STATE OF HAWAI`I
DEPARTMENT OF LAND AND NATURAL RESOURCES
Office of Conservation and Coastal Lands
Honolulu, Hawai`i

180 Exp. Date: December 22, 2014

October 24, 2014

Board of Land and
Natural Resources
State of Hawaii
Honolulu, Hawai`i

REGARDING:	Conservation District Use Application (CDUA) HA-3720 for an Expansion of Capacity at the Blue Ocean Mariculture Facility
APPLICANT:	Blue Ocean Mariculture
CONTACT:	Jennica Lowell, Research Manager; Blue Ocean Mariculture, 74-429 Kealakeha Parkway, Kailua-Kona, HI 96740.
LOCATION:	Offshore of Unualoha Point, North Kona, Hawai`i
TMK:	Offshore of (3) 7-4-043:000 (submerged lands)
LEASE AREA:	90 acres
SUBZONE:	Resource

DESCRIPTION OF AREA

Blue Ocean Mariculture has submitted an application for an increase in production capacity at their existing open ocean mariculture facility located one mile north of Keāhole and 2600 feet offshore of Unualoha Point, Kalaoa, North Kona, Hawai`i. The facility is on submerged lands in the Resource Subzone of the State Land Use Conservation District.

The site is sheltered from the northeast trades by the Kohala, Mauna Kea, and Hualalai volcanos. Heating of the lee slope of Hualalai drives a three to fifteen knot upslope onshore wind (the "Kona Sea Breeze") in the afternoon. After sunset the land cools and a downslope breeze drains offshore. Air quality is generally good, although during periods of weak trades the vog-laden air from Kīlauea pushes over the area.

Seawater in the area is characterized by tropical oceanic conditions with low levels of nutrients, stable salinity, and good visibility. Blue Ocean's water quality monitoring program reports consistent baseline levels for water quality around the site.

The sea state is characterized by minor swells, occasional wind-driven waves, and strong turbulent currents. The strong currents quickly assimilate nutrients in the area. The site is protected from winter's large northern Pacific swells, while summer storms can deliver low, long-period swells. The largest swells are produced by Kona Storms, which can result in three to five meter waves at an eight to ten second interval. Hurricane events are rare; the facility did not notice any impacts from the recent storms of 2014. Tsunami events have not impacted the deep water anchorage of the net pens.

The benthos under the site was formed by the 1801 Haualalai lava flow. Depths range from 55 to 65 meters. The bottom is flat with no natural structures, and is composed of coarse sand one to six feet deep atop a solid basalt substrate. There are no coral communities in the immediate vicinity. The nearest reef is approximately 600 to 1200 meters inshore at Unualoha Point.

The most common predator fish in the area is ulua (*aranx ignobilus*). Bait fish are known to seek shelter under the nets and in the water current shadow; observed species include `opelu (*Decapterus macarellus*) and akule (*Selar crumenphthalmus*). Smaller fish have been observed near the benthos.

Bottle nose dolphins (*Tursiops truncatus*) are frequently observed at the site. They have not presented a predation or safety issue. Spinner dolphins (*Stenella longirostos*) are rarely observed, although it is likely that they transit the site en route to offshore feeding grounds. A variety of shark species were observed on 33 days in 2012 and 26 days in 2013. These visits are generally short, from a few minutes to a few hours.

Seabirds are rarely observed in the area. Seabird activity in the area generally occurs over the traditional fishing grounds west of Keahole Point. The lease area is not part of an identified traditional koa, or fishing ground, although the existing facility has attracted a small number of regular fishermen to the area.

Sea turtles have not been observed at the site.

Monk seals have been observed twice in 2005. On both occasions the seals remained in the area one day and then departed.

The lease site is in the southern boundary of the Hawaiian Islands Humpback Whale Sanctuary. Humpback whales (*Megaptera novaengliae*) were observed transiting the site on seven days between 2010 and 2013. On each occasion the whale finished their transit within a few minutes.

CURRENT USE

The Board of Land and Natural Resources approved Conservation District Use Permit (CDUP) HA-3118 on August 8, 2003 for the original facility. The Chair of the Department of Land and Natural Resources approved CDUP HA-3497 July 1, 2009 for modifications to the permit and an improved management plan.

