

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
OFFICE OF CONSERVATION AND COASTAL LANDS
Honolulu, Hawai'i

180-Day Exp. Date: April 29, 2014

April 11, 2014

**Board of Land and
Natural Resources
State of Hawai'i
Honolulu, Hawai'i**

REGARDING: Conservation District Use Application (CDUA) MA-3688
Wailuku-Kahului Wastewater Reclamation Facility's Shoreline Protection
Extension

APPLICANT: County of Maui Department of Environmental Management
LANDOWNER: State of Hawai'i/ Executive Order 3006

LOCATION: 281 Amala Place, Kahului, Maui

TAX MAP KEY: (2) 3-8-001:188 and Adjacent Submerged Land

SUBZONE: Limited and Resource

BACKGROUND/HISTORY:

On July 28, 1972, the Board of Land and Natural Resources (Board) approved Conservation District Use Permit (CDUP) MA-349 to establish the Kahului Sewage Treatment Plant at the subject location to serve the communities of the Central Maui region.

On October 13, 1978, the Board approved CDUP MA-1074 by the U.S. Army Corps of Engineers to construct 450 linear feet of a planned 1,500 foot long revetment to provide emergency shoreline erosion protection for two injection wells and a holding pond at the subject facility. The project was limited to 450-feet due to limited funding (**Exhibit A**).

In 1980, the land was set aside to the County of Maui that has vested control and management of the property for sewage treatment plant purposes under Governor's Executive Order No. 3006.

On January 11, 2002, the Board approved CDUP MA-3047 for the County of Maui's Department of Public Works for tsunami protection measures including below grade structural and footing reinforcement; addition of walls and flood doors at grade and relocation of components above the 100-year tsunami wave height.

DESCRIPTION OF AREA (Exhibit B & C)

The Wailuku-Kahului Wastewater Reclamation facility is located on the north coastline of Maui approximately 0.5- miles east of Kahului Harbor and 1.0-miles west of Kahului Airport, at 281 Amala Place and lies within in the Limited subzone of the Conservation District. Proposed

improvements will extend into adjacent submerged State land within the Resource subzone of the Conservation District makai of the subject parcel.

The project site is in an industrial area and is adjacent to the shoreline. A drainage canal with Mauoni Pond beyond is to the west; the roadway, Amala Place is to the south with Kanaha Pond Wildlife Sanctuary across the road. The ocean/beach is to the north and is part of Kanaha Beach Park, a narrow beach that extends eastward to Paia that is interrupted by numerous man-made groins.

According to the application, the wastewater reclamation facility provides secondary treatment of sewage and features an activated sludge biological treatment process, secondary clarification, and filtration. The principle solids treatment and handling processes are aerobic digestion and centrifuge dewatering. The final effluent is disposed of primarily via 8 gravity injection wells. The balance of the effluent is recycled for plant use, irrigation and dust control. According to the final Environmental Impact Statement (EIS) for the Proposed Shoreline Protection Extension, the plant is expected to reach capacity in fifteen years (2029) and will need upgrades.

A biological survey of the project area identified common shoreline plants such as naupaka, akiaki, pohuehue and heliotrope. A single nehe plant was the only endemic species located during the survey. A tree tobacco plant that is host to the endangered Blackburn's sphinx moth was also identified.

Biological resources that would be found in the project area include crustaceans and shore-birds. A marine biota survey noted the black foot opihi as the only endemic invertebrate species observed during the survey and the Hawaiian green lionfish and ornate wrasse as the only endemic fish observed. Two coral colonies were located in the area of potential effect. Both colonies were small and located about 50-feet offshore.

The threatened Green Sea Turtle is known to frequent the waters fronting the site. According to the applicant, no other protected, endangered or threatened species are anticipated to utilize neither the project site nor the near shore waters fronting the site. Although no critical habitat is known to exist at the project site, the Kanaha Pond Wildlife Sanctuary is directly inland of the facility and is home to the Hawaiian stilt and coot which are both endangered endemic birds. The pond is also critical habitat for the endangered Blackburn's sphinx moth.

An archaeological assessment survey and an archaeological monitoring plan have been completed. The January 2008 Chapter 6E review by the State Historic Preservation Division has determined it is unlikely that any historic properties will be affected with the implementation of the accepted monitoring plan.

The beach and ocean waters are extensively used by the public. Traditional and customary uses include recreation, fishing, diving and reflection. Lateral access along the existing eastern revetment is possible along the revetment in front of the facility fence.

Studies completed included a geotechnical report that identified that the underlying soil encountered was predominantly sand. The site is relatively flat and ranges in elevation from 6-10-feet above mean sea level (msl). The project site is located within Flood Zone VE with base flood elevations of 15-20-feet msl. Flood Zone VE is a coastal flood zone with velocity hazard

from wave action and determined base flood elevations. The project site is situated within the tsunami evacuation area.

Coastal Hazards (Exhibits D, E & F)

The final EIS notes the shoreline seaward of the facility is experiencing significant rates of erosion. The 2012 Engineering Report included in the EIS states shoreline erosion occurs due to a deficit of sand in the system as a result of historic removal. Other contributing factors to erosion include loss to wind, reduced coral reef productivity, sand grain abrasion and relative sea level rise. By the 1920' beach erosion to the east towards Paia, was a concern and seawalls and rock groins were constructed prior to 1940 to mitigate and prevent beach loss.

According to the University of Hawai'i's Coastal Geology Group the average annual erosion hazard rate appears to be -2.4-feet per year¹. According to the Atlas of Natural Hazards in the Hawaiian Coastal Zone², "The hazard of high waves and storms along the Wailuku coastline is ranked moderately high due to its exposure to annual wave heights of 20-feet during the winter and to hurricanes approaching from the east. Erosion is a serious threat to this low-lying and mostly unconsolidated shoreline due to the persistent high wave energy reaching this coast year round. Erosion is ranked high, sea-level rise is ranked moderately high and Haleakala, considered dormant by most geologist, rather than extinct represents a considerable potential future hazard to Maui residents."

A recent report³ out of the School of Ocean and Earth Science and Technology at the University of Hawai'i utilizes LiDAR remote sensing and GIS to create vulnerability maps, a valuable tool for policy making adaptive strategies in response to future sea level rise. The vulnerability maps from this study illustrate the potential effects of sea level rise on Kahului utilizing a 'best case' scenario and a 'worst case' scenario and states, "Coastal planners may be able to identify facilities that need to be relocated by moving further back from the coast in a planned retreat." In the worst case scenario, the facility appears as an island with Kanaha Pond totally submerged and part of the ocean. More recent work indicates that a sea level rise of 40-inches by 2100 is "highly likely."

Erosion threatens several structures at the facility including structures which cannot be moved.

PROPOSED USE (Exhibits G, H, I, J, K & L)

According to the information submitted, the proposed action involves the construction of an approximately (≈) 1,100-ft rock mound revetment extension to the west of the existing 1978 revetment. Landward extensions of ≈ 125-ft in length at each end of the revetment will be placed to prevent flanking erosion. The overall length of the revetment with the landward extensions will be ≈ 1,350-ft.

¹<http://www.soest.hawaii.edu/coasts/erosion/maui/>. Coastal Geology Group. (2003) University of Hawai'i School of Coastal and Earth Science and Technology.

² http://pubs.usgs.gov/imap/i2761/sections/5_Maui.pdf Atlas of Natural Hazards in the Hawaiian Coastal Zone (2002) Fletcher III, Charles H.; Grossman, Eric E.; Richmond, Bruce M.; and Gibbs, Ann E.

³ Cooper, H.M., Chen, Q., Flecher, C.H., Barbee, M.M. (2012) Assessing Vulnerability due to sea-level rise in Maui, Hawai'i using LiDAR remote sensing and GIS. © Springer Science+Business Media B.V.2012

Approximately 900-linear feet of the revetment will be installed as far as possible landward to minimize the potential for impacts to biological resources, recreational beach area and adjacent beaches. The landward extension will reduce the length of armored shoreline by almost 70%. Over 800-feet of the proposed revetment will be buried landward of the active beach profile.

At the base of the revetment, a layer of geotextile filter fabric, then a layer of bedding stone and 6-feet of 2-ton armor stone is proposed. Backfill as necessary may take place. Excavation will be required with the excess excavated sand proposed to partially cover the revetment and/or for beach placement. Both excavation and fill will be required to prepare the slope for the new revetment. Any required fill will be of beach-quality sand, and any surplus sand will be used to cover a portion of the revetment.

Approximately 29,000 tons of armor and under layer rock consisting of 20,500 tons of 2-ton armor stone and 8,500 tons of 10" -12" of bedding stone will be utilized. About 3,000-yds³ of beach quality sand from the excavation will be used for the 2-foot earthen cap over the landward portion of the revetment. No further sand will be added to the system.

The crest of the proposed revetment will be +13-ft and the toe of the revetment will be \approx -3-ft. The cap will be planted with salt tolerant grass such as akiaki. The crest elevation of the existing revetment will be raised 3-feet to match the new revetment crest height and to provide additional sea-level rise capacity. An increased crest elevation will reduce the risk of run up and over wash from extreme events and provide added protection against the effects of sea level rise.

The eastern 400-foot portion of the revetment will be constructed over the existing beach berm. Armor stone will be added over the existing revetment to increase the crest elevation from +10 to +13 MLLW to accommodate for sea level rise. The design life of the shoreline protection extension is 50-years.

To ensure public beach access, the public will be able to access the area above the buried revetment, the crest of the exposed revetment and along the area between the existing revetment and facility fence. The applicant has noted one of the drawbacks of this proposal would be the potential for impacts to littoral transport and reduction of beach area as the shoreline continues to recede. The proposed revetment expansion is intended to provide additional protection against high wave activity and tsunamis.

General Construction Activities

The construction base yard, storage and staging areas will be onsite. Typical land-based equipment [Scrapers, Bulldozers and Front Loaders] for rock/excavation work will be utilized. Existing vegetation will be cleared and grubbed for access and working space. Vegetation debris will be disposed of properly.

The contractor will mobilize, stage and access the project site from the property. Excavation will be required both landward and seaward of the shoreline. The contractor will be required to place excavators and similar machinery on the beach during favorable tide, wind, and wave conditions. When working on the beach, appropriate signage and public safety measures shall be provided.

Material from the excavation will be stockpiled on site. Compatible beach sand may be placed on the beach in front of the proposed revetment. Excavated material not compatible for beach placement will be used to provide additional cover over the revetment landward of the shoreline.

The subgrade will be prepared with excavators, bulldozers and compaction equipment prior to placement of the filter fabric by hand. The bedding stone, underlayer stone, and armor stone will be delivered to the property, transported onsite by a front-end loader and placed with a backhoe excavator. Modifications and repairs to the existing revetment will be made from the top of the slope using an excavator.

The maximum onsite construction period is estimated to be 12-months. Disturbed areas in the vicinity of the project will be restored to their natural condition.

Mitigation Measures

Typical Best Management Practices will be observed. BMPs will be used to ensure that marine biota is protected from sedimentation and project-related runoff. The applicant has included mitigative measures within the Final Environmental Impact Statement to be utilized to protect the land and ocean resources.

A number of Best Management Practices (BMPs) recommended by the USFWS and the National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS) will be observed to avoid and minimize adverse impacts to threatened and endangered species of sea turtle that includes biological monitors, a marine conservation-training program, and Endangered Species Act (ESA)-listed observers. Implementation of a Seabird Response Plan will be prepared and followed during construction. The plan will be submitted to the USFWS for review and approval prior to commencement of construction.

A tree tobacco plant that is host to the endangered Blackburn's sphinx moth was also identified. Prior to removal of this plant, it will be inspected for eggs or larvae. If found, the U.S. Fish & Wildlife will be consulted to determine what actions will need to be taken to protect the finds.

