

HAWAII REGIONAL SEDIMENT MANAGEMENT

MAUI
Workshop
January 19, 2011

Sanctuary Learning Center
Kihei, HI



US Army Corps
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co-sponsored by:

State of Hawaii Department of Land and Natural Resources

US Army Corps of Engineers, Honolulu District



AGENDA

1300 - 1310	Welcome and Introductions	Conger Conant
1310 - 1330	Regional Sediment Management Overview	Smith
1330 - 1500	Maui RSM	
	Waves Climate	Podoski
	Shoreline Change	Miller-Owens
	Offshore Sand Sources	Miller-Owens
	Region Sediment Budget	Sloop
	Regional Sediment Management Plan	Sloop
1500 - 1515	Break	
1515 - 1615	Kihei Region: Potential RSM Projects	Sloop
	Federal Perspective	Smith
	State Perspective	Conger
	General Discussion	All
1615 - 1630	Break	
1630 - 1725	Kahului Region: Potential RSM Projects	Sloop
	Federal Perspective	Podoski
	State Perspective	Conger
	General Discussion	All
1725 - 1730	Wrap-up and Adjourn	Conger Conant

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REGIONAL SEDIMENT MANAGEMENT OVERVIEW

Thomas D. Smith, P.E.
Honolulu District



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NATIONAL REGIONAL SEDIMENT MANAGEMENT PROGRAM



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REGIONAL SEDIMENT MANAGEMENT

An integrated approach that takes a holistic view of coastal, estuary, and river sediments on a regional scale in the planning and maintenance of water resource projects to achieve balanced and sustainable systems.



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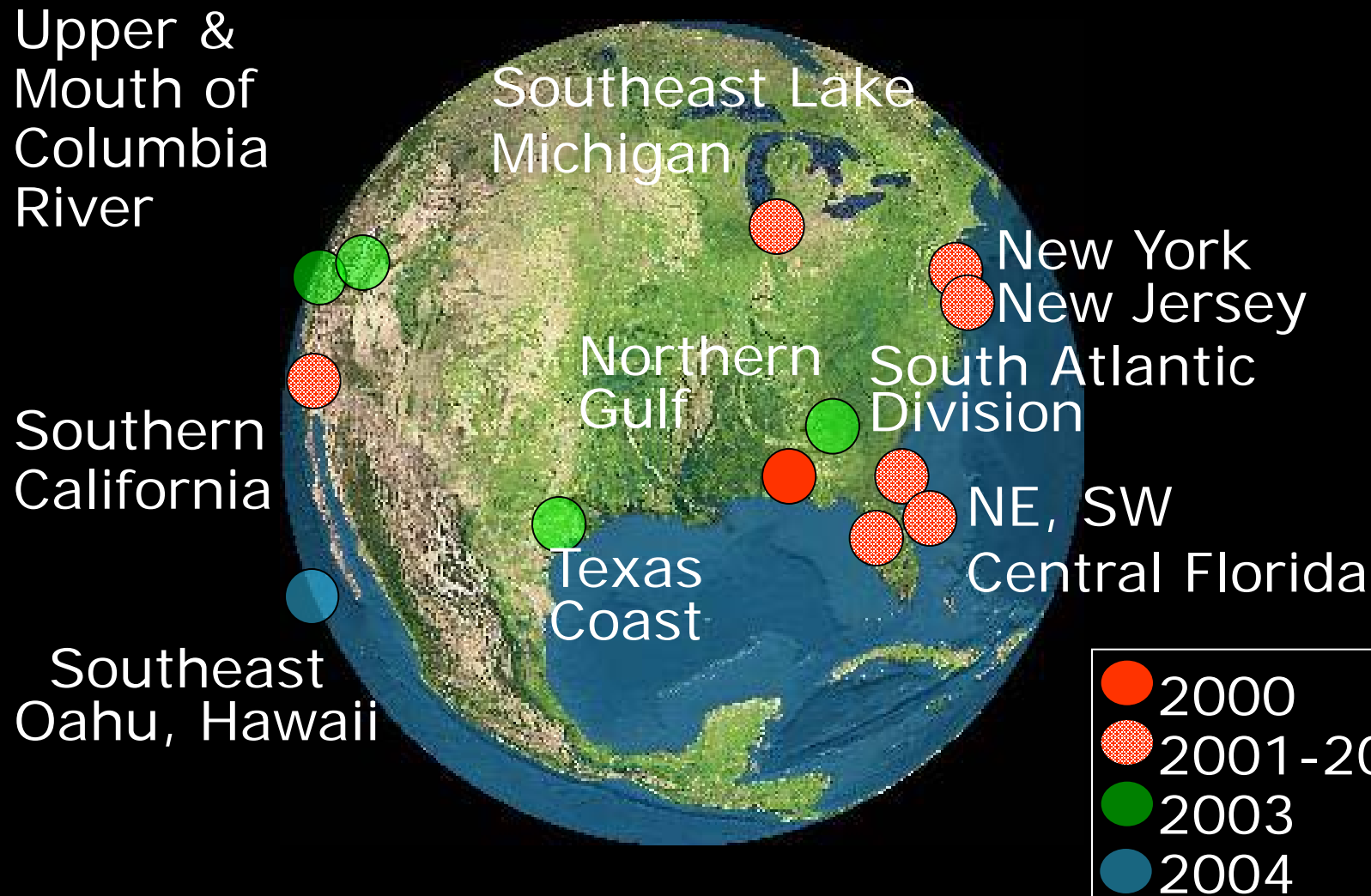
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NATIONAL RSM PROGRAM



