

BC DAM SAFETY PROGRAM ANNUAL REPORT 2015/2016

SUMMARY

This annual report summarizes the achievements, challenges and ongoing improvements to the Ministry of Forests, Lands and Natural Resource Operations (FLNRO) dam safety program. In 2015/2016 the program regulated approximately 1,660¹ water supply dams in British Columbia. During that time, regulated dams that divert and/or store surface water required a water licence issued under the *Water Act* and were subject to the B.C. Dam Safety Regulation. However, effective February 29, 2016, the *Water Sustainability Act* and a new Dam Safety Regulation came into force requiring dams that divert and/or store surface and/or ground water to be licenced and adding an additional 217 dams for a total of 1879 regulated dams. Other dams are added as they become known. These structures include, for example, dams associated with hydro-electric power generation, agricultural irrigation, industrial use, municipal water supply and domestic use, as well as structures that regulate lake or river levels.

Highlights of the 2015/2016 dam safety program include:

Operations

- Dam safety staff reviewed plans for 60 dams, including new dams, rehabilitation or upgrading of existing dams and dam removals, compared to 49 last year. Staff were also involved in monitoring 31 dams in the construction, rehabilitation, upgrading or decommissioning phases, down slightly from 32 dams last year.
- Operation, Maintenance and Surveillance manuals and Emergency Preparedness Plans for 37 dams were reviewed. Updates to these documents are scheduled according to the Dam Safety Regulation.
- Changes in failure consequence classification were considered by dam owners. Staff reviewed 11 requests from owners to ensure that the classification is correctly applied in response to downstream conditions.
- Program staff trained 51 dam owners or their representatives and qualified professionals, including 14 government staff, on dam inspection and maintenance. FLNRO is committed to ensuring opportunities for training are available to dam owners.
- 133 dam safety audits were conducted and the provincial target was met for the year. The audits this year are part of a schedule for the program to meet its commitment to audit all high, very high and extreme failure consequence dams at least once every five years, and each significant consequence dam at least once every 10 years.

¹ The number of dams is derived for dams under the *Water Act* and B.C. Dam Safety Regulation. The number of regulated dams will increase under the *Water Sustainability Act* and Dam Safety Regulation due to the addition of groundwater filled structures.

- Annual dam status reporting forms were received from owners of 99% of the 354 high, very high and extreme failure consequence classification dams in the province. Of these, dam owners reported that 95% of the dams were inspected annually. Compared to 2014/15, this represents an increase in both return of the reports and number of inspections reported as completed by dam owners.
- Of the 117 dam safety review reports submitted this year, 91% are currently being reviewed. Dam safety officers accepted an additional ten dam safety reviews.
- 88% of water supply dams can be viewed on Google Earth and through Data BC. This is a small increase in the number of dams available spatially which is largely due to the increase in the number of dams in the dam registry itself.
- Dam safety officers responded to one dam alert, two dam incidents and ten reports of incidents for dams where no action was required. There were no reports of dam failures this year. These are positive results compared to the previous year when there were two reported dam failures, and more alerts and incidents which required further action.

Program Achievements

- Significant changes have been made to the [dam safety website](#) enabling relevant information, including the new regulation, to be more easily accessed by dam owners and the public.
- The dam registry has been upgraded over the past year to improve information capture and reporting consistent with the new Dam Safety Regulation, such as with emergency contact, signage, surveillance requirements, and dam emergency plans.
- The majority of ministry water staff were introduced to the new regulation at a *Water Sustainability Act* workshop in Richmond. Dam safety staff received further training on its implementation at a community of practice meeting in early March.
- Twenty seven FLNRO staff received training on dam assessments. Dam safety staff continue to educate other staff to assist in dam safety monitoring.
- Dam safety staff again participated in professional development through both internal and external training as provided by other jurisdictions and professional associations.
- Dam safety staff developed policy and guidance documents related to estimating inundation caused by a dam failure, failure consequence classification and began to prepare updated operational policies consistent with the new regulation.

Through a process on continual improvement, progress was made in a number of areas of the dam safety program and ministry staff continue to work to improve areas where dam owners identify needs and where deficiencies are identified.

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INTRODUCTION

This annual report summarizes the achievements, challenges and ongoing improvements to the Ministry of Forests, Lands and Natural Resource Operations (FLNRO) dam safety program for the period April 1, 2015 to March 31, 2016. The publication of an annual dam safety program report meets a key public accountability commitment made by the B.C. Government following the 2010 Testalinden Dam failure.

On February 29, 2016, the *Water Sustainability Act* and new Dam Safety Regulation came into force requiring dams that divert and/or store surface and/or ground water to be licenced. These structures include, for example, dams associated with hydro-electric power generation, agricultural irrigation, industrial use, municipal water supply and domestic use, as well as structures that regulate lake or river levels. Previously, under the *Water Act*, only those dams diverting and/or storing surface water were regulated.

Under the *Water Act*, the dam safety program regulated approximately 1,662 water supply dams across the province. With implementation of the *Water Sustainability Act*, an additional 217 known dams became regulated, for a total of 1,879 dams (Table 1). Still more dams that store groundwater that are now regulated under the *Water Sustainability Act* will be added to this total as owners initiate the licensing process. The number of regulated dams also changes over time as dams are decommissioned or built and previously unauthorized dams become known.

Table 1: Number of known dams in British Columbia, regulated under the *Water Sustainability Act* and the Dam Safety Regulation, classified by failure consequence classification as of March 31, 2016.

