MRHDMS Modeling Activities

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The Water Institute of the Gulf

US Army Corps of Engineers
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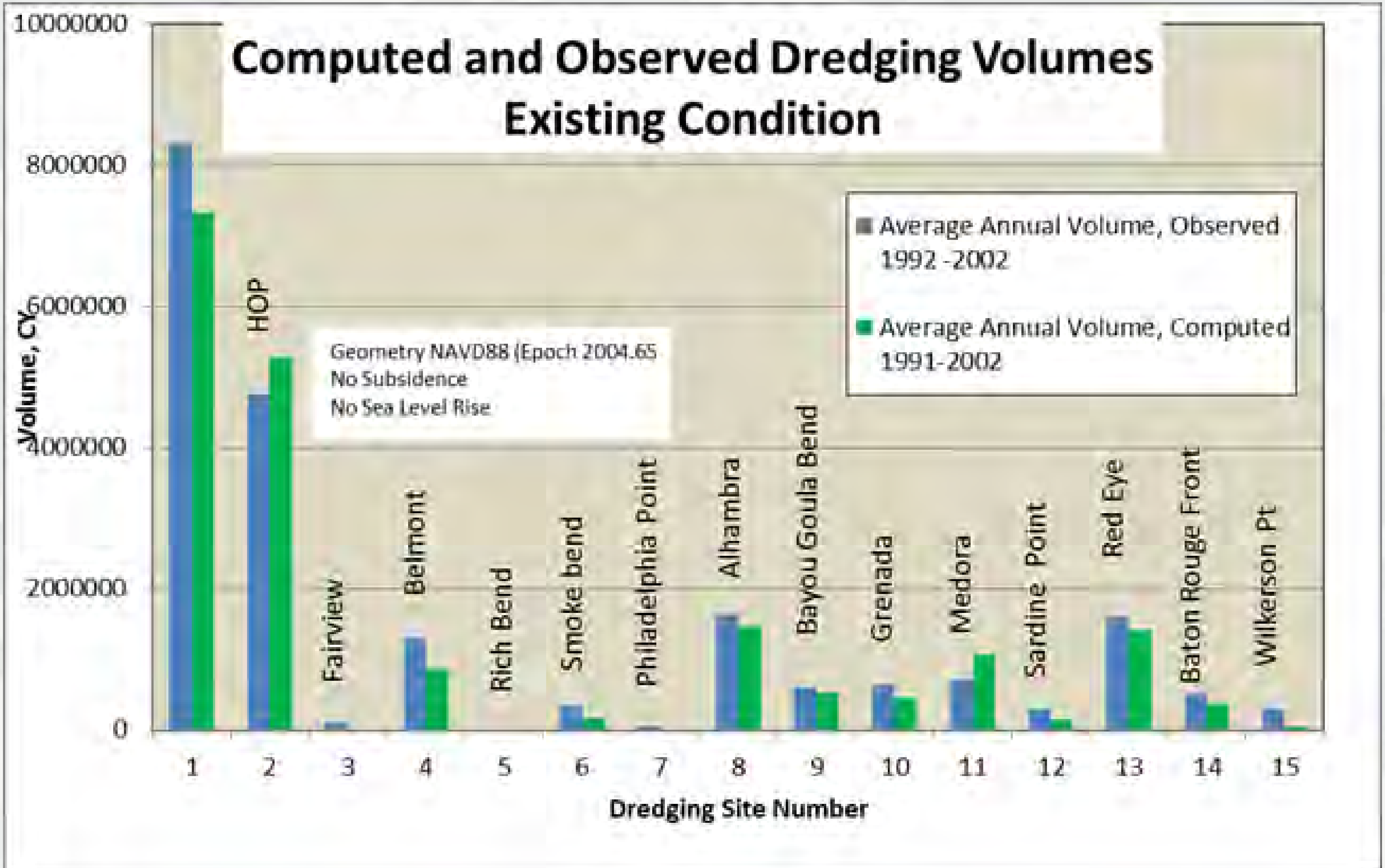
HEC6-T Model

Louisiana Coastal Protection and Restoration Authority



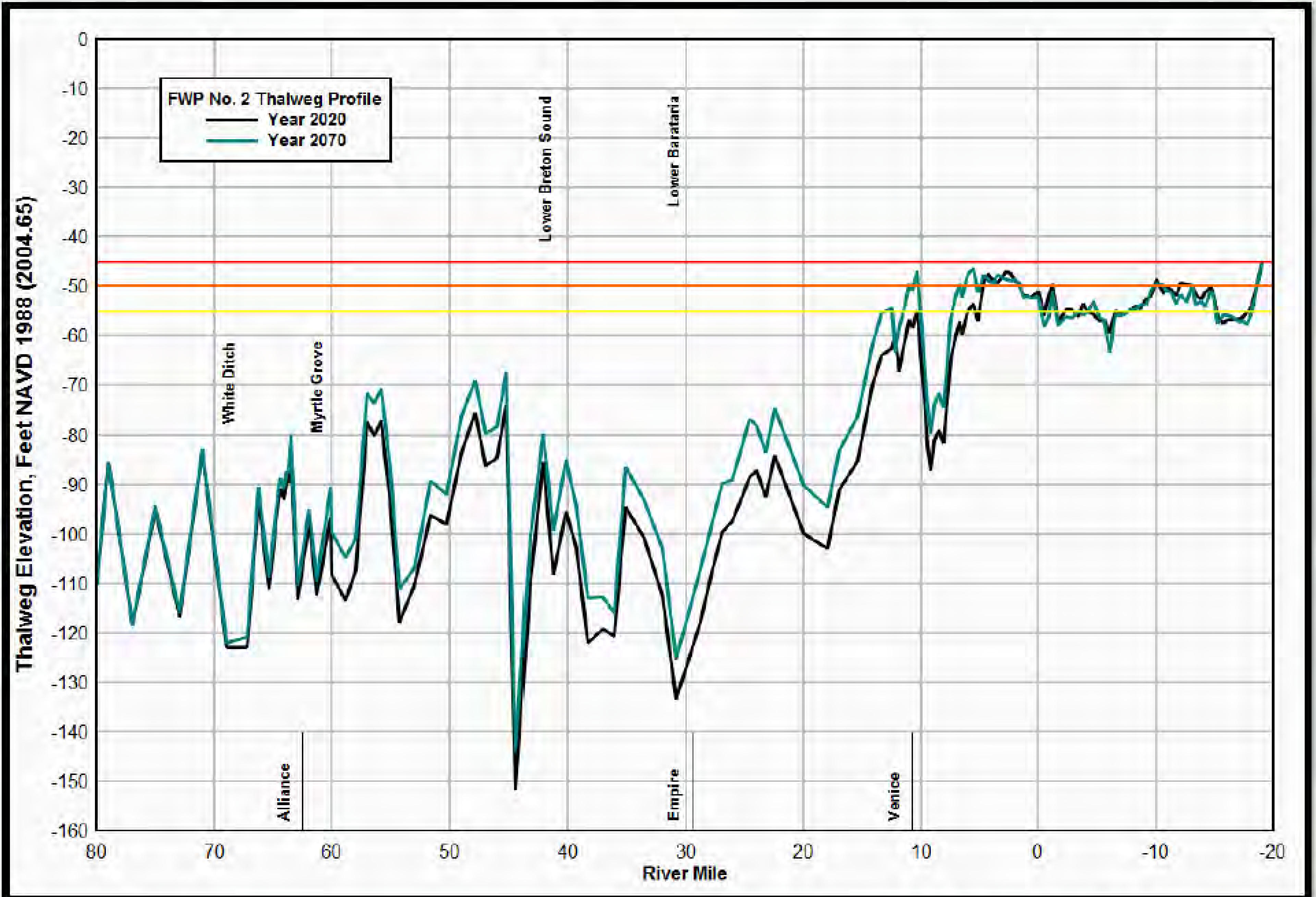
Computed and Observed Dredging Volumes
Existing Condition
Average Annual Volume, Observed 1992 -2002
Average Annual Volume, Computed 1991-2002
Geometry NAVD88 (Epoch 2004.65
No Subsidence
No Sea Level Rise
Volume, CY
Dredging Site Number
10000000
8000000
6000000
4000000
2000000
0
HOP
Fairview
Belmont
Rich Bend
Smoke bend
Philadelphia Point
Alhambra
Bayou Goula Bend
Grenada
Medora
Sardine Point
Red Eye
Baton Rouge Front
Wilkerson Pt
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

FWP Run #2

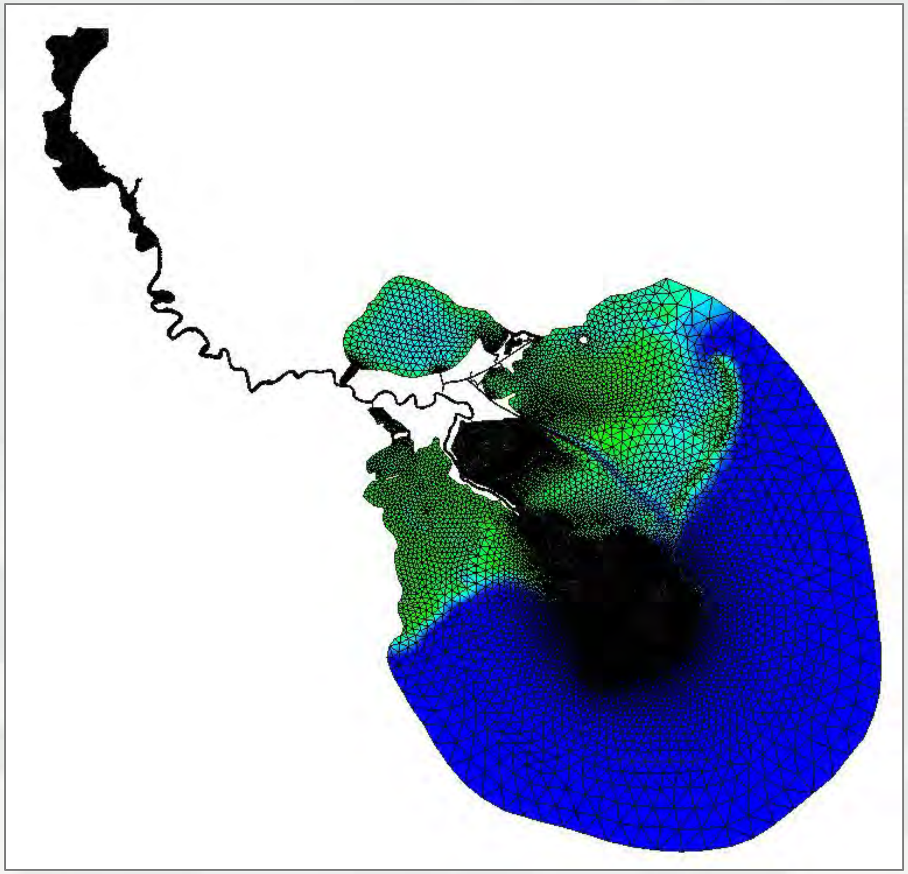
- Diversions open when Tarbert Landing Q ≥ 600,000 cfs

West Maurepas Swamp, RM 144.3	5,000 cfs
White Ditch, RM 68.6	35,000 cfs
Myrtle Grove, RM 60.7	75,000 cfs
Lower Breton Sound, RM 41.8	50,000 cfs
Lower Barataria, RM 29.5	50,000 cfs
Total additional flow diversion:	215,000 cfs

- White Ditch Sediment Diversion operates only during March and April
- Sediment Diversion Coefficients = 1.0 for all grain sizes
- Intermediate Sea Level Rise (NRC Curve I)


FWP No. 2 Thalweg Profile
Year 2020
Year 2070
Thalweg Elevation, Feet NAVD 1988 (2004.65)
River Mile
White Ditch
Myrtle Grove
Lower Breton Sound
Lower Barataria
Alliance
Empire
Venice
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
80
70
60
50
40
30
20
10
0
-10
-20

AdH Domain

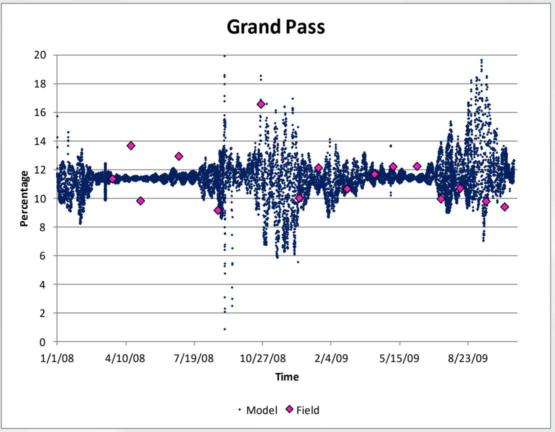


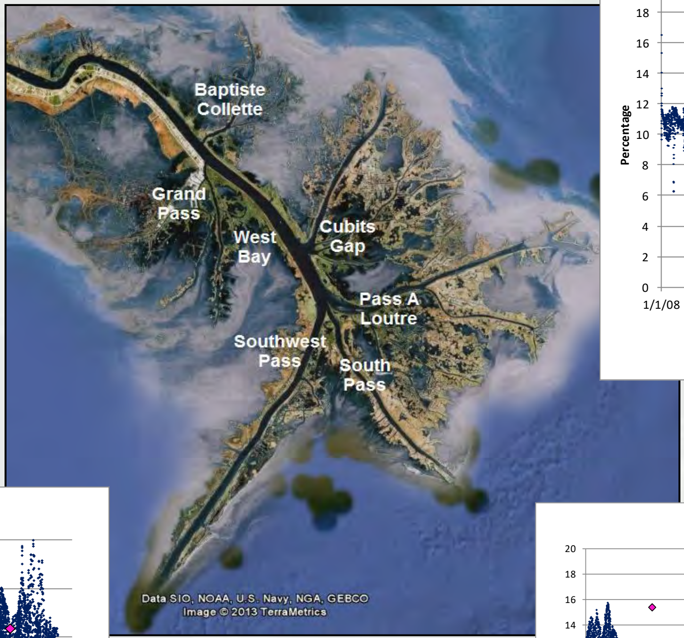
Full Domain extends from Old River Control Structure to the Gulf

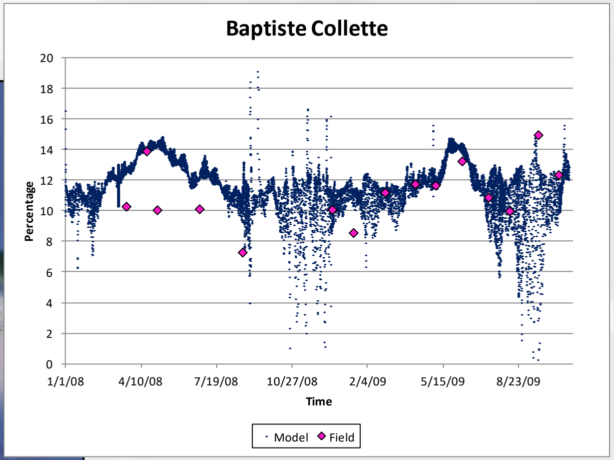
Model performance specs:

