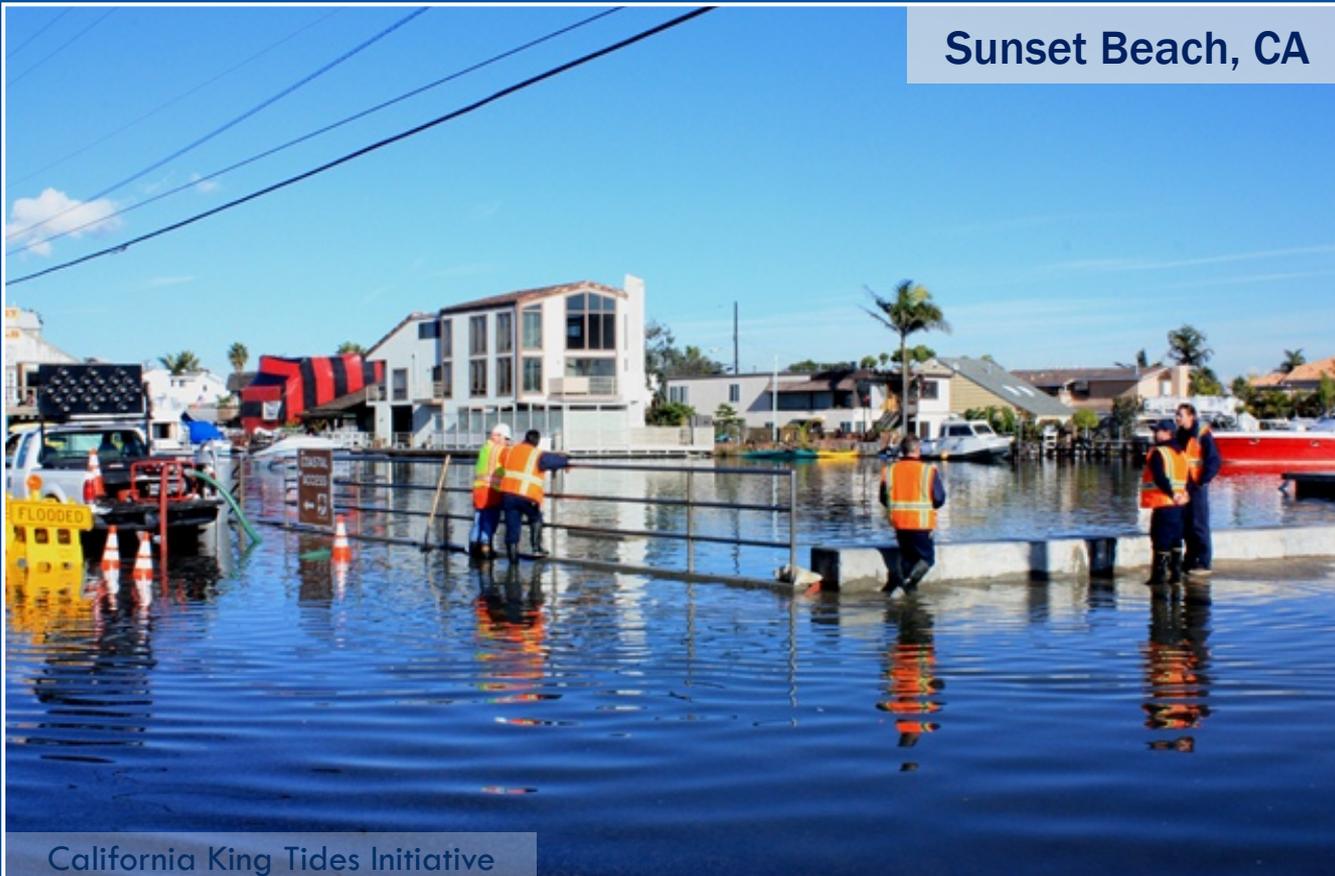


CALIFORNIA COASTAL COMMISSION SEA LEVEL RISE POLICY GUIDANCE

AND SUPPORT FOR LOCAL AND REGIONAL EFFORTS

USC Sea Grant
Adapt LA Workshop
10/23/15

Sunset Beach, CA

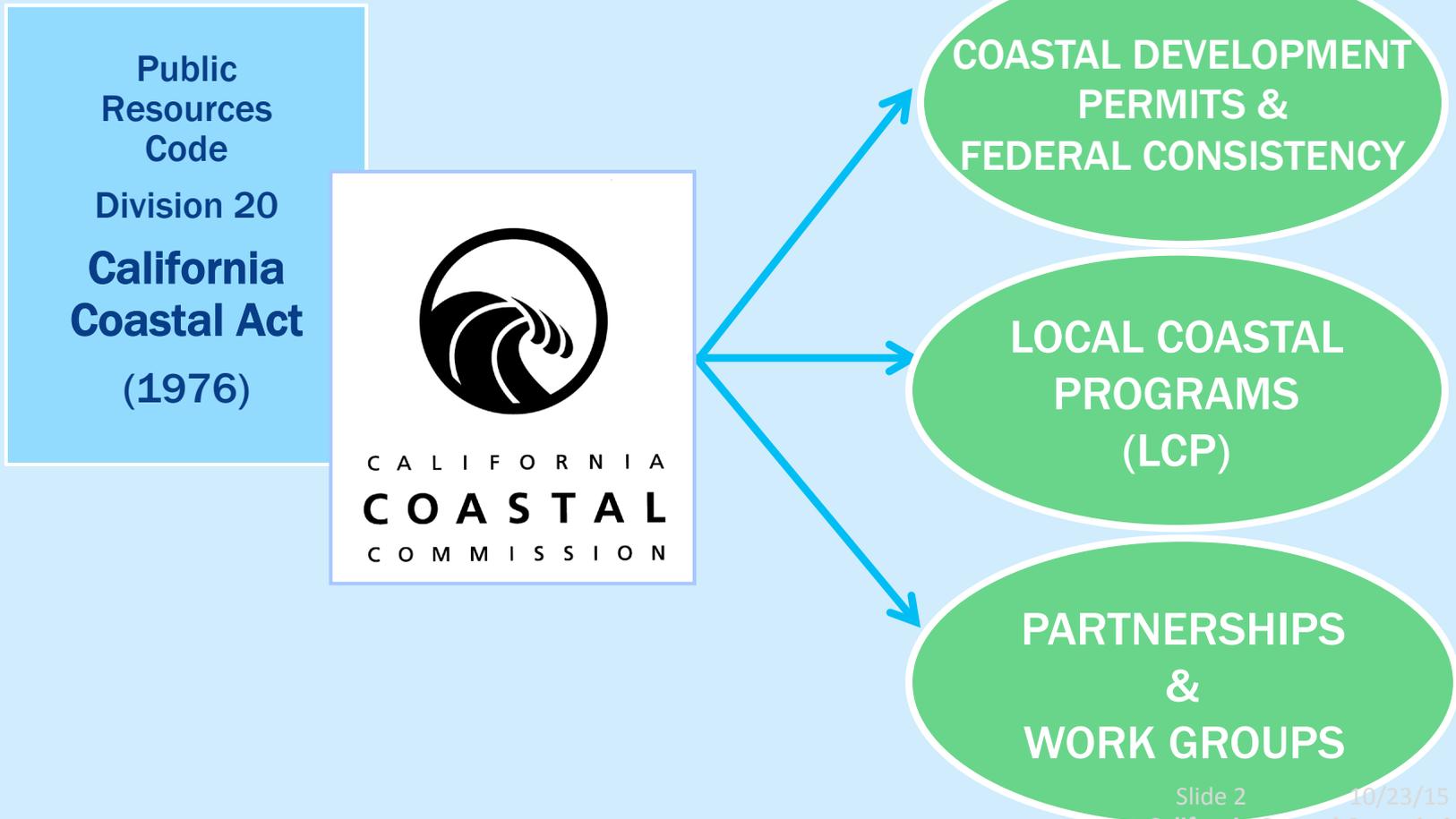


California King Tides Initiative



CALIFORNIA
COASTAL
COMMISSION

CA COASTAL COMMISSION BACKGROUND



COASTAL ACT = STATE + LOCAL

- ❑ **Local Coastal Programs (LCPs)**
 - ❑ **Land Use Plan & Zoning Ordinance**
 - ❑ **Delegates permit authority to local government**



Santa Monica Beach

Photo Credit: Coastal Commission staff



California Coastal Trail, San Francisco

Photo Credit: Coastal Commission staff

COASTAL ACT POLICIES

- **New Development (Section 30253)**
 - Minimize risks to life & property
 - Assure stability & structural integrity
 - Neither create nor contribute to erosion
 - Assure no protective devices needed for life of structure
 - Minimize energy consumption and vehicle miles traveled

COASTAL ACT POLICIES

- **Shoreline Protection Allowed (Section 30235) for:**
 - Coastal dependent uses
 - Public beaches
 - Existing (pre-Coastal Act) structures
- **Mitigation**
 - Required to offset:
 - Loss of beach and sand
 - Other unavoidable impacts (i.e. public access, recreational opportunities)

COASTAL ACT POLICIES

- **Protection of:**
 - **Public Access (30210)**
 - **Marine Resources (30230)**
 - Biological productivity, water quality
 - Limitation on fill; oil spill prevention
 - **Land Resources (30240, 30241)**
 - Environmentally sensitive habitat areas