SOUTHEAST OAHU RSM

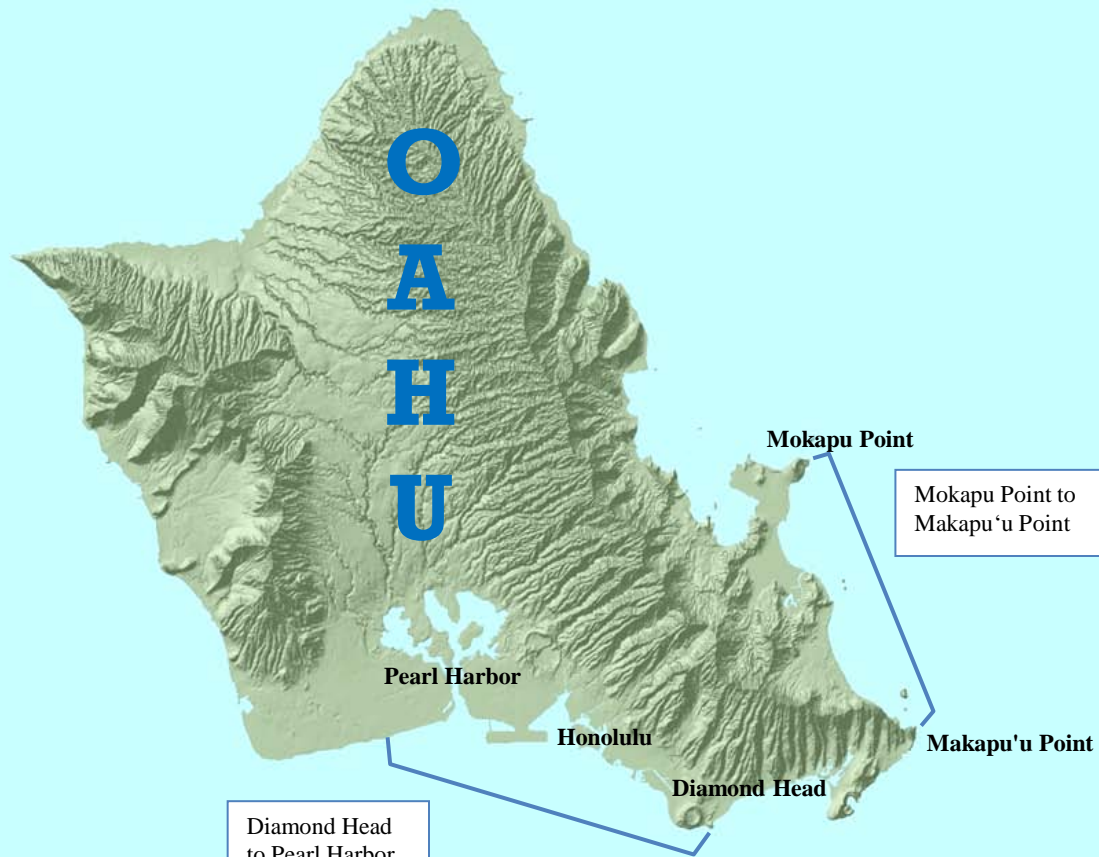
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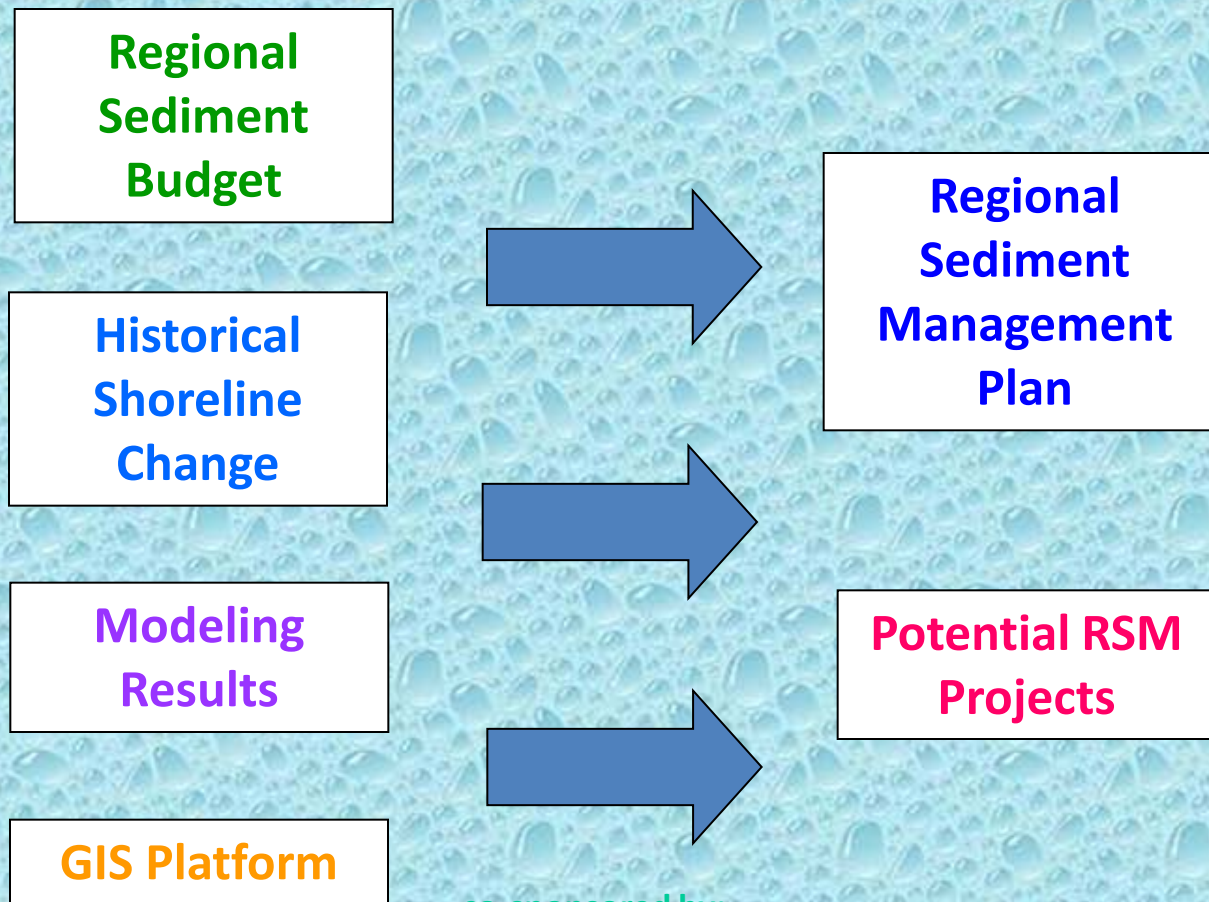
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SOUTHEAST OAHU RSM REGIONS



FINAL PRODUCTS



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MOKAPU POINT TO MAKAPUU POINT

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Southeast Oahu

RSM

- **Location:** Mokapu Point to the north through Makapuu Point to the south.
- **Purpose:** Optimize use of sediment resources.
- **Issues:**
 - Complex sediment transport pathways.
 - Large percentage of critically eroded shorelines.
 - Large percentage of armored shorelines.
 - Economical sand sources yet to be identified.
- **Goal:** Increase understanding of littoral processes with the goal of preserving and restoring beaches in the region with potential application elsewhere.



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MAKAPUU BEACH



September 2005



January 2008



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OFFSHORE SAND SOURCE INVESTIGATION

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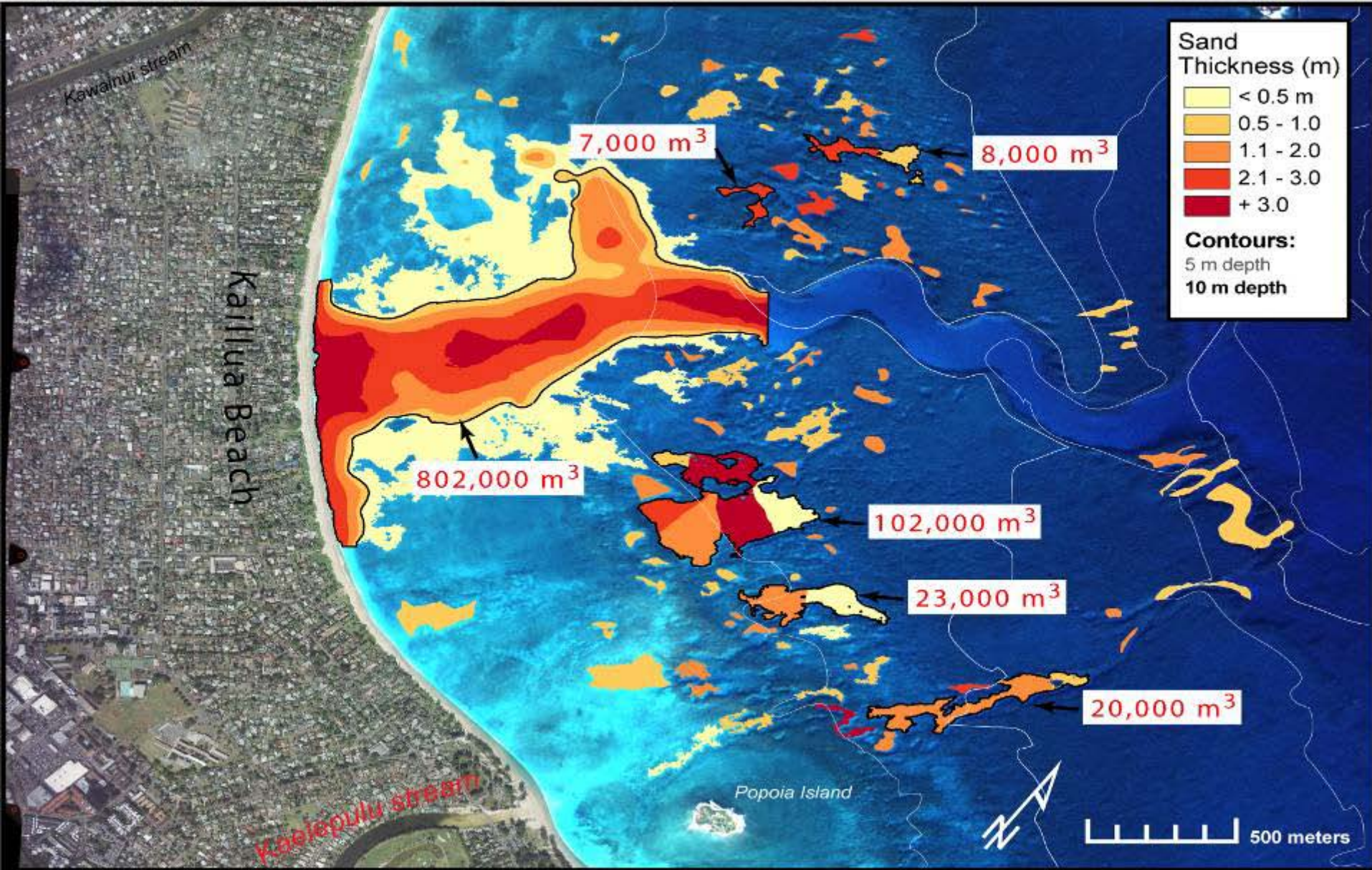
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KAILUA BAY

