



1. Title: Creating a Region-wide Green Infrastructure Strategic Plan for Maunalua Bay

Maunalua Bay is listed as a Department of Health impaired water body. For Mālama Maunalua, the leading community environmental organization the region, there is a critical need for a scientifically rigorous assessment of land-based runoff to identify problem areas to prescribe management action.

2. Name and contact Information

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3. Clients

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4. Proposed Project

A. Objectives. The health of Maunaloa Bay is heavily impacted by urban/storm water runoff from the ten highly suburbanized watersheds that feed into it. In recent years, Mālama Maunaloa (MM) has worked to address the impacts of water pollution in the ocean and on land. However, our effort has been piecemeal in scope and geography. Maunaloa Bay, along with the community which depends upon it for recreation, culture, and livelihoods, would benefit greatly from a region-wide Green-Infrastructure Strategic Plan that:

- 1) Determines priority hotspots for runoff (emphasis on shopping centers, major streams)
- 2) Creates a runoff reduction plan for the worst offending hot spot areas
- 3) Recommends best management options for the greatest ecological gains for the Bay

B. Significance. MM, a non-profit community organization, is the only entity dedicated entirely to the restoration and conservation of Maunaloa Bay, and is considered a leader bay management. MM has launched key projects on land and in the water to address the three main threats to Maunaloa Bay, including land-based sources of pollution, overfishing, and invasive alien algae (IAA) to restore and conserve it. This project would focus on the land-based sources of pollution to the bay from key urban development areas.

MM's land-based program, *Pulama Wai* ("Cherish our Waters"), works with communities, schools, and businesses to implement best management practices and promote stewardship. The project educates community on home and business practices to reduce runoff and installs best management practices (e.g., rain gardens). Though the work has been successful, we are aware that the more challenging causes of runoff are not being addressed.

There is widespread support from the community, especially from fishers and *kupuna* ("elders") who depend upon a healthy bay for their livelihoods and cultural practices, respectively, to address land-based pollution to restore native *limu*, seagrass, and fisheries. At present, MM is implementing various water quality projects with bay users and resource experts.

Due to capacity and expertise, we haven't been able to conduct a full assessment of best management practices for the region; one that identifies and ranks needs, provides solutions, and is integrally linked to the marine ecosystem. This is where Bren School students can provide invaluable assistance in developing a strategic plan with best management practices.

Some questions that could be considered in a management plan:

- 1) What should be done about the cemented streams that carry vast volumes of runoff?
- 2) What is the best way to get homeowners to reduce runoff?
- 3) What is the best technique to reduce runoff from shopping centers?
- 4) What is the trade-off between focusing on the large *mauka* lands verse urbanized zones?
- 5) How can we link management decisions to the ecology of the bay?

MM is the target client, but the work will benefit numerous partners active on the subject: Army Corps of Engineers, City and County of Honolulu, Department of Transportation, Department of Land and Natural Resources, and environmental/community organizations. With this assessment, MM can coordinate specific projects that will have the greatest impact for the Bay. The Bay would benefit from a reduction in urban and storm water runoff. The community would benefit from a healthier bay for recreation, fishing, and ecological integrity.



C. Background

What is the project location? The Maunaloa Region is situated in southeast O‘ahu (Hawai‘i) stretching from Koko Head (*Kawaihoa*) to Black Point (*Kupikipiki‘o*) and to the summit of the Ko‘olau Mountains. The region is approximately 28 mi² in size and has eight miles of shoreline fronting Maunaloa Bay. Maunaloa Bay comprises about 6.5 mi² of submerged waters. The Bay is characterized by large reef flats extending well out from the shoreline to a fore reef that drops to about 15-20 feet.

Maunaloa Bay is a biological and cultural treasure of Hawai‘i with a special history of waters abundant with fish and coral, inland fishponds and farms, and people who lived off and cared for the lands and the waters. With its natural inlet, Maunaloa was an ideal location for early settlements and was developed by ancient Hawaiians into a rich fishpond system. The great Kuapa fishpond was one of O‘ahu's largest. Other fishponds edged the shore of the Bay at Pāiko, Niu and Wailupe. Historically, the fishponds, deep water fisheries, streams and lands were carefully managed for sustainability by a *konohiki* (landlord).

