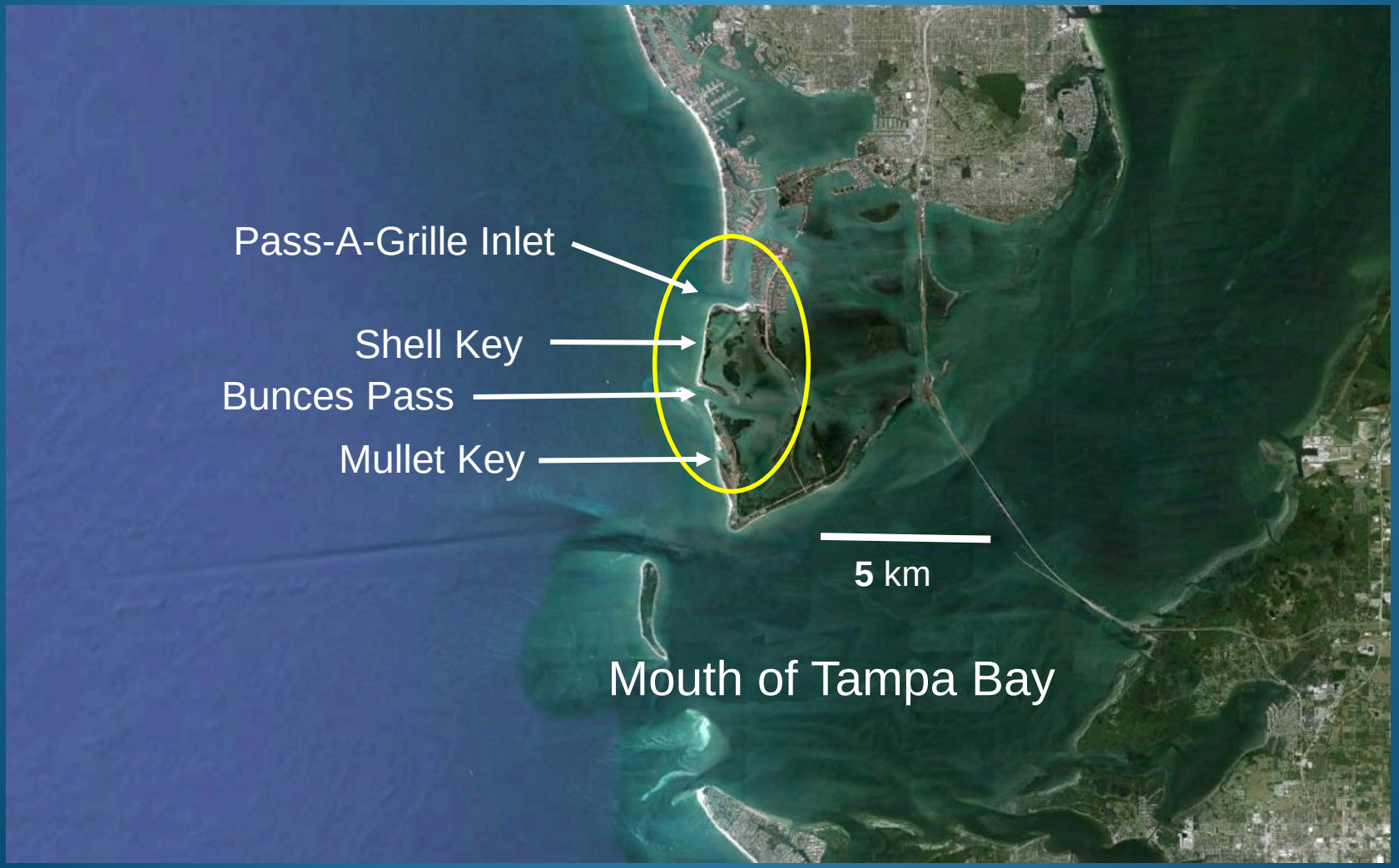
Bunces Pass and Pass-A-Grille Inlet Management Study

- Introduction
- Presentation by Dr. Ping Wang, USF
- Next Steps
- Discussion

Bunces Pass & Pass-A-Grille Inlet Management Study Project Area



Introduction

- Why are we doing this study?
  - Mullet Key was eroding. To understand why, the inlets needed to be studied
  - Pass-A-Grille ebb shoal is a nourishment sand source last approved in 2004
  - Neither inlet has a state approved inlet management plan
  - Presented an excellent opportunity to address both issues in partnership with FDEP
  - Later, the concerns about the closure of North Shell Key Pass were added into the scope

Inlet Management Study (IMS) for Bunces Pass (BP) and Pass-A-Grille (PAG) Inlets, Pinellas County, Florida

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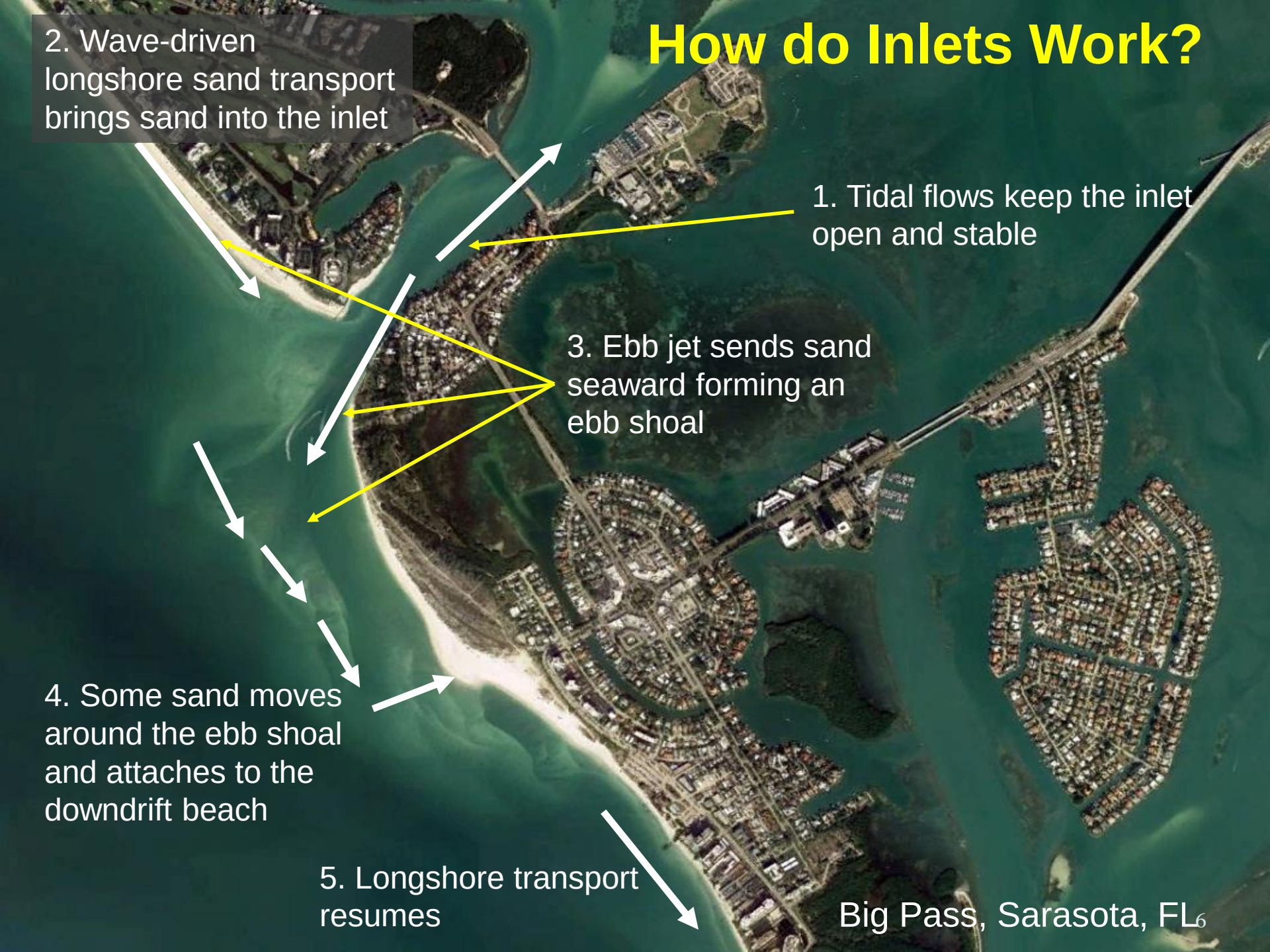
University of South Florida

