# ERDC West Bay Diversion Work Plan

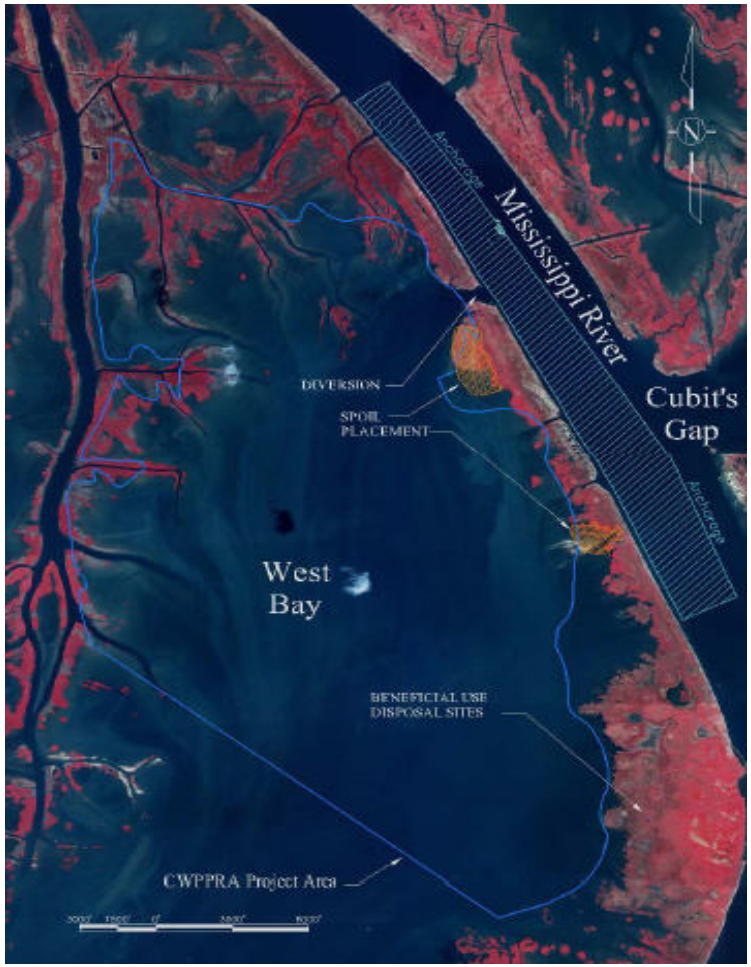
Task 1 – Data collection & Analysis – Thad Pratt
Task 2 – Geomorphic Analysis – Charlie Little
Task 3 – 1D Sedimentation Modeling – Lisa Hubbard
Task 4 – 2D/3D Modeling – Keith Martin

# West Bay Diversion Work Plan, Task #1: Data Collection & Analysis

- Deliverables
- Bathymetric Base Map in vicinity of West Bay
- Current velocities and directions, acoustic and optical backscatter, and salinity along transects
- Suspended sediment concentrations
- Bed sediment grain size distributions

# West Bay Diversion Location

# Detail Map of West Bay Area



# Cutting the Diversion

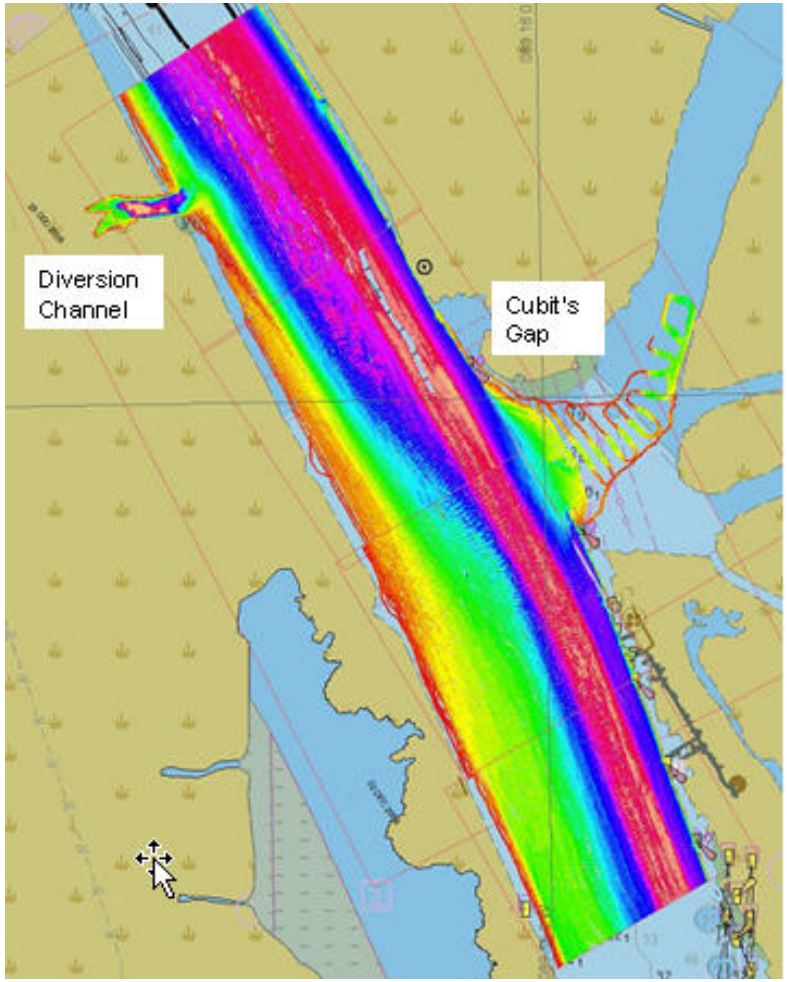
# Instrumentation

- Geo-Acoustics 250 kHz swath system w/ Applanix POSMV IMU
- RDI 600 kHz Broadband ADCP with bottom-tracking and GPS
- P-61 point sampler for suspended sediments
- Push core & bottom surface drag samplers

# Project Progress

- Trip 1, 9-12 March, 22-23 April, 5-6 May: Multi-beam and hydrodynamic surveys, bed load samples and suspended sediment samples
- Trip 2, 27-31 May: Hydrodynamic surveys, suspended sediment samples and additional bed samples from below Cubit's Gap to outside Southwest Pass Jetties
- Trip 3, 15-18 June: Hydrodynamic surveys and suspended sediment samples
- Analysis complete on survey data and samples from Trips 1 & 2, suspended sediment analysis complete for Trip 3
- Draft Data Summary report (Trips 1-3) 75% complete

