

## B.C. DAM SAFETY PROGRAM ANNUAL REPORT 2018/19

### EXECUTIVE SUMMARY

This annual report summarizes the achievements, challenges and ongoing improvements to the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) dam safety program. In 2018/19, the program regulated approximately 1,879<sup>1</sup> dams in British Columbia that divert and/or store surface water or groundwater. These structures include dams associated with hydro-electric power generation, agricultural irrigation, industrial use, municipal water supply, domestic use, and structures that regulate lake or river levels for flood control. They also include dams associated with dugouts<sup>2</sup>, which are often constructed to store water for the purpose of livestock watering or for irrigation. The Dam Safety Regulation requirements may apply if a dugout includes an artificial barrier or embankment that was constructed to retain water. Since the *Water Sustainability Act* and updated Dam Safety Regulation came into effect early in 2016, much effort has been expended in providing education and raising awareness to support compliance with the new legislation and regulation. Highlights of the 2018/2019 B.C. Dam Safety Program operational accomplishments include:

#### Operations

Program Indicators	Number/Percentage completed
Dams audited	115
Percentage of annual dam status reports received from owners of 350 high, very high and extreme failure consequence dams	97%
Percentage of dams inspected, as reported by dam owners in the annual dam status reports	92%
Dam alert responses	5
Dam incident responses	4
Dam non-incident responses	6
Dam failure responses	3

<sup>1</sup> It is anticipated that the number of regulated dams will increase as more groundwater-filled structures and existing water supply dams and dugouts, associated with oil and gas activities in the Northeast region of B.C., are assessed and regulated under the *Water Sustainability Act* and Dam Safety Regulation.

<sup>2</sup> A dugout is a reservoir or impoundment constructed by excavating into the ground or by building an embankment to the land in order to collect and store water.

## ***Program Accomplishments***

- More funding from the Water Information Systems Project (WISP) enabled the dam safety program to test and refine the new digital communication process. This led to the launch of a pilot system where owners of high, very high, and extreme consequence classification dams could submit their annual dam status reports online.
- Further WISP funding enabled the dam safety program to design and digitize the workflows associated with dam safety officers auditing dams and responding to dam incidents, improving workload management.
- Dam safety staff regularly updated the dam database over the past two fiscal years to improve information and data acquisition processes.
- The dam safety program has employed a full time Training Coordinator to develop and facilitate multiple training and education workshops across the province.
- Dam safety staff participated in professional development provided internally by FLNRORD and externally by other jurisdictions and professional associations.
- FLNRORD collaborates with the Oil and Gas Commission (OGC) to establish a dam safety program within the OGC, as part of its water authorization function under the *Water Sustainability Act*.

The dam safety program has been successful in several areas this year and continues to work toward addressing challenges, including:

**Low consequence dams:** Dam safety officers (DSOs) currently address issues with low consequence dams on a reactive or complaint-driven basis. The program is exploring opportunities for additional capacity to proactively engage with owners of low consequence dams, such as formal and informal training sessions.

**Information management system:** Under the guidance of the Water Business Section of the Water Management Branch, the dam safety program continued improvement of the internal dam database to make the E-licensing system more robust. The program has also obtained further funding to enhance e-Licensing to better support DSO interactions with their clients.

**Unauthorized dams:** The proliferation of dams and dugouts as a result of the oil and gas activities in the Northeast region of B.C. is being carefully handled by FLNRORD and OGC to ensure that unauthorized and unregulated water structures are brought into compliance with the *Water Sustainability Act* and the Dam Safety Regulation.

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## INTRODUCTION

This annual report summarizes the achievements, challenges, and ongoing improvements to the Ministry of Forests, Lands, Natural Resource Operations and Rural Development's (FLNRORD) Dam Safety Program for the period of April 1, 2018 to March 31, 2019. 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.

### B.C.'s Dam Safety Program

The aim of the Dam Safety Program is to promote the safety of water storage dams in B.C. by:

- Providing formal and informal training to dam owners and dam safety professionals, based on best practices in both dam safety and education.
- Monitoring dam owner compliance with the Dam Safety Regulation.
- Reviewing project plans for dams to ensure consistency with Canadian Dam Association Guidelines and other industry standard practices.
- Supporting emergency planning and response for dam safety incidents.

### History and Regulatory Framework

B.C.'s dam safety program began in 1967 in response to the rapid development of large hydroelectric dams in B.C. At that time, dams greater than 15 metres in height were inspected by government engineers under the authority of the *Water Act*. Over time, the program expanded to include smaller dams. Inspections focused on ensuring the dams were designed, constructed, operated, and maintained to acceptable standards for public safety.

The first B.C. Dam Safety Regulation under the *Water Act* came into effect in 2000 based on recommendations from an independent program review of the 1995 Cannon Creek Dam failure. The regulation placed legal responsibility for the safety of dams on dam owners; thus, requiring owners to operate, maintain, and inspect dams to minimize risk to the public, the environment, and the economy. In addition to the new regulation, the program reviews recommended enhancements to the dam safety program to improve rigour, consistency, accountability, and to ensure adequate resources were present to deliver the program across the province. The review also recommended that the program follow the standards and guidelines of the Canadian Dam Association (CDA).

Further improvements were made to the regulation and the program in response to the Deputy Solicitor General's recommendations following the 2010 Testalinden Dam failure. These include developing a comprehensive database of dams in the province, requiring signage at dams, updating failure consequence classifications, and making education and awareness a key pillar of the program.

On February 29, 2016, the *Water Sustainability Act* (WSA) and Dam Safety Regulation (Regulation) came into effect replacing the former *Water Act* and B.C. Dam Safety Regulation. The WSA maintains the system of water rights in B.C. for streams and brings groundwater into the water rights scheme. The Regulation therefore now applies to dams in B.C. that impound stream water and/or groundwater under the WSA.

