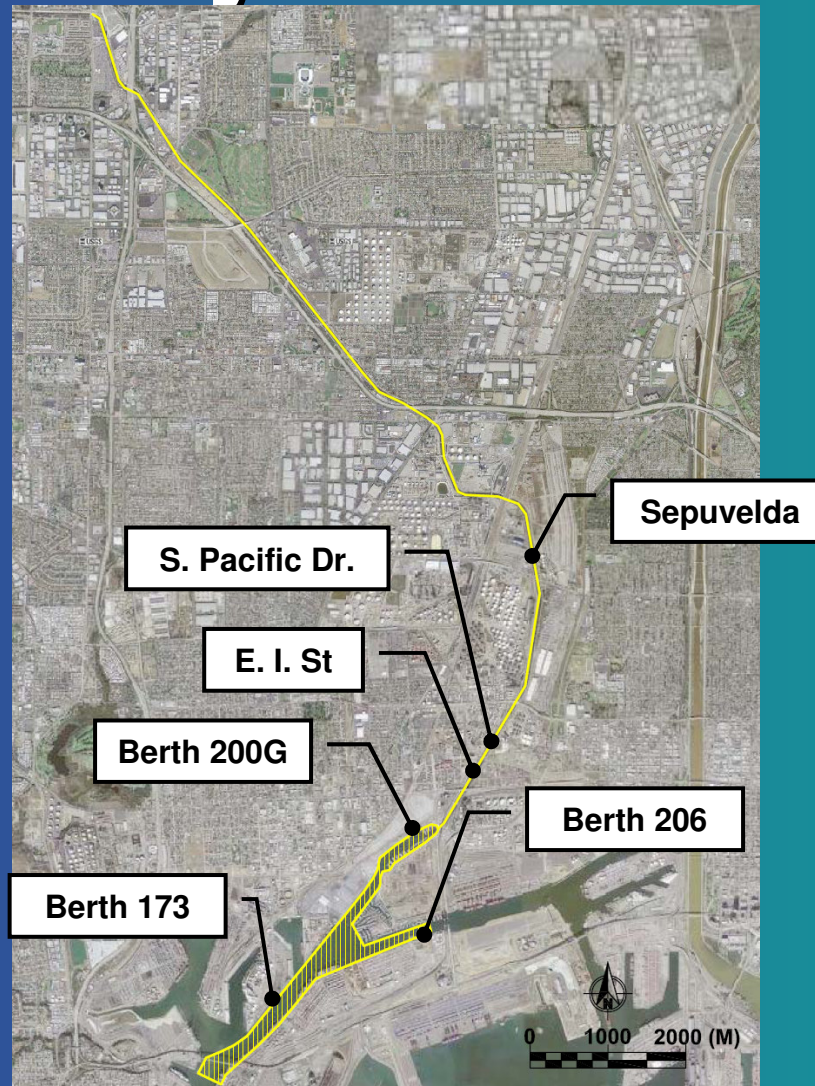


# Dominguez Channel Estuary Model Study

*Funding for this project has been provided in full or in part through an Agreement with the State Water Resources Control Board (SWRCB) pursuant to the Costa-Machado Water Act of 2000 (Proposition 13) and any amendments thereto for the implementation of California's Nonpoint Source Pollution Control Program. The contents of this document do not necessarily reflect the views and policies of the SWRCB, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.*



# DCEM Study Area



Dominguez Channel Estuary Model Study



# Overview

- ❖ Field Program and Data Analysis
- ❖ Model Input Parameters
- ❖ Dry Weather Calibration
- ❖ Wet Weather Calibration

# Field Program

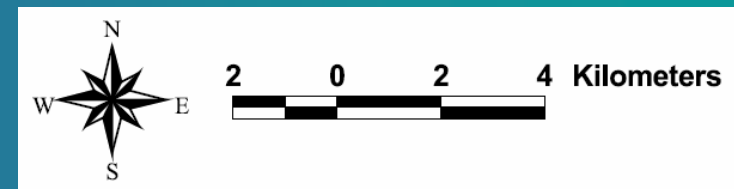
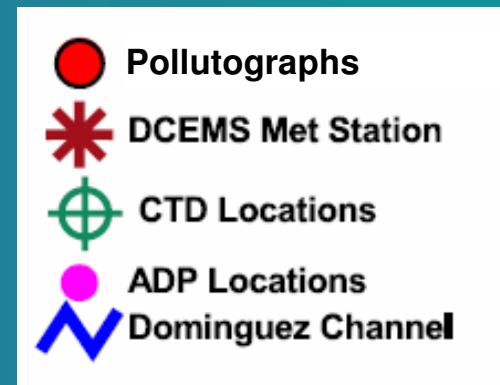
- ❖ Fixed Monitoring (ADP)
- ❖ Vessel Based Surveys
- ❖ Salinity Distribution
- ❖ Estuary Water Quality Sampling (CTD)
- ❖ Pullotographs
- ❖ Dye Tracer Study
- ❖ Meteorological Data



# Fixed Monitoring

- ❖ Continuous monitoring of pressure, velocity and temperature
- ❖ Dominguez Channel velocity profile

# Monitoring Locations



Dominguez Channel Estuary Model Study

# Vessel Based Surveys



## Vessel Based Surveys



Wet Weather Vessel Survey



Dry Weather Vessel Survey



Dominguez Channel

# Salinity Distributions

## ❖ Dry weather

- May 17, 2005
- August 18, 2005

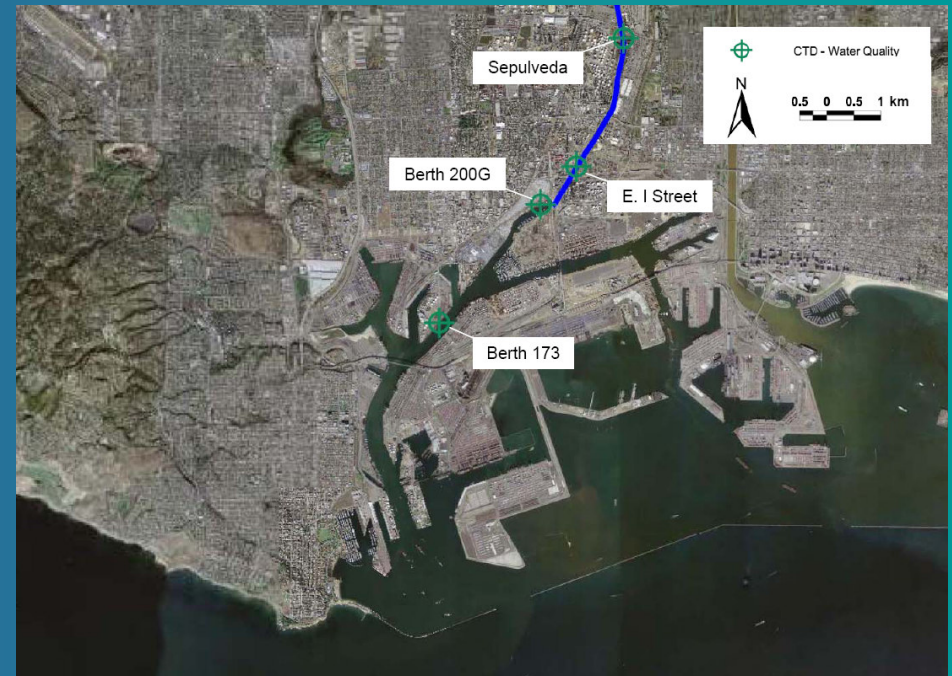
## ❖ Wet weather

- February 27-28, 2006
- February 25-March 15, 2006 (Continuous, fixed location)



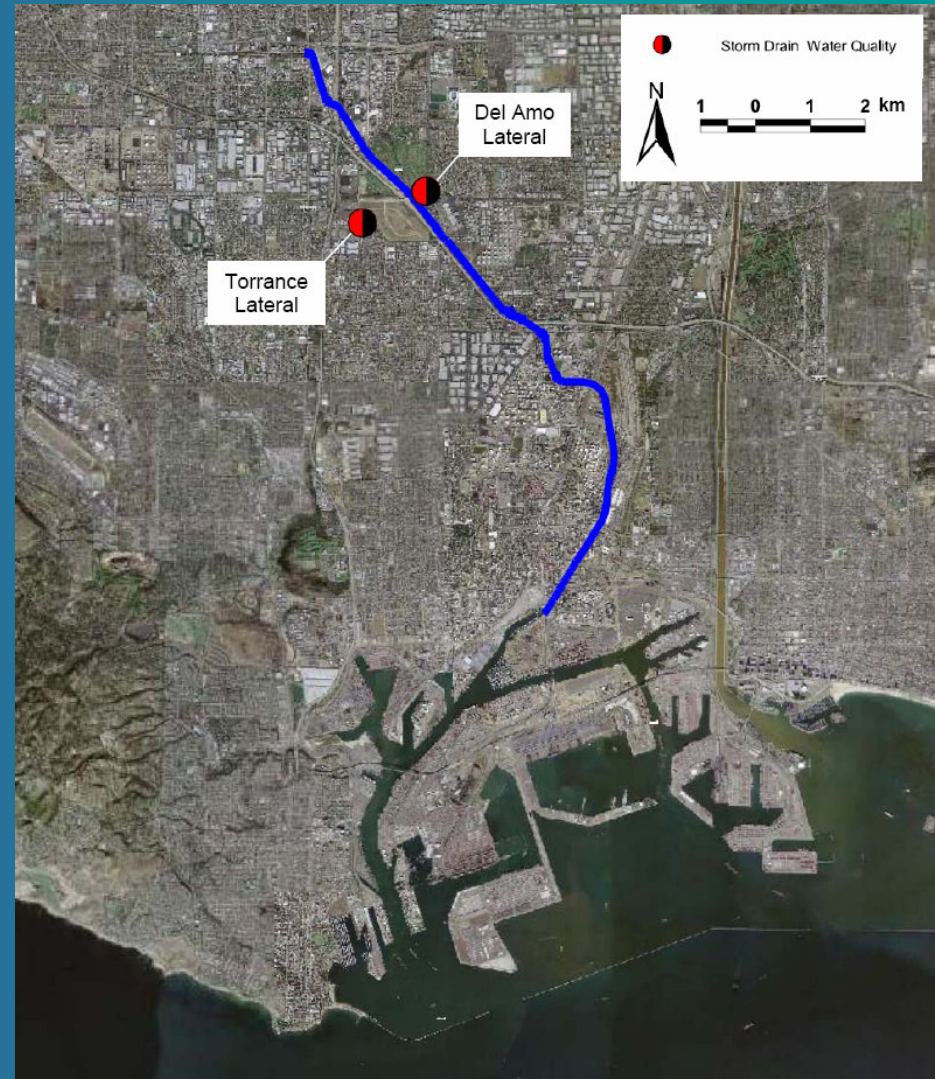
# Estuary Water Quality Sampling

- ❖ 2 channel locations
- ❖ 2 harbor locations
- ❖ Monthly measurements
- ❖ Suite A parameters

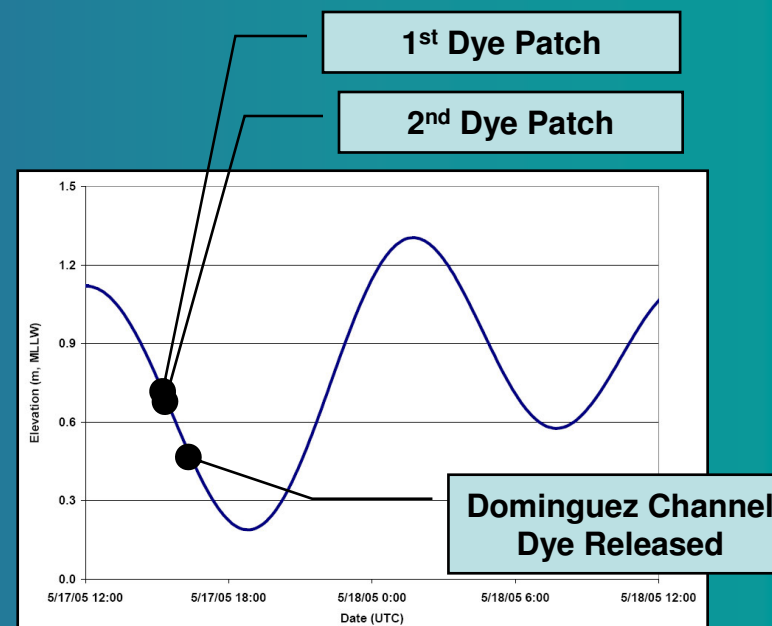
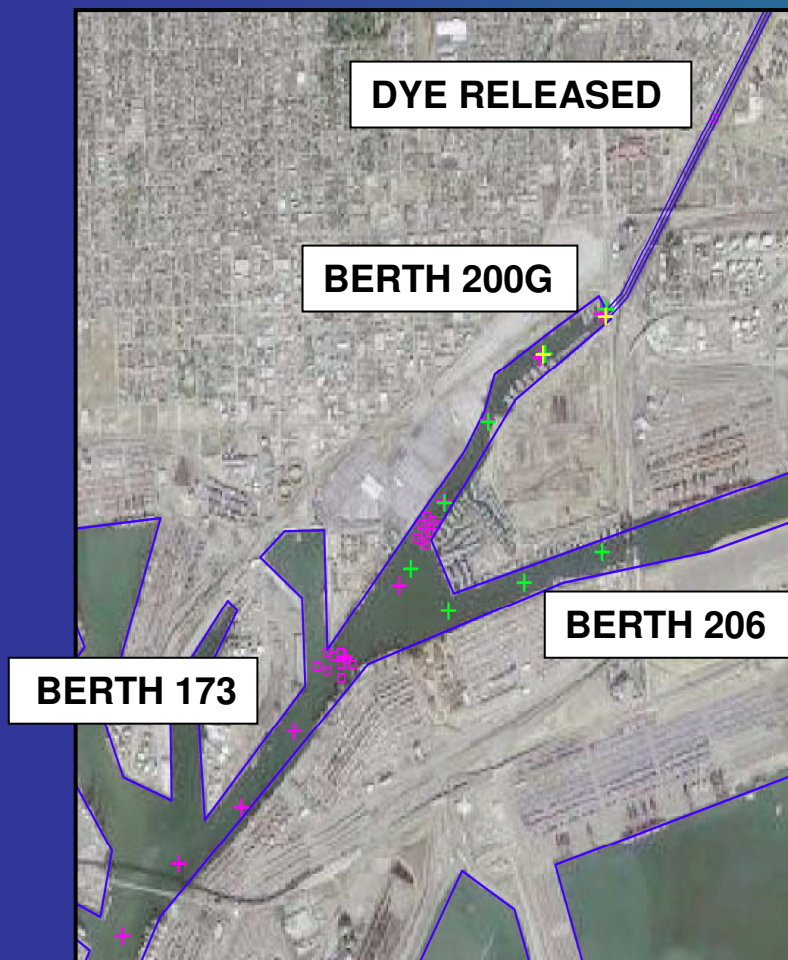


# Pollutograph Sampling

- ❖ Wet weather
- ❖ Suite B parameters



# Dye Tracer Study – May 17, 2005

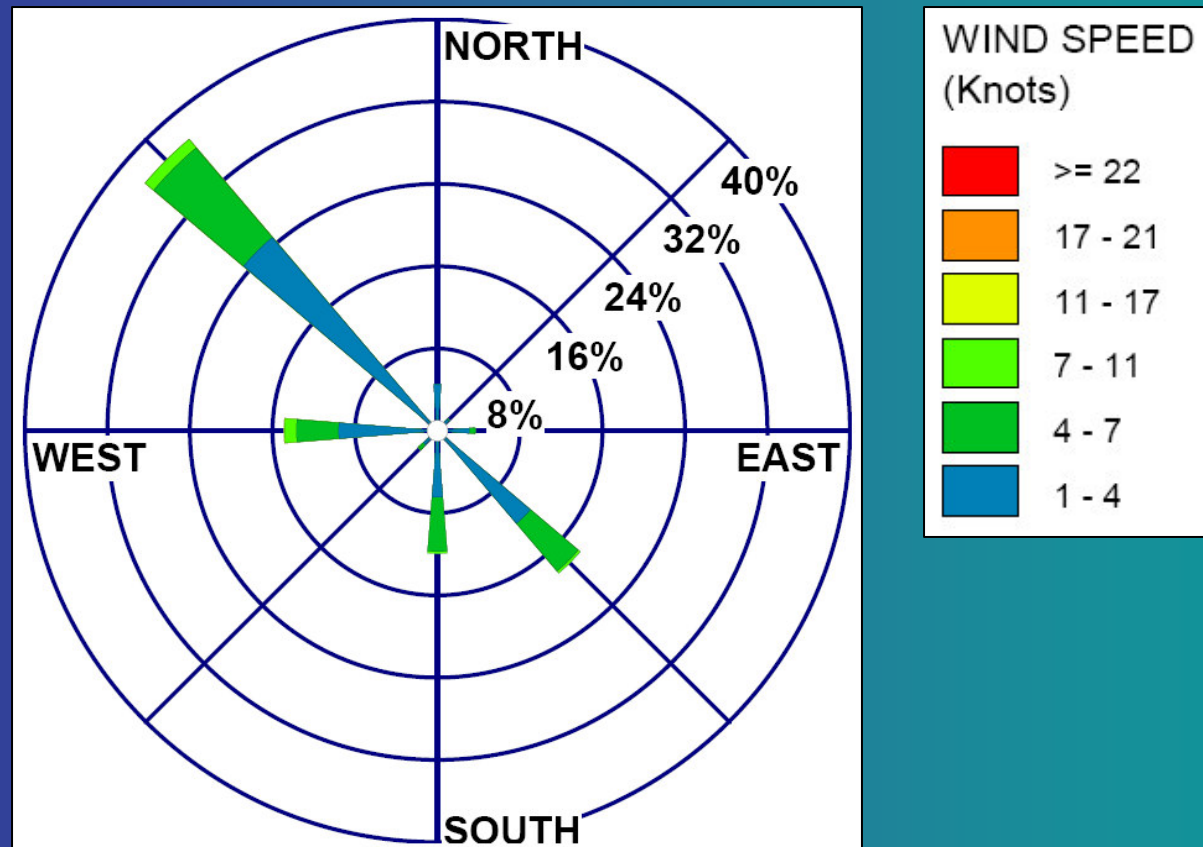


## LEGEND:

- |  |                        |
|--|------------------------|
| Dye Patch Arrays                       | Water Sampling by Boat |
| Water Sampling via in situ Fluorometer | Transect 1             |
|  | Transect 2             |
|  | Transect 3             |



# Meteorological Data - Wilmington



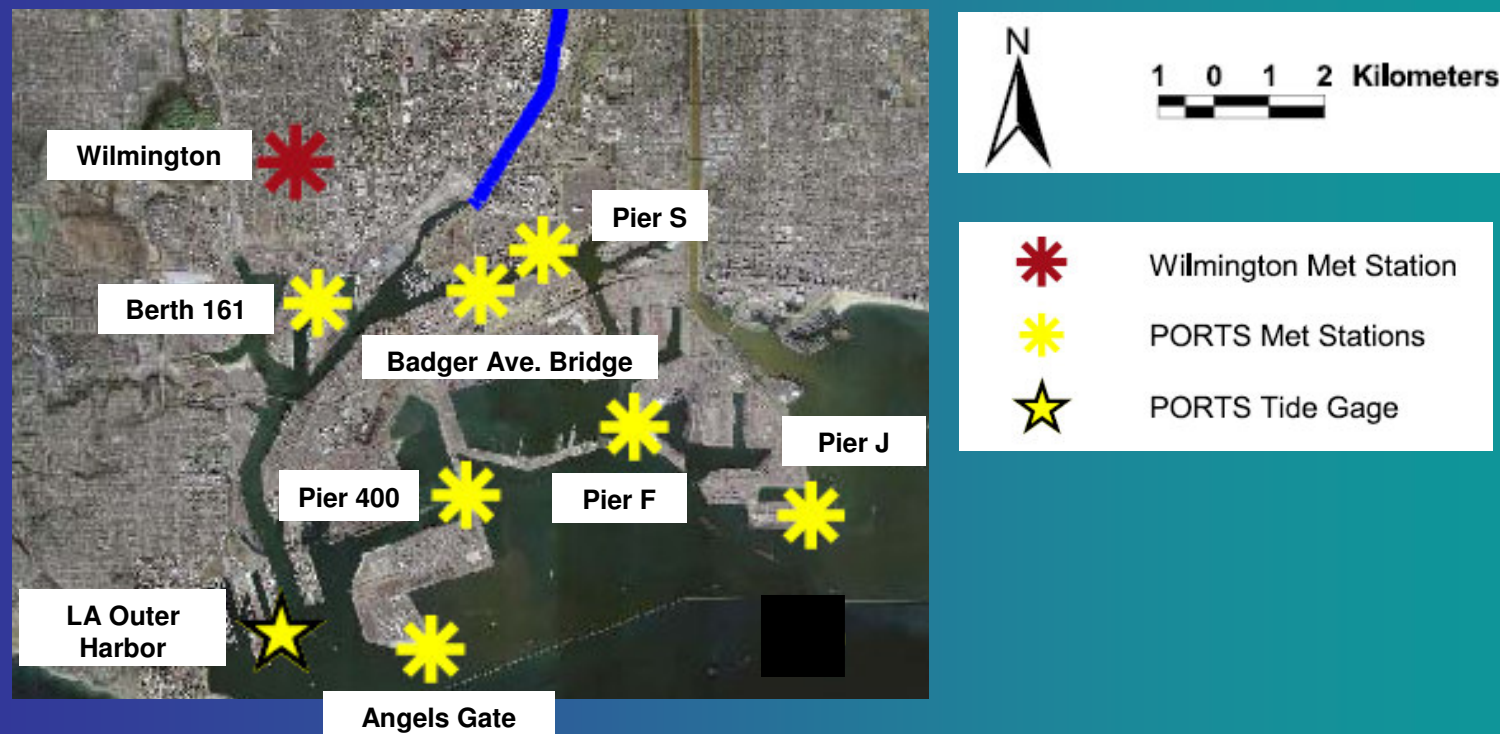
Data Range: 4/27/05 - 3/22/06, Wind Direction: Blow from

