

A graphic featuring a green mountain range in the background. The foreground is a blue gradient representing water, with wavy lines at the bottom. The text 'Marin County' is in black, and 'Sea Level Rise' is in a large, blue, hand-drawn font.

Marin County

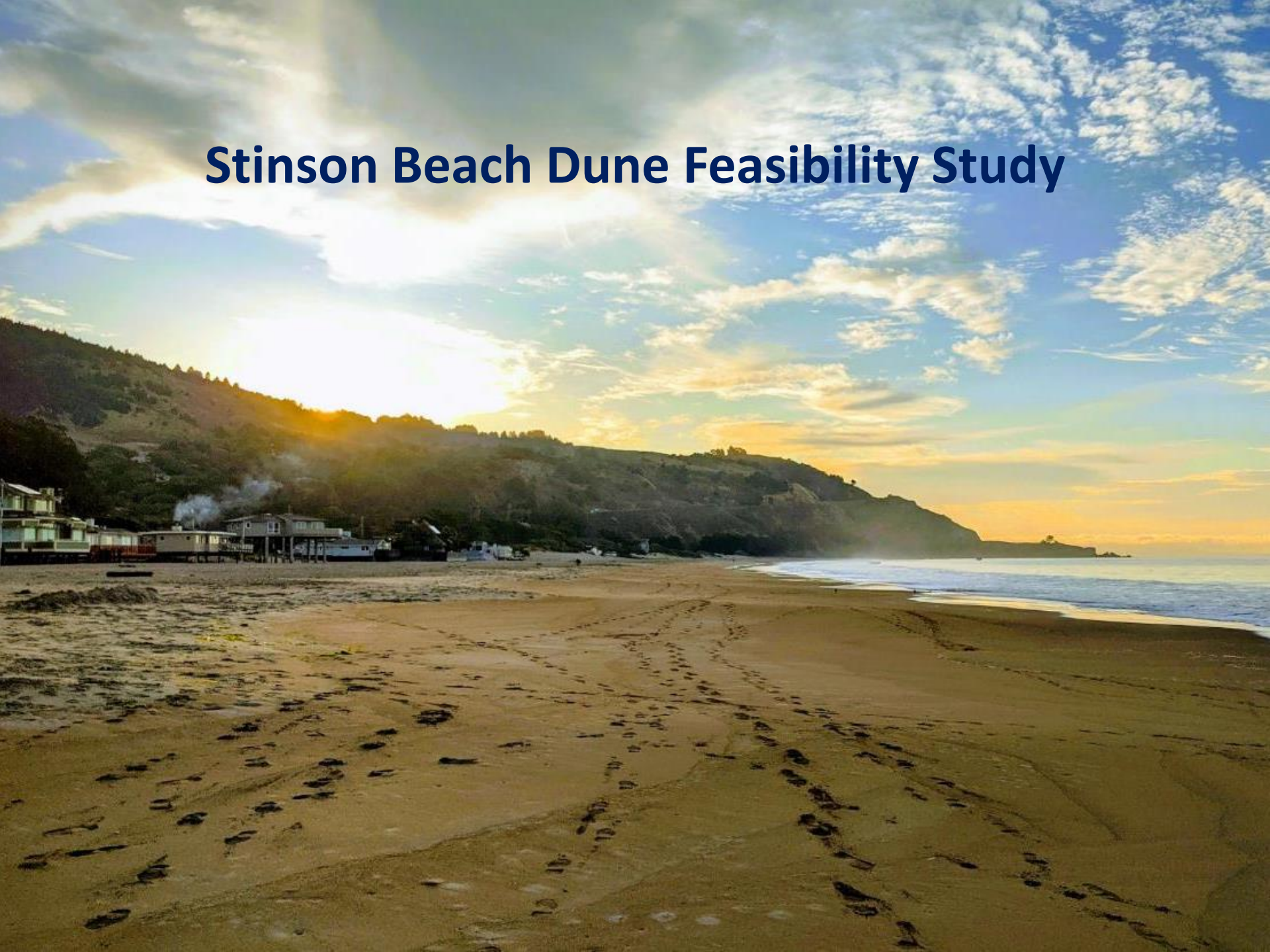
Sea Level Rise

# CCWG Meeting

Adaptation Planning Updates

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# Stinson Beach Dune Feasibility Study



# Stinson Beach Study Overview

**Project Goal: Assess the feasibility of a resilient beach and dune ecosystem that**

- **Enhances habitats and public access,**
- **Supports recreational opportunities for users of all socioeconomic circumstances, and**
- **Improves flood and erosion protection for public and private assets against existing coastal hazards and future sea level rise**



## **Study Set Up**

- **Beach is divided into 5 project reaches**
- **Several types of dunes and combinations are explored**
- **Criteria are used to evaluate each type of dune/dune feature**
- **Alternatives are presented**

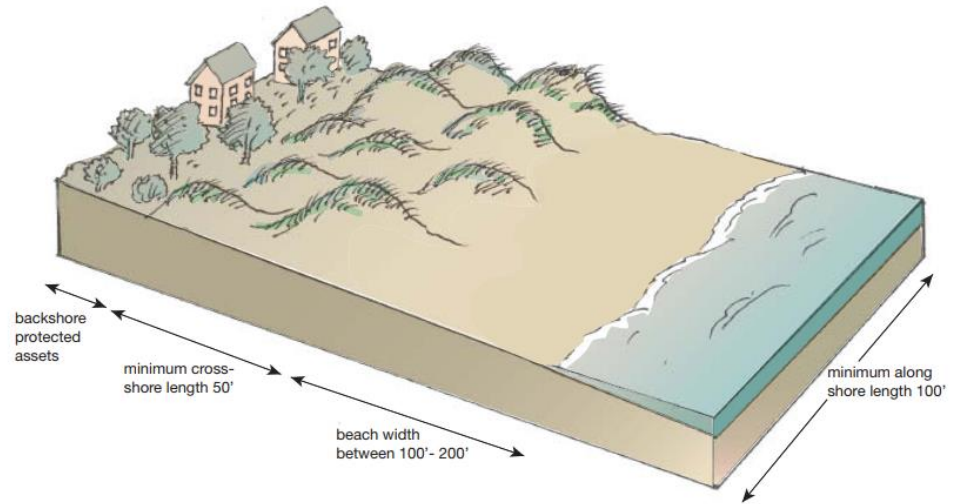
## **We are asking YOU**

**To tell us which alternatives you prefer and whether any alternatives might raise issues in your community**

# **Types of Dune Systems**

# Foredunes

- **Vegetated mounds or ridges of wind-blown sand at the back of the beach**
- **Manage dune vegetation to trap sand blown onshore from the beach during strong winds**
- **Provide a buffer from storm damage, erosion, and flooding (storm wave run-up, overwash)**

