

BC DAM SAFETY ANNUAL REPORT

2012/2013

SUMMARY

The BC Dam Safety Annual Report is a commitment of the Ministry of Forests, Lands, and Natural Resource Operations (MFLNRO) to summarize activities of the Province's Dam Safety Program and the progress of dam owners in achieving compliance with the *BC Dam Safety Regulation* (Regulation) in the fiscal year 2012/13. It also reports on the continued efforts of MFLNRO to meet the remaining recommendations of the Deputy Solicitor General's review of the 2010 Testalinden Dam failure. Program accomplishments for 2012/13 include:

- Provincial dam audit target of 128 dams was exceeded by 15%.
- Project reviews of new dams, rehabilitated dams and dams to be removed totalled 31, plus another 12 reviews of dams in the construction phase.
- Emergency call-outs responded to and resolved included 5 dam failures, 3 dam alerts, 2 dam incidents and 4 dam non-incidents.
- Sixty-seven dam owners or their representatives in five communities received formal training in the safe management of dams.
- Inspections were completed of 15 dams identified in the 2010 Rapid Dam Assessment project as requiring follow-up.
- Non-compliant owners of 130 High, Very High and Extreme consequence dams are proceeding towards compliance by having qualified professional engineers undertake dam safety reviews for their dams.
- Dam Inspection Compliance survey forms were returned for 98% of High, Very High and Extreme failure consequence dams and of those, formal inspections were completed on 98% of the dams. Of 2,119 dams registered with the Province, 82% can be viewed on [British Columbia's Geographic Gateway in iMap](#) and on Google Earth [BC Dams](#).
- Orientation and training was provided for four new staff. A technical training seminar and subsequent Community of Practice meeting provided continuing education opportunities for all dam safety program staff as well as compliance and enforcement staff that support the dam safety program.
- All dam safety positions across the province are filled for a total of 10 FTE's. In addition, Compliance and Enforcement and water allocation staff provide direct support to dam safety in BC. Dam safety website contents and dam registry have been updated to reflect the current Regulation.

INTRODUCTION

This report summarizes the activities undertaken by the Dam Safety Program and reports dam owner compliance for the period April 1, 2012 to March 31, 2013. The report also provides updates on the progress made in addressing the remaining Deputy Solicitor General's recommendations following the Testalinden dam failure in 2010.

By the end of March 2013, there were 2,119 dams in the province, 77.2% of which are regulated under the *Water Act, BC Dam Safety Regulation*. Of the regulated dams, 1,483 are operational dams ranging 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. There are an additional 153 regulated dams that are proposed, breached or abandoned. Unregulated dams are those that do not meet height, storage capacity or dam failure consequence classification criteria specified in the Regulation. The Dam Safety Section in Victoria has responsibility for the administration of the provincial dam safety program and regulation of most dams greater than 9 metres in height (also known as major dams). Dams less than 9 metres high comprise the regional component of the dam safety program and are managed by regional Dam Safety Officers. Each Dam Safety Officer is responsible for a portfolio of dams. Staff support to the program is also provided by the Compliance and Enforcement Branch and other MFLNRO program staff in addition to partner agencies such as Emergency Management BC. Impoundment structures associated with mines in British Columbia are regulated under the *Mines Act* and are not included in this report.

All dam owners in British Columbia are responsible for inspection and maintenance of their dams. To ensure that dam owners are aware of and in compliance with the Regulation, the Dam Safety Officers conduct audits of dams, provide education and awareness to dam owners and maintain information on each of the dams in the Provincial Dam Registry. Dam Safety Officers also review and approve project plans for new dams, the rehabilitation of existing dams or the removal of dams and respond to emergencies and situation call-outs. Each year the owners of dams classified High, Very High or Extreme are required to complete and return Dam Inspection Compliance forms to be used to determine if these dams are being inspected and maintained as per the Regulation. In 2012/13, the 156 primary owners of the 339 dams classified High, Very high or Extreme were asked to provide information on the status of their dam surveillance and formal inspections, Dam Safety Review, Operation, Maintenance and Surveillance Manual and Emergency Preparedness Plan, and whether any dam safety concerns have been identified.

STATUS OF MFLNRO'S RESPONSE TO TESTALINDEN RECOMMENDATIONS

Since 2010/11, MFLNRO had made substantial progress in responding to recommendations in the July 2010 Deputy Solicitor's report regarding the Testalinden dam failure and British Columbia's Dam Safety Program. Much has been reported in the previous year, but specifically in 2012/13, MFLNRO strove to meet its longer term commitments in the following areas:

1. *BC Dam Safety Regulation (Recommendation #7)*: In addition to providing the primary dam owners (those with the largest volume water storage licence) with the updated BC Dam Safety Regulation in 2011/12, other water storage licensees who are also owners of these dams needed

to be informed. Large databases were reviewed in 2012/13 to determine these owners and this work will continue into this year until all owners are identified and informed of their responsibilities under the updated Regulation. In addition to advising dam owners of their responsibilities, this exercise also improves information on current dam ownership in the dam registry.