Dominguez Channel Estuary Model Study



# Other Data Considered

- ❖ NOAA PORTS Meteorological Data
- ❖ NOAA LA Outer Harbor Tide Gage



# Other Data Considered

- ❖ POLA Enhanced Water Quality Monitoring Program



# Other Data Considered

- ❖ POLB/POLA Biological Baseline Study

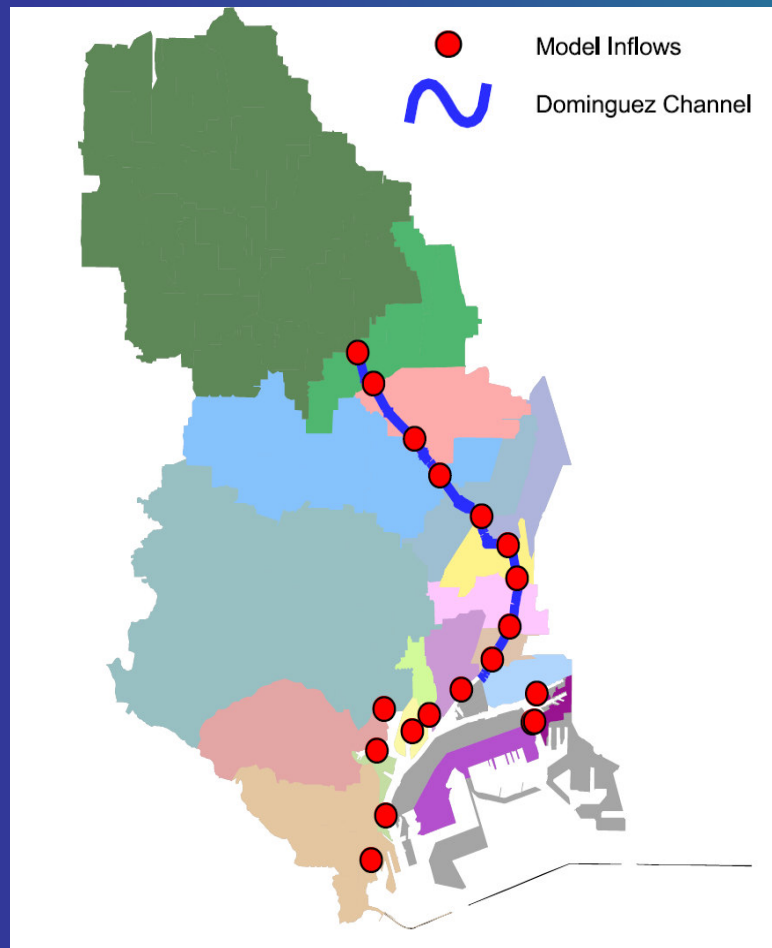
- ❖ Bathymetry

- USACE
- POLA

- ❖ Sediment Quality

- POLA Consolidated Slip Restoration Project
- POLA Dominguez Channel Sediment Investigation

# Typical Dry Weather Flow



$$\text{Flow (m}^3\text{/sec)} = 0.0024 * \text{Area (km}^2\text{)}$$

Stein, E. and D. Ackerman (SCCWRP)  
- Unpublished Data

## Drainage Areas

Vermont Avenue	Johns Manville Street	Slip 5	West Channel
Victoria Street	Sepulveda	Slip 1	Channel No. 2
Gladwick Street	PCH	West Basin	Pier 300 & Pier T
213th Street	Anaheim Street	Battery Street	Pier D- J
223rd Street	Blinn Avenue	Main Channel	

Dominguez Channel Estuary Model Study





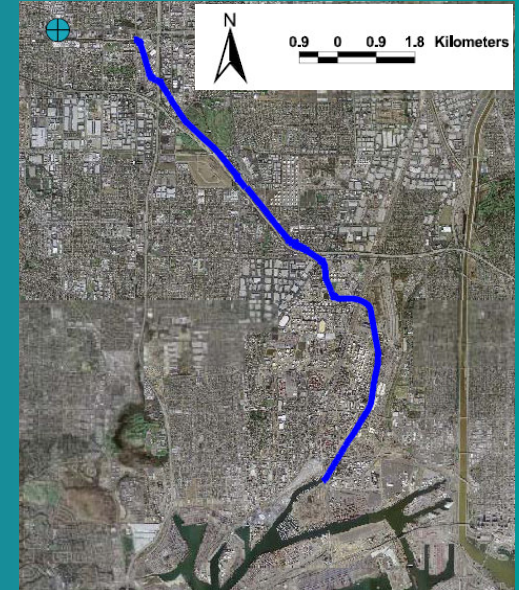
# Artesia Water Quality Sampling

## ❖ Dry weather pollutograph

- May 17, 2005
- August 18, 2005

## ❖ Wet weather pollutograph

- February 27-28, 2006

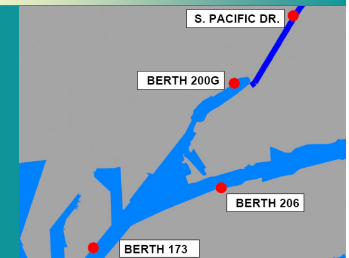


# Field Data Analysis

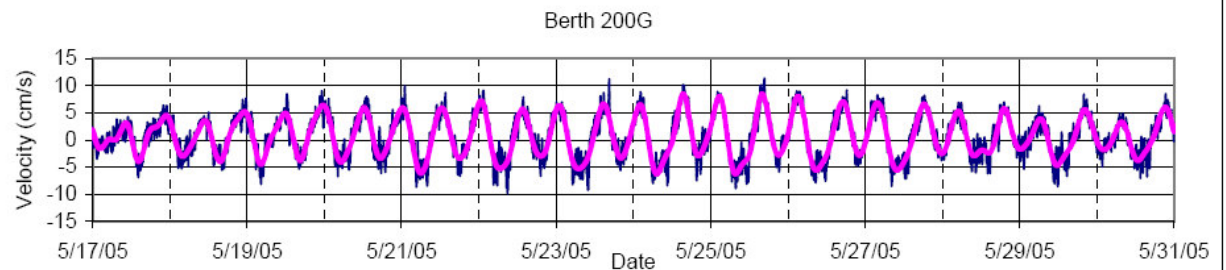
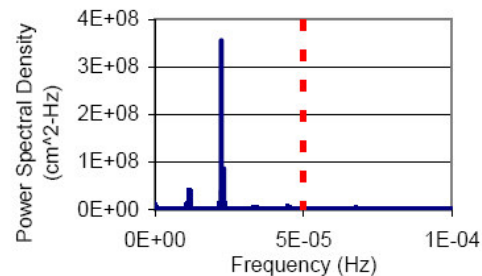
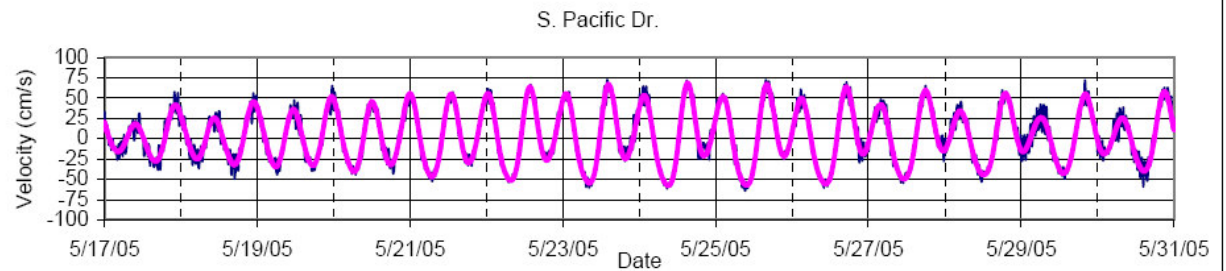
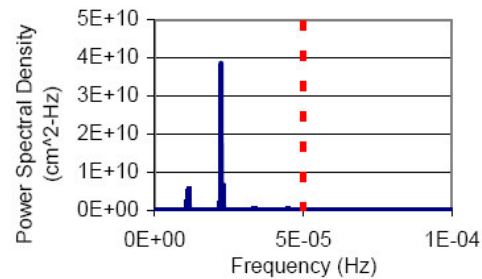
- ❖ Tide elevations – filter NOAA tide gage data
- ❖ Velocities – transform to along channel velocities and filter



# Velocity Data



— Raw Data — Filtered Data



# Model Input Parameters

- ❖ Bathymetry
- ❖ Tide
- ❖ Power plant
- ❖ Wind
- ❖ Coriolis force
- ❖ Initial concentrations
- ❖ Dry weather flows and loadings

# Bathymetry Data Sources



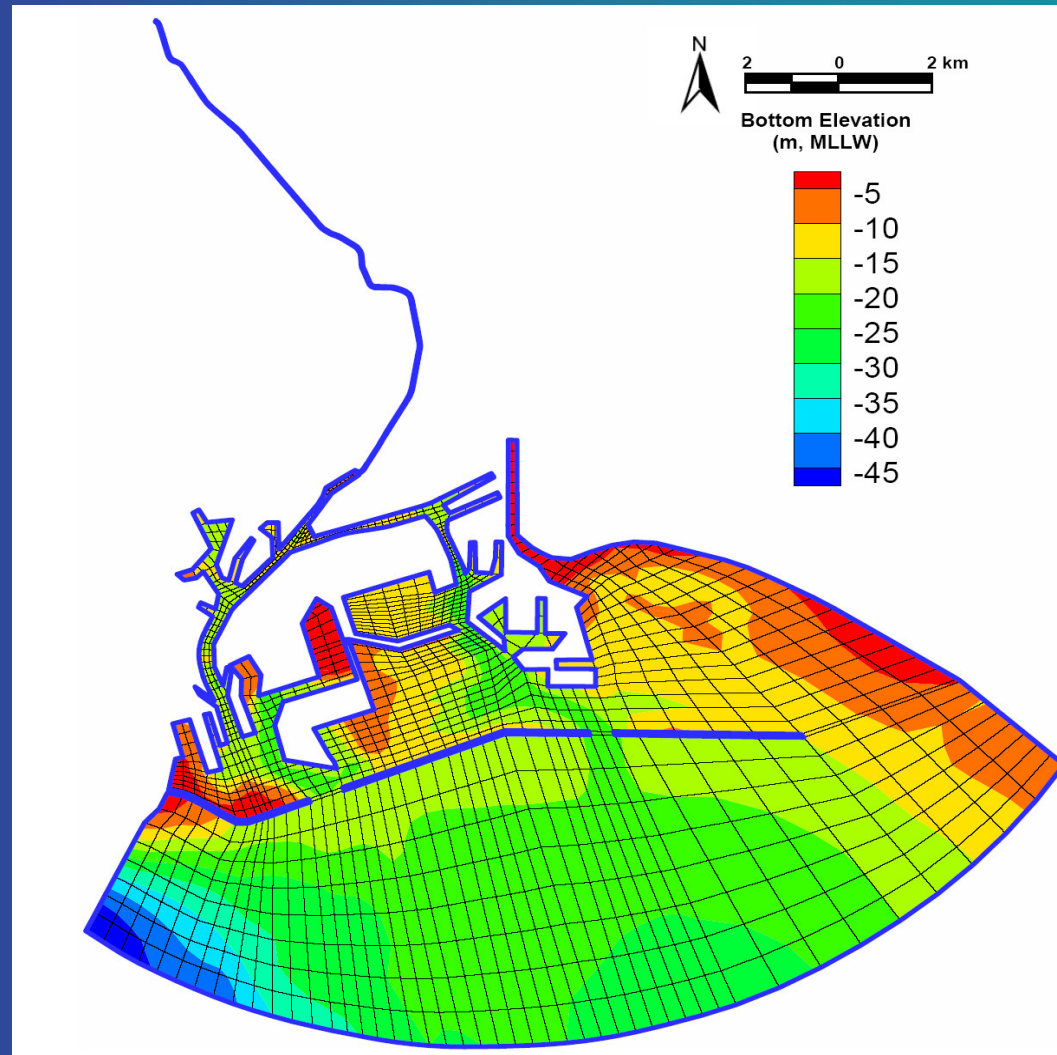
## LEGEND:

-  May 2005 (USACE)
-  October, 2002 (USACE)
-  March, 2001 (USACE)
-  February, 2001 (USACE)

## Note:

1. Dominguez Channel – March, 2006 Survey (POLA)
2. Areas not colored – NOAA Charts (2004) No. 18749 & 18751

# Model Grid



Dominguez Channel Estuary Model Study



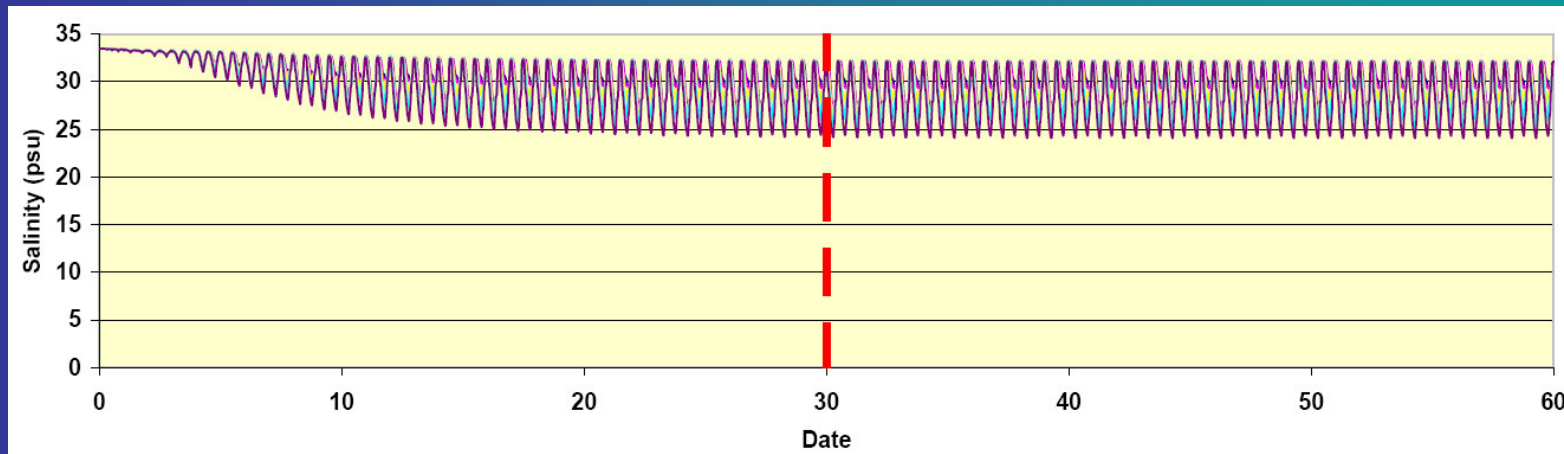
# Power Plant



Dominguez Channel Estuary Model Study

# Initial Conditions

- ❖ Constant initial conditions for water column
- ❖ 30-day spin up time for vertical gradient
- ❖ Initial concentrations from data



# Initial Conditions – Water Column

Salinity	33.5 PSU	2000 Biological Baseline
Dye	0 ppb	--
Cohesive Sediment	3.9 mg/L	DCEMS field data
Noncohesive Sediment	0 mg/L	--
Chromium	1.8 µg/L	POLA Enhanced Water Quality Project 2005-2006 data
Copper	1.7 µg/L	
Lead	1.1 µg/L	
Zinc	10.2 µg/L	



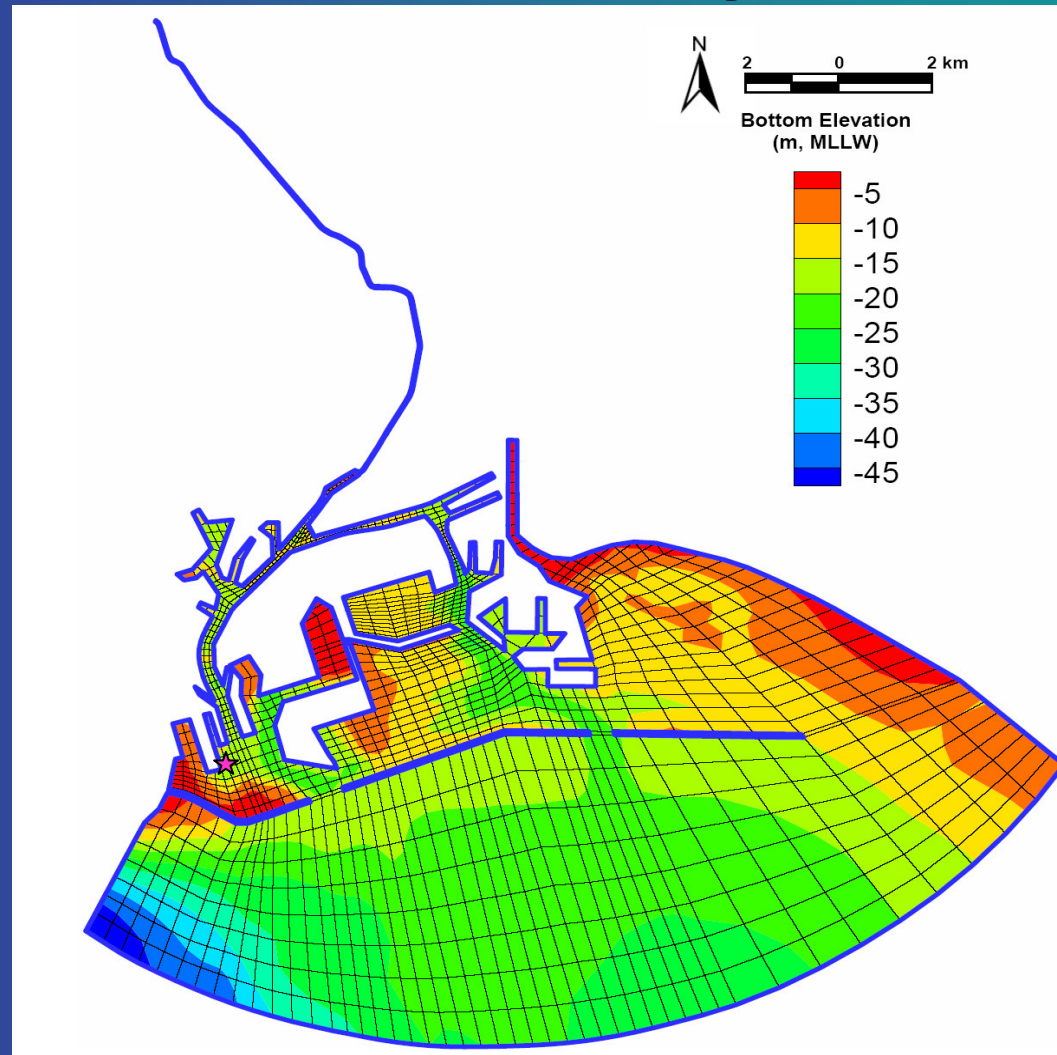
# Initial Conditions – Sediment Bed

Dominguez Channel	30 Fines 70% Sands	Dominguez Channel Sediment Investigation
Consolidated Slip	90% Fines 10% Sands	2000 Biological Baseline
Cerritos Channel	70% Fines 30% Sands	2000 Biological Baseline
Other Model Areas	100% Sands	Assumed

