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Klohn Crippen Berger

65 years of service

ANAHAM MEADOWS DRAINAGE REHABILITATION

10KM NORTH OF ALEXIS CREEK, BC

TL'ETINQOX
GOVERNMENT

2016 AWARD SUBMISSION
KLOHN CRIPPEN BERGER



NAME OF MEMBER FIRM SUBMITTING	Klohn Crippen Berger Ltd		
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CONTACT NAME	Kathy Fowler	EMAIL	kfowler@klohn.com
PROJECT TITLE	Anaham Meadows Drainage Rehabilitation		
LOCATION OF PROJECT	10km north of Alexis Creek, BC		
COMPONENT BEING SUBMITTED	Drainage Rehabilitation		
CATEGORY OF ENTRY	E. Natural Resources, Mining, Industry, Energy		
PROJECT OWNER	Tl'etinqox Government		
PROJECT CLIENT	Tl'etinqox Government		
SUMMARY DESCRIPTION OF PROJECT	Anaham Meadows has been an important agricultural area for the Tl'etinqox community for over 100 years. Klohn Crippen Berger (KCB) was engaged to restore the functionality of an aging irrigation system on a culturally significant site with unique environmental conditions. The primary objective of the project was to restore functionality of the system using as much of the existing structures as possible. Successful project execution required disciplined management, multi-stakeholder engagement, technical innovation and adaptability.		
NAMES OF OTHER CONSULTANTS INVOLVED	Gebauer & Associates Ltd., AquaTerra Environmental Ltd.		
NAME OF CONTRACTOR INVOLVED	Industra Construction Corp.		



innovation

Anaham Meadows is located approximately 10 km north of Alexis Creek on the plateau of the Chilcotin River valley. The meadows have been an important agricultural area for the Tl'etinqox people for over 100 years, and consist of approximately 300 ha of flat, low-lying land on either side of Anaham Creek.

Irrigation is a necessity for crop and livestock production due to the dry climate of the Anaham Reserve area. In 1963 a series of drainage structures were built to facilitate seasonal flooding and draining of Anaham Meadows. Operation of these structures was difficult, and over time the system deteriorated to the point of being deemed inoperable. The result of this lack of operability was ad hoc modifications to the system to maintain some level of functionality, which ultimately resulted in damage to Anaham Creek. KCB was engaged by the Tl'etinqox Government to undertake engineering design and coordinate repair of the existing flow control structures and in 2015 completed the following:

- Construction of fish salvage pools and initial isolation of the meadows
- Repair of the upper dam and installation of slide gates
- Realignment of the diversion channel
- Repair of the lower dam and installation of slide gates

The unique site conditions, project objectives and stakeholder requirements made it necessary for KCB to be innovative and adaptive in designing and implementing the irrigation system repairs. The irrigation system operators required a system that was safe to access, easy to operate and robust. KCB achieved this by replacing a difficult to use stoplog system with slide gates and adding walkways to both the upper and lower dam structures. The aim of the design was to use as much of the existing structures as possible, to avoid costly demolition and rebuild, but also to reduce new concrete and other hazardous materials from being used in this mainly instream work. To this end:

