



Highway 101 Twinning and Avon River Aboiteau and Causeway

Project Update for Community Liaison Committee
June 19, 2019

Overview

1. General Update
2. Highway 101 Twinning Construction Update
3. Archaeological Program Update
4. Update on the Design of the Avon River Aboiteau and Causeway Upgrading
 - Recap of Aboiteau/Causeway Design
 - Update on Geotechnical Program
 - Update on Phase 2 Design Development
5. Questions / Discussion

General Project Update

General Project Update

Project Funding:

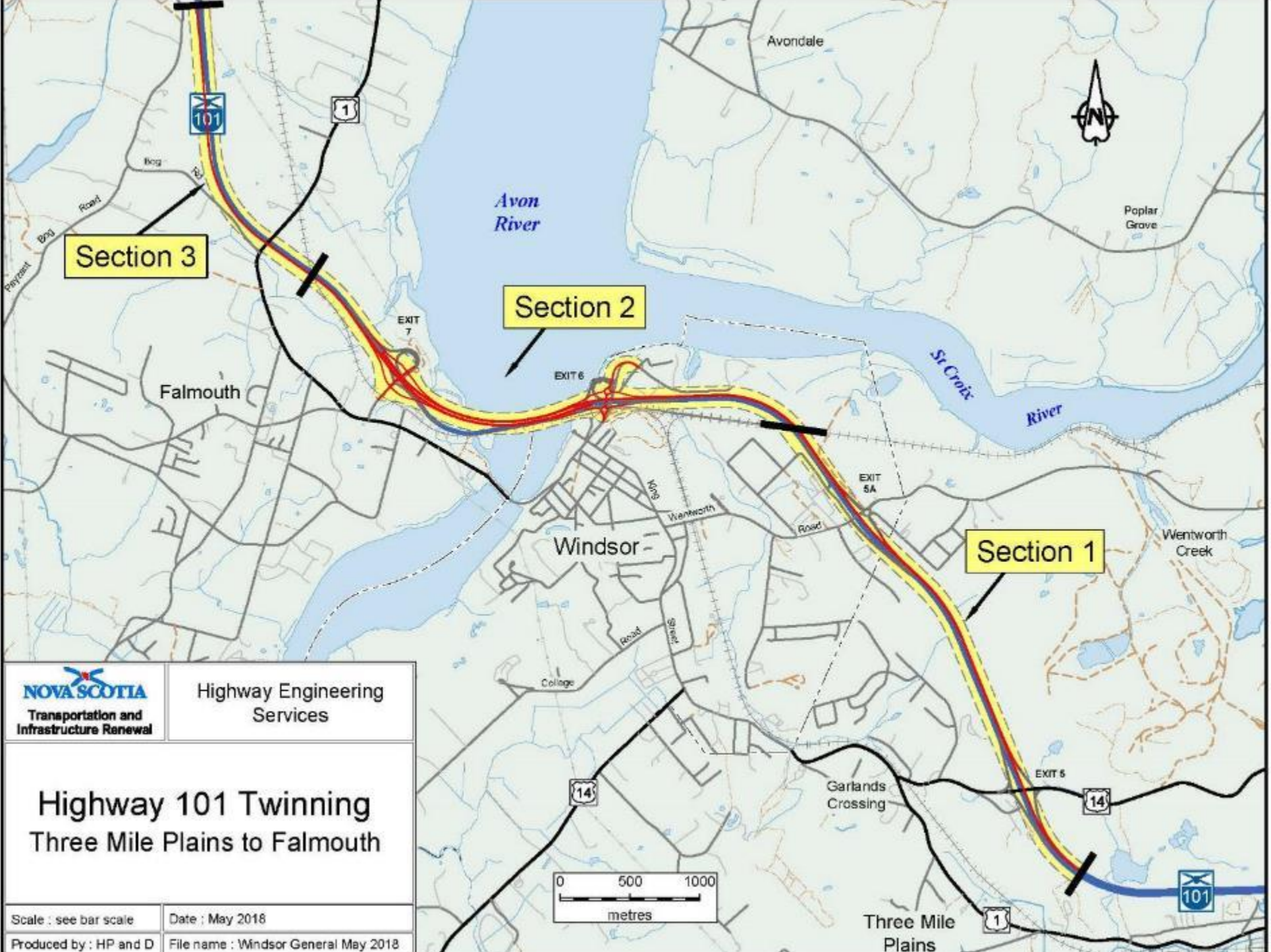
- In April the Federal Government announced \$32 million in Federal funding under the Disaster Mitigation & Adaptation Fund (DMAF) for the Avon River Aboiteau, Causeway and other improvements to the surrounding dyke system.
- This investment will help strengthen the resilience of the dyke system and reduce risks to public safety by protecting the Town of Windsor, Falmouth and surrounding areas from Bay of Fundy coastal flooding.

General Project Update

Project Timelines:

- Overall a 5-year project with completion currently planned by Fall 2022 (currently in year 2 of 5)
- Area between the Windsor Railway and Falmouth Railway crossings (Section 2) will be completed in years 3 to 5 (including the Avon River Aboiteau, Causeway, Interchanges)
- Partial infilling for the widening of the causeway is planned to begin later this summer as it will require time for consolidation (settlement) due to soft sediments in the salt marsh

Highway 101 Twinning Construction Update



NOVA SCOTIA
Transportation and
Infrastructure Renewal

Highway Engineering
Services

Highway 101 Twinning Three Mile Plains to Falmouth

Scale : see bar scale

Date : May 2018

Produced by : HP and D

File name : Windsor General May 2018

Highway 101 Twinning Update

Work Completed to Date:

- **Subgrade** for Section 1: Highway 101 westbound lanes, from Trunk 14 (Exit 5) to the Windsor Railway Overpass – 3.4 km
 - Excavation and fill placement (earthworks)
 - Drainage work & initial erosion/sedimentation controls
- **Bridge Structures** at Exit 5 (Trunk 14) and Exit 5A (Wentworth Road) for new westbound lanes
 - Piles, abutments, and girders installations

Highway 101 Twinning Update

Work Scheduled for 2019:

- Completion of Section 1 subgrade including drainage works, final excavation/placement, grading, gravels & site stabilization
- Completion of Exit 5 (Trunk 14) & Exit 5A (Wentworth Road) structures including bridge decks, barrier walls, approach slabs, crash blocks and final site clean-ups and stabilization

Highway 101 Twinning Update

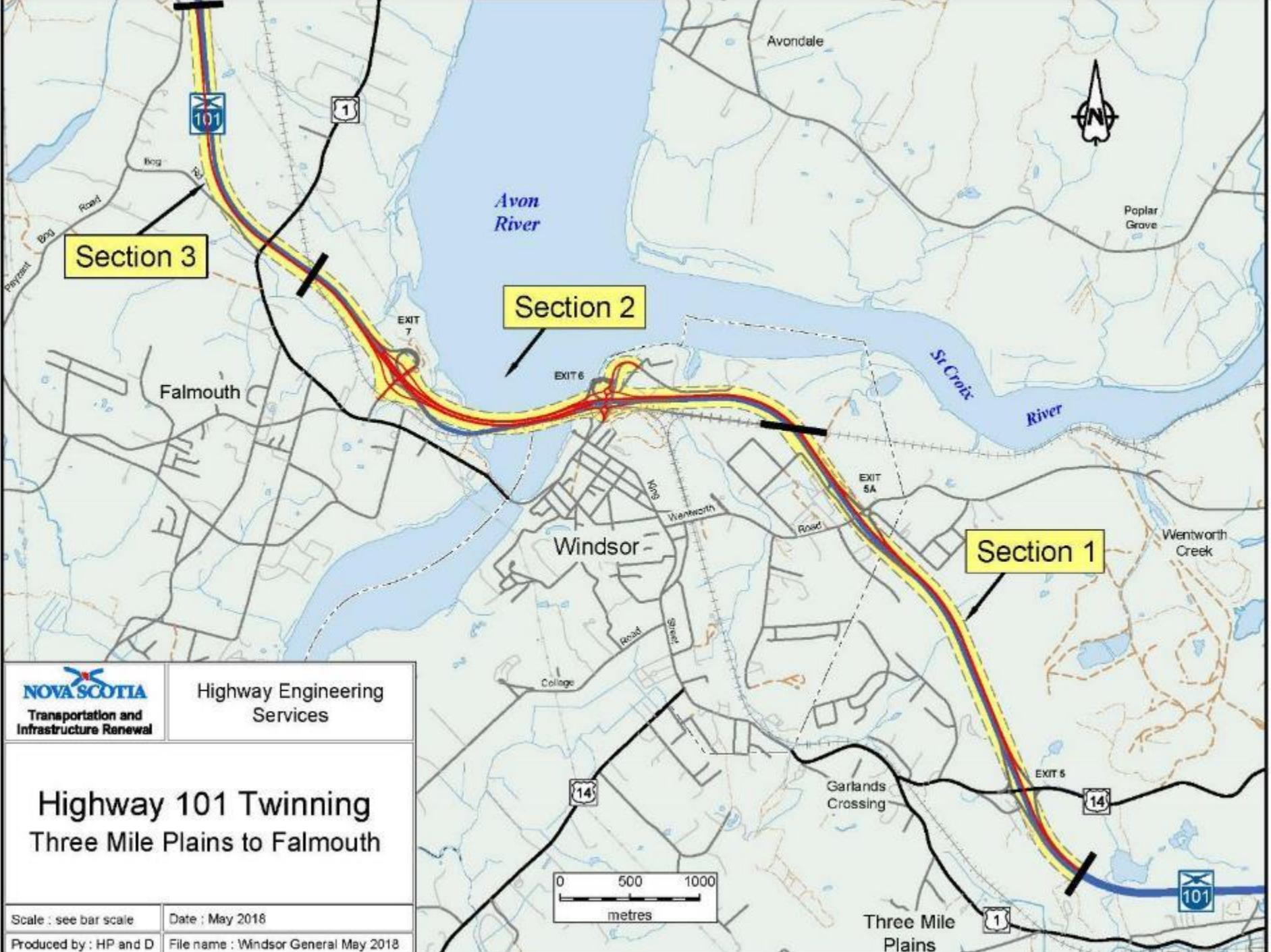
Work Scheduled for 2019:

- **Subgrade** for Section 3: Highway 101 eastbound lanes, from Falmouth Railway Overpass to Existing Twinning –2.4 km
 - Excavation and fill placement (earthworks), drainage works, grading of subgrade
 - Watercourse realignment
 - Base gravels and final site stabilization
- **Bridge Structures** at Trunk 1 and Falmouth Railway Overpasses
 - Bridge foundations (pile installation, abutments)
 - Girders, bridge deck, barrier walls, approach slabs, approach gravels, final site stabilization & securement

Highway 101 Twinning Update

Future Contracts (2019):

- Section 1 Paving:
 - Completion of gravels, paving, signage, guardrail, etc.
- Windsor Railway Overpass Structure
- Initial Causeway Widening
 - Infilling/surcharging for new westbound lanes along causeway and dyke system



Highway Engineering
Services

Highway 101 Twinning Three Mile Plains to Falmouth

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Archaeological Program

Figure 1

Falmouth

**Retain existing
structure**

**New
bridges**

**3 x 3
lanes**

**Windsor
Salt Marsh**



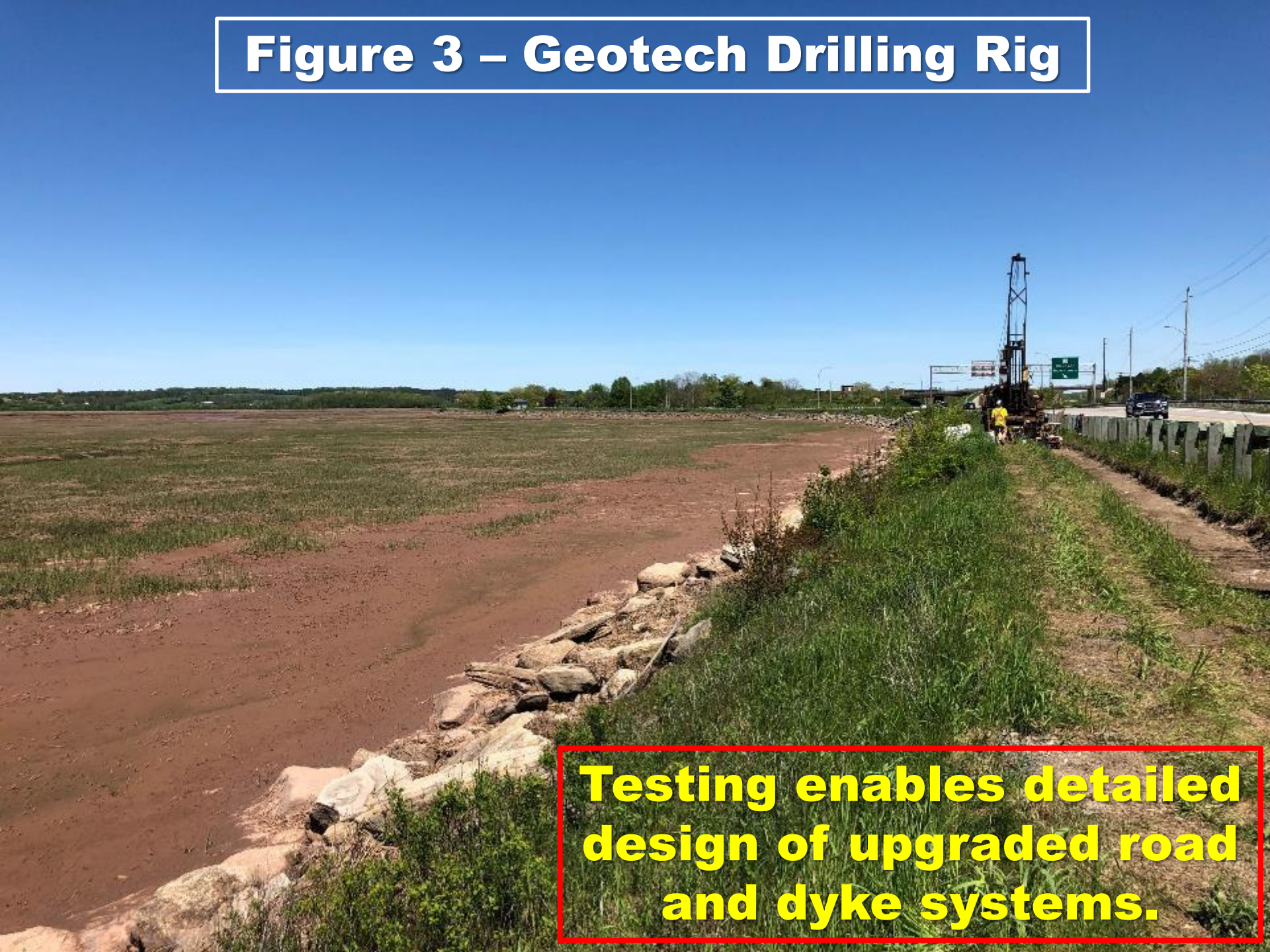
Figure 2 – Additional Archaeology Investigation

Archaeological Resource Impact Assessment (ARIA) and Shovel Testing on the Avon River Banks



NSTIR engaged *Davis MacIntyre & Associates*

Figure 3 – Geotech Drilling Rig



Testing enables detailed design of upgraded road and dyke systems.

