



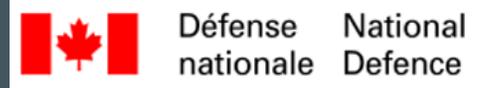
Esquimalt Harbour Remediation Project

Department of National Defence

Importance of Integrated Remedial Investigation

Presented by
Derek Ormerod, Anchor QEA, LLC

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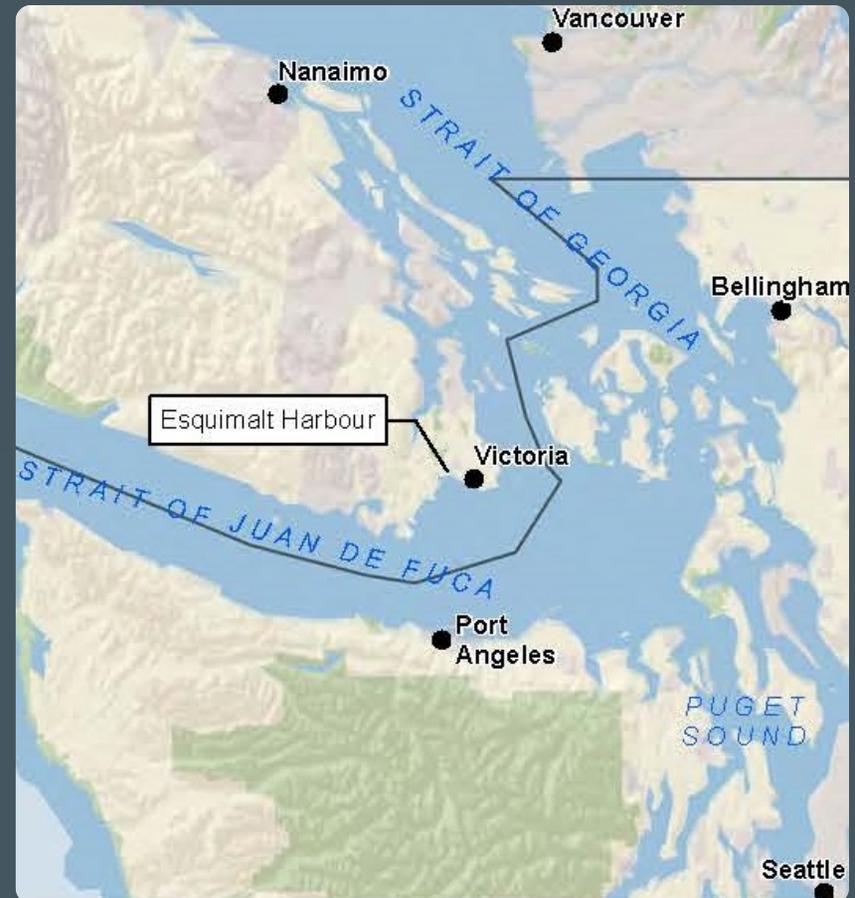


Esquimalt Harbour

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

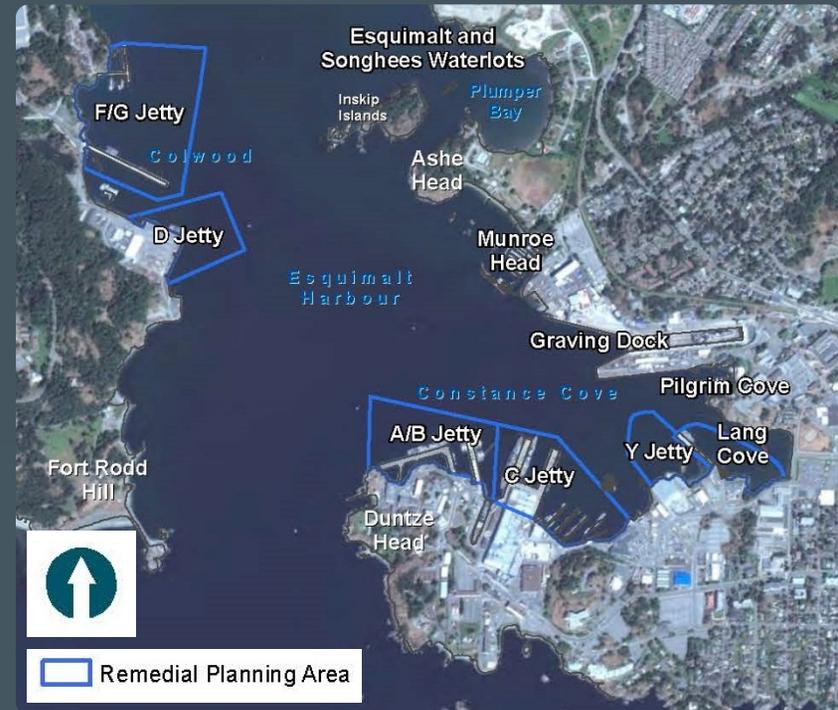


Halifax Class Frigate



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

- Department of National Defence – multiple levels of involvement
 - Headquarters
 - Residual stakeholders
 - Other capital construction projects
 - Queen's harbour master, Formation Safety Environment, Base Construction Engineering

EHRP – Project Complexity (cont.)

