COMMUNITY DEVELOPMENT DEPARTMENT

CITY OF SANTA BARBARA SEA LEVEL RISE ADAPTATION PLAN SUBCOMMITTEE

October 22, 2019

Agenda

1. Monitoring Recommended
2. Adaptation Recommendations for the Coastal Bluff Areas
3. Plan for Public Outreach

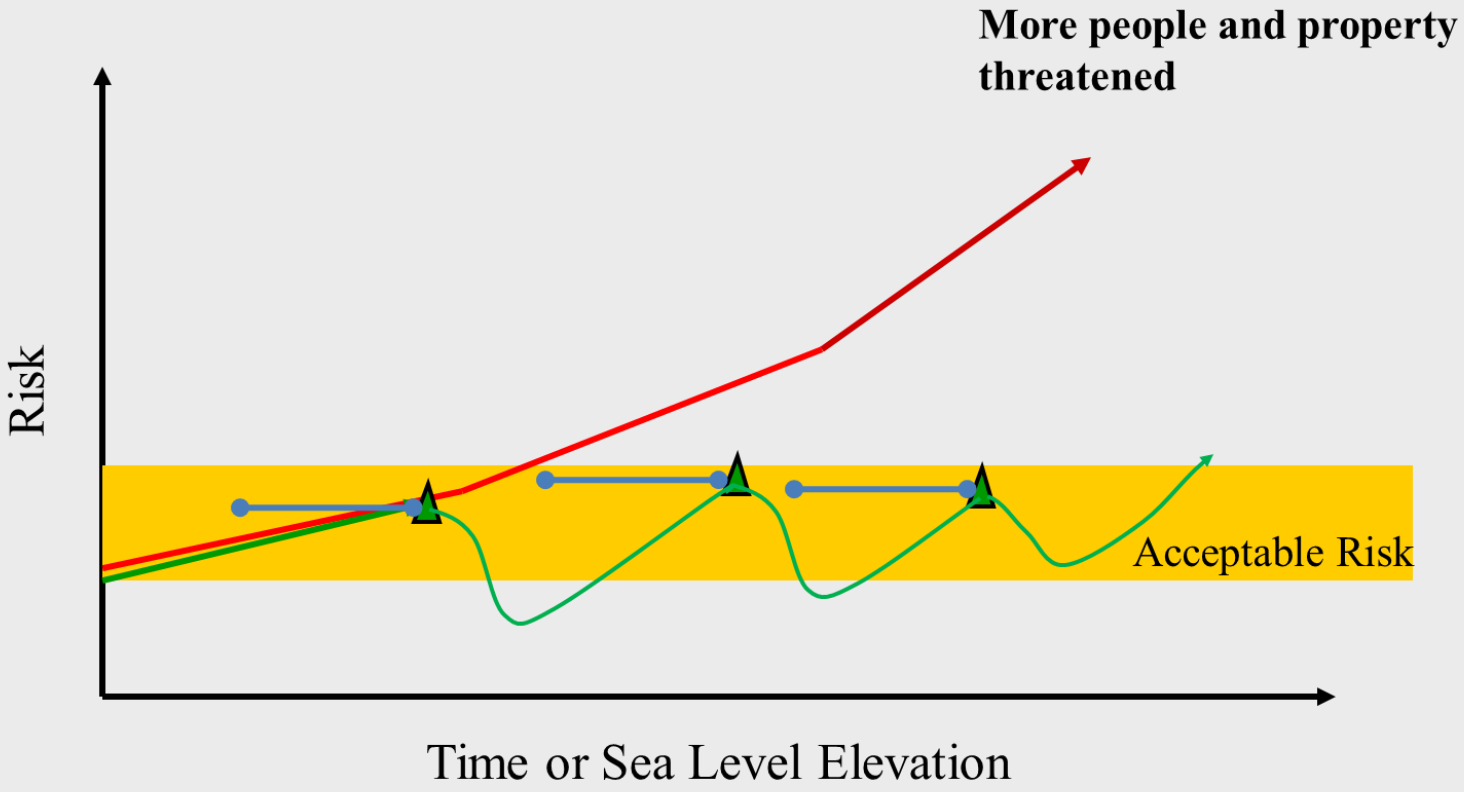
MONITORING RECOMMENDED

Why a Phased Approach?

