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The Use of a Thin-Layer Cap to Manage Hg and PCB Contaminated Sediments in Peninsula Harbour, Ontario, Canada

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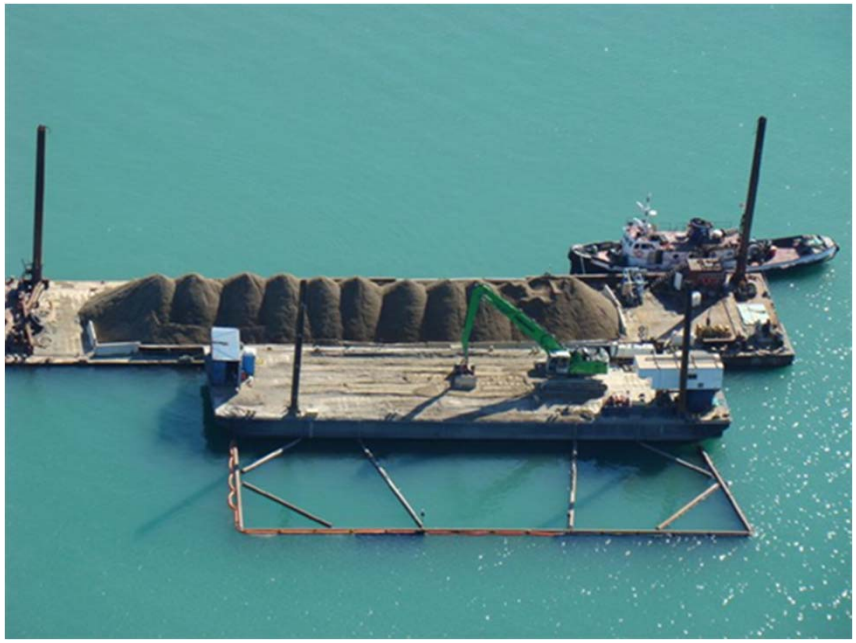
Canada

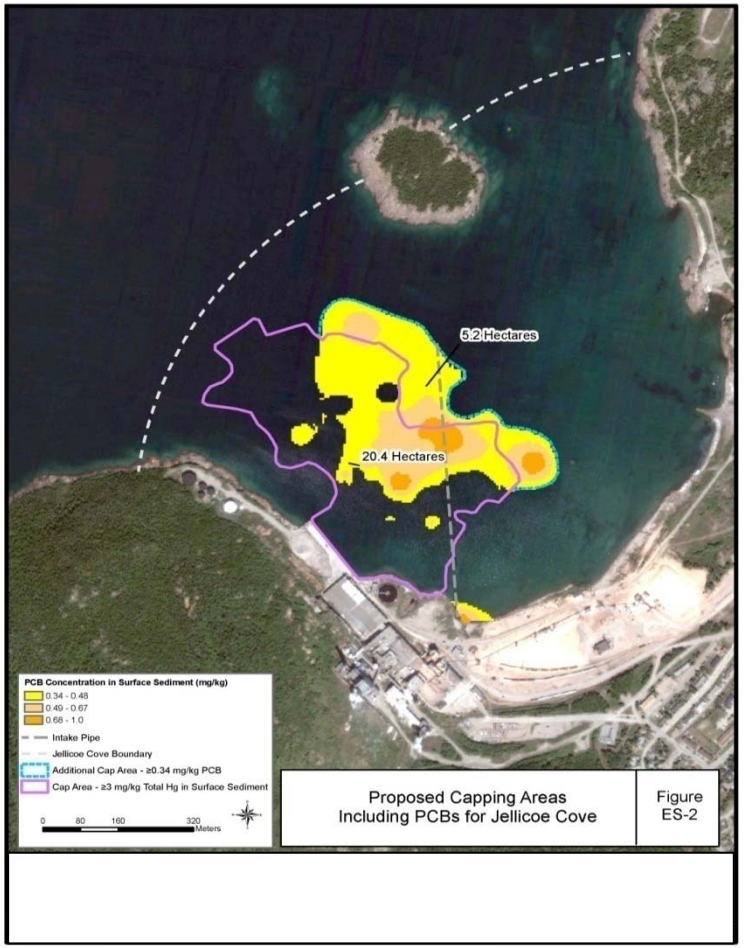
Outline



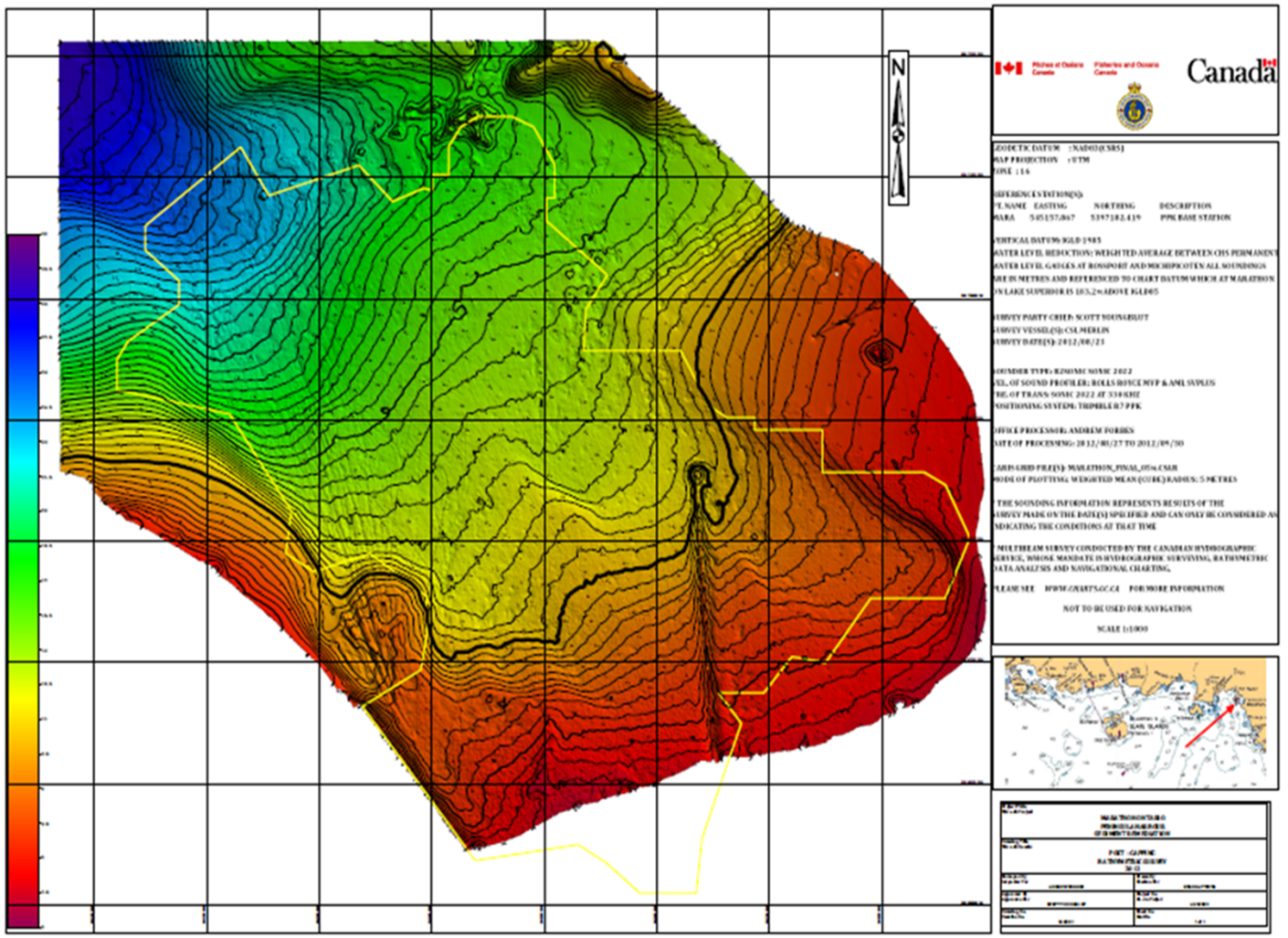
1. Engineering Design
2. Procurement
3. Implementation
4. Lessons Learned
5. Post Construction Monitoring

