Los Angeles County Regional DMMP Pilot Studies

Presented to

Contaminated Sediments Task Force

Presented by

U.S. Army Corps of Engineers
Anchor Environmental
Everest International Consultants
MEC Analytical Systems
Moffatt & Nichol Engineers

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EVEREST

ANCHOR ENVIRONMENTAL, L.L.C.

Overview of Pilot Study Objectives

- **Program Objective -** Evaluate the technical issues and potential environmental impacts associated with implementing each pilot study alternative. Each pilot study was evaluated by assessing specific criteria including short and long-term effectiveness, implementability, environmental impacts, and cost

Cement Stabilization Pilot Study-Objectives

- Evaluate Cement Stabilization effectiveness for treating contaminated sediments from Los Angeles County in a laboratory and field environment
- Evaluate operations parameters to assess Cement Stabilization implementability in the region
- Evaluate cost parameters to assess Cement Stabilization costs in the region
- Evaluate potential environmental impacts of Cement Stabilization

Aquatic Capping Pilot Study- Objectives

- LARE dredging site monitoring goals
  - Measure water quality parameters.
  - Observe construction activities and assess if change in operations affected water quality measurements.
  - Gather information on construction production rates/costs.

Objectives (cont.)

- NEIBP capping site monitoring goals
  - Measure water quality parameters.
  - Assess effectiveness of design criteria.
  - Assess the construction methods.
  - Observe construction activities and assess if change in operations affected water quality measurements.
  - Gather information on construction production rates/costs.
  - Establish baseline conditions for comparison against future monitoring events

Sediment Washing Pilot Study- Objectives

- Evaluate the effectiveness, feasibility, environmental impacts and cost to reduce chloride and TDS concentrations in marine sediments sufficiently to allow upland beneficial use
- ID candidate sediment washing processes and equipment
- Evaluate effectiveness at removing contaminants
- Collect information to allow full scale costs to be estimated

Sediment Blending Pilot Study- Objectives

- Evaluate the effectiveness, implementability, environmental impacts, and costs associated with blending contaminated sediment with various other materials to create either industrial grade fill, structural fill, or for disposal in a waste landfill
- Survey local contractors and recipients of dredge material to review current practices for use

Cement Stabilization Pilot Study- Overview

- Bench Scale Study
  - Marina del Rey, LA River Estuary,POLB Channel 2, POLA Consolidated Slip
- Field Pilot Study
  - POLA Anchorage Road Disposal Site
- Primary objective for bench study to provide guidance for field study
- Due to scheduling and budget constraints, field pilot commenced prior to completion of bench study
- Pilot team review preliminary results from bench

Cement Stabilization Pilot Study- Laboratory Bench Study

Presented by Russ Boudreau of

Moffatt & Nichol Engineers

Cement Stabilization Pilot Study-Field Pilot Study

Presented by Chimin Chian

Everest International Consultants Inc.

Aquatic Capping Construction Components Overview

- Dredging contaminated sediment at LARE
  - 105,000 cubic meters
- Placing contaminated sediment within the NEIBP
- Dredging clean cap sediment from the SEIBP
  - 66,000 cubic meters
- Placing clean cap over the contaminated sediment within the NEIBP

Aquatic Capping Pilot Study Chronology of Events

- Planning/design commence 1/01
- NEPA EA approved 5/9/01
- LARE Dredging started 8/2/01
- LARE Placement completed 8/25/01
- Capping started 12/17/01
- Capping completed 1/16/02
- Post Dredge monitoring completed mid-2/02
- Water and sediment quality data validated 8/02

Aquatic Capping Pilot Study - Engineering Design Overview

- Cap thickness
  - Cap stability against erosion
  - Bioturbation
  - Contaminant mobility
  - Cap consolidation
- Placement methods

Aquatic Capping Pilot Study - Modeling Predictions

- Long-Term Effectiveness Modeling
  - LTFATE
  - Recovery
  - Bioturbation

Modeling Predictions (cont.)

- Environmental Impacts
  - DREDGE
    - Elutriate Testing
  - STFATE
- Implementability
  - MDFATE

Aquatic Capping Pilot Study – Construction Photos

- LARE Dredging
- NEIBP Placement
- Capping
- Water Quality Monitoring


Dredging at LARE
MANSON
ANDREW
NORTH PORT
SEATTLE, WA.

Dredging Sequence


LBCT
LBCT


LBCT
LBCT


NORTH PORT
SEATTLE, WA.


