

# Storm Damage Reduction Project Town of Duck, North Carolina



Coastal Planning & Engineering of North Carolina  
May 21, 2014

Ken Willson

# Outline:

- Engineering & Design:
  - Storm Analysis Update
  - Vulnerability Analysis Update
  - Design Analysis
  - Proposed Design – Discussion
- Schedule Update:
  - Environmental Documentation
  - Engineering Design
  - Offshore Sand Search
- Q & A

# Storm Analysis Update

## Feasibility Study

Return Period	H <sub>s</sub> (ft.)	T <sub>p</sub> (s)	Storm Stage (ft. NAVD)
1	17.6	9.9	4
5	21.2	12.9	4.2
10	22.7	14.2	4.8
20	24.3	15.5	5.7
25	24.8	16	5.8
50	26.3	17.3	6.2

Storm	Date	Measured Data			Approximate Return Period (years)		
		H <sub>s</sub> (ft)	T <sub>p</sub> (s)	Water Level (ft. NAVD)	H <sub>s</sub>	T <sub>p</sub>	Water Level
Perfect Storm	Oct-91	15.1	22.5	4	< 1	> 50	1
Hurricane Isabel	Sep-03	27.3	15.6	5.6	>50	20	10 to 20
Hurricane Irene	Aug-11	24.8	13.6	3	25	5 to 10	< 1
Hurricane Sandy	Oct-12	17.3	13.3	4.5	~ 1	5 to 10	5 to 10

# Storm Analysis Update

## Design Study

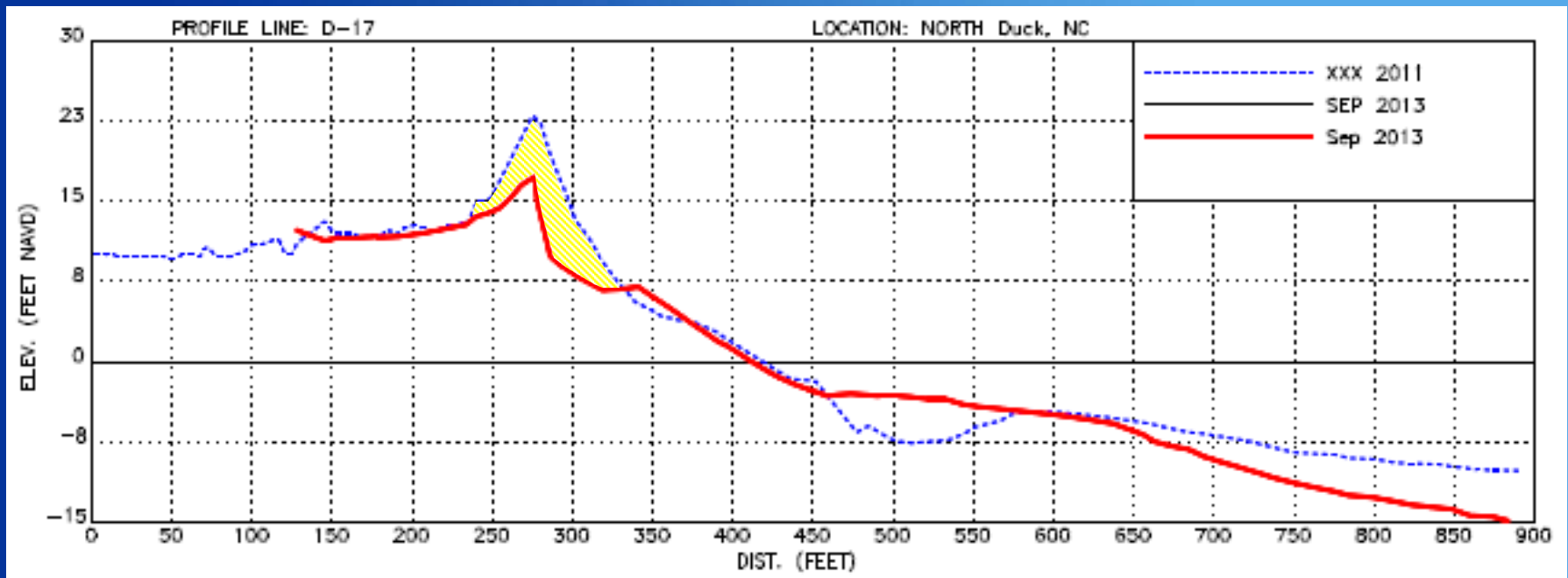
Return Period	H <sub>s</sub> (ft.)	T <sub>p</sub> (s)	Storm Stage (ft. NAVD)
1	15.5	12.8	3.7
5	21.0	16.2	4.5
10	23.7	17.6	4.9
20	26.6	19.0	5.3
25	27.5	19.5	5.4
50	30.5	20.9	5.9

Storm	Date	Measured Data			Approximate Return Period (years)		
		H <sub>s</sub> (ft)	T <sub>p</sub> (s)	Storm Surge (ft. NAVD)	H <sub>s</sub>	T <sub>p</sub>	Storm Surge
Perfect Storm	Oct-91	15.1	22.5	4	< 1	> 50	1
Hurricane Isabel	Sep-03	26.7	17.4	4.4	20	10	25 to 50
Hurricane Irene	Aug-11	24.8	13.6	3	25	5 to 10	< 1
Hurricane Sandy	Oct-12	17.3	13.3	4.5	~ 1	5 to 10	5 to 10

