CORAL REEF ALLIANCE
NOAA CRCP FINAL REPORT
Grant Period: 08/01/2018-01/31/2020
April 30, 2020 → extension received to submit June 30, 2020

A. Project Identifiers

1) *Project Title:* **Delineate, Designate, and Demonstrate Stream Riparian Buffers in Wahikuli, West Maui**
2) *NOAA Grant Award Number:* **NA18NOS4820112**
3) *Project Manager:* **Jennifer Vander Veur, Program Manager**
4) *Period Covered by this Report:* **08/01/2018-01/31/2020**
5) *Program Officer:* **Liz Fairey**

B. Project Summary

West Maui has been designated a priority conservation site by state and federal governments in an effort to address land-based pollution and corresponding declines in coral cover.[1] Several West Maui Watershed plans identify erosion from degraded agricultural fields, dirt roads, and areas of bare soil as major threats to nearby coral reefs. A study led by the University of Hawai'i (UH) confirms that these eroding landscapes supply loose material to gulches and streams, which, during rain events, cause significant sedimentation on coastal reefs.

The Wahikuli-Honokōwai Watershed Management Plan recommended a number of management strategies to address the issue of sedimentation. CORAL has been implementing these recommendations in the first phase of a long-term project to restore the Wahikuli and Honokōwai midslope streams. In 2016, CORAL facilitated a Stream Restoration Knowledge Sharing Group to identify a suite of best management practices (BMPs) that can be executed to achieve this goal. After a reconnaissance survey identified road kickouts[2] as significant contributors of sediment to the stream gulch, CORAL began to address 20 problematic kickouts in the Wahikuli and Honokōwai watersheds utilizing a combination of BMPs. In this project, we expanded the effectiveness of previously installed sediment traps in road kickouts by creating and restoring a riparian buffer approximately 1,500 feet long within the Wahikuli Watershed.

Creating and restoring this riparian buffer will not only have direct near-term benefits on water quality, but will also demonstrate how this approach can be applied to solve sedimentation issues across West Maui. To inform future efforts, we measured the effectiveness of our restoration efforts, the results of which are shared through a report and a 'story map.' We also used our project learnings to secure the restoration and protection of riparian buffer setbacks in West Maui by recommending their formal designation in the 2018-2019 West Maui Community Plan.

C. Progress toward Objectives and Outputs

Objective 1: *Stabilize a highly erosive site in Wahikuli Watershed by installing a suite of ~20 Best Management Practices (BMPs) within a 1000 x 150 foot riparian buffer setback pilot along the edge of Wahikuli Gulch.*

[1] Coral Reef Assessment and Monitoring Program; Trends in Coral Cover 2012
[2] A road 'kickout' is a standard road building and maintenance practice utilized on agricultural dirt roads nationwide. Kickouts are designed to channel stormwater off of the road surface. However, when used in Hawai'i in steep, highly erosive areas next to stream gulches, kickouts become major delivery mechanisms for sediment to adjacent gulches and hence to the nearshore environment.

We are very pleased to report that we have far exceeded our goal numbers for this objective.

As described in our no-cost extension and change of scope requests, approved in August 2019, activities under this Objective were delayed because of unforeseen circumstances at our originally proposed site, Location 4c. As a result, instead of installing 20 BMPs at the originally proposed location, we installed 57 BMPs in a similar site called Location 7c. Location 7c is just 3000 feet upslope from Location 4c, and a critical area for restoration. It is on State land, and the Department of Land and Natural Resource Management is supportive and eager for us to restore the area.