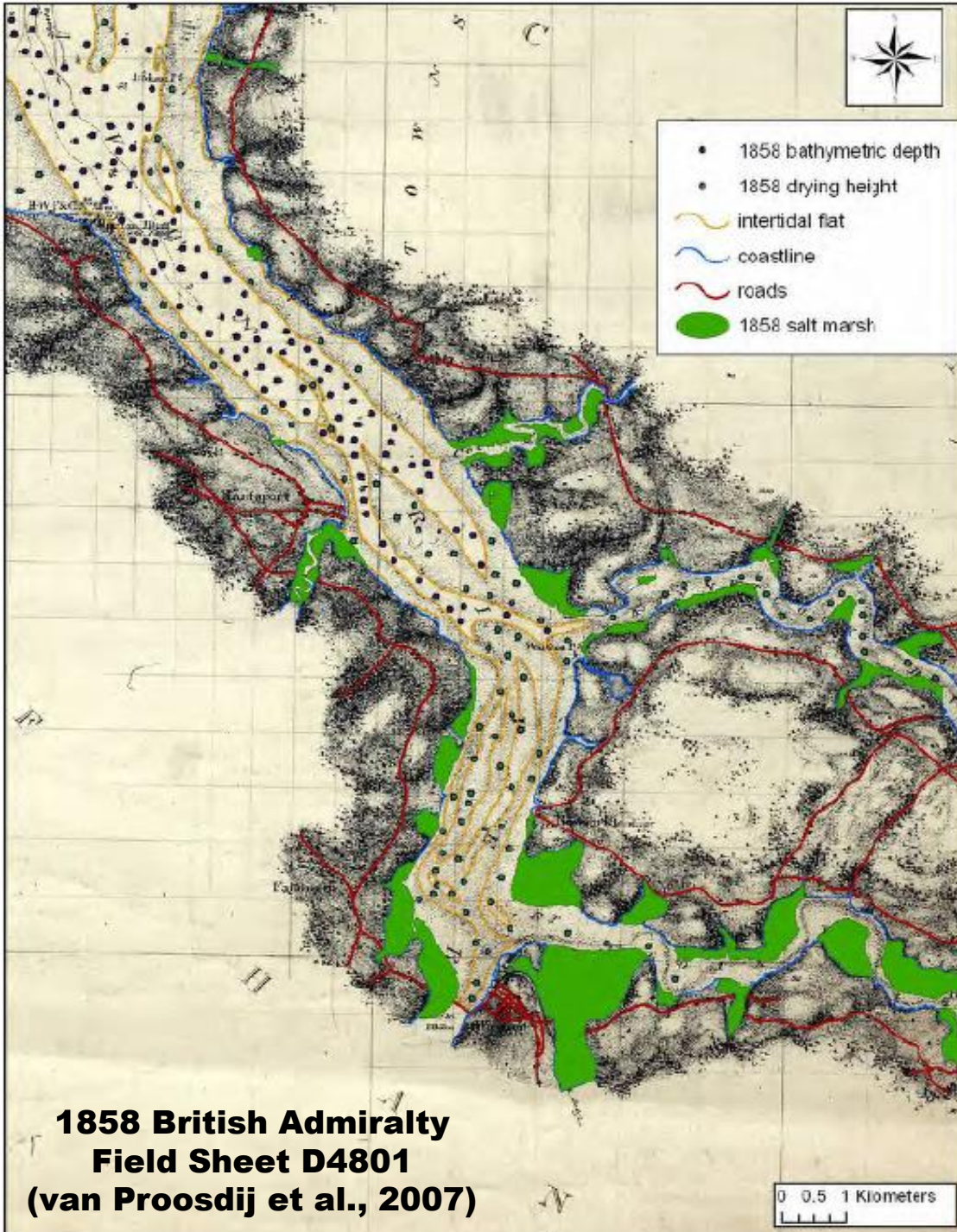


Figure 4

Where are the old shorelines prior to dyke construction & salt marsh loss, and hence historic use & occupation ?

**Recent history –
Upland areas at
Dimock Point and
'Elderkin' Point**

Figure 5

Winter 1963

Upland

Upland

**(Photo by C.A. Banks; see
van Proosdij et al., 2007)**



Figure 6 – Pre-Contact History of Mi'kmaq

Table 1: Mi'kmaw/Archaeological Cultural Periods

Mi'kmaw Period	Archaeological Period	Years
Sa'qiwe'k L'nu'k (the Ancient People)	Paleo-Indian	11,500 – 9,000 BP End of glacial period
Mu Awsami Kejikawe'k L'nu'k (the Not so Recent People)	Archaic	9,000 –3,000 BP Minas Basin forms
Kejikawe'k L'nu'k (the Recent People)	Woodland/Ceramic Period	3,000 –500 BP
Kiskukewe'k L'nu'k (Today's People)	Contact	500 BP – present

Figure 7 – De-Glaciation ~13,000 years ago

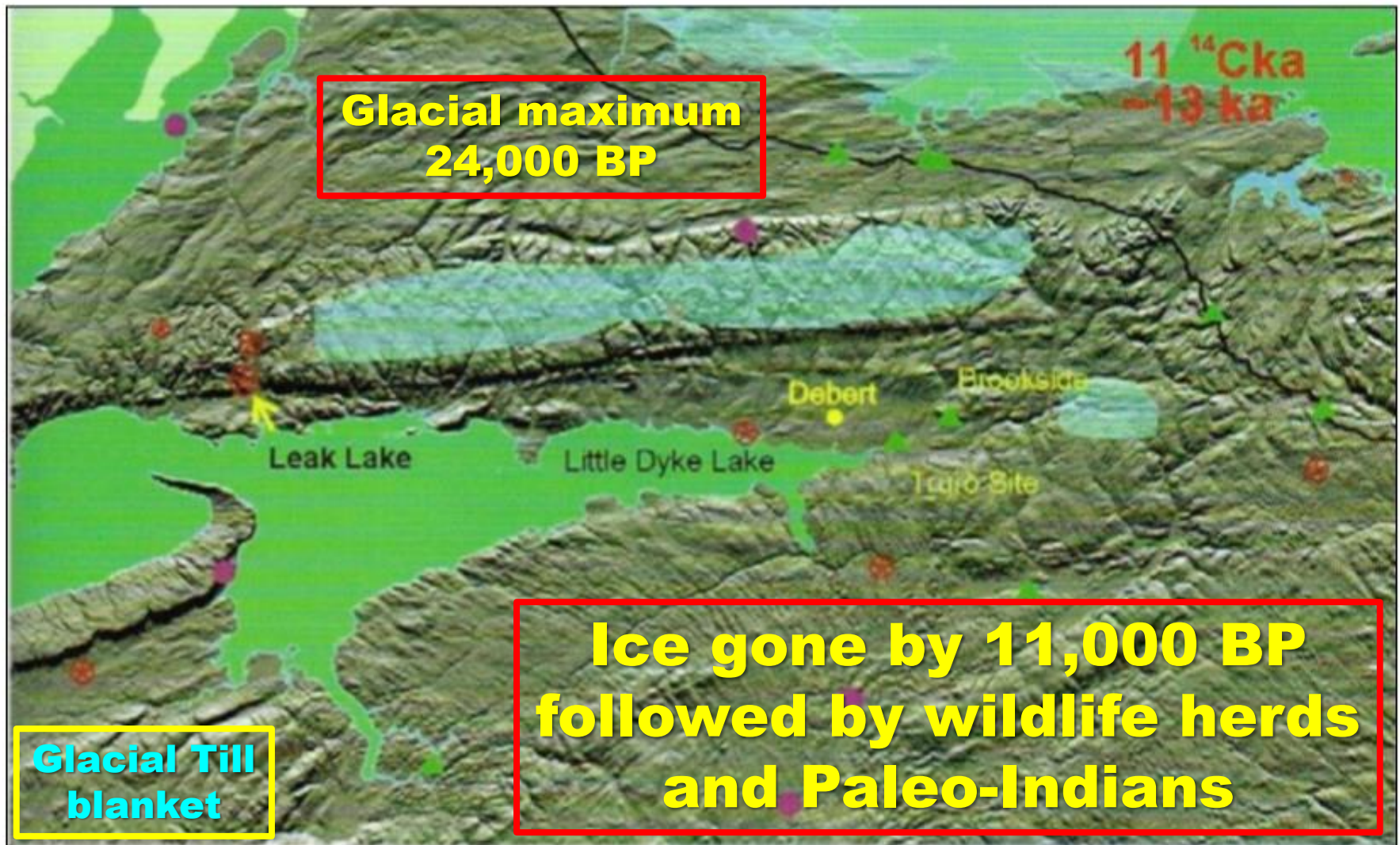


Figure 2.1-2: Deglaciation of the Minas Basin region showing the ice caps (light blue) and former land areas (green) against the current topography at the temporal margin of the Allerød and Younger Dryas periods.²⁹ (Stea, 2005)