# Initial Conditions – Sediment Bed

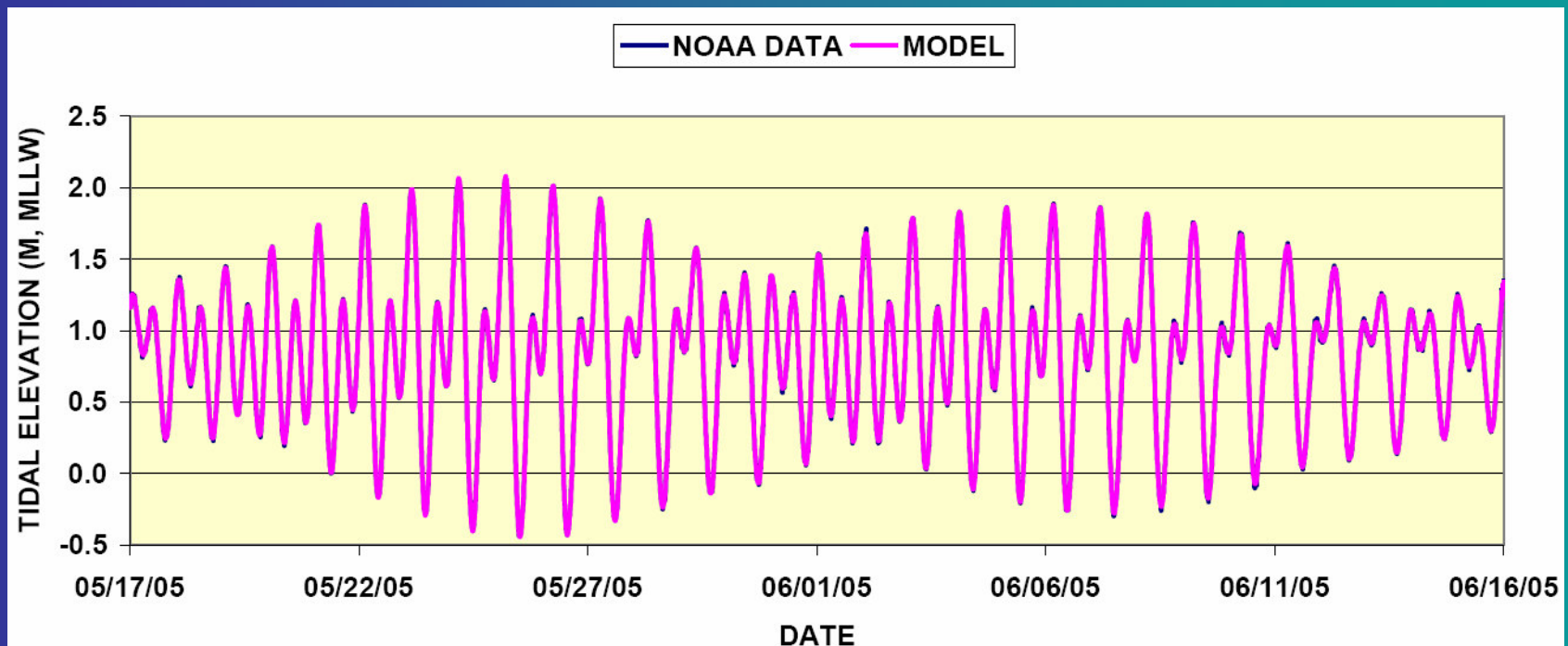
Dominguez Channel	Cr 68 µg/L Cu 95 µg/L Pb 179 µg/L Zn 384 µg/L	Dominguez Channel Sediment Investigation
Consolidated Slip	Cr 246 µg/L Cu 408 µg/L Pb 360 µg/L Zn 1,137 µg/L	Consolidate Slip Restoration Project
Other Model Areas	No metals	Assumed

# Verify Tide Boundary

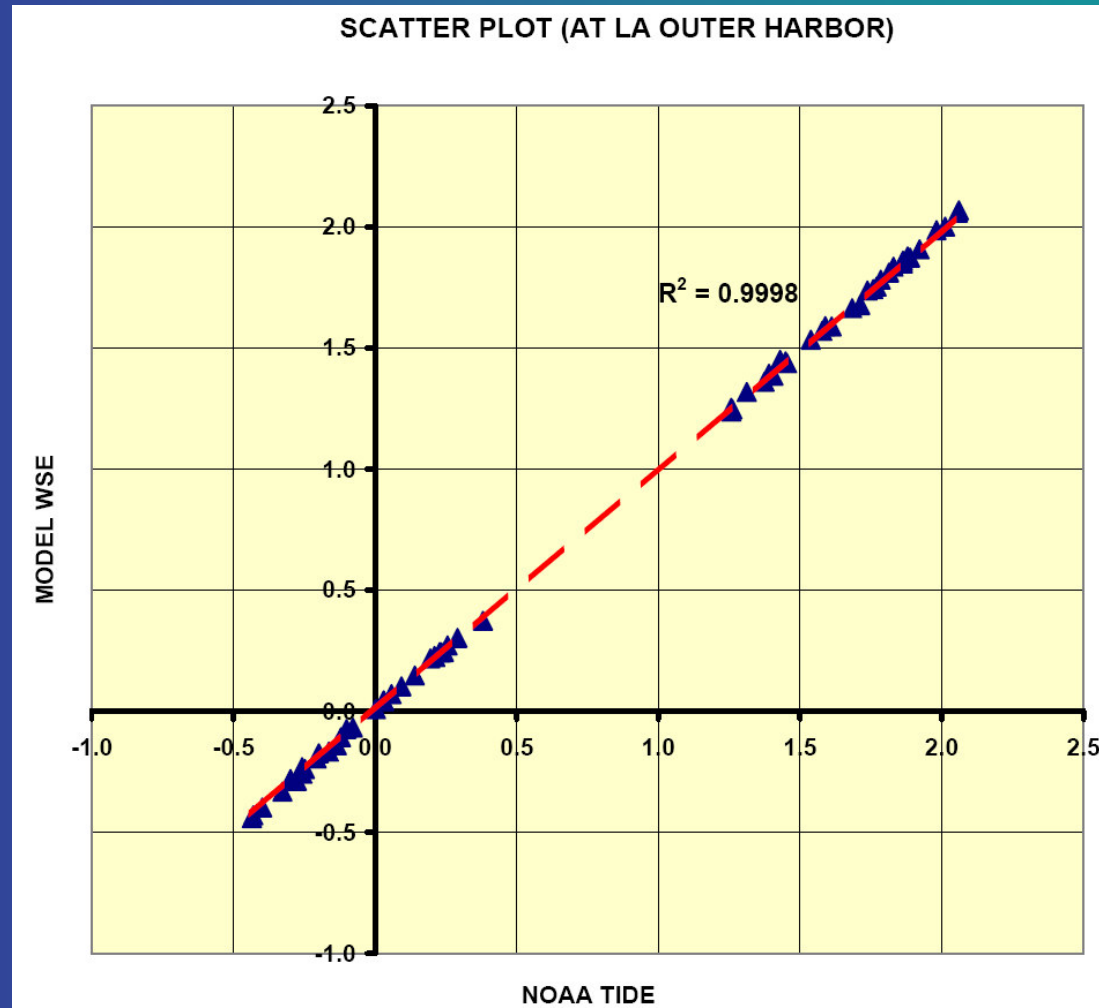


Dominguez Channel Estuary Model Study

# Verify Tide Boundary (LA Outer Harbor)

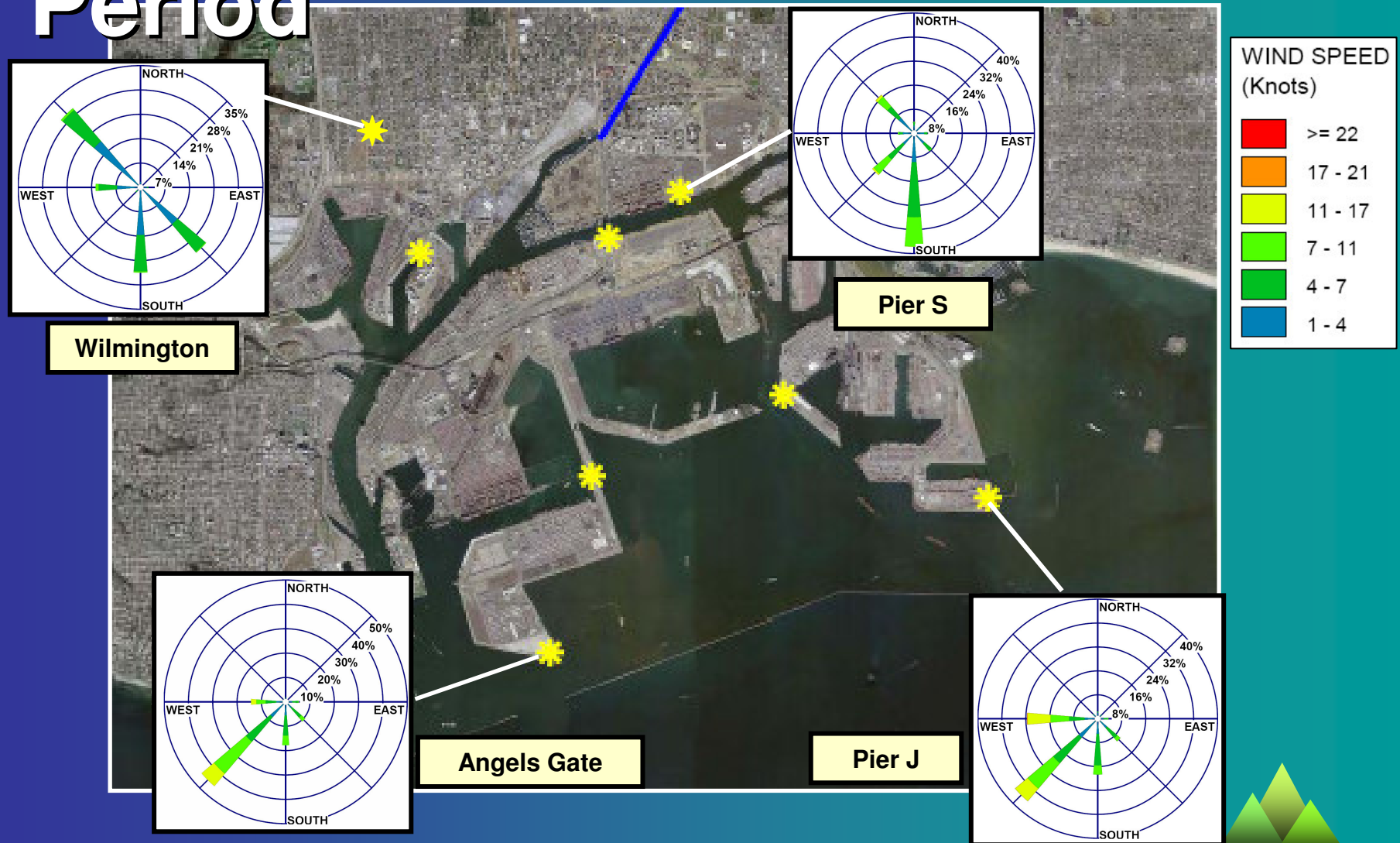


# Water Elevation Scatter Plot (LA Outer Harbor)



Dominguez Channel Estuary Model Study

# Wind Roses – Calibration Period

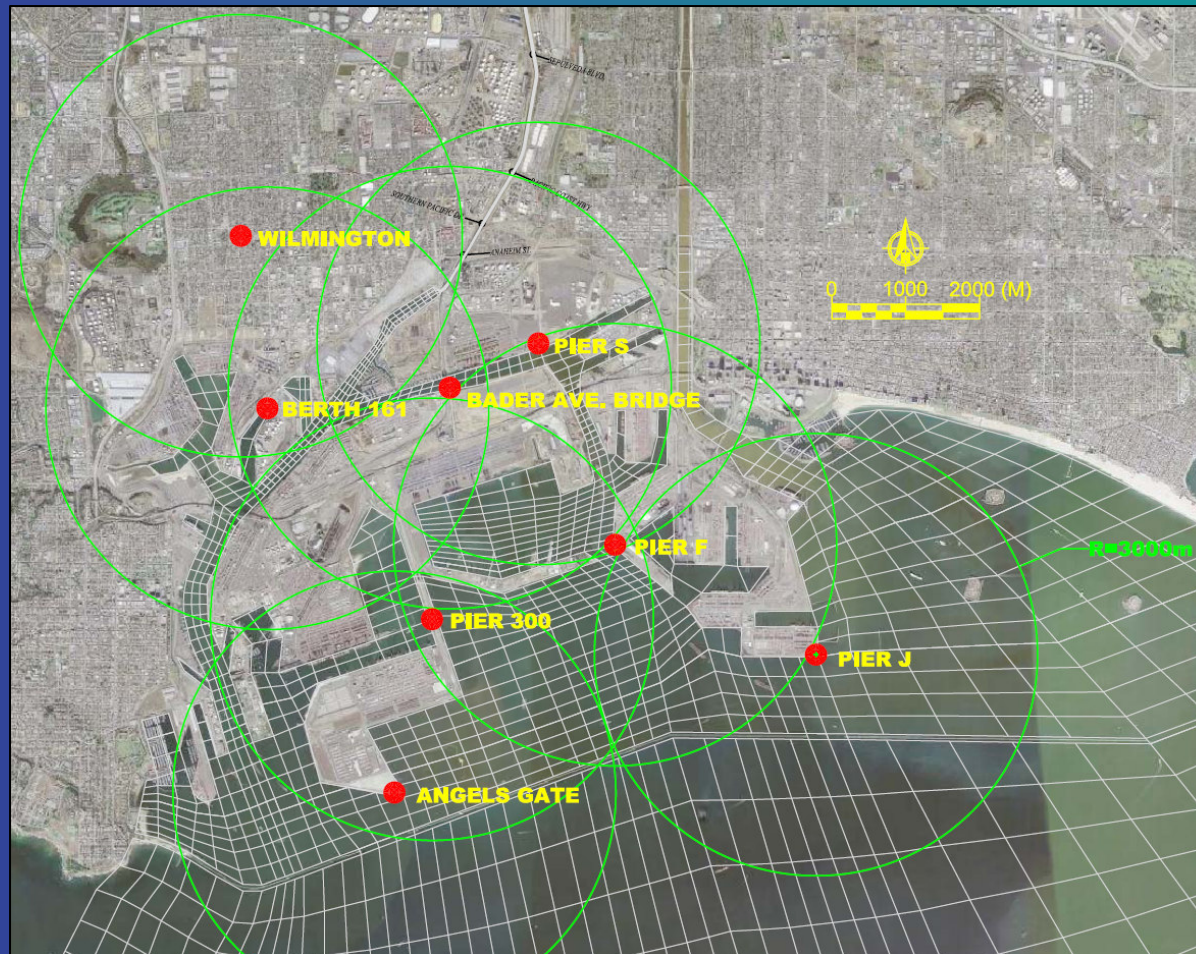


Dominguez Channel Estuary Model Study





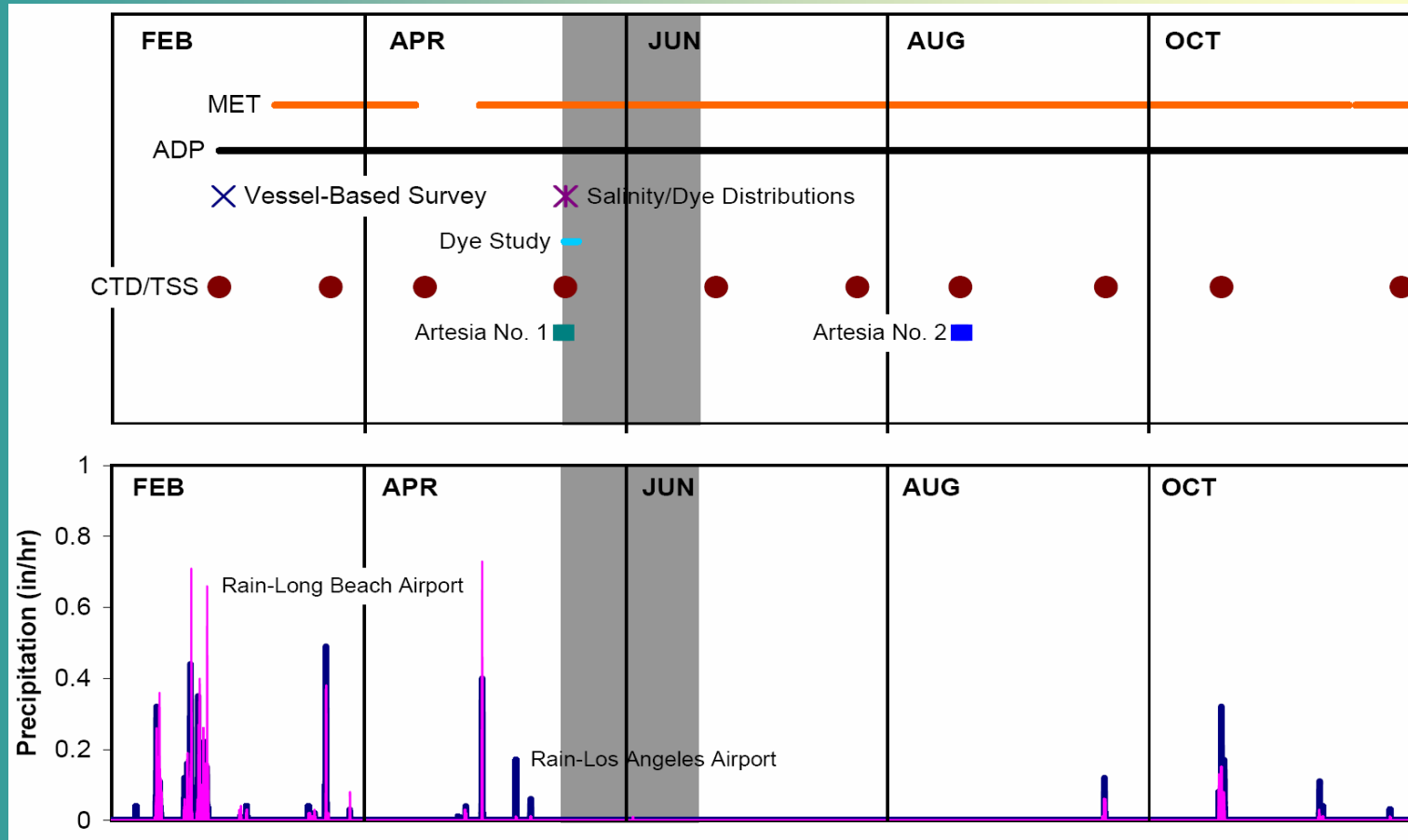
# Multiple Winds



Dominguez Channel Estuary Model Study



# Dry Weather Calibration Period May 17 – June 17, 2005



# Calibration Parameters

- ❖ Horizontal and vertical viscosity/diffusivity
- ❖ Roughness height
- ❖ Cohesive settling velocity
- ❖ Equilibrium partition coefficient

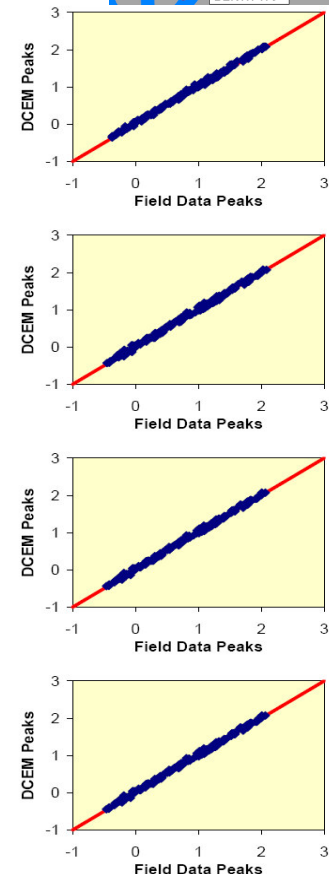
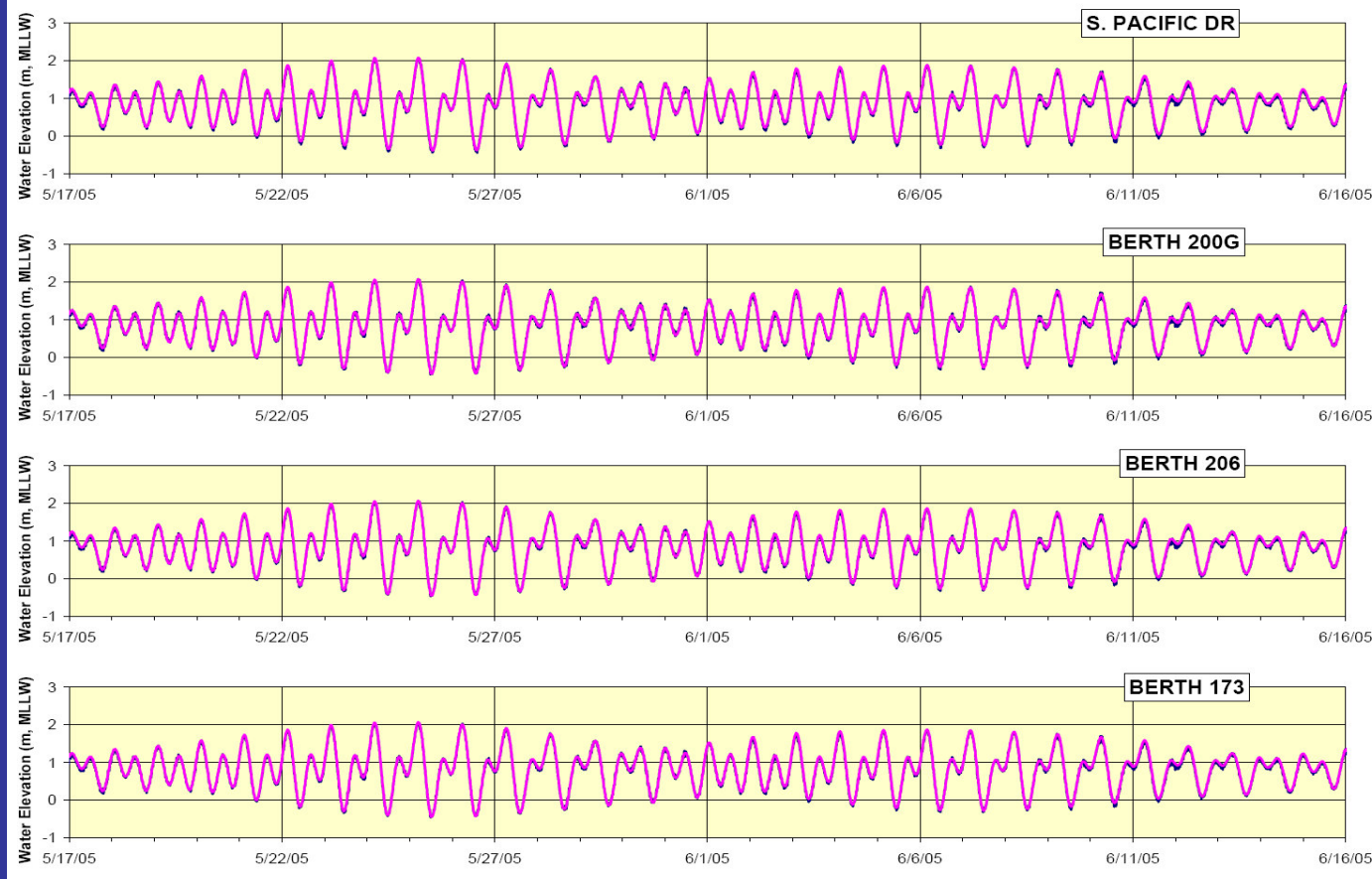
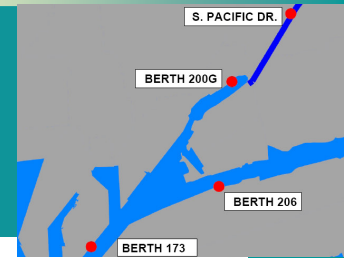
# Hydrodynamics

