



Photo courtesy of Heath Moffatt

Esquimalt Graving Dock Waterlot South Jetty Demolition and Remediation Design Challenges (Phase 2)



Public Works and
Government Services
Canada

Travaux publics et
Services gouvernementaux
Canada

Dan Berlin, Anchor QEA, LLC

WODCON XXI
June 13-17, 2016

Presentation Overview

- Esquimalt Graving Dock (EGD) site description and background
- Phase 2 description and objectives
- Design challenges



Site Description and Background



DND – Department of National Defence

EGD – Esquimalt Graving Dock

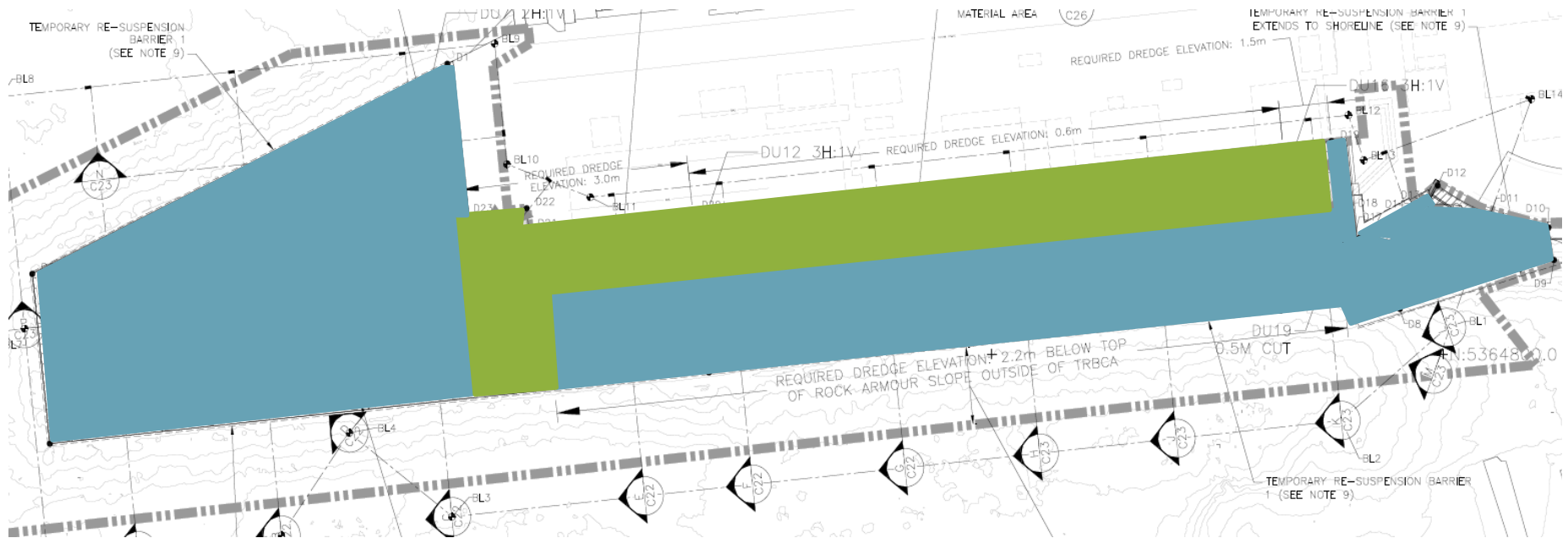
Site Description and Background (cont.)



Site Description and Background (cont.)



Jetty Demolition



-  Timber jetty to be demolished
-  Steel pile-supported jetty to be retained

Active Shipyard/Graving Dock Facility

- More than 50 vessel calls per year



Active Shipyard/Graving Dock Facility (cont.)

- Vessel berthing space is limited



Phase 1A – Under-Pier Erosion Protection System



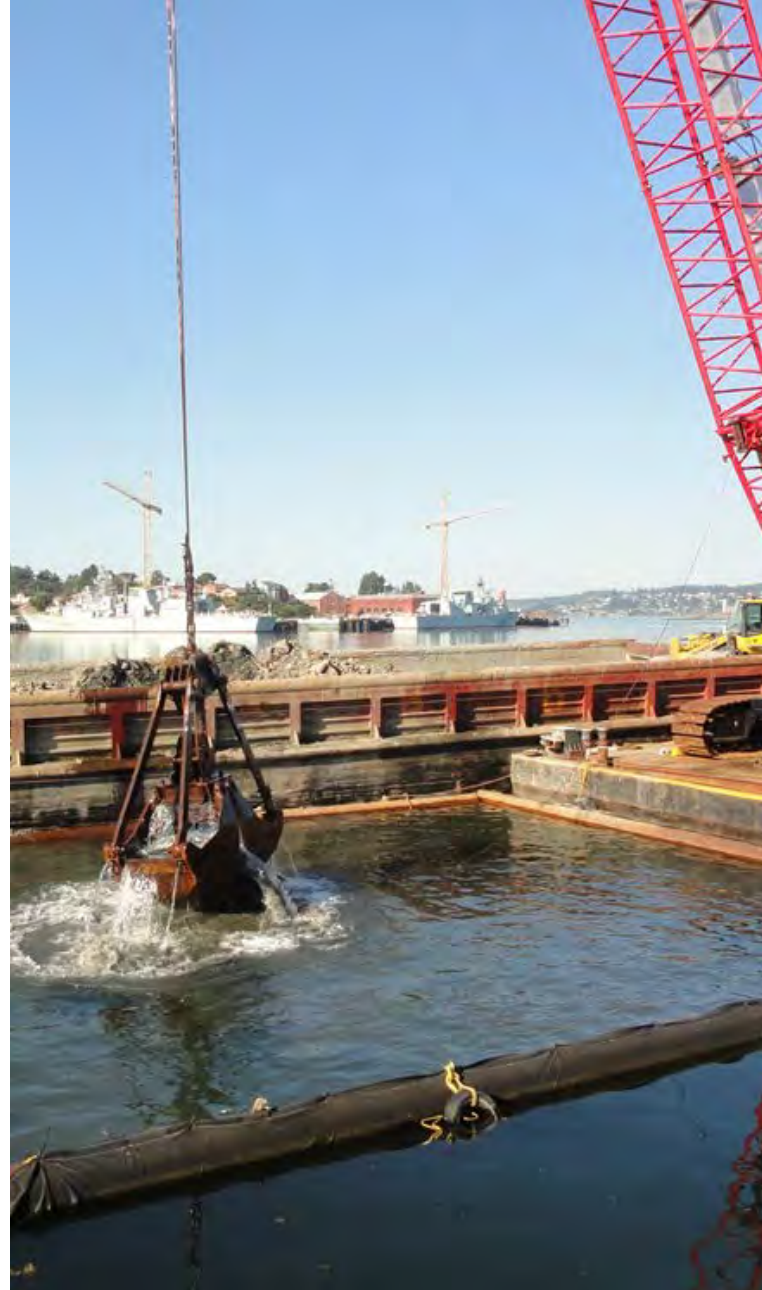
- Sheetpile wall prevents resuspension and transport of contaminated under-jetty sediment into Phase 1B area
- Constructed November 2012 to April 2013

Phase 1A – Under-Pier Erosion Protection System (cont.)

