



Esquimalt Graving Dock Waterlot Remediation Mega-Site (Phase 1B): Design, Contracting, and Construction Challenges

Dan Berlin, Anchor QEA, LLC

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Public Works and
Government Services
Canada

Travaux publics et
Services gouvernementaux
Canada



Presentation Overview

- Esquimalt Graving Dock (EGD) site description and background
- Phase 1B description and objectives
- Challenges
 - Remedial design
 - Construction tendering
 - Construction implementation
- Project performance

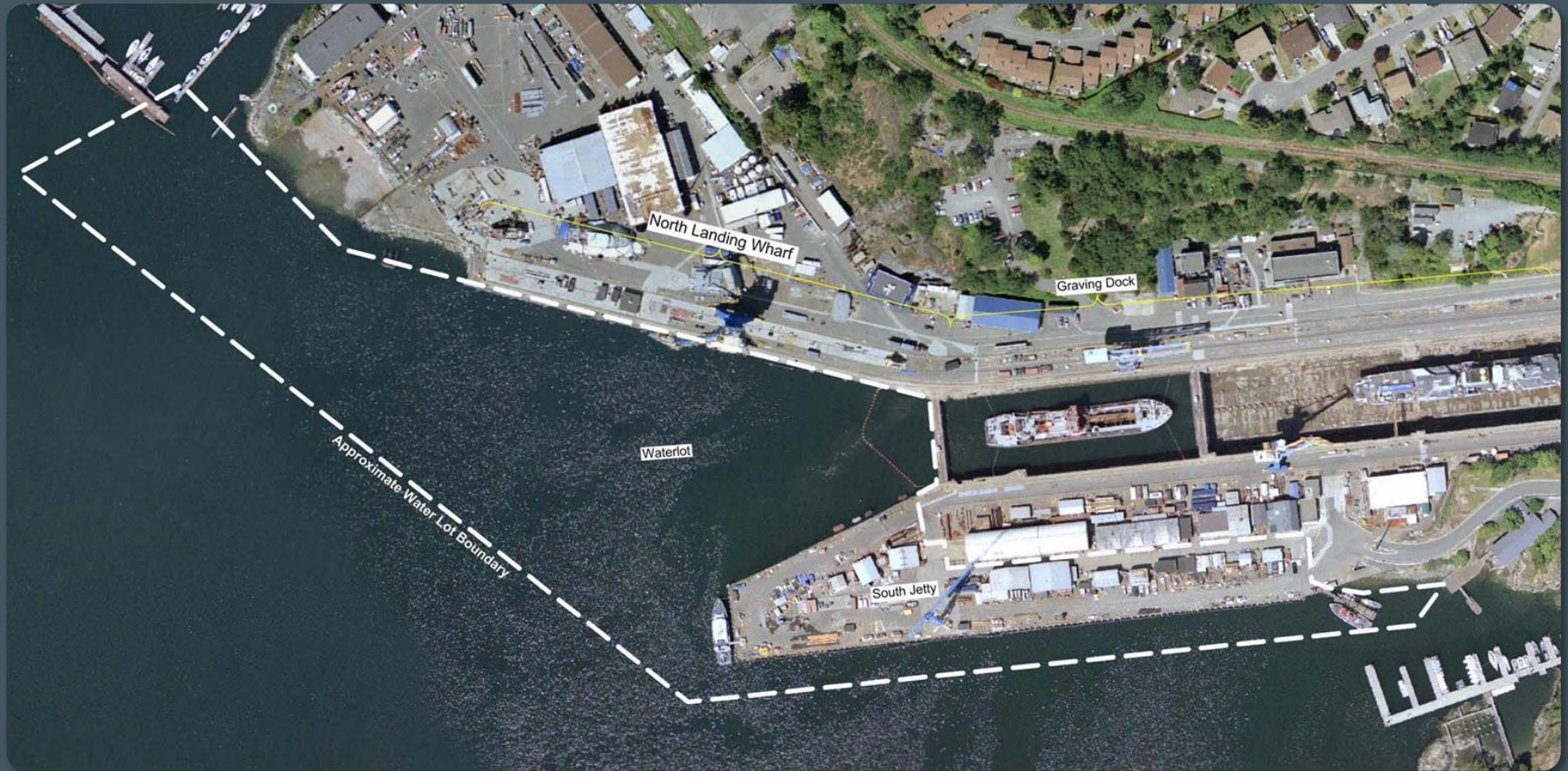
Site Description and Background



DND - Department of National Defence

EGD - Esquimalt Graving Dock

Site Description and Background (cont.)



Site Description and Background (cont.)



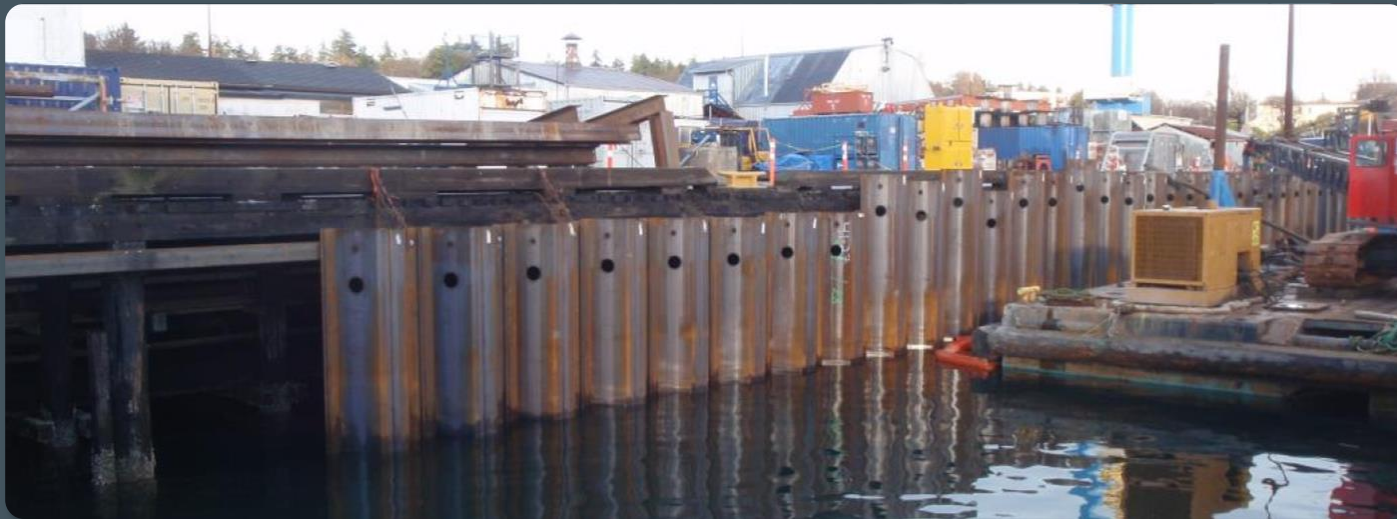
Active Shipyard/Graving Dock Facility

- More than 50 vessel calls per year



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 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.)