# Multi-beam Survey Coverage



# Transect Lines

# Mississippi River and West Bay Diversion Velocities

# Transect Lines

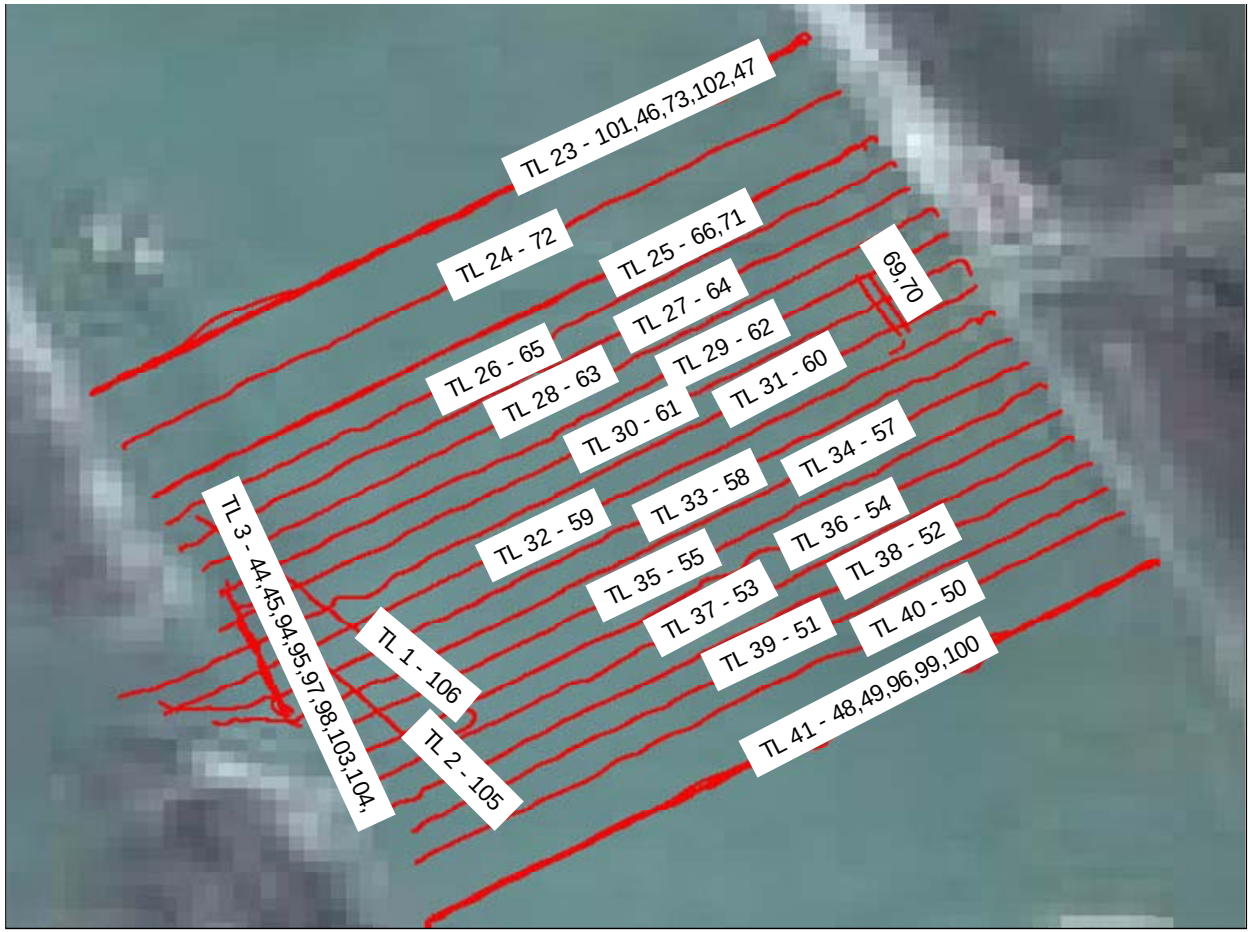
**Area 1 – April 22-23, 2009**

**Area 2 – April 22-23, 2009**

**Area 3 – April 22-23, 2009**

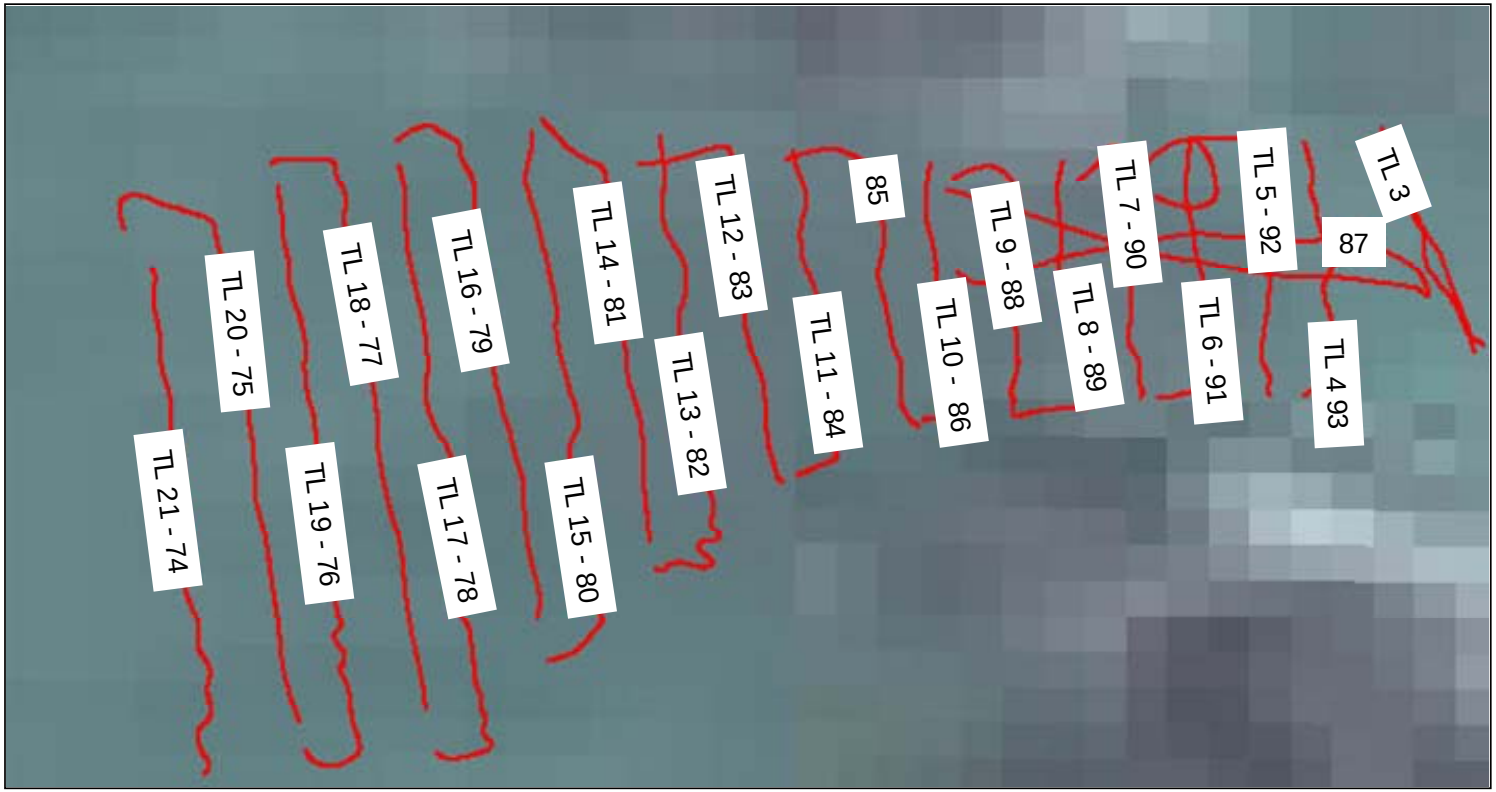
**Area 4 – April 22-23, 2009**

# 3D Velocity Mapping in Vicinity of West Bay Diversion




Area 2 – April 22-23, 2009

# 3D Velocity Mapping Inside West Bay Diversion

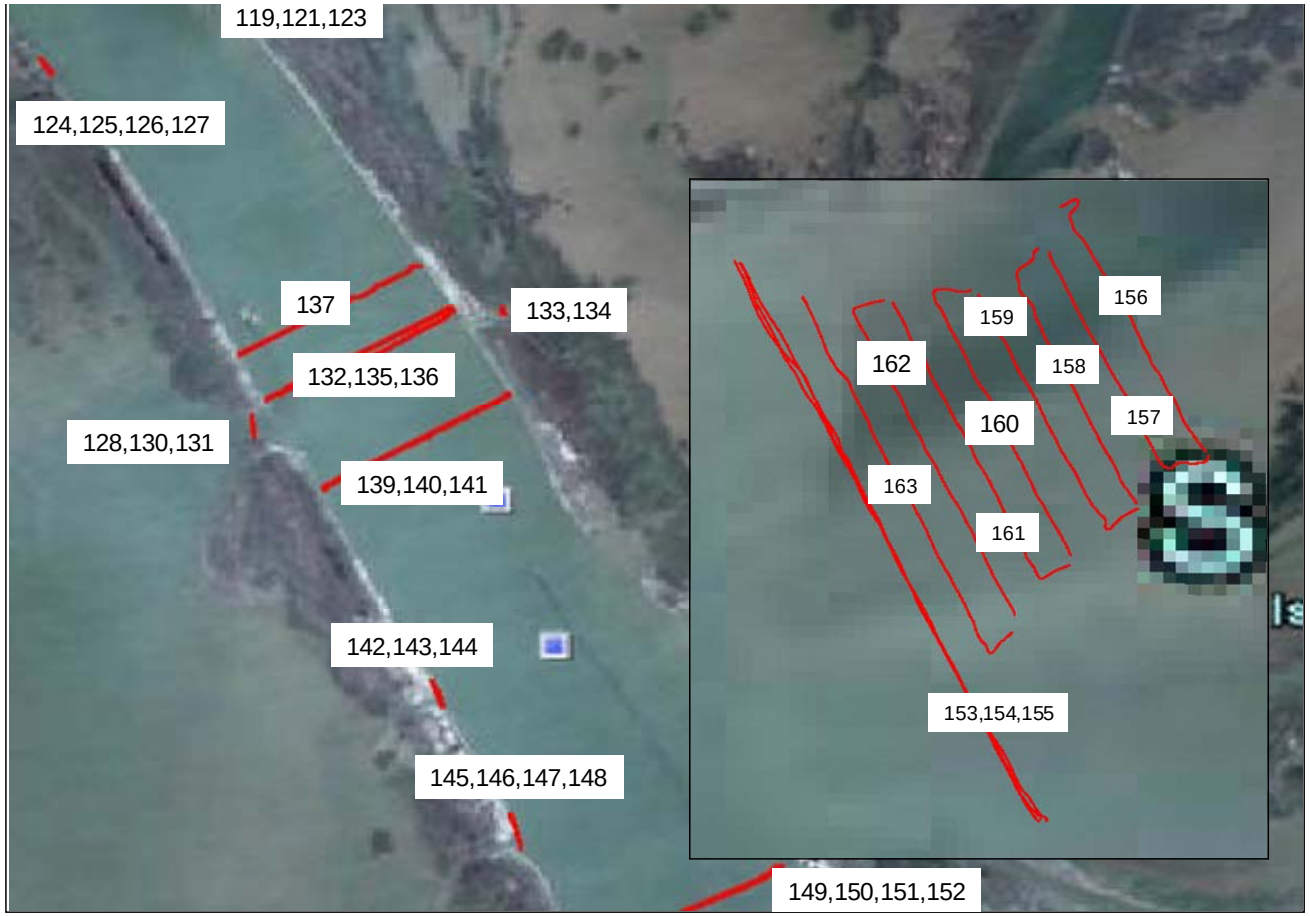



**Area 3 – April 22-23, 2009**

# 3D Velocity Mapping Coinciding with Suspended Sediment Samples

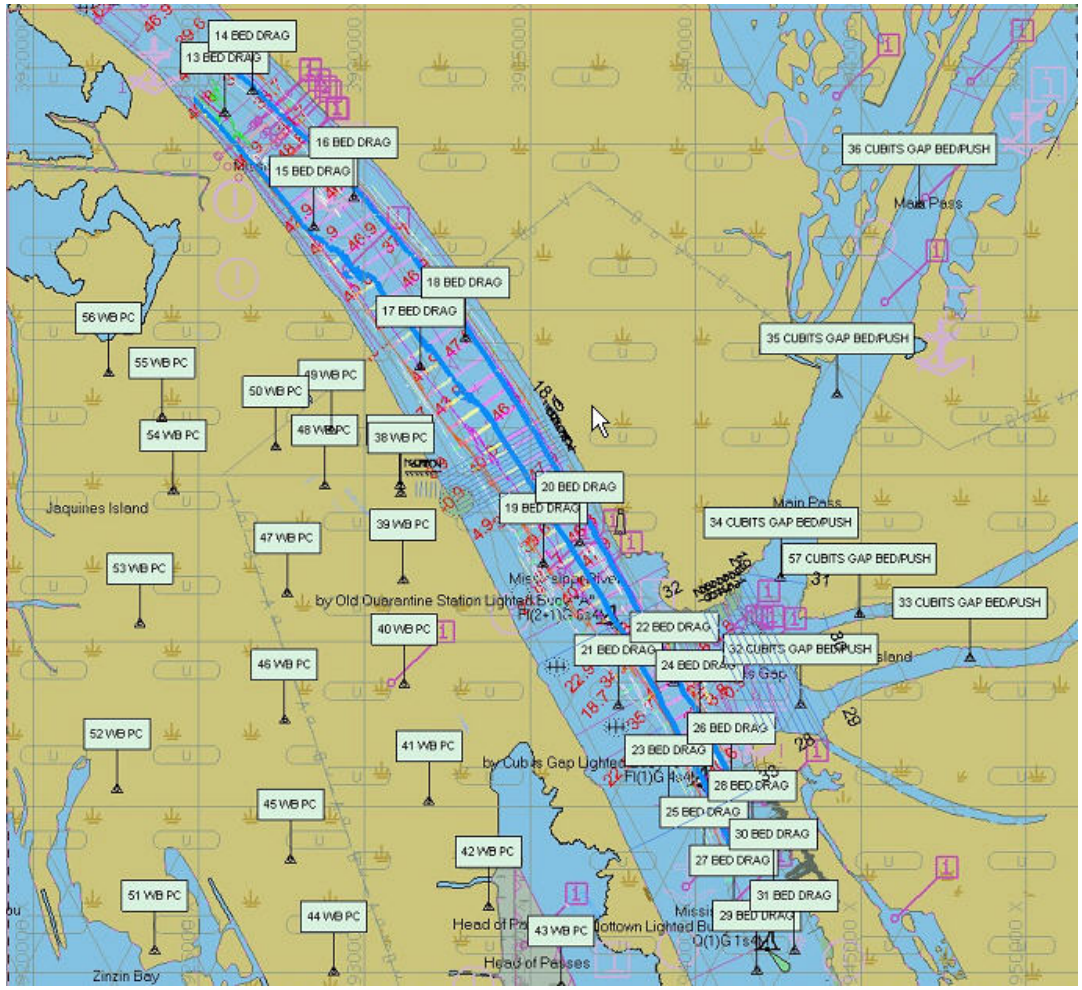
