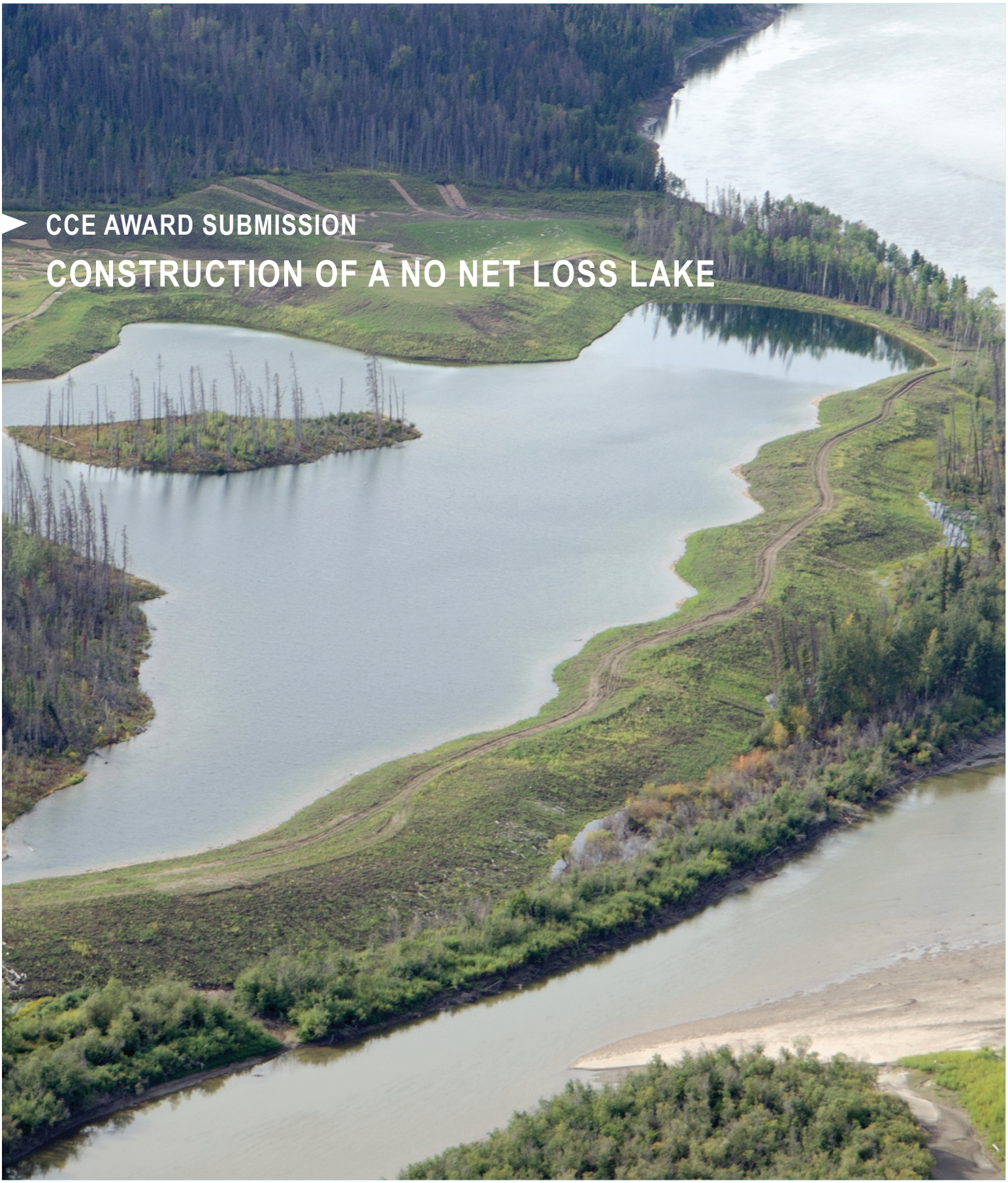


CCE AWARD SUBMISSION

CONSTRUCTION OF A NO NET LOSS LAKE

Golder Associates

PROJECT SUMMARY

The Fort Hills Energy Corporation is developing the Fort Hills Oil Sands Project (the Project), which is located 90 km north of Fort McMurray, Alberta, on the east side of the Athabasca River. The Project includes an open-pit mine, bitumen extraction plant, and supporting utilities and offsite facilities. The Project is jointly owned by Suncor Energy Inc. (Suncor) (previously Petro-Canada Oil Sands Incorporated), Total S.A, and TECK.

Reclamation work and planning were required to minimize the negative effects of this project on the natural vegetation and the fish habitat in Fort Creek, Susan Lake and the Susan Lake outlet channel.

The NNLL was designed and built to implement fish habitat compensation works consistent with Section 35(2) of the *Fisheries Act*. Golder Associates Ltd. (Golder) prepared a conceptual design that compensates for fish habitat losses in Fort Creek, Susan Lake, and the Susan Lake outlet channel by developing a new lake in the lower portion of the Creek A watershed, near its confluence with the Athabasca River.

