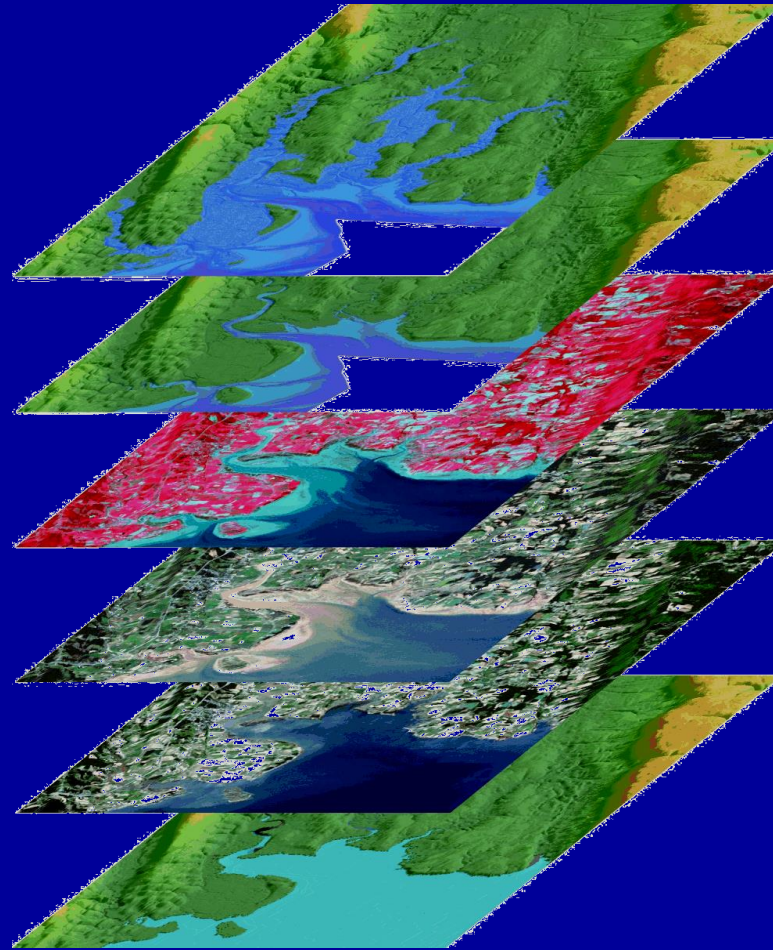


Mapping the High-Water Wrack line from the Dec. 21, 2010 Storm: Tidnish to Gulf Shore (Pugwash) Northumberland Strait



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Cumberland County Storm Surge Dec. 2010



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A vertical strip on the left side of the slide shows a topographic map of a coastal region. The map uses a color gradient from green (low elevation) to yellow and orange (higher elevation) to represent terrain. A blue area at the bottom left indicates the ocean or a large body of water. The map shows a coastline with some inland features.

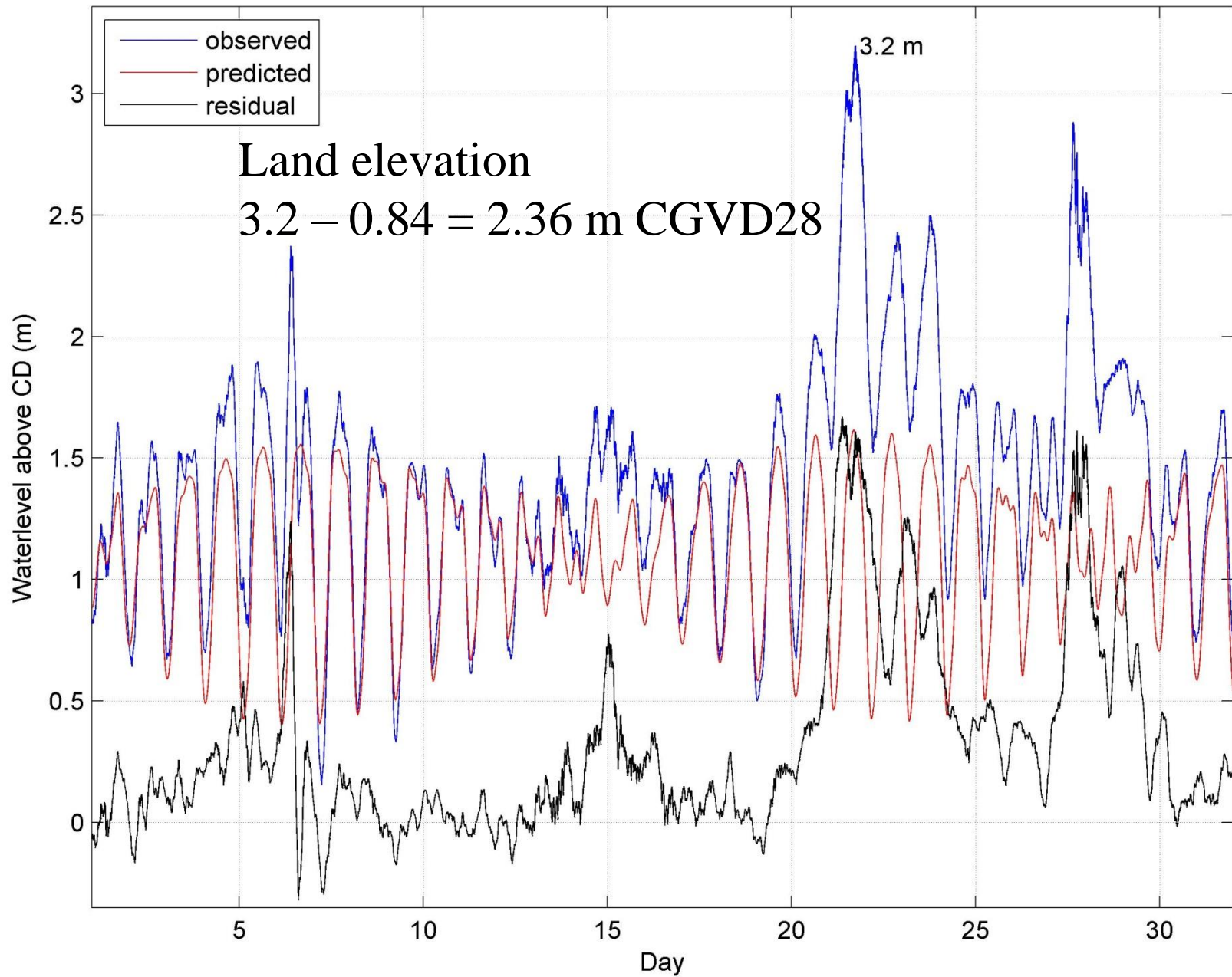
Outline

- Dec. 21 and 28, 2010 significant Nor'easters effected the coast with storm surges
- Limited tide gauge records available (Shediac & Charlottetown)
- Field visit to observe the damage, used RTK GPS to obtain elevation of wrack line (includes waves & storm surge)
- Oblique airphotos to give an appreciation of wrack line inundation & erosion
- Where lidar elevation exists, compared the modelled flood extent to wrack line GPS
- Still water flood risk maps, accurate.

