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2010 Report to the Legislature: Status of High and Significant Hazard Dams in Washington with Safety Deficiencies

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For more information contact:

Barbara Anderson
Water Resources Program
P.O. Box 47600
Olympia, WA 98504-7600

Phone: 360-407-6607

Washington State Department of Ecology - www.ecy.wa.gov

- Headquarters, Olympia 360-407-6000
- Northwest Regional Office, Bellevue 425-649-7000
- Southwest Regional Office, Olympia 360-407-6300
- Central Regional Office, Yakima 509-575-2490
- Eastern Regional Office, Spokane 509-329-3400

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2010 Report to the Legislature: Status of High and Significant Hazard Dams in Washington with Safety Deficiencies

by
Doug Johnson, P.E.
Dam Safety Supervisor

Water Resources Program
Washington State Department of Ecology
Olympia, Washington

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Executive Summary

RCW 90.54.160 directs the Washington Department of Ecology to report to the Legislature “.... as deemed appropriate by the department, on dam facilities that exhibit safety deficiencies sufficient to pose a significant threat to the safety of life and property. The report shall identify the owner or owners of such facilities, detail the owner's ability and attitude towards correcting such deficiencies, and provide an estimate of the cost of correcting the deficiencies if a study has been completed.” This report updates information regarding the condition of 388 dams located above populated areas in Washington, which the Department of Ecology’s Dam Safety Office regulates. The report also provides an update on the progress to repair or improve dams found to be deficient during previous periodic safety inspections. The Executive Summary Figure on Page iv illustrates the number of dams in Washington and their status.

The following three key messages summarize the status of dam safety in Washington in 2010:

- There are now 388 dams in Washington sited above populated areas for which Ecology’s Dam Safety Office is the sole regulatory agency, an increase of 55 dams since 2006. This sharp increase was primarily due to the discovery of dozens of dams under an initiative undertaken in 2008 to find, inspect, and eventually bring into compliance dams constructed without prior approval by the state. Ecology discovered 28 previously unknown high hazard dams, along with 19 significant hazard dams through this initiative.
- Eleven of the high hazard dams had serious safety deficiencies that posed an imminent threat to downstream lives and property, so emergency measures were taken to correct those safety problems. Had we not undertaken this effort, these dams would have gone undetected until they failed, which was highly likely given their poor condition. This was a huge public safety benefit to residents living downstream from these dams.
- In 2007 through 2010, after a few years of progress in reducing the backlog, there was a significant increase in the listing of dams with safety deficiencies. The cause of this increase was primarily the unpermitted dams initiative, which added 20 dams with safety deficiencies to the list. Another 10 dams were added to the list from our regular periodic inspection activity. These 10 aging dams have deteriorated, may lack maintenance, or are not meeting higher safety standards due to population growth and increasing seismic standards. The failures of Mill Creek Dam in 2008 and the French Slough Dairy Waste Lagoon in 2010 are evidence of this problem.

Ecology’s role in getting deficient dams repaired is to work with the owner in an effort to gain voluntary compliance, and only use formal enforcement action as a last resort. Despite the large jump in the number of dams with deficiencies and the unpermitted dams initiative workload, Ecology was able to get 20 dams with deficiencies repaired during the 2007-10 period. This accomplishment was due to adding two engineering staff in 2009, and the Dam Safety Office implementing efficiency measures to streamline inspections and report writing, allowing more time to do compliance and enforcement.

Despite the progress noted above, some deficient dams have been on the list for several years with minimal progress on correcting safety deficiencies. These dams have serious deficiencies but do not pose an imminent threat of failure, so emergency actions have not been taken. Owners of these dams have cited insufficient funding as the reason for their lack of progress in getting repairs done. Unless state or federal funding becomes available for repairing and maintaining existing infrastructure, many owners will not be able to afford repairs, and needed dam repairs will continue to languish. While legislation has been introduced in Congress to create a federal loan fund for repairing the nation's unsafe publicly-owned dams, no funding programs are on the horizon for privately owned dams.

Until funding can be secured, Ecology will continue to prioritize its efforts to ensure that unsafe dams having the greatest number of downstream lives at risk are repaired first. The department will work closely with owners to find innovative ways to reduce the cost of making these necessary repairs. Ecology is also using a portion of our FEMA National Dam Safety Grant to prepare Emergency Action Plans for all high hazard dams without one, to ensure adequate warning and evacuation in the event of an incident or failure.

In 2007-2010, Ecology completed or oversaw:

