Hawai‘i Division of Aquatic Resources Guidelines for Coral Restoration Special Activity Permit Applications

Updated April 2025

Division of Aquatic Resources
Hawai‘i Department of Land and Natural Resources

Department of Land & Natural Resources
Division of Aquatic Resources
1151 Punchbowl Street, Room 330
Honolulu, Hawai‘i 96813

Table of Contents

Department of Land & Natural Resources
Division of Aquatic Resources
1151 Punchbowl Street, Room 330
Honolulu, Hawai‘i 96813

Acknowledgements

This project is supported by Capacity Building to Implement Coral Restoration Action Plans in the U.S. Pacific Islands Grant Opportunity with the National Marine Sanctuary Foundation under Federal Award NA20NMF4630328 and the United States Environmental Protection Agency (U.S. EPA) under assistance agreement 99T93801 to the Department of Land and Natural Resources. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency, nor does the EPA endorse trade names or recommend the use of commercial products mentioned in this document.

This Guidelines document was created by Chelsea Wolke, Honor Weber, Samara Neufeld, and Callie Stephenson. Mahalo to the following people for their assistance with the Division of Aquatic Resources Special Activity Permit Coral Reef Restoration Framework:

Project Team

Hawai‘i Coral Reef Initiative: Kirsten Moy[1,2], Samara Neufeld[1,3], Robert Park[1,2], Callie Stephenson[1,2,4], Honor Weber[1,2], Chelsea Wolke[1,2]

Division of Aquatic Resources: David Delaney[2,12], Alessandra Shea[2], Bert Weeks[2]

Scientific Advisory Board

Tier 1: Eric Conklin[5], Mark Hixon[6], Kira Hughes[4], Cindy Hunter[6], Anthony Montgomery[7], Dan Polhemus[8], Joseph Pollock[5], Robert Richmond[9], Shannon Lyday Ruseborn[10], Hudson Slay[11], Nadiera Sukhraj[7], Rob Toonen[4]

Tier 2: Eric Dilley[1,2], Kim Fuller[2], Cathy Geweke[2], Lara Noren[1,2], Ryan Okano[2], Troy Sakihara[2], Nikki Smith[2], Russell Sparks[2], Chris Teague[2], Kendall Tucker[2], Heather Ylitalo-Ward[2]

Contributors: Damien Beri[13], Jesse Boord[2], Carlo Caruso[4], CJ Cayanan[14], Norton Chan[1,3], Juliette Chausson[15], Zack Craig[1,2], Gerry Davis[15], Daniel DeMartini[17], Megan Donahue[3], Ford Drury[3], Taylor Engle[1,3], Zac Forsman[3], Alika Garcia[17], David Gulko[2], Sean Hanser[18], Tyler Hee[19], Kim Hum[5], Christina Jayne[1,3], Lindsay Kramer[20], Sydney Lewis[1,2], Jen Martin[13], Keelee Martin[1,2], Brian Neilson[2], Blake Nowack[17], Thomas Oliver[21], Matt Parry[7], Jake Reichard[2], Ku’ulei Rogers[3], Julia Rose[5], Anita Tsang[2], Lani Watson[10], Thierry Work[22]

Contributor Affiliations:

[1] Hawai‘i Coral Reef Initiative, University of Hawai‘i at Mānoa
[2] Division of Aquatic Resources, State of Hawai‘i Department of Land and Natural Resources
[3] Hawai‘i Coral Restoration Nursery, Division of Aquatic Resources, State of Hawai‘i Department of Land and Natural Resources
[4] Hawai‘i Institute of Marine Biology, University of Hawai‘i at Mānoa
[5] The Nature Conservancy
[6] School of Life Sciences, University of Hawai‘i at Mānoa
[7] U.S. Fish and Wildlife Service
[8] Aquatic Ecosystem Conservation, U.S. Fish and Wildlife Service
[9] Kewalo Marine Laboratory, University of Hawai‘i at Mānoa
[10] Office of Habitat Conservation, Restoration Center, NOAA Fisheries | U.S. Department of Commerce
[11] U.S. Environmental Protection Agency, Region 9
[12] Delaney Aquatic Consulting LLC
[13] Coral Conservancy
[14] U.S. Army Corps of Engineers
[15] U.S. Environmental Protection Agency, Region 9, Wetlands and Oceans Section
[16] Pacific Islands Fisheries Regional Office, NOAA Fisheries | U.S. Department of Commerce
[17] Kuleana Coral Restoration
[18] Naval Facilities Engineering Systems Command Pacific
[19] Conservation International
[20] Hawai‘i Wildlife Fund
[21] Pacific Islands Fisheries Science Center, NOAA Fisheries | U.S. Department of Commerce
[22] National Wildlife Health Center, U.S. Geological Survey

Department of Land & Natural Resources
Division of Aquatic Resources
1151 Punchbowl Street, Room 330
Honolulu, Hawai‘i 96813

Acronym List

AIS	Aquatic Invasive Species
CBSFA	Community-Based Subsistence Fishing Areas
COO	Coral of Opportunity
DAR	Division of Aquatic Resources
DLNR	Department of Land and Natural Resources
FMA	Fishery Management Areas
GMO	Genetically Modified Organism
HAR	Hawai‘i Administrative Rules
HCRS	Hawai‘i Coral Restoration Strategy
HEPA	Hawai‘i Environmental Policy Act
HIMB	Hawai‘i Institute of Marine Biology
HRS	Hawai‘i Revised Statutes
MLCD	Marine Life Conservation District
MMA	Marine Managed Area
NARS	Natural Area Reserves System
NOAA	National Office of the Atmospheric Association
SAP	Special Activity Permit
TNC	The Nature Conservancy

Introduction

A Special Activity Permit (SAP) issued by the Division of Aquatic Resources (DAR) is required for any individual seeking to conduct reef restoration activities - as all stony coral and live rock are fully protected under sections 13-95-70 and 13-95-71, Hawai‘i Administrative Rules (HAR).

SAP applications are reviewed by DAR Biologists and if the activity is determined to have minimum significant and cumulative impact, DAR can issue a Declaration of Exemption, which grants **most** projects an exemption from Hawai‘i Environmental Policy Act (HEPA) Environmental Assessments or Environmental Impact Statements, normally required under the Authority of Chapter 343, HRS, and Chapter 11-200.1, HAR. Under the authority of HRS 187A-6, any research, educational, or management institution holding an active coral SAP is permitted to participate in coral-related activities within the confines of their permit terms and conditions for up to one (1) year. As such, DAR has outlined which activities are desirable to assist Permittees in designing projects and obtaining permits. For further information, please see Chapter 195D, HAR Chapter 13-95, and HRS 187A-6.

Note: Due to the nature of coral restoration projects, it is likely any proposed project will require additional permits from other agencies. It is the responsibility of the Permittee to consult with all county, state, and federal agencies to ensure compliance and to obtain all the proper permits for the proposed activity. DAR recommends engaging with agencies directly to get an official determination of whether a permit is required or not. DAR may be able to suggest additional contacts or information (see Appendix D) but is not able to make a determination on behalf of other agencies.

Individuals will submit an application to DAR to acquire a SAP to conduct coral restoration. The SAP application is a comprehensive outline of the project's proposed activities, objectives, and methods.

SAP application sections include:

- Project Proposal
    - Purpose with clearly stated goals and/or objectives
        - Project timeline
        - Long-term financial plan
    - Location(s)
- Administrative Plan
    - Curriculum vitae or resume
- Restoration Plan
    - Coral collection plan
    - Coral Collection Site Photos and Maps
    - Aquatic Invasive Species Mitigation Plan
    - *Ex situ* quarantine procedures (if applicable)
    - *In situ* quarantine procedures (if applicable)
    - *In situ* Hurricane and Large Storm Plan (if applicable)
    - *In situ* long-term plan (if applicable)

- Coral transport and outplanting methods and plans
- Baseline survey plans for control and outplant sites
- Identification of acute and chronic stressors at restoration site
- Monitoring Plan
- Evaluation of project performance
- Reporting Plan
- Appendices should also include other supporting material (if applicable)

💡 **Recommended Tip**: Providing as much information as possible in the application will help expedite the review, drafting, and processing of the permit. **Note**: An application may not be deemed “complete” until all project details have been submitted to DAR and an SAP can be drafted from the information provided.

This Guidelines document is meant to guide you through your self-evaluation using the DAR Special Activity Permit Coral Restoration Framework Tool. The self-evaluation Tool will guide applicants in justifying how their project will meet or will not meet the detailed criteria for coral restoration projects in Hawai‘i. Coral restoration criteria will be coded using a true/false dichotomous system, where:

- True Statements: Fast-tracked for approval
- False (blank) Statements: Requires further review, may not meet all legal criteria, and/or may need further justification to be approved

NOTICE:
Only a Special Activity Permit issued and signed by an authorized representative of the Department of Land and Natural Resources grants permission for certain activities involving aquatic organisms belonging to the people of Hawai‘i, under the Hawai‘i Revised Statutes and other applicable laws. This includes the authorization of the Permittee and Authorized Assistants to engage in activities otherwise prohibited by law, subject to the conditions listed in the issued Permit, which include taking, possessing, transporting, disturbing, transplanting, etc., regulated aquatic life.

Application materials, correspondences, or draft permits do not grant permission for activities to be conducted.

💡 **Recommended Tip**: Each section begins with a gray box that outlines the content provided in the SAP Framework Tool. Below each gray box, you'll find supporting material designed to assist applicants in completing the SAP Framework Tool effectively.

Department of Land & Natural Resources
Division of Aquatic Resources
1151 Punchbowl Street, Room 330
Honolulu, Hawai‘i 96813

I. Project Proposal

Applicants must submit project proposals detailing the project's purpose and the locations of proposed restoration activities.

1. Statement of Purpose

1.A. Proposal has clearly stated goals and/or objectives.

To ensure a complete application, the applicant is encouraged to address the following:

a. Project goals and objectives in alignment with the State of Hawai‘i Coral Reef Strategy (HCRS) and/or the Makai Restoration Action Plans (available online: https://dlnr.hawaii.gov/coralreefs/reports/).
b. Justification for the restoration efforts
c. Identification of adequate and realistic funding sources
d. Community engagement with community members and stakeholders
e. Specific locations of the proposed restoration activities, prioritizing Hawaiian coral reef ecosystem services, integrity, and function.
    i. Drivers of degradation in coral resources from point and nonpoint sources at the restoration site(s).
    ii. Existing stressors at restoration site(s) including acute and chronic impacts.
        - Acute impacts, like broken corals from ship groundings or hurricanes, may respond well to restoration, as it is unlikely these acute impacts will cause repeated damage to a site.
        - Chronic impacts, like those from land-based sources of pollution, sedimentation, and heavy human traffic, continuously degrade a habitat. Without mitigation of these drivers, coral restoration in areas experiencing chronic stressors is not likely to experience high degrees of success and may require further justification.
    iii. How ecological services and functions of restoration sites can be improved through restoration.

Community Engagement

Community and stakeholder support are crucial for successful coral restoration projects. Engaging local communities and involving stakeholders in all stages - planning, design, and implementation - is essential. Methods of engagement include neighborhood board meetings, public workdays, education opportunities, and outreach materials. The principles outlined in Kūlana Noi‘i can serve as a starting point.

When working with local communities, consider their language, knowledge, customary practices, lifestyle, and community engagement. When conducting research projects in a specific area, remember

that you're interacting with a place and a people who have been there for generations and whose place-specific knowledge and practices are the result of generations of observations and data collection. Cultural knowledge from community members is invaluable as this generational indigenous research can aid in advancing current scientific knowledge. Working closely with communities and building strong and trustworthy relationships leads to successful research outcomes and managing and restoring resources properly. Being accountable for the wellbeing of Native Hawaiian communities is essential, ensuring that the work that is done ultimately benefits the people of that place.

DAR hopes to build the capacity of community groups to conduct coral restoration projects in their communities, and encourages community members wanting to begin a coral restoration project to seek guidance from DAR. DAR will consult with the SAP Framework's Scientific Advisory Board (SAB) for further guidance in the design, implementation, and monitoring phases of a project's proposal as needed.

1.B. Coral restoration is being conducted for a purpose that is aligned with the State of Hawai‘i Coral Reef Strategy and/or the Makai Restoration Action Plans (available online: https://dlnr.hawaii.gov/coralreefs/reports/).

The State of Hawai‘i Coral Reef Strategy: 2030 Ecosystem Planning Priorities in the Main Hawaiian Islands represents the programmatic focus of coral reef ecosystem planning within DLNR and DAR. DAR and partners (NOAA, TNC, and HIMB) developed the Makai Restoration Action Plans to identify priority areas, interventions, research gaps, and community concerns that best align with the goal of "increasing the ecological function and integrity of coral reefs." The HCRS 2030 and the Makai Restoration Action Plans apply research and evaluations, technology, funding, and knowledge sharing that is collaborative and beneficial for all.

1.C. Project **is not** part of an emergency or damage response coordinated with DAR following a regulated coral damage event (e.g., emergency restoration under Clean Water Act or Oil Pollution Act).

Emergency coral restoration refers to the urgent and rapid response efforts aimed at stabilizing, rehabilitating, or restoring coral reef ecosystems following acute disturbances. These disturbances can include natural events (e.g., hurricanes) or human-induced impacts (e.g., ship groundings). The primary goal of emergency coral restoration is to mitigate immediate damage, prevent further ecosystem degradation, and support the recovery of coral health and biodiversity.

Emergency permits will only be granted following a catastrophic event that requires immediate attention and not for regular restoration activities. Emergency restoration projects should contact dar.sap@hawaii.gov for further instructions in addition to completing the SAP application. Most emergency restoration activities usually also receive exemption from the preparation of an Environmental

Assessment under the Authority of Chapter 343, HRS, and Chapter 11-200.1, HAR, for a Special Activity Permit.