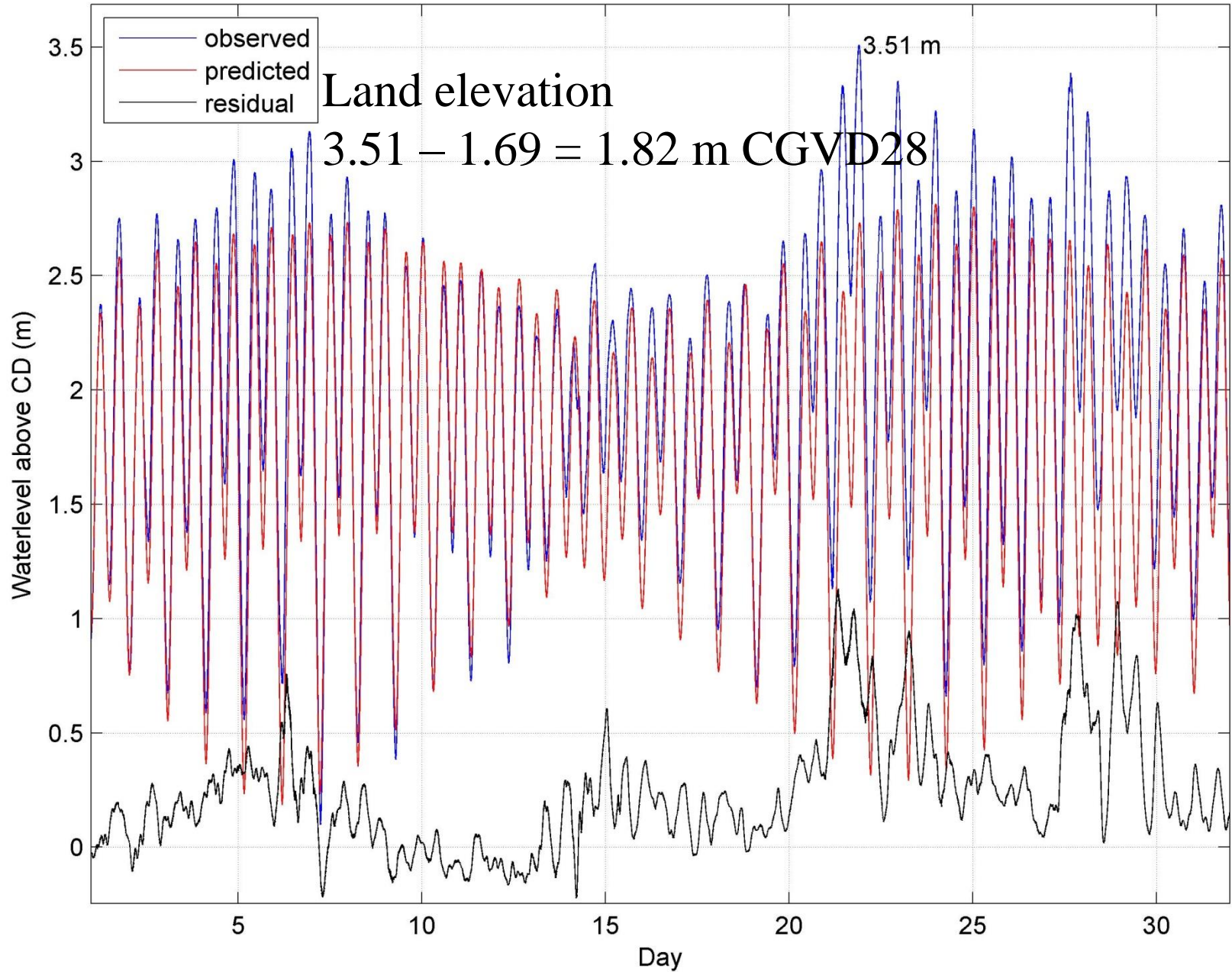
Courtesy of the Amherst Daily News



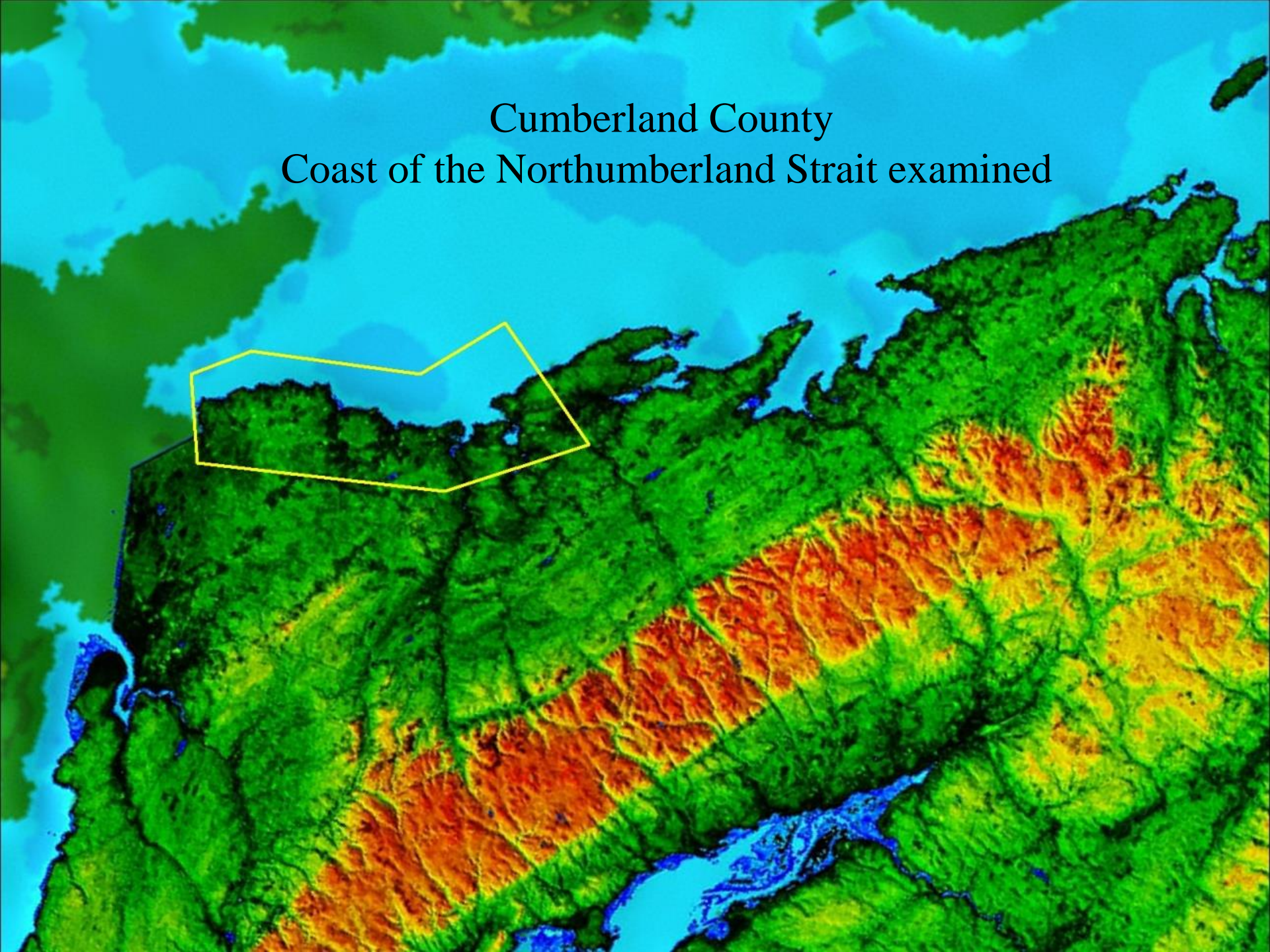
Shediac, Dec 2010



Charlottetown, Dec 2010



Cumberland County