Failure Consequence Class	Regulated Dams Total
Extreme	39
Very High	67
High	248
Significant	559
Low	811
Unclassified	155
Dam Totals	1879

Regulated dams range in size from some of the largest structures in Canada, such as the Mica Dam which generates hydroelectric power, to small earth-filled dams that create water storage for domestic use. For the purposes of this report, unregulated dams are those that do not meet the definition of a dam and combination of criteria (that is, dam height, volume of water stored or failure consequence classification) specified in the regulation and are not authorized under the Act. Minor dams, defined in the new regulation as less than 7.5m in height and impounding less than 10,000m³ of water, are excluded unless the Comptroller of Water Rights or water manager determines otherwise. In addition, breached dams including those intentionally breached as part of decommissioning, or those breached by previous dam

failure are not regulated provided they do not meet the definition and criteria for a dam as specified in the regulation. Dams that are in the application stage, under construction and/or rehabilitation, temporarily drained, filled with sediment, or partially breached are not regulated but many still have oversight by a dam safety officer.

Dam safety program staff also deal with other unregulated water supply dams when necessary to ensure public safety, protect the environment, cultural values, infrastructure and the economy, and to ensure compliance with the Dam Safety Regulation. These include dams that meet the specifications in the regulation but were not previously known to dam safety program staff either because they are historic dams that have been long forgotten or they have been constructed without the required authorization.

Following the Cannon Creek dam failure of 1995, the current form of the dam safety program in B.C. was decided by an independent comprehensive program review commissioned by the Province in 1996 resulting in the recommendations of much needed changes to how dams were managed in B.C. The recommendations included placing the responsibility for the safety of the dam on the dam owner, injecting more rigour, consistency and accountability into the program, and providing the needed resources and staff to deliver the program across the province. The review also confirmed the importance of the dam safety guidance provided by the Canadian Dam Association (CDA) and recommended it be the standard to follow.

Today, the dam safety section in Victoria has responsibility for the administration of the provincial dam safety program and regulation of most water supply dams greater than nine metres in height (also known as major dams). Dams less than nine metres high are primarily administered by seven regional dam safety officers. Staff support to the program is also provided by the ministry's compliance and enforcement branch and other ministry staff, in addition to partner agencies such as Emergency Management BC.

From 1996 to 2007, the dam safety program was empowered by the introduction of an enabling regulation in 2000. This regulation enshrined the requirement that all dam owners in British Columbia are legally responsible for the operation, inspection and maintenance of their dams to minimize risk to the public, the environment and the economy. To ensure that dam owners are aware of, and in compliance with, the regulation and their obligations, dam safety officers conduct audits of dam owners' safety programs and provide education and awareness to dam owners. In addition, each year the owners of dams with a failure consequence of high, very high and extreme are required to complete and return a form, self-reporting on the status of their dam and its dam safety program. The responses help staff determine whether the dams are being inspected and maintained by the dam owner, as per the regulation, between audits conducted by dam safety officers. The self-reporting form is also a good tool for encouraging dam owners to review the status of their dam safety program on a yearly basis.

Dam safety officers maintain information on each of the dams in their portfolio in the provincial dam registry. Dam safety officers also review and approve project plans for new dams, the alteration of existing dams or the removal of dams, as well as respond to emergencies and situation call-outs.

Since the 2010 Testalinden dam failure and the subsequent recommendations by the Deputy Solicitor General, continuous improvements have been made in the dam safety program, most recently the new

Dam Safety Regulation under the *Water Sustainability Act*. The dam safety program has made satisfactory progress in its delivery for 2015/2016 as detailed in the following sections of the report.

PROGRAM ACCOMPLISHMENTS

In 2015/2016, the achievements of the dam safety program are grouped to the following areas:

- Dam owner compliance
- Dam safety plans review, construction and approval
- Program management
- Dam emergency planning and response

DAM OWNER COMPLIANCE

Education and Awareness

The dam safety program has a robust education and awareness program for dam owners ranging from provision of informal training while on-site at their dam, to dam owners and their staff (for example, when dam safety officers audit dams) to formal training in workshops conducted by program staff as well as regular communication for other purposes. This includes mail and email in the November through January period when owners are requested to complete and submit the annual dam status report. E-mails are also sent in early April prior to the spring freshet, reminding owners of high, very high and extreme failure consequence classification dams to ensure their dams are operating properly and maintained to allow the safe discharge of possible flood flows.

Victoria dam safety staff continue to work jointly with regional dam safety officers when formal training is delivered to dam owners and government staff in their region. In the past year, 39 provincial government employees from FLNRO were trained in dam safety at a customized, one-day course on inspection and maintenance of dams in Surrey and Penticton in April of 2015 and Nanaimo in October of 2015, including 14 government dam owners. Regional dam safety officers also delivered a presentation for FLNRO staff in the North and Okanagan regions.

Sponsored by the B.C. Water and Waste Association, 37 participants attended two dam owner workshops in Port Alberni and Langford instructed by dam safety program staff in May and November of 2015 respectively. A similar workshop was also provided to 16 attendees of the Water Supply Association of BC conference in Nelson in October of 2015.

In addition to the regular audit program, the annual meeting was held with BC Hydro and semi-annual meetings with Rio Tinto to discuss their ongoing dam safety programs and infrastructure. Thompson region dam safety staff participated in the review of dam safety issues related to the KGHM's Ajax mine development proposal with the Environmental Assessment Office's working group.

