

Informing Sediment Management through Linked Water Quality – Bioaccumulation Models: Los Angeles and Long Beach Harbors

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Background

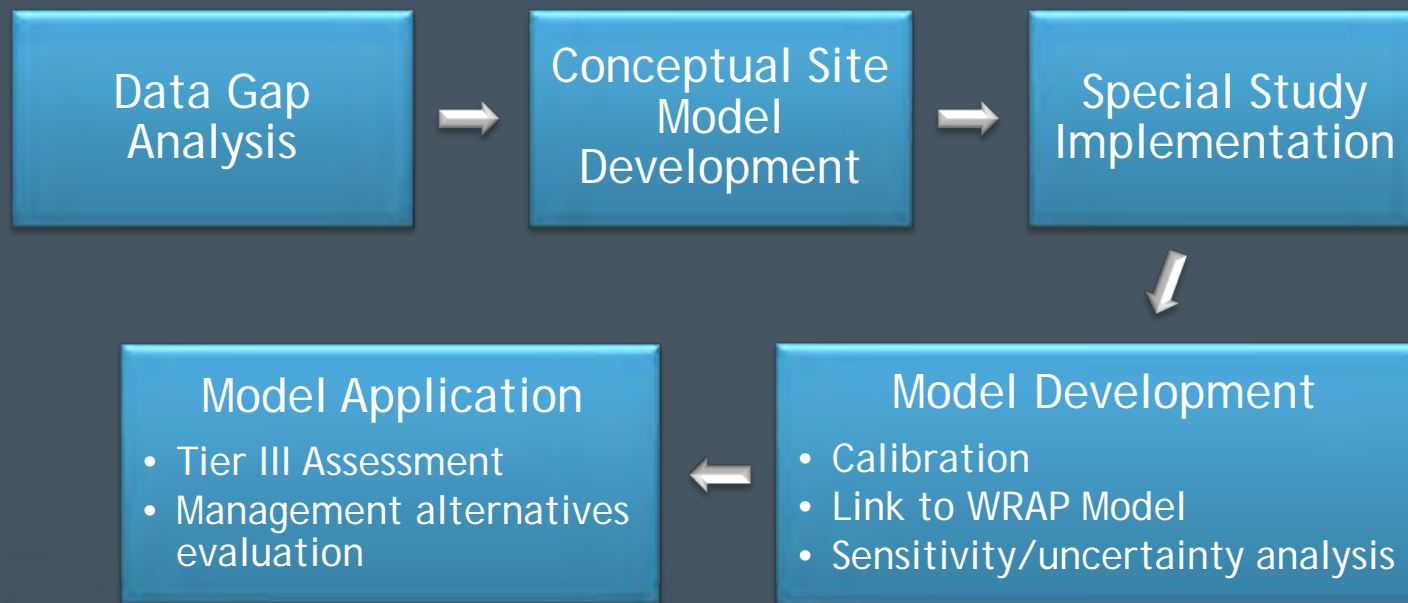
- Harbor Toxics Total Maximum Daily Load for Greater Los Angeles and Long Beach Harbor Waters (TMDL)
 - Numerous sediment impairments throughout harbor for metals and organics
 - Impairments for direct (ecological) and indirect (human health) effects all tied to sediment contamination
 - Key driver is the PCB and DDT concentrations in fish tissue – TMDL compliance targets are extremely low

Addressing Compliance with Fish Tissue Targets

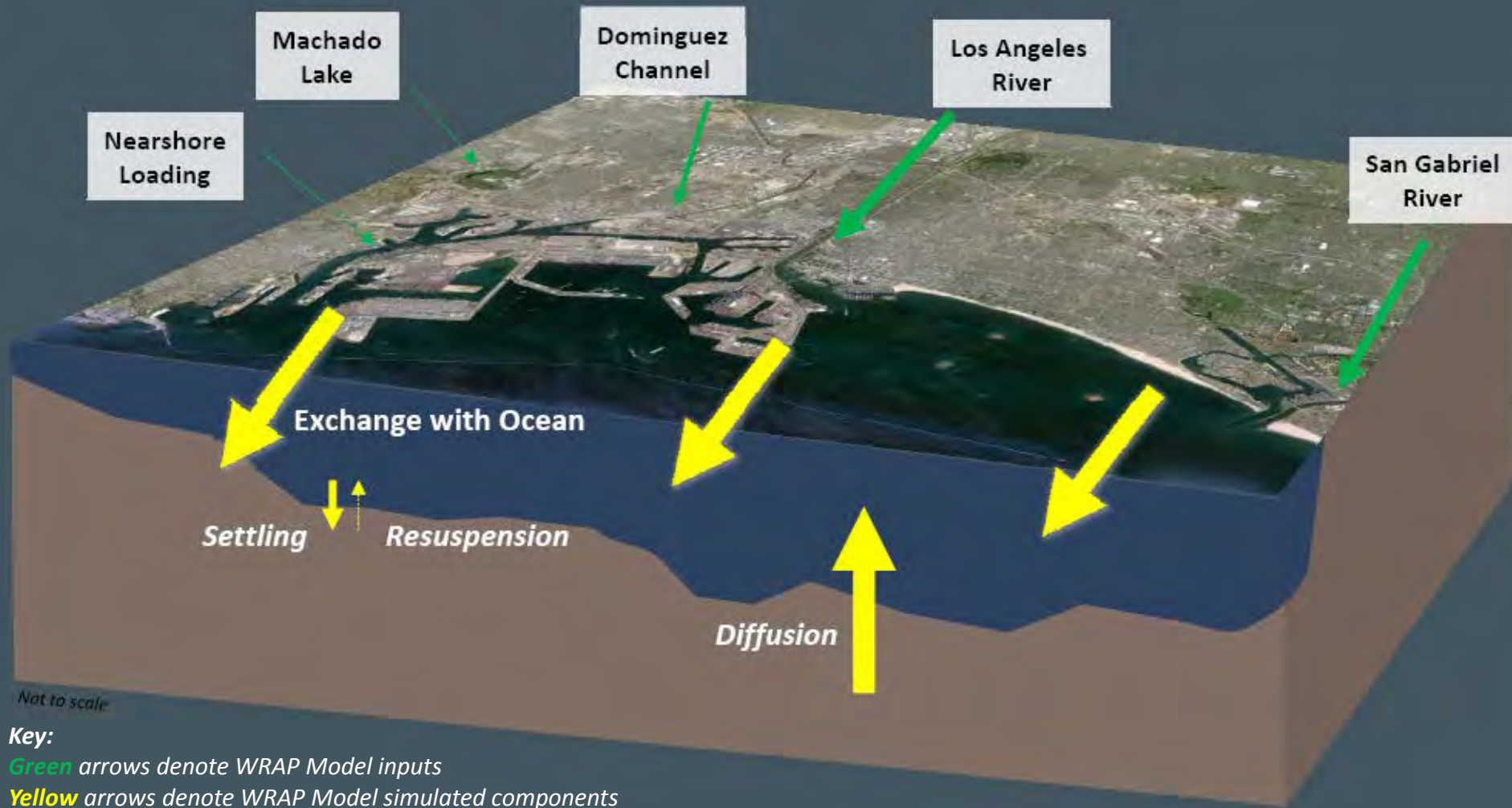
- TMDL allows for alternative compliance
 - Sediment Quality Objectives for Indirect (Human Health) Effects in development
- The LA/LB Harbors are being used as a case study to demonstrate TMDL compliance using SQOs
 - Developing quantitative models for linking sources to fish tissue impairments and for sediment management purposes
 - Work is being vetted by the Harbor Technical Working Group (HTWG) – Regulators and Ports

