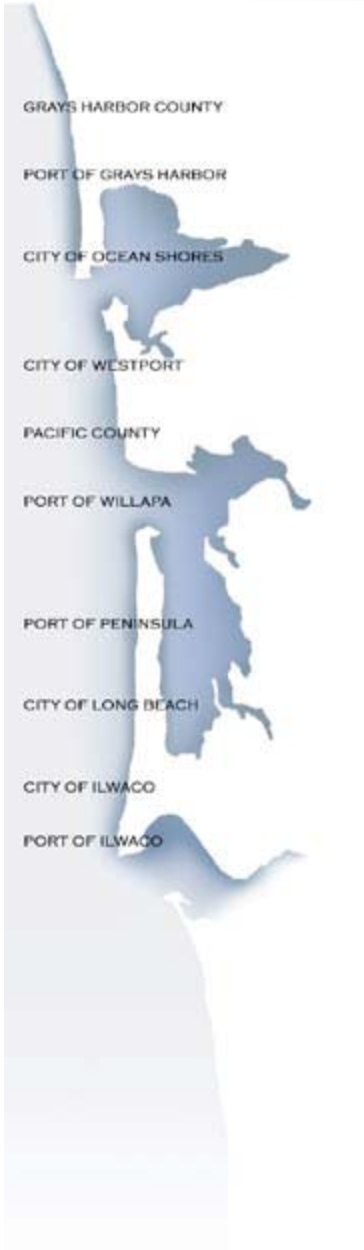


Southwest Washington Littoral Drift Restoration Project (LDR)

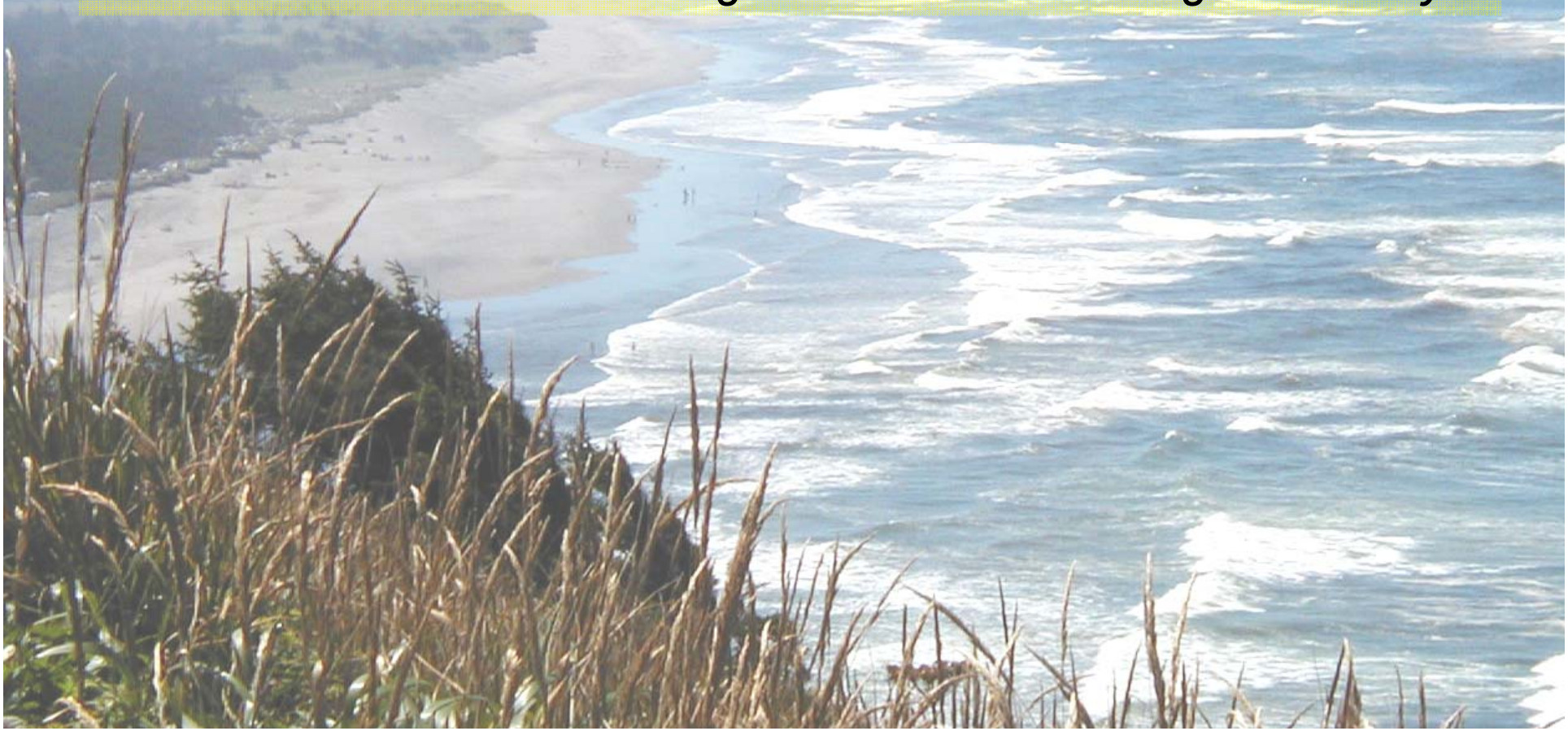
www.washington-coastal.com

March 2006

Project Goal

To restore 2-4 million cubic yards of sediment per year to the littoral drift along the Washington coast to the north of the Columbia River.

Constraints: Maintain existing crab habitat and navigation safety

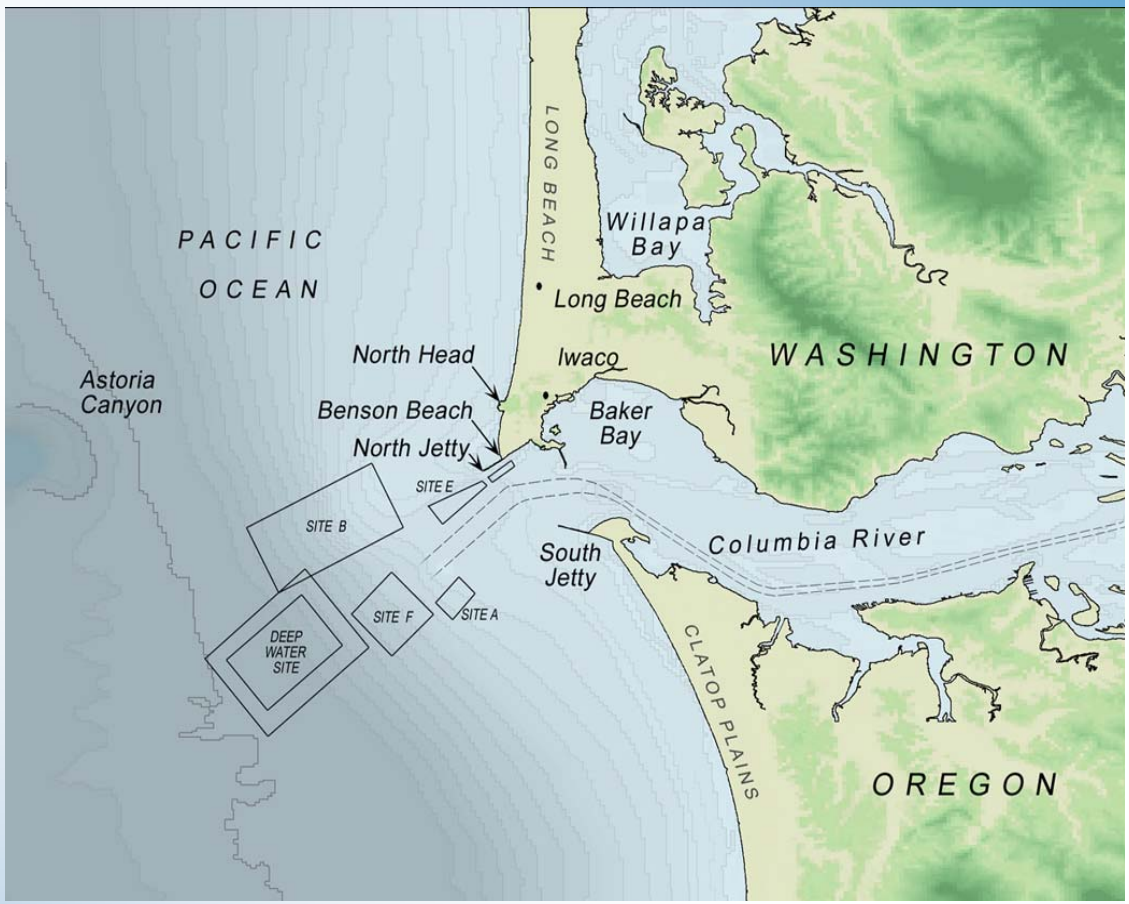


The Southwest Washington Coastal System

- Sand supply to beaches of southwest Washington has declined by a factor of three from 5.6 MCY/yr (1878-1935) to 1.4 MCY/yr (1958-1997) (Gelfenbaum et al. 1999; USGS - WADOE)

The Southwest Washington Coastal System

- The sand on the beaches of southwest Washington originates from the Columbia River
- Long-term net removal of littoral sediment from the Columbia River system by dredging of 3.3 MCY/yr (1939 to 1999) (Allan, 2002)



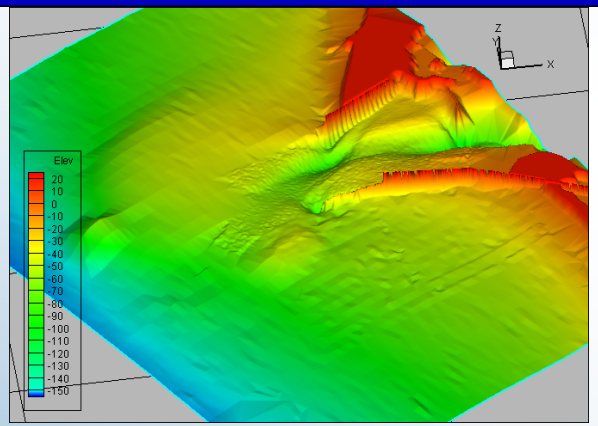
Advancing the goal…
The plan

- ✓ Baseline Data Collection
- ✓ Engineering and Technical Analysis
- Environmental Permitting
- Demonstration Project 2007
- Long-term Project Implementation

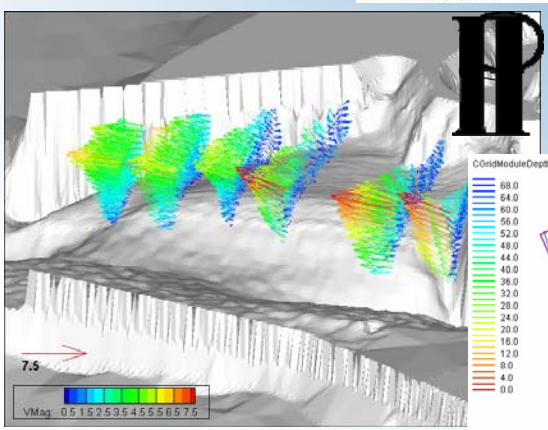
Doing the science...