## Program Delivery and Operations

The Dam Safety Program is delivered by the Dam Safety Section in Victoria and designated dam safety officers (DSOs) from FLNRORD regional offices and from the BC Oil and Gas Commission. The Dam Safety Section in Victoria is responsible for overall administration of the program, in close collaboration with regional and OGC DSOs. This includes leading development of legislation, policies and procedures, coordinating delivery of education/training sessions, reporting progress on program objectives, meeting the program's information systems needs, and leading the dam safety community of practice. DSOs in the Dam Safety Section in Victoria are also responsible for regulating most water supply dams greater than nine metres in height (also known as major dams). Dam safety officers based in FLNRORD regional offices are generally responsible for dams that are less than nine metres high within their regions. Dam safety officers in the OGC are responsible for all dams that are owned by oil and gas permit holders. The program also receives support from FLNRORD's compliance and enforcement branch and partner agencies such as Emergency Management BC.

Dam safety officers undertake the following activities while administering the dam safety program:

- Conduct periodic audits of dam owners' dam safety management systems to ensure that dam owners are compliant with the regulation and dam safety management systems are consistent with both government and CDA guidelines.
- Review annual dam status reports submitted by dam owners summarizing their dam safety activities, as required by the regulation.
- Assess formal dam safety reviews completed by an engineer on behalf of the dam owner, every 7 to 10 years for high, very high, and extreme consequence dams.
- Monitor dam owners' progress on addressing any potentially hazardous conditions at their dams, as identified through dam safety reviews, audits, regular inspections or any other means.
- Review plans for dam construction, rehabilitation, replacement, and decommissioning to ensure consistency with CDA guidelines.
- Review new and modified Dam Emergency Plans as well as Operation, Maintenance, and Surveillance Manuals for consistency with government and CDA guidelines.
- Review failure consequence classifications for new dams or changes to failure consequence classification for existing dams. Failure consequence classification determines the regulatory requirements that apply to a dam. Higher classification dams are subject to higher levels of regulation and oversight.
- Educate dam owners about regulatory requirements, government and industry guidelines, and best practices in dam safety.
- Respond to dam safety emergencies. This can involve a range of activities from overseeing a dam owner's response to hazardous conditions at a dam or, if a dam owner does not respond, undertaking the work necessary to help respond to and mitigate the hazard.

## Regulated Dams in B.C.

A wide range of dams are authorized under the WSA and subject to the Regulation. These include some of the largest dams in Canada associated with hydro-electric power generation (e.g. the Mica Dam), as well as dams used for agricultural irrigation, industrial use, municipal water supply, domestic use and flood control. As of March 18, 2019, there were a total of 2,050 active dams in B.C. of which 1,879 are regulated by the Dam Safety Program. (Table 1).

**Table 1: Number of regulated and unregulated active dams in British Columbia under the *Water Sustainability Act* and the Dam Safety Regulation (as of March 18, 2019).**

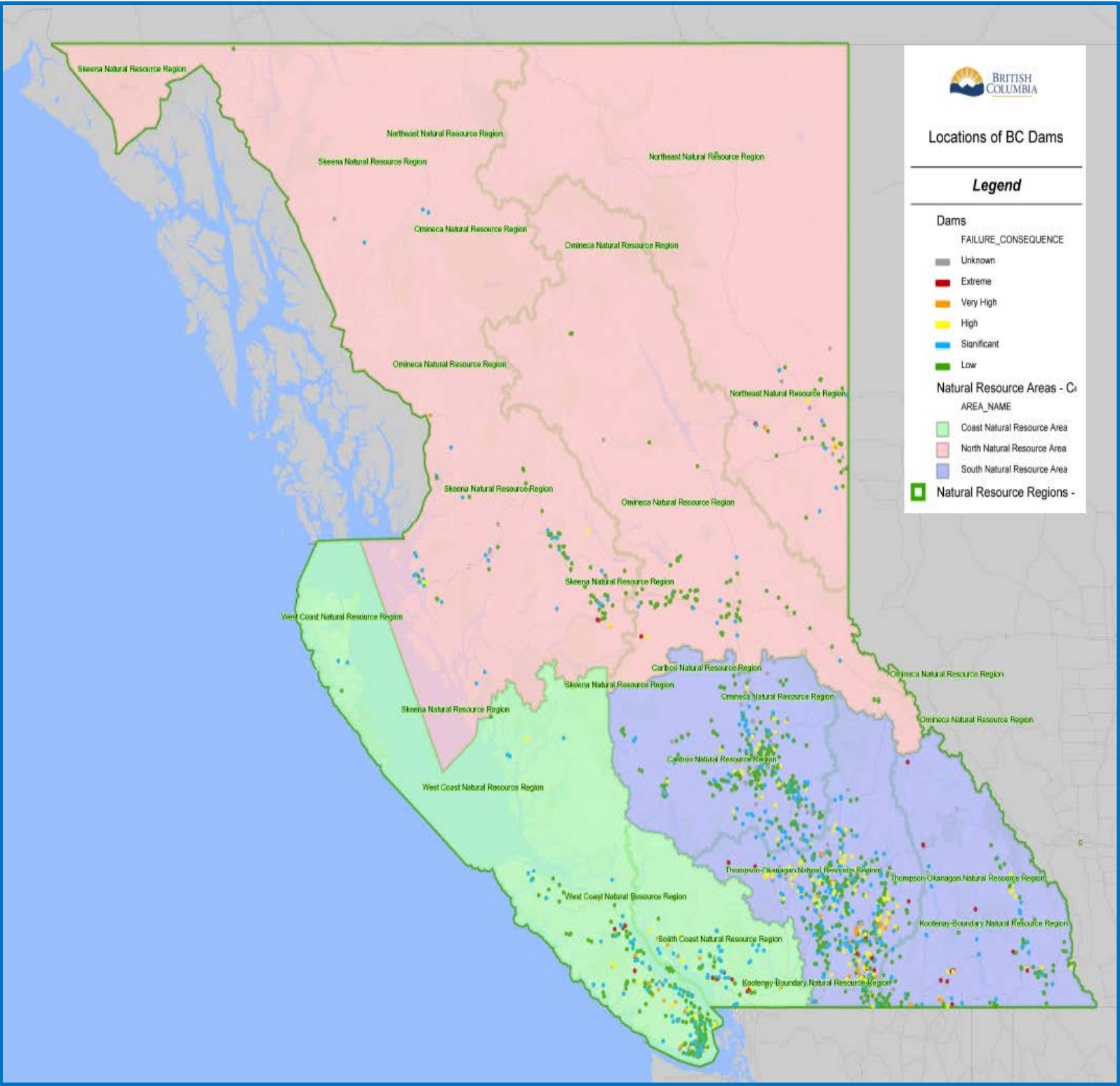
Failure Consequence Class	Regulated Dams	Unregulated Dams	Total
Extreme	43	0	43
Very High	82	0	82
High	229	0	229
Significant	597	7	604
Low	753	97	850
None	0	5	5
Unclassified <sup>3</sup>	175	62	237
<b>Dam Totals</b>	<b>1,879</b>	<b>171</b>	<b>2,050</b>

