



227 12. 1914. South from the tower at the foot of Eighteenth Street, showing the pier at the foot of Lincoln Road and Collins Avenue to the extreme right.

1914 South Beach



South Beach – 1927 Aerial

Miami-Dade County Coastal Resiliency

Alberto Pisani, PE, ENV SP
Miami-Dade County
Department of Regulatory and Economic Resources
Division of Environmental Resources Management

Nicholas J. Bragaia, PE, ENV SP
GHD Services, Inc.

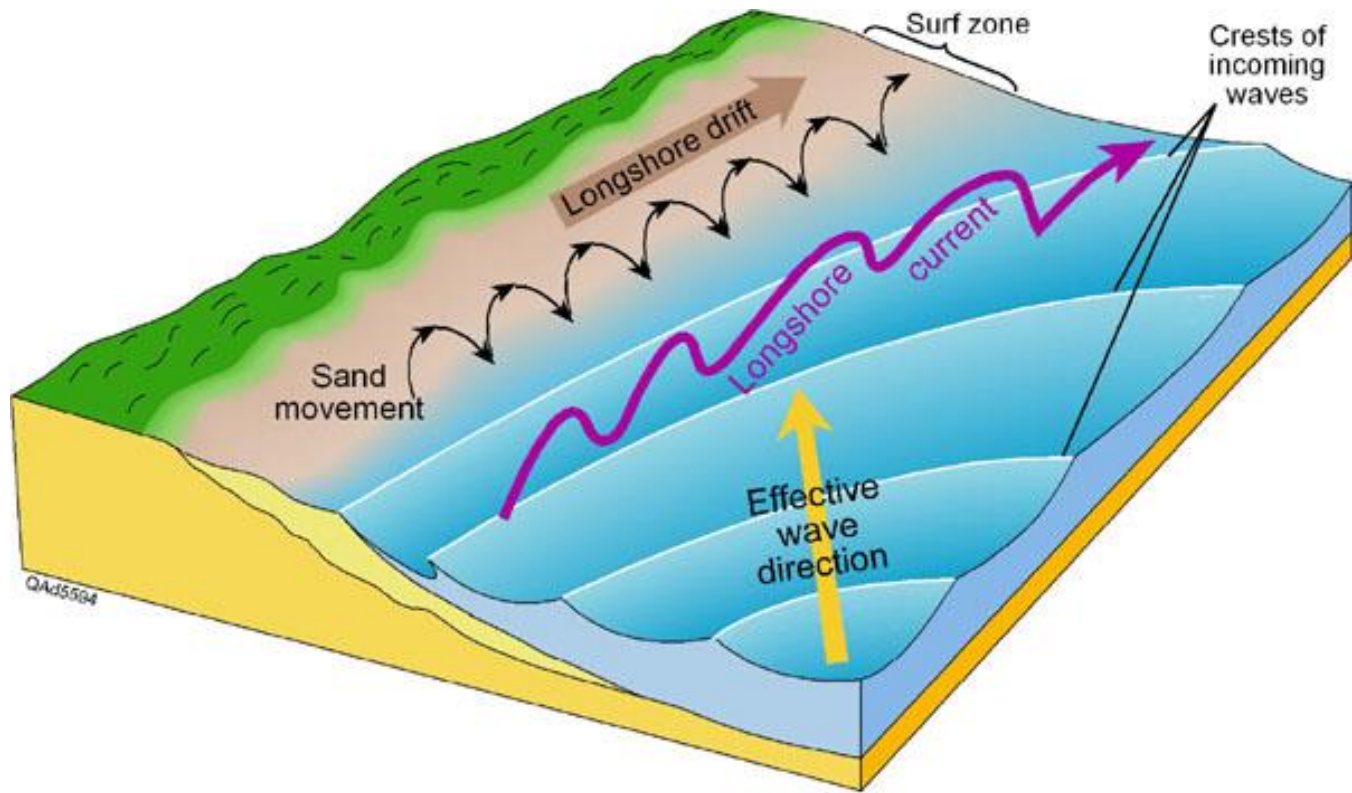




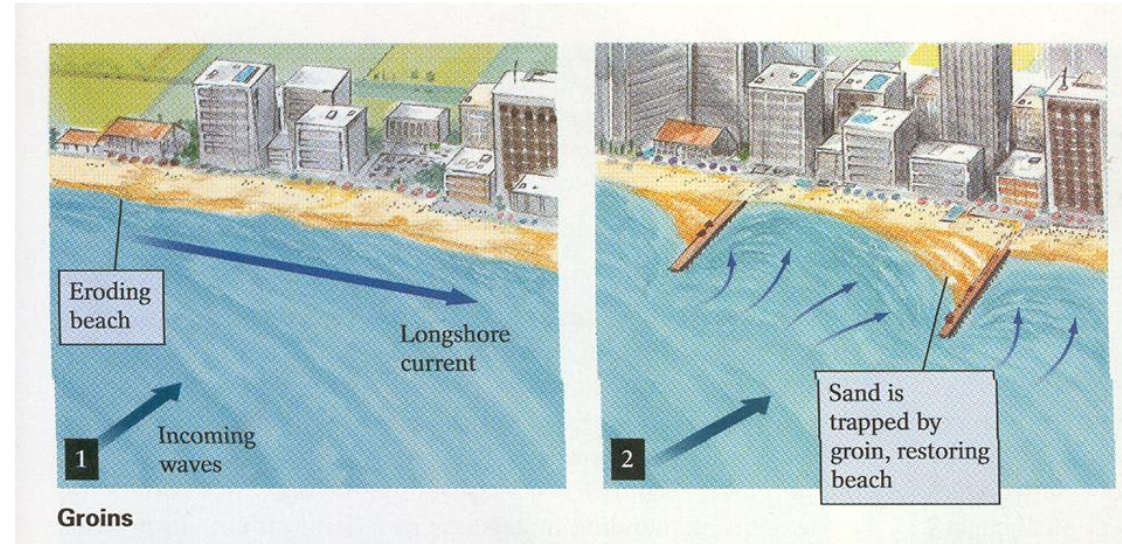
Source: USACE

Miami-Dade County Beach Erosion Control and Hurricane Protection Project



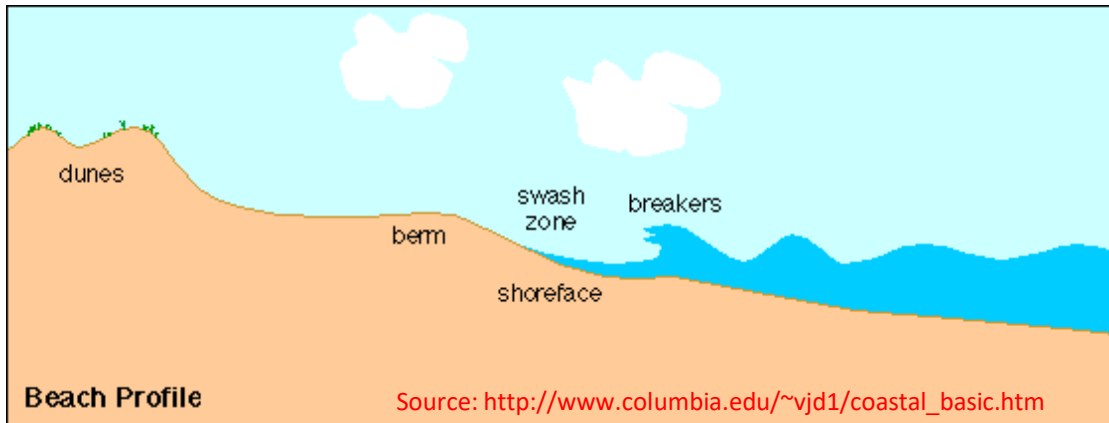


Groins



Source: <https://revisionworld.com/gcse-revision/geography/coastal-landscapes/coastal-processes/longshore-drift>