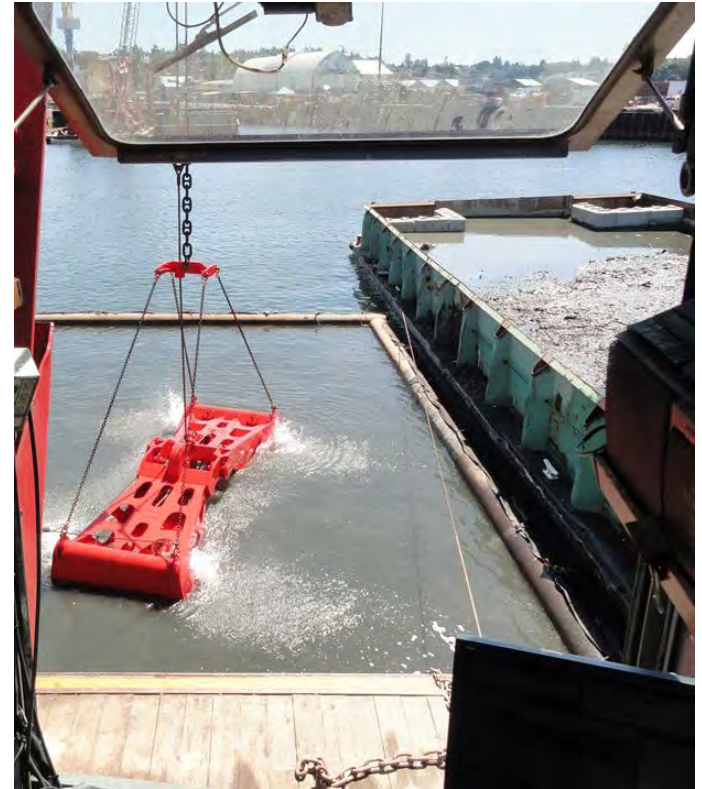


Phase 1B – Open-water Dredging

- Dredging and disposal
 - 145,600 cubic meters (m³)
- In-water slope armouring
 - 22,800 m³
- Residuals management cover placement
 - 45,000 m³
- Structure demolition and temporary relocations
- Construction June 2013 to March 2014



Phase 1B – Open-water Dredging (cont.)





Phase 1C

- Phase 1C – habitat compensation
 - Off-site construction of new intertidal marsh fish habitat
 - Offsets impacts of alteration and isolation of under-pier habitat

Phase 2

- Phase 2 – under-pier remediation
 - 40,000 m³ of contaminated sediment removal
 - Required removal volume (with overdredge): 37,900 m³
 - Missed inventory (contingency): 2,100 m³
 - Total removal volume: 40,000 m³
 - Hazardous waste removal volume: 200 m³
 - Construction initiated in October 2015



Key Phase 2 Objectives

- Remove maximum contamination practicable
 - Reduce Government of Canada financial liability
 - Establish baseline conditions for future operations
 - Meet federal and provincial standards
 - Reduce risks to human health and environment
 - Achieve Federal Contaminated Sites Action Plan objectives



Key Phase 2 Objectives (cont.)

Maximum Contaminant Concentrations



- Contaminants include PAHs, metals, PCBs, and TBT

Key Phase 2 Objectives (cont.)

- Schedule
 - Minimize disturbance to operations
 - Complete by August 2016
- Ensure high level of certainty in project outcome
 - Conservative, practical, and constructible design
 - Proven technologies
 - Qualified contractors

Design Challenges

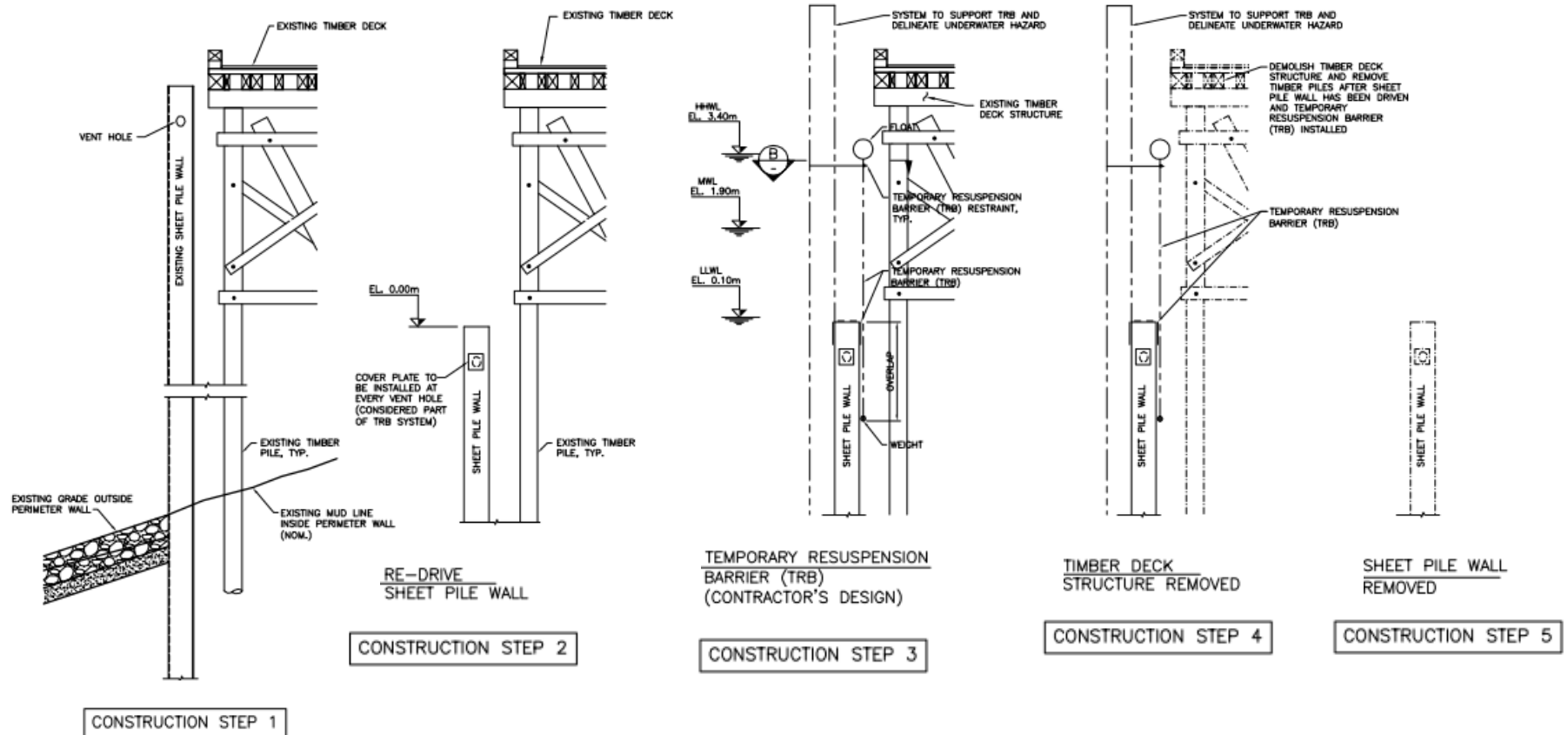
- Recontamination considerations
- Dredging approach
- Capping approach
- Structural modifications
- Construction sequencing



