Palos Verdes Shelf Pilot Capping – Dredged Material Fate Modeling For Cap Placement

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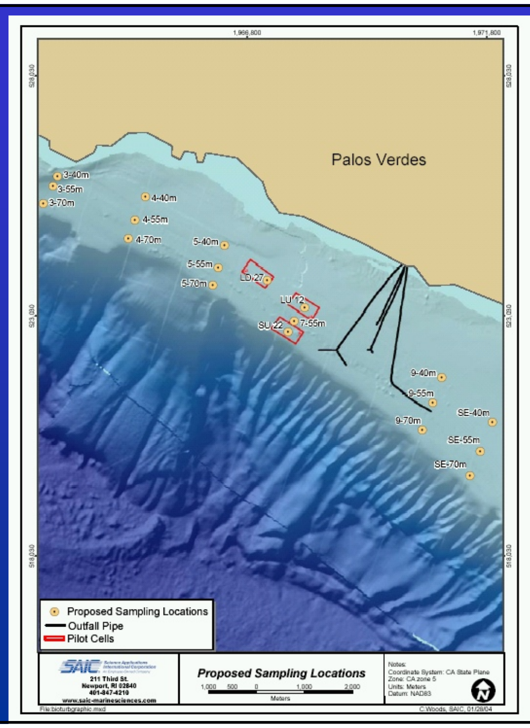
PVS modeling Outline

- PV Site Description
- STFATE and MDFATE Model Objectives
- MDFATE Input and Results
- STFATE Input and Results
- Summary/Conclusions

PVS Site Description

- 22 square km are contaminated from storm sewer outfall
- Water depth of 30-100m
- Storm-driven currents and surface waves as well as internal waves can resuspend bottom sediments
- Can a cap be placed in this deep-water environment?



Placement Methods

- Conventional (point placement)
  - Queen's Gate Sediments in LU and SU
- Spreading (cracked hull)
  - All Borrow Material in LD

Hopper Dredge "Sugar Island"

PVS Modeling Objectives

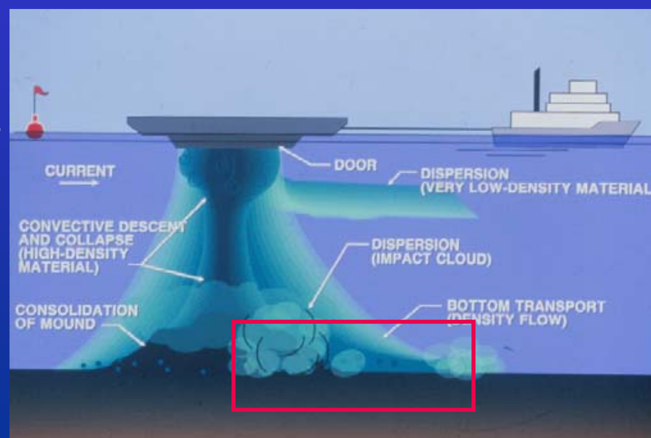
- Determine Fate models' ability to predict capping process
  - MDFATE
    - Extent of single and multiple placement mounds
    - Estimate required volumes (hopper & in-situ) to build cap
    - Guidance on spacing and locations of single loads – monitoring plans

PVS Modeling Objectives

- Determine Fate models' ability to predict capping process
  - STFATE
    - Impact velocity and surge speed
    - Plume movement and size
    - Hindcast: model with measured data and compare results to additional data

STFATE Processes Modeled

- Single Placement
- Water Column
- Bottom Footprint



STFATE Limitations

- **2D non-time varying currents**
- **Sloping bottom (SURGE)**
- **Model sensitivity to geotechnical parameters**
- **Source - rate of material leaving barge**
- **No resuspension by surge current**
- **Coefficients**
- **Model Validation**

MDFATE Processes Modeled

- Predicts Mound geometry from multiple open water disposals
- Conventional and Spreading
- Uses modified versions of STFATE and LTFATE
- Time Scale - Days to years (during & after disposal)

MDFATE Limitations

- **STFATE process limitations**
- **Does not include resuspension**
- **2D non spatially varying currents**
- **Model sensitivity to geotechnical parameters**

