Performance and Design Considerations of Shore Protection Projects in St. Johns County

Florida Shore & Beach Preservation Association 34th National Conference on Beach Preservation Technology February 3-5, 2021

Presented by: Damon Douglas and Stephen Hammond

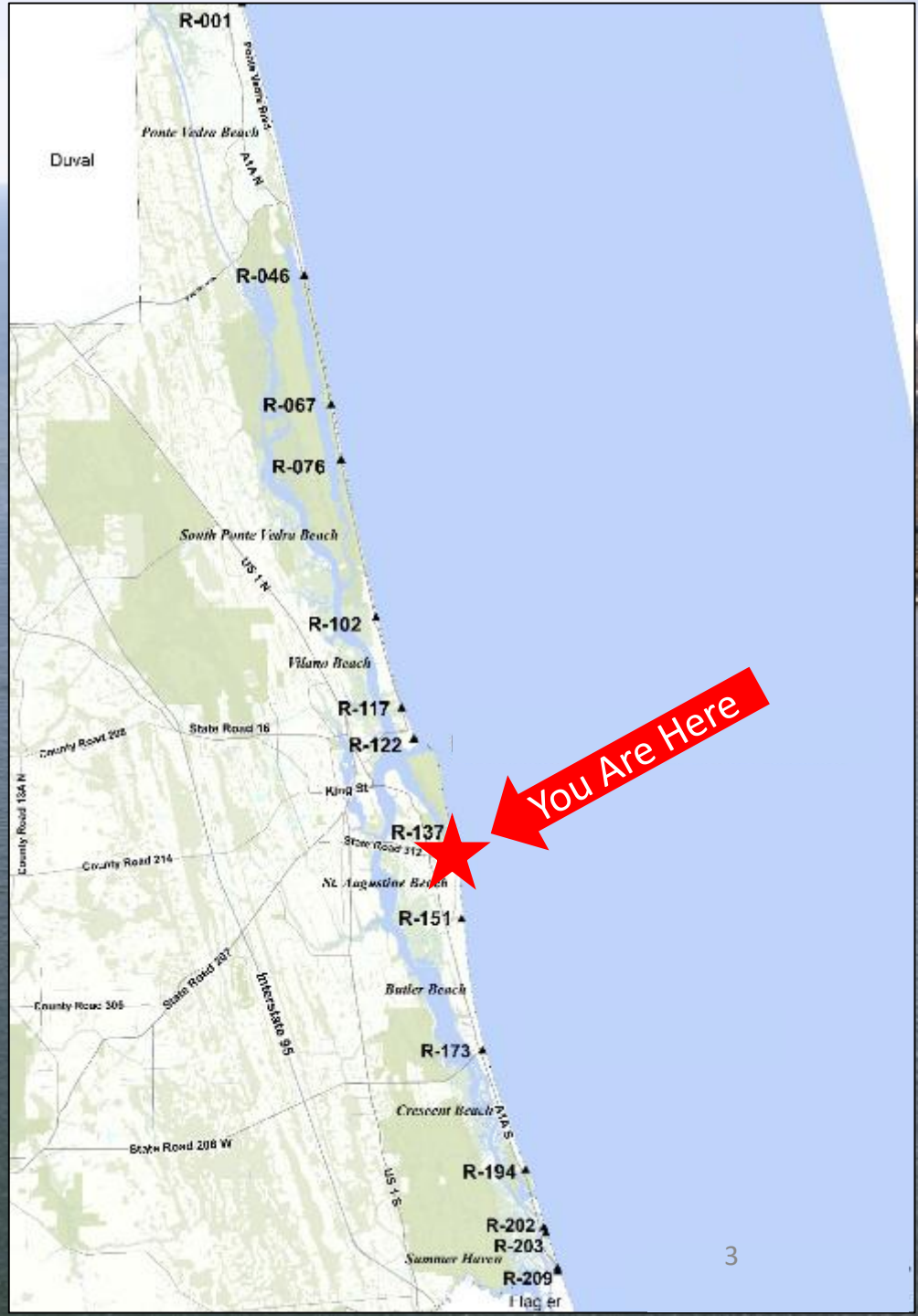
Co-Author: Rajesh Srinivas

Agenda

- Background
- Program Overview
- St. Johns County SPP

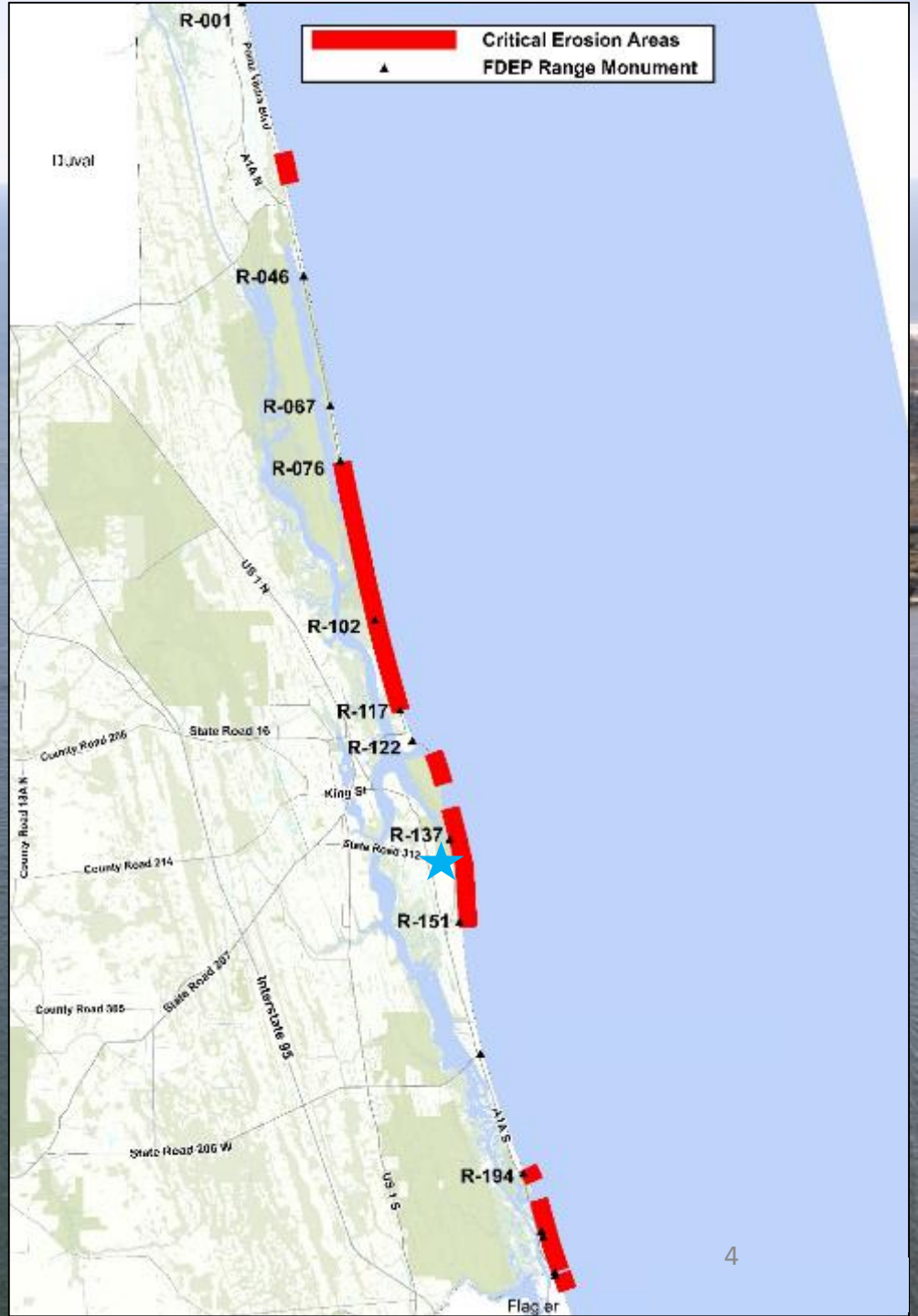
Background

- St. Johns County has 42 miles of Atlantic Coastline
- The County manages 32 miles of the shoreline
- FDEP designates 16.3 miles of our shoreline as critically eroded
- Another eight miles of non-designated beach also requires attention
- Primary causes of erosion:
  - Historic – St. Augustine and Matanzas Inlets
  - Present – Inlets, Hurricanes, Overwash, Seawalls



Background

- St. Johns County has 42 miles of Atlantic Coastline
- The County manages 32 miles of the shoreline
- FDEP designates 16.3 miles of our shoreline as critically eroded
- Another eight miles of non-designated beach also requires attention
- Primary causes of erosion:
  - Historic – St. Augustine and Matanzas Inlets
  - Present – Inlets, Hurricanes, Overwash, Seawalls



Background

- St. Johns County has 42 miles of Atlantic Coastline
- The County manages 32 miles of the shoreline
- FDEP designates 16.3 miles of our shoreline as critically eroded
- Another eight miles of non-designated beach also requires attention
- Primary causes of erosion:
  - Historic – St. Augustine and Matanzas Inlets
  - Present – Inlets, Hurricanes, Overwash, Seawalls

Background

- St. Johns County has 42 miles of Atlantic Coastline
- The County manages 32 miles of the shoreline
- FDEP designates 16.3 miles of our shoreline as critically eroded
- Another eight miles of non-designated beach also requires attention
- Primary causes of erosion:
  - Historic – St. Augustine and Matanzas Inlets
  - Present – Inlets, Hurricanes, Overwash, Seawalls