Outline

- Introduction
  - How do inlets work
  - How do beaches and inlets interact
  - Inlet Management Study (IMS)
- Goals of the Bunces Pass (BP) / Pass-A-Grille (PAG) IMS and project focus areas
- Results and their applications in inlet management

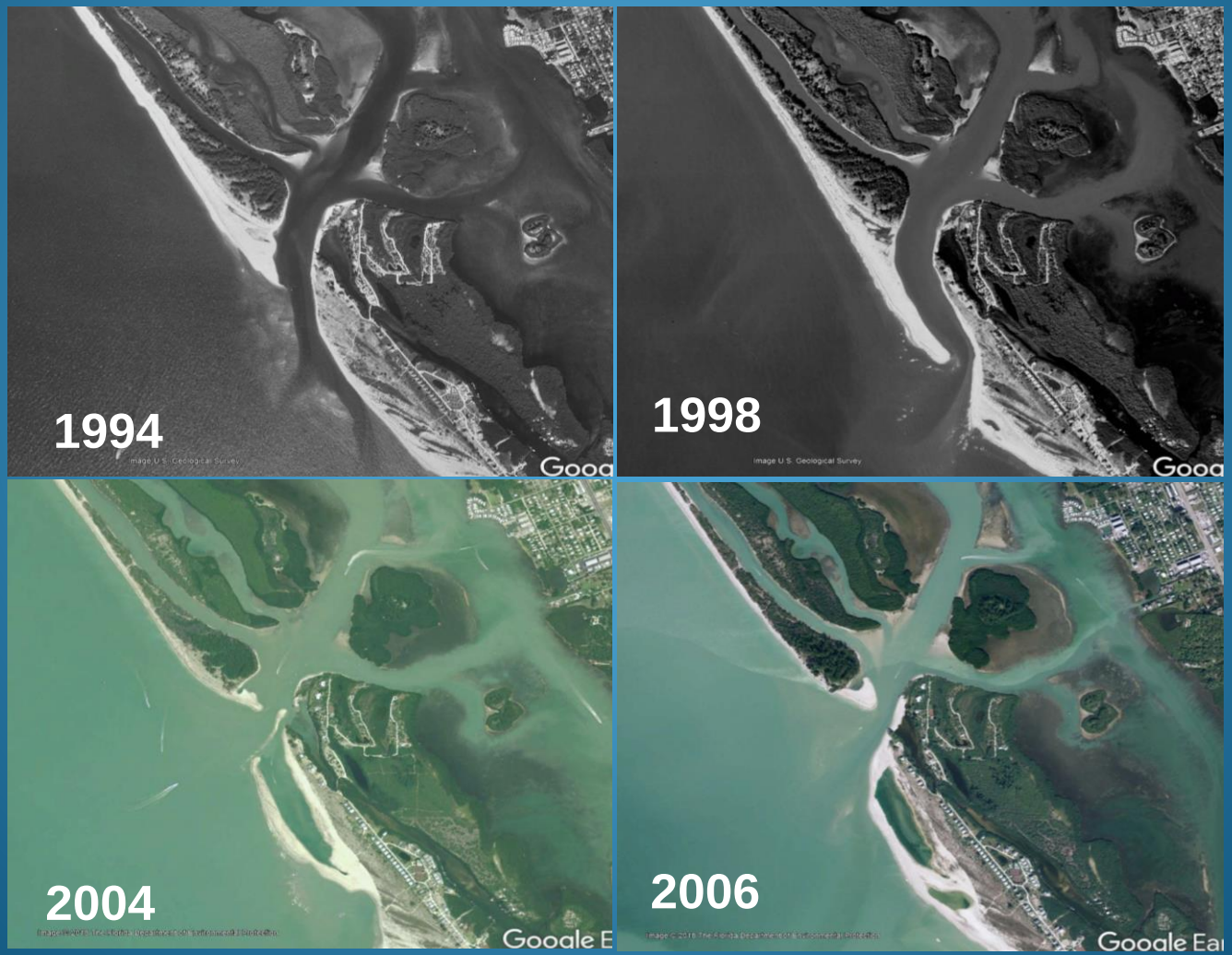
How do Inlets Work?



Beach-Inlet Interaction: Strong tidal current and weak longshore sand transport

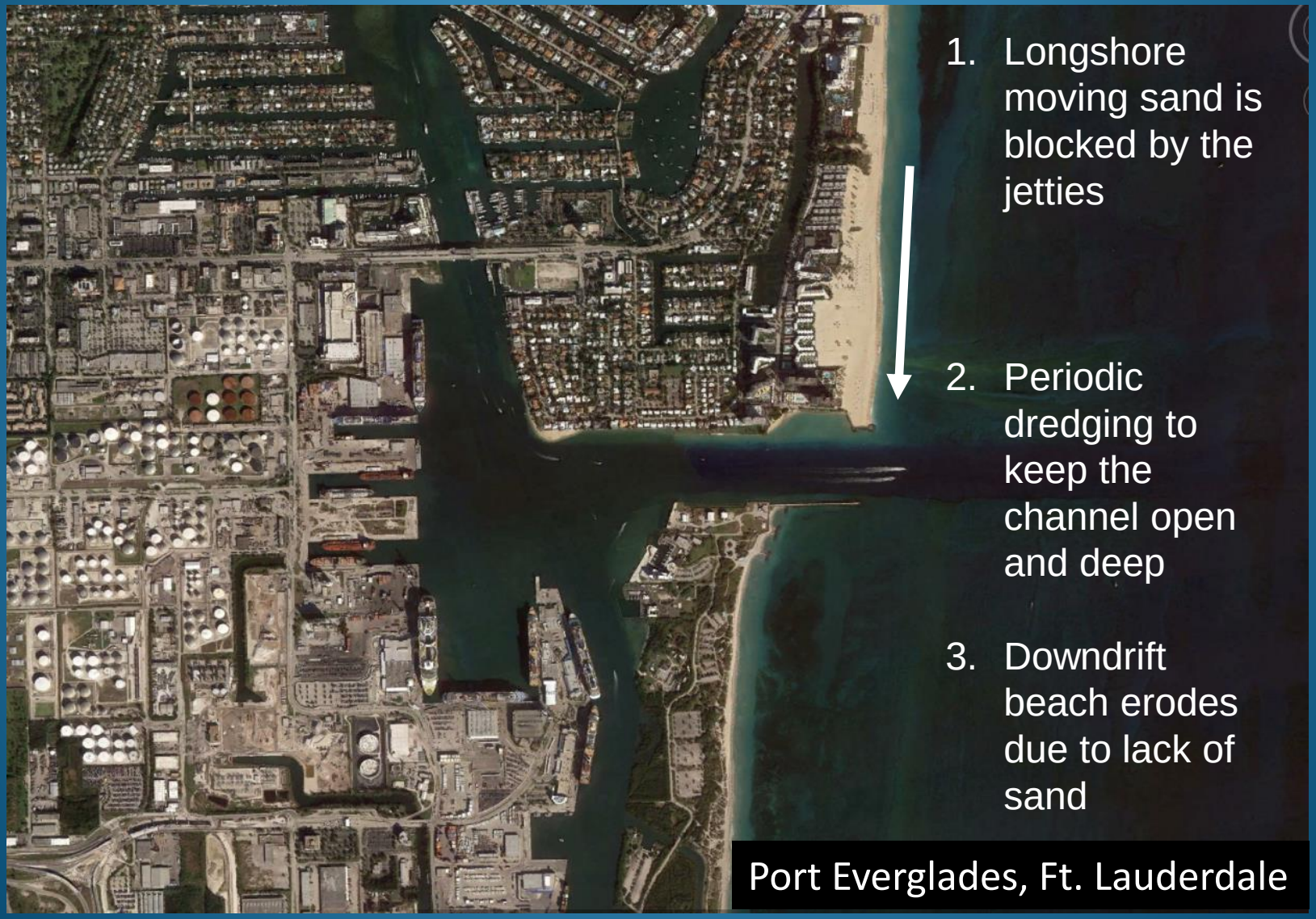
Redfish Pass, Pine Island Sound, Lee County

Beach-Inlet Interaction: Weak tidal current and strong longshore sand transport



Stump Pass, Englewood, Charlotte County

Beach-Inlet Interaction: Heavily controlled



Summary of Beach-Inlet Interactions

- The stronger the tidal flow, or the greater the amount of water that goes in and out:
  - The deeper and more stable the tidal inlet
  - The bigger the ebb shoal
  - More difficult for sand to move to the other side of the inlet

- The greater the longshore sand transport rate:
  - The less stable (or more migratory) the tidal inlet
  - The shallower the ebb shoal (mostly the outer bar)
  - Easier for sand to move from one side of the inlet to the other

Inlet Management Study (IMS)

