

Kauai

Preliminary Sediment Budget

Kim Garvey
Moffatt & Nichol

co-sponsored by:

State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



Kauai Preliminary Sediment Budget

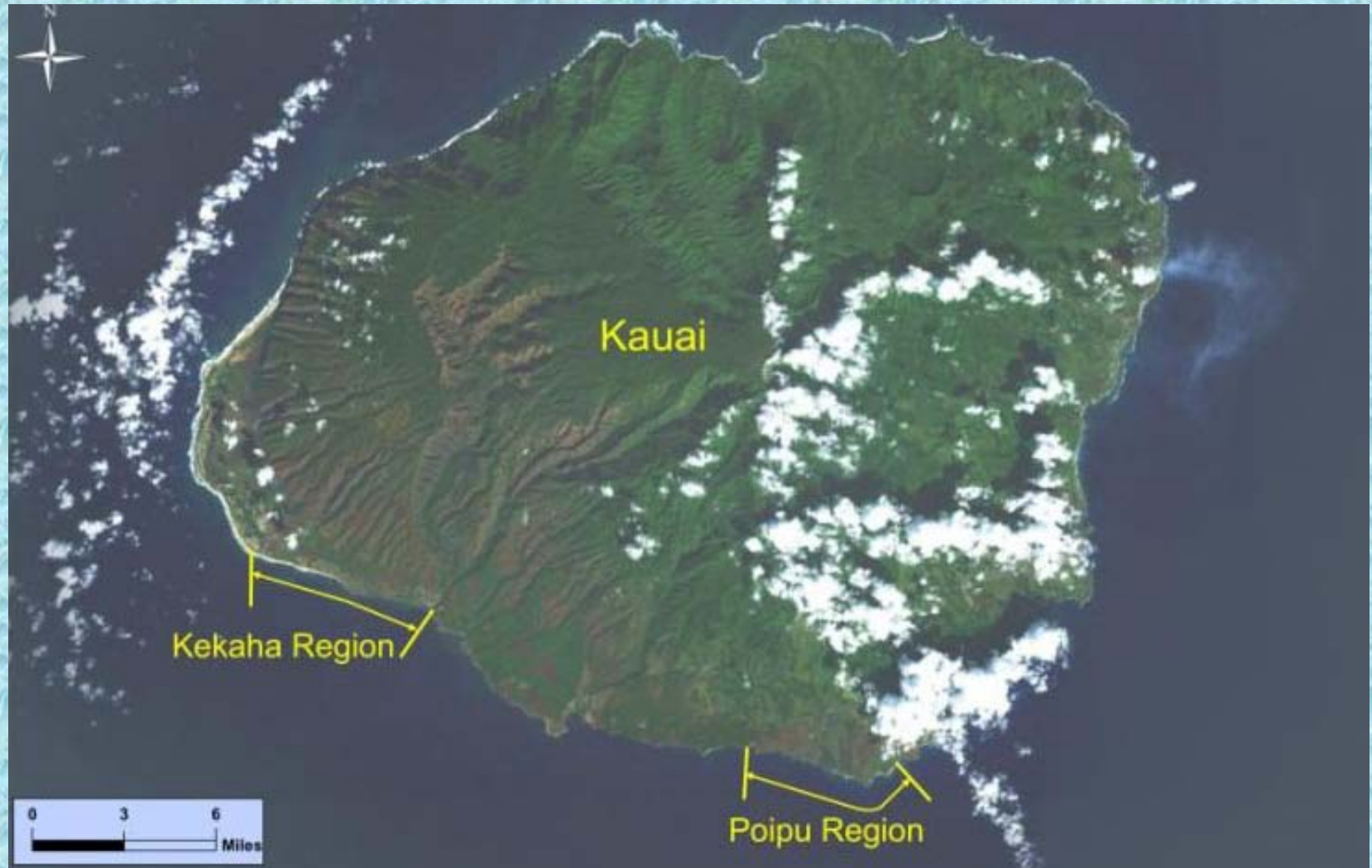
- Littoral Cells in Study Regions
- Methodology
- Sediment Budget by Littoral Cell
- Summary
- Recommendations for Further Study

co-sponsored by:

State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



Kauai Study Regions

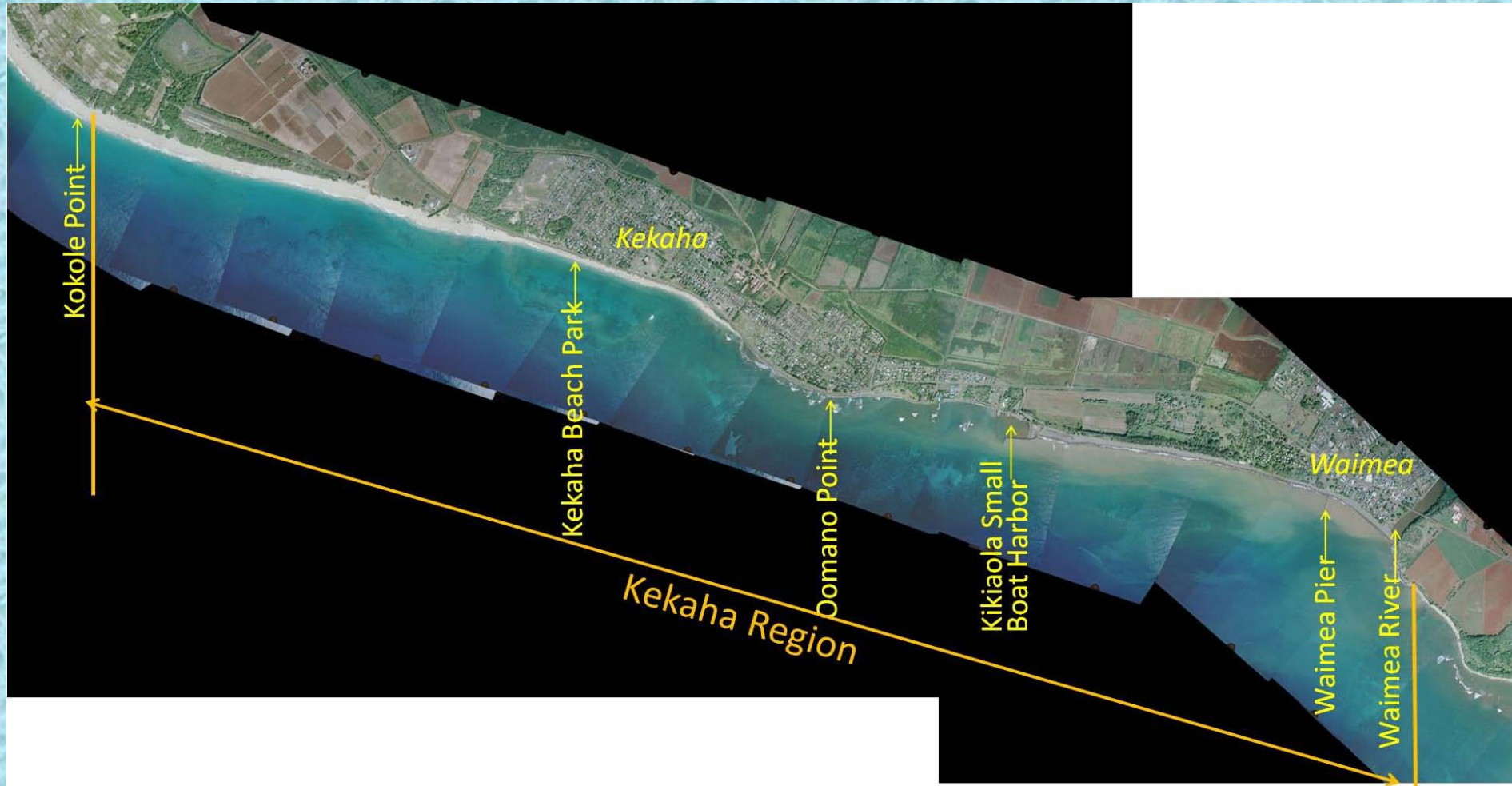


co-sponsored by:

State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



Kekaha Region

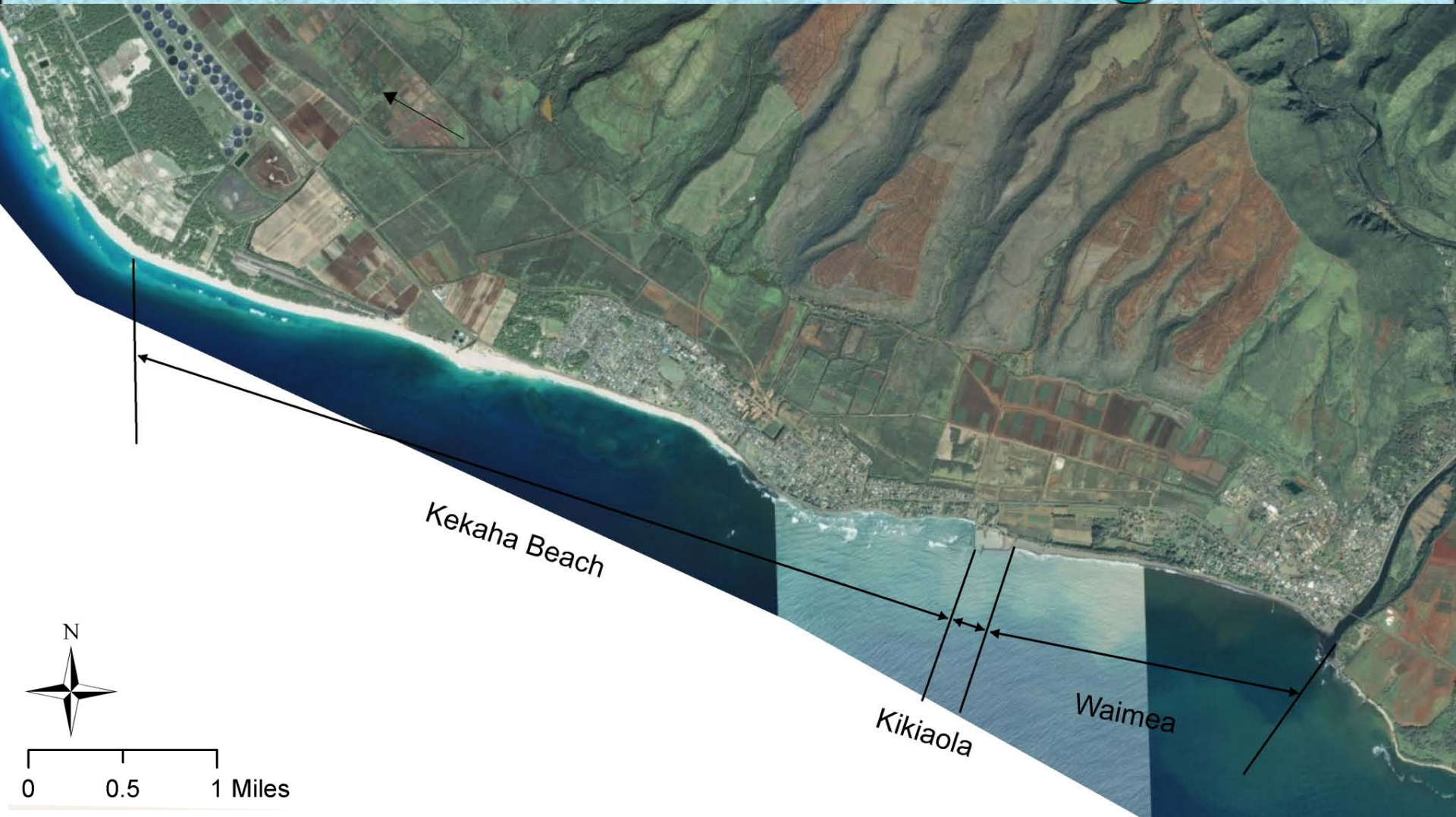


co-sponsored by:

State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



Littoral Cells in Kekaha Region

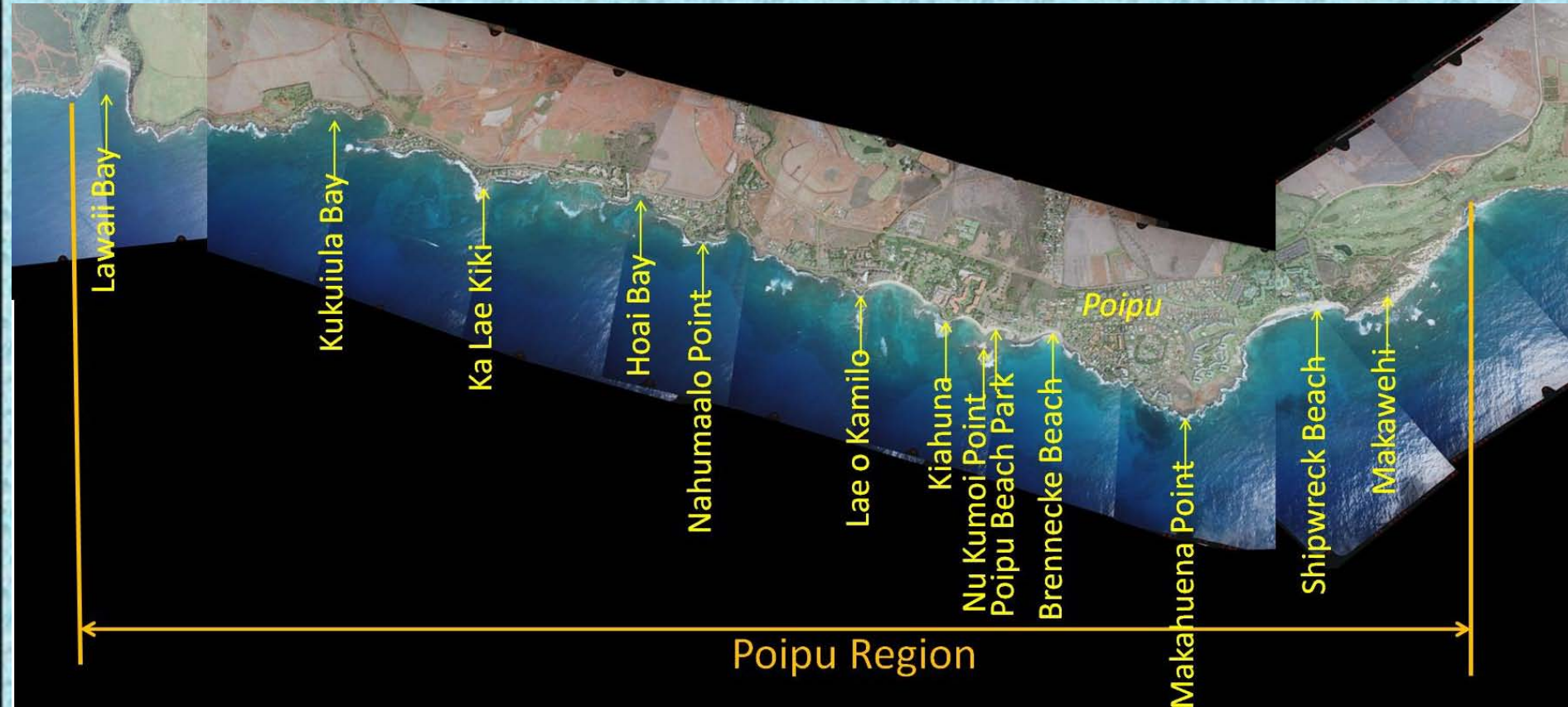


co-sponsored by:

State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



Poipu Region

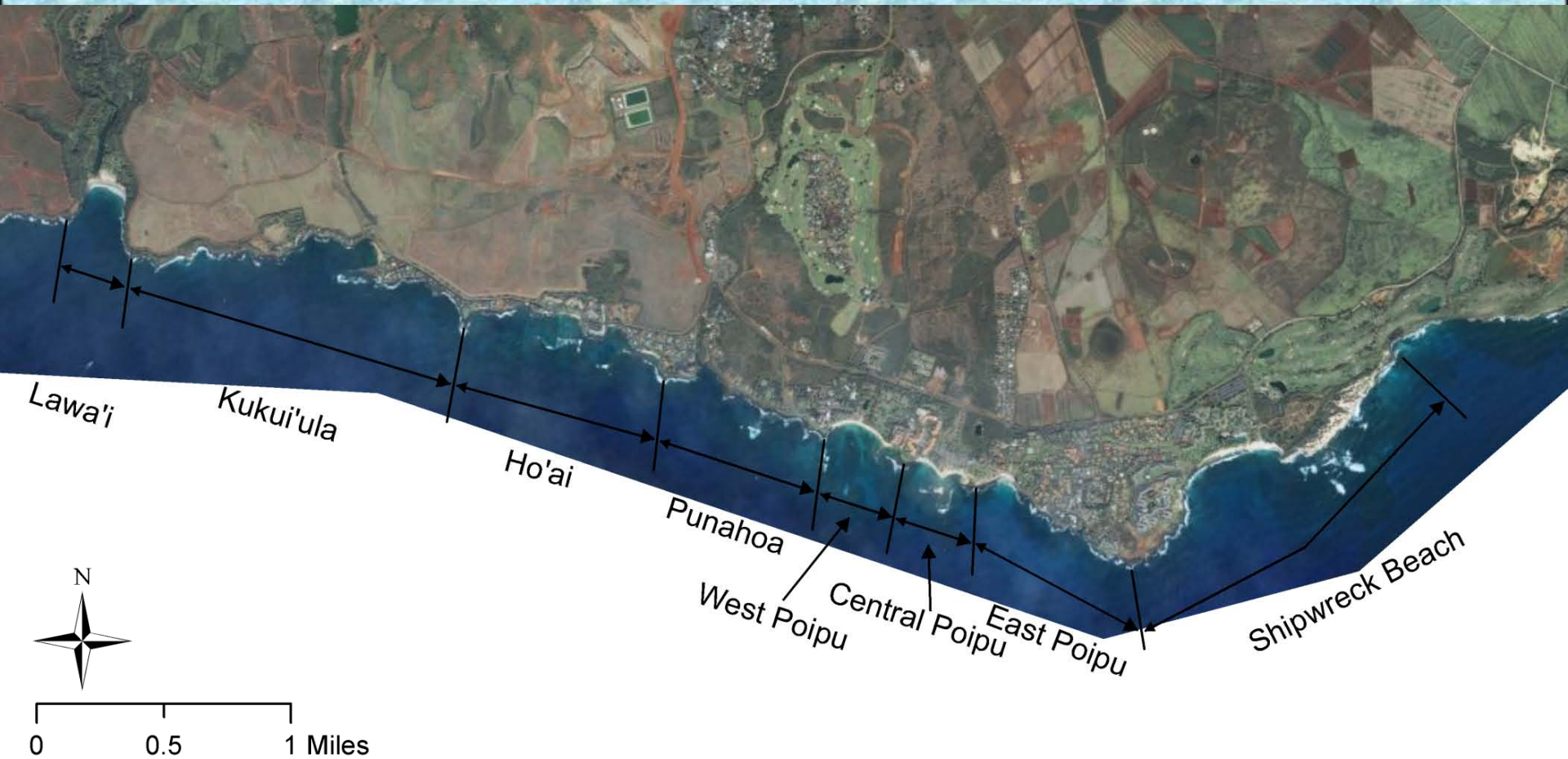


co-sponsored by:

State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



Littoral Cells in Poipu Region



co-sponsored by:

State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



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 beach volume over time.



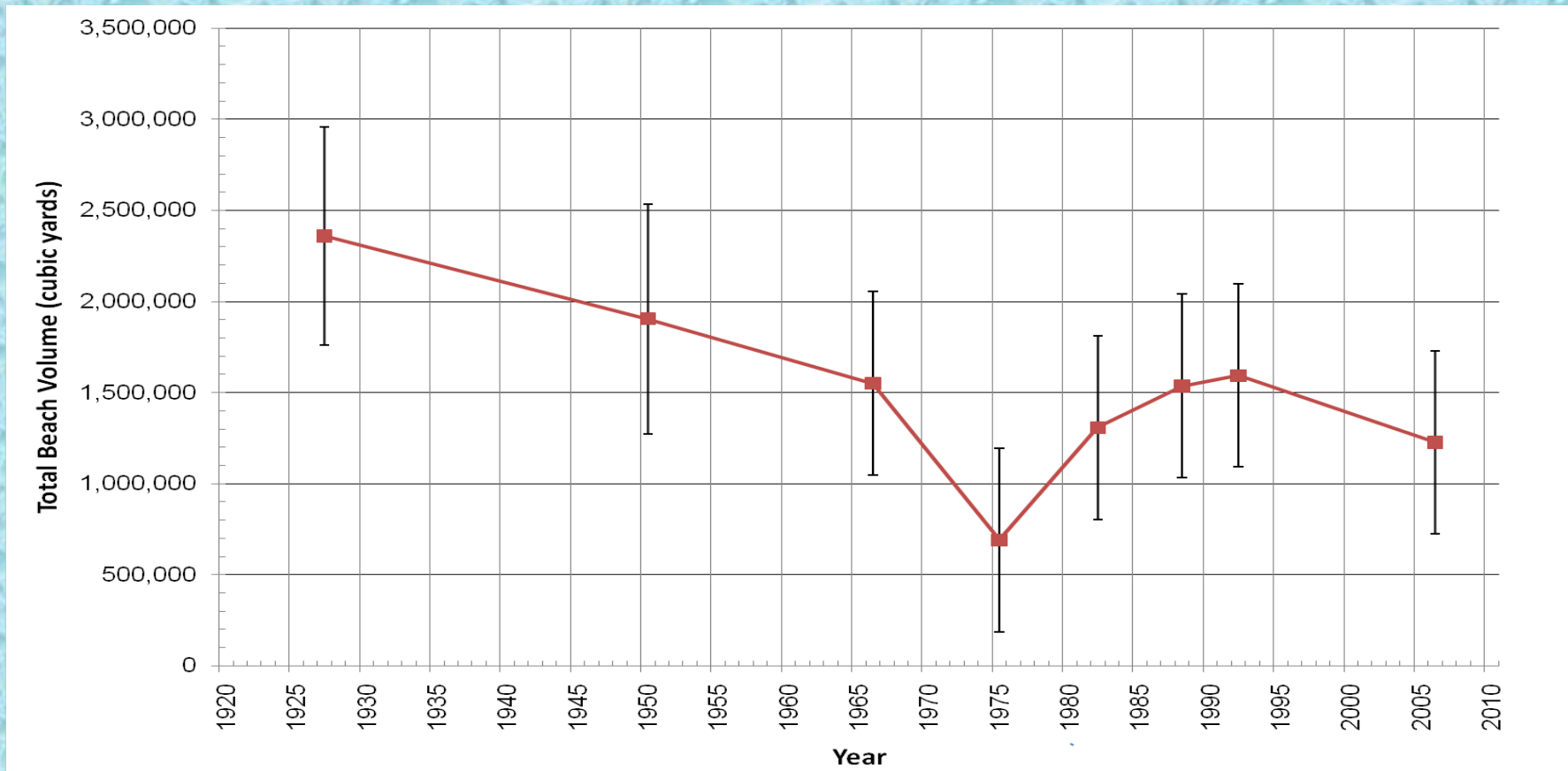
co-sponsored by:

State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



Methodology (cont.)