Hydrodynamic Parameter	DC Locations	Other Locations	Model Comparison	Field Data
Water Surface Elevation	1	3	5/17/05 – 6/17/05	Fixed Velocity (ADP)
Along Channel Velocity	1	3	5/17/05 Peak ebb and flood (neap tide) 5/24/05 Peak ebb, peak flood, and slack tides (spring tide)	Fixed Velocity (ADP)
Along Channel Velocity Profile	1	0	5/17/05 – 6/17/05	Fixed Velocity (ADP)

# Water Quality

Water Quality Parameter	DC Locations	Other Locations	Model Comparison	Field Data
Salinity Vertical Profiles	2	2	Single measurement 5/17/05	Estuary CTD
	0	21	Periodically 5/17/05	Salinity Distribution
Dye	0	3	5/17/05 – 5/20/05	Dye Study
Dye Vertical Profile	0	21	Periodically 5/17/05	Dye Study
TSS	2	2	Single sample 5/17/05 (2 depths for channel locations, 3 depths for harbor locations)	Estuary Water Quality Sampling – Suite B
Chromium (Cr)	2	2		
Copper (Cu)	2	2		
Lead (Pb)	2	2		
Zinc (Zn)	2	2		

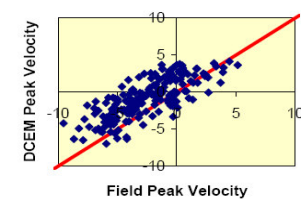
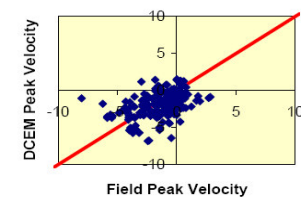
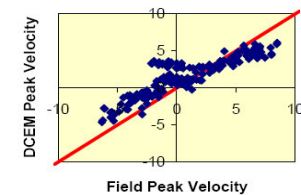
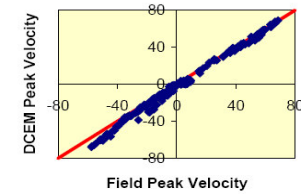
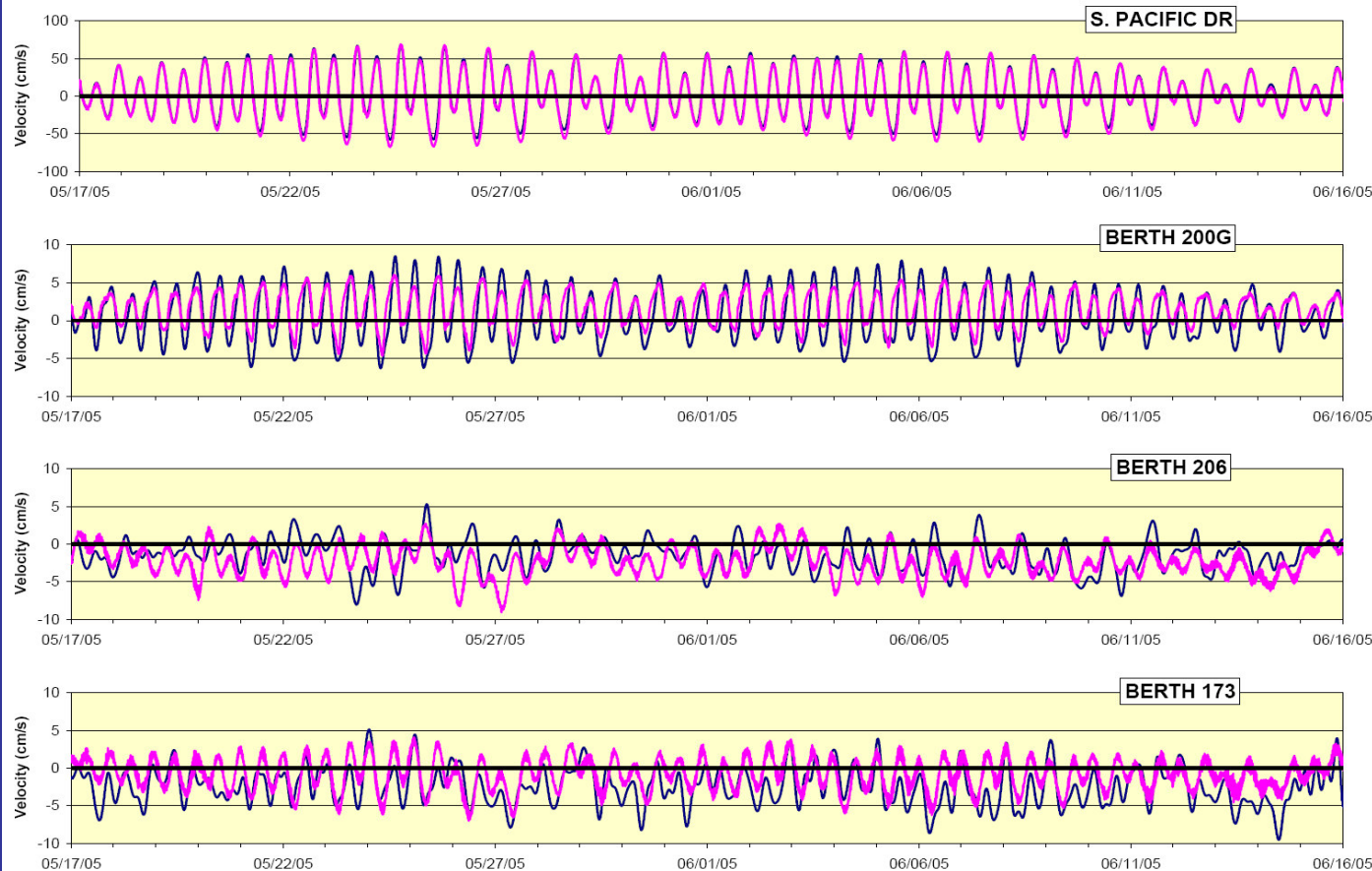
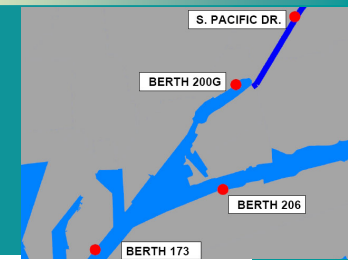
# Water Surface Elevations



— Field Data — DCEM



## Velocity

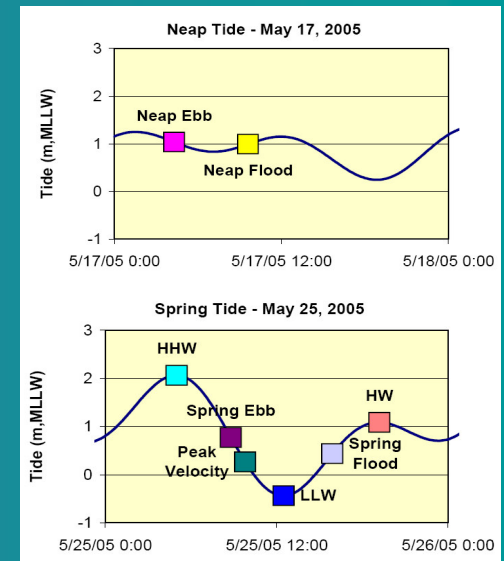
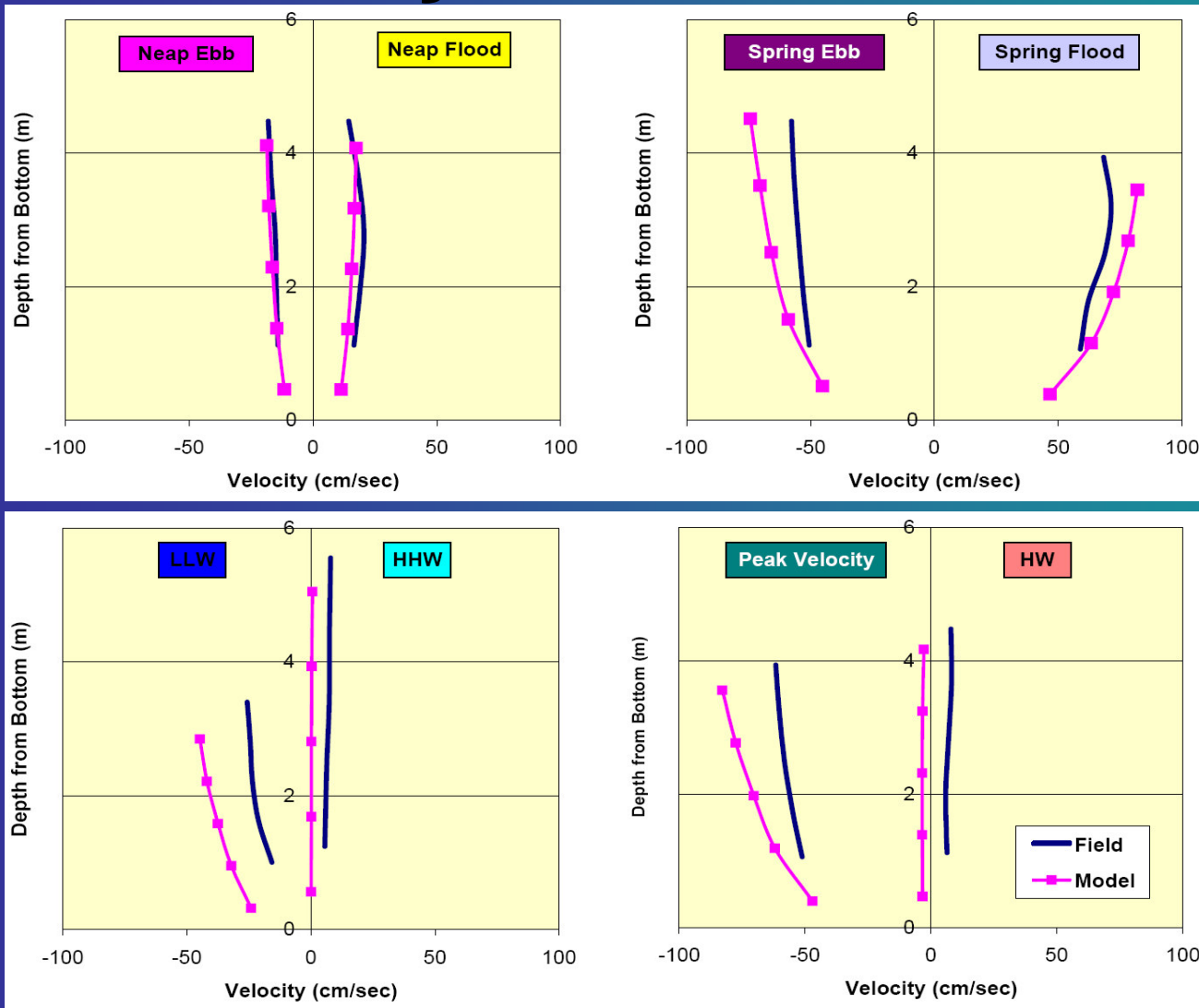


— Field Data    — DCEM

Dominguez Channel Estuary Model Study



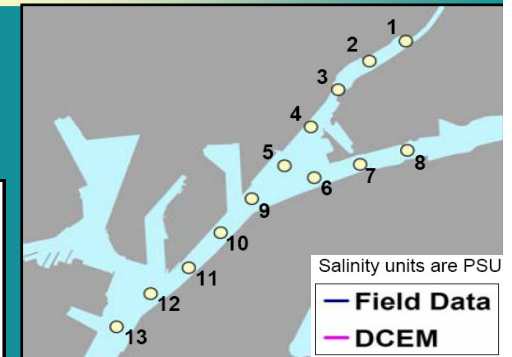
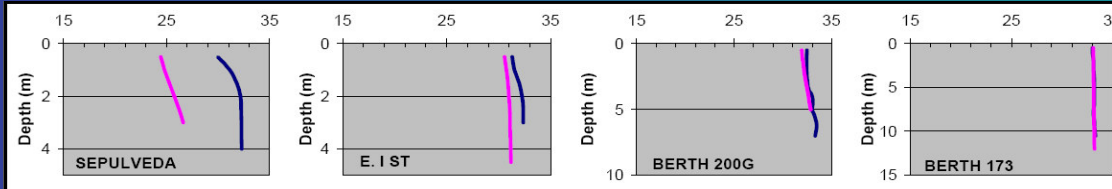
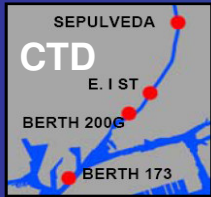
# Velocity Profiles – S. Pacific Dr



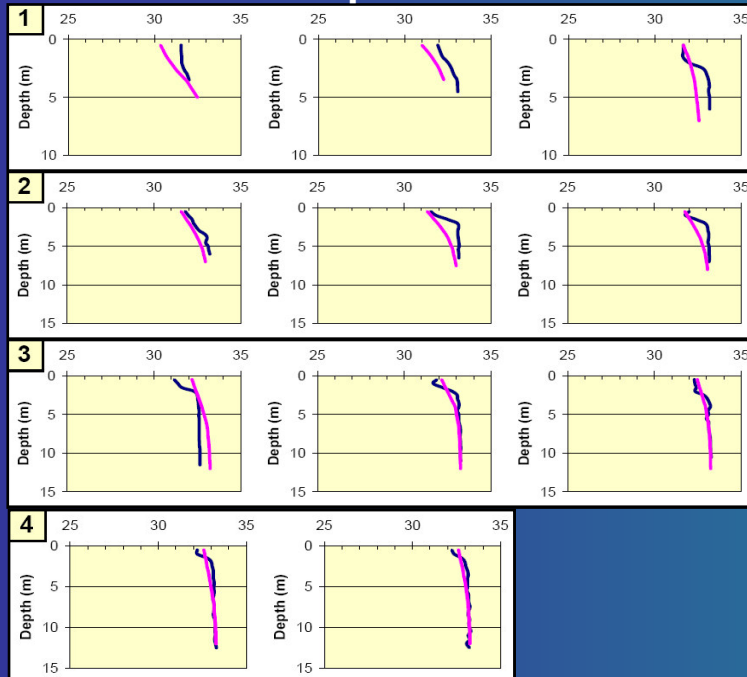
Dominguez Channel Estuary Model Study



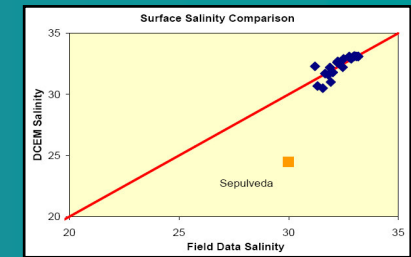
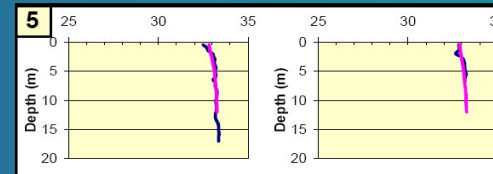
## Salinity