Phases 1C and 2

- Phase 1C – Habitat compensation
 - Offsets impacts of alteration and isolation of under-pier habitat
 - Construction of new intertidal marsh fish habitat
- Phase 2 – Under-pier remediation
 - 40,000 m³ of contaminated sediment removal
 - To be conducted within 10 years in coordination with jetty redevelopment projects

Key Phase 1B 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 the environment
 - Achieve Federal Contaminated Sites Action Plan objectives

Key Phase 1B Objectives (cont.)

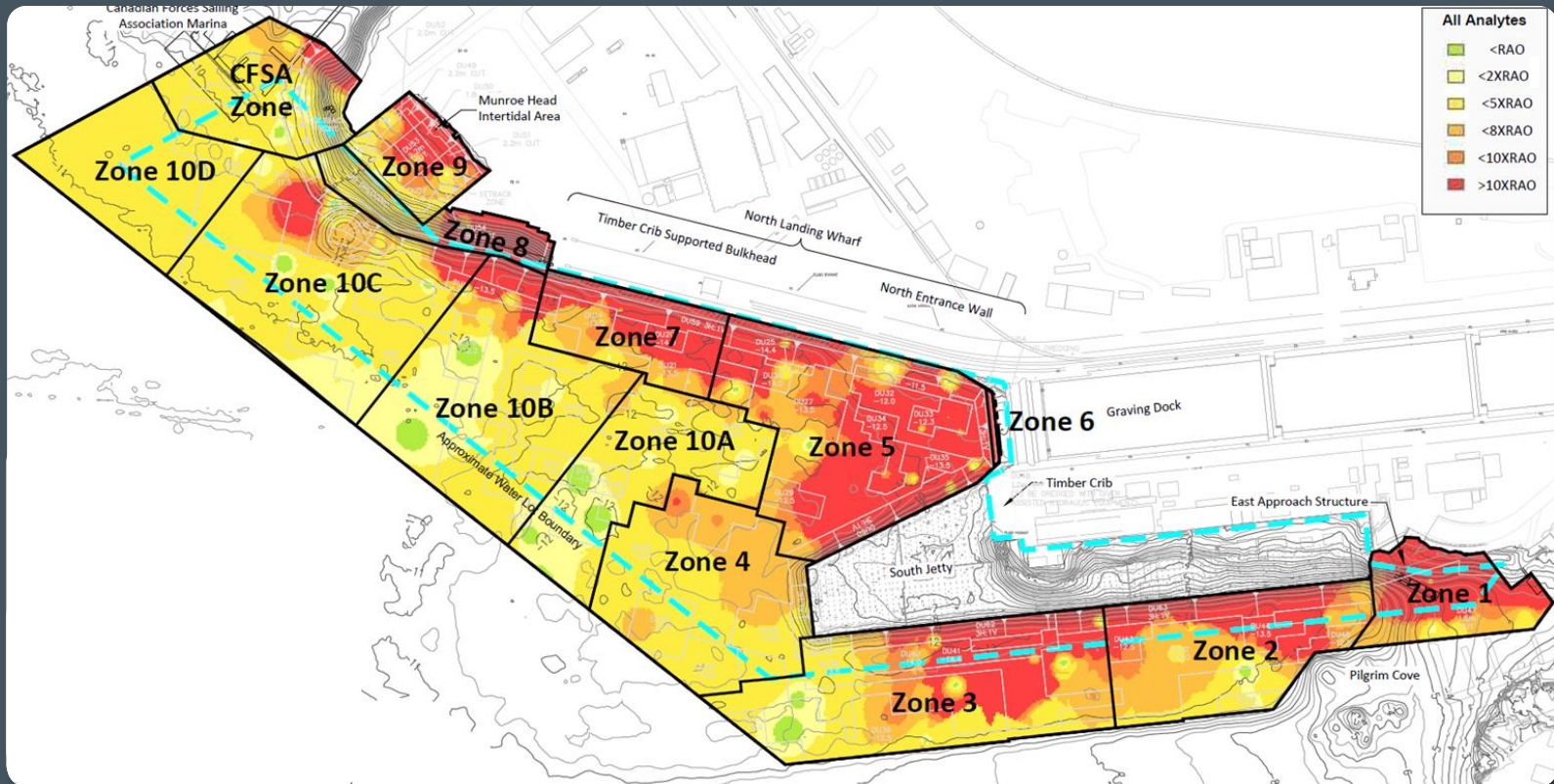
- Schedule
 - Minimize disturbance to operations
 - Complete by March 2014
- Ensure high level of certainty in project outcome
 - Conservative, practical, and constructible design
 - Proven technologies
 - Qualified contractors

Design Challenges

- Development of remedial dredge prism
- Dredge residuals management
- Construction sequencing and operations needs
- Water quality criteria and best management practices (BMPs)
- Geotechnical and structural restrictions
- Balancing use of performance vs. prescriptive specifications
- Risk-based contingency

Development of Remedial Dredge Prism

- Dredge design considerations



Legacy contaminants (metals, tributyl tin [TBT], polycyclic aromatic hydrocarbons [PAHs], and polychlorinated biphenyls [PCBs])

Development of Remedial Dredge Prism (cont.)