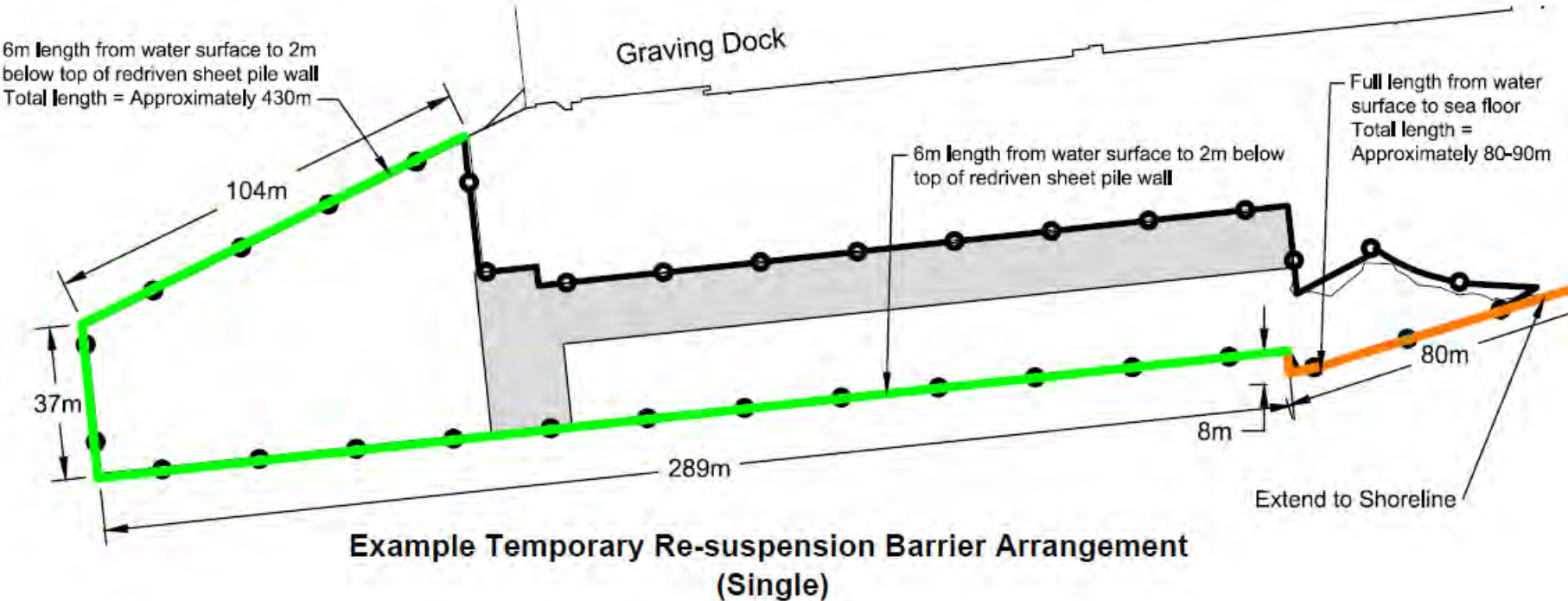
Recontamination Considerations: Under-pier Erosion Protection System (Sheetpile Wall)

- Propped cantilever system to free cantilever system
- Propped and re-driven walls designed using propwash forces and dynamic pressure
- Floating external silt curtain overlapping top of sheetpile wall
- Optional interior silt curtains

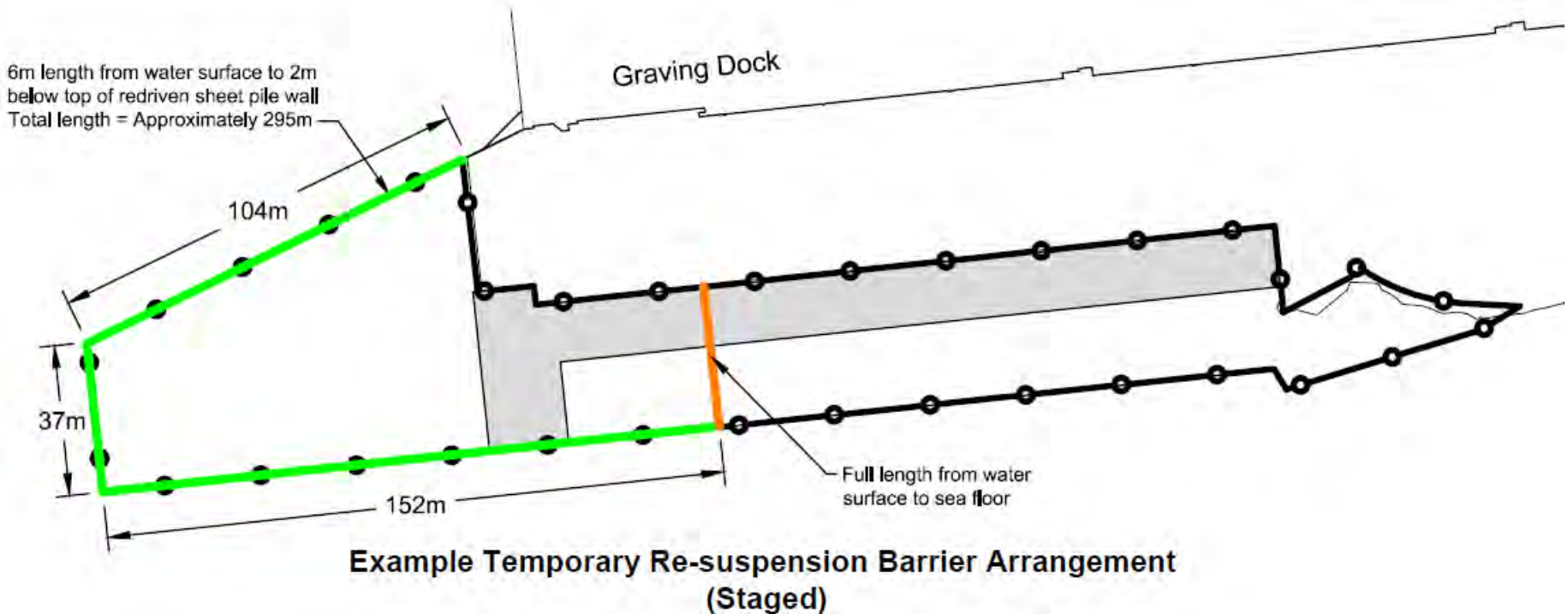
Sheetpile Wall Re-drive and Temporary Resuspension Barrier (TRB) Installation Sequence