 - Prime agricultural land
 - **Water-Oriented Recreational Uses (30220 - 30222, 30213)**
 - Coastal areas suited for recreation, facilities and accommodations
 - **Development (30250)**
 - **Scenic and visual qualities (30251)**

SLR GUIDANCE CONTENTS

Chapters

1. Introduction
2. Guiding Principles
3. Sea Level Rise Science
4. Consequences of SLR
5. Addressing SLR in LCPs
6. Addressing SLR in CDPs
7. Adaptation Strategies
8. Legal Context
9. Next Steps

Appendices

- A. Sea Level Rise Science
- B. Local Hazard Conditions
- C. Resources
- D. LCP Amendment
- E. Funding Opportunities
- F. Coastal Act Policies
- G. CCC Contact Info



CALIFORNIA COASTAL COMMISSION SEA LEVEL RISE POLICY GUIDANCE

*Interpretive Guidelines for Addressing
Sea Level Rise in Local Coastal Programs
and Coastal Development Permits*



UNANIMOUSLY ADOPTED – AUGUST 12, 2015

CONTEXT OF THE SEA LEVEL RISE GUIDANCE

This document IS:

Guidance

Dynamic

Multi-purpose for multiple audiences

A menu of options

This document is NOT:

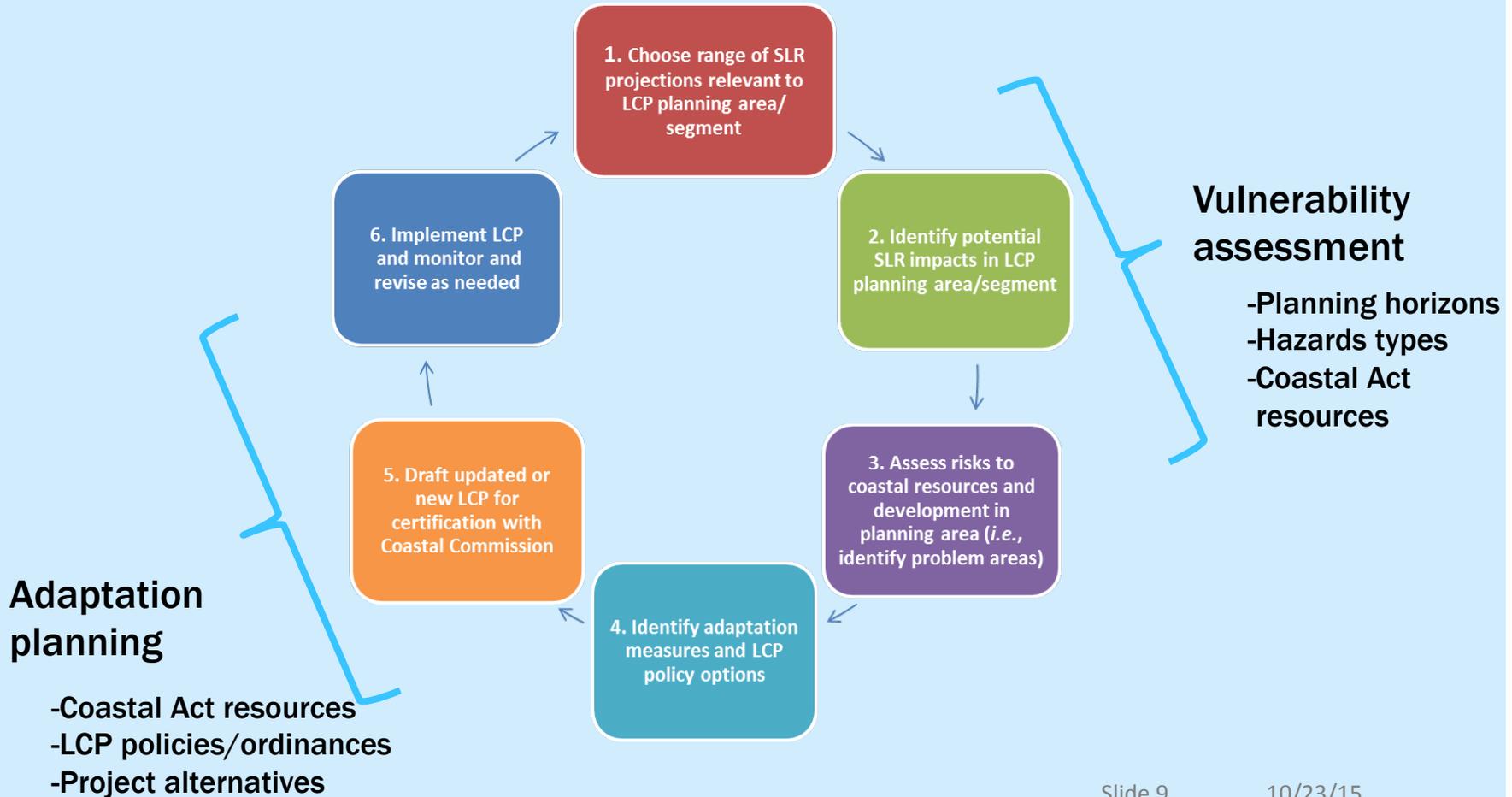
Regulations

Static

Meant to be read cover-to-cover

A checklist

PLANNING STEPS



GUIDING PRINCIPLES

Use science to guide

Best available science

Scenario-based planning

Precautionary approach

Environmental justice

Property owners assume risks

Protect public trust

Coordinate regionally

Maximize participation

coastal hazards
planning and
regulatory standards

Maximize protection of
public access, recreation,
and sensitive coastal resources

