September 10, 2025

Surfers' Beach Pilot Restoration Project: Overview of Engineering Design and Construction

California Marine Affairs and Navigation Conference 2025 | Presentation by Louis White, PE

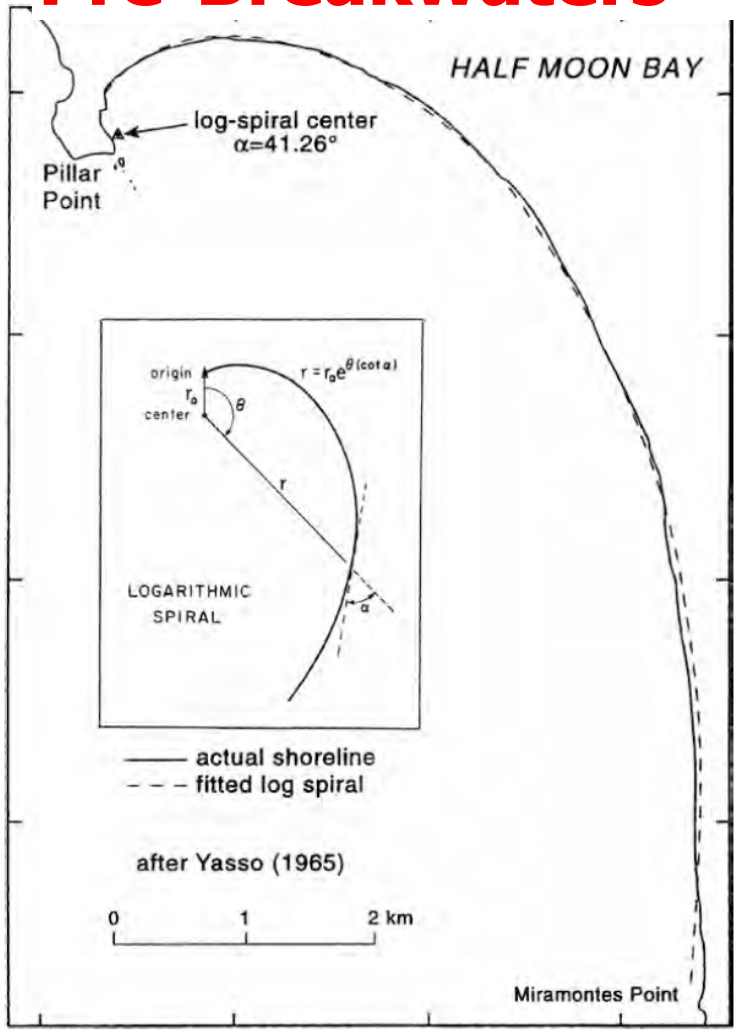
West Breakwater Construction Circa 1960

Source: VanderWerf 1997

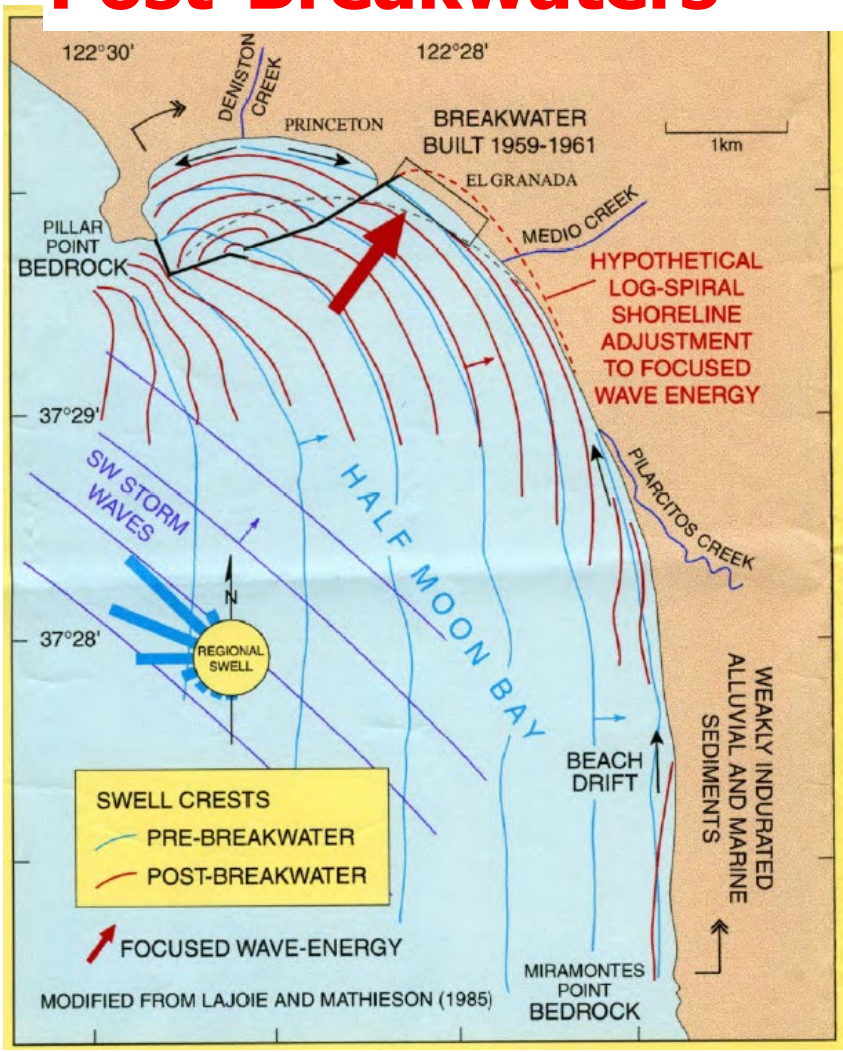
Construction of Harbor Breakwaters Caused Adverse Effects

- Pre-Breakwaters
  - Low erosion rates associated with natural log-spiral shape of bay
- Post-Breakwaters
  - Accelerated erosion rates associated with adjusted log-spiral shore