1.D. Proposal details a project timeline including monitoring efforts.

Please specify the anticipated start dates and duration of activities, including fieldwork seasons, and planned opportunities for community engagement.
If your application includes multiple sub-projects, please ensure a detailed timeline is provided for each.

1.E. Proposal details the long-term financial plan for the project.

The project proposal must show the project's capability to maintain funding throughout the project's duration, including monitoring needs. Funding should also account for the long-term maintenance and potential removal of synthetic materials as appropriate after the project end date. Permittees may be required to conduct up to five (5) years of monitoring of coral transplants/outplants. It is the responsibility of the Permittee to ensure their project is properly permitted and either removed or later transferred to another approved organization for long-term maintenance.

It is important to note that project funding does not need to be secured at the time of submission. Instead, a demonstration of reasonable funding opportunities that will sufficiently support all necessary activities and monitoring will be adequate.

2. Considerations for Restoration Locations

2.A. Project **does not** include collection from regulated and/or sensitive areas (**Statewide:** MLCDs, CBSFAs, FMAs, Natural Area Reserve Systems (NARS), Harbors, and Waters immediately surrounding offshore islets; **Kaua‘i**: Waters surrounding Kaula Rock, Nualolo, Lehua, Mana Barrier Reef Complex, and nearshore waters surrounding Ni‘ihau; **O‘ahu**: Paiko Lagoon, Moku o Lo‘e; **Maui Nui**: Nearshore waters surrounding Moloka‘i; **Hawai‘i**: Puakō, Ka‘ūpūlehu Marine Reserve; **Northwestern Hawaiian Islands**: Northwestern Hawaiian Islands State Refuge).

Sensitive Areas

Regulated and/or sensitive marine areas are usually specific geographic areas designated by statute or administrative rule for the purpose of managing a variety of marine, estuarine, or anchialine resources and their use. The resources may include any type of marine life (mammals, fishes, invertebrates, algae, etc.)

and their habitats. In some cases, particularly Fisheries Management Areas (FMAs), regulations may serve to resolve user conflicts. The goal of Marine Managed Areas (MMAs) may also include preservation of cultural or historical resources. Marine Protected Areas (MPAs) are a subset of MMAs and focus on the protection, enhancement, and conservation of habitats and ecosystems. Some MPAs have very few fishing restrictions and allow sustainable fishing, while others restrict all fishing and are “no-take” areas. In Hawai‘i, forms of MPAs, such as Marine Life Conservation Districts (MLCDs), have been in use for over 40 years.

DAR recognizes that there are many marine stakeholders with the common goal of abundant resources. MMAs in general, and MPAs in particular, are tools DAR uses to achieve that goal. Discretion should be used to avoid conflicts with fishers and other stakeholders during authorized activities.

Projects that include outplanting to regulated and/or sensitive areas will require further review from DAR Biologists to ensure restoration activities will not have negative impacts on the area’s ecology and existing resources, and will minimize biosecurity concerns. In these sensitive areas, collection of some corals may still be allowed; however, these collections will include a justification of need that will be reviewed by DAR for suitability. Justification for restoration and collection activities may include alignment with DAR initiatives and management plans, a demonstrated cultural connection to the resources of concern, or a demonstrated reasonable chance of success (i.e. a project that has been shown successful in other areas may have a higher chance of receiving a permit to work in sensitive areas). A comprehensive list of these regulated areas can be found on DAR’s website: https://dlnr.hawaii.gov/dar/fishing/fishing-regulations/regulated-areas/ and on the DAR interactive map of marine managed areas in the main Hawaiian Islands: https://www.arcgis.com/apps/webappviewer/index.html?id=c0dc296ff373486baa9e041e40f445b2.

Sensitive areas include:

- Statewide
    - Marine Life Conservation Districts (MLCD)
    - Community-Based Subsistence Fishing Areas (CBSFAs)
    - Fishery Management Areas (FMAs)
    - Natural Area Reserve Systems (NARS)
    - Regional Fishery Management Area
        - Fish Replenishment Area
        - Netting Restricted Area
        - Marine Reserve
    - Commercial Harbors and Small Boat Harbors
    - Waters immediately surrounding offshore islets
    - Waters surrounding Ni‘ihau and Kaho‘olawae*
- Northwestern Hawaiian Islands
    - Northwestern Hawaiian Islands State Refuge

- Kaua‘i
    - Waters surrounding Kaula Rock
    - Nualolo
    - Lehua
    - Mana Barrier Reef Complex
    - Nearshore waters surrounding Ni‘ihau
- O‘ahu
    - Paikō Lagoon (Wildlife Sanctuary)
    - Moku o Lo‘e (Marine Laboratory Refuge)
- Maui Nui
    - Nearshore waters surrounding Moloka‘i
- Hawai‘i
    - Puakō
    - Ka‘ūpūlehu Marine Reserve

*Areas surrounding Ni‘ihau and Kaho‘olawae are restricted and require prior approval for access.

Ni‘ihau: Access to nearshore waters of Ni‘ihau requires landowner (Robinson family) coordination and approval.

Kaho‘olawae: Access excludes restricted 2 nautical mile boundary Zone A and Zone B surrounding Kaho‘olawae - unless authorized by Kaho‘olawae Island Reserve Commission.

Areas with high prevalence of Aquatic Invasive Species (AIS)

2.B. Project **does not** include collection from areas with high prevalence of Aquatic Invasive Species (**Statewide:** Commercial harbors; **Kaua‘i**: Anini Beach, Kalapaki Bay; **O‘ahu**: Kāne‘ohe Bay, Pearl Harbor, and Maunalua Bay; **Hawai‘i**: Hilo Bay, Honokōhau, and Kawaihae Harbor; **Northwestern Hawaiian Islands**: Midway Atoll (Kuaihelani), Pearl and Hermes Atoll (Manawai and Holoikauaua), Kure Atoll (Hōlanikū).

Marine areas with a high prevalence of Aquatic Invasive Species (AIS) are also designated as DAR Sensitive Areas. Coral restoration activities will also be limited in these areas and require further DAR review. Some collections of corals will be allowed in these areas; however, these collections should include a detailed plan of how the risk of transferring AIS will be minimized. AIS can contribute to the decline of coral resources, this justification will include how the risks associated with AIS transfer and proliferation are being mitigated either by the Permittee, other resource stewards, or DAR. See the Aquatic Invasive Species Mitigation Plan section for additional guidance.

These areas with high prevalence of AIS are:

- Statewide
    - Commercial Harbors and Small Boat Harbors
- Northwestern Hawaiian Islands
    - Midway Atoll (Kuaihelani)
    - Pearl and Hermes Atoll (Manawai and Holoikauaua)
    - Kure Atoll (Hōlanikū)
- Kaua‘i
    - Anini Beach
    - Kalapaki Bay
- O‘ahu
    - Kāne‘ohe Bay
    - Pearl Harbor
    - Maunalua Bay
- Hawai‘i
    - Hilo Bay
    - Honokōhau
    - Kawaihae Harbor

2.C. Project **does not** include outplanting to regulated and/or sensitive areas (see list in I.2.A. above).

II. Administrative Plan

The Administrative Plan must outline the roles and responsibilities of all project team members. These roles include the Permittee, Scientific Team Lead, and other Project Team members. The Administrative Plan should detail the responsibilities of the project team. This includes the personnel responsible for 1) planning and implementing the Restoration Plan, 2) proposing funding routes for the restoration activities, and 3) developing the methods for the project.

1. Permittee (and/or Scientific Team Lead)

Permittee

1.A. Permittee **has not** conducted unpermitted activities that are regulated under the DAR Special Activities Permit program (e.g. unpermitted collection of regulated aquatic species, use of regulated gear, collection in regulated area) in the past five years.

Each Special Activity Permit (SAP) is overseen by one or more Permittees, who may also serve as the project's Scientific Team Lead. This individual is responsible for project oversight, planning, and communication with DAR SAP staff. Potential Permittees must have been in good standing for the past five years, with no violations of unpermitted activity under the DAR Special Activity Permit program.

If DAR has reason to believe that a potential Permittee has engaged in unpermitted activities, such as collecting regulated aquatic organisms or resources, using regulated gear, or conducting activities in regulated areas, DAR will communicate directly with the Project Lead. Any violation of the terms or conditions of a granted or renewing SAP, or any violation of State law, may result in the revocation of the permit or permit application, as well as other penalties provided by law. Additionally, DAR may consider any such violation as grounds for denying any future application for this or any other permit issued by the Department.

Scientific Team Lead

1.B. Attached a resume or curriculum vitae that details at least two years of relevant experience or graduate-level experience involving corals or coral reef organisms.

1.C. Is knowledgeable in observational and experimental design in marine ecosystems.

1.D. Has experience in coral reef monitoring.

1.E. Will ensure any project staff, volunteers, or other parties working under the permit are knowledgeable of the permit conditions and are supervised to ensure compliance.

DAR requires each project to designate a Scientific Team Lead who can provide adequate expertise to work with delicate coral resources. This person will hold the coral restoration permit (as either sole or co-Permittee) and must be able to justify their expertise within the Administrative Plan.

Project Team

All other members of the project team, paid or unpaid, that will participate in any activities involving regulated aquatic resources, must be listed as Authorized Assistants. Authorized Assistants must be added

to the permit prior to participating in any coral handling activity and may be added throughout the duration of the permit. The Permittee and each assistant are individually responsible and accountable for their actions while conducting activities authorized under any permit; additionally, the Permittee is responsible and accountable for the actions of the Authorized Assistants. Permittees will ensure all other members of the project team have the necessary expertise to conduct proposed activities, or the Permittee will demonstrate the ability to train necessary staff and volunteers for proposed activities. For any person working under an SAP, failure to adhere to conditions, restrictions, and stipulations outlined in the permit can lead to the revoking of the permit or ineligibility for renewal.

III. Restoration Plan

The Restoration Plan is a comprehensive summary of activities to be conducted by the Permittee and Authorized Assistants throughout the duration of the project. It should be structured around the DAR SAP Framework Tool Form and include justifications for areas where further review will be required.

💡 **Recommended Tip:** An application is considered 'complete' only when all necessary information has been submitted to DAR. Providing as much information as possible in the application will help expedite the review, drafting, and processing of the permit . Since coral restoration is a regulated activity, including information for non-regulated activities, such as non-regulated gear use is required. To help ensure a smooth and timely process, please provide detailed information for each section of the application. It is also helpful to write in third person and future tense.

> **Example**: “The Permittee will collect 10-15, <10cm coral colonies in a non-regulated area, Kualoa Beach Park (approx 21.511, -157.841) on O‘ahu, using non-regulated hand-tools (hammer, chisels, plastic bags)”

Restoration Methods

Coral restoration and research have been categorized into four types of interventions: genetic manipulation, environmental, physiological, and physical. These interventions have been defined and graded according to the stoplight system:

Not Acceptable - intervention currently deemed not acceptable and permit will undergo further review by DAR

Requires Review - intervention will require further review

Acceptable - intervention is acceptable to conduct but additional permit terms and conditions may apply

Department of Land & Natural Resources
Division of Aquatic Resources
1151 Punchbowl Street, Room 330
Honolulu, Hawai‘i 96813

Please use the table below to identify your project's intervention(s) and determine if your project is acceptable, required for further review, or deemed currently not acceptable. Explanations for interventions can be found below the table.

Restoration Interventions	Methods	*In situ* Phase	*Ex situ* Phase
Genetic Manipulations	Genetically modified organism (GMO) / transgenic coral		
	Selective breeding		
	Selective collection		
	Assisted migration		
	Cryopreservation		
	Genetic archiving of live samples		
Environmental Interventions	Bio-rock Technology		
	Live rock / Crustose coralline algae (CCA)		
	Artificial structures		
Restoration Interventions	Methods	*In situ* Phase	*Ex situ* Phase
Physiological Interventions	Probiotics		
	Phage therapy		
	Antibiotics		
	Climatization		
Physical Interventions	Nurseries (*in situ* or *ex situ*)		
	Translocation/Transplantation		
	Direct Reattachment		
	Importation		

	Fragmentation/microfragmentation		
	Larval seeding		
	Outplanting		

Genetic Manipulation

- GMO coral: altering coral genes for new function
- Selective breeding: breeding corals for specific resilient traits
- Selective collection: collecting corals with specific resilient traits
- Assisted migration: moving stress-tolerant or diverse genes or colonies just outside species' range
- Cryopreservation: frozen storage of gametes and other cells for later use and transport
- Genetic archiving of live samples: collecting and maintaining genetic archive

Environmental Intervention

- Biorock Technology: material formed when a small electrical current is passed between underwater metal electrodes causing dissolved minerals to accrete onto the cathode to form a limestone base (also referred to as seacrete or seament)
- Live rock/CCA: rock containing live organisms/crustose coralline algae
- Artificial structures: man-made structures to act as substrate for corals, includes both synthetic (rebar, PVC, etc.) and inert (concrete, aragonite, ceramic, etc.) materials

Physiological Intervention

- Probiotics: using probiotics to reshape the coral microbiome/microbial community
- Phage therapy: adding phage viruses to control pathogenic microbes
- Antibiotics: adding antibiotics to control pathogenic microbes
- Climatization: using stress exposure to make colonies more tolerant

Physical Intervention

- Nurseries *ex situ*: land-based nurseries (both closed and open systems)
- Nurseries *in situ*: field-based nurseries
- Translocation/Transplantation: physical relocation of coral colonies into a new location
- Direct Reattachment: attaching loose coral fragments or colonies within the site it was found with no intermediary steps (e.g. in or ex situ nursery)
- Importation: introducing genetically diverse colonies that have not previously been found in the area; introducing diverse species to new regions
- Fragmentation/microfragmentation: cutting colonies into smaller pieces
- Larval seeding: collection, culture, and release of gametes or larvae to targeted sites

- Outplanting: planting colonies from a nursery onto the reef (also referred to as gardening in other regions)

1. Coral Collection Plan

Collection is defined as any act wherein a coral organism, adult or juvenile is removed from its original place in the State of Hawai‘i. Any transfer of corals outside of its collection site for any period of time requires an Aquatic Invasive Species Mitigation Plan to reduce the risk of transfer of AIS, micropredators, and coral disease (see Aquatic Invasive Species Mitigation Plan). The take of colonies should be distributed over an area, with no more than 20% of the target species removed, to avoid taking entire colonies and/or fragments from all colonies of any one species at the same collection site. This aims to maintain the natural genetic distribution of coral species in the natural environment.