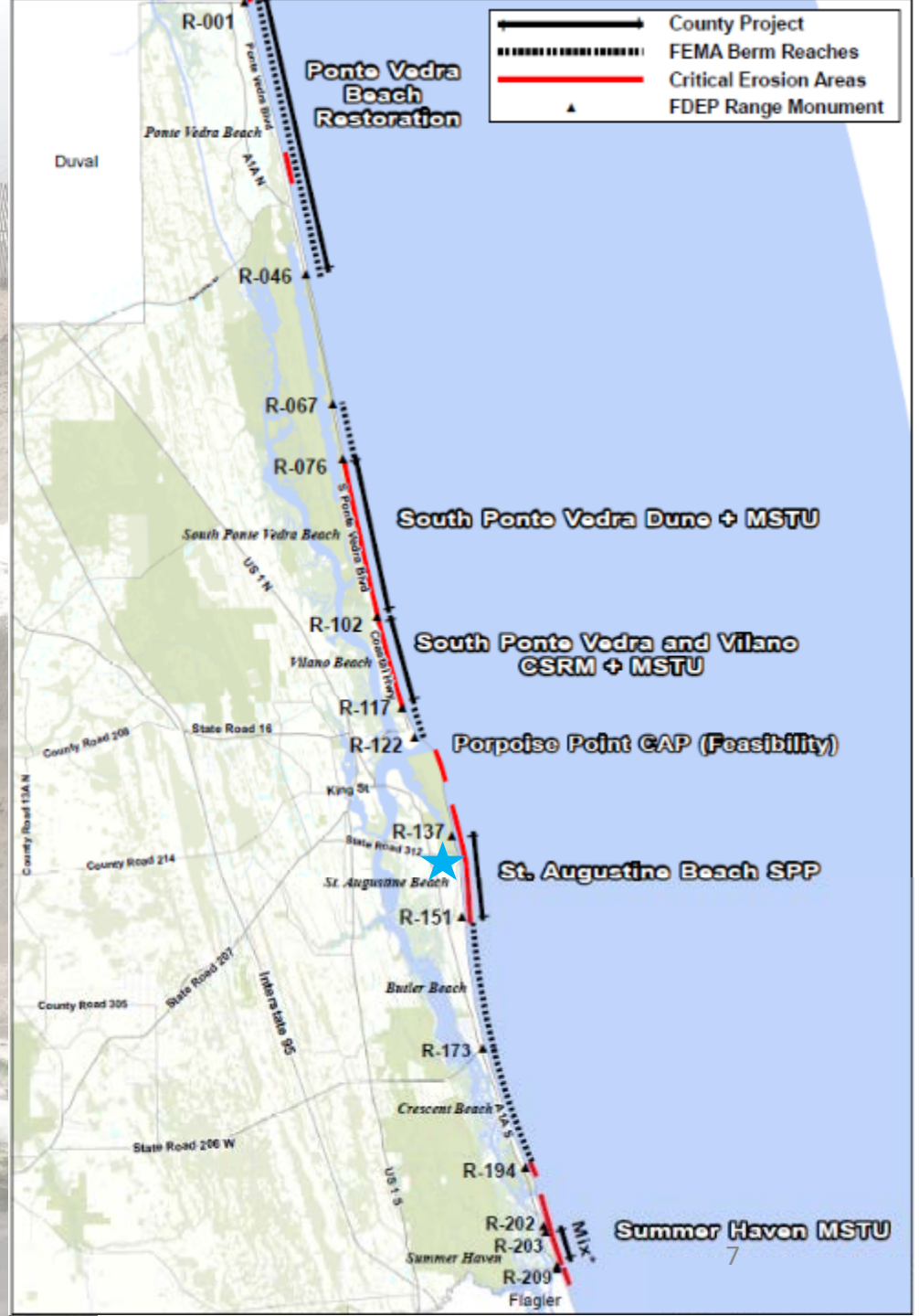






Ongoing Shoreline Initiatives

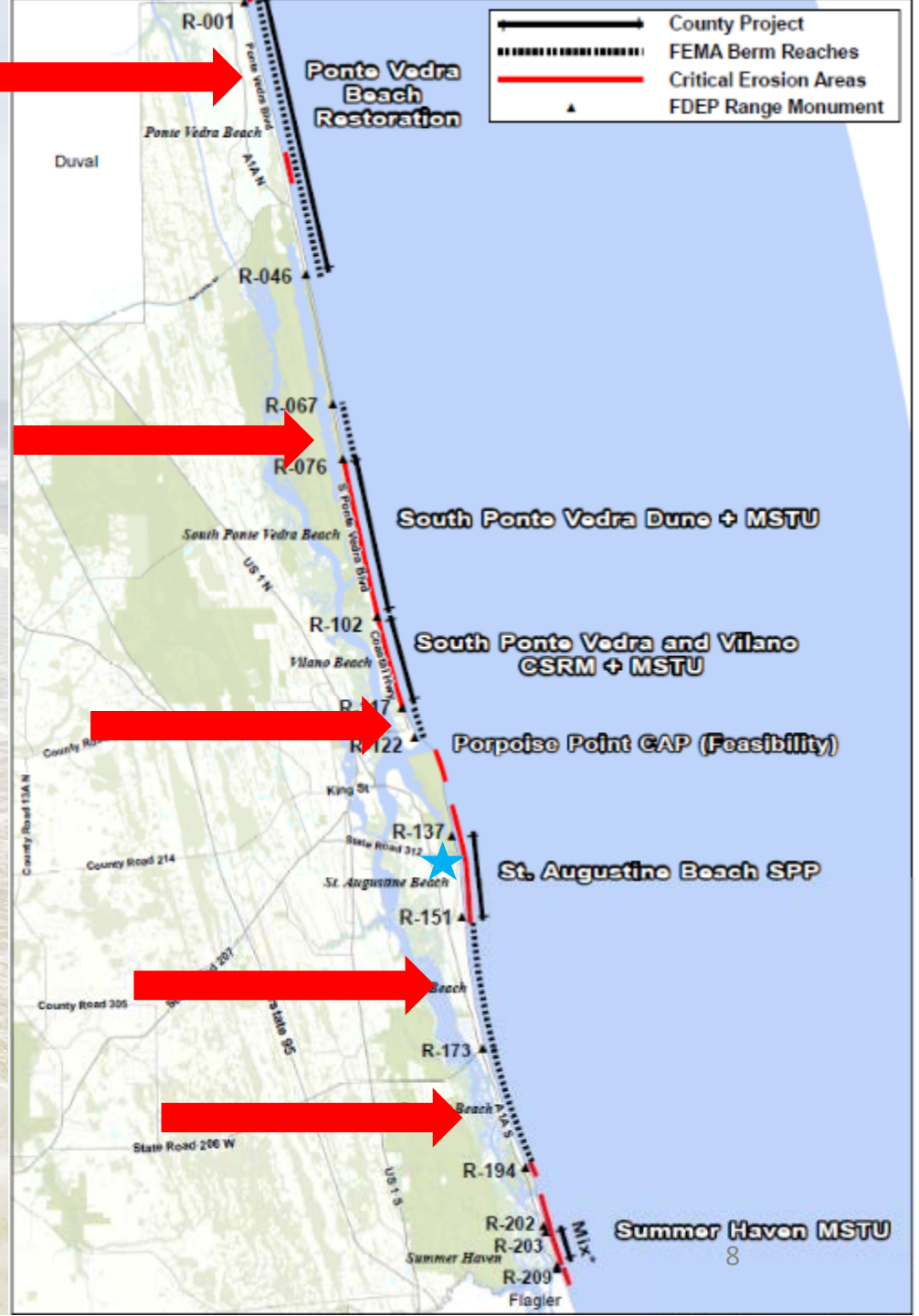
- 7 projects
- Covering 49 miles of shoreline
- Partnered with State, FEMA, and USACE
- Borrow sites include upland, offshore, and inlet complex



FEMA Hurricane Matthew Berms

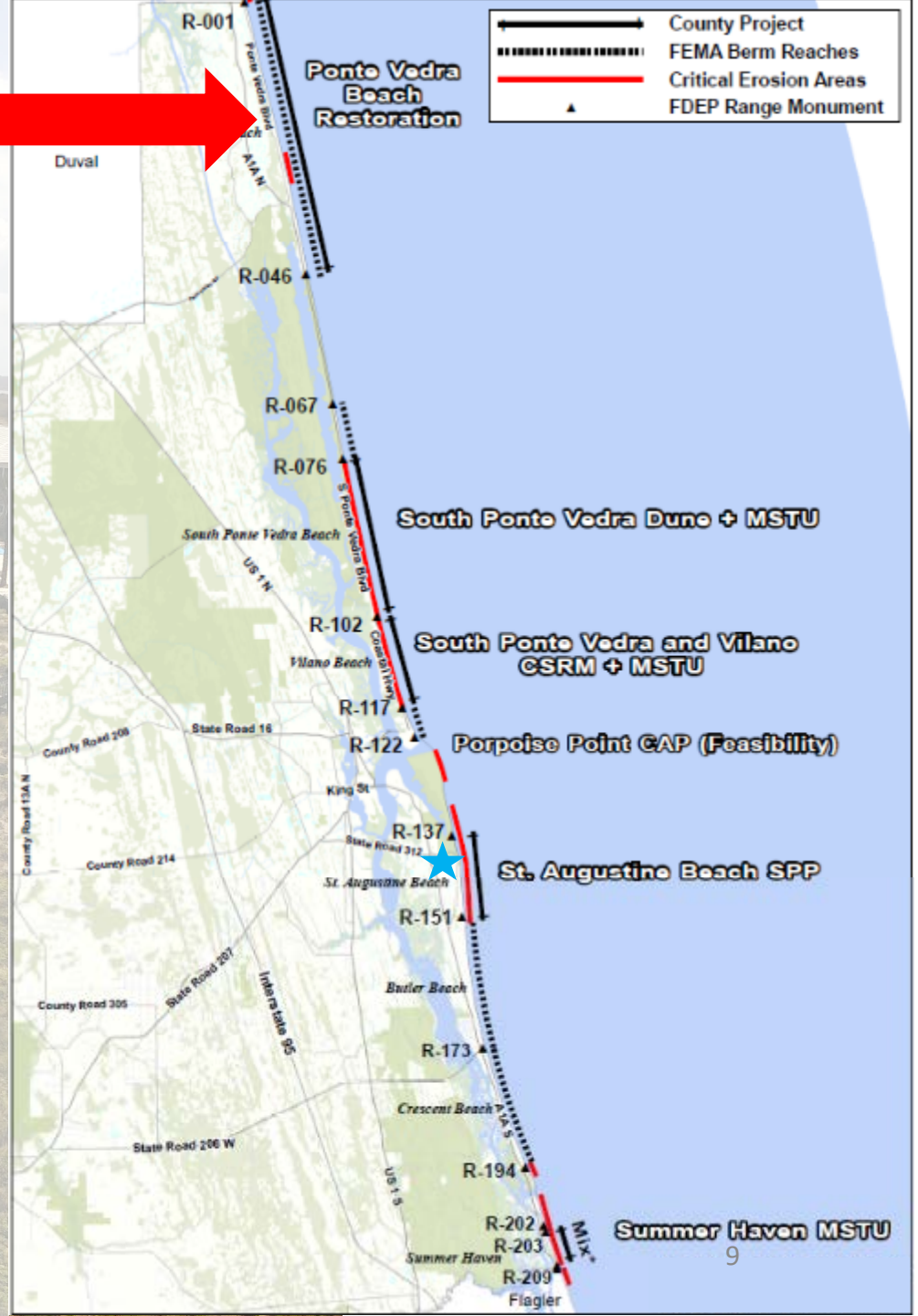
- Sands proposed to be obtained from upland mines
  - Truck hauled to the placement areas
- FEMA completed an EA on sand berms in Oct 2019
- The County is in final approval to bring aboard a design build firm

Beach	Reach	Length		Fill Volume	
		ft	miles	cy/ft	cy
Ponte Vedra Beach (N 1/2)	R1-R23	22,822	4.3	3.4	78,358
Ponte Vedra Beach (S 1/2)	R23-R46	24,106	4.6	4.2	101,338
South Ponte Vedra	R67-R76	9,366	1.8	5.3	49,899
Vilano	R117.5-R122	5,008	0.9	2.7	13,438
Butler	R151-R173	22,272	4.2	2.9	65,483
Crescent	R151-R194	20,811	3.9	4.6	95,416
Total		**104,385**	**19.8**	**3.9**	**403,932**



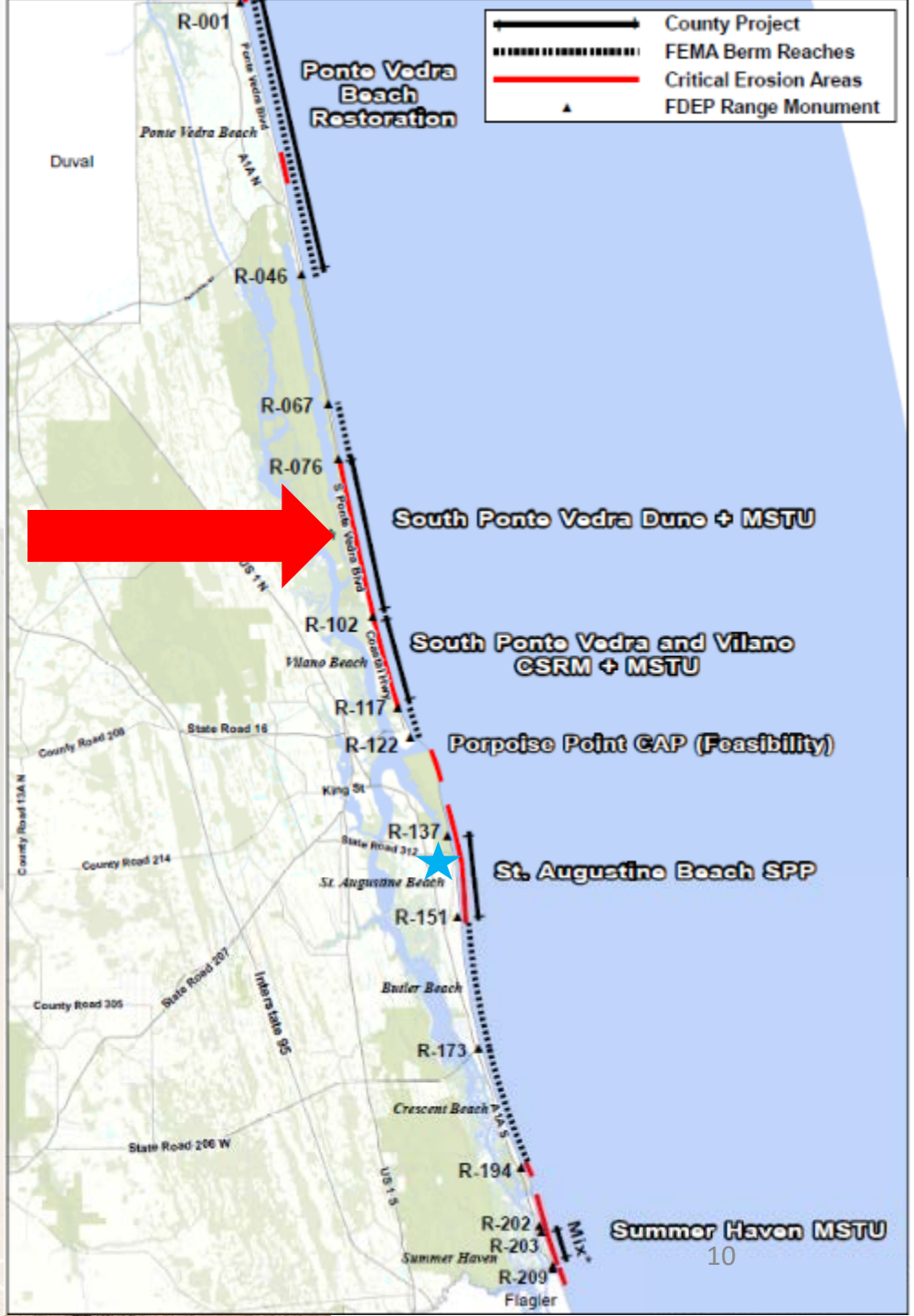
Ponte Vedra Beach Nourishment Project

- Experienced severe erosion from Hurricane Matthew and Irma
- Extends from R1 to R46
- Currently in the project development and permitting phase.
  - Engineering Formulation
  - Borrow Area Definition
  - Permitting – FDEP, USACE, BOEM Lease
- Funding – combination of state's special appropriations, MSTU, County tourism taxes
- Construction anticipated to begin in 2021