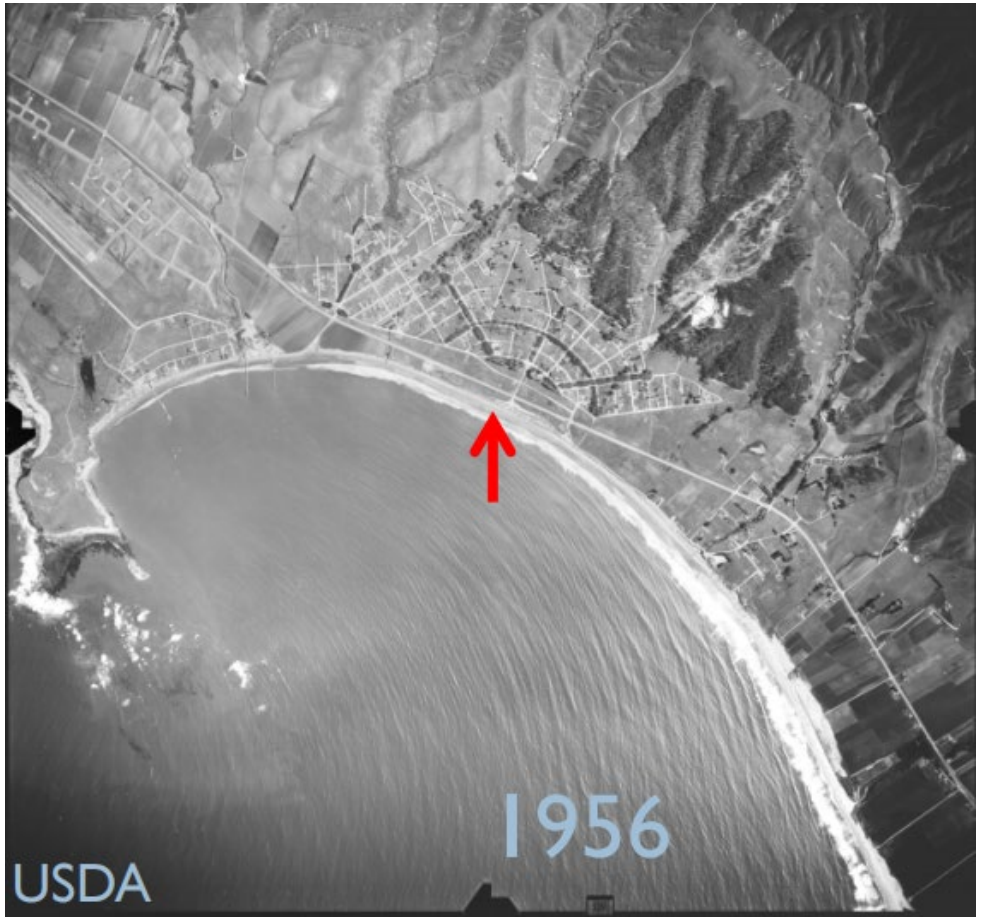
Pre-Breakwaters

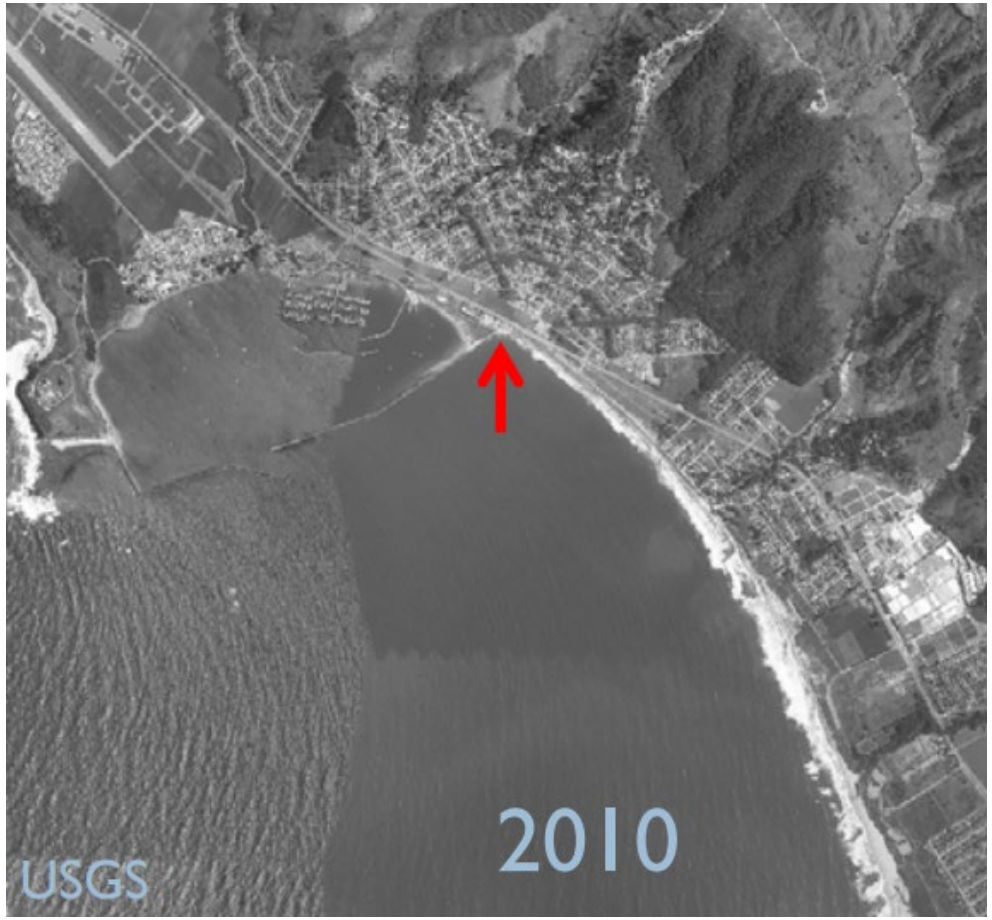


Post-Breakwaters



Beach Loss and Shore Changes





Source: USACE 2013 Slide Deck, Accessed at
https://static1.squarespace.com/static/613d069a1c250f668bd42feb/t/613d07114d65b107fd322c9f/1384559088008/2013-11-08-ArmyCorps-pub-mtg.pdf

Harbor Breakwater Effects: Waves (erosion + accretion)

- Sand trapped in harbor
  - Impedes Harbor Operations (boat launch, moorings, navigation)
  - Reduces Sand Supply to Shore (erosion of Surfers' Beach – Miramar Beach)
- Changes wave patterns
  - Sand moves away from Princeton (development and public access at risk
  - Sand moves away from Surfers' Beach-Miramar causing erosion (e.g., Highway 1, Miramar, and recreation at risk)

Half Moon Bay

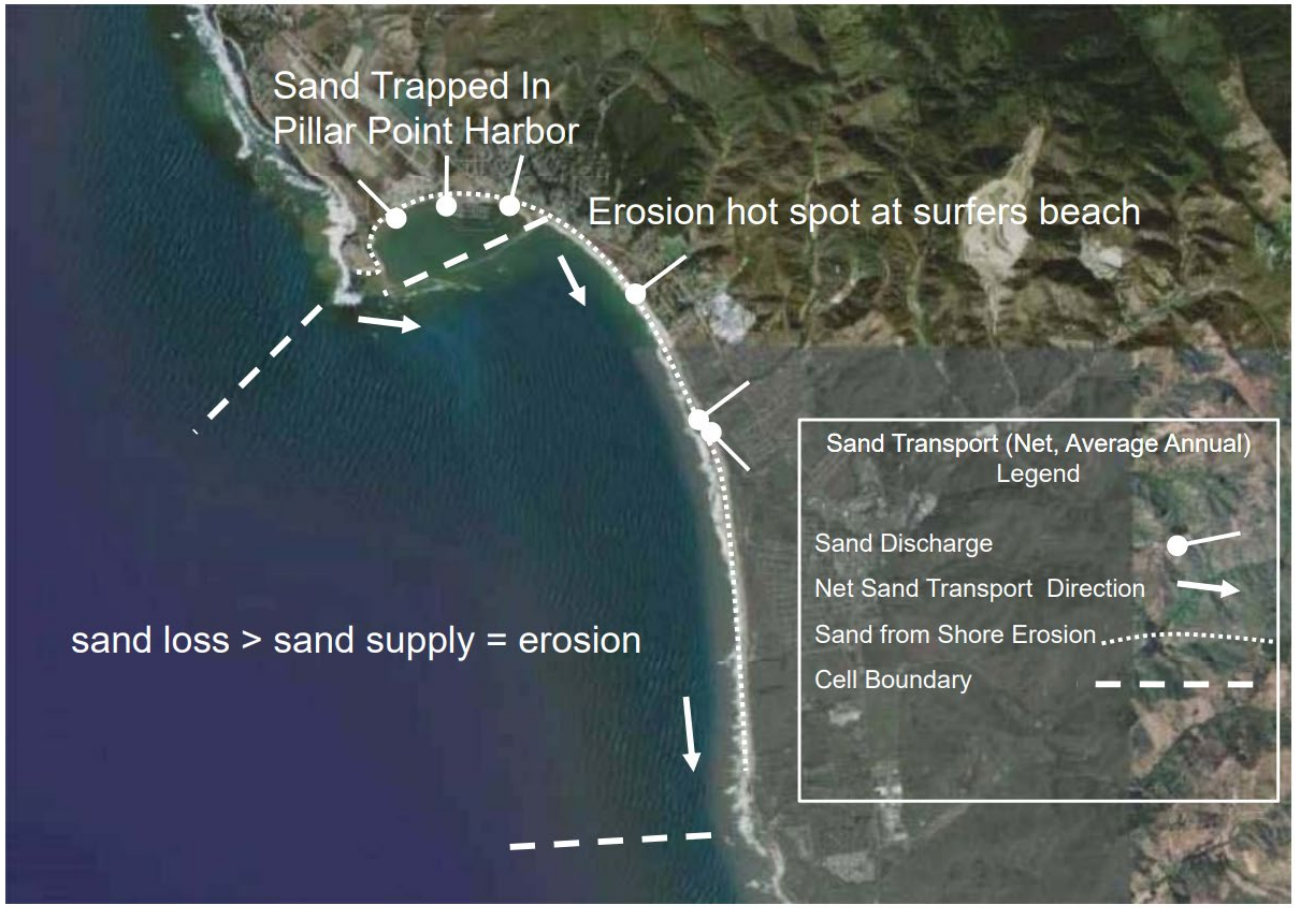
Wave Reflection

Source: Bob Battalio 2009 Slide Deck, Accessed at
https://static1.squarespace.com/static/613d069a1c250f668bd42feb/t/61563371104d633150dd9ee0/1633039219791/2009-10-Surfers-Beach-erosion-Battalio.pdf

Harbor Breakwater Effects: Sand Supply and Transport

- Wave reflection increases sand transport to south
  - Erosion at Surfers' Beach-Miramar
  - Shore armoring, loss of beach, etc.

