

Engineering with Nature: Regional Sediment Management at the Mouth of the Columbia River

**Pacific Chapter WEDA
Fall 2015 Conference**

Jarod Norton, Project Manager

USACE Portland District

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San Rafael, CA



US Army Corps of Engineers
BUILDING STRONG®





Mouth of the Columbia River– Gateway to the Columba-Snake River System

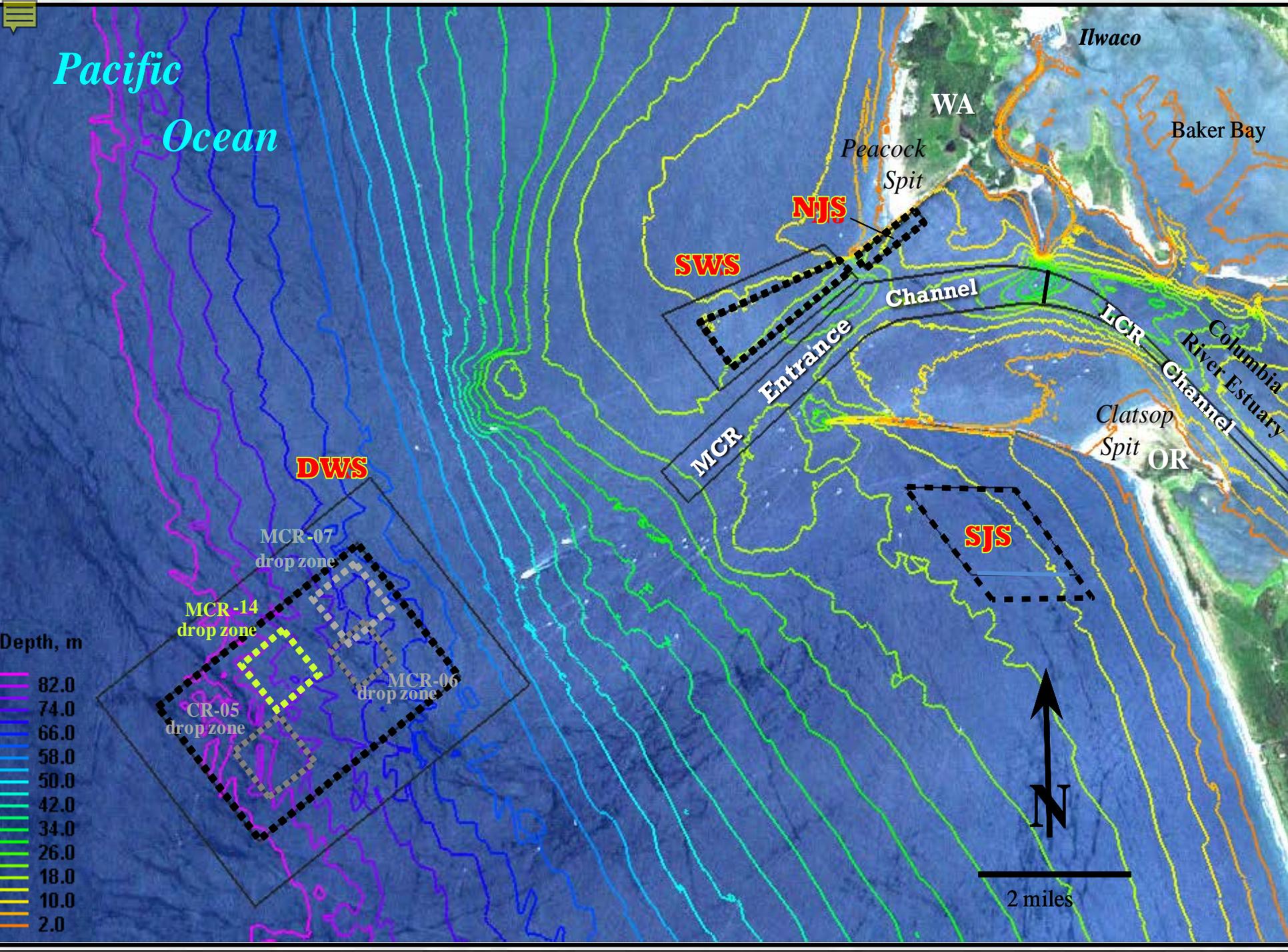
Columbia River at the Mouth, WA & OR

- Entrance channel 55/48 feet deep, 2640 feet wide, and 6 miles long
- Average annual dredging 3.5 MCY, June-Sept work window
- Support Columbia-Snake River Navigation System
 - \$20 Billion worth of U.S. products and 46 million tons of cargo annually
 - Largest wheat and barley export gateway in the Nation
 - Second largest soy export gateway in the World
 - Over \$930M in commercial investments-to-date because of the deepening
 - Supports 40,000 local jobs
- Large group of stakeholders, with varying concerns (deposition depth/benthic impacts)
- Focus on the beneficial use of dredged material and Engineering with Nature to prevent 'wasting' clean sediment resources.
- Innovative monitoring program to build stakeholder trust, leverage opportunities, and collect baseline data for the addition of nearshore sites.
- Disposal Mission, responsible use of the placement sites to maximize capacity

Mouth of the Columbia River RSM Stakeholders

- 1) National Oceanic and Atmospheric Administration (NOAA)
- 2) Environmental Protection Agency (EPA)
- 3) Oregon Governor's Office
- 4) Washington Governor's Office
- 5) WA Department of Ecology (WDOE)
- 6) Columbia River Crab Fishers Association (CRCFA)
- 7) Washington Department of Natural Resources (WDNR)
- 8) Oregon Dept. of Land Conservation and Development (ODLCD)
- 9) Oregon Sea Grant
- 10) Portland State University
- 11) Oregon State University
- 12) Oregon Health Sciences University
- 13) National Policy Consensus Center
- 14) Oregon Department of Environmental Quality (ODEQ)
- 15) Port of Astoria
- 16) Port of Ilwaco
- 17) Port of Chinook
- 18) Pacific County, WA
- 19) Clatsop County, OR
- 20) Oregon Department of State Lands (ODSL)
- 21) US Fish and Wildlife Service (USFWS)
- 22) Oregon Department of Fish and Wildlife (ODFW)
- 23) Washington Department of Fish & Wildlife (WDFW)
- 24) Lower Columbia Solutions Group (LCSG)
- 25) Institute for Natural Resources
- 26) Center for Public Service





Pacific Ocean

Ilwaco

WA

Baker Bay

Peacock Spit

NJS

SWS

Channel

MCR Entrance

LCR

Columbia River Estuary

Clatsop Spit

OR

DWS

MCR-07 drop zone

MCR-14 drop zone

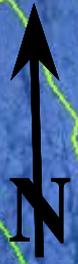
CR-05 drop zone

MCR-06 drop zone

SJS

Depth, m

- 82.0
- 74.0
- 66.0
- 58.0
- 50.0
- 42.0
- 34.0
- 26.0
- 18.0
- 10.0
- 2.0



2 miles

South Jetty Site Operational Placement Process

- 2004 – Oregon Nearshore Beneficial Use Project initiated to collaboratively address the depletion of sand in the nearshore environment south of the MCR South Jetty
- 2005 – First Science-Policy Workshop was held. Additional workshops held in 2007, 2009, and 2010
- 2006 – Pilot Placement Project at SJS by the ESSAYONS
- 2008 – Sediment Tracer Study
- 2010 – Initiate Environmental Clearances
- 2011 – RSMP Completed
- 2012 – Operational Placement at the SJS (initiated in 2014)



Monitoring Program

Benthic Surveys

- Use of the NOAA benthic video sled to enable quantification of macrofaunal abundances and distributions.
- Conduct benthic surveys at control and dredge material deposition sites spanning the operations period.
- Analysis includes extracting organism abundance data from digital video logs and testing for significance in a BACI statistical design.