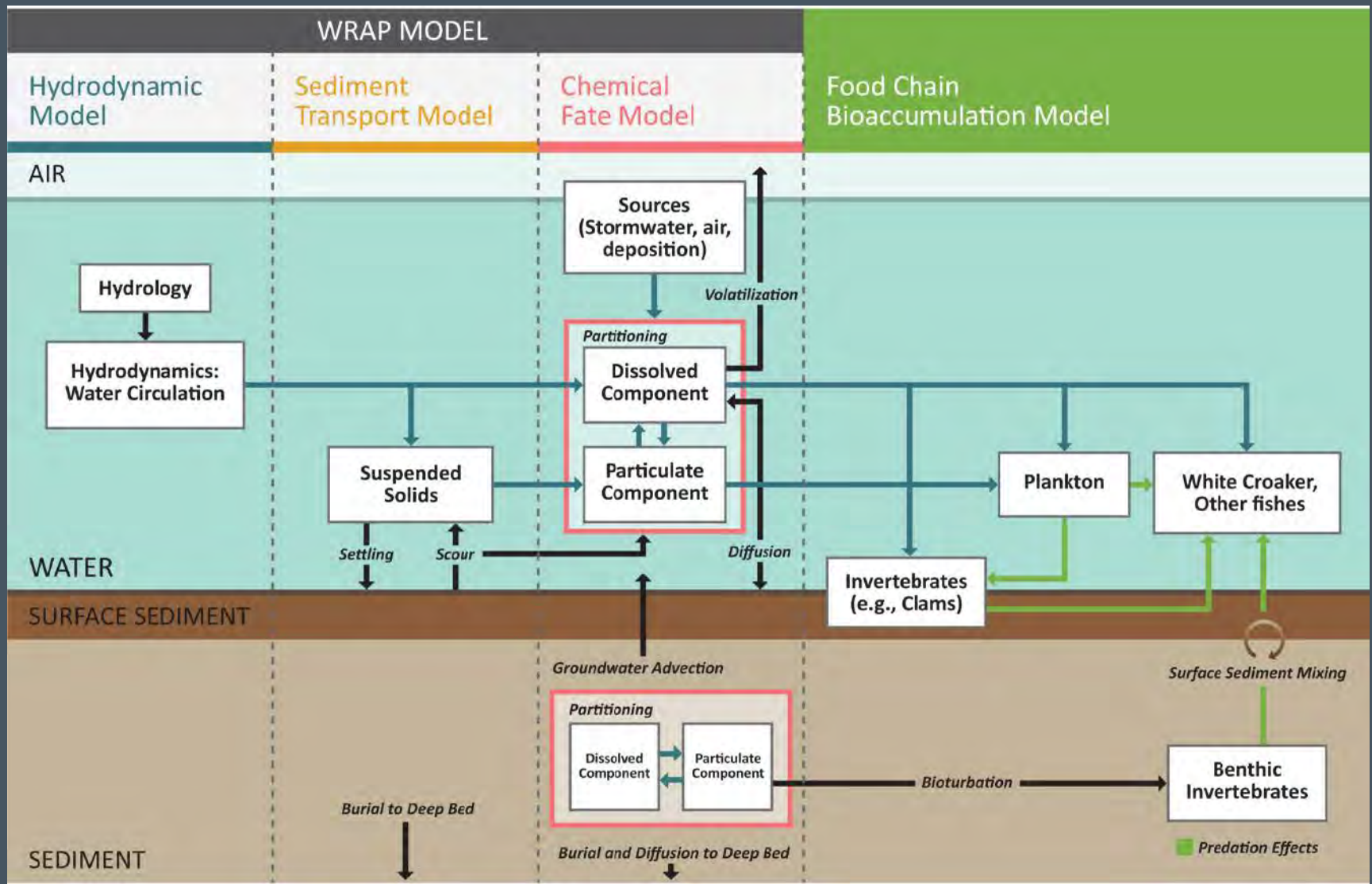
Approach for Assessment and Management

1. Develop a site-specific, linked hydrodynamic/sediment transport (**WRAP model**) and bioaccumulation model that establishes how physical, chemical, and biological processes control the transfer of PCBs and DDTs from sources to fish
2. Use linked model to evaluate effectiveness of management alternatives

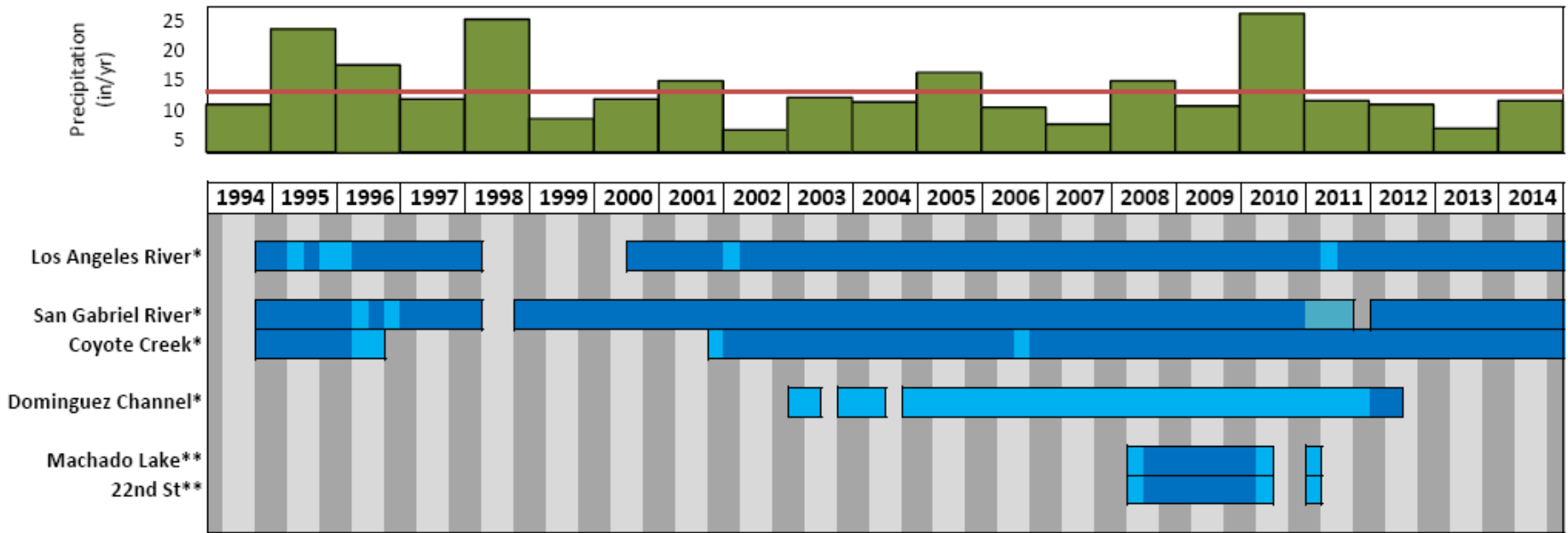


Conceptual Site Model – Key Processes





Available flow and Precipitation Data



Legend

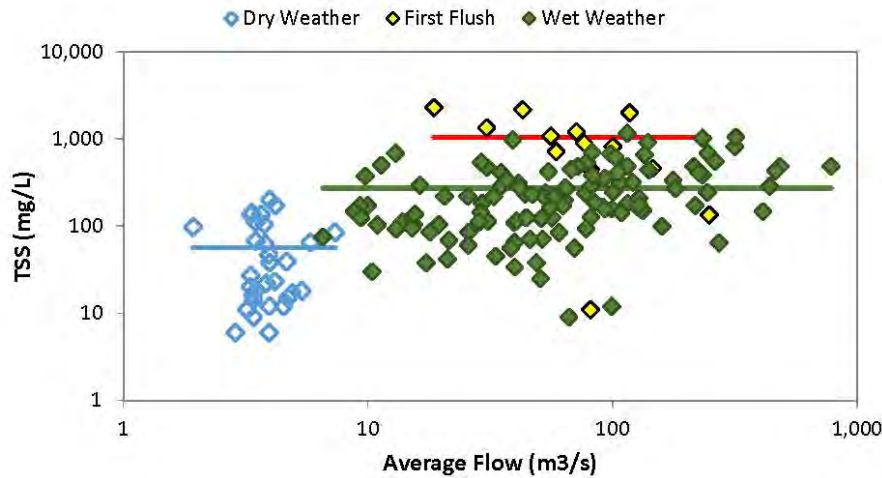
- Flow data available
- Dry season
- Periodic gaps in flow data
- Wet season

*LACDPW flow data
 **POLA flow data

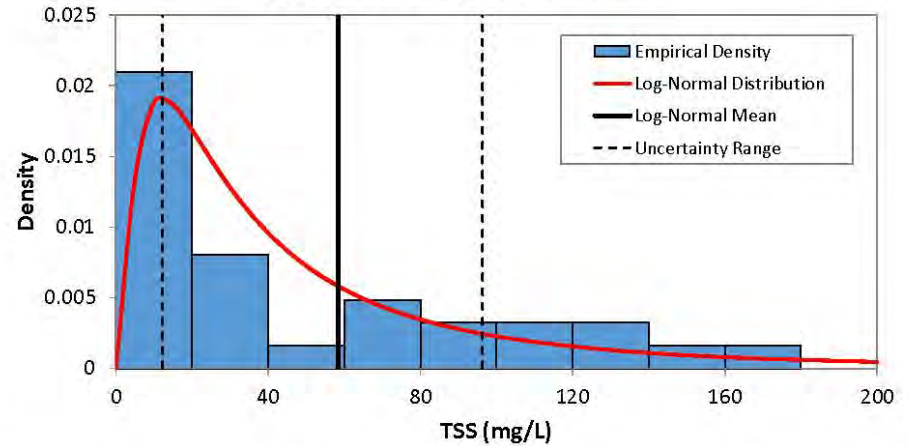
Precipitation data: LACDPW Alert315 Dominguez 1997-2014
 WRCC Long Beach 1994-96