Half Moon Bay Littoral Cell



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Harbor Breakwater Effects: Erosion and Armoring along Surfers' Beach

Rapid Erosion in 1971

Photo: Ken LaJoie, USGS

Armoring and Erosion in 2021

Photo: Scott Smith, ESA

Surfers' Beach has Been Eroding

1970

2019

Popular Surfing Spot for All Levels

Highway 1 is right next to the beach (errr…water)

Harbor Breakwater Effects: Flooding of Shore Armoring at Surfers' Beach

January 22, 2012

December 12, 2012

Photos: Jack Sutton (used with permission)

Harbor Breakwater Effects: Sand Shoaling in Harbor

Shoaling along West Breakwater

Photo: Louis White, ESA

Shoaling along East Breakwater

Photo: Curt Myers, Powerlines Productions

Project Goal

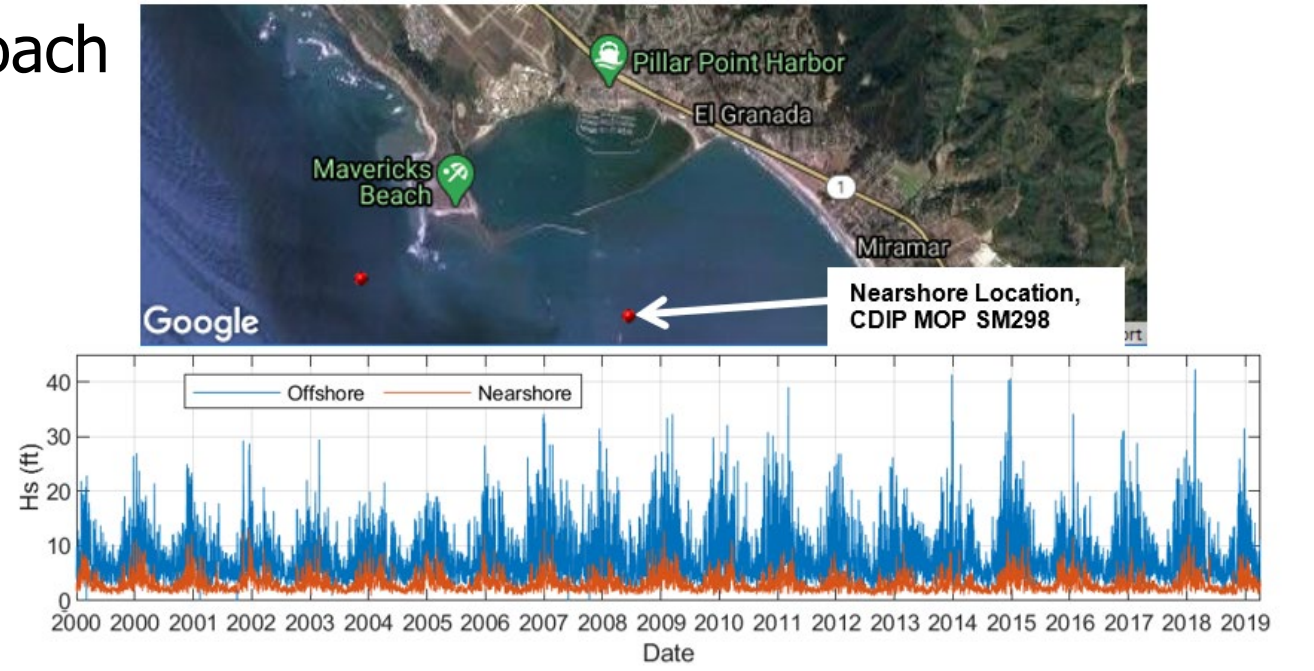
The goal of the project is to study the potential benefits and impacts of implementing a pilot project that beneficially reuses approximately 75,000 to 100,000 cubic yards of sand dredged from Pillar Point Harbor and placed at Surfer's Beach.

Project Objectives

- Prevent or mitigate beach erosion and sea cliff retreat
- Improve protection of Highway 1 and other structures
- Increase quality and quantity of public access and recreation
- Reduce the need for coastal armoring
- Improve biological habitat
- Comply with all relevant federal, state, and local regulatory programs and requirements
- Design and implement project in a manner that prevents, mitigates, or reduces adverse effects to the environment, resulting in net-beneficial environmental impacts and other positive benefits
- Develop and implement a monitoring program, which includes a detailed monitoring plan, that will be used to measure the project benefits and impacts relative to success criteria, including for physical and ecological considerations
- Improve operations of the boat launch ramp in PPH by removing sediments that interfere with the boat launch activities
- Improve navigation and anchorage in the East Basin by deepening areas of significant shoaling
- Minimize construction cost relative to project objectives and constraints

Design Approach for Surfers' Beach Project

- Rely on modeling and technical studies by Corps and others
- Cost-efficient, multi-objective approach
  - Remove sediment from harbor
  - Rebuild Surfers' Beach
  - Mitigate impacts to eelgrass
- Engineering Design with Lots of Regulatory Constraints
- Post-Construction Monitoring