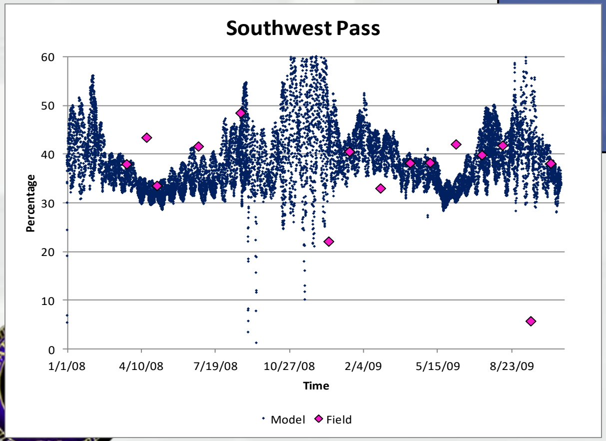
- 241126 nodes
- 471809 elements
- 512 processors
- ~15 days/hour

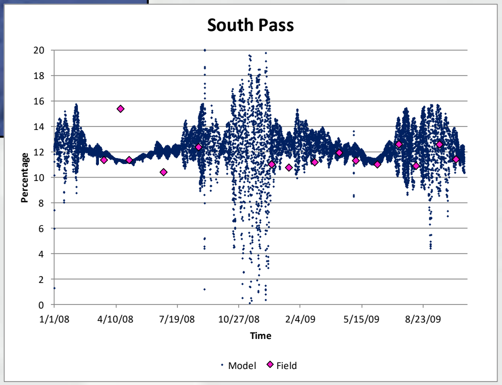
ADH-SEDLIB: Hydro Validation



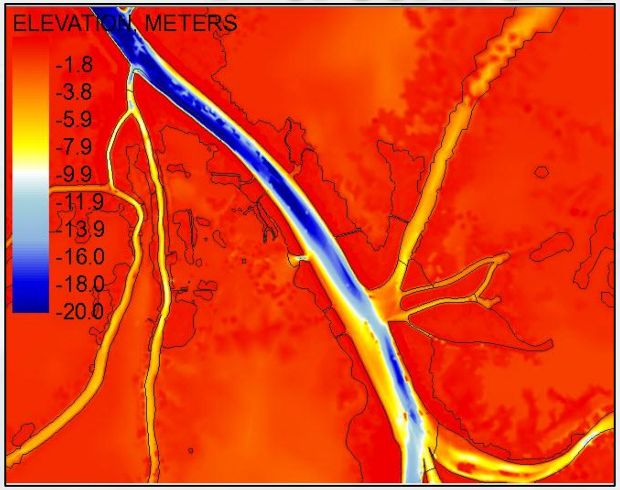




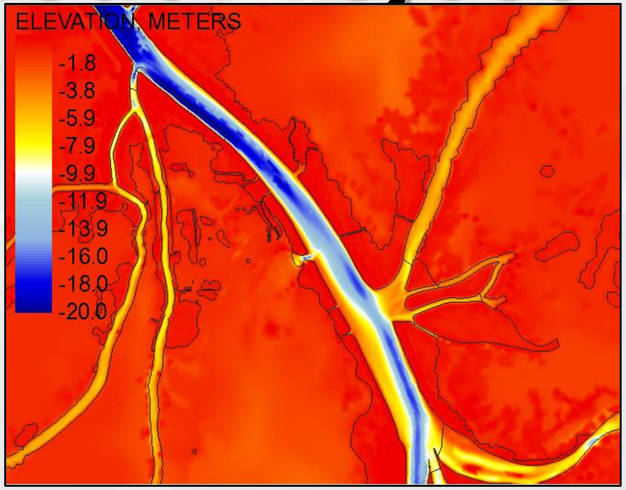




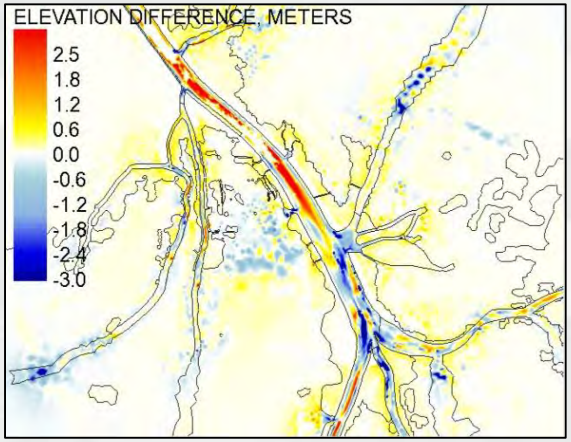
Future Without Project



Existing @ end of run

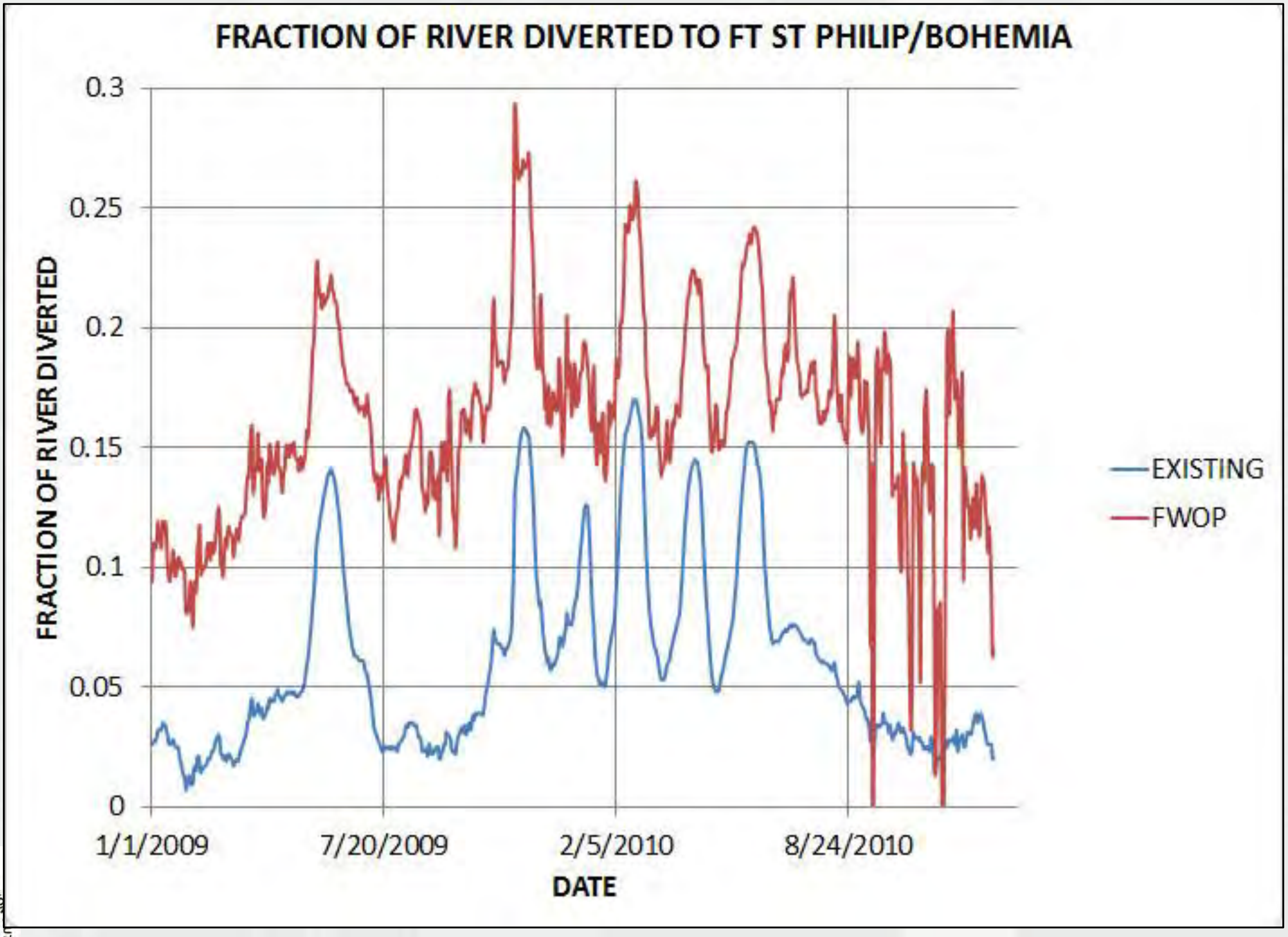


FWOP @ end of run



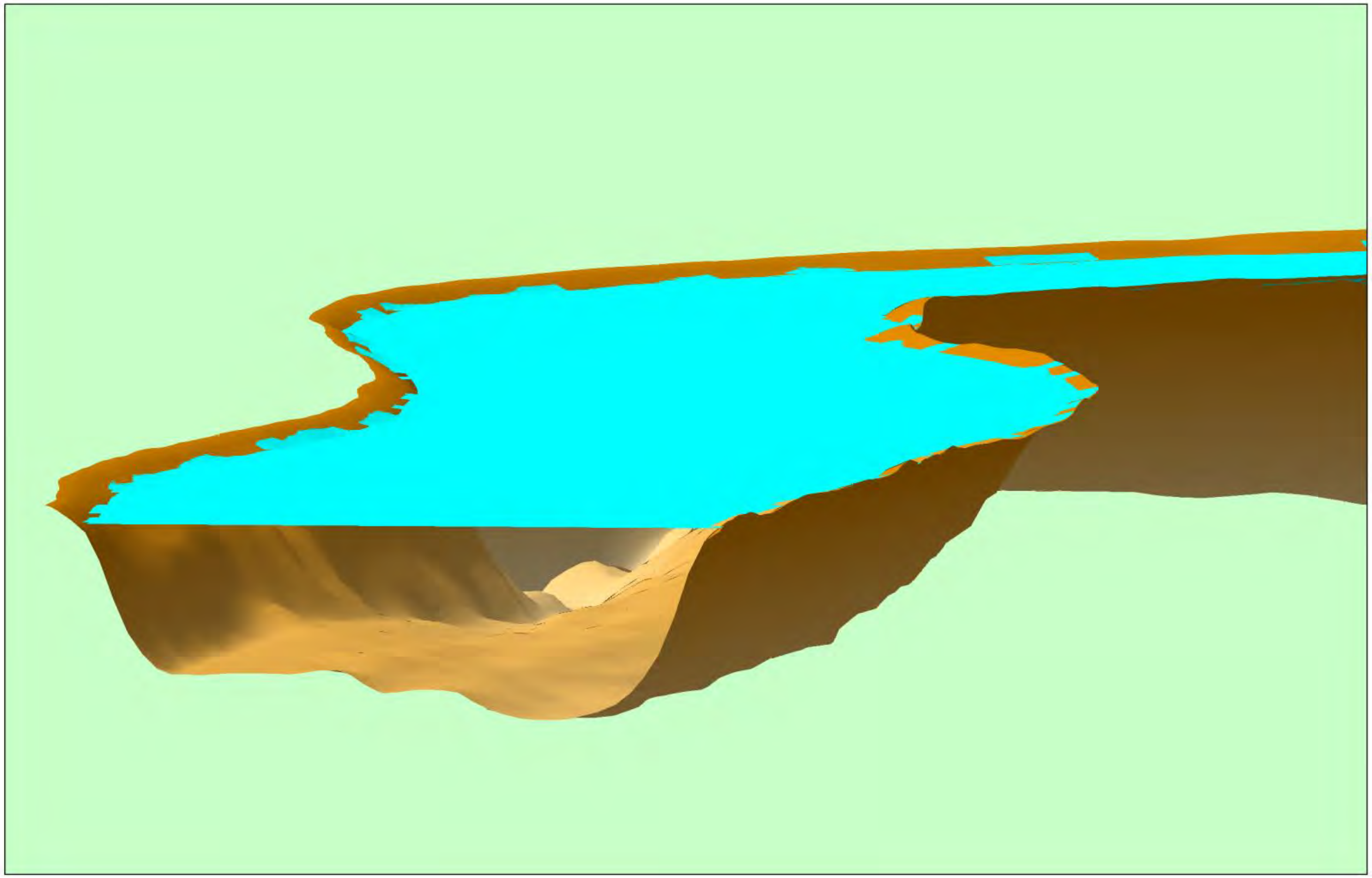
FWOP minus Existing

Future Without Project



Much larger flow fraction diverted at Ft St Philip / Bohemia

3-D Regional Model of the Lower Mississippi River