Example – Beach Volume Graph



co-sponsored by:

State of Hawaii Department of Land and Natural Resource

US Army Corps of Engineers, Honolulu District



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

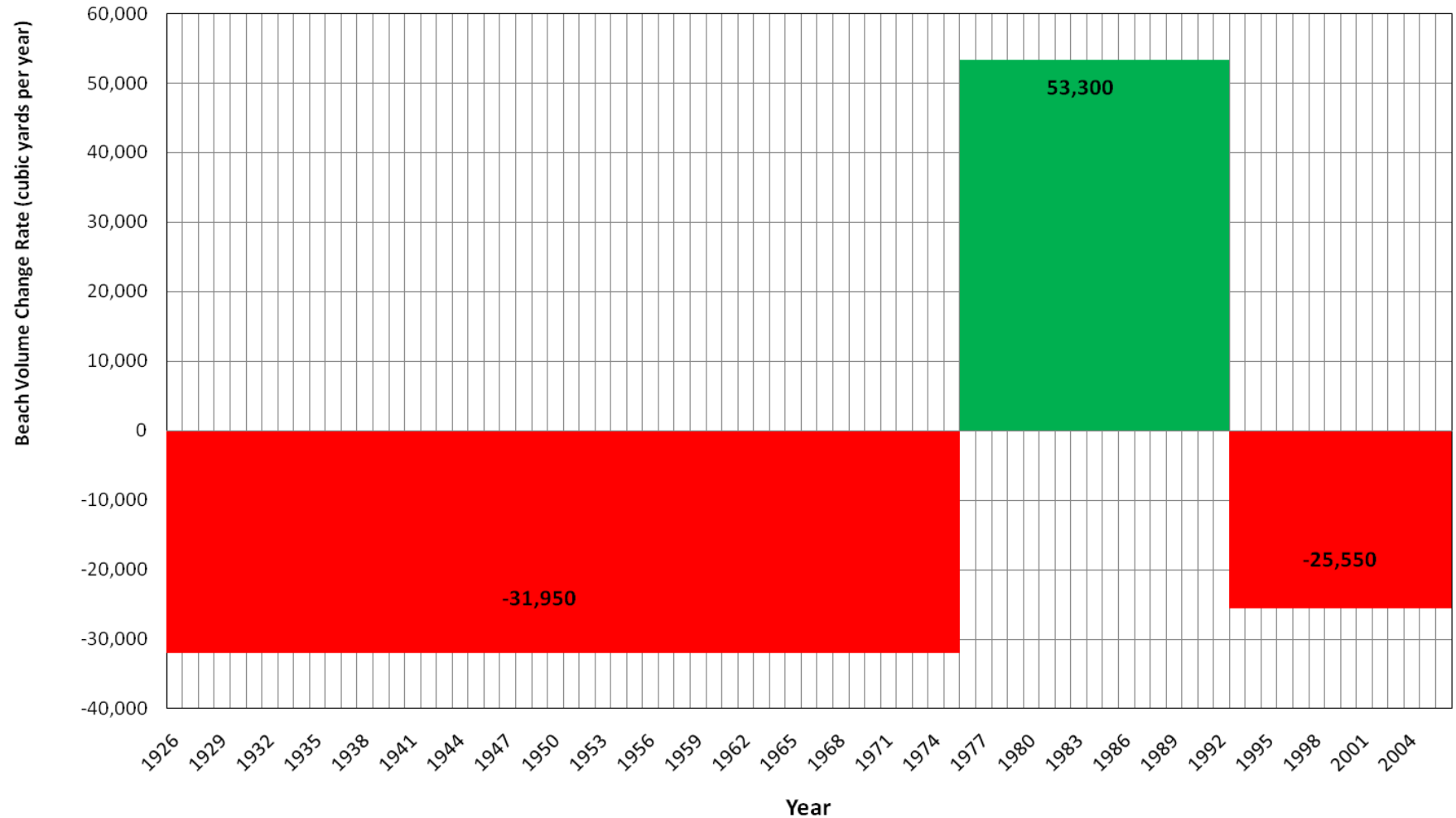
co-sponsored by:

State of Hawaii Department of Land and Natural Resource

US Army Corps of Engineers, Honolulu District



Example – Beach Volume Change Rate History



co-sponsored by:

State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



Sediment Budget by Littoral Cell – Kekaha Region

co-sponsored by:

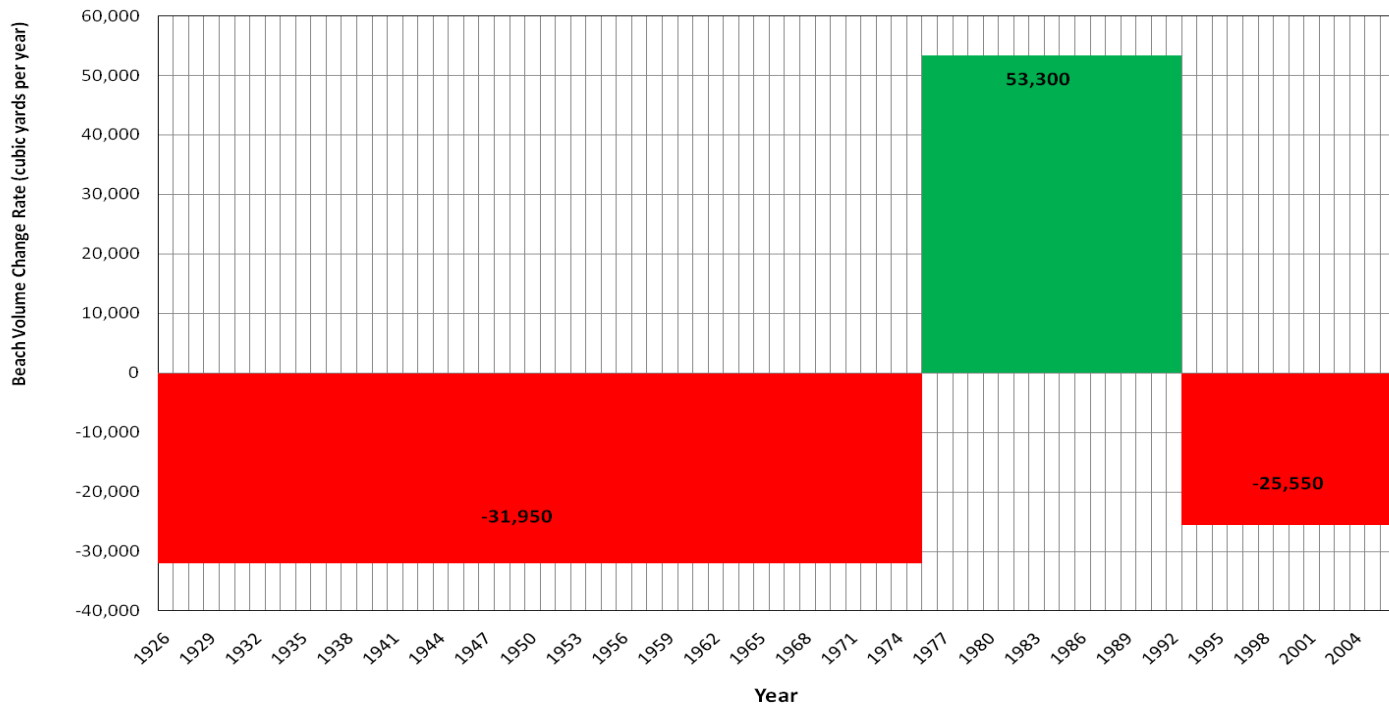
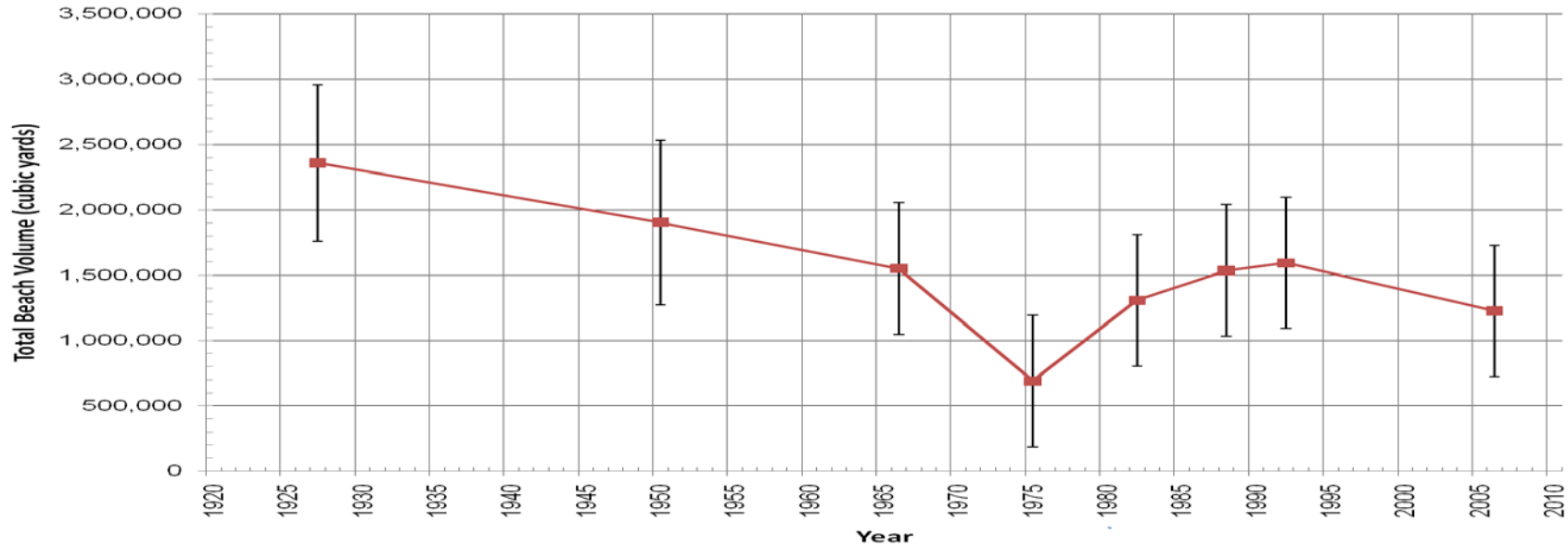
State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



Kekaha Beach Cell – Shoreline Features



Kekaha Cell – Beach Volume History



Kekaha Cell – Beach Volume Change Rate



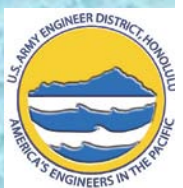
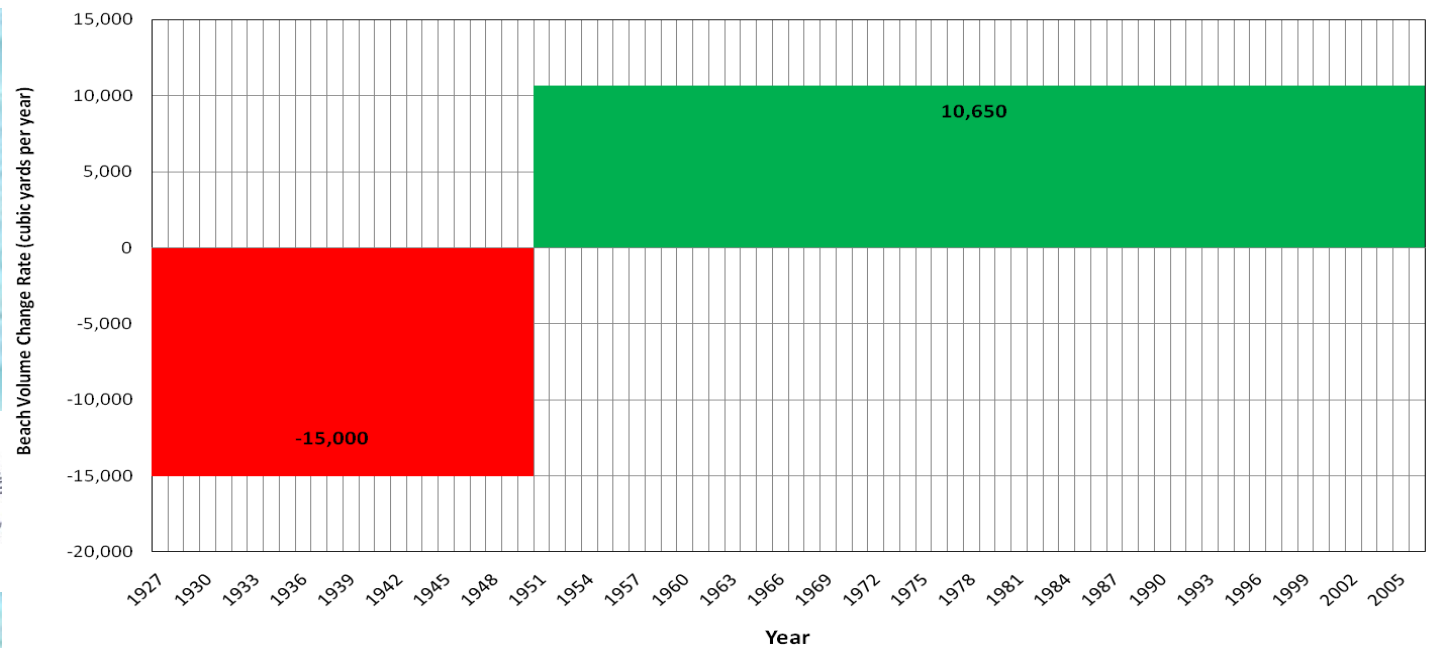
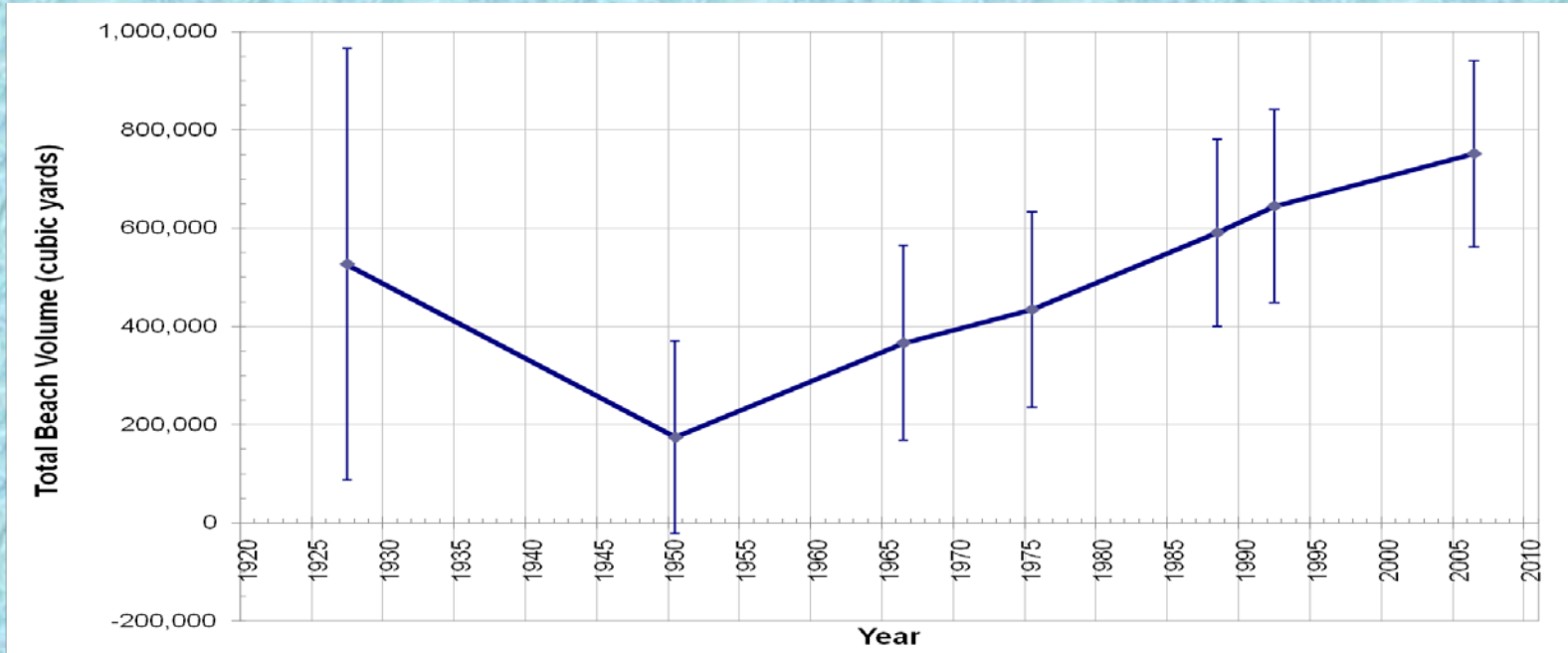
Kikiaola Cell – Beach Volume Change Rate



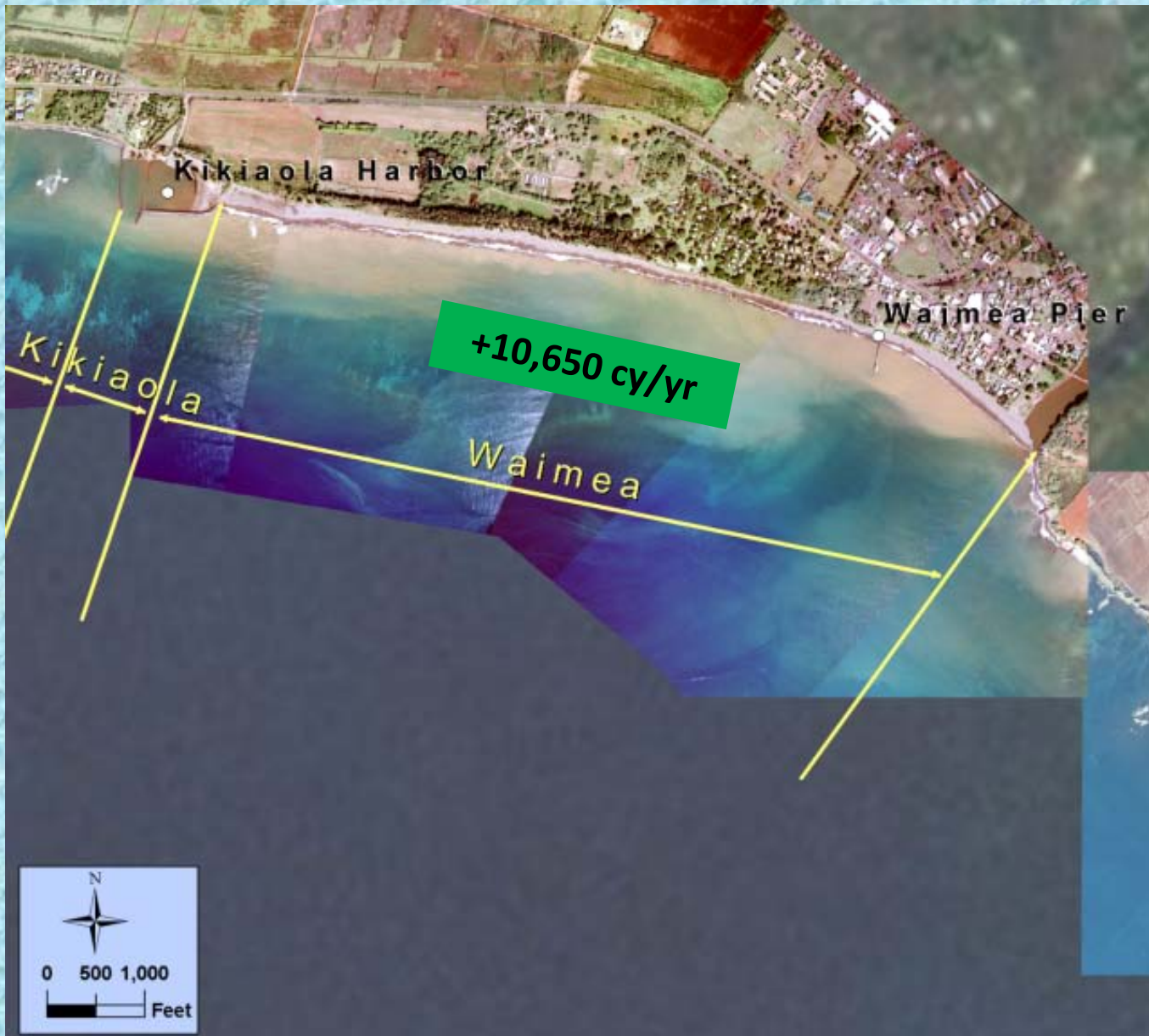
US Army Corps of Engineers, Honolulu District



Waimea Cell – Beach Volume History



Waimea Cell – Beach Volume Change Rate



Summary – Kekaha Region

- Long lengths of sandy beaches result in high volumetric rates (in comparison to D2P rates)
- Both Kekaha and Waimea cells have experienced reversals in trends



co-sponsored by:

State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



Sediment Budget by Littoral Cell – Poipu Region

co-sponsored by:

State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District

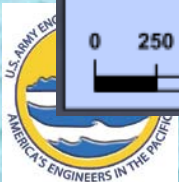


West, Central, East Poipu Cells – Shoreline Features

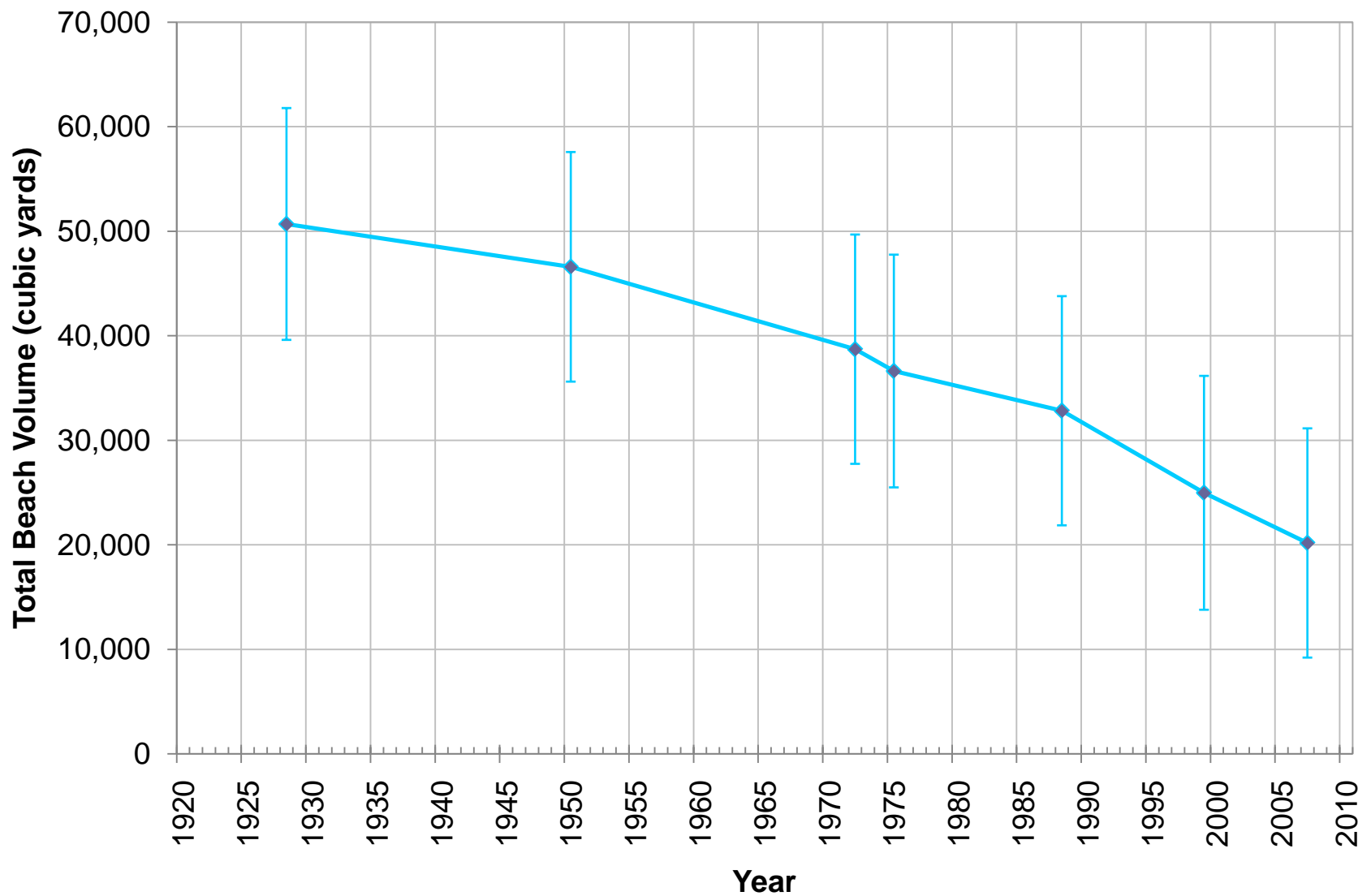


co-sponsored by:

State of Hawaii Department of Land and Natural Resources
US Army Corps of Engineers, Honolulu District



West Poipu Cell – Beach Volume History

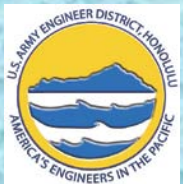
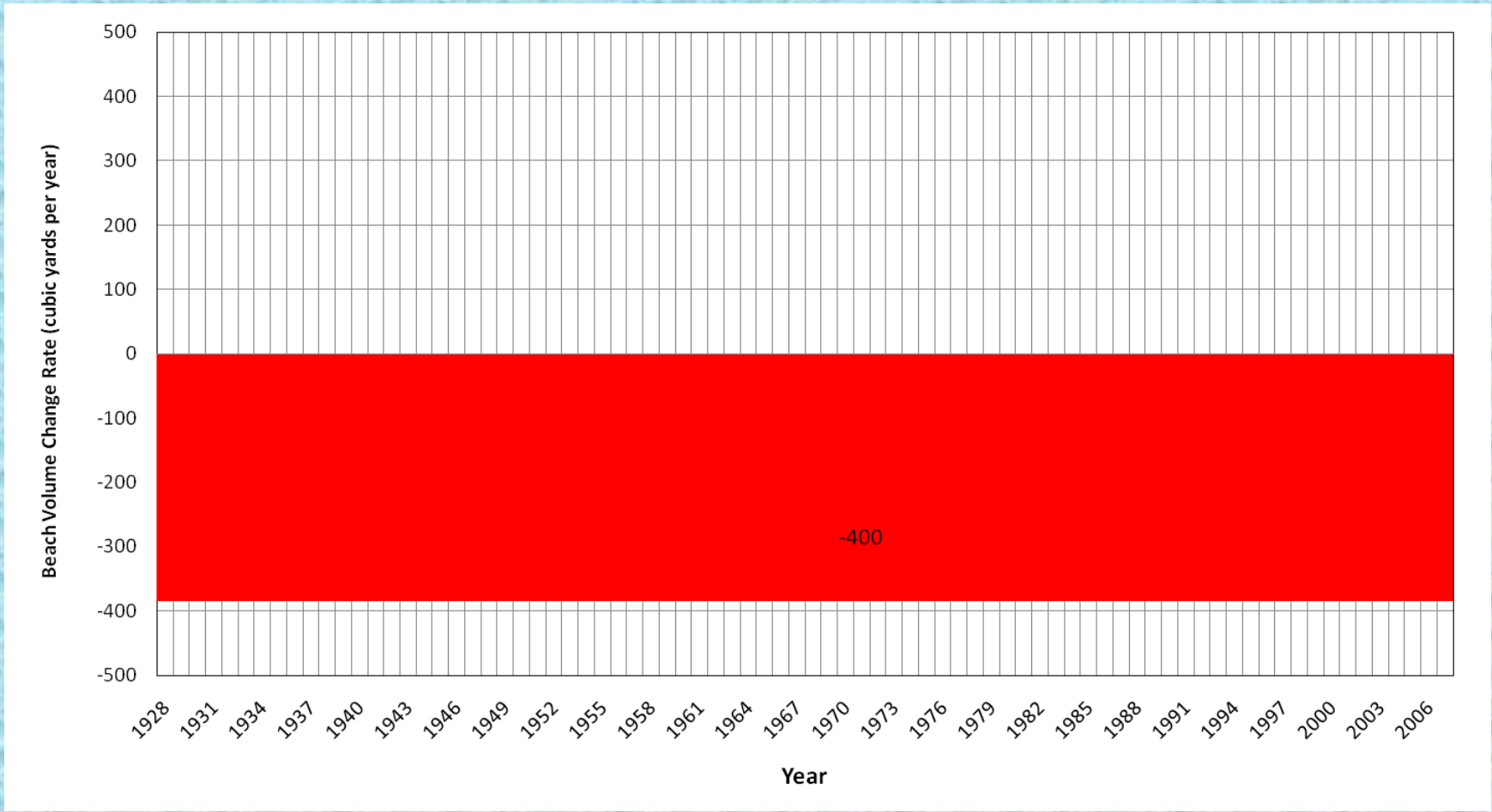