The current permit allows a maximum of five net pens, none larger than 7,000 m^3, and together totaling no greater than the current capacity of 24,000 m^3, in a leased area of

90 acres. The permit allows for the cultivation of kāhala (almaco jack, *Seriola rivoliana* and amberjack, *S. dumerili*), moi (Pacific threadfin, *Polydactylus sexifilis*), mahi mahi (*Coryphaena hippurus*) and ulua (giant trevally, *Caranx ignobilis*).

The only species that is currently cultured in the ocean pens is the almaco jack, although the facility has moi ready to be placed in pens when space allows.

At maximum grow out the facility can produce 500 tons of kāhala per year. The largest year to date was 2013, when 160,000 fish totaling 450 tons were harvested. Since the farm's inception in 2005 they have produced a total of 2500 tons of harvested fish.

PROPOSED USE

With this application Blue Ocean proposes to increase the production capacity of the facility to handle a harvest of 1100 tons of marine finfish per year. Blue Ocean hopes to reach this target in 2018. They are requesting the permit modifications as they believe it will improve the economic viability of the facility

In order to achieve this Blue Ocean is requesting that their permit be modified by increasing the maximum growing volume from 24,000 m^3 to 72,000 m^3, increasing the number of allowable pens from five to eight, and increasing the maximum size of individual pens from 7000 m^3 to 8000 m^3.

In addition, Blue Ocean requests that marine-grade copper alloy mesh be added to the allowable list of materials for pen netting.

Juvenile fish (fingerlings) are produced in Blue Ocean's onshore hatchery facility located in the NELHA aquaculture park. Fingerlings are transported live to the Farm Site on Blue Ocean vessels and released into the net pens for growout. Approximately 60,000 to 120,000 fingerlings are stocked with each new cohort, depending on the size of net pen used. The transfer takes place over a 1-2 week period. Under the proposal, the maximum size of each cohort would remain at about 120,000 fish, and the number of cohorts stocked each year would increase from approximately three to six.

There will be no increase in fish density per pen. The maximum stocking limit for kāhala is 40 kilograms of fish per cubic meter; if the proposed modifications are approved Kona Blue will be able to remain well under this limit; current models indicate that they can achieve the target harvest of 1100 tons with 20 to 30 kilograms / m^3.

Blue Ocean estimates that their feed conversion ratio is 2:3 or better. With the current array this requires 900 tons of feed to produce a 300 to 450-ton harvest. In the proposed array it will require 2350 tons of feed to produce an 1100-ton harvest.

No changes to feed composition or feed delivery are anticipated.

Kāhala will continue to be the dominant species at the facility, although Blue Ocean intends to use more pens for moi in the coming years. The kāhala have a twelve-month grow-out, while the moi have a shorter six to nine-month grow-out.

Blue Ocean uses hydrogen peroxide baths to treat fish for ectoparasite infections. All of the fish inside a net pen are treated for ectoparasites as a group. Fish are crowded inside the net pen and enclosed with low-permeability tarps. Hydrogen peroxideis delivered into the enclosed volume and baths last about 45 minutes, at which point the tarps are removed and the fish are released from crowding. The treatment is done during between ten a.m. and noon to maximize the rate of degredation by the noon-day sun.

The basic treatment method will not change under the proposal. However, the number of treatments delivered will increase proportionally with the increase in production expected under the proposal.

The use of copper alloy netting would significantly reduce biofouling buildup on the net pens, reducing the amount of biofouling lost to the environment. The reduction in biofouling also significantly reduces the habitat for ectoparasite reproduction, which would reduce the number of ectoparasites and hydrogen peroxide bathing requirements.

The facility has not experienced a bacterial infection offshore or delivered an antibiotic treatment offshore since February 2011; the company does not expect an increase in antibiotic treatment frequency under the proposal.

The proposal will require a small modification to the existing mooring grid, and an increase in the number of anchors from 24 to 28. There will be no change in the types of anchors used.

No expansion of the lease area is being proposed. The proposal will not require any change to harbor infrastructure, the on-shore hatchery, or Blue Ocean's existing fleet.

The proposal is still within the range authorized under the current National Pollution Discharge Elimination System (NPDES) permit. Blue Ocean states that, with the proposed increase, they will "grow into" their existing NPDES permit.

Public access to the lease area will be essentially unchanged.

Individual net pen installation requires two to three days. The pens will be installed and stocked sequentially over 18 months, with full implementation targeted for May 2018. At full grow-out the facility will have the capacity to produce approximately 1100 tons of marine finfish per year.