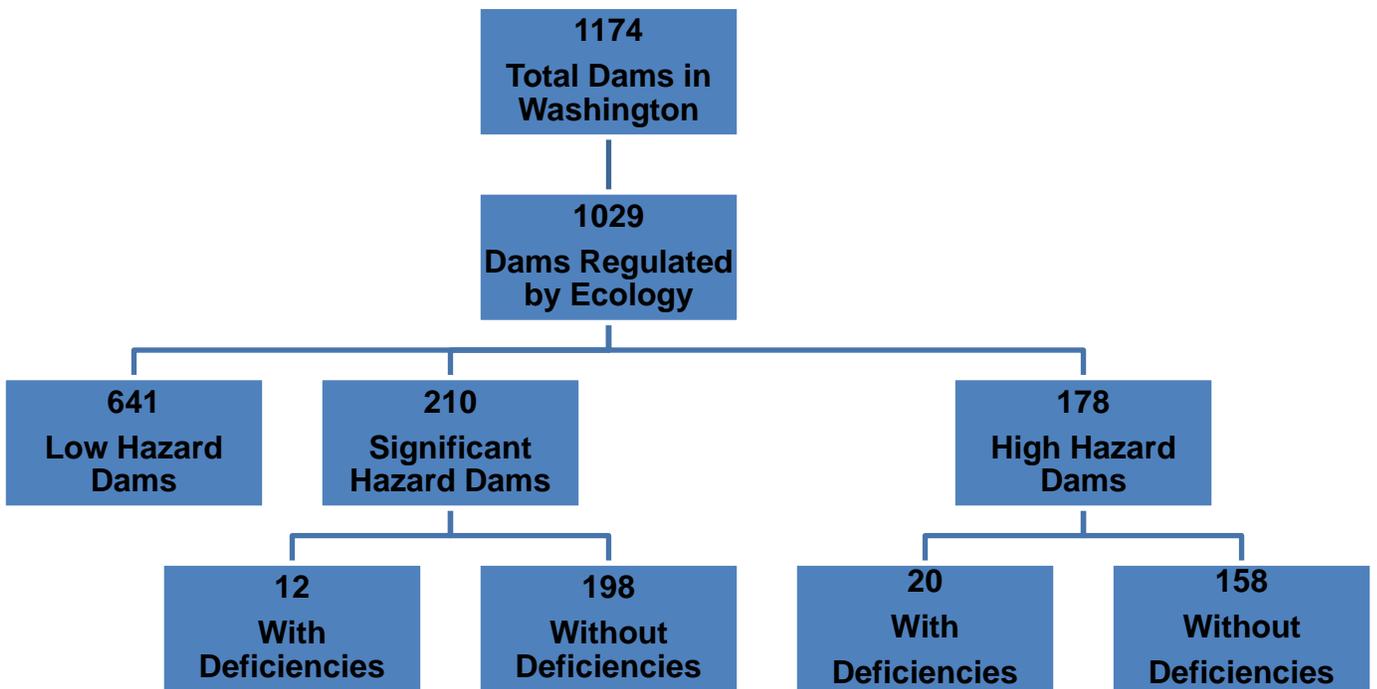
- 75 inspections of high hazard dams
- 60 inspections of significant hazard dams
- 200 investigations of potential unpermitted dams
- 20 safety deficiencies corrected by dam owners

To date, Ecology has identified safety deficiencies on 209 dams cumulatively and actions to correct deficiencies include:

- Deficiencies corrected at 171 dams
- Repairs partially completed at 11 dams

Progress has been made in repairing dams with safety deficiencies, but ongoing inspections are still adding a significant number of dams with deficiencies to the list.

Executive Summary Chart



Introduction

RCW 90.54.160 directs the Washington Department of Ecology to report to the Legislature (at dates) deemed appropriate by the department, on dam facilities that exhibit safety deficiencies sufficient to pose a significant threat to the safety of life and property. The report shall identify the owner or owners of such facilities, detail the owner's ability and attitude towards correcting such deficiencies, and provide an estimate of the cost of correcting the deficiencies if a study has been completed. This information is contained in the tables of **Appendix A**. This is the 18th report, and the first since 2006 that provides information on the status of dams with *High* and *Significant* downstream hazard classifications that have safety deficiencies.

A dam is any artificial barrier or controlling works that impounds or has the ability to impound at least 10 acre-feet of water. The downstream hazard classification refers to the potential effects a dam failure could have on people and property downstream from a dam, and does not relate to the structural or operational condition of a dam. **Table 1** lists the classification system used by the Department of Ecology's Dam Safety Office (DSO).

Table 1: Downstream Hazard Classification

Downstream Hazard Potential	Downstream Hazard Class	Population at Risk	Economic Loss Generic Descriptions	Environmental Damages
Low	3	0	Minimal. No inhabited structures. Limited agriculture development.	No deleterious materials in water
Significant	2	1 to 6	Appreciable. 1 or 2 inhabited structures. Notable agriculture or work sites. Secondary highway and/or rail lines.	Limited water quality degradation from reservoir contents and only short-term consequences.
High	1C	7 to 30	Major. 3 to 10 inhabited structures. Low density suburban area with some industry and work sites. Primary highways and rail lines.	Severe water quality degradation potential from reservoir contents and long-term effects on aquatic and human life.
High	1B	31-300	Extreme. 11 to 100 inhabited structures. Medium density suburban or urban area with associated industry, property and transportation features.	
High	1A	More than 300	Extreme. More than 100 inhabited structures. Highly developed, densely populated suburban or urban area with associated industry, property, transportation and community lifeline features.	

Significant Issues from 2007 to 2010

Much has happened with dam safety in Washington since our last report in 2006. Progress continued between 2007 and 2010 in inspecting dams under the periodic inspection program, correcting dam safety deficiencies, and upgrading dam safety in the state. The following items are of particular note in 2007-2010:

- A total of 20 dams with safety deficiencies were repaired or modified.
- 75 detailed inspections were conducted of high hazard dams, which found safety deficiencies at 22 projects that posed a threat to life or property.
- 60 inspections were performed on the significant hazard dams where there is a moderate potential for loss of life in the event of a dam failure.
- Ecology launched a major statewide initiative to locate and inspect dams that had been built without dam safety approval. (This initiative is described in detail below.)
- There were two dam failures and one spillway failure in the state.
- Ecology continued receiving state funding assistance from FEMA under the National Dam Safety Act.

Unpermitted Dams Initiative

In 2008, Ecology began the unpermitted dams initiative to find, inspect, and eventually bring into compliance dams that had been constructed without prior approval by the state. This effort was prompted by the discovery of numerous unpermitted “frost ponds” and small irrigation reservoirs in the agricultural areas of Washington.

An intern was tasked with reviewing aerial photographs to identify all reservoirs and ponds greater than two surface acres statewide that appeared to be impounded by a dam. This search uncovered some 600 water bodies that appeared to be impounded behind unpermitted dams. A total of 95 of these impoundments appeared to have a high downstream hazard, while another 142 appeared to have a significant downstream hazard.

Over the next 18 months, Ecology performed inspections of the high and significant hazard projects to verify that they were actually dams, and if so, to assess the condition of the dams and the downstream hazard classification. Many of these impoundments were not dams at all, or turned out to be low hazard upon closer examination. However, Ecology did find 28 previously unknown high hazard dams, along with 19 significant hazard dams. Additionally, we took emergency action at 11 of the high hazard dams to correct serious safety deficiencies that posed an imminent threat to downstream lives and property. Had we not undertaken this effort, these dams would have gone undetected until they failed, which could have happened at any time

given their poor condition. Repairing these dams provided a huge public safety benefit to downstream residents.