State of Hawaii Department of Land and Natural Resources

US Army Corps of Engineers, Honolulu District



West Poipu Cell – Beach Volume Change Rate History



co-sponsored by:

State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



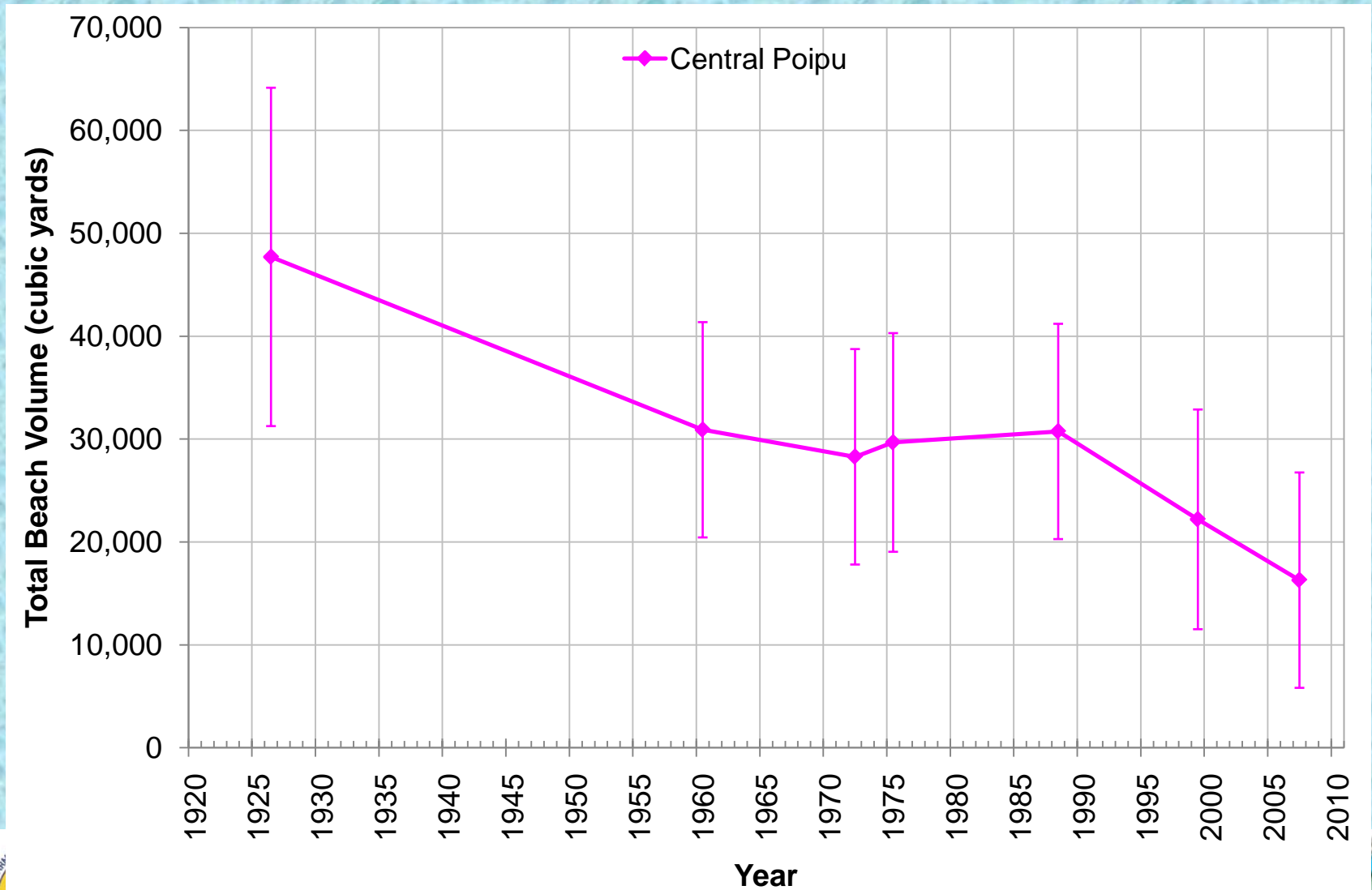
West Poipu Cell – Beach Volume Change Rate



US Army Corps of Engineers, Honolulu District



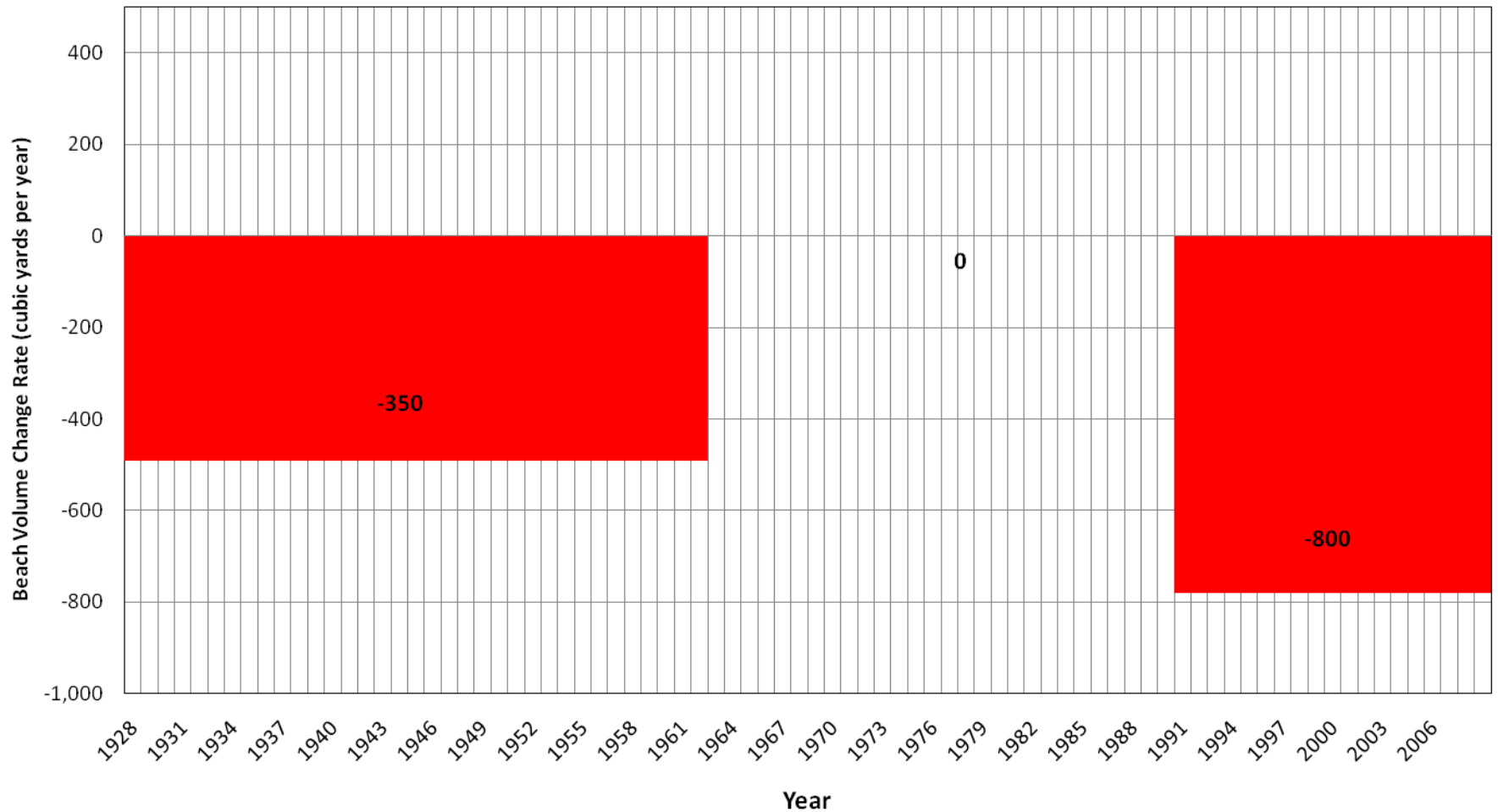
Central Poipu Cell – Beach Volume History



State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



Central Poipu Cell – Beach Volume Change Rate History



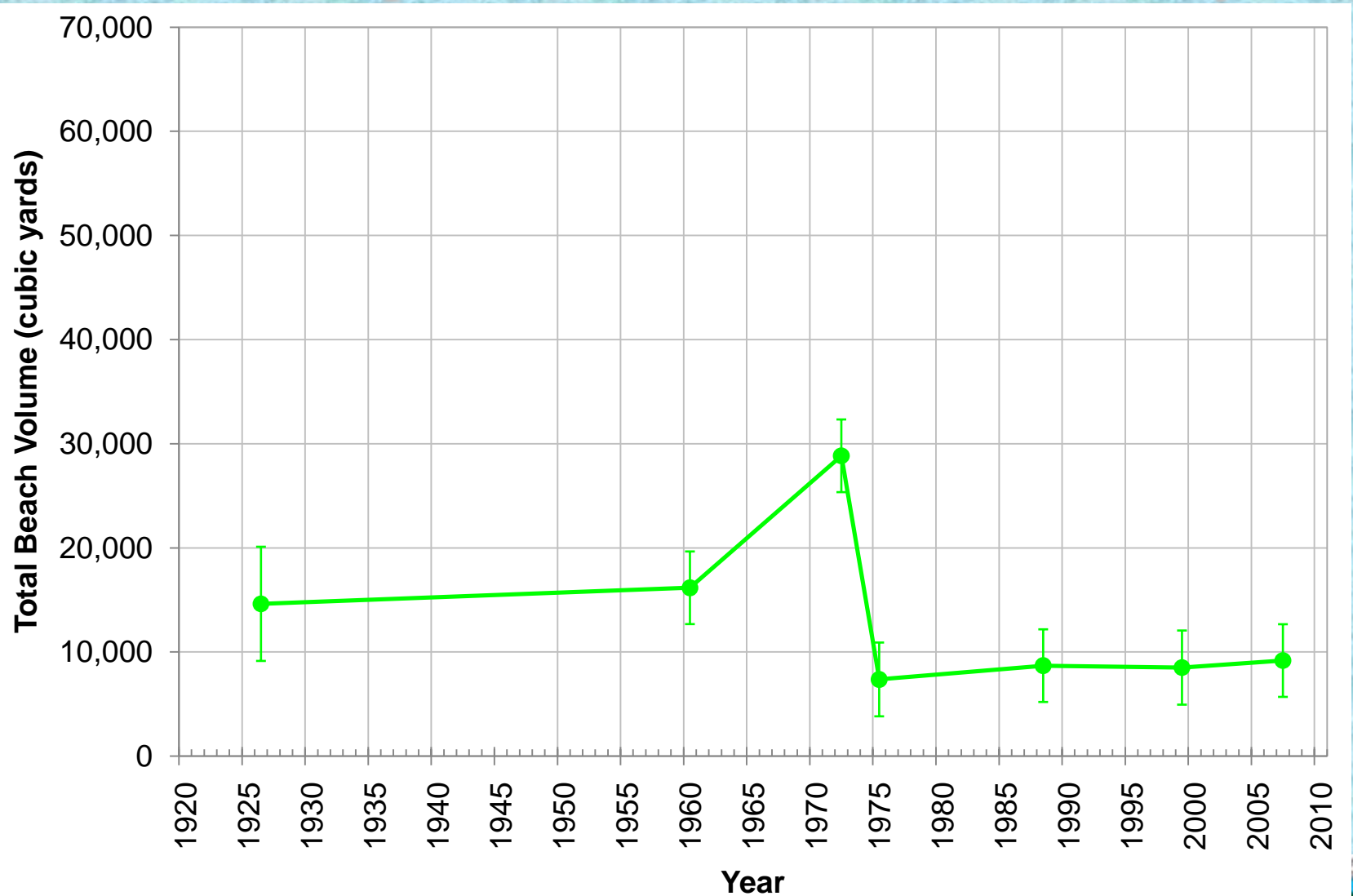
Central Poipu – Beach Volume Change Rate



US Army Corps of Engineers, Honolulu District



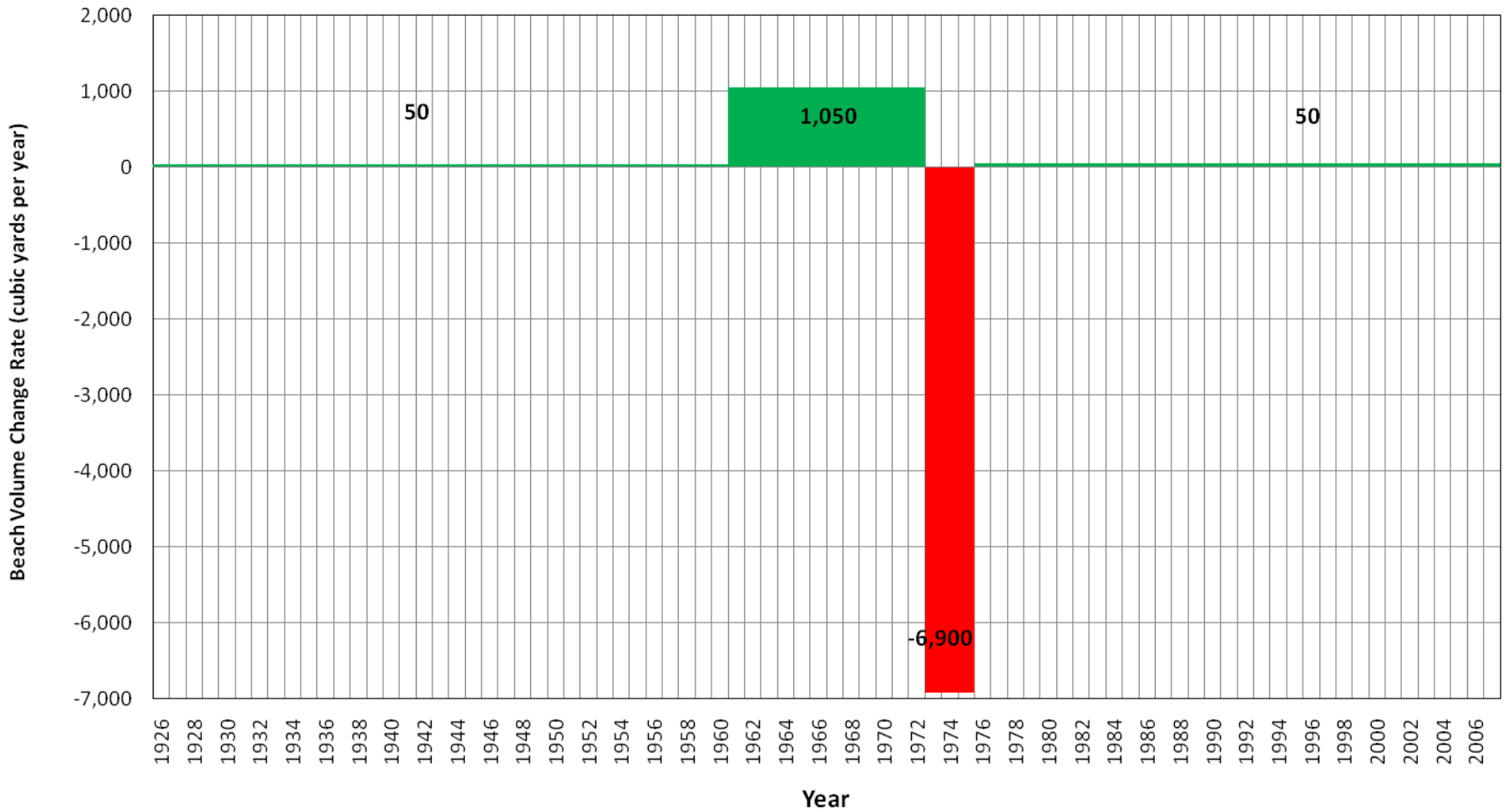
East Poipu– Beach Volume History



State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



East Poipu Cell – Beach Volume Change Rate History



East Poipu– Beach Volume Change Rate



US Army Corps of Engineers, Honolulu District



Lawa'i Cell – Beach Volume Change Rate



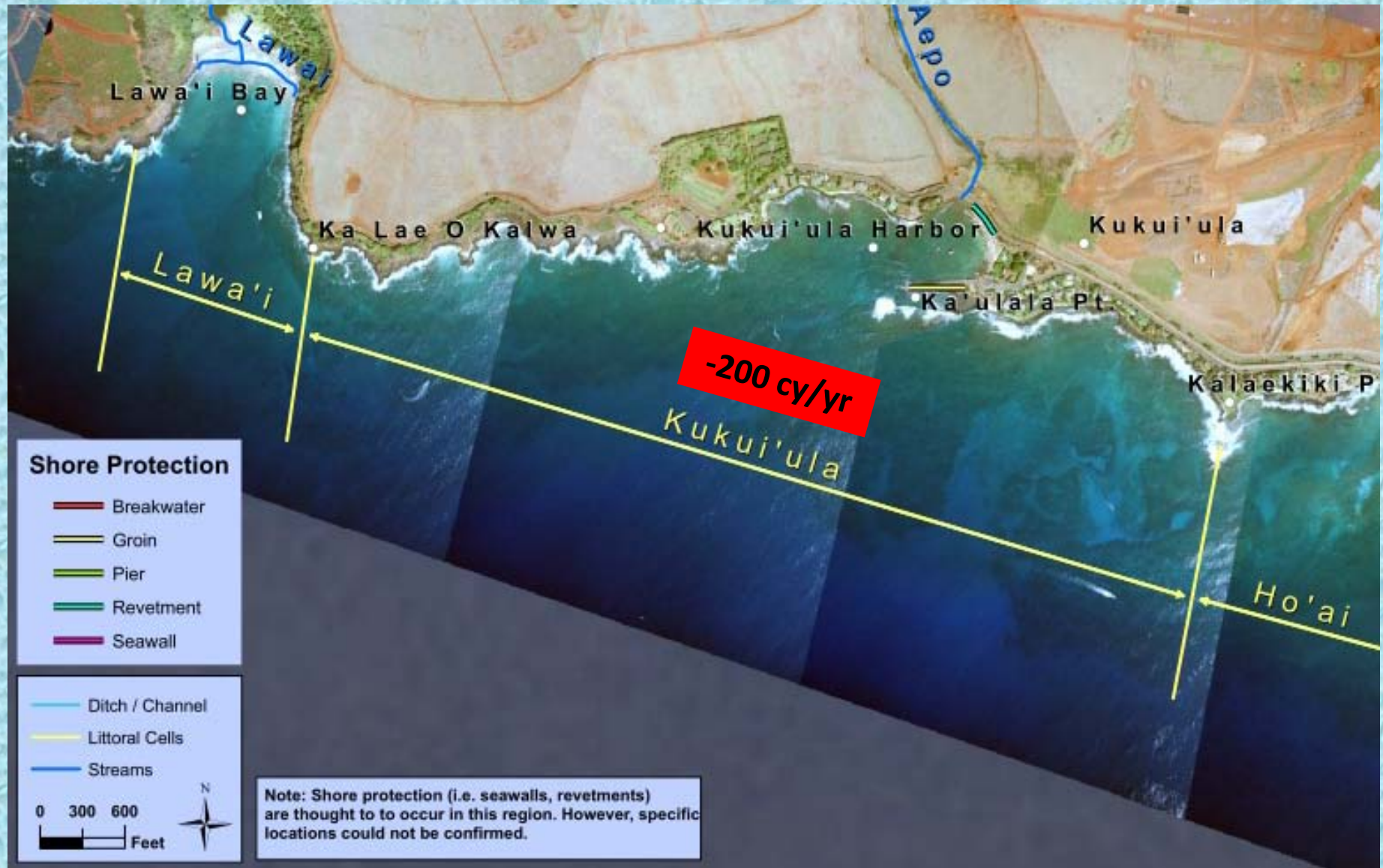
co-sponsored by:

State of Hawaii Department of Land and Natural Resource

US Army Corps of Engineers, Honolulu District



Kukui'ula Cell – Beach Volume Change Rate



Ho'ai – Beach Volume Change Rate



co-sponsored by:

State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



Punahoa Cell – Beach Volume Change Rate



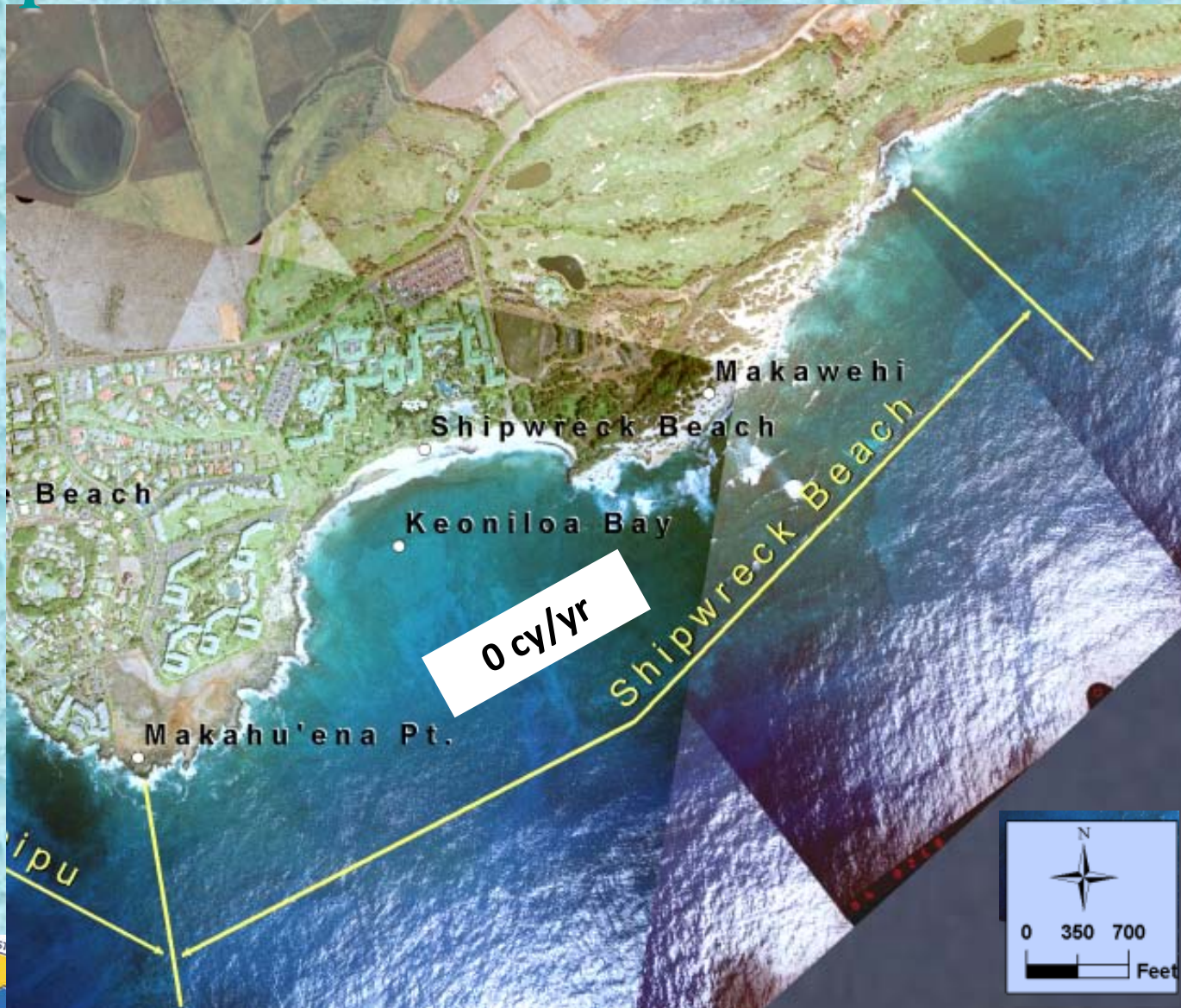
co-sponsored by:

State of Hawaii Department of Land and Natural Resource

US Army Corps of Engineers, Honolulu District



Shipwreck Cell– Beach Volume Change Rate



State of Hawaii Department of Land and Natural Resource

US Army Corps of Engineers, Honolulu District



Summary – Poipu Region

- Erosion rates are relatively small; good opportunities for beach nourishment.
- West and Central Poipu cells have experienced similar (erosional) trends.
- East Poipu cell experienced significant erosion episode between 1972-75 and has not recovered since.



co-sponsored by:

State of Hawaii Department of Land and Natural Resources

US Army Corps of Engineers, Honolulu District



Recommendations for Further Study of Kauai Regions

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



co-sponsored by:

State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



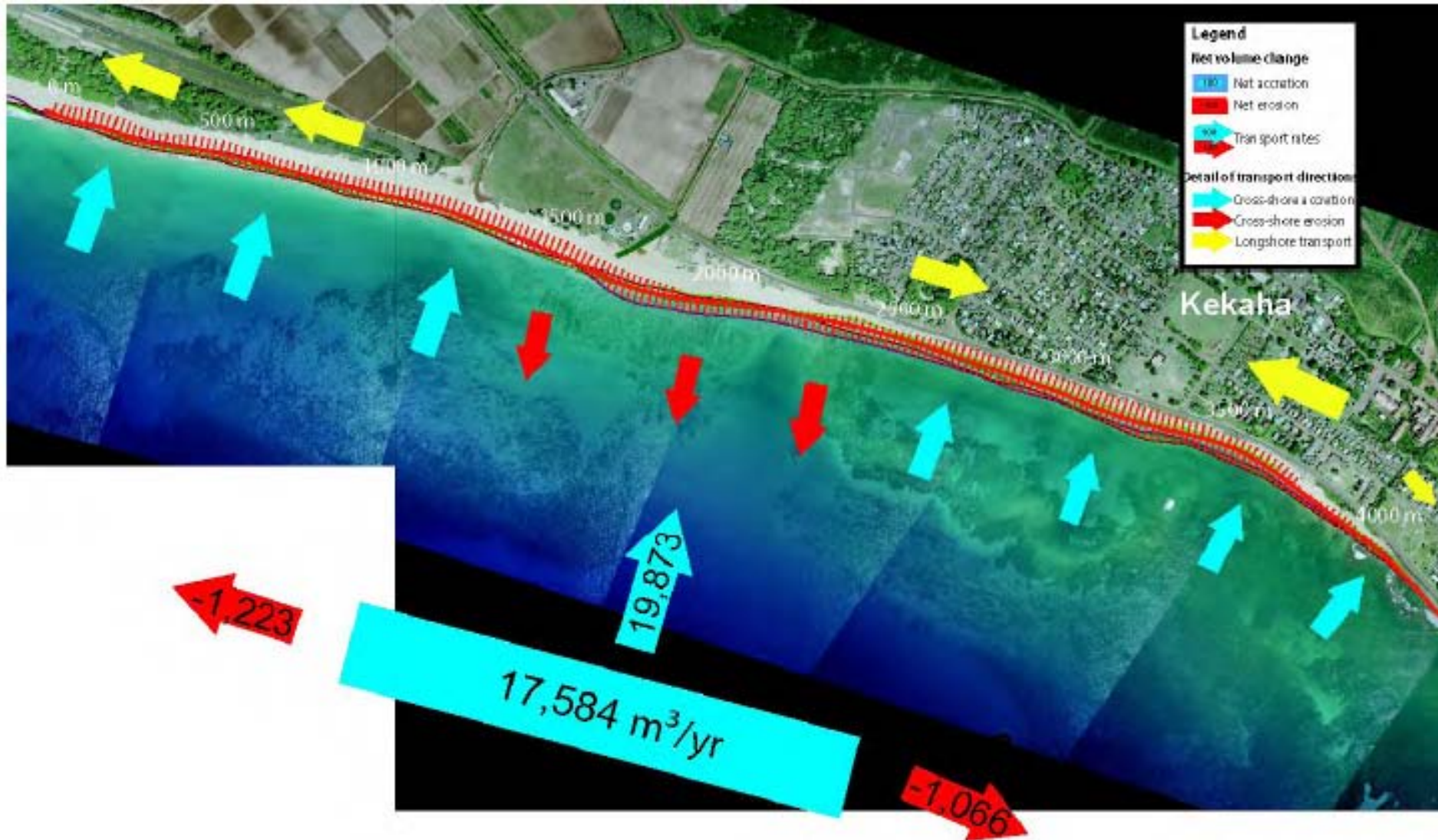
Additional Slides – Kekaha Region

co-sponsored by:

State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



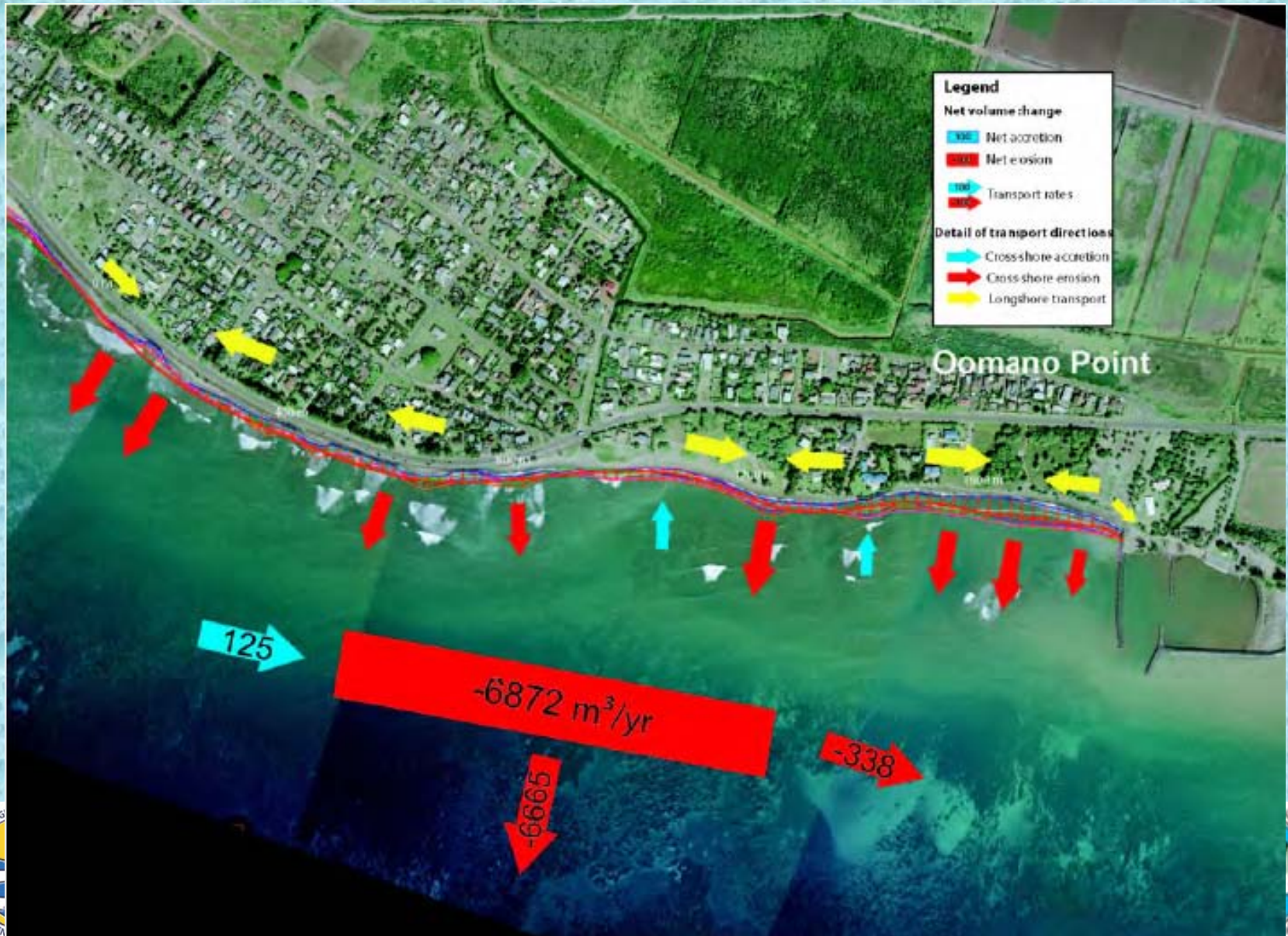
UH Sediment Budget Model Results - Kekaha



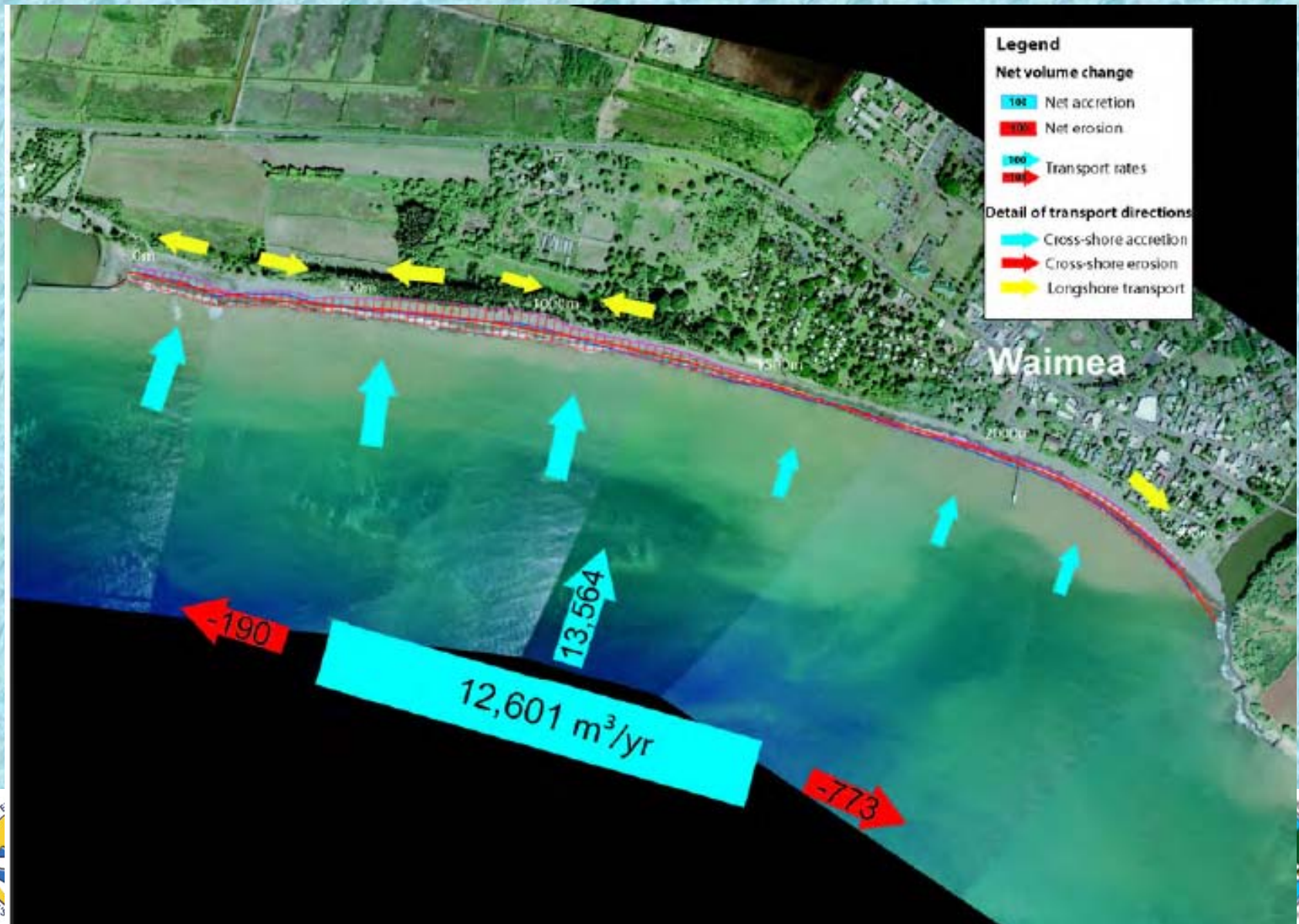
State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



UH Sediment Budget Model Results - Oomano



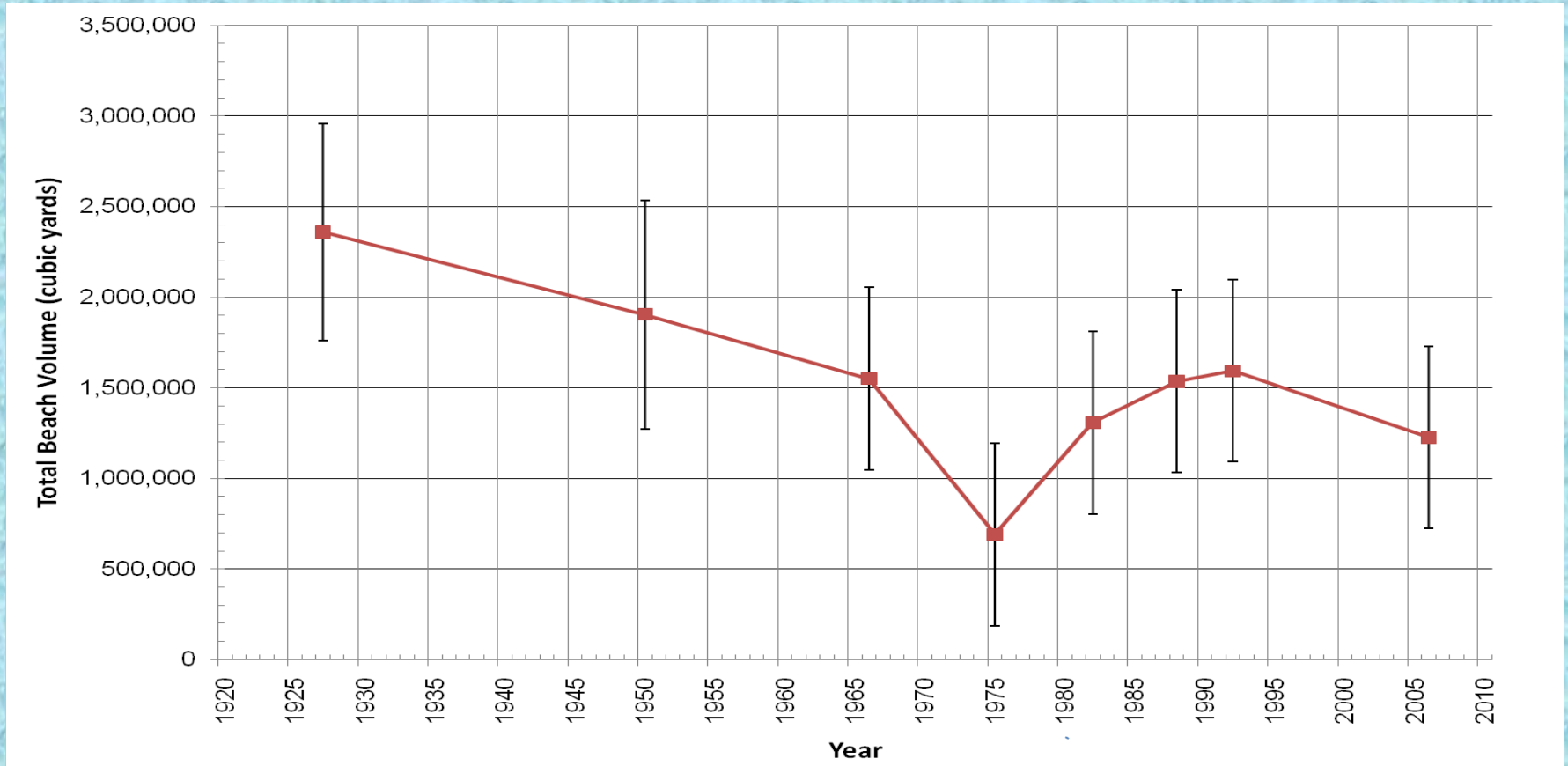
UH Sediment Budget Model Results - Waimea



Kekaha Beach Cell – Shoreline Features



Kekaha Cell – Beach Volume History



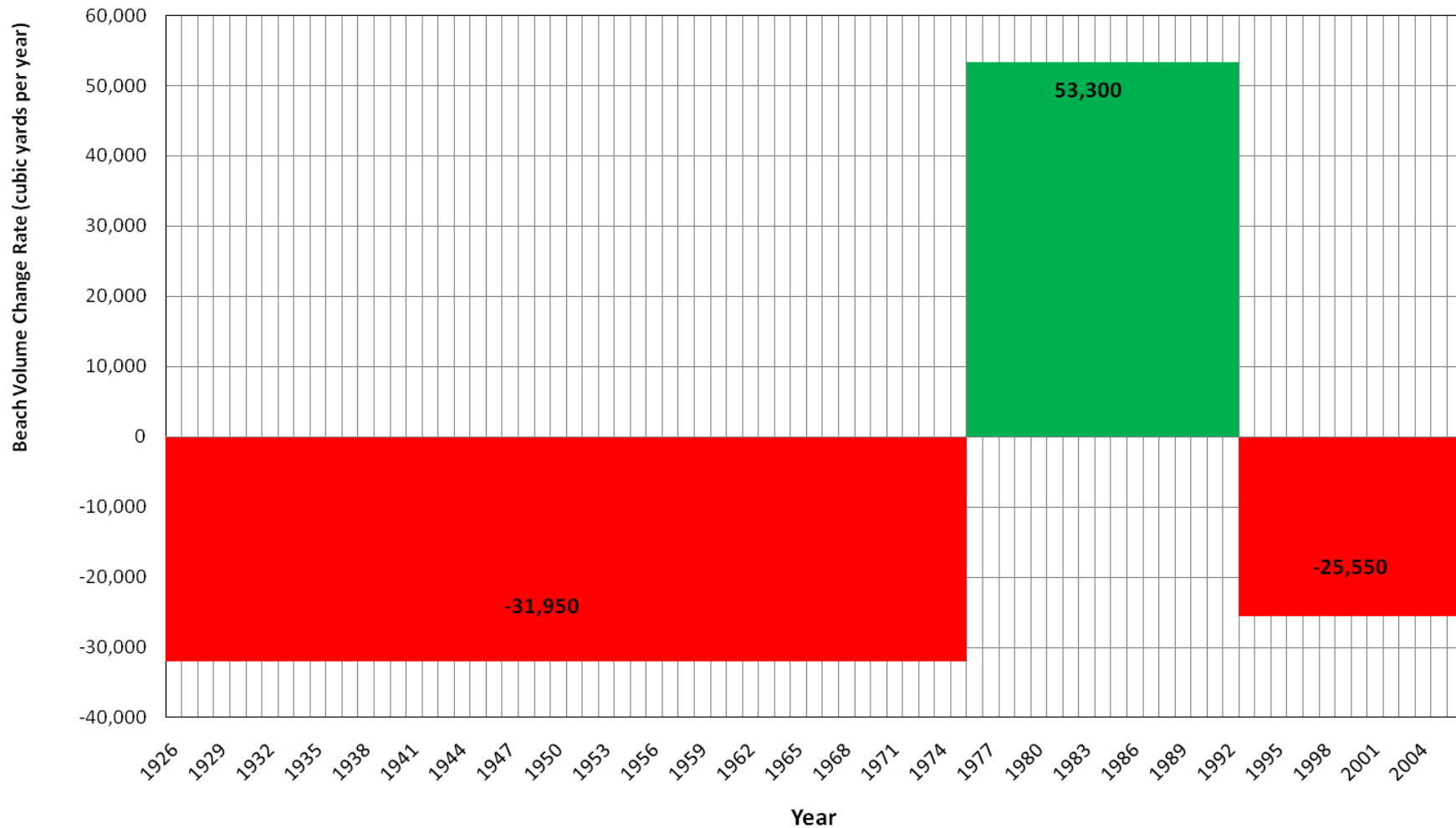
co-sponsored by:

State of Hawaii Department of Land and Natural Resource

US Army Corps of Engineers, Honolulu District



Kekaha Cell – Beach Volume Change Rate History



US Army Corps of Engineers, Honolulu District



Kekaha Cell – Beach Volume Change Rate



Kikiaola Cell – Shoreline Features



State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



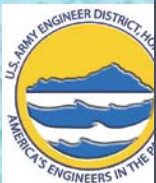
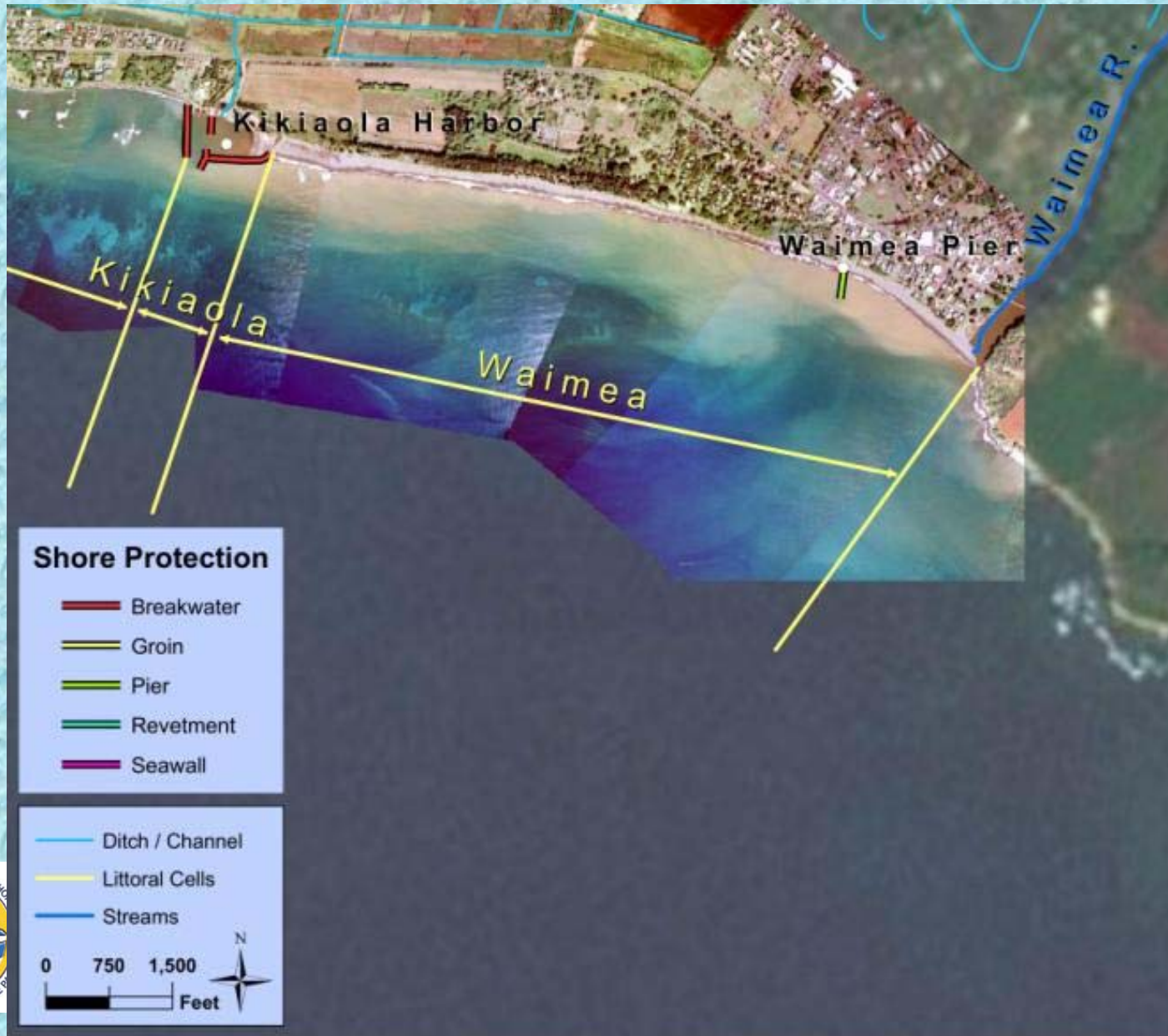
Kikiaola Cell – Beach Volume Change Rate