Until the 1950s, the Maunaloa region was rural, consisting of some homes, vegetable/flower /dairy farms, and the largest fishpond in Hawai‘i, the 523 acre Kuapa Pond. The Bay was healthy. A 1950s fishing cooperative's regulations in the Bay pointed to the stewardship and former abundance of resources: daily catch limits for any one member, his guests, and household were "*30 fish, 5 squid, 5 lobsters, and no limit on crab.*"

Today, the Bay is recognized as one of the most heavily impacted and overfished marine systems in the State: 1) Listed as an impaired water by the State Department of Health, 2) Supports lowest levels of fisheries biomass when compared to other sites monitored around the State, and 3) Inundated by sediment and invasive alien algae (IAA) with coral cover <10%.

How did the problem arise? The decline of health of Maunaloa Bay results from a breakdown of the *konohiki* (traditional resource management) tradition by the middle of the 20th century and inappropriate land development and fisheries management.

In 1970s, there was major push to develop Hawaii Kai, abutting the Eastern portion of the bay. Kuapa Pond was filled and walled for the construction of housing developments and the Hawaii Kai Marina. Since then, the entire buildable coastal fringe and ridgelines have been developed. The region now supports over 50,000 households, 11 shopping centers, and channelized/cemented streams. The State built an extensive network of storm drains to take water off land as quickly as possible - bringing large quantities of runoff into the bay untreated.

During the time period, there was a significant change in fishing practices from traditional to the use modern technologies and increase in number of fishers as the island became more populated. The removal of herbivores has enabled IAA to thrive, smothering coral and native *limu* (“algae”)/seagrass. The loss of a healthy marine system has impacted the Bay’s ability to serve as *i‘a hinai* (“fish basket”) for the community.

D. Equity. The project has the potential to address environmental justice issues. Maunaloa Bay is an important water body for the preservation of culture and provision of food. Though the number of subsistence fishers has diminished with the urbanization of the island, recreational and commercial fishers still depend upon their catch to supplement household food and income security. In addition, the practice and knowledge traditional Hawaiian fisheries management system is continued, largely due to the kupuna (“elders”) living in the region. Improved water quality will assist improved resources and improved sustainability.



E. Available Data

What data are available to address this problem? MM has a substantial amount of pertinent information that will tie directly into the management plan: repository of existing research on Maunaloa Bay (on-line library, ArcGIS), State of Water Quality report, N-SPEC modeling, site-specific best management plans, Department of Health approved Wailupe Watershed Plan, water quality monitoring studies, neighborhood runoff assessments, two comprehensive watershed studies, various regional plans by City & County, Department of Transportation and others, and host of other studies from scientists. The information sheds insights on relevant projects, current thinking about target areas, and water quality issues.

In 2019-20, Bren Students developed a model using the Environmental Protection Agency's Storm Water Management Model 5.1 to facilitate the identification of "hotspot" areas contributing higher stormwater pollution in Wailupe Watershed. This project would build extensively upon the project outcomes to apply the model to the other nine watersheds in the Maunaloa Bay region as well as develop a concrete plan for green infrastructure in hotspot areas. In 2020, Tetra Tech completed a draft Roadmap for Green Stormwater Infrastructure in the Maunaloa Bay Region.

How and where can the students acquire data for their analysis? MM can provide the data directly to the students immediately. MM is also part of several working groups addressing land-based runoff - Maunaloa Watershed Hui (a consortium of residents and regional organizations), water quality team for Maunaloa Bay (e.g., Department of Health, University of Hawaii, The Nature Conservancy), and has relations with experts in the field. MM can connect the students with these groups/ individuals as a resource, if needed.

F. Possible approaches

To address the project objects, the following approaches may be:

- Land based modeling to determine amount of runoff coming from each hotspot area. The goal would be to expand upon the model developed by the 2020 cohort to apply to the other watersheds in order for a regional strategy.
- Literature review of successful green infrastructure projects to apply to Maunaloa.
- Thorough identification and assessment of projects (with detailed steps and expected ecological and social gains) to implement at priority hotspot areas.
- A schematic with associated data to support various options (e.g. X amount of shopping center parking lot converted to Y green infrastructure reduces A amount of runoff).

G. Deliverables. The deliverable is a Region-wide Green Infrastructure Strategic Plan for Maunaloa Bay. Based on the Plan, the Team will work with our Outreach and Communications Coordinator to create brochures and flyers to share with key partners, stakeholders, and community.