Source: <https://slideplayer.com/slide/7830052/>



Source: http://www.columbia.edu/~vjd1/coastal_basic.htm

Natural Sand Movement: Longshore Sand Transport



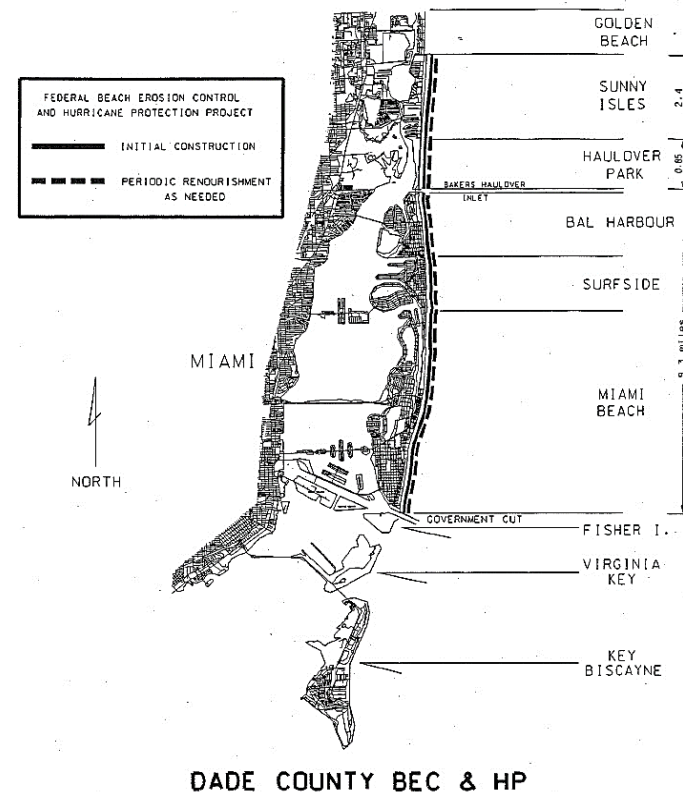
1960s Miami Beach



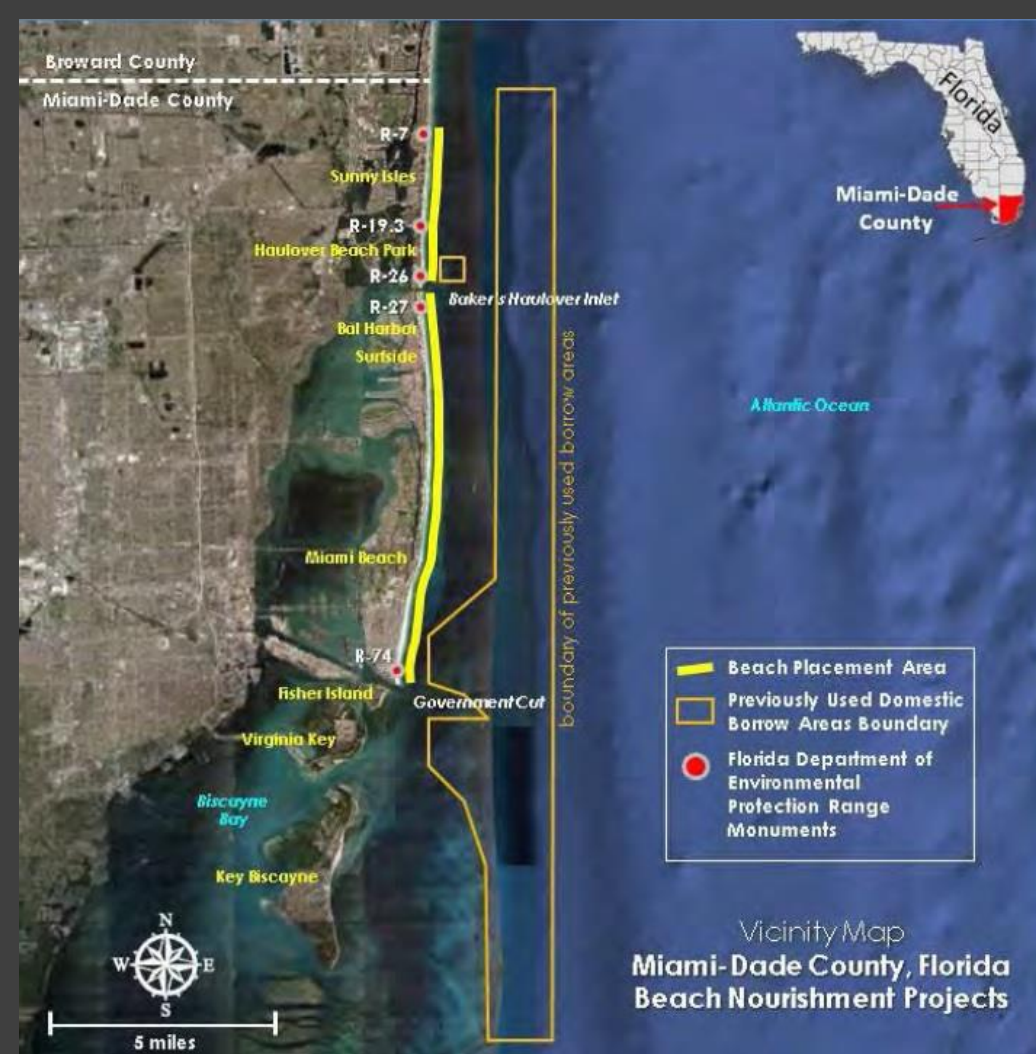
Miami-Dade beaches prior to the federally authorized project

Miami-Dade County Beach Erosion Control and Hurricane Protection Project (BEC&HP)

- 50-year federally authorized beach renourishment project along 13 miles of Miami-Dade County coastline, from Government Cut to Sunny Isles Beach.
- Build and maintain beaches to provide storm protection for life and property, provide recreational/economic benefits, and support future resilience in the face of Sea Level Rise (SLR).
- Administered by the U.S. Army Corps of Engineers (USACE), with Miami-Dade County serving as the Local Sponsor.
- Current cost share:
 - Main Segment 56.6%/43.4% federal/non-federal
 - Sunny Isles Segment 62.7%/37.3% federal/non-federal



- Main Segment: 10.2 miles in length. Initial construction of this segment began in 1975.
- Sunny Isles Segment: 2.4 miles in length. The segment was initially constructed in 1988.



Miami-Dade County Beach Erosion Control and Hurricane Protection Project: Sand Backpassing



Surfside Truck Haul/Continental Heavy Civil

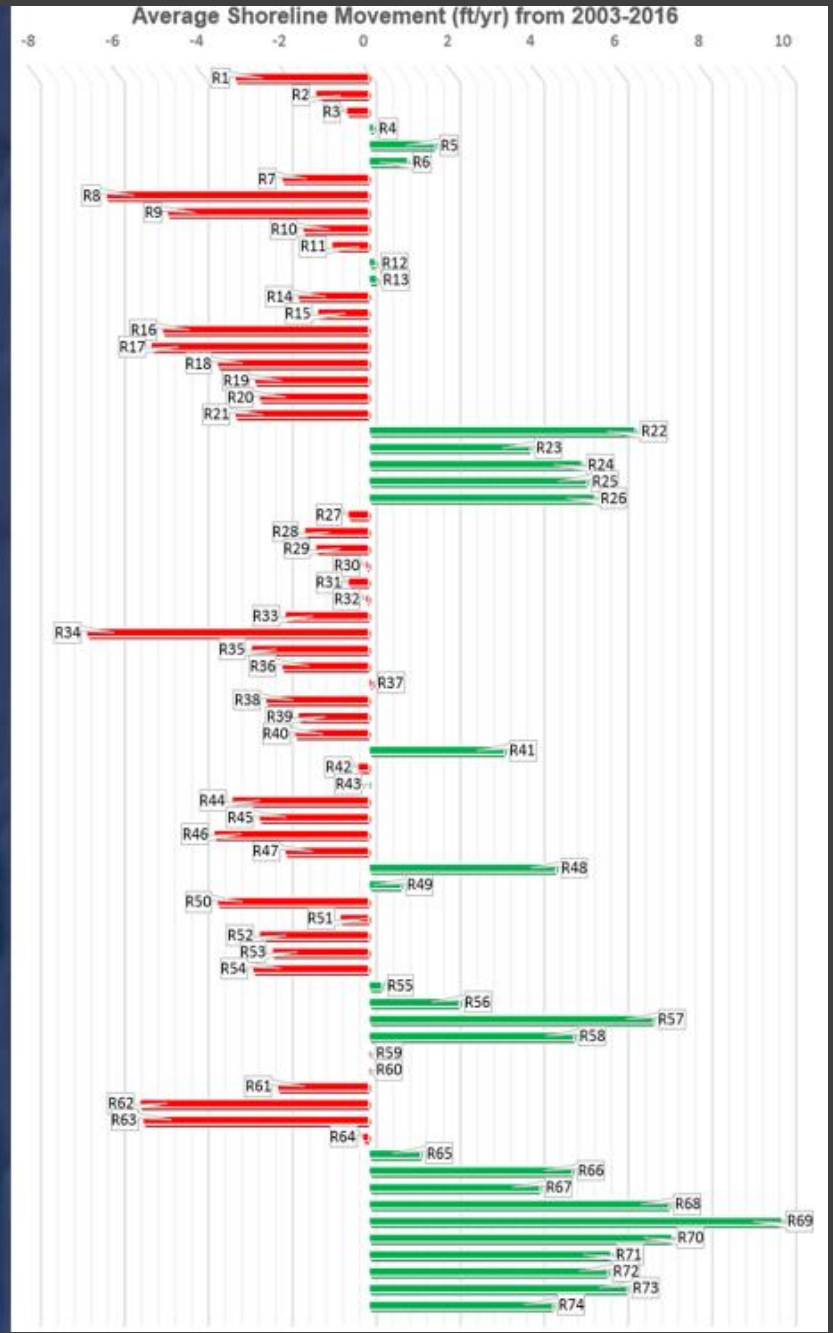
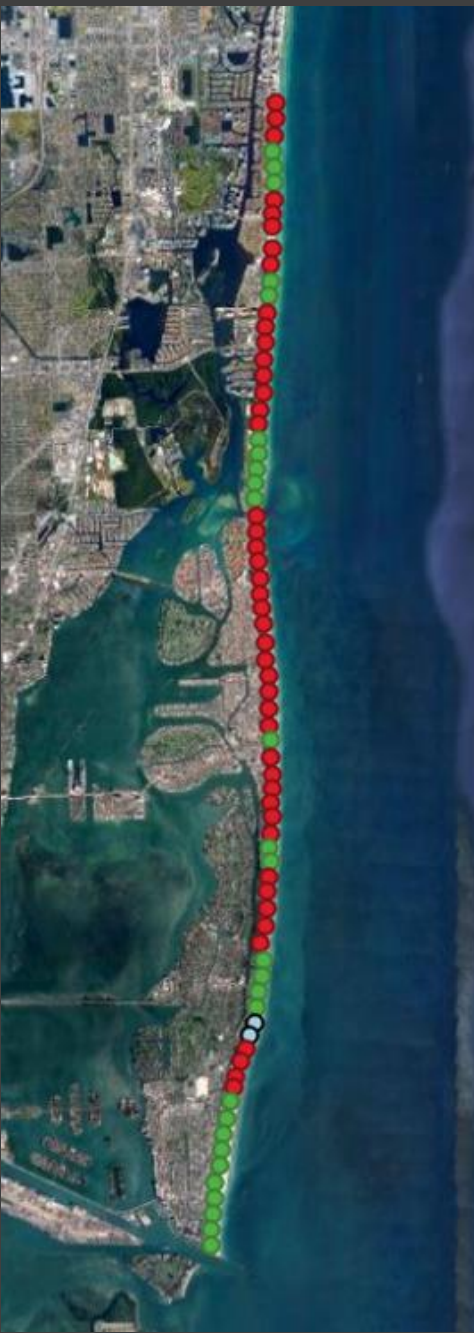
Miami-Dade County Beach Erosion Control and Hurricane Protection Project: Truck Haul Sand



Bal Harbour Dredging/Cashman Dredging



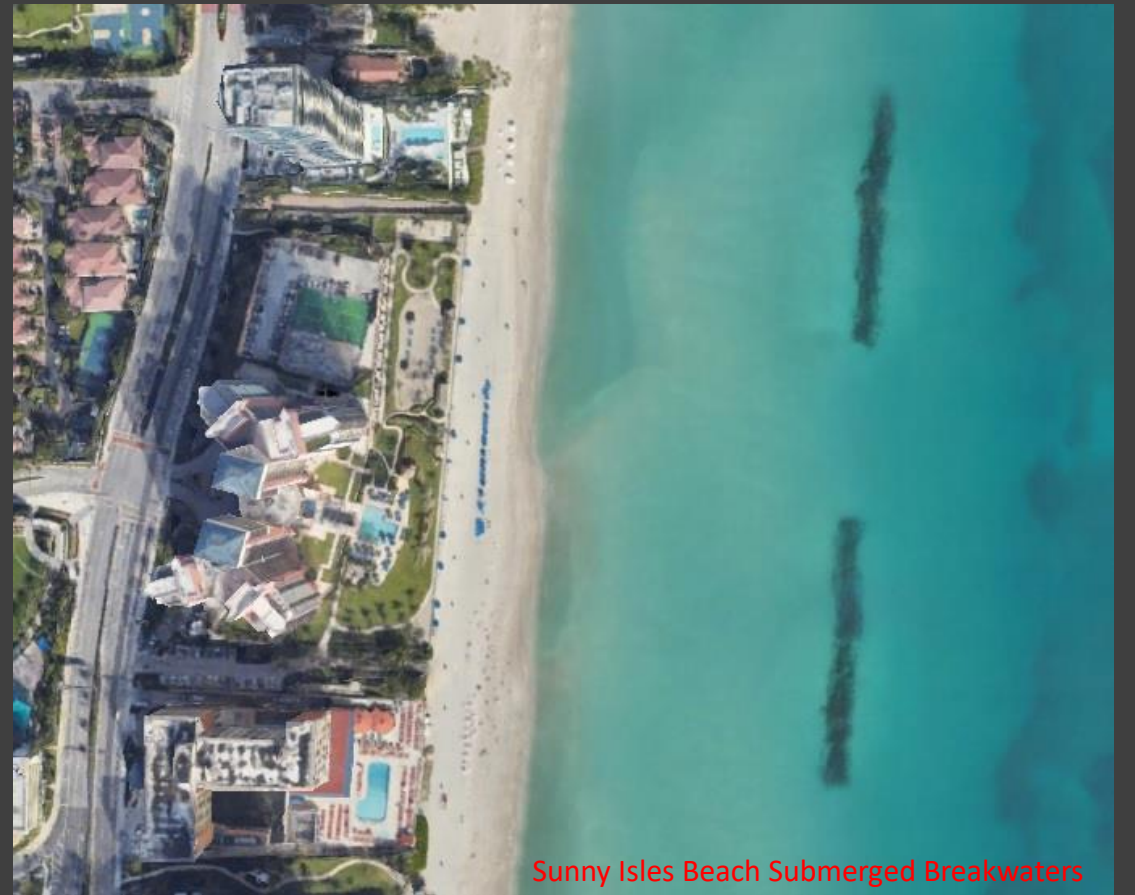
Miami-Dade County Beach Erosion Control and Hurricane Protection Project: Dredged Sand



