Note: Delineations are approximate and are intended to be illustrative only.

Source: Google Earth and NOAA, Office for Coastal Management Digital Coast

Figure 19

Proposed Olowalu Town Master Plan

Three (3) Feet Sea Level Rise Map South of Olowalu Wharf

NOT TO SCALE

Prepared for: Olowalu Town, LLC and Olowalu Ekolu, LLC

MUNEKIYO HIRAGA

OlowaluTown/MasterPl/Final EIS/SeaLevelRiseSouthOlowalu

Note: Delineations are approximate and are intended to be illustrative only.

Source: Google Earth and NOAA, Office for Coastal Management Digital Coast

Figure 20

Proposed Olowalu Town Master Plan

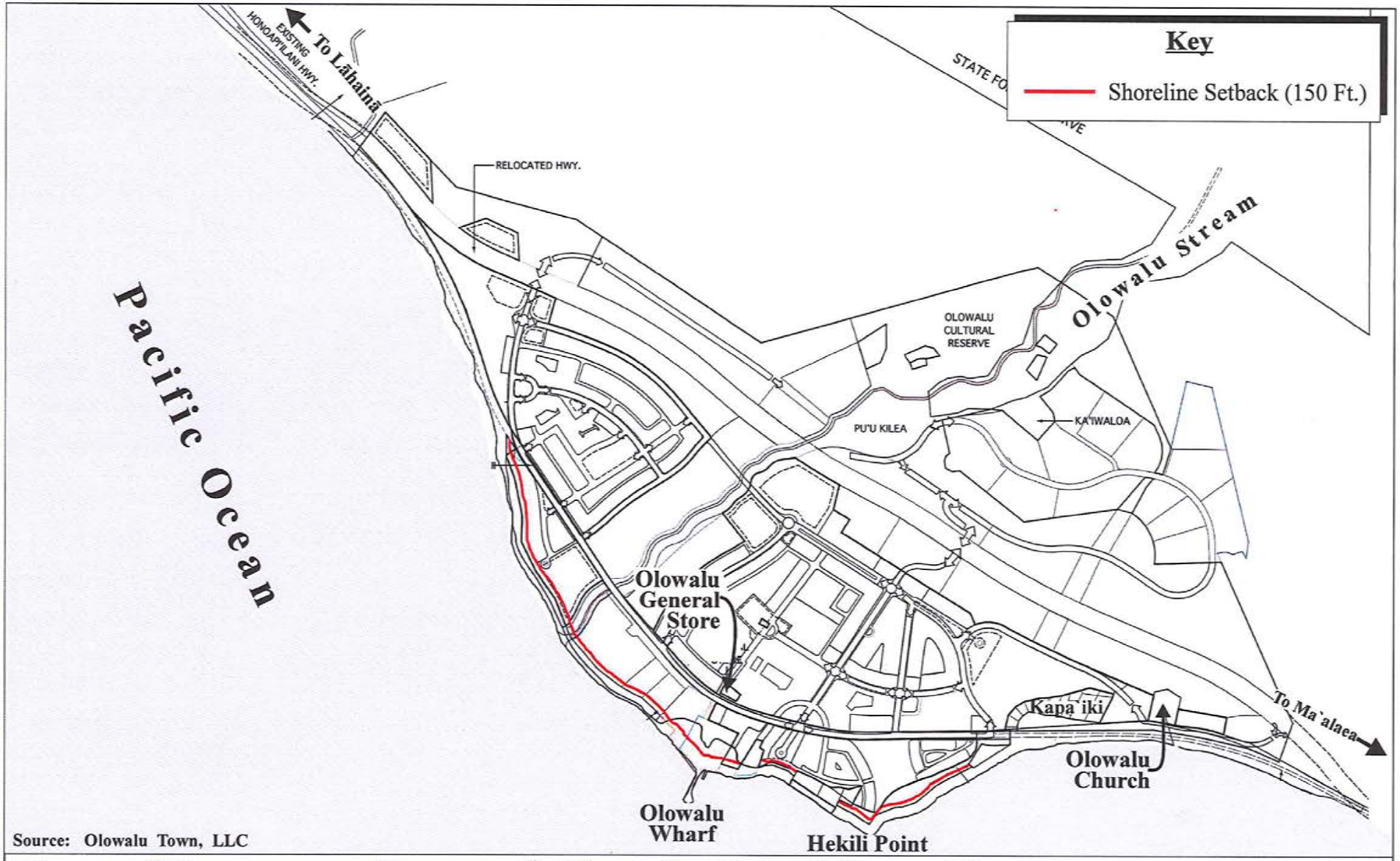
Three (3) Feet Sea Level Rise Map North of Olowalu Wharf

NOT TO SCALE

Prepared for: Olowalu Town, LLC and Olowalu Ekolu, LLC

MUNEKIYO HIRAGA

OlowaluTown/MasterPl/Final EIS/SeaLevelRiseNorthOlowalu



Source: Olowalu Town, LLC

Figure 21

Proposed Olowalu Town Master Plan

Existing 150 Ft. Shoreline Setback Map (Established Through SMA Use Permit No. SM1 990021)

NOT TO SCALE

MUNEKIYO HIRAGA

Prepared for: Olowalu Town, LLC and Olowalu Ekolu, LLC

Regarding wildfire hazards, both fuel breaks and certain grazing patterns can greatly reduce fuel loading and thereby protect against fire hazard. Currently, a portion of the land is being used to graze cattle and horses to reduce grasses that provide fuel to wildfires. The proposed Master Plan for Alternatives 1 and 2 includes the OCR and will provide for parks, greenways, and open space interspersed among residential and commercial development. This development pattern will provide for fuel breaks that will reduce the risk of fire hazard in the region. The Master Plan for Alternatives 1 and 2 will upgrade the existing water system, including fire protection improvements to the existing and future community.

The Master Plan for Alternatives 1 and 2 also proposes areas where a new fire station can be accommodated which will enhance the Fire Department's service areas in West Maui.