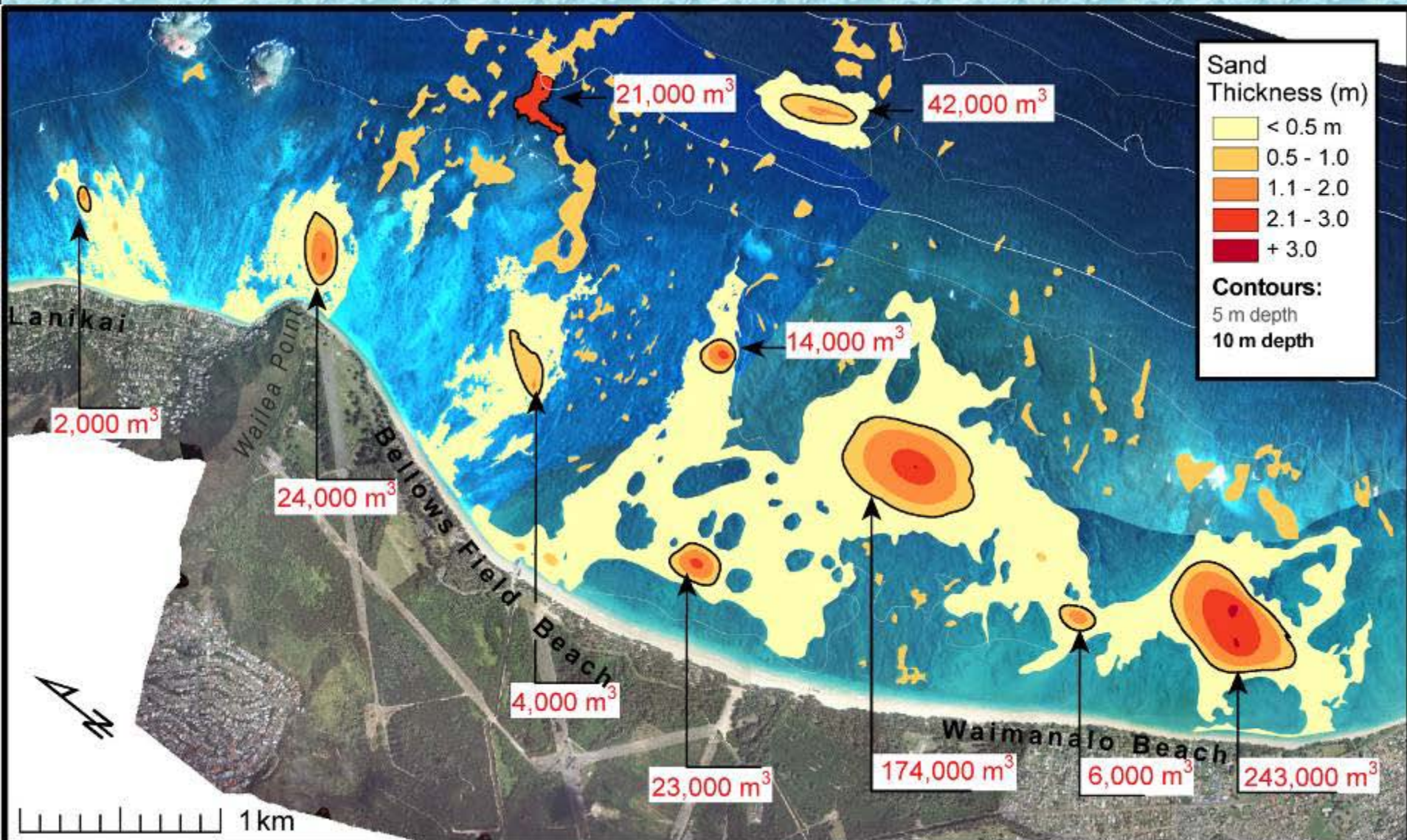




OFFSHORE SAND



NORTH BELLOWS & SOUTH LANIKAI



WAILEA POINT SEDIMENT TREND ANALYSIS

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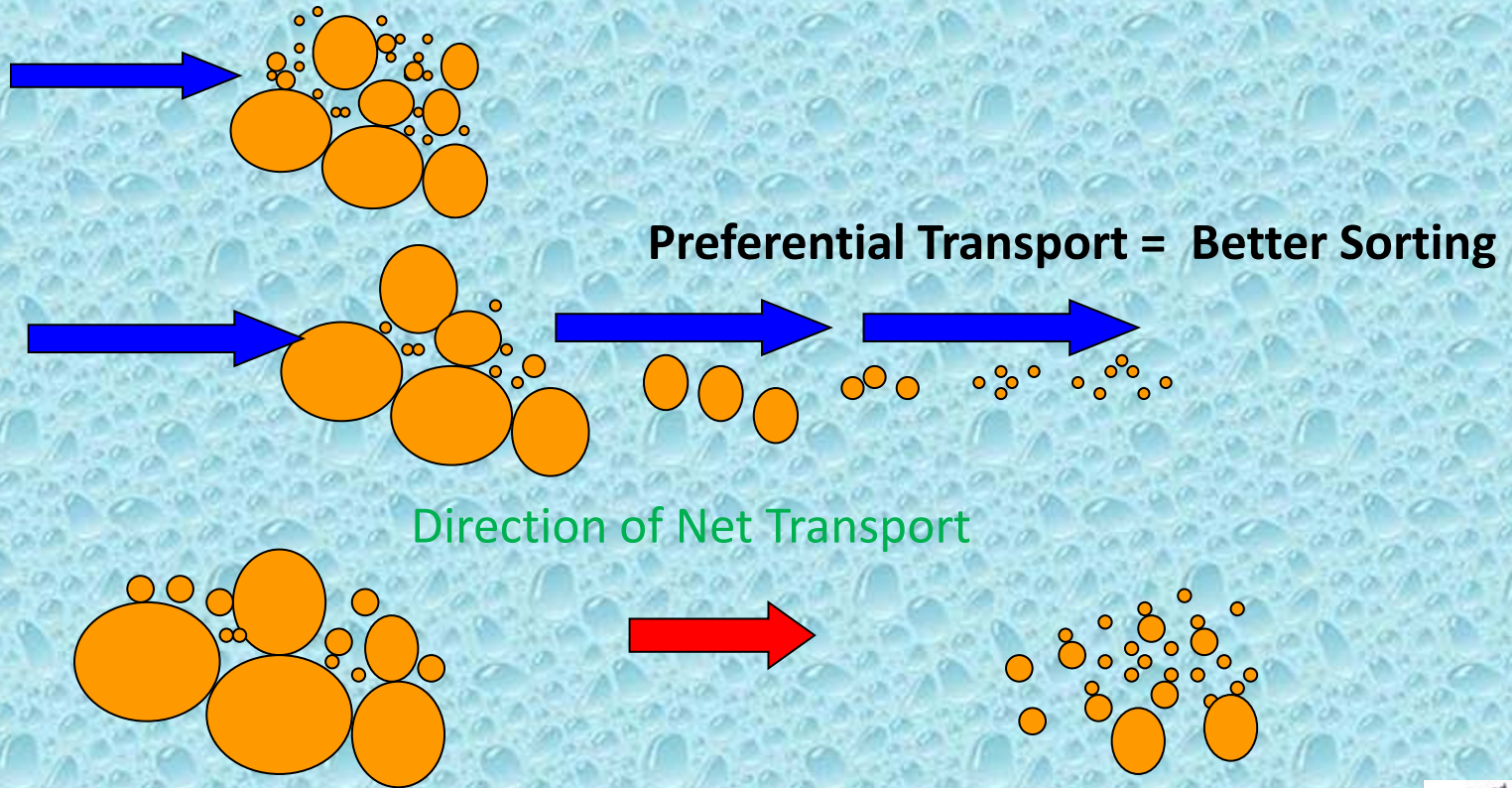




WAILEA POINT S.T.A. ANALYSIS



Sediment becomes better sorted in the direction of transport.



