



Port Darlington West Embayment Shoreline Change Assessment

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Scope of Investigation

- I. Review of construction history for potential littoral barriers
- II. Shoreline change analysis for the regional study area
- III. Sediment bypassing analysis at potential littoral barriers
- IV. Study of development history impacts on shoreline erosion
- V. Reporting



Presentation Outline

- I. Shoreline Change Analysis
- II. Bathymetric Survey and Sonar Collection
- III. Numerical Modeling of Wave and Sediment Transport
- IV. Conclusions
- V. Questions



I – SHORELINE CHANGE ANALYSIS





Chart OF LAKE ONTARIO

Compiled from Surveys made by
CAPT OWEN & LIEUT HERBERT, R.N.

AND
CAPT A. FORD, U.S.N.

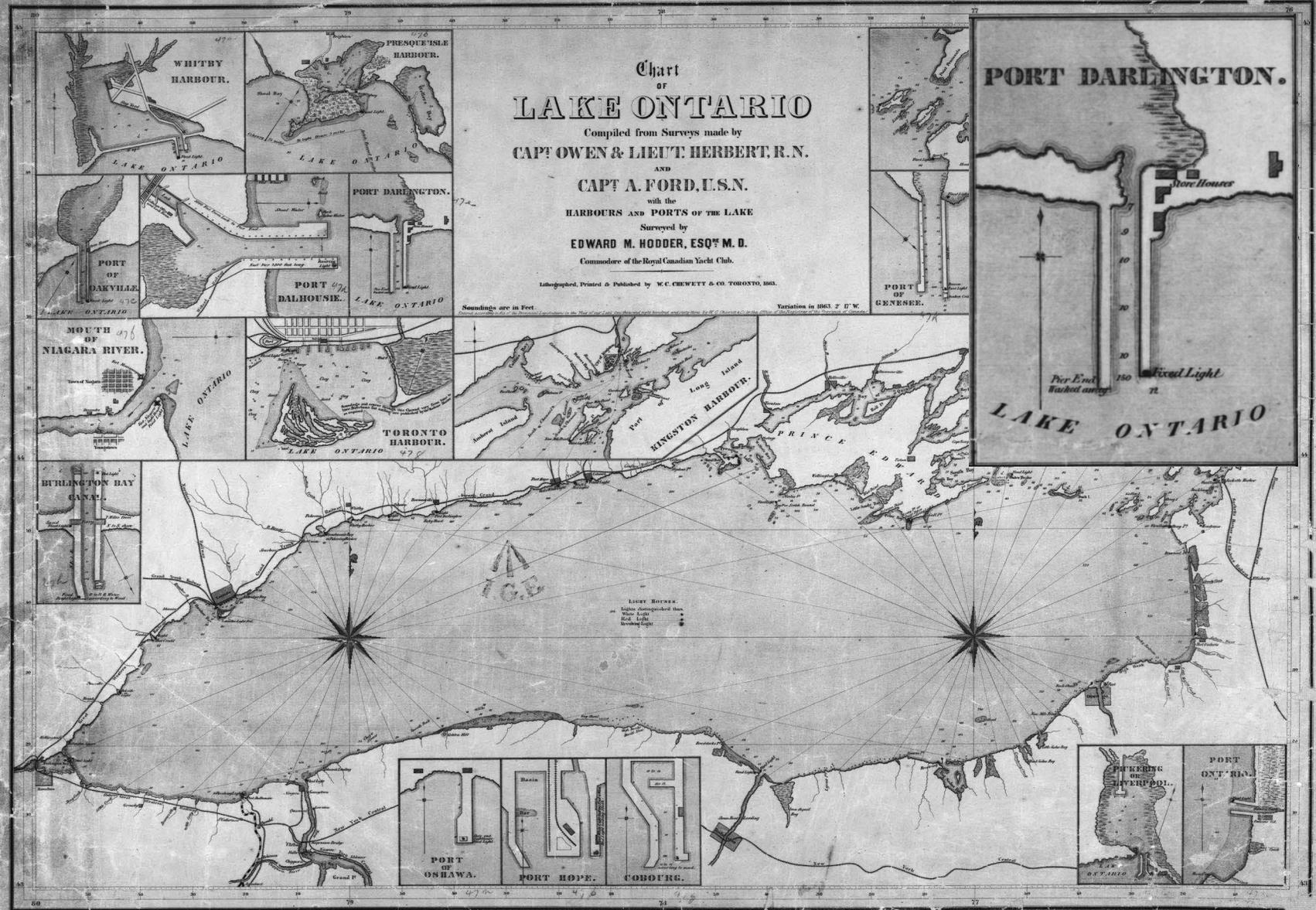
with the
HARBOURS AND PORTS OF THE LAKE

Surveyed by
EDWARD M. HODDER, ESQ^r M. D.
Commodore of the Royal Canadian Yacht Club.

Lithographed, Printed & Published by W.C. CREWETT & CO. TORONTO, 1863.

Soundings are in Feet.

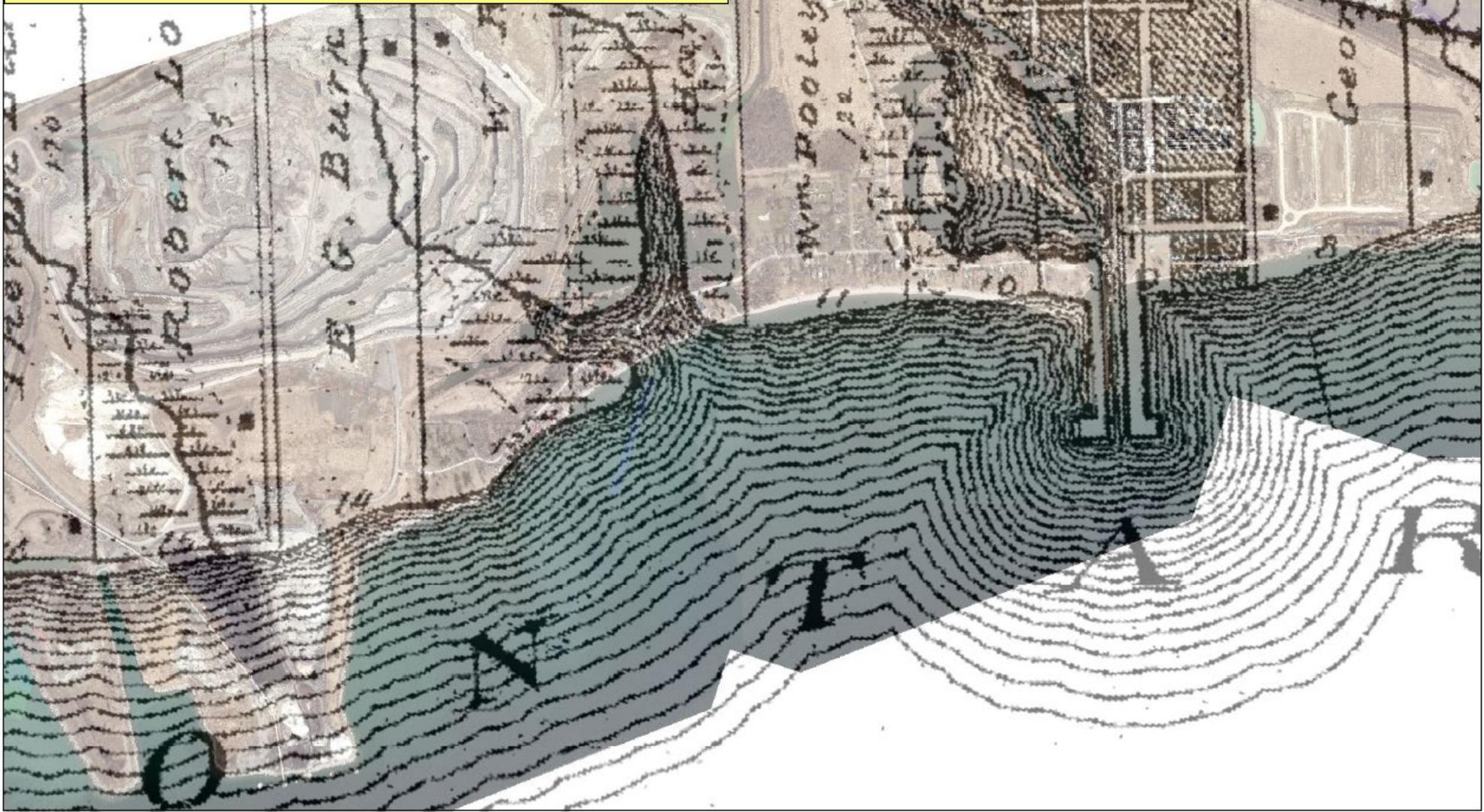
Variation in 1863 2° 17' W.



