Waikīkī Beach Improvement and Maintenance Program

Engineering Design and Rationale

Informational Briefing to the Hawai'i Board of Land and Natural Resources

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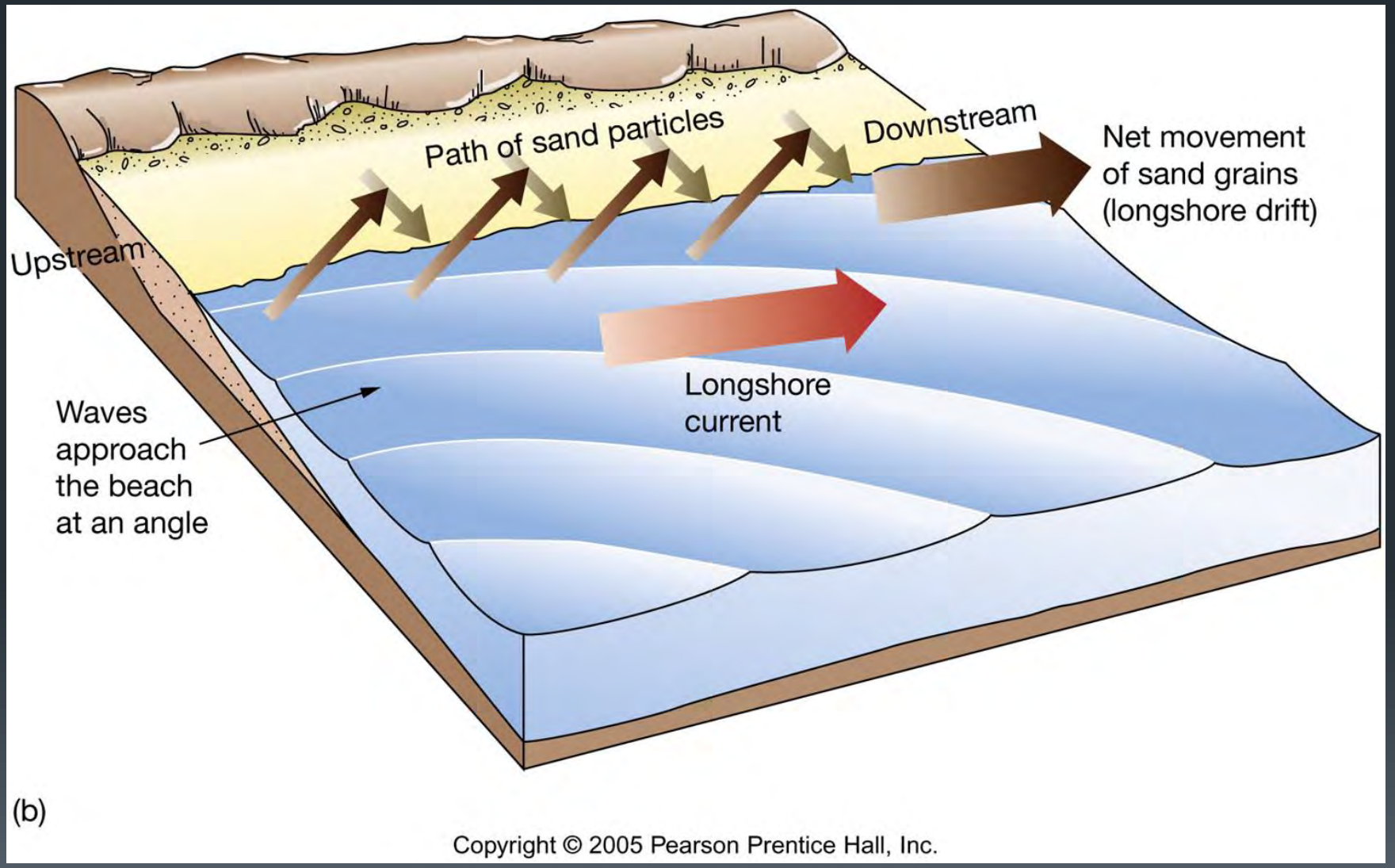
WBSIDA Waikiki Beach SPECIAL IMPROVEMENT DISTRICT ASSOCIATION

SE

Phase 1 – Engineering Design Overview

- Shorelines are inherently complex
- Ocean parameters considered
- What are the natural forces influence beaches?
  - Wind, waves, currents, and sand availability
- How does sand move?
  - Alongshore (i.e., along the shoreline)
  - Cross shore (i.e., toward and away from shore)

Phase 1 – Engineering Design Overview



Phase 1 – Engineering Design Overview

- What are groins and what do they do?
- There are various configurations (straight vs. composite)
- Groins are a “nature-based” solution
- Groins are effective when properly sited and designed

Natural and nature-based solutions may be natural (produced purely by natural processes) or nature-based (produced by a combination of natural processes and human engineering).