- Why an IMS?
  - Most beach erosion is caused by inlets
  - An IMS assesses inlet influence on the adjacent beaches
- What does an IMS do?
  - Clarifies inlet and adjacent beach processes
  - Balances sediment budget for the system
  - Recommends dredge sites and beaches to nourish
- What is an IMS used for?
  - For FDEP to develop an Inlet Management Plan

BP-PAG IMS and Focus Area Tasks

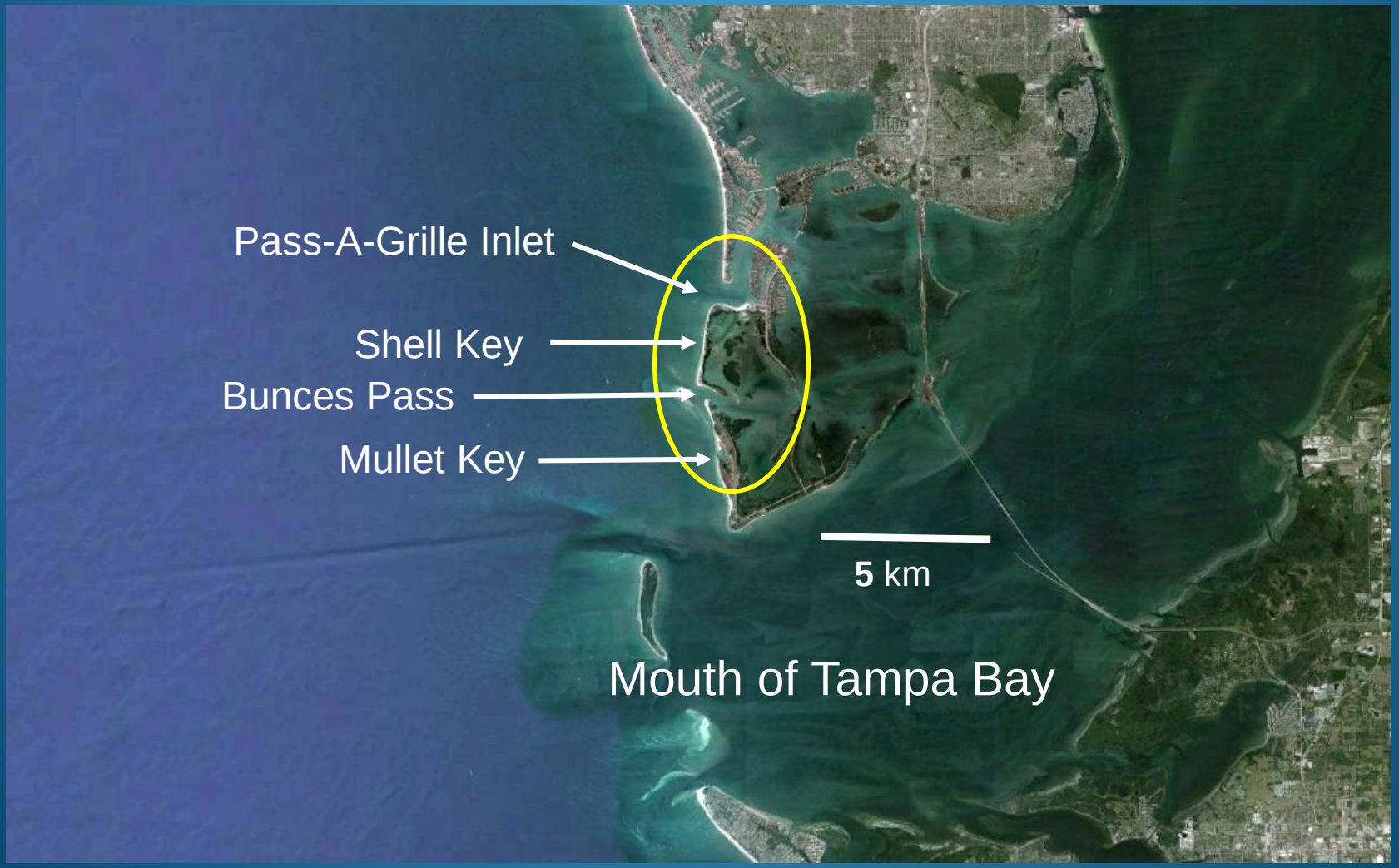
- Literature research
- Field data collection
- Numerical modeling and sediment budget
- Evaluation of inlet management strategies
- Two focus areas:
  - Erosion and mitigation of Mullet Key Beach
  - Stability of North Shell Key Pass

Focus Area Questions

- Mullet Key
  - What caused beach erosion at N. Mullet Key (Ft. De Soto North Beach)?
  - How do we solve the problem?

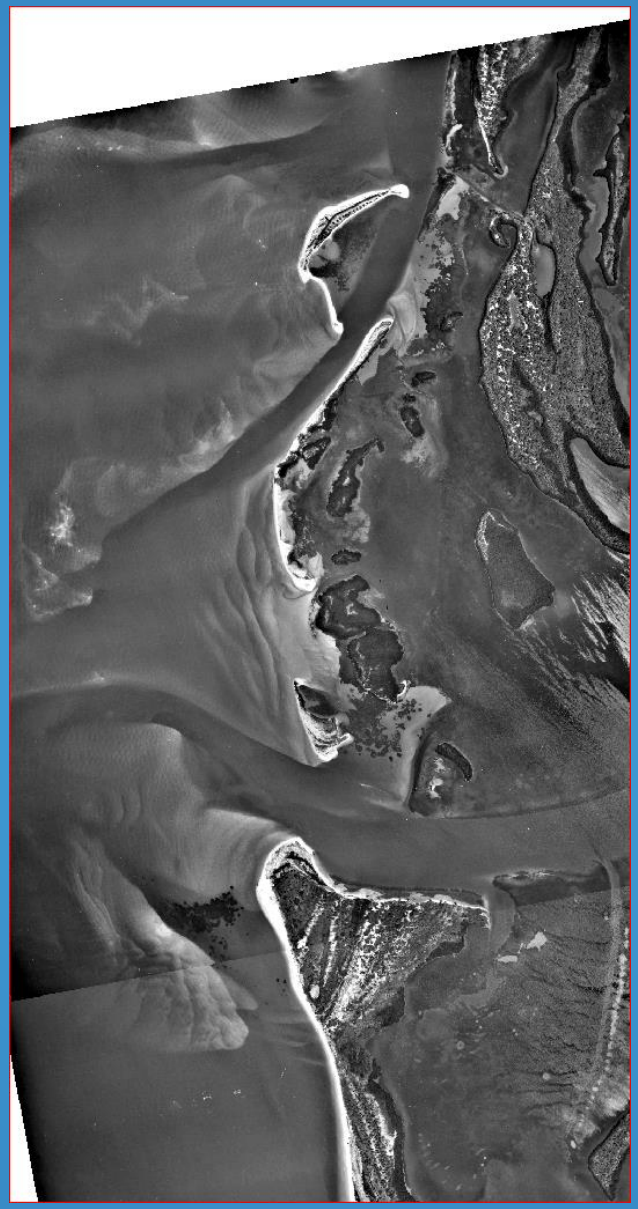
- Shell Key
  - How did the North Shell Key Pass close?
  - What are the sand sources for the closure?
  - What conditions favor the existence of a pass?

