

Kihei and North Shore Shoreline Change Studies

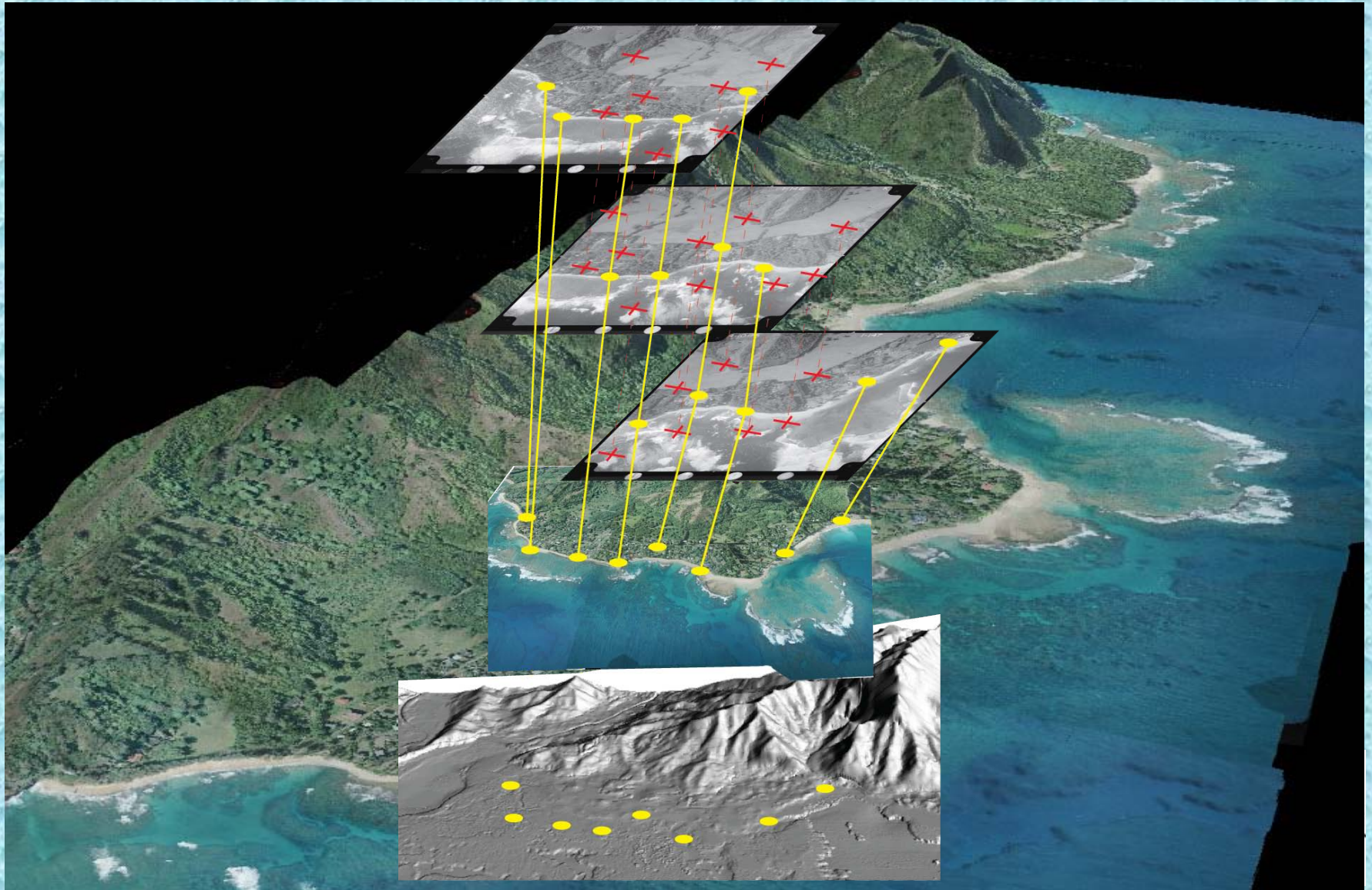
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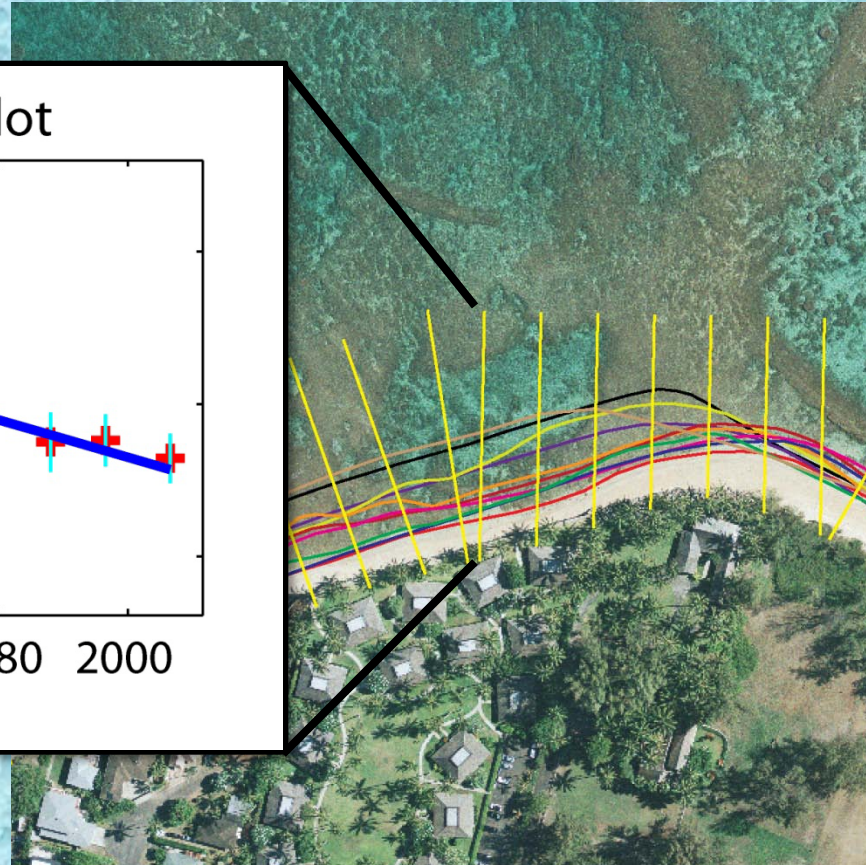
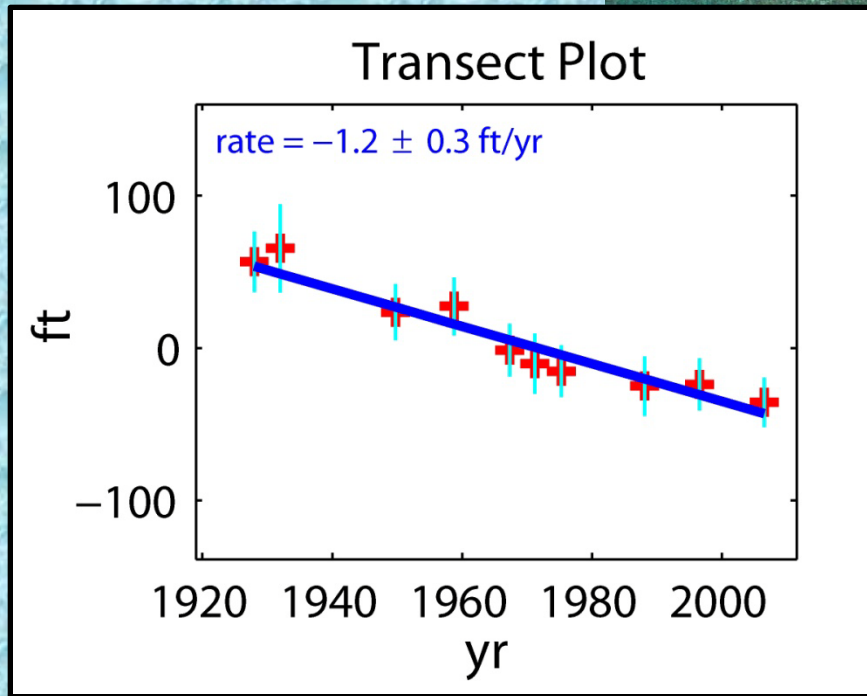
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Historical Aerial Photogrammetry