Figure 8 – De-Glaciation ~12,600 years ago

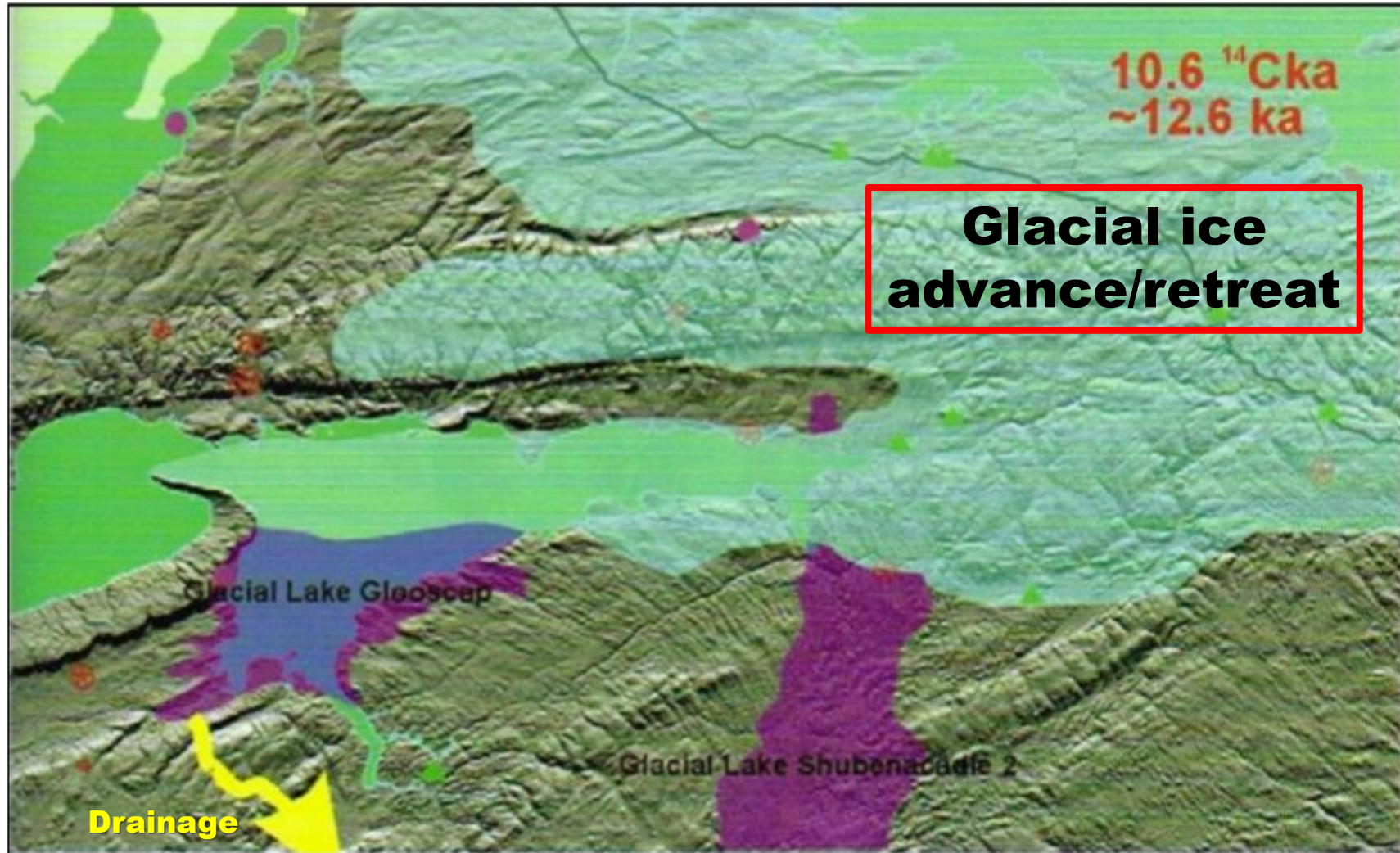
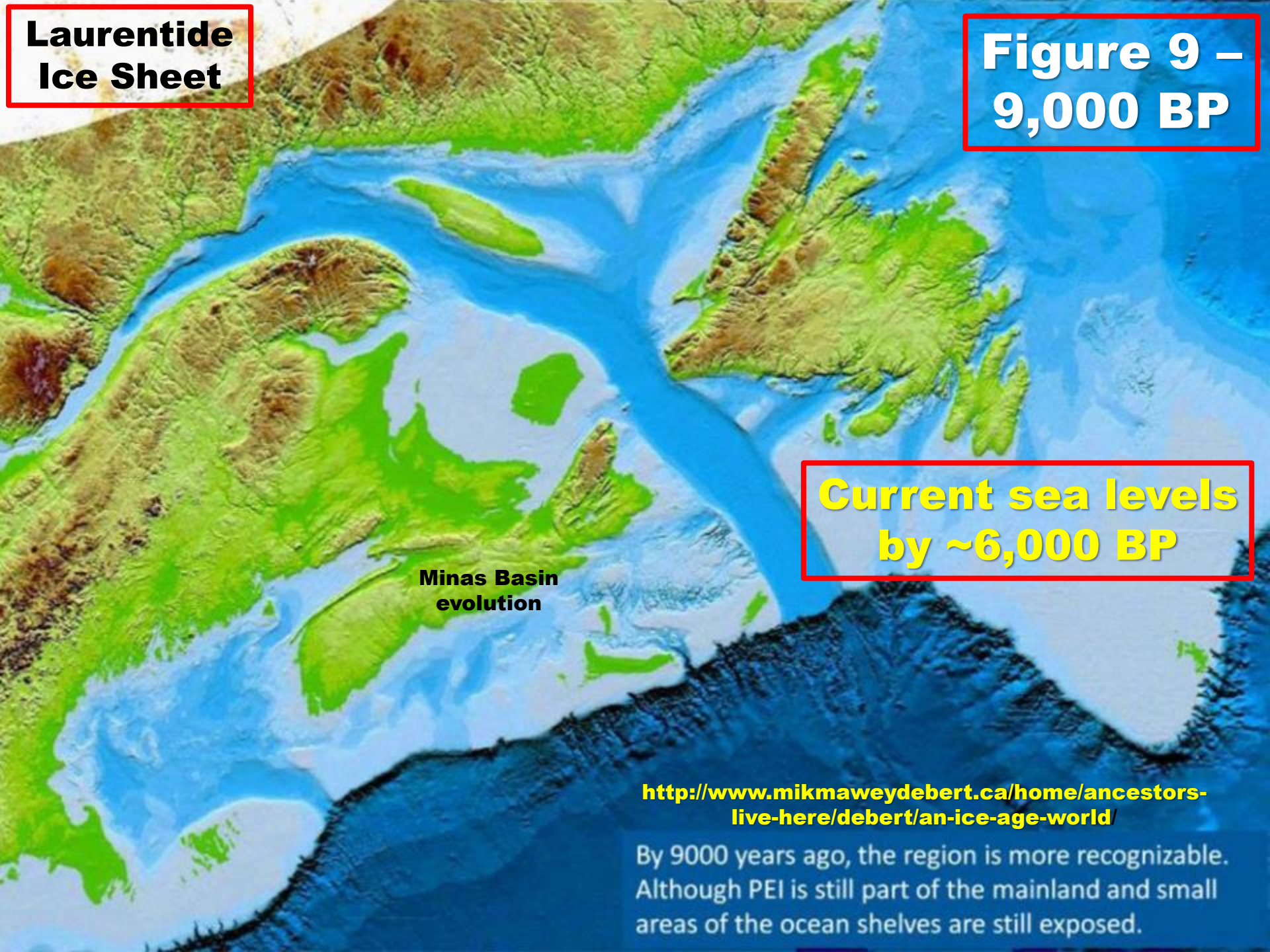


Figure 2.1-3: Deglaciation of the Minas Basin region showing the ice caps (light blue), formation of glacial lakes (purple) and ocean (dark blue), and former land areas (green) against the current topography during the Younger Dryas cooling event.³⁰ (Stea, 2005)

Laurentide Ice Sheet

A topographic map of the North Atlantic region showing the Laurentide Ice Sheet at 9,000 BP. The ice sheet is depicted in light blue, covering much of the northern landmasses. The surrounding ocean is in various shades of blue, indicating depth. Landmasses are shown in green and brown, representing elevation. The map includes labels for 'Laurentide Ice Sheet', 'Figure 9 - 9,000 BP', 'Current sea levels by ~6,000 BP', 'Minas Basin evolution', and a URL.

**Figure 9 –
9,000 BP**

**Current sea levels
by ~6,000 BP**

**Minas Basin
evolution**

<http://www.mikmaweydebert.ca/home/ancestors-live-here/debert/an-ice-age-world/>

By 9000 years ago, the region is more recognizable. Although PEI is still part of the mainland and small areas of the ocean shelves are still exposed.