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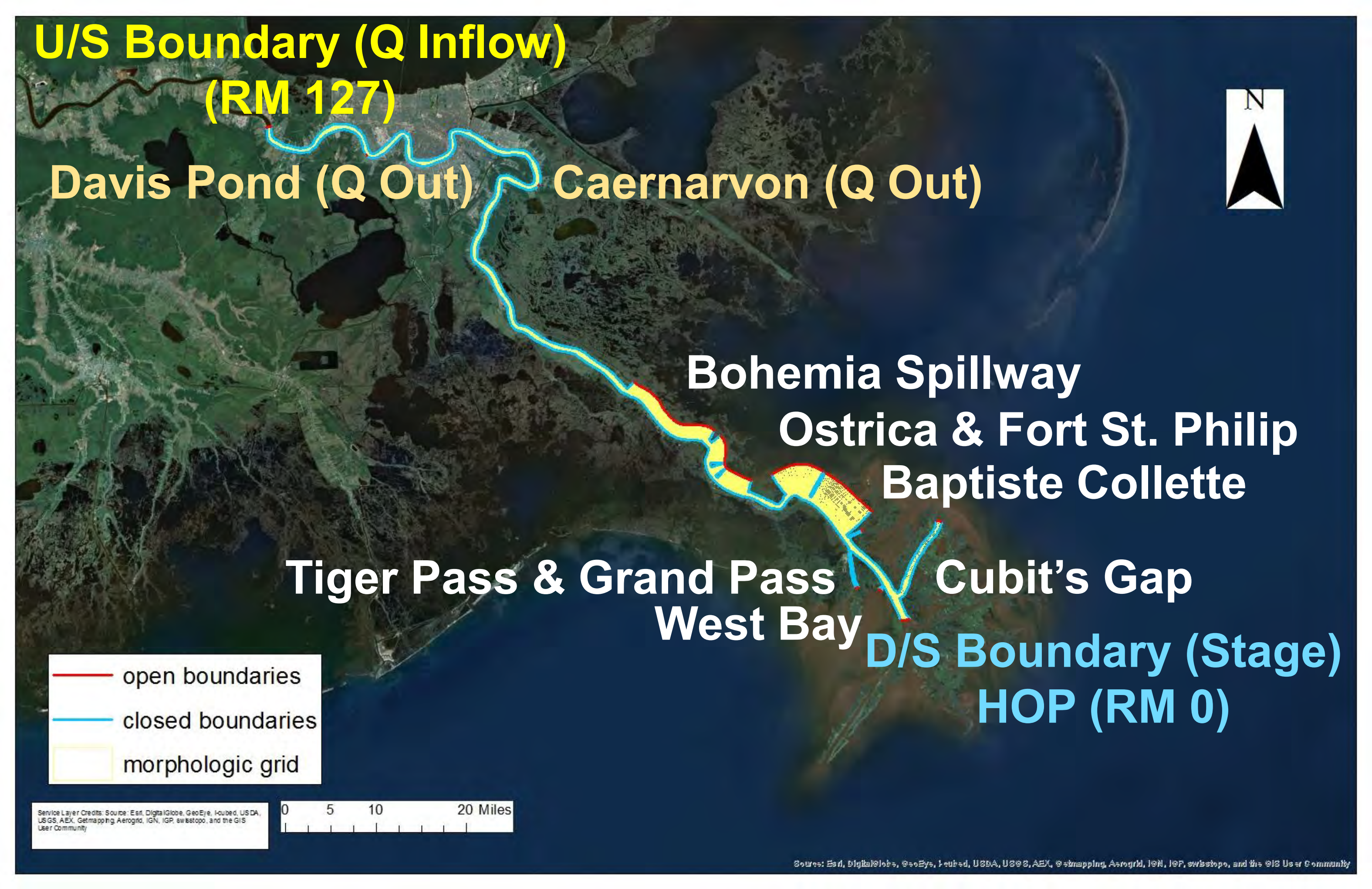
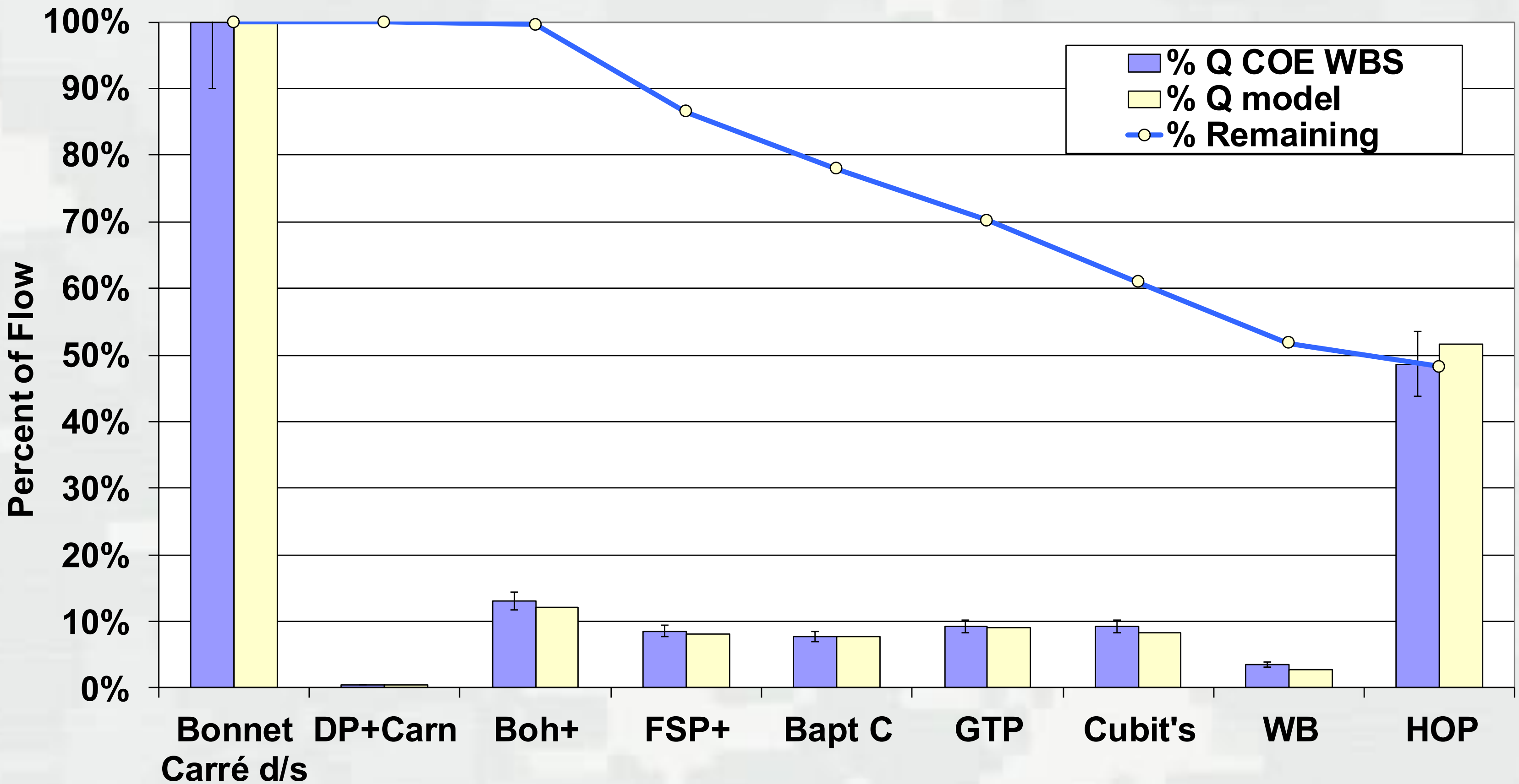
Model Boundary Conditions

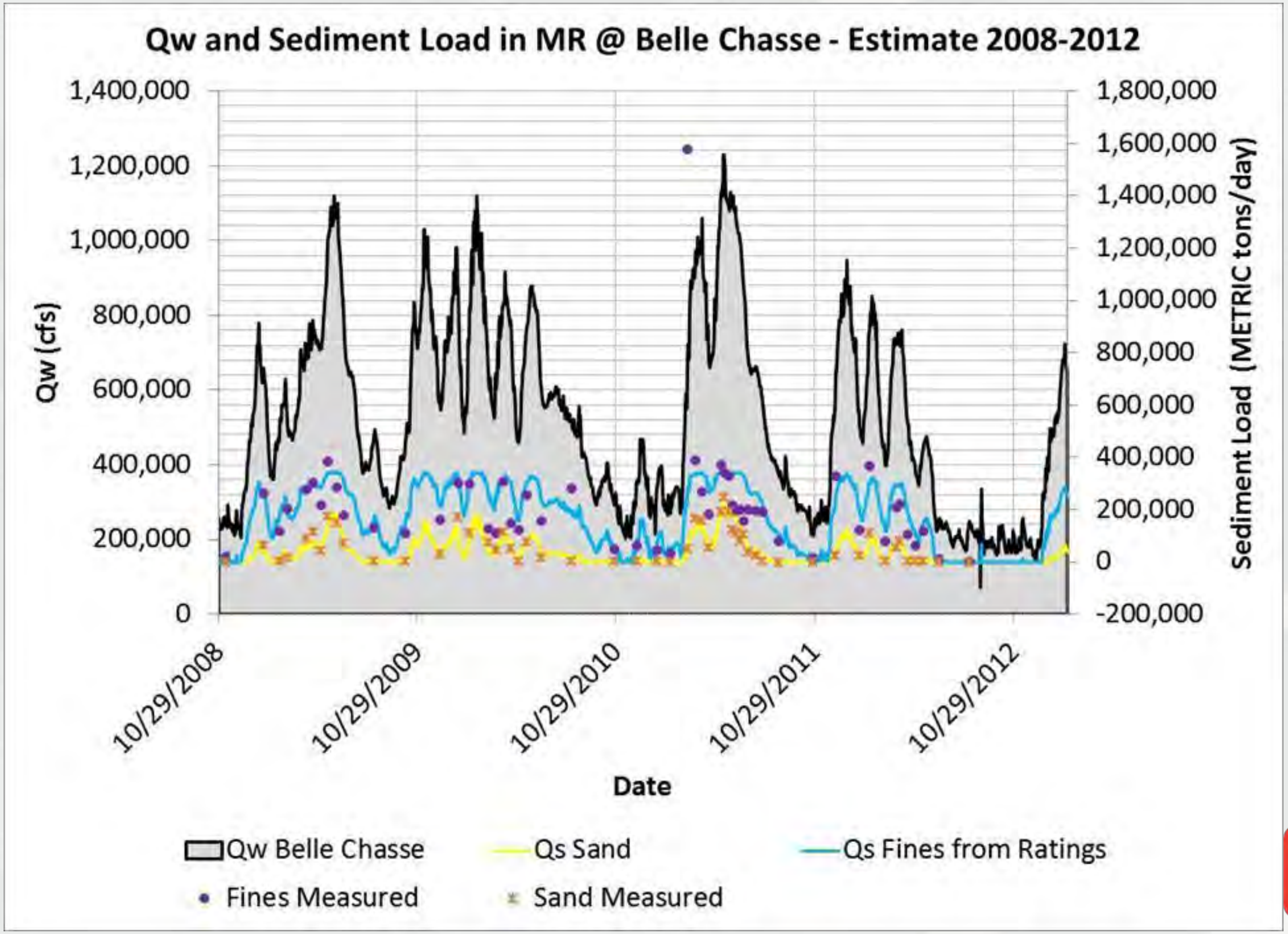


Flow Distribution

River at Flood Stage Q > 1 million cfs



Sediment Transport
U/S Boundary Transport



Hydrodynamics and Salinity Modeling in the Lowermost Mississippi River and Delta Finite Volume Coastal Ocean Model (FVCOM)

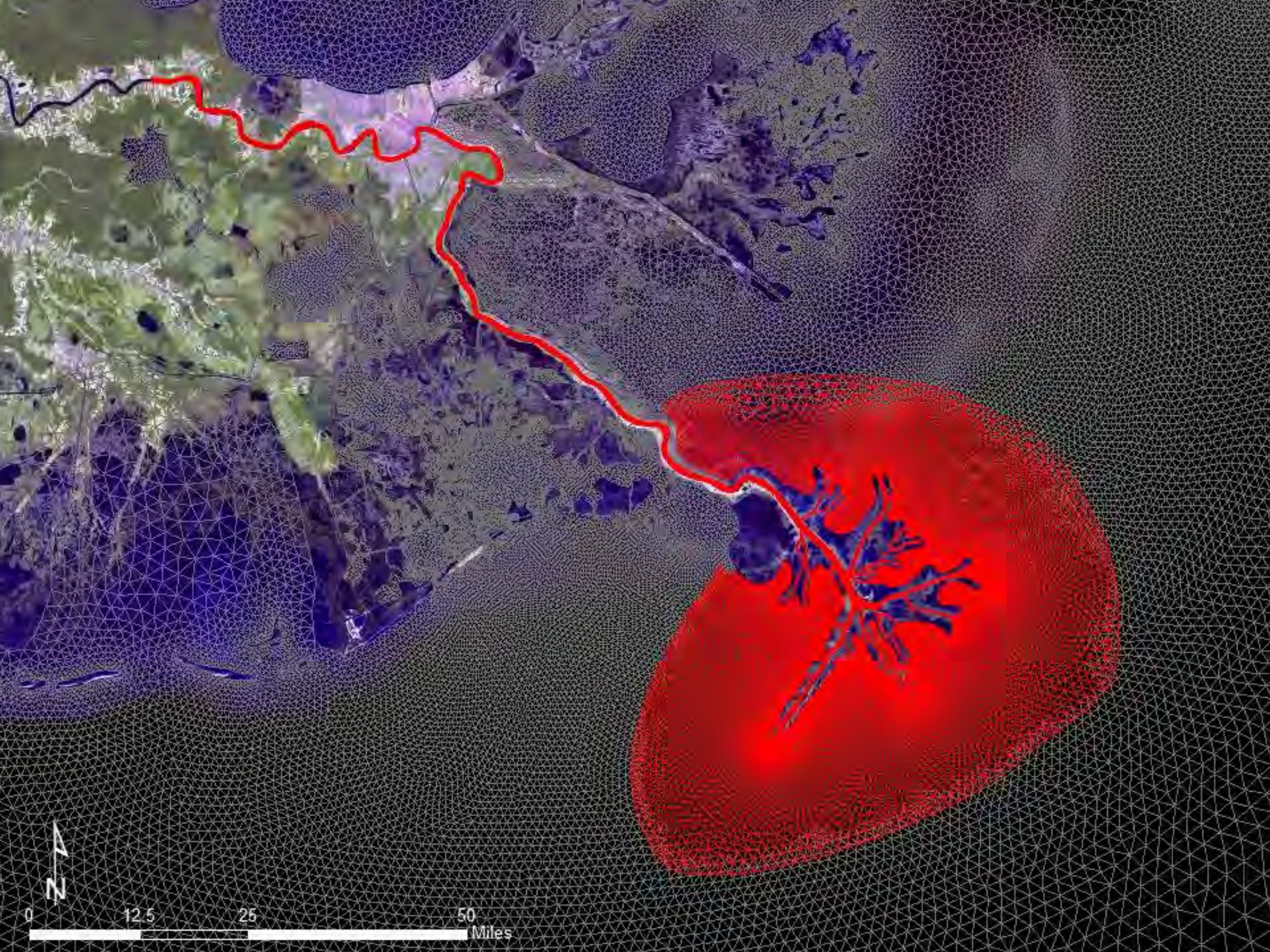
Ioannis Georgiou, Kevin Hanegan

Coastal Hydrodynamics and Sediment Transport laboratory

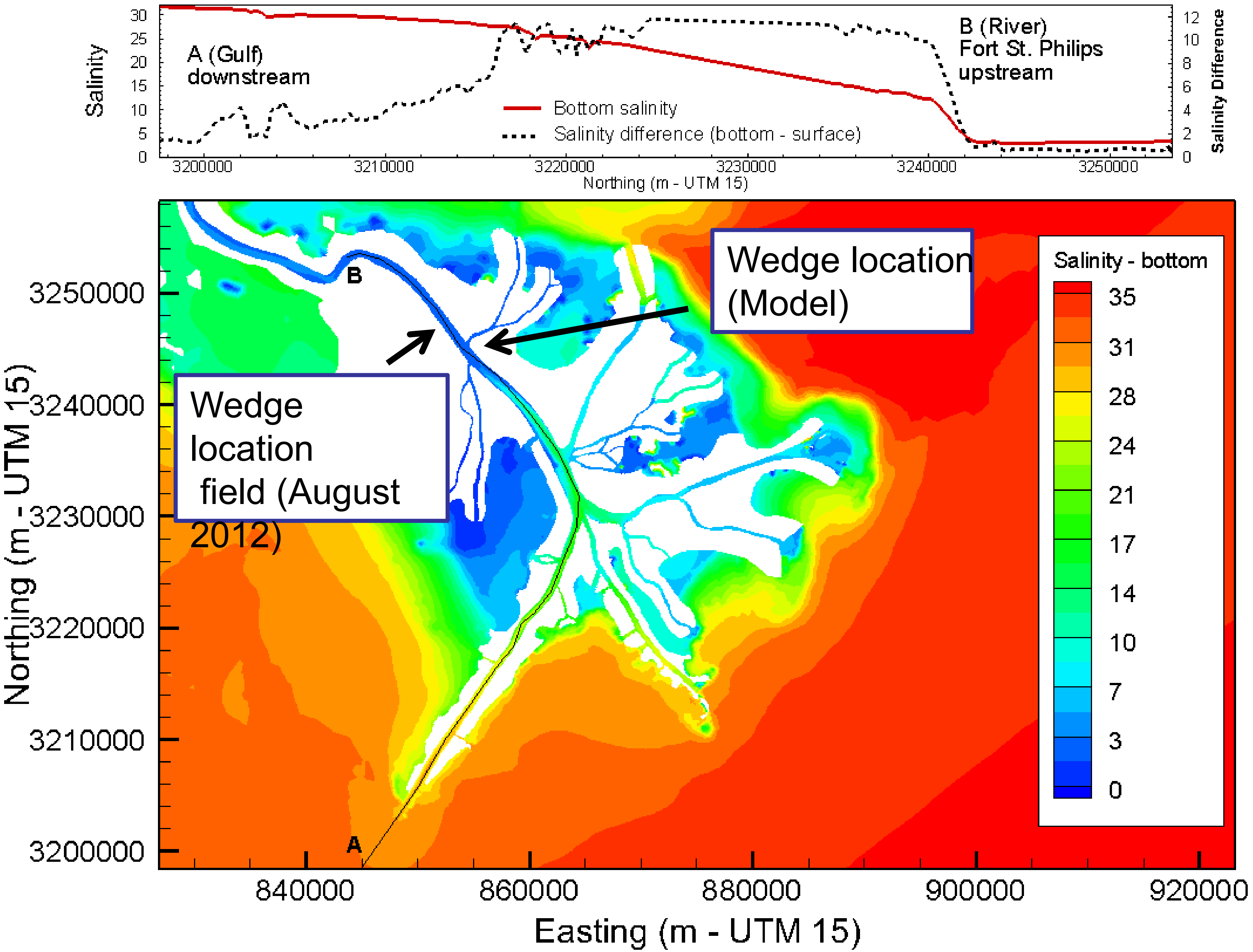
Dept. of Earth and Environmental Sciences, and