Crab Mortality and Motility

- Deploy acoustic receiver moorings at control and impact sites.
- Catch, tag, release and monitor crab movements during and after dredge material deposition events.
- Analysis of crab positions.
- Campod Deployment

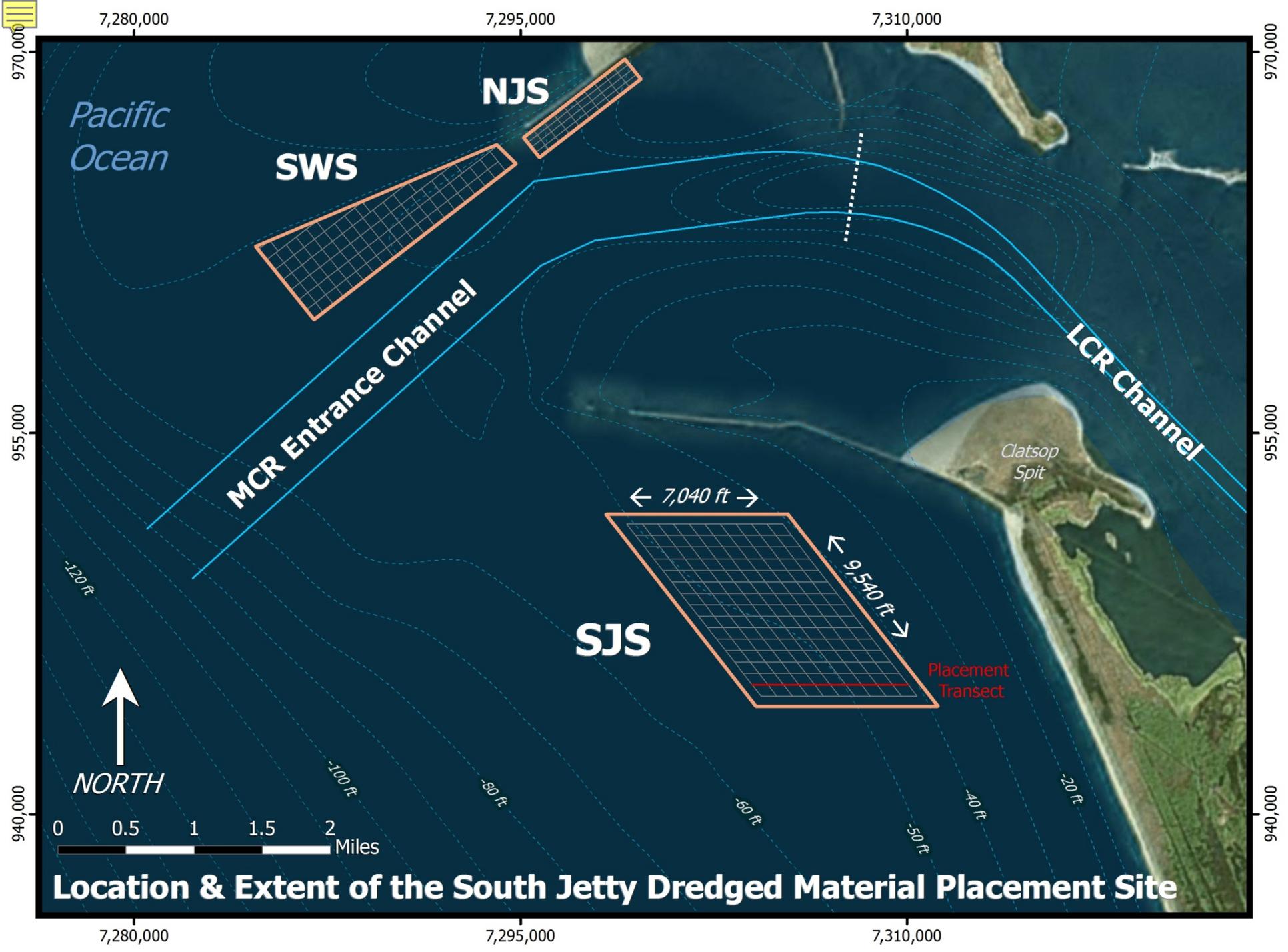
Models, Tools, Databases, etc

- Sediment Profile Imaging Photography (SPI)
- Multi-beam survey data
- Acoustic telemetry to evaluate survival of Dungeness crabs
- Benthic video sled to assess the presence of benthic species
- Benthic Algorithm Development

Benefits

- Keep sediment in the littoral cell
- Slowing the erosion of Clatsop Spit
- Maintain Jetty Foundation/Root
- Reduced costs to the dredging program
- Increased habitat opportunities
- Distribute material between a network of sites
- Reducing the likelihood of mounding in the nearshore sites





Environmental Buoy

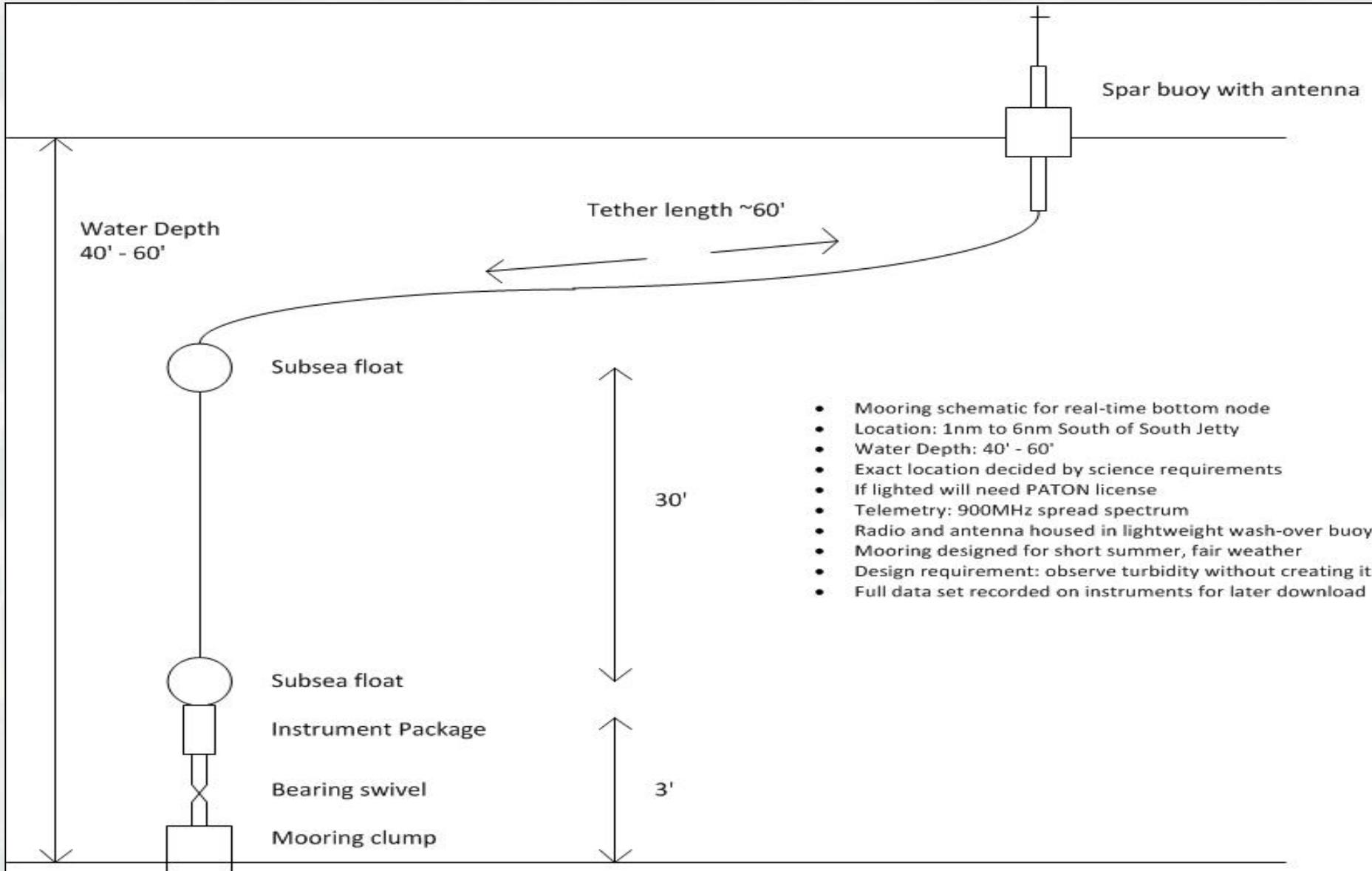
- Prevalent phytoplankton blooms in previous years wasted resources
- Deployed by the Center for Coastal Margin Observation and Prediction (CMOP) Science and Technology University Research Network (SATURN)
- Provides real-time conditions in the SJS allow monitoring during optimal conditions

Reporting Properties:

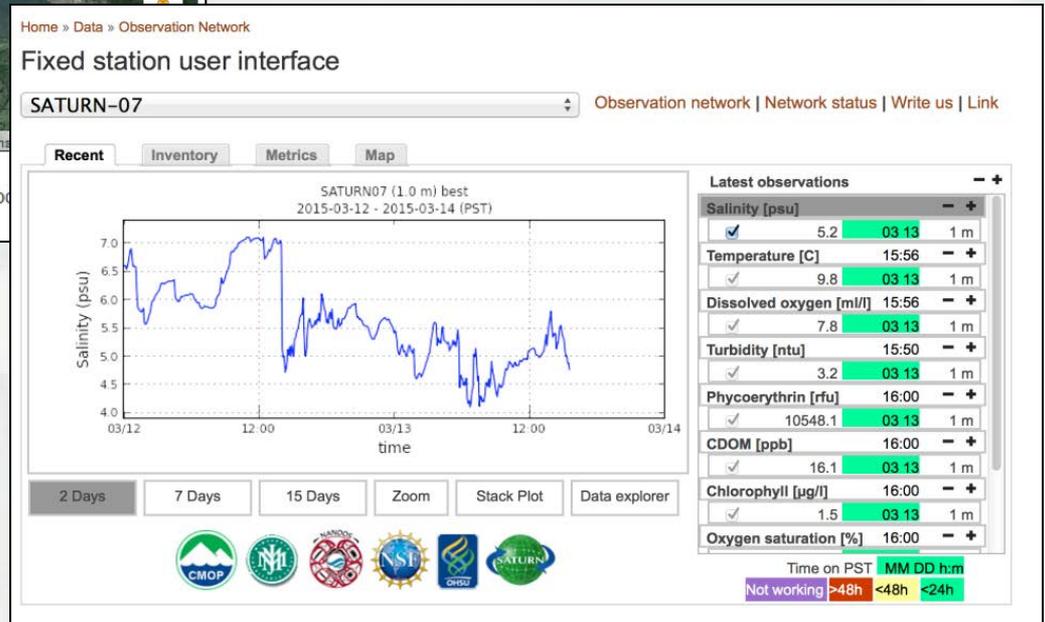
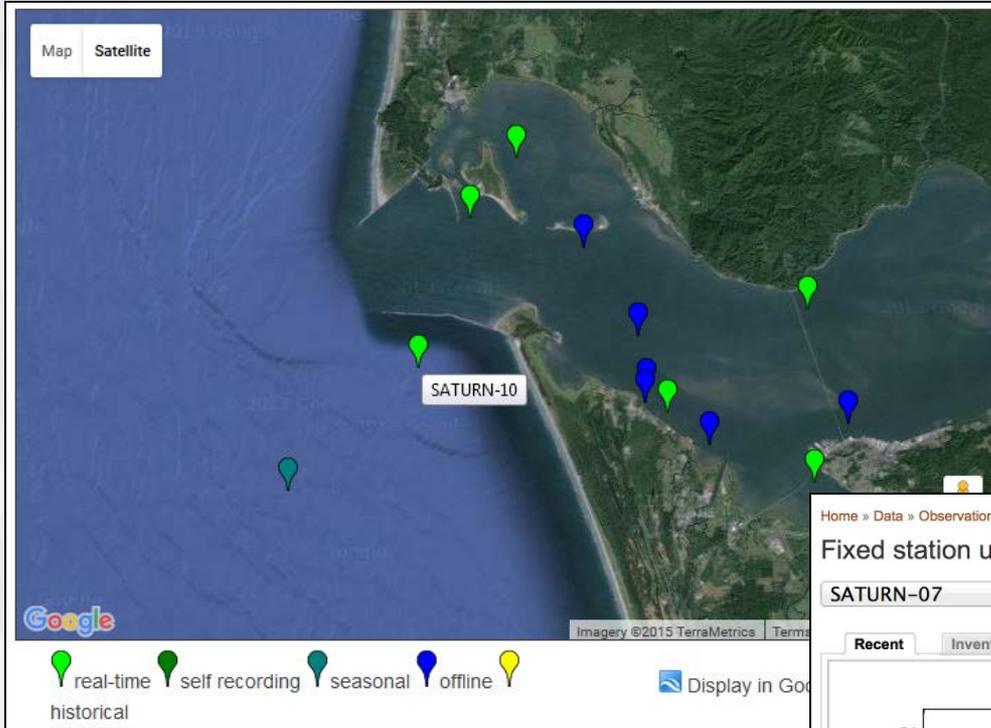
- Salinity
- Temperature
- Dissolved oxygen
- Conductivity
- Turbidity
- Chlorophyll Fluorescence
- Wind information
- National Buoy Data Center (NBDC)



