

**HONOLUA BAY / LIPOA POINT
EROSION AND SEDIMENTATION
STORMWATER MANAGEMENT REPORT**

**HONOAPILANI HIGHWAY
TMK (2) 4-1-001:010
MAUI COUNTY, HAWAII**

Prepared for:

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July 9, 2018

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A handwritten signature in black ink, appearing to read "Michael J. Reyes".

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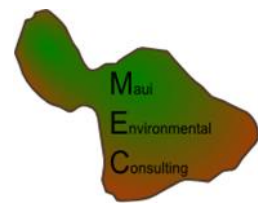


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1.0 INTRODUCTION

This document is provided to identify and offer management strategies for the various stormwater related sources of erosion and sediment currently observed within the Honoloua Bay / Lipoa Point project boundary (Aerial Map). On-site review of observed indicators of erosion, sources of sediment, Department of Health Clean Water Branch (DOH CWB) water quality data, Geographic Information System (GIS) data, local community expert information, and historical literature for the project were reviewed in the preparation of this document.

2.0 PROJECT CHARACTERIZATION

2.1 Project Location

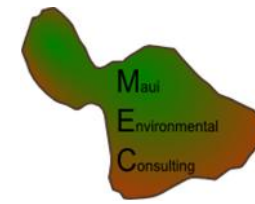
The Honoloua Bay/Lipoa Point project is identified as Tax Map Key (TMK) (2) 4-1-001:010 in Maui County, Hawaii. The property is approximately located between mile markers 32.5 and 36.5 on the makai side of Honoapiilani Highway. It extends from Honoloua Bay at its western boundary to Honokohau Bay at its eastern terminus. The entire area is part of the West Maui Mountains land formation (Location Map).

2.2 Project Description




The approximately 244.12-acre parcel is composed of several different land formations and uses. Starting at approximately mile marker 32.5 along Honoapiilani Highway, the parcel is predominantly forested from the road as it passes over Honoloua Stream moving west towards the ocean and Honoloua Bay. This area is used for parking and trail access to the ocean. As you continue east on Honoapiilani Highway, the northern portion of the property is defined by the cliff coastline of Lipoa Point. In between the highway and the coastal cliffs is a coastal plateau called Kulaokaea that was historically used for growing pineapple but is currently fallow agricultural fields. Continuing east, the cliffs associated with Lipoa Point and Kulaokaea wrap southeast back towards the road and Pohakupule Gulch. East of this gulch, the steep cliffs subside and a sandy beach known as Keonehelele or more commonly as “Windmills Beach”, occurs makai of Honoapiilani Highway. Continuing east, Keonehelele is a narrow stretch of land primarily comprised of high sea cliff terminating at Punaha Gulch. Finally, following the coastal cliffs in between the road and the ocean, the eastern boundary of the parcel terminates at Honokohau Stream (Quadrangle Map).

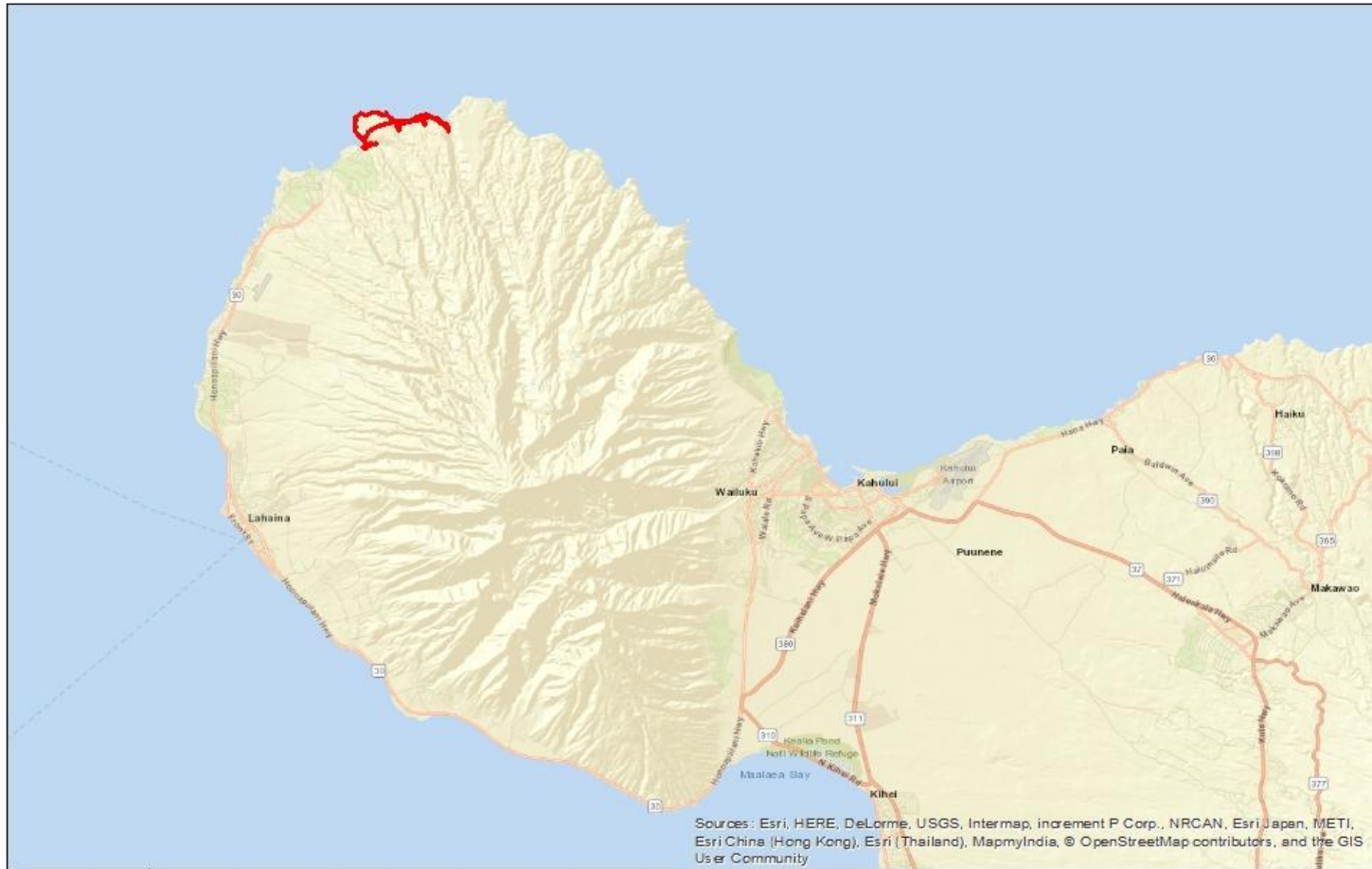
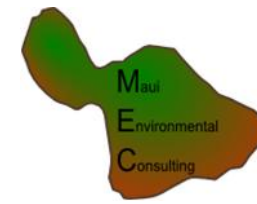
2.2.1 Honoloua Bay

Honoloua Bay marks the western boundary of the project parcel. This bay is part of the Honoloua-Mokuleia Bay Marine Life Conservation District. This bay is protected from the open ocean and the prevailing trade winds by steep cliffs to the east associated with Lipoa Point and by the rocky outcropping of Kalaepiha Point at the northeast terminus of Mokuleia Bay. It is flanked on either side by coral reefs playing host to abundant fish and other marine organisms. Honoloua Stream, which is perennial, flows into the bay. This area is popular with tourists accessing the Bay both by car and from popular snorkeling tour boats which anchor in the Bay. Demand for access to the Bay along Honoapiilani Highway has resulted in disordered parking on the shoulder of the road. The dirt parking lot is filled quickly resulting in cars parallel