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Lag Deposit

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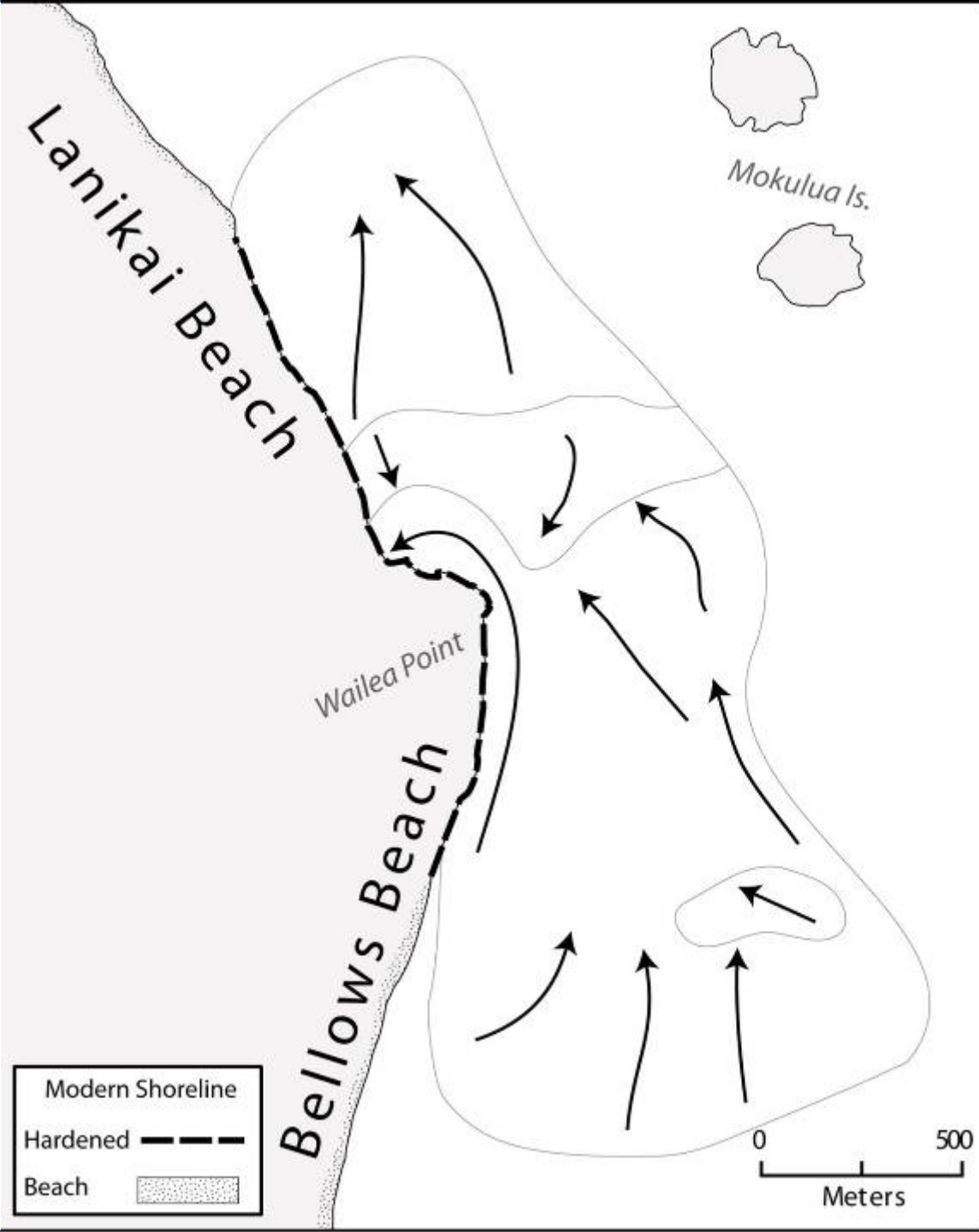
US Army Corps of Engineers, Honolulu District

Lead Deposit



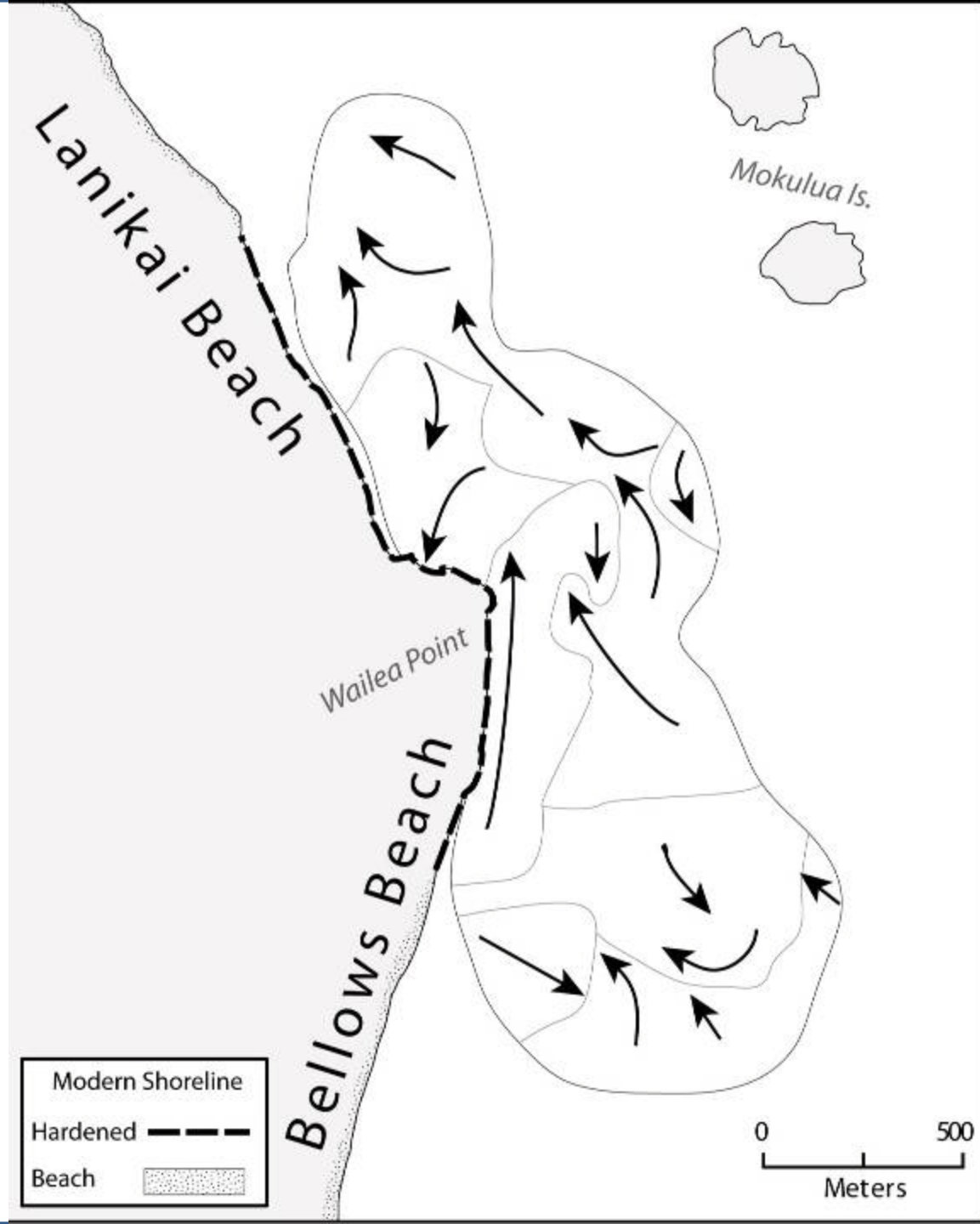
Gao-Collins Method Results

Gao and Collins
(1992)