Annual Dam Status Report - Self Reporting by Owners

Under the regulation, owners of dams with high, very high and extreme downstream failure consequence classifications were required to annually self report on activities they are obligated to do under the regulation. In particular they report on whether they have:

1. Completed the required formal inspections and conducted regular site surveillance;
2. A current dam safety review completed by a qualified professional engineer;
3. A current operations, maintenance and surveillance manual;
4. An updated emergency preparedness plan;
5. Observed and determined whether there has been any downstream land use development that might affect the failure consequence classification of the dam;
6. Identified any new dam safety concerns that have not previously been reported, and
7. Beginning in 2015, keeping the dam safety officer up-to-date with the emergency contact information.

The annual reports submitted by dam owners provide valuable insight for dam safety officers on whether a dam owner is in compliance with the regulation. Annual reports are especially useful in years when a dam is not scheduled for audit by dam safety staff. The reports are also used to prioritize dams where additional audits or a site visit might be beneficial. Since 2006, annual reporting by dam owners has improved substantially, largely as a result of increased effort on the part of dam safety staff in communicating the requirement to dam owners.

Figure 1 provides a summary of the number of dam status report forms submitted by dam owners each year over the last five years. This year, reports were returned for all but five of 354 dams. This is significant as this is the highest return since the reporting began in 2001. In 2013/14, a new strategy was introduced to reduce the amount of staff time spent contacting dam owners to encourage submission of the reports. With the support of the compliance and enforcement branch, dam owners are advised that enforcement measures under the *Act* will be taken if their completed forms were not returned. About 80 percent of the forms are usually received two weeks prior to the deadline due date. Reminders are sent to those who do not submit the forms followed up by dam safety program staff contacting individual dam owners directly requesting them to return the completed reports. This approach is beginning to show positive results where the returns have increased to 99% from 95% in 2014/15. Most of the non-compliant dam owners in 2015/16 were also non-compliant in 2014/15. The dam safety officers responsible for these dams are reviewing the actions of these owners.

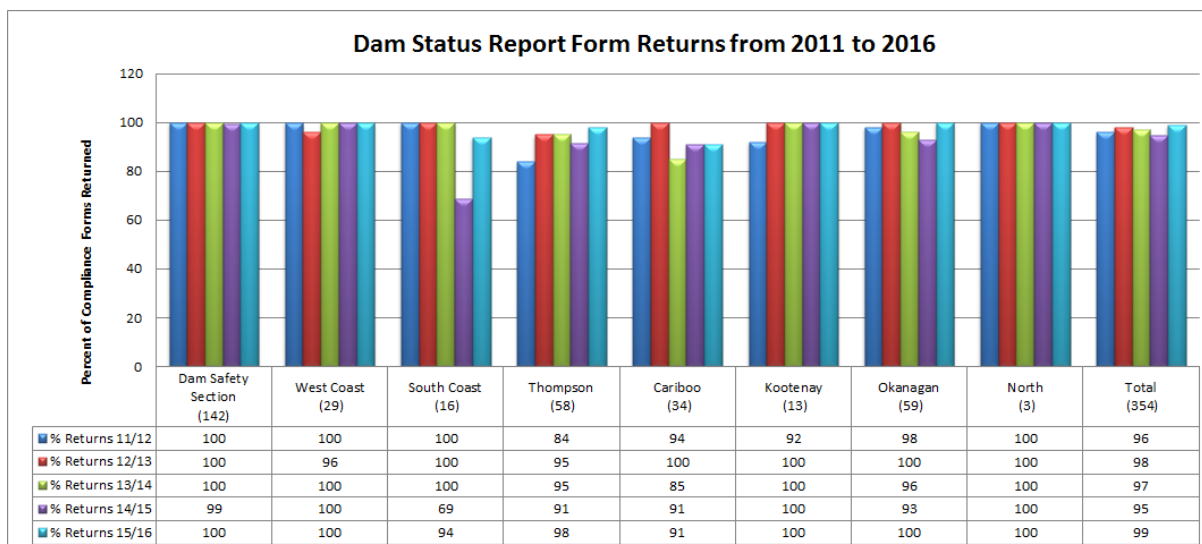


Figure 1: Percent of dam owners returning completed Dam Status Report forms. (Numbers in brackets are the actual number of dams in each administrative unit that required dam status report forms be completed in 2015/16.)

Over the last five years, the returned reports indicate that the overall total percentage of dam owners who completed the required formal inspections varies annually between 90 and 98 percent with an increase of 5% to 95% this year compared to the previous year (Figure 2). This recent improvement is attributable to increases within the South Coast, Thompson, Cariboo, Kootenay, and Okanagan regions and the major dams in the dam safety section portfolio, while the West Coast and North regions remained the same. Periodic audits by dam safety officers also indicate that not everyone who self reports as having conducted a formal annual inspection actually carried out the required work. Where dam owners are not meeting their reporting and inspection obligations, staff follow-up throughout the year to ensure the dam owners understand the regulatory requirements and the link to public safety. Failure to comply with the regulation may result in enforcement action.