US Army Corps of Engineers
Portland District

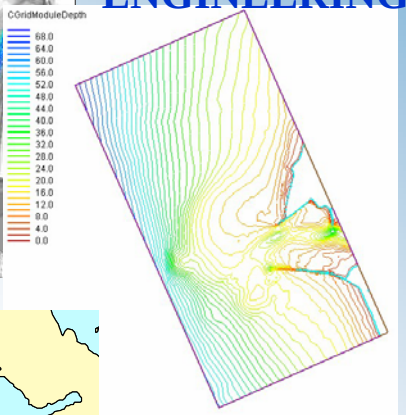
Portland District



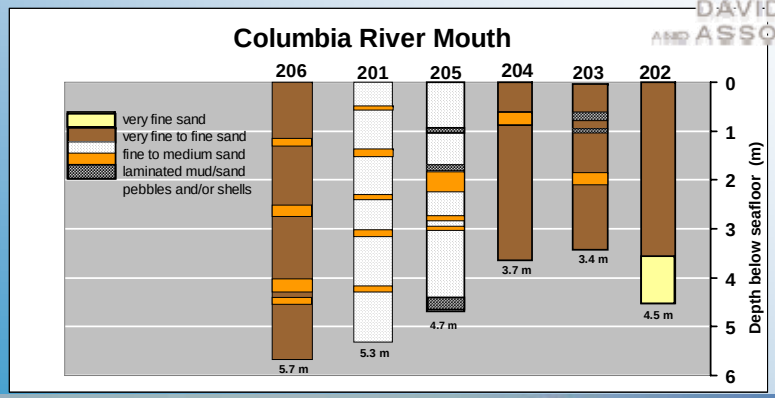
Pacific County



PACIFIC INTERNATIONAL ENGINEERING PLLC



DAVID EVANS AND ASSOCIATES INC.



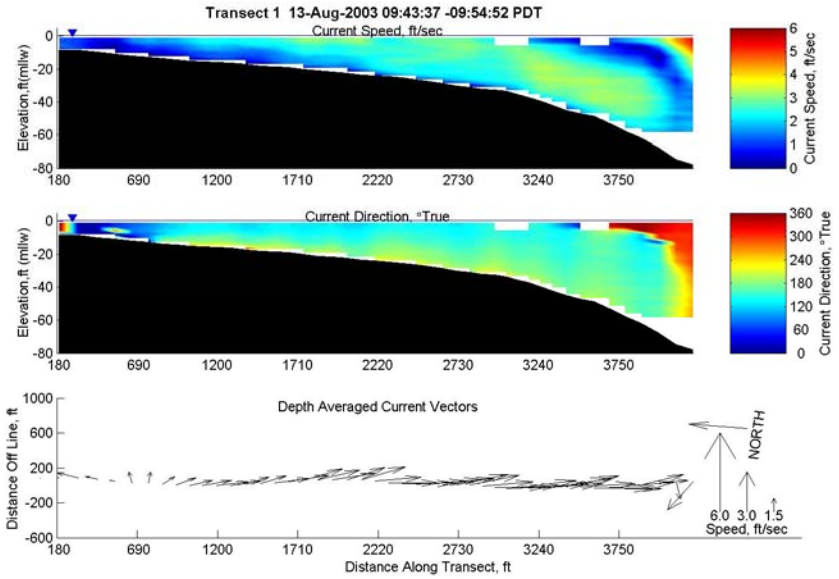
Battelle

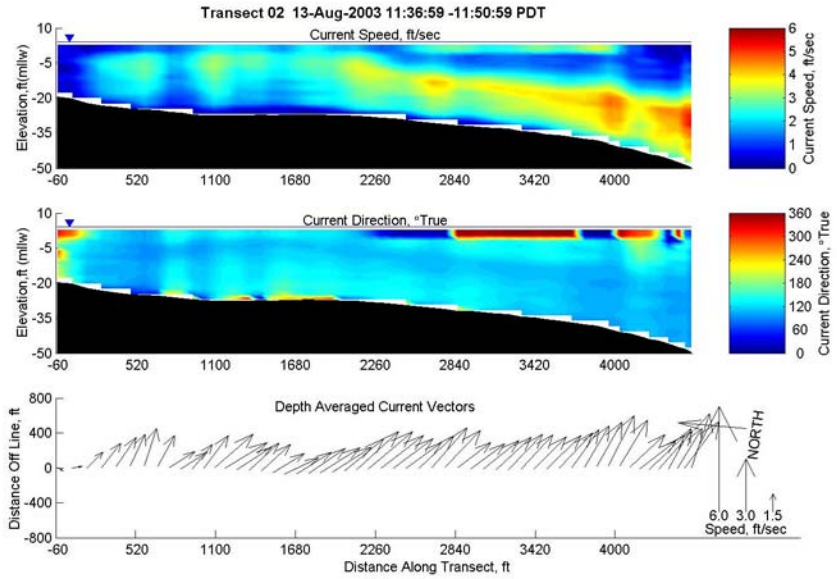
Department of Ecology

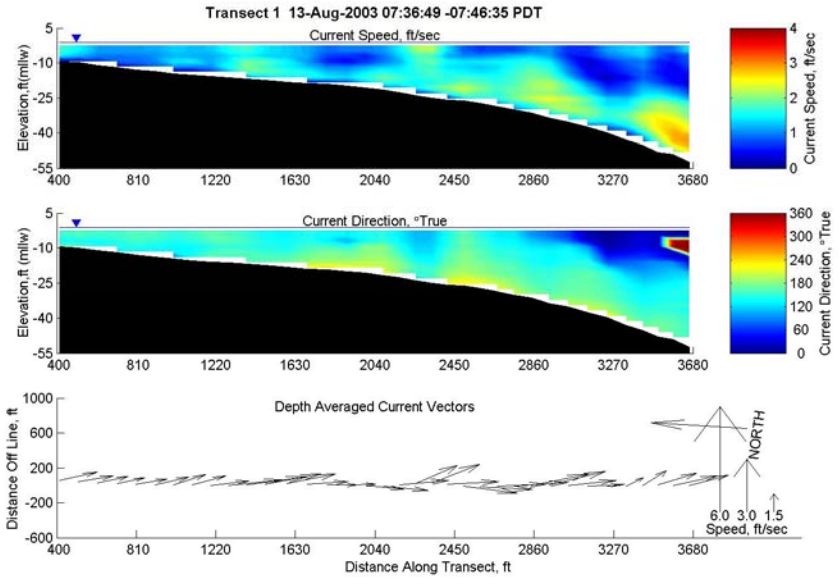
NORTHWEST RESEARCH ASSOCIATES

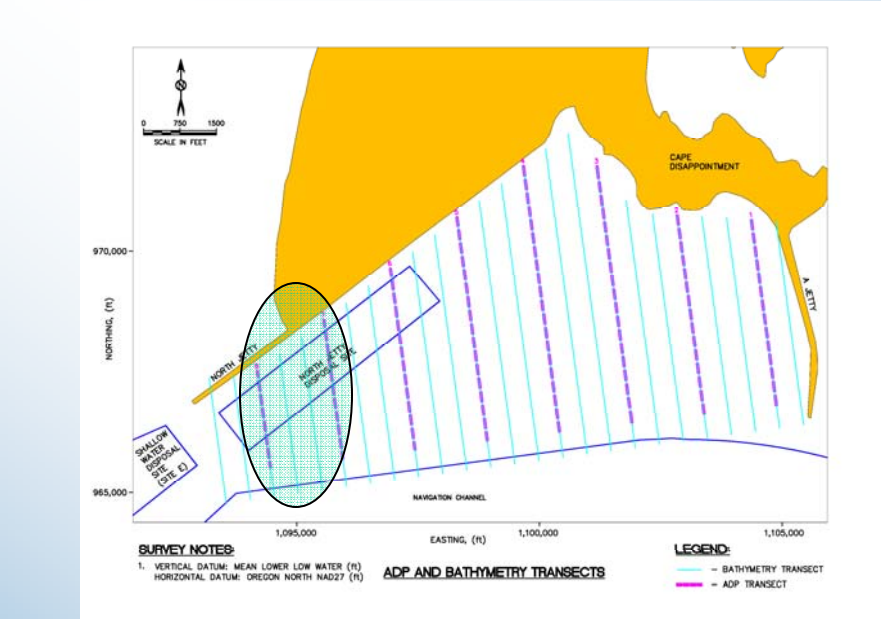
Home Company Products Outreach Research Areas GSA Services Site Map

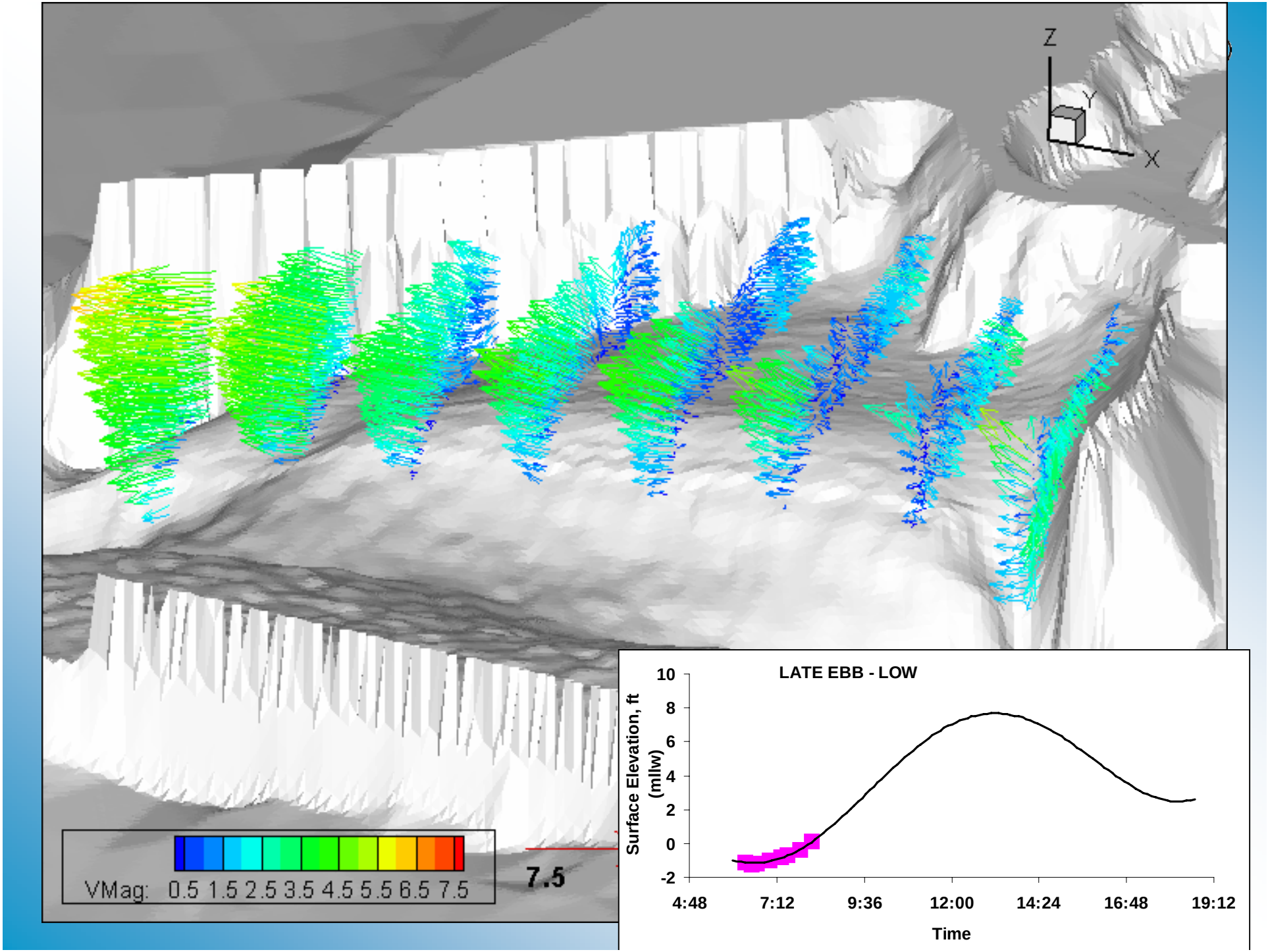
Flood current vertical structure across North Jetty Disposal Site