NORTH PORT
ANDREW

Disposal Sequence


Capping Barge Placement

Capping Rehandling Placement


VULCAN

Water Quality Monitoring at LARE

Water Quality Monitoring at NEIBP

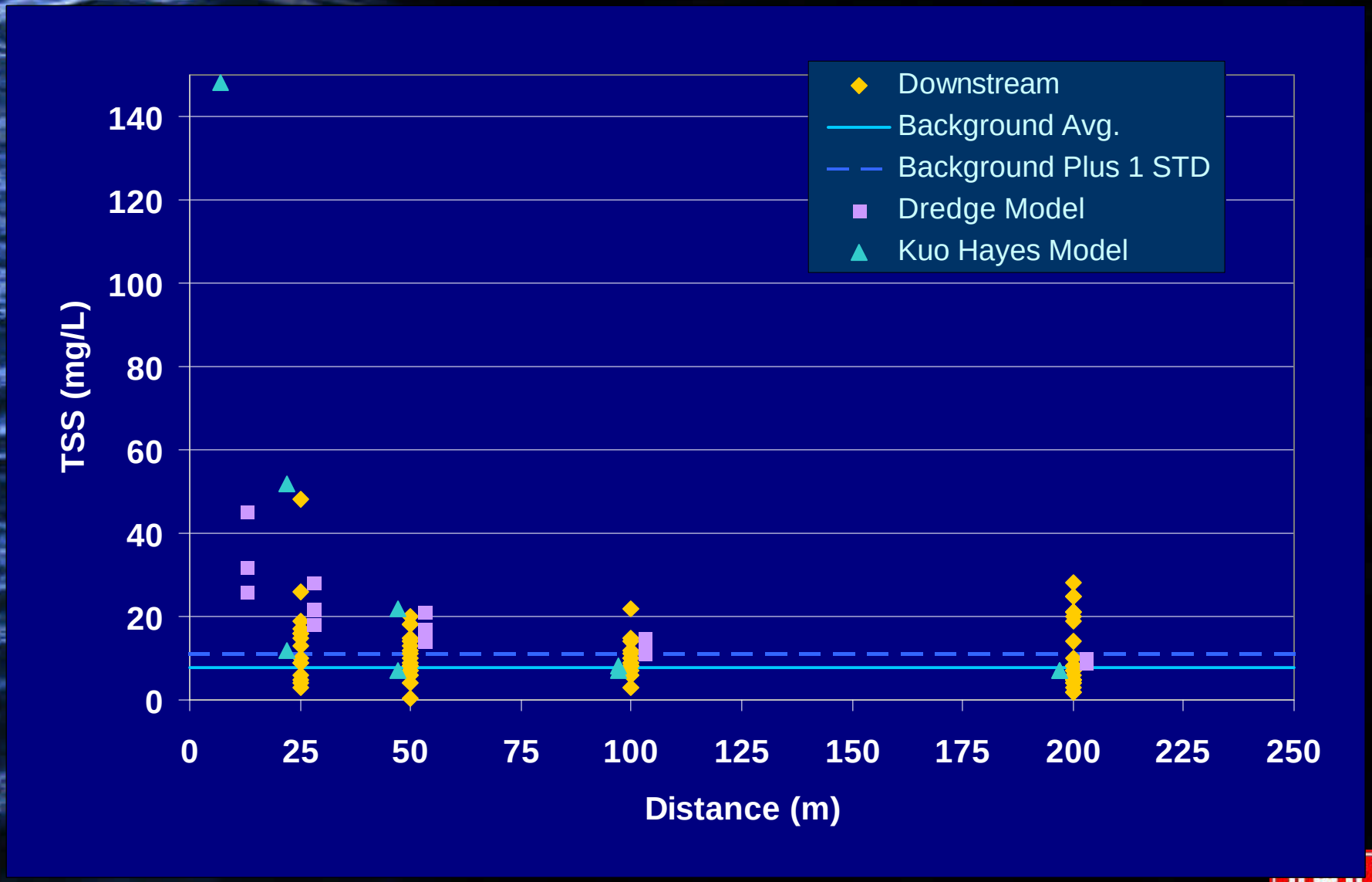
Aquatic Capping Pilot Study – Water Quality and Construction Monitoring

- LARE Dredge Monitoring
- NEIBP Placement
- SEIBP Dredge Monitoring
- Cap Placement
- Post-LARE Placement (pre-cap)
- Post-Cap Construction

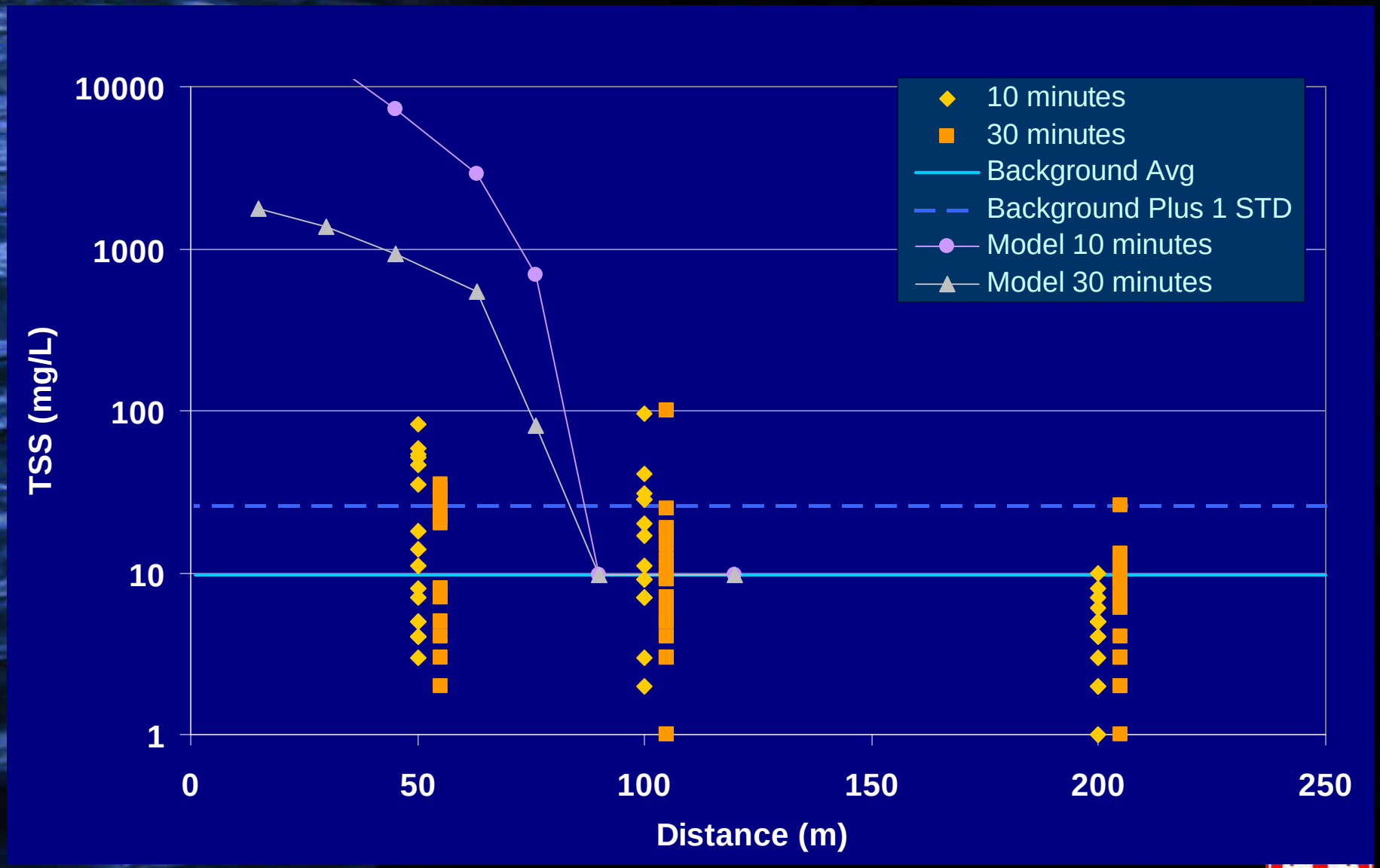
Water Quality and Construction Monitoring