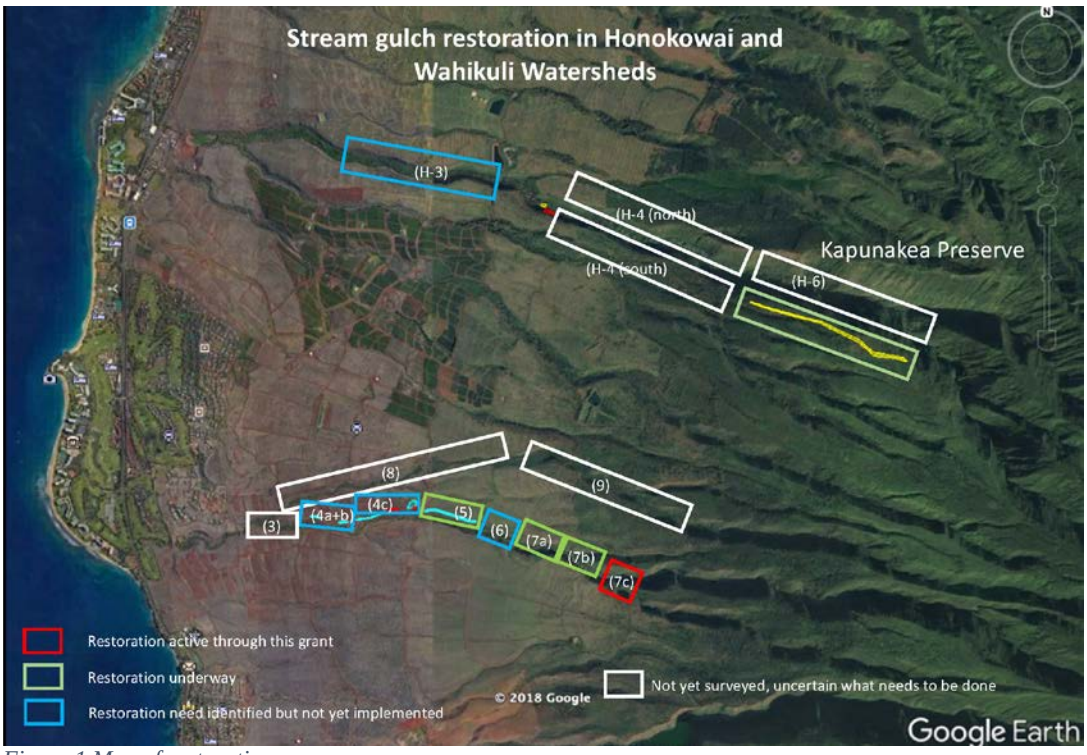

Figure 1 Map of restoration areas

To prepare plants for installing BMPs, we collaborated with Kaunoa Senior Center and the University of Hawai‘i – Maui’s botany class to grow seedlings from native plant seeds collected from Wahikuli Watershed. We also entered into a partnership with the Maui Animal Farm, who donated space on their West Maui farm for a native plant nursery. This partnership has reduced our plant costs (enabling us to plant more plants within our budget) and enabled our volunteers to collect seeds from the restoration site and propagate them at this nursery. Because the nursery is located in West Maui, the seedlings will be acclimatized to the local climate increasing plant survivorship. We also collaborated with Hike Haleakala to create a plan to install an irrigation system at Location 7c.

We first collaborated with partners to create and train a group of volunteers in BMP installation, including building sediment traps and planting native plants. Fifteen volunteers helped us build the nursery, construct a storage shed, and install plants. This nursery site will also enable us to share native plants with other restoration groups, such as Maui Cultural Lands and Kamehameha Schools, thus enabling us to leverage this project for broader impact. Unfortunately, in December 2019 there was a severe storm that blew apart our storage shed and damaged the nursery area. However, we were able to reconstruct and fortify the design to withstand future storms and high wind events.

Figure 2 BMP treatment train

Figure 3 Storage shed and plant nursery at Maui Animal Farm

Activities completed

Land Preparation

- Conducted a preliminary site assessment and created a BMP implementation plan and budget for Location 7c.
- Cleared invasive trees and shrubs off the road to enable access.
- Decommissioned 1,000 ft stretch of highly erosive and discused agricultural roadway located along the gulch edge.
- Prepared logs for check dams.
- Conducted road repairs to make the road drivable which included moving large boulders and installing sandbags to fill in holes caused by erosion.
- Cleared vehicle turn around points to enable access for restoration.

Phase 1 BMP Installation

- Trained and coordinated 48 community volunteers who donated 192 hours over 6 days to install BMPs. Fifteen of these volunteers helped to build a nursery, construct a storage shed, and install plants.
- Stabilized sediment on the dirt road and push piles of sediment material left within the stormwater flow path by installing 57 BMPs which included:
    - 7 check dams
    - 23 rows of vetiver
    - 9 rows of native grasses (kawelu, pili grass, and uki uki)
    - 10 coconut coirs (used instead of GrowSoxx)
    - 8 water redirection BMP using 8 rows of native plants (65 plants total) planted diagonally

between rows of native grass sediment traps which stablized accumulated sediment across .25 acres of exposed dirt road.

Phase 2 Restoration Preparation

- Formed a partnership with Maui Animal Farm to establish a native plant nursery in West Maui where we will grow plants for Phase 2 restoration.
- Constructed a shed and native plant growing area.