- Dynamically changing conditions will require different adaptation tools at different times.
- Desire to keep community assets such as beaches, Waterfront amenities, and the Harbor functioning for as long as feasible.

Why a Phased Approach?

- Rapidly changing information:
  - *Timing and rate of sea-level rise*
  - *Other climate changes: rainfall patterns, etc.*
  - *Feasibility of engineering options*
  - *Feasibility of managed retreat prior to a disaster*
  - *Interpretations of property rights and other laws*
  - *How programs such as FEMA will be modified*


More people and property threatened
Risk
Acceptable Risk
Time or Sea Level Elevation

Adaptation Planning Framework

- Overarching Adaptation Plan
  - *Identifies detailed priorities for near-term*
  - *Considers mid and long-term*
- Short-term action planning (2-5 years)
- Shoreline monitoring program
- Triggers-based implementation
- Reevaluation every 10 years

Shoreline Monitoring Program

- Tracks progress toward identified thresholds
- Reporting every 2-5 years
- Coordination with regional, state, and federal agencies including BEACON and UCSB
  - *Consistent methods*
  - *Shared data*

Potential Monitoring Parameters

Threshold Criteria	Monitoring Data Source/Collection
Sea-Level Rise	The monitoring program should track the following resources for science updates: • CCC Sea-Level Rise Policy Guidance • Ocean Protection Council State of California Sea-Level Rise Guidance • California Climate Assessment • NOAA Tides and Currents, Santa Barbara station • Coordinate with Scripps Institute of Oceanography and follow any scientific reports they produce on sea-level rise in Southern California.
Flooding and Storm Damage Frequency	The monitoring program should record coastal and creek flooding and storm damage events and information: • Photos, videos, reports of event or damage • Date, type, location, and severity of flooding (e.g., depth, duration, wave height), and damages

Potential Monitoring Parameters

Threshold Criteria	Monitoring Data Source/Collection
Beach Width	• The monitoring program should review BEACON beach transect data every 2 years (collected by USGS) • The monitoring program should consider obtaining additional beach transects for the City beaches
Coastal Bluff Top Offset and Bluff Slope	• The monitoring program should review available LiDAR data or aerial photography to track bluff edge relative to different assets and coastal bluff slope • The monitoring program should include regular surveys of transects along the bluffs of bluff slope and bluff edge if reliable and regular LiDAR data cannot be obtained.
Creek Water Levels and Flood Frequency	• The monitoring program should assess water levels at Mission Lagoon, Laguna Creek, Sycamore Lagoon, and the Andrée Clark Bird Refuge through the deployment of new gauges.
Groundwater Levels	• The monitoring program should track groundwater levels through the State Water Board's Groundwater Ambient Monitoring and Assessment (GAMA) Program