Roux Method Results

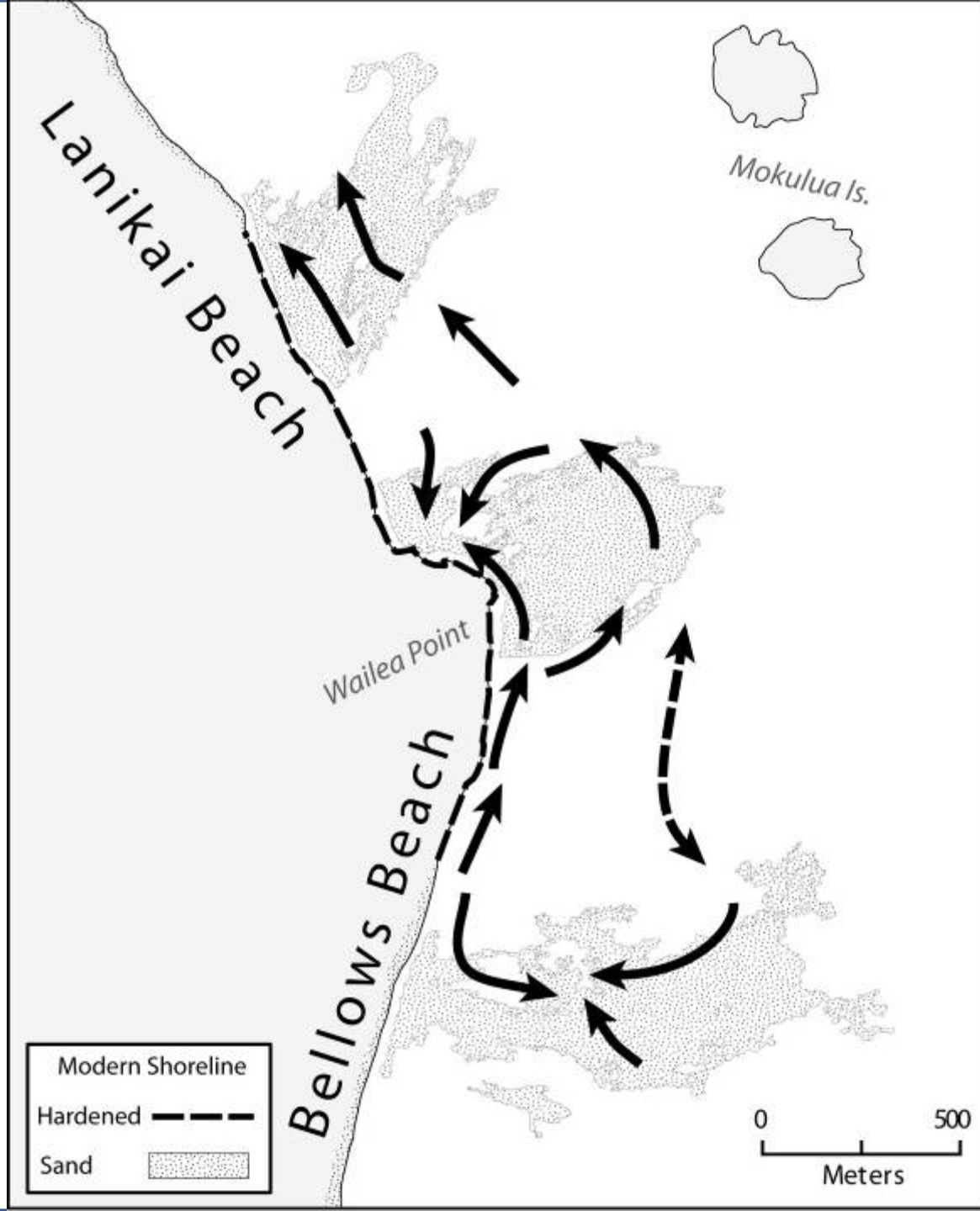
Roux (1994)



Combine Results

Northward transport

Indicates Lanikai has historically received sand from Bellows Beach.





WAILEA POINT S.T.A. ANALYSIS



METHODOLOGY

Historical Analysis

DELPH3D Modeling

Sediment Trend Analysis

RESULTS

1950s: Bellows acts as a source for accretion in South Lanikai

1970s: Revetments stabilize Bellows → South Lanikai erodes

1970-Present: Lanikai net transport to north without replenishment



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REGIONAL SEDIMENT BUDGET



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Waimanalo, Oahu, Hawaii

634400m E 157°42'10" W
 2360700m N 157°40'50" W



Bellows Field Beach Park



AREA DESCRIPTION

Waimanalo Beach is located on the southeast shore of Oahu. The study area (trsects 236 - 378) extends 1.7 miles from Bellows Field Beach Park in the north to Kaiona Beach Park in the south. The coast in this area is exposed to consistent easterly tradewind waves and large seasonal swell during the winter months. The inner shelf and shoreline are protected from large, long period swell by the fringing reef.

Overall, Waimanalo Beach is accreting or stable, with an average rate 0.12 ± 0.18 ft/yr. Previous studies (Hwang, 1981 and Sea Engineering, 1988) accretion in the north of Waimanalo Beach and erosion in much of the south.

For more information see: <http://www.soest.hawaii.edu/asp/coasts/oaahu/index.asp>

Hwang, D., 1981, Beach Changes on Oahu as Revealed by Aerial Photographs, State of Hawaii, Department of Planning and Economic Development, Urban and Regional Planning Program.

Sea Engineering, 1988, Oahu Shoreline Study Part 1 Data on Beach Changes. Prepared for City and County of Honolulu.

Shoreline Change Rate (ft/yr)

SHORELINE CHANGE RATES

- Accretion Rate
- Erosion Rate

Historical shoreline positions are measured every 66 ft along the shoreline. These sites are denoted by yellow shore-perpendicular transects. Changes in the position of the shorelines through time are used to calculate shoreline change rates (ft/yr) at each transect location.

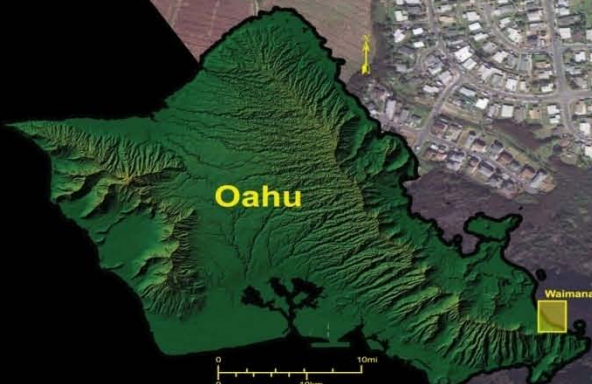
Annual shoreline change rates are shown on the shore-parallel graph. Red bars on the graph indicate a trend of beach erosion, while blue bars indicate a trend of accretion. Approximately every fifth transect and bar of the graph is numbered. Where necessary, transects have been purposely deleted to maintain consistent along-shore spacing. As a result transect numbering is not consecutive everywhere.

The EX method is used to calculate shoreline change rates for the study area. The rates are smoothed along shore using a 1-3-5-3-1 technique to normalize rate differences on adjacent transects. For more information on erosion rate methods and results see: <http://www.soest.hawaii.edu/asp/coasts/oaahu/index.asp>

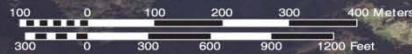
HISTORICAL SHORELINES

- 1911 T-sheet
- 1927
- 1928 T-sheet
- Nov 1949
- Jul 1951
- Nov 1962
- May 1963
- Feb 1967
- Apr 1975
- Feb 1988
- Aug 1996
- Dec 2005
- Erosion rate measurement locations (shore normal transects)

Historical beach positions, color coded by year, are determined using orthorectified and georeferenced aerial photographs and National Ocean Survey (NOS) topographic survey charts. The low water mark is used as the historical shoreline, or shoreline change reference feature (SCRFF). Movement of the SCRFF along shore-normal transects (spaced every 66 ft) is used to calculate erosion rates.