Since the area we restored was different to the area we proposed to restore in our original proposal (which was location 4) we did not need to implement the following:

- Install fencing since we have not seen ungulates. Funds were repurposed to installing BMPs instead. We did install a small fence at the top of Location 7 to deter dirt bikers.
- Install gate and delineate access road. The only users of Location 7 are dirt bikers, we put up a sign to educate dirt bikers about the restoration area and request they ride on a different road.
- We did not expand upon existing vetiver kickouts because Location 7 did not have any restoration implemented prior to our project. All BMPs were implemented from scratch.
- We did not need to use a backhoe to move sediment, instead we repurposed our effort to installing additional BMPs.

Outputs

- 57 BMPs installed along a 1000-foot stretch of decommissioned road.
- Native nursery set up to supply plants for Phase 2 restoration activities.

Objective 2: *Utilize the riparian buffer setback pilot to quantify the effectiveness of riparian restoration along stream gulches in Maui, and report results and recommendations for establishing and restoring riparian buffer setbacks to decision makers.*

We are happy to report that we have completed all project activities under this objective and have attached the two output reports as required.

Through this project we focused on collecting erosion rates at Location 7. We installed three pins in total. One in Location 7a, another in 7b and the third in the site we restored under this grant, Location 7c. Unfortunately, the pin at Location 7c went missing in January 2020. However, we have been able to monitor the other pins and the data is included in the attached report.

Our restoration design and active monitoring of our BMPs at other sites in the Wahikuli watershed has allowed us to hone our approach to the specific site conditions of West Maui's midslope region. For example, the BMPs we installed through our NOAA Coastal Ecosystem Resilience grant (which are just upslope from the originally proposed activities for this grant) appear to be performing very well. As part of that grant, we collaborated with the Commission on Water Resource Management (CWRM) to install stream velocity and turbidity monitors for baseline monitoring at the mouth of the Wahikuli Stream. These monitors allow us to track changes in turbidity over time as we continue to scale and replicate our restoration efforts. Those efforts have helped us understand how best to design and implement restoration projects more broadly, so we are now well-positioned to be able to replicate our work on other restoration sites.

To monitor the impact of stream restoration on the coastal environment, we are collaborating with (1) a local citizen science group, Hui O Ka Wai Ola, which is tracking turbidity along the coastline; and (2) the Division of Aquatic Resources (DAR), whom we will assist in continuing to monitor the sedimentation and coral health on the reef off shore from Wahikuli Watershed.

In addition to conducting baseline monitoring of erosion rates, we planned to collect one round of sediment accumulation data from select sediment traps. We were not able to do this because installation of the BMPs was delayed due to weather. Compounding the delay was the fact that the road was harder to access and clear than we had anticipated. As a result, the BMPs that were planned for installation in October were not installed until December and January. Despite the delay, we are pleased to have now installed sediment posts throughout the site and we collected the first round of sediment accumulation data in March of 2020.

Beyond the scope of this grant, we have been collaborating with researchers and conservation practitioners to develop a monitoring plan for all of our restoration locations. We will finalize the plan to share publicly in 2020. Monitoring protocols include those that help us measure the following indicators:

1. Erosion rates prior to BMP installation
2. Sediment accumulation at selected sediment traps
3. Grain size captured by sediment traps
4. Rainfall
5. Stream velocity and turbidity
6. Nearshore turbidity (data collected by Citizen Science group: Hui O Ka Wai Ola)
7. Sedimentation on coral (data collected in collaboration with the Division of Aquatic Resources)
8. Coral health (data collected in collaboration with the Division of Aquatic Resources)

Throughout 2020 with grant funding from NOAA Coastal Ecosystem Resiliency, Hawai`i Tourism Authority, and two private foundations, we are monitoring the indicators listed above, and also conducting BMP performance monitoring and maintenance of Location 7c.

To educate and engage stakeholders and decision makers about the importance of protecting stream gulch zones from development and restoring them with native vegetation, we developed a story map that describes the extent of the sediment and erosion problems within stream gulch (riparian) zones and how restoration can mitigate this impact. We have already used this story map extensively and successfully to educate and engage volunteers, stakeholders, and decision makers. We have printed versions for use at outreach events and have posted the story map on the CORAL website at www.coral.org/maui.

To enable us to share our restoration process, we have documented a detailed implementation plan and budget for the stream gulch restoration BMPs installed under this grant. We will share this document with conservation practitioners in West Maui and across Hawai‘i.

