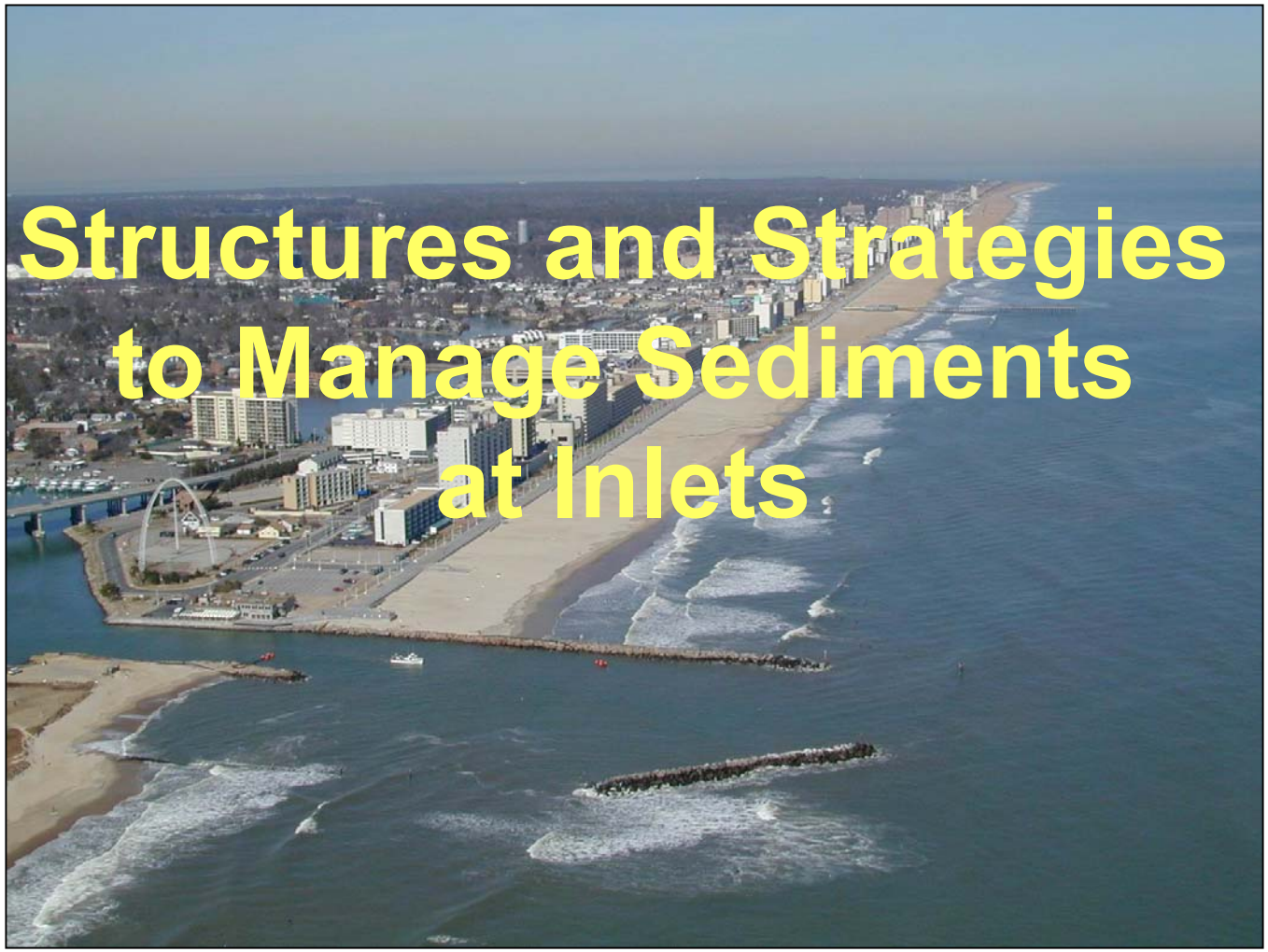
4th Annual Tech-Transfer Workshop
Feb 10-12, 2003



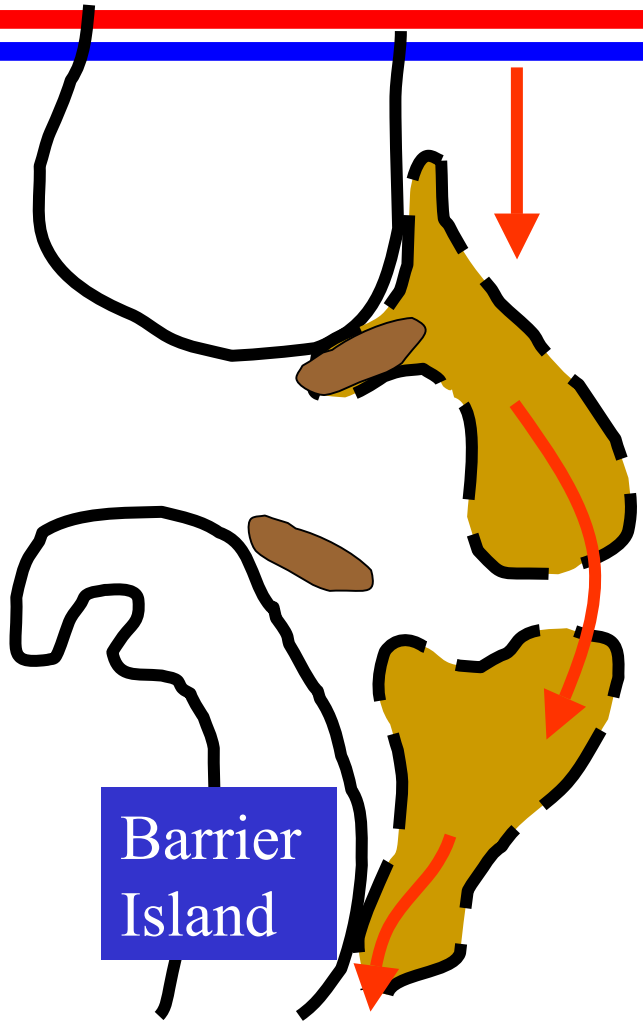
Outline


1. The Inlet Sand System
2. Types and Objectives of Inlet Structures
3. Examples
4. Modeling

USACE's Mission

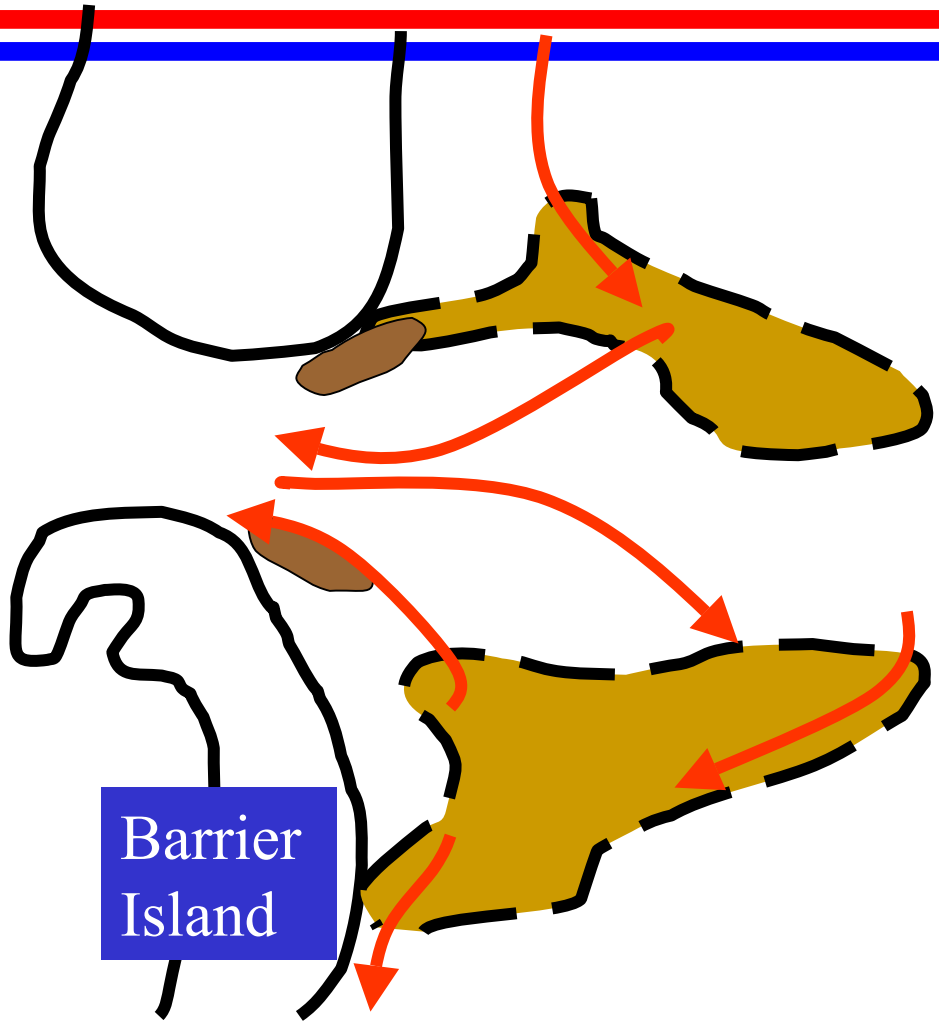
- maintain navigable waterways
- minimize and mitigate for adjacent beach impacts
- maintain and create environmental habitat

Natural Sand Bypassing



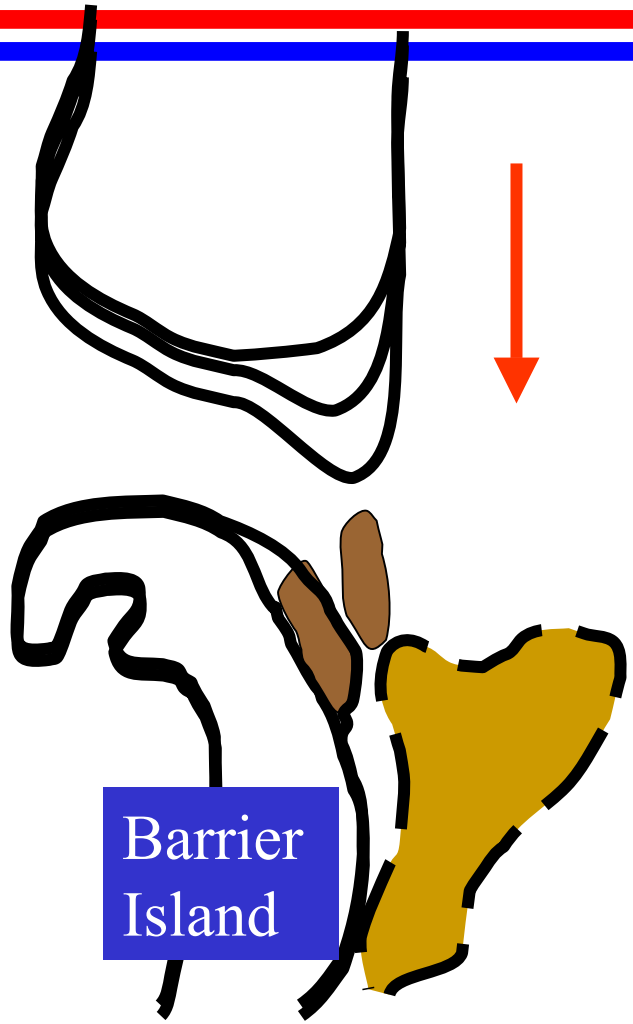
1. Wave-Induced along Ebb Shoal

Natural Sand Bypassing



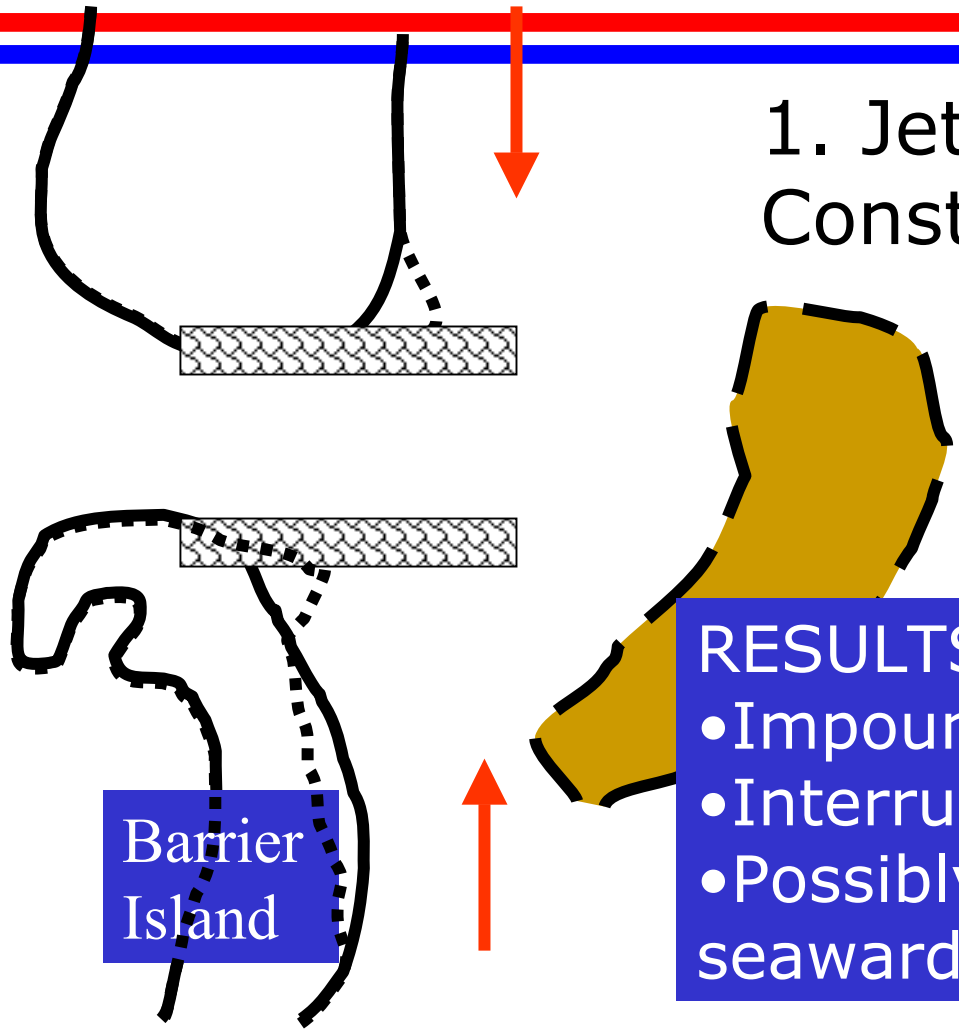
2. Transport into and out of inlet by tidal currents

Natural Sand Bypassing



3. Migration of channels and bars

Inlet Stabilization

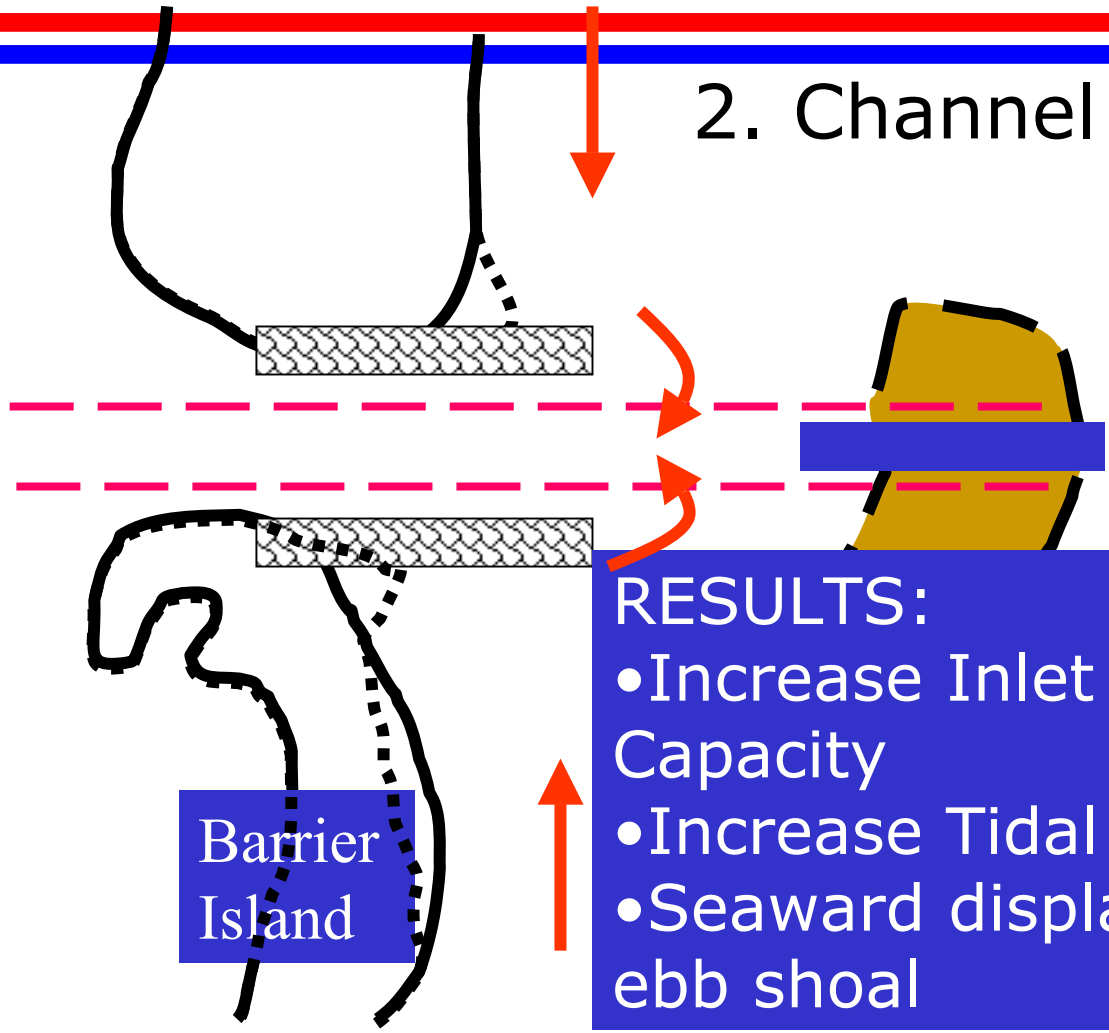


1. Jetties Constructed

RESULTS:
- Impoundment at jetties
- Interrupt bypassing
- Possibly divert sediment seaward (rips)