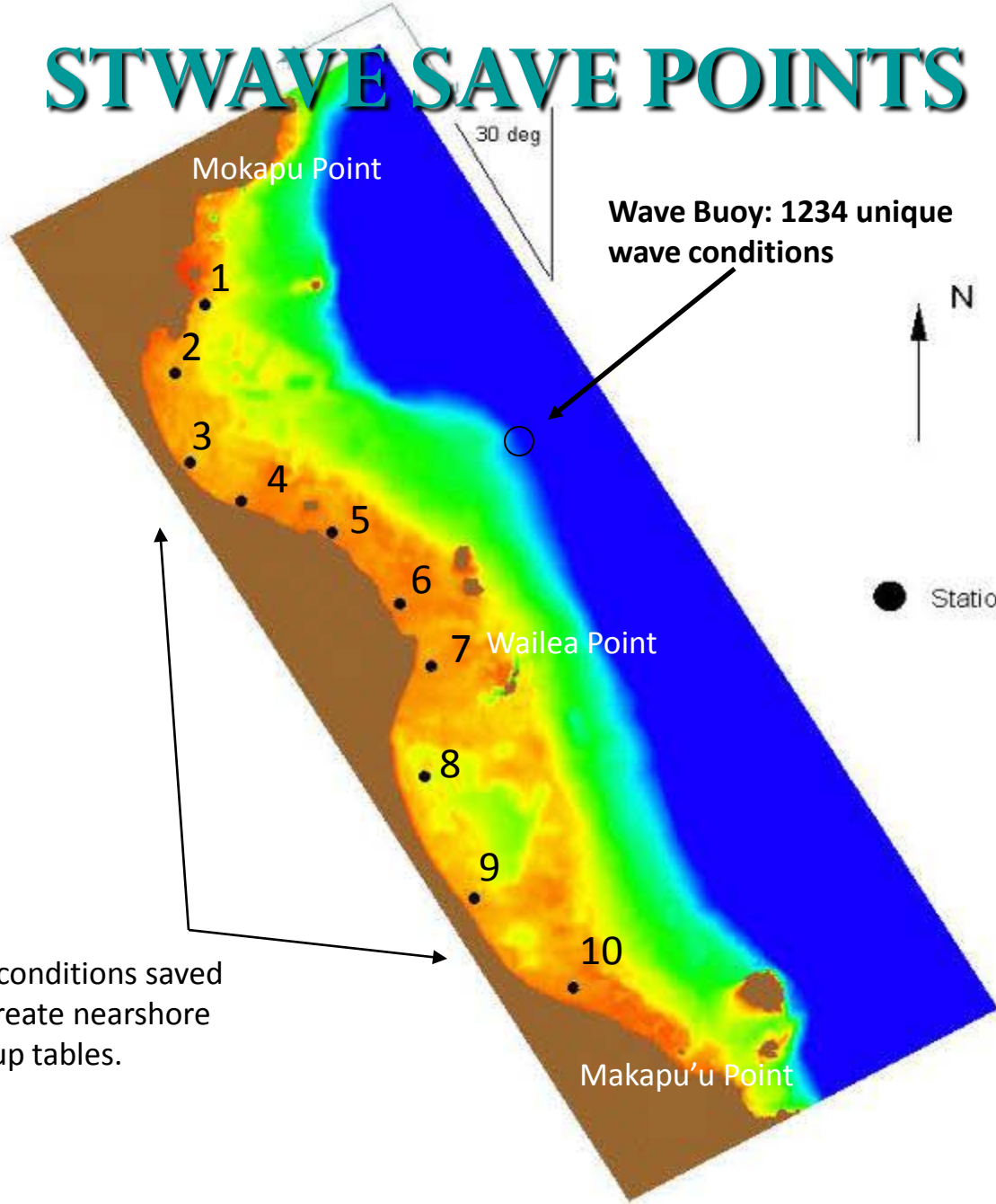
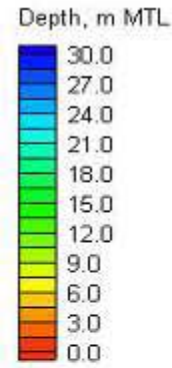


Scale 1:3000



Charles Fletcher, Bradley Romine, Matthew Barboe, Siang-Chyn Lim, Amanda Vinson
 University of Hawaii Coastal Geology Group
 School of Ocean and Earth Science and Technology
 1680 East West Rd., Honolulu, HI 96822, U.S.A.
<http://www.soest.hawaii.edu/asp/coasts/oaahu/>

STWAVE SAVE POINTS



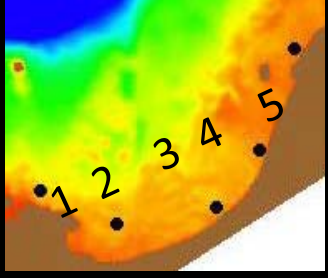
Wave Buoy: 1234 unique wave conditions



● Station Location

1234 nearshore conditions saved at 10 points to create nearshore time series lookup tables.

Kailua Bay, Oahu, Hawaii Smoothed Rates



SMOOTHED RATES

Recent research reports from various sources indicate that the amount of sediment entering the ocean from the Kailua Bay watershed is significantly higher than the amount of sediment that is currently being removed by the Kailua Bay sediment traps. This is due to the fact that the Kailua Bay watershed is a highly urbanized area with a high density of impervious surfaces. This results in a large amount of runoff that carries sediment into the bay. The Kailua Bay sediment traps are currently only able to capture a small portion of this sediment, and the rest is being carried into the ocean. This is a significant problem because sediment is a major pollutant in the ocean and can have a variety of negative impacts on marine life and the environment.

HYDROLOGICAL SURVEILANCE DATA

1988 - 1998

May 1988
 Jun 1988
 Jul 1988
 Aug 1988
 Sep 1988
 Oct 1988
 Nov 1988
 Dec 1988

1999 - 2000

Jan 1999
 Feb 1999
 Mar 1999
 Apr 1999
 May 1999
 Jun 1999
 Jul 1999
 Aug 1999
 Sep 1999
 Oct 1999
 Nov 1999
 Dec 1999

1000000
 2000000
 3000000
 4000000
 5000000
 6000000
 7000000
 8000000
 9000000
 10000000

1000000
 2000000
 3000000
 4000000
 5000000
 6000000
 7000000
 8000000
 9000000
 10000000

00917

13,600 cy/yr

16,600

3,000

1,000

200 cy/yr

2,200



© 2000 USGS
 Hawaiian Islands Water Quality Assessment
 Kailua Bay, Oahu, Hawaii

Lanikai, Oahu, Hawaii

Smoothed Erosion Rates

EROSION RATES

Accretion:

- Blue line: Annual Erosion Hazard Rates (AEHR)

Erosion rates are measured every 20 m along the shoreline. Three sites are labeled: Erosion Hazard Rate (red), Annual Erosion Hazard Rate (red), and Annual Erosion Hazard Rate (red). It is a standard weighted average of calculated erosion rates. Five contributing basins are incorporated in the smoothing process. The basins are weighted by the area of the basin. The AEHRs are shown on the map in the background. Colored lines on the graph correspond to erosion rates basins, approximately every 100 m interval, and are numbered. Where necessary, missing data processing, as a result, is subject to change. Where complete beach loss has occurred, erosion rate calculations apply only to the time point when it first occurred.