1863



2018 Air Photo with 1878 Map Overlay



1878 Map
with 2018
Air Photo



1954 to 2018 Shoreline Change Rates





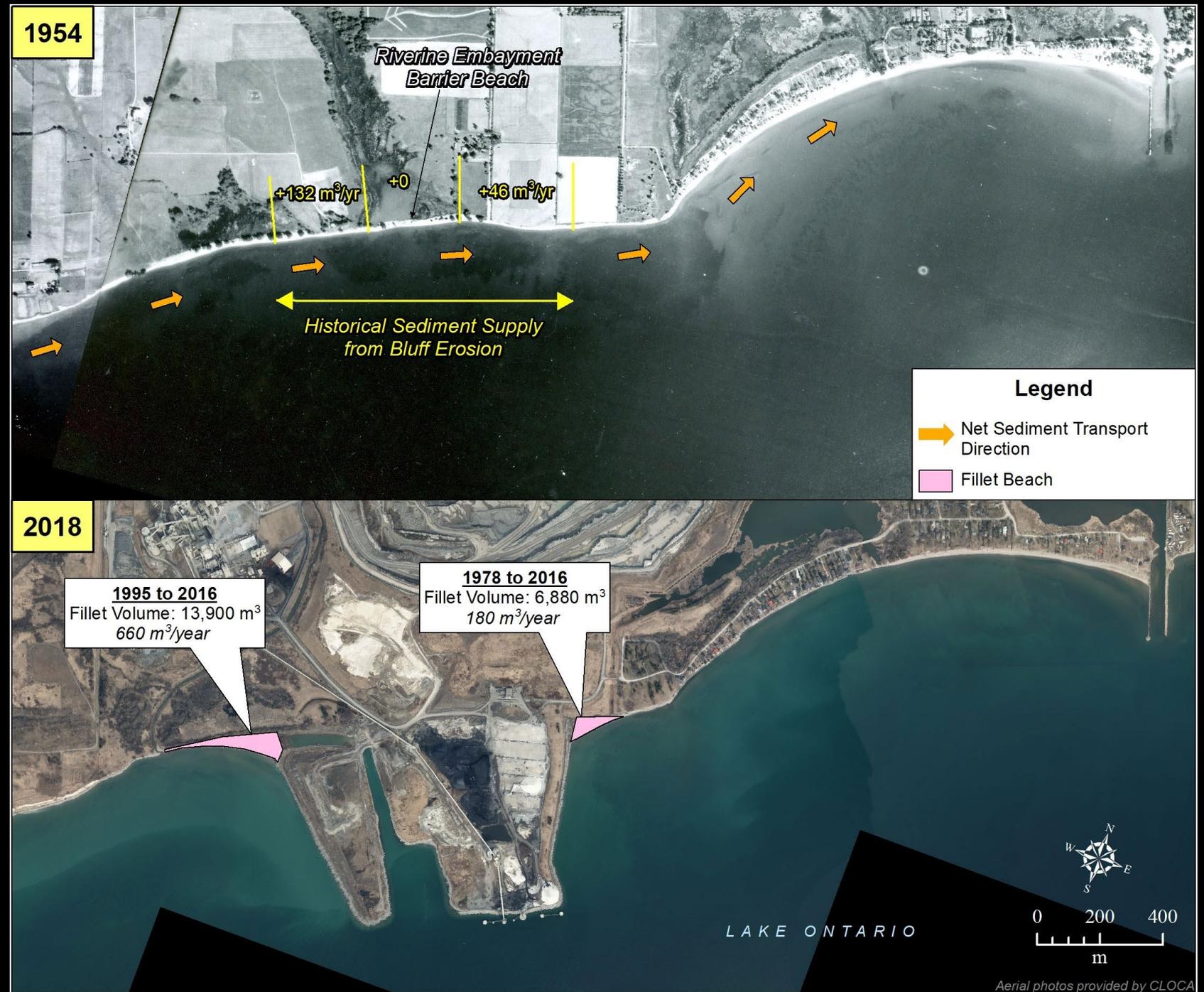
1954 to 2018 Shoreline Change Rates West of St. Marys Headland





Inputs from Bluff Erosion 1954 to 2018

Fillet Beach Growth



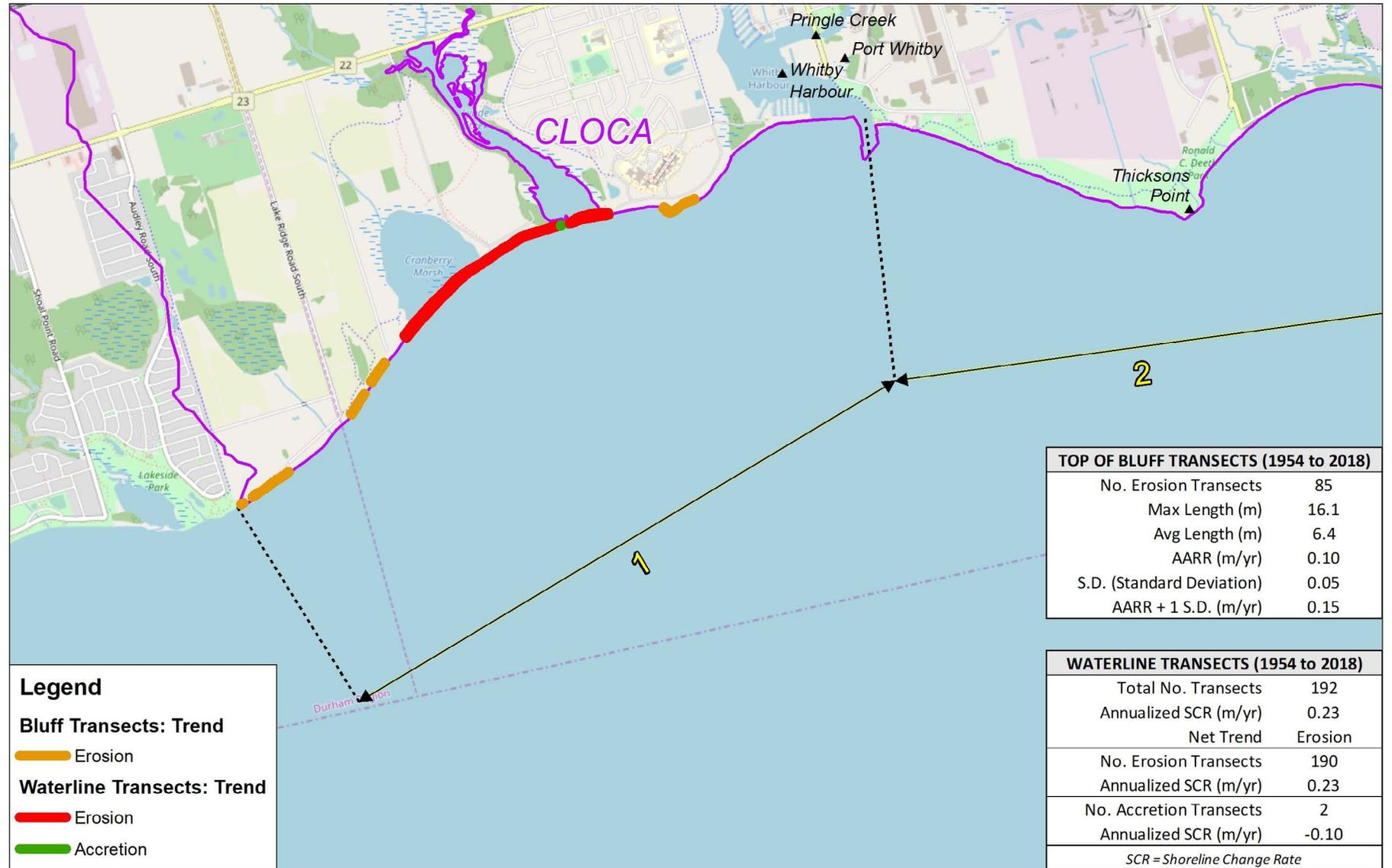


Port Darlington Fillet Beach Growth





Shoreline Change at Lynde Shores CA (a similar site)



Legend

Bluff Transects: Trend

Orange line: Erosion

Waterline Transects: Trend

Red line: Erosion

Green line: Accretion



Shoreline Change at Lynde Shores CA (a similar site)