Collection criteria are divided by the collection method, type of coral organism, and the location.

- Corals of Opportunity (COO): colonies or fragments of coral that have naturally (surge/water motion, storms, etc.) or unnaturally (resulting from boat-strikes/vessel groundings, anthropogenic impact, etc.) been dislodged or unattached from the substrate **and** have a low chance of survival without human intervention, not including naturally free-living corals (dislodged corals vs. corals that may naturally live unattached; e.g. *Lobactis scutaria* (previously *Fungia scutaria*).
    - A sampling design must be submitted that outlines the spread of the collection of coral colonies and fragments to prevent concentration on a single location, allowing some corals to naturally degrade into smaller pieces, supporting natural processes of natural reattachment and formation of rubble and sand.
    - COO are more favorable for restoration purposes than corals attached to artificial reefs or natural reef substrates.
- Coral gametes or larvae: Coral sperm, egg, bundles, or zygotes
    - A sampling plan must demonstrate reasonable subsampling of spawning events (i.e., not collecting from every colony in one area or not collecting the entirety of gametes from individuals attached to natural reef substrates).
    - Projects will clarify any potential assisted gene flow by transfer of sperm, egg, bundles, or zygotes between watersheds. This includes the release of unused gametes in regions outside of the immediate collection area.
- Corals attached to man-made substrates:
    - Corals attached to man-made substrates that must be removed due to impending construction, or similar impact (i.e. mooring, pillars, not including artificial reefs) may constitute emergency restoration.
    - These corals are more favorable for restoration purposes than corals attached to artificial reefs or natural reef substrates.
- Corals attached to artificial reef structures:

    - Corals attached to artificial reefs will be evaluated similarly to corals attached to natural reefs.
- Corals attached to natural reef structures:
    - For these organisms, additional criteria have been created to limit the amount of rare or sensitive corals to be collected. Projects proposing collection of organisms attached to natural reef substrates that do not meet these criteria should justify the necessity of the collection. For a project to be classified as fast-tracked for approval, criteria are as follows:
        - Corals will be collected from colonies under 1-meter at the longest diameter.
        - Collection is planned for months of low bleaching risk: Dec - Jun. See also NOAA's Coral Reef Watch Four-Month Coral Bleaching Outlook page.
        - If collecting from broadcast spawning coral species, the collection is planned at least one month before and/or after the target species' annual spawning events (see Appendix C).
        - The collection primarily targets common Hawaiian species.
            - Rare Species - Attempts to collect rare species will require further review and/or may need further justification. See Appendix B for a comprehensive list of rare Hawaiian coral species. The following species require special permission from the Division prior to inclusion under any permit due to their rarity:
                - *Leptoseris foliosa*
                - *Leptoseris hawaiiensis*
                - *Leptoseris scabra*
                - *Montipora dilatata*
                - *Porites pukoensis*
                - *Porites duerdeni*
                - *Pocillopora molokensis*
                - *Pocillopora verrucosa*

1.A. Project will include collection site photos and maps.

See *section III.5. Baseline Survey and Monitoring* and the DAR Coral Restoration Implementation Guide for more recommendations about coral collection and photo documentation.

Photo Documentation

1.B. All (or at least a subset of 30 **per** collection site) collected coral specimens will be photo documented with a scale bar as follows:

a. Before Collection - capture a photo of the reef area/man-made structure from which the coral is to be collected.
b. Before Collection - capture a top-down photograph of coral specimens to be collected with a scale bar.
c. After Collection - capture a photo of the colony after collection.
d. After Collection - capture a photo of the reef area/man-made structure from which the coral was collected.

Collection of coral colonies will always be done by trained snorkelers and/or scientific divers. All or at least a subset of 30 coral colonies per collection site will be photo documented with a scale bar. In general, every coral collected should be documented through photos, which will be maintained by the Permittee and will be submitted to DAR at the end of the permit period as part of the Annual Report, as requested.

💡 **Recommended Tip:** Every coral collected should be assigned a unique identification code that does not change over time and signifies sets of genetic material. This allows the individual corals to be tracked from collection all the way through monitoring.

- Unique identifiers should follow a formula that is consistent within the organization and across collection events, species, and locations.
- As a suggestion, below is a formula that can be adapted:
  - Three letter code for collection site, ex: Honolulu Harbor = HOH
  - The first letter of the genus followed by the first two letters of the species of the coral, ex: *Pocillopora grandis* = PGR.
  - A number differentiating how many of these colonies were collected.
  - For example, a collection of two fragments from two distinct *Pocillopora grandis* colonies from the South Shore of O‘ahu near Honolulu Harbor, could have theidentifiers:HOH PGR 001 and HOH PGR 002.

Please see *section III. 6: Evaluation and Reporting* and Appendix E for instructions and examples on how to submit photos to DAR.

1.C. Corals **will not** exceed 1-meter in diameter and fragments will not be collected from colonies 1-meter or greater.

Due to the greater ecological function larger colonies contribute to the environment, minimizing the take of colonies to under 1-meter in diameter will minimize negative impacts to the natural genetic distribution of coral species in the natural environment.

1.D. Collection **will not** include **rare coral species** including but not limited to *Leptoseris foliosa, Leptoseris hawaiiensis, Leptoseris scabra, Montipora dilatata, Porites pukoensis, Porites duerdeni, Pocillopora molokensis, and Pocillopora verrucosa.*

See Appendix B for a full list of rare corals in Hawai‘i.

If the project is requesting to collect COO for rare coral species, the Applicant is encouraged to provide further justification for the necessity of collection, as well as restoration plans for those particular species.

1.E. Collection is planned for months of low bleaching risk: November – June.

The Permittee will take special consideration to avoid planning collection activities during months of high bleaching risk to minimize stress to wild colonies and impacting their chance of recovery due to Hawai‘i’s slow growth rates.

See also NOAA’s Coral Reef Watch Four-Month Coral Bleaching Outlook page. If collection of corals is planned during the stated months, applicants are encouraged to provide justification for the timing of the activity.

Aquatic Invasive Species Mitigation Plan

1.F. Proposal includes an **Aquatic Invasive Species Mitigation Plan** that addresses disinfecting, cleaning, and drying of all gear and equipment between collection areas.

The following species remain a concern to DAR:

Algae	**Coral Disease**	**Organisms**
• *Kappaphycus spp.* • *Eucheuma denticulatum*	• *Montipora*, *Pocillopora*, and	• Majano Anemone (*Anemone manjano*)

• *Gracilaria salicornia* • *Acanthophora spicifera* • *Hypnea musciformis* • *Avrainvillea amadelpha/lacerata/erecta* • *Chondria tumulosa*	*Porites* tissue loss syndrome • *Montipora*, *Pocillopora*, and *Porites* anomalies • *Montipora* black band • *Porites* trematodiasis	• Orange keyhole sponge (*Mycale armata/grandis*) • Pulsing Xenia (*Unomia stolonifera)* • Kenyan Tree (*Capnella sp.*) • “Harbor Porites”

Best management practices outlined in the Aquatic Invasive Species Mitigation Plan will aid in reducing the spread of invasive species, diseases, and parasites between sampling areas. These methods include but are not not limited to ensuring that all organisms, hand tools and/or collection bags/containers are inspected and absent of any non-natives or invasive organisms before transportation to lab aquariums, or before collection in a new area, and ensuring that all gear is disinfected or sterilized between collection areas. Additionally, best management practices include a quarantine period during which any specimen collected will not be outplanted from the collection site’s watershed area before first being moved to a closed-system aquarium, an open aquarium with UV filtration on its outfall. Specimens will remain isolated from organisms outside the collection cohort until they are free of AIS, micropredators, and disease following a quarantine period conducted in either a closed system or an open system equipped with UV filtration. Projects seeking to move corals from their original location will detail what actions will be taken to reduce these risks.

Best management practices outlined in the Invasive Species Mitigation Plan will aid in reducing the spread of invasive species, diseases, and parasites between sampling areas. These methods include but are not not limited to:

- Ensuring that all organisms, hand tools and/or collection bags/containers are inspected and absent of any non-natives or invasive organisms before transportation to lab aquariums, or before collection in a new area.
- Ensuring that all gear is disinfected or sterilized between collection areas.
- Inclusion of a quarantine period during which any specimen collected will not be outplanted from the collection site’s watershed area before first being moved to a closed-system aquarium, an open aquarium with UV filtration on its outfall. Specimens will remain isolated from organisms outside the collection cohort until they are free of AIS, micropredators, and disease following a quarantine period conducted in either a closed system or an open system equipped with UV filtration. Projects seeking to move corals from their original location will detail what actions will be taken to reduce these risks.

Best practices for the transport of gear or aquatic resources from areas with AIS include:

- Visually inspect, disinfect, clean, and dry all gear and equipment between any collection events. Disinfecting procedures will include soaking the gear and equipment for a minimum of 10 minutes in a solution containing a chemical disinfecting agent proven to kill live organisms such as diluted bleach (1 part 8.25% bleach : 20 parts freshwater, or similar concentration).
- If collection gear cannot be bleached, gear must be thoroughly rinsed with fresh water and sterilized with another viable method, approved by DAR, and dried in the sun for 24 hours before use in an alternate location, or alternate sampling gear will be utilized.
- The spread of invasive species/disease/parasites will be mitigated by ensuring that all organisms (e.g. coral colonies, fragments or live rock) collected are absent of any algae fragments or basal attachments of invasive algae or other invasive species/disease/parasites.
- Ensuring vessel(s) will be cleaned with freshwater and allowed to dry between any collection event.
- Ensuring any water within the bilge or ballast of the vessel(s) will be emptied before exiting the watershed

Corals of Opportunity

1.G. Project will collect **corals of opportunity** (COO): *colonies or fragments of coral that have naturally or unnaturally been dislodged or unattached from the substrate and have a low chance of survival without human intervention.*

a. COO collection will be distributed over an area, with no more than 20% of the target species removed.
b. Only COO will be collected.

Corals of opportunity (COO) include corals that have been damaged from natural events such as storms, breakage by other marine organisms (e.g. sea turtles), anthropogenic events from boat groundings, or anchor damage. These loose corals provide less ecosystem services and functions compared to intact coral colonies. Utilizing these opportunistic colonies is preferred over impacting healthy attached colonies due slow coral growth rates in Hawai‘i and slow recovery time for larger colonies.

If collecting COO: DAR recommends collecting COO from a wide geographic range to prevent concentrated collection in a single area. This approach supports a percentage of COO naturally reattaching or breaking into smaller fragments, or contributing to the natural accumulation of rubble and sand. The collection plan should include confirmation that targeted corals are COO and not naturally free-

living corals (dislodged corals vs. corals that may naturally live unattached (e.g. *Lobactis scutaria*), unless necessary for a restoration objective.

1.H. Project will collect corals attached to **man-made substrates** (i.e., moorings, piers; not including artificial reefs).

Corals growing on man-made substrates (e.g. moorings, piers) contribute little to ecosystem services as habitat, coastal protection, sand production, and tourism attraction, and therefore have a lower ecological value compared to corals growing on natural healthy reefs. Utilizing these colonies growing on man-made substrates is preferred to minimize impacts to natural reefs. Applicants are encouraged to outline how safe detachment/dislodgement of colonies and/or fragments will be implemented to minimize further fragmentation as well as gear to be used, and steps taken to minimize abrasion of polyps and coral tissue.

Corals growing in areas such as harbors may have a higher risk of AIS, disease, pollution, parasites, or heavy metals in the coral skeleton. If a permit is granted it may include additional terms to mitigate these risks.

1.I. Project will collect corals attached to **natural substrates or artificial reefs**.

a. Collections will **not** include take from more than 20% of the population for any one species at the collection site.

In general, all Permittees and Authorized Assistants will survey coral populations in each collection area and ensure they follow the guidelines listed below:

- Corals attached to natural reef structures:
    - Additional justification is required for collection of corals attached to natural reef substrate, especially if the organisms are considered rare or sensitive.
    - If collecting attached corals, the Applicant is encouraged to outline how safe detachment/dislodgement of colonies and/or fragments will be implemented to minimize further fragmentation as well as gear to be used, and steps taken to minimize abrasion of polyps and coral tissue.
    - Applicants are encouraged to provide pre-collection survey data to demonstrate that less than 20% of the target species will be collected from the site.
- Corals attached to artificial reef structures:
    - Corals attached to artificial reefs will be evaluated similarly to corals attached to natural reefs.

2. *Ex situ* (on land) Facility and Methods

Ex situ Recommendations

An *ex situ* facility intending to hold coral for any purpose is required to meet County, State, and Federal agency standards - including State of Hawai‘i Department of Health and the U.S. Environmental Protection Agency. Agency requirements emphasize the quality and treatment of outfall water from the project facilities. The quality of the seawater used in coral holding systems in a land-based nursery will need to be maintained through the disposal of partial or complete water changes. Flow-through systems provide continuous complete or full water changes as the water enters and exits the system. Closed systems require partial water changes at regular intervals. Disposal of used seawater from land-based nurseries usually occurs in Hawai‘i in one of three permitted ways:

- Seawater outfall into ocean
- Ground sump
- Disposal into County Sewage System

Each of these mechanisms needs special permission and approval from one or more County, State or Federal agencies. Seawater treatment is required where necessary to remove concerns regarding AIS, bacteria, pollutants, nutrients, and/or chemical enhancements. Permit applicants are encouraged to describe how their outfall procedures minimize these risks. Appendix D provides a list of recommended agencies Permittees should contact for further consultation about coral restoration permitting requirements.