Coast of the Northumberland Strait examined



High-water wrack line measurement Tidnish to Pugwash, Northumberland Strait

Legend

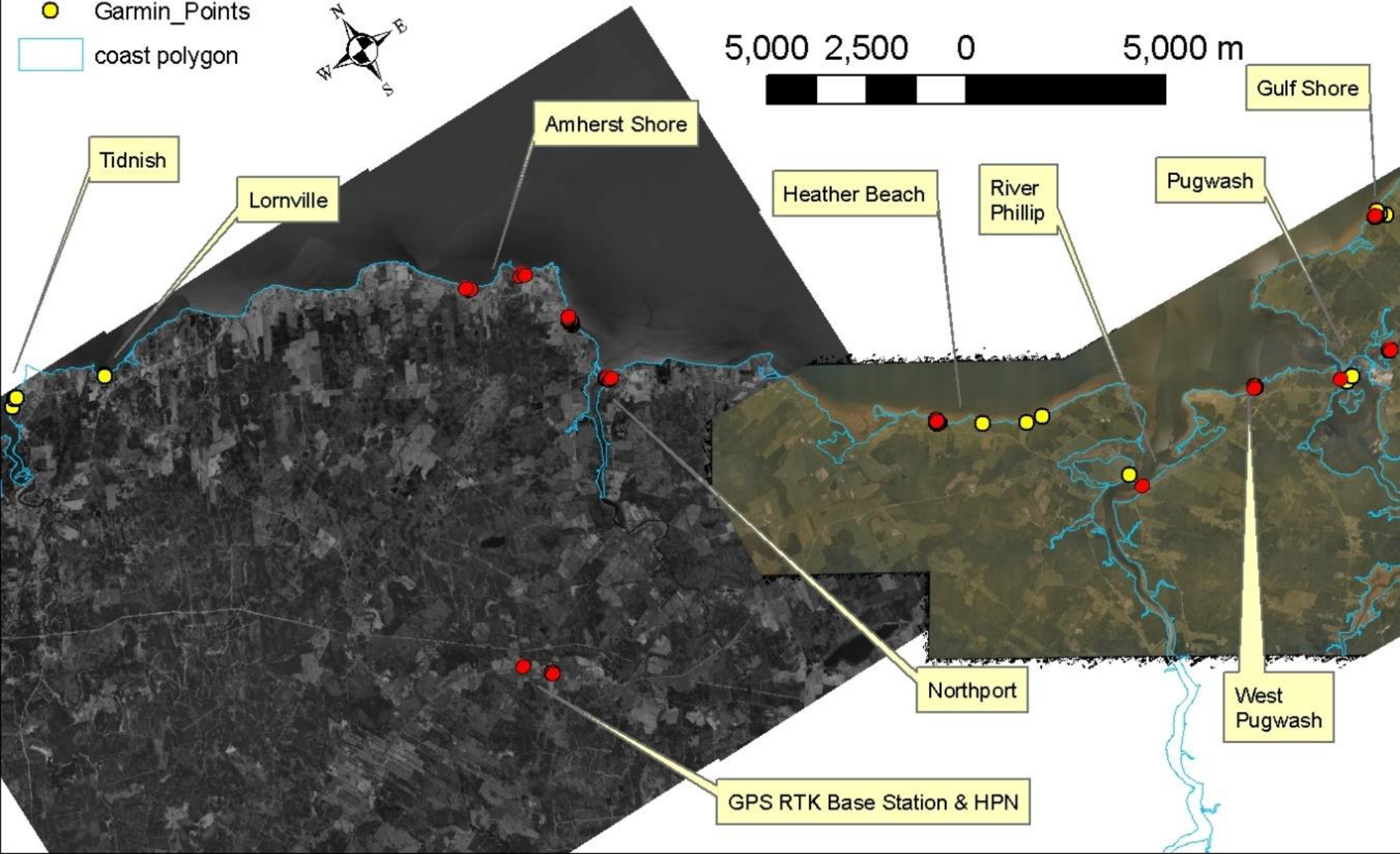
● RTK_wrack_line_Pugwas_Tidnish_Dec21_2010_storm_stdH10cm