Mapping Historical Shorelines



portion of an aerial photo mosaic

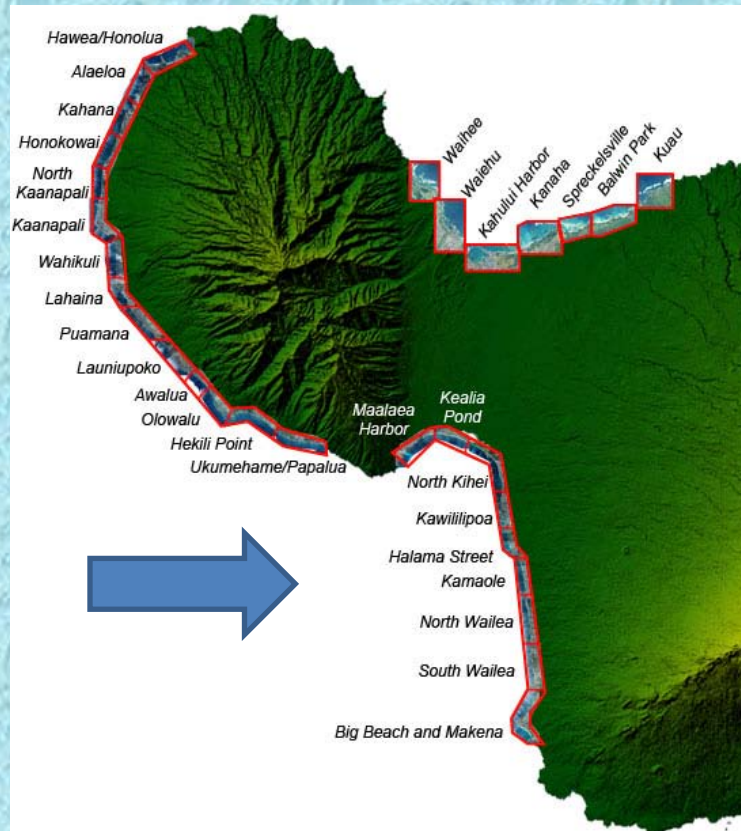
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Shoreline change on the Kihei Coast – Updated Mapping