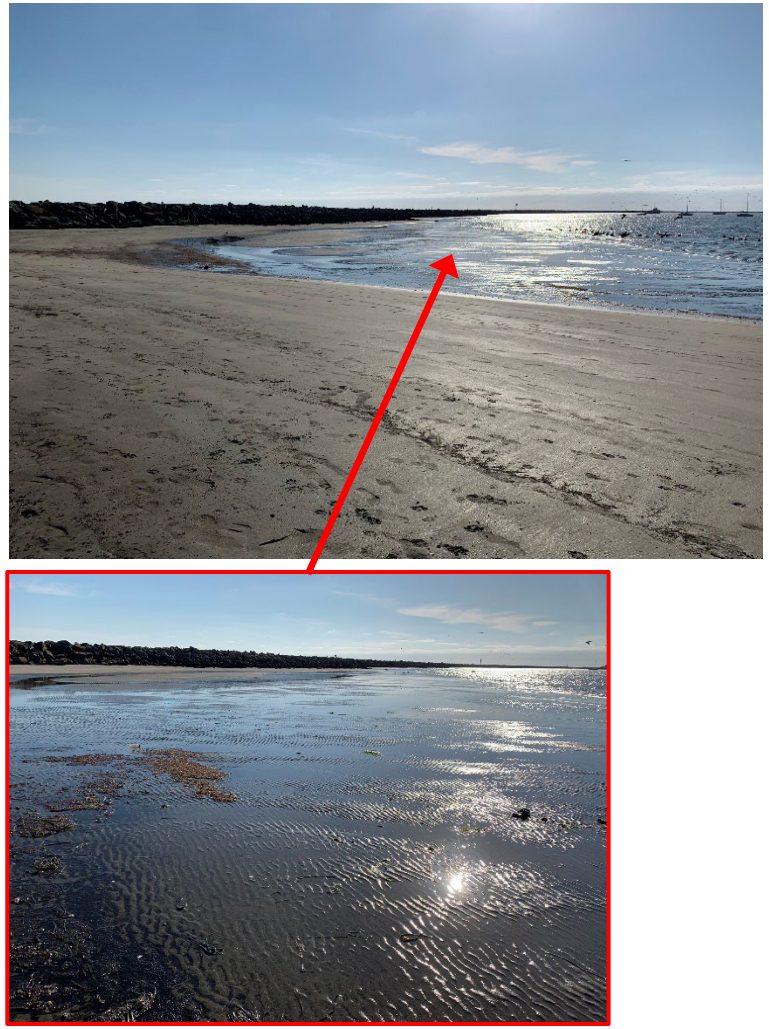


SOURCE: CDIP

Surfer's Beach Pilot Restoration Project

Sand Borrow Areas / Sand Samples

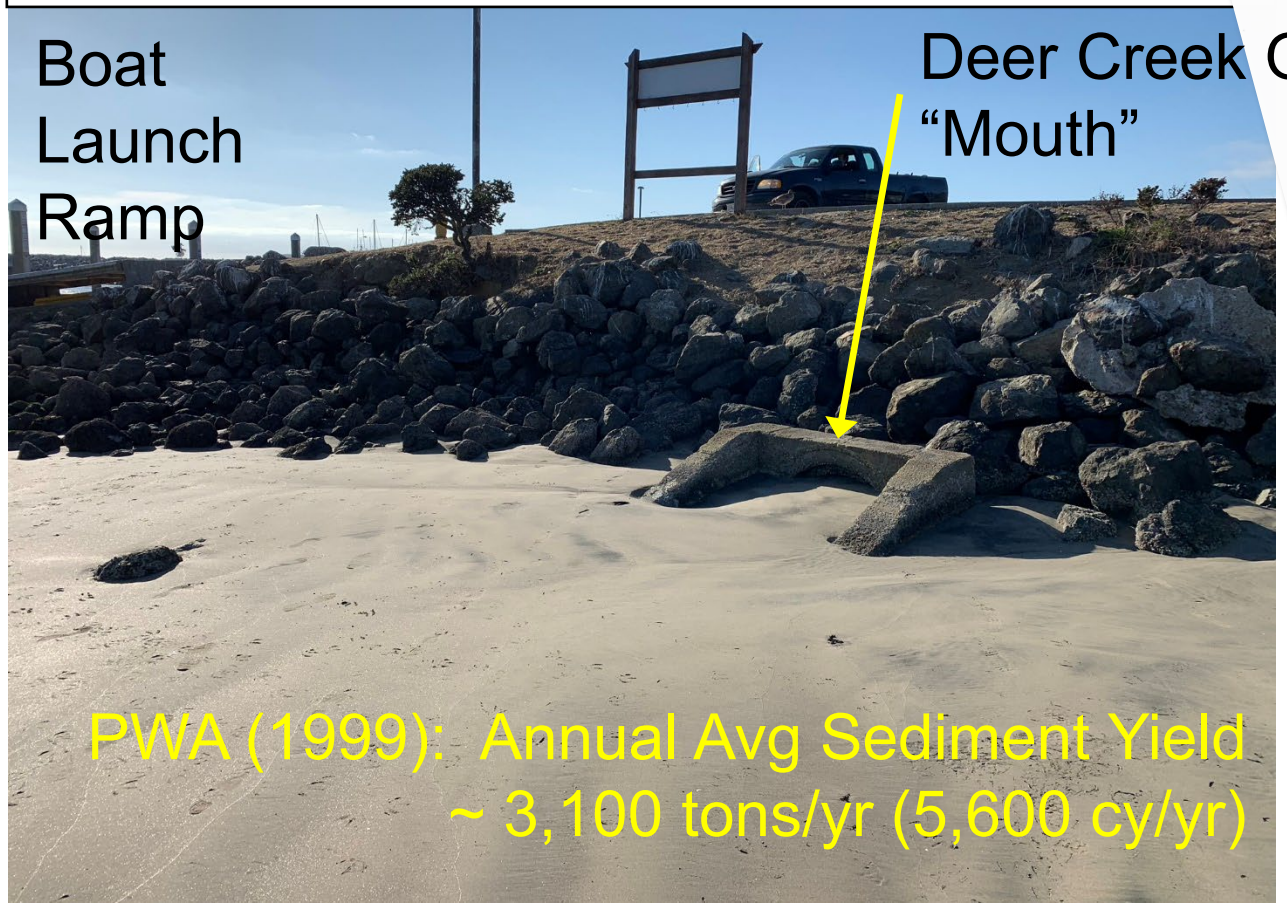
At East Breakwater: Finer Sand Deposits

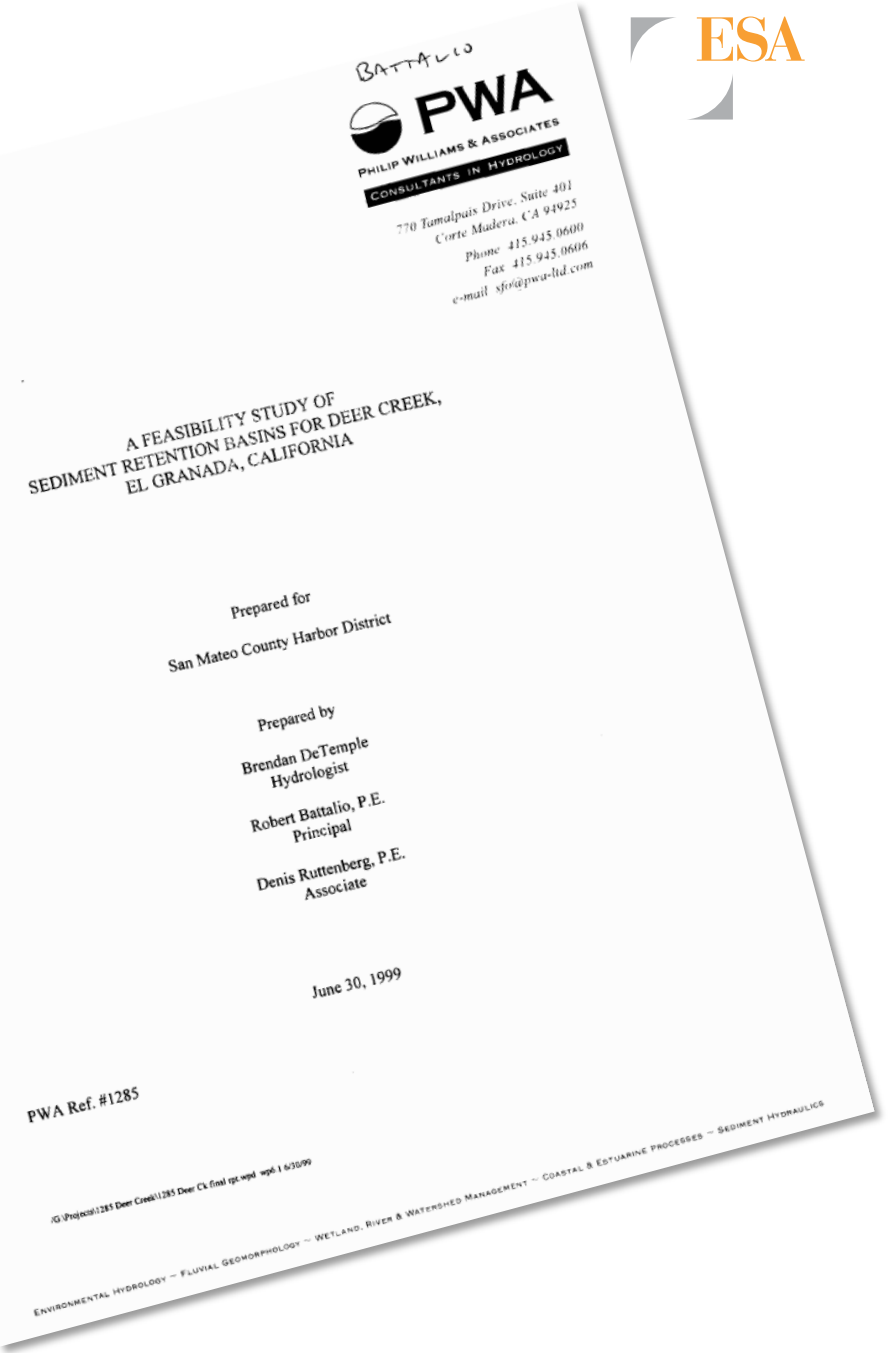


At Boat Launch Ramps: Coarse Sand Deposits (Deer Creek)

Sand Borrow Areas: Deer Creek Outfall

At Boat Launch Ramps: Coarse Sand Deposits / Deer Creek Outfall – Maintenance Issue? Flood implications upstream?

