Study and Modeling of the Physical System

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Our Goal:
Reduce the cost of the project

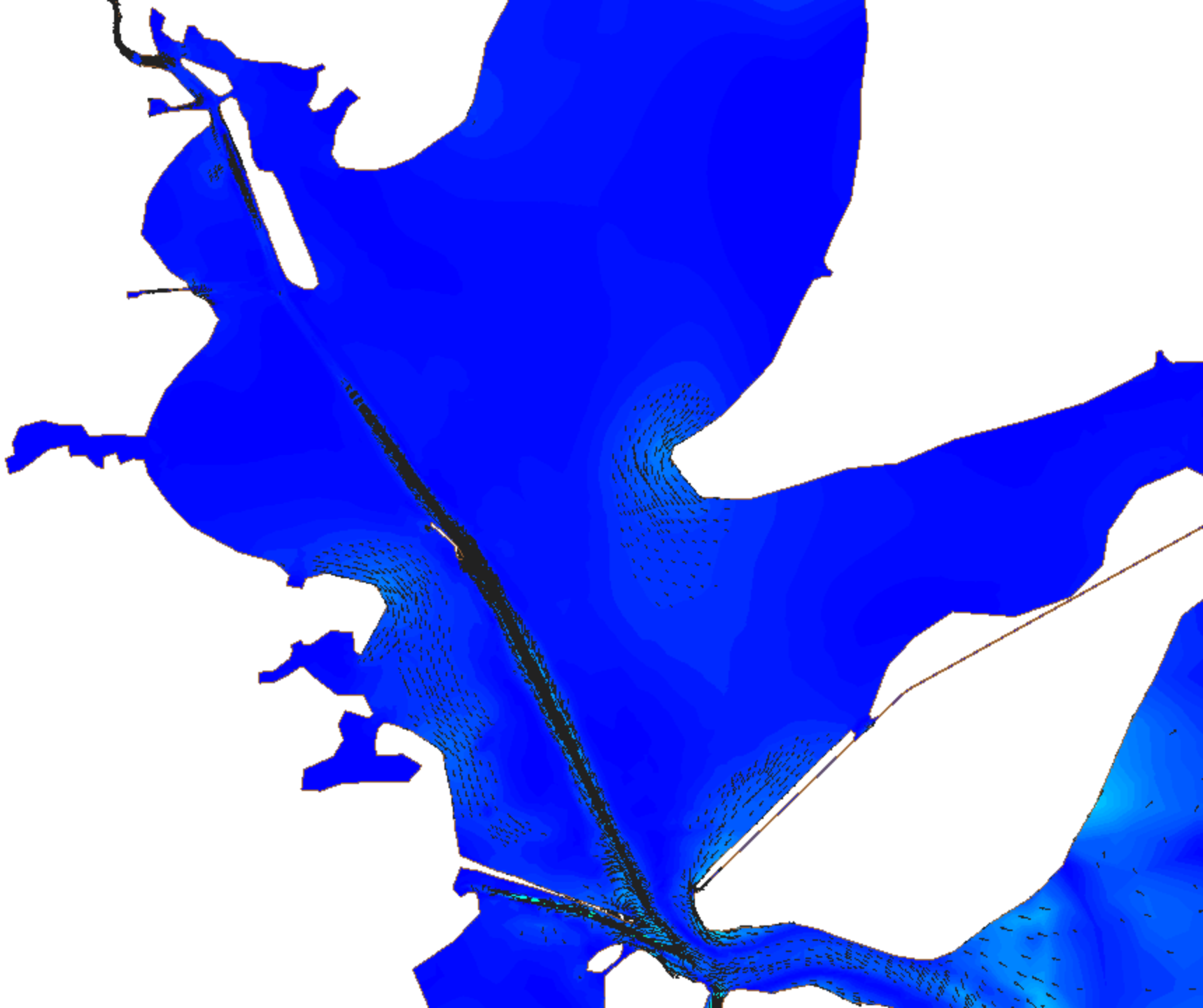
Costs could be in terms of dredging, environmental, property, . . .

Value of Models

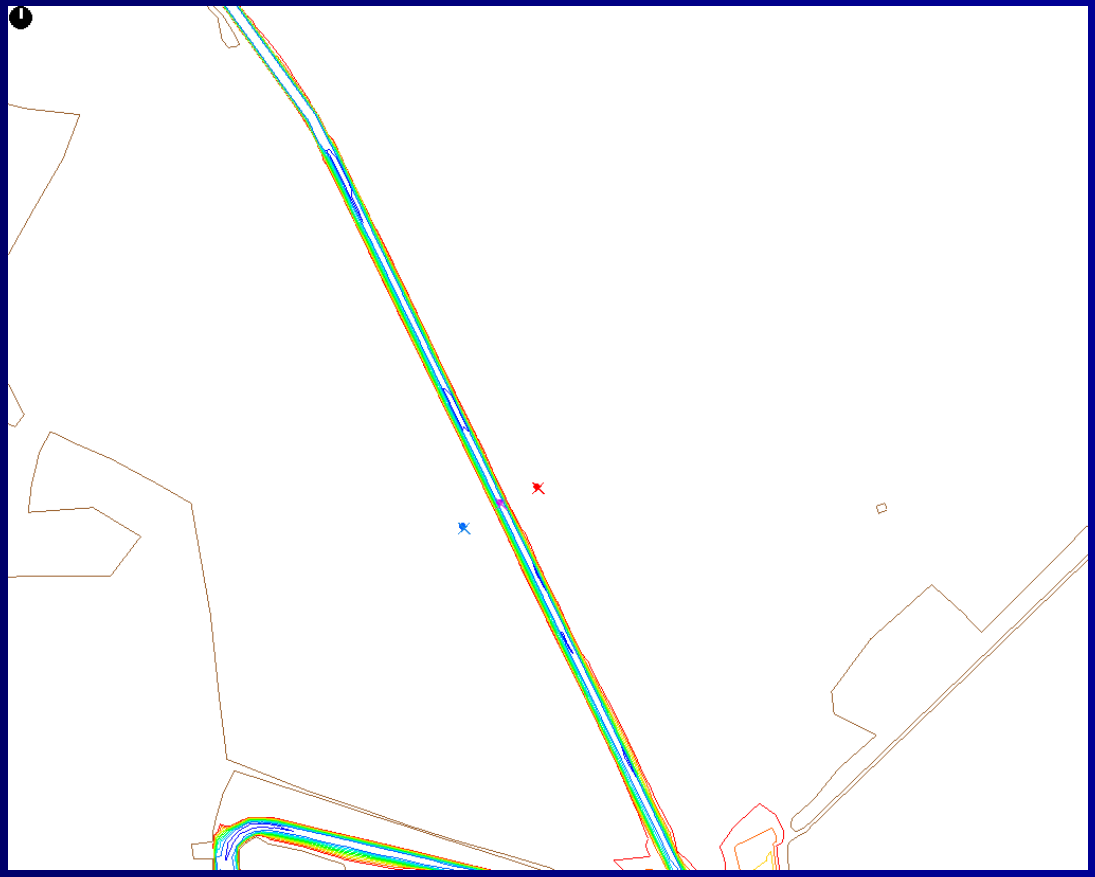
- Insight in how the waterbody works
- Comparing alternatives
- Estimation of impacts