Beach Erosion Protection:
Shore attached breakwaters
constructed by Miami-Dade in
2002



32nd Street Breakwaters



Sunny Isles Beach Submerged Breakwaters



Beach Erosion Protection:
Submerged breakwaters
constructed by USACE in 2001

Miami-Dade County Coastal Risk Management (CSRM) Feasibility Study

- Study authorized in the 2018 Bipartisan Budget Act to provide updated cost share for the main segment and re-authorization of the main segment for another 50-year period.
- Study includes the Main Segment and the Village of Key Biscayne.
- Chiefs report was signed September 26, 2022 for transmittal to Congress.
- New features include a series of groin fields in the Bal Harbour segment and increased dune and berm elevation to account for SLR.
- Cost share 57.6%/42.4% federal/non-federal for first construction, 44.3%/55.7% federal/non-federal for continued renourishment.
- Continued study of Key Biscayne segment to evaluate effects of back bay flooding.
- Initial concept for Key Biscayne includes an armored dune feature with tie-back walls and limited renourishment.
- On track for congressional authorization in 2024.
- Next steps for Miami-Dade: execute new project partnership agreement with USACE.



Miami-Dade County

→ Coastal Engineering Project Summaries



Photo from R-59 - South View

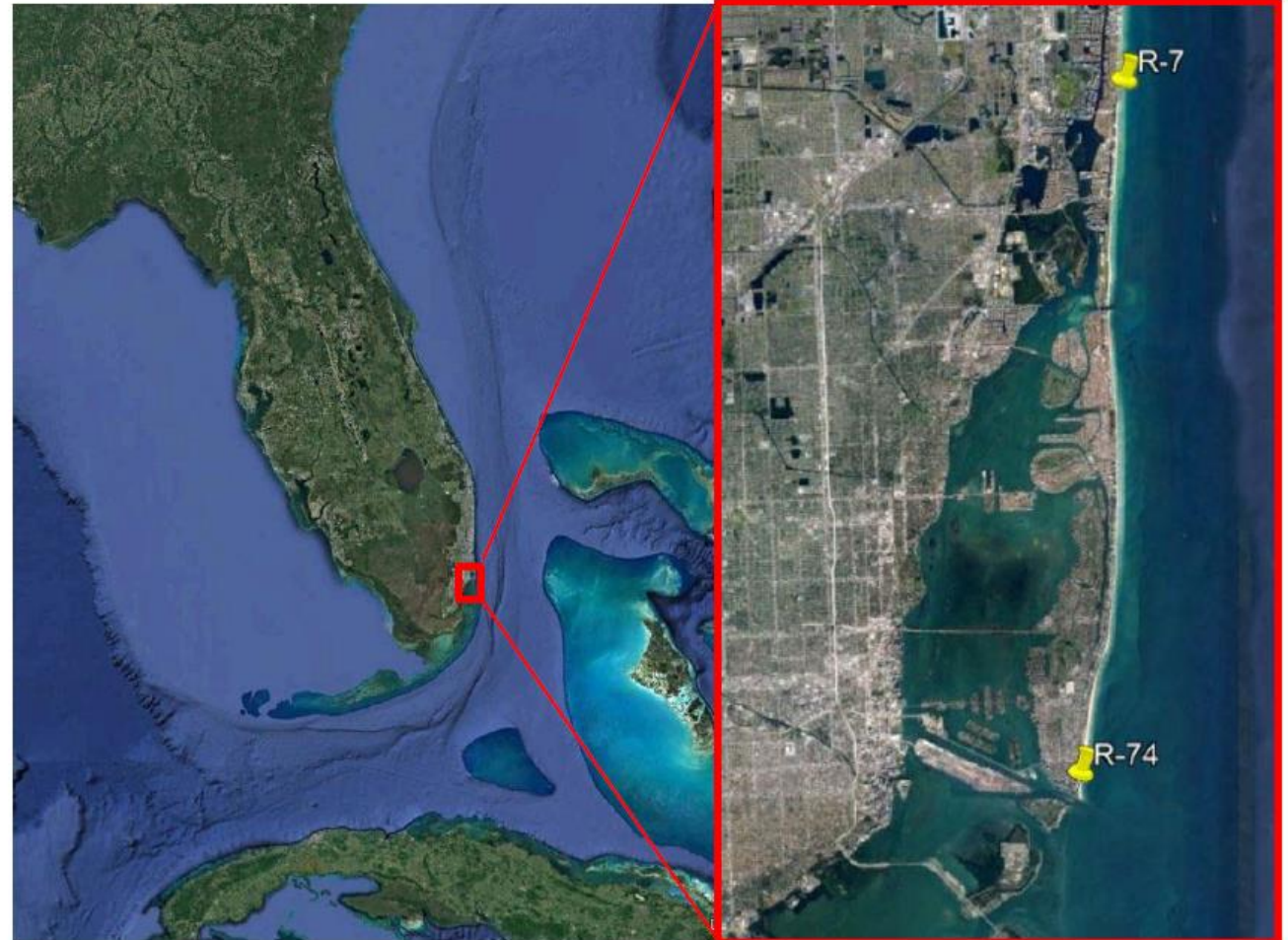
Source: 2019 Breakwater Survey Report Photo Appendix

Outline

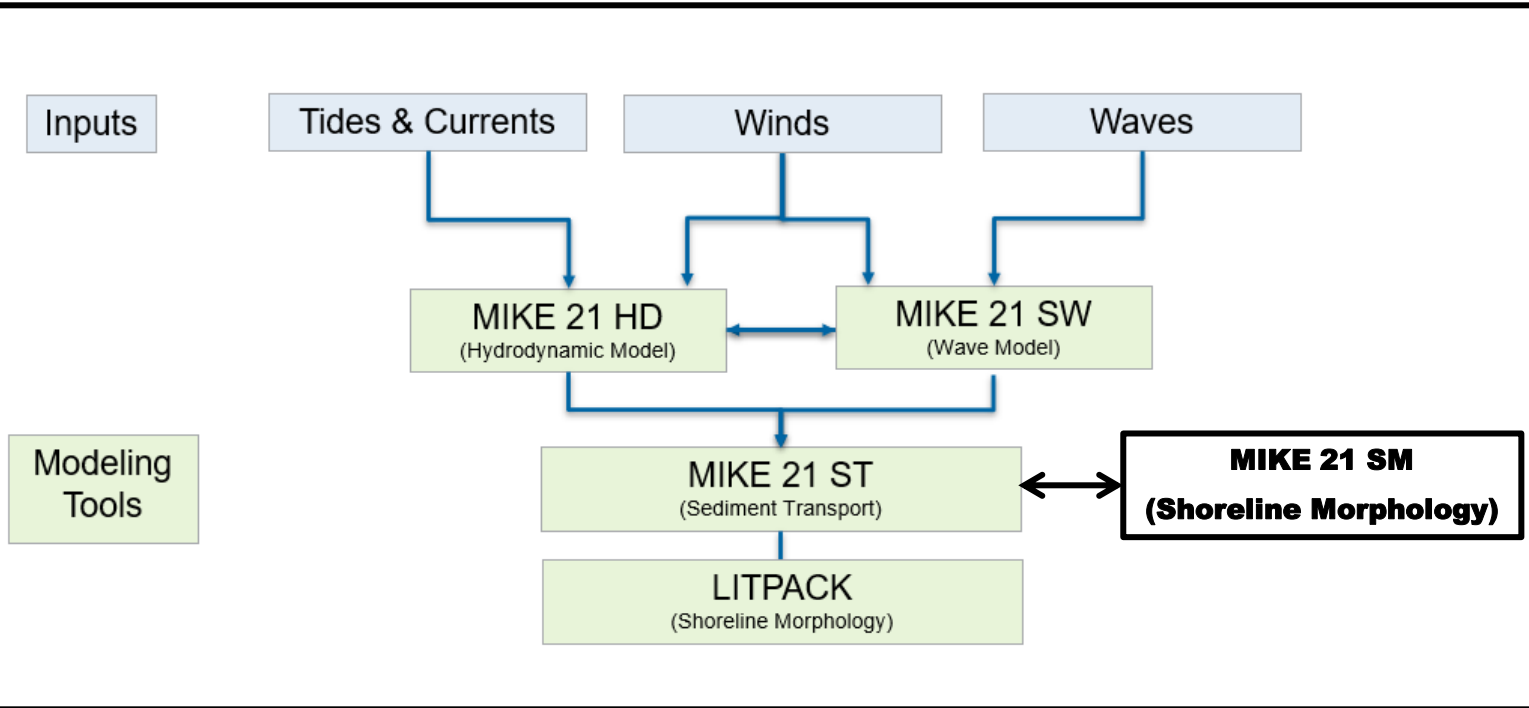
- **Coastal Modeling**
 - Development of a coupled hydrodynamic, wave, and sediment transport model
 - Focused erosional hotspot modeling
- **County-Wide Permit**
 - Submittal of a county-wide beach nourishment plan
- **Baker's Haulover Inlet**
 - Regional sediment study
 - Inlet sediment budget development
 - Alternative scenario evaluation