Bunces Pass (BP) & Pass-A-Grille (PAG) Inlet Management Study Project Area

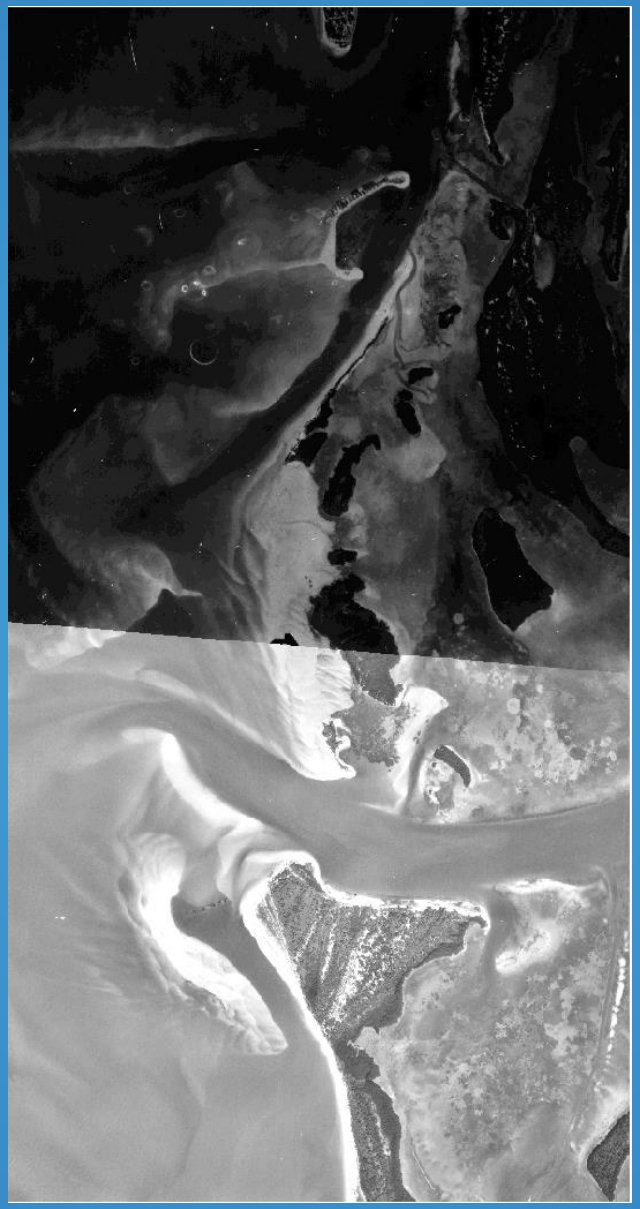


The Formation of Shell Key Time Series 1945 - 2017

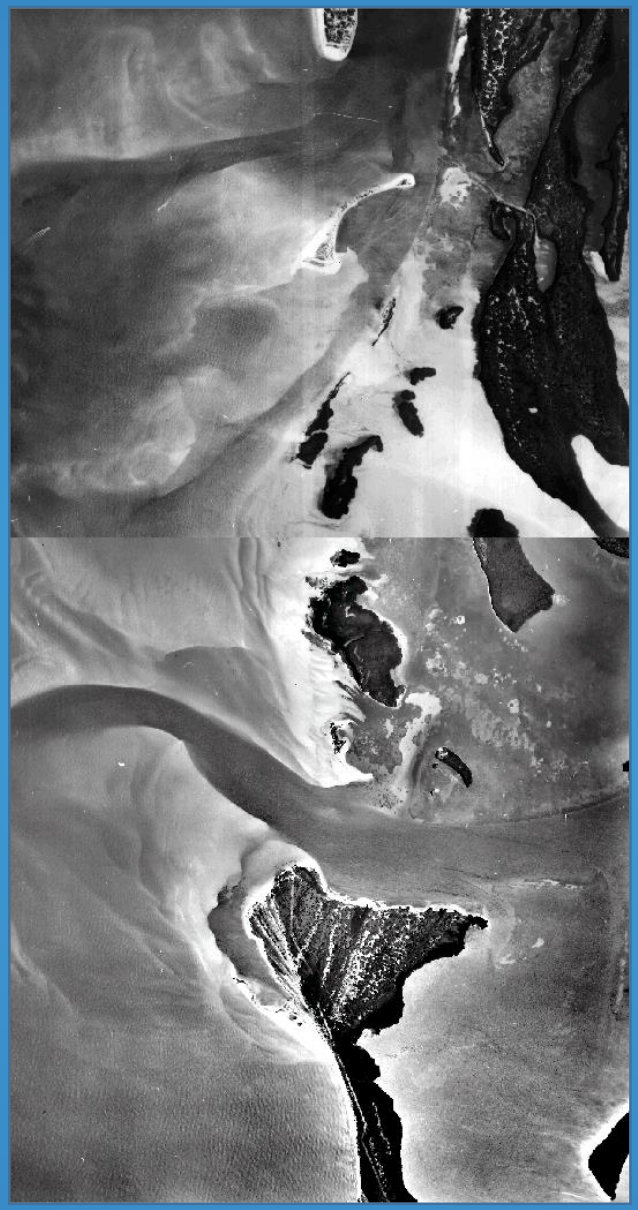
Year: 1945
Time Lapsed: 0 Years



Year: 1951
Time Lapsed: 6 Years



Year: 1957
Time Lapsed: 12 Years

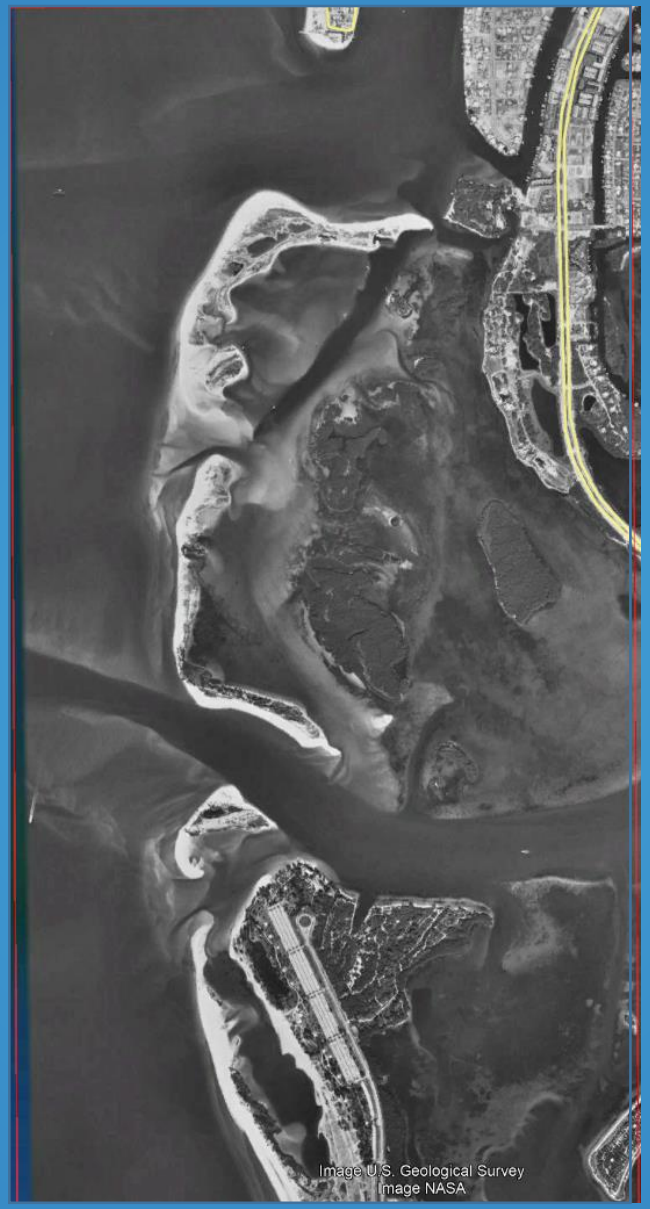


Year: 1973
Time Lapsed: 28 Years

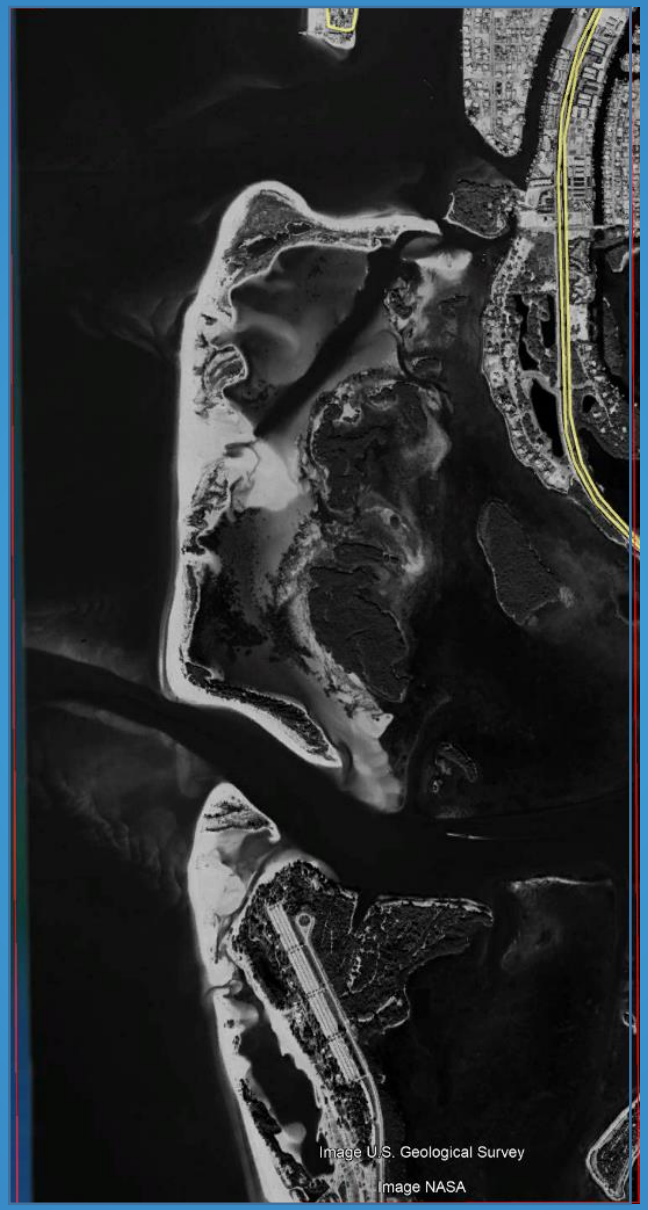
Year: 1975
Time Lapsed: 30 Years

Year: 1980
Time Lapsed: 35 Years

Year: 1994
Time Lapsed: 49 Years



Year: 1998
Time Lapsed: 53 Years



Year: 2007
Time Lapsed: 62 Years

1998 outline

Year: 2017
Time Lapsed: 72 Years

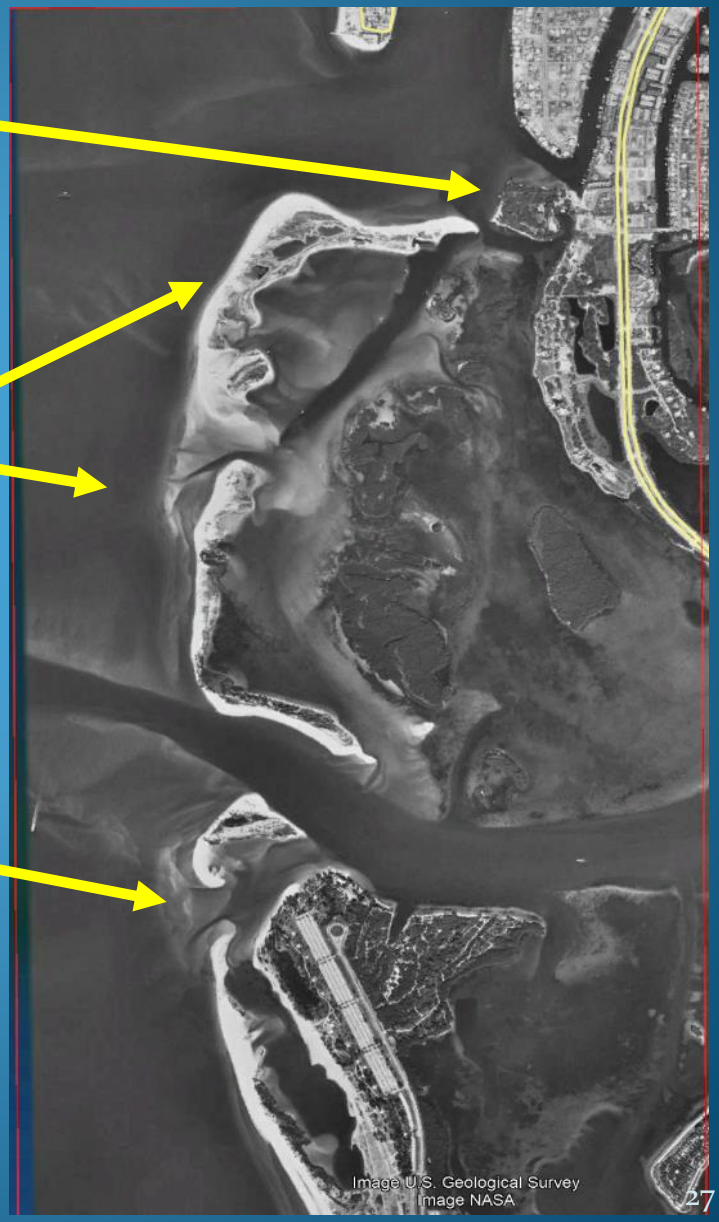
1998 outline