Probability Distributions of TSS Data for Los Angeles River

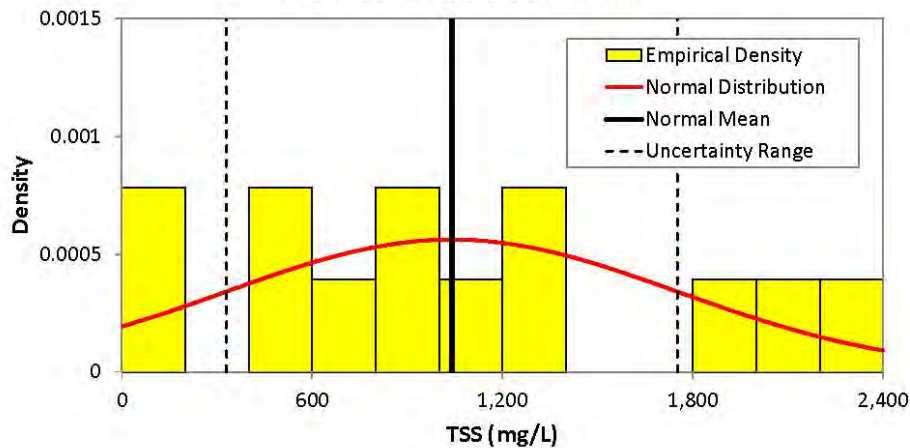
LAR TSS Data



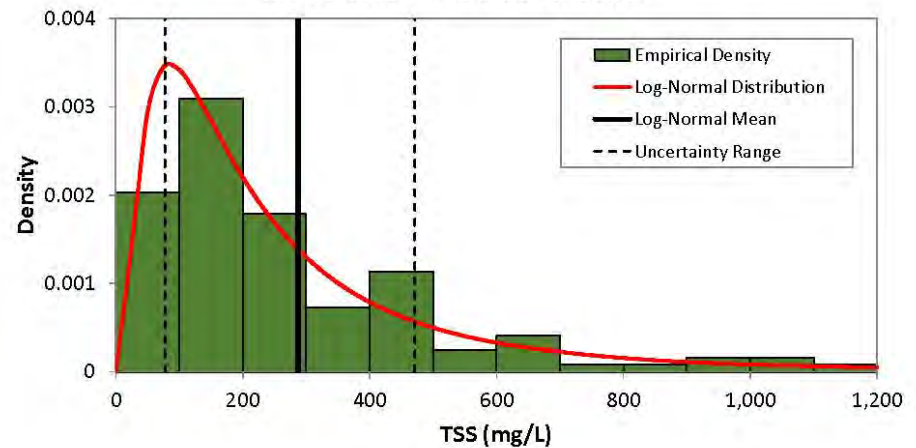
Dry Weather TSS Data Distribution



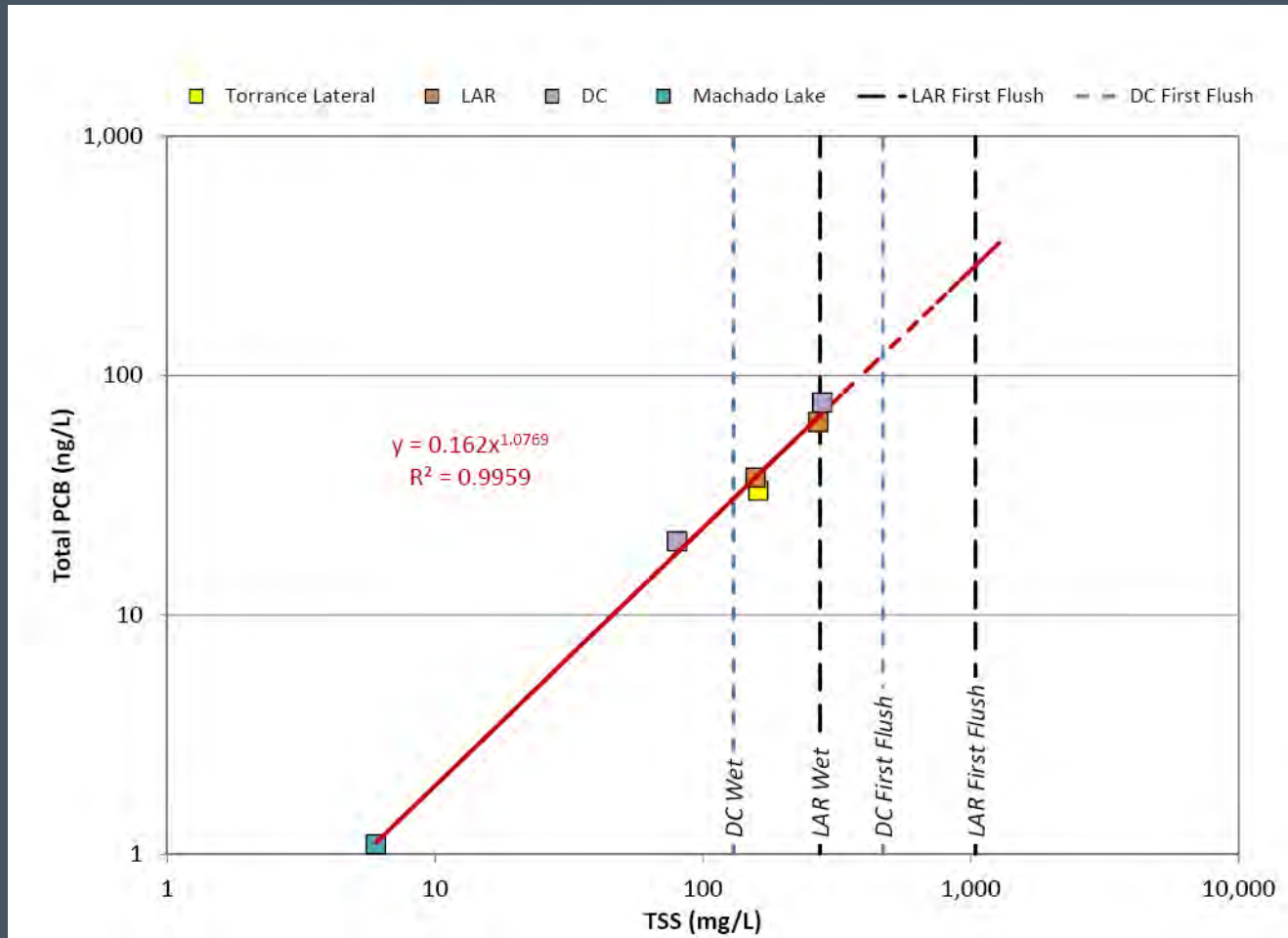
First Flush TSS Data Distribution



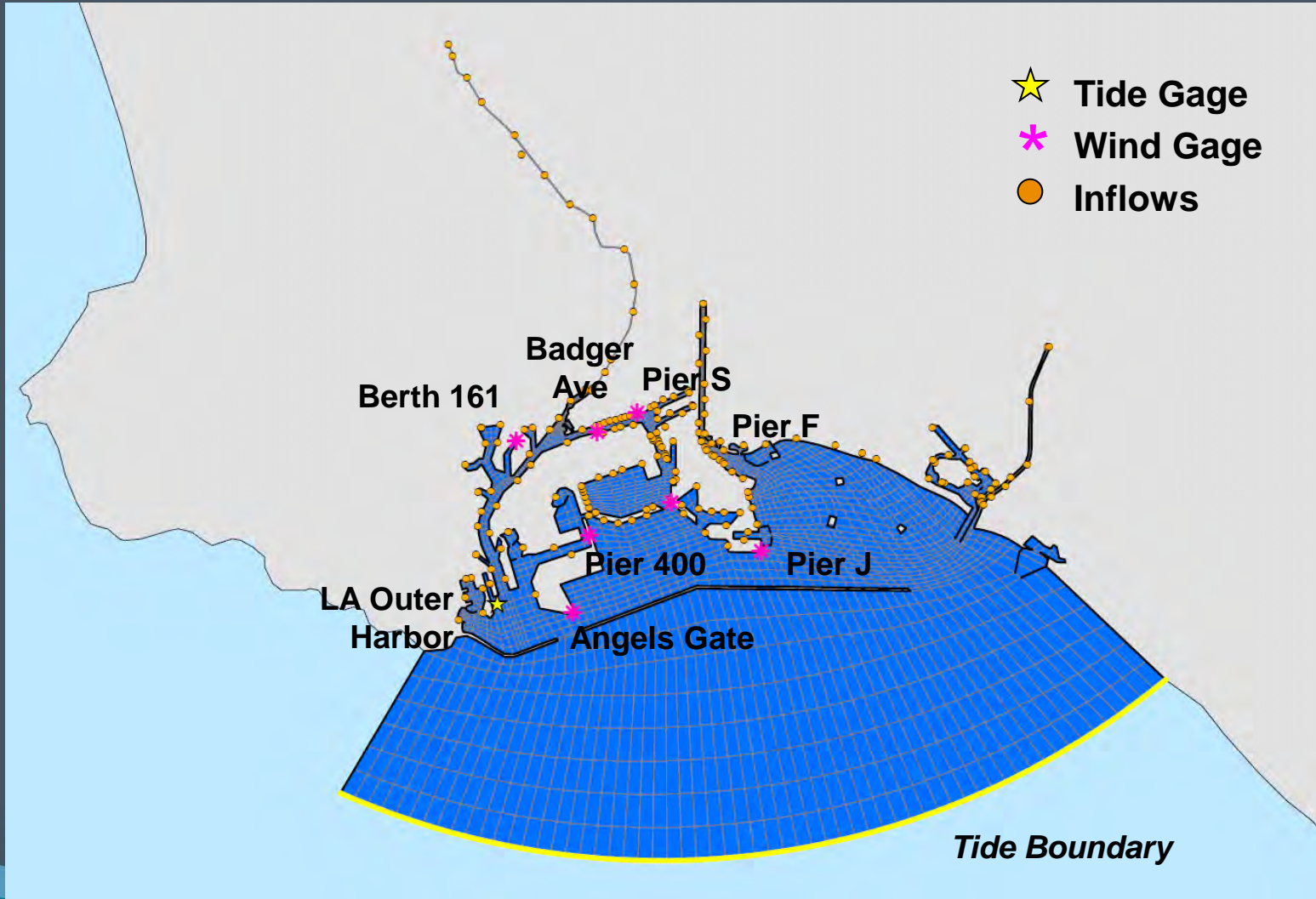
Wet Weather TSS Data Distribution