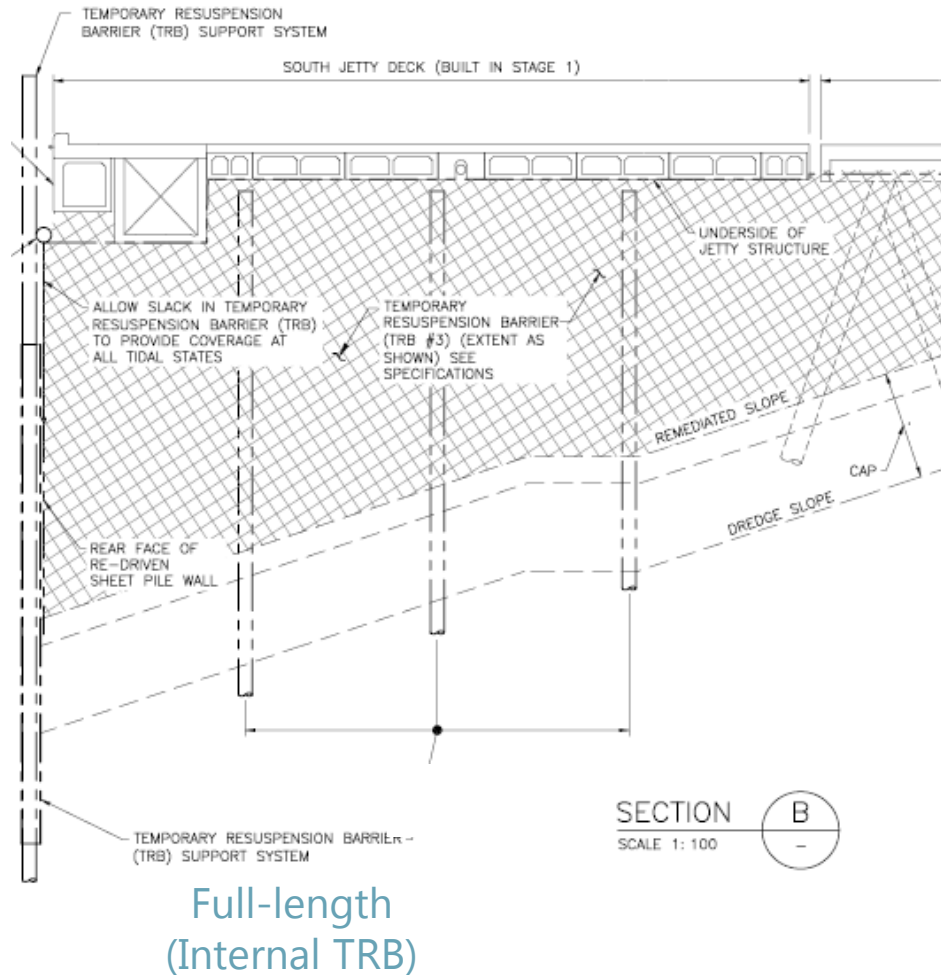
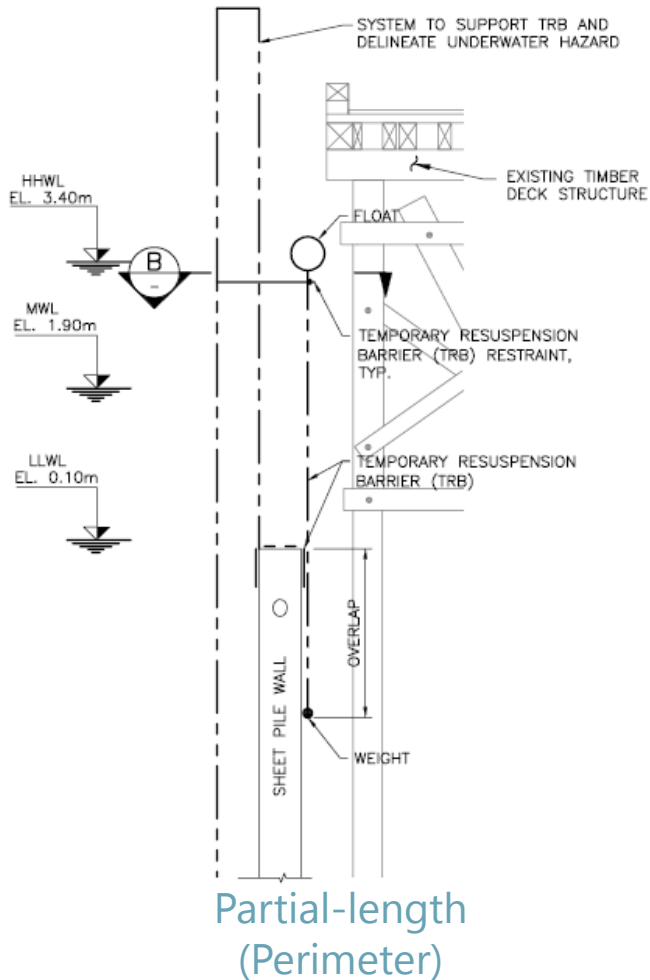
Recontamination Considerations: TRB Barrier Containment Area



Recontamination Considerations: TRB Containment Area (cont.)