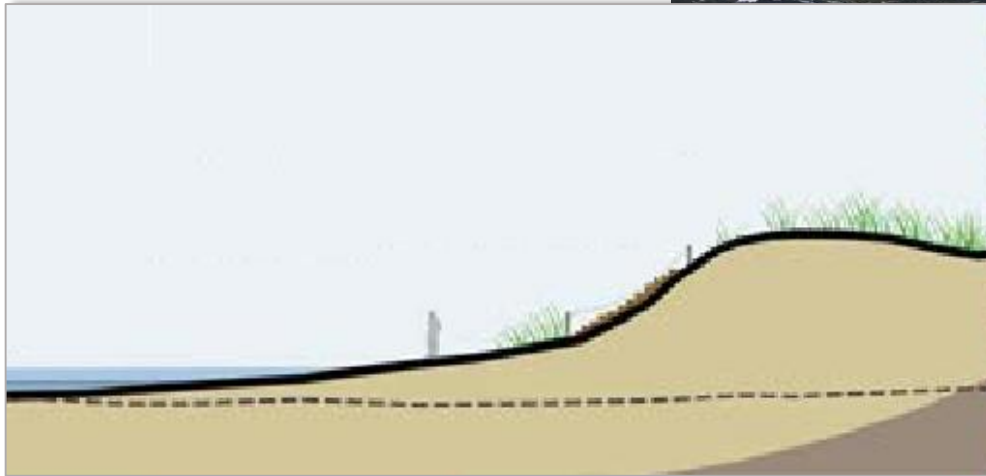


Source: *Natural Shoreline Infrastructure: Technical Guidelines for the CA Coast*



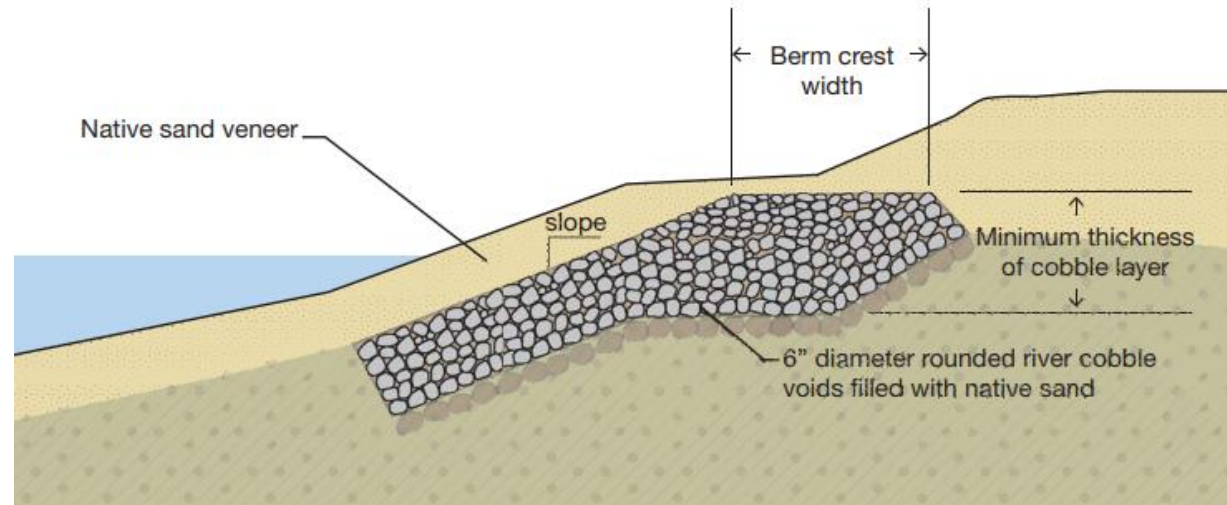
## Dune Embankment

- **Sacrificial, linear dune, minimal footprint**
- **With or without vegetation**



## Cobble Berm

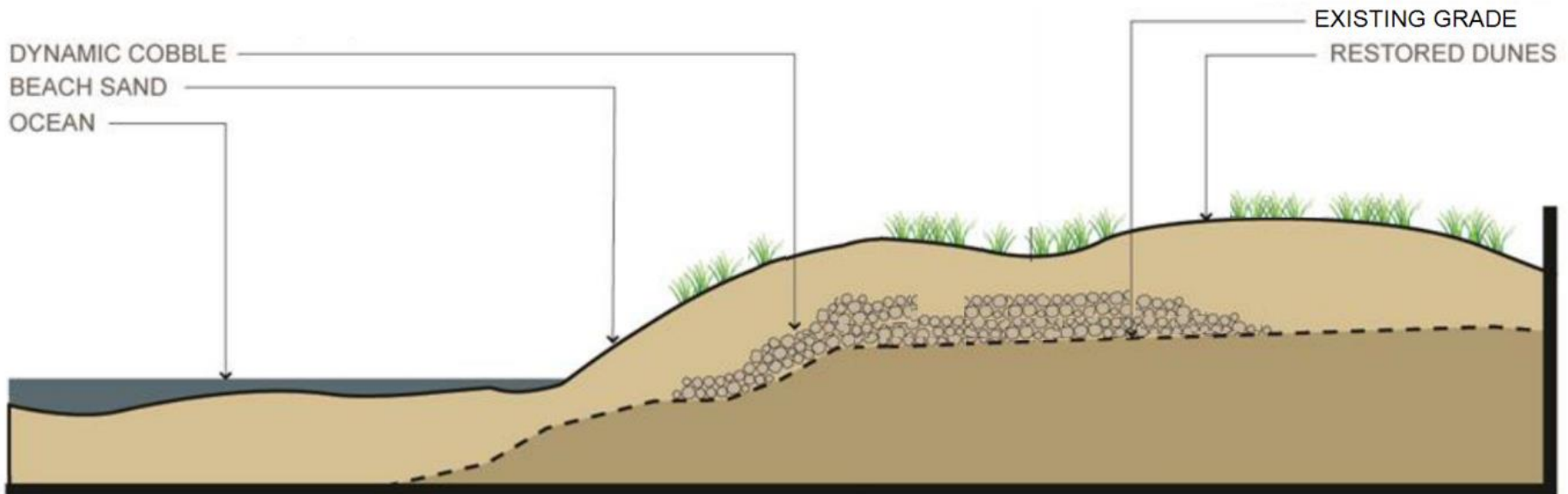
- Dissipate wave energy and act as a “backstop,” limiting landward extent of shoreline erosion
- Can provide habitat equivalency for marine invertebrates and enhance natural aesthetics
- Traversable and friendly form of armoring