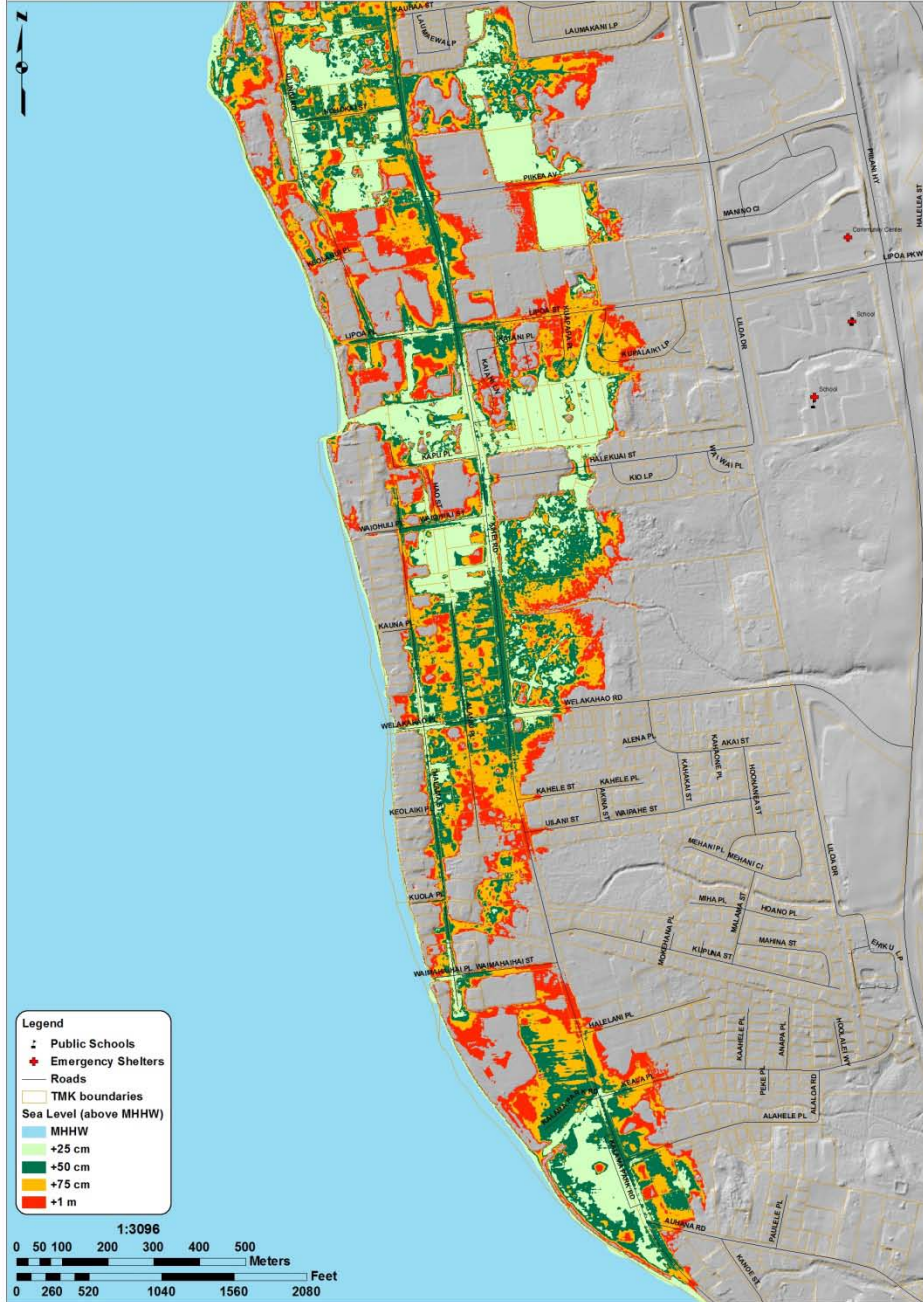
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Sea Level Risk and Vulnerability

Halama Street, Maui, Hawaii



State of Hawaii
US Army

Summary Stats - Kihei

- # transects: 1011 (~20 km)
beach loss: 2.1 km (11%)
- Long-term avg. rate: -0.13 ± 0.01 m/yr
83% erosional, 16% stable
- Short-term (1940's-) avg. rate: -0.12 ± 0.02 m/yr
77% erosional, 20% stable

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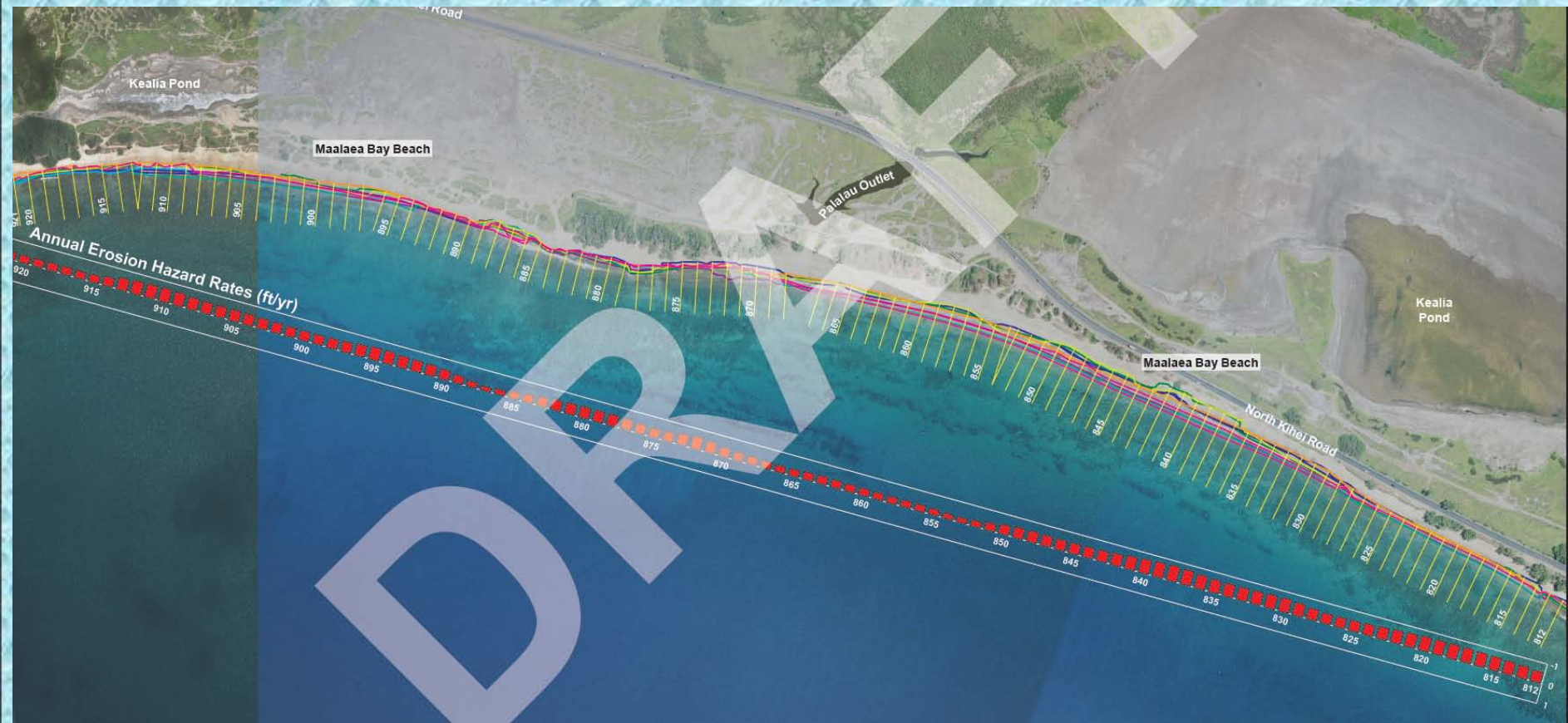
Maalaea Harbor