Evolution of Shell Key and its Relation to the Closure of North Shell Key Pass

1980: Rapid growth of Shell Key

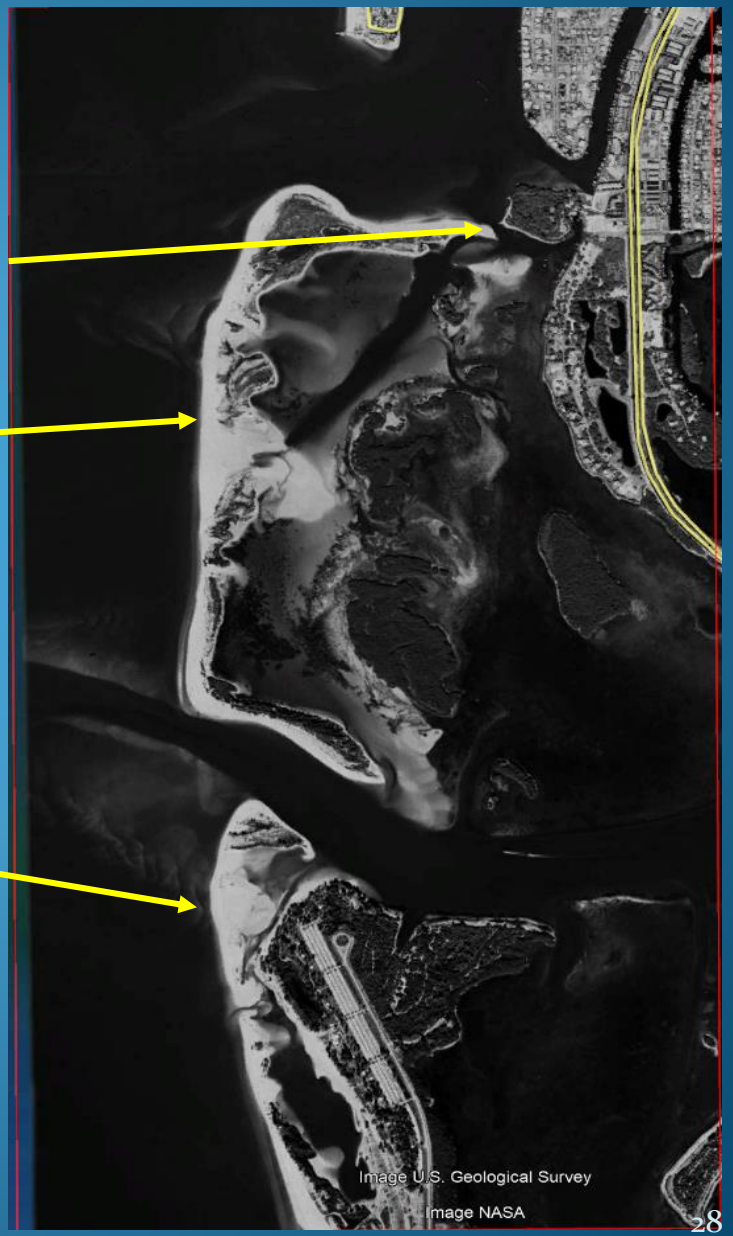
Evolution of Shell Key and its Relation to the Closure of North Shell Key Pass

1994: Rapid growth of Shell Key



Evolution of Shell Key and its Relation to the Closure of North Shell Key Pass

1998: Shell Key growth stabilized



Evolution of Shell Key and its Relation to the Closure of North Shell Key Pass

2007: Shell Key sand redistribution

Evolution of Shell Key and its Relation to the Closure of North Shell Key Pass

2017: Shell Key sand redistribution

Sediment Budget for Shell Key growth and northern Mullet Key Sandbar attachment:

1966 - 2016

1 m^3 = 1.308 yd^3

Pass-A-Grille Sediment Budget: 1998 - 2016

Units: m^3/yr

1 m^3 = 1.308 yd^3

Bunces Pass Sediment Budget : 1998 - 2016

Units: m^3/yr

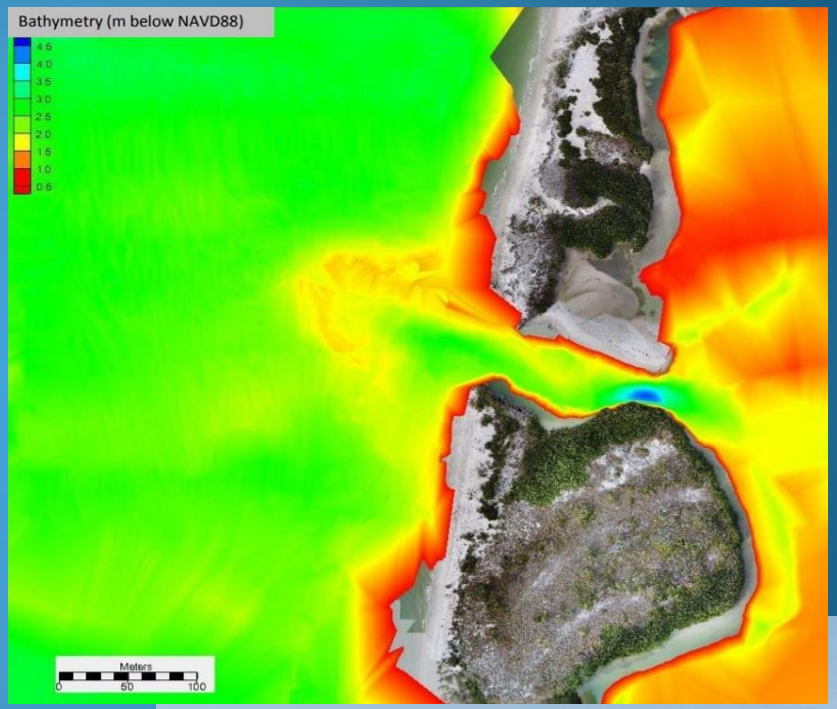
1 m^3 = 1.308 yd^3

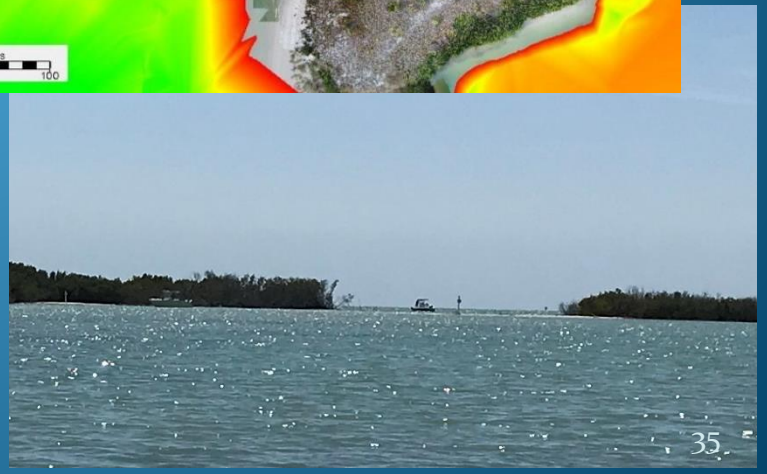
Contribution from Upham Beach and Pass-A-Grill Beach to the PAG System

- Where did the sand go?
  - Blind Pass ebb shoal
  - Middle Long Key (beach has been accreting)
  - PAG ebb shoal northern flank

- How much nourishment sand ended up on Shell Key?
  - Not much because the sand is accounted for elsewhere

Hurricane Irma



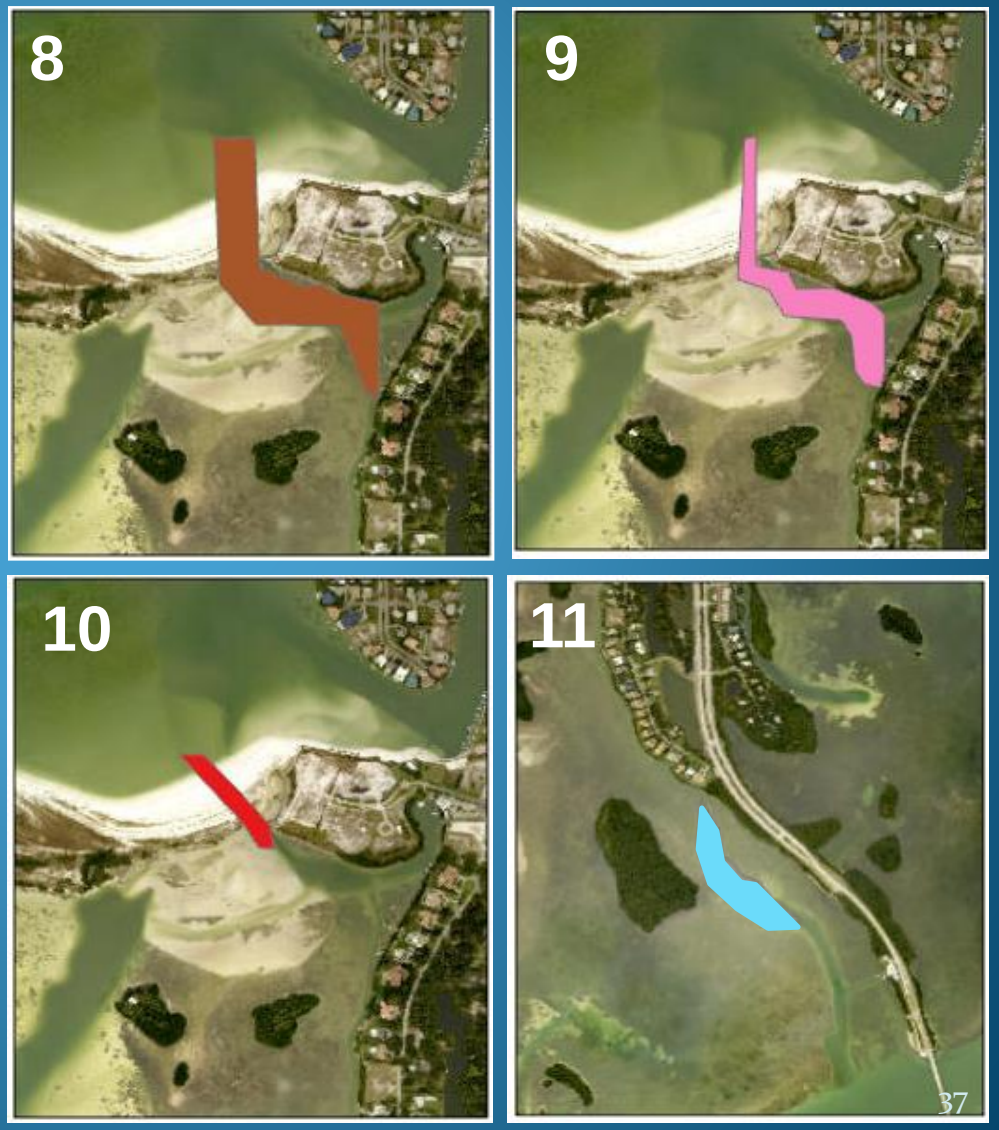


Alternatives Analysis

- 11 Alternatives
  - Alt 1: Baseline
  - Alt 2-7: Different dredging designs
  - Alt 8-10: Shell Key North Pass channel configurations
  - Alt 11: Channel to Bunces Pass

Research Findings: North Shell Key Pass

- Alt 8
  - 140,000 m^3; 80 m wide
  - Dredging cycle ~5 yrs
- Alt 9
  - 35,000 m^3; 20 m wide
  - Dredging cycle: ~1 yr
- Alt 10
  - 30,000 m^3; 40m wide
  - Dredging cycle: <2 yrs
- Alt 11
  - Narrow connector channel



Summary: Shell Key and Mullet Key Focus Areas

- Shell Key Island < 40 years old
  - The North Shell Key Pass (NSKP) closure is part of the Shell Key formation process
  - Artificial re-opening of NSKP would require regular maintenance and need further permittability and cost-benefit analysis

- Erosion at North Mullet Key is part of a natural sandbar-attachment cycle.
  - No infrastructure is threatened by current erosion
  - Sandbar attachment expected in ~3-5 years
  - Significant beach growth would occur

Next Steps

- Allow the natural processes to continue
- Pursue further evaluation of alternatives including sustainability, costs and permittability
  - State indicated lack of support for dredging in the preserve
- Monitor Irma Pass including navigability, water circulation, and how it is influencing the preserve.

