

Winter dredging of the Tracadie Two Rivers Waterway: A unique Canadian environmental window

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Abstract: As part of an employment creation program for northeastern New Brunswick (Canada), the regional development corporation proposed to create a new navigational channel between the estuaries of the Little and Big Tracadie Rivers. The channel would lie inside the barrier island system and be capable of serving vessels up to 20 m length (fishing and recreational), while being protected from the open waters of the Gulf of St. Lawrence (Atlantic Ocean). The project consisted of dredging a new 3.1 km channel (198,000 cubic meters) within the estuary of the Big Tracadie River, a new 290 m channel within the estuary of the Little Tracadie River (20,500 cubic meters) and excavation of a new one kilometre (90,000 cubic meters) channel through a peninsula separating the two estuaries. Because of opposition from fishermen regarding disposal at sea, the dredged material was to be placed on the inner side of the coastal barrier islands.

The Environmental Impact Assessment study identified significant biological resources within the estuaries, as well as a “species at risk” (piping plover) on the barrier islands. The overlap of critical time periods of the Valued Ecosystem Components and inability to identify appropriate mitigation measures resulted in a “no project scenario” within the traditional marine construction season of mid-April to mid-November.

Based on the success in 1998 of a small-scale winter dredging project at the Bouchtouche River Marina, the concept of winter dredging was evaluated for the Tracadie-Sheila project. Dredging in the December to April period would entail excavation through 2 m of ice and underlying seawater to remove the silt. The excavated materials had to be moved by truck across an ice road to a land-based confined disposal facility on the other side of the town (approx. 5000 population). The key benefit would be the total avoidance of disturbance to critical biota, particularly various bird colonies and the species at risk.

Using winter, not normally a marine construction period, as an “environmental dredging window” received regulatory approval in late November 1998. No mitigation measures or concurrent monitoring were required. The project was successfully completed in 42 days (January to March 1999) working on a 24 hour per day/7 day per week schedule. Subsequent monitoring showed that biological resources had not been significantly disturbed. The increased tourist boating traffic has proven to be a successful economic benefit.

Keywords: environmental window, species at risk, winter dredging, Canada.

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1 INTRODUCTION

Numerous rural areas of Canada suffer from significant unemployment and lack of job opportunities, typically due to changes in resource-based industries, such as mining or fishing. As part of a strategy to provide a better distribution of economic development, the federal and provincial governments have expended considerable effort to promote local rural economies through a variety of tax incentives, training agreements and construction of public works. The “Acadian Peninsula”, in northeastern New Brunswick (Fig. 1), is a classic example of such a rural economy. Encompassing an area of 4600 sq km with a population of 83,000, the area has long depended on fishing and fish processing (lobsters, shrimp, snow crab and groundfish). However, declining fish stocks have resulted in unemployment levels of over 20%, with much of the remaining employment being seasonal. In the early 1990’s, the federal and provincial governments focussed on “tourism and recreation” as a strategy for economic diversification for the Acadian Peninsula.

The Corporation du Developpement des Deux Rivieres Tracadie Inc (CDDRT) was formed and identified a series of projects for implementation between 1996 and 2001:

- ❑ Waterfront improvements along the Little Tracadie River estuary (Town of Tracadie-Sheila), including boardwalks, interpretation panels;
- ❑ Ecotourism infrastructure and facilities to promote tourism alternatives throughout the two estuaries;
- ❑ Parc LeRoyer, a cottage and conference centre cluster overlooking the Little Tracadie River estuary;
- ❑ An Ecology Centre on the coastal lagoon dunes to facilitate continued protection of piping plovers and other coastal “species at risk”; and,
- ❑ Tracadie Two Rivers Link Channel which would form the centrepiece of the overall project.

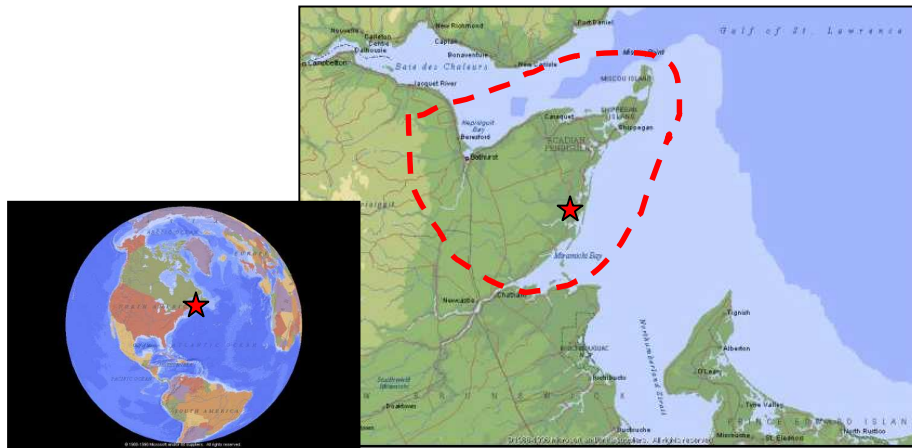


Fig. 1: Location of project site, in northeastern New Brunswick (Canada).
Line denotes “Acadian Peninsula”; star, the project site.