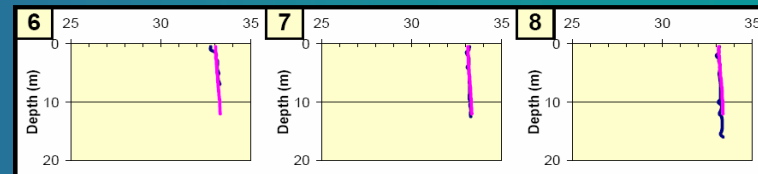
### Consolidated Slip



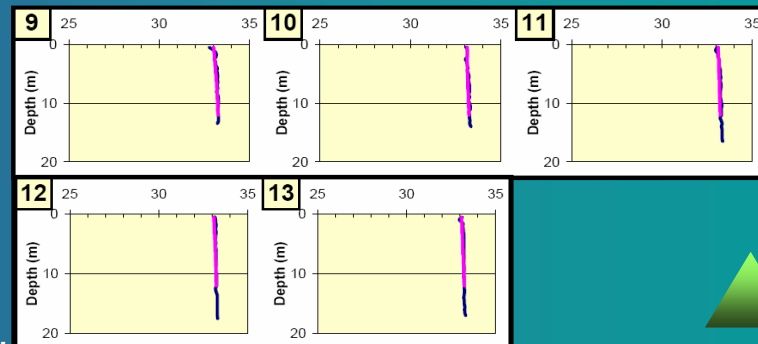
### East Basin



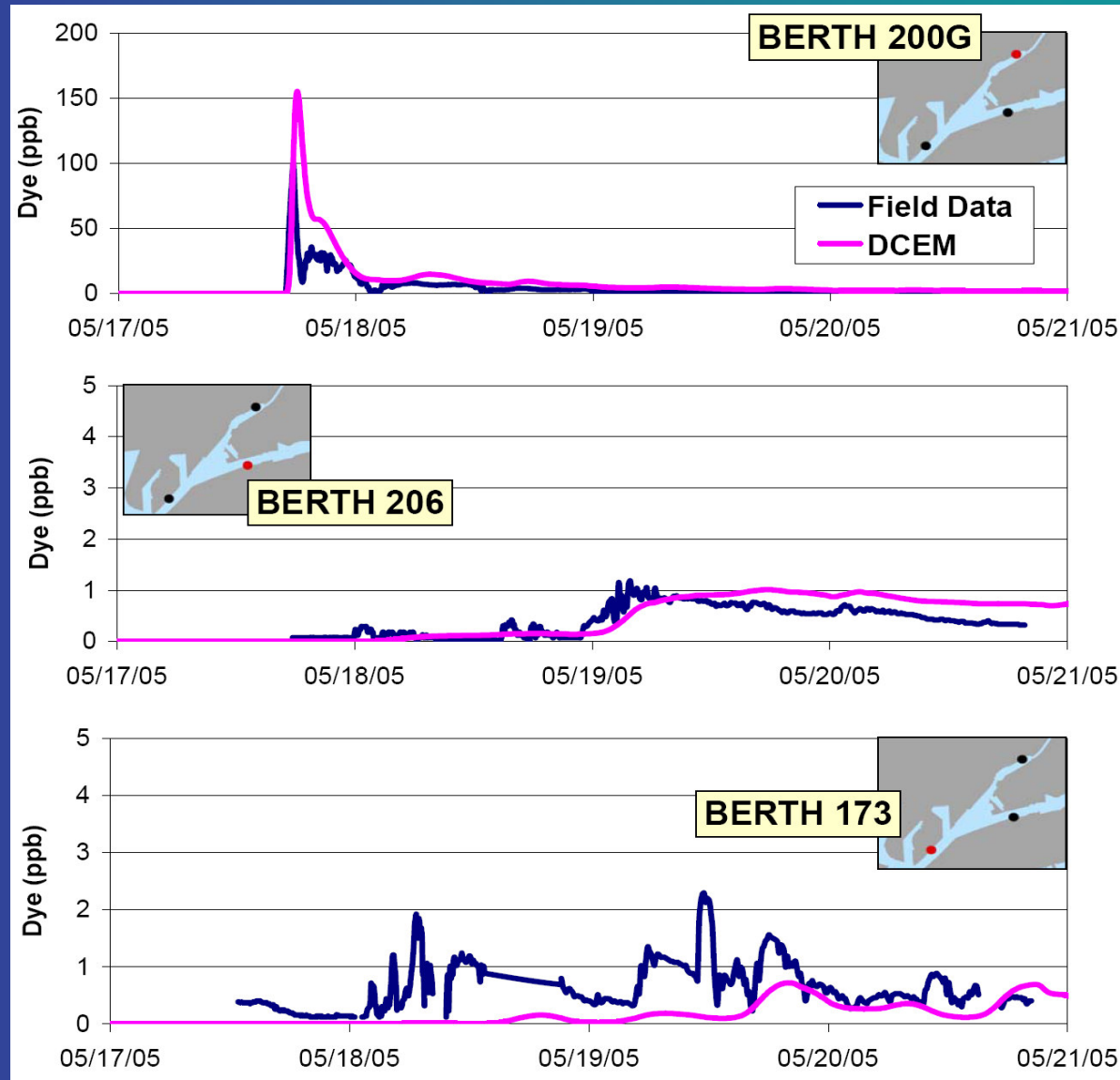
### Cerritos Channel



### Main Channel

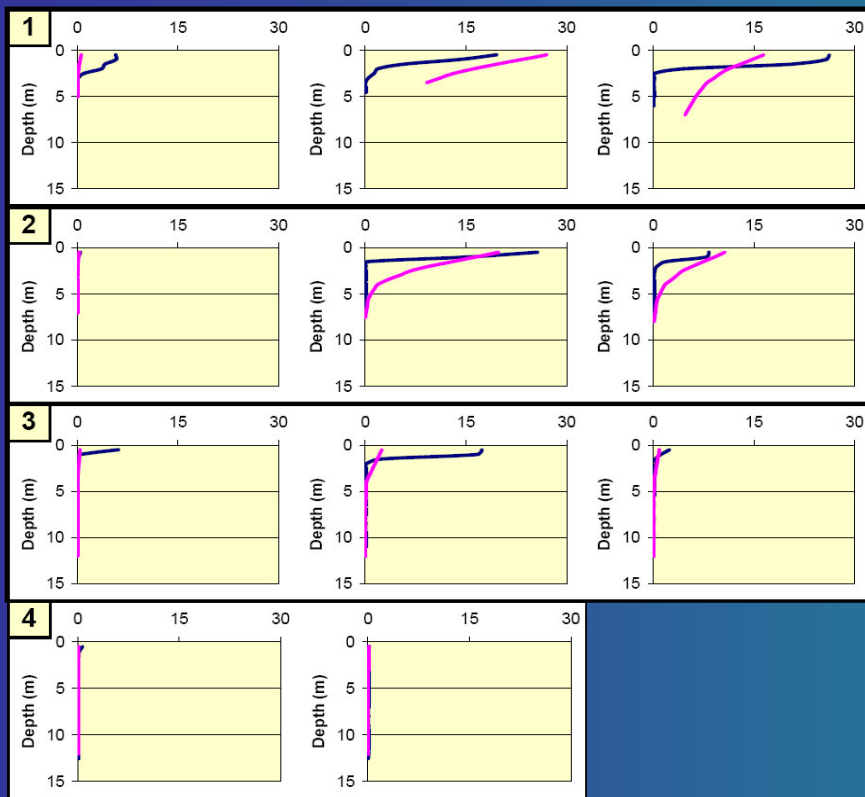


# Dye

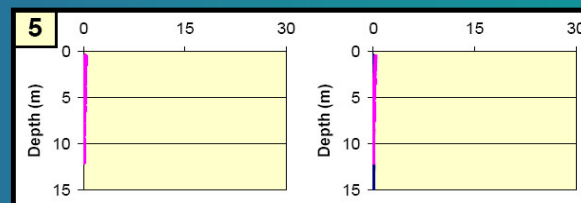


# Dye

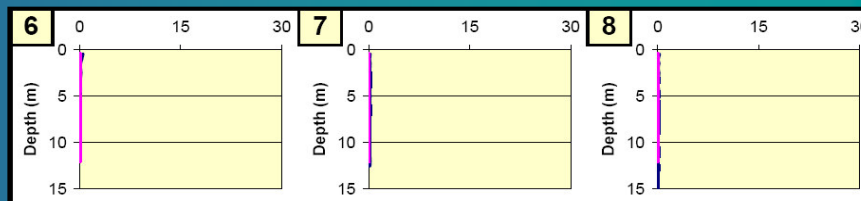
## Consolidated Slip



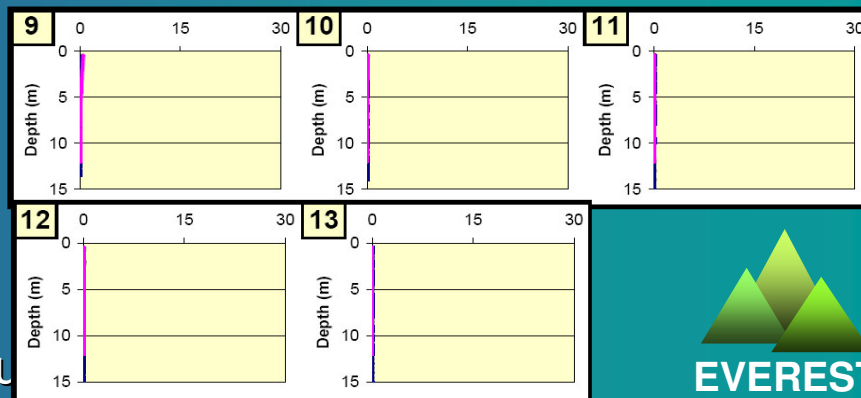
## East Basin



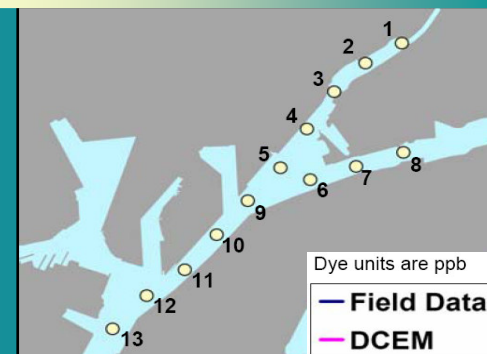
## Cerritos Channel



## Main Channel



## Dry Weather Calibration



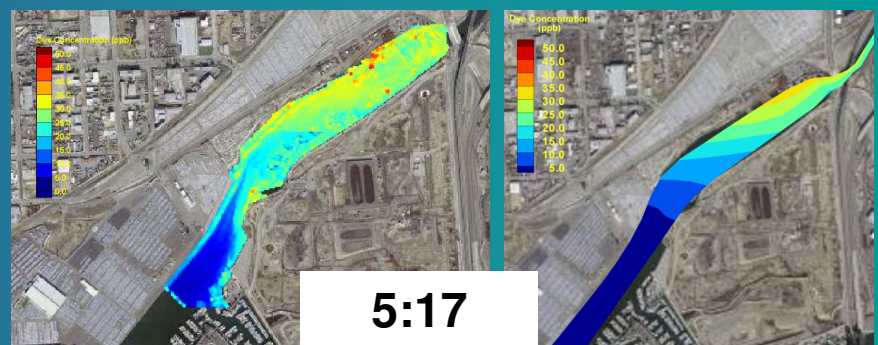
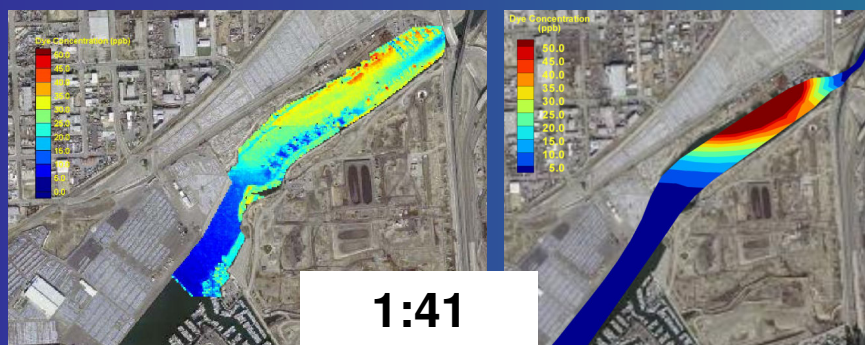
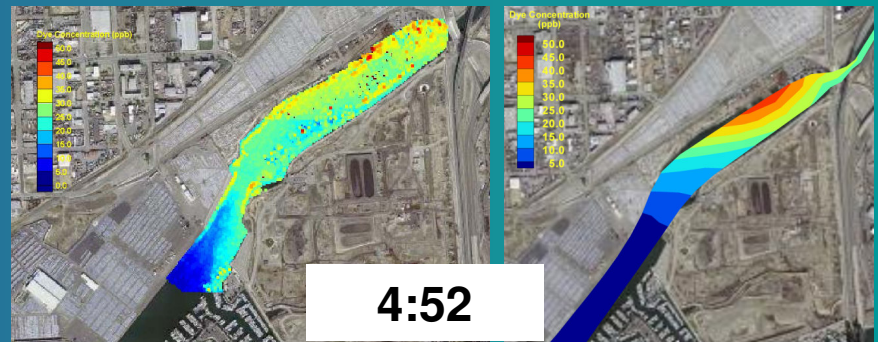
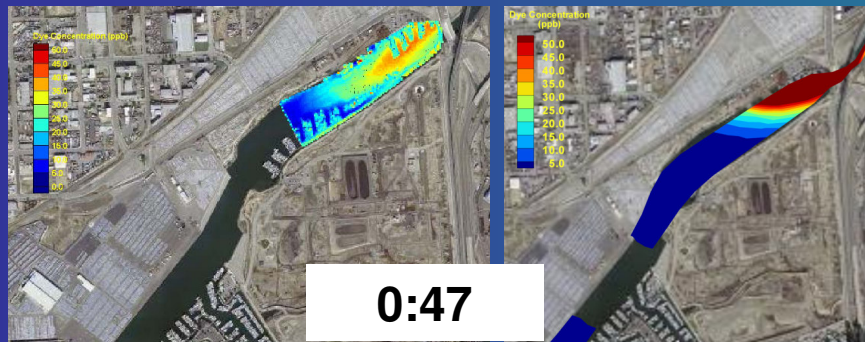
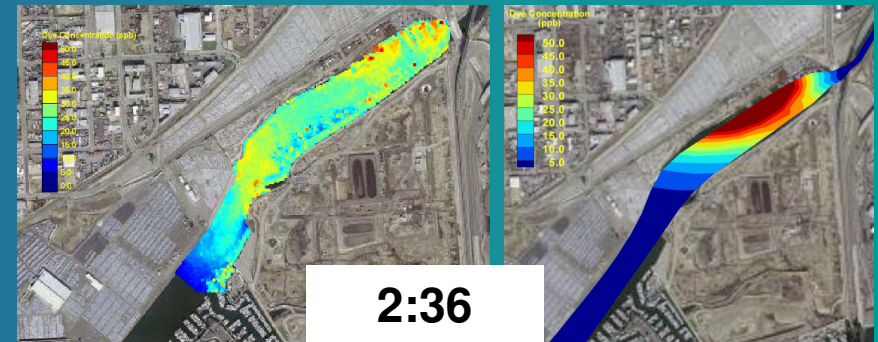
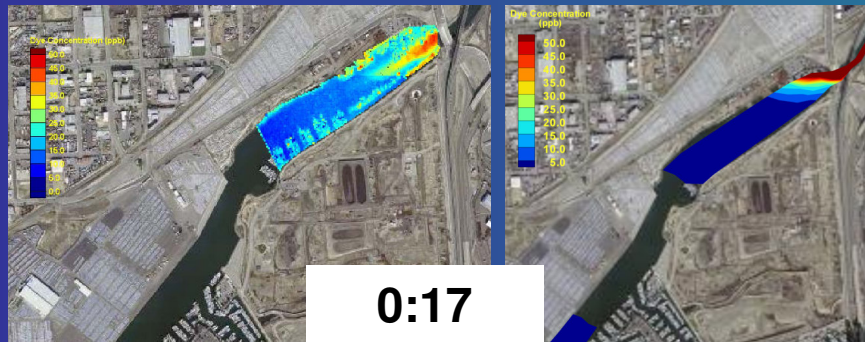
Dominguez Channel Estuary Model Study





# Calibrated Dye

Dry Weather Calibration

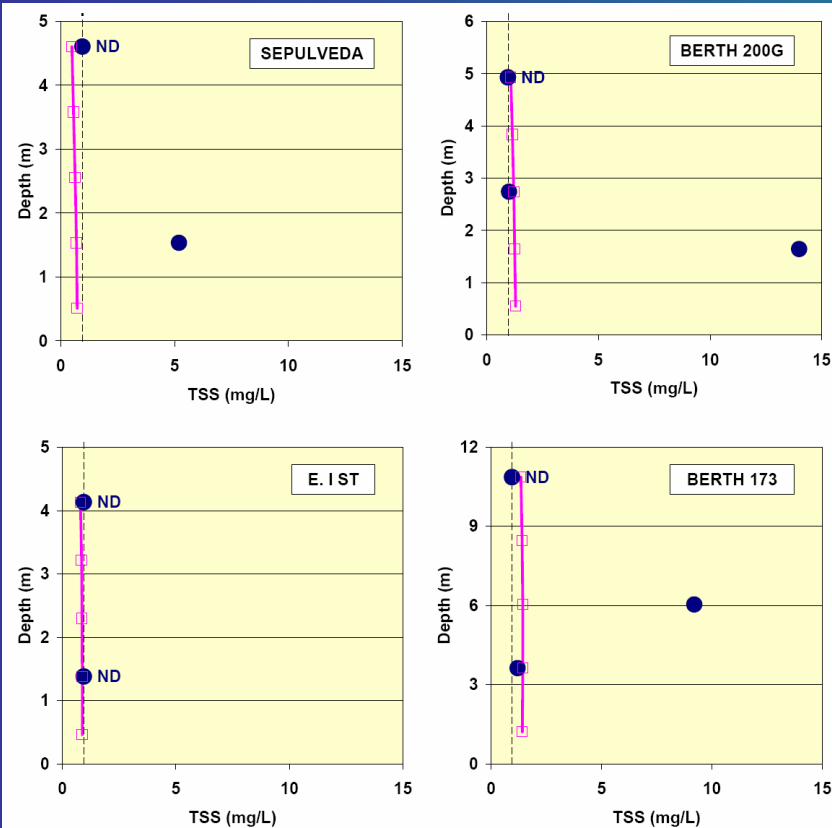


5:17 = 5 hours 17 minutes after Dye Released in Dominguez Channel

Dominguez Channel Estuary Model Study

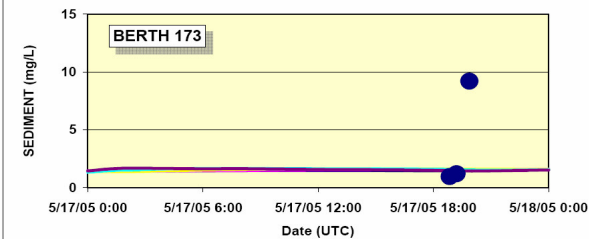
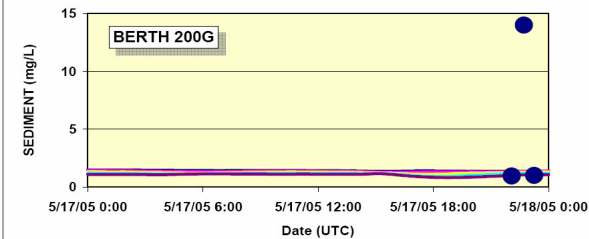
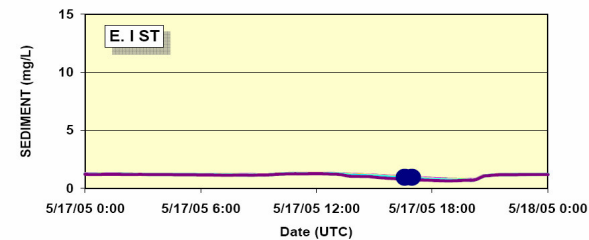
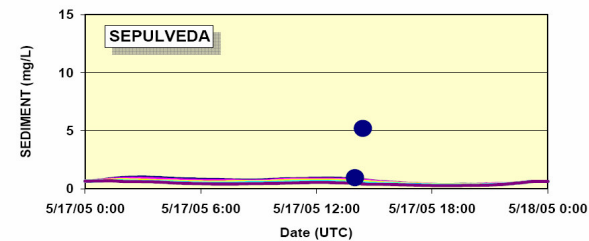


## Calibrated TSS

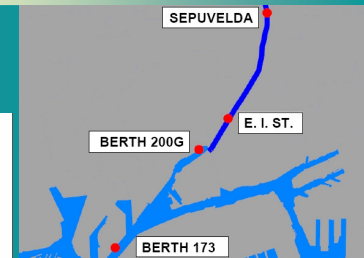


ND=Non-Detect

● Field Data    □ Calibrated TSS    --- TSS MDL



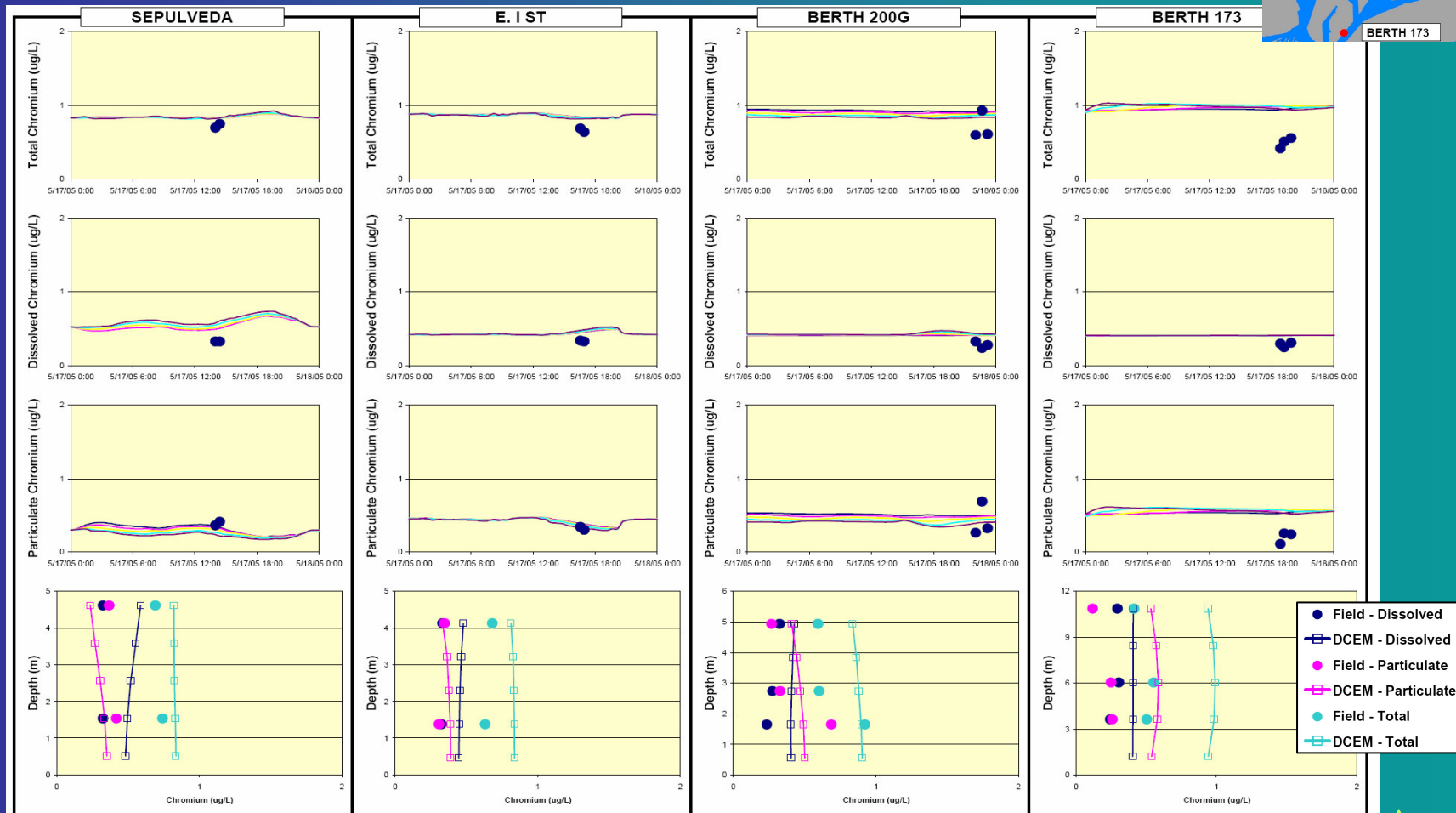
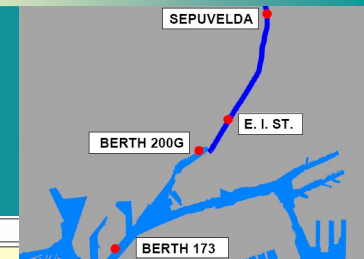
● Field Data    — Bottom    — Middle    — Surface