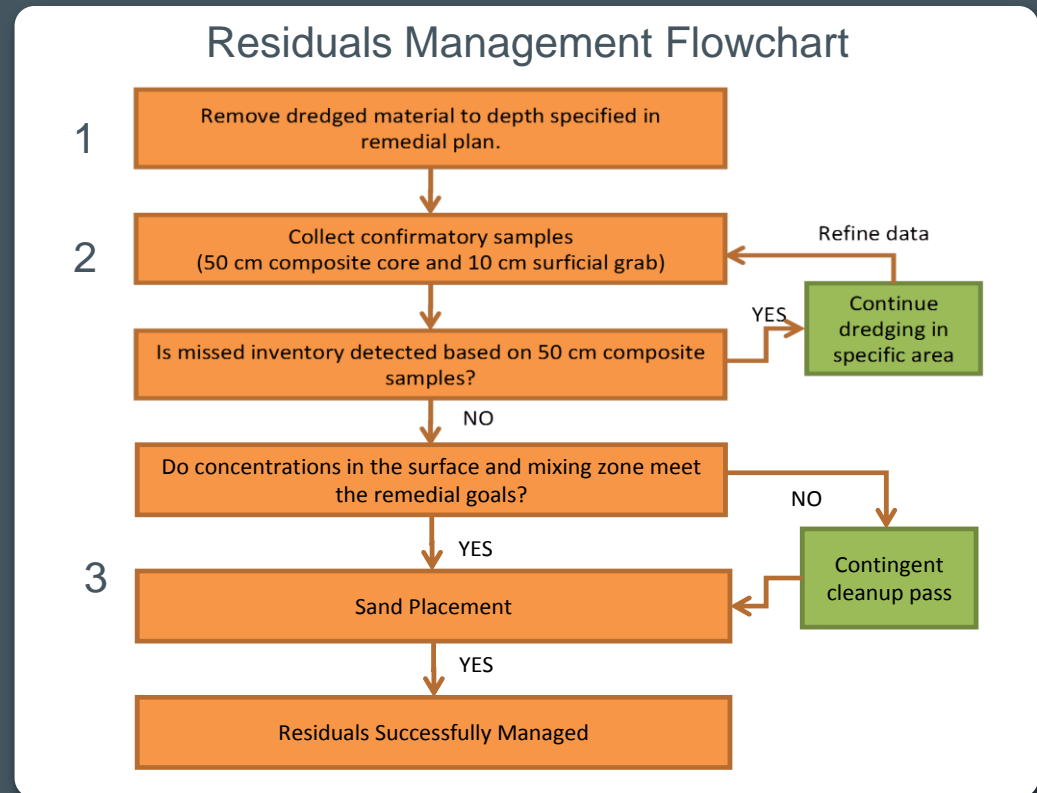
- Dredge design considerations

Removal Scenario	Removal Volume, m ³	Confidence Level
Contaminated Neatline (no OD)	71,250	50%
Contaminated Neatline + 0.3 m OD	98,444	70%
Contaminated Neatline + 0.5 m OD	116,573	85%
Dredge Prism Design (no OD)	117,336	90%
<i>Dredge Prism Design + 0.3 m OD*</i>	<i>149,630</i>	<i>94%</i>
Dredge Prism Design + 0.5 m OD	162,658	99%

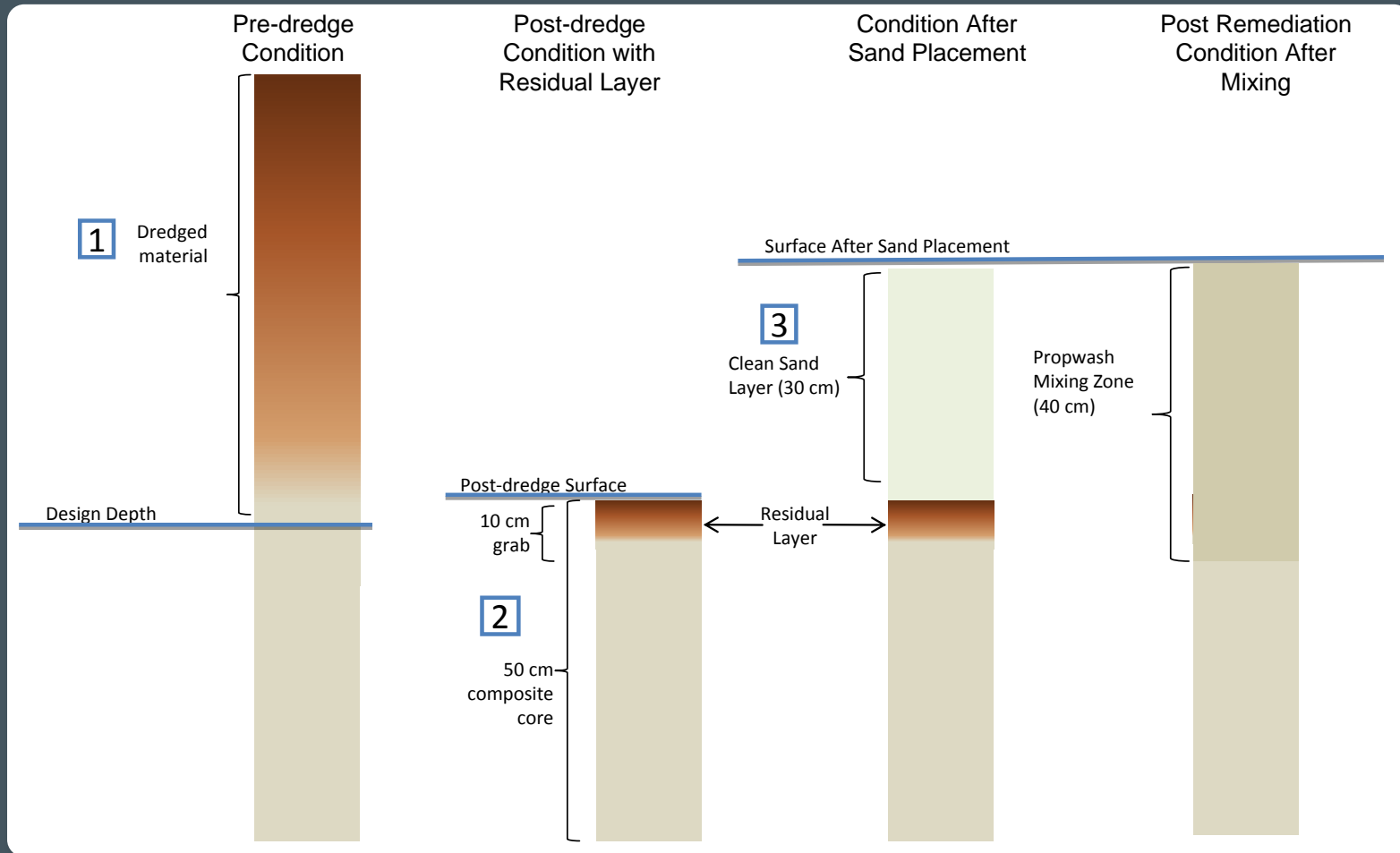
* Selected design criteria

Residuals Management at EGD

- Confirmation testing for contingency dredging
- Placement of residuals management cover material