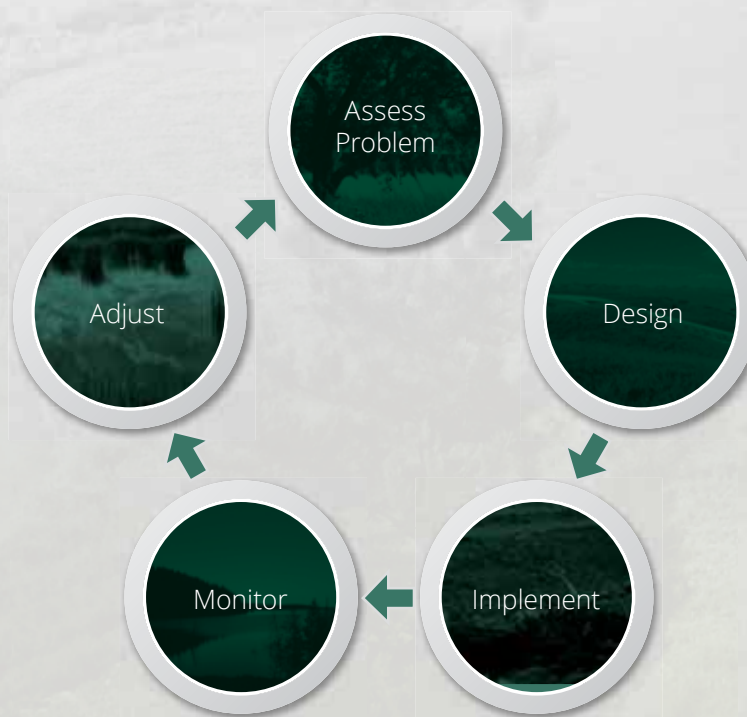
- The existing concrete was assessed to determine condition and the repaired structures remained in place.
- The new walkways were designed to be pre-manufactured to avoid welding, drilling, and application of corrosion coating on site.
- Cast in place (CIP) concrete was minimized by using gabion walls and mats, riprap and lock blocks for erosion protection and structural support. The only CIP concrete used for the project was a reinforced slab to strengthen the existing apron at the lower dam and grout to repair the existing structures.



complexity

In spite of significant schedule delays, KCB successfully executed the repairs using disciplined project management, multi-stakeholder engagement, technical innovation and adaptability. This required collaborative, multi-disciplinary planning and execution to handle the technical, social, environmental and financial challenges that arose over the course of the project. This involved collaboration with the Tl'etinqox Government (project owner), Aboriginal Affairs and Northern Development Canada (project funding), the Department of Fisheries and Oceans and Ministry of Forests, Lands and Natural Resource Operations (environmental and permitting requirements), Gebauer & Associates Ltd. and AquaTerra Environmental Ltd. (aquatic specialists), Industra Construction Corp. (prime contractor) and local landholders. Ongoing consultation with stakeholders allowed KCB to adjust the project plan and schedule in accordance with evolving project requirements.

Adaptive Project Management



Work was completed within the approved government funded budget, and where possible existing infrastructure and local resources were used. Environmental monitoring was carried out over the construction period and no measurable environmental impacts were observed.



social and / or economic benefits

KCB's focus on integrating environmental, social and engineering considerations from project scoping through to commissioning allowed this project to have beneficial effects that go well beyond immediate returns.

First and foremost, restoration of the irrigation system will allow the TI'etinqox community to continue producing crops and livestock in a safe and efficient manner, which will provide long term economic benefits to the community. In the short term, the TI'etinqox Government and local businesses also received economic benefit from the creation of jobs, purchase of construction materials and use of local equipment to complete the works.

Second, construction of fish salvage pools and development of a fish salvage plan will allow irrigation of the meadows to be carried out such that Anaham Creek does not continue to be impacted by agricultural activities. Involvement of TI'etinqox Government employees in construction of the pools and the fish salvage process allowed KCB to incorporate traditional knowledge into management plans and educate community members.

Third, the health and safety of irrigation system operators and landholders will be improved with the new system. The addition of walkways and gates to control flows through the upper and lower dams will make access easier and safer. The new gate system will be much easier to use than the former stoplog system, which will provide operators greater water management control and flexibility.

Finally, consultation and collaboration with the TI'etinqox Government allowed workers to be upskilled in the areas of earthworks, construction and environmental management. This training, combined with infrastructure improvements, will allow landholders and system operators to have safe and consistent access to irrigation water. KCB hopes these improvements in technology and process will help ensure longevity of the irrigation system.

environmental benefits

Early on during project scoping, it was identified that past irrigation system operating practices had damaged Anaham Creek with potentially negative effects on fish populations. As KCB began the engineering design and permitting for the project, numerous regulatory agencies including the provincial Ministry of Forests, Lands and Natural Resource Operations and the federal Department of Fisheries and Oceans imposed environmental management requirements on the project.

The overarching requirement was to protect fish and fish habitat during construction and future operation of the system. To that end, minimum downstream flow requirements were established for the system and a fish salvage plan developed and implemented.