Example – Galveston Bay HSC

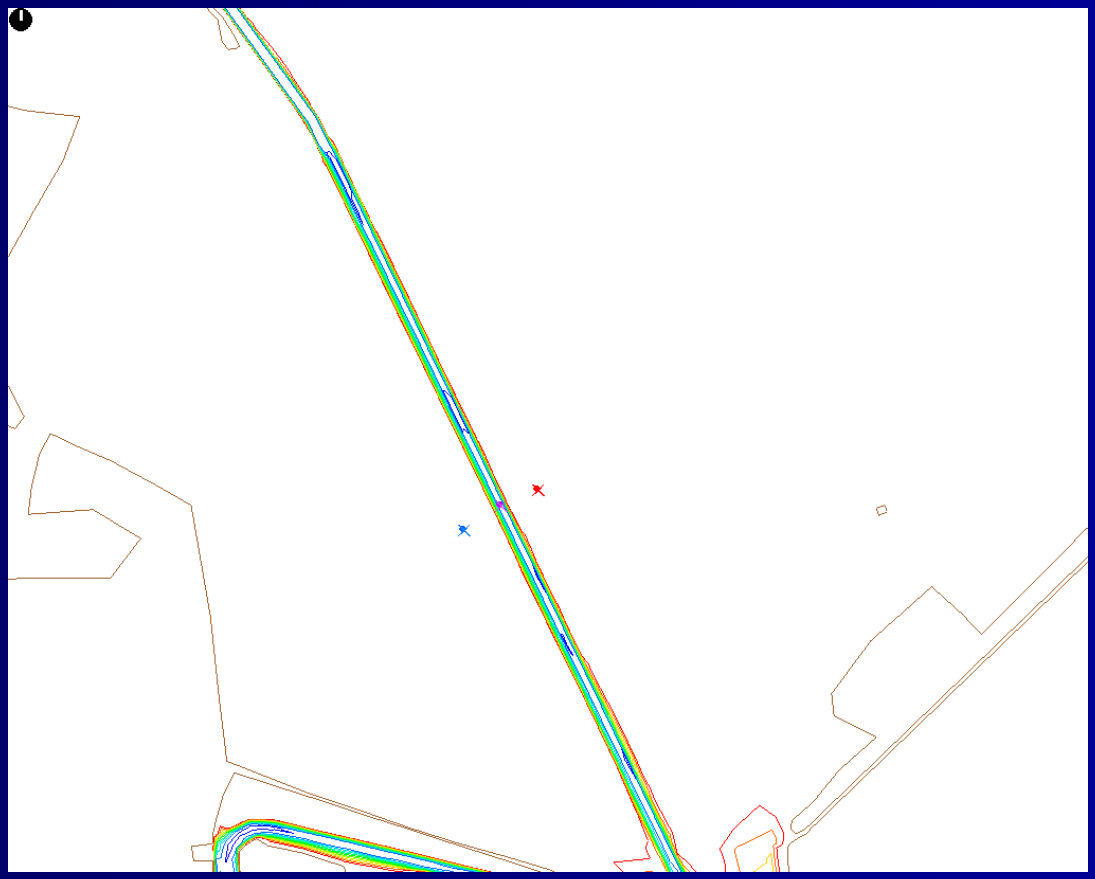
- Insight – estuary is often too complex to understand without a model