Example: Straight Groins

Newport Beach, CA

Example: Composite Groins

Iroquois Point, Oʻahu

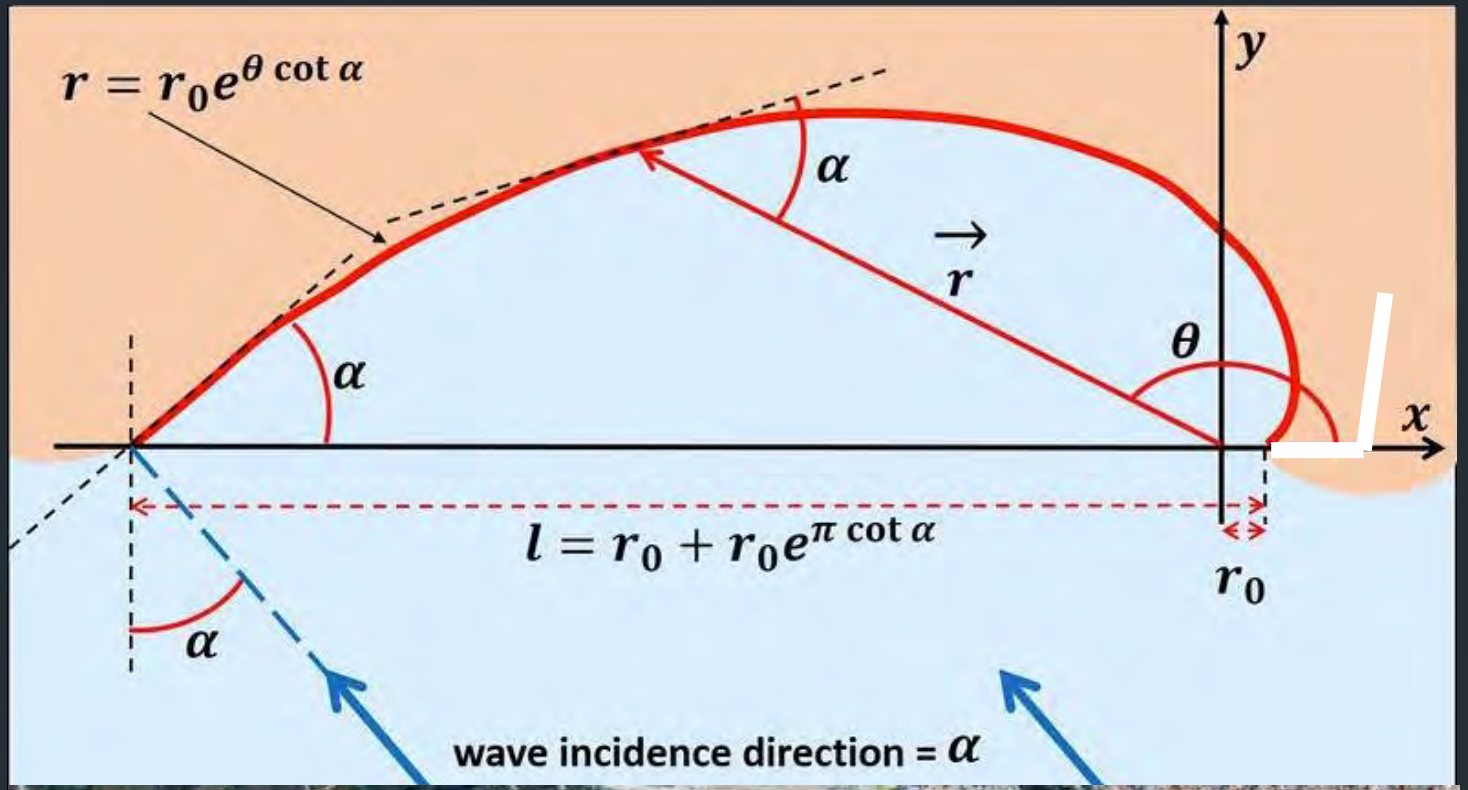
Headland Bay Beaches

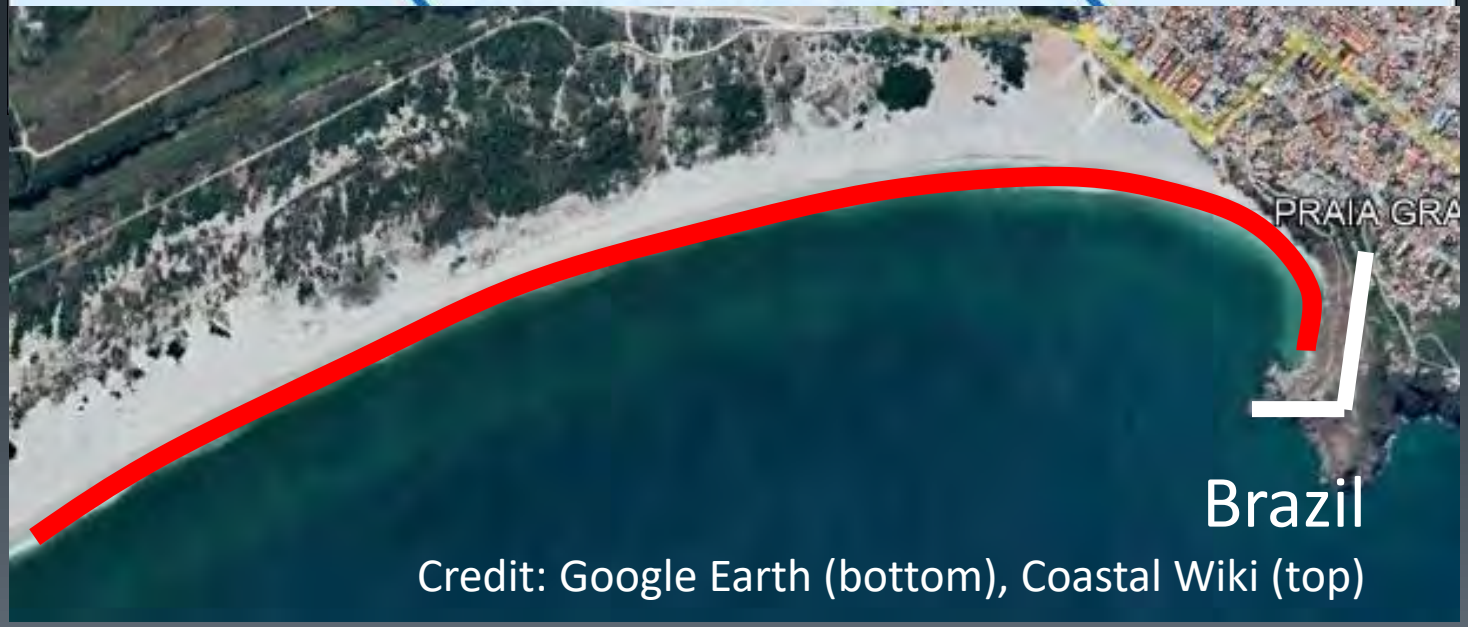
- These are naturally-occurring coastal features
- Headlands are static and non-erodible (e.g., rock)
- Beaches are dynamic and erodible (e.g., sand)
- Headlands transform waves and create curved beaches
- Composite groins are designed to mimic headlands and create curved beaches

Example: Natural Headland Bay Beach

Brazil

Credit: Google Earth





Brazil

Credit: Google Earth (bottom), Coastal Wiki (top)