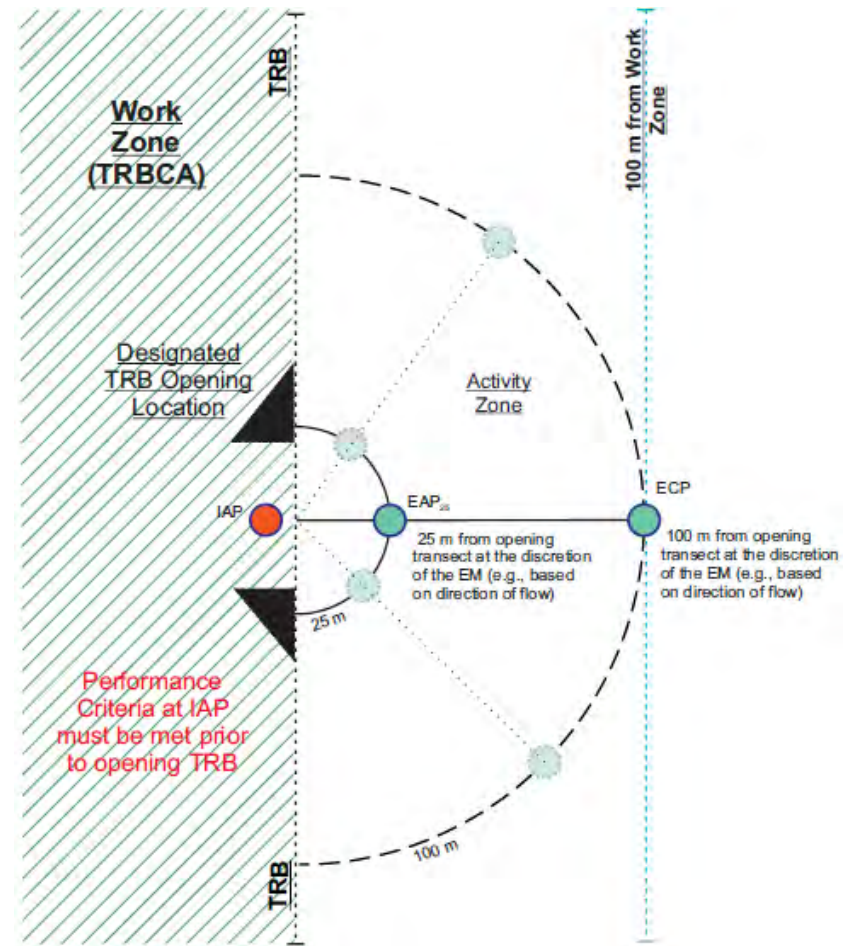


Recontamination Considerations: TRB Containment Area (cont.)



Recontamination Considerations: Intensive Water Quality Monitoring

- Testing for turbidity and chemical concentrations during in-water work
- Monitoring inside the TRB to determine when opening for vessels is permitted



Recontamination Considerations: Sediment Sampling

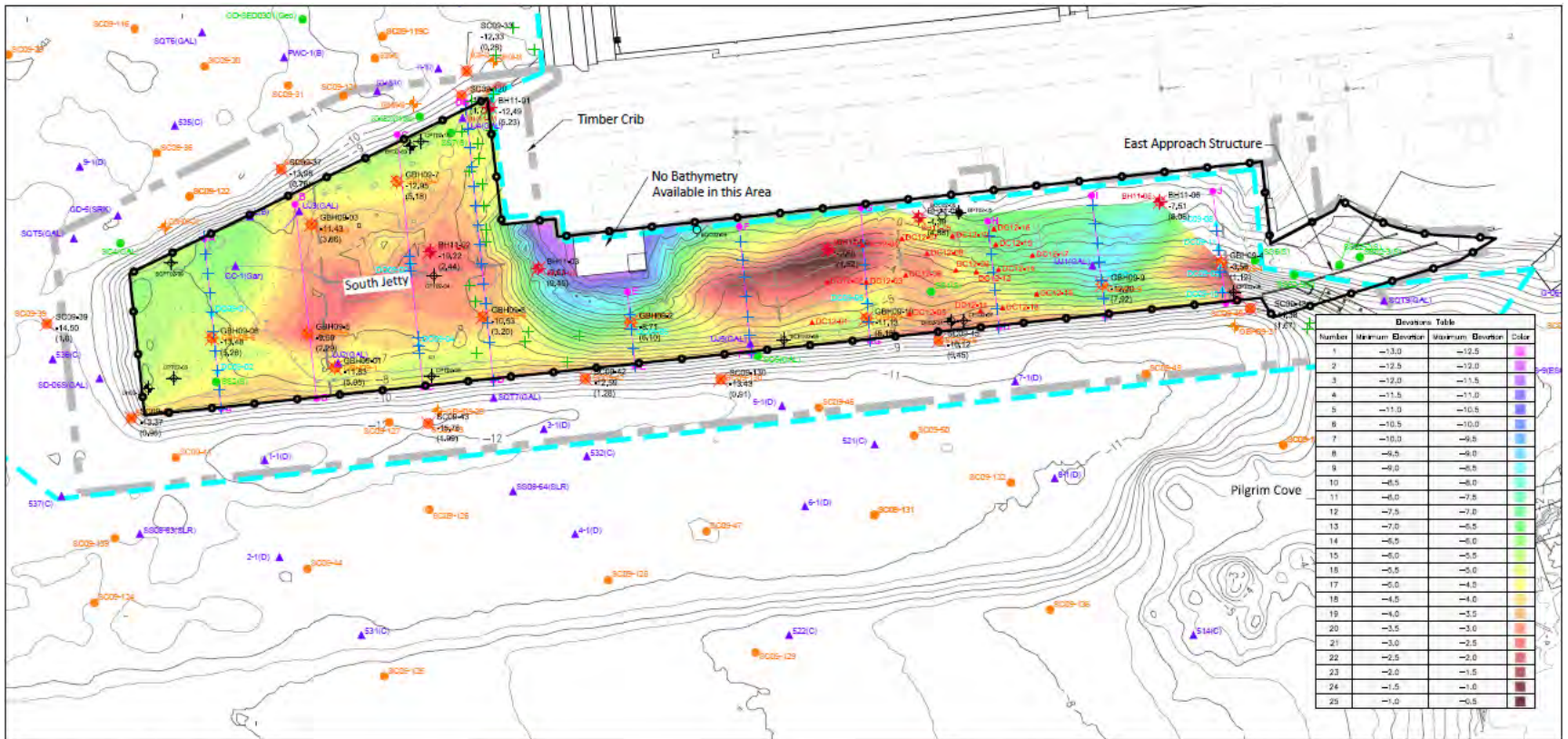
- Pre- and post-dredging samples collected from outside
- Contingency re-dredging or sand cover placement required outside work area



Dredging Approach: Dredge Prism Design Criteria

- Required dredge prism and allowable overdredge
- Creosote-treated timber piles
- Dredge debris
- Development of neatline surface

Dredging Approach: Dredge Prism Design Criteria (cont.)



