Numerical Modeling: A Tool for Urban Conservation and Restoration at Ormond Lagoon

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July 23, 2009
What to Expect

- A Word About Numerical Modeling
- The Setting
- J-Street Drain Project Objectives
- Lagoon Breaching
- Alternatives Considered
- Conclusions
- Discussion
Questions to ask a Modeler...

- What are the specific objectives of the modeling effort?
- Can other methods be applied to answer the question at hand?
- What features of the model suit the application and objectives?
- Is your calibration data representative of your condition of interest?
- Have you identified model uncertainty and effects on results?
- Are you confusing precision with accuracy?

“... all models are wrong, some are useful.”

George Box
J Street Drain Project Objective

- Reduce local flooding while protecting Ormond Lagoon
  - Modify J Street channel geometry and elevation
  - Consider outlet alternatives that minimize impact to the lagoon’s existing functions and future condition
Ormond Lagoon is Very Dynamic

- Lagoons and wetlands were present in 1855 but gone or severely altered by 1945
- J Street & Oxnard Drains historically discharged at different locations
- Existing lagoon formed after 1961, largely seaward of historic lagoon and wetland locations
- Existing beach is much wider than historic beach
- Lagoon tidal prism is too small to maintain connection with the Pacific Ocean
- Lagoon will continue to evolve, move south, reset...
Lagoon Breaching & Closure Illustrated

Data courtesy of VCWPD by CH2MHill
Lagoon After Closure

Date, 2008

Salinity

Elevation, FT [NAVD88]

Lagoon Water Level

Tidal Elevation [Santa Barbara]

Salinity

Data collection by HDR & Coastal Frontiers
Lagoon Breaching & Closure

- Seaward breaching caused by accumulation of freshwater in the lagoon overtopping the beach at lowest elevation
- Following breach, lagoon empties and become tidal, though limited by high lagoon elevations
- Wave driven sediments begin to fill entrance
- When tidal currents drop, the breach closes and lagoon begins to fill with freshwater and some overtopping by waves
- Beach reforms and processes reset with some intermittent breaching
Outlet Alternatives

1. Permanent jettied inlet
2. Permanent concrete channel
3. Inflatable weir w/ bypass channel
4. Beach maintenance
5. Emergency breaching
6. Do nothing

✓ Evaluated 4, 5 & 6 using MIKE21 model.
“No Action” Alternative

Allow breach to continue to form naturally and design channel to accommodate lagoon water levels

- Nominal beach elevations and initial lagoon water levels have been observed at 7.6 ft MSL
- Peak 100-year storm flow overwhelms lagoon and would overtop the beach at multiple locations
- Breach forms early during the 100-year storm, but lagoon water level could reach about 9.6 ft before dropping off
- Primary breach location occurred near OID
“No Action” Before 100-year
“No Action” After 100-year
Emergency Breaching

Excavate a breach pre-storm if lagoon or beach drastically changes from the design conditions considered and flooding is anticipated.

- Lagoon is expected to breach during 100-year event, however, water level could get too high if beach builds beyond historic conditions.
- May be needed to pre-condition lagoon in advance of a severe storm.
- Allows flexibility to respond to unanticipated conditions of lagoon, beach, and future climate.
Emergency Breach Before 100-year

Breach near J-Street
Emergency Breach After 100-year

Breach near J-Street
Emergency Breach Before 100-year

Breach near OID
Emergency Breach After 100-year

Breach near OID
Conclusions

- Modeling demonstrated that the “No Action” alternative actually works for the project.
- The new J Street channel can be designed to accommodate high water level in the lagoon for a 100-yr event.
- Conditions of the lagoon will continue to evolve and allow for future restoration of the lagoon by State Coastal Conservancy or others.
- Numerical modeling provides a tool to explore management and design alternatives.
Acknowledgements

- Ventura County Watershed Protection District
- Ormond Lagoon Task Force
- Coastal Frontiers Corporation
- BEACON
- Phillip Williams Associates
- CH2M Hill
- URS & Tetra Tech
- California Coastal Records Project

www.californiacostline.org
Discussion
Waves

Significant Wave Height (m)

- Above 4.0
- 3.5 - 4.0
- 3.0 - 3.5
- 2.5 - 3.0
- 2.0 - 2.5
- 1.5 - 2.0
- 1.0 - 1.5
- Below 0.5

Calm 2.17%

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