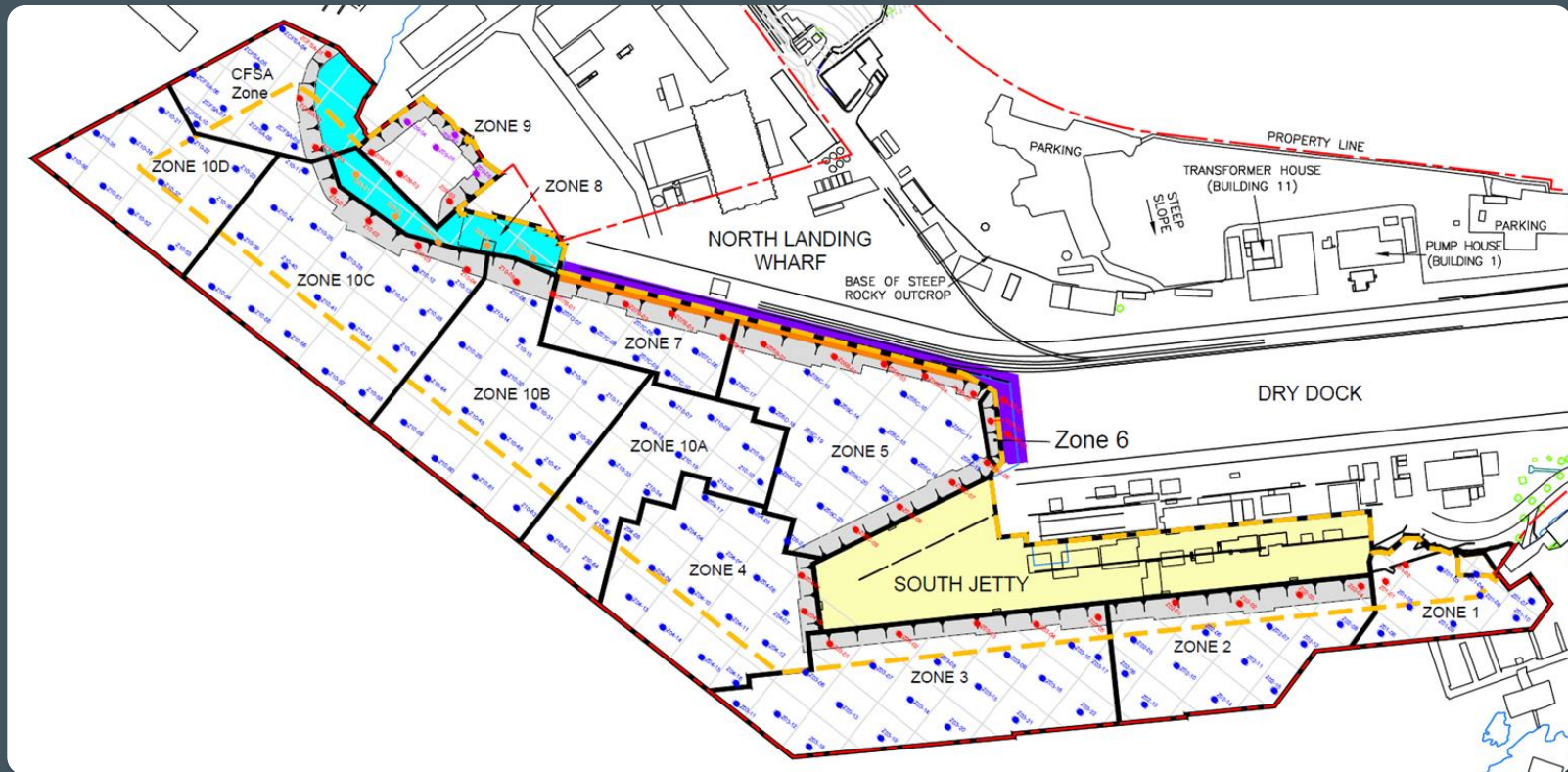


Residuals Management at EGD (cont.)



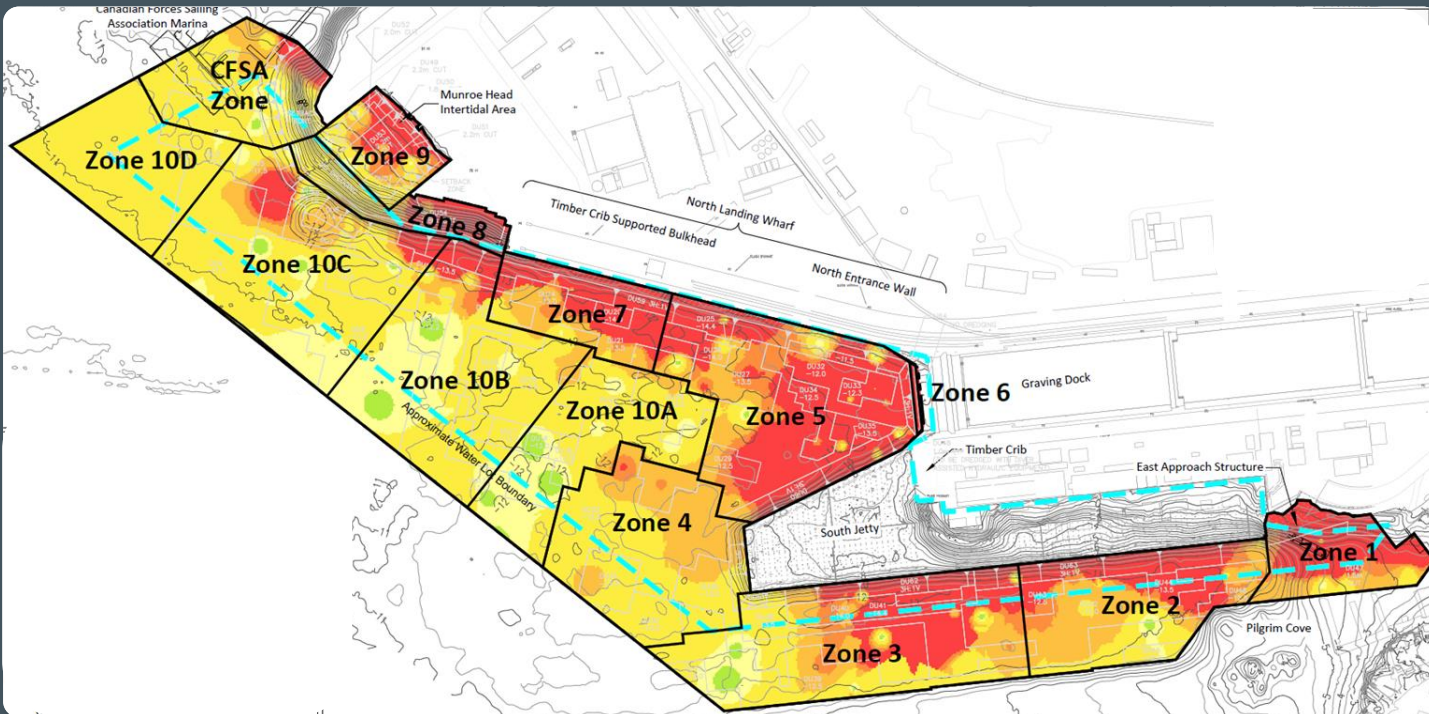
Confirmatory Sampling

- Residuals management strategy included in design
 - Contingency actions during construction



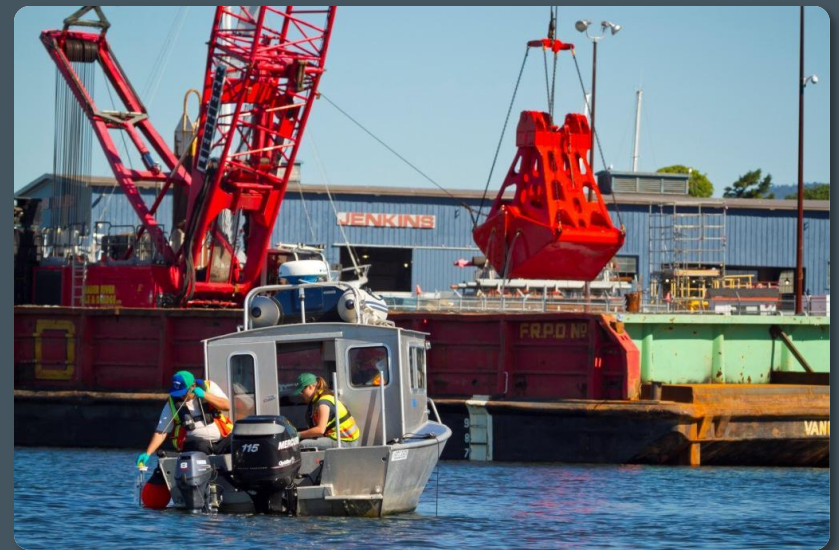
Construction Sequencing

- Construction sequencing to remove “hotter” contamination areas first
- Operational considerations