# Beach Profile Surveys

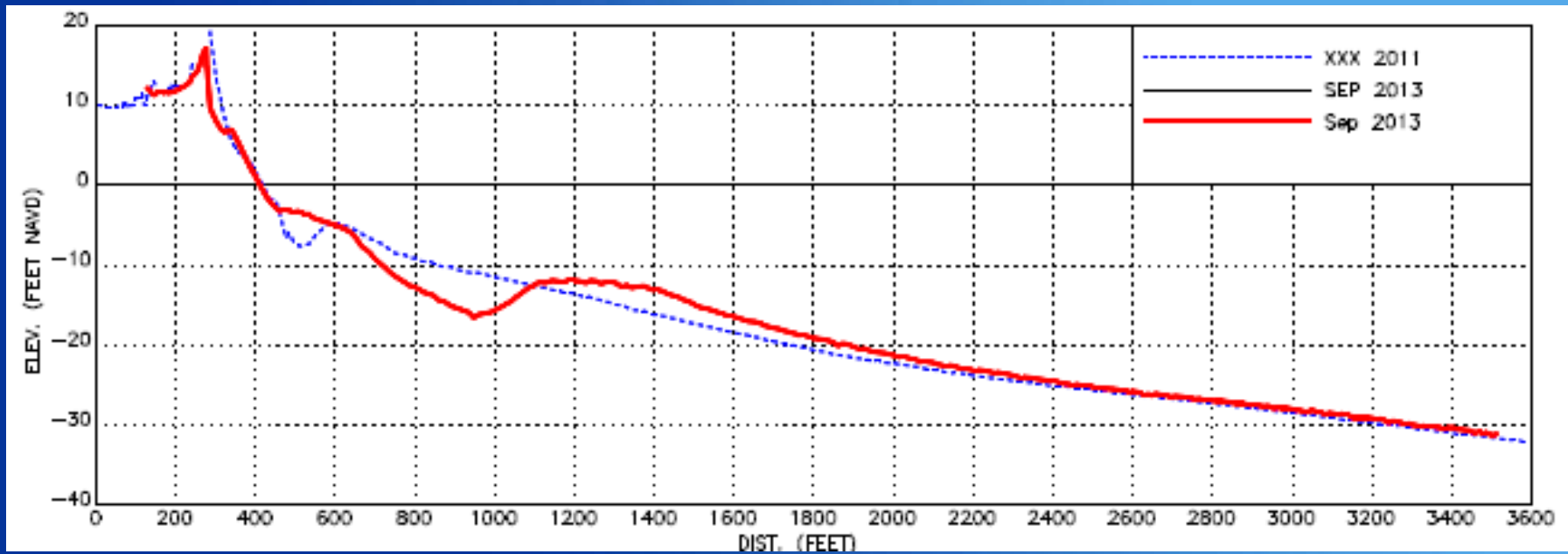


# Beach Profile Surveys





# Beach Profile Surveys



# Vulnerability Analysis Update

## Feasibility Study Values

Segment	Structures Impacted during Storm Event under Existing Conditions					
	1-Year	5-Year	10-Year	20-Year	25-Year	50-Year
1	-	-	-	-	-	-
2	-	-	-	-	2	2
3	-	-	-	1	1	2
4	-	-	-	1	1	8
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	15	19	23	27	32	36
8	2	6	14	20	22	23
9	-	-	-	-	-	-
10	-	-	-	-	-	-