2 PROJECT DESCRIPTION

Much of the coastline of northeastern New Brunswick consists of low flatlands penetrated by numerous small rivers ending in broad estuaries that are often separated from the Gulf of St. Lawrence (part of the Atlantic Ocean) by a series of lagoons and coastal barrier dunes (Fig. 2). These coastal barrier dunes are very dynamic, with a significant north-south long-shore transport of sediment. Natural gaps in the dunes that serve as discharges for coastal rivers often shift position, as old channels infill and new channels are created. As with other rivers along this coast, the Big and Little Tracadie Rivers discharge into coastal lagoons and thence, through natural channels in the barrier islands, to the Gulf of St. Lawrence. As the fishing industry expanded, the federal government attempted to keep the two natural channels (“Val Comeau Gully” and “Tracadie Gully”, Fig. 3 and 4) open through a program of dredging. However, budget reductions resulted in only the Val Comeau Gully being maintained, including construction of armour breakwaters. While this action assisted local fishermen, it effectively isolated the former wharf and marina facilities of the Town of Tracadie-Sheila.

Construction of the Tracadie Two Rivers Link Channel (Fig. 5) would provide (a) a unique viewpoint of other project components, (b) safer navigation within the coastal lagoon system for fishing and recreational vessels, (c) enhance navigable access to Tracadie Harbour (Little Tracadie River estuary) from the Gulf of St. Lawrence and (d) control access to the outer barrier islands, thereby protecting endangered species.



Fig. 2: View south from Val Comeau Gully of coastal barrier beaches, typical of northeastern New Brunswick coast



Fig. 3: Aerial view of Val Comeau Gully from Big Tracadie River and Lagoon to Gulf of St. Lawrence (top of picture). Red line denotes channel at Val Comeau Gully.



Fig. 4: View of Old Tracadie Gully and Little Tracadie Lagoon (Gulf of St. Lawrence to top of picture; McLaughlin Lagoon/Big Tracadie Lagoon to right). Red line denotes former channel and Gully.

The new channel was designed to consist of three sections:

- (1) Dredging of a new marine channel across the McLaughlin Lagoon (northern end of Big Tracadie Lagoon) with a length of 3040 m from Val Comeau Gully to the Whalen Property, having a 6H:1V slope on the channel sides and a requirement to dredge 198,000 cubic meters of fine-grained sediments.
- (2) Excavation of channel across the Whalen Property peninsula consisting of a 1000 m channel with 4H:1V slope on the channel sides and a requirement excavate 90,000 cubic meters of soil and some bedrock.
- (3) Dredging of a new marine channel across Little Tracadie Lagoon from the Whalen Property peninsula to the Tracadie Marina with a length of 290 m having a 6H:1V slope on the channel sides and a requirement to dredge 20,500 cubic meters of fine-grained sediments.

The initial plan was to dredge using a standard floating mechanical clamshell dredge. The Whalen Property was to be excavated “in the dry” using standard excavation equipment with re-use of the excavated soils in a new Industrial Park located to the north on the other side of the Little Tracadie River.