2.A. Project **does not** include an *ex situ* nursery phase.

2.B. Project includes *ex situ* nursery phase.

a. *Ex situ* nursery is permitted and in compliance with county, state, and federal regulations.
b. Application details **quarantine and acclimation procedures** for collected coral specimens.
c. Project **does not** include *ex situ* physiological interventions, including probiotics, phage therapy, and/or antibiotics.
d. Project **does not** use *ex situ* genetic manipulation, including genetically modified/transgenic corals, selective breeding, selective collection, assisted migration, and cryopreservation.

Applicants are encouraged to provide, in as much detail as possible, the quarantine protocol for corals entering the *ex situ* facility to minimize the risk of AIS, bacteria, pollutants, nutrients, and/or chemical exposure, especially if the corals were collected from the following areas:

- Sensitive Areas, defined areas with a high likelihood of containing AIS (see section *1B. Invasive Species Mitigation Plan*).
- A watershed different from the nursery site's outfall

To ensure a complete application, the applicant is encouraged to address the following:

- Type of life support system (closed vs. open aquaria) in which the corals will be held
    - Description of tank specifications: filtration, sterilization, influent and effluent water
- Duration of quarantine period
- Proactive quarantine treatments

Corals collected from 1) Sensitive Areas, defined areas with a high likelihood of containing AIS (see section *1B. Aquatic Invasive Species Mitigation Plan*), or 2) a watershed different from the outplant site will be quarantined from other corals for a minimum of 30 days. During the quarantine period, outfall water will be treated with ultraviolet (UV) sterilization, ozone, or another sterilizing mechanism before being disposed of and corals will be monitored for potential concerns by professionals trained in coral husbandry and AIS detection.

Any coral colony that experiences mortality during this period should be disposed of and recorded. Disposal will take care to not spread infectious or mortality-causing agents within the nursery or into the natural environment. Mortalities will be reported in the annual SAP Report. If an unidentified AIS organism is found on collection specimens, please contact DAR immediately. Collected colonies that show indication of disease and/or parasites will be separated from unaffected colonies and treated appropriately.

See the DAR Coral Restoration Implementation Guide for more recommendations about quarantine.

3. *In Situ* (in ocean) Methods

In situ **Recommendations**

The applicant's Restoration Plan will outline *in situ* methods for holding coral including any preparation of the site, environment surrounding the nursery, structures used to hold coral including anchoring, and the project's plans for coral holding, propagation, and disposal. Applicants should also include deployment and removal (coral and structure), and contingency plans for large storms.

DAR has identified the potential risks associated with *in situ* structures which fall into four broad categories:

- Entanglement of marine life
- Potential physical damage of nearby marine life
- Loss of resources due to large storms
- Alterations of the benthos at the location of the nursery site

The Permittee may required to remove any nursery structures and associated components from the area (e.g. fiberglass table structures, cement blocks, aluminum sand anchors, ropes, lines, etc.) after the project has ended, or in the event of an emergency - if determined necessary by DAR (e.g. storm event or other similar event where damage may occur if the structures are left in place), or for various other reasons (e.g. if there is a violation of the terms and conditions of the permit, where DAR determines the project should not continue).

If a Special Activity Permit is granted, any project that involves *in situ* structure(s) will be subject to additional conditions including contingency on obtaining other necessary county, state, and federal permits. It is the responsibility of the Permittee to consult with all county, state, and federal agencies to ensure compliance and to obtain all the proper permits for the proposed activity. DAR recommends engaging with agencies directly to get an official determination of whether a permit is required or not. DAR may be able to suggest additional contacts or information (see Appendix D) but is not able to make a determination on behalf of other agencies.

3.A. Project **does not** include an *in situ* nursery phase.

3.B. Application details **quarantine and acclimation procedures** for collected coral specimens.

The Applicant must outline quarantine methods for in situ & acclimation. See *section III.1. Aquatic Invasive Species Mitigation Plan*, *section III.2. Ex-Situ Facility and Methods* in this Guidance document, and the DAR Coral Restoration Implementation Guide for more information about quarantine.

The applicant is encouraged to describe how corals within the *in situ* nursery that display signs of poor health (e.g., disease, bacterial or fungal infections, sloughing, discoloration) will be quarantined to prevent contamination of surrounding corals (within the in situ nursery or surrounding reef environment). In addition, outline the disposition of any corals that are collected but not later outplanted.

Rapid relocation of corals without proper acclimation can lead to stress, bleaching, and mortality. Applicants are encouraged to provide an acclimation protocol for any corals being moved between

environments, detailing procedures for managing temperature and PAR (photosynthetically active radiation) adjustments to minimize stress.

3.C. Project includes *in situ* nursery structure that is/will be permitted and in compliance with the Office of Conservation and Coastal Lands (OCCL) and any other required local, state, and federal permits.

Any structure being placed in the marine environment will likely require additional permitting from other county, state, or federal agencies. It is the responsibility of the Permittee to obtain all necessary permits to ensure environmental compliance. It is likely an SAP will be contingent upon obtaining all necessary permits to conduct an activity. Additional measures such as a bond or insurance, limiting sample sizes, minimum required spacing of structure to marine habitat, and modification to accessories (slacklines, loops, holes, etc.) may also be required in the SAP conditions.

See Appendix D for a list of recommended agencies Permittees will contact for further consultation about coral restoration permitting requirements.

3.D. Application provides detailed information on structure placement and anchoring systems, and outlines mitigation measures to prevent environmental impacts. These measures should address potential harm to live coral, rock, or benthic organisms, while minimizing the risk of entanglement.

DAR has identified the potential risks associated with *in situ* structures which fall into four broad categories:

- Entanglement of marine life
- Potential physical damage of nearby marine life
- Loss of resources due to large storms
- Alterations of the benthos at the location of the nursery site

Therefore, DAR has set forth standards for *in situ* structures to minimize such associated risks. These include:

- Depending on size and habitat, DAR may recommend a limited sample size for a trial period to evaluate the effects of storms or water movements on the structures at the nursery site.
- All structures will be held to additional conditions, including but not limited to ensuring placement is a safe distance away from live coral and other benthic organisms, possible structure removal, and required additional anchoring.
- Projects will reduce the risk of entanglement by minimizing the amount of accessory structures or components (loops, holes, slacklines) on the nursery structures/associated with transportation that

may potentially cause entanglement during operations, and ensuring that any ropes or lines remain taut with no slack at all times.

3.E. Application details a **long-term plan** (removal or maintenance) for all nursery structure components after the project has ended.

Applicants are encouraged to provide a detailed long-term plan for managing any *in situ* structures and attached organisms (corals and other colonizers). If the structure is to remain in place for the foreseeable future, is important to outline all administrative details, including but not limited to:

- Structure “ownership”
- Required permits in perpetuity
- Habitat degradation
- Structural degradation
- Continued monitoring and compliance

3.F. Application details **Hurricane and Large Storm Plan** that includes assessing anchoring components and structural integrity in the event of a large storm advisory issued from an official weather service (i.e., the Central Pacific Hurricane Center, National Weather Service, NOAA National Hurricane Center).

In the event of a 72-hr hurricane warning issued from the Central Pacific Hurricane Center (CPHC) or other weather service authority, an immediate assessment of the projected storm path and intensity of the hurricane will be required. Nursery structures containing loose or unattached coral colonies or fragments must include a detailed plan outlining the management and possible relocation of these corals in the event of a major storm, hurricane, or the need for structure removal.

SAP conditions may stipulate that if a nursery site falls within a projected storm path, the Permittee will immediately conduct an on-site inspection and ensure that all anchoring components are in good condition and reinforce if necessary. DAR may require the removal of nurseries and structures to be in severe conditions. The removal of any nursery or structure will be the last option considered during a severe storm. Any operations to inspect, secure, or remove structures will be determined by ocean conditions and team safety.

Should any nursery site fall within the projected storm path and is expected to be subjected to damaging storm conditions, the Permittee will immediately conduct an on-site inspection and ensure that all anchoring components are in good condition. If after conducting the on-site inspection, additional anchoring is needed, modifications to the anchoring system will be completed promptly

3.G. Project **does not** include *in situ* physiological interventions, including probiotics, phage therapy, and antibiotics.

See *section III. Restoration Plan: Restoration Methods* for more information about physiological interventions.

3.H. Project **does not** use *in situ* genetic manipulations, including genetically modified/transgenic corals, selective breeding, selective collection, assisted migration, and cryopreservation.

See section *section III. Restoration Plan: Restoration Methods* for more information about genetic manipulations.

4. Coral Transport and Attachment

Transplanting and Outplanting Corals

Planting of coral specimens fall into four methodologies: transplanting, reattachment, outplanting, and larval seeding (see Glossary).

The applicant is encouraged to provide a comprehensive transport and reattachment/outplant/larval seeding plan that outlines materials, methods, timing, risks, mitigative measures, gear, and personnel.

Outplanting: All outplanting projects will be subject to further review by DAR Biologists.
To ensure a complete application, the applicant is encouraged to address the following:

- Justification for the need for additional coral resources at the restoration site.
- Potential impacts on the genetic diversity of coral populations at the restoration site.
- Protocols to mitigate risks associated with the potential introduction of AIS (Aquatic Invasive Species), pests, and diseases.
- Criteria and processes used to verify the health of coral transplants or outplants.
- Methods for minimizing inter- and intra-specific competition.
- Acclimation or cacheing protocol to reduce stress and prevent shock in coral specimens.
- Description of reference site (if applicable) and how characteristics such as coral specimens spacing and species diversity are considered.
- Protocol for attaching coral fragments and/or colonies, including the tools, gear, materials, and methods to be used.
- Assessment of outplant site and criteria used to justify its selection as a restoration site.
- Acute or chronic stressors at the outplant site.

Transport

4.A. Application details transport method for collected corals.

The transport of coral colonies or fragments must be accompanied by a comprehensive coral transport plan detailing measures to minimize stress, such as preventing polyp abrasion and air exposure, to ensure the health and integrity of the corals are preserved.

Applicants must provide details on how coral transport will be conducted to minimize any environmental damage and ensure coral health and integrity will be maintained. Transportation of colonies and/or fragments should be conducted in a way without abrading polyps or coral tissue or causing excess stress (i.e. prolonged exposure to air). Methods that enable safe collection and transport of colonies can include but are not limited to:

- Careful placement of colonies in or on a structure such as a flexible basket or rigid platform in a low density (i.e., single layer).
- Controlled ascent/descent of colonies using lift bags, surface buoys, or diver propulsion vehicles or divers.
- Open or closed system tanks on-board a vessel with proper water movement or aeration.
- Shelter or shield to protect from excessive UV light and high temperatures.
- Limit exposure to sedimentation, air, or other stressor.
- Same-day attachment to nursery structure or substrate, or placement in cache site.
- Other transportation stipulations may be outlined in SAP conditions.

4.B. Collected corals will be transported and reattached within the same 500-meter area from which they were collected without propagation in a nursery.

See *section III.1. Aquatic Invasive Species Mitigation Plan*, *section III.2. Ex-Situ Facility and Methods* in this Guidance document, and the DAR Coral Restoration Implementation Guide for more information about quarantine.

4.C. Collected corals **will not** be transported and outplanted between watersheds.

4.D. Collected corals **will not** be transported and outplanted between islands.

If corals are to be transported between islands, the applicant is encouraged to provide a detailed transport plan that includes:

- Purpose for transport
- Recipient's address and contact information (must be listed as an Authorized Assistant)
- Description of holding or experimental setup at the receiving facility

> 4.E. Collected corals **will not** be transported to/from outside of the Hawaiian Islands.

If corals are to be transported outside of Hawai‘i, please provide a detailed transport plan that includes:

- Purpose for transport
- Recipient's address and contact information (must be listed as an Authorized Assistant)
- Description of holding or experimental setup at the receiving facility
- Dates and mode of transport
- State of coral (alive, dead, skeleton, tissue, sand, etc.) being transported
- Compliance with other county, state, or federal agencies

> 4.F. Restoration site **will not** subject attached corals to excessive sand scour, sedimentation, and other stressors.

Photo Documentation

> 4.G. All (or at least a subset of 30) outplanted coral specimens from each restoration site will be **photo documented** with a scale bar as follows:
>
> a. Before Attachment - Capture a top-down photo of each colony with a scale bar included for reference.
> b. Outplant Site Preparation - Capture an image of the projected attachment area with a scale bar for reference before outplanting.
> c. After Attachment - Photograph each coral specimen in its restoration location with a scale bar for size reference.

This photo documentation ensures accurate tracking of coral health and site changes throughout the restoration process. All photos should be retained by Permittees and made available to DAR upon request.

Please see *section III.6. Evaluation and Reporting* for instructions on how to submit photos to DAR.

Materials

4.H. Project details application of marine-grade materials for adhering/attaching corals, including Material Safety Data Sheets.