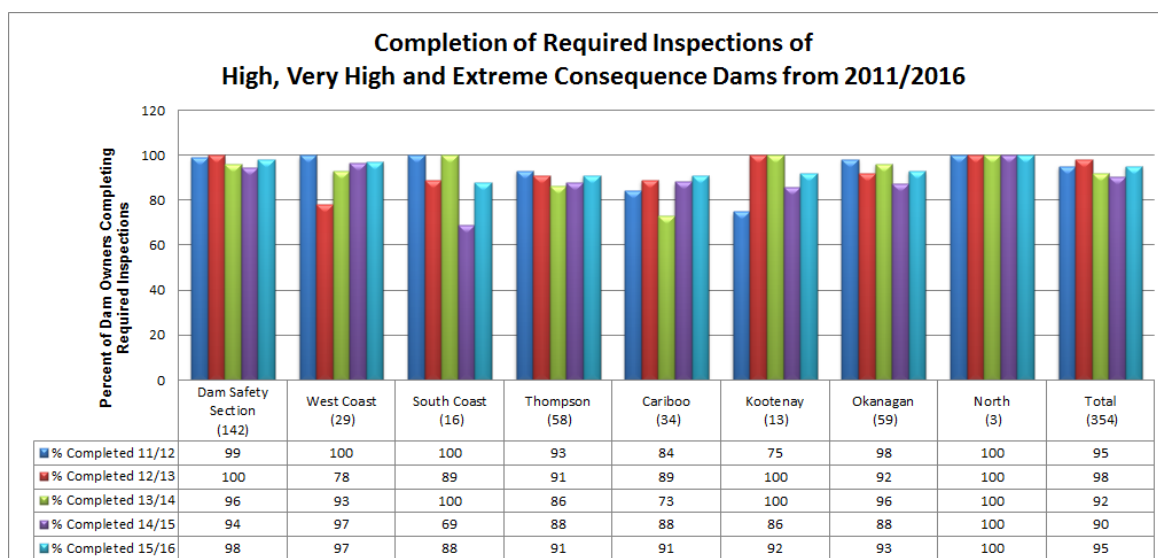


Figure 2: Percent of dam owners self reporting they completed the required annual formal inspections. (Numbers in brackets are the number of dams in each administrative unit that require formal annual inspections in 2015/16.)

Dam Safety Reviews

Under the regulation, owners of high, very high and extreme failure consequence classification dams are legally required to retain qualified engineers to conduct dam safety reviews. The engineers evaluate the safety of the dams and the dam owners' safety programs and prepare a report which is provided to the dam owner and the dam safety officer. The dam owner is then responsible for following up on deficiencies identified in the review. This requirement was introduced in the regulation in 2000 and dam owners were given 10 years to have the first review completed. Reviews are required to be submitted every seven years for extreme failure consequence classification dams and every 10 years for high and very high failure consequence classification dams. Since 2000, some dam owners have completed one or more dam safety reviews, others have dam safety reviews in progress and a few have yet to begin the dam safety review.

Dam safety officers reported the status of dam safety reviews as of March 31, 2016 (Table 2). In this year, 117 dam safety reviews were considered. Of these, 10 were accepted by the dam safety officers while 107 are still outstanding. Of the 107 outstanding dam safety reviews, 7 have not yet been started while 40 are underway by dam owners. An additional 45 have been submitted and are being reviewed by the dam safety officer and 15 dam safety reviews were submitted but have been returned to the owner because additional work is required.

Table 2: Status of dam safety reviews in progress as reported by dam safety officers for 2015/16.

	FLNRO Administrative Areas								
	Dam Safety Section	West Coast	South Coast	Thompson	Cariboo	Kootenay	Okanagan	North	Total
Not started	1	0	0	3	0	1	2	0	7
Dams with Dam Safety Reviews in progress									
Started, with work in progress	11	7	0	16	5	1	0	0	40
Submitted to and being reviewed by dam safety officer	30	0	2	5	0	2	6	0	45
Reviewed but not accepted by dam safety officer. Returned to owner because more work is needed.	2	5	0	1	2	0	5	0	15
Total: Dam Safety Reviews in progress or not started as of March 31, 2016	44	12	2	25	7	4	13	0	107
Dam Safety Reviews accepted in 2015/2016	2	3	0	0	0	1	2	2	10
Total:	46	15	2	25	7	5	15	2	117

The dam safety program, in collaboration with the ministry's compliance and enforcement branch, implemented a strategy in 2012 to have non-compliant dam owners complete overdue dam safety reviews for their dams. All non-compliant owners of each dam (some dams have multiple owners) were notified of their obligations under the previous *Water Act* and given adequate time to contact the

appropriate dam safety officer about the status of their dam safety reviews. In November 2012, non-compliant dam owners were again reminded of the need for a dam safety review when they received their annual dam status reporting form. Non-compliant owners of 133 dams were notified of the requirement by letter. Due to the relatively small number of dams requiring dam safety reviews in their areas, the West Coast region and North areas opted to contact non-compliant dam owners by phone or in person to encourage owners to have dam safety reviews completed. The dam safety review compliance and enforcement project will continue until all the dams requiring a dam safety review are in compliance. Once the initial dam safety review is complete, dam safety officers must then ensure that subsequent dam safety reviews are conducted when the appropriate anniversary arises, every seven to 10 years depending on the failure consequence classification of the dam.

Audits of Owner Dam Safety Programs

Dam safety officers meet with dam owners and conduct audits of their dam safety programs at least once every five years for all high, very high and extreme failure consequence classification dams, and at least once every 10 years for each of the significant failure consequence classification dams. Each dam safety officer has an annual target of audits to complete to ensure that all dam audits are completed within the required time frame. The audits are an opportunity for dam safety officers to meet with dam owners, review the records being kept and do a site visit with the owner. These audits help confirm whether the dam owner is aware of and is carrying out the requirements of the regulation. If deficiencies are found, staff can provide information to help dam owners address the problems. When necessary, follow-up is done by dam safety officers to ensure that any identified issues are corrected.