Dam and Spillway Failures

Mill Creek Dam Failure: On November 12, 2008, the Mill Creek Dam in Cosmopolis failed during a heavy rainstorm. The dam was a 10-foot high concrete dam that impounded a 4-acre lake. The cause of the breach appeared to have been the toppling of trees whose root structures were entwined around sheet piles in the dam. Those sheet piles served as a seepage cutoff. When the trees toppled they pulled the sheet piling out of position opening a breach in the dam cross-section, releasing the contents of the lake. Although the dam was classified as high hazard, and flooding did occur in a residential area below the dam, no injuries occurred. To date, the City of Cosmopolis has not rebuilt the dam.

French Slough Dairy Lagoon Failure: On April 12, 2010, a dairy waste lagoon near the town of Snohomish failed, spilling an estimated 27 million gallons of diluted manure onto adjacent farmland. An undetermined quantity of the liquid drained into nearby French Slough, a tributary of the Snohomish River. The waste storage pond was owned by the Bartelheimer Dairy and was designed by the Natural Resources Conservation Service (NRCS) and completed in 1997.

According to an engineering investigation report issued by the NRCS, an old wooden box drain from the 1940s, left in place below the lagoon's bottom and dam embankment, led to the eventual breaching of the structure. The hydraulic connection between the wooden box drain and the liquid in the full waste storage pond exceeded the critical pressure beneath the confining silt-clay layer and resulted in a blowout near the toe of the downstream embankment. According to the report, the presence of the drain tiles near the waste storage pond was discussed during the planning and design phases of the project, but "field location of the drains tiles should have been conducted prior to construction given the potential hazard to embankment stability from the drain tiles being left in place." The report further concluded, "the wooden box drain tiles' satisfactory removal/relocation should have been confirmed prior to giving final approval to the construction."

NRCS assigned the responsibility for the failure to their own planning and design of the waste storage pond. Ecology's Dam Safety Office concurred with the NRCS findings in its own report on the waste pond failure

(http://www.ecy.wa.gov/programs/wr/dams/Reports/08052010_frenchsloughfailure.pdf). In response to this failure, NRCS is conducting a complete review of its internal procedures and guidance documents to learn how it can improve its design and planning process to further ensure the health and safety of the landowners and surrounding communities. Additionally, the NRCS reportedly plans to review its records for any other existing reservoirs that might be founded over buried field drains. The NRCS reportedly is working with the present dairy owner on an alternate means of dealing with the agricultural wastewater. The original reservoir site is deemed unsuitable as addressing liquefaction concerns with the weak foundations is cost prohibitive.

Pride Packing Dam Spillway Failure: Pride Packing Ranch 19 Dam is located near Sunnyside Washington, and was one of the dams discovered under the unpermitted dams initiative. The 30-foot high dam was found to have an inadequate spillway, so Ecology required the dam owner to construct a new spillway to handle floods from the watershed. Completed in April 2010, the spillway consisted of a concrete chute across the crest of the dam followed by a gabion-lined spillway chute down the face of the dam.

On April 25, water released from an upstream reservoir resulted in a few inches of flow over the new spillway. This small flow resulted in a major failure of the gabion-lined chute, as some of the flow got beneath the filter fabric underlying the gabions and scoured the highly erodible foundation soils. Fortunately, the erosion stopped at the end of the concrete chute section across the crest, so the dam was not in real danger of failing. Nonetheless, the damage to the spillway was severe, and the owner had to rebuild the downstream chute, this time with reinforced concrete. The concrete spillway was completed in October, and the reservoir was placed back in service.

FEMA National Dam Safety Grant

Ecology continued receiving state funding assistance from FEMA under the National Dam Safety Act.

- In 2007, Ecology's grant amount was about \$40,000. This funding was used to hire a contractor to update our risk-based design storms in Technical Note 3 of the Dam Safety Guidelines.
- The 2008 grant amount was again \$40,000, and this money was used toward hiring engineers to work on the unpermitted dams initiative.
- In 2009 and 2010, the grant amount was increased to \$94,000 and \$90,000 respectively, due to FEMA securing additional funding. These grant funds were used to hire a technician to work on improving emergency preparedness at state-regulated dams in Washington. The goals of this effort will be to get to 100% of the high hazard dams with Emergency Action Plans (EAPs), as well as improve our percentage of significant hazard dams with EAPs (currently 30%), provide outreach and education on EAPs to dam owners, and initiate a program of tabletop exercises for larger dams.

Periodic Inspection

In general, periodic inspections and follow-up engineering analyses are performed on existing dams for various purposes including:

- To assess the structural integrity and stability of project elements.
- To identify obvious defects, especially due to aging.
- To assess the stability of the structure under earthquake conditions.
- To determine the adequacy of the spillways to accommodate major floods.
- To evaluate project operation and maintenance.

Periodic inspections are the primary tool for detecting deficiencies at dams that could lead to failure. Correction of these safety deficiencies in a timely manner can prevent dam failures and other serious incidents from occurring. The use of periodic inspections to detect deficiencies and avert disasters continues to be an important preventative tool in the dam safety program. Periodic inspections also help identify dams where significant development has occurred downstream. Greater population at risk requires more stringent design flood and seismic loads.

Responsibility for Inspection of Dams in Washington

Responsibility for the inspection of the 1,174 dams in Washington rests with several agencies.

- Federally-owned and operated dams, such as facilities owned by the U.S. Army Corps of Engineers, Bureau of Reclamation, and various agencies of the Department of Interior are inspected by dam safety units within their respective federal agencies. (86 dams)
- Non-federal hydropower dams, licensed by the Federal Energy Regulatory Commission (FERC) are inspected by private engineering consultants every five years, as required as part of FERC hydropower licensing. (59 dams) The only role of Ecology's Dam Safety Office is as a repository of copies of those private consultant generated reports.
- The remaining 1,029 dams are the sole responsibility of Ecology under RCW 43.21A.064(2). High and significant hazard state-regulated dams are inspected on a periodic basis by Ecology's Dam Safety Office.