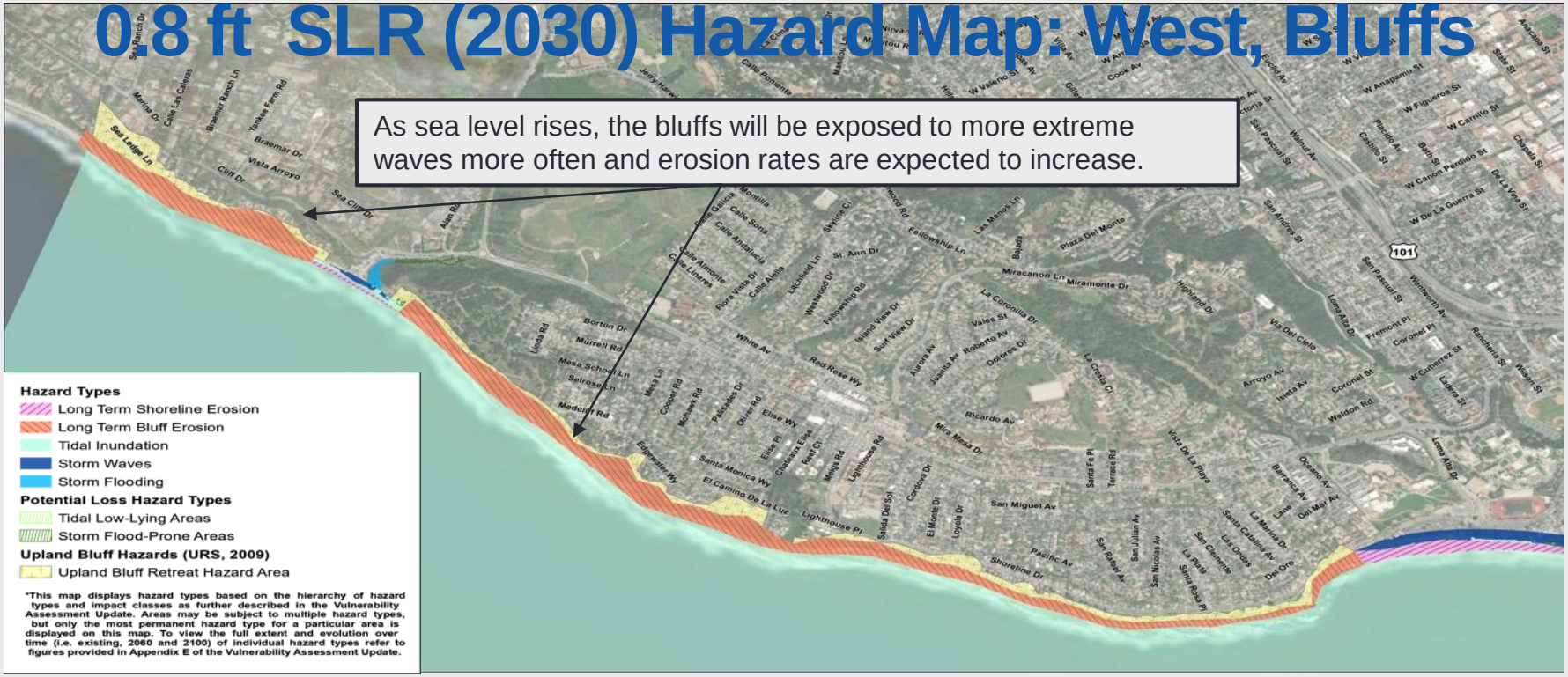
ADAPTATION OPTIONS COASTAL BLUFF AREAS

Planning Timeframes

- Near-term: 0 - 0.8 feet (2020 - 2030)
- Mid-term: 0.8 - 2.5 feet (2030 - 2060)
- Long-term: 2.5 - 6.6 feet (2060 - 2100)