Environmental Buoy



Environmental Buoy

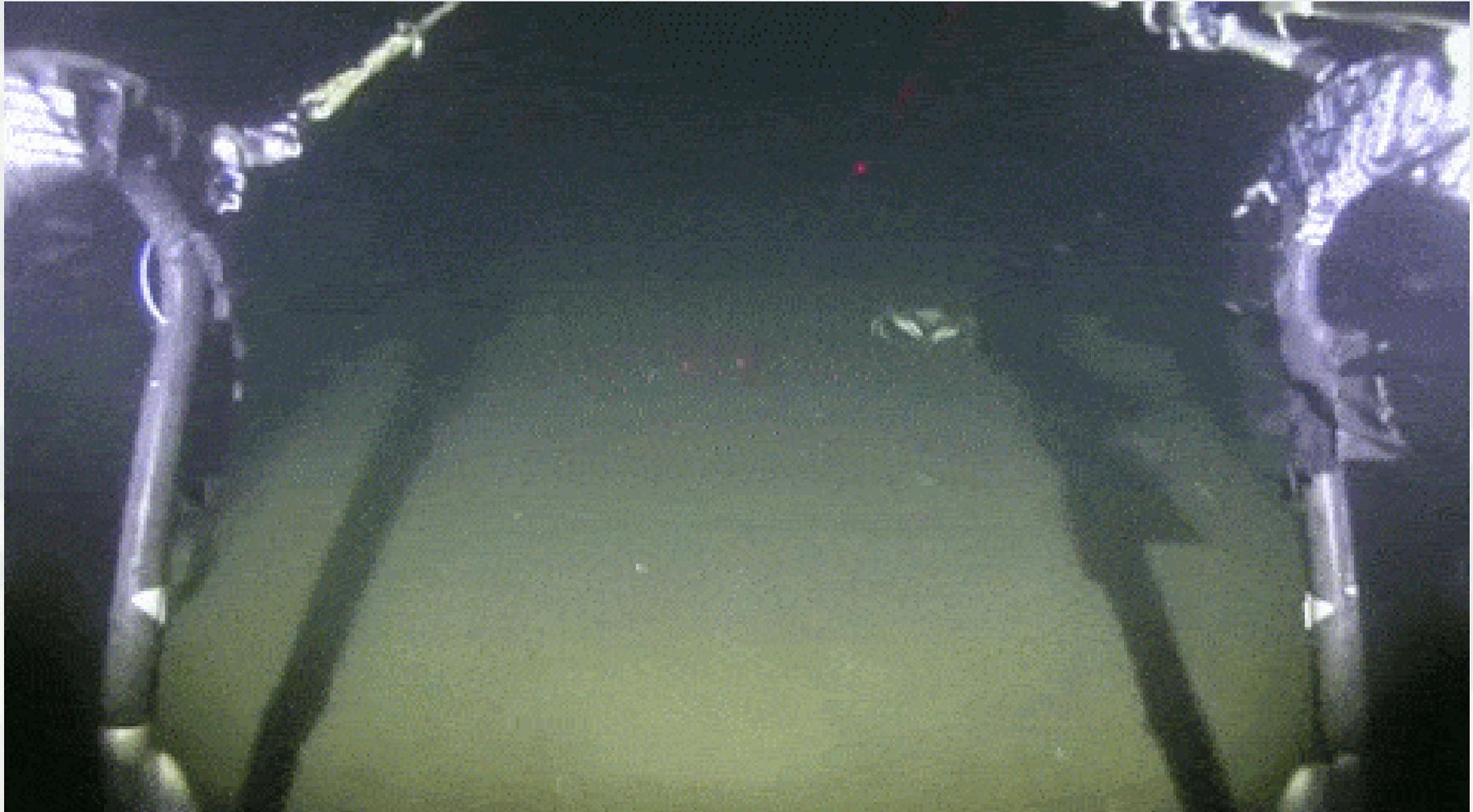


Benthic Video Sled Surveys

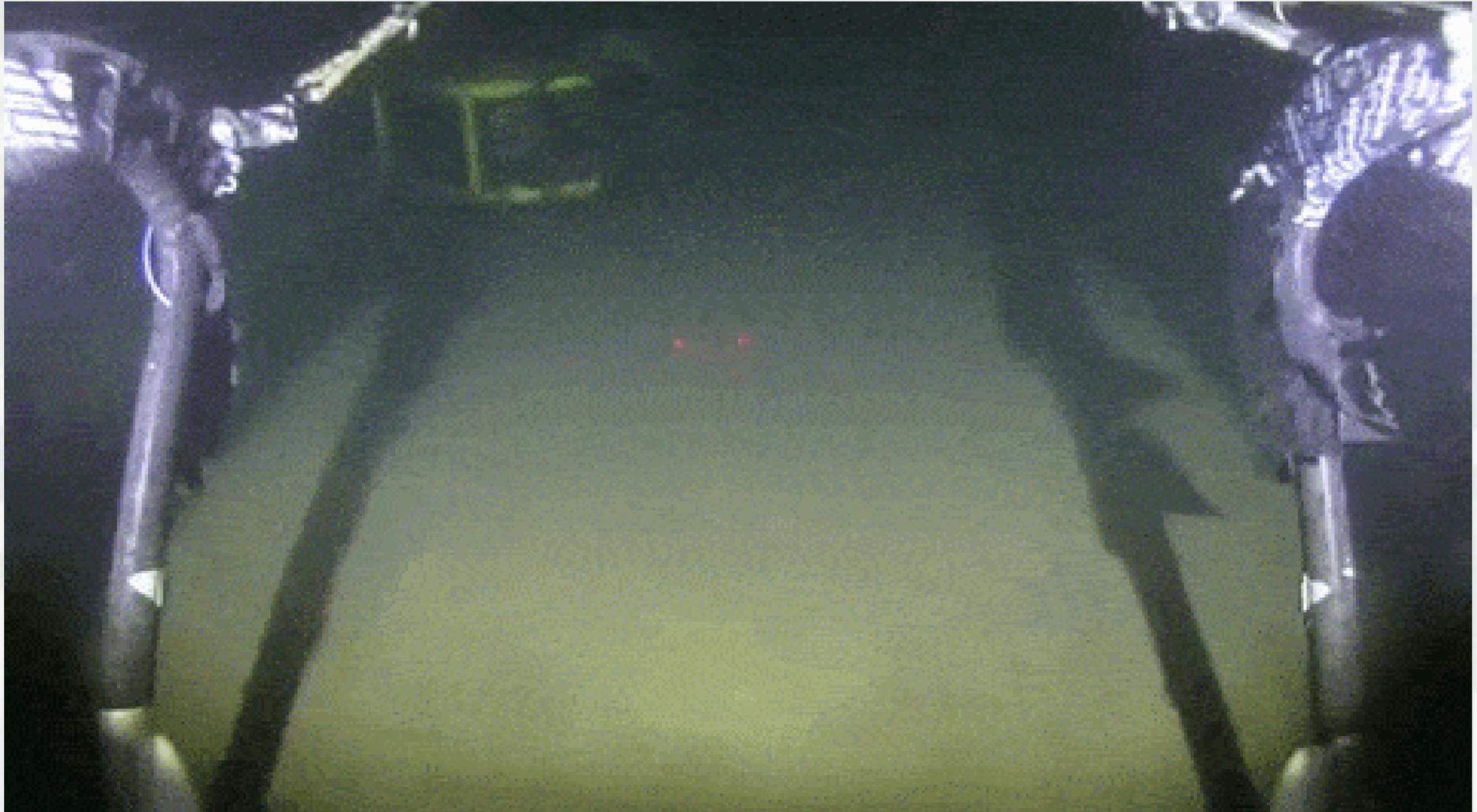
- Use of the NOAA benthic video sled to enable qualitative view of macrofaunal abundances and distributions.
- Conduct benthic surveys at control and dredge material deposition sites spanning the operations period.
- Analysis includes extracting organism abundance data from digital video logs and testing for significance in a BACI statistical design.
- MBARI to develop Automated Event Detection and Classification (AVEDac) Software
- Replaces trawls
- Exploratory surveys to the north for possible expansion of nearshore placement network



Benthic Video Sled



Benthic Video Sled



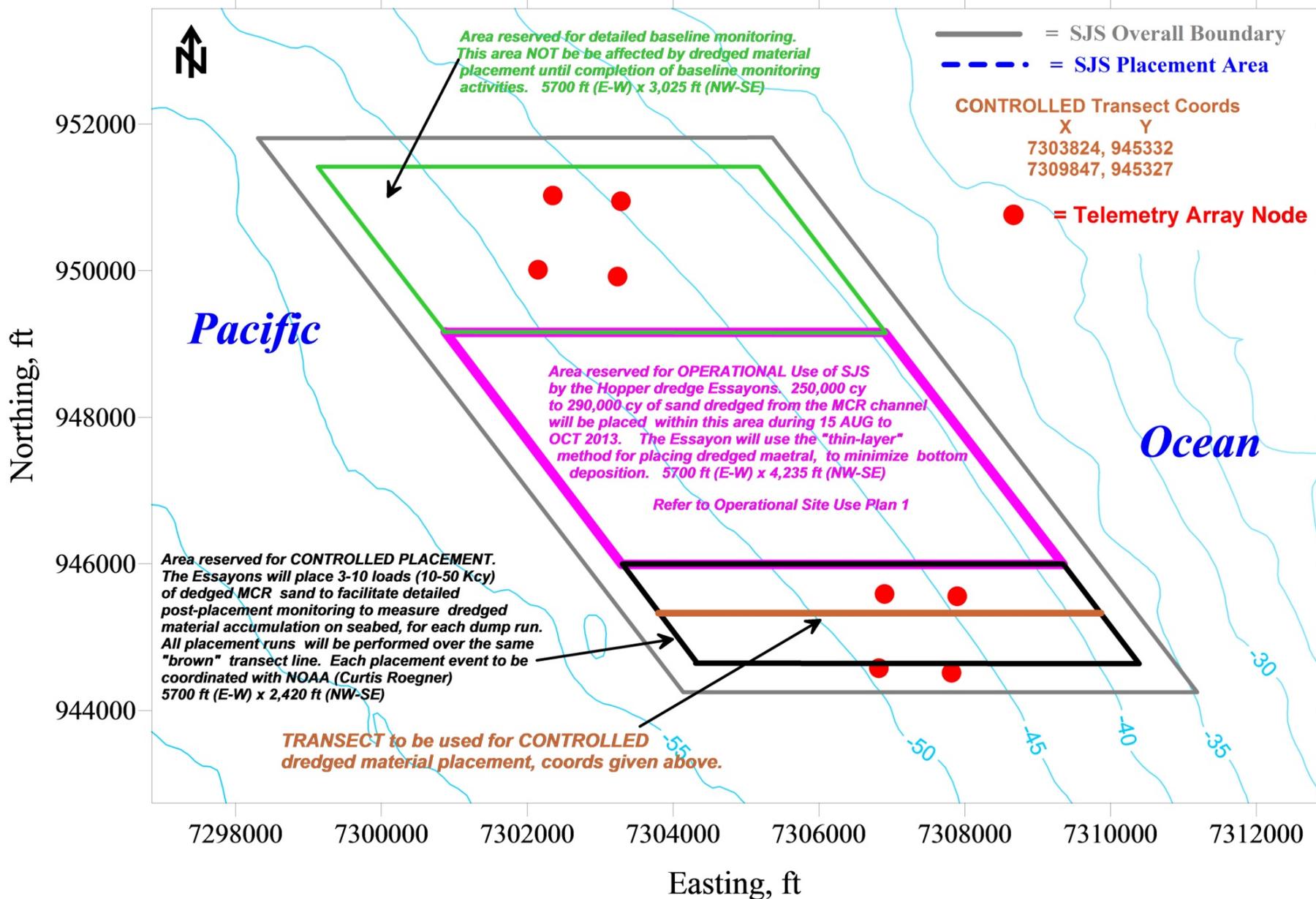
Automated Event Detection and Classification (AVEDac) Software