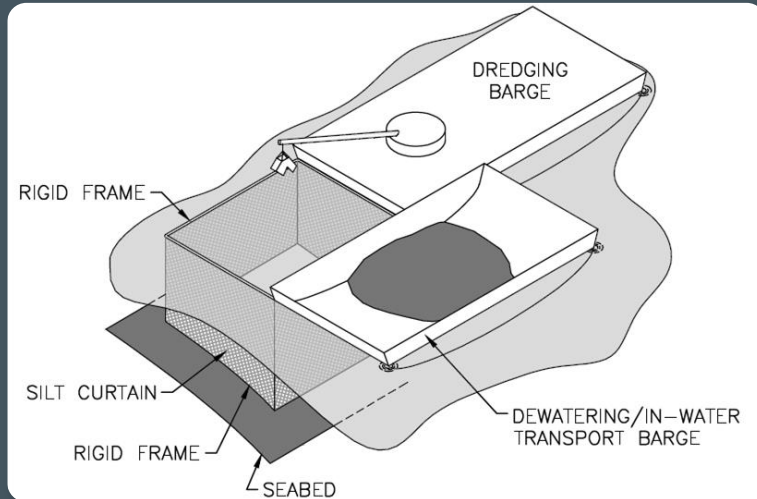


Water Quality Monitoring

- Intensive water quality monitoring as part of comprehensive environmental monitoring program
 - Field turbidity monitoring
 - Assess total suspended solids from dredging
 - Allow faster responsiveness in the field
 - Laboratory analysis to confirm field results



Silt Curtain



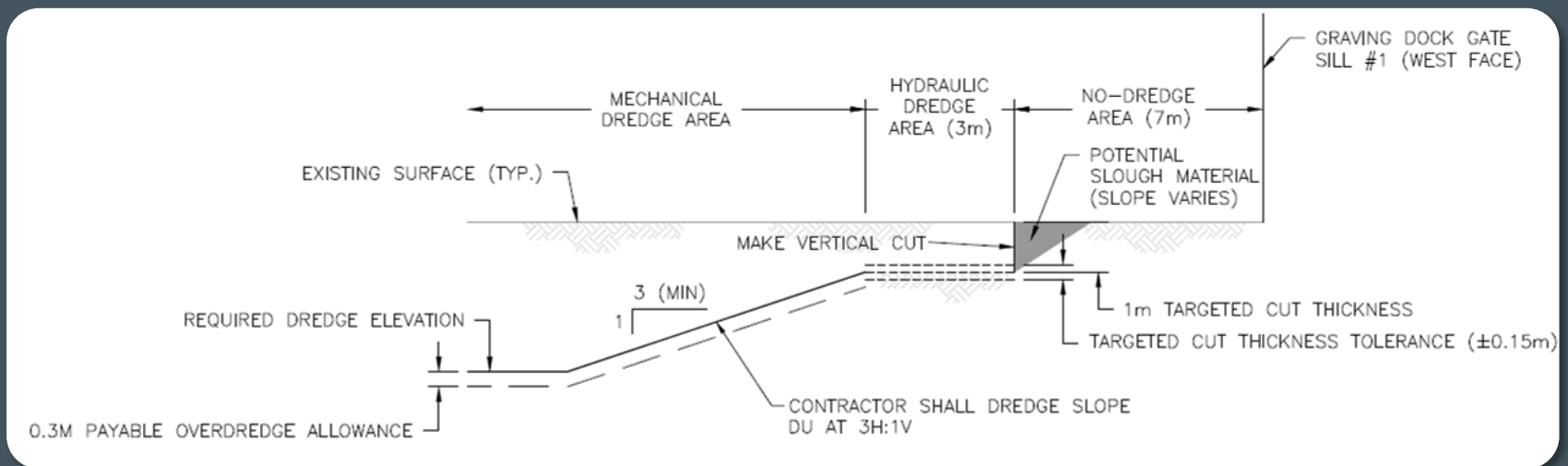
Integrating Geotechnical and Structural Restrictions

- Work adjacent to existing structures
 - Requirements for dredging setback and offsets

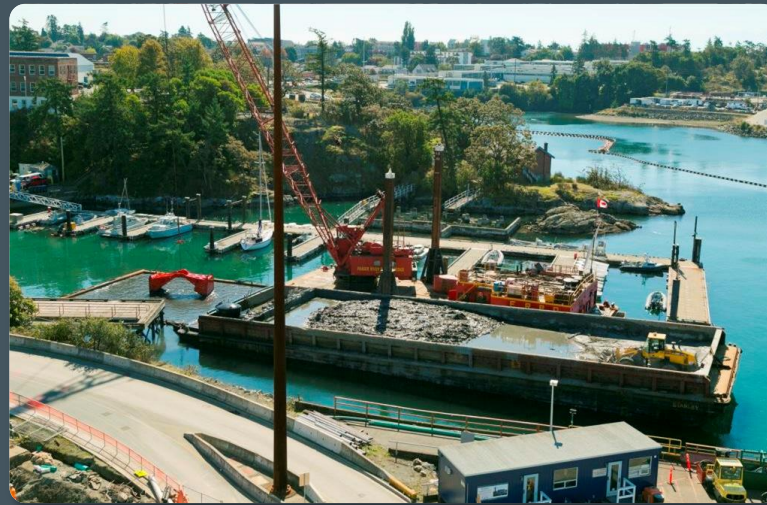


Integrating Geotechnical and Structural Restrictions (cont.)

- Graving dock sill



Integrating Geotechnical and Structural Restrictions (cont.)



Performance-Based vs. Prescriptive-Based Specifications

- Performance-based specifications
 - Achieving required dredge prism
 - Environmental compliance
 - Silt curtain usage
 - Water quality
 - Placement of in-water slope armour and backfill material
 - Transport and disposal

Performance-Based vs. Prescriptive-Based Specifications (cont.)