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A FEASIBILITY STUDY OF
SEDIMENT RETENTION BASINS FOR DEER CREEK,
EL GRANADA, CALIFORNIA

Prepared for

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June 30, 1999

PWA Ref. #1285

G:\Projects\1285 Deer Creek\1285 Deer Ck final rpt.wpd wpd: 6/30/99

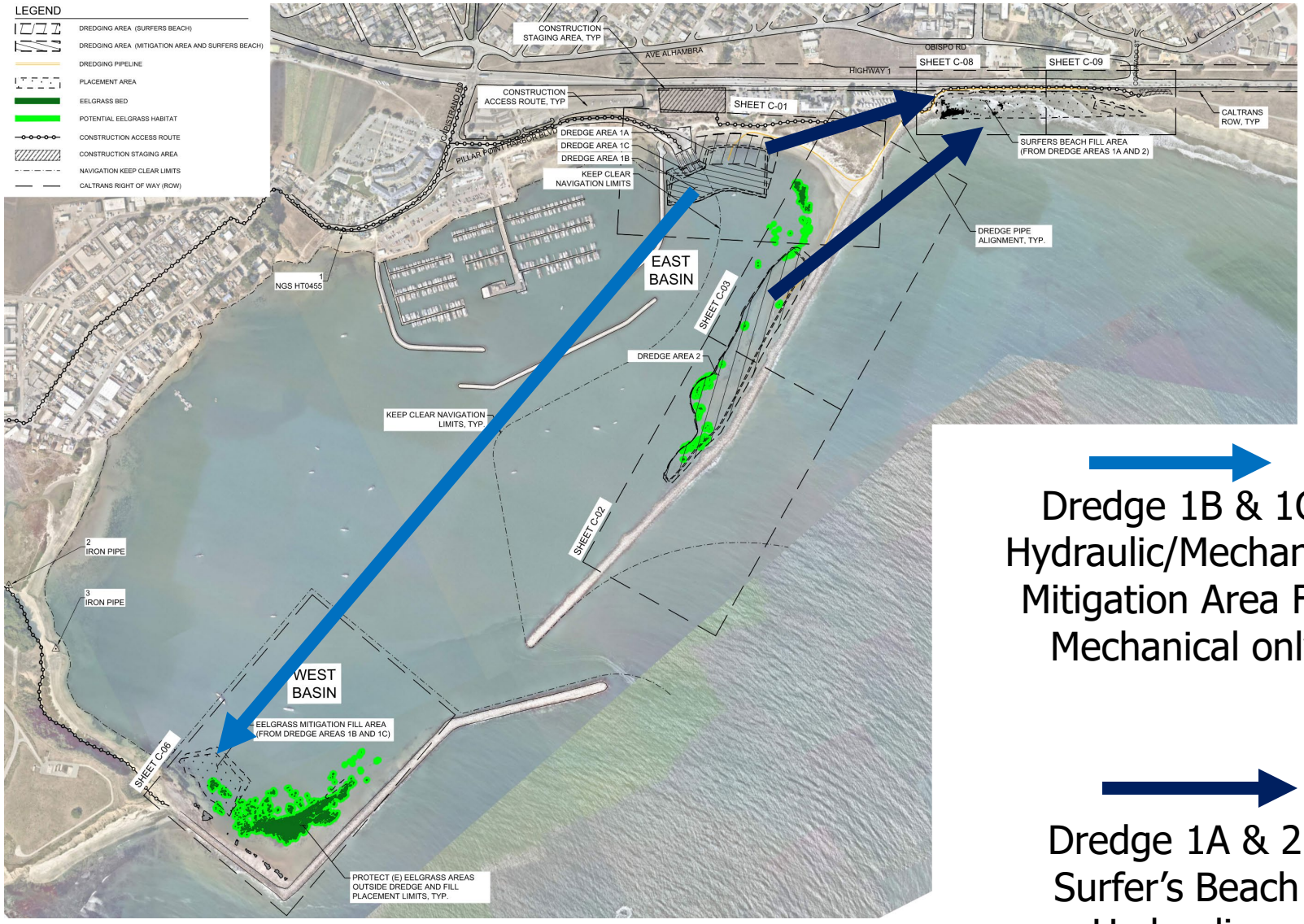
ENVIRONMENTAL HYDROLOGY – FLUVIAL GEOMORPHOLOGY – WETLAND, RIVER & WATERSHED MANAGEMENT – COASTAL & ESTUARINE PROCESSES – SEDIMENT HYDRAULICS

Sand Borrow Areas

Dredge area with over-steepened banks; allow sand on beach to slough in.

Will this help Deer Creek outfall?

