

Sustainable Sediment Management

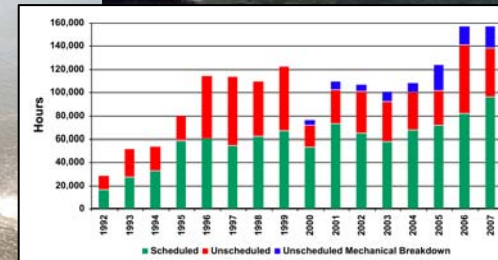
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CMTS
29 Junel 2010

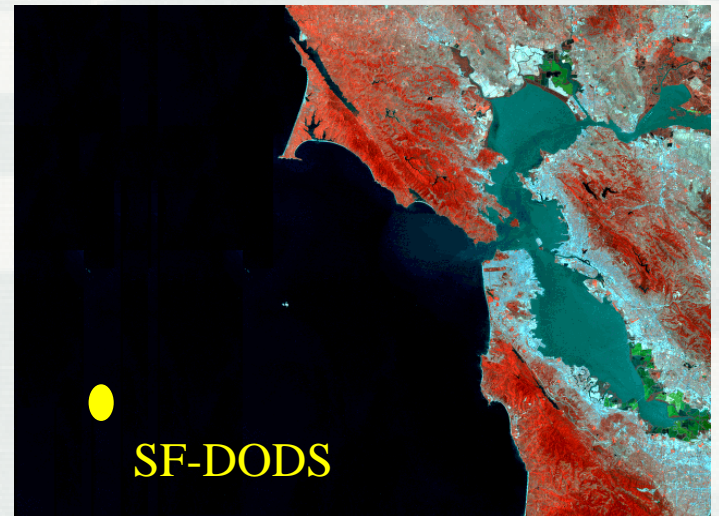


US Army Corps of Engineers
BUILDING STRONG



The Problem

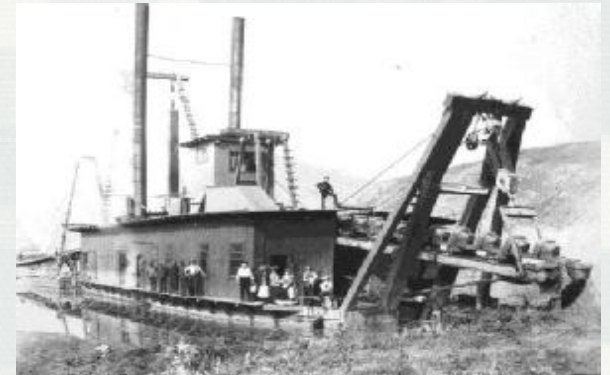
- Not enough sediment where we want it
 - Ecosystems, beaches, etc.
- Too much sediment where we don't want it
 - 250 mcy of sediment dredged annually to support US navigation program
- Uncoordinated regulatory programs
- Insufficient science and engineering to inform a better way



Sustainable Sediment Management

What is it?

Comprehensive approach for addressing the long-term management/conservation of sediments within a watershed to maintain current and future beneficial uses while addressing regional environmental, economic, and social objectives.



Key Features of Sustainable Sediment Management

- Comprehensive – integrated, cross-programmatic coordination
- Long-term goals, long-term cost savings
- Multiple functions - Multiple users and uses of the sediment
- Each watershed/basin is unique
- Sediment is a resource not a waste
- Emphasis on conservation and beneficial use

Sediment is a major cause of beneficial use impairment in US surface waters

NOTE: Click on a cause of impairment (e.g. pathogens) to see the specific state-reported causes that are grouped to make up this category. Click on the "Number of Causes of Impairment Reported" to see a list of waters with that cause of impairment.

Cause of Impairment Group Name	Number of Causes of Impairment Reported
Pathogens	10,662
Mercury	8,890
Metals (other than Mercury)	7,515
Nutrients	6,816
Organic Enrichment/Oxygen Depletion	6,410
Sediment	6,292
Polychlorinated Biphenyls (PCBs)	6,206
pH/Acidity/Caustic Conditions	3,813
Cause Unknown - Impaired Biota	3,266
Temperature	3,044
Turbidity	3,026
Pesticides	1,798
Salinity/Total Dissolved Solids/Chlorides/Sulfates	1,738
Cause Unknown	1,259
Noxious Aquatic Plants	981
Habitat Alterations	702
Dioxins	542
Algal Growth	539
Toxic Organics	459
Ammonia	356
Toxic Inorganics	352
Total Toxics	318
Other Cause	222
Oil and Grease	155
Taste, Color and Odor	115
Flow Alteration(s)	109
Trash	57
Fish Consumption Advisory	56
Radiation	44
Chlorine	34
Nuisance Exotic Species	29
Cause Unknown - Fish Kills	12
Nuisance Native Species	5

