

Executive summary

The purpose of this report is to update the Operations, Planning, Information & Technology Committee of the Board of Directors on key dam risk management activities during the period from April 1 to June 30, 2024 (F2025 Q1) 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 June 30, 2024, but before the completion of this report have also been included.

The key highlights from F2025 Q1 and the beginning of F2025 Q2 documented in this report are:

- Work to remove rockfall from the spillway chute at Terzaghi Dam commenced. The in-chute work is being undertaken exclusively through the use of remotely operated, robotic demolition and excavation equipment. No workers will enter the chute or be exposed to the hazardous conditions therein. Early progress is encouraging. See pages 5 and 6.
- BC Hydro submitted its final argument in the Ladore Spillway Seismic Upgrade Project's regulatory process to the British Columbia Utilities Commission. See page 7.
- Dam Safety issued its Strategic Asset Management Plan, which defines the objectives and approach to the management of physical dam system assets in alignment with BC Hydro's Asset Management Policy, and operationalizes BC Hydro's *Statement on Approach to Managing Risks from Dams*.
- Construction started on the Comox-Puntledge Flow Control Improvements project to replace the first of two spillway gates at Comox Dam, and an intake gate at Puntledge Dam, and implement associated structural and hoist upgrades by September. See page 15.
- Construction on the John Hart Dam Seismic Upgrade Project continued with completion of soil densification and placement of the stabilizing berm on the upstream face of the North Earthfill Dam, mitigating the risk of an upstream slope failure during the Maximum Design Earthquake. Good progress was also made on the upgrades to the Middle Earthfill Dam and the Main Concrete Dam. See page 16.
- Construction to resolve the conditions that led to the development of sinkholes on the downstream slope of the left abutment of Ruskin Dam commenced. Exploratory holes drilled to inform construction identified a void within the bedrock above the penstock and fractured/damaged bedrock. The project team completed the necessary design modifications and are proceeding with penstock grouting works and the installation of piles and shoring walls that are required to excavate and remove the erodible sub-surface clays that led to the sinkholes. See page 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

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- **Vulnerability Index (pp. 3-5):** The aggregated Vulnerability Index increased by 3.5 through F2025 Q1 due to deteriorated condition of booms at La Joie Dam, backup spillway gate drives removed from service at WAC Bennett Dam, and concern for stability of the Checkerboard Creek landslide at Revelstoke Dam, partially offset by improved spillway gate reliability across the system.
- **New and Current Issues (pp. 5-6):** Work commenced to clear the rockfall from the Terzaghi Dam spillway and cellular communications at Terzaghi Dam were restored.

Regulatory Compliance

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- **British Columbia Utilities Commission (p. 7):** BC Hydro has submitted its final argument in the Ladore Spillway Seismic Upgrade Project regulatory process.
- **Operation, Maintenance and Surveillance Manual Updates (p. 8):** The Revelstoke Dikes Manual was issued. Work is advanced on one other Manual that is due in 2024.
- **Dam Safety Reviews (p. 8):** Five Dam Safety Reviews due at the end of calendar year 2024 are expected to be completed by October, well ahead of their due date.
- **Dam Safety Program Management System (p. 8):** The Dam Safety Strategic Asset Management Plan was issued.

Surveillance

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- **Dam Inspections (p. 9):** The field work on formal dam inspections progressed ahead of the work plan. Three of the 411 scheduled routine inspections were missed in Q1; two due to scheduling conflicts and one due to the loss of data from the Inspection App.
- **Reservoir Slopes (p. 10):** The field work for six of the slopes inspections was completed in Q1, ahead of the target of four.

Maintenance and Testing

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- **Civil Maintenance (pp. 10-11):** Preventive and condition-based civil maintenance achieved solid results in Q1.
- **Spillway Gates (pp. 11-14):** 232 of 237 scheduled gate tests were performed through F2025 Q1, and five gates failed to operate on demand during testing. The number of outstanding maintenance tasks increased by five over the quarter.

Projects and Investigations

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- **Capital Projects (pp. 15-19):** Construction commenced on the Comox-Puntledge Flow Control Improvements project. Good progress continued on the John Hart Dam Seismic Upgrade Project, with completion of the berm and densification of the upstream face of the North Earthfill Dam.
- **Dam Safety Investigations (pp. 19-20):** The F2025 program of Dam Safety Investigations is underway.

Legend:

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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.

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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 Q1 are identified in Figure 1 and described below.

- 1** An **addition** of 1.8 (Actual Unusual deficiency) at **La Joie Dam**.
The reservoir booms at La Joie Dam have deteriorated to where they may not function as intended. As Downton Reservoir is presently being operated to a reduced maximum elevation, ineffectiveness of the booms would only become a factor under extreme inflows with return periods estimated at 1000 years or longer. The booms will be replaced within the existing program of boom replacement projects but are prioritized later due to the current reservoir operations and potential changes arising from the La Joie Dam Improvements Project.
- 2** An **addition** of 1.5 (Potential Unusual deficiency) at **Revelstoke Dam**.
The Checkerboard Creek landslide is one of sixteen landslides that are regularly monitored by Dam Safety Surveillance. On reassessment by Dam Safety’s Reservoir Slopes Specialist, the stability of Checkerboard Creek landslide during unusual load conditions (occurring with a frequency of once in 500 years or longer) is uncertain and requires confirmation in a future investigation.
- 3** An **addition** of 3.5 (Gate Serviceability deficiency) at **WAC Bennett Dam**.
The spillway gate backup drives have been taken out of service due to a design deficiency that prevents the hoist brakes from releasing when the backup motors are engaged. Refer to “Spillway Gate Testing and Maintenance” on page 11 for a description of the issue and the work that is underway to address it.
- 4** A net **reduction** of 3.3 (Gate Reliability deficiencies) **system wide**.
The reliability of flood discharge devices and associated Vulnerability Indices are calculated annually based on test and operational data. Through F2024 testing, Vulnerability Indices increased at Stave Falls, John Hart, and Seven Mile Dams and decreased at Falls River, Whatshan, Seton, Sugar Lake, Cheakamus, WAC Bennett, Duncan, Comox, Hugh Keenleyside, Terzaghi, La Joie, and Mica Dams.

