



DEPARTMENT OF
ECOLOGY
State of Washington

Status of High and Significant Hazard Dams

2018 Report to the Legislature

January 2019

Publication 18-11-016

Publication and Contact Information

This document is available on the Department of Ecology's website at:
<https://fortress.wa.gov/ecy/publications/summarypages/1811016.html>

For more information contact:

Water Resources Program
P.O. Box 47600
Olympia, WA 98504-7600
Phone: 360-407-6872

Washington State Department of Ecology – www.ecology.wa.gov

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

To request ADA accommodation including materials in a format for the visually impaired, call Ecology at 360-407-6872 or visit <https://ecology.wa.gov/accessibility>. People with impaired hearing may call Washington Relay Service at 711. People with speech disability may call TTY at 877-833-6341.

Status of High and Significant Hazard Dams

2018 Report to the Legislature

By

Joe Witzak, P.E.

Dam Safety Office Manager

Water Resources Program
Washington State Department of Ecology
Olympia, Washington

This page is purposely left blank

Table of Contents

| | <u>Page</u> |
|---|-------------|
| List of Figures and Tables..... | vi |
| Figures..... | vi |
| Tables..... | vi |
| Executive Summary..... | vii |
| Introduction..... | 1 |
| Overview..... | 1 |
| Dam Safety Hazard Classifications | 1 |
| Dam Information..... | 2 |
| Dam Safety Office Activities..... | 4 |
| About DSO..... | 4 |
| Inspection Services | 4 |
| Construction Services | 5 |
| Emergency Response Services | 5 |
| Dams with Safety Deficiencies..... | 6 |
| Significant Issues | 8 |
| Dam Safety Fee Increase | 8 |
| Dam Failures and Incidents | 8 |
| Efforts to Reduce Risks of Dam Failure..... | 10 |
| Current Efforts | 10 |
| Future Ideas..... | 10 |
| Conclusions..... | 11 |
| Appendices..... | 12 |
| Appendix A. Table of Deficient Dams | 12 |

List of Figures and Tables

Page

Figures

| | |
|---|------|
| Figure 1 Dams in Washington State | viii |
| Figure 2 Number of Dams by County..... | 3 |
| Figure 3 Dam Construction Dates..... | 3 |
| Figure 4 Common Dam Deficiencies | 6 |

Tables

| | |
|------------------------------|----|
| Table 1 Deficient Dams | 14 |
|------------------------------|----|

Executive Summary

This report is submitted as provided by RCW 90.54.160 which states:

“The department of ecology shall report to the legislature on the last working day of December of 1984, 1985, and 1986, and thereafter 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”.

Please note that Ecology does not conduct studies to estimate the correction costs nor are owners required to report these costs to Ecology. For that reason, estimated costs to correct deficiencies are not provided in this report.

There are 1,189 dams in Washington State requiring regulation by a dam safety authority. The Washington State Dam Safety Office (DSO), located within Ecology’s Water Resources Program, provides safety oversight for 1,055 of those dams. The remaining 134 dams are regulated by the federal government.

Of the 1,055 dams regulated by Ecology, 409 are categorized as *high* or *significant* hazard dams which means their failure would threaten human lives and/or cause substantial economic or environmental damage. Ecology has assigned a condition assessment rating of “poor” or “unsatisfactory” to 44 (11%) of these dams. A table identifying the 44 dams and their key attributes can be found in Appendix A.

Ecology’s strategy to address dams with deficiencies is to provide the owner with technical assistance to gain voluntary compliance. Formal enforcement action is only used as a last resort. When possible, Ecology works with owners to find innovative ways to reduce the cost of making necessary repairs.

The owners of 89% of dams have taken the necessary steps to stay in compliance with dam safety requirements. Owners who have not corrected deficiencies typically are private dam owners who often cite a lack of funding to bring their dam into compliance. Where corrections are not made, Ecology focuses technical assistance and regulatory oversight on those dams with a higher likelihood of failure and greater impact on human life and the community should failure occur.

Over the last 50 years, there have been 17 dam failures for an average of one dam failure every three years. Since the 2010 Legislative Dam Safety Report, there have been two dam failures: Wenner Lakes Dams in Okanogan County, and Bonasa Breaks Ranch Dam in Asotin County. In addition, there was a significant dam incident at Eightmile Lake Dam in Chelan County, but no failure occurred.

Ecology continues to look for way to improve the State’s dam safety program through innovation, efficiency and collaboration. These efforts are aimed at reducing the risks posed by dams to human life, property and the environment. Improvements are needed given that aging dams are deteriorating; may lack adequate maintenance; and may not meet currently accepted safety standards for changing conditions such as downstream development and seismic vulnerability. Furthermore, climate change has resulted in longer, hotter summers leading to increased wildfires

and more intense precipitation run-off. This increases the hydraulic demands on dams. Of all the efforts Ecology is making to reduce dam risks, the decision to hire a dedicated compliance person to assist dam owners is expected to have the greatest impact.

