

Creation of Fish and Wildlife Habitat on the Closed Salmon Harbour Mine in Minto, NB

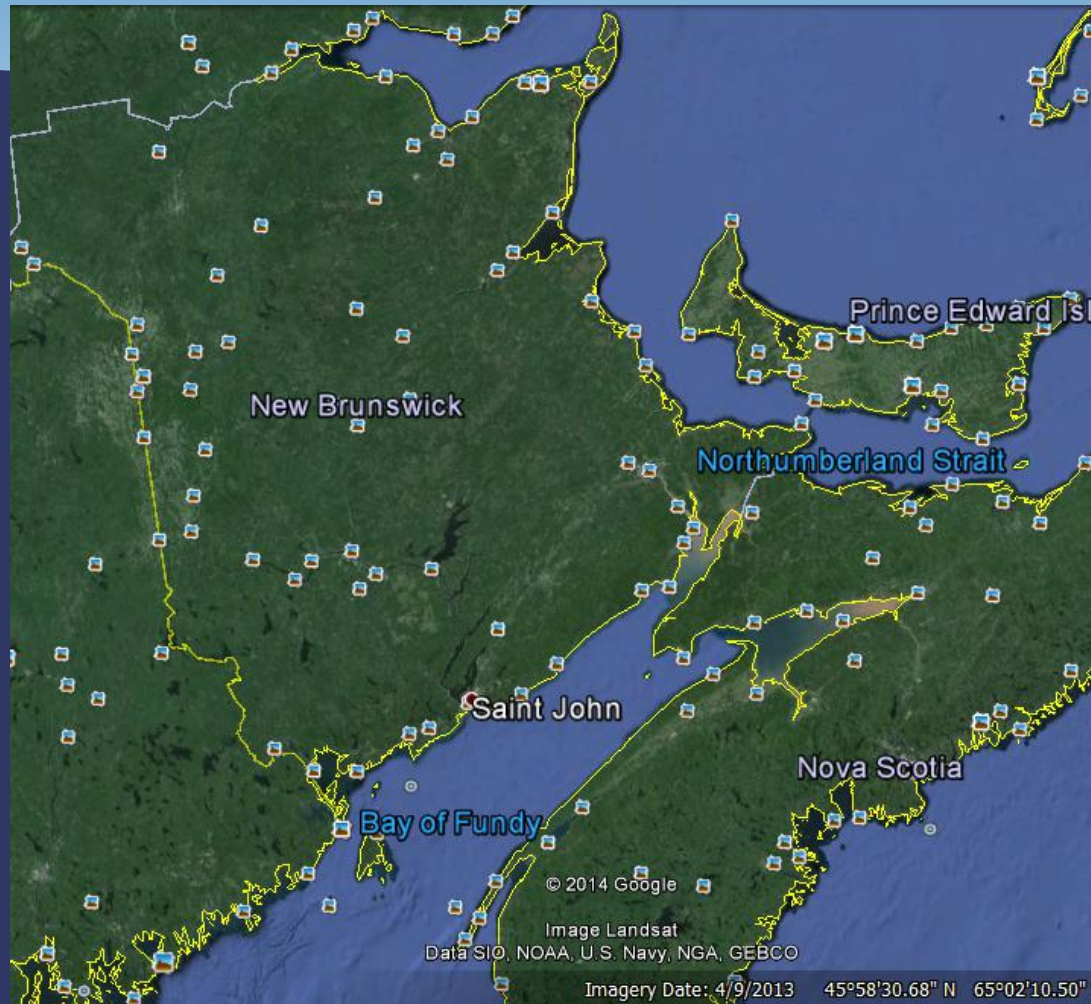
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¹NB Power