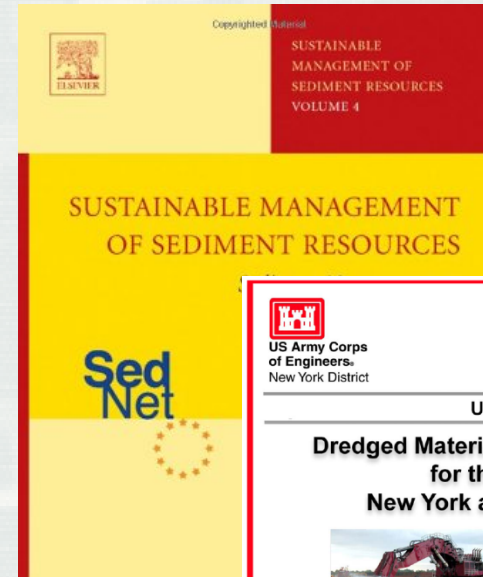
Causes of Impairment for 303(d) Listed Waters

[Description of this table](#)

Total: 75,822 Causes of Impairment

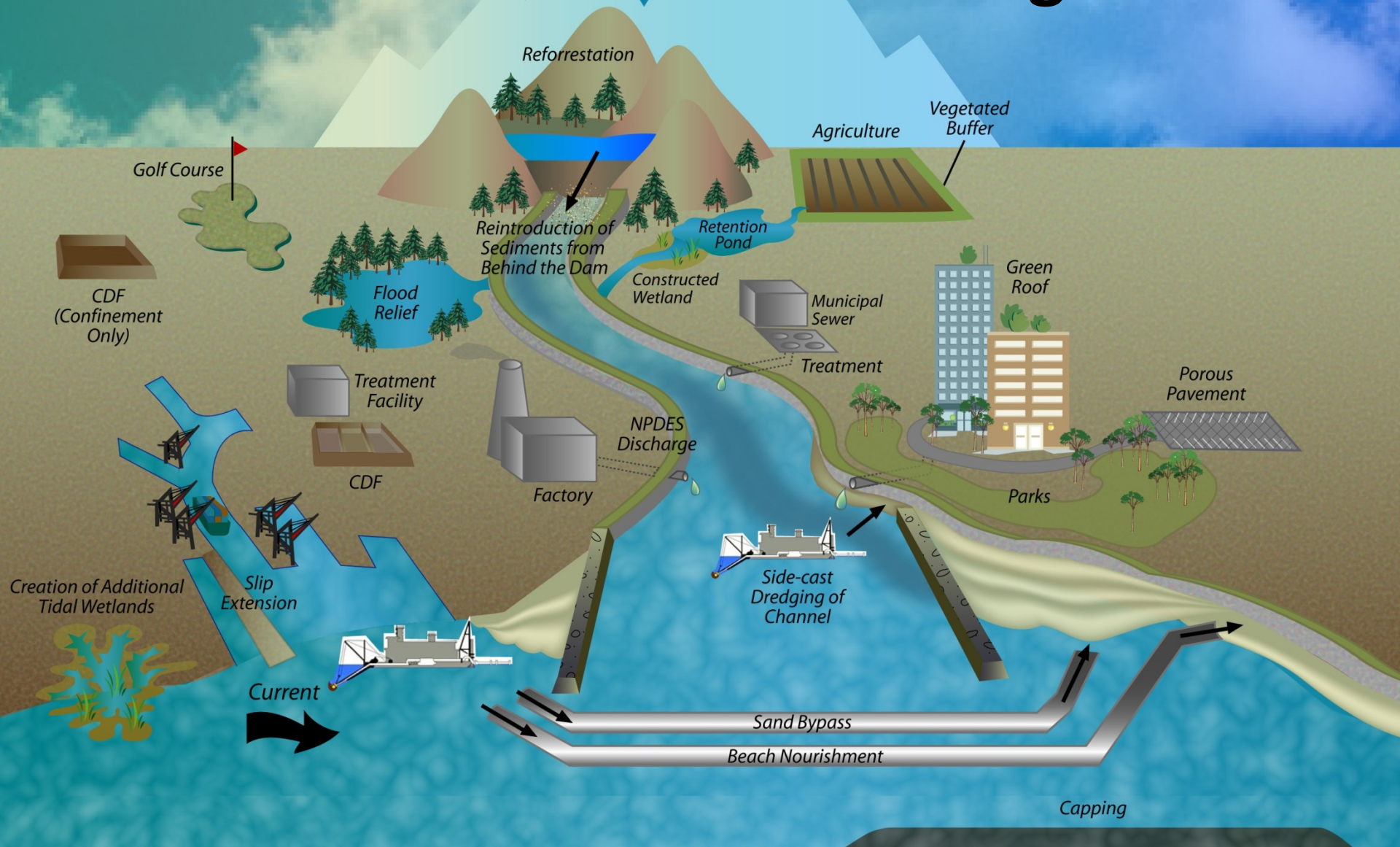
Interest in Comprehensive Management

- USACE – RSM & DMMP efforts
- EU – SedNet
- SETAC 08 – Sustainable Sediment Management
- Battelle 09 – Strategies for Sustainable Sediment Management



Regional Sediment Management

Sustainable Sediment Management



Challenges

- Geomorphological conditions (mountains to coastal planes)
- Adjacent land-use activities (forestry, farming, ports, industry, recreation, urban centers, ...)
- Competing uses (navigation, flood control, water supply, recreation, power, ...)
- Economic and social concerns
