



Hawkesbury Lagoon Site Remediation

2019 ACEC CCE Engineering Excellence Awards | Category D | Environmental Remediation

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Innovative modeling remediates lagoon

Project summary



GHD Ltd. provided design, remedial, and construction services to the Ministry of Natural Resources and Forestry (MNRF) for the Hawkesbury Lagoon Site, Ontario. The presence of waste sludge and water in the lagoon posed a health hazard due to elevated levels of hydrogen sulphide and related odours. **Through innovative hydrodynamic and hydrogeological modelling, our integrated water management plan facilitated successful remediation and the creation of a waterfront parkland** in the center of the town of Hawkesbury.

Innovation



In the 1890's, cellulose manufacturing, a major component in the production of paper, began along the western waterfront in the Town of Hawkesbury. The Hawkesbury Lagoon received fibre-bearing sludge from pulp and paper mill operations and demolition debris after the decommissioning of pulp and paper mills from that area. The lagoon, located on the base of the Ottawa River, contained approximately 260,000-cubic-metres of waste and became a health and safety hazard from the long-term presence of waste sludge and elevated hydrogen sulphide emissions and odours. The chemicals of concern associated within the lagoon included heavy metals, polycyclic aromatic hydrocarbons, phenols, volatile organic compounds, and hydrogen sulfide.

GHD completed the lagoon closure conceptual and detailed design, including:

- pre-design assessments (geotechnical, hydrogeological, and human health and ecological risk screening criteria);
- geotechnical design of the containment cell;
- 3D groundwater flow and multiple species contaminant transport model;
- 2D hydrodynamic model for fate and transport analysis for tracking the concentration of contaminants through the contaminant attenuation zone; and,
- contingency plans for leachate management.

Following ten years of studies undertaken by the MNR, **our team developed and implemented the staged remediation plan, which allowed the MNR to implement the remedial works without further extensive study while protecting the environment.** To permanently close the lagoon, we developed an on-site containment cell for the natural attenuation of leachate. The containment system included a low permeability barrier around the perimeter, vertical drains on the down and cross gradient sides of the cell and use of the *upward vertical groundwater gradient* for the bottom liner. The containment system solution minimized the volume of waste to be relocated, by allowing a portion of the existing waste to remain in place.

A low permeable final cover system was designed to direct a portion of the surface water runoff to the vertical drains creating the hydraulic gradient needed to transport leachate generated through the contaminant attenuation zone (CAZ). The controlled discharge of effluent from the CAZ was integrated into a box culvert carrying flow from the Ottawa River through the remediated lagoon, while hydraulically preventing backflow from the Ottawa River into the vertical drains. **Consolidation of the waste into the containment cell created a landmass for future waterfront parkland.** Reconnection of the remediated lagoon to the Ottawa River, construction of a multiuse perimeter trail, and restoration of the heritage outlet structure as a viewing platform, facilitate repurposing the Site for the community enjoyment.

Complexity



The lagoon sits at the base of the Ottawa River and was built through the construction of dykes between four islands and the shore. The Site was primarily open water with only a narrow path along the dykes between the lagoon and the Ottawa River. Residential and commercial properties abutted the lagoon on two sides.

The former mill operator was released of their responsibilities for the Site in the 1980's. Since that time a number of studies were completed, but due to funding constraints the nature and extent of the contaminants were not fully understood nor were feasible solutions identified. **This project was complex due to limited access and limited land; the proximity to residential and commercial developments; elevated hydrogen sulphide emission; and fiscal financial constraints.** A staged approach was developed that integrated investigation, laboratory and pilot scale testing, and approvals for remediation.

The lagoon's proximity to the property boundary required full time monitoring and controls for air emissions to ensure the protection of public health. The upward vertical groundwater gradient combined with the vertical drains created a natural liner beneath the waste, but also created challenges for removal of the waste from the remainder of the Site. Complex hydrogeo-modelling was completed for the Site with recharge and dewatering rates calculated at various stages of dewatering. Construction was completed over a three-year period aligned with funding. The Site's remediation was accomplished through dewatering, partial excavation of sludge, and cover in place.



Property boundary monitored full time

Social benefits



Over the past century, the Town of Hawkesbury has grown into a beautiful and historical community, with the exception of the contaminated lagoon sitting in close proximity to the town center. The Site is one of the last properties in Hawkesbury that had not been developed or taken into private ownership, and **remediating it became a top priority for the MNR's long term planning and support of the community.**

Approximately eight hectares of the former lagoon was reconnected to the river, with a public walking trail established around the perimeter. Through proper remediation, the water toxicity was minimized and the odours were eliminated. **The staged approach facilitated timely closure of the site in a cost-effective and environmentally sustainable manner,** and returned public access to the remediated portion of the waterfront. The project will in essence be given back to the public for everyone to enjoy, creating long-lasting benefits to the Town of Hawkesbury and its surrounding communities.

Remediating the Hawkesbury lagoon has proven to be a successful social endeavor.



Environmental benefits

Permanent closure of the lagoon was required to protect human health and the environment. The GHD team developed an on-site containment cell for the placement of waste sludge dredged from the lagoon. This solution mitigated the need to transport the large quantity of waste sludge off-site for disposal and allowed for some of the waste sludge to remain in place (i.e., that was already located in the footprint of the containment cell). In addition, the containment cell was designed to protect the surrounding environment, including the natural attenuation of leachate.