● Garmin_Points

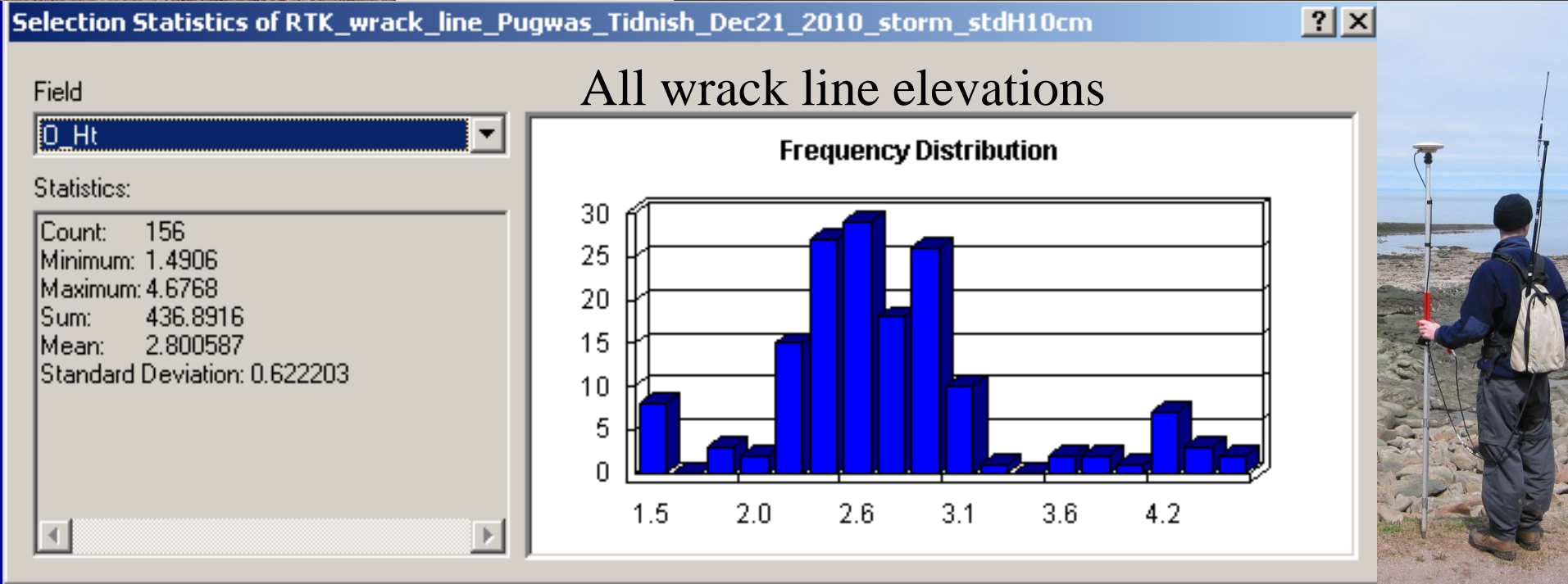
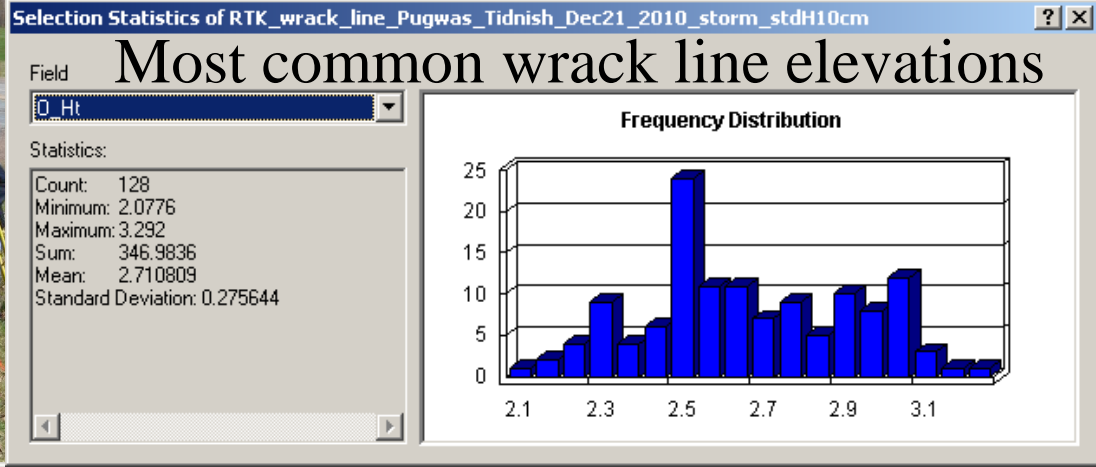
□ coast polygon