Inlet Stabilization

2. Channel Deepened



RESULTS:

- Increase Inlet "Sink" Capacity
- Increase Tidal Prism
- Seaward displacement of ebb shoal

Approach

- Perform historical analysis
- Understand sediment pathways
- Select best strategy to manage sediment

Ebb Shoal, Channel, and Shoreline Evolution

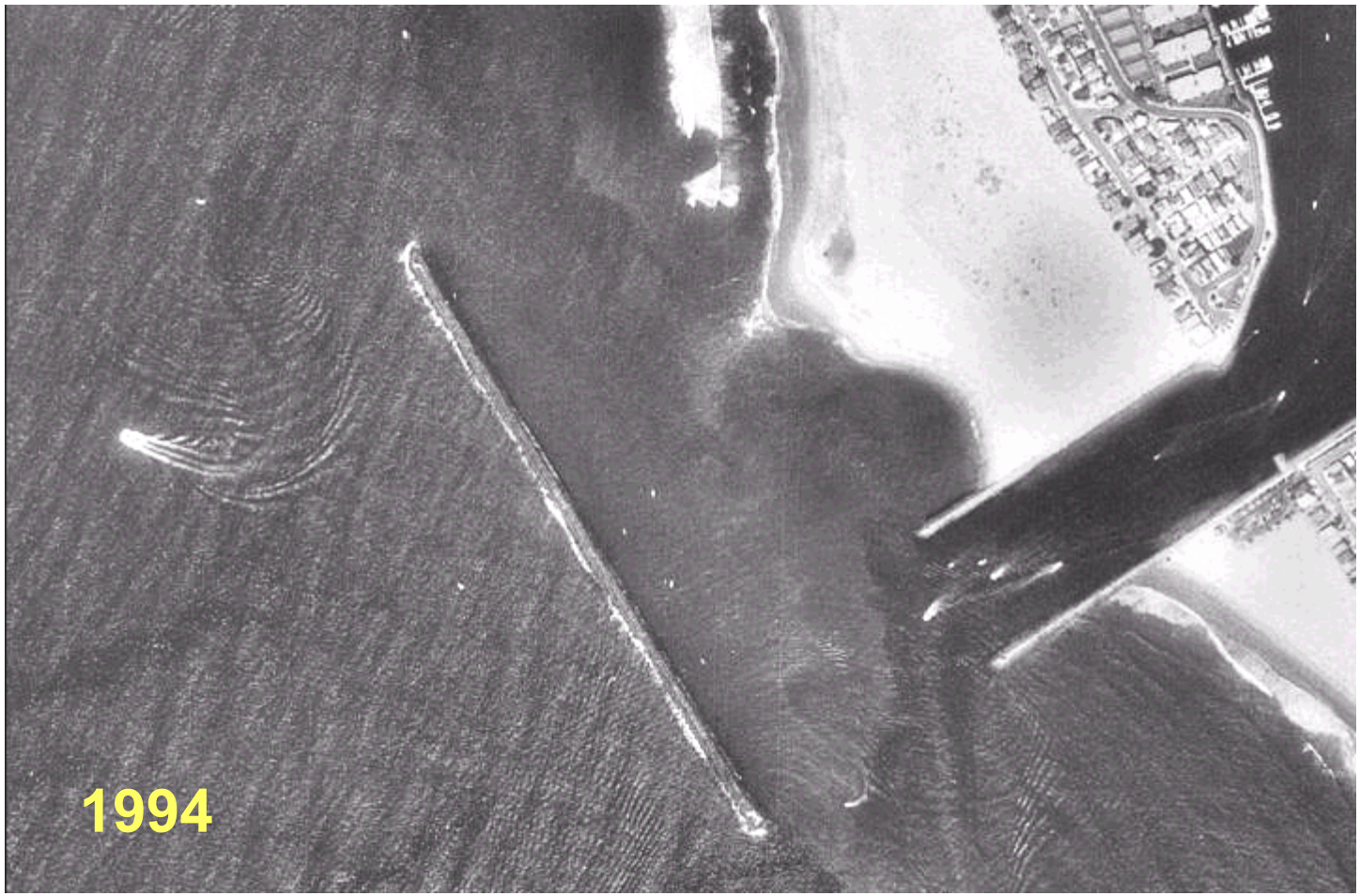
Strategies

- Naturally bypass (most likely, in your dreams)
- Dredge channel and bypass
- Actively intercept the sand and bypass
  - Jet pump system (Rudee Inlet, VA)
  - Fixed plant, (e.g., South Lake Worth Inlet, FL)

Strategies (continued)

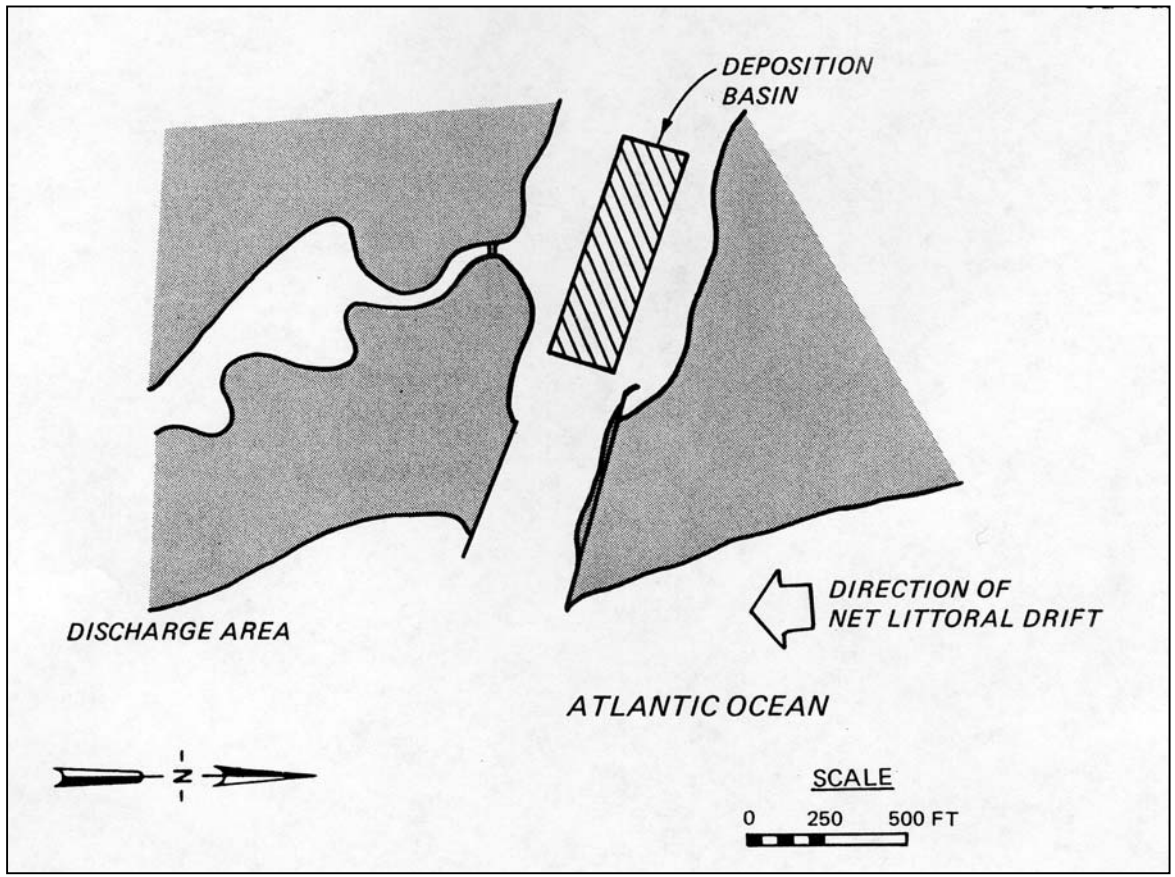
- Provide storage area
  - Deposition basin in channel (Jupiter Inlet, FL)
  - Deposition basin w/ weir jetty (many examples)
  - Fillet adjacent to jetty
  - Offshore breakwater
- Divert
  - Use jetty spurs to keep sand on beach

Offshore Breakwater
Channel Islands Harbor, CA



Jetty Spurs at Suislaw River, OR

Jupiter Inlet, FL
Deposition Basin in Channel



Structure Orientation to Aid Natural Bypassing

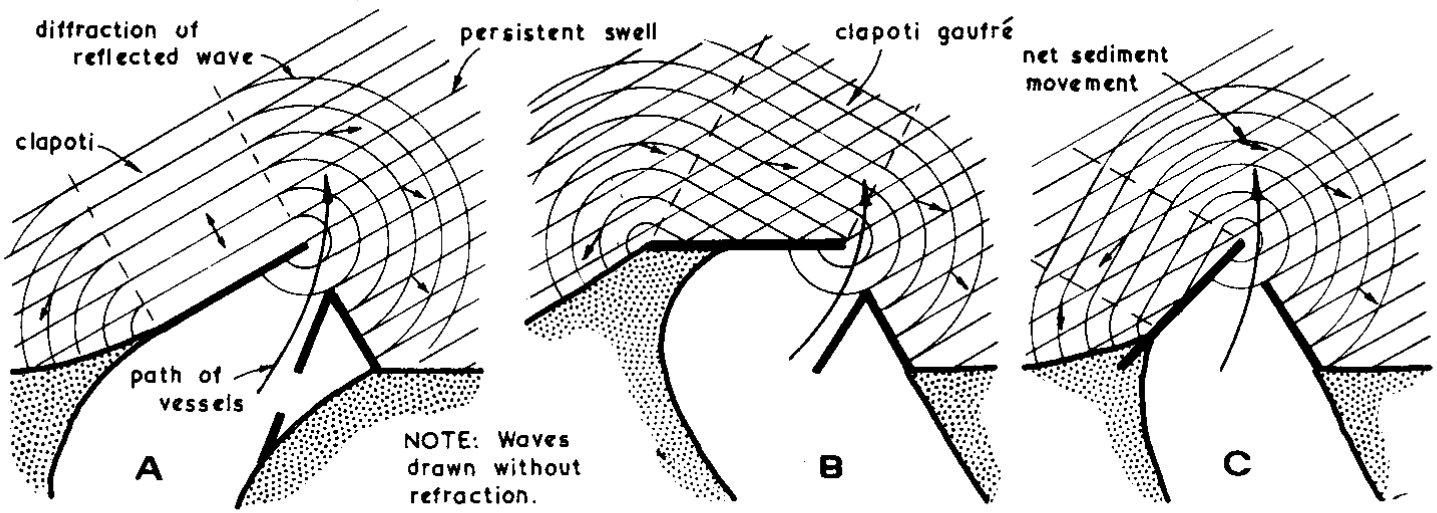
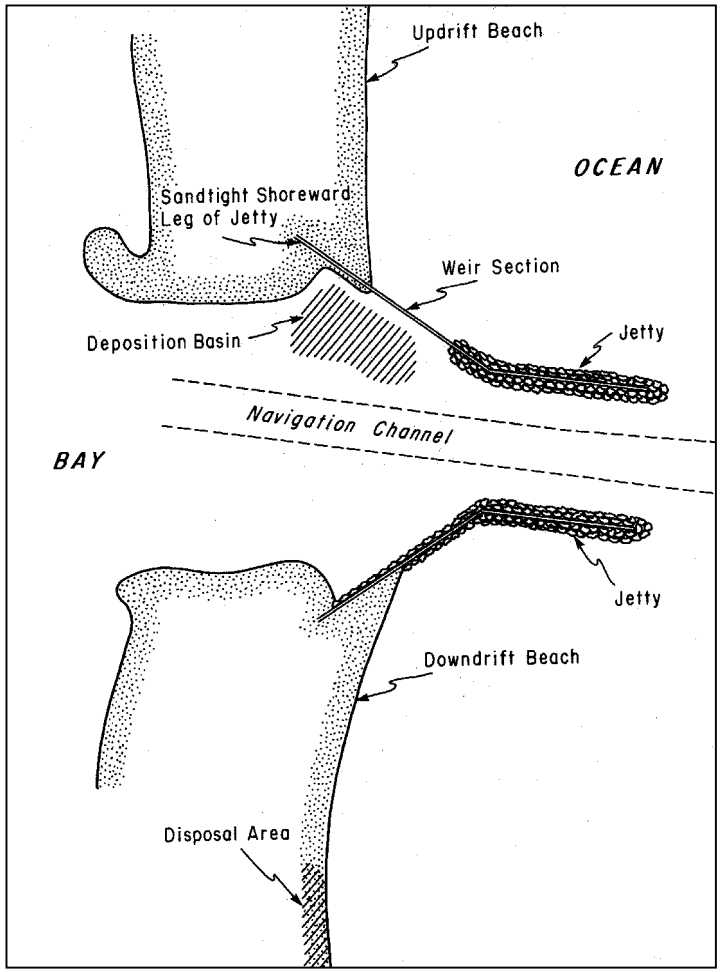


Fig. 3-5. Reflecting breakwaters for re-applying wave energy to sea-bed to expedite sediment transport.

From R. Silvester, 1974

Key Elements of a Typical Weir Jetty System



Performance of an Ideal Weir Jetty System

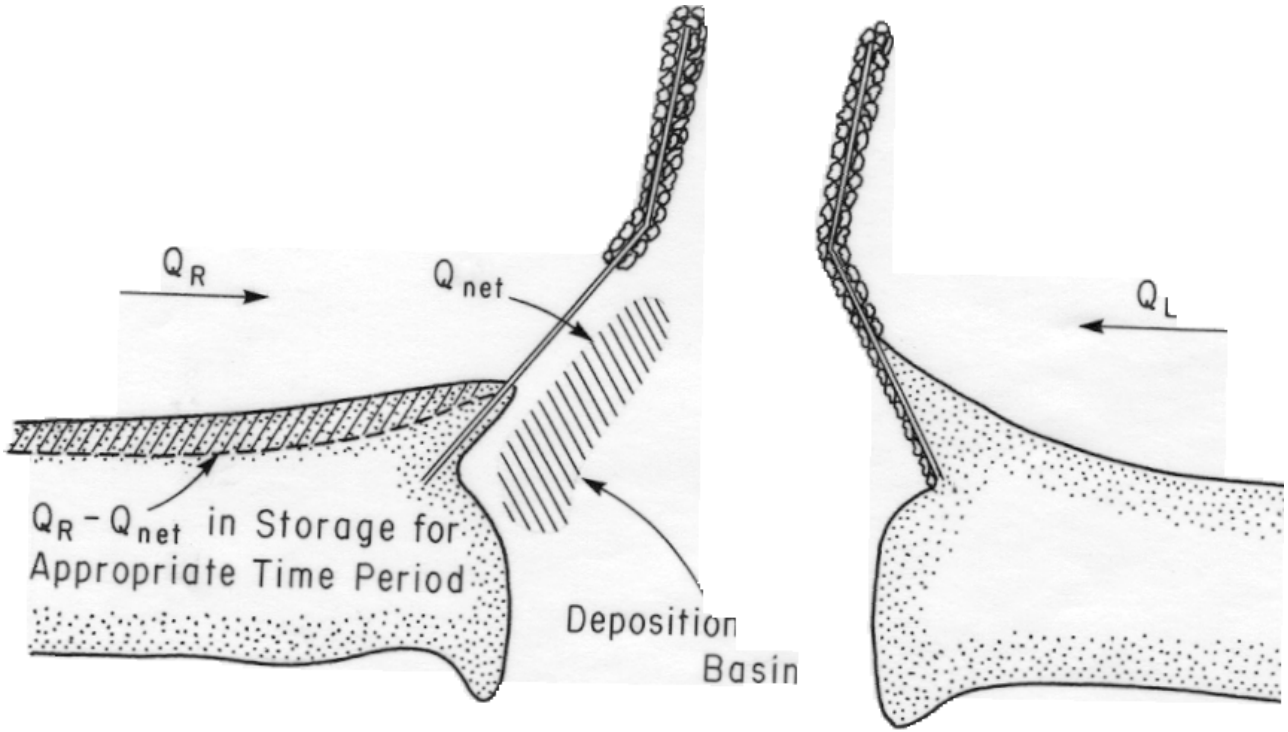


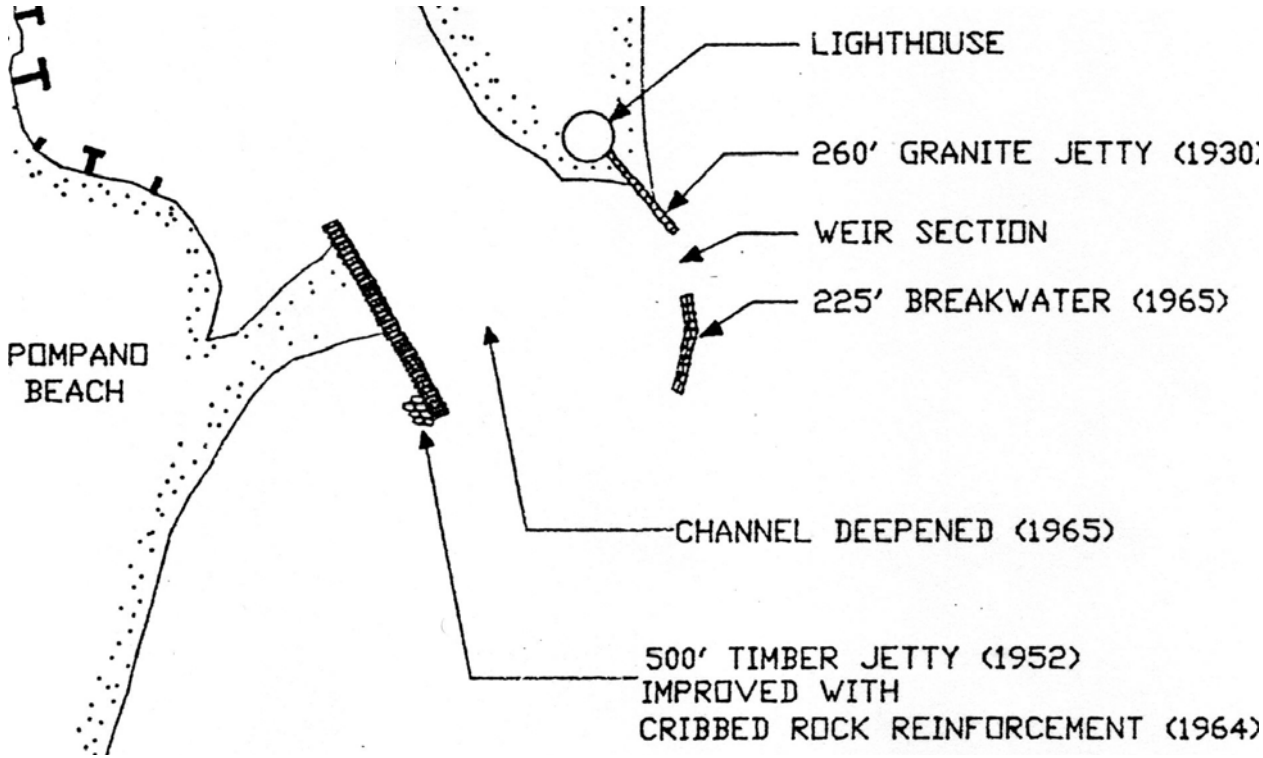
Table 1
Weir Jetty Projects Specifications