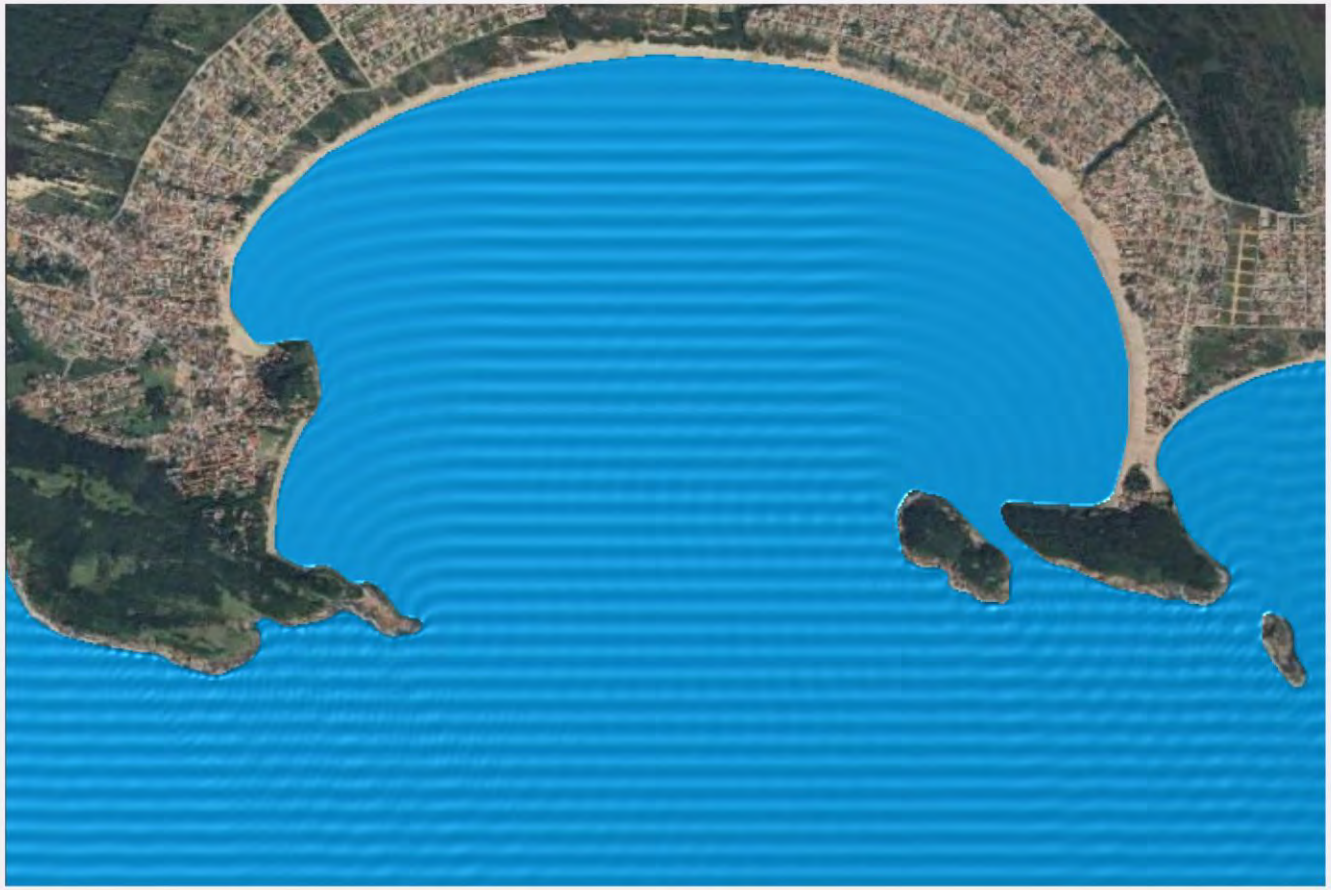
Natural Headland Bay Beach

Example: Natural Headland Bay Beach

Brazil

Natural Headland Bay Beach

Brazil



Example: Natural Headland Bay Beach

Brazil

Example: Natural Headland Bay Beach

Sri Lanka

Example: Natural Headland Bay Beach

East Africa

Example: Natural Headland Bay Beach

Ireland

Example: Natural Headland Bay Beach

British Columbia

Example: Natural Headland Bay Beach

La‘ie, O‘ahu

Credit: Google Earth

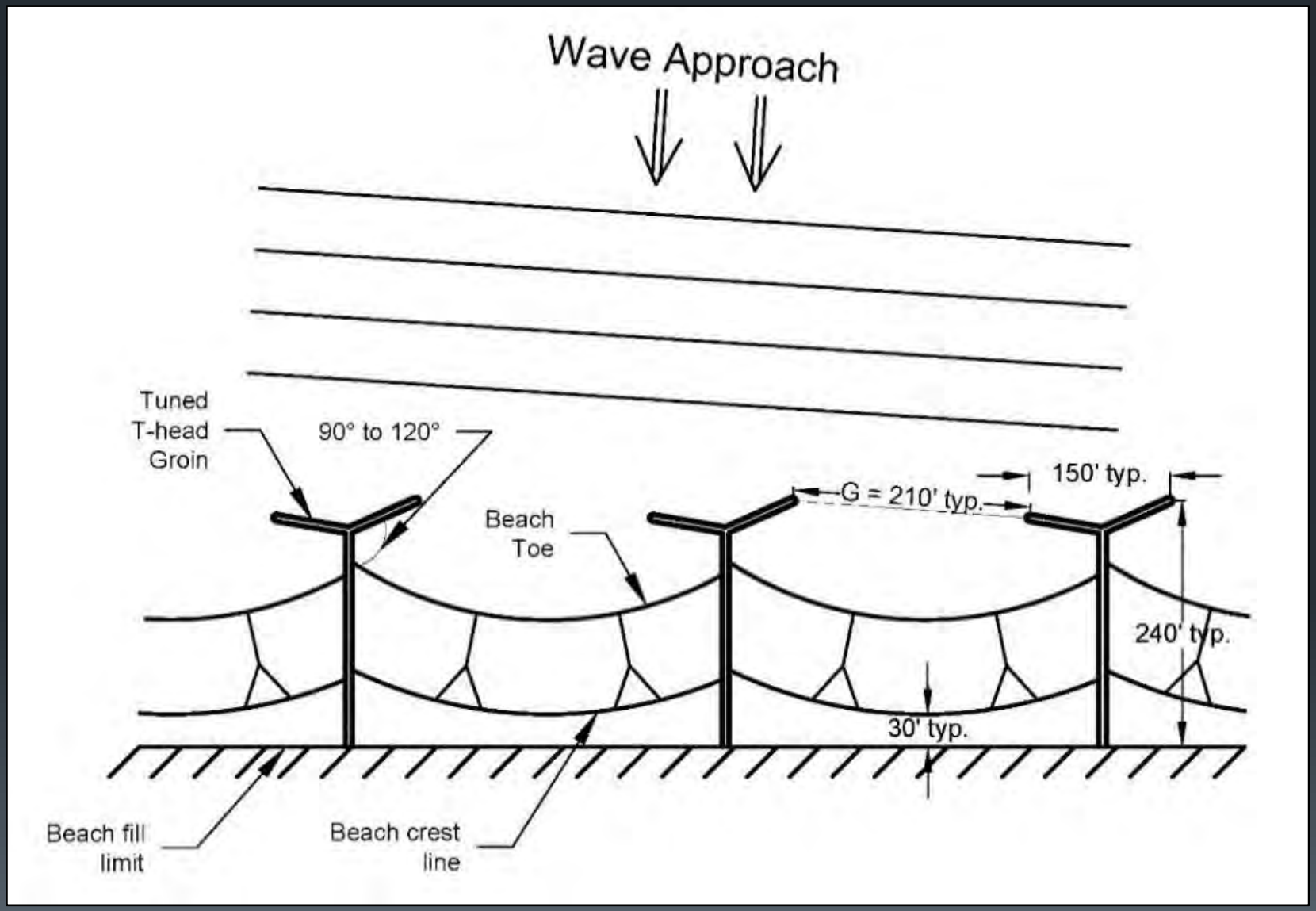
Example: Natural Headland Bay Beach

Poʻipū, Kauaʻi

