Sediment to Sanctuary Beaches: Potential for Beneficial Reuse and Beach Nourishment

Max Delaney and Douglas George (PhD)

Greater Farallones National Marine Sanctuary

Brad Damitz

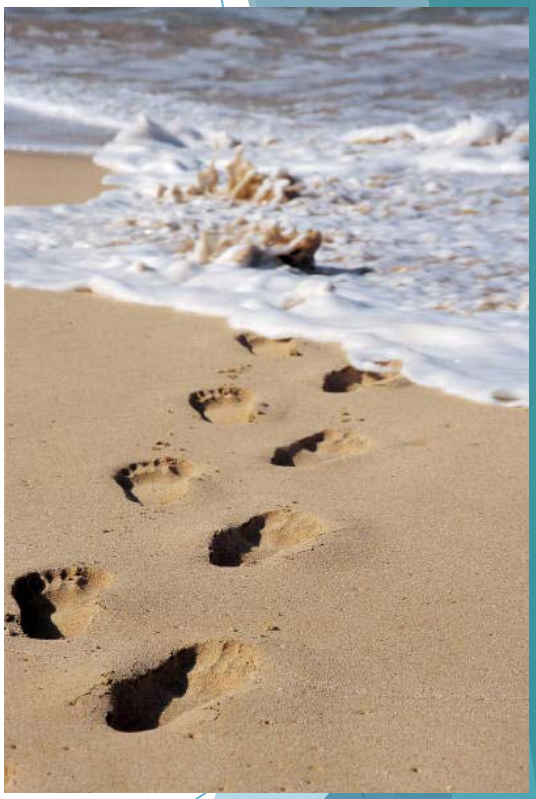
San Mateo County Harbor District

MBNMS and GFNMS Joint Advisory Council Meeting

August 16, 2017

Presentation Pathway

- Sediment Processes
- Managing Sediment Along the Coast
- Pilot Surfer's Beach Sand Replenishment Project
- Regulatory Setting for Conducting Beach Nourishment Using Beneficial Reuse of Dredged Material at Surfer's Beach

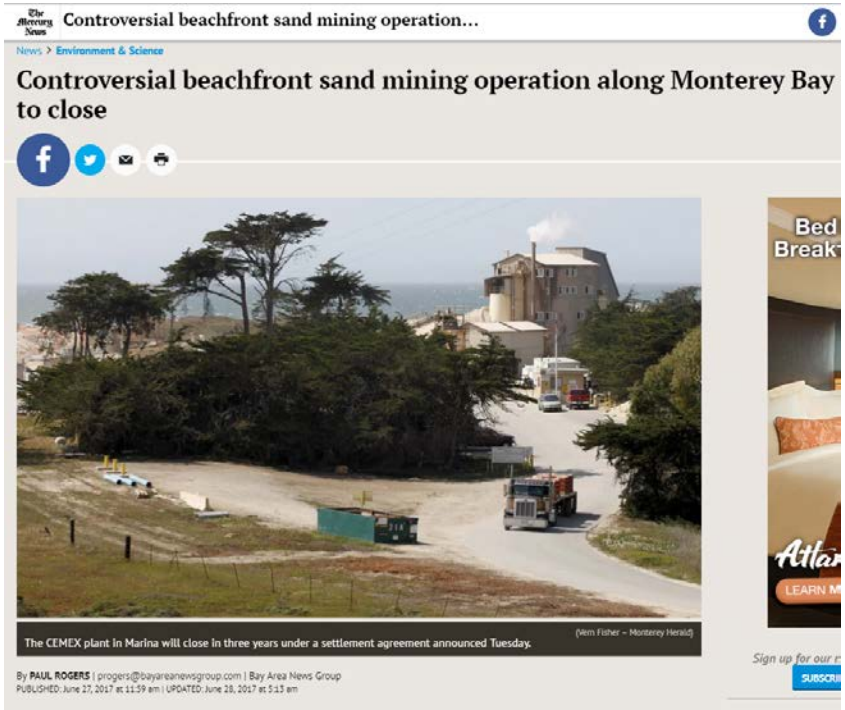


Beaches in a Changing Climate

67% of Southern CA beaches will need human intervention to survive to 2100 - Vitousek, et al., 2017

Likely that Central CA beaches will need similar attention

Two important developments:



The Mercury News Controversial beachfront sand mining operation...

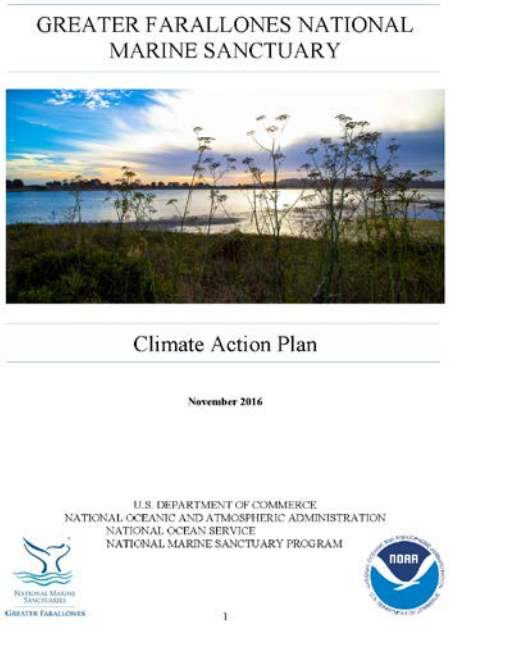
News > Environment & Science

Controversial beachfront sand mining operation along Monterey Bay to close

The CEMEX plant in Marina will close in three years under a settlement agreement announced Tuesday. (Vern Fisher – Monterey Herald)

By PAUL ROGERS | progers@bayareanewsgroup.com | Bay Area News Group

PUBLISHED: June 27, 2017 at 11:59 am | UPDATED: June 28, 2017 at 5:13 am



GREATER FARALLONES NATIONAL MARINE SANCTUARY

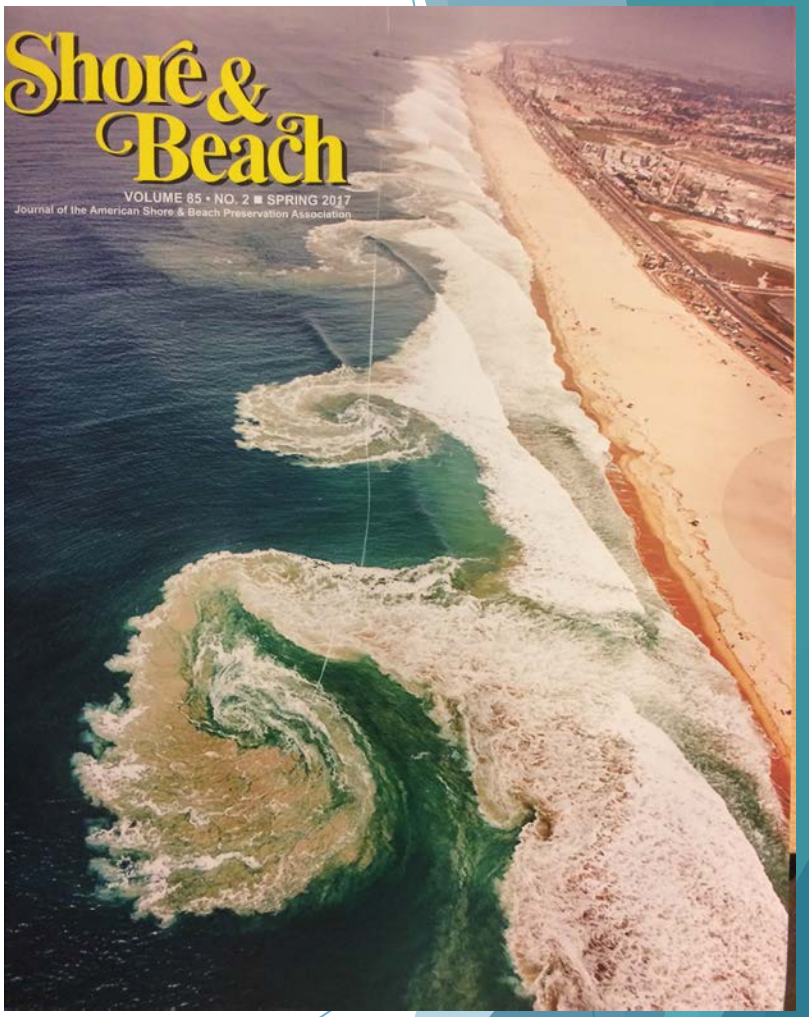
Climate Action Plan

November 2016

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE
NATIONAL MARINE SANCTUARY PROGRAM