inter-agency coordination
and public participation

ASSESSING SEA LEVEL RISE VULNERABILITY

- Identify SLR scenarios
 - Multiple scenarios x multiple time steps
 - Or multiple SLR amounts with expected time ranges of occurrence
- Evaluate physical impacts
- Evaluate impacts to coastal resources

Time Period *	North of Cape Mendocino	South of Cape Mendocino
by 2030	-2 – 9 in (-4 – +23 cm)	2 – 12 in (4 – 30 cm)
by 2050	-1 – 19 in (-3 – +48 cm)	5 – 24 in (12 – 61 cm)
by 2100	4 – 56 in (10 – 143 cm)	17 – 66 in (42 – 167 cm)

* with year 2000 as a baseline

DEVELOPING SCIENCE

Atmos. Chem. Phys. Discuss., 15, 20059–20179, 2015
www.atmos-chem-phys-discuss.net/15/20059/2015/
doi:10.5194/acpd-15-20059-2015
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Atmospheric
Chemistry
and Physics
Discussions

This discussion paper is/has been under review for the journal Atmospheric Chemistry and Physics (ACP). Please refer to the corresponding final paper in ACP if available.

Ice melt, sea level rise and superstorms: evidence from paleoclimate data, climate modeling, and modern observations that 2°C global warming is highly dangerous

J. Hansen¹, M. Sato¹, P. Hearty², R. Ruedy^{3,4}, M. Kelley^{3,4}, V. Masson-Delmotte⁵, G. Russell⁴, G. Tselioudis⁴, J. Cao⁶, E. Rignot^{7,8}, I. Velicogna^{8,7}, E. Kandiano⁹, K. von Schuckmann¹⁰, P. Kharecha^{1,4}, A. N. Legrande⁴, M. Bauer¹¹, and K.-W. Lo^{3,4}

¹Climate Science, Awareness and Solutions, Columbia University Earth Institute, New York, NY 10115, USA
²Department of Environmental Studies, University of North Carolina at Wilmington, North Carolina 28403, USA
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20059

⁶Key Lab of Aerosol Chemistry & Physics, Institute of Earth Environment, Chinese Academy of Sciences, Xi'an 710075, China
⁷Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California, 91109, USA
⁸Department of Earth System Science, University of California, Irvine, California, 92697, USA
⁹GEOMAR, Helmholtz Centre for Ocean Research, Wischhofstrasse 1–3, Kiel 24148, Germany
¹⁰Mediterranean Institute of Oceanography, University of Toulon, La Garde, France
¹¹Department of Applied Physics and Applied Mathematics, Columbia University, New York, NY, 10027, USA

Received: 11 June 2015 – Accepted: 9 July 2015 – Published: 23 July 2015
Correspondence to: J. Hansen (jeh1@columbia.edu)
Published by Copernicus Publications on behalf of the European Geosciences Union.

ACPD
15, 20059–20179, 2015

Ice melt, sea level rise and superstorms

J. Hansen et al.

Title Page
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Conclusions References
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◀ ▶
◀ ▶
Back Close
Full Screen / Esc
Printer-friendly Version
Interactive Discussion

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15, 20059–20179, 2015

Ice melt, sea level rise and superstorms

J. Hansen et al.

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Your source for the latest research news

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Breaking News: Graph

Overnight delivery on thousands of items.

SD Health Physical/Tech Environment Society/Education Quirky

Science News

from research organizations

Two degree Celsius warming locks in sea level rise for thousands of years

Date: October 18, 2015
Source: University of New South Wales

Summary: A jump in global average temperatures of 1.5°C to 2°C will see the collapse of Antarctic ice shelves and lead to hundreds and even thousands of years of sea level rise, according to new research.

Share: f 1233 t 244 s 44 in 59 Total shares: 1580

RELATED TOPICS

- Earth & Climate
- Global Warming
- Climate
- Snow and Avalanches
- Environmental Issues
- Oceanography
- Geography