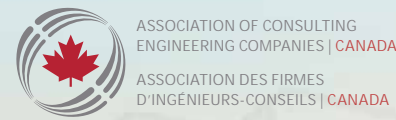
Carrying out fish salvage over the entire 300 ha area prior to construction and before the annual fall draining of the meadows posed significant technical challenges. Fish salvage, which typically requires the use of netting and electrofishing to physically isolate project area, could not feasibly be achieved over the entire area. To address this challenge, KCB engaged with technical experts (Gebauer & Associates Ltd. and AquaTerra Environmental Ltd.) and consulted with the Tl'etinqox Government and regulatory agencies to come up with a plan. The end result was a decision to construct a number of fish salvage pools at strategic locations, where it was expected that fish would congregate during draining of the meadows, thereby allowing salvage and relocation to be carried out in an efficient and effective way. Development of this novel approach exemplifies the innovative and dedicated nature of the project team.

meeting client's needs

The primary objective of the project was to restore functionality of the existing irrigation system to ensure continued economic returns for the Tl'etinqox community and improved environmental management practices. In spite of significant schedule delays, KCB successfully executed the repairs using disciplined project management, multi-stakeholder engagement, technical innovation and adaptability. Although the irrigation system will not be fully commissioned until summer 2016, the expected benefits of the project are continued economic returns for the Tl'etinqox Government and improved management of the unique Anaham Meadows environment.

"The Anaham Meadows are an important agricultural area for our community, and protection of the environment is paramount to the Tl'etinqox people. In the past our ranchers have had to use a difficult and poorly maintained irrigation system to produce hay, which resulted in damage to fish habitat and land. By considering the needs of all system users, Klohn Crippen Berger was able to come up with innovative and practical solutions that will help improve our land management practices for many years to come. The new dams are a great example of a high-tech but user-friendly system that will give the ranchers the control they need to continue being strong agricultural producers while ensuring that fish habitat is improved and maintained to a high standard."

Chief Joe Alphonse, Tl'etinqox Tribal Chairman



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10KM NORTH OF ALEXIS CREEK, BC

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diversion channel



slide gates



upper dam



Original diversion channel at upper dam

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CLIENT

TL'ETINQOX
GOVERNMENT

PARTNERS

Gebauer & Associates Ltd.
AquaTerra Environmental Ltd.

CONTRACTORS

Industra Construction Corp.