Dredging and Fill Placement

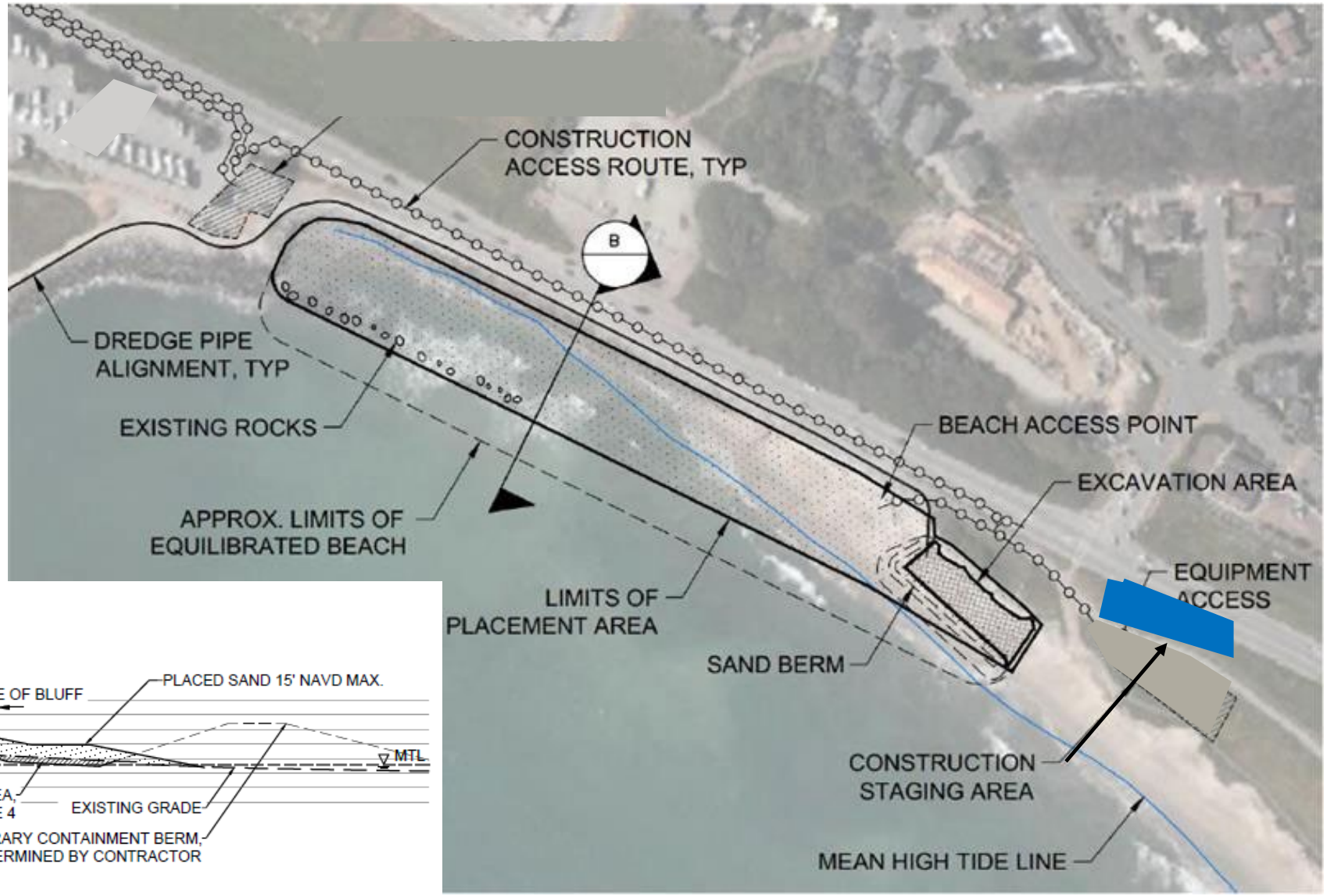


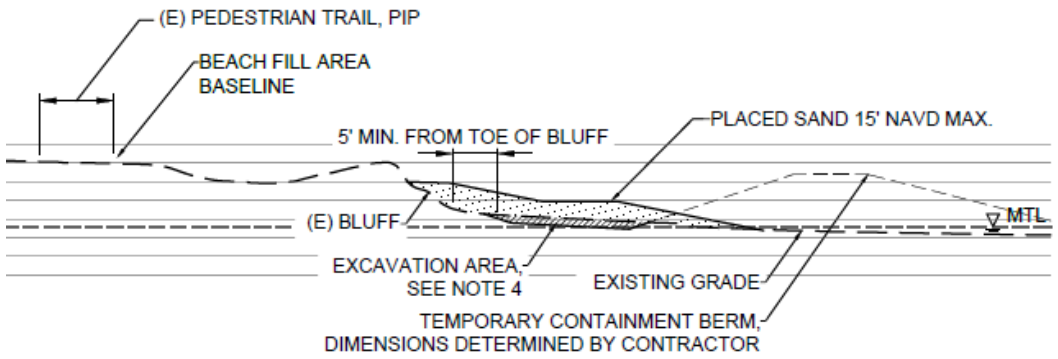
Dredge 1B & 1C: Hydraulic/Mechanical Mitigation Area Fill: Mechanical only

Dredge 1A & 2 and Surfer's Beach Fill: Hydraulic only

Sand Placement Area - Concept

Surfers' Beach Containment and Decant





Eelgrass Transplanting

Sequence and Schedule

Action	Required Predecessor Activities	Completion Date
Transplant Eelgrass from Mitigation Area.	None.	Prior to dredging Areas 1B and 1C.
Dredge Areas 1B and 1C and place fill at Mitigation Area.	Only after eelgrass transplanted from Mitigation Area.	July 15, 2025
Dredge Area 1A and place fill at Surfer's Beach.	Dredge Areas 1B and 1C.	October 15, 2025
Transplant Eelgrass from Area 2.	At least two weeks after fill placement in Mitigation Area.	August 15, 2025
Dredge Area 2 and place fill at Surfer's Beach.	Only after eelgrass transplanted from Area 2 to Mitigation Area.	October 15, 2025

Layout and Surveys

Contractor's Responsibility	Timing	Purpose
Hire Licensed Surveyor	Prior to construction	Quality control
Verify survey control & install tide gauge	Prior to construction	Quality control
Layout and grade control	Throughout construction	Quality control
Daily progress surveys of active areas	Daily	For partial acceptance
Monthly progress surveys *	Monthly	For progress payments
Post-construction Surveys *	At Completion of Dredging	Design compliance and final acceptance
As-built surveys	At end of contract	Document final conditions

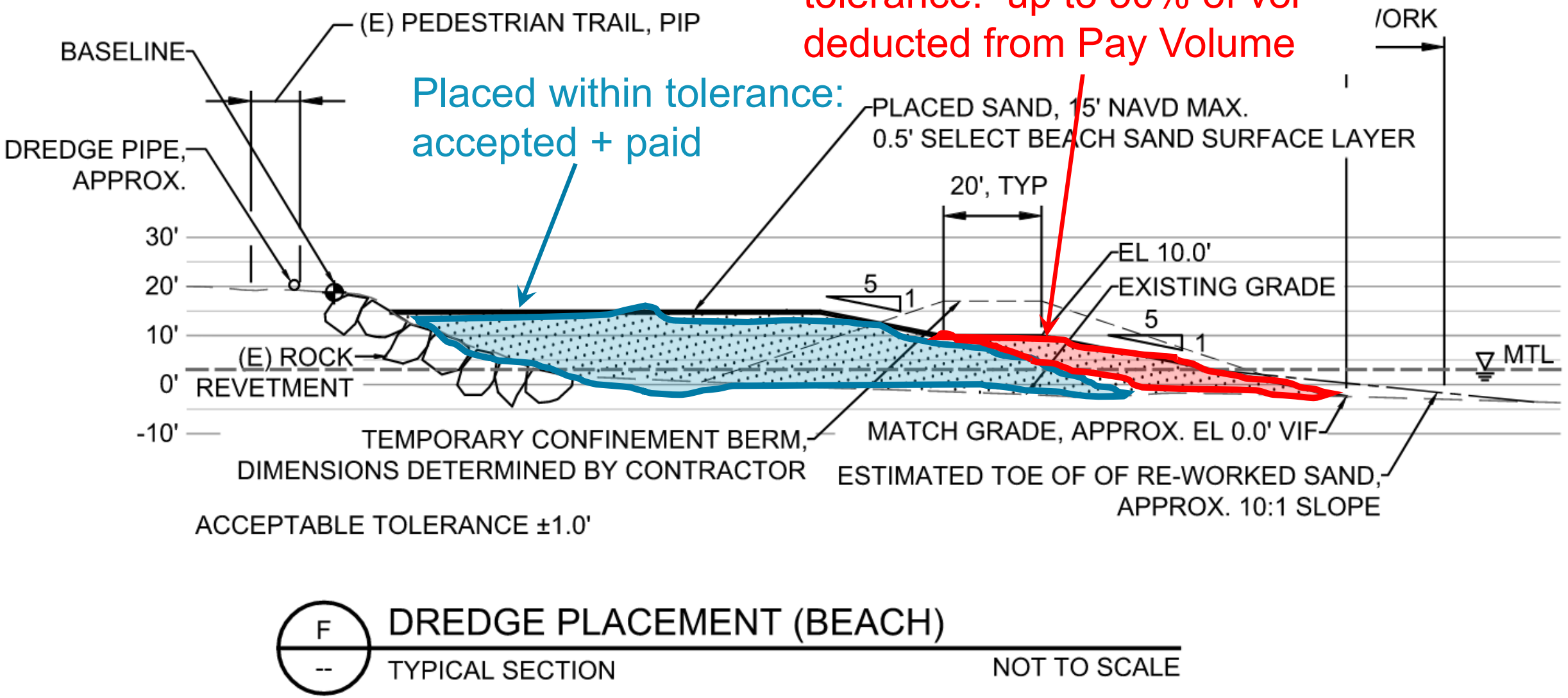
* May incorporate daily progress survey data

Measurement and Payment

- Not a typical navigation dredge project
- Measurement based on dredge volume; payment includes placement requirements

Bid Item	Tolerance	Measurement/ Pay Limit
Dredging and Fill Placement at Eelgrass Mitigation Fill Area	Dredge: +2′/-1′ from over-dredge limit (elev -8 and -11 ft NAVD)	Dredge Volume to over-dredge limit (-10 feet NAVD)
	Fill Placement: Terrace: +/- 0.5 feet Side Slopes: +/- 1.0 feet	
Dredging and Fill Placement at Surfers Beach	Dredge: +2′/-1′ from over-dredge limit (elev -8 and -11 ft NAVD)	Dredge Volume to over-dredge limit (-10 feet NAVD)
	Fill Placement: +/- 1.0 feet	

Measurement and Payment



F -- DREDGE PLACEMENT (BEACH)

TYPICAL SECTION NOT TO SCALE

District's Pre-Construction Surveys

District's Responsibility	Purpose
Bathymetric Survey of dredge areas	Basis for measurement of dredge volumes
Eelgrass Survey	Refine areas for eelgrass transplanting and protection