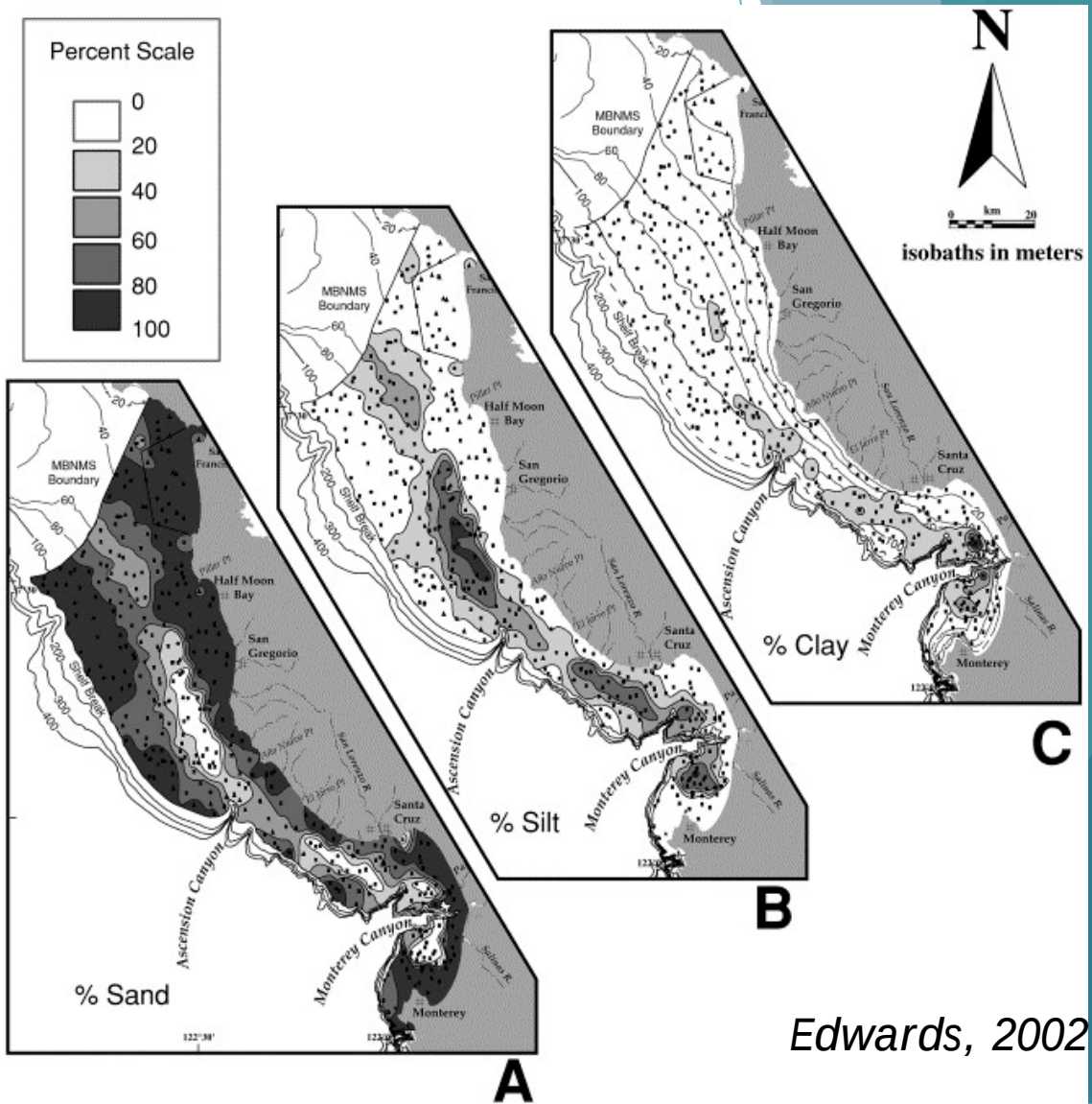
1

Sediment Processes



Regional Sediment Story

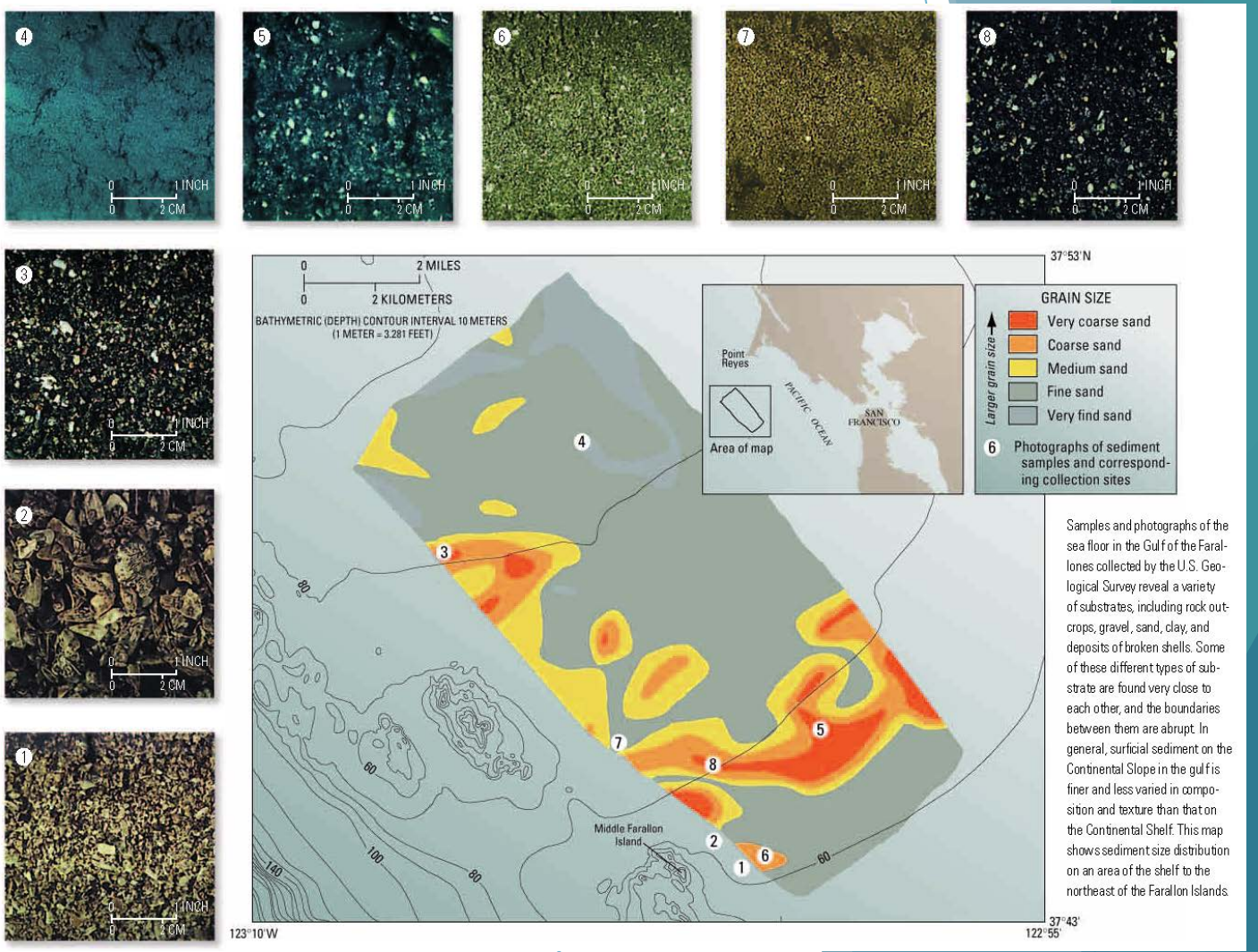
- Generally accepted north-south flow for sand due to currents and waves
- Mud plumes more dispersive across the shelf then reworked by waves