May 5-6, 2009

# 3D Velocity Mapping in Vicinity of Cubit's Gap

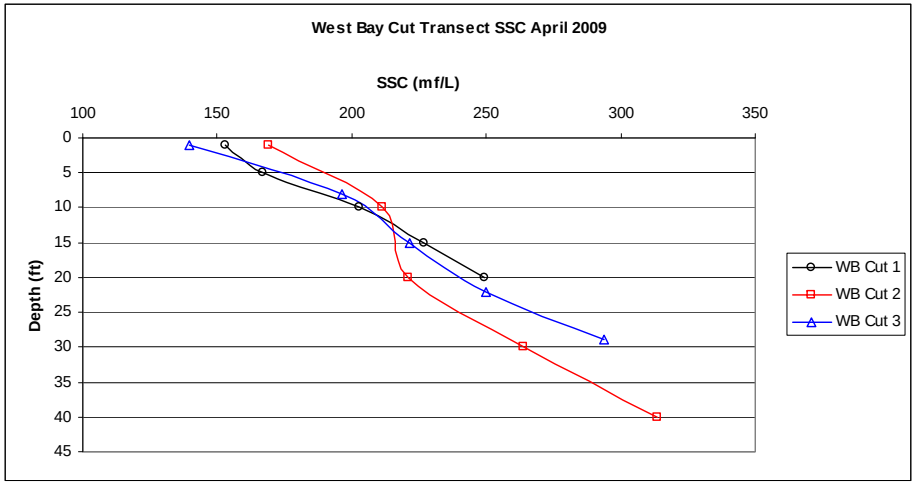


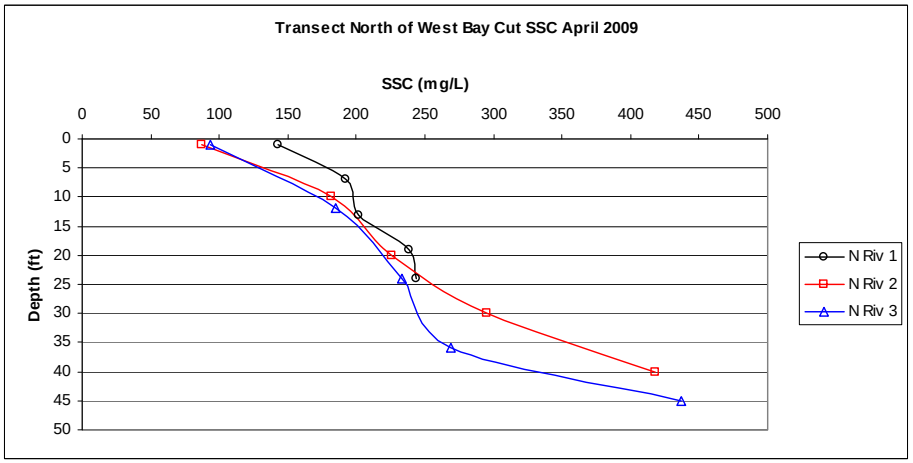

**Area 4 – April 22-23, 2009**

# Bottom and Suspended Sediment Sites



# Suspended Sediment Concentrations

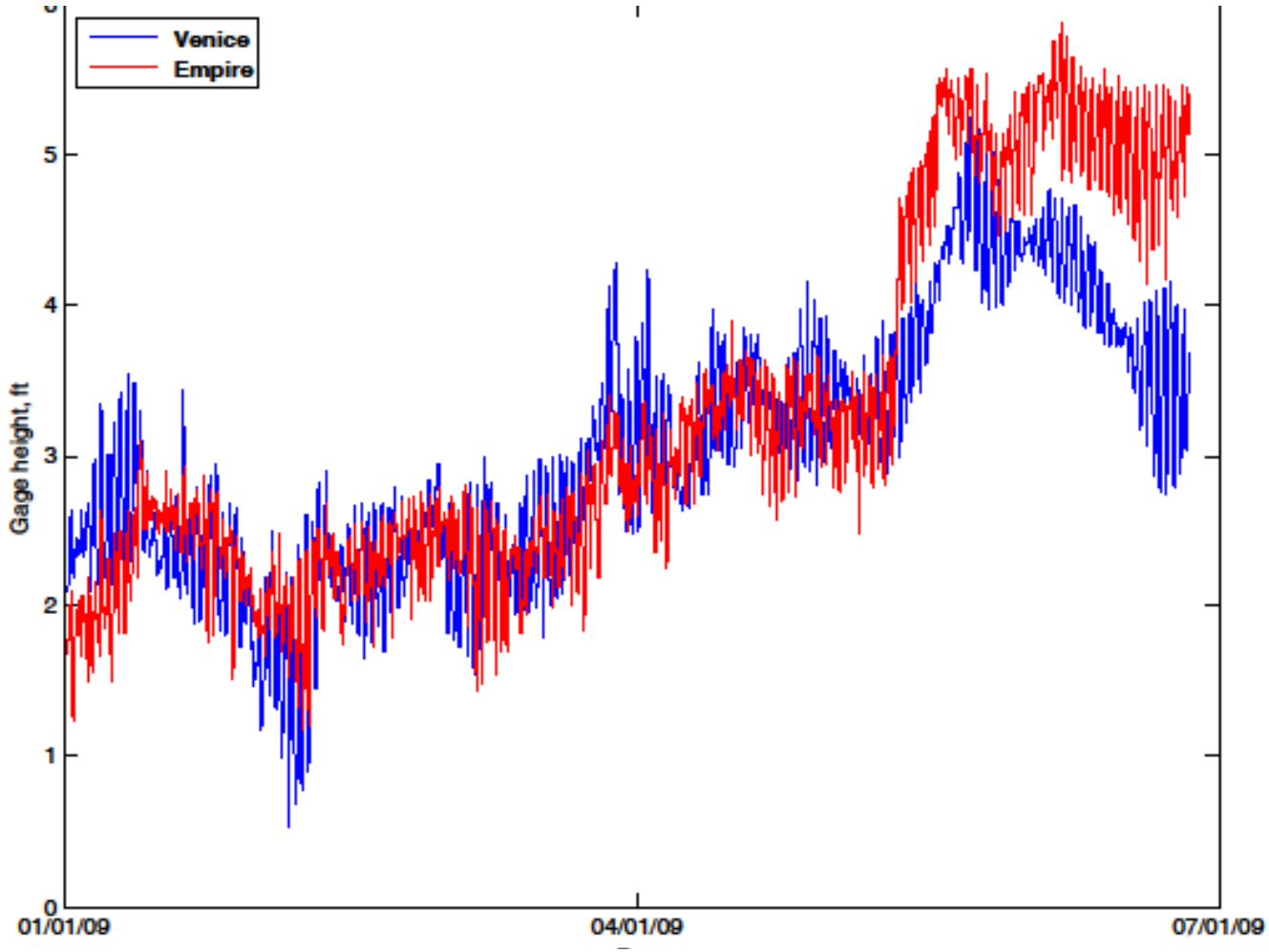


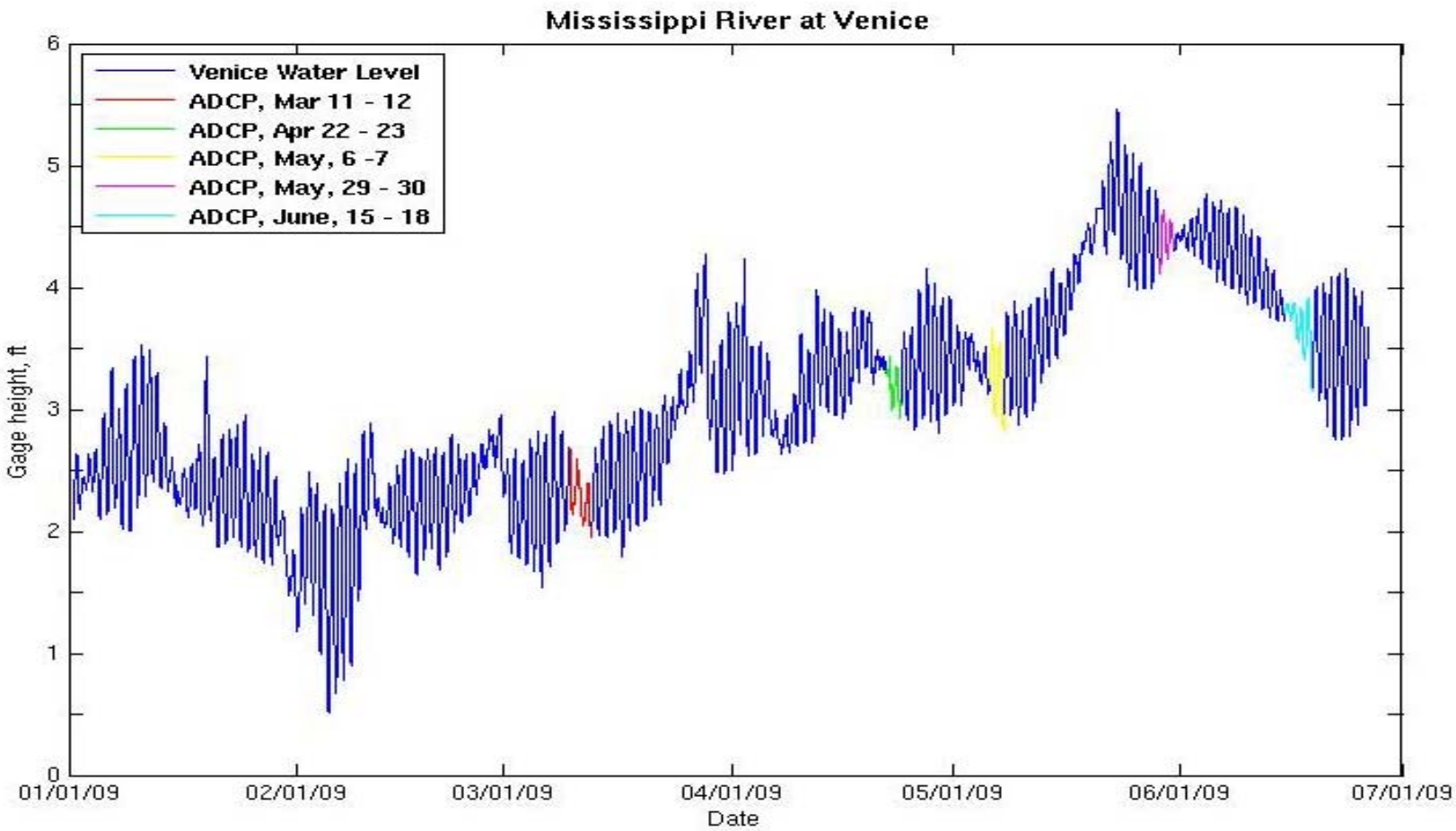
# Observations

- ~45% Total Discharge is lost to the multiple cuts from Venice to below Cubit's Gap
- Bed material grain size in anchorage range from 0-200 microns