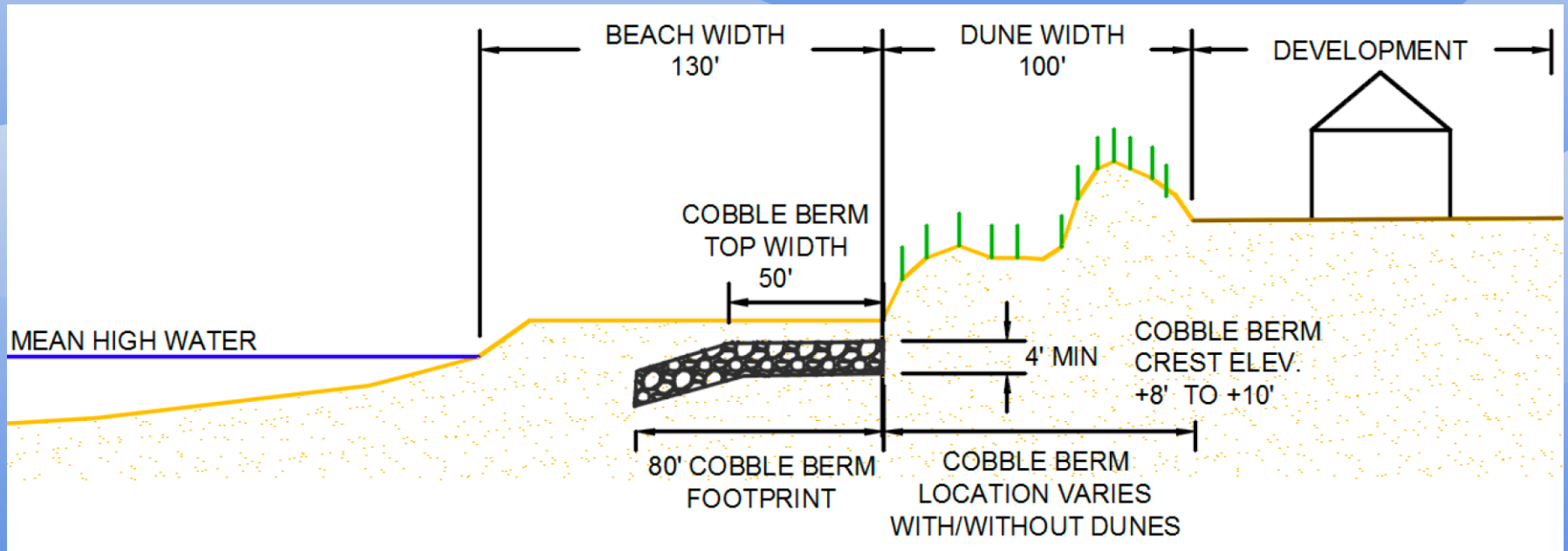
## Dunes with Cobble Berm

- Dunes provide ecological value and serve as a sacrificial buffer during storms
- Cobble berm core serves as backup erosion protection for extreme winters
- Manage dune vegetation to reduce wind-blown sand



# Beach Width Constraints

The minimum space requirements for each dune feature type were determined from:  
the C-SMART analysis and Natural Infrastructure Guidelines  
and  
compared to the existing space available in October 2019



The minimum dune width is 50 feet (foredune and dune embankment features). The minimum top width for cobble berm is 50 feet, while the minimum overall cobble berm footprint is 80 feet including the seaward sloping face. The minimum beach width is 100 feet from either the 50 feet of dunes or the 50 feet of cobble-gravel berm top width.

# Shoreline Evolution

## Historic Beach Widths by Project Reach

— Reach Boundaries

### Shorelines (MHW)

— 07/01/1929

— 07/03/1952

— 10/12/1997

— 04/15/1998

— 05/06/2010

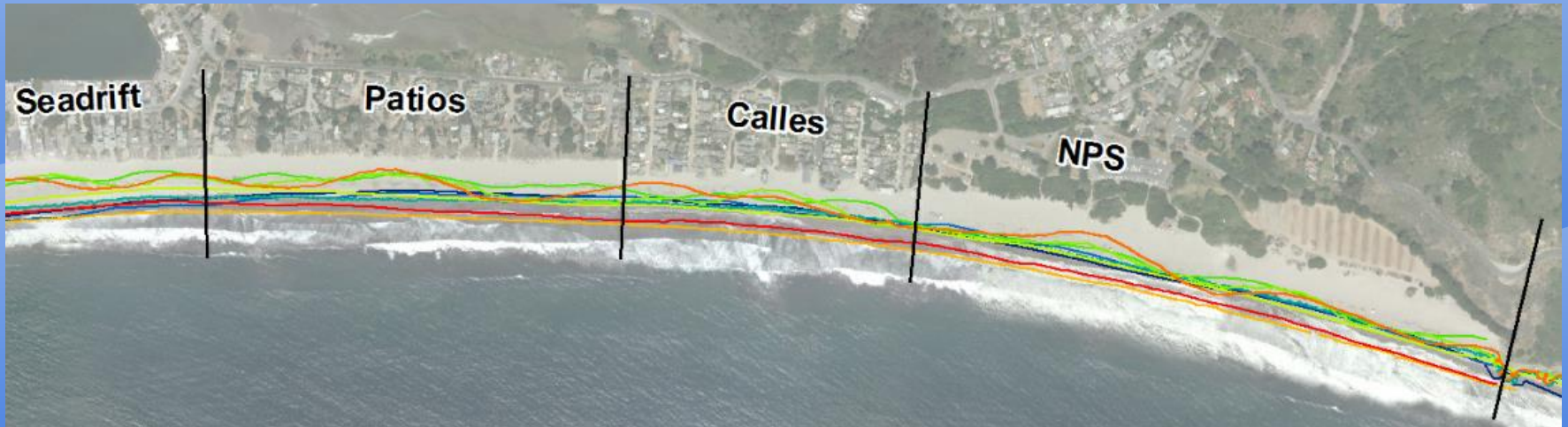
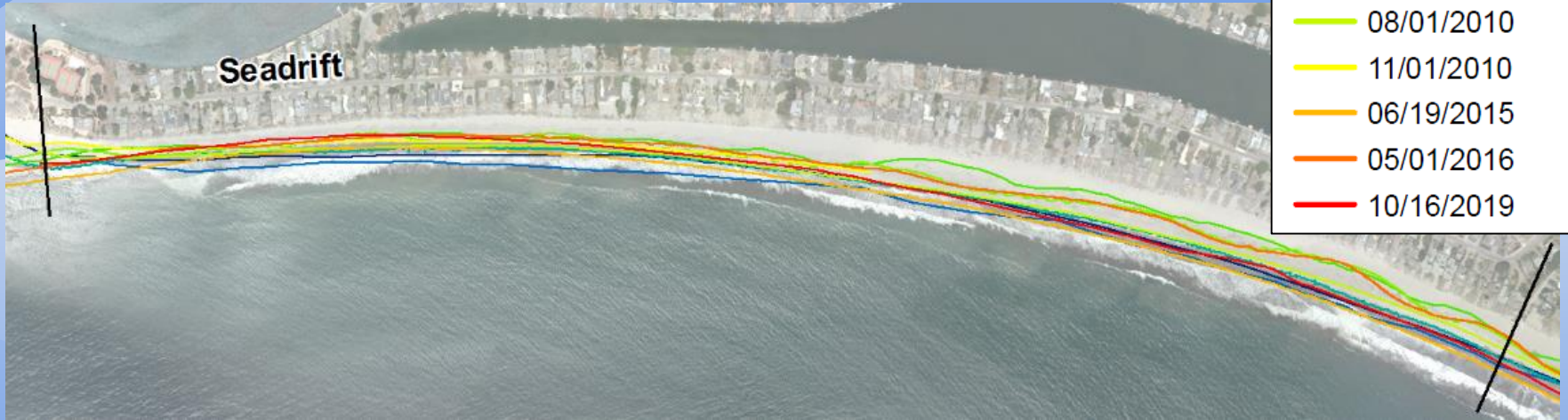
— 08/01/2010