While Significant, High, Very High, and Extreme failure consequence dams are of special concern, they represent about 51% of the total active regulated dams in B.C. Approximately 2% of the total have been classified as Extreme consequence and these include some of the largest dams in B.C. (refer to Appendix: Figure B for percentage distribution of dams). The failure consequence class with the largest number of dams is Low, comprising about 40% of the total active dams. Using the FLNRORD Natural Resource Area administrative system, 61% of the total active regulated dams are found in the South Area, followed by 22% in the Coast Area where most of the population is located, and 16% in the North Area (Figure 1). The South Area has about 30% of the total active regulated Significant to Extreme failure consequence dams, the Coast Area with about 15%, and the North Area with about 5% (refer to Appendix: Figure A for more details on regional distribution of dams).

The total percent of the active dams that have not been classified or do not have a classification is 12% (and is shown collectively as Unknown in Figure 1). Most of these dams have not been authorized under a water licence.

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<sup>3</sup> Unclassified Consequence refers to active dams whose consequence have not yet been determined. The number is due to the fact that these dams are very small and do not fall within the threshold of where the entire regulation applies (in terms of storage and height) and were considered non-regulated prior to the 2016 Regulation amendment. These dams are therefore a low priority for the Dam Safety Program. As well many dams have been built recently in the Northeast for oil & gas purposes and consequence classifications are pending following field assessments.



**Figure 1:** Location of all dams of all failure consequence classes in the three Natural Resource Areas (including Regions) in B.C. in 2018/19



Unregulated dams include those that are less than 7.5 m in height and impound less than 10,000 m<sup>3</sup> of water. These unregulated dams, also referred to as “minor dams,” can be made subject to the Regulation by order of the Comptroller of Water Rights, or a water manager if that person determines the dam is or may become hazardous to public safety, the environment, land or other property. Other unregulated dams include those that are not active such as those still in the application stage, decommissioned, or removed. Unregulated dams however, may remain in oversight by a DSO and subject to orders under the WSA or water licence terms and conditions. The dam safety program also responds to issues at unregulated dams when necessary to ensure public safety and protect the environment and property.

## **2018/19 PROGRAM ACTIVITIES**

The activities of the dam safety program in 2018/19 are grouped into 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 advent of the B.C. Dam Safety Regulation in 2000 placed the burden of responsible dam management solely with the dam owner. To assist the dam owner, the Dam Safety Program promotes and provides dam safety education and awareness initiatives. Every audit that a DSO conducts with a dam owner includes a site visit to the dam, which is a valuable time to discuss dam safety aspects. It is imperative that dam owners fully understand their dam safety responsibilities as per the Dam Safety Regulation and the importance of maintaining a safe dam. Furthermore, the Dam Safety Program has employed a full time Dam Safety Training Coordinator who leads the education and awareness pillar of dam safety and delivers dam safety workshops in provincial regions throughout the year. These workshops are available to all owners of dams and are sponsored, in part, by the Ministry of Agriculture, Water Supply Association of BC, and the BC Waste Water Association. In addition, the Training Coordinator has published a new resource for dam owners and stakeholders, to assist in the inspection and maintenance process of dam management and ownership. The program has published a new Dam Safety Pocketbook, which provides a quick overview on common issues found in earthen embankment dams and includes recommended actions. This resource is included in all workshops run by the program and is available upon request.

Dam safety staff have also delivered dam safety education and awareness training internally. FLNRORD staff have been trained to assist DSOs with rapid dam assessments while they are patrolling an area. Additionally, staff who are responsible for provincially-owned dams, such as dams licenced to BC Parks, Fish & Wildlife, Crown Land Restoration Branch, etc. have also been trained to undertake their dam owner responsibilities as per the Dam Safety Regulation.



FLNRORD staff supported development of the Agriculture Knowledge Transfer Resource, a dam safety education program targeted specifically at owners of agricultural dams. The project was made possible with support from the BC Agriculture & Food Climate Action Initiative, Ministry of Agriculture, Agriculture Canada, and the Cariboo Cattlemen's Association. The Dam Safety Section has added this new initiative into its education program in the form of a dam management workshop. Through the partnerships above, the dam safety section runs many one-day workshops, all free of charge, across the province.

The following table is a list of some of the workshops which have been offered in various locations across B.C. along with the attendance records. The workshop types include; Inspection and Maintenance of Dams (I&M) and Dam Management (DM).

**Table 2: Dam Safety Program Workshops**

Year	Location	Number of Attendees	Sponsor	Type
2019	Dawson Creek	9	BCWWA	I&M
2019	Dawson Creek	8	BCWWA	I&M
2019	Burnaby	6	BCWWA	DM
2019	Burnaby	10	BCWWA	I&M
2019	Nelson	15	WSA	I&M
2019	Williams Lake	19	AGRI	DM
2019	Clinton	8	AGRI	DM
2019	Merritt	12	AGRI	DM
2019	Invermere	18	AGRI	DM
2019	Duncan	19	AGRI	DM
2018	Dawson Creek	Unknown	AGRI	DM
2018	Fort St John	Unknown	AGRI	DM
2018	Kelowna	Unknown	AGRI	DM
2018	Kamloops	Unknown	AGRI	DM

Dam safety education continues to be an important part of the BC Dam Safety Program and is key to ensuring dam owner compliance. Refer to the [BC Dam Safety website](#) for future offerings in dam safety training, including an upcoming online self-directed course on dam safety.

To provide broader opportunities for education of dam owners, consultants, and regulators, many dam safety staff participated in various conferences and professional development committees including the Canadian Dam Association (CDA), the Association of State Dam Safety Officials (ASDSO), and the International Commission on Large Dams (ICOLD).