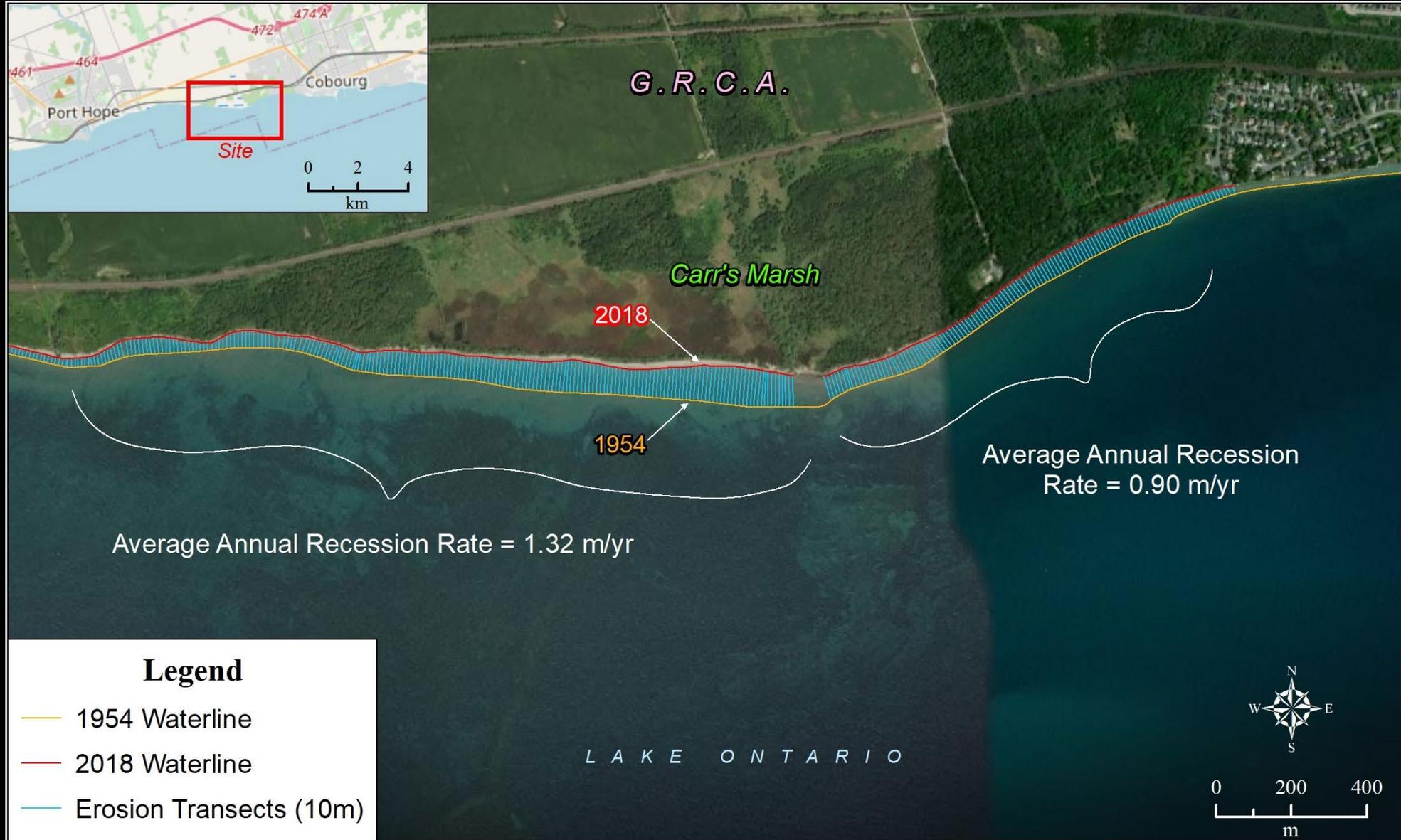


Shoreline Change at Carr's Marsh (a similar site)



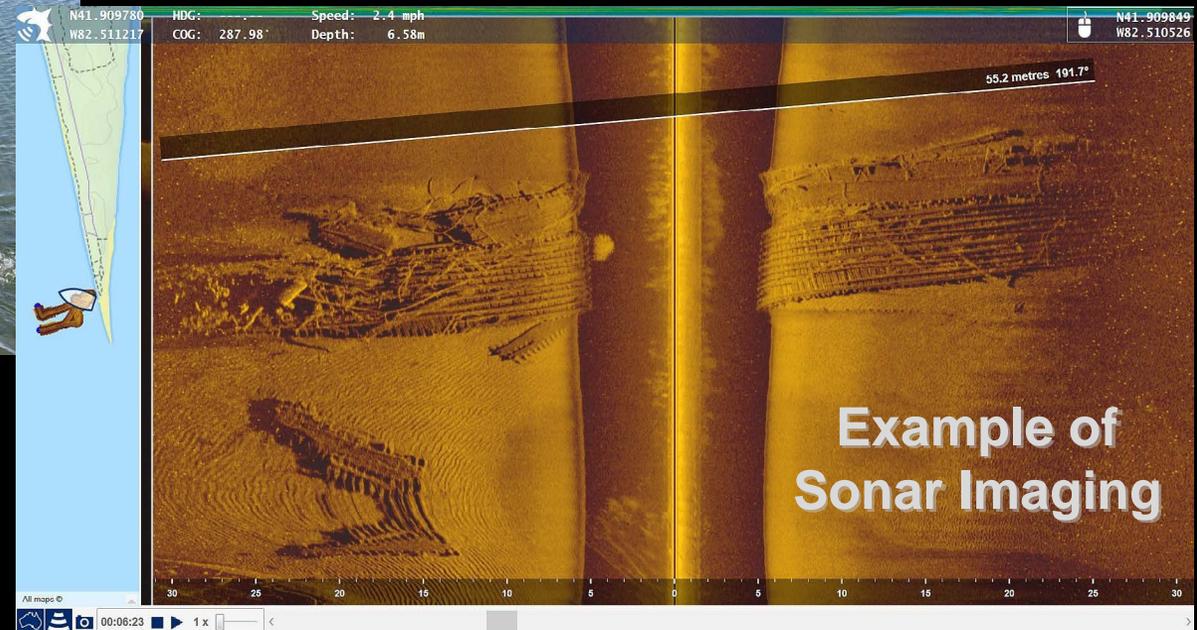


Shoreline Change at Carr's Marsh (a similar site)





II – BATHYMETRIC SURVEY AND SONAR COLLECTION



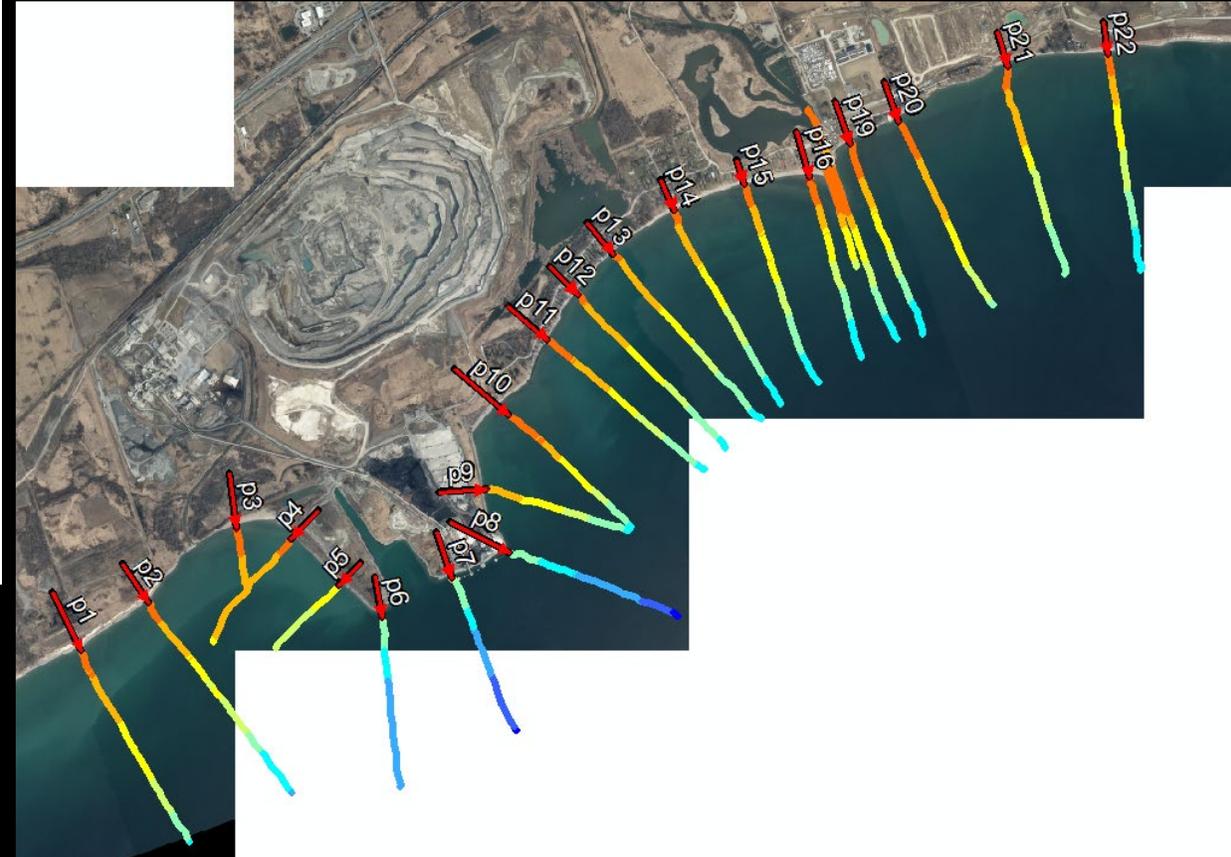
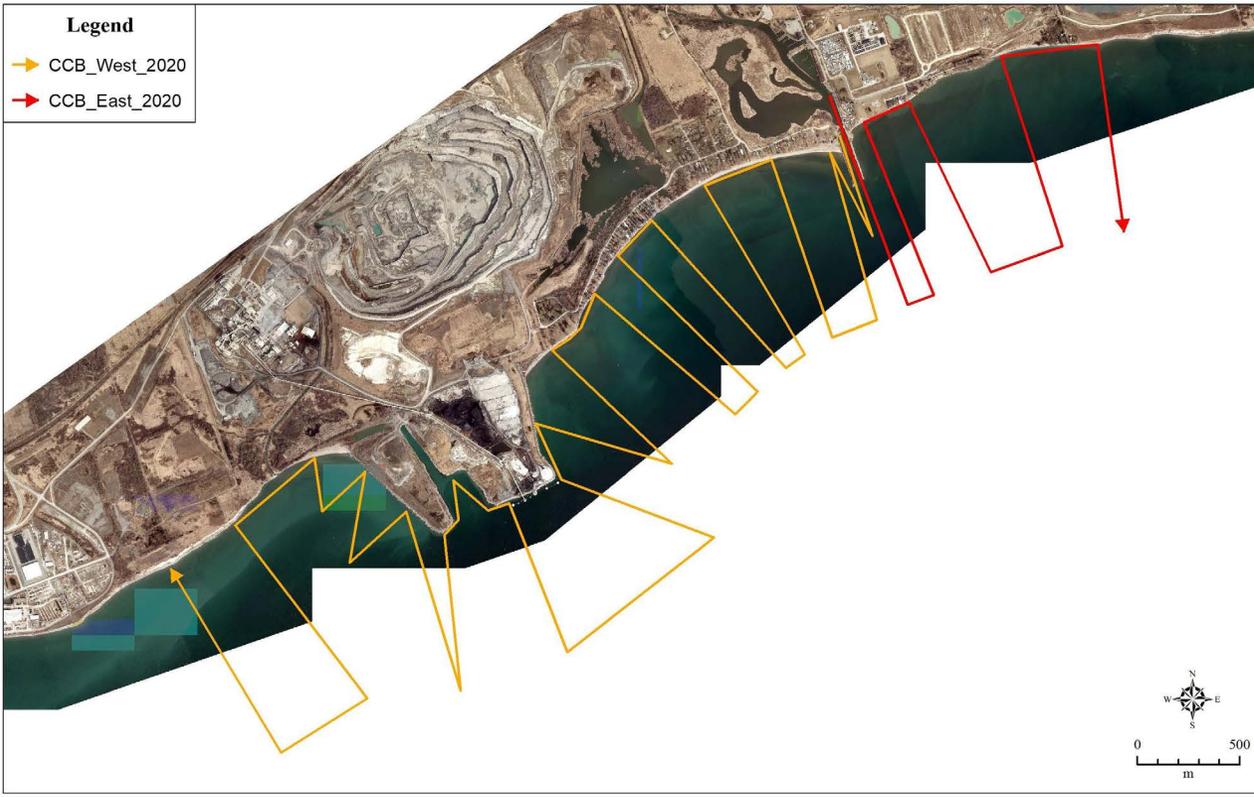


