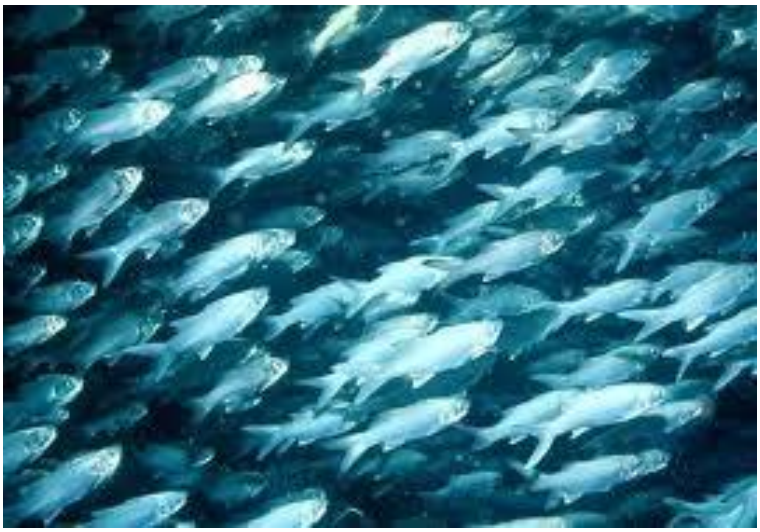
Draft
Environmental Assessment

A Commercial Sea Cage Facility for Moi Aquaculture in the Reef Runway Borrow Pit in Keehi Lagoon, Honolulu, Oahu, Hawaii



Prepared for: Office of Conservation and Coastal Lands
Department of Land and Natural Resources

Prepared by: Aquaculture Planning & Advocacy, LLC
Honolulu, Hawaii

Date: May 15, 2014

Project Summary

Project Name:	A Commercial Sea Cage Facility for Moi Aquaculture in the Reef Runway Borrow Pit in Keehi Lagoon, Honolulu, Oahu, Hawaii
Proposed Action:	Locate a commercial aquaculture facility for the native species moi, Polydactylus sexfilis, in State marine waters encompassing the Reef Runway Borrow Pit adjacent to Honolulu International Airport, Moanalua, Honolulu, Oahu
Applicant:	Mamala Bay Seafood, LLC 24 Sand Island Access Road, Box 27 Honolulu, Hawaii 96819 Contact: Randy Cates Phone: 808-841-4956 Email: catesinternational@hawaiiantel.net
Approving Agency:	Department of Land and Natural Resources Office of Conservation and Coastal Lands Honolulu, Hawaii 96809
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Project Location:	In Keehi Lagoon, adjacent to the Reef Runway of the Honolulu International Airport, Moanalua, Oahu, and within the Borrow Pit created during runway construction.
Tax Map Key:	Seaward of TMK: 1:1:03:por.05
State Land District:	Conservation District and Resource Subzone
Land Owner:	State of Hawaii
Permits Required:	CDUP, DLNR; Dept. of Army Section 10 Permit; NPDES/ZOM Permit
Anticipated Determination:	Finding of No Significant Impact (FONSI)

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Conversion Table

This DEA utilized both English and Metric Units. The values below can be used to convert English Units to Metric Units and Metric Units to English Units. N = value to be converted.

Feet (ft) to meters (m) = N x .3048	Meters to feet = N x 3.281
Inches (in) to centimeters (cm) = N x 2.54	Centimeters to inches = N x .3937
Miles (mi) to kilometers (km) = N x 1.609	Kilometers to miles = N x .6214
Meters^3 to feet^3 = N x 35.312	Feet^3 to meters^3 = N x 0.283
Acres to meters^2 = N x 4046.86	Meters^2 to acres = N x .000247
Knots (kt) to cm/second (sec) = N x 51.44	cm/sec to Knots = N x .019
Pounds (lbs) to kilograms (kg) = N x .45	Kilograms to pounds = N x 2.2

List of Acronyms and Abbreviations

AD	Airports Division, DOT
ACOE	Army Corps of Engineers
ADP	Aquaculture Development Program, DOA
APA	Aquaculture Planning & Advocacy, LLC
BLNR	Board of Land and Natural Resources
BMP	Best Management Practice
BP	Borrow Pit
CI	Cates International, Inc.
CDUP	Conservation District Use Permit
CEFAS	Center for Environment, Fisheries and Aquaculture Science
CWB	Clean Water Branch
DA	Department of the Army
DAR	Division of Aquatic Resources, DLNR
DBOR	Division of Boating and Ocean Recreation, DLNR
DLNR	State Department of Land and Natural Resources
DOA	State Department of Agriculture
DOH	State Department of Health
DEA	Draft Environmental Assessment
DOT	State Department of Transportation
EA	Environmental Assessment
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FAD	Fish Aggregating Device
FCR	Feed Conversion Ratio
FONSI	Finding of No Significant Impact
GFFP	Grove Farm Fish and Poi LLC
HAR	Hawaii Administrative Rules

HD	Harbors Division, DOT
HF	Hukilau Foods
HIA	Honolulu International Airport
HIHWNMS	Hawaiian Islands Humpback Whale National Marine Sanctuary
HOARP	Hawaii Offshore Aquaculture Research Project
HRS	Hawaii Revised Statutes
KBWF	Kona Blue Water Farms, LLC
LD	Land Division, DLNR
LLC	Limited Liability Company
MBS	Mamala Bay Seafood, LLC
NASA	National Aeronautics and Space Administration
NPDES	National Pollution Discharge Elimination System
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OCCL	Office of Conservation and Coastal Affairs
OHA	Office of Hawaiian Affairs
OOA	Open Ocean Aquaculture
RRBP	Reef Runway Borrow Pit
SCUBA	Self Contained Underwater Breathing Apparatus
UH	University of Hawaii
UHSG	UH Sea Grant
US	United States
WCC	Water Circulation Channel
ZOM	Zone of Mixing

cm	centimeter(s)
ft	foot/feet
hr	hour(s)
in	inch(es)
kg	kilogram(s)
km	kilometer(s)
kt	knot(s)
lb	pound(s)
m	meter(s)
mi	mile(s)
sec	second(s)

1.0 INTRODUCTION

Mamala Bay Seafood, LLC (MBS) is proposing to locate a commercial sea cage facility for aquaculture of the native species moi (*Polydactylus sexfilis*) in the Reef Runway Borrow Pit (RRBP) adjacent to the Honolulu International Airport (HIA), Moanalua, Honolulu, Oahu. The purpose of this Draft Environmental Assessment (DEA) is to describe the project, pursuant to Chapter 343, Hawaii Revised Statutes (HRS), as amended, and Title II, Chapter 200, Hawaii Administrative Rules (HAR), as amended. The Environmental Assessment (EA) will be used in the process to obtain the necessary permits and a long-term lease for the proposed activity at the proposed site.

Mamala Bay Seafood, LLC is a new company formed to carry out the project proposed in this DEA. The initial planning was done by Cates International, Inc., a Hawaii aquaculture company that successfully operated another offshore farm. To avoid confusion, MBS will be used throughout this DEA except in Section 2.0 Company History and in the Appendices which were prepared prior to the formation of MBS.

1.1 PROPOSED PROJECT IN BRIEF

MBS proposes to locate a commercial aquaculture facility for the culture of the native species, moi, *Polydactylus sexfilis*, in the Reef Runway Borrow Pit (RRBP) adjacent to the Honolulu International Airport (HIA), Moanalua, Honolulu, Oahu. A 45 year lease is being sought for 75 acres of State marine waters that encompass the Borrow Pit (BP) – a steep-sided, dredged area that was created in the 1970s to provide fill for the Reef Runway. A large portion of the area (approximately 80% or 60 acres) is controlled by the Department of Transportation (DOT) and the balance (20% or 15 acres) is under the Department of Land and Natural Resources (DLNR). The BP site offers several important advantages for aquaculture; namely high water exchange with the open ocean, protection from high winds and waves, relatively deep water (45 ft to 50 ft deep), uniformly flat and depauperate silt bottom to anchor cages, minimal public use, and close proximity to the MBS shore side base yard in Keehi Lagoon.

The proposed fish farm will consist at full build out of an anchored grid of ten (10) Aqualine surface cages, manufactured by Aqualine AS, Trondheim, Norway. Each circular cage will be 114 ft in diameter and enclose a volume of approximately 264,860 ft^3 (7500 m^3). A small work platform surrounds the outside diameter of each cage to allow technicians to access the fish. Projected annual farm production is estimated to be 1.5 M lbs, valued at $6.3 M.

It is anticipated that the netting for the cages will be a specially designed, semi-rigid woven copper alloy mesh that has been in use by the global industry for several years. The material is very strong and has proven very resistant to biofouling, thereby reducing the need for farm maintenance. Alternative fish farm netting (Dyneema netting) is also being considered for some or all of the cages. Cages will also be covered with nets for security and to deter any sea or shore birds from visiting the cages. MBS is requesting a feed/security barge be permanently

moored (24/7) at the site. Stocking, harvesting and daily feeding and maintenance will occur from surface work boats and barges frequently visiting the site, with occasional SCUBA diver assistance.

MBS desires access by the public to the farm site be controlled and public use of the entire lease area be restricted due to safety, security and company liability concerns. It is being requested that no transit or anchoring of any boat or water craft, and no fishing, snorkeling or SCUBA diving be allowed in the lease area, except as provided. MBS will designate and mark a 100 ft. wide transit lane along the inner and outer boundaries of the site to allow Airport Division (AD) access to the Reef Runway and allow the public access to the outer reef seaward of the BP during day time hours only for safety and security reasons; no public access at night to the entire site is being requested. A rule change through the Division of Boating and Ocean Recreation (DBOR), DLNR to remove the 75 acre farm site from a larger State designated Thrill Craft Recreational Area will be needed to secure a long-term lease (Section 13-256-94, HAR).

1.2 POTENTIAL NATIONAL AND LOCAL BENEFITS

On a broad national level, this project will demonstrate that commercial marine fish farming can be carried out in an environmentally sound, economically viable, and socially acceptable manner in nearshore ocean waters. Hawaii has been a leader in the development of commercial open ocean aquaculture (e.g., Kona Blue Water Farms and Hukilau Foods) and currently has one operating commercial offshore farm, Blue Ocean Mariculture in Kailua-Kona, Hawaii Island. In recent years the U.S. Department of Commerce and the National Oceanic and Atmospheric Administration (NOAA) have promulgated policies and plans to rapidly expand American marine aquaculture in a sustainable manner and Congress has considered important legislation to allow farming of the U.S. Exclusive Economic Zone (the largest in the world) (NOAA, 2007; NOAA, 2008; USDOC, 2011; NOAA, 2011).

Going forward, marine aquaculture is expected to continue to expand in U.S. state and federal waters and significantly contribute to increasing seafood supplies (NOAA, 2010). Domestic culture and capture fisheries sources currently contribute only 9% of total US consumption (NOAA, 2011). America continues to be an important global seafood market and about half of all imports are from aquaculture, mostly in developing countries where future supplies may be subject to significant disruption from complex geopolitical and environmental risks. Therefore, enhancement of U.S. seafood security through expanding domestic fisheries and aquaculture production is becoming viewed as a necessity by public and private interests (Corbin, 2010).

Hawaii too, in recent years, has been placing greater emphasis on producing more locally grown food, since as an island state it imports around 90 % of what it consumes. With respect to seafood, the state imports roughly 50 % of supplies and has a per capita seafood consumption of nearly three times the mainland U.S. (Loke, et. al., 2013). It is well recognized in State plans and policies that growing a sustainable aquaculture industry, not only increases the availability

of quality, locally farmed products, but also addresses the critical long-term needs of economic development and diversification and jobs (see Sec. 8 , EA).

MBS strongly desires to benefit the Hawaii economy and residents statewide by focusing on two long-term goals: 1) Sustainably producing quality seafood that significantly contributes to satisfying the local demand for moi, before considering product exportation, and 2) Hiring qualified Hawaii residents for its work force. Among the foreseeable community benefits of the proposed project are: 1) generation of high wage, skilled jobs; 2) local purchasing of equipment and supplies; 3) local purchasing of services for administration, environmental monitoring, and repair of facilities; 4) increased supply of high quality, locally produced seafood for the resident and tourist markets; and 5) payment of lease rents to the State. Further, this aquaculture project also implements Governor Abercrombie's vision as stated in "A New Day in Hawaii, Recovery and Reinvestment Plan," specifically "wise utilization of our natural resources to become more self-sufficient so we can keep dollars and jobs here in the islands."(Anon., 2010)

1.3 PERMITS AND APPROVALS

There are three major permits that govern siting and operating a farm in State marine waters: the US Army Corps of Engineers (USACOE), Department of the Army (DA), Section 10 permit; a DLNR, Conservation District Use Permit (CDUP); and the State Department of Health (DOH), National Pollution Discharge Elimination System (NPDES)/Zone of Mixing (ZOM) permit. In addition, an Aquaculture License from the Division of Aquatic Resources (DAR), DLNR is also needed to possess moi, a regulated species (APA, 2011).

1.3.1. Federal

A USACOE Department of the Army Section 10 permit is required for structures or work in US navigable waters. Structures or work includes deploying anchors, mooring systems, and sea cages. The permit is issued by the Regulatory Branch, Honolulu District, U.S. ACOE. The public interest review of the application requires consultations with appropriate federal and state agencies for potential impacts on: historic resources, protected species, Essential Fish Habitat and Critical Habitat, as well as, consistency with State Coastal Zone Management Program objectives and policies.

1.3.2 State

A CDUP for commercial use of State marine waters and submerged lands is required from the Office of Conservation and Coastal Lands (OCCL), DLNR. All State marine waters are in the Conservation District, Resource Subzone and aquaculture is a permitted use in the Resource Subzone. After public review, the CDUP application, which requires attachment of an EA and a public hearing, is approved at a regularly scheduled meeting of the Board of Land and Natural Resources (BLNR).

The NPDES/ZOM permit issued by the Clean Water Branch (CWB), DOH, regulates fixed point source discharges into State surface waters, including those classified as Class A coastal waters. Offshore cage complexes (one or more cages on a site) are considered a point source discharge and need a NPDES/ZOM permit to operate when production exceeds 100,000 lbs annually (40 CFR Pt. 122.24). Production less than 100,000 lbs can be exempted from the permit requirement. This project will require an NPDES/ZOM permit.

An aquaculture farm growing a species regulated by State fisheries management laws requires an Aquaculture License. Licenses are issued by the DAR.

2.0 COMPANY HISTORY

MBS is owned by John R. (Randy) Cates who also owned Cates International, Inc. (CI) which was in business in Hawaii from January 1, 2000 until the formation of MBS. Notably, Cates leveraged his many years of experience in working in the ocean in Hawaii and around the world as a commercial fisher, diver, salvor, and charter captain, to be a major contributor to developing the innovative technologies and management approaches that have allowed commercial-scale fish farming to be effectively carried out in an open ocean environment, and for the first time conducted totally submerged. Notably, Mr. Cates also served six years on the Marine Fisheries Advisory Committee that advises the Secretary of Commerce on national fisheries and aquaculture policy.

In 2000, CI was the first company to receive an ocean lease of State marine waters under Hawaii's amended law, Chapter 190D, HRS. It was also the first commercial Open Ocean Aquaculture (OOA) lease in the nation. Previously, the company had gained a wealth of experience from participation in the federally funded, comprehensive multi-year cage culture research project, the Hawaii Offshore Aquaculture Research Project (HOARP), which began in April, 1999 and demonstrated sea cage culture at a site several miles off Ewa Beach, Oahu (Ostrowski, et al., 2001). Based on its firsthand experience as part of the HOARP team, CI sought a commercial lease adjacent and seaward of the research project site.

CI received an approved CDUP and authorization for a lease from DLNR on January 26, 2001. Subsequently, on August 23, 2002, a General Lease to CI was approved by BLNR, encumbering 28.077 acres for operation of four cages to grow the native species moi (*Polydactylus sexfilis*).

Successful operation of the four-cage system, approximately two miles offshore, for nearly six years, demonstrated the commercial potential of submerged cage technology for OOA and marketability of moi in Hawaii and on the mainland. In 2006, Grove Farm, a Kauai-based agribusiness firm, expressed interest in investing in CI to significantly expand production. As a result, Grove Farm formed the subsidiary Grove Farm Fish and Poi LLC (GFFP), which acquired CI, and rebranded the operation as Hukilau Foods LLC (HF). Ownership of the fish farm and its

assets was officially transferred to Grove Farm Fish and Poi LLC on April 1, 2006. Mr. Cates remained part owner of the farm and became its Chief Executive Officer.

On June 1, 2010, Mr. Cates officially left HF as CEO and the operating partner. CI continued to operate its marine charter and salvage business, while sorting out legal issues with HF and GFFP, and looking for new opportunities in the aquaculture industry. Mr. Cates' new company, MBS, is now seeking a lease of State marine waters to start up a commercial sea cage culture facility for moi in the more protected area of the RRBF. MBS will utilize the existing shoreside facilities at Keehi Lagoon leased by CI from DBOR, DLNR to support this project. In addition to office space and general storage, these facilities provide feed storage, a maintenance shop and fish transfer and packing capabilities.

3.0 DESCRIPTION OF THE PROPOSED ACTION

3.1 TECHNICAL AND OPERATIONAL CHARACTERISTICS

3.1.1 Location and Technical Characteristics

MBS is proposing to locate and operate a commercial cage aquaculture farm in the RRBP adjacent to the Reef Runway, Keehi Lagoon, Honolulu International Airport (HIA), Moanalua, Oahu (Figs. 1 a, b). The proposed area of about 75 acres was previously dredged to a depth of between 45 and 50 ft to obtain fill for the HIA Reef Runway. Construction on the runway began in 1972 and finished in 1977. The site is located to the West of the Kalihi Channel and is bordered on the eastern side by the Keehi Lagoon Drainage Channel, or Water Circulation Channel (WCC), both the Kalihi Channel and the WCC contribute significantly to large-scale sea water exchange in Keehi Lagoon every day during tidal cycles.

Fig. 1a. Project location and vicinity: Honolulu International Airport, Reef Runway Borrow Pit. Keehi Lagoon, Moanalua, Honolulu, Oahu.

Fig. 1b. Keehi Lagoon area and important locations. Key: a) Reef Runway; b) Borrow Pit; c) Sea Plane Runway; d) canoe racing area; e) water skiing area; f) Water Circulation Channel; and, g) Kalihi Channel.

The RRBP is bordered on its landward side by the inner reef flat adjacent to the Reef Runway and, on its seaward side, by an outer reef exposed to open ocean wind and wave conditions. To the West of the BP is a continuation of the fringing reef (Fig. 2).

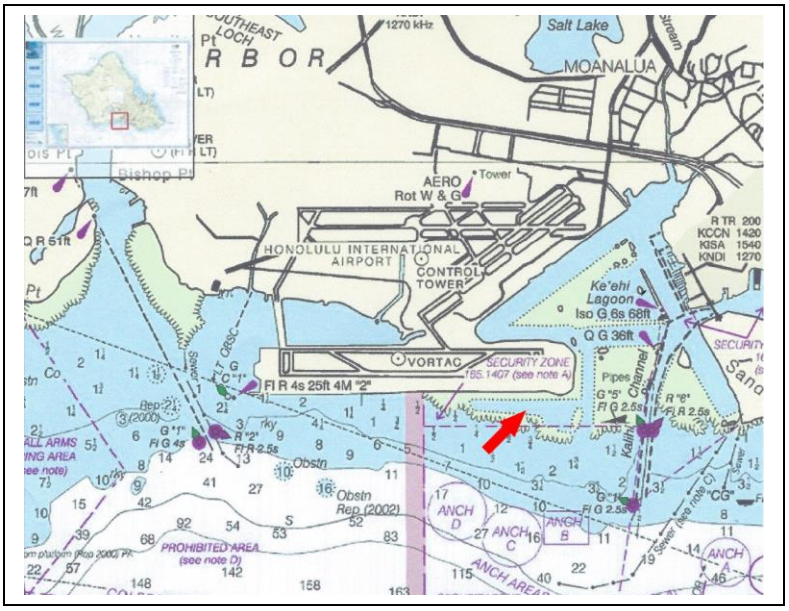

Fig. 2. Reef Runway Borrow Pit (red arrow), Keehi Lagoon, with water depth in feet of surrounding area.

Geologically, Keehi lagoon is a large fringing coral reef that has been significantly altered by dredging and filling since the 1930s. Three perennial streams provide fresh water influx to the lagoon: Moanalua, Kalihi, and Nuuanu streams. Prior to the excavations and shoreline extensions for the HIA and Hickam Air Force Base Golf Course, Keehi Lagoon was comprised of extensive mud flats behind the fringing reef, with some benthic exposure at low tides. Shallow waters provided limited navigable area for boating. Following construction of three separate seaplane runways during World War II, navigable channels and a large triangular reef remnant were created (Fig. 1 a,b).

The Company desires to lease the interior of the RRBP, about 75 acres, for moi culture utilizing ten (10) moored surfaces cages (Fig. 3). The sea cages, the Aqualine brand, are made and distributed by Aqualine AS, Trondheim, Norway. This company has been supplying the global aquaculture industry for over 30 years and its equipment has a reputation for durability. Cages are deployed all over the world on some of the most rugged ocean conditions and are custom made for the area and sea conditions.

This project will use the Aqualine FroyaRing FR400-100 sea cage, which will be constructed to 114 ft in diameter, with a volume of 7,500 m^3. Each cage will be circled by a work platform and hand rail around its circumference that will be about 4 ft above the sea surface. Cages will be attached to each other in a grid layout using the vendor's specifications. Anchoring of the two grids of five cages will be carried out using 28 Danforth anchors weighing between 3000 lbs and 6000 lbs each to maintain taut lines and netting. The nearly flat pit bottom of the RRBP is practically devoid of hard substrate and consists largely of a layer of fine silt. Maximum currents for the area were found to range between 4 cm/sec and 18 cm/sec, well within design specifications of the cage system (Appendix A).

Fish will be grown up to a target density of 10 kg/m^3 (Note, ocean cage operations in other parts of the world can commonly reach densities of 50 kg/m^3 depending on the site). Lower densities will promote faster growth rates in the stock and more rapid recycling of particulate and dissolved effluents from the cages. Feeding will take place from a centrally located feeding/security barge utilizing individual cage feed distribution hoses (Fig. 3). The platform will support remotely controlled fish feeding, remote video monitoring of feeding, stock and cages, and security telemetry. Any telemetry equipment and frequencies will be reviewed and approved by the Airports Division (AD), DOT. Appropriate signage as required will be located throughout the site and buoys will mark the site boundaries and subsurface lines and hoses.

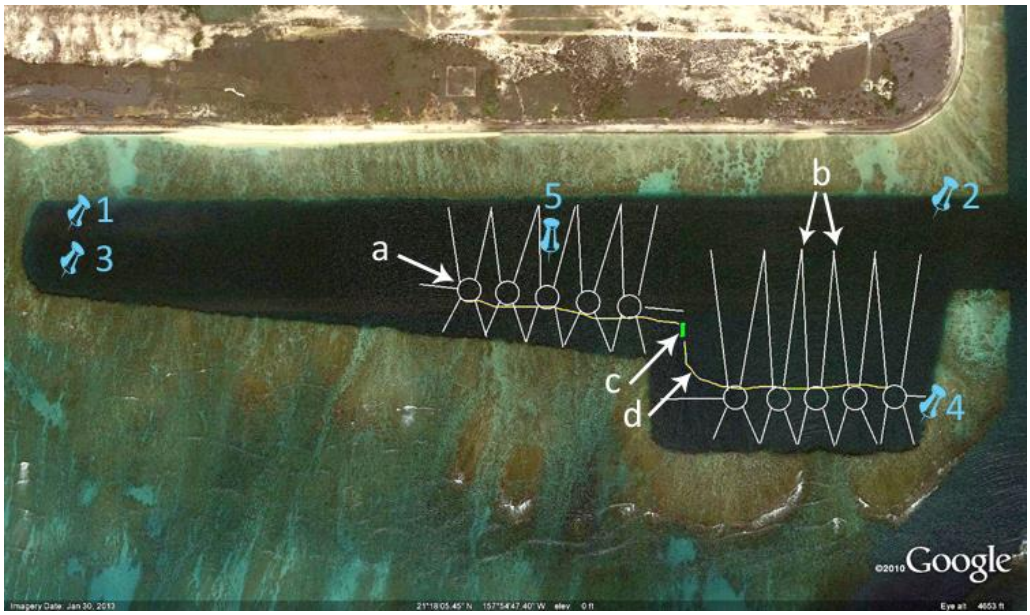

Fig. 3. Graphic of the proposed moi farm within the Reef Runway Borrow Pit, with numbered GPS locations (see text for coordinates). Key: a) cages; b) anchor lines; c) feed barge; and d) feed distribution lines.

The dimensions of the BP site are visually well-defined by the sharp vertical drop-off from the shallow reef flat to the dredged, relatively flat area uniformly 45 to 50 ft deep throughout the site. Site boundaries established by GPS for the irregularly shaped site are described by the following latitude and longitude coordinates in decimal degrees (Fig. 3):

<u>Center Point (5)</u> N 21° 18$^{'}$ 07.16$^{''}$ latitude and W 157° 54$^{'}$ 43.47$^{''}$ longitude

<u>BP Boundaries</u>

West End, North (1): 21° 18’ 9.70” latitude and 157° 55’ 12.81” longitude
West End, South (3): 21° 18’ 6.76” latitude and 157° 55’ 12.92” longitude
East End, North (2): 21° 18’ 10.60” latitude and 157° 54’ 24.77” longitude
East End, South (4): 21° 17’ latitude and 157° 54’ longitude

Notably the RRBP site, as classified by State Land Use Zoning, is entirely in the Conservation District, specifically the Resource Subzone, as all State marine waters are designated. Jurisdiction over most of the proposed area was granted to the AD, DOT by Executive Order 3202. The balance of the proposed site is in State marine waters under the jurisdiction of DLNR. Administration of the proposed lease, should it be approved, is under preliminary discussion with the respective agencies, though DLNR administers other commercial uses in DOT Airport EOs (Fig. 4).

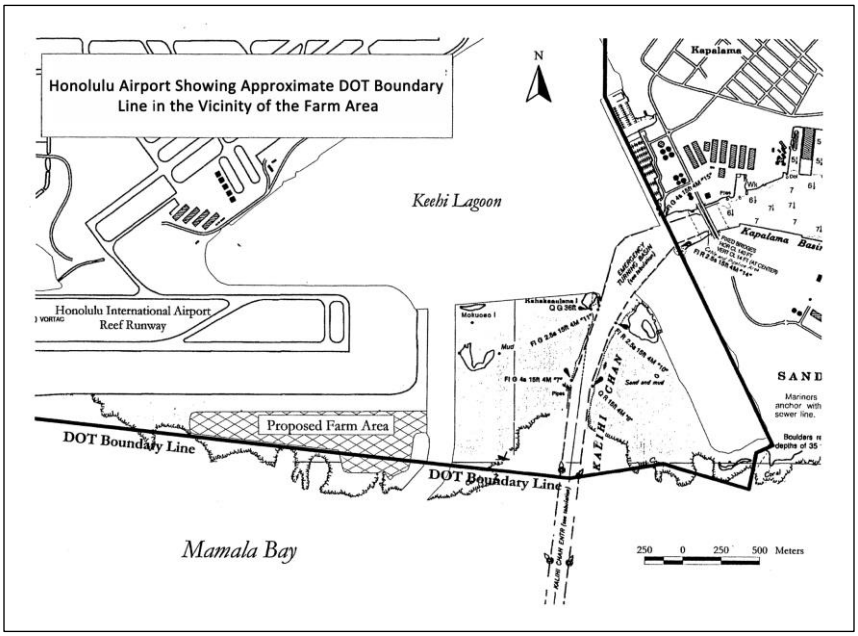

Fig. 4. Approximate boundary line for State Department of Transportation, Airports Division controlled property.

3.1.2 Major Operational Characteristics

MBS proposes to utilize the extensive experience from over seven years of successful operation of an open ocean fish farm off Ewa Beach, Oahu, as well as the latest in proven fish farming technologies from around the world, to build and operate a new facility in the more sheltered RRBP environment. Key aspects of operation are described below.

Culture System

The proposed surface cage culture system will consist of ten (10) Aqualine FroyaRing FR400-100 sea cages structured of flexible, high strength, UV resistant plastics, steel brackets, floating tubes, stays and chains, and utilizing special semi-rigid copper alloy mesh netting (Fig. 5). The mooring grid designed by the vendor will consist of steel brackets, bridles, heavy-duty lines and chains, and 3000 to 6000 lb Danforth anchors. These cage systems are designed for and have been utilized for many years in coastal ocean waters that may have occasional high energy, storm conditions, e.g., the North Atlantic.

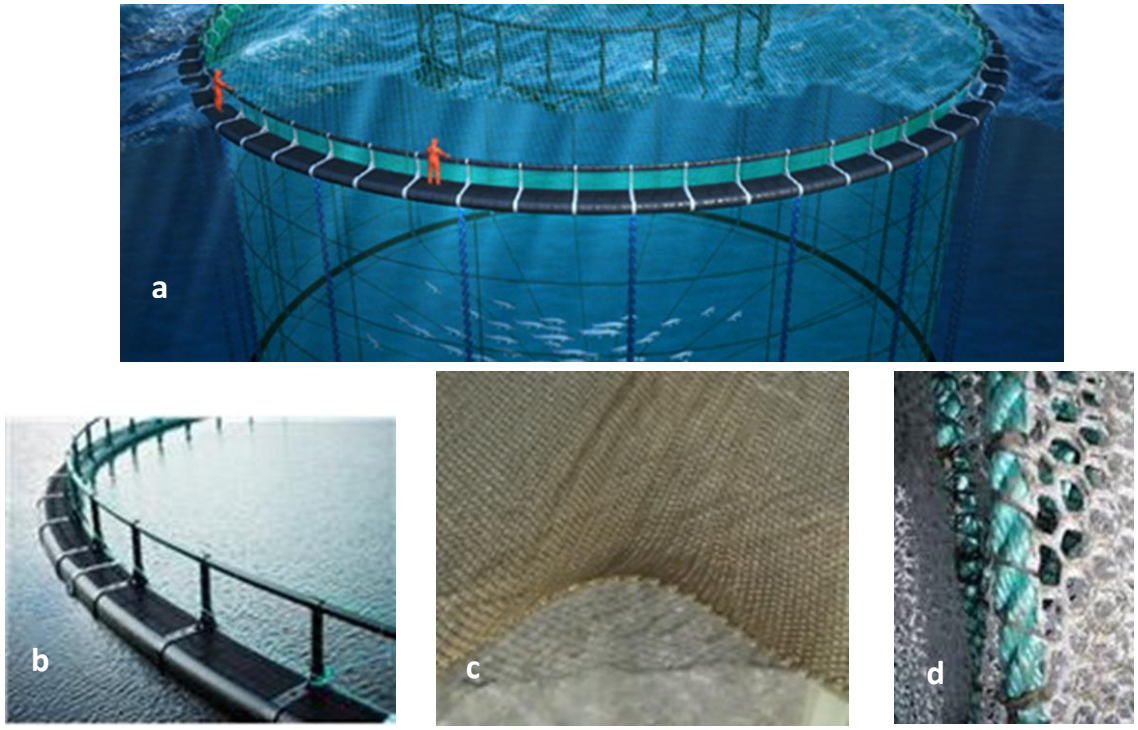

Fig. 5. Representative Aqualine FroyaRing Cage: a) cage; b) work platform; c) copper alloy netting; and d) Dyneema netting.

A single cage is circular in shape, 358 ft in circumference and 114 ft in diameter. A walkway with a 4 ft handrail goes around the entire circumference of the cage. The surface collar is positively buoyant to keep the lip of the cage at the surface at all times to allow ready access to the fish. The bottom of the cage (bottom of the net) will be approximately 18 to 20 ft from the substrate and slightly weighted by tubing filled with steel wire to maintain shape and a volume of approximately 7,500 m^3.

Both of MBS's proposed netting materials have seen use around the world in a variety of environments. The semi-rigid, woven copper alloy mesh made by EcoSea Farming SA, Chile has been in use in Japan since the late 1990's and in Australia and elsewhere since 2005 with no negative environmental impacts (ICA, 2014). The rigid copper alloy material is very strong and has proven resistant to fouling in both temperate and tropical waters, thereby reducing the need for cage maintenance (Fig. 5). The Dyneema netting – the world's strongest fiber, 15 times stronger than steel – has also proven itself very durable and lasting in industrial scale applications in, for example Norway, Scotland, Greece and Australia (Dyneema, 2014). Net mesh size for this project will be one inch. Both netting materials have been approved for use by DLNR and utilized in Hawaiian waters for several years.

Species Choice and Stocking

MBS will focus on the culture of the popular native species moi (Fig. 6). Moi, locally called the "fish of kings," are under-supplied to the local marketplace. The reported yearly wild catch from 2000 to 2010 averaged 533 lbs (DAR, 2013). The fish has a relatively long history of public and private sector aquaculture research and development; hence there is a solid information base for continued culture improvement. For example, genetic mapping of the species has indicated that fish from around the islands are one genetic stock, thus wild brood stock can be sourced from anywhere in local waters (Pan and Yang, 2010). Other native species may be considered at a later time as government research leads to the opportunity for commercialization.

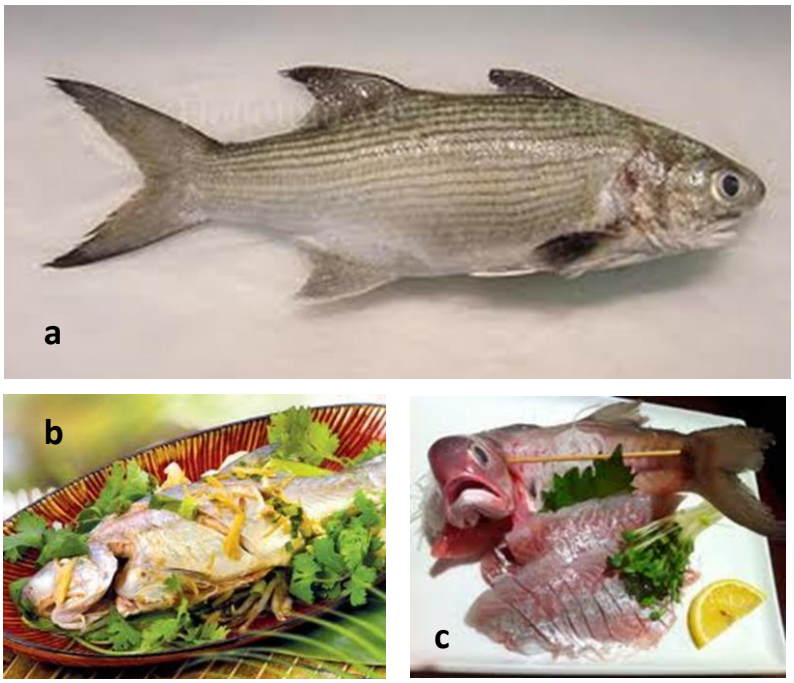

Fig. 6. Moi: a) freshly harvested; b) prepared Chinese-style; and c) prepared as sashimi.

In its history, with Mr. Cates as CEO, Hukilau Foods produced over one million lbs of fish and received great positive feedback from local market sales and limited mainland test marketing. Many well-known local distributors and chefs associated with the Hawaii Regional Cuisine movement, such as Roy's Restaurants and DK's Restaurants, seek out locally produced products like moi to include in their preparations. President Obama and family have also reportedly enjoyed moi during their visits to Hawaii.

Stocking material, fingerling moi, will be produced from captive broodstock at a hatchery, location to be determined. Initial broodstock will be sourced from wild populations and occasionally replenished, making MBS's stocking material genetically the same as wild fish. Fingerlings approximately 2 to 3 inches in length (two to three months old) will be truck transported in tanks to the Company's Keehi Lagoon shore-side facility for loading onto a boat with specially constructed transport tanks. Upon arriving at the lease site, stock will be gently distributed into the sea cages, using hoses that carry fish and seawater into the enclosure. It is

anticipated that grow out to market-size, approximately 1 to 1½ lbs, will take about seven months (Fig. 7).

Fig. 7. a) Moi being stocked in a cage; and b) moi being harvested by a fish pump.

Feeding

Feeding of the farm stock will occur daily from the electronically controlled, central feeding barge located on site (Fig. 8). The barge will store a large supply of pelletized, slow sinking feed (approximately two weeks supply), a portion of which will be distributed to each cage daily through hoses that carry seawater and feed pellets into the cage. Feeding schedules and quantities will vary per cage depending on the biomass present (size of the fish). Feed pellets will be spread widely in a cage to facilitate consumption by all stock and to minimize wastage. The daily feed distribution will be electronically controlled and monitored by video cameras and technicians, so as not to over feed and minimize uneaten pellets. The Company has a strong economic incentive to carefully manage feed consumption and minimize wastage because it is the highest contributing unit cost to each unit of fish production.

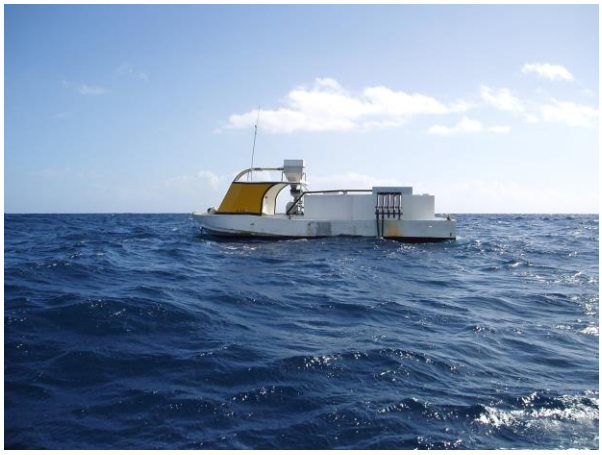

Fig. 8. Prototype feed and security barge.

The feed that will be used is a commercially available, specially formulated slow sinking marine fish diet shipped in bulk from a mainland manufacturer. The pellets are a mixture of fish meal, agriculture grains and a vitamin/mineral mix, with a crude protein content of approximately 43%. According to the feed manufacturer, Skretting, Inc., a global leader in aquaculture feeds, fish meal components are sourced from sustainably managed fisheries (Skretting, 2013). No additives, such as hormones or antibiotics, will be used. Company policy is upon request by DLNR and/or DOH, fish feed can be tested by a mutually agreeable, third party laboratory to affirm composition and results will be provided to the agencies.

Feed Conversion Ratio (FCR), pounds of feed fed divided by the pounds of fish produced, has averaged around 2:1 for moi in the open ocean setting off Ewa Beach, which is generally considered acceptable for culture of a new marine fish species. Reduction of marine fish FCR' s is a priority target of public and private sector marine aquaculture research efforts, with a goal of approaching the remarkable FCR' s achieved in the highly successful global salmon industry, i.e., 1.1:1 (NOAA, 2008). The Company will also continue to monitor the wide ranging international research to develop commercial alternatives to fish meal in marine fish diets (e.g., Kona Kampachi Farms).

Harvesting

Harvesting of market sized fish of about 1 to 1½ lbs from a surface sea cage is a straightforward operation that utilizes a custom surface vessel with holding tanks and a commercially available fish pump to efficiently move fish from the cage to the boat. Farm technicians inside the cage will "herd" marketable fish to a portion of the cage, where they will be gently pumped to the deck of the support vessel. On the vessel, fish will slide into one of two large ice-brine slurry baths to quickly disable them with minimum physical damage to the fish (Fig. 7b). Fish then will be transported whole in the slurry the short distance (a nine minute boat ride) to MBS's Keehi Lagoon facility for off-loading at the dock and pick up by a local wholesaler/distributor. No fish processing will occur at sea during harvests and solid waste disposal will be the responsibility of the wholesaler and other buyers that process the fish.

Security and Maintenance Procedures

MBS staff will be working on the lease site every day, seven days a week, while carrying out stocking, feeding, harvesting and maintenance. In addition, restriction of public access to the RRBP at night is being requested to enhance farm security. These activities and the staff presence will provide a high measure of monitoring and security for the operation. Video surveillance cameras will be set up to have 24/7 observation of critical areas. All telecommunications equipment and frequencies will be reviewed by the AD, DOT and the Federal Aviation Administration (FAA).

Cage maintenance operations will be of three types: 1) Inspection of stock for mortalities and their removal 2) Repair of various cage components, including support structures, the anchor system, and brass netting enclosure, and 3) Cleaning of mooring lines and cage netting to

promote maximum water flow. According to the manufacturer, the anticipated design life of the cage frames is about 15 years and the mooring system about 20 years. The mooring system will be inspected on a monthly interval to anticipate any breakage problems.

The semi-rigid copper alloy mesh netting is designed to have a service life of about 10 years, before it is replaced and the old netting recycled. Based on applications to date this metal netting will provide a high degree of containment, resist fouling and require little routine maintenance (ICA, 2014). The Dyneema netting also has an estimated service life of about 15 years and will be cleaned as needed. Regardless, netting will be inspected regularly. If major repairs are needed, netting will be replaced. Minor repairs can be accomplished by farm technicians, while the cage remains in place and on site.

Again, biofouling has not been a significant issue with this type of culture system and the copper alloy mesh netting greatly reduces the need for cage maintenance. If cage or mooring system cleaning is needed, it will be carried out by farm technicians using a commercially available Power Washer that utilizes a jet of water to dislodge material. No chemicals will be used in the cleaning process. It is anticipated that pulverized material should be minimal and readily suspended and dispersed by the currents and assimilated and recycled by the ocean environment (Appendix A).

3.2 ECONOMIC CHARACTERISTICS AND IMPACTS

MBS's production of moi will impact the Hawaii economy in a number of ways, including through increases in employment opportunities, product availability in the local marketplace, expenditures in local support industries, and increased opportunities for Federal research dollars. Plans are to invest approximately $5.0 million in the project from Company funds, private investors, commercial lenders and/or government loans.

Currently, MBS employs six local people in its marine operations. With a phased build out of a support hatchery and the new cages, MBS anticipates hiring four staff in the hatchery and five staff in the company administration and grow-out operation. Jobs will require a variety of skills, for example experienced divers and hatchery technicians to accounting and marketing specialists. Company policy is to hire Hawaii residents, whenever possible, and it anticipates developing internship programs and other mutually beneficial relationships, with local high schools, colleges and universities, to help create the labor pool for marine aquaculture industry expansion.

Recent estimates of apparent Hawaii seafood consumption indicate average annual total consumption, from commercial and non-commercial (recreational) sources, was approximately 50,387,000 lbs or per capita consumption of approximately 37 lbs per person. Imported seafood accounts for about 49% of annual supply, with the balance from local sources (both commercial and recreational fishing) (Loke et. al., 2013). Hawaii on a per capita basis eats more

than twice the amount of seafood than the US mainland, underscoring the fact that Hawaii tourists and residents love their seafood.

Plans are to gradually phase up MBS production to approximately 1.5 million lbs per year of moi, over a period of two years. The Company will focus initially on contributing to satisfying local demand and import substitution with high quality, fresh moi product, before considering exporting. Previous test marketing of moi on the mainland and Japan have been very successful. Public comments over the years to Mr. Cates strongly indicate that the local seafood supply chain will welcome year-round, predictable availability of this local favorite. Supply from wild sources is limited in quantity and seasonal due to fishery management regulations – moi fishing season is closed in June, July and August every year – and moi populations are small and to dispersed to be regularly targeted by commercial fishers.

Estimated wholesale value of MBS production at full scale is projected to be about $6.3 million per year, with a projected wholesale market price of $4.25 per lb. State revenues will benefit from increased personal income tax and corporate taxes, as well as lease rents paid to DLNR, which increase with the amount of production due to a percentage of gross sales provision seen in previous offshore aquaculture leases. Positive economic impacts on support industries will be fostered through: sales to the wholesale and retail fish trade; processing and packing activities; use of transportation providers; and company purchase of services, equipment and supplies.

The Hawaii aquaculture industry has benefited from close collaboration with the research capabilities within the UH System, as well as with the internationally known Oceanic Institute. Expanding the commercial aquaculture sector will provide an added basis for these entities to write research proposals and compete for federal grants to improve industry technology and economics, as well as attract students from the mainland and overseas. Federal research dollars coming to Hawaii not only expand the knowledge base, but create jobs and bring valuable revenue into the state.

