Maui Preliminary Sediment Budget

Rob Sloop, PE Moffatt & Nichol



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Maui Preliminary Sediment Budget

- Littoral Cells in Study Regions
- Methodology
- Sediment Budget by Littoral Cell
- Summary
- Recommendations for Further Study



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Study Regions





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Kahului Region



Littoral Cells in Kahului Region



Kihei Region

Maalaea Bay Beach

Aine: Region

Maalaea Harbo

Papawai Point

0.5

Miles

Kealia Pond

Kihei Pier

Koieie / Fishpond

Kalama Beach Park

Littoral Cells in Kihei Region



Methodology

Historical Beach Volumes For Each Littoral Cell

- Beach volume defined as beach between stable backbeach line and mobile shoreward toe line
- Calculated beach widths for each available historic shoreline (from UH erosion maps)
- Calculated beach area for each available historic shoreline (multiplied average beach width X cell shoreline length)
- Calculated beach volume by multiplying beach area (SF) X 0.40
 CY sand per SF of beach (UH/USGS beach profiles)
- Produced graphs of relative beach volume over time.



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Methodology (cont.) Example – Beach Volume Graph





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Methodology (cont.)

Beach Volume Change Rate

- Selected time periods of interest based on line graphs and historical events within each littoral cell
- Calculated change rates for each time period and over complete period of record
 - Rate calculated using regression analysis / least squares fit, factors in seasonal variations and other uncertainties.
 - Rate corrected for any historic beach nourishment

Sand Pathways

- Some sand sources and sinks identified
- Sediment transport directions not defined/quantified



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Example – Beach Volume Change Rate History



Year



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Sediment Budget by Littoral Cell – Kahului Region







Kanaha Beach Cell – Shoreline Features



Kanaha Cell – Beach Volume History









Kanaha Cell – Beach Volume Change Rate

Kanaha Beach

Kanaha Beach Park

Kite Beach

Coral Beach

Spreckelsville Beach

Kahului Airport

Hobron Pt.

Wailuku Kahului WRF

0 500 1,000

Pier

Anther Sincers IN THE PARTY OF

Kahana Pond Wildlife Santuary

US Army Corps of Engineers, Honolulu District

-10,550 cylyr

Kaa



Kahului Airpor

Sprecklesville Cell – Shoreline Features Beldwin Park

Spartan Reef

Baldwin Par

Wawau Pt. Baldwin Beach

> Shore Protection Breakwater Groin Pier Revetment Seawall

Ditch / Channel Littoral Cells Streams 1,000 Feet

Sugar Cove

Coral Beach

Spreckelsville

ckelsville Beach Spreckelsville-

lui Airport

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13 Beach

Kahului Airport

State of Hawaii

Sprecklesville Cell – Beach Volume History



Sprecklesville- Beach Volume Change Rate



Baldwin Park Cell – Shoreline Features

Baldwin Park

Wawau Pt.

Sugar Cove

SENGINEERS IN

Fly Water PointMantokuji Ba

2 212

Pa'ia Bay Shore Protection Breakwater Groin Pier Revetment Seawall Ditch / Channel Littoral Cells Streams 0 500 1.000 Feet

US Army Corps of Engineers, Honolulu District

Baldwin Park – Beach Volume History



Baldwin Park – Beach Volume Change Rate

Fly Water Point^{Mantokuji} Bay

400 CNI Pa'ia Bay defunct lime kiln Baldwin Park

Wawau Pt. Baldwin Beach

Baldwin Park

Sugar Cove

kelsville



Kua

Bay

Paia East Cell – Beach Volume Change Rate





Hookipa Cell – Beach Volume Change Rate





Paukukalo – Beach Volume Change Rate





Kahului Harbor – Beach Volume Change Rate

Paukukalo Beach

Puuone

Kahului LDH

Kahului Harbor

Hobron Pt.

Kanaha Be

Kahului Harbor

Pier 3 Pier 2

Kahului Beach

-800 cy/yr

Hoaloha Park

0 250 500

Summary – Kahului Region

- Kanaha Beach-WWRF area and Baldwin Park beaches have historically high historic erosion rates
 - However, since ~1976, Baldwin Park erosion rate relatively low.

Kanaha Beach erosion rate has gotten worse
Sprecklesville and Paia East relatively constant erosion rate over period of record.
Paukukalo cell beach volume stable since ~1960.