- Jurisdictional, regulatory, policy issues

Strategies for Sustainable Sediment Management

- Workshop; 15-19 March, 2010; Vicksburg, MS
- Sponsored by USACE Dredging Operations Environmental Research Program (DOER) and Weston Solutions
- 40 experts from 8 countries
- Scope
 - ▶ Policy, Regulations & Programs
 - ▶ Processes
 - ▶ Technical Tools & Approaches
 - ▶ Conceptual Matters
 - ▶ Case Studies
- Book to be published by Wiley



R&D Needs: Prevention

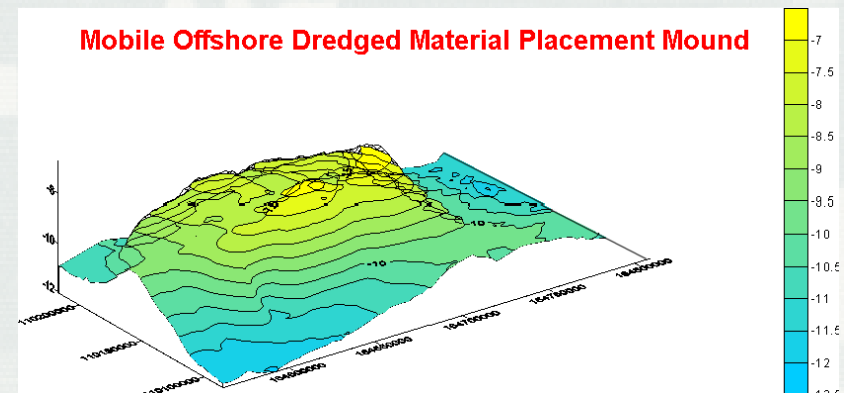
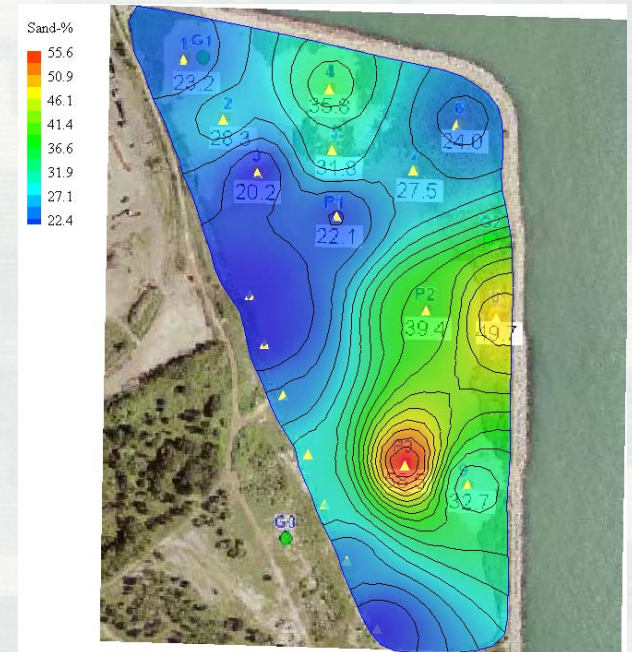
- Science, engineering, technology to reduce misallocation of sediment
 - ▶ Reducing soil erosion
 - ▶ Innovative use of created habitats
 - ▶ Navigation structures
 - ▶ Sediment diversions
 - ▶ Etc.