- Prescriptive-based specifications
 - Operational considerations
 - Construction sequencing
 - Fisheries and Oceans Canada (DFO) work windows
 - Work near structurally sensitive areas
 - Quality control
 - Surveying
 - Reporting
 - Transport and disposal

Risk Management Contingency Budget

- Identify key construction risks and potential consequences
- Identify controls and risk response strategy
- Calculate risk allowance
 - Based on likelihood, impact, and response
- Calculate Risk Management Contingency
- Update during course of project

Construction Tendering Challenges

- Limited pool of potentially qualified contractors
 - Develop Invitation To Tender qualification criteria
 - Contaminated sediment dredging > 40,000 m³
 - In-water slope armoring
 - Silt curtains and projects requiring Environmental Management Plans
 - Active marine site
 - Land transport and landfill disposal > 20,000 m³
 - Contracting strategy
 - Single Design-Bid-Build contract
 - Public tender
 - Balance cost competitiveness vs. risk

Key Pre-Construction Challenges

- Pre-construction submittal requirements
 - Landfill disposal and offload facility permits
 - Construction work plan
 - Environmental protection plan
 - Quality control plan
- Public communication and outreach
- Design team responsibilities
 - Construction Quality Assurance Plan
 - Environmental Management Implementation Plan
 - Confirmatory Sediment Sampling Plan

Key Construction Challenges

- Construction impacts on EGD operations
 - Operations takes precedence over construction
 - Booking schedule changes
 - Limited on-site staging area
 - DND facility coordination
- Contractor schedule changes
- Residual management cover placement after dredging is complete



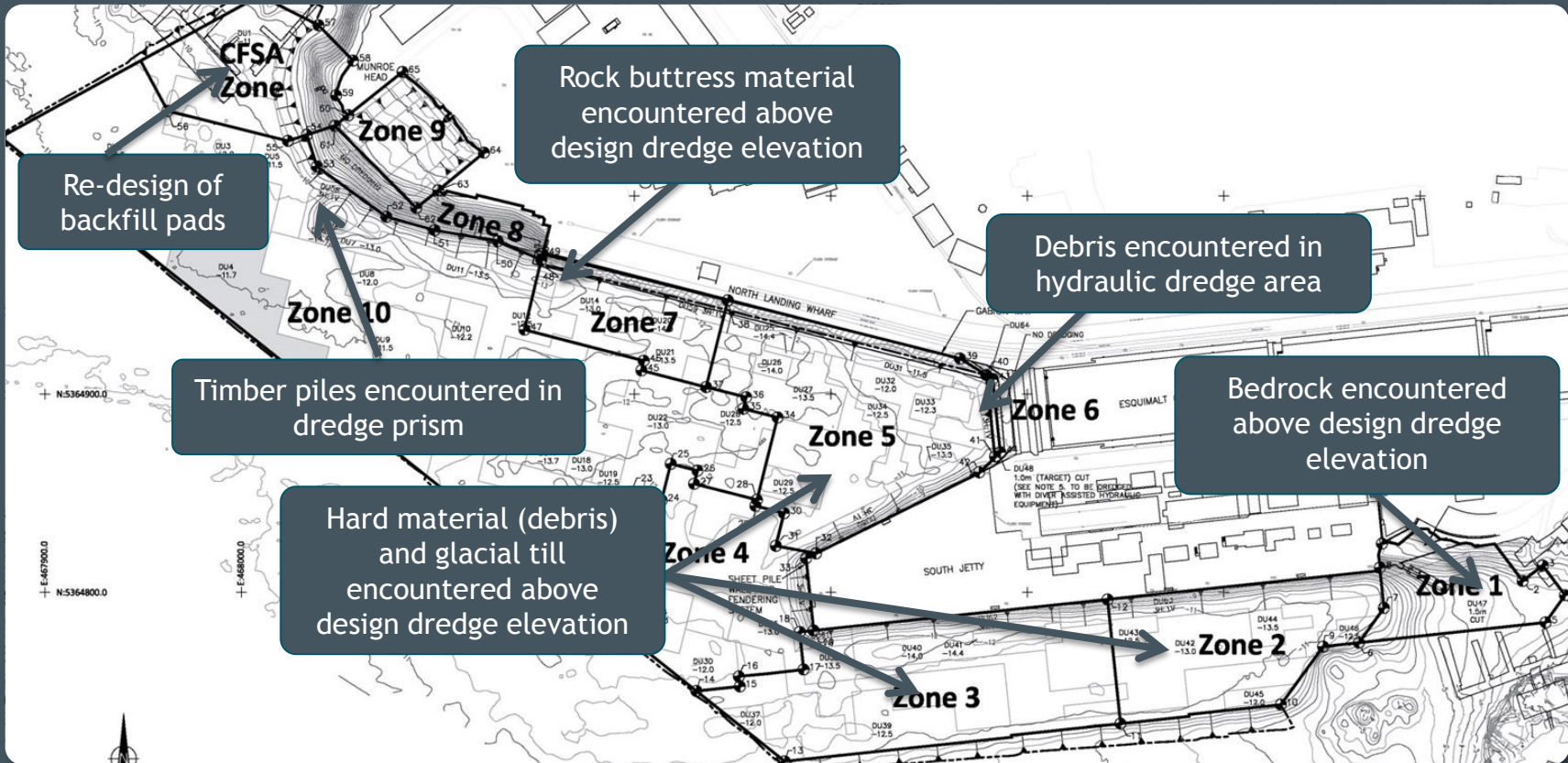
Key Construction Challenges (cont.)

- Contractor experience with large-scale sediment remediation
 - Achieve tight design tolerances
 - Offload facility production rate
 - Diver-assisted hydraulic dredging
 - Dewatering



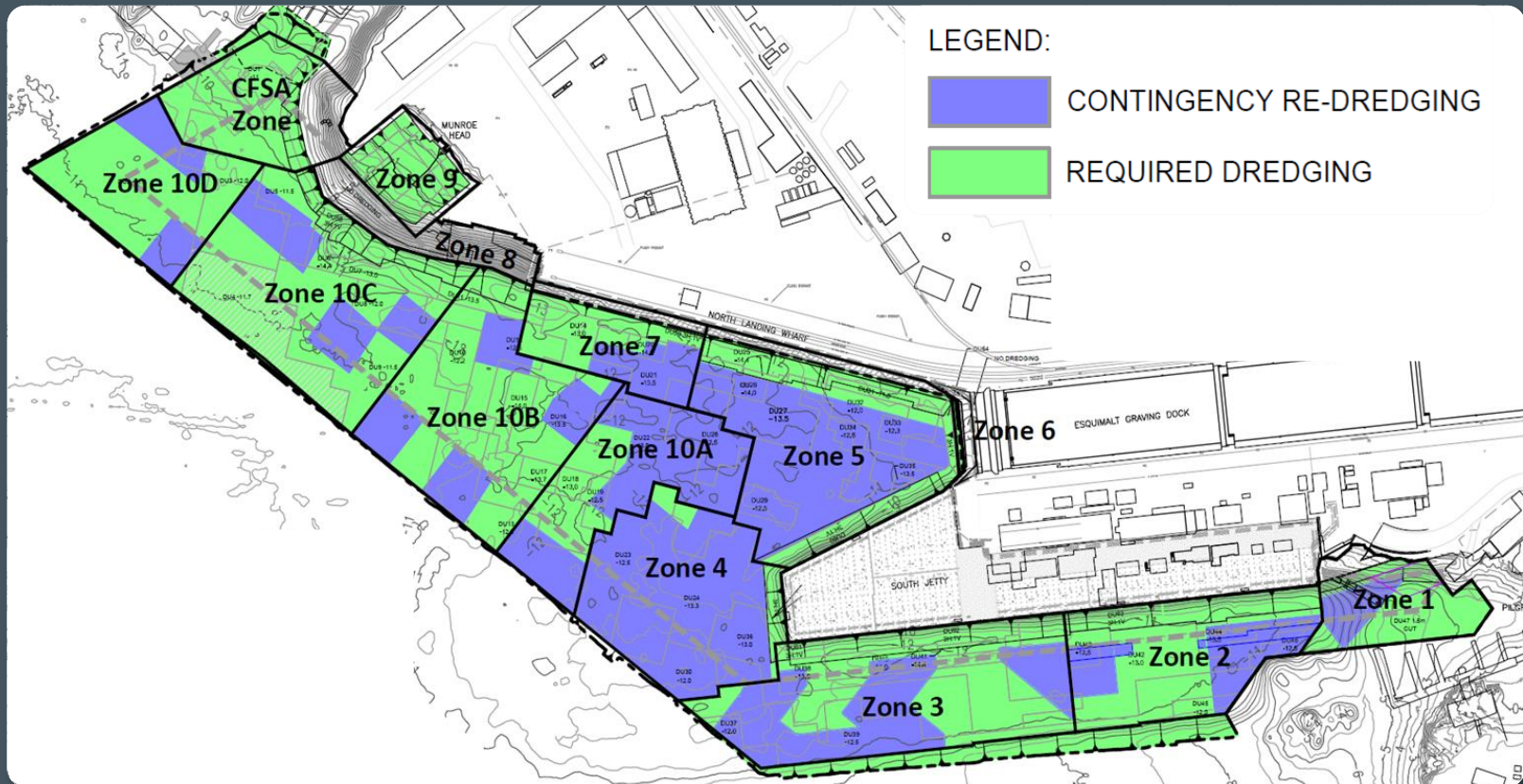
Key Construction Challenges (cont.)