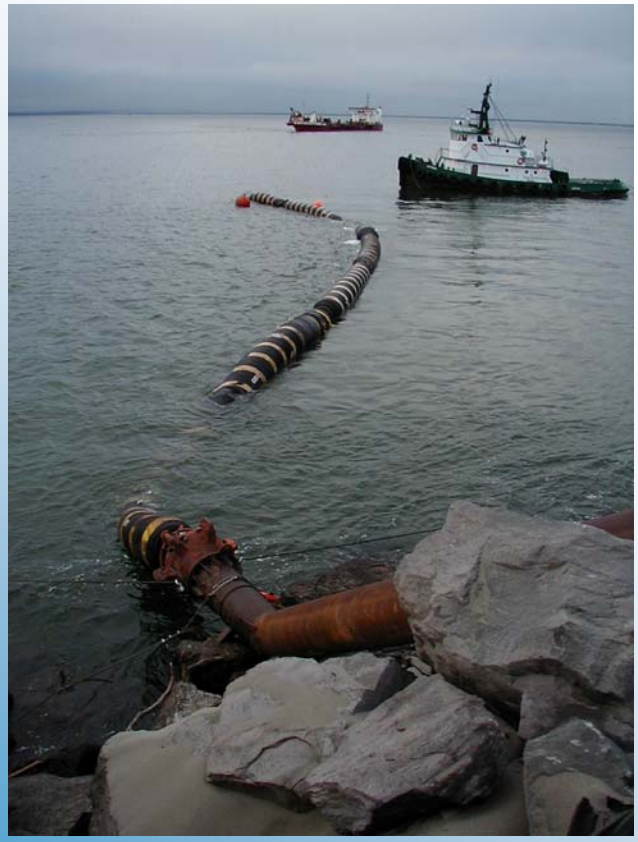





Z
Y
X
VMag: 0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5
7.5
LATE EBB - LOW
Surface Elevation, ft (mllw)
10
8
6
4
2
0
-2
4:48
7:12
9:36
12:00
14:24
16:48
19:12
Time

Dredging/placement alternatives

Direct pump-off from hopper dredge
Re-handle at a sump with pipeline dredge

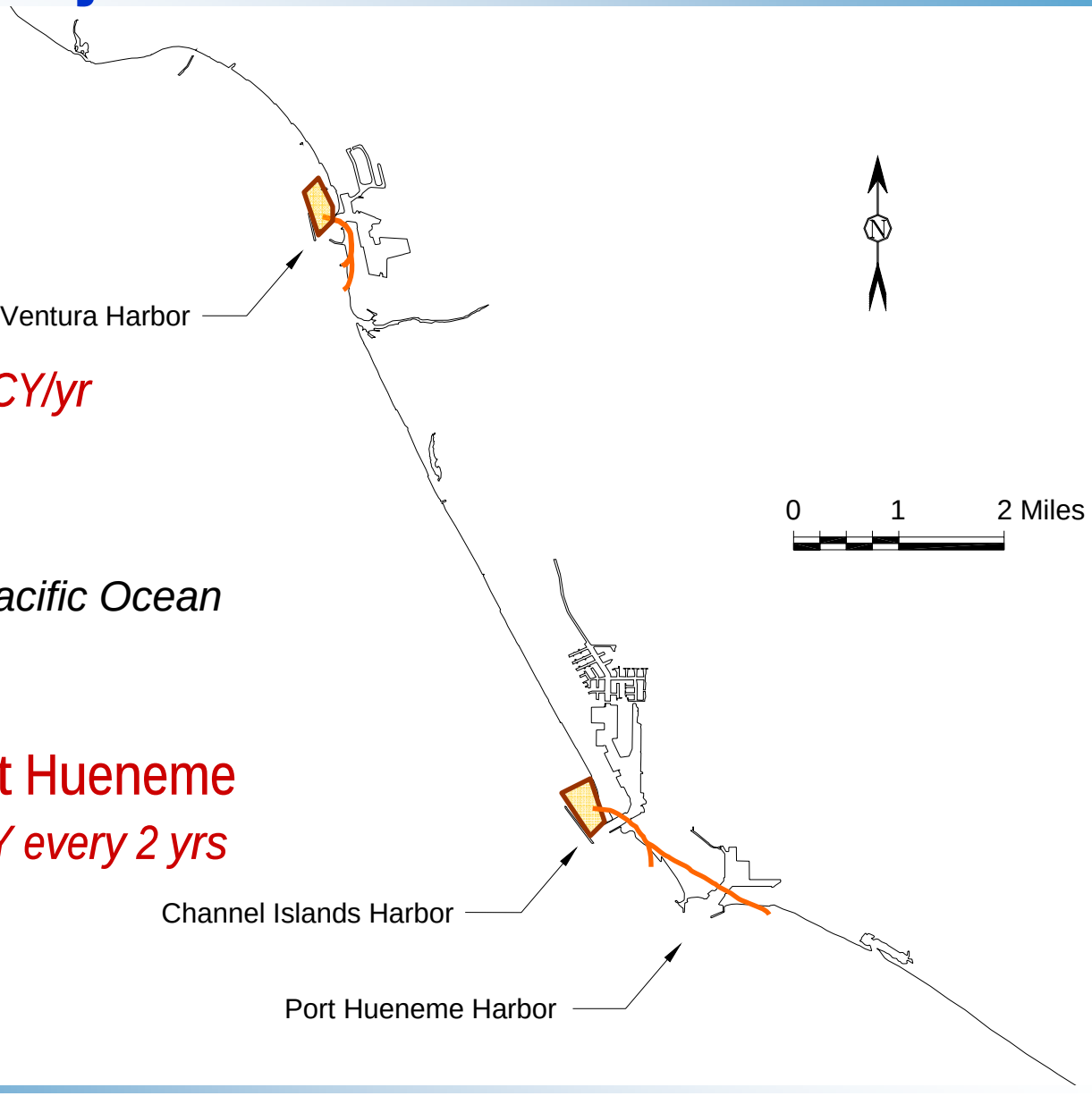


July 16-20, 2002
Trial placement
43,000 cubic yards

Established Re-handling/Bypassing Projects in California

- Ventura Harbor
  pipeline dredge 700 kCY/yr
  $2.0 M ($2.80/CY)

- Channel Island/Port Hueneme
  pipeline dredge 2 mCY every 2 yrs
  $5.6M ($2.67/CY)

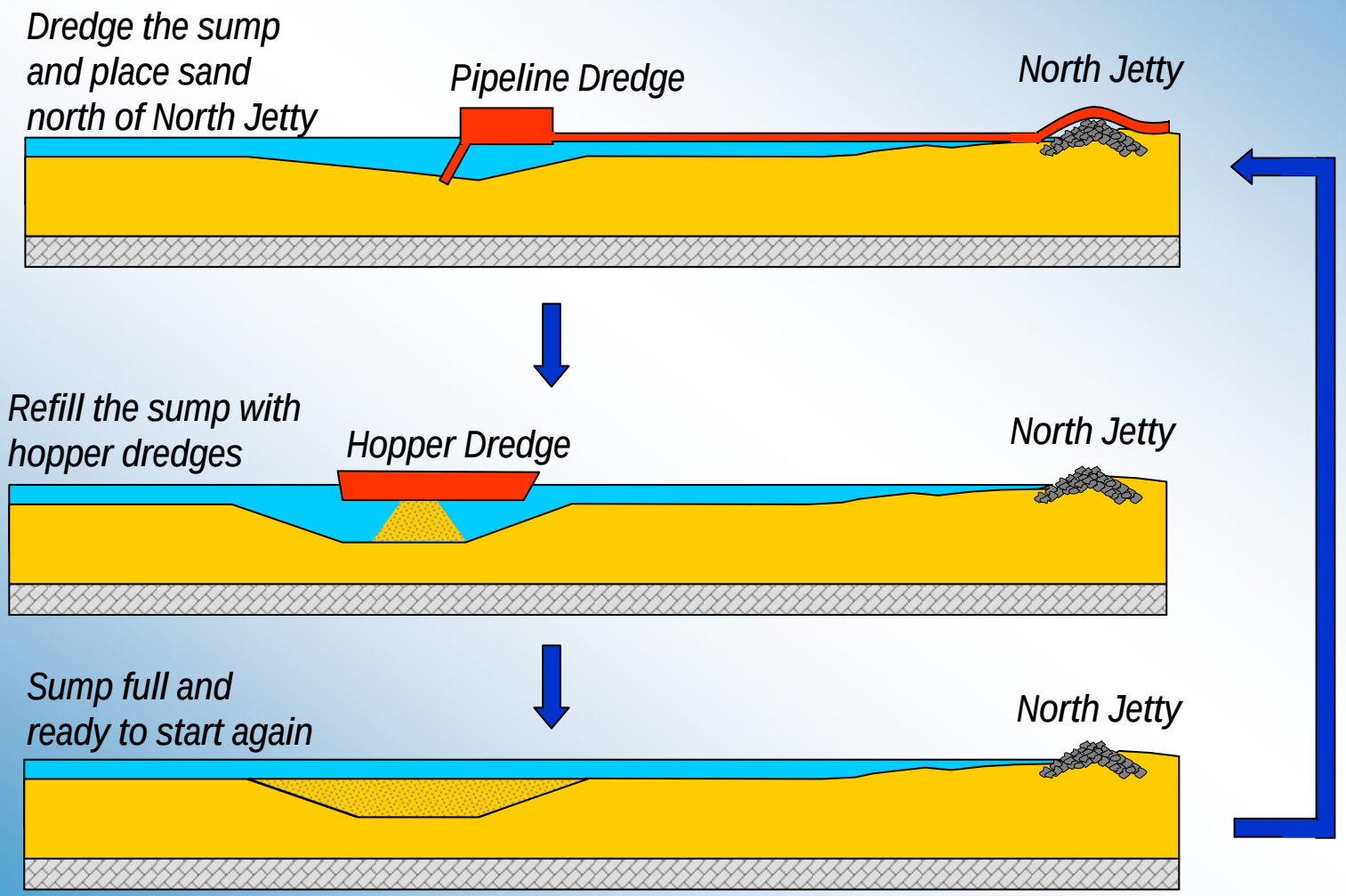


Restoration of Littoral Drift

- **Goal is to get maximum beneficial use of dredged materials by placing material in locations where it will re-join the littoral drift**
- **Benson Beach appears to be the ideal location**
- **Can pump sediment across jetty from hopper dredge but only limited volumes (~0.5MCY/yr)**
- **To make a significant impact we propose a sump to stockpile sand – efficient both from an operational and a sediment management perspective.**