2. *Rapid Dam Assessment (Recommendation #8)*: During the 2010 Rapid Dam Assessment, 473 dams were identified as requiring non-urgent follow-up. MFLNRO regional dam safety staff in the West Coast, South Coast, Cariboo, Okanagan and Kootenay continue to work towards resolving the issues associated with these dams, be it licensing issues or dealing with possible dam deficiencies. The Little Trapper (Scotty Creek) Reservoir Dam in the Okanagan, for example, was inspected because of a discovery of seepage in the dam. The outcome, in this case, is the dam owner is reviewing the option of either decommissioning or rebuilding the dam.
3. *Consistent oversight and regulation of all water related structures (Recommendation #11)*: With the expansion in the oil and gas industry in northeastern BC, dugouts are proliferating. Water is being stored in dugouts to be sold later to gas mining companies for fracking purposes. These structures are not currently licensed. The Ministry of Environment together with MFLNRO are currently developing policy around dugouts for the storage of water. These dugouts may have dam-like properties which can be a dam safety issue (Figure 1).



Figure 1: A dugout pond which has a dammed slope on one side.

4. *Reviewing record keeping practices (Recommendation #1)*: In 2011/12, a misinterpretation of the dam registry data led to reporting that there was a large improvement in the updating of data in the registry by dam safety officers that year. However, a recent analysis of the data over the last two years reveals that progress varied from none to more modest improvements depending on the type of data considered (Figure 2). Dam safety officers are required to keep the information current for regulated dams and continue to update the database with additional information following dam site visits. Regions with large numbers of dams and insufficient resources are challenged in updating dam information in the registry.

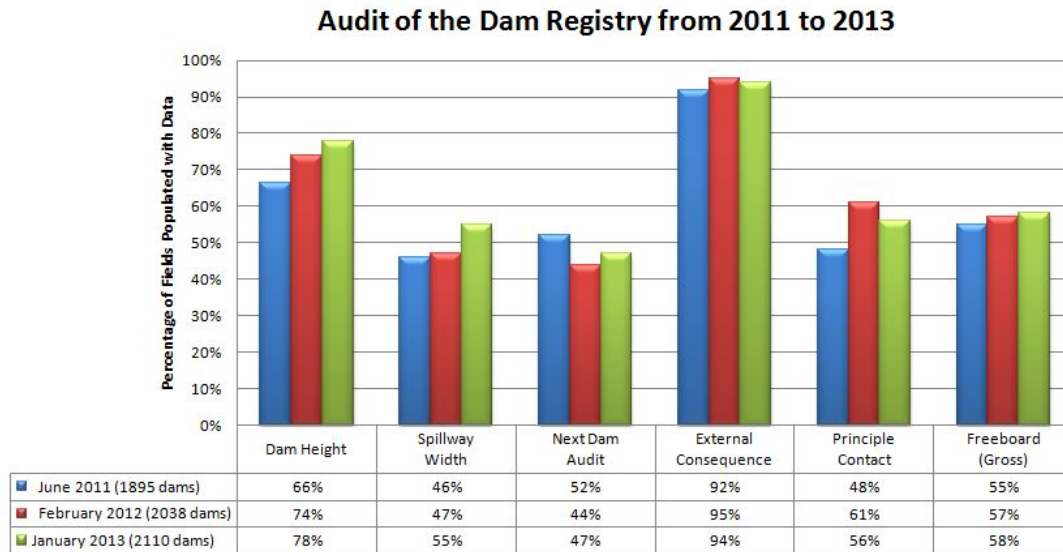


Figure 2: Audit of 6 dam safety parameters in the Dam Registry as a measure of progress in updating of the database by the Dam Safety Officers.

5. *Continue building a robust Dam Registry (Recommendation #9):* In 2012/13, changes to data fields in the dam safety management component of the E-licensing platform made entering data consistent with the current Regulation. Satisfactory progress continues with updating geospatial information for current and new active dams. Work still remains to improve the structure and some functions in the Dam Registry and this will be undertaken as resources permit.
6. *Continuing to expand education and awareness of dam safety practices (Recommendation #12):* Education and awareness is a central component of the Dam Safety Program and an update is provided in the section on the Education and Awareness program below.

PROGRAM ACTIVITIES AND INITIATIVES

In 2012/13, the Dam Safety Program accomplished many activities and initiatives, including:

Education and Awareness

Dam safety officers often conduct informal training when inspecting or auditing dams with dam owners. In 2012/13, there has been a concerted team effort by dam safety officers both in Victoria and regionally to educate dam owners and government staff at various locations across the province. These formal education opportunities for dam owners are led by the Dam Safety Section but sponsored and partially funded by various stakeholder groups. This partnership has resulted in the training of dam owners or their representatives in different areas of the province. A total of 67 attendees participated at the BC Water and Waste Association workshops in Chemainus, Port Alberni and Williams Lake, the Water Supply Association of BC workshop in Nelson and at a Bowen Island Municipal meeting. Additionally, staff informed stakeholders through dam safety presentations at several meetings including the Public Works Association of BC annual conference in Penticton. Staff have also collaborated with dam owners such as the municipal governments of Barriere and Nanaimo in emergency preparedness planning or large stakeholder groups such as Ducks Unlimited (Canada) in the design, management and

decommissioning of dams. Internally, in 2012/13, dam safety staff trained a total of 39 MFLNRO Natural Resource Officers and Water Management staff in the North region to assist in dam safety inspections or investigations.