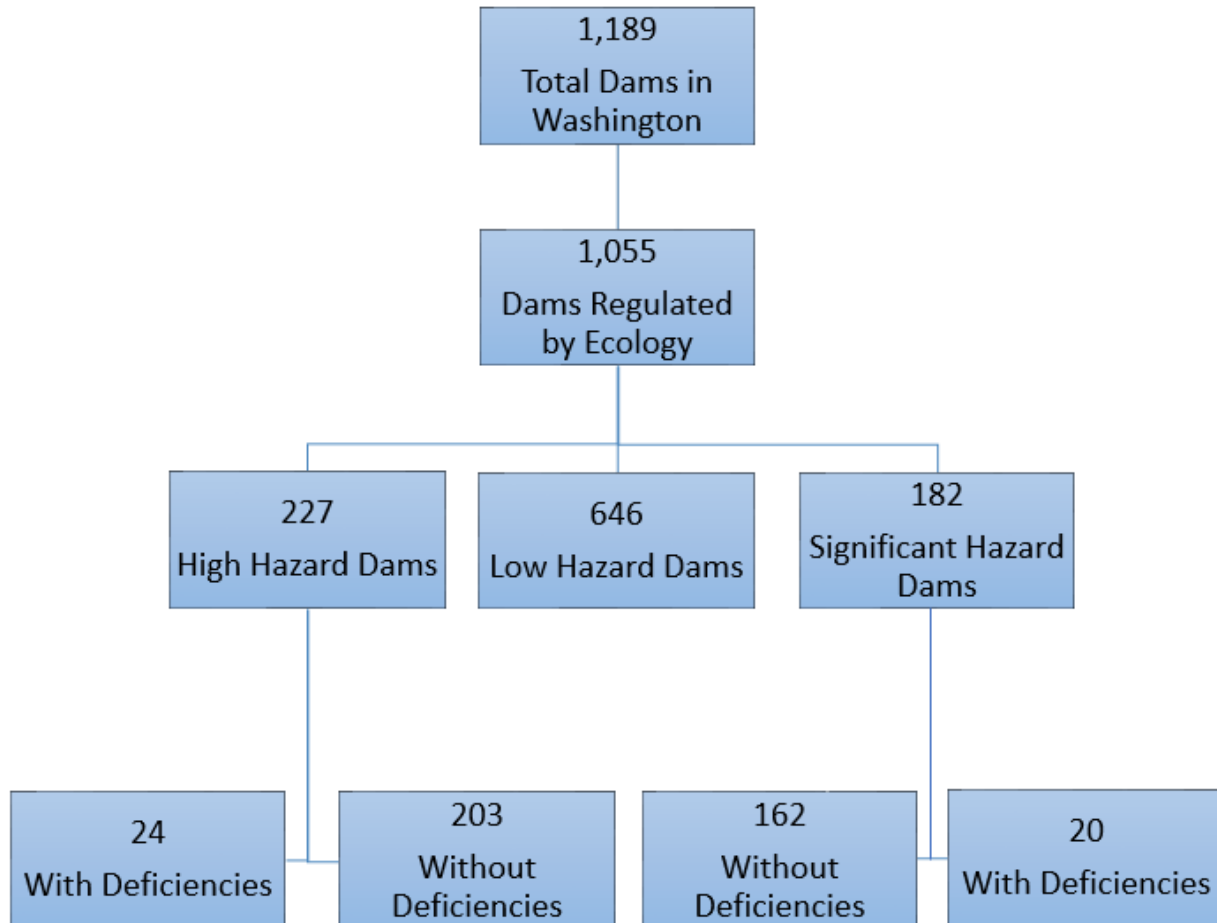


Figure 1 Dams in Washington State

Introduction

Overview

In Washington, a dam is defined as any artificial barrier that has the ability to impound at least 10 acre-feet of water (about 3.25 million gallons). There are 1,189 such dams located in Washington requiring safety regulation. The Washington State Dam Safety Office (DSO), located within the Department of Ecology's (Ecology's) Water Resources Program, provides safety oversight for 1,055 of those dams. The remaining 134 dams are regulated by the federal government. The requirements for dam safety are set forth in Chapter 173-175 Washington Administrative Code (WAC).

This report is submitted as provided by RCW 90.54.160 which states:

“The department of ecology shall report to the legislature on the last working day of December of 1984, 1985, and 1986, and thereafter 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”.

The list of these dams and attributes, including location, owner names and the owner's level of progress in correcting the deficiencies is contained in Appendix A. Please note that Ecology does not conduct studies to estimate the correction costs nor are owners required to provide these costs to Ecology. For that reason, estimated costs to correct deficiencies are not provided in this report.

Dam Safety Hazard Classifications

All dams are classified by Ecology as having either a *low*, *significant*, or *high* hazard class depending on their potential impact on people, property, and the environment downstream should a dam failure occur. The classification does not relate to the structural or operational condition of a dam.

Ecology assigns a hazard class to each dam as part of the permitting process for new dams or modifications to existing dams. Classifications can change over the life of a dam based on property development and watershed characteristics downstream of the dam. For *high* and *significant* hazard dams, a reassessment occurs every five years during Ecology's periodic inspection.

Ecology classifies dams according to the following guidelines provided in WAC 173-175-130:

- Failure of a *high* hazard dam could threaten seven or more human lives. DSO assumes each residential structure is occupied by three people. So a *high* hazard dam would threaten more

than 2 homes. A *high* hazard classification can also be assigned for excessive economic or environmental impacts.

- Failure of a *significant* hazard dam could threaten up to six lives (2 homes) or the dam impounds materials which could threaten human health upon contact such as wastewater lagoons. A *significant* hazard classification can also be assigned for moderate economic or environmental impacts.

Of the 1,055 dams regulated by Ecology, 409 are categorized as *high or significant* hazard dams. This is an increase of 21 dams since the 2010 Legislative dam safety report. Of these 409 dams, 227 are categorized as *high* hazard dams. The other 182 dams are categorized as *significant* hazard dams. These dams receive prioritized attention by Ecology for design standards and inspection frequency.