Background

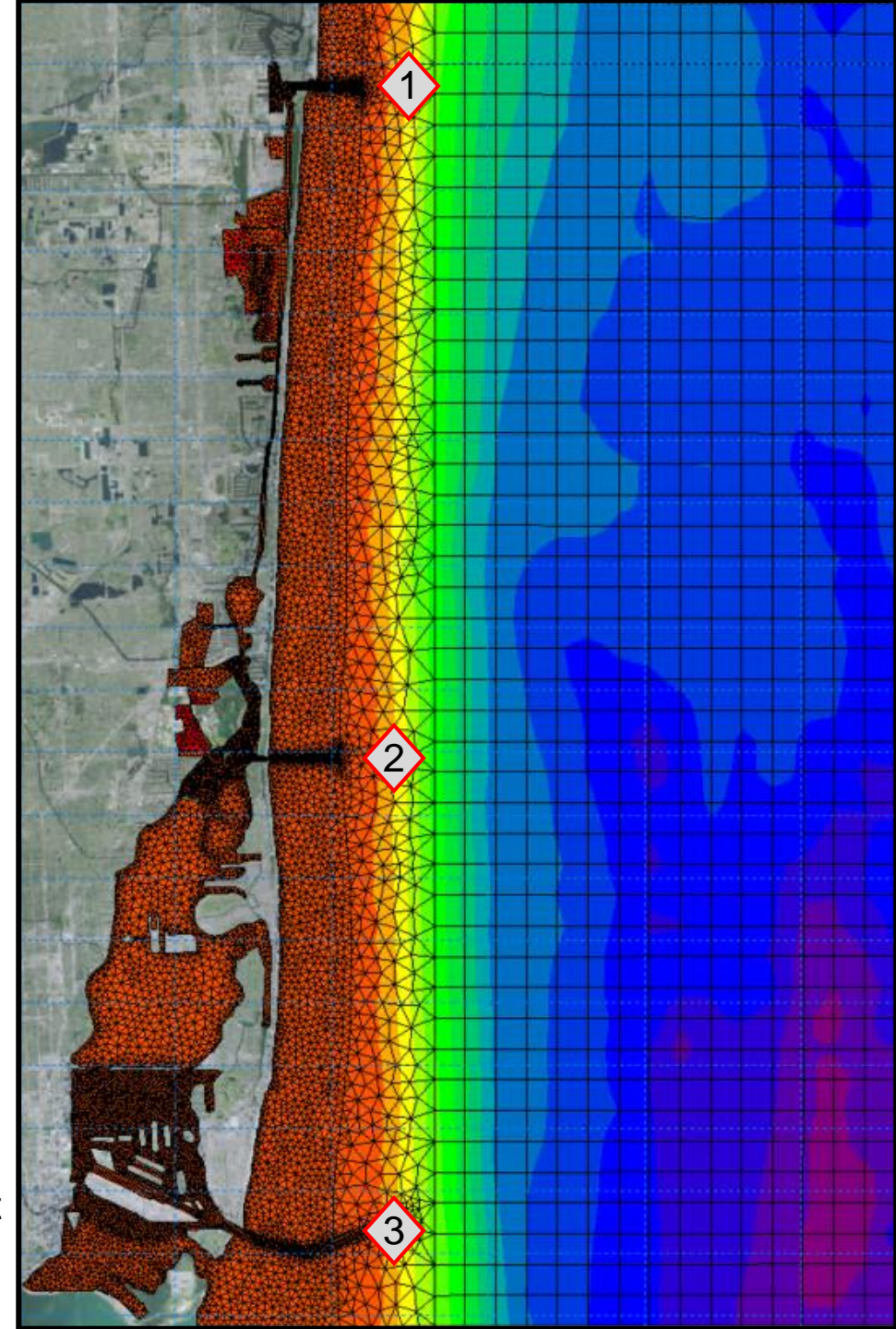
- RER-DERM and GHD begin data gathering and development of numerical model
- Model domain and mesh development
- Setup and calibration of coupled hydrodynamic, wave, and sediment transport model
- Simulation of historic shoreline changes
- Simulation of improvement scenarios for most critical erosional area
- Refinement of model within area of interest
- Simulation of improvement scenarios and conceptual design development



Modeling Framework



- 1 Port Everglades Inlet
- 2 Baker's Haulover Inlet
- 3 Government Cut Inlet



Modeling of Improvement Scenarios - 2021

- One-line model utilized to simulate (3) improvement scenarios with a goal of:
 - Mitigating the erosion hotspot located south of the 32nd street breakwaters, and
 - Minimizing downdrift erosion effects south of the proposed segmented breakwaters
- The results indicate that a nearshore breakwater system can be effective at mitigating erosion immediately south of the 32nd street breakwaters but may have some downdrift erosion effects.
- Additional modeling is necessary to formulate a solution that minimizes downdrift erosion effects.

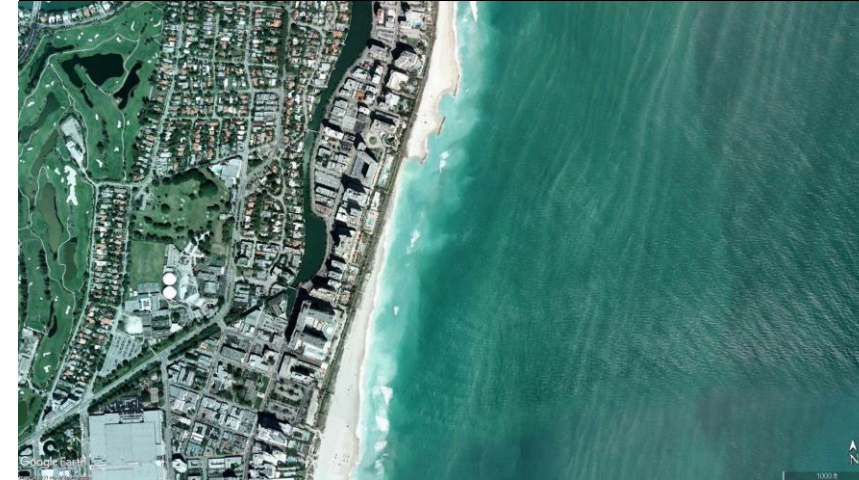


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January 2005

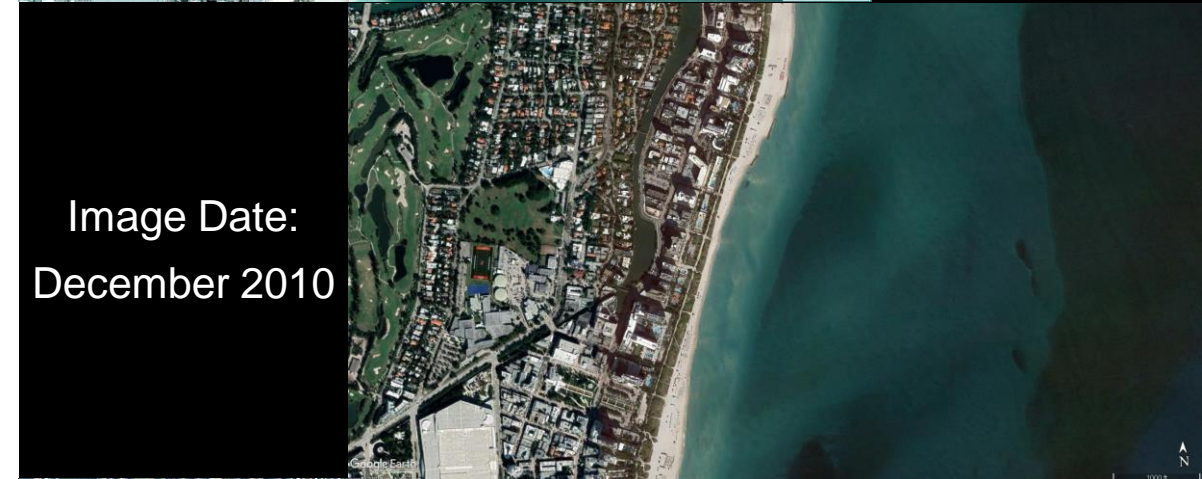


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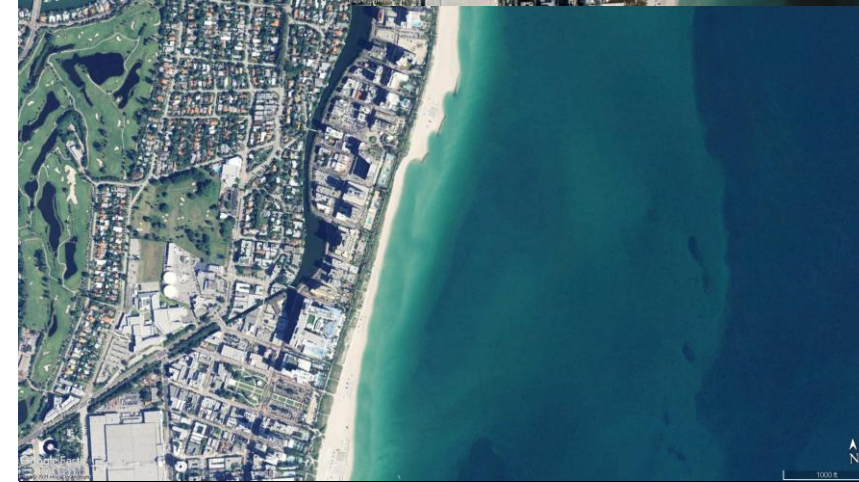
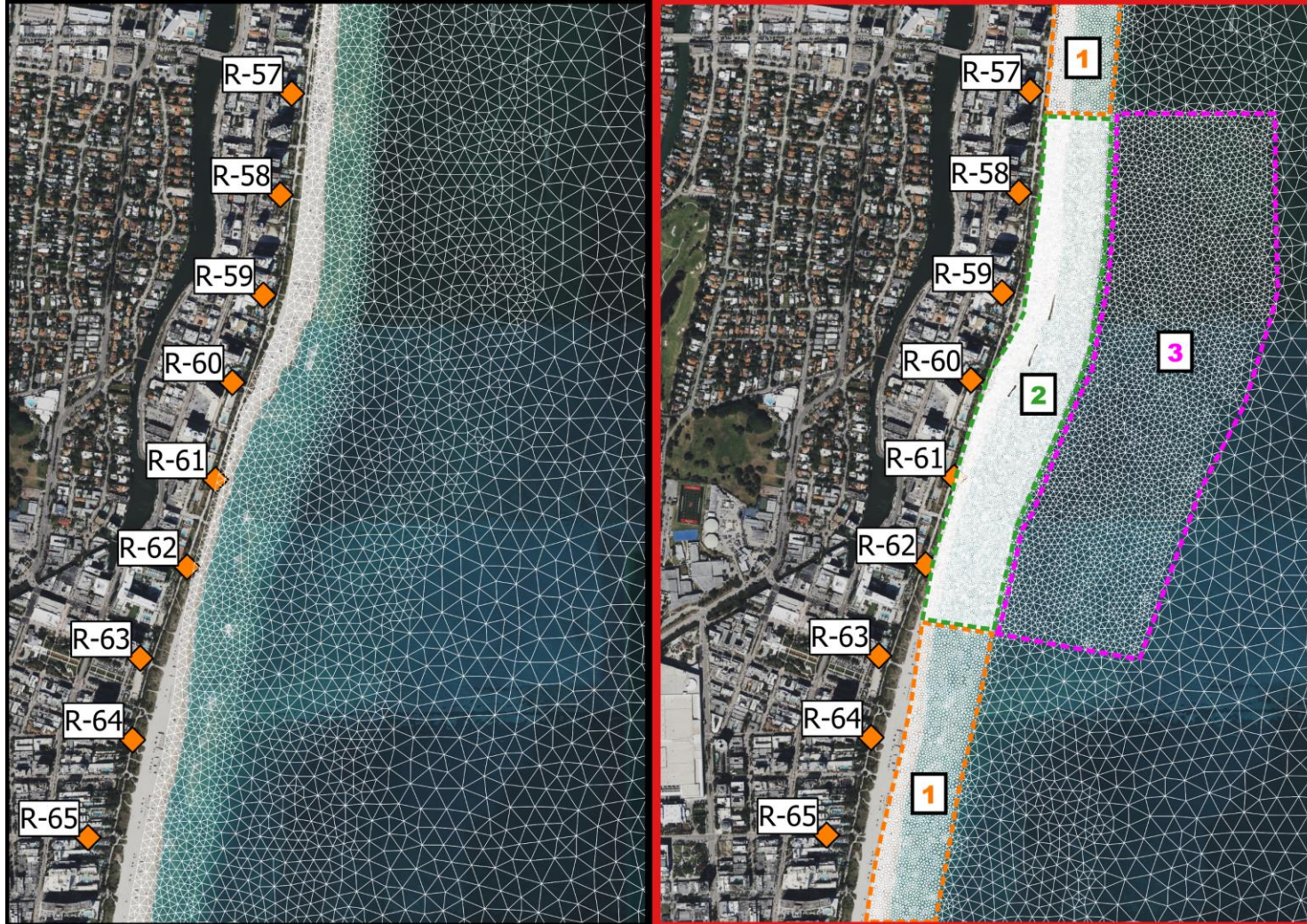