Edwards, 2002

Regional Sediment Story

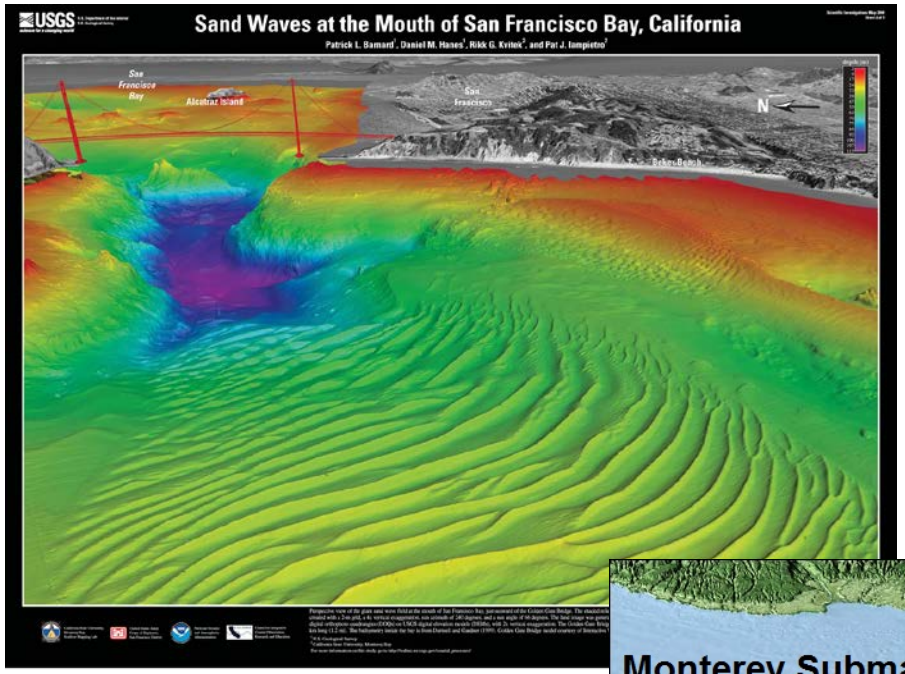
- Grain sizes on the seafloor

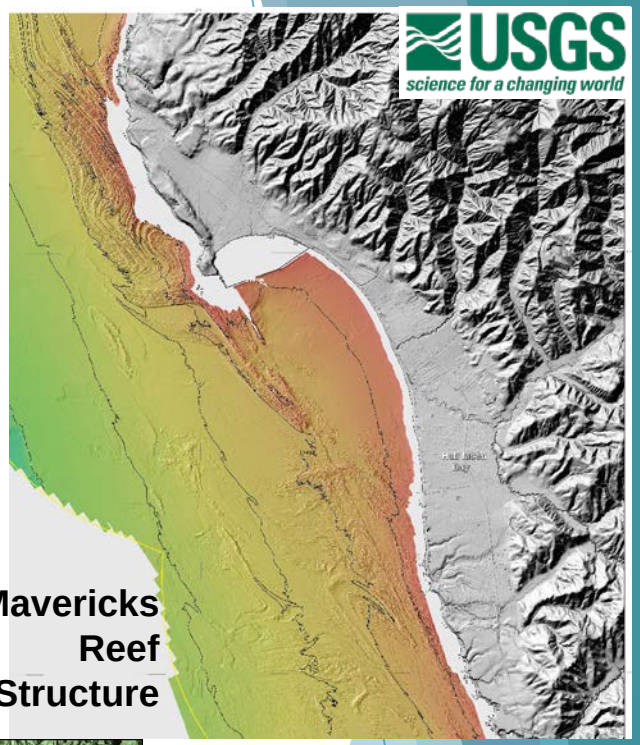


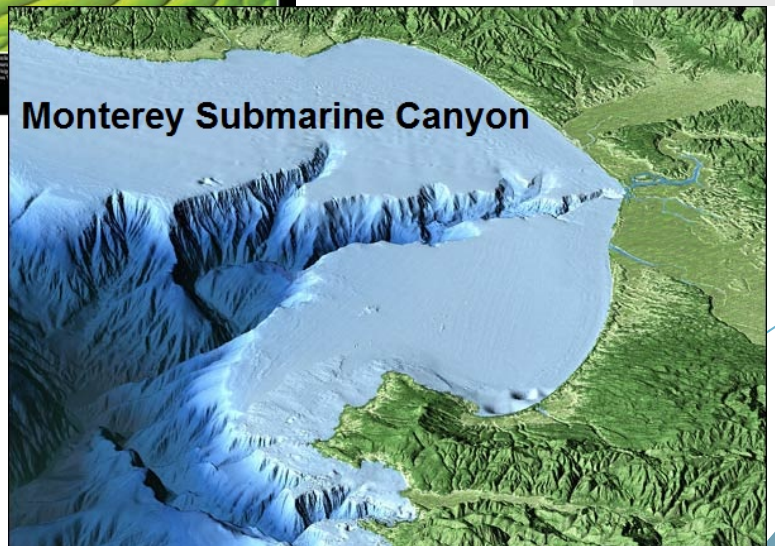
USGS, 2001

Regional Sediment Story

- Morphology

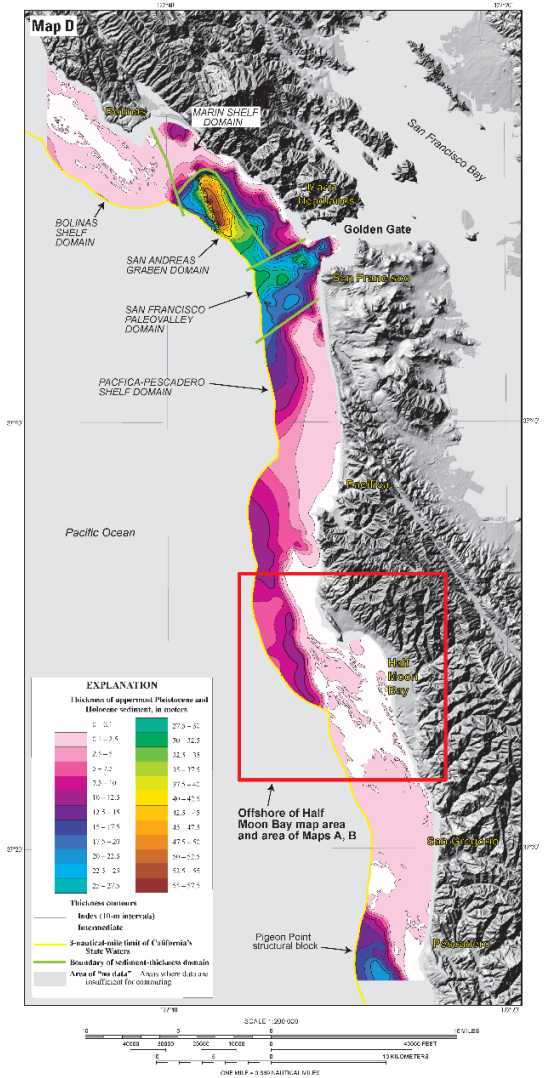


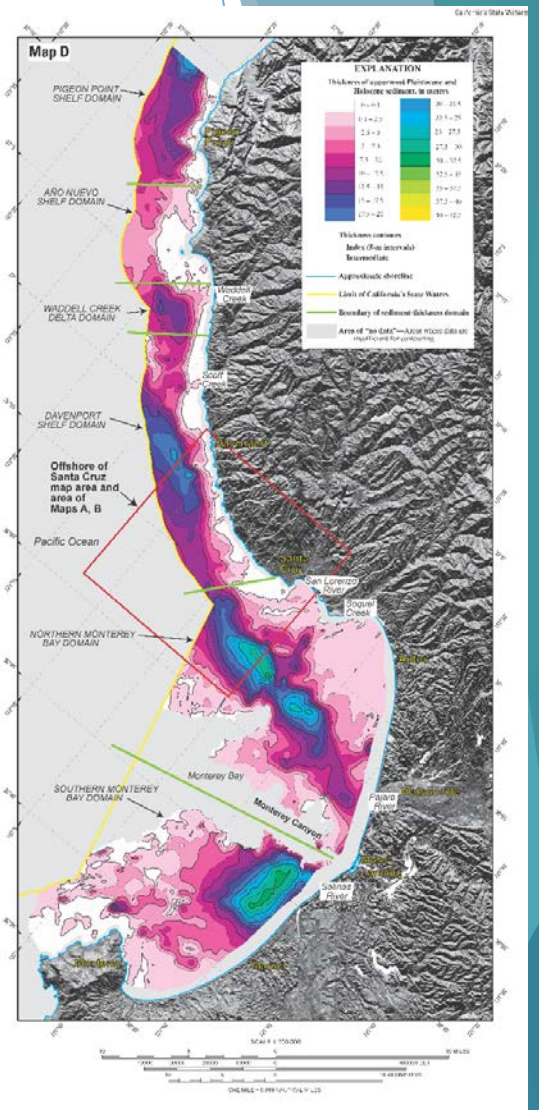




Regional Sediment Story

- Sediment Thickness on Seafloor

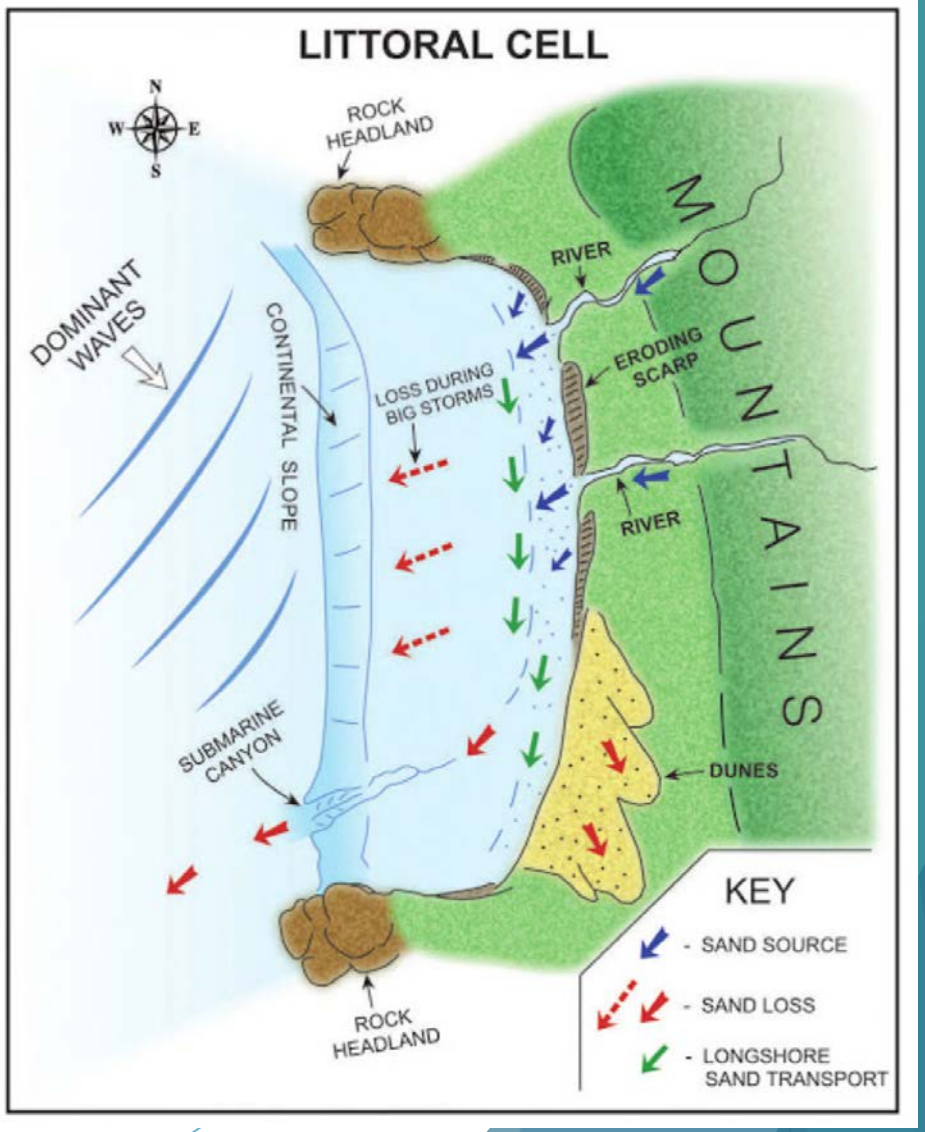




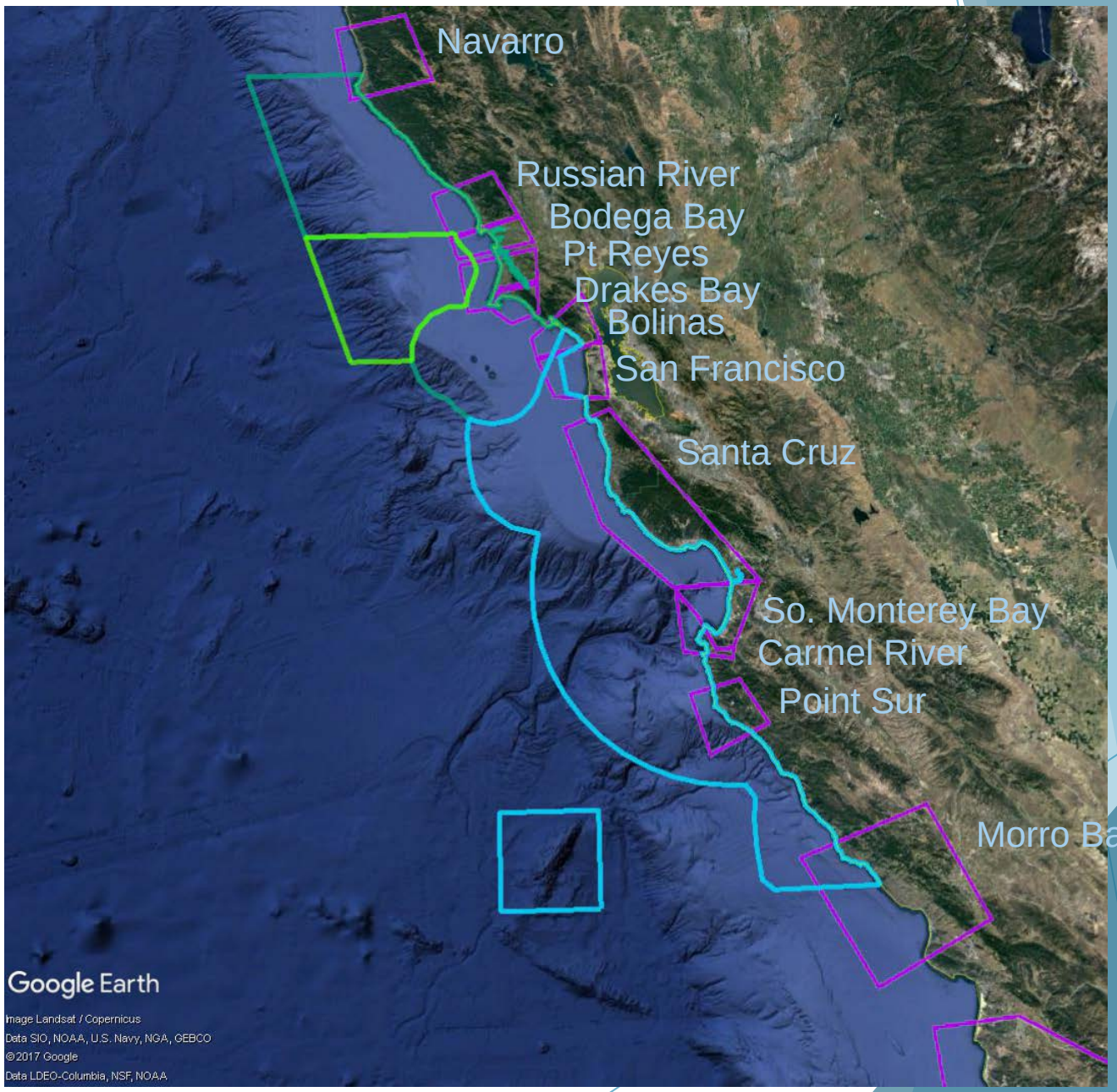
USGS
science for a changing world

Sediment Units

- **Littoral cell** – geographic area offshore that contains a complete cycle of sedimentation including sources, transport paths, and sinks.



Littoral Cells of the Sanctuaries



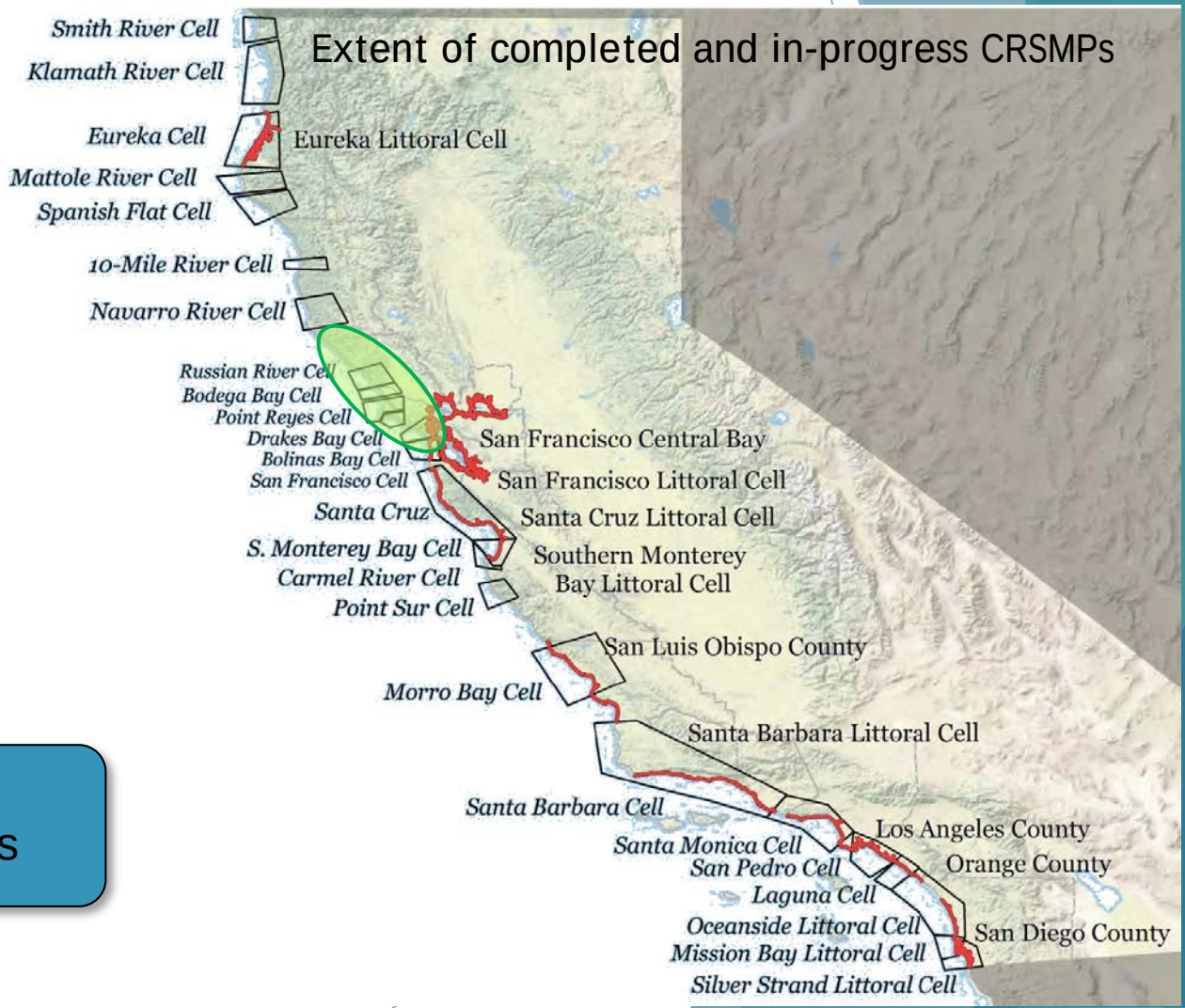
Managing Sediment Along the Coast

Coastal Regional Sediment Management Plans (CRSMPs)

Coastal Sediment Management Workgroup

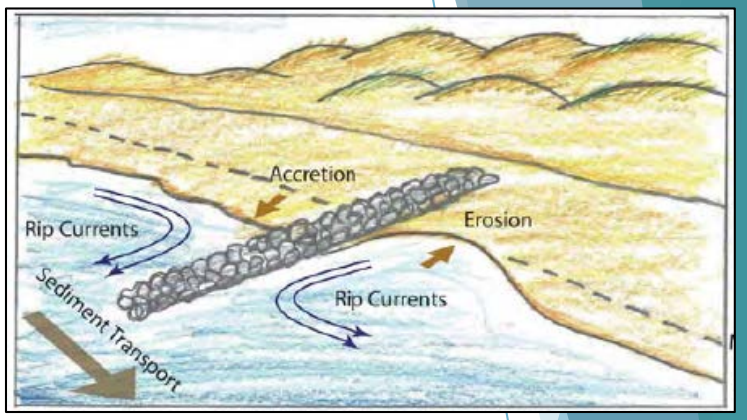
Present Ideas for Local Projects

- Policy & Governance
- Economics & Infrastructure
- Ecology
- Geology & Morphology
- Physical Processes



Sediment Management Tools

- Traditional (Gray) Infrastructure
  - Jetties/groins
  - Seawalls/riprap
  - Breakwaters/reefs
- Impacts to Beach Ecosystem



89.3 KPCC LISTEN LIVE NEWS PROGRAMS EVENTS SUPPORT US ABOUT US DONATE NOW

Environment & Science

Seawalls pose greater risks with higher ocean levels

Emily Dugdale August 08 2017

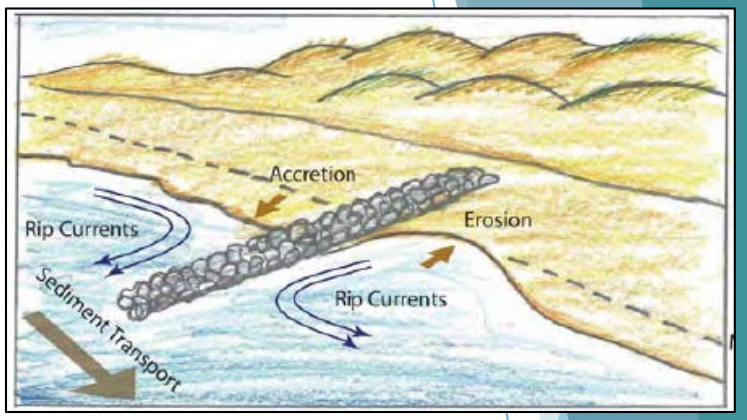
A wave hits a timber seawall on the Gaviota Coast in Santa Barbara. JENIFER DUGAN/UCSB

"The birds would not sit in front of the seawalls — their food was gone"
Jenifer Dugan, UCSB

Dugan et al (2017)

