13: Quarterly Dam Safety Report

Executive summary

The purpose of this report is to update the Operations, Planning, Safety and Information Technology Committee of the Board of Directors on key dam risk management activities during the period from October 1 to December 31, 2024 (F2025 Q3) and to provide reasonable assurance that the safety of dams operated by BC Hydro continues to be managed to the established guidelines and criteria of the Dam Safety Program. To keep the Committee as fully abreast of the Dam Safety Program as possible, some notable developments that took place after December 31, 2024, but before the completion of this report have also been included.

The key highlights from F2025 Q3 and the beginning of F2025 Q4 documented in this report are:

- The two concrete pontoons of the floating guidewall for the navigation lock at Hugh Keenleyside Dam, which sunk during a storm in January of 2020, were refloated and towed to temporary anchorages in November and December of 2024. The two salvaged pontoons will be inspected and potentially refurbished for return to service in an upgraded guidewall, for which a project has been initiated. See pages 8 and 9.
- To maintain full generating capacity at G.M. Shrum Generating Station while one generating unit at Peace Canyon Generating Station remains out of service, two spillway gates at Peace Canyon Dam have had their heating systems augmented with temporary systems to prevent the build-up and bridging of ice on the gates' trunnions and arms and the gate bodies, and so improve their reliability for winter operation. These measures were implemented in advance of a planned (but not yet released) project to reinstate failed components in those gate heating systems. An Interim Dam Safety Risk Management Plan specifies operational measures for preventing ice accumulation during spilling, which have been shown to be effective at Site C Dam during its continuous spill through this winter. See pages 6-7 and 16.
- Dam surveillance was performed in full conformance with the plan in Q3. All 408 scheduled routine inspections were completed, all field work for formal inspections of the dams and reservoir slopes has been completed, and issuing of the formal engineering reports is ahead of plan. See pages 11 and 12.
- Maintenance and testing of dam safety assets was effectively performed through Q3. Monthly spillway gate testing at Comox Dam revealed a deficiency in the capacity of the backup power supply that arose from an ongoing project, leading to timely implementation of interim measures. See pages 12-15.
- Further to the previous bullet item, deficiencies in the work delivered by the Comox-Puntledge Flow Control Improvements Project have required the urgent implementation of temporary measures, including the rental of diesel generators, to manage and mitigate the resulting interim risks. Permanently rectifying these deficiencies will require an additional construction season. The project's quality plans are being reviewed to identify and implement improvements before the next construction season. See pages 7-8 and 18.

Presenter: Bob Schubak (Director, Dam Safety)

Dam Safety Program Dashboard

The following dashboard provides an overview of the status of the Dam Safety Program. "Traffic lights" provide a qualitative indication of the status of each of five elements of the Program and trend arrows identify whether the status is improving, deteriorating or unchanged. As referenced, these indicators are supported by more detailed metrics and narratives in the report.

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Risk Profile and Issues Management	G →	• **Vulnerability Index (pp. 3-5):** The aggregated Vulnerability Index increased slightly by 1.4 through F2025 Q3 due to the recharacterization and re-rating of previously identified issues at Comox and Whatshan Dams, partially offset by the determination that Cheakamus Dam will not be overtopped in the Probable Maximum Flood as previously thought. • **New and Current Issues (pp. 6-9):** Salvage of the sunken pontoons for the navigation lock guidewall at Keenleyside Dam was successfully completed. Temporary heating for the spillway gates at Peace Canyon Dam was installed to provide reliable winter operation. Interim measures are in place to manage deficiencies on the Comox-Puntledge Flow Control Improvements Project.
Regulatory Compliance	Y ↓	• **Comptroller of Water Rights (pp. 9-10):** The annual meeting between BC Hydro and the Comptroller of Water Rights was held in Victoria in November. • **Operation, Maintenance and Surveillance Manual Updates (p. 10):** An administrative error led to the Clayton Falls Dam update being mistakenly planned for completion at the end of calendar year 2025, rather than at the end of calendar year 2024 when it was due. *This Program element's performance indicator has been downgraded to yellow as a result.* BC Hydro will complete and issue this update in Q4 of F2025 to return to full regulatory compliance. • **Dam Safety Reviews (p. 10):** Reviews progressed and were issued according to plan. • **Dam Safety Program Management System (p. 10):** Eighteen additional sections of the expanded and restructured *Implementation Manual* were issued .
Surveillance	G →	• **Dam Inspections (pp. 11-12):** Field work is complete and issued reports are ahead of plan on formal dam inspections. All of the 408 scheduled routine inspections were completed in Q3. • **Reservoir Slopes (p. 12):** Field work is complete and issued reports are ahead of plan on reservoir slopes inspections.
Maintenance and Testing	G →	• **Civil Maintenance (pp. 12-13):** Condition-based civil maintenance was completed slightly ahead of plan through the first three quarters of F25. There was continued improvement in preventive civil maintenance and year-to-date completion reached 93 percent. • **Spillway Gates (pp. 13-15):** All 235 scheduled gate tests were performed in Q3, in which four gates failed to operate on demand. The number of outstanding maintenance tasks was unchanged through Q3, with the number of completed tasks being offset by new ones.
Projects and Investigations	Y ↓	• **Capital Projects (pp. 17-20):** Civil works on the John Hart Dam Seismic Upgrade Project progressed; Stage 1 civil scope of seismic upgrades to the Alouette-Stave Tunnel, refurbishment of the foundations of the four Bridge River 1 penstocks, and recoating of the exterior of the Lake Buntzen 1 penstock were completed. Deficiencies in gate system upgrades in the Comox-Puntledge Flow Control Improvements Project will require an additional construction season to correct; the project's quality plans are under review and *this Program element's performance indicator has been downgraded to yellow*. • **Dam Safety Investigations (p. 20):** No notable updates.

Legend:

G	All areas within the Program element are being implemented to a satisfactory level. Minor, isolated issues may exist but are not deemed to be indicative of deteriorating performance.
Y	One or more areas within the Program element exhibit or are at risk of underperformance and are being monitored.
R	One or more areas within the Program element exhibit unsatisfactory performance and require correction.
↑	Status of the Program element has improved over the quarter.
→	Status of the Program element was unchanged over the quarter.
↓	Status of the Program element deteriorated over the quarter.

Risk Profile of BC Hydro's Dams

Dam Safety Contribution to Enterprise Risk

Dam Safety is assigned a high "risk priority" within BC Hydro's Enterprise Risk report. Please refer to that report for additional details.

Vulnerability Index Update

Identified physical deficiencies in BC Hydro's dams and the degree of concern that exists with respect to their impact on the integrity and performance of the dam are characterized by the Vulnerability Index. The higher the value of the Vulnerability Index (scale of 0-10), the higher the likelihood of that deficiency leading to poor performance. The Vulnerability Index for each identified issue at each dam site is shown in Figure 1. Vulnerability Indices for the individual deficiencies are aggregated into stacked bars for each dam, and dams are sequenced from left to right in order of increasing downstream consequences per the BC Dam Safety Regulation. Changes in Vulnerability Index for actual and potential deficiencies (including those related to spillway reliability), aggregated across the entire fleet of dams, are tracked on a quarterly basis and shown in Figure 2. Notable changes in Vulnerability Index in F2025 Q3 are identified in Figure 1 and described below.

1. A ***reduction*** of 0.3 (Potential Unusual deficiency) at ***Cheakamus Dam***.
   Under a previous routing of the Probable Maximum Flood, the earthfill dam was estimated to be overtopped for a period of 17 hours, which could have led to backward erosion of the dam crest and a breach of the dam. Routing of the most recently calculated Probable Maximum Flood, however, demonstrates that the reservoir will not overtop the dam. This issue is now closed.

2. An ***addition*** of 1.1 (Potential Unusual deficiency) at ***Whatshan Dam***.
   This issue was recently reassessed as a part of the dam's annual database review, and its Vulnerability Index was increased from 0.4 to 1.5. During drilling to install anchors in 1961, granular material was found in the boreholes under the main concrete dam, and there is no documentation that a cut-off was established under the dam during original construction. Without a cut-off, the foundation under the central section of the concrete dam may be susceptible to piping-type failure. Under normal load conditions, there has been no evidence of seepage or mobilization of fine particles beneath the dam since its construction in 1952, but it is postulated that, in an unusual flooding event occurring approximately once every 1000 years, pressure gradients under the dam could be high enough to mobilize the granular material and lead to a piping failure.