### Communications and Engagement

In addition to formal and informal education, the dam safety program communicates regularly with dam owners and communities of interest. Dam safety staff participated in the following communications and engagement activities in 2018/19:

- The program's Dam Safety Engineer attended a UBC engineering class as guest lecture speaker and provided insight on dam safety best practices for university students.

- Met and assisted with Brookefield Renewable staff in a public meeting to discuss inundation areas and raise awareness of dam safety in local community.
- Met with BC Hydro and Rio Tinto representatives for annual and semi-annual dam safety meetings, respectively.
- Notified owners of high, very high and extreme failure consequence dams in early April ensuring their dams are maintained and operating properly to allow the safe discharge of possible flood flows during spring freshet.

### **Annual Dam Status Report – Self-Reporting by Owners**

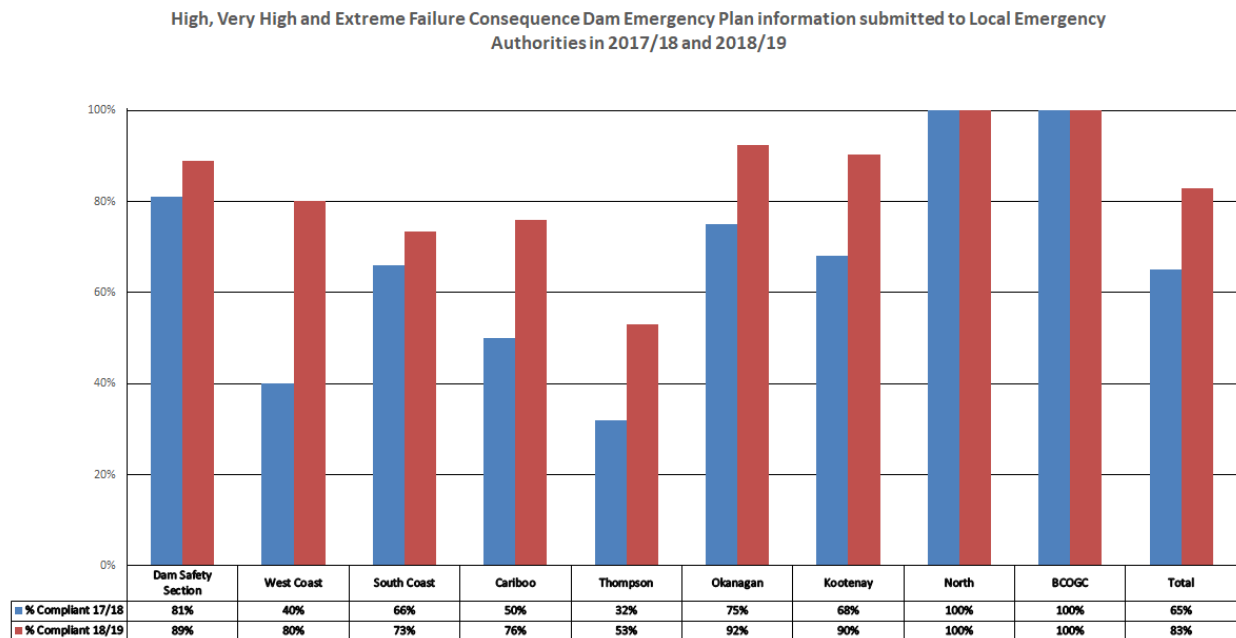
By order of the Comptroller of Water Rights under the WSA, owners of high, very high, and extreme consequence classification dams are required to report annually on dam safety activities, including their compliance with regulatory requirements. Prior to 2018, the annual report form was mailed and emailed to dam owners in November each year. Owners were required to complete the form and respond to questions regarding the following requirements by January of the next year.

- Formal inspection(s) and regular site surveillance
- Dam safety review completed by a qualified professional engineer
- Operations, maintenance, and surveillance manual
- Dam emergency plan and emergency contact information
- Submission of dam emergency plan information to local emergency authority
- Changes to downstream land-use that might affect the failure consequence classification of the dam
- New dam safety concerns that have not previously been reported

Annual Dam Status Reports were completed and submitted online for the first time in the 2018/19 fiscal year. This change was part of a system-wide effort to improve communication between the DSO and the dam owner. The purpose of this initiative was to implement a systematic communication system between the dam owner and the DSO, allowing the dam owner to provide information more efficiently, consistently and effectively. The online response from the dam owners was 72%. As this process was new to dam owners and the system was in development, the low result was expected. Due to this innovative pilot period, dam safety staff have been using this opportunity to train dam owners and their staff in using the new reporting system. Dam safety staff are confident that there will be a higher number of online dam owner responses within three years.

The annual reports submitted by dam owners are used by DSOs as an important source of information to assess compliance, assign risk levels, and to prioritize dams where additional audits may be beneficial. Since 2006, annual reporting by dam owners has improved substantially. If a dam owner does not submit a report for three consecutive years, an enforcement action may be initiated. A total of 338 reports were submitted in 2018/19. Audits conducted by DSOs show that many dam owners are not following through with the work indicated on their report. Whenever dam owners are not meeting their reporting and inspection obligations, DSOs follow up throughout the year to make sure that dam owners and their staff understand the regulatory requirements and the importance of public safety. Failure to comply with the Regulation can result in enforcement action.

Under the Dam Safety Regulation, owners of significant, high, very high, and extreme failure consequence classification dams are required to provide local emergency authorities with dam emergency plan information. Owners of existing dams were given until March 31, 2019 to meet this requirement. For the 2018/19 reporting period, owners of 83% of the dams reported that they had complied with this requirement (Figure 2) which is about 18% more than that of the previous year. DSOs will continue to work with dam owners and local authorities to ensure that all parties are aware of the new requirement.



**Figure 2: Percentage of dam owners self-reporting submission of dam emergency plans information to local emergency authorities in 2017/18 and 2018/19 by administrative unit.**

### Dam Safety Database

Accurate information about B.C. dams is important for DSOs to manage their portfolio of dams, report on the state of dams, and for quick access to information during emergencies. The dam safety database is comprised of two separate but linked digital information systems:

- e-Licensing - houses text-based data records for each dam, and
- BC Dams geographic dataset - provides geospatial data.

E-Licensing is the interface used by DSOs and is available to authorized internal users. Key information from eLicensing for each dam is available to the public in a geospatial layer that can be viewed on [DataBC's iMap service](#).