— 11/01/2010

— 06/19/2015

— 05/01/2016

— 10/16/2019



## Suitability of Dune Type by Reach

	Beach width (feet) <sup>1</sup>	Foredunes	Foredunes with Cobble-Gravel Berm	Dune Embankment	Dune Embankment with Cobble-Gravel Berm	Cobble-Gravel Berm
<b>Desired Natural Infrastructure Width (feet)</b>		230	130	100	100	80
<b>Seadrift West</b>	103			Marginal	Marginal	X
<b>Seadrift East</b>	214		X	X	X	X
<b>Patios</b>	250	X	X	X	X	X
<b>Calles</b>	235	X	X	X	X	X
<b>NPS</b>	264	X	X	X	X	X

# **Selection Criteria**

## Selection Criteria

**Natural Harmony – the dune type is consistent with natural setting**

- **Foredunes already occur naturally**
- **Dune embankment & cobble-gravel berm are not native**

## Ecology Benefits

- **Foredunes support native plants**
- **Dune embankments can provide ecology benefits**
- **Cobble-gravel berm benefits equivalent to sandy beach**

## Access and Aesthetics

- **Foredunes- least barrier to access & views, generally aesthetically pleasing**
- **Dune embankments- can make public access difficult and block views**
- **Cobble-gravel berm- more natural and traversable compared to other engineered structures**



## **Effectiveness of Protective Services- protects development**

- **Foredunes most efficiently provide protection**
- **Dune embankments higher relief, but will erode and scarp**
- **Cobble-gravel berms function best in combination with dunes**

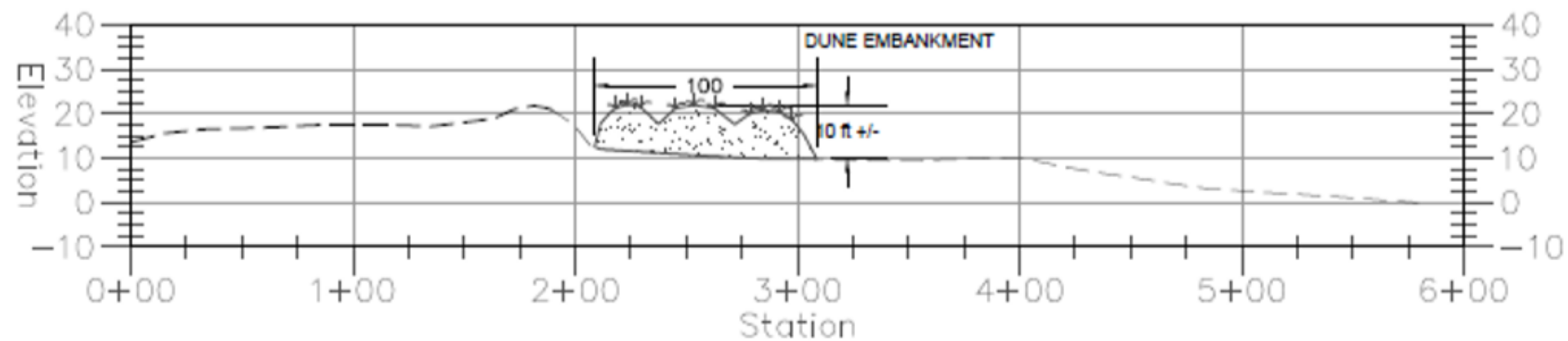
# Selection Criteria

**Relative Costs- lower construction and lower maintenance costs are given higher rankings**

- **Foredunes- lowest construction cost, low maintenance once vegetated**
- **Dune embankments- higher construction and maintenance costs**
- **Cobble-gravel berms- high construction and low maintenance costs**