RELATED TERMS

- Larsen Ice Shelf
- Sea level
- Ice sheet
- Greenland ice sheet
- Polar Bear

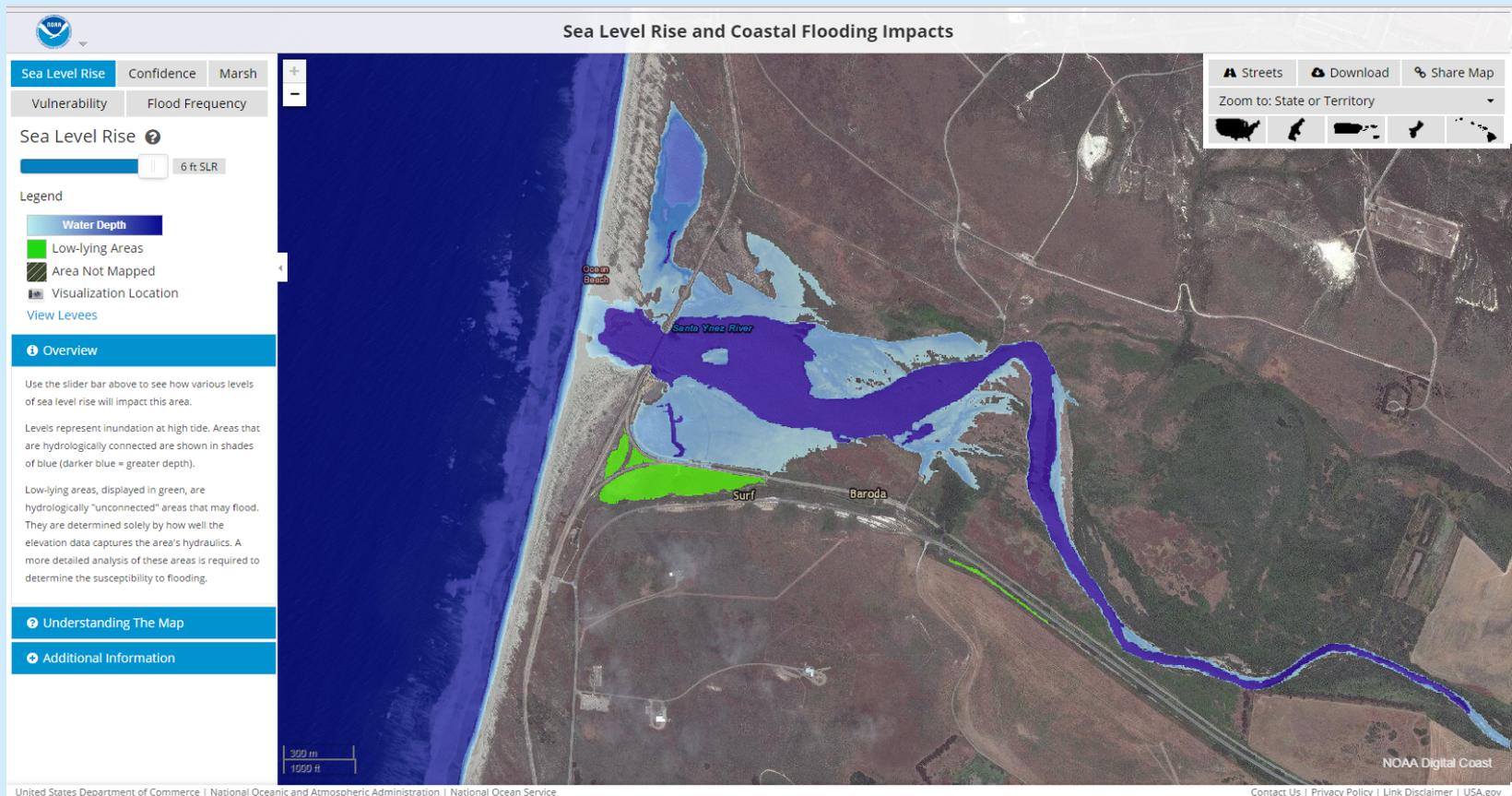


Paradise Bay, Antarctica (stock image).
Credit: © mrallen / Fotolia

A jump in global average temperature of 1.5°C-2°C

ASSESSING SEA LEVEL RISE VULNERABILITY

NOAA Sea Level Rise Viewer



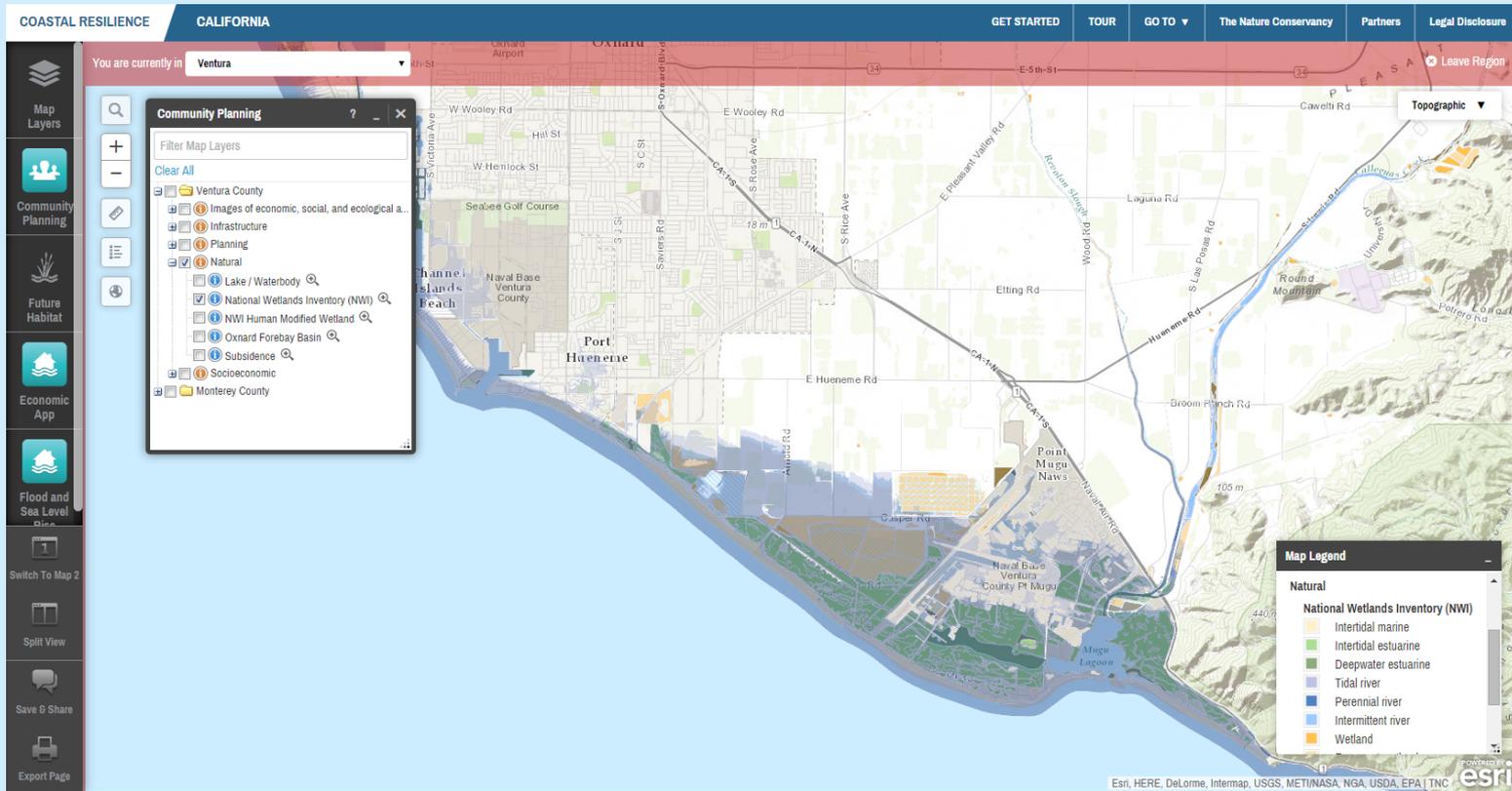
ASSESSING SEA LEVEL RISE VULNERABILITY

NOAA Sea Level Rise Viewer



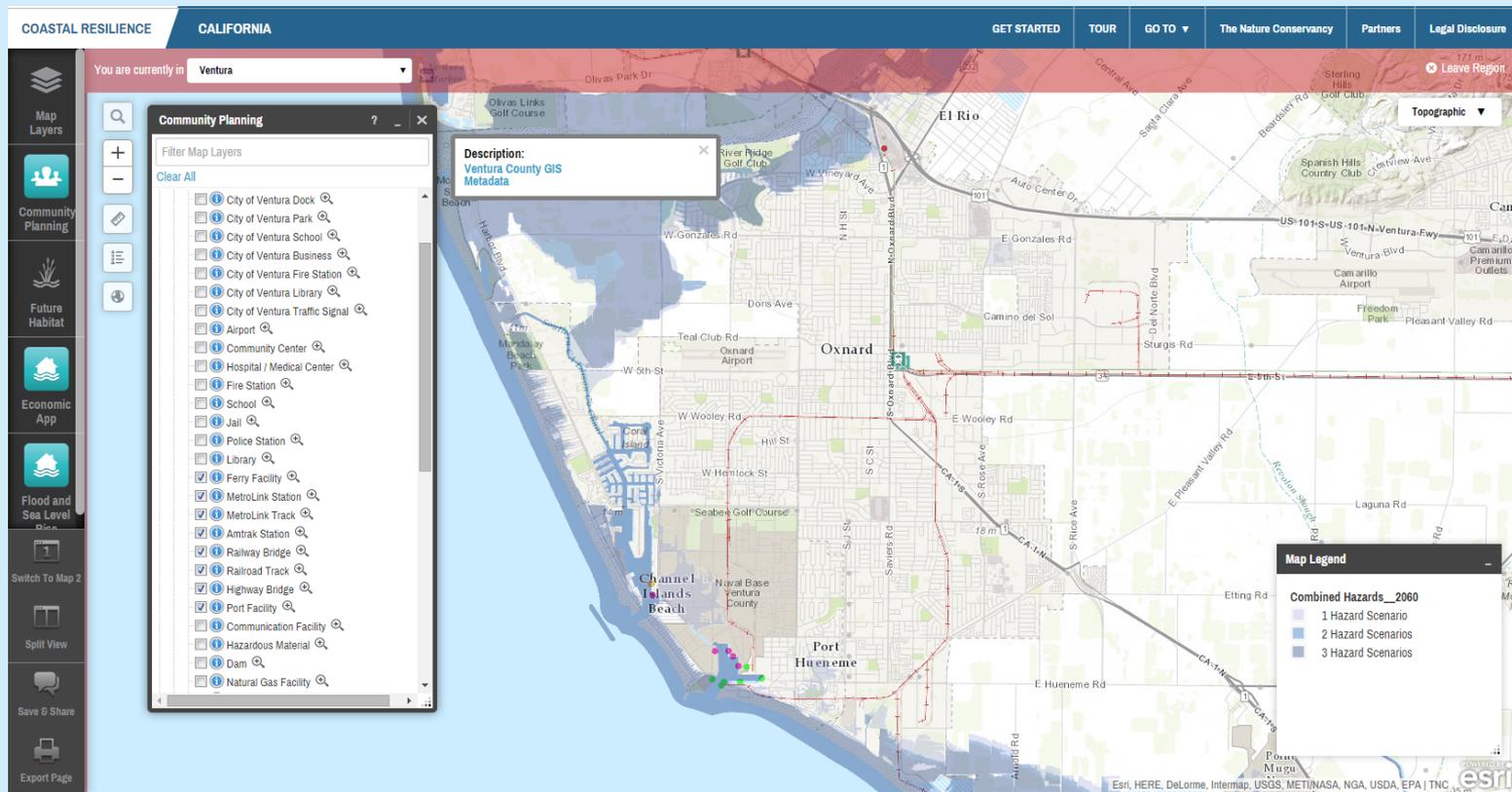
ASSESSING SEA LEVEL RISE VULNERABILITY

TNC Coastal Resilience Ventura tool



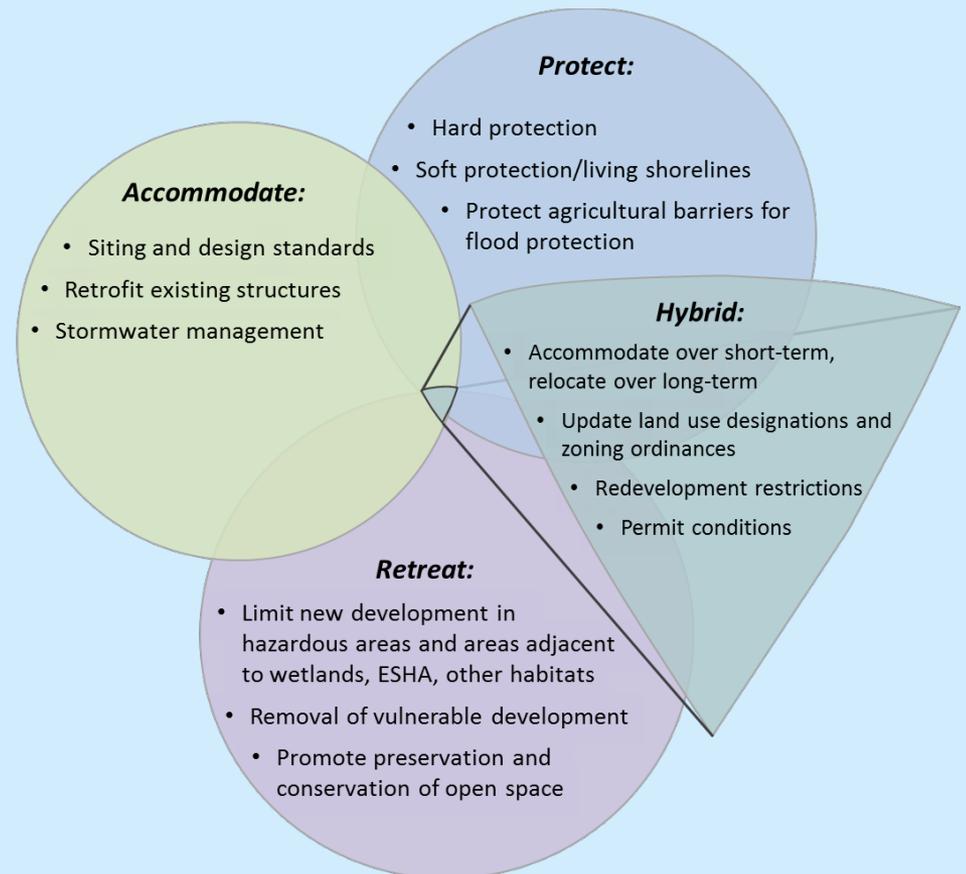
ASSESSING SEA LEVEL RISE VULNERABILITY

TNC Coastal Resilience Ventura tool



ADAPTATION PLANNING & LCP UPDATES

- Sea Level Rise Guidance provides a library of adaptation strategies
 - Applicable to either LCPs or individual projects
 - Organized by Coastal Act resource, then planning goal



BEFORE ADAPTATION: AVOID HIGH HAZARD AREAS



Sometimes the Biggest Decision is the Decision to DO NOTHING

AVOIDANCE OPTIONS



- **Fee Simple Acquisition**
- **Conservation Easements**
- **Present Use Tax**
- **Transfer of Development Rights**

MOVE AWAY FROM HAZARDS



- Fee Simple Acquisition
- Conservation Easements
- Present Use Tax
- Transfer of Development Rights