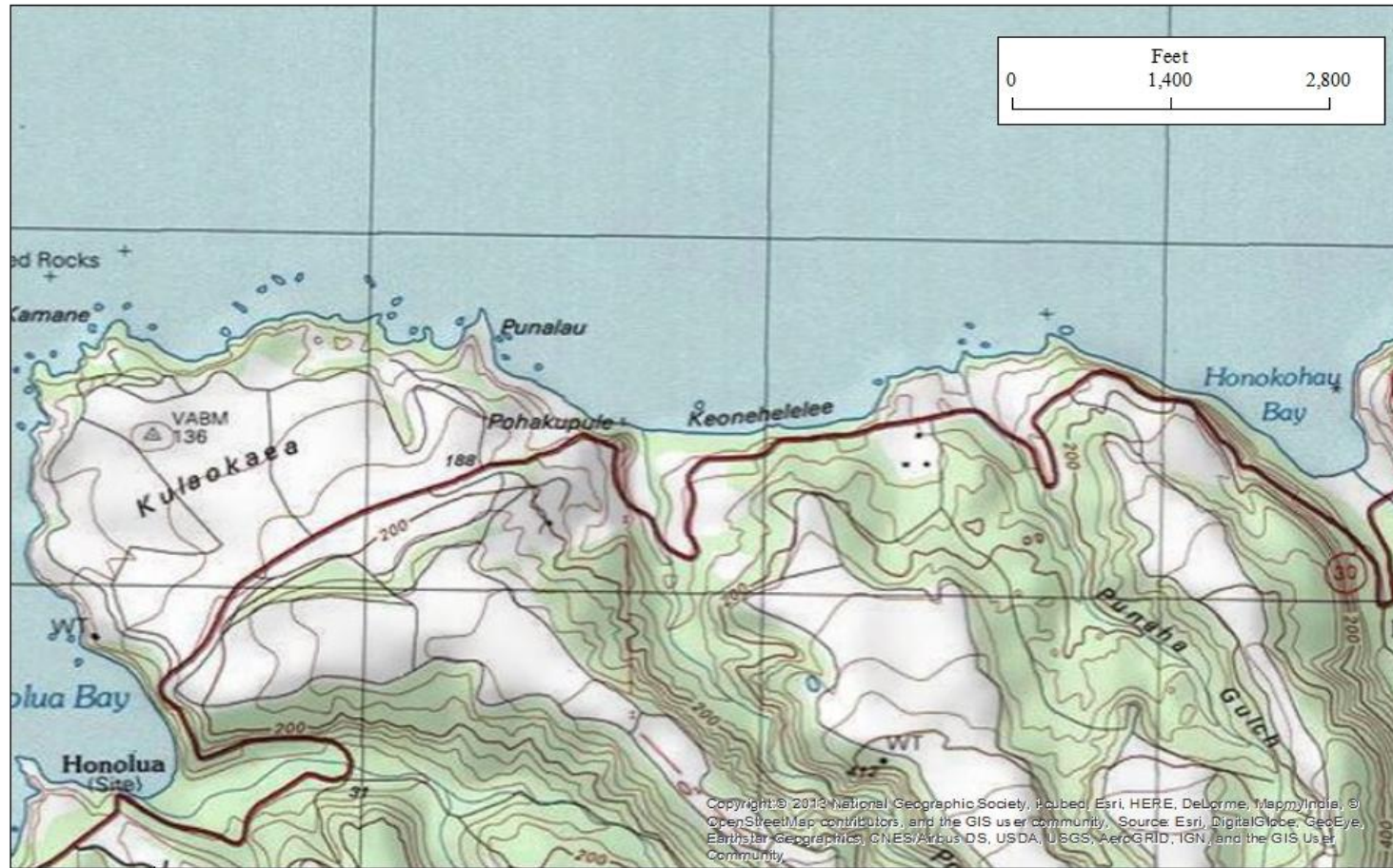





Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

	HONOLUA BAY AND LIPOA POINT STORM WATER MANAGEMENT PLAN	 Sources: Esri, HERE, DeLorme, USGS, Intermap,		AERIAL MAP
	MAUI COUNTY, HAWAII			



	HONOLUA BAY AND LIPOA POINT STORM WATER MANAGEMENT PLAN	<p>Kahului Sources: Esri, HERE, DeLorme, USGS, Intermap.</p>		LOCATION MAP
	MAUI COUNTY, HAWAII			



	HONOLUA BAY AND LIPOA POINT STORM WATER MANAGEMENT PLAN	 <p>Sources: Esri, HERE, DeLorme, USGS, Intermap,</p>		QUADRANGLE MAP
	MAUI COUNTY, HAWAII			



parking in undesignated areas to the east and west of this lot. Over time, several walking paths have been cut into the riparian zone of Honolua Stream as a result of heavy foot traffic from visitors parking along Honoapiilani Highway and walking to the main trail that follows the northeastern bank of Honolua Stream. The riparian zone in the area is dense with canopy, sub-canopy and groundcover vegetation. While the majority of this riparian zone is made up of non-native species, the area is aesthetically pleasing, offering visitors a brief forest hike before arriving at the cobble beach of Honolua Bay.

2.2.2 Kulaokaea

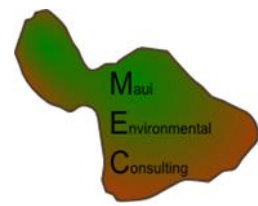
Moving east from Honolua Bay, sea cliffs rise to the large rock outcropping known as Lipoa Point. The relatively flat or gently sloping plateau south of Lipoa Point is known as Kulaokaea. This area has historically been used as an agricultural plot for the cultivation of pineapple. Currently, the area is dominated by weedy, non-native grasses. There are almost no sub-canopy or canopy species in this area, with the exception of some haole koa (*Leucaena leucocephala*) that have established at the periphery of this fallow plot.

A popular dirt driveway accessed by a sharp bend in Honoapiilani Highway follows the eastern cliff of Honolua Bay as it makes its way rather steeply towards Lipoa Point. This driveway is situated at the top of the cliff and is used by the local community to access the world-renowned surf associated with Honolua Bay. In addition, this driveway affords breathtaking views to the west of Honolua Bay and of the surrounding landscape, including the Kapalua coastline and mauka views of the West Maui Mountains. Vehicle traffic from both the local community and from tourists is fairly high on this driveway. When surf conditions in Honolua Bay are good, vehicles parallel park along both sides of this driveway.

The driveway has been cut into the side of Kulaokaea and is situated just below the large plateau. It delineates the gently sloping fallow agricultural fields from the steep cliffs that drop into the eastern portions of Honolua Bay and its associated coral reefs. While most of these cliff faces are vegetated with non-native grasses and shrubs, foot traffic from surfers and fisherman has carved out several steep paths leading down to the Bay. Other than this driveway, very little bare ground occurs in the Kulaokaea area, with the exception being old farming roads not yet overtaken by weedy grasses and some hiking trails that follow the cliff coastline and offer access to the tidal pools east of Lipoa Point along the coastline.

2.2.3 Pohakupule Gulch

Pohakupule Gulch flanks the eastern portion of Kulaokaea. Pohakupule Stream has an ephemeral flow regime discharging on the western side of “Windmills Beach” (also known as Keonehelele Beach or Keonehelele Beach). The beach has formed where the stream outfalls into the ocean and the sea cliffs associated with Lipoa Point and Kulaokaea recede away from the coastline briefly and become less steep. Aggregate reef, including scattered coral and rock, line the coast beginning at the stream outfall and continuing east towards Keonehelele, where the sea cliffs resume their steep drop to the ocean. The shoreline of this area has a sandy beach littered with chunks of dead coral and shells. Mauka of the beach is a clay capped embankment popular for overnight camping due to the shade and privacy offered by mature ironwood trees



(*Casuarina equisetifolia*) and relatively flat ground. Naupaka (*Scaevola taccada*) shrubs grow at the edge of the embankment and delineate the camping area from the beach several feet below. This area is accessed by an unmaintained 4x4 driveway leading west down from Honoapiilani Highway and terminating just east of the Pohakupule Stream outfall. From here, a narrow driveway meanders through a thicket of ironwoods, following the clay embankment east, offering access to multiple undesignated car campsites. This area terminates where steep coastal cliffs resume.

2.2.4 Keonehelele and Punaha Gulch

From “Windmills Beach”, the Keonehelele portion of the project parcel continues east towards Punaha Gulch. Much of this area is comprised of a narrow strip of land in between Honoapiilani Highway and the ocean and is primarily steep cliff and rocky shoreline. A relatively flat piece of land exists above the shoreline cliffs as the highway leaves the coastline to make its way around Punaha Gulch. An outparcel exists makai of the road where local vendors sell food and drinks to tourists. Beyond this, an undeveloped gently sloping area exists associated with the banks of Punaha Gulch. Access to this area is limited, with a small pullout makai of the highway that exists on the eastern side of Punaha Gulch. Vegetation in this area is dominated by various invasive grasses, haole koa, and ironwood tress. The coastline is comprised of steep cliff with a rocky shoreline below.

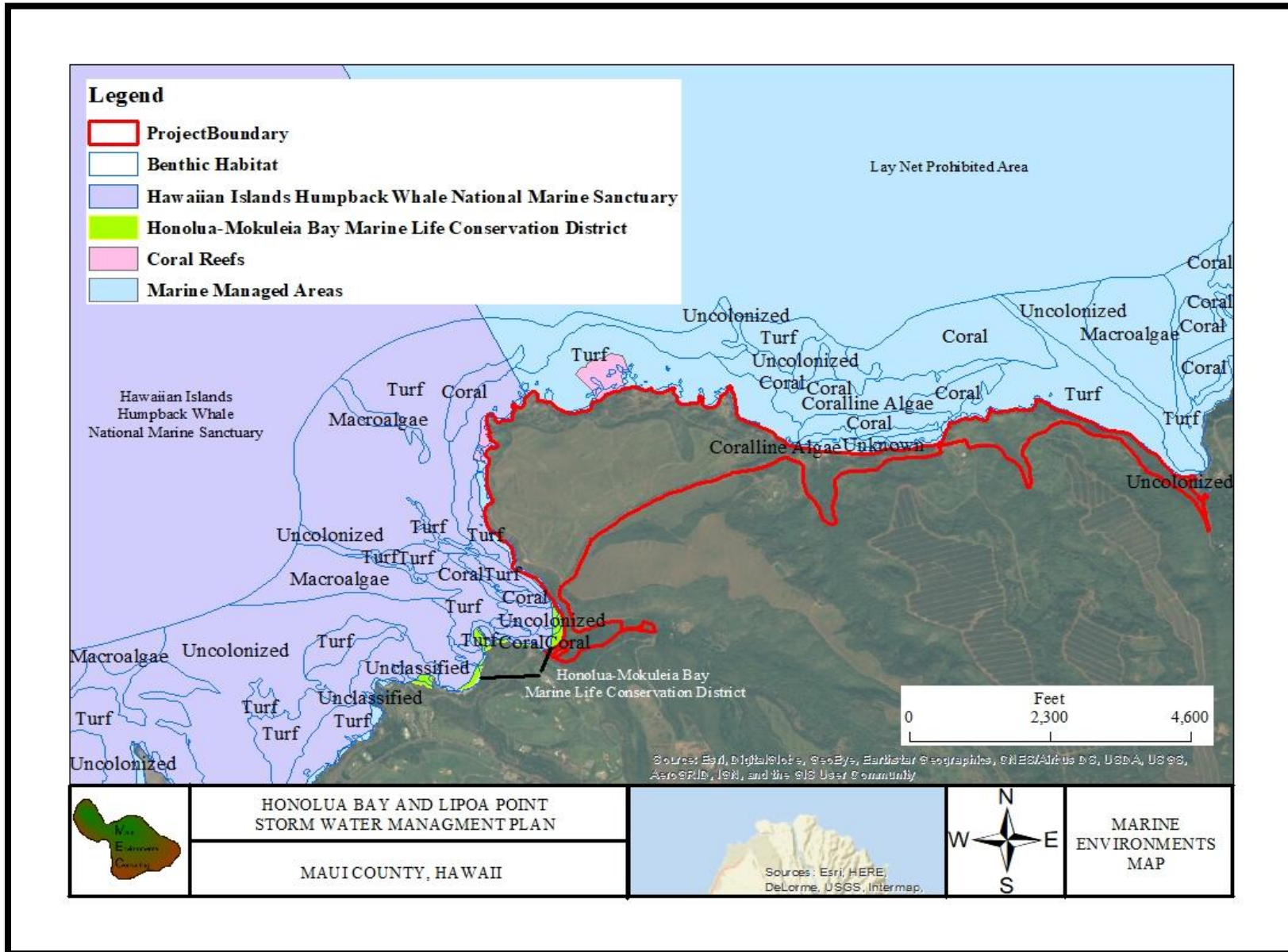
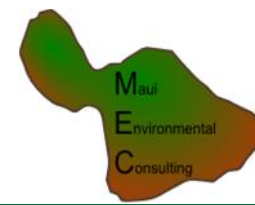
2.2.5 Honokohau Bay

Heading east from Punaha Gulch, the project parcel follows the makai side of Honoapiilani Highway towards Honokohau Bay. The majority of this area is a narrow strip of land terminating at steep cliff and rocky shoreline. There are no pullouts or access points on this stretch of land. The property ends at the western bank of Honokohau Stream where it discharges into the ocean.