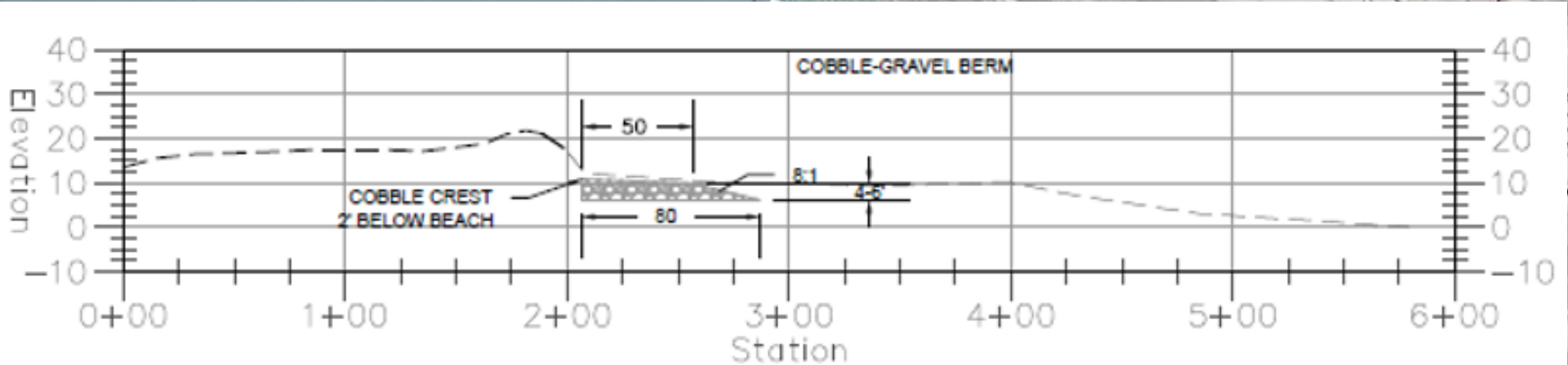
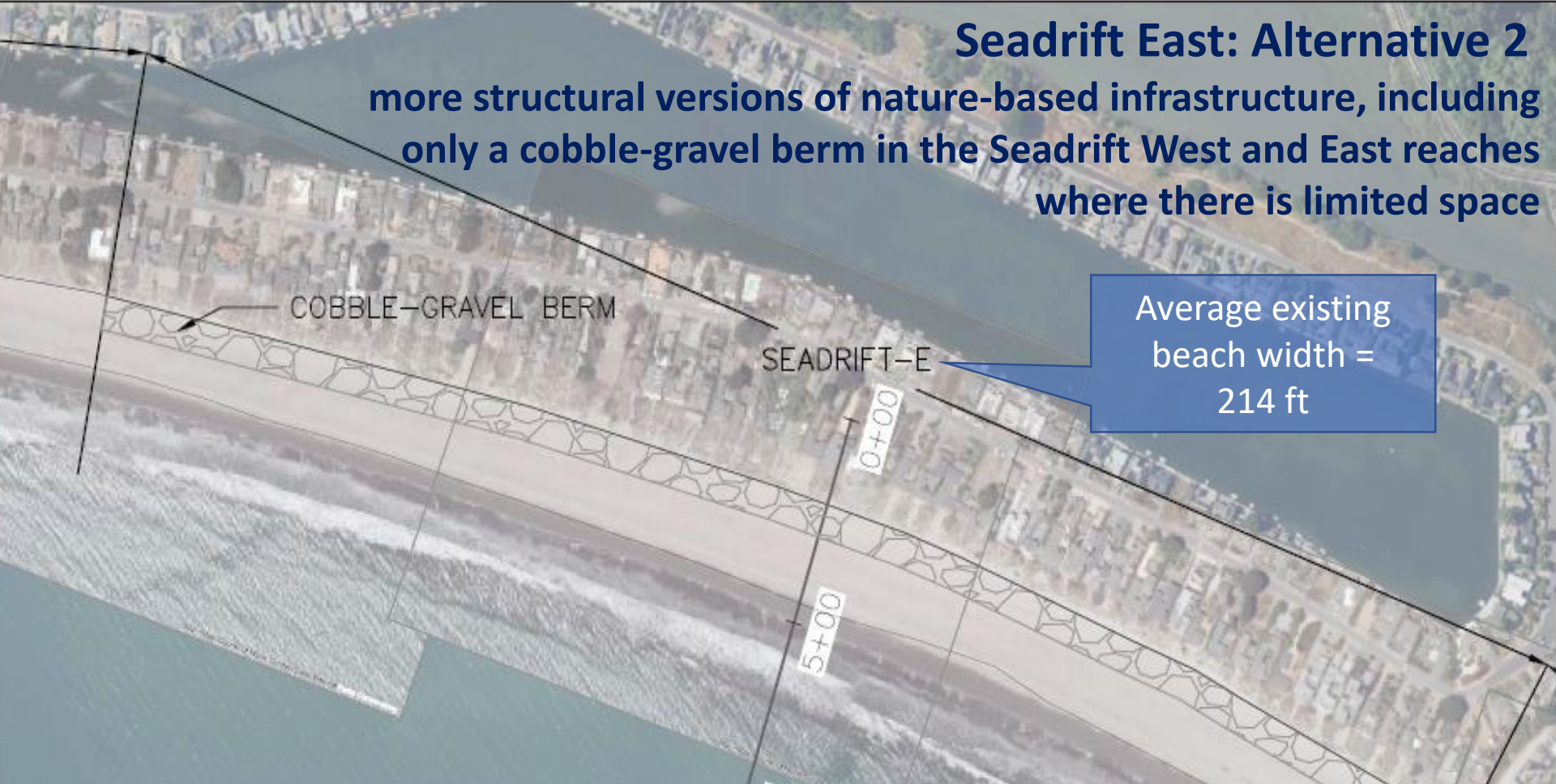
# Seadrift East: Alternative 1

“most natural” nature-based infrastructure types, consisting of foredunes where there is sufficient space and dune embankments where space is limited.