Peninsula Harbour AOC

- COCs: Mercury and PCBs
- Source: historical pulp mill and Chlor-Alkali plant activities
- Sediment Management Area: 250,000 m^2 (25 ha or 50 football fields)
- Hg Management Target: 3 ppm
- PCB Management Target: 0.34 ppm



Capped Area



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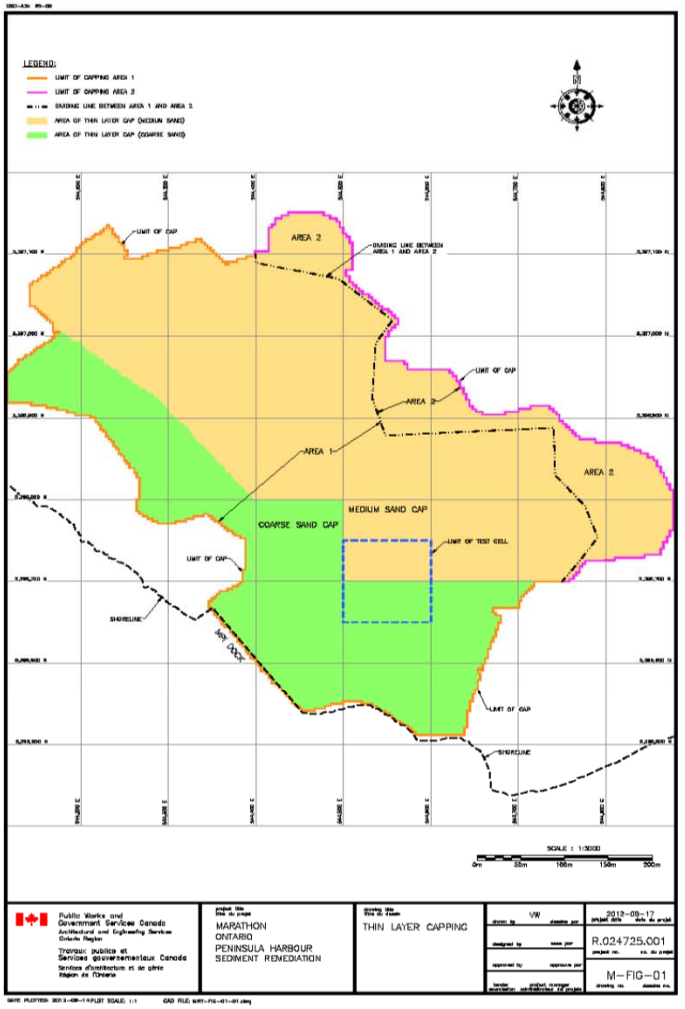
Design – Cap Thickness

- Medium: 10 – 30 cm with average of 15 cm
- Coarse: 12.5 – 37.5 cm with average of 20 cm
- A thicker cap and heavier sand was used in areas of high energy



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Engineering Design

Sand Gradation

	Medium sand	Coarse sand
Size	% passing	% passing
25 mm	100	100
12 mm	100	90-100
#10 sieve-2 mm	50-80	20-45
#40 sieve-0.425mm	10-40	0-10
#100 sieve-0.15 mm	<10	<10
#200 sieve-0.075 mm	<6	<6
Uniformity coefficient	<8	<8
Plasticity (fine fraction)	non-plastic	non-plastic
D50 mm	0.5	2.25
Specific Gravity	>2.64	>2.64