The remaining 646 Ecology-regulated dams are classified as *low* hazard dams. Although they must meet the safety requirements for regulated dams, they are not inspected by Ecology unless requested by the owner or a complainant.

Dam Information

Ecology maintains information on all the dams in a database. General information from that database can be found on the Ecology website in the Inventory of Dams report.¹ The inventory is categorized by county. See Figure 2 below for the distribution of dams by county.

About 58% of dams in Washington are owned by a private entity, 21% by local government, 8% by public utility, 7% by the federal government, and 5% by state government. The privately-owned dams are the most likely to have difficulty achieving full compliance with the dam safety regulations. As dams age and require more attention, Ecology expects to have more issues achieving compliance at privately-owned dams.

The average life expectancy of a dam is about 50 years and over half of Washington's dams are at or beyond that age. (See Figure 3 below.) The age of a dam may be a factor in its stability because some materials may deteriorate under continued load and environmental conditions. In addition, as with any technology, there have been enhancements in dam materials, design, and construction techniques over the years that earlier projects could not take advantage of. In particular, seismic design for the earthquake potential in the Pacific Northwest has advanced greatly and some older dams may not withstand the dynamic conditions posed by a significant earthquake.

¹ <https://fortress.wa.gov/ecy/publications/documents/94016.pdf>

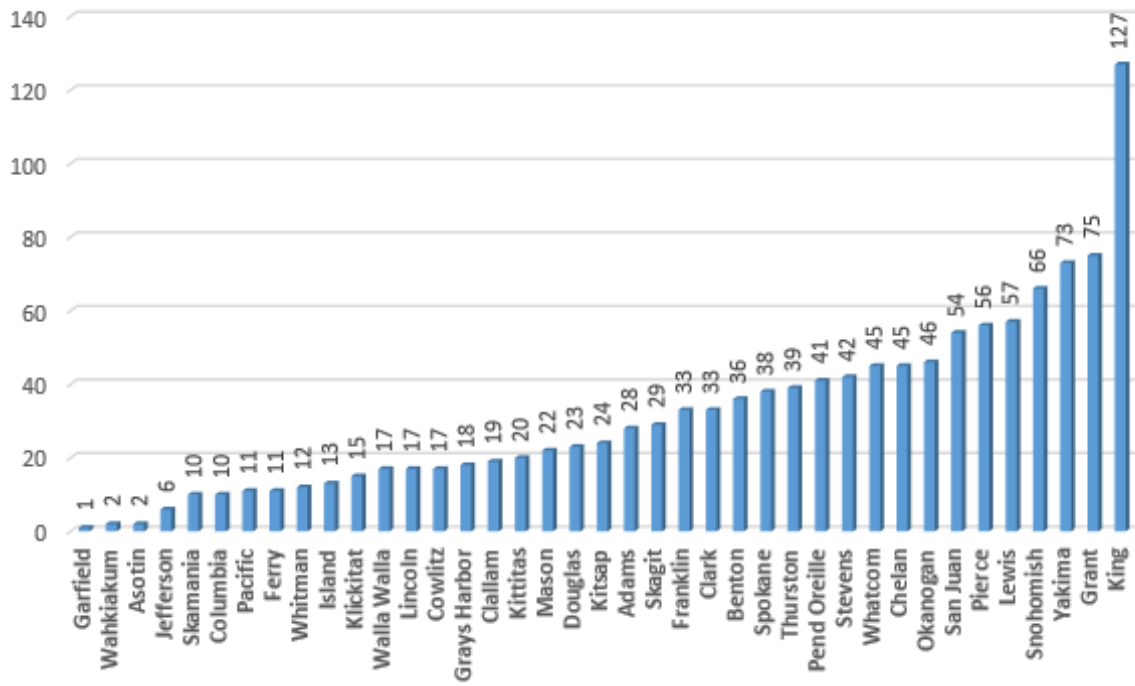


Figure 2 Number of Dams by County

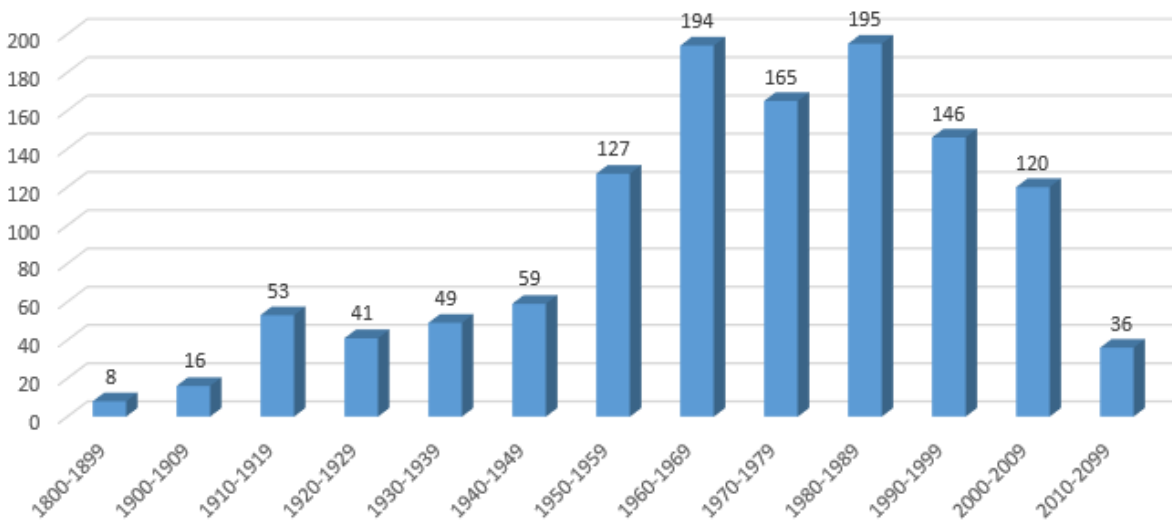


Figure 3 Dam Construction Dates

Dam Safety Office Activities

About DSO

Safety is the top priority and Ecology's DSO has rigorous procedures in place to protect people and property located downstream of dams. In addition to enforcing the dam safety regulations, DSO prepares policy, guidance, and technical memoranda to assist dam owners in safely building and managing dams.

While Ecology regulates the majority of dams in Washington, it is not the only regulator. There are 134 dams that are owned and/or regulated by the federal government including:

- 57 dams - Federal Energy Regulatory Commission (large hydroelectric projects)
- 34 dams - Bureau of Reclamation (federal irrigation projects)
- 16 dams - U.S. Army Corps of Engineers (large flood control dams)
- 27 dams - Other (U.S. Fish and Wildlife Service, National Park Service, etc.)

Ecology stays connected with these agencies through training events, consultations, and joint inspections. Similarly, Ecology works with other states to share information and resources. This is primarily done through the Association of State Dam Safety Officials which is a national non-profit organization representing each state and supported by federal dam safety agencies, dam owners, and dam engineering consultants.

DSO provides three main services: inspection, construction, and emergency response services. Each of these services is discussed below.

Inspection Services

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. Periodic inspections also help identify dams where significant development has occurred downstream. New development could raise the hazard classification of the dam.

Over the last 5 years, Ecology has conducted 409 periodic inspections at *high* and *significant* hazard dams which is about 82 inspections per year. The 646 *low* hazard dams must meet dam safety regulations but are only inspected by Ecology upon request or complaint.