2.2.6 Marine Environments

The coastal waters off Honolua Bay and Lipoa Point are protected by various Federal and State agencies (Marine Environments Map). The Hawaiian Humpback Whale Sanctuary extends from Lipoa Point across Pailolo Channel to the island of Molokai. As noted earlier, Honolua Bay is protected from fishing and other forms of take to marine life by the Honolua-Mokuleia Bay Marine Life Conservation District. East of Lipoa Point and continuing east throughout the offshore environments of the project boundary, a State of Hawaii Department of Natural Resources Division of Aquatic Resources Marine Managed Area exists and places a prohibition on the use of lay nets (DLNR DAR 2017).

Marine Benthic habitat is comprised of coral, macroalgae, turf, coralline algae, and uncolonized areas of sand and rock. Large prolific coral reefs exist on the flanks of Honolua Bay and several locations offshore from Lipoa Point. Smaller reefs, rock, and coral outcroppings occur in the marine environment throughout the offshore waters associated with the project parcel. In addition, numerous tide pools exist along the rocky shoreline (NOAA, 2007).





2.3 Land Use Districts

The Honoloua Bay / Lipoa Point project boundary is comprised of two State Land Use Districts (State Land Use District Map). Conservation lands begin on the makai side of Honoapiilani Highway at the western boundary and continue until the dirt driveway at the top of the sea cliff on the eastern portion of Honoloua Bay. Here, the conservation lands continue north along the coastline, wrapping around Lipoa Point. West of Pohakupule Gulch and continuing east, the property makai of Honoapiilani Highway is conservation land. The relatively flat area of fallow agricultural land historically used for growing pineapple associated with Kulaokaea falls in the agricultural land use district. In addition, a small section of land just west of Honokohau Stream at the eastern border of the property is also classified as agricultural land. State land use boundaries were compiled by the State Land Use Commission and were most recently updated in 2014.

2.4 Land Use Classifications

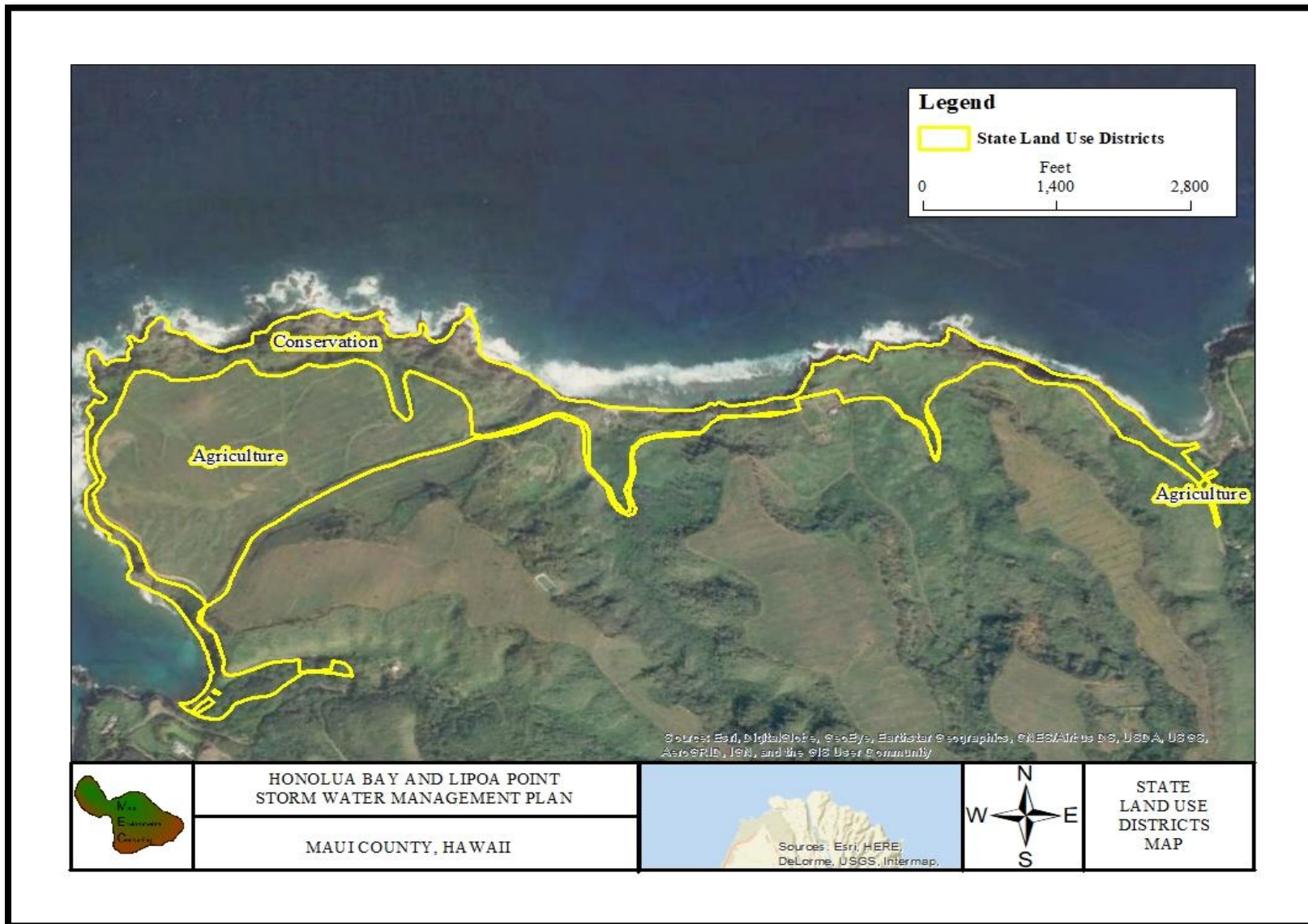
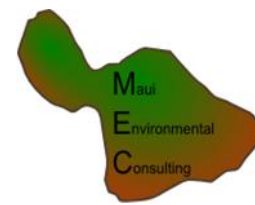
State land use and land cover data consists of historical land use and land cover classifications that were based on the manual interpretation of 1970's and 1980's aerial photography. There are 21 possible categories of cover type. Within the project boundary, two types of land cover were observed. The 'Shrub and Brush Rangeland' category makes up most of the parcel and includes the riparian corridor of Honoloua Bay and the coastal lands beginning at Lipoa Point continuing east to Honokohau Stream at the eastern end of the property. The 'Crop and Pasture' land category begins at the eastern sea cliff of Honoloua Bay and moves east, terminating west of Pohakupule Gulch and south of Punalau Point. The fallow pineapple fields associated with Kulaokaea fall under this land use classification (State Land Use Classifications Map).

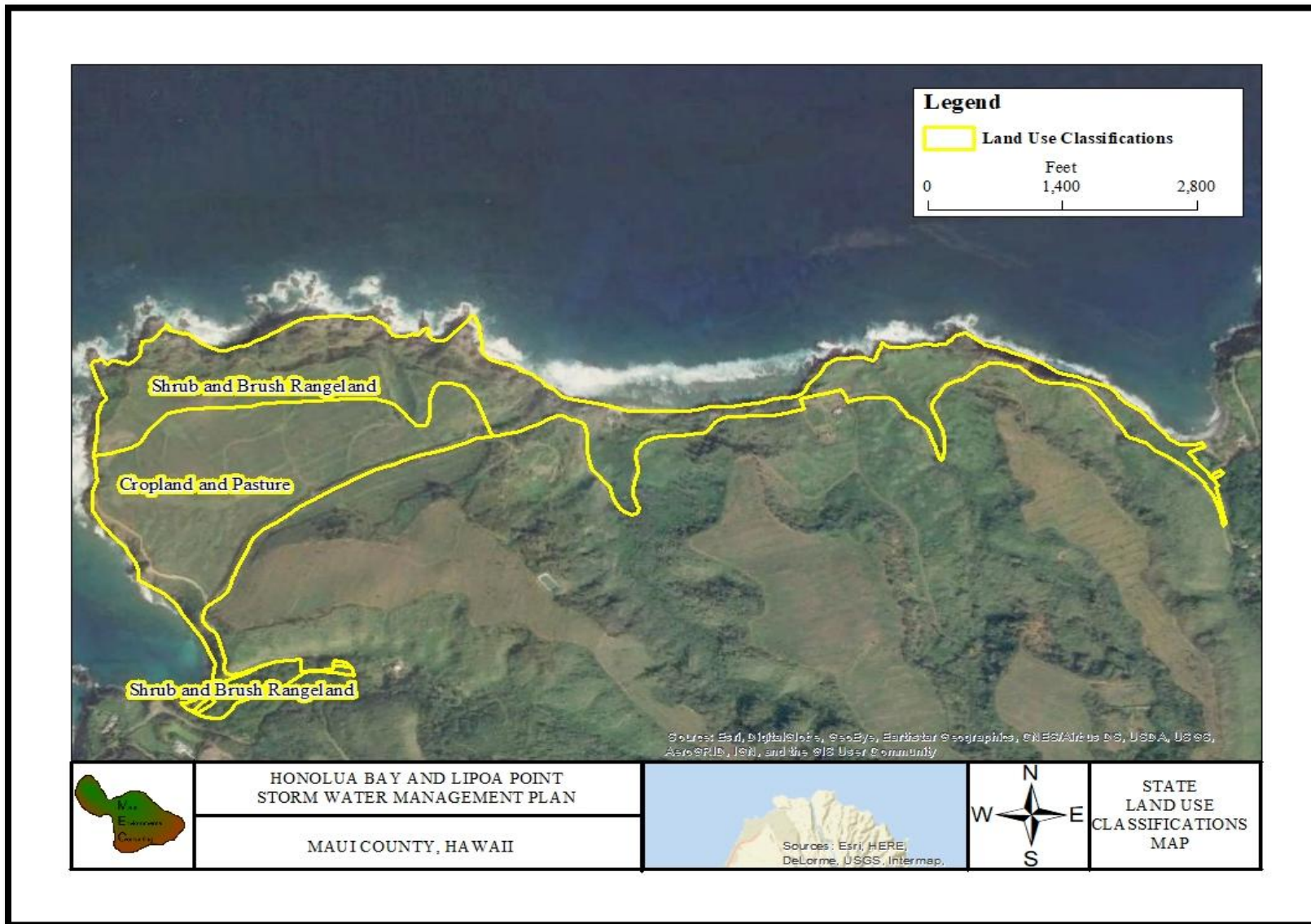
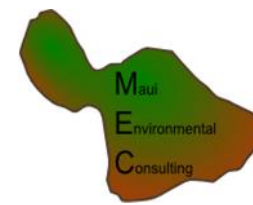
2.5 Streams