MDFATE Simulations

- Predictive/Scoping
  - (Jan-June 00), > 50 Simulations
  - Vary GSD, Currents, Dredge Velocity
- Operations
  - Jul-Aug 00 (10 Simulations)
  - Some actual data, original void ratios
- Hindcast
  - Mar 01 – July 01 (>30 Simulations)
  - Lack definitive full cap thickness LU

Sources of MDFATE Input

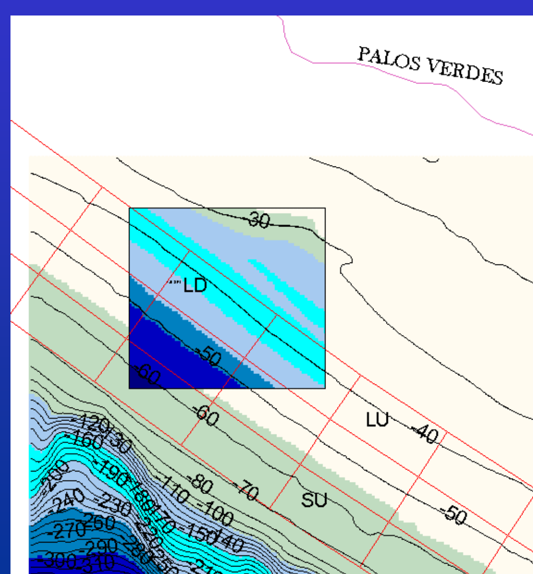
- ADISS – position, duration, velocity,heading, load, draft
- Hopper Samples – GSD, SG
- Cores – In situ void ratio
- Currents – ARESS, ADCP, ADCIRC
- Hindcast thickness – SPI/Cores*

MDFATE Input Typical Values

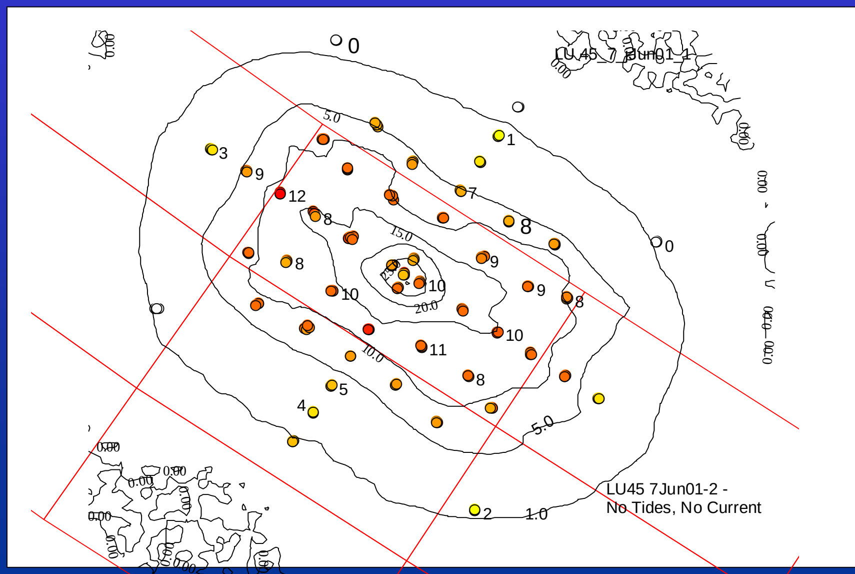
Variables	LU and SU (Queens Gate Conventional)	LD (AIII Spreading)
Load	1,000 cu m	1,200 cu m
Duration	3.5 - 4.5 minutes	7.5 minutes
Velocity	0.3 – 0.4 knots	2 knots
In situ Void Ratio	1.05*	0.75