The inspections are performed by DSO's professional engineers and involve:

- Review and analysis of data and information on the dam's history, design and construction.
- Visual inspection of the dam and measurement of key dam features.
- Assessment of the hydraulic capabilities, structural stabilities under static and seismic loading conditions, and any other condition that presents a hazard to the integrity of the dam.
- Evaluation of the downstream hazard classification.

- Evaluation of the dam's operation, maintenance, and inspection procedures.
- Review of the emergency action plan for the dam including dam breach inundation maps.

Ecology prepares a comprehensive report for the owner, which includes findings from the inspection, any change in hazard classification, and any remedial work required to correct deficiencies.

For dams with outstanding deficiencies, Ecology prioritizes its efforts using a risk-based approach. This methodology targets resources to dams with a higher likelihood of failure and greater impact on human life and the community should failure occur. Ecology's priority is public safety. Therefore, dams with more people downstream are designed to a higher standard and receive more oversight.

Construction Services

Any person who wants to build a new dam or modify an existing dam must apply for a dam construction permit from Ecology. Through document reviews and construction inspections, DSO staff help ensure dams are properly designed and constructed. Washington State's Dam Safety regulations require the plans to be prepared by a professional engineer licensed in Washington State. Over the last five years, Ecology has approved 32 dam permits for an average of about seven per year.

After approval of the design through the permitting process, construction must be overseen by the owner's engineering consultant. Ecology also conducts inspections at key points in the construction process to ensure new and modified dams are being built per the approved plans and specifications. Ecology

Emergency Response Services

Ecology is available to support dam owners and emergency responders facing dam emergencies and incidents.

In the event of an emergency situation, the DSO offers technical assistance and direction to the owner; provides information on a dam's attributes and potential impacts; and helps communicate between various parties. In Washington State, the dam owner has primary responsibility for managing a dam during an emergency. The primary responsibility for public alerts and evacuations lies with local emergency responders. In the event of an emergency, dam owners are instructed to call 9-1-1 to reach local and state emergency responders. The State Emergency Management Division can reach DSO staff 24 hours a day, 7 days a week.

Ecology also helps owners prepare for the worst through emergency action plans which identify signs of dam problems, people and property at risk, and communication protocols for dam concerns and emergencies. Owners of dams classified as *high* or *significant* hazard are legally required to have emergency action plans in place, but Ecology encourages all dam owners to have plans for emergency situations.

Dams with Safety Deficiencies

Of the 409 *high* or *significant* hazard dams overseen by Ecology, 44 (11%) have safety deficiencies leading to an Ecology-rated condition assessment of “*poor*” or “*unsatisfactory*”. These dams have characteristics which are unwanted, unexplained, or unknown. Without proper management, assessment and correction, they pose an elevated risk of failure. Common deficiencies are listed here and depicted in Figure 4.