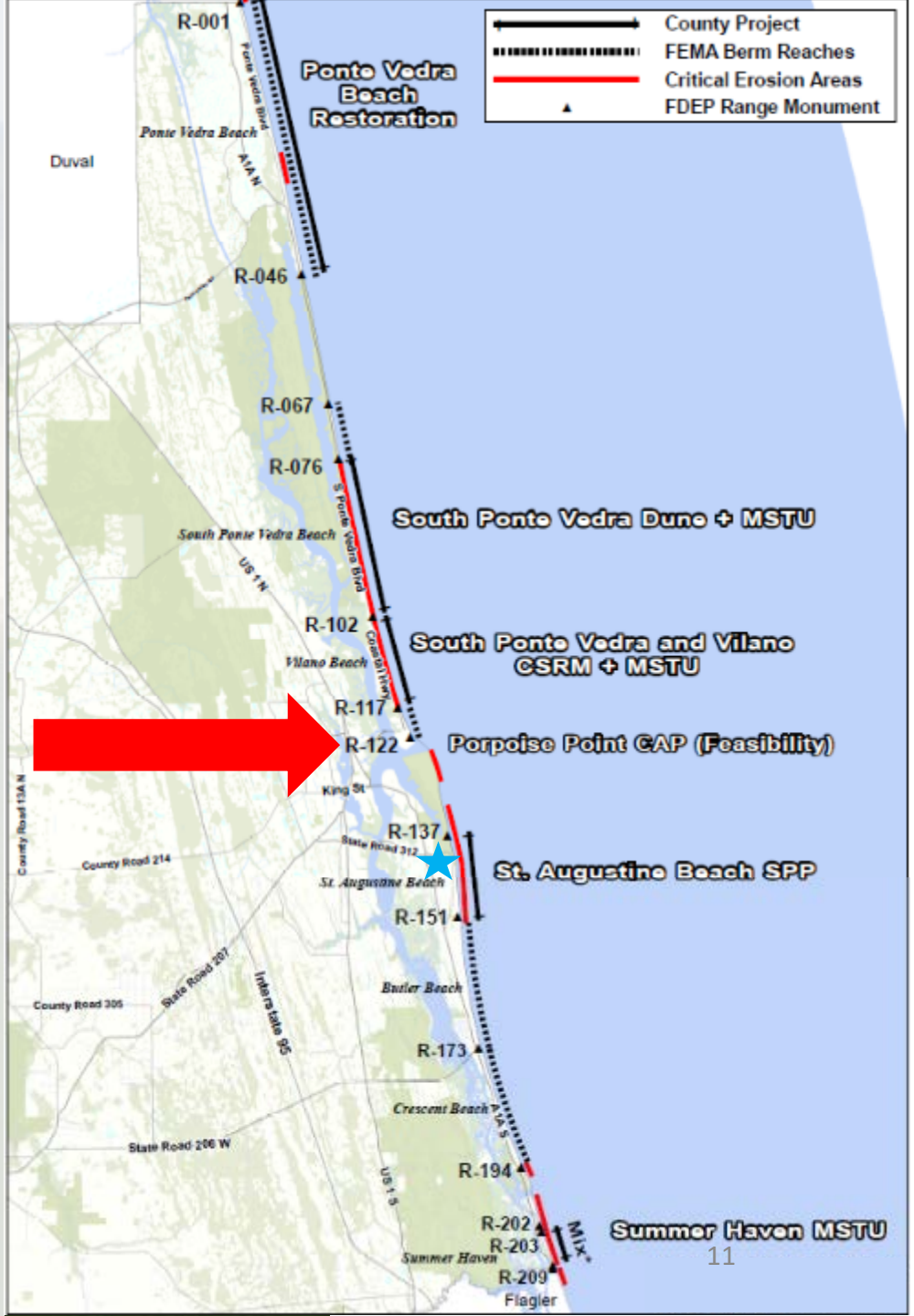
South Ponte Vedra Beach Dune Project

- Extent – R76 to R102.5
  - South end ties-in with new federal project
- Beach volume to average 20 cy/ft
- Borrow area in federal waters
- Permitting – FDEP, USACE, BOEM Lease
- Currently in final design phase
- Funding – State, MSTU, and County
- Construction anticipated Summer/Fall 2021



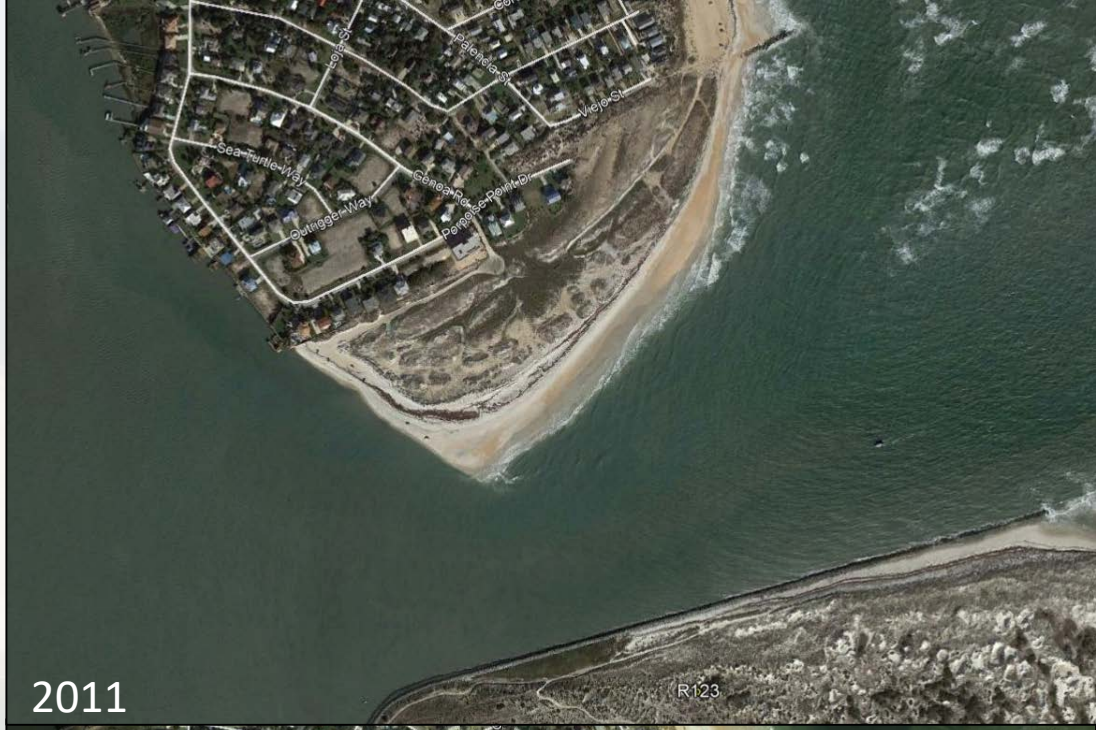
Porpoise Point

- Dynamic shoreline experiencing rapid sand loss in recent years
  - Erosion threatens homes and county road south of the St. Augustine Inlet north groin
- Frequent flooding during rain events
  - Inadequate drainage
  - Severe flooding during large events



Porpoise Point

- Dynamic shoreline experiencing rapid sand loss in recent years
  - Erosion threatens homes and county road south of the St. Augustine Inlet north groin
- Frequent flooding during rain events
  - Inadequate drainage
  - Severe flooding during large events

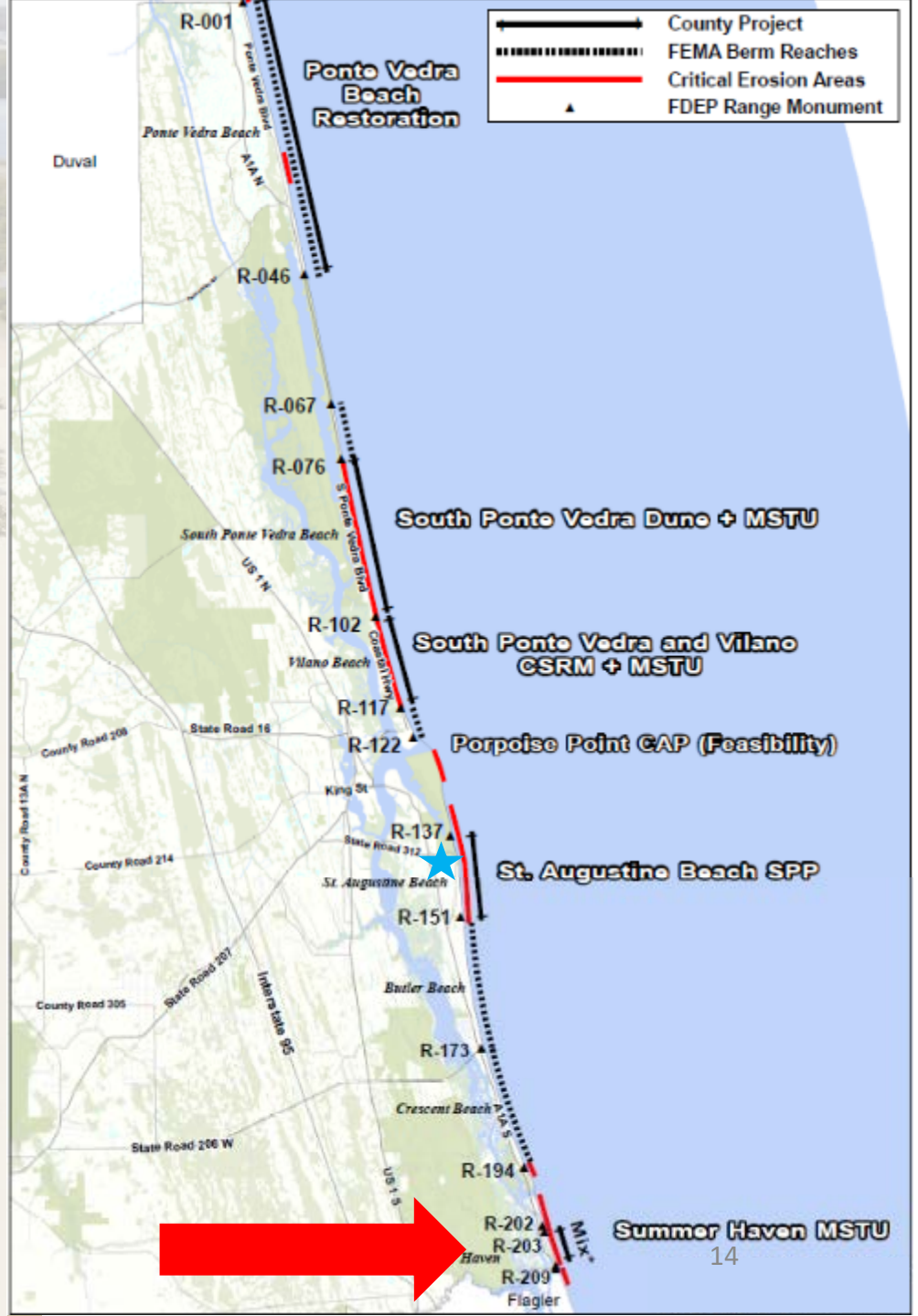


Porpoise Point

- USACE Hurricane and Storm Damage Reduction Project, Section 103 Continuing Authority Program
- Federal cost cannot exceed $10M
- Currently in the study phase
  - Federally funded up to $100,000. Costs over $100,000 are shared 50/50.
  - A screening process has narrowed project alternatives
  - Wrestling with CBRA issues
- Design and Construction Cost: 65% Federal, 35% Non-Federal