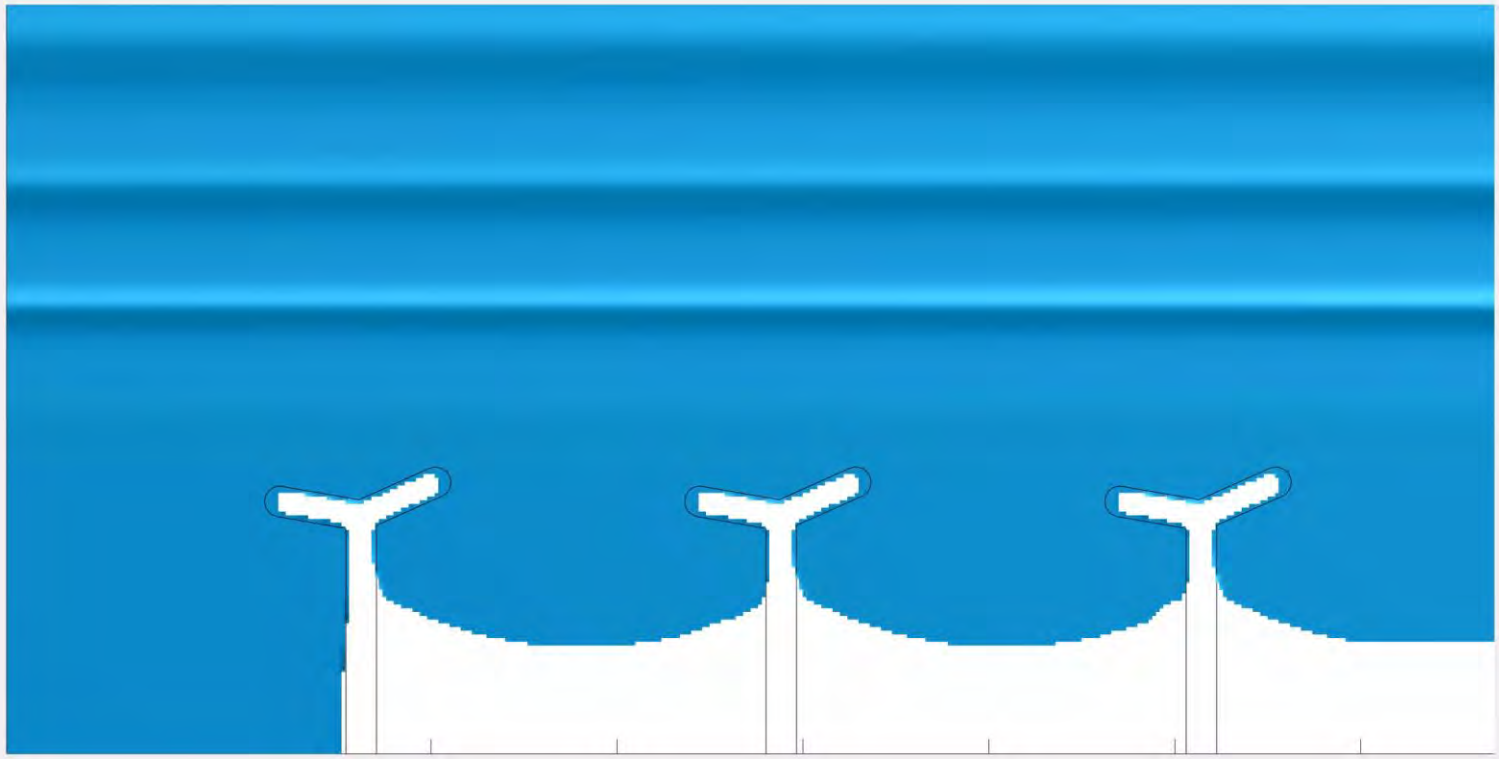
Example: Natural Headland Bay Beach

Kipu Kai Beach, Kauaʻi

T-head Groin Design Schematic



T-head Groin Design Schematic (wave model)



Example: Nature-based Headland Beach

Fisher Island, Florida

Example: Nature-based Headland Beach

Tybee Island, Georgia

Example: Nature-based Headland Beach

Fort Clinch, Florida

Example: Nature-based Headland Beach

Japan

Credit: Google Earth

Example: Nature-based Headland Beach

Bali, Indonesia

Example: Nature-based Headland Beach

Malaysia

Credit: Google Earth

Example: Nature-based Headland Beach

Iroquois Point, ʻEwa, Oʻahu

Engineered Headlands
Nature-Based Engineering

- Community resilience project (backshore elevation +5 ft)

- 9 T-head groins and 100,000 cy of sand formed 8 stable beach cells
- ASBPA Best Restored Beach Award (2014) and Weigel Award (2022)

Halekūlani Beach Sector

Design Parameters

- Proposed action: Beach Restoration and Stabilization
- WBCAC acknowledged the need for groins to create a stable beach
- Ft. DeRussy outfall/groin and Royal Hawaiian Groin serve as bookends—no downdrift erosion concerns