- poor vegetation control,
- excessive seepage or piping,
- blocked or inadequately-sized spillways
- failing conduits and valves,
- excessive erosion, cracking, settlement or slope failure
- damage from burrowing animals
- unpermitted and poor design and construction

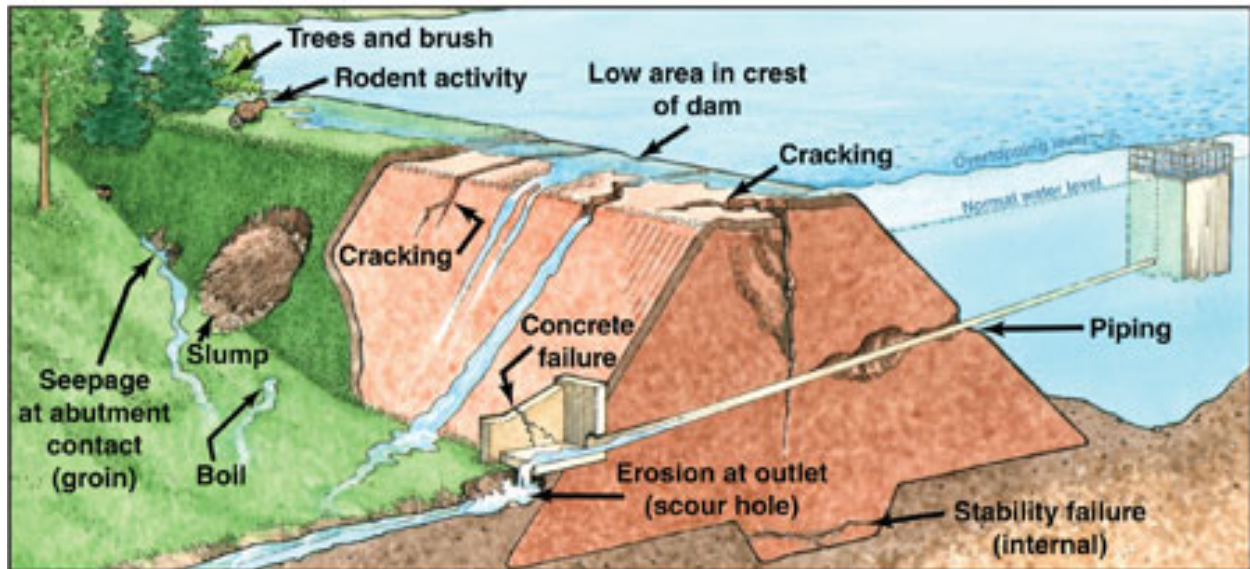


Figure 4 Common Dam Deficiencies

In the 2010 Legislative report, 8% of *high* and *significant* hazard dams were listed as having deficiencies. The increase to 11% could be attributed to a number of factors including the rising age in dams, the subjective nature of dam rating systems, improved knowledge of dam conditions, and the availability of more precise data and technology. Given the variability from these factors, the difference between the 2010 and 2018 percentages is negligible.

Ecology’s strategy to address dams with deficiencies is to provide the owner with technical assistance to gain voluntary compliance. Formal enforcement action is only used as a last resort. When possible, Ecology works with owners to find innovative ways to reduce the cost of making necessary repairs.

Appendix A lists the 44 dams along with key attributes and deficiencies. Ecology has inspected each of those dams within the last five years and will revisit them at least every five years to improve safety. Information on the deficiencies has been provided to the owners along with the required actions to correct the deficiencies. All but four of the 44 dams have Emergency Action Plans in place (all of them should), which help ensure adequate warning and evacuation in the event of an emergency situation.

Of the 44 dams, 27 are making some degree of effort to come into compliance. Some of these dams have restrictions placed on their use to reduce risks, while others are in various states of repair or modification to correct the deficiencies. The other 17 dams have owners who have made little progress towards compliance including those with recurring deficiencies over more than one inspection cycle with minimal progress.

Although privately-owned dams make up 68% of the 44 dams, they represent 100% of dams that have made little or no progress towards compliance. There are various reasons for a dam owner's non-compliance including a lack of priority, limited funding, or disagreement with Ecology's findings. Appendix A provides a "level of compliance" for each of the 44 dams.

Ecology does not always have the time and resources to follow-up with out-of-compliance dam owners by reminder messages, answering questions, and completing formal inspection reports. Without the follow-up, some dam owners lose focus on compliance. In response, Ecology has recently re-prioritized funds to create a compliance staff position to work with dam owners on the remedial actions required by the dam inspectors. This commitment is expected to greatly improve Ecology's ability to track compliance, assist dam owners, and ultimately reduce risks.

Detailed cost estimates to correct the deficiencies are typically not provided to Ecology and are difficult to accurately estimate depending on a number of factors including permitting, design options, location, materials, etc. However, for the 44 dams in Appendix A, Ecology has identified a "level of deficiency" which is a broad estimate of the complexity in addressing the deficiencies. The level of deficiency is one indicator of cost.

It is expected that deficiency levels will increase with time as dam infrastructure ages and deteriorates. These deficiencies may be compounded by limited maintenance funds and increased development below the dams. Furthermore, climate change has resulted in longer, hotter summers leading to increased wildfires and more intense precipitation run-off. This will add to the hydraulic demands on dams.

To manage this anticipated trend, Ecology continues to make improvements to the dam safety program. This includes providing more outreach to owners to help them keep up with evolving dam safety standards and technology for issues such as seismic vulnerability. Other enhancements to the dam safety program are identified in the section below "Efforts to Reduce Risks from Dam Failures".

Significant Issues

New issues since the 2010 dam safety Legislative report include a fee increase for dam owners, two dam failures, and one dam incident.

Dam Safety Fee Increase

RCW 90.03.470 requires Ecology to collect fees to cover the costs of conducting dam safety inspections and reviewing dam plans and specifications. In 2011, the Legislature passed Second Engrossed Substitute House Bill 1087 that authorized Ecology to raise dam safety fees not more than 35% in Fiscal Year 2012 and 4.62% in Fiscal Year 2013. In February 2012, the Department of Ecology amended Chapter 173-175 WAC, Dam Safety, to increase dam safety fees.