Sediment Management Tools

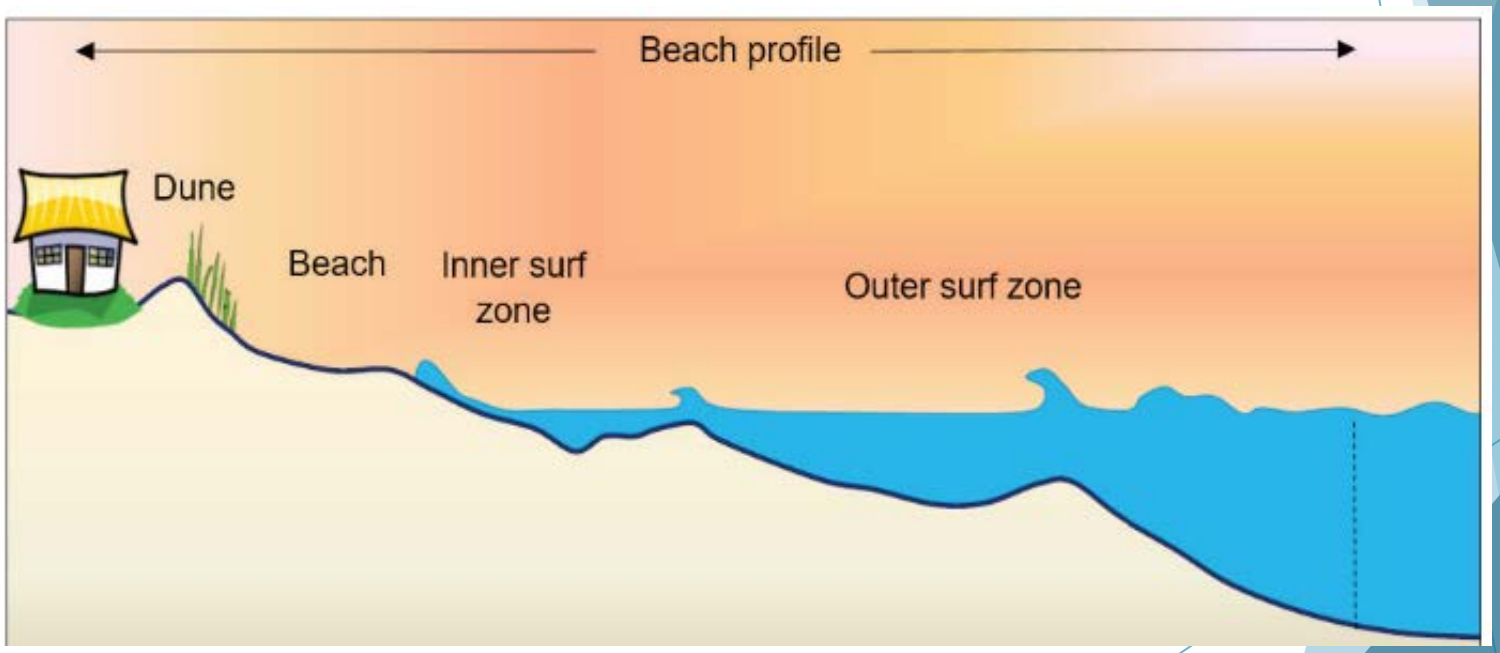
- Traditional (Gray) Infrastructure
  - Jetties/groins
  - Seawalls
  - Breakwaters/reefs
- Softer approaches
  - Beach nourishment
  - Living shorelines
  - Dredging
- Overarching
  - Restoration of natural processes and habitats (remove dams and redesign culverts)
  - Retreat



Carlsbad Nourishment, SANDAG

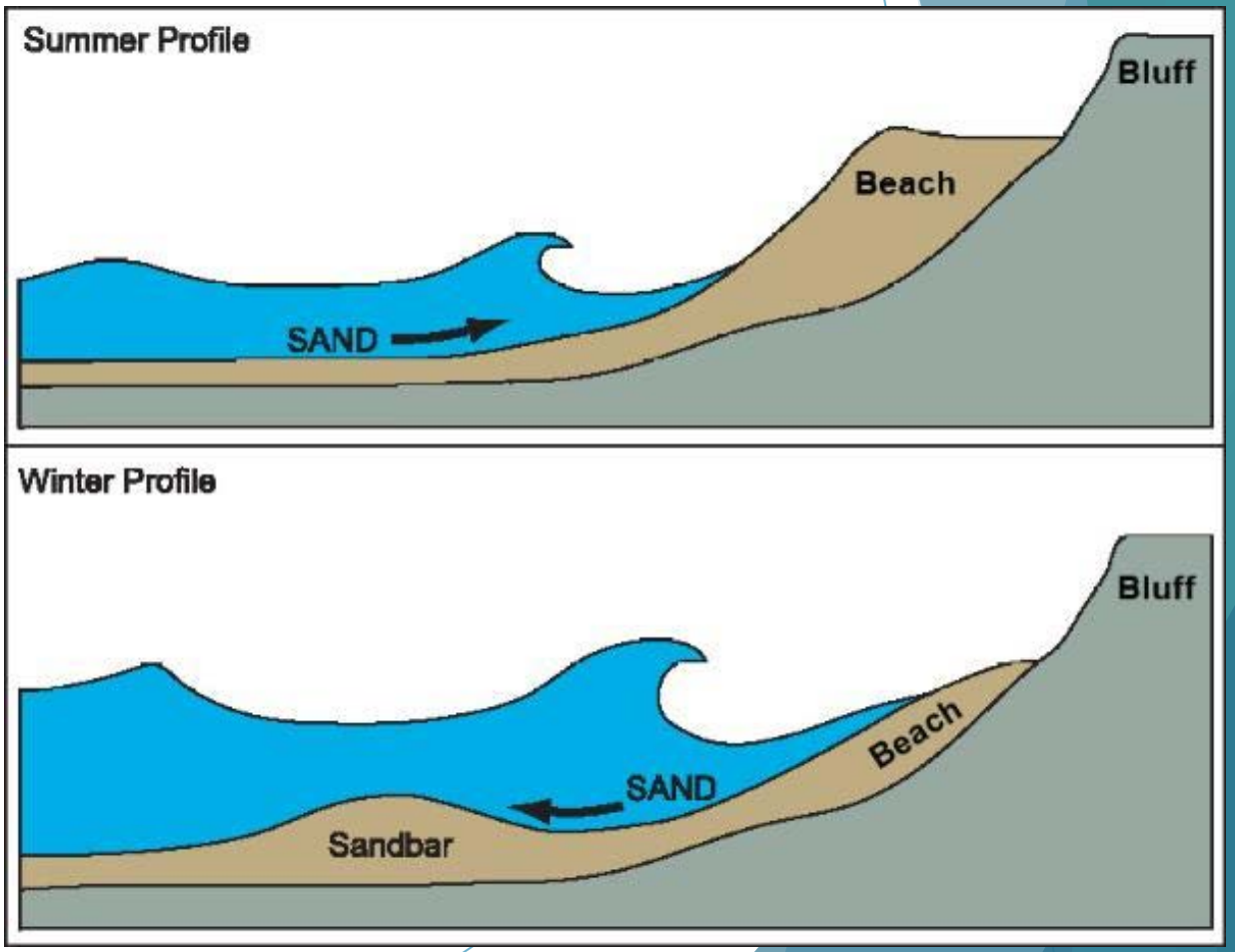
Beach Morphology and Dynamics

- Parts of our beaches

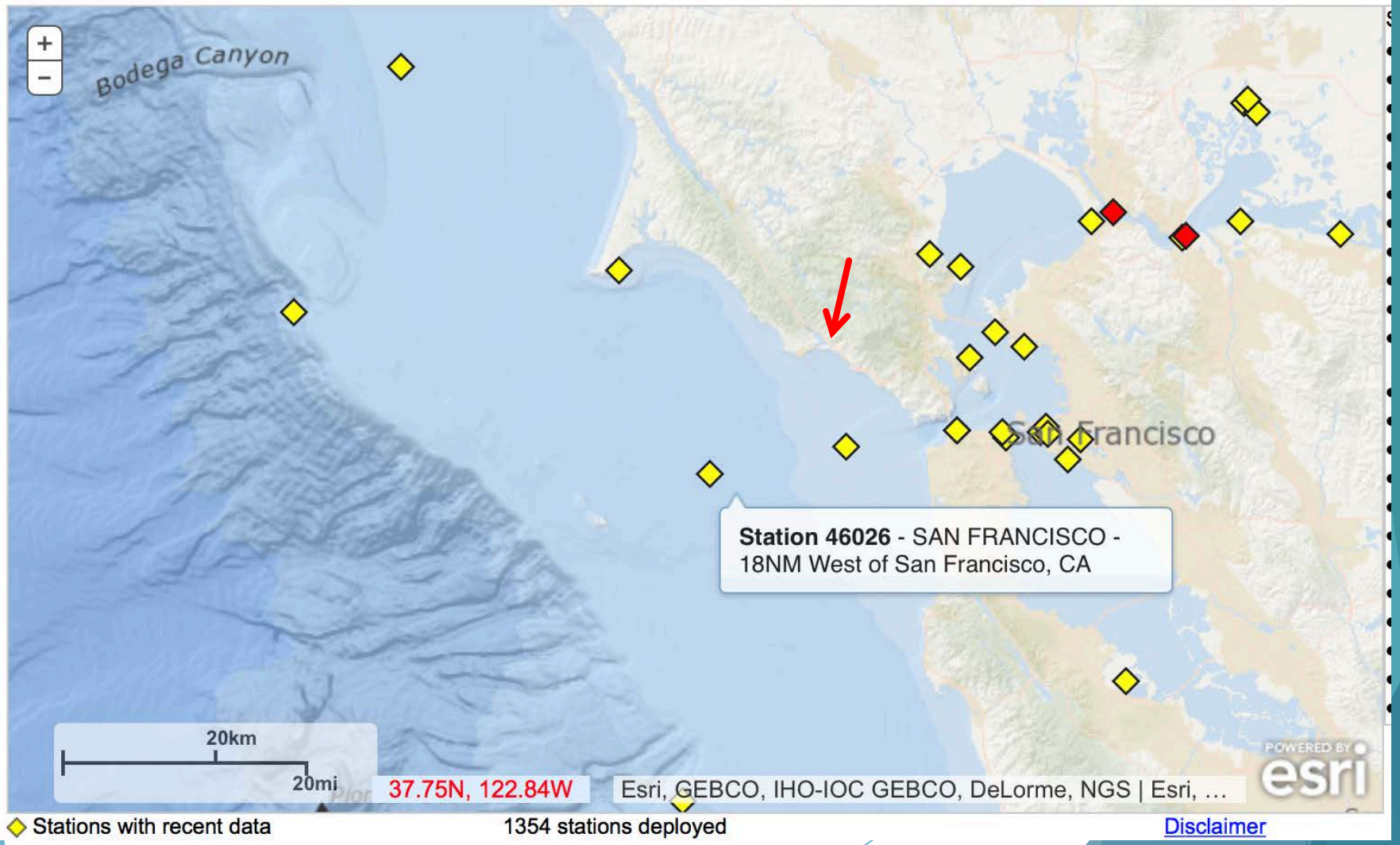


Beach Morphology and Dynamics

- Seasonal cycles
- Summer is widest
  - Low wave energy moves sand onshore
- Winter is most eroded
  - High wave energy pulls sand to offshore bars



Seasonality is Variable



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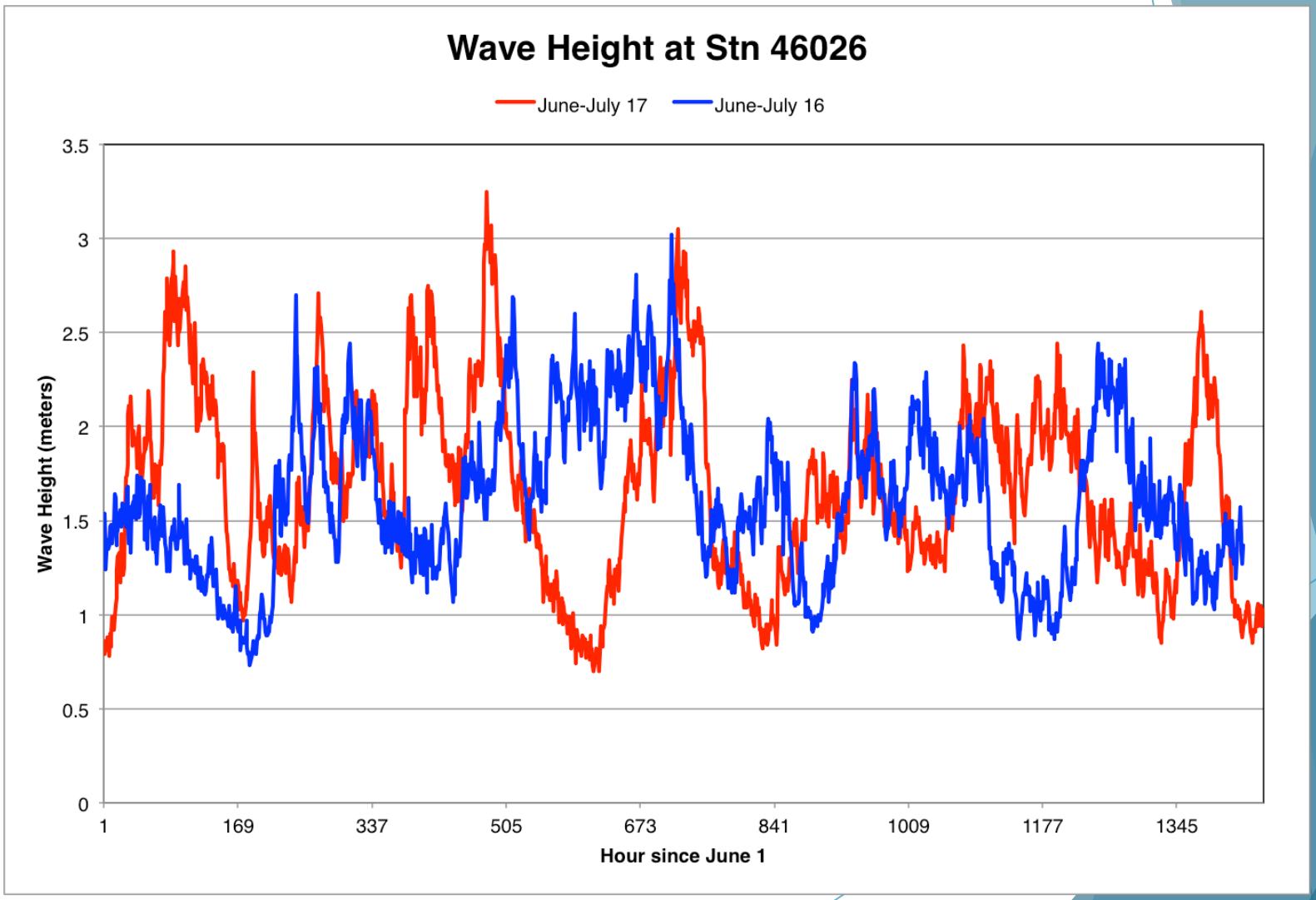

