The Real Cost of Sediment Remediation

Key Factors to Consider During
Remedial Planning and Costing

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CERCLA & MTCA | Advanced Sediments Topics

Reid Carscadden, P.E.

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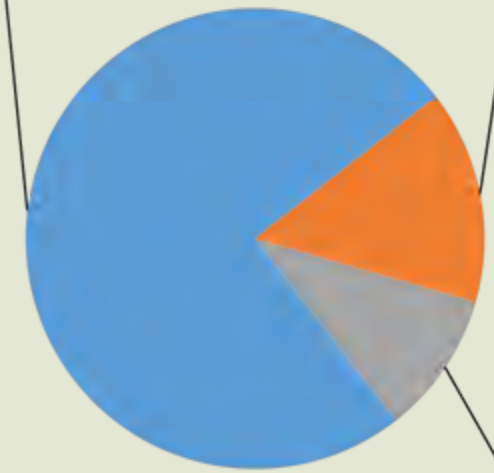
Outline

- Overview of Remedial Cost Elements
- Trends in Sediment Cleanup Costs
- Key Considerations for FS Costing
  - Cost-Effectiveness Determination
  - Consistency vs. Accuracy
  - Scope and Cost Creep
- Managing Cost Risk and Uncertainty
- Q & A

Overview of Remedial Cost Elements

Direct Construction Costs, 75%
Mobilization/Demobilization
Support Facilities
