



CANADIAN CONSULTING ENGINEERING AWARDS 2023
CATEGORY C: WATER RESOURCES

Woodworth Dam Optimization

PROJECT OVERVIEW

The City of Prince Rupert needed to replace the aging Woodworth Dam on British Columbia's Northwest coast. It was a critical undertaking, as the 100-year-old infrastructure serves as a reservoir and water source for the community. The city turned to Austin Engineering, now known as BBA, to optimize the dam redesign, help secure the project and make it a state-of-the-art freshwater distribution facility.

A life-changing project:

The dam is the main source of drinking water for the citizens of Prince Rupert.

SERVICES

- Concrete dam design
- Value engineering to optimize design for cost savings
- Physical modelling and hydraulic testing
- Engineering field services

OBJECTIVES AND ACHIEVEMENTS

The aging dam and water supply lines needed to be replaced, and the city set about seeking funding and approval for an ambitious multi-year project to secure its primary freshwater source.

Securing the future of the project

Despite the success of the initial project stages, the challenges and costs associated with building a new dam in a remote region with limited road access threatened the project's future.

By undertaking a comprehensive value engineering review, our team optimized the initial Woodworth Dam design and significantly decreased the project budget of nearly 17% using an innovative 3D printing approach, which in turn reduced:

- **Rock anchor quantity by 40%**
- **Concrete volume by 25%**
- **Rock excavation volume by 18%**

What makes this project outstanding?

- ① Innovative 3D printing approach
- ② Collaboration with First Nations
- ③ Remote site management
- ④ Safety & environmental excellence
- ⑤ Quality of life improvement: access to safe, reliable drinking water

Providing sustainable solutions

Our team's goal was not only to reduce project costs to get the green light, but to work collaboratively in the interest of the environment and local communities:

- Re-using foundation rock saved 500 trips up and down the service road.
- Reducing rock excavation limited the amount of debris entering the stream.
- Reviewing and assessing First Nations ceremonial trees, traditional wetlands and other culturally significant features ensured special attention and care.
- Implementing best industry practices ensured climate resilience and dam safety.



CHALLENGES AND TECHNICAL EXCELLENCE

Remote site management

The site was located seven kilometres from a tidal barge landing, which could only be accessed to load and unload equipment no more than three hours per day during high tide. All equipment, concrete, rock, aggregate and other items from the project needed to be delivered by barge to this landing and then trucked seven kilometres up a single lane forestry service road.

Innovative 3D printing approach

When revising the initial design, our team compared several models using an innovative process: the dams were 3D printed, the riverbeds were CNC routed, and they were all tested in hydraulic flumes, to confirm their flow characteristics, and optimized for concrete volume reductions.

Dam safety and climate resilience

- Discovery of weak shale rock above the north abutment led to required slope stabilization before being able to access the dam site.
- Additional measures were taken to ensure safety during mudslides, which is a one-in-75-year and one-in-50-year rainfall event, which happened to occur during the project.
- Since Prince Rupert is known for its significantly heavy rainfalls, care was taken to predict and allow for future changes in flow regimes within the river system as a result of climate change. The spillway capacity was oversized to allow for future flood flows and demands.



The innovative 3D printing approach reduced the concrete, rock anchor volume and excavations.



Realistic model structures were used to communicate the new design to stakeholders in a visual and interactive way.



Dam safety best practices: the overall dam was designed to be overtopped entirely during a flood event.

SUSTAINABILITY AND SOCIAL CONTRIBUTION

Close collaboration with First Nations

The project is located on First Nations land, and these communities have been involved throughout the project. This collaboration ensured that special attention and care was taken to respect their culture. First Nations would hold traditional ceremonies, using sections of ceremonial cedar trees, so these trees were carefully relocated and returned to the communities. Also, the environmental consultant for the project was a First Nations joint venture partnership.

Environmental excellence

In addition to all the solutions reducing the concrete, rock anchor volume and excavations, the best environmental practices were put in place throughout the project to ensure its sustainability.



Preservation of a significant First Nations cultural symbol: the ceremonial cedar tree

Major improvement in quality of life: access to safe, reliable drinking water

The City of Prince Rupert has been under a boil water advisory for a number of years due to turbidity in the water system that pumps from Shawatlan Lake.

The completion and commissioning of the Woodworth Dam was celebrated on October 14, 2022. It now allows water to be taken directly from the Woodworth Reservoir and piped via HDPE pipeline down and across the harbour, entering the city of Prince Rupert's water system.

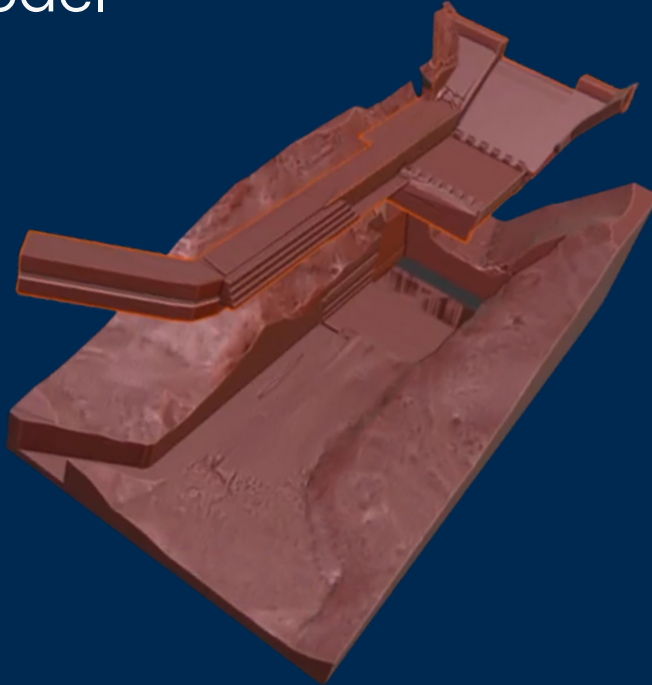
“This is a huge day for this community.”

– Lee Brain, Prince Rupert Mayor



Oct. 14, 2022 – A celebratory delegation of more than 25 staff, city council members, contractors and media attended the remote dam location.

Original model



BBA's optimized model