3. An ***addition*** of 0.1 (Potential Unusual deficiency) at ***Comox Dam***.
   This issue was recently reassessed as a part of the dam's annual database review, and its Vulnerability Index was increased from 1.0 to 1.1. A flood event estimated to occur once every 2,000 years would overtop the dam, initiating erosion of the right abutment.

4. An ***addition*** of 0.5 (Potential Unusual deficiency) at ***Comox Dam***.
   This issue was recently reassessed as a part of the dam's annual database review, recharacterized to a Potential Unusual deficiency, and assigned a Vulnerability Index of 0.5. A flood event estimated to occur once every 2,000 years would overtop the dam and the right abutment, cutting off access to the gate control building and potentially destroying the buried services running from the building to the dam.

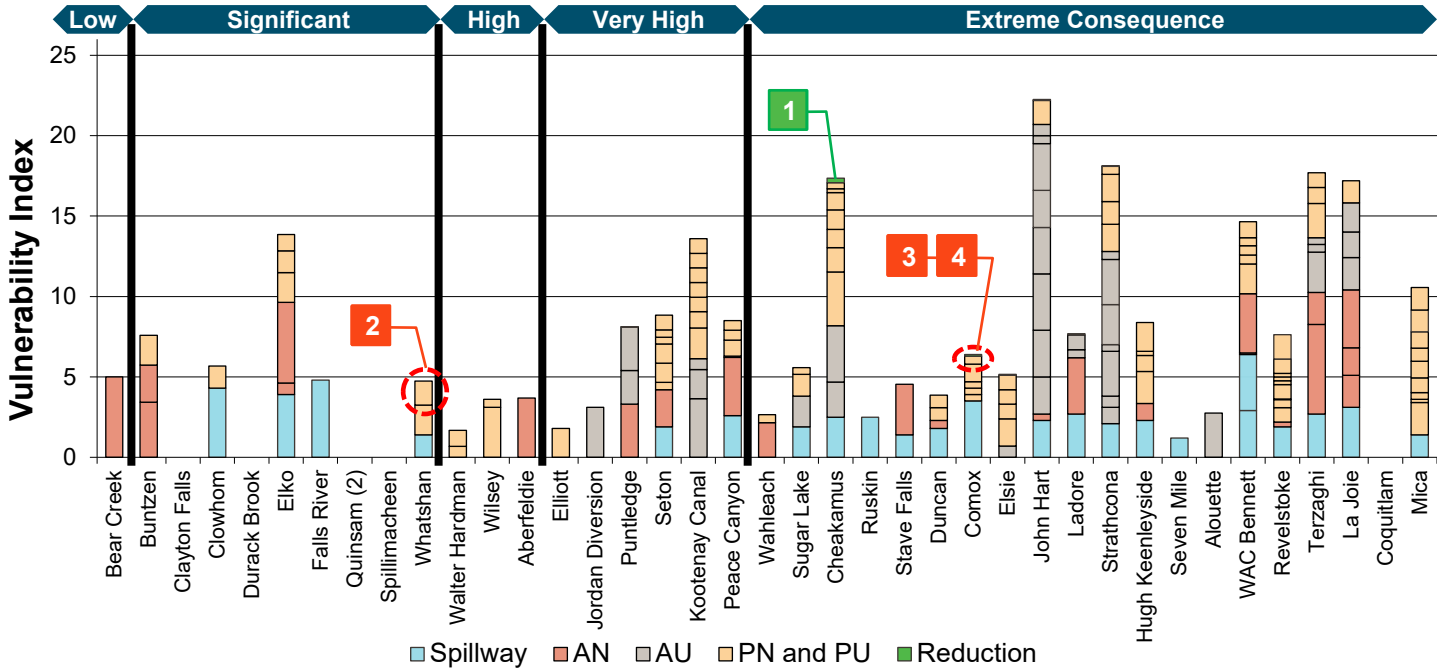

Figure 1 Dam Safety overall risk profile at the end of F2025 Q3, as represented by the Vulnerability Index. Changes this quarter are indicated by the numbered boxes.

AN	***Actual*** deficiency (demonstrated to exist) under ***normal*** load conditions.
AU	***Actual*** deficiency (demonstrated to exist) under ***unusual*** load conditions.
PN and PU	***Potential*** deficiency (requiring further investigation to demonstrate existence) under either normal or unusual conditions.
Spillway Reliability	Deficiency related to operational reliability or serviceability of the dam's spillway and/or other flood discharge systems.

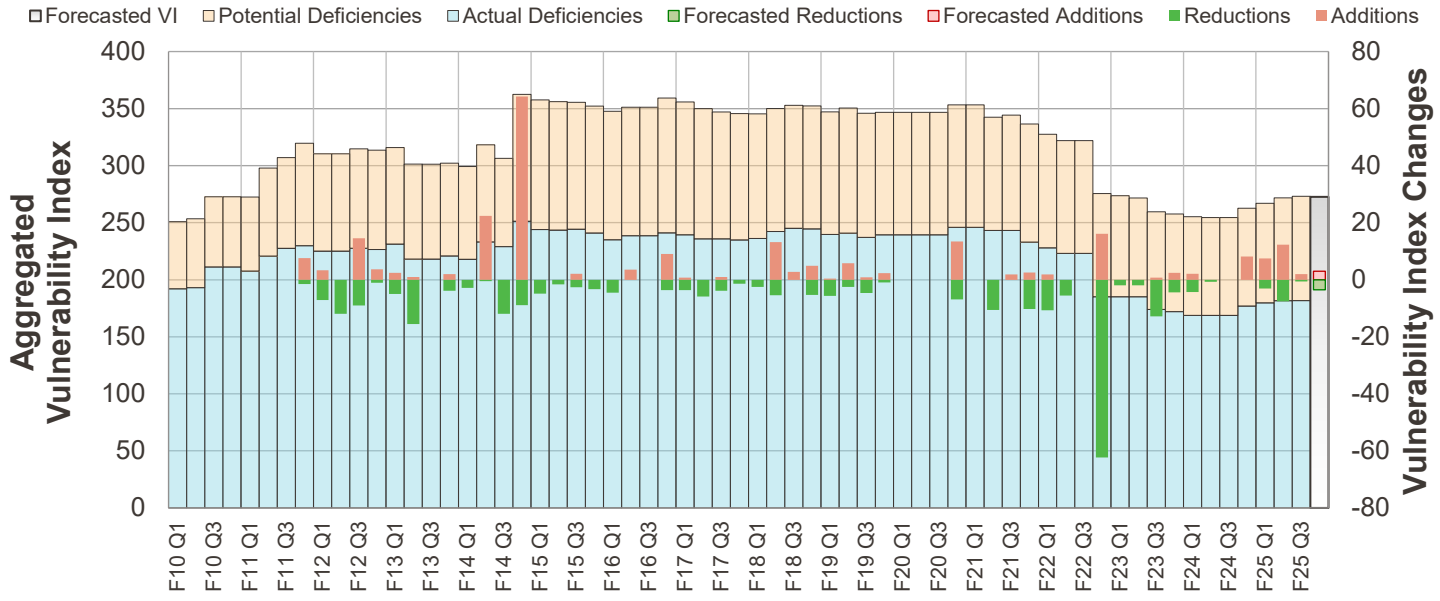

Figure 2 Historical and forecast changes and trends in the Vulnerability Index aggregated across the BC Hydro system.

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Over the last several years, new issues have added to the aggregated Vulnerability Index at a rate of approximately 12 per year. To prevent deterioration of the overall risk position, reductions in Vulnerability Index through resolved issues should occur at the same pace or faster. As evident in Table 1, below, Vulnerability Index reductions have lagged behind additions and have not met the target pace over the past four quarters but are anticipated to meet the target over the current fiscal year.

Table 1 Trends and forecasts for Vulnerability Index changes in F2025.