It is essential to use marine-grade materials to securely attach coral outplants to the reef substrate, especially in areas with high water movement and swell. Use of adhesives can have negative effects on coral, divers, and the surrounding environment. Because of the caustic properties of adhesive materials, the SAP (if issued) will likely include additional conditions. The applicant is encouraged to provide the following information about materials to be used:

- Types of materials and tools to be used
- Material Safety Data Sheet (MSDS) for each product (if applicable) and detail perceived risk to the environment
- Methods to minimize the production of any “plumes”
- Methods to minimize the contact of material with live coral tissue
- Protocol for outplanting coral fragments and/or colonies using material(s), this includes clearing substrate, dispersal method, curing times, and method of placement of coral fragments and/or colonies to seafloor with attachment method
- If using plastic materials (Zip ties or similar), provide how and when the material will be used and removed from the marine environment
- If using an identification tag, specify how it will be attached to the substrate and the duration of attachment

The State of Hawai‘i cannot endorse products, however, DAR has received feedback that the following products have been used with success in Hawai‘i:

- Pettit Paint A-788 Splash Zone Epoxy (also known as “ Z-Spar”)
- All-Fix
- Apoxie Sculpt
- Cyanoacrylate glue
- Cured dry concrete
- Sisal rope or Zip ties
- Steel pins

4.I. Coral specimen attachment is planned for months of low bleaching risk: November – June.

5. Baseline Survey and Monitoring

Baseline Survey

5.A. Application details completed or planned **baseline survey(s)** for coral restoration sites (and control/reference sites if applicable) utilizing a combination of landscape and close-up photos to provide data on habitat metrics. If available, DAR encourages projects to utilize Structure-from-Motion (SFM) photogrammetry and 3D orthomosaics.

a. Ecological footprint area (m^2) of reef where corals will be outplanted and/or reattached
b. Depth range of restoration site.
c. Comparison of mean, minimum, and maximum monthly water temperatures at depth at the collection site and restoration site for the duration of the project.
d. Species assemblages of coral predators.
e. Benthic survey with quantifiable metrics:
    i. Substrate characterization
    ii. Coral community composition and cover
    iii. Presence absence of target outplant species and approximate sizes
    iv. Species assemblages of coral predators

Before implementing any type of coral restoration, Permittees are expected to plan and conduct a baseline survey to ascertain data confirming available suitable substrate for restoration activities and establish a baseline for coral restoration monitoring. Findings from the baseline survey will be reported to DAR at the time of annual reporting. This must include:

Habitat Metrics:

- Total Ecological Footprint: area (m^2) of reef that encompasses where corals will be outplanted
- Depth range of restoration site
- Comparison of mean, minimum, and maximum monthly water temperature at depth at the collection site and restoration site for the duration of the project

  💡 **Recommended Tip**: Water temperature monitoring devices are highly precise but may require additional permits for deployment. Alternatively, most dive watches provide reasonably accurate temperature readings and can serve as a convenient option.
- Benthic survey with quantifiable metrics
    - Substrate characterization (see Appendix A, Table 2)
    - Coral community composition
    - Presence/absence of target outplant species at intended outplant sizes

- Species assemblages of coral predators (crown-of-thorns sea star, cushion stars, large puffers, etc.), competitors (macroalgae), and facilitators (crustose coralline algae and herbivores)

💡 **Recommended Tip**: It is important to recognize that substrates with high crustose coralline algae (CCA) coverage play a crucial ecological role in habitat stabilization. Therefore, careful consideration should be given when selecting sites for coral attachment. The ideal substrate is mostly bare, with minimal CCA, macroalgae, and invertebrate cover.

DAR employs Fish Assessment Habitat Utilization (FAHU) marine monitoring techniques to assess Hawaiian coastal marine resources, including evaluating benthic assemblages, resource invertebrates, coral bleaching, and disease. Various survey methods are utilized running from fixed transects to timed swims. Appendix A offers a Modified DAR FAHU for Coral Restoration Monitoring SOP, with emphasis on belt survey techniques for monitoring benthic cover. This resource is intended to assist projects in refining their survey methodologies.

The use of photogrammetry and 3D mosaics in surveys and monitoring is highly encouraged. This technology is becoming increasingly accessible and may eventually be required for all coral restoration projects.

If reintroducing an extirpated species (one documented to be locally extinct), there should be evidence of the target species previously existing at that site, such as records from the Marine Biogeographic Assessment of the Main Hawaiian Islands or records from publications about specific sites.

5.B. Application identifies the presence and details the extent of acute (i.e., ship grounding, contaminant spill) stressors that have driven coral degradation at the restoration site.

5.C. Application identifies the presence and details the extent of chronic (i.e., stream runoff, sedimentation) stressors that have driven coral degradation at the restoration site.

Monitoring

5.D. Application details a **Monitoring Plan** that includes:

a. For restoration site and control/reference sites (if applicable):
   i. Depth range of site
   ii. Comparison of mean, minimum, and maximum monthly water temperatures at depth

iii. Substrate characterization
iv. Species assemblages of coral predators, competitors, and facilitators
v. Percent survivorship of coral colonies and percent live coral tissue

b. For all or a subset of 30 outplanted coral specimens:
i. Unique identifier for outplants
ii. Measurements of maximum specimen length, width, and height
iii. Percent live coral tissue per colony
iv. Coral specimen health score
v. All (or at least a subset of 30) restored coral specimens from each restoration site will be **photo documented** with a scale bar (photos will be available to DAR by request at the conclusion of the project.)
1. Top-down photo with a scale bar of coral specimens

Projects will plan to monitor a suite of restoration metrics, including but not limited to the metrics listed above in question 5.D. This information will be planned as part of the Restoration Plan and reported on as part of each annual permit renewal (DAR's most recent "SAP Request and Reporting Spreadsheet" can be found on the DAR SAP website). Best practices for how to collect this data can be found in the Coral Restoration Consortium's Coral Reef Restoration Monitoring Guide. While reporting to DAR is only required for a subset of 30 outplanted coral specimens, it is expected that projects are actively monitoring more than just those 30 - ideally, the entire set of outplants.

💡 **Recommended Tips**:

- See Appendix A, Table 2 for substrate characterizations.
- Species assemblages:
  - Coral Predators (including but not limited to): crown-of-thorns sea star, cushion stars, large puffers
  - Competitors (including but not limited to): macroalgae
  - Facilitators (including but not limited to): crustose coralline algae, herbivores
- It is recommended to document percent live coral tissue using the following size bins:
  - 0% live tissue (100% mortality)
  - 1 - 25% live tissue (99 - 75% mortality)
  - 26 - 50% live tissue (74 - 50% mortality)
  - 51 - 75% live tissue (25 - 49% mortality)
  - 76 - 99% live tissue (1 - 16% mortality)
  - 100% live tissue (0% mortality)
- Percent live coral tissue per colony - software such as CoralNet or ImageJ can be used to analyze photographs

Health Score

A health score must be assigned to each monitored coral (all or at least a subset of 30 per restoration site). Organizations with an established health assessment system are encouraged to provide a detailed outline of their scoring criteria and methodology. Those without a predefined system are encouraged to use the scoring system below to assess and report coral health to the best of their ability.

Score	Observation
0	Colony is dead, biofilm or algae may be present
1	> 75% of coral specimen is compromised
2	~50% of coral specimen is compromised
3	< 25% of coral specimen is compromised
4	Coral specimen shows no signs of compromised health
Compromised coral health is indicated by signs of distress including but not limited to: bleaching, disease, discoloration, sloughing, fungus, bacteria, or other adverse conditions.	

Please see *section III.4. Coral Transport and Attachment* for photo documentation instructions.

Photo documentation

For each restoration site, all or a subset of 30 coral colonies must be photo documented, preferably, a top-down photo of each colony with a scale bar. Photos should be captured in alignment with the monitoring timeline (see 5.E. below) and submitted to DAR in the Annual Report. To ensure consistency, the **same** coral colonies must be photographed at each monitoring interval.

💡 **Recommended Tip**: DAR highly recommends that coral outplanting events be clustered to reduce monitoring logistics. It is recognized that outplanting events are complex and may occur in “batches” - in these events, although it is preferred photo documented coral colonies be randomized and representative of restoration activity, it is appropriate to select the first 30, or the most convenient group of 30 to photo document.

Please see *section III.6. Evaluation and Reporting* for instructions on how to submit photos to DAR.

5.E. Monitoring will take place at the time of outplanting activities, and after outplanting within 1-week (pilot projects only), 1-month, 3-months, 1-year, 2-years, and 3-years after outplanting.

Projects will plan to monitor these metrics over time. While DAR recommends monitoring corals as often as is logistically feasible, as this increases the chance of finding stressors to colonies before mortality, DAR will require projects plan to monitor corals at these time points:

- Time of outplant
- 1-week after outplant (pilot projects, especially those testing novel methods, will include a plan to check on coral restoration sites)
- 1-month after outplant
- 3-months after outplant
- 1-year after outplant
- 3-years after outplant

DAR highly recommends that coral outplanting events be clustered to reduce monitoring logistics. Additionally, any project attempting to outplant corals using a new attachment methodology that they have not conducted previously will be required to monitor a statistically rigorous subset of coral colonies within one week of outplanting. This ensures that the Permittee will be able to understand if the new attachment method was successful or should be amended for further outplantings. In these cases, the Permittee will be prepared to report to DAR the number of corals outplanted with the attachment method and the number subsequently remaining attached one week later. Any changes to the permitted attachment method will be submitted to DAR for a permit amendment.

Note: Most projects will be required to conduct monitoring for a minimum of 3-years, as outlined in the conditions of their issued Special Activity Permit. However, in accordance with HRS 187-A, the Division may extend this requirement for up to 5 years if deemed appropriate. Monitoring is a mandatory condition of the SAP, and even after an SAP has expired, continued monitoring is expected and results are to be submitted to DAR to support ongoing assessment and management efforts.

6. Evaluation and Reporting

Expected Survivorship

Coral restoration aims to enhance coral reef resources; however, some methodologies result in a loss of coral resources. For example, this may occur when using degraded resources, such as COO, or

methodologies involving *ex situ* experimentation or stress hardening. Projects are expected to estimate the expected survivorship of corals at various stages of the restoration process before restoration is permitted. In each Annual Report, the Permittee must submit the realized survivorship data derived from their analysis at the specified time points listed below. The report should also include explanations for any significant differences between the estimated and realized survivorship.

For projects planning to transplant or reattach adult or juvenile corals:

- 1-month post-outplant
- 3-months post-outplant
- 1-year post-outplant

For projects using coral nurseries:

- Post-quarantine
- Post-propagation or experimentation

6.A. Application includes a detailed methodology for measuring the project's success.

6.B. Application includes **performance measures** relevant to the goals and objectives of the project, including:

a. Estimated restored coral % survivorship and % live coral cover/produced during (*in situ/ex situ)* nursery phase.
b. Estimated restored coral % survivorship and % live coral cover at 1-month post-outplanting.
c. Estimated restored coral % survivorship and % live coral cover at 3-months post-outplanting.
d. Estimated restored coral % survivorship and % live coral cover at 1-year post-outplanting.

6.C. The monitoring plan includes sufficient data to evaluate the project's success relative to the outlined project proposal and objectives.

Application should detail what data is being gathered and how it will support the goals and objectives of their project. (outlined in *I. Project Proposal, 1. Statement of Purpose*).

6.D. Application includes a plan to submit an **Annual Report** to DAR detailing all activities including the following:

a. Project narrative
b. Reporting spreadsheet
c. Methodology photo documentation
    i. Gear, nursery area, materials, fieldwork, laboratory space, protocols, etc.
d. Coral photo documentation
    i. Collection
    ii. Transplant/reattachment/outplant phases
    iii. Monitoring
e. Baseline survey findings
f. Monitoring data (including % live coral tissue and survivorship for individual colonies)
g. Evaluation of performance measures (estimated and realized survivorship analysis)

Annual Report

Conditions for a general the Annual Report will be specified in the issued SAP. SAPs approved for coral restoration activities must include the general Annual Report requirements, along with additional coral-restoration specific requirements, please see Appendix E for a checklist.

IV. Permit Renewal

1. Permit Renewal

The Permittee must provide an Annual Report to DAR containing the information listed in section **III.6. Evaluation & Reporting** no later than 30 days prior to the permit's expiration, if a renewal is requested. Projects aiming to renew their SAP and continue coral collection, propagation, and outplanting activities must submit an updated list of organisms requested for collection , along with any additional proposed locations or activities. A renewal request will only be considered complete once all Annual Report materials and detailed updates are submitted. Under §187A-6, Special Activity Permits (SAPs) are issued for a maximum of one year; if activities involving aquatic resources are intended to continue beyond the current SAP's expiration date, the Permittee must apply for a renewal, as extensions cannot be granted.

1.A. Project will submit the required Annual Report to qualify for a permit renewal.

Refer to Appendix E for a checklist of all required Annual Report information for coral restoration projects.

V. Glossary

Acclimation[1] - phenotypic adaptation in response to variation in the natural environment; it can alter performance and possibly enhance fitness, but it does not involve genetic change.

Brooder[1] **-** a mode of scleractinian coral sexual reproduction involving internal fertilization and development; typically, fewer but larger larvae that may already have their algal symbionts are released and settle more quickly after release.

Cache site - a naturally occurring pocket, valley, drop-off, or depression at a lower elevation than the surrounding reef area resulting in an area of reduced turbulence, water movement, and currents, such that unattached corals in the cache site have a low potential for movement to the surrounding reef.

Corals of Opportunity (COO) - Colonies or fragments of coral that have naturally or unnaturally been dislodged or unattached from the substrate and have a low chance or survival without human intervention.

Cryopreservation[1] - a process that preserves organelles, cells, tissues, or any other biological constructs by cooling the samples to very low temperatures.

Direct Reattachment - reattaching loose or dislodged coral colonies or fragments directly onto the substrate with no intermediate steps (e.g., in or ex situ nursery)

Emergency Coral Restoration - urgent and rapid response efforts aimed at stabilizing, rehabilitating, or restoring coral reef ecosystems following acute disturbances. These disturbances can include natural events (e.g., hurricanes) or human-induced impacts (e.g., ship groundings).