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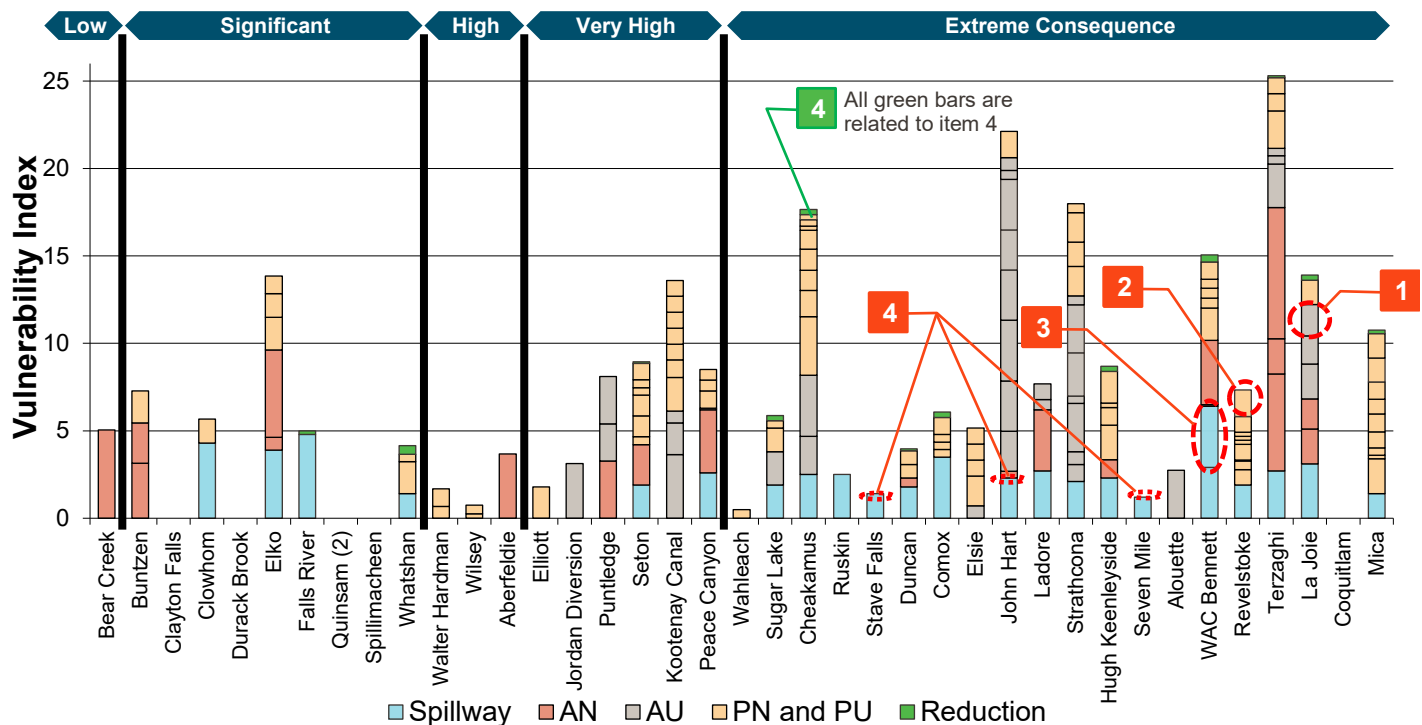


Figure 1 Dam Safety overall risk profile at the end of F2025 Q1, as represented by the Vulnerability Index. Changes this quarter are indicated by the numbered boxes.

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.

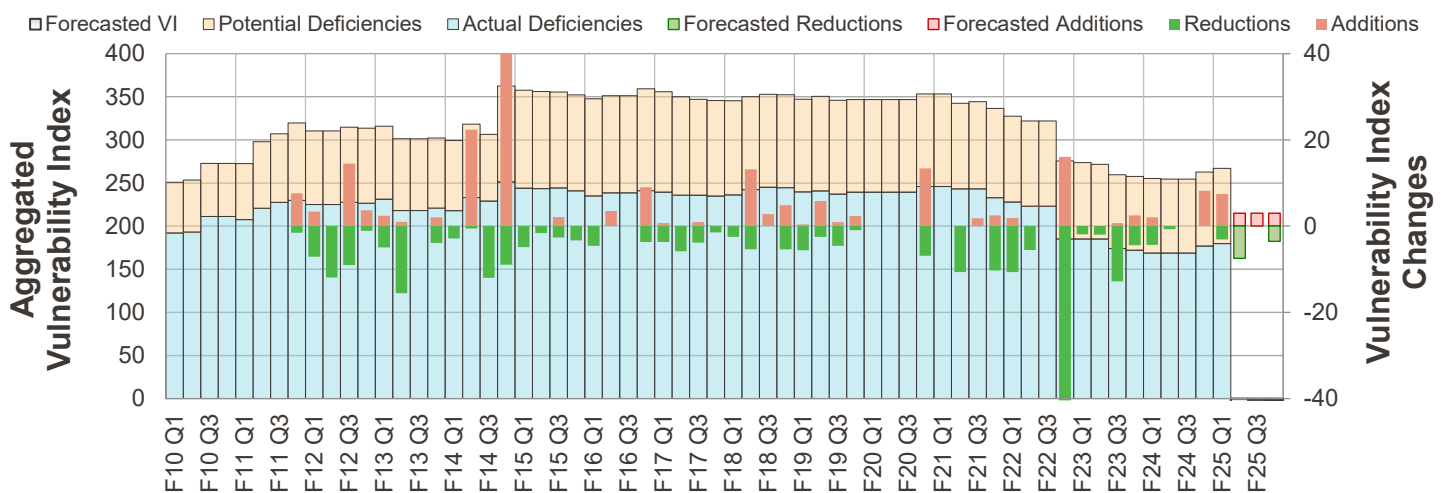


Figure 2 Historical and forecast changes and trends in the Vulnerability Index aggregated across the BC Hydro system.