		Actual / Forecast	Target	
Dam Safety Vulnerability Index	Reductions – Last 4 quarters	11.3	12	✘
	Reductions – Fiscal Year Forecast	14.8	12	✓
	Additions - Last 4 quarters	30.0		

Non-Conformances in the Dam Safety Program

Non-Conformance issues arise where the established procedures, systems and instructions of the Dam Safety Program Management System are not being followed at a particular dam, or where procedures that form part of established and generally accepted good practices have not been implemented within the Dam Safety Program Management System or at a particular dam.

Activities to identity, review, resolve and close Non-Conformance issues continued through F2025 Q3. As a result, 31 Non-Conformance issues were resolved and 10 new issues were identified, leaving 225 issues outstanding. Since the start of F2019, when resolution of such issues was made a priority within the Dam Safety Program, the number of Non-Conformance issues has been reduced by 60 percent. Figure 3 below shows the continuing progress in reducing the number of Non-Conformance issues.

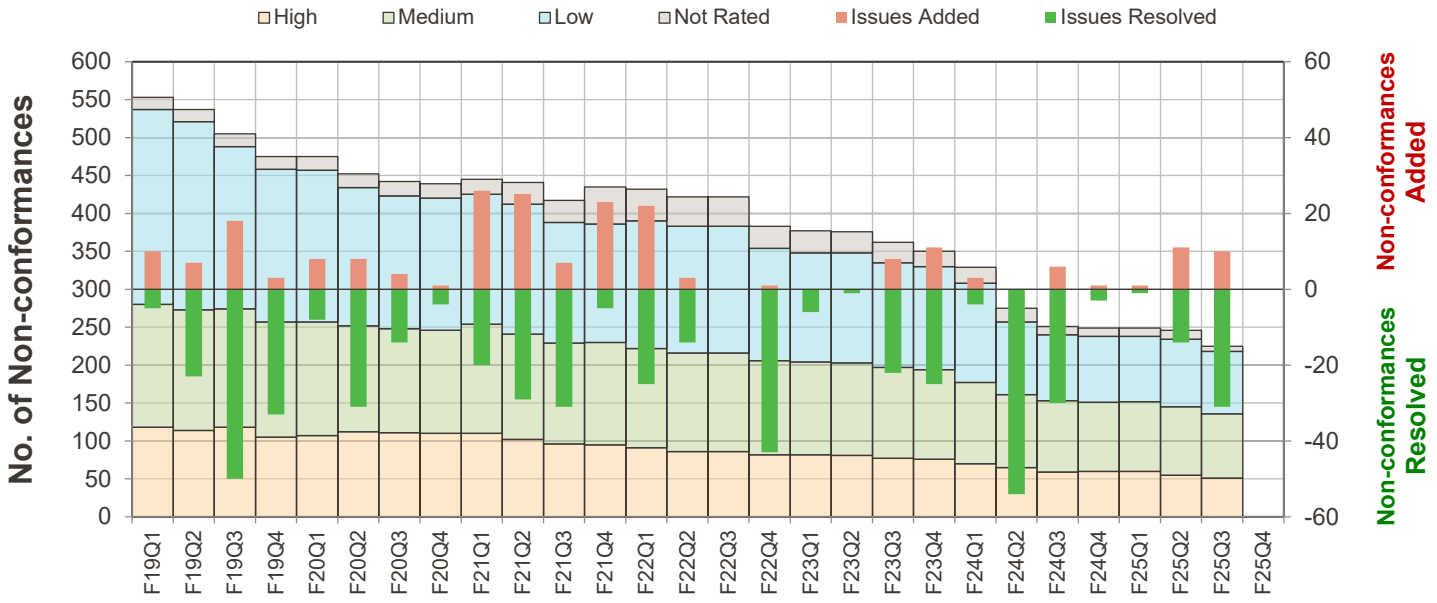

Figure 3 Changes and trends in the total number of Non-Conformance issues (characterized by level of importance) within the Dam Safety Program.

New Issues

Winter Operability of Peace Canyon Spillway Gates

The three generating stations on the Peace River – G.M. Shrum, Peace Canyon, and Site C – provide a large portion of BC Hydro's capacity and are critical to meeting peak winter loads on the power system. One of Peace Canyon's four generating units is out of service, reducing the powerhouse's generating capacity – and its water conveyance capacity – by one-fourth.

Due to their close proximity to one another and the small storage capacity of the Dinosaur Reservoir between them, the water passing through Peace Canyon to G.M. Shrum must be approximately equal to safely maintain reservoir levels. A 25 percent net reduction in water conveyance through Peace Canyon would also reduce the water conveyance *and* generating capacity of GM Shrum by 25 percent. While normal practice is to provide the flow through each station using the generating units, operation of G.M. Shrum to meet peak power system loads may require releasing water through the Peace Canyon Dam's spillway gates. Generation System Operations has identified that spills may be required several times through the winter, with durations of several days, and potentially during the coldest days of the year.

Peace Canyon Dam's six spillway operating gates were designed with provision for winter operation. Agitators prevent the development of ice in the reservoir immediately upstream of each gate, and heaters along the gates' sills and side guides prevent ice formation across the interfaces between the gate bodies and the spillway structure. These agitators and heaters are all in place and functional.

Gates 3 and 4 in the middle of the spillway are equipped with more winterization features than the other gates, having enclosed spaces with heaters to prevent ice formation on the gate body, heaters installed on the gate arms to prevent ice "bridging" between the arms and the piers, and heaters to prevent ice build-up on the trunnions around which the gates pivot to open and close. See the bottom of Figure 4, at right. These two gates alone can pass the anticipated flows, but several of their additional heaters are no longer functioning. A small project to restore those heaters has been planned but has not yet

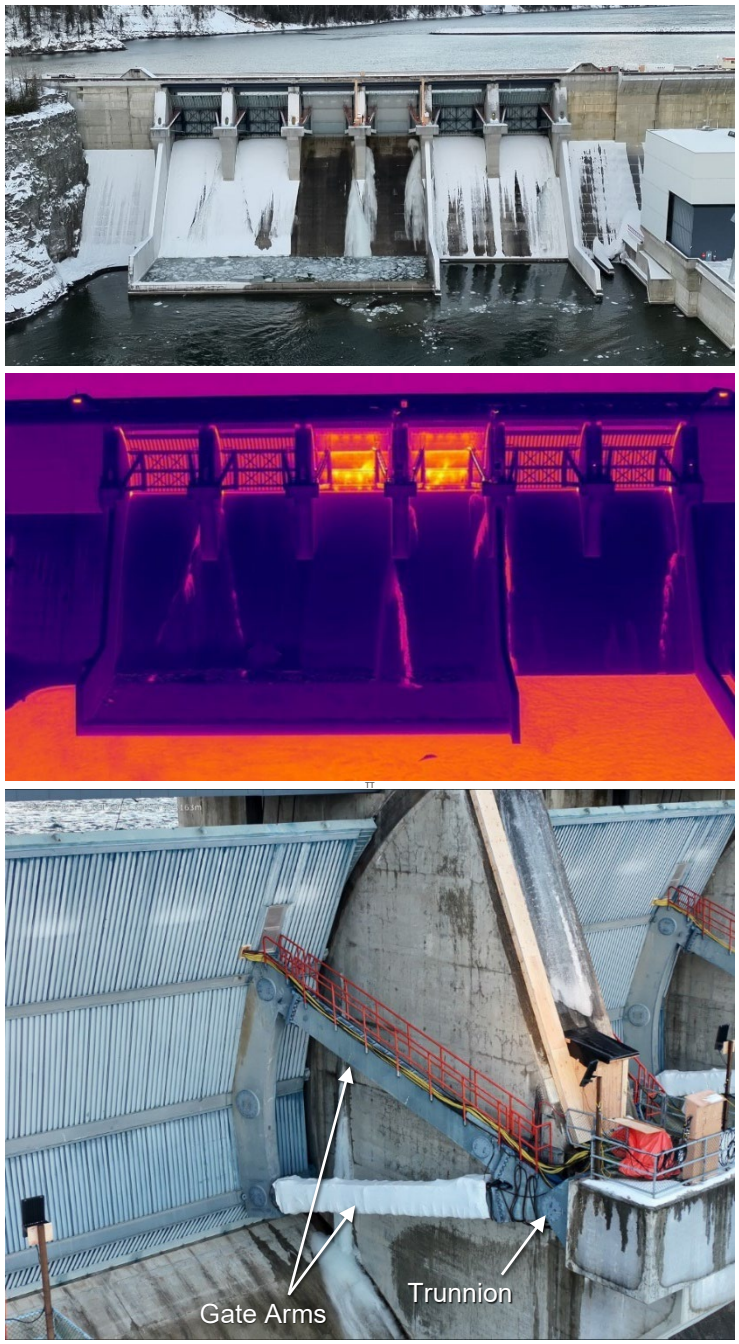

Figure 4 Top: Peace Canyon Dam spillway following the weekly test of spillway operating gates 3 and 4 at -15C on December 23, 2024. Middle: Thermal imaging before the weekly test on December 18. Bright orange colouring indicates warmer temperatures. Bottom: Close-up of gate 4 showing the temporary heating measures that have been installed.

been released. Without proper functioning of these additional heating systems in spillway operating gates 3 and 4, satisfactory winter performance of the spillway gates to support multiple spills through the winter was uncertain at best.