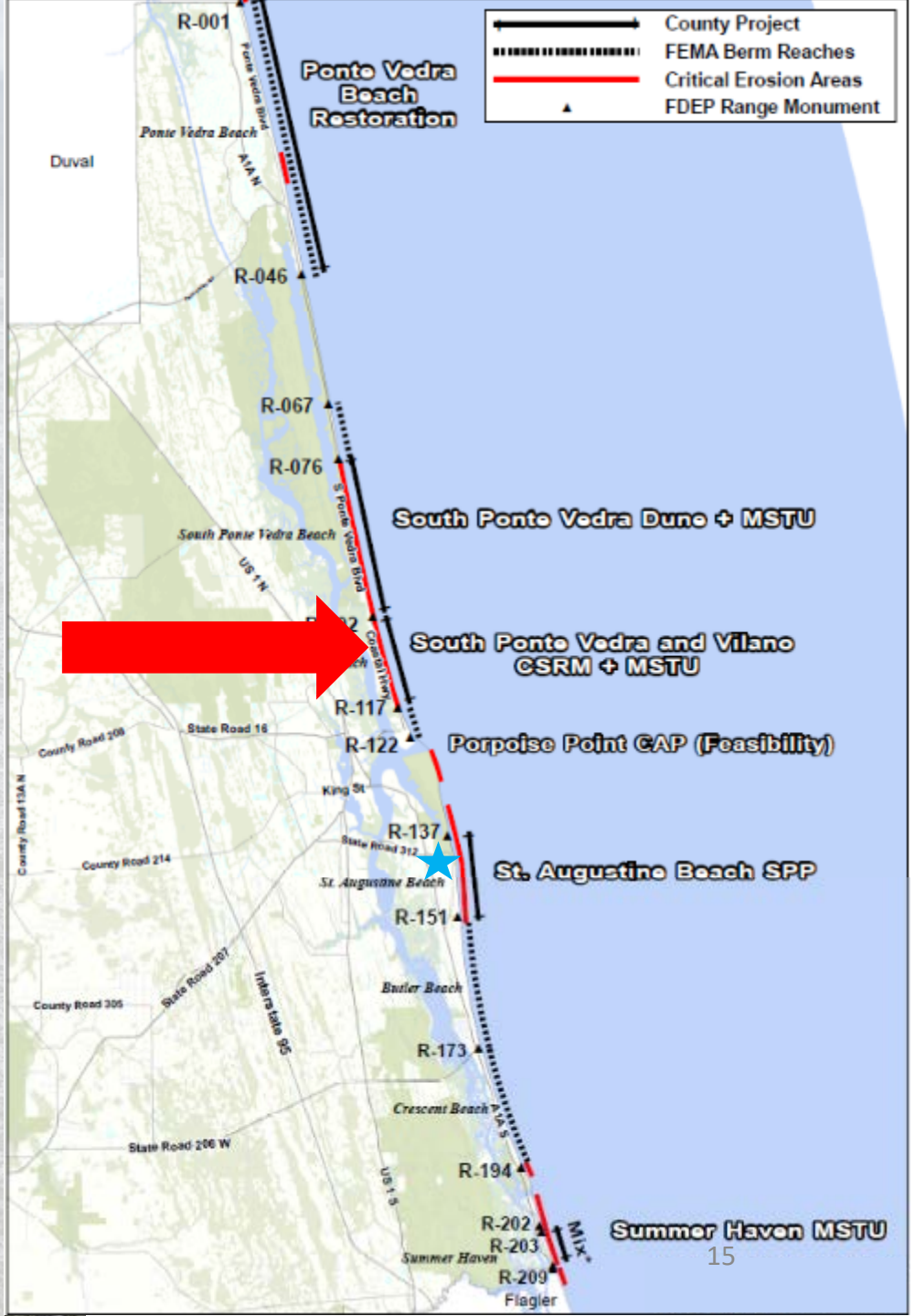
Summer Haven

- Long history of erosion, wash overs, and breaches
- Current Measure:
  - FEMA vegetated dune (Spring 2021)
  - Continue to collaborate with USACE and FIND to strategically place dredge material from the Intracoastal Waterway to mitigate erosion



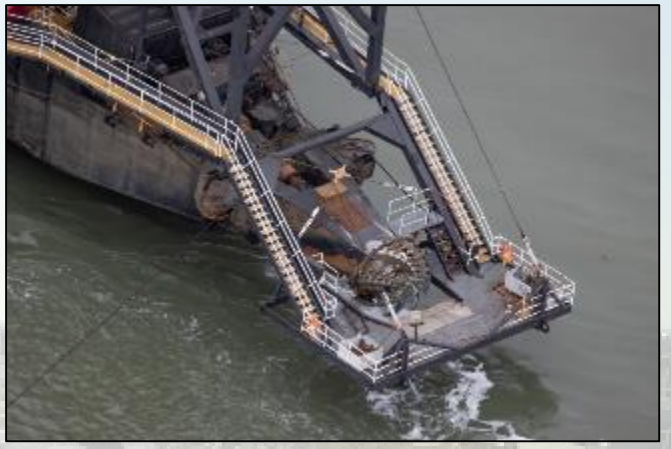
South Ponte Vedra and Vilano Beach CSRM

- Authorized by 2018 WRDA
- Length – Three Miles
  - R-102.5 to R-117.5
- 50-Year Project
- Borrow Site – St Augustine Inlet Flood Shoals
- Funded Federal 29%, State 24.6%, and Local 46.4%
  - Local share is funded through TDC and MSTU



South Ponte Vedra and Vilano Beach CSRM

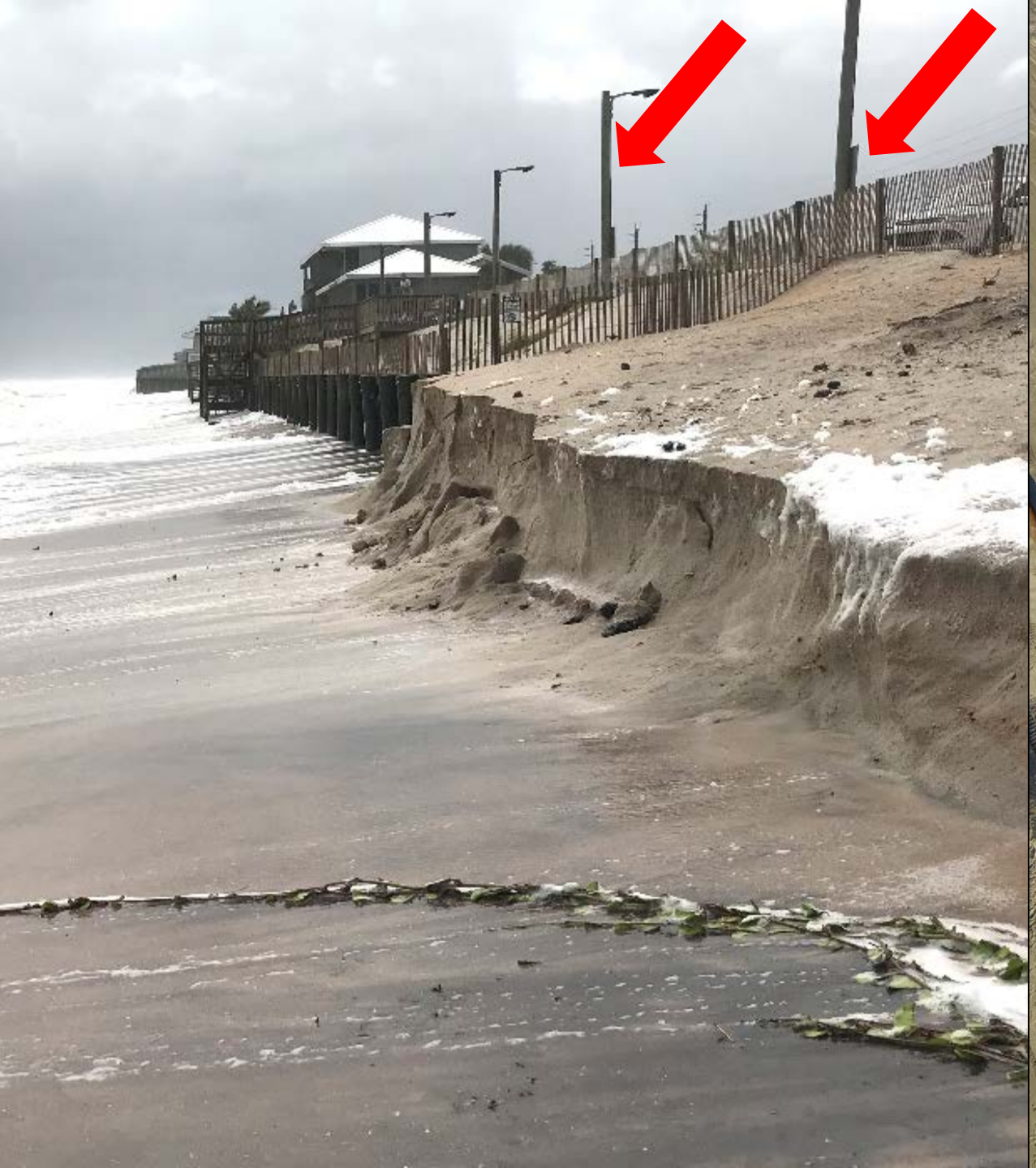
- Construction:
  - Great Lakes Dredging and Dock Company, LLC
  - The Dredge Ohio
  - 10/08/2020 – 01/05/2021
- 1.3 M CY final volume
- Project template includes vegetated dunes