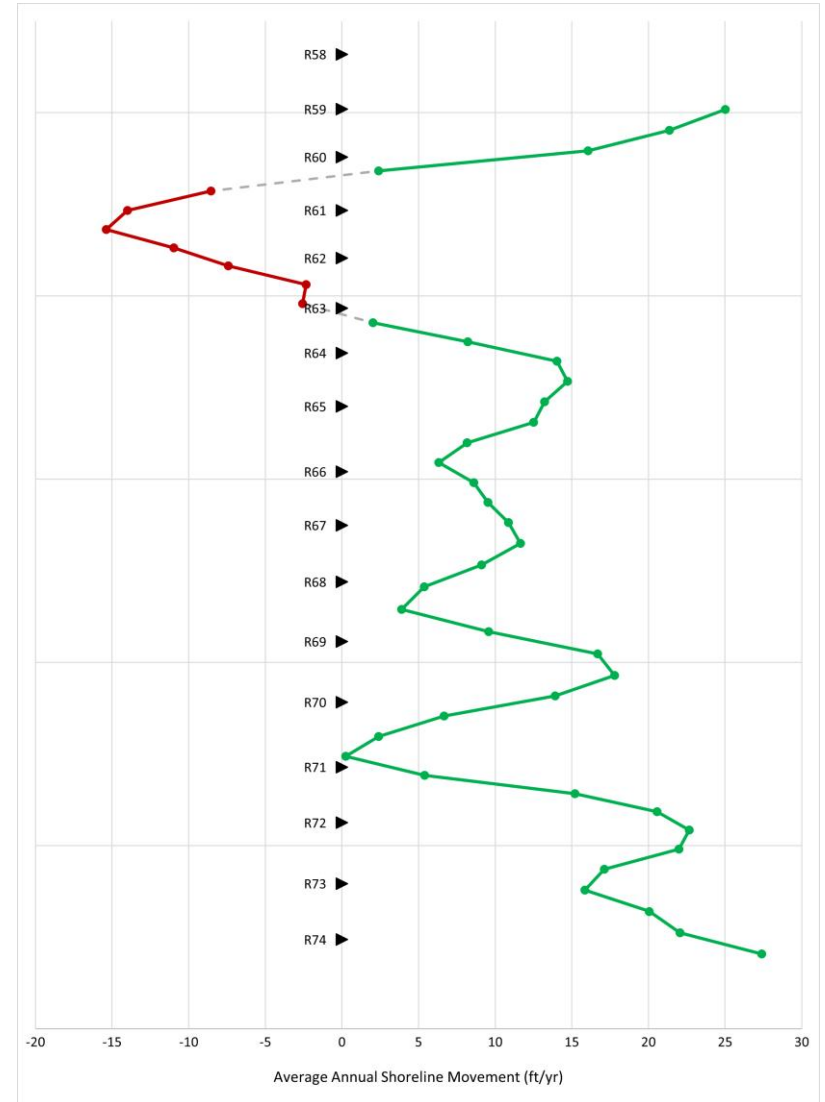
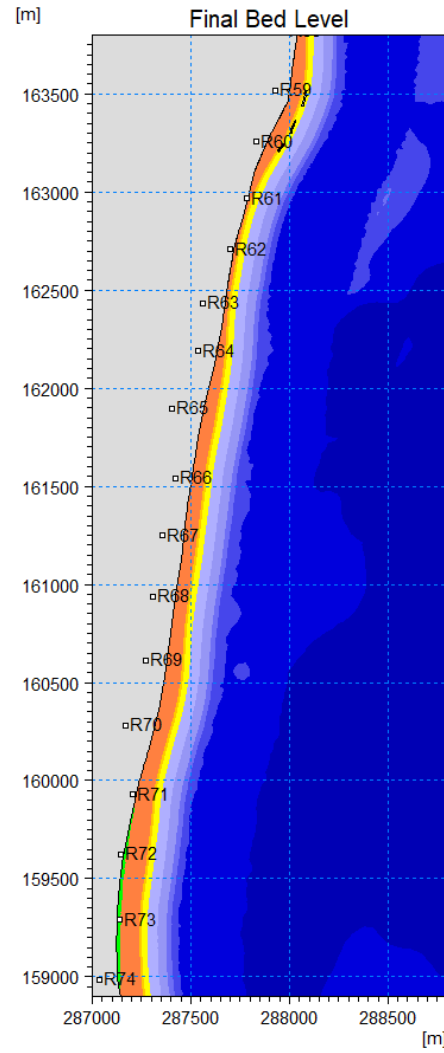
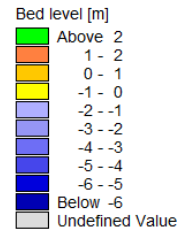
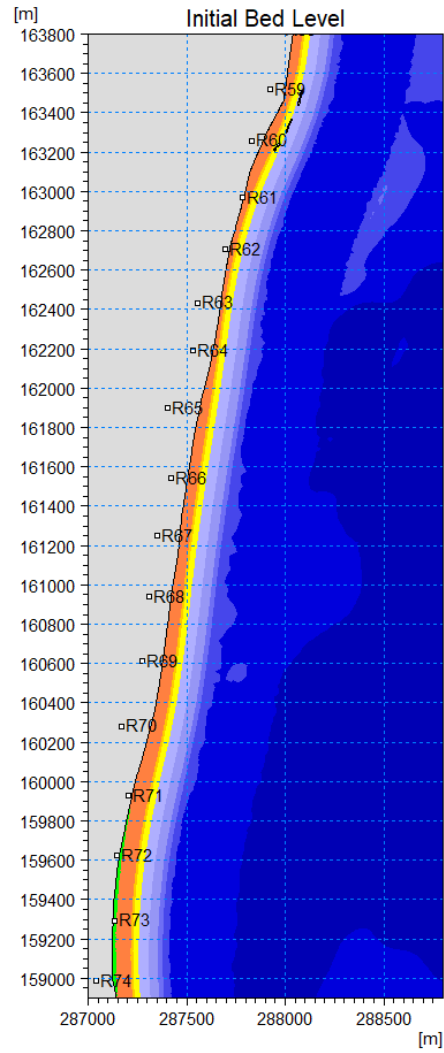
Image Date:
January 2021

Model Development



Zone	Location Description	Approximate R-Monument Range	Resolution (ft)
1	Nearshore zone	<ul style="list-style-type: none"> Northern domain limit to R-57.2 R-62.5 to southern domain limit 	20
2	Nearshore zone, upstream and downstream of 32 nd Street structures.	R-57.2 to R-62.5	10
3	Offshore bypassing area.		45

Model Verification



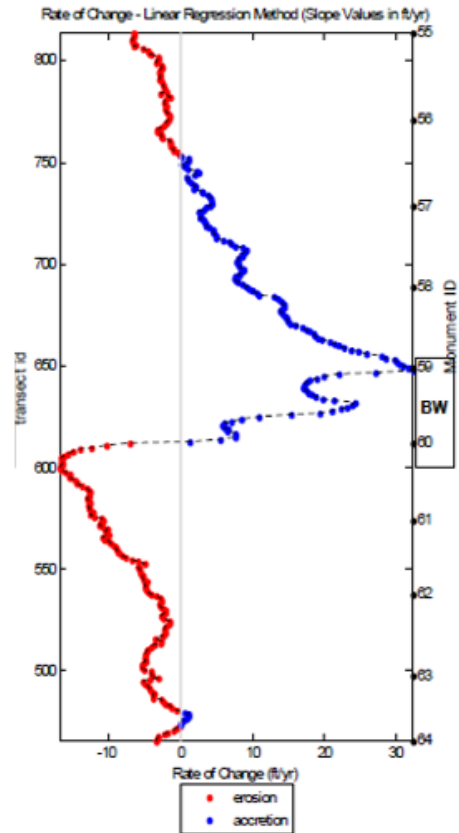
Model Verification

Data Set 1 (FDEP, 2003-2016)

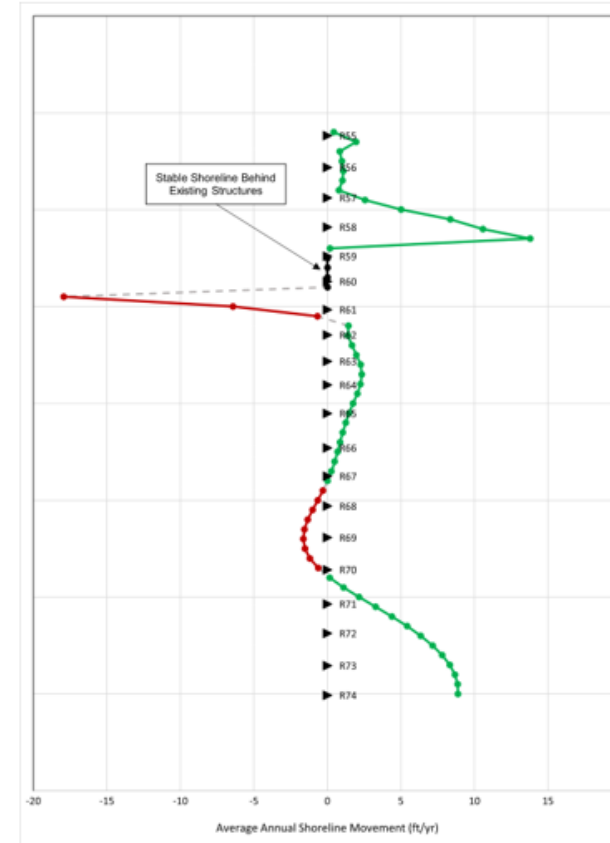
Table 10 Average Annual Shoreline Movement from MHW Surveys 2003 - 2016

R-Monument	Average Annual Shoreline Movement (ft/yr)
R-60	-1.5
R-61	-9.1
R-62	-5.5
R-63	-5.4
Average:	-5.4

Data Set 2 (FIT, 2008)



Data Set 3 (GHD, 2021)