Pontchartrain Institute for Environmental Sciences

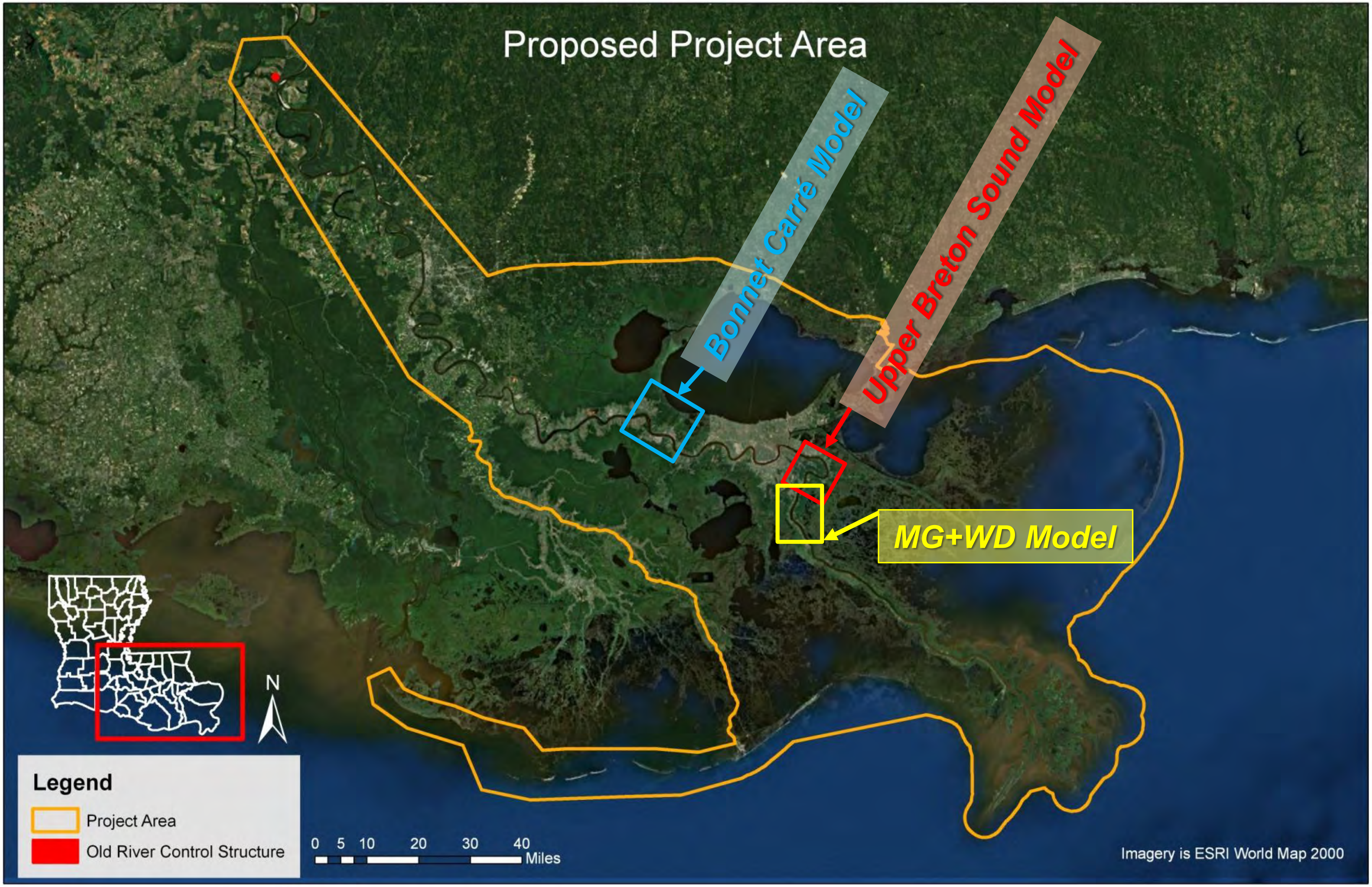
University of New Orleans



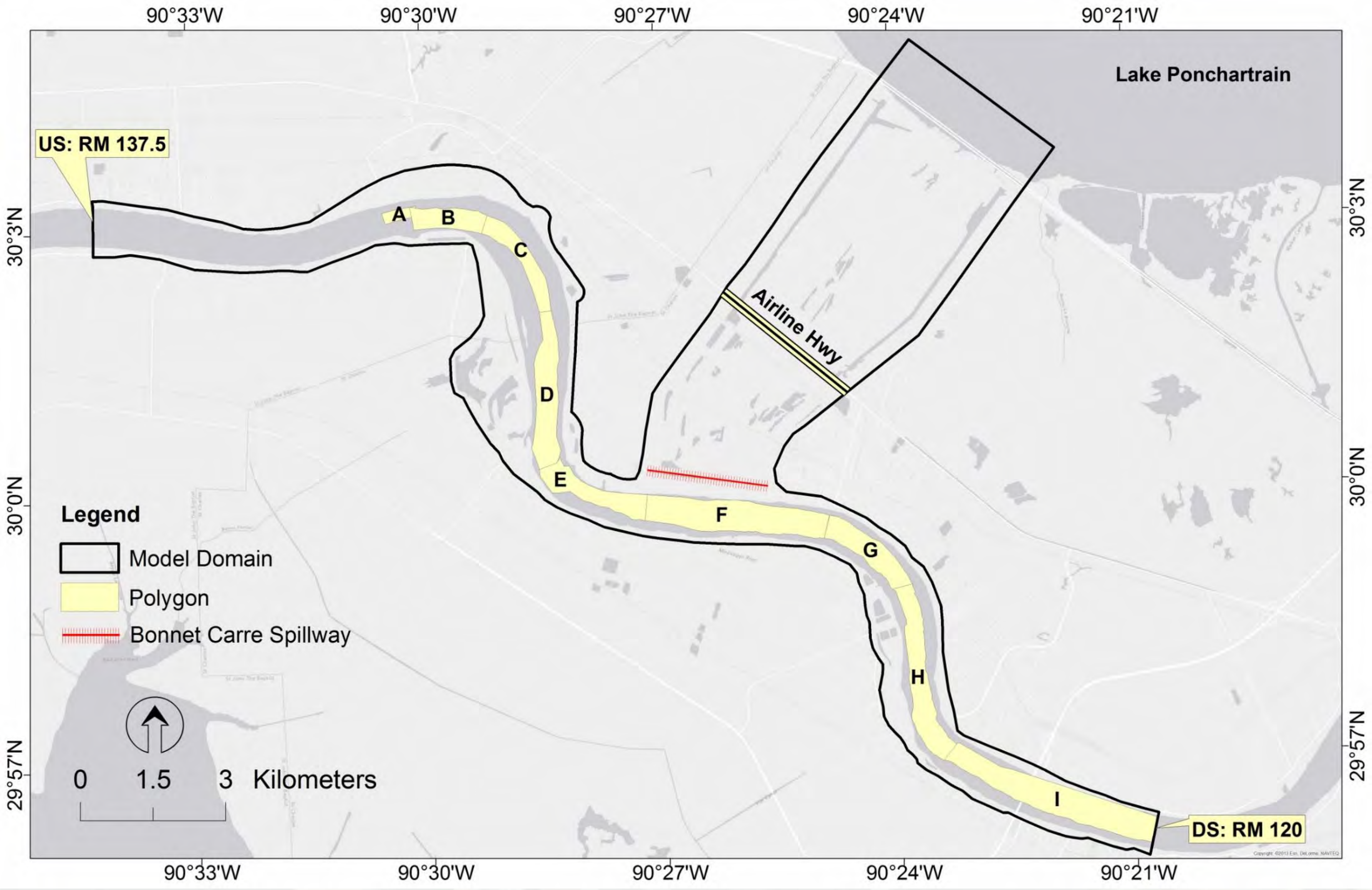
N
0
12.5
25
50
Miles


Salinity
A (Gulf)
downstream
B (River)
Fort St. Philips
upstream
Bottom salinity
Salinity difference (bottom - surface)
Salinity Difference
Northing (m - UTM 15)
30
25
20
15
10
5
0
12
10
8
6
4
2
0
3200000
3210000
3220000
3230000
3240000
3250000
B
A
Wedge location
(Model)
Wedge
location
field (August
2012)
Salinity - bottom
35
31
28
24
21
17
14
10
7
3
0
Northing (m - UTM 15)
3250000
3240000
3230000
3220000
3210000
3200000
840000
860000
880000
900000
920000
Easting (m - UTM 15)