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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, and primarily due to the timing of the Program's portfolio of risk reduction projects, Vulnerability Index reductions 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	3.9	12	✗
	Reductions – Fiscal Year	14.1	12	✓
	Additions - Last 4 quarters	15.6		

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. In F2025 Q1, the issuance of memoranda to update the characterization of dam performance was paused while management developed revised guidance for this activity. See the second bullet under Dam Safety Program Management System on page 8. As a result, only one Non-Conformance issue was resolved and closed, and one new Non-Conformance issue was added in Q1.

Issues Database reviews for all of BC Hydro's dam sites are scheduled throughout Q2 through Q4 and the ongoing trend of resolving and reducing the number of Non-Conformances is expected to resume and be demonstrated in future reports.

New Issues

No new issues arose in F2025 Q1.

Update on Existing Issues

Rockfall in Terzaghi Dam Spillway Chute

As described in the F2024 Q3 Quarterly Dam Safety report, at some time between January 11 and January 15, 2024, several hundred cubic metres of rock fell from the steep slope adjacent to the spillway at Terzaghi Dam, blocking the spillway.

Work to remove this rock from the spillway is actively underway. The access road and crane pad have been constructed. Figure 3 top left shows these features in early July, just prior to their completion. The equipment was mobilized to the site and in-chute work commenced in late July. As previously described, all work within the spillway is being performed by lowering remotely controlled units, shown in Figure 3 top right, to break up and move the rock so that it can be removed by a crawler crane situated on the new crane pad. No personnel will be required to enter the spillway. Figure 3 bottom shows the work just having got underway. Within two days of this photo being taken, the large boulders had been broken up and removed. Early indications are that the spillway cleanout will be completed in September.

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Figure 3 Progress in the work to remove rockfall from the Terzaghi Dam spillway chute. Top left: the access road and crane pad, shown near completion in early July. Top right: one of the remotely controlled demolition and excavation units being readied for mobilization to site. Bottom: excavation underway as of July 25, 2024. The excavator operators can be seen on the wooden platform on the left side of the spillway chute.

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Bridge River Wildfires

The F2024 Q2 Quarterly Dam Safety Report described how two large wildfires had impacted the Bridge River System, damaging or destroying BC Hydro infrastructure in proximity to Terzaghi Dam and the Bridge River 1 and Bridge River 2 Generating Stations. Damage to power supplies and lines of communications impacted Dam Safety operations, requiring use of backup power (solar panels, batteries) and communications (satellite) systems. Power supplies were restored in December 2023, as described in the F2024 Q3 Quarterly Dam Safety Report. Cellular communications were restored to Terzaghi Dam on June 19 and are now the primary communication path for Terzaghi Dam instrumentation, and satellite communications has reverted to being the backup system.

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 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 and progressed through F2025 Q1. Work continues on engineering and construction planning work to enable salvage operations within a potential window in the fall of 2024.

Compliance with Processes and Regulations

Regulatory Communications – British Columbia Utilities Commission

BC Hydro submitted an Evidentiary Update for the Ladore Spillway Seismic Upgrade Project and the Strathcona Discharge Upgrade Project Application on May 30, 2024. The update comprised an Updated Project Cost Estimate for the Ladore Project. As BC Hydro has not determined whether there may be a similar need to file an updated Project Cost Estimate for the Strathcona Project, and as the two projects have different implementation schedules with the Ladore Project further advanced than Strathcona, BC Hydro requested the Commission to separate the proceedings for the two projects, to adjourn the regulatory process for the Strathcona Project until a determination on the need for an updated Project Cost Estimate is determined, and to adopt a proposed schedule for the remainder of the Ladore Project regulatory process. With minor schedule changes, the Commission accepted BC Hydro's requests.

Information Requests pertaining to the Ladore Project's updated Projected Cost Estimate were received on June 17 and BC Hydro submitted its responses on July 18 and its final argument on July 25. Intervenor final arguments are due on August 15. The Commission has further directed BC Hydro to file an update on the status of the Strathcona Project cost information on October 31, 2024.

Regulatory Communications – Comptroller of Water Rights

Requests for authorization to alter WAC Bennett Dam with the decommissioning of the Low Level Outlets and to alter Elko Dam with the permanent removal of stoplogs and piers in the West Spillway were submitted in April. Authorization for both projects is expected in August. The plan to decommission Durack Brook Dam was accepted in May. Acceptance of instrumentation work at Wahleach, Coquitlam, and additional work at Peace Canyon Dams was also received in Q1. BC Hydro also provided input into draft "Guidelines for Invasive Investigation Plans & Instrumentation Records" that the provincial Dam Safety Office hopes to publish this year.

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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 Revelstoke Dikes Manual was issued in Q1. Work was begun on updating the Aberfeldie Dam Manual, which is due at the end of 2024. Work on updating five other Manuals with later due dates is also planned for F2025.

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 that are due at the end of 2024 were originally targeted for early completion in Q4 of F2024. The final reports for two – Wilsey Dam and WAC Bennett Dam – were received in Q1. The report for Cheakamus Dam was issued by the Review engineer in April, but further work has been identified before the report can be accepted. Updated draft reports have been received for Comox and John Hart Dams, but these also require minor further work before finalizing. All reports are expected to be finalized and submitted to the Comptroller of Water Rights in August thru October, well ahead of their regulatory due date in December. In alignment with BC Hydro’s new practice, the reports will be submitted along with sealed engineering memoranda by the dams’ Dam Safety Engineers that identify how the Reviews’ findings and recommendations have been captured in the Dam Safety Issues Database.

In F2025, Dam Safety Reviews are scheduled to commence for Alouette, Duncan, Elliott, Revelstoke, and Seven Mile Dams. Site visits have been scheduled for Duncan, Elliott, and Seven Mile Dams and the Revelstoke site visit has been completed. Work on the Alouette Dam Safety Review is scheduled to begin in Q4.

Dam Safety Program Management System

In F2025 Q1, a number of actions to support, improve, or further develop the Dam Safety Program Management System were completed.