Dredging/placement alternative

Sediment re-handling and sump

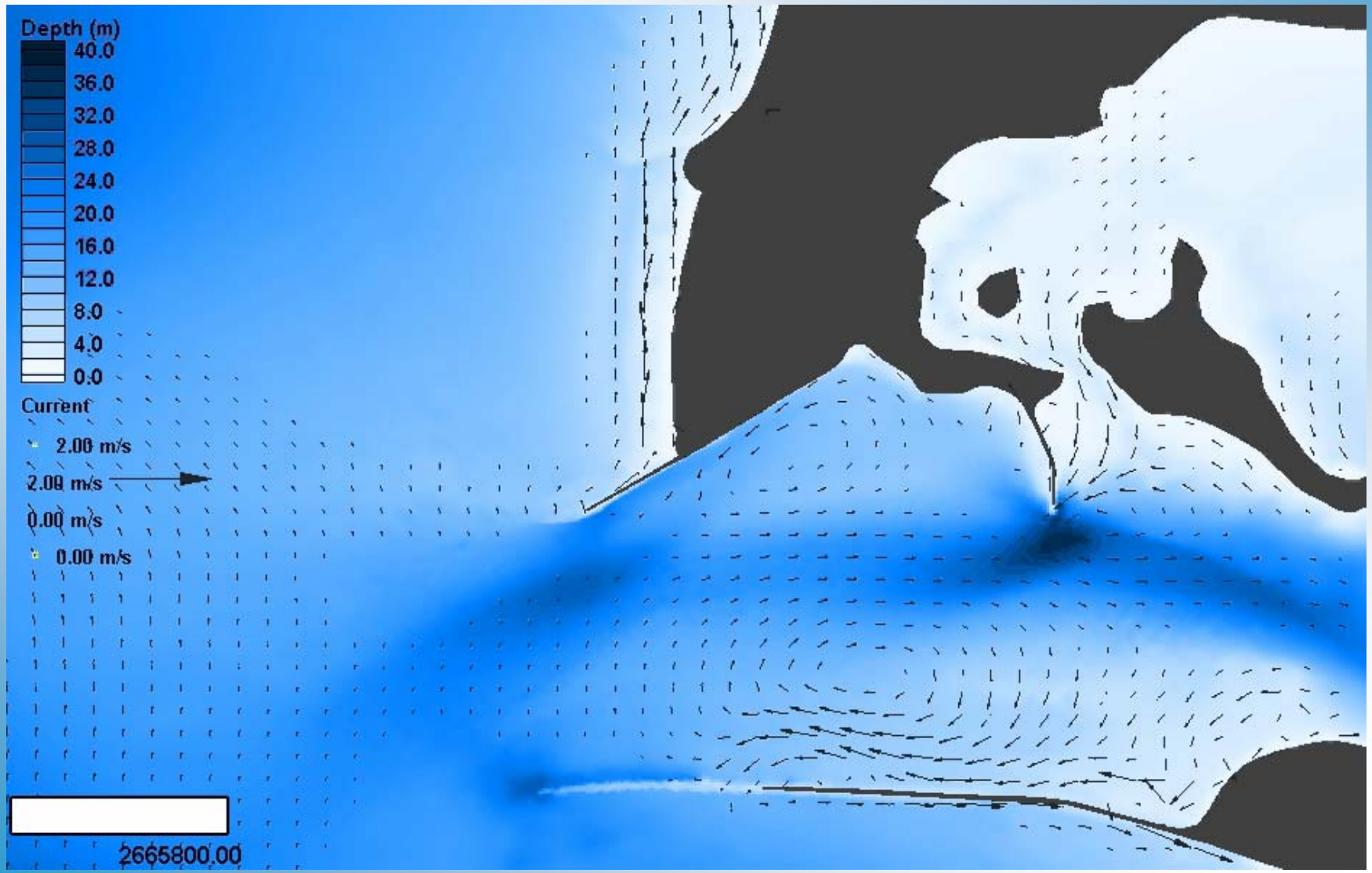


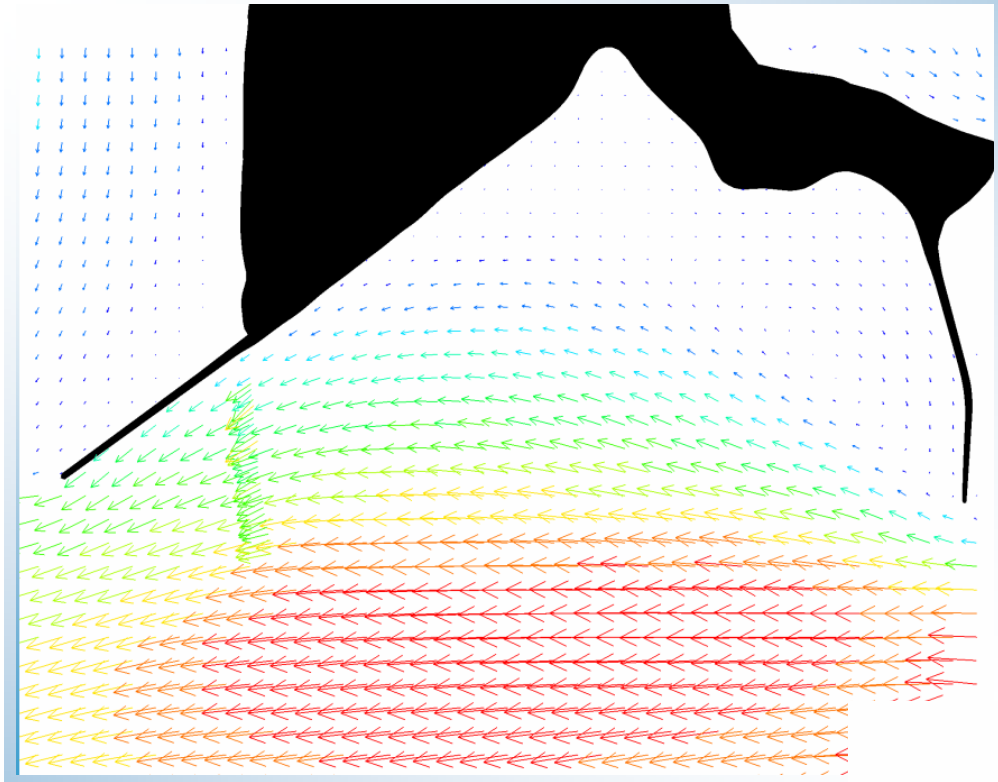
For the sump to work we have to understand sand movement in the area…

Numerical modeling of circulation, wave, and sediment dispersion

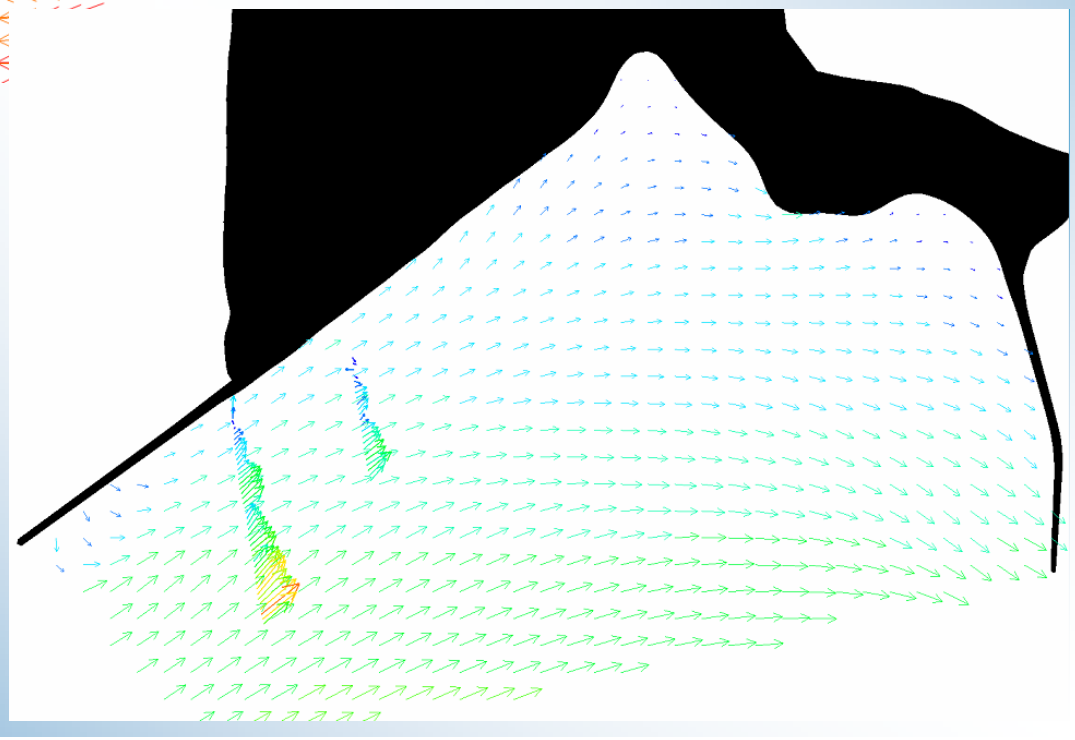
- Quantify hydraulic conditions (waves and currents) at the north side of the entrance (proposed sump area)
- Evaluate potential operating constraints for sediment re-handling operation during the summer dredging season
- Evaluate potential changes to hydraulics and sediment transport that might arise from the project
- Investigate the potential re-distribution of sediments if alternative placement areas are used