Total PCB – General Storm Water

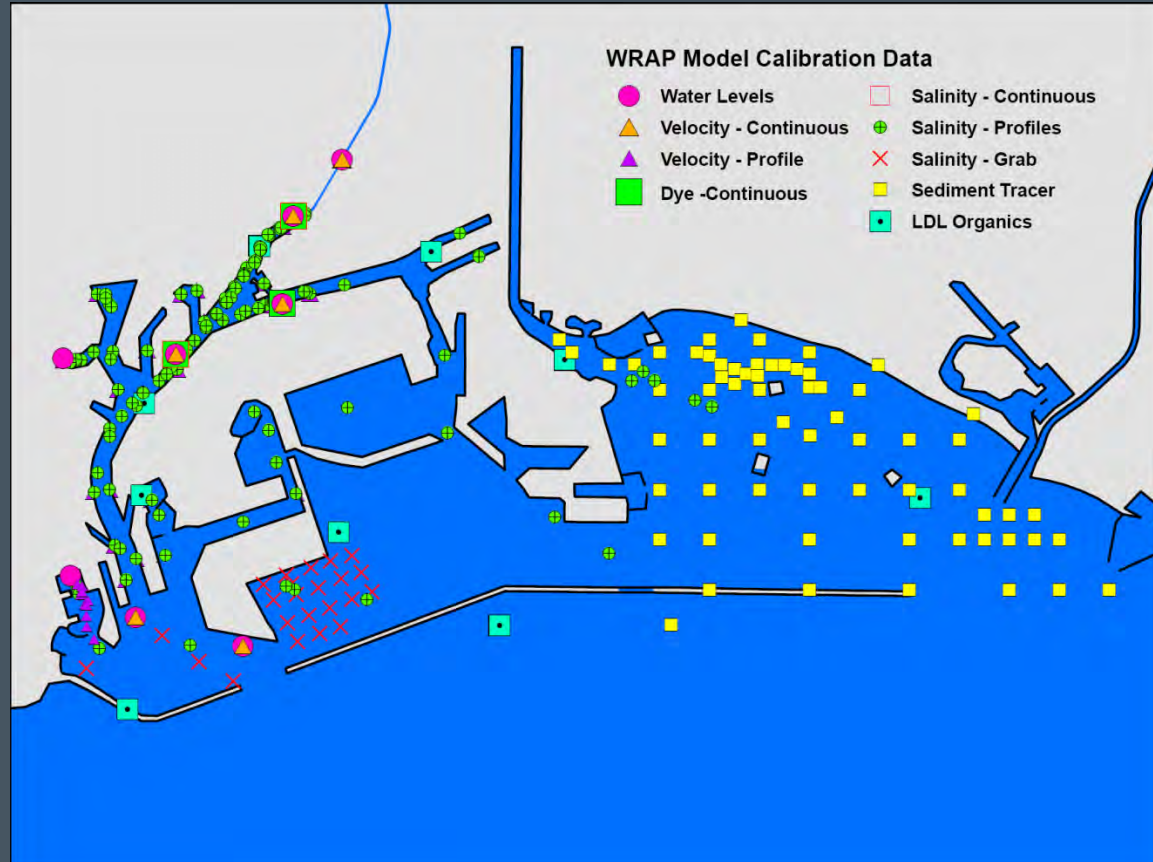


WRAP Model Setup

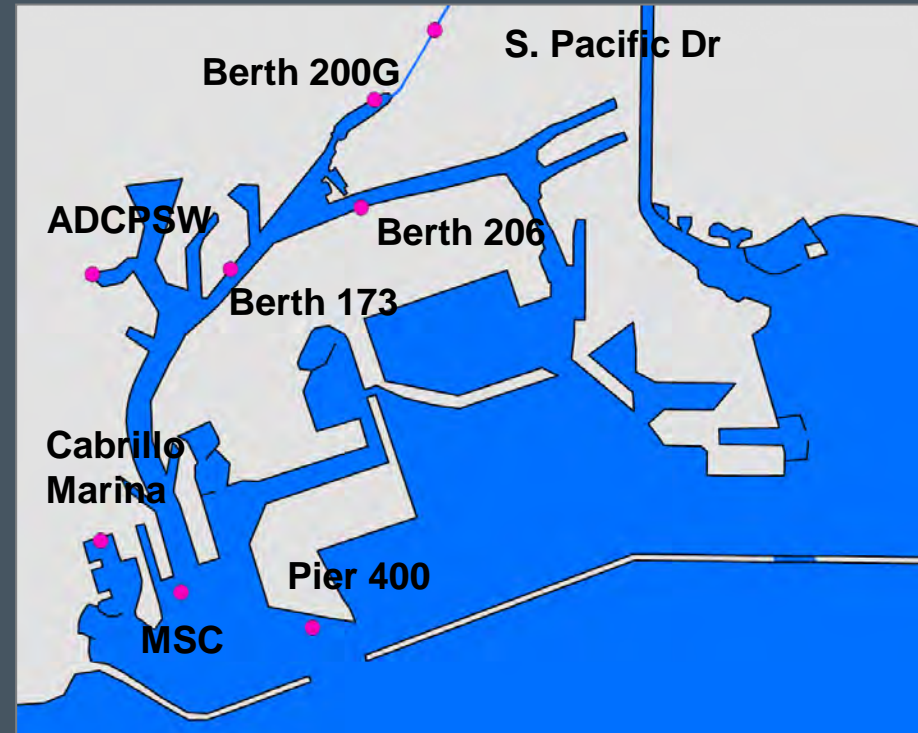
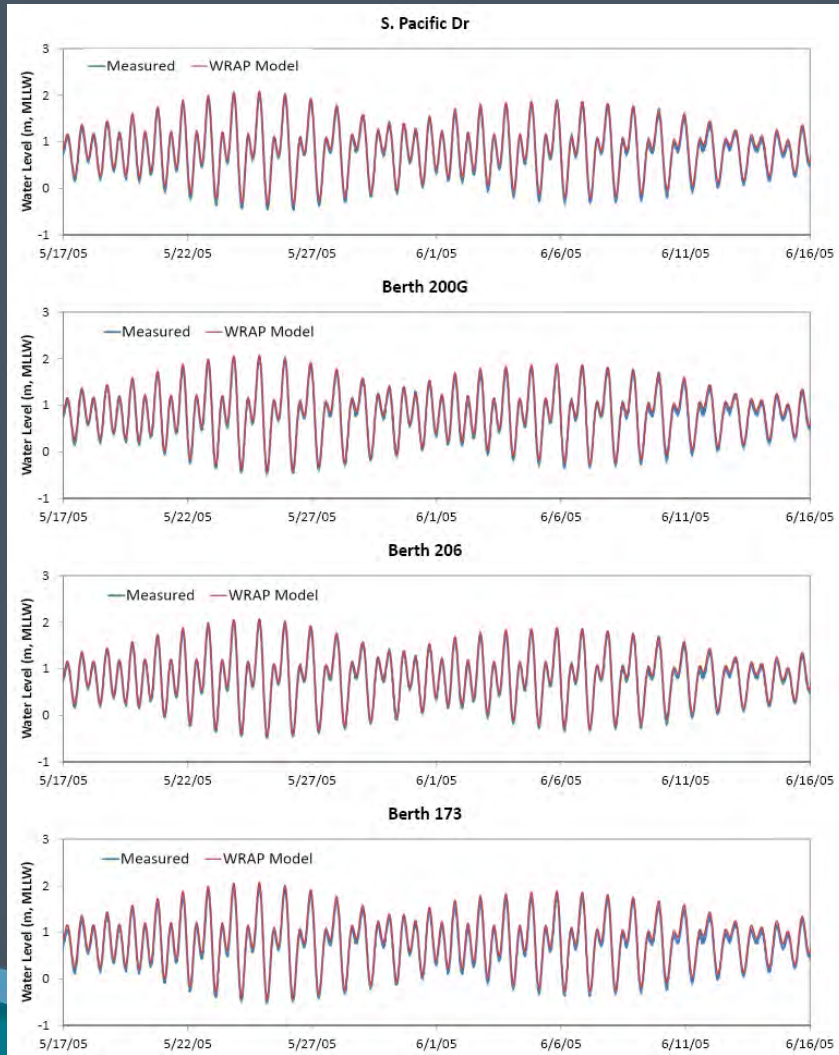


WRAP Model Calibration Data Overview

- Water Levels
- Velocity
- Dye
- Salinity
- Sediment Tracer
- Sediment Deposition
- Organics (PCB and DDT)