Location	Weir Elevation, ft mlw	Length of weir ft	Length of weir jetty ft	Orientation of weir[1] degrees	Weir material	Gross Longshore Transport Rate Estimates cu yd/year
Boca Raton, FL	0 ft (N.G.V.D.)	65	North jetty 650	90	Concrete bags	Net rate 120,000 to S
Charleston, SC	-13	6,000	15,400 N 19,100 S	70	Rubble mound	-
Colorado River Mouth, TX	0.0	1,000	East jetty 2,650	90	Rubble stone	300,000
East Pass Channel, FL	-0.5	1,000	West jetty 4,850	45	Concrete sheet pile	195,000
Hillsboro Inlet, Fl	Varying +0.5 - +3.5	260	North jetty 485	0	Natural rock	120,000
Masonboro, NC	+2.0	1,100	North jetty 3,639	85	Concrete sheet pile	340,000
Murrells Inlet, SC	+2.2	1,350	North jetty 3,455	30	Rubble mound	250,000
Perdido Pass, AL/FL	-0.5	1,000	East jetty 1,800	45	Concrete sheet pile	195,000
Ponce DeLeon, FL	0.0 +4.0	1,500 300	North jetty 4,050	60	King piles and adjustable concrete beams	700,000
Rudee Inlet, VI	+2.15	452	South jetty 815	90	Timber	600,000
St. Lucie, FL	0.0	900	North jetty 3,975	90	Rubble mound	260,000

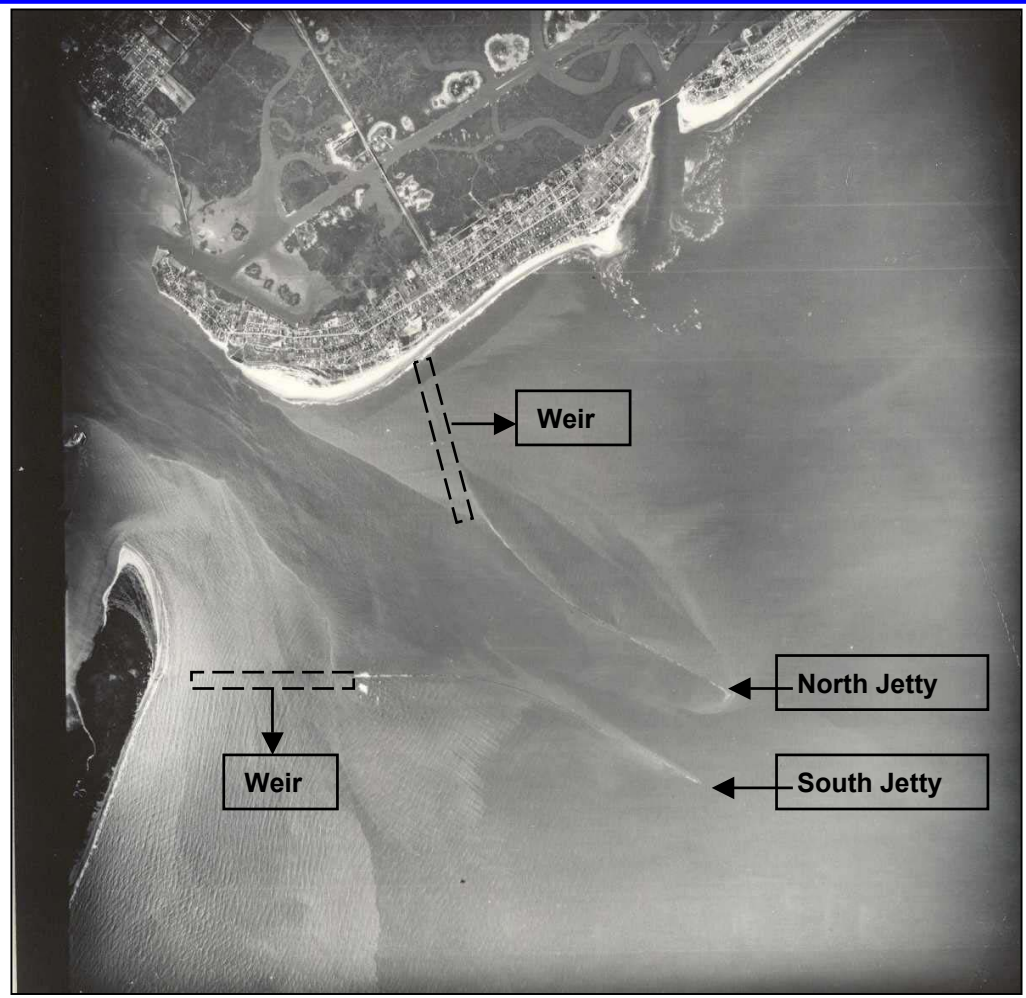
1. Angle from general trend of shoreline measured on the channel side.

Hillsboro Inlet, FL, 1 September 1995

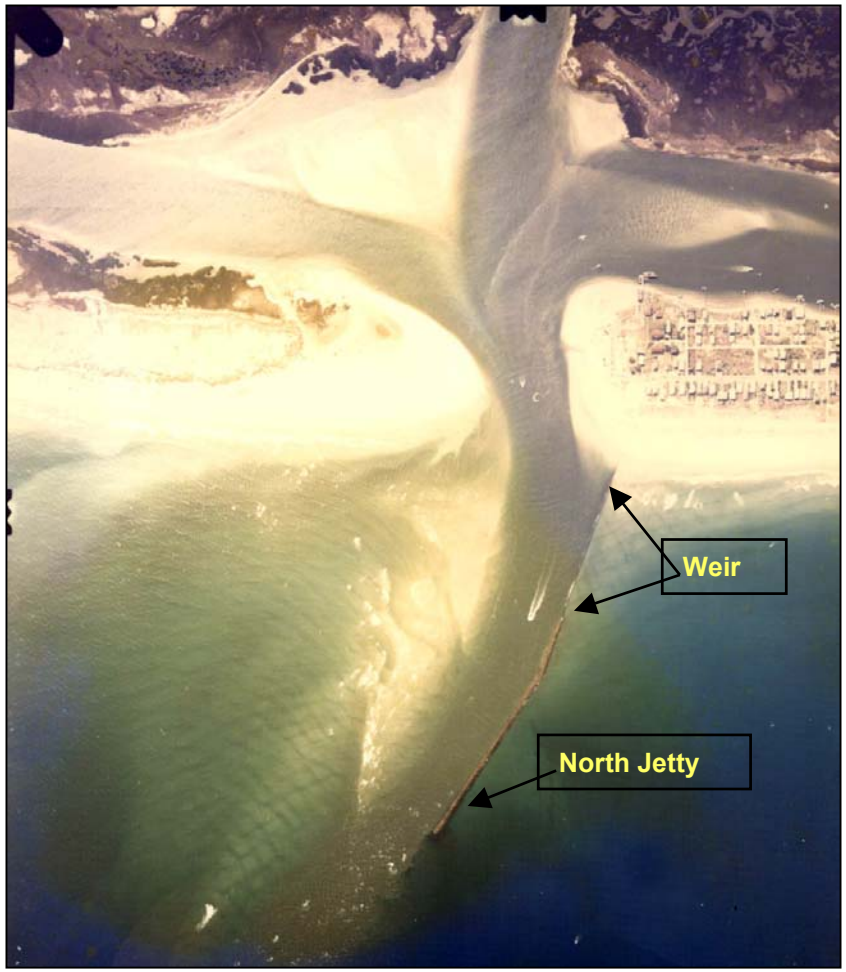
Hillsboro Inlet Plan View



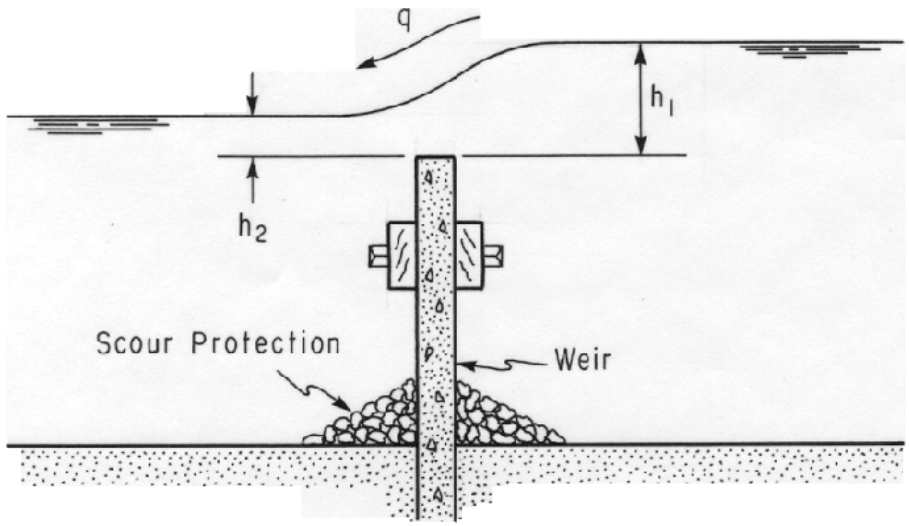
Charleston Harbor, SC, 1968



Masonboro Inlet, NC
September 1974



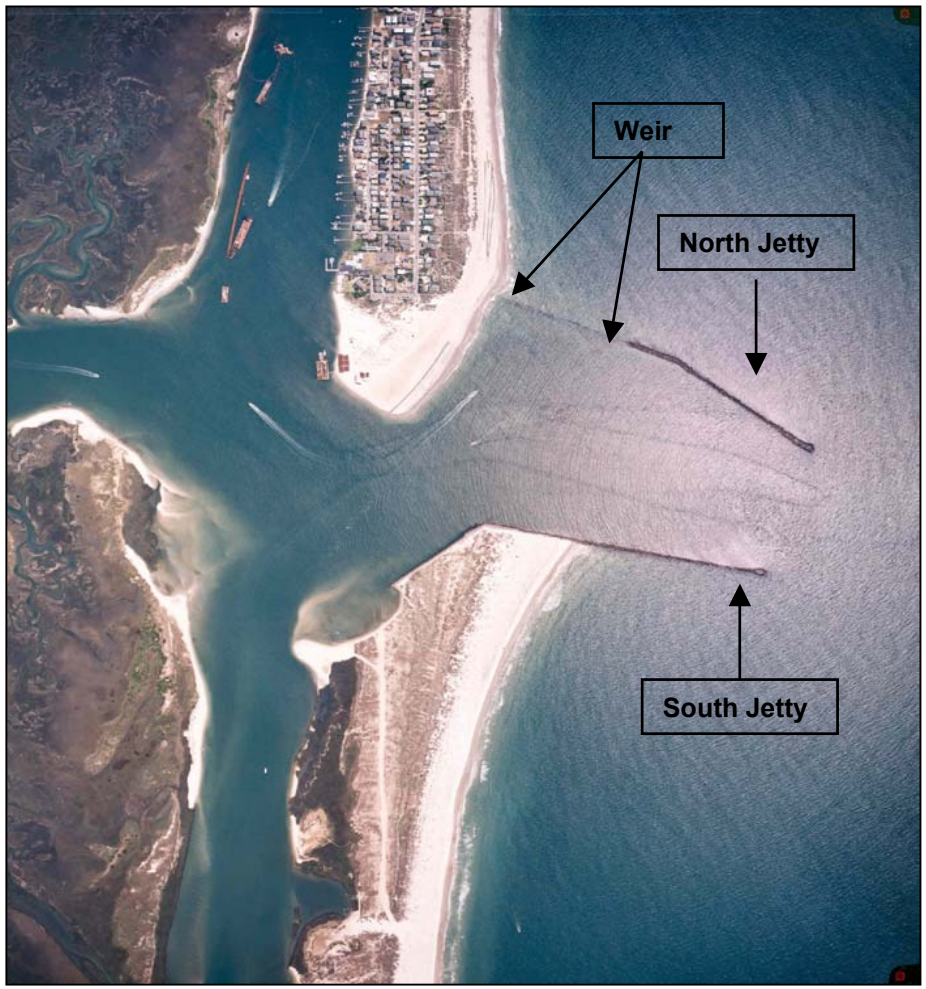
Sheetpile Weir at Masonboro Inlet



Submerged Weir During Floodflow

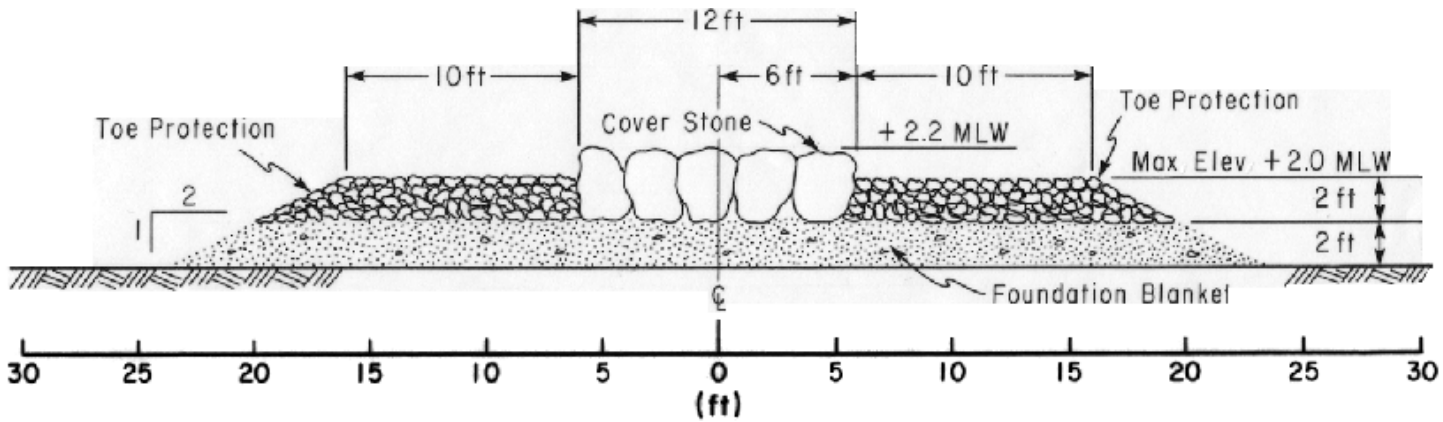
$$q = C\sqrt{(2g\,(h_1 - h_2)}\quad \left\{\frac{2}{3}\,h_1 + \frac{1}{3}\,h_2\right\}$$