- Developed by MBARI, Caltech, and USC for analysis of ROV video
- Software is capable of tracking objects of interest through video frames
- Continued development of the software to review video and classify species
- Quality Control by OSU graduate student
- Once developed it should reduce labor requirement

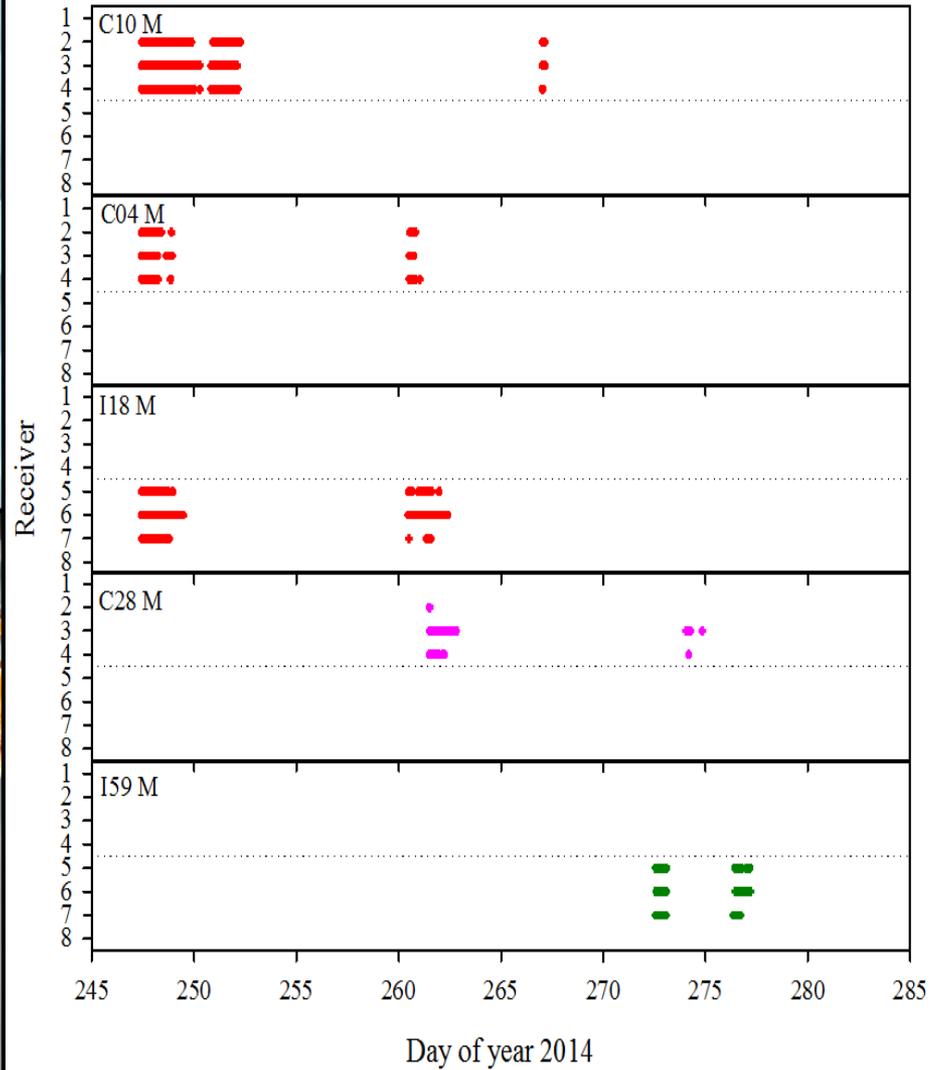


MCR South Jetty Site - SJS (CWA 404)

Layout For Phased Implementation of Initial Site Utilization & Monitoring Plan 2014



Acoustic Crab Tags



(Preliminary data courtesy of NOAA)

Deposition Monitoring Instruments (Campods)

- Measure material deposition following placement by dredge ESSAYONS (target 5cm)
- Monitoring crab response to placement (mortality at 10cm burial)
- Capture baseline conditions in the SJS



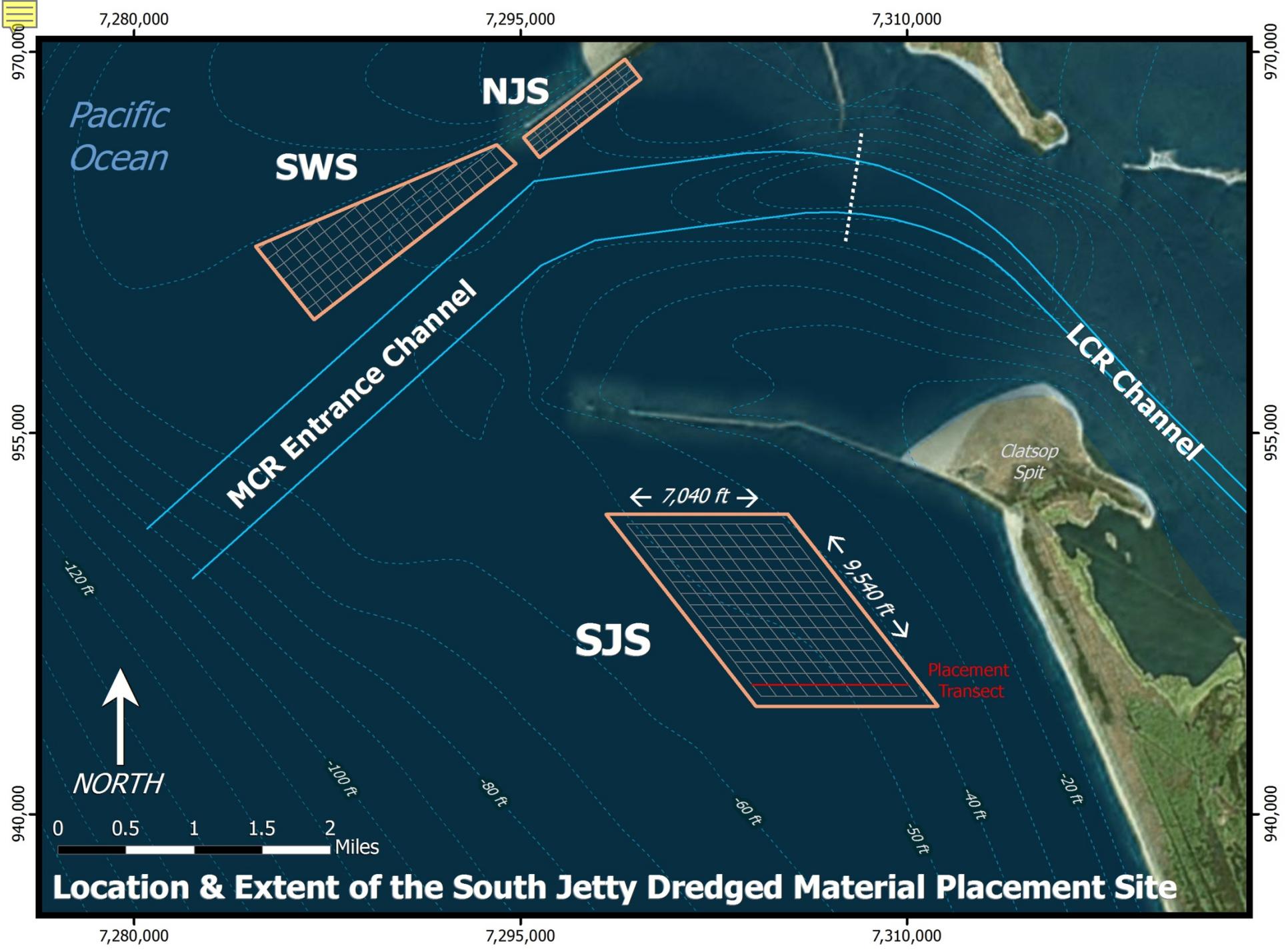


Prototype deployable deposition meter, via Curtis Roegner-NOAA. These are designed to go “over the side” and be retrieved like crab traps.

A Gopro camera, attached to the deposition meter mount, can record the deposition event.