3.3 SOCIO-CULTURAL CHARACTERISTICS

3.3.1 Multiple Use Conflicts

Previous studies of public use of the RRBP have indicated light to moderate use of the inner and outer reef edge areas and limited use of the interior (where the cages will be located) except for occasional transiting to another location. Observed activities in the site area and in the vicinity include boating, fishing, diving (e.g., spear fishing and fish collecting), and thrill craft (Jet Ski) use (BPI, 2001). Numerous site observations made by MBS over the time period 2006 to the present generally confirm these types of uses (it is specifically noted no jet ski use has been observed), with a very low level of activity of any kind in the vicinity of the RRBP and on its borders. Recreational activities in the deeper interior of the pit are rare (Appendix D).

MBS requests that access to its farm site be highly controlled and boating, thrill craft use, fishing and diving in the proposed lease area be restricted due to staff and public safety concerns, maintenance of farm security, and company insurance liability issues. MBS notes that the surface cages and feed barge occupy less than 2.39 surface acres, while the mooring and feeding systems stretch out to occupy approximately 59 acres and the access lane occupies about 6 acres of the 75 acre site. MBS is formally requesting there be no transit or anchoring of any boat or water craft (e.g. thrill craft and kayak), and no fishing, snorkeling or SCUBA diving allowed within the main lease site. MBS will designate 100 ft wide boat transit lanes along the inner reef and outer reef portions of the site, so that recreational use of the outer reef areas can continue and ready direct water access is maintained to the Reef Runway for the AD.

The Company's principal has extensive experience in dealing with curious boaters and fishers around the HF offshore site and there were no complaints in 10 years of operation. The proposed site boundaries will have large size markers (e.g., markers 48 inches in diameter) for the site edges and smaller buoys marking near surface hoses and mooring lines. Signage to alert the public to the farming operation and the lease dimensions and restrictions will be prominently placed. MBS will make a concerted effort to inform and engage the interested public as cage operations are phased in and resolve any issues. The general outreach approach will be that used previously, that is, "one-on-one" onsite discussions with ocean users and the Company principal continuing to be an active and involved member of the Keehi Lagoon and Oahu marine community.

The issue of the thrill craft or Jet Ski use in the RRBP is a special situation that will need to be addressed. Pursuant to Section 13-256-94, Hawaii Administrative Rules (HAR), the proposed 75 acre site is designated by the State as part of an 867 acre recreational thrill craft area (Fig. 9). As such, a rule change will be sought to remove the proposed commercial aquaculture lease area from the larger Jet Ski area. Preliminary discussions with the Division of Boating and Ocean Recreation (DBOR), DLNR, the agency that administers the rule, indicate it could be mutually beneficial to the jet ski community and MBS to reconfigure the Thrill Craft Zone by removing the RRBP area and providing a more accessible area with better waves in another location. Approval of the proposed project by DLNR and DOT would be subject to reconfiguration of the Recreational Thrill Craft Zone by DBOR to be proposed in 2014 (Underwood, 2013).

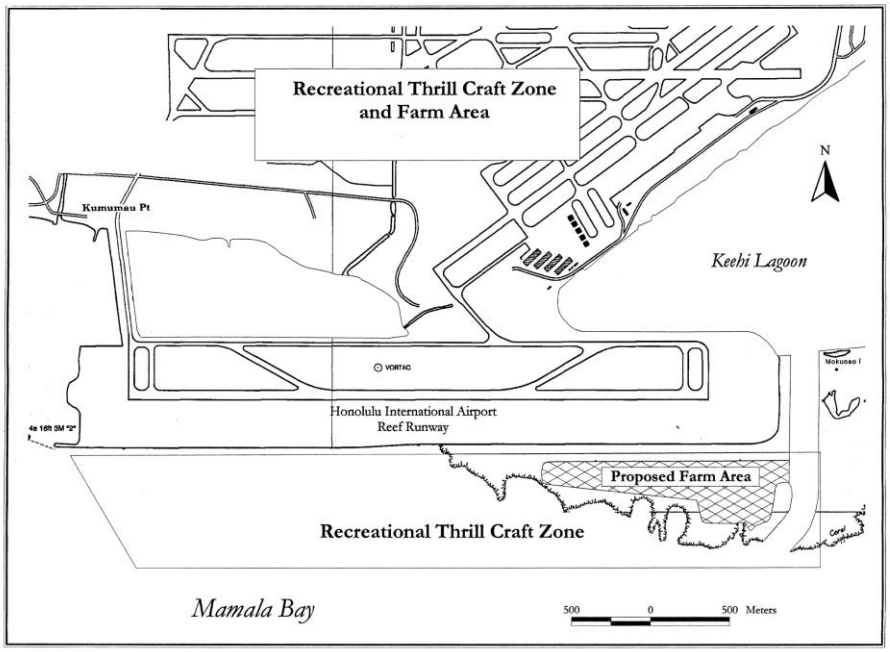

Fig. 9. State designated Reef Runway Recreational Thrill Craft Zone "F" showing approximate location of the proposed aquaculture project.

3.3.2 Cultural Resource Issues

Chapter 343, HRS, as amended, requires the EA to identify and assess any potential impacts of a proposed project on native Hawaiian cultural practices and resources. Keehi Lagoon and the adjacent shoreline is a highly disturbed and developed environment that has been subject to numerous studies and assessments over many decades (Table 1). Property under the jurisdiction of the AD, DOT (under Governor's Executive Order 3202), consists of 2,520 acres of fast land and 2,000 acres of submerged land, including the majority of the RRBP. Review of the 2010 HIA Master Plan indicates, "There are no archeological, historical or cultural sites of significance on the airport property or properties to be acquired" (Ed Noda and Associates, 2010). This statement is inclusive of most of the area of the BP and is consistent with visual surveys by MBS that showed there are no sites in the remainder of the property.

Hawaiian cultural practices and gathering rights are another important aspect that must be reviewed. Previous environmental studies of the RRBP, confirmed by MBS dive surveys, indicate the proposed site is very uniform in depth (45-50 ft), with a fine silt substrate practically devoid of relief that would be attractive to aquatic animals. Areas of interest that may be used for performing these cultural practices (e.g., limu gathering and fishing) include the borders of the dredged area, the inner reef fragment, and the outer reef faces that are only accessible by boat. Access to the airport property by land is restricted by AD for security reasons. MBS intends to designate a 100 ft wide access lane on both the inner and outer reef borders to accommodate access by native Hawaiian and non-Hawaiian ocean users to the seaward outer reef (Appendix E).

3.4 ENVIRONMENTAL CHARACTERISTICS

3.4.1 Operations

Operationally, the proposed MBS fish farming project will be managed in similar fashion to an offshore fish farm (e.g., HF), with some important differences. The considerably less dynamic ocean environment inside the RRBP allows well-constructed surface cages to be effectively utilized for fish culture. For example, routine stocking, feeding, harvesting and maintenance procedures become less labor intensive and more cost efficient when stock can be accessed and managed in surface cages and without the extensive use of SCUBA divers.

Critical water exchange rates between the RRB P and the ocean were studied by MBS using drogues and well placed current meters (Appendix A). Data confirm MBS's visual observations that large volumes of ocean water pass into the BP hourly, by flowing over and through the spur and groove structure of the outer reef, where it becomes mixed thoroughly ,i.e., water temperature with depth measurements show no significant stratification in the pit (Appendix A and B). BP water then moves easterly out the 480 ft dredged gap in the reef and into the WCC where it mixes and flows out to the ocean (Fig. 10).

Another major contributor to this pattern of water exchange in the BP is the configuration of circulation in the large expanse of Keehi Lagoon, i.e., flood tide currents enter from the open ocean through Kalihi Channel and mixed lagoon water exits though the WCC at the eastern end of the RRBP, along with water exciting the BP (Fig.10). Thus because of this repeated replenishment, mixing and exchange of the well mixed MBS site waters with the offshore ocean waters, driven by consistent trade wind patterns and wave and tidal forces, the Company concluded aquaculture production scaled to the available site area and hydrodynamics is feasible and sustainable.

The farm will be serviced daily by one or two motorized vessels (25 ft and 80 ft in length) based at MBS's Keehi Lagoon shore side facility. Boats will be powered by standard diesel engines or outboard motors. Noise levels will be no more than boats of comparable size that frequent Keehi Lagoon and be insignificant compared to background airport traffic. Operations carried out from the support vessels include routine stocking and regular harvesting of the cages, as well as bi-weekly replenishment of the feed barge.

Operationally, staff managing the farm will consist of SCUBA qualified farm technicians to work outside, inside, and under the cages and personnel that will carry out their jobs from the boats and/or the work platforms surrounding each cage. It is anticipated in the case of the copper alloy mesh netting, it will greatly reduce biofouling. Moreover, the calmer waters of the RRBP will generally reduce the need for farm maintenance and make daily farm operations routine.

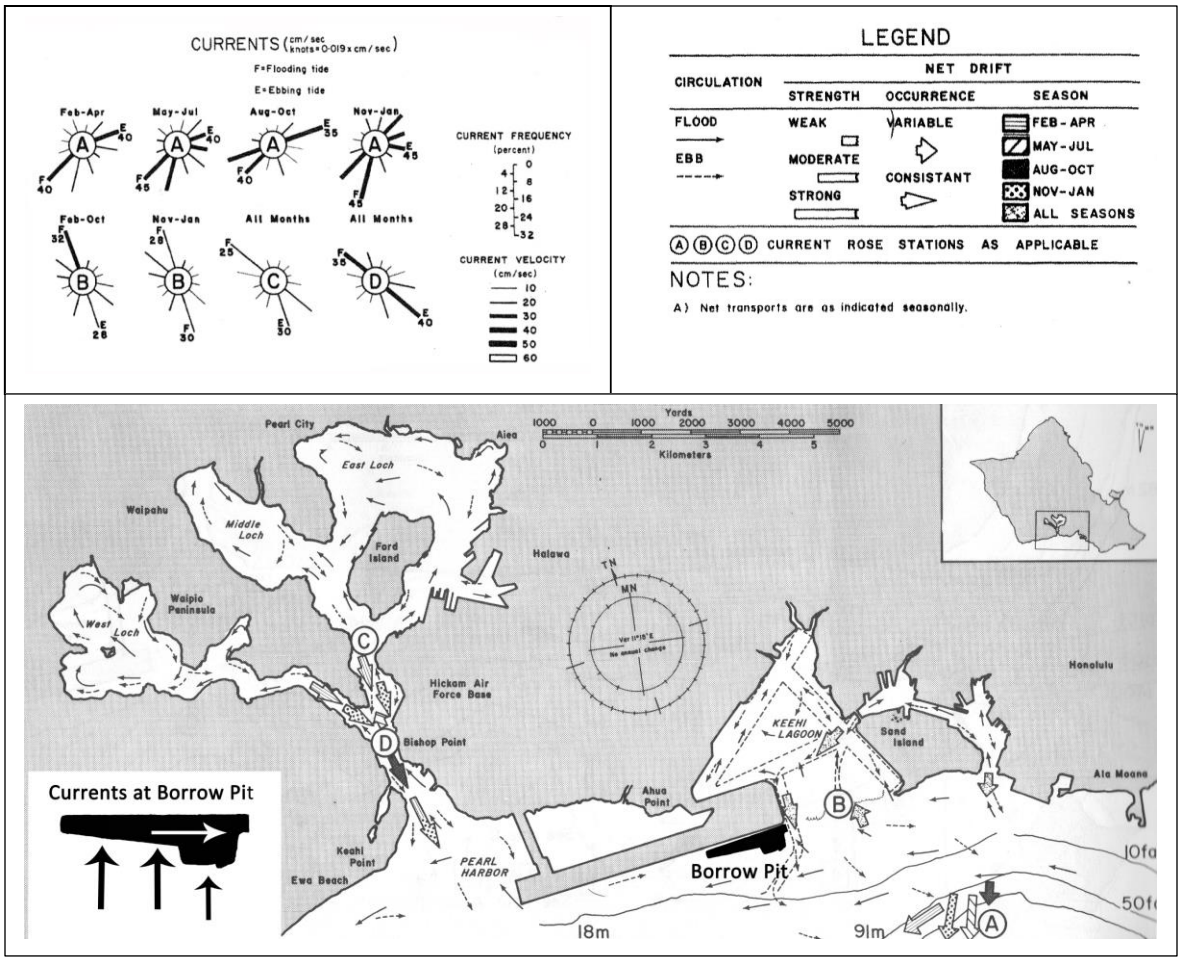

Fig. 10. Current patterns in Keehi Lagoon and vicinity. (Source: K. Bathen, 1978). Note: Borrow Pit pattern added based on field data.

It is requested that a low profile feed/security barge, about 74 ft long by 24 ft wide, be permanently moored at the site (Fig. 8). Fish feeding in individual cages will be observed by cameras and at times by divers, to verify management techniques and not to over feed and keep wastage to a minimum. Data on the water quality, currents and water exchange of the site suggest any feed not consumed and fish waste products (primarily dissolved nitrogen and feces) will likely be diluted and dispersed by currents within the BP and exit through the WCC to the open ocean. These organic materials will be rapidly recycled and reused by other organisms, e.g., fish, invertebrates, seaweeds and microalgae (Appendices A and B).

3.4.2 Proximity to a Coral Reef

The proposed MBS aquaculture project is located in the RRBP and adjacent to a reef flat in the western most portion of Keehi Lagoon; a highly disturbed fringing reef near urban Honolulu. It is a dredged area almost entirely surrounded on four sides by a shallow water area categorized as a coral reef (NOS, 2013a). BP waters will enter from the open ocean by flowing

over the outer reef, pass through the cage array and exit through a 480 ft opening in the eastern pit boundary to the WCC; a deep, dredged drainage channel (over 400 ft wide and 45 ft deep) leading to the open ocean (Fig. 10).

Recent mapping of shallow water benthic habitats in the main Hawaiian Islands by the National Ocean Service (NOS) have classified the habitats in and surrounding the RRBP into several zones: Reef Flat, Fore Reef, Bank/Shelf and Dredged (Fig. 11). As previously described, the entire proposed 75 acre site has been dredged and is designated Dredged on Fig.11. The seaward BP boundary consists of near vertical walls that level off to the adjacent shallow area termed Reef Flat (Fig. 11).

Operationally, the cages and the mooring system will be anchored within the BP boundary and not touch the vertical walls or the surrounding reef flat. A proposed 100 ft. wide access/buffer lane will be marked off and maintained around the site boundary to allow access to the Reef Runway by the AD and to the outer reef area by the public. MBS notes that submerged anchors and anchor lines will extend into the 100 ft wide lane to the base of the vertical pit wall on both sides and anchor lines will be kept no shallower than 15 ft. from the surface for boat clearance. MBS work boats will stay a safe distance from the BP edge during all farming operations.

MBS is working with Federal and State scientists to develop a proposed coral reef habitat monitoring plan in conjunction with the project and a draft outline can be found in Appendix B.

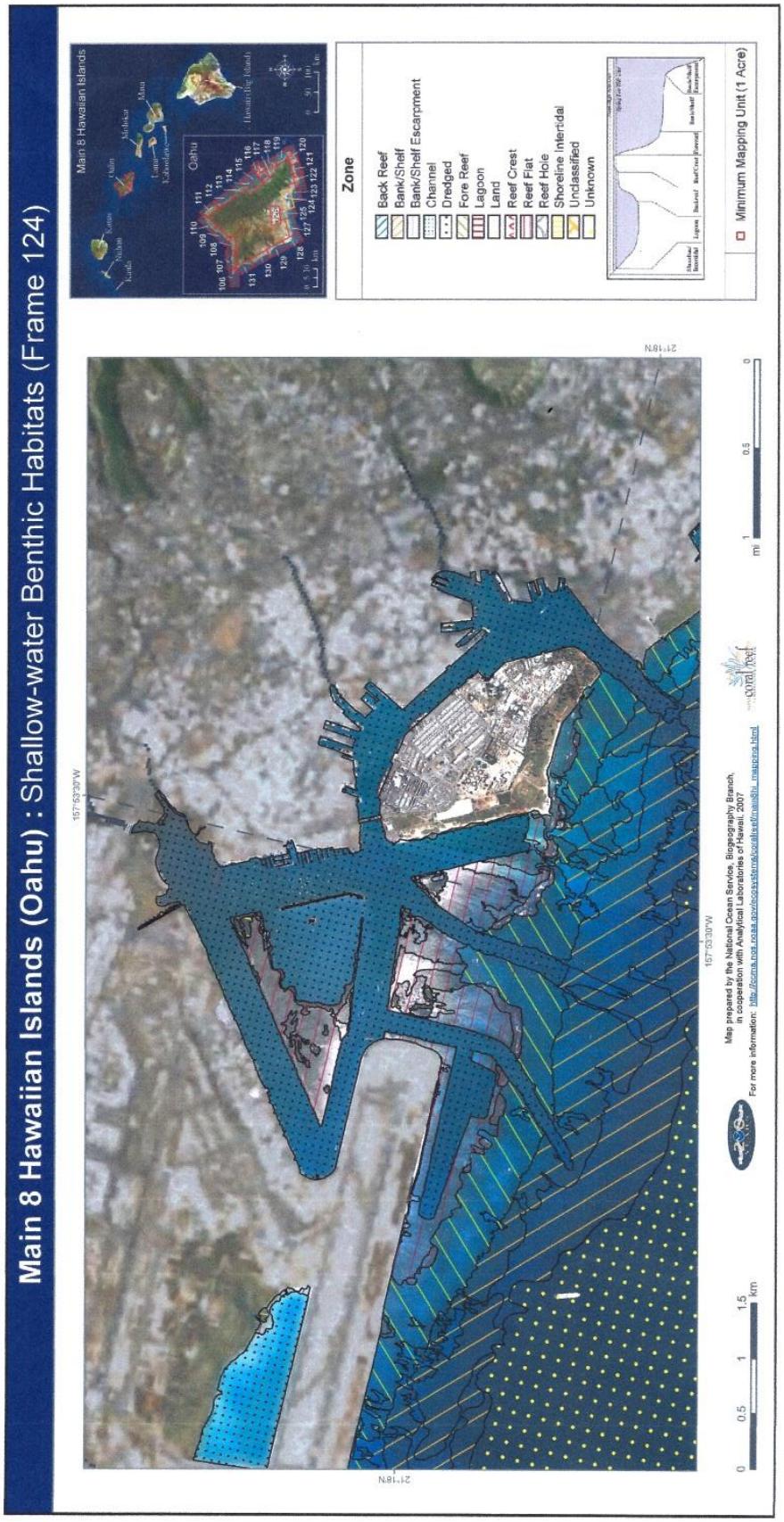

Fig. 11. Map of area surrounding the RRBP showing Benthic Zone classifications (Source: National Ocean Service).

4.0 ALTERNATIVE TO THE PROPOSED ACTION

4.1 PREFERRED ALTERNATIVE

MBS has significant experience working in Hawaiian ocean waters and specifically in siting and hands-on operation of a commercial-scale fish farm under open ocean conditions (APA, 2009). To illustrate this further, the Company Principal, over the past ten years, has been called upon to consult on site evaluations for ocean cage culture projects in remote locations around the world, including the Marshall Islands, the People's Republic of China, South Korea, Ireland, and the Bahamas (Cates, 2013). MBS utilized this expertise to evaluate the RRBP as a suitable site for surface cage technology, taking into account such key siting factors as:

- **Protection from severe storms and high surf allowing use of surface cages.** The BP's seaward edge is bordered by an extensive reef flat the length of the pit.
- **Significant currents and water exchange and mixing.** MBS observed that daily, large volumes of ocean water continuously flowed into the RRBP, pushed by the wind and waves. The inflow was mixed to the depth of the pit and excited through the eastern opening into the WCC and back to the ocean.
- **Water depth suitable for surface cages.** Depth of the steep-sided Borrow Pit was found to be dredged to a uniform depth of 45 ft to 50 ft, with little or no relief.
- **Bottom substrate suitable for anchoring cages.** The RRBP substrate was found to be flat and composed of fine silt less than a foot deep that would work well for anchoring cages.
- **Acceptable land influences on water quality.** The RRBP was found to not be significantly influenced by land runoff (e.g., three perennial streams in the area) due to its remote location and existing current patterns.
- **Compatibility with any protected species that may visit the area.** The RRBP is not appropriate habitat for most of Hawaii's protected species, with the exception of the green sea turtle (*Chelonia mydas*). Coral reefs are located in close proximity to the site and MBS has studied this issue in detail and finds it manageable.
- **Proximity of available harbor support facilities.** MBS noted the great advantages of this site with its closeness to the Company's existing shoreside facility and the seven day a week, 24/7 accessibility to the site through sheltered waters.
- **Manageable multiple uses.** Many years of site observations indicate the recreational use by the public of the site, particularly the interior of the BP where the cages would be located, is rare and the infrequent use of the BP borders can be accommodated.

MBS concluded from the evaluation, after preliminary discussions with the appropriate permitting agencies, that the Company has identified "off-the-shelf" surface cage technology that can be scaled to sustainably and responsibly produce moi within the 75 acres of the RRBP. The site offers MBS an opportunity to continue in successful commercial aquaculture while providing an environmentally manageable and logistically superior location to an open ocean site.

4.2 OTHER ALTERNATIVES EVALUATED

Several alternative approaches were considered to allow MBS to monetize its many years of aquaculture experience and continue to farm moi for the local market and export. Finding a suitable open ocean site on another island, with appropriate nearby harbor facilities was considered. While there may be acceptable offshore sites in reach of a harbor, execution would require substantial capital and not be consistent with the MBS financial plan of mostly self-financing, utilizing existing infrastructure advantages, and a phased development.

Likewise, MBS considered finding another site off the southeastern coast of Oahu. A previous consideration of this action found that ocean conditions, recreational and commercial use in candidate areas, location of domestic waste outfalls, and various restricted areas along this coast would make finding an available site a significant challenge. Again, with this approach, while there may be acceptable sites, it would require substantial capital to construct and start up a minimum size farm and this would not be a wise company strategy to move forward.

4.3 NO ACTION ALTERNATIVE

The No Action Alternative would mean the fish farm would not be built. Moi production for the local market would remain limited and supply statewide would continue to be inadequate. Economic benefits of the proposed project would not be realized e.g., no increase in employment, no increase in direct and indirect expenditures, and opportunities to further refine sustainable aquaculture technologies for Hawaii and contribute to an emerging global industry sector would be lost. Hawaii could lose a new, environmentally sustainable supply of seafood that would contribute significantly to greater seafood self-sufficiency and the Company would not be able to apply its accumulated aquaculture expertise to a new project. Thus the No Action Alternative is unacceptable.

5.0 DESCRIPTION OF THE ENVIRONMENT

The Keehi Lagoon, airport and RRBP areas have been extensively studied over the years as a result of HIA construction projects, as well as other shoreside and off shore developments (Table 1). Reference is made in the following sections to these studies, in addition to studies made by MBS.

5.1 REGIONAL SETTING

The proposed RRBP site is located in the western portion of Keehi Lagoon that has been previously extensively dredged to provide fill for the HIA Reef Runway. Keehi Lagoon is a large fringing coral reef located seaward of urban Honolulu's Moanalua District, that has been significantly altered by dredging and filling since the 1930s. Three perennial streams provide

fresh water influx into the lagoon: Moanalua, Kalihi and Nuuanu streams. The RRBP itself is bordered on its landward side by a small inner reef flat directly adjacent to the HIA Reef Runway and on its seaward side by a much larger outer reef flat exposed to open ocean conditions. The western extent of the BP ends in a continuation of the fringing reef. The eastern end of the BP opens to the Keehi Lagoon Drainage Channel, also called the Water Circulation Channel (WCC), which opens to the ocean and was constructed specifically to improve circulation and water exchange in the lagoon (Fig. 1 a, b) (FAA Pacific Region, 1972).

As a well-developed part of urban Honolulu, significant coastal features abound in the region (Fig. 1a, b). Most prominent is HIA and its Reef Runway, which was completed in 1977. HIA played host to 262,716 take offs and landings and 18 million passengers in 2011 (HIA, 2013).

To the west of HIA is Hickam Air Force Base, with its shore side recreation area, Hickam Harbor, and further west the entrance to Pearl Harbor. The eastern shore of Keehi Lagoon is bordered by a variety of light industry and marine-related recreational and commercial uses, e.g., Keehi Lagoon Park, Keehi Harbor, and Offshore Mooring Area, La Mariana Sailing Club, Sand Island Regional Park, Hawaiian Marine Educational and Training Center, and various small businesses on Sand Island and along Lagoon Drive (Fig. 1 a,b).

Seaward, within the eastern lagoon, there are designated two occasionally used sea plane runways, a Canoe Racing Zone and a competitive Water Ski Zone. Notably, as previously discussed, the entire RRBP site is within a designated Recreational Thrill Craft Zone for Jet Ski riding (Fig. 9). Well offshore of the RRBP, there are three designated anchorages for large ships awaiting entrance to Honolulu Harbor and the eastern border is part of a large Security Zone that extends toward the ocean and encompasses the entrance to Pearl Harbor (Fig. 2).

Table 1. Partial List of Environmental and Planning Studies for Projects at or Near Honolulu International Airport, Oahu.

Federal Aviation Administration, Pacific Region, 1972. Final Environmental Impact Statement, Reef Runway Project, Honolulu International Airport, Honolulu Hawaii. FAA, Pac. Region, Jan., 1972.

AECOS, 1979. Post Construction Water Quality, Benthic Habitat and Epifauna Survey for the Reef Runway, HIA. AECOS, Inc., 1979.

OI Consultants, 1986. Survey of Water Quality, Benthic Habitat, and Infaunal Populations for Keehi Lagoon, Hickam Harbor, Marine Pond, HIA. KFC Airport, Inc., 1986.

Brock, R., 1986. Post Construction Biological Survey for HIA Reef Runway: Eight Years Later. KFC Airport Inc. 1986.

OI Consultants, 1988. Survey of the Water Quality, Benthic Communities and Avifaunal Populations of Keehi Lagoon, Hon. Hi. KFC Airport Inc., 1988.

Airports Division, DOT and KFC Airport, Inc., 1989. Environmental Assessment for the Honolulu International Airport Master Plan Update and Noise Compatibility Program, Vol. 3. Airports Division and KFC Airport In., September 1989.

Noda, E.K. and Associates, Inc., 1990. Keehi Lagoon Recreation Plan and Final Environmental Impact Statement. DOT, Harbors Division, 1990.

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5.2 CLIMATE

The prevailing weather pattern throughout the Hawaiian Island chain is Northeast trade winds, which blow around 80% of the time at an average of 8 to 12 kts. Kona winds, where the direction is from the Southeast or Southwest, occur about 20% of the time (Juvik, et al., 1998). On Oahu, the Koolau and Waianae mountain ranges provide some shelter to reduce the intensity of wind, rain and seas generated by trade winds, making the near shore coastal waters of South facing shores of the Islands attractive for sea cage culture. Rainfall in Leeward Oahu averages between 30 and 40 inches per year (Juvik and Juvik, 1998).

5.3 OCEAN SETTING

5.3.1 Waves and Currents

Wind generates two types of waves: 1) sea that is caused by prevalence and intensity of wind in specific areas; and 2) swell or the wave, whose origin may be distant storms, that continues to travel without relation to local winds. Swell will break to form surf that is in direct relation to the size of the wave and the depth of the rising bottom. Both types of waves impact the RRBP.

The variable oceanic currents in the vicinity of the Hawaiian Islands are believed to depend mostly on the velocity and direction of the wind. The offshore waters along Oahu's South facing shore experience a general pattern of East to West flow in the range of 0.5 to 2 kts. During the semi-diurnal tidal changes (twice per day), the current velocity diminishes, and in some offshore areas, reverses in a circular motion.

The project site is almost completely protected from episodes of very high surf generated from North Pacific winter storms. South swells that can directly impact the area are generated from storms in the Southern Hemisphere and occasionally occur during summer months. Energy from these storm waves is largely dissipated by the extensive outer reef offshore of the project area and these episodes have a minimal physical impact on the interior of the pit, though large volumes of water flow into the BP at these times.

Water movement within Keehi Lagoon itself is highly dependent on tidal current influent and effluent and typical trade wind patterns. The 50 ft deep and 400 ft wide, dredged drainage channel or WCC, adjacent to the RRBP was specifically designed to provide for a counter-clockwise circulation pattern around the lagoon's outer reef and dramatically improve water quality in the lagoon (FAA Pacific Region, 1972). Flood tide currents enter the lagoon largely through the Kalihi Channel, which also drains Honolulu Harbor. Seaward water flow exits primarily out through the WCC (Fig. 10). The WCC generally serves as the main exit for seaward lagoon water flows, including the RRBP, due to the characteristic tidal and trade wind driven circulation (Appendix A).

MBS conducted numerous visual observations of current patterns from 2006 to 2013 and current meter and drogue studies two depths to look at current speeds and direction in and around the RRBP (Appendix A). Visual observations (including diver observations) at all times of the day and all phases of the tidal cycle indicate there is nearly a constant unidirectional flow of ocean water over the entire 5000 ft long length of the seaward outer reef border into the BP. BP water then flows eastward through the 480 ft gap in the BP to the WCC (a dredged channel 45 to 50 ft deep and about 400 ft wide) and out to Mamala Bay and the open ocean (Fig. 10).

A two day and ten day current meter study on the seaward BP border provided estimated average current speeds of water into the BP of between 3 cm/sec and 4 cm/sec for the two day deployment and 3 cm/sec to 5 cm/sec for the 10 day deployment (Appendix A). Two drogue studies deployed at two depths (12 ft and 25 ft) showed the pattern of water movement from the BP into the WCC where it is mixed with Keehi Lagoon water exiting to the ocean to ultimately mix with the Pacific Equatorial Current. Current speeds as measured by the drogue studies were about 6 cm/sec.

The observations support the characterization of the ocean water leaving the RRBP as a “wall of water” as it mixes with the WCC circulation (Appendix A).

5.3.2 Water and Sea Floor Quality

Water Quality

The MBS site is located in a sheltered nearshore dredged area that is dominated by inflows of open coastal seawater coming over the outer reef flat (Appendix A). The site is classified by the CWB, DOH as Class A waters, which allow effluent discharges by NPDES/ZOM permit from the CWB. Specific receiving water criteria for open coastal conditions based on Chapter 54 Hawaii Administrative Rules (HAR) are found in Table 2. Since the site receives open coastal water and is subject to significant fresh water runoff, the “wet” water quality criteria should be applied Appendix B).

Being in the Subtropics, coastal water temperatures for ocean waters off Oahu generally range between 23 °C and 28 °C and are very suitable for fish culture. A past study at the farm site indicated water temperatures in the RRBP are fairly uniform from the sea surface to near the bottom, demonstrating a well-mixed system within the BP (BPI, 2001). This pattern was confirmed by MBS’s sampling efforts (Appendix B).

Table 2. State of Hawaii Open Coastal Water Quality Criteria

Parameter	Geometric mean not to exceed the given value	Not to exceed the given value more than 10% of the time	Not to exceed the given value more than 2% of the time
Total Nitrogen (µg N/L)	150.00*	250.00*	350.00*
Ammonia Nitrogen (µg N/L)	3.50*	8.50*	15.00*
Nitrate + Nitrite Nitrogen (µg [NO_3 + NO_2] – N/L)	5.00*	14.00*	25.00*
Total Phosphorus (µg P/L)	20.00*	40.00*	60.00*
Chlorophyll *a* (µg/L)	0.30*	0.90*	1.75*
Turbidity (NTU)	0.50*	1.25*	2.00*
pH Units	shall not deviate more than 0.5 units from a value of 8.1		
Temperature	shall not vary more than 1˚C from "ambient conditions" considering input and oceanographic factors		
Dissolved Oxygen	not less than 75% saturation		

µg = microgram; L = liter; NTU = Nephelometric Turbidity Units

* "wet" criteria apply when the open coastal waters receive more than three million gallons per day of fresh water discharge per shoreline mile

BPI also conducted a survey of water quality in the RRBP in 1999 to determine current baseline values for parameters of interest to the DOH. Three locations were sampled; two within the BP and one on the outer reef seaward of the project site. Three depths were sampled, surface, mid-depth and near bottom. BPI concluded the data suggest that the water quality within the BP is a mix of water from within the lagoon and offshore ocean water that flows over the reef due to wave and tidal action. Further, analysis of the data suggested the water in the BP is dominated by the inflow of open coastal water from over the reef, and its quality is far more similar to the values observed in the offshore ocean stations. The data confirmed a consistent pattern of large ocean water flows passing over the outer reef and into the RRBP, where mixing occurs and the mixed water exits through the WCC (BPI, 2001).

MBS conducted two water quality profile studies in and near the proposed RRBP site to establish a baseline on December 21, 2010 during clear weather and on August 6th, 2013 after a rain event. The 2010 study consisted of vertical profiles of water temperature, salinity, and

dissolved oxygen measured as a percentage saturation at three stations two within the BP and one in the WCC. While the 2013 study consisted of surface and near bottom water samples at six stations, three within the BP and three in the WCC. Water quality criteria evaluated in 2013 included all specific criteria designated by the DOH for standards for open coastal waters in Chapter 11-54, Section 06 (b) (Open Coastal Waters), HAR (Appendix B).

Highlights from analysis of these temperature and salinity samples (both dates) include (Appendix B):

- All the stations within the RRBP had similar salinities (35.3 ppt to 35.5 ppt) in surface and deep samples showing little variability of the BP source water. The salinity profile plot strongly supports this point. Moreover, small range and salinity values indicate the BP consists of water of open ocean origin, i.e., inflow over the seaward reef.
- All stations had similar temperatures on the sampling date (26 ^{o}C and 28 ^{o}C) for surface and deep waters also indicating a common source. The temperature profile strongly supports this point.
- Salinity data for the profiles and the surface and deep samples taken together after a rain event show that: 1) a shallow layer of lower salinity water caused by runoff into Keehi Lagoon flows out the WCC; 2) stations in the BP show a slight depression of salinity in the first few feet, but the underlying strata are essentially oceanic composition; and 3) during rain events, salinity where the farm will be located will not be greatly affected.

In summary, data indicate the BP is characterized by typical open ocean coastal waters entering over the seaward outer reef with little contamination from land. Moreover, incoming water undergoes extensive mixing top to bottom while flowing eastward into the WCC and the ocean.

Highlights from analysis of water for nutrient and other parameters taken in 2013 include (Appendix B):

- Nutrient values found in BP and WCC samples vary from station to station probably due largely to biological activity, i.e., unlike temperature and salinity which are conservative parameters that change slowly over time, nutrient concentrations can change in minutes and hours.
- Within the BP nitrate nitrogen is elevated in surface water, while bottom water is substantially lower. Ammonium nitrogen in the surface water at Station 1, the western most part of the BP, is also substantially elevated. These variations are likely due to biological activity on the reef and in the BP.
- Turbidity values at the most landward station in the WCC are higher than the most seaward station in the WCC. This is attributed to turbid water from Keehi Lagoon flowing out the WCC.
- Values for chlorophyll a (an indicator of phytoplankton abundance) ranged between 0.96 and 1.96 µg/L, with the highest values from stations within the BP. These elevated values maybe a response to longer water residence times in the BP allowing for greater nutrient uptake by phytoplankton.

Sample values for nitrate, ammonium, total phosphorus, total nitrogen and turbidity fell within the DOH water quality standards for open coastal water, with the exception of one ammonium sample. The chlorophyll a values are the only parameters that exceeded a DOH criteria at every station, perhaps indicating influence of estuarine water from Keehi Lagoon on that day. Supporting this point, when values are compared to DOH criteria for embayments, none would be greater than either the Not to Exceed (NTE) 10% and NTE 2% and all but three samples would be below the Geometric Mean value. Hence, these values reflect typical values of more productive coastal embayments (Appendix B).

Sea Floor Quality

The RRBP was created in the early 1970s to provide fill for construction of the Reef Runway. In all, 1,000 new acres of new land were created using 19 million cubic yards of material from several sites including the Borrow Pit. Water depth ranges between 18 to 21 ft at the bottom of the steep reef edges and quickly descends to between 45 and 50 ft depth in the majority of the 75 acre site.

Previous SCUBA diving surveys in 1999 have described the BP margins as dominated by rock outcrops, with the southern margin descending at a steep angle and the northern and eastern margins inclining more gradually to the pit floor. Calcareous rock and rubble and coarse-grained sand are found in the reef flat and slope areas between 0 and 15 ft depth, particularly on the southern margin of the reef, which is subject to greater wave action (BPI, 2001).

The pit bottom was described as very flat due to the dredging and consists entirely of fine silt of varying depth. There was no hard substrate or relief of any kind in the central portions of the pit (Fig. 12). Visibility along the bottom was limited to around 3 ft due to the heavy silt loading and its constant suspension in the water column. Observations made by MBS from several dive surveys of the pit from 2009 to 2013 confirm these conditions have not changed extensively.

MBS carried out a benthic study of the BP on 10/10/13 (Appendix C). Samples were collected using SCUBA from six locations coincident with the approximate location of the aquaculture cages. The following parameters were assessed for each sample: general appearance, macro fauna, macro algae, oxidation/reduction potential (ORP) reading, and odor (presence of hydrogen sulfide or anoxic conditions). Subsamples were collected from each sample for laboratory analysis of: total organic carbon (TOC), benthic sand characterization (particle size), and micro mollusk characterization. These parameters are also used for benthic quality reporting to DOH and other agencies.

All samples were remarkably uniform in appearance, composition and analytical values (Appendix C). All samples were composed of fine silt. There was no evidence of live coral, hard substrate, or any macro organisms or biota in the samples or subsamples. The lack of biota and hard substrate is characteristic of sites near shore and inside a protected outer reef. These sample sites are all exposed to a high level of tidal currents, as well as swell energy and the resulting mixing may be driving the homogeneous sediment structure.

Chemical analyses were performed on the samples collected (Appendix C). Measuring the amount of TOC in benthic samples provides information on the amount of material that may be derived from decaying vegetation, bacterial growth, and metabolic activities of living organisms. Areas of high TOC content are also likely to be depositional sites for fine sediments. The sediments at all sites were uniformly fine in size. According to EPA pollution impact values, the measured TOC values are considered either good or fair (Appendix C).

ORP provides an indirect method to evaluate the level of biological activity in the benthos. Low ORP values that approach zero indicate a high amount of biological activity and insufficient exchange to maintain aerobic conditions. ORP values for all sites exhibited very high value (greater than 200) and show no evidence of anaerobic conditions in the substrate. This is also reflected in the light color and lack of odor of the sediments.

Samples were analyzed for mollusk shells, and indicator of the presence of living organisms. Results show all samples contained fine silt and not much else. The few items identified included: one mollusk shell, remains of small foraminifera (calcareous plankton) and a few pieces of crustacean carapace (Appendix C).

Fig. 12. Photo of a representative portion of the Borrow Pit substrate.

5.4 FAUNA AND FLORA

5.4.1 Terrestrial

Keehi Lagoon and the vicinity is an important recreational and commercial area for urban Honolulu that has been subject to major developments and ecological disturbances since the 1930s (Table 1). Native terrestrial fauna and flora have been degraded and displaced by intensive urbanization to the shoreline bordering the lagoon. Extensive dredging of what was a tidal lagoon with mud flats and a lengthy fringing coral reef was carried out at the beginning of

World War II. These changes included formation of several small islets that became populated by scrub vegetation and habitat conducive to water birds. During the construction of the Reef Runway over the period 1971 to 1977, several of these islets were destroyed, but the loss was mitigated by construction of three new island habitats within Keehi Lagoon and two large wildlife areas within the U.S. Naval Station, Pearl Harbor (FAA Pacific Region, 1972; Ed Noda and Associates, et al., 1991).

A recent environmental assessment in conjunction with an airport modernization project mentions approximately 17 species of introduced (i.e., non-native) birds that use HIA and the surrounding area as habitat (Parsons and Environet, 2013). Most all these species are birds that do not frequent the shore habitat. The lagoon area itself has occasionally been habitat for several common migratory shore birds: the Golden Plover (*Pluvialis dominica fulva*), Ruddy Turnstone (*Arenaria interpes*), and the Sanderling (*Crocethia alta*), that winter in the Hawaiian Islands.

With respect to native water birds, four species could reside in the general lagoon area, all of which are federally-protected species: These species are:

- Hawaiian Moorhen (*Gallinula chloropus sandvincensis*) - prefers freshwater habitats.
- Hawaiian Coot (*Fulica alai*) - prefers fresh and brackish water wetlands.
- Hawaiian Duck (*Anas wyvilliana*) - prefers fresh water habitats.
- Hawaiian Stilt (*Himantopus mexicanus knudseni*) - can use shallow fresh, brackish and salt water areas.

Review of the habitat preferences and Oahu population distribution of the moorhen, coot and duck indicate these species do not frequent the Keehi lagoon area and available feeding and nesting habitats are not acceptable in the lagoon area (e.g., full strength sea water and generally too deep); particularly in the RRBP and the aquaculture farm (USFWS, 2011).

Prior to the construction of the Reef Runway, the Hawaiian Stilt, a rare and endangered species, used the lagoon area as a seasonal feeding and roosting ground from June to January. While the eastern portion of the lagoon is still a resting and feeding site for stilts to some extent, experts indicate the large mitigation habitats constructed by the US navy at Honouliuli and the Pearl Harbor area became much more beneficial for populations of water birds. Oahu-wide observations indicate most water birds, particularly the Hawaiian stilts, have left Keehi Lagoon and re-established elsewhere (DLNR, 2013; USFWS, 2011).

5.4.2 Marine

The marine ecosystem in and around Keehi Lagoon has been well-studied over the past 40 years due to execution of numerous major plans and projects for the area (Table 1). Virtually every study that focused on the Lagoon has concluded that the inner lagoon is poorly populated by invertebrates and demersal fish and most marine species are characteristic of disturbed habitats. Comparisons in 1972 (prior to construction of the Reef Runway) with other

reef areas in Hawaii concluded that the mid-reef and reef edge at Keehi Lagoon are poor in terms of marine mollusk and coral species diversity and abundance. Benthic algae found in abundance in Keehi Lagoon are forms that tolerate or require fairly high levels of inorganic nutrients (FAA Pacific Region, 1972).

A 1989 study of the Keehi Lagoon marine ecosystem for the HIA Master Plan EA found a species complex typical of environmentally stressed areas, but noted the area is inhabited by a number of invertebrates and fish, some of which have recreational value. The same study indicated that significant changes to the water quality and/or benthic fauna of the lagoon have not occurred since construction of the Reef Runway (Ed Noda and Associates, et al., 1991).

A 2001 project did an evaluation of the biological community, specifically in and around the RRBP, in conjunction with an EA for a pearl farm. The study also concluded that Keehi Lagoon generally is a poor area biologically relative to most Hawaiian coastlines due in large part to episodes of high turbidity and high organic loading. Moreover, the distribution and abundance patterns for corals are more typical of a disturbed environment (BPI, 2001).

This same pearl farm project did more extensive field surveying of the biological community (macro algae, macro invertebrates and coral substrate coverage and type) in and around the edges of the RRBP. A total of 24 twenty five meter transects, encompassing 8 sites and 3 depths (1 m, 3 m, and 10 m), were carried out (BPI, 2001). With respect to the steep edges of the BP, there was a strong correlation between algal abundance and diversity and depth. Forty-one species of algae were found at stations above 1 m, declining to 14 species at the 3 m depth and only 4 species at 10m. Algal abundance (coverage) at 10 m and 3 m was similar at around 2%, while average coverage increased to over 26% at the most shallow depth.

MBS carried out a biological assessment of the RRBP in 2013, with emphasis on the coral community. The field survey identified coral species (discussed in the next section), in addition to reef fish, invertebrates and macro algae on the RRBP edges and the seaward reef flat (Appendix B).

Reef fish were common throughout the area with counts of 574 individuals along the wall and 400 on the reef flat, with species numbers being 28 and 29 respectfully. The most abundant fish were the parrotfish (*Scarus psittacus*), particularly along the wall. Other abundant species were several species of surgeon fish (i.e., the Yellow Tang (*Zebrasoma flavescens*) and the Unicorn fish (*Naso unicornis*). Along the basin wall, numerous small papio (*Caranx melanpygus*) and Moorish Idols (*Zanclus cornutus*) were observed (Appendix B).

Considering non-coral invertebrates, the most numerous taxa were sponges, which were abundant in crevices and under ledges. Several species of tunicates, sea slugs, bryozoans, fan polychaete worms were also common on the basin walls and reef flat. Other common species were sea urchins: Collector Urchin (*Tripneustes gratilla*), Long Spined Urchin (*Echinothrix* spp.), and Boring Urchin (*Echinometra mathaei*). Pearl oysters (*Pinctata margaratifera*) and

introduced Saddle Oyster (*Anomia nobilis*) were also common in both areas. All the observed invertebrates are considered common in offshore reef environments (Appendix B).