Presented by David Moore of MEC Analytical Systems

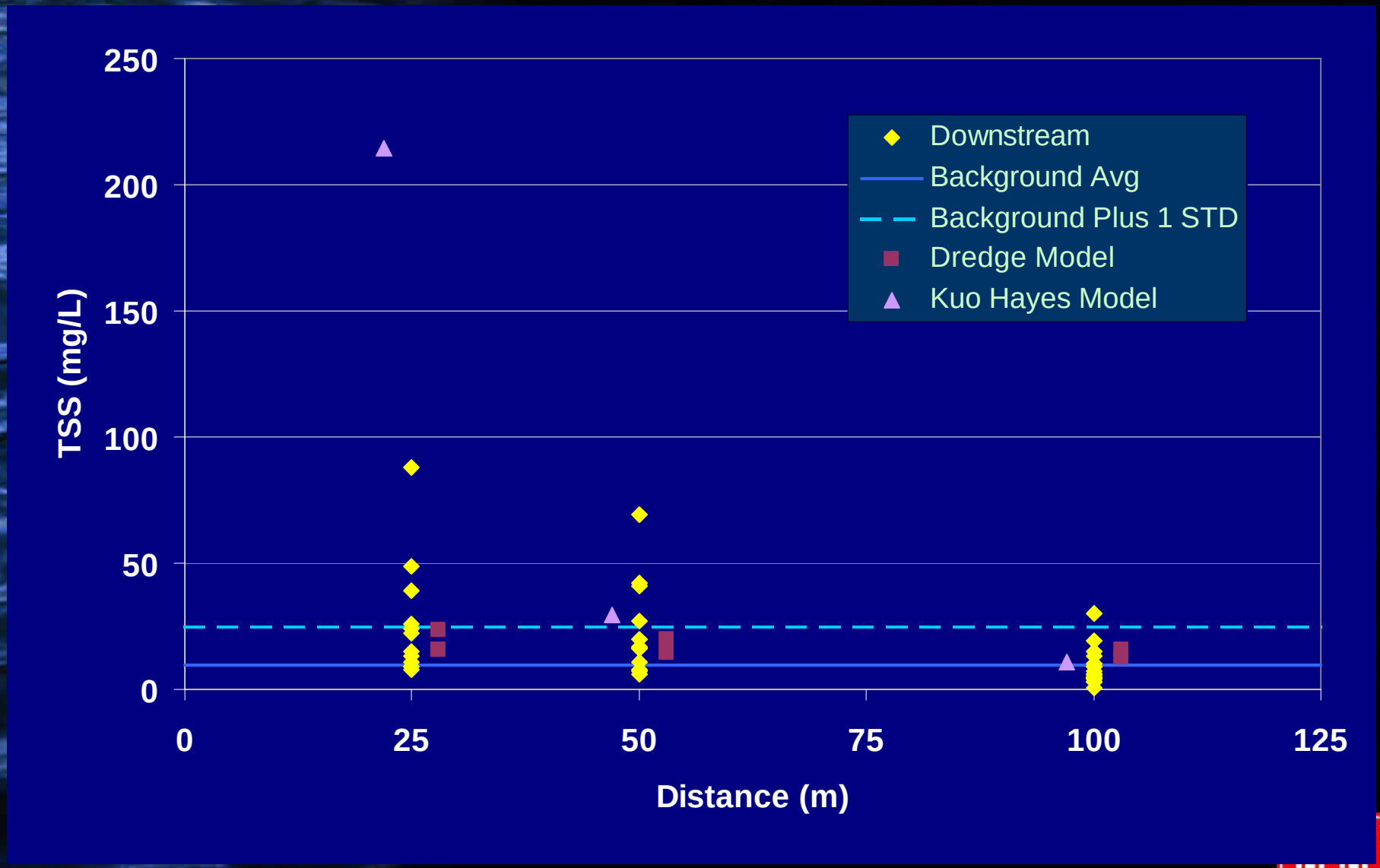
LARE Dredging – Models vs. Data



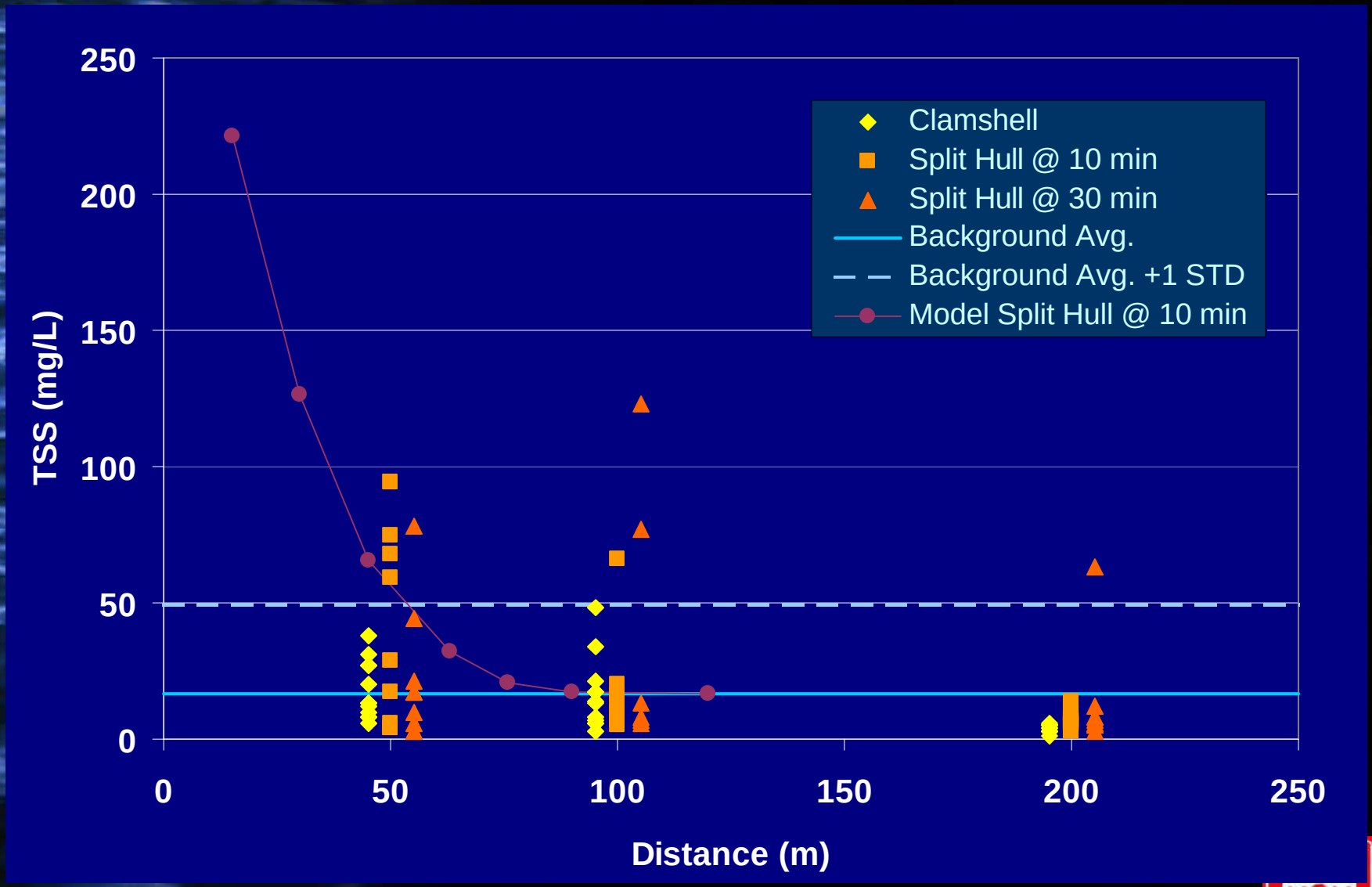
Sediment Placement – Model vs. Data



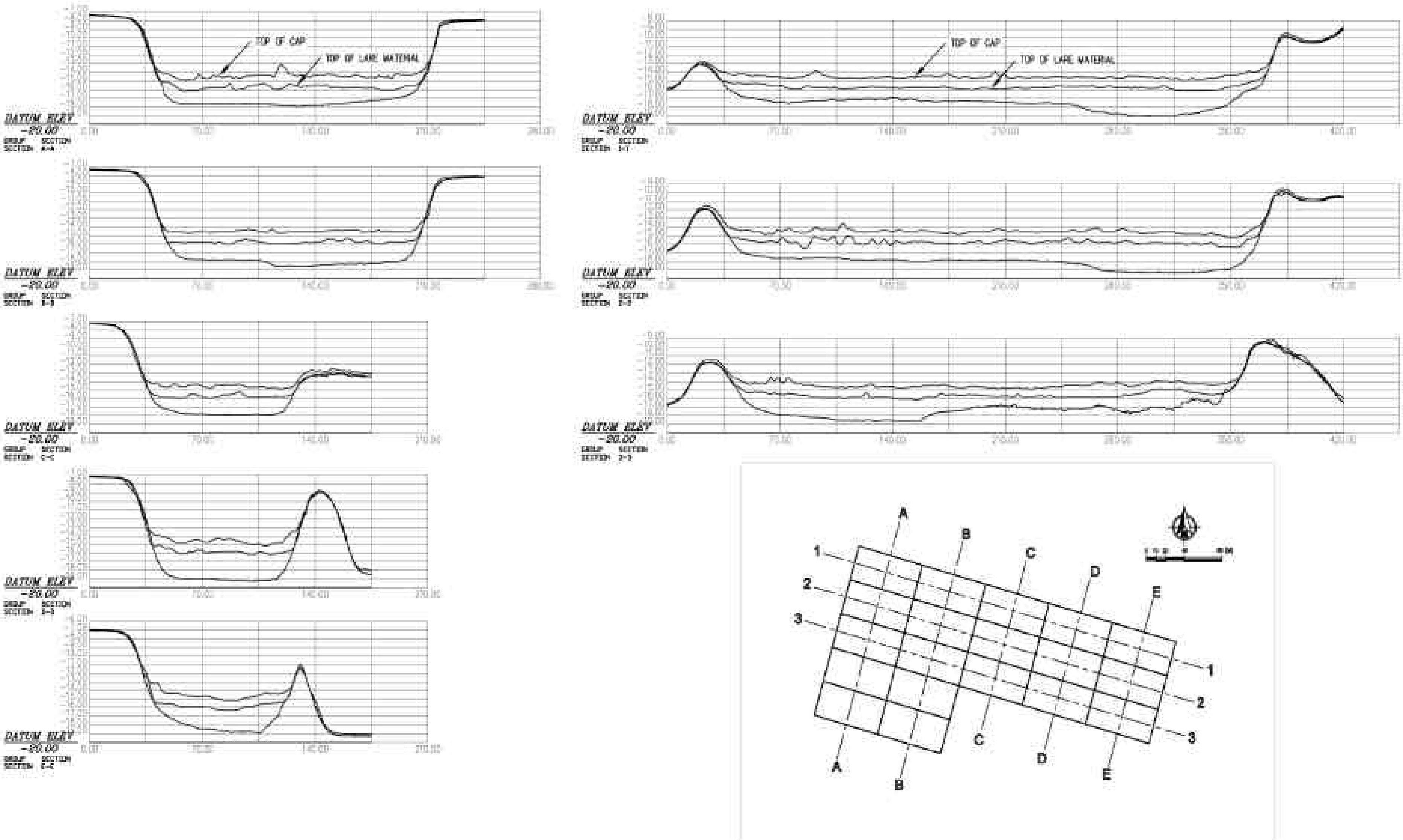
Cap Dredging – Models vs. Data



Cap Placement – Model vs. Data



Cap Thickness Profile



Aquatic Capping Pilot Study - Lessons Learned

- NEIBP foundation sediment is susceptible to displacement during sediment disposal.
- Displacement of resuspended foundation sediment did not cause significant environmental impact.
- No appreciable difference in cap mixing using bucket rehandling versus controlled barge discharge.

Lessons Learned (cont.)

- Dredging and disposal occurred at a faster rate than estimated.
- Bottom-dump barge placement need to be controlled near site boundaries to prevent unintended placement outside the designated target area.
- Vibracoring may provide excessive mixing of the core profile.
- Adaptive management is important to project success.

Sediment Washing Pilot Study- Laboratory Bench Study

- Overall Objective
  - Reduction of Chloride and TDS