Next Steps

- Shell Key Management Plan Update
  - Finalization of the plan update was paused to complete the Inlet Management Study
  - Schedule additional public meeting in Tierra Verde to present the study and discuss finalization of the plan update
  - Present plan update to BCC for review and approval
  - Submit Shell Key Management Plan Update to FDEP Acquisition and Restoration Council for review

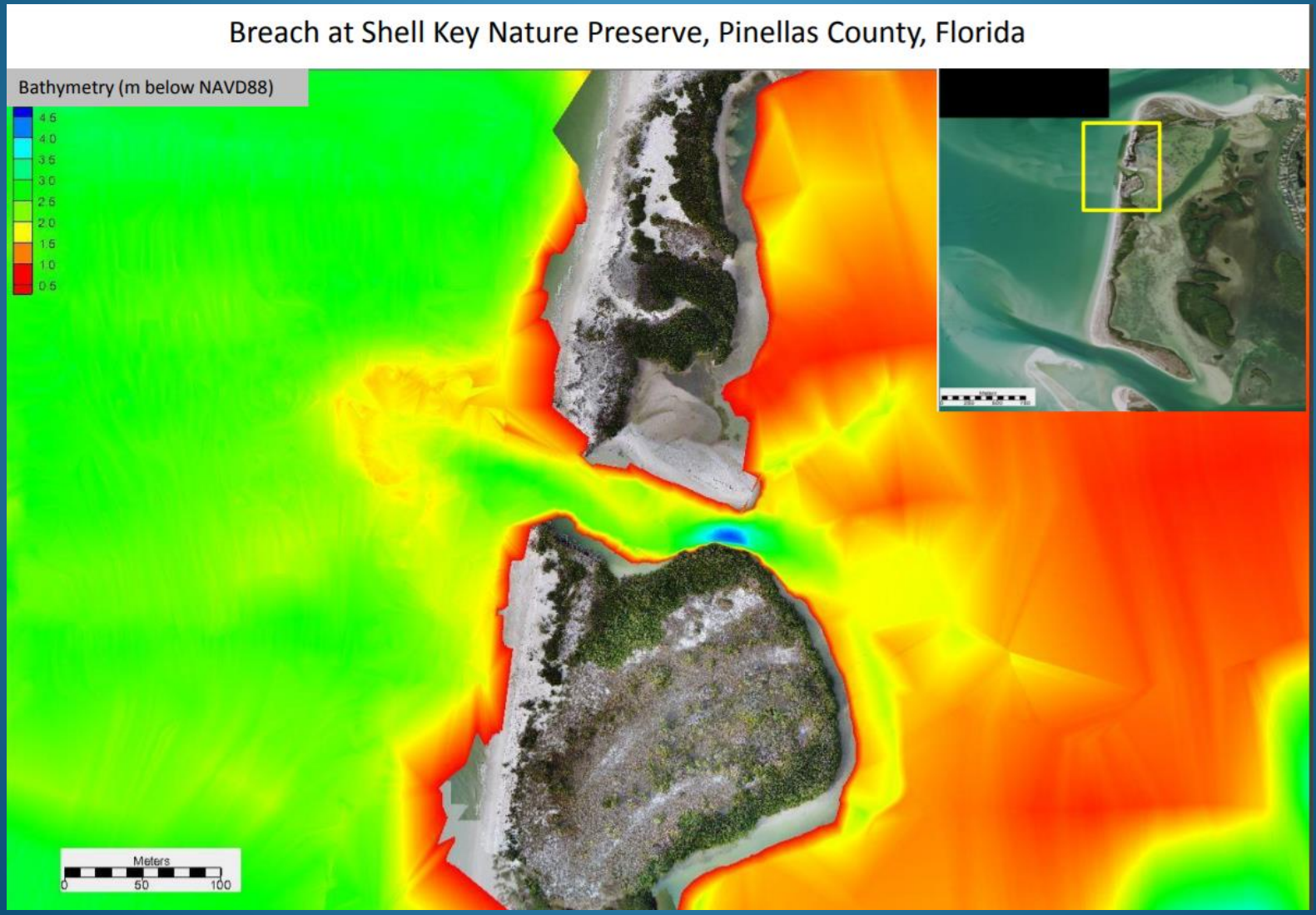
Questions?

Supplemental Information

Inlet Management Study Conclusions

- PAG ebb shoal is gaining sand from offshore area, and can be used as sand source for beach nourishment.
- PAG ebb shoal has been successfully used before as sand sources.
- BP ebb shoal is gaining sand from offshore area, and can be used as sand source for beach nourishment.
- BP ebb shoal has not been used before as sand sources.

Irma Pass

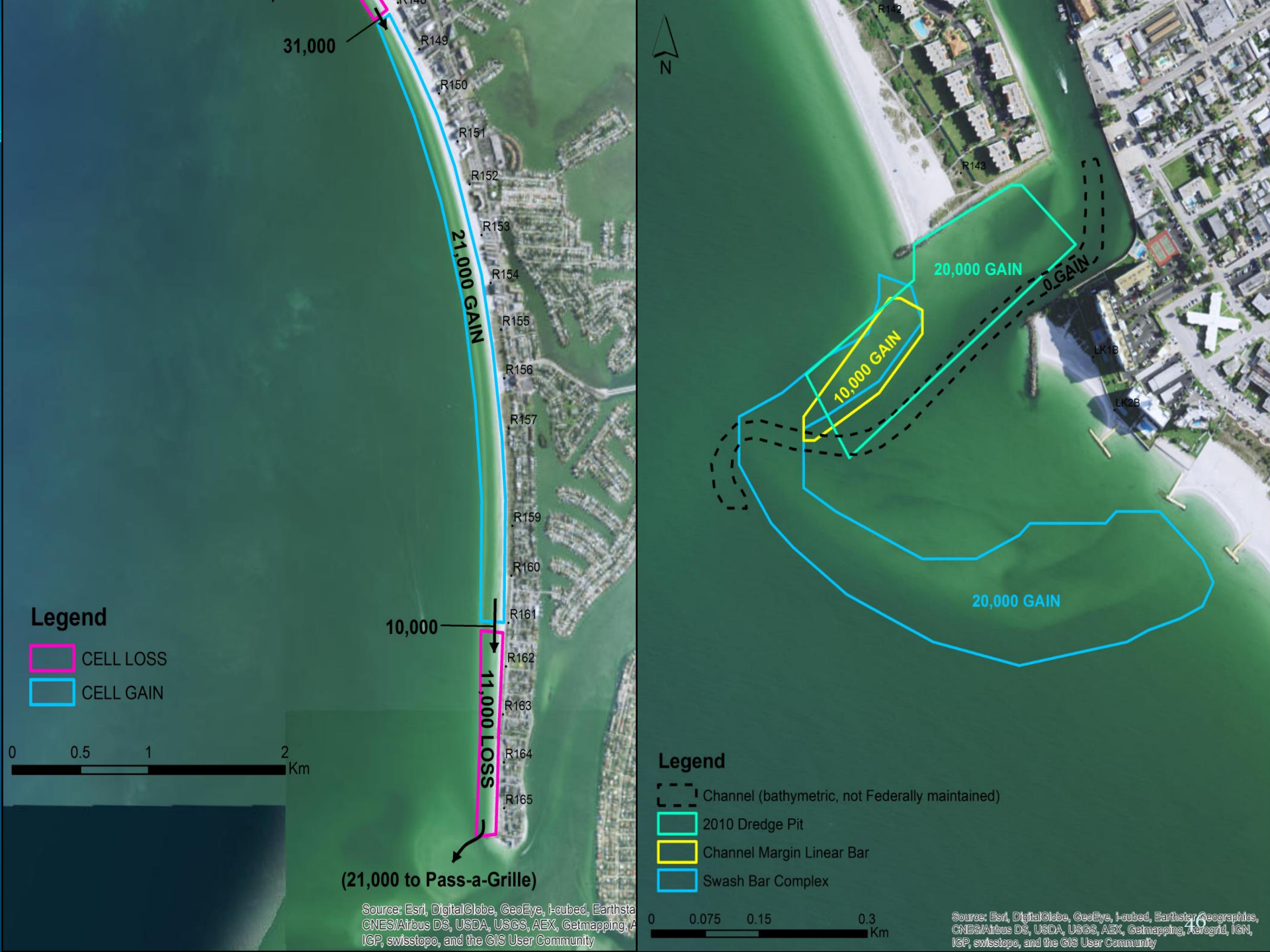

Breach at Shell Key Nature Preserve, Pinellas County, Florida
Bathymetry (m below NAVD88)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
Meters
0
50
100

Contribution from Upham and Pass-A-Grille Nourishments to the PAG System

1975 Upham:	75,000 cy
1980 Upham:	253,000 cy
1986 Upham:	97,000 cy
1986 PAG:	73,000 cy
1991 Upham:	230,000 cy
1996 Upham:	253,000 cy
2000 Upham:	407,762 cy
2004 Upham:	366,092 cy
2004 PAG:	147,000 cy
2006 Upham:	104,636 cy
2010 Upham:	159,572 cy
2014 Upham:	160,545 cy
2014 PAG:	140,053 cy