Outreach and Professional Development

Externally, dam safety staff have continued to engage with their counterparts in other jurisdictions, industry and professional associations to collaborate in the development of dam safety practices. In 2012/13, staff participated at the Canadian Dam Association's (CDA) Dam Safety Review Working Group in preparation for development of a Technical Bulletin in 2013. Staff have also collaborated with the Association of Professional Engineers and Geoscientists of BC (APEGBC) in finalizing new Dam Safety Review Guidelines for professionals that will be released in the summer of 2013.

Internally, dam safety staff across the province participated in a two and a half day technical training seminar in Kamloops in the fall of last year. Experts from industry and academia as well as dam safety program peers provided information to advance their technical knowledge of dams and dam safety practices. In the following spring at the 27th annual Dam Safety Community of Practice in Kelowna, this collaboration extended to discussing and finding solutions to dam safety issues, in particular, the development of a Dam Safety Compliance and Enforcement strategy. At this event, Natural Resource Officers from the Compliance and Enforcement Branch participated with dam safety staff, exploring compliance and enforcement issues in dam safety and how to respond when they arise. New dam safety staff also received training to become Dam Safety Officers from Victoria, Nelson, Penticton and Williams Lake.

Dam Inspection Compliance

Under the *BC Dam Safety Regulation*, owners of dams with High, Very High and Extreme downstream failure consequence classifications are annually required to report whether they have for each dam:

- Completed the required annual inspections and conducted regular site surveillance;
- Have a Dam Safety Review completed by a qualified professional engineer;
- A current Operations, Maintenance and Surveillance manual; and
- An updated Emergency Preparedness Plan.

Each successive year since 2005, annual reporting by dam owners has improved substantially. Total returns in the last three years have plateaued in the high ninety percentage range overall (Figure 3). These increases are a result of efforts made by Dam Safety Program staff in directly contacting individual dam owners to ensure they return their compliance forms. For those dam owners that have not returned their forms, follow up is being done by Dam Safety Officers, sometimes with the assistance of Natural Resource Officers, to ensure that the forms are completed. A strategy will be developed in 2013/14 for a more effective means to ensure timely return of the completed forms by dam owners without the exceptional effort of staff in contacting non-compliant dam owners.

Note that in the following discussion and figures, for 2010/11, the older classification of High and Very High Consequence dams was in place, whereas subsequent years uses the revised classification, High, Very High and Extreme. Since the measures are reported as a percentage, it is still possible to make a valid comparison over time.

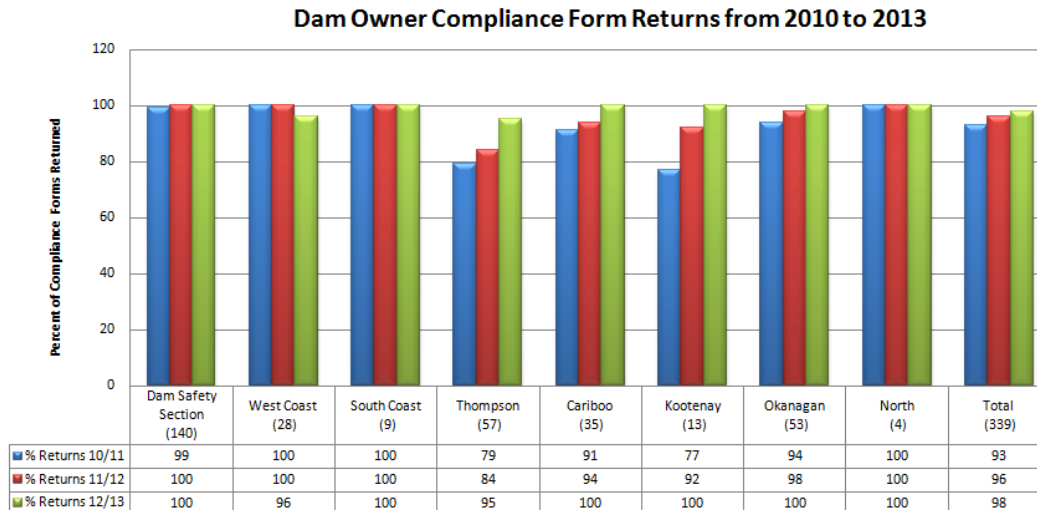


Figure 3: Percent of dam owners returning the completed Dam Inspection Compliance Forms. (Note: numbers in brackets are the total number of High, Very High, and Extreme Consequence Dams in each administrative unit for 2012/13.)

Over the last three years, based on the number of forms which dam owners have returned for their dams, the overall provincial percentage of dams where owners had completed the required formal inspections has been maintained at or above 95% (Figure 4). For 2012/13, there was a decrease in the number of dams where owners had completed the required inspections in the West Coast, South Coast, Thompson and the Okanagan regions. Where dam owners are not meeting their obligations, staff follow-up to ensure dam owners understand the regulatory requirements.