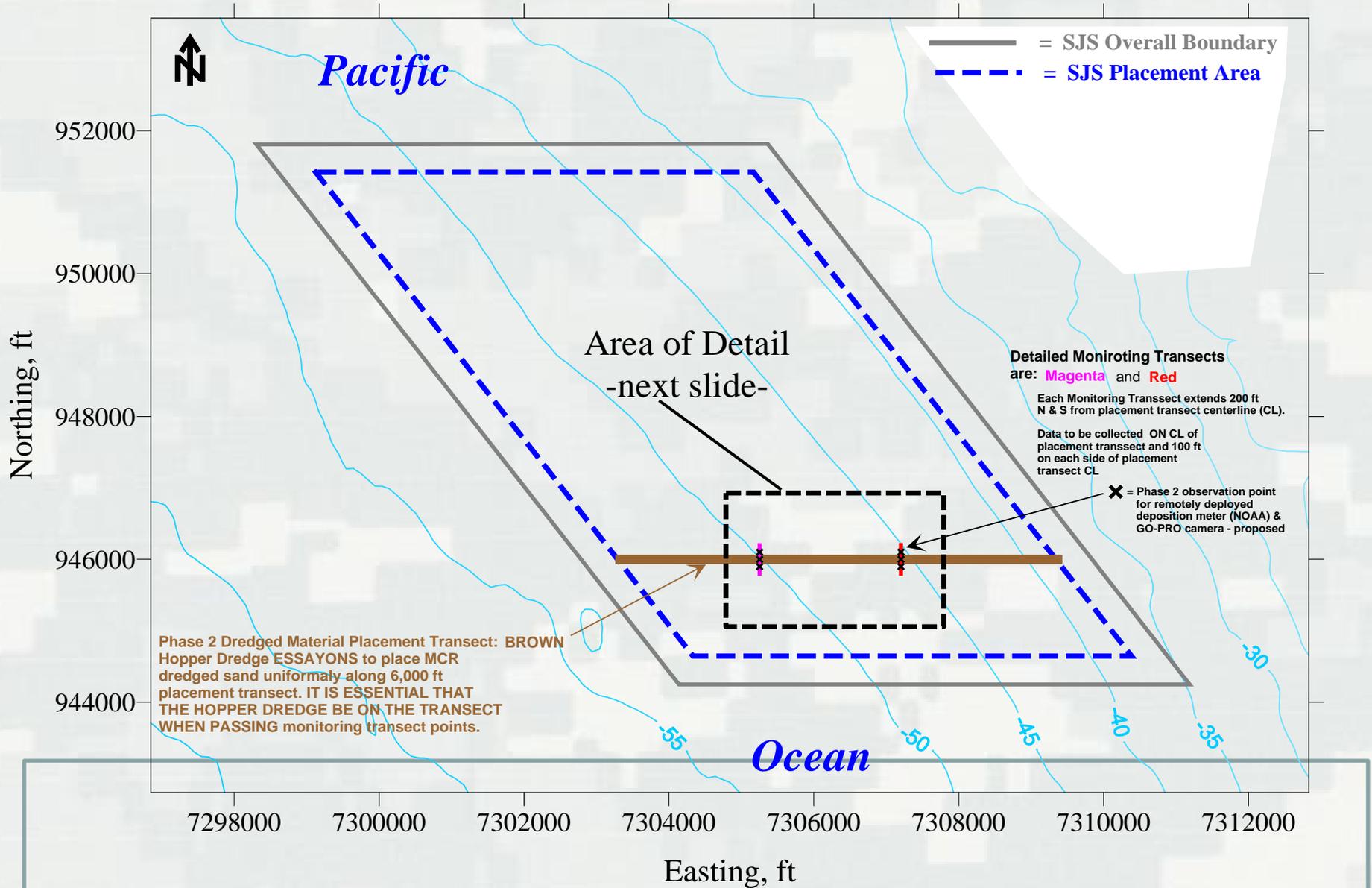


COURTESY OF CURTIS ROEGNER-NOAA



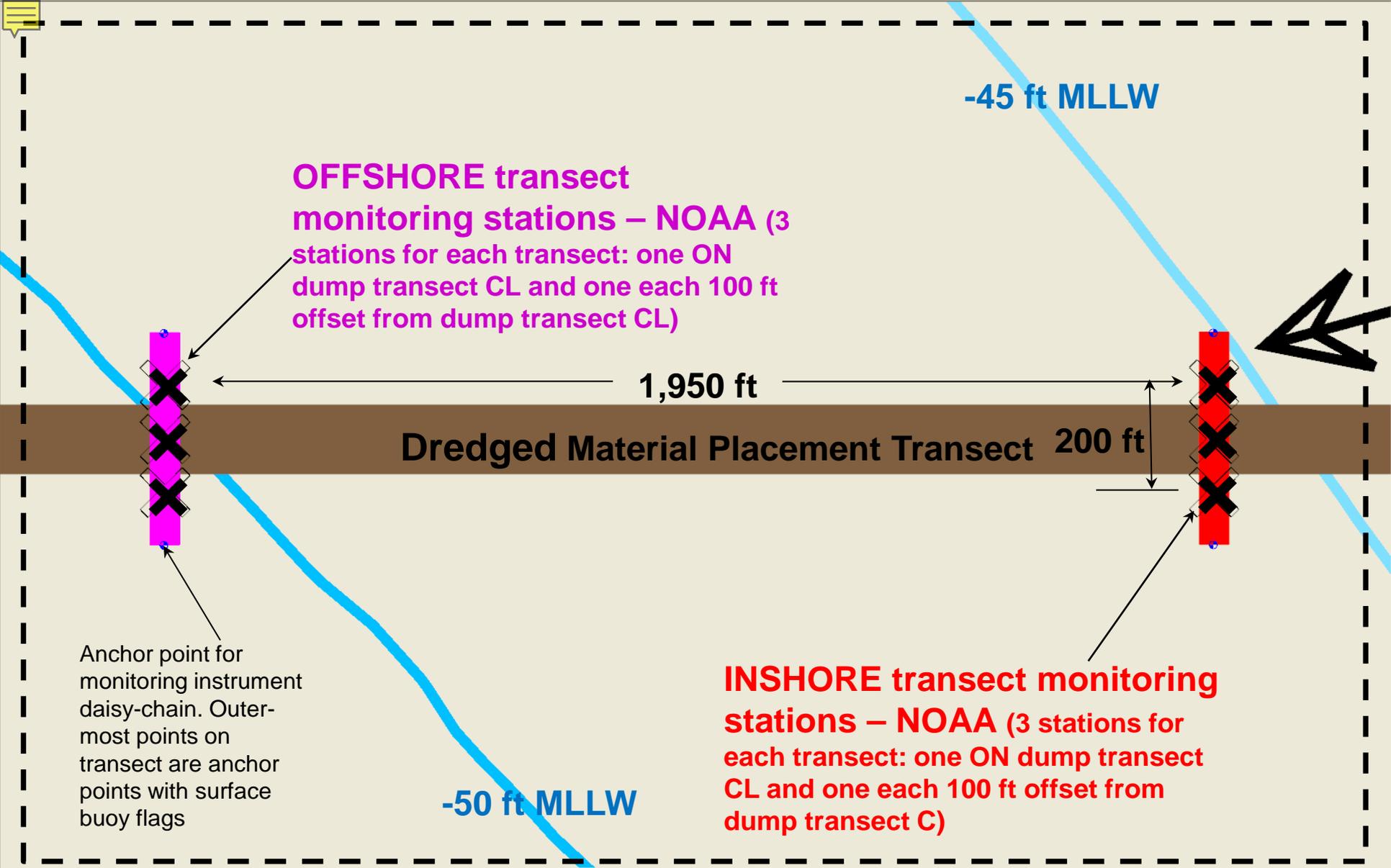
MCR South Jetty Site - SJS (CWA 404)