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Kealia Pond



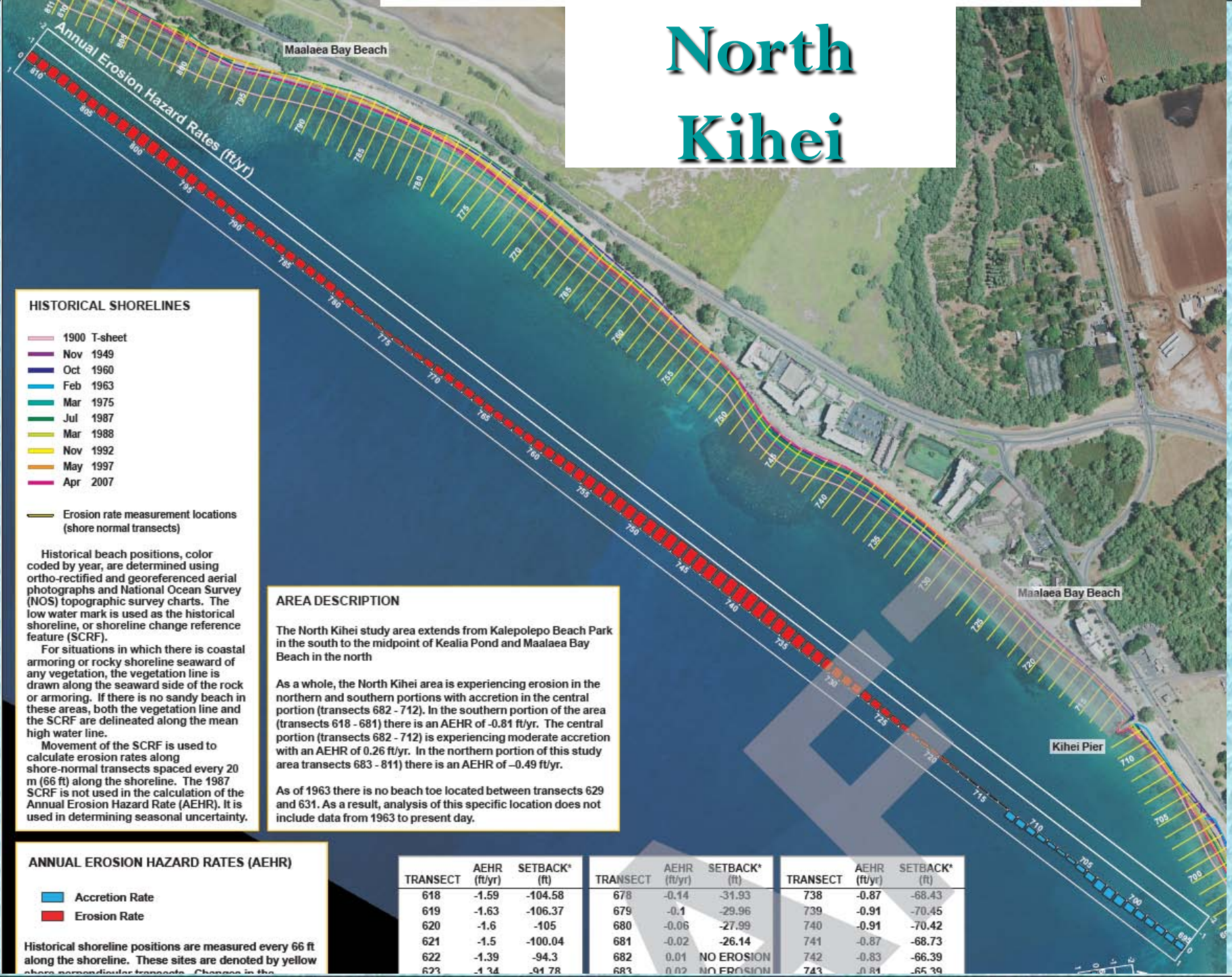
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North Kihei



HISTORICAL SHORELINES

- 1900 T-sheet
- Nov 1949
- Oct 1960
- Feb 1963
- Mar 1975
- Jul 1987
- Mar 1988
- Nov 1992
- May 1997
- Apr 2007
- Erosion rate measurement locations (shore normal transects)

Historical beach positions, color coded by year, are determined using ortho-rectified 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 (SCRf).