7. Flora, Fauna, and Aquatic Resources

a. Existing Conditions

A Flora and Fauna Survey was conducted for the Master Plan area in May 2010. The survey covered 636 acres of ~~land~~the Alternative 1 lands. The Alternative 2 lands are encompassed in the study area. See **Appendix "~~E~~F"**. The majority of the project area is heavily disturbed from over 100 years of intensive agricultural activity. In pre-contact times, the area would have been characterized as a dry native shrubland with a few scattered trees. By the latter half of the 1800s, the entire area was converted to sugarcane cultivation. Following the end of sugar production in the region, most of the land stands idle and has reverted to a dry grassland/shrubland dominated by hardy, non-native species.

Two (2) species dominate the property: buffelgrass (*Cenchrus ciliaris*) and opiuma (*Pithecellobium dulce*). Buffelgrass has spread throughout the dry leeward districts of Maui. `Opiuma has also spread dramatically in former sugarcane lands. Within the project site, `opiuma is most prolific along Olowalu Stream and on the coastal plain where its deep roots can access ground water resources. Koa haole (*Leucaena leucocephala*), Java plum (*Syzygium cumini*), `uhaloa (*Waltheria indica*), kiawe (*Prosopis pallida*),

sourbush (*Pluchea carolinensis*) and Castor bean (*Ricinus communis*) are also common.

Eighteen (18) species of endemic and indigenous native plants were found during the survey of the project site. All but one (1) of these were found only in areas that had not been previously used as sugarcane fields. Only the hardy `ulahoa was found everywhere on the property. While all of the native plants except the `ulahoa were of rare occurrence within the property, all are widespread in Hawai`i in general.

No federally protected threatened or endangered plant species or candidate species were found during the survey. In addition, no critical habitat for any protected species occurs on or adjacent to the project site.

Five (5) species of non-native mammals were recorded during four (4) site visits conducted for the Flora and Fauna Survey. These included domestic cat, domestic dog, axis deer, and several horses and cattle that were pastured within the property. A dense cover of vegetation prevented good visibility of other ground dwelling mammals in much of the property. However, one may also expect to see rats, mice, and mongoose.

Tracks of the endangered nēnē goose (*Branta sanvicensis*) were seen in mud in an irrigated pasture. These endangered geese are multiplying in West Maui and are frequently sighted at the OCR. The nēnē are strong fliers and can range over large areas on a daily basis, such as the entire southern half of West Maui, especially within the West Maui Mountains. They are known to appear in areas with succulent grasses on which they like to feed, such as golf courses, parks, large lawns and hydro-mulched road banks. They are also attracted to the fringes of water features or temporarily irrigated areas.

A few other non-native birds might be expected to use this habitat but the area is not suitable for Maui's native forest birds which now only occupy native forests at higher elevations beyond the range of mosquitoes and the avian diseases they carry. ~~The~~While no ae`o or Hawaiian stilt (*Himantopus mexicanus knudseni*), `alae ke`oke`o or Hawaiian coot (*Fulica alai*), and the koloa or Hawaiian duck (*Anas wyvilliana*) were ~~reported by a~~seen during the survey, the property's water management crew ~~as been seen in~~reported rare occurrences of these birds around reservoirs within the project ~~site~~area.

A special effort was made to look for the endangered Hawaiian Hoary bat by making an evening survey and using a bat detection device. However, no bat activity was detected.

While insects in general were not recorded by the Survey, they were observed and their status noted. No native insects were seen. This habitat is not suitable for most native species. One (1) endangered native moth, the Blackburn's sphinx moth (*Manduca blackburni*), could occur in this type of habitat. Its host plants are native aiea species (*Nothocestrum* spp.) and non-native species of tree tobacco (*Nicotiana glauca*), tobacco (*Nicotiana tabacum*), and tomato (*Solanum lycopersicum*). Only a few young tree tobacco plants were found within the property. Each tree tobacco plant was carefully examined and no Blackburn's sphinx moths or their larvae were detected.

According to the Aquatic Resource Survey conducted by Robert W. Hobdy, six (6) aquatic features were identified. The survey did not observe any Federally listed species or their habitat as well as any other sensitive species. See **Appendix "~~E-1~~F-1"**. Previously, aquatic resources found in Olowalu Stream include *oopu nakea* (Awaous stamineus) and *oopu nopili* (Sicyopterus stimpsoni) (Char 1999, Hawai`i Stream Assessment, 1990).

b. <u>Potential Impacts and Mitigation Measures</u>

As previously mentioned, most of the project area has been heavily disturbed from over 100 years of intensive agricultural activity. The vegetation throughout the project area is dominated by non-native plant species and there were no Federally protected threatened or endangered plant species identified during the survey. The primary threat to Federally protected species in this part of West Maui is fire. Buffelgrass, one of the most prominent non-native species within the project area, dries out during the long dry seasons and has proven to be a major fuel for wildfires. As long as the vegetation remains as it is in the project area, it will represent a significant fuel hazard for fires and a threat to human and natural resources on-site and beyond. Fuel breaks and certain grazing practices can greatly reduce fuel loading and help protect resources from fire. Currently, a portion of the land is being used to graze cattle and horses to reduce grasses that provide fuel to wildfires. In the long term, the proposed Master Plan will provide for irrigated parks, greenways,

and open space interspersed among residential and commercial development removing the existing dry grasses that are a fuel hazard. This development pattern will provide for fuel breaks that will reduce the fire hazard in the region. Besides grazing, interim measures include clearing buffers for fire breaks by removing vegetation along property boundaries adjacent to residential areas such as Kapa`iki.

Many of the dryland native plants that grow in leeward West Maui are ideally adapted to the soils and climate. The OCR has succeeded in cultivating a number of these species. The Master Plan for Alternatives 1 and 2 will incorporate these native plants in the landscaping scheme for the project, to the extent practicable.

As noted in the Flora and Fauna Survey, ~~Nēnē~~nēnē are wide-ranging, opportunistic birds that are attracted to certain types of water features and other types of irrigated and open landscapes where lush grasses grow. The geese like to spend some time feeding and resting in such places but then move to other widespread and diverse sites over the course of each day. Individually, these sites could be considered important habitats for these endangered geese, but would not be considered critical to their survival. The irrigated pasture within the project site, where the tracks of the nēnē were seen in mud, is a type of temporary habitat that is useful to the nēnē in the broad scheme of things in West Maui. Unlike the blades of wind turbines, these features are not dangerous to nēnē and mitigation measures are not warranted.