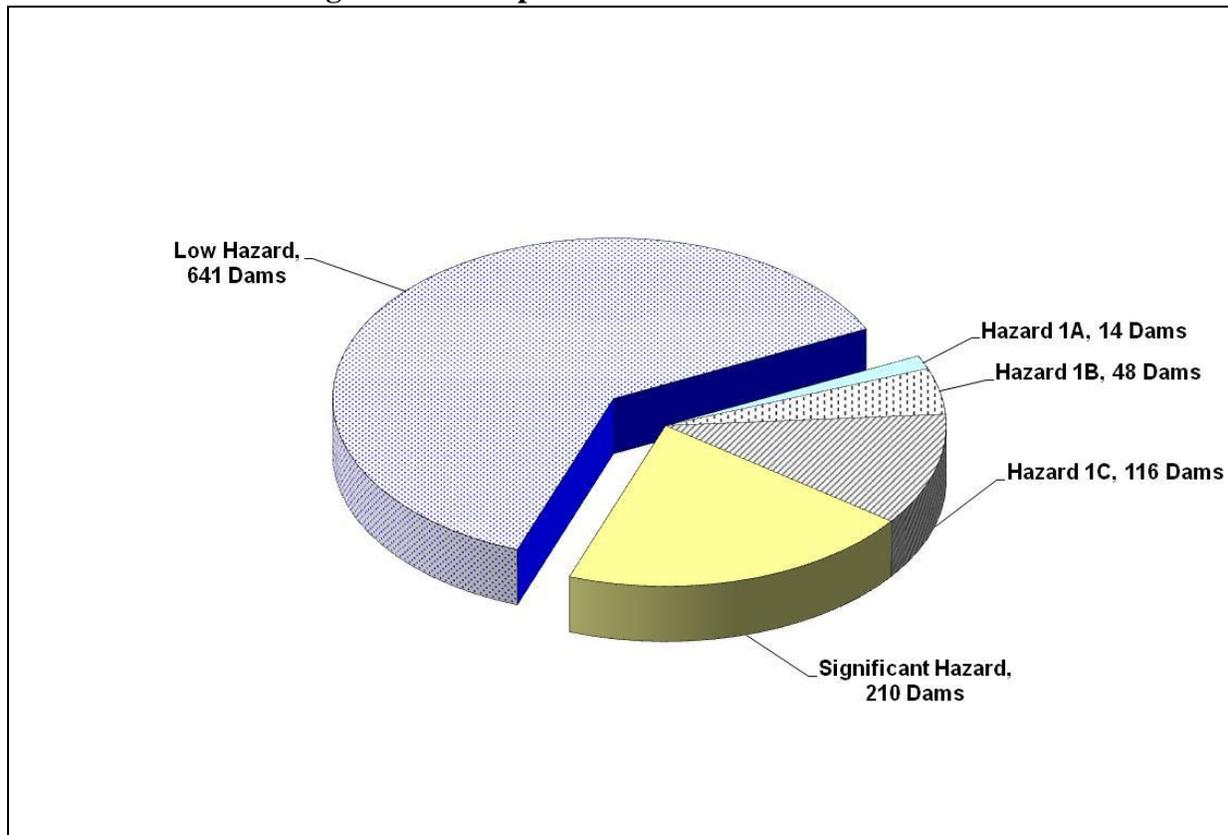
Number of Dams Classified as High or Significant Downstream Hazard Potential

As stated above, Ecology currently has sole regulatory authority over 1,029 dams. Of these, 388 dams are situated above populated areas, and are classified as having *high* or *significant* downstream hazards if they were to fail. Priority is given to the periodic inspection of these 388 dams.

The number of dams classified as high or significant hazard potential has increased significantly from those reported in prior years. This increase in the number of dams primarily resulted from the unpermitted dams initiative, which added 28 high and 19 significant hazard dams. Some dams were also added as new dams were built, or as existing dams were inspected and downstream hazard classifications were upgraded to reflect current development in the downstream valley. Of these 388 dams, about two-thirds are privately owned, and one-third are publicly owned. The breakdown of dams by hazard classification is shown in Figure A.

Figure A: Number of Dams by Hazard Classification

Refer to the table on Page 1 for descriptions of hazard classifications



Current Dam Safety Inspection Program

The Dam Safety Office conducts periodic inspections of particular projects to reasonably secure safety to life and property, as authorized under RCW 43.21A.064. In 2004, the Dam Safety Office formalized its periodic inspection program with the adoption of WAC 173-175-705. Under this program, inspections are performed on dams where there is the potential for loss of life and significant property damage in the event of a dam failure. Dams with *high* hazard classifications are to be inspected on a 5-year cycle. Dams with *significant* hazard classifications

were initially inspected on a 10-year cycle. However, a 2009 legislative budget provision requires Ecology to inspect significant hazard dams every five years starting July 1, 2009. The periodic inspection program does not include dams classified as *low* hazard.

The inspections are performed by professional engineers from the Dam Safety Office and involve:

- Review and analysis of available data on the design, construction, operation, and maintenance of the dam and its appurtenances.
- Visual inspection of the dam and its appurtenances.
- Evaluation of the safety of the dam and its appurtenances, which may include assessment of the hydrologic and hydraulic capabilities, structural stabilities, seismic stabilities, and any other condition which could constitute a hazard to the integrity of the structure.
- Evaluation of the downstream hazard classification.
- Evaluation of the operation, maintenance, and inspection procedures employed by the owner and/or operator.
- Review of the emergency action plan for the dam including review and/or update of dam breach inundation maps.