Placement Cells with Typical MDFATE Grid

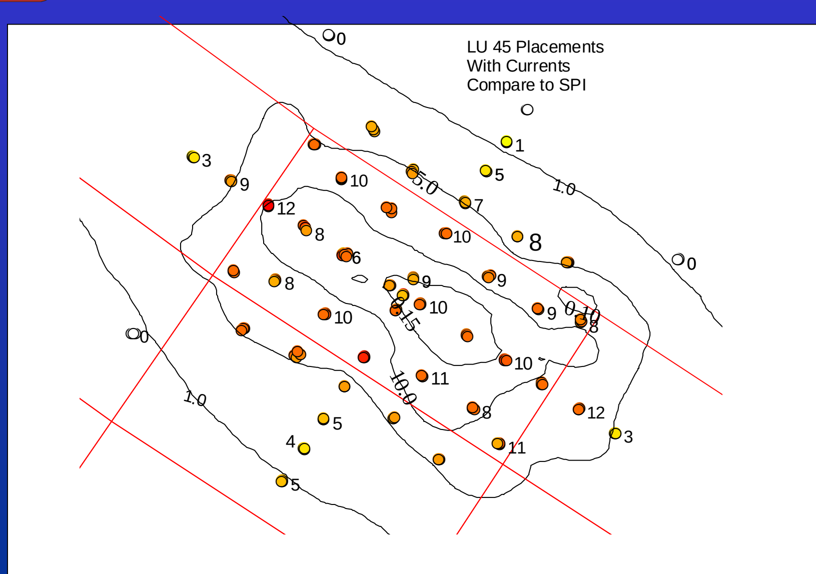
- Initially 30 m cell size
- Hindcast 15 m cell size