Funded by the Water Information Systems Project beginning in 2017, the dam safety database was upgraded in e-Licensing to capture more information associated with dams and associated infrastructure, aligning with the requirements set out by the new legislation and regulation. A team of

FLNRORD staff, including dam safety staff, was created to re-design the e-Licensing component of dam safety to be more supportive of the DSO work and facilitate efficient and timely communication between FLNRORD staff and the dam owner. The upgrades will enable the dam owner to directly respond to the DSO electronically and upload reports. The annual dam status report initiative resulted in a database improvement, where dam information is updated more effectively from communication between the dam owner and the DSO. Dam safety staff have been working diligently during the 2018 pilot period with dam owners and their staff to ensure familiarity with the dam status report submission system.

### 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 significant failure consequence classification dams. Each DSO has an annual target of audits to ensure that all dam audits are completed within the required time frame. The audits are an opportunity for DSOs to meet with dam owners to review records and conduct site visits. These audits help confirm whether the dam owner is aware of and is carrying out the requirements of the Regulation. If deficiencies are found, DSOs provide information to help dam owners understand requirements and resolve issues. When necessary, DSOs follow up with owners to ensure that any identified deficiencies are corrected.

In 2018/19, DSOs completed a total of 115 audits. The West Coast, Cariboo, Okanagan and North administrative units met or exceeded their targets. Other administrative units such as the South Coast, Thompson, Kootenay and the Dam Safety Section did not meet their targets (Table 3). This was the result of staff unavailability to complete audits.

**Table 3: Number of audits conducted by dam safety officers in 2018/19 by administrative unit**

FLNRORD Administrative Unit	Dam Audit Target for 2018/19	Dam Audits Completed
Dam Safety Section	33	26
West Coast	15	15
South Coast	6	4
Thompson	26	23
Cariboo	17	20
Kootenay	5	1 <sup>4</sup>
Okanagan	18	18
North	8	8
Total	133	115

In years when targets are not met, the shortfall is usually addressed in a subsequent year.

<sup>4</sup> Audit data are normally provided by DSOs, but alternatives sources such as E-licensing Last Audit Date data are sometimes used in their absence.

## **REVIEW OF PLANS AND MONITORING OF WORK**

### **Reviewing Plans and Monitoring Work in Progress**

The Regulation requires dam owners to submit plans for construction, alteration, or decommissioning of a regulated dam. The DSO must evaluate the plans before the dam owner can commence work. DSOs review these plans for consistency with the Regulation and CDA guidelines and may conduct periodic site visits to monitor construction while the work is underway. DSOs also provide professional advice to other statutory decision makers to coordinate requirements under WSA authorizations (e.g. issuing a leave to commence construction under a water licence), and when a statutory decision maker is issuing an order under the WSA for work related to a dam.

### **Operational Reviews**

The Regulation requires owners of dams, other than those with a low failure consequence classification, to periodically review and revise, if necessary, their Operations, Maintenance, and Surveillance (OMS) manuals as well as their Dam Emergency Plans (DEP). Any revisions and/or updates are submitted to the DSO. This is required at least every 10 years for significant and high failure consequence dams and every 7 years for very high and extreme failure consequence dams. The annual dam status report includes questions on the status of the OMS and DEP, while serving as a reminder to dam owners of their obligation to maintain these documents.

The Regulation also requires owners of dams to review downstream conditions and notify a DSO of any changes that may impact a dam's failure consequence classification. These reviews help ensure that dams are subject to appropriate regulatory requirements and oversight.

## **PROGRAM MANAGEMENT**

### **Outreach and Professional Development**

In 2018/19, dam safety staff continued to collaborate with their counterparts in other jurisdictions, agencies, industry, and professional associations on developing and improving dam safety best practices. Staff represented B.C. at the 2018 CDA Annual General Meeting and Conference in Quebec City, and participated on the CDA Committee on the Regulation of Dams and CDA working groups focused on design and construction guidance and emergency management.

Dam Safety Officers participated in various technical webinars provided by the Association of State Dam Safety Officials, Engineers and Geoscientists B.C., and Natural Resources Canada.

Dam safety officers from the Dam Safety Section, Regions, and the OGC participated in the 35<sup>th</sup> annual Dam Safety Program Community of Practice (COP) in Victoria in February of 2019. The annual COP meetings bring all dam safety staff across the province for an in-person conference. This allows all staff to discuss key issues relating to our program such as regulatory compliance, technical questions, administrative inconsistencies, and legal aspects. Attendance to this meeting, along with the biennial Technical Training, is also required by all DSOs to maintain their designation under the Water Sustainability Act. The 2018/19 COP meeting covered failure mode assessments and capital projects, the Canadian Dam Association Emergency Bulletin, recent developments in internal erosion of dams, impact

of extreme floods and climate change, professional reliance, and training on the newly improved dam database system. Field trips to several local dams in the Capital Regional District provided a backdrop to discuss dam safety issues faced by dam owners.

In 2018/19, dam safety officer training was offered to several new regional dam safety staff in the North, Cariboo, and Westcoast regions, as well as three staff from the Oil and Gas Commission. All new dam safety program staff are required to receive a basic program orientation overview and undertake audits under the supervision of an experienced DSO, before receiving a DSO designation. This, along with monthly conference calls, the annual community of practice meeting and biennial technical training, helps ensure that staff have the skills necessary to fulfill their role as DSOs. It also promotes consistency in the application of the program and Regulation across the province.

## **DAM INCIDENTS & FAILURES**

When an incident relating to a dam is reported to the province, a DSO or other FLNRORD staff person will immediately respond, occasionally with support from regional compliance and enforcement staff. The dam owner is contacted and depending on the situation, Emergency Management BC and other agencies may be involved. These investigations are recorded in incident reports. Not all reported incidents are an emergency or even an issue related to a dam, but regardless each one is followed up on and a Dam Incident Report is created and filed. The following is a summary of the dam incidents reported in 2018/19.

### **Dam Breach (Breach of dam imminent, in the process of breaching, or has breached)**

There were three dam breaches reported in 2018/19.