Marine macro algae were not overly abundant at any of the survey locations. Five species of algae were observed, with only one species (*Halimeda opuntia*) considered abundant. Another alga, (*Padina* sp.) was the only other alga considered common on the basin wall (Appendix B).

5.4.3 Coral Reef Habitat

The RRBP site is nearly surrounded by benthic habitat broadly classified as coral reef. Detailed GIS mapping of the area by NOS includes data layers describing: typical insular shelf and geomorphology or zones, geomorphological structure types, and benthic communities' substrate and/or cover type (NOS, 2013b).

The RRBP is nearly surrounded by habitat classified as Reef Flat (Fig. 13 a). A reef flat is defined as:

Reef Flat - Shallow (semi-exposed) area between the shoreline and intertidal zone and the reef crest of a fringing reef. This zone is protected from high-energy waves commonly experienced on the shelf and reef crest. Typical habitats are: sand, reef rubble, sea grass, algae, and patch reef (NOS, 2013b).

Seaward of the reef flat is a zone classified as Fore Reef (Fig. 13 a) Fore reef is defined as:

Fore Reef - Area from the seaward edge of the reef crest that slopes into deeper water to the landward edge of the bank/shelf platform. Features not forming an emergent reef crest but still having a seaward-facing slope that is significantly greater than the slope of the bank/shelf are also designated as fore reef. Typical habitat is spur and groove (NOS, 2013).

The structure seaward of the RRBP is Spur and Groove (Fig 13 a). Spur and groove is defined as:

Spur and Groove - Structurally having alternating sand and coral formations that are oriented perpendicular to the shore or bank/shelf escarpment. The coral formations (spurs) of this feature typically have a high vertical relief relative to pavement with sand channels and are separated from each other by 1-5 meters of sand or hard bottom (grooves), although the height and width of these elements may vary considerably. This structure typically occurs in the fore reef or bank/shelf zone (NOS, 2013b).

Survey information is also available for the habitat surrounding the RRBP (Fig. 13 b) In this case habitat refers to each benthic community's cover type. It is noted that habitats are defined by NOS in a collapsible hierarchy ranging from four classes, to more detailed categories, to patchiness of some specific features, e.g., per cent coverage (Fig. 13 b).

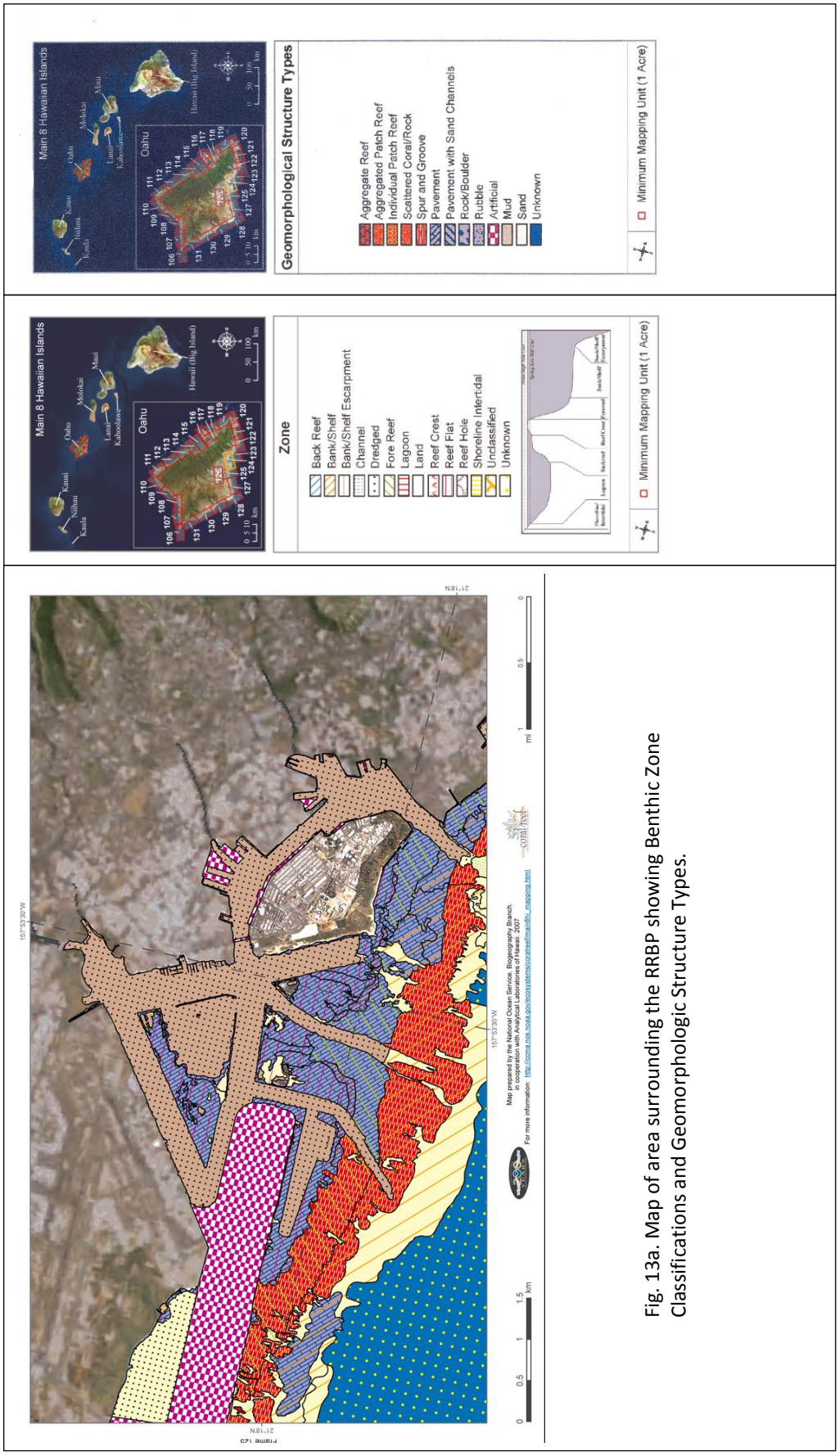

Fig. 13a. Map of area surrounding the RRBP showing Benthic Zone Classifications and Geomorphologic Structure Types.

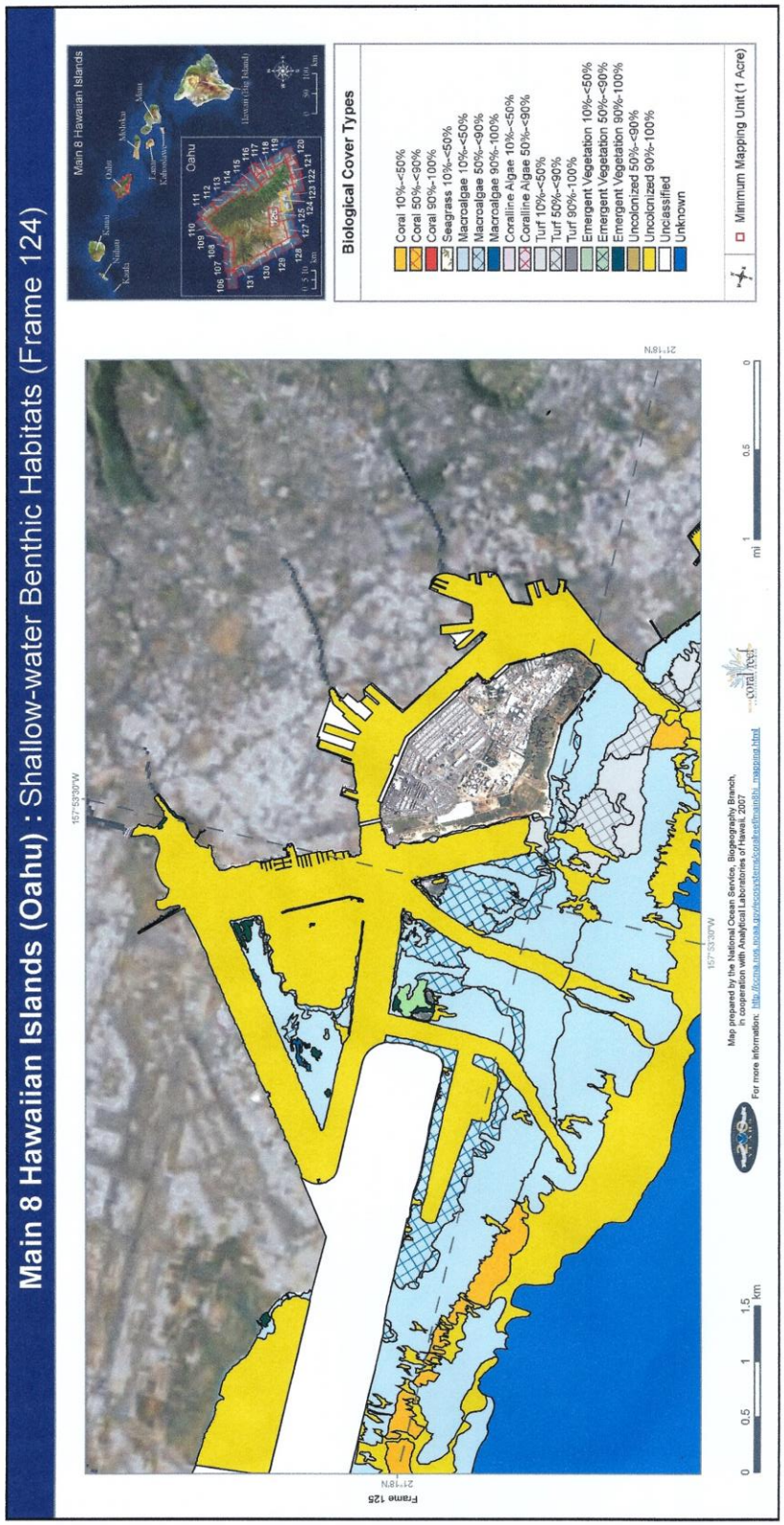

Fig. 13b. Map of area surrounding the RRBP showing the Biological Cover Types (Source: National Ocean Service).

According to the NOS survey, the RRBP is surrounded by habitat coverage that is dominated by macro algae not corals (Fig. 13 b). Coverage of macro algae, i.e., a patchy discontinuous distribution, is between 50 % to less than 90 %. This is consistent with the previous BPI biological survey that described a coral distribution and abundance in the BP area that were both low (BPI, 2001). Coral colony size was small. Colonies were nearly absent on the borrow pit walls below 10m due to siltation and total average coverage was 0.06%. The 3m depth had the highest average percent coral cover at 1.7% and highest species diversity. Dead coral and rubble dominated the majority of coverage at this depth. This study also observed that the reef flat at 1m depth had low coral cover (0.5%) with colonies of very small size due to frequent high wave energy conditions (BPI, 2001).

MBS's biological assessment of the farm site and surrounding area particularly took note of coral communities. A total of ten species were observed; four species were abundant on the shallow basin walls (*Porites lobata, Pocillopora meandrina, Montipera capita, Montipera patila*) and no species were considered abundant on the reef flat.

Corals on the shallow reef flat were predominantly small and scarce, with the majority consisting of colonies of *Pocillopora damicornis.* In contrast, corals growing on the edges and vertical walls of the pit comprised a relatively diverse community of large colonies of varied species and growth forms. Most abundant were large hemispherical colonies of *Porites lobata* and *P. annae.* The survey noted that based on its status as an endemic species, *M. putula* is a candidate species for Endangered Species status, though there has been no final decision (Appendix B).

Overall, the 2013 MBS assessment of corals is generally consistent with the previous 2001 BPI assessment and more recent NOS GIS mapping.

5.5 RARE, THREATENED AND ENDANGERED SPECIES

The Hawaiian stilt is a State recognized indigenous species and listed federally and by the State as Endangered and is occasionally seen in the Keehi Lagoon area. On Oahu, most of the population can be found on the North Shore and Windward coast at Kahuku and Nuupia ponds in Kaneohe (DLNR, 2013). Further, there are no critical habitats designated for the stilt in the Keehi Lagoon area. It is known the stilt prefers sites with a water depth of less than 9 inches and limited and low growing vegetation, or exposed tidal flats (DLNR, 2013). The RRBP, the surrounding reef flats and the cage system do not provide this type of habitat.

The other important rare, threatened and endangered species of concern to Federal and State authorities in Hawaii are: the hawksbill turtle (*Eretmochelys imbricata*), green sea turtle (*Chelonia mydas*), monk seal (*Monachus schauinslandi*), and the humpback whale (*Megaptera novaeangliae*).

Monk seal sightings occasionally occur in the main Hawaiian Islands, and statewide there are usually a few sightings every year. Monk seals are generally not observed in well-populated areas, though sightings regularly occur on some popular beaches.

The hawksbill turtle is infrequently seen in the main Hawaiian Islands. Green sea turtles frequent the main Hawaiian Islands, though their principal nesting sites are in the Northwest Hawaiian Islands. Green sea turtles have been observed by MBS on occasion at the RRBP site during the site assessment visits.

Humpback whales winter in the Hawaiian Islands from approximately December to April every year. Notably, the South shore of Oahu is not part of the Hawaiian Islands Humpback Whale National Marine Sanctuary. Moreover, the proposed inshore site in not suitable whale habitat.

5.6 OCEAN ACTIVITIES

Keehi Lagoon today functions as a large, mixed-use commercial and recreational area for the people of Honolulu. The eastern portion of the lagoon is bordered by numerous small businesses, many of which require access to the ocean, e.g., ship repair, ocean tourism, commercial dockage, etc. Passage to the ocean is primarily through the Kalihi Channel and to a lesser extent, through the WCC adjacent to the RRBP. Notably, one of the islands, Mokauea Island, in the eastern portion of the lagoon and roughly opposite the State boat ramp, is the location of several permitted houses.

Designated areas within the lagoon are set out for competitive canoe racing, water skiing, and jet skiing. There are several shoreline parks, extensive mooring areas for power and sail boats, and launching ramps for trailered boats. These activities are concentrated in the eastern portion of the lagoon, while the proposed farm site is located in the far western portion (Fig. 1 a, b). There are also several designated sea plane runways located in the western lagoon, with one commercial sea plane charter business based on Lagoon Drive currently operating.

A previous study of the ocean activities within the BP and on the inner and outer reef flats that border the dredged area have been described as: fishing, from boat and shore; SUCBA diving and snorkeling from boats; kayaking; tropical fish collecting from boats; and thrill craft riding (BPI, 2001). There are two man-made islands bordering the WCC, approximately opposite the end of the Reef Runway and in the airplane takeoff flight path (Fig. 1a, b). The islands, named Mokuoeo Island and Oufi's Island, are only accessible by boat and they are occasionally used for recreational purposes, e.g., shore fishing.

A 2001 EA for locating a pearl farm in the RRBP describes a six-month user survey of fishing and recreational activities in the Keehi Lagoon area from March to August, 1999 (BPI, 2001). Highlights from the survey that relate to use of the RRBP are as follows:

- A ramp questionnaire survey of boaters from Keehi Marine and the Sand Island boat ramp indicated only 13% of respondents frequented the BP area (inner and outer reefs) and 2% reported fishing in the pit.
- Respondents that reported fishing for recreation only was 76%, with the balance fishing commercially.
- Principal target species of fish by rod and reel were surgeon fish (palani, *Acanthurus dussermerii*), goatfish (moana, *Mulloidichthys* spp.) and barracuda (kaku, *Sphyraena sphyraena*). Notably, only one fish was reported being caught in the BP, a banded goatfish (moana, *Mulloidichthys* spp.).
- The study concluded that although there is occasional heavy recreational and subsistence fishing on the seaward outer reef flat area; there is negligible fishing activity in the dredged portions (BPI, 2001).

MBS visited the RRBP 80 times over the period 2006 to 2013; on various days of the week, times of day, and weather conditions. The purpose was to observe wave and current conditions, water quality, and public use leading to a determination of site suitability for surface cage aquaculture (Appendix D).

Highlights of this study include:

- On 20% of the trips of 16 times fishing in the area was observed. On 69 % of those occasions or 11 times, the activity occurred on the seaward outer reef bordering the BP.
- On 6 % of the trips or 5 times, diving (mostly snorkeling) was observed. On all occasions this activity took place offshore on the outer flat.
- During these 80 site visits, no jet ski use of the BP was observed and on one occasion a kayak was seen on the outer reef.
- MBS concludes the RRBP, and its seaward edge, is lightly used by the public and the interior of the 75 acre BP is rarely or not used at all, except for perhaps an occasional boat transiting the area.

Possible reasons for this use profile include: the BP is a dredged area of low biological productivity; noise levels from the nearby airport runway; jet ski enthusiasts prefer a more challenging environment; and the popular belief that the RRBP is a secure zone since the World Trade Center tragedy and off limits (Appendix D).

5.7 SCENIC AND VISUAL RESOURCES

The RRBP portion of Keehi Lagoon is located within a highly urbanized, industrialized area of Honolulu, bordered by the HIA and the Reef Runway. For example, in 2011 HIA hosted 262,716 takeoffs and landings and 18 million passengers (HIA, 2013). Access to the shoreline of the pit is highly controlled by the AD for security reasons in a post-9/11 world.

Past and recent studies of BP use indicate the proposed fish farm site is not heavily utilized by the public for recreational boating, fishing, diving, thrill craft riding, kayaking, etc. (Appendix D). This in part may be due to the generally unattractive nature of the RRBP habitat and the

frequent loud aircraft noise from take offs and landings, as well as, the popular belief that the area is restricted due to airport security concerns. Directly offshore of the farm site there are three designated anchorages for large ships prior to their entering Honolulu Harbor (Fig. 2).

The sea cage farm will visually consist of ten 114 ft in diameter circular surface cages, each surrounded with a ramp and rail 4 ft above the water. In addition, the 75 acre site will contain a low profile feed/security barge approximately 75 ft long and 24 ft wide and 8 ft above the surface that will be permanently moored in the area. The site boundaries and the mooring grid will be marked by surface buoys of varying sizes (Fig. 3). Overall, MBS believes the project footprint will be low profile, unobtrusive and not significantly detract from the existing scenic value of the Reef Runway area.

5.8 HISTORICAL AND CULTURAL RESOURCES

The HIA and the RRBP are located in the Moanalua Ahapuaa, a region with a rich cultural history and that had a sizable native Hawaiian population living there prior to western contact. After western contact in the late eighteenth century, the coastal area bordering Keehi Lagoon gradually changed over the years from a rural agriculture and fishing community to a developed and industrialized part of urban Honolulu. In particular, major changes (e.g., dredging and filling) occurred in the coastal area and large fringing reef just prior to and during World War II. The last significant change occurred with the construction of the Reef Runway in the early 1970's (Appendix E)

HIA consists of 4,520 acres, 2,520 acres of fast land and 2,000 acres of submerged lands. Keehi Lagoon is today an urbanized coastal area, highly developed and ecologically disturbed, with portions of the marine environment dedicated to various ocean activities. The HIA land and water site has been extensively surveyed and studied over the years as a result of numerous small and large renovation and expansion projects for the Airport (Table 1). A comprehensive EIS, finalized in 1991, concluded there are no archeological, historical and cultural sites on the airport property (Ed Noda and Associates, et al., 1991). This is consistent with MBS's numerous observations at the RRBP (Appendix E).

Further, based on its eight years of intermittent observations of the site (2006 to 2013), MBS believes the RRBP inner reef area is not an area used by individuals or families for traditional practices or customary gathering rights. Access to the shoreline is limited and highly controlled by Airport Security after the 9/11 attack and subsequent Homeland Security regulations.
The outer reef of the BP area can be reached in good weather by boat for fishing and diving activities, as noted by past studies and MBS's observations (BPI, 2001, Appendix D). However, the BPI use survey indicated frequency of activity was very limited along the walls and in the deeper, interior waters of the BP, where the cages would be sited (BPI, 2001).

MBS from repeated visual surveys of the RRBP area from 2006 to 2013 believes this pattern of limited use continues today. The inner reef shoreline is even less accessible by land due to

heightened airport security measures in recent years. Moreover, MBS understands from casual conversations with ocean users that boaters tend to avoid this area due to the noise from the runway, its low productivity, and airport security concerns.

The outer reef flat of the RRBP, which extends to deep ocean water and is accessible from the ocean on relatively calm days, has much greater quantity and diversity of marine life in general and does receive greater public use. However, as noted by both surveys, the deep portions of the BP are rarely if at all utilized for fishing and diving. This is again probably due in large part to the depauperate nature of these environments for desirable marine life. Frequency of transit through the BP to the outer reef area could increase after the farm is in place and this issue will be addressed later in this EA (Appendix E).

6.0 Potential Impacts and Mitigation Measures

The Keehi Lagoon and RRBP area have been extensively studied over the years as a result of various construction projects at HIA, as well as other shore side and offshore developments (Table 1). Reference is made in the following sections to these studies, in addition to studies made by MBS.

6.1 SHORT-TERM IMPACTS

MBS plans to initially deploy five (5) cages in the BP in the first six months after the lease approval (Phase I); those five cages shown in the eastern portion of the grid (Fig. 3). In general the mooring grid and anchors for the initial five cage array will be installed first. The floating ring portions of the cage will be assembled one at a time offsite near the Company's Keehi Lagoon base yard and towed to the site one at a time. The choice of netting will be brought to the site by work boat and installed for each cage. Lastly, the feed /security barge will be placed (Fig. 8). Aqualine AS representatives, who have installed cages all over the world, will be in Hawaii to advise on the installation and MBS will utilize its staff that is highly experienced in working in the ocean.

There will be short-term and insignificant impacts on the water quality and soft bottom sediments, while farm infrastructure is put in place. Installation of the cages and anchors will cause minor, short-term disturbances to water quality and turbidity, which should clear up quickly given the water depth and consistent current patterns at the site. The bottom of the RRBP consists of fine silt and is devoid of relief and depauperate with respect to animal and plant life. Installation equipment will stay away from the BP walls and the shallow reef flat during all farming activities.

The general installation plan, with estimated timeframes, will be carried out as follows:

Phase I

Step 1: The mooring grid for the five cages, 14 anchors and the required cables, fasteners and lines will be installed followed by the mooring for the feed/security barge. Work boats with appropriate crane equipment for lifting and lowering heavy anchors will be used. (Timeframe - 5 days).

Step 2: The newly deployed anchor grid will undergo final adjustment of the tensions in the connecting system. (Timeframe - 2 days)

Step 3: The initial two floating cage rings will be assembled off site and towed to the RRBP one at a time. The cages will be connected to the mooring grid as recommended by the manufacturer. (Timeframe - 7 days)

Step 4: The feed/security barge will be towed to the site and installed at the appropriate grid location. (Timeframe - 2 days)

Step 5: The netting materials for each cage will be assembled into net sections off site and brought to the site by work boat. Netting will be installed for each cage, with the assistance of a boat-mounted crane and farm technicians and SCUBA divers. Attachment of the netting to the floating ring will be made using the brackets and connectors provided. (Timeframe - 10 days)

Step 6: Once cages and netting are in place, the feeding hoses will be run from the feed/security barge to the initial cages. (Timeframe - 1 day)

Step 7: Within 6 months and additional 3 cages will be added to the grid, by repeating the steps described above. (Timeframe - 14 days)

Phase II

Step 8: Within 3 years of approval and successful operation of the first five cages, installation of the remaining five cages and mooring system will be carried out in the more western portion of the site, as described above (Fig.3). (Timeframe - 40 days)

In summary, the estimated installation time for the first 5 cage array in Phase I is approximately 41 days or less. Phase II could also take up to 40 days to deploy. Factors affecting these estimated timetables include: weather, scheduling of equipment and personnel and availability of fingerlings from the Company's hatchery for stocking.

6.2 LONG-TERM IMPACTS

6.2.1 Water and Substrate Quality

Water Quality

MBS has observed environmental conditions in the RRBP site for many years and under a wide variety of weather conditions, since its place of business is on Sand Island. The Company has tested the water quality under normal trade wind conditions and a during severe rain event, when runoff visibly impacts Keehi Lagoon and has concluded that land derived sources of sediment and pollutants are occasional and don't significantly affect the RRBP site (Appendix B).

An important issue with conducting fish farming in the RRBP is the potential for accumulation of nutrients (particulates and dissolved) around the cages that result primarily from daily feeding of stock and the waste products generated from fish metabolism. MBS has conducted several types of current studies in the RRBP to determine the current speeds and direction, water residence time in the basin and the number of daily exchanges of water experienced by an individual fish cage (Appendix A). Results suggest top to bottom mixing of BP water and practically uni-directional flow of ocean water coming over the reef flat into the pit and a "wall of water" flowing out the eastern side to the WCC (Appendix A). Using the range of predominantly observed current speeds of 1 cm/sec to 6 cm/sec, the volume of an individual cage would roughly turnover from 1 to 6 times per hour or 24 to 144 times per 24 hour period. Therefore MBS has concluded at proposed maximum stock densities of 10 kg/m^3, water quality can be managed to meet State effluent discharge standards (Table 2). That is, the farm can be managed to stay within the assimilative capacity of the BP environment based on the strong currents and mixing pattern of circulation, as well as, the anticipated up take of particulate and dissolved waste products by the existing ecosystem and the marine life induced by the cage system (Price and Morris, 2013).

The MBS farm will require a NPDES/ZOM permit from the State DOH when biomass reaches 100,000 lbs. per year (APA, 2011). A comprehensive monitoring program by a qualified consultant will be put in place and reports regularly made to the responsible agencies. A recent comprehensive review of the scientific literature covering impacts of marine aquaculture on the environment concluded that two important keys to sustainable marine aquaculture are: 1) a site with sufficient currents to mix, dilute and recycle waste products and 2) a well-designed environmental monitoring program to identify problems early for mitigation (Price and Morris, 2013).

Should issues over elevated nutrients arise, a number of effective mitigation measures are available to MBS to control amounts of particulates (uneaten food and feces) and dissolved (largely ammonium, the non-toxic form of ammonia, at the pH of sea water) waste products into the environment. These measures include: 1) modifying electronically controlled feeding schedules, 2) adjusting cage biomass, 3) altering cage cleaning schedules, and 4) if necessary,

periodically repositioning cages within the grid to allow recovery of a particular spot (see below).

Substrate Quality

As previously described, the 75 acre RRBP was extensively dredged in the early 1970's to produce fill for the Reef Runway. Past and recent surveys by MBS indicate the BP has steep nearly vertical walls and the floor is relatively flat and laden with silt (Appendix B). Moreover, based on previous descriptions the physical structure of the pit and the WCC has not significantly changed since their creation.

At full build out, the aquaculture farm will consist of 10 surface cages, a mooring grid and 28 anchors. Anchors will be deployed on the silty, barren bottom on both sides of the BP (Fig. 3). Once deployed, expectations are they will remain in place for the project duration. With the very sturdy mooring system being utilized, the bottoms of the surface cages will be maintained approximately 20 ft. off the substrate and away from the pit walls at all times.

The MBS sampling and analyses points to several important conclusions that relate to maintenance of BP benthic quality (Appendix C):

- The farm site is characterized by its lack of biota and hard substrate and similar to other Hawaii locations behind a protective reef.
- All samples sites are exposed to a high level of tidal currents, as well as, energy, and the resulting mixing causes the homogeneity of sediment structure. Also, this study confirms the strong mixing and currents in the RRBP measured by the MBS current study (Appendix A).
- The lack of biota and homogeneous substrate, provide evidence that any discharge will have little effect on the benthic composition.
- A low TOC value confirms the absence of potentially harmful organic chemicals from industrial discharge. Also confirming the conclusion from water quality analyses the RRBP environment is largely oceanic in origin and is not influenced by land runoff (Appendix B).
- Consistent monitoring of the RRBP and adjacent area will provide sample data to identify potential deleterious impacts on the sediments, though none are expected.

Conducting fish farming in the RRBP environment raises the issue of accumulation of nutrients in the sediments, which numerous studies indicate is the greatest quality maintenance issue (Price and Morris, 2013). MBS believes the issue is manageable and the farm can stay within the assimilation capacity of the environment. The site has a large volume water exchange with the ocean and the wind, wave and current patterns present cause the pit to be well mixed over its depth, with a high turnover rate and have an erosional sea floor swept by strong currents (Appendix A and C, EA; Price and Morris, 2013). In addition, the surrounding reef ecosystem and the ecosystem that will develop around the cages will mitigate impacts by consuming particulate and dissolved waste products for recycling and reuse by the environment (Price and Morris, 2013).

Benthic impacts will be regularly monitored by a qualified consultant, as part of the planned overall monitoring program. Mitigation measures are available to manage impacts of feeding and waste product production, if needed, including: 1)quantitatively modifying feeding amounts and schedules, 2)adjusting cage biomass, 3)modifying cage cleaning schedules and 4)if necessary, periodically repositioning cages within the grid.

This last measure, called fallowing a site, is used in European offshore aquaculture and elsewhere, as a tool to help manage water and substrate quality on near shore cage farm sites, usually in sheltered waters (Price and Morris, 2013) In the RRBP situation, if necessary due to unwanted nutrient build up in the substrate under a cage, MBS would move the cage on the grid line about one cage diameter, so that the former area would not have any more nutrient inputs. The area could then naturally return to ambient conditions. Expectations are this process would occur relatively quickly (a matter of weeks or months), as has been demonstrated by offshore farms in Hawaii and elsewhere (Lin and Baily-Brock, 2008; Price and Morris, 2013).

6.2.2 Fauna and Flora

General Discussion

Placement of a surface cage aquaculture farm in the RRBP will essentially create new habitat in an otherwise barren area of Keehi lagoon. The sea cages and mooring system provide new substrate for attraction and attachment of reef animals and algae. Species may be expected to take up residence for days, weeks or longer or be highly transient.

The main nutrient sources that will help maintain this new ecosystem are uneaten feed, fish waste products and pulverized material cleaned from cages and moorings. Experience with placing structures in the ocean indicates this new habitat will attract a dynamic mix of species that comes into a dynamic balance with the environment around the cages. The impact of this cage ecosystem on near and distant organisms and habitat (e.g., recruitment of the larvae and juveniles of various reef species) is not considered significant given the relative size of the farm habitat and the large expanse of available natural habitat for reproduction and recruitment on the South Shore of Oahu (Appendix B).

Disease

There is a public concern over the potential for disease transfer from cultured stock to wild fish and a farmer concern over transfer of disease from wild species to farmed species. MBS will apply well tested Best Management Practices (BMP's)to its operations; including inspection of fingerlings for disease prior to stocking, maintaining highly controlled feeding rates to minimize wastage, utilizing low stocking densities suitable for the growing environment and regular removal of fish mortalities and cage cleaning.

Stringent biosecurity procedures, adapted from large-scale marine hatcheries in Europe, will be adopted at the MBS hatchery, including highly controlled access to the facility by visitors and managed movement of staff within the facility (CEFAS, 2009). Plans are for extensive disease testing at three stages of the grow out process: 1) stock going into the cage, 2) at 4 months into the grow out, and 3) just before the fish are harvested. Should a disease event occur in the stock, State officials (DLNR, DOA, and DOH) will be notified and approved treatment and stock disposal procedures for aquatic species will be followed.

Escape of Stock

Escape of the cultured stock from the cage environment has been an issue raised with Hawaii offshore projects due to the concerns over potential for transfer of disease to wild stocks and genetic impacts of escaped cultured fish on wild fish. Essential business priorities for farmers are maintenance of fish health and no fish losses from escapes. In the case of the MBS farm, the strength of the proposed netting options provides an added benefit of being much more resistant to tearing than conventional netting.

In regard to the genetics impact issue, several points can be made. Broodstock moi to produce fingerlings for stocking will be sourced by MBS from various locations around the main Hawaiian Islands. It is known that Hawaiian moi are genetically the same and represent one population (Pan and Yang, 2010). Therefore, fingerlings produced from these wild fish would be genetically the same as wild fish. Any escape would function as a stock enhancement event similar to that previously carried out by DLNR (Ziemann, et. al., 2004). Moreover, small moi will be subject to intense predation by near shore predators.

Broodstock for the MBS hatchery will be replenished about once a year by capturing up to 100 juvenile and adult fish from the wild and on site breeding will not be carried out. This amount of fish is needed because moi are protandric hermaphrodites, that is, they start off life as a male and at a certain size become a female capable of egg production. Thus to have a sufficient ratio of males to females for reproduction, up to 100 fish are required to be kept in the hatchery.

Attraction of Water Birds

Locating the MBS fish farm near a major airport runway is an issue defined as, could the farm infrastructure increase the number of birds in the lagoon area? HIA has an active program with the Wildlife Services, US Department of Agriculture to deter all types of birds from occupying sites on and around the airport's runway system where they could possibly strike operating aircraft (Thompson, 2013). HIA currently experiences an average of around 50 bird strike incidents a year. According to records, birds of major concern are not shore or water birds (HIA, 2012).

The RRBP and the MBS aquaculture farm should not create habitat that will attract sea and shore birds of any kind to the Reef Runway area, particularly the Hawaiian stilt. The literature

indicates stilts prefer calm, natural shallow water habitat for feeding and nesting is not present on or around the farm (USFWS, 2011). The reef flat surrounding the RRBP is not acceptable habitat and likewise, the cage system (with its daily host of farm activities) should not create an attractive site for the birds. Moreover, MBS notes other structures in Keehi Lagoon, e.g., commercially operated Jet Ski and water ski platforms have not had any bird attractant issues. MBS will be purchasing and deploying the bird netting cage cover system sold by the cage supplier for each cage.

Invasive and Protected Species Attachment

The State government and the public are very concerned about aquatic invasive species (animals and plants) in Hawaiian waters and displacement of native species. Regarding an offshore cage farm, the issue is cages and the mooring system can provide a potential substrate (albeit a comparatively very small area in comparison to the overall coastal ecosystem and all its uses) for attachment of invasive algae. There is also a concern over potential attachment of corals and other protected sessile species, such as the Black Lipped Pearl Oyster (*Pinctada margeritifera*).

MBS believes that the relatively remote location of the RRBP and the existing current patterns will act as a deterrent to attachment of invasive species. Moreover, the copper alloy and Dyneema netting, which resists fouling organisms, and the regular cleaning of cages and mooring lines will strongly reduce the likelihood of these unwanted species establishing a population on the farm. Should protected corals or pearl oysters attach to the MBS cages, the Company will cooperate with DAR, DLNR to relocate the animals to more suitable locations, as has been carried out previously by other Hawaii farms, e.g., Blue Ocean Mariculture and Hukilau Foods. MBS has extensive experience in coral reef restoration.

Potential Impacts on Coral Reefs and Monitoring

Potential for impact of ocean uses on coral abundance, such as aquaculture, is a significant issue for Federal and State regulatory agencies and the public. MBS is very aware of this concern and will confine its farming operations to the RRBP and within the lease site. There will be no anchoring of MBS boats on the bordering reef flat and some cage anchors will be placed at the bottom of the seaward vertical wall of the BP.

As previously discussed, acceptable water quality in the BP will be maintained by applying Best Management Practices and the consistent flow of ocean water over the seaward reef flat into the RRBP. Where the incoming ocean water will pass through the cages, nutrients will be mixed and diluted and exit through the 480 ft gap into the currents of the WCC and out to the ocean. As such, nutrients emanating from the farm should not be directed to the reef flat and diluted nutrients will pass out of the WCC to the open ocean re-enter the food web along the way.

It is instructive that past experience with offshore aquaculture projects off Ewa Beach (Hukilau Foods) and Kailua Kona (Kona Blue Water Farms, now Blue Ocean Mariculture), has shown

certain species of corals can settle and grow on farm infrastructure; thus demonstrating a degree of compatibility with the activity (Cates, 2012; Everson, 2013). Moreover, the corals can easily be removed and relocated by Federal and State officials. Though research studies elsewhere have mixed conclusions regarding impacts of cage farming on corals , there is some evidence that aquaculture in tropical waters can actually benefit coral abundance and growth by being a nutrient source(Price and Morris, 2013).

MBS is working with responsible agencies to draft a Coral Monitoring Plan for the proposed project. In general, the plan will gather data on the coral reef habitats surrounding the RRBP in two important areas: coral abundance and coral recruitment and settlement. Tentatively, regarding measuring abundance, eight stations will be established on the surrounding reef flat and baseline data will be collected via transects and photography. Then the stations will be regularly sampled twice a year to note any significant changes. Regarding coral recruitment and settlement, a special collection apparatus will be deployed in four locations around the site. Data on settlement will be collected twice a year. All data will be reported to the responsible agencies (see Proposed Plan, Appendix B, EA).

MBS is anticipating no significant impacts on the existing condition of the corals and reef habitats around the RRBP area from this aquaculture project Appendix B). However, issues arise mitigating actions are available (see Section 6.2.1)

Sharks

There is a public concern that nearshore aquaculture farms may affect numbers of sharks and in particular increase the number of pelagic sharks, e.g., the Tiger Shark (*Galeocerdo cuvier*) in the area. MBS with others has made numerous visits to the RRBP, since 2006, including six recent dives and has not seen a shark of any kind to date. A 1999 six month site survey of fishing effort for those fishers that launch at the Keehi Marina and Sand Island boat ramps, noted several sharks (unknown species) were caught in the Keehi lagoon area and only one near the RRBP (BPI, 2001).

Recent State funded shark telemetry studies that tagged sand bar and tiger sharks near the fish cages two miles off Ewa Beach, Oahu, found sharks did occasionally stay for periods of time near fish cages from time to time, but more often were highly transient (Papastimatiou, et al., 2010). MBS discussed the situation with a shark expert at the University of Hawaii, Hawaii Institute of Marine Biology. He indicated the inshore, dredged habitat of the RRBP is not well suited for pelagic sharks. Moreover, tagging studies in Hawaiian waters generally show pelagic sharks, particularly Tiger Sharks, are extremely mobile often ranging over very long distances and their extended presence (i.e., take up residence) at a farm site like MBS's would be rare (Holland, 2013).

Regardless, MBS recognizes this issue and will mitigate the potential for attracting pelagic sharks by regularly removing any stock mortalities from the cages on a daily basis and utilizing shark resistant netting.

6.2.3 Protected, Threatened and Endangered Species

Concern over the potential farm impacts on protected, threatened and endangered species generally focus on altering an animal's behavior or habitat and the potential for entanglement with farm netting and mooring lines. As previously described the RRBP is a highly disturbed, depauperate dredged pit that is located near shore. From many years of MBS site observations and consideration of the preferred habitats of these species, the area appears to be unsuitable for most species of concern, i.e., marine mammals and seabirds.

The area is well removed from the suitable open ocean habitat for dolphins and humpback whales; species protected by Federal and State laws and regulations. Likewise, the BP area does not appear to be suitable habitat to be attractive to monk seals. Green sea turtles, a regulated species, have been observed in the BP, particularly along its steep sides. MBS believes, based on many years of experience with its previous open ocean farming venture, that farming operations will not significantly affect turtle use of the edges of the BP for feeding and resting.

Potential coral reef impacts of the farm and their monitoring were discussed in Section 6.2.2.

MBS will adhere to the recommended BMP's for avoiding protected species entanglement by maintaining taut netting and mooring lines and carrying out routine inspection of the integrity of the cage netting. Moreover, should any protected species be encountered, the appropriate Federal and State authorities will be contacted per a preapproved notification plan.

6.2.4 Ocean Activities

Maintaining public access to Hawaii's abundant ocean resources, as well as managing commercial and recreational uses of ocean space, are important State agency and public concerns. Chapter 190 D HRS, Ocean and Submerged Lands Leasing, passed by the Legislature and signed into law in 1999, provides for long-term leasing and "negotiated exclusive use" of State marine waters for commercial aquaculture, that is the balancing of the company's need to control site access with the public's opportunity to access the resource. Thus far, commercial offshore aquaculture projects have requested some degree of exclusivity and restricted public use to be able to operate efficiently and safely. Companies have also been able to accommodate certain uses by the public that are compatible with farm operations.

To illustrate, a four cage submerged system operated all toll for eleven years under the direction of MBS principal Randy Cates in the open ocean off Ewa Beach, Oahu. Boats could transit the lease area while moving to another location or trolling the area. However, anchoring of boats within the lease site was prohibited due to concerns for: entanglement with the mooring system, disruption of farm operations, and safety of staff and the fishers. In addition no SCUBA diving or snorkeling was permitted within the lease. While it is noted the farm was

two miles off Ewa Beach, no complaints were received during this timeframe and the limitations on public use worked well.

MBS is requesting no access by any boat or water craft to the interior portions of the BP, where the cage array and feed/security barge will be located, except as provided by the Company. For potential day time ocean users, a clearly marked 100 ft wide transit lane will be provided around the entire boundary of the RRBP, so the public can access the outer reef. The access lane nearest the Reef Runway will allow unencumbered access by AD, DOT at any time of the day or night. Further, MBS also is requesting the public be restricted from anchoring and conducting any diving activities in the 100 ft access lane (where portions of the mooring grid , the anchors, will be located) and be prohibited from night time access to the entire RRBP for safety and security reasons.

MBS will provide appropriate site infrastructure as required to mark the area and implement these proposed restrictions; including marker buoys for boundaries and mooring lines and approved signage, lighting and remote camera systems. Studies show boating, fishing, and diving in the RRBP have been minor activities and restrictions should not cause significant disruption (Appendix D). Moreover, MBS will make concerted outreach efforts, e.g., information meetings, to inform the Keehi Lagoon community of the change in status of the RRBP and staff will undergo training on how to manage any curious members of the public coming on site. MBS's own boat traffic to and from its base yard on Sand Island – estimated at 2 to 4 trips a day at full operation – will not add significantly to existing traffic in Keehi Lagoon.

6.2.5 Noise and Air Quality

Noise and air quality impacts of MBS farm operations will be insignificant, considering current and future background levels. Fish farming activities (e.g., work boat engines, cranes, and air compressors) will not significantly add to ambient noise levels from HIA, which currently hosts over 230,000 takeoffs and landings a year (HIA, 2013). Air emissions from the work boats, equipment, and the feed/security barge will be insignificant in comparison to that emitted by HIA and existing coastal developments.

6.2.6 Aesthetics

Viewscape, particularly involving ocean views, is very important to coastal property owners, as well as, all manner of ocean enthusiasts. The RRBP is located in the western most portion of Keehi Lagoon and adjacent to a busy airport runway. The MBS farm is well removed from the recreational and commercial users and uses of the majority of Keehi Lagoon (Fig. 1a, b).

The visual profile of the farm is low, with the cage railings extending about 4 ft and the feed/security barge extending about 8 ft above the water surface. Cages will be black and white

in color and the feed/security barge will be painted in a similar fashion. Approved night time lighting will be low intensity and directed towards the ocean surface.

One or two work boats will be on site daily and will be indistinguishable at a distance from normal boat traffic. These activities and structures will be barely visible, if at all, by the residents of the upland areas of Moanalua, though they may provide a curiosity for arriving and departing HIA passengers. MBS believes the fish farm will have no significant impacts on the existing ocean aesthetics or viewscape.

6.2.7 Historical and Cultural Resources

The area in and around airport has been extensively surveyed and studied for important historical and cultural resources because of the numerous developments at HIA and in the vicinity (Table 1). MBS has reviewed those studies that examine the area near the BP for relevant information. The Company combined this review, with the many years of its own site observations of users, particularly any concerned with traditional gathering of fish and seaweed (Appendix E).

While the *ahupuaha* of Moanalua is extremely rich in Hawaiian history and cultural resources, the RRBP (which is a recent man made structure) does not appear to be the location of any of these resources. This conclusion is supported by the 2010 HIA Master Plan study, which states, "There are no archeological sites on the airport property" (Ed Noda and Associates, 2010).

There are no known traditional fishing grounds or natural resources at the project site. Moreover, based on a previous study of the RRBP has been infrequently used by the public for fishing, diving, and traditional gathering (BPI, 2001). MBS's more recent observations confirm this conclusion (Appendix E). This use situation is probably due to many factors, including: a) The BP is a highly ecologically disturbed, dredged area and not very productive; b) The site and its shallow reef flat boundaries are difficult to get to from land and requires a boat; c) The proximity of the busy Reef Runway and the ambient noise levels tend to discourage recreational use, when other nicer and quieter areas are available; and d) there is a popular belief in the marine community that the area is restricted by AD.

MBS desires to cooperate with the native Hawaiian and other members of the public that want to access the outer reef through the RRBP. It will provide a marked 100 ft access lane around the entire site perimeter for their daytime use.

6.2.8 Cumulative Impacts

The proposed MBS action will not obligate DLNR to consider any additional expansion at the site or additional leases at other sites. Requests for additional ocean acreage anywhere in the

state must be justified and approved according to the permitting and lease process specified by Federal and State law.