Masonboro Inlet, NC, 16 May 2002



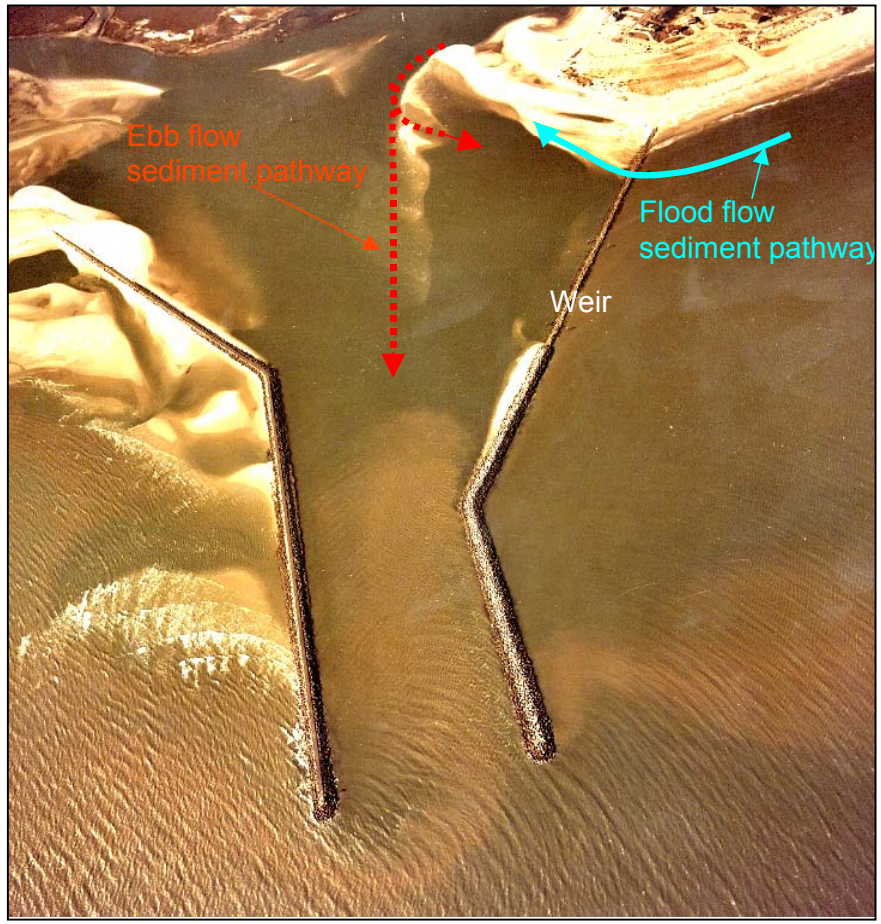
Murrells Inlet, SC, 14 January 1982

Rubble-mound Weir



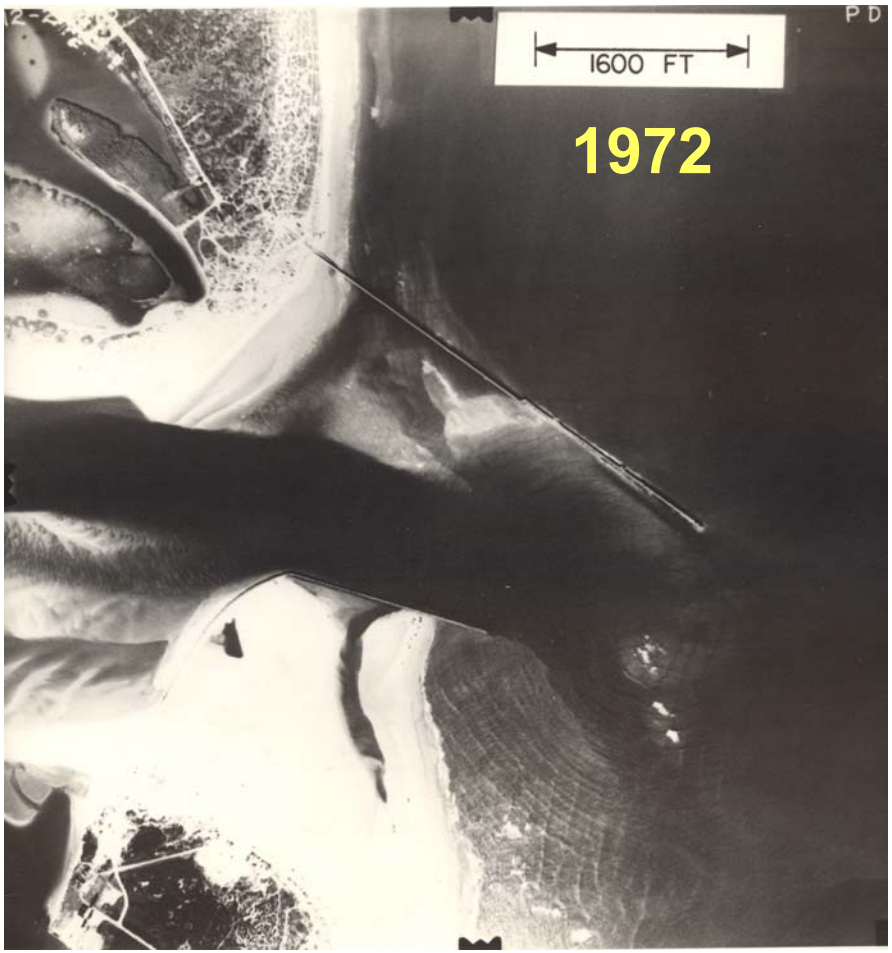
Note Dimensions and Stone Size will Vary with Local Conditions

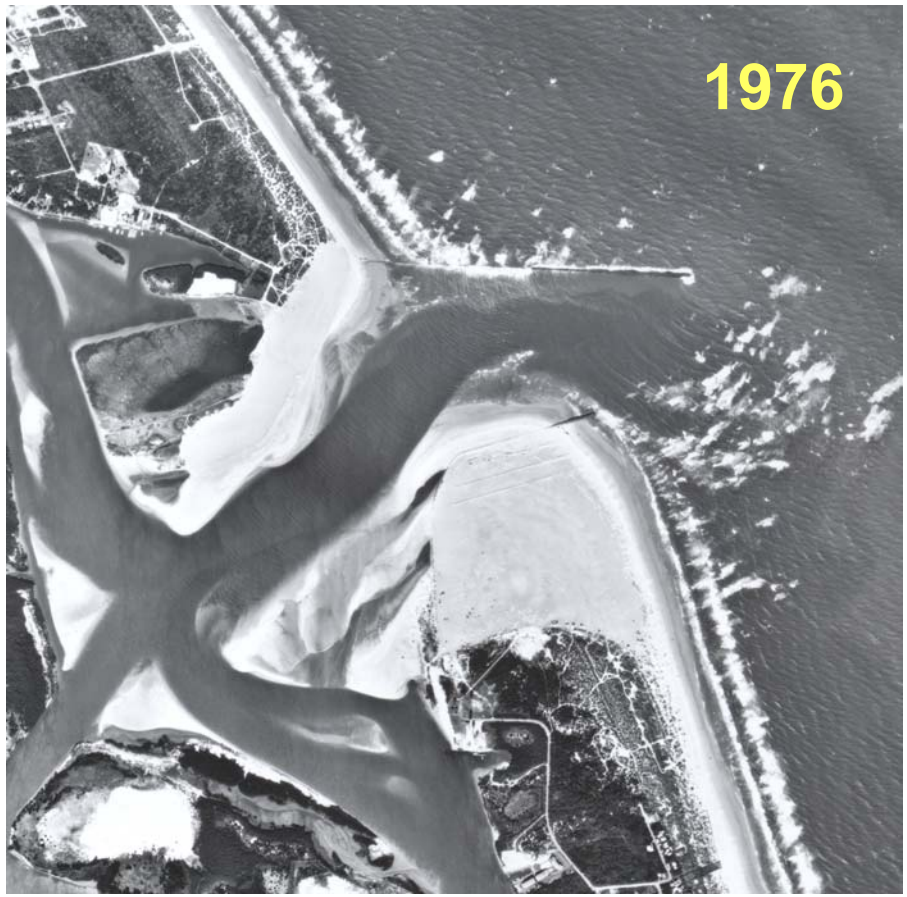
Sediment Pathway for Average Wave Conditions at Murrells Inlet, SC



Little River Inlet, SC 1984

Ponce De Leon, FL





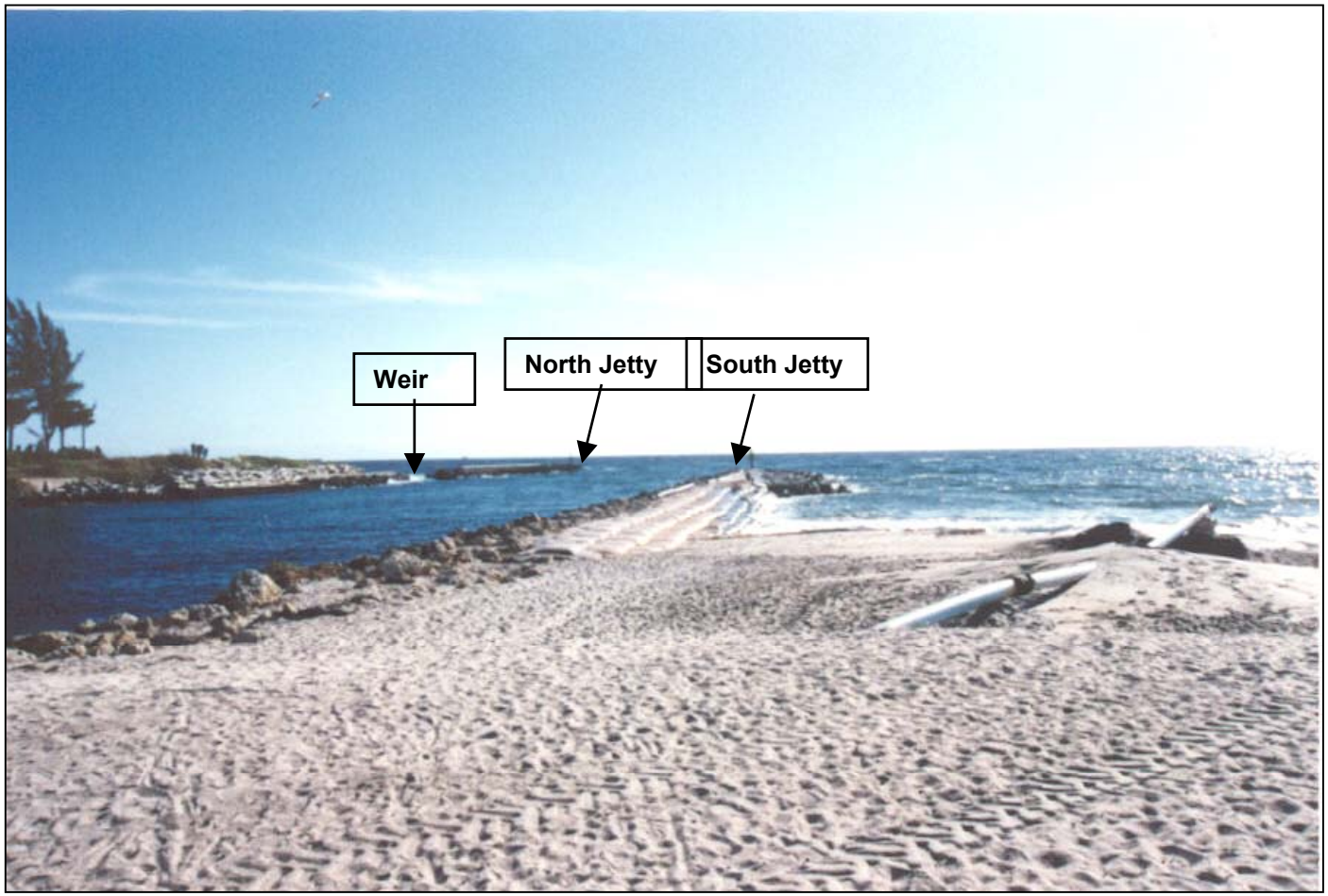
Ponce De Leon, FL, 13 December 1995 (Weir Closed)