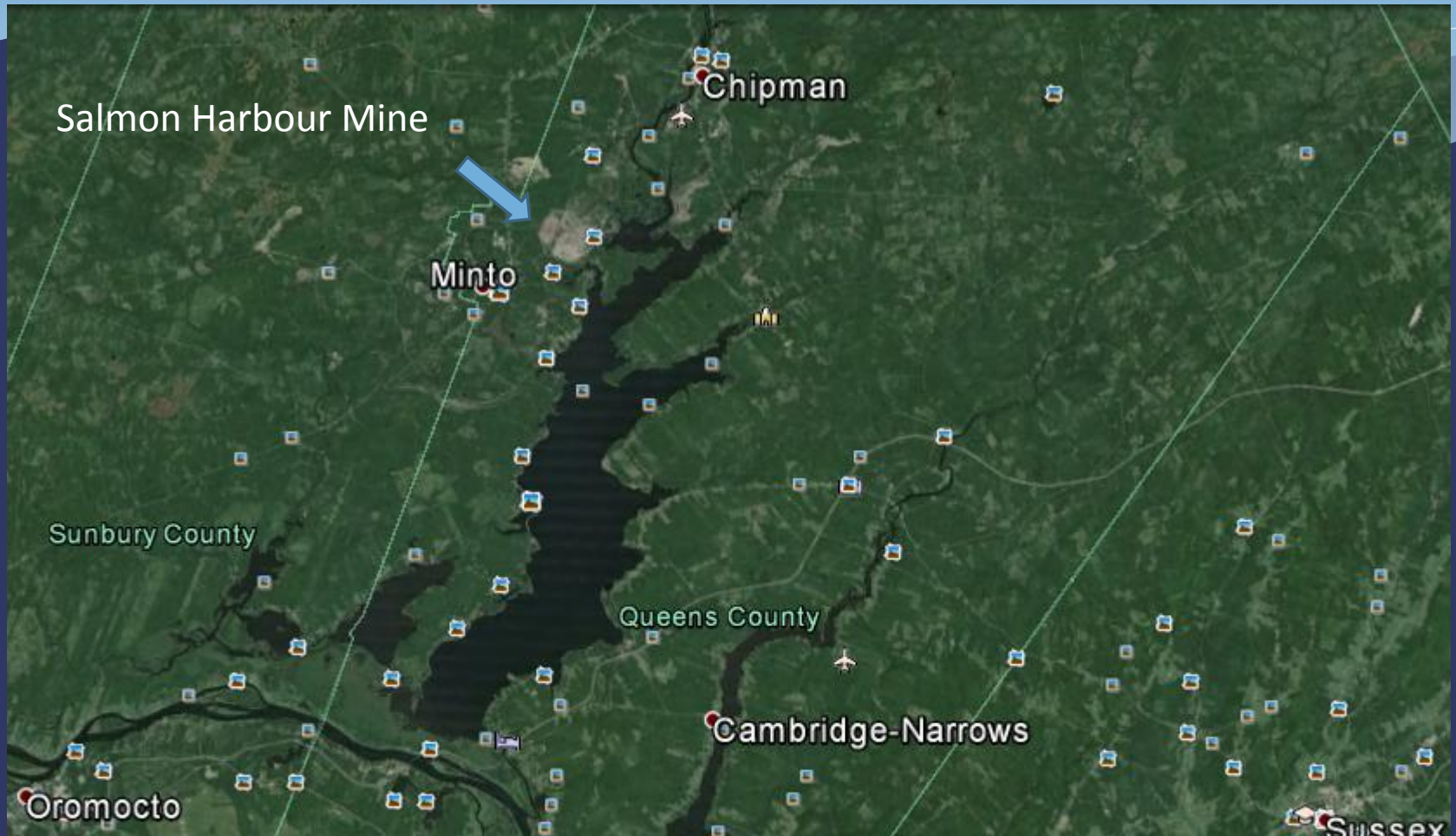
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Location of Minto, NB



Minto, NB on Grand Lake



Salmon Harbour Mine Original Stream Location



Salmon Harbour Mine

Maid Marion Dragline 1982-2005



- Surface coal mining operation.