An Interim Dam Safety Risk Management Plan has been implemented with the following provisions:

- A temporary heating system to replace the non-functioning heaters in gates 3 and 4 was installed and is being operated through the winter. Glycol liquid (food safe) is heated on the dam crest and fed through lines that run down the backs of the spillway piers and are wrapped around the gate trunnions and arms. Glycol lines are also fed into the gate bodies where they feed into heat exchangers that blow warm air through the enclosed spaces. See the bottom photo of Figure 4. Thermal imaging of the spillway gates, seen in the middle photo of Figure 4, demonstrates the effectiveness of the temporary heating system.
- Temperatures at key locations in the gate bodies, on the arms and on the trunnions are being continuously monitored through Dam Safety's Automated Data Acquisition System. Warning and alarm thresholds are set, any temperature excursions below which are automatically communicated to Dam Safety personnel for investigation and response.
- Weekly inspections and tests of the two spillway gates are being conducted throughout the winter. As of the time of writing, the gates have been successfully operated in each test at temperatures as low as -15C. See the top photo in Figure 4, showing the spillway shortly after one such test.
- In the event of winter spill operations, the gates will be inspected daily and operated daily to disrupt ice accumulation. Similar measures at Site C Dam have demonstrated this to be an effective mitigation against deleterious ice build-up, as described on page 16 of this report. As of the time of writing, no spill at Peace Canyon has yet been required.

Getting this critical system in place for the winter season required the collective efforts of Dam Safety, Engineering Services, Stations Field Operations, Program and Contract Management, and Construction Services. This latter group, in particular, merits recognition, having completed the installation within a month of first being engaged for the work.

Comox Dam Spillway Gates Backup Power

At the Comox Dam, the Comox-Puntledge Flow Control Improvements Project commissioned the newly installed control building and spillway gate hoist (connected to the old gate) and returned it to service at the end of October. In November, the routine monthly test revealed the existing standby diesel generator could no longer operate either of the two spillway gates. The normal power supply for the gates is a distribution feeder, but it is prone to outages during storms, and the standby diesel generator was the principal backup power supply. These gates are in continuous use to regulate normal and flood flows in the Puntledge River, so a backup power supply is critical.

To address this shortcoming, a larger temporary diesel generator was rapidly sourced, installed, and tested in December. It will remain on site as the standby power supply until a permanent solution is implemented, it will be tested as part of the monthly spillway gate tests, and it will be maintained following the manufacturer's instructions. Further, the gates' auxiliary drives, which are a very slow alternative means of operating the gates, will be tested monthly instead of quarterly. These temporary measures are documented in an Interim Dam Safety Risk Management Plan.

Puntledge Dam Intake Operating Gate Closure

In December, the same project commissioned the newly installed control building and the first of two new intake operating gates at the Puntledge Dam, downstream of the Comox Dam. Commissioning revealed that, when closing under gravity without power, the new gate closed far too slowly to fulfil its safety role for emergency closure. Further, until the second intake operating gate and reliability upgrades at the Puntledge powerhouse are commissioned, the new gate must be temporarily "dogged" with pins that prevent it from closing spuriously, which may require power to lift the gate off the pins before it can be closed. Provision for closing the gate during an outage of the principal distribution power supply requires

a backup power supply. The existing backup mobile diesel generator at Puntledge Generating Station is too small to operate the new gate. As an interim measure, the project team has obtained a temporary mobile diesel generator with sufficient capacity to power both gates and has connected it directly to the intake control building. The project has also installed heating on the gearbox to reduce oil viscosity and speed closure under gravity alone. Again, these temporary measures are documented in an Interim Dam Safety Risk Management Plan.

The project team is working to develop long-term solutions for both issues. For additional information, please see “Comox-Puntledge Flow Control Improvements” under “Capital Projects” on page 18 of this report.

Update on Existing Issues

Hugh Keenleyside Dam – Navigation Lock Floating Guidewall

The F2020 Q4 Dam Safety Quarterly Report described the January 2020 sinking of two pontoons of the upstream floating guidewall that directs marine traffic safely into the navigation lock. The F2024 Q3 report further described how unusually low levels in the Arrow Lakes Reservoir resulted in these sunken pontoons posing a potential hazard to the remaining guidewall pontoons, requiring reorientation of the guidewall and ongoing adjustments by Stations Field Operations to protect it from further damage.

The project to salvage the sunken pontoons and move them to another location – where the pontoons can be safely inspected and potentially rehabilitated for return to service in an upgraded guidewall – was initiated in F2024. The project was managed by the Stations Portfolio team in Programs and Contracts Management and supported by personnel from Stations Field Operations, Construction Management, Generation Stations Civil Engineering, Generation System Operations, Supply Chain Infrastructure Projects, Safety, Environmental Field Services, and Community Relations.

The project engaged two different contractors to develop salvage plans utilizing two different approaches: a heavy lift option where the pontoons would have been raised by a large crane on barges, and an option to reestablish buoyancy and refloat the pontoons by carefully introducing pressurized air to displace the water from the pontoons’ interior cells. In August 2024, after review of the two plans, refloating the pontoons was selected and Canpac Marine Services of North Vancouver was authorized to move forward with detailed planning and preparations.

The contractor’s divers worked through the fall of 2024 to prepare the pontoons for the salvage operation, during which they installed: anchorage points for towing, mooring and positioning lines; internal bracing to support the pontoon walls against differential water and air pressures; specialty valved hatches that allow air to be pumped in and water expelled from the pontoons; and external air tanks (sponsons) for additional buoyancy and stability through salvage operations. Ultimately, the two pontoons were successfully refloated and towed to temporary anchorages in the reservoir. Pontoon 6 was recovered on November 15 and Pontoon 5 was recovered on November 22, 2024. Subsequently, the guidewall was reoriented to its desired alignment on December 11, 2024. See Figure 5 on the following page.

Going forward, the two salvaged pontoons will be inspected to determine the scope of required repair and refurbishment. The intent is to return the pontoons to service in an upgraded guidewall, for which a separate project was initiated in Q1 of F2025.

Figure 5 Salvage operations for the two sunken pontoons of the Hugh Keenleyside Dam's navigation lock guidewall Left: Salvage of Pontoon 6 on November 15, 2024. The pontoon in the centre of the photo has just broken the surface and water is continuing to be expelled by pressurized air. The work barge is visible behind the salvaged pontoon. Right: Guidewall realigned on December 11, 2024. The refloated Pontoons 5 and 6 are anchored at the locations identified by the arrows.

Compliance with Processes and Regulations

Regulatory Communications – British Columbia Utilities Commission

As described in the F2025 Q2 Quarterly Dam Safety Report, the Commission issued its Final Order accepting the schedule of capital expenditures for the Ladore Spillway Seismic Upgrade Project on October 22, 2024.

The application for acceptance of the schedule of capital expenditures for the Strathcona Discharge Upgrade Project remained adjourned through Q3. BC Hydro is preparing an update regarding the project cost estimate for submission on January 31, 2025.

Regulatory Communications – Comptroller of Water Rights

The annual meeting between BC Hydro (Dam Safety and Generation System Operations) and the Water Management Branch of the Ministry of Water, Land and Resource Stewardship was held in Victoria over three days in November 2024. Attendees from the Water Management Branch included the Comptroller of Water Rights and key personnel from Water Licensing and the BC Dam Safety Program. The format of the annual meeting has evolved over the past three years in an effort to improve communications between BC Hydro and the Water Management Branch; particularly on the status of projects that will require authorization or acceptance by the Water Management Branch, but also to provide a forum for discussion of topics of mutual interest. The format and agenda was assessed to work well, and the next year's meeting has been scheduled for November 2025.