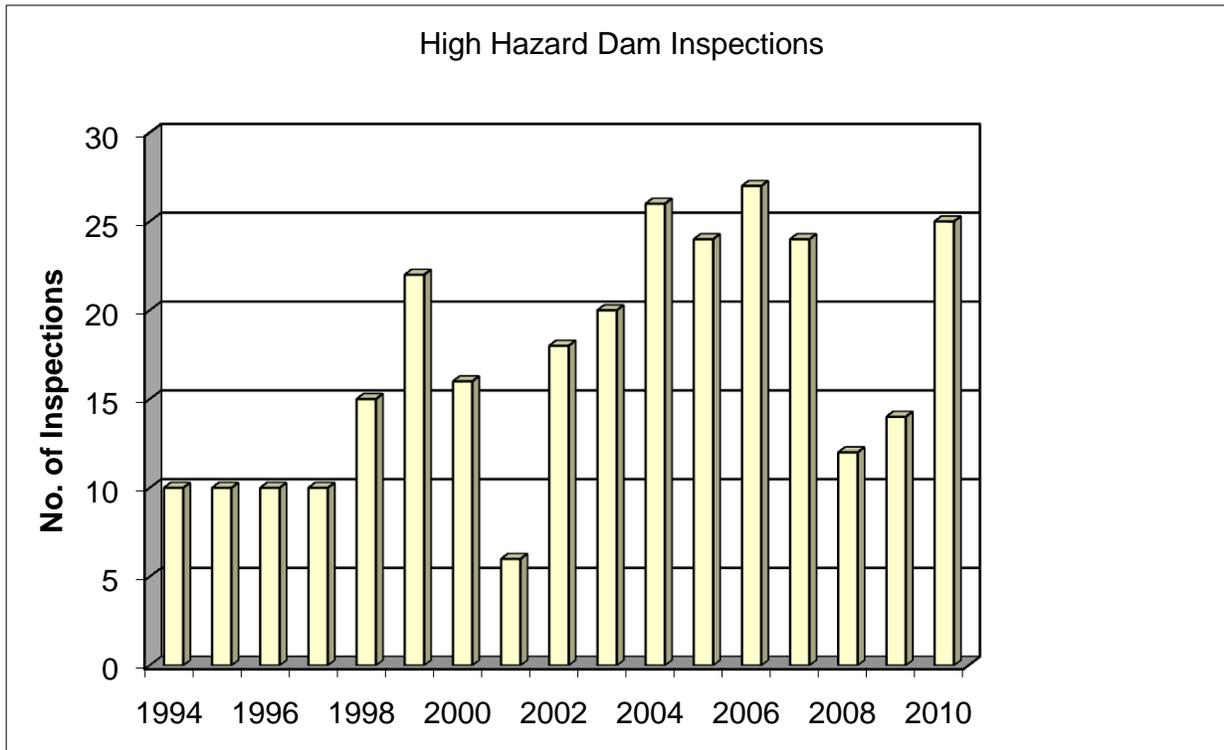
The Dam Safety Office prepares a comprehensive report of the findings for the owner, which includes findings from the inspection, and any remedial work required.

Between 2007 and 2010, 75 high hazard dams were inspected under the regular periodic inspection program, and eight were found to have serious deficiencies. In addition, another 95 potential high hazard dams were investigated as part of the unpermitted dams initiative, and 14 of these dams had safety deficiencies.

Ecology also inspected 60 smaller dams where there is a moderate to low potential for loss of life in the event of a dam failure. Two of these significant hazard dams had safety deficiencies. In addition, another 142 potential significant hazard dams were investigated under the unpermitted dams initiative, and six of these dams had safety deficiencies.

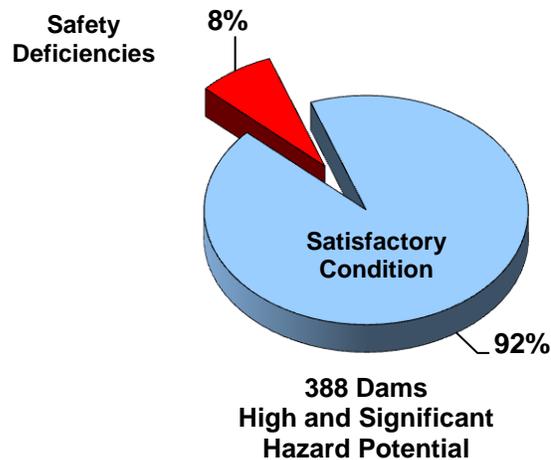
Figure B provides a summary of the high hazard dam inspection activity over the last 16 years. As can be seen in the figure, the level of high hazard dam inspection activity decreased in 2008 and 2009, largely due to the workload imposed by the unpermitted dams initiative. However, now that the initiative is complete, high hazard inspections have rebounded to meet the 5-year cycle.

Figure B: Summary of Periodic Inspection Activity Since 1994



Up to this point, this report has focused on the identification of dams with deficiencies and progress in correcting those deficiencies. Figure C gives a broader perspective of the periodic inspection program for dams situated above populated areas. This chart shows that most of the dams above populated areas are in satisfactory condition, but there are still a significant number of dams that are in need of repairs.

Figure C: Condition of Dams Above Populated Areas in Washington - 2010



Remedial Activity

Progress in Repairs to Dams during 2007-2010

Based on inspections performed in 2007 through 2010, 30 dams were added to the list of dams with safety deficiencies. This increase was largely due to the unpermitted dams initiative, which discovered 20 unpermitted high and significant hazard dams with safety deficiencies. Because of this increase, more dams were added (30) to the list as having deficiencies than were removed (20). Table 3 summarizes the dams where repairs were completed during this period.

Table 3: Dams Repaired or Modified in 2007 through 2010

County	Project and Dam Name	Owner
CHELAN	Great Depression Reservoir	Lappin Forest LLC
FERRY	Grouden Dam	U.S. Forest Service
GRAYS HARBOR	Swano Lake Dam	Grays Harbor College
KING	Masonry Dam (Cedar Moraine)	Seattle Public Utilities
LEWIS	Brian Dam	Michael B. Scott
PIERCE	Lake Tapps Dike No. 15	PSE/Cascade Water Alliance
SAN JUAN	Buck Mountain Reservoir Dam 2	Eastsound Water Users
SPOKANE	Hog Lake Dam	Wash. State Dept. of Fish & Wildlife
STEVENS	Beitey Lake Dam	Gerald Beitey
THURSTON	Berger Dam	Robert Strawn & Jeffry Wong
YAKIMA	Berghoff Dam	Dwight Berghoff
	Den Hoed Dam No. 2	Art Den Hoed
	Evans Flavorland Res. 1 and 2	Bill Evans
	Evans Pond Dam	Bill Evans
	Evans Tieton Pond	Bill Evans
	Gamache Dam	Black Star Orchards
	Pride Packing Ranch 19 Dam	Pride Packing Company
	Roche Pomona Dam	Roche Fruit Company.
	Zirkle Selah-Naches Reservoir	Zirkle Fruit Company

Remedial work has now been completed on 171 of the cumulative 209 dams that have been identified since 1981 as having safety deficiencies (Figure D). In addition, partial repairs have been completed on 11 dams. As shown in Figure D, there was a significant increase in the number of dams found with deficiencies between 2007 and 2010, and a corresponding increase in the number of dams repaired. This is largely due to the dams found as part of the unpermitted dams project in 2008 and 2009, which discovered 20 dams with safety deficiencies. The remaining increase was due to aging materials, lack of maintenance, or dams not meeting higher safety standards required by downstream population growth or increasing seismic standards.