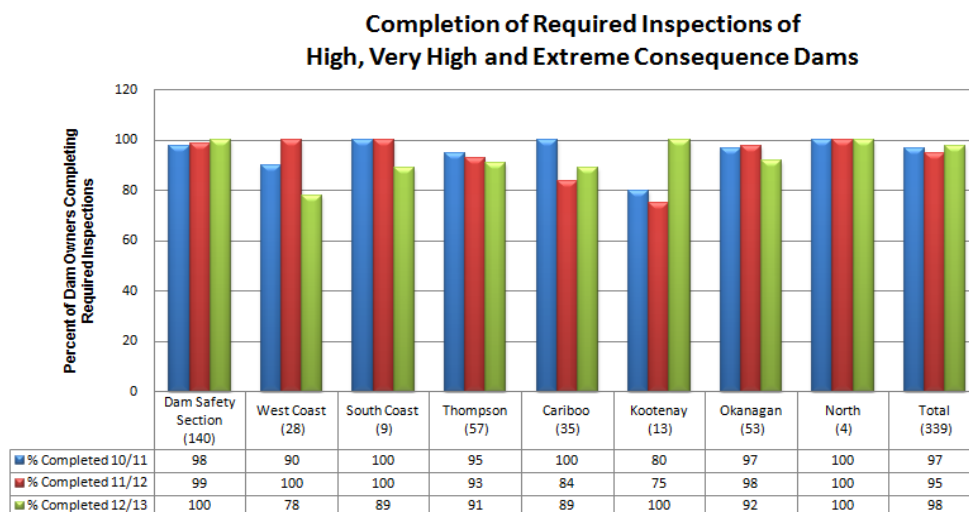


Figure 4: Percent of dam owners that returned their Compliance Form and indicated that they had completed the required annual dam inspections. (Note: numbers in brackets are the total number of dams for each administrative unit in 2012/13.)

Dam safety reviews are comprehensive formal evaluations of dams conducted by a qualified engineer every 7 years for extreme consequence classification dams and every 10 years for high and very high consequence dams to determine whether an existing dam meets current engineering standards. Despite annual notification since 2009 by the Comptroller of Water Rights regarding this regulatory requirement, the number of dam safety reviews completed expressed as a percentage of the total number of dams considered in the compliance survey remains low (Figure 5). Reporting of completed dam safety reviews for major dams (>9m high) has shown a slight improvement (3%) over this time period. Fewer than 50% of dam safety reviews for smaller dams (<9m high) in the regions have been completed, except for the Okanagan which is above 50%. Overall, there is a small improvement of about 5% over the past three years for completed dam safety reviews.

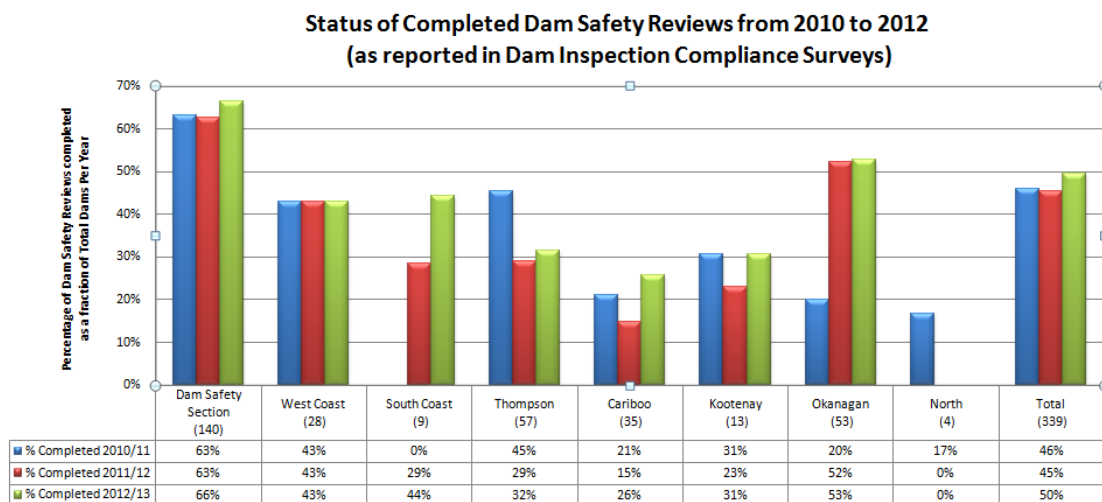


Figure 5: Percent of dams owners having Dam Safety Reviews for their dams. (Note: numbers in brackets are the total number of dams for each administrative unit in 2012/13.)

Data from the compliance forms suggests that for the most part owners of High, Very High and Extreme consequence dams are compliant with the *Dam Safety Regulation* with respect to returning completed survey forms and completing formal inspections. However, the survey still shows that about 50% of dam owners have not completed the required dam safety reviews. Hiring a professional engineer to complete a review of a dam can be costly for some dam owners. In several cases, dam owners have opted to abandon or cancel their water licences and have the dams removed. As a result of the high number of dam owners that have not completed the required Dam Safety Reviews, in summer of 2012, compliance action was initiated as described in the section below “Compliance and Enforcement”.

Dam Safety Review Compliance and Enforcement

In the summer of 2012, the Dam Safety Program in collaboration with the Compliance and Enforcement Branch across the province implemented a strategy to encourage non-compliant dam owners to complete dam safety reviews for their dams or face escalating enforcement. These dam owners were notified by the appropriate authority under the *Water Act* and given adequate time to respond to their Dam Safety Officer on the status of the Dam Safety Reviews being completed for their dams. In addition to the annual dam inspection compliance form sent in the fall of 2012, the dam owners were reminded again on the need for a dam safety review. Because a dam safety review is a requirement under the *BC*

Dam Safety Regulation, dam owners still non-compliant after being given ample time to initiate a dam safety review were subject to enforcement action under the *Water Act*. As a result of this initiative, 197 non-compliant owners of 133 dams across the province (except West Coast Region and North Areas) were notified of this requirement by letter. The West Coast Region and North Areas opted to contact non-compliant dam owners directly to encourage them to complete dam safety reviews.