Suncor retained Golder to prepare the detailed engineering design of the Project's NNLL, using the conceptual design as a starting point. The design allowed for twice as much compensation habitat to be created, than was destroyed, and for the creation of a lake that would look like a natural lake, be deep enough for over-wintering fish, and have long-term resilient sustainability, even through extreme weather events.

Golder is pleased to have been able to serve the Fort Hills Oil Sands Project through the design and construction of this beautiful and ecologically functional lake.

COMPLEXITY AND MANAGING RISK

The NNLL was a challenging project due to its location and geography. The majority of the construction work needed to happen in winter because the site was more accessible after freeze-up. The fish habitat features designed to be built on the lake needed to be constructed precisely for maximum habitat and ecosystem function.

Photo 1: Aerial view of material placement and water management at NNLL in 2013, Photo courtesy Suncor.

The Golder resident engineers were on-site and advised during construction. They provided quality assurance, used the observational approach to address conditions that varied from the design basis, and made sure the precise design objectives were met for the new fish habitat.

Water management during construction was a major challenge on-site. Excess water back-flooded into the construction area from an adjacent aquifer during construction of the temporary access road. Sedimentation ponds were created to capture and treat the water before it was released to the receiving Athabasca River. The sedimentation ponds were relocated during construction to facilitate the construction of the various parts of the lake (shown in Photo 1).

Photo 2: Trees burned in the 2011 fire, Photo courtesy Suncor.

Photo 3: Cracks along the earthfill structure due to settling

The mid-project company merger of Petro-Canada and Suncor added risk to the project as this changed Golder's contacts with Suncor, and their expectations. The Suncor-Golder team (together with the construction contractor) working on the project was able to reestablish these ties and deliver a product that exceeded the client's expectations.

After the completion of Phase 1, a fire in 2011 burned down many of the trees in the area that was going to be the island within the NNLL (shown in Photo 2), thus damaging the existing vegetation and adding other uncertainties to the project. The status of the trees and other burnt vegetation had to be re-evaluated to determine if vegetation would be able to re-establish naturally in that area.

During construction, the earthfill structure along the Athabasca River started to settle and form cracks along the top (shown in Photo 3). This was a concern, as the earthfill structure was designed to prevent the Athabasca River from flooding the NNLL while it contained the NNLL. Golder was able to design a toe berm along the earthfill structure to combat this issue. The toe berm was constructed and the settlement was reduced.

INNOVATION

Certain features of the design of this NNLL point to Golder's technical excellence and rapid employment of innovation when it was urgently needed.

The complexity of design required for the specific geography and location.

Various fish habitat compensation lakes and ponds have been built within the last two years in the oil sands region. Usually they are built by excavation only or by building a dam across an existing stream in a valley.

The specific geography and location of the NNLL posed complexities that could not be addressed by using these simple approaches. The water management requirements and geotechnical challenges could not be met with the usual approaches to NNLL design.

The construction of this NNLL was a combination of both innovative and technically thorough ideas by Golder. The encountered site conditions made innovation and technical excellence essential for the job.

Rapid assimilation of changing design factors and re-engineering of the geotechnical aspects due to unpredictable encountered site conditions.

A number of design factors were changed at a moment's notice in order to adapt to encountered site conditions. Golder worked with Suncor to optimize the use of available resources.

During the construction of the earthfill structure, the material outlined in the specifications to be used for the core was scarce and the required quantities were unavailable on-site.

Golder Associates

Golder worked closely with Suncor to meet the needs of the NNLL and performed geotechnical evaluations of the other soils found on-site to design a mix of soils that most closely resembled the specifications of the required materials (shown in Photo 4). Golder also provided Suncor with the advantages and risks of using the new material.

As the new material could not provide as much stability as the specified material, Golder designed a toe berm to enhance the stability of the earthfill structure. This toe berm was built from excavated material that would otherwise have been hauled off-site, thus saving construction costs. Golder's technical know-how and innovation proved to be immensely cost-effective for Suncor and kept the project on schedule.

The difference between encountered and expected field conditions was a consistent challenge, as the lake was designed many years before its construction. To optimize the resources at the NNLL site, Golder provided technical advice in the field, changing the design contours (and accordingly the lake bathymetry) to avoid additional earthfill during lake excavation, and to leave vegetation undisturbed where possible. This both reduced the workload of the contractor and also kept the project on schedule.

Photo 4: Use of new material in the earthfill structure.

New design for a fish ladder when the materials needed were not available.

According to the NNLL design, large woody debris was required to reduce the flow velocity and serve as a hiding and resting area for fish in the outlet channel; however it was unavailable on-site during construction in the required quantities. In order to meet the design intent, Golder suggested replacing the woody debris with boulder clusters; this satisfied the requirement of reduced flow velocity while maintaining the integrity of the outlet channel as a fish ladder.