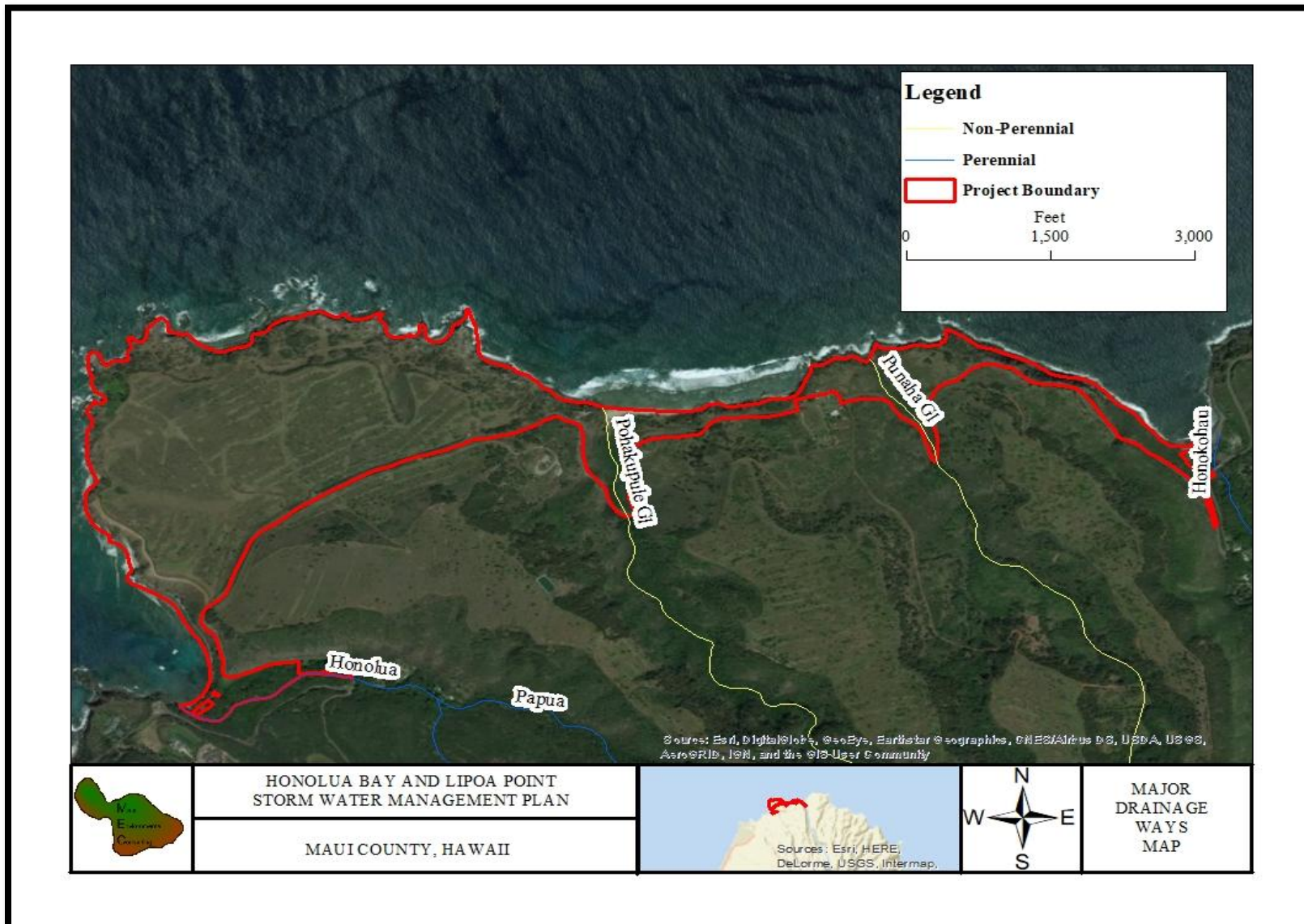
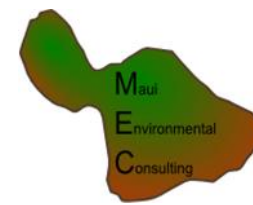
There are five streams associated with the Honoloua Bay / Lipoa Point project (Major Drainage Ways Map). Moving west to east, these include Honoloua, Papua, Pohakupule, Punaha, and Honokohau. Of these, Papua is a tributary of Honoloua, with the confluence of these two streams occurring off site and mauka of the property, due south of Punalau Point and east of Honoloua Bay. Honoloua, Papua, and Honokohau Streams are considered perennial streams while Pohakupule and Punaha have ephemeral flow regimes.

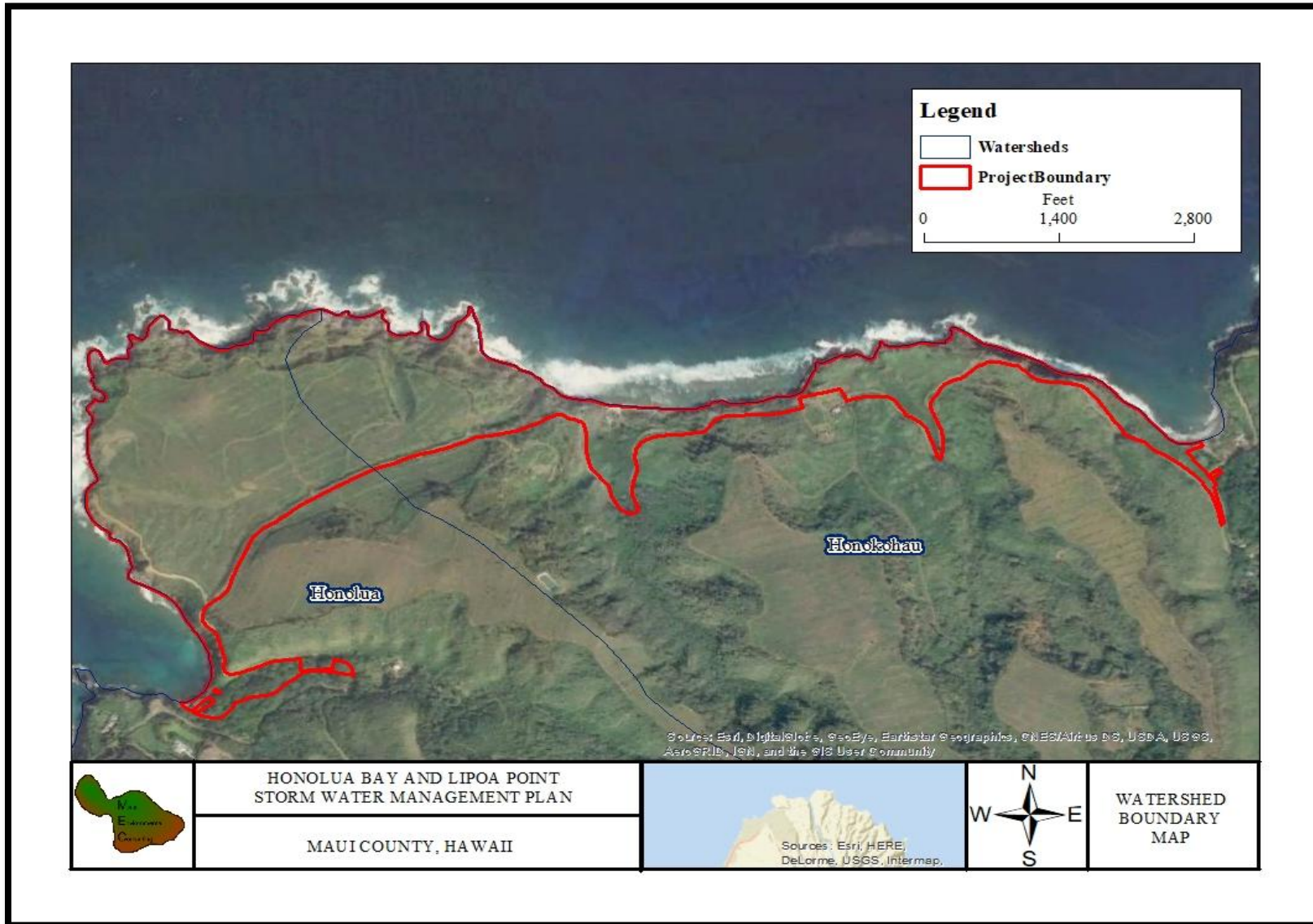
2.6 Watersheds

The Honoloua / Lipoa Point project falls within the boundaries of two watersheds; Honoloua and Honokohau (Watershed Boundary Map). Honoloua is the smaller of these two, with a total area of approximately 3,265 acres. The watershed begins at approximately 4,300 feet near the peaks of the West Maui Mountains and makes its way down to the coast. Along the coastline, it reaches from the west end of Mokuleia Bay to roughly the mid-section of Kulaokaea. Honoloua Stream and Papua Stream both originate within this watershed. Papua headspring is located at 1,600 feet in elevation while Honoloua Stream originates just below 3,800 feet near the top of the watershed.