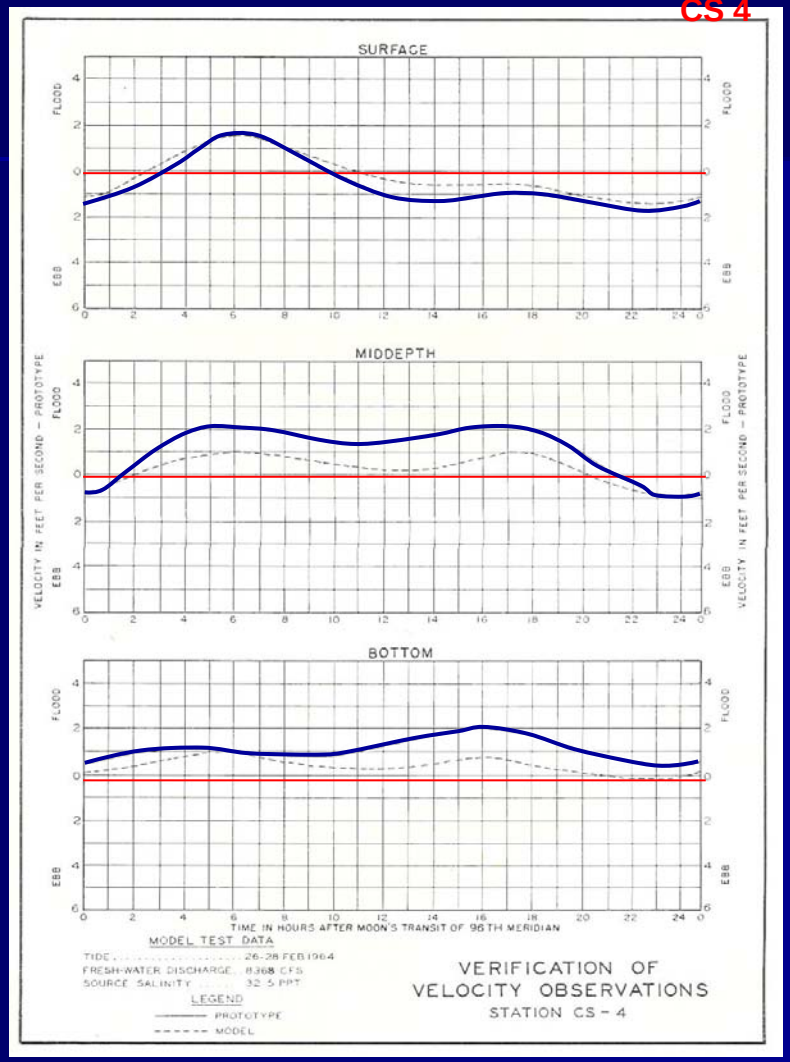
Surface Currents



Bottom Currents

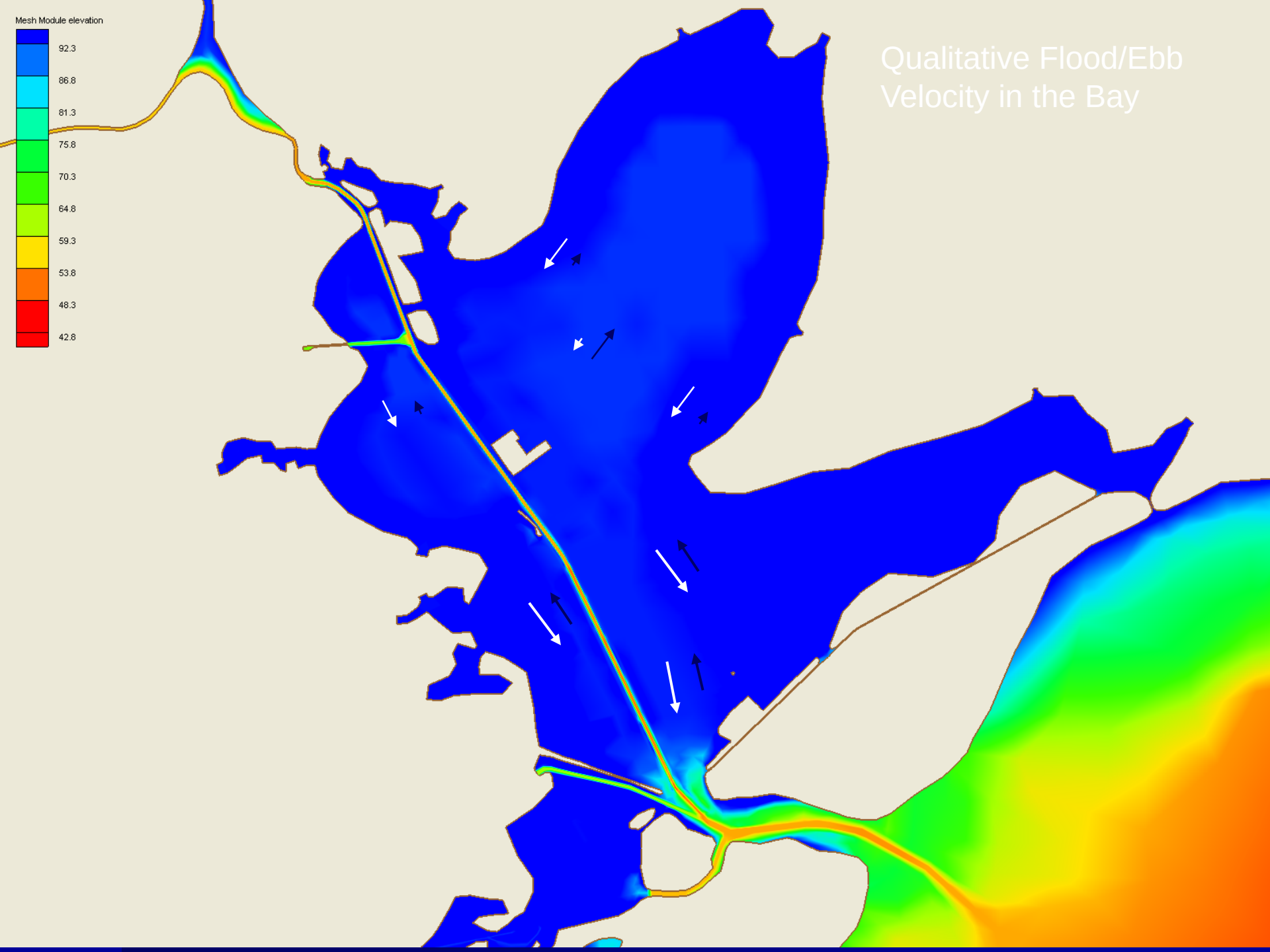


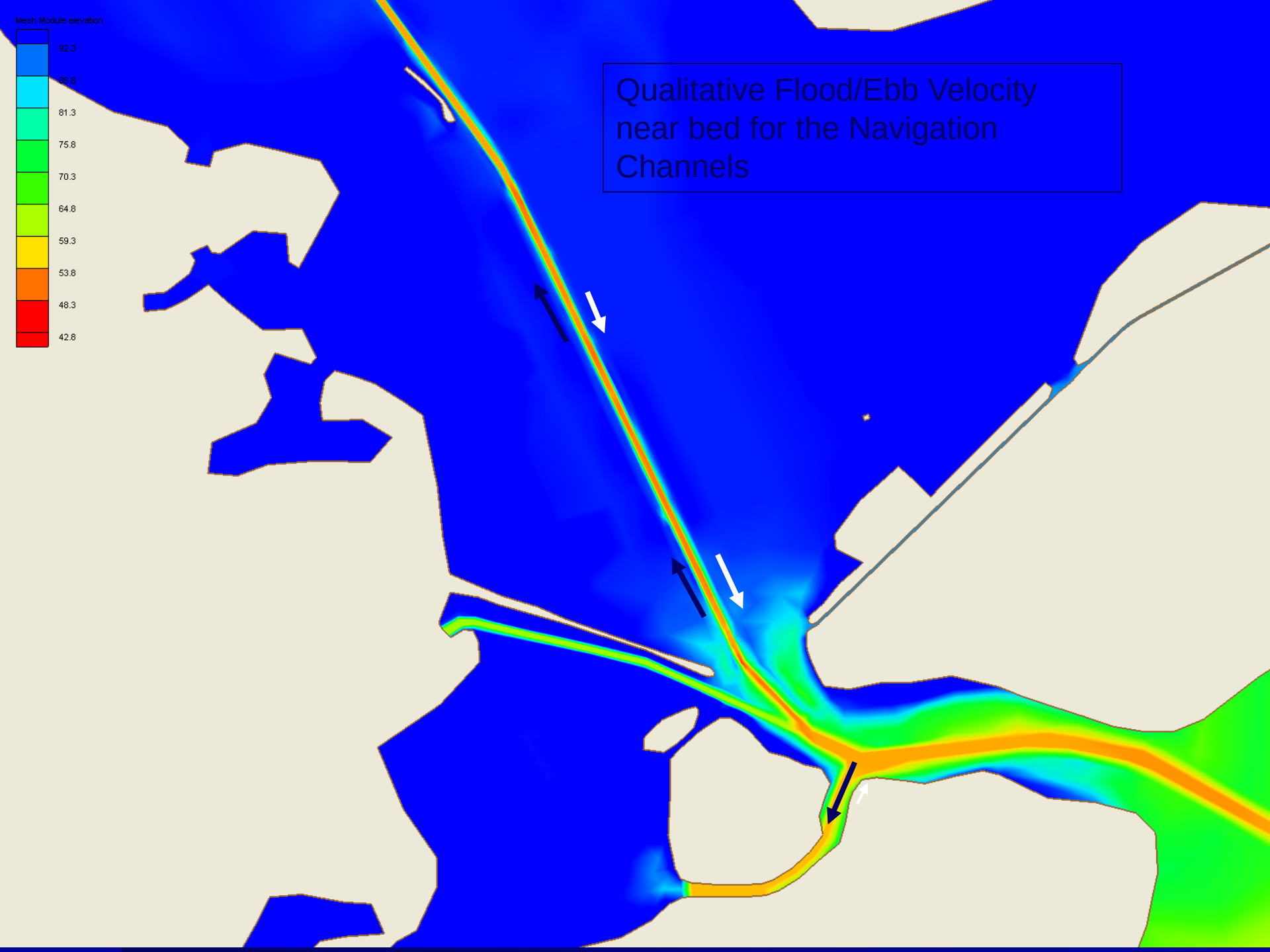
Station CS-4



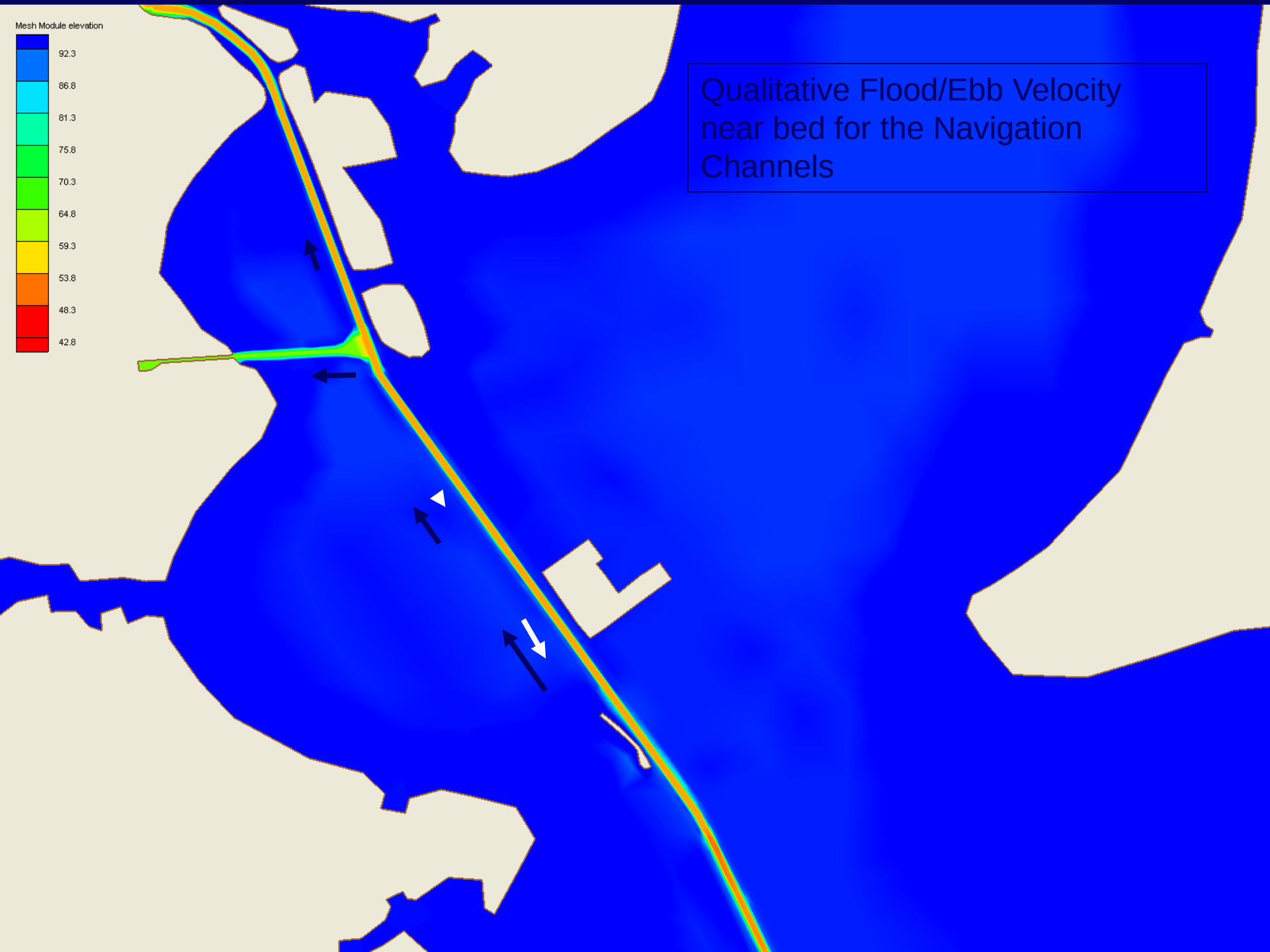
Field Data from the 60's

In channel near present site of mid-bay disposal


Mesh Module elevation
92.3
86.8
81.3
75.8
70.3
64.8
59.3
53.8
48.3
42.8
Qualitative Flood/Ebb
Velocity in the Bay