CUMULATIVE NUMBER OF DAMS SINCE 1981

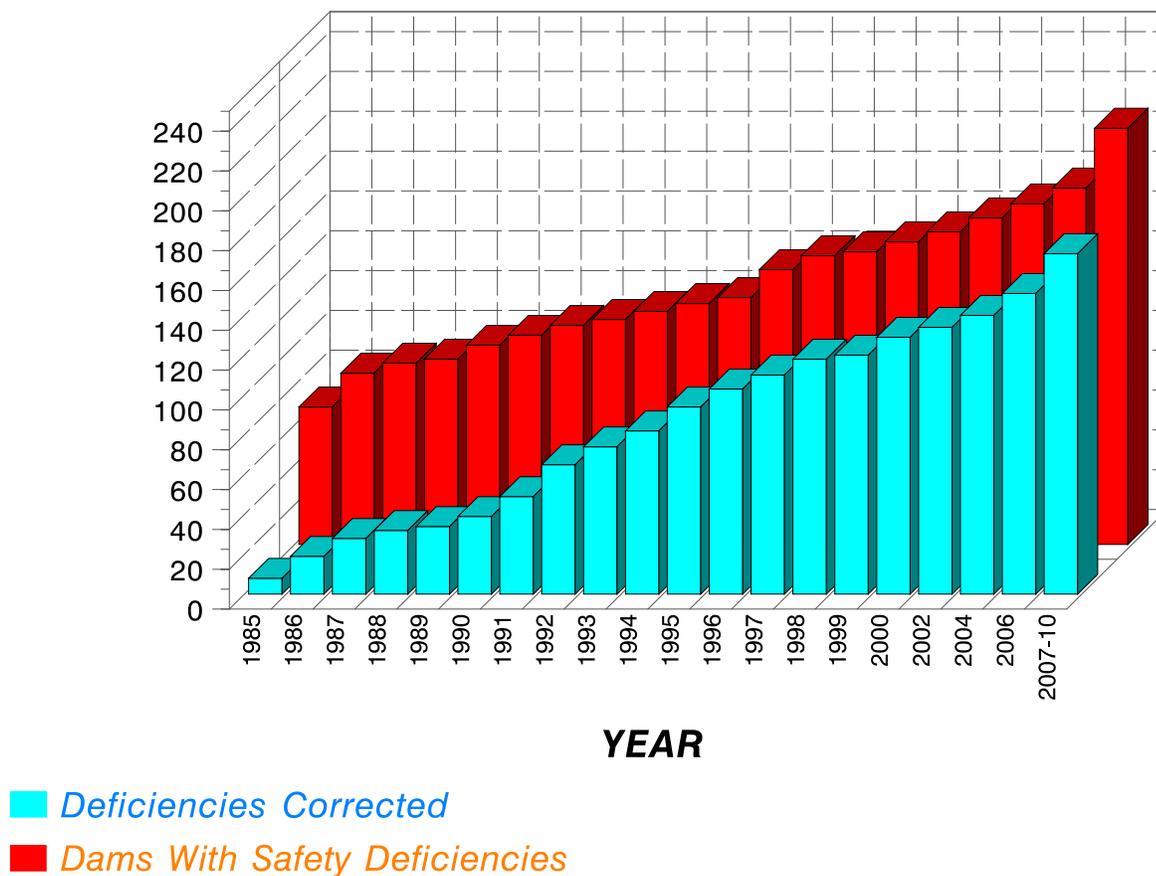


Figure D: Cumulative Summary of Corrective Action

Conclusions

There are now 388 dams in Washington sited above populated areas for which Ecology's Dam Safety Office is the sole regulatory agency, an increase of 55 dams since 2006. This sharp increase was primarily due to the discovery of dozens of dams under the unpermitted dams initiative. Despite this increase in workload, all of the 188 dams located upstream of three or more residences (high downstream hazard potential) have been inspected at least once and are now on a five-year inspection cycle. The first round of inspections for the 210 dams classified as having a significant downstream hazard has also been completed, and these projects are also on a 5-year inspection cycle. The addition of two engineering positions in the 2009 budget allowed the Dam Safety Office to complete the unpermitted dams project and still meet the inspection workload required to achieve these cycles. This resulted in 75 inspections of high hazard dams, 60 inspections of significant hazard dams, and over 200 inspections of unpermitted dams.

In 2007 through 2010, after a few years of progress in reducing the backlog, there was a significant increase in the listing of dams with safety deficiencies. The unpermitted dams initiative alone added 20 dams with safety deficiencies to the list. Another 10 dams were added to the list from our regular periodic inspection activity. Aging dams are deteriorating and may lack maintenance, or do not meet higher safety standards required by downstream population growth or increasing seismic standards. This was evidenced by the failures of Mill Creek Dam in 2008 and the French Slough Dairy Waste Lagoon in 2010.

Despite the large jump in the number of dams with deficiencies and the workload imposed by the unpermitted dams project, Ecology was able to get 20 dams with deficiencies repaired during this period. Adding two engineering staff in 2009 and implementing new efficiency measures to streamline inspections and report writing provided more staff hours for compliance and enforcement.