HISTORICAL

- 1911: Forest
- 1928: T-Adapt
- Nov 1949
- Jul 1950
- Nov 1963
- May 1967
- Feb 1975
- Dec 1982
- Feb 1986
- Aug 1989
- Aug 1998
- Dec 2005

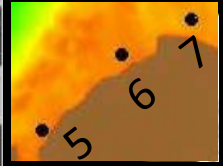
Erosion rate measurement locations (blue normal brackets)

Historical beach profiles, their extent by year, and the location of the National Ocean Survey (NOS) hydrographic array charts. The low water mark is same as the 1988 SCOR. The 1988 SCOR is not used in the calculation of the AEHR, however it provides a gauge of substantial vulnerability.

For situations in which there is coastal accretion or rocky shoreline seaward of any vegetation, the vegetation line is shown along the shoreline. The 1988 SCOR is not used in the calculation of the AEHR, however it provides a gauge of substantial vulnerability.

Annual Erosion Hazard Rates (AEHR)

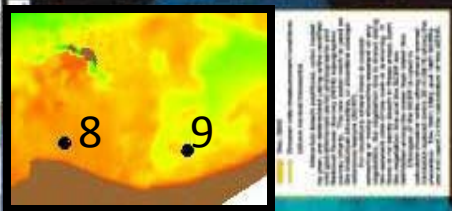
Erosion rates are measured every 20 m along the shoreline. Three sites are labeled: Erosion Hazard Rate (red), Annual Erosion Hazard Rate (red), and Annual Erosion Hazard Rate (red). It is a standard weighted average of calculated erosion rates. Five contributing basins are incorporated in the smoothing process. The basins are weighted by the area of the basin. The AEHRs are shown on the map in the background. Colored lines on the graph correspond to erosion rates basins, approximately every 100 m interval, and are numbered. Where necessary, missing data processing, as a result, is subject to change. Where complete beach loss has occurred, erosion rate calculations apply only to the time point when it first occurred.



620000m E UTM coordinates
 157°44'45" W Lanikai Longitude coordinate
 1922500m N UTM coordinates
 19°42'20" N Lanikai Latitude coordinate

Bellows, Oahu, Hawaii

Smoothed Erosion Rates



RESOURCES

1. Hawaii Department of Land and Natural Resources, Division of Forestry, Forest Management Planning Unit, Forest Management Plan for the Bellows Forest Reserve, 1998.

2. Hawaii Department of Land and Natural Resources, Division of Forestry, Forest Management Planning Unit, Forest Management Plan for the Bellows Forest Reserve, 1998.

3. Hawaii Department of Land and Natural Resources, Division of Forestry, Forest Management Planning Unit, Forest Management Plan for the Bellows Forest Reserve, 1998.

4. Hawaii Department of Land and Natural Resources, Division of Forestry, Forest Management Planning Unit, Forest Management Plan for the Bellows Forest Reserve, 1998.

5. Hawaii Department of Land and Natural Resources, Division of Forestry, Forest Management Planning Unit, Forest Management Plan for the Bellows Forest Reserve, 1998.

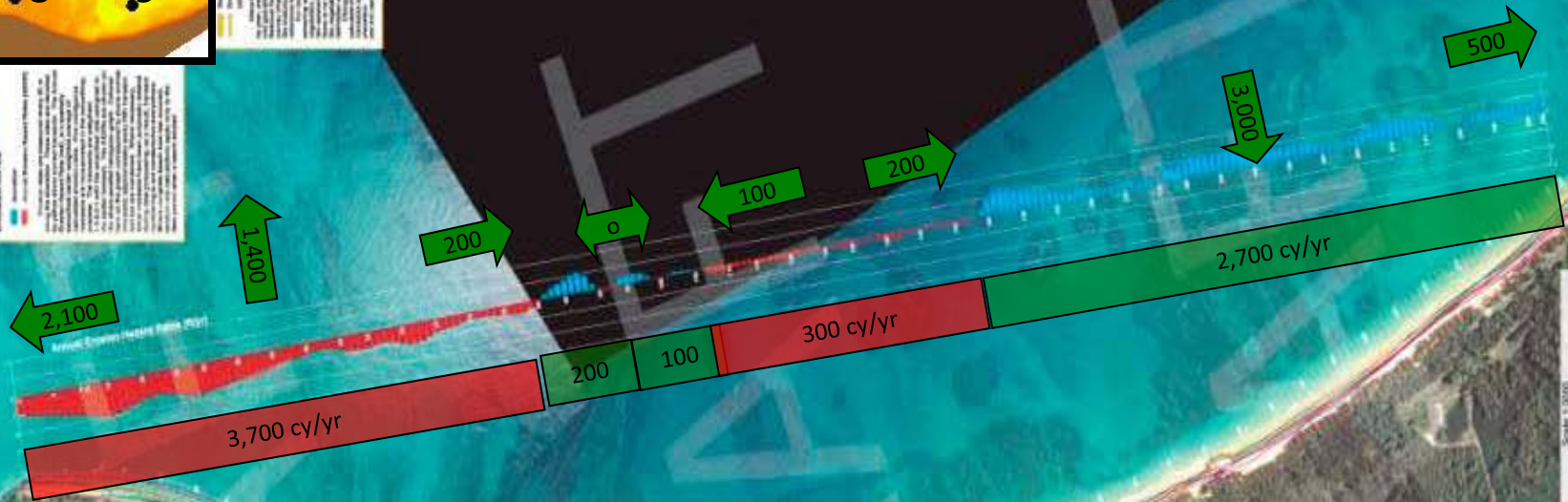
6. Hawaii Department of Land and Natural Resources, Division of Forestry, Forest Management Planning Unit, Forest Management Plan for the Bellows Forest Reserve, 1998.

7. Hawaii Department of Land and Natural Resources, Division of Forestry, Forest Management Planning Unit, Forest Management Plan for the Bellows Forest Reserve, 1998.

8. Hawaii Department of Land and Natural Resources, Division of Forestry, Forest Management Planning Unit, Forest Management Plan for the Bellows Forest Reserve, 1998.

9. Hawaii Department of Land and Natural Resources, Division of Forestry, Forest Management Planning Unit, Forest Management Plan for the Bellows Forest Reserve, 1998.

10. Hawaii Department of Land and Natural Resources, Division of Forestry, Forest Management Planning Unit, Forest Management Plan for the Bellows Forest Reserve, 1998.



Potential RSM Projects

- Ka`elepulu Stream
- Bellows Air Force Station
- Kaupo & Kaiona Beaches
- Lanikai Beach