The ADCIRC/STWAVE model



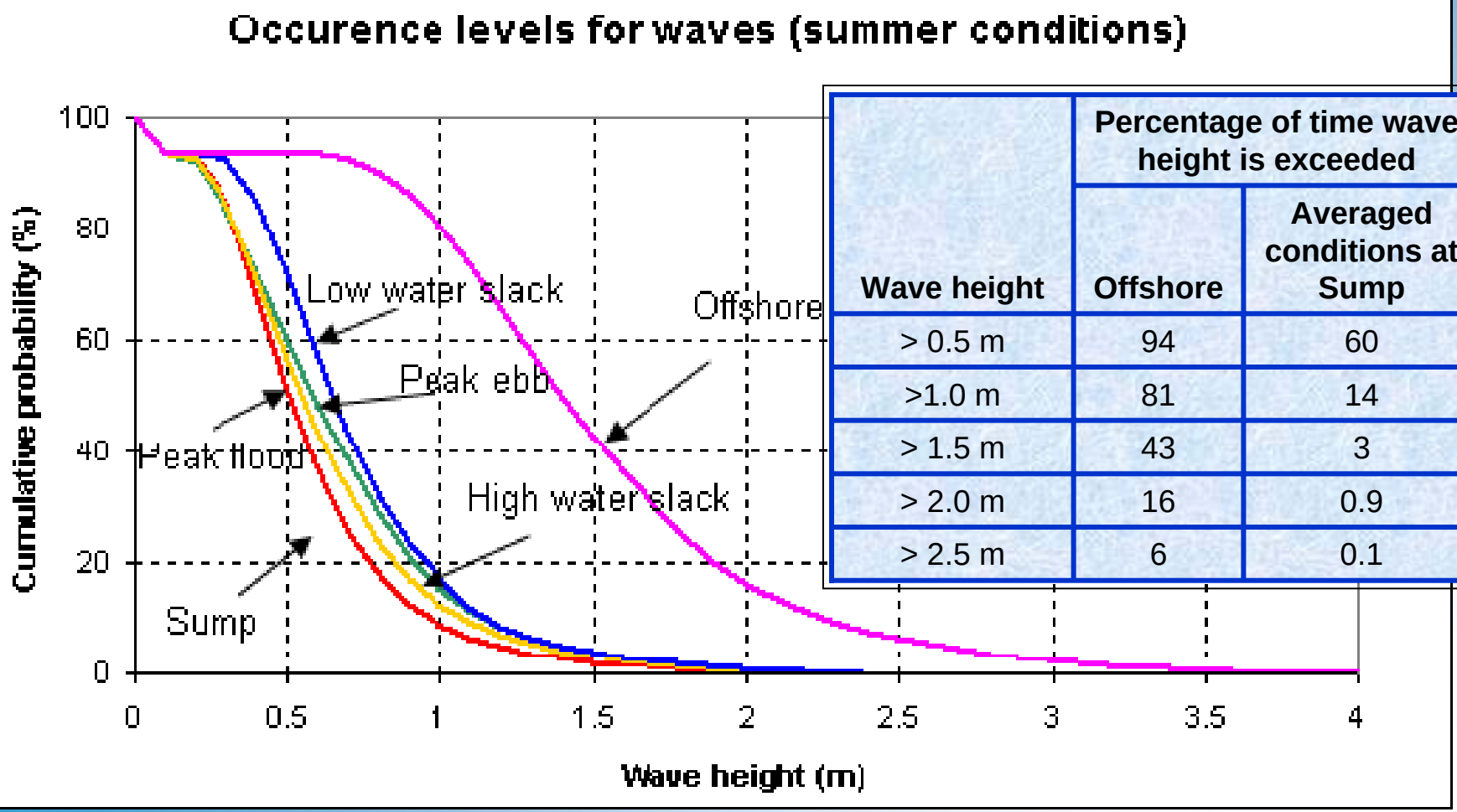


Modeled depth-averaged currents compared to measured currents



Predicted bottom currents compared to bottom currents measured by ADCP

Predicted Summer Wave Climate at Sump Area

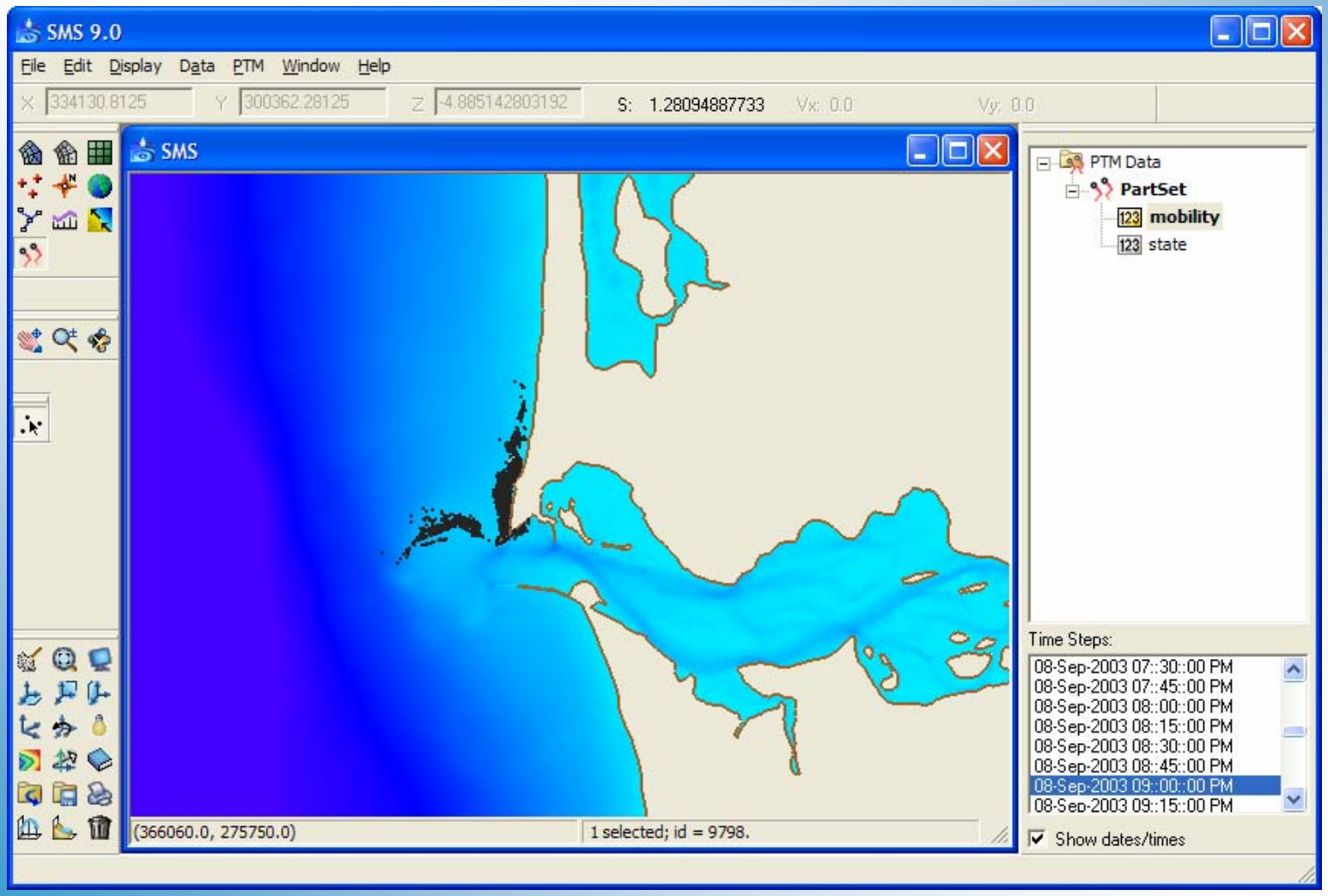


Wave height	Percentage of time wave height is exceeded	
	Offshore	Averaged conditions at Sump
> 0.5 m	94	60
>1.0 m	81	14
> 1.5 m	43	3
> 2.0 m	16	0.9
> 2.5 m	6	0.1

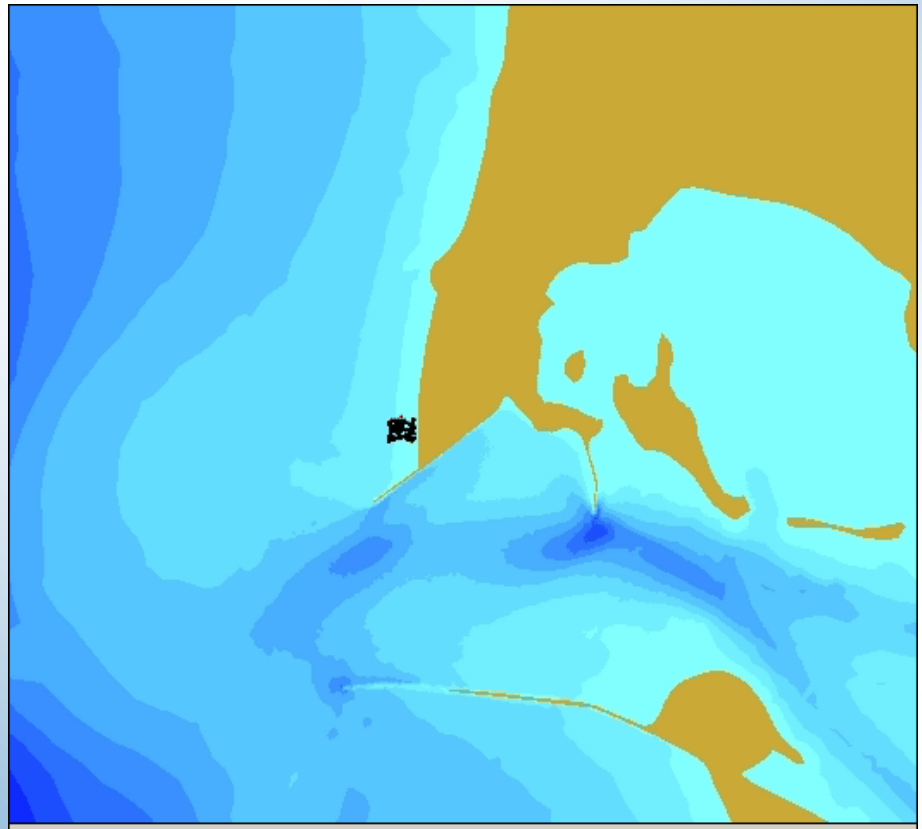
Sediment Pathway Analysis

Particle Tracking Model - PTM

(Developed for USACE ERDC's CIRP & DOER programs)