- Suspended sediment concentrations range from 50-350 mg/l in the vertical
- Grain size in suspended sediments range from 0-100 microns w/ mean size at surface 8-9 microns and w/ mean grain size 1 foot above bed ~15 microns

# Mississippi River Stages



# Mississippi River Stage & Survey Dates



# Q values & River Stage at Venice

| Date(GMT) | Line # | Q(ft^3/sec) | Stage |
|---|---|---|---|
| 3/10 18:00 | 23 | 326,000 | 2.25 |
| 4/22 18:11 | 23 | 540,000 | 3.37 |
| 5/5 21:14 | 23 | 465,000 | 3.29 |
| 5/29 20:25 | 23 | 744,000 | 4.63 |
| 6/16 21:00 | 23 | 568,000 | 3.68 |

North of WB

Diversion

# Q values & River Stage at Venice

| Date(GMT) | Line # | Q(ft^3/sec) | Stage |
|---|---|---|---|
| 4/22 17:30 | 3 | 45,000 | 3.37 |
| 5/5 21:35 | 3 | 41,000 | 3.29 |
| 5/29 18:53 | 3 | 67,000 | 4.58 |
| 6/16 19:10 | 3 | 52,000 | 3.58 |

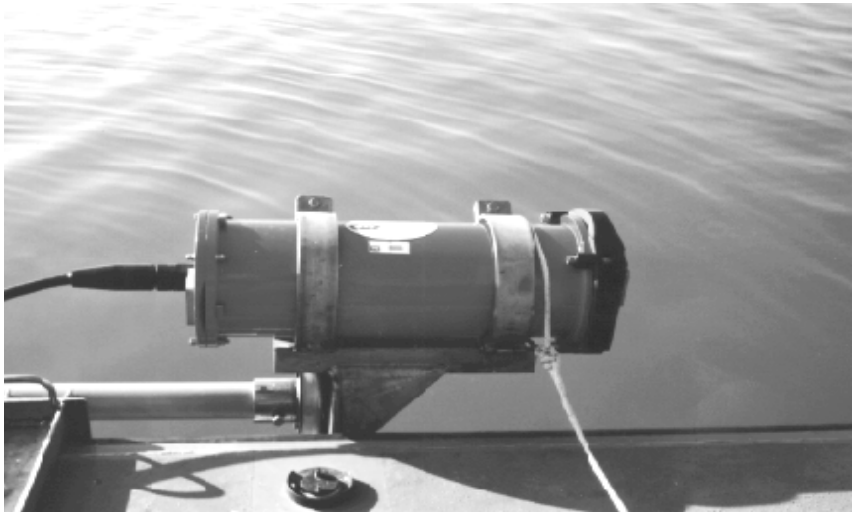
Inside
WB
Diversion

# Q values & River Stage at Venice

| Date(GMT) | Line # | Q(ft^3/sec) | Stage |
|---|---|---|---|
| 4/22 18:59 | 40 | 473,000 | 3.29 |
| 5/6 18:53 | 40 | 512,000 | 3.45 |
| 5/29 15:03 | 41 | 676,000 | 4.49 |
| 6/16 15:12 | 41 | 485,000 | 3.71 |

South of
WB
Diversion

# Vessel Mounted ADCP



# Questions ?

# West Bay Diversion Work Plan, Task #2: Geomorphic Assessment

**Objective:** Conduct a geomorphic assessment of the lower Mississippi River (Belle Chasse to East Jetty) to determine causes of observed shoaling in Pilottown Anchorage Area, with emphasis on evaluating long term river adjustments to changes in hydrology, sedimentation and channel maintenance activities as well as diversion construction.

# Geomorphic Assessment Tasks

- Hydrographic Survey Data Analysis
- Gage/Discharge/Sediment Data Analysis
- Dredge Record Assessment
- Historic Event/Timeline Analysis
- Integration of Analyses/Interpretation