Dominguez Channel Estuary Model Study



# Chromium



● Field Data — Bottom — Middle — Surface

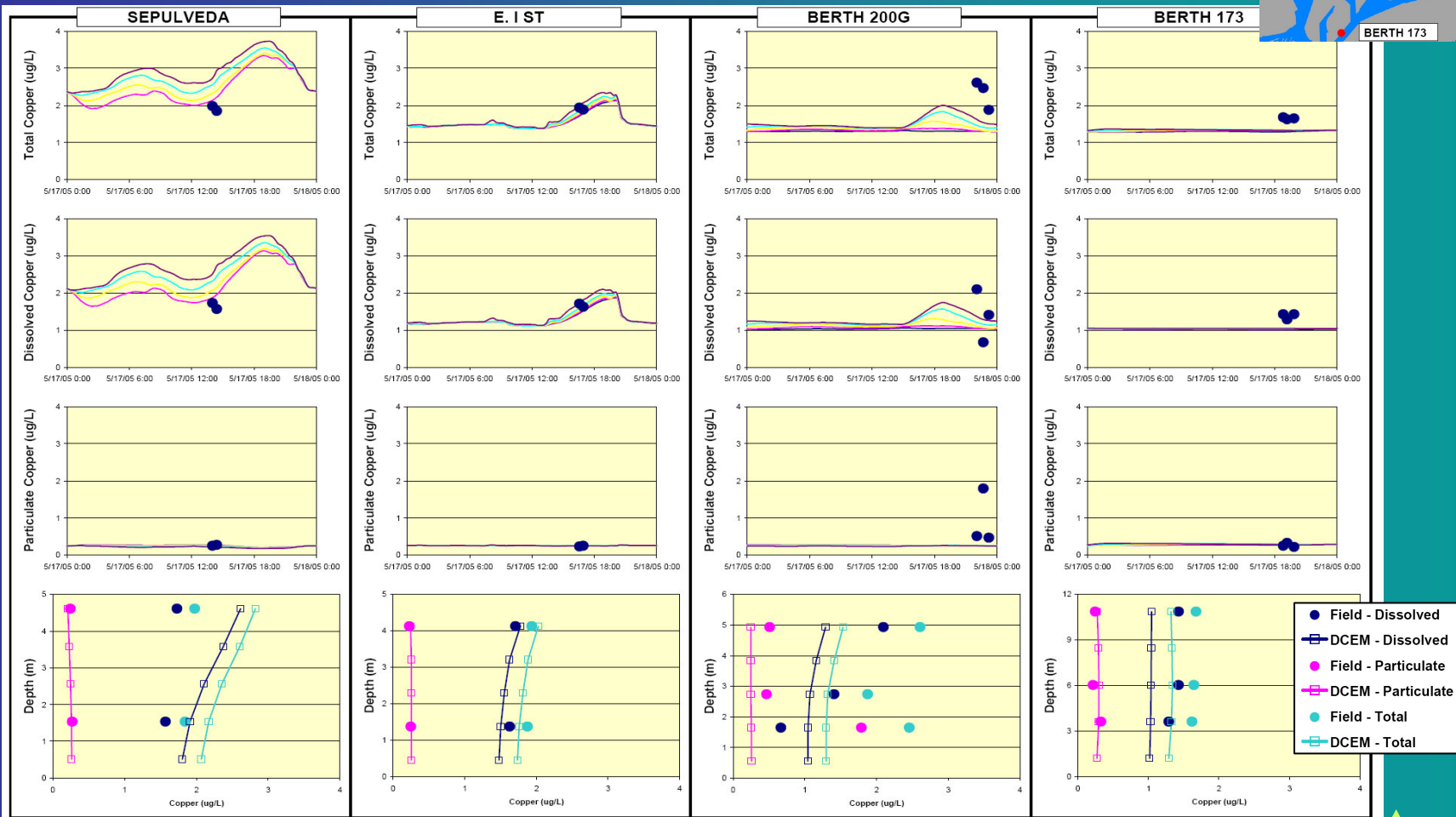
Dominguez Channel Estuary Model Study





# Copper

## Dry Weather Calibration

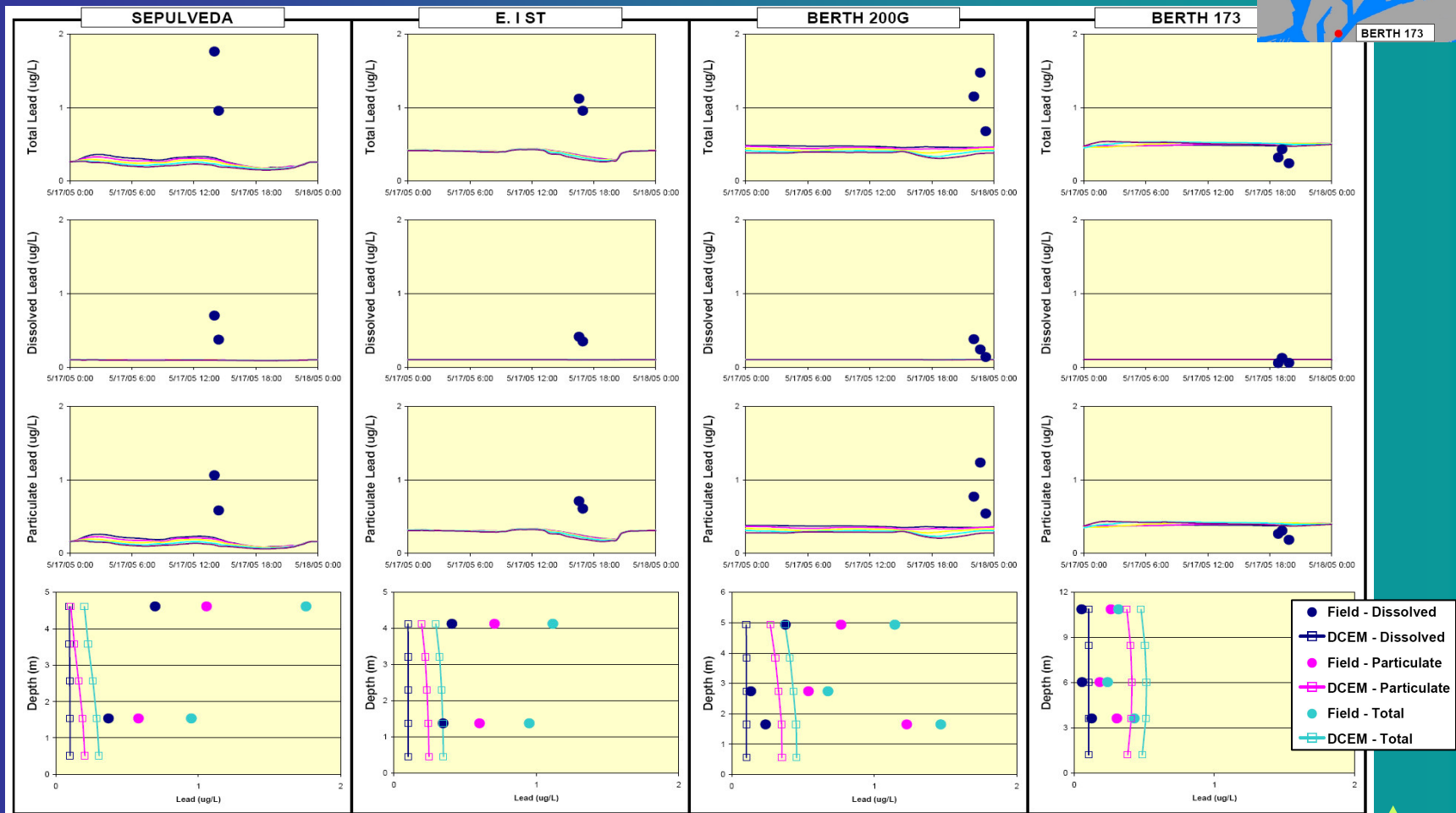
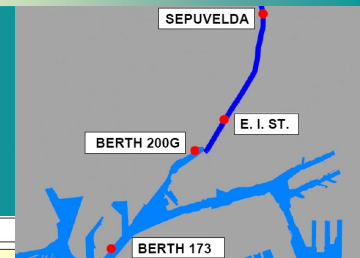