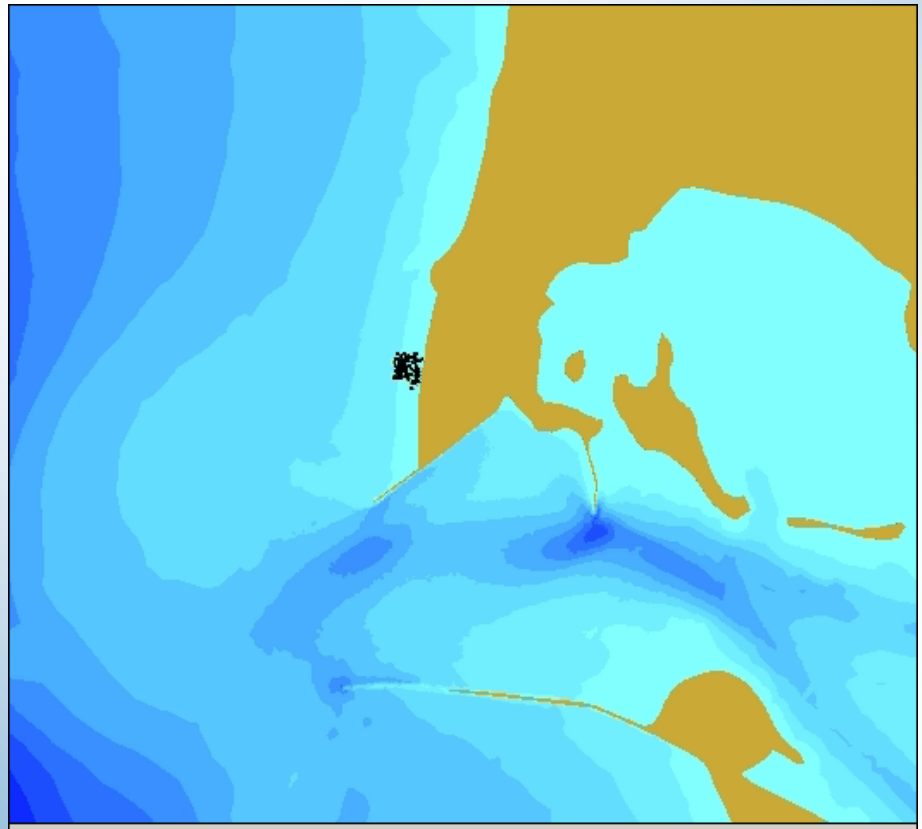


PLACEMENT ON BENSON BEACH NEAR THE JETTY (Summer Storm, Spring Tide, Waves from due west)



PLACEMENT ON BENSON BEACH FURTHER UP THE BEACH

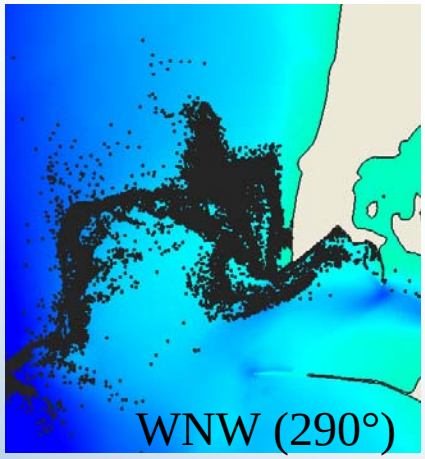
(Summer Storm, Spring Tide, waves from due west)

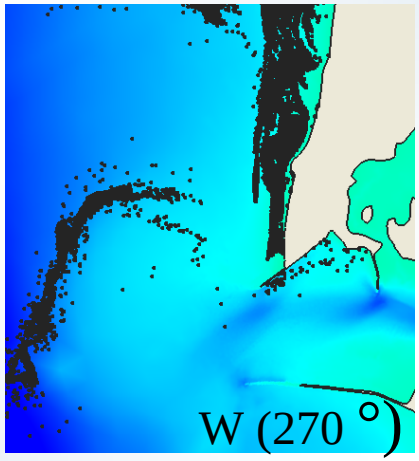


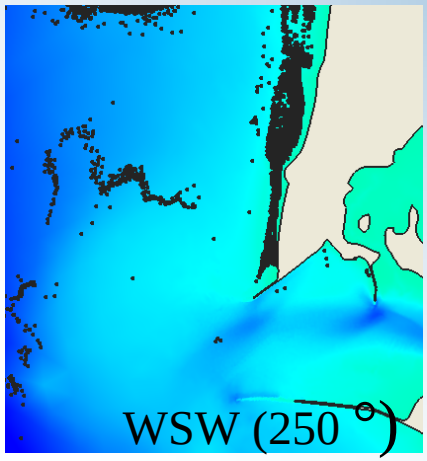
LDR_Storm2W_spring_BB2.avi

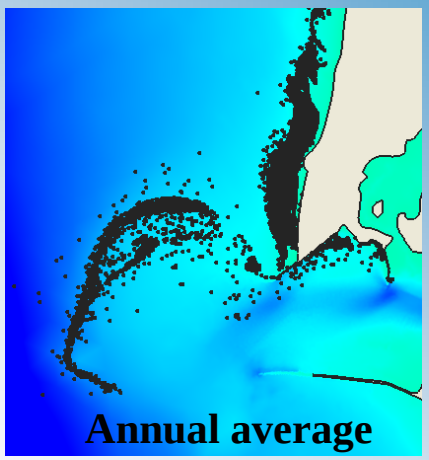
Results from sediment trap analysis – BB1
Summer wave conditions

Spring tide

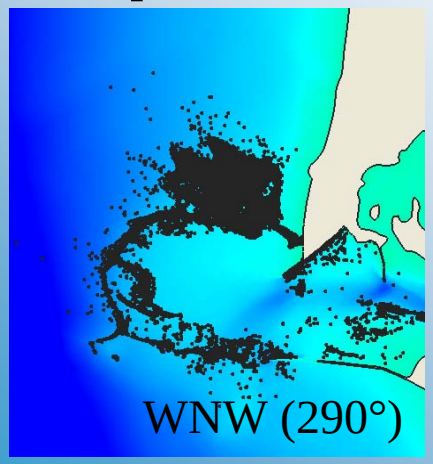


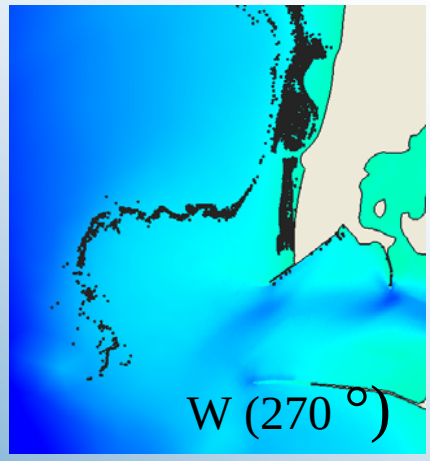


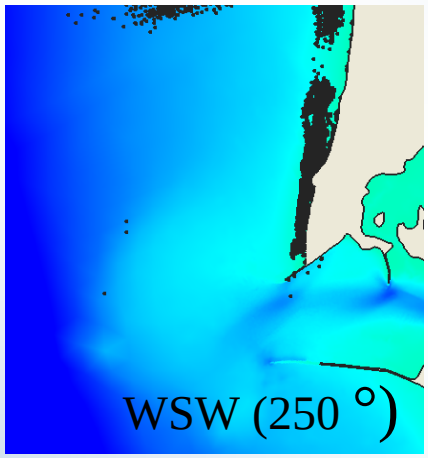




Neap tide







Littoral Drift Restoration - Project Plan

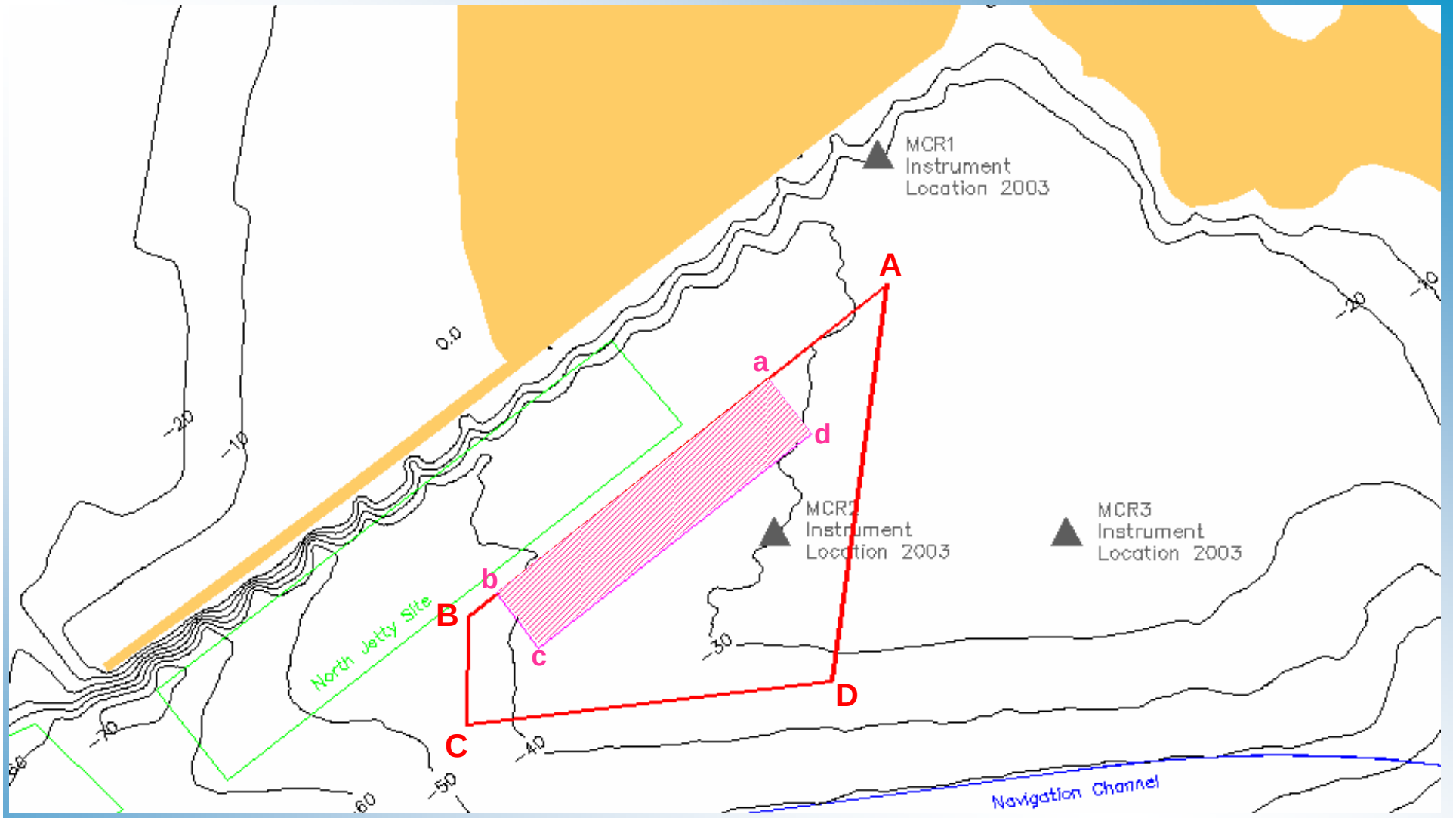
Year 1 (FY03-04)
✓Baseline data collection
✓Dredging alternatives analysis
✓Circulation and wave model development

Funding request $2.1M

Year 2 (FY05-06)
❑ Continue baseline data collection (Argus)
❑ Formulate and plan alternatives
❑ Contracting, bid documents and specifications
❑ Environmental permitting
❑ Placement optimization / sediment fate analysis
❑ Evaluation of potential sump impacts
Funding request for demonstration project $1.6M