Rudee Inlet, Virginia, February 2002

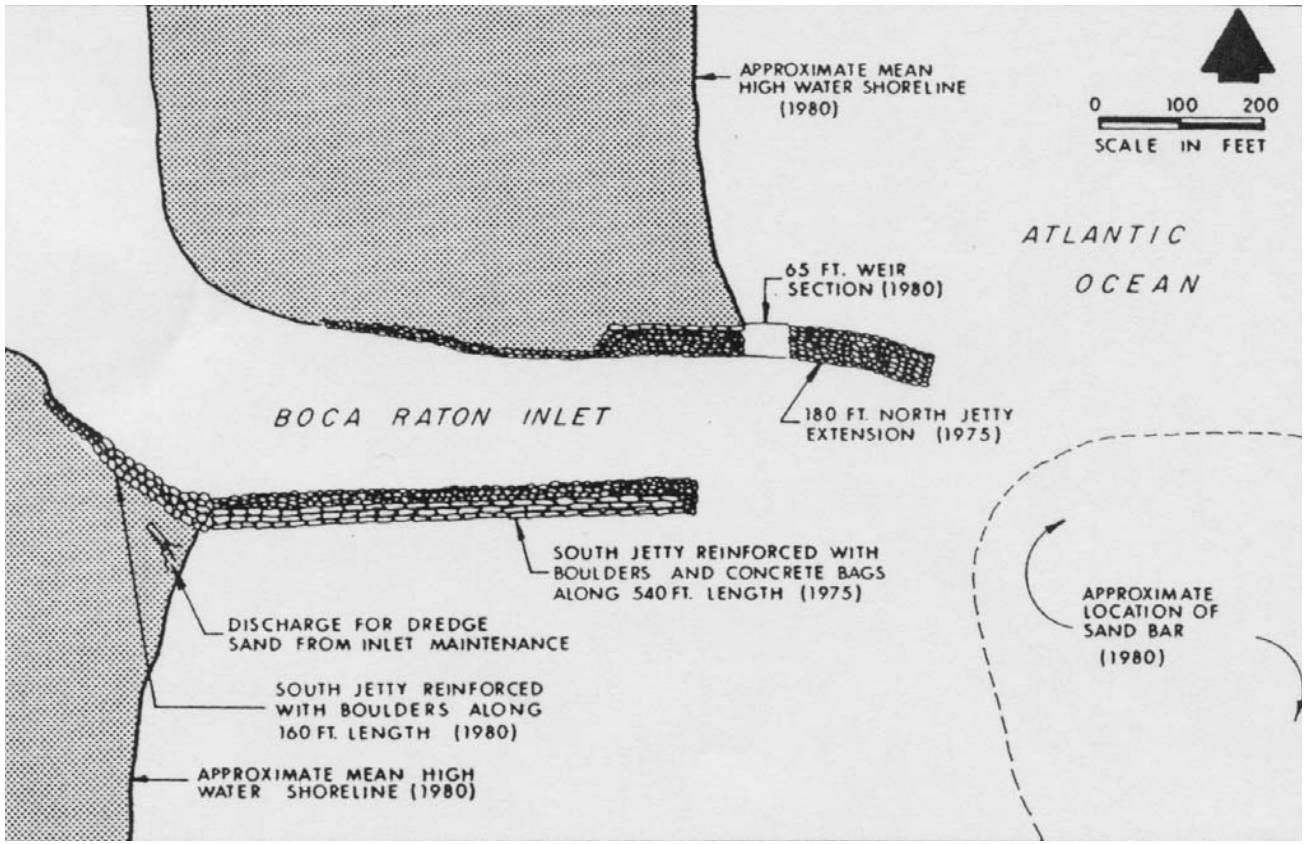
Rudee Inlet , VA
Feb 02

St. Lucie, FL,
23 November 1996

Boca Raton Inlet, FL, 1996



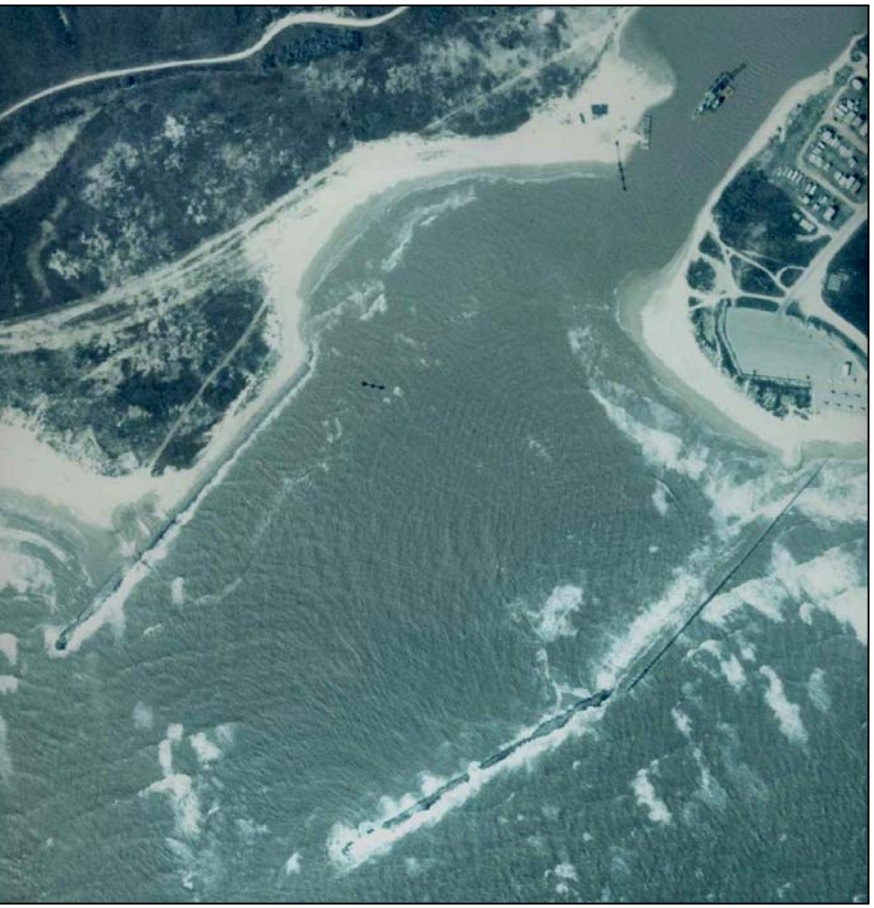
Weir Jetty System, Boca Raton Inlet, FL

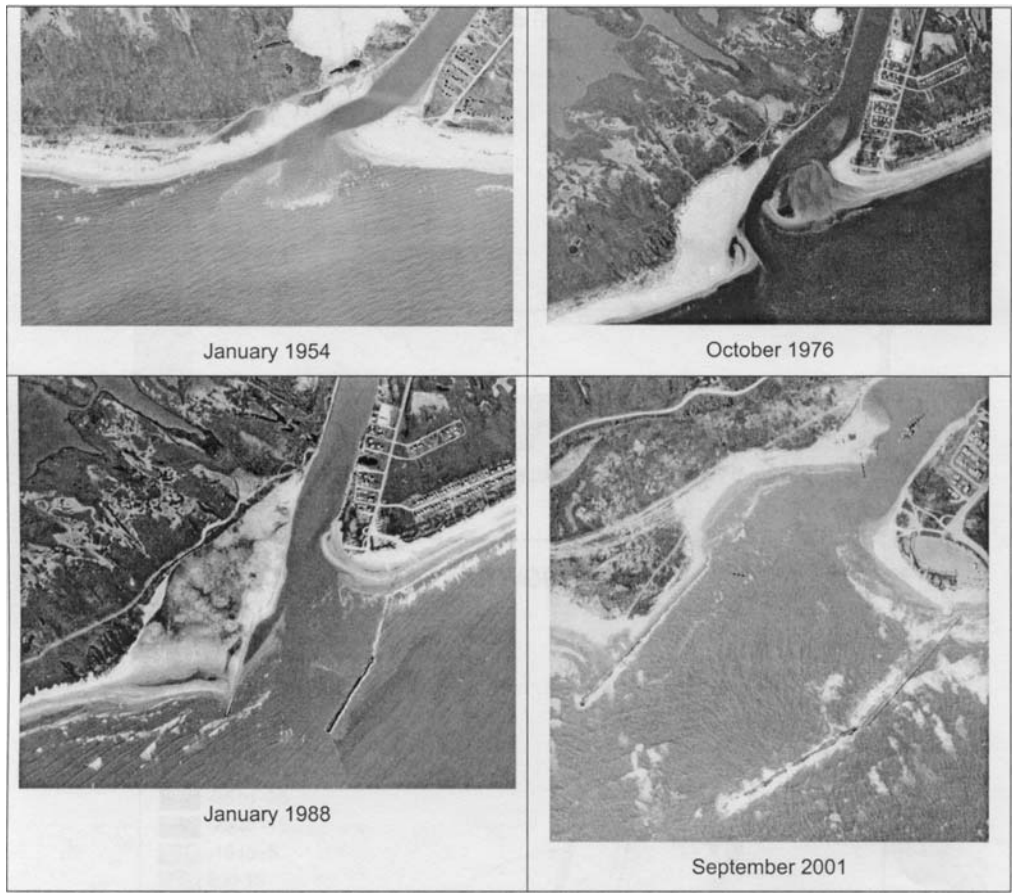


East Pass Channel, FL, 1973

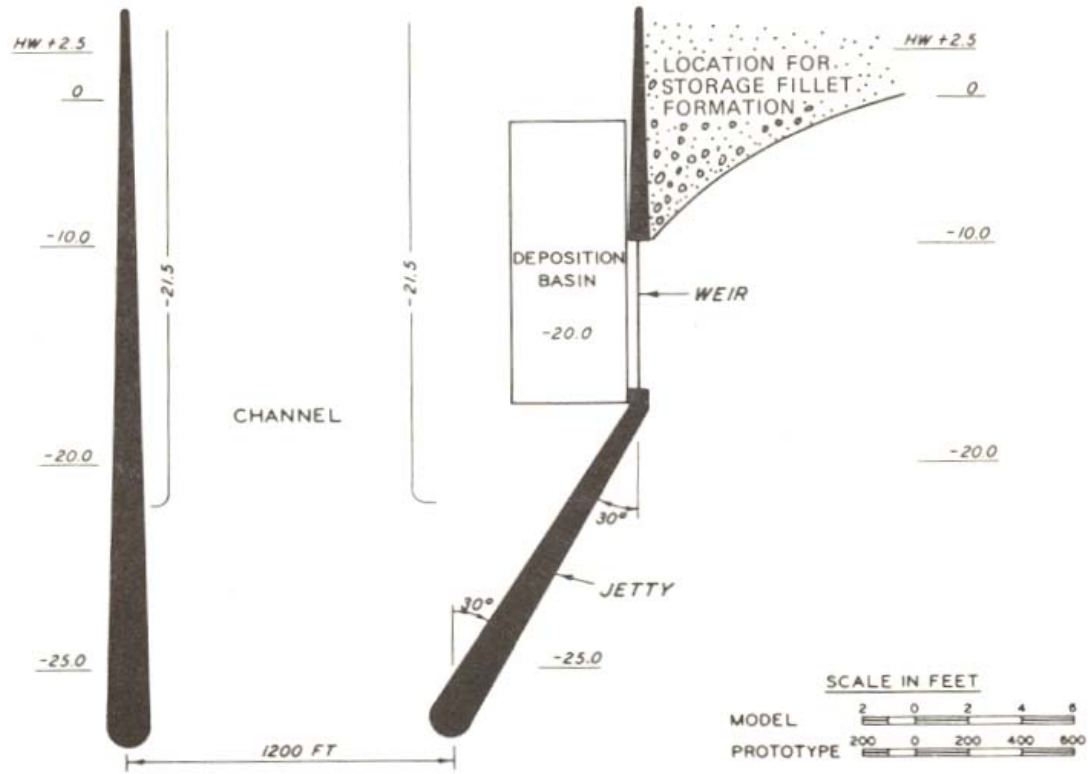
Perdido Pass, AL/FL

Colorado River Navigation Channel, TX

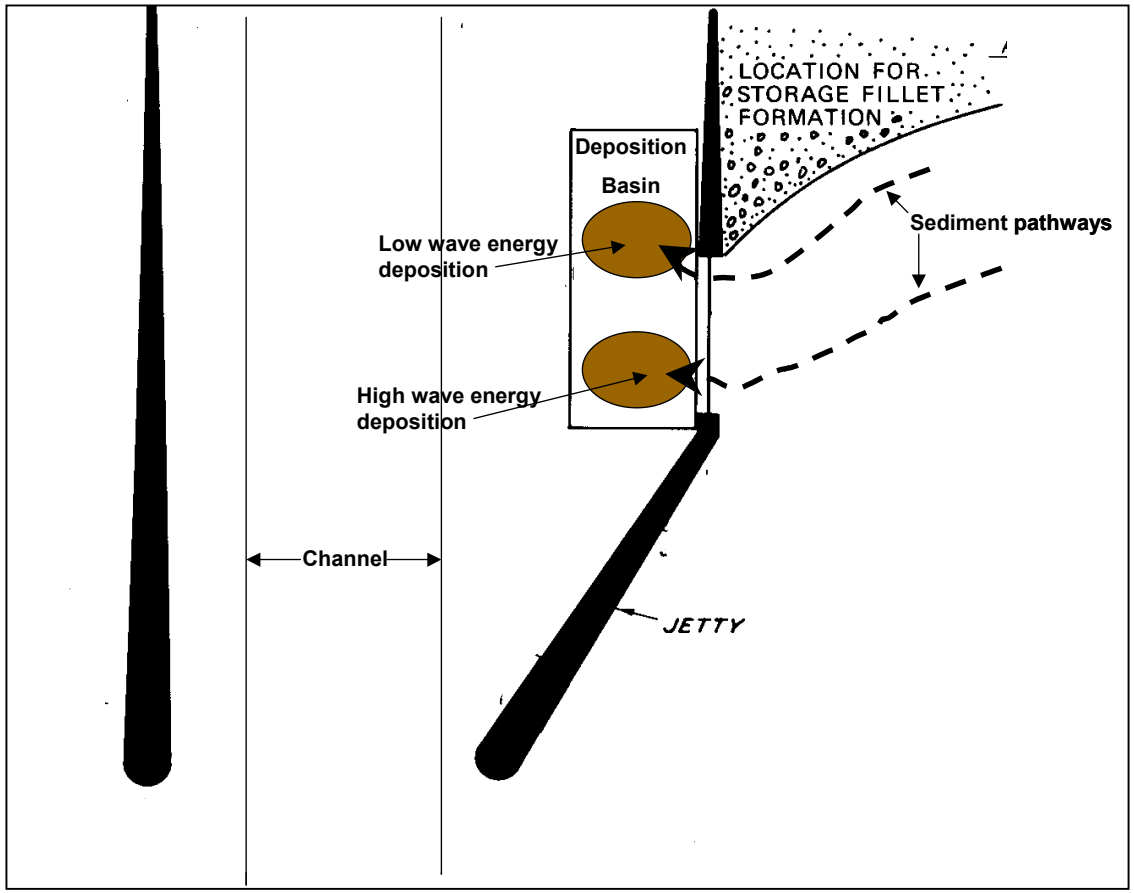




Shoreward Offset of Deposition Basin With Respect to Weir Location

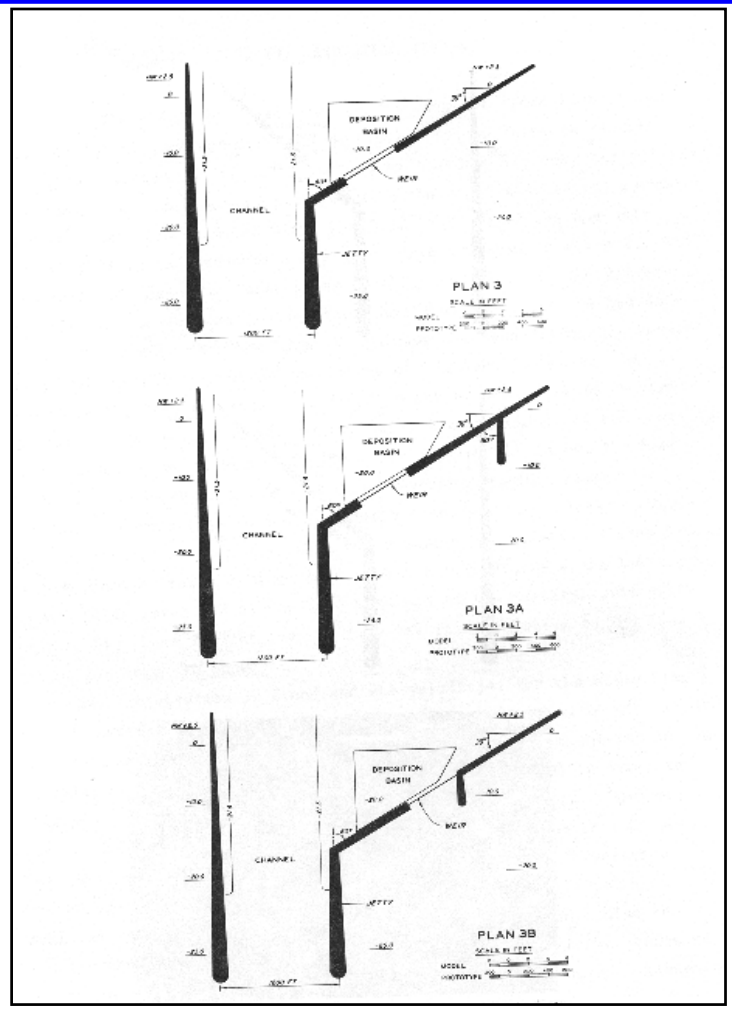


Sediment Pathways Over Weir for Low and High Wave Conditions



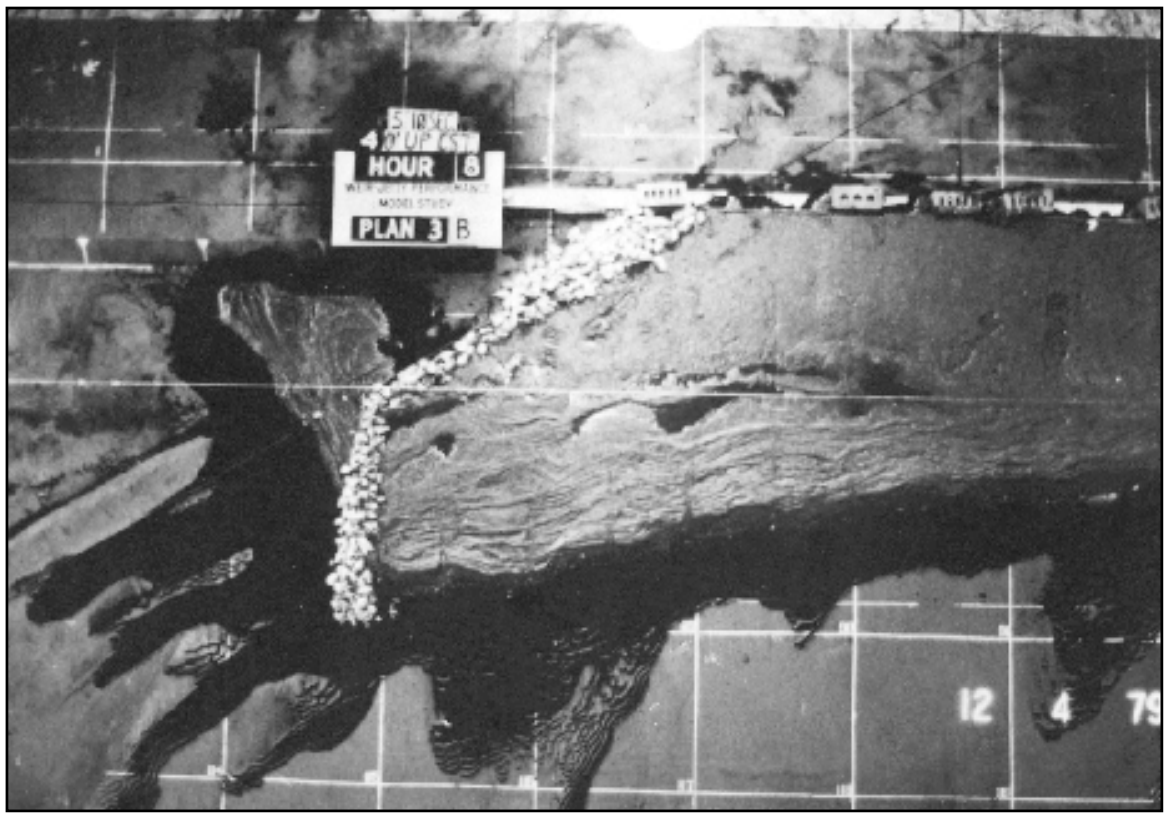
Typical Sediment Movement Over Weir Section