Dredging/Dewatering
Transportation/Disposal
Capping/Treatment/ENR
Field Engineering/Surveying

Indirect Costs, 15%
Pre-Design Investigations
Remedial Design/Permitting
Property Lease/Acquisition
Construction Quality Assurance
Project Management/Legal
Agency Oversight



Long-Term Costs, 10%
Long-Term Performance Monitoring
Operation & Maintenance
Institutional Controls

Trends in Cleanup Costs

Selected Sites

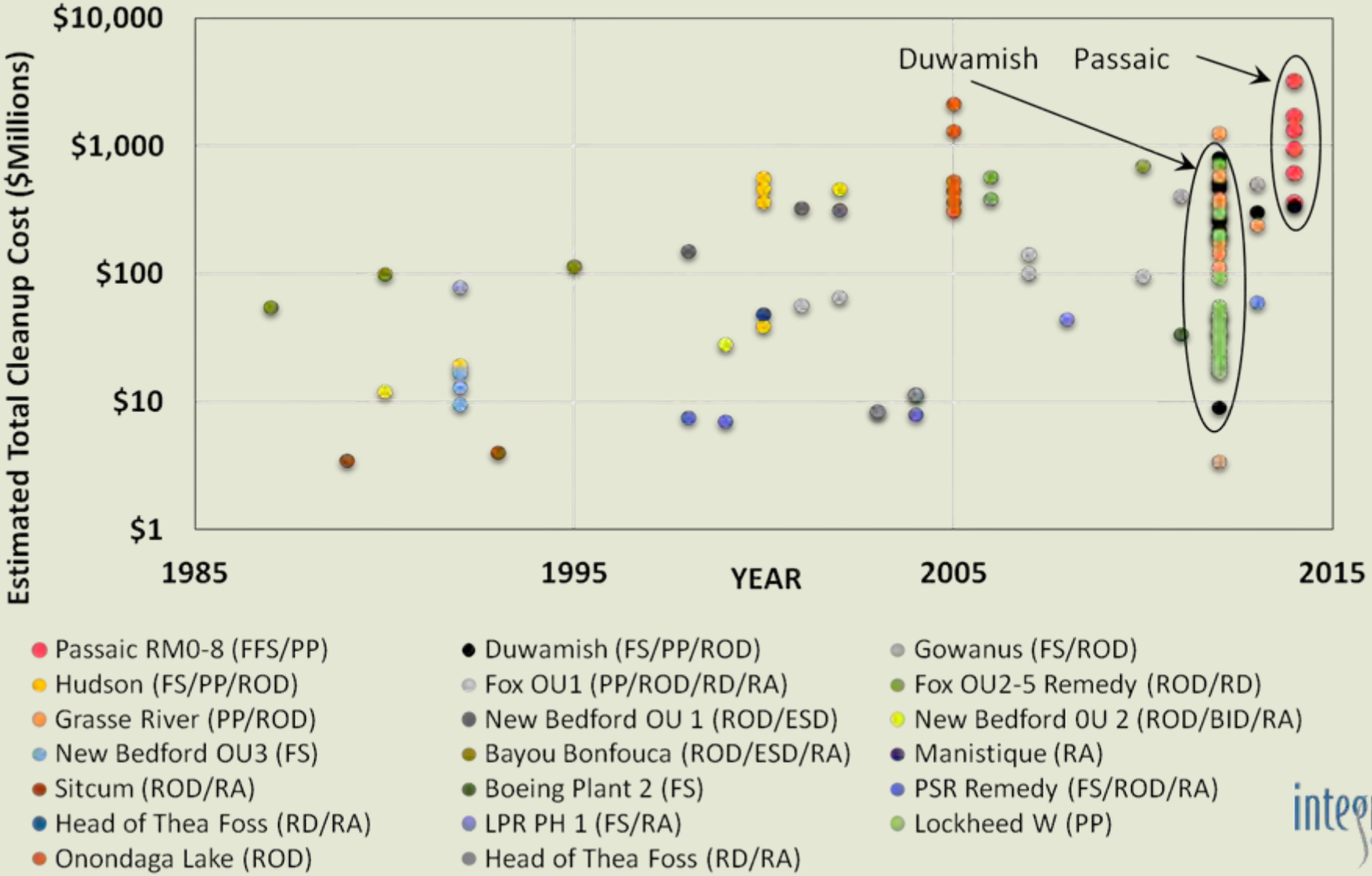
- Fox River
- Grasse River
- Hudson River
- New Bedford Harbor
- Onondaga Lake
- Thea Foss Waterway
- Sitcum Waterway
- Duwamish Waterway
- Lower Passaic River
- Gowanus Canal
- Portland Harbor
- Bayou Bofouca
- Manistique River