In 2015/16, dam safety officers and other trained staff completed a total of 133 audits, one more than the average annual target of 132 dam audits (Figure 3). All administrative units had either exceeded or met their targets except in the South Coast and Cariboo regions where qualified staff to do the audits were not available. In the Cariboo, the position was vacant for some time before it was filled in mid-2015 so there was insufficient time to undertake all of the audits. In the South Coast, insufficient time was allocated to allow all of the scheduled audits to be completed. Several dam safety officers met or exceeded their target, in some cases making up for previous years when targets were not met. An increase in annual dam audits can be attributed to several factors. For example, efficiencies gained when a large number of dams belonging to one dam owner are grouped together for audits or a number of dams within the same geographic area are audited at the same time. In years when targets are not met the shortfall is usually addressed in a previous or subsequent year to ensure all dams are audited on schedule. For example, in 2014/15, the Cariboo exceeded their target by eight dams and the South Coast met their target.

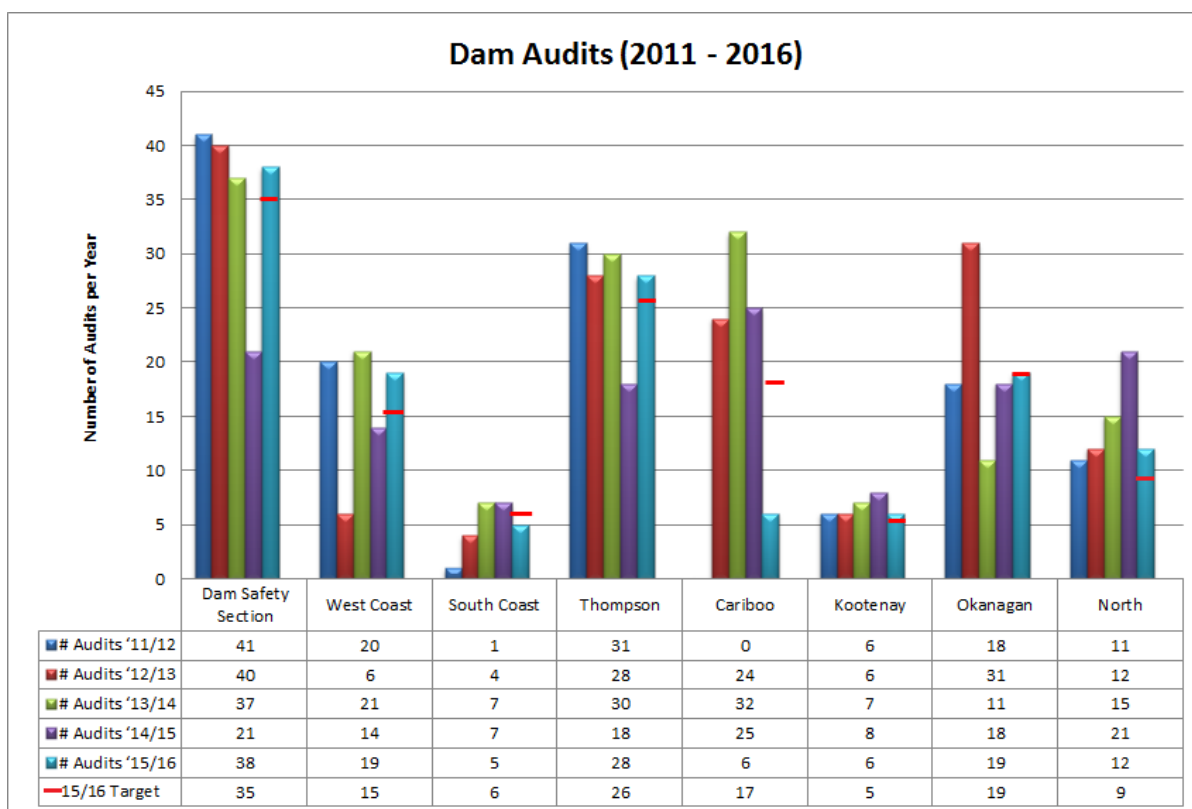


Figure 3: Number of audits completed by dam safety officers compared to their 2015/16 target.

Dam Registry

The dam registry is comprised of two separate but linked digital information systems. One is a database management system, known as e-licensing, that houses textual data records about each dam. The other provides geospatial data allowing programs such as Google Earth and iMap to depict dam information spatially. E-licensing is available to authorized internal users only but key information from e-licensing for each dam is shown alongside the geospatial data when viewed as [BC Dams](#) on Google Earth or on iMap through [DataBC](#).

Accurate dam information is important for dam safety officers in managing their portfolio of dams, for reporting on the state of dams in the province and for rapid access to information during emergencies. To determine if dam safety officers update the dam registry on a regular basis, audits of the registry are carried out annually.

An examination of the data over the last five years of three parameters for dam height, next dam audit date and failure consequence classification shows a positive steady increase in updating the information (Figure 4). For the first time in five years, the dam failure consequence data has increased to 98% for these dams over this period. Consistency and accuracy of data entry into the dam registry and ensuring that information is current remains an ongoing goal for staff in the dam safety program.