Auxiliary Structures for Sediment Management

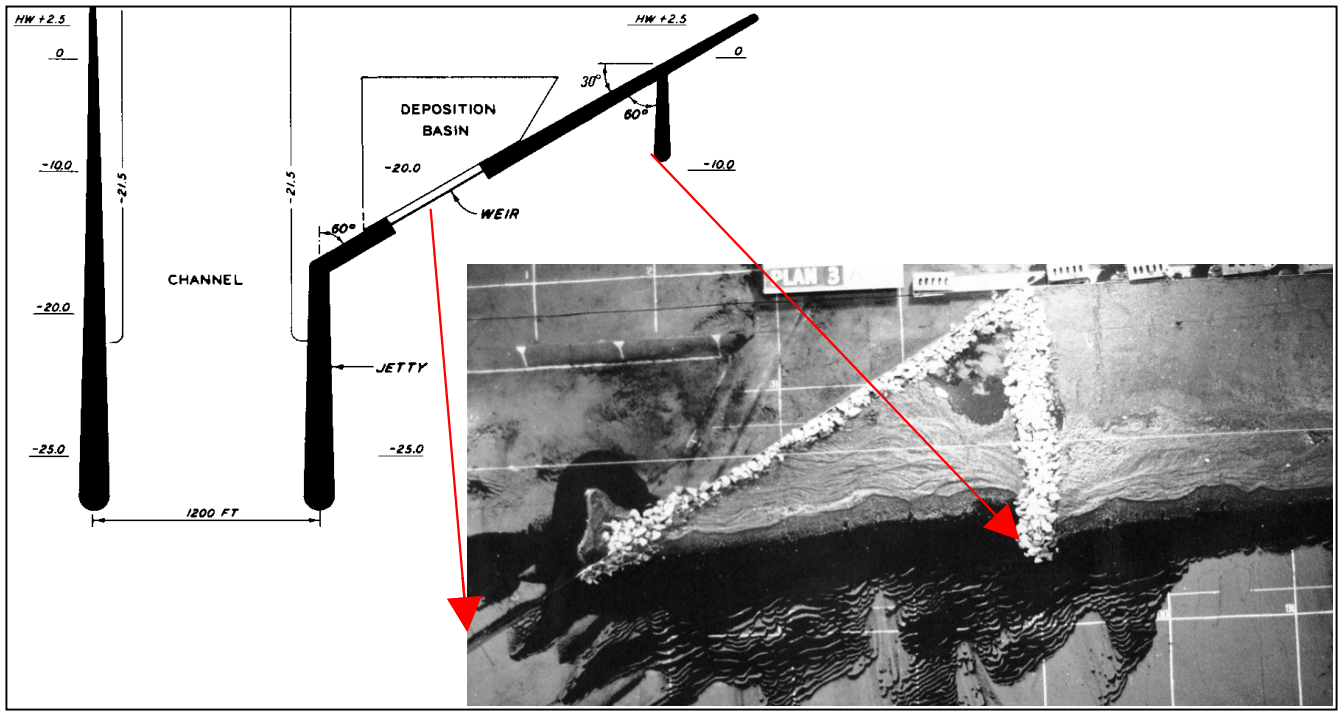


Basic Weir Jetty

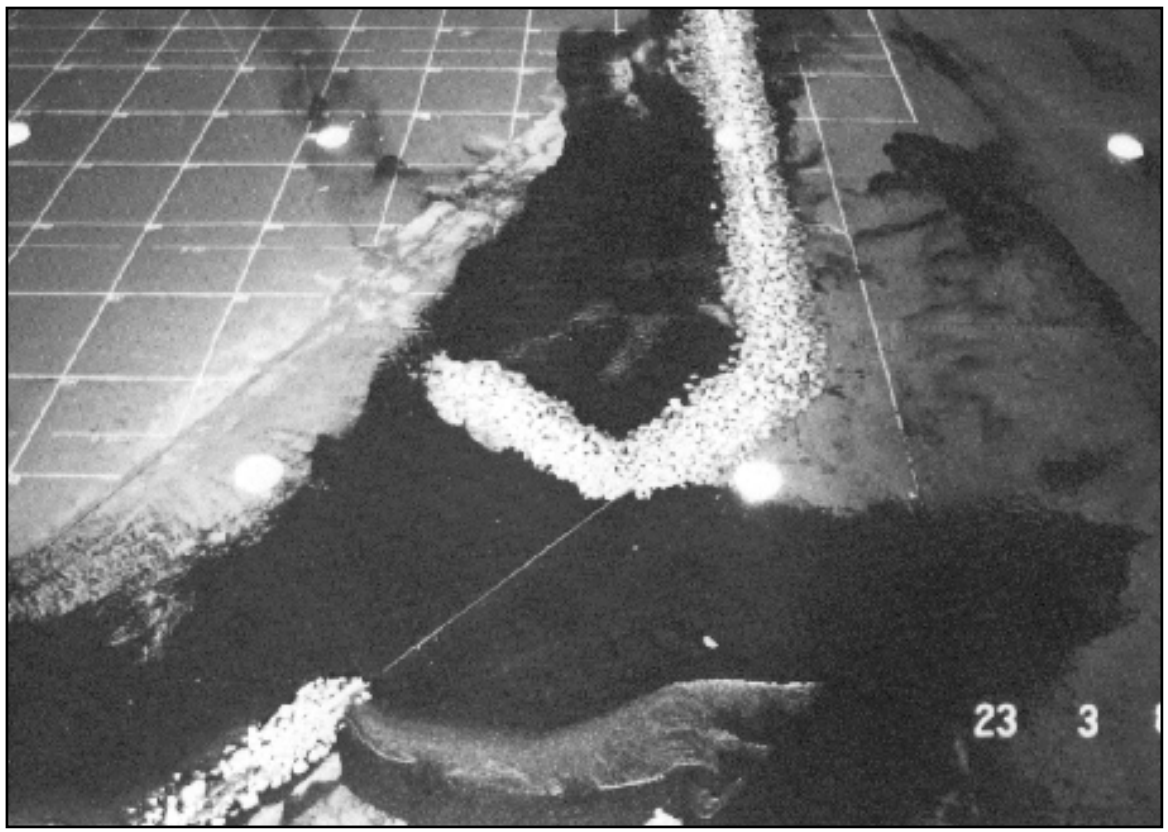
Terminal Groin at Weir



Terminal Groin upcoast of Weir Jetty to Aid in Capturing Only Net Sediment Volume in Deposition Basin



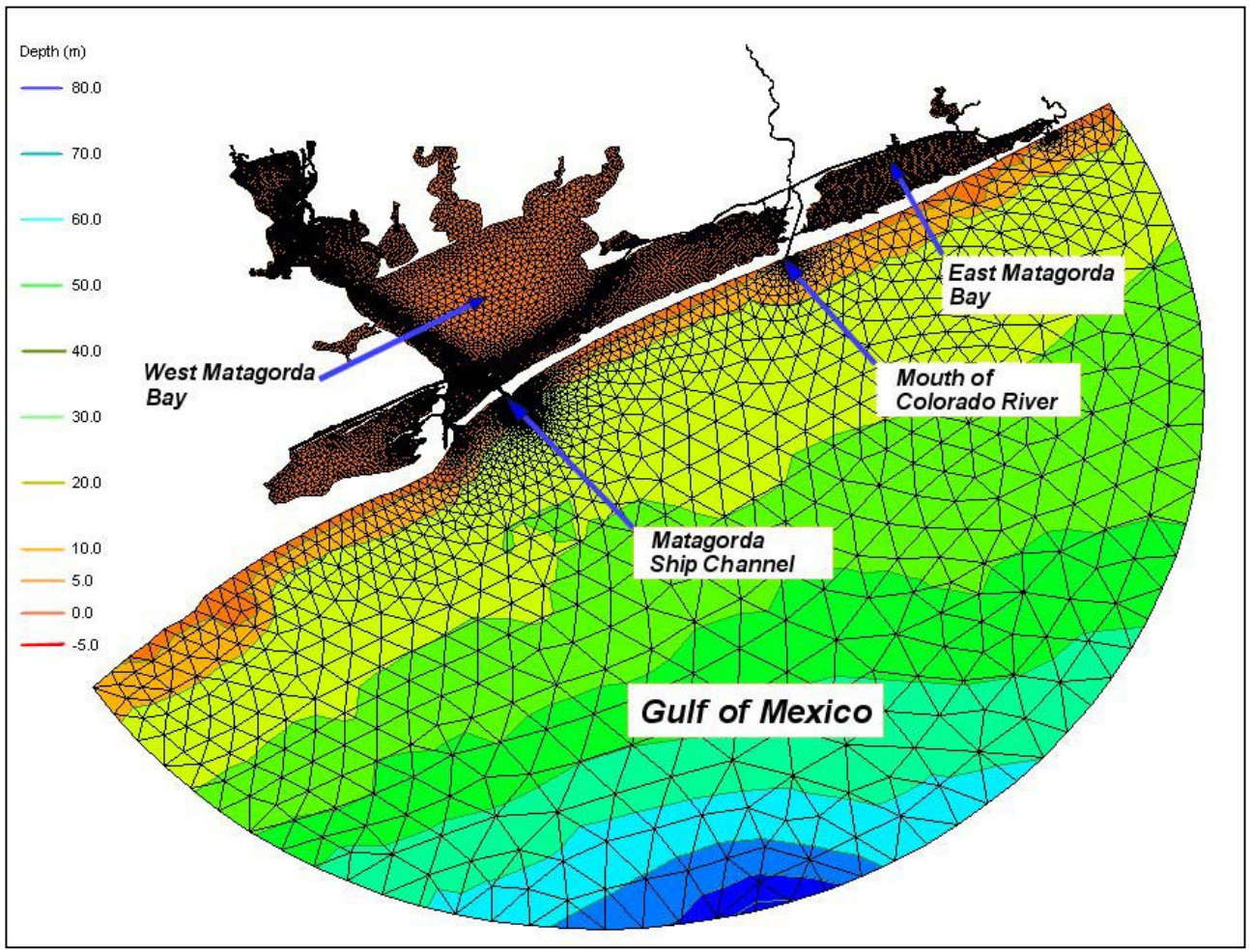
Groin Seaward of Weir



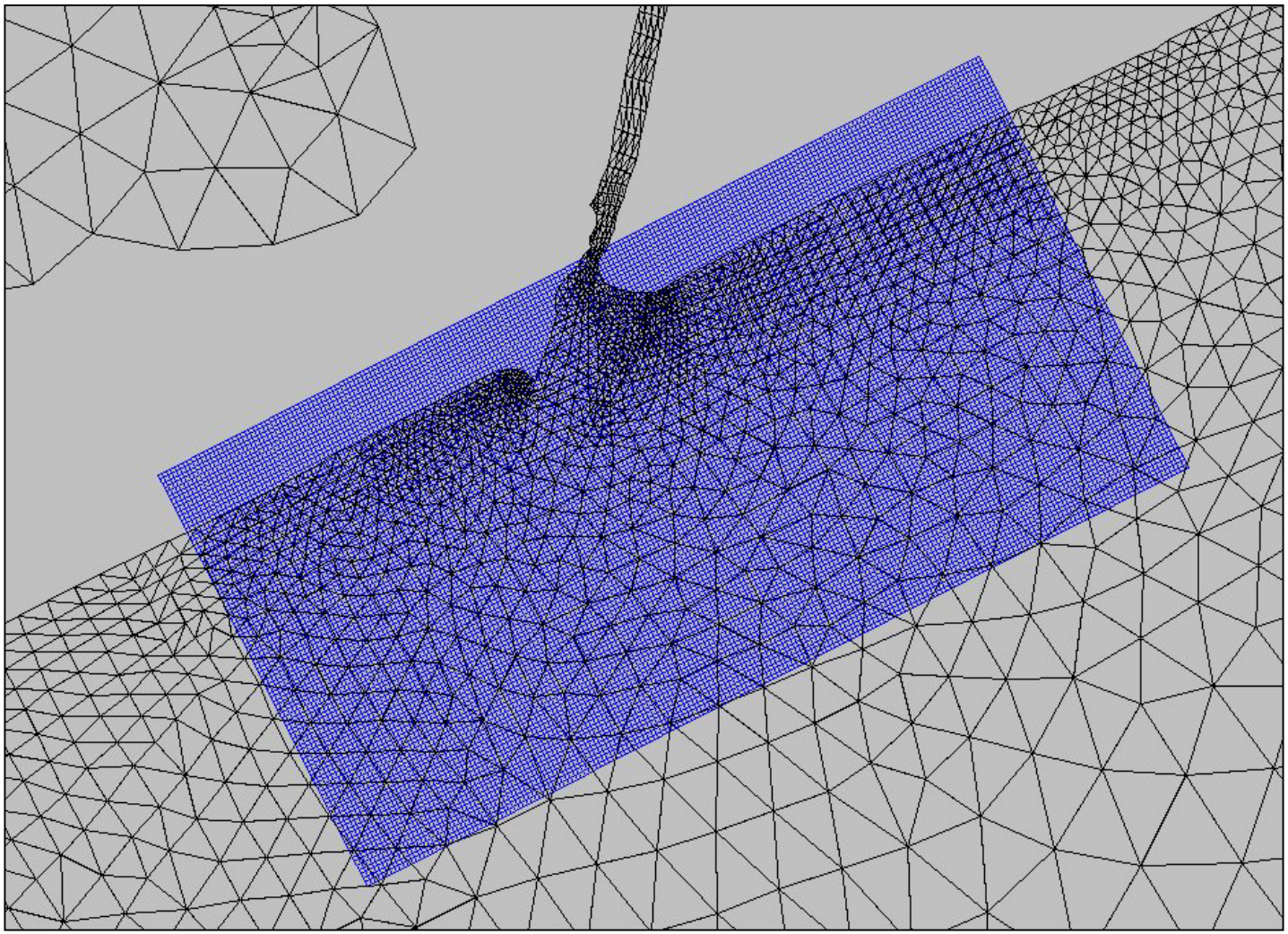
Update on Modeling Inlet Structures

Examples Provided by
Dr. Lihwa Lin, CHL
&
Ms. Mary Cialone, CHL

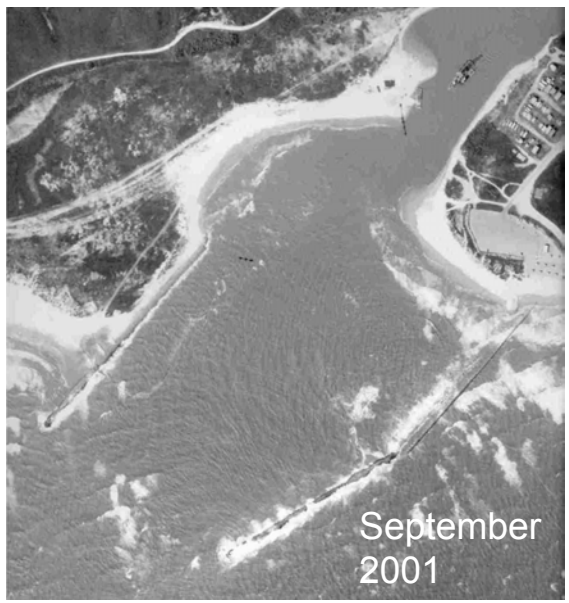
Regional ADCIRC Grid for Tidal Currents



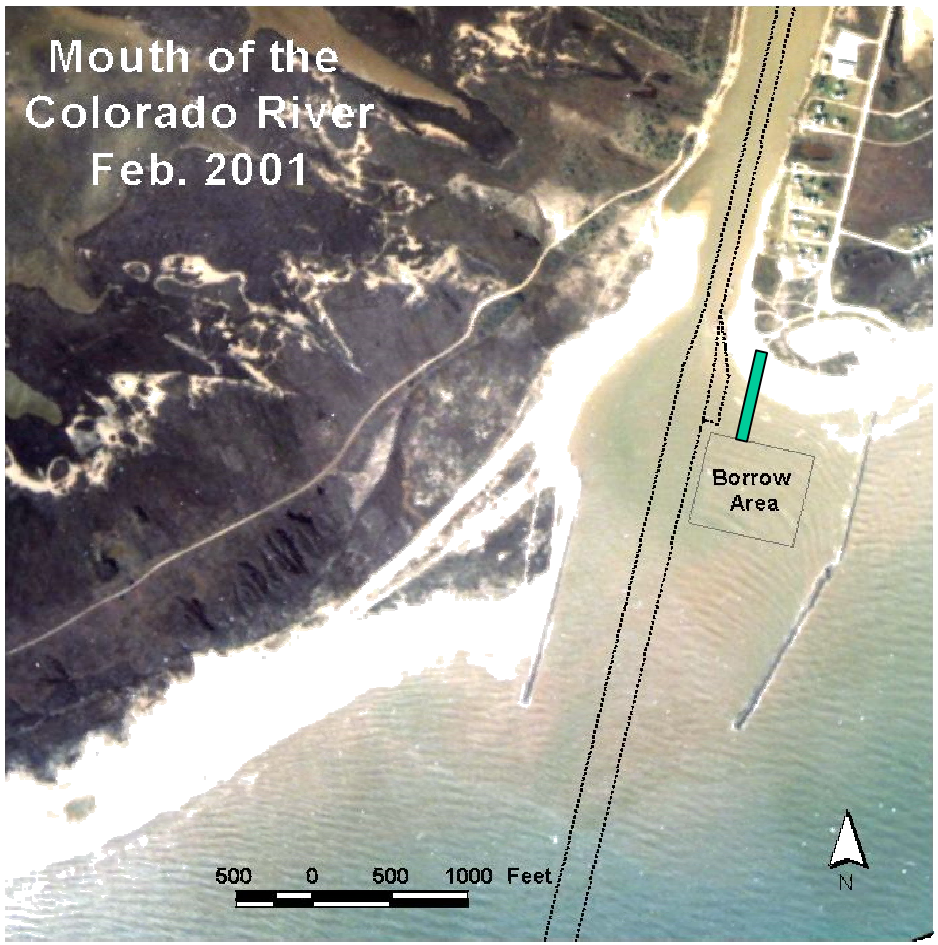
STWAVE Grid for Wave-Driven Currents



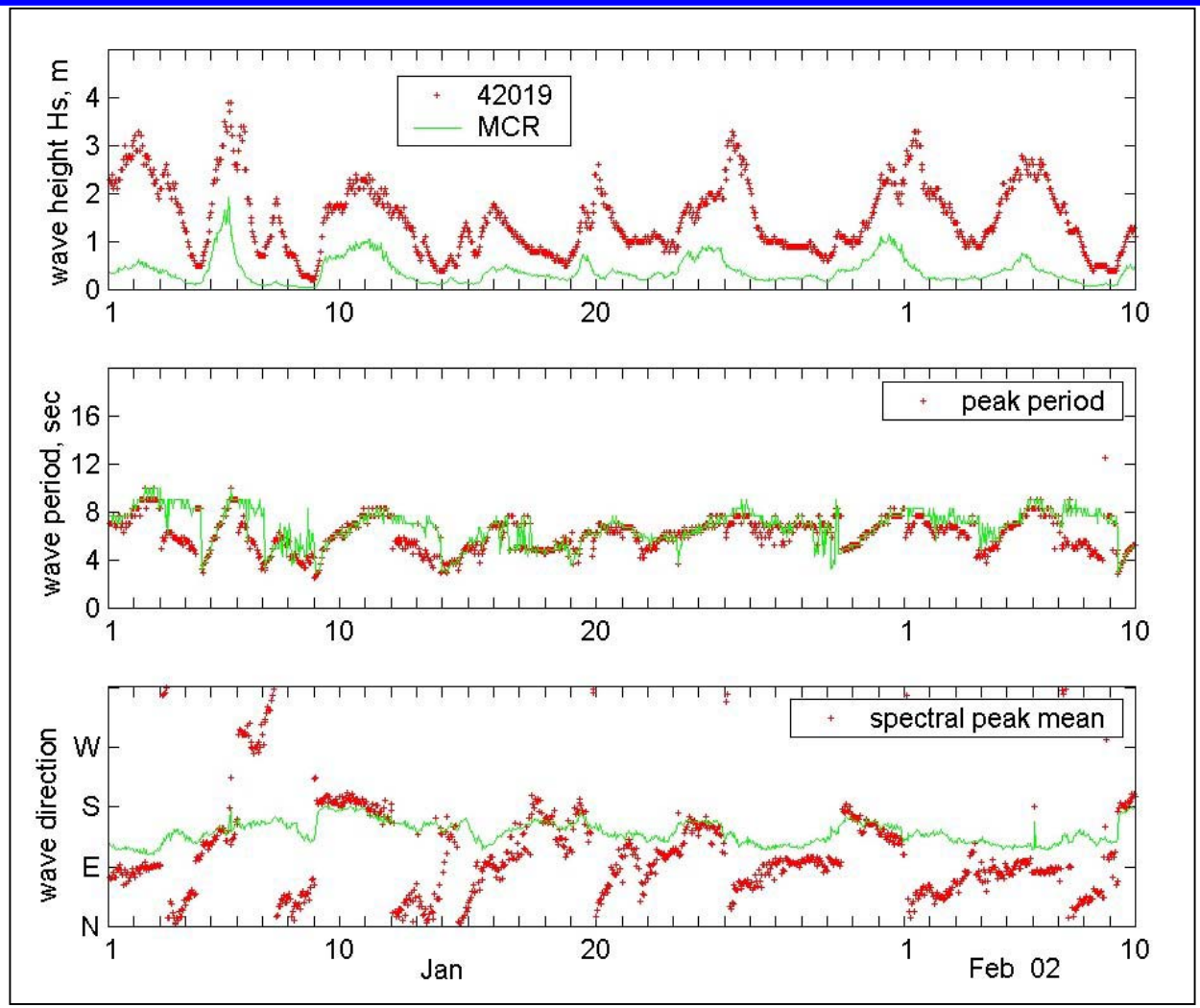
Morphologic Evolution of the Mouth of the Colorado River