Courtesy: Matt Kondolf

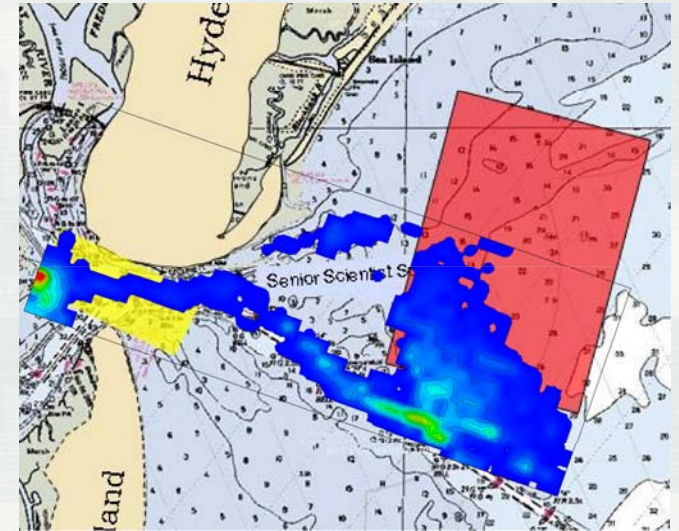
R&D Needs: Navigation Dredging

- Extending the life of CDFs
- Reducing energy usage and carbon footprint associated with operations
- Environmental and economic benefits of beneficial use of dredged material
- Engineering for reducing costs of environmental BU (e.g., long distance conveyance, etc.)
- Low cost management methods for minimally-moderately contaminated sediment