HONOLUA BAY AND LIPOA POINT
 STORM WATER MANAGEMENT PLAN

MAUI COUNTY, HAWAII



Sources: Esri, HERE,
 DeLorme, USGS, Intermap.



WATERSHED
 BOUNDARY
 MAP



The Honokohau watershed has a total area of approximately 7,890 acres. The watershed begins at an elevation of roughly 5,700 feet at the summit of the Kahoolewa Ridge in the West Maui Mountains. From here, it drops almost due north to the coast where it flanks the Honolua Watershed on its western border. To the east, it terminates at Nakalele Point. Pohakupule, Punaha, and Honokohau Streams originate in this watershed. The Pohakupule Stream begins at approximately 1,300 feet while Punaha and Honokohau originate at 500 feet and 5,200 feet respectively.

3.0 SOURCES OF SEDIMENT

Sediment sources associated with the Honolua / Lipoa Point project were assessed using field observations made during two field events occurring on May 3rd and June 6th, 2018. In addition, the Nonpoint Source Pollution and Erosion Comparison (NSPECT) model was used to identify sediment sources and loading estimates for the Honolua and Honokohau Watersheds to better understand sediment sources at a landscape level.

While this document focuses on localized sediment sources found within the Honolua Bay / Lipoa Point project boundary, it should be noted that recent studies suggest much of the sediment affecting marine coastal waters in West Maui is due to stream bank erosion from legacy sediment ‘fill terraces’ which were created when material was actively pushed into gulches while leveling fields for farming the areas of the landscape above the stream gulches. (Stock, J.D., et al, 2016). Many of these leveled agricultural plots exist mauka of Honoapiilani High and the project site.

3.1 Field Observations

Maui Environmental Consulting, LLC (MEC) staff visited the project site to identify and photo-document sources of sediment and areas with high erosion potential due to both natural and anthropogenic circumstances. Specifically, MEC recorded observations of bare ground, rills and channels on the soil surface. These conditions were also observed in stream channels which contained areas of high runoff and exhibited evidence that included head cutting, scouring, undercut banks, exposed tree roots, and areas with obvious soil deposits. Four areas were identified as having appreciable sources of sediment vulnerable to erosion during high storm water events. These included:

1. the parking area and walking trails associated with the Honolua Bay access trail;
2. the dirt driveway along the western edge of Kulaokaea;
3. old agricultural roads and trails within Kulaokaea and the Pohakupule Gulch; and
4. the 4x4 driveway and camping area associated with “Windmills Beach”.

Appendix A provides a photo-document depicting sediment hot spots observed in these four areas.

3.1.1 Honolua Bay

Within the access area to Honolua Bay along Honoapiilani Highway, three major sources of sediment were observed. These include the unimproved parking area along the highway, the dirt hiking trail leading to the cobble beach, and a dirt road crossing Honolua Stream near the



ocean. Section one of the photo-document following this report as Appendix A depicts the current conditions at these locations within the riparian corridor of Honoloua Stream.

While portions of the main parking area along Honoloua Highway are paved or covered with gravel, large sections are exposed dirt and mud that flow freely into Honoloua Stream during rain events. Here, bare muddy soil deposits are continually disturbed by vehicles pulling into and out of the parking area. Muddy tire tracks, rills, and small channels leading to Honoloua Stream were observed.

The dirt walking path leading to Honoloua Bay follows the northern bank of the stream. The path consists of bare ground with exposed roots, rills, and channels sloping directly into the adjacent stream with little to no vegetative buffer to prevent sediment from entering the stream. This trail has high use by tourists throughout the year. Many additional side trails have been cut into the riparian zone near the highway as tourists make their way from undesignated overflow parking areas towards the main walking path, further exacerbating erosion in this area.

In addition, a dirt road crosses the stream channel near the cobble beach. Here, the banks of the stream have been undermined. Exposed tree roots, muddy sediment deposits, and undercut banks are evident at this road crossing. The dirt road leading to this crossing slopes down toward the stream from a secondary parking area along Honoapiilani Highway. Rills and channels are evident in the road and provide an additional source of sediment to the stream and ultimately to the stream outfall into Honoloua Bay approximately 200 feet to the northwest.

3.1.2 Dirt Driveway on West End of Kulaokaea

The dirt driveway flanking the western cliff Kulaokaea is situated directly above Honoloua Bay. Sediment erosion is evident along the driveway and within the makeshift trails leading from the driveway to Honoloua Bay below. As mentioned earlier, this driveway is popular with surfers, fisherman, hikers, and tourists alike. Section two of the photo-document following this report as Appendix A depicts the current conditions at these locations.

Deep rills and long uninterrupted channels are evident throughout the driveway as it drops approximately 80 feet, heading north from Honoapiilani Highway towards Lipoa Point. Further evidence of erosion is provided by the exposed fragments of black plastic used historically for agricultural practices. Failed water bars, kickouts, and undermined swales can be observed throughout the driveway.

In addition, many steep makeshift trails have been cut into the cliff leading from this dirt driveway down to Honoloua Bay by surfers, fisherman, and tourists alike. Erosion and sediment transport from the dirt driveway are facilitated by these trails. Scouring is evident along many of these pathways. Exposed fragments of black plastic can also be observed along these trails, providing further evidence of erosion in these areas.



3.1.3 Agricultural Roads and Trails

As noted earlier, the large gently sloping area of Kulaokaea has historically been used as an agricultural plot for the cultivation of pineapple. Currently, the area is dominated by weedy, non-native grasses. Bare ground agricultural roads used to access field plots within the area are no longer being maintained. In addition, several outfalls from the agricultural lands in the form of old roads and hiking trails exist. Section three of the photo-document following this report as Appendix A depicts the current conditions at these locations.

Along the numerous dirt roads in this area, rills and channelization are evident. Soil deposits were observed where these roads turn or run into vegetation. Storm water falling on these highly compacted soils builds speed and, using the roads as a conduit, flows down slope toward the ocean. These uninterrupted flows cause additional erosion to the roads and surrounding landscape and deliver sediment laden storm water to the ocean.

At the top of the coastal cliffs where Kulaokaea drops toward the ocean, various old roads and hiking trails drop to the tidal pools and coastal areas below, acting as discharge channels. These flow ways contain stream cuts, undercut banks, exposed roots, and large piles of sediment deposits and other debris, all indicators of high flow volumes during storm water events.

3.1.4 Pohakupule Gulch and “Windmills Beach”

As noted earlier, Pohakupule Gulch flanks the eastern edge of Kulaokaea as it discharges into the ocean. This outfall is located on the western edge of “Windmills Beach”. Three areas of sedimentation were observed to be associated with Pohakupule Gulch and “Windmills Beach”. Section four of Appendix A depicts the current conditions at these locations.

Where Pohakupule Stream crosses Honoapiilani Highway to the south, large wrack lines can be observed well above the concrete walls associated with the culverts placed under the road. These piles of debris are just below the road and indicate high volumes of fast moving water flowing through Pohakupule Gulch during storm water events. At the stream outfall to the ocean, undercut banks, exposed tree roots, scouring, and sediment deposits are all evident.

The steep 4x4 driveway from Honoapiilani Highway down to “Windmills Beach” is highly eroded. Rills and deep channelized cuts are found throughout the dirt driveway as it makes its way down the campground area. Like the abandoned agricultural roads associated with Kulaokaea, this dirt driveway is highly compacted and provides a conduit for storm water to quickly flow downhill towards the ocean, exacerbating erosion. In addition, the steep hill just east of this 4x4 driveway leading down from the highway to the camping area is largely devoid of vegetation. A makeshift hiking trail has been created on this hill by pedestrians avoiding the 4x4 driveway entrance to “Windmills Beach”. Instead, these individuals park in a small turnoff along the highway and hike down the hill.

The clay capped level embankment used for camping has a dirt driveway through its center. Vehicles driving over this area have caused the driveway to become severely compacted, leaving the soils highly impermeable and promoting additional runoff to the shoreline below.



Naupaka grows along the embankment where it meets the shoreline and acts to stabilize soils in this area. Where Naupaka is absent due to camper trails for accessing the beach, rills, channels, exposed tree roots, undercut banks, and large sediment deposits are present.

3.2 NSPECT Modeling

NSPECT is an informative spatial tool developed by the National Oceanic Atmospheric Administration (NOAA) Coastal Services Center (CSC) for watershed managers and planners (Eslinger, 2012). It is a GIS-based application that models potential water-quality impacts from non-point source pollution and erosion. The model inputs include soil maps from U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), Soil Survey Geographic Database, 30m Digital Elevation Maps (DEMs) from the United States Geological Survey (USGS), annual precipitation from the Parameter- elevation Regressions on Independent Slopes Model (PRISM) group, and Coastal Change Analysis Program (CCAP) land cover. Each land cover type has an associated impervious surface co-efficient.

MEC ran the NSPECT model for sediment delivery throughout the Honolua and Honokohau Watersheds. The model provides estimates of both accumulated sediment in the gullies and gulches making their way towards the ocean and localized sediment contributions based on the model inputs listed above.