BC Hydro provided feedback on draft *Guidelines for Invasive Investigation Plans and Instrumentation Records*, prepared by the BC Dam Safety Program to explain to dam owners the requirements of the Dam Safety Regulation and the

expectations of the BC Dam Safety Program. These were subsequently issued in November. Also in November, that office requested that BC Hydro provide feedback on draft *Submission Guidelines for New Construction, Alteration, Improvement to or Replacement of a Dam*. Initial feedback has been provided and more discussion is expected on this guidance.

Operation, Maintenance and Surveillance Manuals

Each dam has an Operation, Maintenance and Surveillance Manual ("Manual") for Dam Safety that identifies responsibilities and expectations within BC Hydro for maintaining the safety of the dam. These Manuals are required by the Dam Safety Regulation and must be updated every seven to ten years, depending upon the dam's failure consequences classification.

The updated Manual for Aberfeldie Dam was issued in December 2024 and the updated Manual for Terzaghi Dam was completed in January 2025. Updates for Falls River Dam and Jordan Diversion Dam are also being drafted but are not due until the end of calendar year 2025, and priority has been diverted to completing an update to the Manual for Clayton Falls Dam. Due to an administrative error in the Dam Safety business unit, the due date for the Clayton Falls Dam was thought to be at the end of calendar year 2025, when it was in fact at the end of calendar year 2024. This update will be completed and issued in Q4 of F2025 to bring the Dam Safety Program back into full regulatory compliance.

Dam Safety Reviews

Dam Safety Reviews are independent, systematic reviews and evaluations of all aspects of a dam's physical condition, design, construction, operation, maintenance, processes, and other systems affecting the safety of the dam. Performed by external consultants, they are carried out at minimum intervals of every five to ten years for dams that are classified in accordance with the Dam Safety Regulation as High, Very High, and Extreme consequence dams.

Five Dam Safety Reviews – for Cheakamus, Comox, John Hart, WAC Bennett, and Wilsey Dams – were due at the end of calendar year 2024. All five were completed and submitted to the Comptroller of Water Rights in Q3.

Five more Dam Safety Reviews – for Alouette, Duncan, Elliott, Revelstoke, and Seven Mile Dams – are due at the end of calendar year 2025 and are currently underway. First drafts of the reports for Elliott, Revelstoke and Seven Mile were received in Q3.

Dam Safety Program Management System

As previously described in the F2024 Q2 Quarterly Dam Safety Report, a general revision to the Dam Safety Program's Management System has been developed. One aspect of that revision is a restructuring of the Management System's *Implementation Manual* into a series of more than 120 documents that each separately describe one aspect or "section" of the Management System. Notably, because implementation of the Dam Safety Program involves business units from across BC Hydro, the *Implementation Manual* is being expanded to document (or refer to other source documents) the processes by which those other business units perform their roles within the Dam Safety Program, so completing and issuing many of these sections requires consultation, input, and ultimately acceptance and sign-off from the contributing business units. This is new to the Management System – and novel for the industry – and is providing added clarity to personnel across BC Hydro regarding their roles and responsibilities for dam safety.

Since September of 2024, eighteen additional sections of the *Implementation Manual* have been issued, describing procedures and requirements pertaining to records and information management, investigations and capital projects, maintenance, public safety around dams and reservoirs, and management of interim risks. Approximately two-thirds of the sections are now complete and issued. Many additional sections are under active development, and completion of the *Implementation Manual* is targeted for F2026.

Surveillance

Key activities comprising dam safety surveillance include inspections, monitoring of instrumentation and quality control of data, and characterization of dam performance. Table 2 below provides key metrics regarding these activities, which are described in the following sub-sections of the report.

Table 2 Dam safety inspections and surveillance activities.

		Quarter Q3		Year-to-date	
		Actual	Target	Actual	Target
Routine dam inspections	Completed	408/408 = 100%	100%	1256/1259 = 99.8%	99.5% ✓
	Missed	**0**		**3**	
Formal (annual and semi-annual) dam inspections	Field work completed	14	16	71	71 ✓
	Reports issued	20	21	37	31 ✓
Instrumentation data checks		204/195 = 105%	97%	589/585 = 101%	99% ✓
Reservoir slopes inspections	Field work completed	5	2	21	21 ✓
	Reports issued	13	8	16	15 ✓

Routine Dam Inspections

Routine weekly and monthly inspections are a regulatory requirement. These visual inspections are carried out by trained inspectors within Dam Safety or Stations Field Operations using checklists prepared by the Dam Safety Engineer. The purpose of these inspections is to identify changing conditions at a dam, reservoir, or appurtenant structure that could threaten the safety of the dam. None of the 408 scheduled routine inspections were missed in Q3.

Formal Dam Inspections

Formal inspections of the dams are regulatory inspections completed by Dam Safety Engineers on a semi-annual or annual frequency, as dictated by each dam's Consequence Classification. These inspections include a comprehensive visual inspection, a review of the monitoring data, and an assessment of the condition of the water containment and conveyance structures. At the end of Q3, the field work for formal dam inspections was complete and the number of issued reports was ahead of the work plan.

Instrumentation and Monitoring

Dam Safety Surveillance collects, checks, and assesses about two million data points a month. A vast majority of the data is collected and checked against threshold values automatically by the Automated Data Acquisition System. Even though most of the data is checked automatically it is essential that qualified staff review the data regularly to ensure the systems are functioning as expected. The Dam Safety Technologists in each region regularly check instrumentation data plots for all dams to ensure the Automated Data Acquisition System is functioning as expected, identify any unusual trends, and ensure continued accuracy of the data for ongoing engineering assessment. They are tasked to perform three such checks per week. The 204 data checks completed in Q3 exceeded the planed number of 195.

Reservoir Slopes

Reservoir Slopes inspections are completed on a frequency ranging from semi-annually to once every 10 years depending on the assessed hazard of the slope. They are typically carried out by the Reservoir Slopes Geologist and the Specialist Dam Safety Engineer for the Upper Columbia Region. Each inspection generally consists of a review of all monitoring data, a visual inspection completed from helicopter with boots-on-ground assessment of identified areas of concern, and documentation by a sealed engineering report. At the end of Q3, the field work for slopes inspections was complete and the number of issued reports was ahead of the work plan.

Unusual Events or Observations

The Dam Safety on Call Person responded to 81 calls in Q3, which typically includes instrumentation alarms, operational inquiries, operations notifications during high inflows and earthquake notifications. This number of calls and responses is considered normal for this time of year.

Civil Maintenance

Results for the Preventive and Condition-Based Civil Maintenance programs are summarized in Table 3, below.

Table 3 Dam Safety and Generation Civil Maintenance for F2025.

		Quarter Q3		Year-to-date	
		Actual	Target	Actual	Target
Corrective and Condition-Based Maintenance	Spend ($k)	814	793	3033	3011
	Work Orders Completed	10	9	17	16
Preventive Maintenance	Tasks Completed	280	304	695/753 = 93%	

Preventive Maintenance

In Q3 of F2025, the Civil Preventive Maintenance program achieved a completion rate of 92%, with Stations Field Operations and Engineering Services completing 280 out of the planned 304 work orders in the quarter. Additionally, fieldwork for 33 more work orders was completed, with reports currently being prepared. The year-to-date program completion stands at 93% of the plan.

Corrective and Condition-Based Maintenance

The Corrective and Condition-Based Civil Maintenance Program also made good progress in Q3, with seventeen projects completed against a target of sixteen. The program is expected to remain on budget through the end of Q4.

One notable maintenance project completed in Q3 was the Terzaghi Low Level Outlet Gate #1 guide repairs. Inspections had identified concrete deterioration and exposed reinforcement within both sides of the gate guide slots. Continued and unabated deterioration of the concrete would eventually have undermined the support for the gate guides, allowing them to deform, and potentially lead to the gate becoming jammed and nonfunctional. Executed by the Construction Services Mechanical Specialty team, this project repaired the slots by installing steel plates and backfilling the deteriorated areas with concrete. It required extensive planning to coordinate outage requirements with Stations Field Operations, to establish safe access into the confined space using a crane truck and personnel basket, and to implement rope access measures for provision of worker rescue. The work was completed within schedule and budget. See figure 6 below.