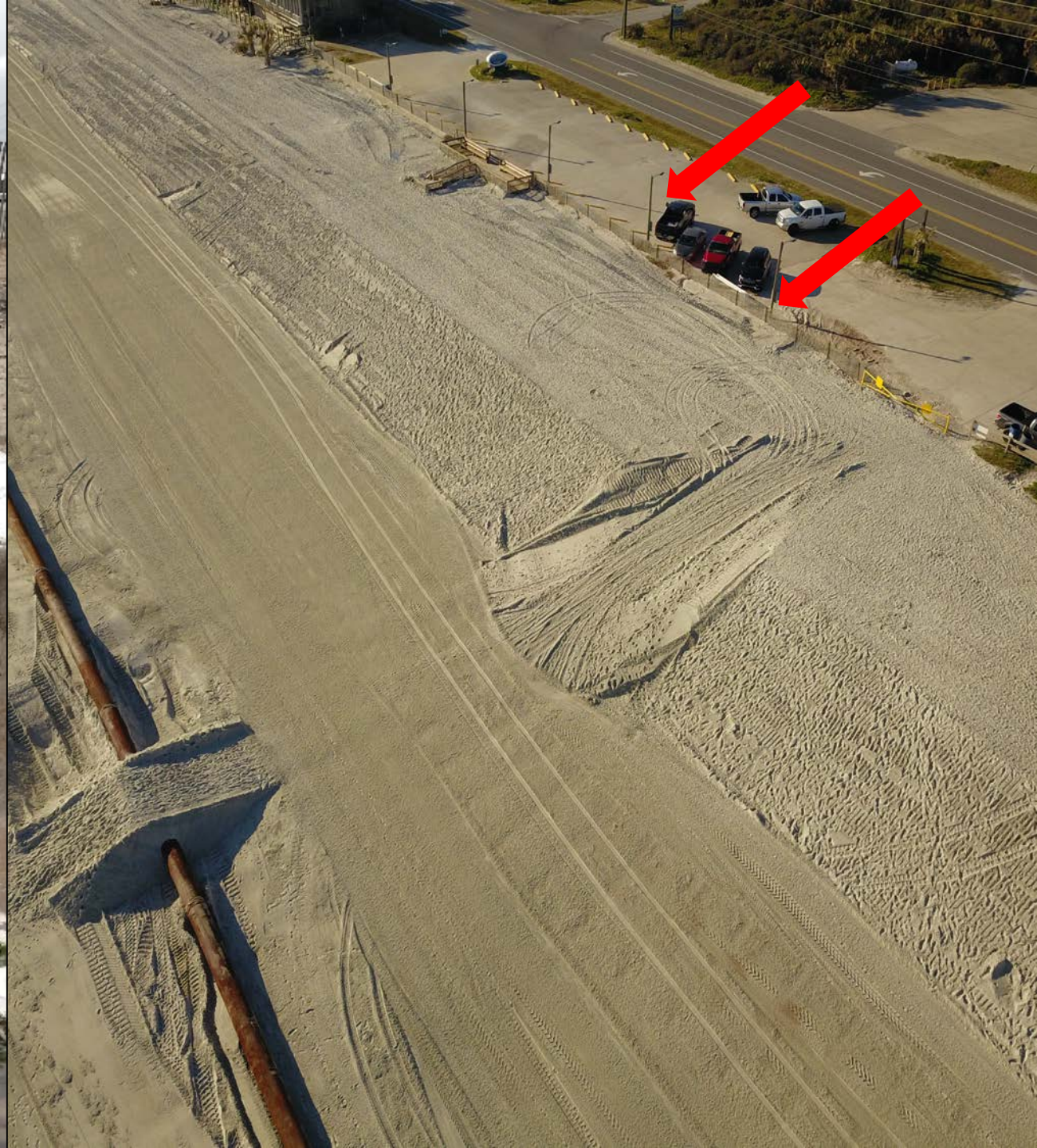


US Army Corps of Engineers®

Beginning of Project

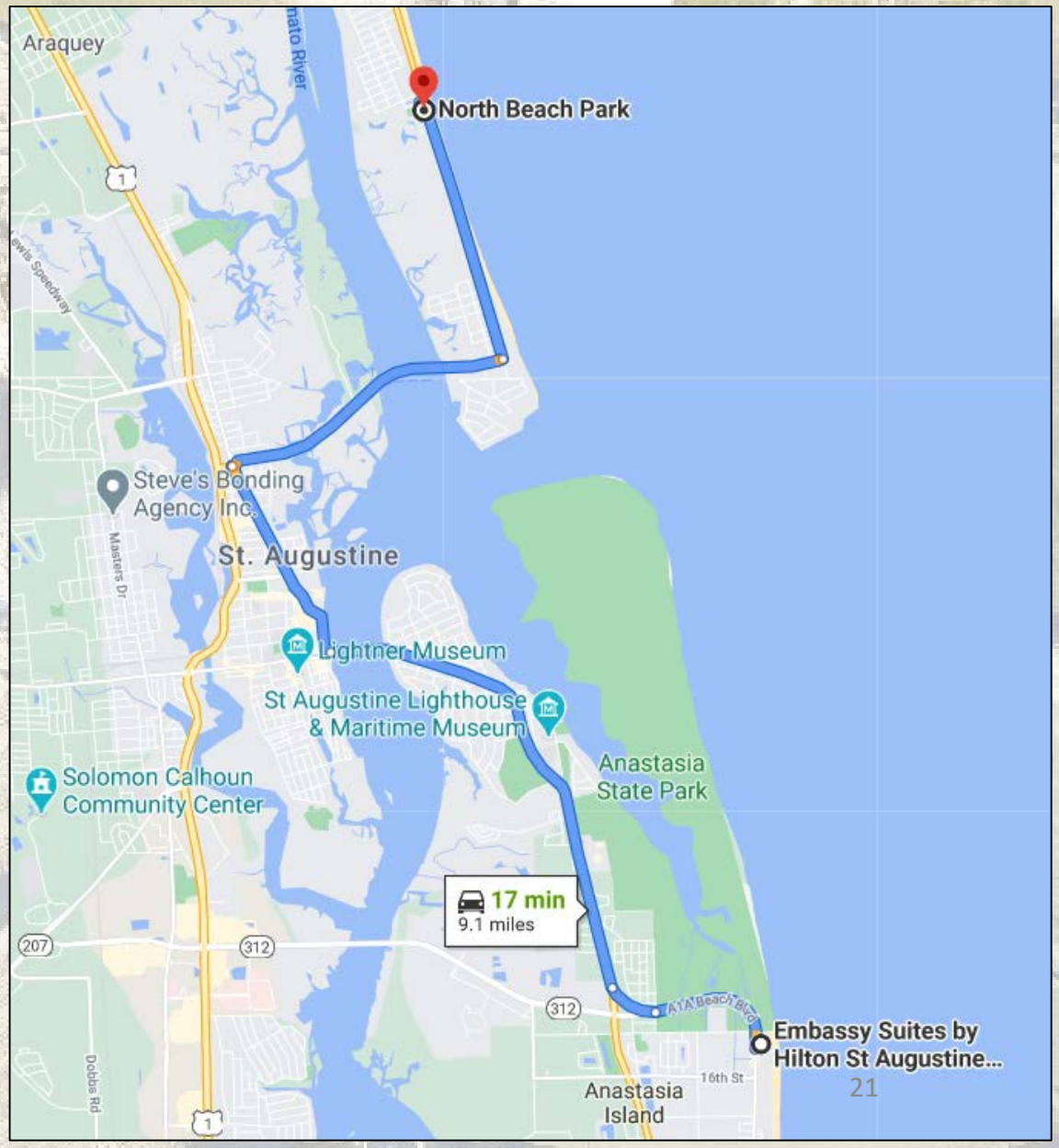
End of Project





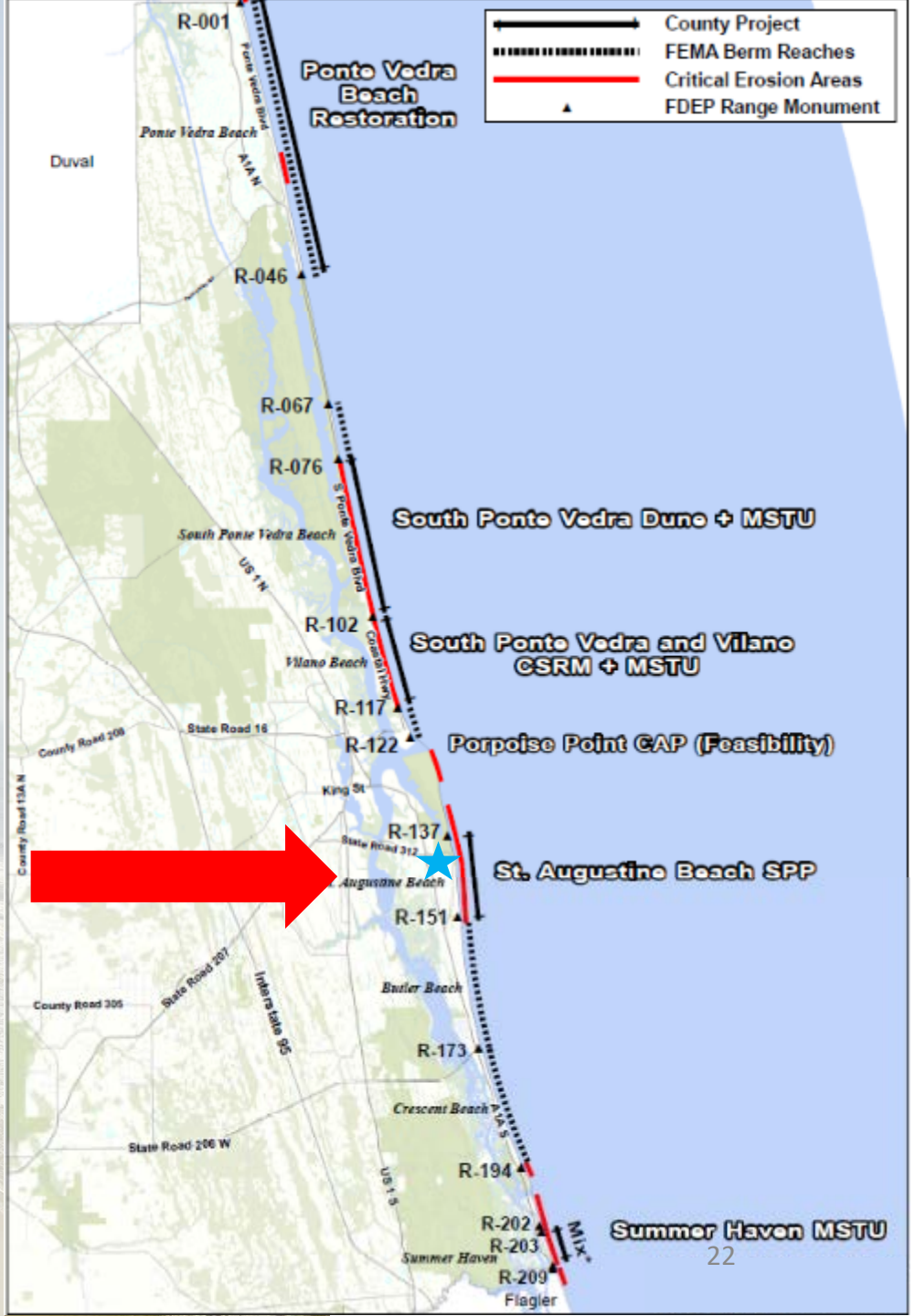
Directions to the CSRM

- 17 minutes drive North
- North Beach Park
  - North Beach Park, 3721 Coastal Hwy, St. Augustine, FL 32084



St. Johns County SPP

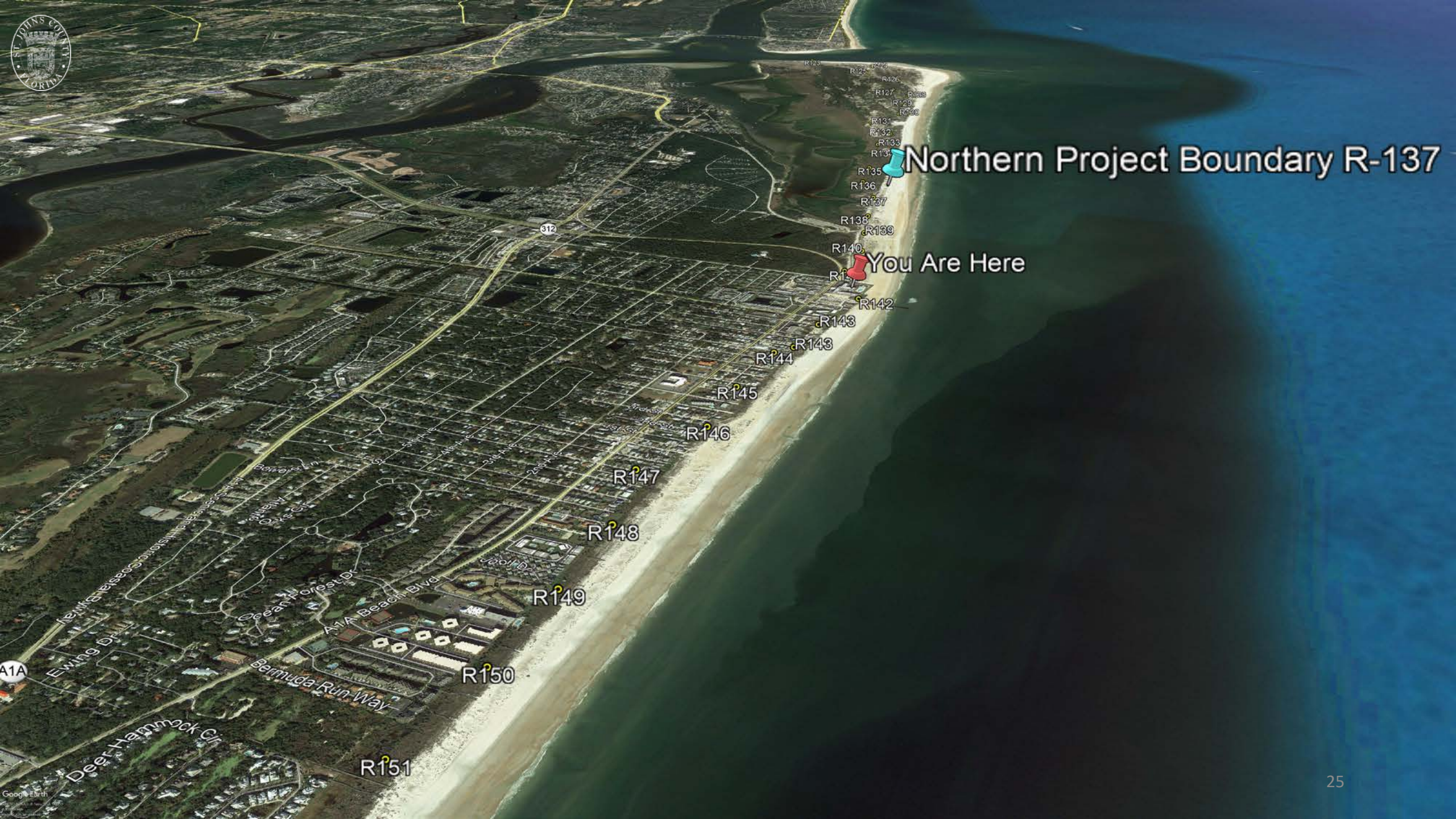
- Federal project, authorizes:
  - Extent = R137 to R150
  - Length = 2.7 miles
  - 60 ft berm extension at 9.0 ft NAVD88
  - Renourishment interval = 5 years
- Borrow Area: St. Augustine Inlet Channel and Ebb Shoal
- Cost Shares: Federal 80.5%, State 8.5%, County 11%