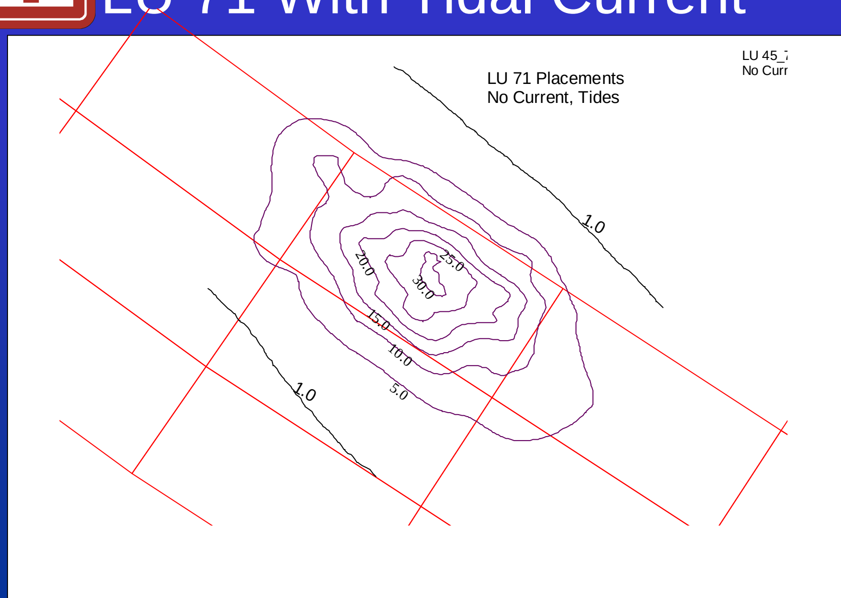
LU 45 No Tides



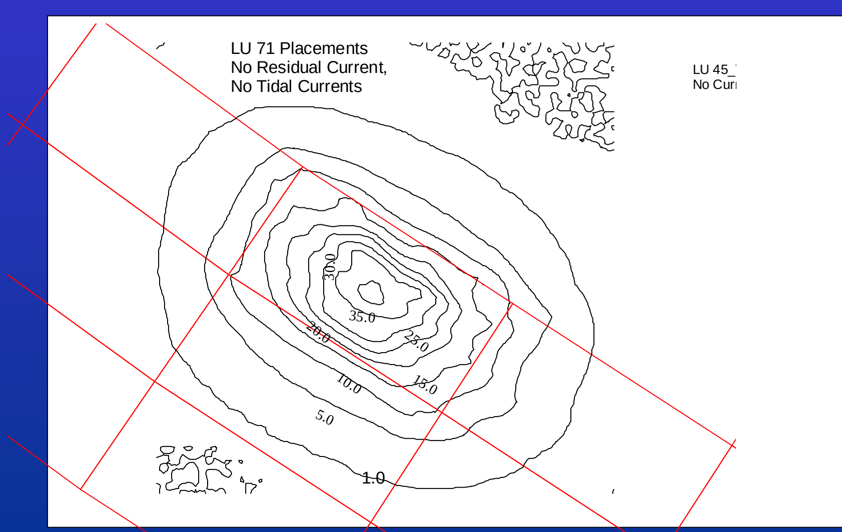
LU 45 Placements With Tides



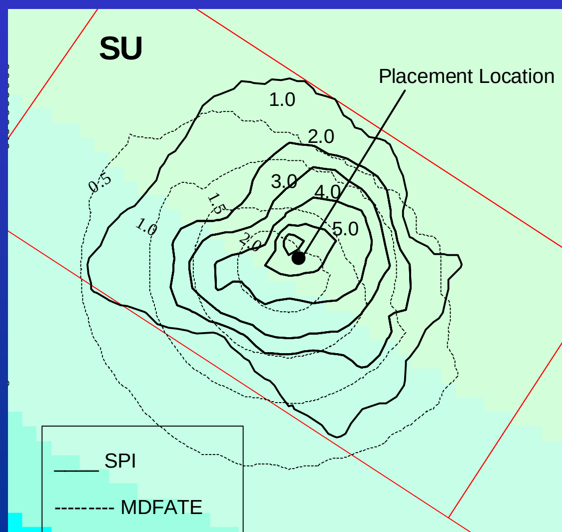
LU 71 With Tidal Current



LU71 No Tides or Current

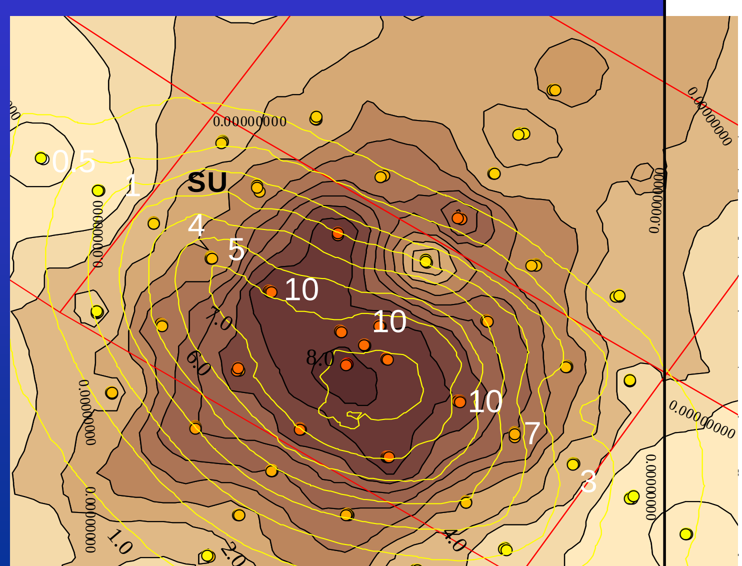


SU 1 - Preliminary

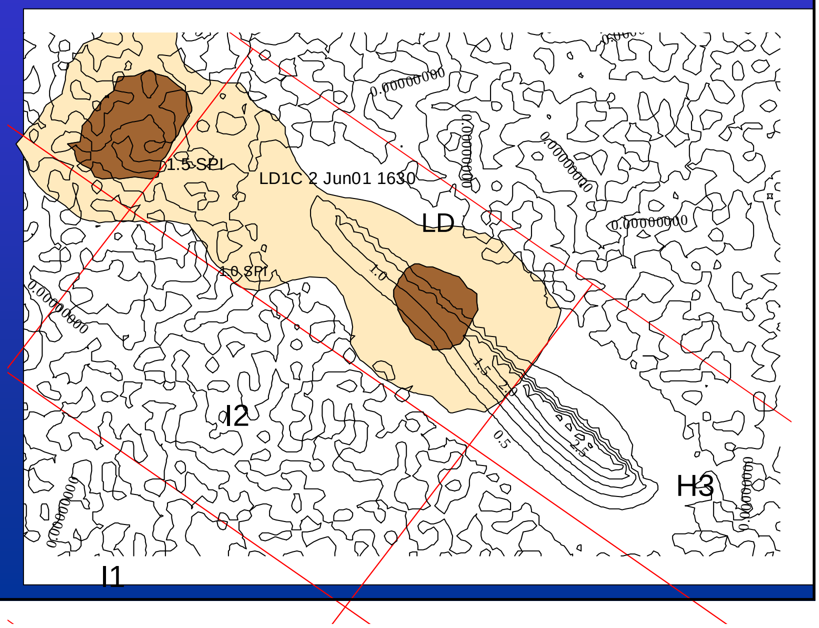


SU 21 With Tides

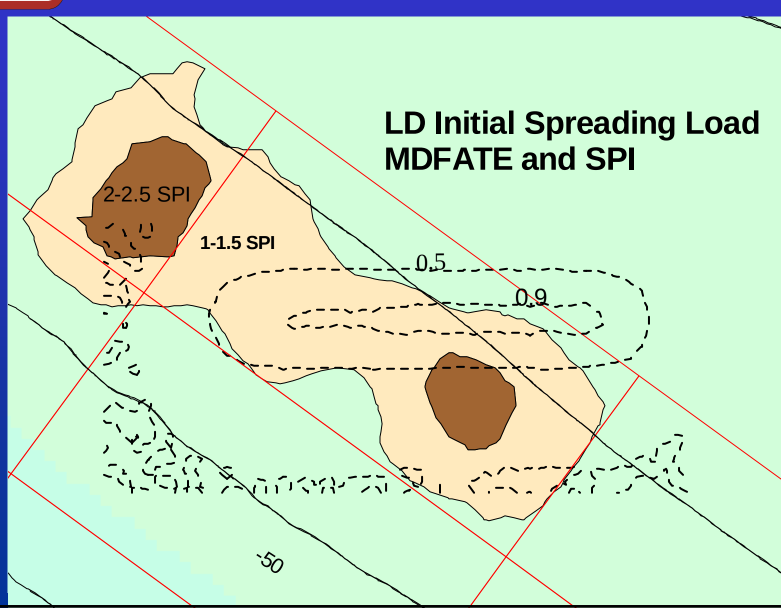
- Using LU sediments and void ratio



LD1 Conventional



LD Single Placement Spreading



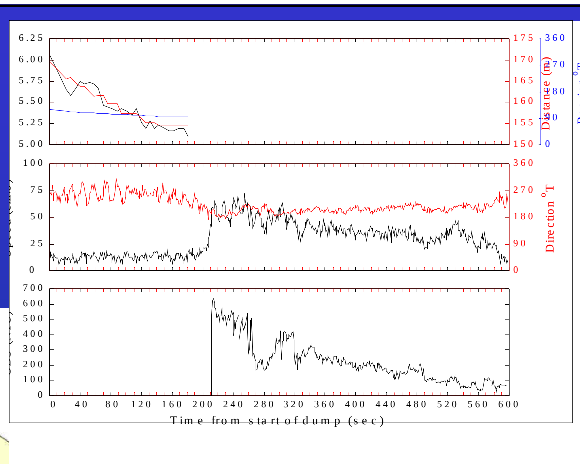
MDFATE Modeling Summary

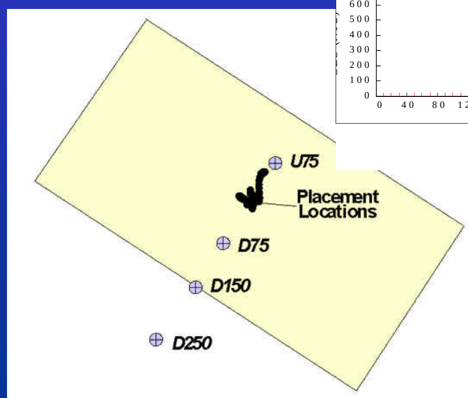
- Conventional Placement
  - Single loads, cap thickness underpredicted, extent good agreement, no currents
  - Full (45 loads) – thickness and extent, reasonable agreement with tidal currents
  - Slope effects not well modeled
  - Void Ratio is critical for good thickness predictions
- Spreading
  - Reasonable agreement on single load (no currents)
  - Reasonable agreement on multiple loads
- Additional sensitivity testing needed

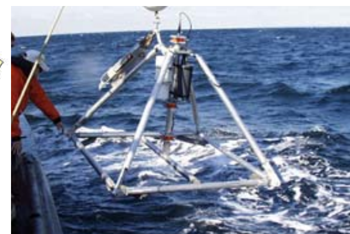
STFATE Simulations

- Predictive/Scoping
  - (Jan-June 00), ~ 5 Simulations
  - Impact Velocities, Far Field – Kelp Impacts
- Hindcast
  - Mar – May 01 (>10 Simulations)
  - Surge Velocity Comparisons
  - Far Field Comparisons