The NNLL is the first compensation lake in the oil sands to be designed with a geomorphic outlet channel of this kind.

ADDED ENVIRONMENTAL VALUE

Building the NNLL restored important environmental factors in the Fort Hills fish habitat, including the following:

- Long-term sustainability was built into the facility, so that it is now able to withstand extreme weather events without environmental damage. The lake was also made deep enough so that the fish could survive through the winter.
- The fish are now able to access the lake from the Athabasca River. Free fish passage is essential to the ecosystem's health and the health of the fish populations.
- The facility was given a natural appearance, and difficult groundwater conditions were transformed so that good water quality is now available for fish and other wildlife.
- The shore line has been designed and built to support natural vegetation and provide spawning habitat.
- The dam's embankment has a sophisticated design of cobbles and suitably impervious soils to enable self-healing in the event of erosion.

The *Fisheries Act* Section 35(2) Authorization issued by DFO specified the HADD for Fort Creek (i.e., initial habitat losses associated with the project), as well as habitat alterations associated with creation of the NNLL. It is anticipated that the creation of the NNLL may exceed the legally required compensation requirements. It is expected that it may be possible to compensate for the HADD of Susan Lake and the Susan Lake outlet channel in addition to the HADD for Fort Creek through the development of the NNLL. The exceedance of the required fish habitat will be determined in the future based upon the performance of the NNLL by monitoring the fish population on-site. Golder anticipates that the required fish habitat units will exceed the necessary amount which would add even more environmental value than required.

SOCIAL AND ECONOMIC BENEFITS

Society will benefit from the Project in the following ways:

- Direct and indirect jobs are created in the mining and upgrading of bitumen.
- This Project will contribute substantially to provincial royalties.
- Energy is produced.
- This NNLL will improve the net fish habitat, as compared to the situation pre-development.
- The NNLL is designed for long term sustainability and allows fish to access extra habitat in the lake from the Athabasca River.
- The NNNL project design was completed in compliance with Section 35(2) of the *Fisheries Act*.

DESIGN

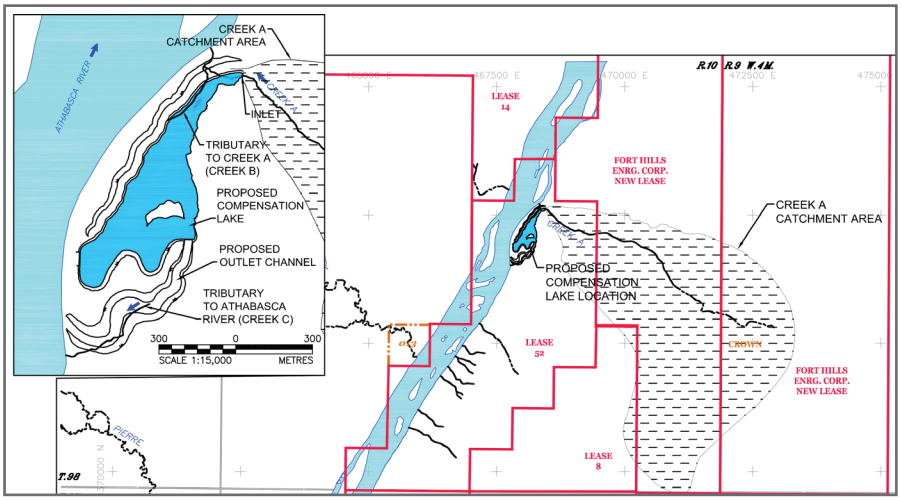
No Net Loss Lake Study Objectives

Golder prepared a study as part of the No Net Loss Lake Development Plan. The major tasks of the study included:

- Review the conceptual design of the NNLL Plan (Figure 1, Photo 5) to confirm general lake siting issues and key design considerations.
- Field studies document existing site conditions and provide the data necessary for the detailed design of the NNLL.
- Optimize the NNLL basic lake design based on topographic, geotechnical, hydrologic, hydrogeologic and fisheries issues.
- Mediate discussions with regulators and stakeholders to obtain agreement on major issues pertaining to the design, construction and operation of the NNLL.
- Assess and confirm the feasibility and expected performance of the NNLL based on key design considerations and simulation modelling.
- Design (preliminary) specific habitat features for selected fish species proposed to be introduced into the NNLL.
- Develop a plan for the construction of the NNLL.
- Develop a monitoring plan to determine the effectiveness of the NNLL fisheries compensation plan.

Golder Associates

A number of field studies were undertaken to document existing conditions at the proposed NNLL area, to provide data necessary for the design of the lake and for use in designing appropriate closure and reclamation strategies for disturbed areas. These studies included:



- LIDAR remote sensing and bathymetric surveys
- Fish habitat surveys
- Hydrometric monitoring in Creek A, Creek B and Creek C
- Water quality sampling
- Hydrogeological, soil, vegetation, and geotechnical investigations.