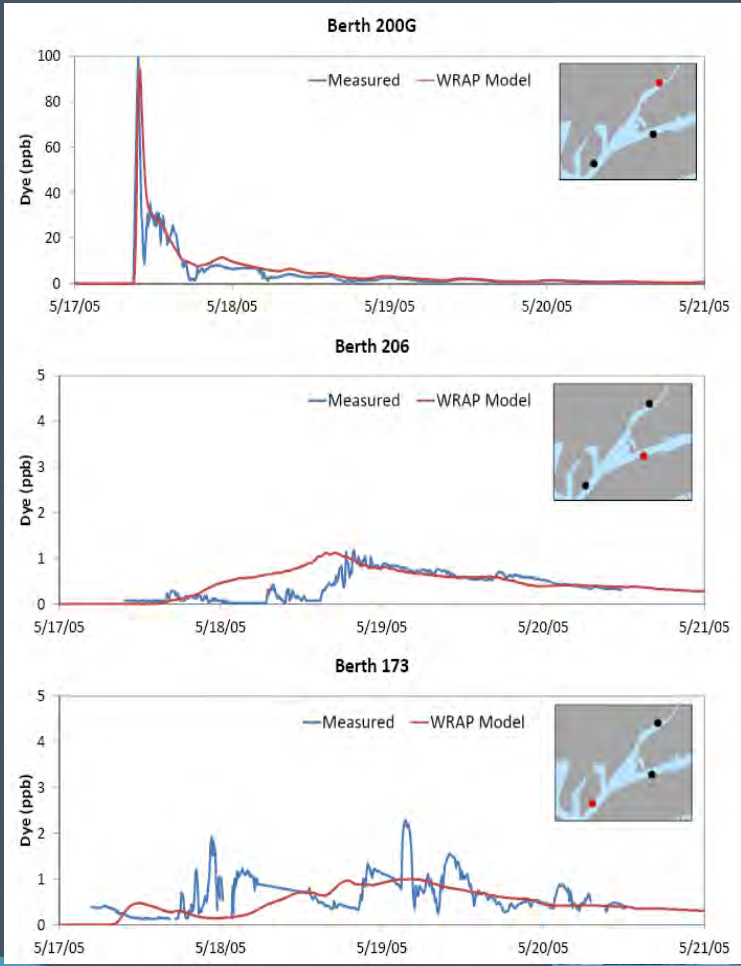


WRAP Model Calibration – Water Levels

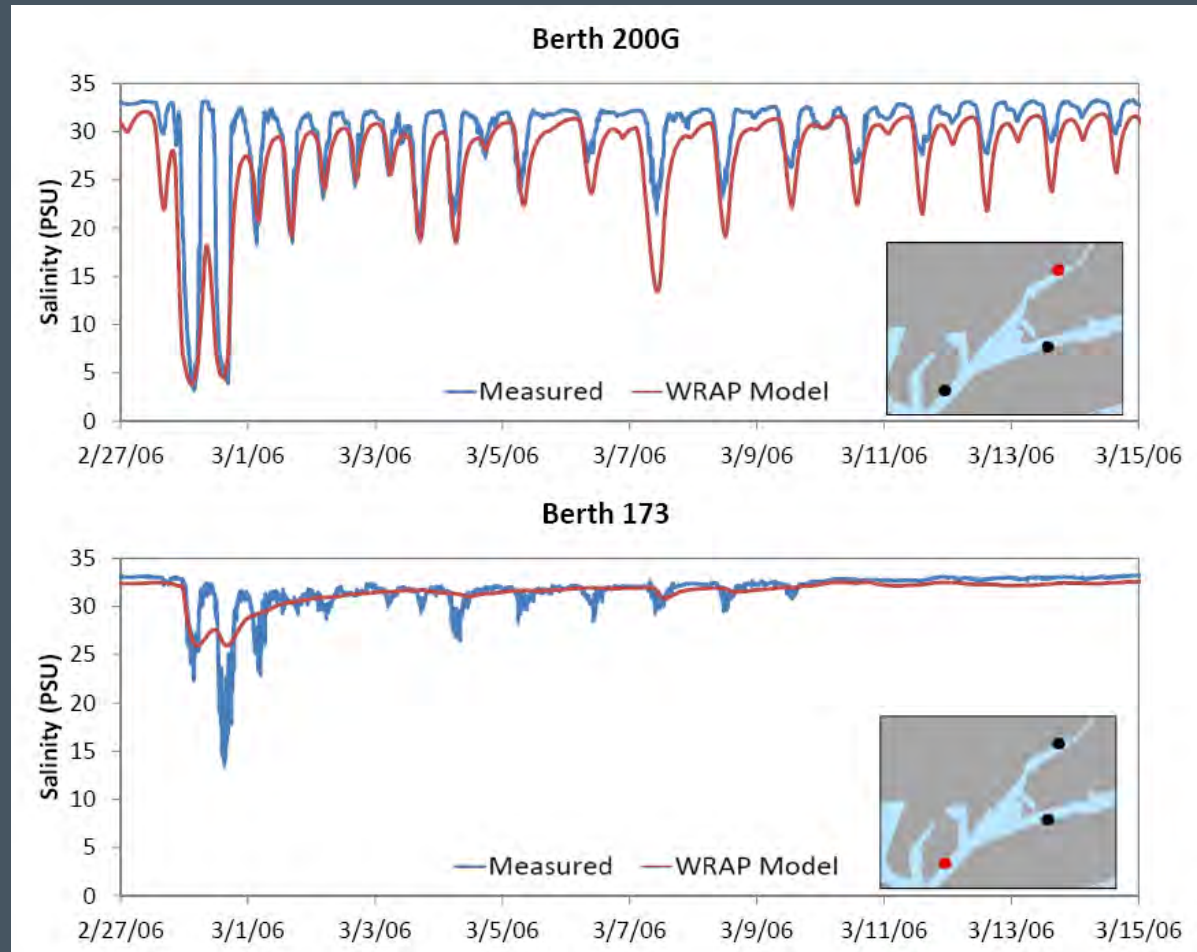


WRAP Model Calibration – Dye

Consolidated Slip



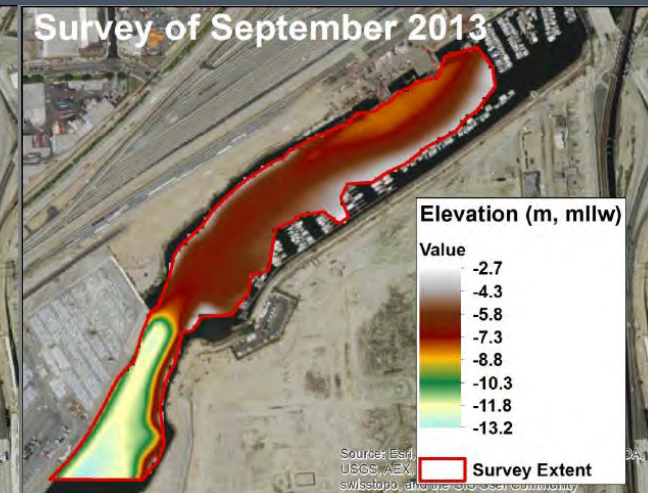
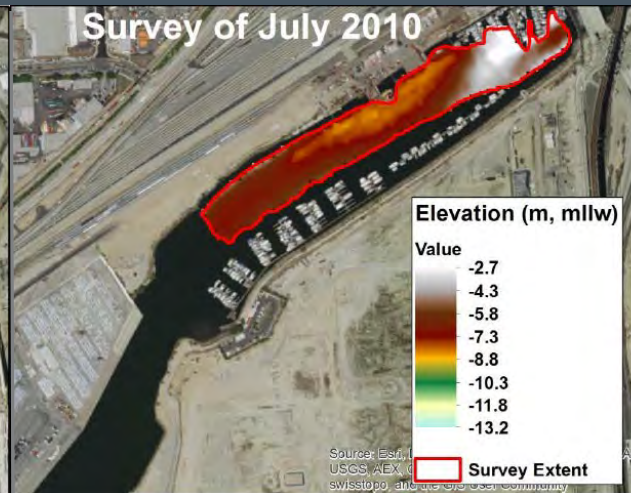
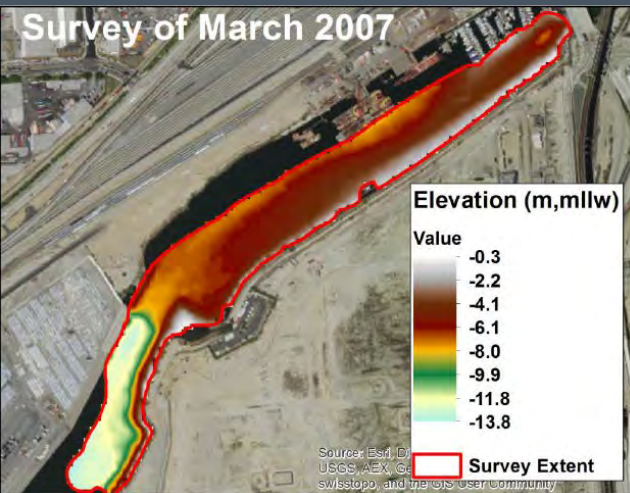
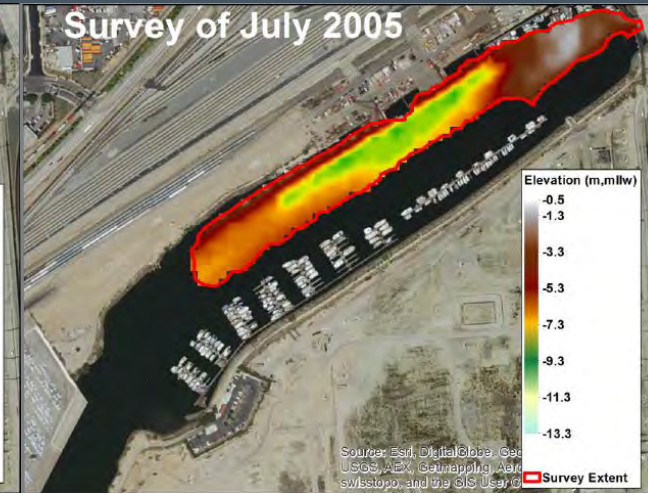
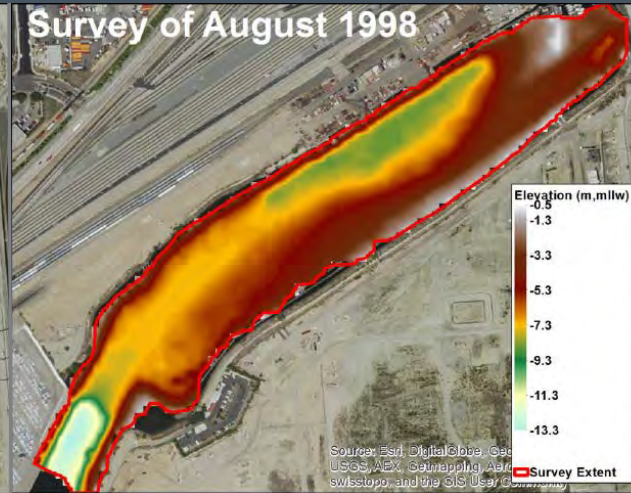
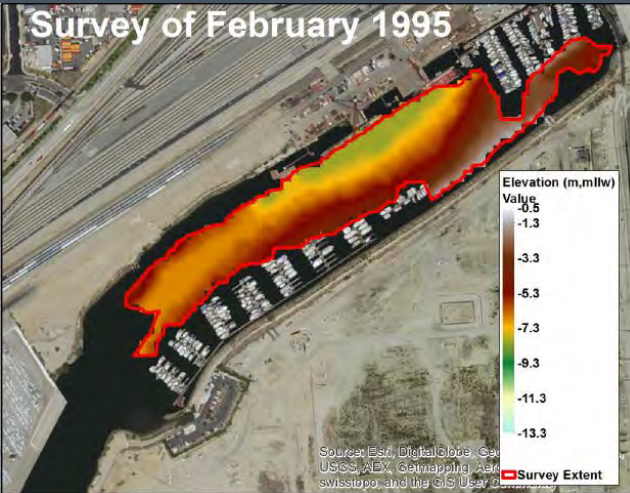
Salinity