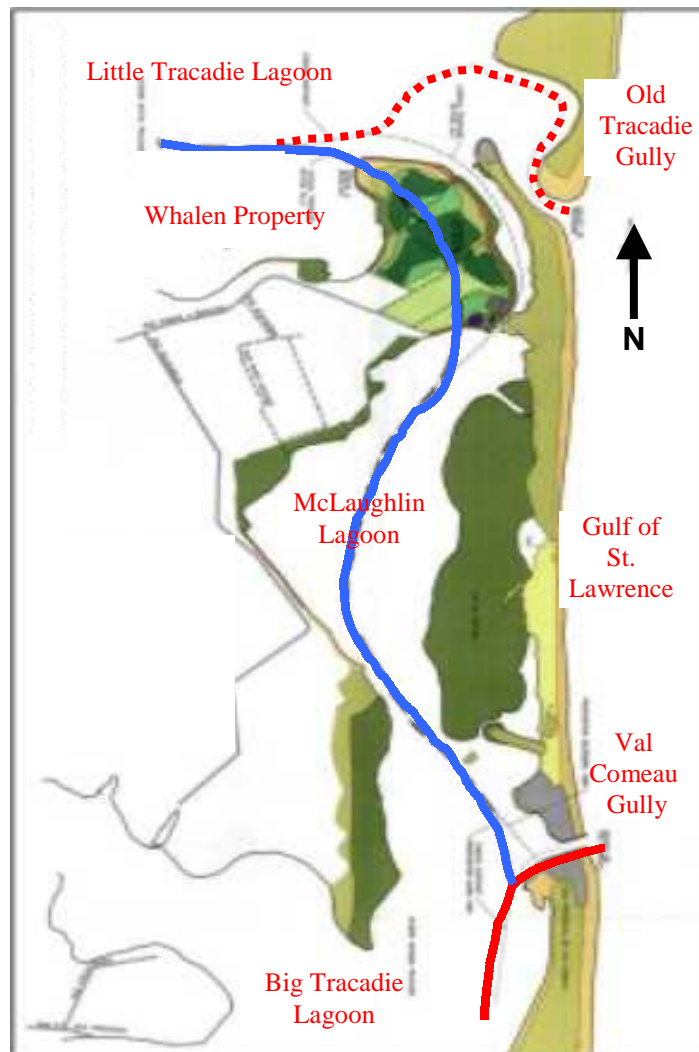


Fig. 5: Map of project alignment (blue line)
 (colours denote different types of vegetation cover)

3 ENVIRONMENTAL CONSTRAINTS

The initial environmental review of the proposed Tracadie Two Rivers Link Channel identified four key environmental issues that required further study and assessment within an Environmental Impact Assessment (EIA) study (Groupe Roy Consultants, 1997):

- (1) Impact of the new channel on sedimentation patterns within the Big Tracadie River estuary and its entrance through the coastal dune system (Val Comeau Gully);
- (2) Disposal of dredged sediments from the channel construction;
- (3) Loss of estuarine benthic habitat by dredging of the new channel; and,
- (4) Disturbance of bird habitat and colonies on the coastal dunes (particularly of terns and piping plover).

Field studies and computer modelling of sediment dynamics of both the inside and outside sedimentary systems defining the coastal dune system of the two Tracadie Lagoons were conducted in 1995-1997. Those studies concluded that creation of a new channel through McLaughlin Lagoon, to the north of and connected to Val

Comeau Gully, would not significantly alter the sedimentary system of the Gully. More critical to the fishermen using Val Comeau Gully, the new channel would not promote or alter sediment deposition and therefore not create a requirement for additional maintenance dredging either of the existing Val Comeau Gully or of the proposed waterway.

In contrast, several significant deleterious impacts were identified with respect to biological Valued Ecosystem Components. As an alternative to placement of dredged materials on the barrier islands, open-water disposal in the Gulf of St. Lawrence or in other areas of the Lagoons, was evaluated. However, local fishermen rejected the concept. Open-water disposal of fine-grained sediments in coarse sand sediments that occurred offshore was considered to be deleterious to lobster and snow crab habitat. Any disposal site would have to be located at least five kilometres outside of Val Comeau Gully, with potential problems of limited access by disposal barges due to sea state and other weather conditions. Therefore this project alternative was rejected.

The most critical deleterious impacts were to birds using the outer barrier islands and the estuary acting as a nursery area for Gulf of St. Lawrence fish stocks. Piping plover, *Charadrius melodu*, is a small bird favouring isolated beaches, such as occur along the northeastern New Brunswick shoreline, as its breeding habitat. It is an endangered species and requiring critical habitat protection. Issues of noise during construction, loss of habitat with on-shore placement of dredged materials and improved access to beach habitat (i.e., public access to beach nesting areas) after construction of the waterway were identified as significant deleterious impacts. Terns, *Sterna nilotica*, although not an endangered species, were also identified as having significant habitat on the barrier beaches, particularly near Val Comeau Gully. Terns, during nesting, are also highly susceptible to noise from nearby construction. To avoid noise-related disturbance would have required significant re-alignment of the proposed channel through McLaughlin Lagoon, adding approximately 25% to the overall volume to be dredged and to the overall project cost. Therefore this project alternative was rejected.

4 ENVIRONMENTAL WINDOWS FOR DREDGING

The US National Research Council Transportation Research Board (2002) has defined *environmental windows* as:

“.. periods in which regulators have determined that the adverse impacts associated with dredging and disposal can be reduced below critical thresholds, and dredging is therefore permitted.”