LOCAL MODELS

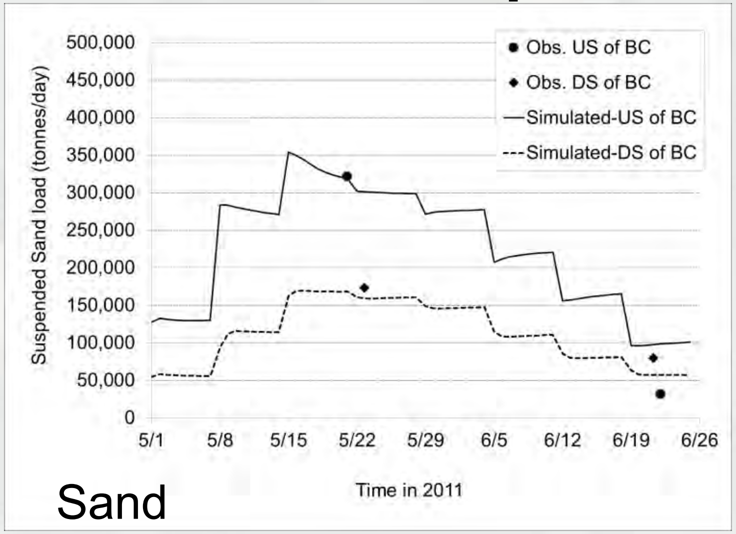


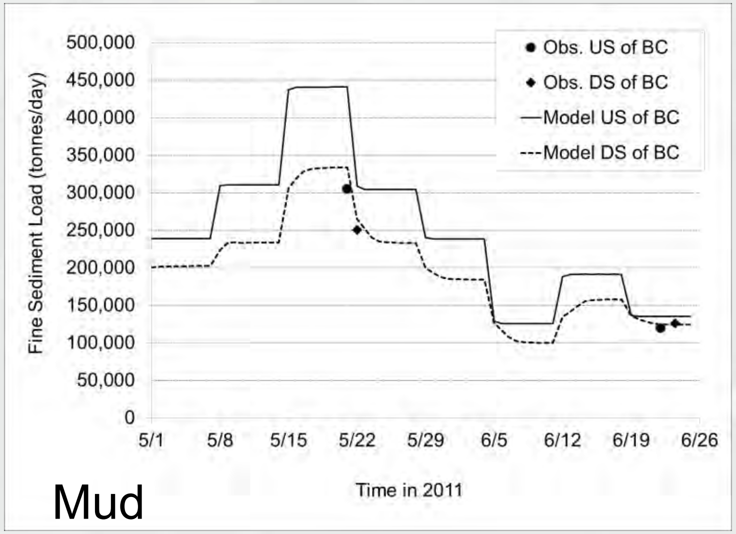
BONNET CARRÉ – Delft3D



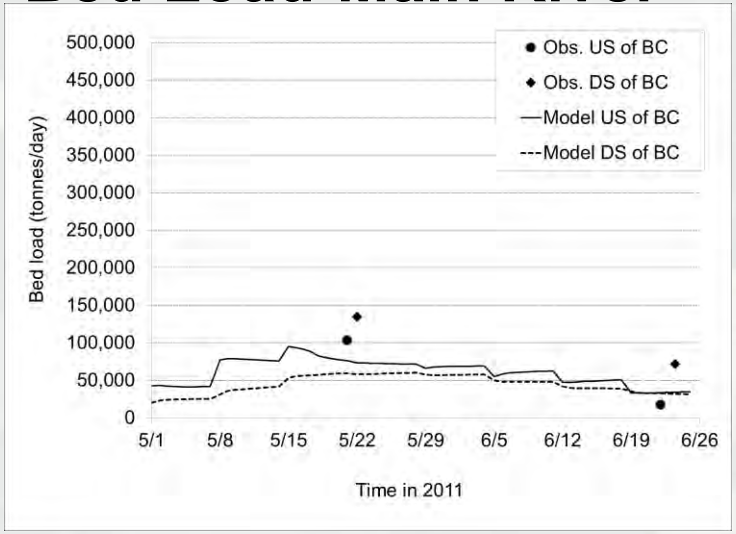
MODEL CALIBRATION

Suspended Load-Main River





Bed Load-Main River



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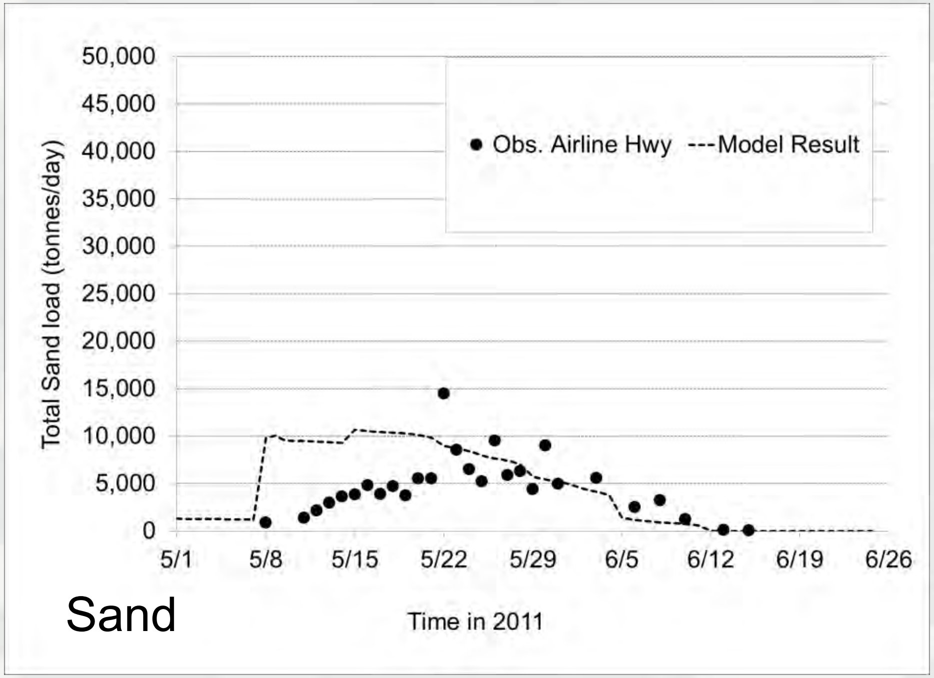
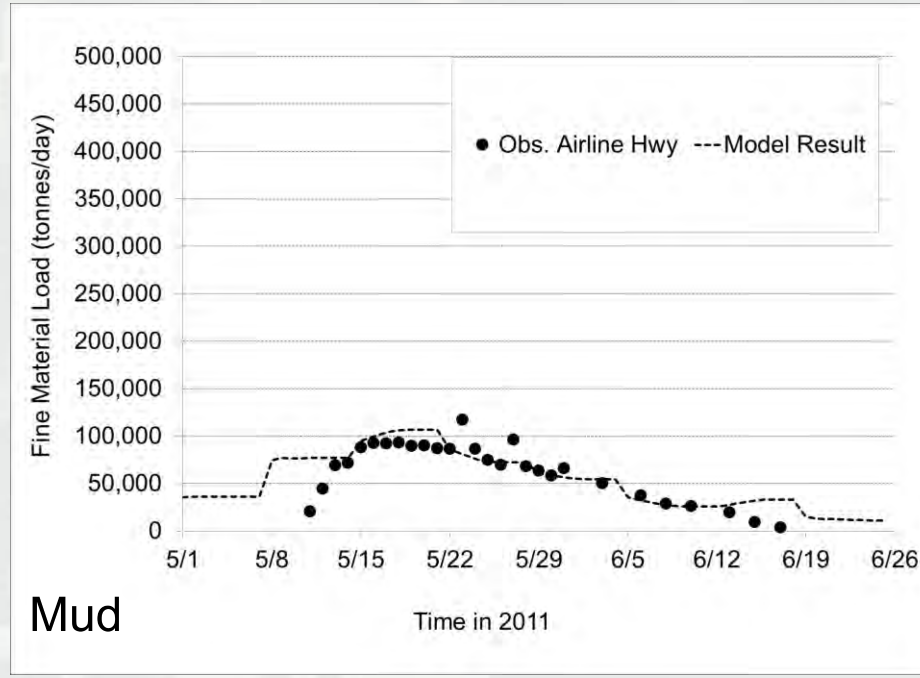
MODEL CALIBRATION

Loads at Airline Highway





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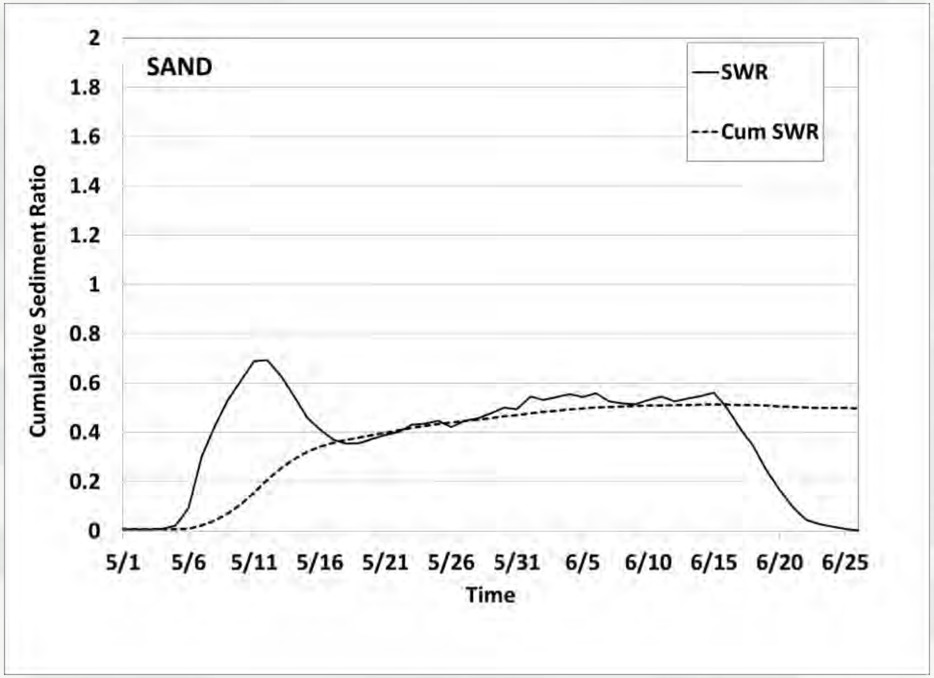
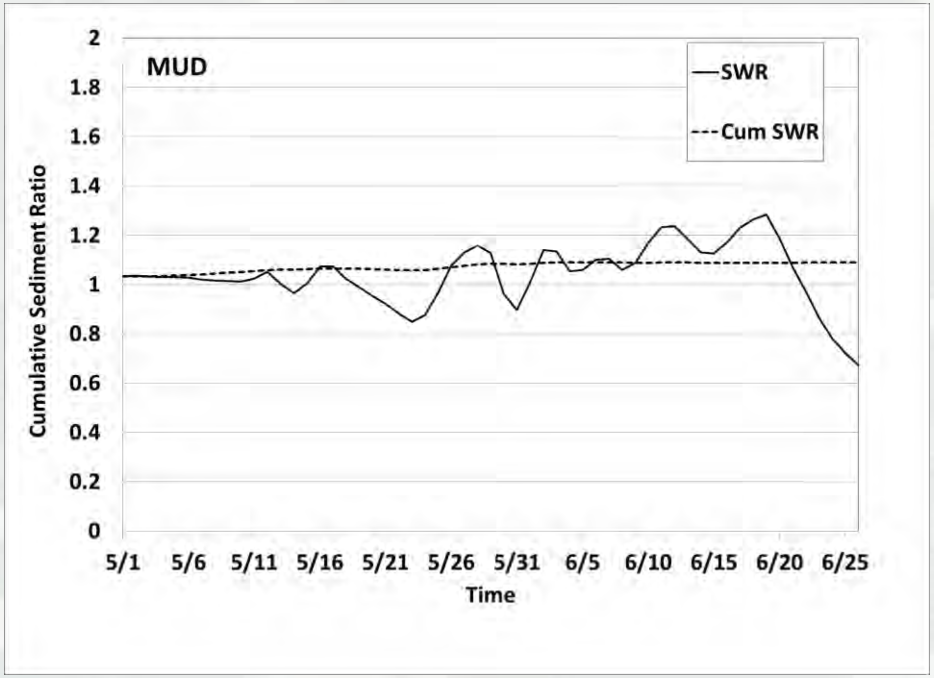
SEDIMENT-WATER RATIO

$$\textit{Sediment Water Ratio, SWR} = \frac{\textit{Sediment Concentration Diverted}}{\textit{Sediment Concentration in the River}}$$





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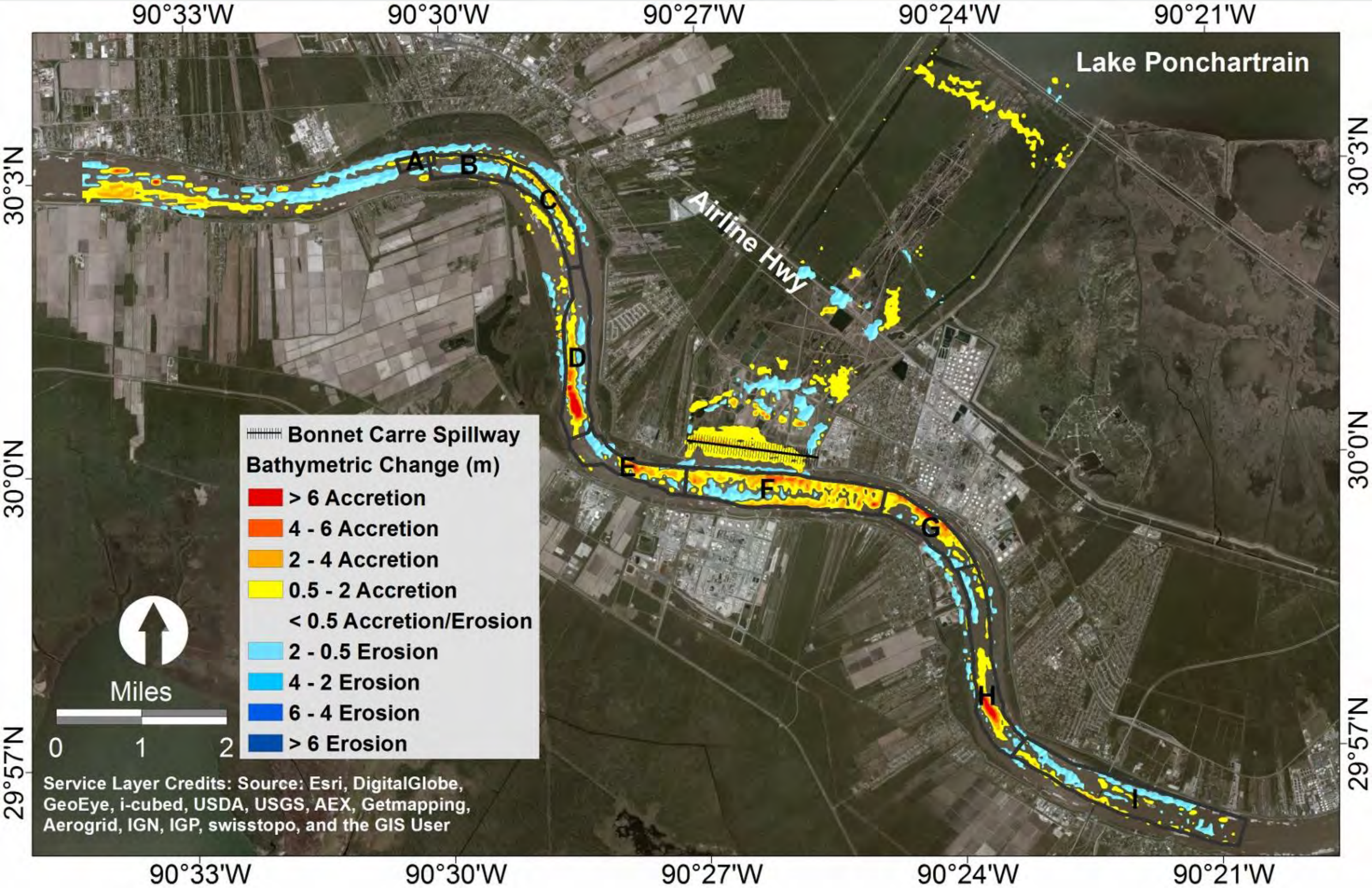
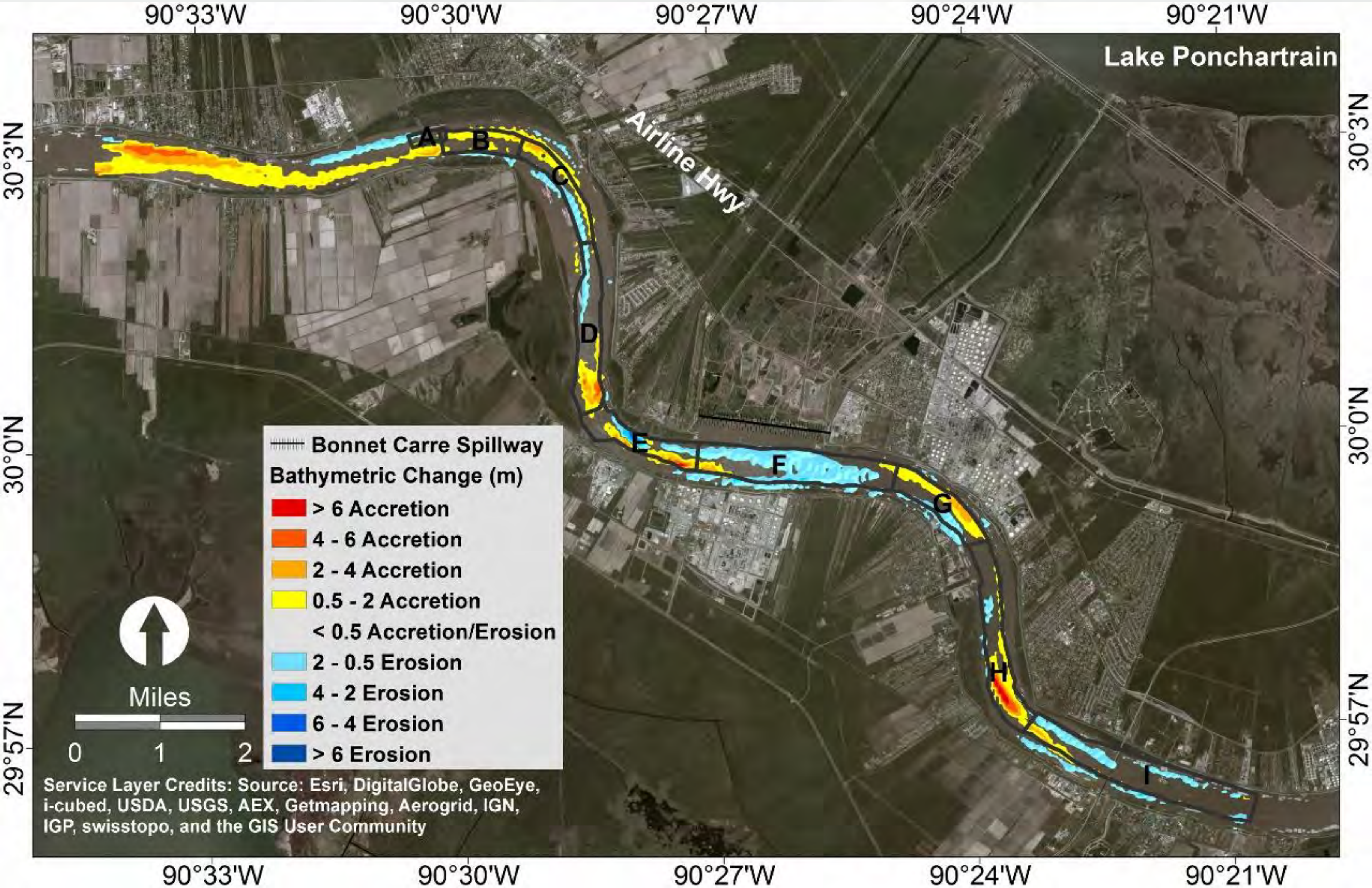
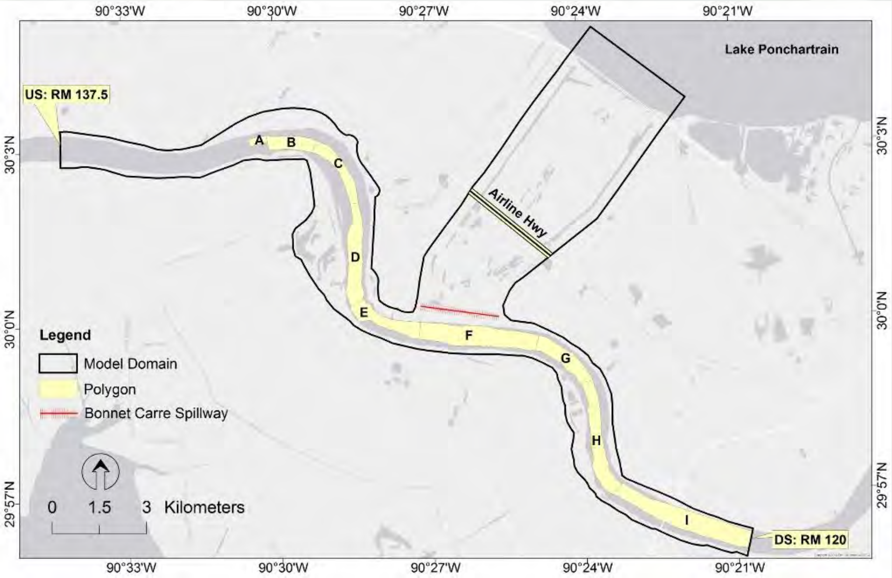
Bathymetric change (FLOOD 2011) observation polygon A to I

