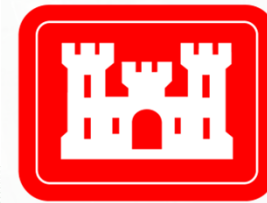


Adjusted Dredging Approach and Sediment Core Re-Sampling to Improve Project Performance at Hudson River

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US Army Corps
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Introduction



- Summary of Project To-Date
- Challenges Encountered
- Steps Taken to Address Challenges
- Results and Discussion
- Questions



Project Overview



- Removal of ≈ 2.65 million cubic yards (C.Y.) of PCB-contaminated sediments from 40 miles of Hudson River (≈ 500 acres targeted)
- USEPA developed Engineering Performance Standards (EPS) to track and assess remediation
 - Resuspension/Residuals/Productivity
- Project conducted in two phases separated by a review from an independent panel of experts
 - Phase 1: Less than full-scale production/extensive monitoring
 - Phase 2: Remainder of project



Phase 1 Challenges



- Two of the challenges identified included:
 - Uncertainties in depth of contaminated sediments (referred to as DoC)
 - Woody debris/bedrock/glacial lake clay
 - Difficulties during dredging operations
 - Impacted sampling for design purposes



Peer Review Recommendations



“A key obstacle to simultaneously achieving the performance standards involved incomplete, inaccurate, and imprecise DoC characterization combined with disagreement on how to interpret and attain target levels.”

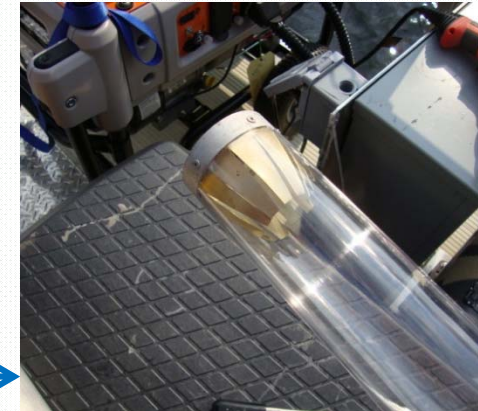
– Hudson River Phase 1 Dredging Peer Review Report (Executive Summary, iii)

- Steps taken to address challenge:
 - Adjust sampling program and resample specific locations
 - Adjust the method for evaluating sediment core data, including:
 - New sediment data to assist dredge prism design
 - Residual sediment data following completion of each dredge pass

Adjustments to Sampling Program



- Refinements to previous sampling program included:
 - Increased acceptable core recovery from **60% to 80%**
 - Sample to **8-foot depth** or to bedrock/clay
 - Tested alternative sampling methods
 - Vibracoring with “core-catchers”
 - Barge mounted sonic drilling
 - Allowed more flexibility to sampling approach based upon sub-bottom conditions at sample location