Figure 6 Terzaghi Low Level Outlet Gate #1 guide repairs. Left: Concrete deterioration with exposed reinforcement in the guide slot. Middle: Completed removal of delaminated concrete, surface preparation, and rust cleaning from the reinforcement. Right: Welded steel plate installed in the slot, with the concrete void backfilled.

Spillway Gate Testing and Maintenance

Spillway Gate Testing

During Q3 of F2025, all 235 scheduled gate tests were completed. This includes the annual tests of ten gates. Table 4 below provides key metrics related to spillway gate testing.

Table 4 Spillway gate testing results for F2025.

		Quarter Q3		Year-to-date	
		Actual	Target	Actual	Target
Monthly Tests	Completed	235/235 = 100%	100% ✓	697/702 = 99.3%	98% ✓
	Missed tests	**0**		**5**	
Gates Failing to Operate on Demand during Testing	No. of failures	**4**		**11**	
	Failure rate	4/235 = 1.7%		11/697 = 1.6%	

No gate tests were missed in Q3.

Four gates failed to operate on demand in Q3.

- At Comox Dam, one spillway gate failed to operate while using the existing standby diesel generator. This is a splendid example of the value of these regular tests. See the new issues section on page 7.
- At Mica Dam, the standby diesel failed to start because the heater was turned off; a malfunctioning thermostat was causing overheating. The thermostat issue was identified in October and work is in progress. However, one spillway gate and both outlet works gates (three gates in total) were scheduled to be operated with the diesel and were not.

At Falls River Dam, auto-spill and gate control from the control center were lost on two occasions. On the first occasion, this was due to the automatic controller locking out. The second instance is still being investigated. In both cases, crews were able to operate the gates locally, so these have not been counted as failures to operate. The cause for these occurrences will be investigated in the spring of 2025 along with another, potentially related issue where remote and programmable logic controller operation is not functional when the gate system is powered by the spillway diesel.

Exemptions to gate testing scopes (*e.g.*, to exclude gate movements) are authorized in circumstances where: there would be the potential to cause harm to species at risk or other deleterious environmental consequences; there would be the potential to cause damage to the gate system or other infrastructure; or gates are locked out to support the safe performance of downstream or adjacent construction activities and returning the gate(s) to service for testing would be impracticable. Authorization for such exemptions is either provided for in Maintenance Instructions, where those circumstances occur routinely, or by the Director of Dam Safety or delegate in unusual circumstances. In Q3, gate testing scopes were reduced to exclude gate movements on 48 of the 235 tests completed.

Gates Out of Service or Under Restricted Service

The availability of flood passage devices is a key measure of our ability to pass high inflows and manage reservoir levels. At the time of writing this report, all spillway gates and flood passage devices were in service. As described above, however, the two spillway gates at the Falls River Dam are only operable locally.

Spillway Gate Maintenance

Spillway gate maintenance results for F2025 Q3 are shown in Table 5, below, and the number of outstanding gate maintenance tasks is shown in the chart in Figure 7. Over the first three quarters of F2025, with the addition of newly identified maintenance tasks and the completion of planned and emergent tasks (Table 5), the number of outstanding tasks has increased from 100 to 116 and the number of outstanding high priority tasks has decreased from twelve to eight. The increase in the overall number is largely due to an annual review of maintenance tasks that was performed in Q2 and identified an additional 32 existing tasks that are related to gate reliability but weren't previously identified as such.

Table 5 Spillway gate maintenance results for F2025.

Corrective and Condition-Based Maintenance Tasks	Quarter Q3		Year-to-date
	Completed	Planned	
Planned Tasks	14	12	29/32 = 91%
Emergent Tasks	11		21

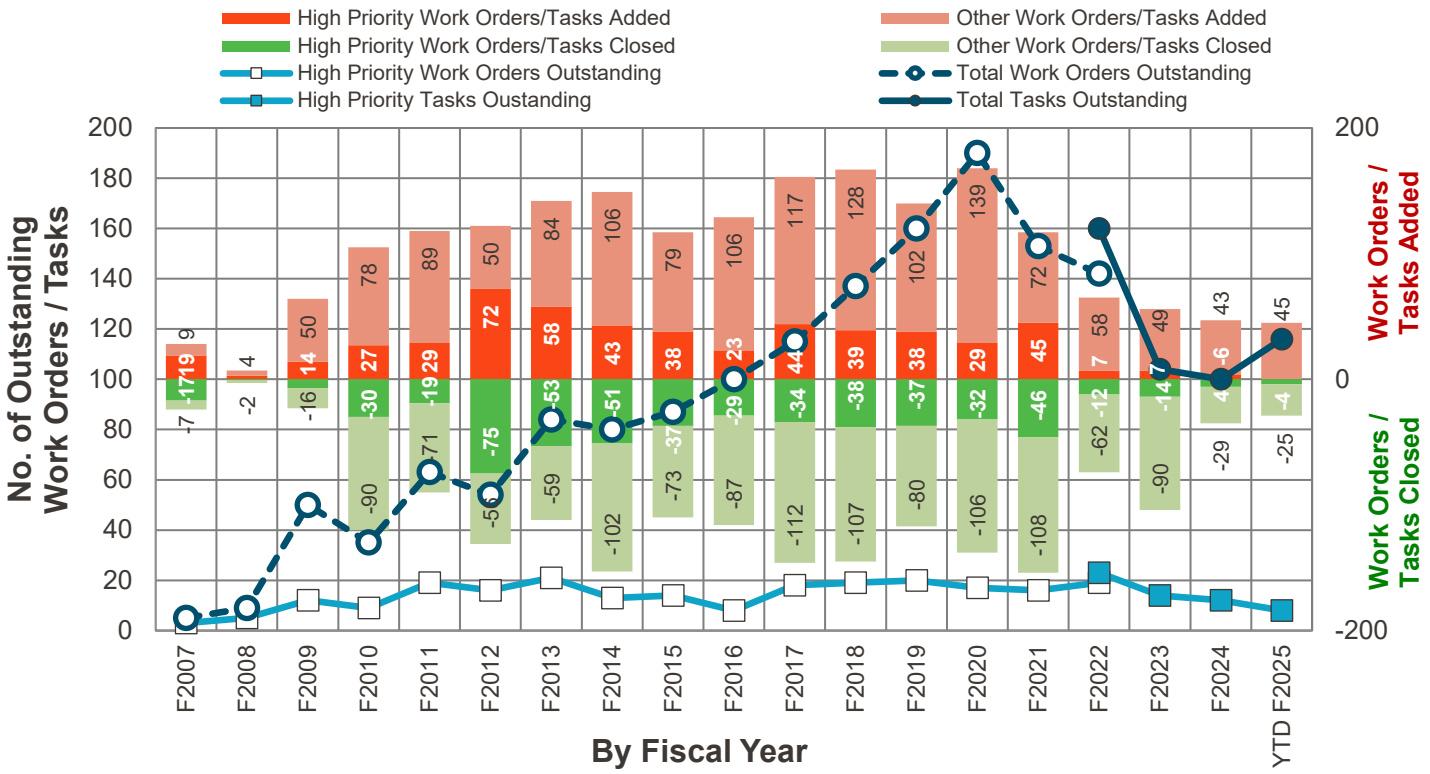

Figure 7 Number of outstanding corrective and condition-based spillway gate maintenance work orders and tasks, new work orders and tasks added, and work orders and tasks closed as at the end of each previous fiscal year.

Notes:
1. At the conclusion of F2022 moving forward into F2023, figures were restated as outstanding tasks instead of outstanding work orders to align with Operations reporting.
2. The number of tasks added and closed does not include any recategorized or cancelled tasks. As such, the net change in the number of tasks will not always equal the difference between tasks added and closed.