Figure1: Conceptual Design of the NNLL Plan.

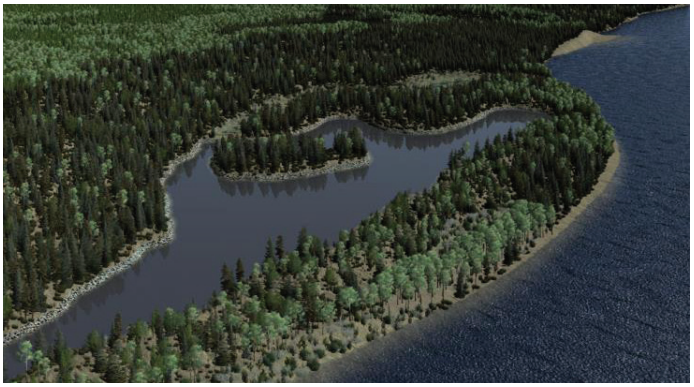


Photo 5: Conceptual image of NNLL, Photo courtesy Suncor.

Photo 6: View of Construction of NNLL in 2013, Photo courtesy Suncor.

Key No Net Loss Lake Design Criteria

The NNLL was designed according to accepted hydrologic, hydraulic, geomorphic and geotechnical principles. The design incorporates several considerations and criteria, including the following:

- A lake area of 15 ha
- Lake depths, shore configuration, littoral zone and water quality to provide year-round fish habitat
- Lake bathymetry design to avoid excavation in areas where valley wall slope failures are considered a possibility
- Sufficient lake capacity such that sediment deposition in the lake due to sediment inflows will not impair habitat values
- Adequate lake outflow capacity to pass large inflow events up to the probable maximum flood (PMF) without overtopping
- A geomorphically stable, natural-appearing outlet channel
- Sufficient littoral zone to provide for an appropriate level of aquatic productivity

- Sufficient habitat complexity and diversity in the littoral zone to provide habitat for a variety of species
- Provision of areas suitable for spawning by fish species that will inhabit the lake
- Depths and velocities in the lake outlet channel to facilitate, to the extent possible, fish passage between the NNLL and the Athabasca River
- Habitat characteristics in the outlet channel similar to those that occur in natural watercourses
- Protection against shore and river erosion during annual and extreme flood events
- Emergency spillway for operation during frozen or blocked outlet channel conditions and large inflow events
- Protection against lakeshore erosion caused by wind and waves
- Protection against erosion by the Athabasca River
- Stable valley wall and terrace area
- Long-term sustainability of a lake containment structure without ongoing monitoring and maintenance.

Key Features of the Lake - Geotechnical Details

The NNLL is located on a terrace on the east side of Athabasca River. The terrace is about 150 m wide at each end, 500 m wide in the middle and 1,400 m long. The terrace is bounded by the Athabasca River to the west, the existing Creek A to the north, bedrock bluffs about 40 to 50 m high to the east and a bedrock bluff about 5 to 10 m high to the south.

Landslide features occur at the bluffs along the east side of the proposed lake location approximately 200 to 400 m south of Creek A. Surficial drainage to the lake includes inflows from Creek A and an adjacent area that drains directly to the terrace. Much of the drainage enters the lake as near-surface groundwater flow. The resulting total surficial drainage area of the lake is about 15 km^2. The lake is also fed by groundwater from deeper aquifers within the valley walls, which carry discharge from outside of the surficial drainage area.

The NNLL has a surface area of 15.34 ha, a volume of 534,000 m^3 and a typical operating elevation of 232 meters above sea level (masl). Lake depths vary and the lakeshore includes sufficient littoral area to provide sustainable fish habitat. Micro- and macro-undulations of the shoreline are incorporated into the design to provide habitat complexity and diversity in the littoral zone.

The lake was developed by excavation and construction of an earthfill containment structure on the west side. The 232 masl lake level exceeds existing average ground levels by 3 m. Containment for the top three meters of lake depth was provided by a robust earthfill structure that was configured with discontinuities to mimic natural features. The earthfill structure was constructed to a varying crest elevation that equals or exceeds the 234 masl elevation. The north end of the structure was raised to a minimum elevation of 235 masl in the vicinity of Creek A to allow for sediment accumulation at the Creek A inlet. The crest elevation and width of the earthfill structure vary to create the desired natural appearance. The barrier fill structure was built with side slopes not less than 4H:1V and up to 6H:1V in some locations and with a crest width not less than 20 m.

The main inlet to the lake is at the north end of the terrace, where Creek A enters the lake. The main outlet from the lake is located at the south end of the terrace. The lake outlet channel discharges to the Athabasca River.

The NNLL outlet channel has an invert at the lake of 232 masl, and consists of a 2 m to 3 m wide channel that meanders within a 20 m to 30 m wide floodplain channel. The outlet channel is designed to provide fish habitat and passage from the Athabasca River to the NNLL. The lake design also includes a flood spillway outlet located at the southwest corner of the lake. It has been cut into bedrock at an invert at the lake of 233 masl.