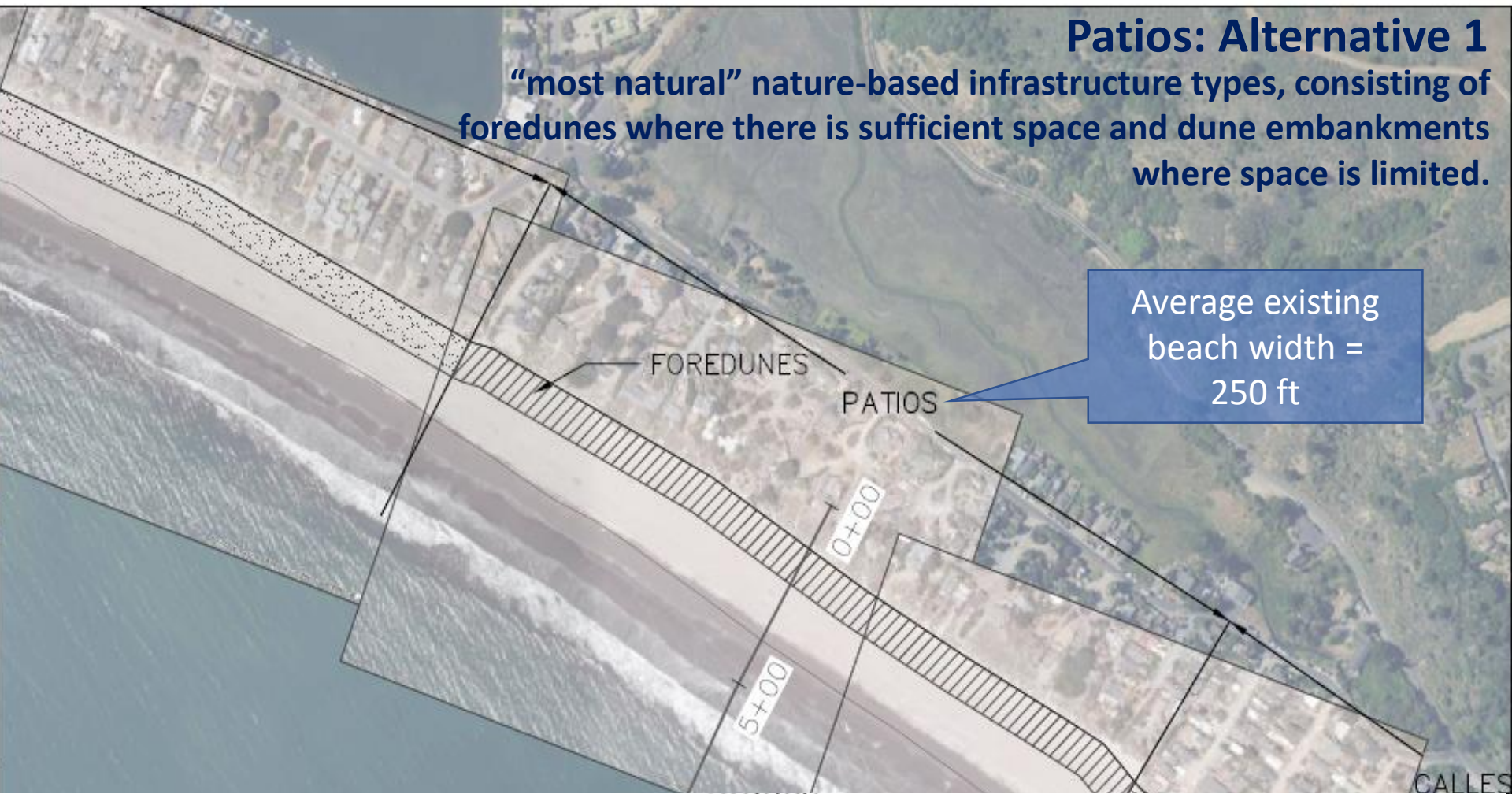
# Seadrift East: Alternative 2

more structural versions of nature-based infrastructure, including only a cobble-gravel berm in the Seadrift West and East reaches where there is limited space

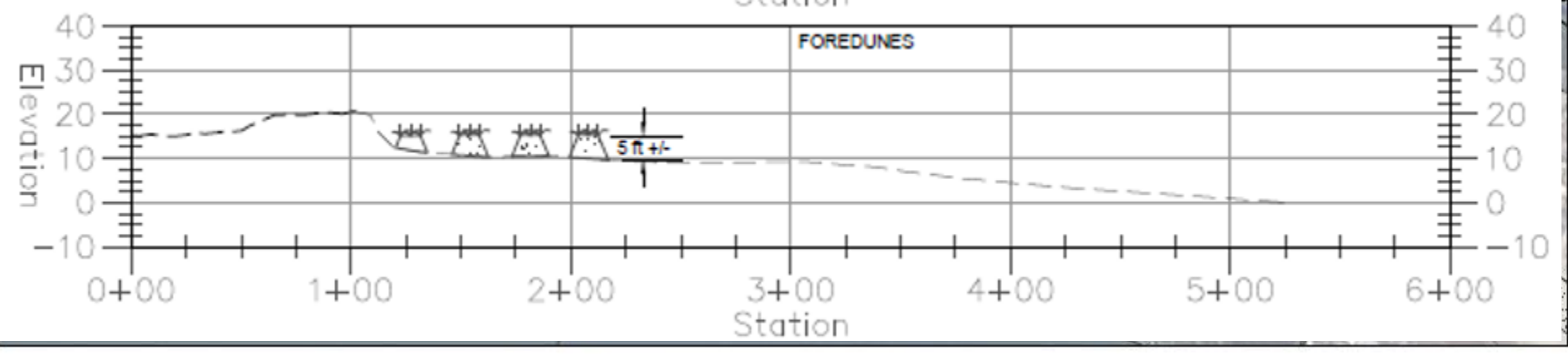


# Patios: Alternative 1

“most natural” nature-based infrastructure types, consisting of foredunes where there is sufficient space and dune embankments where space is limited.