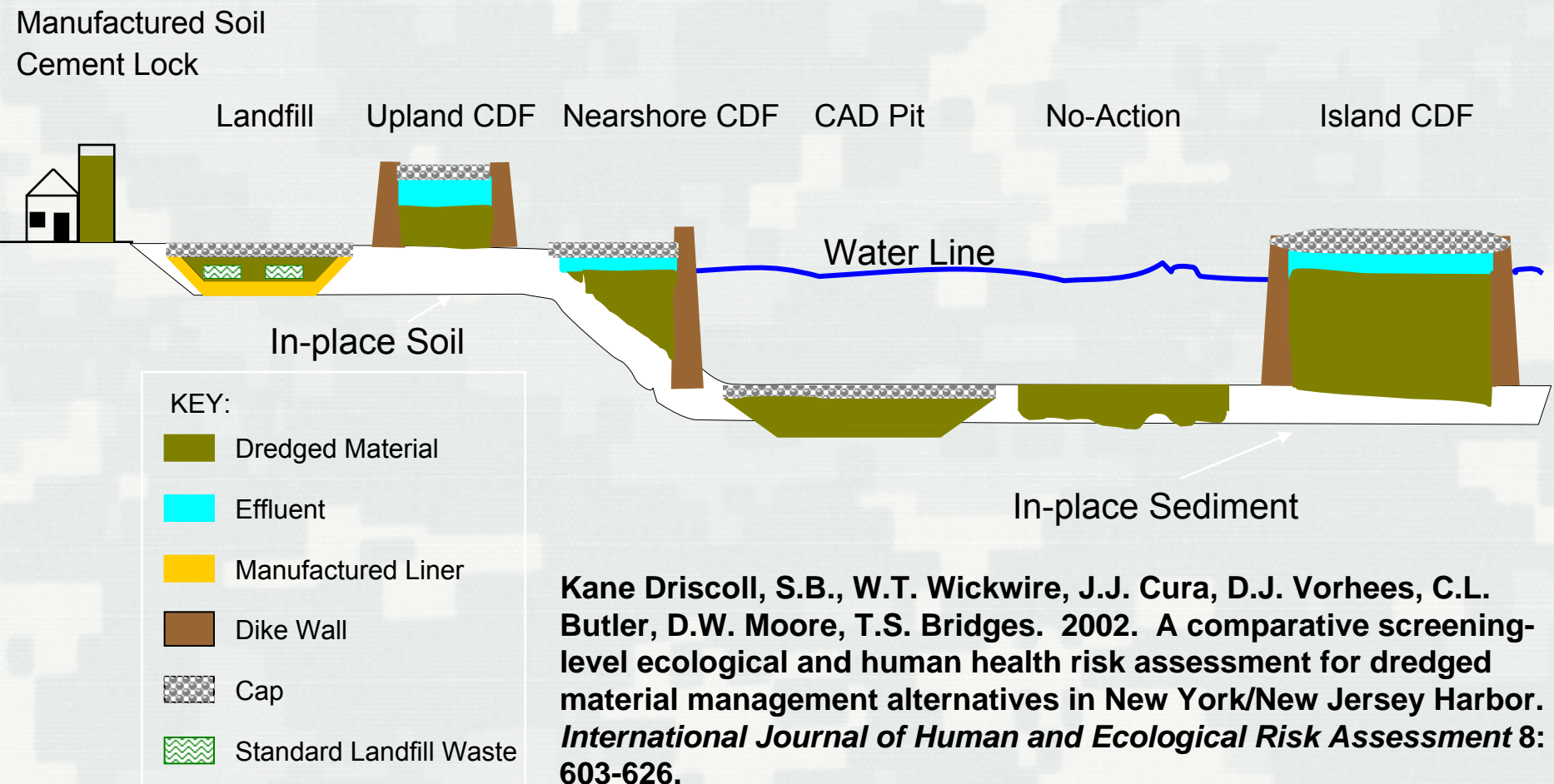


R&D Needs: System-Scale Modeling

- Predictive tools for doing comparative risk analysis for alternative management actions
- Technology to support near-real-time monitoring, data analysis, modeling
- Advanced visualization methods to support negotiation and multi-party decision-making
- Decision analytic methods to guide consideration of uncertainties