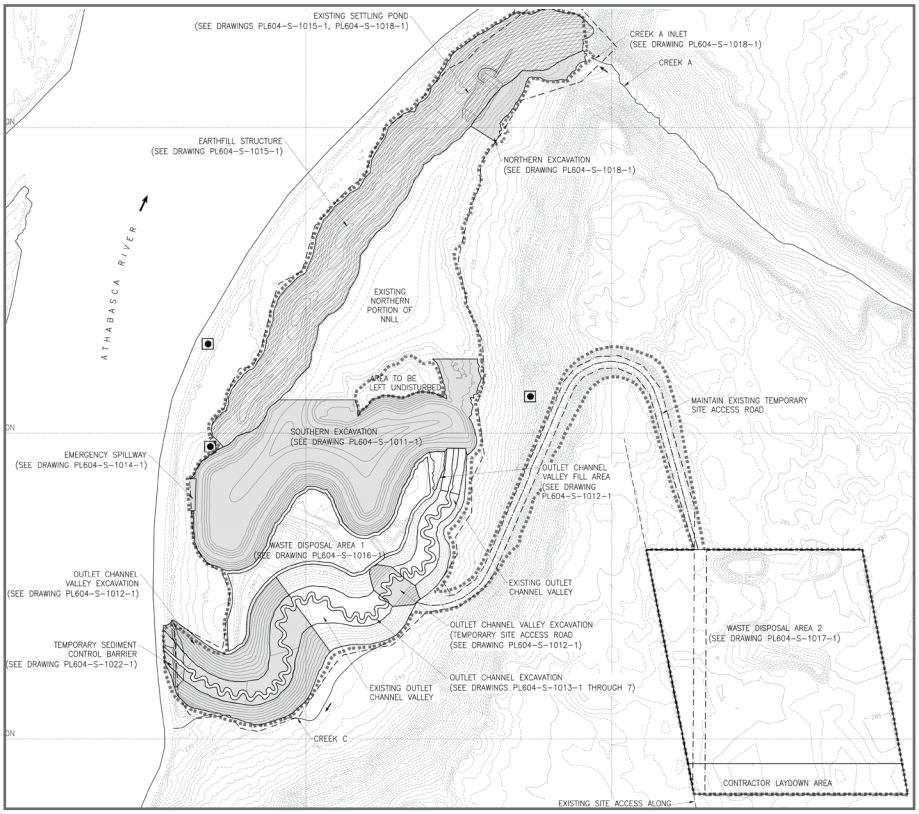


Figure 2: Issued for Construction plan view of the NNLL, Golder 2012.

Fish Habitat Characteristics

The NNLL has an average depth of about 3.5 m, a maximum depth of 6 m and a surface area of 15.34 ha.

The littoral zone in the lake represents approximately 36% of the total surface area of the lake. The littoral area is the area that receives sunlight, which is usually up to a depth of approximately 3 meters deep. This is the area where subsurface vegetation grows, and where most of the fish live, eat, and mate, therefore it is the most important area in regards to fish habitat.

In addition, fish also need some deep zones that do not freeze, where they are able to survive the cold winters. This is provided with the 6 m deep area of the NNLL.

The shoreline of the lake is irregular and the lake bed in the littoral zone is constructed to provide a variety of depth characteristics. These features create habitat complexity and diversity in the littoral zone, and therefore provide habitat characteristics suitable to support a variety of fish species. The depth distribution is as follows: 15% of the total lake surface area is less than 1 m deep, 21% will be between 1 and 3 m deep, 13% will be between 3 and 4 m deep, 40% will be between 4 and 6 m deep and 11% will be at the maximum depth of 6 m.

Water quality conditions in the NNLL are suitable to support a variety of fish species. Surface water temperatures during the summer are expected to range from about 10 °C to 16 °C, compared to temperatures in Fort Creek, that range from -0.1 °C to 14.4 °C. The warmer temperatures will be suitable for the specific species which are supposed to inhabit the lake.

Water temperatures are in the 0 °C to 4 °C during the winter, gradually increasing to approximately 5 °C to 7 °C during spring. It is anticipated that dissolved oxygen levels during the open-water period will remain sufficiently high (between 8 to 14 mg/L) to provide good quality habitat for all fish species that are included in the lake fish community. The lake has sufficient volume (approximately 534,000 m^3) and depth to provide a winter dissolved oxygen concentration suitable for overwintering fish.

Benthic productivity in the compensation lake is similar to that in a natural lake of similar size and morphology in the region. For benthic invertebrates, the most productive part of a lake is the littoral zone, where aquatic vegetation provides food and cover for invertebrates. The water level is predicted to be sufficiently stable to preclude drawdown-related effects on aquatic plants. The littoral zone is predicted to be stable and productive, with abundant macrophyte growth and high-quality habitat for benthic invertebrates and small forage fish species.