HORIZONTAL DATUM: UTM Zone 10 Grid, NAD83.
VERTICAL DATUM: Chart Datum (C.D.)
NOTES:

- Lower intertidal and subtidal bathymetry from February 2009, June 2010 and January 2011 CRA Canada Surveys Ltd. multi beam survey. Upper intertidal elevations from September 2009 and July 2011 survey by Focus Corporation.
- Base map from Golder Associates dated 2012.

LEGEND:

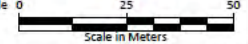
- Dive Transects
- Bathymetry in Meters
- Waterlot Boundary
- Temporary Re-suspension Barrier Containment Area (TRBCA)
- EGD Work Site Boundary

GBH-09-5 (Exploration #) -14.0 (Elevation of Contamination) Depth of Contamination
 (2.29) (Thickness of Contamination)

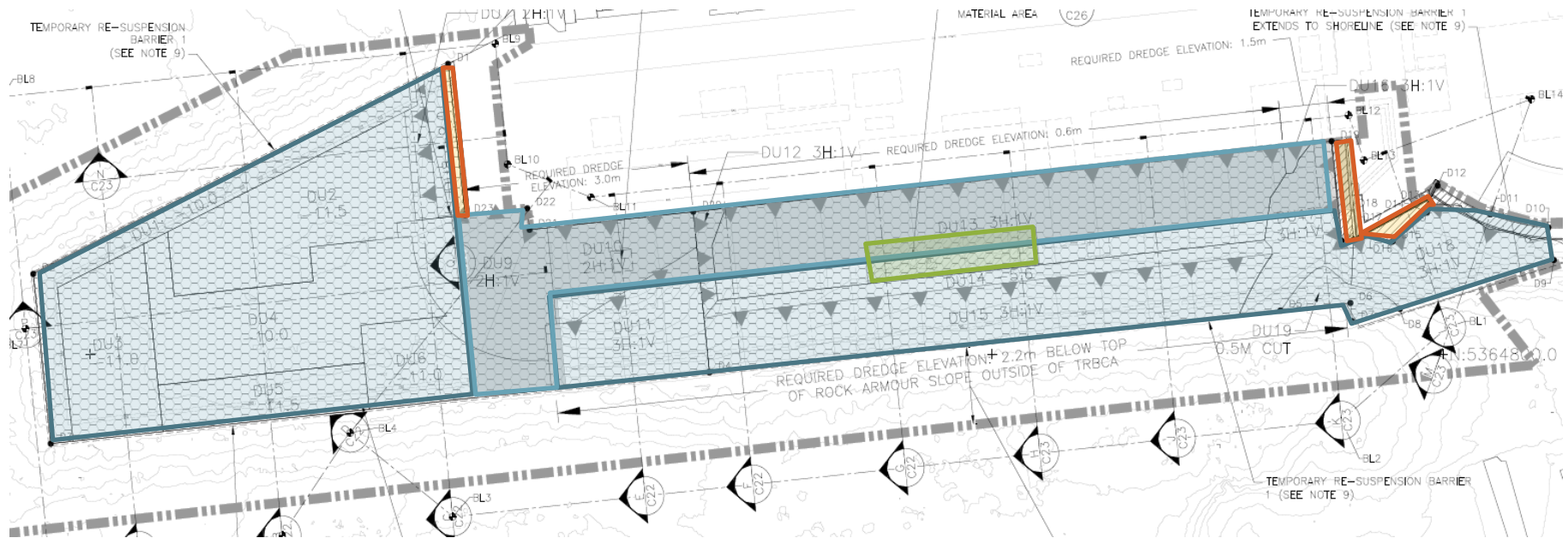
Exploration Locations

- Golder 2012 Diver Core
- Golder 2011 Borehole
- Golder 2010 Sediment Core
- Golder 2010 Sonic Borehole
- Golder 2009 Sediment Core
- Golder 2009 Sonic Borehole
- Golder 2009 Diver Core

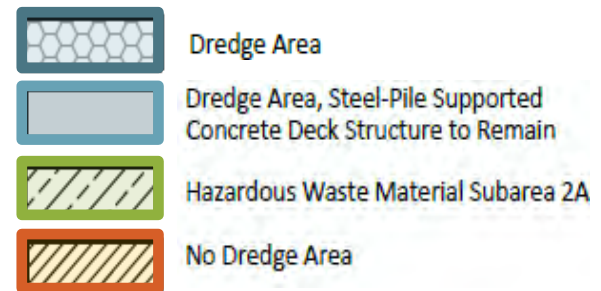
- Golder 2010 Jet Probe
- Golder 2009 Jet Probe
- Golder 2009 Hand Probe
- Historical Sediment Core
- Historical Sediment Grab Sample
- Klohn 2002 Samples



Dredging Approach: Dredge Prism Design Criteria (cont.)



- Removal up to 6.3 m; 2.5 m at sheetpile face
- All dredged material transported from EGD work site via barge to contractor's off-load location



Dredging Approach: Dredge Prism Design Criteria (cont.)