Shovel Test & Borehole Units, 2019

Figure 10 – Testing for artifacts & sediments

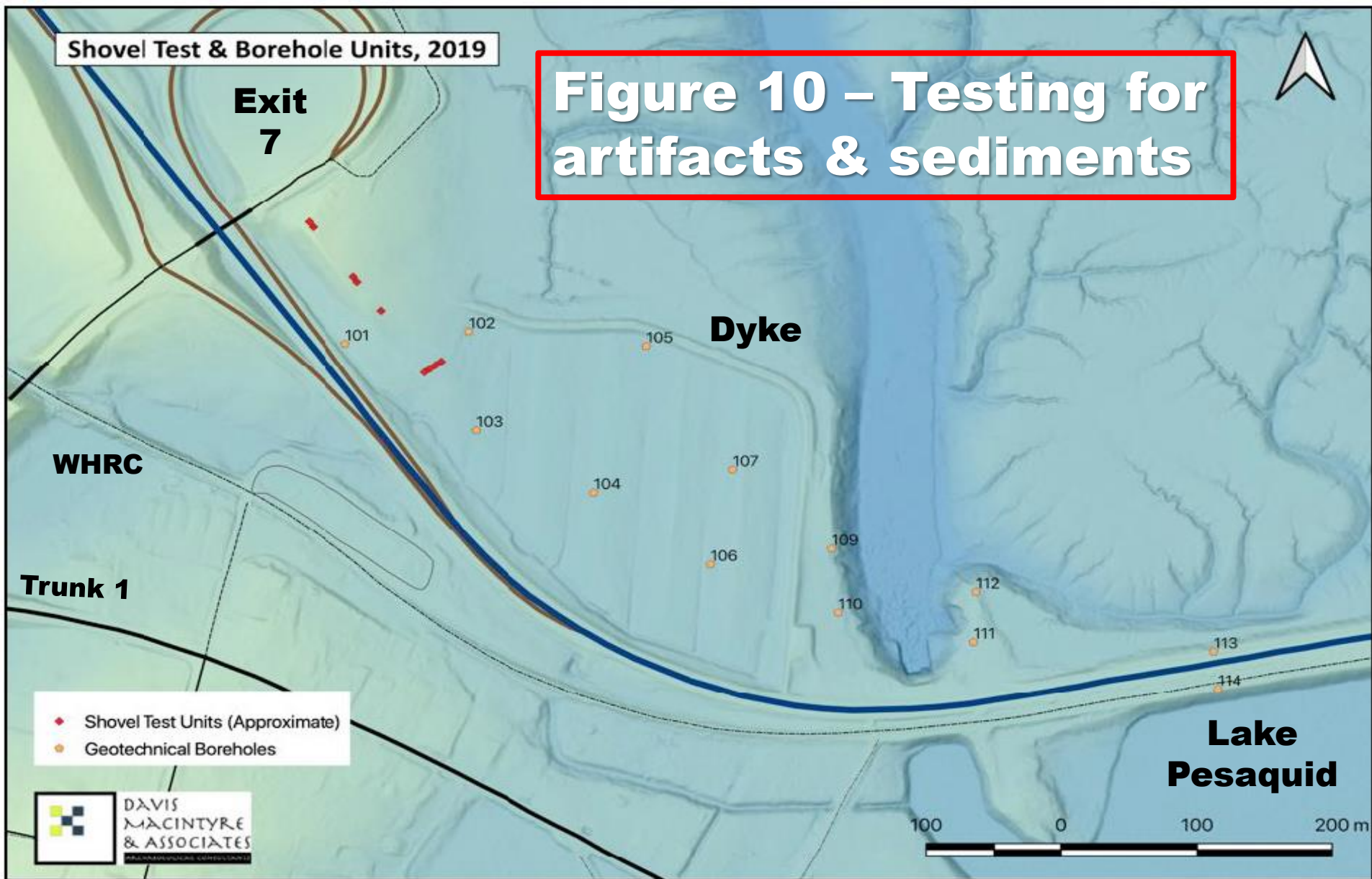


Figure 3.4-1: The approximate positions of the 2019 test units (yellow) in relation to the geotechnical boreholes and the surrounding landscape, which is shown in false-colour LiDAR imagery. Late twentieth-century crowning of the marsh fields is clearly seen as the north-south drainage pattern southeast of the units.



Figure 11

Plate 1: Backfilled shovel tests N0 E0 and N0 E5, looking southeast along the ridge line towards the other test unit sites. The Avon River Aboiteau gatehouse and support building can be seen to the upper left as the blue buildings at the edge of the dykeland fields.

40 cm x 40 cm shovel test pits; 1.2 m deep with additional four-corner, hand-augering to a maximum 2.05 m depth in silty-clay sediments; All material sieved through ¼ inch mesh.



**No
artifacts
found
(& 'land' not
habitable)**

Sediments below 30 cm were undisturbed glacial till and deposited more than 20 ka BP

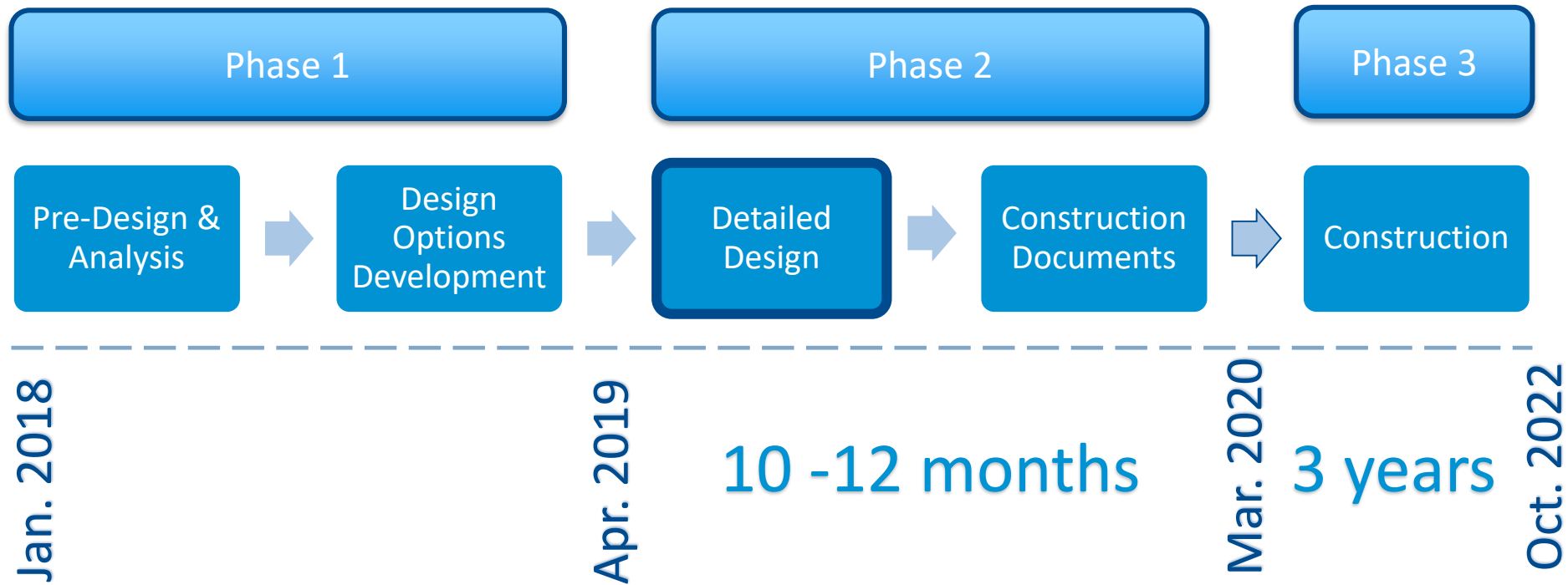
Plate 2: Shovel test N0 E90, showing water inundation before augering.

**Figure 13 – Geotech drilling continues
with archaeologists monitoring**

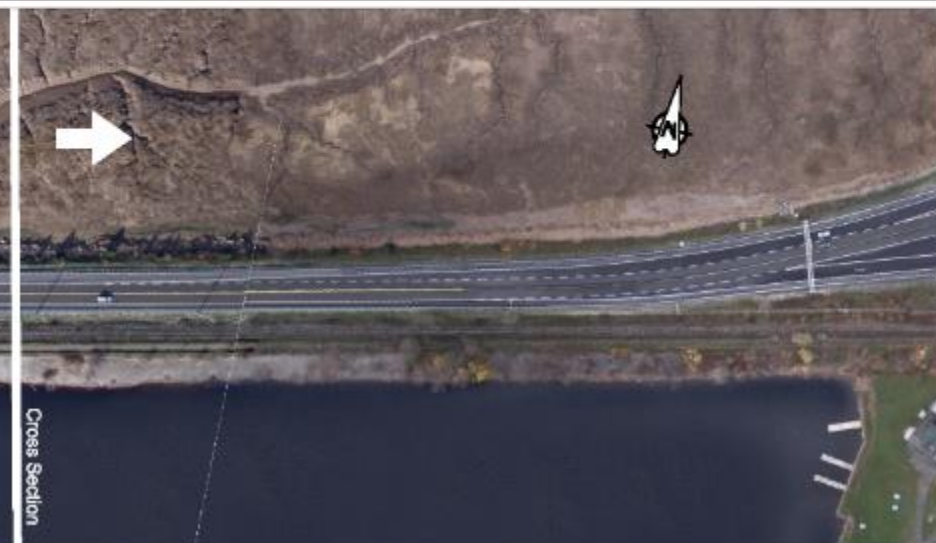
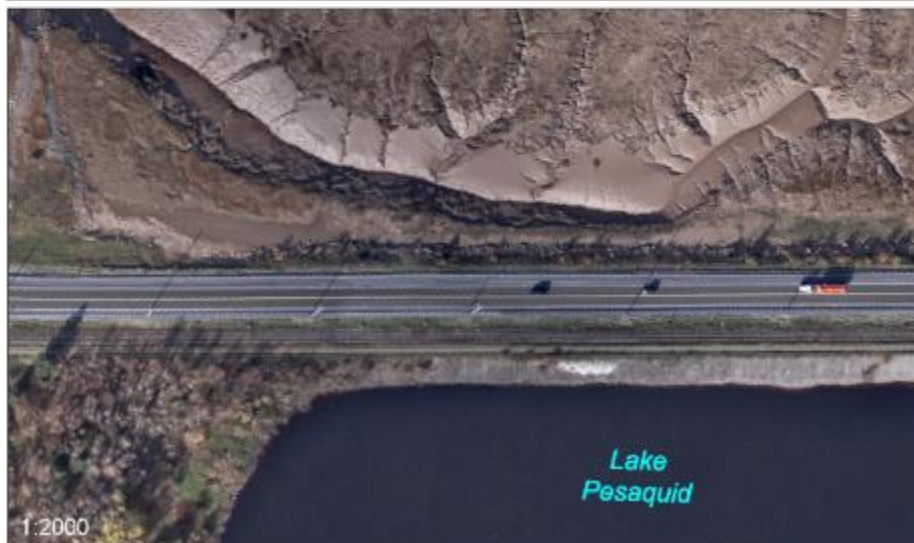
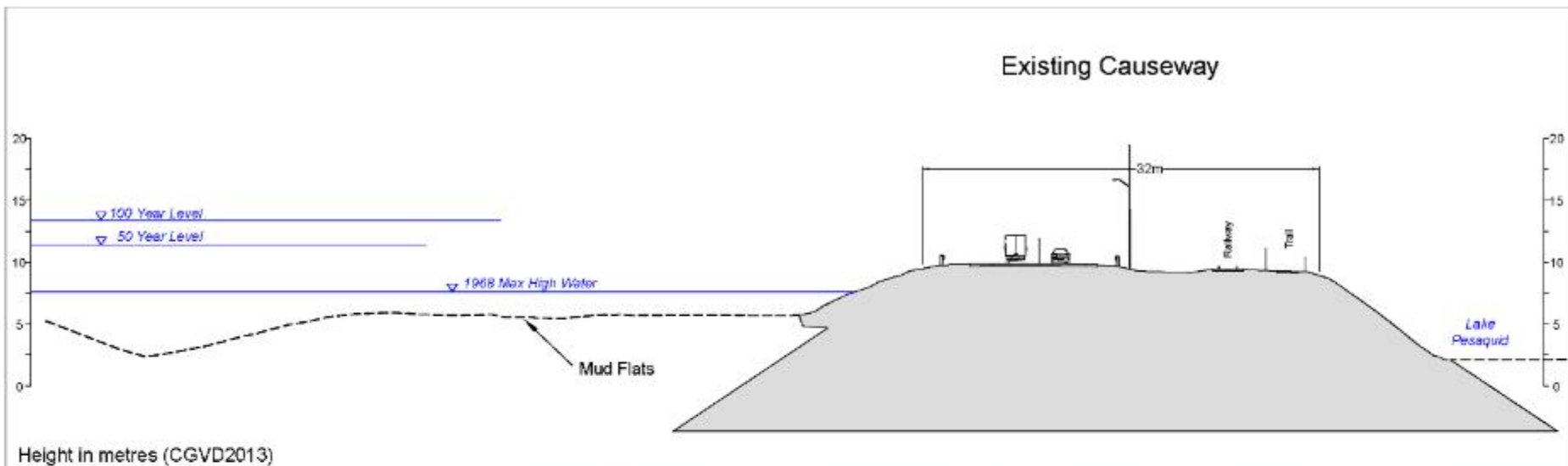