Maintaining water quality through construction BMPs and avoiding directly impacting coral colonies by construction activities will avoid loss and damage. BMPs during construction will be implemented to minimize turbidity and to protect listed marine species.

Archaeological work performed in 2007 and 2012 revealed no historic sites or cultural resources. However, due to the sand deposits and shoreline location, a general Archaeological Monitoring Plan was approved by SHPD and will be implemented during any ground disturbing activities. Archaeological monitoring will be implemented in accordance with the approved archaeological monitoring plan. Should any archeological remains be encountered during construction, work in the vicinity of the find will be stopped and the SHPD will be contacted.

Major construction activities will be done when fair weather conditions are expected and at low tide. Construction related noise is expected to be temporary, of limited duration, and restricted to daytime hours.

Unresolved Issues

The Applicant has identified 2 unresolved issues Water Quality and Beach Erosion. Moving the revetment inland has minimized impacts of the project on nearshore water quality and the review of the Department of the Army permit and Department of Health Water Quality Certification process may identify additional mitigation measures to further ensure protection of water quality and marine resources. A water quality monitoring program will be implemented for the project in order to measure any degradation.

Regarding beach erosion, construction of the shoreline revetment extension will not prevent ongoing beach erosion along the shoreline fronting the facility. Beach erosion is expected to continue until the erosion reaches the proposed revetment extension and landward flanking of the facility will further continue.

Alternatives Considered

The EIS identifies a number of alternatives to the proposed erosion protection extension that were considered in addition to alternatives for Central Maui's Wastewater needs. The project was the preferred alternative as the capital infrastructure already exist onsite and the proposed shoreline revetment extension plan was deemed to be the most cost-effective. Other alternatives include:

Rock Mound Revetment Alternative-This alternative is similar to the project however the footprint of the structure would have a more seaward alignment and the rock mound would be exposed rather than partially buried. Although this may be a less costly alternative, the footprint upon the public beach would be much greater.

Beach Nourishment-Two alternatives were considered one for a 4,000-ft area requiring an initial 215,000-yds³ to create an 80-foot berm with an additional 85,000-yds³ and the other for a 2,650-ft area that would require 145,000-yards³ with an additional 55,000-yds³ every 8 years. Both projects have a higher cost then the chosen alternative and sand retention is not guaranteed. The availability of a viable source of beach quality sand on Maui is very limited. The use of dredged sands from Kahului Harbor was also reviewed; however the quality of sand and the timing of the dredge put this out of consideration.

Rock mound with Beach Nourishment-This alternative combined the rock mound revetment and the smaller beach nourishment alternative. This alternative would require replenishment of the sand over the entire life of the project and would have the same challenges as a beach nourishment alternative.

Onsite Strategic Retreat of Facilities-This would involve relocation of facilities at risk to other areas of the site. Structures currently at the highest risk due to shoreline erosion such as the existing injection Well #2, access road, and existing sludge holding tanks could possibly be relocated. However, it is not feasible to relocate certain structures due to the size and position in the wastewater treatment process. Relocation costs are also prohibitive.

The applicant has stated, "Even if the most threatened structures were to be relocated, other parts of the facility would soon become threatened by erosion. Thus, relocation is not a cost-effective or a reasonable long-term solution."

Other Alternatives

- Use of coral fill as beach nourishment-impractical due to the lack of source material;
- Use of rock or geotextile groins: this alternative considered constructing 7 T-groins and filling the area with sand. This was deemed ineffective due to the high cost, low net longshore transport rates in the offshore littoral cell and limited protection from run up and overtopping during large wave events or tsunamis;
- A vertical seawall and hybrid structure: Not pursued as the potential for increase of beach erosion and wave scour; and
- The Hayashi seawall: This flattens the slope of the revetment to reduce wave energy as well as allow the deposit of sand. However, the Hayashi wall would require a much larger footprint upon submerged land.

No Action Alternative-This alternative presents the highest environmental and financial risk to the County. This alternative would not address the purpose and need for this project and was ranked last and rejected by the responsible agency.

Defer Action- This would have the same consequences as the no action. As a result, this option was also rejected by DEM.

Alternatives for Central Maui's Wastewater Needs

The EIS included a number of options the County of Maui has reviewed in providing for the wastewater needs of Central Maui for the next 20 to 30 years. The Central Maui Wastewater Reclamation Facility Study (May 2006) identified 5 core wastewater treatment facility concepts with multiple effluent disposal options.

The County has implemented a number of wastewater management practices such as water conservation programs, retrofitting fixtures and expanding the reduction of infiltration/inflow into the system. While wastewater management practices have been implemented to some extent, it does not eliminate the long-term need to increase wastewater treatment capacity in the central Maui region.

Potential new site options and relocation of the treatment plant/conversion to a pump station has also been under consideration. Studies for site selection, conception, authorizations, financing and construction has been noted as requiring several years to develop with an estimated cost of \$500 million.

SUMMARY OF COMMENTS

The Office of Conservation and Coastal Lands referred this application to the following agencies for review and comment: the Federal Department of the Army; the State-Department of Health; the Office of Hawaiian Affairs; the Office of Environmental Quality Control; the Department of Land and Natural Resources Divisions of: Aquatic Resources, Conservation and Resource Enforcement, Historic Preservation, and the Maui District Land Office; the County of Maui-Departments of Planning and Surfrider Maui. In addition, the CDUA was also sent to the nearest public library, the Kahului Public Library to make this information readily available to those who may wish to review it.

Comments were received by the following agencies and summarized by Staff as follows:

DEPARTMENT OF LAND AND NATURAL RESOURCES

Division of Aquatic Resources

There has been no turtle nesting in Kahului. The closest honu nests have been in Waiehu and Spreckelsville Beaches. The number of beached honu or green turtles appears to have decreased over the past 20 years. There could be honu foraging in near shore waters along Kanaha beach and Kahului Harbor. We have had reports of individual basking turtles at Kanaha Beach Park by County Water Safety Officers. These turtles have been reported with and without tumors.

Besides kite surfing, shoreline fishing and diving occurs around the project location. We strongly recommend that public access and shoreline gathering of limu be maintained.

Applicant's response

- 1) There have been reports of individual basking turtles at Kanaha Beach Park and they are known to forage in near shore waters along Kanaha beach and Kahului Harbor. An applicable monitoring and assessment plan will be implemented during construction to minimize effects on sea turtles that may be in the area.
- 2) The area is used for kite surfing, shoreline fishing, and diving and as such, as much as practicable public access and shoreline gathering of limu shall be maintained.

Division of Resource Enforcement

No objections provided that actions will be implemented:

- 1) To avoid adverse effects to marine resources during the construction;
- 2) Provide safe public beach access near the construction site;
- 3) Fence off the construction site to prevent beach goers and fishermen from entering the area; and
- 4) Place posted signs to warn and educate the public.

Applicant's response

- 1) Implementation of the Marine Biological Monitoring Plan, including best management practices for the protection of endangered species and the marine environment, will avoid adverse effects to marine resources during construction;
- 2) As may be practicable, safe public beach access near the construction site will be provided. However, for public safety there may be times during construction on the ocean-side when access cannot be provided;
- 3) Temporary construction barriers and fences will be provided during construction in accordance to OSHA safety requirements in order to protect the public from entering the construction site; and
- 4) Warning signs will be posted at both ends of the project. The signs will state the name of the project, project owner and have the words 'NOTICE: CONSTRUCTION AREA. DO NOT ENTER'. The sign will be 4-ft x 3-ft.

Maui District Land Office (HDLO)

The shoreline fronting the proposed revetment should be cleared of all trash, debris and overgrown vegetation. We have no objections to the project.

Applicant's response

In coordination with Maui District Land Office, the Department of Environmental Management (DEM) as practicable, will remove trash, debris and overgrown vegetation from the shoreline fronting the proposed revetment.

COUNTY OF MAUI

Department of Parks and Recreation

We are in support of the proposed improvements and would like to be included in any project correspondences that relate to the construction impacts on the Kanaha Beach Park.

Applicant's response

The DEM will keep Parks and Recreation informed of construction impacts on the Kanaha Beach Park.

Planning Department

On September 24, 2013, the Maui Planning Commission approved Special Management Area (SMA) Use Permit (SM1 2012/0004) and Shoreline Setback Variance (SSV 2012/0003) for the portion of the proposed structure that is within the SMA and shoreline area, with five SSV conditions and 13 SMA conditions. We are providing additional suggestions for additional mitigation relevant to the Conservation District.

As part of the project, during the deployment of heavy excavation equipment, the State has the unique opportunity to improve the condition of the beach area fronting the entire length of the proposed revetment and Makai of the shoreline. A September 6, 2013 site inspection revealed the beach strewn with hazardous ironwood tree stumps, concrete debris, and areas taken over by invasive hau bush with complex woody root systems claiming large areas of potential beach access for the public. Since the SSV includes a condition that any excess sand shall be stockpiled on the parcel and made available for future shoreline-related projects, the Applicant further specifies in the CDUA that excess beach quality sand will be placed on the beach fronting the revetment. The department encourages the State to take advantage of this unique mitigation opportunity via the CDUA and additional permits in order to improve the beach's condition for public use. To accomplish the above mitigation as part of the CDUA, the Department encourages the Applicant, to include the following mitigation actions:

- 1) The Applicant shall responsibly manage the beach and dune environment, including the removal of dead and hazardous ironwood stumps and woody debris, as needed for access and sand placement, and the placement of excess sand on the beach and dune area Makai of the revetment once stumps and debris are removed;
- 2) The Applicant shall provide at least one post-construction topographic survey of the beach. This baseline topographic survey will allow the State and County to establish a baseline for monitoring beach changes over time; and
- 3) The Applicant shall provide photo documentation of the shoreline before, during, and after construction. If possible, use the same locations and viewpoints as documented by the "Key Map, Shoreline Photos, August 13, 2013" referenced in Exhibit 1 of the Maui County Planning Departments' Report to the Planning Commission.

Applicant's response

- 1) The removal of trash, debris, stumps, and overgrown vegetation will be coordinated with the DLNR Maui Land District Office. As proposed, the excess sand will be placed on the beach, provided, all required permits have been approved by the various State and Federal permitting agencies.
- 2) A post-construction topographic survey of the beach shall be provided to the Department of Planning.
- 3) Photographic documentation of the shoreline before, during, and after construction shall be provided. The Department of Environmental Management will attempt to the extent practical, use standard views and viewpoints as earlier photographs submitted to the Department of Planning so comparisons can easily be made.

General Public

Thank you for bringing the Public Hearing to Maui. It saddens me that there is a poor public turn out.

Industrial uses, tsunami, rising seas are concerns that are the government's responsibility to address and there was nothing at the hearing that was discussed regarding the impacts to the ocean, land or shoreline. Incidents like the molasses spill in Honolulu are killing our culture.

Applicant's response

We appreciate your concerns regarding potential environmental hazards that may occur in the Kahului Harbor area from the existing industrial uses that may be similar to the molasses spill in Honolulu Harbor.

The proposed shoreline protection extension and rehabilitation of the existing revetment will minimize the potential for such environmental hazards from happening. The purpose of the shoreline extension is to protect the existing facility from potential damage which may result from shoreline erosion and prevent sewage from entering the ocean. Further, the extension and the existing revetment will be built to accommodate sea level rise anticipated within this century. The existing revetment will be raised three feet to match the height of the proposed revetment. These measures are being implemented by the DEM to minimize environmental hazards from occurring as a result of damage to the facility.