Emergency Preparedness and Public Safety

Emergency Preparedness is managed by Security & Emergency Management. Dam Safety reports on the updating of emergency plans for compliance with the Dam Safety Regulation as part of annual reporting to the Comptroller of Water Rights. Public safety near dams and reservoirs is managed by the Public Safety team in Safety Programs. Dam Safety reports on Public Safety activities related to dams during the Dam Safety Reviews. Please refer to the Quarterly Safety & Emergency Management Report, submitted to the Operations, Planning, Safety & Information Technology Committee, for updates on emergency preparedness and public safety.

Site C Clean Energy Project

Filling of the Site C reservoir commenced on August 25, 2024, and by November 6 had reached its normal operating elevation range of between 460 and 461.8 metres. Throughout the reservoir filling period and since, visual observations, measurements and instrumentation readings have indicated that the dam, abutments, and ancillary structures are all performing well, and that the slopes are performing as expected.

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The Site C Dam's spillway gates are being operated through the winter under temporary power and controls by project staff at site, with no misoperation to date. Commissioning of the gates' permanent power and controls, which will require taking one gate out of service at a time, is currently planned to commence in mid-March.

With only two of the six generating units in service, water is being continuously spilled this winter, which is not typical of future planned operations and is putting the winterization of the gates to an extreme test. Figure 8 shows the spillway on January 17, 2025. There are large accumulations of ice on the concrete structures – particularly of the central wall – of the stilling basin downstream of the spillway. In these locations, the ice does not interfere with the spill or gate operations. In contrast, the three spillway gates are essentially free of ice. The gate bodies, trunnions, trunnion arms, gate sills, and gate guides are equipped with heaters, the gates are operated daily to break any ice formations along the gates' edges, and the gates are opened by 3-4 metres each week to allow water flows to melt and wash away ice accumulations along the pier walls. These provisions have been effective and have informed the measures taken to winterize the spillway gates at Peace Canyon Dam, described in "New Issues" on pages 6 and 7 of this report.

Figure 8 The spillway and spillway operating gates of Site C Dam during winter spill operations. Top: Overview of the spillway showing the very large accumulation of ice on the stilling basin's central wall. Bottom: From left to right, spillway operating gates 3, 2 and 1, showing the absence of accumulated ice on the gates and piers, and demonstrating the effectiveness of the installed heating and operational measures to remove ice.

Capital Projects

Summaries of Dam Safety Capital Projects are available for reference in the Dam Safety "book" in Diligent. This section of the report describes newly launched projects and provides updates for projects where significant developments occurred, or where milestones were achieved.

Alouette Headworks Tower and Surge Tower Seismic Upgrade

The spillway of Alouette Dam would be damaged in a major earthquake – one with ground motions expected to occur at that location once every 1,000 to 2,500 years – so that post-earthquake regulation of the Alouette Lake Reservoir would rely upon the continued functioning of the tunnel that conveys water to Stave Lake from the north end of Alouette Lake (the Alouette-Stave Tunnel). But that tunnel and its ancillary gate control structures and equipment were constructed in the 1920s and would not withstand even a moderate earthquake. This project is being undertaken to seismically upgrade the tunnel and its associated infrastructure so that it can reliably convey and regulate the flow of water from Alouette Lake into Stave Lake after undergoing earthquake ground motions that are expected to occur there only once every 10,000 years.

The project has been staged to first complete the upgrades on the Stave Lake end of the tunnel, where the gate that regulates tunnel flows is located. This first stage of work includes upgrades to the structures and equipment that enable operation of the "adit gate" that regulates flow through the tunnel. The civil scope – structural upgrades to segments of tunnel linings, the surge shaft and surge tower above, site preparation and foundations for control and backup power enclosures, and stabilization of adjacent slopes – was completed in Q3. See Figure 9, below.

Remaining work on the Stave Lake end comprises the supply and installation of the backup power and communications systems. As had been previously reported (F2024 Q4 Quarterly Dam Safety Report), the contractor's original supplier of backup power equipment filed for bankruptcy and a new supplier was secured. With this and associated delays, completion and the In Service Date for this first stage of the project is now forecasted to be October 31, 2025.

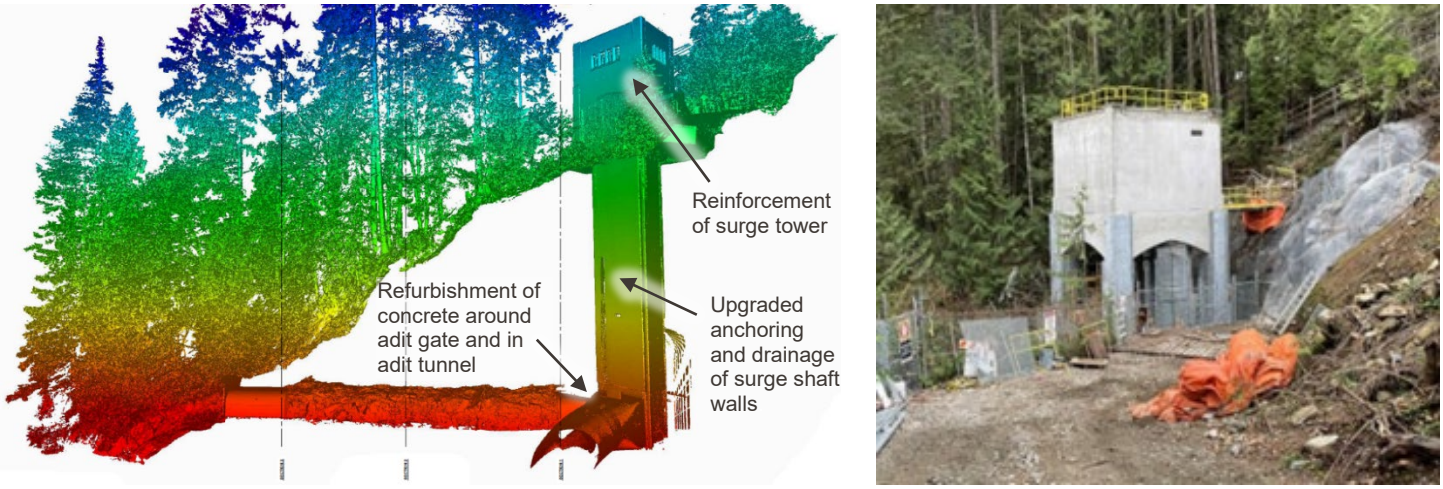

Figure 9 Civil engineering scope of seismic upgrades on the Stave Lake (downstream) end of the Alouette-Stave tunnel within the Alouette Headworks Tower and Surge Tower Seismic Upgrade project. Left: A three-dimensional point cloud indicating the extent of the upgrades to the surge tower, the surge shaft, and the adit tunnel. Right: Completed seismic reinforcement of the surge tower.

Bridge River 1 Penstock Foundation Refurbishment

There are four steel penstocks at Bridge River 1 Generating Station that convey water down a steep mountain slope to the four 50-megawatt generating units. Over the seventy years since the penstocks were built, loose rock had sloughed down the slope and covered more than forty percent of their concrete foundations. Of the foundations that were visible, inspections revealed widespread concrete pedestal cracking, structural support anchor bolt deterioration, and damage to the sliding supports that allow for thermal expansion of the penstock sections; all of which potentially compromised the structural integrity and service life of the penstocks. This project was initiated in F2021 Q4 to remove the rock debris, locally stabilize the slopes adjacent to the penstocks, refurbish adjacent retaining structures to contain and divert rock debris from the penstocks, and refurbish the concrete foundations and steel penstock supports. The project was put In Service on October 31, 2024, ahead of the target milestone date of January 25, 2025, and is forecasting to be $5 million under the $70.2 million budget.

Figure 10 Completed slope improvements and foundation refurbishment on one of the four penstocks at Bridge River 1 Generating Station.

Comox-Puntledge Flow Control Improvements

The objective of this project is to improve control of water conveyance at Comox and Puntledge Dams, with specific consideration to flows and risks to public safety downstream of Puntledge Dam. The project will improve the Puntledge generation water conveyance by upgrading or replacing existing components of the flow control system at Puntledge Dam and in the powerhouse. It will also replace the Comox Dam spillway gates and improve their reliability.

Several deficiencies arose through the course of the project's first construction season. These include the excessive power draw of the spillway gates on the existing backup power supply at Comox Dam and the power draw and slow closure speed of a new intake operating gate at Puntledge Dam (see "New Issues" on pages 7 and 8 of this report), as well as the welding deformation of a new spillway gate at Comox Dam that prevented it from being installed as planned (see the F2025 Q2 Quarterly Dam Safety Report).