The best avoidance strategies involve educational warnings such as placement of signs at strategic access points to any water features or irrigated fields. These warning signs would identify the nēnē (a drawing or picture), include a statement of its endangered status and warn against harming these special birds.

The Endangered Species Act (ESA) provides a program for the conservation of threatened and endangered plants and animals and the habitats in which they are found. The federal agencies tasked with implementation of the Act are the U.S. Fish and Wildlife Service (USFWS) and NOAA. Section 10 of the ESA regulates a range of activities affecting plants and animals designated as endangered or threatened, and the habitats upon which they depend. With some exceptions, the ESA prohibits activities affecting these protected species

and their habitats unless authorized by a permit from the USFWS or NOAA. Incidental take permits are required when non-Federal activities will result in take of threatened or endangered species. Through consultation with the USFWS and NOAA, the law promotes the protection of those listed species. Although the Flora and Fauna Survey noted that the irrigated pasture within the project site is a type of temporary habitat for the nēnē, rather than critical to its survival, consultation with USFWS and NOAA will continue through project design to ensure the protection of those listed species.

~~The~~It is noted that the Flora and Fauna Survey recommended the creation of a more attractive and permanent shallow-sided water feature within the upper portion of the OCR that would attract nēnē as well as ae`o, `alae ke`oke`o, and koloa. Such water features within the Master Plan for Alternatives 1 and 2 could provide good habitat for the endangered nēnē and serve as an educational and cultural component of this project.

The Flora and Fauna Study also recommended that vegetation which serves as habitats for the endangered Hawaiian Hoary bat (öpe`ape`a) also be retained. Although the bat was not found during the survey, they may be present during the winter months when insect populations spike. The bats roost individually in trees and shrubs, under ledges in gulches during the day and are active in the evening and throughout the night. The Master Plan for Alternatives 1 and 2 proposes ~~approximately 223 acres of~~land set-asides for parks and open space. Open space areas include the OCR along the Olowalu Stream that will retain vegetation that may serve as habitats for the Hawaiian Hoary bat.

Although the Master Plan ~~area~~areas for Alternatives 1 and 2 ~~itself is~~are not ~~a~~ suitable habitats for protected seabirds which are known to nest high in the West Maui Mountains during the summer and fall months, these birds must fly over the lowlands during the evening and early morning hours to get to their burrows and to return to the open ocean. During the late fall when young birds are inexperienced and uncertain fliers, they are often confused by bright lights, which may cause them to crash into the light source. ~~As such, all~~

All major outdoor light sources within the project area, such as street lights and flood lights, will be shielded so that light is directed downward to avoid confusion for young seabirds. In Alternative 1, there will be no structures

developed within the 150 ft. shoreline setback for the project. Work within the shoreline setback will be limited to landscaping and public access to and along the shoreline. As such, structures will be set back from the shoreline at a minimum of 150 ft., with a substantial portion of areas envisioned for town centers located several hundred feet beyond the 150 ft. setback. Refer to **Figure 4**. In Alternative 2, no development will occur makai of Honoapi`ilani Highway. The existing uses will be maintained. Refer to **Figure 5**.

In general, designs for outdoor lighting will consider the need to respect the night sky and its impacts to wildlife.

With the implementation of the aforementioned mitigation measures, ~~the proposed project is~~Alternatives 1 and 2 are not expected to have a significant ~~negative~~adverse impact on botanical ~~or~~, fauna, or aquatic resources in this part of West Maui.

The OCR is currently restoring taro fields (lo`i) in its restoration of native Hawaiian plants and agricultural practices which will be enhanced by the Master Plan for Alternatives 1 and 2. Portions of the land adjacent to Olowalu Stream are included in the OCR. A goal of the OCR is to eventually restore stream flow to the ocean. Once stream flow to the ocean is restored, a riparian restoration program for Olowalu Stream can be developed with the approval of the OCR.

8. Marine Resources

a. Existing Conditions

NOAA's National Centers for Coastal Ocean Science initiated a coral reef research program in 1999 to map, assess, inventory, and monitor U.S. coral reef ecosystems. The Shallow-Water Benthic Habitats on the Main Hawaiian Islands 2007 study mapped the eight (8) main Hawaiian Islands, including Maui. The study found that on the Island of Maui the coral reef habitat can generally be characterized as described in **Table 20**:

Table 20. Coral Reef Structure for Maui Island

Coral Reef Structure Type	Major and Detailed Habitat Area (km²)
Pavement	32.529
Spur and Groove	4.201
Individual Patch Reef	0.127
Aggregated Patch Reef	0.462
Aggregated Reef	18.360
Rock/Boulder	46.169
Pavement with Sand Channels	0.595
Rubble	0.110
Scattered Coral/Rock	0.148
Total Coral Reef and Hard Bottom	**102.702**
Sand	98.996
Mud	0.657
Pavement with Sand Channels	**99.623**
Rubble	0.200
Scattered Coral/Rock	**0.200**
Total Coral Reef and Hard Bottom	**202.525**
Source: NOAA, 2007	

Map 71 of the study covers the Olowalu area and identifies the benthic habitats offshore. The classification scheme defines benthic habitats on the basis of large geographic "zones" which are comprised of smaller geomorphological structure and biological cover of the reef system. Biological cover indicates the predominate biological component colonizing the surface of the feature. Geomorphological structure indicates the physical structural composition of the feature (NOAA, 2007).

Zones identified in Olowalu by the 2007 NOAA Study from land to open water included lagoon, fore reef, and bank shelf, while the geomorphological structure types were pavement, aggregate reef, spur and grove, and sand.

The Assessment of Marine Water Chemistry and Biotic Community Structure surveyed approximately 454 acres of the nearshore waters in Olowalu. Refer to **Appendix "E"**. As noted in **Appendix "E"**, the aggregate reef structure is located mostly south of Olowalu Point. The overall coral cover in the

survey area was about 37 percent of bottom cover, while macroalgae accounted for about 8 percent of bottom cover; 21 percent of the bottom was covered with sand and 33 percent of the bottom consisted of mud and sediment bound in algal turf.