Expectations are the requested acreage will provide the long-term production capacity desired by the Company for a successful and sustainable business, given the application of best management practices and oceanographic and use characteristics of the site. For example, considering the consistent wave and current patterns that result in frequent BP turnover, a barren and mobile silty substrate suitable for anchoring cages, the limited marine life in the area and the limited public use. The Company's ability to successfully manage this new farm; including stocking, feeding, harvesting and maintenance, is supported by ten years of successful operating experience with Hukilau Foods and its application of the latest open ocean aquaculture knowledge and technology available

Further, a comprehensive environmental monitoring program for water quality, substrate quality, and the surrounding coral reefs will provide the feedback needed to determine any unacceptable changes early and allow MBS to proactively address them (Appendix B). As previously mentioned, mitigation measures are available to manage unacceptable farm impacts, including: quantitatively adjusting feeding amounts and schedule, adjusting cage biomass, modifying cage cleaning schedules, and periodically repositioning cages within the grid site.

In summary, any cumulative impacts on the lease site and surrounding ocean environment are expected to be manageable and the measured regulatory parameters are expected to be kept within permit conditions.

6.2.9 Irreversible and Irretrievable Commitment of Resources

The proposed MBS action does not involve an irreversible and irretrievable commitment of marine resources or State finances. A long-term lease on 75 acres of State marine waters is being requested. The initial lease term of 45 years, is a necessary length for investment recovery and to facilitate access Federal loan sources. Moreover, the lease is revocable by the State for cause.

It is standard State procedure that the lease will require the lessee to post a bond that in the event of MBS bankruptcy, funds will be available for the State to remove structures and return the environment to its former condition. There will be no State funds involved in the financing of this project.

The ocean environment off Oahu and around the main Hawaiian Islands has demonstrated a great capacity to rapidly assimilate and recycle excess nutrients from fish farming. Consistent currents mix and disperse fish waste products into ambient, low nutrient ocean conditions, i.e., tropical ocean waters are low in nitrogen, nitrogen limited (APA, 2009; Price and Morris, 2013). Marine organisms in the water column and in the substrate will consume particulate wastes

and macro ad micro algae will assimilate dissolved nutrients. Should the source of these nutrient inputs stop, such as with removal of the fish farm, it has been demonstrated the ambient conditions prior to placement of the fish farm can return in a matter of months (Lin and Baily-Brock, 2008; Price and Morris, 2013).

7.0 RELATION TO THE STATE CONSTITUTION AND STATE LAWS, PLANS AND POLICIES

The proposed action to carry out commercial open ocean aquaculture in State marine waters is consistent with the State Constitution and State laws, plans and policies related to: economic development and diversification, marine resource conservation and use, sustainable food production, and food security and self-sufficiency. Below are excerpts from various documents that support this conclusion.

7.1 STATE CONSTITUTION

Article XI Conservation, Control and Development of Resources

"Section 1. For the benefit of present and future generations, the State and its political subdivisions shall conserve and protect Hawaii's natural beauty and all natural resources, including land water, air, minerals, and energy sources, and shall promote the development and utilization of these resources in a manner consistent with their conservation and in furtherance of the self-sufficiency of the State …

Section 6. The State shall have the power to manage and control the marine, seabed, and other resources located within the boundaries of the State, including the archipelagic waters of the State, and reserves to itself all such rights outside state boundaries not specifically limited by federal or international law.

All fisheries in the sea waters of the State not included in any fishpond, artificial enclosure or state- licensed mariculture operation shall be free to the public, subject to vested rights and the right of the State to regulate the same; provided that mariculture operations shall be established under guidelines enacted by the legislature, which shall protect the public's use and enjoyment of the reefs."

7.2 STATE PLAN LAW, CHAPTER 226, HRS

"Section 226-4 State Goals. In order to guarantee, for present and future generations, those elements of choice…
it shall be the goal of the State to achieve:

(1) A strong, viable economy, characterized by stability, diversity, and growth, that enables the fulfillment of the needs and expectations of Hawaii's present and future generations…

Section 226-7 Objectives and policies for the economy—agriculture.

(a) Planning for the State's economy with regard to agriculture shall be directed towards achievement of the following objectives:

(2) Growth and development of diversified agriculture throughout the State.

(3) An agriculture industry that continues to constitute a dynamic and essential component of Hawaii's strategic, economic and social well-being…

(9) Enhance agricultural growth by providing public incentives and encouraging private initiatives…

(12) Expand Hawaii's agricultural base by promoting growth and development of flowers, tropical fruits…food crops, aquaculture, and other potential enterprises.

(13) Promote economically competitive activities that increase Hawaii's agricultural self-sufficiency.

Section 226-103 Economic priority guidelines. (a) Priority guidelines to stimulate economic growth and encourage business expansion and development to provide needed jobs for Hawaii's people and achieve a stable and diversified economy:

(1) Seek a variety of means to increase the availability of investment capital for new and expanding enterprises.

(A) Encourage investments which:

(i) Reflect long term commitments to the State;

(ii) Rely on economic linkages within the local economy;

(iii) Diversify the economy;

(iv) Reinvest in the local economy;

(v) Are sensitive to community needs and priorities;

(vi) Demonstrate a commitment to provide management opportunities to Hawaii residents.

(2) Encourage the expansion of technological research to assist industry development and support the development and commercialization of technological advancements…

(8) Provide public incentives and encourage private initiative to develop and attract industries which promise long-term growth potentials and which have the following characteristics:

(A) An industry that can take advantage of Hawaii's unique location an available physical and human resources.

(B) A clean industry that would have minimal adverse effects on Hawaii's environment.

(C) An industry that is willing to hire and train Hawaii's people to meet the industry's labor needs at all levels of employment…

(d) Priority guidelines to promote the growth and development of diversified agriculture and aquaculture:

(1) Identify, conserve and protect agricultural and aquacultural lands of importance and initiate affirmative and comprehensive programs to promote economically productive agricultural and aquacultural uses of such lands…
(7) Encourage the development and expansion of agricultural and aquacultural activities which offer long-term economic growth potential and employment opportunities."

7.3 STATE ENVIRONMENTAL POLICY, CHAPTER 344, HRS.

Section 344-3 Environmental policy. It shall be the policy of the State, through its programs, authorities, and resources to:
(1) Conserve the natural resources, so that land, water, mineral, visual, air, and other natural resources are protected by controlling pollution, by preserving or augmenting natural resources, and by safeguarding the State's unique natural environmental characteristics in a manner which will foster and promote the general welfare, create and maintain conditions under which humanity and nature can exist in productive harmony, and fulfill the social, economic and other requirements of the people of Hawaii…

(5) Economic development
(A) Encourage industries in Hawaii which would be in harmony with our environment;
(B) Promote and foster the agricultural industry of the State; and preserve and conserve productive agricultural lands; …
(D) Encourage all industries including the fishing, aquaculture, oceanography, recreation, and forest products industries to protect the environment; …
(F) Promote and foster the aquaculture industry of the State; and preserve and conserve aquacultural lands."

7.4 COASTAL ZONE MANAGEMENT, CHAPTER 205 A, HRS.

"Section 205 A-2 Coastal zone management program; objectives and policies.
(a) The objectives and policies in this section shall apply to all parts of this chapter…
(b) Objectives…
(5) Economic uses;
(A) Provide public or private facilities and improvements important to the State's economy in suitable locations…
(10) Marine Resources;
(A) Promote the protection, use and development of marine and coastal resources to assure their sustainability…
(c) Policies…
(5) Economic uses;
(C) Direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:

(1) Use of presently designated locations is not feasible; …

(ii) Adverse environmental effects are minimized; and

(iii) The development is important to the State's economy…

(10) Marine resources;

(A) Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;…

(E) Encourage research and development of new, innovative technologies for exploring , using or protecting marine and coastal resources."

7.5 OCEAN AND SUBMERGED LANDS LEASING LAW, CHAPTER 190 D, HRS.

Section 190 D-2 Findings and purpose.

Article XI of the Constitution of the State of Hawaii relating to…

The legislature finds that the State's marine waters offer the people of Hawaii sources of energy, minerals, food, and useable space. The legislature further finds that the proper management and development of these ocean resources require defined rights of usage and tenure."

7.6 HAWAII OCEAN RESOURCES MANAGEMENT PLAN, JULY, 2013.

"Food Security

Approximately 85-90 % of Hawaii's food is imported into the state, mostly on ships. This makes Hawaii's food security vulnerable to natural disasters and global events that could disrupt the food supply. …

Supporting restoration of fishponds, providing access to the coastline for gathering, proactively managing near shore fishing, and sustainable aquaculture are all ways to increase food security. …

Management Priority # 6 Ocean Economy

Goal A: Develop aquaculture standards, based on current scientific data, to support culturally, environmentally and economically sustainable operations which increase production for local consumption."

7.7 HAWAII 2050 SUSTAINABILITY PLAN.

" The Five Goals For Hawaii 2050

The Hawaii 2050 goals are integrated philosophies that express the suitable future of Hawaii. They reflect a deeply held sense of where Hawaii should be headed…

Our diversified and globally competitive economy enables us to meaningfully live, work and play in Hawaii.

A sustainable Hawaii cannot occur without a sustainable economy. …

The need for economic diversification. …

Our natural resources are responsibly and respectfully used, replenished and preserved for future generations.

Strategic and Priority Actions

Priority actions: Intermediate steps for the year 2020…

5. Develop a more diverse and resilient economy. …
7. Increase production and consumption of local foods and products, particularly agriculture."

7.8 HAWAII STATEWIDE COMPREHENSIVE ECONOMIC DEVELOPMENT STRATEGY 2010

Economic Development Opportunities and Challenges

A. Strengths and Opportunities

Three major strategic strengths have been noted that tend to give the State an overall comparative advantage for numerous economic development opportunities. Those strengths are: …

- Oceans, rich volcanic soil and varied growing conditions and geographic isolation provide a strong base for aquaculture, specialty agriculture such as coffee and tropical fruits, and agricultural-based genetic research like the fast-growing hybrid seed corn research industry. …"

7.9 A NEW DAY IN HAWAII

"Economy and Jobs

- Save and create jobs now, and seed the good jobs of the future: … support small business; infuse technology and innovation throughout the economy.
- Increase self-reliance and protect our resources: Produce our own energy; grow our own food; … advance sustainable … development. …

Food and Agriculture

- Raise the supply of local food

- Raise the demand for local food
- Support agricultural exporting …"

7.10 INCREASED FOOD SECURITY AND FOOD SELF-SUFFICIENCY STRATEGY

"The purpose of the increased Food Security and Food Self-Sufficiency Strategy (Strategy) is to increase the amount of locally grown food consumed by Hawaii residents. This will increase food self-sufficiency which is a component of food security. …

The Strategy has three strategic objectives:

- Increase Demand for and Access to Locally Grown Foods
- Increase Production of Locally Grown Foods
- Provide Policy and Organizational Support to Meet Food Self-Sufficiency Needs."

8.0 AGENCIES, ORGANIZATIONS AND INDIVIDUALS CONSULTED

Agencies, organizations, and individuals consulted during the preparation of this DEA are listed below. Correspondence received is included in Appendix F.

8.1 FEDERAL AGENCIES

US Army Corps of Engineers
    Regulatory Branch

Western Pacific Regional Management Council

US Department of Commerce, National Oceanic and Atmospheric Administration (Washington DC)
    NOAA- Fisheries
    NOAA- Aquaculture Program
    NOAA- Marine Fisheries Advisory Committee

US Department of Commerce, NOAA (Pacific Region)
    NOAA- Pacific Islands Regional Office (PIRO), Fisheries Services
        Sustainable Fisheries
        Protected Resources
        Habitat
    NOAA- PIRO, Pacific Islands Regional Aquaculture Coordinator

US Fish and Wildlife Service
    Pacific Islands Fish and Wildlife Service Office

US Coast Guard

8.2 STATE AGENCIES

Department of Agriculture
- Chairperson
- Aquaculture Development Program

Department of Business, Economic Development and Tourism
- Director, Office of Planning
- Coastal Zone Management Program

Department of Land and Natural Resources
- Chairperson
- Office of Conservation and Coastal Lands
- Land Division
- Division of Aquatic Resources
- Division of Boating and Ocean Recreation

University of Hawaii
- College of Tropical Agriculture and Human Resources
- School of Ocean and Earth Science and Technology
- Hawaii Institute of Marine Biology

Department of Transportation
- Harbors Division
- Airports Division

Department of Health
- Office of Environmental Quality Control
- Clean Water Branch
- Enforcement Section

8.3 COUNTY AGENCIES

City and County of Honolulu
- Department of Planning and Permitting

8.4 OTHER ORGANIZATIONS AND INDIVIDUALS

Hawaii Aquaculture and Aquaponics Association

The Oceanic Institute

United Fishing Agency

Roy's Restaurants

D.K.'s Restaurants

Tropic Fish Hawaii LLC

Hiroshi Restaurant

Hawaii Oceanic Technology

Blue Ocean Mariculture

9.0 PRELIMINARY DETERMINATION AND SIGNIFICANCE CRITERIA

The Significance Criteria listed in Chapter 200, HAR, were reviewed in consideration of the proposed action to lease 75 acres of State marine waters for commercial aquaculture purposes, encompassing the RRBP, Keehi Lagoon, Oahu. A Finding of No Significant Impact (FONSI) is anticipated based on the information presented in this DEA.

1. Involves an irreversible commitment to loss and destruction of any natural or cultural resource.

There will not be an irrevocable commitment to loss or destruction of any natural or cultural resource by this action. The proposed 75 acre site was a coral reef that was previously dredged to between 45 ft. and 50 ft. deep to provide fill for the Reef Runway. The site has a shallow, silty substrate over a hard rock bottom, with no natural relief or significant fish populations or other marine resources. Likewise, the site has been extensively studied before and after the dredging and lacks any cultural resources.

Currents in the RRBP will suspend and mix dissolved and particulate farm waste products and will aid in their rapid assimilation and recycling by the highly dynamic, nutrient poor ocean environment. It is anticipated that any species population changes in the surrounding reef flat and the BP's substrate infauna will be minimal and not ecologically significant. Should significant changes become evident, experience suggests they can be reversed once the source of excess nutrients are reduced or removed (Price and Morris, 2013).

In addition, the requested farm lease is for a specific time period of 45 years. The lease, if granted, will specify that all improvements must be removed by the lease upon termination and a bond will be posted to assure funding for compliance with this condition.

2. Curtails the range of beneficial uses of the environment.

MBS is requesting several restrictions to public use of the RRBP area, but the impacts should be small. Eight years of relatively frequent observations by MBS and a previous six month user survey of the public's use of the general location of the farm by another project indicates limited existing public use. There is little regular recreational or commercial activity within the lease area, which is adjacent to the Reef Runway and well removed from the main portion of Keehi Lagoon.

The proposed action is requesting the lease formerly restrict public access to the central portion of the RRBP, that is, no boating or other water craft and no diving in the lease area, except as provided by the Company by the designated access lane. This request is prompted by concerns over security, staff and public safety and the potential for disruption of farm operations, as well as, company insurance liability issues. These requested limitations are consistent with previous State offshore aquaculture leases and land leases.

MBS will provide a 100 ft. wide access buffer or transit lane around the perimeter of the RRBP to allow the public to access the outer reef flat in day time hours through the RRBP and the State AD to access the Reef Runway anytime. Night time restriction of public use to the entire farm site is being requested for safety and security reasons. MBS believes the farm should not significantly interfere with the public's limited use of the outer reef flat.

Currently, the BP is part of a State designated Reef Runway Recreational Thrill Craft Zone "F". MBS has requested under separate action that the farm site be removed from this designation.

3. Conflicts with the State's long-term environmental policies or goals or guidelines as expressed in Chapter 344, HRS.

The proposed action, which sustainably expands commercial aquaculture in State marine waters and increases supplies of high quality seafood for tourists and residents in an environmentally responsible manner, is consistent with State environmental goals, policies, and guidelines as stated in Chapter 344, HRS. To illustrate, Section 344-3 discusses managing the State's unique natural environment for the benefit of residents;" in a manner which will foster and promote the general welfare, create and maintain conditions under which humanity and nature can exist in productive harmony and fulfill the social, economic and other requirements of the people of Hawaii."

Further, Section 344-4 states aquaculture should be promoted by the State; "(F) Promote and foster the aquaculture industry of the State; and preserve and conserve productive aquacultural lands."

4. Substantially affects the economic or social welfare of the community or state.

The proposed action will positively affect the economic or social welfare of the community and state and no negative effects are anticipated. Expanded environmentally sustainable fish farming activities will increase employment opportunities for residents, provide greater amounts of high quality moi for the local market, and stimulate the economy by the Company's expenditures to local support industries for equipment, supplies and services. The State will benefit from payment of lease rents to the administering agency for use of the ocean resources, as well as the increased personal income and corporate taxes paid. It is anticipated the proposed action will be financed by a combination of private investment and federal loans and not require State funds.

5. Substantially affects public health.

The proposed action will increase the availability of locally produced, high quality, healthy seafood (moi) for residents and tourists, statewide. Numerous scientific studies support the consumption of more fish to improve human health (American Heart Association, 2014). The project will be responsibly managed to be environmentally sustainable and not have any significant impacts on the quality of state marine waters, as regulated by the DOH and DLNR.

6. Involves substantial secondary impacts, such as population changes or effects on public utilities.

No significant secondary impacts, such as shifts in human population or impacts on public utilities, will be involved in the proposed action. The Company's existing support facilities at Keehi Lagoon are compatible and consistent with current land uses in the area.

7. Involves substantial degradation of water quality.

The proposed action will not involve any substantial degradation of water quality in the vicinity of the RRBP. The continuous dilution and flushing of the RRBP waters out to the open ocean should readily disperse dissolved and particulate farm waste products and facilitate assimilation and recycling and reuse by the ocean environment. Moreover, the project will be subjected to a rigorous water quality and substrate monitoring program to assure State receiving water standards are being met.

8. Cumulatively has considerable effect on the environment or involves a commitment for larger actions.

The project is relatively small in comparison to the large and busy ocean area of Keehi Lagoon and the coastal area along the South Shore of Oahu. MBS expects the proposed farm will have no significant impact on water quality in the cage area or the substrate beyond the possibility of some minor and reversible changes in the immediately below the cage area. Thus, no cumulative impacts on the water column are anticipated and any unacceptable impacts on the substrate beneath the cages can be managed by MBS. Likewise, no long lasting cumulative negative impacts on the reef flat surrounding the project site are anticipated considering the

inherent stability of the reef flat ecosystem. Implementation of the proposed action does not involve any commitment to a larger action at the site.

9. Substantially affects a rare, threatened or endangered species or its habitat.

There are no substantial effects anticipated on any rare, threatened or endangered species by the project. Most protected species of concern, except for green sea turtles, have not been seen at the site. Previous observations at other Hawaii ocean farms indicate that green sea turtles and their habitat are unaffected by cage aquaculture activities and the animals co-exist very well with ocean farming (BPI, 2009; APA, 2009). Moreover, the Company will maintain the integrity of netting and mooring lines at all times to deter any potential issues with protected aquatic species. Also, cages will be covered by netting to deter interactions with sea and shore birds, such as the protected Hawaiian Stilt.

10. Detrimentally affects air or water quality or ambient noise levels.

The project has no significant air borne emissions beyond those of standard boat engines and farm equipment. Any noise generated by farm operations will come from logistics and support vessels and will be insignificant compared with noise generated by airplanes at HIA. As discussed, above there will be no detrimental effects on water quality by the proposed action due to the dynamic ocean setting and rigorous farm management and monitoring practices that will be employed.

11. Affects or is likely to suffer damage by being located in an environmentally sensitive area, such as a flood plain, tsunami one, beach, erosion prone area, geologically hazardous land, estuary, fresh water, or coastal waters.

The proposed action is connected to near shore coastal waters and in a man-made, deep borrow pit created by dredging fill material for the HIA Reef Runway construction. The farm area is protected from high winds and waves by an extensive reef flat that extends 2000 to 3000 ft offshore and makes up the ocean side border of the site.

The biology and ecology of the RRBP itself is generally depauperate and reflective of other coastal marine areas disturbed by up land and coastal development. The site is surrounded by an area categorized by a NOS survey as Reef Flat, that is further categorized as a Spur and Groove geological structure (consists of deep channels punctuating the reef flat). The reef flat substrate is dominated by macroalgae not corals. Relatively constant inflow of ocean water over the reef, subsequent mixing in the BP, and the flushing of the BP waters out through WCC to the open ocean, will substantially help the farm meet State water quality standards that will result in insignificant impacts on the surrounding environment.

The cages and the mooring system utilized are designed for severe open ocean storm conditions in for example the North Atlantic, so they are extremely sturdy and should be stable and work well in the relatively protected environment of the RRBP.

12. Substantially affects scenic view planes or vistas.

The MBS site is located in the western most portion of Keehi lagoon and adjacent to the Reef Runway. The low profile surface cages will be unobtrusive and not distract from the ocean expanse visible from upland areas of Moanalua. A permanently moored feed/security barge is being requested for the site. The low profile barge, as well as the work boats will appear as normal vessel traffic from the ocean and should be barely visible from land.

13. Requires substantial energy consumption.

There will be an insignificant increase in State energy usage required by MBS's work vessels that provide logistics and maintenance support to the proposed farm site.

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APPENDIX A

Current Patterns and Speeds for the Reef Runway Borrow Pit
and the Surrounding Area
Prepared by: Aquaculture Planning and Advocacy, LLC

1.0 Purpose

Cates International, Inc. (CI) collected information on current patterns and speeds for the Reef Runway Borrow Pit (RRBP) and the surrounding area, Keehi Lagoon, Oahu to study the suitability of the site for an aquaculture farm. In particular, the Company was interested in studying the daily pattern of current movement into and out of the RRBP and the daily pattern of current movement and speeds over the outer reef flat bordering the pit, which will govern the volume of ocean water passing through the proposed farm area (Fig. A-1). In addition, previous environmental studies of the area were reviewed for pertinent information.

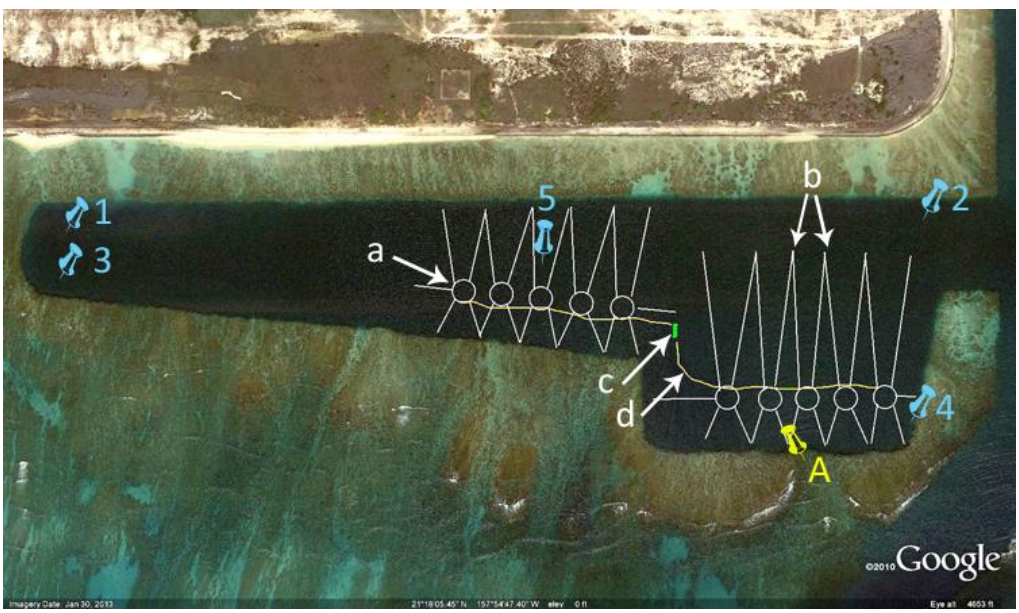

Fig. A-1. Graphic of the proposed moi farm within the Reef Runway Borrow Pit, with project elements, numbered GPS locations and locations of the current meter used for collecting data. Key: A) current meter; a) cages, b) anchor lines; c) feed barge; and d) feed distribution lines

2.0 Methods

Currents were studied by a variety of qualitative and quantitative methods. CI made 80 trips by small boat to the RRBP and vicinity form 2006 to 2013, noting among other relevant observations the direction and general speed of currents in the area (see also Appendix D). A number of these trips included snorkeling and SCUBA diving in the area to observe marine life in situ, as well as currents.

These qualitative, visual observations of current were verified and enhanced by quantitative measurements utilizing current meters (Brand, Nobska MAVS – 3, Acoustic Current Meter) placed on the edge of the outer reef flat on two occasions, one in 2012 and one in 2013 (Fig. A-1) and two drogue studies in 2011. The 2012 current meter study was from 1/11 to 1/13 and the 2013 study was from 1/28 to 2/7.

Subsurface drogues are used by oceanographers to measure ocean currents speed and direction. The movement of the drogue system is considered to approximate the current at the depth of the drogue. A surface buoy keeps the drogue near its required depth and provides a marker which can be tracked from a boat (Hughes, 2002). Drogues were deployed in the Borrow Pit (BP) on two occasions in 2011, 10/4/11 and 10/5/11, to estimate current speed and direction at depths of 12 ft and 25 ft. Weather conditions during these deployments were a moderate south swell and light winds, with an incoming tide. The BP is 75 acres in size and uniformly 45 to 50 ft deep over the majority of its area.

3.0 Results

Numerous visual observations from a small boat and while snorkeling and SCUBA diving in the RRBP, clearly showed a strong prevailing current pattern of open coastal waters from offshore being driven by winds and tidal forces over the outer reef flat (characterized as Spur and Groove, see Section 5.4.3) and into the BP. Ocean water builds up in the RRBP and flows east and out through the 480 ft dredged gap and into the Water Circulation Channel (WCC) – a dredged 45 ft deep and 400 ft wide channel created to enhance water exchange between Keehi Lagoon with the open ocean. There it combines with exciting Keehi Lagoon water and the water mass moves out the WCC to be mixed and dispersed by the near shore current system in Malama Bay and becomes open coastal water (Fig. A-2).

Visual observations at all times of the day and all phases of the tidal cycle indicate there is nearly constant unidirectional flow of offshore water over the entire 5000 plus foot length of the irregular outer reef flat border into the RRBP and through the gap and out the WCC. Indeed the WCC was expressly designed and created to improve water quality in Keehi Lagoon through increasing circulation and flushing (turnover) of the lagoon (FAA, 1972). Previous field studies of the BP as a location for a pearl oyster farm described a similar circulation pattern (BPI, 2001).

CI was interested in quantifying current speed and direction to obtain a thorough understanding of the flushing rate and turnover of the RRBP water. On two occasions, a current meter was placed on the outer reef flat to continuously measure current speed over a 24 hour tidal cycle and for multiple days in a row (Fig. A-1). The 2012 study lasted 2 days, due to technical problems, and the 2013 study lasted 10 days (Fig. A-3a, b, c). The 2013 study also included collecting current direction data, termed heading, and water temperature.

Current speeds during the 2012 deployment ranged between 1 cm/sec to almost 7 cm/sec, with and estimated average speed of between 3 cm/sec and 4 cm/sec (Fig. A-3a). Current

speeds during the 10 day deployment in 2013 had a wider range of speeds, from less than 1 cm/sec to 12 cm/sec (Fig. A-3b). The estimated average speed in 2013 was between 3 cm/sec and 5 cm/sec. In terms of movement, the predominant direction of the current was pushing water from the ocean, over the reef flat and into the RRBP (Fig. A-3c).

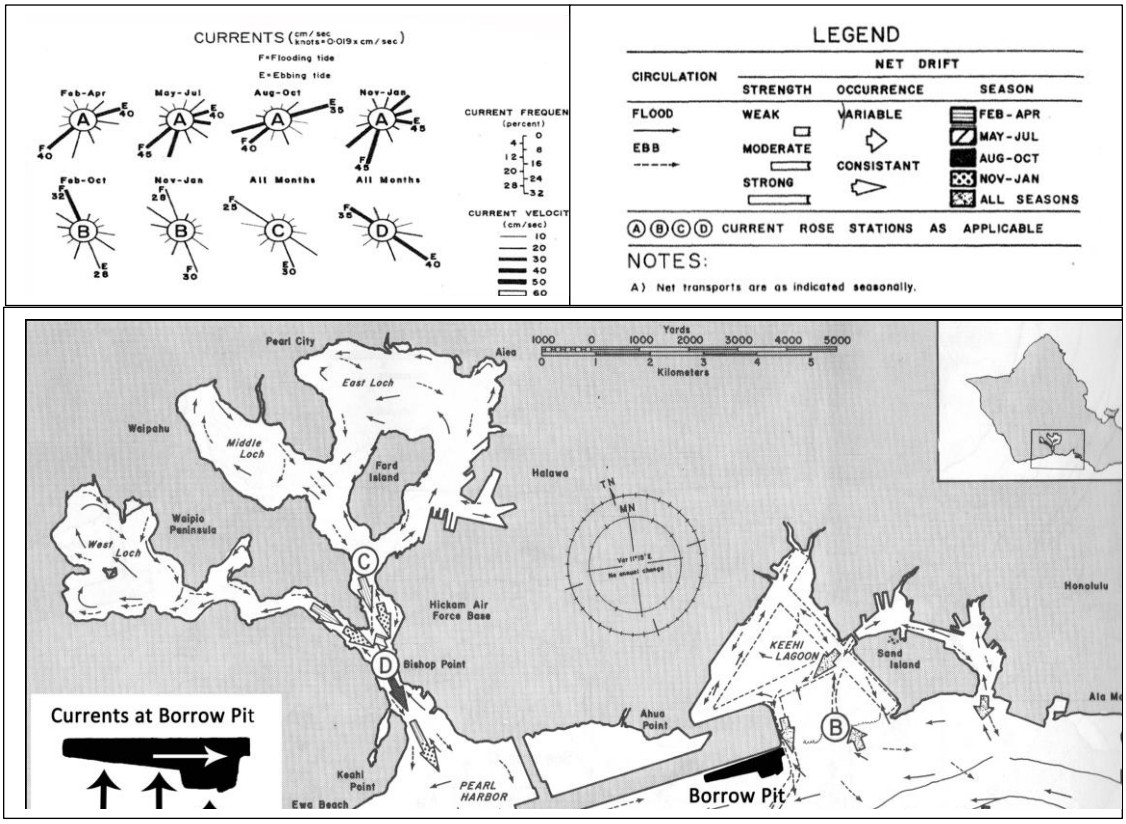

Fig. A-2. Current patterns in Keehi Lagoon and vicinity. (Source: K. Bathen, 1978). Note: Borrow Pit pattern added based on field data.

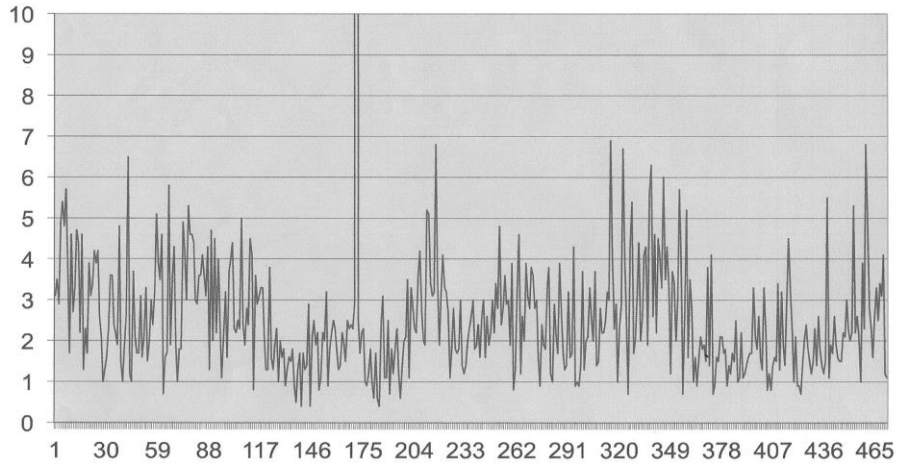

Fig. A-3a. Results of deployment of a current meter from 1/11/12 to 1/13/12 on the outer reef border of the Reef Runway Borrow Pit, Oahu.

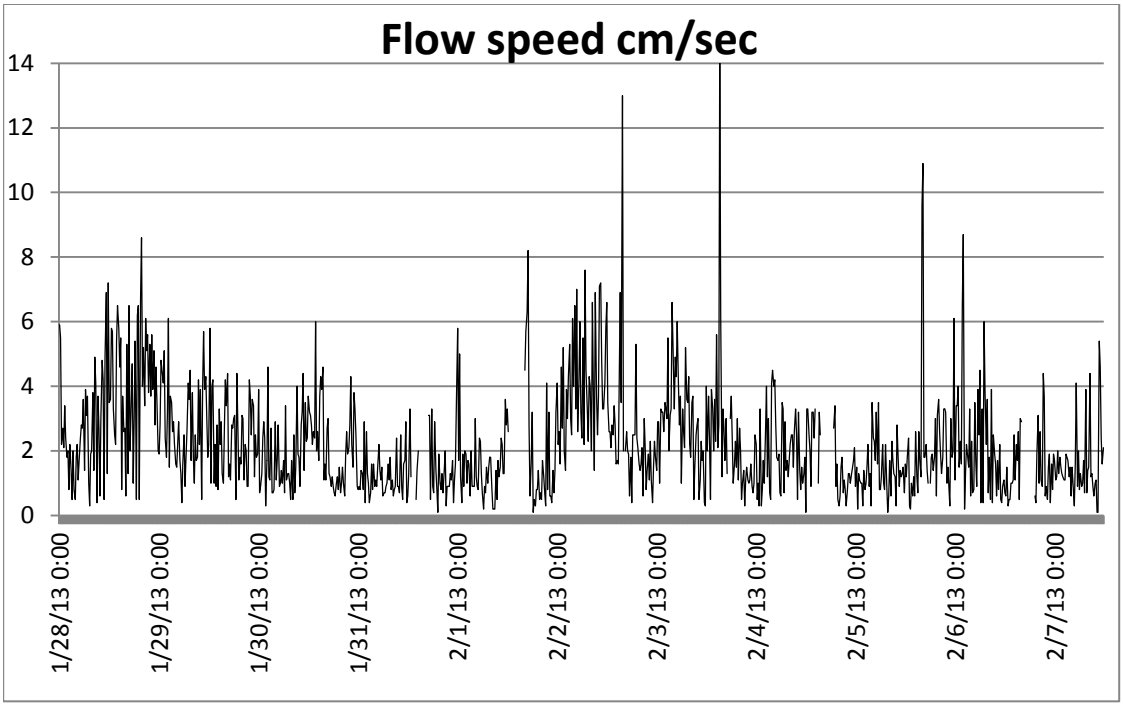

Fig. A-3b

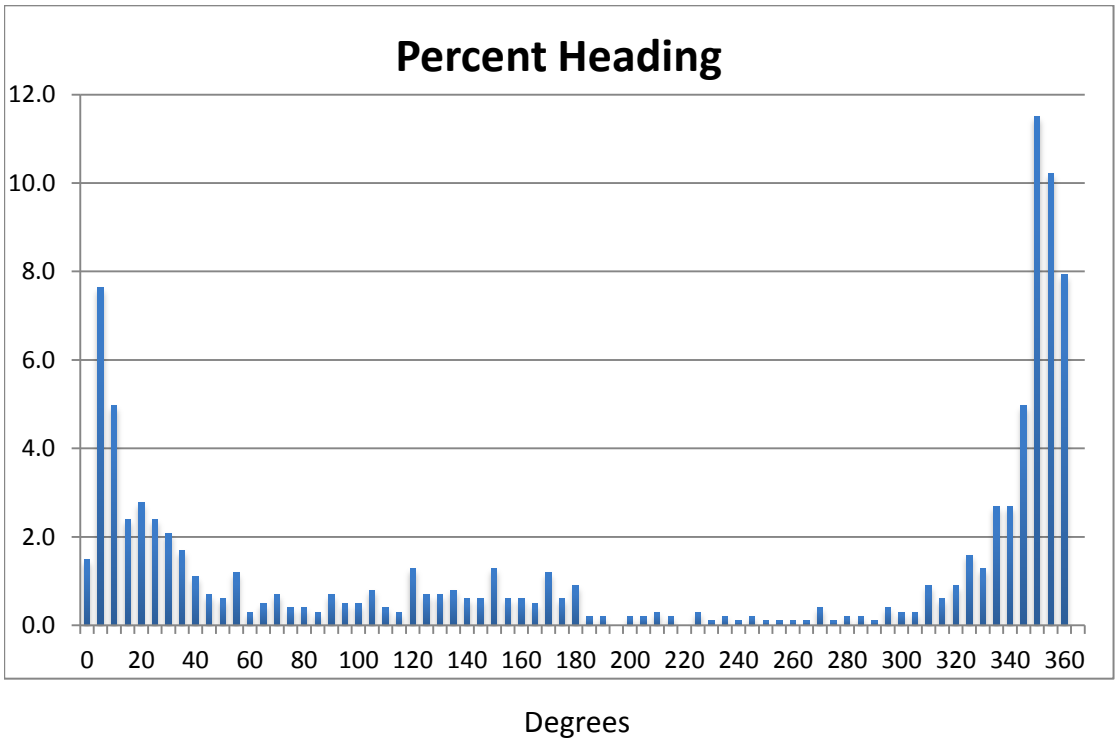

Fig. A-3c

Fig. A-3 b,c. Results of a deployment of a current meter from 1/28/13 to 2/7/13 on the outer reef border of the Reef Runway Borrow Pit. Data are: b) Flow Speed in cm/sec; c) Percent Heading.

The drogue studies of the RRBP further support the observation that the predominant flow of ocean water is over the outer reef, into the BP and out the WCC (Fig. A4). The drogue measurements made at depths of 12 ft and 25 ft, along with the data from vertical water column profiles of the conservative (change very slowly) parameters of temperature and salinity (Appendix B), strongly suggest RRBP water is relatively well-mixed from top to bottom (no pronounced stratification) and moves easterly as a “wall of water” out the dredged gap in the reef, into the WCC and out to the ocean. Current speeds measured by this study varied between 3cm/sec and 6 cm/sec.

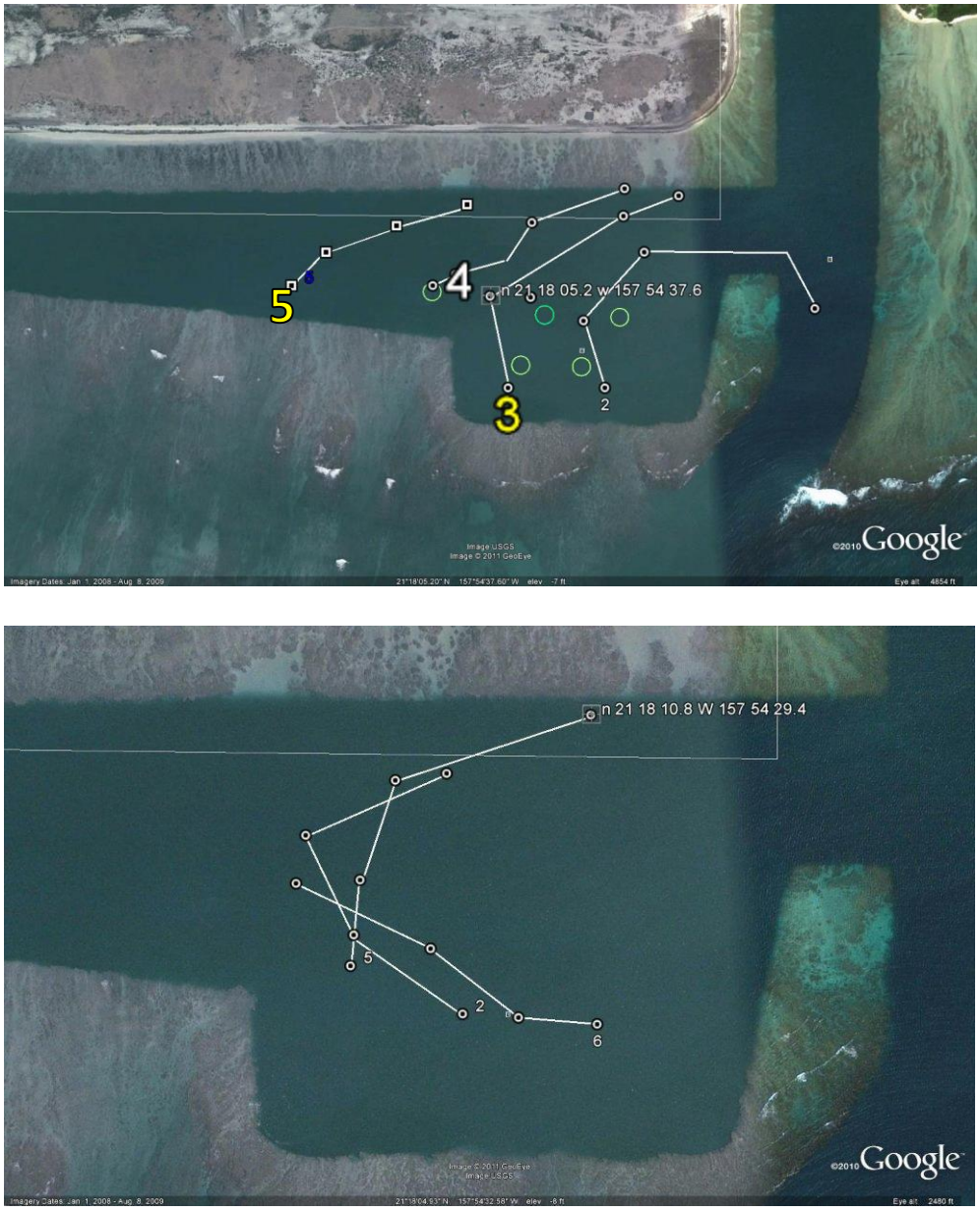

Fig. A-4. Results of subsurface drogues deployed in the Reef Runway Borrow Pit, Oahu, to study current movement: a) deployed on 10/4/11; and b) deployed on 10/5/11. Each track starts with the numbered bullet.

4.0 Conclusions

Numerous visual observations and several field studies using current meters and drogues, confirm the pattern of water movement in the RRBP. Open coastal water driven by wind and waves flows more or less constantly over the 5000 ft length of the outer reef flat border and into the BP, where it is well mixed top to bottom and moves out the dredged gap in the reef to WCC that drains large volumes of Keehi Lagoon water into the near shore ocean environment of Malama Bay. Current speeds over the outer reef vary but average between 3 cm/sec and 5 cm/sec.

Incoming open coastal waters are thoroughly mixed in the BP by wind and wave, as indicated by the uniformity of the vertical profile measurements for temperature and salinity. BP water then moves in what can be described as a "wall of water" easterly towards and through the large dredged gap in the reef at speeds of around 3 cm/sec to 6 cm/sec. There it mixes with exiting Keehi Lagoon water and is dispersed to the open ocean through the WCC discharge where it is mixed further. CI believes based on all these site observations and data taken together that this is the dominant current pattern all year round for the RRBP.

Using the current speed information, CI has calculated how often the complete volume of one of the cages will turn over. It is important to note that though this calculation is for single cage, all ten cages are being placed parallel to the outer reef border, i.e., the incoming current, hence each can be considered acting like this single cage description. Maintenance of acceptable water quality in the BP is critical to fish growth and wellbeing, as well as maintaining the quality of the surrounding coral reef ecosystem and meeting State receiving water permit standards (see section 1.3.2).

Table 1 presents the estimated time for new seawater coming into the RRBP to travel the diameter, the widest point, of a cage or 114 ft at different observed current speeds. This information was then used to calculate hourly and daily turnover of the cage water volume. Given the layout of the cages as perpendicular to the current coming over the reef, turnover rates in each cage can be approximated by this calculation.

Results indicate that at the lowest observed current speeds of 1 cm/sec to 2 cm/sec, the cage water turns over 1 to 2 times an hour or 24 to 48 times a day. At the higher observed current speeds of 4 cm/sec to 6 cm/sec, the cage water will turn over 4 to 6 times an hour or 96 to 144 times per day. CI has concluded that given the relatively low densities of fish being considered, these substantial turnover rates should be able to maintain acceptable water quality for all the cages and the entire lease site by thoroughly mixing and dispersing particulate and dissolved waste nutrients to facilitate recycling and return to the natural food web. Moreover, the large volume of open coastal water that flows through the site will allow the farm to meet State water quality standards for the water column and the BP substrate.