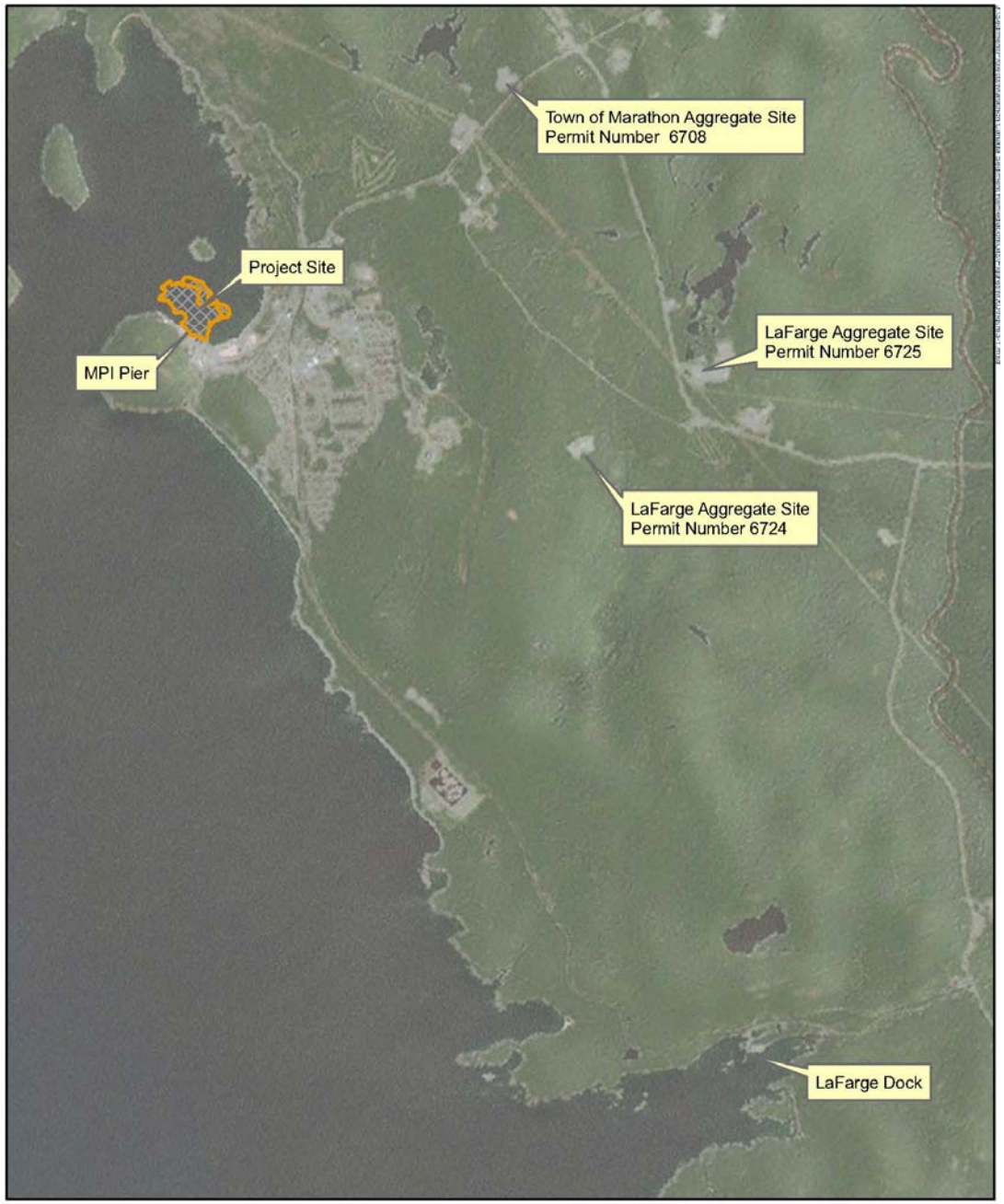
Engineering Design
Sand Specification - Chemical

- Chemical properties of the sand to meet CCME's Interim Freshwater Sediment Quality Guidelines except for Chromium and Copper

- Cr and Cu levels were revised to local background levels as these levels are naturally high in this area. (Cr <=50 ppm; Cu <=90 ppm)

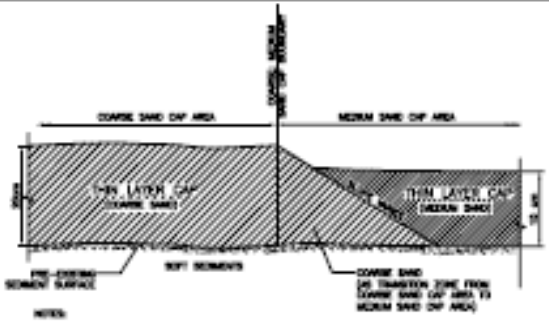
Engineering Design - Sand

Staging and Borrow Areas in Relation to TLC Site

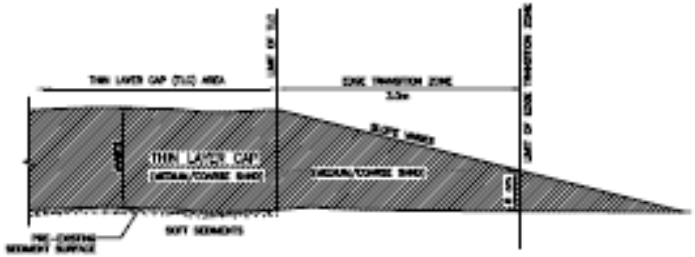


MEDIUM SAND CAP (1 / M-09)

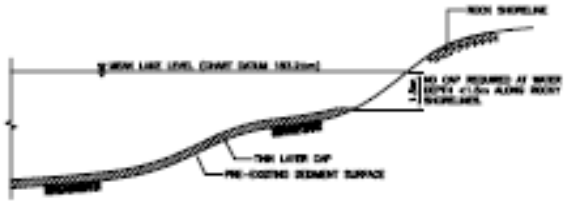
COARSE SAND CAP (2 / M-09)



COARSE: MEDIUM SAND CAP TRANSITION (3 / M-09)



EDGE OF CAP (4 / M-09)



CAP ALONG SHORELINE (5 / M-09)

Cap Transition Zones

MARATHON Ontario

PENINSULA HARBOUR SEDIMENT REMEDIATION

DETAILS: CAP

2009-10-27

R.024725.001

M-10

Contracting

1. EC was the project lead and PWGSC was the contracting authority

2. Tendering vs. RFP methods of procurement were examined

3. Decided to go with an RFP based on performance criteria (i.e., RFP specified the performance criteria and it was up to bidders to come up with methodology to meet the performance criteria)

4. Bids evaluated by EC, MOE, AECOM and PWGSC

Contracting – Performance Criteria

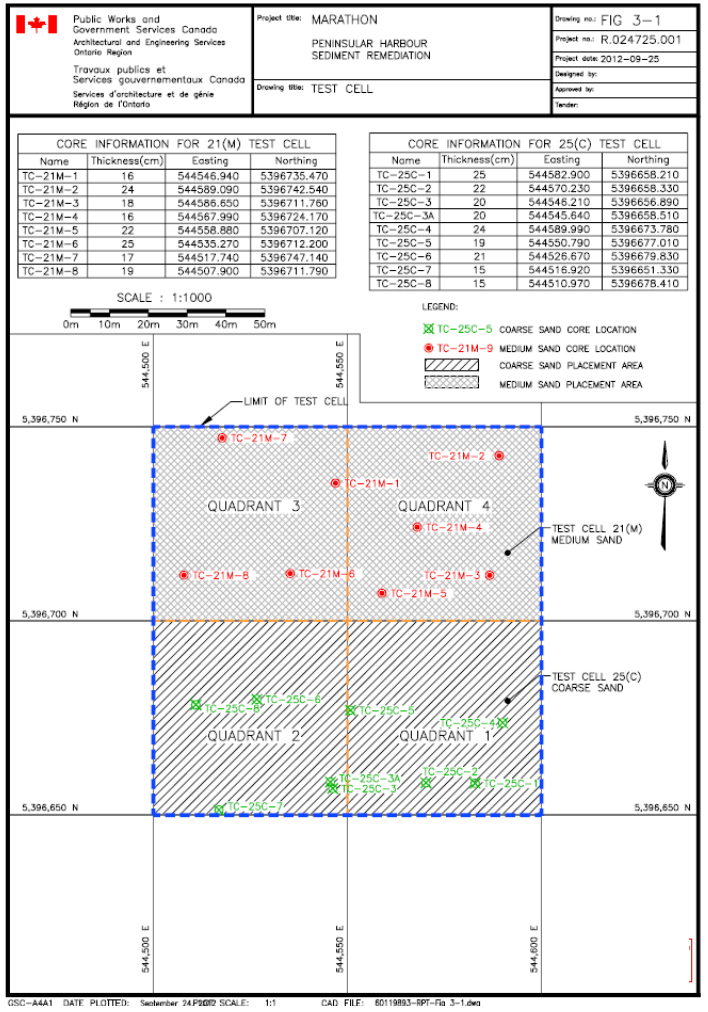
1. Cap area coverage
2. Cap thickness
3. Sand gradation
4. Sand chemistry
5. Turbidity
6. Water Chemistry – release of Hg and PCBs from contaminated sediment