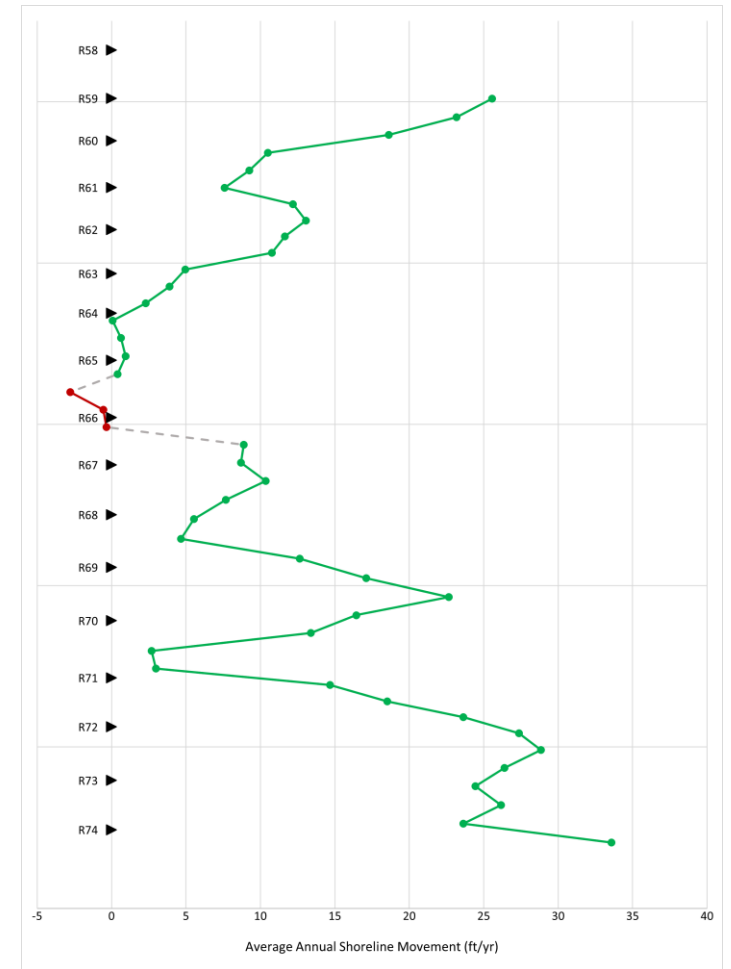
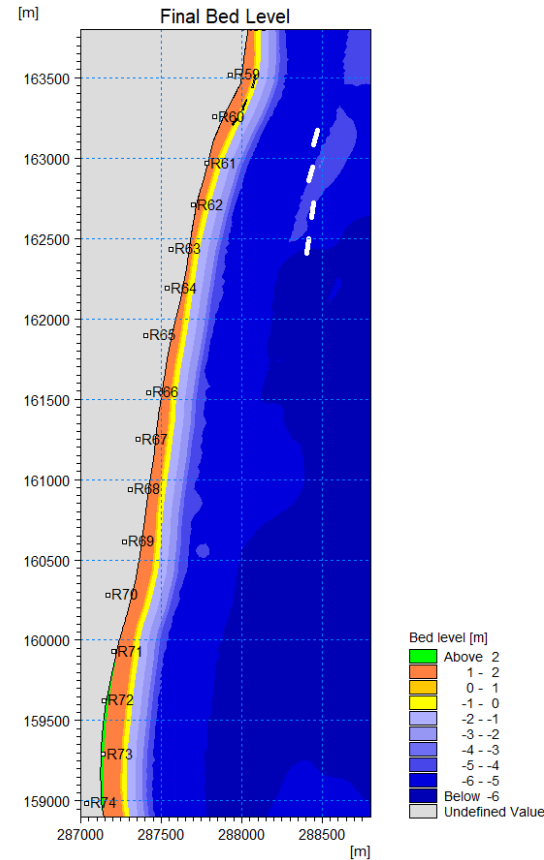
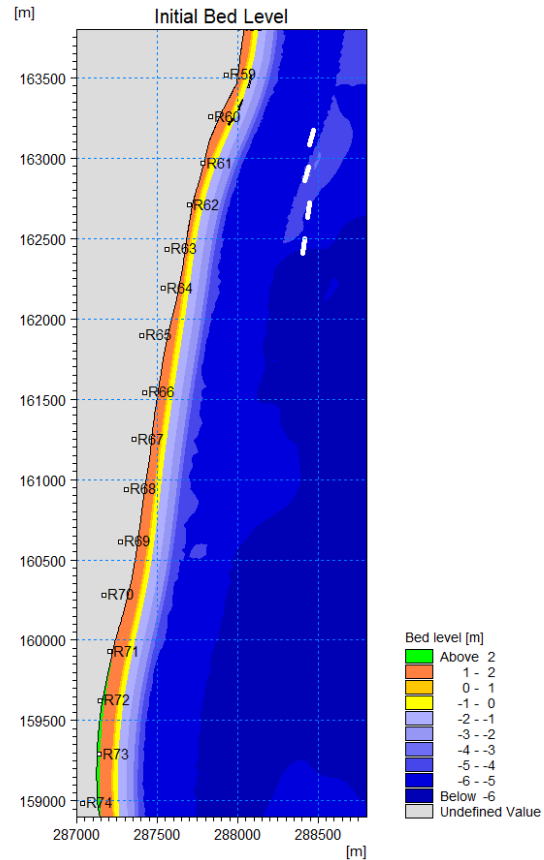




Modeling of Improvement Scenarios – Current Works

- 18 Scenarios modeled
 - Different combinations of breakwater alignment, orientation, distance offshore, crest height, etc.
- Improvements made in maximum erosion rate, average erosion rate, and erosional segment length compared with baseline conditions
 - Max. Erosion Rate:
 - *Scenario 1 (baseline)*: -15 ft/yr.
 - *Scenario 15*: -3 ft/yr.
 - Average Erosion Rate:
 - *Scenario 1 (baseline)*: -9 ft/yr.
 - *Scenario 15*: -1 ft/yr.
 - Maximum Erosional Segment Length:
 - *Scenario 1 (baseline)*: 2,300 ft
 - *Scenario 15*: 1,000 ft

Scenario 15 – (4) Offshore Breakwaters



- (4) Offshore, submerged breakwaters
- Structure Length (TYP): 300ft
- Gap Width (TYP): 450ft
- Structure Distance Offshore: 1,900ft (northern-most), 2,000ft (2nd northern-most), & 2,200ft (southern structures)



Miami-Dade County Truck Haul Nourishment Permitting Modification

Purpose of Project

- Obtain a permit modification of Miami Beach Truck Haul Nourishment Projects to authorize future truck haul sand placement events over the entirety of Miami-Dade's Federal Shore Protection Project limits – Sunny Isles to Government Cut.**

USACE Permit History Summary

(Source: Miami Dade - RER files & correspondence)



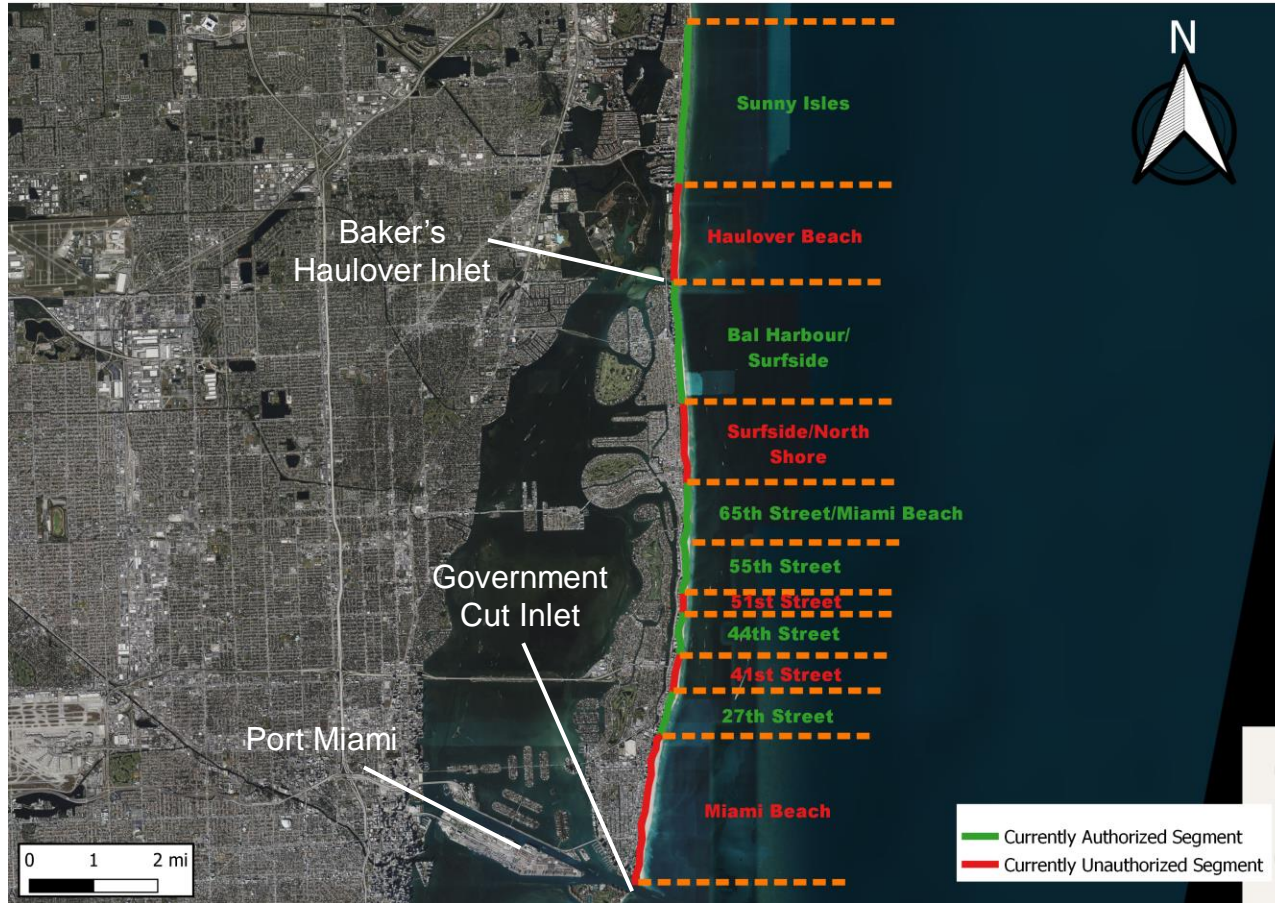
- ❑ Regional General Permit SAJ-81, SAJ-2013-02947 for Maintenance Dredging of Navigable Waters (9/22/2015)
- ❑ Regional General Permit SAJ-93, SAJ-2013-02947 for Maintenance Dredging of AIWW (4/26/2016, exp 4/26/2021)
- ❑ Department of Army (DA) Permit SAJ-2009-02039 (IP-IF) R-7 to R-12 Sunny Isles Beach (12/10/2010, exp: 12/10/2020)
- ❑ DA Permit SAJ-2009-2470 (IP-IF) R-45 to R-48.7 Miami Beach (9/3/2010, exp: 9/3/2020)
- ❑ DA Permit SAJ-2009-2469 (IP-IF) R-12 to R-15 Miami Beach (8/5/2010, exp: 8/5/2020)
- ❑ DA Permit SAJ-2009-02468 (IP-IF) R-29 to R-35 Miami Beach (8/5/2010, exp: 8/5/2020)
- ❑ DA Permit SAJ-2009-2038 (IP-IF) R-43 to R-44.5 Miami Beach (10/23/2010, exp: 10/23/2020)
- ❑ DA Permit SAJ-2009-02040 (IP-IF) R-27 to R-29) Sunny Isles (11/16/2010. exp: 11/16/2020)
- ❑ DA Permit SAJ-2008-3955 (IP-IF) R-48.7 to R-50.7 Miami Beach (4/24/2010, exp: 4/24/2020)
- ❑ DA Permit SAJ-2008-3953 (IP-IF) R-60 to R-61 Miami Beach (3/12/2010, exp: 3/12/2020)
- ❑ DA Permit SAJ-2008-3952 (IP-IF) R-53.7 to R-55.5 Miami Beach (5/26/2010, exp: 5/26/2020)

FDEP Permit History



- ❑ Initial permit 0233882-001-JC (9/22/2006)
- ❑ Subsequent Minor, Administrative and Major Modifications issued 2007-2016
Additional shoreline segments
 - Permit conditions
 - Additional sand sources
- ❑ Consolidated Major Modification 0233882-010-JM issued 6/16/2017
- ❑ Minor Modifications -012 through -017 processed and issued 2/06/2018 – 3/25/2021 (-011 was withdrawn)
- ❑ **Permit Expiration Date: 03/24/2024**

Authorized and Unauthorized Shoreline Segments



Currently Authorized Shoreline Segment Name and Corresponding FDEP Reference Monument Limits

Shoreline Segment (Location)	R-Monument*	Segment Length	
		Ft	Miles
Sunny Isles	R-7 to R-19.3	13,906	2.63
Bal Harbour/Surfside	R-27 to R-36.5	10,032	1.90
65th Street/Miami Beach	R-42.4 to R48.7	6,192	1.17
55 th Street	R-48.7 to R-51.6	2,944	0.56
44 th Street	R-52.9 to R-56	3,549	0.67
27 th Street	R-59 to R-62.8	3,572	0.68
Total Currently Authorized		40,196	7.61

*Note: decimal point value after R-monument indicates distance south of the monument, in ft(x100); limits are as prescribed in File Numbers 0233882-004-JM and 0233882-017-JN

Segment Name and Corresponding FDEP Reference Monument Limits for Shorelines to be Considered for Inclusion in File 0233882


Shoreline Segment (Location)	R-Monument*	Segment Length	
		Ft	Miles
Haulover Beach	R-19.3 to R-27	7,478	1.42
Surfside/North Shore	R-36.5 to R-42.4	6,484	1.23
51st Street	R-51.6 to R-52.9	1,477	0.28
41st Street	R-56 to R-59	3,056	0.58
Miami Beach	R-62.8 to R-74.3	12,039	2.28
Total Proposed		30,534	5.79

*Note: decimal point value after R-monument indicates distance south of the monument, in ft (x100).