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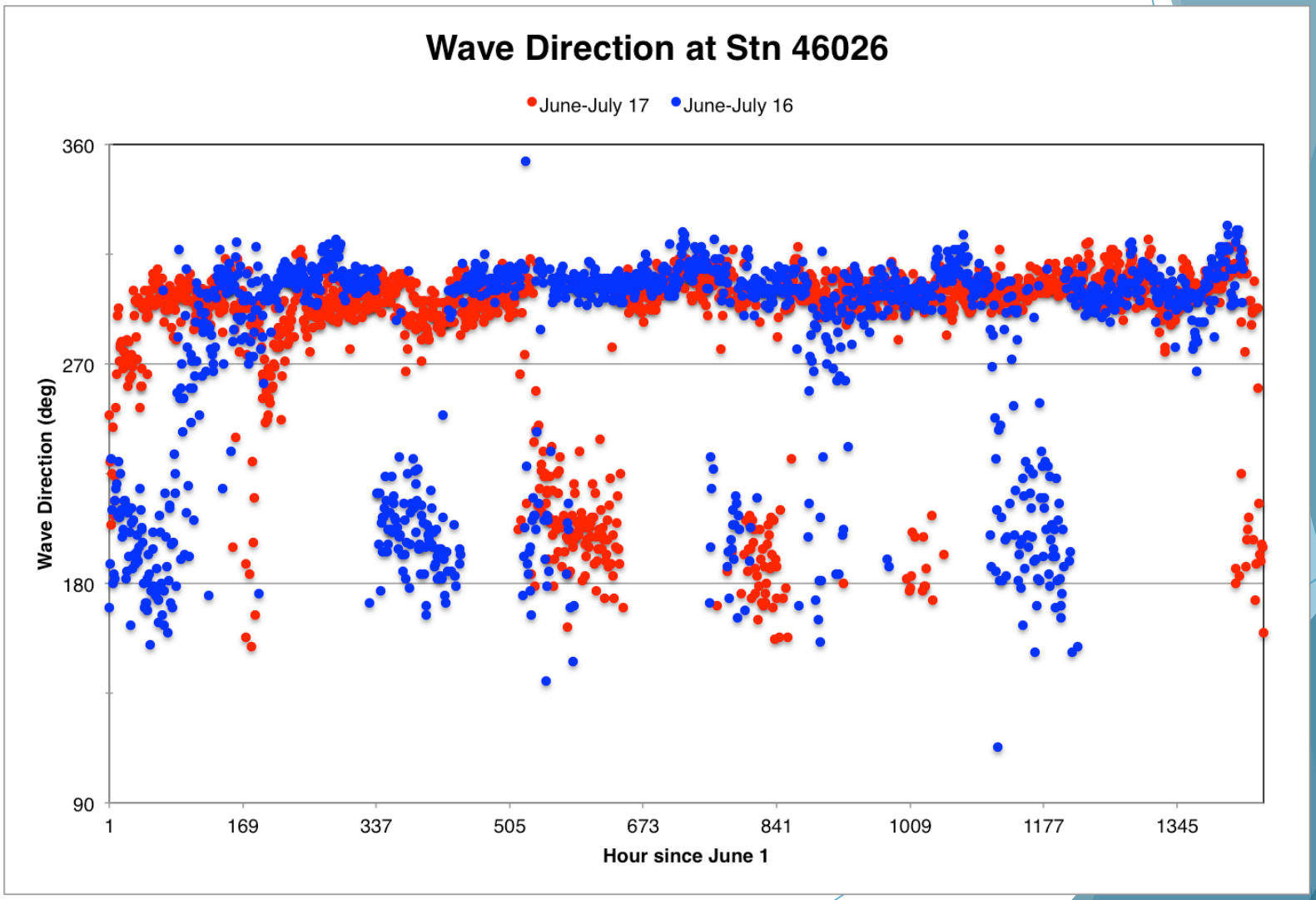


Seasonality is Variable

- 2017 compared to 2016
  - Larger waves with long period occurred in late June and early July
  - Some of the wave events came from the south
  - Result:
    - Increase in mid-summer wave energy directed at Bolinas and other south-facing shores

Beneficial Reuse and Beach Nourishment → BRBN

- **Beneficial reuse** - the application of dredged materials determined to be eligible for use in locations for enhancement, restoration, or creation of a habitat.
- **Beach nourishment** - the process of dumping or pumping sand from elsewhere onto an eroding shoreline to create a new beach or to widen the existing beach.

Methods of Beach Nourishment

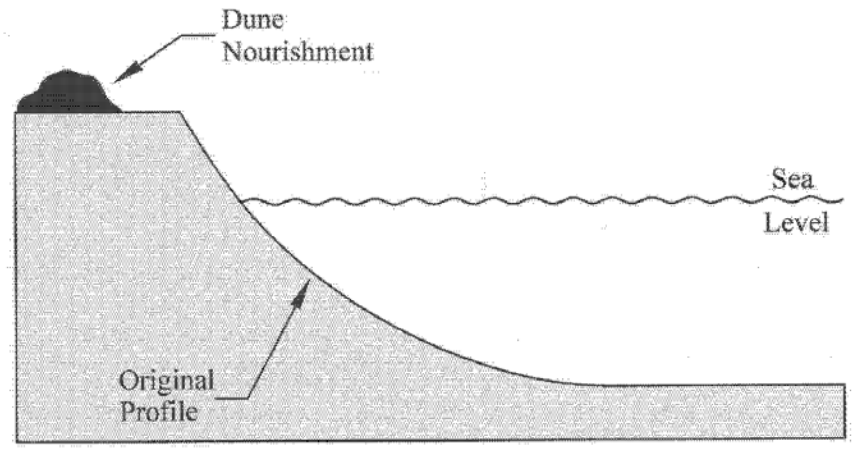


Figure 4.1 Dune nourishment

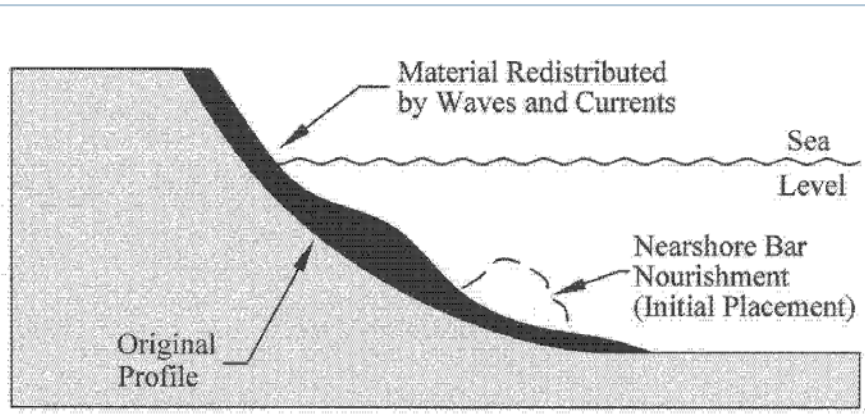


Figure 4.4 Nearshore bar nourishment

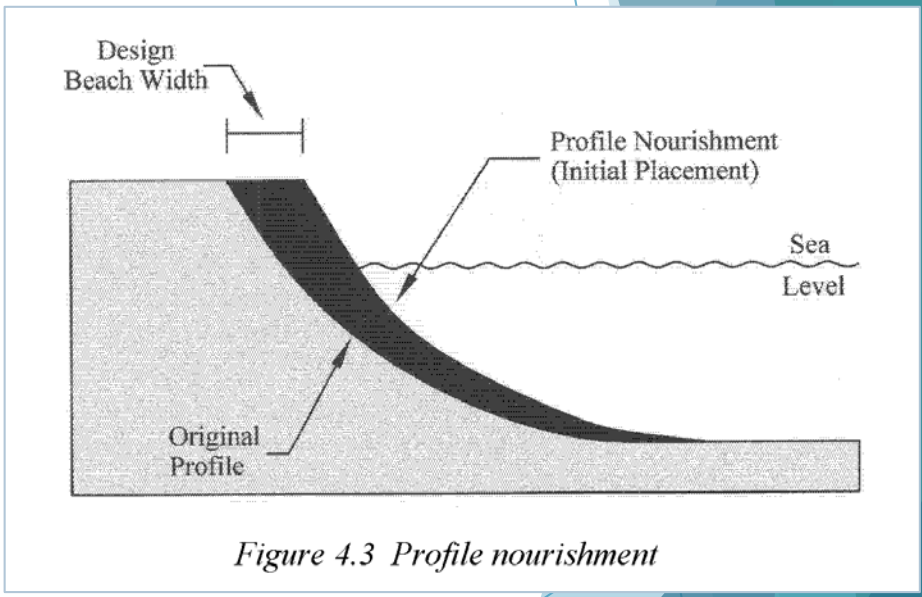


Figure 4.3 Profile nourishment

CA Beach Restoration Study (2002)

Tenets of BRBN

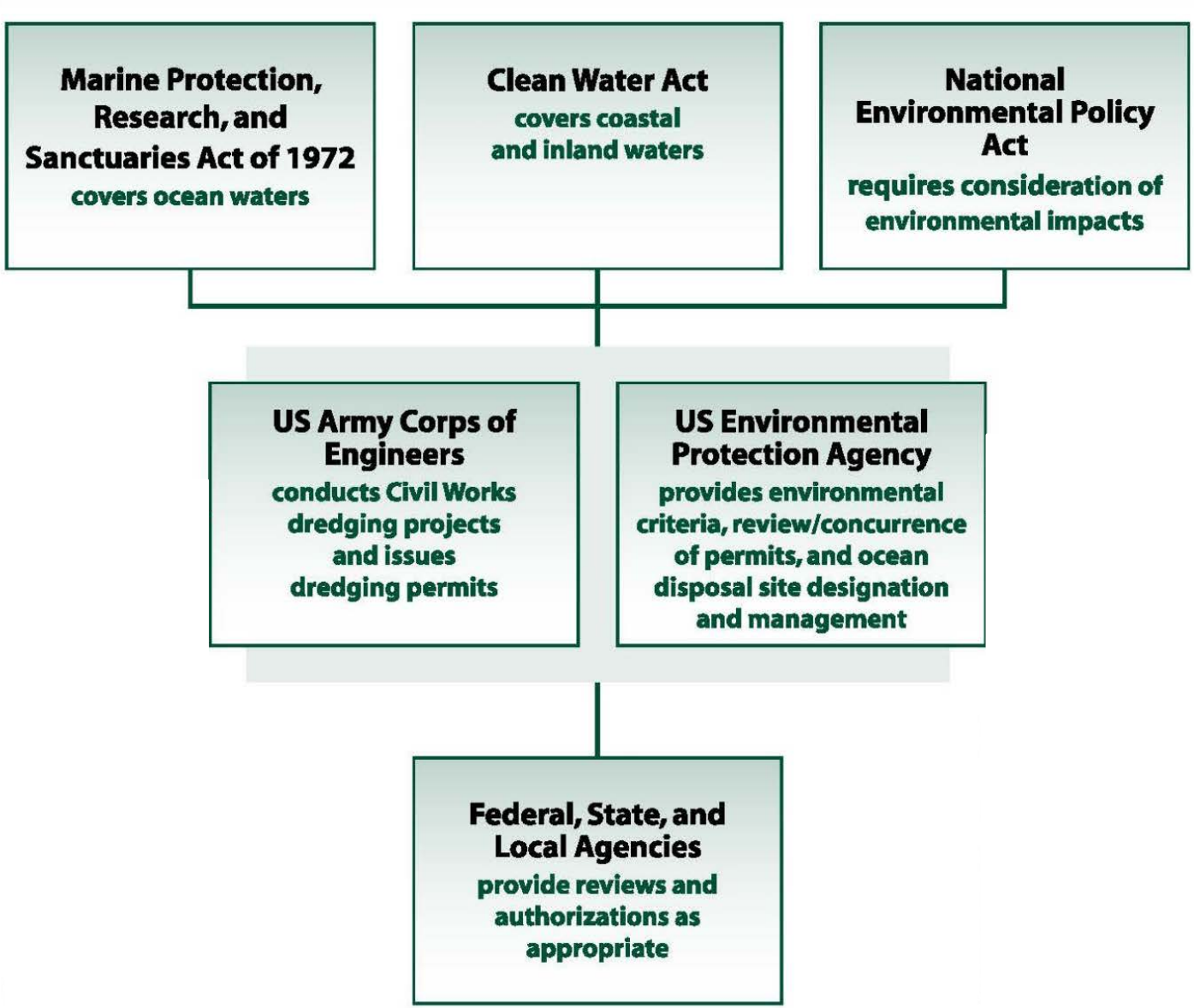
- We want:

1. Clean and compatible sediment
2. Minimal biological impacts
3. Long-lasting placement

- We consider:

1. Sediment sources for beach nourishment
    1. Cleanliness, match, proximity
2. Potential effects on sensitive species and habitats
3. Nearshore dynamics
    1. Transport pathways
    2. Erosion uncertainty