5,000 2,500 0 5,000 m



RTK GPS ~ 2 cm



100 50 0 100 m

Tidnish Harbor

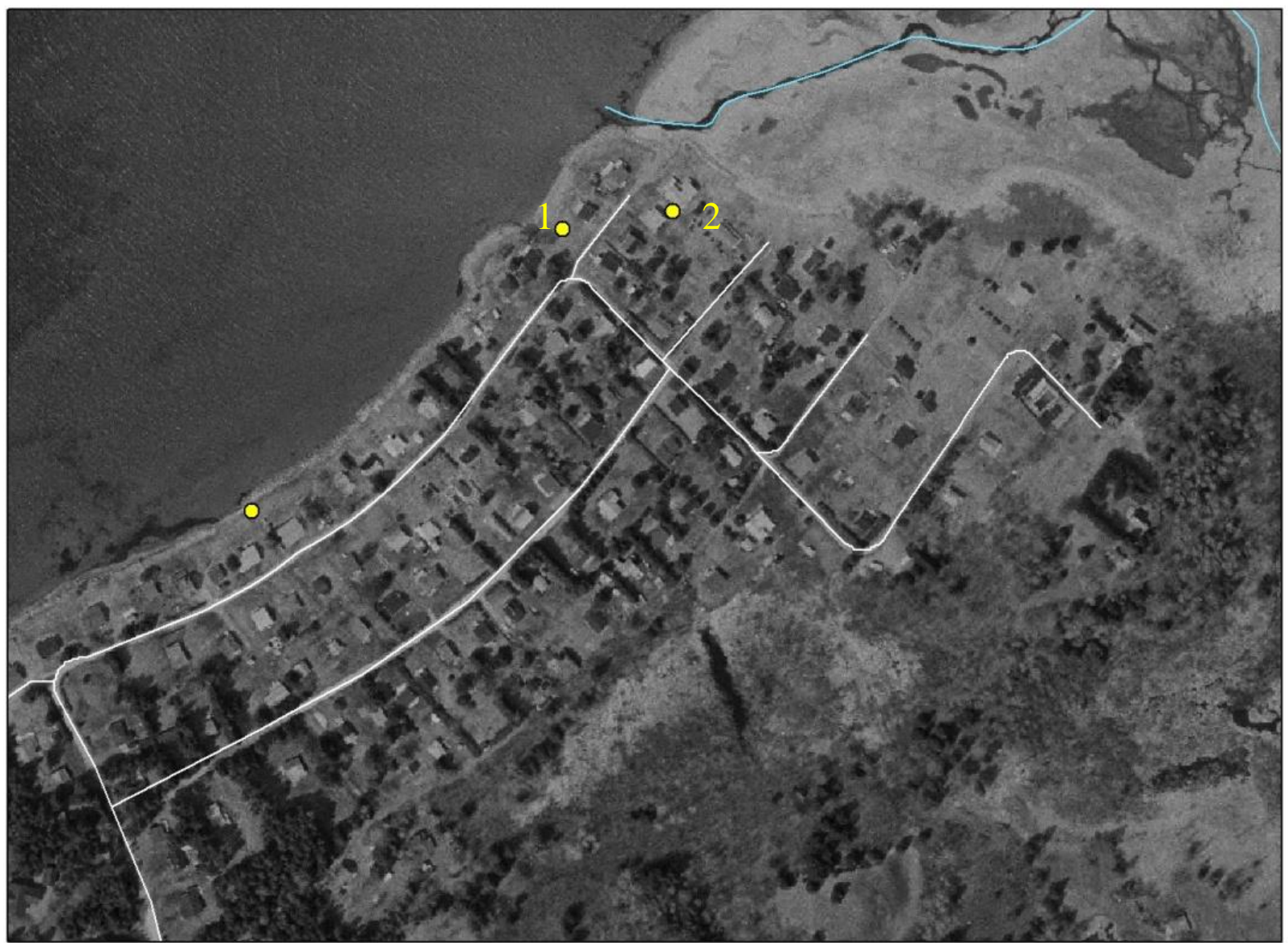


Oblique airphoto
Tidnish



100 50 0 100 m

Tidnish Wrack Line Locations



Jackson Point



Wreck line location 1

Jackson Point

Wreck line continued location 2



Photo © T. Webster



Jackson Point

Photo © T. Webster

Jackson Point



Courtesy of the Amherst Daily News

Courtesy of the Amherst Daily News

Jackson Point



During the flooding

Jackson Point



Courtesy of the Amherst Daily News

100 50 0 100 m

Wrack Line Locations

Tidnish Cross Roads









Photo © T. Webster





Photo © T. Webster



Photo © T. Webster

100 50 0 100m



Amherst Shore Wrack Line



2.60 m CGVD28 Stdev 4 cm

Amherst Shore Vertical



Ground
photos

West side of marsh



Amherst Shore
ground photos



East side of marsh

Photo © T. Webster