The reefs at Olowalu are considered somewhat unique in that sediment deposition (or lack thereof), rather than wave forces, appears to be the major determinant of physical and biotic reef structure. Along the northern side of Olowalu Point, deposition of terrigenous sediment emanating from Olowalu Stream creates a habitat where coral communities are limited to species and growth forms that can withstand the sub-optimal conditions created by high rates of sediment deposition. South of Olowalu Point, a shallow, wide, triangular-shaped reef flat, formed from deposition of alluvial material from Olowalu Stream, terminates in a fore reef composed of actively accreting coral assemblages that show little or no effect of sediment stress. The outer reefs consist of extensive actively accreting coral formations where growth and community composition are not controlled by wave forces, as is the typical situation on most Hawaiian open coastal areas. Also, reefs at the southeastern end of the project site (near 14-Mile Marker) showed distinct indications of sediment stress, although no major streams discharge regularly in this area. Refer to **Appendix "E"**.

Populations of reef fish in the area are typical of Hawai`i reefs, although numbers of larger fish were very low, likely as a result of fishing pressure. The most abundant families consisted of wrasses, damselfish and surgeonfish. The highest abundance of fish was on the outer fore reef with the rarest in the areas with the heaviest deposition of mud. Reef communities on the outer reef flat and fore reef represent essentially pristine ecological settings unaffected by most human activities, with the exception of fishing.

Numerous sharks were also observed on the inner reef flat. Marine biologist Pauline Feine states in her comments on the Draft EIS that the Olowalu area is a nursery for black-tip sharks.

Information received from the NOAA, National Marine Fisheries Service (NMFS) identified three (3) marine species protected under the Endangered Species Act that frequent the area and may potentially be affected by the proposed project. The three (3) marine species identified include the

threatened green sea turtle (*Chelonia mydas*), the endangered hawksbill sea turtle (*Eretmochelys imbricate*), and the endangered Hawaiian monk seal (*Monachus schauinslandi*). Maui hosts a nesting population of hawksbill sea turtles on the southern shore of the island. Green sea turtles also occur offshore of the area and may bask onshore. Several green sea turtles were observed during the course of fieldwork for the *Assessment of Marine Water Chemistry and Biotic Community Structure in the Vicinity of the Olowalu Town Master Plan.* Refer to **Appendix "E"**. According to NOAA, the Olowalu area may provide a suitable shoreline habitat to support sea turtle nesting. Hawaiian monk seals are also known to occur in the area and have been frequently sighted hauled out on beaches.

In addition, nine (9) species of corals found in Hawai`i were petitioned for listing under the Endangered Species Act. One of these coral species, *Montipora patula*, was found to occur in the nearshore waters off of the project area. In 2014, NOAA listed 20 corals as threatened but the list did not include the nine (9) candidate species that are found in Hawai`i (Garden Island, 2014). Refer to **Appendix "E"**.

Since the preparation of the *Assessment of Marine Water Chemistry and Biotic Community Structure in the Vicinity of the Olowalu Town Master Plan* new circumstances have occurred that have altered the results of my previous surveys. Recent elevated ocean temperatures around the State of Hawai`i have resulted in bleaching of corals in at least some nearshore settings. Visual inspection of the reef at Olowalu conducted on September 24, 2015 indicated that such bleaching has occurred at the Olowalu study sites, resulting in a reduction of live corals. See **Appendix "E-1"**.

b. <u>Potential Impacts and Mitigation Measures</u>

The change in character of the Olowalu reef observed in 2015 by natural phenomenon is not directly related to activities on land. There is no reason to suggest the possibility of different or likely increased environmental impacts not previously dealt with in the 2011 report. Rather, decreasing sediment delivery to the ocean over the existing situation will likely provide an enhancement to recover the reef that survives the bleaching event. Refer to **Appendix "E-1"**.

Overall, the assessment of the biotic community structure found that the existing episodic discharge of land-derived sediment is the most pervasive stress to the reefs off Olowalu. However, the area of such discharge is limited, and does not affect all areas of the reef. Reef communities on the outer reef flat and fore reef represent essentially pristine ecological settings unaffected by most human activities, with the exception of fishing. Refer to **Appendix "E"**.

As long as Best Management Practices (BMPs) are utilized to avoid any unforeseen impacts during the construction and operational phases of the project, and engineering considerations in the design of the retention basins include maximizing sediment trapping, negative impacts to the marine environment are not anticipated. Refer to **Appendix "E"**.

Recommended BMPs in the Storm Water Quality Enhancements study include Low Impact Development (LID) or non-traditional measures to handle storm water runoff and improve water quality. Measures such as bio-retention basins, landscape areas, vegetated swales and subsurface retention systems will be considered in the development of the OTMP. Although not expected, the storm water runoff (pre- and post-development) that may eventually sheet flow into the ocean is expected to be reduced and water quality improved over the existing runoff that currently flows through the existing culverts to the ocean. These measures are anticipated to protect ocean and marine resources. Refer to **Appendix "C-2"**.

The endangered Hawaiian monk seal is sensitive to human disturbance and could be negatively affected by increased human presence if not properly mitigated. The Applicants will work with the NOAA, NMFS to develop an educational program, including appropriate signage within the project limits, to inform residents and visitors to Olowalu of the need to minimize human disturbances and interactions with Hawaiian monk seals. Similarly, the educational program will also include information to protect the threatened green sea turtle, the endangered hawksbill sea turtle, as well as the Hawaiian nēnē.

The Master Plan for Alternatives 1 and 2 will not involve any work within the ocean. Potential impacts to the marine environment may be attributed to land based activities, such as sedimentation in stormwater runoff. The drainage

plan proposes to capture runoff in a series of detention and retention basins that will allow sediments to settle within these basins. The reduction of sediments into the ocean will likely improve or at the very least maintain the water quality and marine biota in Olowalu.