Photo 7: View of meandering outlet channel during its construction, Photo by Golder.

Photo 8: Close up of outlet channel showing fish habitat materials, Photo by Golder.

The habitat requirements and preferences of fish species that may potentially be included in the lake fish community were reviewed and incorporated in the design, to provide suitable habitat for each community. Fish species identified as being most suitable for inclusion in the NNLL include northern pike, yellow perch, white sucker, longnose sucker, brook stickleback, lake chub, pearl dace, fathead minnow and slimy sculpin. Forage fish will be added as needed to the lake approximately two years after filling. Predator fish species will be added as needed to the lake approximately three years after filling.

Lake Construction Strategy

The construction strategy for the NNLL (See Figure 2 for the construction plan view) involved three stages over several years to allow for optimal site conditions during construction

Stage 1 included preliminary work such as clearing of the NNLL site, upgrades to the existing cut-line road, construction of a temporary access road to the NNLL, and ditching and drainage of the wet, low-lying area at the proposed site of the NNLL. Stage 1 construction was completed in 2007/2008.

Stage 2 (see below Lake Construction Strategy) consisted of temporary access road upgrades, excavation of the northern portion of the NNLL, and the upper portion of the meandering outlet channel valley (shown in Photo 7).

Stage 3 construction included excavation and blasting of the bedrock outcrop located at the south end of the proposed lake, construction of the earthfill structure along the west side of the NNLL, revegetation around the NNLL, littoral habitat construction in the NNLL and armoring of the outlet channel to provide the required fish habitat. The NNLL was completed between February and September 2013.

Reclamation and Closure

A Development and Reclamation (D&R) Plan was formulated to address reclamation issues resulting from construction and operation of the NNLL, and to allow the site we left behind to have the maximum sustainable environmental benefits.

The D&R Plan defined potential impacts of the proposed project on the existing landscape resources, proposed measures for mitigating these effects to the degree practical, and provided prescriptions for reclaiming the terrestrial disturbances to a self-sustaining ecosystem.

The key components of the plan included:

- Timber salvage
- Identification of rare plant occurrences and mitigation to preserve and maintain those plants
- Topsoil salvage recommendations
- Reclamation materials balances
- Topsoil replacement strategies
- Conceptual revegetation prescriptions

Implementation of the D&R Plan will allow the Fort Hills Energy Corporation to comply with the applicable regulatory requirements and to minimize potential for long-term impacts of the NNLL development on the environment.

The earthfill structure that will contain the upper part of the lake is designed with suitable soil cover to maintain the ecological role of riparian habitat and a potential wildlife movement corridor. Reclamation of this structure was implemented immediately after construction, and appropriate native species have been planted.

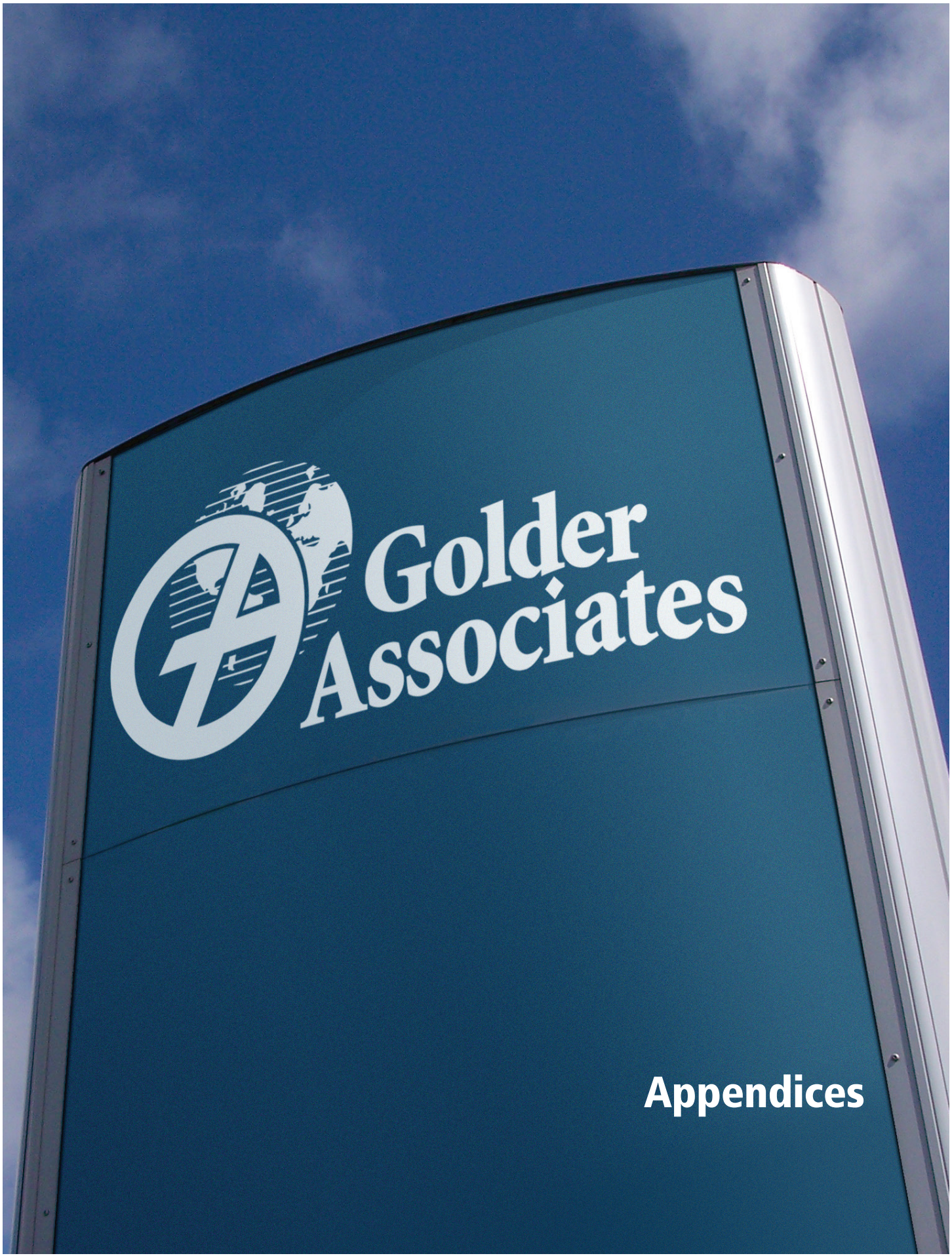
The way that Golder designed the earthfill structure exceeded the client expectations and government regulations. We feel good to know that after mine closure, the NNLL will provide healthy fish habitat and a good contribution to the ecosystem, be maintenance-free, and will blend in beautifully and naturally with the reclamation landscape.