Photo © T. Webster

100 50 0 100 m

Wrack Line & Erosion Locations

Annabelles Brook





Annabelles Brook



Variable shoreline protection methods

Photo © T. Webster





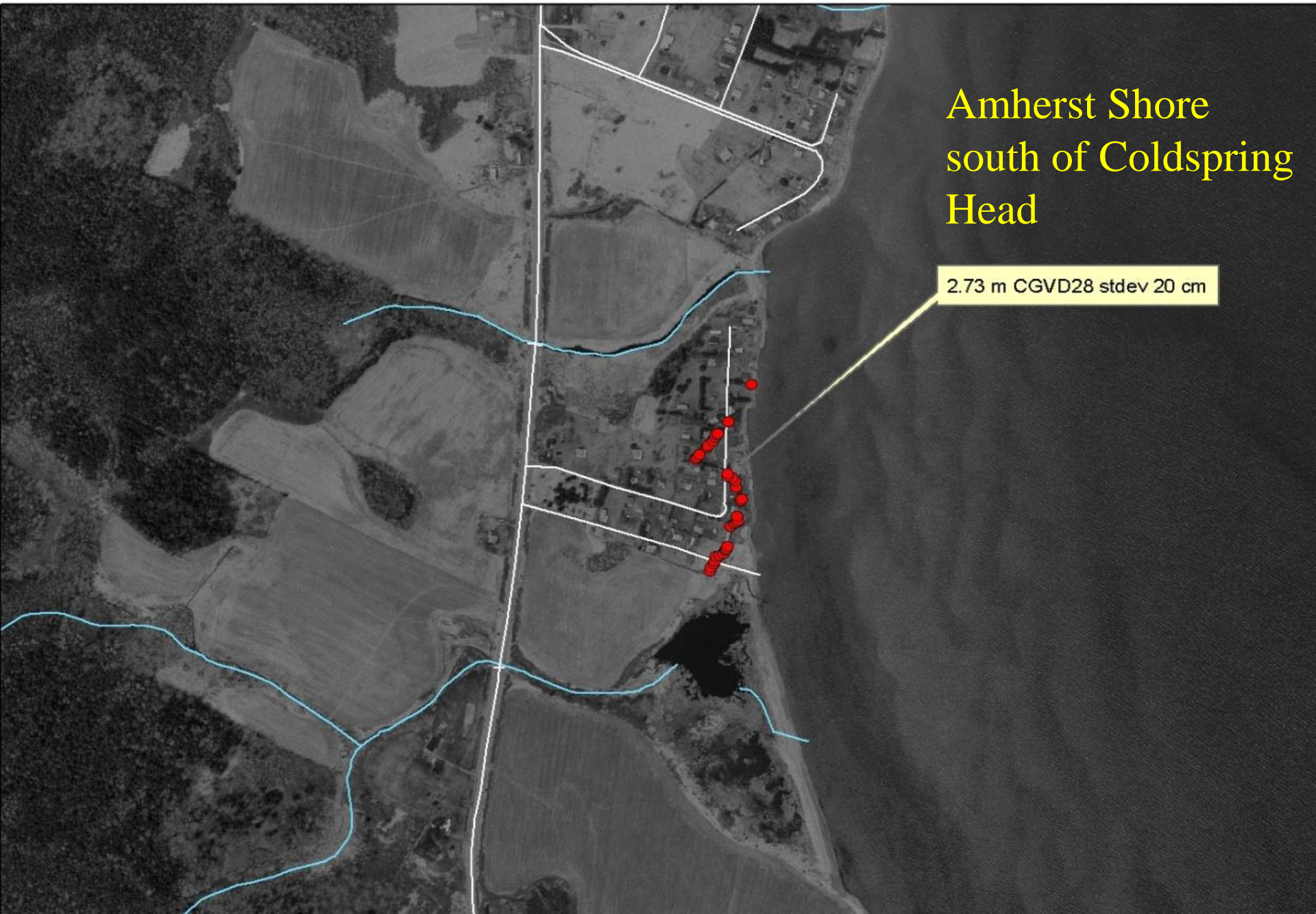
210 105 0 210 m

Amherst Shore Wrack Line Locations



Amherst Shore
south of Coldspring
Head

2.73 m CGVD28 stdev 20 cm



Oblique airphotos





Photo © T. Webster



Ground photos





Cottage undermined



80 40 0 80 m

Northport Wrack Line Locations





Photo © T. Webster



Photo © T. Webster



Photo © T. Webster

Courtesy of the Amherst Daily News





Photo © T. Webster

Ground photos



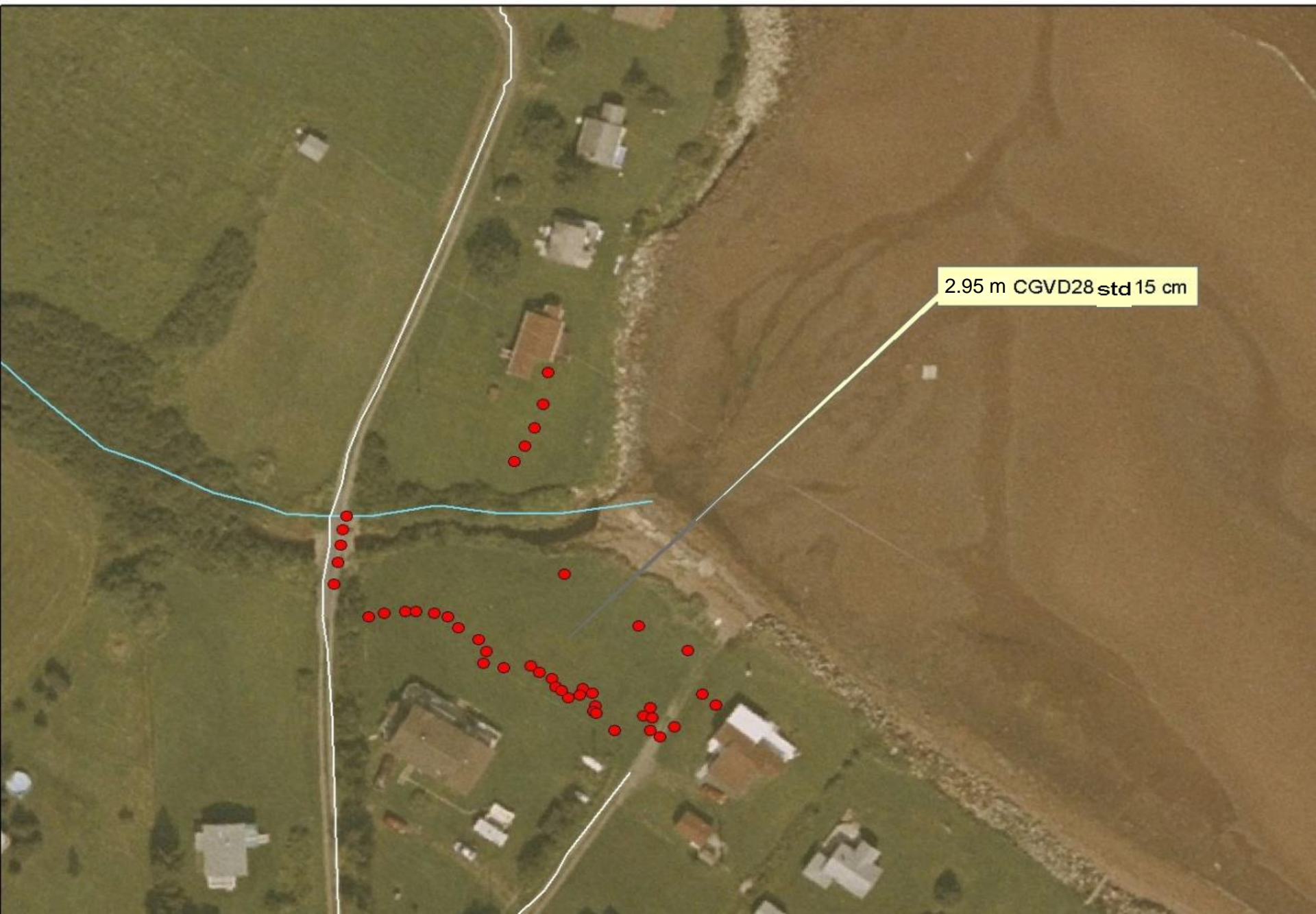
Photo © T. Webster



Photo © T. Webster

30 15 0 30 m

Wild Rose Land Wrack Line & Erosion Locations



2.95 m CGVD28 std 15 cm



Photo © T. Webster



Photo © T. Webster



Photo © T. Webster