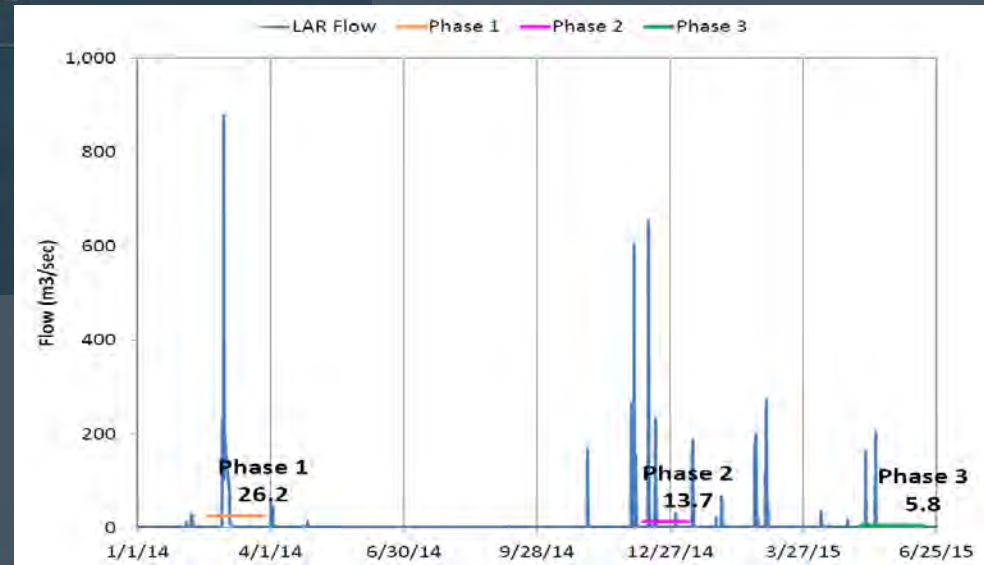
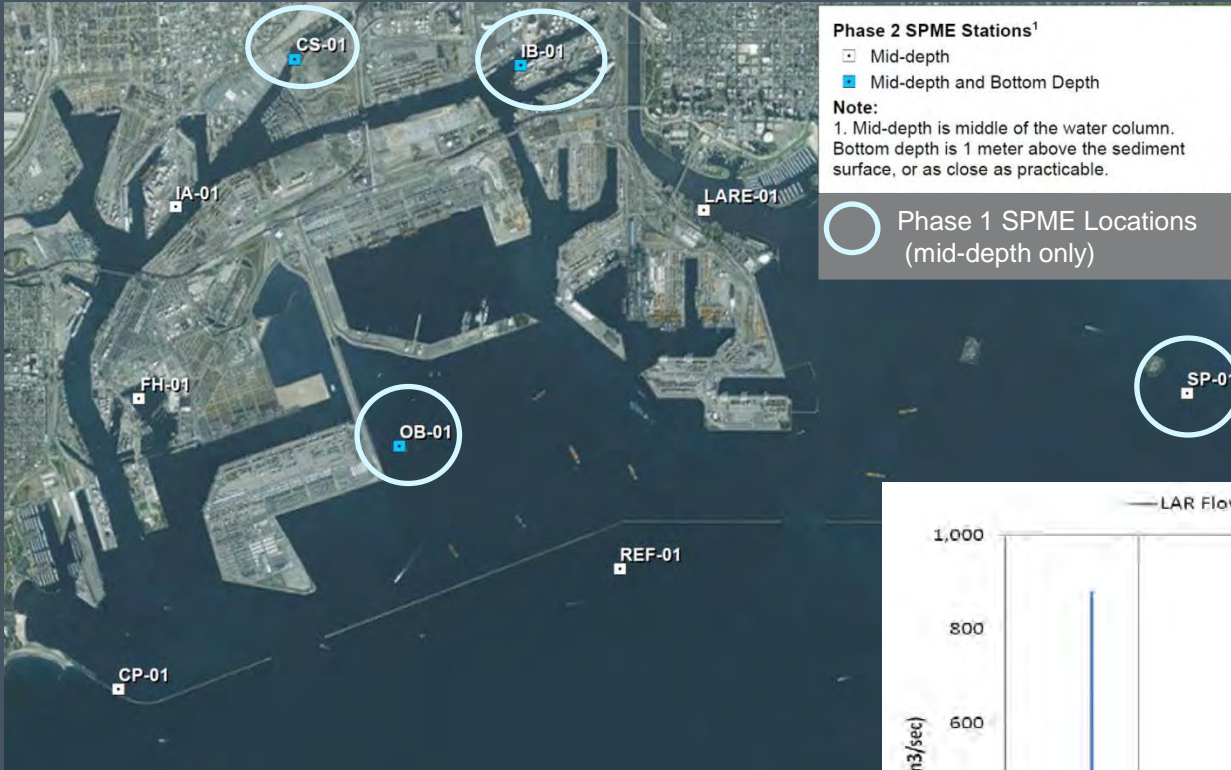
USACE LAR Tracer Study