For situations in which there is coastal armoring or rocky shoreline seaward of any vegetation, the vegetation line is drawn along the seaward side of the rock or armoring. If there is no sandy beach in these areas, both the vegetation line and the SCRf are delineated along the mean high water line.

Movement of the SCRf is used to calculate erosion rates along shore-normal transects spaced every 20 m (66 ft) along the shoreline. The 1987 SCRf is not used in the calculation of the Annual Erosion Hazard Rate (AEHR). It is used in determining seasonal uncertainty.

AREA DESCRIPTION

The North Kihei study area extends from Kalepolepo Beach Park in the south to the midpoint of Kealia Pond and Maialaea Bay Beach in the north

As a whole, the North Kihei area is experiencing erosion in the northern and southern portions with accretion in the central portion (transects 682 - 712). In the southern portion of the area (transects 618 - 681) there is an AEHR of -0.81 ft/yr. The central portion (transects 682 - 712) is experiencing moderate accretion with an AEHR of 0.26 ft/yr. In the northern portion of this study area transects 683 - 811) there is an AEHR of -0.49 ft/yr.

As of 1963 there is no beach toe located between transects 629 and 631. As a result, analysis of this specific location does not include data from 1963 to present day.

ANNUAL EROSION HAZARD RATES (AEHR)

- Accretion Rate
- Erosion Rate

Historical shoreline positions are measured every 66 ft along the shoreline. These sites are denoted by yellow shore normal transects. Changes in the

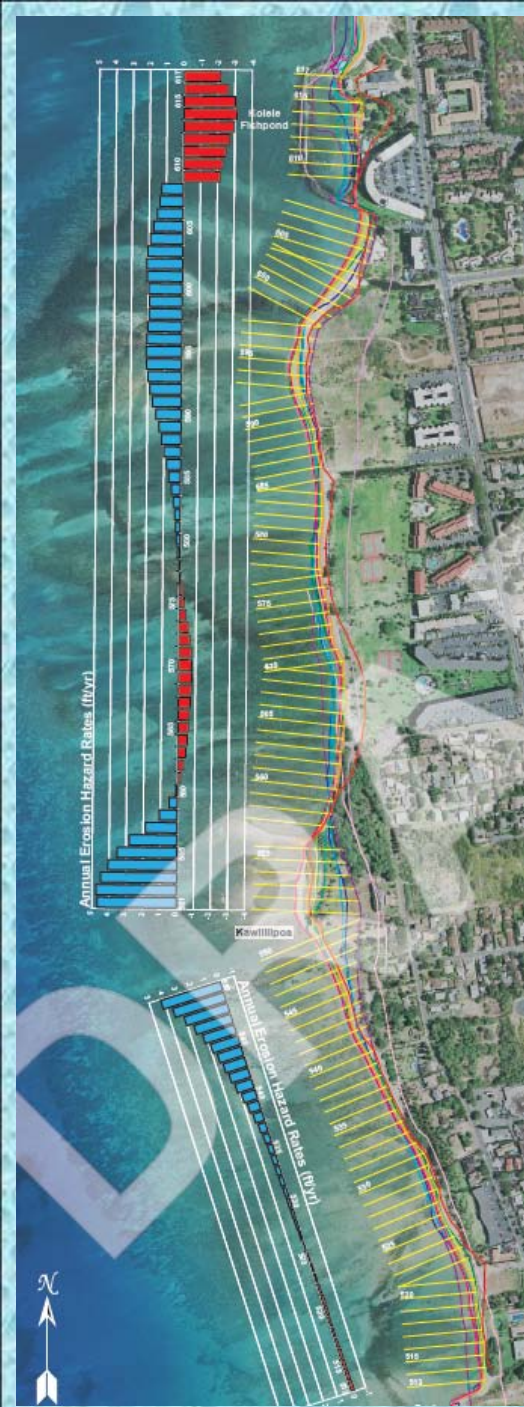
TRANSECT	AEHR (ft/yr)	SETBACK* (ft)	TRANSECT	AEHR (ft/yr)	SETBACK* (ft)	TRANSECT	AEHR (ft/yr)	SETBACK* (ft)
618	-1.59	-104.58	678	-0.14	-31.93	738	-0.87	-68.43
619	-1.63	-106.37	679	-0.1	-29.96	739	-0.91	-70.45
620	-1.6	-105	680	-0.06	-27.99	740	-0.91	-70.42
621	-1.5	-100.04	681	-0.02	-26.14	741	-0.87	-68.73
622	-1.39	-94.3	682	0.01	NO EROSION	742	-0.83	-66.39
623	-1.34	-91.78	683	0.02	NO EROSION	743	-0.81	-65.39