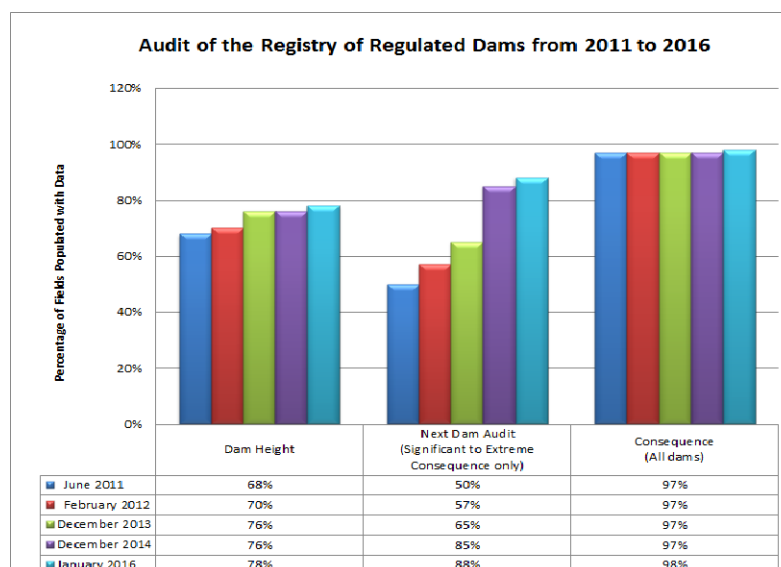


Figure 4: Audit of the dam registry

In 2015/16, more improvements were made to the dam registry to better capture information related to requirements of the new Dam Safety Regulation. Fields have been added to capture information on emergency contact, dam emergency plans, signage requirement, and regular surveillance in the database. Other enhancements include better capabilities for searching and reporting in the e-licencing platform to gather this information, refining measurement data for dam and spillway and specifying whether there is multiple ownership for a dam.

Recording the location parameters of a dam is required for spatial representation of the dam on maps and on Google Earth. Of the total number of dams in the dam registry, 88% have associated spatial information, an improvement of 1% from 2014/15. However, there still exist 274 dams without the required geo-referenced data and therefore cannot be viewed on Google Earth or DataBC. Of these, 42% are identified as operational dams which are regulated. Spatial data for these remaining dams is updated as opportunities arise.

Work with e-licensing and the data warehouse is ongoing as time and resources allow to further improve the management of dam information and make the databases more useful for dam safety program staff. These ongoing improvements help create a more robust registry that provides useful, accurate and timely information.

REVIEW OF PLANS AND MONITORING OF WORK

Reviewing Plans and Monitoring Work in Progress

Dam safety officers are involved in the review and approval of project plans for new dams, dams undergoing alteration, rehabilitation or decommissioning. They also monitor ongoing work during the construction or decommissioning phases of projects. Provincially in 2015/16, there were a total of 20 project reviews for new dams, 28 project reviews for rehabilitated dams and 12 project reviews for the removal of dams. There also were six monitoring activities for new dams under construction and 16

similar ones for rehabilitated dams. Likewise, five monitoring activities were completed for decommissioning of dams in progress and four final inspections of decommissioned dams.

Operational Reviews

The Dam Safety Regulation requires owners of dams, other than those with a low failure consequence classification, to review and revise if necessary, their Operations, Maintenance and Surveillance (OMS) manual and their Emergency Preparedness Plan (EPP), now called Dam Emergency Plan in the new regulation. This is required at least every ten years for significant and high failure consequence classification dams and every seven years for very high and extreme failure consequence dams. The annual dam status report includes questions on the status of the OMS and EPP, serving as a reminder to dam owners of their obligation to maintain these documents. In 2015/16, dam safety officers reviewed 37 new or revised OMS manuals and 37 new or revised EPPs.

The regulation also requires owners of dams to review downstream conditions and notify a dam safety officer if there are any changes that may impact the failure consequence classification. These reviews help ensure that dams are being managed responsibly and in the interest of public safety. In 2015/16, dam safety officers reviewed 11 requests for changes in failure consequence classification.

PROGRAM MANAGEMENT

Outreach and Professional Development

In 2015/16, dam safety staff continued to collaborate with their counterparts in other jurisdictions, agencies, industry and professional associations on developing and improving dam safety practices. Staff were involved with the Association of Professional Engineers and Geoscientists of BC in the discussion of responsibilities surrounding inspections and maintenance of embankment or water retention structures at the annual general meeting and conference and on the development of APEGBC's Guideline: [Site Characterization for Dam Foundations in B.C.](#) Participation also continues with the Canadian Dam Association's working group on the emergency technical bulletin and a design and construction guidance document.

Dam safety officers have made use of opportunities to participate in various technical webinars provided by the Association of State Dam Safety Officials (ASDSO) and Natural Resource Canada. In the last year, several dam safety staff have advanced their knowledge through participation at the ASDSO regional conference and the Canadian Dam Association's annual general meeting and conference and represented B.C.'s interest at these meetings. Dam safety section staff also attended Canadian Geotechnical Society presentations.

A dam safety technical workshop attended by dam safety and other FLNRO staff was held in Victoria over three days in November, 2015. Experts shared their knowledge either in person as guest speakers or on ASDSO webinars related to spillway hydrology, construction and rehabilitation of dams, dam decommissioning and emergency management.

The 31st annual dam safety program community of practice was held in Campbell River in March. The focus was on the new *Water Sustainability Act* and Dam Safety Regulation, and policy and guideline

review and discussion. Field trips to two dams on Vancouver Island, including the BC Hydro John Hart Dam provided excellent opportunities for discussion with the dam owners on dam rehabilitation projects.