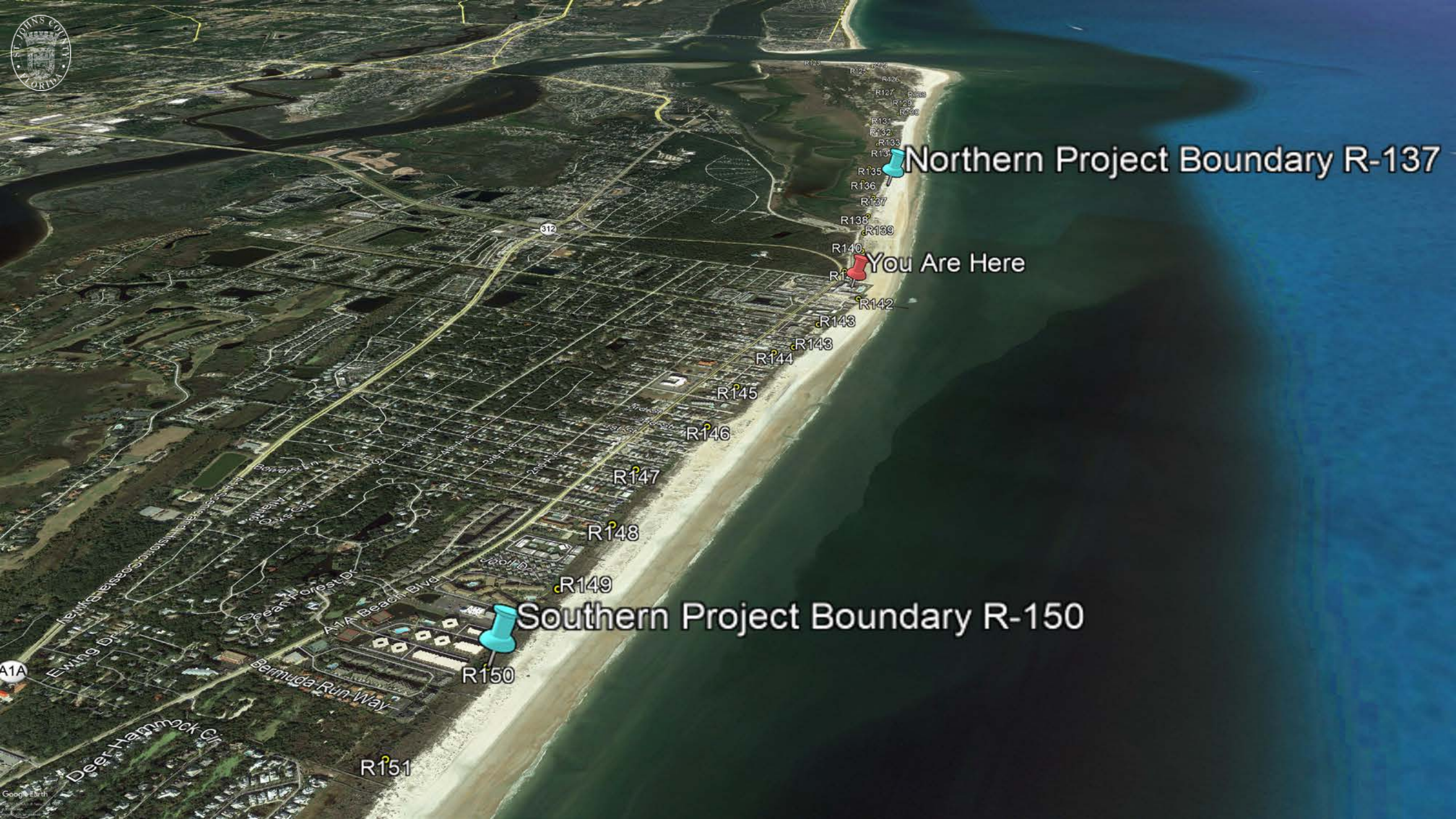


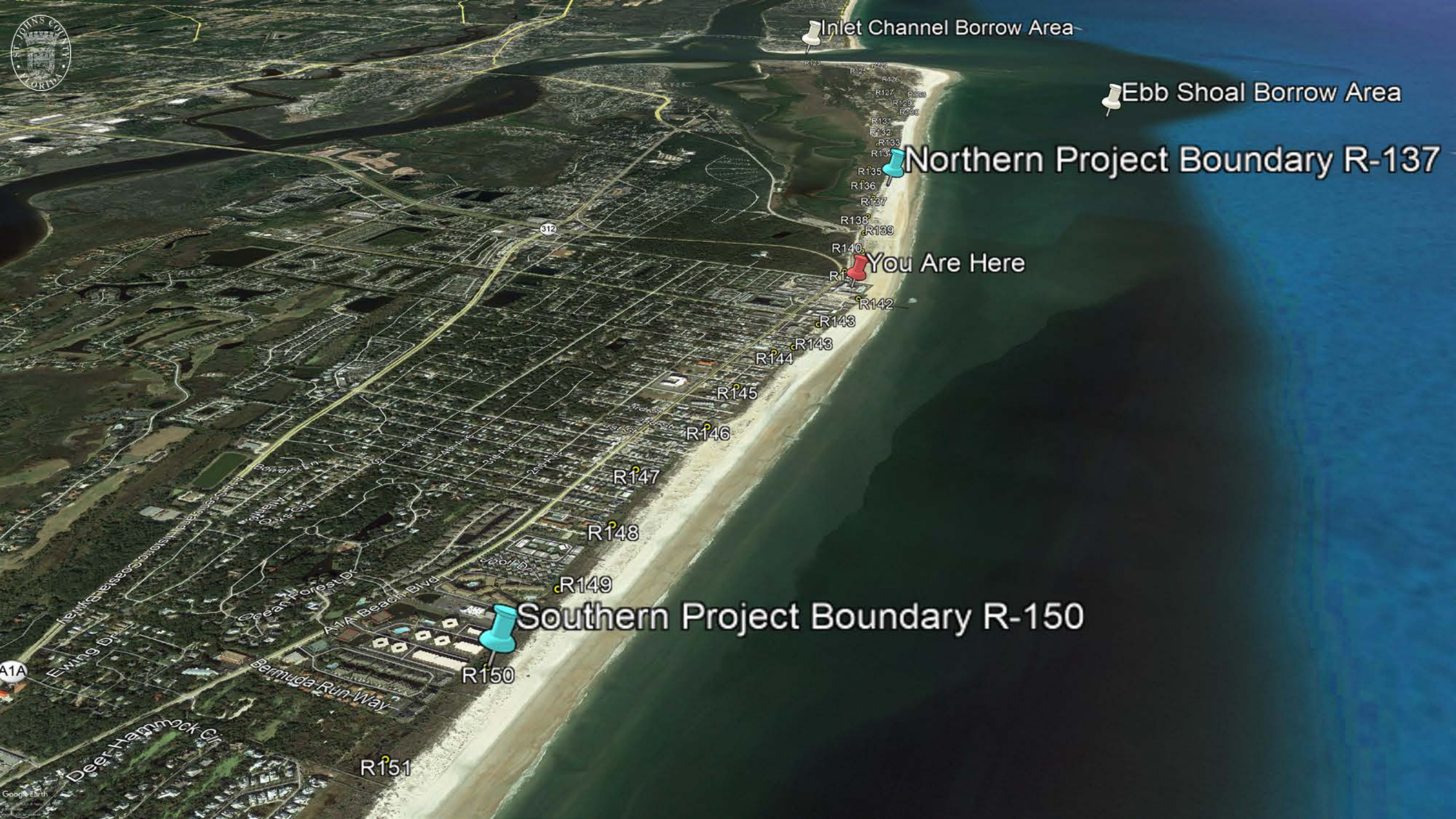
St Johns County Shore Protection Project

Project Analysis


R123
R125
R126
R127
R128
R129
R130
R131
R132
R133
R134
R135
R136
R137
R138
R139
R140
You Are Here
R142
R143
R143
R144
R145
R146
R147
R148
R149
R150
R151
312
A1A
A1A Beach Blvd
Ocean Forest Dr
Ewing Dr
Bermuda Run Way
Deer Hammock Cir
Google Earth


Northern Project Boundary R-137
You Are Here
R137
R138
R139
R140
R142
R143
R143
R144
R145
R146
R147
R148
R149
R150
R151
312
A1A
A1A Beach Blvd
Ocean Forest Dr
Ewing Dr
Bermuda Run Way
Deer Hammock Cir
Google Earth


Northern Project Boundary R-137
You Are Here
Southern Project Boundary R-150
R123
R125
R126
R127
R128
R129
R130
R131
R132
R133
R134
R135
R136
R137
R138
R139
R140
R141
R142
R143
R143
R144
R145
R146
R147
R148
R149
R150
R151
312
A1A
A1A Beach Blvd
Ocean Forest Dr
Ewing Dr
Bermuda Run Way
Deer Hammock Cir
Google Earth


Inlet Channel Borrow Area
Ebb Shoal Borrow Area
Northern Project Boundary R-137
You Are Here
Southern Project Boundary R-150
R123
R125
R126
R127
R128
R129
R130
R131
R132
R133
R134
R135
R136
R137
R138
R139
R140
R142
R143
R143
R144
R145
R146
R147
R148
R149
R150
R151
312
A1A
A1A Beach Blvd
Ocean Forest Dr
Ewing Dr
Bermuda Run Way
Deer Hammock Cir
Google Earth

Background

- Initial construction 2001-2003 (in two phases)
- Renourishment in 2005 (FCCE), 2012, and 2018
- Affected by Hurricanes Frances and Jeanne in 2004, Matthew in 2016, Irma in 2017, Dorian in 2019
  - Project performed very well protecting upland infrastructure
- Total sand volume placed = 9.4 Mcy

Pre-Initial Construction (circa 2000)

2018 Construction

2018 Post-Construction

Other Projects Relevant to SPP

- 2002 State Project in Anastasia State Park
  - 470,000 cy + dune vegetation and sand fences – R132 to R141
    - Beach and dune – R132 to R137
    - Dune only – R137 to R141
- USACE dredged material disposal events in ASP
  - IWW-dredged sands disposal
    - 2005 – 124,904 cy
    - 2012 – 122,648 cy
  - Inlet-dredged sand placement
    - 2013 – 182,998 cy