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Sediment Budget by Littoral Cell – Kihei Region







North Kihei Cell – Shoreline Features





North Kihei Cell – BeachVolume History



and and

North Kihei – Beach Volume Change Rate 41₁

+9,400 cy/yr

Kihe

North

Ko'ie'ie Fish

Ma'alaea Bay Beach Kihei Pier

Mai Poina Oe lau Beacl

Ka Ipu Kai Hina

Kalepolepo Beach

Kihei

Kawililipoa Beach







Kawililipoa – Beach Volume History



Year



Kawililipoa- Beach Volume Change Rate







Kalama Cell – Shoreline Features

Kalama

Halama St. / St. Therese Groin

Kalama Beach Co. Park



Kaluahakoko Boat Ramp Kalua'ehakoko Pt.

aimanainai

Kamaole Beach Park No.1

2 anne

Kalama Cell – Beach Volume History



Kalama – Beach Volume Change Rate







West Maalaea Cell – Beach Volume Change Rate




Maalaea Harbor – Beach Volume Change Rate





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Maalaea Bay Beach – Volume Change Rate





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Kealia Cell- Beach Volume Change Rate

Palalau Outlet

Kealia

Kealia Pond

Ma'alaea Bay Beach

-2,800 cv/yr

Ma'alaea Bay Beach

S. C.L.

Kihei Pier







Summary – Kihei Region

- North Kihei and Kawililipoa cells currently accretional
 - Although based on limited data points
- Kealia and Kalama have highest erosion rates within Kihei region
- Maalaea Bay Beach cell erosion rate has slowed since ~1950.



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Recommendations for Further Study

- Complete wave transformation and circulation modeling to define sediment transport directions.
- Develop data on sediment yields (inputs) from streams and rivers.
- Quantify losses associated with winds and dune breaching.
- Analyze grain size compatibility of beaches versus potential sand sources
- Perform jet probing of ocean sand sources



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Additional Slides – Kahului Region



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Paukukalo Cell - Shoreline Features







Paukukalo Cell – Beach Volume History



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Paukukalo Cell – Beach Volume Change Rate History



Year



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Paukukalo – Beach Volume Change Rate





Kahului Harbor Cell – Shoreline Features



Kahului Harbor Cell – Beach Volume History





Kahului Harbor Cell – Beach Volume Change Rate History



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Kahului Harbor – Beach Volume Change Rate

Paukukalo Beach

Puuone

Kahului LDH

Kahului Harbor

Hobron Pt.

Kanaha Be

Kahului Harbor

Pier 3 Pier 2

Kahului Beach

-800 cy/yr

Hoaloha Park

0 250 500

Kanaha Beach Cell – Shoreline Features



Kanaha Cell – Beach Volume History



Year



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Kanaha Cell -**Beach Volume Change Rate History**



Year



Kanaha Cell – Beach Volume Change Rate

Kanaha Beach

Kanaha Beach Park

Kite Beach

Coral Beach

Spreckelsville Beach

Kahului Airport

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Sugar Cove

Coral Beach

Spreckelsville

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lui Airport

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13 Beach

Kahului Airport

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Sprecklesville – Beach Volume History



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Sprecklesville Cell – Beach Volume Change Rate History



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Sprecklesville- Beach Volume Change Rate



Baldwin Park Cell – Shoreline Features

Baldwin Park

Wawau Pt.

Sugar Cove

SENGINEERS IN

Fly Water PointMantokuji Ba

2 212

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Baldwin Park – Beach Volume History



Year

Baldwin Park Cell – Beach Volume Change Rate History



Year



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Baldwin Park – Beach Volume Change Rate

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Baldwin Park

Sugar Cove

kelsville



Kua

Bay

Paia East Cell – Shoreline Features



Paia East – Beach Volume History



Year

Paia East Cell – Beach Volume Change Rate History





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Paia East Cell – Beach Volume Change Rate





Hookipa Cell – Shoreline Features



Hookipa – Beach Volume History



Hookipa Cell – Beach Volume Change Rate History



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Hookipa – Beach Volume Change Rate





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Additional Slides - Kihei Region






West Maalaea Cell – Shoreline Features





West Maalaea – Beach Volume History



West Maalaea Cell – Beach Volume Change Rate History



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West Maalaea – Beach Volume Change Rate





Maalaea Harbor Cell – Shoreline Features



Maalaea Harbor – Beach Volume Change Rate





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Maalaea Bay Beach Cell – Shoreline Features



Maalaea Bay Beach – Beach Volume History



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Maalaea Bay Beach Cell – Beach Volume Change Rate History



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Maalaea Bay Beach – Volume Change Rate





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Kealia Cell – Shoreline Features



Kealia Cell – Beach Volume History



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Kealia Cell – Beach Volume Change Rate History



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Kealia Cell- Beach Volume Change Rate



North Kihei Cell – Shoreline Features





North Kihei – Beach Volume History



North Kihei – Volume Change Rates



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North Kihei – Beach Volume Change Rate 41₁

+9,400 cy/yr

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Kihei

Kawililipoa Beach







Kawililipoa Cell – Shoreline Features



Kawililipoa – Beach Volume History



Year



Kawililipoa Cell – Beach Volume Change Rate History





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Kawililipoa- Beach Volume Change Rate







Kalama Cell – Shoreline Features

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Kamaole Beach Park No.1

2 June

Kalama Cell – Beach Volume History





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Kalama Cell – Beach Volume Change Rate History





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Kalama – Beach Volume Change Rate