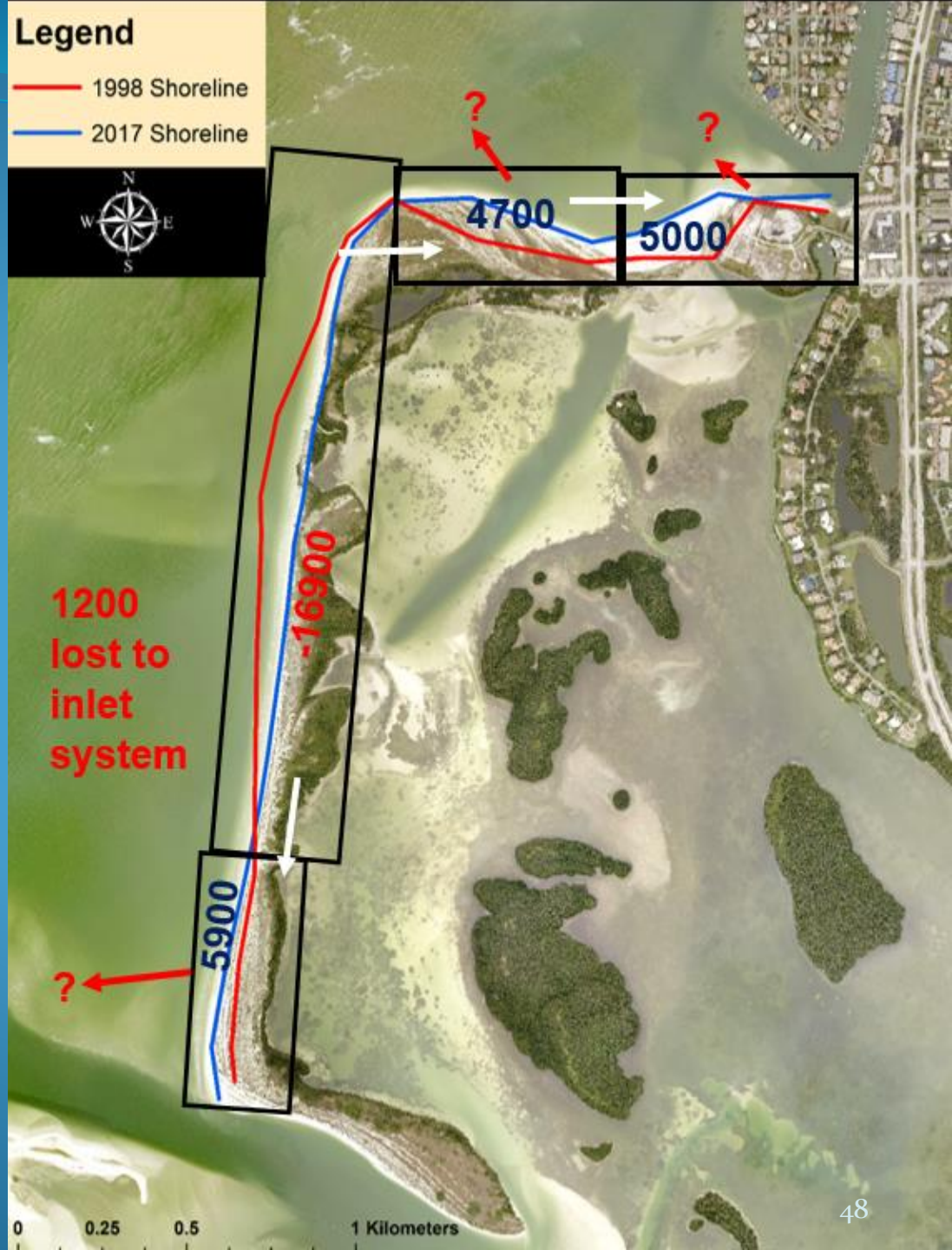
2.5 million yd^3 (1.9 m^3) placed on the beaches over 43 years

or 57,500 yd^3 (44,000 m^3) per year


31,000
R149
R150
R151
R152
R153
R154
R155
R156
R157
R159
R160
R161
R162
R163
R164
R165
21,000 GAIN
10,000
11,000 LOSS
(21,000 to Pass-a-Grille)
Legend
CELL LOSS
CELL GAIN
0
0.5
1
2
Km
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthsta
CNES/Airbus DS, USDA, USGS, AEX, Getmapping, A
IGP, swisstopo, and the GIS User Community
N
R142
R143
20,000 GAIN
0 GAIN
10,000 GAIN
LK1B
LK2B
20,000 GAIN
Legend
Channel (bathymetric, not Federally maintained)
2010 Dredge Pit
Channel Margin Linear Bar
Swash Bar Complex
0
0.075
0.15
0.3
Km
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics,
CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN,
IGP, swisstopo, and the GIS User Community


1 km
10,000
-11,000
28,000
21,000
+49,000
+5,000
+5,000
10,000
+29,000
28,000
1,000
-17,000
6,000
2010 aerial

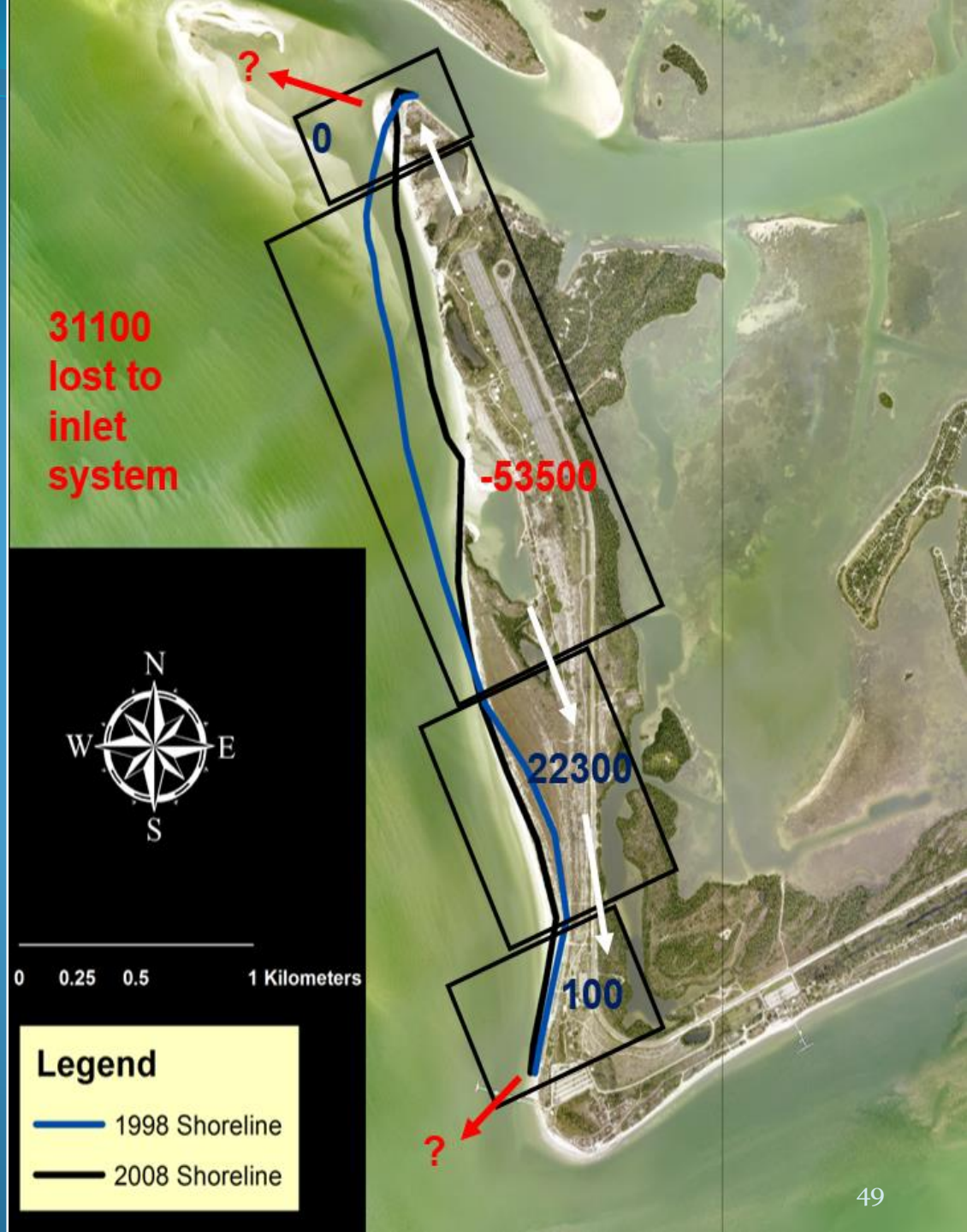
Shell Key Sediment Budget: 1998-2016



Units: m^3/yr

1 m^3 = 1.308 yd^3

Mullet Key Sediment Budget: 1998 - 2016



Units: m^3/yr

1 m^3 = 1.308 yd^3