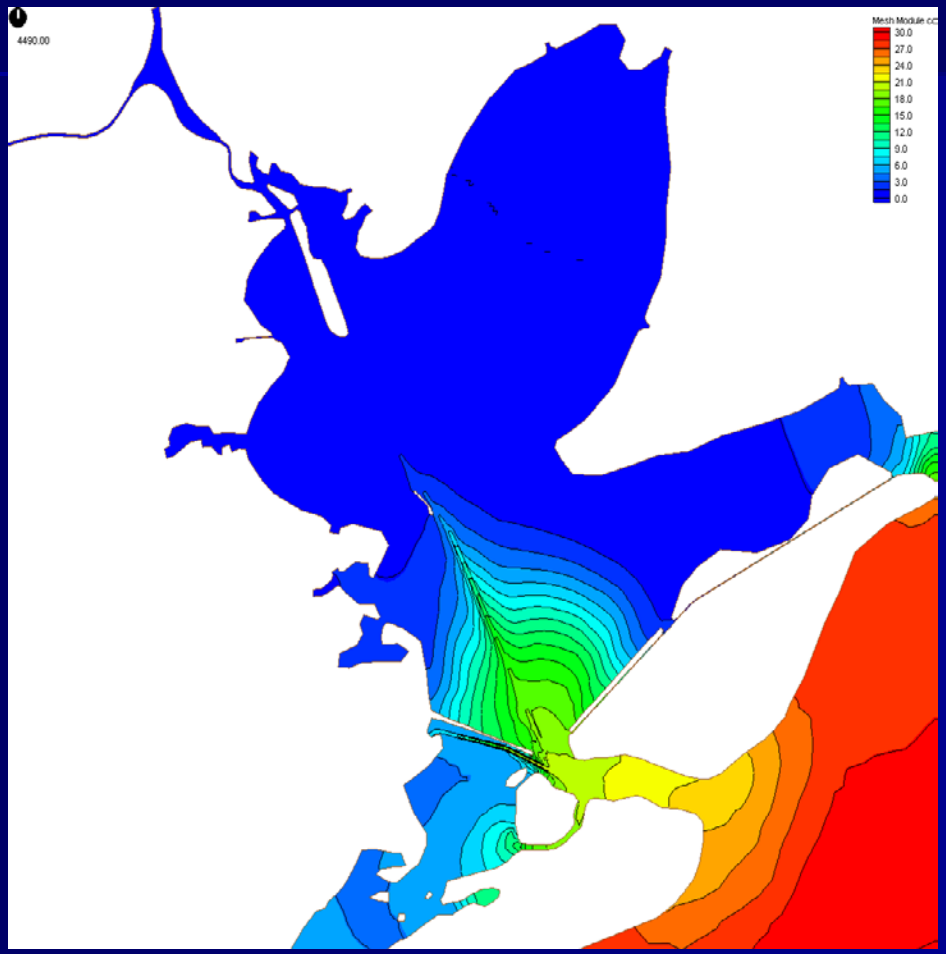


Qualitative Flood/Ebb Velocity near bed for the Navigation Channels

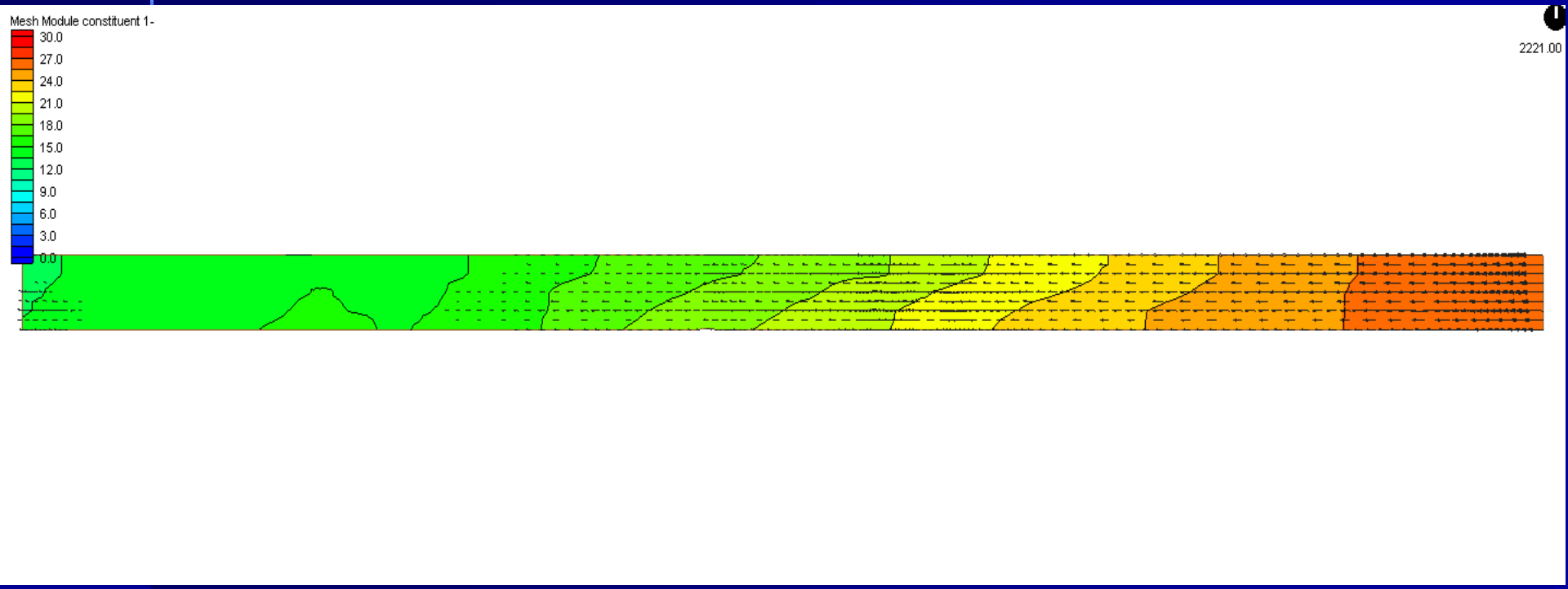


Qualitative Flood/Ebb Velocity near bed for the Navigation Channels

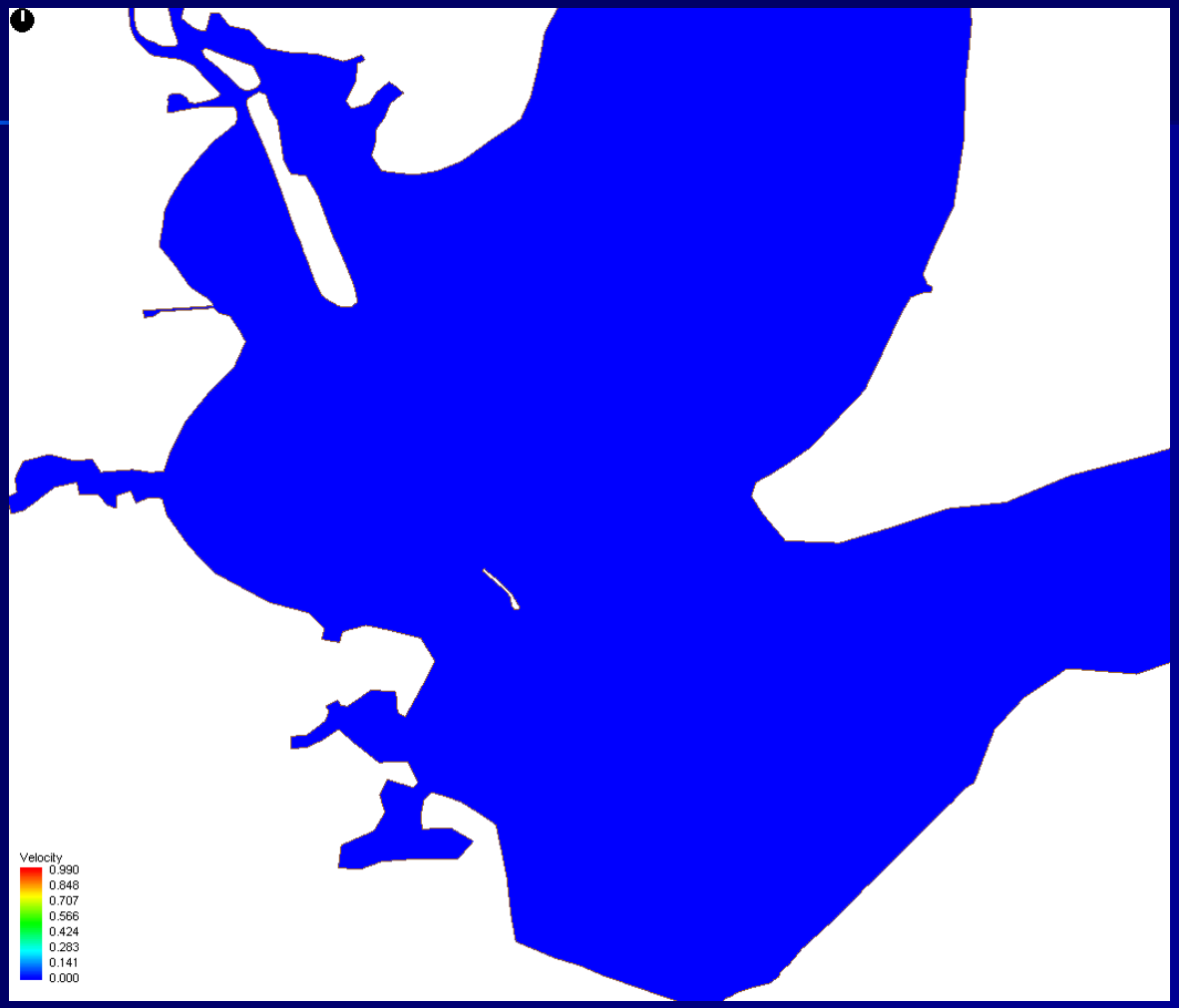
Plan View Salinity



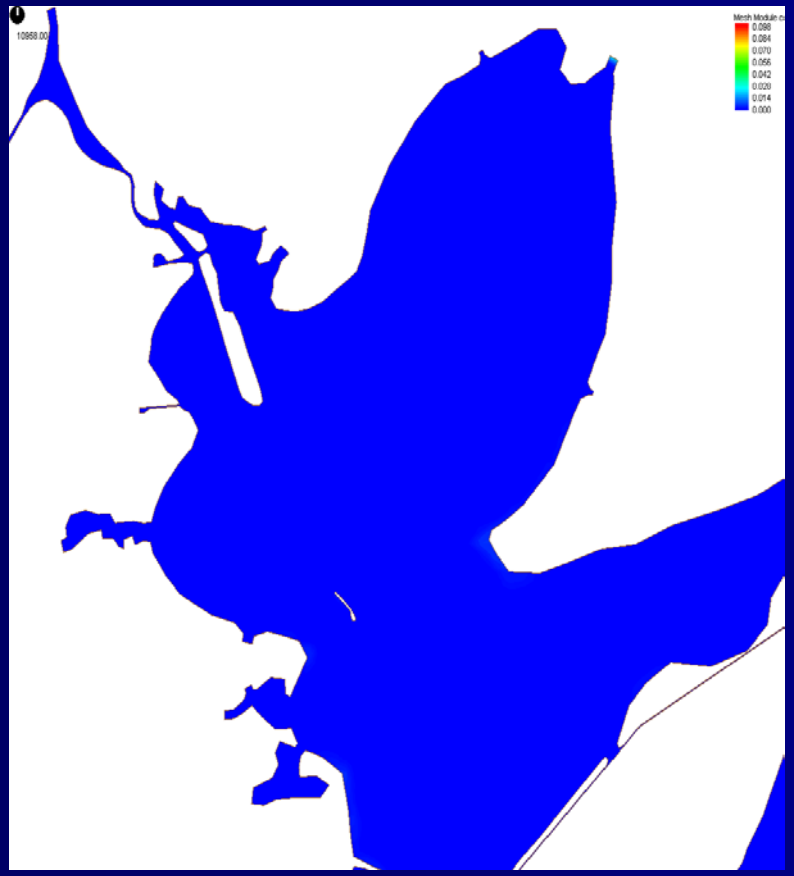
Channel Profile Salinity and Velocity

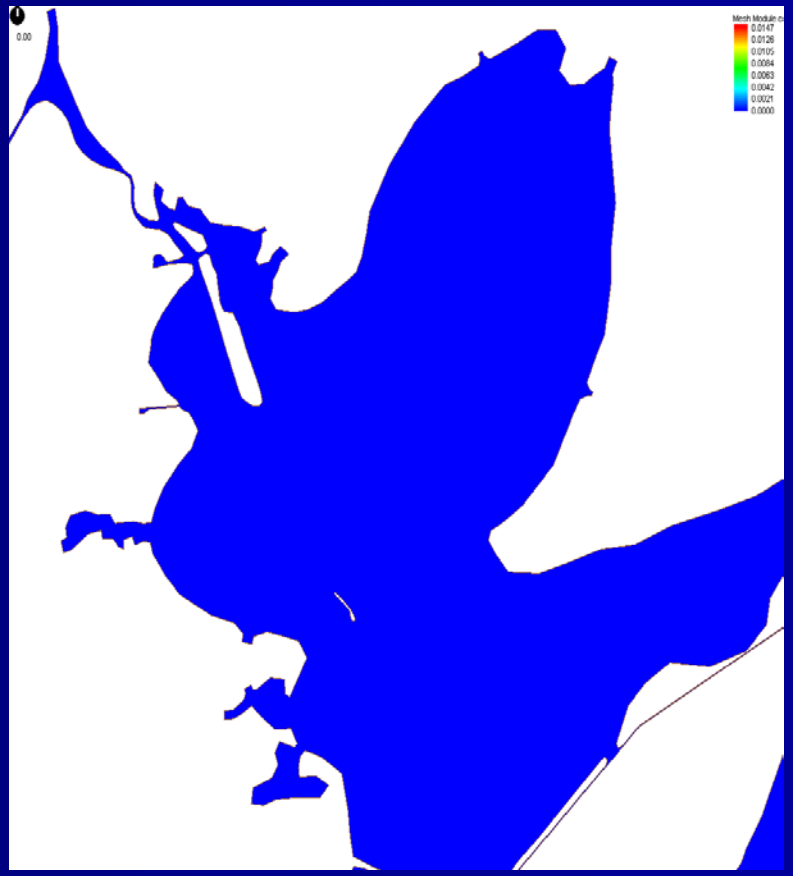


Vessel Impacts



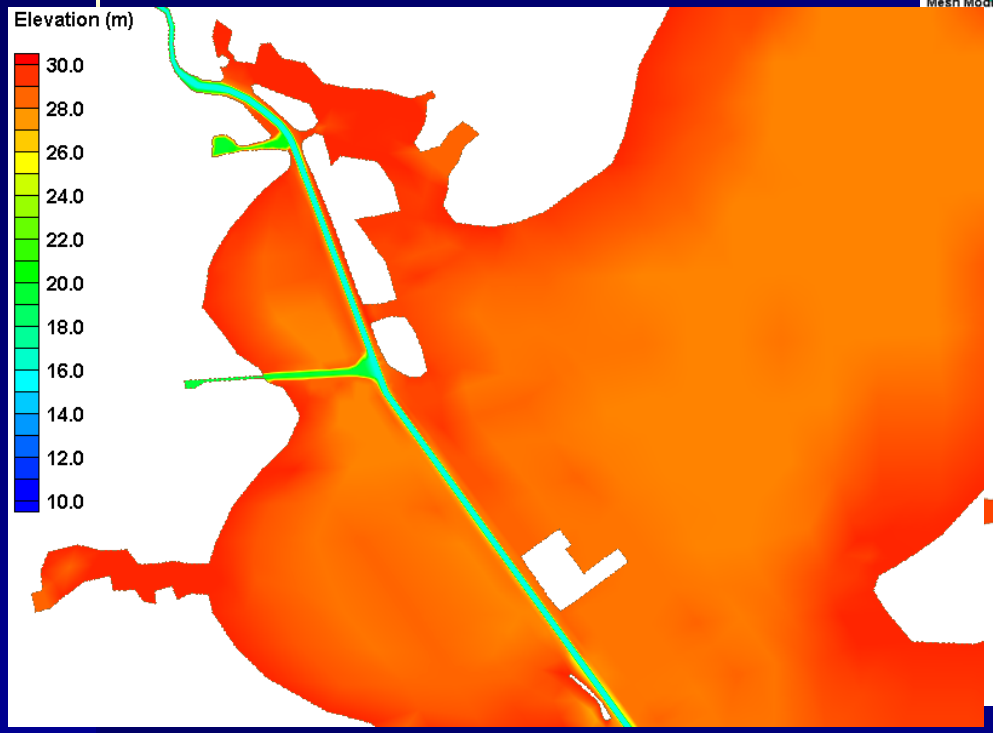
Suspended Sediment and Shoaling

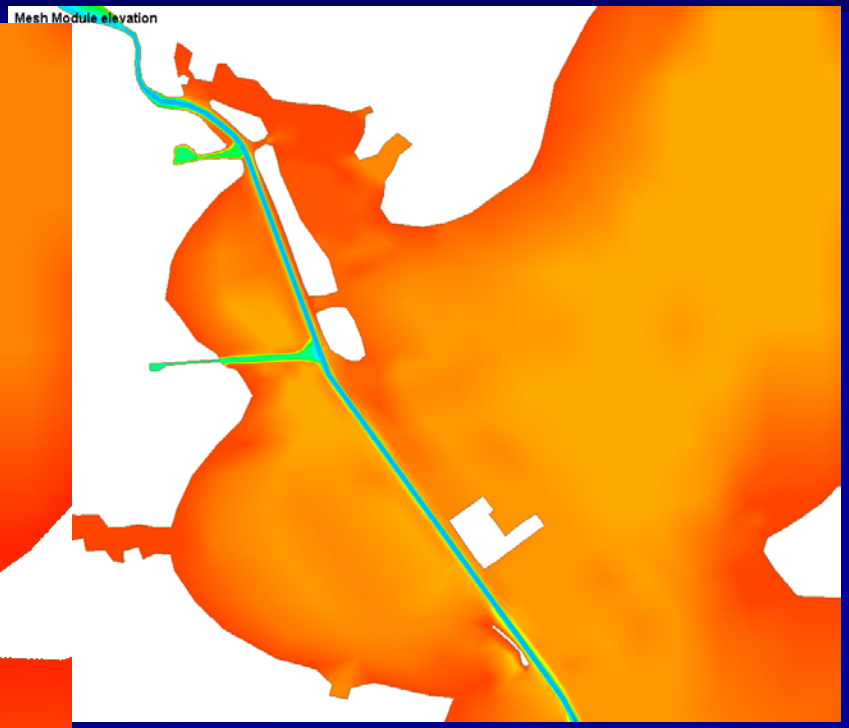




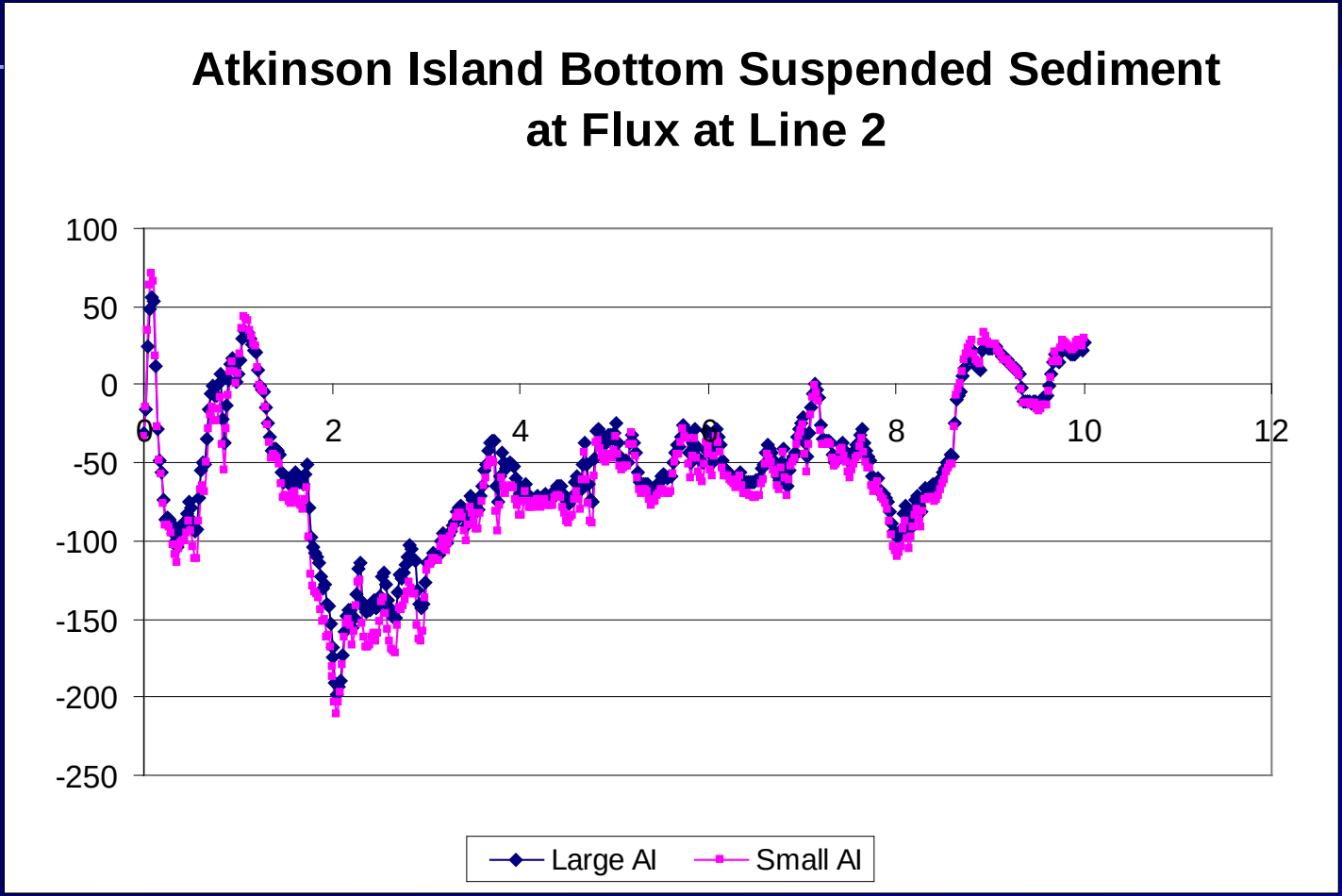
Comparison of Alternatives