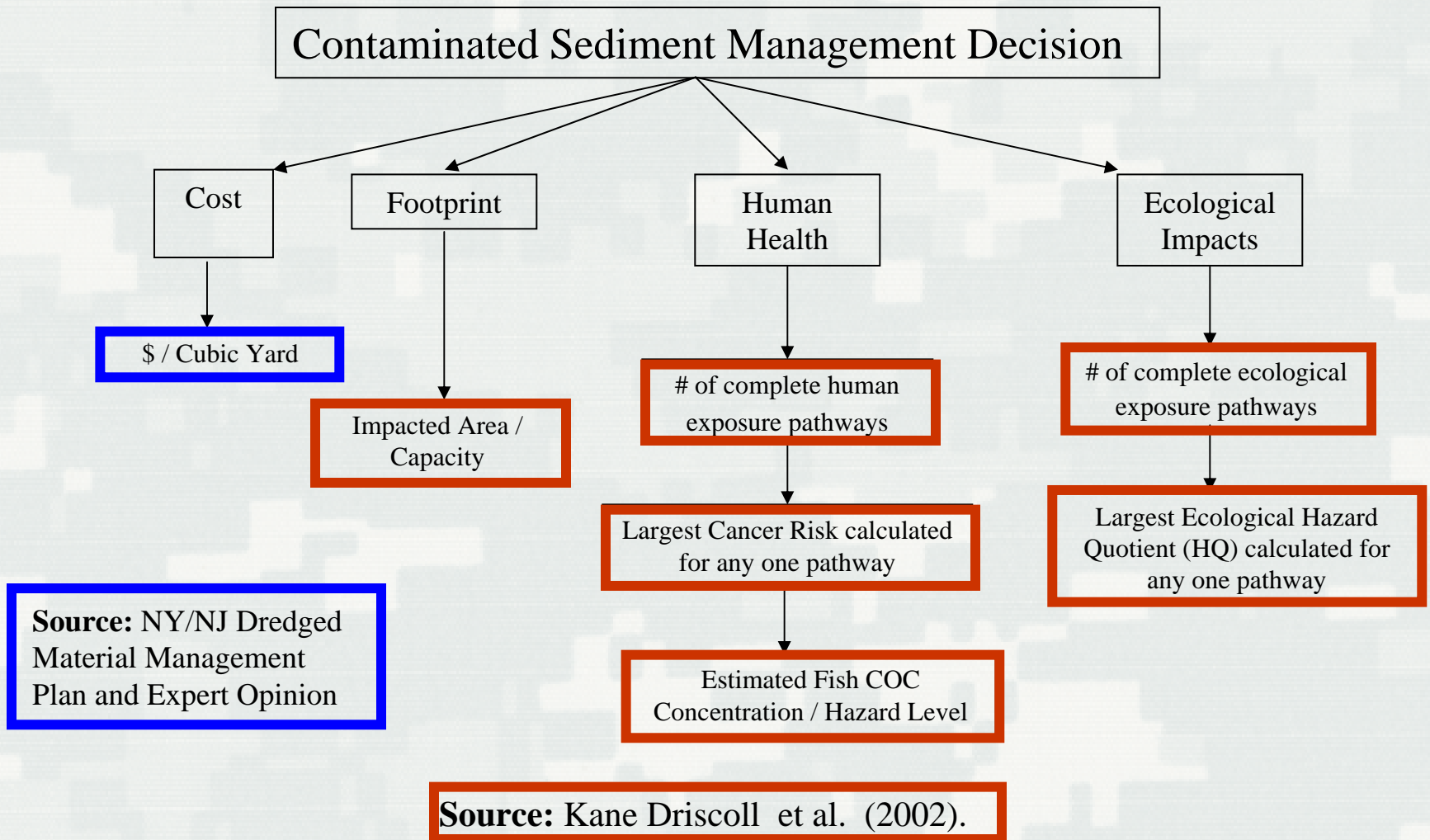
Approaches for Informing Deliberation



Kane Driscoll, S.B., W.T. Wickwire, J.J. Cura, D.J. Vorhees, C.L. Butler, D.W. Moore, T.S. Bridges. 2002. A comparative screening-level ecological and human health risk assessment for dredged material management alternatives in New York/New Jersey Harbor. *International Journal of Human and Ecological Risk Assessment* 8: 603-626.

G. A. Kiker, T. S. Bridges, J. B. Kim. 2008. Integrating Comparative Risk Assessment with Multi-Criteria Decision Analysis to Manage Contaminated Sediments: An Example From New York/New Jersey Harbor. *Human and Ecological Risk Assessment* 14:495-511.

Decision Criteria: NY/NJ Harbor



Criteria Levels for Each DM Alternative

	<i>Cost</i>	<i>Footprint</i>	<i>Ecological Risk</i>		<i>Human Health Risk</i>		
DM Alternatives	(\$/CY)	Impacted Area/Capacity (acres / MCY)	Ecological Exposure Pathways	Magnitude of Ecological HQ	Human Exposure Pathways	Magnitude of Maximum Cancer Risk	Estimated Fish COC / Risk Level
CAD	5-29	4400	23	680	18	2.8 E -5	28
Island CDF	25-35	980	38	2100	24	9.2 E -5	92
Near-shore CDF	15-25	6500	38	900	24	3.8 E -5	38
Upland CDF	20-25	6500	38	900	24	3.8 E -5	38
Landfill	29-70	0	0	0	21	3.2 E -4	0
No Action	0-5	0	41	5200	12	2.2 E -4	220
Cement-Lock	54-75	0	14	0.00002	25	2.0 E -5	0
Manufactured Soil	54-60	750	18	8.7	22	1.0 E -3	0