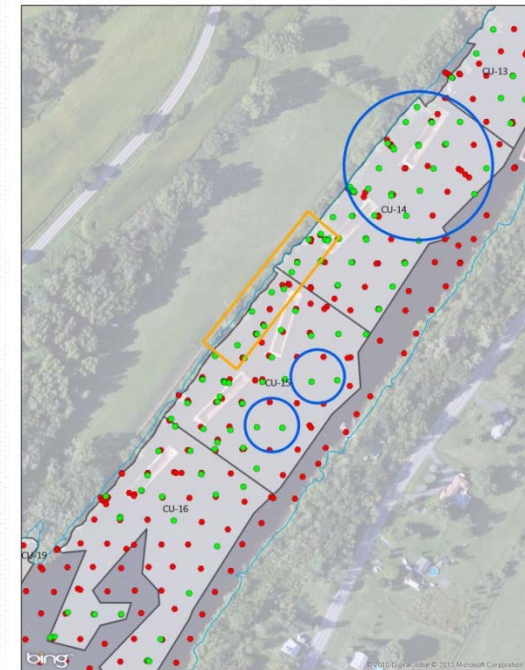
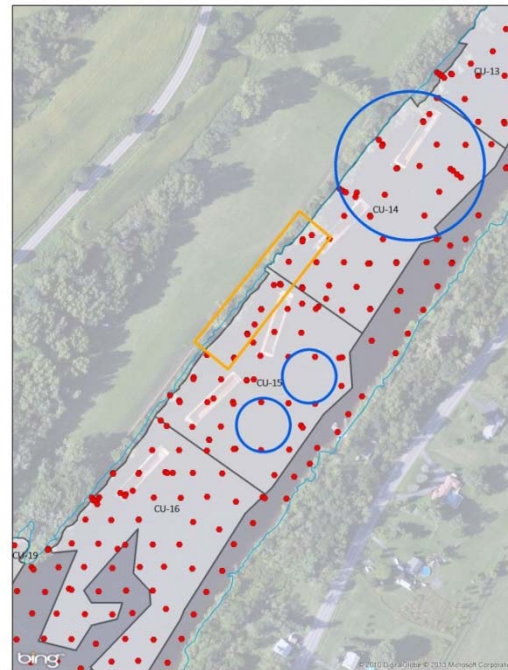
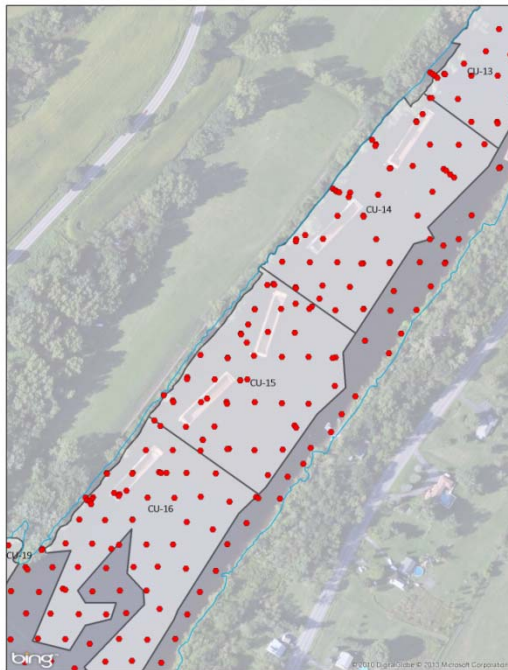


Sediment Resampling



- Initiated in advance of Phase 2 dredging operations
- Focused resampling on three “areas”:
 - High-confidence (HC):
 - DoC defined by sediment core data
 - Resample portion of HC locations to confirm DoC
 - Low-confidence (LC):
 - DoC determined through extrapolation of sediment core data
 - Resample all LC locations
 - Missing Data (MD):
 - Locations where a lower sampling density was utilized
 - Resample where needed to achieve 80-foot sampling density

Sediment Resampling - Example



Resampling Program To-Date



- Program conducted from 2010 to 2012 (Phase 2)
 - 1,789 sediment core locations targeted
 - 1,403 sediment cores obtained
 - Some locations inaccessible or acceptable core recovery criteria not met



Overview of Sampling Program Results



- Of the 1,403 sediment cores obtained:
 - 252 HC locations sampled
 - 240 (95%) confirmed HC location
 - 586 LC locations sampled
 - 433 (74%) “converted” to HC location
 - 530 MD locations sampled
 - 417 (79%) obtained HC sediment core
- Resampling allowed for improvement in data quality

Overview of Sampling Program Results (cont.)