Environmental Mitigation Measures

- Silt fence placed to prevent sand from entering water in the staging area
- Installed turbidity curtains to protect two nearshore habitat areas as per DFO/MNR advice
- Turbidity curtain box attached to the capping barge (bidder)

Implementation – Testing Cell

- Objective of the testing cell is to try out different placement methods to meet performance criteria
- Test cell chosen to cover both medium and coarse sand area
- Duration: 1 week
- Thickness Verification: 16 cores



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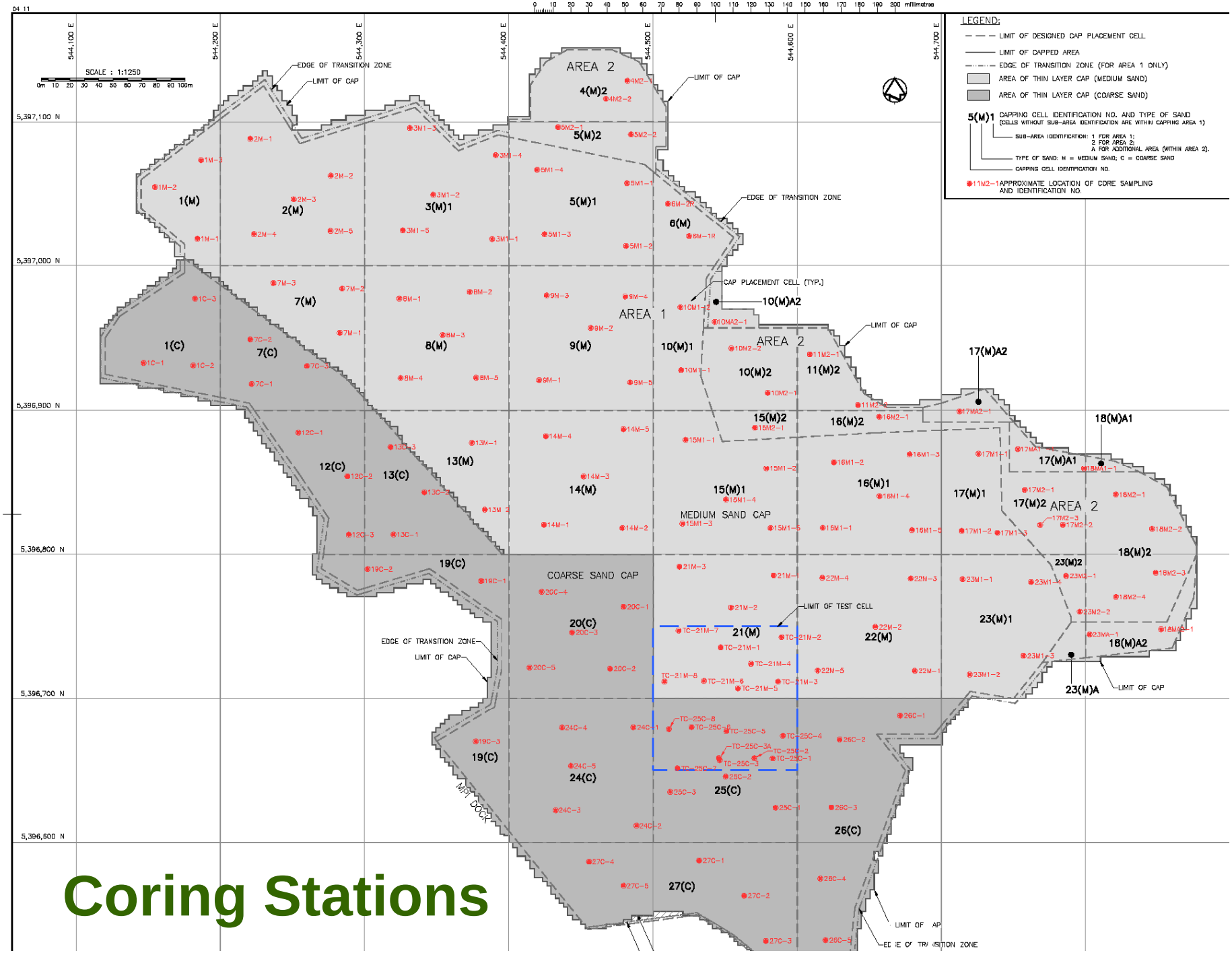


Coring Stations

Capping Operation Summary

- Capped 23 ha with medium/coarse sand
- Placed 36,000 tonnes of coarse; 49,600 tonnes of medium
- Average production 4,635 m^2/day or 1,616 tonnes/day
- Started capping on June 5 and finished on Aug 5, 2012
- 3 hours of delay due to weather; 26 hours of delay due to mechanical problems

Cost of TLC Implementation

- Estimate at SMO stage: $3.43 million (2007)
- Estimate at 33% design (excluding project management cost): $5 million (2010)
- Estimate at 99% design stage (excluding project management cost): $6 million (2011)
- Tender = received five bids; lowest price exceeded budget. Switched from coarse to medium sand in approximately five hectares to stay within budget (did not impact the environment or effect the integrity/functionality of the cap).
- At completion (excluding project management cost): $6.3 million

Cost of TLC Implementation

- Construction: $6.3 million
- AECOM (supervision): $547,656
- PWGSC (project management): $138,400
- Post Cap Bathymetry Survey: $15,000
- Total Cost: $ 6,980,236
- Funds remaining at the end of project from $7.3 million budget: $319,764