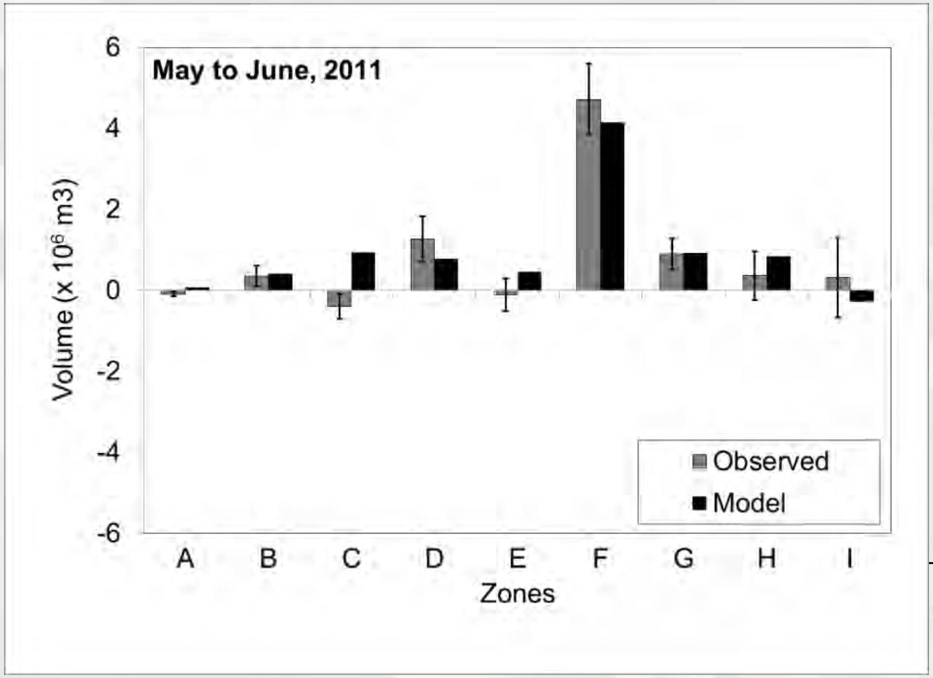


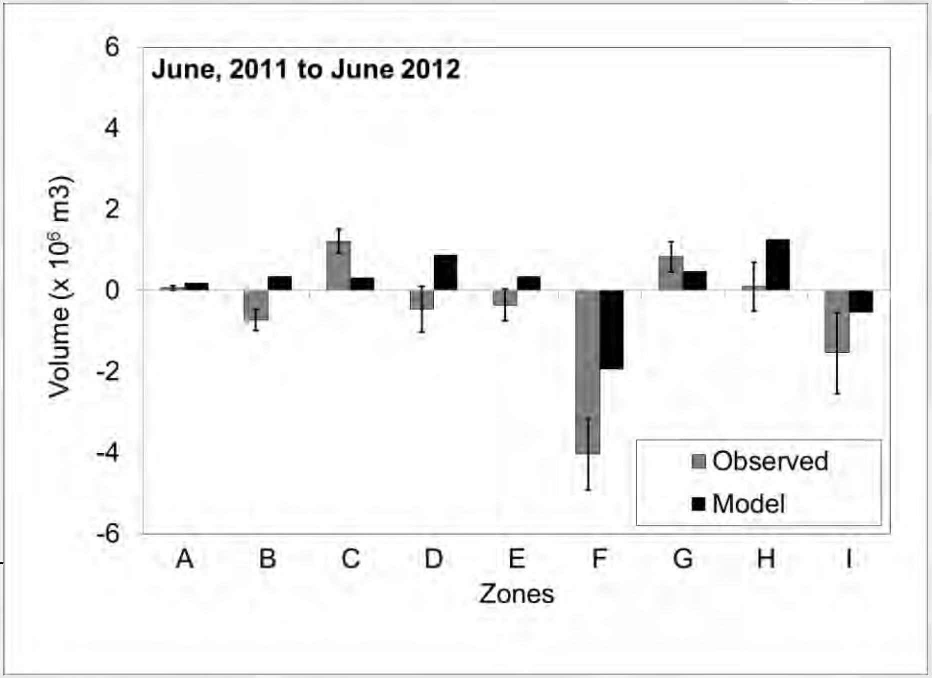
Bathymetric change (June 2011-June 2012)polygon A-I



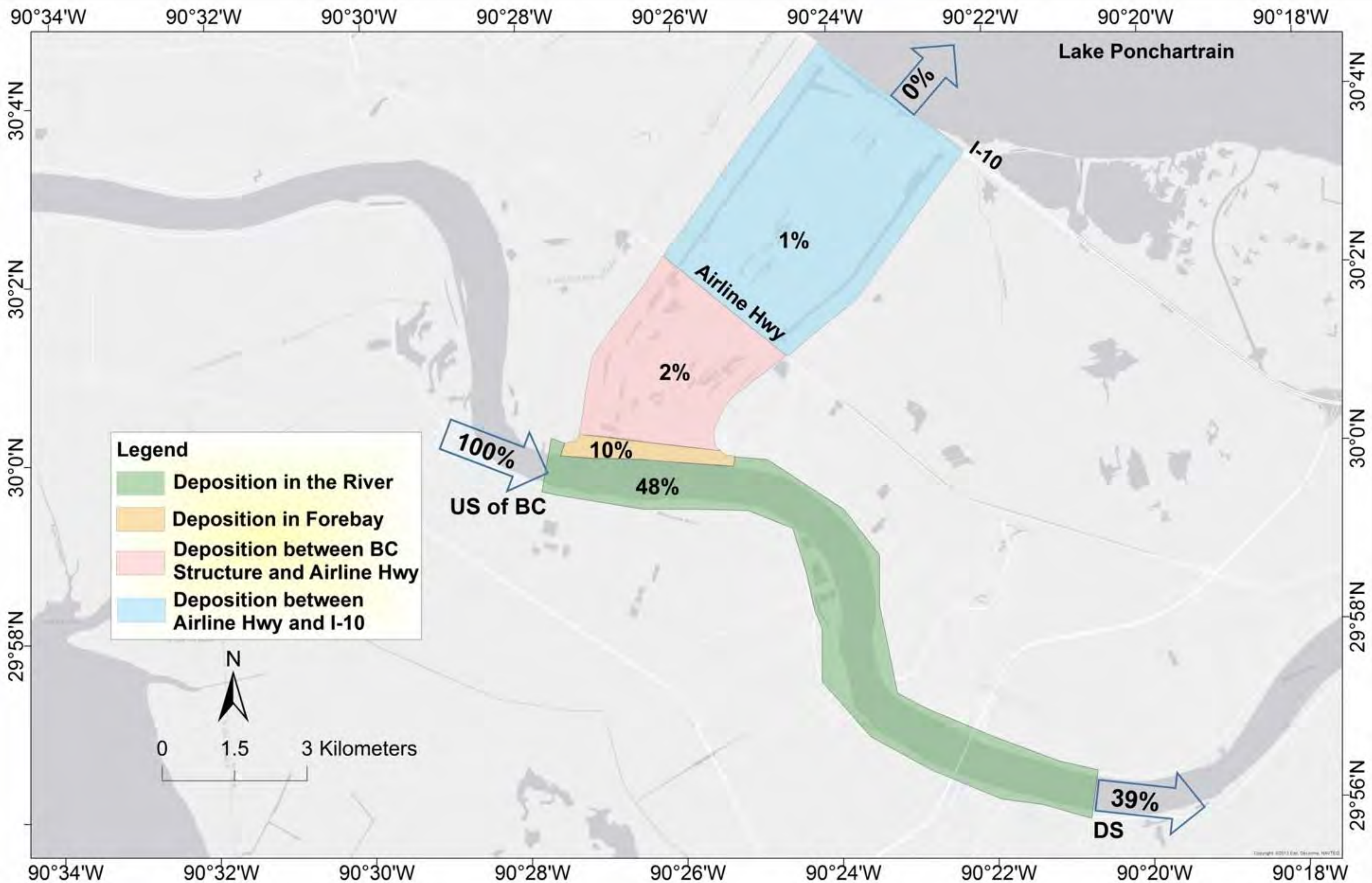
Volume of Erosion and Accretion



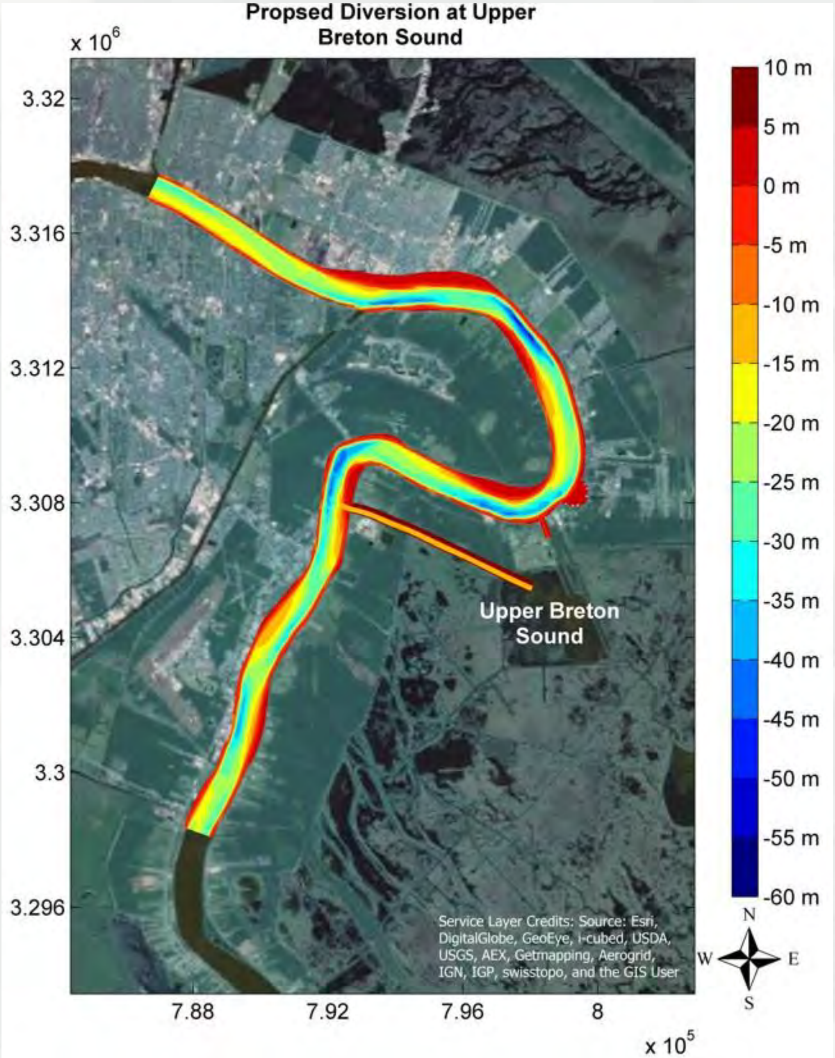




SAND BUDGET 2011 flood



UPPER BRETON SOUND MODEL
Grid with Diversion



- *Capacity= 250k CFS when 1 million CFS in the River*
- *Length of the Outfall= 3.6 miles*
- *Width of the Channel= 500 ft*
- *Bottom Elevation at the Outfall=-40ft NAVD88*

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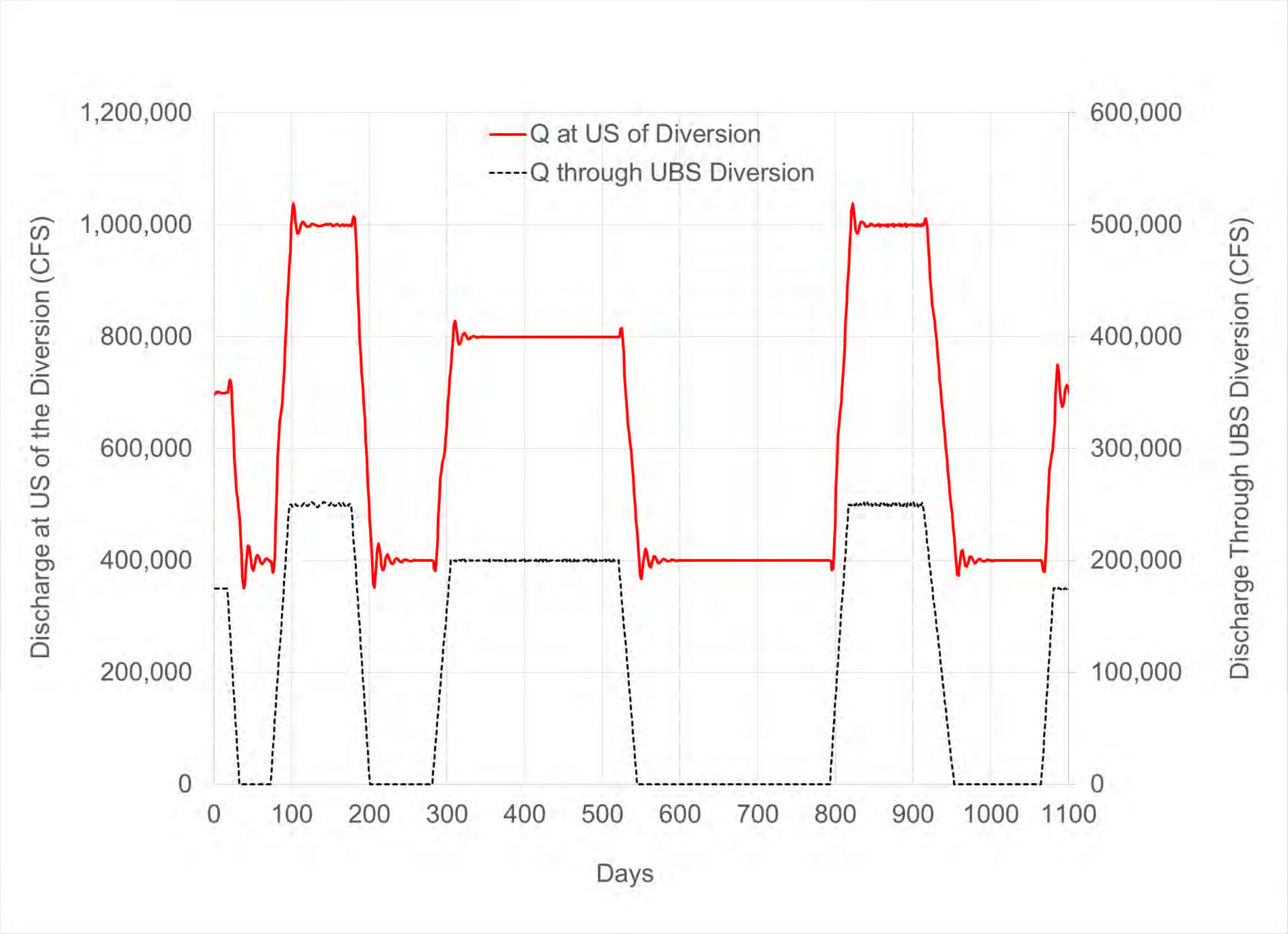
Discharge Through UBS Diversion-3 Years Simulation