F. Internships. Please refer to the client's letter of support.



5. Supporting Materials

A. Citations

Crile, W. 2019. Maunalua Watershed Hui Priority Projects Report.

DLNR DAR. 2010. Long-Term Monitoring of Coral Reefs of the Main Hawaiian Islands. Final Report 2009 NOAA Coral Reef Conservation Program State of Hawai'i Monitoring Report 10/01/2006 – 09/30/2010.

Dornan N., E. Durand, E. Johnson, T. Jagadeesh. 2020. mauka2makai.weebly.com.

NOAA Pacific Islands Fisheries Science Center. 2016. Pacific Reef Assessment and Monitoring Program. Ecological monitoring 2015—reef fishes and benthic habitats of the main Hawaiian Islands, Northwestern Hawaiian Islands, Pacific Remote Island Areas, and American Samoa. Data Report DR-16-002.

McDuff et al. 2012. Invasive alga removal accelerates sediment flushing in Maunalua Bay. Research Poster.

Pollock J. 1928. Fringing and fossil coral reefs of Oahu. Bernice P. Bishop Museum Bulletin 55.

The Department of Health, Honolulu. 2008. 2006 State of Hawaii Water Quality Monitoring and Assessment Report: Integrated Report to the U.S. Environmental Protection Agency and the U.S. Congress Pursuant to §303(d) and §305(b), Clean Water Act (P.L.97-117). Chapter IV Assessment of Waters.

The Nature Conservancy of Hawaii. 2009. Maunalua Marine Survey Report.

Wolanski et al. 2009. Quantifying the impact of watershed urbanization on a coral reef: Maunalua Bay, Hawaii. *Estuarine, Coastal and Shelf Science* 84 (2009) 259–268.

Sustainable Resources Group Intn'l, Inc. 2010. Watershed Based Plan for Reduction of Nonpoint Source Pollution in Wailupe Stream Watershed. Final Report.

Tetra Tech. 2020. Roadmap for Green Infrastructure in the Maunalua Bay Region. Prepared for Malama Maunalua.

For a more complete list of reports and articles on Maunalua Bay, please go to:
<http://www.malamamaunalua.org/resource-library>



B. Budget and Justification

Mālama Maunalua does not anticipate many, if any, associated costs for this project. At present, the item that comes to mind would be the license for a computer program (such as ESRI ArcGIS) for which MM will cover.

C. Client letter of support. Refer to attached client letter of support.

- i. Internships
 - MM is committed to supporting student research projects.
 - As stated in the letter of support, MM intends to offer one paid internship. Through the Student Science and Research Program, MM invites other interested students to intern (unpaid) with the organization. The internship can be at any time of the year.
 - Final projects are shared widely with our partners and the community to ensure that the work is used. In particular, the recommendations from this project will lead MM's land-based efforts and become central to the Maunalua Watershed Hui's agenda.
- ii. Funding. Refer to attached client letter of support.
- iii. Data. MM expects that all of the data will be provided to the student group with no stipulation for a non-disclosure agreement or restriction for publication. If by some unexpected reason a non-disclosure agreement is required, MM will work with the research and the student group to work out the constraints around the use of the data.



January 19, 2021

Dear Group Project Committee,

Thank you for considering supporting Mālama Maunalua and our critical work in restoring and conserving Maunalua Bay today and for future generations. Your work with Mālama Maunalua will have a far-reaching impact on the communities that depend upon a healthy watershed for their livelihoods and pleasure.

In recent years, Mālama Maunalua (MM) has built a strong Student Science and Research Program. The purpose is two-fold: 1) for MM to receive additional assistance on research in Maunalua Bay from college/graduate students, and 2) for the next generation of resource managers and stewards to get in-the-field experience for what they are learning in the classroom. Our efforts have led to a greater understanding of the bay, and provided students with valuable real-world experience.

MM will offer at least one paid summer internship, and several unpaid internships. MM is committed to providing data, additional funding (subject to review) and/or any other resources for the project. We have a long track-record of providing valuable, multi-disciplinary mentorship to students, including working with Bren students this past year, whose work is directly guiding terrestrial restoration in the Maunalua Bay region.

We look forward to working with Bren School of Environmental Science and Management in general and a student group in particular.

Aloha,

A handwritten signature in black ink, appearing to read 'D Harper', is positioned above the typed name.

Doug Harper
Executive Director