Restricting dredging and disposal of dredged material to particular seasons is not new. For example, as early as 1984, we had used the concept of limiting site activities for dredging of the Miramichi River estuary (south of this project site) to a late Spring start-up, to avoid fish migration. But this identification of “acceptable” operating times has not been a sophisticated exercise. The concept of environmental windows provides for a tighter boundary on the timing of site activities, where boundaries are more closely defined by specific Valued Ecosystem Components and the potential impact to those components.

In the case of the Tracadie Two Rivers Link Channel, each impacted Valued Ecosystem Component was assessed to define potential environmental windows. The sum of the evaluations identified that no dredging should occur between April and late November; i.e., the normal periods of open water at the project site. In effect, there were no environmental windows for normal dredging activities.

In this area of Canada, the on-set of winter typically begins in late November with rivers and local embayments freezing and then followed by more traditional colder temperatures and snow through to about mid-April. Winter daytime average temperatures are in the -10°C to -20°C range, with total snowfall on the order of 350 cm. All of the Gulf of St. Lawrence and the coastal embayments are ice-covered, with typical thickness of one to two metres.

Winter is therefore not considered as a traditional time for channel dredging and construction. However, it does offer an excellent environmental window that is unique to northern climates, such as Canada:

- (1) All fish migrate offshore to deeper waters.
- (2) Any mammals hibernate or retreat inland to winter protection in the deep forest.
- (3) All birds migrate south, particularly the critical terns and piping plovers.
- (4) Aquatic vegetation dies off and is limited to root systems.

- (5) Under appropriate conditions in the coastal lagoons, ice cover may extend to the bottom with no free water to transport suspended solids released from a dredging operation.

Because of cold weather, snowstorms and short daylight periods, little or no outdoor construction occurs in northern New Brunswick in the winter period. Traditionally, construction companies have shut down about 15 November with workers going on unemployment insurance until construction projects traditionally start in late April.

Re-assessment of the Valued Ecosystem Components (OCL Services Ltd., 1998a) concluded that dredging of the marine channels in winter would offer an environmental window in which none of the Valued Ecosystem Components would be impacted by the project. Therefore submission was made to the regulatory agencies to approve the dredging project for the 1 January to 1 April period, potentially requiring two winter periods to complete the project. A revised EIA was presented in September 1998 and given final approval on 25 November 1998. This approval set the stage for the first large-scale “through ice” dredging project in the Maritimes. A small project at the Bouchtouche Marina, about 100 kilometres further south, had shown that excavators could work on ice cover and successfully “dredge” a project site. However, that project had been small scale, completed within one month and had proceeded in January 1998 as much to facilitate marina use that summer as to mitigate environmental impacts.

Key elements of the winter “dredging” were:

1. Use of a minimum of four large-capacity “land type” excavators positioned on either side of the channel line.
2. Removal of excavated sediment by truck to the selected disposal site, at distances of three to eight kilometres from the dredging site.
3. Beneficial use of all marine dredged sediment and excavated rock/soil from the channel through the Whalen Property as fill material in a low-lying area within the Tracadie-Sheila Industrial Park.
4. Operation of all activities on a 24 hour per day/7 day per week basis.
5. Implementation of a strict health & safety plan (OCL Services, 1998b) to ensure full worker protection, as well to limit access by winter recreation vehicles near the work site.

5 PROBLEMS AND SUCCESSES

As illustrated in Fig. 5, the channel through the McLaughlin Lagoon was to extend 3050 m from Val Comeau Gully to the shoreline at the Whalen Property. The nearest section of channel was about 500 m from land; many sections would be more than one kilometre from land. Beginning in mid-December, the contractor began to pump seawater onto the existing ice to create an extra-thick layer of ice to act as a roadway. At the beginning of actual excavation, sandy soil and rock from the Whalen Property channel was used to provide a non-skid surface on the ice road (Fig. 6 and 7). As the excavation progressed, materials used for the temporary ice road were also removed.

Site work and excavation commenced on 15 January 1999. As to be expected, all project participants were very concerned with the potential loss of equipment, trucks or workers through the ice cover (Fig. 6 to 9). However, by the end of the first week, the flow of operations had become very smooth. Initially, excavation was planned to proceed from Val Comeau Gully northward to the Whalen Property. By the end of project week 1, it was recognized that the project could proceed more rapidly and therefore excavation was also initiated from the northern end of McLaughlin Lagoon (Fig. 10 and 11). By the end of project week 4, excavation of the McLaughlin Lagoon channel section was complete and work began immediately on the Little Tracadie Lagoon channel section. This was completed by end of project week 5. At the same time, additional excavation equipment was mobilized and the Whalen Property channel section was completed by the end of project week 6 (Fig. 12).