To date, safety deficiencies have been identified on a total of 209 dams, and actions to correct deficiencies are summarized below:

- Deficiencies fully corrected on 171 dams.
- Partial repairs completed on 11 dams.
- Engineering studies and/or design work is underway for 19 dams.

Some deficient dams have been on the list for several years with minimal progress on correcting safety deficiencies. These dams have significant deficiencies but do not pose an imminent threat of failure, so enforcement actions have not yet been taken. Owners of these dams have cited insufficient funding as the reason for their lack of progress in getting repairs done.

Unless state or federal funding becomes available for repairing and maintaining existing infrastructure, many owners will not be able to afford repairs, and needed dam repairs will continue to languish. While legislation has been introduced in Congress to create a federal loan fund for repairing the nation's unsafe publicly owned dams, no funding programs are on the horizon for privately owned dams. Until funding can be secured, Ecology will continue to prioritize ensuring that unsafe dams with the greatest number of lives at risk downstream are repaired first. The department will work closely with owners to find innovative ways to reduce the cost of making these necessary repairs. Ecology is also using a portion of our FEMA National Dam Safety Grant to

prepare Emergency Action Plans for all high hazard dams without one, to ensure adequate warning and evacuation in the event of an incident or failure.

Appendix A - Project Status

The status of the remaining projects with uncorrected deficiencies as identified during the Ecology inspections prior to 2007 is provided in Table I. The dams identified as having deficiencies from 2007 through 2010 are shown in Table II.

Within these tables, individual projects are listed by county location and project name in alphabetical order. The dam identification numbers are also provided as listed in the state inventory of dams. Project owners are listed next, followed by a brief description of the identified major safety deficiencies. The status of activity, reflecting, in part, the owners' attitude to make the needed repairs or modifications, is indicated by the following letter codes:

- C** - Deficiencies corrected
- I** - Some deficiencies corrected-necessary modification incomplete
- S** - Action started but currently not progressing
- P** - Action started and studies and/or work progressing satisfactorily
- A** - Informal enforcement action initiated (i.e., advisory/warning letter)
- R** - Formal enforcement action initiated (i.e., regulatory order issued)
- N** - No response or progress
- L** - Regulatory order appealed to Pollution Control Hearings Board or in litigation
- F** - Inadequate funding for repairs cited by owner

The final columns in the tables provide information on rehabilitation or modification costs. Where no detailed engineering assessment was available, an estimated cost range was provided based on an assumed range of probable options that may come under consideration. These figures are shown to indicate the relative order of magnitude of the problem and, necessarily, cannot be assumed to be highly reliable.

TABLE I: PROJECT REHABILITATION STATUS SUMMARY OVER LAST 4 YEARS
(DAMS INSPECTED PRIOR TO 2006)

County I.D #	Project Name	Owner	Safety Deficiencies	Status Attitude		Estimated Repair Cost \$ Thousands	Repairs Completed	Population at Risk
				2006	2010			
BENTON	Blair Reservoir Dam	Kennewick Irrigation District	Inadequate Spillway	A,P	S	50-100	None	30-50
CHELAN 194	Great Depression Reservoir Dam	Lappin Forest LLC	Inadequate Spillway Capacity	A,P	C	5-10	Completed	10-15
72	Meadow Lake Dam	Galler Ditch Co.	Inadequate Spillway Capacity	S	S, F	10-20	None	7-15
FERRY 622	Grouden Dam	U.S Forest Service	Inadequate Spillway Capacity	P	C	100-200	Completed	6-12
GRAYS HARBOR 663	College Hill Reservoir	City of Hoquiam	Seismic Stability Issues	S	S	50-100	None	50-100
547	Swano Lake Dam	Grays Harbor College	Spillway Pipe Deterioration	A,P	C	100	Completed	1-3
ISLAND 691	Minckler Dam B	Sherwood Minckler	Embankment Stability	A,P	A,I,P,F	20-50	Partial	10-15
KING 255	Masonry Dam	Seattle City Light	Cedar Moraine Stability	A,P	C	3,000	Completed	1-10

C = Deficiencies corrected; I = Some deficiencies corrected, but incomplete; S = Action started but currently not progressing; P = Progressing satisfactorily A = Informal enforcement action; R = Regulatory Order issued; N = No response or progress; L = Litigation; F = Inadequate Funding for repairs by owner

County I.D #	Project Name	Owner	Safety Deficiencies	Status Attitude		Estimated Repair Cost \$ Thousands	Repairs Completed	Population at Risk
				2006	2010			
KLICKITAT 446	Johnson Creek Res.	Jim Meduna	Spillway Erosion	P	P	20-30	None	1-3
OKANOGAN 220	Forde Lake Dam	WA Department of Fish and Wildlife	Spillway Erosion	P,I	P,I, F	10	Partial	10-30
PACIFIC 522	Indian Creek Dam	City of Ilwaco	Inadequate Freeboard	P, I	P, I	20	Partial	1-3
PIERCE 366	Lake Tapps Dike No. 15	Cascade Water Alliance	Seismic Stability of Embankment	P,I	C	500	Completed	10-30
SAN JUAN 486	Buck Mountain Reservoir Dam 2	Eastsound Water Users	Deteriorated Outlet Conduit	A,P	C	50-100	Completed	3-10
444	Roache Harbor Dam	Roache Harbor Water Co.	Inadequate Spillway Capacity	P	S	100	None	3-10
SKAGIT 382, 383,384	Cultus Mountain Dams A, B, and C	Evergreen Council, Boy Scouts of America	Spillway Rehabilitation, Seismic Stability	S	C	10-70	Completed	3-10
141	Nookachanps Hills Dam	MV Association	Inadequate Spillway Cap., Embankment Stability	S, I	S	30-50	Partial	3-6
SNOHOMISH 1521, 1522	Neilson Dams B & C	Green Acres Mobile Home Park	Inadequate Spillway Capacity	P	A,S	10	None	7-10

C = Deficiencies corrected; I = Some deficiencies corrected, but incomplete; S = Action started but currently not progressing; P = Progressing satisfactorily A = Informal enforcement action; R = Regulatory Order issued; N = No response or progress; L = Litigation; F = Inadequate Funding for repairs by owner