Table A-1. Calculation of Single Cage Volume Turnover Rates at Observed Current Speeds for the Reef Runway Borrow Pit.[1]

		Single Cage Volume Turnover Rates	
Current Speed (cm/sec)	Time for New Water to Travel One Cage Diameter (min.)	Total Volumes per Hour	Total Volumes per 24 Hours
1	58	1x	24x
2	29	2x	48x
4	15	4x	96x
6	10	6x	144x

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BPI, 2001. *Final Environmental Assessment, A Pearl Farm and Pearl Oyster Reseeding Project in the Reef Runway Borrow Pit in Keehi Lagoon, Honolulu, Oahu, Hawaii.* Land Division, DLNR, 150 p.

Federal Aviation Administration, Pacific Region, 1972. *Final Environmental Impact Statement, Reef Runway Project, Honolulu International Airport.* FAA, Pacific Region, Jan. 1972.

Hughes, Steven A., 2002. "Estimating Surface Currents Using Dyes and Drogues." U.S. Army Corps of Engineers, ERDC/CHL CHETL VI-37, 20 p.

APPENDIX B
Part A

ASSESSMENT OF THE MARINE ENVIRONMENT
IN THE VICINITY OF THE PROPOSED
COMMERCIAL AQUACULTURE FACILITY
OFF THE REEF RUNWAY, HONOLULU, HAWAII

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I. INTRODUCTION

Cates International (CI) is proposing to locate a commercial aquaculture facility for the culture of the native fish species *Polydactylus sexfilis* (moi) in a dredged basin located on the reef flat fronting the Reef Runway of the Honolulu International Airport (HIA) located in Moanalua, Honolulu, Oahu (Figure 1). The dredged region is a steep-sided borrow pit that provided coral fill material for construction of the reef runway in the 1970's. Cates International is seeking a long-term lease for the area which encompasses 75 acres of State marine waters that includes the dredged basin. Portions of the area are under the control of the Department of Transportation (DOT) and the balance is under the Department of Land and Natural Resources (DLNR). The dredged site offers several important advantages for marine aquaculture, including: 1) rapid exchange of water between the reef flat and the open ocean; 2) protection from high winds and waves; 3) relatively deep water (45 to 50 feet); 4) uniformly flat and depauperate mud-sand bottom to anchor cages; 5) minimal public use, and 6) close proximity to the Cates International shoreside base yard in Keehi Lagoon.

At full build out the proposed aquaculture facility will consist of grid of ten (10) anchored Aqualine surface cages, manufactured by Aqualine AS, Trondheim, Norway. Each circular cage will be 114 feet in diameter and enclose a volume of approximately 264,860 feet^3 (7500 m^3). A small work platform, used to assess the condition of fish, will surround the outer diameter of each cage. Projected annual farm production is estimated to be 1.5 M lbs., valued at $6.3 M.

It is anticipated that the cage netting will be a specially designed, semi-rigid woven copper alloy mesh that has been in use by the global marine aquaculture industry for several years. The material is very strong and has proven very resistant to biofouling, thereby reducing the need for farm maintenance. Alternative fish farm netting is also being considered. Cages will also be covered with nets to deter any birds. Cates International is requesting that a feed/security barge will be permanent moored on site. Stocking, harvesting and daily feeding and maintenance will occur from surface work boats and barges visiting the site, with occasional SCUBA diver assistance.

Cates International requests that access by the public to the aquaculture facility site will be controlled, with the entire lease area restricted due to safety, security and company liability concerns. It is being requested that no transit or anchoring of any boat or water craft, and no fishing, snorkeling or SCUBA diving be allowed within the majority of lease area. Cates International will designate and mark a 100 ft. transit lane along the inner and outer boundaries of the site to allow Airport Division access to the Reef Runway and allow the public access to the outer reef. A rule change through the Division of Boating and Ocean Recreation (DBOR), DLNR to remove the 75 acre farm site from a larger State designated Thrill Craft Recreational Area will be needed to secure a lease.

The purpose of this document is to provide the results of a rapid ecological assessment (REA) of the marine environment within and surrounding the dredged basin that is the proposed site of the moi aquaculture facility. The assessment consists of two parts: 1) marine biotic community

structure, and 2) marine water chemistry. Marine community structure, primarily in terms of coral reef and reef fish assemblages are described based on in-situ surveys. Water chemistry is assessed based on a single collection and analysis of samples from a series of stations within the basin as well as the channel which connects Keehi Lagoon to the open ocean.

The purpose of these REAs was to provide a description of the existing condition of the marine environment in order to gain insight not only on the biotic composition, but also on the physical and chemical factors that influence the marine setting. As coral communities are both long-lived and attached to the bottom, they serve as the best indicators of the time-integrated forces that affect offshore reef areas. Understanding the existing physical, chemical and biological conditions of the marine environment that presently occur provides a basis for predicting potential affects that might occur as a result of the proposed aquaculture facility. The purpose of this investigation was not to compile an all inclusive list of species, or to collect a quantitative data set depicting community structure, but rather to provide an overall picture of the physical and biotic setting of the area proposed to contain the aquaculture facility.

II. METHODS

A. Water Quality/Chemistry

Fieldwork was conducted on August 6, 2013. Water chemistry was assessed at six stations evenly spaced within the dredged basin and in the channel connecting Keehi Lagoon with the open ocean (Figure 1). At each station samples were collected at two depths; a surface sample was collected within approximately 20 (cm) of the sea surface, and a near-bottom sample was collected within 50 cm of the sea floor. Surface water samples were collected by filling pre-rinsed 1-liter polyethylene bottles. Bottom water samples were collected using a Niskin-type oceanographic sampling bottle. The bottle is lowered to the desired sampling depth (approximately 1-2 off the bottom) with spring-loaded endcaps held open so water can pass freely through the bottle. At the desired sampling depth, a weighted messenger released from the surface triggers closure of the endcaps, isolating a volume of water.

Water quality parameters evaluated included the all specific criteria designated for open coastal waters in Chapter 11-54, Section 06 (b) (Open Coastal waters) of the State of Hawaii Department of Health (DOH) Water Quality Standards. These criteria include: total dissolved nitrogen (TDN), nitrate + nitrite nitrogen (NO_3^- + NO_2^-, hereafter referred to as NO_3^-), ammonium nitrogen (NH_4^+), total dissolved phosphorus (TDP), Chlorophyll a (Chl a), turbidity, temperature, pH and salinity. In addition, silica (Si) and orthophosphate phosphorus (PO_4^{-3}) were also reported because these parameters are sensitive indicators of biological activity and the degree of input of materials from land.

Subsamples for nutrient analyses were immediately placed in 125-milliliter (ml) acid-washed, triple rinsed, polyethylene bottles and stored on ice. Analyses for Si, NH_4^+, PO_4^{3-}, and NO_3^- were performed of filtered subsamples with a Technicon Autoanalyzer using standard methods for seawater analysis (Strickland and Parsons 1968, Grasshoff 1983). TDN and TDP were analyzed in a similar fashion following digestion. Total organic nitrogen (TON) and total organic phosphorus (TOP) were calculated as the difference between TN and dissolved inorganic N and TP and dissolved inorganic P, respectively.

Water for other analyses was subsampled from 1-liter polyethylene bottles and kept chilled until analysis. Chl a was measured by filtering 300 ml of water through glass-fiber filters; pigments on filters were extracted in 90% acetone in the dark at -20° C for 12-24 hours. Fluorescence before and after acidification of the extract was measured with a Turner Designs fluorometer. Salinity was determined using

an AGE Model 2100 laboratory salinometer with a readability of 0.0001‰ (ppt). Turbidity was determined using a 90-degree nephelometer, and reported in nephelometric turbidity units (NTU) (precision of 0.01 NTU). Vertical profiles of salinity, temperature and depth were acquired using a RBR-620 CTD calibrated to factory standards.

All fieldwork was conducted by Dr. Steven Dollar. All laboratory analyses were conducted by Marine Analytical Specialists located in Honolulu, HI (Labcode: HI 00009). This analytical laboratory possesses acceptable ratings from EPA-compliant proficiency and quality control testing.

B. Marine Biotic Community Structure

Biotic composition of the survey area was assessed by divers using SCUBA working from a small boat. Dive surveys were conducted by swimming in a vertical zigzag pattern along the face of the dredged basin from the edge of the reef platform to the floor of the dredged basin, at a depth of approximately 40-50 feet. In addition, survey swims were conducted for a distance of up to approximately 25 meters onto the reef flat. During these investigations, notes on species composition were recorded, and numerous digital photographs recorded the existing conditions of the area. The baseline assessment was conducted by S. Dollar, S. Matadobra, and L. Kroeger.

III. RESULTS

A. *Physical Structure*

Physical composition of the survey area containing the proposed aquaculture facility site consists of a polygon shaped dredged basin approximately 5,000 feet long in the east-west direction (parallel to shore) and 1,300 feet wide at the widest point. The shallow reef platform surrounding the dredged basin is part of a spur and groove fringing reef that extends from the shoreline to between 2,800 and 3,300 feet from shore (Figure 1). The surface of the reef nearshore region is composed of sediment-covered eroded fossil reef limestone platform interspersed with sand pockets (Figure 2). Small undercut ledges and protruding rocks also are dispersed throughout the platform (Figure 3). The edges of the dredged base consist primarily of nearly vertical faces with a distinct upper edge (Figure 4). The boundary of the eastern edge of the dredged basin is different, consisting of a bed of a sloping bed of coral rubble (Figure 5). The coral rubble slope grades into a bed of sandy mud that lines the entire floor of the dredged basin (Figure 5).

The baseline biological survey was conducted during a period of moderate south swell, and waves of 3-5 feet in face height were breaking on the outer edge of the reef platform. Concussive forces of breaking waves was largely dissipated on the outer reef flat, resulting in low wave heights in the area of the dredged basin. However, water transported across the reef flat by wave energy resulted in moderate easterly flowing currents through the dredged basin

2. *Water Chemistry*

Table 2 shows results of water chemistry analyses from the samples collected within the dredge basin and Keehi Lagoon entrance channel. Figures 6 and 7 show histograms of concentrations of eight water chemistry constituents at each station, while Figure 8 shows vertical profiles of

temperature, salinity and dissolved oxygen from the surface to the bottom at each sampling site. Examination of Table 2 and Figure 6 reveals several consistent patterns. With a single exception (Station 5), discrete salinity at all stations was elevated in bottom samples relative to surface samples. The greatest difference between surface and bottom water salinity was at Station 6, located at the inshore end of the Keehi Lagoon channel (Figure 6). In addition, the overall salinity throughout the water column is lower at Station 6 than anywhere else in the sampling regime (Figure 9). The lower salinities in the inner channel reflect discharge of estuarine water from Keehi Lagoon to the ocean. Figure 9 shows similar vertical profiles of salinity taken on December 21, 2010 following a period of heavy rainfall. All of the stations within the dredged basin had similar salinities in surface and deep water indicating little variability of source water in the basin. The small range of salinity values at all stations (35.33‰ to 35.41‰) indicates that the entire survey regime consists of water of open coastal ocean origin.

Comparing the profiles of salinity in Figures 8, taken during a period of dry weather, and Figure 9 taken immediately following a period of wet weather, illustrates the effect of runoff from land has on salinity in the Keehi channel and dredged basin. The profile of salinity at Station 6 in December shows a steep gradient in the upper meter of the water column, reflecting fresh water runoff draining out of Keehi Lagoon. However, while there is slight depression of salinity in the upper several meters at the stations within the dredged basin (stations 1-4), water in the underlying strata is essentially oceanic in composition. Hence, even during periods of heavy rainfall and runoff, it appears that water quality, in terms of salinity, is not greatly affected within the area proposed for the fish farm.

Histograms of dissolved silica (Figure 6) exhibit a similar pattern as salinity, with elevated values in bottom water at all stations. As silica is generally elevated in groundwater relative to ocean water, the depressed values in the surface water at all stations indicates that the upper layer of lower salinity water is surface runoff of rainwater rather than discharge of groundwater. The histograms of nitrate nitrogen and phosphate phosphorus (Figure 6) have the lowest values at Station 6, located in the Keehi Lagoon channel, where salinity is lowest. As these two inorganic nutrients are always elevated in groundwater, it is evident from the comparative concentrations between the channel and basin stations that groundwater discharge is not a major factor in shaping water quality of the area, at least during the period of sampling. The lower values of nitrate and phosphate in the channel are likely a result of planktonic nutrient uptake within Keehi Lagoon prior to flushing of Lagoon waters to the ocean.

Within the dredge basin values of nitrate nitrogen is distinctly elevated in surface water at Stations 1-4, while bottom water is substantially lower. Ammonium nitrogen in surface water at Station 1 is also substantially elevated over all other samples. As the salinity at these locations indicates that the water is of oceanic quality, the variations in nutrient concentrations are likely a result of biotic activity on the reef and in the dredged basin.

Values of turbidity range between 0.30 and 0.55 at Stations 1-3 within the dredged basin. Values of turbidity are slightly higher at Station 6 at the most landward sampling point in the Keehi Lagoon channel, and are slightly lower as Station 4 at the seaward end of the channel (Table 2, Figure 7). Such a pattern likely is a reflection of more turbid water from Keehi Lagoon flowing through the channel toward the open ocean.

Values of Chlorophyll *a* range from 0.96 to 1.96 μg/L, with the highest values at Stations 2 and 3 within the dredged basin (Table 2). The slightly elevated values may be a response to longer water residence times in the basin relative to the channel, allowing greater nutrient uptake and planktonic development within the basin.

Also shown in Table 2 are Department of Health water quality standards for open coastal waters under wet conditions. Wet conditions are applied as the area likely receives more than 5 million gallons per day per mile of shoreline from discharge from Keehi Lagoon. Also shown are three specific water quality criteria for each constituent listed in the standards: not to exceed more than 2% of the time; not to exceed more than 10% of the time, and geometric mean. As all of these criteria are based on a statistical treatment of multiple samplings, they are not strictly applicable to the single sampling conducted to date that is reported in this document. However, comparison of the one-time sampling results to the criteria is useful to indicate the overall quality of water relative to DOH standards.

It can be seen in Table 2 that with the exception of a single measurement of ammonium nitrogen at Station 1S, the only constituent to consistently exceed any of the three DOH specific criteria is Chlorophyll *a*. The likely reason for the exceedance of Chlorophyll a is that while the environment is classed as open coastal waters, there is an influence to water quality from drainage of estuarine water from Keehi Lagoon. When values of Chlorophyll a are compared to DOH water quality criteria for embayments ("NTE 10% = 4.50 μg/L; NTE 2% = 8.50 μg/L; geomean = 1.5 μg/L), none would be greater than either the NTE 10% and 2% criteria, and all but three samples would be below the geometric mean criteria. Hence, values of Chlorophyll a in the dredged basin reflect typical values of coastal embayments, which are typically more productive habitats than open coastal settings.

3. Biotic Community Structure

Reef Coral Communities

Composition of the coral reef communities in the vicinity of the dredged basin off the Reef Runway were markedly different between the reef flat adjacent to the basin, and the vertical walls of the basin. Table 3 shows abundance estimates of corals on the basin walls and adjacent reef flat. A total of ten species of corals were observed. Four species were abundant on the basin walls, while no coral species were considered abundant on the reef flat. Corals on the shallow reef flat were predominantly small and scarce, with the majority consisting of colonies of *Pocillopora damicornis* (Figure 2). In contrast, corals growing on the edges and vertical walls of the dredged basin comprise a diverse community of large colonies of varied species and growth forms. Most abundant were large hemispherical colonies of *Porites lobata* and *P. annae*, which occurred throughout the edges of the basin. In some areas, colonies of hemispherical *Porites* grew in clusters with edges of the colonies in contact with each other (Figure 10). Many of the colonies of *Porites* had a knobby growth form, which indicates that the species may be *P. annae*, rather than *P. lobata* (Figures 10 and 11). Also occurring throughout the area were mounds of finger coral *Porites compressa* (Figure 11). The occurrence of such large colonies of *P. compressa* in shallow water (less than 20 feet) reflects the relative lack of impacts of wave energy in the

area. Generally large colonies of this species are only found in deeper water below the influence of wave forces, which cause breakage of the fragile branches.

Other corals that were abundant on the basin walls were several species of *Montipora*. The most abundant species of this genus, *M. capitata* occurs in a variety of growth forms, including large mounds and flat encrustations (Figure 12). *Montipora patula* was also abundant, occurring in a somewhat unusual growth form of spiked fingers emanating from flat encrustations (Figure 13). Of note is that based on its status as endemic species, *M. patula* is one of the species listed as a candidate for Endangered Species status, although a ruling has not yet been made on the acceptance of the candidacy. A somewhat unusual member of the coral community found in abundance along the edges of the dredged basin was *Porites rus* (Figure 14.)

Other Benthic Invertebrates and Algae

Table 4 shows estimates of abundances of non-coral invertebrates and algae observed during reconnaissance swims along the walls of the dredged basin and adjacent reef flat. All of the observed invertebrates are considered common on offshore reef environments, and none were considered unique. The most numerous taxa were sponges, most of which were small encrusting forms. Sponges were particularly abundant in crevices and under ledges on the basin walls. Several species of tunicates, sea slugs, and bryozoans were also common on both the basin walls and reef flat (Table 4).

The most conspicuous invertebrate in both habitats was the feather duster worm (*Sabellastarte spectabilis*). These polychaete worms live in a leathery tube in holes or cracks in the reef, often occurring on living coral colonies. The tube is topped with radial crown of branched tentacles that retract into the tube when the worm is touched. Other common macro-benthos included the collector sea urchin (*Tripneustes gratilla*) and long-spined urchin *Echinothrix* spp. and the boring sea urchin (*Echinometra mathaei*). *E. mathaei* were especially common on the upper edge of the basin wall. Pearl oysters (*Pinctata margaratifera*) and the introduced saddle oyster (*Anomia nobilis*) also were common on the basin wall and reef flat (Table 4).

Marine macroalgae were not overly abundant at any of the survey locations. Five species of algae were observed, with only one species (Halimeda opuntia) considered abundant (Table 4). *Padina* was the only other alga considered common on the basin wall (Table 4).

Reef Fish

Table 5 shows estimates of reef fish abundance observed along the basin walls and reef flat. Reef fish were common throughout the area with counts of 574 individuals along the wall and 400 on the reef flat. Number of species in each habitat was similar at 28-29 (Table 5). The most abundant fish were the parrotfish (*Scarus psittacus*) which were particularly numerous along the basin wall. Other abundant species were several species of surgeonfish, particularly the yellow tang (*Zebrasoma flavescens*) and the unicorn fish (*Naso unicornis*). Along the basin wall, numerous small papio (*Caranx melampygus*) and Moorish idols (*Zanclus cornutus*) were observed (Table 5).

IV. DISCUSSION and CONCLUSIONS

The purpose of this assessment is to assemble the information to make valid evaluations of the potential for impact to the marine environment from the proposed aquaculture facility within the dredged basin located on the reef flat off the Reef Runway. The information collected in this study provides the basis to understand the processes that are operating in the area with respect to conditions suitable for biotic community settlement and growth.

Results of this baseline study reveal that the major factor shaping the composition of the marine communities off the project site is the degree of vertical relief. Coral reef community structure is far more developed in terms of both species and number of colonies on the vertical face of the dredged basin compared to either the adjacent shallow reef flat or sediment column that forms the floor of the basin. Such a positive correlation between vertical relief and coral community structure is typical for Hawaiian reefs. The documented structure of the coral communities along the walls of the dredged basin can be considered in excellent condition with high abundance and diversity, and essentially no outward appearance of stress. In addition, there were no observations of any aggregations of species of nuisance species of algae or other introduced invertebrates.

The proposed plan for the marine aquaculture facility calls for mesh cages anchored to the floor of the dredged basin, with no interactions with the dredged walls. Hence, there will be no direct contact between the fish cages and the existing reef structures. While operation of the farm will likely result in some fallout of feed or fecal material through the cages (even is catch devices are fitted to the bottom of the cages), such fallout should have no effect on the neighboring reefs. It has been documented that unidirectional currents drive water through the basin from the west to the east during all phases of the tide, with the velocity of the current largely a function of the magnitude of wave action driving water across the reef flat. Hence, any particulate material emanating from the farm that does not settle on the sediment floor of the basin is likely to be rapidly flushed from the basin to the open ocean. As a result, there should be no buildup of any farm-related materials in the water column that could have a potentially harmful effect to the surrounding reefs.

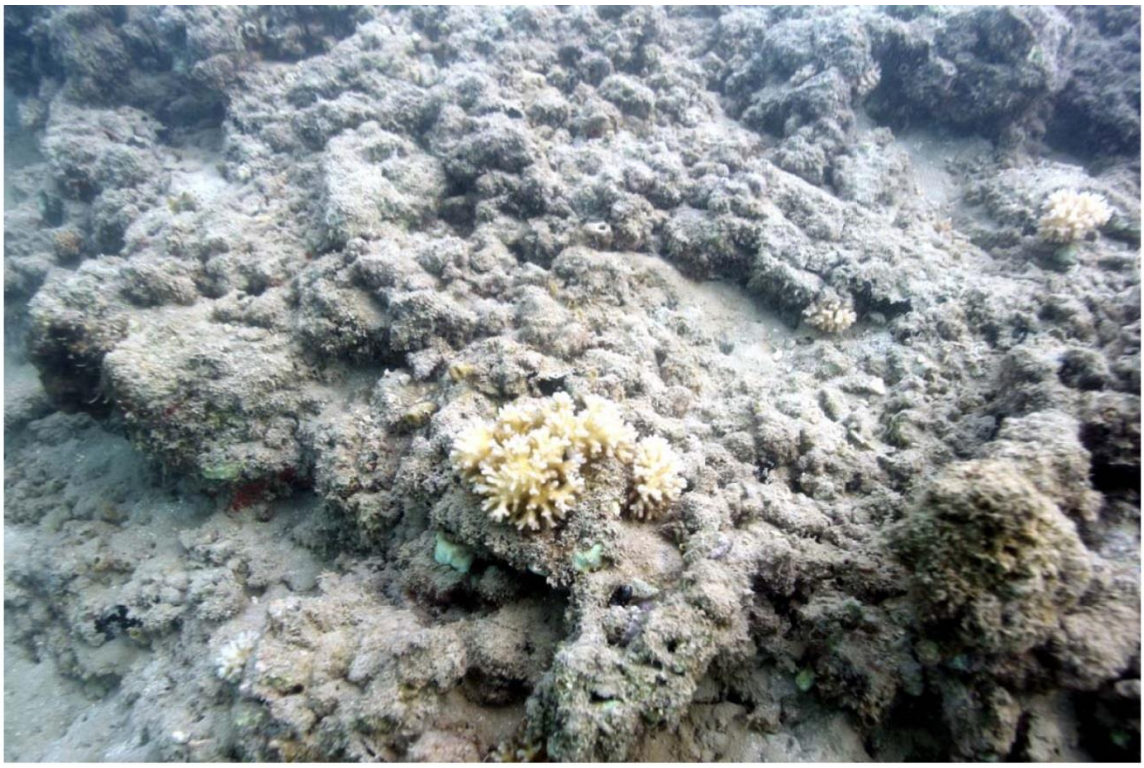
It is also noteworthy that submerged fish cages in offshore farms fronting Ewa served as settling surfaces for a variety of corals. These corals continually colonized solid structures of the cages, as well as net surfaces to form what appeared to be healthy colonies. There is no reason not to expect similar colonization and growth of corals on surfaces of the proposed aquaculture facilities in the dredged basin off the Reef Runway. Hence, as the floor of the basin presently does not contain any corals, colonization of cage structures will result in a net increase in corals in the area.

Another important marine environmental factor affecting the proposed aquaculture facility is water quality. Successful operation of the facility would be optimized within an area of continual flushing of essentially pristine ocean water. Such flushing will function both to minimize the potential for buildup of any by-products of the operation, as well as to provide optimal oceanographic conditions for the aquaculture species. While limited to a single evaluation for nutrients and two acquisitions of vertical profiles of salinity, temperature and dissolved oxygen,

the data presented in this document indicates that the dredged basin off the reef runway is characterized by typical open coastal waters with little contamination from land. However, water flowing through the channel adjacent to the basin connecting Keehi Lagoon with the open ocean is a pathway of movement of estuarine water from land to the ocean. Vertical profiles collected following an episode of heavy rainfall reveal that such weather conditions can result in a surface plume of freshwater draining from Keehi Lagoon through the connecting channel to the open ocean. However, change to water quality within the dredged basin were minimal from the rainfall event, and were restricted to the upper several meters of the water column, well above the depth where cages will be deployed. In addition, separate studies of current velocity and direction indicate that the residence time of water in the dredged basin is relatively short, with good flushing through the basin from west to east toward the Keehi Lagoon channel. These factors indicate that impacted water quality will not be a factor to limit aquaculture production within the dredged basin. In addition, patterns of water circulation suggest that buildup of aquaculture byproducts should not occur within the water column of the basin.

All of these considerations indicate that the proposed marine aquaculture facility in the dredged basin off the Reef Runway will not have any significant negative or possibly even measurable, effect on marine biota in the neighboring reef habitats. Because of the strong and consistent flushing characteristics of the environment, changes to the marine environment as a result of the fish farm will likely be undetectable, resulting in little or no change from the present conditions.

FIGURE 1. Aerial image of basin dredged in reef off the Reef Runway on the south shore of Oahu, Hawaii. Yellow circles show locations of six water sampling stations within the dredged basin and channel leading from Keehi Lagoon to the open ocean. See Table 1 for coordinates of sampling locations.



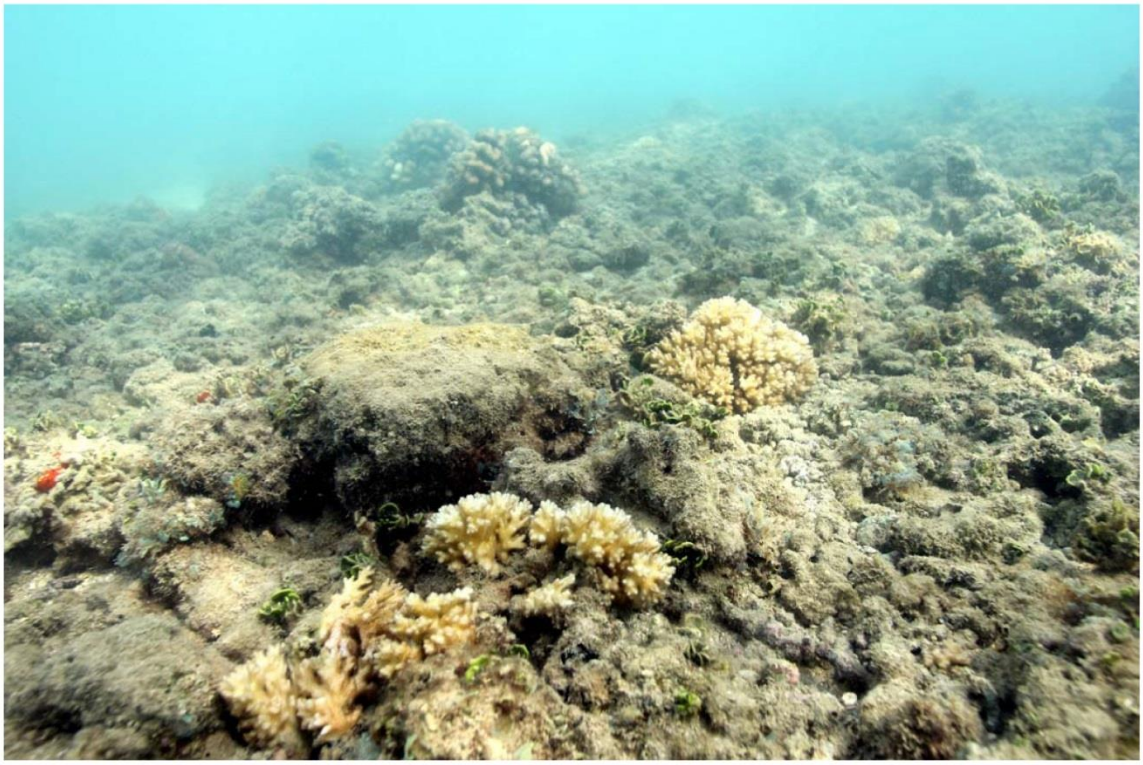


FIGURE 2. Two photos of the upper reef platform adjacent to the dredged Reef Runway borrow pit showing colonies of Pocillopora damicornis. Water depth in both photos is approximately 4 feet.

FIGURE 3. Two photos of the reef platform seaward of the dredged Reef Runway borrow pit. Upper photo shows a small ledge on the reef surface, while the lower photo shows a small mound colonized by the green calcareous alga *Halimeda opuntia*. Feather duster worm (*Sabellastarte spectabilis*) is in center of mound. While sparse, the majority of corals colonizing the reef flat were of the genus *Pocillopora,* which are visible in both photos.

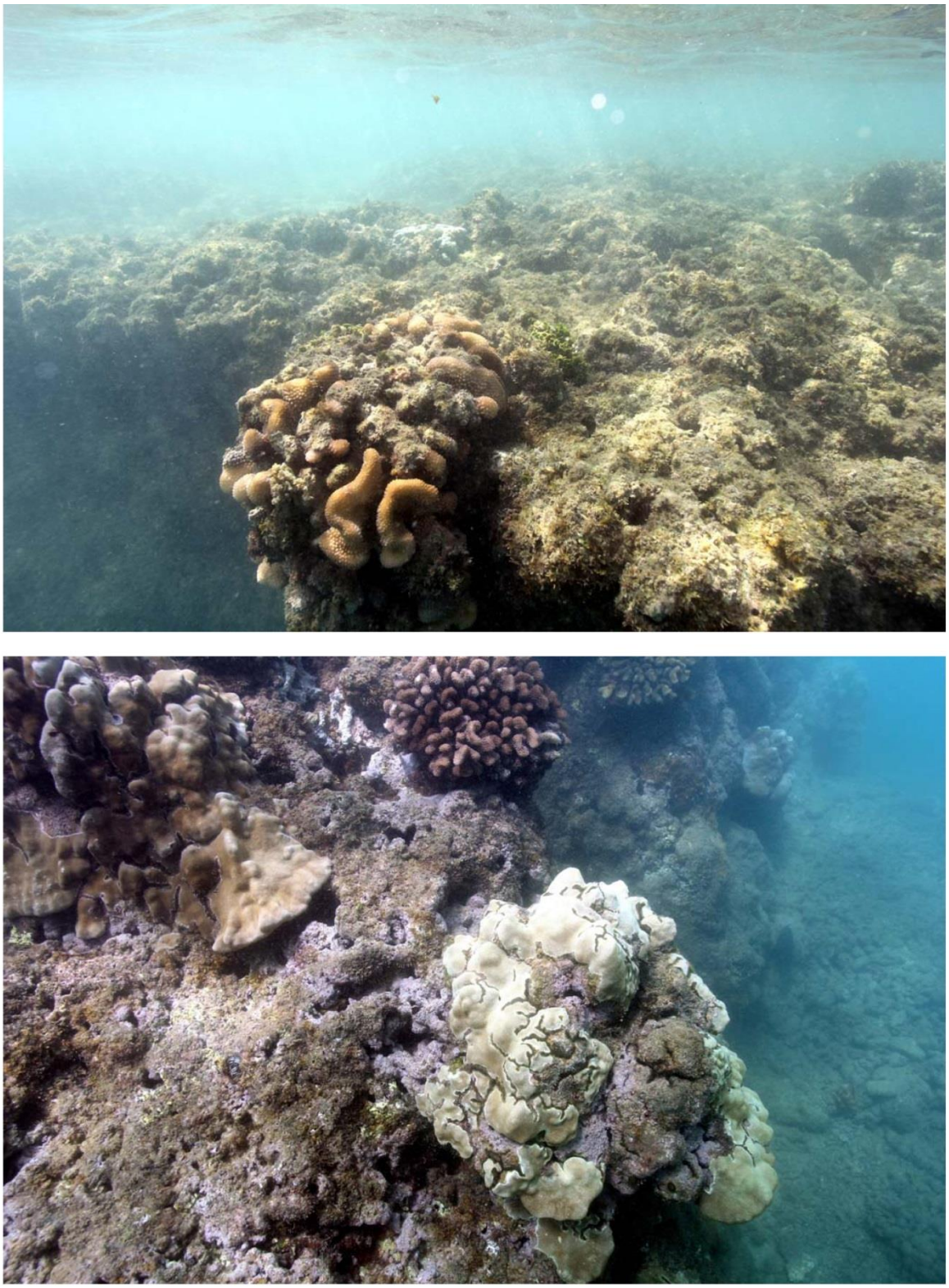


FIGURE 4. Two photos of the upper seaward edge of the dredged Reef Runway borrow pit. Upper photo shows partially dead colony of *Pocillopora meandrina* growing on undercut surface at the pit edge; lower photo shows assemblage of *Pocillopora* and *Porites lobata* at edge of pit.

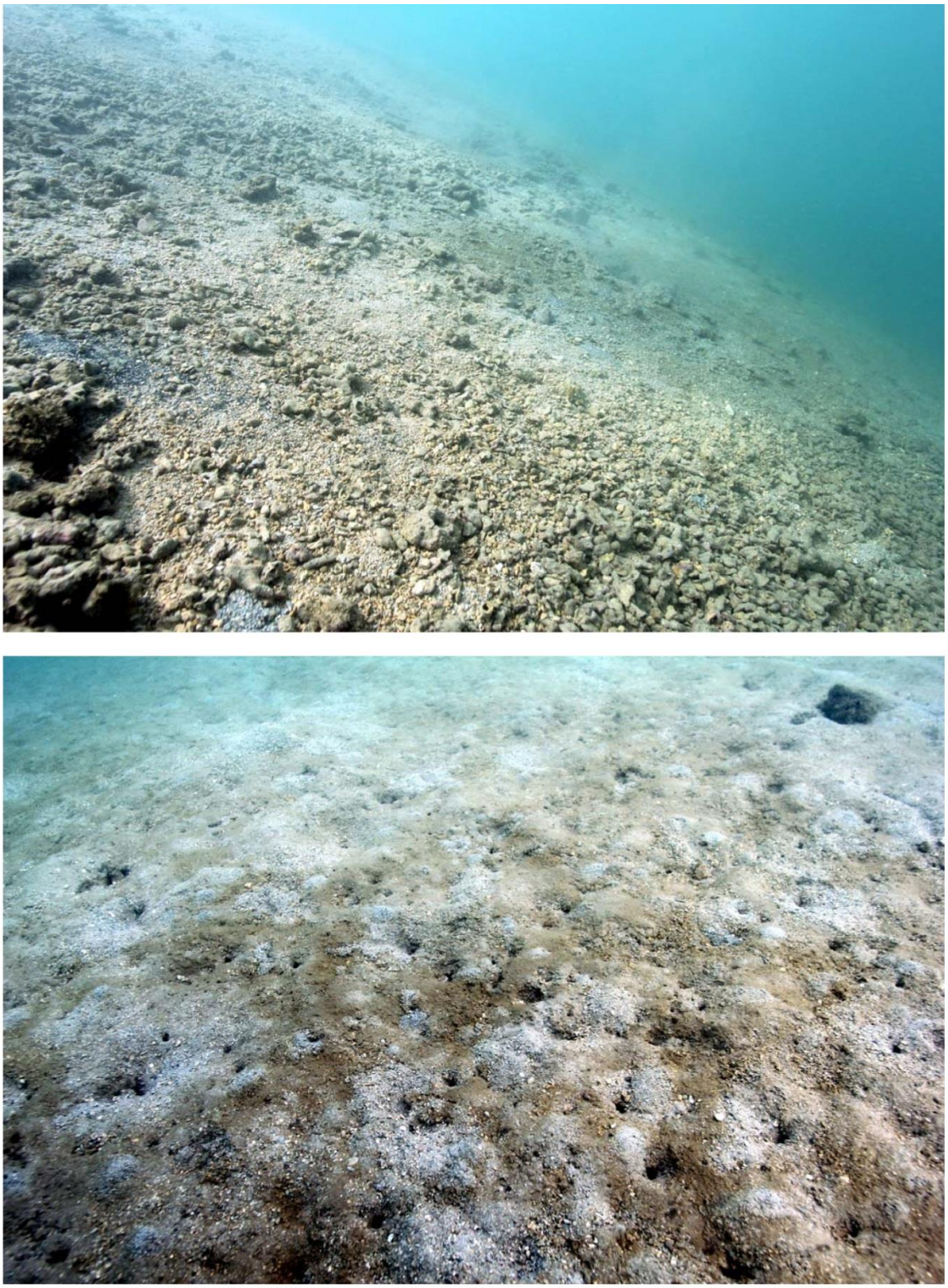


FIGURE 5. Upper photo shows rubble slope that descends from reef platform to edge of dredged area on reef flat off Reef Runway. Bottom photo shows sand-mud surface that covers the bottom of the dredge area.

TABLE 1. Coordinates of water sampling stations in dredged basin and Keehi Lagoon entrance channel (See Figure 1).

STATION	LATITUDE	LONGITUDE
1	N 21 18.140	W 157 55.191
2	N 21 18.127	W 157 54.781
3	N 21 18.052	W 157 54.523
4	N 21 17.864	W 157 54.393
5	N 21 18.088	W 157 54.293
6	N 21 18.452	W 157 54.287

TABLE 2. Water chemistry measurements (in μg/L) in the dredge basin off the Reef Runway, Ocean Pointe collected on August 6, 2013. Abbreviations as follows: S=surface; D=deep; BDL=below detection limits. Concentrations of nutrients are shown in units of micrograms per liter (μg/L). Also shown are the State of Hawaii, Department of Health (DOH) "not to exceed (NTE) more than 10% of the time" and "not to exceed more than 2% of the time" water quality standards for open coastal waters under "wet" conditions. Shaded values exceed on of the DOH standards. For site locations, see Figure 1.

SAMPLE SITE	Depth (m)	PO_4^{3-} (μg/L)	NO_3^- (μg/L)	NH_4^+ (μg/L)	Si (μg/L)	TOP (μg/L)	TON (μg/L)	TP (μg/L)	TN (μg/L)	TURB (ntu)	SAL (ppt)	CHL a (μg/L)	TEMP (deg C)	pH	O2 (%sat)
1S	0.1	1.55	4.90	15.82	62.16	8.06	168.4	9.61	189.1	0.31	35.38	1.12	27.34	8.06	98.47
1D	14.9	1.86	0.28	1.96	66.92	7.75	103.9	9.61	106.1	0.41	35.40	1.33	26.82	8.07	98.10
2S	0.1	0.93	1.12	0.84	68.32	7.44	109.9	8.37	111.9	0.45	35.35	1.51	27.26	8.07	93.10
2D	14.7	1.24	0.14	0.28	77.00	7.13	106.7	8.37	107.1	0.55	35.40	1.96	26.88	8.05	86.81
3S	0.1	1.24	2.52	2.66	77.28	7.13	108.8	8.37	114.0	0.44	35.37	1.60	27.45	8.08	94.80
3D	14.3	0.93	1.12	0.28	79.52	7.13	109.2	8.06	110.6	0.30	35.39	1.25	26.81	8.05	81.00
4S	0.1	1.24	4.62	1.68	49.84	7.75	104.3	8.99	110.6	0.33	35.36	1.09	27.11	8.11	98.66
4D	13.4	1.55	1.96	bdl	54.04	6.82	84.00	8.37	85.96	0.14	35.41	1.25	26.57	8.04	96.19
5S	0.1	1.24	0.42	1.26	54.32	6.20	107.8	7.44	109.5	0.34	35.41	0.96	27.56	8.14	98.62
5D	15.3	1.86	2.80	0.28	74.20	5.89	105.6	7.75	108.6	0.44	35.39	1.71	26.72	8.06	86.58
6S	0.1	0.93	bdl	0.70	87.64	7.75	131.2	8.68	131.9	0.60	35.33	1.42	27.21	8.07	92.10
6D	15.4	0.62	0.14	0.70	93.80	8.06	121.2	8.68	122.1	0.78	35.40	1.36	26.54	8.05	87.98
DOH	NTE 10%		14.00	8.50				40.00	250.0	1.25		0.90			
WQS	NTE 2%		25.00	15.00				60.00	350.0	2.00	*	1.75	**	***	****
	Geometric mean		5.00	3.50				20.00	150.0	0.50		0.30			

* Salinity shall not vary more than ten percent from natural or seasonal changes considering hydrologic input and oceanographic conditions.

** Temperature shall vary no more that 1 °C from "ambient conditions"

*** pH shall not deviate more than 0.5 units from a value of 8.1

**** Dissolved oxygen shall not be below 75% saturation

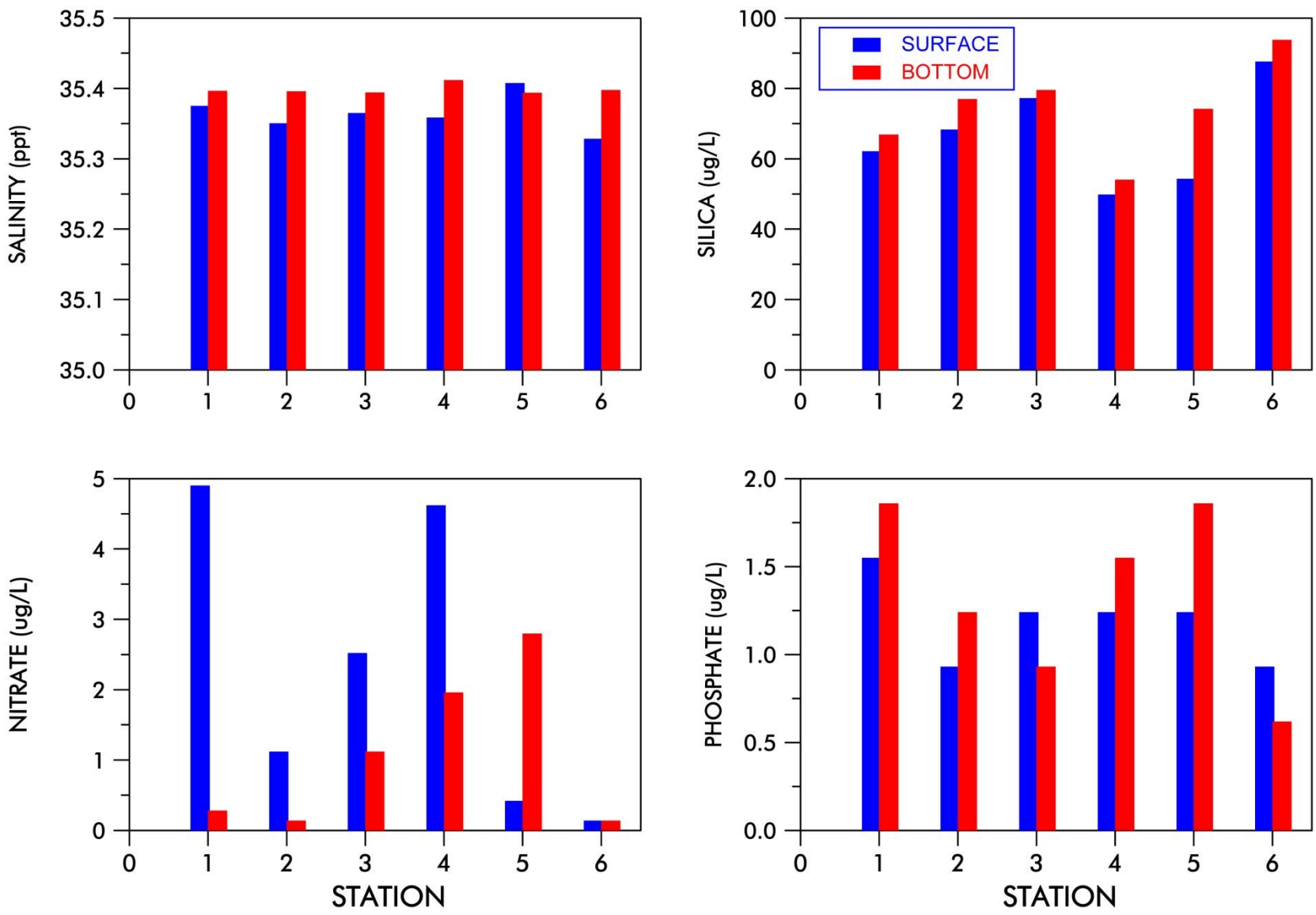


FIGURE 6. Bar graphs showing concentrations of salinity, silica, nitrate nitrogen and phosphate phosphorus in samples collected in the dredged basin and Keehi Lagoon channel on August 6, 2013. For locations of sampling stations, see Figure 1.