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KA`ELEPULU STREAM



Dune Erosion Downdrift



Stream Plugged with Sand

BELLOWS AIR FORCE STATION



Wide Beach to the South



Narrow Hardened Beach to North

KAUPO & KAIONA BEACHES



Problem
Area

Kaiona Beach



Problem
Area

Kaupo Beach

LANIKAI BEACH

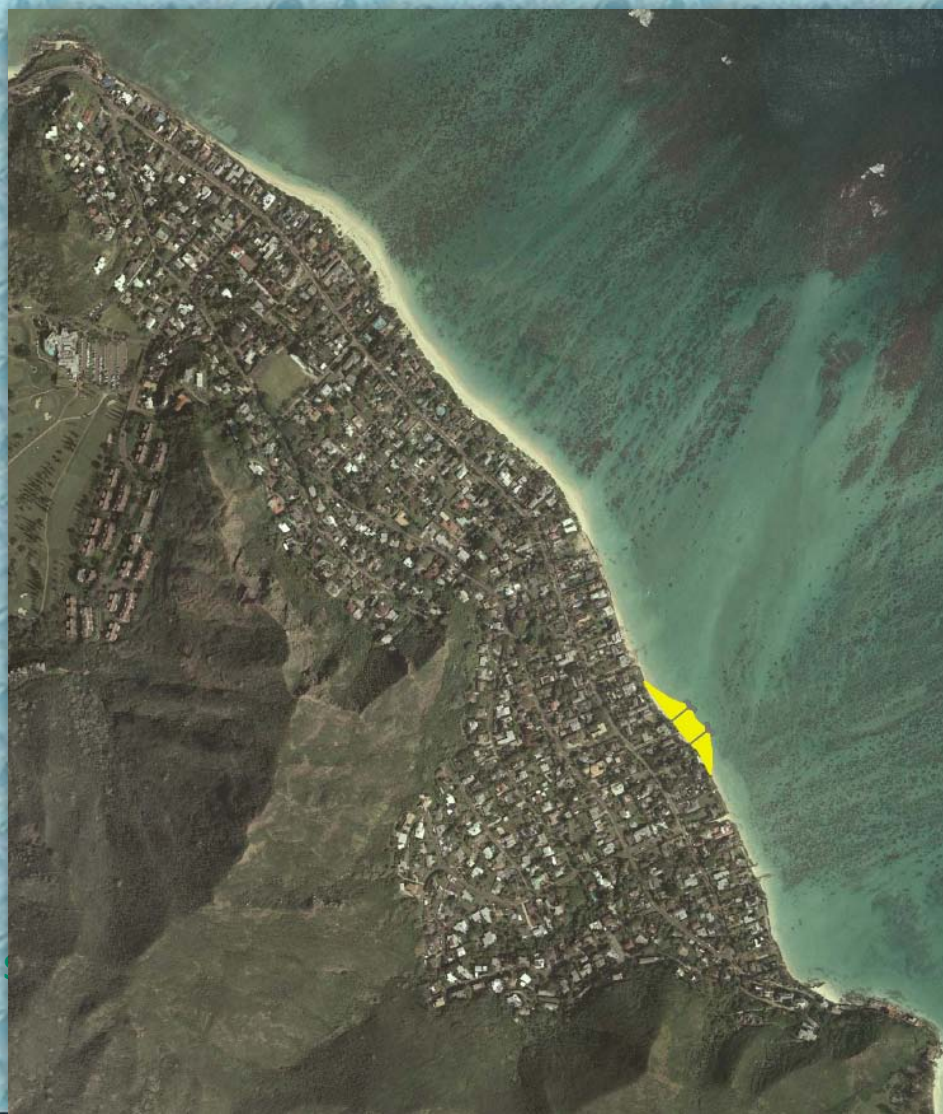


Lanikai Beach Looking North



Lanikai Beach Looking South

LANIKAI BEACH RESTORATION PILOT PROJECT



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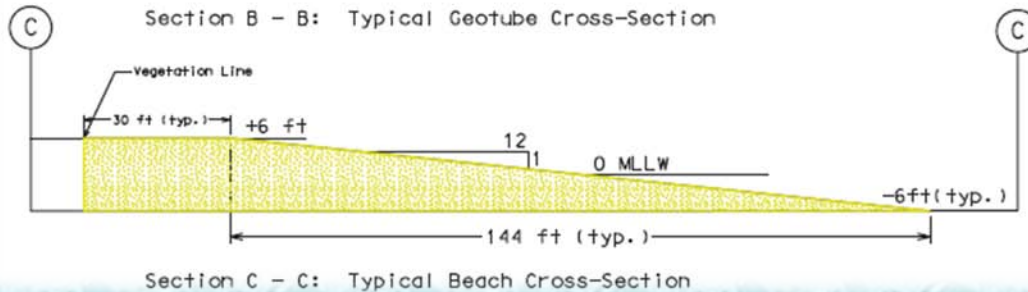
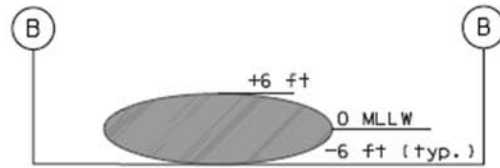
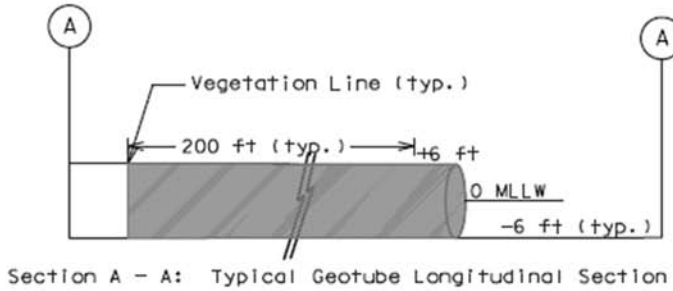
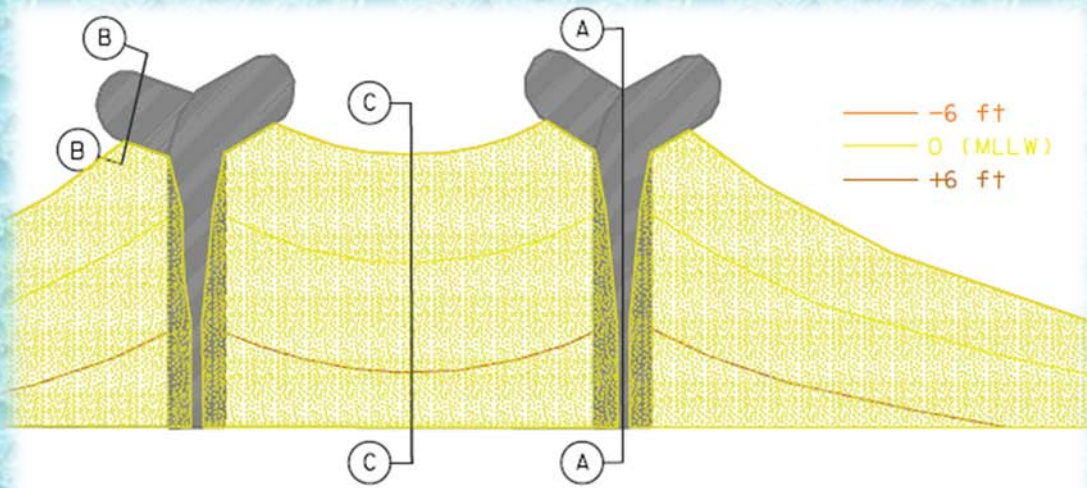
LANIKAI BEACH RESTORATION PILOT PROJECT



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LANIKAI BEACH RESTORATION PILOT PROJECT



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**SOUTHEAST OAHU
REGIONAL SEDIMENT MANAGEMENT
DEMONSTRATION PROJECT**

REGIONAL SEDIMENT MANAGEMENT PLAN

Prepared for:
U.S. Army Corps of Engineers
Honolulu District
and
State of Hawaii
Department of Land and Natural Resources
Office of Conservation and Coastal Lands

Prepared by:
Oceanit Laboratories, Inc.

December 30, 2006



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HAWAII REGIONAL SEDIMENT MANAGEMENT

RELEVANT
READY
RESPONSIVE
RELIABLE

*Proudly serving the Armed Forces and
the Nation now and in the future.*

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National RSM

Hawai'i RSM

News

Online Mapping

Links

Contact Us

Welcome to the Hawai'i Regional Sediment Management (RSM) web site. Herein, you will find an abundant amount of information related to the Honolulu District's efforts to manage one of Hawai'i's most valuable assets - sand. Studying the islands from mauka (*towards the mountains*) to makai (*towards the ocean*), the Honolulu District, State of Hawai'i Department of Land and Natural Resources, and various other partners will gain a better understanding of sediment transport and its management on a regional scale.

The Honolulu District has several exciting ongoing RSM projects. Please use the links to the left to navigate to your desired location. You can also explore the [News](#) portion of the web page to get the latest information on Hawai'i RSM activities, such as upcoming activities, new photos and maps, and online tools.

Modern and Historic Sand Bodies off Waikiki



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MAUI REGIONAL SEDIMENT MANAGEMENT FY10 FINDINGS

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MAUI REGIONAL SEDIMENT MANAGEMENT WAVE CLIMATE



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MAUI REGIONAL SEDIMENT MANAGEMENT SHORELINE CHANGE



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MAUI REGIONAL SEDIMENT MANAGEMENT OFFSHORE SAND SOURCES



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REGIONAL SEDIMENT BUDGET

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MAUI REGIONAL SEDIMENT MANAGEMENT

MAUI RSM PLAN

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MAUI REGIONAL SEDIMENT MANAGEMENT

POTENTIAL RSM PROJECTS

KIHEI

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MAUI
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POTENTIAL RSM PROJECTS
KAHULUI



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