DSO's fiscal year 2018 budget was about \$1.1 million state general fund (excluding cost allocation and agency administration) and \$90K federal grant funds. This covered nine staff including the DSO manager and secretary; an environmental specialist; and six engineers. About 27% (\$300K) of the state general fund operating costs are covered by fees.

Dam Failures and Incidents

Wenner Lakes Dams Failure

In August 2014, five dams on the Wenner Lakes in the Benson Creek watershed in Okanogan County were overwhelmed by considerable flooding. This flooding caused the failure of three dams, and the overtopping of the two other dams. Fortunately, there were no fatalities, injuries, or missing persons. The area had previously been burned by the Carlton Complex wildfire. The burned area greatly amplified the rainfall runoff anticipated for the watershed and exceeded the dams' capacity. DSO's engineering analysis of these failures can be accessed on Ecology's website.²

Bonasa Breaks Ranch Dam Failure

The dam, located in Asotin County, was significantly enlarged in 2007-08 without a DSO permit. The dam was poorly designed, constructed, and maintained. It failed suddenly in April 2017 and released about 29 acre-feet of water (over 9 million gallons) which traveled down Rattlesnake Creek and into the Grand Ronde River about 6.5 miles away. The resulting flood caused extensive damage to public infrastructure, private property, and critical stream habitat. Fortunately, no lives were lost. The owner was issued two penalties from Ecology totaling \$115K. DSO's engineering analysis of this failure can be accessed on Ecology's website.³

Eightmile Lake Dam Incident

This 90-year-old dam is located in the Alpine Lakes Wilderness in Chelan County. After the 2017 Jack Creek wildfire, the area was left vulnerable to erosion, flash flooding, and possible

² <https://ecology.wa.gov/Water-Shorelines/Water-supply/Dams/Emergency-planning-response/Incidents>

³ <https://fortress.wa.gov/ecy/publications/documents/1711008.pdf>

2018 Dam Safety Report

dam failure during the 2018 spring runoff. DSO estimated 50 homes could be impacted by a dam failure. The dam owner, the Icicle-Peshastin Irrigation Districts, declared an emergency as did the county. The county Department of Emergency Management led the response effort and notified local residents. DSO provided technical and regulatory support to the work to stabilize and repair the dam. The work was completed in summer 2018.

Efforts to Reduce Risks of Dam Failure

Ecology continues to look for ways to improve the dam safety program through innovation, efficiency and collaboration. These efforts are aimed at reducing the risks posed by dams to human life, property and the environment.

Current Efforts

This list highlights some of Ecology efforts already completed or in progress:

- * **Improve the accuracy of dam data:** DSO hired an engineering intern to help assess and make improvements to the quality and completeness of Ecology's dam data
- * **Increase education and outreach to dam stakeholders:** DSO has updated its web presence and informational documents; created an email ListServe and newsletter; and has reached out to partners in dam safety management.
- * **Improve relationships with emergency managers:** DSO is meeting with the state Department of Emergency Management to coordinate on dam emergency preparedness
- * **Develop relationships with local planners:** DSO is reaching out to local government planners to inform them of dam locations and hazards for their consideration in planning and development decisions
- * **Improve compliance follow-through:** Ecology has re-prioritized funds to hire a staff person to work with dam owners on the corrective actions required by the dam inspectors. This will prepare Ecology to fully comply with statutory reporting requirements in future editions of this dam safety report.
- * **Use Federal Emergency Management Agency (FEMA) funds to help with Emergency Action Plans:** DSO receives an annual grant from FEMA for about \$90,000 which is used to help dam owners prepare Emergency Action Plans.

Future Ideas

This list highlights some of the ideas that Ecology may consider in the future depending on stakeholder interest, priority assessments, budget, and legislative authority. These are not yet recommendations to pursue but reflect Ecology's efforts to continuously improve the program.

- * **Inspect *low hazard dams*:** Some of these dams may now be considered *high* or *significant* hazard dams based on new downstream development
- * **Disclose dams during real estate transactions:** Some transactions occur without awareness that a dam exists on the property or that the property is in a dam's flood path.
- * **Use dam condition and compliance in fee schedules:** Restructure inspection fees to reward dam owners who manage their dams in compliance with dam safety requirements.
- * **Provide a grant/loan program for *high and significant hazard dam owners with limited resources*:** Some states and the federal government already have these programs to help correct deficiencies. The federal National High-Hazard Potential Dam Rehabilitation Grant Program is new but not significantly funded nor viable for privately owned dams.

Conclusions

Ecology's Dam Safety Office provides safety oversight for 1,055 dams in Washington State. This includes providing inspection, construction, and emergency response services. Ecology's assistance contributes to the fact that 365 of the state's 409 *high* and *significant* hazard dams (89%) are in compliance with the state's dam safety laws and regulations.

The other 44 dams (11%) have safety deficiencies leading to a condition assessment of "*poor*" or "*unsatisfactory*". This percentage is typical for Washington State (in the 2010 Legislative report Ecology estimated the percentage as 8%). Therefore, at any one time, about 10% of Washington's *high* and *significant* hazard dams have deficiencies posing elevated risks to the downstream communities.

Of the 44 dam owners, 27 are making some degree of effort to come into compliance. Although privately-owned dams make up 68% of the 44 dams, they represent 100% of dams that have made little or no progress towards compliance. There are various reasons for a dam owner's non-compliance including a lack of priority, limited funding, or disagreement with Ecology's findings.