As of May 1st, 2013, dam safety officers across the province have resolved the dam safety review status of dams which had been included in the non-compliance project (Figure 6). About 32% of the dams considered were “not applicable” to the project for a number of reasons: Dam Safety Reviews were completed and updates not required yet; dams were being decommissioned; dams were currently undergoing redesign/rehabilitation; the failure consequence rating of the dam was incorrect and was being reclassified to low; or dams were under legal review. At this time, 51% of the dams were confirmed by their owners to have dam safety reviews underway, and another 11% have reports completed and submitted by professional engineers. The remaining 6% of the dams are still non-compliant. Most of these dams are administered by different levels of governments and funding for dam safety reviews are being solicited at this time. There are two dams in the Cariboo region whose owners have not responded. Enforcement action is underway in getting these remaining two dam owners to comply. The Dam Safety Review compliance and enforcement project will continue until all dam owners are compliant.

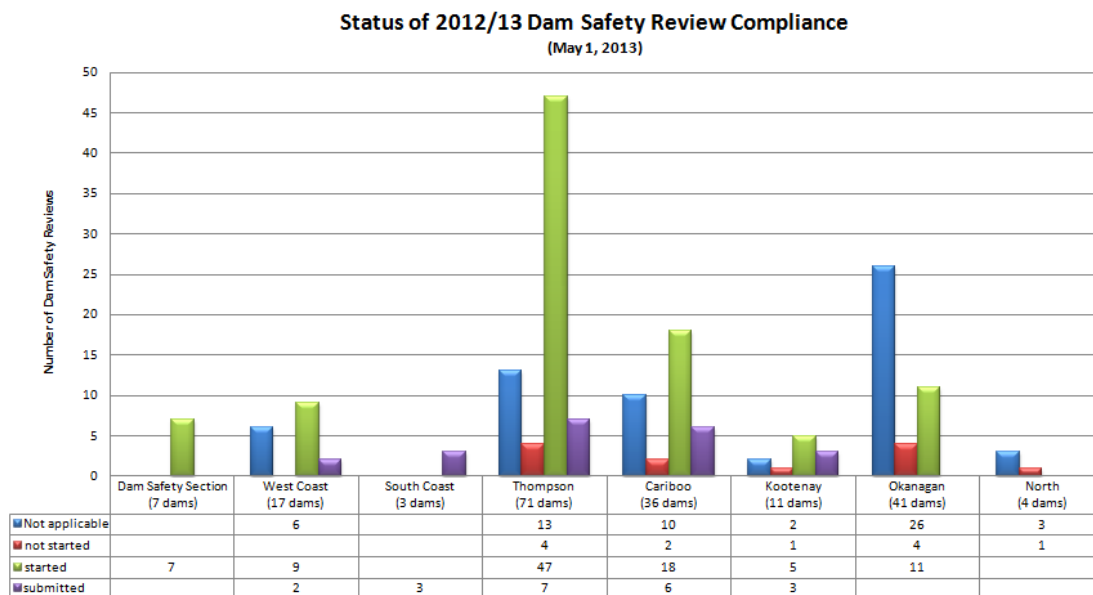


Figure 6: Status of Dam Safety Reviews for dams Identified as requiring Dam Safety Reviews.

Dam Audits

Under the Dam Audit Program, Dam Safety Officers are required to meet with dam owners and conduct a dam audit once every 5 years for High, Very High and Extreme consequence dams and once every 10 years for Significant consequence dams. The audits are an opportunity for Dam Safety Officers to meet

with dam owners, review the records being kept and visit the dams with the dam owner. These audits help determine if the dam owner is aware of and is carrying out requirements under the Regulation. If deficiencies are found, the Dam Safety Officer can usually assist the dam owner in resolving the problem. Where necessary, follow up is done by the Dam Safety Officer or their alternate to ensure that deficiencies are corrected. Each Dam Safety Officer has a target number of audits to complete annually to ensure that all dam audits will be completed within the required time frame as per the Regulation.

In 2012/13, new Dam Safety Officers added to the Dam Safety Program resulted in more dam audits being completed. This is evident with the major dams, managed by the Dam Safety Section in Victoria and the Cariboo, Okanagan and Northern regional dams where the targets have been exceeded by 14%, 41%, 63%, and 71% respectively (Figure 7). Overall, the provincial target was exceeded by 15%. Increase in dam audits are also attributable to efficiencies gained when a large number of dams belonging to one dam owner are completed together as is the case with some major dam owners. Target numbers vary over the years due to new dams added or existing dams deleted from the auditable pool of dams when consequence classification changes for a dam or dams are built or removed. As a result, the average number of dams over the auditable period for different consequence classes is used. In some years, the target is not met and the shortfall is addressed in a subsequent year as is apparent with the Okanagan and Thompson regional dams and with the major dams audited by the Dam Safety Section in Victoria.