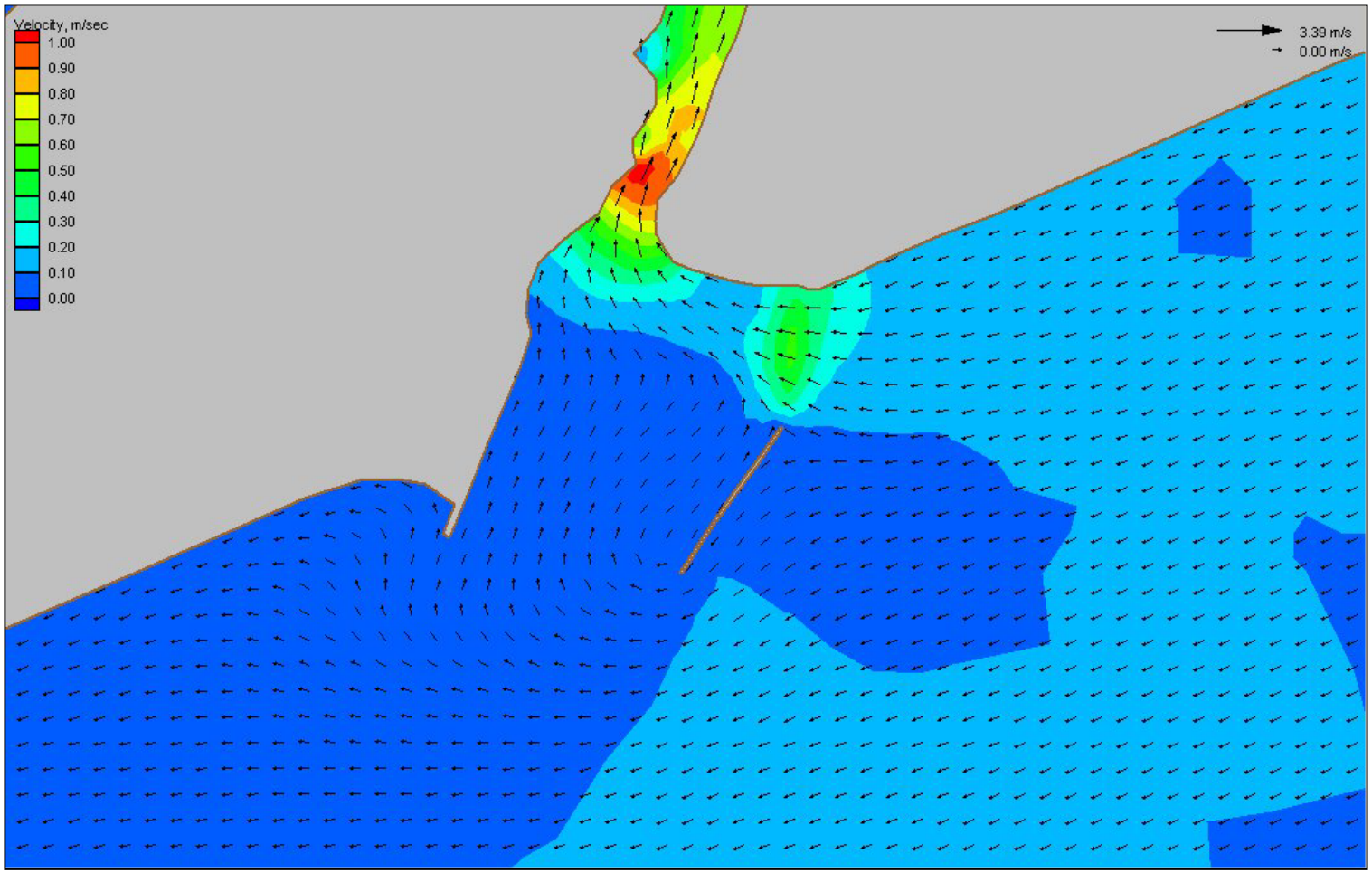
Plan for Colorado River



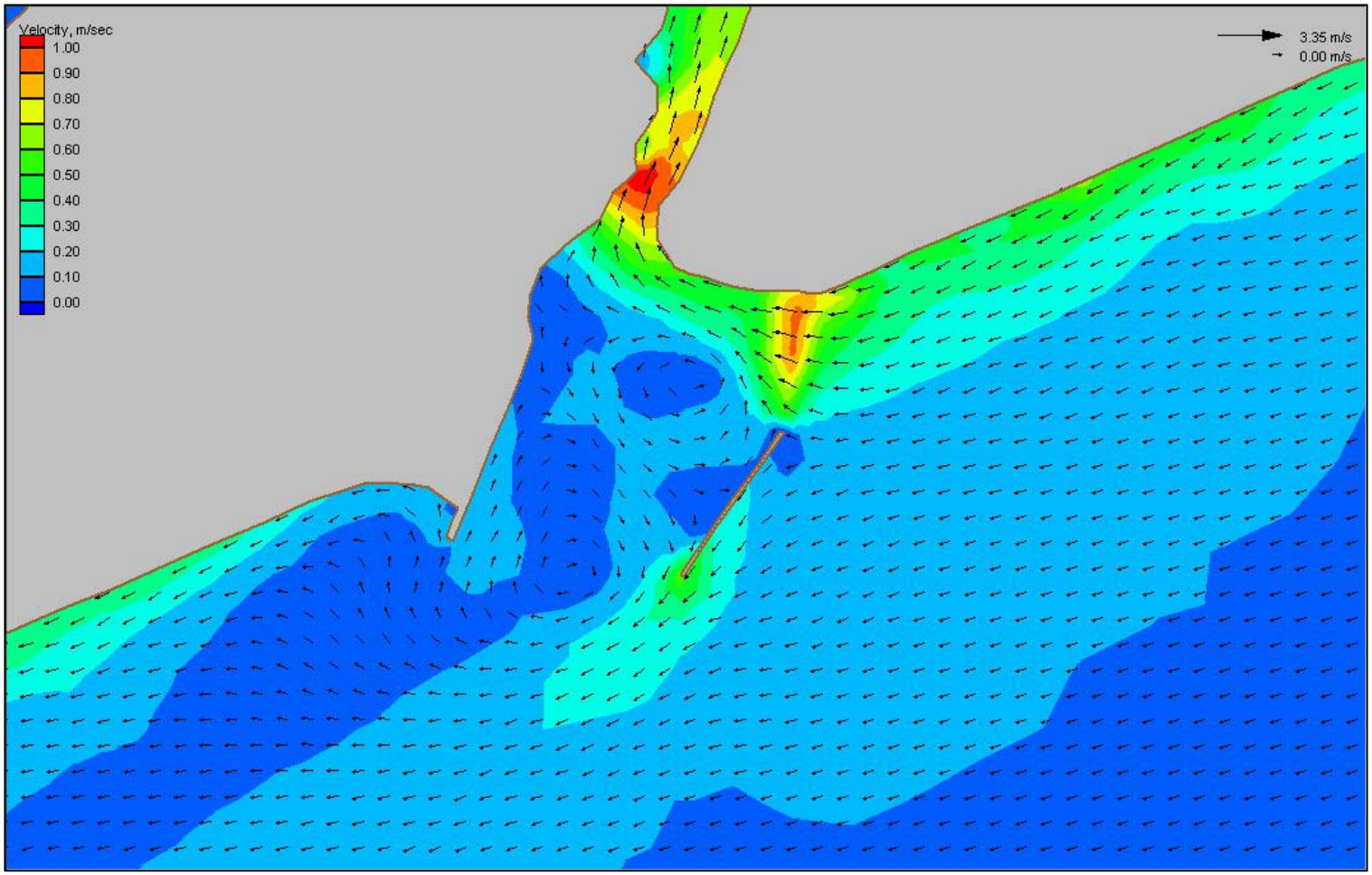
Wave Conditions at Buoy 42019 and MCR



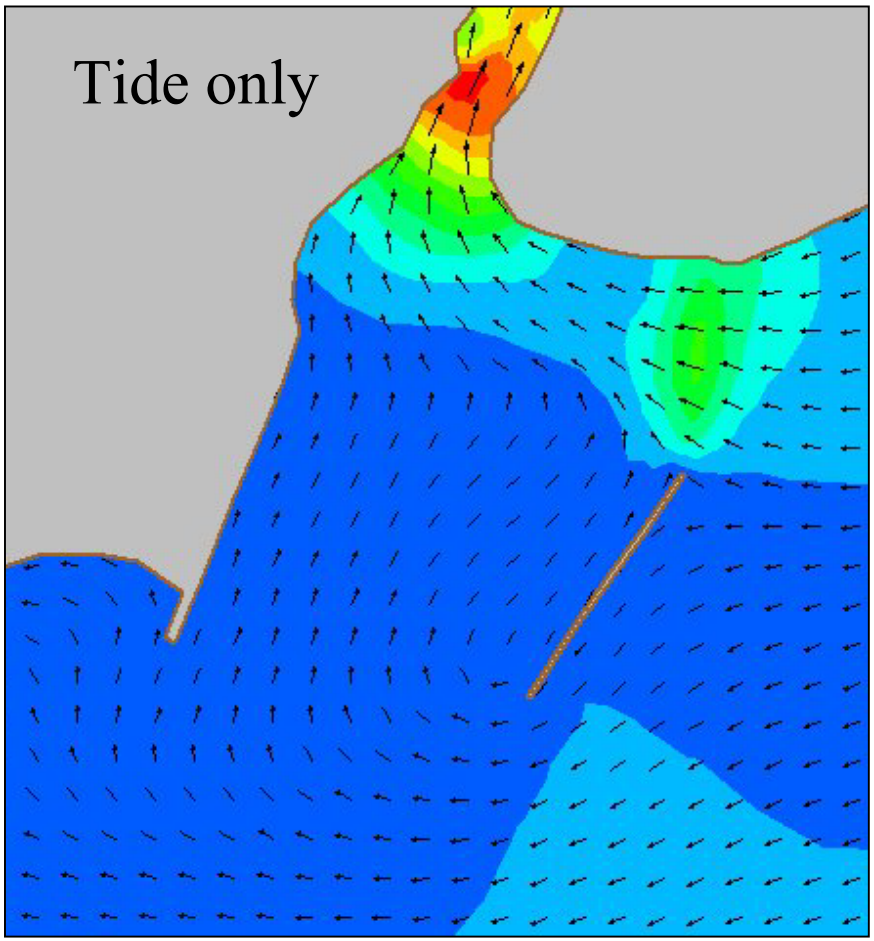
ADCIRC, 2 Jan 2002 at 00:00 Hr (Flood Cycle)

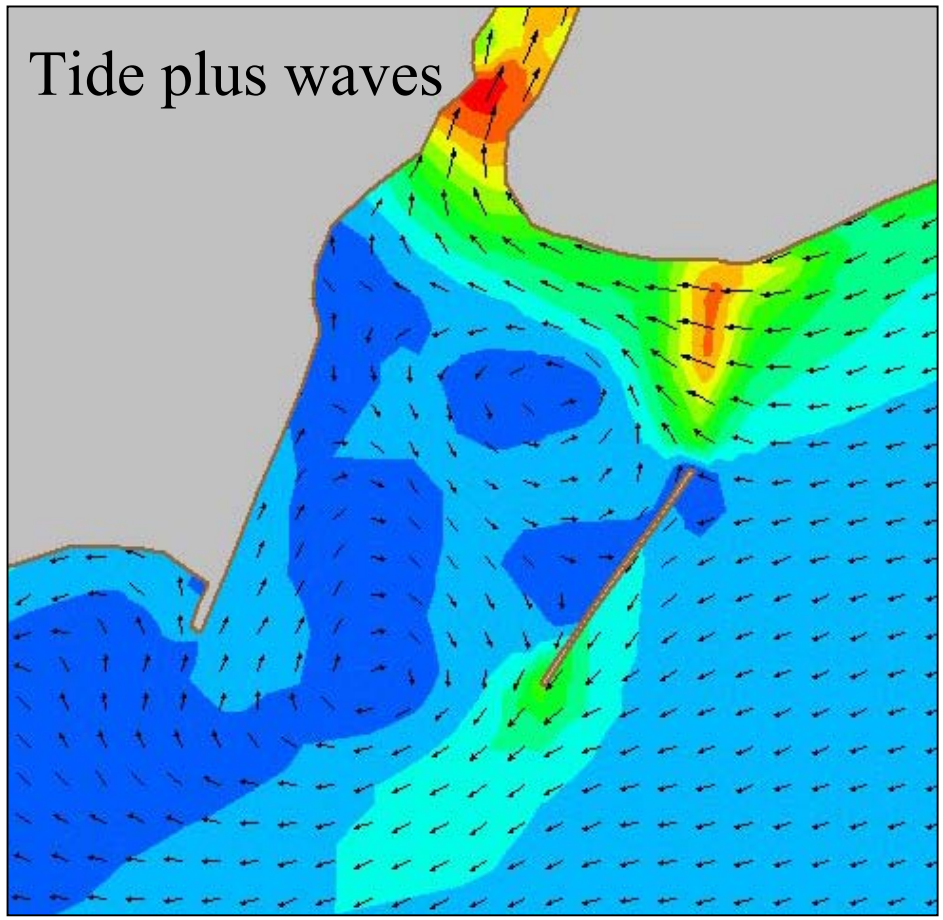


ADCIRC/STWAVE, 2 Jan 2002 at 00:00 Hr (Flood Cycle) Offshore Waves: 3 M, 8 Sec, From E