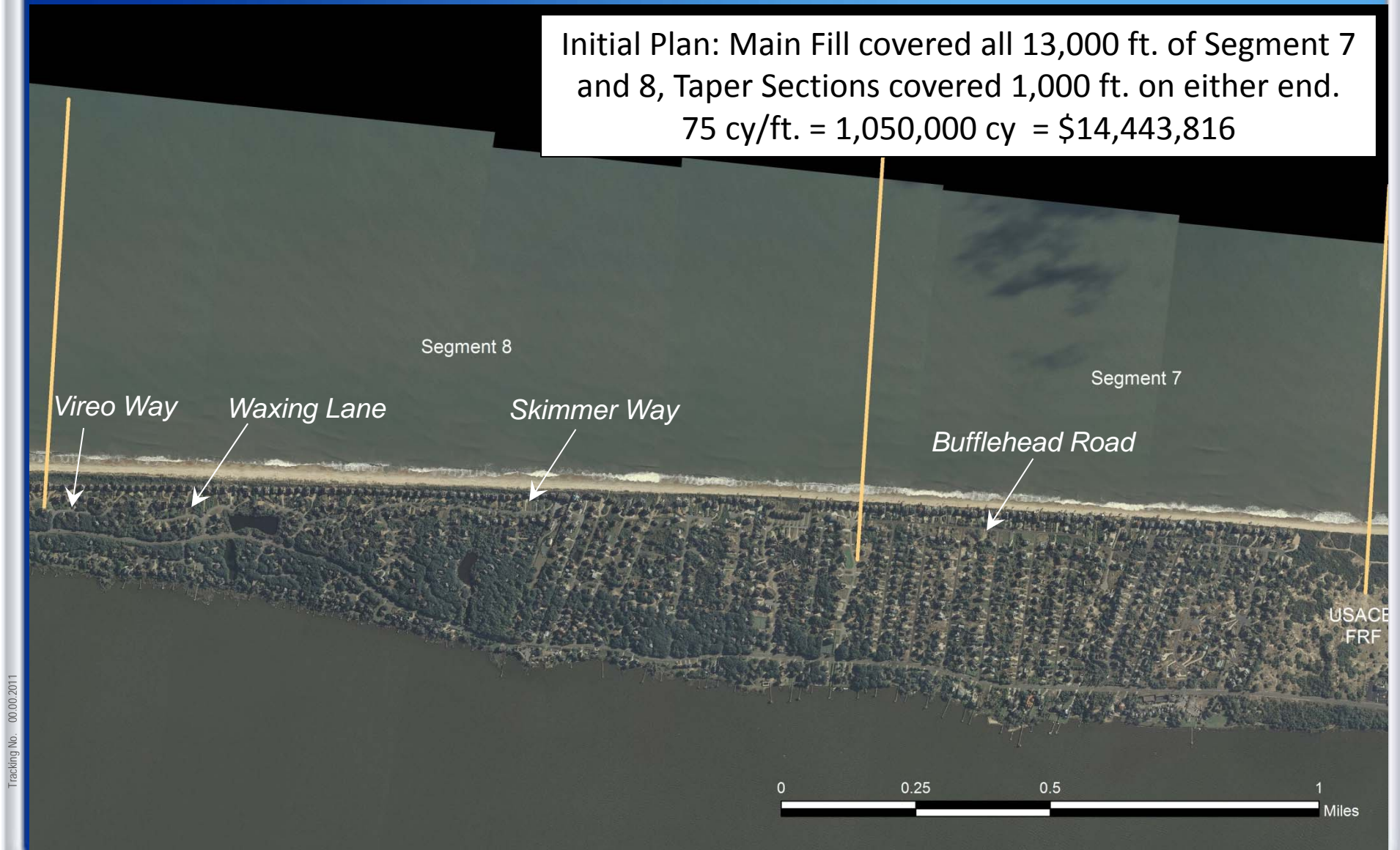
# Vulnerability Analysis Update

## Updated Survey Data and Storm Data

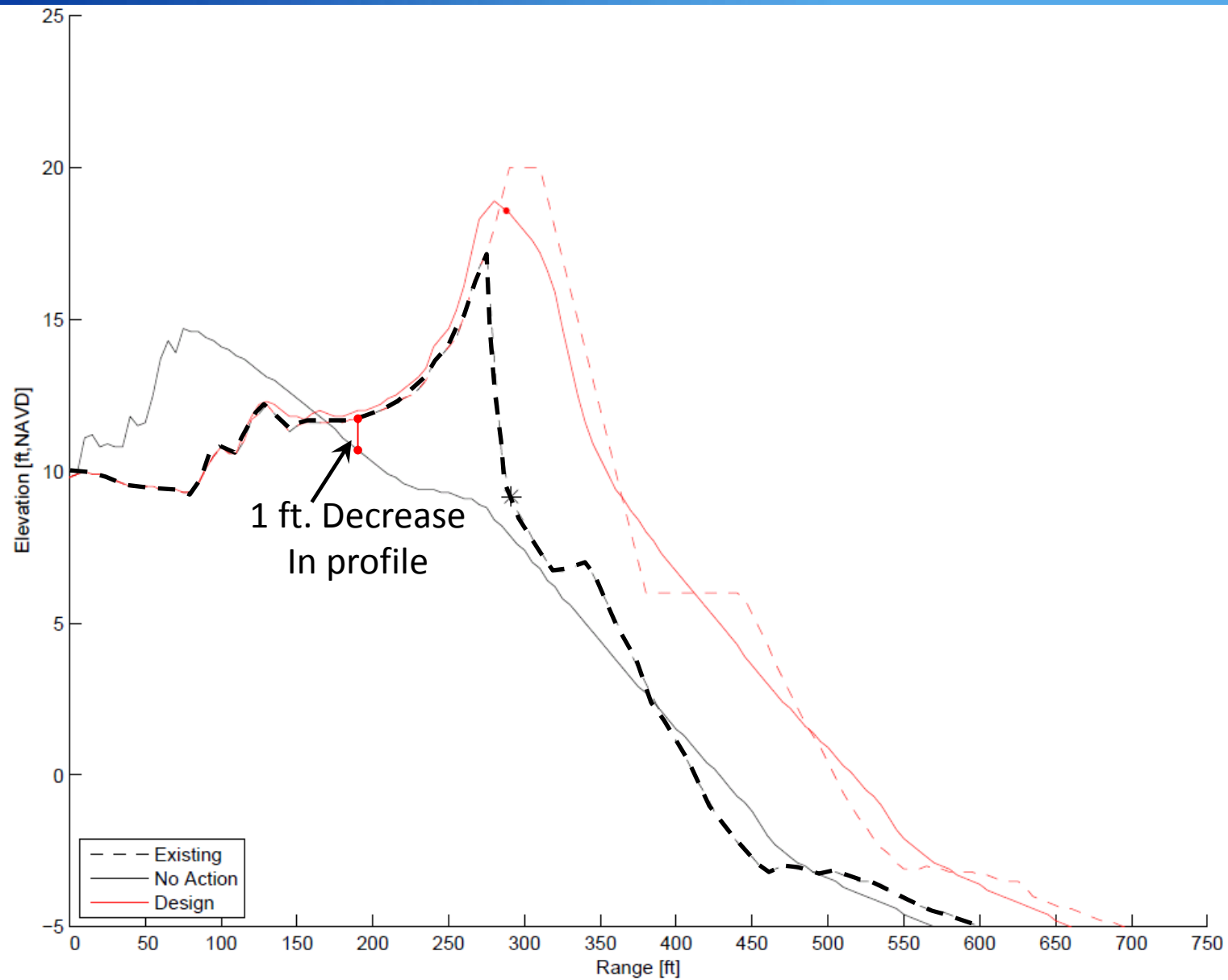
Segment	Dwelling Structures Impacted (Simulated Isabel Conditions)
	Without Project
1	-
2	4
3	5
4	3
5	-
6	-
7	49
8	34
9	1
10	-

# Design Analysis

Initial Plan: Main Fill covered all 13,000 ft. of Segment 7 and 8, Taper Sections covered 1,000 ft. on either end.  
 $75 \text{ cy/ft.} = 1,050,000 \text{ cy} = \$14,443,816$