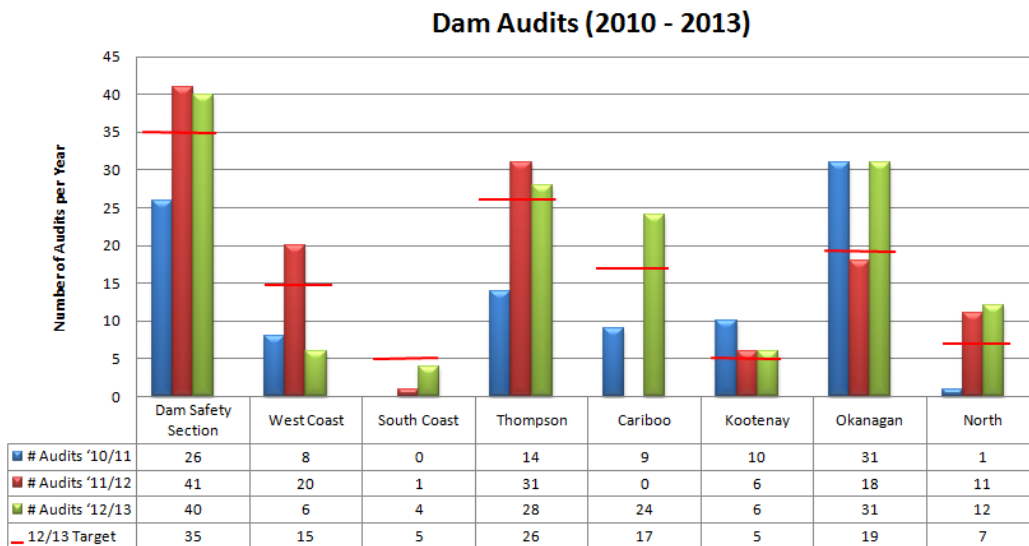


Figure 7: Number of audits completed by Dam Safety Officers compared to the target number of audits over the last three years.

Dam Project Reviews

Dam Safety Officers are involved in the review and approval of project plans for new dams and dams undergoing rehabilitation or removal. They review the work during the design and construction phases of the projects. The following table summarizes the number of dams reviewed in 2012/13 (Table 1).

Table 1: Summary of Project Reviews and Construction for Dams in BC 2012/13.

Areas	New Dams ¹		Rehabilitation		Removal	
	Project Review	Construction	Project Review	Construction	Project Review	Construction
Dam Safety Section (Major Dams >9m high)	0	1	5	2	2	1
West Coast	0	1	0	0	1	0
South Coast	4	0	1	0	0	0
Thompson	0	0	1	1	1	1
Okanagan	1	0	2	0	1	1
Kootenay	1	0	0	0	1	0
North	0	1	0	0	3	1
Cariboo	0	0	2	0	4	2
Total	6	3	11	3	14	6

Dam Registry

The dam registry, accessed only by registered government users, is comprised of two separate but linked digital information systems. One is a database management system referred to as E-Licensing that houses textual data records of dams. The other provides geospatial data to map viewers such as Google Earth and iMap to depict dam information spatially.

In 2012/13, the E-licensing component of the dam registry was improved by updating fields within the database to conform to the Regulation as amended in 2011. Although these changes were made in some parts of the E-licensing database, the same changes could not be made throughout nor in the database that supports the geospatial information system. Therefore, further work needs to be done in 2013/14 to implement the changes throughout the entire database system. Accuracy of dam information is important not only for managing clients but also for reporting on the state of dams in the province and for rapid access to information during emergencies. Consistency and accuracy of data entry into the Dam Registry and ensuring that information is current remains an ongoing activity for the Dam Safety Program.

With the increase in the number of dams registered over the last two years, there is a need to ensure that the spatial locations of the dams are recorded. Of the total number of dams in the dam registry, 82% have associated spatial information. There still exists 376 dams which cannot be viewed on Google Earth or iMap with 56% of those identified as operational dams. Spatial data for the remaining dams is updated as opportunities arise.

Additional database changes to improve the Dam Registry within e-Licensing have been identified and prioritized with other e-Licensing initiatives. These revisions will assist Dam Safety Officers and other users to create a more robust registry that will provide useful and timely information especially in emergency response situations.

¹ Includes increasing the height of a dam to create additional storage.

Provincial Program Management

In addition to activities described in the sections above, there are a number of other accomplishments of the Dam Safety Program:

1. *Program Staffing:* The Dam Safety Program is comprised of the Dam Safety Section (4.5 FTE's), Water Management Branch in Victoria and Regional Senior Dam Safety Officers that report through the Ministry regional structure (5.5 FTE's). Although the Dam Safety Program has had vacant positions in various locations across the province over the past few years, March 2013 marked the first time that all positions were filled. In the Dam Safety Section the following positions were filled: Section Head, Senior Dam Safety Engineer and half-time Dam Safety Program Specialist responsible for training and policy development. Regionally, the Dam Safety Officer positions for the Cariboo and Kootenay were filled. The large Dam Safety Program in the Okanagan was bolstered with an additional dam safety officer covering the northern part of the region. In several regions, administrative staff, water allocation staff, Natural Resource Officers and auxiliary hires assisted the dam safety officers with the Dam Safety Review project, licensing updates, dam site visits, dam registry updates and resolving locations of dams.
2. *Communication:* Guidance documents and weblinks on the [Dam Safety Program website](#) have been updated throughout the year to ensure that information is current with that of the BC Dam Safety Regulation and policies. A new version of the guidance document on Dam Safety Reviews is now available on the website. This will be updated when a comprehensive guide to conducting a Dam Safety Review, being prepared by the Association of Professional Engineers and Geoscientists, becomes available later this year. Prior to the spring freshet (that is, runoff), owners of High, Very High and Extreme failure consequence dams were notified of the need to ensure that their dams were operating properly and suitably maintained to safely discharge possible flood flows.