- Alternative methods proved useful in specific areas
 - Core-catchers helpful in finer sediments
 - Sonic drilling highly successful in difficult sub-bottom conditions (i.e., wood debris/coarse sediments)
- Some decrease in sampling production
 - Pre-Phase 1 Design Sampling: \approx 12 cores / day
 - Re-Sampling Program: \approx 8 cores / day
- Coupling sediment core collection to elevation at the time of sampling important
 - Bathymetry approach (i.e. DoC)
 - vs.
 - On-board RTK DGPS approach (i.e. EoC)



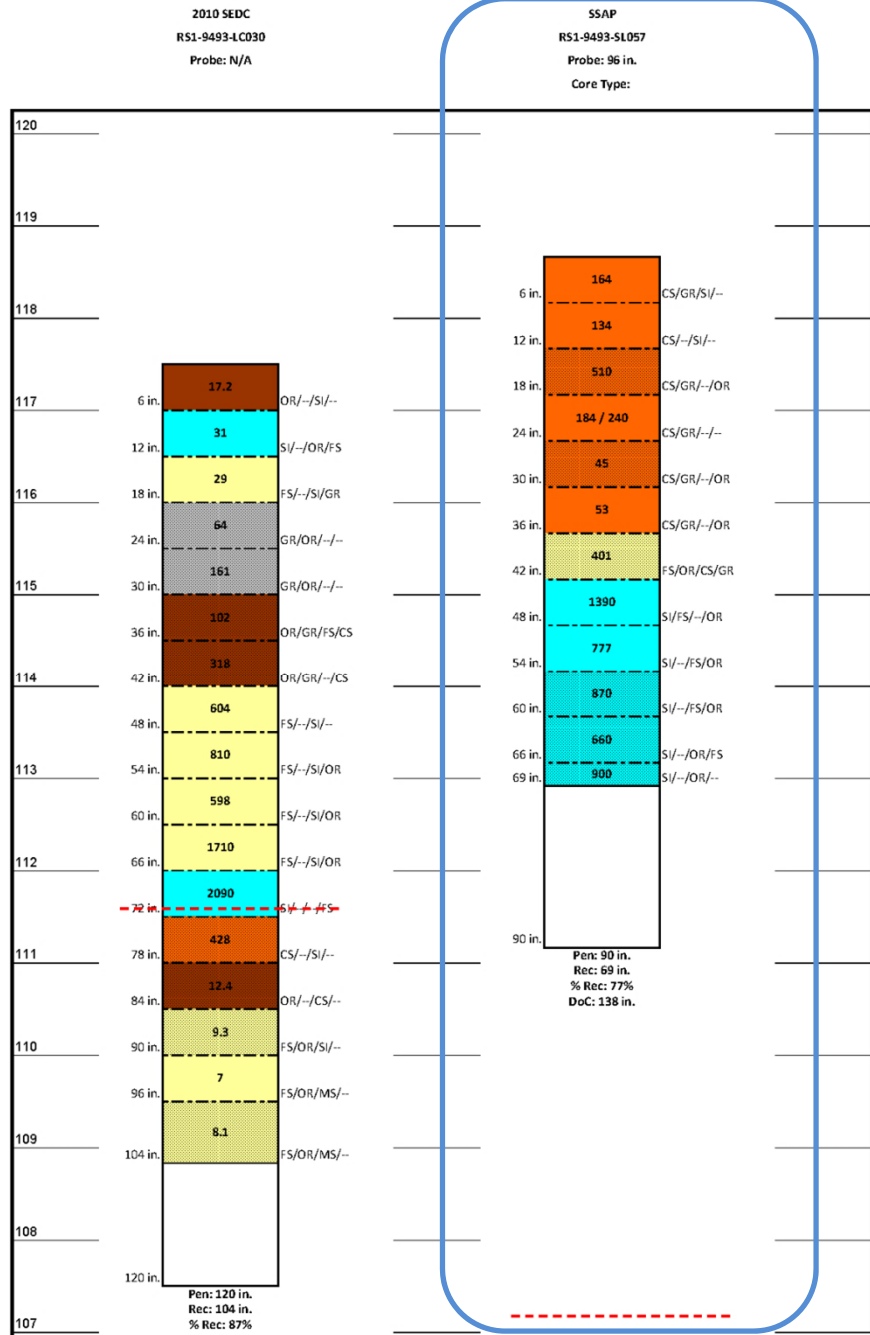
Dredge Prism Design Process



- How was the new data used?
 - For HC locations, compare DoC of existing data to DoC from new data (manual evaluation)
 - Need to account for small scale spatial variability
 - For LC locations, assess quality of new data
 - If higher quality, then supersede existing data
 - If same or lower quality, then discard if appropriate
 - For MD locations, use in terrain modeling process