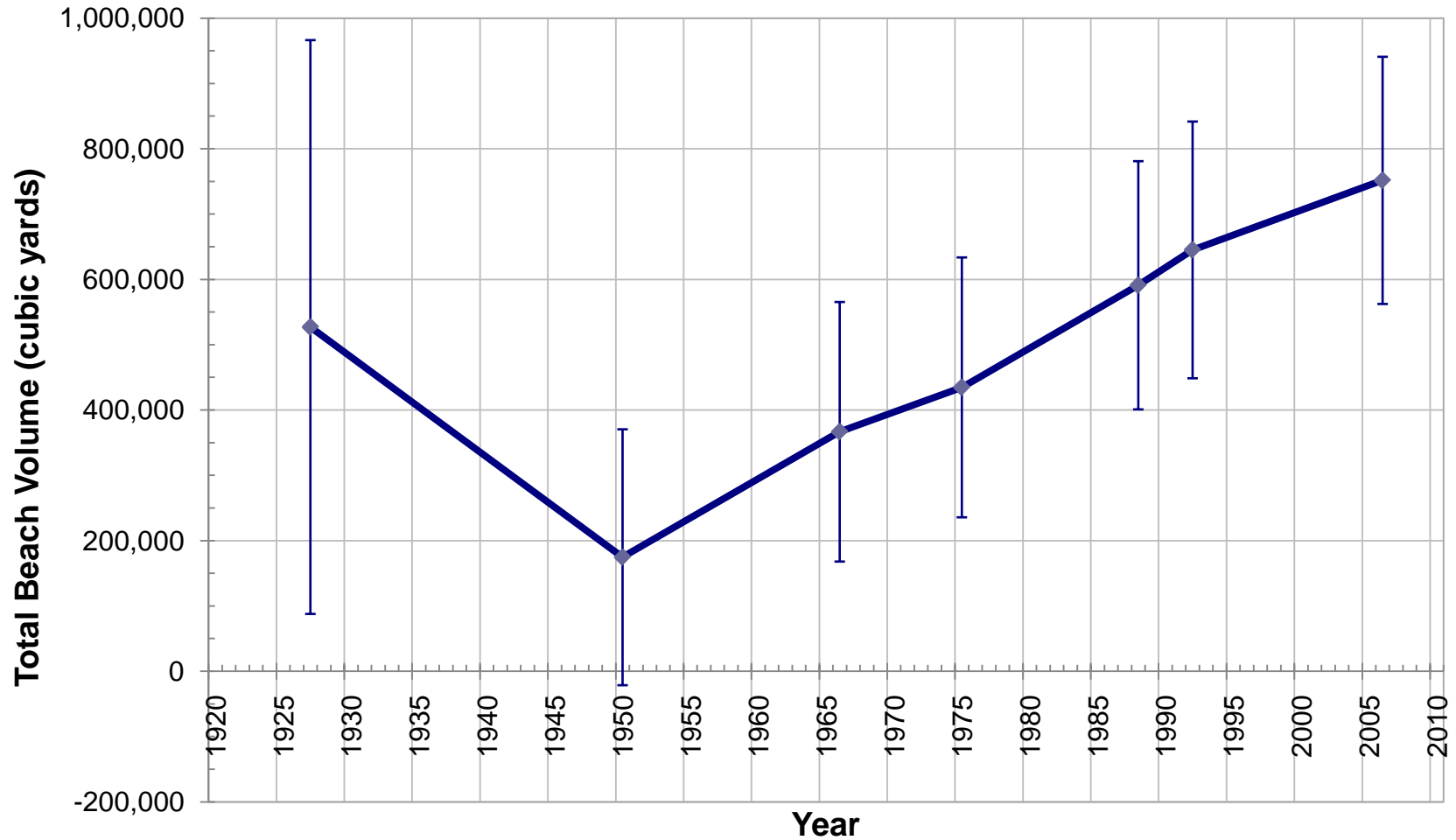
US Army Corps of Engineers, Honolulu District



Waimea Cell – Shoreline Features



Waimea Cell – Beach Volume History

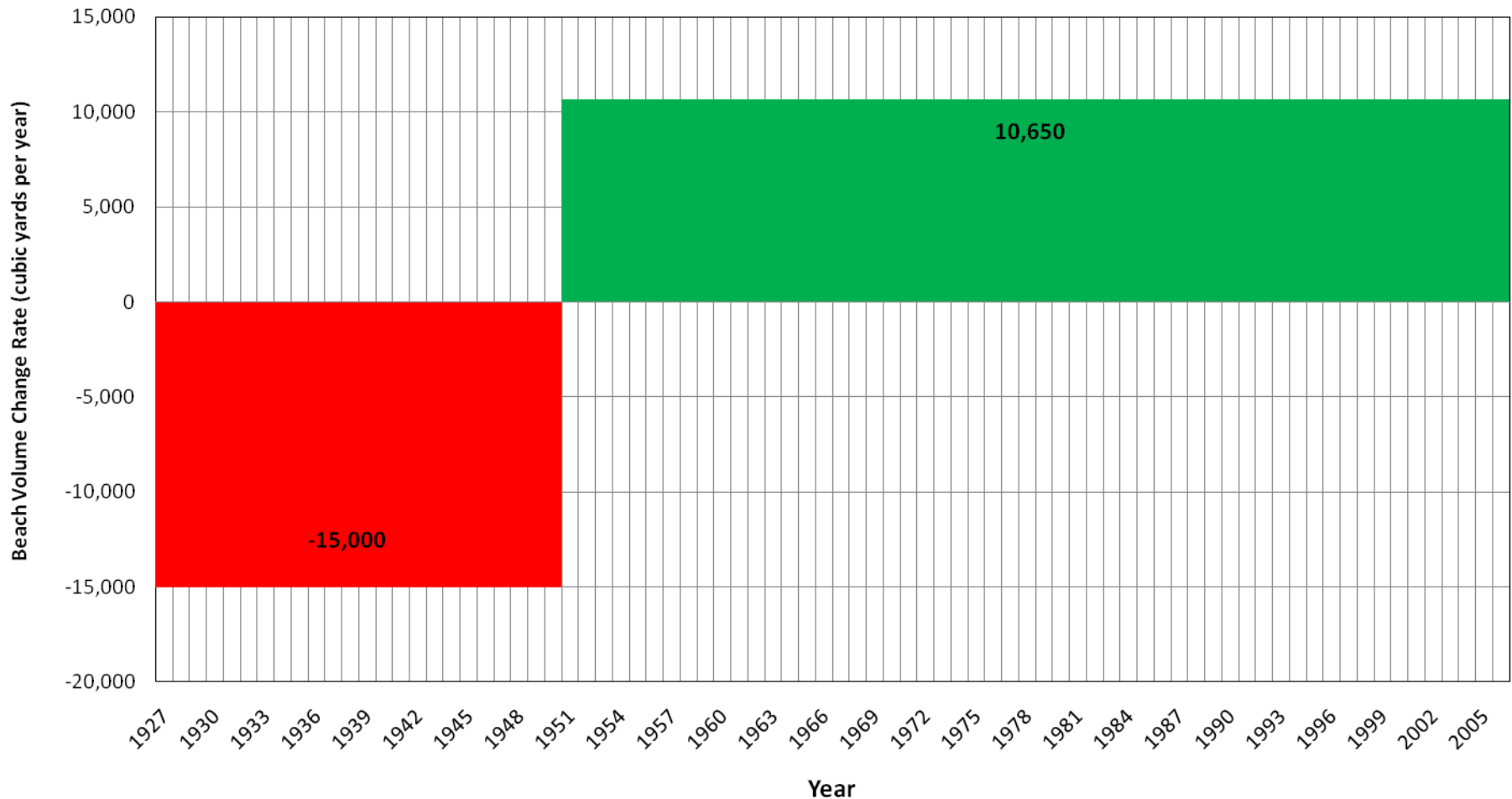


State of Hawaii Department of Land and Natural Resource

US Army Corps of Engineers, Honolulu District



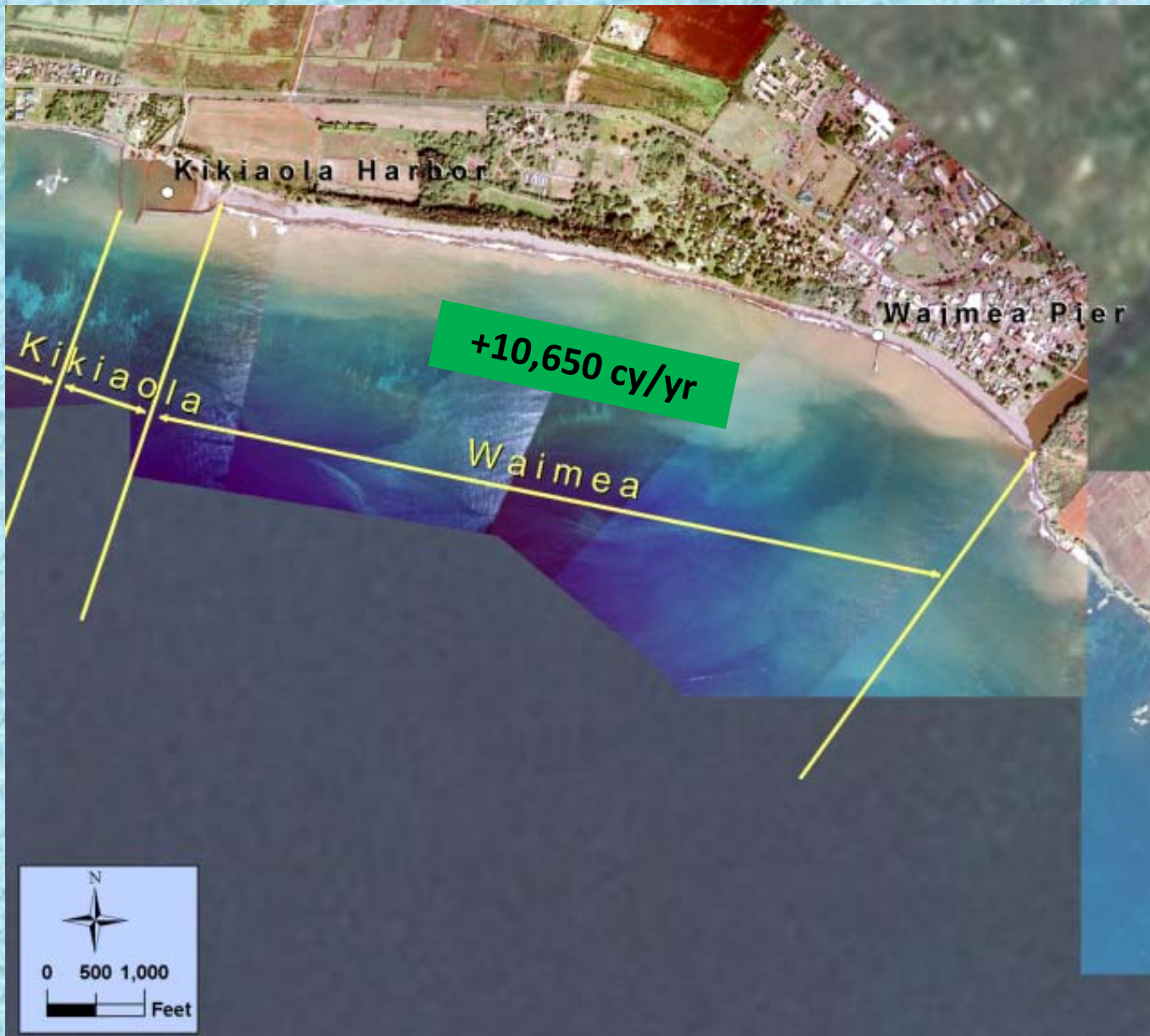
Waimea Cell – Beach Volume Change Rate History



US Army Corps of Engineers, Honolulu District



Waimea Cell – Beach Volume Change Rate



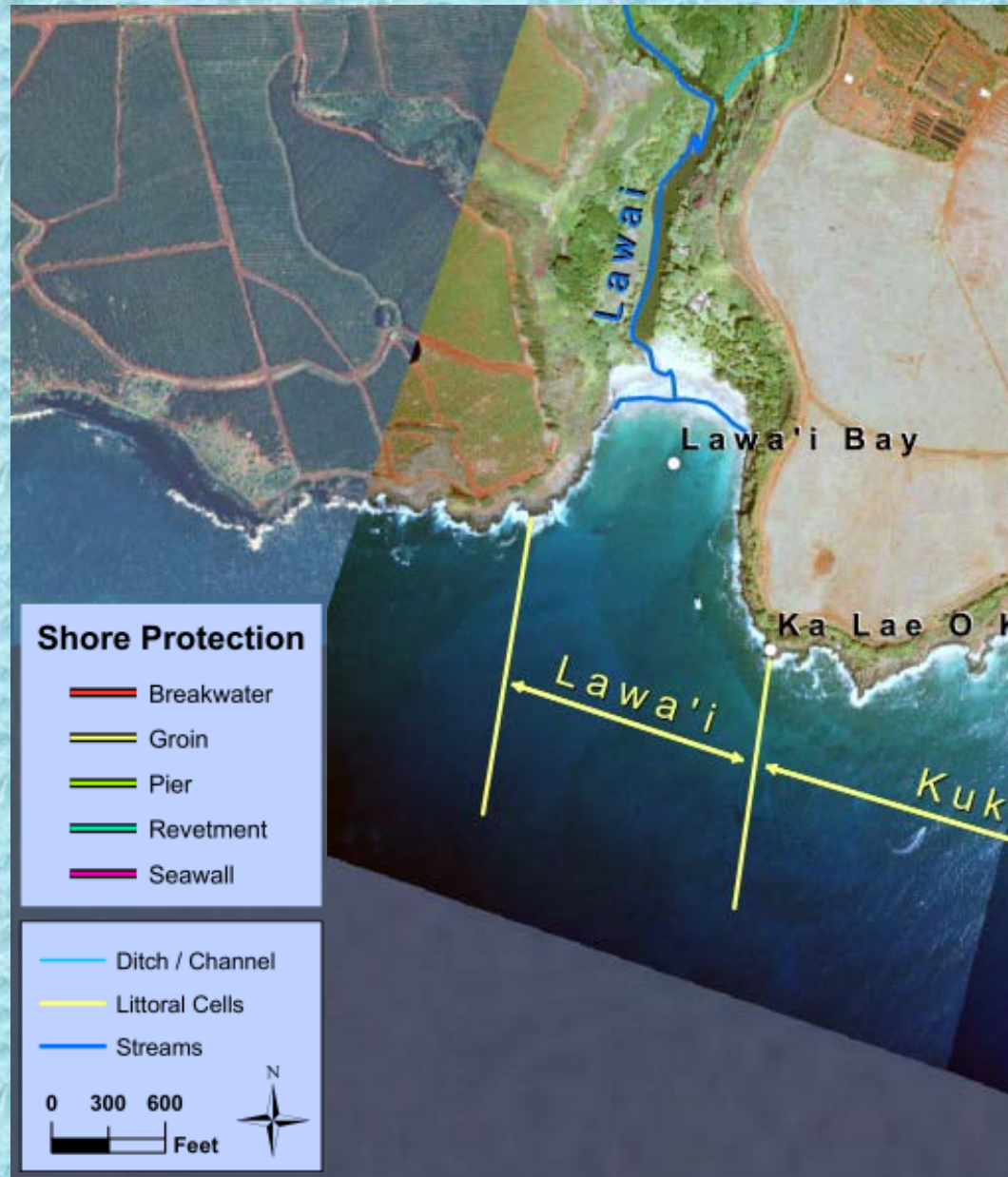
Additional Slides – Poipu Region

co-sponsored by:

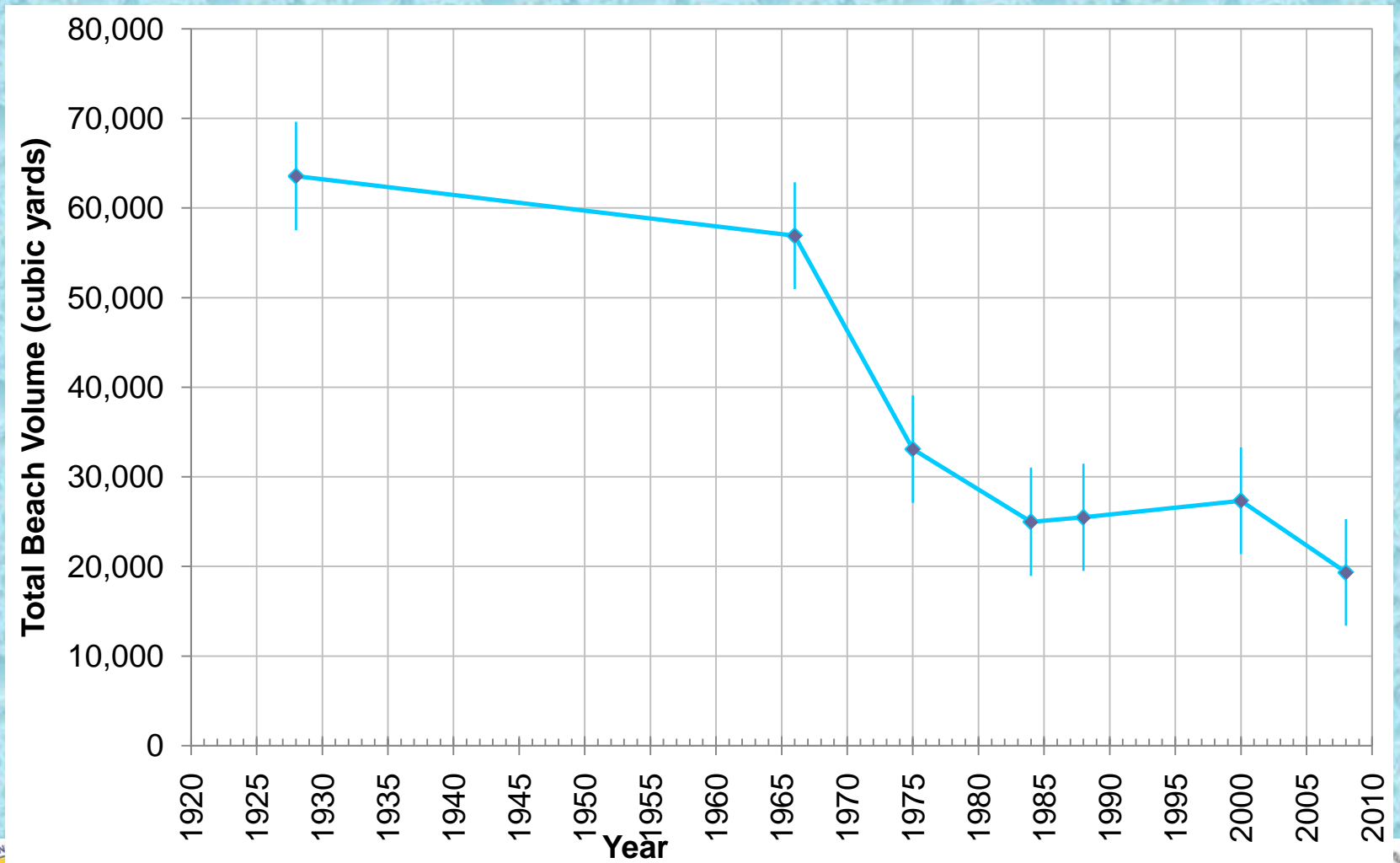
State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



Lawa'i Cell – Shoreline Features



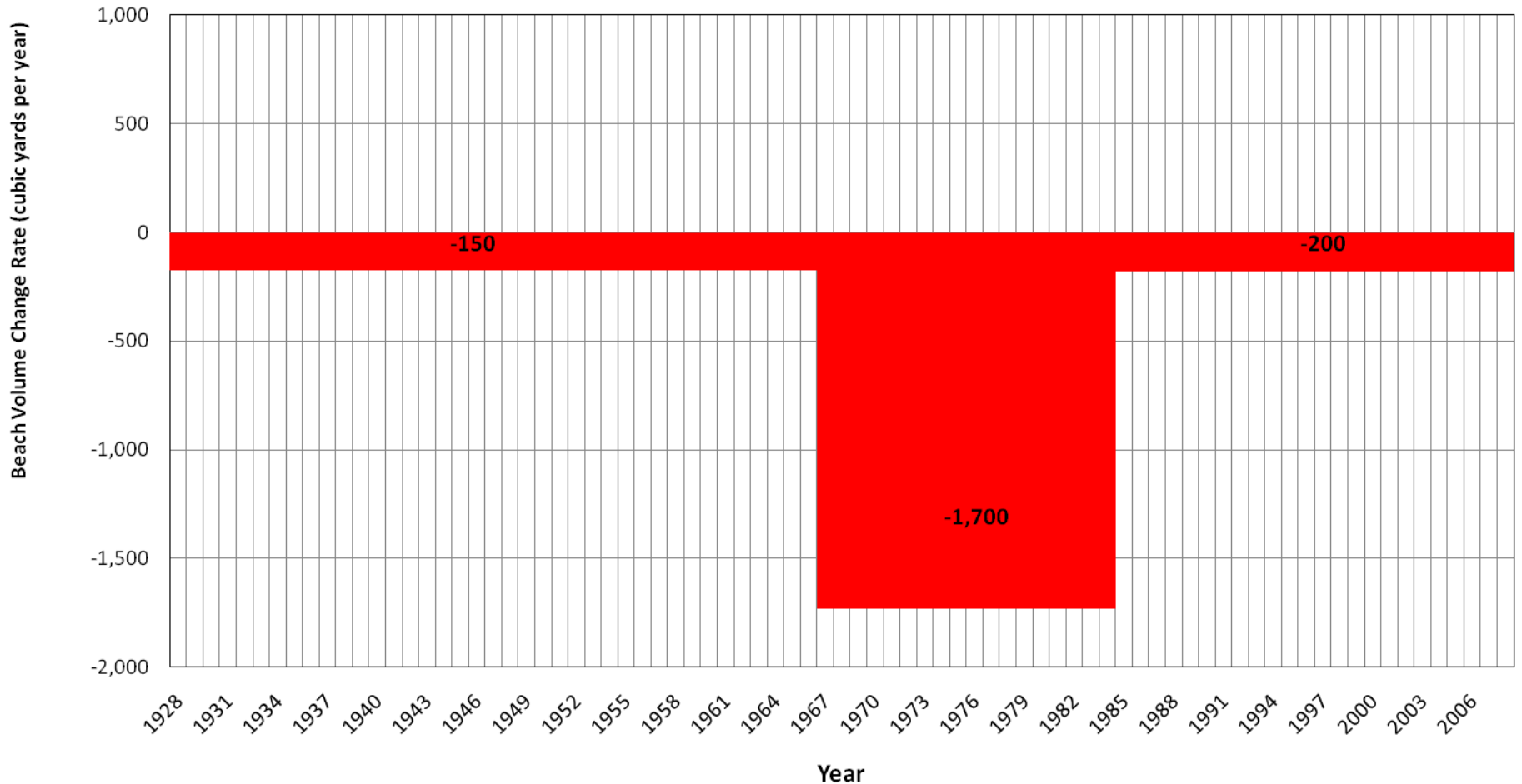
Lawa'i Cell – Beach Volume History



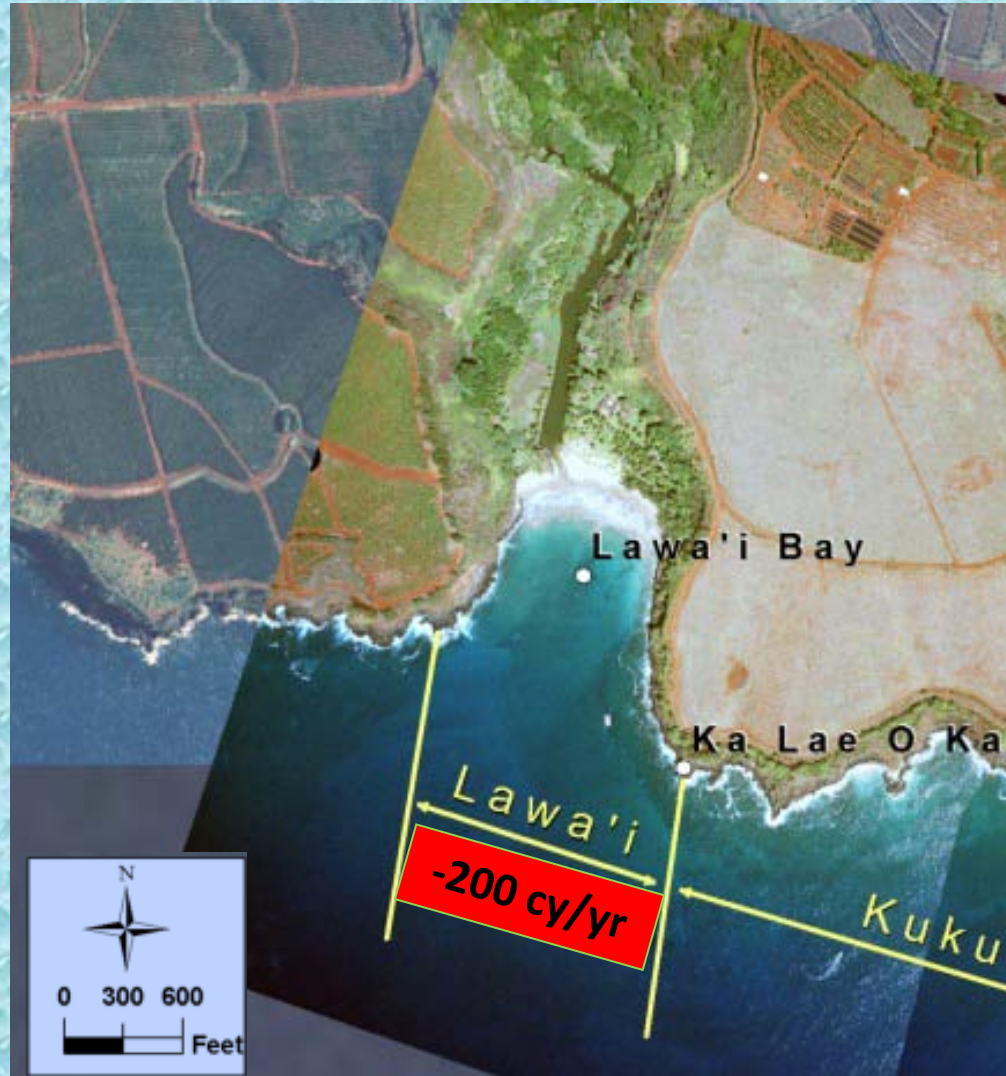
State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