1. Dam Name: Dalzall Creek (unauthorized) dam  
DFile : none  
Date: December 27, 2018  
Consequence Classification: Unknown  
Location: North of Duncan

On December 27, 2018, a local resident reported a breach of an unauthorized dam north of Duncan (*Photo 1*). The breach was caused by the weakening of the embankment from trees being uprooted by windthrow. The culvert spillway of the dam was also blocked, raising water levels in the reservoir and causing further erosion, contributing to the breach. FLNRORD staff was informed by the dam owner that the damage and contents of the breach was limited to the owner's property only. FLNRORD staff followed up with the dam owner regarding the stability of the dam breach and invited the dam owner to a January training workshop in Duncan.





**Photo 1:** Stable breach on dam on Dalzell Creek

2. Dam Name: Stack Valley (unauthorized) dam  
DFile : none  
Date: May 7, 2018  
Consequence Classification: Unknown  
Location: Riske Creek area

On May 7, 2018, FLNRORD staff reported that an unknown 89m long dam in the Riske Creek area had overtopped (*Photo 2*). The 3m wide crest and 1.5m of the embankment along the lower level outlet pipe had eroded, potentially causing the breach of the dam. The dam owner had cut a trench along the spillway pipe to enable further discharge, allowing the water level in the reservoir to drop. FLNRORD staff directed the owner to monitor the reservoir level over the subsequent days and report any changes.





**Photo 2:** Unknown dam near Riske Creek overtopping.

3. Dam Name: Valley Pond (Upper) Dam  
DFile : D810560-00  
Date: April 24, 2018  
Consequence Classification: Low  
Location: Near 150 Mile House

On April 24, 2018, FLNRORD staff discovered Valley Pond (Upper) Dam overtopping, slumping, undergoing erosion and in the process of breaching at several locations (*Photo 3*) during a site visit of this Low consequence dam near 150 Mile House. The spillway was blocked with debris and was partially flowing. FLNRORD directed the agent of the dam owner to notify the Ministry of Transportation (MOTI), downstream property owners and stakeholders, and to immediately remove the spillway debris as soon as possible. FLNRORD staff informed MOTI, the Cariboo Regional District, and Emergency Management BC about the incident. The agent had complied with the direction and

was later required to draw down the water level and retain the services of a qualified engineer to assess the dam and submit a plan for repair.



**Photo 3:** Overtopping and erosion of the Valley Pond (Upper) Dam embankment

### **Dam Alerts (Abnormal conditions requiring immediate action to avert breach)**

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. There were five dam alerts reported in 2018/19.

1. Dam Name: Bubna Slough Dam  
DFile : D240261-00  
Date: April 10, 2018  
Consequence Classification: Significant  
Location: Northwest of the Kelowna airport

On April 10, 2018, City of Kelowna staff notified FLNRORD of a potential overtopping issue regarding an unauthorized Significant failure consequence dam (*Photo 4*) located northwest of the



international airport. A breach of the two-metre-high dam would release about 57,000 m<sup>3</sup> of water and overwhelm the detention ponds of the landfill below, sending leachate downhill onto agricultural fields. The Emergency Operations Centre was prepared to pump the ponded water at the landfill elsewhere to prevent contamination.



**Photo 4:** Bubna Slough dam near overtopping from high water level in reservoir

2. Dam Name: Kitley Creek Dam  
DFile : D220141-00  
Date: April 3, 2018  
Consequence Classification: Low  
Location: Willowbrook Area

On April 3, 2018, FLNRORD staff conducted a cursory audit of the Low consequence dam and reservoir, while responding to flooding conditions around Prather Lake, Kearns Creek and the Willowbrook area. The review determined that despite a six-inch diameter lower level outlet fully

discharging, there was less than a foot of freeboard left below the dam crest (*Photo 5*) and no spillway. An Order was issued to the dam owner directing an immediate drawdown of the reservoir and Prather Lake under the supervision of a qualified engineer. This requirement was to continue until freshet inflows subsided. The owner willingly complied, noting that in 2018 that the dam will be decommissioned.



**Photo 5:** Kitley Creek dam crest with less than a foot of freeboard

3. Dam Name: Minton Lake Dam  
DFile : D810436-00  
Date: May 19, 2018  
Consequence Classification: High  
Location: Northeast of Williams Lake airport

On May 19, 2018, Cariboo Fire Centre staff reported that freeboard at the lowest point of their dam was less than a foot (*Photo 6*) and diminishing due to rising water level in the reservoir caused by freshet and snowmelt. As the lower level outlet and spillway were flowing unhindered, FLNRORD



staff advised increasing discharge through the lower level outlet to further reduce the water level. The owner was also advised to work with the Cariboo Regional District, who alerted downstream residents and property owners of the potential flooding. A qualified engineer was hired by the owner to monitor and assess conditions at the dam site. This activity together with the monitoring of downstream crossings, enabled the owner to inform all the stakeholders of the developments and actions taken. After the reservoir level had subsided to approximately one meter of freeboard, the emergency was lifted.



**Photo 6:** Rising water level in the reservoir of the Minton Lake dam

4. Dam Name: Park Rill Dam  
DFile : D220177-00  
Date: April 11, 2018  
Consequence Classification: Significant  
Location: South of Willowbrook

On April 11, 2018 during record high stream flows, FLNRORD staff discovered a Significant failure consequence dam south of Willowbrook, BC having only three inches of freeboard remaining (*Photo 7*). Continued flows at this rate would lead to overtopping of the dam and cause downcutting of the

unarmoured emergency spillway, potentially leading to an uncontrolled release of the reservoir. A previous inspection noted that the dam, spillway, and other support structures were deteriorating or inadequate for their purpose. A dam breach would cause significant damage downstream, placing numerous residents at risk. The dam owner was directed by FLNRORD staff to hire a qualified engineer to develop a plan to protect the spillway from erosion and to maintain adequate freeboard on the dam. The owner declined to retain an engineer and instead, provided more site surveillance and regular updates on the freeboard of the dam. FLNRORD staff had planned to follow up with the owner with a directive to provide a plan to address the deficiencies of the dam.