Kawiliilipoa

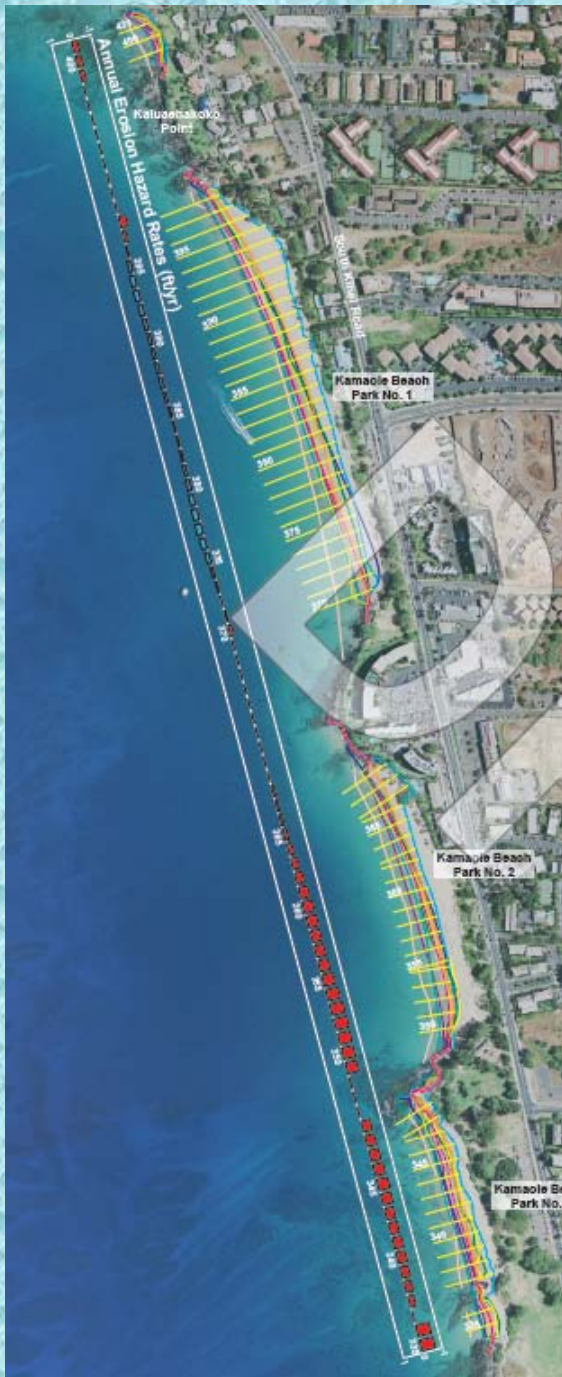
Halama Street

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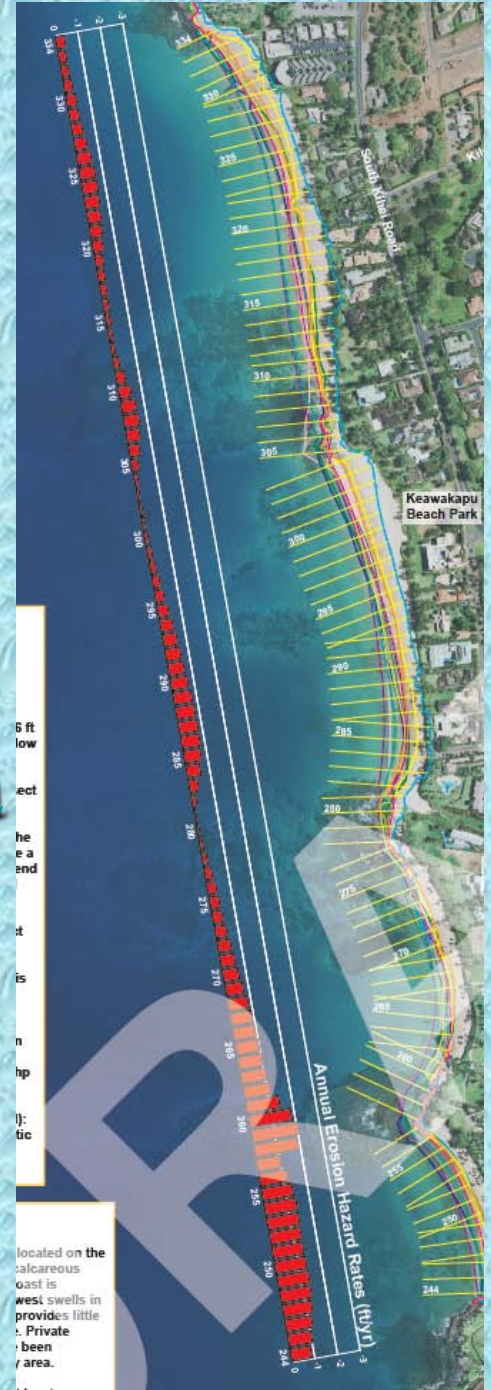
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Kamaole



North Wailea



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located on the
calcareous
east is
west swells in
provides little
Private
been
/ area.