Immediately after hiring, the new dam safety staff for the Cariboo and Thompson regions received dam safety officer training from the dam safety section staff and after completing some additional work were designated as dam safety officers by the Comptroller of Water Rights. All new dam safety program staff are required to receive a basic program orientation and overview and undertake a few audits with an experienced dam safety officer before being designated as an officer themselves. This, along with monthly conference calls, annual community of practice and biennial technical training, helps ensure staff have the skills necessary to fulfill their role as dam safety officers and promotes consistency in application of the program and regulation across the province.

Other Dam Safety Program Highlights

In addition to activities described in the sections above, there were a number of other notable accomplishments in the past year:

1. *Program Staffing:* The dam safety program is comprised of the dam safety section, Water Management branch in Victoria (4.5 FTEs) and regional senior dam safety officers who report through the ministry regional structure (5.5 FTEs). All regions were staffed, with either a full-time or part-time dam safety officer, for most of the year including staffing of two vacant positions, one in each of the Thompson and Cariboo regions. The Kootenay position was recently vacated and refilled temporarily with an experienced auxiliary. In regions such as the North in the Skeena subregion, West Coast, South Coast, Thompson, Cariboo and the dam safety section, an additional 1.15 FTEs of water allocation staff time were reported as involved in supporting dam safety officers. In addition, other ministry staff, temporary employees and new hires all contributed to the dam safety program.
2. *New Dam Safety Regulation:* In 2015, dam safety program staff spent considerable time developing the policies required for the new regulation ensuring that appropriate dams are regulated and the correct owners are legally responsible for its management. The effort resulted in bringing the regulation into force on February 29, 2016 concurrent with implementation of the *Water Sustainability Act*. FLNRO, Front Counter BC and corporate services staff were introduced to the changes being implemented by the *Act* and regulation at a workshop in Richmond in February, 2016 and in greater detail for dam safety staff at the dam safety community of practice in Campbell River in early March of 2016.
3. *Citizen-centric Website:* A complete revision of the [dam safety program website](#) to meet the external Government of B.C. Web 2.0 standards was undertaken this year to ensure that information on the regulation, policies and other guidance and resource documents on dam safety are current and readily accessible by any user. Most of the documents and webpages have been revised to reflect changes associated with the new [Water Sustainability Act](#) and the [Dam Safety Regulation](#).
4. *Development of Guidelines:* Failure consequence classification guidelines have been modified and divided into two sets of guidelines: one to provide dam owners a simplified method of

estimating downstream inundation and the other to provide dam safety practitioners means to determine the failure consequence of a dam. Both are available on the website. Dam decommissioning guidelines are being drafted and will be completed in 2016/17. A guide and dam emergency plan template was completed and is also available on the website.

DAM INCIDENTS

When an incident relating to a dam is reported to the ministry, a dam safety officer or other staff person will immediately respond, sometimes with support from regional compliance and enforcement staff. The dam owner is contacted and, depending on the seriousness of the situation, other agencies, including Emergency Management BC, may be contacted. These investigations are recorded in incident reports. Not all reported incidents are an emergency or even a dam issue, but regardless each one is followed up on and recorded. The following is a summary of the dam incidents reported in 2015/16.

Dam Failures

There were no dam failures reported in 2015/16.

Dam Alerts

There was one dam alert reported in 2015/16. A dam alert occurs when an abnormal condition is observed at a dam or a dam performs abnormally and, without swift and effective intervention, failure may occur.

1. Swan Lake Dam (D240213-00) – On April 1, 2015, City of Vernon staff reported overtopping of the 1.5 metre high dam (*Photo 1*) south of Swan Lake on the northern side of the city. Very high water level on the lake caused the overtopping in addition to flooding of an adjacent field, nearby roads and a downstream creek. Culverts immediately downstream from the dam were surcharged about 10 centimetres over the culvert inlets, creating backwater conditions behind the stream crossing. Erosion removing vegetation was observed around each abutment. Sandbags were placed to protect the abutments. Some debris had accumulated over the centre grate spillway. The principal dam owner complied with an FLNRO order to engage a qualified engineer to inspect and provide options to stabilize the dam and associated works. FLNRO had scheduled a meeting with the owner to discuss the review.



Photo 1: Flow over the crest of Swan Lake Dam. Note flooding around abutments.

Dam Incidents

There were two dam incidents reported in 2015/16. A dam incident occurs when an abnormal condition is observed at a dam or the dam performs abnormally but the condition is not expected to lead to a failure of the dam.

1. West Munday Creek Dam – On February 18, 2015, FLNRO staff reported a problem with an unregistered, unregulated dam on a creek next to Walnut Grove Secondary School in the Township of Langley. Municipal staff had discovered that an area of compacted soils in the abutment was eroded as a result of high water a month earlier. After a site visit, FLNRO staff issued a compliance notice for the regulation of the significant failure consequence classification dam including retaining a qualified engineer to design a solution to rectify the deficiency. The municipality is cooperating with FLNRO to repair the hole in the abutment.
2. Partington Creek Tributary #2 dam – On September 24, 2015, FLNRO staff provided direction to the City of Coquitlam regarding an unlicensed unregistered low failure consequence dam on a tributary of Partington Creek near Edwards Street in Coquitlam. The four metre-high dam, impounding about 2000 cubic metres of water, was observed to have erosion around the outfall and outfall culvert and had signs of previous overtopping. City staff were advised to apply for a water licence to authorize storage of water and obtain the services of a qualified engineer should they retain the dam.