**Photo 7:** Three-inch freeboard left on the Park Rill dam at the highest water level

5. Dam Name: Saltgrass Pond (unauthorized) dam  
DFile : D220171-00  
Date: April 7, 2018  
Consequence Classification: Significant  
Location: South of Willowbrook

On April 7, 2018, FLNRORD was notified by a member of the public about a recently constructed dam impounding 32,700 m<sup>3</sup> of water on a wetland area south of Willowbrook. An audit of the Significant failure consequence dam by FLNRORD staff revealed that the dam was near overtopping with an



inch of freeboard to spare. It was not authorized through a water licence nor was it constructed to provincial standards and lacked a spillway and a lower level outlet. The failure of this dam would result in a risk of overwhelming the Park Rill Dam and downstream culverts on the Seacrest road below. The road would be eroded, creating a debris flow that would scour the channel and deposit the debris in the Sportman's Bowl area. Potential flooding would overtop and compromise Highway 97. The dam owner, ordered by FLNRORD staff to immediately lower the reservoir level, used culverts to siphon the water (*Photo 8*). The local emergency authority for the Regional District of Similkameen and Emergency Management BC were notified of the incident and the need to evacuate downstream residents.



**Photo 8:** Siphoning of the reservoir also caused erosion of the Saltgrass Pond dam

### **Dam Incidents (Conditions NOT requiring immediate intervention to avert breach)**

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.

There were four dam incidents reported in 2018/19.

1. Dam Name: Spillimacheen Dam  
DFile : D330000-00  
Date: March 15, 2019  
Consequence Classification: Significant  
Location: West of Spillimacheen



On March 15, 2019 west of Spillimacheen, BC Hydro staff reported to FLNRORD the rupture of a small bypass pipe downslope of a Significant failure consequence dam. Although this resulted in a large release of uncontrolled water to the hillside above the penstocks and the powerhouse, it did not threaten the safety of the dam, which was located further upstream on the Spillimacheen River. The dam creates a head pond which diverts water into a tunnel leading down to the penstocks. The bypass pipe is associated with one of two penstock intake valves controlling the flow through penstocks. Due to the bypass pipe situated at the downstream end of the tunnel (*Photo 9*), the uncontrolled pipe flow was stopped by stoplogs being placed at the tunnel intake. Assessment of the hillside slope showed no risk of a landslide that would affect the dam. Power to the nearby community was disrupted and the powerhouse was flooded.



**Photo 9:** View of rupture in bypass pipe associated with the tunnel diverting water from the head pond of the Spillimacheen dam.

2. Dam Name: Kitley Lake (unauthorized) dam  
DFile : D220155-00  
Date: April 3, 2018  
Consequence Classification: Low  
Location: Okanagan

On April 3, 2018, FLNRORD staff discovered that this unauthorized low consequence dam was overtopping and did not have a spillway. The agent of the dam owner was informed of the incident

and instructed to stop further erosion from the overtopping. Should a breach occur as a result of this, the owner would be held responsible under the **Dam Safety Regulation** for any damages caused by the breach. The owner indicated that he would protect the dam crest by laying down a filter fabric. A dam file was created for this dam.

3. Dam Name: Frank Lake (unauthorized) Dam  
DFile : D230122-00  
Date: June 6, 2018  
Consequence Classification: Significant  
Location: Near the Nighthawk/Washington border crossing

On June 6, 2018, FLNRORD staff reported that an unauthorized Significant failure consequence dam was exhibiting signs of instability on the upstream slope (*Photo 10*) located near the Nighthawk/Washington border crossing. The reservoir was estimated to hold approximately 130,000 m<sup>3</sup> of water at the time of discovery. A dam breach or discharge would significantly impact a residence and a secondary highway downstream. On February 14, 2019, FLNRORD issued an Order to the dam owner to:

- a. Immediately release the stored water,
- b. Hire a qualified engineer by April 30,
- c. Prepare a dam decommissioning plan under direction from the DSO (DSO),
- d. Submit the plan to the DSO by July 1 for acceptance, and
- e. Begin decommissioning the dam by September 1 so that completion will occur prior to 2020 spring freshet season.

The owner has not complied with the Order. Since the owner formerly owned the Testalinden dam near Oliver which failed in 2010, the file is now administered by FLNRORD Compliance and Enforcement Branch. A dam file was created for this dam.



**Photo 10:** Upstream slope of Frank Lake dam showing signs of slumping

4. Dam Name: South Fork Dam  
DFile : D720007-00  
Date: January 3, 2019  
Consequence Classification: Very High  
Location: South of Nanaimo

On January 3, 2019, City of Nanaimo (dam owner) staff reported to FLNRORD that a log boom guarding the water intake entrance of the South Fork Dam failed (*Photo 11*). The water intakes and the dam had not been impacted by the log debris. The dam owner waited for the river flows to decrease to reinstall the log boom. Emergency Management BC was contacted regarding this incident.



**Photo 11:** Log debris held by free floating log boom located upstream from the South Fork Dam

### **No Dam Incidents (Conditions NOT impacting safety of the dam (verify as appropriate))**

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 no reports classified as “no dam incidents” in 2018/19.

## **PROGRAM CHALLENGES AND OPPORTUNITIES**

The Provincial Dam Safety Program continues to make progress in addressing the recommendations of the 2010 Deputy Solicitor General’s report on the Testalinden Dam failure. Program staff is working to address a number of challenges:

**Low consequence dams:** Dam safety officers (DSOs) currently address issues with low consequence dams on a reactive or complaint-driven basis. The program is exploring opportunities for additional capacity to proactively engage with owners of low consequence dams, such as formal and informal training sessions.

**Information management system:** The internal dam database (e-Licensing) is undergoing further improvements to make the system more robust. The program has obtained funding to enhance e-Licensing to better support DSO activities. Under the guidance of the Water Business Section of the Water Management Branch, dam safety staff are beginning to make improvements in their business interactions with their clients through this improved database.