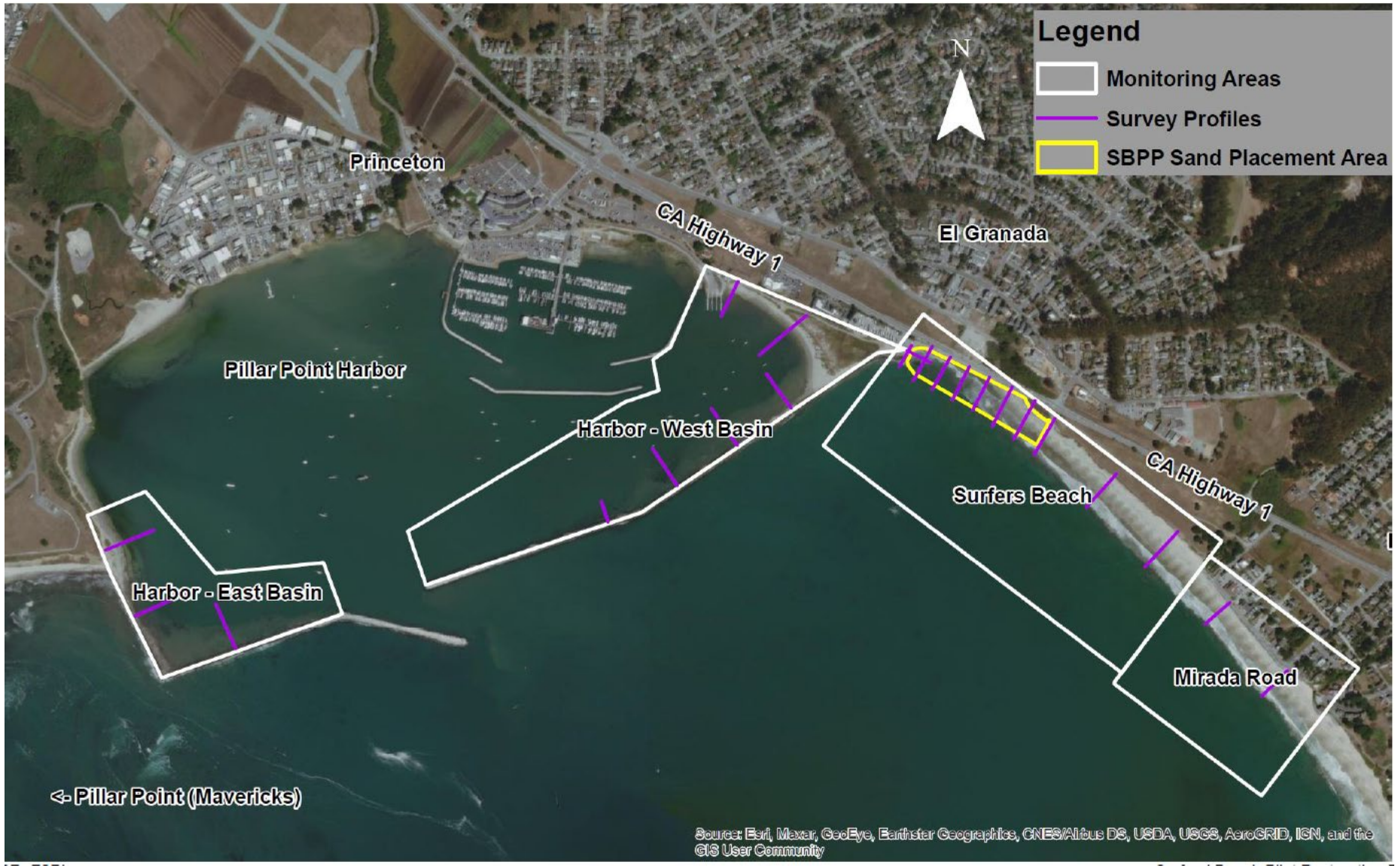
Contractor's Pre-Construction Submittals

Submittal	Submit By
Caltrans Contractor Authorization Form	Within 5 days of NTP
Caltrans Submittal	Prior to Caltrans pre-job meeting
Traffic Control Plan	Prior to mobilizing to the site
Operations Plan	Prior to beginning construction.
Dredging Operations Plan	Prior to beginning construction.
Water Control Plan	Prior to beginning construction.
Licensed Surveyor's Verification	10 days prior to survey work
Survey Plan	Prior to mobilization

Post-Construction Monitoring

- Surveys to track progress and movement of sand
- Waves – Install a buoy to measure waves offshore
- Water Levels / Tides – Install tide gauge in harbor
- Surfing and Beach Recreation – observations and camera / video
- Sediment sampling – grain size distributions over space and time
- Time lapse and other photography
- Adaptive Management Actions

Monitoring Area and Transects



Adaptive Management Actions: Scarp Grading (Example at South Ocean Beach)