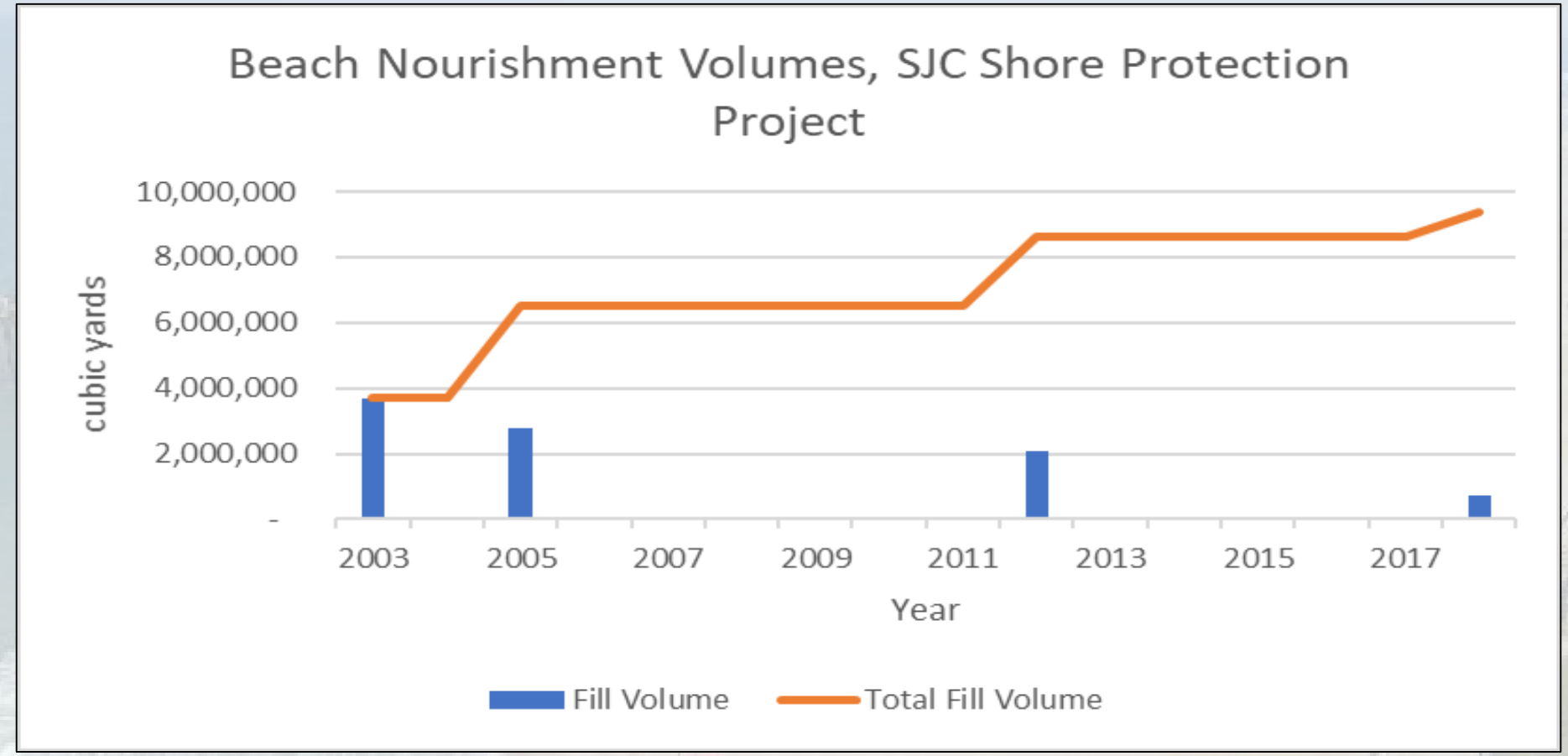
Non-Federal Dune Enhancements

- 2003 – local planting and sand fencing initiatives
  - Southern portion of the project
- 2006 – planting project
  - 4,000 ft in the ASP and 7,100 ft in the southern portion of the project
  - 75,000 plants
  - Created secondary dune system
  - Port District and City of St. Augustine Beach funds
- 2019 – planting project
  - 6,500 ft in the southern portion of the project
  - 43,100 plants
  - Created secondary dune system
  - Achieved 100% success after six months
  - City of St. Augustine Beach funds

Project Analysis

- Split the project coastline into three sections
  - Natural (R-137 to R-139)
  - Developed exposed seawall (R-140 to R-144)
  - Developed south of seawall (R-145 to R-151)
- Analyzed parameters
  - Placement Volume
  - Dune Growth
  - Profile Slope Evolution
  - Beach volume changes

Placement Volumes

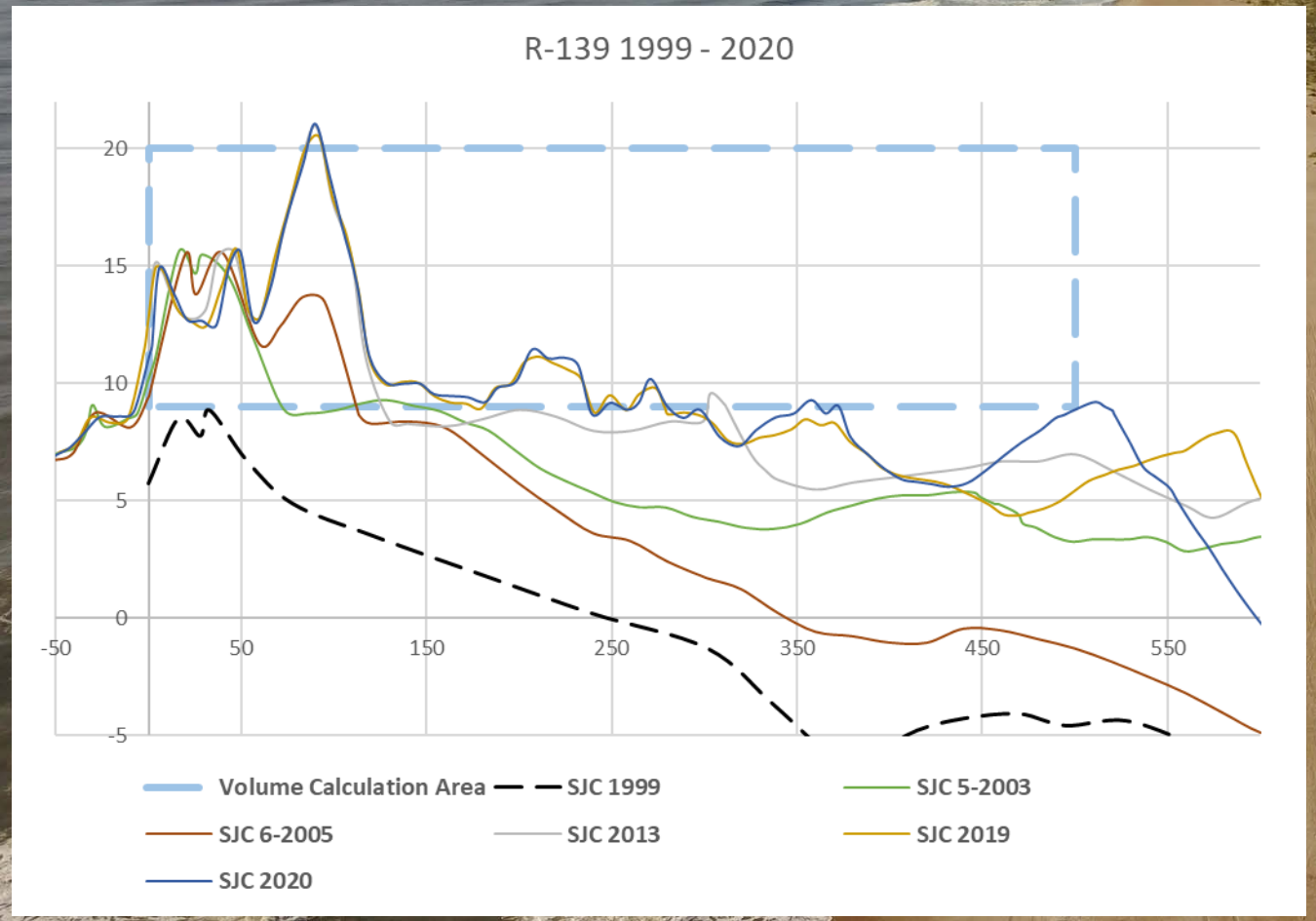


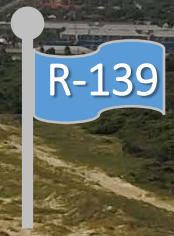
Date	Volume Placed	Length	Segment
2003	3,800,000	2.7	R137-R151
2005	2,800,000	2.7	R137-R151
2012	2,100,000	1.5	R139-R147
2018	750,000	0.9	R139.7-R144.4

Dune Growth

Dune Growth

Dune Growth





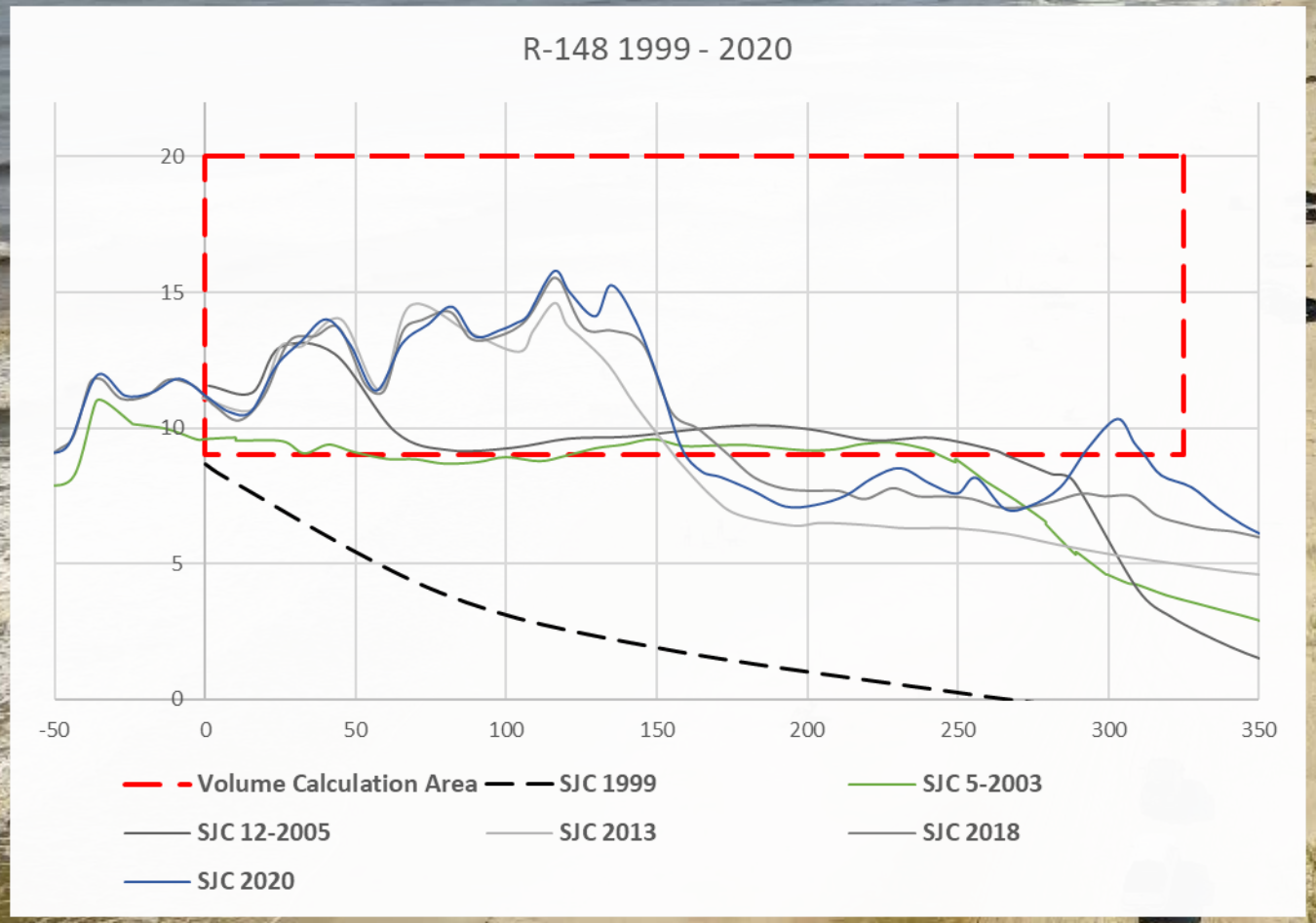
Volume Above +9 ft		
Year Post Project	FT^3	CY
2003	309	11
2005	451	17
2013	766	28
2019	889	33
2020	884	33

