoggin, Kennebec and Penobscot Rivers range from 1,000 to 1,500 feet above sea level – major potential identified
- ☑ 3,100 “mill powers” available for development

Maine Climate

- ☑ Average rainfall:
42 inches
- ☑ Average snow fall:
83 inches
- ☑ Average summer
temperature: 62° F
- ☑ Average winter
temperature: 13° F



1987 April Fool's Day flood. Railroad bridge over the Stillwater River (a tributary to the Penobscot River), Orono, Maine

Other Attributes

- Favorable geology for building dams
- Many lakes interconnected by rivers
- Terrain and ground cover favor low evaporation
- Favorable storage and runoff conditions

Types of Dams

Many combinations of:

- Earth Embankment
- Rockfill
- Gravity
- Buttress
- Arch
- Concrete
- Masonry
- Stone
- Timber Crib

Dam Ownership

- ☑ Federal Government – 1%
- ☑ State Government – 5%
- ☑ Local Government – 16%
- ☑ Public Utility – 24%
- ☑ Private – 54%

Hazard Classification (FERC)

- ☑ High Hazard Potential – “Dams located where failure may cause serious damage to homes, agriculture, industrial and commercial facilities, important public utilities, main highways or railroads, and there would be danger to human life.”
- ☑ Significant Hazard Potential – “Dams located in predominately rural or agricultural areas where failure may damage isolated homes, secondary highways or minor railroads; cause interruption of use or service of relatively important public utilities; or cause some incremental flooding of structures with possible danger to human life.”
- ☑ Low Hazard Potential – Dams with a small storage capacity, the release of which would be confined to the river channel in the event of a failure and therefore would represent no danger to human life.



Dam Statistics (2005)

- ☑ There are about 1015 dams in Maine
 - ☑ 831 State Regulated Dams (MEMA)
 - ☑ 25 High Hazard
 - ☑ 80 Significant Hazard
 - ☑ 726 Low Hazard
 - ☑ 174 FERC Regulated Dams – Mostly Hydropower Dams.
 - ☑ 32 High Hazard
 - ☑ 13 Significant hazard
- ☑ Most of these dams are more than 50 years old. As dams age, concern over their safety and integrity grows, and oversight and a regular inspection program are extremely important.

FERC Regulation

Federal Energy Regulatory Commission (FERC) Dams:

- The Commission has the largest dam safety program in the United States.
- Approximately 3,036 dams are in the FERC national program (174 in Maine). Two-thirds of these dams are more than 50 years old.
- FERC Provides regulation for hydroelectric dams. A license from the FERC is required to construct, operate, and maintain a nonfederal hydroelectric project that is or would be (a) located on navigable waters of the United States; (b) occupy U.S. lands; (c) utilize surplus water or water power from a U.S. government dam
- A small hydroelectric project of 5 MW or less may be eligible for an exemption.

FERC Regulation

The Commission staff inspects projects on an unscheduled basis to investigate:

- potential dam safety problems;
- complaints about constructing and operating a project;
- safety concerns related to natural disasters; and
- issues concerning compliance with the terms and conditions of a license.

FERC Regulation

High and Significant Hazard Dams:

- ☑ PART 12 Safety Inspections – Required every 5 years. An independent consulting engineer, approved by the Commission, must inspect and evaluate projects with dams higher than 32.8 feet (10 meters), or with a total storage capacity of more than 2,000 acre-feet (2.5 million cubic meters).
- ☑ In the last 6 years FERC updated their Dam Safety Program to include a Potential Failure Mode Analysis (PFMA), and a Supporting Design Report.

FERC Regulations Cont.

- ☑ Dam owners are required to maintain and perform repairs as recommended by the Part 12 independent consultant and the FERC Inspector.
- ☑ During and following floods, FERC staff visits licensed projects, determines the extent of damage, if any, and directs any necessary studies or remedial measures the licensee must undertake.
- ☑ The Commission publishes "Engineering Guidelines for the Evaluation of Hydropower Projects". This guides the Commission's engineering staff and licensees in evaluating dam safety.
- ☑ Most of FERC regulated high and significant hazard dams have Emergency Action Plan's (EAP's).



State Dam Inspections

In 1989, the Legislature enacted a dam safety statute which is administered by the Maine Emergency Management Agency (MEMA). This law focuses on identifying and regulating those dams posing a risk of loss of life or substantial property damage in the event of failure.