Emergency Response

Whenever an incident about a dam is reported to the Ministry, a Dam Safety Officer will respond, sometimes with support from regional Compliance and Enforcement staff investigating the incident. 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 logged in incident reports. The following is a summary of dam incidents logged by the Dam Safety Officers for 2012/13:

Dam Failures

There were a total of 5 dams in the Okanagan region which were reported breached in 2012/13. Three of these dams were not licensed by the Province.

1. *North Nine Mile Creek dams:* On May 10, 2012, three unauthorized dams previously discovered on March 29, 2012 on private property were visited by MFLNRO staff. The first dam had impounded approximately 1000 m³ of water and had large sinkholes on the dam crest (Figure 8).



Figure 8: Large sinkholes on crest of one North Nine Mile Creek dam.

The second dam impounded 10,000 m³ of water and had a large breach recently created at the centre of the dam crest as a result of internal erosion due to gopher activity (Figure 9).



Figure 9: Aerial view of a large breach on another North Nine Mile Creek dam.

The third dam, the largest of the three, was overtopped in 5 locations but the breach was clearly evident on the western end where erosion of the abutment had also occurred (Figure 10). Heavy rains and above average temperatures exacerbated erosion conditions leading to partial breaches of the three dams. Immediate action was taken on the second dam with the construction of a relief spillway and continued excavation of the breach on the western end of the third dam. On May 15, 2013, a controlled breach was performed on the second dam when the water level behind the dam was low enough. As a safety measure, the owner was also directed to maintain another foot of freeboard by lowering the reservoir level behind the third dam.



Figure 10: Breach of the western end of the third North Nine Mile Creek dam.

2. Knox Lake and Weddell Lake dams - During the audit of these dams located east of Kelowna near McCulloch Reservoir on September 10, 2012 by staff, these earthfilled structures were discovered to have been breached (Figures 11 and 12). Freeboard was inadequate for both dams. To stop the breach from progressing due to overtopping, a tarp was initially used by the dam owner to cover the breach. MFLNRO are following up with the dam owner on an alternative strategy to deal with the dam.



Figure 11: Partial breach of Knox Lake.



Figure 12: Evidence of overtopping on crest of Weddell Lake dam

Dam Alerts

There were three dam alerts reported in 2012/13. A dam alert occurs when an abnormal condition is observed at a dam or a dam performs abnormally and, without swift and effective intervention, a breach may occur.

1. *Clark Lake (Big White Beaver Pond) Dam:* A section of the 201 Forest Service Road crosses this dam and a culvert functions as the dam spillway. On May 16, 2012 following warm temperatures and significant rainfall, the reservoir level rose and overtopped the dam crest and road, causing significant erosion. Upon inspection, the main culvert was found to be entirely blocked by beaver debris. Had the dam failed, 40 acre feet of water could have been suddenly released into Clark Creek causing environmental damage. The nearest downstream community, Carmi, is located approx. 20 km away; however, it was felt that a full breach would not impact the infrastructure or population. The culvert was cleared on May 18, 2012.
2. *Harkin Creek Pond Dam:* The incident was not reported by the dam owner at the time that it occurred. On June 26, 2012, MFLNRO staff auditing the earthfilled dam east of Skaha Lake were informed by the dam owner that one of the buckets used for floating the low level outlet pipe off the bottom of the reservoir became unattached and blocked the spillway pipe. Water in the reservoir rose almost to the crest before the dam owner removed the blockage and the reservoir level was brought back to the normal operating range. The owner was advised to increase the freeboard as it was less than 0.5m and to construct a proper spillway.
3. *Little Trapper Reservoir Dam:* On September 21, 2012, one of the dams in the James Reservoir area east of Kelowna was found to have notable seepage around the outlet gate and through the dam. The water level in Little Trapper Reservoir (also known as Scotty Creek Meadows Reservoir) is influenced by water diverted from the upper James Reservoir. At the time conditions were dry and there was minimal water in the reservoir. The outlet gate at the James Reservoir was shut to minimize water flowing into Little Trapper reservoir and the reservoir was drained to the height of the seepage in the dam. Looking at the longer term, the owner of the dam was required to provide a professional engineer's report to discuss the future options for the dam.

Dam Incidents

There were two dam incidents reported. A dam incident occurs when an abnormal condition is observed at a dam or the dam performs abnormally but the condition is not expected, at the time it is observed, to lead to a breach of the dam.