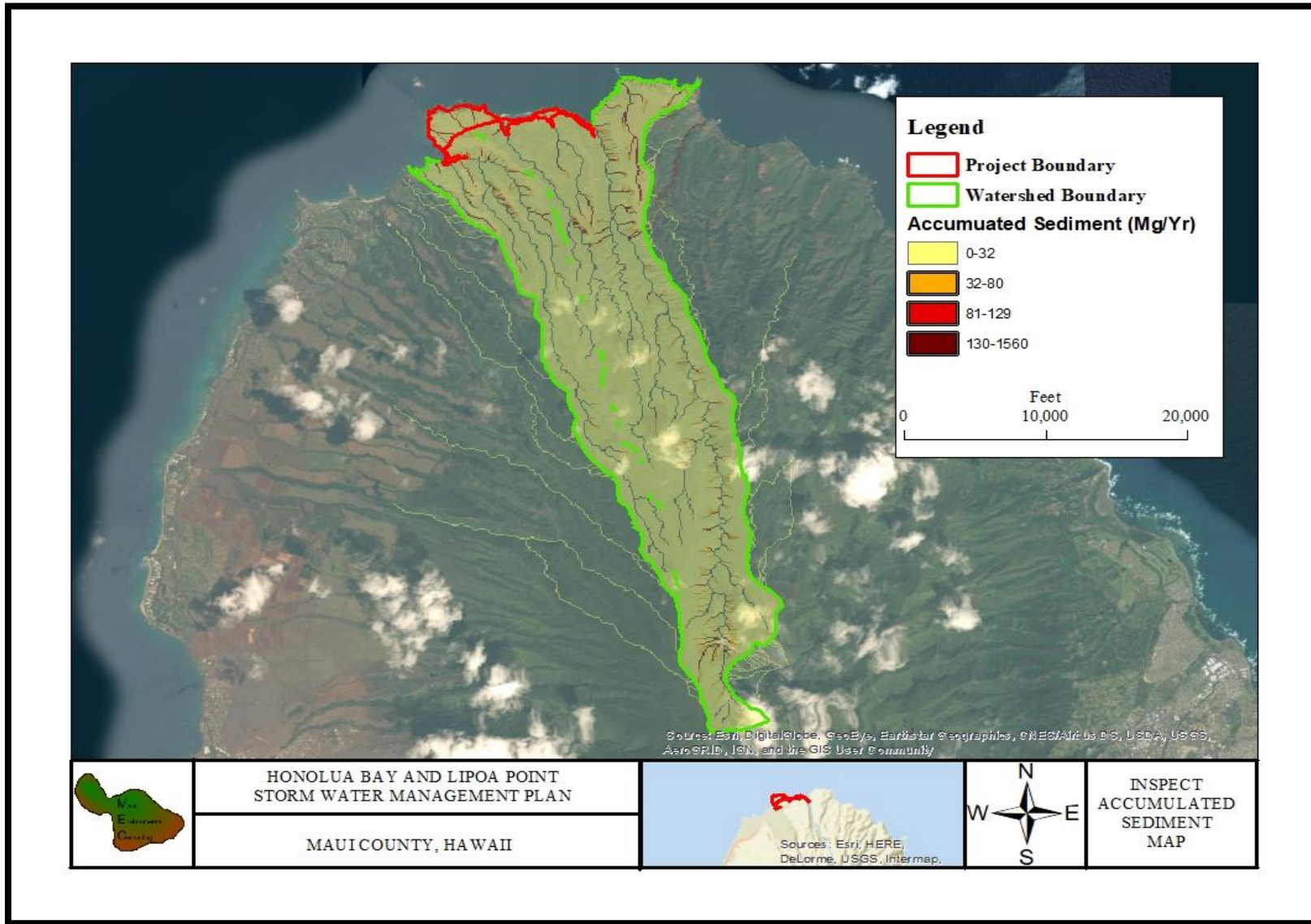
It should be noted that NSPECT has known limitations with accuracy and precision when modeling for erosion in wet, steep slopes like those mauka of the Honolua Bay / Lipoa Point project. This is due, in part, to a lack of available data collection from inaccessible mountainous areas. Inputs to NSPECT, such as rainfall days and soil erosion factors, are often very different throughout the landscape being modeled and may not be accurately represented by the input data. MEC recognizes that there are other models available, namely InVEST, and that there are trade-offs between cost-efficiency and higher accuracy (more robust modeling methods and procedures can be costly and time-intensive).

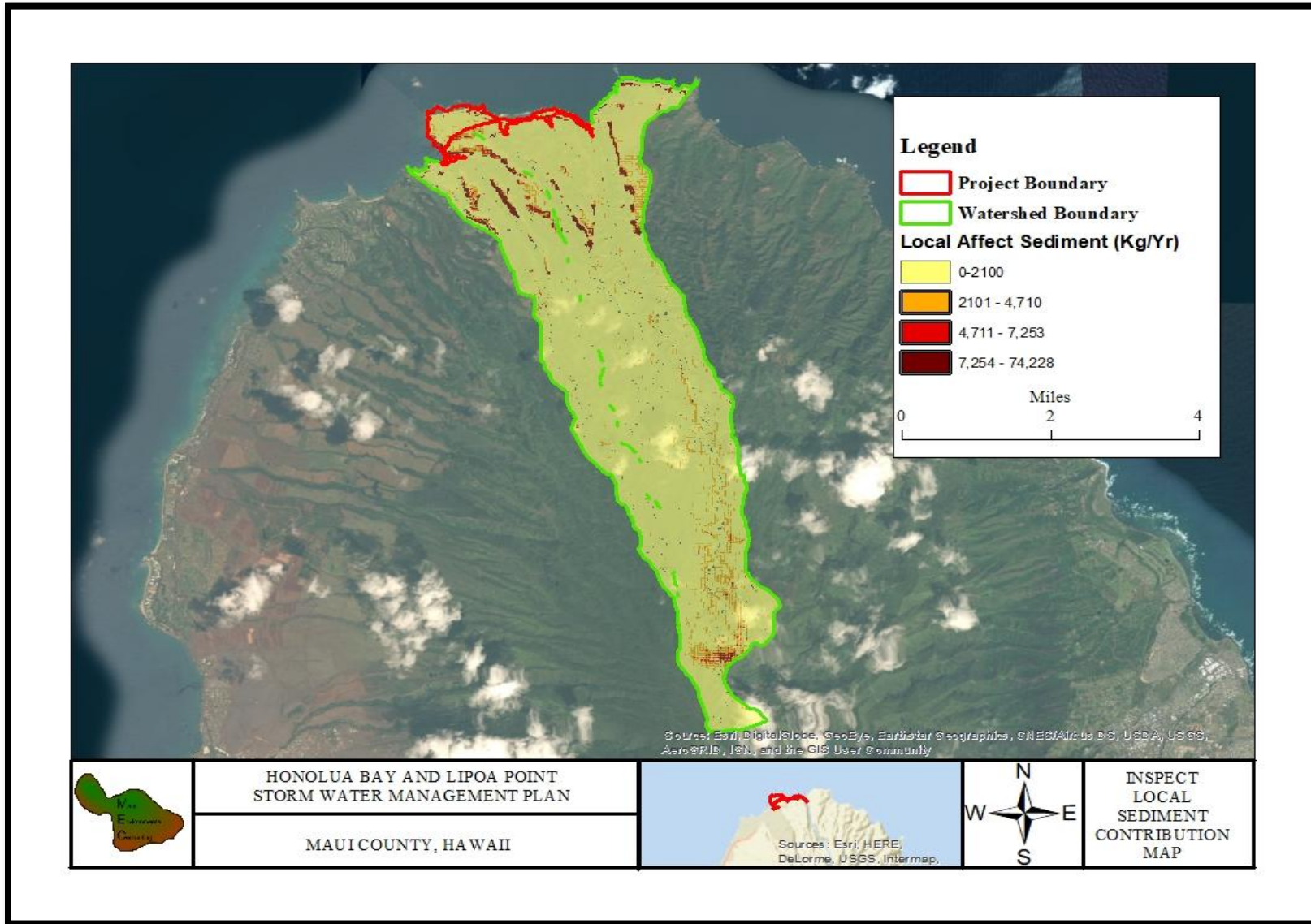
For these reasons, MEC will not discuss quantitative data resulting from the modeling effort in this report but instead has included the results of the NSPECT modeling exercises for accumulated and localized sediment as figures (Accumulated Sediment Map and Local Sediment Contribution Map). These figures are offered as qualitative data serving as visual representations of the various sediment sources and sediments loads produced as water moves from the upper reaches of the West Maui Mountains down to coastal waters.

The Accumulated Sediment Map depicts two areas within the watershed where sediment transport is particularly high. In the upper reaches of the watershed near major stream headwaters, where the slope of the West Maui Mountains changes from being extremely steep with water flowing in smaller gullies and in sheet flow across nearly vertical faces into the upper reaches of the various streams ultimately leading to the coastline, accumulated sediment transport is high. In addition, mauka of Honoapiilani Highway, where agricultural terraces have been positioned at the tops of land masses flanked on either side by gulches, accumulated sediment levels are much higher than



throughout the rest of the Honolua and Honokohau Watersheds.







The Local Sediment Contribution Map highlights the agricultural plots terraced mauka of Honoapiilani Highway as well. The model shows that these areas contribute an inordinate amount of sediment to the watershed. These plots contain bare ground roads subdividing individual plots. These dirt roads have been compacted over time and their barren soils have become less permeable than the surrounding plots that while fallow, are still covered with dense grasses and other vegetation. During storm events, surface water sheet flow collects in these roads, building up speed as it flows down slope. Dirt roads along the periphery of these agricultural fields have water bars and kickouts that divert storm water into the adjacent gullies and gulches. In this way, sediment laden storm water travels from fallow agricultural fields to coastal marine waters, impacting water quality in the Honolua and Honokohau Watersheds along the way.

4.0 WATER QUALITY DATA

MEC reviewed the Final 2016 State of Hawaii Department of Health (DOH) Clean Water Branch (CWB) Integrated Water Quality Report (IWQR) as well as the Draft 2018 IWQR for water quality data specific to the Honolua Bay / Lipoa Point project.