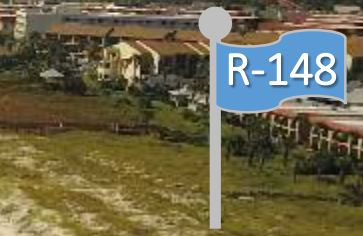
8/04/2020

Dune Growth

Dune Growth

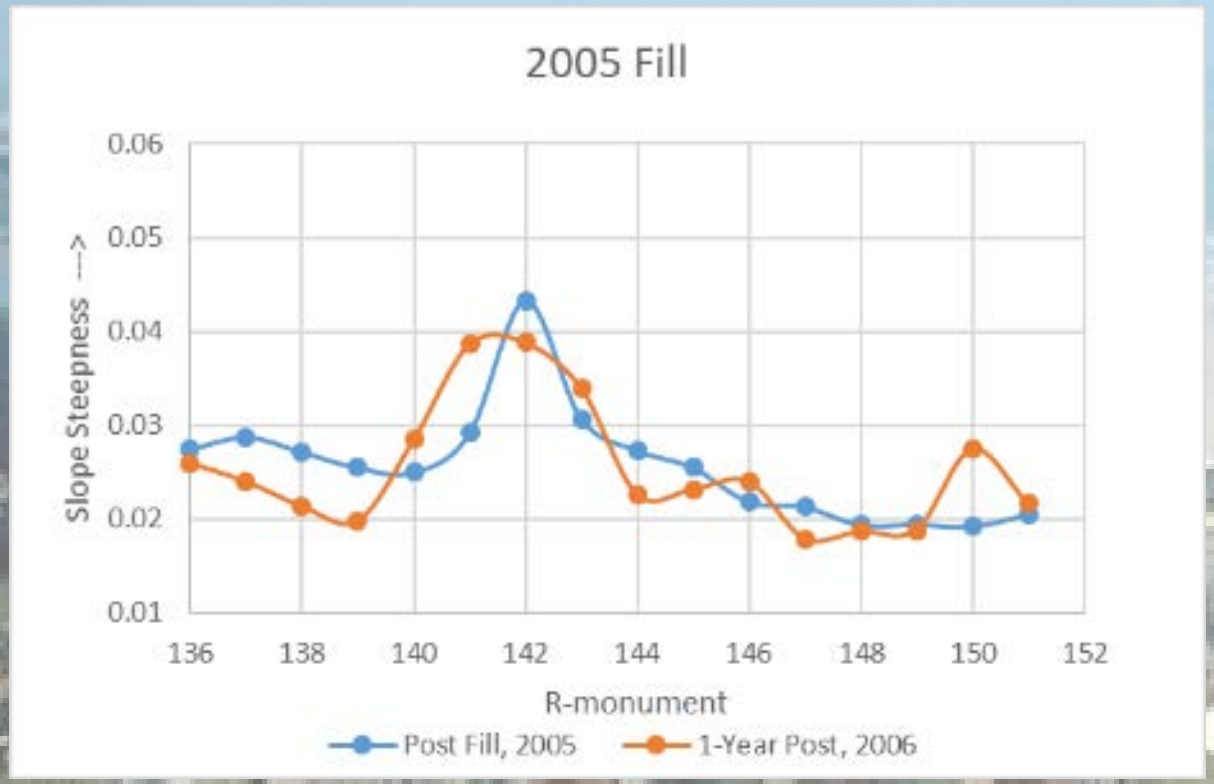
Dune Growth

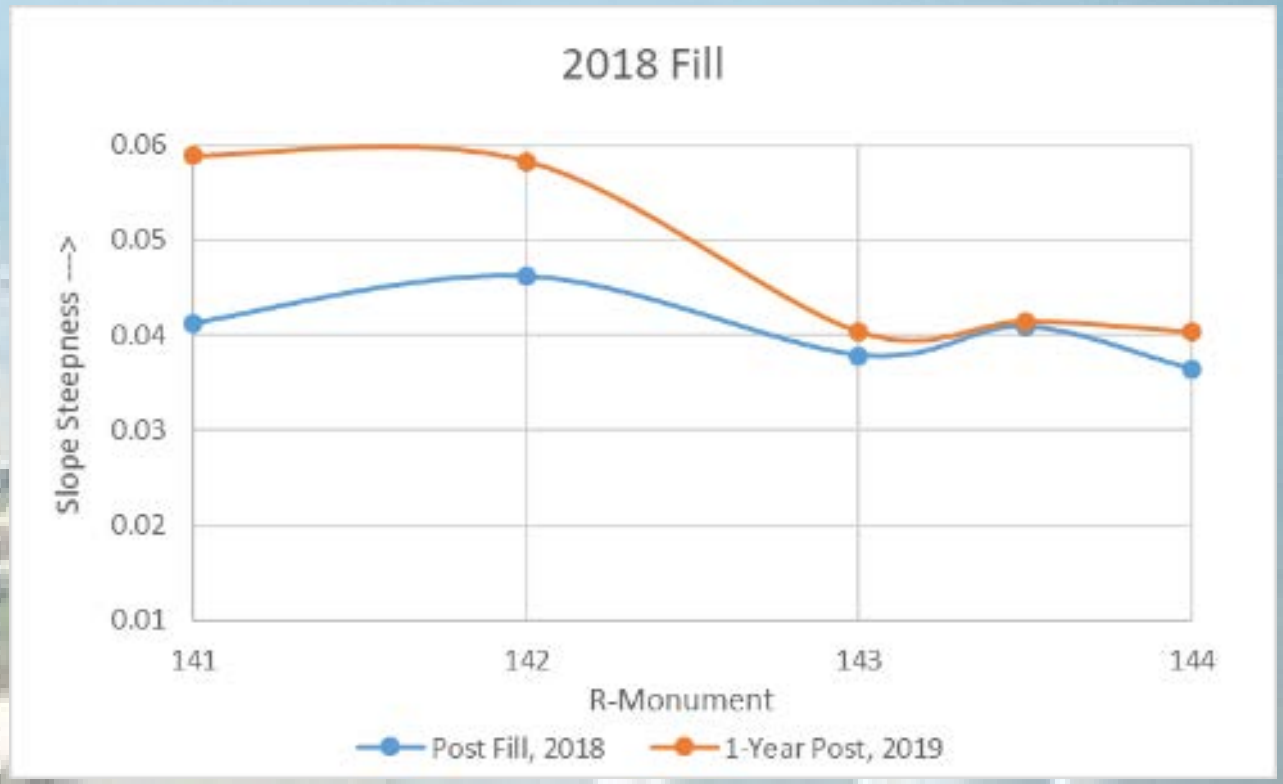




Volume Above +9 ft		
Year Post Project	FT^3	CY
2003	62	2
2005	314	12
2013	565	21
2018	641	24
2020	674	25

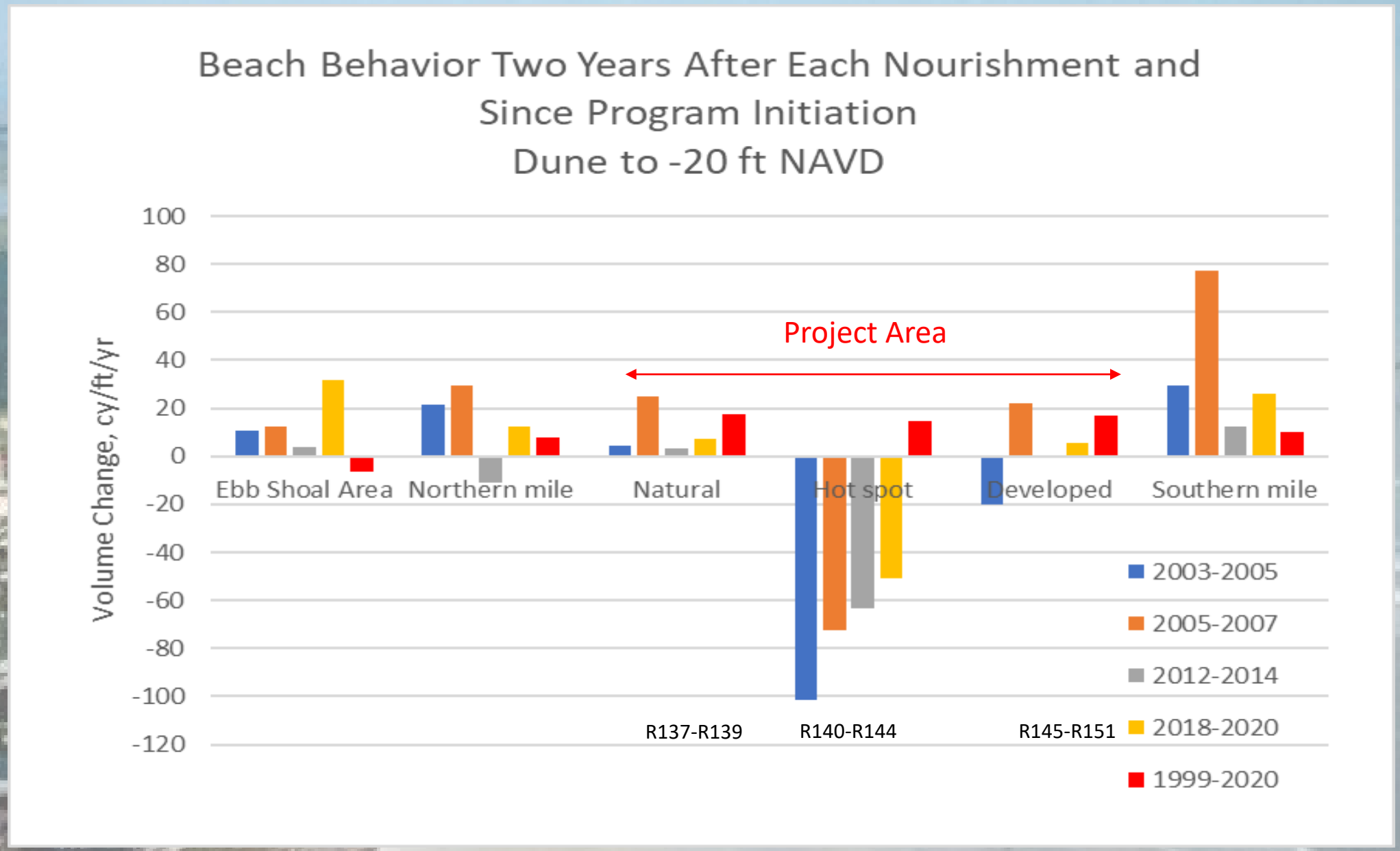
Slope Calculations





		Natural	Hot spot	Developed
Average	Post 2005	0.027	0.031	0.021
	1 Year Post 2006	0.023	0.033	0.022
	Post 2018		0.041	
	1 Year 2019		0.050	

Beach Fill Performance



SPP – Volume Change

Period	Location		Length	Total Volume Change*
			ft	CY
1999-2020	SPP	R137-R151	15,097	5,100,000
1999-2020	Inlet Influence Region	R123-R151	29,877	4,700,000
1999-2020	Southern Mile	R152-R157	5,962	1,300,000
***Dune to -20 ft NAVD**				

SPP – Volume Change

Period	Location		Length	Total Volume Change*	Volume Placed**	Volume Change Ex-Fill	
			ft	CY	CY	CY	CY/YR
1999-2020	SPP	R137-R151	15,097	5,100,000	9,400,000	(4,300,000)	(200,000)
1999-2020	Inlet Influence Region	R123-R151	29,877	4,700,000	10,300,000	(5,600,000)	(270,000)
1999-2020	Southern Mile	R152-R157	5,962	1,300,000	0	1,300,000	60,000
***Dune to -20 ft NAVD**							
****Includes SPP borrow source, and inlet and IWW dredging projects**							

Evolution of Inlet Influence on South Beach

- Inlet's southern influence extends 5.7 miles (R-123 to R-151)
- 2014 IMP allows 185,333 cy/yr mechanical bypassing to the south
- Recent data suggest inlet dredging allowed by the IMP may prove insufficient to fully mitigate erosion within (southern) region of inlet influence

Period	Volume Change Ex-Fill
	CY/YR
1999-2020	(270,000)
1999-2010*	(179,300)
1974-1995	(384,500)
*Legault et al. (2012)	
** Srinivas and Taylor (1989)	

Summary

- Over the 19 years of the St. Johns County SPP
  - Placed over 9.4 Mcy of sand
  - More sand on the beach now than before the project
  - Dune enhancement projects have successfully brought about primary and secondary dune growth
  - Profile equilibration shows expected flattening everywhere, except in the hotspot
  - The 2014 Inlet Management Plan sediment budget may not allow enough mechanical sand bypassing to fully mitigate erosion in the project area


Questions?

Contacts

- Damon Douglas
  - Coastal Manager
  - St. Johns County Disaster Recovery
  - Phone (904) 209-0794
  - Email ddouglas@sjcfl.us
- Rajesh Srinivas, PhD, PE
  - Phone (904) 233-9612
  - Email rvsrini@gmail.com
- Stephen Hammond, EIT
  - Coastal Environment Project Manager
  - St. Johns County Disaster Recovery
  - Phone (904) 209-0272
  - Email shammond@sjcfl.us