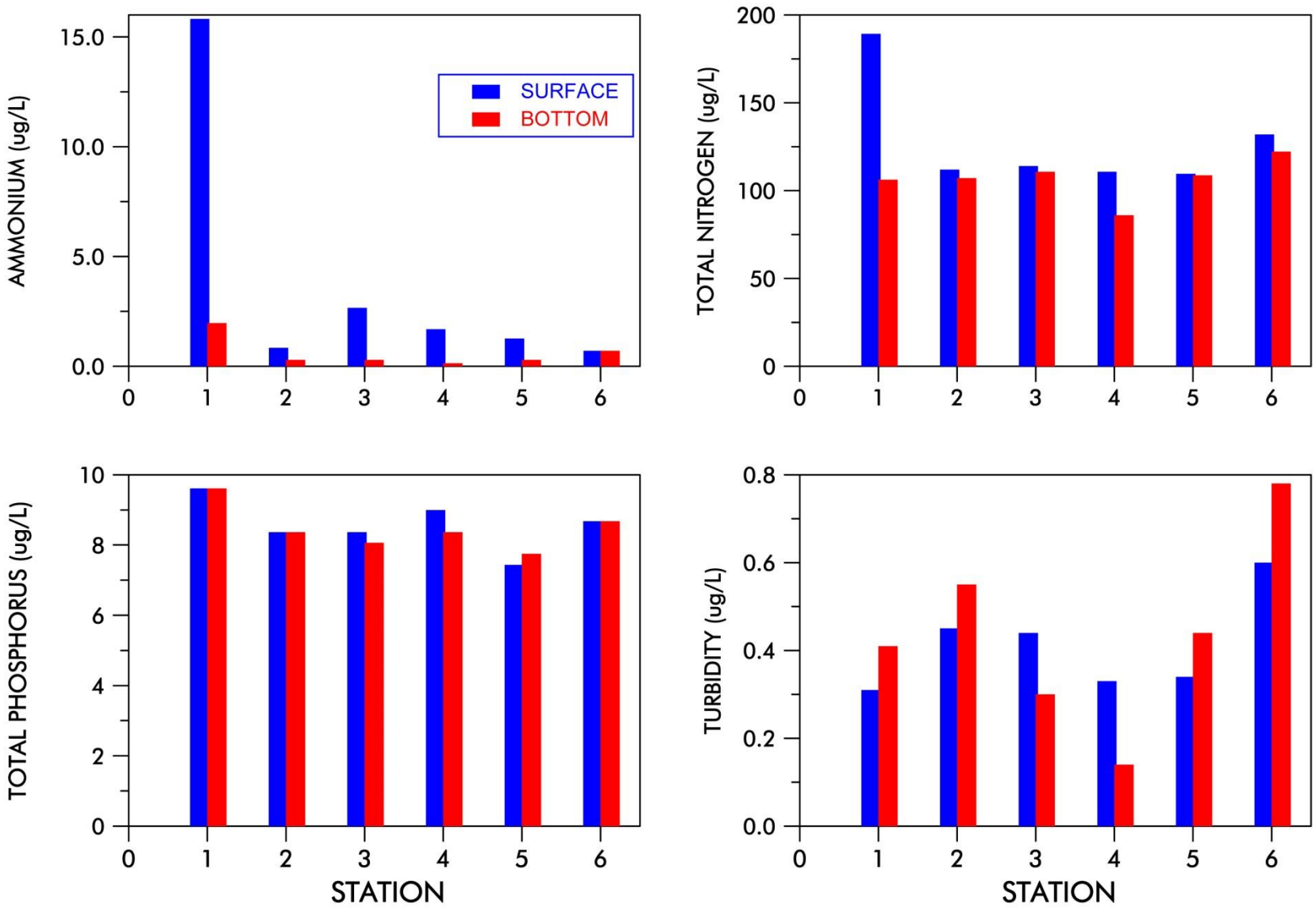


FIGURE 7. Bar graphs showing concentrations of ammonium nitrogen, total nitrogen, total phosphorus ans turbidity in samples collected in the dredged basin and Keehi Lagoon channel on August 6, 2013. For locations of sampling stations, see Figure 1.

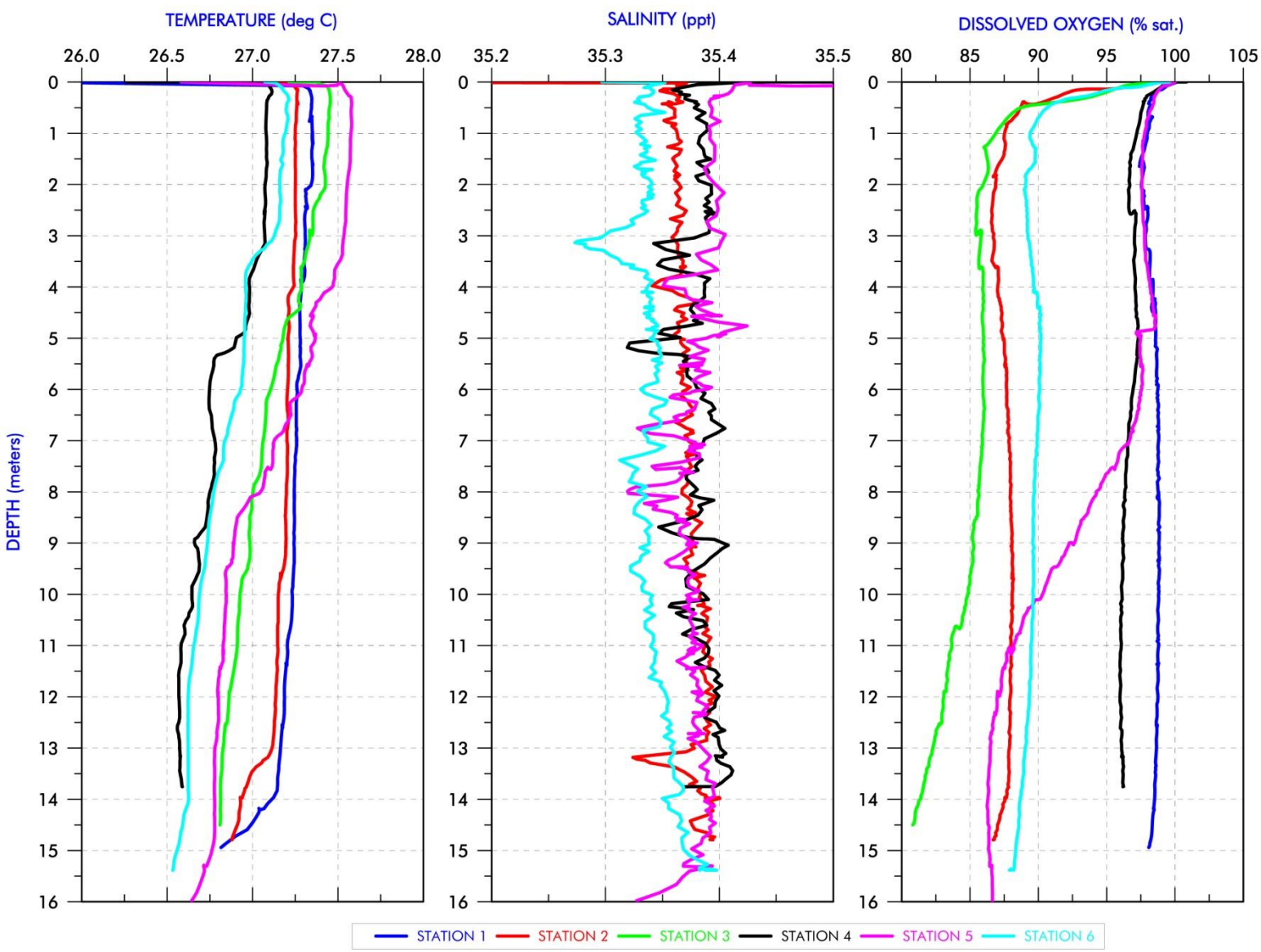


FIGURE 8. Vertical profiles of temperature, salinity and dissolved oxygen at six stations in the dredged basin off the Reef Runway on the south shore of Oahu, Hawaii. Profiles were acquired on August 6, 2013. For locations of sampling stations, see Figure 1.

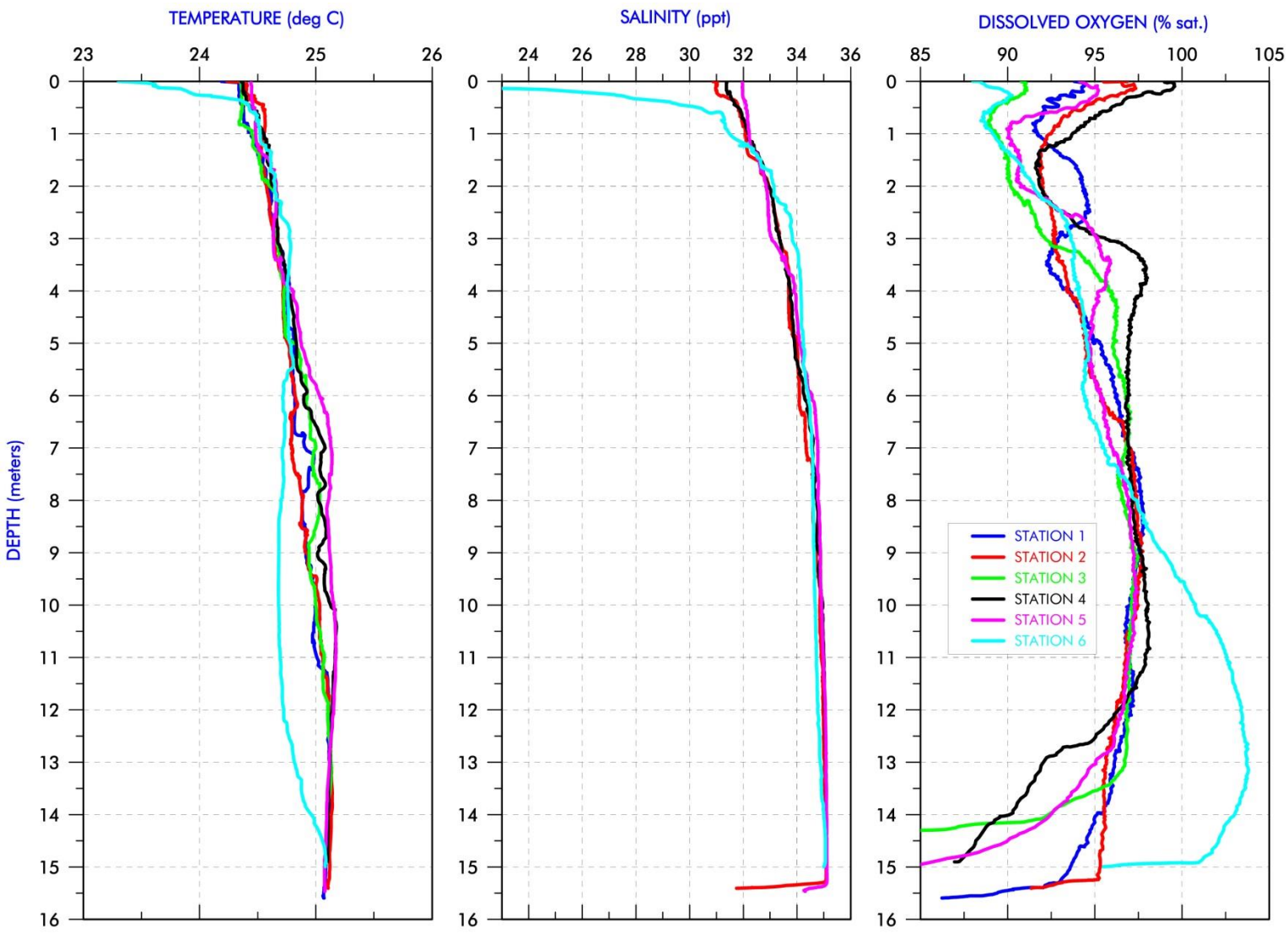


FIGURE 9. Vertical profiles of temperature, salinity and dissolved oxygen at six stations in the dredged basin off the Reef Runway on the south shore of Oahu, Hawaii. Profiles were acquired on December 21, 2010. For locations of sampling stations, see Figure 1.

TABLE 3. Estimate of coral species abundance in dredged basin and reef flat by class: R=rare (<10 individuals); C=common (10-50 individuals); A=abundant (>50 individuals. Blank cells indicate no observations.

	Abundance Class	
SPECIES	BASIN WALLS	REEF FLAT
Porites compressa	C	
Porites lobata	A	C
Porites annae	C	
Pocillopora meandrina	A	R
Pocillopora damicornis	R	C
Montipora capitata	A	C
Montipora patula	A	R
Leptastrea purpurea	R	R
Pavona varians	R	R
Porites rus	C	

TABLE 4. Estimates of non-coral invertebrate and algal abundance on walls of dredged basin and surrounding reef flat off Reef Runway, Honolulu, Hawaii. Abundance Classes are R= rare (<10 individuals; C=common (10-50 individuals); and A=abundant (>50 individuals).

		Abundance Class	
	SPECIES	BASIN WALLS	REEF FLAT
SPONGES	*Chalinula pseudomolitba*	C	R
	Chondrosia chucalla	A	C
	Clathria sp.	R	R
	Gelloides fibrosa	C	C
	Haliclona caerulea	A	A
	Liosina paradoxa	R	R
	Mycale armata	R	R
	Phorbas amaranthus	A	C
	Sigmadocia sp.	C	R
	Zygomycale parishii	C	C
TUNICATES	*Ascidia sydneiensis*	R	R
	Didemnum sp.	R	R
	Herdmania momus	C	C
	Phallusia nigra	R	R
SEA SLUGS	*Plakobranchus ocellatus*	C	R
	Tambja morosa	C	R
BRYOZOANS	*Amathia distans*	C	C
	Bugula stolonifera	C	R
ANNELIDS	*Chaetopterus sp.*	C	R
	Loimia medusa	R	C
	Sabellastarte spectabilis	A	C
	Salmacina dysteri	R	C
	Spirobranchus sp.	R	R
ECHINODERMS	*Echinometra mathaei*	A	A
	Echinothrix sp.	A	A
	Tripneutes gratilla	A	A
	Holothuria sp.	R	R
MOLLUSCS	*Anomia nobilis*	A	C
	Pinctada margaritifera	C	R
SHRIMP	*Stenopis hispidus*	C	R
ALGAE	*Halimeda opuntia*	A	A
	Halimeda discoidea	R	R
	Martensia fragilis	R	R
	Padina spp.	C	R
	Stypodium hawaiiensis	R	R

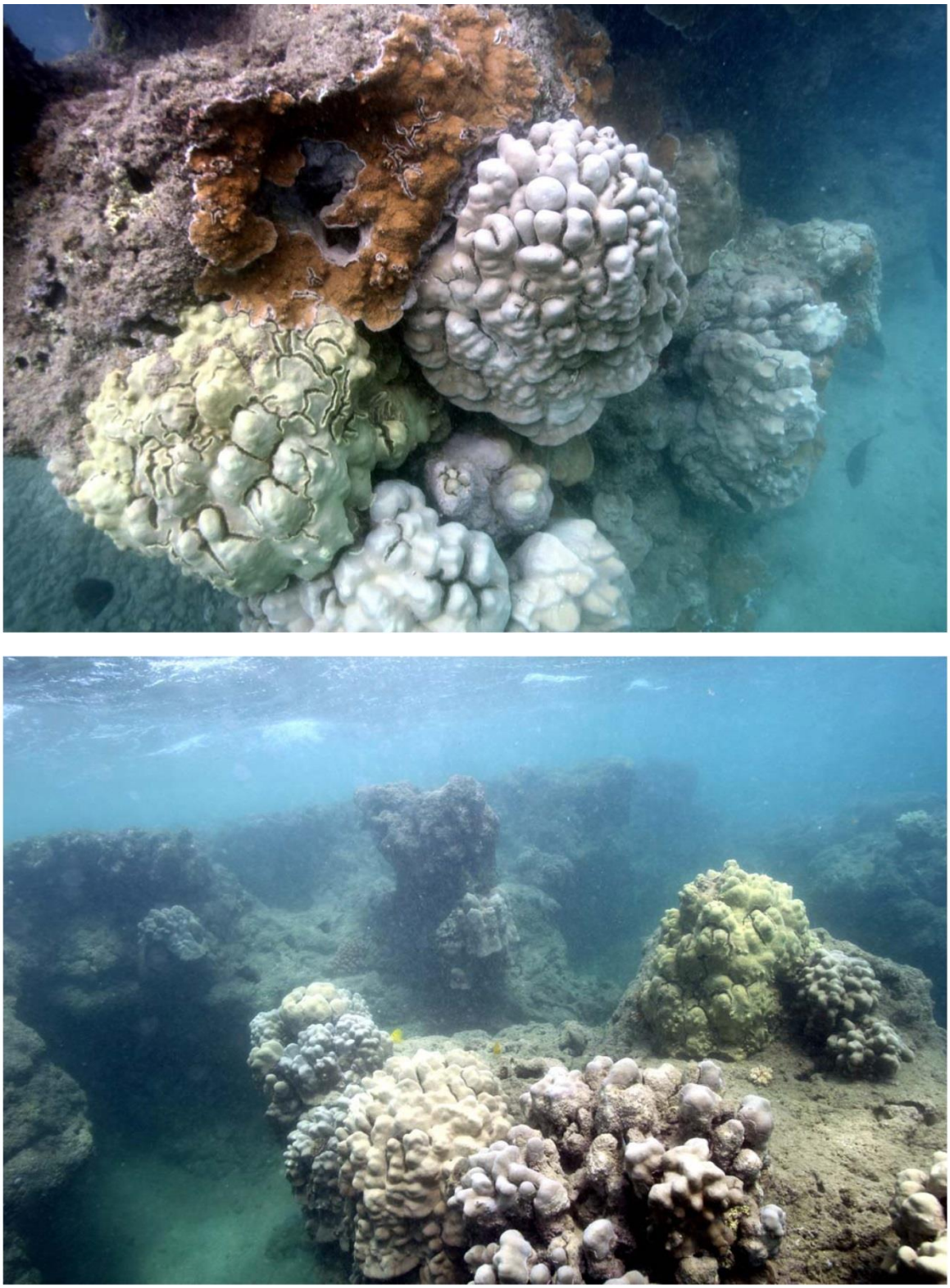
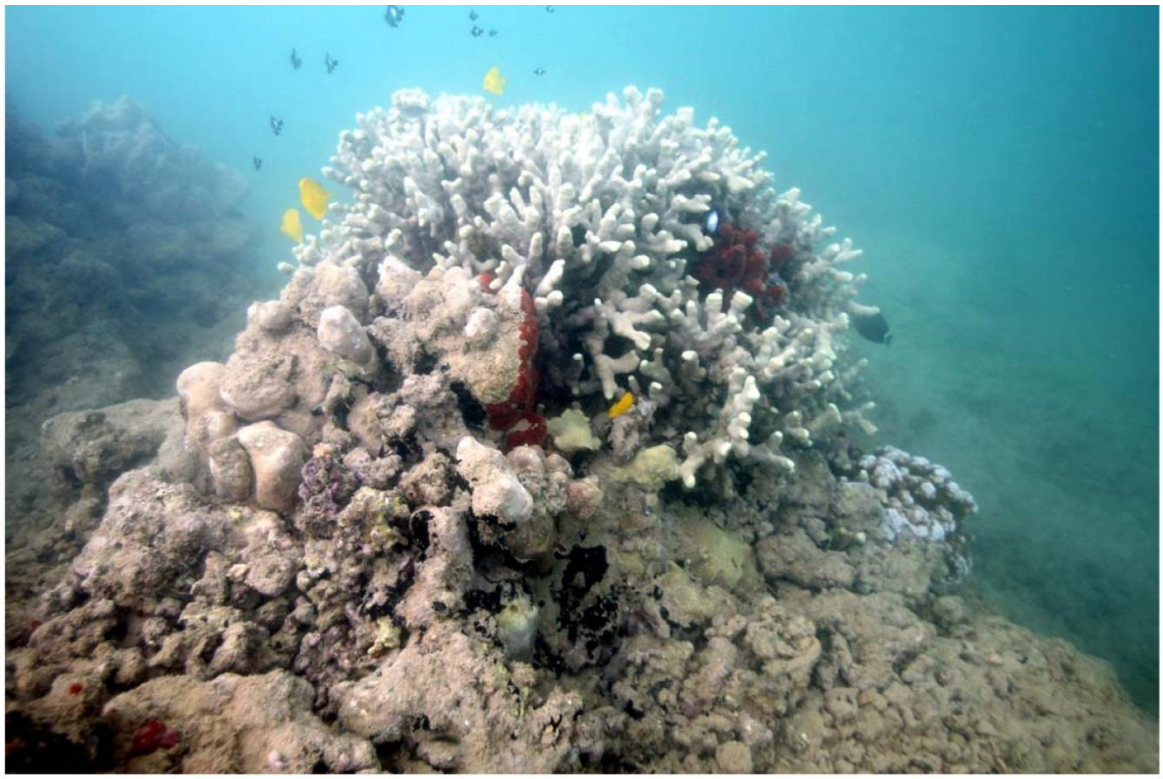


FIGURE 10. Two photos of the upper seaward edge of the dredged Reef Runway borrow pit. Upper photo shows coalescing assemblage of colonies of *Porites lobata* and *Montipora patula* (rust brown color) on vertical face of dredge pit. Lower photo shows multiple large colonies of *Porites* spp on upper edge of reef at edge of pit.



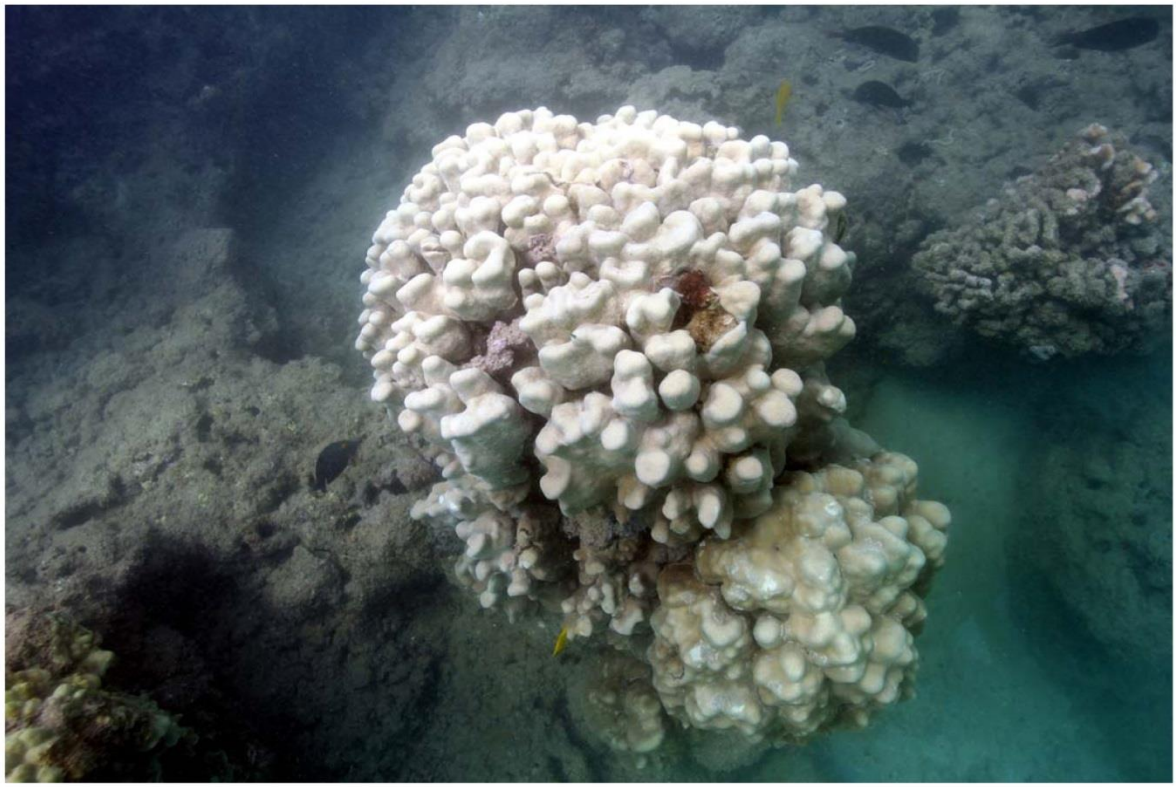


FIGURE 11. Large colony of *Porites compressa* in upper photo growing on the edge of the reef platform adjacent to the dredged Reef Runway borrow pit. Coral in lower photo is likely *Porites annae* (nodule coral). Water depth is approximately 20 feet in both photos.

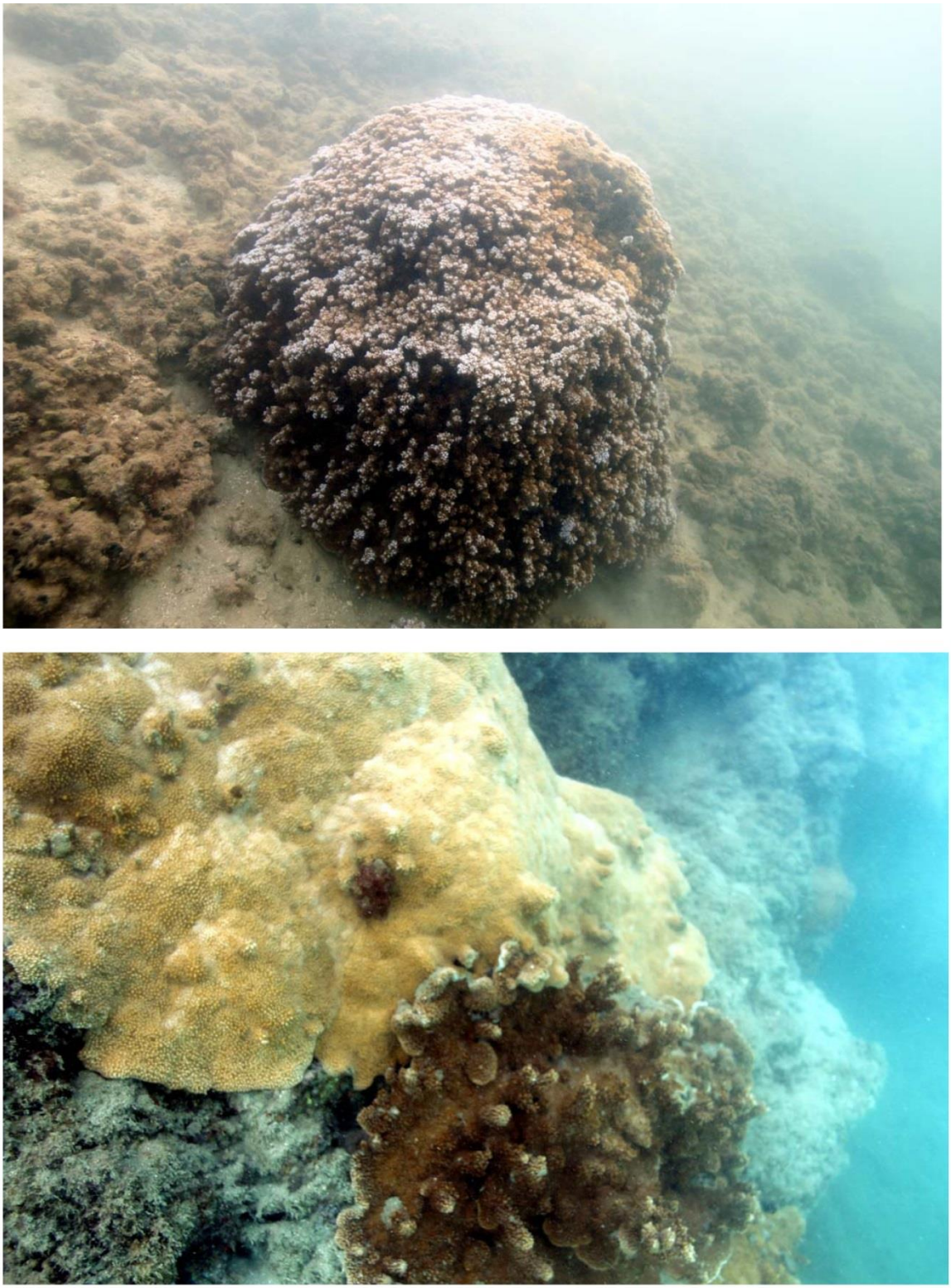


FIGURE 12. Two photos of the vertical wall of the dredged Reef Runway borrow pit showing colonies of *Montipora capitata*. Bottom photo shows two colonies of the same species (*M. capitata*) with different growth forms and color in contact at colony edges.

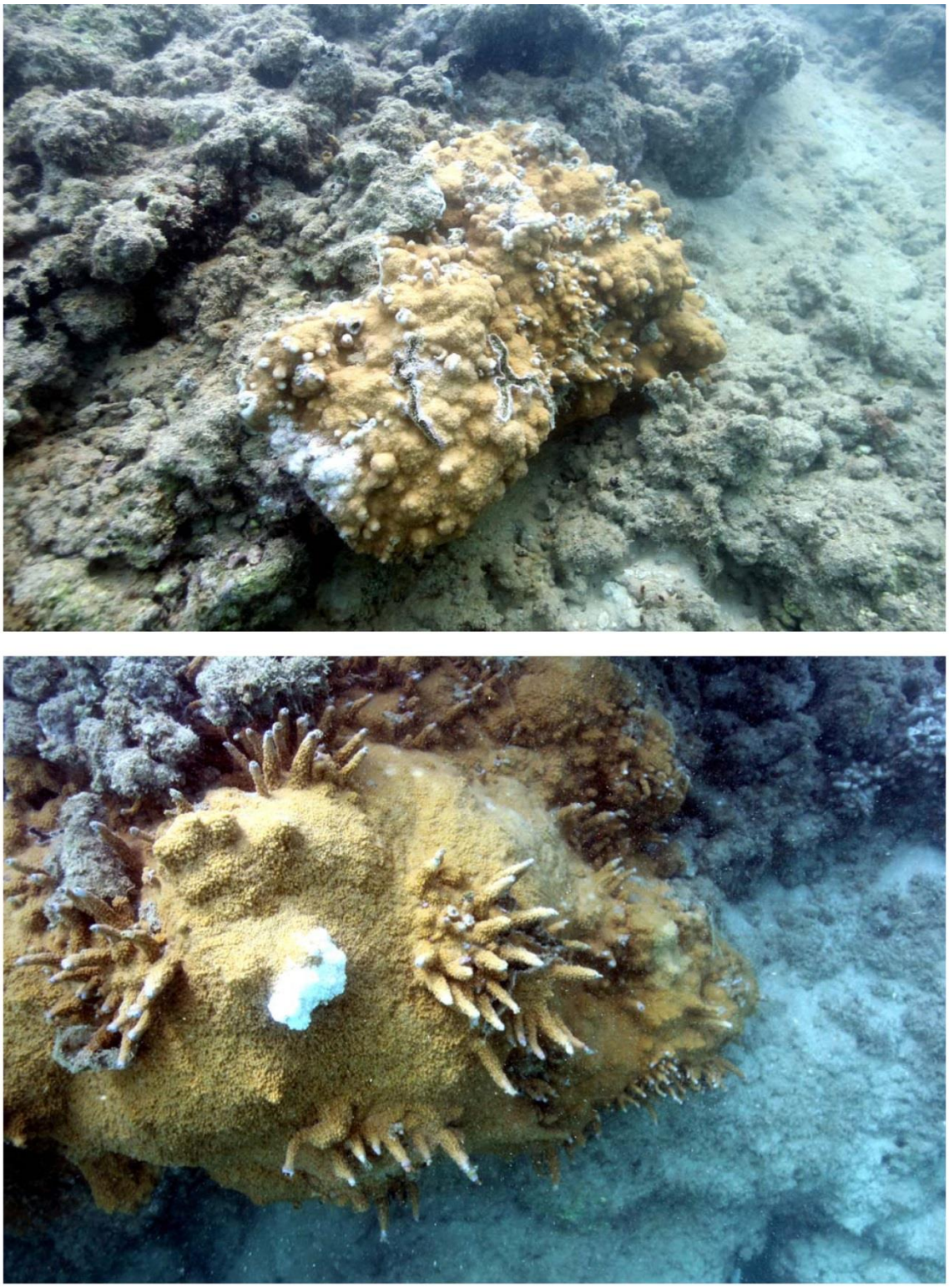
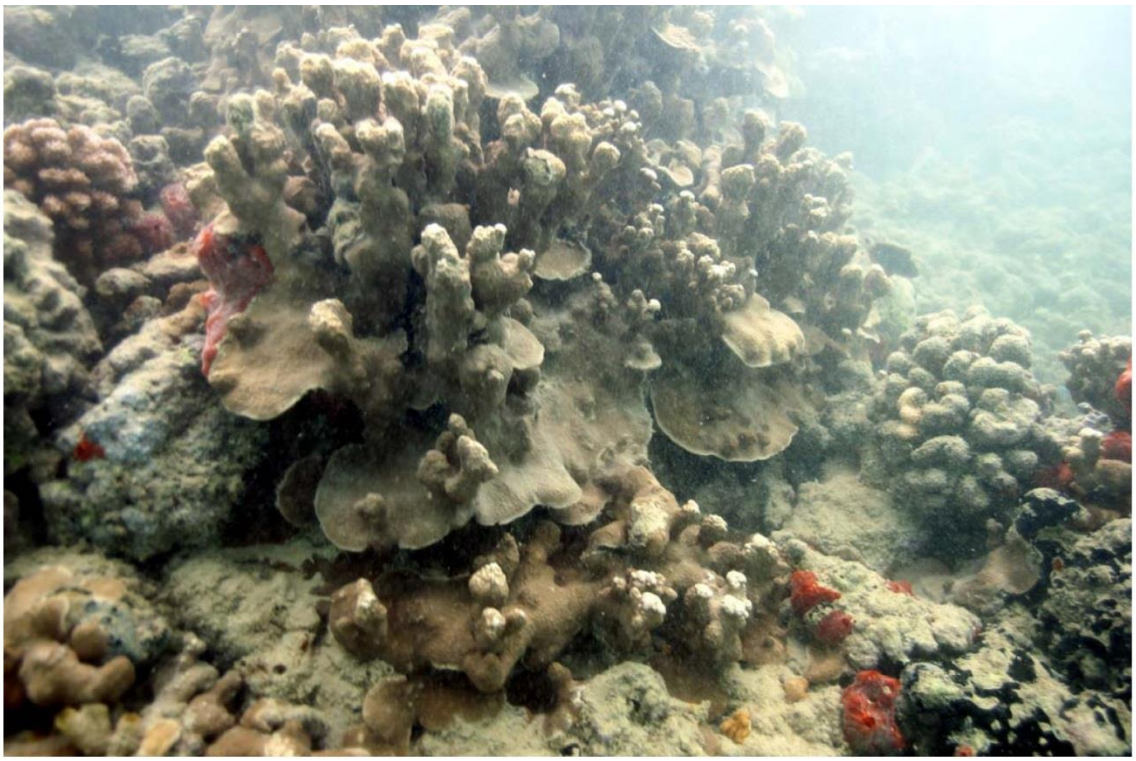


FIGURE 13. Two photos of the vertical wall of the dredged Reef Runway borrow pit showing colonies of *Montipora patula*. Colony in bottom photo has a somewhat unusual growth form comprised of both flat encrusting areas and spiked fingers.



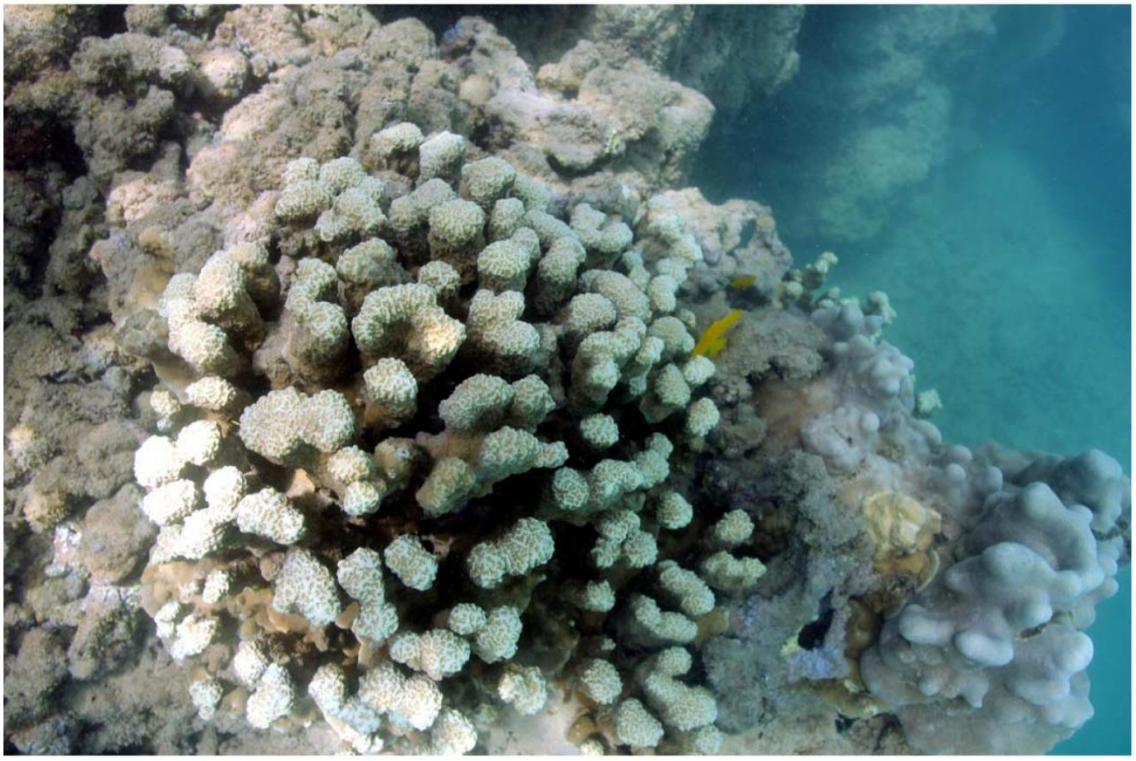


FIGURE 14. Two photos of colonies of *Porites rus* growing on the edge of the reef platform adjacent to the dredged Reef Runway borrow pit. Water depth is approximately 20 feet in upper photo, and 10 feet in bottom photo.

TABLE 5. Reef fish observed along the dredged basin wall and adjacent reef flat off the Reef Runway, Honolulu, Hawaii.

Station	BASIN	REEF FLAT
Butterflyfishes		
C. auriga	23	4
C. lunula		1
C. lunulatus	2	1
C. milliaris	1	
C. ornatissimus	4	
C. quadrimaculatus		2
C. unimaculatus	7	1
F. flavissimus		12
Damselfishes		
A. abdominalis		
A. vaigiensis	23	12
D. albisella	125	20
Goatfishes		
P.multifasciatus	1	12
P. porphyreus		1
Parrotfishes		
C. perspicillatus		
C. spilurus	10	25
S. psittacus	95	53
S. rubroviolaceus		
Pufferfishes		
C. jactator	5	4

Station	BASIN	REEF FLAT
Surgeonfishes		
A. dussumieri		21
A. nigrofuscus	29	52
A. olivaceus		1
A. triostegus	15	8
C. strigosus	37	1
N. hexacanthus	2	
N. lituratus	2	3
N. unicornis	42	80
Z. flavescens	34	30
Z. veliferum	1	1
Wrasses		
G. varius	6	1
H. ornatissimus	20	13
L. pthirophagus	3	1
T. duperrey	10	18
Others		
Apogon evermanni	16	
Caranx melampygus	20	
L. fulvus	3	
Neoniphon sammara		1
Priacanthus meeki		1
Z. cornutus	37	20
Eels		
Gymnothorax meleagris	1	

TOTAL INDIVIDUALS	574	400
TOTAL SPECIES	28	29

APPENDIX B
Part B

Proposed Coral Monitoring Plan for Mamala Bay Seafood's Moi Farm, Reef Runway Borrow Pit, Oahu

Mamala Bay Seafood (MBS) is proposing a monitoring plan as part of its site management responsibilities for the coral reefs adjacent to its proposed fish farm to be located in the Reef Runway Borrow Pit (RRBP). The plan consists of two key components: 1) establishing eight stations on the reef areas surrounding the project to monitor coral coverage and health; and 2) establishing a separate set of four stations surrounding the project to monitor coral recruitment and settlement (see attached Fig. 1).

Monitoring Coral Coverage and Health

To monitor coral coverage and health at the site, nine stations have been selected that surround the cage array (Fig. 1). Initially, baseline data for each station will be gathered consisting of several photos along a transect, on three different occasions prior to cage installation. Each station will have marker pins to be sure the same location and same transects are photographed every time.

Once Phase I of the project, installation of five cages, is implemented, monitoring will begin. With this first phase under way, monitoring activities will consist of photo transects of the five closest stations, twice a year.

When Phase II of the project begins, installation of the other five cages, monitoring activities will increase to photo transects of all eight stations, three times a year. MBS envisions this level of activity will continue for a minimum of five years. If at that time, the data show no significant impacts from farm operations, MBS will request approval from DLNR to collect data twice a year for the remainder of the lease term.

Monitoring Coral Recruitment and Settlement

To monitor coral recruitment and settlement at the site, four stations have been selected on reef areas surrounding the project (Fig. 1). Data will be collected utilizing four coral settlement/recruitment apparatus – a design used in previous studies by MBS in a plan approved by the Department of Land and Natural Resources – constructed for this purpose (Fig. 2). These apparatus will be suspended at a depth of approximately 20 feet in the borrow pit, near the reef area to ensure they are not disturbed by any vessel traffic or physically impact the reef.

These four stations, with their collecting apparatus, will be established prior to installation of the first five cage array (Phase I). They will be inspected on a yearly basis for the term of the lease to gather data on the numbers and types of corals that settle out. These data should provide insight into the effects of the farm operations on coral settlement and recruitment.

MBS notes that the coral settlement apparatus will be built in a manner that if in the future, either Federal or State agencies express a need or desire to utilize these corals, they can easily be removed. If agency use of corals does occur, then MBS will re-establish a clean apparatus at the station. MBS recognizes that this aspect of monitoring will be a learning process for both the responsible agencies and MBS in terms of determining best substrate and structure to utilize, but MBS is pleased to help develop improved coral management tools.

All data from this monitoring plan will be collected and compiled by MBS, using well-qualified third party consultants. The collected information will be reported to the Department of Land and Natural Resources and directed to the Office of Conservation and Coastal Lands and the Division of Aquatic Resources, as well as other agencies as required.

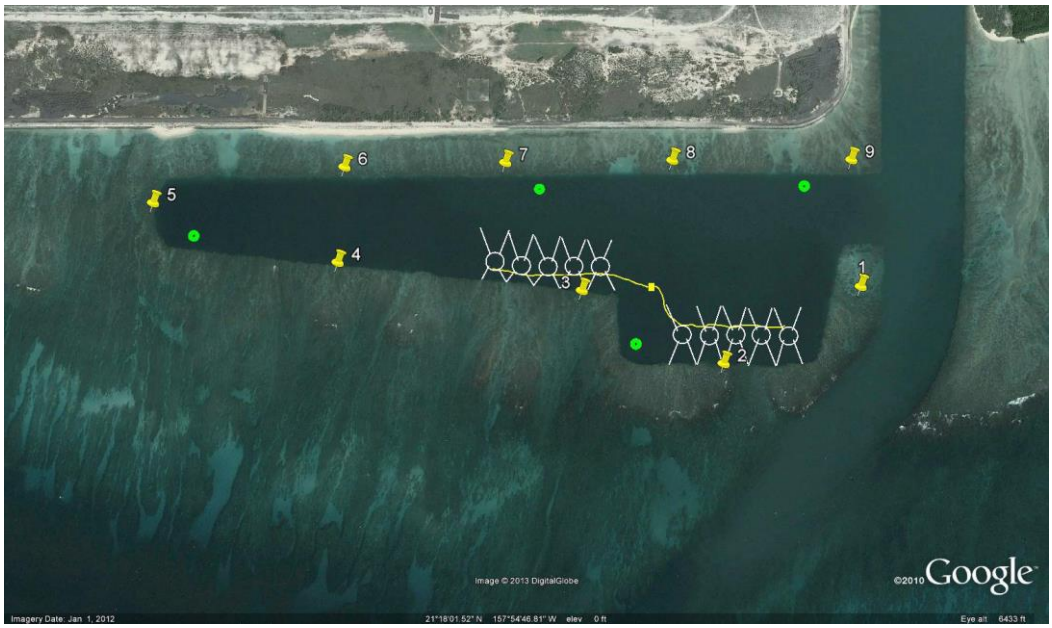


Fig. 1. Location of nine stations for regular transects to monitor coral coverage and health (yellow pins) and four stations to monitor coral settlement (green dots)), RRBP, Oahu.