ANALYSIS

After reviewing the application, by correspondence dated November 5, 2013, the Department has found that:

1. The proposed use is an identified land use in the Resource subzone of the Conservation District, pursuant to §13-5-22, Hawaii Administrative Rules (HAR), P-15 SHORELINE EROSION CONTROL Seawall, revetment, groin, or other coastal erosion control structure or device, including sand placement, to control erosion of land or inland area by coastal waters, provided that the applicant shows that (1) the applicant would be deprived of all reasonable use of the land or building without the permit; (2) the use would not adversely affect beach processes or lateral public access along the shoreline, without adequately compensating the State for its loss; or (3) public facilities (e.g., public roads) critical to public health, safety, and welfare would be severely damaged or destroyed without a shoreline erosion control structure, and there are no reasonable alternatives (e.g., relocation). Requires a shoreline certification. Please be advised, however, that this finding does not constitute approval of the proposal;

2. Pursuant to §13-5-40(a)(4), HAR, a Public Hearing is required;
3. In conformance with Chapter 343, Hawaii Revised Statutes (HRS), as amended, and Chapter 11-200, HAR, the Final Environmental Impact Statement (FEIS) was published in the OEQC's May 8, 2013 Environmental Notice and the County of Maui Department of Environmental Management was the accepting authority of the FEIS;
4. On September 24, 2013, the Maui Planning Commission approved the application for a Special Management Area (SMA) Use Permit and Shoreline Setback Variance (SSV) [SM1 2012/0004 and SSV 2012/0003] for the proposed extension of the existing rock mound revetment that is the subject of this CDUA.

Notice of was published in the December 8, 2013 issue of the Environmental Notice.

A public hearing was held on January 14, 2014 at Lihikai Elementary in Wailuku, Maui to receive public testimony. 7 individuals other than DLNR staff and project consultants were in attendance. Concerns shared include:

- **Tsunami inundation** as the design will not address tsunami threat and the potential of a chlorine gas release and water quality degradation. Staff from DEM explained tsunami protection measures including below grade structural and footing reinforcement; addition of walls and flood doors at grade and relocation of components above the 100-year tsunami wave height were completed under a 2002 CDUP.
- **Recreational use:** It was stated when the wind pushes wind surfers toward the revetment, gaining access back to the shore is a challenge because you cannot climb the revetment and must continue to the other side of the facility and then walk along the fence and revetment to get back to the park. According to the applicant, lateral access will continue to be provided behind the revetment along the proposed fence line that will allow access from one end of the property to the adjacent County park on the east side of the property.
- **Relocation.** Testifiers would like the facility relocated away from the shoreline.

CONSERVATION CRITERIA

The following discussion evaluates the merits of the proposed land use by applying the criteria established in §13-5-30, HAR:

- 1) *The proposed use is consistent with the purpose of the Conservation District.*

The objective of the Conservation District is to conserve, protect and preserve the important natural resources of the State through appropriate management and use to promote their long-term sustainability and the public health, safety and welfare.

The existing facility was approved by the Board of Land and Natural Resources in 1972 and the existing east end revetment was also approved by the Board in 1978. Back in 1978, it was known that additional protection would be required for the facility.

- 2) *The proposed land use is consistent with the objectives of the Subzone of the land on which the use will occur.*

The objective of the Limited Subzone is to limit uses where natural conditions suggest constraints on human activities.

The objective of the Resource Subzone is to ensure with proper management, the sustainable use of the natural resources of those areas.

The proposed use is an identified land use in the Limited and Resource subzone of the Conservation District, pursuant to §13-5-22, Hawaii Administrative Rules (HAR), P-15 SHORELINE EROSION CONTROL Seawall, revetment, groin, or other coastal erosion control structure or device, including sand placement, to control erosion of land or inland area by coastal waters, provided that the applicant shows that:

- (1) The applicant would be deprived of all reasonable use of the land or building without the permit;
- (2) The use would not adversely affect beach processes or lateral public access along the shoreline, without adequately compensating the State for its loss; or
- (3) Public facilities (e.g., public roads) critical to public health, safety, and welfare would be severely damaged or destroyed without a shoreline erosion control structure, and there are no reasonable alternatives (e.g., relocation). Requires a certified shoreline.

Regarding demonstrating the need of the erosion control structure:

- (1) A major county facility would eventually be deprived of all reasonable use due to expected damage from erosion and wave overtopping. A planned retreat from the shoreline would not be possible and potential health and resource degradation challenges most likely would ensue;
 - (2) It is expected that the beach fronting the revetment will continue to erode due to expected erosion generated by sand deficits created by past land uses and sea level rise. It is known this site has a high erosion rate. With the proposed project, once the beach erodes completely, sand may continue to be removed by waves and currents and buried portions of the revetment will become exposed resulting in sand loss in an area used for recreation. However, the proposed use will provide access along the shoreline;
 - (3) The proposed use would protect a critical public facility for the health and welfare of the Central Maui population. It is not feasible to relocate the facility at this time. The proposed use may be part of the planned retreat. A certified shoreline was gained in April 2014.
- 3) *The proposed land use complies with the provisions and guidelines contained in Chapter 205A, HRS entitled "Coastal Zone Management", where applicable.*

On September 24, 2013, the Maui Planning Commission approved Special Management Area (SMA) Use Permit (SM1 2012/0004) and Shoreline Setback Variance (SSV

2012/0003) for the portion of the proposed structure that is within the SMA and shoreline area, with five SSV conditions and 13 SMA conditions.

Regarding the Coastal Management Criteria:

Recreational resources: Shoreline access will be maintained during construction, for safety reasons, recreation at the construction site, may be limited;

Historic resources: No archaeological or cultural resources are expected in the project site; however an archaeological monitor shall be present during construction;

Scenic and open space resource: Upon completion, there may be slight change to ocean views due to an increase of 3-ft to the revetment and length of extension but appears to be compatible with an industrial area;

Marine and Coastal ecosystems: BMPs will be deployed to prevent potential pollutant discharges in storm water runoff and will be in place and functional before project activities begin and maintained throughout the construction period; and

Coastal hazards and Beach protection: To the greatest extent possible, it should be a policy of the Department, Board, and all public agencies to mitigate or eliminate existing human-induced threats to Hawaii's beaches and to anticipate, prevent, or otherwise mitigate the impacts of future uses from damaging Hawaii's beaches. Staff believes the proposed revetment is part of the strategy of a planned retreat from the shoreline.

Staff notes that it is a Coastal Zone Management policy to "Minimize the construction of public erosion-protection structures seaward of the shoreline." The term "minimize" suggests that shoreline armoring in front of public facilities might be feasible under some circumstances.

- 4) *The proposed land use will not cause substantial adverse impact to existing natural resources within the surrounding area, community or region.*

The shoreline is already experiencing chronic erosion due to sand deficit along this coastline. The proposed project will protect the facility from shoreline erosion. Taking action to protect the facility from shoreline erosion is critical, as the no action alternative is highly undesirable because it places the facility and the nearshore environment at a higher risk of damage.

- 5) *The proposed land use, including buildings, structures and facilities, shall be compatible with the locality and surrounding areas, appropriate to the physical conditions and capabilities of the specific parcel or parcels.*

The site is located in an area of heavy industrial uses related to Kahului Harbor and in proximity to the Airport as well. As previously stated, a number of coastal mitigation action has been in place since the 1940's. The shoreline protection extension will not adversely impact the character of the surrounding land uses.

- 6) *The existing physical and environmental aspects of the land, such as natural beauty and open space characteristics, will be preserved or improved upon, whichever is applicable.*

The shoreline fronting the facility has limited use by the public. There may be possible beach loss and loss of lateral access due to erosion. However lateral access will be allowed along the exposed crest and the area between the revetment and the wastewater facility fence.

- 7) *Subdivision of land will not be utilized to increase the intensity of land uses in the Conservation District.*

No subdivision of land is proposed.

- 8) *The proposed land use will not be materially detrimental to the public health, safety and welfare.*

The proposed improvements will protect a critical public facility and ensure the public's health and safety. The project will be implemented to comply with Federal, State, and County of Maui rules and regulations governing public safety and health. Potential sources of adverse impacts have been identified and appropriate mitigative measures have been developed. Anticipated short term concerns are associated with construction activities that may involve temporary air, water, noise and shoreline impacts. Staff is of the opinion that the proposed improvements will not be materially detrimental to the public health, safety and welfare.

CULTURAL IMPACT ANALYSIS

The cultural impact analysis contained interviews with a handful of individuals that was familiar with the area and would utilize the shoreline and ocean for the gathering of limu, fishing, diving, canoe paddling and kiawe wood gathering. One concern was for offshore ko'a in the water and the potential effect the protection device would have on it and another individual was concerned about cultural impacts due to the potential beach loss. Staff notes, whether the project is completed or not, there is still a potential for beach loss due to sea level rise and shoreline erosion.

Traditional or culturally significant resources are not expected in the project site area. However the project will be conditioned that if cultural finds are discovered, all work will cease and SHPD will be notified.

Traditional cultural practices would include gathering, fishing, diving, and ocean recreational activities. During construction, use of the site may be prevented for public safety reasons. Upon completion, the project would not curtail these activities. During the processing of this application, no comments were received from native practitioners, the Office of Hawaiian Affairs or the Historic Preservation Division. To the extent to which traditional and customary native Hawaiian rights are exercised, the proposed action does not appear to affect traditional Hawaiian rights; it is believed that no action is necessary to protect these rights.

DISCUSSION

Many beaches in Hawai'i have been degraded or lost due to coastal armoring. In a 2012 study by Romine/Fletcher published in the Journal of Coastal Research, 70% of all beaches measured in the Hawaiian Islands indicated an erosion trend. More than 13 miles or 9% of the total length of the beaches studied were lost to erosion over the past century. In nearly all cases, the beaches were replaced with seawalls or other coastal structures. Accelerated sea level rise (SLR) will hasten beach loss and increase the frequency and severity of coastal hazard events here and throughout Hawaii.

In order to address the serious threats to our beaches and coastal communities, the Board adopted the Hawaii Coastal Erosion Management Plan (COEMAP) in 1999/2000. COEMAP provides for 5 alternatives to protect land from erosion: abandonment, beach restoration, erosion control, adaptation, and hardening.

Abandonment

Abandonment involves taking no action to protect human developments or infrastructure along an eroding shoreline. This alternative is not feasible at this time because the wastewater facility provides a vital service for Central Maui. In the short-term, the potential to create major harm to public health, safety and welfare from loss of the wastewater treatment facility is far too serious to consider abandonment. Abandonment of the existing facility cannot be considered until another facility is on line to service the Central Maui region.

Beach Restoration

Beach restoration involves the placement of sand on an eroding shoreline to re-supply deficiencies in natural sand volume lost to waves, currents and/or human activities. Beach restoration has been used in numerous locations in Hawaii to repair beach ecosystems and improve protection for coastal communities and public infrastructure from coastal hazards. While it may be feasible to construct a beach in lieu of a revetment at this location, other considerations suggest that this may not be the best course of action. The shoreline in the vicinity of the project area has a sand deficit and has chronic erosion. While it may be possible to construct a sand beach fronting the project area, engineered structures, such as shore-perpendicular rock groins would likely be needed to hold the sand in-place.

Within the EIS, two restoration alternatives were evaluated. It appears beach restoration has a higher cost, sand retention is not guaranteed, and the availability of a viable source of beach quality sand is very limited.

Erosion Control

Coastal erosion control techniques use structures that are designed to reduce sediment losses and thus slow the rate of erosion. Breakwaters or groins could be installed offshore to reduce currents and waves that cause erosion. This approach may also be impractical given reason stated in the preceding section (i.e., impacts would be similar and protection would be less than a revetment) as well as concerns over impacts to surfing, fishing, and other water based activities.

Adaptation

Adaptation requires that development patterns change in order to allow natural shoreline processes to continue without interference. Adaptation in this case could be interpreted to mean that the entire facility could be relocated landward as an alternative to hardening the shoreline.

and public beach resources and would alleviate the need for future requests for shoreline hardening in this area.