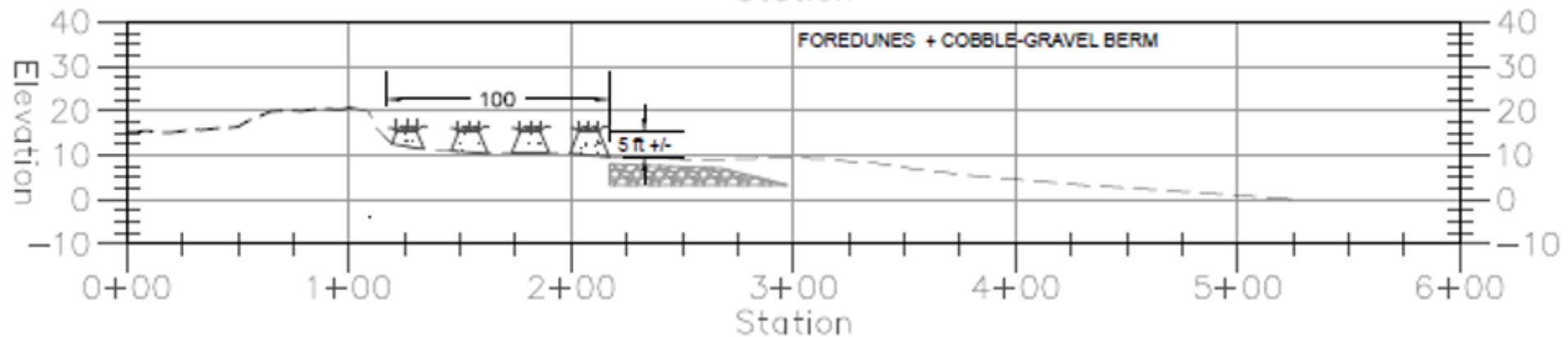
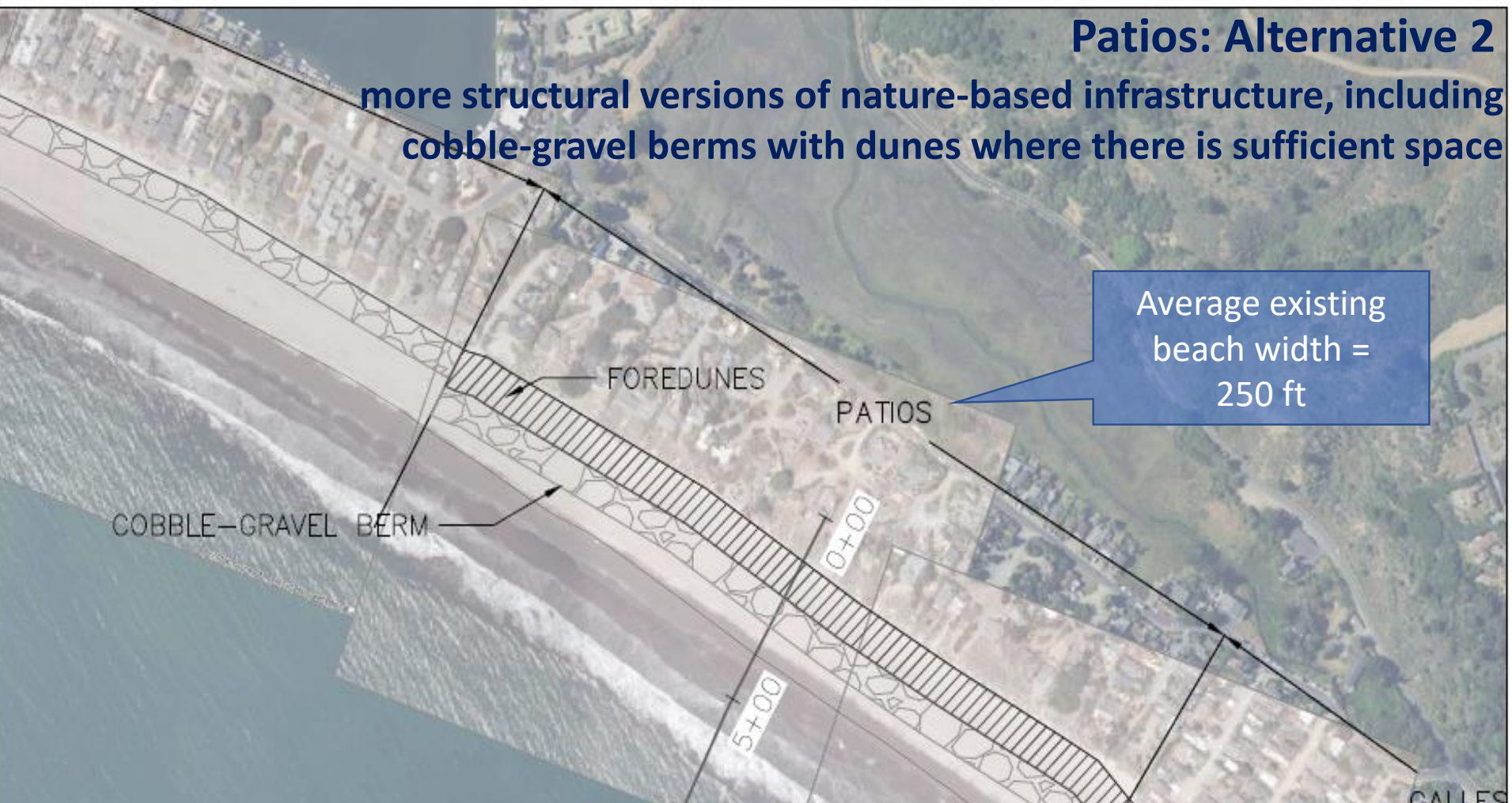


Average existing beach width = 250 ft

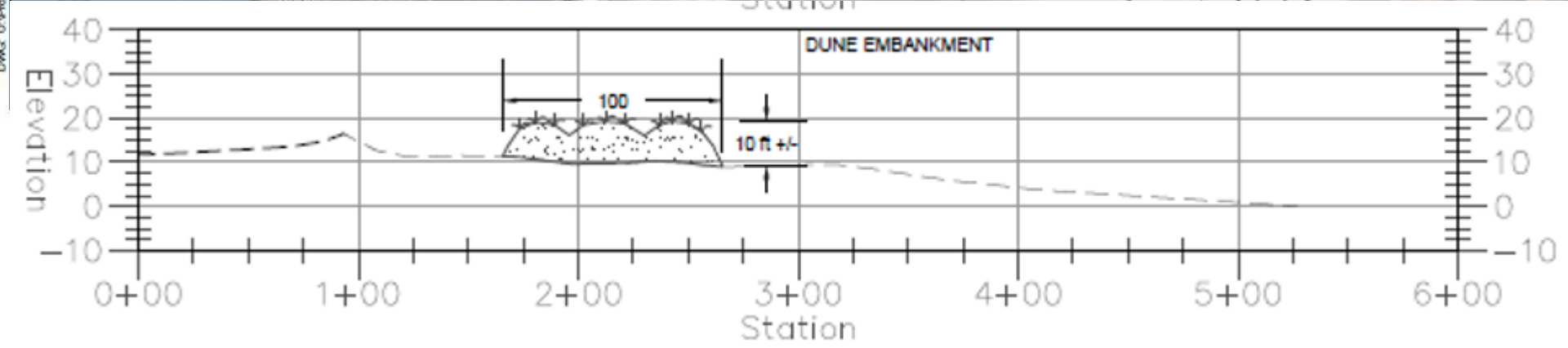


# Patios: Alternative 2

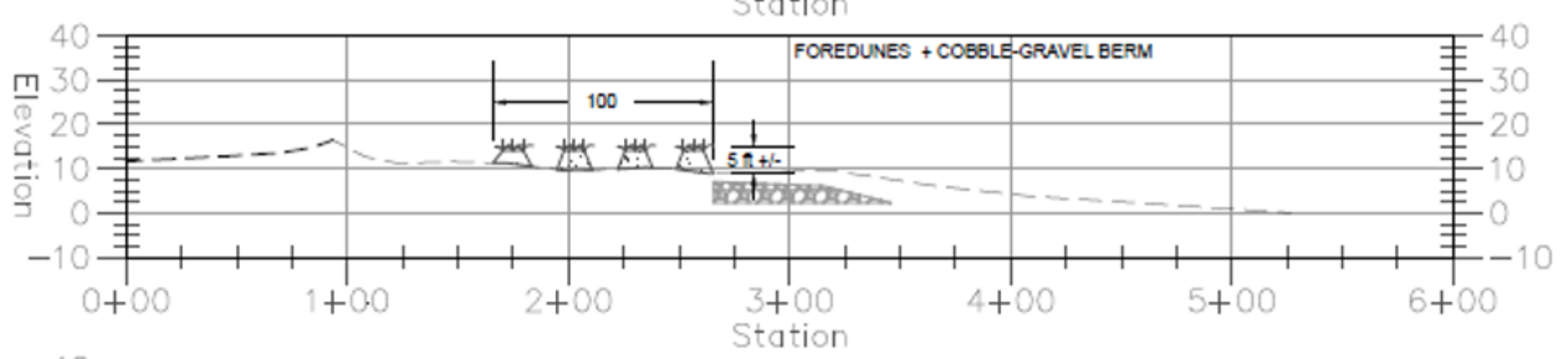
more structural versions of nature-based infrastructure, including cobble-gravel berms with dunes where there is sufficient space