Photo © T. Webster



Photo © T. Webster

Heather Beach

50 25 0 50 m





Photo © T. Webster



Photo © T. Webster



Photo © T. Webster

Heather Beach Provincial Park Parking Lot





Photo © T. Webster



Photo © T. Webster



Photo © T. Webster

50 25 0 50 m

River Phillip Wrack Line Locations



50 25 0 50 m

River Phillip Wrack Line Locations





Photo © T. Webster

Pugwash

Millar Road



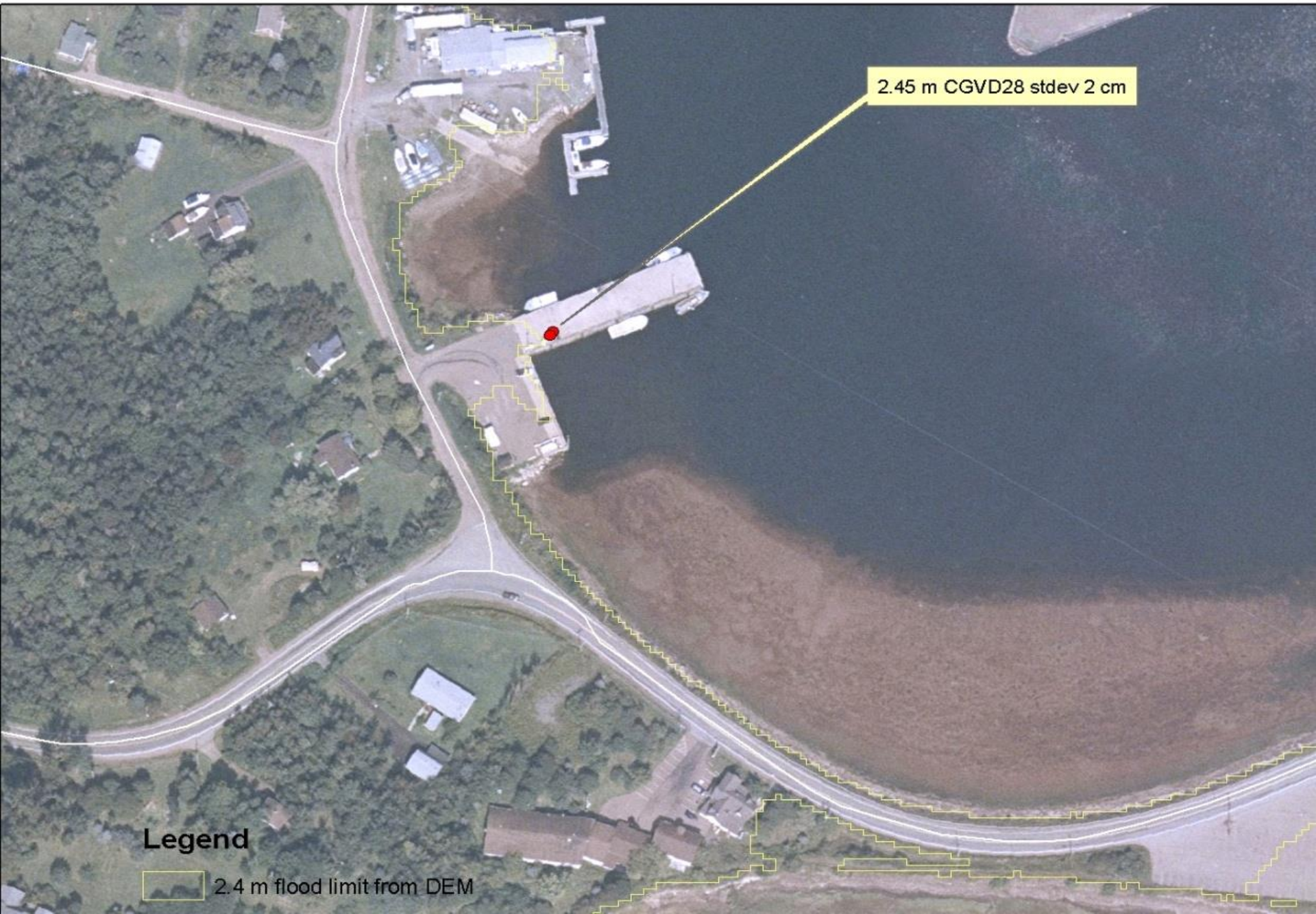
Fisherman's Wharf




50 25 0 50 m



Fisherman's Wharf deck

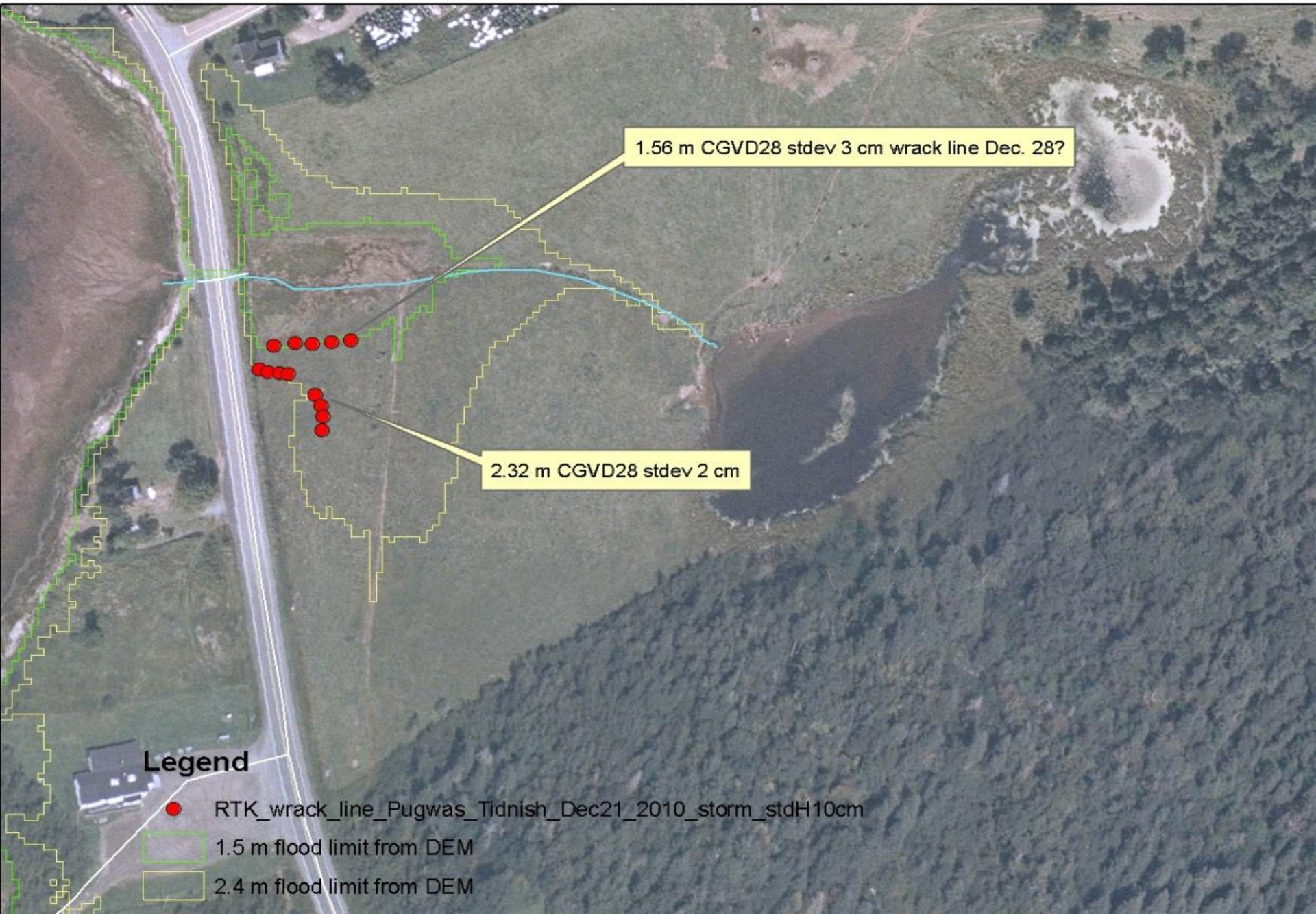


Legend

 2.4 m flood limit from DEM

50 25 0 50 m

Miller Road still water wrack line



Culvert connecting the ocean



Photo © T. Webster

Max. of the 2 wrack lines present



50 25 0 50 m

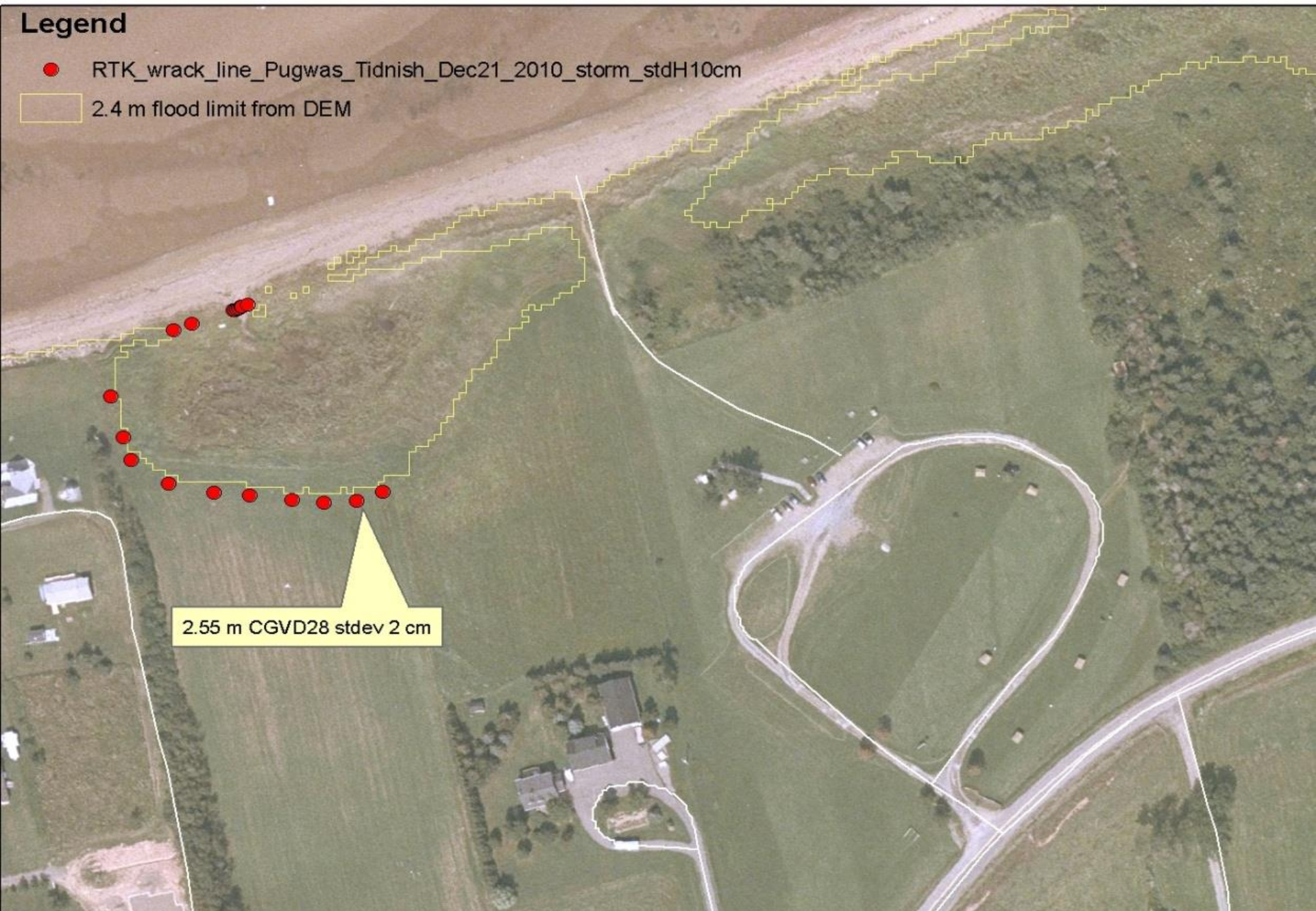


Gulf Shore Park wrack line

Legend

● RTK_wrack_line_Pugwas_Tidnish_Dec21_2010_storm_stdH10cm