- 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 (Federal Contaminated Sites Action Plan - 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

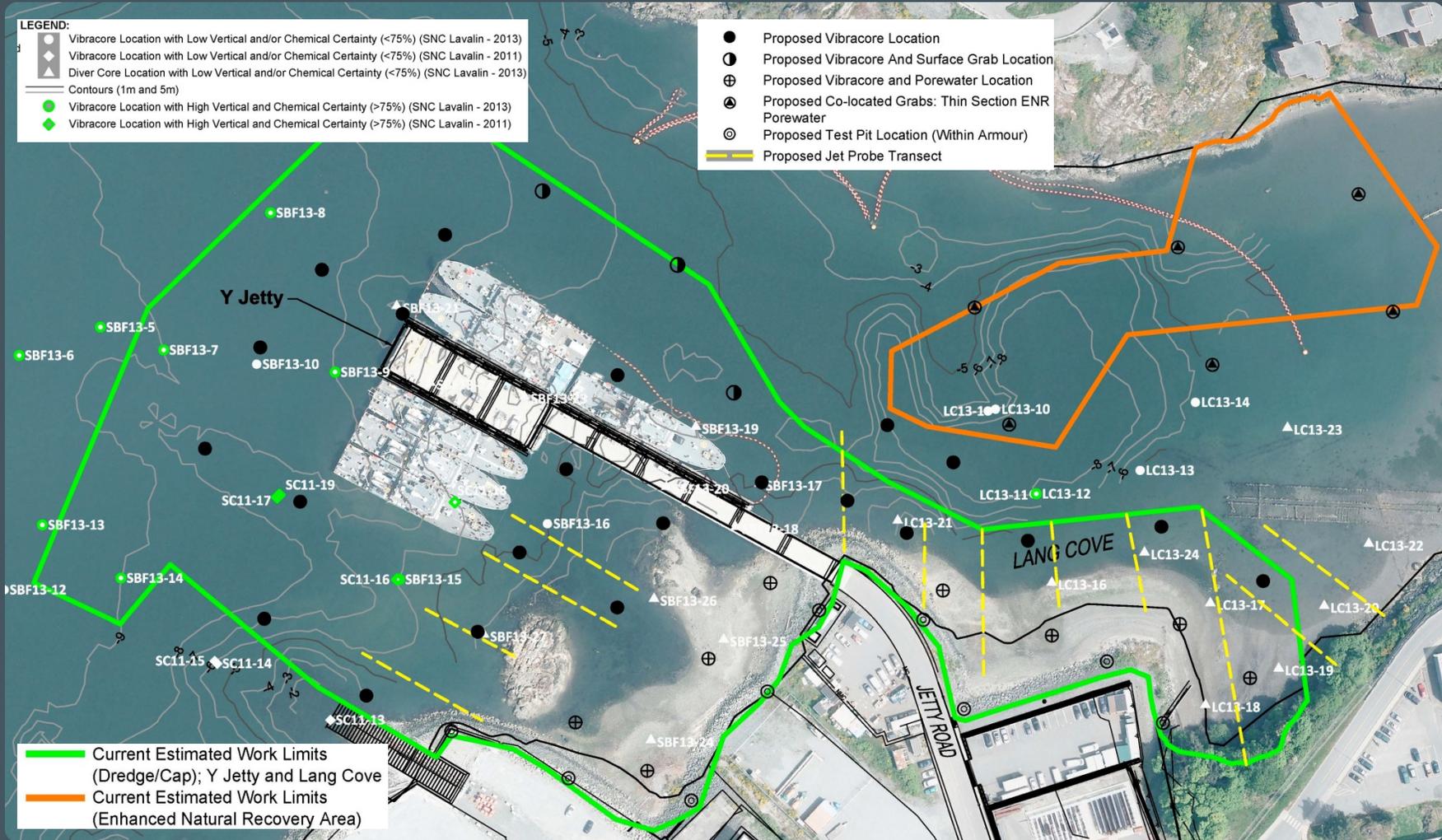
- Review full range of existing information/data
- Data quality considerations
 - Assess reliability of existing data for remedial design purposes
 - Confirm outlier observations
- Identified data gaps
 - Lateral and vertical extents of contamination
 - Unresolved outlier data and lateral boundaries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