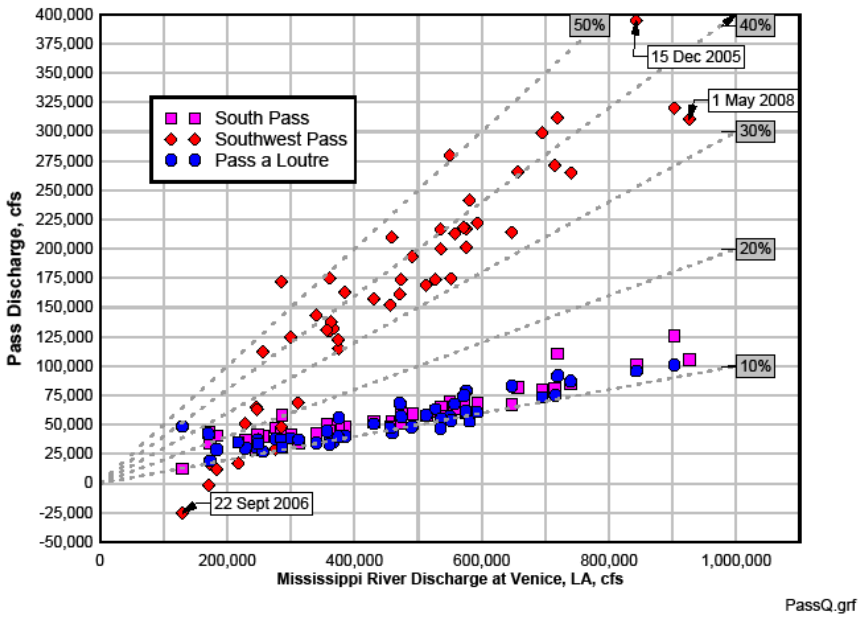
# Hydrographic Survey Data Analysis

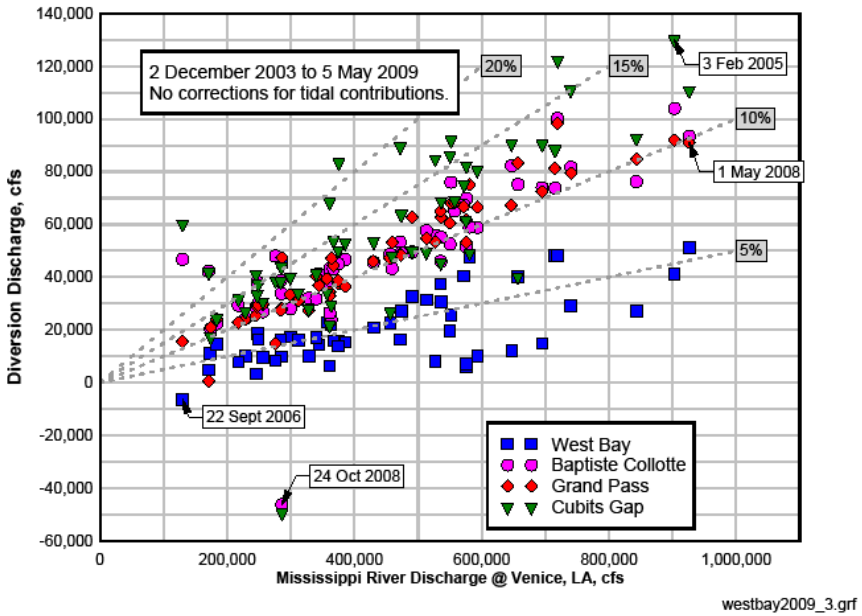
- Comprehensive hydro surveys from 1960s, 1970s, 1980s, 1990s, 2000s, and annual channel condition surveys from 1990-present.
- Convert to common vertical datum NAVD1988 (data in NGVD1929, NAVD1988 and Mean Low Gulf).
- XYZ data entered in ArcGIS, develop surfaces (TINs) for analysis.
  - XYZ data contoured and compared to hydro survey sheets for quality control.
- Data analyzed to determine volumetric changes by reach, cross section comparisons (width & depth), and channel thalweg position.

# Gage/Discharge/Sediment Data Analysis

- Analysis of long-term discharge record to determine trends in flow distribution at diversions and birds foot passes.
- Analysis of Sediment Data
  - Bed material distribution
  - Long-term sediment yield at Tarbert Landing

# Example Plots of Flow Distribution



# Questions ?

# West Bay Diversion Work Plan, Task #3: 1D Sedimentation Modeling

**Software:** HEC-6T Sedimentation In Stream Networks

**Model:** Base Model - Regional HEC-6T Developed by the MVK (not calibrated for very fine sand)

**Spatial Limits:** Model Limits – Vicksburg to East Jetty (Analysis Concentrates on Belle Chasse (RM 75) to Head Of Passes (RM 0))

**Simulations:** 50 years consisting of a typical hydrograph that includes at least one low water year and one high water year within each 10 year period for the with & without West Bay Diversion

# Required Model Modifications

- Add Cross Sections Especially Within Anchorage Area
- Add Major Diversions / Distributaries
- Fully Calibrate The Model

# Project Progress

- Regional HEC-6T Model Acquired from MVK on June 17, 2009
- HEC-6T Software Package Purchased from Mobile Boundary Hydraulics on June 30, 2009

# Next Action Items

- Load MVK HEC-6T Model and Review Model Input. (Collaborate with MVK to make sure that we fully understand model input, assumptions, calibration efforts, etc.)
- Meeting with Tony Thomas of Mobile Boundary Hydraulics to review software updates, requirements, and limitations. Scheduled for July 10, 2009
- Modify model as necessary to accurately define the West Bay Diversion

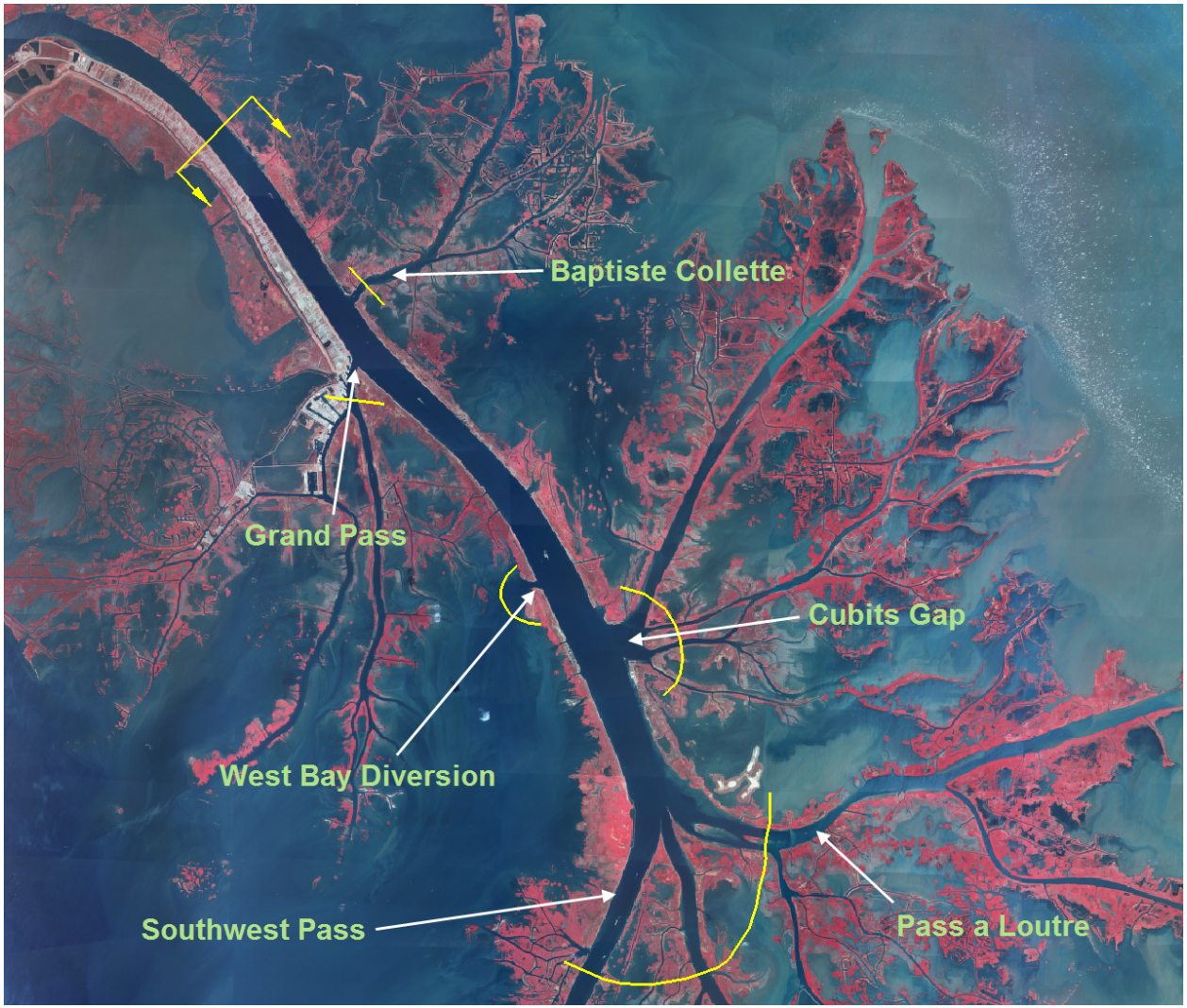
# Questions ?