- The succession plan for the Dam Safety business unit, covering all key roles therein, was updated and issued.
- The Manager, Dam Safety Surveillance provided updated guidance to Dam Safety Engineers for the preparation of memoranda documenting their periodic reviews of the Dam Safety Issues Database and updating the characterization of dam performance issues.
- The Manager, Dam Safety Regulatory and Asset Planning documented joint understanding with Engineering Services that requires formal Dam Safety acceptance of maintenance engineering reports. Specifically, prior to being issued, these reports will be reviewed by Dam Safety to ensure findings and recommendations are clear, well supported, actionable, aligned with business practices for work prioritization, and allow for alternative approaches or solutions to address any risks or deficiencies.
- The Dam Safety Strategic Asset Management Plan was issued. That document defines the objectives and approach to the management of physical dam system assets within BC Hydro in a manner that is consistent with BC Hydro’s Asset Management Policy, and operationalizes BC Hydro’s *Statement on Approach to Managing Risks from Dams*.

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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 Q1		Year-to-date	
		Actual	Target	Actual	Target
Routine dam inspections	Completed	408/411 = 99.3%	100%	408/411 = 99.3%	99.5% 
	Missed	3		3	
Formal (annual and semi-annual) dam inspections	Field work completed	32	20	32	20 
	Reports issued	0	0	0	0
Instrumentation data checks		190/195 = 97%	97%	190/195 = 97%	97% 
Reservoir slopes inspections	Field work completed	6	4	6	4 
	Reports issued	0	0	0	0

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.

Three of the 411 scheduled routine inspections are considered to have been missed in Q1.

- Two inspections – one each at Sugar Lake and Wilsey Dams – were missed due to scheduling conflicts. These misses have been discussed with Stations Field Operations management and steps are being taken to prevent a recurrence.
- One inspection is considered to have been missed at Mica Dam. In this instance, the inspection was performed by Operations, but the information collected and stored in the Dam Safety Inspection App was lost. Dam Safety's Data Technology team is investigating to determine the cause.

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. In Q1, the field work for 32 inspections was completed, ahead of the planned target of twenty.

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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 being for ongoing engineering assessment. They are tasked to perform three such checks per week. 190 checks were completed against a plan of 195 in Q1.

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. The field work for six of the slopes inspections was completed in Q1; ahead of the target of four.

Unusual Events or Observations

The Dam Safety On Call Person responded to 92 calls in Q1, 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 Q1		Year-to-date	
		Actual	Target	Actual	Target
Corrective and Condition-Based Maintenance	Spend (\$k)	976	1084	976	1084
	Work Orders Completed	5	2	5	2
Preventive Maintenance	Tasks Completed	126	151	126/151 = 83%	

Preventive Maintenance

In Q1 of F2025, satisfactory progress was towards completing the Civil Preventive Maintenance plan. Against a plan of 151 preventive maintenance tasks, Stations Field Operations and Engineering Services fully completed 126 tasks, with an additional 27 tasks that were “field-completed” and awaiting reports and documentation before being formally marked as complete.

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Corrective and Condition-Based Maintenance

The Corrective and Condition-Based Civil Maintenance Program was underspent by \$109k at the end of Q1. The variance is due in part to road repairs at Sugar Lake Dam being rescheduled from the spring to the fall.

The concrete repair project at Whatshan Dam was completed in Q1. Work to repair spalled concrete and exposed reinforcement on the spillway's stoplog guides was previously completed in F2024. The second phase of the project, comprising repairs to the stoplog sills, was completed by BC Hydro's Vernon Construction Services team in Q1 of F2025. See Figure 4, below.

Other work completed in Q1 included the Seton Canal forebay concrete repairs, Seven Mile Dam downstream face cleaning, and the La Joie Dam shotcrete face repairs.



Figure 4 Repairs of stoplog sill at Whatshan Dam. At left: Completed removal of deteriorated concrete and newly installed reinforcement. At right: Completed concrete placement.

Spillway Gate Testing and Maintenance

Spillway Gate Testing

During Q1 of F2025, 232 of 237 of scheduled gate tests were completed, including annual gate tests of 22 gates. Table 4 below provides key metrics related to spillway gate testing.

Table 4 Spillway gate testing results for F2025 Q1.

		Quarter Q1		Year-to-date	
		Actual	Target	Actual	Target
Monthly Tests	Completed	232/237 =98%	100% ❌	232/237 =98%	98% ✅
	Missed	5		5	
Gates Failing to Operate on Demand during Testing	No. of failures	5		5	
	Failure rate	5/232= 2.2%		5/232= 2.2%	

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Five gates failed to operate on demand in Q1:

- Comox Dam Spillway Operating Gate 1 would not open during the monthly test in May. Troubleshooting identified the failed component, for which a replacement was not readily available. As the gate was planned to be removed from service and replaced in July as part of a planned capital project (see “Comox-Puntledge Flow Control Improvements” under “Capital Projects” on page 15), inflows were forecast to remain typically low through the summer, Spillway Operating Gate 2 remained available for remote operation to make normal flow adjustments, and Gate 1 could be operated in emergency conditions using an auxiliary drive, no further investigations or corrective actions were undertaken.
- At Mica Dam in May, the brake on the east spillway operating gate did not release and the gate would not open. The brake was re-built during the subsequent annual maintenance outage in May and June, and operation of the gate was successfully tested in June.
- At the WAC Bennett Dam, during spillway project commissioning tests conducted prior to the May test, problems with the fluid couplings on the Spillway Operating Gate 1 and 2 main drives were identified. In addition, when using the backup motors, the brakes on all three gates were found not to release and the gates could not be opened. Since that time, fluid coupling oil levels and bolt torques have been adjusted and the gates tested to demonstrate they are functional. As of early June, the main drives for all three gates are in service and operational, providing one functional path for operating each gate. However, all three backup drives are out of service due to the noted brake issues. Brake operation has been a persistent deficiency on the spillway upgrade project and based on investigations in F2024 the project team is now re-designing the brake system. A gate serviceability deficiency has been entered into the Issues Database with a Vulnerability Index of 3.5. See item 3 under “Vulnerability Index” on page 3.