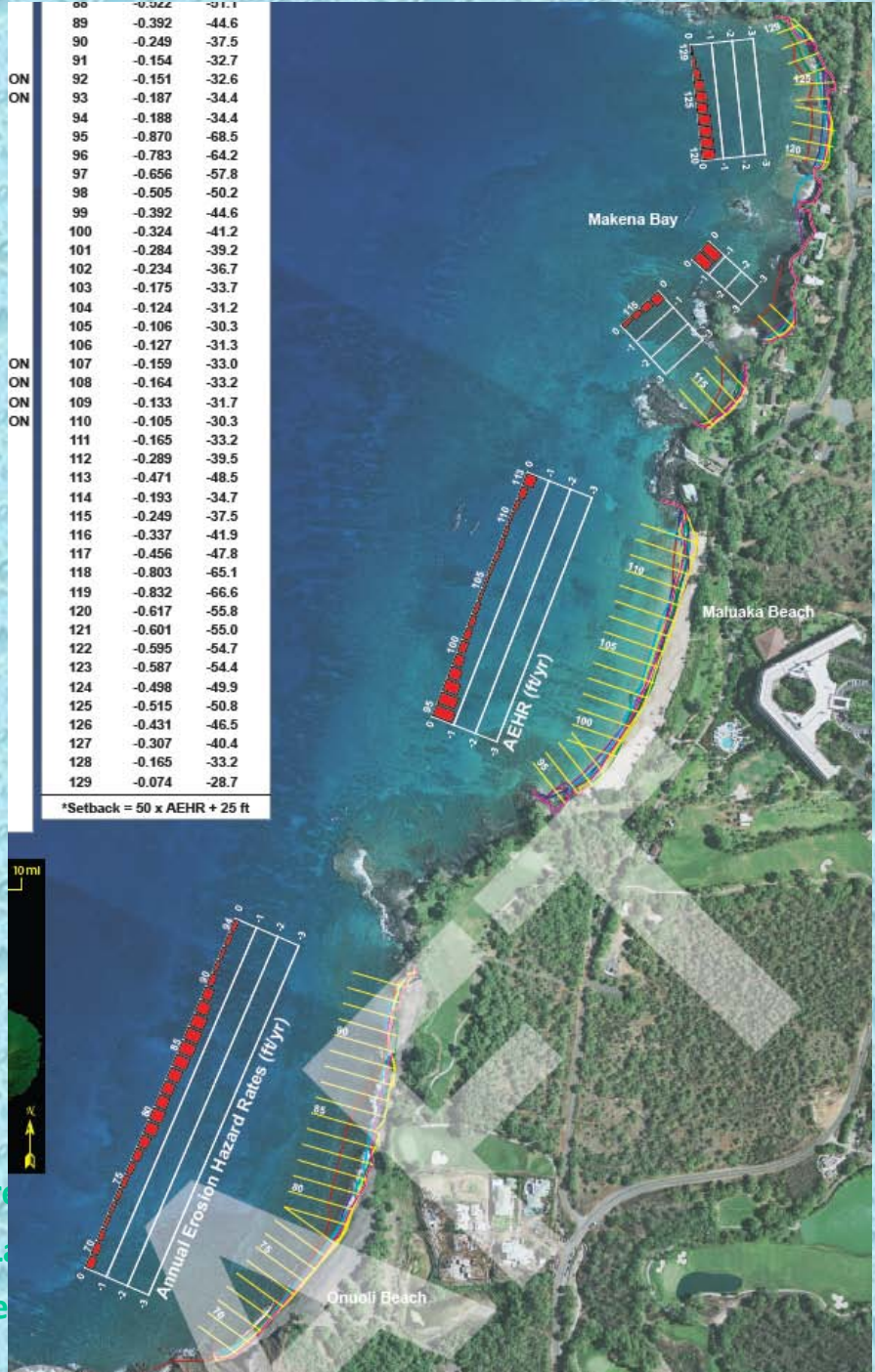
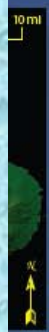
South Wailea

Big Beach



88	-0.322	-44.6
89	-0.249	-37.5
90	-0.154	-32.7
91	-0.151	-32.6
92	-0.187	-34.4
93	-0.188	-34.4
94	-0.870	-68.5
95	-0.783	-64.2
96	-0.656	-57.8
97	-0.505	-50.2
98	-0.392	-44.6
99	-0.324	-41.2
100	-0.284	-39.2
101	-0.234	-36.7
102	-0.175	-33.7
103	-0.124	-31.2
104	-0.106	-30.3
105	-0.127	-31.3
106	-0.159	-33.0
107	-0.164	-33.2
108	-0.133	-31.7
109	-0.105	-30.3
110	-0.165	-33.2
111	-0.289	-39.5
112	-0.471	-48.5
113	-0.193	-34.7
114	-0.249	-37.5
115	-0.337	-41.9
116	-0.456	-47.8
117	-0.803	-65.1
118	-0.832	-66.6
119	-0.617	-55.8
120	-0.601	-55.0
121	-0.595	-54.7
122	-0.587	-54.4
123	-0.498	-49.9
124	-0.515	-50.8
125	-0.431	-46.5
126	-0.307	-40.4
127	-0.165	-33.2
128	-0.074	-28.7

*Setback = 50 x AEHR + 25 ft



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Summary Stats – North Shore

- # transects: 903 (~18 km)
beach loss: 0.9 km (6%)
- Long-term avg. rate: -0.26 ± 0.02 m/yr
87% erosional, 12% stable
- Short-term (1940's-) avg. rate: -0.22 ± 0.03 m/yr
74% erosional, 16% stable