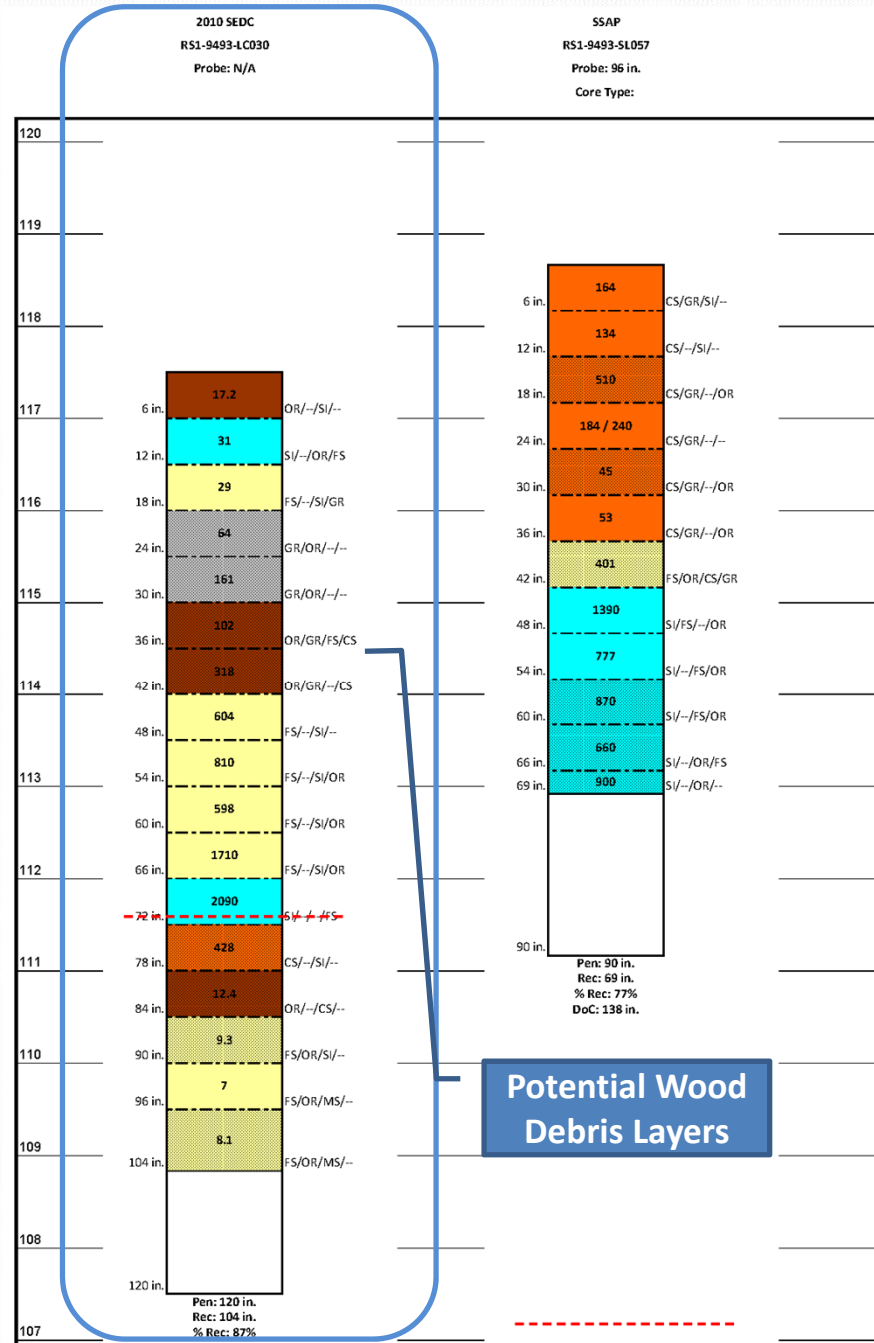
Example Data Evaluation

- SSAP Core (right-side):
 - Vibracore
 - Low-confidence core
 - 77% recovery (69 / 90 in.)
 - Extrapolated DoC to 138 in. (11.5 ft.) based upon available data (assumes first-order decay)
 - Last measured segment TPCB concentration of 900 mg/kg