Disposal of dredged material on land required a large number of heavy trucks. Further, the many of the trucks would have to traverse both local roads and the main roadway through Town to the disposal site in the industrial park. While there is always a public concern regarding heavy truck traffic, only two truck accidents occurred during the eight weeks of trucking: one flat tire and one minor incident of an empty truck hitting another empty truck. No loads of sediment were accidentally lost or spilled; no workers or equipment were lost through the ice.

The key factor in the project being essentially complete within six weeks was “Mother Nature”. This area of New Brunswick normally averages daytime temperatures of -5°C to -10°C , with snowfalls of about 10-20 cm at least once per week for a winter total of about 350 cm. During the Tracadie Two Rivers Link Channel construction, average daytime temperatures were -10°C , with no snow fall from 1 January until 6 March; i.e., the construction period. On 8 March, the community received a snowstorm equal to about 50% of their normal annual snowfall; on 16 March, the community received the other half of their annual snowfall.

In late April 1999, the contractor was able to install geotextile and local sand stone along the Whalen Property channel section to limit shoreline erosion due to shipwake (Fig. 13). The Tracadie Two Rivers Link Channel was officially opened in Spring 1999 (Fig. 14).

Another element of success for the project was the cooperation of the local community. During the preparation of the EIA, local residents, particularly along the shores of the McLaughlin Lagoon raised several concerns regarding the environmental impacts to the sensitive environment of the Lagoon. While it was recognized by the community that a winter environmental window offered an excellent opportunity to avoid environmental impacts, there remained numerous concerns. To address these concerns and provide a better conduit of information, implementation of a Community Roundtable during construction and subsequent operation was recommended by the project team. This concept proved very successfully and ensured an adequate “voice” for the community at large and the local ecological group regarding the piping plover issue.



Fig. 6: Placement of excavated soil for temporary on-ice road. Note truck to one side directly on the ice.



Fig. 7: “Dredging” using on-ice excavators.



Fig. 8: Removal of “dredged” sediment by truck. Note opened channel to left of picture



Fig. 9: Dredging in Little Tracadie Lagoon. Note temporary light standard to permit 24-hour operations.



Fig. 10: Aerial picture (west) of channel excavation through McLaughlin Lagoon



Fig. 11: Aerial picture to north of completed channel across McLaughlin Lagoon and work underway on Whalen Property



Fig. 12: Final stages of excavation through Whalen Property peninsula.



Fig. 13: View of completed channel (Whalen Property section) August 1999. Note shoreline armouring to reduce erosion from shipwake.

6. CONCLUSIONS

To meet the overall goals of environmentally sustainable development and promoting eco-tourism, construction of the Tracadie Two Rivers Link Channel had to be undertaken in an environmentally appropriate manner. The initial Environmental Impact Assessment identified several Valued Ecosystem Components, with overlapping periods of critical sensitivity. The combined result identified that there was no acceptable work period within the traditional construction season of April to November in northeastern New Brunswick. Further, no mitigation measures could be identified to reduce the significance of the potentially deleterious impacts.

By selecting winter as the construction period, a unique environmental window was opened for the dredging project. Previously identified significant deleterious impacts would not occur during winter and therefore the project could be approved to proceed. While initially, there was significant concern by the contractor as to actually being able to undertake a winter-time project of dredging by excavation through ice, the project went smoothly and was completed within 6 weeks of initiation. Only two very small truck accidents occurred and there was no loss or spillage of dredged material.

Subsequent assessment of critical tern and piping plover populations and habitat showed no impact of either the construction or of the subsequent use of the waterway. In fact, the identification of environmental issues and the use of winter construction to mitigate impacts helped to focus community attention on the environmentally sensitive coastal dune system and assisted the local ecological group in protecting Piping plovers.

By establishing a Community Roundtable at the beginning of construction, the CDDRT also ensured that community concerns were fully voiced and rapidly addressed within a public forum. The transparency of the environmental assessment and review and of the construction process greatly assisted in gaining public confidence and support.

By 2000, the project was meeting its goal of attracting economic opportunities. The Town tripled the size of the visitor marina to handle the large number of tourist yachts attracted to the area. In turn, two new restaurants were opened and a tour boat operation began. With completion of the cottage/conference centre, the new waterway fully justified its cost.



Fig. 14: Aerial view (to the southeast) of the completed channel project

7 ACKNOWLEDGEMENTS

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