Boat Track and Depth Data

Legend

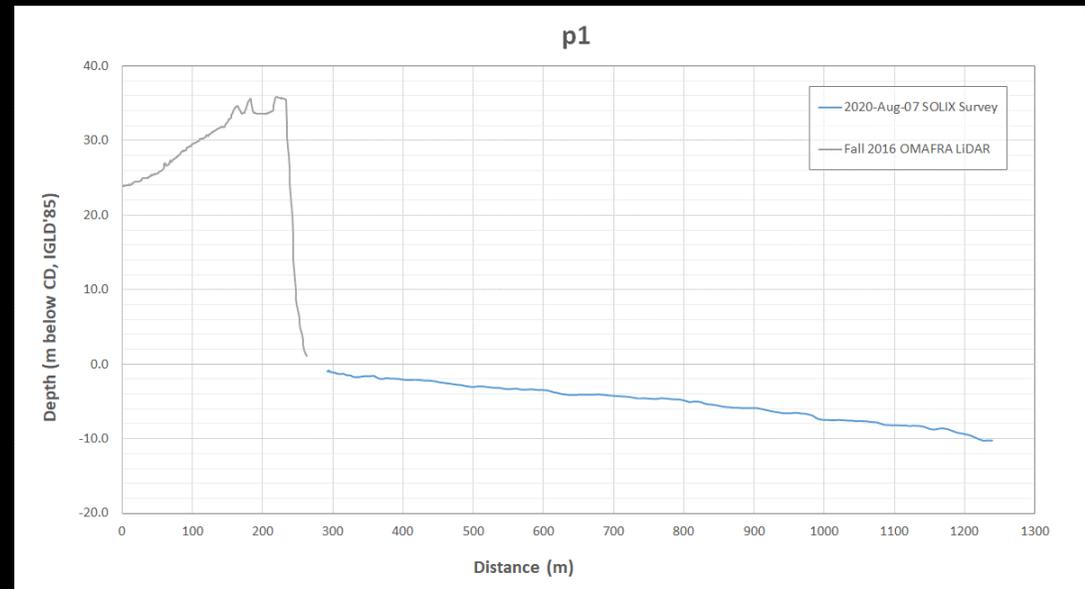
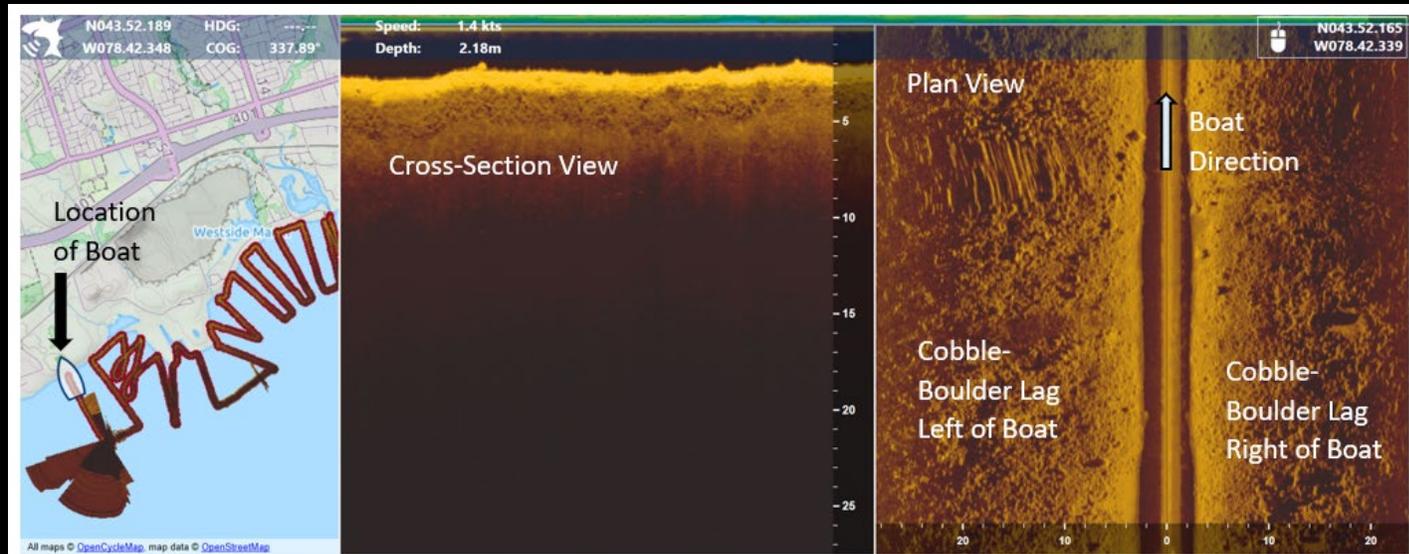
→ CCB_West_2020