Ecology recently added a dam safety compliance position which should substantially improve the program's ability to assist dam owners in achieving compliance. This will reduce the overall risk to human life, property, and the environment posed by Washington dams.

Regardless of efforts to reduce risks, dam failures and threatening incidents will continue to occur as dam infrastructure ages and downstream populations increase. The Dam Safety Office will remain supportive of dam owners, emergency responders, and at-risk communities similar to the support provided on the failures at Wenner Lakes Dams and Bonasa Breaks Ranch Dam as well as the threat of failure posed by Eightmile Lake Dam in 2018.

Ecology has a strong dam safety program that rates highly in national assessments conducted by the American Society of Civil Engineers and the Association of State Dam Safety Officials. The Dam Safety Office has undertaken a number of efforts to improve the program and has identified future actions to consider as a means to further reduce the risks posed by the state's dams.

Appendices

Appendix A. Table of Deficient Dams

This table identifies the 44 high and significant hazard dams in Washington that currently have a condition assessment rating of “poor” or “unsatisfactory”. Dams are listed alphabetically by County. Additional information on some of the column entries are provided below.

Deficiency Category

ANALYSIS: engineering analysis or surveying needed for hydrology, geotechnical, or other work

CONDUITS: piping and valve problems

CONSTRUCTION: inadequate materials or construction practices

DESIGN: minimum or standard design requirements not met

DISTRESS: problems with the dam face such as erosion, sinkholes, vehicular damage, cracks, offset joints

LINER: damage to an impoundment’s liner such as tears, stretching, bubbles

SEEPAGE: excessive leakage or piping through the dam

SPILLWAY: damaged, missing or undersized spillway

VEGETATION: excessive vegetation compromising dam integrity, preventing inspection and maintenance, or clogging the spillway

DELINQUENT: past due fees or sent to collections

MAINTENANCE: neglected routine maintenance issues such as burrowing animal control

Level of Deficiency (Cost)

Detailed cost estimates to correct all the deficiencies are typically not provided to DSO and are difficult to accurately estimate depending on a number of factors including permitting, design options, location, materials, etc. Therefore, no cost estimates are provided. However, the table provides a “level of deficiency”. The level of deficiency is one indicator of cost.

HIGH: Deficiencies typically requires a significant construction effort.

MED: Deficiencies may require hiring an outside consultant to perform analyses; or multiple low cost efforts.

LOW: Deficiencies may include routine vegetation removal or minor maintenance/repair

Level of Progress (Ability and Attitude)

This field identifies progress to correct the deficiencies. It reflects the owner's ability and attitude towards their dam responsibilities including their responsiveness, the chronic nature of deficiencies, their ability to fund corrections and their record of paying annual fees.

HIGH: Progressing satisfactorily. Good communication and on-time fee payments

MED: Minimal or partial progress. Good communication and mostly on-time fee payments.

LOW: Little or no progress and communication. Recurring issues. Misses fee payments. Enforcement action taken.

People at Risk

The number of people at risk from a dam failure as typically identified through inundation mapping.

Table 1 Deficient Dams

| County | Dam Name (ID #) | Owner | Deficiency Category | Level of Deficiency | Level of Progress* | People at Risk |
|--------------|--|----------------------------------|-----------------------------------|---------------------|--------------------|----------------|
| Adams | Ritzville Wastewater Lagoons (1812) | City of Ritzville | Analysis, Vegetation, Maintenance | LOW | HIGH | 0 |
| Benton | Paterson Ranch Reservoir (1995) | Zirkle Fruit Company | Distress, Seepage, Vegetation | MED | LOW | 3 |
| Benton | Blair Reservoir Dam (59) | Kennewick Irrigation District | Distress, Spillway, Vegetation | MED | LOW* | 189 |
| Benton | Gap Road Reservoir (1874) | Zirkle Fruit Company | Design, Maintenance | MED | HIGH | 15 |
| Benton | Ste Michelle Canoe Ridge Evaporation Pond (2042) | Ste Michelle Wine Estates | Distress, Spillway, Vegetation | MED | MED | 0 |
| Chelan | Meadow Lake Dam (72) | Galler Ditch Co. | Distress, Spillway, Vegetation | MED | LOW* | 10 |
| Clallam | Elwick Dam (1063) | Douglas Short and Vanessa Brower | Conduits, Vegetation, Delinquent | MED | LOW | 3 |
| Clark | Tri Mountain Estates Dam (103) | Tri-Mountain Estates LLC | Conduit, Distress, Vegetation | MED | MED | 15 |
| Ferry | Boman Reservoir Dam (2021) | Boman Revocable Trust | Distress, Spillway, Vegetation | MED | LOW | 3 |
| Grant | Zirkle Partridge Ranch Dam (2009) | Zirkle Fruit Company | Distress, Liner, Spillway | HIGH | MED | 12 |
| Grays Harbor | Swano Lake Dam (547) | Grays Harbor College | Spillway, Vegetation | LOW | MED* | 3 |