Fragmentation[1] **-** a type of sexual reproduction by cutting a portion of the living tissue off of a parent or donor colony to attach and grow into a new colony.

Gametes[1] - eggs or sperm

Gene Flow[1] - the movement of individuals, and/or the genetic material they carry, from one population to another occurs via processes such as migration and dispersal.

Larval Seeding[1] - a coral restoration intervention that aims to speed the return of coral cover to a disturbed or damaged reef by increasing the number of available coral larvae for natural settlement, particularly where the reef has a low larval supply.

Live Rock[1] - coral rubble or substrate with living encrusting and fouling organisms.

Microbiome[1] - the community of microorganisms - such as bacteria, archaea, fungi, as well as viruses - that inhibit an ecosystem or organism.

Microfragmentation[1] **-** a type of fragmentation using smaller portions of living tissue to produce larger number of fast-growing coral colonies, used for massive coral species as well as branching coral species.

Outplant - the transfer from the source location to a secondary location (e.g. coral nursery) and then transfer again to the restoration location. The secondary location may be *in-* or *ex situ*, and may or may not include some form of propagation or experimentation that alters the number of coral resources eventually outplanted.

---

[1] Vaughan, D.E. (ed.). (2021). *Active Coral Restoration: Techniques for a Changing Planet*. J. Ross Publishing.

Photomosaics[1] **-** utilization of multiple images to combine into one large patchwork of photos, such as to monitor a whole reef.

Reattachment - movement of corals in situ between source and restoration location less than 500-meters.

Reference Site - a natural or undisturbed coral reef area that serves as a benchmark or standard for evaluating the success of restoration efforts.

Resource Invertebrate - marine invertebrate species that are actively managed or utilized for their ecological, cultural, or economic value (see Appendix A. Table 1.)

Selective Breeding[1] - crossing individuals to generate genotypes exhibiting certain desirable phenotypes and/or to increase genetic variation within offspring populations to be used for restoration.

Sensitive Area - specific geographic areas designated by statute or administrative rule for the purpose of managing a variety of marine, estuarine, or anchaline resources and their use.

Transplantation - movement of corals *in situ* between the source and restoration location over 500-meters in a short period of time.

Department of Land & Natural Resources
Division of Aquatic Resources
1151 Punchbowl Street, Room 330
Honolulu, Hawai‘i 96813

VI. Appendices

Appendix A: Modified DAR FAHU for Coral Restoration Monitoring

Modified DAR FAHU for Coral Restoration Monitoring

Adapted from the DAR Standard Operating Procedure for Long-term monitoring of reefs and fish in Kaua‘i, Maui, and O‘ahu using belt transects.
Revised August 2024[2]

The Division of Aquatic Resources (DAR) employs Fish Assessment Habitat Utilization (FAHU) marine monitoring techniques to assess Hawaiian coastal marine resources. This includes evaluating benthic assemblages, mobile invertebrates, coral bleaching, and disease. Various survey methods are utilized running from fixed transects to timed swims. This standard operating procedure (SOP) specifically focuses on belt survey techniques for monitoring benthic cover. This SOP draws heavily on the Fish Habitat Utilization Surveys (FHUS) methodology developed by Alan Friedlander at the University of Hawai‘i (UH) Fisheries Ecology Research Laboratory (see details below).

1. Equipment and Personnel

The following equipment and personnel are required for the collection of coral distribution data and benthic cover. A minimum of two divers/snorkelers are required for the collection of visual census data using FAHU methods - a benthic photographer and an invertebrate surveyor.

- Surveyor 1 should be trained to identify coral species and categorize benthic habitat.
- Surveyor 2 should be trained to use an underwater camera and identify resource invertebrates.

1. SCUBA diving or snorkel equipment (minimum of two complete sets, including compasses for bearing)
2. Underwater slate, pencils, data sheets, and rubber bands
3. 25-meter aluminum cave reel transect reels are used with dacron lines marked as follows:
    a. White indicators at the start and end
    b. Black marks at each meter interval
    c. Red mark 3 m before the end of the survey (i.e., 22 m)
4. Geographical Positioning System (GPS) units and spare batteries
5. Photography equipment, including cameras, housing, O-rings, grease, batteries, SD cards, and monopod

[2] The original FAHU SOP was written by Laura Gajdzik, Heather Ylitalo-Ward, Russell Sparks, Paul Murakawa, McKenna Allen, Tatiana Martinez, Mia Melamed, and Kristy Stone. This modified FAU SOP was written and edited by Chelsea Wolke and Honor Weber.

2. Procedure

2A. Site and transect selection

Transects at each site are randomly selected by generating X points on hard bottom areas using GIS tools. The number of points selected will depend on the survey area's size to ensure statistical significance. Base maps produced by NOAA are utilized to select GPS points, which are stratified by depth and habitat. Transect surveys typically begin with a random set of coordinates from a reference point within each habitat type at the site.

In the field, divers assess the suitability of each GPS point. If predetermined GPS points are found to be hazardous (e.g., strong wave action, low visibility, strong current), or if it does not fall over continuous hard bottom or within the desired depth range, transects are then randomly repositioned within a 100 m radius of the original GPS point. New coordinates are recorded using a GPS unit.

Once repositioned, the two surveyors orient themselves using either a predetermined bearing (i.e., 0°, 90°, 180°, and 270°) generated by a random number generator or by selecting a bearing directly on site. If the selected bearing does not cover a contiguous bottom substrate, divers should rotate clockwise in 90-degree increments until an appropriate bearing is found, provided the depth remains consistent and a hard substrate is present. If suitable habitat is still not found, divers will swim in 20-kick increments to locate an appropriate hard substrate.

2B. Benthic survey

Once the transect line is secured to the bottom and laid out in the appropriate direction, Surveyor 2 should white balance the digital camera and capture four panoramic shots of the seascape. These shots provide an overview of the site, with each photo capturing approximately 60% benthic habitat and 40% water column in each of the cardinal directions (**Figure 1**).

Next, starting at the white indicator on the transect line, Surveyor 2 takes a benthic photo every meter along one side of the 25 m transect line (e.g., the inshore side for O‘ahu) (see **Figure 2 “1”**). When taking benthic photos, ensure the monopod remains perpendicular to the bottom and only 1 inch of the monopod foot is in the photo directly center bottom (**Figure 3**).

Once Surveyor 2 is at least 5 m away, Surveyor 1 can start recording all coral species and colony sizes within 2.0 m on the opposite side of the transect previously photographed (see **Figure 2 “1”**), until the white indicator “end” mark on the transect line is reached. It is recommended to record colony sizes using the following size bins:

- > 0 - 10 cm
- > 10 cm - 20 cm
- > 20 cm - 40 cm
- > 40 cm - 60 cm
- > 60 cm - 80 cm
- > 80 cm

Surveyor 1 should also include estimates of the total percentage of live coral cover and the percentage of bleached coral as well as the three dominant coral species showing signs of

bleaching. The severity of bleaching should be assessed using the following 0 - 4 scale:

- “0” - No bleaching observed
- “1” - Sparse onset of bleaching (pale color)
- “2” - Most coral colonies lost pigments
- “3” - Most colonies are bleached
- “4” - Most colonies have recently died, and biofilm is present

Once Surveyor 2 completes the benthic photos, they follow the line back to the start of the transect while counting each resource invertebrate (see **Table 1** and **Figure 2 “2”**) within a 1 m wide swath on the opposite side that the benthic photos were taken, or within 0.5 m on both sides of the transect line. Upon returning to the start of the transect line, Surveyor 1 swims the length of the transect to the end and rolls up the tape behind Surveyor 2.

Once Surveyor 1 completes the coral survey and reaches the start of the 25 m transect, they record all benthic habitats (see **Table 2**) as well as a rugosity score R1 - R5 (see **Table 3** and **Figure 2 “2”**) every 5 m along the 25 m transect. Once both Surveyors complete gathering data, Surveyor 2 is to take a photo of the data sheets and both Surveyors either proceed to the next transect or surface for boat pickup.

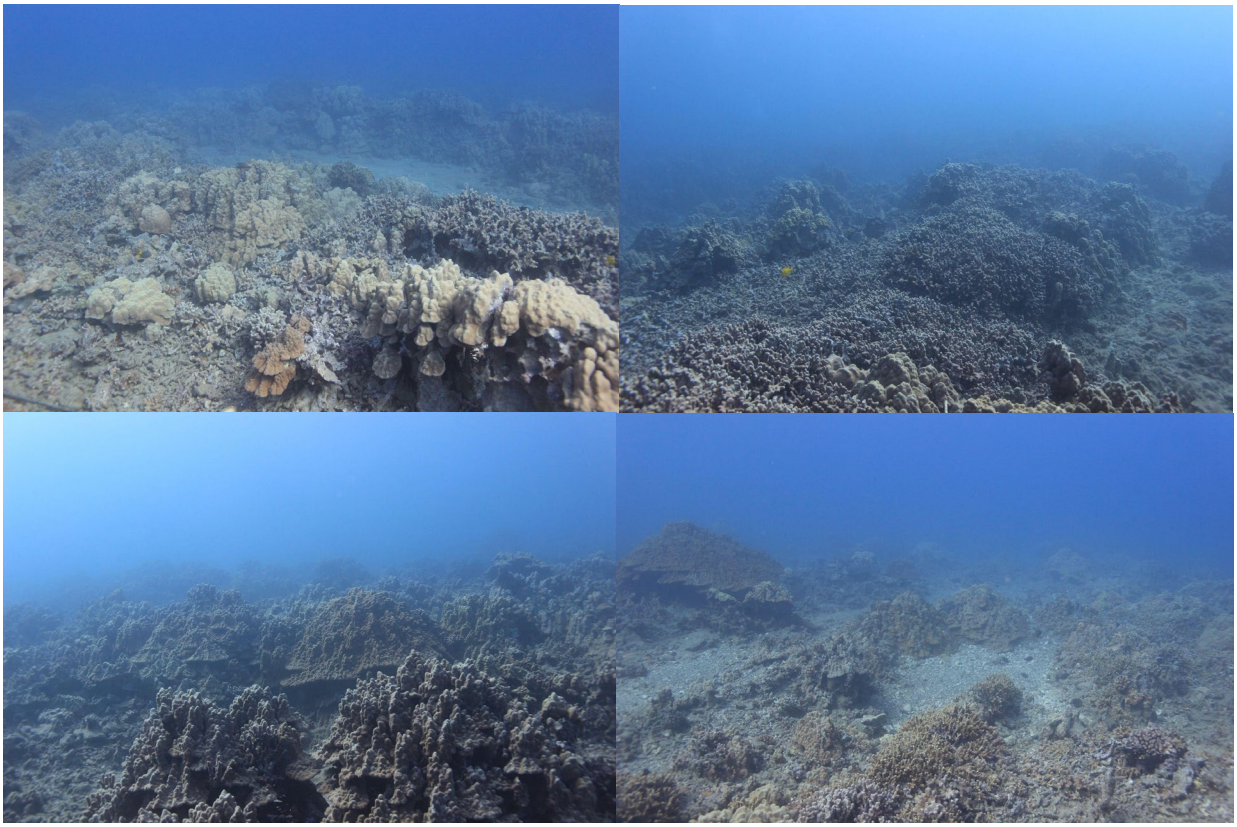


Figure 1. Example of panoramic shots of the seascape.

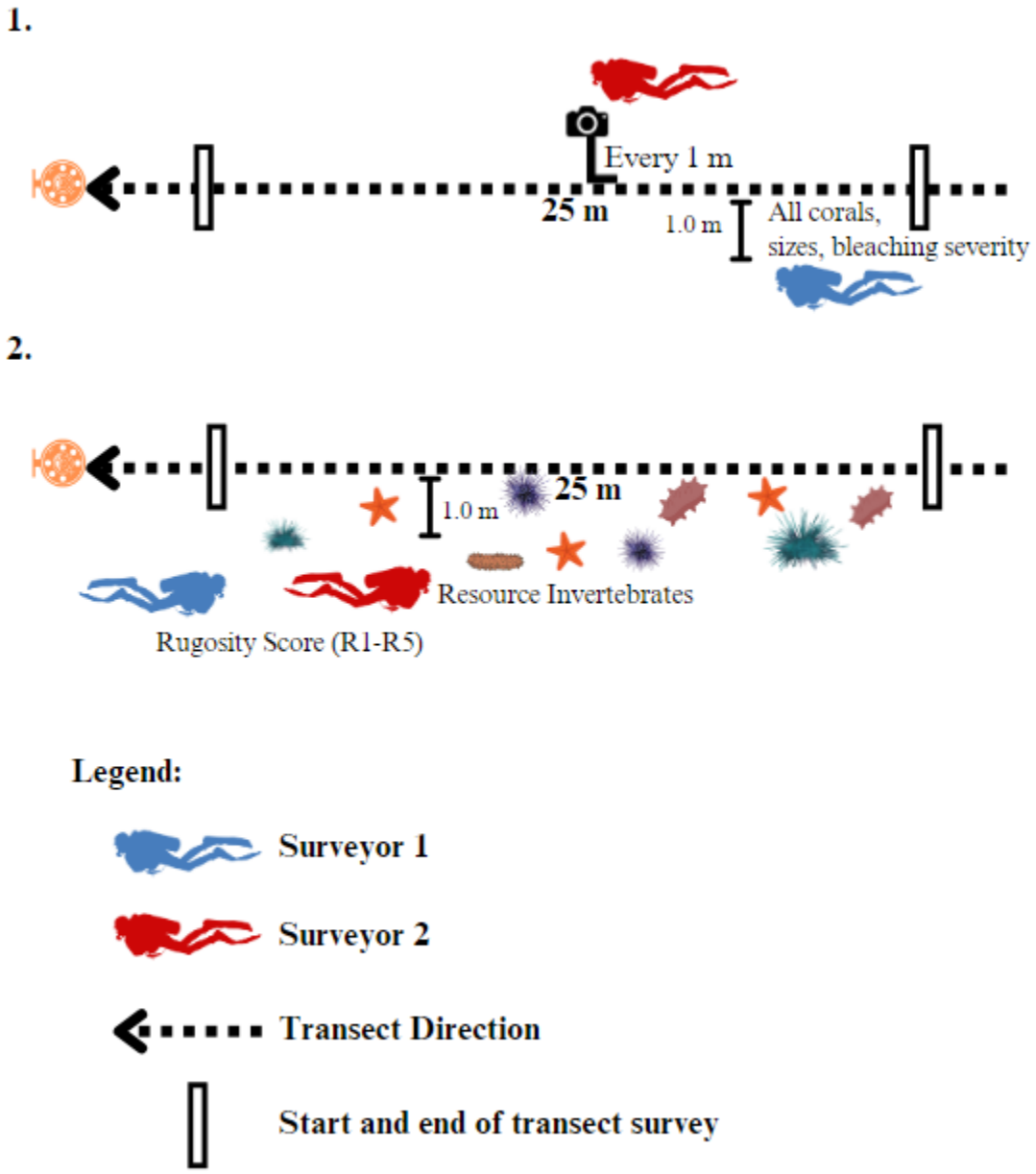


Figure 2. FAHU surveys consist of four main steps.
Step 1: Secure the 25 m transect line on a hard substrate where the survey will be conducted after collecting the metadata.
Step 2: Surveyor 2 white balances the camera, takes panoramic photos and then begins capturing benthic photos along the transect line at every meter marker using a monopod
Step 3: Once Surveyor 2 is at least 5 m away, Surveyor 1 starts the survey (25 m x 2 m) recording all coral species, size bins, and bleaching severity.