Lawa'i Cell – Beach Volume Change Rate History



Lawa'i Cell – Beach Volume Change Rate



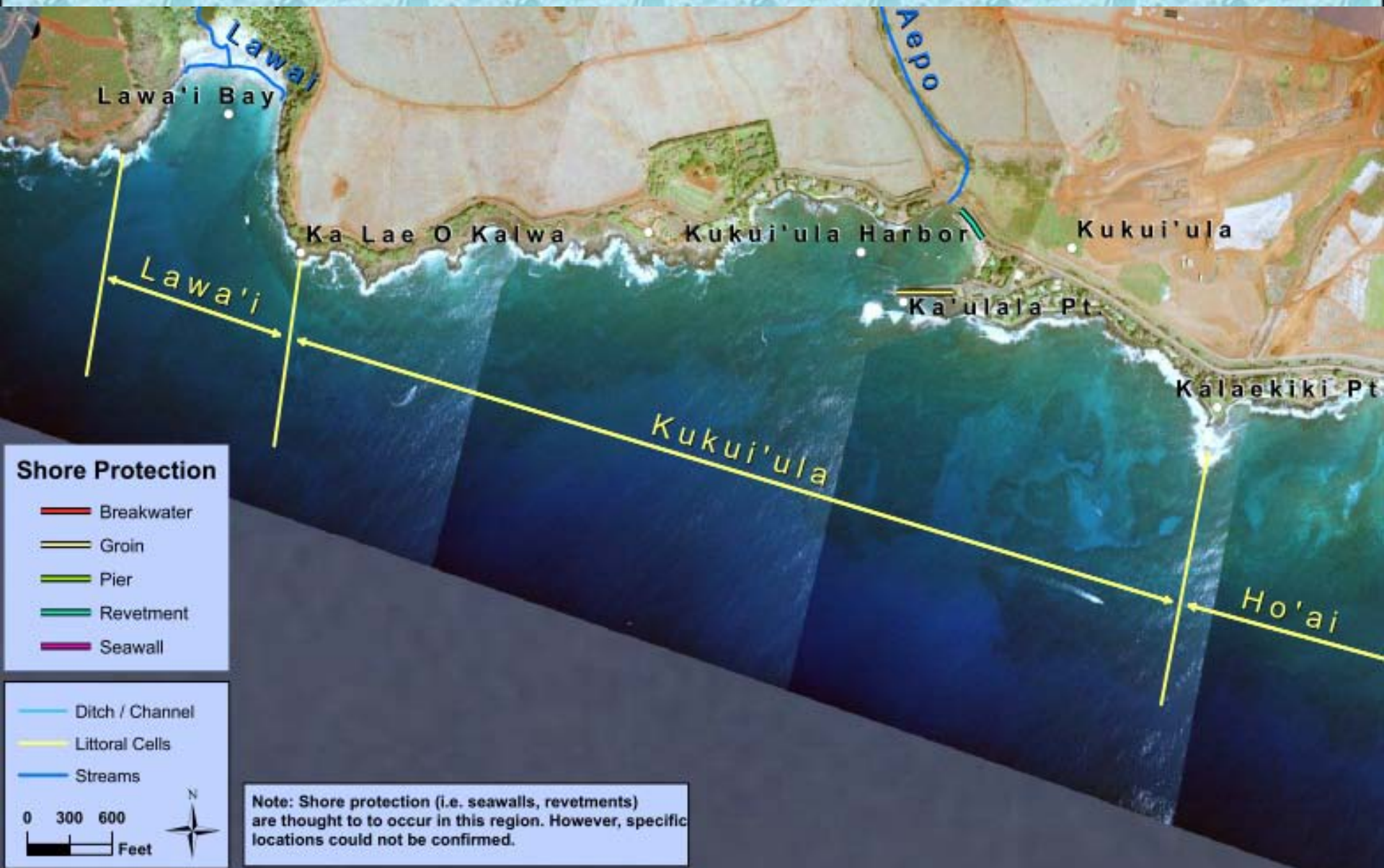
co-sponsored by:

State of Hawaii Department of Land and Natural Resource

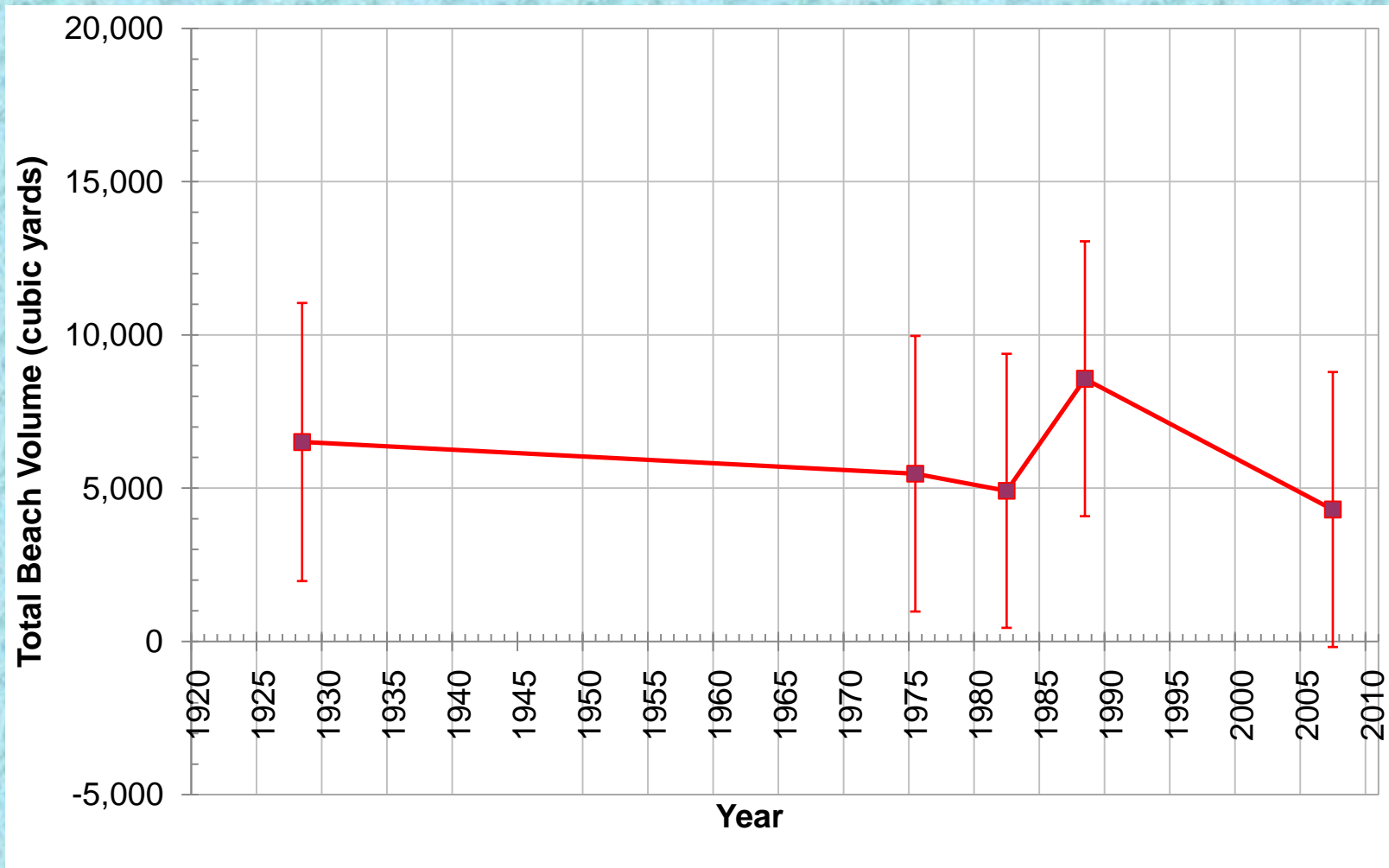
US Army Corps of Engineers, Honolulu District



Kukui'ula Cell – Shoreline Features



Kukui'ula Cell – Beach Volume History

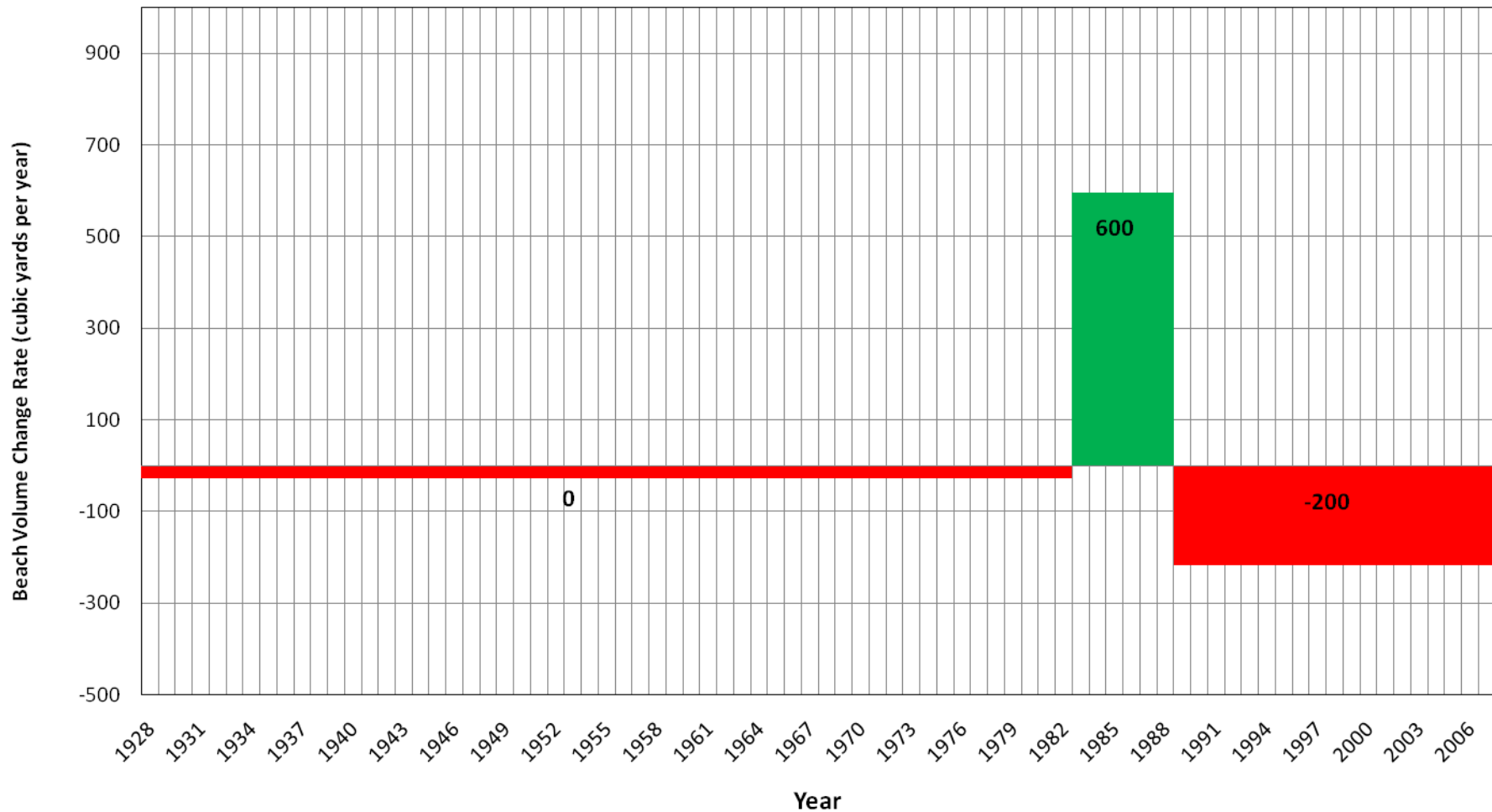


co-sponsored by:

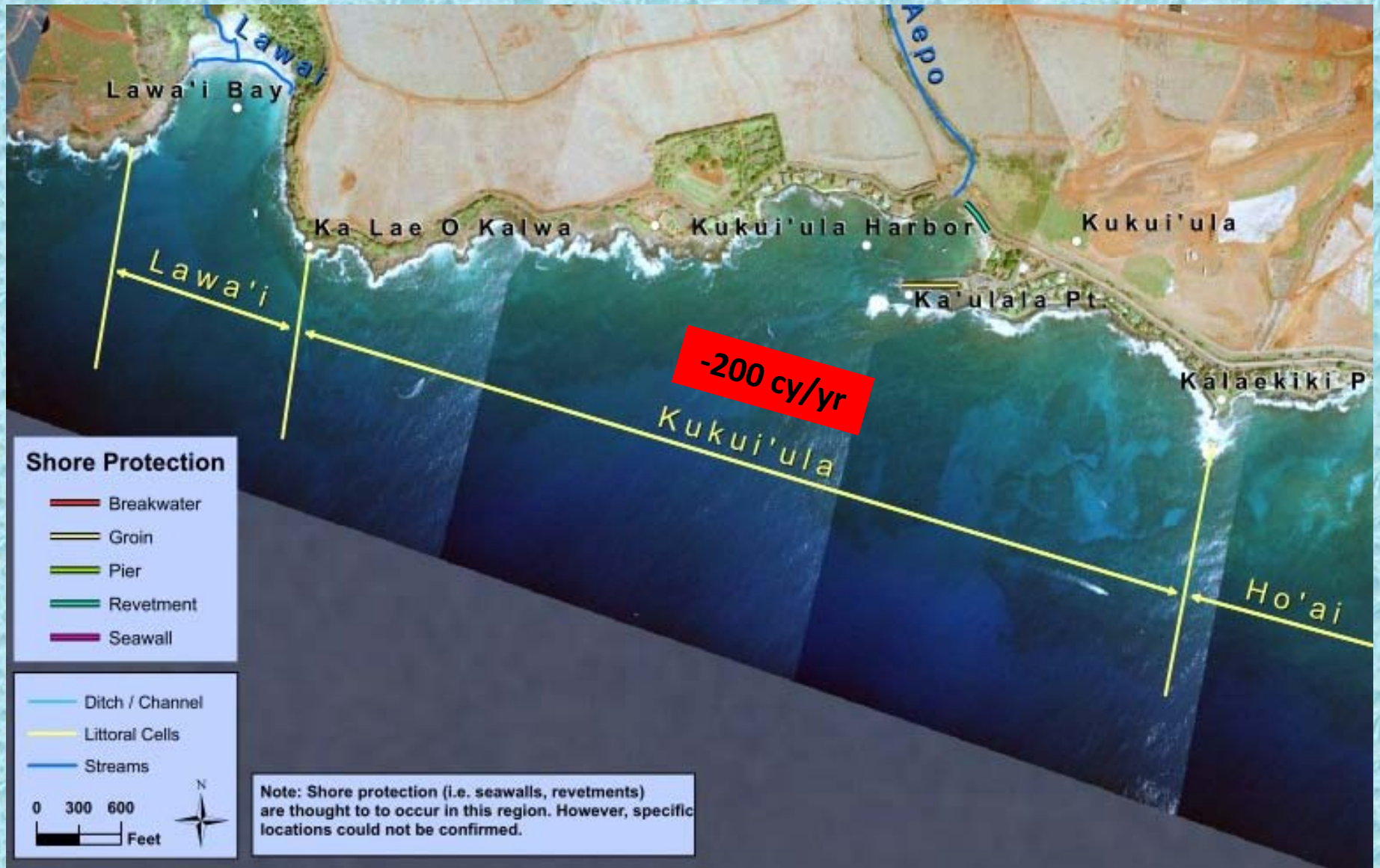
State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



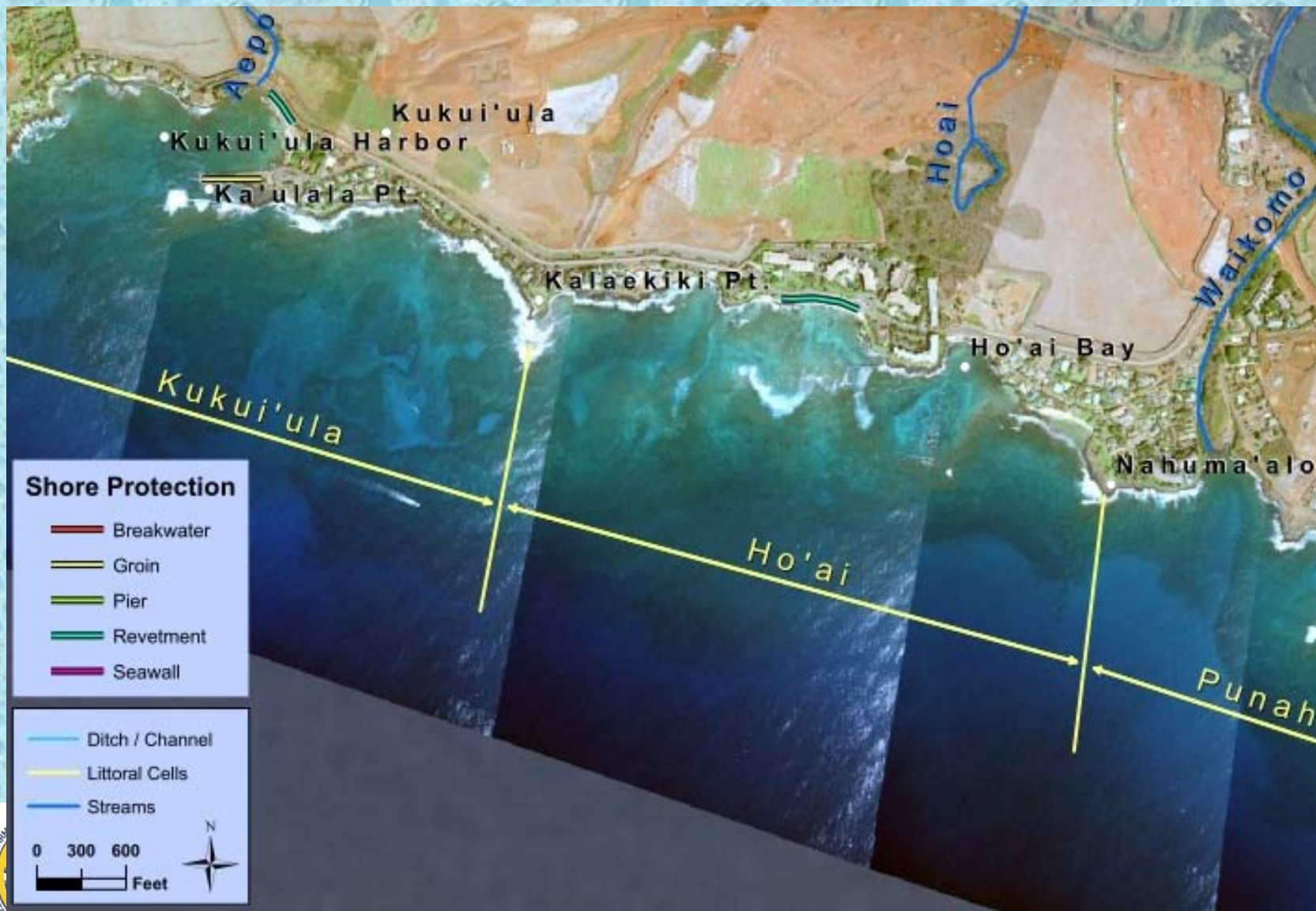
Kukui'ula Cell – Beach Volume Change Rate History



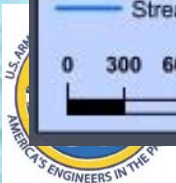
Kukui'ula Cell – Beach Volume Change Rate



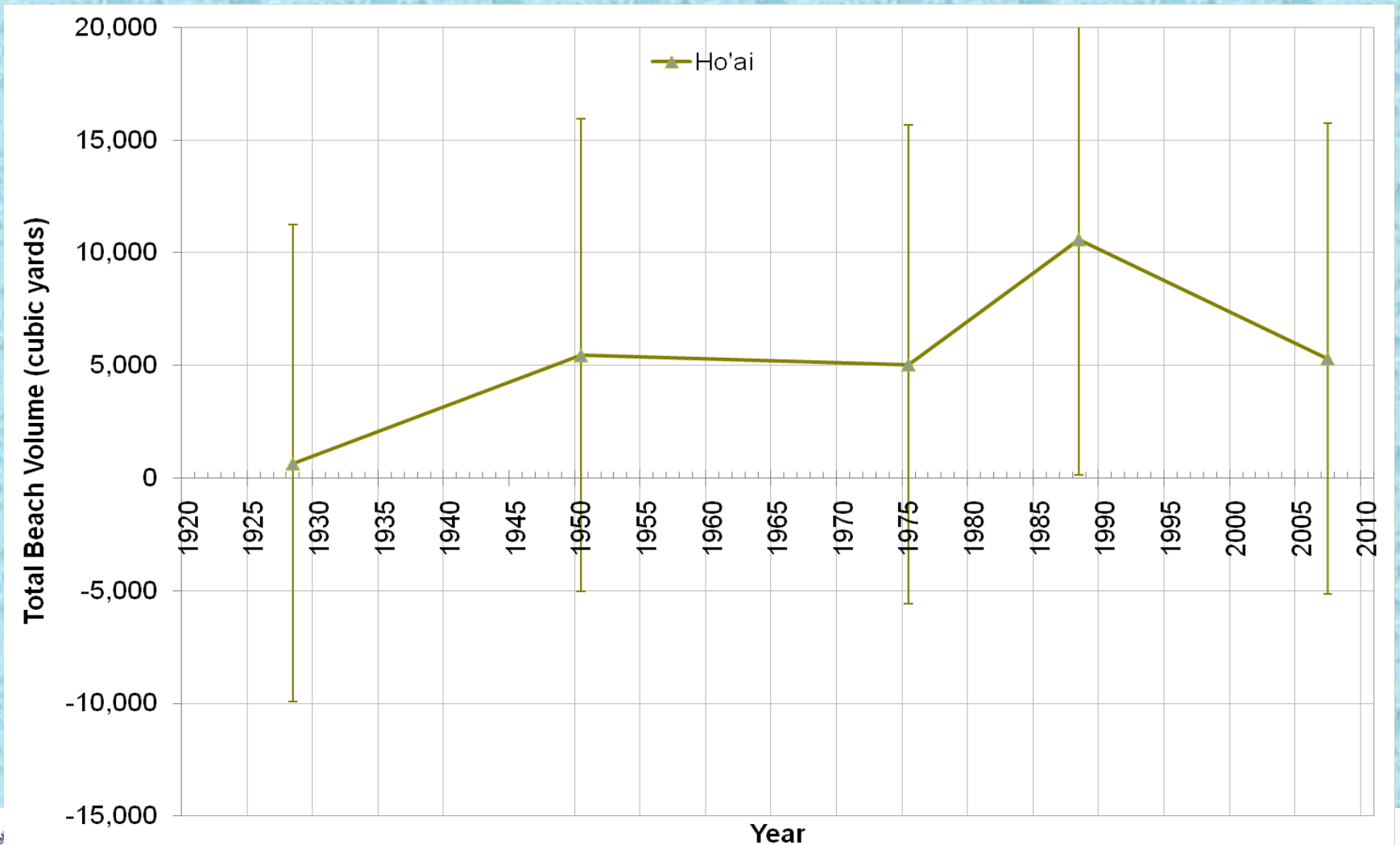
Ho'ai Cell – Shoreline Features



US Army Corps of Engineers, Honolulu District



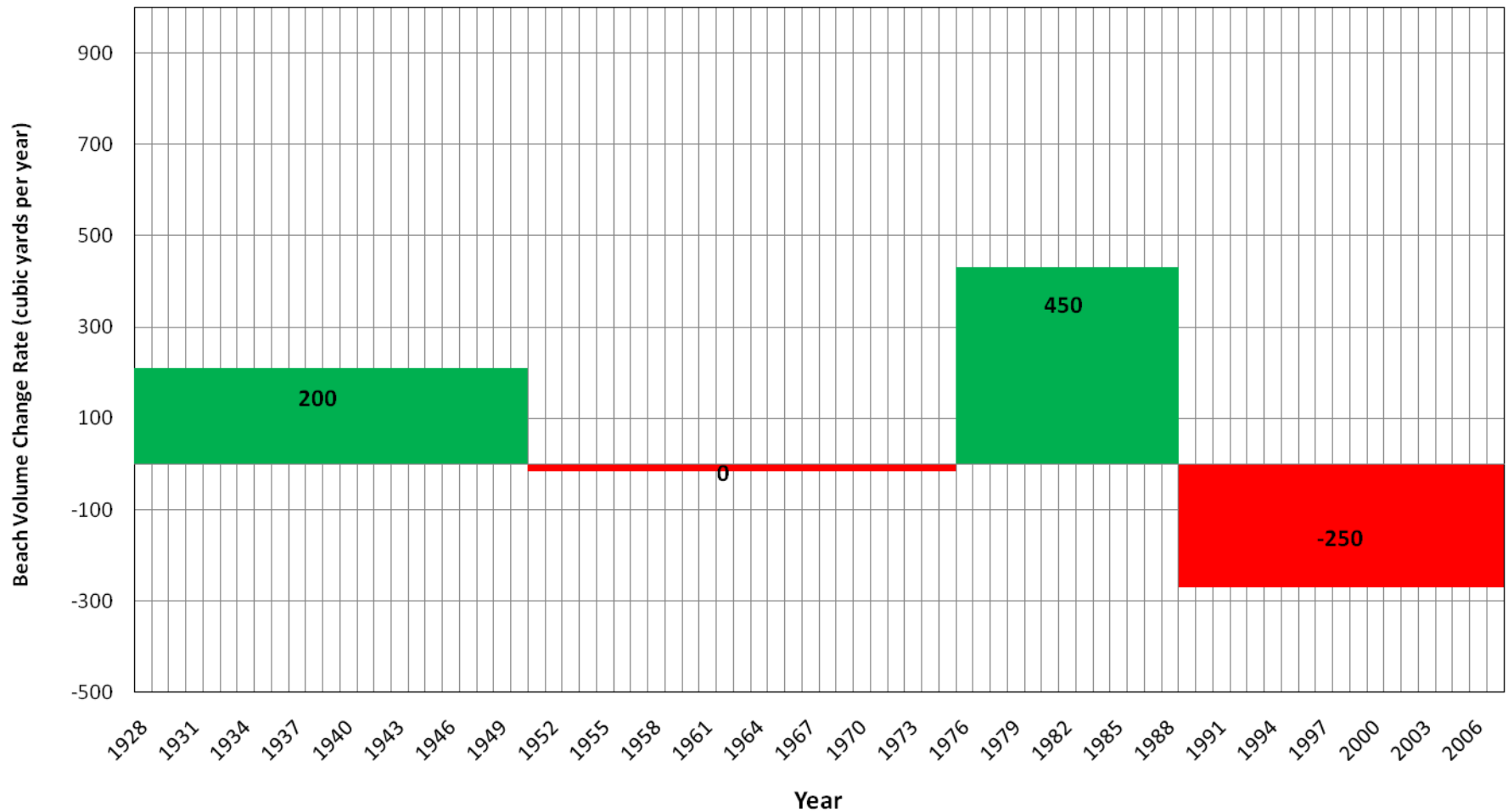
Ho'ai Cell – Beach Volume History



State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



Ho'ai Cell – Beach Volume Change Rate History



US Army Corps of Engineers, Honolulu District



Ho'ai Cell – Beach Volume Change Rate



co-sponsored by:

State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



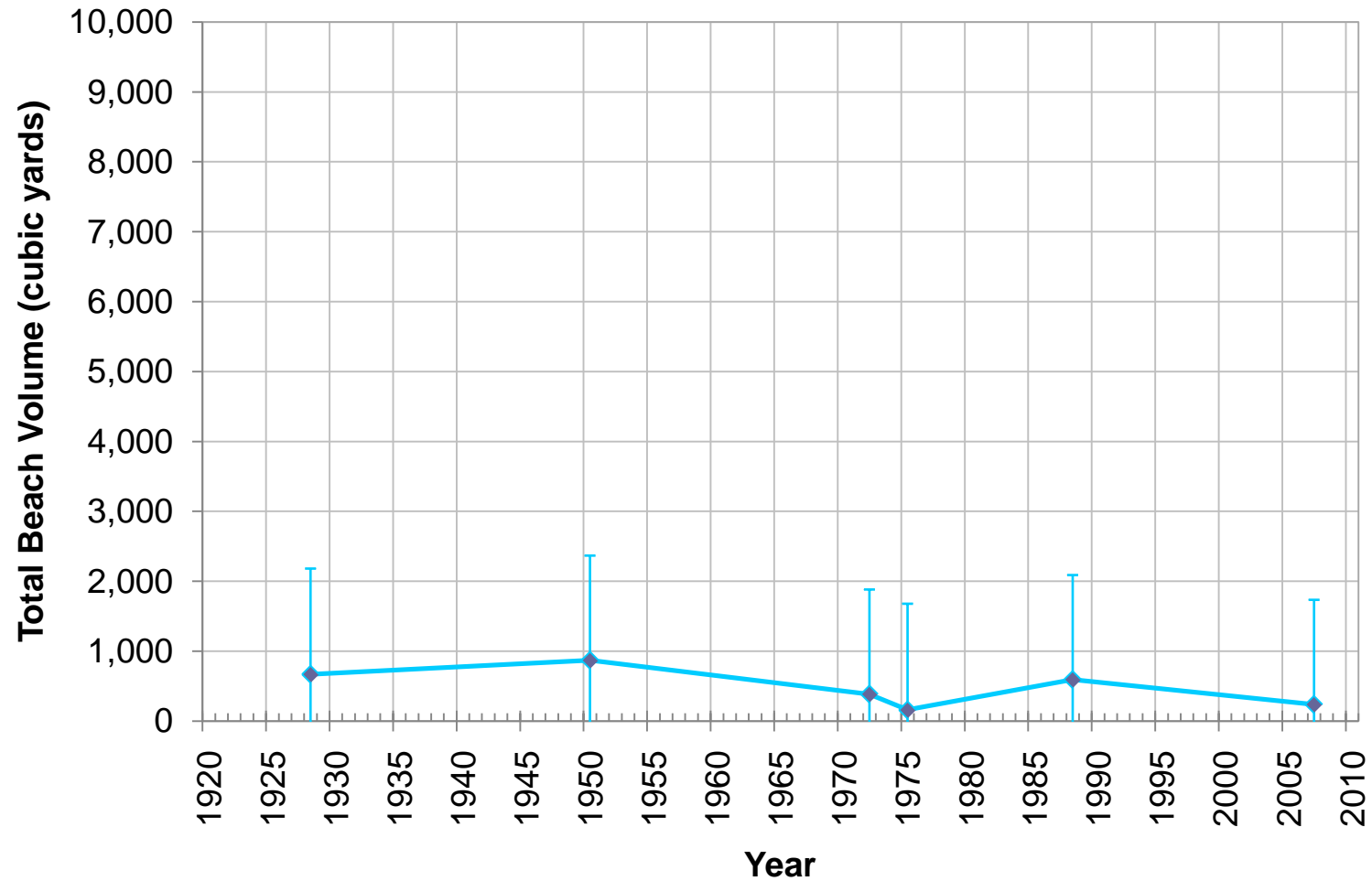
Punahoa Cell – Shoreline Features



US Army Corps of Engineers, Honolulu District



Punahoa Cell – Beach Volume History



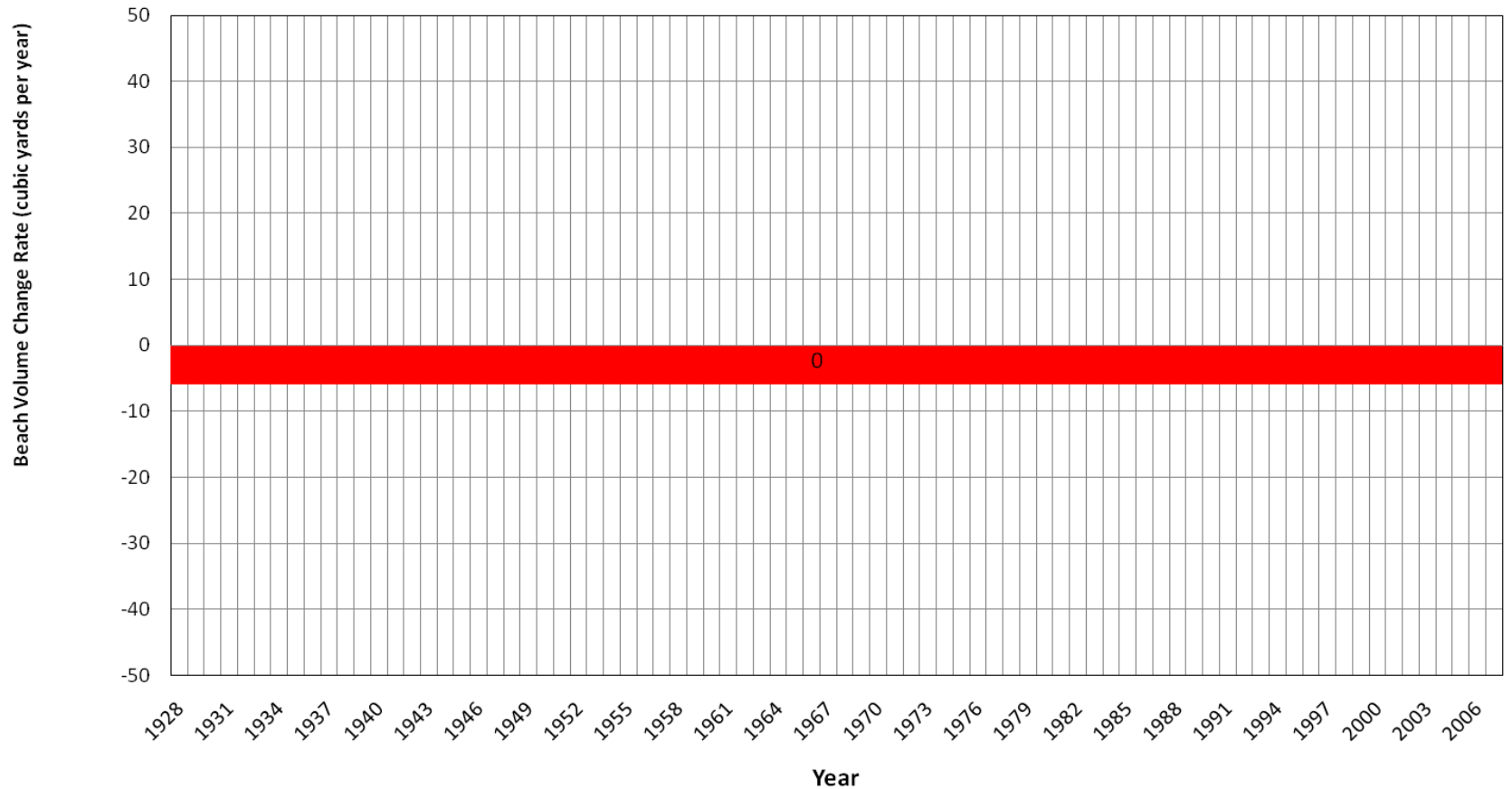
co-sponsored by:

State of Hawaii Department of Land and Natural Resource

US Army Corps of Engineers, Honolulu District



Punahoa Cell – Beach Volume Change Rate History



co-sponsored by:

State of Hawaii Department of Land and Natural Resource

US Army Corps of Engineers, Honolulu District



Punahoa Cell – Beach Volume Change Rate



co-sponsored by:

State of Hawaii Department of Land and Natural Resource

US Army Corps of Engineers, Honolulu District



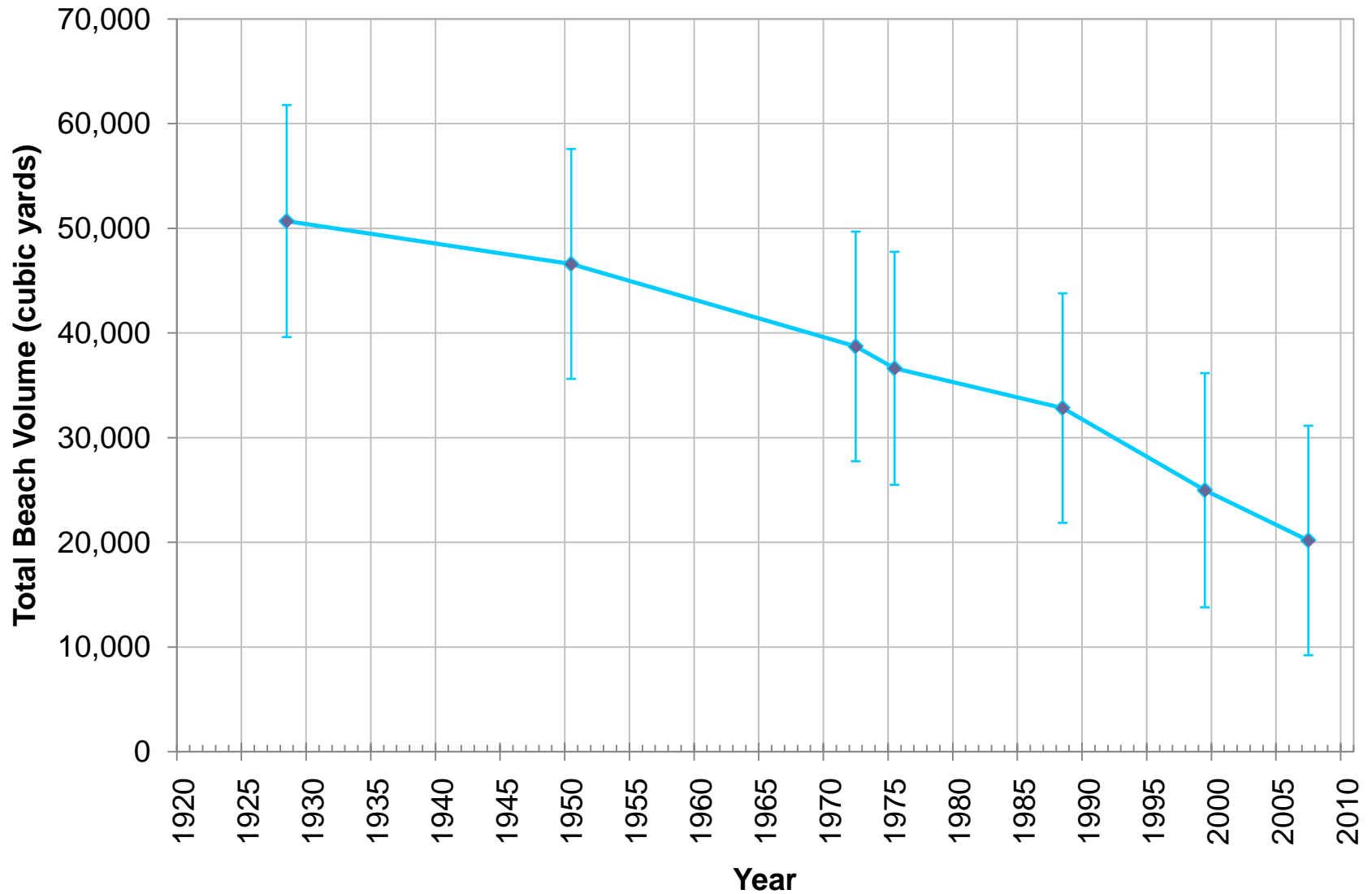
West Poipu Cell – Shoreline Features



US Army Corps of Engineers, Honolulu District



West Poipu Cell – Beach Volume History

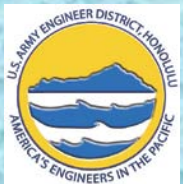
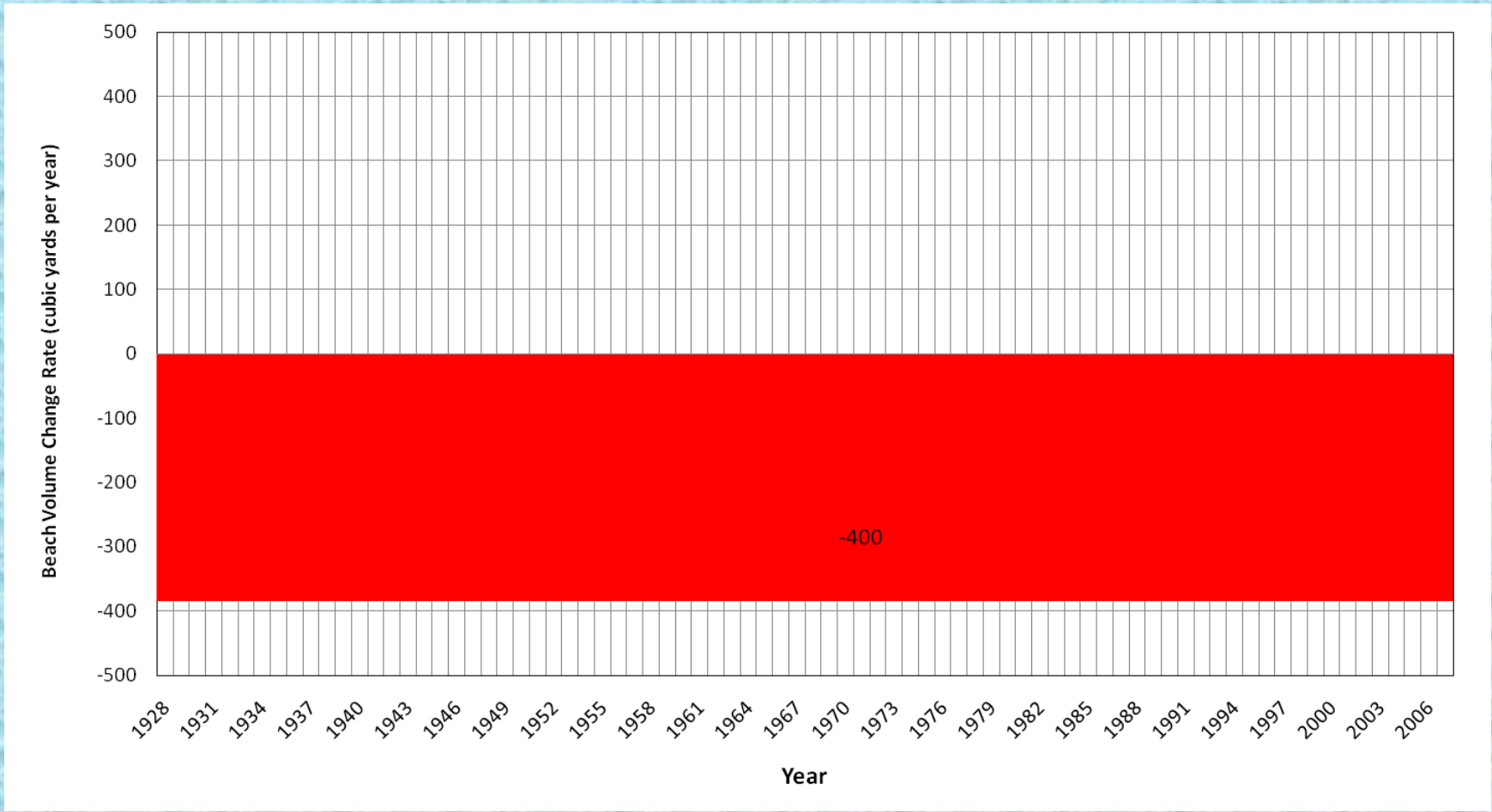


State of Hawaii Department of Land and Natural Resources

US Army Corps of Engineers, Honolulu District



West Poipu Cell – Beach Volume Change Rate History

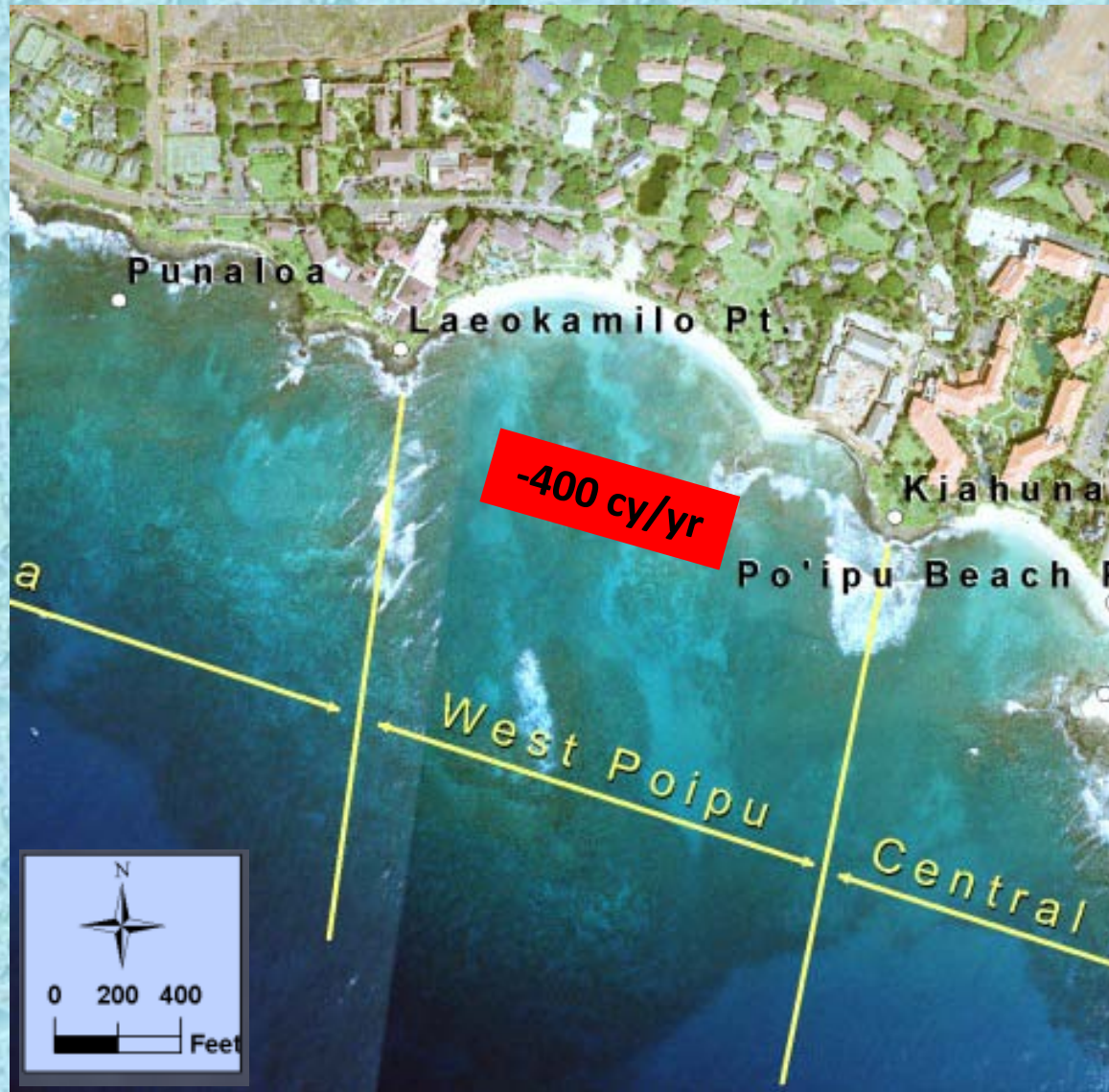


co-sponsored by:

State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



West Poipu Cell – Beach Volume Change Rate



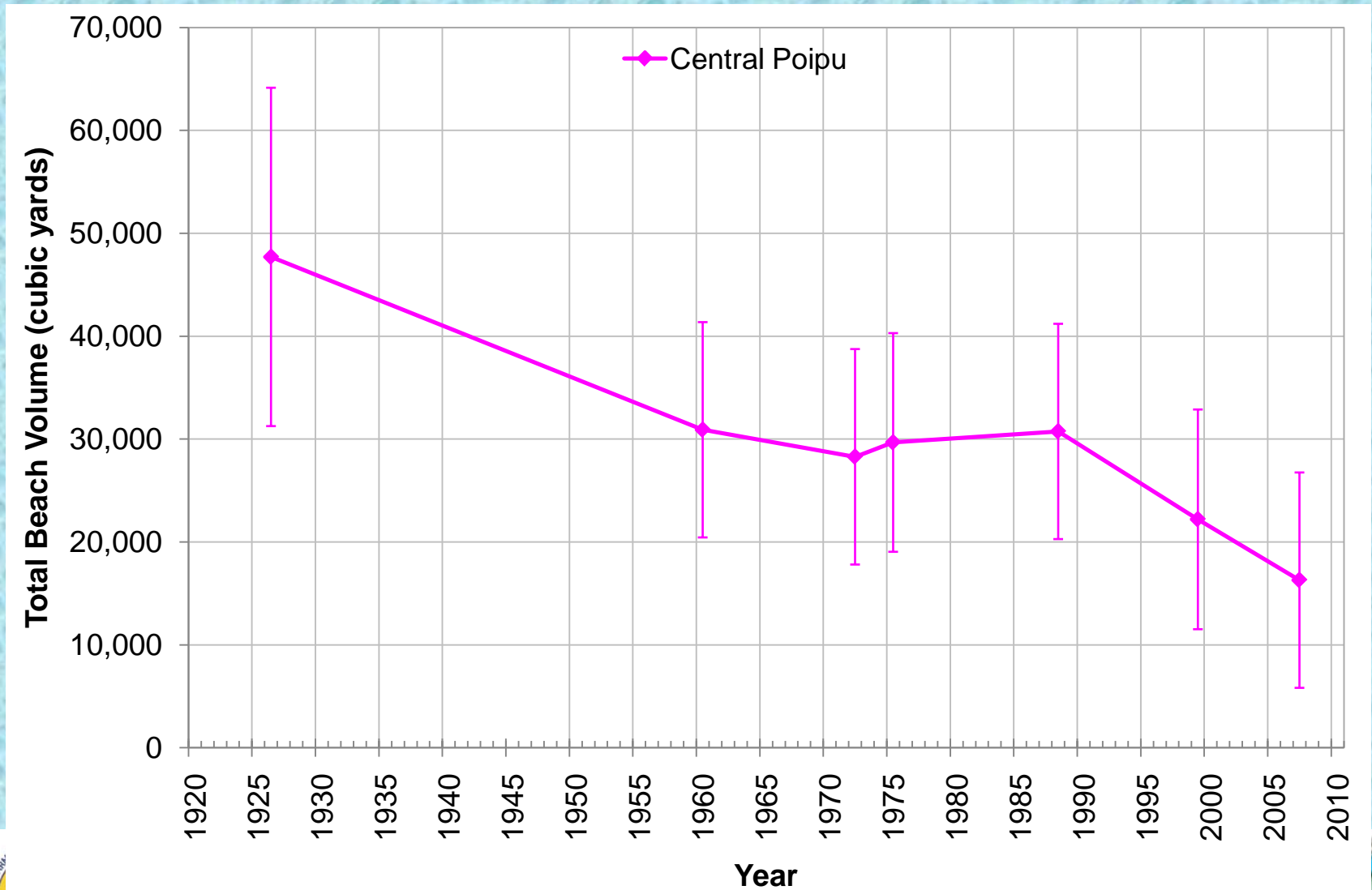
US Army Corps of Engineers, Honolulu District



