Esquimalt Harbour Remediation Project
Department of National Defence
Importance of Integrated Remedial Investigation

Presented by
Derek Ormerod, Anchor QEA, LLC

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Esquimalt Harbour

- Vancouver Island, British Columbia
- Pacific homeport of the Royal Canadian Navy (RCN)
- Crown-owned harbour, including sediment

![Halifax Class Frigate](image)
Esquimalt Harbour Remediation Project (EHRP)

- Historical RCN and industrial activities
- Legacy contamination
- Selected remedial planning areas
  - Previously identified sediment contamination
  - RCN operational areas
EHRP – Project Complexity

• DND - multiple levels of involvement
  - Headquarters
  - Residual Stakeholders
  - Other capital construction projects
    - Queen’s harbour master, Formation Safety Environment, Base Construction Engineering

• Two contracting authorities:
  - Public Works and Government Services Canada
  - Defence Construction Canada

• Six Consultants
  - Additional field services contractors
Remedial Investigation Approaches

• Standard/phased approach: independent sampling and testing for each step in process
  - Problem identification
  - Risk assessment
  - Nature and extent of contamination
  - Remedial alternatives development
  - Engineering design and environmental compliance

• Integrated approach: combined investigation to address all aspects of project concurrently
Investigation Approach Typical Drivers

- **Standard/phased**
  - Comply with regulatory processes
  - Focused investigations
  - Greater site complexity
  - Greater confidence

- **Integrated**
  - Expedited timeframe for completing remediation
  - Limited budget for phased investigations
  - Lower site complexity
Pros and Cons – Standard/Phased Investigation Approach

• Pros
  - Matches regulatory framework
  - Focused investigation - collecting only required data needs

• Cons
  - Extended timeframe to complete multiple sampling rounds
  - Inefficiency in potentially duplicating data collection efforts
Pros and Cons – Integrated Investigation Approach

• Pros
  - Reduced overall timeframe
  - Lower costs
    • Fewer mobilizations
    • Avoid duplication

• Cons
  - Collection of “extra” data
  - Requires presumptive understanding of remedial design
  - May result in not fully addressing uncertainties
Victoria Harbour Example
Standard/Phased Investigation Approach

• Risk-driven remediation strategy
• Multiple investigation phases
  1. Harbour-wide general investigations
  2. Risk-based investigations
  3. Site-by-site alternative development sampling
  4. Design-oriented specific sampling events
• Multiple sites at various stages of completion
• Remedy ultimately completed in several construction events
Esquimalt Harbour Example
Integrated Investigation Approach

• Driven by short funding timeframe (FCSAP)
• Comprehensive data gaps analysis
• Requires understanding of potential remedies at sites
  – Operational needs limit options
• Integrated investigation with strong remedial design focus
  – Nature and extent of contamination
  – Data obtained to address structural and slope stability considerations
• Conservative sampling plans
EHRP Data Gaps Analysis

• Review full range of existing information/data
• Data quality considerations
  – Assess reliability of existing data for remedial design purposes
  – Confirm outlier observations
• Identified data gaps
  – Lateral and vertical extents of contamination
  – Unresolved outlier data and lateral boundaries
  – Lack of comprehensive structure drawings and conditions reports
  – Lack of subsurface and slope conditions
  – Lack of comprehensive harbour-wide basemap and existing site features
  – Basemap status
Basemap Surveys

- Bathymetry and topography
  - Multiple sites datum reconciliation
  - Single comprehensive survey
- LiDAR supplemental data
- Structural surveys
  - Reconnaissance/dive surveys to verify drawings/conditions
  - Verify structure positioning
- Underwater utilities
- Debris and UXO surveys
EHRP Site Sediment Investigations
Integrated Sediment Investigations

- Paired grabs and cores
  - Grabs to delineate lateral extents
  - Vibracores for vertical extents of impacted sediment (volume considerations)

- Proposed thin section cores to assess sediment deposition rates

- Porewater sampling
  - Porewater collection from extra core volume
  - Provide in situ water conditions for cap areas
Additional Integrated Investigations

- Jet probing (bedrock delineation)
- Foreshore test pits (structural and chemical)
- Geotechnical borings (barge and land based)
- Water quality investigations (environmental compliance)
- Residuals and recontamination evaluation
- Operational assessment (sequencing and staging, recontamination)
- Habitat baseline surveys (environmental compensation)
Jet Probe Survey

- Completed in nearshore areas to delineate soft sediment thickness over bedrock or clay

Deeper Water

Shallow Water
Geotechnical Investigations

- Barge- and land-based drilling program
  - Data for slope stability determinations
  - Provide material types for dredging suitability
- Foreshore test pits
  - Composition of existing armouring
  - Additional information on adjacent upland contamination
Water Quality Investigations

- **Dredging elutriate test (DRET)**
  - Paired sediment and water samples
  - Used to model water quality impacts during dredging

- **Barge dewatering**
  - Bulk sediment chemistry and partitioning
  - Inform water treatment choices
Integrated Sampling: Lessons Learned

- Requires early agreement on remedial action
  - Challenges with stakeholder concurrence including regulatory approval
- Carefully address reasonable range of remedial actions in data gaps analysis and sampling plan development
- Reliance on experienced remedial design experts is critical to minimize limitations of integrated approach
Integrated Sampling: Lessons Learned (cont.)

- Funding strategy is critical as integrated approach results in expedited schedule and sampling timelines
- Tiered sampling analyses and intensive communications between lab and design team can minimize overall testing costs
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Questions?