1. *Yellow Lake Dam:* On May 25, 2012, during regular surveillance of the dam, new seepage near the low level outlet of the dam located southwest of Penticton was reported. The seepage was noted and reported by the owner and flow increased significantly over the course of a couple of weeks. Vegetation around the dam was recently cleared to increase the visibility of the dam. The seepage is being monitored.
2. *Tie Lake Dam:* On June 27, 2012, MFLNRO, Ministry of Transportation and Infrastructure (MOTI) and Regional District of East Kootenay staff visited Tie Lake dam and the dikes near Jaffray as the reservoir had only 5" (12cm) of freeboard and the water level was rising (Figure 13). MFLNRO staff recommended appropriate monitoring frequency, techniques to apply to prevent wave erosion, and clearance of debris and vegetation in culverts downstream of the dam. The Regional District was informed that emergency and evacuation plans were needed to assist emergency response personnel and the residents in the immediate area and beyond in case the Tie Lake Road be overtopped, and flooding occur downstream in residential areas. MFLRNO advised that a professional engineer was needed to assess the safety of the dam especially the lack of freeboard and spillway capacity.



Figure 13: High water level of the Tie Lake reservoir

No Dam Incidents

This term is for reports that are initially received as dam incidents but that do not impact the safety of a dam. This could be an erroneous report or a report about an abnormal condition that could be interpreted as a threat to a dam. There were four reports classified as 'No Dam Incidents' in 2012/13.

1. *Morehead Lake Dam:* On April 23, 2012, Emergency Management BC contacted the Dam Safety Section about a loose flashboard on the Morehead Dam, located west of Likely, as reported by a neighbouring resident. Regional MOTI and MFLNRO staff in Williams Lake were dispatched to the site to inspect the dam. The top flashboard was discovered lying flat in the reservoir, not upright as was intended, with water flowing over it causing it to move slightly. No safety concerns were found with the dam or flashboard structure.

2. *Chute Lake Dam*: On April 27, 2012, due to heavy rainfall from the previous day, reservoir inflows exceeded the capacity of 4 culverts on the Elinor Forest Service Road located just 10m downstream of the dam which is located south of Kelowna. This resulted in the road impounding water from the reservoir to an approximate height of 0.6m above the dam. Significant internal erosion of the road and creation of sinkholes in the road threatened to cause a sudden release of 200 acre-feet of water into Ratnip and Chute Creek, which placed numerous downstream properties at risk (Figure 14). Twenty four hour monitoring of site conditions and ultimately removal of a section of Elinor road defused the situation. This is considered a 'no dam incident' because at issue were the Forest Service Road culverts and the road itself, not the dam.
3. *Former HB Mines tailings pond dam*: This dam is not regulated under the *BC Dam Safety Regulation* therefore is classified as 'No Dam Incident' by the Dam Safety Program. The dam is regulated by the Ministry of Energy and Mines under the *Mines Act*. On July 3, 2012, a slough occurred on the dam which is located near Salmo. In the process of drawing down the reservoir a sinkhole was revealed on the inside face of the dam, located 1.8m below the normal highwater mark. To repair this dam, an additional supporting berm was created to ensure stability and retention of the tailings. Longer term remediation is required.
4. *Johnson's Landing*: On July 12, 2012, initial reports suggested that torrents bringing down large boulders on Gar Creek near Johnson's Landing was due to the failure of a dam. Regional MFLNRO staff from the Nelson office inspected the site and verified that the dam was located on a different stream and was not the cause of the torrent. The debris torrent was a landslide (Figure 15).



Figure 14: Sinkhole in Elinor Forest Service Road.



Figure 15: Landslide near Johnsons Landing.

Conclusion

In 2012/13, MFLNRO made substantial progress in a number of areas in the Dam Safety Program, continuing with the commitment to deliver on the recommendations arising from the review of the Testalinden dam failure. Many dam owners or their representatives received training in dam safety and dam safety staff and other MFLNRO staff were trained to be knowledgeable about current dam safety practices to better assist dam owners in attaining compliance with the regulation and to identify safety

concerns when visiting dams. Staff have continued collaboration with the APEGBC and the CDA to develop improved technical bulletins and information for dam owners and their consultants (e.g. Dam Safety Review Guidelines) to help ensure consistency in expectations of dam owners across the province. Within its community of practice, dam safety officers have co-operated jointly with natural resource officers in developing a compliance and enforcement strategy to better enable dam safety in the province. One area which has benefited from this collaboration is the improvement in the number of dam safety reviews being started by dam owners in 2012/13. Throughout the year, vacant dam safety positions across the province were filled allowing program activities to continue and, in some areas, were responsible for exceeding performance targets for dam audits for the year while effectively reducing the backlog of audits that was created when positions were vacant for extended periods. Dam safety officers have responded to emergencies which included dam failures, dam alerts, dam incidents and non-incidents. They have also been involved in emergency preparedness planning with other levels of government.

A large return of the Dam Inspection Compliance forms was maintained this year as a result of staff diligence. A high percentage of owners of High, Very High and Extreme failure consequence classification dams reported conducting formal inspections. Updating the dam registry to be current with the 2011 Regulation has been partially successful and more improvements are slated for 2013/14. The audit of the dam registry has revealed that in some areas there have been improvements in the quality of the information, but more work is still needed by the dam safety officers to ensure that the database is current and accurate. The Dam Safety website and its contents have been updated to meet the standards of the current Regulation.

BC Dam Safety Program
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