Step 4: Upon reaching the end of the transect, Surveyor 2 follows the line back to the start counting each resource invertebrate within a 1 m wide swath on the opposite side that the benthic photos were taken, or within 0.5 m on both sides of the transect line.
Step 5: Once Surveyor 1 completes gathering coral data, they swim the length of the transect back to the start recording benthic habitat types and rugosity score R1 - R5 (see **Table 5**) every 5 m every 5 m along the 25 m transect.
Step 6: Once Surveyor 2 returns to the start of the 25 m transect, they swim the length of the transect back to the end and roll up the line behind Surveyor 1. Once all data is gathered, data sheets are photographed, the transect line is rolled up, and the Surveyors retrieve the reel and float (see **Figure 2 "#2"**).

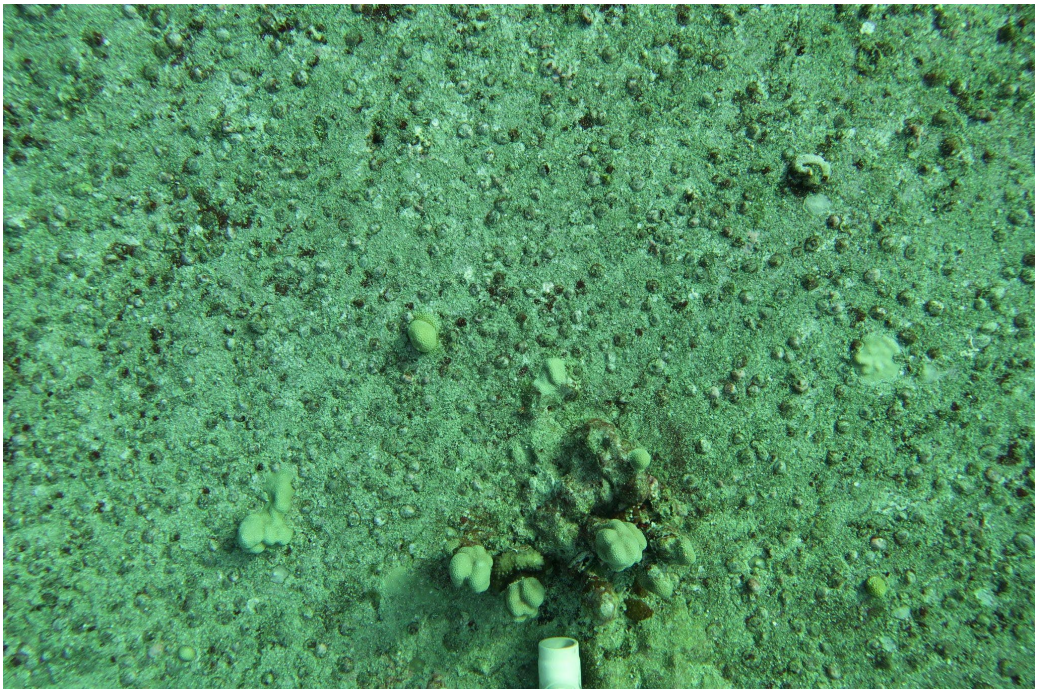


Figure 3. Example of a benthic photo.

Table 1. **Resource invertebrates**. These species are important for the subsistence of local communities or have a cultural value.

Invertebrates	Scientific name	Family
Sea cucumbers	*Actinopyga mauritiana*	Holothuriidae
	Actinopyga obesa	Holothuriidae
	Holothuria whitmaei	Holothuriidae
	Holothuria atra	Holothuriidae
Sea snails	*Antisabia imbricata*	Hipponicidae
	Pilosabia trigona	Hipponicidae
	Cellana exarata	Nacellidae
Sea stars	*Cellana sandwicensis*	Nacellidae
	Acanthaster planci	Acanthasteridae
Sea urchins	*Tripneustes gratilla*	Toxopneustidae
	Echinothrix diadema	Diadematidae
	Echinothrix mathaei	Echinometridae
	Heterocentrotus mamillatus	Echinometridae
	Echinometra oblonga	Echinometridae
	Echinothrix calamaris	Diadematidae
	Chondrocidaris gigantea	Cidaridae
	Diadema paucispinum	Diadematidae
	Echinostrephus aciculatus	Echinometridae

2C. Transect replicates and habitat types

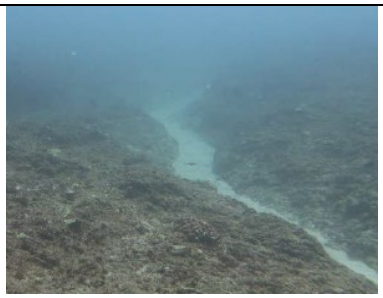
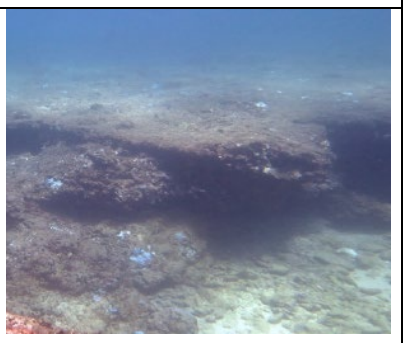
There are 8 main habitat types, which encompass continuous reef substrate to mainly sparse rubble **(Table 3)**. Along the 25 m transect, record all benthic habitat types (see Table 2) as well as rugosity score R1 - R5 (see Table 3) every 5 meters..

2D. Environmental data

In addition to the coral species and size distribution, metadata and environmental parameters are recorded.
These include:
Site – The reef name if any and GPS coordinates as well as tidal, cloud and wind info.
Transect – The transect number.
Date – The date of census in the format MM/DD/YY.
Observer – Initials of the observer carrying out the surveys.
GPS start point and end point – Latitude and longitude expressed in decimal degrees.
Bearing – The cardinal direction of the transect.

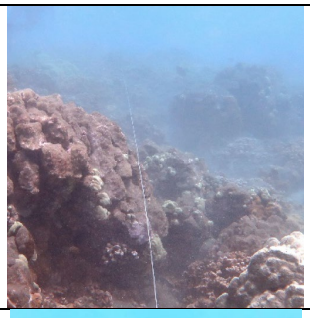
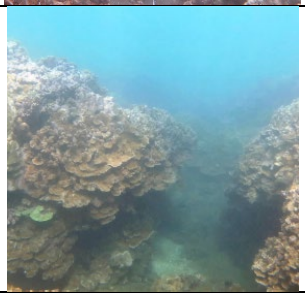
Time – At the start and end of each transect, time is recorded.
Depth – Recorded to the nearest meter at the start of each transect.
Visibility – Recorded in feet or meter distance before the start of any survey. Visibility is gauged by estimating the distance to the point where objects become indistinct.
Rugosity – Rugosity is a proxy of habitat complexity and is subjectively estimated on each transect using a grading from R1 to R5 from low to high relief **(Table 4)**.

Table 2. Benthic habitat category with description and photos.

Habitat	Description	Photo
Pavement (PAV)	Limestone or basalt substrate with low relief, complexity (<1m/3ft), and coral cover	
Pavement with sand channels (PSC)	Limestone or basalt substrate with large sand channels	
Pavement with ledges (PAL)	Limestone or basalt substrate with caves, lobster holes, undercuts, which have >1m/ 3ft vertical relief	

Habitat	Description	Photo
Rock/Boulders (ROB)	Large rocks and boulders, NOT rubble	
Rock rubble (RRB)	Small to Mid sized rocks and rubble, may consist of dead coral pieces or coral rubble (<25cm diameter). High rubble:sand.	
Mixed medium depth (MMX)	Mixed substrate with rubble, sand, and degraded areas and with patches of higher coral cover at typically a depth of 3-8 m/	

Table 3. Rugosity parameters categorize surface roughness.

Rugosity category	Surface roughness in meters (m)	Photograph
R1	0 – 0.5 m	
R2	0.5 – 1.0 m	
R3	1.0 – 1.5 m	
R4	1.5 – 2 m	
R5	2 – 2.5 m	

Department of Land & Natural Resources
Division of Aquatic Resources
1151 Punchbowl Street, Room 330
Honolulu, Hawai‘i 96813

Appendix B. List of Rare Corals in Hawai‘i. (Updated 1/13/2025)

Acroporidae
- *Acropora sp.*
- *Anacropora forbesi*
- *Montipora dilatata**
- *Montipora studeri**
- *Montipora verrilli*

Agariciidae
- *Gardineroseris planulata*
- *Leptoseris foliosa*
- *Leptoseris hawaiiensis*
- *Leptoseris incrustans*
- *Leptoseris mycetoseroides*
- *Leptoseris papyracea*
- *Leptoseris scabra*
- *Leptoseris tubulifera**
- *Leptoseris yabei*
- *Pavona maldivensis*

Coscinaraeidae
- *Coscinaraea wellsi*

Dendrophylliidae
- *Cladopsammia eguchii*
- *Rhizopsammia verrilli*
- *Tubastraea coccinea* (pink morph)
- *Tubastrea sp.* (black morph)

Fungiidae
- *Cycloseris fragilis*
- *Cycloseris sp.* (red morph)*
- *Cycloseris fragilis*
- *Cycloseris vaughani*
- *Pleuractis granulosa*

Leptasteridae
- *Leptastrea bewickensis*
- *Leptastrea pruinosa*

Merulinidae
- *Cyphastrea agassizi*

Pocilloporidae
- *Pocillopora ligulata*
- *Pocillopora molokensis**
- *Pocillopora verrucosa*

Poritidae
- *Porites duerdeni**
- *Porites hawaiiensis**
- *Porites lichen*
- *Porites monticulosa*
- *Porites pukoensis*
- *Porites solida*
- *Porites studeri*

Psammocoridae
- *Psammocora explanulata*
- *Psammocora nierstraszi*
- *Psammocora profundacella*
- *Psammocora stellata*
- *Psammocora verrilli**

Subclass Octocorallia & Other
- *Simularia densa*
- *Simularia molokensis**
- *Clavularia sp.*

*endemic species

The families and species identified in this list are current as of January 2025.
Rare or endemic classifications may differ between sources and may be subject to change as ongoing taxonomic and population studies are conducted. This list is intended for reference purposes only and should not be cited as a scientifically rigorous source.

Department of Land & Natural Resources
Division of Aquatic Resources
1151 Punchbowl Street, Room 330
Honolulu, Hawai‘i 96813

Appendix C. Hawaiian Coral Spawning Events.

Hawaiian Coral Spawning Events

- sexual morphotype (**G**, gonochoric[10]; **H**, hermaphroditic[11]),
- mode of reproduction (**B**, brooder; **S**, spawner)
- reproductive season (**Sp**=spring, **Sr**=summer, **F**=fall, **W**=winter, **Yr**=year round),
- lunar phase and location of fertilization (**P**=polyps, **W**=Water column, **S**=Surface). *=Inferred.

Information was compiled from studies conducted at the Hawai‘i Institute of Marine Biology and from literature reviews: Fadlallah 1983, Richmond and Hunter 1990, Richmond 1997. Table reproduced from Kolinski and Cox 2003.