4.1 Clean Water Act Sections 303(d) and 305(b)

The Hawaii State Department of Health (DOH) is obligated by the Clean Water Act (CWA) Sections (§) 303(d) and 305(b) to report on the State's water quality on a two-year cycle. The CWA §305(b) requires states to describe the overall status of water quality statewide, and the extent to which water quality provides for the protection and propagation of a balanced population of shellfish, fish, and wildlife, and allows recreational activities in and on the water. The CWA §303(d) requires states to submit a list of waters that do not attain applicable water quality standards, plus a priority ranking of impaired waters for Total Maximum Daily Loads (TMDL) development based on the severity of pollution and the uses of the waters.

The IWQR informs the public on the status of marine and inland (streams and estuaries) water bodies and serves as a planning document to guide other CWA programs. The Final 2016 IWQR incorporates data collected from November 1, 2013 to October 31, 2015 to provide an updated snapshot of water body conditions throughout the state and carries over the assessment results from previous IWQRs. In addition, the Draft 2018 IWQR report has been published on the DOH CWB website for initial public viewing.

Impaired waters—waters that do not meet the State's water quality standards (WQS)— in the IWQR may be targeted for further monitoring activities to develop TMDLs, to plan and evaluate CWA §319 nonpoint source (NPS) pollution control projects and set requirements for National Pollutant Discharge Elimination System (NPDES) permits and §401 Water Quality Certifications (WQCs). The IWQR not only identifies areas in need of restoration but serves as a baseline to validate the State's efforts to improve water quality and eventually delist impaired waters that have been rehabilitated.



4.1.1 2016 State of Hawaii Integrated Water Quality Report - Clean Water Act §305(b) Assessments and §303 (d) List of Impairments

In the most recent finalized Integrated Water Quality Report (Hawaii Department of Health, 2016), two water quality monitoring stations are monitored by the DOH CWB that fall within the Honoloua Bay / Lipoa Point project boundary. These include the marine coastal waters of Honoloua Bay and the inland waters of Honokohau Stream. The inland waters of Honoloua Stream are listed as a site within the report, but no data is being collected within the stream at this time. Likewise, the marine coastal waters of Honokohau are also listed as a sampling site in the report but no data is currently being collected from this site.

While this report focuses on erosion and sediment transport affecting water quality, Honoloua Bay is currently listed in both the 2016 Final and 2018 Draft IWQR reports for enterococcus, nitrate+nitrite, ammonium, total phosphorus, turbidity and chlorophyll-*a* impairments. The site has been given high priority status for the development of a Total Maximum Daily Load (TMDL) for these parameters. Turbidity measurements in exceedance of water quality standards can be caused by sediment laden water discharging from freshwater streams and/or from the resuspension of sediment cause by tidal or wave action within the bay. Increased sedimentation and nutrient loading on the extensive offshore reef complex threatens the health of the reef ecosystem. Sediments deposited by one storm event can be subsequently re-suspended. Recent studies have demonstrated that increases in sediment discharges from watersheds associated with poor land-use practices can impact reefs over 100 km from shore, and that ecosystem-based management efforts that integrate sustainable activities on land, while maintaining the quality of coastal waters and benthic habitat conditions, are critically needed if coral reefs are to persist (Richmond, et al., 2007).

Honokohau Stream has no water quality impairments as of the Final 2016 and Drat 2018 IWQR reports. No data is currently being collected in the marine coastal waters of Honokohau Bay.

5.0 PROPOSED MANAGEMENT STRATEGIES

As stated earlier, many of the land use practices occurring mauka of the project boundary are likely having a more significant deleterious affect on Honoloua Bay and the marine coastal waters associated with Lipoa Point, “Windmills Beach”, and Honokohau Bay. Many of these land management issues are currently being addressed with mitigation practices by the DOH CWB, West Maui Lands Division of the Hawaii Department of Land and Natural Resources (DLNR), the Kaanapali Operators Association (KOA), Maui Cultural Lands (MCL), NRCS, the Army Corps of Engineers, the USGS, The Nature Conservancy, West Maui Ridge to Reef Initiative, and the Coral Reef Alliance. The following land management strategies are designed to address onsite erosion and sediment issues that may be negatively impacting coastal water quality, coral reefs and other live-bottom benthic habitats.



5.1 Honoloua Bay Management Strategies

5.1.1 Update Parking Lot(s) and Access to Honoapiilani Highway

The parking areas along Honoapiilani Highway should be updated with Low Impact Development (LID) techniques so that vehicles no longer come in contact with loose and muddy soils. This can be done in a variety of ways including by extending the pavement to include the entire parking area, resurfacing the parking area with pervious concrete or asphalt, installing pervious pavers in those areas that are now bare ground, and with the installation of bioswales with vegetation makai of the parking area to catch sediment and water originating from the parking area before it reaches Honoloua Stream.

In addition, the various trails leading from overflow parking spaces along Honoapiilani Highway should be decommissioned and planted over with either vetiver or native vegetation. Vetiver grass is a popular plant used for restoration throughout the US and other geographies. It has very long roots which help to secure sediment in place and sink rainwater deep into the ground. The ‘sunshine’ cultivar of vetiver is specifically recommended for use in Hawai i as it has low invasive potential, produces sterile seed, and has been approved by the USDA for use in a restoration context in Hawai i. (Coral Reef Alliance, 2017) Signs should be placed at the beginning of these decommissioned trails explaining why they are not access points to Honoloua Bay and should provide directions to the main trail(s).

5.1.2 Improve Honoloua Bay Access Trail

Currently, little to no shrub and ground cover exists along the dirt trail leading to Honoloua Bay. At a minimum, the northern bank of Honoloua Stream should be planted with appropriate vegetation to slow sheet flow from the access trail and capture any resulting sediment. In addition, this trail can be elevated by the installation of a boardwalk or paved with pervious concrete or asphalt.

5.1.3 Lo i at Honoloua Bay Access Trail

This management strategy aims to restore lo i kalo structures and optimize them for sediment retention within the riparian zone of Honoloua Stream. Often lo i kalo use an auwai, which brings water into the lo i from the stream. Ponds are delineated and separated from one another with stacked stone walls that allow water to permeate between ponds. The sediment captured in a lo i provides an ideal wetland substrate for traditional Hawaiian farming of kalo (taro plants) and numerous other crops important for consumption, utilitarian uses, and cultural practices.

Lo i can improve water quality by trapping nutrient and sediment pollutants (Coral Reef Alliance 2017). Lo i also slow storm water, reducing erosion potential, and allowing sediment to settle out of suspension. Lo i also expose more water surface area to sunlight, speeding up biological processes within the water to increase photosynthesis and nutrient uptake by plants.



A lo i's impact on water quality is predicated on certain factors including size, shape, configuration, and the number and type of plants it contains. It is not uncommon for a small pond or series of ponds at varying elevations to remove 90-100 percent of the sediment suspended in the water that flows through the ponds.

Stakeholders have suggested lo i as a viable solution for reducing sediment pollution in West Maui for some time. Assuming a conservative dry season calculation of sediment loads for a typical intermittent stream in West Maui, a relatively small lo i (<1 acre) could prevent an average of 275 pounds of sediment per day from entering the marine environment.

5.1.4 Road Crossing

The dirt road crossing Honolua Stream should be elevated using culverts or pipe arches to protect the stream bottom and stream banks. These culverts must be sized to handle current and storm flows of water. Consultation with the West Maui Soil and Water Conservation District technicians or appropriate engineers should be conducted to assist with proper installation of culverts. Failure to properly size a culvert can lead to washed out roads and serve to increase erosion.

5.2 **Dirt Driveway at West End of Kulaokaea**

In this section, proposed management strategies are organized by two options. Option 1 considers storm water management projects that should be implemented if the dirt driveway continues to be used in its current capacity and is not decommissioned. Option 2 calls for the decommission of this driveway and instead replaces it by the installation of an access road further east along Honoapiilani Highway, within the relatively flat plateau of Kulaokaea where ingress and egress to the property are not located at a blind curve in the highway and access to the area by vehicles is substantially safer.

5.2.1 Option 1 – Keep Existing Dirt Driveway

-) Grade Existing Driveway Away from Cliff – The existing dirt driveway should be graded so that water is forced to flow away from the cliff edge and Honolua Bay and towards Kulaokaea.
-) Water Bars – If the driveway is to remain in place, water bars should be installed for every six feet of elevation drop or as appropriate to further divert water away from the cliff and Honolua Bay northeast towards Kulaokaea.
-) Bioswales – Water collected by driveway grading and water bars should be collected in a bioswale paralleling the driveway. This swale should be planted with vetiver, native grasses and shrubs, or other vegetation deemed appropriate to slow the movement of stormwater and sediment. In addition, this swale can be fortified with geotextiles or geo webbing to further protect against rills, channelization and loss of sediment.
-) Kickouts and Detention Basins – In order to capture water and sediment diverted into



the bioswale, kickouts leading to small detention basins located within Kulaokaea north east of the driveway and away from Honoloua Bay should be installed. These kickouts will ensure stormwater does not build momentum as it moves downhill along the dirt driveway. Fast moving storm water within the bioswale has the potential to undermine water bars and geotextiles, overwhelm plants put in place to slow the water, and would ultimately lead to additional erosion along the driveway. Water diverted by kickouts to strategically placed detention basins will capture storm water, allowing sediment to fall out of suspension while also acting as a source of ground water recharge.

- J) Additional Planting Along Cliff – Native grasses and shrubs and/or vetiver should be planted makai of the driveway along the top of the cliff. The vegetative barrier will serve to slow any storm water sheet flow not diverted by water bars and grading to be slowed as it flows over the cliff and into Honoloua Bay. This vegetation will also serve to armor existing soils further reducing erosion potential and sediment from reaching coral reefs in nearshore coastal waters.
- J) Designate Appropriate Access Trails to Ocean – Currently, several access trails exist leading from the dirt driveway down to Honoloua Bay. These trails have been haphazardly cut into the cliff wall by surfers and fishermen accessing the water. Trails should be optimized to maximize user access to popular areas, and minimize storm water flow through the use of known trail best management strategies including the use of switchbacks, water bars, kickouts, etc. Additional trails should be decommissioned and replanted with native vegetation and/or vetiver to discourage their continued use.