Example Data Evaluation (cont.)

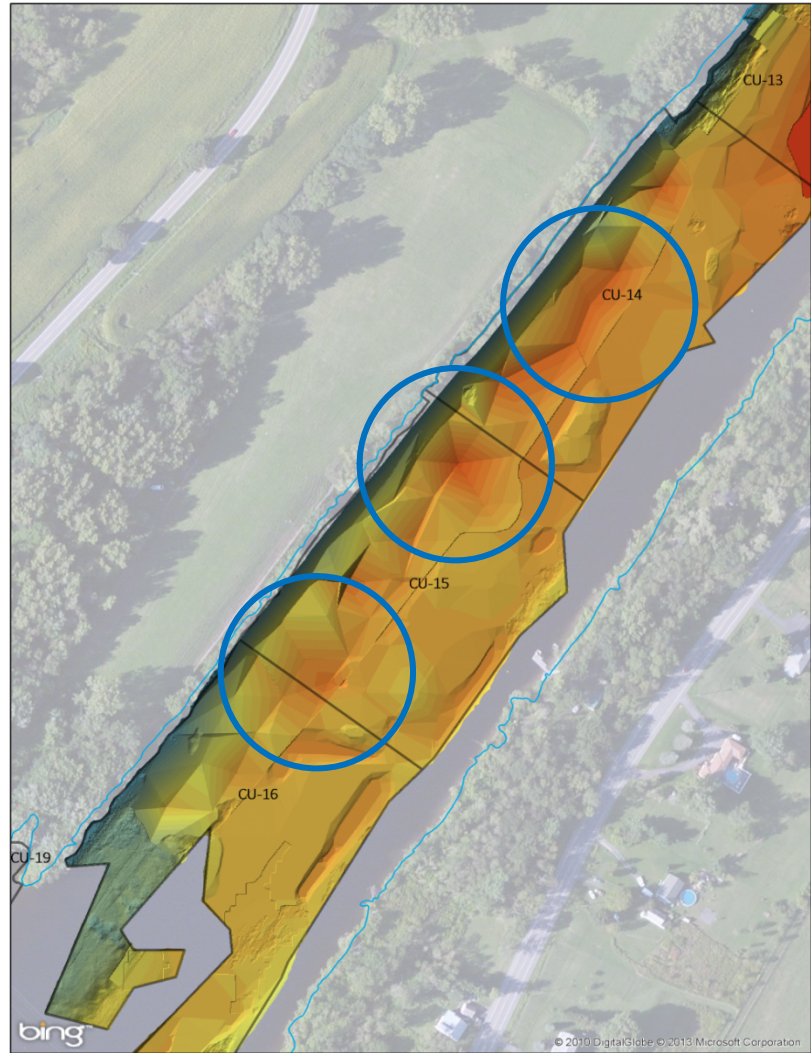
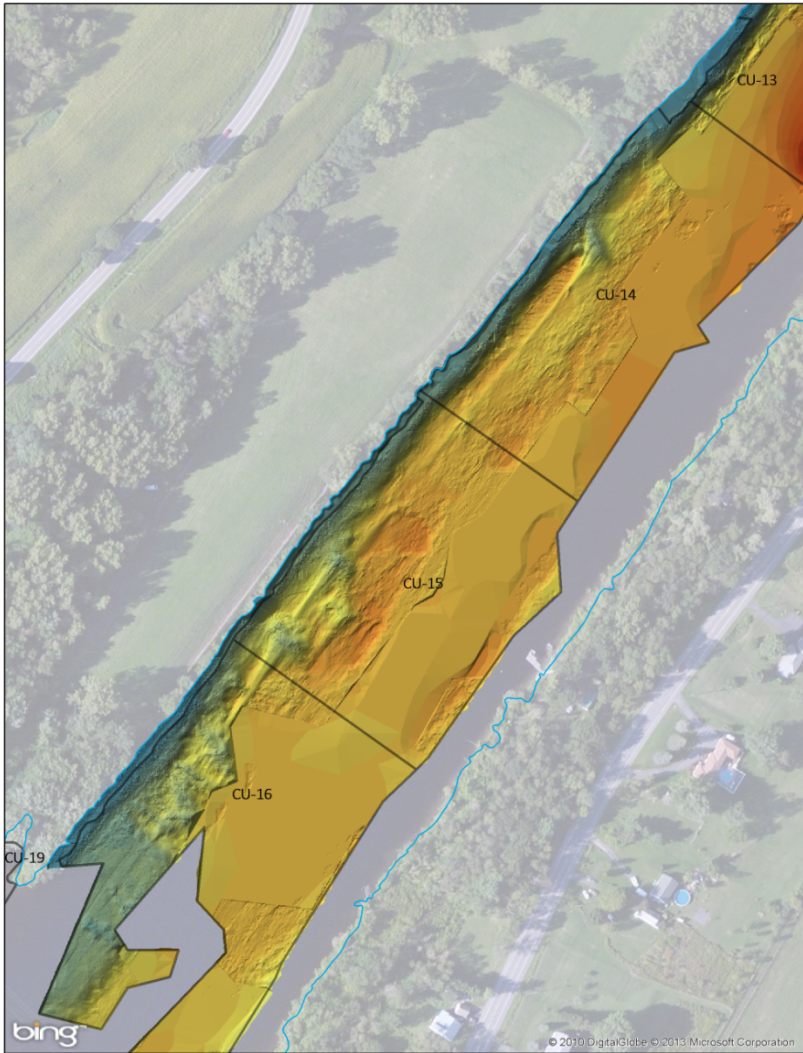
- SEDC Re-Sample (left-side):
 - Sonic Drilling
 - 87% recovery (104 / 120 in.)
 - Interpolated DoC at re-sampling location (based upon available SSAP data at the time) of 72 in.
 - Extrapolated DoC of 111 in. per SEDC core data (assumes same first-order decay)
 - SEDC re-sample showed contamination extended nearly 40 in. deeper than initial interpolated DoC based upon SSAP core alone