To mitigate impacts to sea turtle nesting areas, the design for outdoor lighting will consider the need to respect the night sky, its impacts to the coastal shoreline areas, and impacts to threatened and endangered species. As applicable, the Applicants will implement a lighting plan for the Master Plan areas for Alternatives 1 and 2 that are sensitive to threatened and endangered species and incorporates recommendations from NOAA, NMFS. All exterior lighting will be shielded and directionally aimed downward. These design considerations are anticipated to mitigate light pollution and prevent light from traveling across property boundaries toward the ocean and shoreline.

As noted, no structures will be developed within the existing 150–foot shoreline setback area, which will mitigate impacts through avoidance.

With the implementation of the aforementioned mitigation measures, Alternatives 1 and 2 are not expected to have a significant adverse impact on marine resources in Olowalu.

~~8.~~9. Streams and Reservoirs

a. Existing Conditions

The Master Plan ~~area~~ for Alternatives 1 and 2 encompasses a large alluvial fan that was created over several millennia by the deposition of soil and rocks washed down the narrow Olowalu Canyon. Olowalu Stream traverses this alluvial fan. On either side of Olowalu Stream, several smaller rocky gulches drain the steep, dry forehills of the West Maui Mountains.

An Aquatic Resource Survey identified six (6) aquatic features within the project area, including Olowalu Stream. Refer to **Appendix "~~E-1~~F-1"**. The original alignment of Olowalu Stream was altered by the former sugar company in the 1860's. The original outlet of the stream was on the Mā`alaea side of Olowalu Wharf at Hekili Point.

Olowalu Stream is classified as a perennial stream. Although stream flows are year-round in the upper reaches, lower elevation flows are intermittent. The Aquatic Resources Survey reports that an intake and ditch constructed for sugarcane cultivation diverts water from Olowalu Stream, turning the perennial stream into an intermittent stream that only flows to the sea following significant rainfall events. The diversion is still in use even though sugar production has ended. A four (4) to six (6) foot high berm was also created along the edges of Olowalu Stream where it passes through the gentler slopes of the alluvial fan and coastal plain. The berm was built to contain the flood waters generated by unusually large storms within the stream channel so that field crops would not be damaged. Even if the diversion was removed, due to the high amount of ground seepage, the stream would still be intermittent (Tom Nance, 2011).

There are no wetlands within or in close proximity to the project site. However, the Master Plan ~~area~~ for Alternatives 1 and 2 encompasses four (4) irrigation reservoirs which were constructed to support the past sugar cultivation activities of Pioneer Mill. Historically, approximately four (4) million gallons per day (mgd) of water were diverted to these reservoirs from Olowalu Stream.

In addition to Olowalu Stream, the Aquatic Resource Survey identified two (2) unnamed tributaries, the Kapa`iki Drainage Channel, the Kaloko o Kapa`iki Fishpond, and an unnamed ephemeral tributary within the project site. Refer to ~~**Exhibit "E-1"**~~**Appendix F-1"**. These aquatic resources are described below:

- **Unnamed Tributaries** - The two (2) unnamed tributaries are typically dry for most of the year. Winter storms bring sufficient rainfall to make the tributaries run for two (2) to three (3) days, two (2) or three (3) times a year.

- **Kapa`iki Drainage Channel** - The Kapa`iki Drainage Channel is situated along the north edge of Kapa`iki, with small amounts of water running continuously to a low sandy wave washed berm where high tide waves wash in and out.

- **Kaloko o Kapa`iki Fishpond** - The Kapa`iki Fishpond is an ancient structure located approximately 100 feet from the ocean, mauka of Honoapi`ilani Highway. The fishpond was drained in the 1960s and remains today as a depression in the earth. During winter rain storms, flood waters accumulate in the fishpond depression and drains out into the ocean.

- **Unnamed Ephemeral Tributary** - The unnamed ephemeral tributary/ditch is located mauka of Honoapi`ilani Highway. During winter storms, rain water sheet flows off a small slope and the coastal plain and ponds in the ditch. When the ponded waters reach a depth of over one (1) foot, they are channeled under Honoapi`ilani Highway to the shoreline. Remaining waters are absorbed into the soil.

b. Potential Impacts and Mitigation Measures

The natural drainage characteristics of the Olowalu Stream will not be altered as part of implementation of the Master Plan for Alternatives 1 and 2. The land plan for the ~~project~~ alternatives provides for the OCR along the stream to preserve and enhance the streams functional and cultural values. The existing Olowalu Stream diversion is the source of non-~~potable~~drinking water to the OCR for their cultural activities and practices.

~~The Master Plan~~ Alternatives 1 and 2 proposes to ~~reduce the amount of water currently diverted from Olowalu Stream through~~ use ~~of~~ recycled water from the proposed wastewater treatment facility for the project. The recycled water will be a new source of non-~~potable~~drinking water for irrigation purposes. It is anticipated that there will be an increase in stream flows as ~~non-potable water replaces the water diverted from the stream and~~ future repairs and maintenance to the Olowalu Ditch is conducted to reduces leaks and loss of water between the point of diversion and the location of current flow rate measurements within the irrigation system. This will help to enhance native habitat within the Olowalu Stream ecosystem.

910. Nearshore Waters

a. Existing Conditions

An Assessment of Marine Water Chemistry and Biotic Community Structure was prepared by Marine Research Consultants, Inc. for the vicinity of the Master Plan for Alternatives 1 and 2 in July 2011. Refer to **Appendix "ĐE"**. The study provided a baseline assessment of the marine environment, including an evaluation of the water chemistry and coral reef structure. The assessment of nearshore marine water chemistry was carried out by evaluating data from 60 water samples collected at five (5) ocean sites offshore from the project site. At each site, water samples were collected on transects perpendicular to the shore, extending to distances of approximately 500 to 600 meters offshore. The evaluation of the marine habitat and biotic communities involved the use of remote sensing satellite imagery combined with extensive ground-truth data collection.