Hardening

In some cases, shoreline hardening may be necessary to protect infrastructure that is critical to public services and safety. Shoreline hardening is usually the approach of last resort and may be given more consideration where beach resources are not expected to be impacted (e.g., rocky shoreline, marginal beach resource).

Inappropriate shoreline development, alteration, and/or armoring on beaches where these uses are incompatible with sustained, long-term beach conservation, preservation, and protection should be discouraged. Where there exists a potential threat to the long-term conservation of a beach; whether it is in the form of a proposed coastal development, an application for shoreline armoring, the existence of an unauthorized shoreline structure, or a request for emergency shore protection, or otherwise; the Department and Board should and does consider and weigh all potential impacts, issues and alternatives.

It remains a policy of the Department and Board of Land and Natural Resources to preserve, protect, and otherwise conserve all beaches in the State of Hawaii for public use for present and future generations. In implementing its policy, the Department and Board recognize that there are existing or planned uses of the coastal zone that may be incompatible with long-term beach conservation, especially on low-lying coasts with a trend of chronic shoreline recession.

While beach loss fronting the revetment appears inevitable, it is difficult to forecast the exact timing of such events. Beach loss along the eastern half of the revetment is highly likely within a decade or two. Estimates of shoreline position using historical erosion rates from the UH Coastal Geology Group studies suggests complete beach loss fronting the entire revetment within 50-100 years. Beach erosion rates are likely to accelerate fronting the revetment due to disruptions in longshore sediment transport, increased reflected wave energy, and impoundment of sand behind the revetment.

In regards to impacts to public beaches, a case may be made for compensatory mitigation if impacts to coastal ecosystems and public beach resources are significant and measurable. Language in Chapter 13-5, HAR and Chapter 205A, HRS both suggests some form of compensation is required for the loss of sandy beach that will most likely occur as a result of the project. Compensatory mitigation requires the responsible entity to compensate the State for the loss of beach resources due to the impact of the shoreline structure on the beach.

It is uncertain in this particular case what type of mitigation would be appropriate or whether a public service agency should be subject to compensatory mitigation at all. All public agencies should endeavor to mitigate or eliminate existing human-induced threats to Hawaii's beaches and to anticipate, prevent, or otherwise mitigate the impacts of future uses from damaging Hawaii's beaches.

The applicant attempts to mitigate impacts by proposing to install approximately 900-linear feet of the revetment as far possible landward to minimize the potential for impacts to biological resources and adjacent beach. Excavated sand will be used to partially cover the revetment and

for beach placement. By moving the revetment landward, the length of armored shoreline will be reduced by almost 70%.

Given the high risk of coastal hazards, sea level rise and ongoing degradation of the beach resource fronting the facility, OCCL believes that the ideal course of action would be complete relocation (adaption) of the facility. The County of Maui should continue to pursue optional sites that would be a landward relocation away from the shoreline as a long-term adaptation measure. However, such a plan cannot be completed fast enough to alleviate the present erosion problem at a critical public facility. Staff believes the potential risks to the General Public are too grave to do nothing.

Staff recommends approval of this erosion protection structure of a needed public facility. With the hopefully 50 year lifetime of the structure, the County will be able to decommission, retrofit and relocate this public infrastructure in preparation of sea level rise. Shoreline protection is critical to the continued operation of the facility, and the ability to provide for wastewater needs. The extension of the shoreline revetment will protect an existing major infrastructure facility to ensure the continued operation of waste-disposal services for the Central Maui region.

Not only is the erosion control structure protecting the site, but it will also protect the ocean from the site. As noted, relocation of the wastewater facility will require preparation of a site selection study, identification of available technologies and appropriate environmental review before any decision can be made. This may take several years to complete, as well as seeking appropriate permits and sources of financing before the facility can be relocated. The site will need to be converted to a pump station to redirect sewage to any future inland relocated facility since the existing collection system transmission lines will continue to flow to the site.

The proposed shoreline protection extension and rehabilitation of the existing revetment will minimize the potential for environmental hazards from happening. The purpose of the shoreline extension is to protect the existing facility from potential damage which may result from shoreline erosion and prevent sewage from entering the ocean. Further, the extension and the existing revetment will be built to accommodate sea level rise anticipated within this century. The existing revetment will be raised three feet to match the height of the proposed revetment. These measures are being implemented by the DEM to minimize environmental hazards from occurring as a result of damage to the facility.

RECOMMENDATION

Based on the preceding analysis, Staff recommends that the Board of Land and Natural Resources APPROVE this application for the construction of an approximately (\approx) 1,100-ft rock mound revetment extension with landward extensions of \approx 125-ft in length at each end of the revetment located at 281 Amala Place, Kahului, Maui, Tax Map Key:(2) 3-8-001:188 and adjacent submerged land subject to the following conditions:

1. The permittee shall comply with all applicable statutes, ordinances, rules, and regulations of the federal, state, and county governments, and applicable parts of this chapter;
2. The permittee, its successors and assigns, shall indemnify and hold the State of Hawaii harmless from and against any loss, liability, claim, or demand for property damage, personal injury, and death arising out of any act or omission of the applicant, its

- successors, assigns, officers, employees, contractors, and agents under this permit or relating to or connected with the granting of this permit;
3. The permittee shall obtain a land disposition from the department for the occupancy of state lands;
 4. The permittee shall comply with all applicable department of health administrative rules;
 5. The permittee shall implement a decommissioning plan for the Wailuku-Kahului Wastewater Reclamation Facility by June 30, 2064 and restore the shoreline to the best possible condition as practical;
 6. Before proceeding with any work authorized by the department or the board, the permittee shall submit four copies of the construction plans and specifications to the chairperson or an authorized representative for approval for consistency with the conditions of the permit and the declarations set forth in the permit application. Three of the copies will be returned to the permittee. Plan approval by the chairperson does not constitute approval required from other agencies;
 7. Unless otherwise authorized, any work or construction to be done on the land shall be initiated within two years of the approval of such use, in accordance with construction plans that have been signed by the chairperson, and shall be completed within three years of the approval of such use. The permittee shall notify the department in writing when construction activity is initiated and when it is completed;
 8. All representations relative to mitigation set forth in the accepted environmental impact statement for the proposed use are incorporated as conditions of the permit;
 9. The permittee understands and agrees that the permit does not convey any vested right(s) or exclusive privilege;
 10. In issuing the permit, the department and board have relied on the information and data that the permittee has provided in connection with the permit application. If, subsequent to the issuance of the permit such information and data prove to be false, incomplete, or inaccurate, this permit may be modified, suspended, or revoked, in whole or in part, and the department may, in addition, institute appropriate legal proceedings;
 11. Where any interference, nuisance, or harm may be caused, or hazard established by the use, the permittee shall be required to take measures to minimize or eliminate the interference, nuisance, harm, or hazard;
 12. Obstruction of public roads, trails, lateral shoreline access, and pathways shall be avoided or minimized. If obstruction is unavoidable, the permittee shall provide alternative roads, trails, lateral beach access, or pathways acceptable to the department;
 13. During construction, appropriate mitigation measures shall be implemented to minimize impacts to off-site roadways, utilities, and public facilities;

14. The permittee shall obtain a county building or grading permit or both for the use prior to final construction plan approval by the department;
15. Where applicable, provisions for protection of beaches and the primary coastal dune shall be established by the permittee, to the satisfaction of the department, including but not limited to avoidance, relocation, or other best management practices;
16. The permittee acknowledges that the approved work shall not hamper, impede, or otherwise limit the exercise of traditional, customary, or religious practices of native Hawaiians in the immediate area, to the extent the practices are provided for by the Constitution of the State of Hawaii, and by Hawaii statutory and case law;
17. Should historic remains such as artifacts, burials or concentration of charcoal be encountered during construction activities, work shall cease immediately in the vicinity of the find, and the find shall be protected from further damage. The Historic Preservation Division shall be contacted (692-8015), which will assess the significance of the find and recommend an appropriate mitigation measure, if necessary;
18. Monitoring of the nearshore water quality shall be conducted in accordance with best management practices;
19. Work shall be conducted during calm weather periods to the most practical extent possible and no work shall occur if there is high surf or ocean conditions that will create unsafe work or beach conditions;
20. The permittee shall implement the proposed Best Management Practices (BMPs) and monitoring and assessment plan to maintain BMPs to minimize dirt and silt from entering the ocean and the ability to contain and clean up fuel, fluid, or oil spills immediately under this authorization and immediately report any spills or other contamination(s) that occurs at the project site to the Department of Health and other appropriate agencies;
21. The permittee shall ensure that excessive siltation and turbidity is contained or otherwise minimized to the satisfaction of all appropriate agencies, through silt containment devices or barriers, or other requirements as necessary;
22. Appropriate safety and notification procedures shall be implemented. This shall include high visibility safety fencing, tape or barriers to keep people away from the active construction site and a notification to the public informing them of the project;
23. All placed material including the excavated sand, shall be free of contaminants of any kind including: excessive silt, sludge, anoxic or decaying organic matter, turbidity, temperature or abnormal water chemistry, clay, dirt, organic material, oil, floating debris, grease or foam or any other pollutant that would produce an undesirable condition to the beach or water quality;
24. The activity shall not adversely affect a federally listed threatened or endangered species or a species proposed for such designation, or destroy or adversely modify its designated critical habitat;

25. The activities shall not substantially disrupt the movement of those species of aquatic life indigenous to the area, including those species, which normally migrate through the area;
26. When the Department is notified that an individual activity deviates from the scope of work approved by this authorization or activities are adversely affecting fish or wildlife resources or their harvest, the Chairperson will direct the permittee to undertake corrective measures to address the condition affecting these resources. The permittee must suspend or modify the activity to the extent necessary to mitigate or eliminate the adverse effect;
27. No contamination of the marine or coastal environment (trash or debris) shall result from project-related activities authorized under this permit;
28. The Office of Conservation and Coastal Lands shall be notified (587-0377) in advance of the anticipated construction dates and shall be notified immediately if any changes to the scope or schedule are anticipated;
29. The permittee shall maintain safe lateral beach access for the life time of the structure;
30. Other terms and conditions as may be prescribed by the Chairperson; and
31. Failure to comply with any of these conditions shall render this Conservation District Use Permit null and void.