# Design Analysis

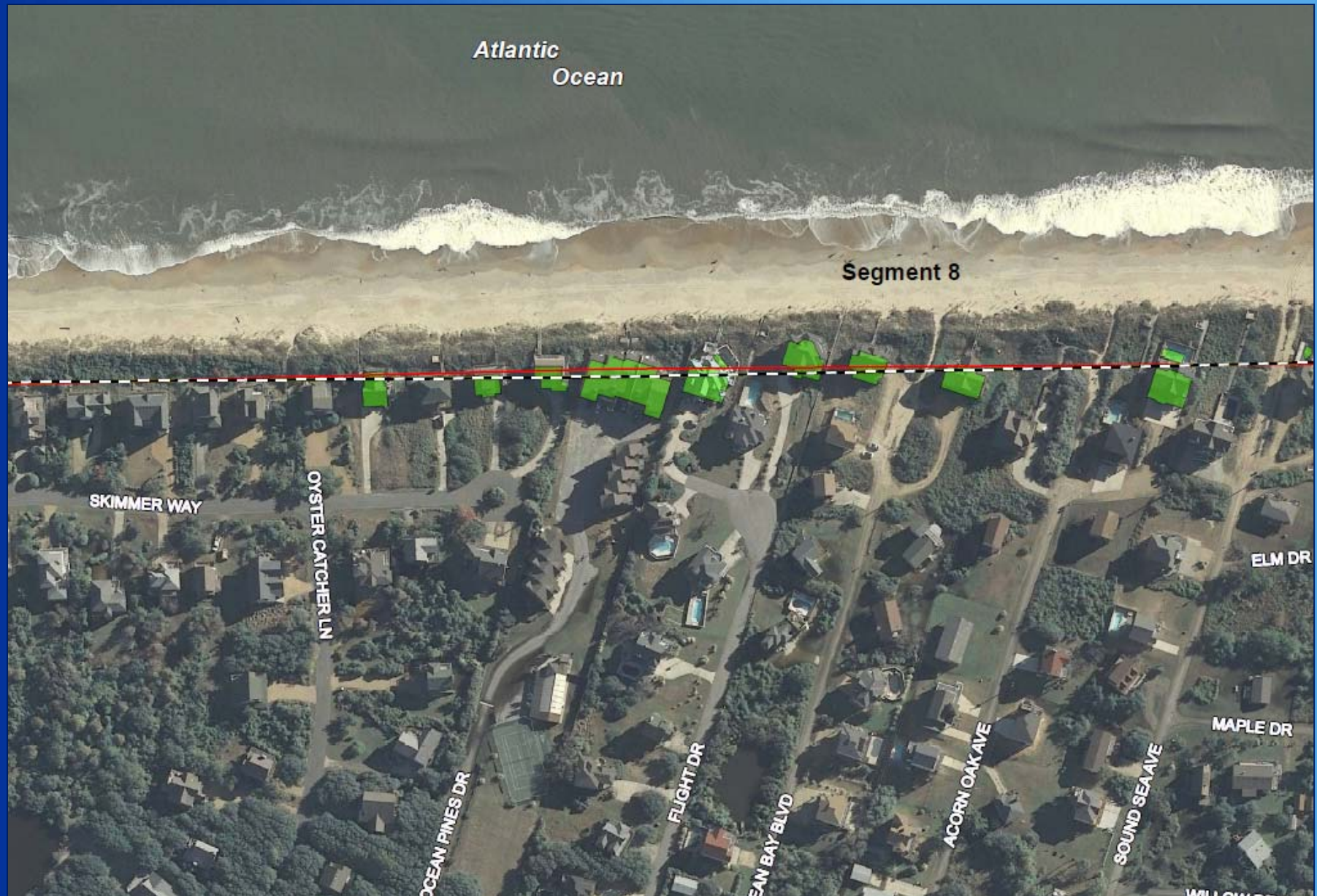


# Design Analysis

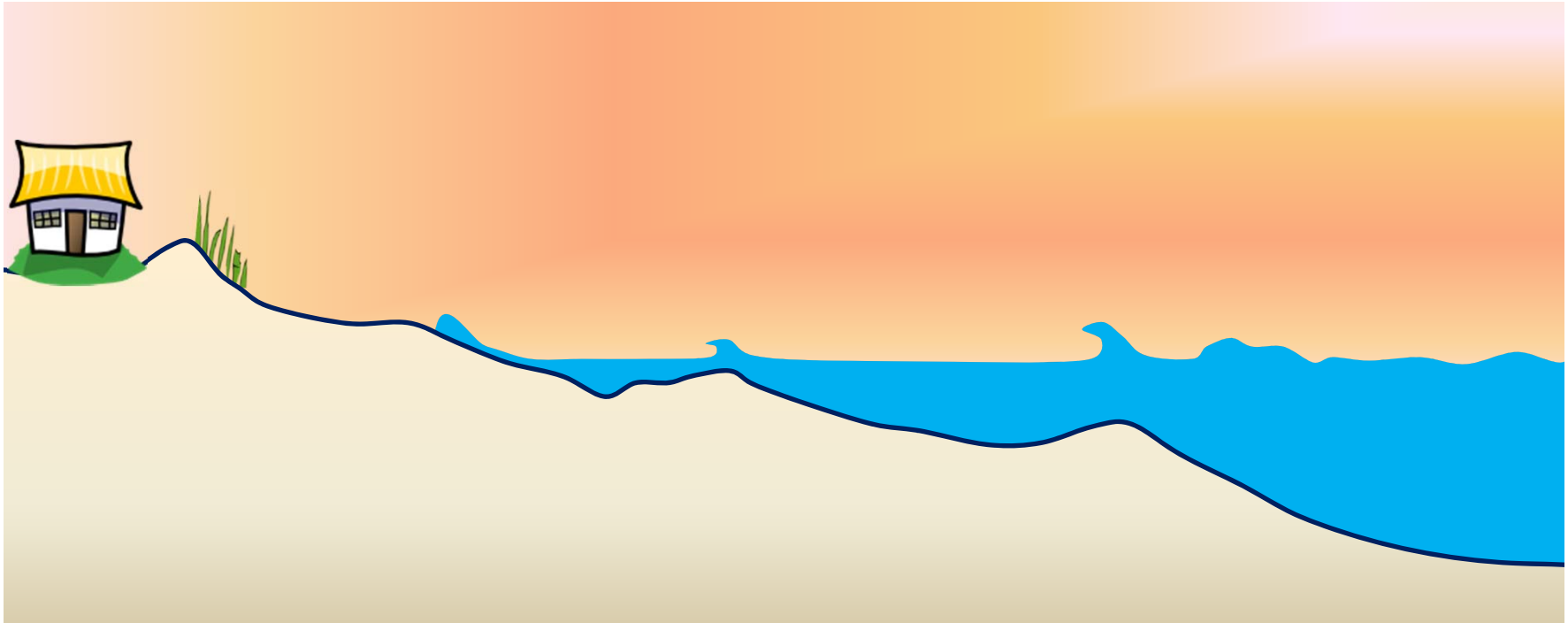




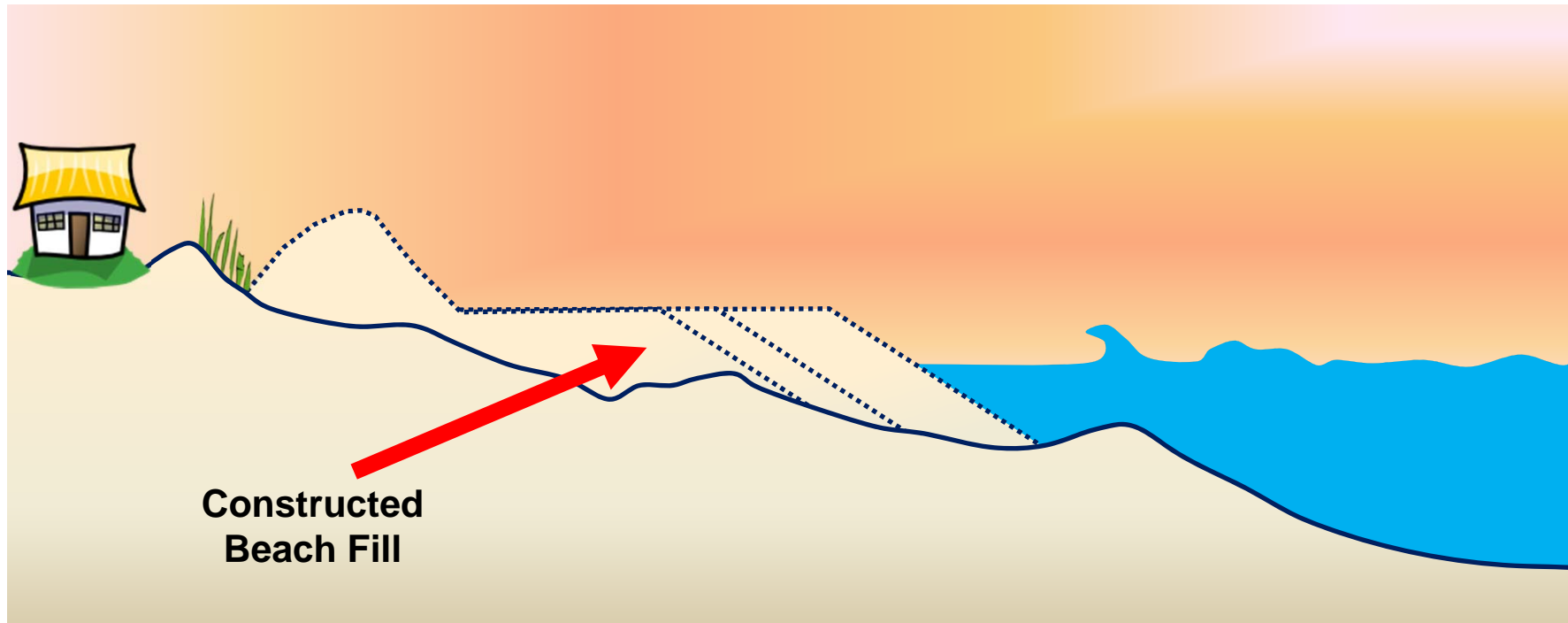
# Design Analysis



# Storm Damage Reduction Project

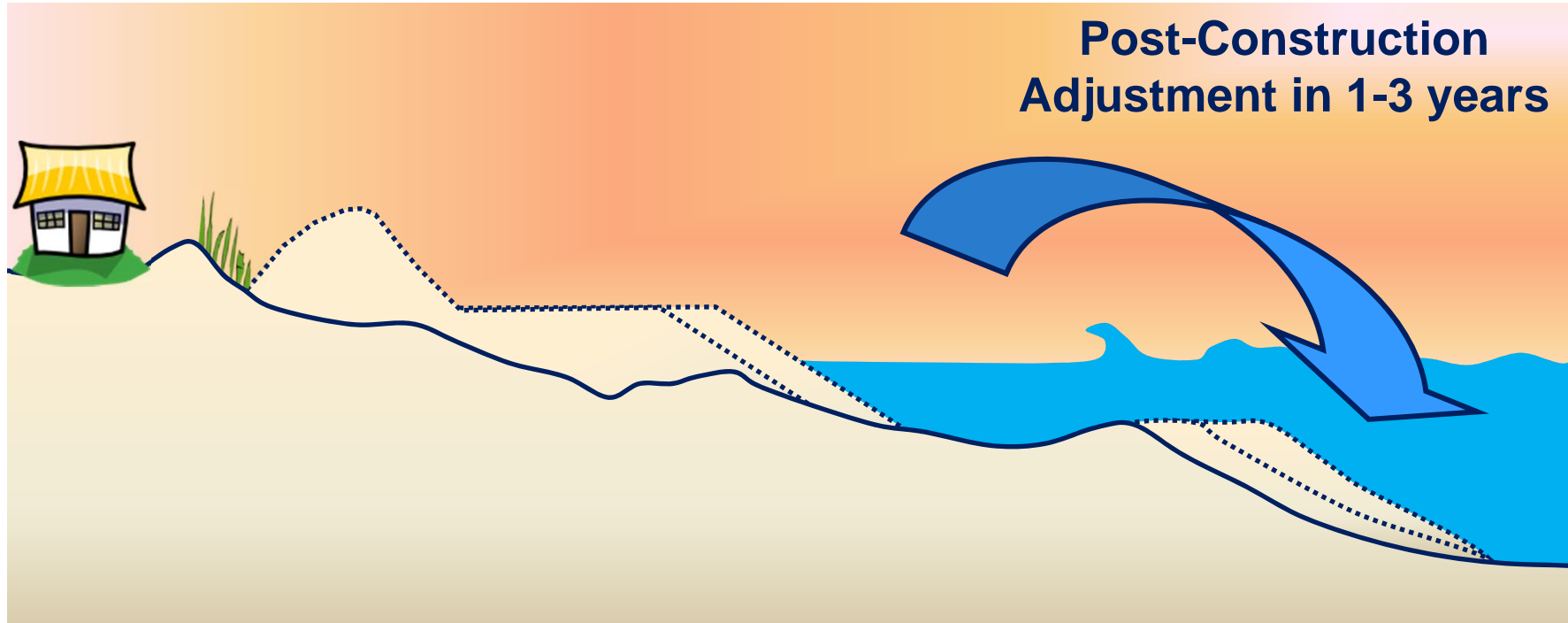


# Storm Damage Reduction Project

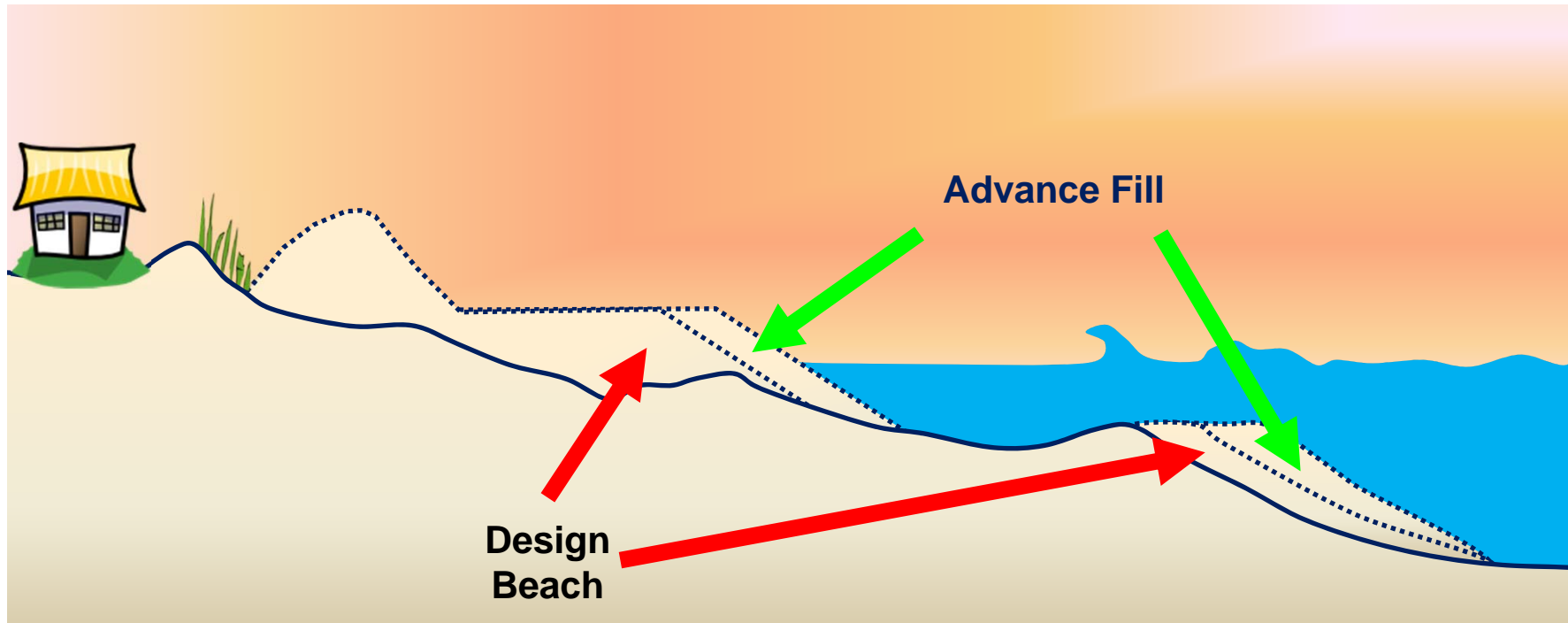




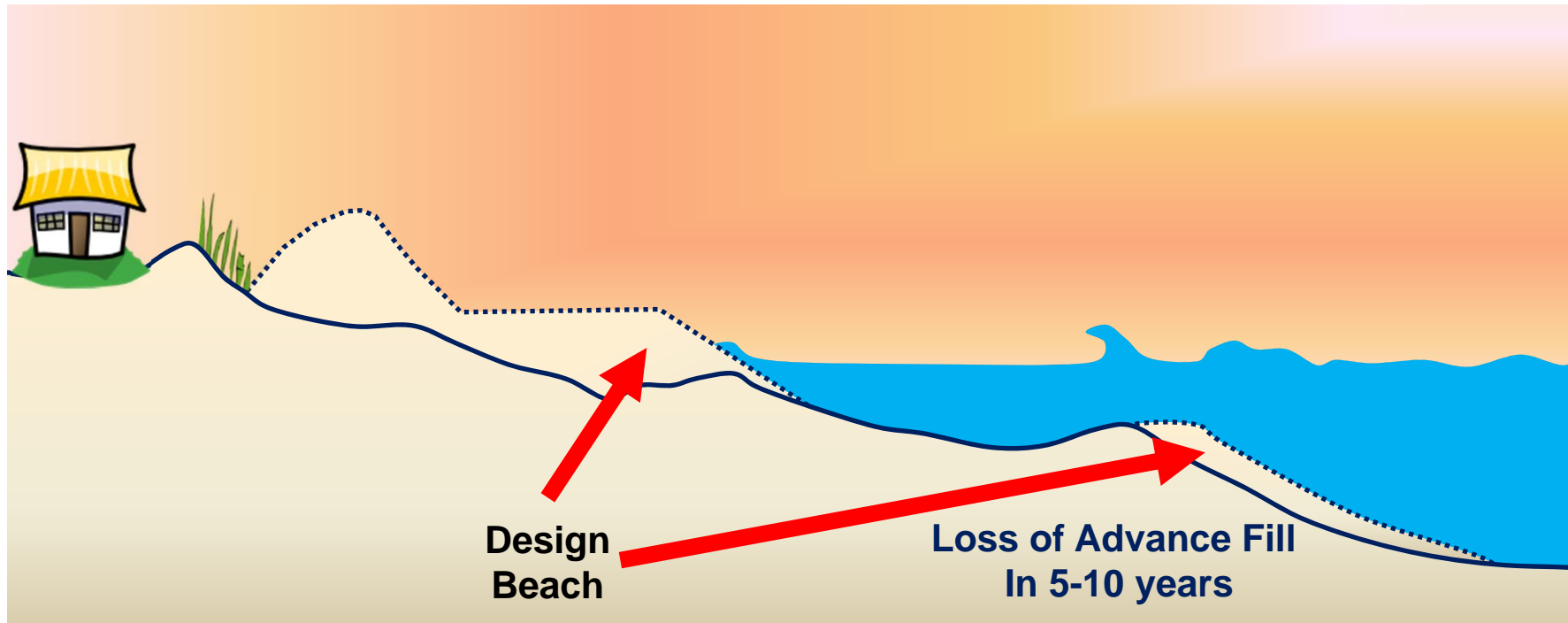
# Storm Damage Reduction Project



# Storm Damage Reduction Project



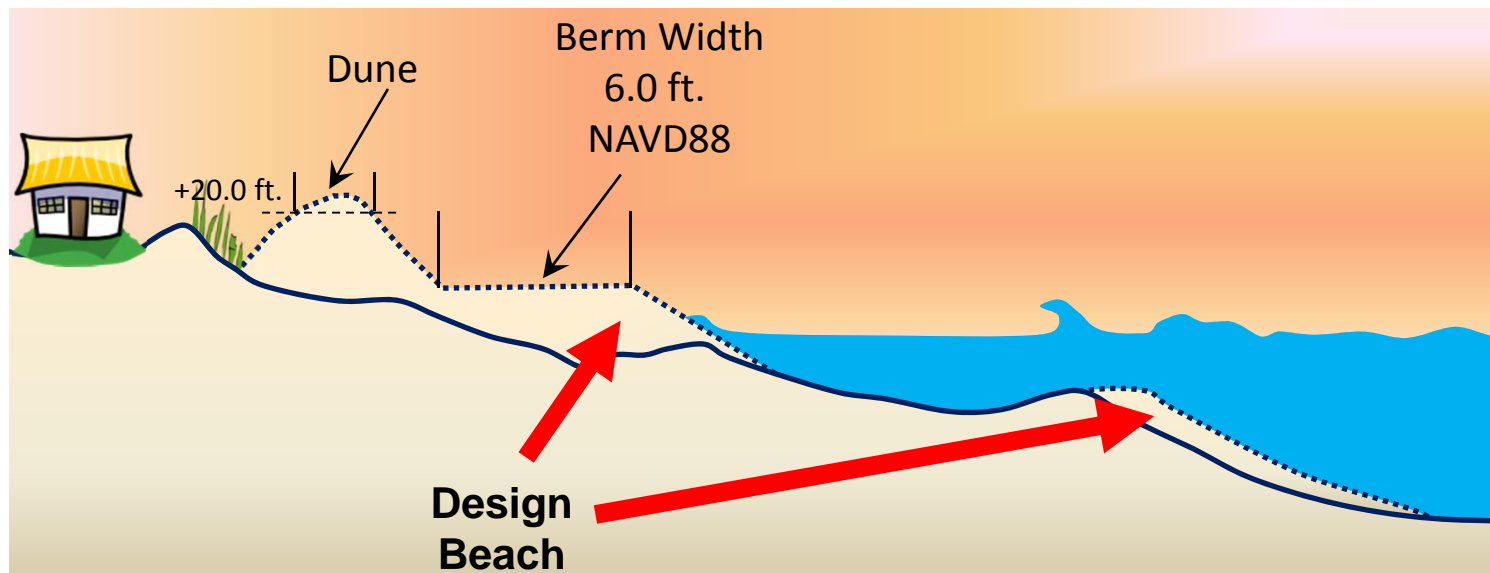
# Storm Damage Reduction Project



Over 70 different designs were simulated