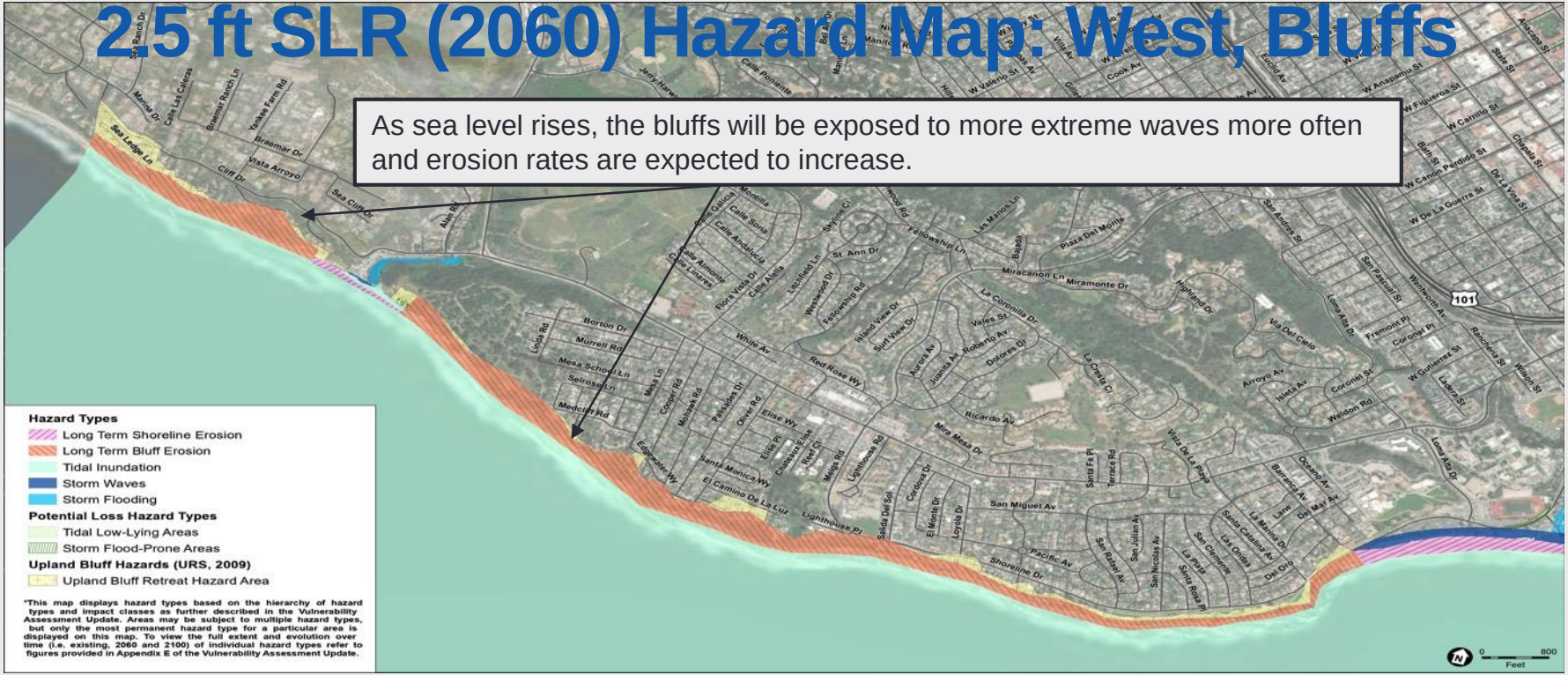
0.8 ft SLR (2030) Hazard Map: West, Bluffs

As sea level rises, the bluffs will be exposed to more extreme waves more often and erosion rates are expected to increase.