The performance of this project is being addressed through the following measures:

- The project has been directed to undergo an independent review of the project-level and supporting quality plans. The review's findings and recommendations are to be reported to the Director, Dam Safety and implemented prior to commencement of the project's F2026 construction season.
- The project schedule has been revised. The scope of work for the F2026 construction season will now concentrate on rectifying the identified deficiencies from the F2025 construction. Construction to replace the second intake operating gate at Puntledge Dam and the second spillway gate at Comox Dam will not proceed until those existing deficiencies are corrected through permanent measures. An additional construction season in F2027 has been added to the schedule for this purpose.

The delay to the project's In Service Date is regrettable but warranted, given the project's public safety objectives and correspondingly demanding requirements for operational reliability of the constructed upgrades to the water conveyance systems along the Puntledge River.

John Hart Dam Seismic Upgrade Project

Good progress continued on the main civil works portion of the John Hart Dam Seismic Upgrade project through F2025 Q3.

On the Middle Earthfill Dam, installation of more than 300 H-piles on the downstream toe to improve the stability of the dam was completed. Placement of the new downstream slope fill is underway.

Upstream of the dam, the removal of stumps and dredging in the reservoir is continuing. This work is being performed to prepare a sound foundation for new upstream berms for the Middle Earthfill Dam and Intake Dam. By the end of Q3, approximately one-half of the total material to be dredged from the reservoir had been removed. Dredgeate placement continues in the storage cells located in the old penstock trench.

Construction to stabilize the Intake Dam by filling in the old penstock trench with an earthfill berm is underway. The top photograph in Figure 11 shows the early works, including protection of the slopes of the trench on which the berm will be placed. The Bailey bridge in the middle of the photograph will eventually be removed and the road will be constructed directly across the top of the berm. Another berm will also be constructed on the upstream side of the Intake Dam, following completion of the dredging as described above.

On the Concrete Main Dam, the construction of the upstream cofferdam and preparations to convert the gravity dam blocks to a passive overflow spillway continued. The middle photograph in Figure 11 shows an overview of the work on the Main Concrete Dam in progress, with the North Earthfill Dam in the background. The bottom photograph in Figure 11 shows the steel cofferdam being installed on the upstream face of the Main Concrete Dam in November. This cofferdam will act as a temporary water barrier to allow cutting through the dam's concrete blocks and construction of the passive overflow spillway.

Work is also underway on the Concrete Main Dam to reinforce and infill the bents supporting the roadway along the crest of the dam's north segment.

These Main Civil Works of the John Hart Dam Seismic Upgrade Project will continue through 2025 and 2026.

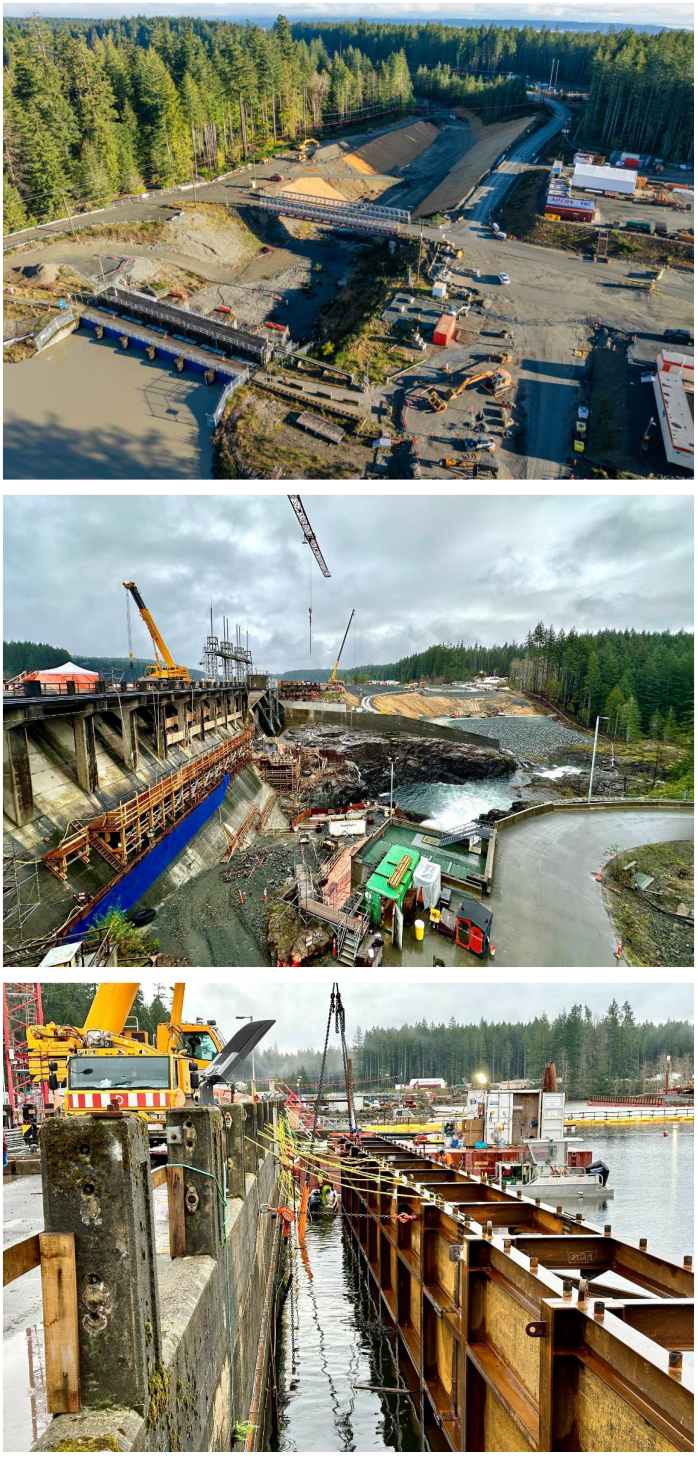

Figure 11 Construction on the John Hart Dam Seismic Upgrade Project. Top: Preparations to stabilize the Intake Dam. Middle: Work in progress on the Main Concrete Dam. Bottom: Cofferdam installation on the Main Concrete Dam.

Lake Buntzen 1 Penstock Exterior Recoat

This project was released to recoat the exterior steel surfaces and thereby extend the life of the penstock at Lake Buntzen 1 Generating Station. The exterior recoating and ancillary civil construction works (earthworks for surface water management and asbestos encapsulation) are complete. Improvements to the cable tray running along the crown of the penstock and installation of a new fibre optic cable within the tray, which will enable future upgrades to intake gate controls, were also completed as a part of the project. The project met its target In Service Date of October 31, 2024, and final costs are forecast to be within the Expected Amount of $32.5 million.

Figure 12 Recoated penstock at Lake Buntzen 1 Generating Station.

Ruskin Dam Left Abutment Sinkhole Remediation

This project was released to develop and implement remedial solutions to the causes and impacts of the sinkholes that developed on the left abutment of Ruskin Dam in 2020. The F2025 Q1 Quarterly Dam Safety Report described the discovery of a void within the bedrock above the penstock and fractured bedrock underlying the soil overburden, necessitating design modifications. Implementation of the modified design continued through Q3 of F2025. The installation of piles around the future excavation has been completed and the grouting to cut off potential seepage paths around the penstock is proceeding well.

Dam Safety Investigations

Dam Safety Investigation Projects (“Investigations”) are generally performed to either refine knowledge regarding potential issues or non-conformances of information recorded in the Dam Safety Issue Database or to perform precursor work for planned capital upgrade projects. This section provides descriptions of newly launched Investigations and updates for those Investigations where significant developments have occurred or where milestones were achieved.

Dam Safety currently has nine active Investigations underway to assess dam performance, investigate known issues, and collect additional information that is necessary to characterize the condition and performance of various dams in BC Hydro’s fleet. Additionally, there are eight ongoing programs of work to update hydraulic, flood and inundation models, assess the effectiveness of public warning systems, develop vegetation management plans for dams and generating stations, reconcile historic and current survey datums, and improve capabilities in monitoring dams and reservoir slopes across the system.

There were no significant updates from the Dam Safety Investigations in Q3.