Respectfully submitted,



K. Tiger Mills, Staff Planner
Office of Conservation and Coastal Lands



William J. Aila, Jr., Chairperson
Board of Land and Natural Resources



East Flank of Existing Revetment



West Flank of Existing Revetment

EXHIBIT A

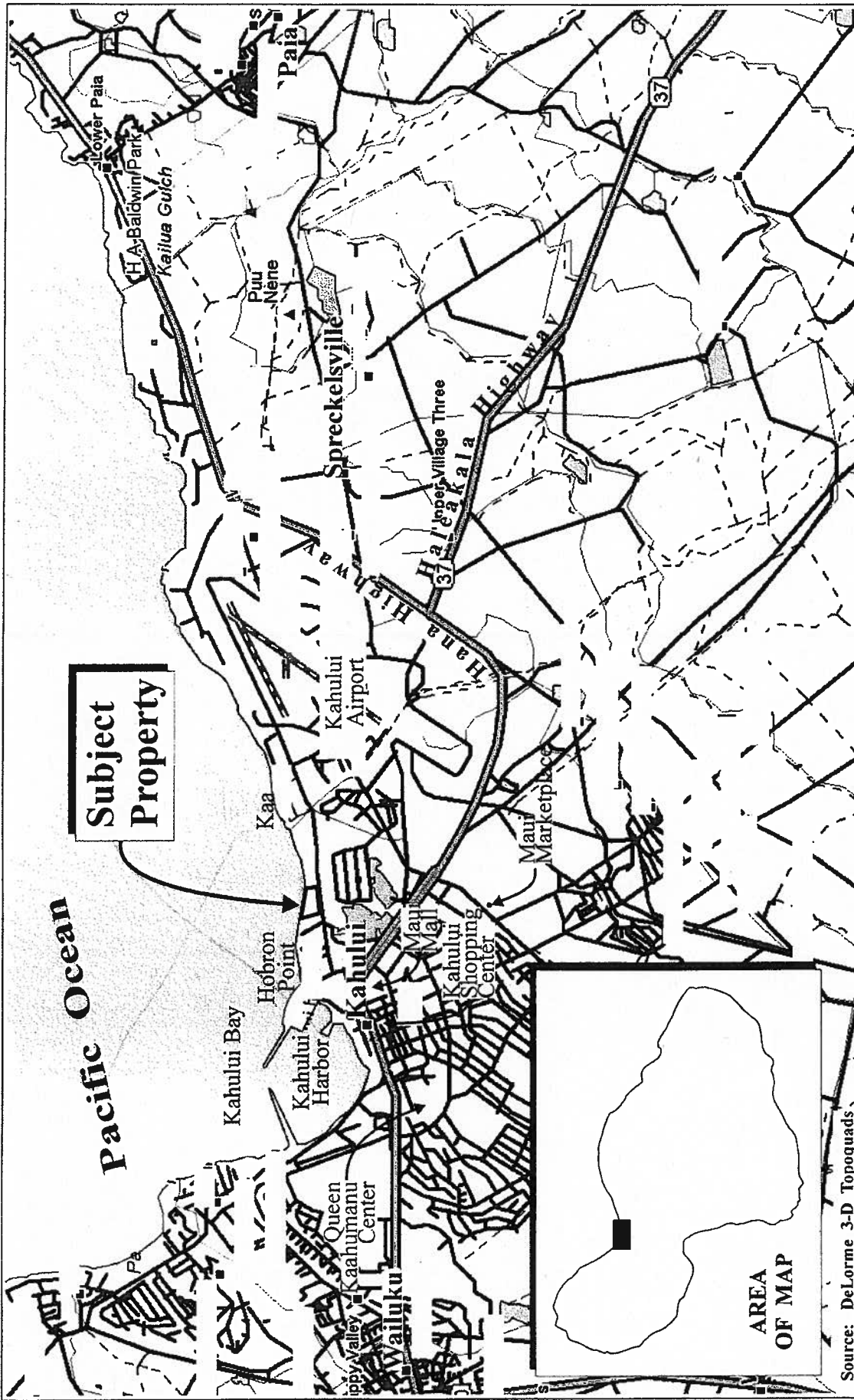
Source: Moffatt & Nichol

**Proposed Shoreline Protection
Extension at Wailuku-Kahului
Wastewater Reclamation Facility
Photographs of Existing Revetment**

Prepared for: County of Maui, Department of Environmental Management


MUNEKIYO & HIRAGA, INC.

Moffatt/Nichol\WK WWRFDraftEIS\ExistingRevetmentPhotos



Source: DeLorme 3-D Topoquads

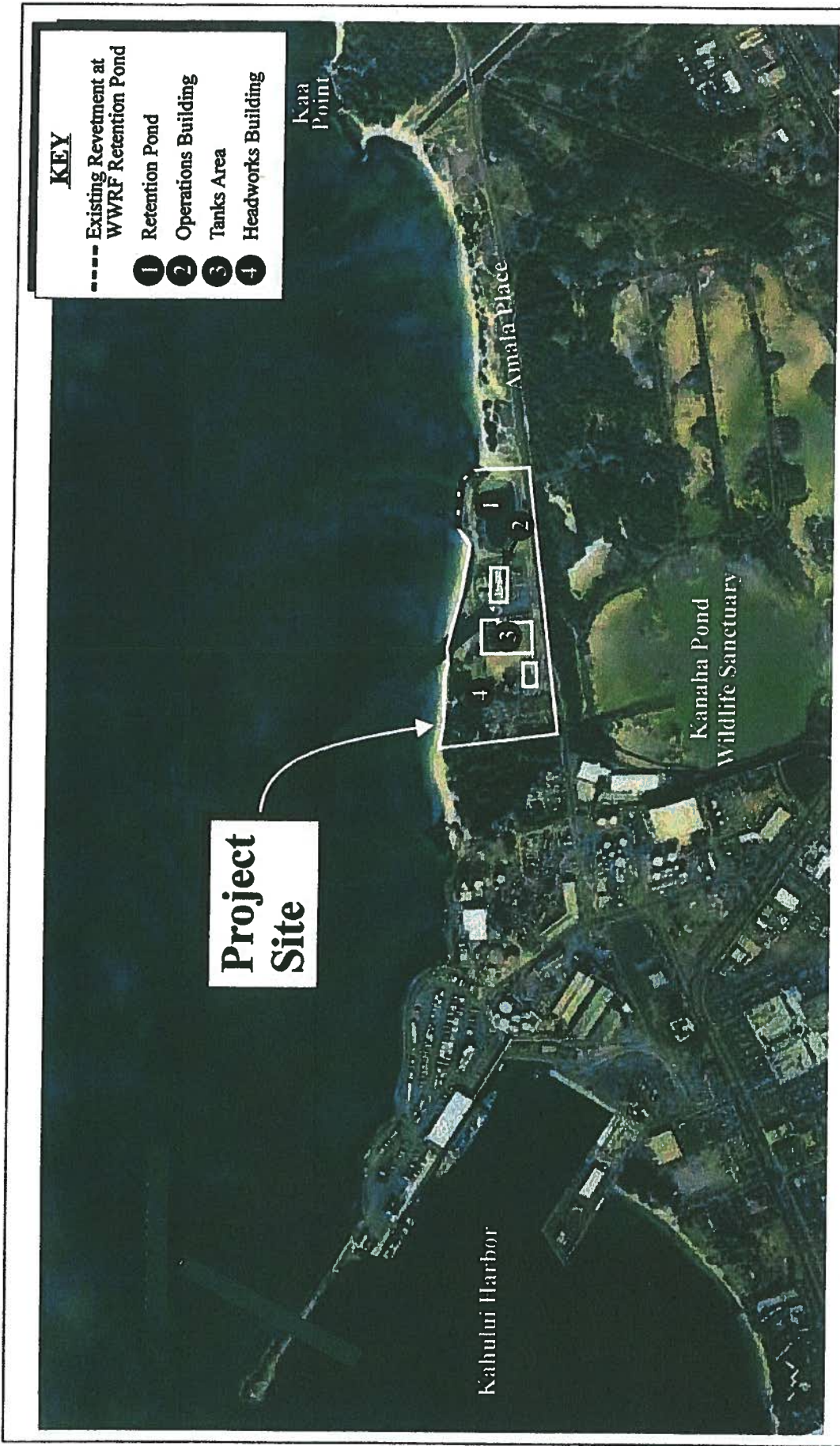
NOT TO SCALE

Proposed Shoreline Protection Extension at Wailuku-Kahului Wastewater Reclamation Facility Regional Location Map



Prepared for: County of Maui, Department of Environmental Management





KEY

- Existing Retevment at WWRF Retention Pond
- 1 Retention Pond
- 2 Operations Building
- 3 Tanks Area
- 4 Headworks Building

Source: Moffatt and Nichol

**Proposed Shoreline Protection Extension
at Wailuku-Kahului Wastewater Reclamation Facility**



NOT TO SCALE

Aerial Photograph of Project Site and Surrounding Area



Prepared for: County of Maui, Department of Environmental Management

MoffattNichol\WK WWRFDraftEIS\erial photo

Limits of Shoreline Protection

Annual Erosion Hazard Rates (ft/y)

Existing Revetment

HISTORICAL SHORELINES

- 1989
- 1973
- 1959
- Oct 1988
- Mar 1975
- Aug 1977
- Mar 1990
- May 1977
- Feb 2002
- Existing (unrestrained) Beachline
- Existing (restrained) Beachline

Historical beach positions, whether recorded by year, are distinguished using orthorectified and georeferenced aerial photography from the National Oceanic and Atmospheric Administration (NOAA). The year and month of the photograph are noted on the individual datafiles, or alternative change reference imagery, for each year. The year and month of the photograph are noted on the individual datafiles, or alternative change reference imagery, for each year. The year and month of the photograph are noted on the individual datafiles, or alternative change reference imagery, for each year.

EROSION RATES

Annual Erosion Hazard Rates (AEHR) are calculated every 20 m along the shoreline. These rates are derived from the difference between the existing and the proposed beachline, divided by the time interval. The AEHR is a measure of the rate of erosion, expressed in feet per year. The AEHR is a measure of the rate of erosion, expressed in feet per year. The AEHR is a measure of the rate of erosion, expressed in feet per year.

The Kahului Harbor area extends from Kahului Harbor Point east to Maui, at the west end of Keolu Beach Point. The coastline is comprised of sandy beach, hard shoreline and various structures. Kahului Harbor, constructed beginning in 1970, provides protection for the study area into two sections for descriptive purposes.

As a whole, the area has experienced moderate to severe erosion since 1989 with an average AEHR of -1.6 ft/y. Kahului Beach and Waiheke Point are located in the eastern portion of Kahului Harbor (reaches 0 - 65). This area is characterized by sandy beaches separated by rip-rap revetments and a groin field. This section of the study area has experienced light to moderate erosion over time with an average AEHR of -0.5 ft/y.

East of Kahului Harbor, a large white sandy beach extends from Hahaione Point to Maui, characterized by five boulder groins. Otherwise it is a wide fringing reef. The Waiheke Point Wastewater Reclamation Facility, constructed between 1975 and 1977, is situated in the center of this region. Between 1977 and 1987 a revetment was built to protect the eastern side of the existing part of the facility from erosion and wave over-wash. This portion of the study area (reaches 65 - 54) has experienced severe erosion since 1989 with an average AEHR of -4.2 ft/y. This number agrees with the trend identified by Sea Engineering, 1991, for this section of shoreline.

Average beach width, the average horizontal distance from the vegetation line to the low water mark, in the Kahului Harbor study area has decreased 20% between 1989 and 2002. Where revetments have been installed, beach width change and erosion has resulted in the loss of approximately 500 ft of beach. Kahului Beach, inside the harbor, has experienced a 34% decrease in average beach width while outside of the harbor there has been a 9% decrease between 1989 and 2002.

*Based on Coast Engineering and Sea Engineering, 1991, Aerial Photograph Analysis of Coastal Erosion on the Islands of Maui, Molokai, Lanai, Haleakala, and Hawaii. State of Hawaii Office of Planning, Coastal Zone Management Program.