+ Selected Early Actions

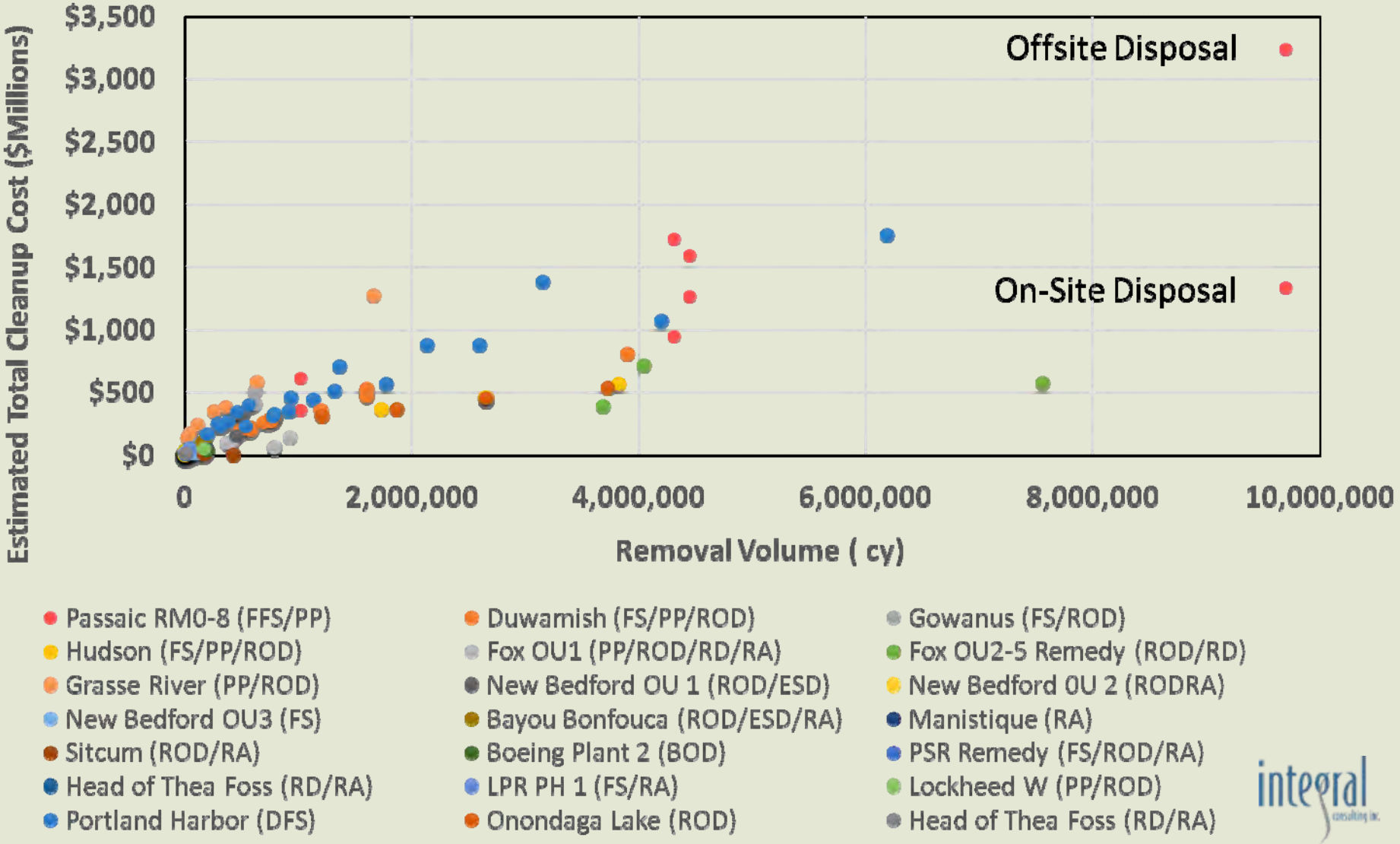
About the Data

- Estimates represent "all-in" costs (e.g., direct + indirect + long-term monitoring)
- Obtained from published reports at key milestones (FS, PP, ROD, ESD, RD, RA)