Dominguez Channel Estuary Model Study



# Lead

## Dry Weather Calibration



● Field Data — Bottom — Middle — Surface

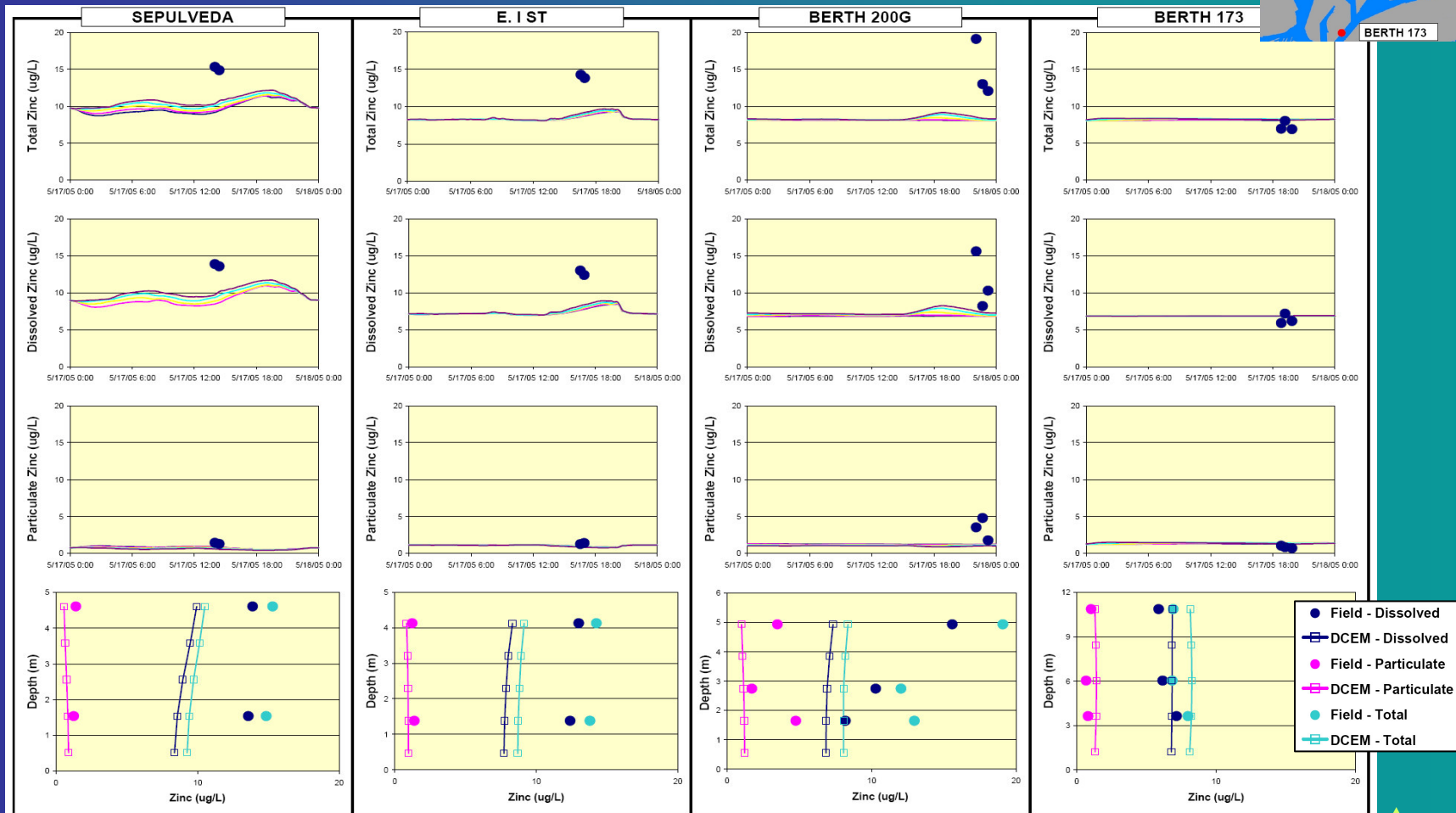
Dominguez Channel Estuary Model Study





# Zinc

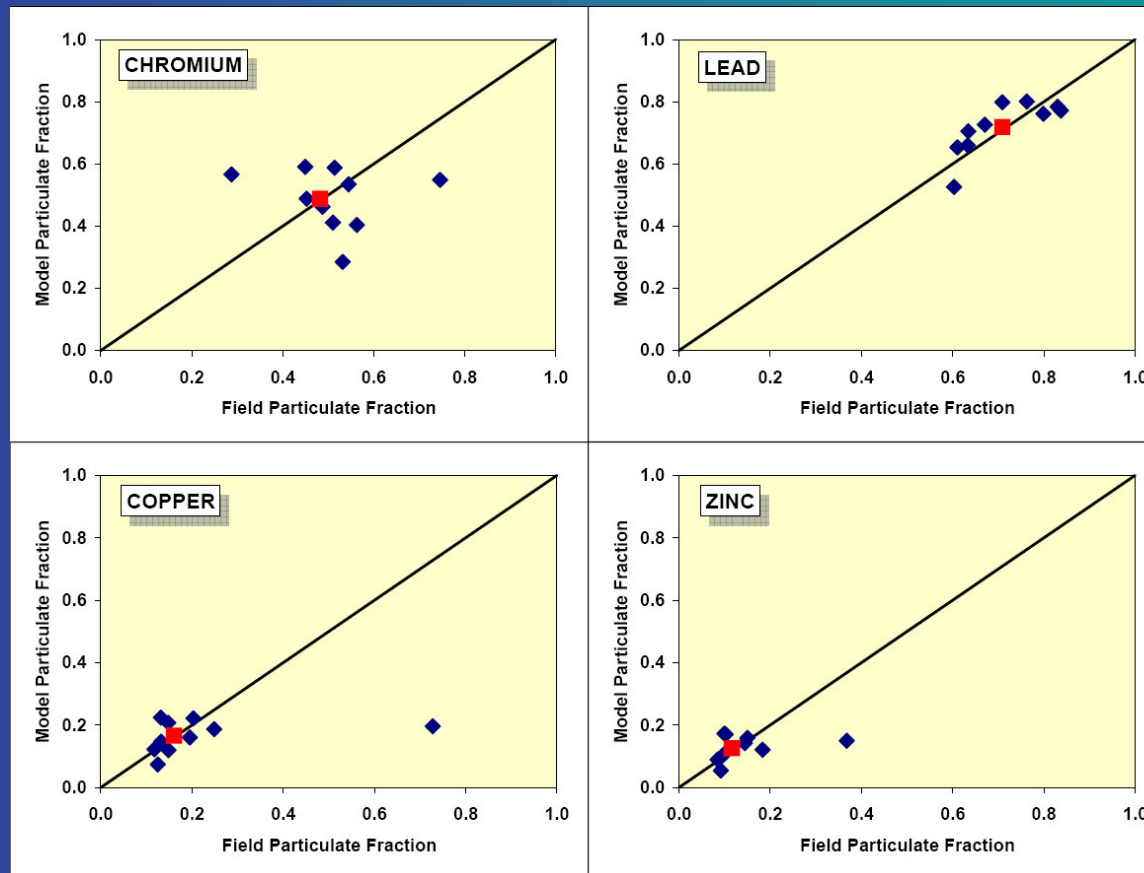
## Dry Weather Calibration



Dominguez Channel Estuary Model Study

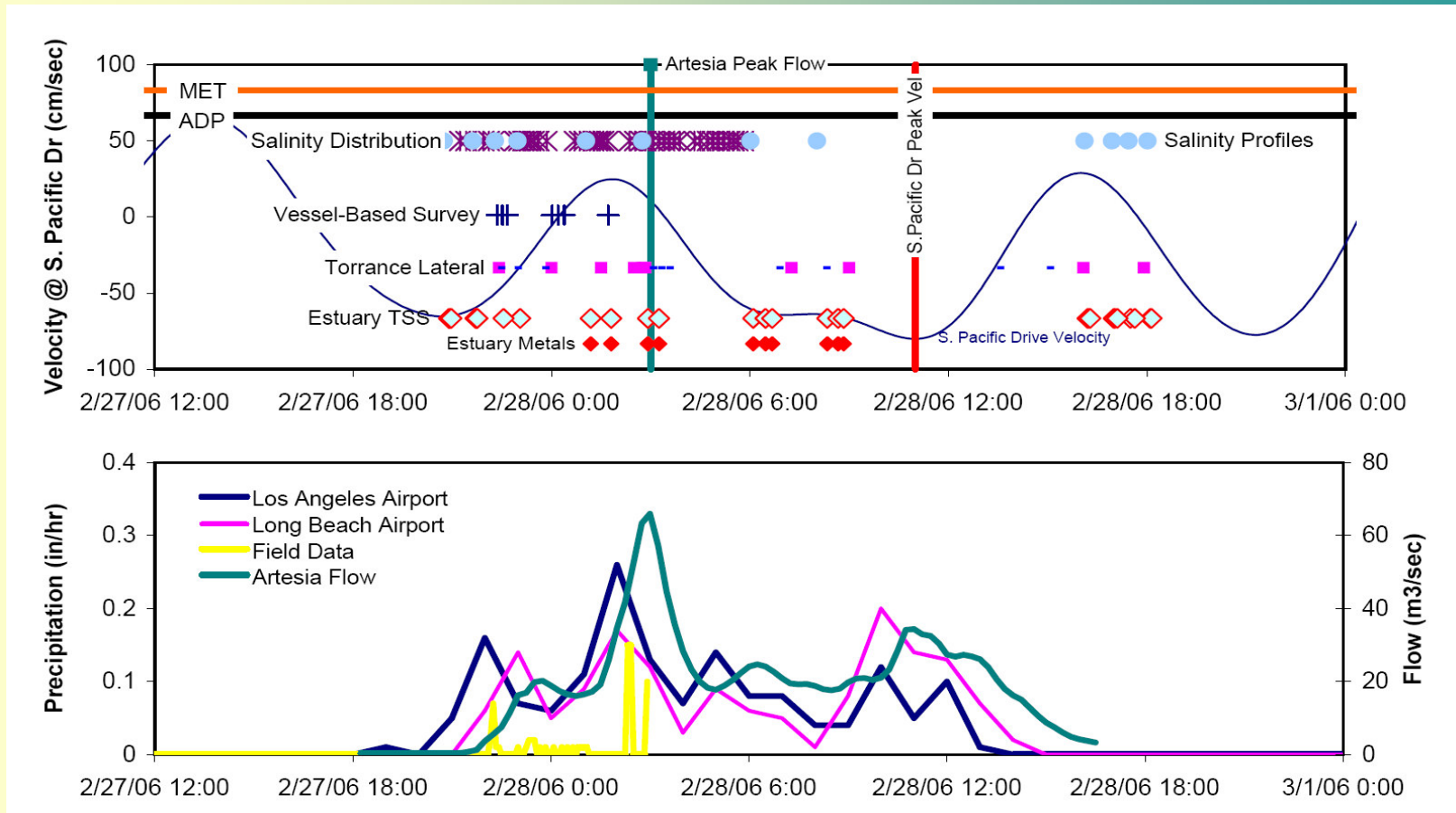


# Particulate Fraction

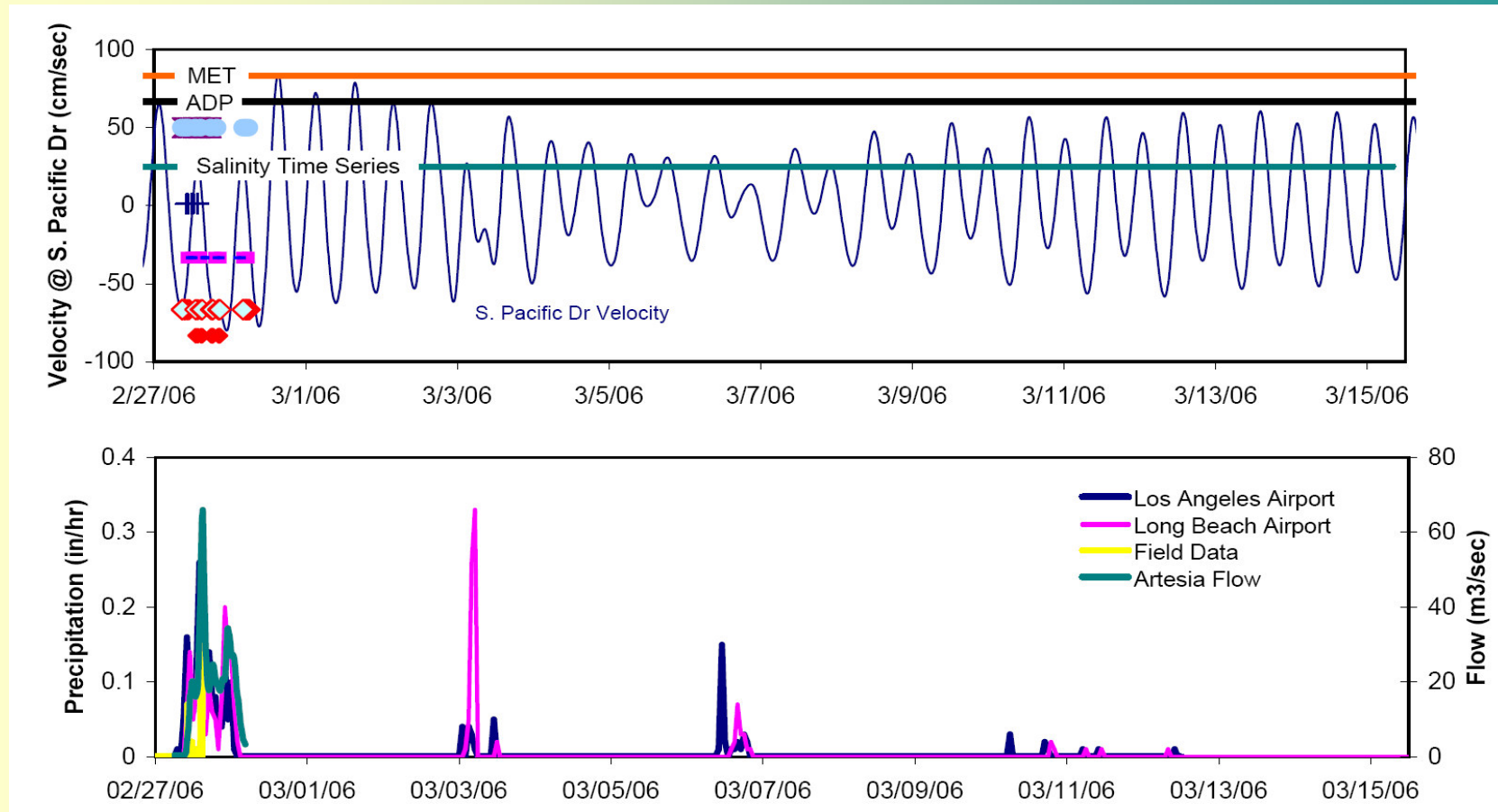


◆ Metal Particulate Fraction ■ Average

# Wet Weather Calibration February 27-28, 2006



# Wet Weather Calibration February 27-28, 2006

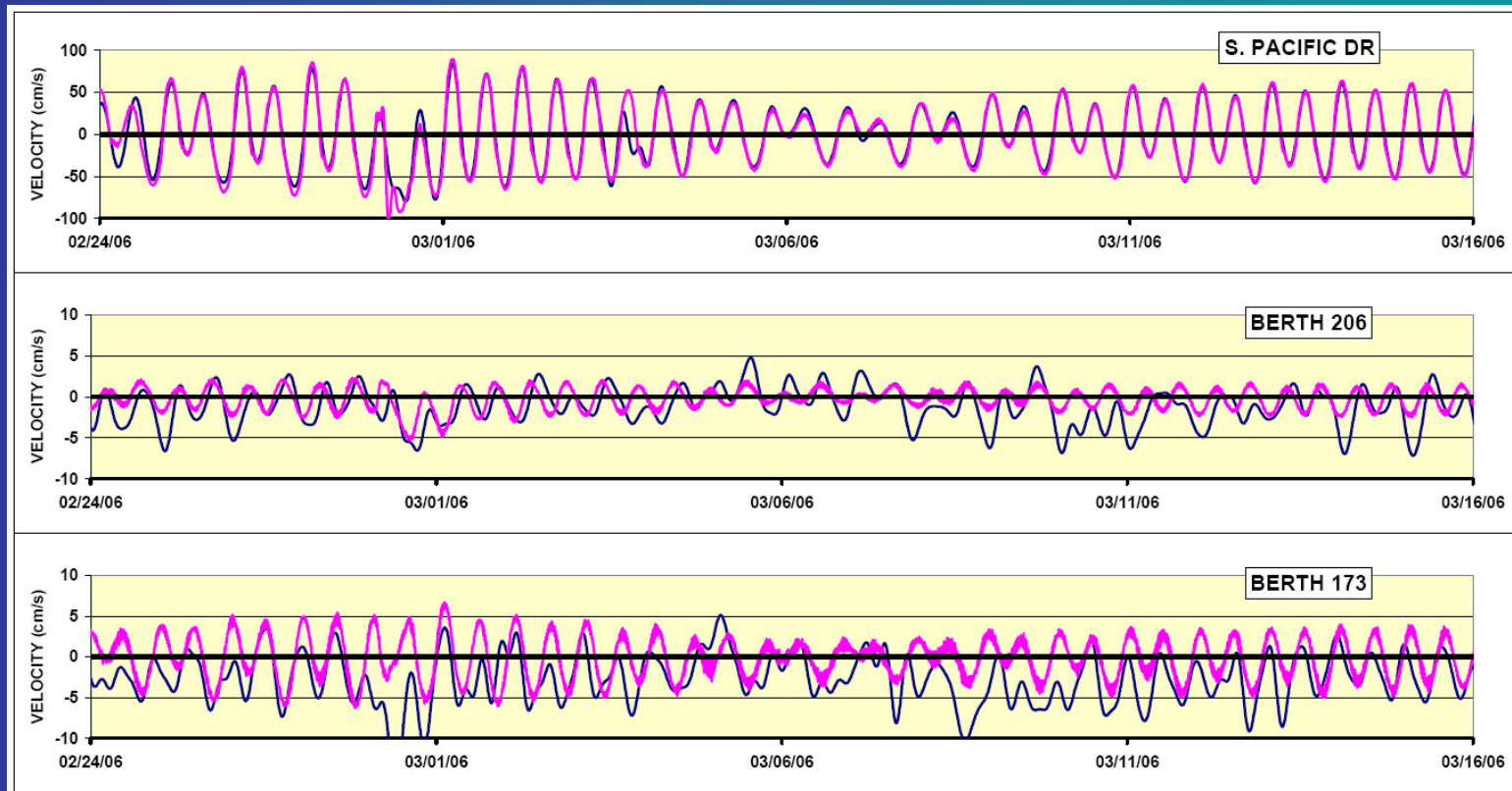
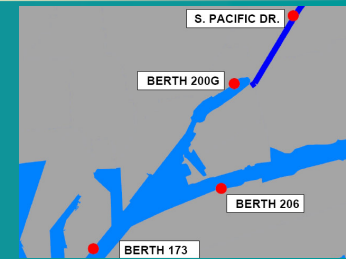


# Wet Weather Calibration

- ❖ Initial conditions same as dry weather
- ❖ Start calibration with dry weather parameters, then modify

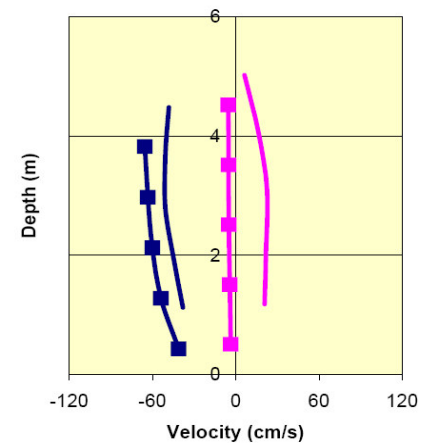
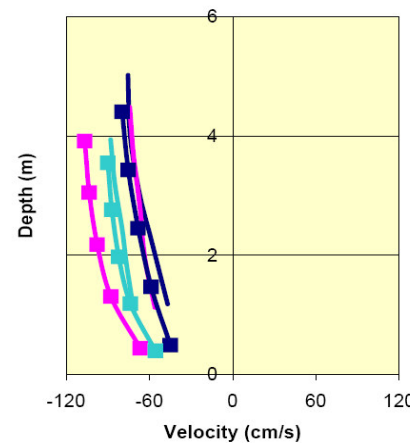
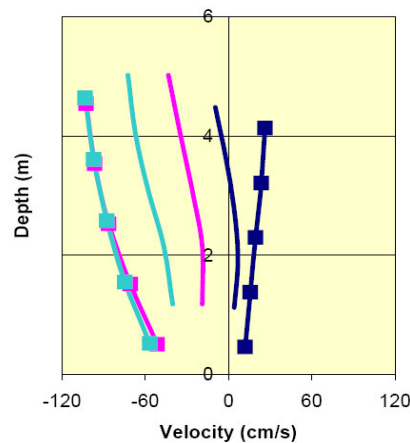
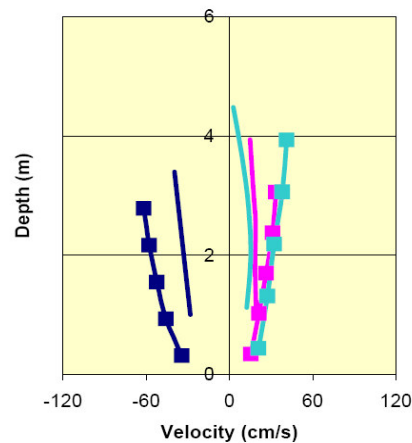
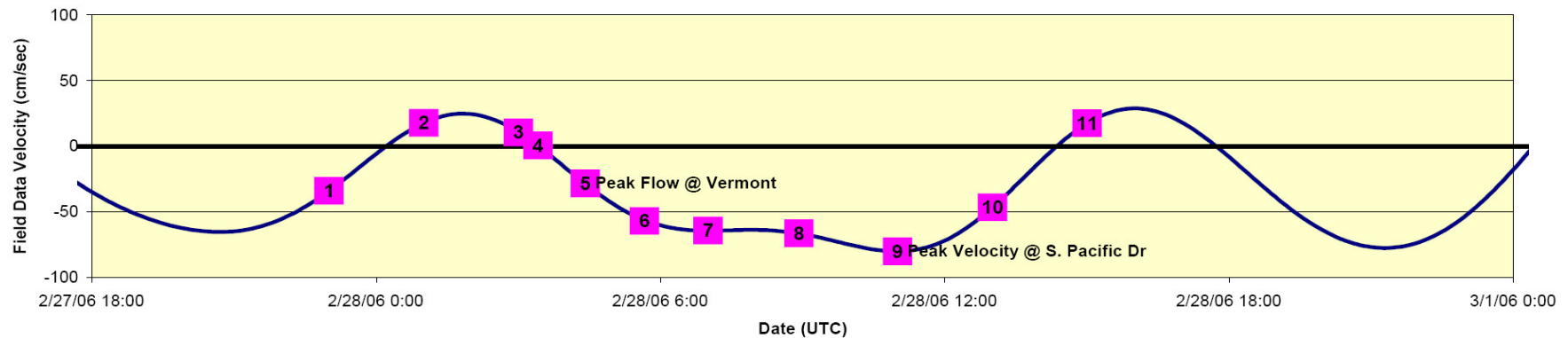


## Velocity



— Field Data — DCEM

# Velocity Profiles – S. Pacific Drive



Field 1    Field 2    Field 3  
DCEM 1    DCEM 2    DCEM 3

Field 4    Field 5    Field 6  
DCEM 4    DCEM 5    DCEM 6

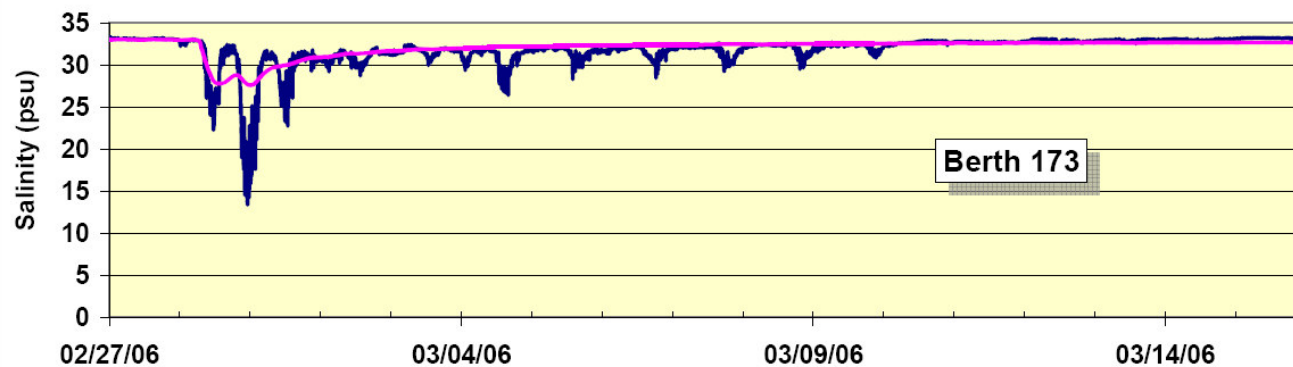
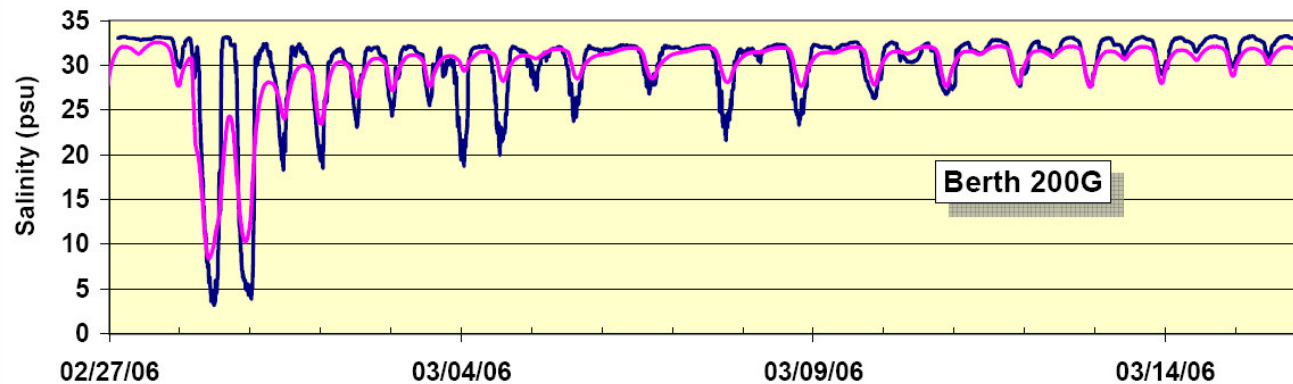
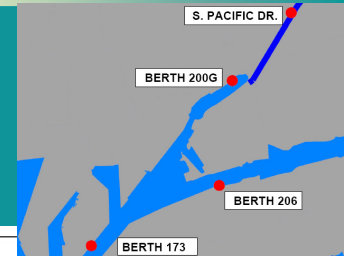
Field 7    Field 8    Field 9  
DCEM 7    DCEM 8    DCEM 9

Field 10    Field 11  
DCEM 10    DCEM 11

# Salinity Field Data



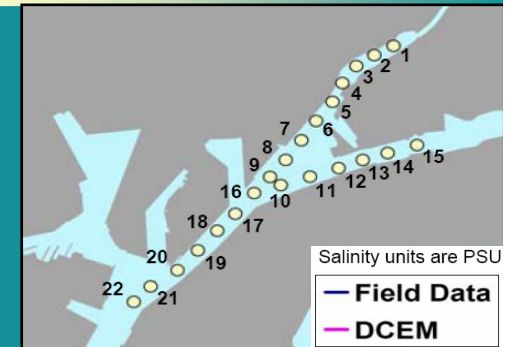
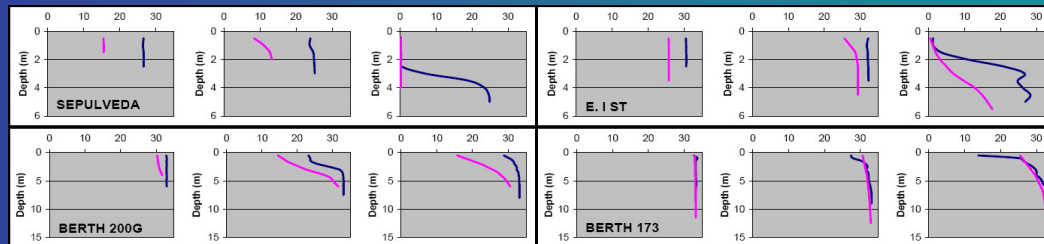
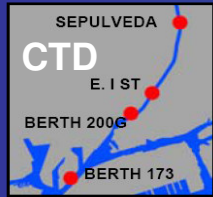
# Calibrated Salinity



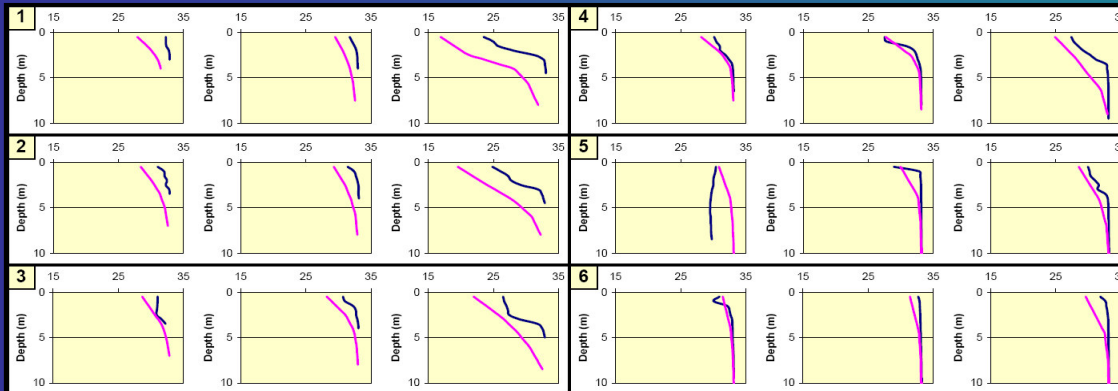
— Field Data — DCEM



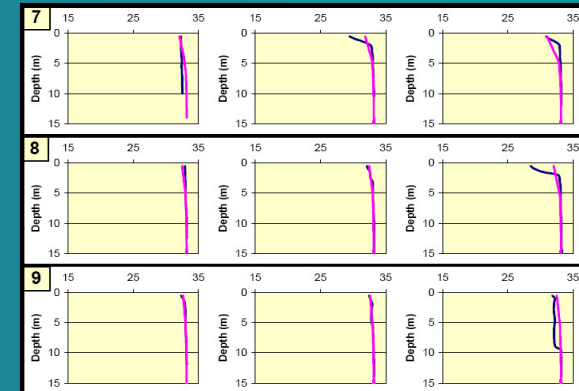
## Salinity



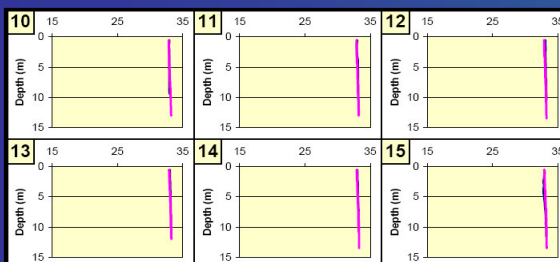
## Consolidated Slip



## East Basin



## Cerritos Channel



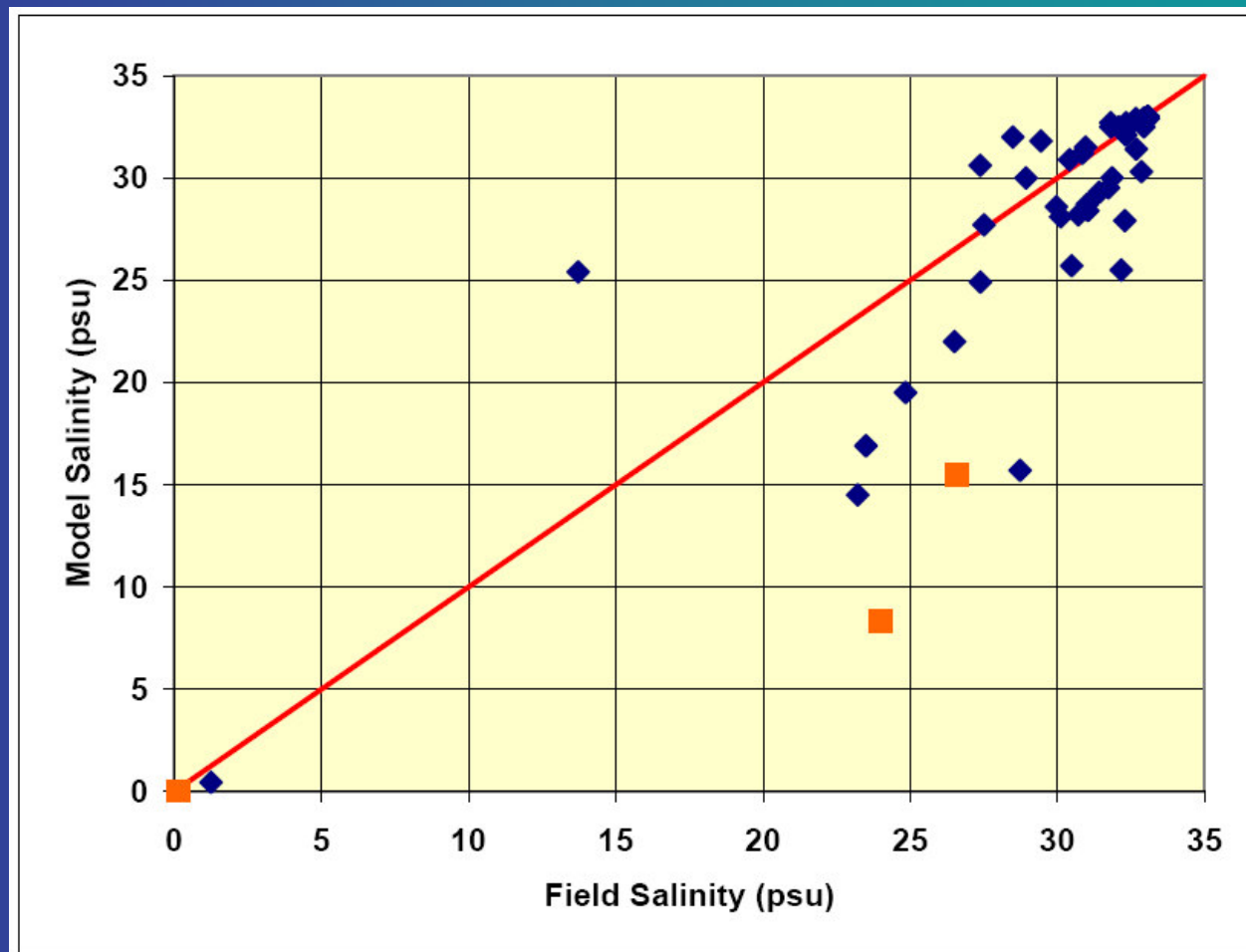
## Main Channel



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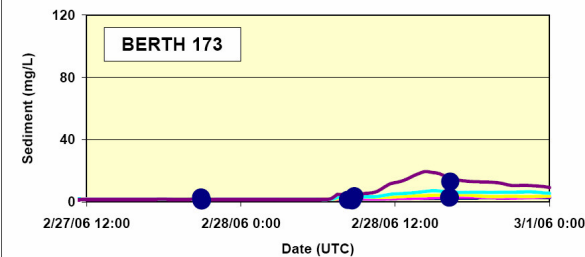
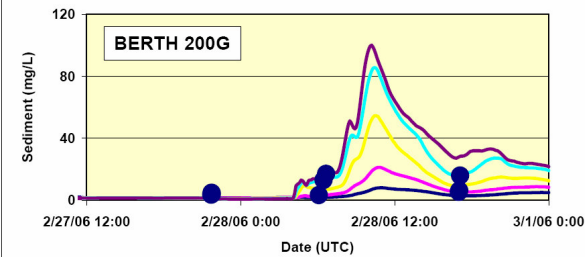
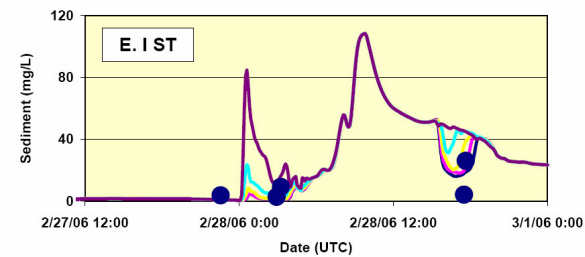
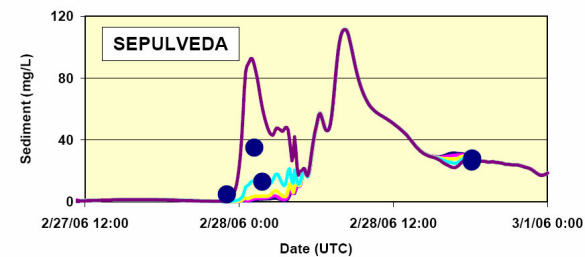
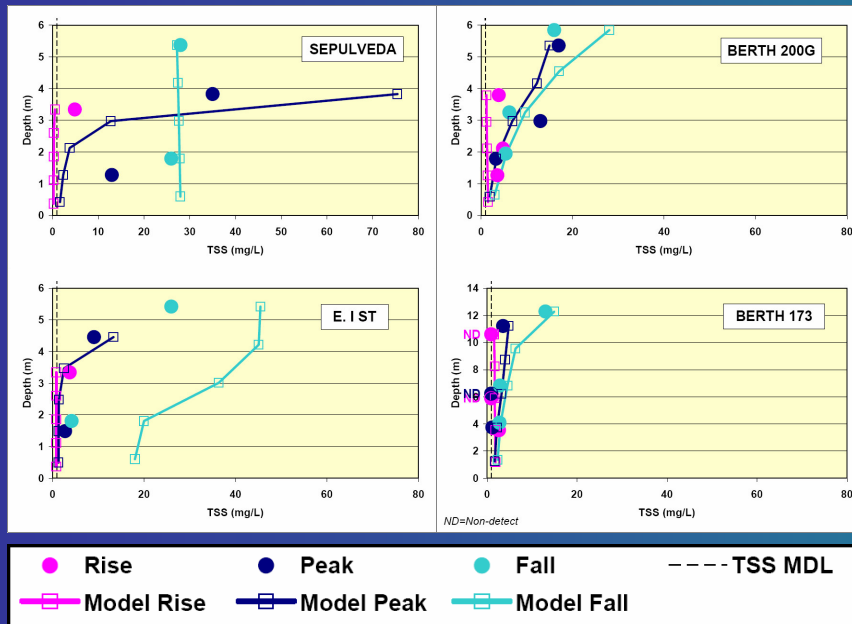
# Salinity Profiles