The five missed gate tests occurred at two sites:

- At the Elko Dam in April, the Maintenance Instruction was filled out for the two spillway gates, but the gates were not operated as required. New crew members assigned to perform the tests misinterpreted the requirements for testing under winter-like conditions that are common for that time of year. The Maintenance Instruction was subsequently reviewed and confirmed to be clear, and the Field Maintenance Engineer has now explained the test schedule to the crew.
- At the WAC Bennet Dam in June, the monthly tests for the three spillway gates were not completed due to the brake and fluid drive issues described above.

Gate testing scopes are commonly reduced to exclude gate movements 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 gate test scope reductions 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 2025 Q1, gate testing scopes were reduced to exclude gate movements on 32 of the 232 tests completed.

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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 are in service except:

- As described in the F2024 Q3 and Q4 Quarterly Dam Safety reports, the two spillway gates at Terzaghi Dam are operational, available and being maintained, but the rockfall into the spillway chute (see Update on Existing Issues, pages 5-6) means the spillway should not be used to release flow until the rockfall is cleared.
- The gate position of one of the two low level outlet gates at Terzaghi Dam is not visible to operators. The gate remains operable for large releases, since gate position is not critical for large releases, but it has not been regularly tested through the winter and is not useable for the required environmental flows. Repair is scheduled for July 2024. In the longer term, the Terzaghi Low Level Discharge Reliability Improvement Project is in progress with a planned in-service date in 2030.
- As described above, one of the two spillway gates at the Comox Dam is out of service for the planned gate replacement project; work on the gate started in July 2024.
- As described above, the three spillway gates at the WAC Bennett dam are operating with reduced reliability since the backup drives are out of service.

Spillway Gate Maintenance

Spillway gate maintenance results for F2025 Q1 are shown in Table 5.

Table 5 Spillway gate maintenance results for F2025.

Corrective and Condition-Based Maintenance Tasks	Quarter Q1		Year-to-date
	Completed	Planned	
Planned Tasks	7	15	7/15 = 47%
Emergent Tasks	2		2

Dam Safety had identified and prioritized a total of 38 gate maintenance tasks for completion in F2025. Due to an administrative error, an additional 12 tasks were added into the plan (erroneously raising the total to 50). Therefore, some portion of the 15 tasks shown to have been planned in Table 5 were never intended to be completed in F2025. Dam Safety is working with Project and Contract Management to reconcile these numbers for future reporting.

The number of outstanding gate maintenance tasks is shown in the chart in Figure 5. Following significant decreases in each year from F2020 through F2023, the inventory only decreased slightly in F2024. In Q1 of F2025, the number of tasks increased. The number of high priority tasks has not changed.

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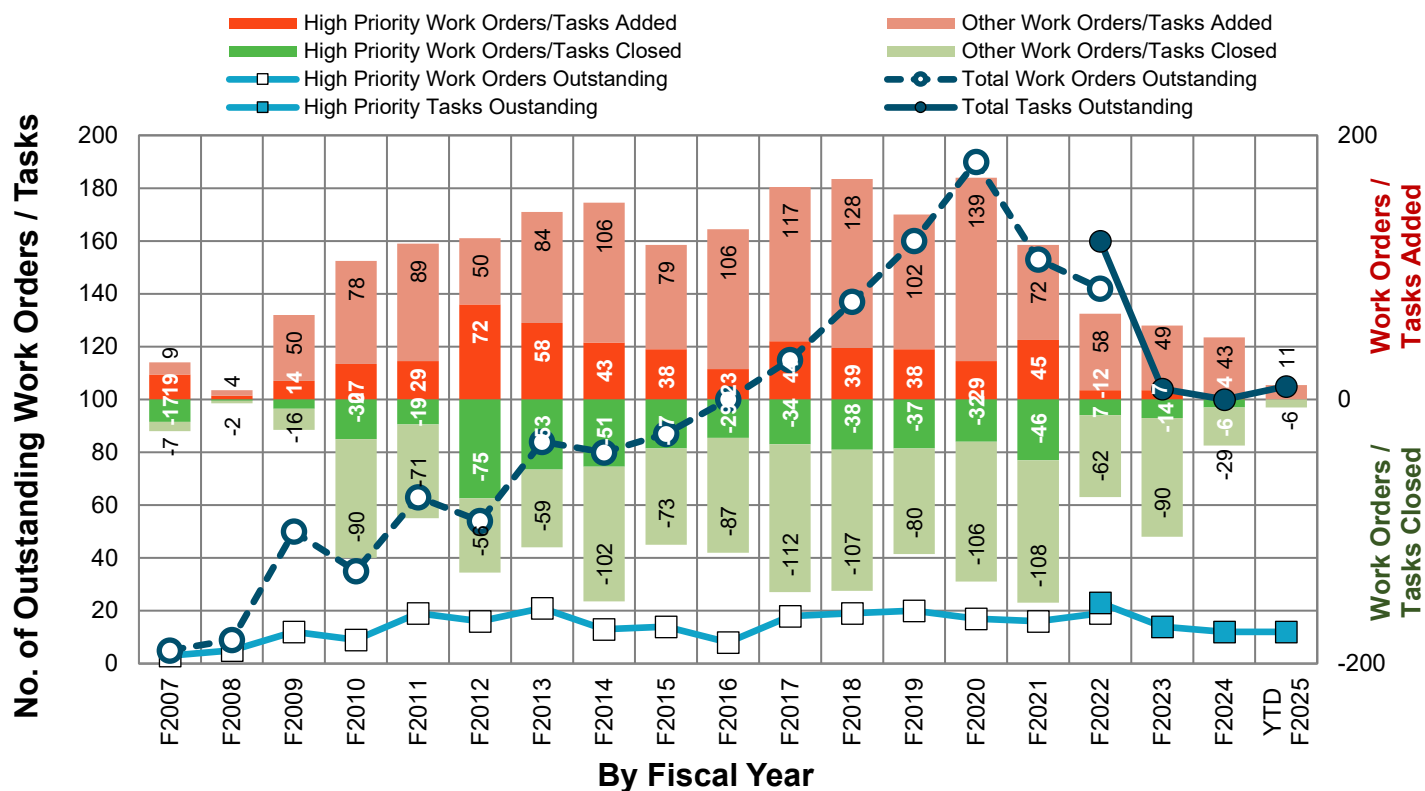


Figure 5 Number of outstanding corrective and condition-based spillway gate maintenance work orders and tasks, new work orders and tasks added, and work orders and tasks closed as at the end of each previous fiscal year.