Avon River Aboiteau and Causeway Upgrading Design Update

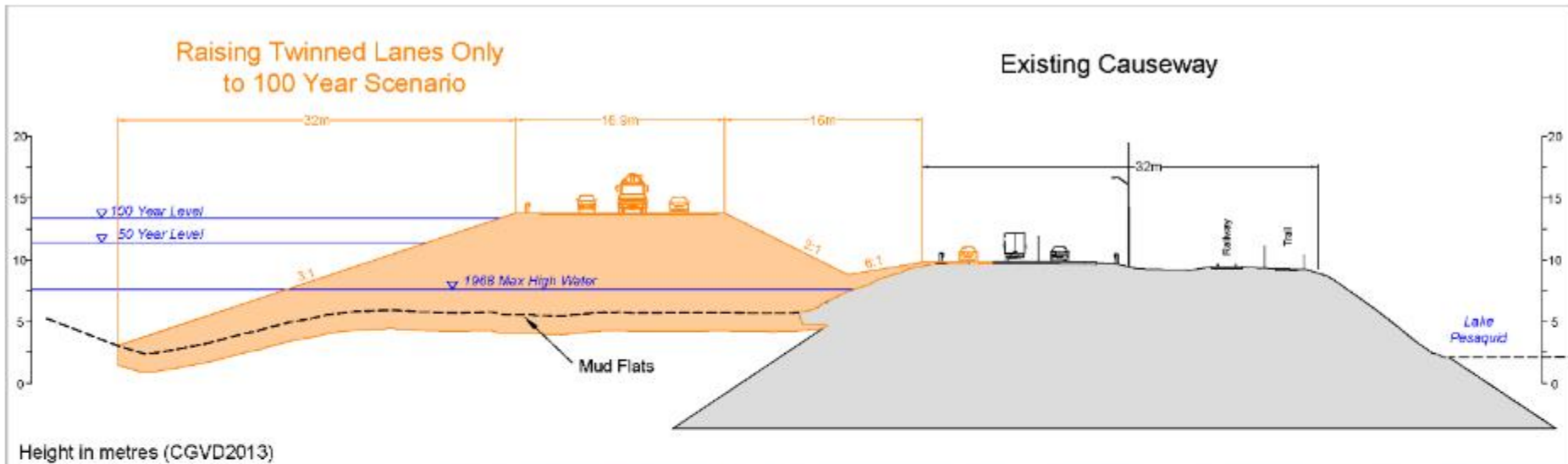
Aboiteau Design Timelines



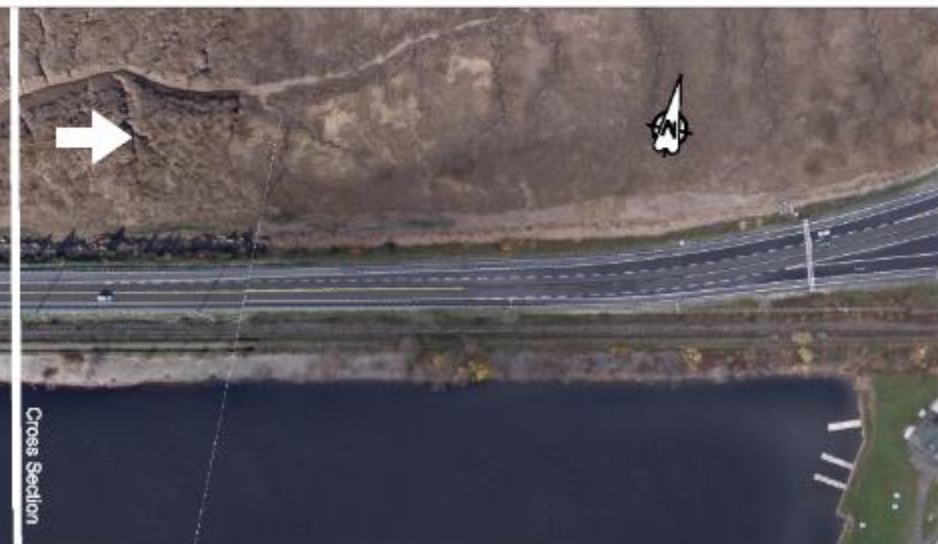
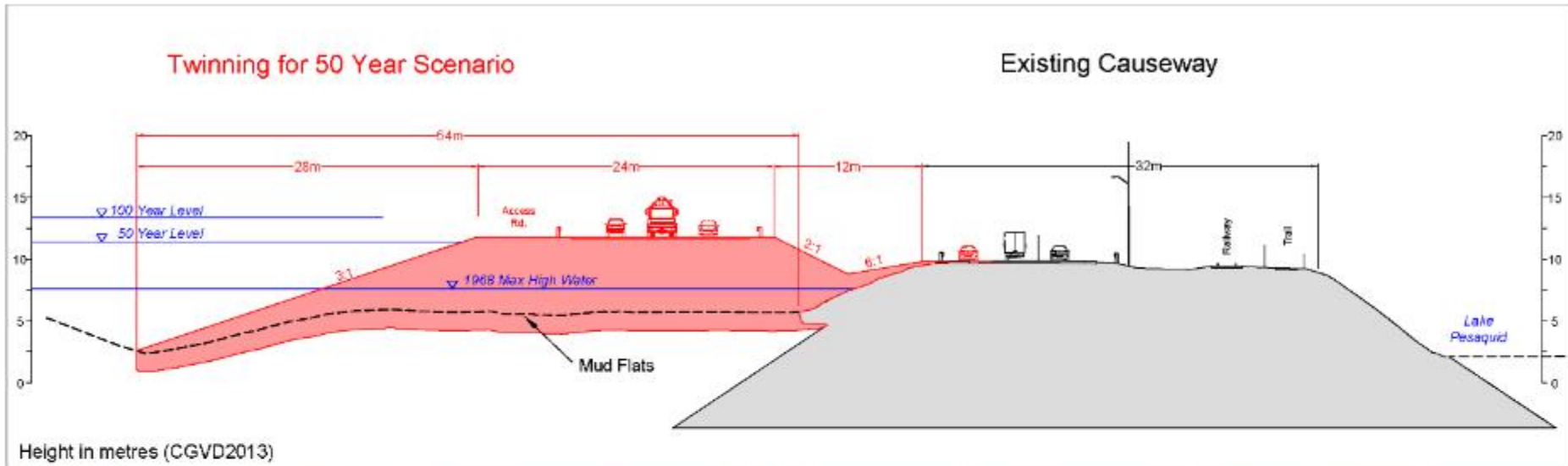
Causeway Upgrading