Source: Coastal Geology Group, School of Ocean and Earth Science and Technology, University of Hawaii at Manoa

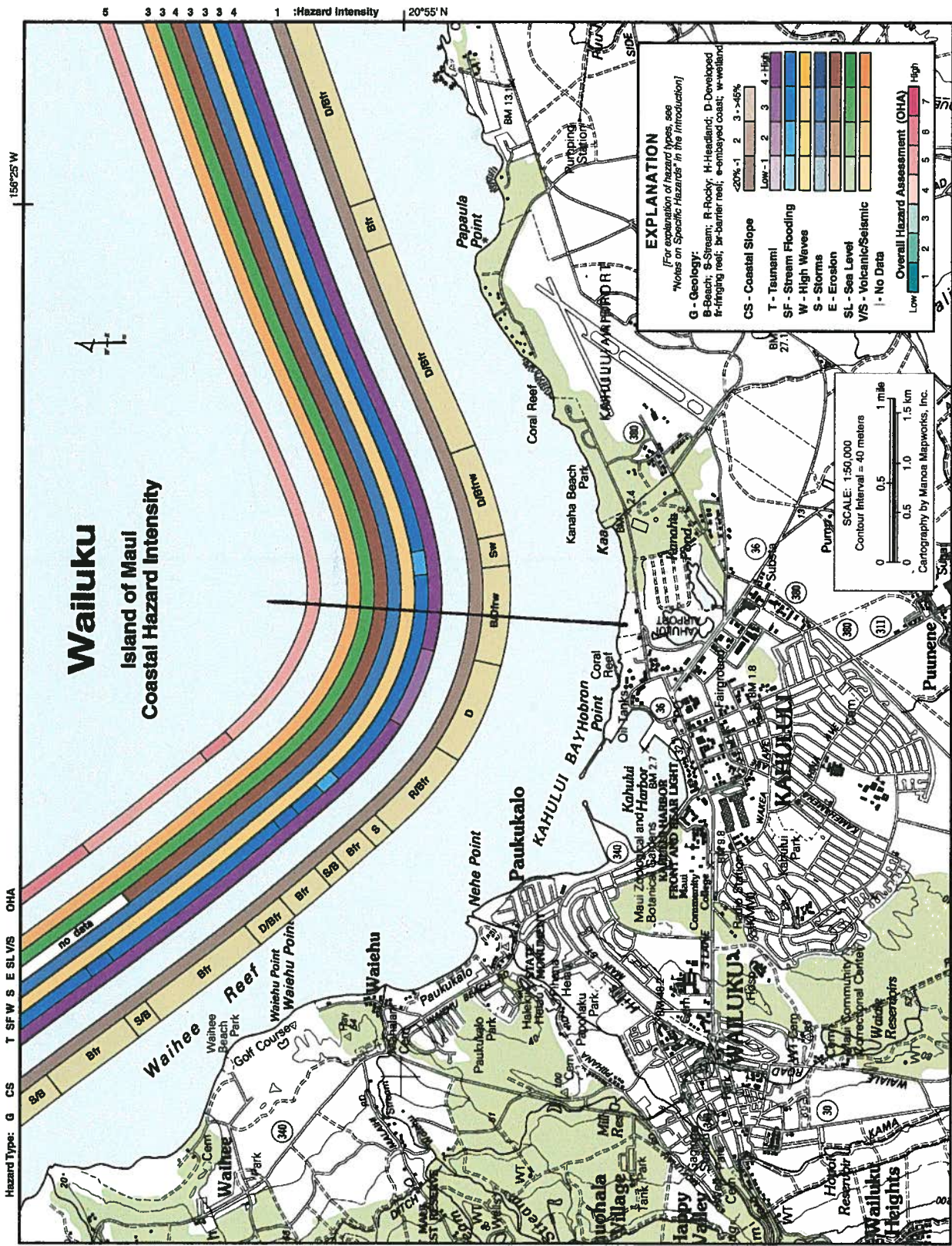
Proposed Shoreline Protection Extension at Wailuku-Kahului Wastewater Reclamation Facility Annual Erosion Hazard Rate Map

NOT TO SCALE



Prepared for: County of Maui, Department of Environmental Management

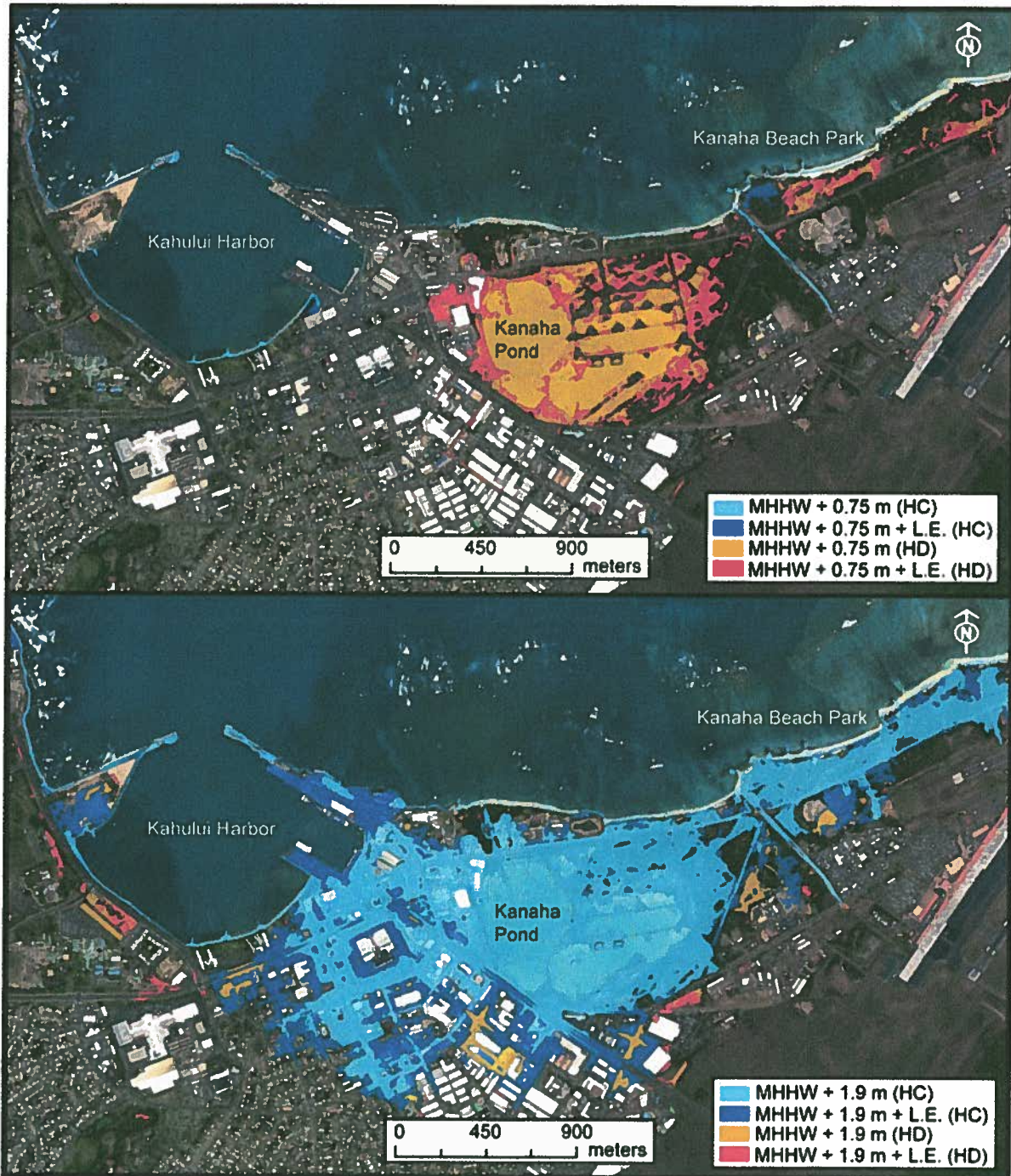
Mofatt/Nishi/WTK WWRP/Draft/EIS/Annexation



Base Credit: USGS 1:50,000 Makawao, Hawaii 5718 IV W733 Edition 1-DMA and USGS 1:50,000 Wailuku, Hawaii 5619 I W733 Edition 1-DMA

EXHIBIT E

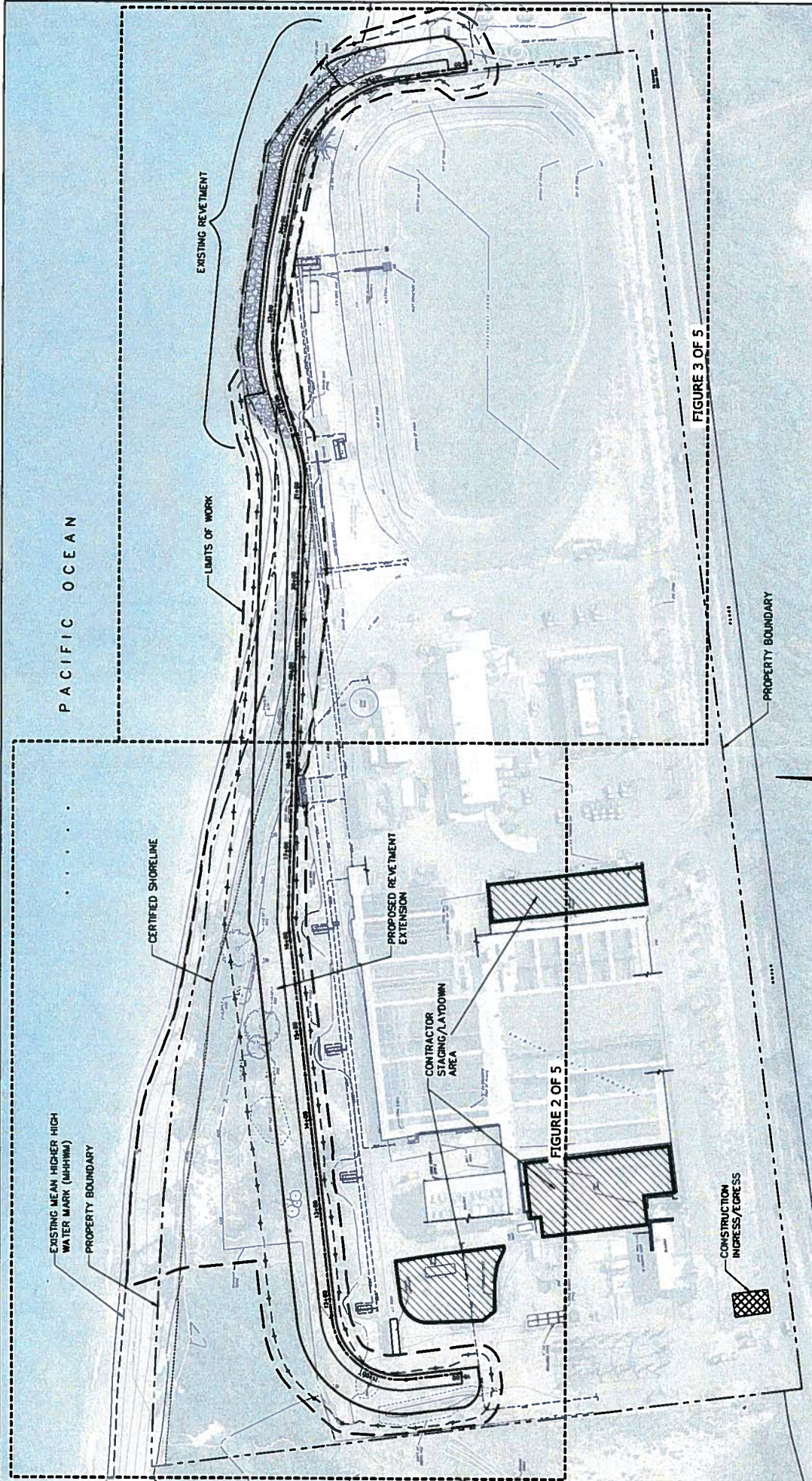
Atlas of Natural Hazards in the Hawaiian Coastal Zone (2002) Fletcher III, Charles H.; Grossman, Eric E.; Richmond, Bruce M.; and Gibbs, Ann E.