Modification of Atkinson Island

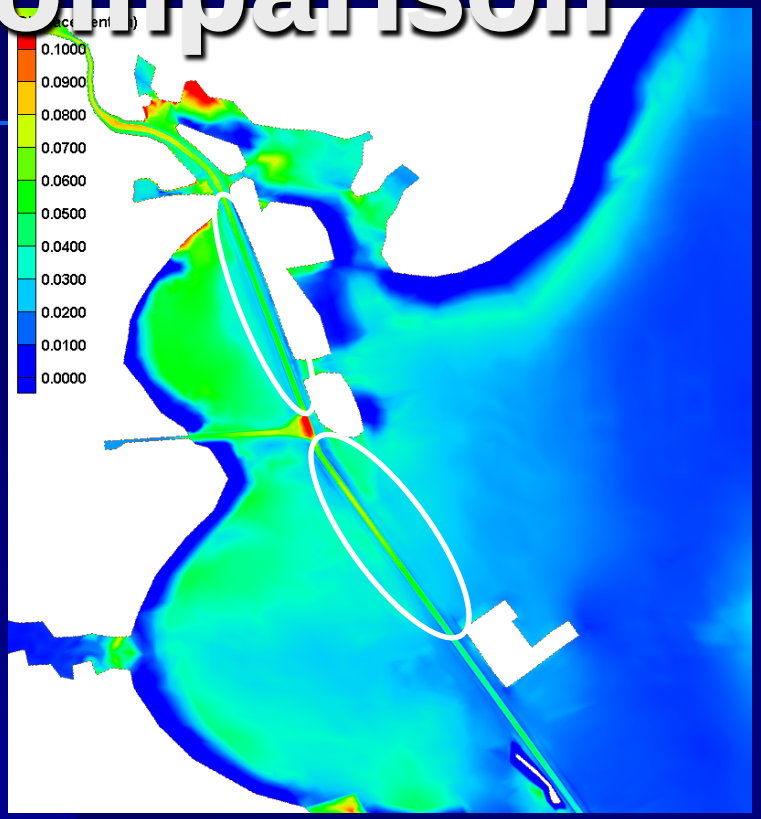


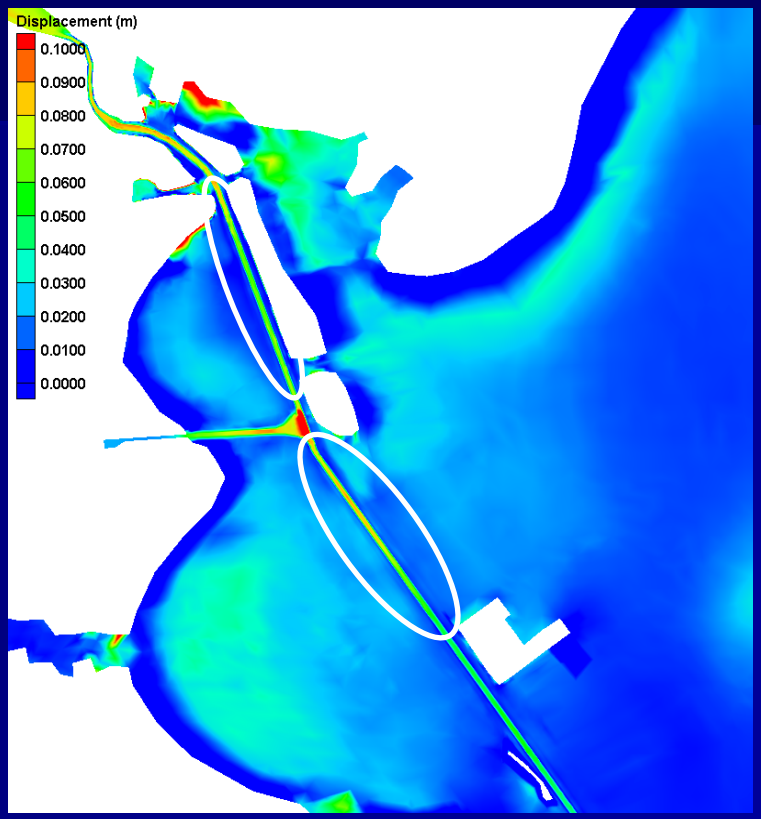


Plan Comparison



Channel Bed Change Comparison





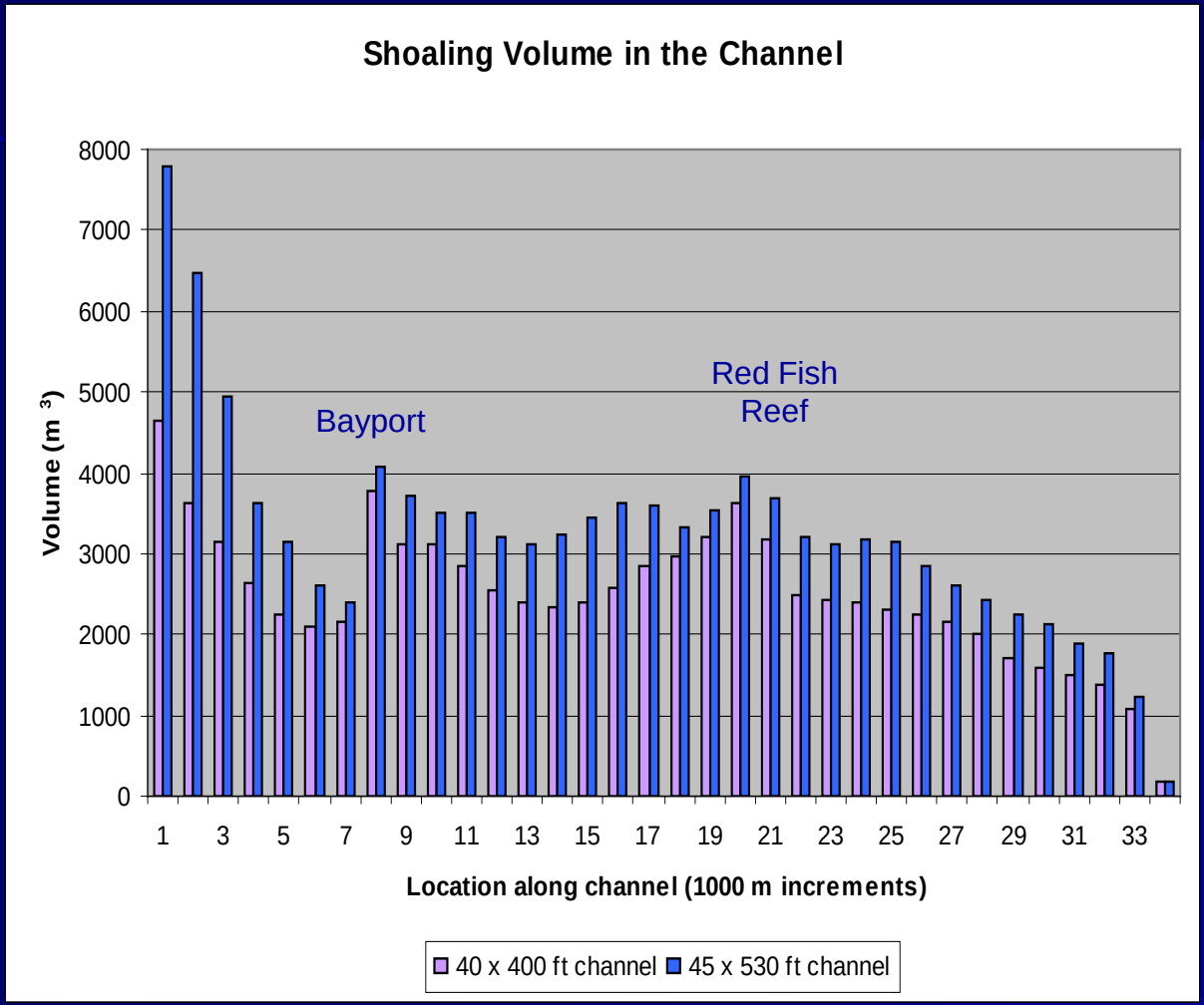
Even though the larger island removes some shoaling “hotspots”…

Along Atkinson Island – larger island increases deposition 4%
Bayport to Marsh Site – larger island increases deposition 10%

Estimation of Impacts

- Hydro model, field sediment data, assumption, and desk study (2006)
  - Increase 20 to 30%
- Hydro model, field sediment data, sediment model (2008)
  - Distribution and also predict overall increase of about 30% and shift upland

Channel Shoaling Volume



Setting up a study

Expenses in a study

- The biggest items are (in order)
  - Field Data Collection
  - Sediment model validation
  - Hydrodynamic model validation
  - Plan testing

Time required in a study

- Sediment model validation
- Hydrodynamic model validation
- Field data collection
- Plan Studies

Controlling Time and Cost

- Bring in ERDC subject area expert early
  - Do we have existing model, can assumptions be reasonably made, field data may be time critical
- Good communication about the need for the estimate, limitation for funding and time, and partner in H&H

Levels of Study

- Expert Advise – systems like yours
- Hydrodynamic model with sediment desk study (need change in currents)
- Hydrodynamic model and sediment model

Typical Testing – controlling costs

- Screening – Advise about clear problems or preferences
- Alternative Testing – Limited length of modeling
- Final Plan – more extensive length of simulations and sensitivities.

Summary

- Subject area expert brought in early
- Complete discussion of needs and capabilities to determine best study route
- Develop insight
- Stages of study