APPENDIX C

Benthic Monitoring Report

For the Period

October 2013

By

PlanB Consultancy

Chief Scientist: John Burns

Subject Location

Proposed Open Ocean Mariculture Site

Cages are planned to be installed to the west of the Kalihi channel, in Mamala Bay, on the South Shore of Oahu

Site will be operated by

Cates International

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Chemical Analysis_____Pg. 117

Micromollusc Distribution Report_____Pg. 122

Lab Report & Chain of Custody Forms_____Pg. 124

Benthic Monitoring Report
For
Cates International

Samples Collected At The Proposed Offshore Farm Site On:

October 10th, 2013

By

PlanB Consultancy

Chief Scientist: John Burns

This report details the 2013 benthic monitoring for the Cates International proposed offshore aquaculture site. The proposed site is located in Mamala Bay, on the west side of the Kalihi channel adjacent to Sand Island, Oahu. All samples were collected at the proposed net locations (see coordinates below) using SCUBA. Samples were collected from the six locations proposed for commercial aquaculture operations (Figure 1). Upon retrieval, the samples were transferred from the collection bottles and placed in a receptacle along with the seawater collected with each sample.

The following parameters were assessed immediately for each sample:

- *General appearance*
- *Macro fauna*
- *Macro algae*
- *Oxidation/Reduction Potential (ORP) readings*
- *Odor (presence of H_2S)*

Sub-samples were collected from each sample in order to analyze the following parameters:

- *Total organic carbon (TOC)*
- *Benthic sand characterization*
- *Micromollusc characterization*

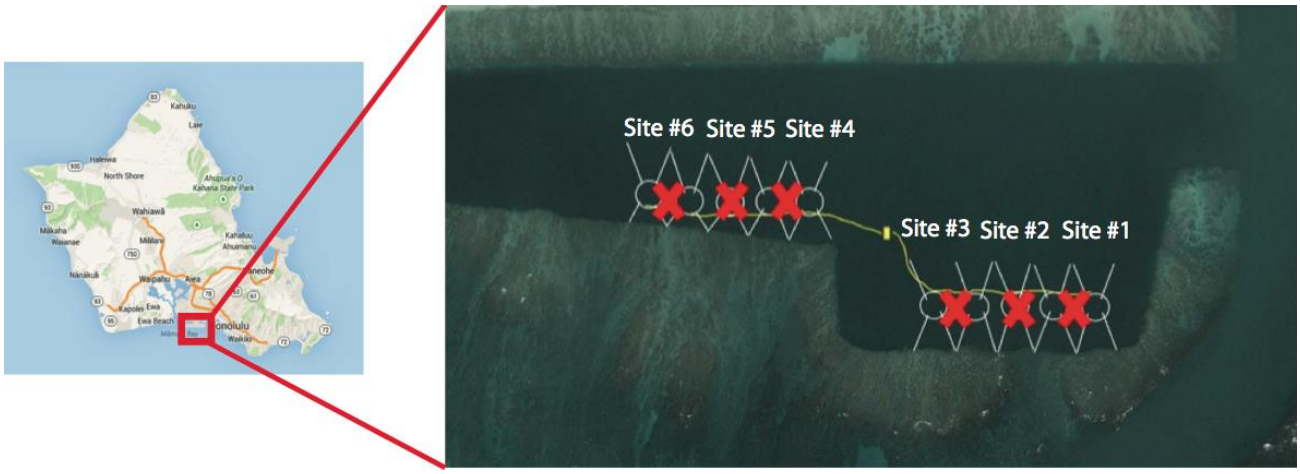


Figure 1. Site image of proposed Cates International aquaculture cages. Red 'X's represent the locations utilized for benthic sampling. White lines represent a diagram of the planned install formation for the fish pens.

Coordinates:

Site # 1	*N 21 18.006*	*W 157 54.445*
Site # 2	*N 21 18.022*	*W 157 54.532*
Site # 3	*N 21 18.047*	*W 157 54.631*
Site # 4	*N 21 18.087*	*W 157 54.697*
Site # 5	*N 21 18.111*	*W 157 54.782*
Site # 6	*N 21 18.129*	*W 157 54.903*

General *In-Situ* Sampling Observations and Data Description

Site # 1	**8:46am**	**Site # 2**	**8:52am**
Appearance:	Light Brown	Appearance:	Light Brown
Macro Fauna:	None	Macro Fauna:	None
Macro Algae:	None	Macro Algae:	None
ORP:	244.6	ORP:	239.3
Odor:	None	Odor:	None
Site # 3	**9:06am**	**Site # 4**	**9:13am**
Appearance:	Light Brown	Appearance:	Light Brown
Macro Fauna:	None	Macro Fauna:	None
Macro Algae:	None	Macro Algae:	None
ORP:	235.8	ORP:	240.1
Odor:	None	Odor:	None
Site # 5	**9:20am**	**Site # 6**	**9:24am**
Appearance:	Light Brown	Appearance:	Light Brown
Macro Fauna:	None	Macro Fauna:	None
Macro Algae:	None	Macro Algae:	None
ORP:	241.7	ORP:	246.1
Odor:	None	Odor:	None

Benthic Sand Characterization

Intro/Methods

Sediments play a significant role in the structure of benthic communities due to the fact that many organisms have grain size preferences, thus changes in sediment composition can affect organisms occupying the benthic habitat. Furthermore, sediment characteristics can provide useful information about source materials, the depositional environment (amount of energy in waves and currents), and other physical and chemical factors.

Sediment samples were collected in order to assess sediment composition. Sub-samples from each site (Sites # 1-6) were washed with fresh water to remove salt and then sun-dried. Sand grain size analysis was conducted using a set of 7 US Standard sieves (5,10,35,60,120,230, and Dust). Samples were processed through the sieves using a motorized shaker to adequately separate sand grains based on physical size. An electronic balance was used to measure the mass of each sample proportion that was isolated in the individual sieves. The average retained weights, and percentage of total weights, are presented in the data table below.

Data/Results

Site # 1		
Mesh Size	Mean Retained Weight (grams)	Mean Percentage of Total
5	0.00	0.0%
10	0.00	0.0%
35	0.00	0.0%
60	48.52	90.4%
120	4.32	8.1%
230	0.59	1.1%
Dust	0.23	0.4%
TOTAL	53.66	

Site # 2		
Mesh Size	Mean Retained Weight (grams)	Mean Percentage of Total
5	0.00	0.0%
10	0.00	0.0%
35	0.00	0.0%
60	45.50	97.0%
120	1.13	2.4%
230	0.21	0.4%
Dust	0.07	0.1%
TOTAL	46.91	

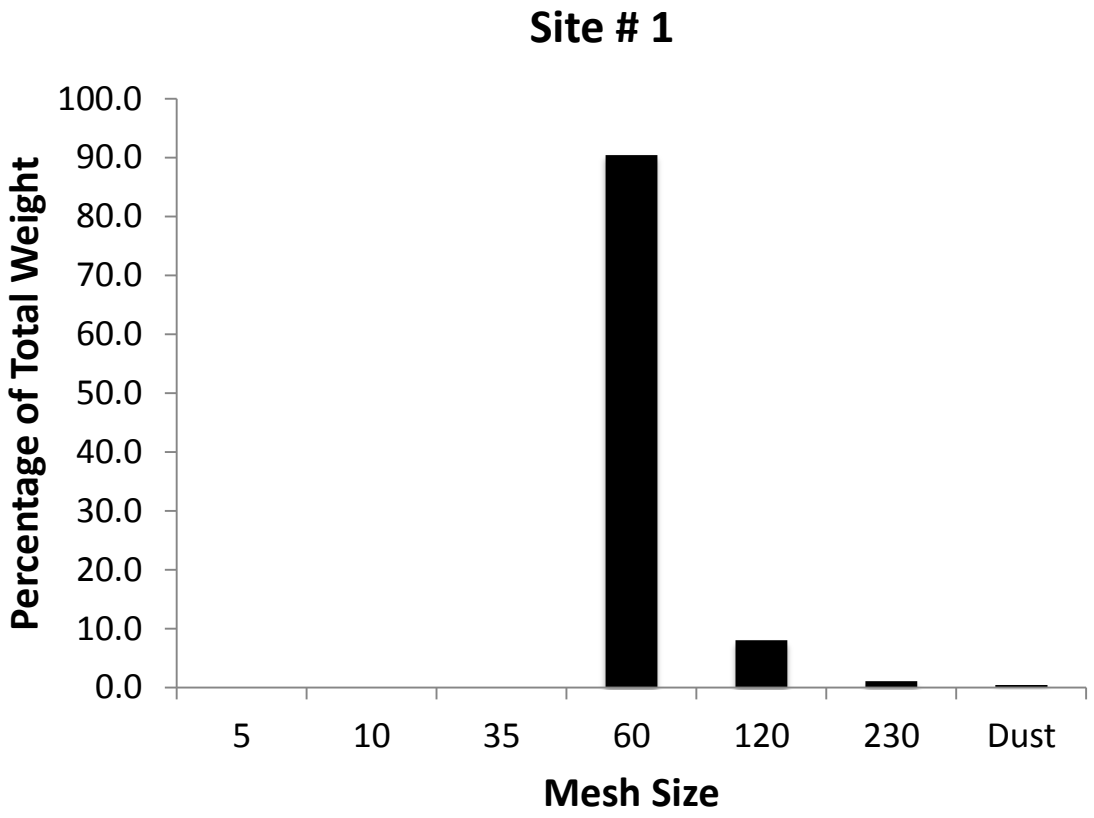
Site # 3		
Mesh Size	Mean Retained Weight (grams)	Mean Percentage of Total
5	0.00	0.0%
10	0.00	0.0%
35	0.00	0.0%
60	63.99	96.0%
120	2.17	3.3%
230	0.40	0.6%
Dust	0.09	0.1%
TOTAL	66.65	

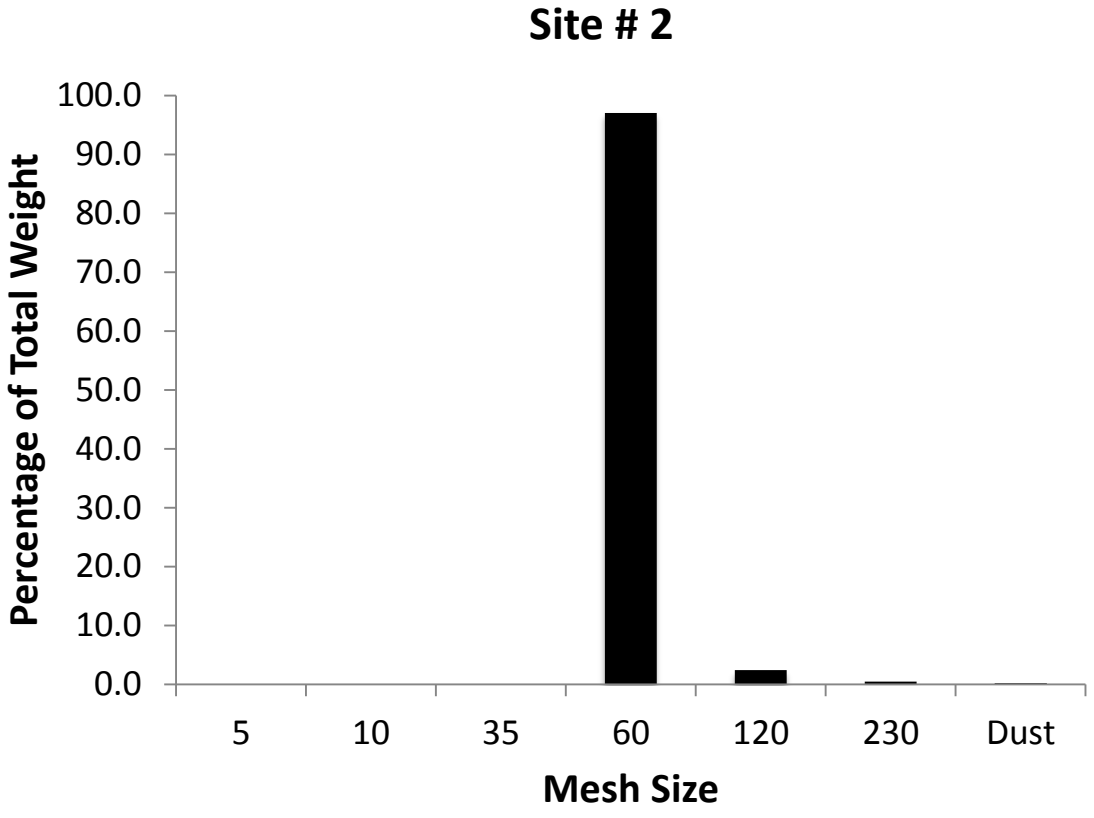
Site # 4		
Mesh Size	Mean Retained Weight (grams)	Mean Percentage of Total
5	0.00	0.0%
10	0.00	0.0%
35	0.00	0.0%

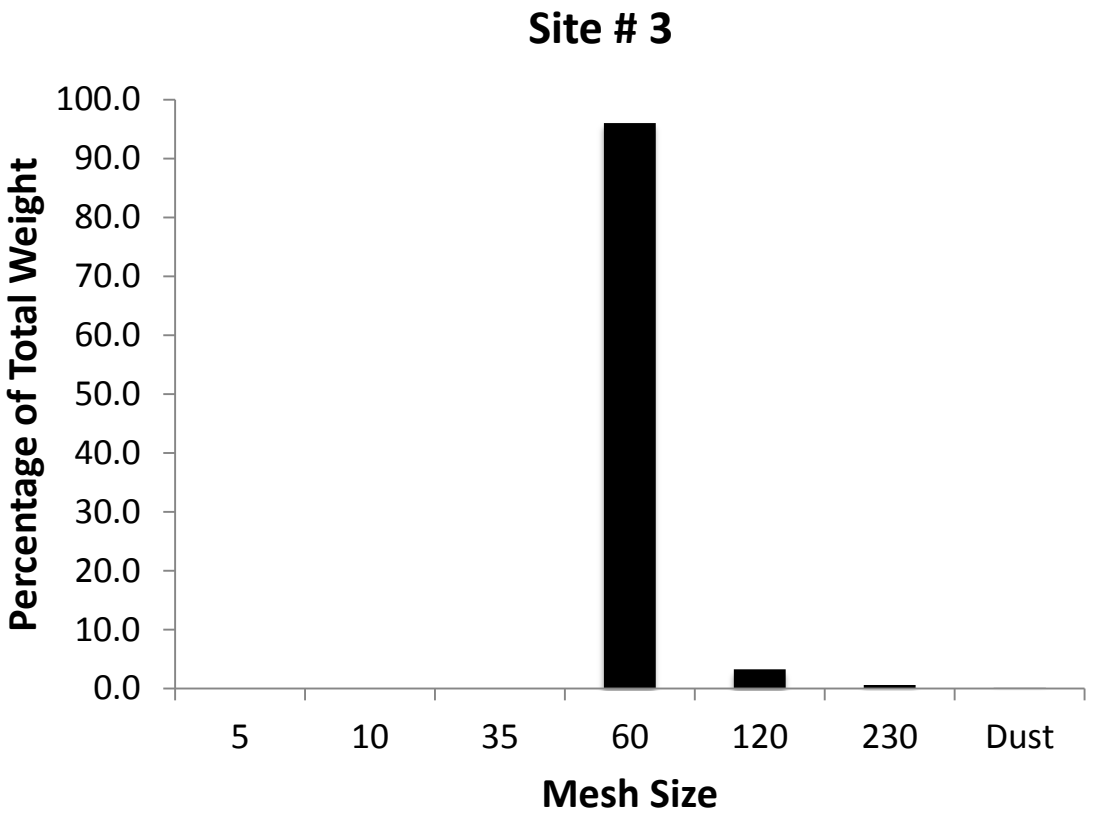
60	56.02	95.3%
120	2.29	3.9%
230	0.37	0.6%
Dust	0.10	0.2%
TOTAL	58.78	

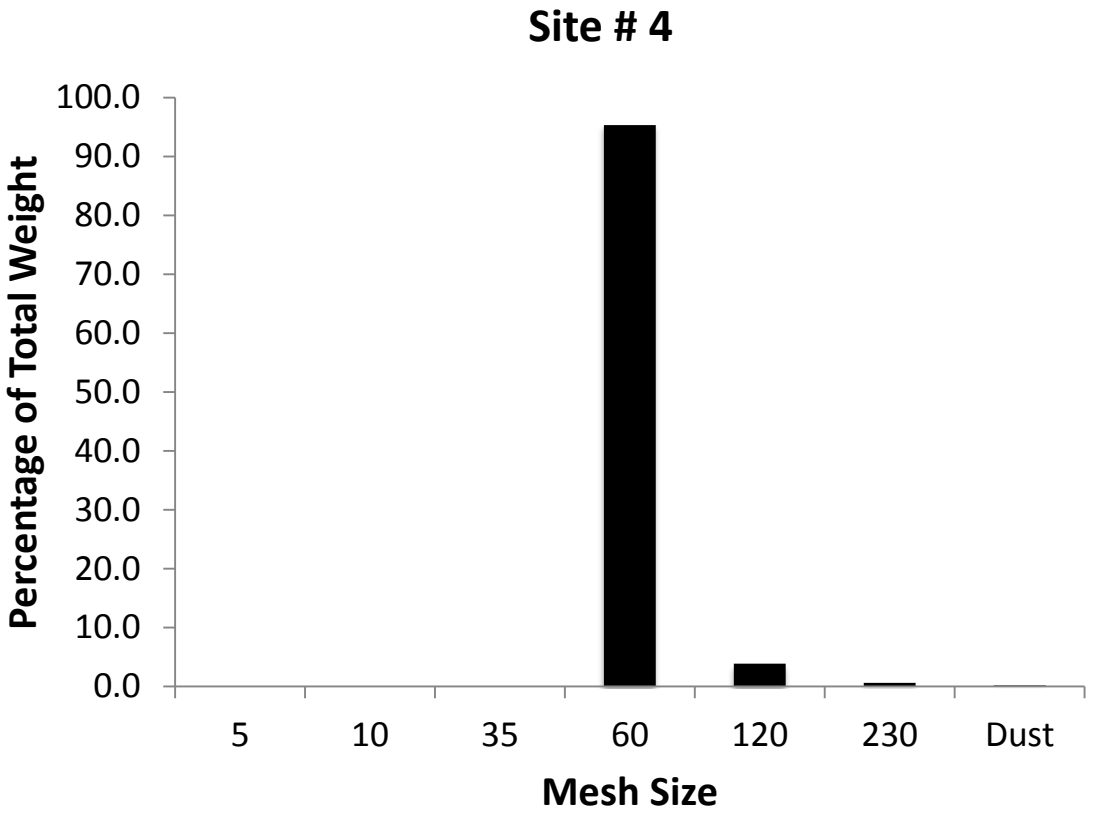
Site # 5		
Mesh Size	Mean Retained Weight (grams)	Mean Percentage of Total
5	0.00	0.0%
10	0.00	0.0%
35	0.00	0.0%
60	74.87	96.0%
120	2.66	3.4%
230	0.34	0.4%
Dust	0.10	0.1%
TOTAL	77.97	

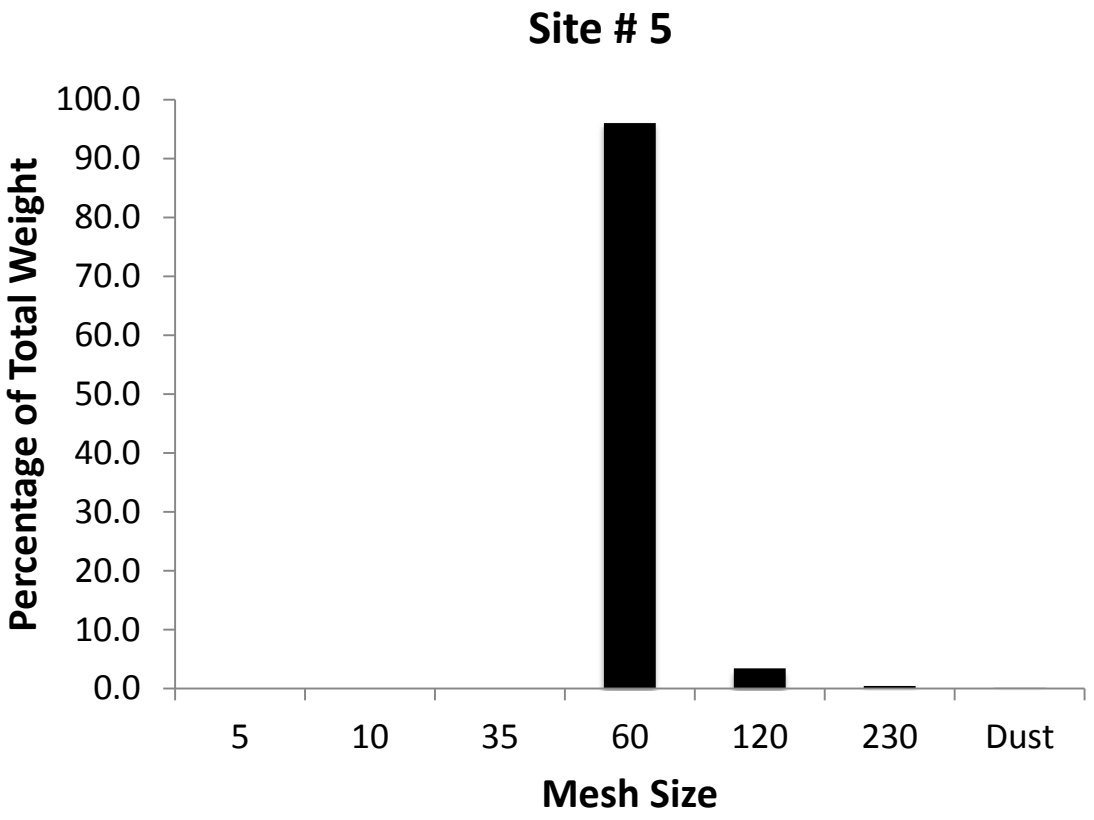
Site # 6		
Mesh Size	Mean Retained Weight (grams)	Mean Percentage of Total
5	0.00	0.0%
10	0.00	0.0%
35	0.00	0.0%
60	59.94	93.2%
120	3.65	5.7%
230	0.60	0.9%
Dust	0.15	0.2%
TOTAL	64.34	

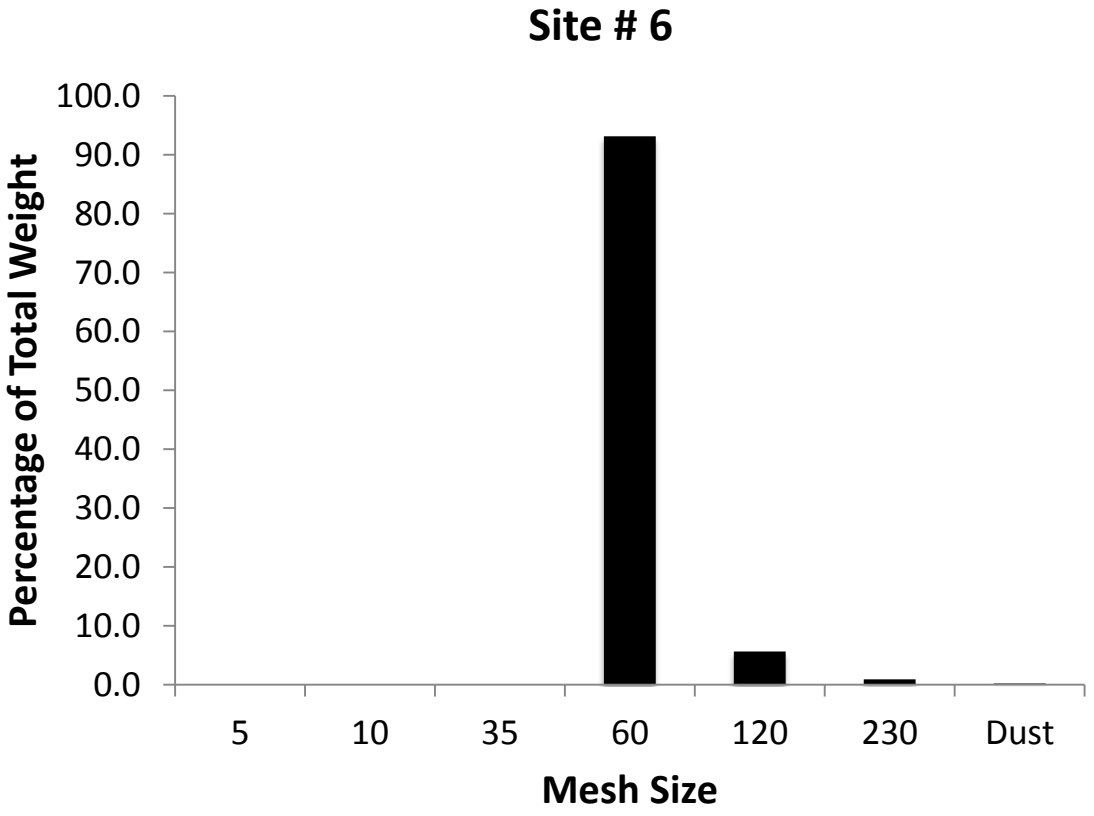

Site # 1
Percentage of Total Weight
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
5
10
35
60
120
230
Dust
Mesh Size


Site # 2
Percentage of Total Weight
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
5
10
35
60
120
230
Dust
Mesh Size


Site # 3
Percentage of Total Weight
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
5
10
35
60
120
230
Dust
Mesh Size


Site # 4
Percentage of Total Weight
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
5
10
35
60
120
230
Dust
Mesh Size


Site # 5
Percentage of Total Weight
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
5
10
35
60
120
230
Dust
Mesh Size


Site # 6
Percentage of Total Weight
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
5
10
35
60
120
230
Dust
Mesh Size

Summary

The sediment compositions of the 2013 samples were very homogenous, and all sites exhibited similar values (see graphs above). All samples were composed of primarily fine sand and silt. There was no evidence of live coral, hard substrate, or any macro-organisms or biota from the collected samples. The lack of biota and hard substrate is characteristic of sites nearshore and inside of a protective outer-reef. The sites are all exposed to a high level of tidal currents, as well as swell energy, and the resulting mixing may be driving the homogenous sediment structure. This data will provide a useful metric for detecting any changes to the sand composition that may be driven by the proposed aquaculture operations. The lack of biota, and homogenous substrate, do provide evidence that any discharge will have little affect on the benthic composition.

Chemical Analysis

Intro/Methods

Chemical analyses were performed on samples collected from each monitored location. Sub-samples were properly stored and transported to the Aquatic Research Incorporated Laboratory for Total Organic Carbon (TOC) analysis. The percentage of total solids in each sample was measured by utilizing EPA method 160.3, and the percentage of TOC was measured by utilizing EPA method 9060. A quality control check was run in conjunction with all samples to ensure accurate values were obtained (see attached lab report). Oxidation/Reduction Potential (ORP) was measured immediately with an ORP meter upon sample retrieval while in the boat.

Measuring the amount of TOC in benthic samples provides information on the amount of sample material that may be derived from decaying vegetation, bacterial growth, and metabolic activities of living organisms or chemicals. Levels of TOC can be indicative of contaminants from discharge, and therefore provides an important measure of the potential effects of industrial discharge on the environment and human health. TOC is a highly sensitive, and non-specific, measurement of all organics present in a sample. A low value of TOC can confirm the absence of potentially harmful organic chemicals in water exposed to any form of industrial discharge.

ORP provides an indirect method to evaluate the level of biological activity in a benthic sample. This analytical technique also provides a measure of chemical exchange between the substrate and the water column. Low ORP values indicate a high amount of biological activity and an insufficient exchange for maintaining aerobic conditions. Readings below the value of 0 indicate anaerobic conditions. Anaerobic conditions typically occur when high levels of biological activity remove oxygen faster than it can be restored, thus creating an anaerobic environment. Aerobic and anaerobic conditions will determine the types of organisms that can inhabit the substrate and can cause a shift in the composition of the fauna and flora. Introduction of excess organic materials (fish feces, uneaten feed, or large amounts of bio-fouling material from cages) can be deposited on the substrate and result in anaerobic conditions. ORP therefore enables monitoring of the aerobic state of the substrate below the cages in order to ensure the fish farm is not affecting the biological composition of the sea floor.

Data/Results

Site	ORP Value
Site # 1	244.6
Site # 2	239.3
Site # 3	235.8
Site # 4	240.1
Site # 5	241.7
Site # 6	246.1

Site	Total Solids (%)	Water (%)	TOC (%)
Site # 1	27.7%	72.3%	1.73
Site # 2	22.3%	77.7%	2.16
Site # 3	22.9%	77.1%	1.14
Site # 4	26.1%	73.9%	1.39
Site # 5	29.3%	70.7%	1.99
Site # 6	31.3%	68.7%	2.04

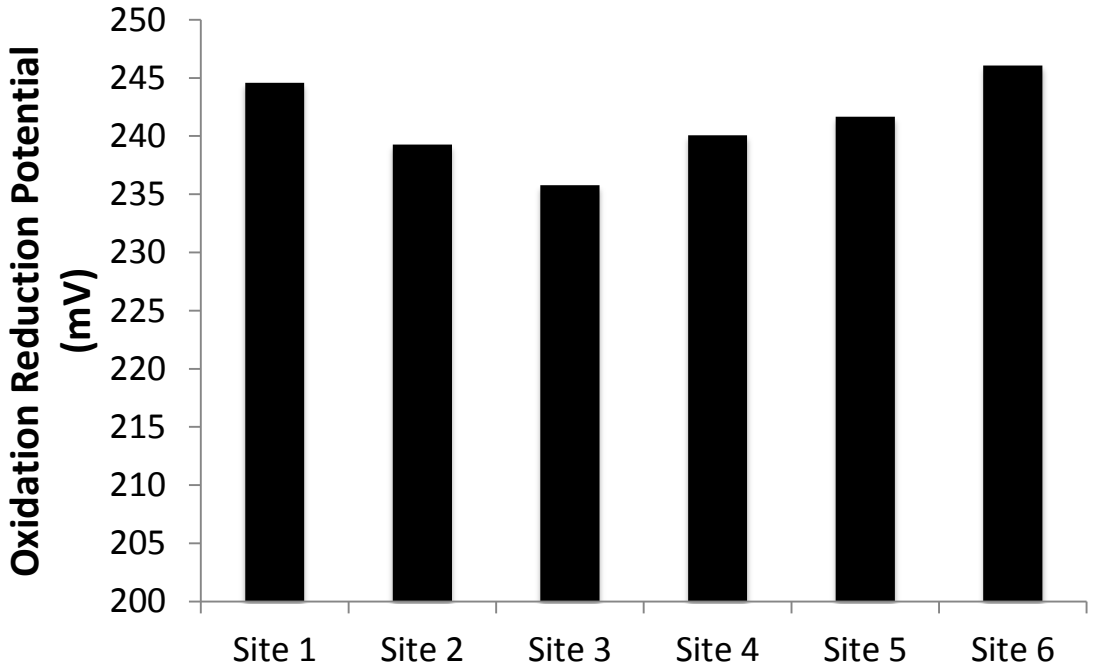


Figure 2. Comparisons of ORP values measured at each monitoring location.

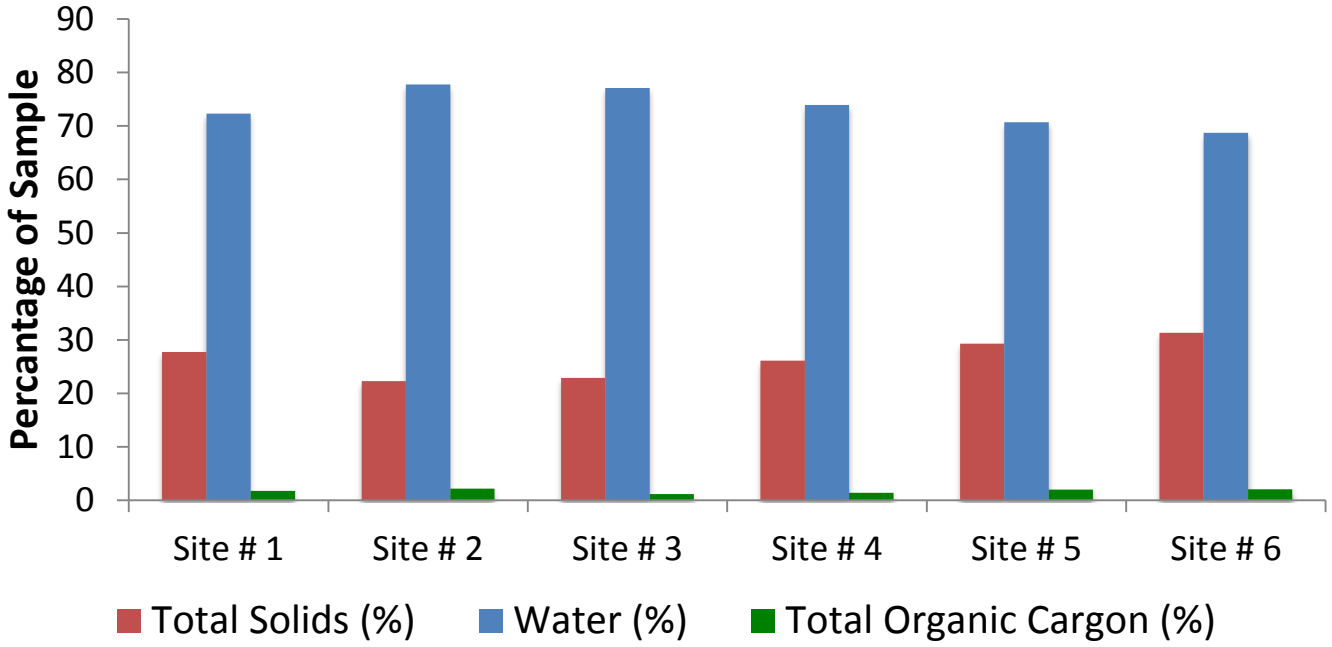


Figure 3. Comparisons of TOC values measured at each monitoring location.

Summary

ORP readings taken from all sites exhibited values over 200 Millivolts (Figure 2). These ORP values provide no evidence of anoxic conditions in the substrate below any of the monitored sites. This is also reflected in the color and lack of odor from the samples monitored this year. These findings provide evidence that the benthic substrate below the cages is aerobic, however it is also devoid of any macro-algae, biota, or fauna. The aerobic conditions (indicated by the ORP readings) are likely due, in large part, to the hydrologic mixing induced by the strong currents and wave action that affect the benthic substrate in this area.

TOC values can be used to assess sediment contaminants or organic enrichment in areas where there is considerable deposition of organic matter. TOC exists naturally in coastal sediments and is the result of the degradation of autochthonous and allochthonous organic materials (i.e. phytoplankton, leaves, twigs, dead organisms) and anthropogenic sources (i.e. organic industrial wastes, untreated or only primary-treated sewage). An increase in either of these factors can significantly elevate the level of TOC in sediments. TOC in coastal marine sediments is often a source of food for some benthic organisms, and high levels of TOC can result in dramatic changes to the benthic community structure. For example, increasing TOC can impact the natural species composition and cause dominance by pollution-tolerant species. Increased levels of sediment TOC can also reduce the general availability of organic contaminants (i.e. PAHs, PCBs, pesticides). Regions of high TOC content are also likely to be depositional sites for fine sediments. If there are pollution sources nearby, these depositional sites are likely to be hot spots for contaminated sediments.

The sediments at the monitored sites were all relatively 'fine,' with grains predominantly in the mesh size of '60' (see sand characterization above). Furthermore, this site is nearshore and adjacent to the Sand Island industrial

Rating	Cutpoints
Good	The TOC concentration is less than 2%.
Fair	The TOC concentration is between 2% and 5%.
Poor	The TOC concentration is greater than 5%.

Table 1. EPA-cutpoints for assessing sediment quality based on TOC values

district, and is thus exposed to a presumably high level of contaminated run-off and discharge. It will be important to monitor TOC values over time to ensure and discharge produced by the planned aquaculture cages does not contaminate the sediment to a harmful level. According to the EPA cutpoints, the current TOC values are considered either 'good' or 'fair' (Figure 3, Table 1). These values seem reasonable considering the fine sediment, and close proximity to industrial areas. Consistent monitoring, and monitoring of the adjacent area, will provide ample results to determine any potential deleterious impacts the aquaculture operations may impose on the sediment quality in this area.

References:

Environmental Protection Agency (2012) National Coastal Condition Report IV

Pearson TH, Rosenberg R (1978) Macrobenthic succession in relation to organic enrichment and pollution of the marine environment. *Oceanography and Marine Biology: An Annual Review* 16: 229-311

Micromollusc Distribution Report for Keahole Point Fish

Marta deMaintenon, UH Hilo Marine Science

February 2014

Methods

Sediment samples were taken from six sites at the proposed location for the Cates International aquaculture operation on Oahu. Each sample (one per site) was rinsed in fresh water, dried, and three 15ml subsamples were taken. The subsamples were picked for mollusk shells using an Olympus SZX12 dissecting stereomicroscope.

Fresh shells were picked from each sample, identified and counted. Bivalve halves were counted as whole individuals. Since it is not possible to identify shells that are truly freshly dead vs. dead for some time, the samples should be considered time-averaged. Identifications were made using Kay (1979) and Severns (2011). Kay (1979) provides some information on habitat and ecology, and more was derived from Beesley et al. (1998).

Results

The six samples of sediment from Oahu contained very fine clay silt, and that was pretty much all that was in them. There was one mollusc shell, likely a cerithioid gastropod (but less than 1mm long and not mature enough to be identifiable), in sample 5. Cerithiids are ubiquitous marine snails that eat mostly microalgae and detritus. The only other biotic remains in the samples were foraminifera, many very small, most of which appeared to be from the family Miliolidae (based on comparison with figures in Phillips 1977), a crab dactyl, and a very few ostracod carapaces in samples 3 and 5.

Summary re. Mollusca:

1 juvenile cerithioid shell, sample 5

Phillips, F.J. 1977. Protozoa. Pp. 12-52 in: Devaney, D.M & Eldredge, L.G., eds., Reef and Shore Fauna of Hawaii Sect. 1: Protozoa through Ctenophora. Bernice P. Bishop Spec. Publ. 64(1): 278 pp.

IEH - AQUATIC RESEARCH

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: MIS030-94 **PAGE 1**
REPORT DATE: 11/25/13
DATE SAMPLED: 10/10/13 **DATE RECEIVED:** 10/11/13
FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON SEDIMENT SAMPLES FROM PLANB CONSULTANCY

CASE NARRATIVE

Six sediment samples were received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on the subsequent page.

SAMPLE DATA - DRY WEIGHT BASIS

SAMPLE ID	TOTAL SOLIDS (%)	WATER (%)	TOC (%)
SITE 1	27.7%	72.3%	1.73
SITE 2	22.3%	77.7%	2.16
SITE 3	22.9%	77.1%	1.14
SITE 4	26.1%	73.9%	1.39
SITE 5	29.3%	70.7%	1.99
SITE 6	31.3%	68.7%	2.04

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CASE FILE NUMBER: MIS030-94 **PAGE 2**
REPORT DATE: 11/25/13
DATE SAMPLED: 10/10/13 **DATE RECEIVED:** 10/11/13
FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON SEDIMENT SAMPLES FROM PLANB CONSULTANCY

QA/QC DATA

QC PARAMETER	TOTAL SOLIDS (%)	TOC (%)
METHOD	EPA 160.3	EPA 9060
DATE ANALYZED	11/24/13	11/25/13
DETECTION LIMIT	1.00	0.01
DUPLICATE		
SAMPLE ID	SITE 6	SITE 1
ORIGINAL	31.3%	1.73
DUPLICATE	31.4%	1.79
RPD	0.41%	3.52%
SPIKE SAMPLE		
SAMPLE ID		
ORIGINAL		
SPIKED SAMPLE		
SPIKE ADDED		
% RECOVERY	NA	NA
QC CHECK		
FOUND		3.08
TRUE		3.35
% RECOVERY	NA	91.94%
BLANK	NA	<0.01

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski

Damien Gadomski, PhD
Laboratory Manager

c/o DAMIEN GADOMSKI

Aquatic Research Inc.
3927 Aurora Avenue N, Seattle, WA 98103
P 206.632.2715 | F 206.632.2417

MIS030-94

www.aquaticresearchinc.com

SHEET 1 OF 1

CHAIN-OF-CUSTODY RECORD

CLIENT:
SAMPLING DATE: 10/10/2013
SAMPLERS: JOHN BURNS (PLAN B)

PROJECT ID:
CASE FILE NO.:
DATA RECORDED BY:

SAMPLE INFORMATION

BENTHIC SAMPLES FOR GATES (OAHU) TOC ANALYSIS

PARAMETERS: T.O.C.

SAMPLE ID	DATE/TIME COLLECTED	BOTT #	NOTES
C1-B #1	"SITE 1"		50mL CONICAL
C1-B #2	"SITE 2"		
C1-B #3	"SITE 3"		
C1-B #4	"SITE 4"		
C1-B #5	"SITE 5"		
C1-B #6	"SITE 6"		

- ALL SAMPLES COLLECTED 10/10/13
- TIMES: 1-8:53
  2-9:04
  3:9:21
  4:9:36
  5:9:48
  6:10:04

	Relinquished By	Date/Time	Received By	Date/Time
Printed Name	JOHN BURNS	10/10/13 10:30AM	S. HILLIGSON	10/11/13 0900
Signature	[illegible]			
Affiliation	PLAN B		ARI	

	Relinquished By	Date/Time	Received By	Date/Time
Printed Name				
Signature				
Affiliation				

Miscellaneous Notes (Hazardous Materials, Quick turn-around time, etc.): ALL SAMPLES SENT FOR TOTAL ORGANIC CARBON (TOC) ANALYSIS

3927 Aurora Ave. N | Seattle, WA 98103 | 206.632.2715

APPENDIX D

User Observations 2006 to 2013 at the Reef Runway Borrow Pit and the Surrounding Area, Keehi Lagoon, Oahu

Prepared by: Cates International, Inc.

Purpose: Cates International, Inc. (CI) has been interested in the Reef Runway Borrow Pit (RRBP) location for a potential aquaculture project since 2006. The Company considered establishing a moi nursery at the site - since it was at the time operating a sea cage farm two miles off Ewa Beach. Later a plan to evaluate the area for a moi cage farm was developed. MBS's principal made numerous visits to the site to observe ocean conditions, water quality and public use with the purpose of determining its suitability for cage aquaculture.

This report summarizes the results of numerous visits to the RRBP from the period 2006 to 2013. The focus of these observations was on uses and users of the RRBP and the surrounding area.

Methods: CI's place of business is on Sand Island and Company's boats are docked in Keehi Lagoon. The RRBP is about a 9 minute boat ride, through the relatively protected confines of Keehi Lagoon. MBS was able to visit the site semi-regularly and a total of 80 visits are reported here. A log was kept by CI for each visit noting the date and time, purpose of the visit, weather conditions and uses and users in the general area, as well as the approximate location of the activity.

Results: The abbreviated observations are presented below by year and month.

2006

2-21-2006 – 1100 hrs, site visit to airport reef runway area, weather very rough (Kona winds), basin was very workable in terms of potential new fish farm. No other boats observed in area.

2007

4-16-2007 – 0945 hrs, visited the potential fish farm site in the RRBP, conducted scuba dive to observe the bottom, the borrow pit is approximately 50' in depth, weather normal trade wind day. No other boats or users in area, approximately 90 minutes on station.

8-13-2007 – 1300 hrs, conducted site visit for potential new farm, no other boats or users observed in area. Weather normal trade wind conditions.

2008

2-28-2008 – 0840 hrs, the vessel "Steel Breeze" grounded itself on the reef within the RRBP. No other boats or users in area. Note: DLNR hired CI to cut up and remove the vessel, operations were conducted from 2-30-2008 to 3-12-2008, during this time period, CI was in area from 0900

hrs to 1430 daily over that time period, only one vessel observed in area conducting fishing up on outer reef area.