2.5 ft SLR (2060) Hazard Map: West, Bluffs

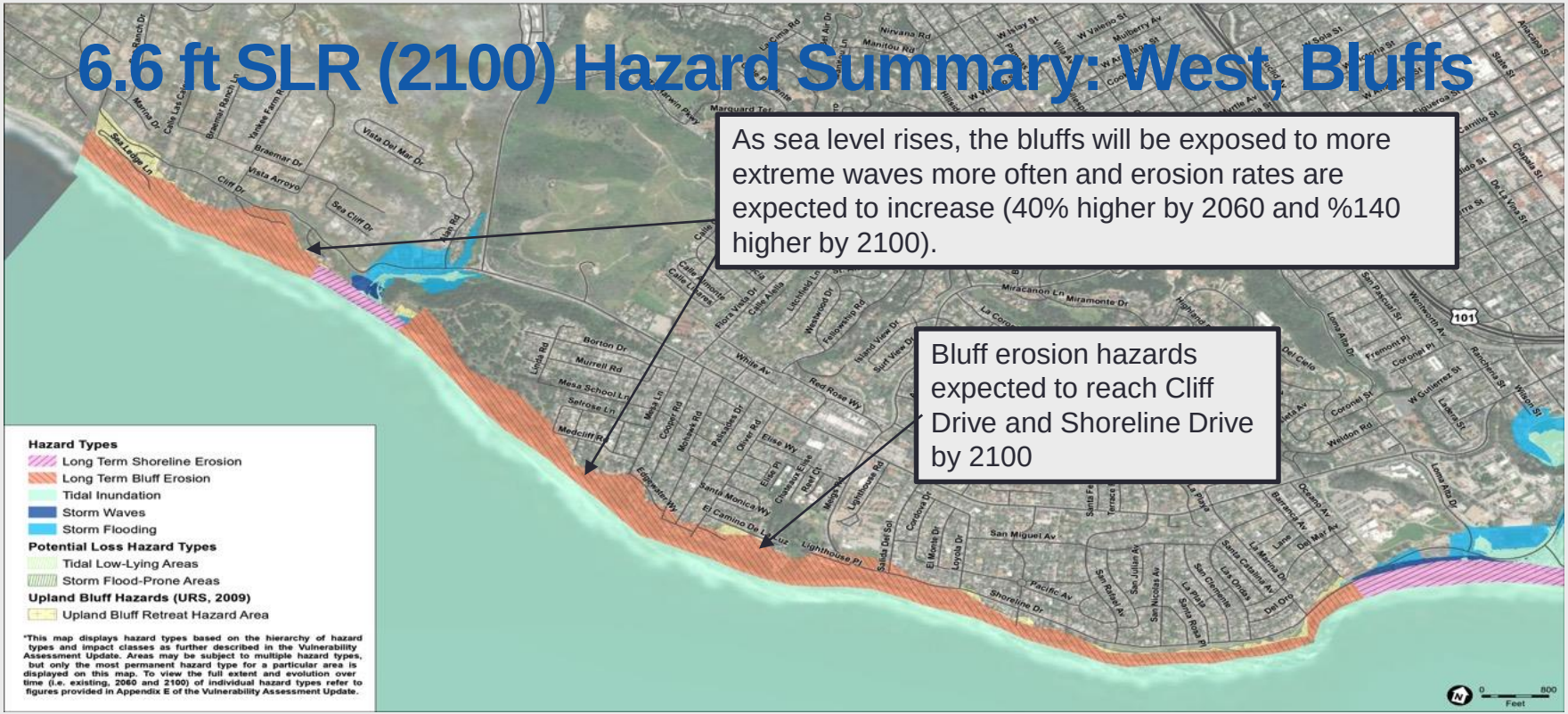
As sea level rises, the bluffs will be exposed to more extreme waves more often and erosion rates are expected to increase.



6.6 ft SLR (2100) Hazard Summary: West, Bluffs

As sea level rises, the bluffs will be exposed to more extreme waves more often and erosion rates are expected to increase (40% higher by 2060 and %140 higher by 2100).