Federal Dredged Material Programs



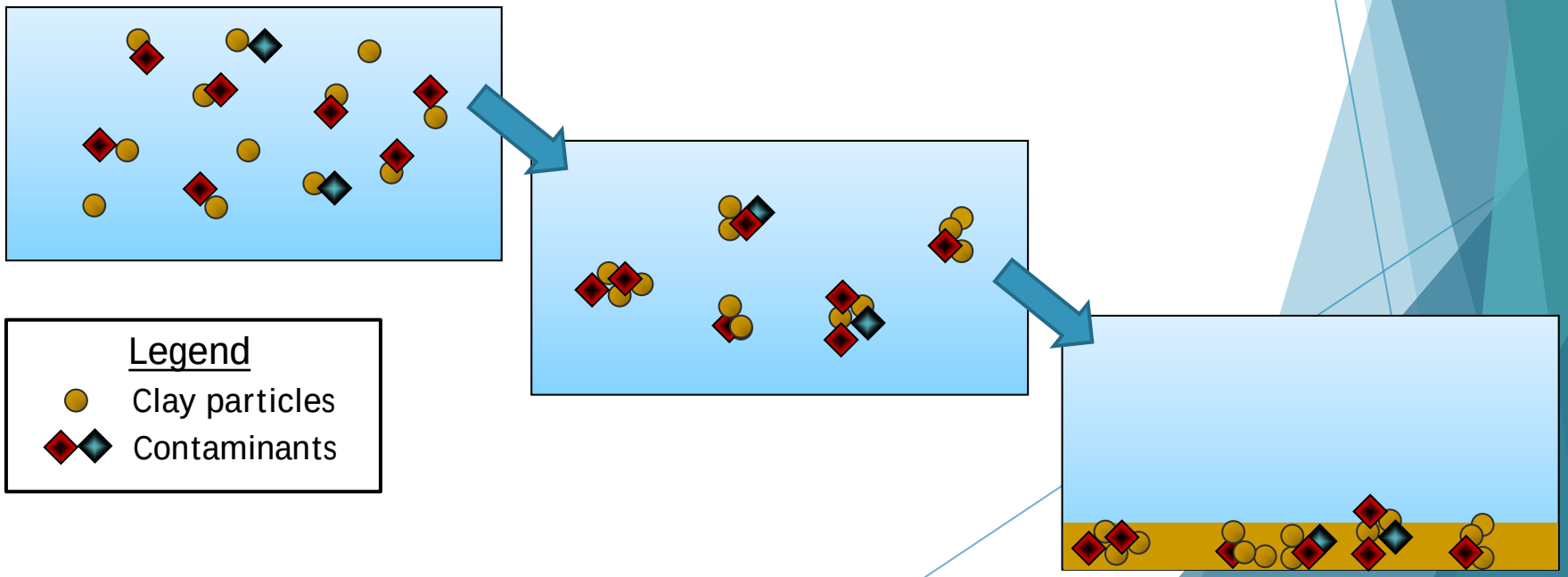
1. Clean and Compatible Sediment

Federal and state required with oversight by EPA and Water Board

1. Sampling and Analysis Procedure for Beneficial Reuse of Sediment
2. Tier I Information
3. Project Description
4. Computation of Sampling and Analysis Requirements
5. Sampling Procedures
6. Physical and Chemical Testing
7. Biological Testing (if required based on results of previous tests)
8. Personnel Responsibilities

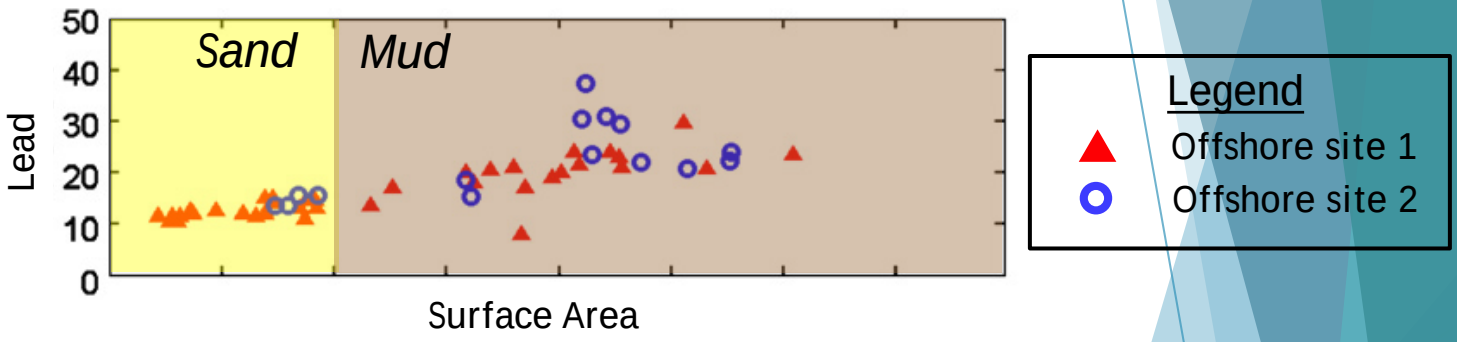
Contaminants and Sediment

- Positively-charged contaminants bind with negatively-charged clay particles
- Contaminant-mud colloids incorporate into flocs
- Flocs settle to seafloor



Contaminants and Sediment

- Sand is not a typical carrier of contaminants



Take home message:

grain size ↑ ↓

contaminants ↓ ↑

George et al, 2007

2. Minimal Biological Impacts

- Smothering
- Habitat conversion
  - Loss of rocky habitat? Are those habitats naturally occurring or a product of the armoring?
  - Addition of wrong sediment size – too much mud can change from a sandy (crab) to a muddy (worm) environment

Beach Nourishment BMPs for Biology

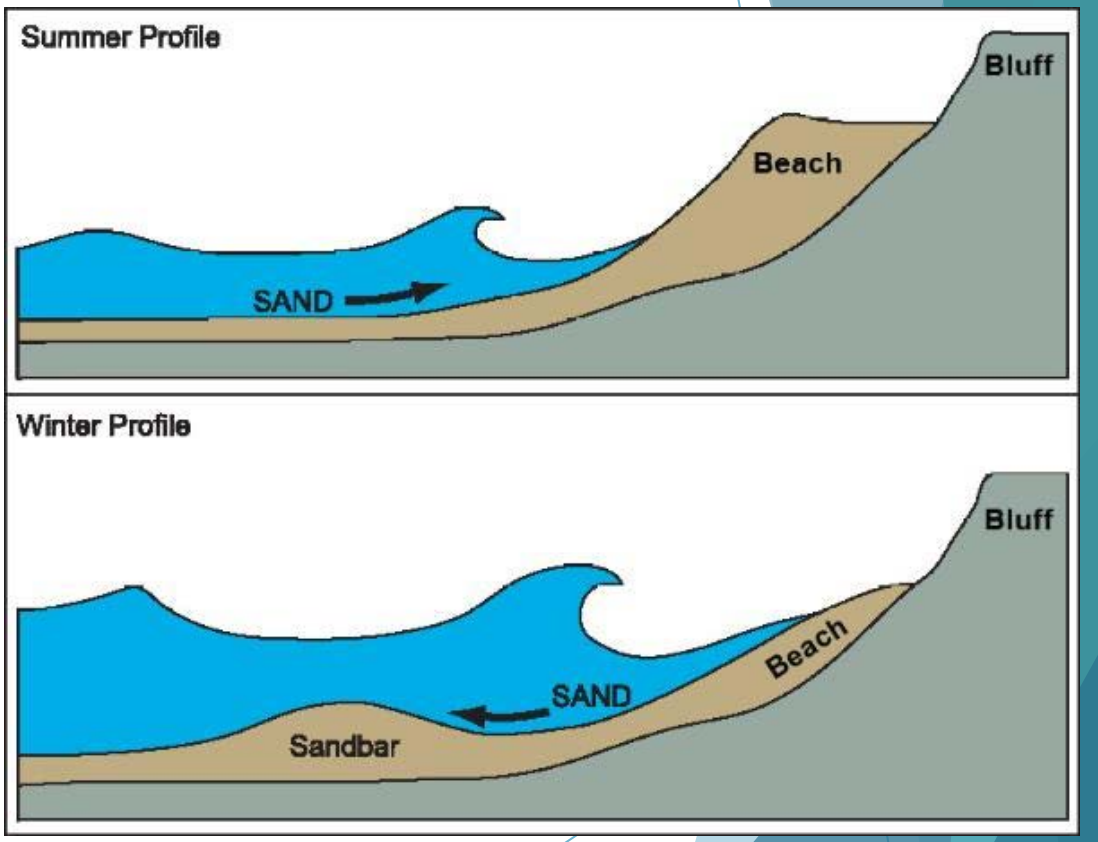
Wilber et al (2009), CSA (2009), Rosov et al (2016)

Goal: minimize recovery times and retain similar benthic infaunal community composition

1. Avoid beach nourishment activities during peak larval recruitment
2. Complete projects prior to the natural seasonal decline
3. Use compatible sediments between the native beach and the borrow source
4. Locate borrow sites in areas that are likely to refill rapidly with beach compatible sediments

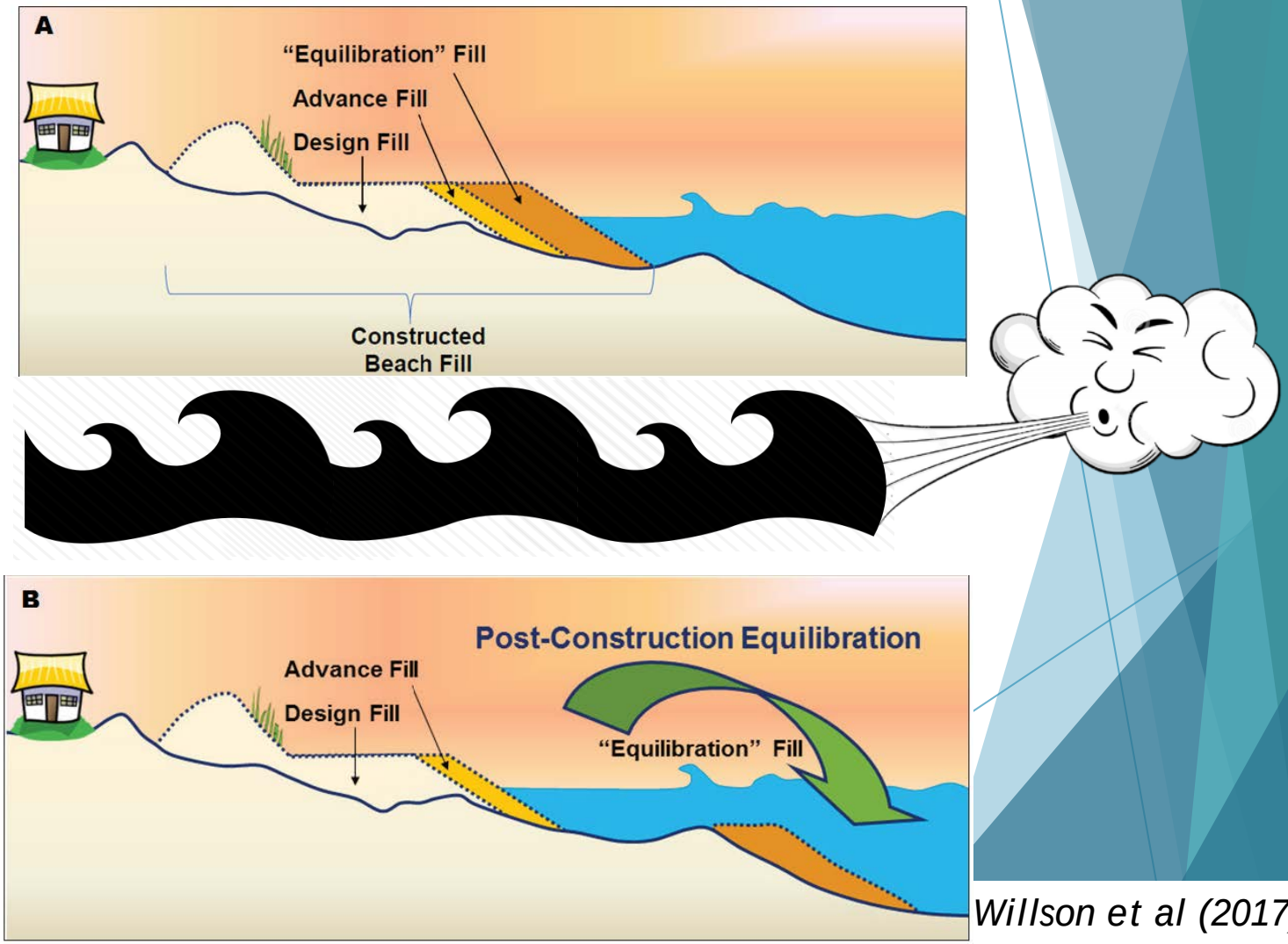
3. Long-lasting Placement

- Nearshore dynamics
  - Seasonal cycle of beaches
- Erosion rates
- Climatic events
  - ENSO changes
- Placement Specifics
  - Volume
  - Frequency



Where'd the Placed Sand Go?