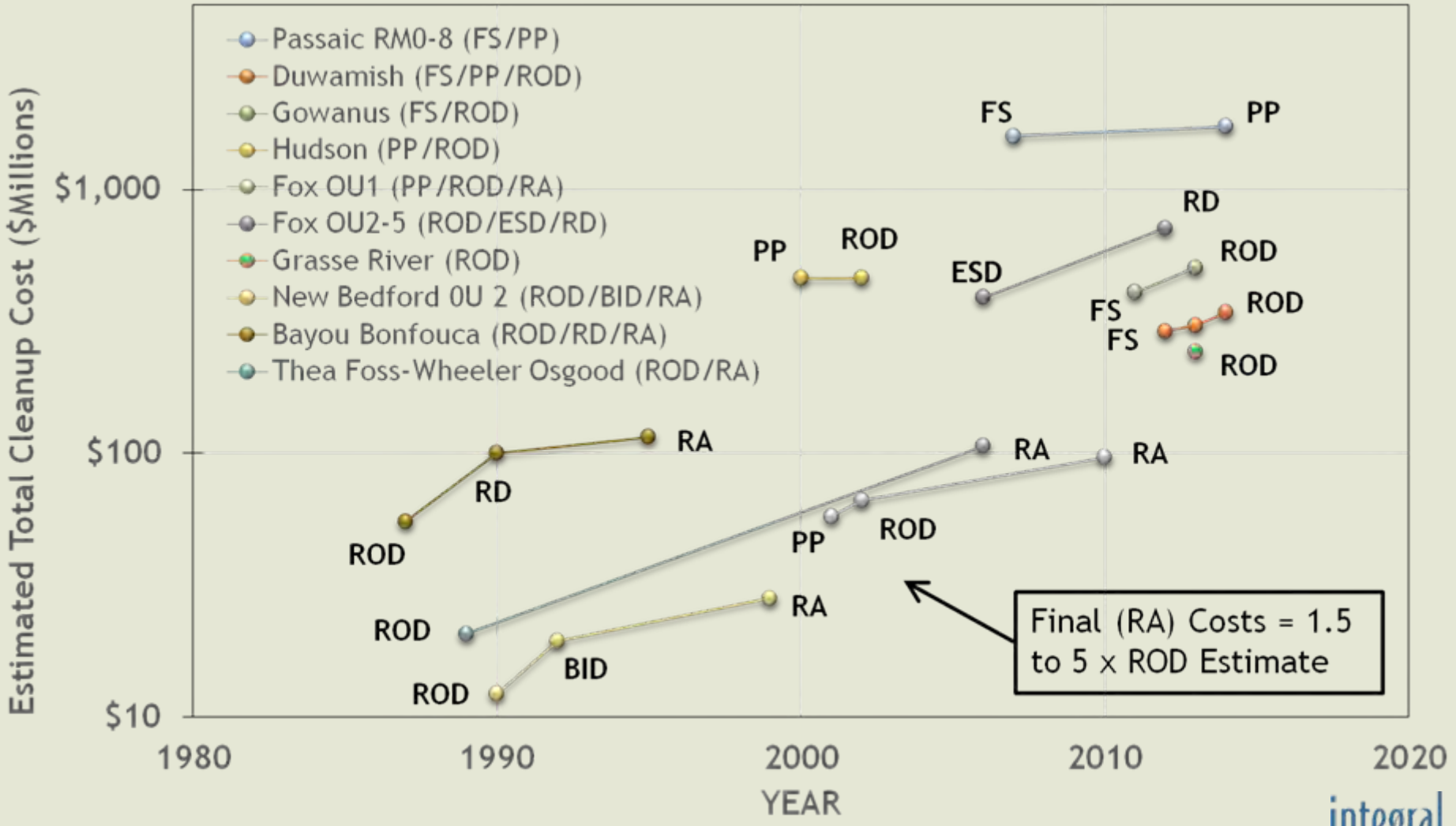
Trend in Cleanup Costs Over Time



Estimated Cleanup Costs vs. Removal Volume



Evolution of Costs throughout Project Development



Key Costing Considerations

- FS Estimate Objectives
  - Facilitate comparative evaluation of alternatives
  - Assess cost-effectiveness for remedy selection
  - Provide initial estimate for financial planning
- Key Considerations
  - Importance of cost-effectiveness determination
  - Tradeoff between consistency and accuracy of cost assumptions
  - Potential for scope and cost creep

Cost-Effectiveness Determination

- NCP requires that remedial actions be "cost-effective"

  "Each remedial action selected shall be cost-effective, provided that it first satisfies the threshold criteria set forth in § 300.430(f)(1)(ii)(A) and (B)….A remedy shall be cost-effective if its costs are proportional to its overall effectiveness." (40 CFR §300.430(f)(1)(ii)(D))

  "Costs that are grossly excessive compared to the overall effectiveness of alternatives may be considered as one of several factors used to eliminate alternatives." (40 CFR 300.430(e)(7)(iii))