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North Shore



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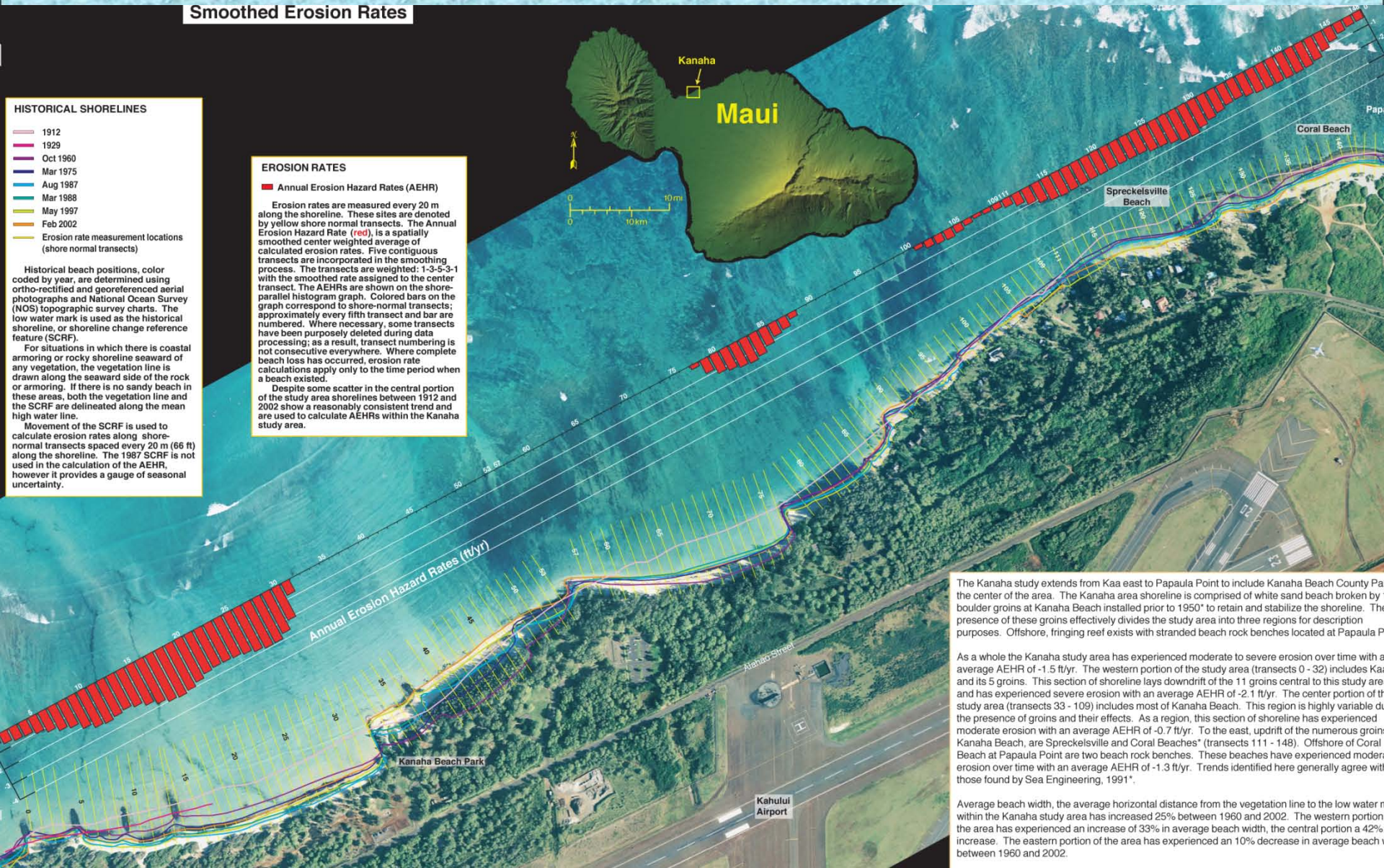
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Kanaha Region

Smoothed Erosion Rates



HISTORICAL SHORELINES

- 1912
- 1929
- Oct 1960
- Mar 1975
- Aug 1987
- Mar 1988
- May 1997
- Feb 2002
- Erosion rate measurement locations (shore normal transects)

Historical beach positions, color coded by year, are determined using ortho-rectified 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 (SCRF).

For situations in which there is coastal armoring or rocky shoreline seaward of any vegetation, the vegetation line is drawn along the seaward side of the rock or armoring. If there is no sandy beach in these areas, both the vegetation line and the SCRF are delineated along the mean high water line.

Movement of the SCRF is used to calculate erosion rates along shore-normal transects spaced every 20 m (66 ft) along the shoreline. The 1987 SCRF is not used in the calculation of the AEHR, however it provides a gauge of seasonal uncertainty.

EROSION RATES

- Annual Erosion Hazard Rates (AEHR)

Erosion rates are measured every 20 m along the shoreline. These sites are denoted by yellow shore normal transects. The Annual Erosion Hazard Rate (red), is a spatially smoothed center weighted average of calculated erosion rates. Five contiguous transects are incorporated in the smoothing process. The transects are weighted: 1-3-5-3-1 with the smoothed rate assigned to the center transect. The AEHRs are shown on the shore-parallel histogram graph. Colored bars on the graph correspond to shore-normal transects; approximately every fifth transect and bar are numbered. Where necessary, some transects have been purposely deleted during data processing; as a result, transect numbering is not consecutive everywhere. Where complete beach loss has occurred, erosion rate calculations apply only to the time period when a beach existed.

Despite some scatter in the central portion of the study area shorelines between 1912 and 2002 show a reasonably consistent trend and are used to calculate AEHRs within the Kanaha study area.

The Kanaha study extends from Kaa east to Papaula Point to include Kanaha Beach County Park, the center of the area. The Kanaha area shoreline is comprised of white sand beach broken by boulder groins at Kanaha Beach installed prior to 1950* to retain and stabilize the shoreline. The presence of these groins effectively divides the study area into three regions for description purposes. Offshore, fringing reef exists with stranded beach rock benches located at Papaula Point.

As a whole the Kanaha study area has experienced moderate to severe erosion over time with an average AEHR of -1.5 ft/yr. The western portion of the study area (transects 0 - 32) includes Kanaha Beach and its 5 groins. This section of shoreline lays downdrift of the 11 groins central to this study area and has experienced severe erosion with an average AEHR of -2.1 ft/yr. The center portion of the study area (transects 33 - 109) includes most of Kanaha Beach. This region is highly variable due to the presence of groins and their effects. As a region, this section of shoreline has experienced moderate erosion with an average AEHR of -0.7 ft/yr. To the east, updrift of the numerous groins at Kanaha Beach, are Spreckelsville and Coral Beaches* (transects 111 - 148). Offshore of Coral Beach at Papaula Point are two beach rock benches. These beaches have experienced moderate erosion over time with an average AEHR of -1.3 ft/yr. Trends identified here generally agree with those found by Sea Engineering, 1991*.

Average beach width, the average horizontal distance from the vegetation line to the low water mark within the Kanaha study area has increased 25% between 1960 and 2002. The western portion of the area has experienced an increase of 33% in average beach width, the central portion a 42% increase. The eastern portion of the area has experienced a 10% decrease in average beach width between 1960 and 2002.

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