- Sand doesn't go away, it is stored offshore



Willson et al (2017)

BRBN Case Study 1:
Seal Beach Wildlife Refuge, Orange Co

- Sediment Augmentation Project in a Protected Wetland

1. Dredge Huntington Harbor
2. Analyze sediment
3. Clean mud to the wetlands
4. Clean sand to the beaches

BRBN Case Study 2: Ocean Beach, San Francisco


Photo: SPUR

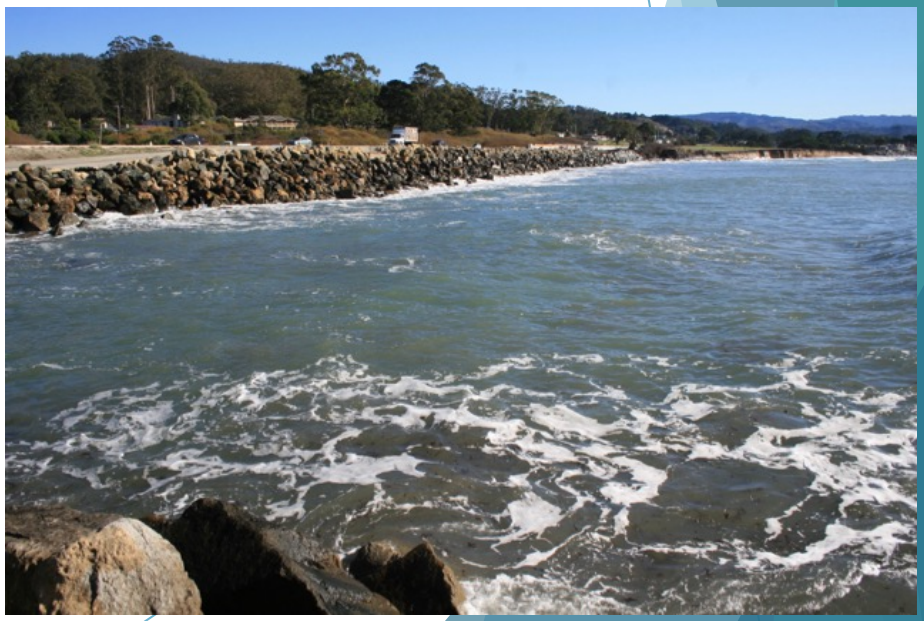
- City of SF and NPS (GGNRA)
  - Sand trucking from NOB to SOB
  - in 2012, 2014, 2016
- USACE
  - Single placement of 300,000 cubic yards
    - Dredged sediment pumped onshore at Sloat and to 4000' south
  - Designation as permanent site
- Ocean Beach Master Plan
  - 2 million cubic yards of sand placed every 10 years from dredging SF Shipping Channel

Surfer's Beach Sand Replenishment Pilot Project

Aerial Photo of Pillar Point Harbor and Surfer's Beach

Project Background

- Construction of the East Breakwater at Pillar Point Harbor completed in 1961, resulted in increased erosion rates.
- 2007: community members approached Harbor District requesting action be taken.
- 2007: District formally requested that US Army Corps of Engineers (USACE) investigate erosion.

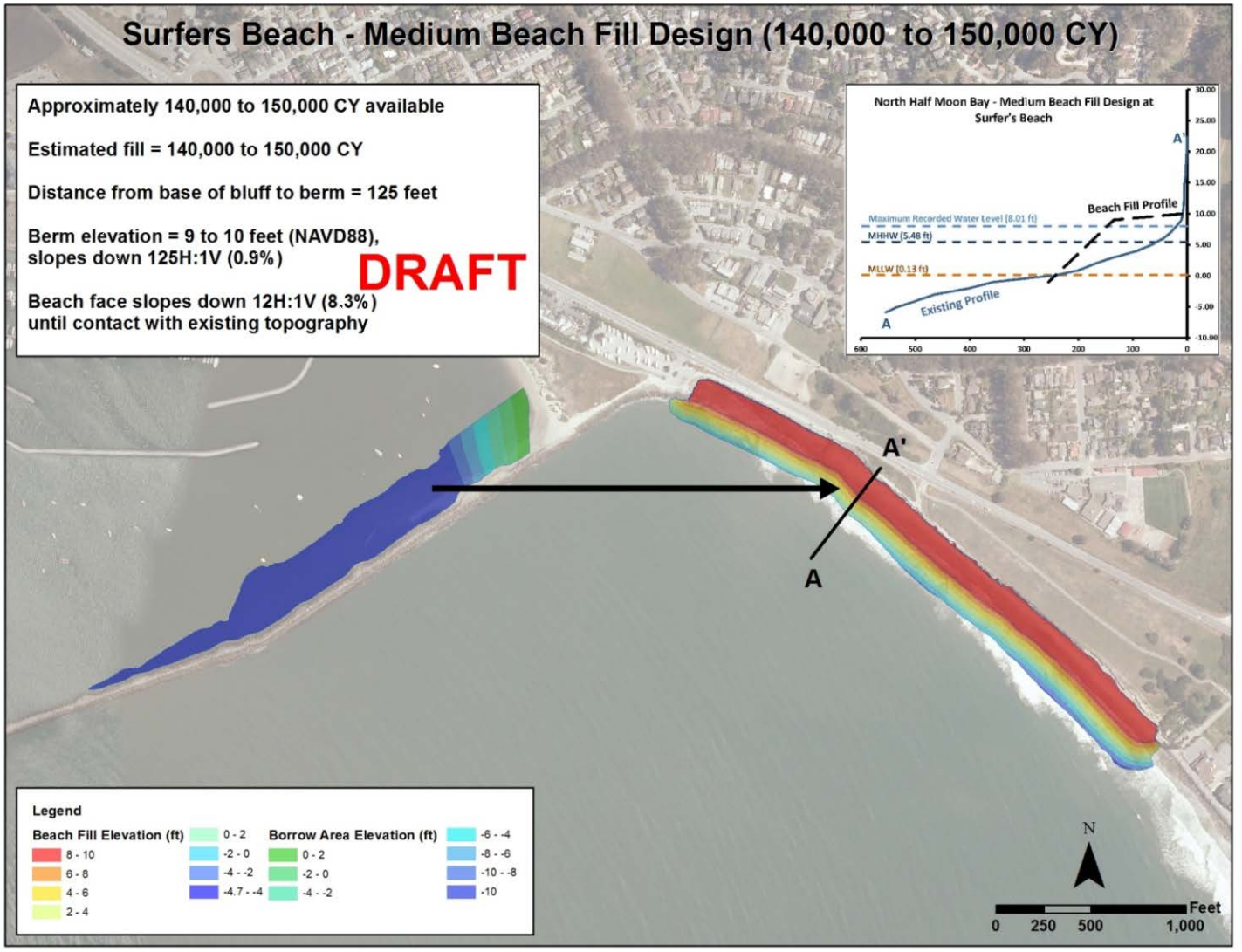


Project Background

- The USACE analysis determined that the bluffs along Surfer's Beach eroded at an average rate of 1.64 feet per year between 1993 and 2012.
- The study also found that there is a significant accumulation of sand within Pillar Point Harbor.

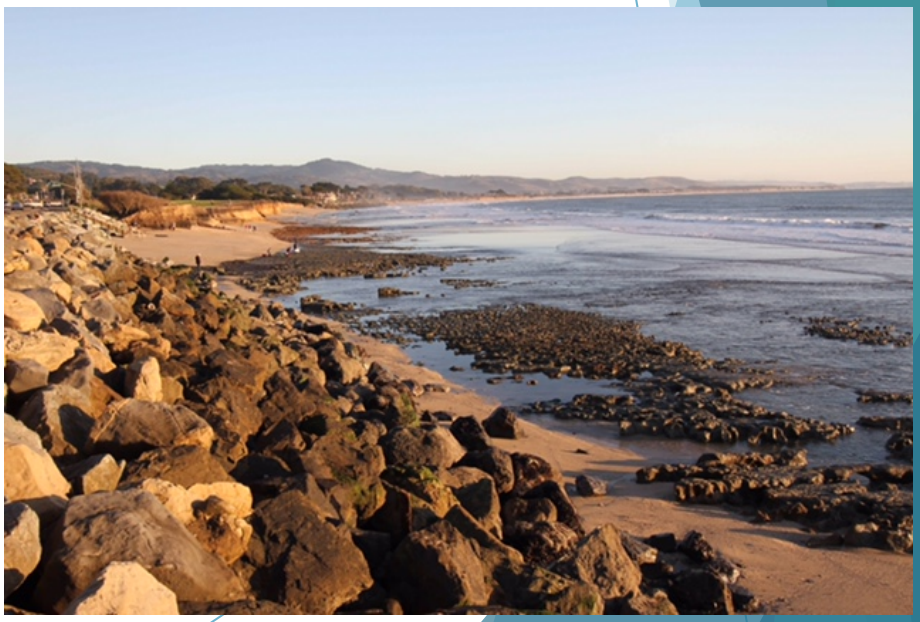

Bluff Edge 19 May 2012
10 Year Erosion Zone
50 Year Erosion Zone
N
North Half Moon Bay
Projected Bluff Retreat
at 10 and 50 yrs
US Army Corps
of Engineers
San Francisco District
1455 Market Street
San Francisco, CA 94103
Data Sources: Bluff Position Digitized by James Zoulas
(USACE). Background imagery from Google Earth (2012)
Projection: NAD 1983 California State Plane III (US Feet)
0
125
250
500
Feet

USACE Medium Beach Fill Design Engineering Model Results



Project Background

- USACE has since determined that there is not a federal interest in pursuing a beach nourishment project.
- In lieu of federal funding, the Board of Harbor Commissioners voted, in late 2015, for the District to pursue a pilot Surfer's Beach Replenishment Project.



Project Background

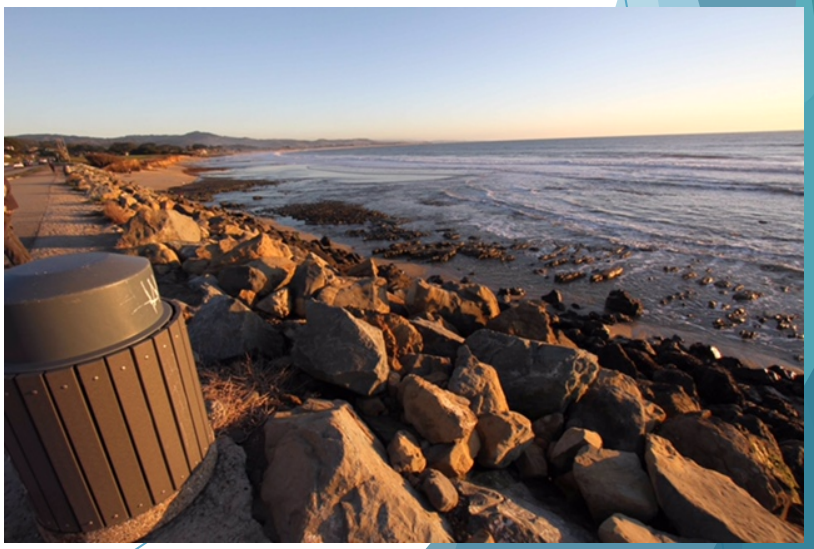
- February 2016: District submitted a grant application to Division of Boating and Waterways for $800,000 to fund the Project implementation (construction and monitoring).
- Grant request was approved and the District was notified in July 2017 that there is $800,000 in the California budget to implement the proposed pilot project.

Project Background

- April 2016: District submitted a funding request to California Ocean Protection Council (OPC) for a $75,000 Prop 84 grant to help pay for the Project Planning Phase.
- The OPC grant was approved in October 2016 and a grant agreement issued in June 2017, allowing the District to initiate the planning process.

Project Description

- The proposed Project involves one-time placement of approximately 75,000 cubic yards of sand.
- It is a “Pilot” project meant to study benefits and impacts.
- Extensive biological and physical monitoring will be included.
- Comprehensive planning process is now underway.



Project Goal and Potential Benefits

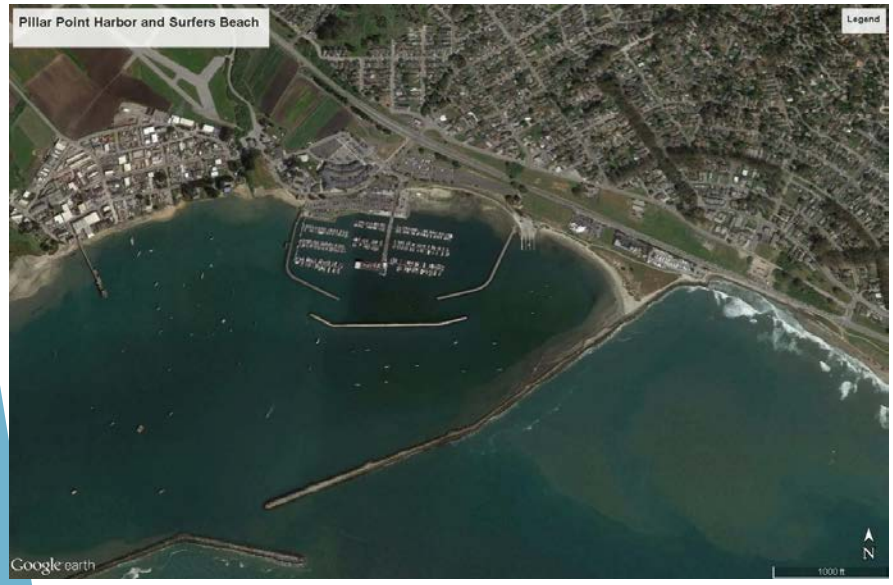
- The overall goal is to address the accelerated coastal erosion rates as a result of the construction of the East Breakwater.
- The Project will address impaired public access/recreational impacts and damages from coastal storms.
- Benefits include: preventing or mitigating beach erosion and sea cliff retreat; improving protection of Highway 1 and other structures; increasing quality and quantity of public access and recreation; reducing the need for coastal armoring, and improving biological habitat.

Proposed Project Planning Process

- Planning Phase includes the following components:
  - Stakeholder collaboration and public outreach process
  - Project design and engineering
  - Environmental review
  - Permitting and agency consultation
  - Biological and physical monitoring design/planning
- Planning Phase now underway and will continue until project implementation, which is expected in late Summer or Fall 2018.