The solution also allowed eight hectares of the former lagoon to be reconnected to the Ottawa River, with a public walking trail established around the perimeter. The staged approach facilitated timely closure of the site in a cost-effective and environmentally sustainable manner. **Public access has been restored to the remediated portion of the waterfront and now provides valuable waterfront lands that residents can enjoy.**



Ottawa River at Sunset





Meeting client's needs

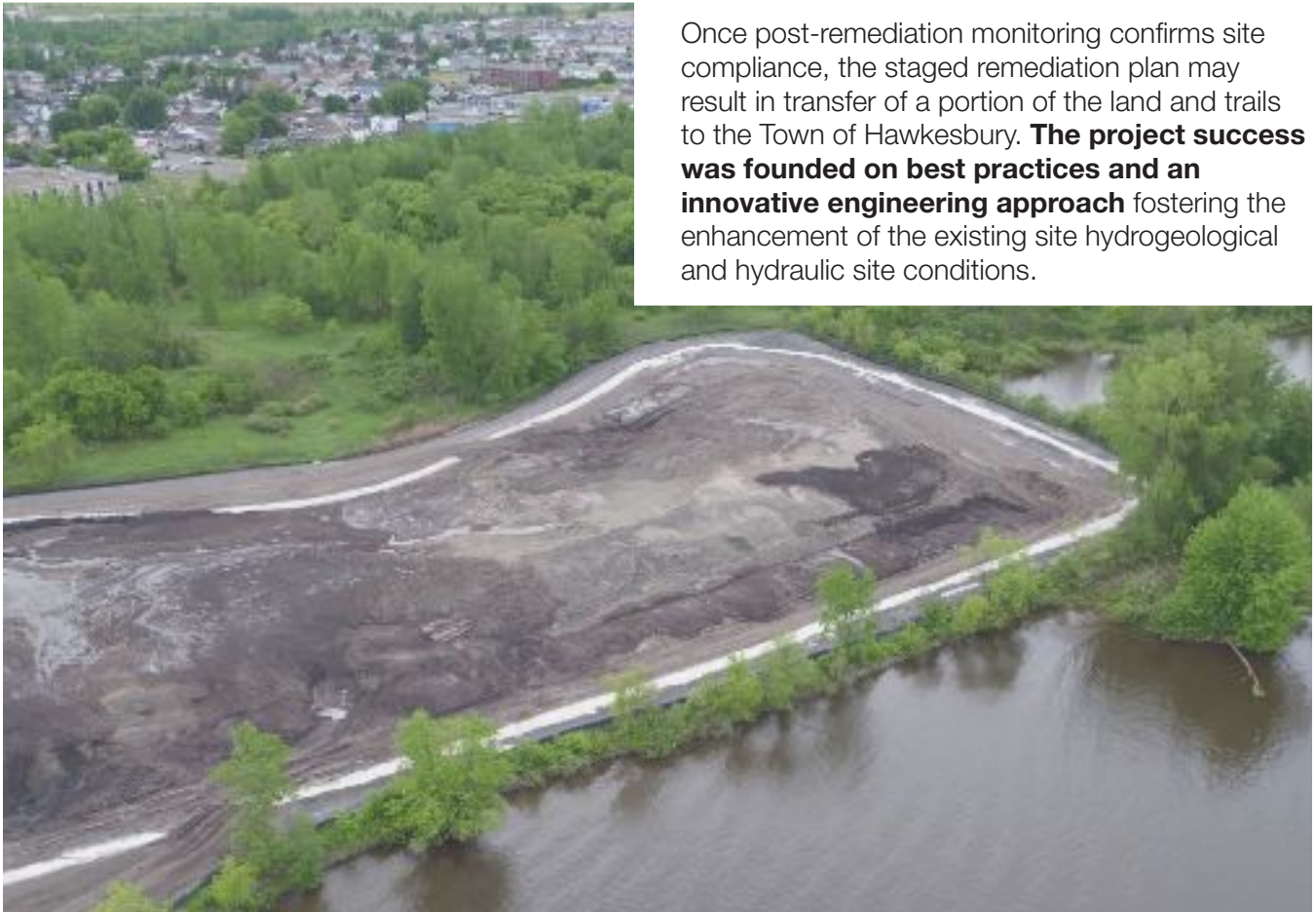
The MNRF assumed responsibility for the Site in the 1980's after the mill was closed and demolished. **The goal of the project was to remediate the Site in a manner that was environmentally sound and protective of human health and the environment.**

The staged approach permitted early development and implementation of the remedial solution and allowed the MNRF to take immediate action.

The solution provided the best value to the MNRF by minimizing the following:

- capital expenditures;
- post remediation operational expenditures through the use of natural attenuation mechanisms; and,
- environmental impacts while providing net social benefit to the community through the development of multiuse trails and parkland.

Once post-remediation monitoring confirms site compliance, the staged remediation plan may result in transfer of a portion of the land and trails to the Town of Hawkesbury. **The project success was founded on best practices and an innovative engineering approach** fostering the enhancement of the existing site hydrogeological and hydraulic site conditions.



Repurposing Hawkesbury waterfront



Shoreline after remediation



This approach created an environmentally sound solution and repurposed one of Hawkesbury's few available waterfront properties for public enjoyment.



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