□ 2.4 m flood limit from DEM



2.55 m CGVD28 stdev 2 cm

Gulf Shore Provincial Park



Photo © T. Webster

Oblique photo of wrack line



New channel cross-section



Photo © T. Webster



Photo © T. Webster



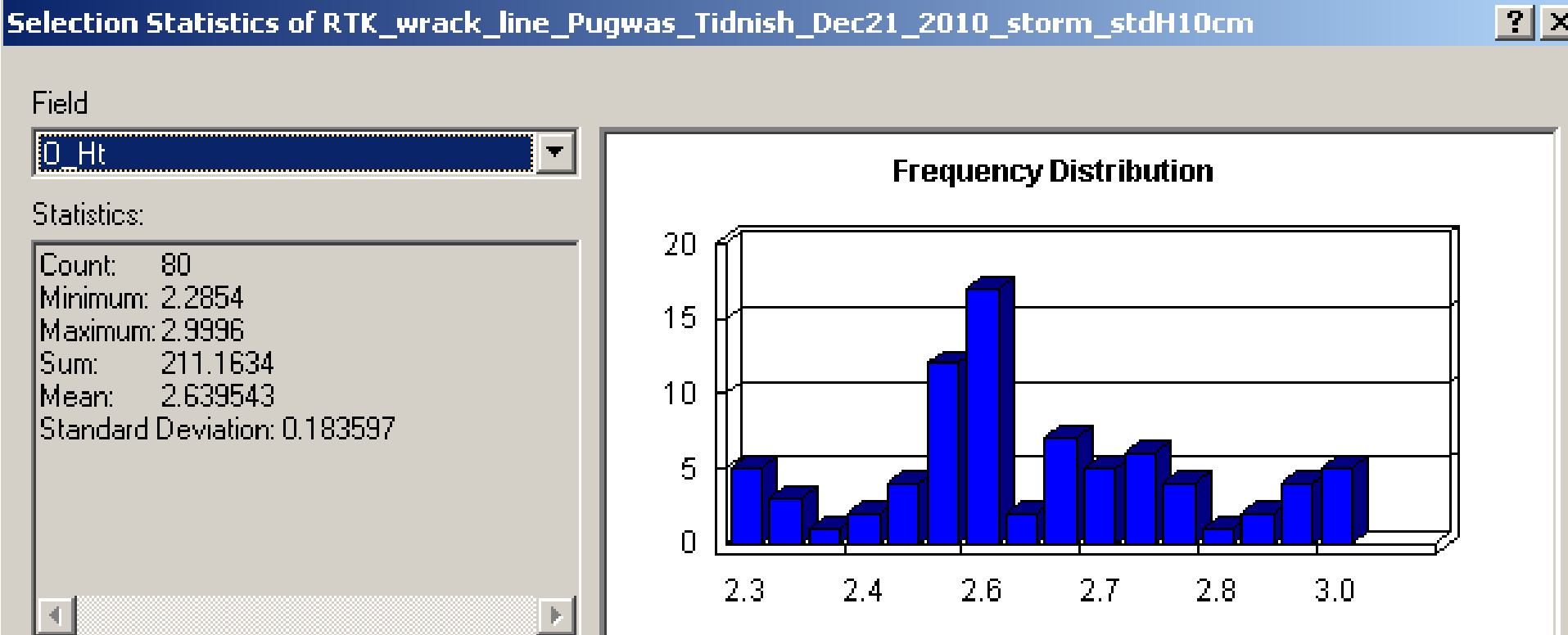
Photo © T. Webster

Provincial park infrastructure



Best estimate of still water level:
2.6 m
with wave action:
debris up 4.5

Tide gauge at
Cape John 2.2 m
Wrack line 2.4 m



Conclusions

- Dec 21 2010 Nor'easter significant damage to north and east face coasts
- Effect of variable shoreline protection structures is very evident (promote armouring)
- Combination of ground visit, oblique air photos & RTK GPS to document the damage
- Lidar with flood layers in agreement with still water wrack line elevations
- Benchmark storm for future sea-level rise conditions under climate change