Halekūlani Beach Sector

Phased Approach

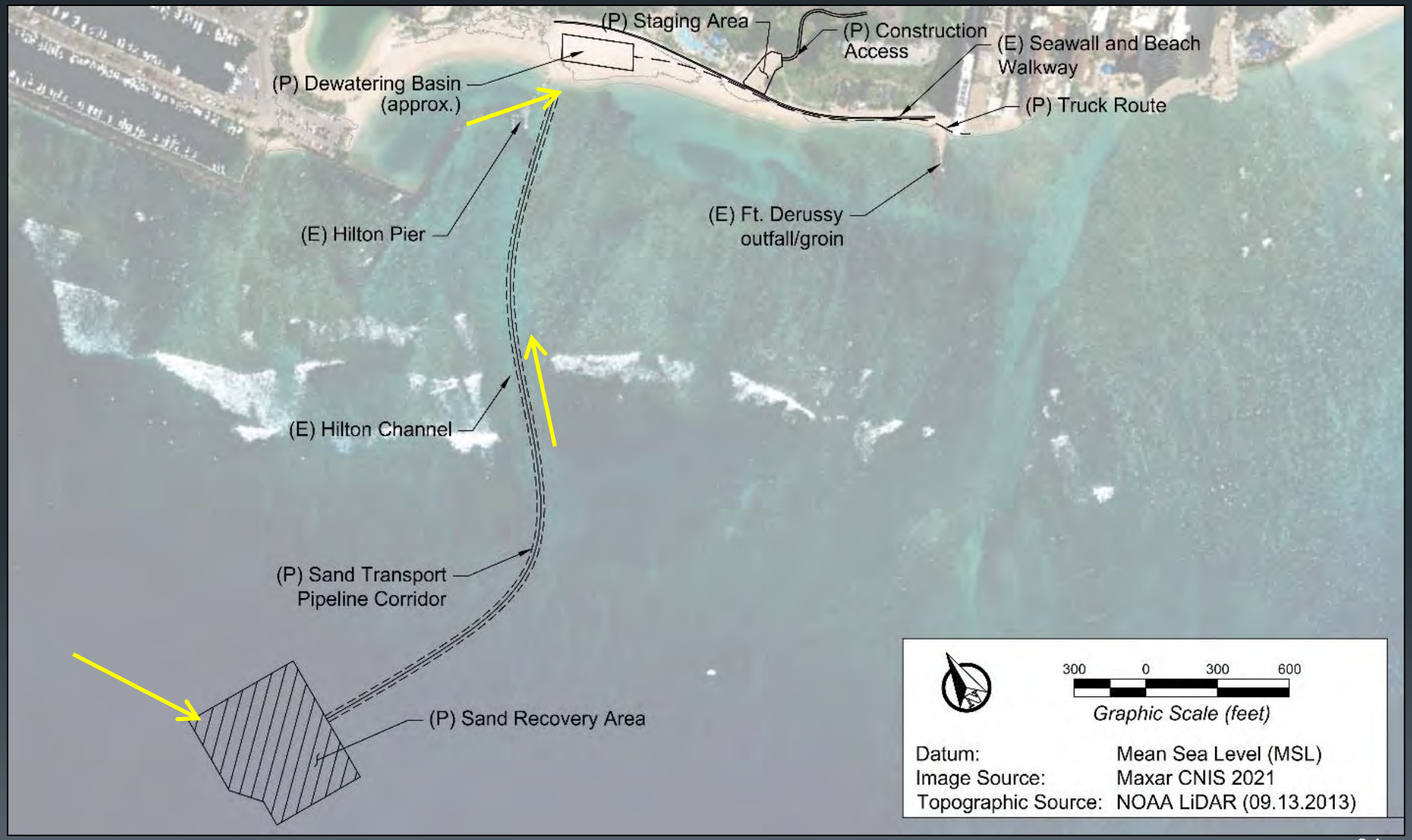
- Initial phase would produce one stable beach cell
- One new L-head groin and one new T-head groin
- 10,000 cy of sand
- Sand retaining wall