- Important because…

  —FS alternatives are typically designed to satisfy common RAOs

    » Thus, may have similar overall rankings with respect to NCP criteria

  —Therefore, cost-effectiveness can be a key differentiator for remedy selection

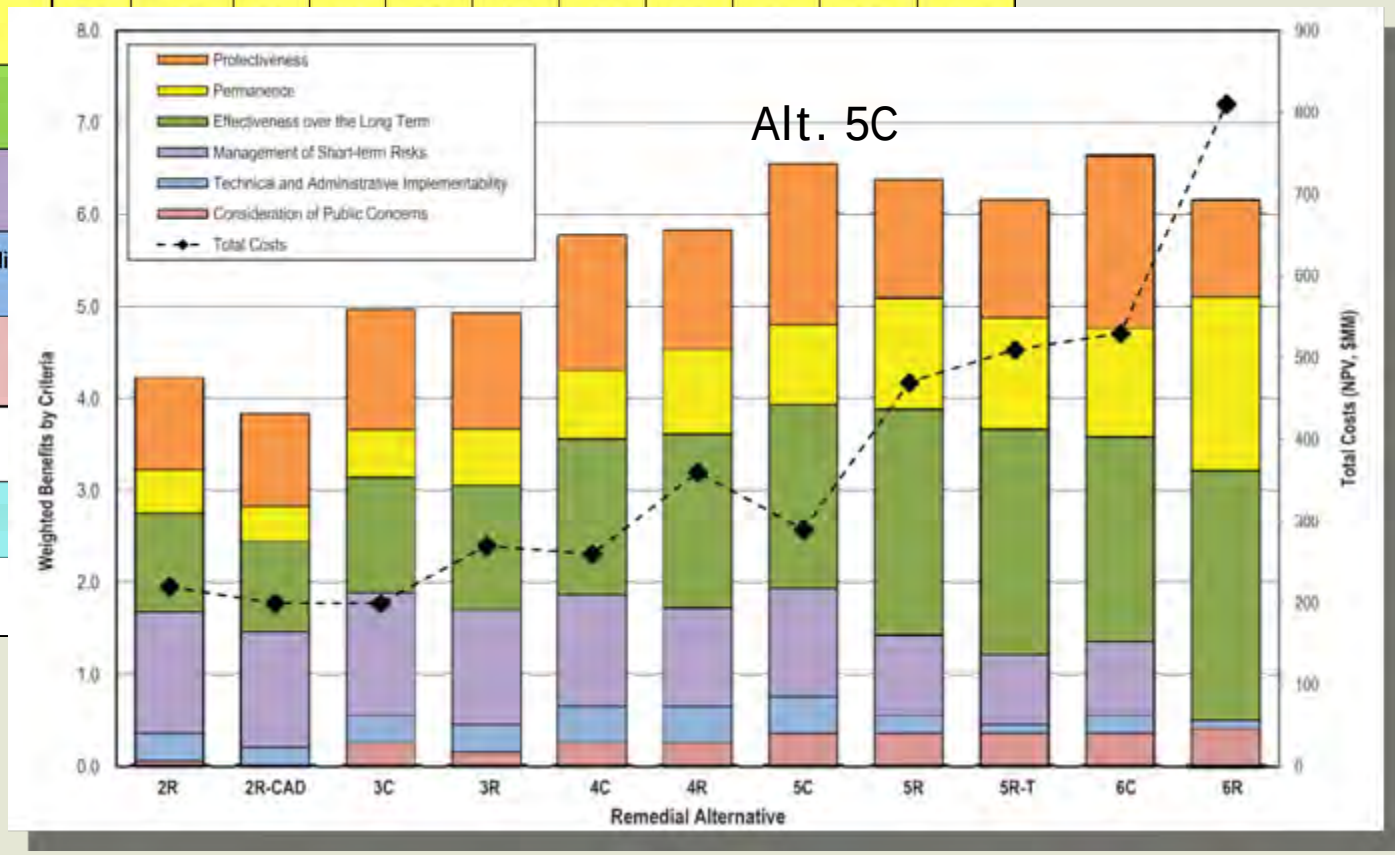
Cost-Effectiveness Determination

- Methodology?
  - Limited EPA policy or guidance
  - EPA emphasizes the use of qualitative methods to assess costs relative to other NCP criteria (EPA Guidance 1988, 1996, 1999, 2000)
  - But fails to provide quantitative methods or metrics to identify disproportionate cost/benefit relationships
  - Examples of quantitative analyses are also limited in FS reports

Cost-Effectiveness Determination

- Lower Duwamish "Disproportionate Cost Analysis (DCA)"

	Evaluation Criteria	Remedial Alternatives and Scores[a] 2R	2R-CAD	3C	3R	4C	4R	5C	5R	5R-T	6C	6R
1	Protectiveness – total weighting factor: 25%	4.0	4.0	5.2	5.0	5.9	5.2	7.0	5.2	5.2	7.5	4.2
2	Permanence – total weighting factor: 20%											
3	Effectiveness Over the Long Term – total weighting factor: 30%											
4	Management of Short-term Risk – total weighting factor: 15%											
5	Technical and Administrative Implementabili total weighting factor: 5%											
6	Consideration of Public Concerns – total weighting factor: 5%											
7	Total Weighted Benefits											
8	Cost ($millions net present value)											
9	Benefit/cost (Benefit points per $billion)											