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. Work Orders / Tasks Added includes new work orders / tasks created in the year and identified with the gate reliability work group. It does not include work orders / tasks from previous years that were recategorized with the gate reliability work group.
3. Work Orders / Tasks Closed includes work completed through the annual maintenance program. It does not include cancelled work orders / tasks or work orders / tasks that were recategorized out of the gate reliability work group.
4. Due to notes 2 and 3, above, the net change in the number of Outstanding Work Orders / Tasks will not always equal Work Orders / Tasks Added less Work Orders / Tasks 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 Engineering & Work Methods. 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, and Information & Technology Committee, for updates on emergency preparedness and public safety.

Site C Clean Energy Project

Dam Safety, Generation System Operations and the Site C Clean Energy Project team are engaged in ongoing collaborations to integrate the Project's design and construction activities and the constructed facilities into BC Hydro's Dam Safety Program. In preparation for reservoir fill:

- The Operation, Maintenance and Surveillance Manual and the Interim Dam Safety Risk Management Plan for Peace River Operations were updated and issued;
- A second Interim Dam Safety Risk Management Plan, pertaining to the planned operation of the spillway and low level outlet gates under temporary power and controls, has been drafted and is being reviewed and refined as supporting documents and procedures are developed and implemented; and
- Dam Safety Surveillance is engaged in weekly meetings with the project team to plan and coordinate the surveillance activities that will be performed by the two groups.

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.

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 flow downstream of Puntledge Dam, which can pose a significant risk to public safety. The project will improve the Puntledge generation water conveyance by upgrading or replacing existing components of the flow control system at the Puntledge Diversion dam and in the powerhouse. It will also replace the Comox Dam spillway gates and improve their reliability.

The project is currently in Implementation. Early works, including construction of two new control buildings at Comox and Puntledge Dams, concluded in May. The first construction outage has started, where the project is on track to replace the first of two spillway gates at Comox Dam and an intake gate at Puntledge Dam, and implement associated structural and hoist upgrades. This work is planned to be completed by September. Additional work at the powerhouse to upgrade the Turbine Inlet Valve and the Pressure Relief Valve is also underway.



Figure 6 Spillway at Comox Dam in early July. Hoarding is being installed in preparation for work to upgrade the spillway gates.

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John Hart Dam Seismic Upgrade Project

Good progress continued on the main civil works portion of the John Hart Dam Seismic Upgrade project through F20225 Q1.

On the North Earthfill Dam, compaction and densification of the dam's upstream (in-reservoir) fills and placement of the upstream stabilizing berm has been completed and verified to meet the design specifications. This work resolves a significant deficiency for the North Earthfill Dam by mitigating the risk of an upstream slope failure during the Maximum Design Earthquake. The top photo in Figure 7 shows the new berm and densification work in progress, as well as the effectiveness of the silt curtain in containing sediment within the work area. The downstream excavation of the North Earthfill Dam has progressed to the toe, and placement of the new downstream stabilizing berm is underway.

On the Concrete Main Dam, raising of the spillway's left training wall has been completed. This is visible as the new concrete in the upper left corner of the middle photo in Figure 7. Works to facilitate construction of the apron blocks for the new passive overflow spillway are visible in the left foreground of that same photo. A diversion wall to divert spillway gate flows away from that area of construction has been built and the cofferdam to isolate that area from tailwater during spilling is nearly completed. Rock foundation preparation for the apron blocks is underway.

On the Middle Earthfill Dam, excavation of the downstream face to improve stability is nearly complete. The work has progressed well, with rock armoring being placed as the excavation continues down the Middle Earthfill Dam. Upstream, the silt curtain has been installed and removal of stumps is progressing, shown in the bottom photo of Figure 7. Dredgeate storage berms have been completed in advance of the dredging beginning upstream on the Middle Earthfill Dam.