The water chemistry analysis evaluated 14 water chemistry constituents, including all specific constituents in the DOH's water quality standards. The assessment found evidence of groundwater efflux at the shoreline, producing a zone of mixing where nearshore waters are a combination of ocean water and groundwater. In all cases, the nearshore zone of mixing was restricted to a narrow zone that extended a maximum of only 10 meters from the shoreline. Beyond this distance, water chemistry at all sites was representative of pristine open coastal waters. Groundwater flow is also retained within a buoyant surface lens that does not come in contact with the reef surface. Evaluating water chemistry using DOH specific criteria for Open Coastal Waters indicates many of the measurements in the nearshore areas (within 10 meters of the shoreline) exceed standards, particularly for various forms of nitrogen. These standards do not take into consideration mixing of high nutrient naturally occurring groundwater with ocean water, in which such exceedances are expected and normally occur throughout most Hawaiian nearshore marine areas.

~~The analysis of the marine habitat covered 454 acres offshore from the Master Plan area. Overall, coral cover represents approximately 37 percent of this area, while macroalgae accounted for eight (8) percent of bottom cover, sand comprised 21 percent of bottom cover, and 33 percent of the bottom consisted~~

~~of mud and sediment bound in algal turf. Populations of reef fish in the area are typical of Hawai`i reefs, although the numbers of larger fish was very low, likely as a result of fishing pressure. The most abundant families consisted of wrasses, damselfish, and surgeonfish. Numerous small sharks were also observed on the inner reef flat. Overall, the study found that the existing episodic discharge of land-derived sediment is the most pervasive stress to the reefs off Olowalu. However, the area of such discharge is limited, and does not affect all areas of the reef. Reef communities on the outer reef flat and fore reef represent essentially pristine ecological settings unaffected by most human activities, with the exception of fishing.~~

b. Potential Impacts and Mitigation Measures

The proposed Master Plan for Alternatives 1 and 2 does not propose any direct alteration of the shoreline or offshore areas. Therefore, potential impacts to the marine environment can only be considered from land-based activities that may result in delivery of materials (primarily fresh water and nutrients) to the ocean through surface runoff or infiltration to groundwater on land with subsequent discharge to the ocean. The Assessment of Marine Water Chemistry and Biotic Community Structure study evaluated the potential for such impacts resulting from the proposed project. Refer to **Appendix "~~D~~E"**.

The study estimated changes to groundwater flow rate and the loading of nitrogen and phosphorus discharged along the project's shoreline based on water use, wastewater generation amounts, irrigation practices (including use of R-1 recycled water), and fertilizer use at full build-out of the project. The groundwater flow rate discharged into the marine environment is expected to be reduced by six (6) percent over present conditions as a result of the project. As such, the extent of offshore effects would be reduced due to more rapid mixing of the smaller volume of discharged groundwater to background marine concentration. Because groundwater presently has essentially no effect on existing marine communities, the small changes to groundwater fluxes associated with the ~~proposed project~~alternatives are not anticipated to have negative impacts to the ocean.

The ~~project's~~alternatives' drainage system and retention basins are to be designed to keep post-development peak rates and volumes of runoff less than existing conditions for a 100-year, 24-hour designated storm. For smaller

rainfall events, the actual surface runoff from the project site will be less than the existing, undeveloped condition. The retention basins will function as sediment traps, resulting in a decrease in sediment discharge, particularly during high intensity rainfall events. Because it is the sediment loads of streamwater, rather than the volume of streamwater discharged to the ocean, that affects biotic composition, it is possible that the net effect of the project may result in an overall improvement of offshore reefs. Future design considerations for the retention basins will focus on maximizing sediment trapping as well as runoff.

To mitigate stormwater impacts on water quality, a Stormwater Quality Enhancements Study was prepared by Brown and Caldwell for the ~~Master Plan~~OTMP which proposes to implement an aggressive stormwater quality management program of LID measures that aims to reduce the amount of stormwater from a development and to improve the quality of the runoff that occurs. ~~See~~Refer to **Appendix "~~B-1~~C-2"**. The goals of the Best Management Practices (BMPs) for the ~~Master Plan~~alternatives are as follows:

- Increase the volume of stormwater that infiltrates into the soil.
- Reuse stormwater where feasible.
- Improve the quality of stormwater that does run off.

To accomplish these goals the following stormwater BMPs in **Table ~~10~~21** are being considered for the project.

Table ~~10~~21. Proposed Stormwater BMPs for Olowalu Town Master Plan Alternatives 1 and 2

BMP	Applicable Olowalu Town Parcels				
	Residential		Commercial	Public Utilities	Green Space/ Recreational
	Single Family	Multi-Family			
Bio-retention rain gardens	◆	◆	◆	◆	◆
Rain barrels and rain tanks	◆				
Subsurface tanks		◆	◆	◆	◆
Vegetated roofs				◆	◆
Permeable paving			◆	◆	◆
Subsurface chamber stormwater management systems		◆	◆	◆	◆
Hydrodynamic devices			◆	◆	
Reinforced turf surfaces					◆
Infiltration trenches					◆

Figure 22 illustrate examples of LID measures to be implemented in the Master Plan.

Based on the aforementioned findings and proposed mitigation measures, ~~the proposed Master Plan~~Alternatives 1 and 2 will not likely pose any significant negative effects on the nearshore waters of the ~~Master Plan~~Olowalu area.