5-23-2008 – 1430 hrs, went to RRBP, conducted bottom survey. No other vessels or users observed, weather normal trade wind conditions

5-24-2008 – 0930 hrs, conducted visual survey of area, no other vessels or users in area, approximately 1 hr in area. Weather normal trades.

11-25-2008 – 1340 hrs, spent 45 minutes in area, no other vessels or users, light trade winds. Observed a strong current coming over the outer reef area and into the RRBP.

2009

3-12-2009 – Note: Naval vessel "Port Royal" went aground near the proposed site. CI went into area at approximately 1345 hrs, a secure zone was in the process of being setup. No other vessels in area.

CI was contracted by the Navy to assist with managing the grounding of Naval vessel "Port Royal" and the removal of the ship. No vessels in area for period of time due to security zone set up by USCG.

5-23-2009 – 0830 hrs, CI worked on the Port Royal, within the barrow pit area all day, no other vessels in area. Winds normal trades.

6-2-2009 – 0845 hrs , CI worked in barrow pit area on the vessel "Port Royal", conducted several dives within the area. Winds normal trades, no other users operating in the area.

6-20-2009 – CI worked in RRBP area for several weeks, job was completed on 6-20-2009, during this time period we observed two small fishing vessels in area, they fished up on the outer reef flats.

11-20-2009 – 0830 hrs, removing the anchors that were set for the operations of the vessel "Port Royal", during this time, one small vessel observed near entrance of barrow pit area. Winds/weather normal conditions.

2010

5-17-2010 – 1045 hrs, visited RRBP area for approximately 1 hr, observed one vessel on reef flat area fishing. Winds/weather normal trades.

8-17-2010 – 1030 hrs, visited proposed site, conducted swim on reef flat area, observed one vessel fishing on reef flats. Winds'/weather normal trades.

11-3-2010 – 0900 hrs, visited site for about 90 minutes, no other user's observed in area. Winds normal trades.

12-19-2010 - 0900 hrs, site visit to area, heavy rains with flooding on Oahu. Observed the area closely, barrow pit area is much cleaner than the Water Circulation Channel, appears that run off very light in this area.

12-21-2010 – 1030 hrs, took out Consultant for water sampling in the RRBP, storm continues for several days with major flooding on Oahu. No other vessels in area, all site observations look very promising, heavy rains have not affected area. All measurements of water quality such as salinity, D/O look very good. No other vessels or users in area.

2011

2-26-2011 – 1030 hrs, site visit with Consultant, on location for approximately 2 hrs. Observed two vessels in area fishing up on outer reef flat area. Winds normal trades.

6-24-2011 – 1045 hrs, site visit for 30 minutes, observed no other vessels in area, winds normal.

9-27-2011 – 0830 hrs, observed one vessel in area that had divers in water up on edge of outer reef, weather normal trades.

10-4-2011 – 0745 to 1530 hrs, CI conducted a current study with drogues, had several floats in area. Observed two vessels in area during this time period, both were fishing near RRBP entrance on reef flat area.

10-5-2011 – 0915 to 1530, conducted second day of current study, no vessels in area during this time period. Normal weather, trade winds.

12-19-2011 0900 hrs, site visit to area, heavy rains with flooding on Oahu. Observed the area closely, barrow pit area is much cleaner than Water Circulation Channel, appears that run off very light in this area.

2012

1-2-2012 – 0930 to 1100 hrs, CI site visit with Drs. Marlin Atkinson and Steve Dollar, in water survey conducted both in basin and on the inner reef flat. No other vessel or users in the area were observed, winds/weather normal.

1-11-2012 – 0830 hrs, CI deployed current meters, one vessel observed in area fly fishing up on reef flats. Meters deployed for several weeks, wind/weather normal.

2-8-2012 – 0900 hrs, CI pulled current meter out of water, observed no other vessels in area. Winds/weather normal trades.

4-20-2012 – 1130 hrs, site visit, observed one boat in area fly fishing up on inner reef flat area, in basin for 2 hrs, wind/weather normal.

5-30-2012 – 0930 hrs, site visit, no other vessels in area, conducted two dives for approximately 2 hrs. Strong trade winds.

6-18-2012 – 1015 hrs, spent 1 hr onsite, no other vessels or users in area. Winds/Weather, calm.

8-14-2012 – 0845, conducted Biological Survey, took Dr. Steve Dollar and several UH Grad Students out to site for dive survey work related to the proposed farm, onsite for approximately 6 hrs, observed one vessel in area during this time that was fishing up on outer reef flats for about 45 minutes. Wind/Weather good.

10-6-2012 – 0830 hrs, site visit, in area for about 45 minute, observed one vessel in area fishing up on outer reef flats. Wind/Weather normal trades

10-7-2012 – 1300 hrs, in area for 30 minutes, observed no other users in area. Normal trade winds.

10-8-2012 – 0830 hrs, in area for about 15 minutes, no other vessels in area. Wind/Weather normal trades. Second site visit at 1530 hrs, observed one vessel in area near entrance, fishing.

10-12-2012 – 0840 hrs, in area for 15 minutes, no other users in area. Second visit at 1615 hrs, no other vessels or users, wind/weather normal trades

10-13-2012 – 0815 hrs, first visit to site, no other vessels or users in area. 1410 hrs, one vessel in area, fishing up on the outer reef flats, winds normal trades.

10-19-2012 – 0915 hrs, site visit on way out to sea, no other vessels in area, weather calm. 1640 hrs, second site visit for day, one vessel in area fishing near reef flats.

10-20-2012 – 0840 hrs, first site visit, no other vessels in area. Second visit 1610 hrs, observed no other vessels in area, weather normal trade winds.

11-21-2012 – 1530 hrs, visited site area, no other vessels in area. Winds/weather normal trade winds, on site for 30 minutes.

2013

1-14-2013 – 0945 hrs, conducted site visit, one vessel in area diving up on top of reef flats. In area for 45 minutes, weather normal trades.

1-24-2013 – 1130 hrs, conducted site visit, no other vessels in area, 45 minutes in area, weather normal trade winds.

1-28-2013 – 0915 hrs, CI deployed several current meters with Dr. Marlin Atkinson, in area approximately 2 hrs. Observed one vessel in area outside of reef flats fishing. Normal trade winds

1-29-2013 – 1200 hrs, conducted site visit with consultant, observed one vessel in area with snorkeler on outer reef flat areas, approximately 45 minutes in area. Weather normal trade winds.

2-7-2013 – 1200 hrs, CI retrieved current meters with Dr. Marlin Atkinson, observed two vessels in area with snorkelers up on top of reef area. In area for 2 hrs, light trade winds

2-19-2013 – 0815 hrs, conducted site visit, in area for 45 minutes, observed no other vessels, normal trade winds.

3-20-2013 – 1015 hrs, conducted site visit with State Officials, in area for 90 minutes, observed no other vessels in area. Weather, normal trade winds.

3-26-2013 – 1000 hrs, conducted site visit with Federal Officials, in area for nearly two hours, conducted several dives in RRBP area. Observed one vessel fishing near reef flat areas, weather normal trade conditions.

3-27-2013 – 1100 hrs, conducted site visit with State Officials, William Aila conducted dive study of area for nearly 2 hrs, observed one vessel with snorkeler up on reef top area. Weather, normal trade winds.

4-1-2013 – 1030 hrs, site visit, in area for approximately 30 minutes, no other vessels observed in area. Weather, nice, normal trade winds.

8-6-2013 – 1345 hrs, conducted site survey and water samples with Dr. Steve Dollar, approximately one hour in area, observed one small vessel in area fishing up on reef flats. Weather, windy trades.

8-29-2013 – 1400 hrs, visited site, one vessel in area fishing up on reef flats, stayed for approximately 30 minutes. Weather, normal trades.

The pertinent results of these observations can be summarized as follows:

- On 20 % of the trips or 16 times, fishing in the area was observed. On 69 % of those occasions or 11 times when fishing was observed, the activity occurred on the outer reef flat bordering the BP. On 21 % of these occasions or 6 times the fishing occurred at the reef edge of the BP or at the entrance.
- On 6 % of the trips or 5 times, diving (mostly snorkeling) in the area was observed. On all occasions this activity took place on the outer reef flat adjacent to the BP.
- During these 80 site visits, no Jet Ski use of the BP was observed and on one occasion a kayak was seen on the outer reef.
- While specific observations of BP use for traditional and customary gathering by native Hawaiians were not specifically made, CI suggests the same site characteristics that deter general public use would also apply to limit use by native Hawaiians.

Conclusion

CI made many occasional visits to the RRBP and the surrounding area from 2006 to 2013, with the purpose of making observations on determining ocean, water quality and use conditions. Over this period, the site was visited 80 times on various days of the week, various times of day and various weather conditions.

These observations support the conclusion that the RRBP and the immediate reef flat area bordering it is lightly used by the public and the interior of the 75 acre BP is not used at all, except for occasional boats transiting the area. The most frequent activity observed was fishing and the next most frequent was diving, but these pursuits did not occur in the interior of the RRBP, where the fish farm would be located. These occasional activities usually occurred on the outer reef flat of the RRBP during good weather, with the exception of fly fishing which occurred on the inner portion of the reef flat border.

CI believes this observed lack of use of the RRBP by the public today probably stems largely from: the borrow pit being a dredged area of low productivity, jet ski enthusiasts look for more challenging environments, the noise levels of air planes in the area, and the popular belief in the marine recreational community that the RRBP is a secure zone since the World Trade Center tragedy and off limits. The low recreational use of the area significantly contributes to making the RRBP a very good site for a commercial aquaculture farm.

APPENDIX E

Cultural Assessment

Prepared by: Aquaculture Planning and Advocacy LLC

1.0 Introduction and Description of the Action

A Cultural Assessment is required in conjunction with any Environmental Assessment (EA) and Environmental Impact Statement (EIS) (Chapter 343 HRS, as amended). The assessment should identify and assess any potential impacts of a proposed project on cultural features and the use of natural resources at the proposed site and its vicinity by native Hawaiians, including impacts on traditional and customary practices.

Cates International (CI) is proposing to locate a commercial aquaculture facility for the culture of the native species, moi, Polydactylus sexfilis, in the Reef Runway Borrow Pit (RRBP), adjacent to the Honolulu International Airport (HIA), Honolulu, Oahu. A long-term lease is being sought for 75 acres of State marine waters that encompass the Borrow Pit (BP) – a steep-sided, dredged area that was created in the 1970s to provide fill for construction of the Reef Runway. A large portion of the area is controlled by the State Department of Transportation (DOT) and the balance is under the Department of Land and Natural Resources (DLNR) (see Section 3.1.1 of EA). Notably, the RRBP is part of a State designated 867 acre Recreational Thrill Craft Zone that must be amended to remove the BP acreage and allow the project to proceed (see Section 13-256-94 HAR).

1.1 Description of the Action

The proposed farm at full build out will consist of an anchored grid of ten (10) Aqualine surface cages with copper alloy or Dyneema fiber netting. Each circular cage will be 114 ft in diameter and enclose a volume of approximately 264, 860 ft ^{3}. A small work platform surrounds the outside diameter of each cage to allow technicians to access the fish. CI is requesting a feed/security barge be permanently moored (24/7) at the site. Stocking, harvesting, and daily feeding and maintenance will occur from surface work boats and barges frequently visiting the site, with occasional SCUBA diver assistance (see Section 3.3 of EA).

CI desires access by the public to the farm site be controlled and public use of the entire lease area be restricted due to safety, security and company liability concerns. CI requests that no transit or anchoring of any boat or water craft, and no fishing, snorkeling or SCUBA diving be allowed within the majority of the lease area, i.e., central portion of the BP. CI will designate and mark a 100 ft wide transit lane along the inner reef and outer reef boundaries of the site to allow the Airports Division (AD) of DOT ready access to the Reef Runway at any time and allow the public access to the outer reef seaward of the BP during day time hours only. At night, CI

requests the entire 75 acre BP site be off limits to the public, including the area marked as a transit lane.

2.0 Methods

The HIA and the Keehi Lagoon shoreline have been a highly developed and urbanized area since the late 1930s and early 1940s. The Lagoon itself and vicinity has become an important ocean recreation destination for the people of Honolulu (see Section 5.1 of EA). This active development history has caused numerous EAs and EISs, as well as planning documents to be prepared that comprehensively describe the environmental, economic, social and particularly cultural history of the area (Table E-1). CI reviewed these studies and others to gather cultural resource information relevant to the proposed project.

In addition, CI contacted the responsible agencies, including the State Historic Preservation Division, DLNR; the AD, DLNR; and the Office of Hawaiian Affairs (OHA) for comments on the proposed project. No comments were received from SHPD and OHA. However, AD noted the heightened security situation for HIA and the Reef Runway that was implemented after World Trade Center tragedy and the increased concern over terrorism.

As part of its site investigation, CI carried out 80 site visits over the period 2006 to 2013; the results of which are found in Appendix D of the EA. Among the information collected during these visits were observations on the types of uses of the BP and the location of the particular use (see Appendix D, EA). Specific inferences can be drawn from these numerous visits as to frequency, location and type of use, that are important to understanding the potential impacts of the project on site use by the public, including native Hawaiians.

3.0 Results

3.1 Regional Setting

HIA and its RRBP lie within the seaward portion of the Moanalua Ahapua'a. Early records of European visitors to Moanalua during the first quarter of the nineteenth century provide evidence that, by the time of western contact late in the eighteenth century, there was a sizable population of native Hawaiians living there. The land consisted of a rich alluvial plain that bordered a shallow lagoon with an extensive fish population. The Hawaiians created an irrigated system of agricultural fields supported by the natural stream flows to the sea (Airports Div., DOT and USDOT, FAA, 2013).

These superb coastal conditions were also highly suitable for the construction methods available to build unique fishponds (loko kuapa), which were located along the coast. There were five documented fishponds along the shoreline of Moanalua that were controlled by the ali'i. They were: Kaloaloa, Kaihikapu (258 acres), Lelepua (332 acres), Waiaho (32 acres) and Keoki.

Table E-1. Partial List of Environmental and Planning Studies for Projects at or Near Honolulu International Airport, Oahu.

Federal Aviation Administration, Pacific Region, 1972. Final Environmental Impact Statement, Reef Runway Project, Honolulu International Airport, Honolulu Hawaii. FAA, Pac. Region, Jan., 1972.

AECOS, 1979. Post Construction Water Quality, Benthic Habitat and Epifauna Survey for the Reef Runway, HIA. AECOS, Inc., 1979.

OI Consultants, 1986. Survey of Water Quality, Benthic Habitat, and Infaunal Populations for Keehi Lagoon, Hickam Harbor, Marine Pond, HIA. KFC Airport, Inc., 1986.

Brock, R., 1986. Post Construction Biological Survey for HIA Reef Runway: Eight Years Later. KFC Airport Inc. 1986.

OI Consultants, 1988. Survey of the Water Quality, Benthic Communities and Avifaunal Populations of Keehi Lagoon, Hon. Hi. KFC Airport Inc., 1988.

Airports Division, DOT and KFC Airport, Inc., 1989. Environmental Assessment for the Honolulu International Airport Master Plan Update and Noise Compatibility Program, Vol. 3. Airports Division and KFC Airport In., September 1989.

Noda, E.K. and Associates, Inc., 1990. Keehi Lagoon Recreation Plan and Final Environmental Impact Statement. DOT, Harbors Division, 1990.

Noda, E.K. and Assoc., Inc., Chapman Consulting Services and GK, and Associates 1991. Final Environmental Impact Statement, HIA, Hon., Oahu, Hi. DOT Airports Division, April, 1991.

Sea Engineering, Inc., 1997. Final Environmental Assessment, Environmental Impact Statement Preparation Notice, Voyager Submarines Hawaii Artificial Reef Installation. Sea Engineering Inc., 1997.

Black Pearls Inc., 2001. Final Environmental Assessment, A Pearl Farm and Pearl Oyster Reseeding Project in the Reef Runway Borrow Pit in Keehi Lagoon, Honolulu, Oahu, Hi. Land Division, DLNR, April 2001.

Noda, E., 2010. Honolulu International Airport Master Plan-2010. DOT, Airports, 2010.

Airports Division, DOT and US DOT, Federal Aviation Administration, 2013. Final Environmental Assessment, Proposed Airport Modernization Program, Honolulu, Oahu, Hawaii. Airports Div., DOT and US Dot, Fed. Aviation Administration, Jan. 2013.

With western contact in the 19th century, Moanalua changed drastically and native populations in the area dwindled for a variety of reasons. By 1884, much of the area was pasture, with portions leased to sugar, rice and banana growers. An 1881 government survey reportedly showed no development in the area that is now HIA, other than several fishponds. At the end of the 19th century, the Honolulu Sugar Company began leasing portions of Moanalua, including portions that would become HIA, for sugarcane cultivation.

The next major phase of change for Moanalua occurred just prior to and with the advent of World War II in the 1940s. Of strategic interest were improvements in John Rodgers Airport (now HIA), dedicated in 1927, and the Navy had carried out extensive dredging for its nearby base at Pearl Harbor. Fill from this later construction was generally placed in surrounding low lying areas and wet lands (AD, DOT and USDOT, FAA, 2013).

With the urgency of the war, substantial dredging and fill activities and construction along the coastal area bordering Keehi Lagoon occurred. This period is when most of the ancient fishponds that served the Hawaiian community so well as sources of protein were filled in to create land for development (Athens, 2000).

Prior to World War II, Keehi Lagoon ecologically was a tidal lagoon located on shallow mud flats and a fringing coral reef that stretched from Barbers Point to Diamond Head. The Lagoon at the time, though defined as navigable waters, had extensive shallow mud flats and only one usable, but irregular channel, Kalihi Channel. During World War II the Navy carried out extensive dredging operations to create 3 large seaplane runways within the Lagoon – their dimensions were 13 ft deep, 1000 ft wide and 10,000, 15,000, and 16,000 ft long. After the war this modified lagoon area, which left a triangular shaped remnant of the reef flat, became a popular recreation area (FAA, Pacific Region, 1972).

The RRBP came about as part of a 1968 Honolulu International Airport Plan projecting airport infrastructure needs out to 1985. Creation of the Reef Runway was a major component in the three phase plan to modernize the airport facilities to accommodate the next generation of commercial aircraft. Completed in 1977, its unique offshore location insured that noise levels around populated areas would be reduced and safety would be increased through changing of flight paths away from downtown Honolulu.

The Reef Runway structure is 16,100 ft by 2050 ft. More than 1000 acres of new land was created by dredging more than 19 million cubic yards of material. All dredged fill was placed in 1 ft to 30 ft of water. The so called RRBP was left as a visible reminder of the mammoth dredging job (HIA, 2013).

The construction of the Reef Runway split Keehi Lagoon into two parts, the western part or Hickam Harbor side and the eastern side, or the Sand Island side. Notably, this massive project was one of the first airport facilities to file an EIS under the 1969 National Environmental Policy Act.

3.2 Previous Environmental Documents

Due to the extensive development in the Keehi Lagoon region, HIA's land and near shore ocean areas have been well studied for the presence of historic sites, as well as uses for traditional and customary practices. In all, HIA encompasses 4,520 acres; 2520 acres of fast land and 2000 acres of submerged land (HIA, 2013). The 75 acre CI project site is about 80% in the HIA

boundary, administered by DOT, with about 20% being State marine waters under the jurisdiction of DLNR.

Considering the history of the RRBP and the vicinity, it is unlikely that there would be any undiscovered archeological sites. The CI project area was a shallow coral reef that was extensively dredged to a depth of 50 ft to create large amounts of fill for the construction of the Reef Runway. The Final EIS for the Reef Runway states: " The Reef Runway will not require use of any publically owned land … of national, State or local significance as determined by Federal, State, or local officials having jurisdiction thereof, or any land from an historic site of national , State, or local significance, as so determined by such officials (FAA, Pacific Region 1972).

A 1991 EIS for HIA addressing additional site work is more specific, stating: "There are no archeological sites on airport property. Nineteen sites have been identified in the airport environs, but most have been destroyed (Ed Noda and Assoc. et al, 1991)."

Impact on access to and use of traditional and cultural resources by native Hawaiians is an important consideration for any development project. A 1999 EA for locating a pearl oyster farm in the RRBP carried out extensive user research highlighted below.

The Company, Black Pearls Inc. (BPI) carried out a preliminary evaluation of activity at the Reef Runway reef flat and Borrow Pit areas for a three week period early in 1999 recording all activities. This was followed by a lengthy boat ramp and shore survey- interviewing fishers that launch at both Keehi Marine and Sand Island. The timeframe for the observations was June 18, 1999 to August 1, 1999, including weekends, week days and holidays. Relevant conclusions include:

- Though the RRBP is zoned for recreational thrill craft use, during the course of studying the area only one Jet Ski was observed in the BP, suggesting it is not a preferred area.
- There are presently no existing traditional gathering or cultural practices being carried out in the project site, probably due to the depth of the water and the low productivity. Customary collection of marine organisms, such as through fishing or diving, would occur primarily on the adjacent reef flats. Some collection of seaweed and aquarium fish was reported along the edges of the BP.
- Of the 160 boaters interviewed, only 13% frequented the Reef Runway area, and only 2% reported fishing in the BP. These boaters were spear fishers, who would dive the reef edge. Only one fish was reportedly caught in the BP (BPI, 2001).

3.3 Recent Observations

During the recent preparation of an EIS for HIA modernization, a Mr. Roddy Kamawaelualani Kawehi Akau, a direct descendent of one of the original settlers of Moanalua Ahapua'a, was interviewed to find out his thoughts on the cultural impacts of HIA expansion. His comments are as follows:

"Mr. Akau believes that although the lower or Makai reaches of the ahupua'ha have experienced extensive change and development, transforming from a culturally significant agrarian ecosystem to a highly commercial, industrial job center, the original seeds and character of this ahupua'a remain below the surface today. Mr. Akau maintains that whatever is envisioned for development should proceed only by following proper protocol; that is, all elements need to be in sync in terms of being technically sound and with cultural respect , to create a strong foundation to succeed."(AD, DOT and USDOT, FAA, 2013)

CI fully supports Mr. Akau's statements.

Public activity in and use of the ocean around HIA was affected by the 9/11/2001 terrorist attack on the World Trade Center, NY and increased security precautions were put in place, according to airport officials. HIA became a Category X airport according to the Department of Homeland Security, one of twenty three such airports nationally. Passengers at these designated airports are subject to the highest level of screening and the grounds the highest level of security; due to potential attack. Likewise, in 2006 the U.S Coast Guard established a number of permanent security zones in waters of Oahu, Maui, the Big Island and Kauai. One such zone includes the RRBP and the waters off HIA. This particular type of zone is not continuously active, but is activated during times of heightened risks. When activated, vessels are prohibited from entering the areas without the express permission of the Captain of the Port (Sakata, 2013)

Taken together, CI understands this well publicized heightened level of security, as well as, the increasing airport traffic and noise, has significantly contributed to low public use of the RRBP area for fishing, diving and recreation. Discussions with airport officials support this conclusion (Sakata, 2013).

This anecdotal information is underscored by CI's own user observations found in Appendix D of the EA. CI made 80 trips to the RRBP and vicinity from 2006 to the present at all times of the day. It is clear the proposed farm area under goes very limited use, as does the BP reef edge. The most frequently observed activity on the reef edge was fishing, followed by diving, but these activities do not occur in the interior portions of the RRBP. It is not known if the few boaters observed in the vicinity of the BP were pursuing culturally significant activities, however numerous observations indicate use of any kind is light.

4.0 Conclusions

Based on the review of past cultural resource and use studies of the RRBP and vicinity, as well as CI's current observations, the Company believes the proposed aquaculture project will not impact any cultural or historic resources or significantly interfere with any existing traditional or customary practices by native Hawaiians. Moreover, the proposed transit lane will allow any existing public users of the outer reef area seaward of the BP continued access through the farm area, while CI maintains its exclusive use of the interior of the BP to bring back fish culture to Moanalua.

References

Airports Division, DOT and USDOT, FAA, 2013. Final Environmental Assessment, Proposed Airport Modernization Program, Honolulu International Airport. Airports Div., DOT and USDOT, FAA, Jan. 2013.

Athens, J. Stephen (ed.), 2000. Ancient Hawaiian Fishponds of Pearl Harbor: Archeological and Historic Studies on U.S. Navy Lands, Hawaii. State Historic Preservation Div., DLNR, 128 p.

Black Pearls Inc., 2001. Final Environmental Assessment, A Pearl Farm and Pearl Oyster Reef Reseeding Project in the Reef Runway Borrow Pit in Keehi Lagoon, Honolulu, Oahu, Hawaii. Land Div., DLNR, 150 p.

Federal Aviation Administration, Pacific Region, 1972. Final Environmental Impact Statement, Reef Runway Project, Honolulu International Airport. FAA, Pac. Region, Jan. 1972.

Honolulu, International Airport, 2013. Reef Runway. Web site: [http://hawaii.gov/hnl/airport-information/reefrunway]

Noda, E.K. and Assoc., Chapman Consulting Services, and G.K. and Associates, 1991. Final Environmental Impact Statement, HIA, Hon., Oahu, Hi. Airports, Div., DOT, 1991.

Sakata, Roy K., Oahu District Airports, pers. comm., 2013.

APPENDIX F

Pre-consultation Correspondence

Prior to preparation of this Draft Environmental Assessment (DEA), Cates International (CI) sent out a brief background paper describing the proposed project to Federal, State and County agencies for initial comments and to identify issues. Part 1 provides the mailing list of agencies receiving the document and Part 2 provides the responses received and utilized in writing the DEA.

Administrator
DLNR, Off. of Cons. & Env. Affairs
Kalanimoku Building, Room 131
1151 Punchbowl Street
Honolulu, HI 96813

Administrator
DLNR, Land Division
Kalanimoku Building, Room 220
1151 Punchbowl Street
Honolulu, HI 96813

Administrator
DLNR, Div. of Aquatic Resources
Kalanimoku Building, Room 330
1151 Punchbowl Street
Honolulu, HI 96813

Administrator
DLNR, Div. of Forestry & Wildlife
Kalanimoku Building, Room 325
1151 Punchbowl Street
Honolulu, HI 96813

Administrator
DLNR, Div. of Boating & Ocean Rec.
Kalanimoku Building, Room 300
1151 Punchbowl Street
Honolulu, HI 96813

U.S. Army Corps of Engineers
Honolulu District
Regulatory Branch, Building 230
Fort Shafter, HI 96858-5440

Administrator
DBEDT, Office of Planning
Coastal Zone Management Program
P.O. Box 2359
Honolulu, HI 96804

Branch Chief
DOH, Environmental Management
Division, Clean Water Branch
919 Ala Moana Blvd., Room 301
Honolulu, HI 96814-4920

Assistant Regional Administrator
Protected Resources, PIRO
NOAA, Fisheries Service
1601 Kapiolani Blvd., Suite 1110
Honolulu, HI 96814

Assistant Regional Administrator
Habitat, PIRO
NOAA, Fisheries Service
1601 Kapiolani Blvd., Suite 1110
Honolulu, HI 96814

Assistant Regional Administrator
Sustainable Fisheries, PIRO
NOAA, Fisheries Service
1601 Kapiolani Blvd., Suite 1110
Honolulu, HI 96814

Field Supervisor
Pac. Islands Fish & Wildlife Serv. Office
U.S. Fish and Wildlife Service
300 Ala Moana Blvd., Room 3-122
Honolulu, HI 96850

Administrator
DOT, Harbors Division
Hale Awa Ku Moku Building, Room 310
79 South Nimitz Highway
Honolulu, HI 96813-4898

Administrator
DOT, Airports Division
400 Rodgers Blvd., 7th Floor
Honolulu, HI 96819-1880

Director
DBEDT, Office of Planning
P.O. Box 2359
Honolulu, HI 96804

Director
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, HI 96813

Mr. Alan Everson
Pacific Islands Region Aquaculture
Coordinator, PIRO
1601 Kapiolani Blvd., Suite 1110
Honolulu, HI 96814

Chairperson
Hawaii Department of Agriculture
1428 S. King Street
Honolulu, HI 96814

Mr. Todd Low
Manager
DOA, Aquaculture & Livestock Support
1428 S. King Street
Honolulu, HI 96814

From: Danielle Jayewardene- NOAA Affiliate <danielle.jayewardene@noaa.gov>

To: Cates International <catesinternational@hawaiiantel.net>; JSCorbin <JSCorbin@aol.com>

Cc: Alan Everson - NOAA Federal <alan.everson@noaa.gov>; David Nichols - NOAA Federal <david.nichols@noaa.gov>; Foster, Kevin <kevin_b_foster@fws.gov>; Wendy Wiltse <wiltse.wendy@epamail.epa.gov>; Stevens, Emilee R POH <Emilee.R.Stevens2@usace.army.mil>; Dave Gulko <david.a.gulko@hawaii.gov>; Robert.T.Nishimoto <Robert.T.Nishimoto@hawaii.gov>

Subject: Feedback re pre-application meeting for Cates Aquaculture project

Date: Fri, Mar 15, 2013 4:53 pm

Attachments: Preparing_an_EFH_assessment.pdf (667K)

Hi Randy and John,

Again, thanks for providing us information on the proposed project today during the pre-application meeting.

As mentioned in the meeting, the Army Corps permit will trigger the requirement to do an Essential Fish Habitat (EFH) consultation with NMFS (also other Federal requirements including ESA, FWCA). This consultation responsibility is Corps, but it often falls on the the Applicant to provide the information needed to conduct the consultation. So, it's helpful for you to know that to satisfy the EFH consultation requirement, an "EFH assessment" will need to be developed. Attached is some guidance on how to develop this document. If you were developing a federal EA, there could be a section in the EA that addressed EFH needs. However, since your EA is to satisfy State requirements, the EFH assessment would be developed separately (but can be referenced and attached to the State EA as an appendix).

Some initial recommendations as you move forward:

- Conduct a baseline assessment of the marine environment that may be influenced by all components (cages, anchoring, operations, transport routes for equipment, the hatchery etc) of the proposed action. This would include surveying and determining the character and condition of the adjacent reef, the benthic habitat below the proposed cages, determining the ambient water quality, the currents etc. Be sure in doing these assessments to collect the types of information that the resource agencies will come to need to avoid having to repeat efforts (e.g for coral: coral size-frequency information not only coral cover).

- Use the baseline information and all previous studies from across the globe, but most importantly those relevant to Hawaii and coral reefs, to analyze the potential impacts from the entire proposed action to water quality, the benthic community, the adjacent reef community, currents and the ecosystem as a whole. As part of this analysis, consider how the cages may come to act as aggregation devices hence what ecosystem effect they may have (e.g. will reef grazer be attracted to the cages to feed on algae in turn effecting ecosystem dynamics). Consider how the cages may alter water flow and currents and how this may influence water quality. Consider marine biological impacts that may occur if cages were to break free, be vandalized.

- Develop monitoring plans (benthic, water quality, adjacent reef) that are supported by the resource agencies (i.e. that address their questions).

- Develop contingency plans for various scenarios such as cages breaking free, for modification of operations and structures that may come to be required if the monitoring indicates that there is significant environmental impact, the business closing down etc.

Ok, well that's what I can think of for now. Don't hesitate to get in touch with any comments or for more specific insight on the EFH consultation needs.

Aloha,
Danielle

OFFICE OF PLANNING
STATE OF HAWAII

235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

NEIL ABERCROMBIE
GOVERNOR

JESSE K. SOUKI
DIRECTOR
OFFICE OF PLANNING

Telephone: (808) 587-2846
Fax: (808) 587-2824
Web: http://hawaii.gov/dbedt/op/

Ref. No. P-13898

March 4, 2013

Mr. John Corbin
Aquaculture Planning & Advocacy LLC
47-215 Iuiu Street
Kaneohe, Hawaii 96744

Dear Mr. Corbin:

Subject: Proposed Commercial Sea Cage Facility for Moi Aquaculture in the Reef Runway Borrow Pit – Draft Environmental Assessment Proposal
Keehi Lagoon, Moanalua, Honolulu, Oahu, Hawaii

Thank you for the opportunity to provide comments on the documents provided for preparation of a Draft Environmental Assessment (DEA), for the Commercial Sea Cage Facility for Moi Aquaculture in the Reef Runway Borrow Pit in Keehi Lagoon.

The Office of Planning has reviewed the documents you provided, and has the following comments to offer:

1. The entire state is defined to be within the Coastal Zone Management Area (Hawaii Revised Statutes (HRS) §205A-1 - definition of "coastal zone management area"). Your Draft Environmental Impact Statement should include a discussion of the proposed project's consistency with the objectives and policies set forth in HRS §205A-2.

2. The construction project may have nonpoint pollution concerns which may impact coastal waters. We invite the applicant to review the Hawaii Watershed Guidance, which provides a summary of, and links to, management measures that may be implemented to minimize coastal nonpoint pollution impact. The Hawaii Watershed Guidance document can be found on-line at http://hawaii.gov/dbedt/czm/initiative/nonpoint/HI Watershed Guidance Final.pdf.

3. The Final EIS should include the Coastal Zone Management Act, HRS Chapter 205A, in the list of "Relationship to Land Use Plans, Policies, and Controls" (pg. 6-1 of your EIS Preparation Notice).

4. A Coastal Zone Consistency Review may be required in conjunction with federal permits such as the U.S. Army Corps of Engineers permit. The document can be found at coastalmanagement.noaa.gov/consistency/regulations.html.

5. In accordance with the information provided, the proposed project site is in the Conservation District, as designated by the State Land Use Commission. However, Cates International, LLC will utilize its existing shoreside baseyard facilities at Keehi Lagoon, leased from the Department of Land and Natural Resources, Division of Boating and Recreation, to support the proposed project. We suggest that the applicant contact the City and County of Honolulu's Department of Planning and Permitting, to confirm whether a Special Management Area permit is required.

If you have any questions regarding this comment letter, please contact Leo Asuncion, Coastal Zone Management Program Manager, at 587-2875.

Sincerely,

Jesse K. Souki
Director

c: Mr. John R. Cates, Cates International, LLC
Office of Environmental Quality Control

NEIL ABERCROMBIE
GOVERNOR

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
JADE T. BUTAY
FORD N. FUCHIGAMI
RANDY GRUNE
JADINE URASAKI

IN REPLY REFER TO:
AIR-EP
13.0029

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU, HAWAII 96819-1880

February 21, 2013

Mr. John S. Corbin
President
Aquaculture Planning & Advocacy LLC
47-215 Iuiu Street
Kaneohe, Hawaii 96744

Dear Mr. Corbin:

Subject: Proposed Commercial Sea Cage Facility for Moi Aquaculture
Reef Runway Borrow Pit in Keehi Lagoon
Moanalua, Honolulu, Oahu, Hawaii

In response to your letter of January 21, 2013 on the proposal by Cates International LLC, we have the following comments:

- The Airports Division is especially concerned about the cages becoming a wildlife attractant to seabirds and possible wetland birds such as the Black-crowned Night Heron. The Federal Aviation Administration's Advisory Circular 150/5200-33 states no wildlife attractant within five (5) statute miles of the airport. There was no mention on whether the cages would be covered or if there was any mitigation proposed to prevent it from becoming a wildlife attractant.

- In addition to the birds, there have been sightings of the endangered Hawaiian Monk Seals along the reef runway which could also become attracted to the moi.

- The depicted location of the sea cages would hamper critical water rescue operations in the vicinity of the Reef Runway.

- We believe that the proposed area is a restricted area, where only marine biologists are allowed to conduct their studies. It is recommended that the Transportation Security Administration (TSA) and the Federal Aviation Administration (FAA) also be contacted.

Thank you for allowing us the opportunity to review your proposal. It is recommended that these items be addressed in your Draft Environmental Assessment and to continue coordination with the Airports Division as you go forward with this project.

Mr. John Corbin
February 21, 2013
Page 2

Should you have any questions regarding the above, please contact Ms. Lynn Becones, Planner, at (808)838-8817.

Aloha,

FORD N. FUCHIGAMI
Deputy Director – Airports

c: Mr. Gordon Wong, FAA-ADO

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

February 26, 2013

John Corbin
Aquaculture Planning & Advocacy
47-215 Iuiu Street
Kaneohe, Hawaii 96744

via email: jscorbin@aol.com

Dear Mr. Corbin,

SUBJECT: Pre-Assessment Consultation Re A Proposed Commercial Sea Cage Facility for Moi Aquaculture in the Reef Runway Borrow Pit in Keehi Lagoon

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR) Land Division distributed or made available a copy of your report pertaining to the subject matter to DLNR Divisions for their review and comments.

At this time, enclosed are comments from the (1) Land Division – Oahu District; (2) Division of Boating and Ocean Recreation; (3) Engineering Division; and (4) Office of Conservation and Coastal Lands on the subject matter. No other comments were received as of our suspense date. Should you have any questions, please feel free to call Supervising Land Agent Steve Molmen at 587-0439. Thank you.

Sincerely,

Russell Y. Tsuji
Land Administrator

Enclosure(s)

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

January 24, 2013

MEMORANDUM

TO: **DLNR Agencies:**
X Div. of Aquatic Resources
X Div. of Boating & Ocean Recreation
X Engineering Division
X Div. of Forestry & Wildlife
Div. of State Parks
__Commission on Water Resource Management
X Office of Conservation & Coastal Lands
X Land Division Oahu District
X Historic Preservation

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Pre-Assessment Consultation Re A Proposed Commercial Sea Cage Facility for Moi Aquaculture in the Reef Runway Borrow Pit in Keehi Lagoon
LOCATION: Reef Runway Borrow Pit in Keehi Lagoon, adjacent to the Honolulu International Airport (HIA), Moanalua, Honolulu, Oahu
APPLICANT: John R. (Randy) Cates, President, Cate International, LLC through consultant, John S. Corbin, Aquaculture Planning and Advocacy LLC

Transmitted for your review and comment on the above-referenced document. We would appreciate your comments on this document. ~~If we have not provided you with a copy of the CD, a copy is available for checkout on the Oahu shelf next to our reception area.~~ (No CD)

Please submit any comments by February 14, 2013. If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Supervising Land Agent Steve Molmen at (808) 587-0439. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(✓) Comments are attached.

Signed: _____
Print Name: _____
Date: Jan. 30, 13

COMMENTS:
Improvements built on State land requires a disposition from the Board.

c: Central Files

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

2013 JAN 29 P 2:56
DEPT. OF LAND & NATURAL RESOURCES STATE OF HAWAII

January 24, 2013

MEMORANDUM

TO: **DLNR Agencies:**
X Div. of Aquatic Resources
X Div. of Boating & Ocean Recreation
X Engineering Division
X Div. of Forestry & Wildlife
Div. of State Parks
Commission on Water Resource Management
X Office of Conservation & Coastal Lands
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( ) We have no comments.
( ) Comments are attached.

OCCL will meet with applicant to discuss CD guidelines for mariculture facilities

Signed:
Print Name:
Date: 2-7-13

c: Central Files

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

'13 JAN 29 PM 3:5P ENGINEERING

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

January 24, 2013

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Attachments

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( ) We have no comments.
(✓) Comments are attached.

Signed: _____
Print Name: Carty S. Chang, Chief Engineer
Date: _____

c: Central Files

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/ Russell Y. Tsuji
REF: Pre-Assessment Consultation for Proposed Commercial Sea Cage Facility for Moi Aquaculture in the Reef Runway Borrow Pit in Keehi Lagoon, Moanalua, Honolulu Oahu.005

COMMENTS

( ) We confirm that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Flood Zone .

(X) Please take note that a part of the project site, according to the Flood Insurance Rate Map (FIRM), is located in Flood Zone VE. The National Flood Insurance Program regulates developments within VE as indicated in bold letters below.

( ) Please note that the correct Flood Zone Designation for the project site according to the Flood Insurance Rate Map (FIRM) is .

(X) Please note that the project site must comply with the rules and regulations of the National Flood Insurance Program (NFIP) presented in Title 44 of the Code of Federal Regulations (44CFR), whenever development within a Special Flood Hazard Area is undertaken. If there are any questions, please contact the State NFIP Coordinator, Ms. Carol Tyau-Beam, of the Department of Land and Natural Resources, Engineering Division at (808) 587-0267.

Please be advised that 44CFR indicates the minimum standards set forth by the NFIP. Your Community's local flood ordinance may prove to be more restrictive and thus take precedence over the minimum NFIP standards. If there are questions regarding the local flood ordinances, please contact the applicable County NFIP Coordinators below:

(X) Mr. Mario Siu Li at (808) 768-8098 or Ms. Ardis Shaw-Kim at (808) 768-8296 of the City and County of Honolulu, Department of Planning and Permitting.

( ) Mr. Frank DeMarco at (808) 961-8042 of the County of Hawaii, Department of Public Works.

( ) Mr. Carolyn Cortez at (808) 270-7813 of the County of Maui, Department of Planning.

( ) Ms. Wynne Ushigome at (808) 241-4890 of the County of Kauai, Department of Public Works.

( ) The applicant should include project water demands and infrastructure required to meet water demands. Please note that the implementation of any State-sponsored projects requiring water service from the Honolulu Board of Water Supply system must first obtain water allocation credits from the Engineering Division before it can receive a building permit and/or water meter.

( ) The applicant should provide the water demands and calculations to the Engineering Division so it can be included in the State Water Projects Plan Update.

( ) Additional Comments: _____

( ) Other:

Should you have any questions, please call Mr. Dennis Imada of the Planning Branch at 587-0257.

Signed: _____
CARTY S. CHANG, CHIEF ENGINEER

Date. _____

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
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Attachments

(X) We have no objections.
( ) We have no comments.
( ) Comments are attached.

Signed: [signature]
Print Name: Gerald E. Sherwood
Date: 1/24/13

c: Central Files

Subj: **Cates International Proposed Aquaculture Cage Farm (2013A156)**
Date: 1/28/2013 3:45:56 P.M. Hawaiian Standard Time
From: kris.poentis@doh.hawaii.gov
To: jscorbin@aol.com
CC: darryl.lum@doh.hawaii.gov, norsalin.pascua@doh.hawaii.gov, linda.hiirida@doh.hawaii.gov

Dear Mr. Corbin:

Thank you for the opportunity to comment on your proposal, dated January 21, 2013. The Department of Health, Clean Water Branch (CWB) has the following comments:

1. Any project and its potential impacts to State waters must meet the State's: 1) Antidegradation policy, which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected; 2) Designated uses, as determined by the classification of the receiving State waters; and 3) water quality criteria (Hawaii Administrative Rules (HAR), Chapter 11-54).

2. The Army Corps of Engineers should be contacted at 438-9258 to see if this project requires a Department of the Army (DA) permit. Permits may be required for work performed in, over, and under navigable waters of the United States. Projects requiring a DA permit also require a Section 401 Water Quality Certification (WQC) from our office.

3. The proposed commercial aquaculture cage farm requires a National Pollutant Discharge Elimination System (NPDES) individual permit since it is considered to be an aquaculture project. An aquaculture project means a "defined managed water area which uses discharges of pollutants into that designated area for the maintenance or production of harvestable freshwater estuarine or marine plants or animals." It would also require a Zone of Mixing (ZOM), which allows exceedances of the State's water quality standards within this area. The ZOM must meet the requirements in HAR, Chapter 11-54 and it must be demonstrated that the waterbody can assimilate the pollutants of concern, including, but not limited to, nutrients, turbidity and copper.

4. The proposed hatchery would also require an NPDES individual permit if it discharges wastewater into State waters.

5. Discharges associated with the construction of the hatchery also require NPDES permit coverage. Types of discharges associated with construction include, but are not limited to, the following:

    - Storm water associated with construction activities, including excavation, grading, clearing, demolition, uprooting of vegetation, equipment staging, and storage areas that result in the disturbance of equal to or greater than one (1) acre of

total land area. *An NPDES permit is required before the start of the construction activities.*

- Hydrotesting water.
- Dewatering effluent.
- Treated effluent from well drilling activities.

6. An application for an NPDES individual permit must be submitted at least 180 calendar days before the commencement of the discharge or start of construction activities. The NPDES application forms may be picked up at our office or downloaded from our website at http://www.hawaii.gov/health/environmental/water/cleanwater/forms/indiv-index.html.

Please note that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage and/or Section 401 WQC are required, must comply with the State's Water Quality Standards. Noncompliance with water quality requirements contained in HAR, Chapter 11-54 and/or permitting requirements specified in HAR, Chapter 11-55 may be subject to penalties of $25,000 per day per violation.

Kris Poentis
Environmental Engineer, Clean Water Branch
Environmental Management Division
Department of Health
919 Ala Moana Boulevard, Room 301
Honolulu, Hawaii 96814
808.586.4309