    - 30 mg/l Chloride
    - 500 mg/l TDS
- Specific Objectives
  - Identify suitable processes
  - Evaluate feasibility at bench scale

Sediment Washing Pilot Study- Laboratory Bench Study

- Conducted by USACE ERDC (WES)
- Phase I
  - Literature/industry search
- Phase II
  - Bench scale testing

Sediment Washing Pilot Study- Laboratory Bench Study

- Literature Search Results
  - No documented case studies
- Candidate processes
  - Passive washing
    - CDF placement/leaching
  - Mechanical washing
    - Plate & frame filter cake washing
    - Counter current washing

Sediment Washing Pilot Study- Laboratory Bench Study

- Bench Testing
  - Sediment/Site Water Characterization
    - Chemical analysis (Cl, TDS, metals)
    - Geotechnical testing
  - Modeling washing processes
    - Cake washing curves
    - Evaluate post-washing releases

Sediment Washing Pilot Study- Laboratory Bench Study

- Column Testing
  - Model passive washing
- Pressure Filter Testing
  - Model mechanical washing

Sediment Washing Pilot Study- Laboratory Bench Study

- Column Testing Procedures
  - Material prep
  - Load & decant
  - Surcharge
  - Washing (continuous)
  - Filtrate sampling & analysis
  - Cake sampling & analysis
  - Secondary extraction/equilibration

Sediment Washing Pilot Study- Laboratory Bench Study

- Pressure Filter Testing
  - Loading & sampling as for column tests
  - Batch operation
  - Cake washing
  - Cake sampling & analysis
  - Residual testing

Sediment Washing Pilot Study- Laboratory Bench Study

	Bulk	Sand	Fines
Column Tests (unconsolidated)	CT1,CT2	CT3, CT5	CT4, CT6
Column Tests (surcharged)	SC3, SC4	N/A	SC2, SC5
Pressure Filter Tests	PF1, PF2, PF7	PF3, PF5	PF4, PF6

Sediment Washing Pilot Study- Laboratory Bench Study

- Study Goals
  - Volume water versus volume voids
  - Residence time – f (flow rate & cake thickness)
  - Volume water versus initial sediment volume or weight
  - Post treatment cake and supernatant concentrations

Sediment Washing Pilot Study- Bench Study Column Results

Test	Void Volumes (Vw/Vv)	Wash Water to Sediment Ratio (Vw/Vsed)	Mean Vw/Vsed Ratio
CT1 Bulk	1.5	0.9-2.9	1.9
CT2 Bulk	8.4		
CT3 Sand	9.7	2.6-7.5	5.1
CT5 Sand	3.1		
CT4 Fines	26	64-104	84
CT6 Fines	60		