No Dam Incidents

This term is used for reports that are initially received as dam incidents but do not impact the safety of a dam. It could refer to an erroneous report, or a report about an abnormal condition that could be interpreted as a threat to a dam. There were 10 reports classified as “no dam incidents” in 2015/16.

1. Buck Lake Dam (D730001-00) – On April 21, 2015, FLNRO staff reported increased clear seepage near an abandoned steel intake pipe at the left abutment of the main dam located near Otter Bay. Capital Regional District estimated the flow at two litres per minute and described the flow as not a threat to the integrity of the dam. The owner would excavate the intake to locate the seepage source and conduct underwater inspection of the pipe.
2. Ripley Lake Dam (D220186-00) – On April 13, 2015, a member of public contacted FLNRO staff about a possible overtopping of a dam west of Oliver. At the time, there was not enough freeboard as the reservoir was held at a high water level and the concern was that overtopping would occur should a high intensity storm arrive. Staff conducted a site visit and noted that there were no deficiencies. The owner was directed to provide site inspection.
3. Peter Hope Lake Dam (D130167-00) – On April 11, 2015, a campsite operator apprised FLNRO of a concern with a significant release of water through the lower level outlet of a nearby dam near Kamloops. It was an uncommon practice for that time of the year. FLNRO staff discovered that the dam owner was relieving the pressure on the spillway which required repair. The owner had monitored the situation.
4. O'Connor Lake Dam (D120243-01) – On April 19, 2015, a dam owner at a ranch near Kamloops reported to FLNRO of a discovery that the lock and chain was removed on the headgate and the lower level outlet was opened fully to release water unnecessarily. No damage downstream was noted. The owner has secured the headgate equipment. The owner and RCMP are monitoring.

5. Unknown dam – On August 10, 2015, a report was filed by FLNRO staff about a dam failure on Two Mile Creek near Cariboo Lake. The owner of a cancelled water licence which was authorized for log crib dam construction had reported a flooding of her property; however, the dam was not built and the flooding was due to a failed beaver dam (Photo 2). No further action is anticipated.



Photo 2: Beaver dam failure on Two Mile Creek near Cariboo Lake

6. Five Mile Dam (D810514-01) – On April 17, 2015, a concerned resident downstream of the dam near Williams Lake contacted FLNRO about the owner not operating the dam correctly. The report noted the boom was broken, the water level in the reservoir was above the limit and the spillway flow was heavy. FLNRO staff made a subsequent visit to investigate and no concerns were found.
7. Joan Pond Dam (D810526-00) – As a follow up after the decommissioning of the dam, an audit was done on December 16, 2015 at the dam site. It was noticed that the inflow trench was infilled but the headgate had not been removed. The owner was asked to remove the headgate.
8. McGhee Lake South Dam (D810123-01/02) and McGhee Lake North Dam (D810123-01) – Both dams were breached without authorization and the owner was asked to conform to the recommended breach requirements. An order was issued for non-compliance with the BC Dam Safety Regulation for failure to submit the dam safety review report for the McGhee Lake South Dam.
9. Twin Lakes (Jumelle Lakes) Dam (D810452-00) – On January 9, 2015, the Ministry of Transportation and Infrastructure informed FLNRO about ice covering a portion of the Stanchfield Road. A possible breach of the dam was suspected. FLNRO staff conducted a site inspection to investigate the dam. Several deficiencies were noticed at the dam; however, the dam did not appear to have overtopped nor breached.
10. Minton Lake Dam (D810436-00) – On October 5, 2015, the dam site was visited for an audit as a concern was raised about the possibility of erosion over the exposed portion of the embankment. The low level outlet pipe was replaced recently and a weak portion of the embankment downstream slope was also repaired. Erosion control measures were not installed over the exposed portions and there was the possibility of erosion and sedimentation in the creek. The dam owner's representative was asked to install proper erosion control measures.

CONCLUSION

In 2015/16, the B.C. Dam Safety Program, Ministry of Forests, Lands and Natural Resource Operations invested considerable time and effort towards policy development leading to the new Dam Safety Regulation. Its introduction into mainstream FLNRO business is proceeding and this was initiated by ensuring FLNRO staff were trained in appropriate areas of the new regulation.

Educating dam owners and their representatives continues to be an important part of the dam safety program. Several workshops and presentations were made by dam safety staff to dam owners and operators at locations around the province. More opportunities were had by dam safety and support staff to receive training at a technical workshop on current dam safety best practices and to contribute to policy and guideline development at provincial and national levels on dam removal, emergency response and construction.

The return rate of annual dam status reports by dam owners reached the 99% mark in 2015/16. The number of dams receiving annual inspections by owners was at 95%, below the previous high of 98% in 2012/13. Non-compliant dam owners are followed up with by dam safety officers with support from natural resource officers to ensure compliance with the reporting and inspection requirements.

Dam safety officers reported that owners are progressing with dam safety reviews including new reviews underway and submission of those started in the previous year. The quality of dam safety reviews remains a concern although there has been some improvement as the consulting community gains experience. Overall, dam safety audits are about on par with the provincial target. Compared to 2014/15, dam safety officers responded to more reported concerns about dams that were not an emergency but frequently required follow-up by the owner. There were no dam failures reported this year.

Dam safety officers are adding more information into the dam registry ensuring that important information about regulated dams are current and available. The dam registry has also been upgraded to include requirements in the new regulation. The database enhancements will assist dam safety staff in accessing information on the status of an owners dam safety program and retrieving key information should the need arise.

B.C. Dam Safety Program
Ministry of Forests, Lands and Natural Resource Operations
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