Layout For Phased Implementation of Initial Site Utilization & Monitoring Plan

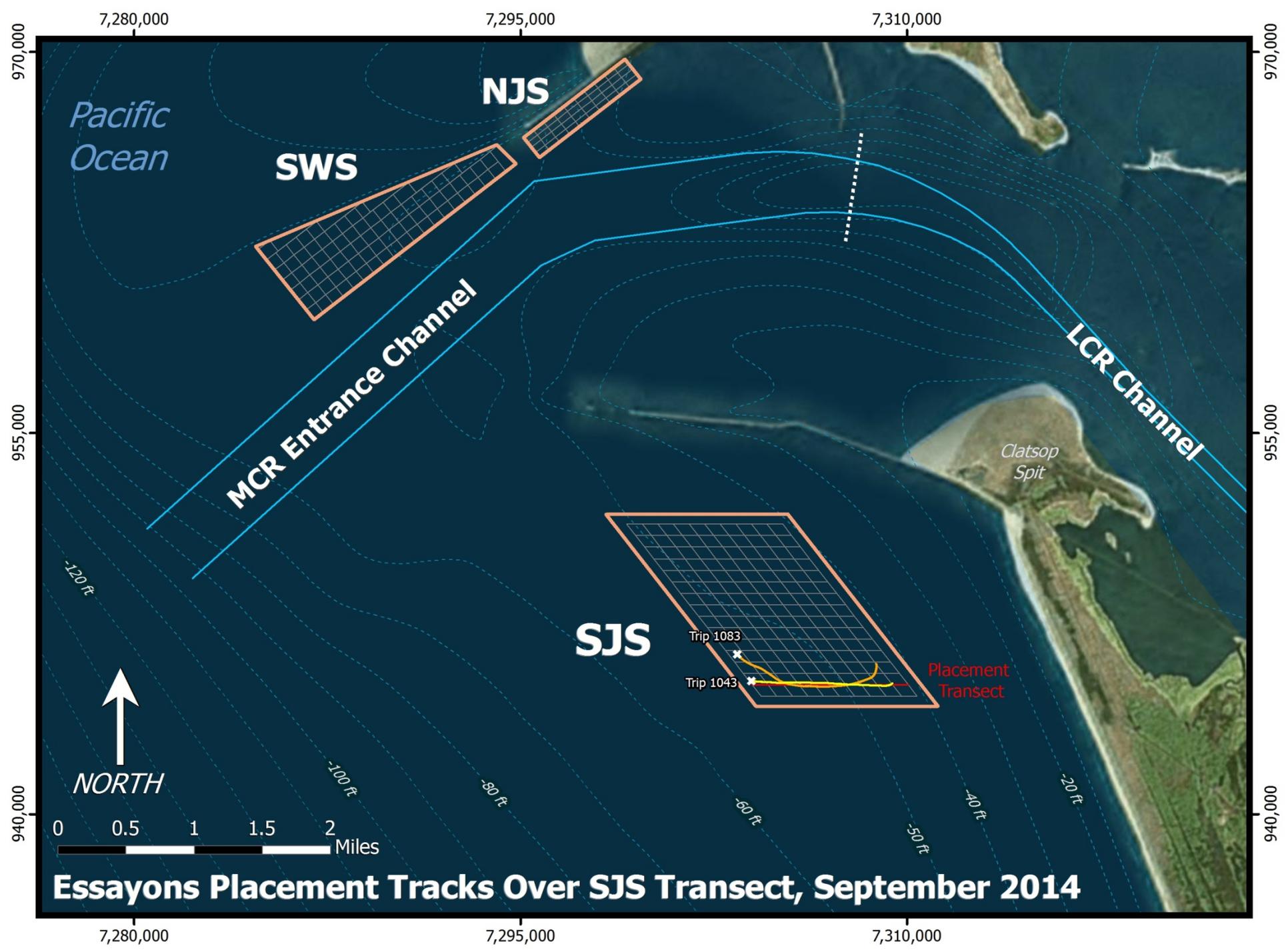


coordinates are SPCS Oregon, north, ft NAD83
elevations are in ft, below MLLW, data = Aug 2012, contour interval = 5 ft

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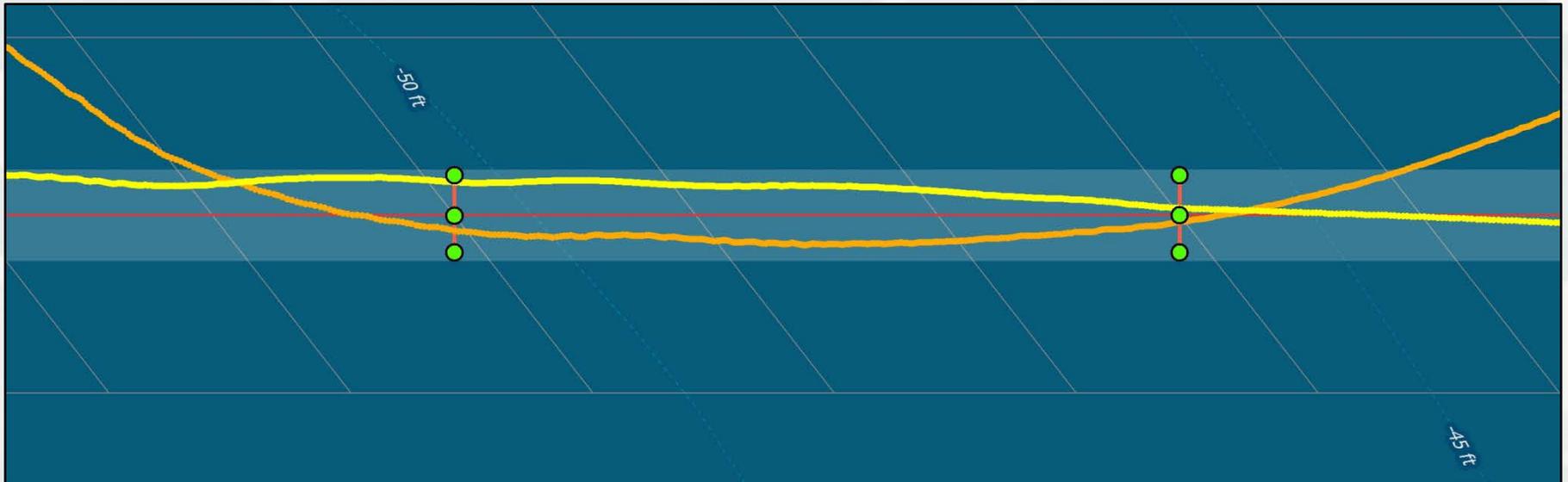


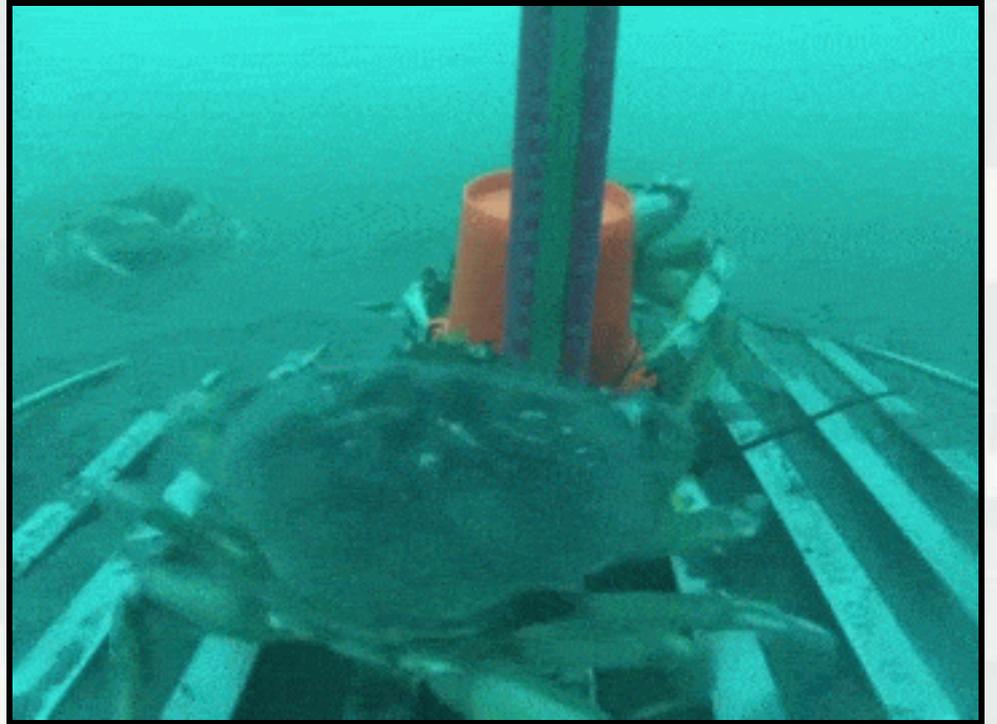
Close-up View of SJS Phase II - Monitoring Transect Details