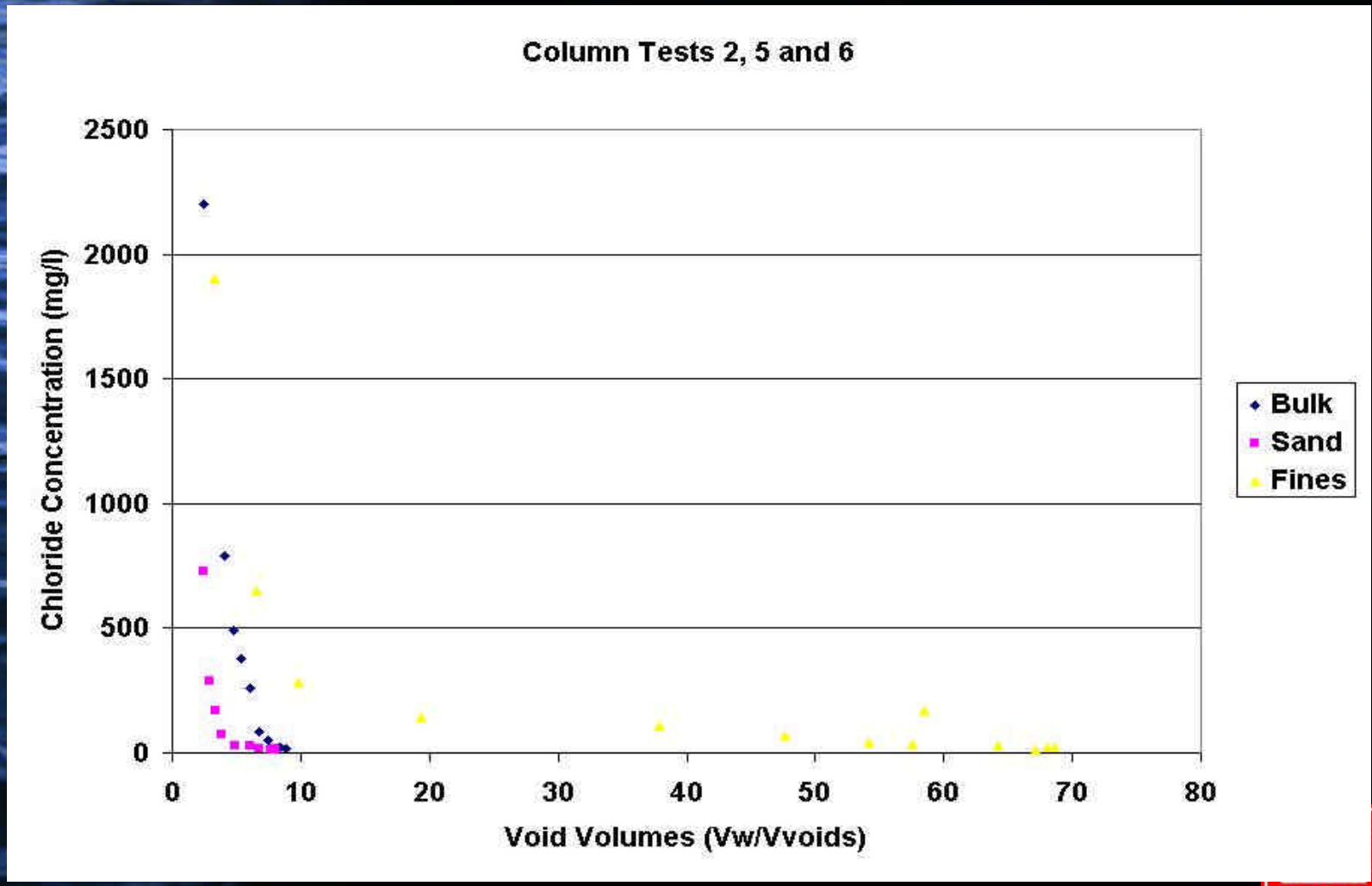
Sediment Washing Pilot Study- Bench Study Filter Results

Test	Void Volumes (Vw/Vv)	Wash Water to Sediment Ratio (Vw/Vsed)	Mean Vw/Vsed Ratio
PF2 Bulk	7.6	2.4-2.6	2.5
PF7 Bulk	6.0		
PF3 Sand	6.1	1.7-1.8	1.75
PF5 Sand	3.1		
PF4 Fines	21	12-27	20
PF6 Fines	15		