# Calles: Alternative 1 "more natural"



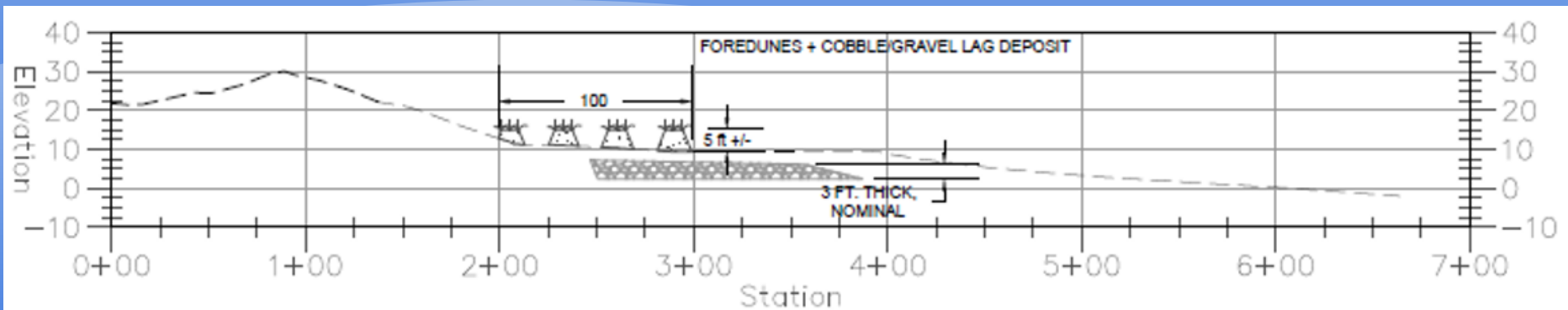
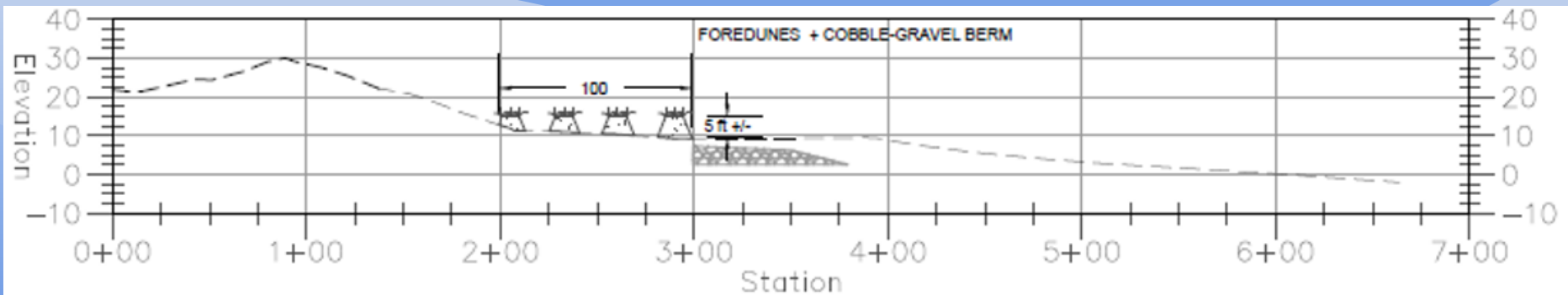
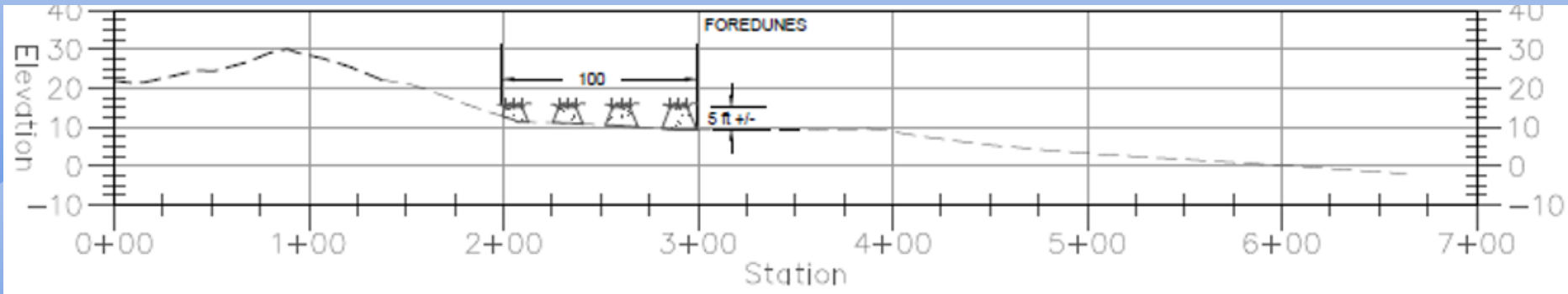
# Calles: Alternative 2 "more structural"





# NPS Alternatives

Average existing beach width = 264 ft



# Alternatives by Reach

Reach	Potentially Suitable Screening (Table 1 space criteria)	Selected for Analysis (Table 2 Desirability Criteria)	Notes
Seadrift West	Cobble-Gravel Berm	Cobble-Gravel Berm	Limited space, existing shore armor
Seadrift East	Foredunes	<ol style="list-style-type: none"> <li>1. Dune Embankment</li> <li>2. Cobble-Gravel Berm</li> </ol>	Limited but increasing space, existing shore armor
Patios	Foredunes + Cobble-Gravel Berm	<ol style="list-style-type: none"> <li>1. Foredunes</li> <li>2. Foredunes + Cobble-Gravel Berm</li> </ol>	Development set back, some existing foredune infrastructure
Calles	Dune Embankment	<ol style="list-style-type: none"> <li>1. Foredunes + Cobble-Gravel Berm</li> <li>2. Dune Embankment + Cobble-Gravel Berm</li> </ol>	Irregular development line creates pockets of additional space for natural infrastructure
NPS	Dune Embankment + Cobble-Gravel Berm		
	Cobble-Gravel Berm	<ol style="list-style-type: none"> <li>1. Foredunes</li> <li>2. Foredunes + Cobble-Gravel Berm</li> <li>3. Foredunes + Cobble-Gravel lag deposit</li> </ol>	Cobble-Gravel berm with cobble-gravel lag geometry added as third option

## **Next Steps**

**Tonight: Provide feedback on alternatives and any issues**

**We will use your feedback for further alternatives analysis**

**Consultant will take a deeper look at alternatives and selection criteria, providing more accurate costs and cross sections**

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Marin County

Sea Level Rise

Thank You

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[MarinSLR.org](http://MarinSLR.org)