- Remove maximum contamination practicable
 - Unanticipated subsurface conditions



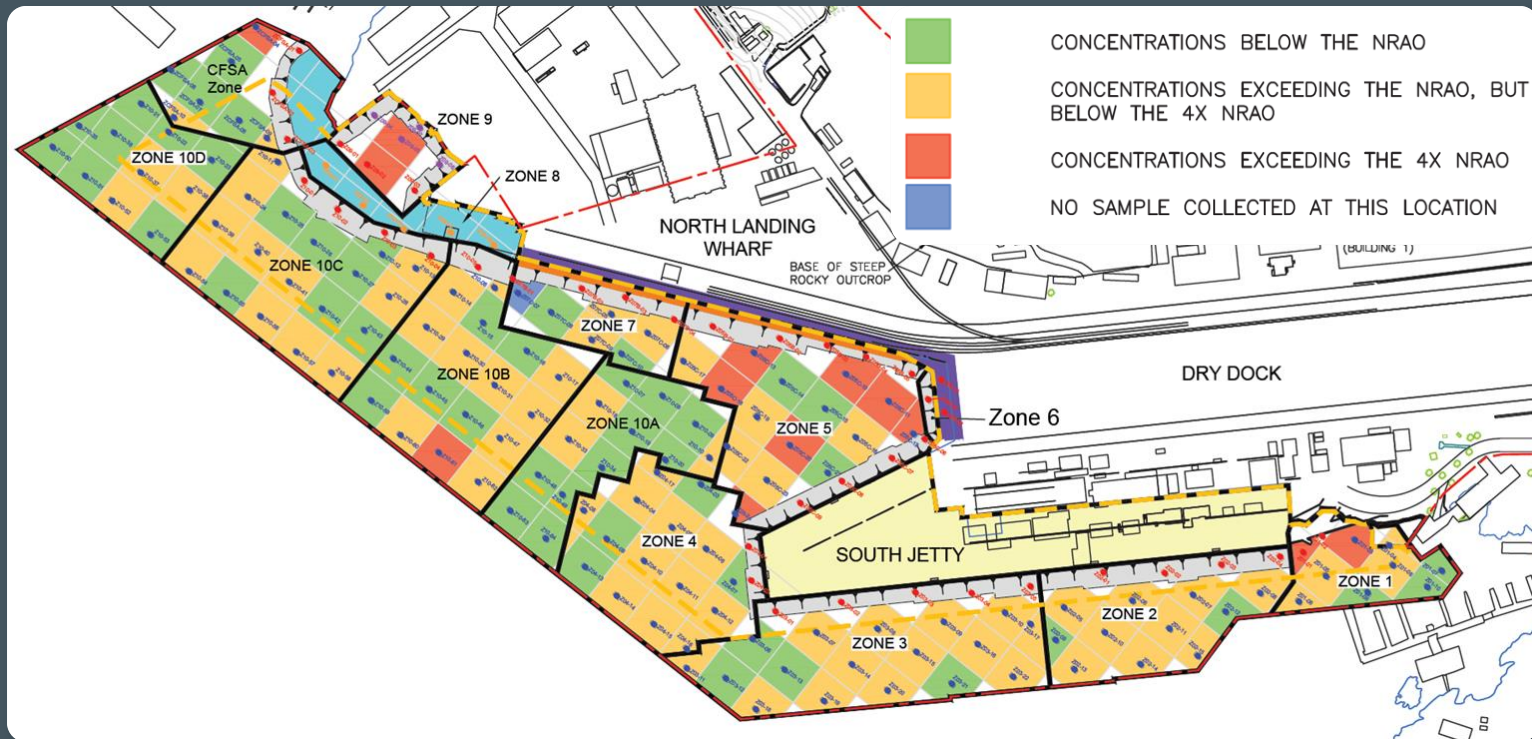
Key Construction Challenges (cont.)

- Remove maximum contamination practicable
 - Missed inventory and residuals contingency dredging