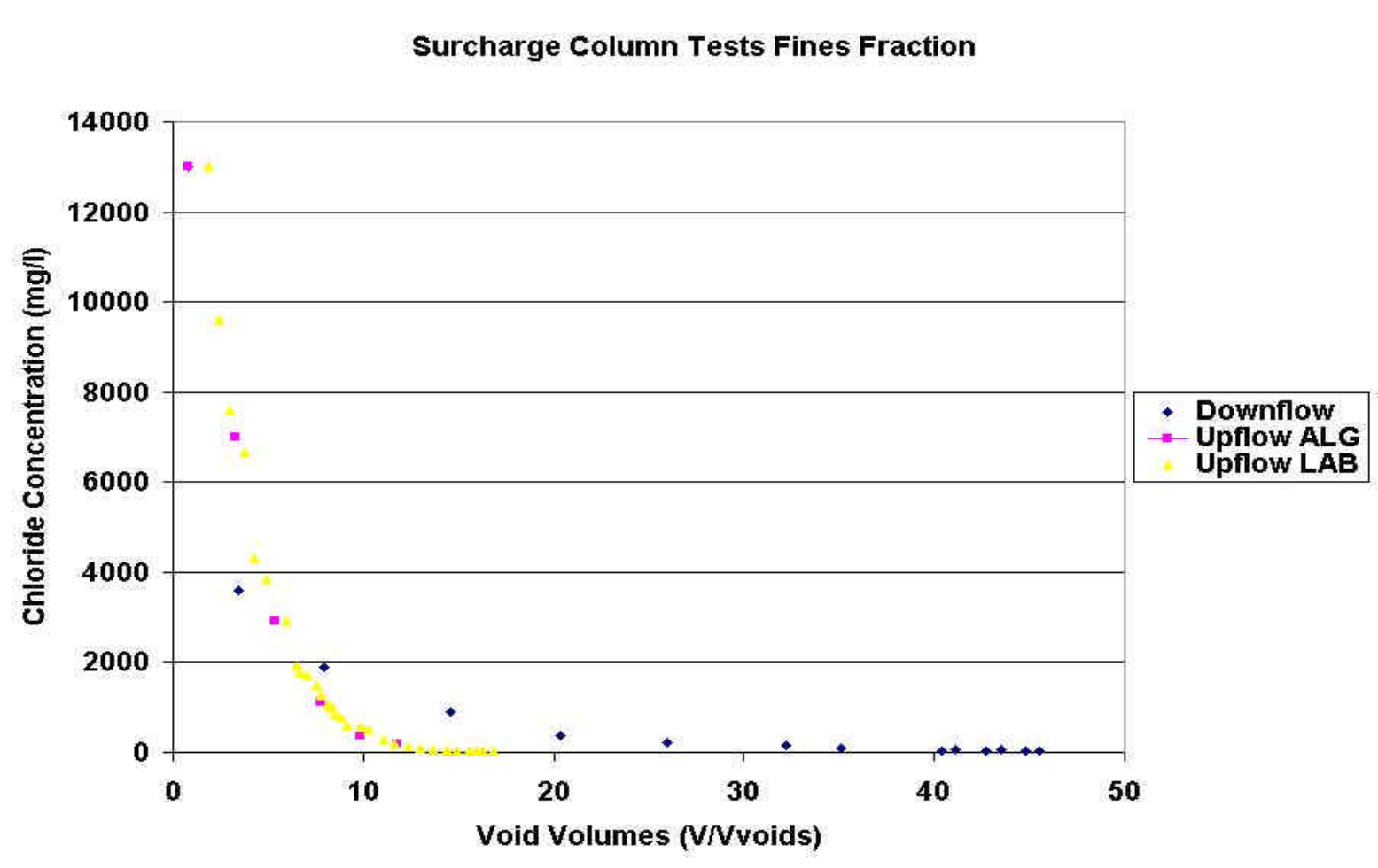
Sediment Washing Pilot Study- Bench Study Surcharge Results

Test	Void Volumes (Vw/Vv)	Wash Water to Sediment Ratio (Vw/Vsed)	Mean Vw/Vsed Ratio
SC3 Bulk	4.1	1.5-4.7	3.1
SC4 Bulk	12		
SC2 Fines	40	11-26	19
SC5 Fines	15		

Sediment Washing Pilot Study- Laboratory Bench Study



Sediment Washing Pilot Study- Laboratory Bench Study



Sediment Washing Pilot Study- Bench Study Results

Comparison of Bulk Cake Contaminant Levels to Bulk Sediment									
Sample	Contaminant Concentration as Percent of Bulk Sediment Concentrations (%)								
	Cl^-	As	Cd	Cu	Pb	Hg	Ni	Zn	Na
Bulk Sediment Concentration (mg/kg)									
A	520	1.5J	0.7	19.3	35.4	0.05	11.6	94.9	2980
B	440	1.6J	0.7	19.4	81.1	0.05	10.6	96.1	2790
Bulk Cake Concentration as Percentage of Mean Bulk Sediment Concentration (%)									
CT1	3.1	132	91	115	61	113	124	104	16
CT2	45	116	73	86	23	113	89	89	16
PF2	36	142	104	116	45	123	104	128	18
PF7	3.5	90	69	67	19	82	64	67	11
SC3	10	110	84	105	100	140	93	104	9
SC4	31	103	71	105	29	120	79	109	9
Mean %	21.4	134	95	99	46	115	92	100	13

Sediment Washing Pilot Study- Bench Study Results

Test	Constituent Concentrations (mg/L)										
	Cl	TDS	No. 24-hr Equilibration Periods	As	Cd	Cu	Pb	Hg	Ni	Zn	Na
C Test 1 (Bulk)	3.43	781	0	0.011	<0.0025	0.0056	<0.010	0.00004	0.0056	0.033	81.2
C Test 2 (Bulk)	5.7	546.67	0	0.0048J	0.0009J	0.02	0.07	0.000059	0.11	0.33	82.27
PF Test 2 Bulk	8.33	480.7	0	0.005	0.001	0.024	0.030	0.000051	0.013	0.10	67.1
PF Test 7 Bulk	17.0	567.7	2	0.0087	0.002	0.069	0.098	0.00015	0.019	0.212	87.17
SC Test 3 Bulk	6.03	326.3	2	0.0067	0.00087	0.066	0.37	0.00016	0.0176	0.165	30.17
SC Test 4 Bulk	3.73	457.3	3	<0.015	0.0047	0.012	0.016	0.00003	0.0077	0.057	21.9
C Test 3 (Sand)	4.9	297.3	0	0.01	0.0013	0.01	0.02	0.0000433	0.01J	0.06	26.6
C Test 5 (Sand)	4.93	238.3	2	0.01	0.00293	0.07	0.14	0.000223	0.02	0.32	22.63
PF Test 3 Sand	7.03	235.3	1	0.004	0.001	0.031	0.066	0.000159	0.011B	0.164	28.5
PF Test 5 Sand	3.87	204.7	2	0.0074	0.0011	0.0293	0.0597	0.0001	0.0093	0.134	20.3
C Test 4 (Fines)	780	2014	0	0.012J	<0.0025	0.0062J	0.0066	0.00002J	0.0069J	0.015	544
C Test 6 (Fines)	9.5	510	2	0.012J	0.0034	0.160	0.141	0.00022	0.023	0.331	82.0
PF Test 4 Fines	4.05	495.3	1	<0.015	<0.0025	0.004	0.009	0.0000145	0.0078	0.0365	83.9
PF Test 6 Fines	6.55	703	2	<0.015	<0.002	0.039	0.0365	0.00008	0.0145	0.105	12.4
SC Test 2 Fines	5.5	586	6	0.0037	0.0011	0.028	0.027	0.00004	0.014	0.050	78.2
SC Test 5 Fines	11.4	518.3	1	0.019	0.0005	0.016	0.019	0.00027	0.008	0.[illegible]	33.9