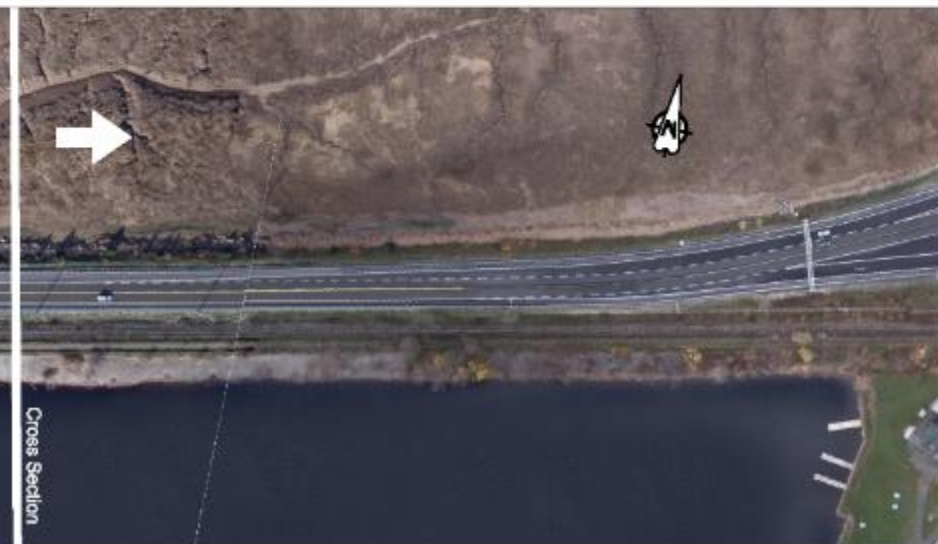
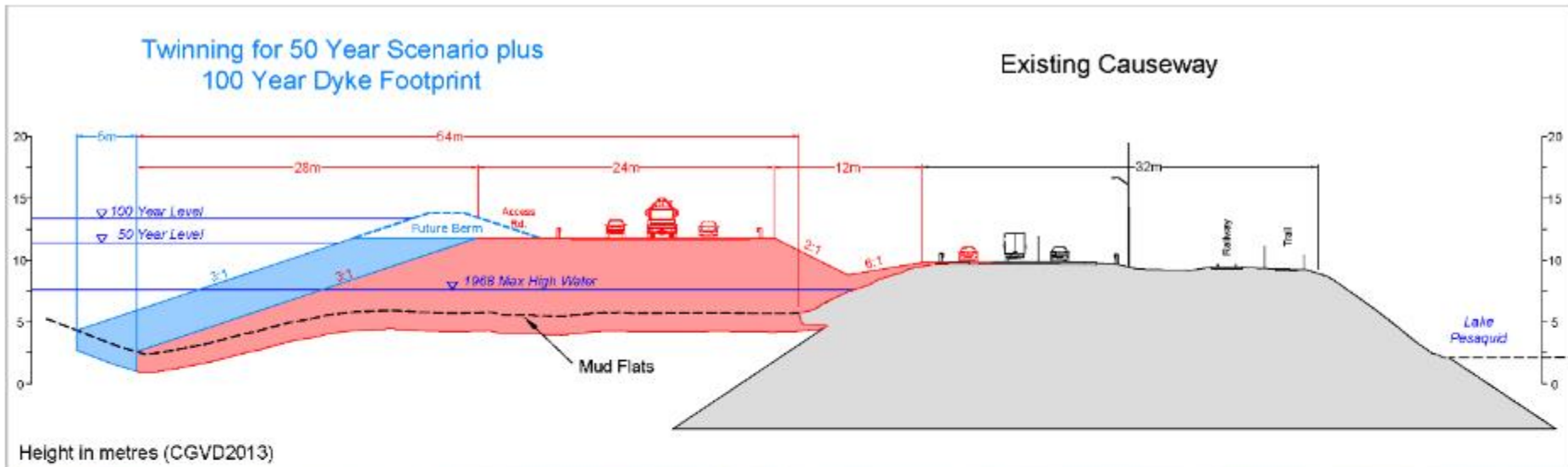
Causeway Upgrading



Causeway Upgrading

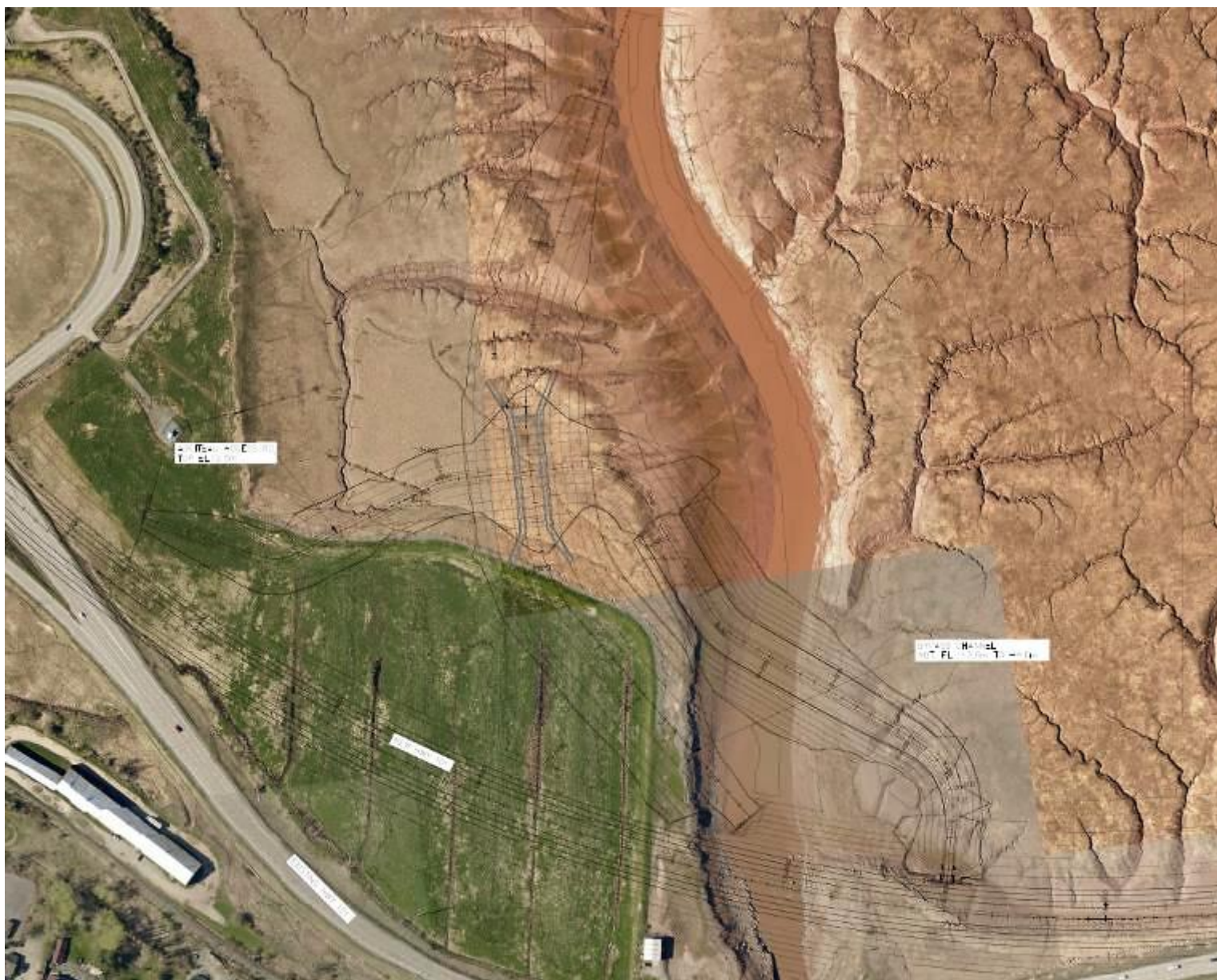


Causeway Upgrading



Aboiteau Location / Configuration





Aboiteau - Hybrid Option D

Hybrid Option D was selected as the best solution for the new aboiteau that would proceed to the detailed design phase

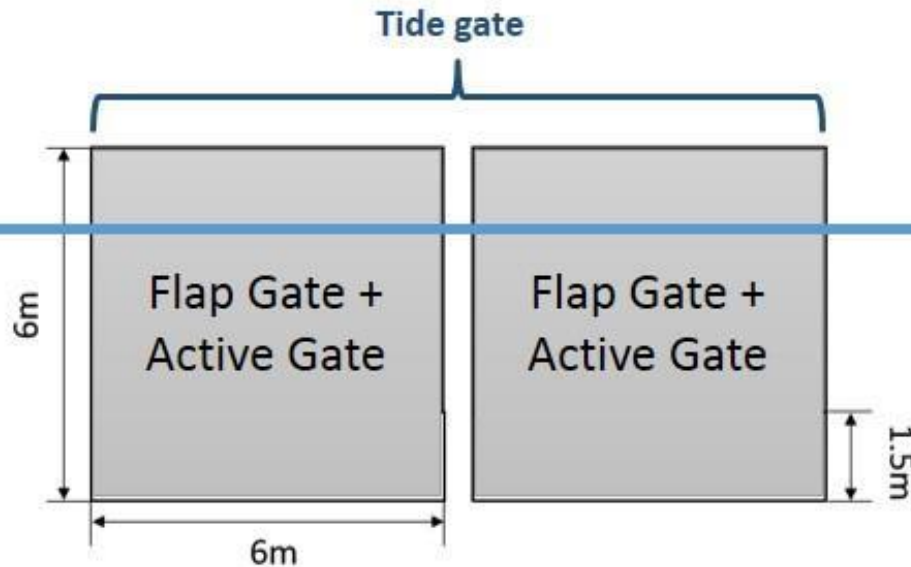
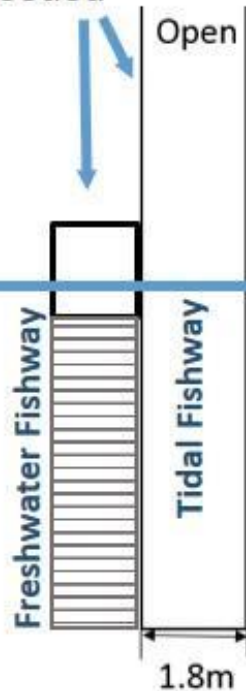
Key Items to Note:

- Proceeding to the detailed design phase does not limit potential future operating scenarios
- The goal is to initially operate in a manner that maintains the lake while maximizing opportunity for fish passage
- Ongoing monitoring will be required to assess fish passage
- Option D will still have the ability to operate with partial tidal exchange (Option C) if required to do so in the future

Aboiteau - Hybrid Option D

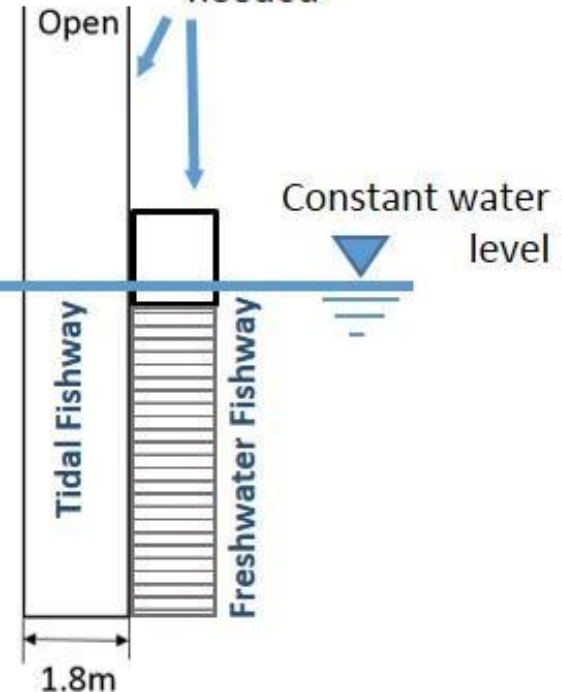
Either Gate can
be closed as
needed

Open



Either Gate can
be closed as
needed

Open



Aboiteau - Hybrid Option D

Key Benefits:

- Balanced solution that can accommodate a wide range of interests and concerns
- Additional functionality provides a flexible and adaptable solution to help achieve the goals or requirements of both today and in the future
- Most robust option with greater redundancy for flood protection and public safety, but also for fish passage
- The aboiteau is not limited to a single mode of operation
- Allows for ongoing monitoring and testing to confirm analysis conducted during the design phase



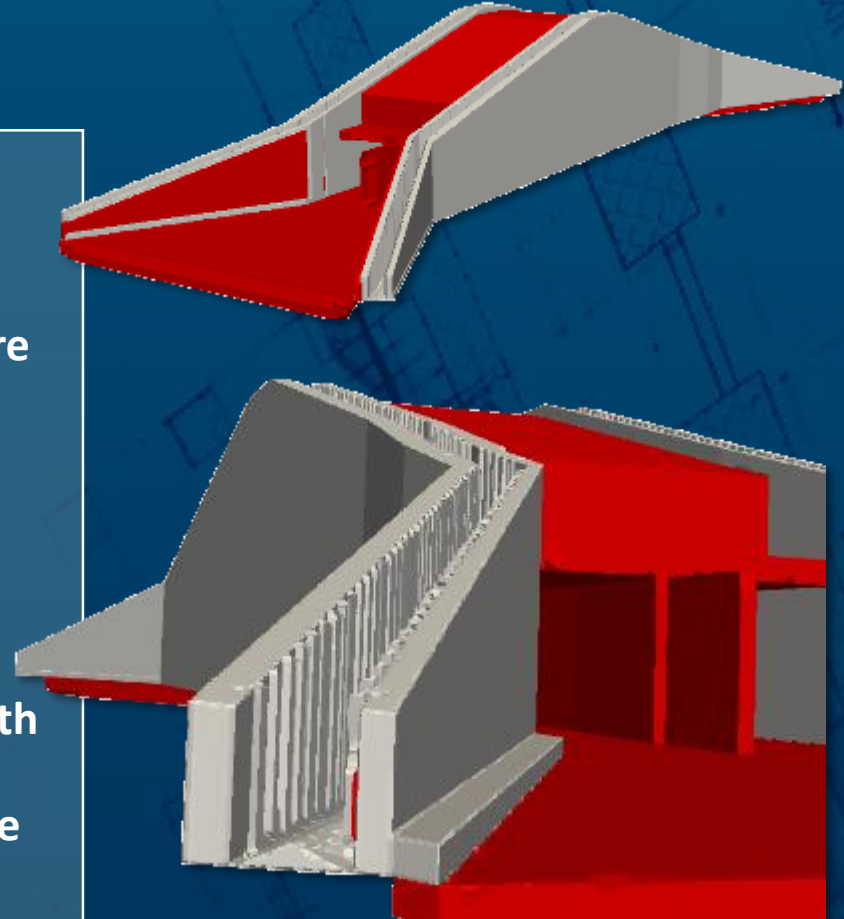
Geotechnical Program Progress

- Started April 24 with areas outside of saltmarsh, including trail area (which is complete with no further access restrictions)
- Analysis of pre-load requirements underway
- Footprint may be larger than anticipated due to soft soils, toe berms will be required
- Planning to drill holes in salt marsh adjacent to existing causeway in the next few weeks



Phase 2 Design Update

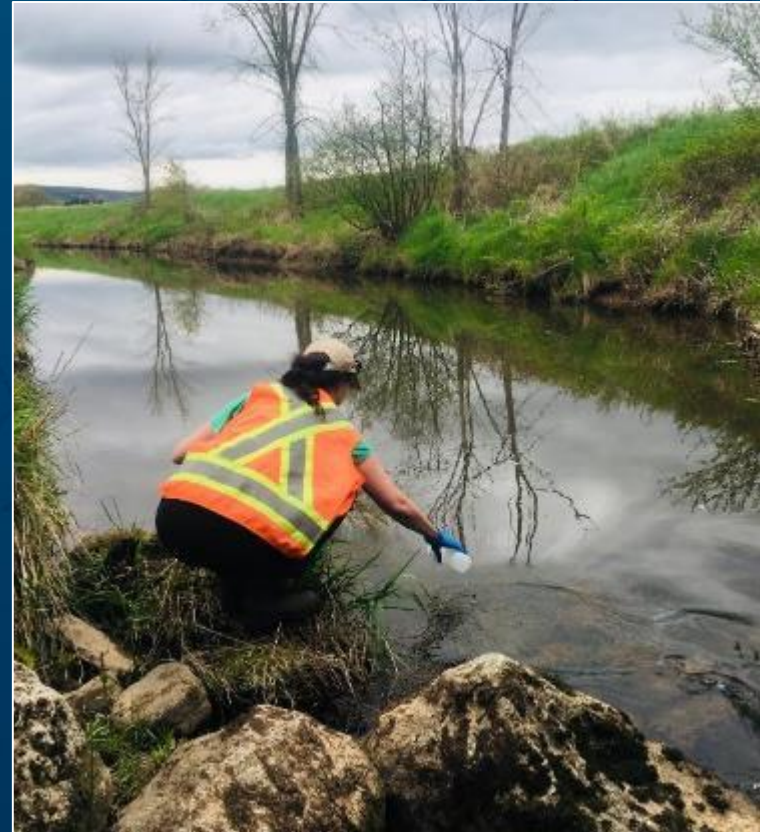
- Geotechnical investigation is continuing. Numerous boreholes have been drilled, and samples recovered for testing
- A 3D computer Model of the aboiteau structure has been created for use in hydrodynamic modelling
- Hydrodynamic modelling is proceeding to optimize the sizes of the aboiteau barrels and fishways
- Options for the final location of the aboiteau structure are being explored in conjunction with SMU
- Modelling to optimize the configurations of the fishways is proceeding





Phase 2 Design Update

- A water sampling program is underway to establish baseline water quality information upstream and downstream of the aboiteau structure
- Baseline groundwater sampling/monitoring plan being developed
- Baseline vegetation survey being completed upstream
- Water management scenarios being developed to inform the modelling
- Environmental Permit Applications have been submitted to NSE and DFO where infilling of the salt marsh is expected. Additional Environmental Permit Applications will be completed in the future for the aboiteau structure.



Conclusion / Next Steps

- Option D will continue to be advanced through Design Development (Phase 2)
- Geotechnical Investigation to continue this summer
- Partial infilling for the causeway widening currently planned for later this summer to accommodate further geotechnical investigation, while also allowing for the consolidation (settlement) process to begin on the mud flats
- Regulatory applications for the aboiteau structure will be completed in the future once the design is further along

Questions / Discussion