SLR vulnerability maps of Kahului, Maui, highlighting lands vulnerable under the best-case SLR scenario of +0.75 m, and the worst-case SLR scenario of +1.9 m. The linear error (L.E._z) at 95 % confidence upper bound (0.45 m) estimates the vertical uncertainty of the elevation data at each SLR scenario contour. Vulnerable areas are separated by hydrologic connection (HC) and hydrologic disconnection (HD) from the ocean

Cooper, H.M., Chen, Q., Flecher, C.H., Barbee, M.M. (2012) Assessing Vulnerability due to sea-level rise in Maui, Hawai'i using LiDAR remote sensing and GIS. © Springer Science+Business Media B.V.2012



EXHIBIT F



LIST OF FIGURES

- FIGURE 1 REVETMENT EXTENSION - OVERALL PLAN
- FIGURE 2 REVETMENT EXTENSION PLAN - 10+00 TO 20+00
- FIGURE 3 REVETMENT EXTENSION PLAN - 20+00 TO 27+07
- FIGURE 4 REVETMENT TYPICAL SECTIONS A AND B
- FIGURE 5 REVETMENT TYPICAL SECTIONS C AND D

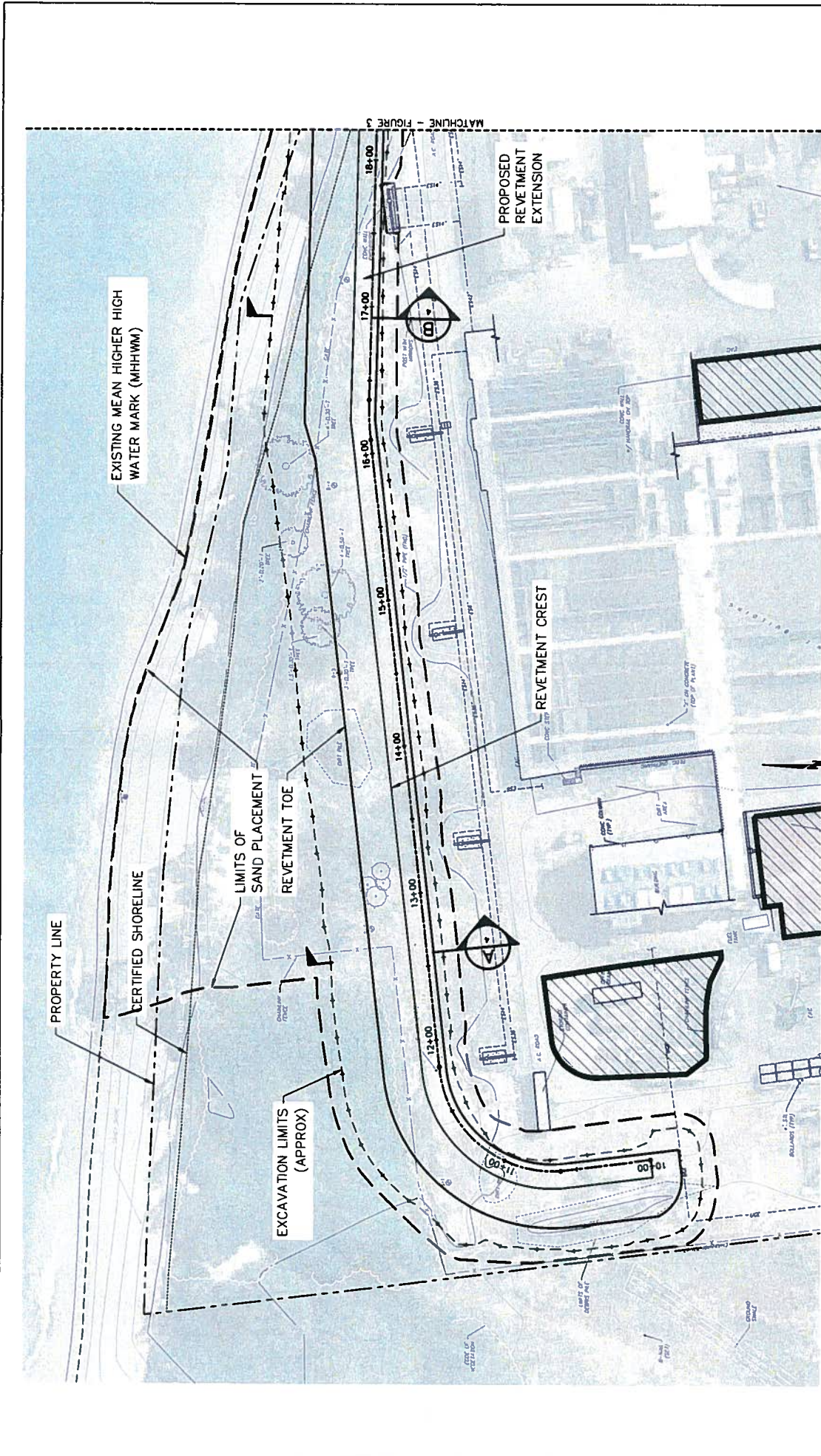
LEGEND:

-  CONTRACTOR STAGING AREAS
-  CONSTRUCTION ENTRANCE



WAILUKU-KAHULUI WWRF SHORELINE PROTECTION EXTENSION
 REVETMENT EXTENSION - OVERALL PLAN

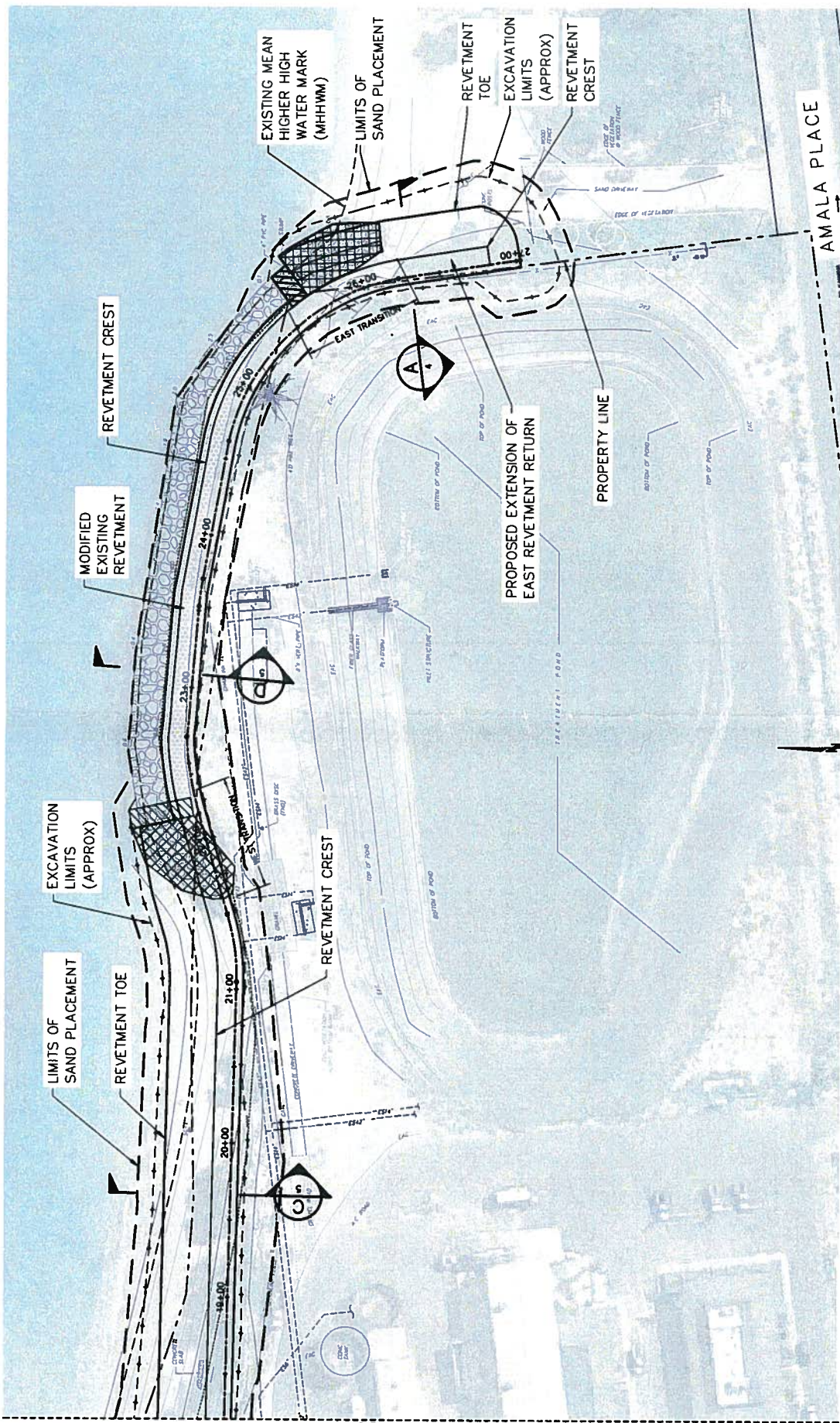
EXHIBIT
 5





WAILUKU-KAHULUI WWRf SHORELINE PROTECTION EXTENSION
 REVETMENT EXTENSION PLAN
 STATION 10+00 TO 20+00

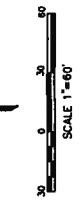
FIGURE 2
 2 of 5

EXHIBIT
 H



TRANSITION NOTES:

-  REMOVE EXISTING REVEMENT & RECONSTRUCT PER PLANS AND SPECIFICATIONS
-  REMOVE AND REPLACE ARMOR STONE AS NEEDED TO INTERLOCK NEW ARMOR LAYERS WITH EXISTING REVEMENT

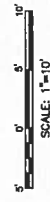
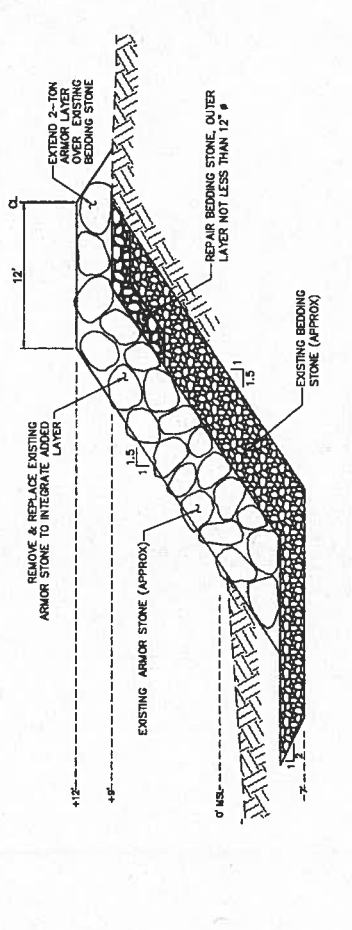
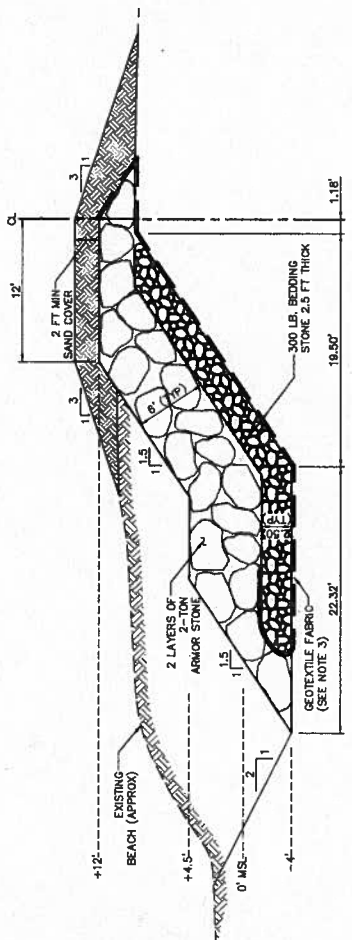
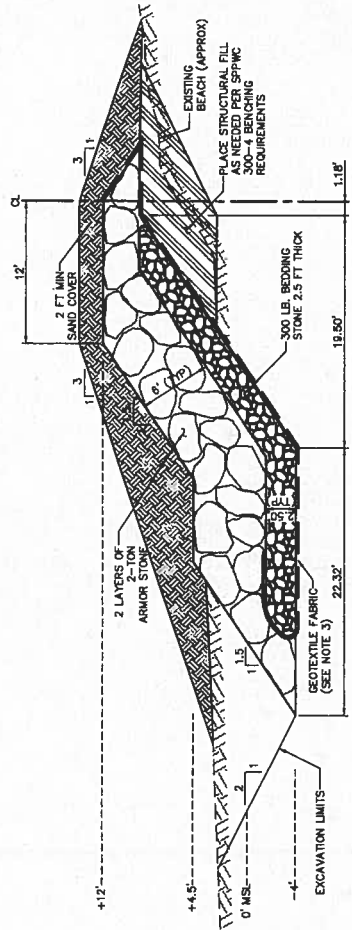
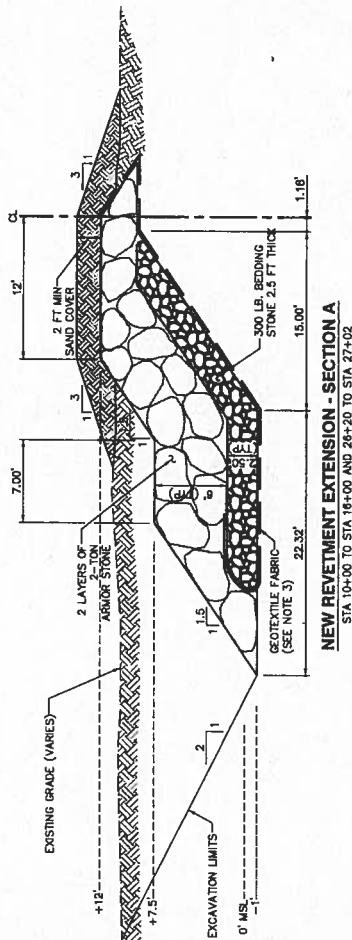