Bluff erosion hazards expected to reach Cliff Drive and Shoreline Drive by 2100


Hazard Types
Long Term Shoreline Erosion
Long Term Bluff Erosion
Tidal Inundation
Storm Waves
Storm Flooding
Potential Loss Hazard Types
Tidal Low-Lying Areas
Storm Flood-Prone Areas
Upland Bluff Hazards (URS, 2009)
Upland Bluff Retreat Hazard Area
*This map displays hazard types based on the hierarchy of hazard types and impact classes as further described in the Vulnerability Assessment Update. Areas may be subject to multiple hazard types, but only the most permanent hazard type for a particular area is displayed on this map. To view the full extent and evolution over time (i.e. existing, 2060 and 2100) of individual hazard types refer to figures provided in Appendix E of the Vulnerability Assessment Update.
Shoreline Dr
Pacific Av
San Miguel Av
Lighthouse Pl
Cliff Dr
Sea Cliff Dr
Vista Del Mar Dr
Vista Arroyo
Braemar Dr
Borton Dr
Murrell Rd
Mesa School Ln
Selrose Ln
Medcliff Rd
Edgewater Wy
Santa Monica Wy
El Camino De La Luz
Miramonte Dr
Miracanon Ln
Red Rose Wy
White Av
Marguard Ter
Nirvana Rd
Manitou Rd
Weldon Rd
Coronel St
Coronel Pl
Fremont Pl
Lomas Alto Dr
Ocean Av
Del Mar Av
Barranca Av
Lane
Santa Cruz Av
Santa Rosa Pl
San Clemente
La Plata
San Nicolas Av
San Julian Av
San Rafael Av
Santa Catalina Av
Las Ondas
La Marina Dr
Del Orto
Terrace
Santa Fe
Lighthouse Rd
Salida Del Sol
Cordova Dr
El Monte Dr
Loyola Dr
Cooper Rd
Mesa Ln
Mesa Rd
Palisades Dr
Olivet Rd
Elise Wy
Elise Pl
Chelsea Elise
Ron Ct
Misty Ln
Flora Vista Dr
Calle Alegria
Calle Cerrito
Calle Fuente
Calle Cerrito
Calle Cerrito
Calle Cerrito

Bluff Adaptation Options

- Beach nourishment
- Sand retention structures
- Bluff erosion best management practices (BMPs)
- Shoreline protection devices
- Managed retreat

Bluff Adaptation Options

- ~~Beach nourishment~~
- ~~Sand retention structures~~
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Bluff Erosion BMPs

- Manage surface water & groundwater drainage
- Investigate contribution of overwatering of landscaping
- Implementation of City's updated Coastal LUP policies on bluff restoration, stabilization, and erosion control measures

Examples of existing BMPs in Santa Barbara

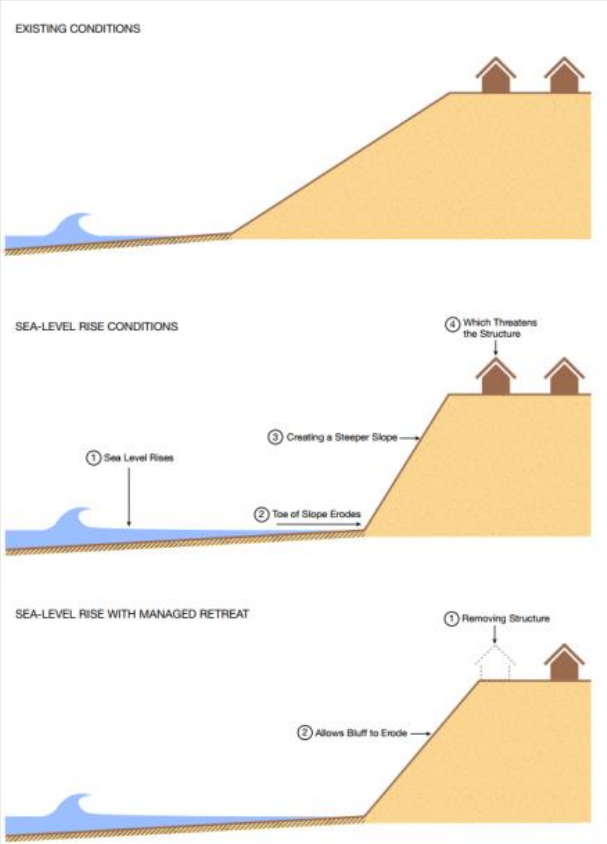
Drainage drop inlet

Low-irrigation landscaping

Drain pipes directing water to the toe of the bluff

Managed Retreat

- Removal of development
- Relocation of development
- Rerouting of roads
- Hazard avoidance



Managed Retreat

- Existing hazard avoidance policies:
  - Bluff setbacks for new development and substantial redevelopment
  - Limitations on uses on bluff face and bluff setbacks
  - When whole parcels in setbacks, primary structure limited in size allowed if no shoreline protection device required