County I.D #	Project Name	Owner	Safety Deficiencies	Status Attitude		Estimated Repair Cost \$ Thousands	Repairs Completed	Population at Risk
				2006	2010			
205 STEVENS	Rainbow Springs Dam	Rainbow Springs Community Club	Outlet Pipe Deterioration	A,P	P	20	None	10-20
64 THURSTON	Beitey Lake Dam	Gerald Beitey	Inadequate Spillway	S,R,L P,L	C	30	Completed	10-20
220 WHATCOM	Berger Dam	Robert Strawn & Jeffry Wong	Inadequate Spillway Capacity	P	C	15-25	Completed	1-3
1719 YAKIMA	Bagley Dam	U.S. Forest Service Mt. Baker District	Concrete Deterioration	P	S, F	10-100	None	1-3
1809	Berghoff Dam	Dwight Berghoff	Inadequate Spillway Capacity	S, I	C	20-30	Completed	1-3
1010	Stevenson Dam	Robert White	Inadequate Spillway Capacity	A,S	C	20-50	Completed	3-6

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TABLE II: PROJECT REHABILITATION STATUS SUMMARY
(DAMS INSPECTED BY DAM SAFETY OFFICE BETWEEN 2007 & 2010 AND FOUND TO HAVE DEFICIENCIES)

County	I.D #	Project Name	Owner	Safety Deficiencies	Status/Attitude	Estimated Repair Cost \$ Thousands	Repairs Completed	Population at Risk
					2010			
CLALLAM								
	2003	Interfor Pacific Stormwater Dam	Interfor Pacific	Inadequate Spillway Capacity,	A, P	50	None	10-30
COLUMBIA								
	1286	Spring Lake Dam	WA Department of Fish and Wildlife	Inadequate Spillway, Embankment Stability	A,S,F	50-100	None	1-3
GRANT								
	1943	Lawrence Orchard Dam	Josh Lawrence	Inadequate Spillway	A,S	10-20	None	1-6
JEFFERSON								
	726	Port Townsend Paper ASB Lagoon	Port Townsend Paper Co.	Seismic Stability Issues	A,P	50-100	None	3-6
KING								
	195	Crystal Lake Dam	Crystal Lake Inc.	Inadequate Spillway Capacity	A,I,P,F	50-100	Partial	50-100
	671	Port of Seattle Lagoon No. 3	Port of Seattle	Inadequate Spillway Capacity & Freeboard	A,I,P	30-50	Partial	10-20
KITSAP								
	188	Tahuya Lake Dam	Tahuyeh Lake Community Club	Inadequate Spillway Side Wall	A,P,F	10-20	None	90-100
LEWIS								
	1959	Brian Dam	Michael Scott	Inadequate Spillway Capacity	C	10-20	Completed	10-20
PEND OREILLE								
	46	Cedar Lake Dam	Ron & Ellen Rock	Inadequate Spillway Capacity	A,I,P	10-25	Partial	10-15

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TABLE II: PROJECT REHABILITATION STATUS SUMMARY (cont)

County I.D #	Project Name	Owner	Safety Deficiencies	Status/Attitude	Estimated Repair Cost \$ Thousands	Repairs Completed	Population at Risk
				2010			
PIERCE							
421	Lake Tapps Dike No. 3	Cascade Water Alliance	Embankment Stability, Seepage	A,P	100-150	None	30-100
SNOHOMISH							
199	Kayak Lake Dam	Mountain View Park Comm. Club	Inadequate Spillway Capacity	A,P	20-30	None	10-30
SPOKANE							
56	Hog Lake Dam	WA Department of Fish and Wildlife	Inadequate Spillway	C	30-50	Completed	10-30
720	Spokane Hutterian Brethren Dam	Spokane Hutterian Brethren	Inadequate Stability, Seepage, Inadequate Spillway Capacity	R,P	50-100	None	1-3
STEVENS							
1324	Beryl Baker Dam	Beryl Baker	Inadequate Spillway Capacity	A,I,P	50-100	Partial	10-30
WHATCOM							
175	Louise Lake Dam	Sudden Valley Community Assoc.	Inadequate Spillway & Outlet Pipes	A,P	50-100	None	1-6
YAKIMA							
1936, 1937, 1938	Avalon Fruit Dams 1,2,3	Avalon Fruit Co.	Inadequate Spillway Capacity, Seepage	A,I,P,F	50-100	Partial	10-30
2018	Bosma Dairy Dam 3	Steve Bosma	Inadequate Spillway, Embankment Stability	A,P	20-40	None	1-3
1949	Den Hoed Dam No. 2	Art Den Hoed	Inadequate Spillway Capacity	C	30-60	Completed	30-50
715, 716	Evans Flavorland Reservoirs No 1 and 2	Bill Evans	Inadequate Spillway Capacity	C	100	Completed	30-50

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TABLE II: PROJECT REHABILITATION STATUS SUMMARY (cont)

County I.D #	Project Name	Owner	Safety Deficiencies	Status/Attitude	Estimated Repair Cost \$ Thousands	Repairs Completed	Population at Risk
				2010			
YAKIMA							
717	Evans Tieton Pond Dam	Bill Evans	Inadequate Spillway Capacity	C	100	Completed	10-30
1919	Evans Pond Dam	Bill Evans	Inadequate Spillway Capacity	C	30-50	Completed	1-6
1947	Gamache Dam	Black Star Orchards	Inadequate Spillway Capacity	C	50	Completed	10-20
2019, 2020	Liberty Acres Dairy Dams 1 and 2	Steve Bosma	Inadequate Spillway, Embankment Stability	A,P	30-50	None	1-3
719	Pride Packing Ranch 19 Dam	Pride Packing Co.	Inadequate Spillway Capacity	C	100-150	Completed	30-50
1918	Roche Pomona Dam	Roche Fruit Co.	Inadequate Spillway Capacity, Embankment Stability	C	100-150	Completed	30-50
1964	Zirkle Selah-Naches Reservoir	Zirkle Fruit Co.	Inadequate Spillway Capacity	C	20	Completed	10-20

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