2018 Dam Safety Report

| County | Dam Name (ID #) | Owner | Deficiency Category | Level of Deficiency | Level of Progress* | People at Risk |
|--------------|--|------------------------------|---|---------------------|--------------------|----------------|
| King | Newcastle Railroad Embankment Dam (648) | City of Newcastle | Conduit, Distress | HIGH | HIGH | 12 |
| King | Lake Kittyprince Dam (201) | WA DSHS | Spillway, Vegetation | LOW | MED | 90 |
| Kitsap | Koura Dam (1336) | Meadowmeer Golf Club | Conduits, Distress, Vegetation | MED | MED | 3 |
| Kittitas | Upper Sunlight Lake Dam (666) | Sunlight Waters Country Club | Conduits, Distress, Vegetation | MED | LOW | 12 |
| Klickitat | Johnson Creek Reservoir Dam (446) | 5M LLC | Maintenance, Spillway, Vegetation, Design, Delinquent | MED | MED* | 6 |
| Lincoln | Davenport Sewage Lagoon No. 3 (560) | City of Davenport | Analysis, Distress, Vegetation | MED | MED | 30 |
| Mason | Mason Co. Belfair WWTP Treated Water Storage (728) | Mason County | Distress, Vegetation | HIGH | MED | 45 |
| Okanogan | Fanchers Dam (40) | Antoine Valley Ranch LP | Seepage, Spillway, Vegetation | HIGH | LOW | 35 |
| Okanogan | Schweitzer Dam and Reservoir (2026) | Marion E. Schweitzer | Distress, Spillway, Vegetation, Analysis | MED | LOW | 9 |
| Pacific | Indian Creek Dam (522) | City of Ilwaco | Seepage | MED | HIGH* | 6 |
| Pend Oreille | Metaline Falls Wastewater Lagoon No. 3 (1823) | City of Metaline Falls | Distress, Spillway, Vegetation | MED | HIGH | 0 |
| Pierce | Slavic Lake Dam (1744) | Slavic Christian Center | Distress, Seepage, Spillway, Vegetation | MED | MED | 3 |
| Pierce | Butterworth Dam (178) | WA DOC | Distress, Seepage | HIGH | HIGH | 0 |

| County | Dam Name (ID #) | Owner | Deficiency Category | Level of Deficiency | Level of Progress* | People at Risk |
|-----------|--------------------------------------|---|--|---------------------|--------------------|----------------|
| Skagit | Nookachamps Hills Dam (141) | Nookachamps Hills HOA | Spillway, Vegetation | MED | MED* | 3 |
| Skagit | Whistle Lake Dam (705) | City of Anacortes | Analysis, Distress, Vegetation | HIGH | MED | 12 |
| Skamania | Camp Kwoneesum Dam (131) | Weyerhaeuser Columbia Timberlands | Conduit | HIGH | HIGH | 12 |
| Snohomish | Kayak Lake Dam (199) | Mountain View Park Community Club | Conduits, Seepage, Vegetation | MED | MED* | 9 |
| Snohomish | Nielsen Dam B (1521) | Green Acres Mobile Home Park | Seepage, Spillway, Vegetation, Conduit | MED | LOW* | 9 |
| Snohomish | Nielsen Dam C (1522) | Green Acres Mobile Home Park | Spillway, Vegetation | MED | LOW* | 9 |
| Spokane | Spokane Hutterian Brethren Dam (720) | Spokane Hutterian Brethren | Construction, Seepage, Vegetation | HIGH | LOW* | 18 |
| Spokane | Newman Lake Flood Control Dam (396) | Newman Lake Flood Control Zone District | Distress, Construction | HIGH | MED | 66 |
| Spokane | Fairfield Sewage Lagoon No. 1 (1528) | City of Fairfield | Liner, Vegetation, Maintenance | MED | HIGH | 6 |
| Stevens | Van Stone Pit Lake Dam (2033) | Stevens County | Analysis, Seepage, Vegetation | MED | MED | 9 |
| Stevens | Van Stone Tailings Dam (608) | Stevens County | Distress, Spillway | MED | MED | 0 |
| Stevens | Beryl Baker Dam (1324) | Pearl Street Apartments LLC | Analysis, Spillway, Vegetation | MED | MED* | 24 |
| Stevens | Ponderosa Lake Dam (41) | Pearl Street Apartments LLC | Analysis, Seepage, Spillway | HIGH | MED | 3 |

2018 Dam Safety Report

| County | Dam Name (ID #) | Owner | Deficiency Category | Level of Deficiency | Level of Progress* | People at Risk |
|----------|-------------------------------|--------------------------------------|--|---------------------|--------------------|----------------|
| Thurston | Kyte Dam (1057) | Jorgensen Timber & Winlock Veneer Co | Seepage, Spillway, Vegetation | MED | LOW | 3 |
| Yakima | Parker Reservoir Dam (287) | Michael Harrison | Maintenance, Seepage, Spillway, Vegetation | MED | LOW | 9 |
| Yakima | Evans Konnowac Dam (1933) | Evans Fruit Co. Inc. | Distress, Maintenance | MED | LOW | 3 |
| Yakima | Coleman Dam (1864) | Rabbitbrush Ranch LLC | Construction, Distress, Vegetation | MED | HIGH | 3 |
| Yakima | Black Rock Orchards Dam (506) | Zine & Najiba Badissy | Distress, Spillway, Vegetation, Analysis, Delinquent | MED | MED | 15 |
| Yakima | Evans Pond Dam (1919) | Evans Fruit Co. Inc. | Distress, Maintenance, Analysis | LOW | LOW* | 42 |
| Yakima | Den Hoed Dam No. 1 (1948) | Sunnyside South Ranch LLC | Analysis, Spillway | MED | LOW | 20 |

* An asterisk denotes the dams that are also listed on the 2010 Dam Safety Legislative Report.