Halekūlani Beach Sector

Now vs. Proposed

Halekūlani Beach Sector

Sand Recovery and Transport Plan



Halekūlani Beach Sector

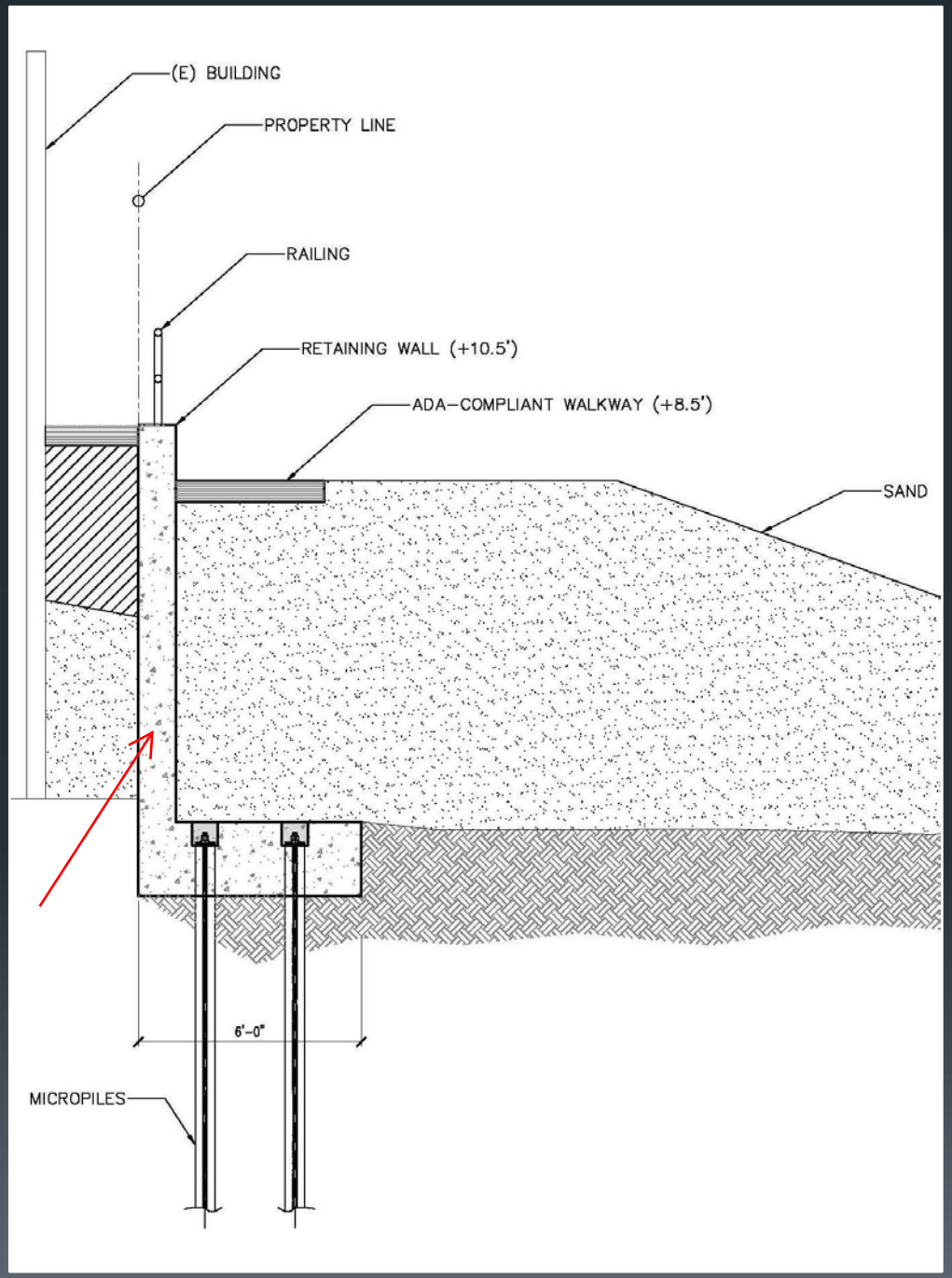
Resilience to Sea Level Rise

- Projects are designed for and can be adapted to SLR
  - Two phases
    - Initial phase: 1.5 ft of Sea Level Rise
    - Adaptive phase: 3.2 ft of Sea Level Rise
  - Beach elevation (+8.5 ft)
  - Groin head elevation (+8.0 ft)
    - RHG = +6.0 ft
  - Groin stem elevation (+8.0 ft to +10.5 ft)
  - Groins can then accommodate an additional 1.5 ft of sand
- 10,000 cy of sand
- Sand retaining wall

Halekūlani Sector

Sand Retaining Wall

- Beach at +8.5’
- Backshore amenities
- Safe lateral access
  - ADA Compliance
- Flood reduction



Kūhiō Beach Sector

Waikīkī Beach Improvement and Maintenance Program

For additional Information, please visit:
https://dlnr.hawaii.gov/occl/waikiki/