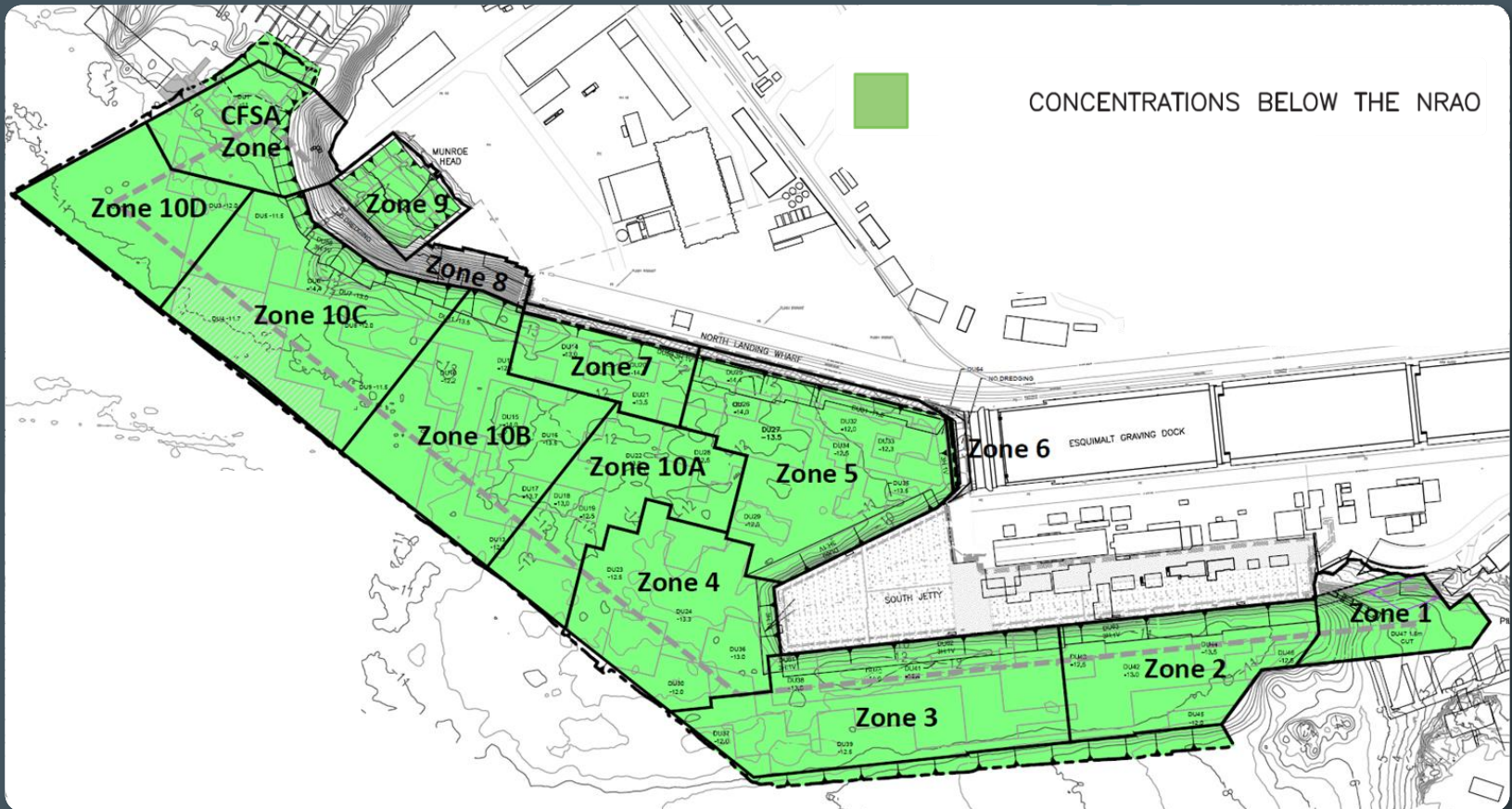
Project Performance

- Work completed on schedule in March 2014
- Maximum contaminant removal - 145,600 m³
- Confirmatory results

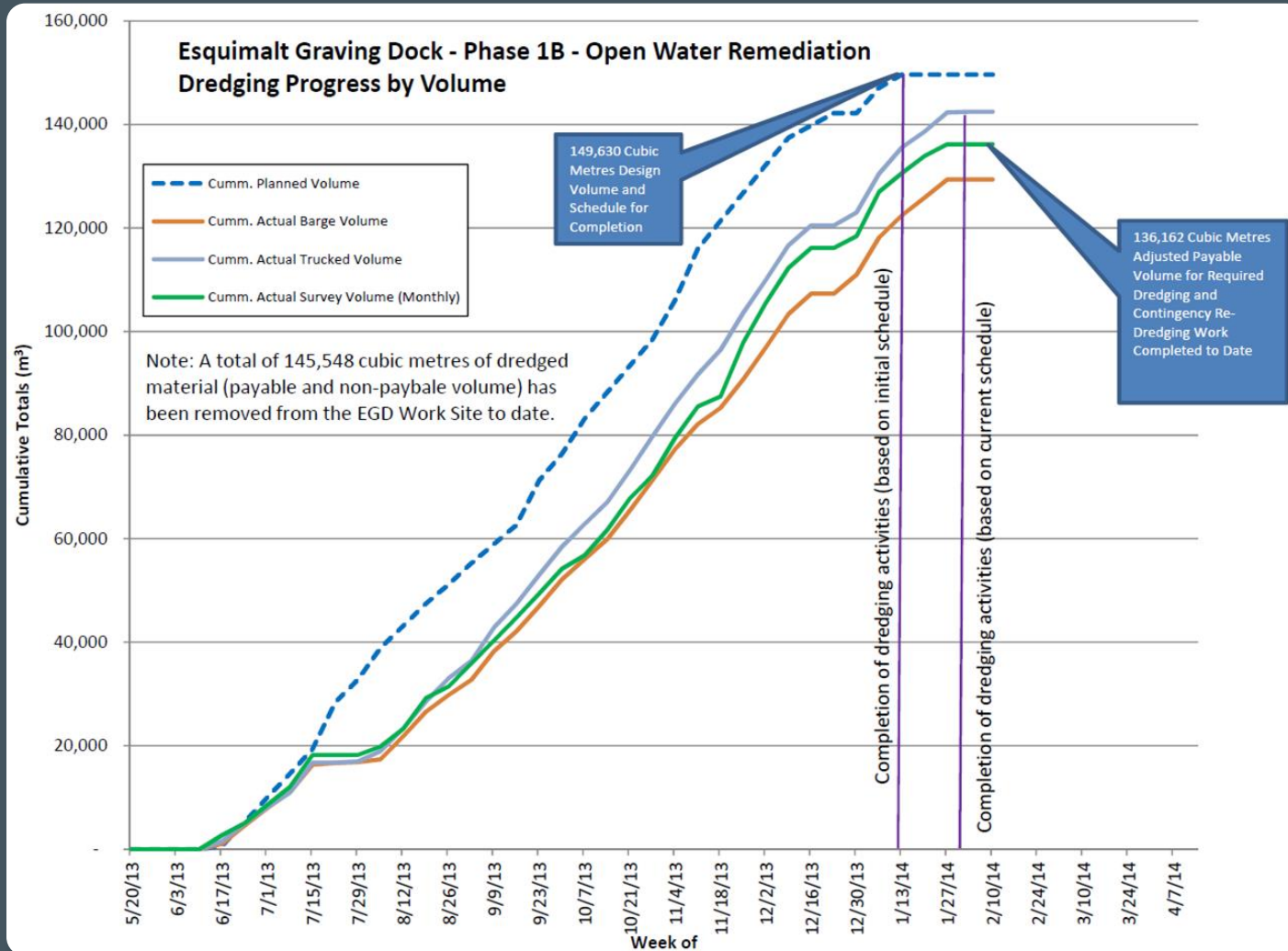


Project Performance (cont.)

- Predicted post-cover mixed concentration



Project Performance (cont.)



Lessons Learned

- Develop specifications to address risk and minimize claim potential
 - Allow contractor flexibility in means and methods
 - Be prescriptive where operational needs govern
- Plan for dredge residuals with sequencing, BMPs, and contingency actions
- Incorporate risk-based contingency into project cost estimate
- Select qualified contractor using criteria that balance cost-competitiveness and risk

Lessons Learned (cont.)

- On-site construction management staff reinforce objectives of the cleanup
 - Slower pace of work
 - Techniques to manage more precise dredge cuts
 - Maximize removal of contamination
- Minimize impact to operations
 - Regular communication with contractor is essential
 - Full-time construction inspection improves coordination
 - Adaptive management approach is critical

Questions?



Photograph courtesy of Heath Moffatt