→ CCB_East_2020



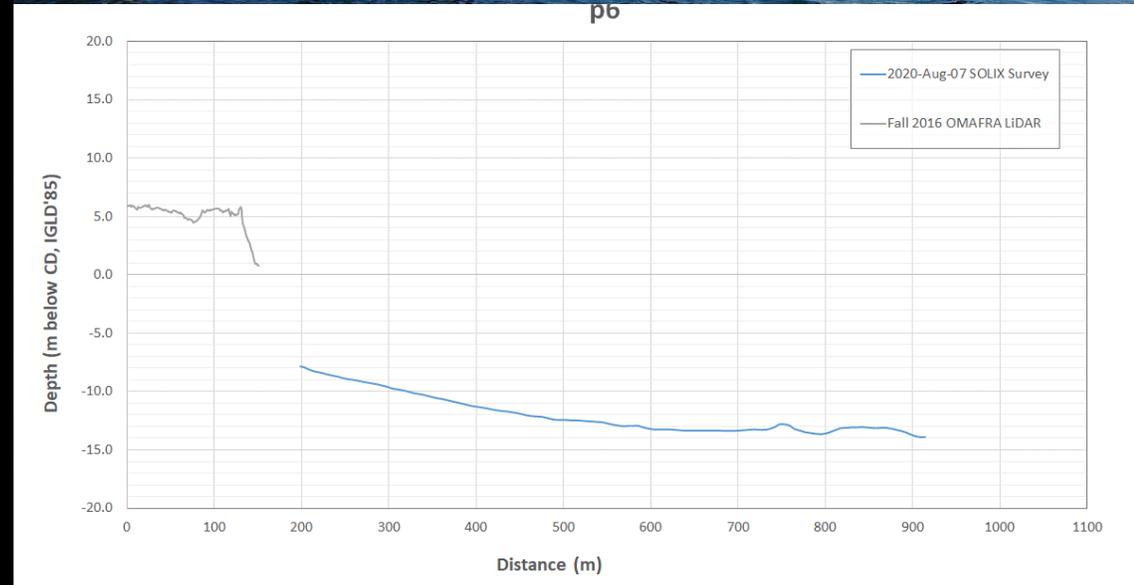
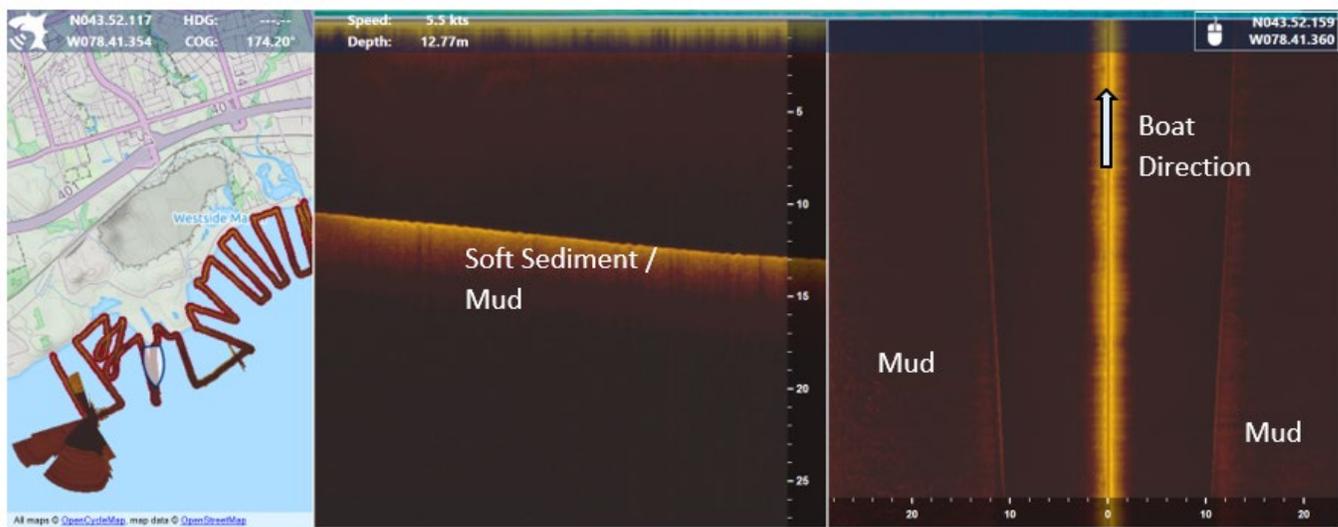
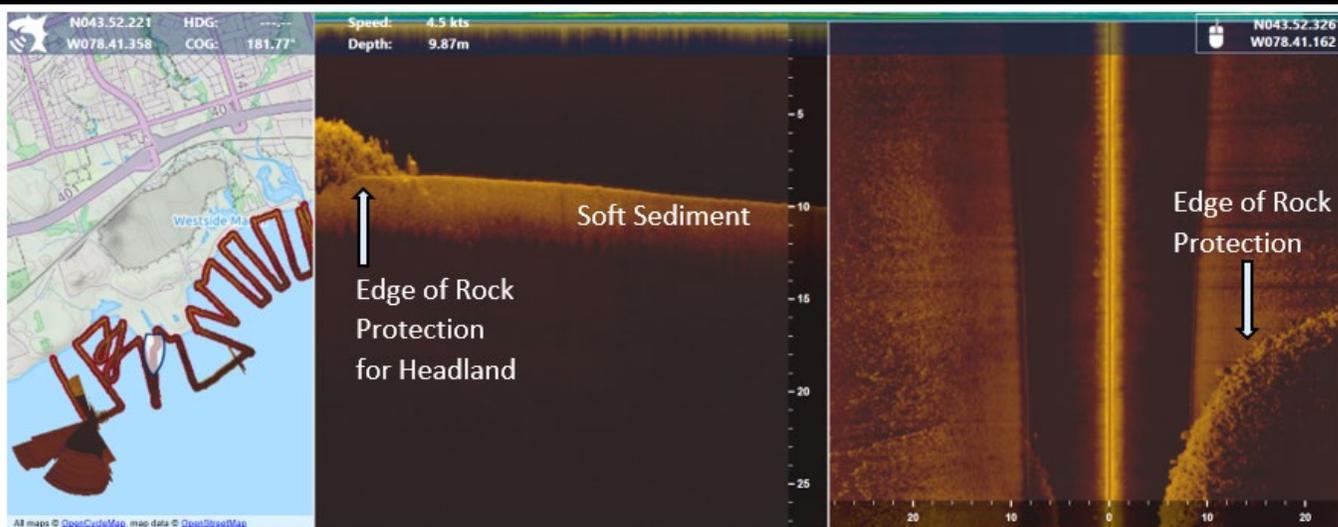


West of St. Marys Cement Headland



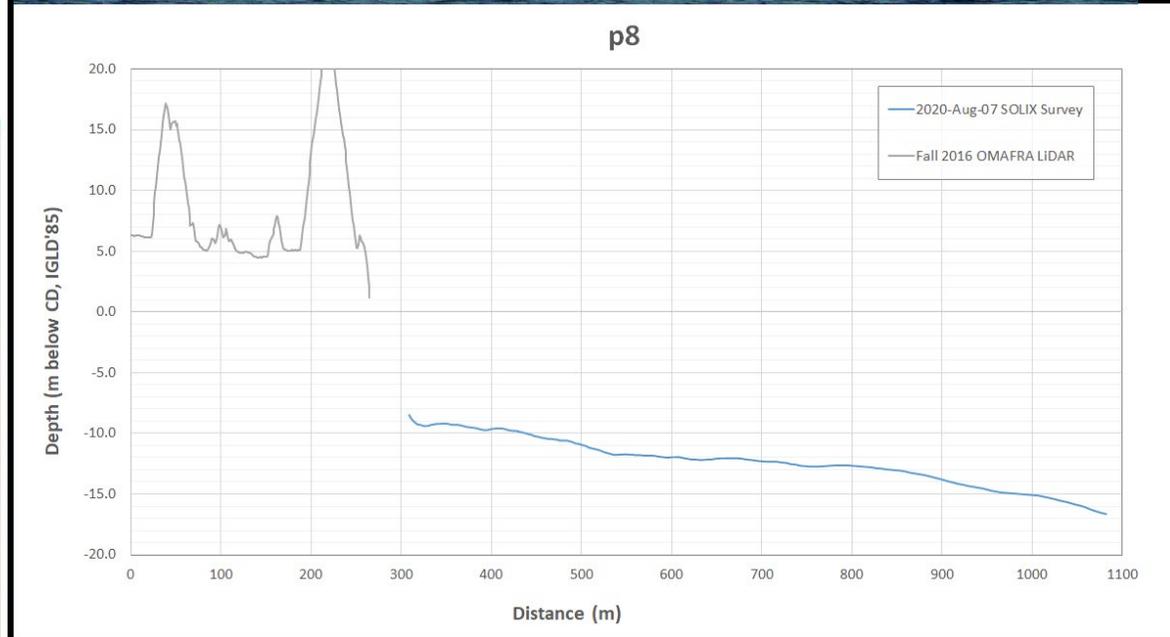
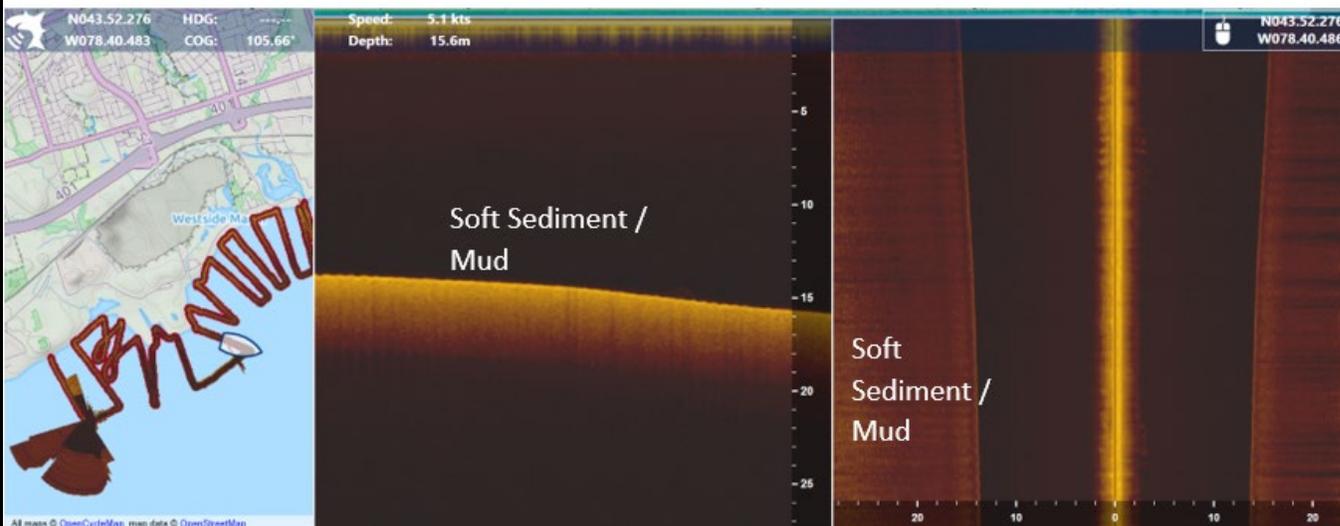
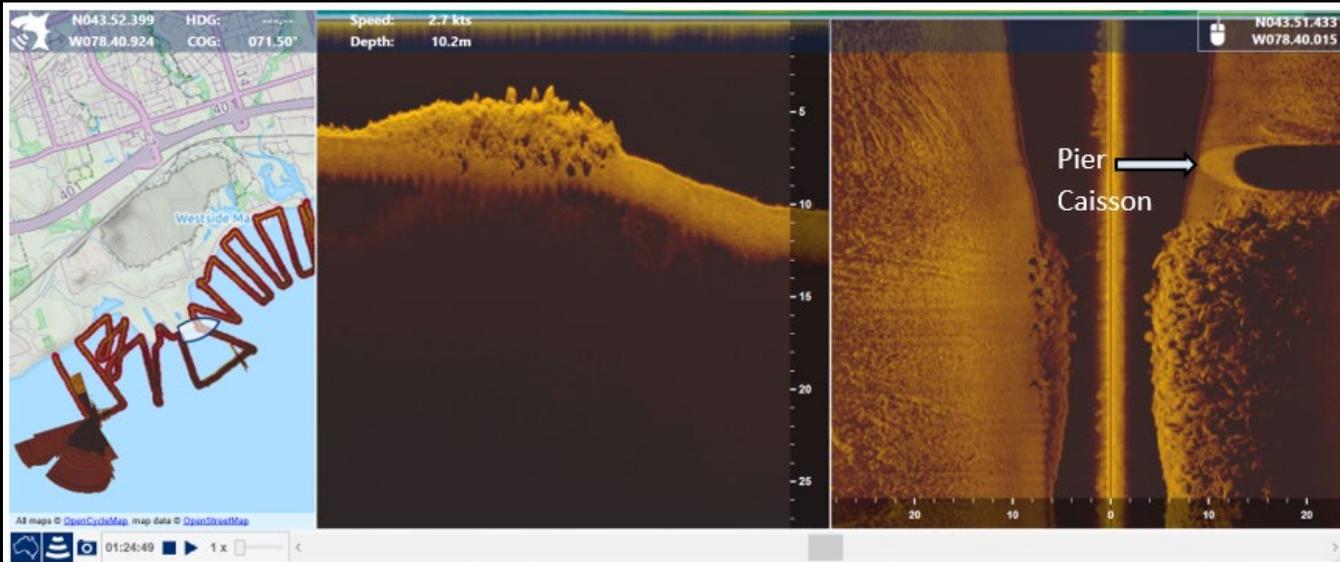