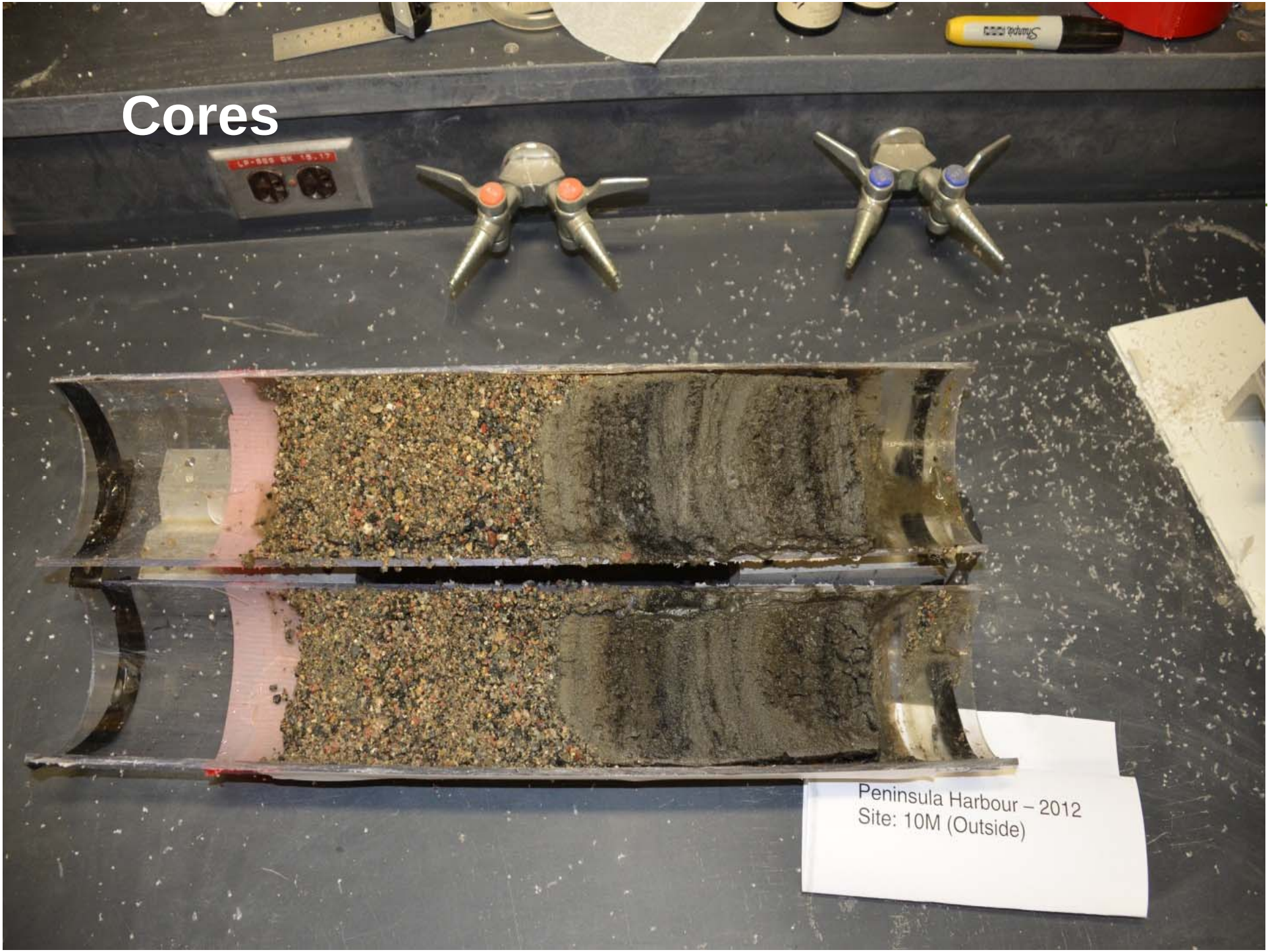
Lessons Learned

- The project was completed ahead of schedule due to starting the project early in the year when we had good weather.
- Allowed flexibility in the sequencing of cell being capped to maintain/maximize productivity.
- Need better methods to quantify amount of sand applied in each cell. (Used sand displacement measurements on the barge but on days where multiple cells were capped, it was difficult to determine the volume for each cell.)

Post Implementation Monitoring Studies

- Sediment Profile Imagery (SPI)
- Submerged Aquatic Vegetation and Cap Movement
- Tracer Study – to determine the mixing between the cap and native material

Cores



Submerged Aquatic Vegetation (SAV) and Cap Movement (Northern Bioscience)

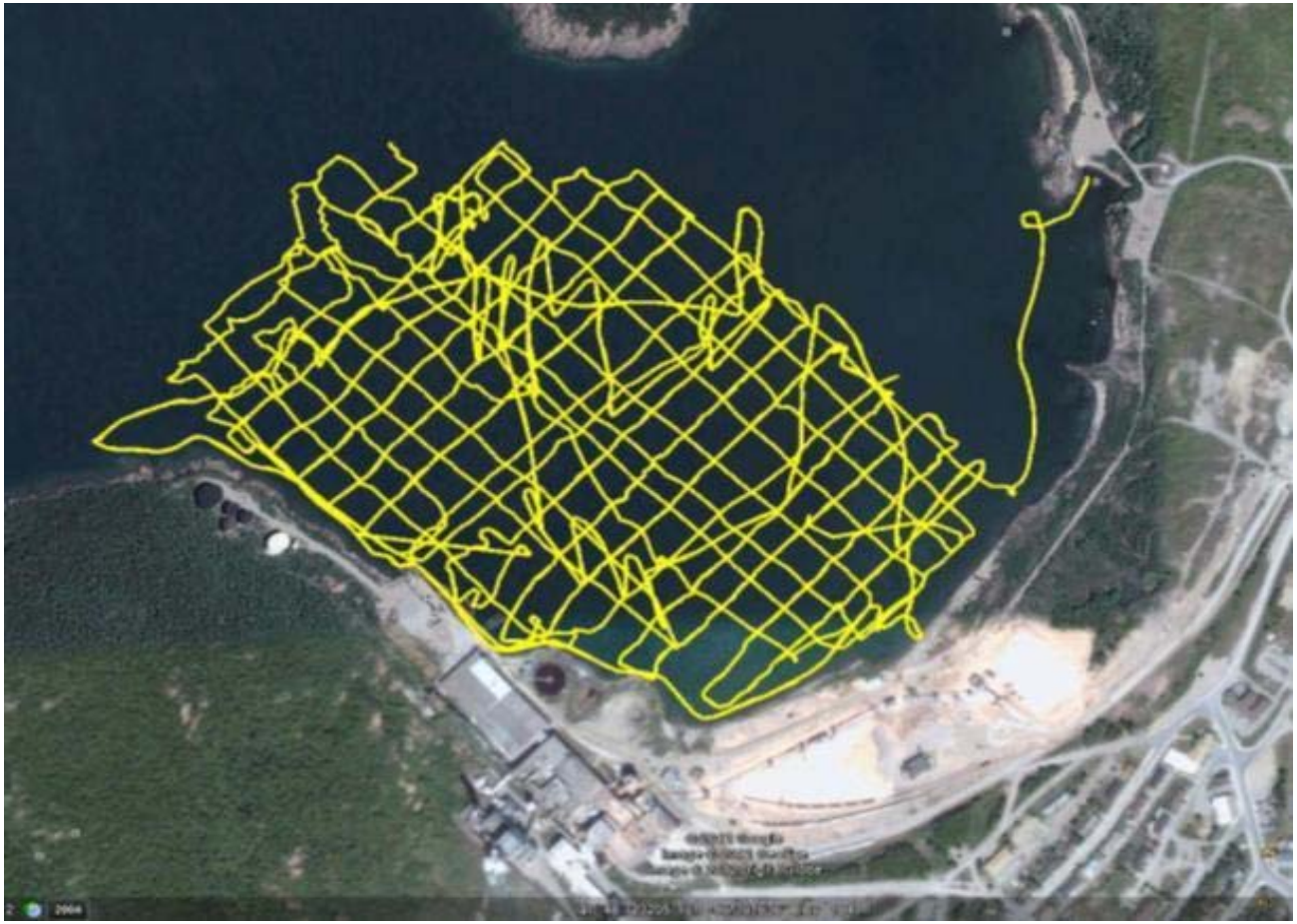
The study was designed to provide post-construction baseline data to monitor:

- the distribution and potential movement of the sand cap; and
- the recovery of SAV within the cap

Submerged Aquatic Vegetation

- Stonewort (*Chara*)
- Pondweed (*Potamogeton*)
- Canada Waterweed (*Elodea canadensis*)

Survey Grid

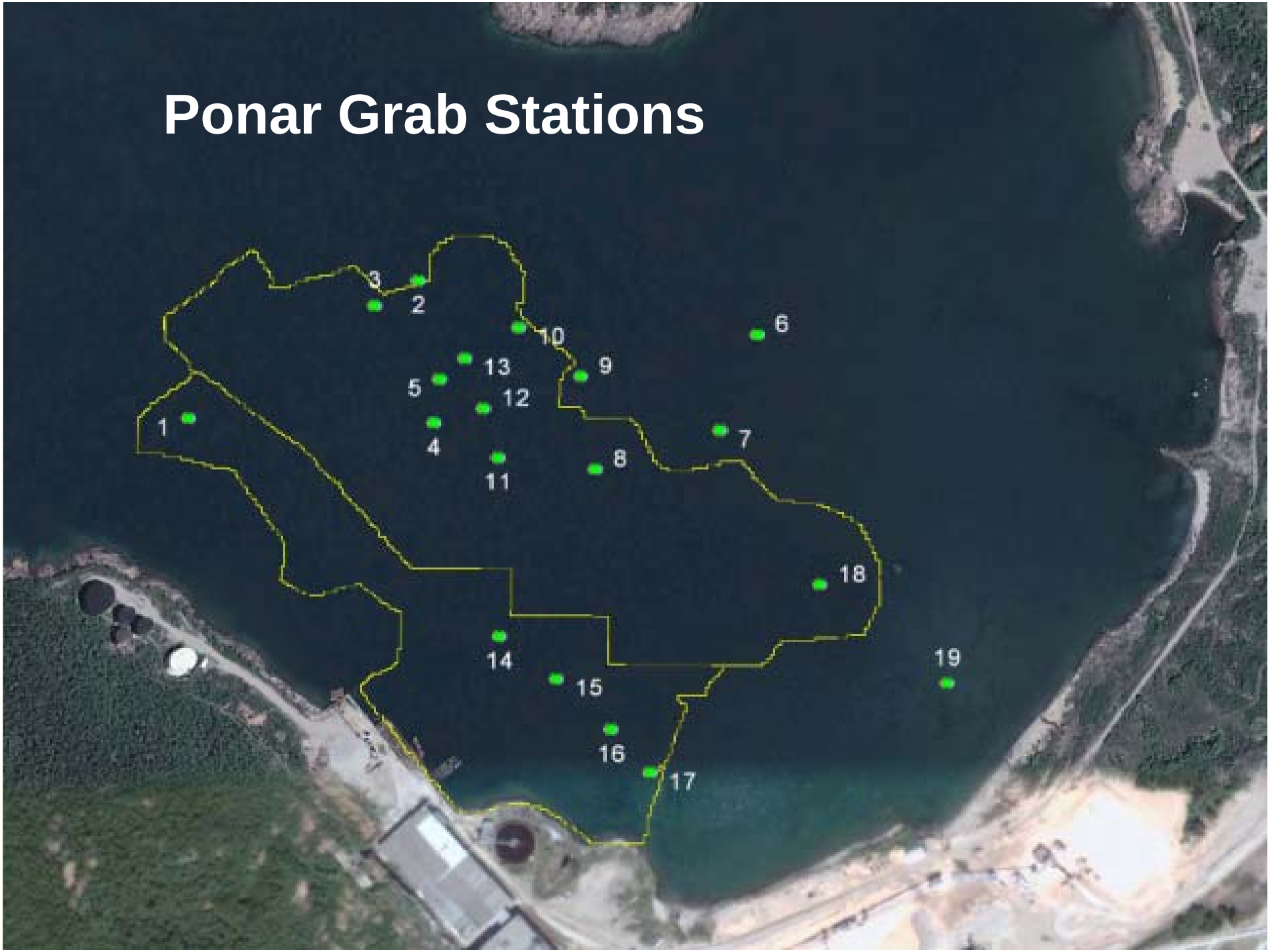


Cap Imagery

Inside the Cap

Outside the Cap

Ponar Grab Stations

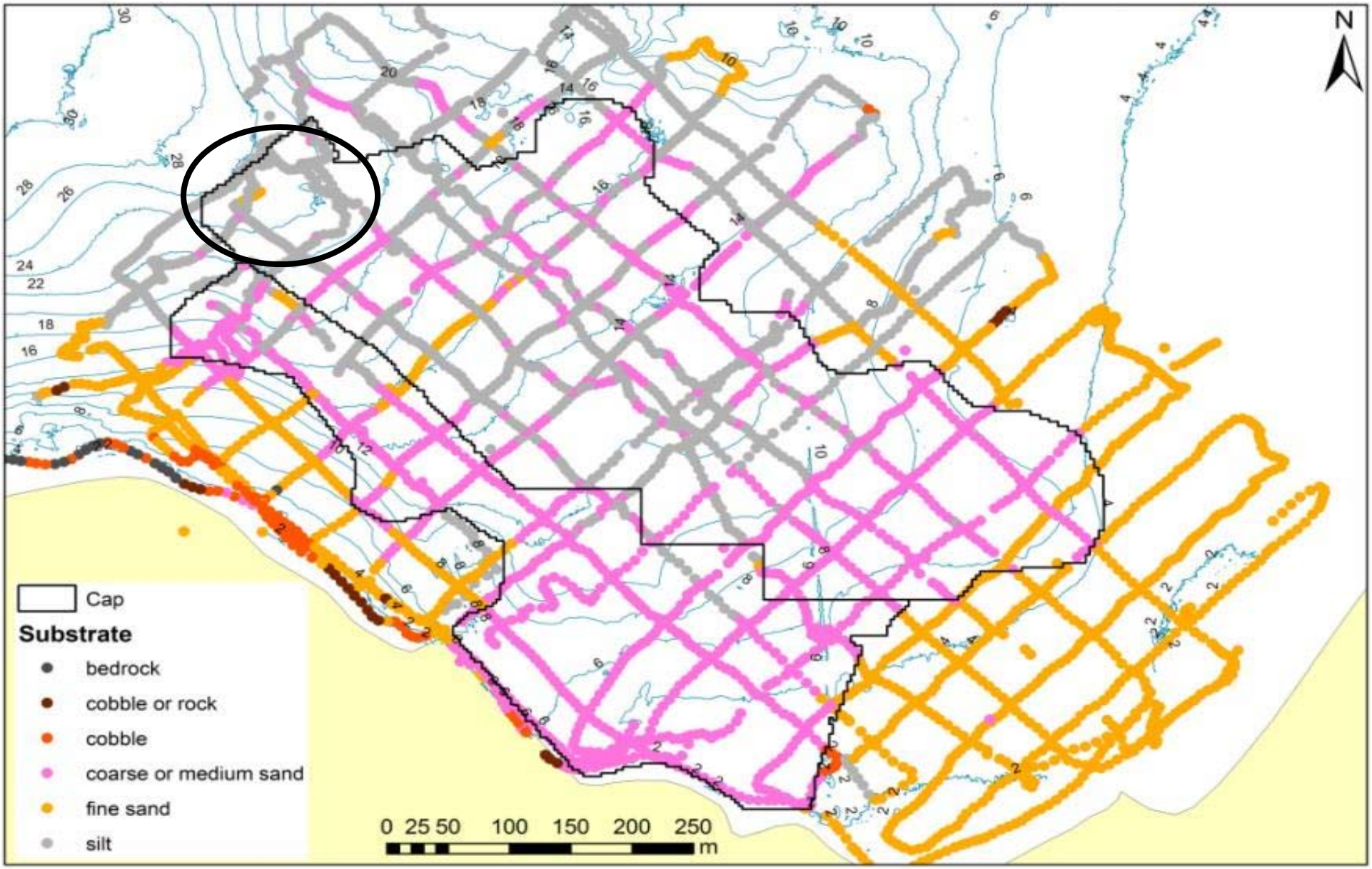


Capping Material

Cap Material from Grab Sampler

Outside Cap

Results – Cap Substrates

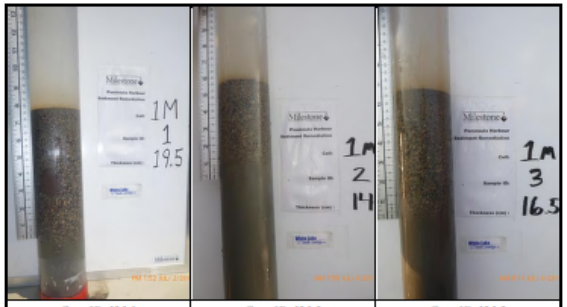


Core Thickness

Photo Log – Piston Core Measurements:

Marathon Ontario Jellicoe Cove Peninsula Harbour
Peninsula Harbour Sediment Remediation

Cell 1(M) Piston Core Photographs

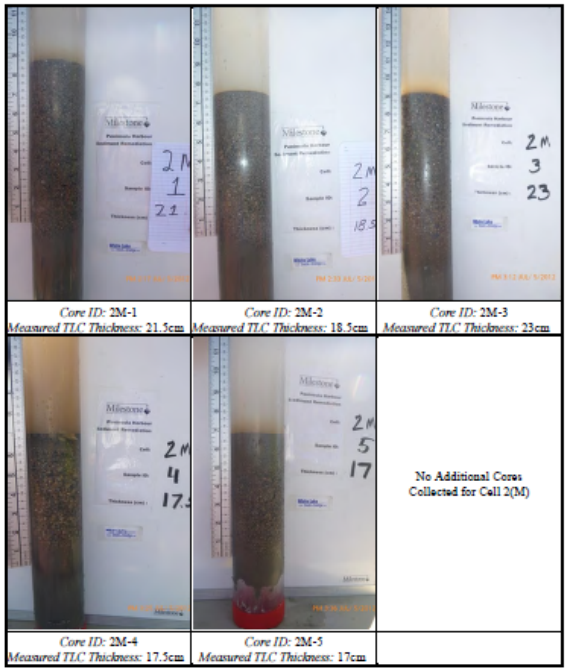


Core ID: 1M-1 *Measured TLC Thickness:* 19.5cm	*Core ID:* 1M-2 *Measured TLC Thickness:* 14cm	*Core ID:* 1M-3 *Measured TLC Thickness:* 16.5cm
No Additional Cores Collected for Cell 1(M)	No Additional Cores Collected for Cell 1(M)	No Additional Cores Collected for Cell 1(M)

Photo Log – Piston Core Measurements:

Marathon Ontario Jellicoe Cove Peninsula Harbour
Peninsula Harbour Sediment Remediation