Activities completed

- Installed an advanced weather monitoring system, donated in-kind by Skye Instruments Ltd.
- Installed one erosion pin station to record sediment loss/transport from within the site.
- Under the guidance of the Stream Restoration Knowledge Sharing Group, conducted extensive monitoring pre- installation of sediment loss/transport from/to the site. We installed monitoring equipment to enable us to monior post-installation in the coming year, but the BMPs were installed near the end of the grant period and during the dry season, thus there was no sediment accumulation yet to monitor. We plan to conduct monitoring over the coming year using other grant funds.
- Developed an implementation plan for stream gulch restoration at 7c.
- Created a one-page story map describing the extent of the sediment and erosion problems within stream gulch (riparian) zones and how restoration can mitigate this impact.

Outputs

- Implementation plan and budget for Location 7c describing methods for stabilizing sediment

along riparian buffer setbacks that can be used by conservation practitioners across Hawai‘i.
- Report quantifying sedimentation reduction potential that can be achieved with restoration within these setbacks.
- Story map graphic illustrating the extent of the sediment and erosion problems within riparian buffer setbacks in West Maui, available at www.coral.org/maui

Objective 3: *Secure long-term protection and expansion of riparian buffer setbacks in West Maui by ensuring these zones are formally designated by their inclusion in the West Maui Community Plan.*

We are excited to report that we have successfully completed this objective and its accompanying activities and outputs.

We continue to collaborate with Maui County representatives and the West Maui Community Planning Advisory Committee (CPAC) to raise awareness about the importance of restoring stream gulch zones and to seek their support for including protection of these areas in the West Maui Community Plan. We have also successfully used our story map to educate and engage County officials, who expressed their support for our approach.

In February 2019, the Maui County Long Range Planning Department (one of the groups responsible for compiling information for the Community Plan) held a community design workshop focused on a suite of community sub-areas of West Maui. The goal of the workshop was to provide an opportunity for the community to communicate what they want to preserve and change over the next decade. CORAL attended this meeting and advocated for the protection and restoration of stream gulch zones.

To ensure that nominees to the CPAC and other key members of Maui County are also supportive of stream gulch protection, we led a field trip in March 2019 to the stream gulch site restored through our NOAA Coastal Ecosystem Resilience grant. The six attendees included Community Plan nominees and staff representatives from Maui Park and Recreation as well as the Department of Public Works.

As a result of our various collaborations and engagements, we are proud to report that the first draft of the West Maui Community Plan now includes stream gulch protection. This draft plan includes “no development” zones along stream gulches. This is critical because the midslope region is under significant development pressure. We are delighted with the interest we have recieved from Maui County in our project and restoration design ideas. We presented to the West Maui Community Planners Advisory Committee on September 24, 2019 and are pleased to report wide support of these policies and our restoration efforts. One of the committee members has also joined our volunteer team! We will continue to engage with Maui County to ensure this protection is included in the final plan and leverage our relationships to determine how we can continue to secure sufficient resources to restore watersheds across West Maui.

On September 11, 2019 we took 25 representatives from all Counties across Hawai‘i to visit our demonstration stream gulch site and provided an overview of the importance of stream gulch restoration. Russel Sparks from the Division of Aquatic Resources also provided an overview of the West Maui Ridge to Reef Initiative and the importance of stream gulch restoration for mitigating negative impacts to coral reefs. We also discussed the need for policy to protect stream gulches from future development and the need to solve liability challenges with private land owners to facilitate broad-scale restoration. The visitors were extremely engaged. Outcomes from this event included:

a) Some Maui County representatives offered to help us approach and solve the liability challenges of the project.
b) The event organizer confimed how impressed the participants were by the project. He also expressed an interest to work with CORAL on developing formal recommendations from the County Planing Department for restoration based on the BMPs we have developed and tested

through this NOAA grant. This will result in the Maui County planning department recommending these BMPs be implemented along stream gulches, and will ensure the resources we are developing through this project are embedded within local land management and shared broadly.

c) We have recommended that stream gulches are protected in the new West Maui Community Plan and this field trip helped us to strengthen support from County officials for implementing the zones.
d) We raised awareness about the need and solutions for stream gulch restoration among planning employees of Kauai, Honolulu, and Hawai‘i Counties.

Figure 2 Group photo from September 2019 visit to CORAL restoration site

Early in 2020, we learned that the new draft plan for the Hawaiian Homelands land in Honokōwai Watershed also includes stream gulch protection. We are excited to see the adoption of this concept and look forward to sharing our restoration implementation plans and monitoring results with other stakeholders so that the information can inform new restoration efforts across West Maui.