Managed Retreat

Complexity

- Moving, removing, or limiting accessory development
- Moving development farther back on same parcel
- Moving or removing non-critical infrastructure
- Moving assets within public parks

- Entire parcel is at risk
- Relocating critical assets and rerouting major roads

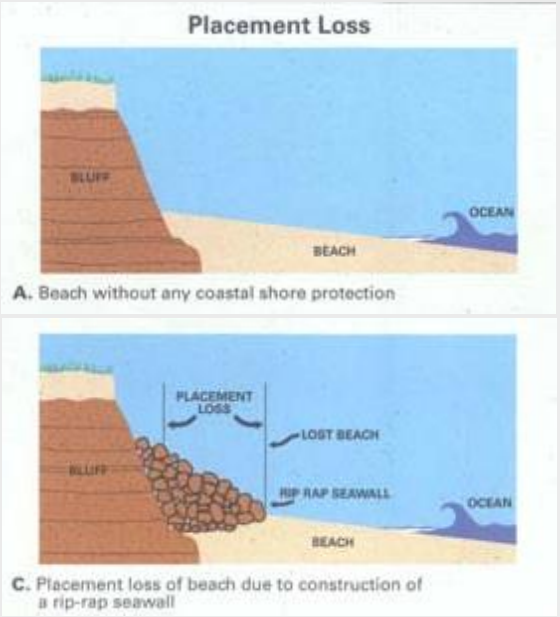
Shoreline Protection Devices

- Revetments impact beach
- Differences in permitting for residential and for public roads.
- Slope protection may be needed in addition to shoreline protection.
- Feasibility after 3-5 feet of sea-level rise unknown

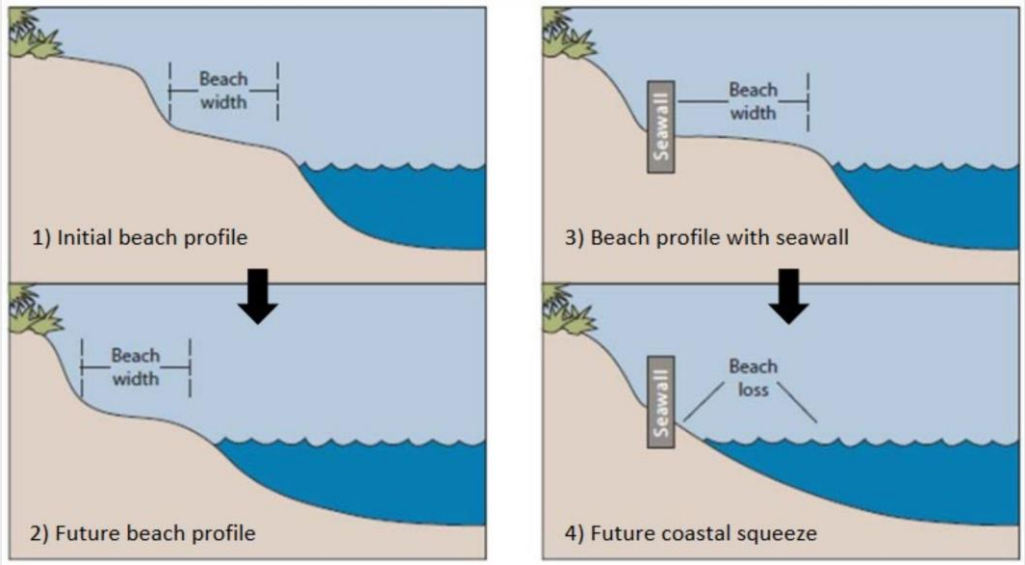
Shoreline protection devices are subject to failure when bluffs collapse, as shown here in Ocean Beach, San Francisco

Source: Westside Observer 2014. http://www.westsideobserver.com/2014/climate.html