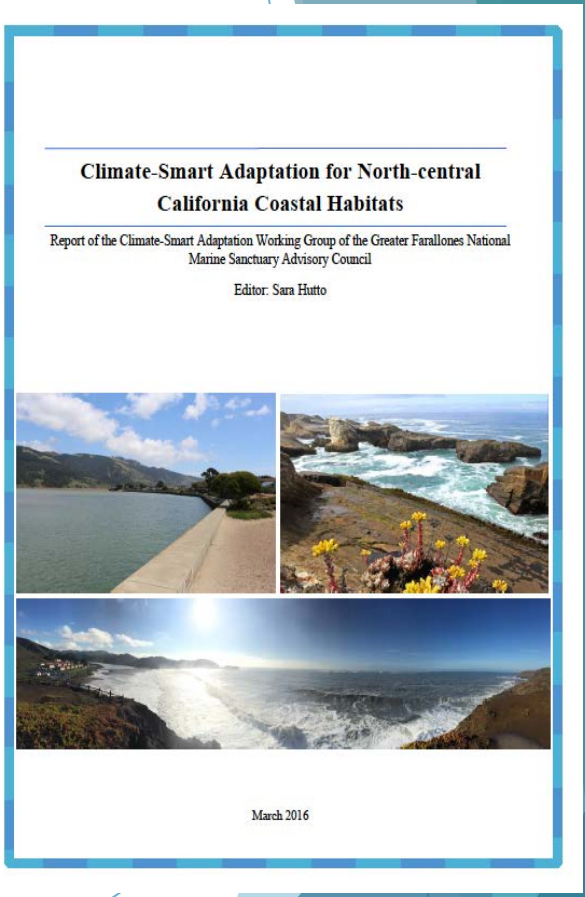
Project Implementation Phase

- Includes Project Construction and Biological and Physical Monitoring
- Construction anticipated to begin in late Summer or Fall of 2018 and take 1-3 months to complete.
- Project Monitoring to begin several months prior to construction and continue for up to 2-years thereafter.



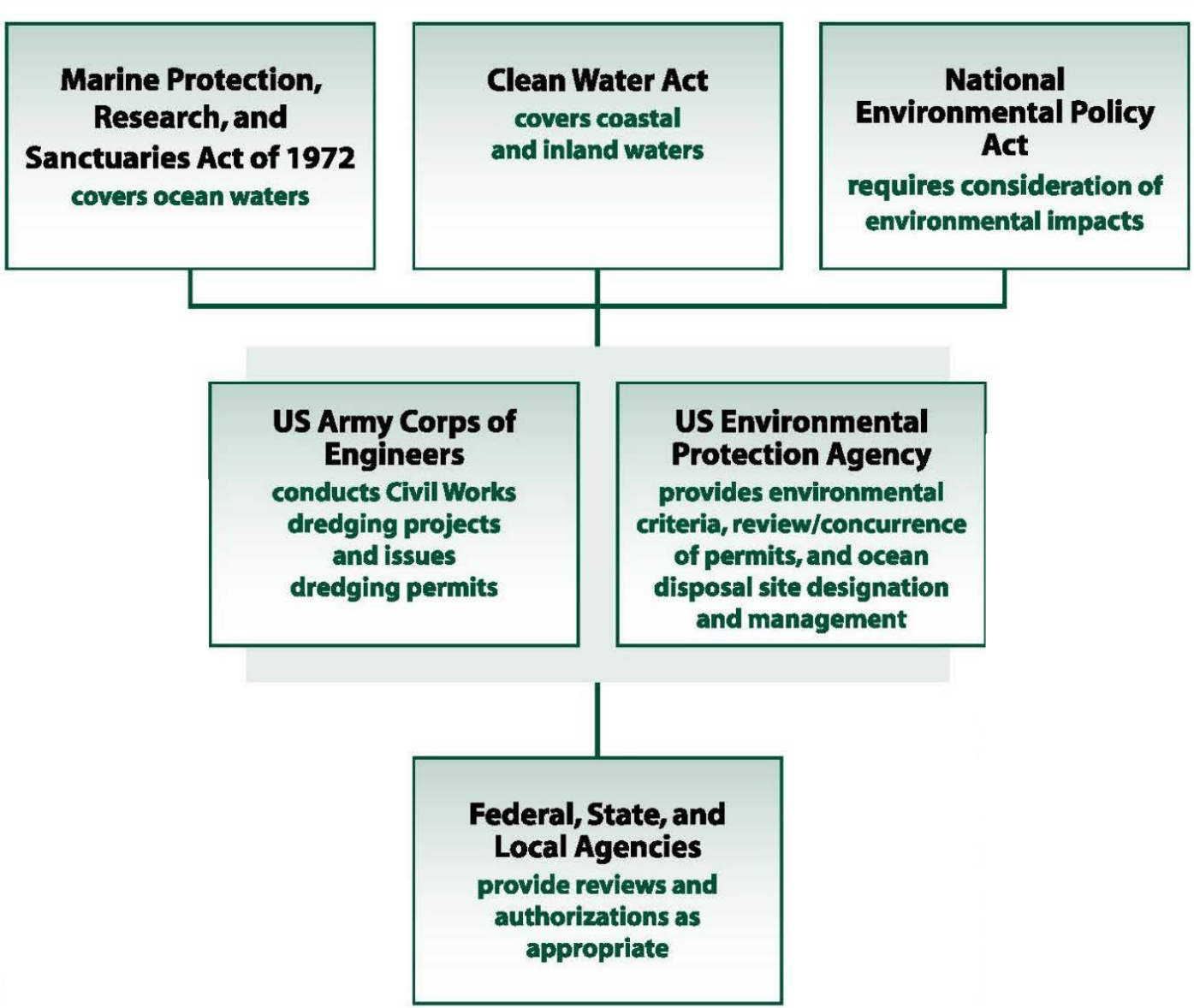
Plans Recommending Potential BNBR at Surfer's Beach

- Santa Cruz Littoral Cell RSM Plan
- North-Central CA Coast Climate Action Plan
- US Army Corps of Engineers North Half Moon Bay Continuing Authorities Program (CAP) 111 Study
- MBNMS Management Plan
  - *Harbors and Dredge Disposal Action Plan*
  - *Coastal Armoring Action Plan*



Regulatory Setting for Conducting Beach Nourishment from Beneficial Reuse

Federal Dredged Material Programs



Agencies Likely Involved in Reviewing / Approving BRBN at Surfer's Beach

FEDERAL

- **US Army Corps of Engineers** *(Permit under Section 404 CWA and Section 10 RHA)*
- **US Environmental Protection Agency** *(review under 404 CWA)*
- **NOAA National Marine Fisheries Service** *(consult under MMPA and ESA/EFH under MSFMCA)*
- **U.S. Fish and Wildlife Service** *(consult under MMPA/ESA)*

STATE

- **Central Coast Regional Water Quality Control Board** *(Water Quality Certification under Section 401 CWA /Porter-Cologne)*
- **CA Coastal Commission** *(Coastal Development Permit / consistency determination)*
- **CA Department of Fish and Wildlife** *(consult under CESA)*

MBNMS Regulation that May Apply to BRBN Projects

- **1) Discharging or depositing, from within or into the Sanctuary, any material or other matter**

- 2) Discharging or depositing, from beyond the boundary of the Sanctuary, any material… that… enters and injures a Sanctuary resource or quality
- 3) Drilling into, dredging or altering submerged lands… or constructing, placing, or abandoning any structure… in the Sanctuary
- 4) Possessing, moving, removing or injuring a Sanctuary historical resource
- 5) Taking or possessing any marine mammal, sea turtle, or bird within or above the Sanctuary
- 6) Introducing or otherwise releasing introduced species

MBNMS Regulations

- MBNMS regulations prohibit permitting or approving of the disposal of dredged material except at disposal sites that were authorized by EPA prior to designation of the Sanctuary:

- *(f) Notwithstanding paragraphs (d) and (e) of this section, in no event may the Director issue a National Marine Sanctuary permit under 15 CFR 922.48 and 922.133 or a Special Use permit under section 310 of the Act authorizing, or otherwise approve: …the disposal of dredged material within the Sanctuary other than at sites authorized by EPA (in consultation with COE) prior to January 1, 1993 (15 CFR 922.132(f))*

Approval of BRBN actions under MBNMS Regulations:

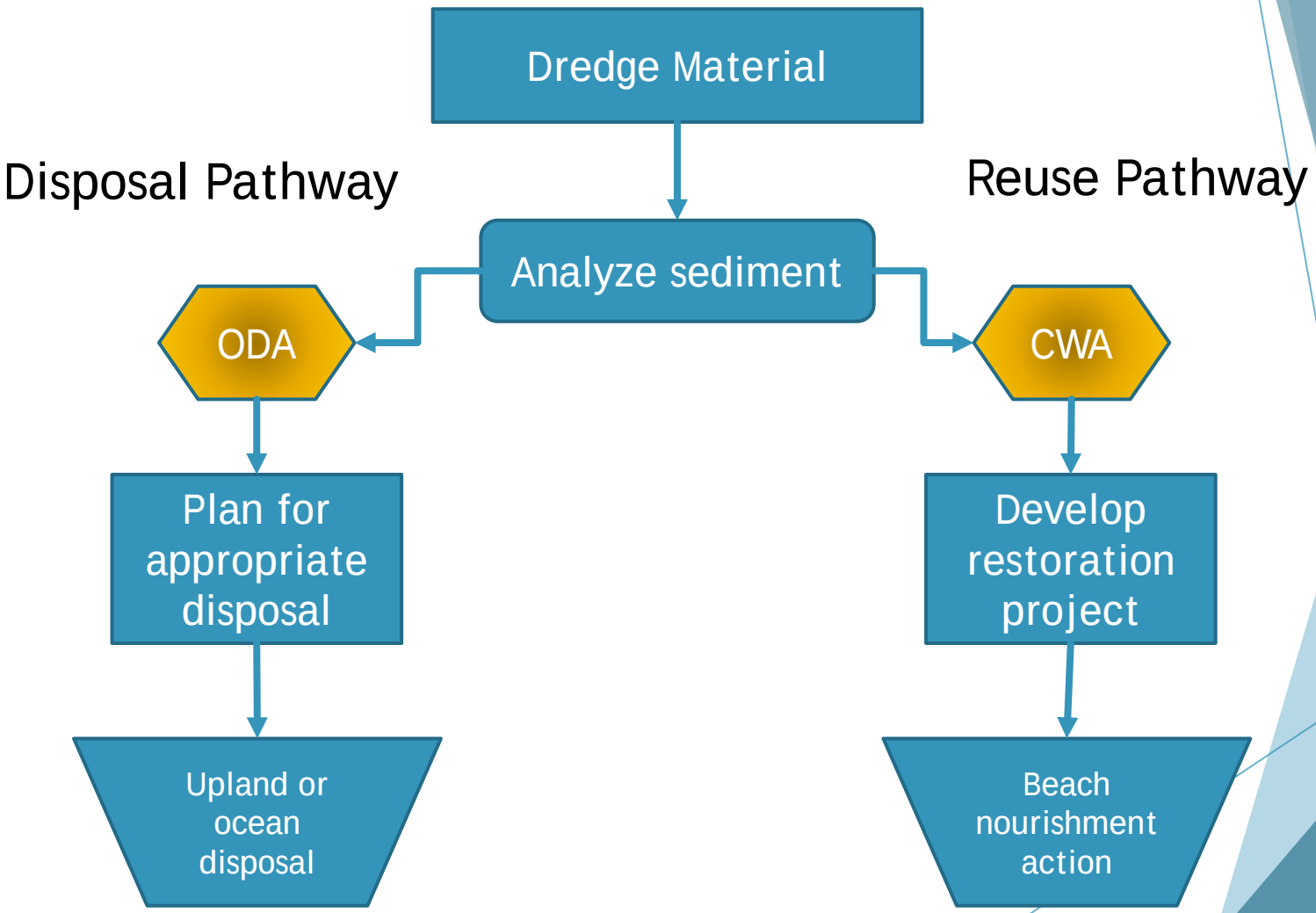
CAN ALLOW

- Placing clean non-dredged material below Mean High Water (MHW) by issuing a permit
- Placing clean dredged material above MHW (would not require a permit, ONMS would provide input)

CANNOT ALLOW

- “Disposing” of clean dredged material below MHW

Handling Dredged Material (USACE and US EPA)



CA Coastal Commission guidance on BRBN:

- CA Coastal Commission, Sea Level Rise Policy Guidance (August 2015):
- **Establish a beach nourishment program and protocols**
- **Maintenance or restoration of natural sand supply**
- **Beneficial reuse of sediment through dredging management:** *Policies can be developed with an LCP and/or carried out through a CDP to facilitate delivery of clean sediment extracted from dredging to nearby beaches or wetland areas where needed.*

San Mateo County LCP

- **Limiting Shoreline Structures on Sandy Beaches**

To avoid the need for future protective devices that could impact sand movement and supply, prohibit permanent structures on the dry sandy beach

Goal for Surfer's Beach

Restore natural habitat and beach function at the site

Question

Should we allow beneficial reuse of dredged material (specifically the placement of sand from inside Pillar Point Harbor below MHW at Surfer's Beach)?

Considerations

material is tested and meets sanctuary permitting criteria & other agency requirements

the project is designed to avoid impacts to sanctuary resources

SAC Actions

- MARCH 2016 – GFNMS SAC recommendation: *"articulate a definition of beneficial reuse of clean dredged materials from harbors or other appropriate sources at the Surfer's Beach site."*
- No MBNMS SAC recommendation received yet
- Seeking feedback today
- Recommendations from SACs at upcoming meetings