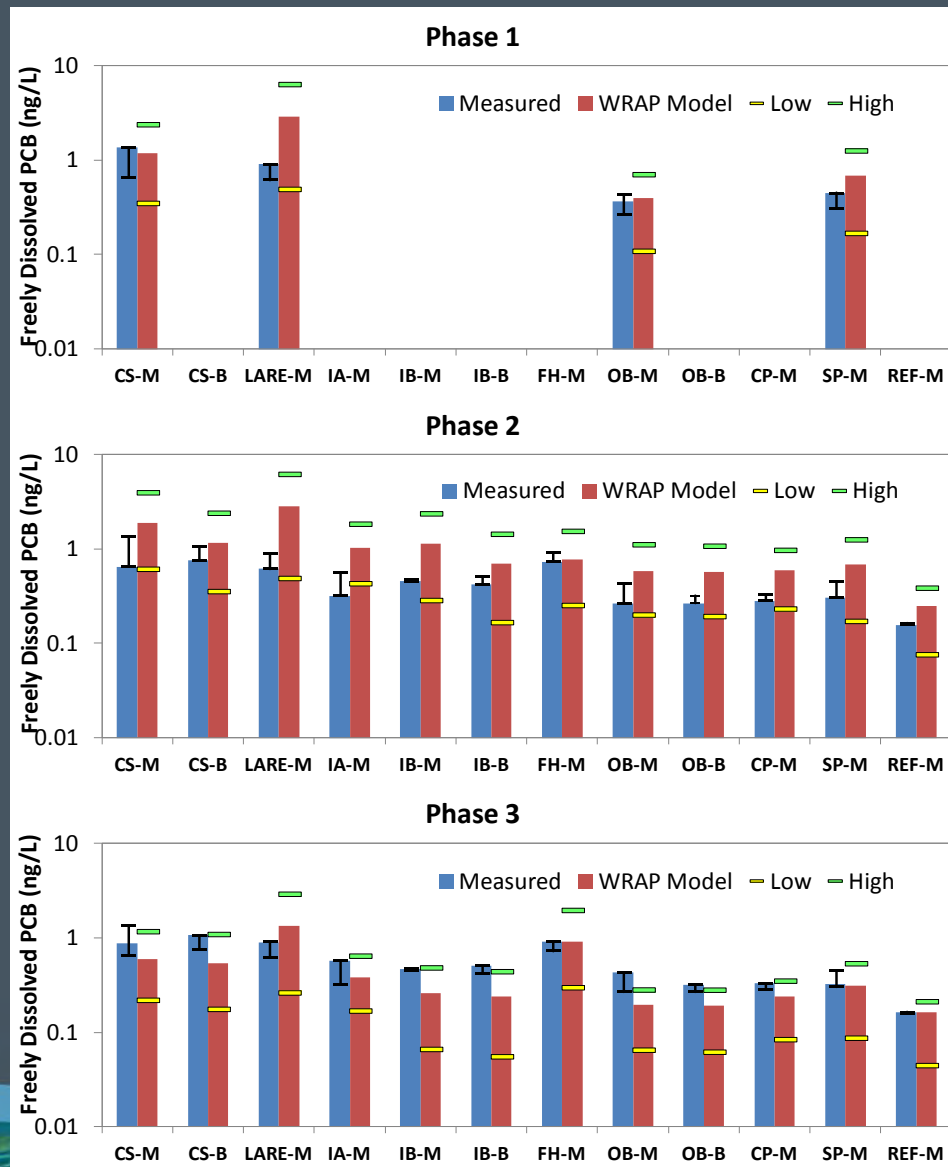
Consolidated Slip – Bathymetry Surveys



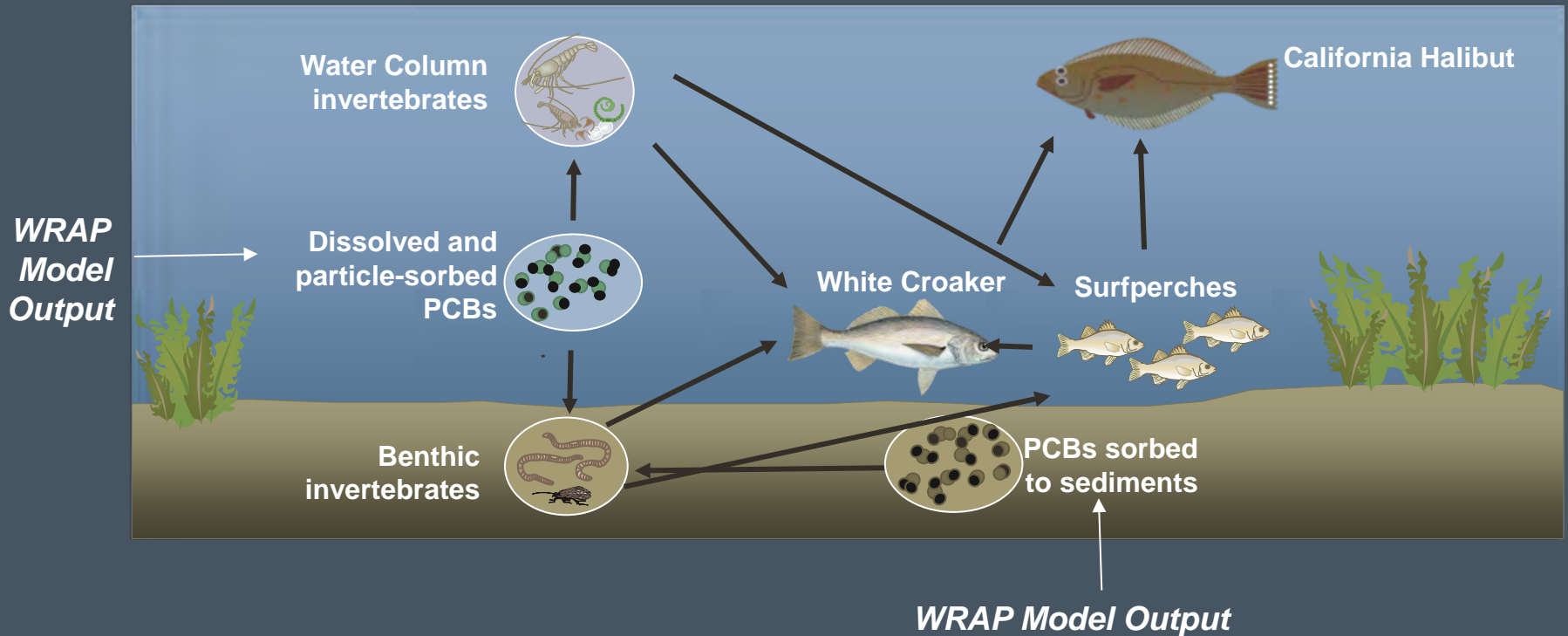
WRAP Model Calibration – Organics



Comparison between Measured and Predicted PCB

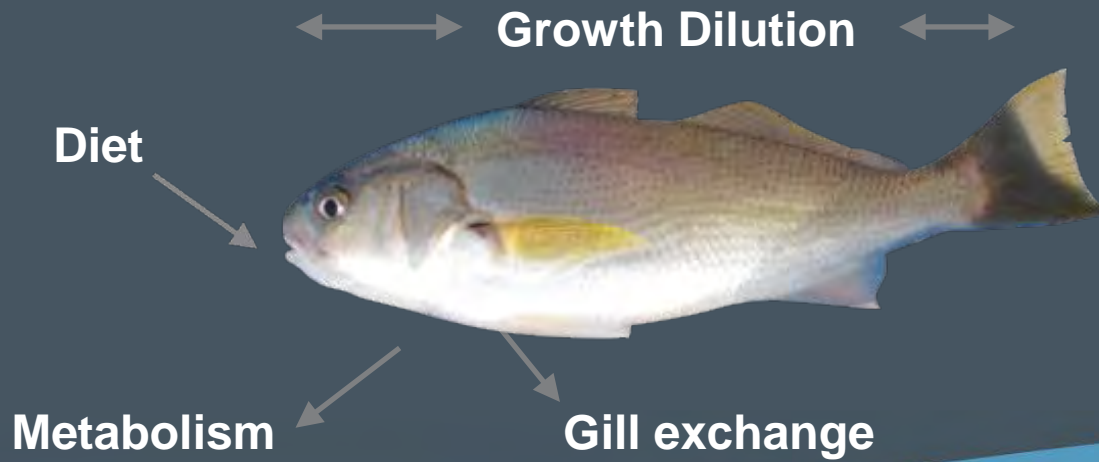


Linkage to Bioaccumulation Model

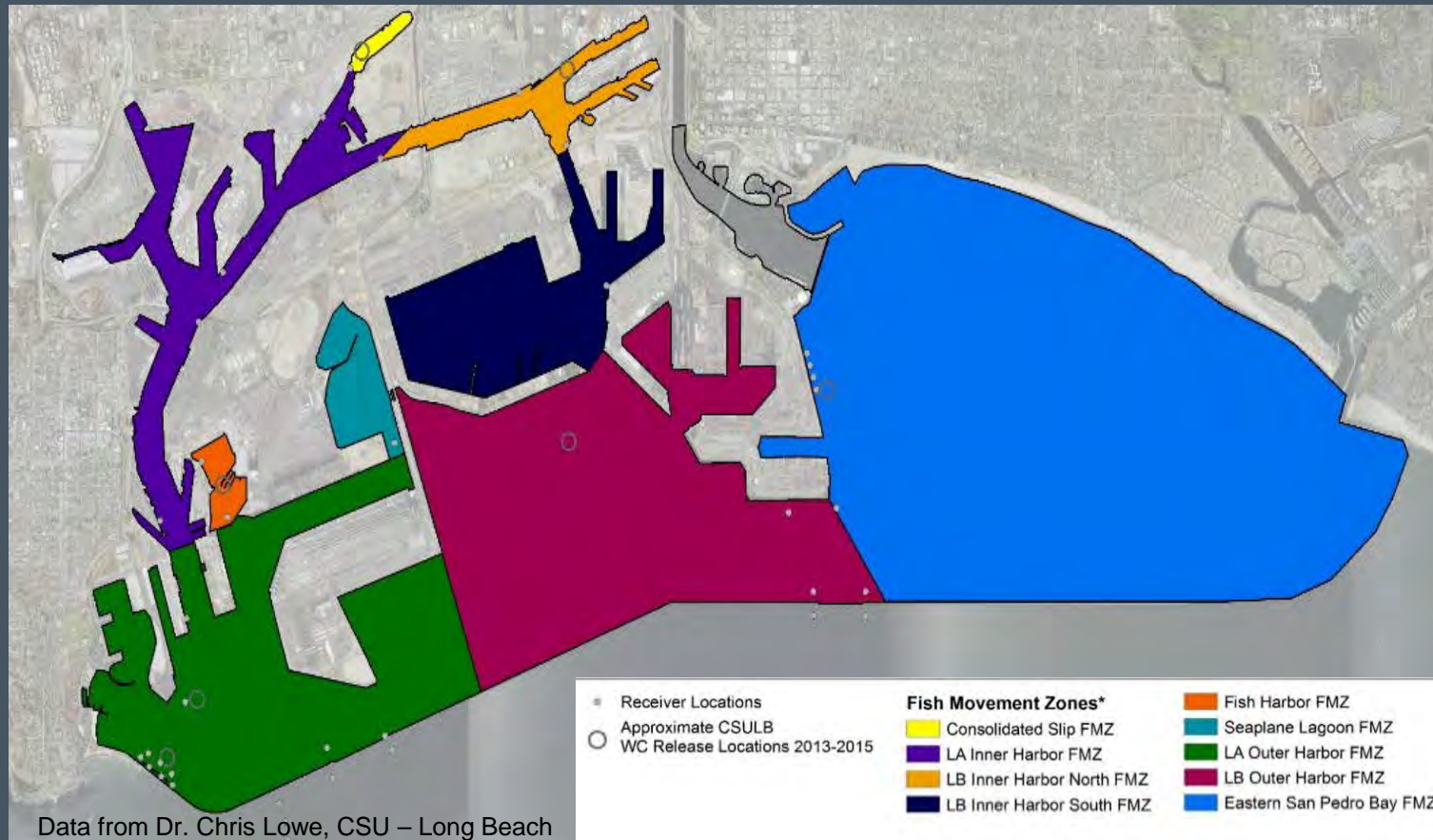


Bioaccumulation Model

- AQFDCHN
 - Bioenergetic, mechanistic, dynamic modeling framework
 - Accounts for complex food web structure and fish movement, in addition to site-specific growth rates and lipid contents