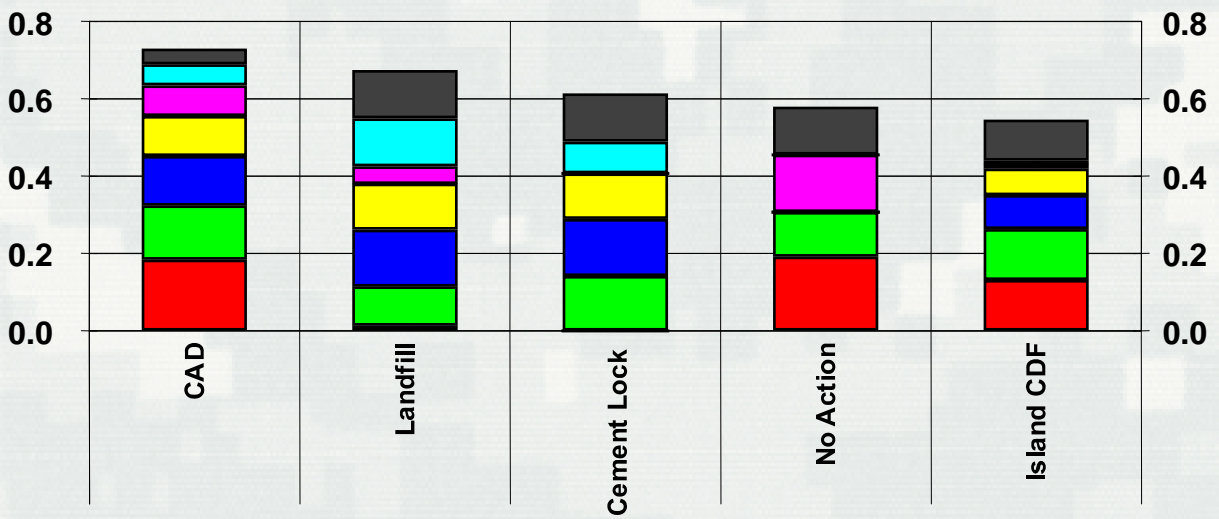
Blue Text: Most Acceptable Value

Red Text: Least Acceptable Value

USACE/EPA Survey Results: Criteria Weights (%)

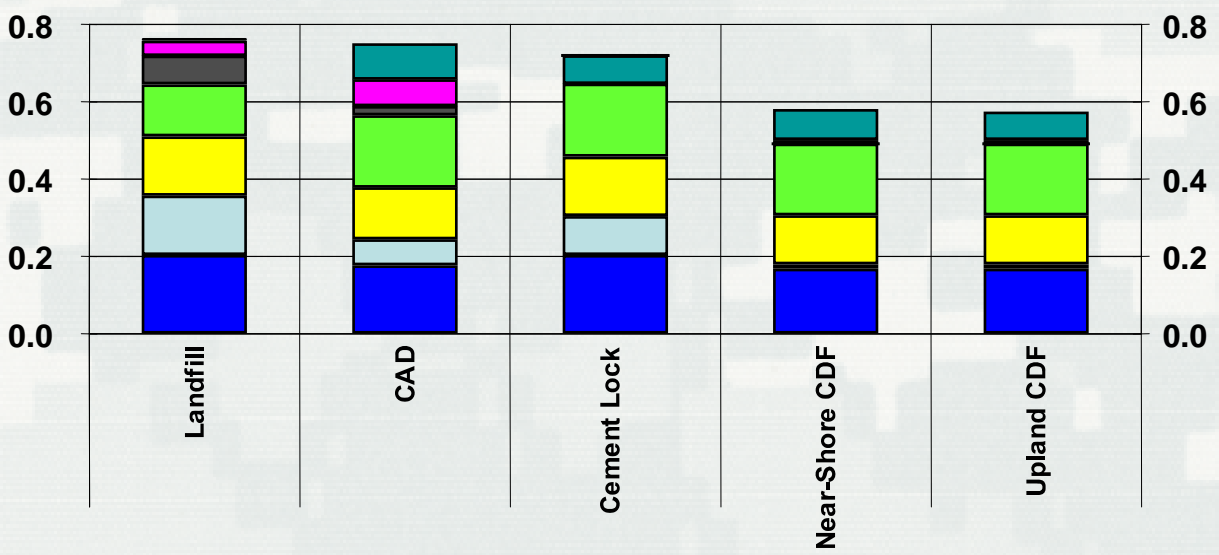
	EPA	USACE
Footprint	7.4	12.5
Ecological Health	35.6	27.1
Human Health	47.0	40.7
Cost	10.0	19.7

MCDA Rankings



USACE weighting

- Cost
- Maximum Cancer Probability (Non-Barge Worker)
- Ecological Hazard Quotient
- Est. COC Conc in Fish / Risk-based Conc
- Complete Human Health Exposure Pathways
- Complete Ecological Exposure Pathways
- Ratio of Impacted Area to Facility Capacity



EPA weighting

- Cost
- Maximum Cancer Probability (Non-Barge Worker)
- Ecological Hazard Quotient
- Est. COC Conc in Fish / Risk-based Conc
- Complete Human Health Exposure Pathways
- Complete Ecological Exposure Pathways
- Ratio of Impacted Area to Facility Capacity

The Solution

- Build the basis for system-scale optimization
 - Knowledge of relevant processes
 - Comprehensive modeling capability
 - Tools for informing deliberation