Mine Implications- Brook Destruction



- Note original stream location.
- Original plan was to put restored brook in final cut location.
- Over 80,000m³ of fish habitat compensation required for Ghost Hollow Brook

Reclamation of Lake Area Initiated 2005



- Photo 3 months after mine water pumps were turned off.
- Work stopped due to landowner interference.
- Culvert installation to accommodate rising groundwater levels

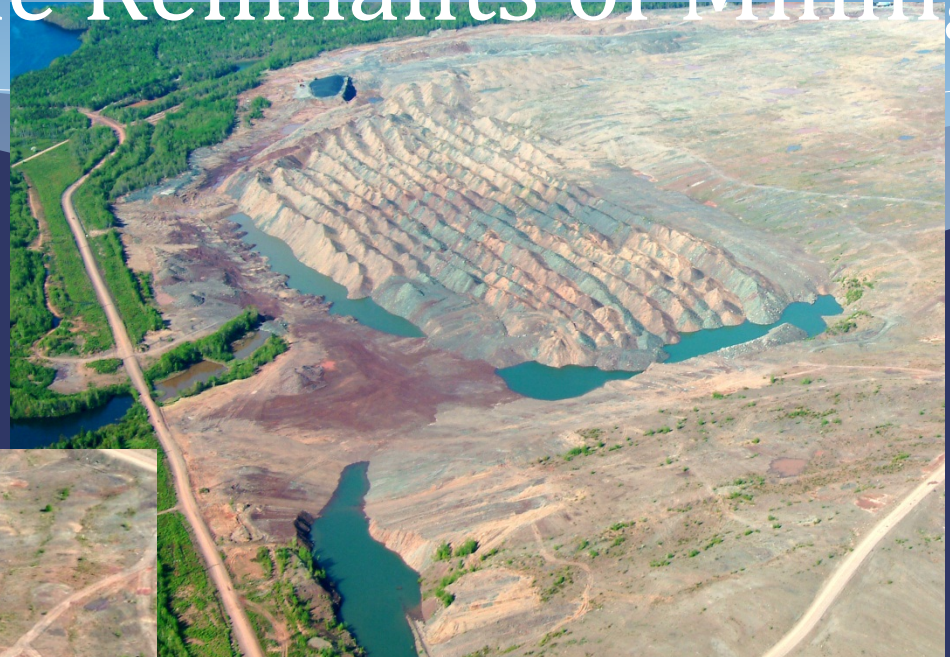
Overview of Compensation Project

- In 2010, plans to complete the compensation were reinitiated.
- Revisions included reviewing location of final brook channel.
- Over 80,000m³ of fish habitat compensation required for Ghost Hollow Brook
- Revised plan divided the compensation into five locations;
 - 1. Trout spawning and rearing structures in drain
 - 2. Installation of digger logs and floodplain construction
 - 3. Shade creation vegetation and digger logs in lower channel
 - 4. Culvert installations with baffles at road crossing
 - 5. Lake area



Designing the Lake Area for Fish Habitat using the Remnants of Mining

Quick review of what was on the ground



Some of the Remnants of the Mining

- Steep high banks with little vegetation.



Some of the Remnants of the Mining

- Steep banks
- Note shallow but narrow littoral zone before drop-off



Some of the Remnants of the Mining

- Steep banks with little vegetation.
- Note the scale!



Other Issues to Contend with –Private Land Parcels

- Note the active rock quarry on private land on the high wall.





Lake Area Proposal

- Lake Features
 - This could be a very productive lake because of its connection to the fish bearing Grand Lake.
 - Littoral area with attached aquatic macrophytes was limited to small patches along the shore where the water depth was less than 1m deep.
 - Advantage to having the wetlands spread for additional shallow zones.
 - We could expect more minnows in shallow areas.
 - We know alewife were there and they would spawn in the shallow areas.
 - Diversity of fish species if water depths can be varied.
 - Deep areas surveyed 16 to 18 meters deep.
- Construction consisted of four phases; bank grading and stabilization, creation of the littoral zones, construction of sediment traps and final culvert removal.

Spoil Pile and High Wall Bank Slopes

- Slopes averaged 300m long with 6-7% grades.
- Natural vegetation not sufficient for sediment control.
- Deep rills evident.
- The first stage for this stabilization entailed shaping the slopes by regrading the material back into the mine site and installing erosion control terraces.