- Removal/Relocation
- Managed Retreat
- Setbacks
- Rolling Easements

REMOVAL/RELOCATION



REMOVAL/RELOCATION



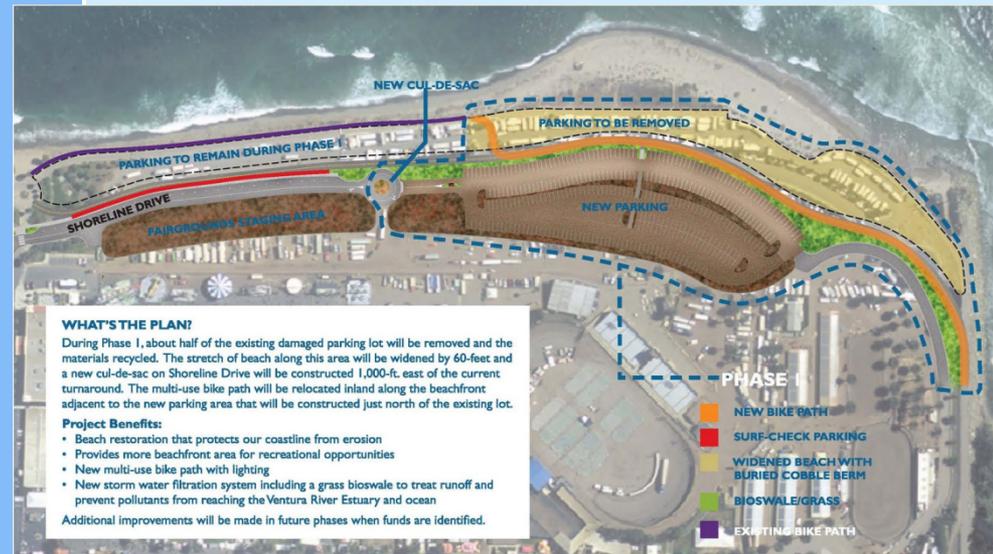
BEACH RECOVERY STILLWELL HALL Monterey County, CA

Photos: Copyright (C) 2002-2005 Kenneth &
Gabrielle Adelman, California Coastal
Records Project

MANAGED RETREAT - EXAMPLE

Surfers Point, Ventura

- Shoreline Erosion
- Property Damage
- Development too close to Shoreline
- Loss of Public Access
- Polluted Run Off
- Structures Impede Watershed Sediment
- Established Surf Resource at River Delta



MANAGED RETREAT EXAMPLE

- **Managed Retreat of Bike Path & Parking**
- **Reconfigure Parking to Maintain Access**
- **Vegetated buffers and Permeable Pavement for Water Quality**
- **Cobble Berm for Shore Protection**
- **Restore Sediment Supplies**



DEVELOPMENT SETBACK – PISMO BEACH



Pre-Coastal Act

Required Setback

MOVE HAZARDS AWAY (SOFT PROTECTION)

- **Maintain or Restore Natural Sand Sources**
- **Beneficial Reuse of Sand**
- **Improve or Augment Sand Supplies**
- ***Innovative Sand Sources***
- **Retain Sand at Specific Locations**
- ***Innovative Sand Retention Efforts***