Southwest Corner of St. Marys Cement Headland



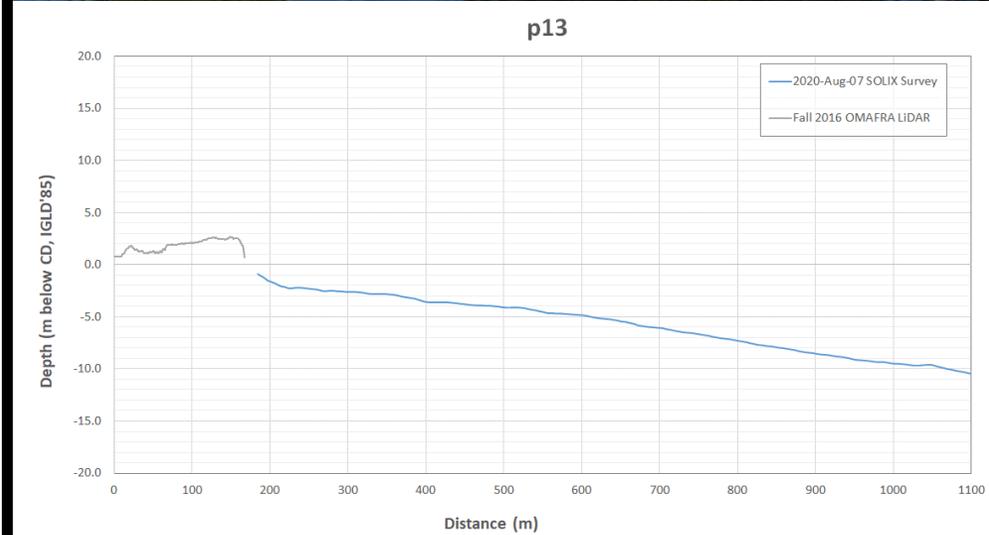
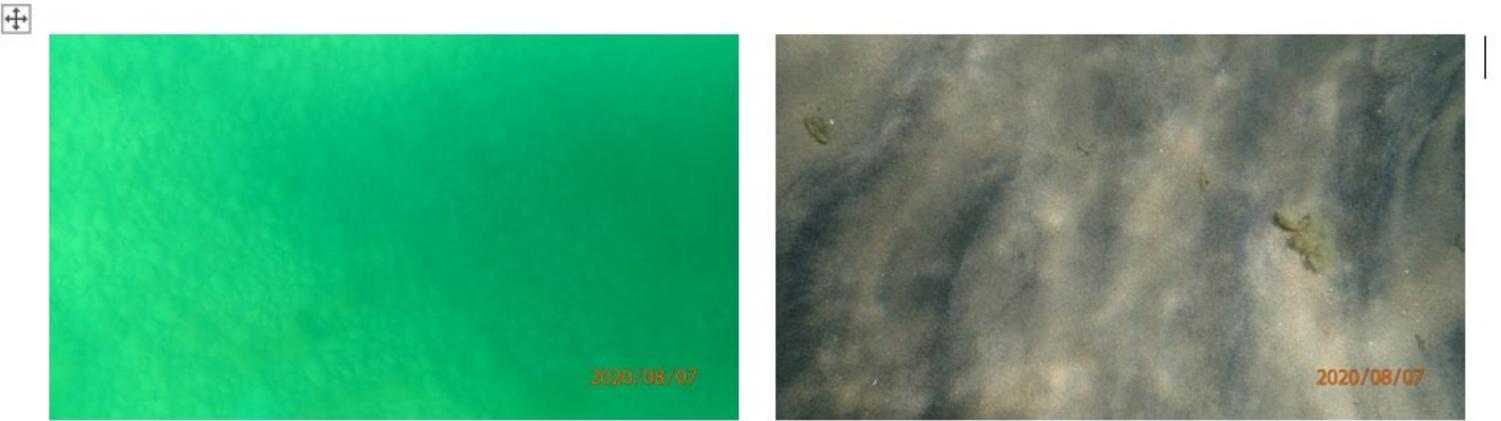
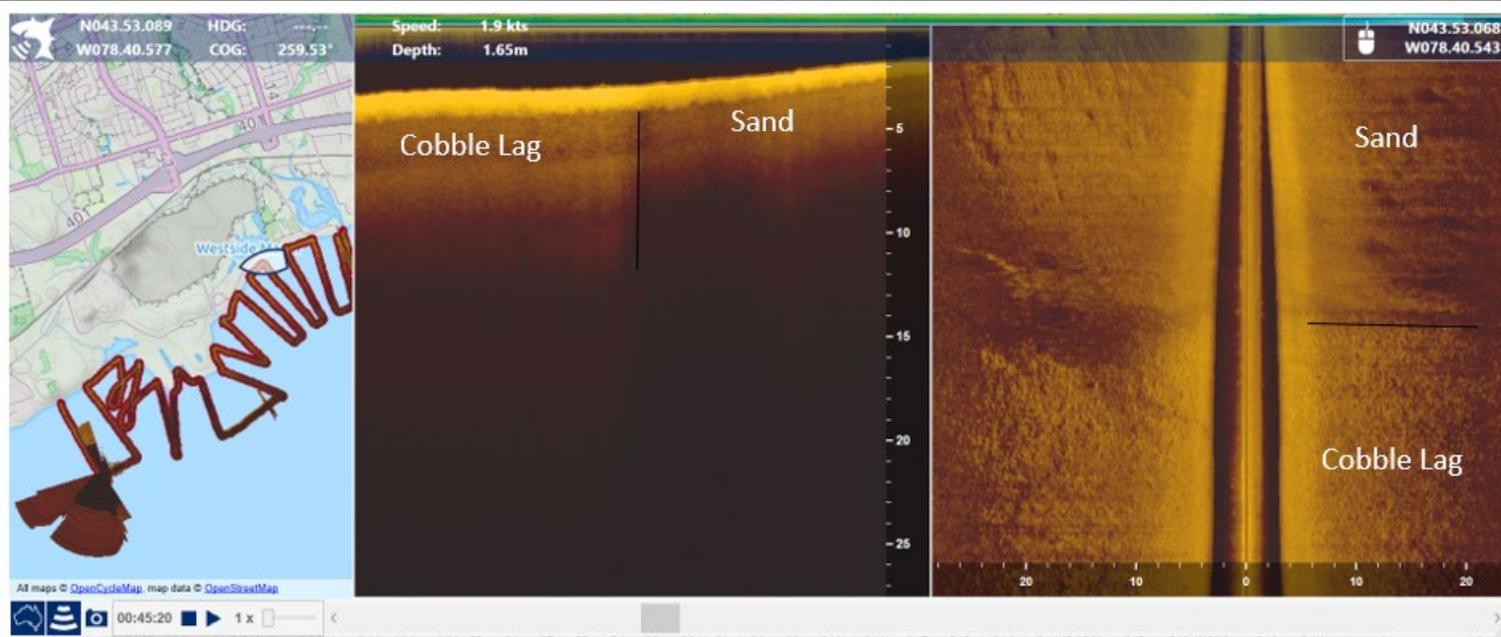