# West Bay Diversion Work Plan, Task #4: 2D/3D Modeling

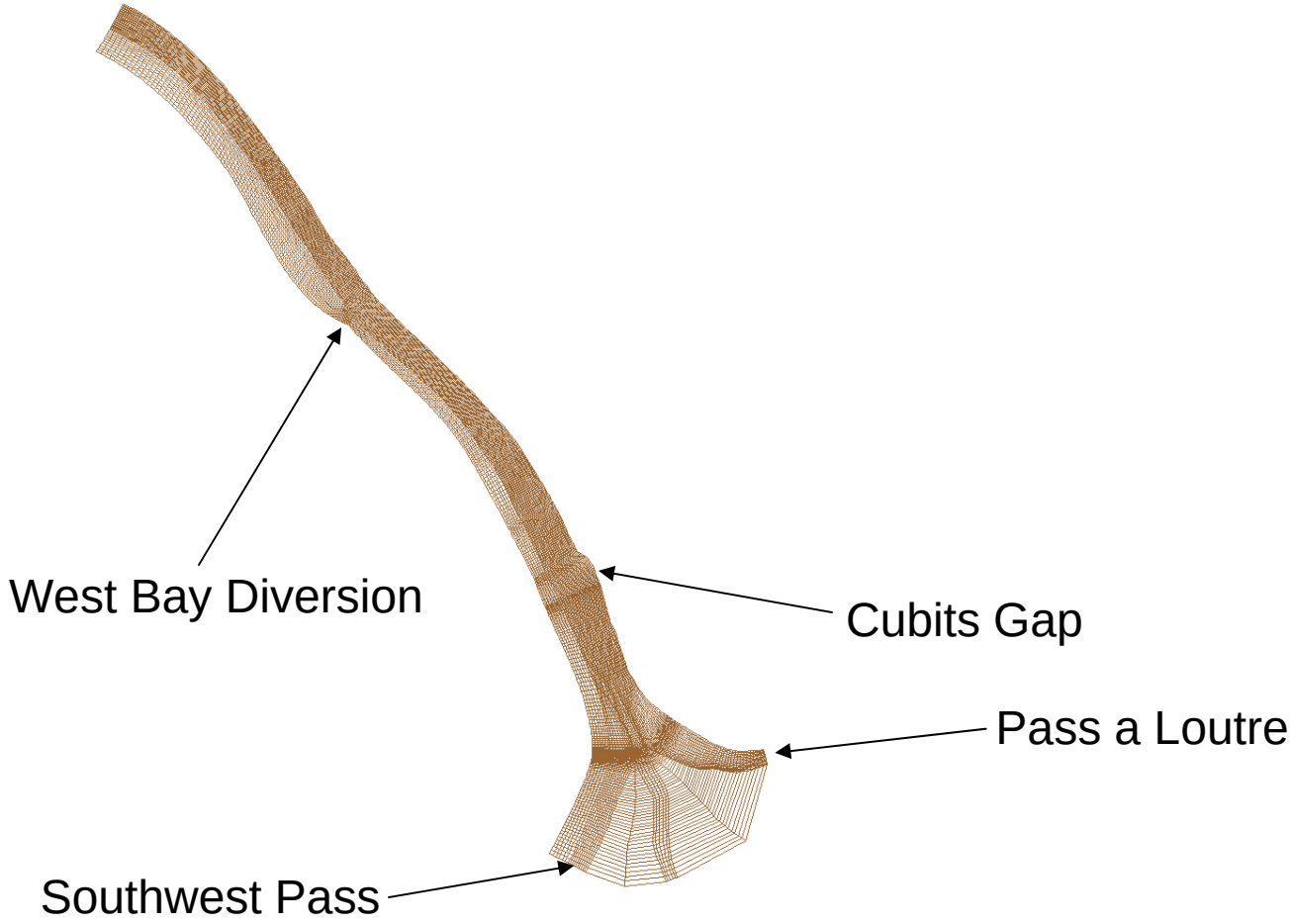
- Existing ADH mesh and CH3D grid will be refined were necessary
- Development of boundary conditions using available data and 1D model output
- Calibration & verification using existing data & data collected in 2009. 6-month effort is for coarse grained sediment
- Run simulation scenarios. Steady state runs, slug test and hydrograph

# Project Progress

- CH3D has undergone significant improvements since the last study of this area of the MS river (Pass a Loutre). As a stability test, the boundary conditions for the Pass a Loutre study were adapted for the improved code and a model simulation was performed. This test was successful
- The previous CH3D grid has been updated with improved resolution and the inclusion of channel features that are important to this study. A preliminary version of this grid is presented in a future slide. Once the final grid is completed, updated bathymetry from ERDC field measurements will be incorporated.
- Analysis is underway to determine appropriate validation periods from ERDC field measurements. One high flow and one median flow condition will be selected.




# 3D Model Domain




Initial CH3D Mesh

# Questions ?