# Design Analysis

- **20/40** - Dune: 20 ft. wide crest at 20 ft. NAVD88 elevation; Berm: 40 ft. wide berm at 6 ft. NAVD88 elevation
- **20/60** - Dune: 20 ft. wide crest at 20 ft. NAVD88 elevation; Berm: 60 ft. wide berm at 6 ft. NAVD88 elevation
- **20/80** - Dune: 20 ft. wide crest at 20 ft. NAVD88 elevation; Berm: 80 ft. wide berm at 6 ft. NAVD88 elevation



# Design Analysis





# Design Analysis





# Design Analysis





# Design Analysis

Initial Plan: Main Fill covered all 13,000 ft. of Segment 7 and 8,  
Taper Sections covered 1,000 ft. on either end.

$$75 \text{ cy/ft.} = 1,050,000 \text{ cy} = \$14,443,816$$

Design	Volume (cy)	Average Density (cy/ft.)
20/40	768,000	85
20/60	965,000	107
20/80	1,166,000	129

# GENESIS Analysis

- Used to assess the taper lengths and shoreline orientation
- 3 separate taper lengths were simulated (500 ft., 1,000 ft., and 1,500 ft.)
- Analysis suggests a 500 ft. taper
- Model generated shoreline orientation used to develop Hybrid Design.

# Design Analysis





# Design Analysis





# Design Analysis





# Design Analysis



# Design Analysis

Design	Volume (cy)	Average Density (cy/ft.)
20/40	768,000	85
20/60	965,000	107
20/80	1,166,000	129
Hybrid	1,063,000	117
75 cy/lf.	676,000	75



# Vulnerability Analysis Update

## Updated Survey Data and Storm Data

		Segment 7	Segment 8	Total % Reduction
<b>Without Project</b>	Num. Structures Impacted	49	34	
	% Reduction			
<b>20/40 Design</b>	Num. Structures Impacted	4	11	82%
	% Reduction	92%	68%	
<b>20/60 Design</b>	Num. Structures Impacted	2	7	89%
	% Reduction	96%	79%	
<b>20/80 Design</b>	Num. Structures Impacted	1	3	95%
	% Reduction	98%	91%	
<b>Hybrid Design</b>	Num. Structures Impacted	1	6	92%
	% Reduction	98%	82%	
<b>75 cy/lf Design</b>	Num. Structures Impacted	25	18	48%
	% Reduction	49%	47%	