Source: LDW FS (AECOM 2012)

Consistency vs. Accuracy

- EPA Guidance emphasizes consistency over accuracy of cost assumptions
  - To minimize cost-bias
  - Recommended range: +50%/−30%
- U.S. GAO (2010): actual cleanup costs often exceed ROD estimates by 100%
- Finding the right balance….
  - Certain degree of accuracy is required to identify a "truly" cost-effective remedy
  - Consider Scope/cost "creep" and uncertainty
  - And financial planning needs of performing parties

U.S. GAO (2010): "Actual construction costs never equal the cost estimated in the ROD"…. "[ROD estimates] can vary by 100 percent from the actual costs of implementing a remedy."

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Sources of Scope and Cost Creep

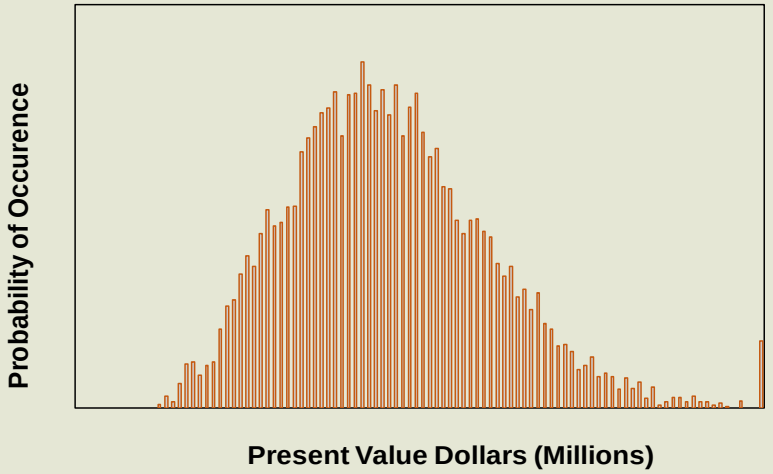
- Available data points to a range of contributing factors, including:
  - Deferral of technical analyses for critical elements
    - » Navigational constraints, material processing requirements, availability/suitability of resources and infrastructure
  - Inappropriate discount rate for NPV analyses
    - » EPA guidance stipulates 7%. Realistic?
  - Modifications to remedy design (following FS)
    - » During development PP, ROD, RD and/or RA
  - Unanticipated conditions during RA
    - » Debris/utilities, additional contamination, residuals

Managing Uncertainty

- Focus on critical project elements with highest cost and uncertainty
- Use realistic design assumptions
- Identify appropriate cost sources
  - Use cost guides with caution
  - Draw on actual cost data, vendor quotes
  - Utilize multiple costing methods for critical elements
- Consider resource availability and market conditions
  - Can vary widely regionally and seasonally
  - Critical in regions with concurrent cleanups

Managing Uncertainty

- Use Realistic Contingencies
  - Address both “Scope” and “Cost” uncertainty
  - FS guidance recommends uniform contingency
  - Typical range 25–45%
    - » Check sensitivity
- Probabilistic Cost Analysis
  - Generates distribution of costs relative to key risk drivers
    - » Useful to communicate potential consequences of decisions
    - » And to determine how much risk impact to include in project budget/reserves



Conclusions

- Size and complexity of sediment cleanups continues to increase
- Actual cleanup costs are exceeding FS/ROD estimates by significant margins
- Manage uncertainty by:
  - Focusing on remedy elements with highest cost/uncertainty
  - Identifying appropriate degree of accuracy
  - Considering both remedy selection and financial planning needs
  - Anticipating and planning for scope and cost creep
  - Applying appropriate contingencies and assessing cost sensitivity and risk

Questions?

Contact Info
Reid Carscadden, P.E.
rcarscadden@integral-corp.com

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