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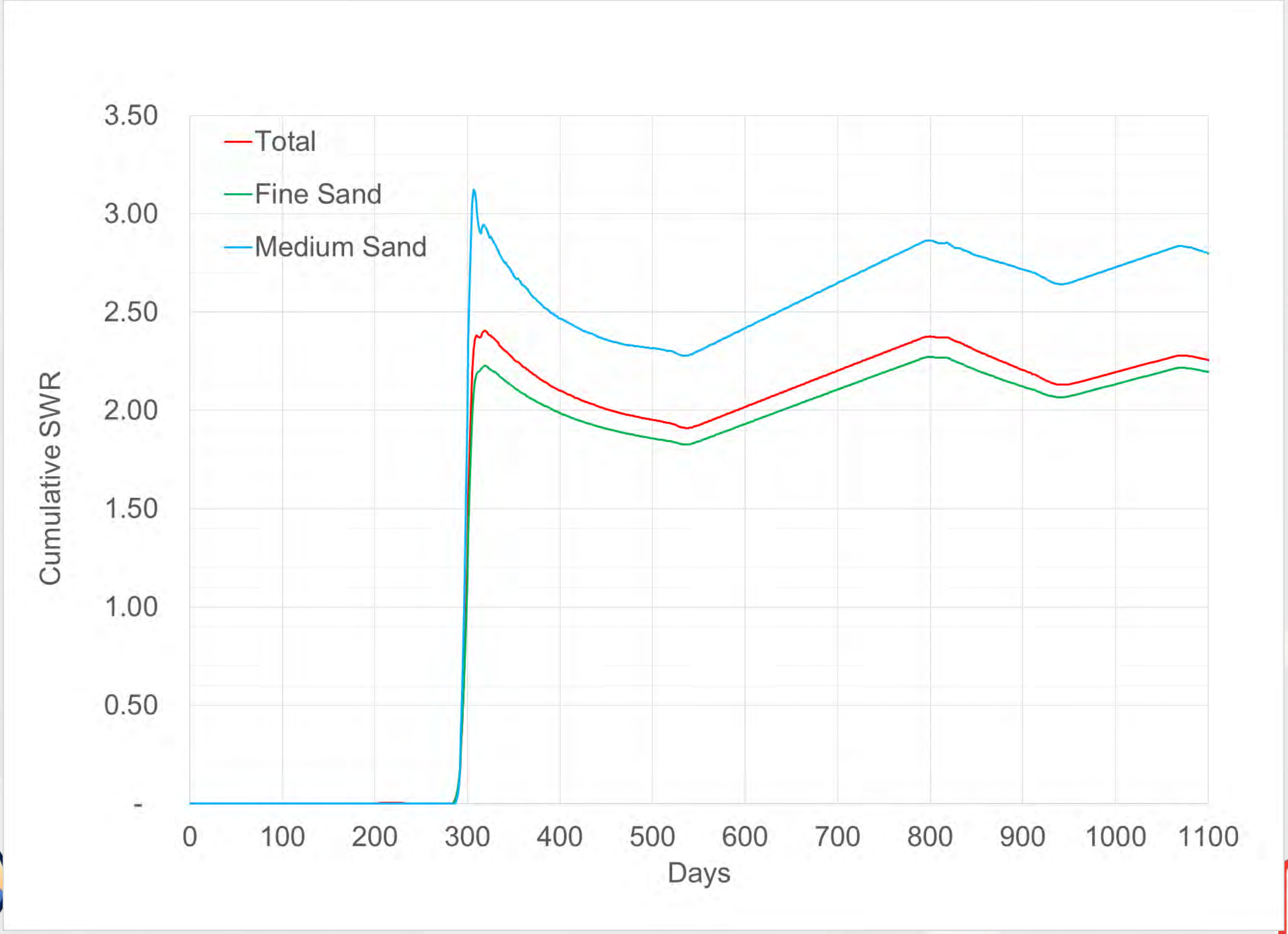
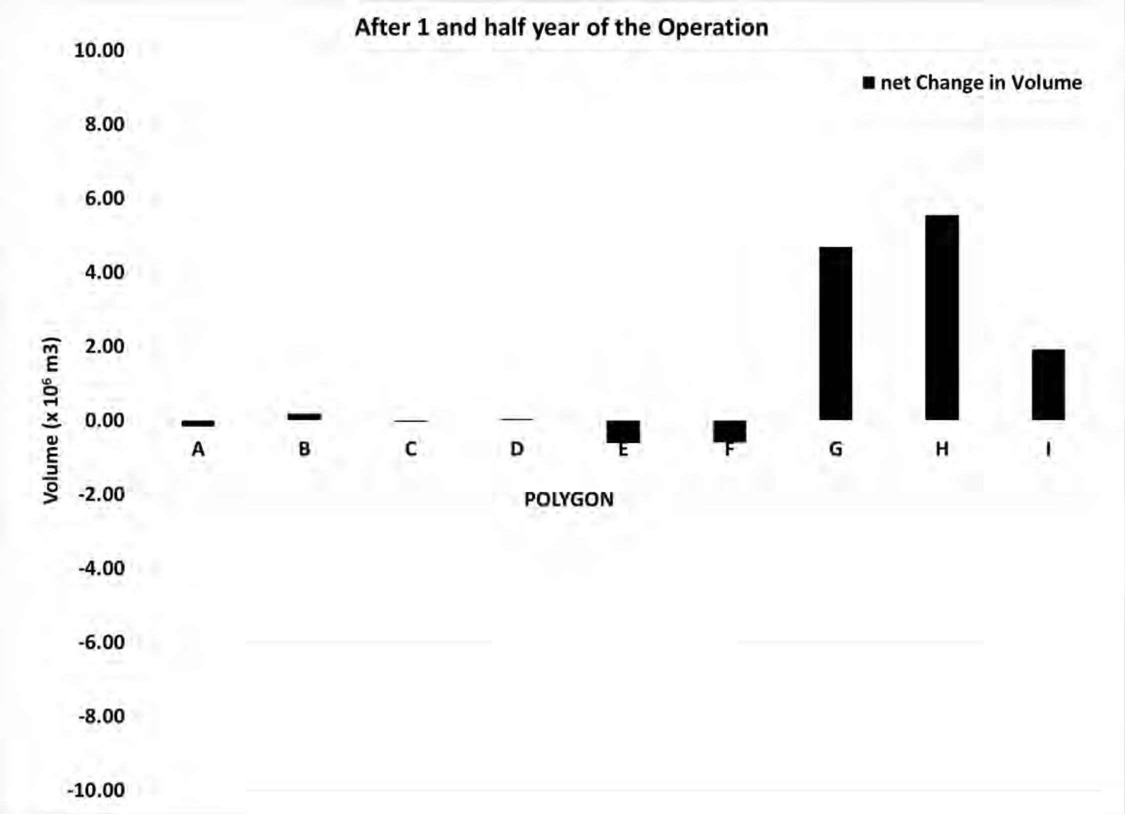
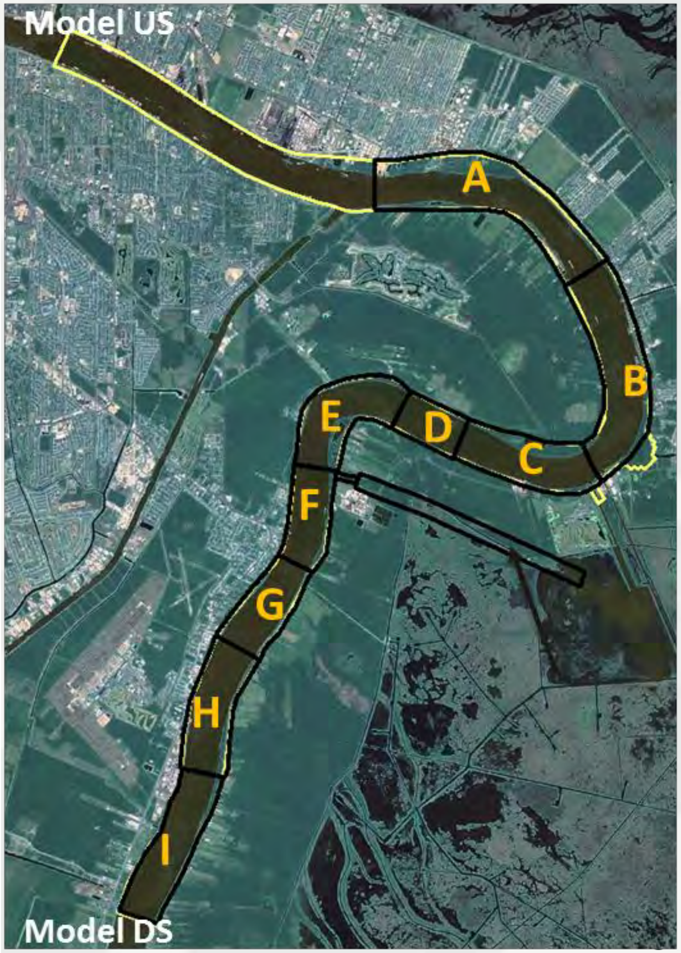
Cumulative Sediment Water Ratio(SWR)-UBS Diversion