Year 3 (FY07)
❑ **DEMONSTRATION PROJECT**
❑ Baseline and project monitoring
❑ Evaluation of demonstration project

Funding request for **full scale project**



Sump location for the 2006 demonstration project resulting from discussions at LDR meeting on March 24, 2005 in Longview. (3000 feet by 600 feet)

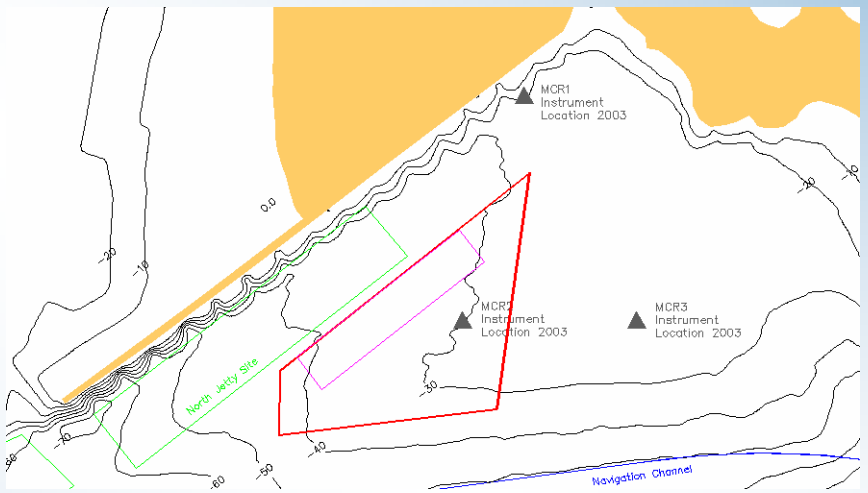
Sump zone from LDR technical meeting in Portland on March 22, 2005.

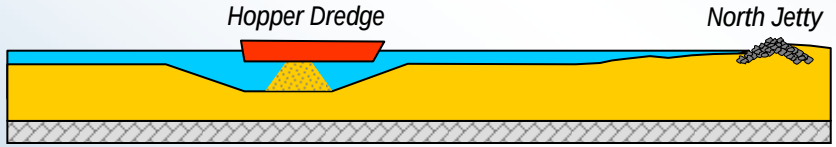
Moving Forward…

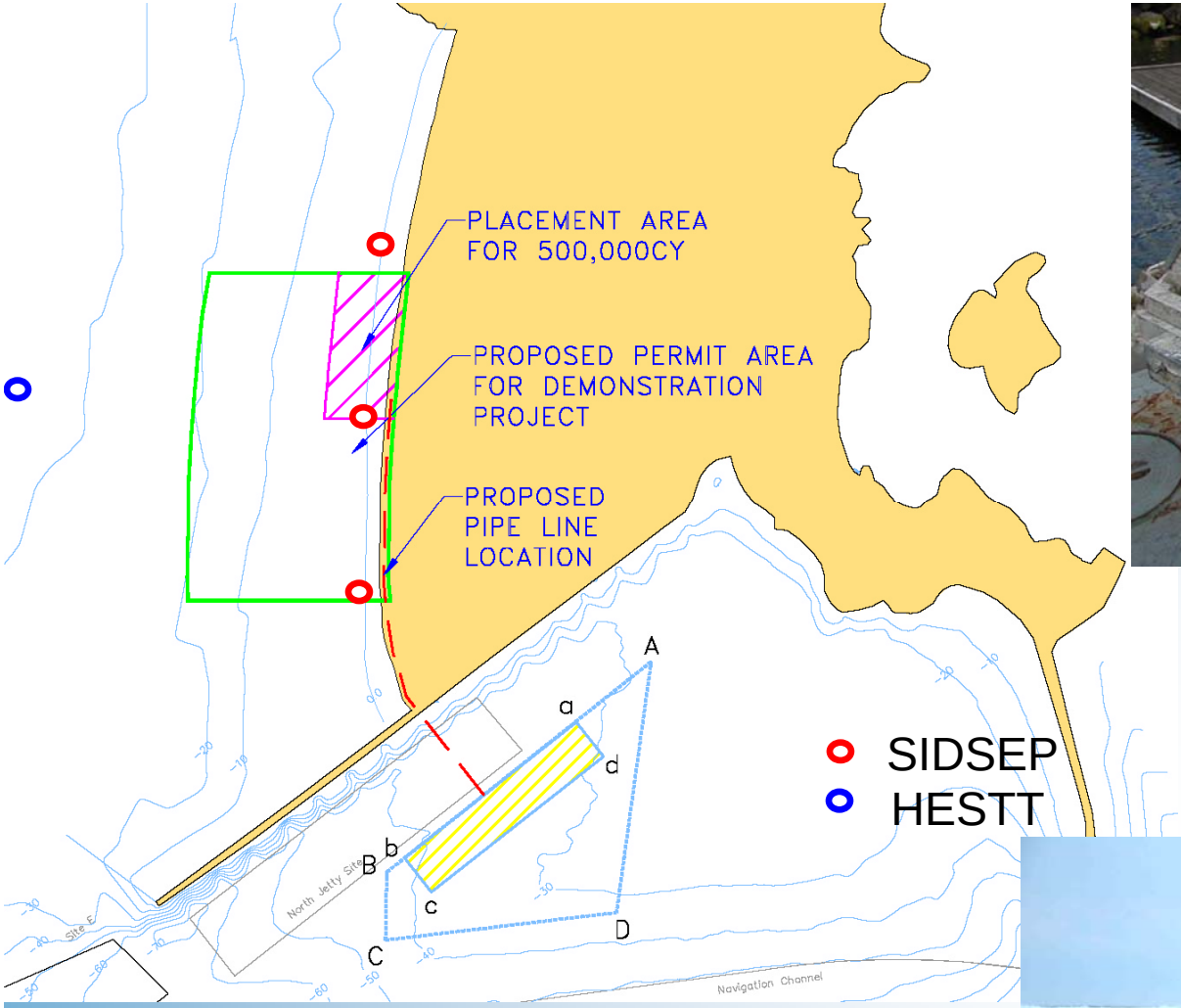
Demonstration Project Objectives

To evaluate the alternative of re-handling dredged sediment using a sump.

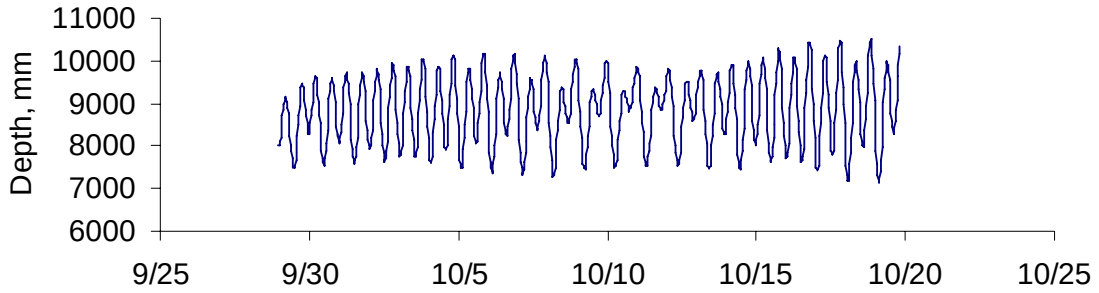
- Sump feasibility / performance
- Re-handling operation efficiency
- Cost estimate of larger-scale re-handling and littoral drift restoration
- Littoral system response

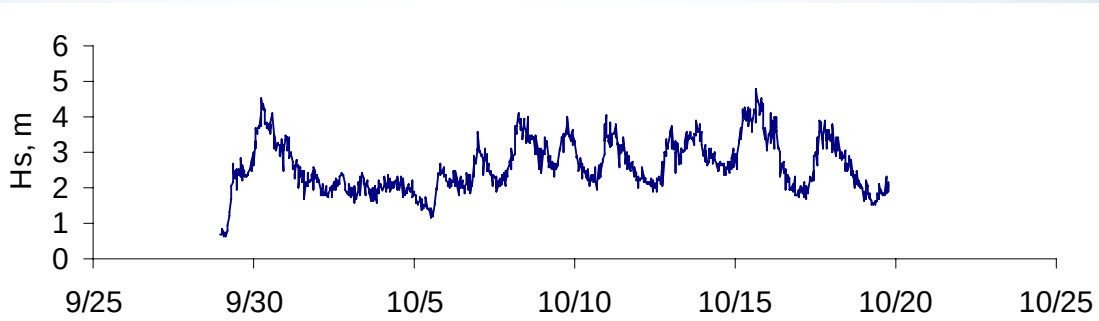


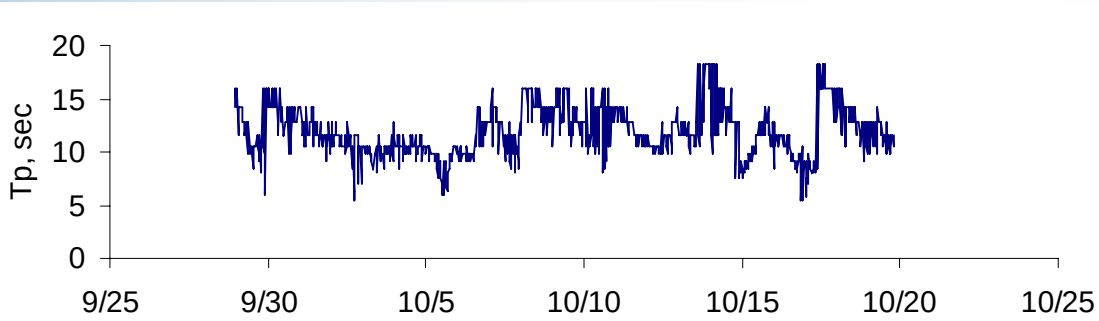


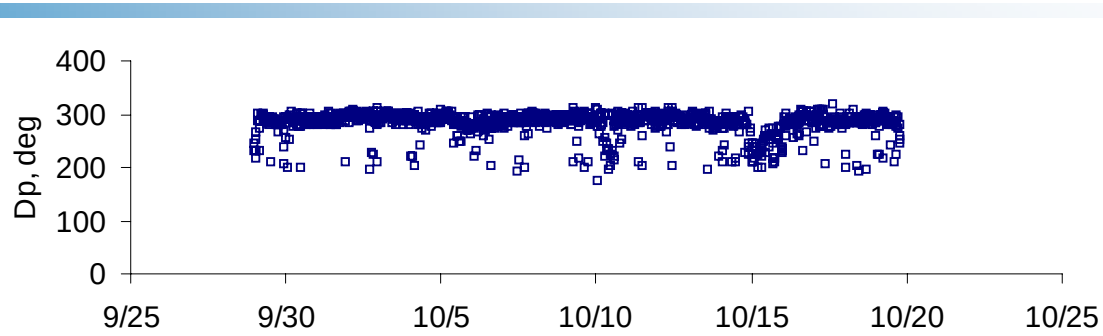


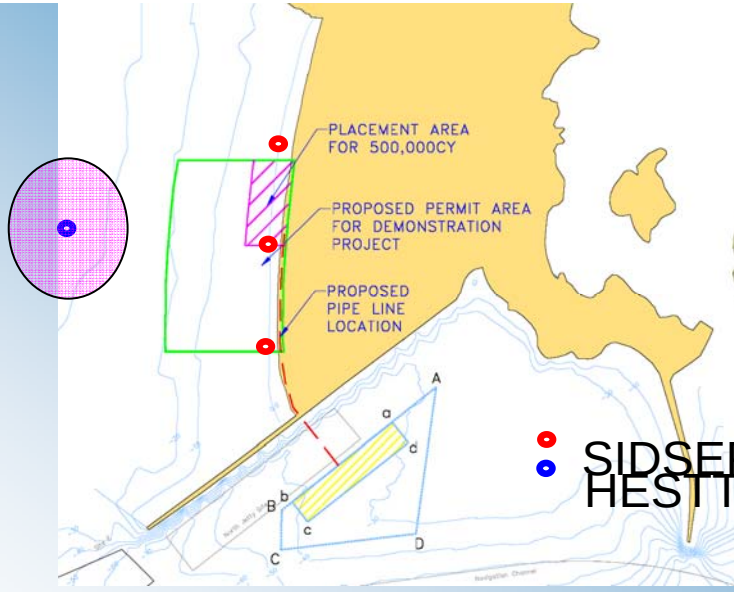
Field measurements
Placement area
Sept 28-Oct 19, 2005