Sediment Washing Pilot Study- Bench Study Summary

- High variability
  - Vw/Vsed range 1.5-60
  - f (grain size, flow rate)
- Low/intermittent flow regime optimal
  - Minimize Vw required
  - Minimize Na and Cl cake residuals
  - Minimize subsequent Cl & TDS releases

Sediment Blending Pilot Study- Overview

- Original intent was to conduct laboratory bench studies to develop performance curves
- Literature review and user's survey suggested laboratory studies would not be useful

Sediment Blending Pilot Study- Literature Review

- Examples of past uses of dredge material
  - Construction fill
  - Landfill daily cover
  - Road base fill
  - Cement-based mixes
  - Manufactured soils

Sediment Blending Pilot Study- Literature Review

- Examples of blending materials
  - Clean sand
  - PROPAT (shredded auto fiber)
  - Organic materials (biosolids)
  - Cement/Lime/Kiln Dust

Sediment Blending Pilot Study- User's Survey

- Interviewed
  - Ports
  - Contractors
  - Consultants
  - Agencies

Sediment Blending Pilot Study- User's Survey

- Results
  - Dredge materials not currently blended prior to use for regional projects
  - With the exception of landfill daily cover, no local beneficial use for contaminated dredge materials
  - Dredge materials layered in fill and "managed" after construction

Sediment Blending Pilot Study- Example Landfill Cross-Section

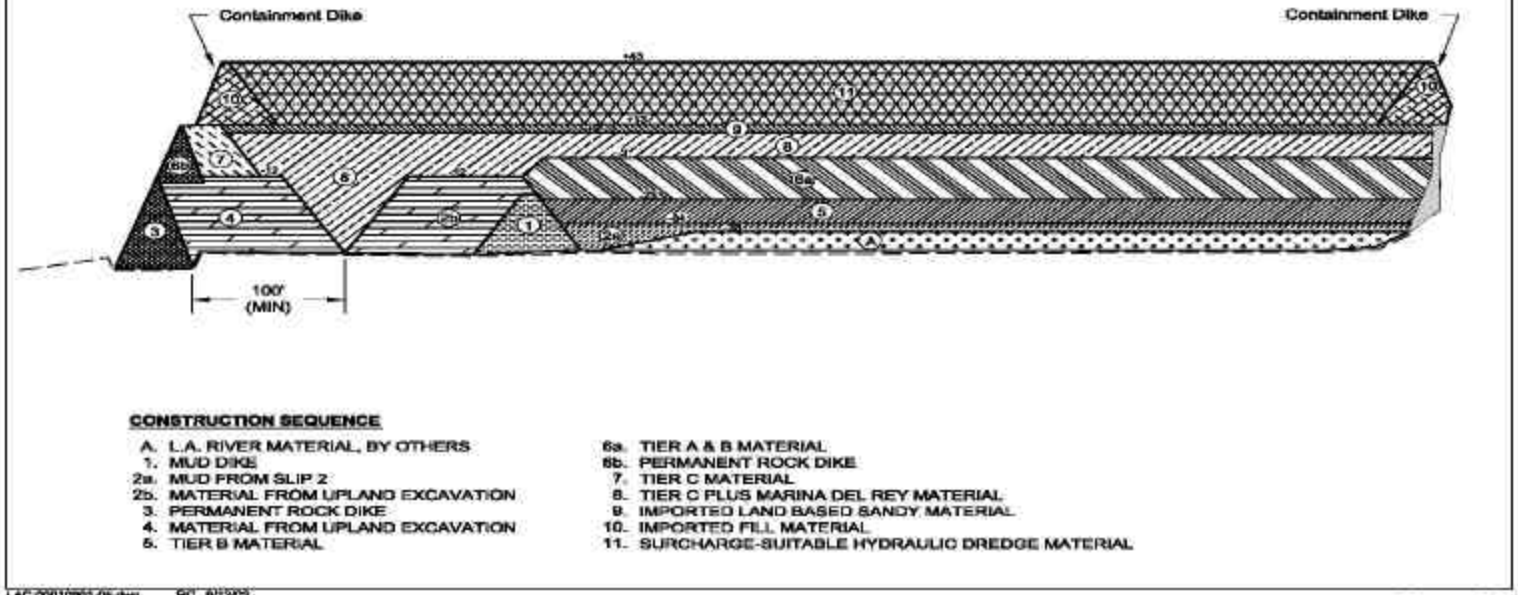


Figure C-2
Example Construction Sequence for a Typical Port Landfill Development Project (POLB Pier T Marine Terminal)

Sediment Blending Pilot Study- Conclusions

- Sediment Blending not currently conducted for purpose of re-using contaminated dredge materials
- Sediment Blending not conducted regionally by typical users of dredge material
- Sediment Blending is technically feasible, but is expensive and typically does not bind contaminants

Pilot Study-
Program Conclusions

- Aquatic Capping and Cement Stabilization appear capable of managing contaminated sediments.
- Sediment Washing and Sediment Blending appear to be technically feasible alternatives with many limitations.
- There is less flexibility in implementing the treatment alternatives (Cement Stabilization, Sediment Washing, Sediment Blending).
- There is greater cost uncertainty associated with implementing a treatment alternative than with implementing Aquatic Capping

Questions / Discussion