Beach Impacts of Revetments



Coastal Squeeze



Bluff Adaptation Scenario Analysis

- Comparison of “No Action” with two potential adaptation scenarios
  - Not intended as proposed or preferred approach
  - Bracket a wide-range of possible actions
  - City will have flexibility to implement different strategies
- Economic benefit-cost analysis or scenarios
  - Compares relative costs/benefits of “No Action” with adaptation
  - Provides high-level understanding of costs/benefits of adapting

Bluff Adaptation Scenarios Analyzed

1. **Protect**: armor bluffs and build flood control to protect all public and private assets in place
2. **Retreat/Protect Hybrid**: retreat public and private assets up to major public roads, then armor bluffs to protect major roads in place while also preserving 25-foot wide lateral public access along road/bluff top

Protect Bluff Adaptation Scenario – 2.6 ft SLR (2060)

Protect Bluff Adaptation Scenario – 6.6 ft SLR (2100)

Retreat/Protect Hybrid Bluff Adaptation – 2.5 ft SLR (2060)

Retreat/Protect Hybrid Bluff Adaptation – 6.6 ft SLR (2100)

Bluff Adaptation Scenario Results

- Both scenarios reduce impacts
  - Cumulative economic benefits are similar
  - Neither scenario maintains beaches
- Costs of Protect are order of magnitude greater than Retreat/Protect Hybrid

- **Protect:** costs greater than benefits (by order of magnitude)
- **Retreat/Protect Hybrid:** benefits greater than costs (same order of magnitude)

Bluff Adaptation Plan Framework

Sea-Level Rise:	NEAR-TERM (0.8' rise (2030))	MID-TERM (2.5' rise (2060))	LONG-TERM (6.6' rise (2100))
Key Vulnerabilities (with no action):	By 0.8' rise: • Bluff erosion rates similar to today • Erosion impacts to: » Private Property » Douglas Preserve » Shoreline Park	By 2.5' rise: • Loss of 80% of bluff-backed beaches to erosion • Bluff erosion rates 40% higher than today's rates • Coastal bluff erosion impacts to: » Portions of Shoreline Drive » Douglas Family Preserve and Shoreline Park » Sewer lines, stormwater drainage pipes, and portions of minor roads » Private parcels	By 6.6' rise: • Loss of nearly all bluff-backed beaches to erosion • Bluff erosion rates 140% higher than today's rates • Continued coastal bluff erosion impacts: » Multiple locations on Shoreline Drive » Cliff Drive » Several minor roads » Douglas Family Preserve and Shoreline Park » Sewer lines » Stormwater drainage pipes » Private parcels

POTENTIAL ADAPTATION APPROACHES

Options for Near-Term		• Continue current regulatory requirements for bluff setbacks and limits for shoreline protection • Expand drainage best management practices	
	Plan & Permit	Reconstruct public stairways, shoreline protection for select public assets, and remove select public facilities as needed	
Additional Options for Mid- to Long Term	Plan & Permit	Revetments and Slope Protection for Major Public Roads and Public Access	Feasibility unknown
	Plan & Permit	Remove or relocate development and reroute roads	

Recommended Near-Term Actions

- Continue current regulatory practice of:
  - Requiring bluff setbacks for new development and substantial redevelopment that factor in accelerated bluff erosion rates from sea-level rise over time.
  - Limiting the construction of shoreline protection devices where feasible, except when necessary to protect essential public services, major public roads, and public access stairways.
- Update Shoreline Hazard Screening Map in Coastal Land Use Plan

Recommended Near-Term Actions

- Expand drainage best management practices
- Plan for removal, relocation or, as needed, protection of public assets in Shoreline Park and Douglas Family Preserve.
- Plan for repairs or replacement of public access beach stairways as needed.
- Plan for protection of Shoreline Drive at select locations when erosion levels trigger action.

Recommended Near-Term Actions

- Further study safe bluff setbacks and trigger distances, which will be used to inform the City on when adaptation measures are needed.
- Further study whether shoreline protection alone or additional slope protection measures (gunite, soldier piles, etc.) would be needed to protect major public roads and bluff top access areas due to underlying geologic conditions and landslide risk.

Questions or Comments?

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