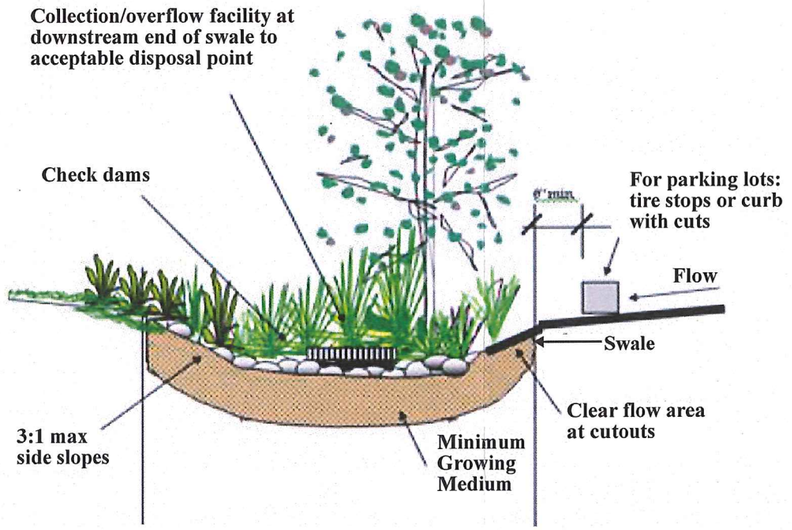
~~10~~11. Archaeological Resources

a. Historical Context

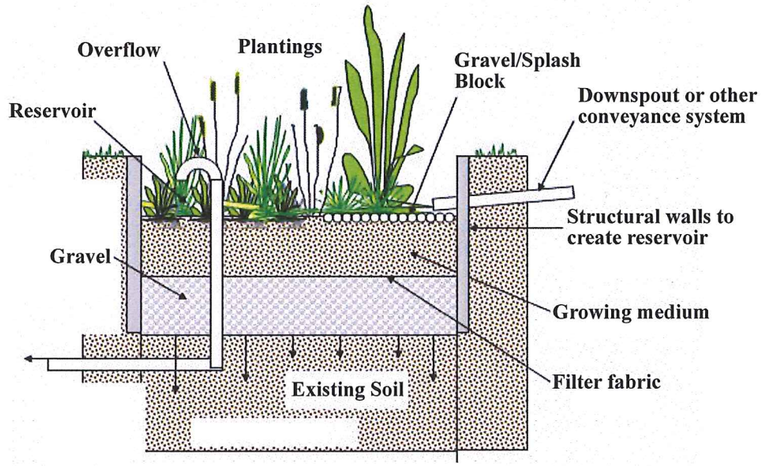
~~The Master Plan area is~~Alternatives 1 and 2 are located in the Olowalu Ahupua`a. Olowalu was an important agricultural area in pre-contact times.

The ahupua`a system allowed Hawaiians to thrive as they were able to grow breadfruit and taro in the higher areas and sweet potato and coconuts closer to

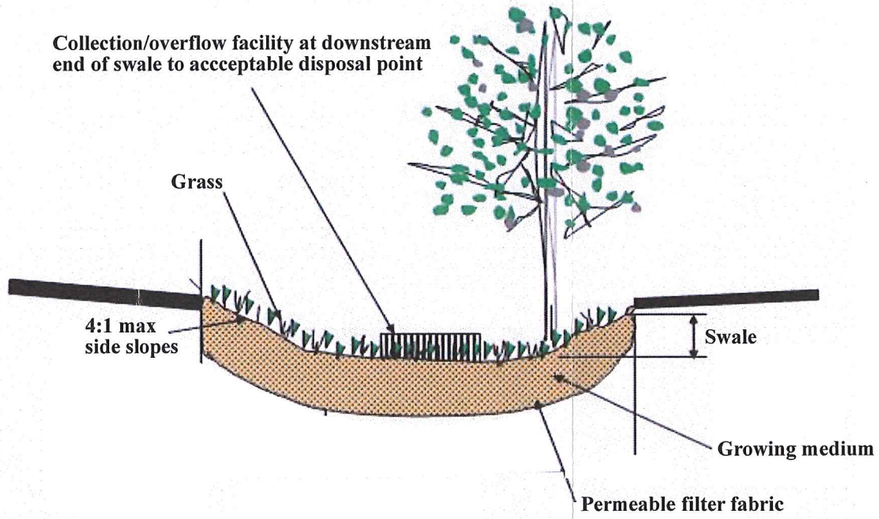
A Bio-Retention Rain Garden



Vegetated Swale



Schematic of a Bio-Retention Rain Garden



Grassy Swale

Source: Brown and Caldwell

Figure 22

Proposed Olowalu Town Master Plan

Low Impact Development Examples

NOT TO SCALE

Prepared for: Olowalu Town, LLC and Olowalu Ekolu, LLC

MUNEKIYO HIRAGA

Olowalu/MasterPlan/Final EIS/LowImpactDevelopment

shore. The sea provided fish and the forest supplied wood for canoes and housing. A Hawaiian born in the valley could learn a skill, raise a family, trade, play, work, and worship within the Olowalu Ahupua`a. Hawaiians supported themselves by growing *kalo* (taro) in extensive *lo`i* (irrigated terraces), and by cultivating *`uala* (sweet potato), *`ulu* (breadfruit) and *niu* (coconut), made possible by water that flowed out of the West Maui Mountains through Olowalu Stream. Olowalu was particularly suited for growing *`ulu* in the lower areas of the valley and *`uala* on the *kula* (open field) lands closer to shore. Both *kalo* and *`uala* served as principle food sources along with fish caught along the coast (Ainsworth).

Several archeological sites at Olowalu have been identified as having been used for religious purposes. Due to its size and location, the Ka`iwaloa (or Kawaloa) Heiau was likely used for major religious ceremonies involving high chiefs. This suggests that Olowalu played a significant role in religious matters in the moku (district) of Lāhainā. Hawaiians probably used another medium-sized heiau still remaining in Olowalu for local rituals. Smaller shrines still extant at Olowalu indicate use as fishing and agricultural shrines used by one (1) or more families (Ainsworth).

Though gone now, a fishpond did exist in pre-contact Olowalu. It was located in the low areas just behind the coastal dunes. These were swampy lands resulting from intermittent run-off and possibly fresh water springs. Hawaiians converted these swampy lands into a fishpond for the growing of fish for the high chiefs. Oral history indicates that this fishpond was named Kaloko o Kapa`iki and dates back at least into the 1700s (Ainsworth).

*Pu`uhonua: The Legacy of Olowalu* by Katherine Kama`ema`e Smith provides a brief history of Olowalu before 1790. See **Appendix "FG"**. Olowalu is where Kalola Pupukahonokawailani (Kalola), daughter of Maui and Hawai`i's King Kekaulike, lived at the beginning of the eighteenth century. High kapu Ali`i Nui Wahine Kalola had a son Kīwala`ō, with her brother Kamehamehanui. When she married Kalaniopu`u, ruling King of Hawai`i, her son became his heir. Kalola and Kalaniopu`u had two (2) daughters who carried the highest kapu rank of any ruling chiefs ever recorded. Their daughter Keku`iapoiwa Liliha was the mother of Queen Keopuolani.