MAINTAIN OR RESTORE NATURAL SUPPLIES OF SAND TO THE COAST



Sand Mining in San Juan Creek, CA



Matilija Dam, Ventura County, CA

BENEFICIAL REUSE OF SAND



Harbor By-passing at Santa Cruz Harbor

Photo Credit: California Coastal Records Project

BENEFICIAL REUSE OF BEACH SAND



Sand Back-passing at East Beach, Long Beach, CA

Photo Credit: California Coastal Records Project

AUGMENT SAND SUPPLIES



**Over 35 Million CY of Sand
added to
Santa Monica Bay Beaches
since late 1930s**



AUGMENT SAND ON BEACHES OFFSHORE SAND SUPPLIES



RETAINING SAND – BEACH BERMS



December 3, 2007



December 20, 2002

Berm Building/Beach Scraping in Carpenteria, CA

Photo Credit: Matt Roberts, Parks and Recreation

RETAINING SAND - GROINS



Will Rogers Beach with Groins

Photo Credit: California Coastal Records Project

Slide 33

10/23/15

California Coastal Commission

RETAINING SAND - BREAKWATERS



Venice Breakwater

Photo Credit: California Coastal Records Project

RETAINING SAND – DUNE NOURISHMENT



Beach Dunes
Stinson Beach and Ocean Beach

Photo Credit: California Coastal Records Project

RETAINING SAND – ARTIFICIAL HEADLANDS



Laguna Beach

Photo Credit: California Coastal Records Project

Slide 36 10/23/15
California Coastal Commission

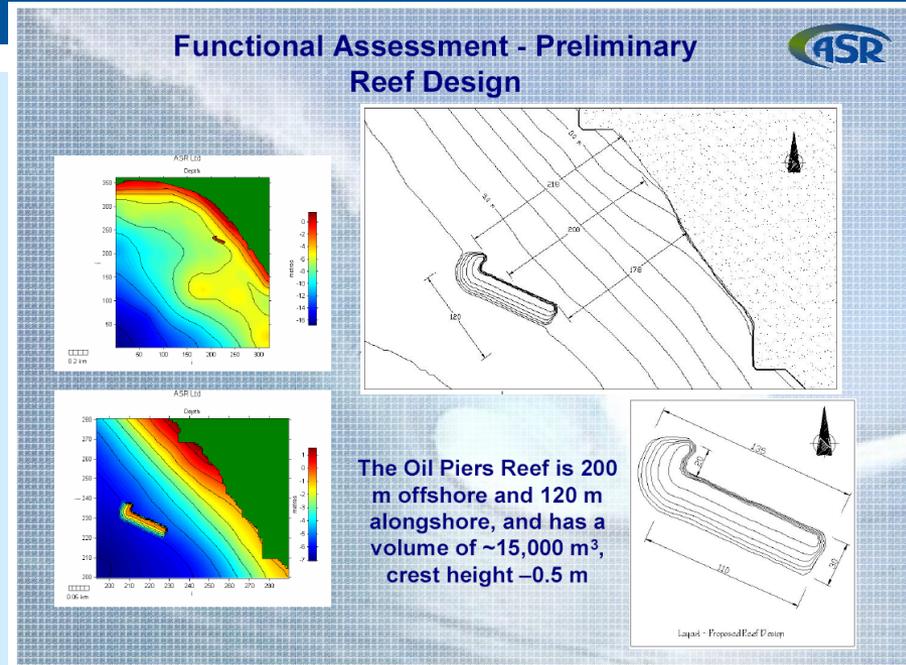
RETAINING SAND – AUGMENT DELTAS



**Topanga Creek (top) and
San Mateo Creek (right)**

Photo Credit: California Coastal Records Project

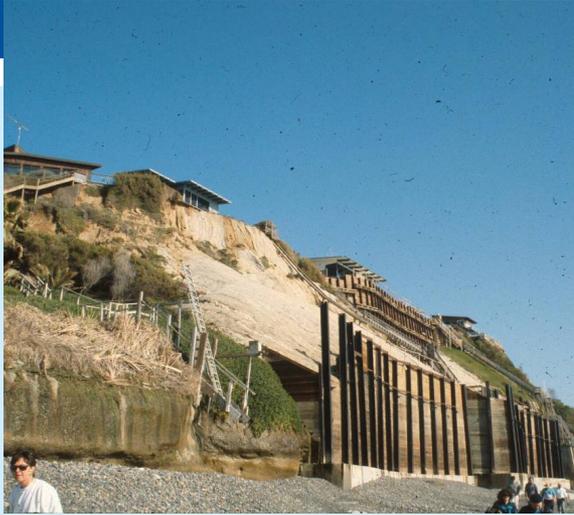
INNOVATIVE RETAINING STRUCTURES



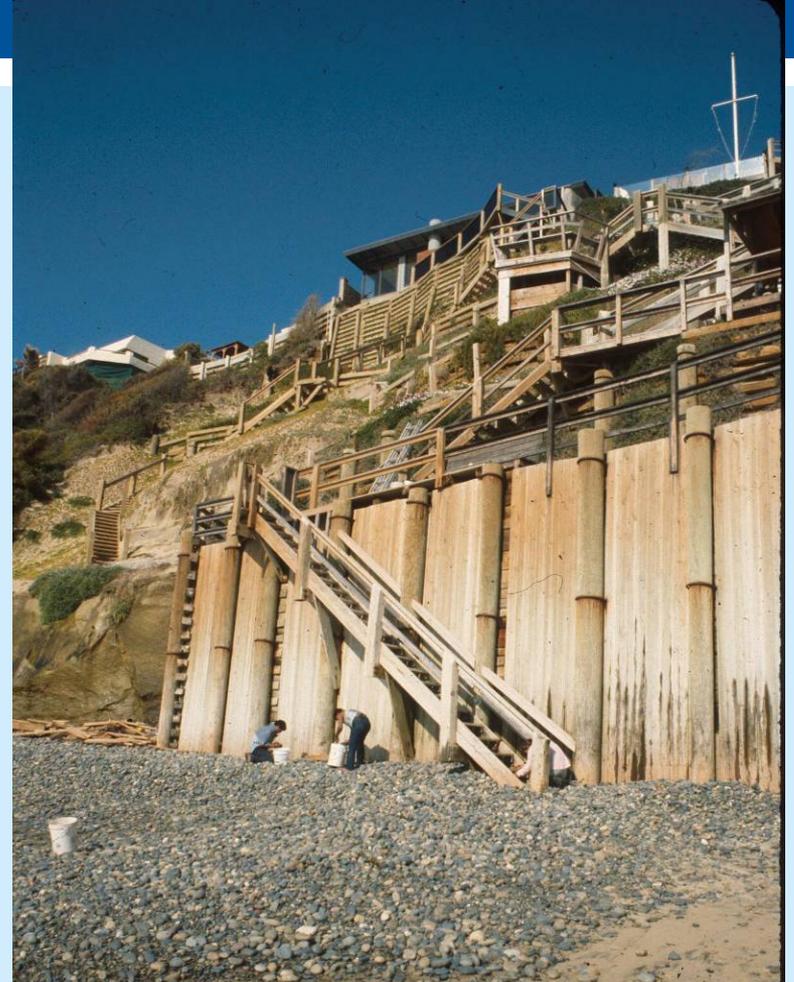
**Artificial Seaweed,
Multi-purpose Reefs,
Concrete Unit Reefs,
Floating Breakwaters**



PROTECTIVE BARRIERS – HARD ARMORING



Vertical Seawalls



BARRIERS TO PROTECT DEVELOPMENT

Revetments,
Gabions, Multiple
designs

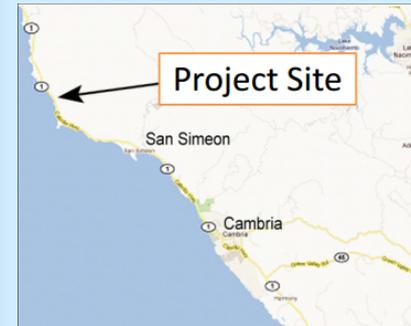


ADAPTIVE HARD PROTECTION GOLETA BEACH



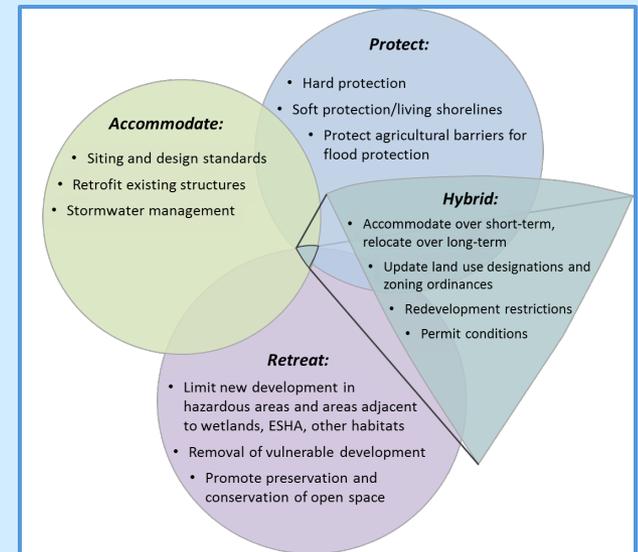
ADAPTATION: HWY 1 PIEDRAS BLANCAS REALIGNMENT

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CHOOSING ADAPTATION STRATEGIES

- Different strategies for different locations, hazards, and resource protection goals.
- The effectiveness of adaptation strategies will vary across spatial and temporal scales.
- Consider a hybrid approach that uses multiple strategies



ADAPTATION STRATEGIES

Coastal Development and Hazards

Public Access and Recreation

Coastal Habitats, ESHA, & Wetlands

Agricultural Resources

Water Quality and Supply

Archaeological and
Paleontological Resources

Scenic and Visual Resources

A. Coastal Development and Hazards

The Coastal Act requires that new development be sited and designed to be safe from hazards and to not adversely impact coastal resources (Coastal Act Sections 30235 and 30253). The main goals that relate to hazards and coastal development are:

- Update land use designations, zoning maps, and ordinances to account for changing hazard zones
- Include sea level rise in hazard analyses and policies
- Plan and locate new development to be safe from hazards, not require protection over its entire lifespan, and be protective of coastal resources

Goal: Plan and locate new development to be safe from hazards, not require protection over its entire lifespan, and be protective of coastal resources

A.4 Limit new development in hazardous areas: Restrict or limit construction of new development in zones or overlay areas that have been identified or designated as hazardous areas to avoid or minimize impacts to coastal resources and property from sea level rise impacts.

A.5 Cluster development away from hazard areas: Concentrate development away from hazardous areas. Update any existing policies that cluster development to reflect additional hazard zones due to sea level rise.

A.5a Concentration of development/smart growth: Require development to concentrate in areas that can accommodate it without significant adverse effects on coastal resources. This strategy is applicable for community wide planning through an LCP, but may also apply to CDPs for subdivisions or for larger developments involving large or multiple lots.