Net Change in Volume between 'With and without' the diversion





WEST BAY DIVERSION

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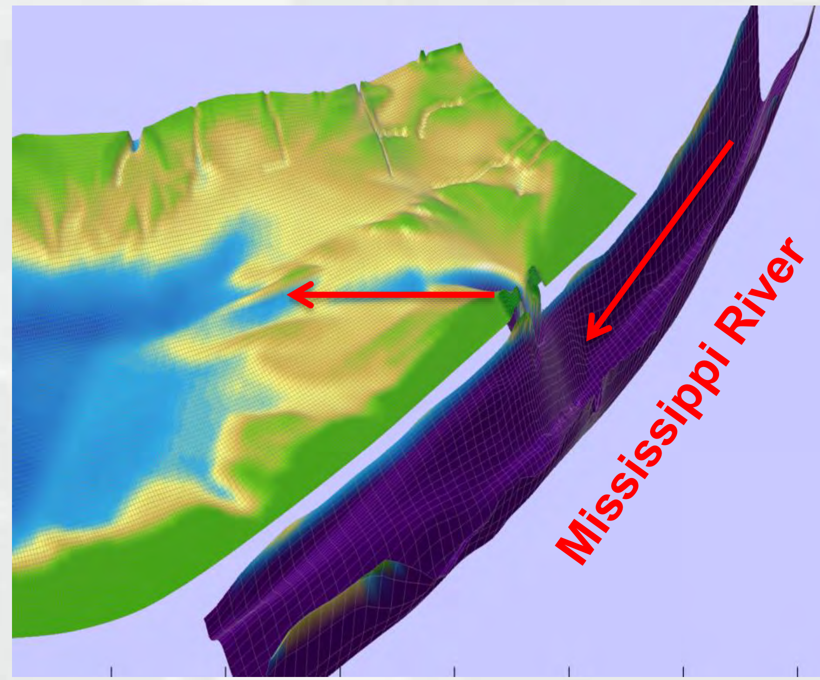
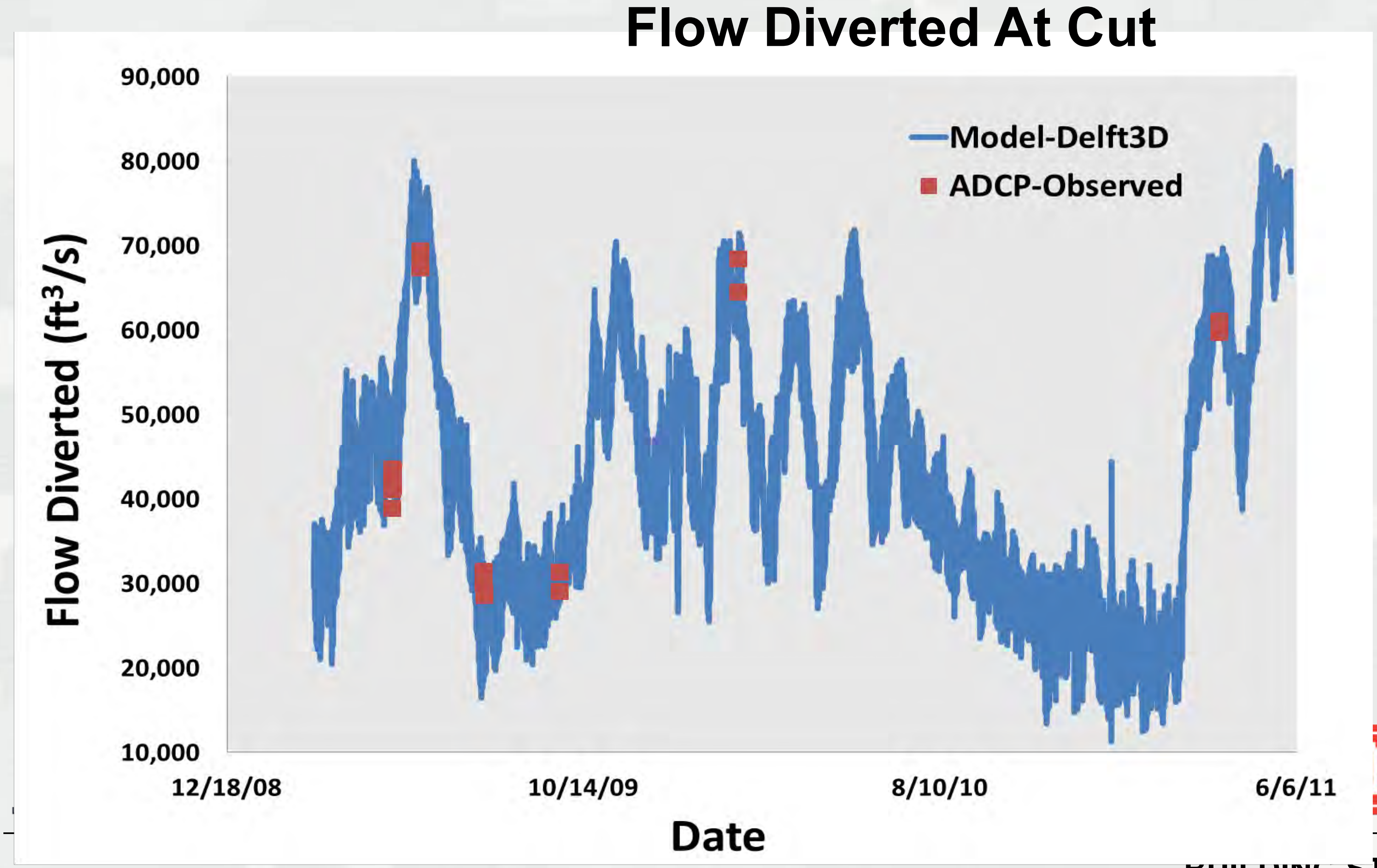
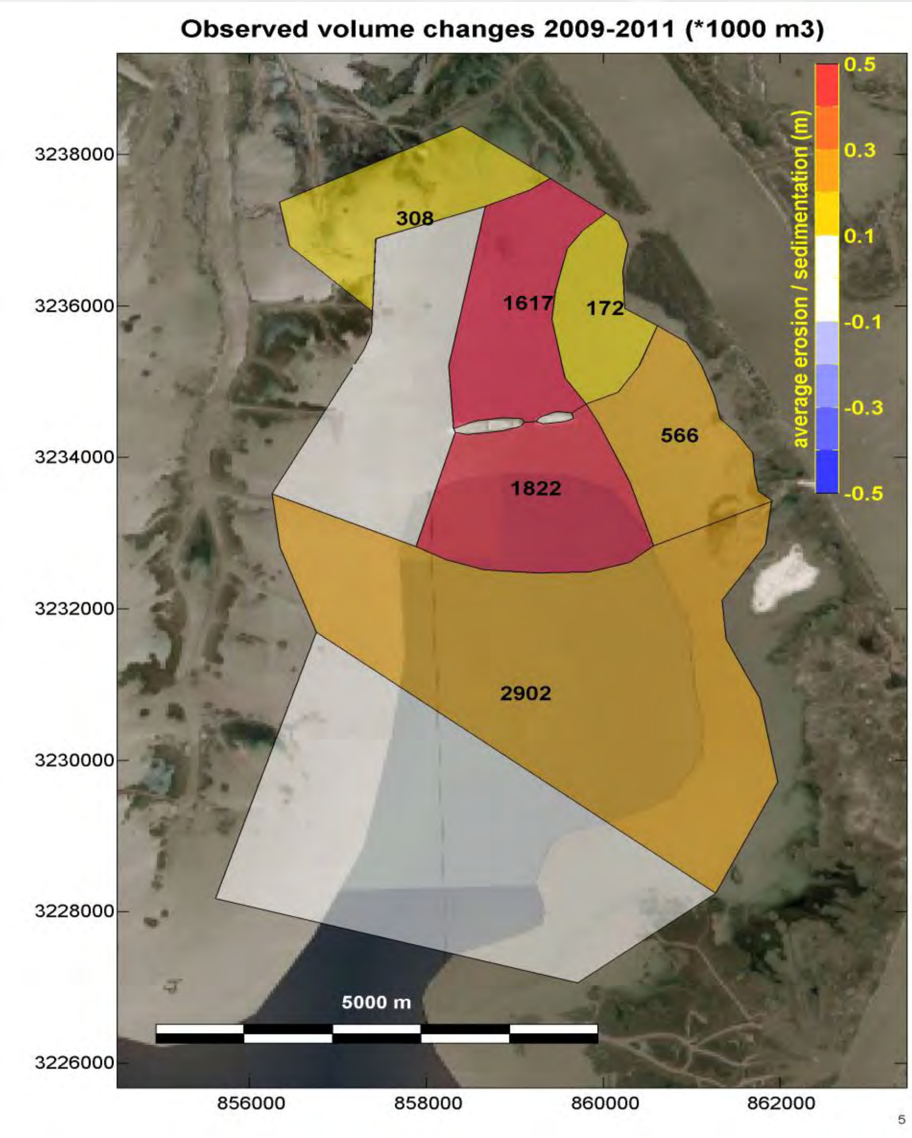
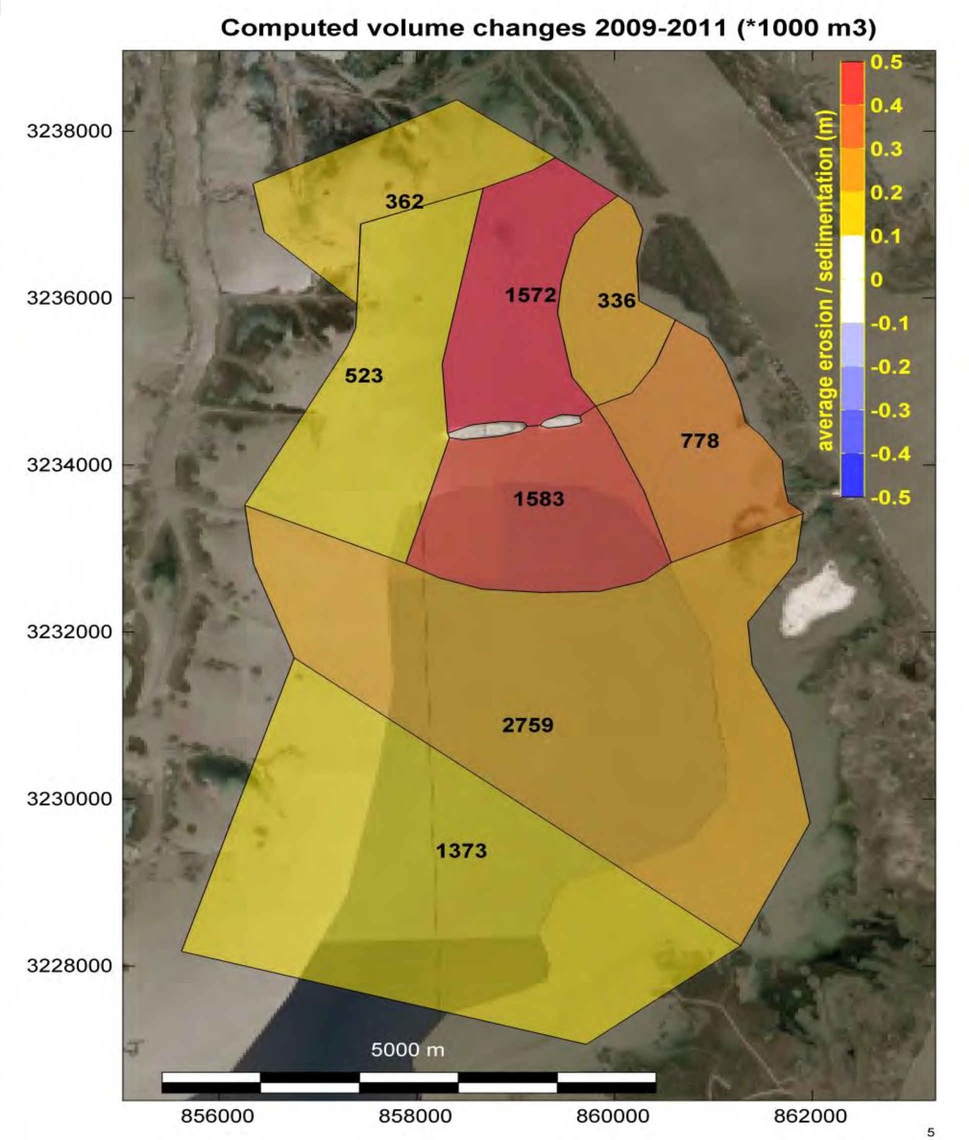


HD CALIBRATION RESULTS (CONTD)

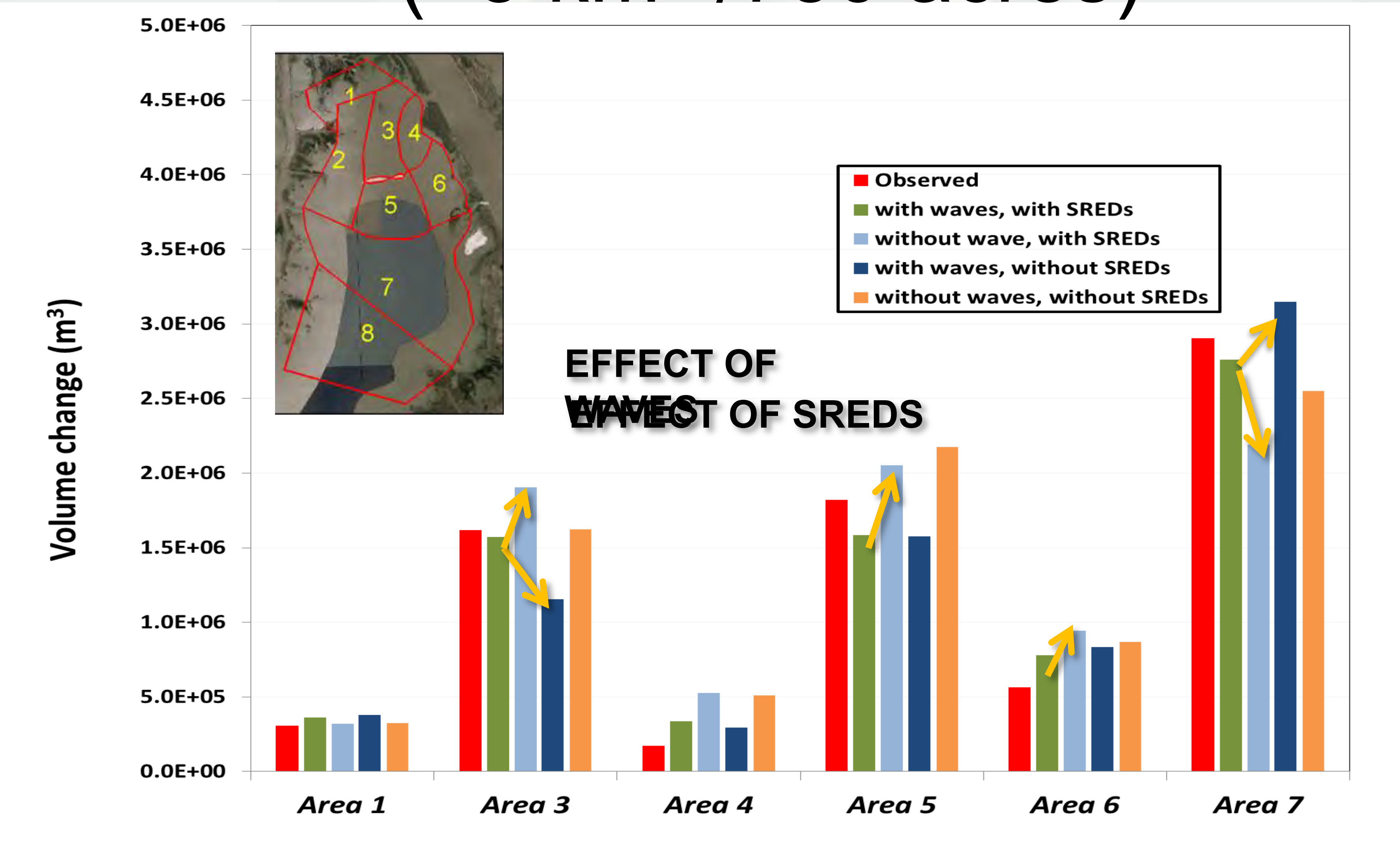


2009-2011 volumes





2009-2011 Land Building (~3 km^2 /750 acres)



Combined Model: Myrtle Grove (MG) and White Ditch (WD) Diversions

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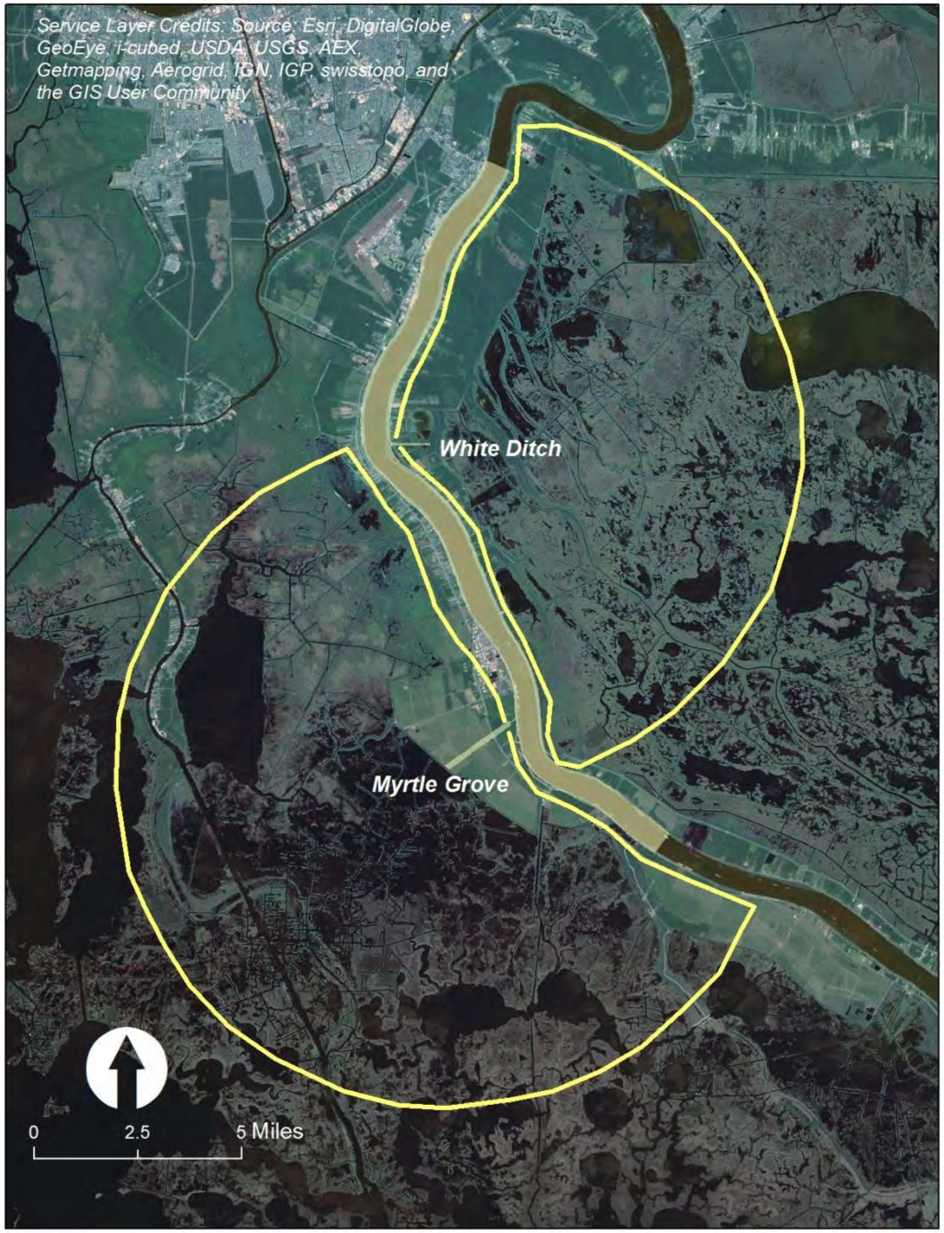
Combined Model Domain



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Lessons Learned

- Models provide valuable insights and inform the decision making process
- Multiple models reduce risk and provide multiple-line-of-evidence
- Diversions should be located at lateral sand bars
- Intake inverts should be sufficiently deep “near surface of sand bars”
- Models provide quantitative information on shoaling and how it can be used beneficially in the receiving areas to:
  - Absorb energy
  - Reduce erosion
  - Enhance sediment retention