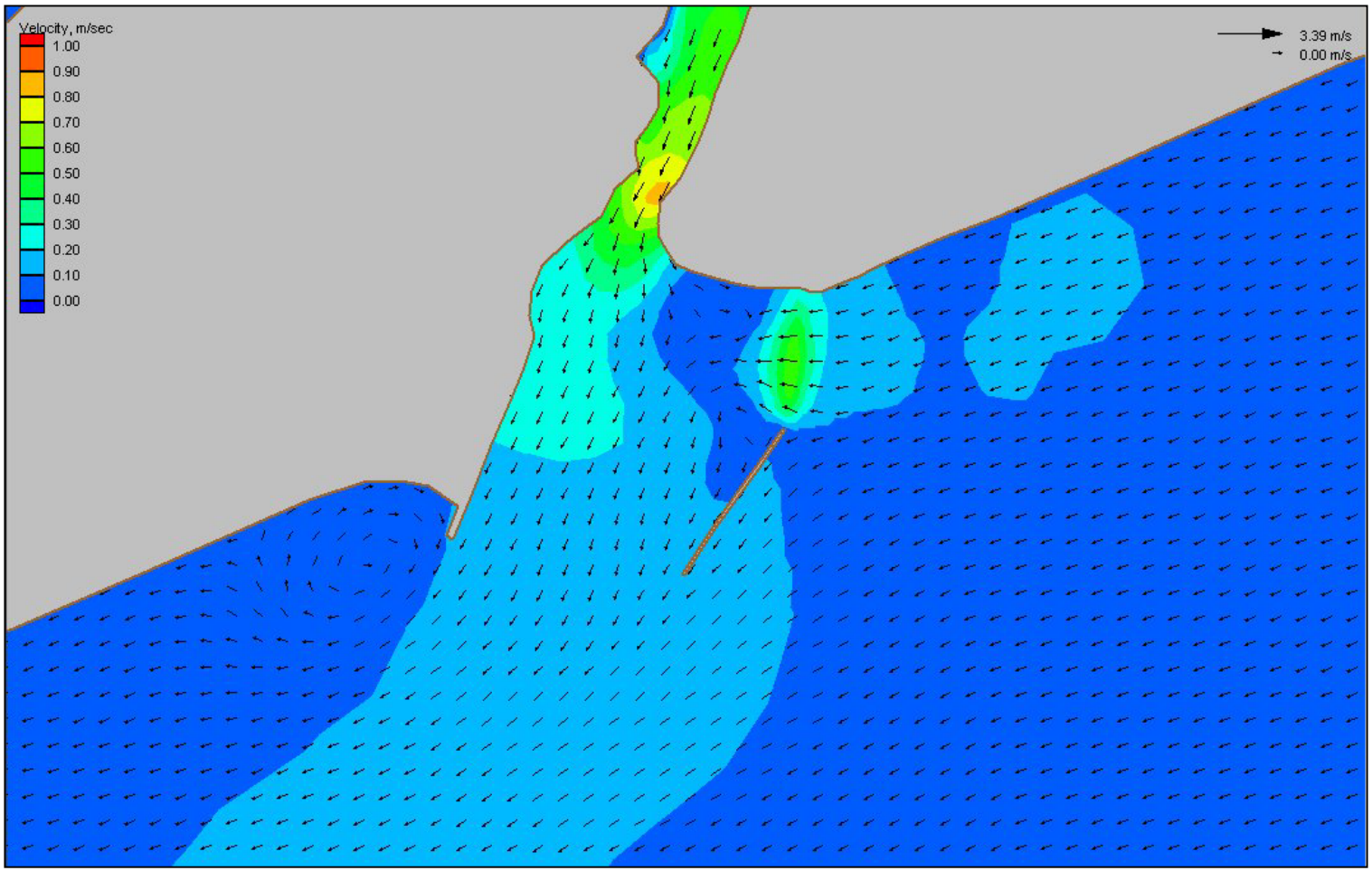


Comparison of Previous Two Slides

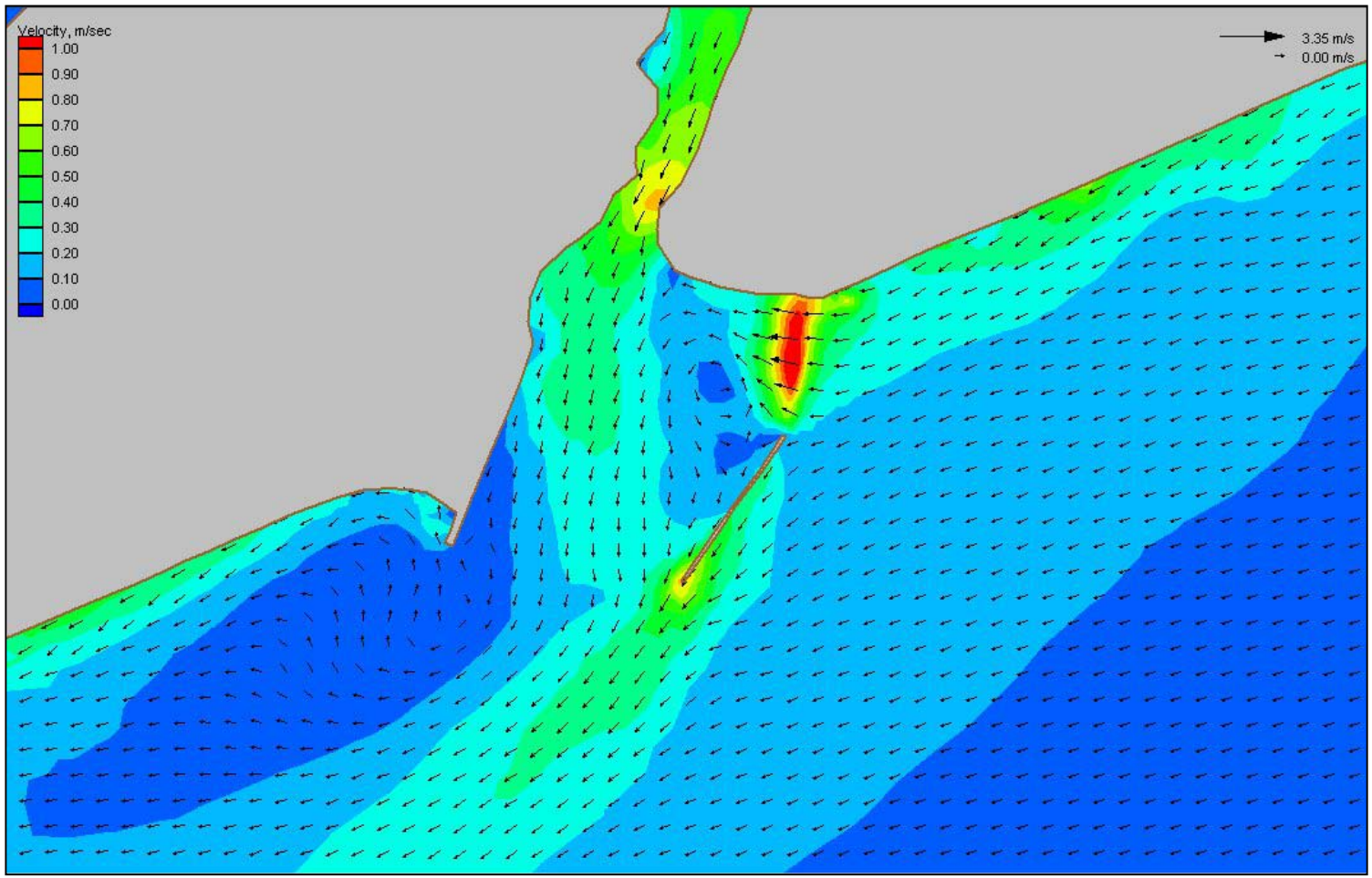




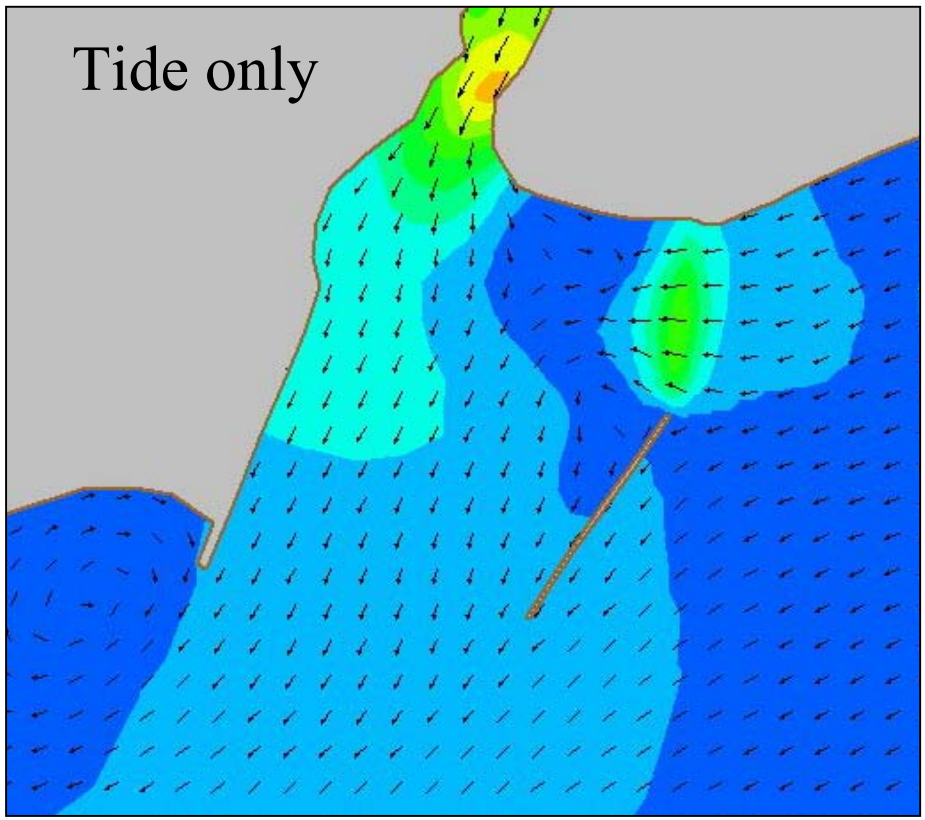
ADCIRC, 3 Jan 2002 at 01:00 Hr (Ebb Cycle)

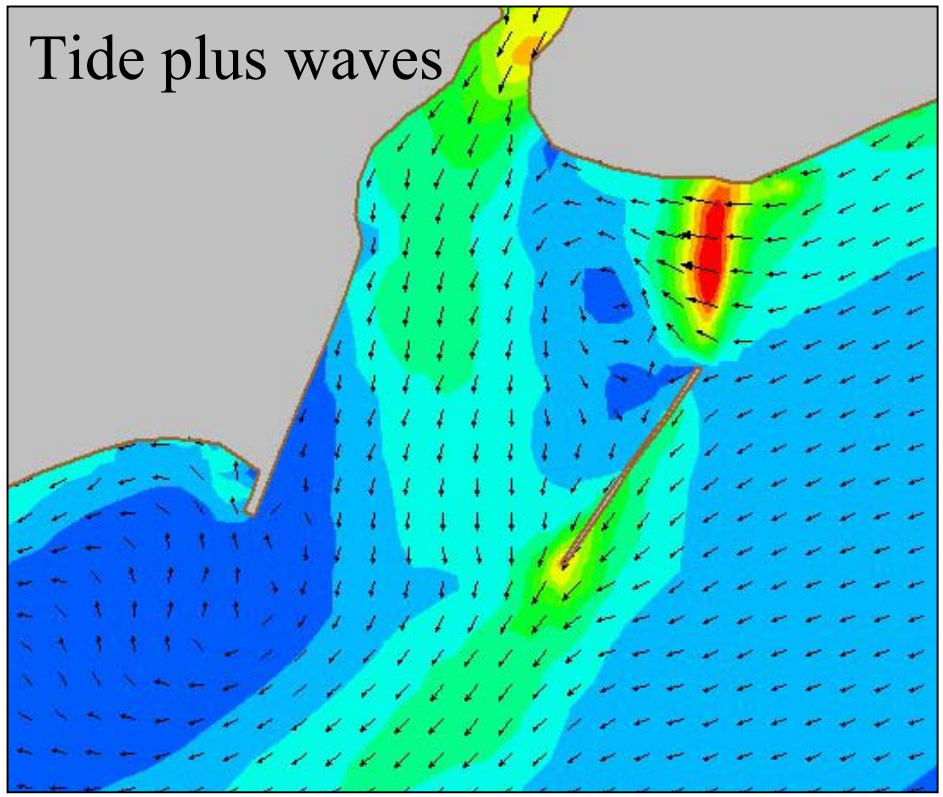


ADCIRC/STWAVE, 3 Jan 2002 at 01:00 Hr (Ebb Cycle) Offshore Waves: 2 M, 7 Sec, From E

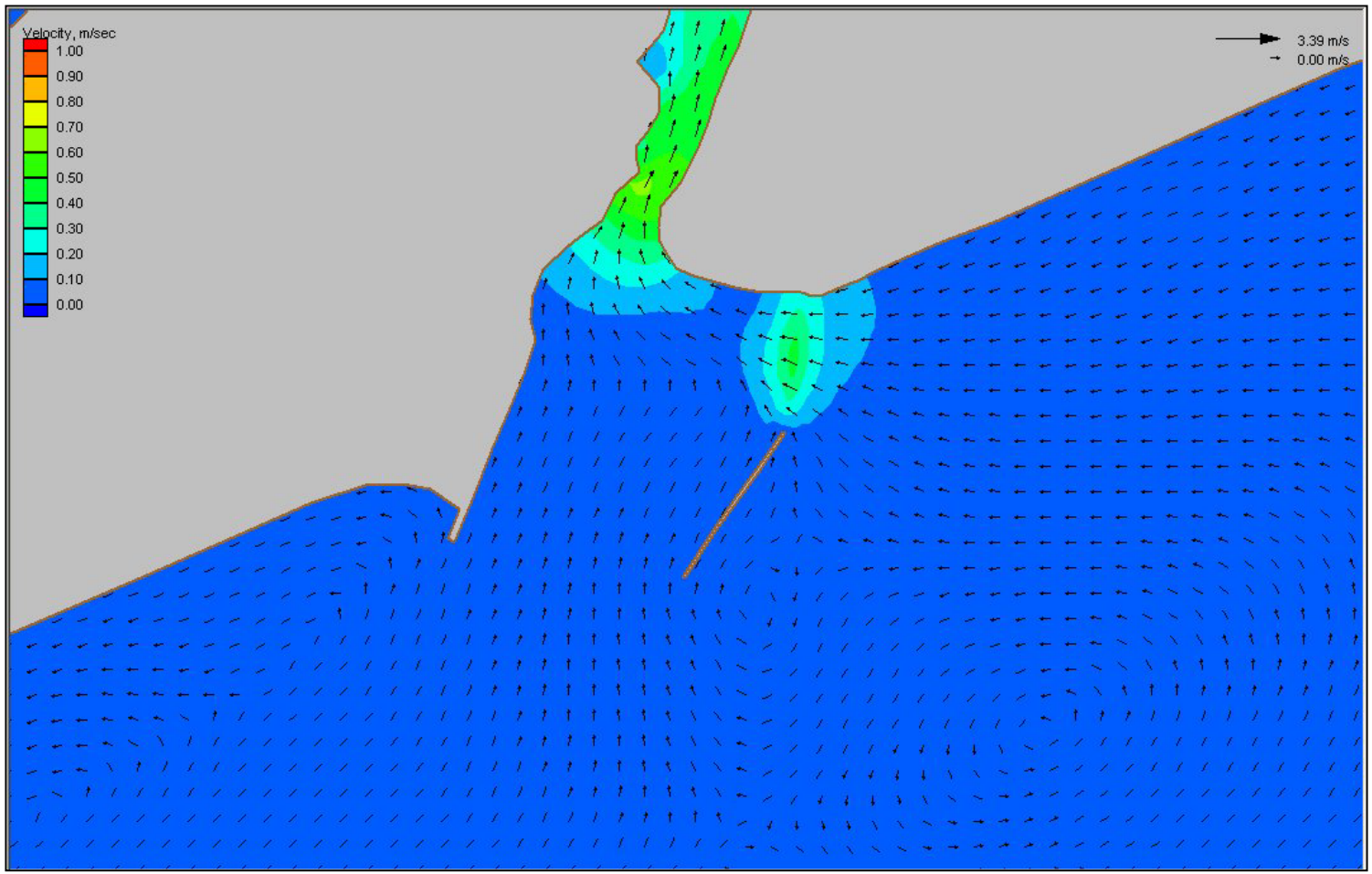


Comparison of Previous Two Slides

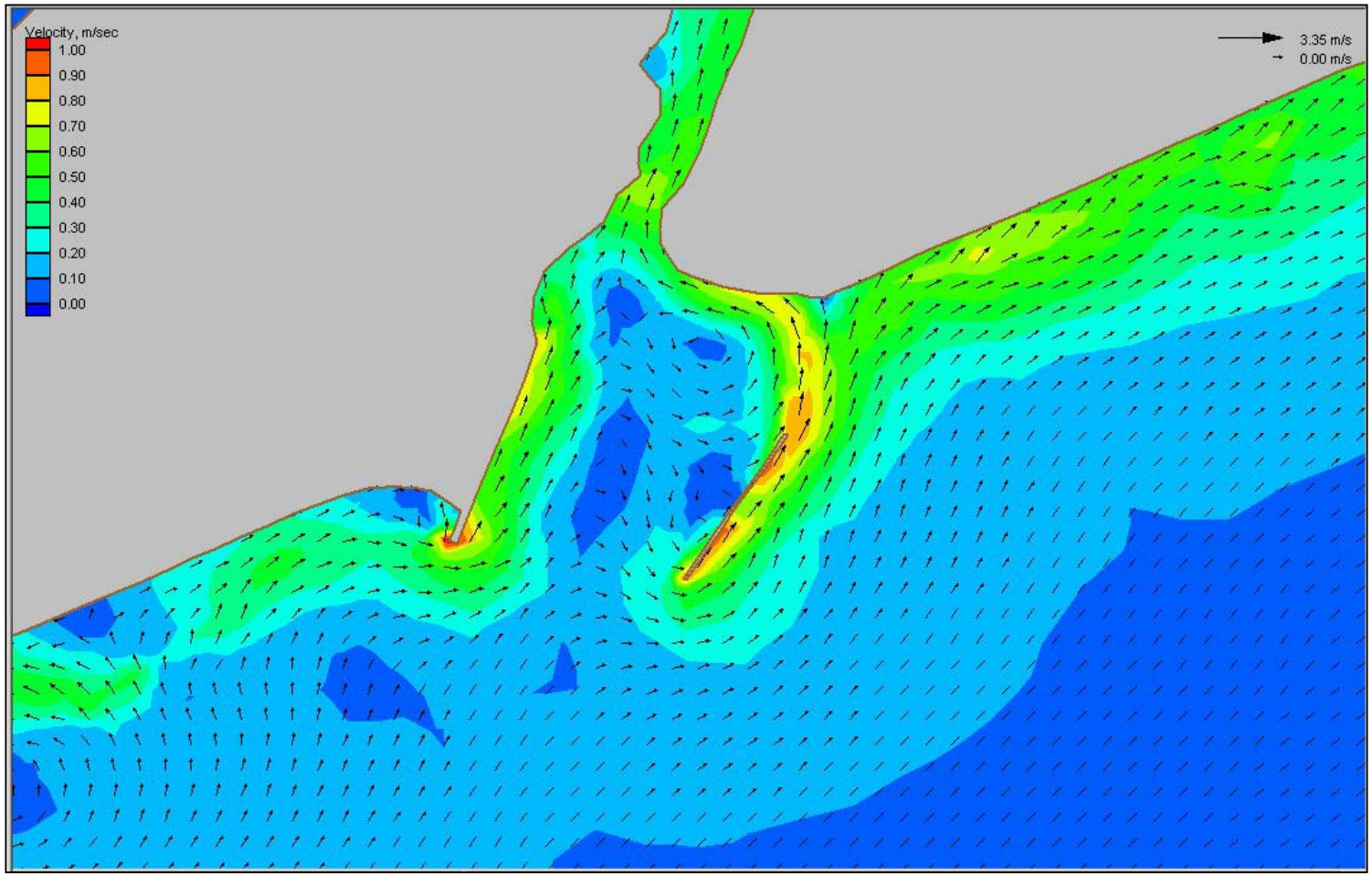




ADCIRC, 20 Jan 2002 at 00:00 Hr (Flood Cycle)



ADCIRC/STWAVE, 20 Jan 2002 at 00:00 Hr (Flood Cycle) Offshore Waves: 2 M, 7 Sec, From SSW



Grays Harbor / Ocean Shores, WA
Submerged Spur