5.2.2 Option 2 – Move/Decommission Existing Driveway

- J) Relocate Driveway - As stated earlier, the entrance to the dirt driveway at the west end of Kulaokaea is dangerously positioned at a blind curve in Honoapiilani Highway. Further east, roughly three quarters of a mile past mile marker 33, along a straightaway in the highway, exists another entrance to Kulaokaea. This entrance was used when agricultural operations were ongoing and is better situated for high traffic volumes entering and existing the property. Ample space exists within this section of Kulaokaea for the installation of parking areas and bathroom facilities. From here, walkways and interpretive trails could lead throughout Kulaokaea, including down to the dirt driveway suggested for decommission. Locating roads and parking features in the interior section of the site is better for preventing possible erosion and sediment transport to the ocean.
- J) Till Existing Dirt Driveway and Plant Vegetation – In this option, the existing dirt driveway would be tilled and replanted with mat forming grasses to stabilize the soils. Tilling would most likely be necessary to break up compacted soils and allow for vegetation to take hold. Likewise, these highly compacted soils are highly impermeable to storm water. Geotextiles could be employed to further protect against erosion and assist in vegetative establishment.
- J) Terrace Existing Dirt Driveway – In an effort to minimize the roughly 80-foot drop in elevation from Honoapiilani Highway to its terminus near Lipoa Point, the existing dirt driveway should be terraced at several locations to turn northeast towards the center of



- Kulaokaea. In this way, the slope of the driveway can be made more gradual.
-) Limit Access to Pedestrians – In Option 2, the existing dirt driveway would be accessible only to pedestrians who have parked at the proposed parking area mentioned above. Trails leading down to the Honolua Bay surf break would be designated and improved from their current condition in the same manner as discussed in Option 1 above. The dirt driveway would serve as a cliffside park overlooking the bay while still providing access to surfing, fishing, and hiking trails near Lipoa Point. This less intense form of traffic would reduce soil compaction, erosion, and sedimentation of nearshore coastal waters. In addition, vehicular traffic would be redirected to the central entrance of Kulaokaea, reducing ingress and egress safety concerns along Honoapiilani Highway and providing adequate distance between vehicles and nearshore coastal waters.

5.3 Agricultural Roads and Trails within Kulaokaea

Kulaokaea is presently covered in non-native grasses and shrubs. While this land cover is not ideal, these plants act to hold sediment in place and reduce erosion potential throughout the area. If Kulaokaea is slated for change into a park or other land use, additional storm water management practices should be employed to ensure sediment and erosion are not exacerbated during the transition. Particular care should be exercised while grading or grubbing any land to prevent sediment loss that could negatively affect sensitive tide pool habitats in this area. For the purposes of this document, management strategies have been designed to account for current conditions on the property.

5.3.1 Decommission Roads and Plant Native Plant Species and/or Vetiver

Legacy agricultural roads should be tilled to improve soil permeability and enable vegetation to colonize these areas. Once tilled, these roads should be planted with suitable vegetation. In addition, geotextiles can be utilized to minimize soil loss until plants are able to adequately colonize these areas.

Water bars, bioswales and kickouts should also be utilized to slow storm water runoff and divert it away from the coastline towards detention basins where sediment can fall out of suspension and provide ground water recharge.

5.3.2 Designate Access to the Ocean and Decommission Additional Hiking Trails

Various old roads and hiking trails drop to the tidal pools and coastal areas below Kulaokaea, acting as discharge channels for sediment and storm water runoff. Trails should be designed to minimize storm water flow with known trail best management strategies including the use of switchbacks, water bars, kickouts, etc. Additional trails should be decommissioned and replanted with native vegetation and/or vetiver to discourage their continued use.

5.3.3 Restore old catchment basins and install new basins

Three detention basins are depicted in the West Maui Watershed Plan developed by Group 70



within Kulaokaea (Group 70, 2016 and AMEC, 2014). These silt catchment basins were installed between 1997 and 1999 using EPA 319 grant funding. Currently, these basins are largely unrecognizable from the surrounding landscape due to dense vegetative cover. These basins should be incorporated into any site plan development and restored and enhanced to perform as originally intended.

5.3.4 Remove Sediment Deposits, Head Cuts, and Debris from Natural Flow Ways

Within Kulaokaea, general maintenance to natural flow ways will improve water quality entering coastal waters. Sediment buildup from legacy agricultural operations should be removed or anchored in place using vegetation and/or geotextiles. Head cuts and debris along flow ways should be removed with the use of heavy machinery. Removed material could be utilized on site for fill as needed.

5.4 **Pohakupule Gulch and “Windmills Beach”**

Management strategies for Pohakupule Stream outfall and “Windmills Beach” are presented below. From field observations, the dirt driveway leading from Honoapiilani Highway to the campsite at “Windmills Beach” is the major contributor of sediment within this area.

5.4.1 Install Catchment Basin at Bottom of Dirt Driveway

A small detention basin should be placed at the bottom of the 4x4 driveway to catch sediment laden storm water flowing along the driveway conveyance. The basin will allow for sediment to fall out of suspension while acting as a source of ground water recharge.

5.4.2 Improve 4x4 Driveway with Water Bars and a Swale Leading to Proposed Detention Basin

The 4x4 driveway is quite steep in grade but few modifications to its footprint are possible due to the limited room along the hill leading from Honoapiilani Highway. The driveway is currently bare ground but could be improved with gravel, permeable concrete or asphalt. In addition, a swale should be cut paralleling the 4x4 driveway. Water bars should be placed in high frequency along the driveway, directing water into the swale and eventually into the detention basin recommended above.

5.4.3 Plant Naupaka Along Clay Terrace with Designated Shoreline Access

The campsites located along the clay terrace associated with “Windmills Beach” currently have numerous access points to the shoreline below. Naupaka or other appropriate native shoreline vegetation should be planted at the edge of the camping area where it drops toward the beach to discourage pedestrian traffic. Designated beach access points should be created throughout the campsite to minimize erosion from foot traffic.

5.4.4 Plant Hillslope

The hillslope leading from Honoapiilani Highway down to “Windmills Beach” is currently devoid of shrub and groundcover vegetation. Soil should be anchored in place along the hill



with the use of vegetation.

5.4.5 Plant camp driveway

Currently, access to individual campsites at “Windmills Beach” is made possible by an unimproved dirt driveway. The edges of this driveway should be planted with vetiver or native vegetation to slow sheet flow and capture sediment before it reaches the nearby shoreline.

6.0 STAKEHOLDER PROPOSED IMPROVEMENTS

In July of 2017, stakeholder meetings were held to ascertain what proposed improvements to the Honoloua Bay / Lipoa Point project were recommended by the public. While the management strategies discussed in this Storm Water Management Report focused on known Best Management Practices (BMPs) and Low Impact Development (LID) strategies for addressing erosion and sediment transport, many of the stakeholder recommendations are in accordance with the suggestions made in this document. The following list provides stakeholder recommendations organized by the four geographic sub regions of the Honoloua Bay / Lipoa Point project (Coastal Planners LLC, 2018). Those recommendations that are in agreement with management strategies proposed in this document are underlined and italicized.

6.1 Honoloua Bay Stakeholder Recommendations

1. *Purchase the abutting 9.1-acre parcel owned by MLP*
2. *Remove the informal parallel parking along Honoapiilani Highway*
3. Trim trees along the Honoloua Bay Access trail
4. *Restore native habitat in partnership with community groups including the planting of Kalo and new Lo i*
5. Construct a Hawaiian hale-style culture and marine education facility / pavilion
6. Install new compostable or portable toilets.

6.2 Dirt Driveway at West End of Kulaokaea with Access to Honoloua Bay and Lipoa Point

1. *Grade and slope the access driveway to Lipoa Point*
2. Place boulders and/or a post and rope barrier along the cliff instead of guardrails
3. New compostable or portable toilets
4. New portable toilets
5. *Partner with community groups to restore plant and bird habitat*
6. *Enhanced coastal wilderness / nature trail*
7. *Enhanced coastal access trail*
8. *Soil remediation, sustainable agriculture and/or native tree reforestation provided that such uses do not contribute to sedimentation of coastal waters*

6.3 Fallow Lands Associated with Kulaokaea



1. Partner with community groups to restore plant and bird habitat
2. Enhanced coastal wilderness / nature trail
3. Enhanced coastal access trail
4. Soil remediation, sustainable agriculture and/or native tree reforestation provided that such uses do not contribute to sedimentation of coastal waters

6.4 “Windmills Beach”

1. New compostable or portable toilets; and
2. Improved access driveway and parking using a permeable surface.

7.0 REFERENCES

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APPENDIX A

PHOTO DOCUMENT

Section 1 Honoloua Bay:



Unimproved Parking with Disturbed Soils



Dirt Trail Sloping to Honolua Stream



Dirt Trail with Little to No Groundcover



Road Crossing Honolua Stream

Section 2 Dirt Driveway at West End of Kulaokaea with Access to Honoloua Bay and Lipoa Point:



Rills and Channelization



Failed Water Bars



Makeshift Access Trail to Honoloua Bay
Showing Erosion



Makeshift Access Trails to Honoloua Bay
Showing Scouring

Section 3 Lipoa Point and Kulaokaea:



Agricultural Dirt Road



Head Cut and Debris in Flow Way



Soils Erosion and Sediment Deposits



Dirt Road Leading to Ocean

Section 4 “Windmills Beach”:



4x4 Driveway from Honoapiilani Highway to Terrace
“Windmills Beach” and Campsites



Dirt Driveway and Campsites Along Clay



Beach Access from Campsites



Hill Leading from Honoapiilani Highway to Campsites at “Windmills Beach”