SEDIMENT MANAGEMENT AND NAVIGATION OPTIMIZATION AT COLLIER CREEK, FL

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COLLIER CREEK
COLLIER COUNTY, FL
PROBLEM OVERVIEW

► Access to 1/3 of Marco Island boaters
► High traffic area + strong currents
► Turbulence
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Credit: Ben Farnsworth (VDMW)
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2009-2011: 4 accidents causing structural damage
PROBLEM OVERVIEW

Collier Creek Dredging
(24,100 cy)

2001 2002 2003 2005

2010 2012 2013

2016 2017 2018

Collier Creek Dredging
(9,300 cy)

Collier Creek Dredging
(12,000 cy)

Collier Creek Dredging
(13,600 cy)

Bathymetry (ft NAVD), August 2017

Bathymetry (ft NAVD), August 2017 + Channel dredging
PROBLEM OVERVIEW

► Regional coastal dynamics (water & sediment)
► Scour hole deepening (cause/consequence)
PROBLEM OVERVIEW

Collier Creek Dredging (24,100 cy)


Hurricane Irma: seawall collapse; channel shoaling

Before After
MANAGEMENT PLAN DEVELOPMENT

► Data collection: sediment samples, bathy/topo, waves/currents/tides
► Sediment budget: quantify morphology changes and sediment fluxes
► Numerical modeling
  - Flow model
  - Sediment Transport & Morphology model
► Permitting and Engineering
  Engagement of local stakeholders from start:
  - City of Marco Island
  - VDMW Condominium
HYDRODYNAMIC MODELING

► Model calibration: model vs. measurements (waves, currents and tides)

► Model application
  - Understand existing conditions
  - Evaluate the performance of alternatives
HYDRODYNAMIC MODELING

Flood tide → driving conditions

- Current speed along the piers
- Cross-current
- Current along the navigation channel
- Turbulence (scour & navigation threat)

(overall scoring)

USE MODEL TO TEST ALTERNATIVES
HYDRODYNAMIC MODELING

Flood tide → driving conditions

- Current speed along the piers
- Cross-current
- Current along the navigation channel
- Turbulence (scour & navigation threat)

USE MODEL TO TEST ALTERNATIVES

8 initial alternatives
HYDRODYNAMIC MODELING

Flood tide → driving conditions

- Current speed along the piers
- Cross-current
- Current along the navigation channel
- Turbulence (scour & navigation threat)

USE MODEL TO TEST ALTERNATIVES

8 initial alternatives (most did not really work!)
HYDRODYNAMIC MODELING

Flood tide → driving conditions

- Current speed along the piers
- Cross-current
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- Turbulence (scour & navigation threat)

7x benefit of baseline alternative

30 additional variations
MORPHOLOGY
MODELING
MORPHOLOGY MODELING

Model calibration (replicate sed. budget)
MORPHOLOGY MODELING

Model calibration (replicate sed. budget)

4-year simulations

6 Final Alternatives + 2 baseline
MORPHOLOGY

Model calibration (repl)

4-year simulations
MORPHOLOGY

Model calibration (repl)

4-year simulations
MORPHOLOGY MODELING

► Engineering (feasibility and economic analysis)
  Cost of Alternative vs. Operational Savings(*)

► Permitting (pre-consultation is ongoing)
CONCLUSIONS
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Collier Creek’s shoaling & scour problem required 3D modeling to illuminate the underlying processes.

Results pointed towards a non-intuitive solution that may alleviate the problem.
QUESTIONS

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