Spoil Pile and High Wall Bank Slopes



Spoil Pile and High Wall Bank Slopes



Finished sections

Spoil Pile and High Wall Bank Slopes



- Finished sections
- Note features
- A few tree seedlings were planted on a trial basis but its too early to determine their viability.
- Slopes will gradually be occupied by early successional tree species (birch, pin cherry, aspen)
- Changed seed mixture



Littoral Zone

- To improve the ecology of the lake and enhance the spawning areas for perch, pumpkinseeds and minnow species, shallow littoral zones were created over approximately 27,600sqm in the shallower areas of the lake.
- To be able to preserve the deeper sections of the lake, littoral zones were created in shallow areas rather than a wide strip along the water's edge.
 - working platform method into or along the water with a tractor and then scattering the material with an excavator.
 - material pushed as elevated roads into the shallower sections allowed for a more continual littoral zone.
 - Loose rocks, boulders, and cobbles on the surface or below the water table also created habitat, cover and diversity for both aquatic and non-aquatic species including birds.

Construction of Littoral Zones



- Issue during construction was high water levels



Littoral Zones



- Lower water levels allowed for better control of material left above the surface of the water

Sediment Traps

- Proposal-
- Approximately three meter wide sediment traps to collect sheet run-off constructed as shallow ditches, where possible, around the perimeter of the lake- with the excavation occurring in the land adjacent to the water.
- The bottom of the trap will be 0.075 to 0.15m below the normal lake water level so there will usually be water in it and eventually vegetation, hence making it a more stable sediment trap.
- The berm will be less than 0.15m above the water table.
- Rock lined channels with breaks in the berms will allow for a controlled water level in the sediment trap.
- Vegetation could be encouraged with the transplanting of cattails and the staking with willow, red orsier dogwood and alder stakes.
- Habitat for ducks, geese and turtles.

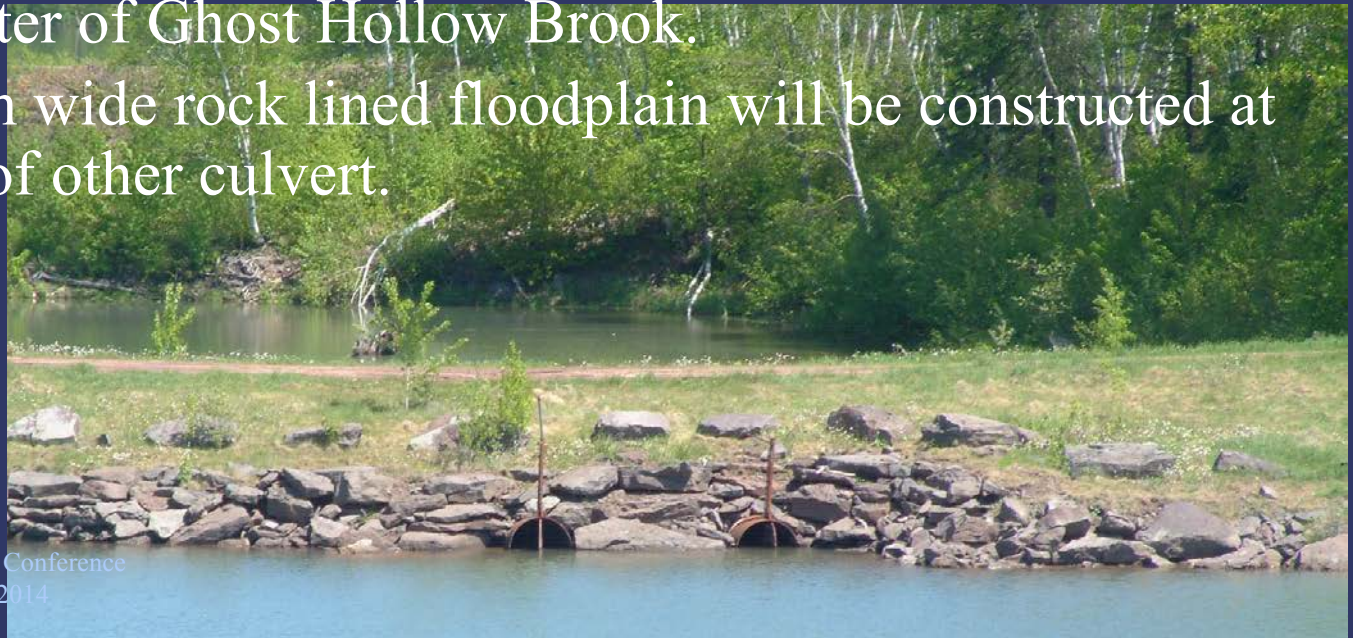
- Emerging or planted vegetation in sed traps
- Very successful in capturing any runoff and sediment.
- The establishment of shoreline vegetation through live staking with dogwood and willow shoots had mixed results. Although the shoots did well in some areas, the survival in other spots was disappointing.