Adjustments to Dredge Prism Design



- Recommendations from the Peer Review Panel incorporated by USEPA:
 - Defining DoC based upon two 6-inch segments with TPCB concentration < 1 mg/kg
 - Analyze entire residual sediment core following each dredge pass (slightly modified during implementation)
 - Limited use of “over dredge” to account for dredge tolerance (i.e., vertical accuracy of dredge bucket positioning)
- Reexamined utility of historical dredging data



Results of New Data/Adjusted Approach



- In Phase 1:
 - Capped \approx 36% of remediated footprint
 - Up to five dredge passes in some areas
 - Limited exceedances of Resuspension Standard resulting in temporary suspension of dredging operations
- In Phase 2 (to-date):
 - Capped \approx 11% of remediated footprint (some unavoidable)
 - Majority of dredging completed in single pass
 - Fewer exceedances of Resuspension Standard with no suspension of dredging operations

Summary By the Numbers



- Phase 1
 - 2009: 283,000 C.Y. dredged from 48 acres
- Phase 2
 - 2011: 363,000 C.Y. dredged from 75 acres
 - 2012: 663,000 C.Y. dredged from 118 acres
 - 2013: 628,00 C.Y. dredged from 124 acres

Adjustments have assisted in increasing productivity while limiting performance standard exceedances

For More Information



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