Major Permit Modification

Draft Submitted – Review(s) in Progress

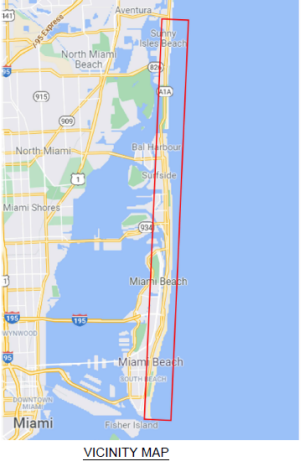
Shoreline Segment Sand Placement Template Parameters – Authorized by File 0233882



GHD, INC.
P.O. BOX 228026
MIAMI, FL 33222 USA



FEDERAL SHORE PROTECTION PROJECT TRUCK HAUL NOURISHMENT MIAMI-DADE COUNTY, FL



SHEET #	REF #	TITLE	LATEST UPDATE	REV.
01	C=001	CONTRACT SHEET AND SUMMARY MAP	8/2/2022	0
02	C=001	SITE PLAN (R=7 TO R=8)	8/2/2022	0
03	C=002	SITE PLAN (R=10 TO R=12)	8/2/2022	0
04	C=003	SITE PLAN (R=13 TO R=15)	8/2/2022	0
05	C=004	SECTION (R=7 TO R=8)	8/2/2022	0
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07	C=003	SECTION (R=13 TO R=15)	8/2/2022	0
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30	C=014	SECTION (R=46 TO R=48)	8/2/2022	0
31	C=015	SECTION (R=49 TO R=50)	8/2/2022	0
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33	C=016	SITE PLAN (R=53 TO R=55)	8/2/2022	0
34	C=017	SECTION (R=52 TO R=54)	8/2/2022	0
35	C=018	SECTION (R=55 TO R=56)	8/2/2022	0
36	C=017	SITE PLAN (R=56 TO R=58)	8/2/2022	0
37	C=019	SECTION (R=57 TO R=58)	8/2/2022	0
38	C=018	SITE PLAN (R=59 TO R=60)	8/2/2022	0
39	C=020	SECTION (R=58 TO R=62)	8/2/2022	0
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41	C=021	SECTION (R=63 TO R=65)	8/2/2022	0
42	C=020	SITE PLAN (R=66 TO R=68)	8/2/2022	0
43	C=022	SECTION (R=66 TO R=68)	8/2/2022	0
44	C=021	SITE PLAN (R=69 TO R=71)	8/2/2022	0
45	C=023	SECTION (R=69 TO R=71)	8/2/2022	0
46	C=022	SITE PLAN (R=72 TO R=74)	8/2/2022	0
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Shoreline Segment (Location)	R-Monument*	Segment Parameters				
		Max. Dune Height, Ft	Slope tie-in top of dune to existing grade & berm	Authorized Max. Berm Height, Ft	Slope tie-in top of berm to MHWL	Slope tie-in MHWL to Construction Toe of Fill
Sunny Isles	R-7 to R-19.3	-	-	6.9 NAVD	1:20	1:40
Bal Harbour	R-27 to R-36.5	9.3 NAVD	1:5	6.9 NAVD	1:20	1:40
65th Street/Miami Beach	R-42.4 to R48.7	9.3 NAVD	1:5	7.0 NAVD	1:20	1:40
55th Street	R-48.7 to R-51.6	9.8 NAVD	1:5	7.7 NAVD	1:20	1:40
44th Street	R-52.9 to R-56	9.8 NAVD	1:5	7.7 NAVD	1:20	1:40
27th Street	R-59 to R-62.8	9.8 NAVD	1:5	7.7 NAVD	1:20	1:40

*Note: decimal point value after R-monument indicates distance south of the monument, in ft (x100).

Propose uniform 7.0 NAVD

Shoreline Segment Proposed Sand Placement Template Parameters – Shorelines not Currently Authorized by File 0233882

Shoreline Segment (Location)	R-Monument*	Berm Height, Ft	Slope tie-in to existing grade at 1.14 NAVD
Haulover Beach	R-19.3 to R-27	7.0 NAVD	1:10
Surfside/North Shore	R-36.5 to R-43	7.0 NAVD	1:10
51st Street	R-51.6 to R-52.9	7.7 NAVD	1:10
41st Street	R-56 to R-59	7.7 NAVD	1:10
Miami Beach	R-62.8 to R-74.3	7.7 NAVD	1:10

*Note: decimal point value after R-monument indicates distance south of the monument, in ft (x100).

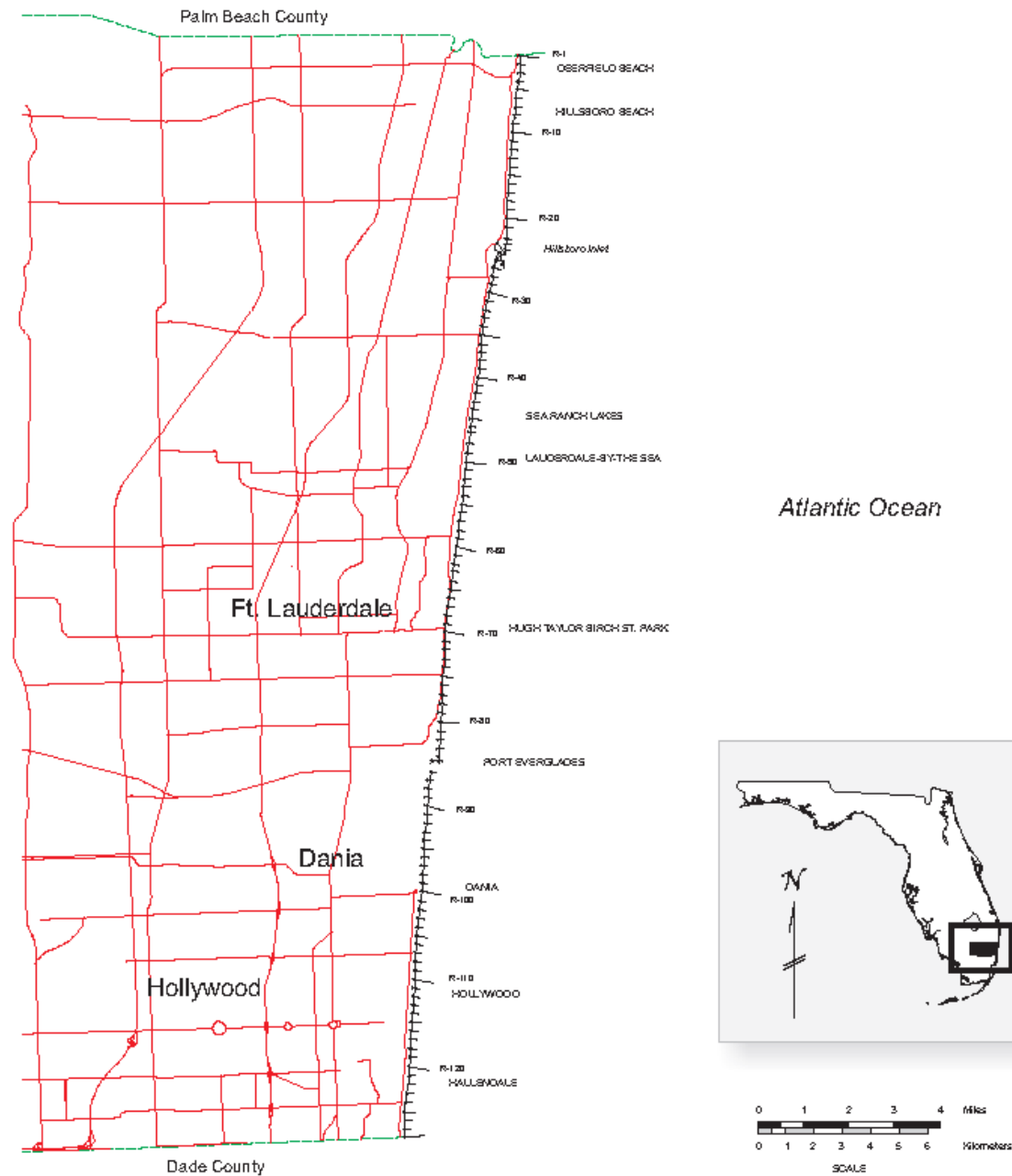
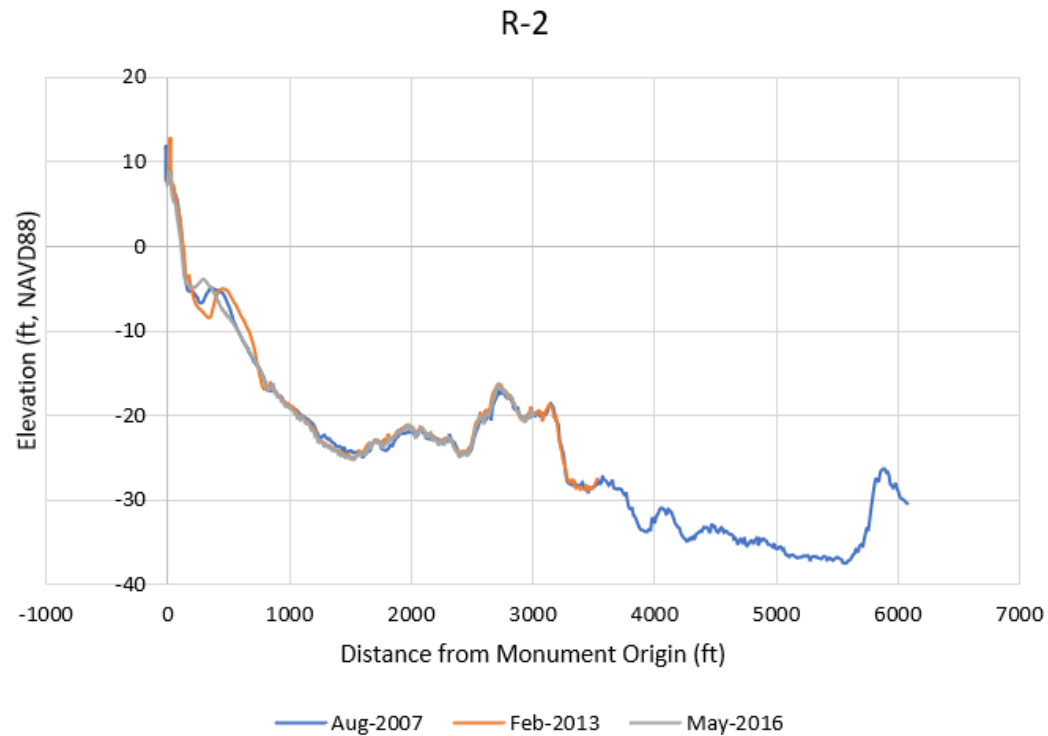
Baker's Haulover Inlet Study