SOURCE: ESA

Surfers' Beach Pilot Restoration Project

Construction Progress

Eelgrass Mitigation Sediment Placement Barge

Dredging Operations Near Boat Launch Ramp

Dredge Equipment

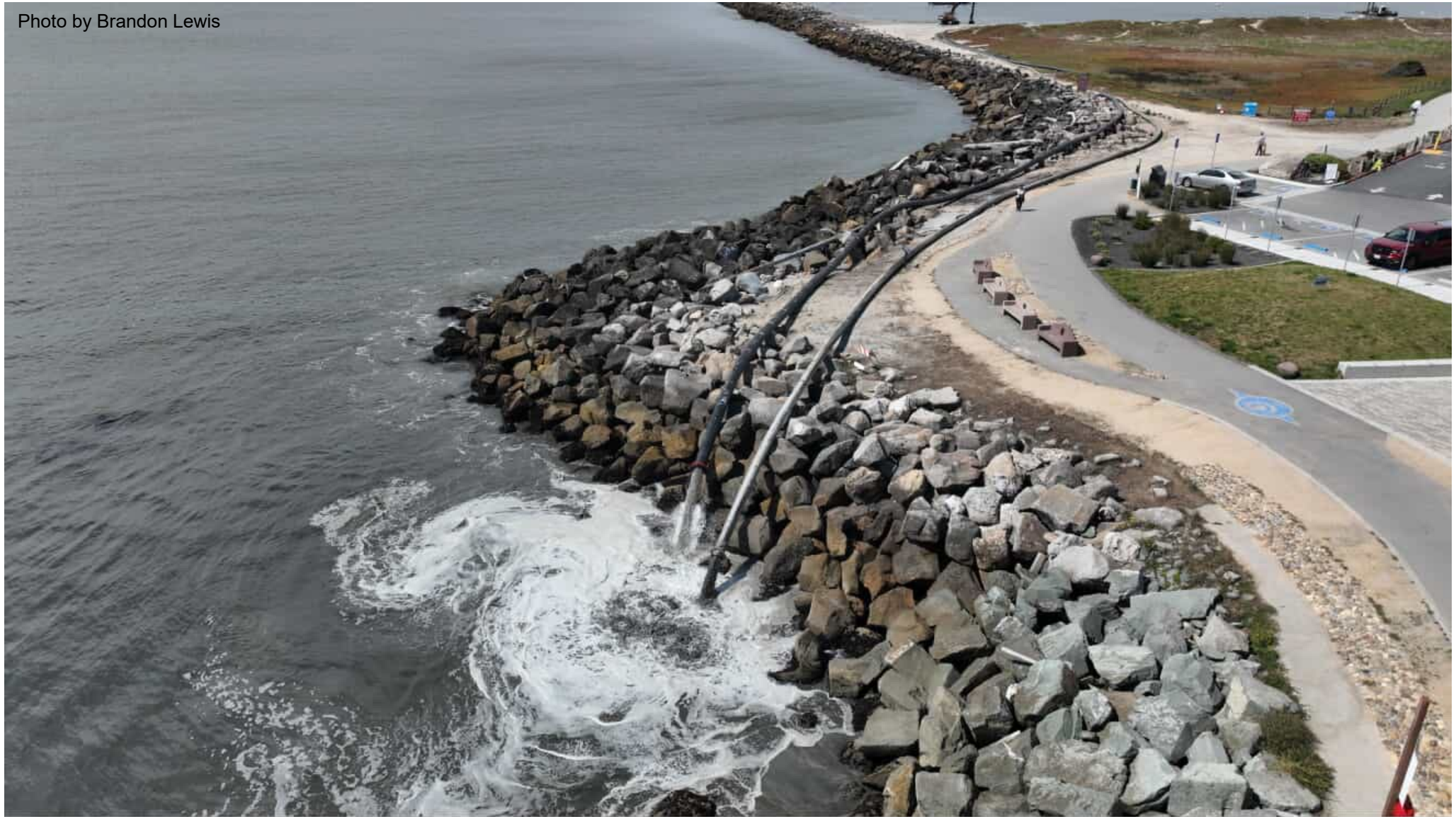
Cutter Head

Second Dredge Arrival

Pumping Sand Slurry to North End of Surfers Beach

Discharging to North End of Surfers Beach

Discharging to North End of Surfers Beach



Discharging to North End of Surfers Beach

Photo by Brandon Lewis

Aerial view: Discharging to North End of Surfers Beach

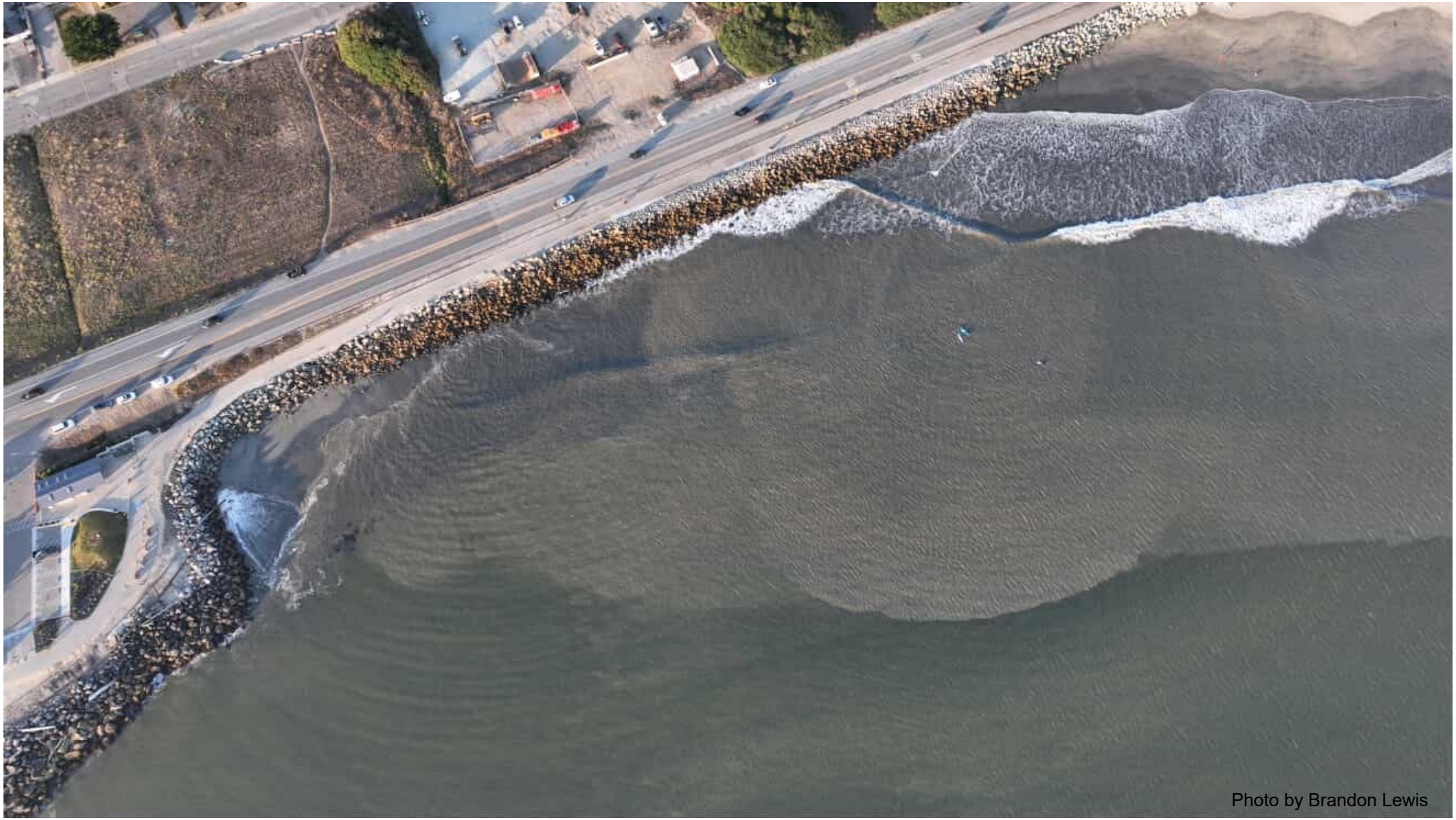


Photo by Brandon Lewis

Aerial View: Discharging to North End of Surfers Beach

Photo by Brandon Lewis

North End of Surfers Beach After ~5,000 cy

Sand Accumulating at North End of Surfers Beach (9/8/25)

Before and after discharge of ~10,000 cy to North End

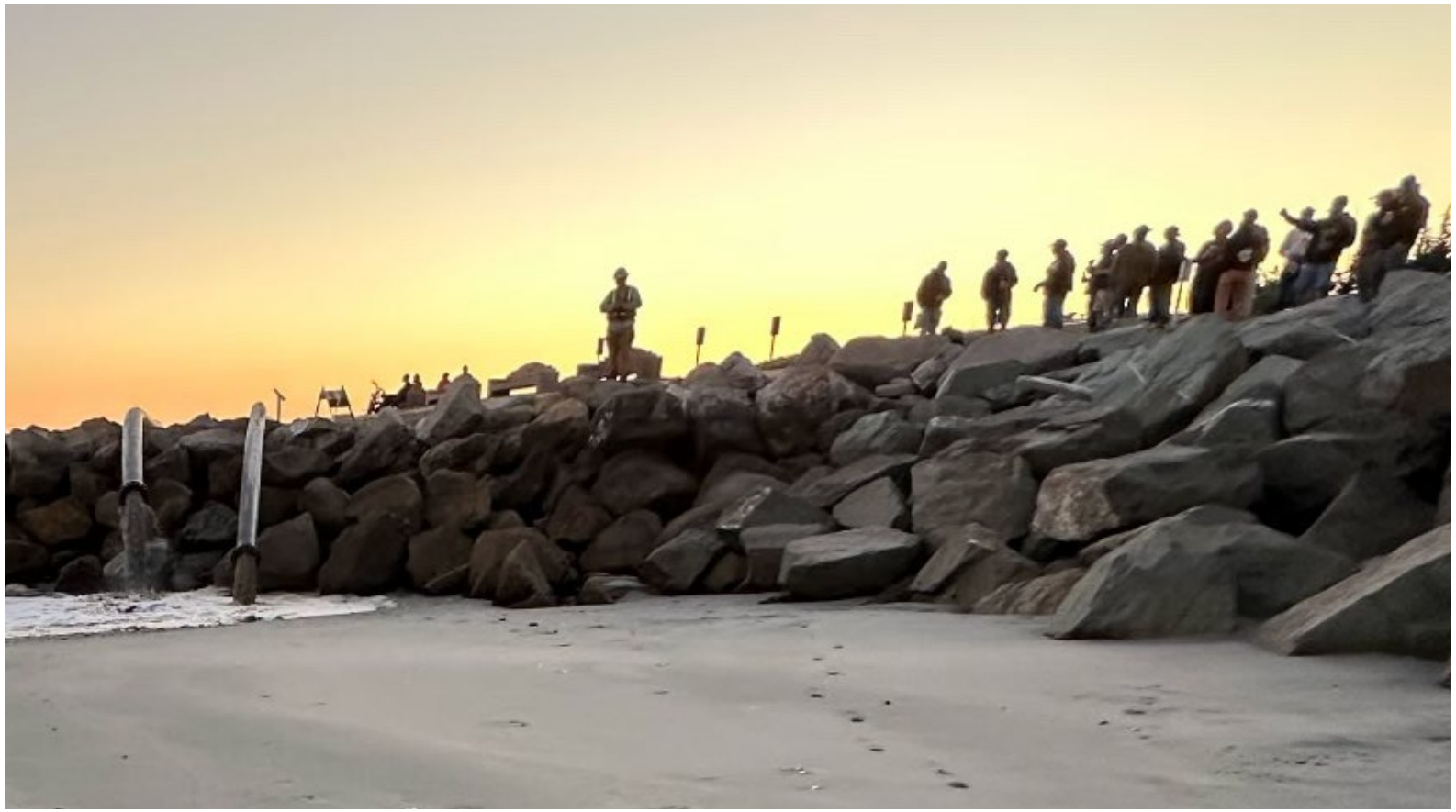
Before Discharge Started

After ~ 2 weeks / 10,000 cy

Grading of Berm for Discharge to South End 9/9/25

Discharging into Containment Cell at South End 9/9/25

Community is Buzzing and Excited



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