# Schedule and Progress Update

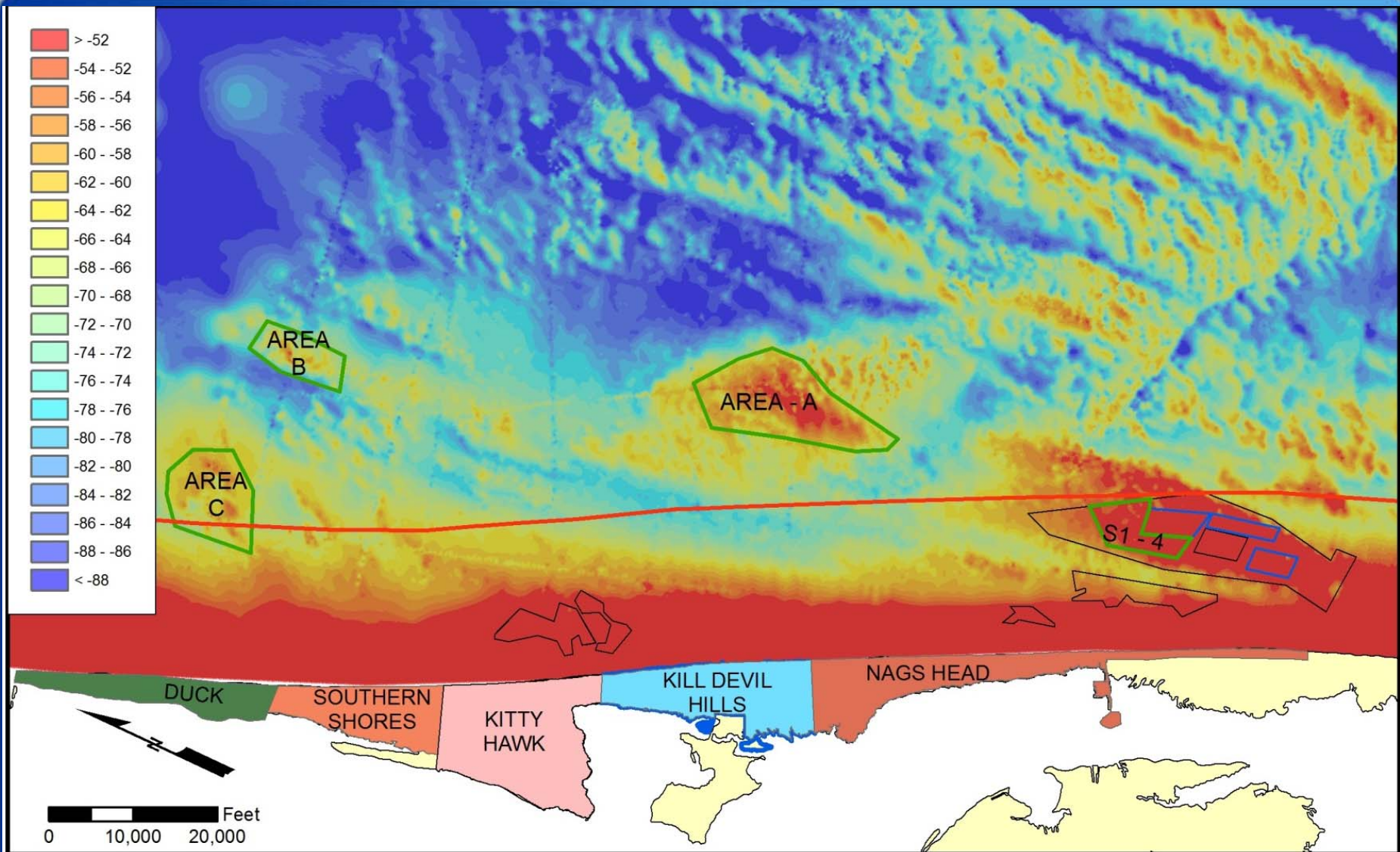
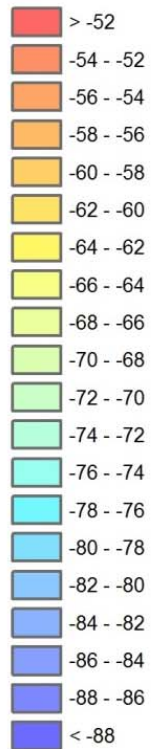
- Environmental Permitting and Documentation:
  - Submit Preliminary Draft EA (USACE & BOEM) – June 29, 2014 (In Progress)
  - USACE & BOEM Review of Preliminary Draft EA – June - August 2014
  - Submit Draft EA for Publishing in Federal Registry – September 2014
  - Public Comments – Month of September, 2014
  - Address Comments and Develop Final EA – Dec 30, 2014

# Schedule and Progress Update

- Environmental Permitting and Documentation (Continued):
  - Development of Draft BA and EFH – August 15, 2014
  - USACE and BOEM Review of Draft BA and EFH – August 16 through October 14, 2014
  - Submit Final BA and EFH – November 13, 2014
  - 1 – Year coordination period between BOEM/USACE/NMFS/USFWS (November, 2014 – November 2015)
  - USACE Review of Final EA, Public Comments and Development of FONSI – June 28, 2015
  - Permits Issued – November, 2015

# Schedule and Progress Update

- Engineering & Design:
  - Beach Profile Surveys – September 2013 (Completer)
  - Update Shoreline Change Rates – January 2014 (Complete)
  - SBEACH Analysis – April 2014 (Complete)
  - GENESIS Analysis – May 2014 (Complete)
  - Develop and Finalize Design Alternatives – June 2014 (In Progress)
  - Development of Engineering Report – July 2014 (In Progress)



### Notes:

1. Bathymetry data based on historical NOS bathymetry (assume MLW ft).

### Legend:

- STATE/FEDERAL BOUNDARY
- PROPOSED SURVEY AREAS
- NAGS HEAD BORROW AREAS
- USACE BORROW AREAS



# Schedule and Progress Update

- Borrow Area Investigations and Design:
  - Planning & Permitting – March 2014 (In Progress)
  - Preliminary Geophysical Survey and Data Reduction – May 2014 (Field work anticipated to begin this weekend)
  - Vibracore Sampling and Analysis – June 2014
  - Design Survey and Cultural Resource Survey – July 2014
  - Compatibility Analysis and Borrow Area Design – August 2014 (In Progress)

**KEY DATE – Complete Draft Compatibility Analysis and  
Borrow Area Design by Mid-August  
To Keep Environmental Review Process on Schedule**

# Schedule and Progress Update

- Permits Issued – October 2015
- Advertise for Construction Bids – November 2, 2015
- Open Bids – December 2, 2015
- Review Bids and Seek Approval from LGC
- Award Contract – January 2016
- Construction – February 2016 – February 2017





**Thank You!**

**Questions?**

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