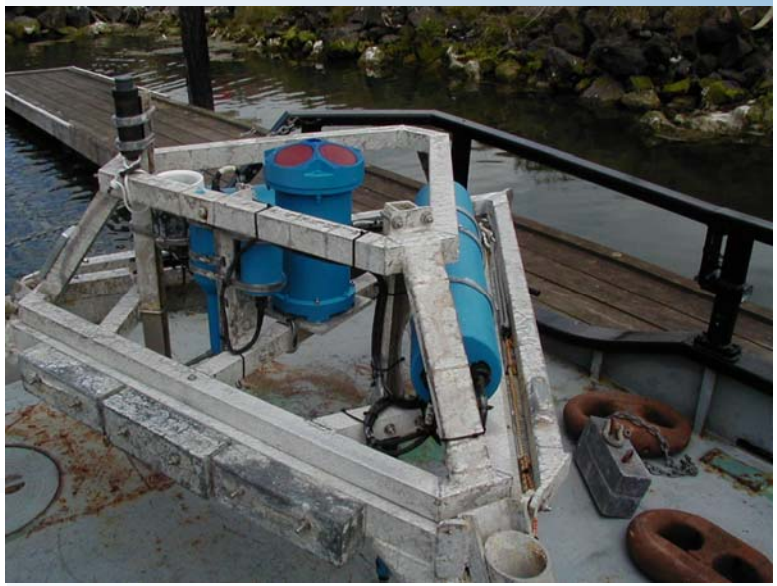

Depth, mm
11000
10000
9000
8000
7000
6000
9/25
9/30
10/5
10/10
10/15
10/20
10/25

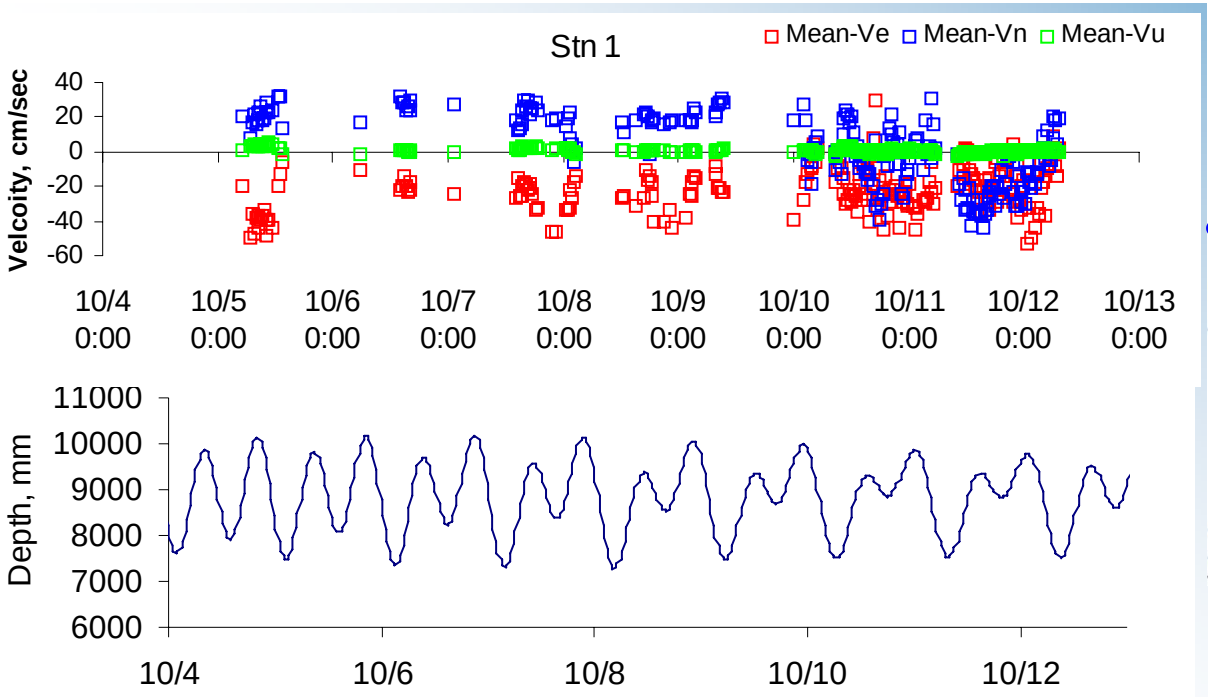

Hs, m
6
5
4
3
2
1
0
9/25
9/30
10/5
10/10
10/15
10/20
10/25

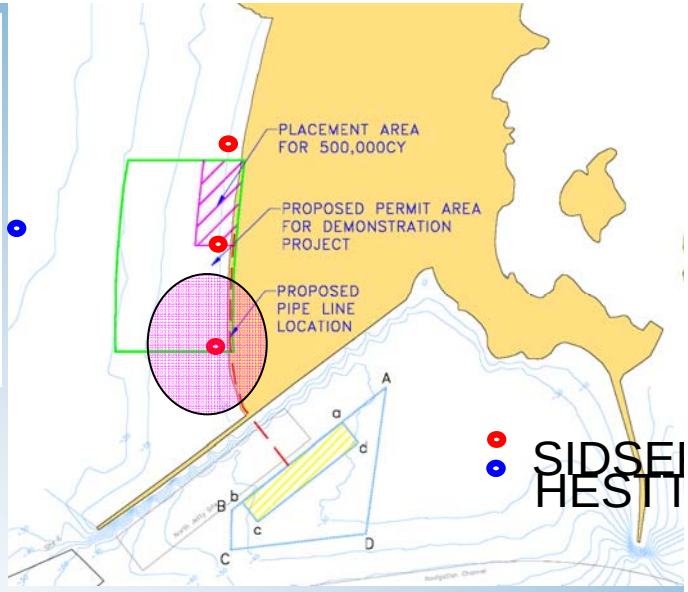

Tp, sec
20
15
10
5
0
9/25
9/30
10/5
10/10
10/15
10/20
10/25

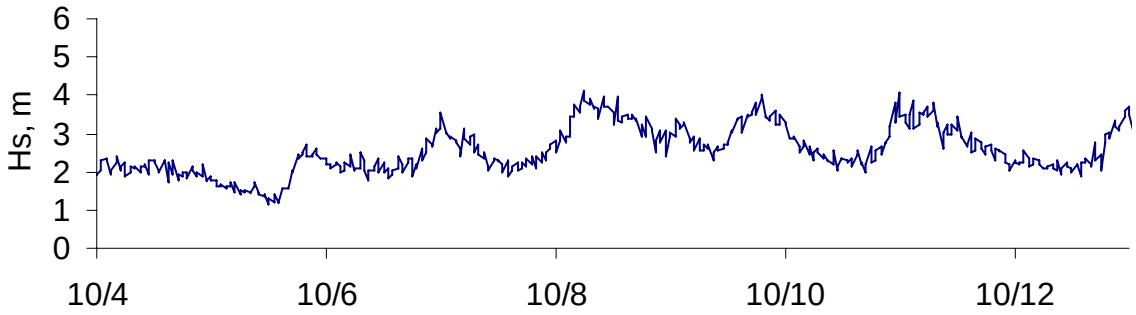

Dp, deg
400
300
200
100
0
9/25
9/30
10/5
10/10
10/15
10/20
10/25

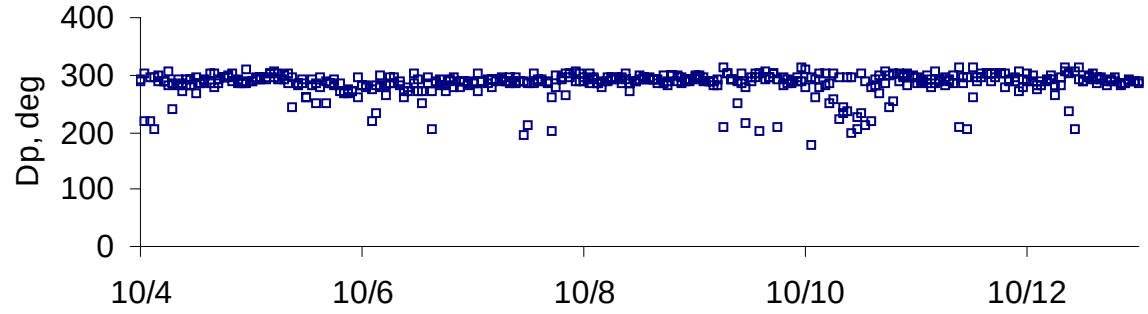

PLACEMENT AREA
FOR 500,000CY
PROPOSED PERMIT AREA
FOR DEMONSTRATION
PROJECT
PROPOSED
PIPE LINE
LOCATION
A
B
C
D
a
b
c
d
SIDSEI
HESTI




Stn 1
Mean-Ve
Mean-Vn
Mean-Vu
Velcoity, cm/sec
40
20
0
-20
-40
-60
10/4 0:00
10/5 0:00
10/6 0:00
10/7 0:00
10/8 0:00
10/9 0:00
10/10 0:00
10/11 0:00
10/12 0:00
10/13 0:00
Depth, mm
11000
10000
9000
8000
7000
6000
10/4
10/6
10/8
10/10
10/12


PLACEMENT AREA FOR 500,000CY
PROPOSED PERMIT AREA FOR DEMONSTRATION PROJECT
PROPOSED PIPE LINE LOCATION
A
B
C
D
a
b
c
d
SIDSEI
HESTI


Hs, m
6
5
4
3
2
1
0
10/4
10/6
10/8
10/10
10/12


Dp, deg
400
300
200
100
0
10/4
10/6
10/8
10/10
10/12