State regulated dams are required to be inspected by a state dam inspector in accordance with the following schedule:

- ☑ All significant hazard potential dams, at least once every 4 years;
- ☑ All high hazard potential dams, at least once every 2 years;
- ☑ Any dam, within 30 days of a request for an inspection from the dam owner or the municipality in which the dam is located; and
- ☑ At any time any dam that may, in the judgment of the commissioner, constitute a potential risk to public safety.

Emergency Action Plans (EAP)

- ☑ All High and Significant hazard dams require an EAP that needs to be updated every 2 years.
- ☑ 23 of 25 high hazard dams have an EAP
- ☑ About 75% of State regulated dam owners that are required to file plans have filed.

State Dam Safety Performance

- ☑ Maine meets 22 out of 32 basic legislative/regulatory criteria found in the National Dam Safety Act.
- ☑ There were 13 deficient dams identified in 2005 as compared to 59 in 1998. This is a big improvement. **“Deficient”** is defined as a dam that is not capable of performing safely under all required design pool and loading conditions.
- ☑ State Staffing = 1.5 FTE's (Full Time Equivalent). Maine ranks 41 in the US for FTE's devoted to Dam Safety.
- ☑ State Budget for dam Safety is about \$36,914 which is \$44.42 per dam, or \$1,476.56 per high hazard dam. Maine ranks 40 for State dollars toward dam safety.

State Dam Safety Performance

- ☑ Maine spends around \$110,000 annually on dam safety. This is in the bottom five States in the Nation. This includes the inspectors salary.
- ☑ Vermont has about half the number of dams and has twice the budget.
- ☑ New Hampshire has more than three times the number of dams and six times the budget of Maine.
- ☑ There currently is no enforcement division at MEMA.



Dam Maintenance

Do dams have to be maintained by their owners?

- ☑ DEP has no law requiring that a dam be maintained in good condition. However, if a water level order or permit has been issued, it will be necessary to maintain the dam so as to comply with the permit or order.
- ☑ MEMA can require that a dam be maintained or operated in a certain way if necessary to protect public safety. Otherwise, a dam can fall into disuse and disrepair until it either breached or is rebuilt by the owner.
- ☑ Of course a private owner may be liable for property damage or loss of life due to dam failure. (NOTE: Effective July 4, 1996, government agencies and municipalities are exempt from liability under the Maine Tort Claims Act from any claim for damages resulting from the construction, ownership, maintenance or use of dams.)
- ☑ The above concerns mostly low hazard dams that are not a concern for public safety. High and significant hazard dams are maintained as required by MEMA to protect public safety.

Regulating Laws

Are there other laws regulating dams in Maine?

- ☑ YES. Construction or repair of a dam may be subject to regulation under one of several other state laws. These include: the Natural Resources Protection Act (for non-hydropower dams); the Maine Waterway Development and Conservation Act (for hydropower dams); and the Land Use Regulation Law (for dams in unorganized territories).
- ☑ The construction, repair or alteration of a non-hydropower dam, as well as any associated dredging, draining, filling or soil disturbance, that occurs in, on, over or adjacent to a "protected natural resource" needs a permit from DEP. Protected natural resources include rivers, streams, brooks, great ponds, coastal wetlands, certain freshwater wetlands, and areas of significant wildlife habitat.

Dam Rehabilitation Funding

- ☑ Most of Maine dams are over fifty years old. Many are nearing the end of their design life. These dams all show signs of weathering and movement to various degrees.
- ☑ While FERC dams, which are mostly revenue producing, can sustain repairs and maintenance on a regular basis most of the State regulated dams cannot and their continual deterioration should be a cause for concern.
- ☑ Most State regulated dams have no construction records and cannot be structurally assessed without considerable investigation and cost.

Dam Rehabilitation Funding

- ☑ There are two dam safety bills under consideration in both the house and the Senate.
- ☑ One bill would reauthorize the National Dam Safety Act, which expires this year. The current act provides up to \$6 million to help states operate dam-safety programs. Maine receives \$36,114 annually - or about one-third of its dam-safety budget.
- ☑ The Second is the National Dam Rehabilitation and Repair Act (HR 3224). The House of Representatives passed the bill in October 2007. This program would provide \$200 million over 5 years in federal grant funds for the needed repairs of non-federal publicly owned dams.
- ☑ Estimated repair costs of Maine public dams - \$11,900,000 (for 17 dams)
- ☑ Proposed funding – \$1,780,00

Conclusion

Dams in Maine are essential to infrastructure, providing hydroelectric power (718 MW), irrigation, recreation, flood protection and water supply. As dams age, and development downstream of dams increase, dams require more attention spent on inspecting and maintaining dams to ensure public safety.