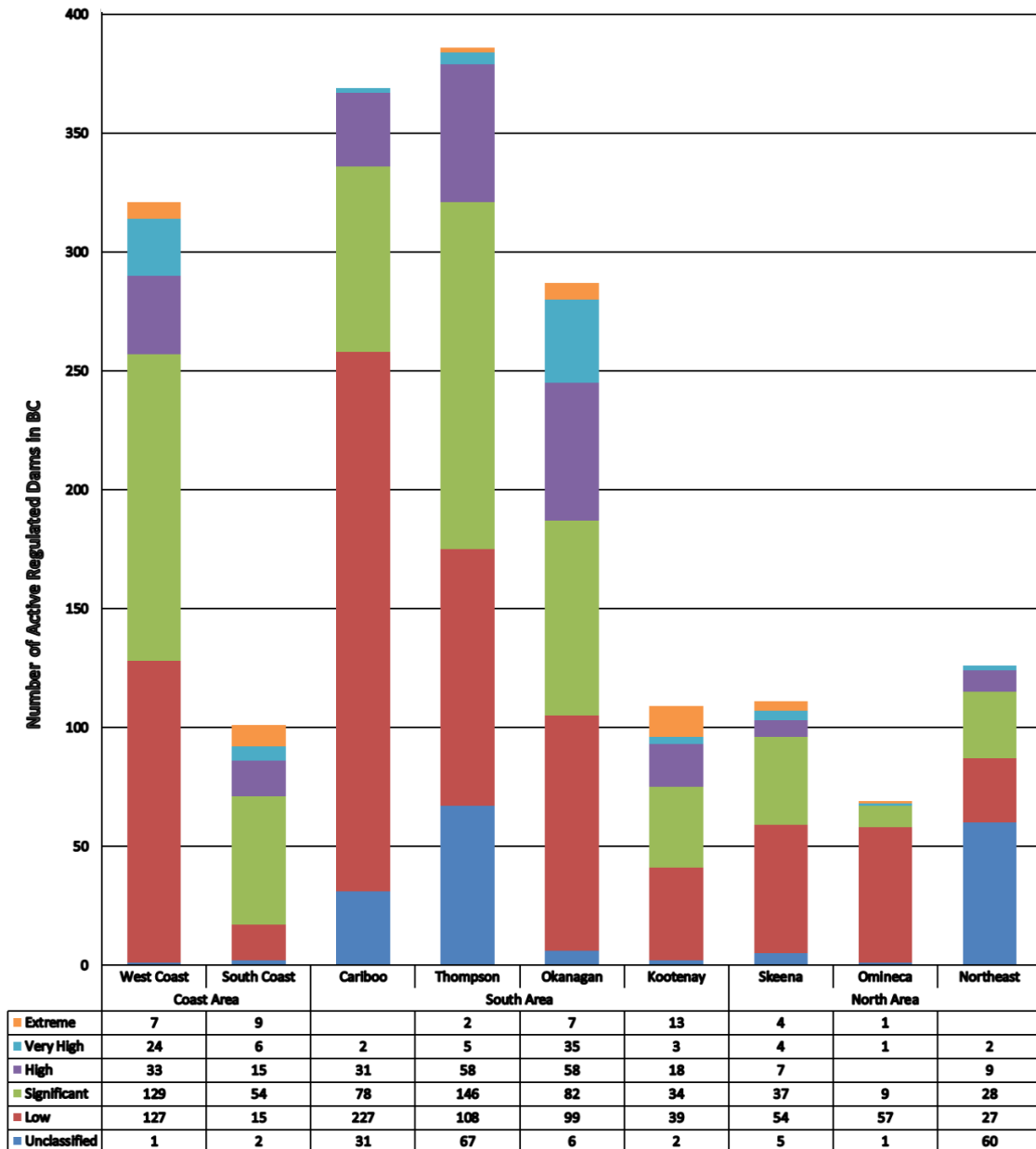
**Unauthorized dams:** The proliferation of dams and dugouts as a result of the oil and gas activities in the Northeast region of B.C. is being carefully handled by FLNRORD and OGC to ensure that unauthorized and unregulated water structures are brought into compliance with the *Water Sustainability Act* and the Dam Safety Regulation.

B.C. Dam Safety Program  
Ministry of Forests, Lands and Natural Resource Operations and Rural Development  
September 2019



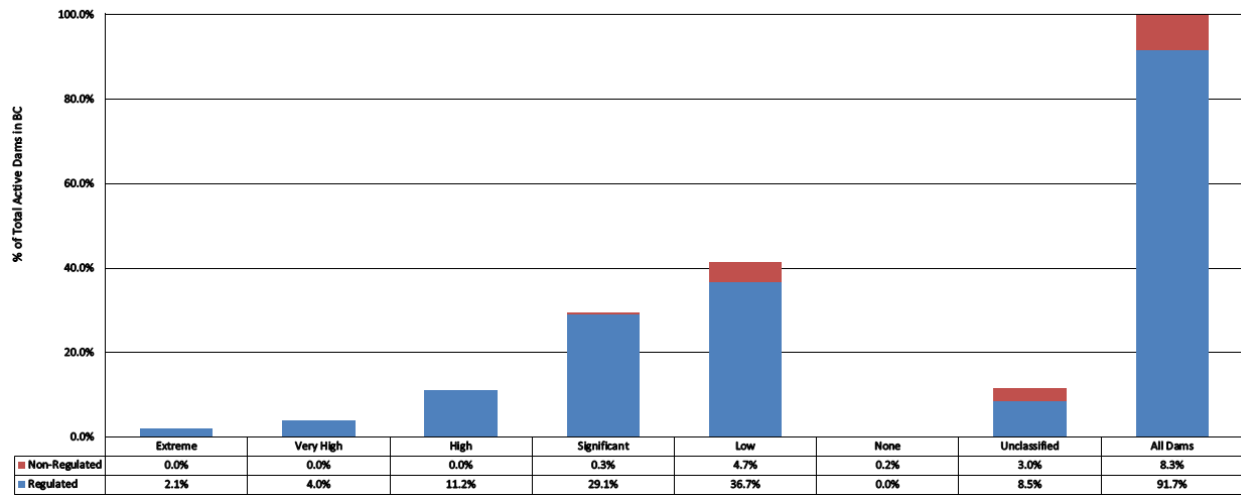
## APPENDIX

**Distribution of BC Active Regulated Dams by Failure Consequence Class and by FLNR Natural Resource Area and Region**



**Figure A:** The distribution of active regulated dams by failure consequence classes and by Natural Resource Areas and Regions (as of March 18, 2019)

**Percent Distribution of BC Active Dams by Failure Consequence Class and by Regulatory Status**



**Figure B: The regulated status of active dams in B. C. of all failure consequence classes (as of March 18, 2019)**