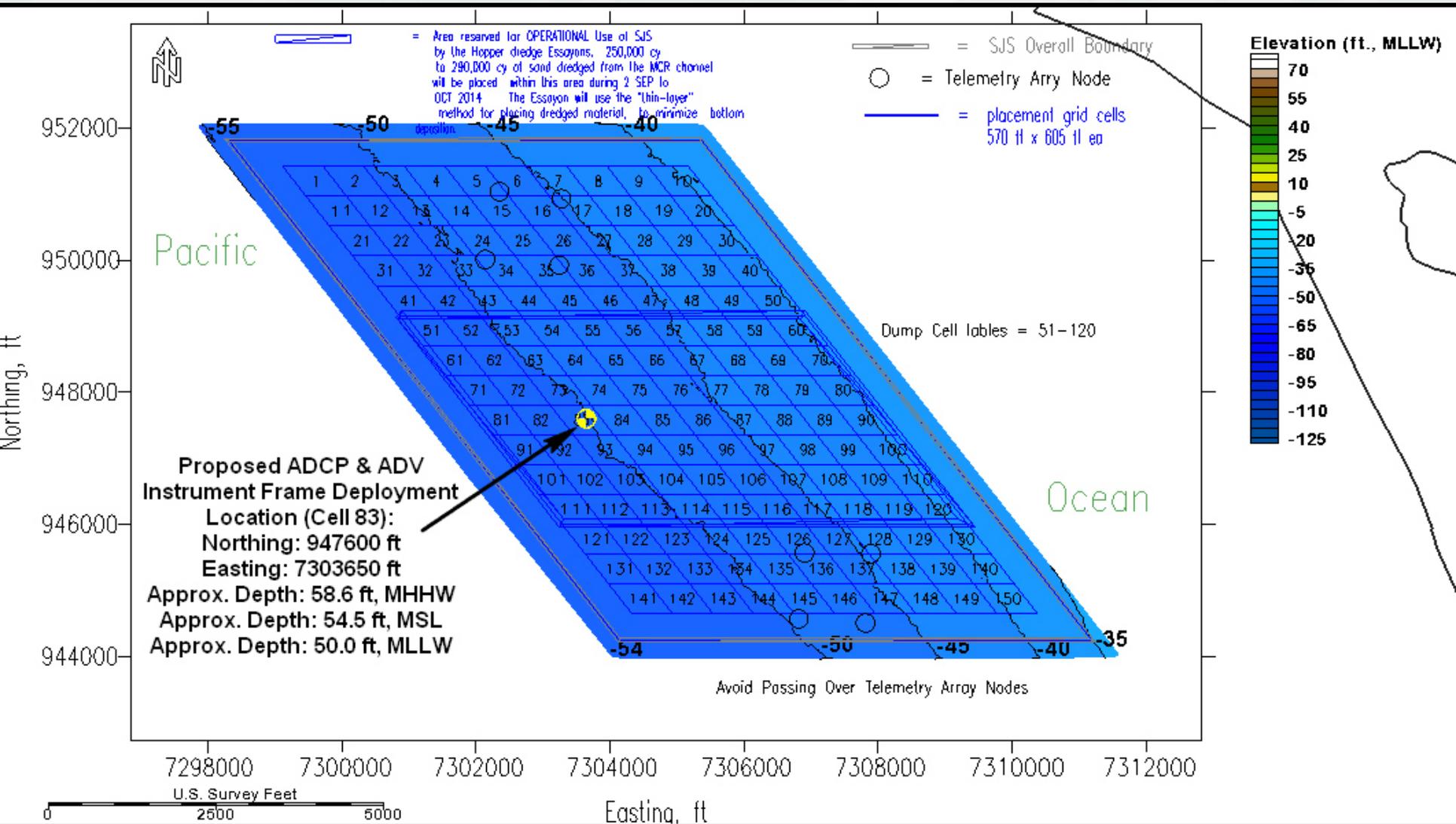


MCR vids





Acoustic Doppler Current Profiler (ADCP)



ADCP Data Collection

Data collection includes:

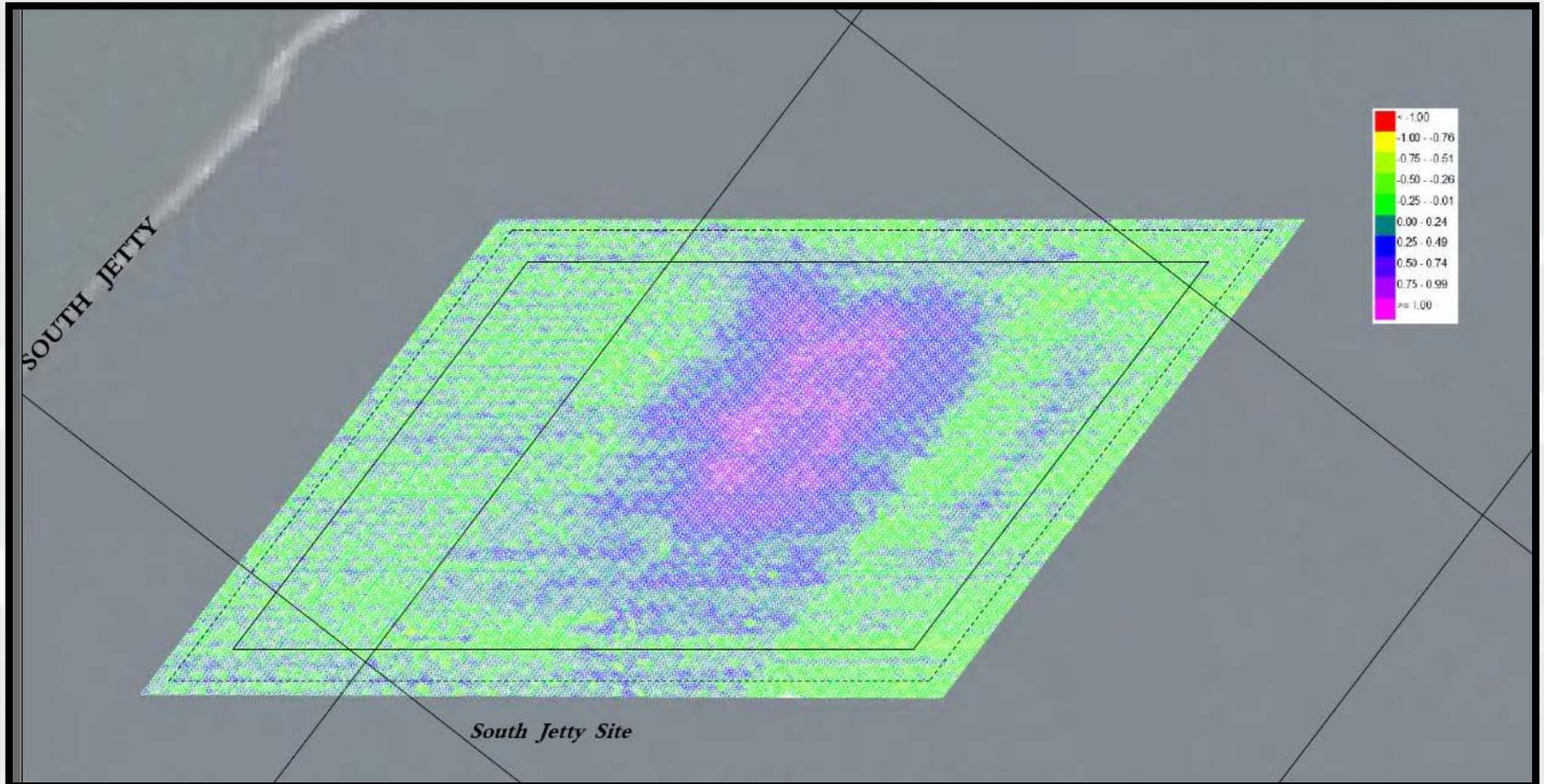
- Measured currents through the water column
- Directional waves
- Suspended sediments
- Bottom current regime

- The intent of the data collection is to measure dredge material plume velocities and suspended sediments

- Infer impacts to benthic communities based on lab results



SJS Difference Plot 2014



Conclusions/Limitations

- Critical need for on-going stakeholder engagement
- Measurements of benthic response to dredged material placement
- Expand network of nearshore sites
- Continue developing innovative monitoring techniques
- AVEDac software needs work to be fully operational
- On-going operational placement of 300kcy
- Monitoring the migration of material from the nearshore site to the beach
- Passive acoustic detections