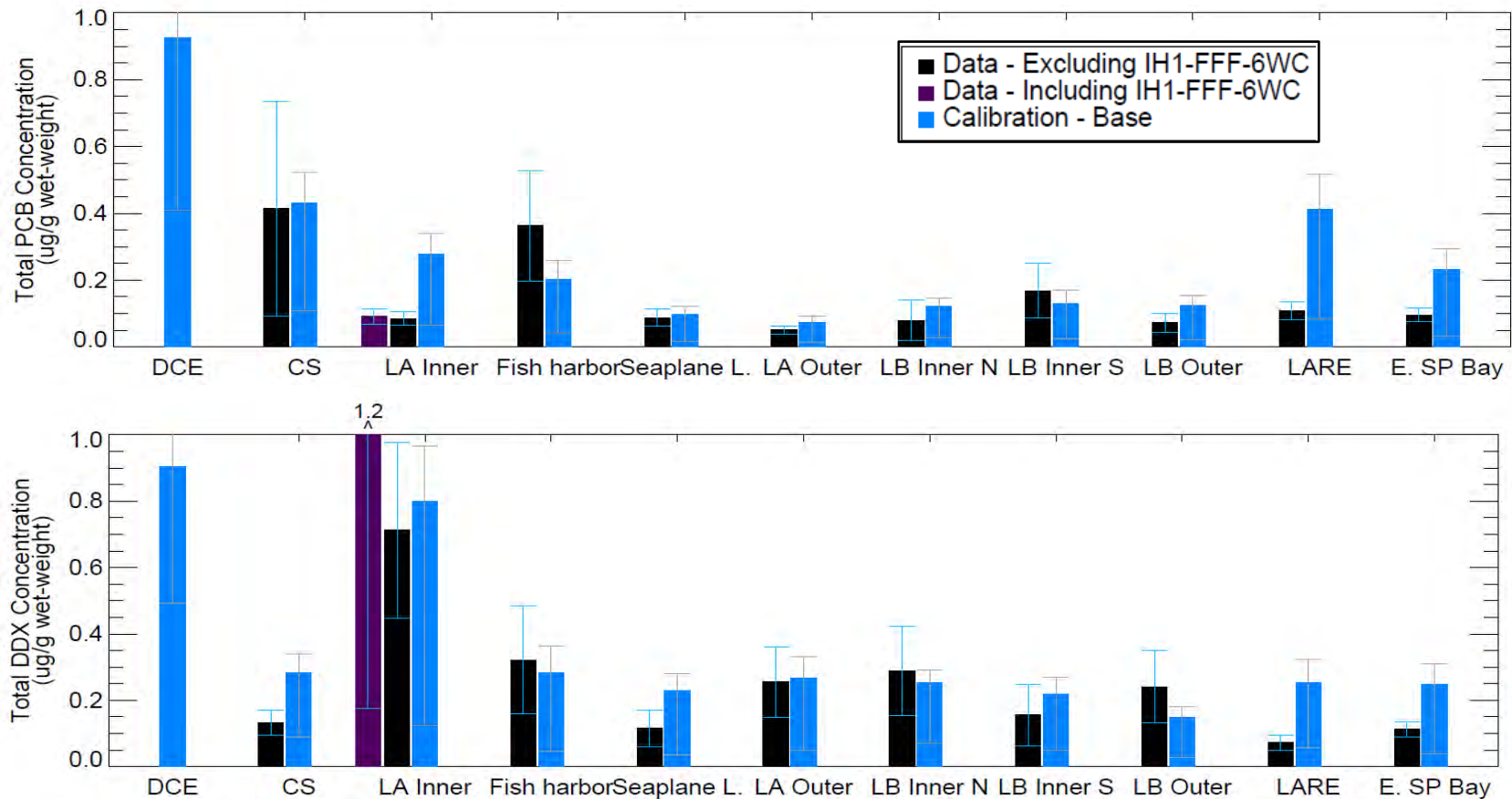


Fish Movement Zones



- Data from regional fish tracking studies were used to divide the harbor into zones based on movement patterns and to determine the proportion of time/exposure each fish subpopulation spent in each zone.

White Croaker Model Calibration

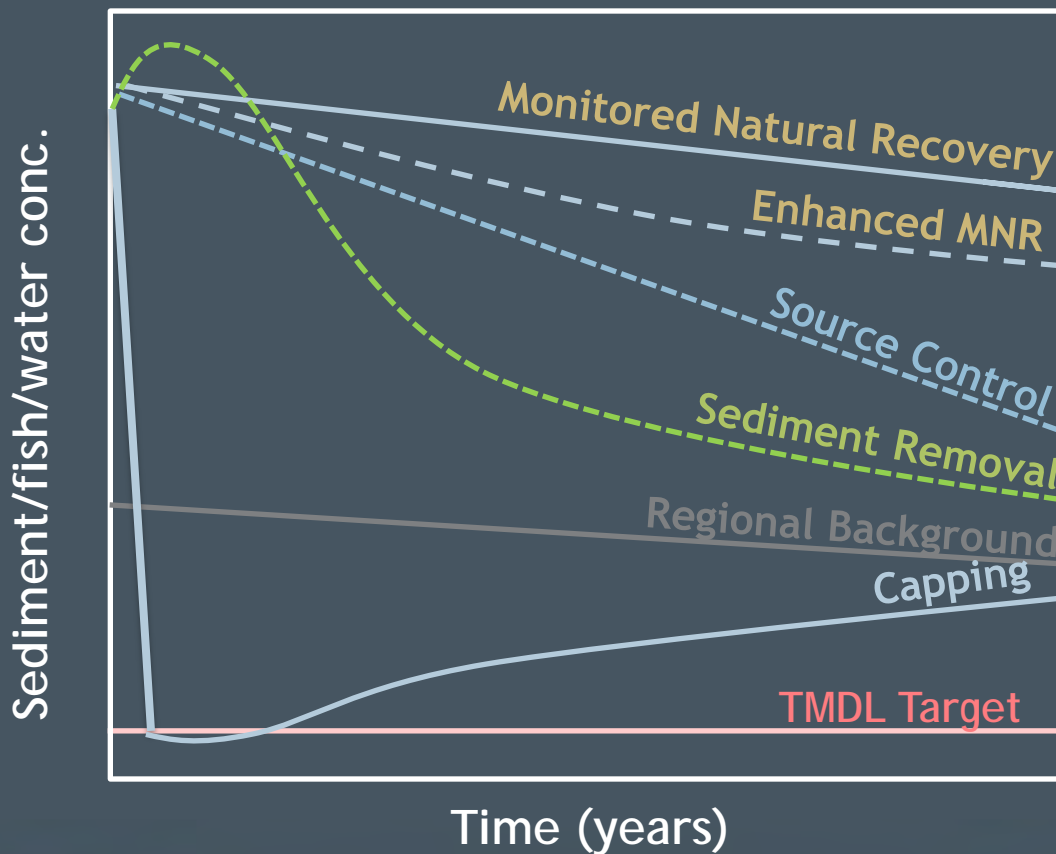


- For most fish movement zones there is a good fit between model estimated and measured fish tissue concentrations, after incorporating fish movement and exposure information.

Model Application: Sediment Management Alternatives Evaluation

- The linked model will be used to determine effectiveness of sediment management alternatives
 - Evaluate the Harbor under both current and projected future conditions
 - Involves longer-term model simulations (20-30 years)
 - Evaluate different sediment managements alternatives such as natural recovery, source control, and dredging/remediation of specific subareas of the Harbor

Determining Effective Management Strategies



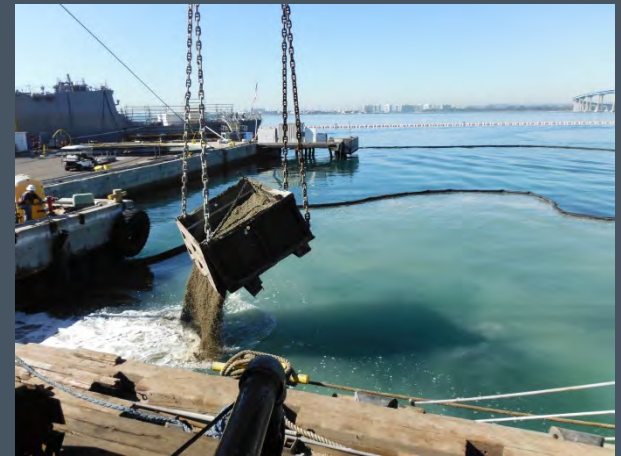
- Modeled management scenarios will simulate long-term effectiveness of reducing fish tissue concentrations of PCBs and DDTs
- Compare cost and effectiveness of management strategies

Potential Model Scenarios

- Baseline (includes natural recovery, and ongoing and expected Port operations)
- Baseline and Watershed Load Reductions
- Baseline, Watershed Load Reductions, and Dominguez Channel Estuary Remediation
- Baseline, Watershed Load Reductions, Dominguez Channel Estuary Remediation, and Consolidated Slip Remediation
- Baseline and Consolidated Slip Remediation
- Baseline and Fish Harbor Remediation.

Analysis of Management Alternatives

- Predicted load reduction to sediment and fish
- Estimated cost
- Technical, logistical, and economic feasibility
- Social and environmental impacts
- Estimated time to complete



THANK YOU !