Sediment Traps



Culvert Removal

- At the completion of the slope grading, the two 1.2m diameter culverts at the lake discharge were removed.
- The bottom of one culvert was replaced with a rocked one meter wide channel to be considered the stream thalweg.
- The thalweg contains 0.5m of water during normal summer flows to match the elevation of water in the downstream receiving water of Ghost Hollow Brook.
- A 1.8 to 2.1m wide rock lined floodplain will be constructed at the location of other culvert.



Culvert Removal

- Must maintain lake elevation at elevation of receiving brook
- Constructed at low flow
- Adjacent rocky floodplain.
- Elevated water level result of high water table on the mine side or elevated water levels in Grand Lake (Spring freshet and fall rains)



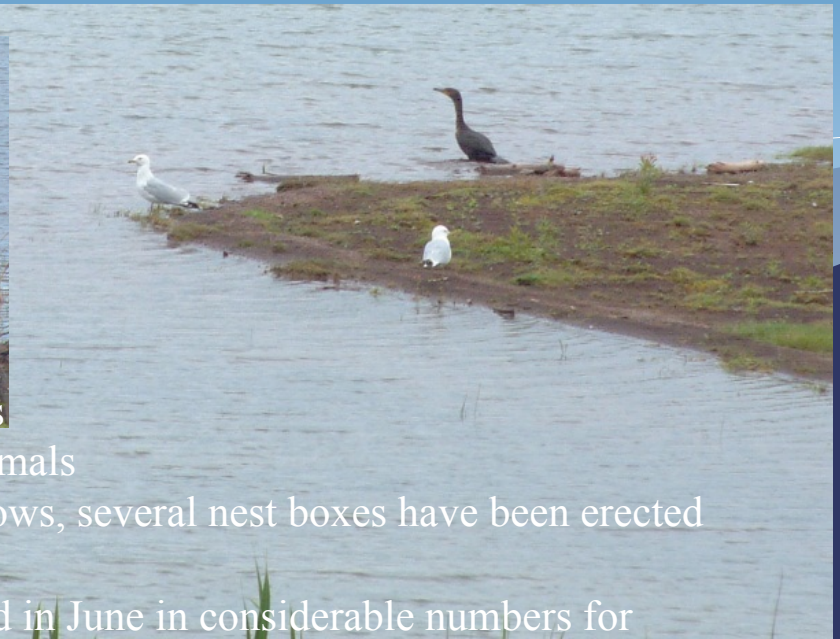
Inlet after 50 mm precipitation

Outlet shortly after construction

Current Uses



Future Uses?



- Wildlife habitat in and surrounding lake
 - Loons, various ducks, geese and shorebirds
 - Turtles, muskrats, raccoons and large mammals
- To enhance the use by other birds such as swallows, several nest boxes have been erected and a duck nest box will also be erected.
 - Gaspereau were observed entering the pond in June in considerable numbers for spawning. Gaspereau are an important commercial fish species in the Grand Lake system.
- Fish jumping was a favorite visual activity on field days.
- Recent minnow traps produced four fish species (golden shiner, fallfish, white sucker and banded killifish). It is likely that sports fish such as pickerel and perch now reside in the pond too.
- Considered by some biologists to have potential as trout habitat.
- Future activity fishing and potentially ice fishing?
 - Based on landowner permissions