Dredging Approach: Geotechnical and Structural Restrictions

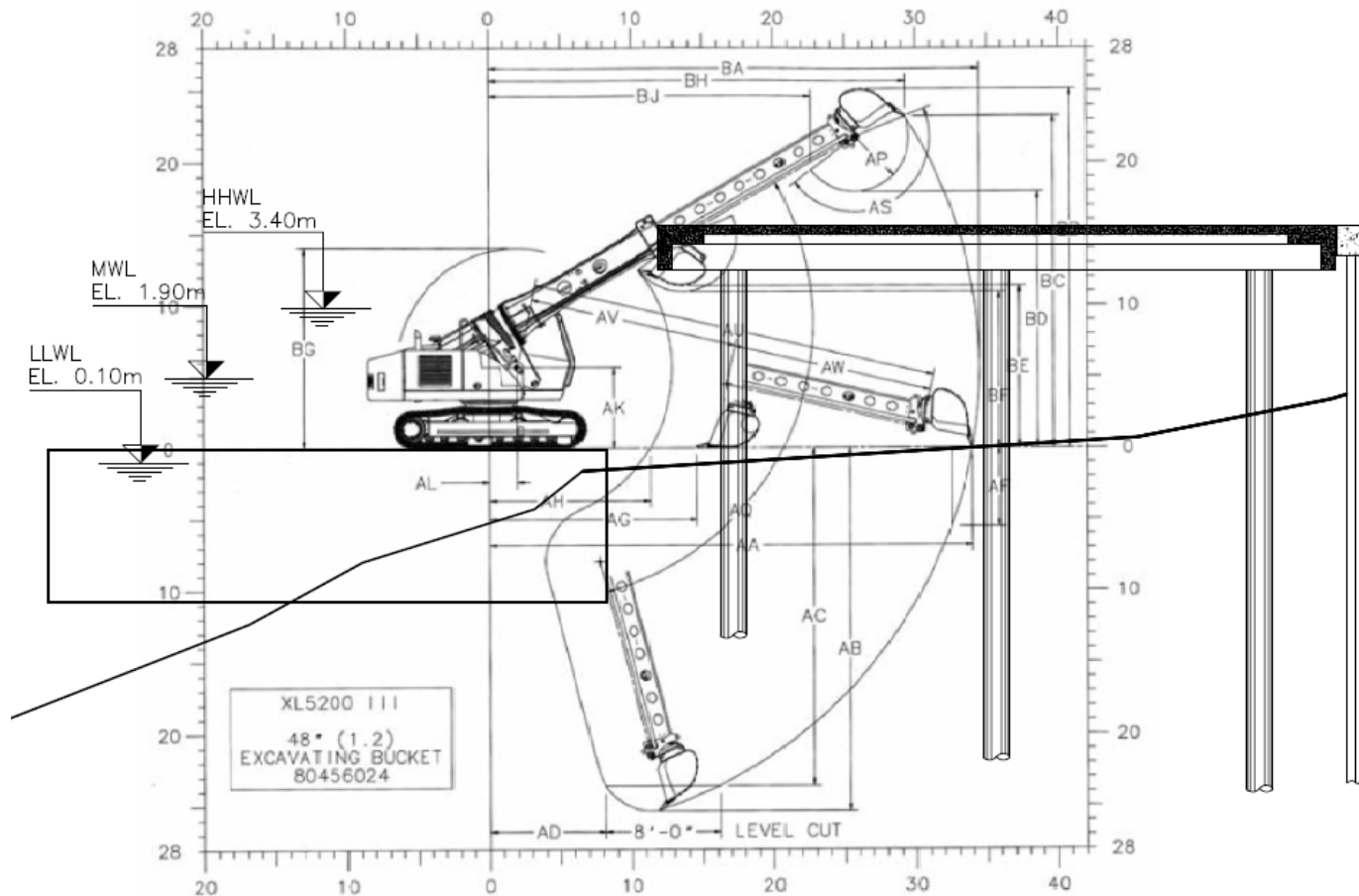
- Existing adjacent structures prevent removal of all contaminated sediments
- Capping in place to address contaminated sediments
- Specific dredge criteria to provide stable slopes following construction



Dredging Approach: Geotechnical and Structural Restrictions (cont.)



Dredging Approach: Equipment Selection Under-pier Removal – Gradall

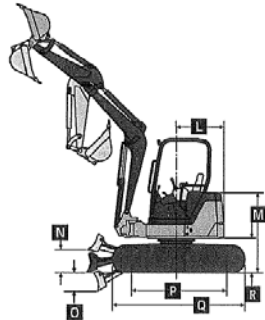
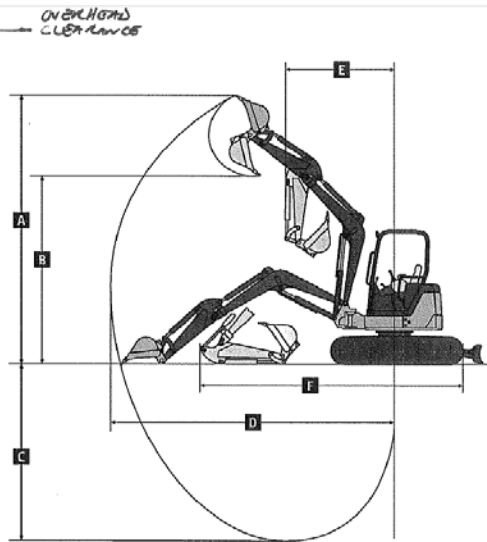


Dredging Approach: Equipment Selection Under-pier Removal

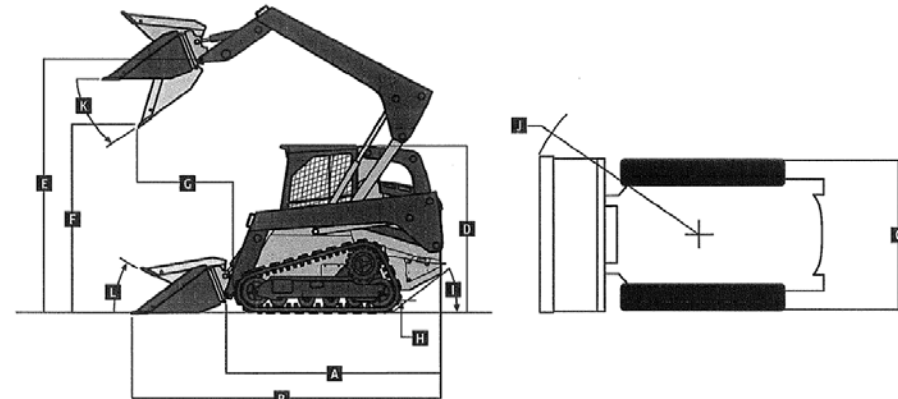
Mini Excavator

Skidsteer Loader

H Overall Height	2.51 m (8 ft. 3 in.)
Canopy	2.55 m (8 ft. 4 in.)
I Track Width	400 mm (16 in.)
J Undercarriage Width	2.00 m (6 ft. 7 in.)
K Ground Clearance	340 mm (13.4 in.)
L Tail Swing Radius	
Standard Arm	1.00 m (3 ft. 3 in.)
Long Arm with Extra Counterweight	1.08 m (3 ft. 7 in.)
M Engine Cover Height	1.51 m (4 ft. 11 in.)
N Maximum Blade Lift Above Ground	430 mm (16.9 in.)
O Maximum Blade Drop Below Ground	335 mm (13.2 in.)
P Sprocket Center To Idler Center	1.99 m (6 ft. 6 in.)
Q Track Length	2.50 m (8 ft. 2 in.)
R Counterweight Clearance	610 mm (24 in.)