Monitoring Plans and Conclusion

A monitoring program may be implemented from immediately after construction, up to the year 2023 to evaluate the effectiveness of the NNLL compensation strategy, and will include the following:

- **Aquatic monitoring** will evaluate the effectiveness of compensation habitats (the NNLL and the outlet channel) in providing habitat for fish and meeting the quantitative compensation objectives. This monitoring will include:
  - Physical, chemical and biological characteristics of constructed compensation habitats
  - Determination of frequency and types of fish using the habitats
  - Information on fish populations, benthic invertebrates, plankton, aquatic vegetation, water quality, thermal regime, hydrology, lake levels and ice conditions
  - Documentation of the colonization of the NNLL by fishes from the Athabasca River
  - Monitoring habitat use to determine seasonal versus year-round use of the lake and the outlet channel.
- **Terrestrial monitoring** will evaluate the success of reclamation activities including terrain and drainage restoration, erosion control and site stability strategies as well to monitor revegetation of all disturbed areas.
- **Earthfill structure performance and stability monitoring** will be used as documentation for the decommissioning of the earthfill structure - it will be a dam that will not require regulation and monitoring following mine closure.

Golder has enjoyed working on this project that has provided a much improved fish habitat in the oil sands and is honoured to qualify to apply for this award. If you have any questions, please contact Dirk Scharbatke, Dirk_Scharbatke@golder.com or Les Sawatsky, Les_Sawatsky@golder.com.



Appendices

Category I - Community Outreach & In-house Initiatives
Nature of the Project
Effort and Complexity
Social, Economic & Other Benefits

75 words summary

Suncor retained Golder to design and construct a No Net Loss Lake for the Fort Hills Oil Sands Project. Field studies and research were completed prior to developing a detailed design engineering plan. Innovative design changes were devised when encountered site conditions were not what was expected. The result was an improved fish habitat and a long-term-sustainable lake that preserves the natural environment and connects with the Athabasca River.

CATEGORY C - WATER RESOURCES

Innovation

The No Net Loss Lake (NNLL) associated with the Fort Hills Oil Sands Project is located in a remote location, 90 km north of Fort McMurray. It was designed and built to implement fish habitat compensation works consistent with Section 35(2) of the Fisheries Act. Certain features of the NNLL point to Golder's innovation when it was urgently needed.

Various fish habitat compensation lakes and ponds have been built within the last two years in the oil sands. Usually they are built by excavation or by building a dam across an existing stream in a valley. The specific geography of the NNLL posed complexities that could not be addressed by using these standard approaches. The water management requirements and geotechnical challenges could not be met with the usual approaches to NNLL design. The design and construction of the NNLL was a combination of both innovative and technically thorough ideas. It included excavation, blasting of limestone, and the construction of a berm (naturally looking earthfill structure) from material encountered on site.