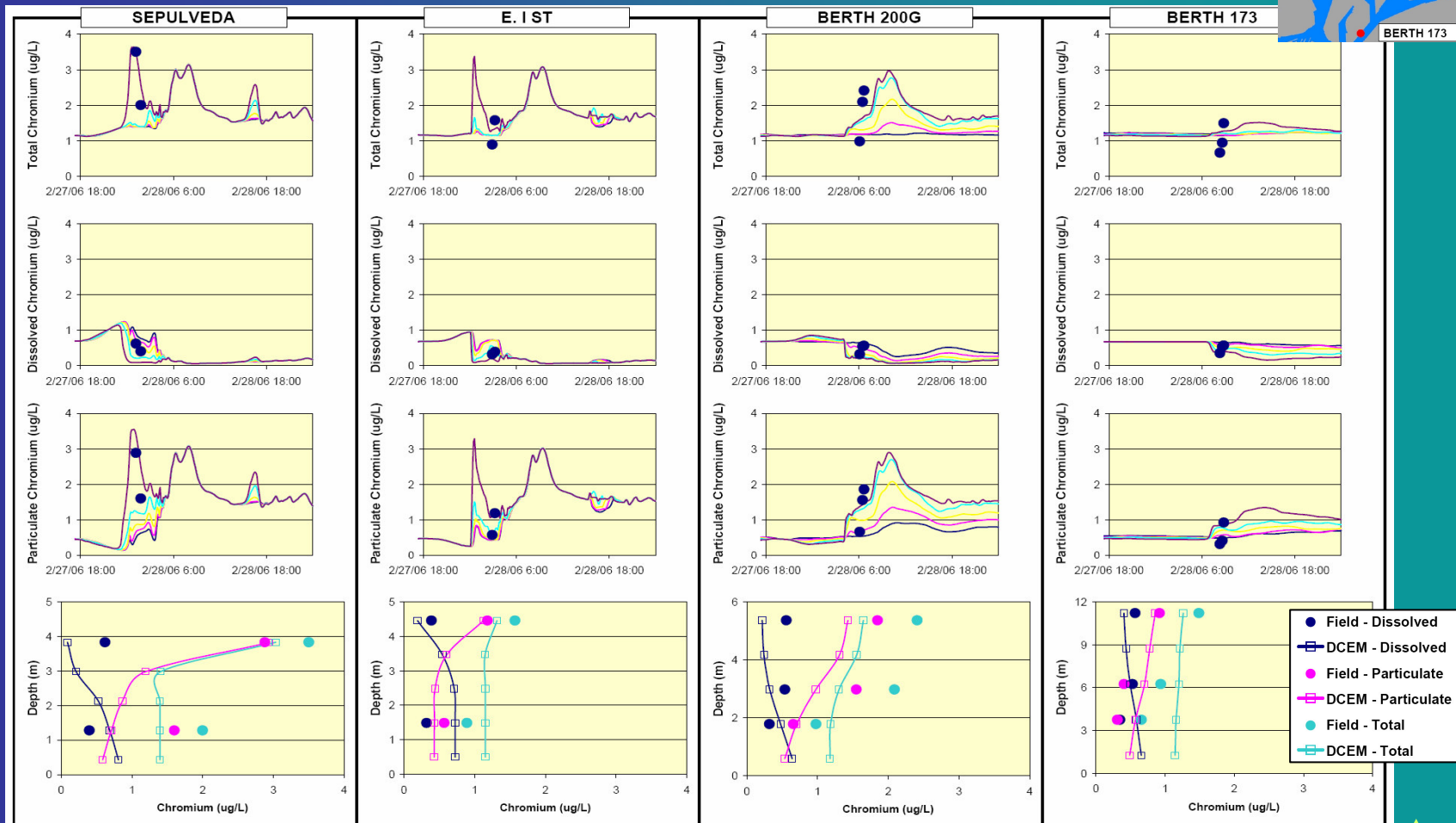
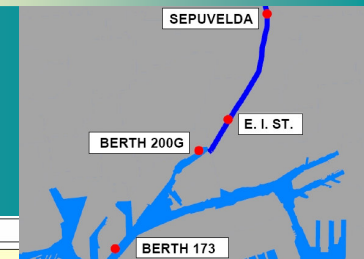
◆ Transects and Other CTD Locations    ■ Sepuvela

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## Calibrated TSS

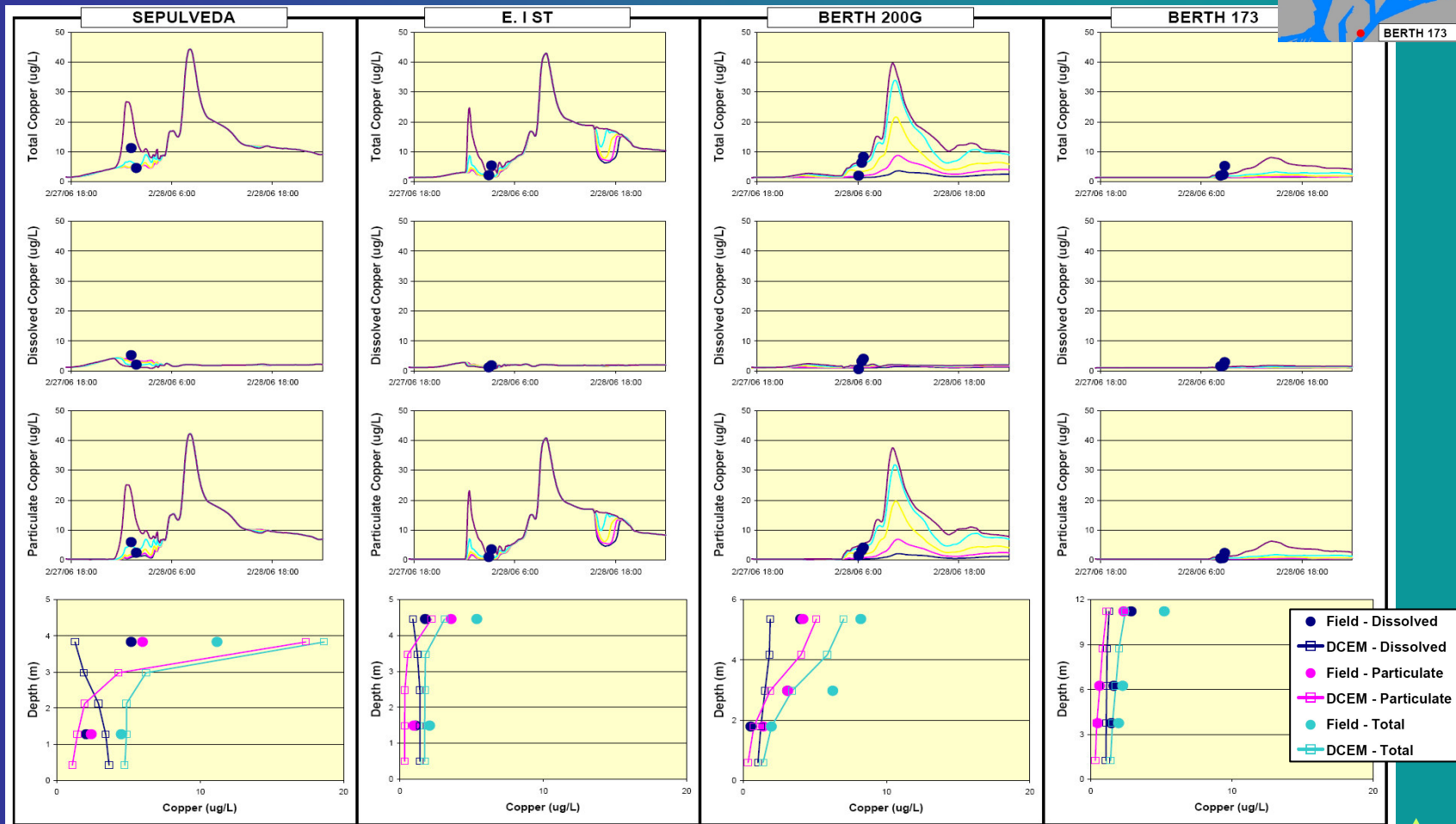
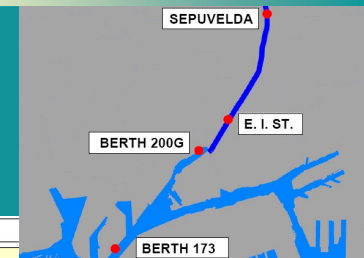


# Chromium



● Field Data — Bottom — Middle — Surface

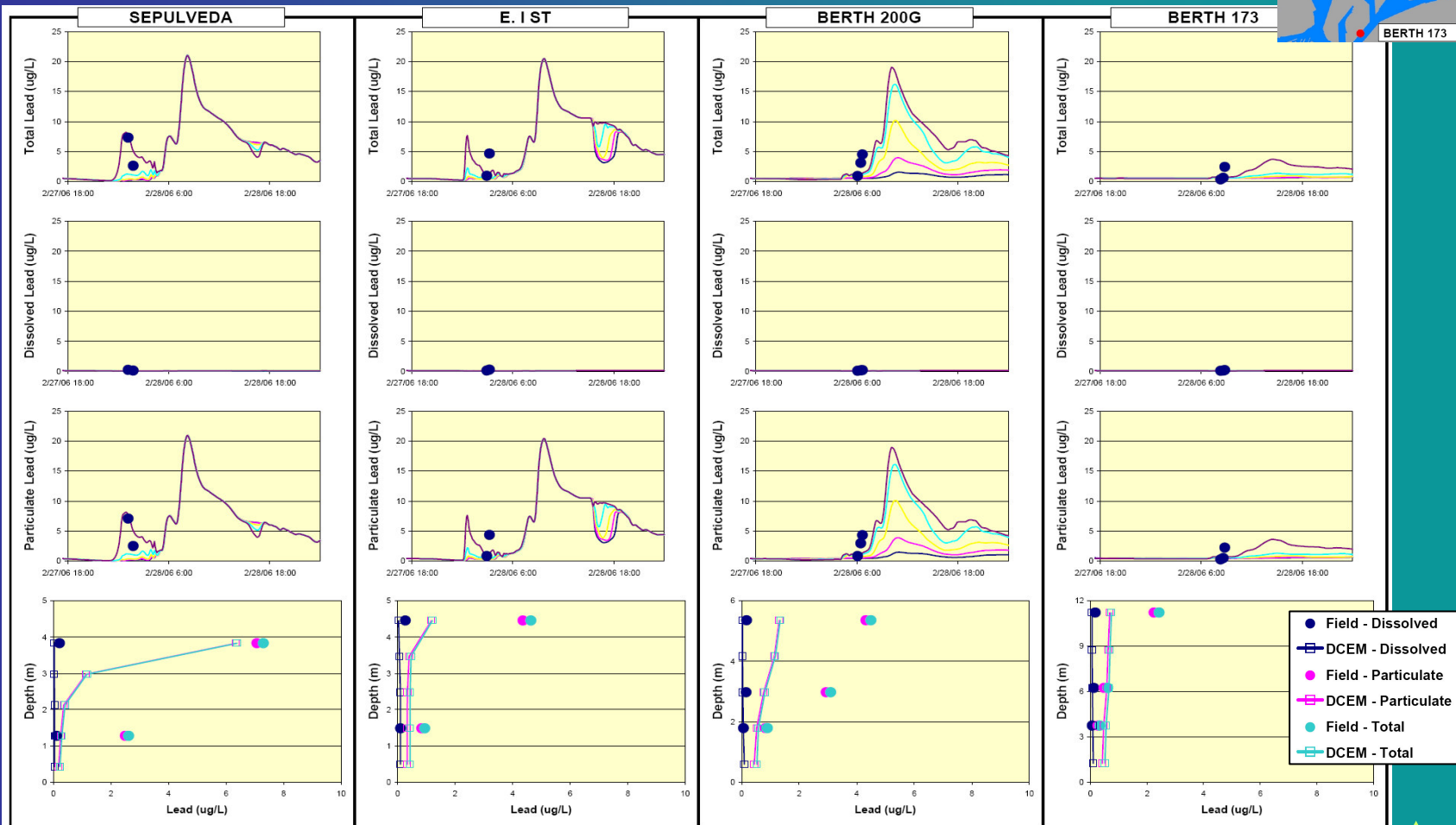
# Copper



● Field Data — Bottom — Middle — Surface

# Lead

## Wet Weather Calibration



● Field Data — Bottom — Middle — Surface

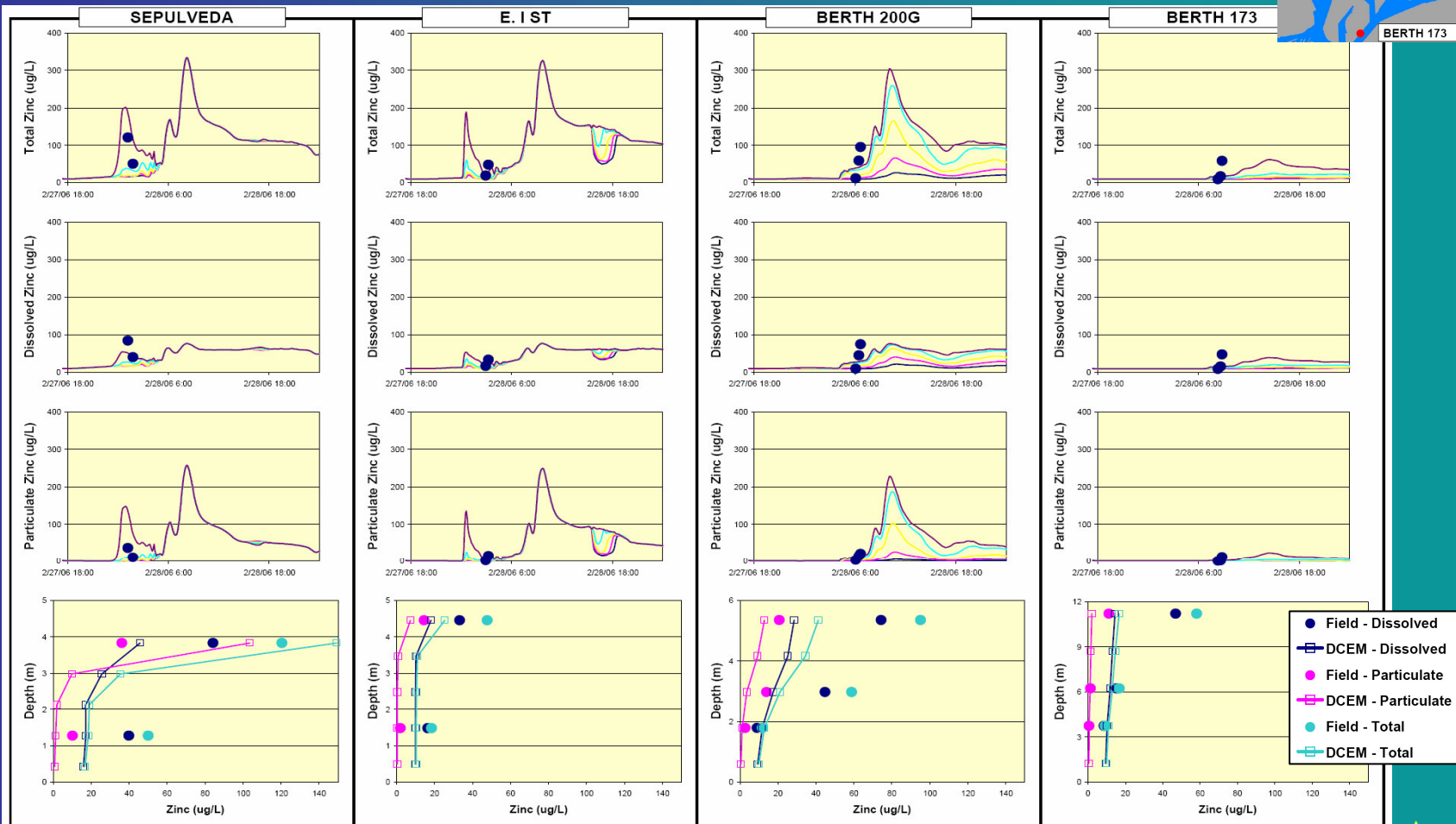
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# Zinc

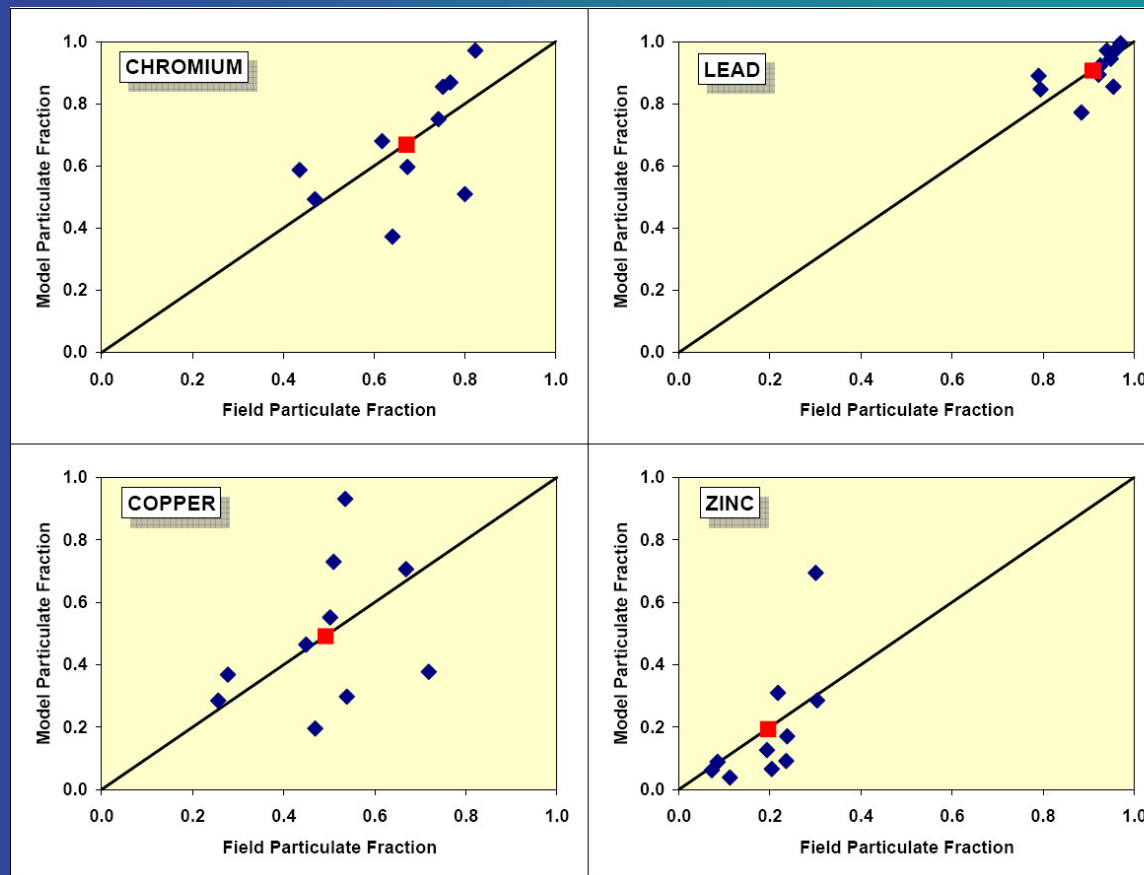
## Wet Weather Calibration



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# Particulate Fraction



◆ Metal Particulate Fraction ■ Average

# Summary

- ❖ A 3-D hydrodynamic and water quality model (DCEM) was developed
- ❖ A field program was designed to collect suitable data for model calibration and verification
- ❖ The DCEM was calibrated for the dry and wet weather conditions, and was verified for the dry weather only

# Thank You!!

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