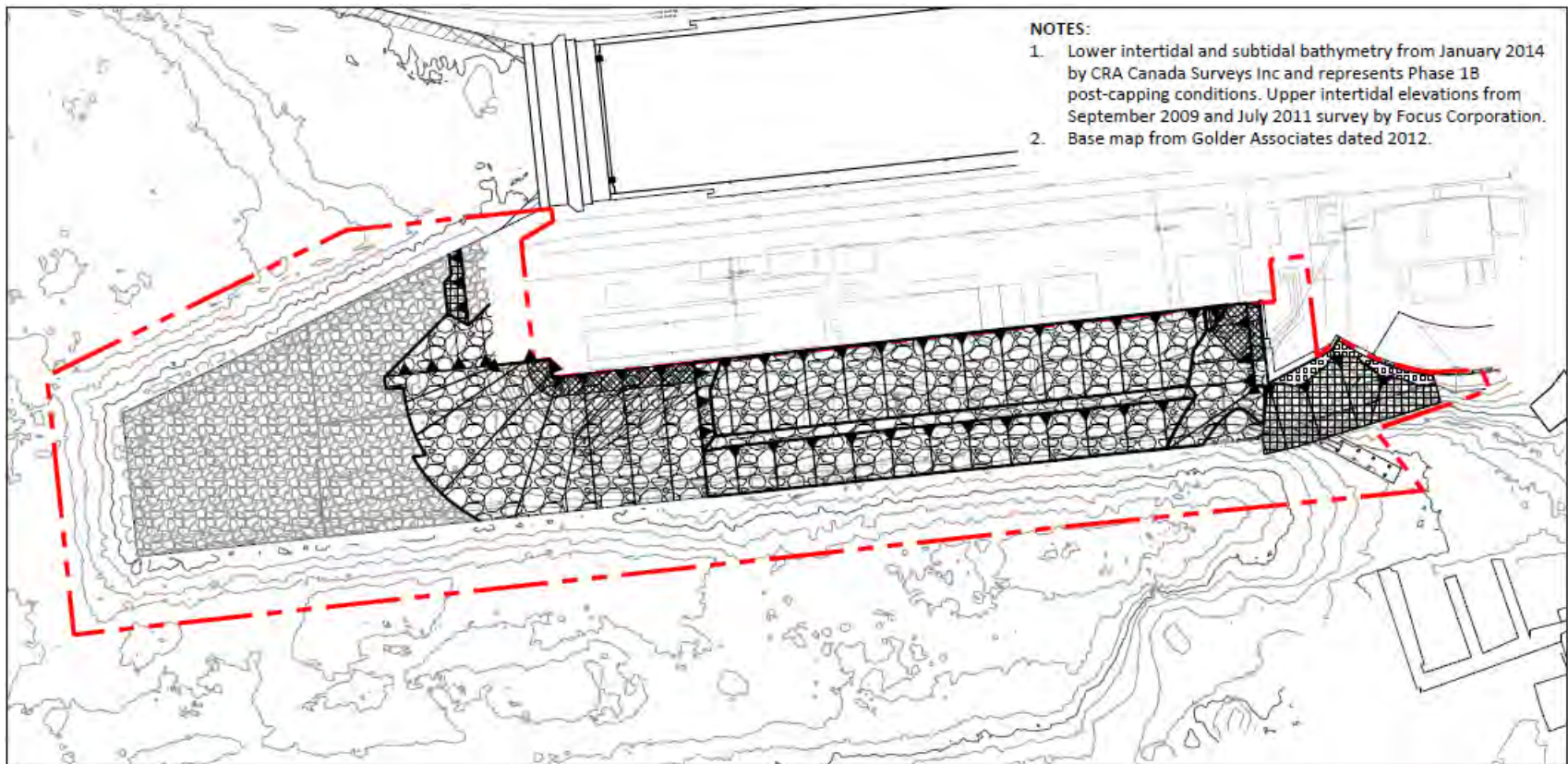
D Height to Top of ROPS	2.15 m (7 ft. 1 in.)	2.15 m (7 ft. 1 in.)
E Height to Hinge Pin	3.20 m (10 ft. 6 in.)	3.20 m (10 ft. 6 in.)
F Dump Height	2.59 m (8 ft. 6 in.)	2.59 m (8 ft. 6 in.)
G Dump Reach		
With Foundry Bucket	819 mm (32.2 in.)	819 mm (32.2 in.)
With Construction Bucket	1.00 m (3 ft. 3 in.)	1.00 m (3 ft. 3 in.)
H Ground Clearance	265 mm (10.4 in.)	265 mm (10.4 in.)
I Angle of Departure	32 deg.	32 deg.
J Front Turn Radius	2.17 m (7 ft. 1 in.)	2.17 m (7 ft. 1 in.)
K Dump Angle (full lift height)	45 deg.	45 deg.
L Bucket Rollback (ground level)	35 deg.	35 deg.



Capping Approach: Cap Modeling

- Reible steady-state model to account for movement of dissolved contaminants by advection and diffusion
- Determine minimum thickness of isolation material and time for cap sediments to reach steady-state
- Determine erosion prevention and slope stabilization requirements




Capping Approach: Cap Types








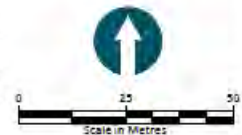
NOTES:

1. Lower intertidal and subtidal bathymetry from January 2014 by CRA Canada Surveys Inc and represents Phase 1B post-capping conditions. Upper intertidal elevations from September 2009 and July 2011 survey by Focus Corporation.
2. Base map from Golder Associates dated 2012.

HORIZONTAL DATUM: UTM Zone 10 Grid, NAD83.
VERTICAL DATUM: Chart Datum (CD).

-  EGD Work Site Boundary
-  Temporary Re-suspension Barrier Containment Area (TRBCA)
-  Impermeable Geosynthetic Material

-  Type 1 Engineered Cap: 0.15-metre Rock Armour Layer Over Filter Layer Over Sand (Type 1) Layer.
-  Type 2 Engineered Cap: 0.15-metre Rock Armour Layer Over Filter Layer Over Sand (Type 2) Layer.
-  Type 3 Engineered Cap: 0.30-metre Rock Armour Layer Over Filter Layer Over Sand (Type 2) Layer.
-  Type 4 Engineered Cap: 0.30-metre Rock Armour Layer Over Filter Layer Over Sand (Type 3) Layer.
-  Type 5 Engineered Cap: 0.15-metre Rock Armour.



Capping Approach: Impermeable Liner

- Impermeable geosynthetic material
- Used in areas where structural and geotechnical requirements limit dredging elevation and placement thickness





Structural Modifications

- Temporary relocation (tug boat wharf)
- Temporary removal/ reinstatement of cathode protection system
- Selective demolition and reinstatement (e.g., cat walk, safety ladders, and mooring boards)

Construction Sequencing

- Test dredge
 - Assess contractor's means and methods, positioning control, and water quality criteria
- Hazardous waste material
 - Sequenced to prevent recontamination
 - Confirmation testing
- Staged or concurrent construction
 - Contractor's option
 - Silt curtain requirements

Schedule

- Contract award: August 2015
- Construction: October 2015 to October 2016





Questions

- Dan Berlin, dberlin@anchoragea.com