WAILUKU-KAHULUI WWRF SHORELINE PROTECTION EXTENSION
 REVEMENT EXTENSION PLAN
 STATION 20+00 TO 27+07

MATCHLINE - FIGURE 2

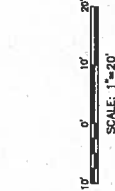
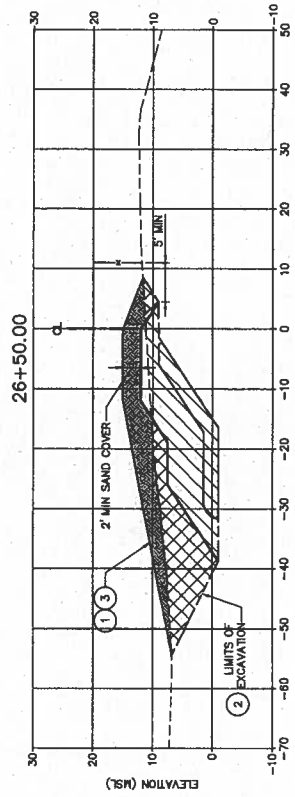
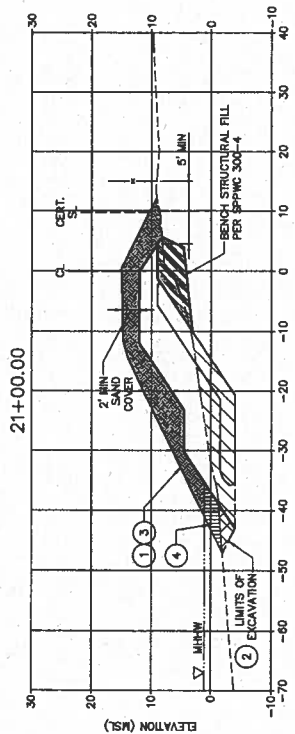
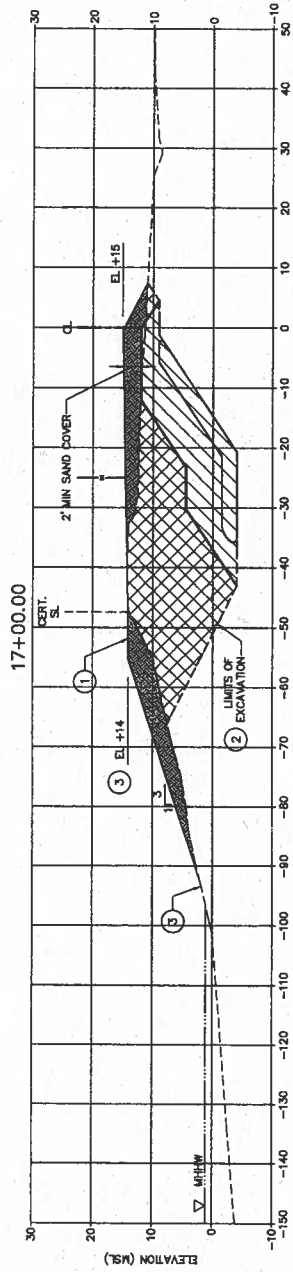
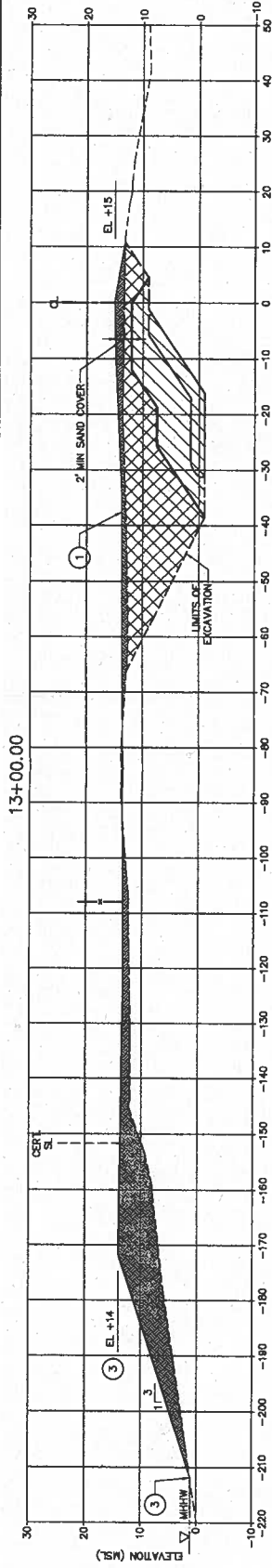
EXHIBIT

1



EXHIBIT





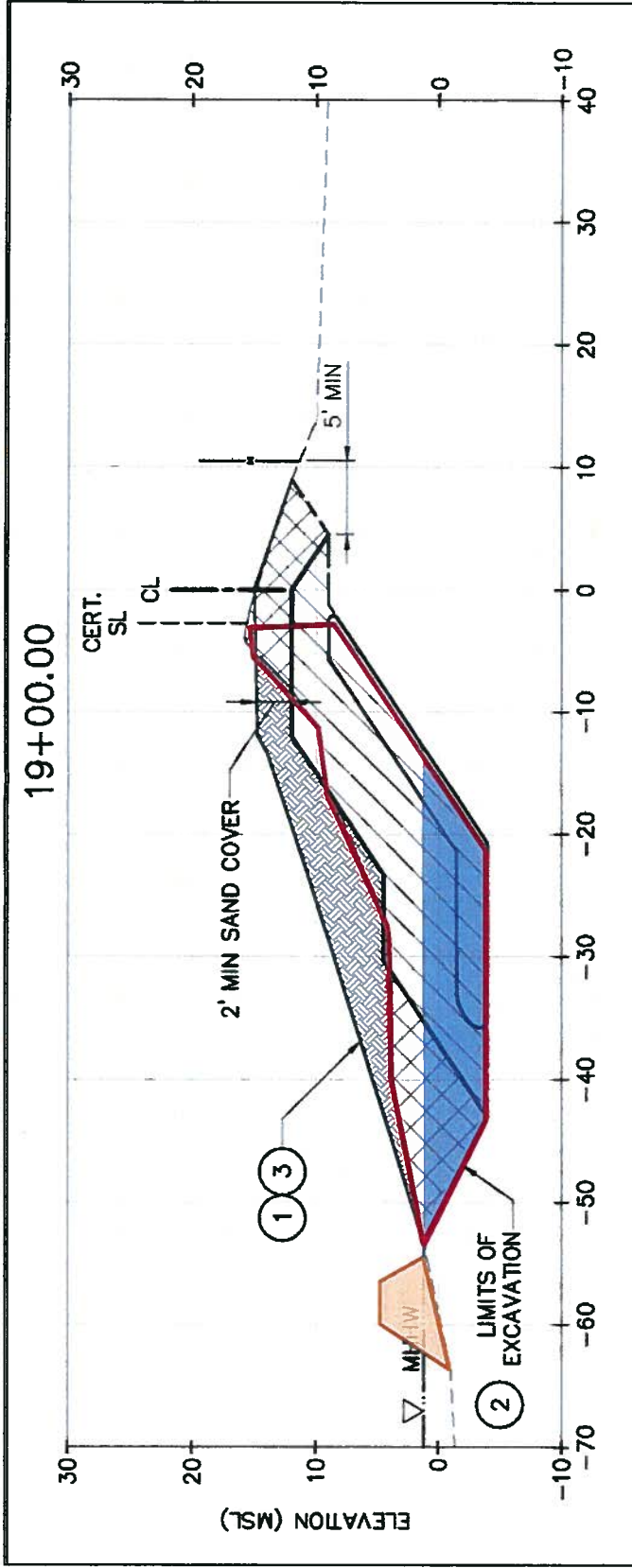
- CONSTRUCTION NOTES:**
- 1 FINISH GRADE VARIES FROM LIMITS OF EXCAVATION TO A MINIMUM OF 41/2 INCH OVER THE RETAINMENT CREST.
 - 2 SAND EXCAVATED SEAWARD OF THE CERTIFIED SHORELINE MUST BE REPLACED SEAWARD OF THE CERTIFIED SHORELINE AS COVER FOR THE RETAINMENT.
 - 3 PLACEMENT OF BEACH QUALITY SAND MUST OCCUR ABOVE THE MHHW SHORELINE WEST OF STA 18+00 AND WITHIN LIMITS OF EXCAVATION EAST OF STA 18+00. FINISH GRADE DIMENSIONS MAY VARY DEPENDING ON BEACH CONDITIONS AT TIME OF CONSTRUCTION.
 - 4 FILL BELOW MHHW MUST USE BEACH SAND EXCAVATED SEAWARD OF THE CERTIFIED SHORELINE.

- LEGEND:**
- EXCAVATION
 - EXCAVATION & BACKFILL
 - STRUCTURAL FILL
 - FILL TO FINISH GRADE
 - EXISTING GRADE
 - FILL BELOW MHHW
 - EXCAVATION LIMITS
 - GEOTEXTILE
 - UNDERLAYER
 - RETAINMENT
 - FINISHED GRADE
 - 8' ALUMINUM CHAINLINK FENCE


EXHIBIT

←

Grading work within the shoreline area (Typical from 19+00 to 23+00)



 Sand excavated seaward of certified shoreline may be used to create a temporary sand berm

 Backfill below MHHW must use existing beach sand from excavation seaward of certified shoreline

 Finish grading above MHHW must use either existing beach sand or "beach quality" sand from upland excavation

CONSTRUCTION NOTES:

- ① FINISH GRADE SLOPE VARIES FROM LIMITS OF EXCAVATION TO A MINIMUM OF +15 MSL OVER THE REVETMENT CREST.
- ② SAND EXCAVATED SEAWARD OF THE CERTIFIED SHORELINE MUST BE REPLACED SEAWARD OF THE CERTIFIED SHORELINE AS COVER FOR THE REVETMENT.
- ③ PLACEMENT OF BEACH QUALITY SAND MUST OCCUR ABOVE THE MHHW SHORELINE WEST OF STA. 19+00 AND WITHIN LIMITS OF EXCAVATION EAST OF STA. 19+00. FINISH GRADE DIMENSIONS MAY VARY DEPENDING ON BEACH CONDITIONS AT TIME OF CONSTRUCTION.

EXHIBIT

5