Importantly, our successes have opened the door to new restoration opportunities with two local West Maui non-profit organizations. These organizations have requested CORAL’s technical assistance with their restoration programs. Additionally, the Hawai‘i Department of Land and Natural Resources (DLNR) has requested CORAL’s restoration expertise and assistance along stream gulches on state-owned land in Wahikuli. We are pleased to have developed expertise in an area that is sorely needed and to be able to share the knowledge we have gained through this work broadly.

Activities completed

- Participated in West Maui Community Planning meetings to provide information about the benefits of establishing riparian buffer setbacks in future plans and development in West Maui
- Leveraged our illustrative story map to communicate the importance of stream gulch protection to important stakeholders.

- Educated nominees to the CPAC about the importance of protecting stream gulch zones from development and implementing restoration within these areas to protect coral reefs.
- Conduct site visits to the pilot buffer zone and restoration sites for Committee members and County Planning officials from across the state to understand the importance of midslope restoration activities within the Community Plan.
- Advocated for the protection and restoration of stream gulch zones at the the Maui County Long Range Planning Department community design workshop.
- Supported CPAC members with expertise and information, as needed, through our attendance at three Committee meetings.

Outputs

- The draft West Maui Community Plan and the Department of Hawaiian Home Lands include stream gulch protection.
- Community Plan Committee members, County Planners, and County Council members educated about the importance of midslope restoration work for the protection of West Maui's coral reefs.

D. Conclusion

We are thrilled with the important work we were able to complete under this grant with the support of NOAA CRCP. Today we are able to report that we satisfactorily completed all proposed objectives. In the long term we believe this will result in a big step towards our overarching goal of restoring the health of West Maui's coral reefs through the reduction of sediment pollution. We are grateful to NOAA CRCP for allowing us the flexibility to modify the location and timeline of the originally proposed work which was crucial to achieving the success we have towards this overarching goal.

Lessons Learned

At the beginning of the grant period, Maui experienced a set of severe storms. During that period, we learned that the BMPs installed along the stream gulch zone through our other NOAA grants performed very well in terms of sediment retention. This underscored our understanding that we need to remain flexible with implementation plans due to unpredictability of weather. Severe storms in Maui demonstrate the importance of our restoration work for the reduction of coastal sediment pollution.

Throughout the grant period, our greatest lesson learned has been to remain flexible and adaptively manage this project to maximize success and impact. For example, as explained in our no-cost extension, certain parts of our project were delayed because of unforeseen circumstances which slowed our ability to secure the necessary permissions for restoration work at Location 4c. As part of our adaptive management of this project, we had to change our site to Location 7c and request a 6-month grant extention to complete all activities. We chose to redirect our efforts to implement the same restoration activities proposed for Location 4c in a similar site called Location 7c. Location 7c is on State land, and the Department of Land and Natural Resource Management is eager for us to restore the area. Location 7c is at the top of the old agricultural area and is also the steepest area along the midslope region of this watershed, making it a high priority for restoration. By installing these BMPs in this area we will reduce the velocity of water along these roads trapping sediment and as the native plants become established their seeds will spread through the area increasing the native plant seedbank in the soil.

This shift was consistent with our acknowledgement that in order for conservation to be successful and durable, we must have the enthusiastic buy-in of local stakeholders, including land owners and management companies. We continue to work with Ka'anapali Land Management Corporation (KLMC) to finalize the

right of entry (ROE) documents[3] that will enable us to also access and restore Location 4.

Next Steps

Over the next four years, we will implement the following:

- Continue to implement restoration BMPs along the Wahikuli Watershed stream gulch. We anticipate completing the full stretch of Locations 5 through 7. Each stretch of road is restored over a 3-year phased approach.
- Establish and train volunteers to operate the native plant nursery at Maui Animal Farm in order to supply native plants to our project sites and other restoration efforts in the area.
- Finalize a stream gulch BMP monitoring plan that practitioners across Hawai`i can use to monitor restoration projects with standardized data.
- Monitor the performance of BMPs between Locations 5 through 7 and create a final report that describes the overall performance of these BMPs.
- Collaborate with local partners to integrate our implementation plans, budgets, and monitoring results to develop BMP recommendations and implementation instructions that are adopted by local institutions and shared broadly.
- Continue to advocate for stream gulch protection across West Maui and Maui Nui.
- Identify pathways for scaling stream gulch restoration.

We look forward to continuing to work with NOAA CRCP to advance these efforts.

[3] We are currently in the process of offering feedback to KLMC on the draft right of entry documents they provided.