Cell 2(M) Piston Core Photographs

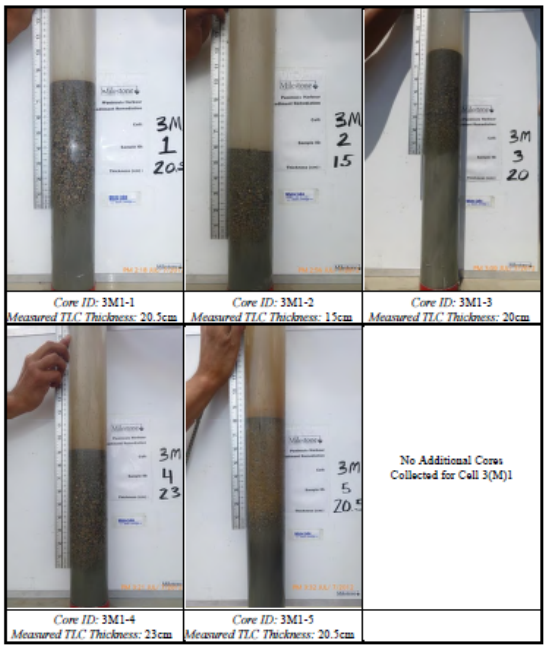


Core ID: 2M-1 *Measured TLC Thickness:* 21.5cm	*Core ID:* 2M-2 *Measured TLC Thickness:* 18.5cm	*Core ID:* 2M-3 *Measured TLC Thickness:* 23cm
Core ID: 2M-4 *Measured TLC Thickness:* 17.5cm	*Core ID:* 2M-5 *Measured TLC Thickness:* 17cm	No Additional Cores Collected for Cell 2(M)

Photo Log – Piston Core Measurements:

Marathon Ontario Jellicoe Cove Peninsula Harbour
Peninsula Harbour Sediment Remediation

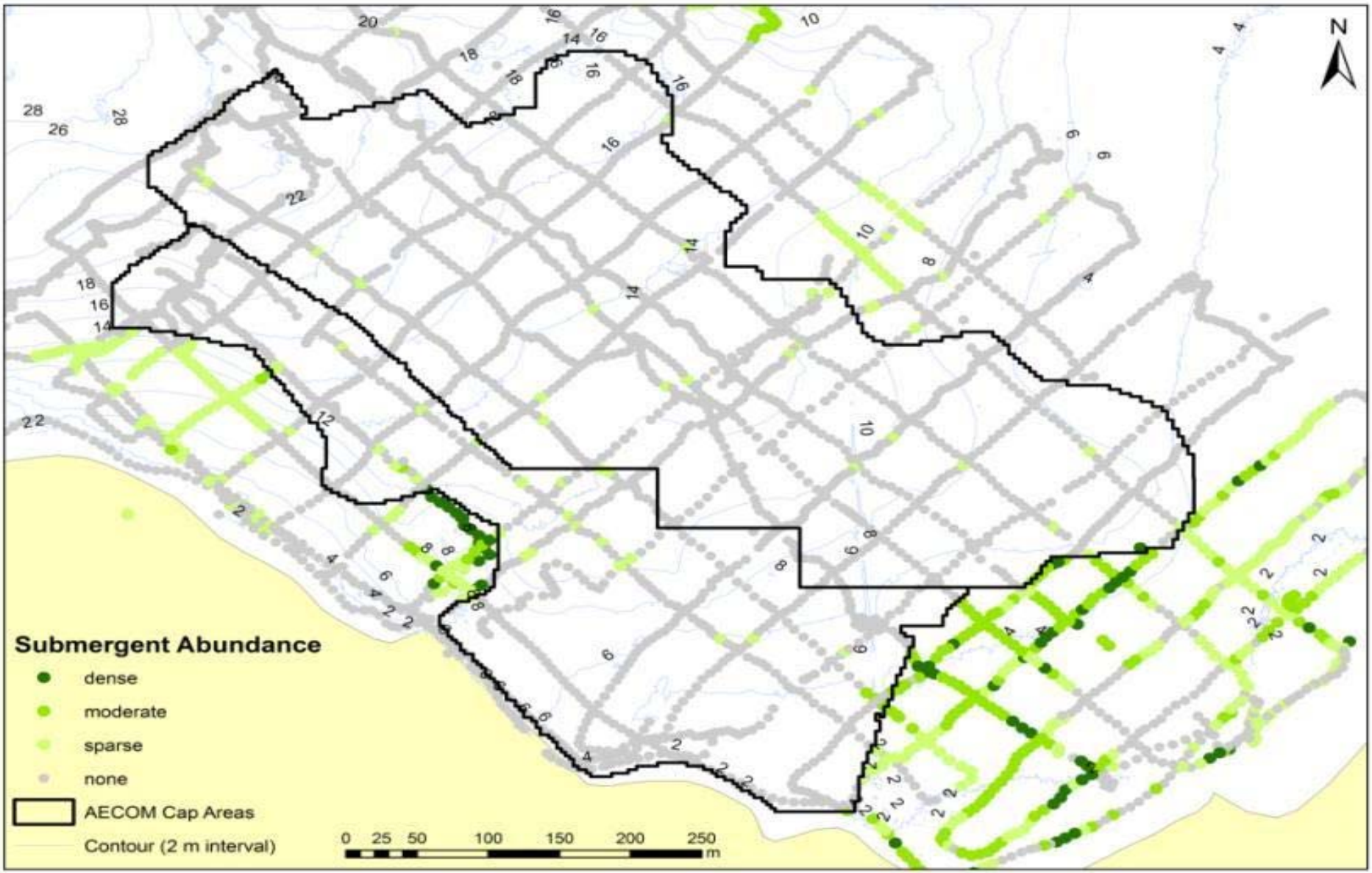
Cell 3(M)1 Piston Core Photographs



Core ID: 3M1-1 *Measured TLC Thickness:* 20.5cm	*Core ID:* 3M1-2 *Measured TLC Thickness:* 15cm	*Core ID:* 3M1-3 *Measured TLC Thickness:* 20cm
Core ID: 3M1-4 *Measured TLC Thickness:* 23cm	*Core ID:* 3M1-5 *Measured TLC Thickness:* 20.5cm	No Additional Cores Collected for Cell 3(M)1

Before - After

SAVs


N
Submergent Abundance
dense
moderate
sparse
none
AECOM Cap Areas
Contour (2 m interval)
0 25 50 100 150 200 250
m

Long Term Monitoring Studies

- Re-colonization of submerged aquatic vegetation and cap movement study (0, 1, 3, 5, 10 yrs)
- Re-colonization of benthic community (5, 10, 15, 20)
- Benthic invertebrate tissue survey (Hg) (5, 10, 15, 20)
- Fish tissue survey (5, 10, 15, 20)
- Sediment Chemistry (5, 10, 15, 20)

Thank You

- PH Sediment Remediation Technical Team
- PH Sediment Remediation Management Committee
- Community Liaison Committee
- EcoSuperior Environmental Programs