A.5b Transfer of Development Rights programs (TDR): Restrict development in one area ("sending area") and allow for the transfer of development rights to another area more appropriate for intense use ("receiving area"). LCPs can establish policies to implement a TDR program to restrict development in areas vulnerable to sea level rise and allow for transfer of development rights to parcels with less vulnerability to hazards. A TDR program can encourage the relocation of development away from at-risk locations, and may be used in combination with

COASTAL DEVELOPMENT & HAZARDS

COASTAL ACT GOALS

- Update land use designations, zoning maps, and ordinances to account for changing hazard zones
- Include sea level rise in hazard analyses and policies
- Plan and locate new development to be safe from hazards, not require protection over its entire lifespan, and be protective of coastal resources
- Incorporate sea level rise adaptation into redevelopment policies
- Encourage the removal of development that is threatened by sea level rise
- Use “soft” or “natural” solutions as a preferred alternative for protection of existing endangered structures
- Limit bluff and shoreline protective devices to protect existing endangered structures
- Require special considerations for critical infrastructure and facilities
- Protect transportation infrastructure

PUBLIC ACCESS AND RECREATION

Coastal Act Goals

- Maximize public access and recreational use by protecting beaches and other coastal areas
- Protect lower cost visitor and recreational facilities
- Foster efforts to better understand impacts of sea level rise



COASTAL HABITATS, ESHA, & WETLANDS

Coastal Act Goals

- **Protect, enhance, and restore sensitive habitats**
- **Avoid significant disruption to habitats**
- **Avoid significant impacts to habitats from adjacent development**
- **Manage sediment in ways that benefit habitats**
- **Incorporate sea level rise into habitat management actions**

EXAMPLE OF COAST WETLAND PROTECTION

**San Elijo Lagoon
Present**



**San Elijo Lagoon
After I-5 Widening**



WATER QUALITY AND SUPPLY

Coastal Act Goals

- **Control runoff and stormwater pollution**
- **Minimize adverse effects of wastewater discharges and entrainment**
- **Improve long-term water quality through research**

AGRICULTURAL RESOURCES

Coastal Act Goals

- **Protect the maximum amount of prime agricultural land**
- **Limit conversion of lands suitable for agriculture to non-agricultural uses**
- **Minimize impacts to water quality that could result from agricultural practices**
- **Promote water conservation efforts**



Oxnard Shoreline

Photo Credit: Coastal Records Project

SCENIC RESOURCES ARCHAEOLOGICAL AND PALEONTOLOGICAL RESOURCES

Coastal Act Goals

Protect views to and along the ocean and scenic coastal areas

Development shall be sited and designed to: *“Protect views to and along the ocean and scenic coastal areas, to minimize the alteration of natural landforms... and to restore and enhance visual quality in visually degraded areas”*

Coastal Act Goals

Protect archaeological and paleontological resources

“Where development would adversely impact archaeological or paleontological resources as identified by the State Historic Preservation Officer, reasonable mitigation measures shall be required”

SEA LEVEL RISE GUIDANCE RESOURCES

Goal: Include sea level rise in hazard analyses and policies

A.2 Update policies to require sea level rise to be included in hazard analyses and management plans: LCP policies should include requirements to analyze projected sea level rise. Consider specific projection scenarios to be analyzed. (See [Chapter 3](#) of the Guidance for a description of scenario planning.) LCPs could also specify which analyses are required for various types of projects/development (see Step 2 of Chapters [5](#) and [6](#) or [Appendix B](#) for suggested analyses).

A.2a Site-specific evaluation of sea level rise: Update policies, ordinances, and permit application requirements to include a required site-specific evaluation of coastal hazards due to sea level rise over the full projected life of any proposed development. Analyses should be conducted by a certified Civil Engineer or Engineering Geologist with expertise in coastal processes.

A.2b Incorporate wave runup zones and sea level rise in coastal flood hazard maps: Develop coastal flood maps that include areas that will be subject to wave action and flooding due to sea level rise. These maps may be able to rely upon existing flood maps, such as the FEMA Flood Insurance Rate Maps, for current flood areas and base conditions, but should be augmented to include future conditions, including sea level rise, likely to occur through the life of proposed new development.

A.2c Incorporate sea level rise into calculations of the Geologic Setback Line: Update geotechnical report requirements for establishing the Geologic Setback Line (bluff setback) to include consideration of bluff retreat due to sea level rise in addition to historic bluff retreat data, future increase in storm or El Niño events, and any known site-specific conditions. The report should be completed by a licensed Geotechnical Engineer or an Engineering Geologist.

A.2d Include sea level rise in wave runup, storm surge, and tsunami hazard assessments⁴⁶: Sea level rise should be included in wave runup analyses, including storm event and tsunami hazard assessments. This should include evaluating tsunami loads/currents on maritime facilities and coastal structures. Since tsunami wave runup can be quite large, sea level rise projections of only a few inches may not have a large impact on these assessments. However, for time

ols vary in their complexity: some inundation with simple rise in sea level rise. Others include factors like wind, waves, and storm surge. A useful first look at possible sea level rise scenarios is provided in [Appendix B](#), which provides information on determining hazard

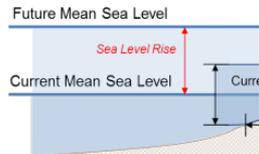


Figure B-3. Sea level rise and changes to tidal range.

Table B-3. General Resources for Information

Resource	Description
Aerial Photographs	Useful for general shoreline trend photos can help identify changes.
LIDAR	Fairly detailed providing GIS data on conditions and LIDAR data sets changes.
Topographic Maps	Useful for base site changes; or to distinguish sea level inundation or tidal changes.
NOAA Sea Level Rise and Coastal Flooding Impacts Viewer	Useful to show level location if changes in the erosion.
NOAA Tidal Data	Measured and components for the open coast.
NOAA Technical Report NOS 2010-01: Technical Considerations for use of Geospatial Data in Sea Level Change Mapping and Assessment	Provides technical information for agencies, practitioners, and decision makers seeking to use geospatial data to assist with sea level change assessments.

NOAA National Ocean Service
http://www.tidesandcurrents.noaa.gov/publications/tech_rpt_57.pdf

property at risk, miles of vulnerable roads and railroads, vulnerable power plants and wastewater treatment plants, and wetland migration potential.

	Link
th	
to	NOAA Office for Coastal Management, http://coast.noaa.gov/digitalcoast/tools/slr
1.4	http://cal-adapt.org/sealevel/
es	http://www.pacinst.org/reports/sea_level_rise/maps/
For the 2009 report <i>The Impacts of Sea-Level Rise on the California Coast</i> visit:	http://pacinst.org/publication/the-impacts-of-sea-level-rise-on-the-california-coast/

GRANTS FOR LCP UPDATES



Round 1: Awarded Dec. 2013
\$1,000,000 to 11 jurisdictions

Round 2: Awarded Nov. 2014
\$1,000,000 to 12 jurisdictions

Future rounds coming soon!

OTHER PROJECTS

- Case studies / example language
- Typology project: model ordinances for safe shoreline residential development
- UCLA Model Ordinance project
- Working with State Lands Commission on public trust issues

...Others?

THANK YOU!

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