- Develop a regional sediment budget that influences the Baker's Haulover Inlet area
- Calculate a localized sediment balance for Baker's Haulover Inlet
- Oneline (1D) coastline modeling of the immediate updrift (northern) and downdrift (southern) shorelines



Source: Miami New Times

Beach Volume Change Analysis Methodology



BROWARD COUNTY LOCATION MAP

- Beach volume changes calculated using cross-shore beach profile data collected at FDEP reference monument locations
- Volumetric changes were calculated between dry beach and depth of closure at each monument location

Beach Volume Change Analysis

April 2007 – May 2016



Nourishment Projects near Baker's Haulover Inlet				
Date	Project Location (R monument)	Length (mi)	Sand Source	Volume (cy)
Jul 2009	R7 – R10.5	0.6	Upland	10,000
Mar 2014	R12 – R16	0.8	BHI AIWW	35,000*
2015	R7 – R9	0.4	Upland	2,600
Jan 2018	R – R10	0.6	Upland	93,052
Jan 2018	R15 – R17	0.4	Upland	29,217
Apr 2018	R12 – R15	0.6	Upland	28,500
Apr 2019	R11 – R2	0.2	Upland	18,764
Apr 2019	R12 – R13	0.2	Upland	24,934
2007	R27 – R31	0.8	AIWW	30,000
2009	R27 – R28.8	0.34	Upland	15,000
Nov 2010	R28 – R29	0.2	AIWW	33,080
2014	R27 – R31	0.8	BHI	49,592
Jan 2014	R27 – R31	0.8	BHI (ebb shoal)	235,733
Apr 2014	R32 – R36	0.8	Upland	12,800
Dec 2017	R28 – R29	0.2	AIWW	43,500

Beach Volume Change (cy) (GHD, 2022)			
Segment	Location	Apr. 2007 to Jan/Feb. 2013	Feb. 2013 to May 2016
Broward County	R-86 to R-128	-319,200	-**
Golden Beach	R-1 to R-7	43,000	-72,600
Sunny Isles	R-7 to R-19	-83,900	1,600
Haulover Park	R-19 to R-26	156,700	-49,600
Bal Harbour	R-27 to R-31	-116,000	99,900
Surfside	R-31 to R-38	-127,400	12,900

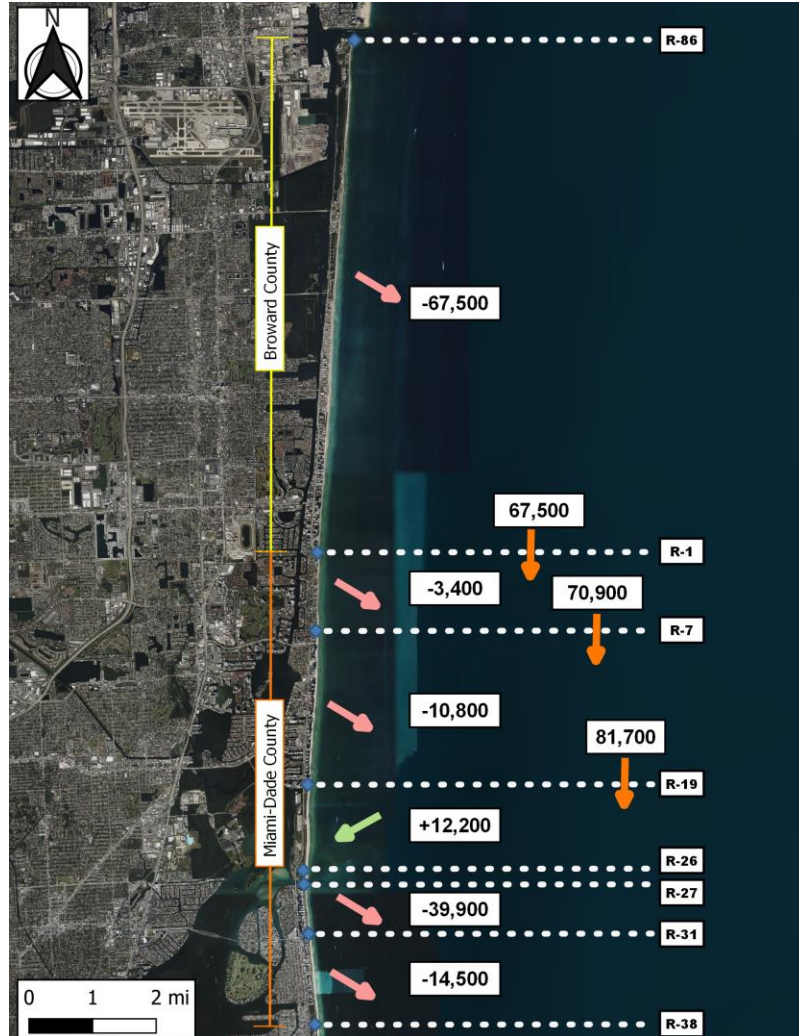
*Other sources report this volume as 49,592cy

**no profile data available in Broward County between '13-'16

Development of a Sediment Budget

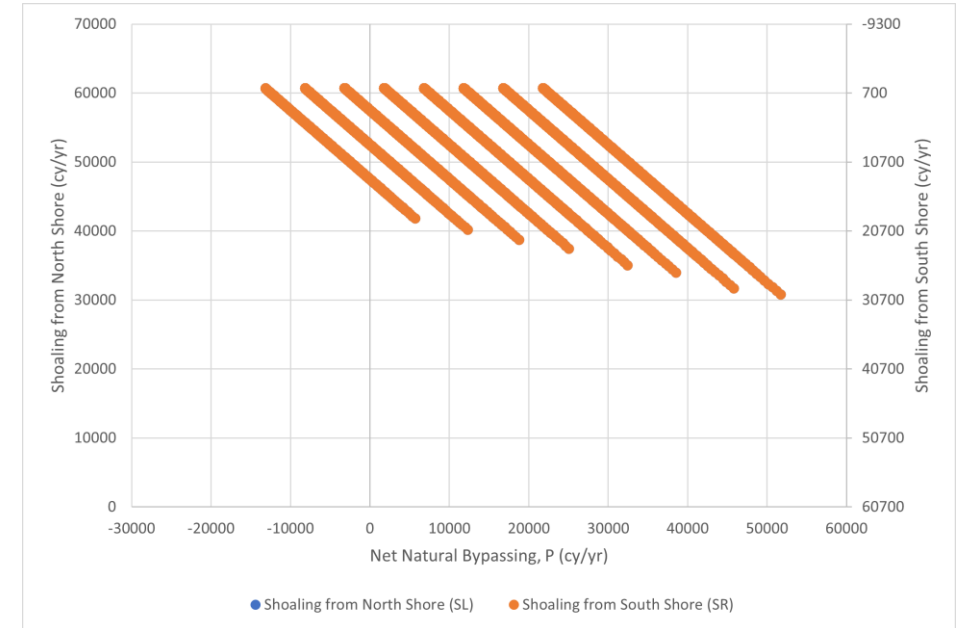
Regional

(R-Monument Beach Profile Changes)



Local

(Family of Solutions Method (Bodge, 1999))



- Some Inputs Include:
 - Net transport rate
 - Jetty permeability
 - Ratio of north/south directed transport
 - Dredging placement quantities
- Outputs range of viable solutions that can then be narrowed to a representative solution

Online Modeling

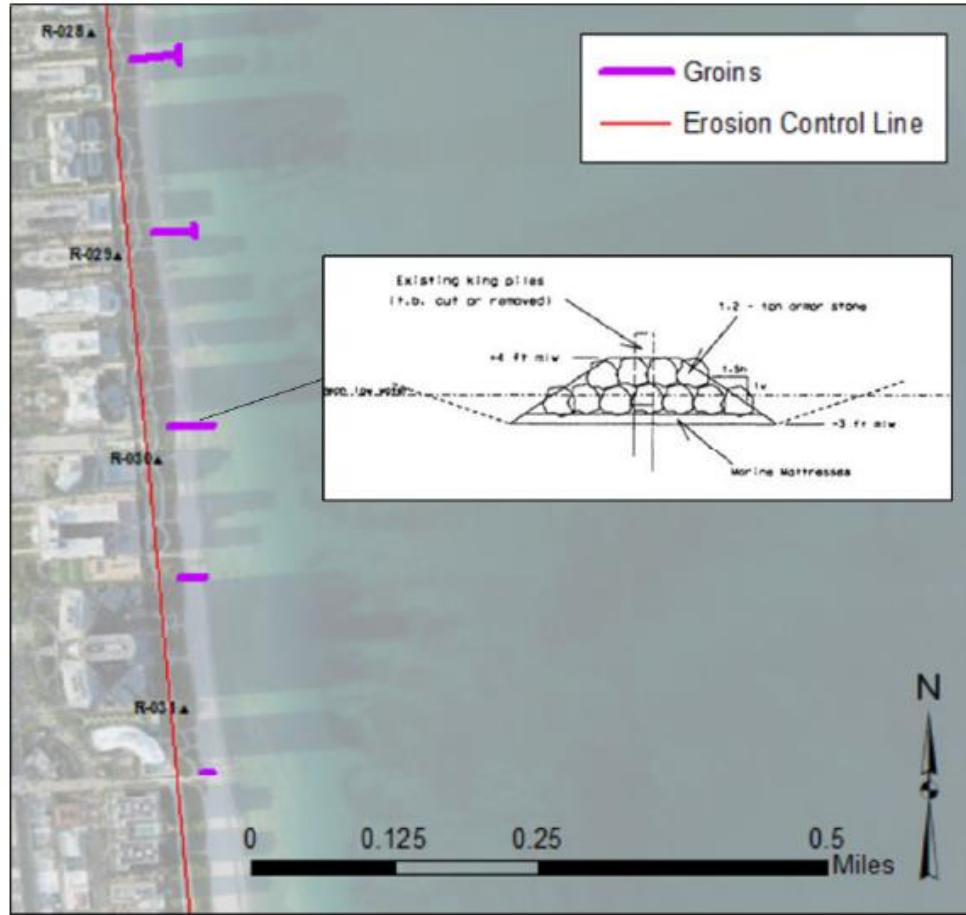


Figure adapted from USACE Miami-Dade County; Coastal Storm Risk Management Report dated November 2021



Thank You