After Kalaniopu`u died, Kalola took Maui Chief Ka`opuiki for her husband. While Kalola lived in Olowalu, she ruled the pu`uhonua of Olowalu and presided over Ka`iwaloa Heiau, but her heiau of state was Hale Ki`i Heiau in Wailuku. This fact indicates the connection between `Īao and Olowalu was important, both spiritually and economically. Kalola was ruling at Olowalu in 1790 when Captain Simon Metcalf fired cannons on Olowalu. This incident is infamous as the 'Olowalu Massacre'. The Olowalu Massacre occurred as a result of an incident at Honua`ula, Maui when Captain Metcalf anchored his trading ship, the *Eleanora*, off shore to barter for necessary provisions. A chief stole one (1) of Metcalfe's small boats and killed a watchman. After learning the thieves had fled to Olowalu, a place of sanctuary, Metcalf sailed off toward Olowalu. Chiefess Kalola, knowing the explosive nature of the situation, declared a three (3) day kapu on all canoes approaching the *Eleanora*. When the kapu was lifted and Kalola's husband Ka`opuiki returned only the stolen boat's keel and the watchman's stripped thigh bones, an enraged Metcalf encouraged trading canoes to approach the *Eleanora* and then opened fire with the ship's guns. Over 100 Hawaiians were killed in the incident with over 100 others wounded. Hawaiians referred to the slaughter as Kalolopahu, or spilled brains. Metcalf violated the sanctity of Olowalu, forever breaking the faith Hawaiians had in the safety and nurture of this pu`uhonua.

Several months after the massacre at Olowalu, Kalola watched the Great Battle of Kepaniwai from `Īao Valley. Kalola escaped through the Olowalu Pass and down to Olowalu, where she boarded canoes for Moloka`i. Kamehameha followed Kalola to Kalama`ula, Moloka`i and asked for Keopuolani to be his queen. Kalola, who was sick and dying, agreed to give Kamehameha Keopuolani and her mother Kekui`apoiwa Liliha, if he would allow the girls to stay at her death bed until she passed. Kamehameha camped on Moloka`i until Kalola died, and returned to Kona with his high kapu queen Keopuolani. Kalola was buried at Kalama`ula on Moloka`i.

The land where Kalola's kauhale stood in Olowalu is on Saffery land, near the Loko o Kapa`iki.

Western Influence

As foreign influence became more pervasive following the unification of the Hawaiian Islands under Kamehameha, Lāhainā became the center for West Maui because of favorable conditions for sailing craft.

Along with western influence came diseases that decimated the Hawaiian population 45 years after western contact. It is estimated that the Hawaiian population on Maui decreased by as much as half by 1823. In 1831, missionaries estimated 832 Hawaiians lived at Olowalu (Schmitt 1973). ~~Based on the 1831 population~~

Within Olowalu Valley and along the original stream route, traditional Hawaiian agricultural practices were fairly intense and based primarily on *lo`i* agriculture. There were approximately 1,124 *lo`i kalo*, 28 *`uala* (potato) patches, 27 kula (open field or pasture), and 31 plots of land with unspecified land uses. When examining this level of agricultural intensity during the mid-1800s, and its correlation to population, Marion Kelly presents missionary estimates for the productivity of *lo`i kalo* as a minimum of 10 to 30 individuals per acre (Kelly, 1989). Based on the intensity of agriculture and these estimates, it is estimated that 2,000 or more Hawaiians resided in Olowalu before western contact.

Five (5) years after the 1831 census, the missionary census put Olowalu's population, combined with Ukumehame's, at only 718 showing a further decline. In 1866, the census indicated the population of Olowalu had further decreased to 169, a 76 percent drop from 1836. Nearly 100 percent of the residents were full-blooded Hawaiian and the predominant occupation reported on the census was *mahi`ai*, or someone involved in agriculture. In 1878, the census was counted by the Hawaiian kingdom with 231 people living in Olowalu.

The first Christian missionaries arrived on Maui in 1823 and made Lāhainā the first Protestant mission station on the island. Olowalu, shortly thereafter, became an outstation of the Lāhainā mission. The Olowalu outstation also served the people of Ukumehame. As an outstation, Olowalu did not have its own minister, instead relying on visits from Lāhainā. A succession of Lāhainā missionaries successfully converted the Hawaiians of Olowalu.

In 1835, Reverend Ephraim Spaulding built a 26-foot by 43-foot adobe church at Olowalu, with the intention of using it as both a church and school. In 1858, a stone building replaced the original structure. Ten (10) years later, the 250 members of the Olowalu Church broke with the Lāhainā Mission Station and became an independent church named the Olowalu Hawaiian Protestant Church. In 1897, the independent Olowalu Hawaiian Protestant Church re-affiliated itself with the Waine`e Church (now called Waiola Church) in Lāhainā. In the 1930's, ash from a cane fire caused a fire that burned the roof of the church. Although still missing its roof, the church exists today and is used as a community meeting place.

The Great Mahele in 1848 established a system of private land ownership in Hawai`i. There were 50 individual Land Commission awards granted in the Ahupua`a of Olowalu consisting of approximately 115 acres of arable land. The majority are in the upper reaches of the property, along Olowalu Stream. The distribution of land awards and a review of late 1800s and early 1900s plantation maps suggest that the stream was channeled in a general, straighter north-south direction sometime after the Mahele. This was probably done to control flooding of agricultural fields (Ainsworth, 2011).

Plantation Era

In 1864, King Kamehameha V joined with Ferdinand W. Hutchison and Rose Ranch owner James Makee in the formation of the West Maui Sugar Association, also called the West Maui Sugar Company. The West Maui Sugar Association planted sugar on crown lands in Olowalu and Ukumehame leased from Kamehameha V. Although the West Maui Sugar Association grew sugar in Olowalu, it sent its harvest to the Lāhainā Sugar Company to be processed in its mill. In 1869, the West Maui Sugar Association took over the Lāhainā Sugar Company mill.

The sugar industry slumped in the 1870s. The Olowalu venture, struggling to survive, received a major blow when King Kamehameha V died in 1872. Two (2) years later, the West Maui Sugar Association sold both its plantation and mill in 1874 to the owners of the Pioneer Mill Plantation.