During the construction of the earthfill structure, the material outlined in the specifications to be used for the core was scarce and the required quantities were unavailable. Geotechnical evaluations of the soils found on-site were completed to design a mix of soils that most closely resembled the specifications of the required materials. This approach ensured that Suncor's requirements for the permeability of the lake's earthfill structure were met. The new material could not provide as much stability as the material outlined in the specifications, which led to the requirement to design a toe berm to enhance the stability of the earthfill structure.

In the initial design, large woody debris was specified to reduce the flow velocity and serve as a hiding and resting area for fish in the outlet channel. However the debris was unavailable on-site in the required quantities during construction. In order to meet the design intent, the project team suggested replacing the woody debris with boulder clusters. This satisfied the requirement of reduced flow velocity while maintaining the integrity of the outlet channel as a fish ladder.

The difference between encountered and expected field conditions was a consistent challenge. Following technical analysis of encountered conditions, recommendations to address site challenges were implemented, resulting in changes to the design contours. The need for and associated cost of additional earth fill during lake excavations was avoided.

Complexity

The location and geography of the NNLL were challenging: the majority of the construction was planned for winter as the site was more accessible after freeze-up. As well, the fish habitat features designed for the lake needed to be precisely constructed for maximum habitat and ecosystem function.

The water management during construction was another major challenge on-site. Excess water back-flooded into the construction area from an adjacent subsurface aquifer during construction of the access road. Sedimentation ponds were created to capture and treat the water before it was released to the receiving Athabasca River. The mid-project company merger of Petro-Canada and Suncor added risk since the client contacts, and their expectations changed. The team was able to re-establish these ties and deliver a product that exceeded expectations.

After the completion of Phase 1, a fire in 2011 burned down many of the trees in the area that was planned to be the island within the NNLL, damaging the existing vegetation. The status of the trees and other burnt vegetation had to be re-evaluated to determine if vegetation would be able to re-establish naturally in that area. During construction, the earthfill structure along the Athabasca River began to settle and form cracks along the top. This was a concern, as the structure was designed to prevent the Athabasca River from flooding the NNLL while it contained the NNLL. Golder successfully addressed this issue by designing and constructing a toe berm along the earthfill structure.

Social and/or Economic Benefits

There are many social and economic benefits from the creation of the No Net Loss Lake. Social and economic benefits are derived from thes direct and indirect jobs that are created from the mining and upgrading of bitumen. Energy is derived from the bitumen. The Fort Hills Project will contribute substantially to provincial royalties.

The NNLL was designed for long term sustainability and allows fish to access extra habitat in the lake from the Athabasca River. The design allowed for twice as much compensation habitat to be created, than was eliminated by the mine development. Additionally, the net fish habitat of this region (compared to pre-development) has increased due to the creation of the NNLL.

The location of the lake allows for fishing and recreation as it is located far away from the mine sites. The project design was completed in compliance with Section 35(2) of the Fisheries Act. Excavated material that would otherwise have been hauled off-site was used for construction of the toe berm, resulting in cost savings during construction.

Environmental Benefits

Building the No Net Loss Lake restored important environmental features to the Fort Hills fish habitat, including:

- Long-term sustainability was built into the facility, so that it is now able to withstand extreme weather events without environmental damage. The lake was also made deep enough so that the fish could survive through the winter.
- The fish are now able to access the lake from the Athabasca River. Free fish passage is essential to the ecosystem's health and the health of the fish populations.
- The lake was given a natural appearance, and difficult groundwater conditions were transformed so that good water quality is now available for fish and other wildlife.
- The dam's embankment has a sophisticated design of cobbles and suitably impervious soils to enable self-healing in the event of erosion.

The *Fisheries Act* Section 35(2) Authorization issued by DFO specified the harmful alteration, disruption or destruction (HADD) for Fort Creek (i.e., initial habitat losses associated with the project), as well as habitat alterations associated with creation of the NNLL need to be adequately addressed.

It is anticipated that the creation of the NNLL may exceed the legally required compensation requirements: the exceedance of the required fish habitat will be determined in the future based upon the performance of the NNLL by monitoring the fish population on-site. Golder anticipates that the required fish habitat units will exceed the necessary amount which would add even more environmental value than required.

Meeting Client's Needs

A Development and Reclamation (D&R) Plan was formulated to address reclamation issues resulting from construction and operation of the NNLL. The D&R Planallows that the site left behind will have the maximum sustainable environmental benefits. Implementation of the D&R Plan allows the Fort Hills Energy Corporation to comply with the applicable regulatory requirements and to minimize the potential for long-term impacts of the NNLL development on the environment.

Golder's design of the earthfill structure exceeded the client's expectations and government regulations. At mine closure, the NNLL will be maintenance-free, contribute to the ecosystem, provide healthy fish habitat, and will blend in beautifully and naturally with the reclaimed landscape.

Golder's know-how helped Suncor to address their stakeholders' concerns and to be compliant with the Fisheries Act. The final result is the creation of a lake that looks like a natural lake, is deep enough for over-wintering fish, and will have long-term resilient sustainability - even through extreme weather events.

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