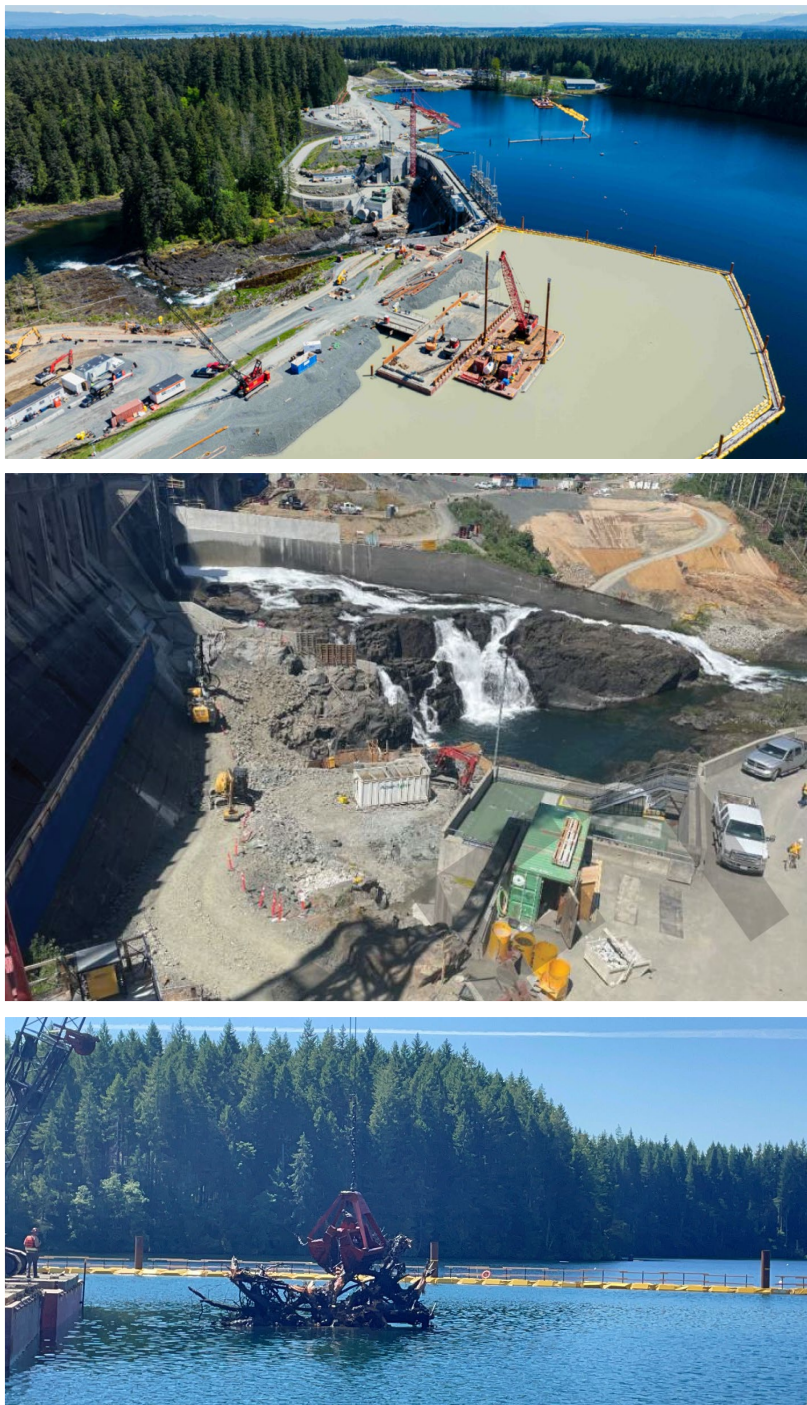


Figure 7 Top: View of the North Earthfill Dam berm densification work. Middle: View of left training wall and rock foundation preparation downstream of Concrete Main Dam. Bottom: Middle Earthfill Dam silt curtain installation and stump removal in advance of dredging.

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Hugh Keenleyside Floating Guidewall Upgrade

The Hugh Keenleyside floating guidewall that directs marine traffic safely into the dam's navigation lock is over fifty years old and consists of six concrete pontoons measuring 100 feet long by 20 feet wide by 20 feet deep. In 2020, as described in the F2020 Q4 Dam Safety Quarterly Report, a series of events led to the two outermost pontoons (5 and 6) taking on water and sinking. See "Update on Existing Issues" on page 7 regarding ongoing efforts to salvage the two sunken pontoons. Since then, there have been a series of other issues identified with the floating guidewall that have impacted the operation of the reservoir and the navigation lock. The floating guidewall no longer meets operational needs for use of the navigation lock. This new project was released in F2025 Q1 to refurbish and upgrade the floating guidewall and address the ongoing operational concerns such that it can meet its original design intent.

Lake Buntzen 1 Penstock Exterior Recoat

This project was initiated to extend the life of the Lake Buntzen 1 steel penstock through recoating of the exterior steel surfaces and refurbishment of the steel and concrete pedestals. The exterior recoating of the penstock is now substantially complete, and refurbishment of the penstock pedestals is continuing through Q2.

Project execution was complicated by the identification of asbestos-contaminated soils beneath the penstock. Additional containment measures were put in place to ensure the safety of workers. The project is evaluating preferred options for long-term containment of the contaminated soil as construction is concluded.

La Joie Dam Intake Operating Gate and Follower Replacement

The F2021 Q4 Quarterly Dam Safety Report described the March 2021 failure of the lifting mechanism of Intake Operating Gate 4, one of two intake operating gates on the upstream end of La Joie Dam's low level outlet that is referred to as the North Conduit. Subsequent inspections identified that the gate body and the mechanism components called "followers" were in very poor condition or, in the case of some of the followers, a failed state. This project was initiated in Q1 of F2022 to replace the followers on all four gates, to replace North Conduit's Intake Operating Gates 3 and 4 and refurbish the gate guides. This project will ensure that the gates can reliably manage the Downton Reservoir levels until completion of the La Joie Dam Improvement Project.

Previously, the Intake Operating Gate 4 and 3 followers were replaced in April of 2022 and June of 2023, respectively. In Q1 of F2025, the followers for Intake Operating Gates 1 and 2 were replaced and the gate guides were refurbished.

The final element of this project's scope is the replacement of Intake Operating Gates 3 and 4. Planning is underway for replacement of the two gates in F2026.

Peace Canyon Dam Piezometers and Drains Upgrade

The Peace Canyon Dam's spillway is founded on sedimentary rock. Due to the low strength of bedding planes that separate different strata of rock, drainage and a sump pump system were constructed to improve the dam's stability against sliding. Maintaining high drainage efficiency and controlling uplift pressures in the dam's foundation are essential to its stability. The objectives of this project are to upgrade the drains to improve sliding stability of the spillway blocks and to install additional instrumentation to monitor uplift pressures and movement across the bedding planes.

In F2025 Q1, the project commenced installation of the new instruments. Thirteen holes have been drilled into the foundations from the spillway drainage galleries. Five piezometers and five inclinometers will be installed, along with three riser pipes for automated deformation monitoring instruments. The added instrumentation will improve the ability to monitor pore pressures and detect movement and deformation at the spillway and spillway bucket blocks.

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Ruskin Left Abutment Sinkhole Remediation

At Ruskin Dam on January 6, 2020, after an extended period of heavy precipitation, a small depression was observed in the filter blanket that was recently constructed on the left abutment behind the powerhouse. An investigation confirmed this to be a sinkhole. A second sinkhole was subsequently discovered in the same area, and both were found to be increasing in size. See the F2020 Q4 and the F2021 Q3 Quarterly Dam Safety Reports for additional information.