Southeast Corner of St. Marys Cement Headland



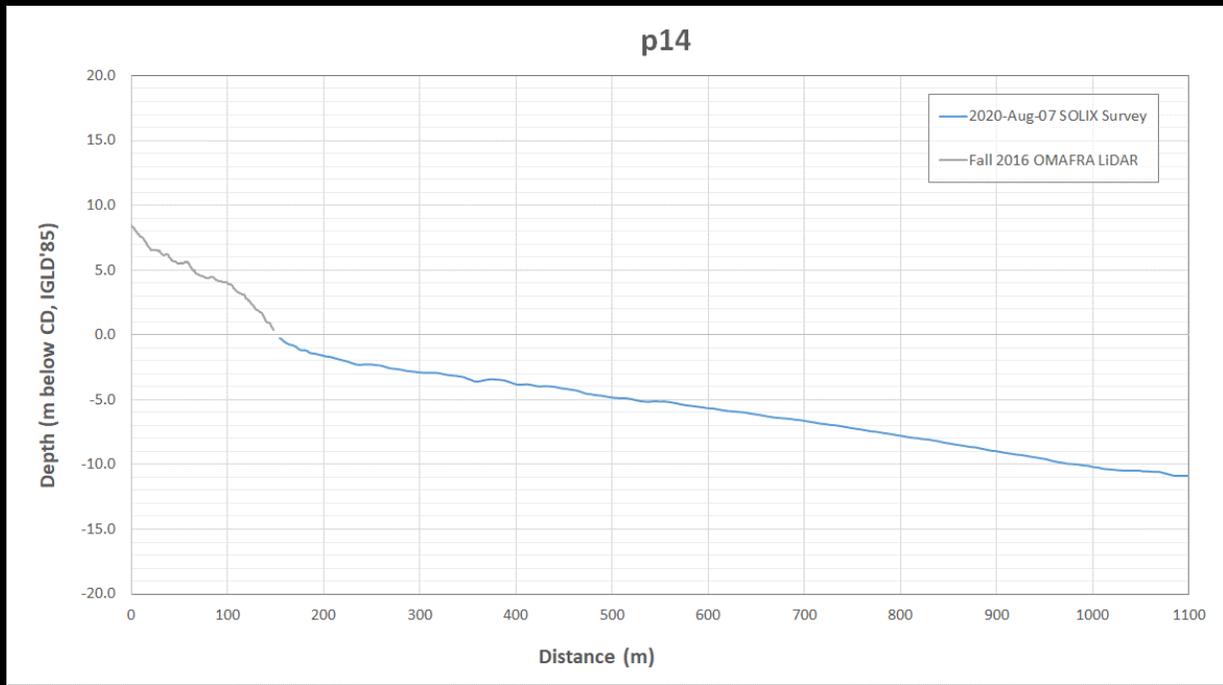


Cedar Crest Beach (Profile 13)

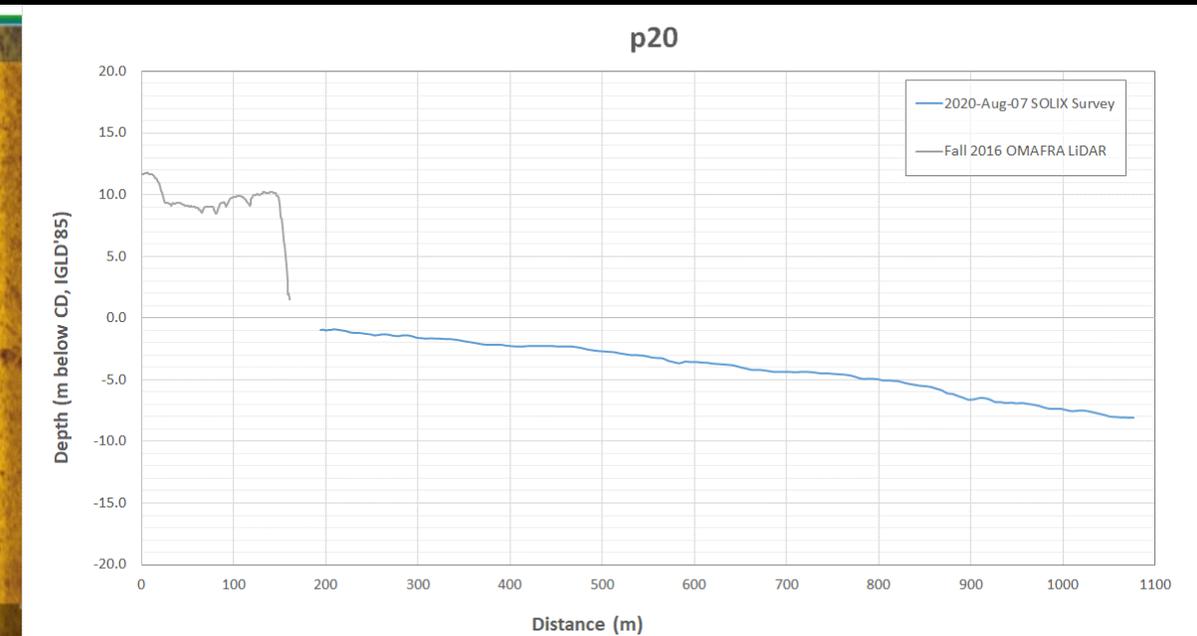
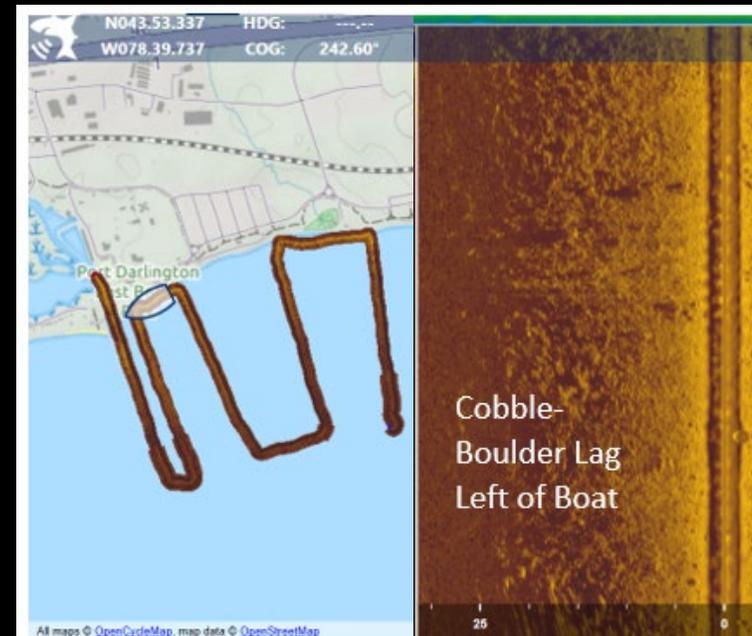




West Beach Profile 14



Profile 20 East of Port Darlington





III – NUMERICAL MODELLING OF WAVES AND SEDIMENT TRANSPORT

Three Scenarios:

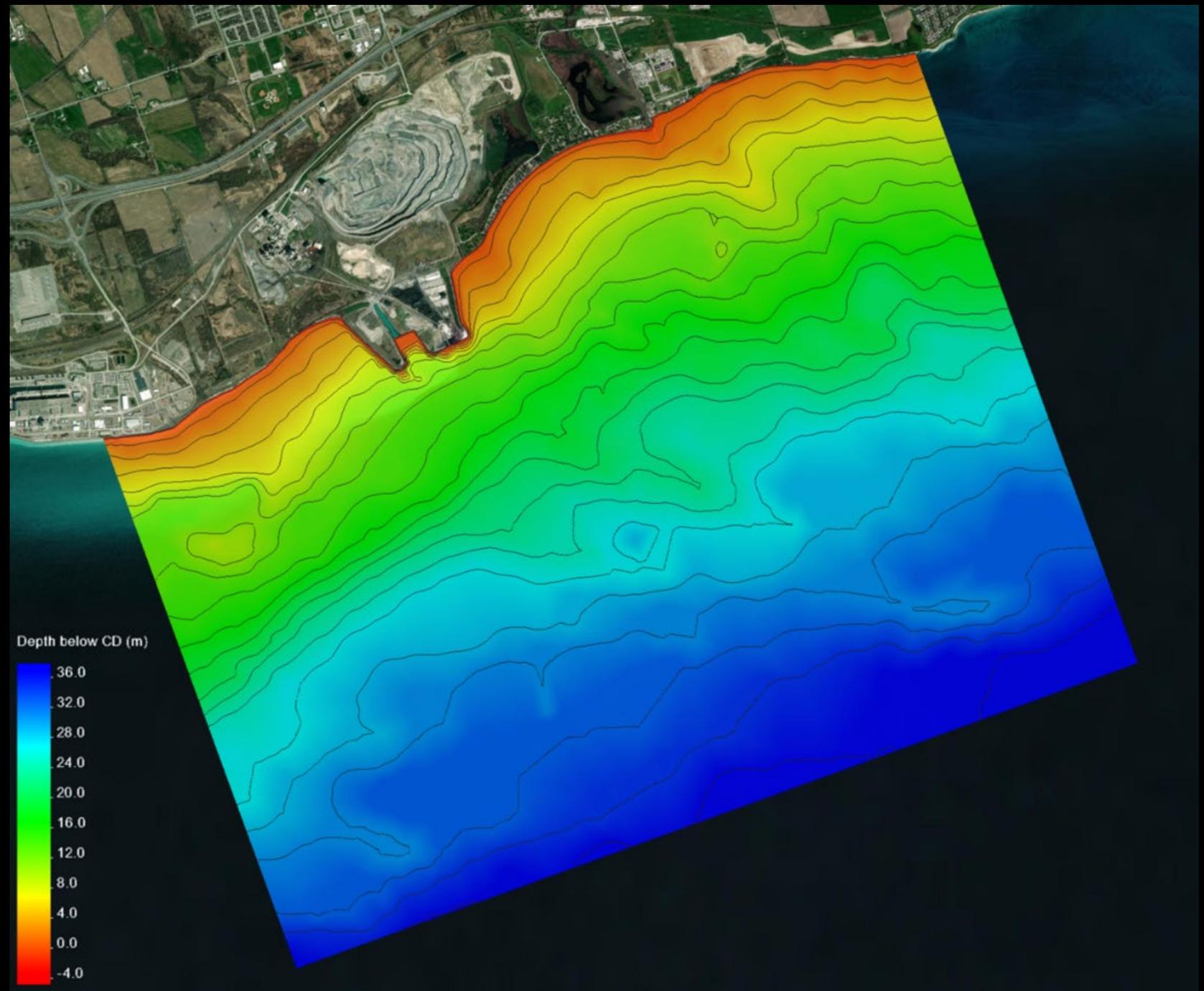
A: Pre-development Natural Shoreline

B: Mid-1800s to 1970 (Port Darlington, no SMC)

C: Post 1970s (present conditions)



Computer Model Domain and Depths (m)





Sediment Transport Capacity for SW Storms

- 1800s: No barriers to trap sediment transport moving west to east
- 1970s: Sediment transport capacity decreases towards the Port Darlington jetties and sand is deposited in West Beach
- Present: Sediment transport capacity decreases towards the SMC Headland and Port Darlington jetties, resulting in sand accumulation in the fillet beaches





Sediment Transport Capacity for ESE Storms

- 1800s: No barriers to trap sediment transport moving from East to West
- 1970s: Without the SMC Headland, currents have the potential to move sediment westward out of the embayment
- Present: SMC Headland traps sediment in the embayment for southeast storms





IV – CONCLUSIONS





Benefits and Impacts of Littoral Barriers

- **BENEFITS:**

- The Port Darlington jetties created West Beach. Without the jetties West Beach would not exist
- The SMC Headland stabilized the eroding bluffs west of Cedar Crest Beach

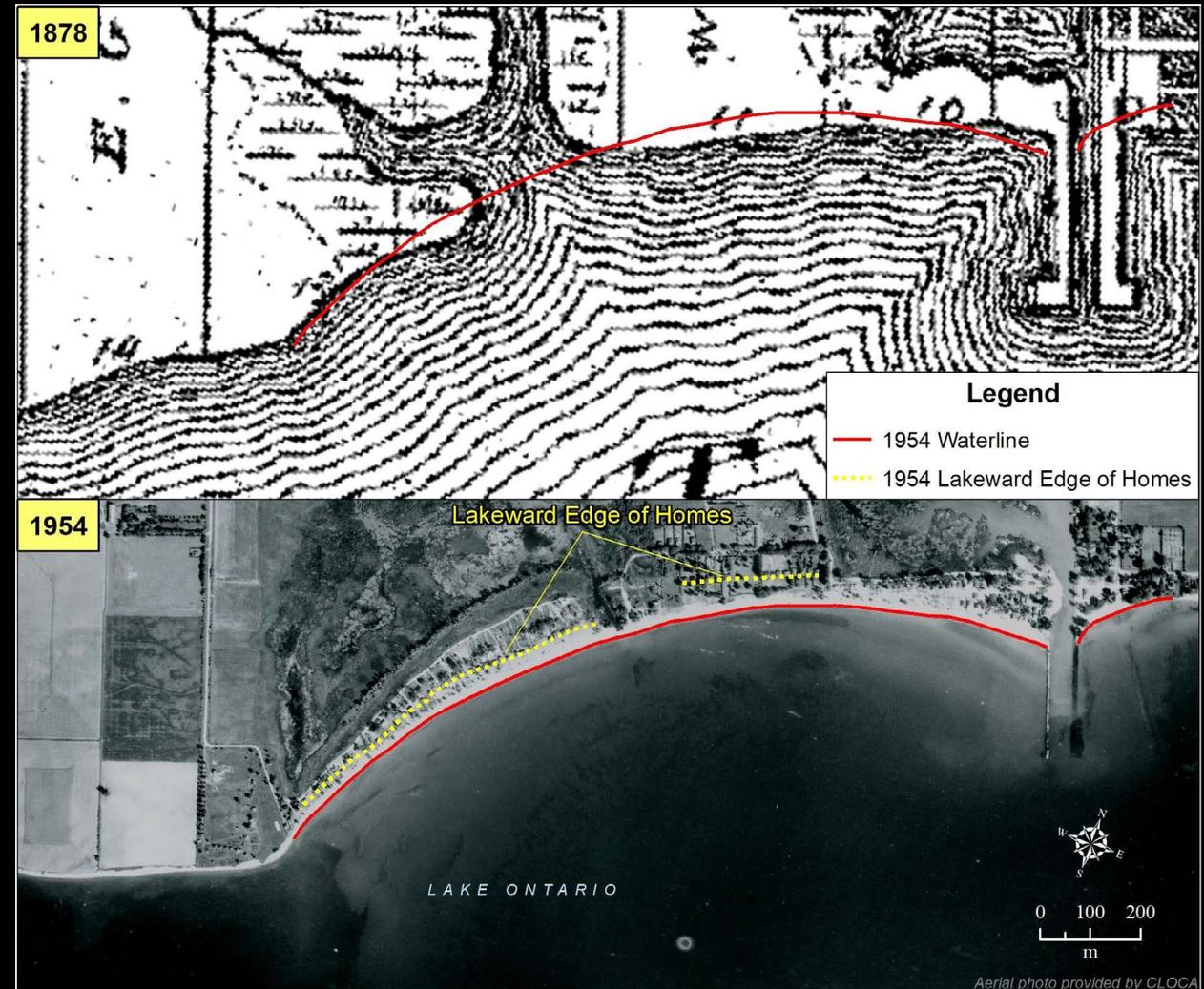
- **IMPACTS**

- The Port Darlington jetties have starved the bluff shoreline to the east of its natural supply of sand and gravel for more than 160 years
- The SMC Headland has reduced the supply of sand and gravel to the Port Darlington West Embayment



Understanding the History

- Pre-1800s, the embayment featured a large inlet (see 1878 map)
- Homes were constructed on top of a dynamic barrier beach and the former inlet
- The homes were constructed closer to the waters edge in the western half of the embayment
- The entire shoreline features a long-term recession trend





Factors Contributing to the Erosion Hazards along Cedar Crest Beach

- A reduction in sediment supply to the Port Darlington West Embayment due to the SMC Headland
- The embayment shoreline features a natural long-term recession rate
- The shoreline orientation is not conducive to the accumulation of sand and gravel
- Homes were constructed too close to the waters edge and on top of a dynamic receding low-lying barrier beach
- Vertical shore-parallel protection was constructed at the waters edge that is not conducive to beach building



Questions