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



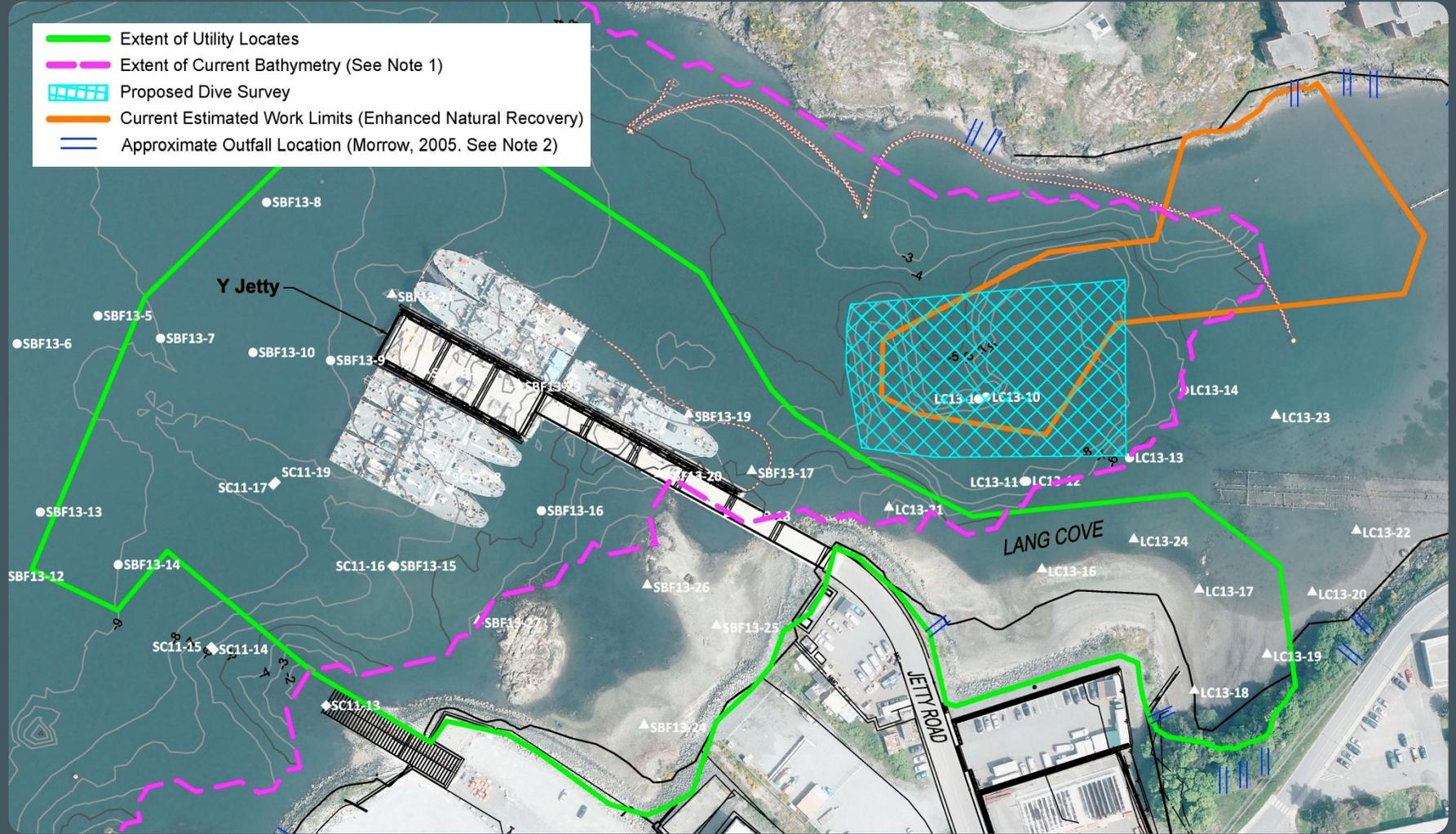
Integrated Sediment Investigations

- 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



EHRP Site Surveys

- Extent of Utility Locates
- Extent of Current Bathymetry (See Note 1)
- Proposed Dive Survey
- Current Estimated Work Limits (Enhanced Natural Recovery)
- Approximate Outfall Location (Morrow, 2005. See Note 2)



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 because integrated approach results in expedited schedule and sampling timelines
- Tiered sampling analyses and intensive communications between laboratory and design team can minimize overall testing costs



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Questions?