This project was released to develop and implement remedial solutions to the causes and impacts of the sinkholes. After completing extensive field investigations and analyses, detailed design was completed. However, more recent exploratory holes drilled to inform construction have identified a void within the bedrock above the penstock and fractured/damaged bedrock, requiring additional investigations and design modifications. The project team has completed the design modifications and are proceeding with penstock grouting works and the installation of piles and shoring walls that are required to excavate and remove the erodible sub-surface clays that led to the sinkholes.



Figure 8 Left abutment of Ruskin Dam adjacent to the powerhouse. Pile driving is underway to construct shoring walls for excavation of erodible sub-surface clays. Polyethylene sheets that are being used to protect the slope from water infiltration during heavy precipitation events are visible in the foreground.

Seton Canal 6-Year Concrete Refurbishment

The Seton Canal was constructed in the early 1950s. 3,850 metres long, it conveys water from Seton Lake Reservoir at the Seton Dam to the Seton Generating Station and the Fraser River. Through aging and progressive concrete deterioration, deficiencies such as failed joints, cracks and leakage through the concrete liner have been observed.

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To prevent excessive leakage that could damage and destabilize the supporting earthfill embankments, scheduled plant outages are used to conduct regular inspections, conduct smaller-scale repairs, and, during longer outages when the canal is dewatered every six years, perform larger-scale refurbishment projects to address the highest priority defects in the canal lining.

Canal concrete refurbishment commenced in F2025 Q1. During concrete removal to refurbish one of the joints, a significant water-filled void was discovered under the canal. Engineering and the project team developed a design to fill the void and replace the adjacent concrete. Further investigation was carried out to identify any other voids, and none were found. However, the addition of this unplanned scope resulted in fewer defects being remediated within the available outage window than was originally planned. Outstanding deficiencies will be prioritized for future projects and outages.



Figure 9 Water-filled void found under the Seton Canal during concrete remediation works.

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.

The F2025 program of Dam Safety Investigations, described in the following, includes updates to hazard characterizations and engineering investigations of Potential Deficiencies and Non-Conformances of Information at our facilities.

Safety Evaluation Flood Updates

The Safety Evaluation Flood is the uppermost extreme flood used to evaluate whether the dam has adequate discharge capacity. As new data and methodologies become available, the Safety Evaluation Flood for each dam needs to be reevaluated to determine if the dam still has adequate discharge capacity to meet current good practices. In F2025, the Safety Evaluation Flood for Terzaghi Dam, Sugar Lake Dam, Alouette Dam, and Wahleach Dam will be updated.

Updating Flood Simulation Models

Flood simulation models are used to determine the extents and time to flooding in the event of a dam breach. In F2025, the flood simulation models for Duncan Dam and Kootenay Canal will be updated, and engineering reports produced.

Developing and Updating Transient Simulation Models

Transient simulations are used to model the transient hydraulic pressures that penstocks experience during irregular events, such as load rejections and full flow valve and gate closures. These models facilitate analysis following unplanned events and the preparation of procedures for equipment testing. In F2025, transient simulation models for Mica and Revelstoke Dams will be developed.

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Embankment Dam Special Investigations

The overall objective of this investigation is to develop tools and methodologies appropriate for performance assessment and monitoring of BC Hydro's large embankment dams. The focus of the investigation is on WAC Bennett Dam and Mica Dam, though the methodologies and tools are expected to be applicable to BC Hydro's other large embankment dams. The investigation has completed site characterization for both dams and has nearly completed the development of three-dimensional Geographical Information System models, as used in the Dam Safety Information System (F2023 Q3 Quarterly Dam Safety Report). These models are expected to be finalized in F2025. Two-dimensional static and seismic stress analysis has been completed for WAC Bennett Dam, and the three-dimensional analysis is underway. The two-dimensional analysis is underway for Mica Dam. As described in the F2024 Q2 Quarterly Dam Safety Report, an extensive laboratory testing program is also underway to characterize the expected performance of both dams. In F2025, work will progress on the performance assessment of WAC Bennett and Mica Dams. Additional laboratory testing of WAC Bennett Dam's filter, transition and inner shell materials will be undertaken to inform expected dam performance.

Strathcona Dam Performance Assessment

The Strathcona Dam investigation leverages the learnings from the Embankment Dam Special Investigation described above. Similar to that investigation, a three-dimensional Geographical Information System model is being developed that will facilitate the static, seismic and seepage performance assessments of the dam. Work completed to date includes substantial completion of a conventional three-dimensional computer model and some laboratory testing of the embankment dam's filter material. In F2025, the first version of the computer model will be completed and further progressed towards a Geographical Information System model. Additional samples of dam core and shell material will be collected and tested in the laboratory to assess filter compatibility.

Peace Canyon Dam Spillway Stability Assessment

The F2024 Q1 Quarterly Dam Safety Report described the scope and early progress of this investigation, the objective of which is to assess the stability of the concrete dam and to evaluate the scouring and erosion of the rock in the plunge pool immediately downstream of the spillway. Work completed to date includes a review of existing information, a detailed survey and inspection of the plunge pool, a review by external experts of the modeled parameters for the foundation's bedding planes, a survey and three-dimensional laser scan, and commencing development of a three-dimensional computer model. In F2025, the investigation will progress through a hydraulic analysis of the spillway, and a plunge pool scour assessment to characterize the potential extents of scour downstream of the spillway.

Landslide Wave Modeling

The F2024 Q4 Quarterly Dam Safety Report described work completed to simulate a landslide into a reservoir and the resultant wave using two different numerical approaches, which was intended to establish a standard methodology for future BC Hydro landslide wave modelling studies. Last year's pilot study demonstrated promise in using the two different approaches. These same approaches will now be used to simulate wave heights from several postulated slide volumes of the Checkerboard Creek landslide, located upstream of Revelstoke Dam. The modelled results will be compared to those from a 2005 physical model study.

Kootenay Canal Intake Dam Block Stability

This investigation will reevaluate the stability of the Kootenay Canal Intake Dam using uplift pressure data collected from piezometers that were installed in 2020 under the Kootenay Canal – Install Intake Dam Foundation Uplift Instrumentation project (F2021 Q2 Quarterly Dam Safety Report).