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photos



ORIGINAL INFRASTRUCTURE

Diversion channel at upper dam



ORIGINAL INFRASTRUCTURE

Lower dam



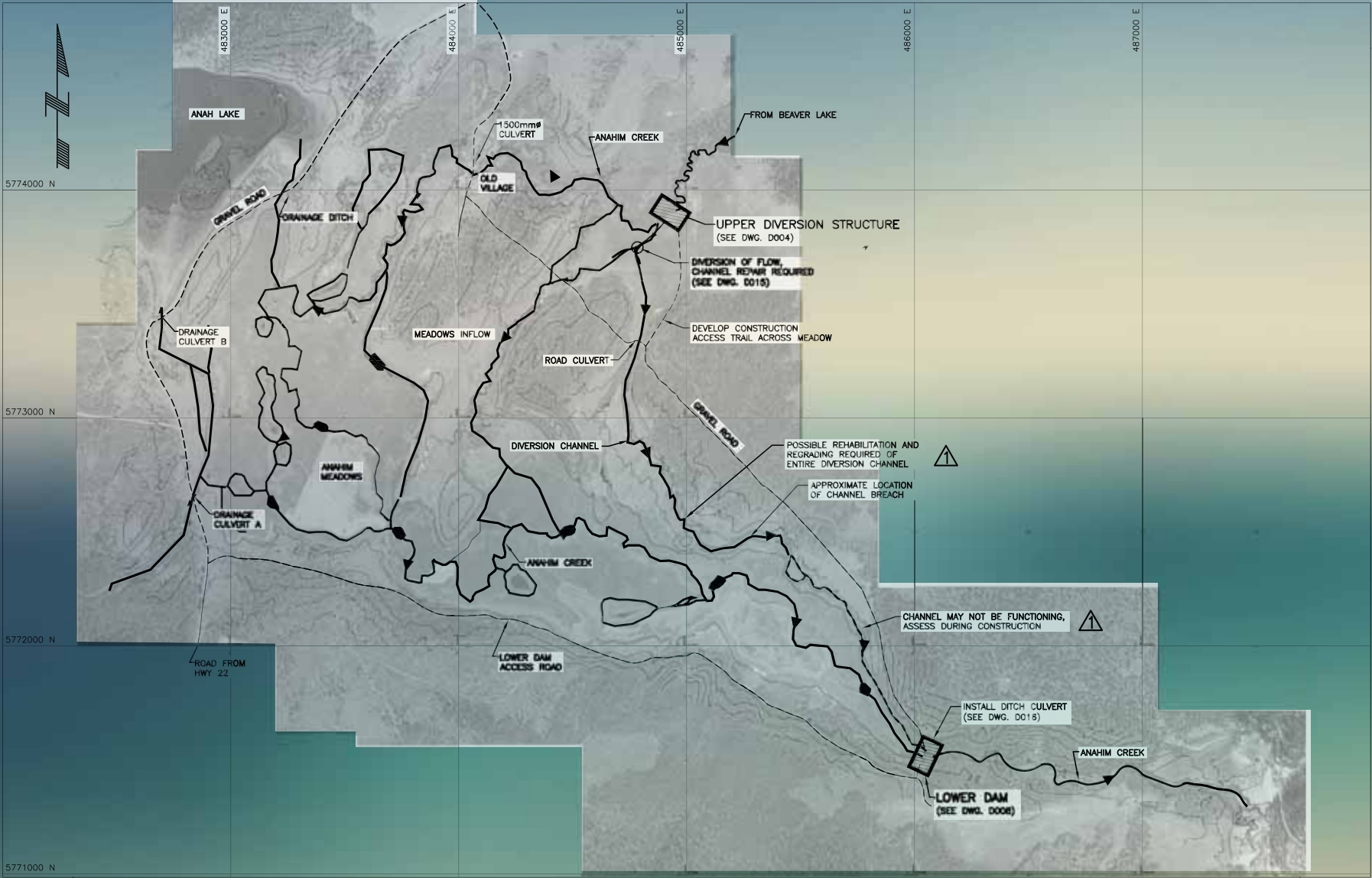
NEW INFRASTRUCTURE

Upper dam



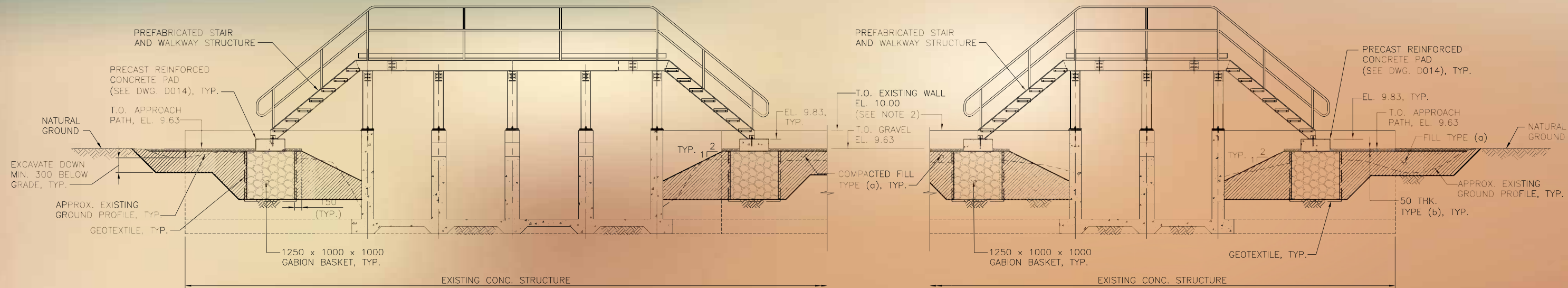
NEW INFRASTRUCTURE

Diversion channel and precast box culvert



general site plan

upper diversion structure





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