Species[12]	**Sex**	**Mode**	**Season**	**Moon Phase**	**Spawning Times**	**Fertilization**
ACROPORIDAE[13]						
Acropora cytherea	H	*S	*Lt Sp-Sr		*Jun-Aug	
A. humilis	H	*S	Lt Sp	*1stQ	*Jun	*S
A. valida	H	*S	Sr	*New-4thQ?	*Jul-Aug	*S
Montipora capitata	H	S	Lt Sp-Sr	New-1stQ	Jul-Aug, May-Sep, 20:45-22:30	S
M dilatata	H	S	Sr	New, Full-3rdQ	July-Aug, 20:30-21:45	S
M. flabellata	H	S	Sr-*F		July-*Sept, 21:05-21:50	S
M. patula	H	S	Sr	New-1stQ, Full-3rdQ	July-Sep, 22:05-23:10	S
M. studeri	H	S	Sr	New-1stQ, Full-3rdQ	July-Sept, 22:23-23:00	S
M. verrilli	H	S	Sr	Full-3rdQ	July	*S
AGARICIIDAE						
Pavona duerdeni	G	S				*W
P. varians	G	S	Lt Sp	Full-3rdQ	Jun 19:05-20:15	*W, S
DENDROPHYLLIDAE						
Tubastrea coccinea		B	Lt Sp-W	All Jun-Jan;	diurnal and nocturnal	P
Species[12]	**Sex**	**Mode**	**Season**	**Moon Phase**	**Spawning Times**	**Fertilization**

FAVIIDAE	H	B		Yr	All	P
Leptastrea bottae	G	S				*W
L. purpurea	G	S				*W
FUNGIIDAE						
Fungia scutaria	G	S	Sr-F	Full-3rdQ	Jun-Nov, 17:00-19:00	W
POCILLOPORIDAE						
Pocillopora damicornis	H	B	Yr	All	Diurnal and nocturnal	P
P. meandrina	H	S	Sp	Full-3rdQ	Apr-May, 07:20-08:15	W
PORTIDAE						
Porites brighami	G, H	B	S r			P
P. compressa	G	S	Sr	Full-3rdQ	Jun-Sep, 23:00-01:30	W
P. evermanni	G	S	Sr	Full-4thQ	Aug-Sep	*W
P. lichen	H	B				P
P. lobata	G	S	Lt Sp-Sr	Full-3rdQ	Jun-Aug, 01:20-03:14	W
SIDERASTREIDAE						
P. stellata		B?	Sr	Full	July, *19:50-21:00	*P

10 Gonochoric organisms are equipped with either male or female reproductive organs.
11 A hermaphrodite is an organism which is equipped with both male and female reproductive organs.
12 Taxonomy according to Maragos 1995.
13 In Hawai‘i, fertilization in Acroporidae occurs predominantly at the surface. This has important implications for planning of activities that could potentially result in surface pollution or spills.

Appendix D. County, State, and Federal Permitting Agencies.

Agency and Permit	Contact
City and County Agencies	
Department of Planning and Permitting	
Land Use Permits Division	Website: https://www.honolulu.gov/dpp/permitting.html Phone: (808) 768-8011
State Agencies	
Hawai‘i State Department of Land and Natural Resources (DLNR)	
Division of Aquatic Resources (DAR) ● Special Activity Permit	Website: https://dlnr.hawaii.gov/dar/licenses-and-permits/special-activity-permit/ Phone: (808) 587-2270 Email: dar.sap@hawaii.gov Program Staff: Cathy Gewecke, Aquatic Biologist (catherine.a.gewecke@hawaii.gov)
State Historic Preservation Division (SHPD) (National Historic Preservation Act) ● HRS 6E Review ● Section 106	Website: https://dlnr.hawaii.gov/shpd/ Phone:(808) 692-8015 Email: dlnr@hawaii.gov
Land Division (LD) ● Shoreline Certification	Website: https://ags.hawaii.gov/survey// Phone: (808) 587-0419 Email: landsurvey@hawaii.gov
Office of Conservation and Coastal Lands (OCCL) ● Site Plan Approval (SPA) ● Conservation District Use Application (CDUA)	Website: https://dlnr.hawaii.gov/occl/ Phone: (808) 587-0377
Division of Forestry and Wildlife (DOFAW) ● NARS Special-Use Permit, Section 195	Website: https://dlnr.hawaii.gov/dofaw/sap_landing_page/ Program Staff: Cara Oba (cara.m.oba@hawaii.gov) and Jaianne Rimando (jaianne.z.rimando@hawaii.gov)

Hawai‘i Office of Planning and Sustainable Development	
State Coastal Zone Management Program ● HRS Ch. 205A Special Management Area (SMA) Permit ● Sect 307 Coastal Zone Management Act Federal Consistency Review	Website: https://planning.hawaii.gov/ Phone: (808) 587-2846 Email: dbedt.op.czm@hawaii.gov
Environmental Review Program ● Hawai‘i Environmental Protection Act (HEPA) ○ Environmental Assessment / Environmental Impact Statement / Exemption	Website: https://planning.hawaii.gov/erp/ Phone: (808) 586-4185 Email: https://planning.hawaii.gov/erp/
Hawai‘i State Department of Health (DOH)	
Clean Water Branch (CWB) (EPA Section 404(e) and 401 of the Clean Water Act) ● National Pollutant Discharge Elimination System (NPDES) Permit ● Section 401 Water Quality Certification (WQC)	Website: https://health.hawaii.gov/cwb Phone: (808) 586-4400
Federal Agencies	
U.S. Fish and Wildlife	
U.S. Fish and Wildlife (USFWS) Coordination Act ● Coordination Report	Website: https://www.fws.gov/law/fish-and-wildlife-coordination-act
NOAA	
Essential Fish Habitat (EFH) Provisions of the Magnuson-Stevens Fishery Conservation Management Act (MSA) ● Consultation in the Pacific Islands	Website: https://www.fisheries.noaa.gov/national/habitat-conservation/essential-fish-habitat#consultations Email: efhesaconsult@noaa.gov Specific questions can be directed to EFH Consultation

	Biologist, Dr. Alexandria Barkman, (alexandria.barkman@noaa.gov)
Section 7 Endangered Species Act (ESA) ● Consultation in the Pacific Islands	Website: https://www.fisheries.noaa.gov/pacific-islands/endangered-species-conservation/esa-consultations-pacific-islands Email: nmfs.pir.esa.info@noaa.gov / efhesaconsult@noaa.gov
Section 307 of the Coastal Zone Management Act (CZMA) ● Federal Consistency Review *See **State Office of Planning and Sustainable Development (OP)** in table above for more info.*	Website: https://planning.hawaii.gov/czm/federal-consistency/
U.S. Environmental Protection Agency (EPA)	
● **Pacific Island Office, Region 9**	Website: https://www.epa.gov/hawaii Phone: (808) 541-2710 Email: r9info@epa.gov
U.S. Army Corps of Engineers	
Regulatory Branch ● Nationwide Permit (NWP) 27 [1] Pre-Construction Notice (PCN)	Website: https://www.usace.army.mil/missions/civil-works/Regulatory-Program-and-permits/Obtain-a-Permit/ Phone: (808) 835-4303 Email: CEPOH-RO@usace.army.mil

Appendix E. DAR SAP Annual Report Checklist for Coral Restoration Projects.

Required for all SAPs:

- Project Narrative
    - This report captures any additional information that can not be communicated in the "Reporting Spreadsheet." It is encouraged to include and elaborate on the following:
        - Description of the activity and the objective of the project.
        - Explanation as to how the collection of, or activity with, a fully protected or regulated marine species for scientific, education, management, or propagation purposes is benefiting the State of Hawai‘i in general, and specifically, the improved management of the species or related species.
        - Examples of protocols, best practices, key findings, challenges, and lessons learned.
        - If the project utilized alternative methods to address unforeseen events at any time during the permit period.
        - Community engagement efforts.
- Reporting Spreadsheet
    - Download and populate the "DAR SAP Request and Reporting Spreadsheet" based on conducted activities.
        - All applicants must complete a "Request" spreadsheet when applying for an SAP, the same spreadsheet can be edited and submitted in the Annual Report, as the "Reporting" spreadsheet to reflect *actual* conducted activities, take, and disposition.
- If available/applicable, analysis of the data and any relevant publications and/or reports that were associated with your SAP (e.g., annual summary reports for funders, published protocols or journals, white papers, etc.).
- Methodology Photo Documentation
    - Representative photos of materials, gear, methods, lab space, protocols, etc.
        - Please see below for an example photo documentation submission.

          Note: original photos will be kept by the Permittee and available to DAR upon request.
- Signature Pages

**The items listed above are mandatory for all SAPs. For more details, refer to Section 'E. Annual Report' in approved SAPs or visit the DAR SAP website. This appendix serves as a supplementary resource; the issued SAP conditions outline specific obligations for Permittees.*

Required for all Coral Restoration SAPs

- Coral Restoration Photo Documentation

  Note: Original photos will be kept by the Permittee and available to DAR upon request.

  - **Collection Photo Documentation**
    - All (or at least a subset of 30 **per** collection site) collected coral specimens will be photo documented with a scale bar as follows:
      - Before Collection - capture a photo of the reef area/man-made structure from which the coral is to be collected
      - Before Collection - capture a top-down photograph of coral specimen to be collected with a scale bar
      - After Collection - capture a photo of the colony after collection
      - After Collection - capture a photo of the reef area/man-made structure from which the coral was collected
  - **Outplanting/Reattachment/Transplantation Photo Documentation**
    - All (or at least a subset of 30 **per** restoration site) attached coral specimens will be photo documented with a scale bar as follows:
      - Before Attachment - Capture a top-down photo of each colony with a scale bar included for reference.
      - Outplant Site Preparation - Capture an image of the projected attachment area with a scale bar for reference before outplanting
      - After Attachment - Photograph each coral specimen in its restoration location with a scale bar for size reference.
  - **Monitoring**
    - **Photo Documentation**
      - All (or at least a subset of 30 **per** restoration site) restored coral specimens will be photo documented with a scale bar as follows:
        - Top-down photo with a scale bar of coral specimen

- Baseline Survey Findings
  - Details completed **baseline survey(s)** for coral restoration sites (and control/reference sites if applicable) utilizing a combination of landscape and close-up photos to provide data on habitat metrics. If available, include Structure-from-Motion (SFM) photogrammetry and 3D orthomosaics.
    - Ecological footprint area (m^2) of reef where corals will be outplanted and/or reattached

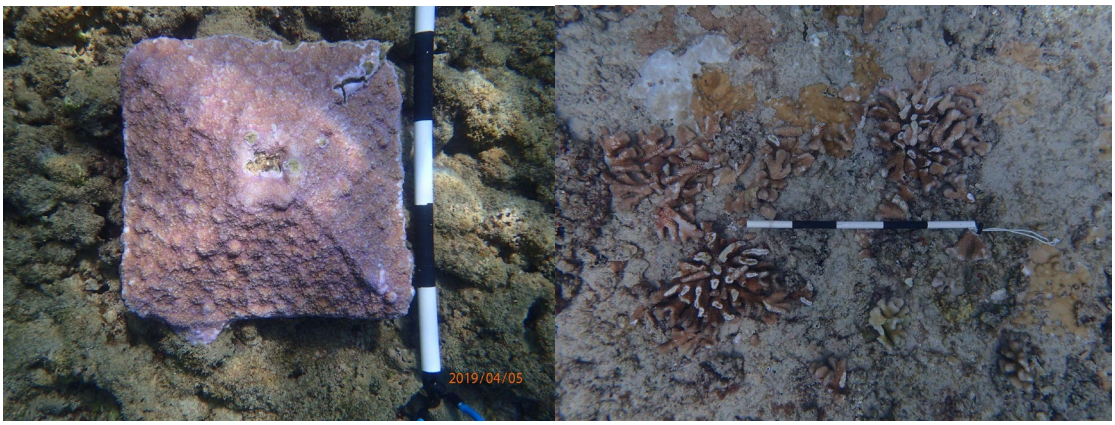
- Depth range of restoration site
- Comparison of mean, minimum, and maximum monthly water temperatures at depth at the collection site and restoration site for the duration of the project
- Species assemblages of coral predators
- Benthic survey with quantifiable metrics
    - Substrate characterization (see Appendix A, Table 2)
    - Coral community composition and cover
    - Presence absence of target outplant species and approximate sizes
    - Species assemblages of coral predators (crown-of-thorns sea star, cushion stars, large puffers, etc.), competitors (macroalgae), and facilitators (crustose coralline algae and herbivores)

- Monitoring Results
    - For each restoration site:
        - If available, include Structure-from-Motion (SFM) photogrammetry and 3D orthomosaics.
        - Unique identifier methodology for outplants
        - Estimated percent live coral cover
        - Comparison of mean, minimum, and maximum monthly water temperature at depth of the restoration site for the duration of the project/
    - Substrate characterization (see Appendix A, Table 2)
    - For all or a subset of 30 coral specimens per restoration site:
        - Measurements of maximum colony length, width, and height
        - % live coral tissue for each outplanted colony
            - It is recommended to document percent live coral tissue using the following size bins:
                - 0% live tissue (100% mortality)
                - 1 - 25% live tissue (99 - 75% mortality)
                - 26 - 50% live tissue (74 - 50% mortality)
                - 51 - 75% live tissue (25 - 49% mortality)
                - 76 - 99% live tissue (1 - 16% mortality)
                - 100% live tissue (0% mortality)
        - Coral specimen health score
            - Organizations with an established health assessment system are encouraged to provide a detailed outline of their scoring criteria and methodology. Those without a predefined system are encouraged to use the scoring system below to assess and report coral health to the best of their ability.

Score	Observation
0	Colony is dead, biofilm or algae may be present
1	>75% of coral specimen is compromised
2	~50% of coral specimen is compromised
3	<25% of coral specimen is compromised
4	Coral specimen shows no signs of compromised health
Compromised coral health is indicated by signs of distress including but not limited to: bleaching, disease, discoloration, sloughing, fungus, bacteria, or other adverse conditions.	

- Evaluation of performance measures (estimated and realized survivorship data) relevant to the goals of the project, including but not limited to:
    - Estimated restored coral % survivorship and % live coral cover/produced during (*in situ/ex situ)* nursery phase
    - Estimated restored coral % survivorship and % live coral cover at 1-month post-outplanting
    - Estimated restored coral % survivorship and % live coral cover at 3-months post-outplanting
    - Estimated restored coral % survivorship and % live coral cover at 1-year post-outplanting

Please see below for example photos.



(Above) Examples of coral outplant (left) and coral collection (right) top-down photo.

Department of Land & Natural Resources
Division of Aquatic Resources
1151 Punchbowl Street, Room 330
Honolulu, Hawai‘i 96813