Central Poipu Cell – Shoreline Features



Central Poipu Cell – Beach Volume History

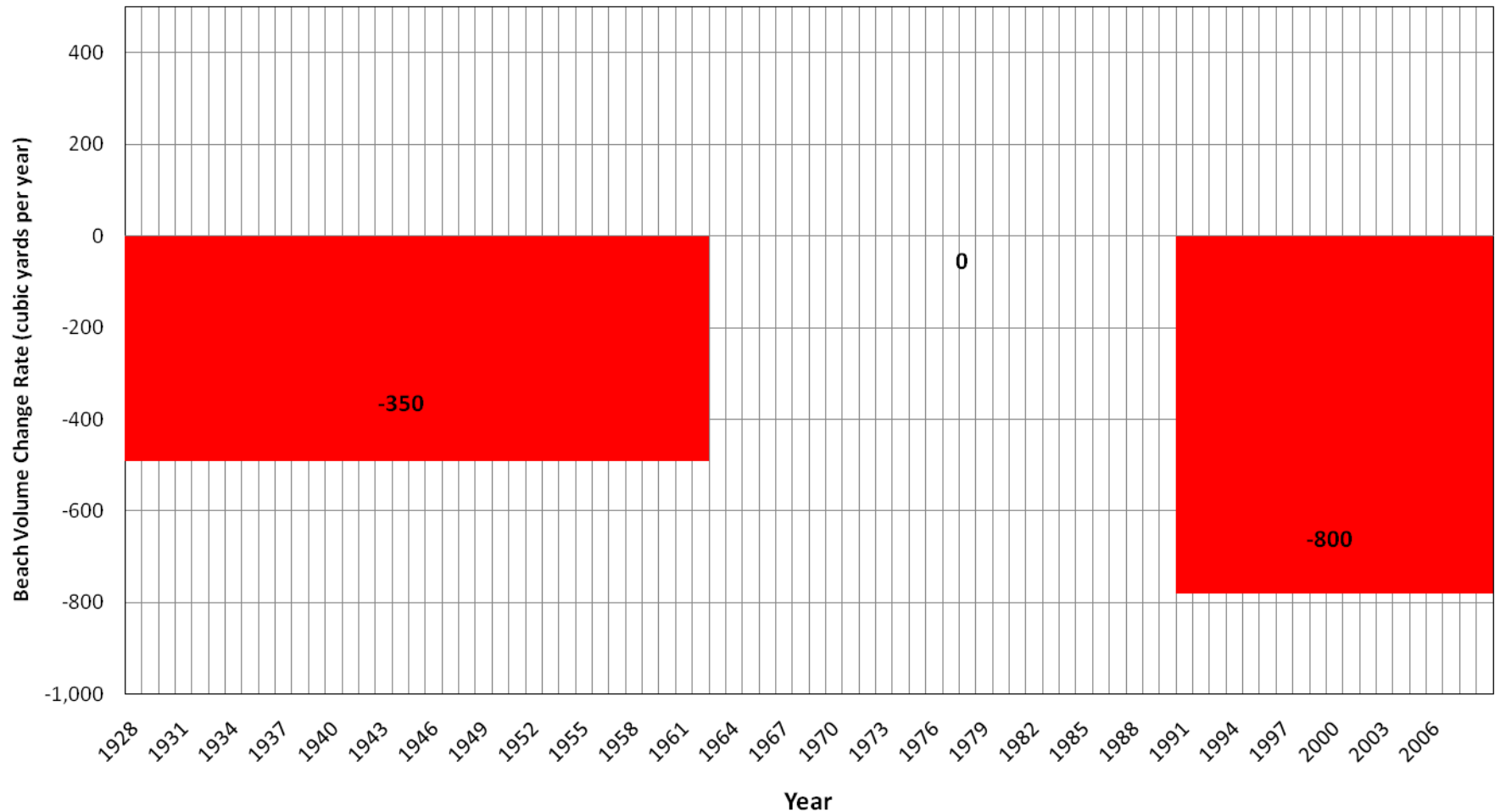


State of Hawaii Department of Land and Natural Resource

US Army Corps of Engineers, Honolulu District



Central Poipu Cell – Beach Volume Change Rate History



Central Poipu – Beach Volume Change Rate



US Army Corps of Engineers, Honolulu District



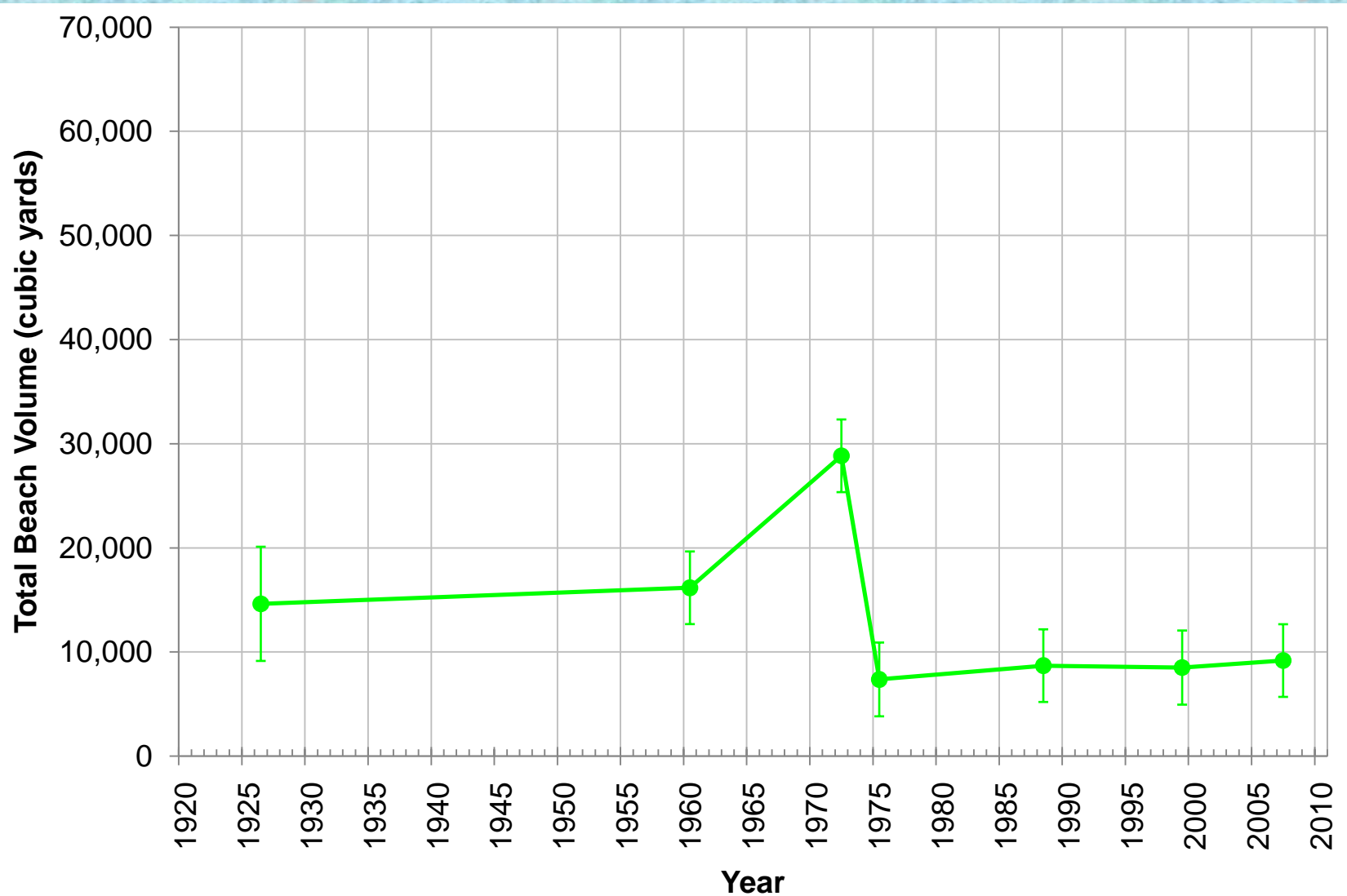
East Poipu Cell - Shoreline Features



US Army Corps of Engineers, Honolulu District



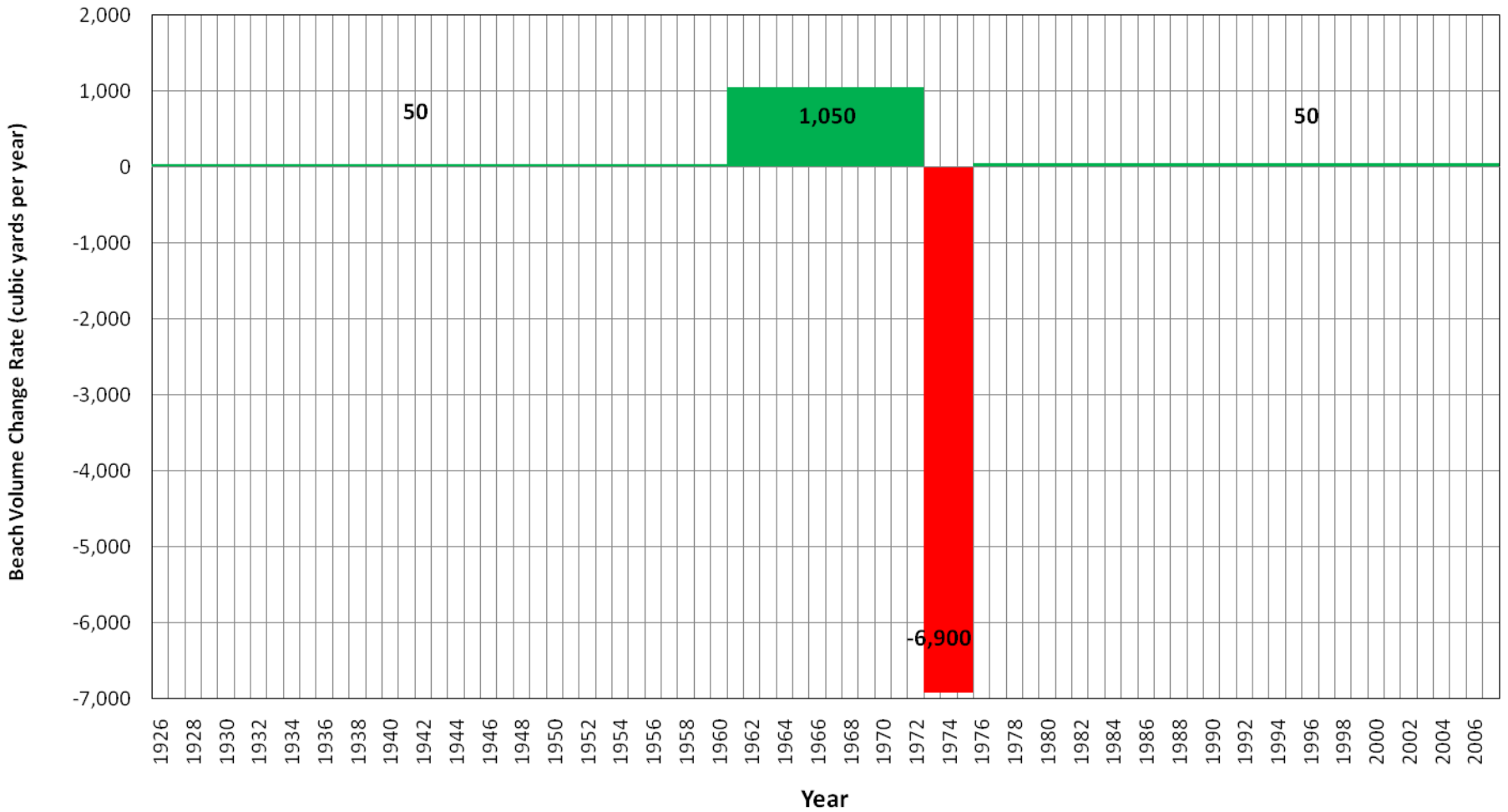
East Poipu Cell – Beach Volume History



State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



East Poipu Cell – Beach Volume Change Rate History



East Poipu– Beach Volume Change Rate



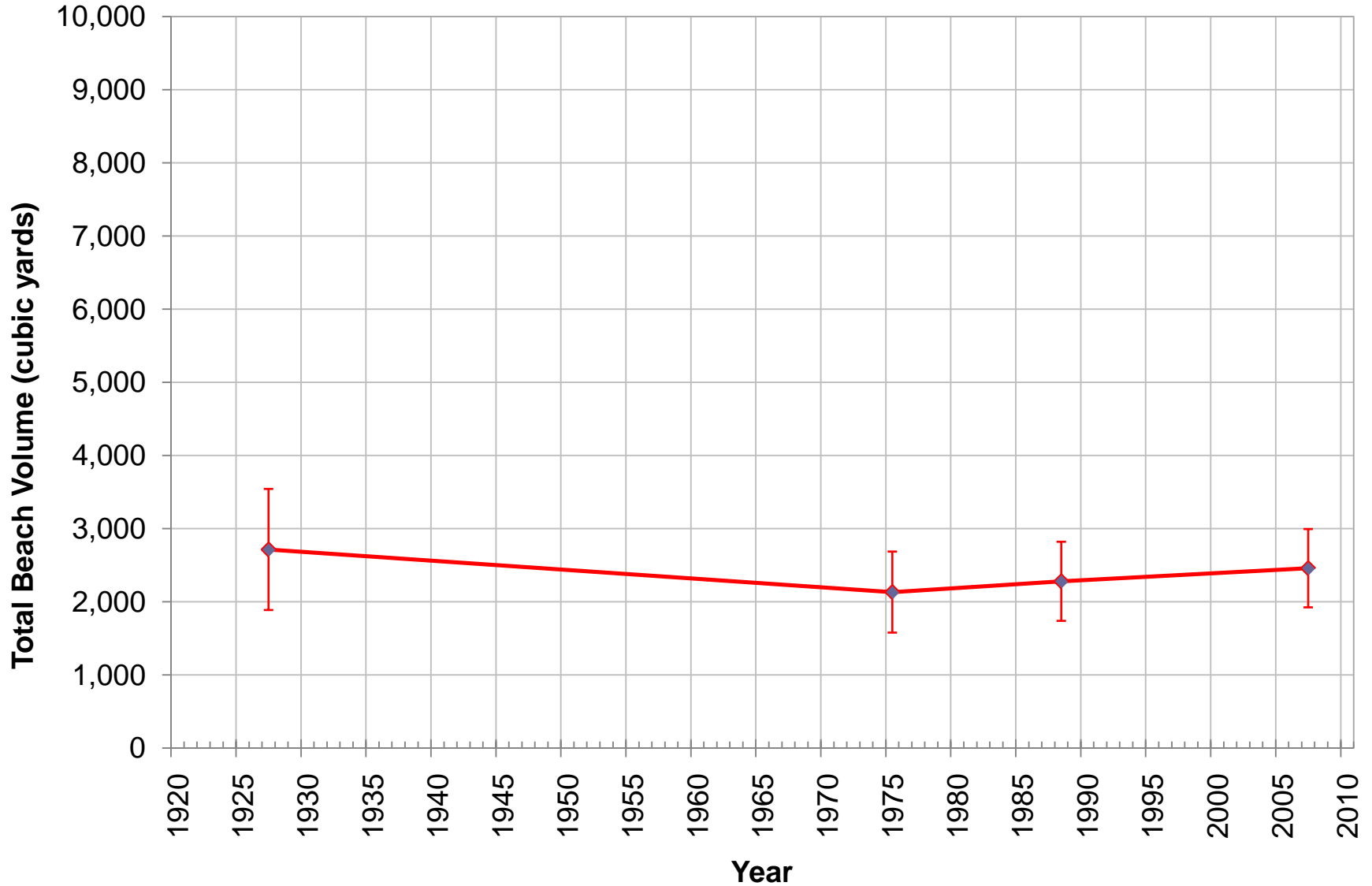
US Army Corps of Engineers, Honolulu District



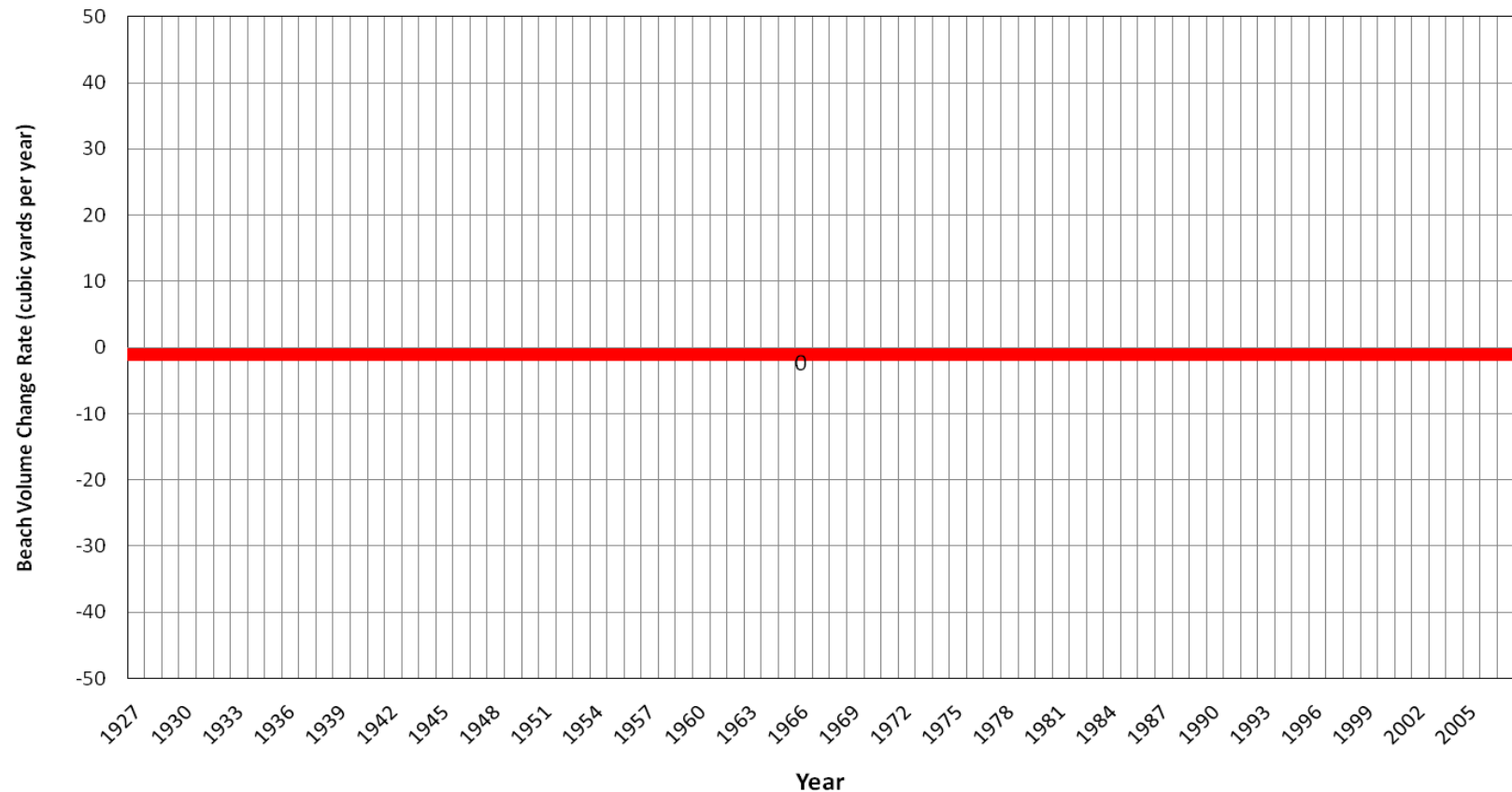
Shipwreck Beach Cell – Shoreline Features



Shipwreck Cell – Beach Volume History



Shipwreck Cell – Beach Volume Change Rate History

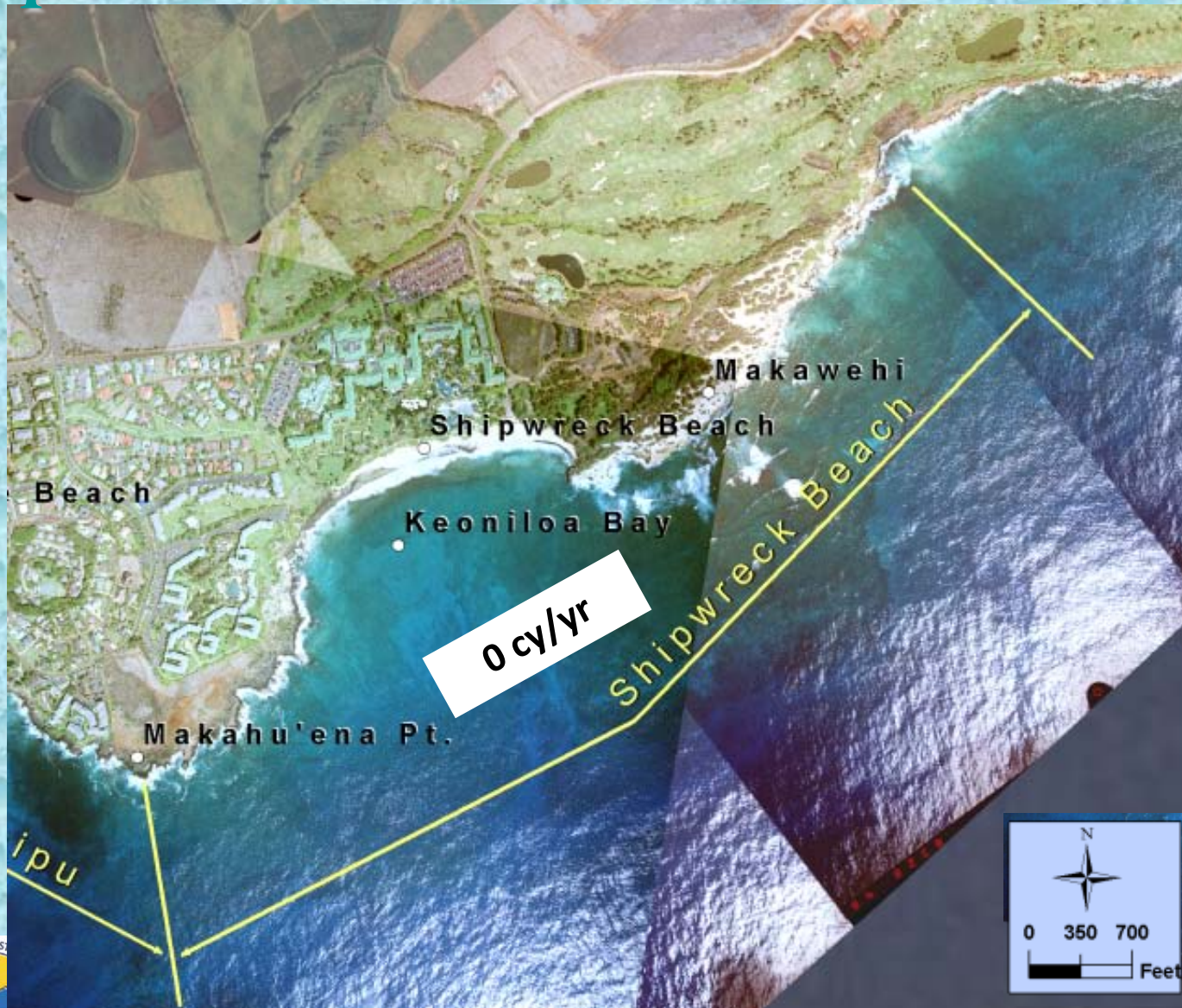


co-sponsored by:

State of Hawaii Department of Land and Natural Resource
US Army Corps of Engineers, Honolulu District



Shipwreck Cell– Beach Volume Change Rate



State of Hawaii Department of Land and Natural Resource

US Army Corps of Engineers, Honolulu District