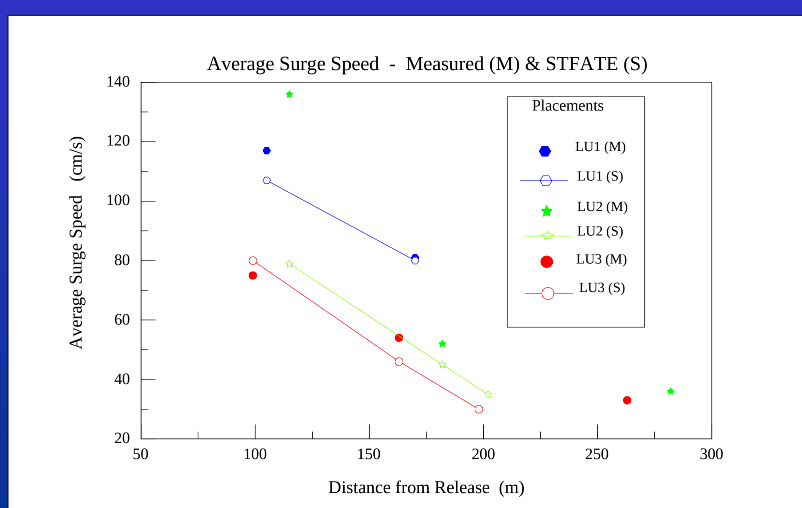
Average Surge Speed Computation



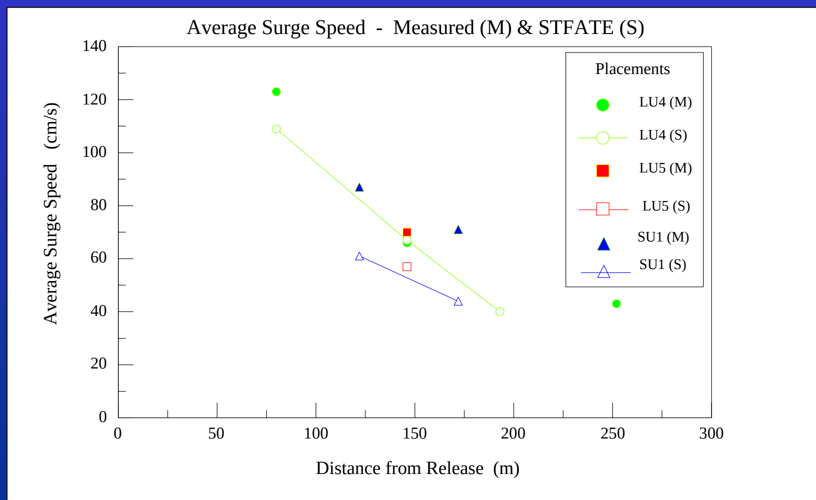




Measured vs Predicted Surge Currents

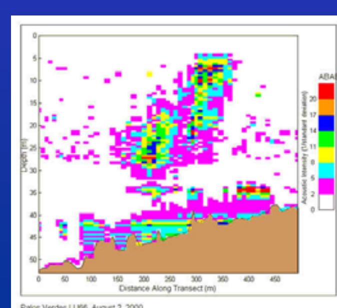


Measured vs Predicted Surge Currents



STFATE FAR-Field Plume Comparisons

- STFATE Far Field Plume dimensions compared well qualitatively with ADCP



STFATE Modeling Summary

- **STFATE surge speeds compared reasonably well to measured surge speeds**
  - **STFATE tends to under estimate with increasing distance from release**
  - **For steeper slope at SU agreement not as good**
- **Plume characteristics**
  - **Qualitative agreement**
- **Impact Velocity**
  - **Averaged 10 ft/s**

PV Modeling- Summary

- MDFATE - Reasonable agreement for mound thickness, good agreement on mound extent, volume losses still to be predicted
  - Lack of resuspension – under predicts single load thickness
- STFATE – Surge predictions agree well with measurements
  - Slope effects, >200 m not well predicted
- Insufficient data for quantitative far field plume comparisons