The following exhibits have been included with this report:

Exhibit 1: Farm Site Location and Modified Mooring Array

Exhibit 2: Mariculture Lease Area

Exhibit 3: Potential Impacts and Mitigation Measures

SUMMARY OF COMMENTS:

The Office of Conservation and Coastal Lands referred the application to the following agencies for review and comment: Office of Hawaiian Affairs; Hawai`i County Planning; DLNR- Land Division, Historic Preservation, DOCARE, Division of Aquatic Resources, DOBOR; Kanaka Council; US Army Corps of Engineers; US Fish and Wildlife Service; US Coast Guard; National Marine Fisheries Service; and the State Department of Health.

A notice of the application was placed in the July 8, 2014 edition of the Office of Environmental Quality Control's *Environmental Notice*.

Copies of the application and EA were available for review at the Thelma Parker Public Library in Waimea and the Kailua Kona Public Library. They were also available on OCCL's website.

OCCL held a public hearing on August 12, 2014 at the West Hawai`i Civic Center in Kailua-Kona.

Comments were received from the following agencies:

DLNR – Land Division

The original permit was issued to Kona Water Blue Water Farms LLC, lessee for General Lease S-5721. In January 2010 the Board approved the assignment of the lease from Kona Blue Water Farms to Keahole Point Fish LLC. The current application is for "Blue Ocean Mariculture;" in order to be consistent with the previous CDUP, the applicant should be the same as the current Lessee.

Applicant's Response

There has been no change in ownership of the business since the lease was assigned from Kona Blue Water Farms to Keahole Point Fish in January 2010. Keahole Point Fish, LLC is wholly owned by Blue Ocean Mariculture, LLC and is the "dba". Blue Ocean's only business is the Kona fish farm, which includes both the offshore farm site and the hatchery facility located in the Natural Energy Laboratory.

DLNR – Division of Boating and Ocean Recreation

No comments

DLNR – Division of Aquatic Resources

The proposed activities described in the CDUA submitted for comments were reviewed by several DAR staff biologists.

Additionally, on May 30, 2014 the Kona DAR staff biologist was thoroughly briefed on the proposed project by Jennica Lowell, Research Manager and Lance Hubbert, General Manager, both of Blue Ocean Mariculture. Based on the information provided during this meeting and the accompanying documentation, submitted for his review, DAR's Kona staff biologist is supportive of the project.

DAR does not have any concerns related to Blue Ocean Mariculture's proposed activities as described in the CDUA submitted for review and has no other comments for OCCL.

Applicant's Response

The applicant thanks staff for their review of the application. We believe that working together with the Division of Aquatic resources is integral to intelligent management of our farm site and its surrounding environs.

State Department of Health, Clean Water Branch

Any project in State waters must meet the following criteria:

- The antidegradation policy contained in Hawai`i Administrative Rules (HAR) §11-54-1.1
- The designated uses contained in §11-54-3,
- The water quality criteria contained in §§11-54-4 through 11-54-8

You may be required to obtain a National Pollutant Discharge Elimination System (NPDES) permit.

All discharges related to the project must comply with the State's Water Quality Standards contains in HAR Chapter 11-54 and the permitting requirements in Chapter 11-55.

Applicant's Response

We currently operate under a NPDES permit administered by Clean Water Branch. By operating under the regulation set forth in this permit we follow the State's anti-degradation policy and maintain the designated uses and water quality of the surrounding waters as stated in HAR 11-54.

Blue Ocean Mariculture currently maintains a Letter of Permission pursuant to Section 10 of the Rivers and Harbors Act of 1899 through the Department of the Army, Army Corps of Engineers.

Prior to making any modification to our offshore farm site, such as those outlined in this environmental assessment, we will work with the ACOE Honolulu District office to update this LOP and carry out work under the guidelines provided in said letter.

County Planning Department

The Kona Community Development Plan calls for a water quality monitoring program. Should one be adopted by the County, the Department asks that the applicant incorporate County program requirements into their monitoring protocols.

The Department also notes that the draft EA contains correspondence from associates of the farm but no consultation with appropriate agencies or groups with expertise. They encourage Blue Ocean "to seek consultation and comments from those agencies and groups identified as being consulted with."

Applicant's Response

We ensure you that we will continue to comply with any and all current and future regulation that applies to our farm site including those dictated by the County if they become applicable.

During the course of the draft environmental assessment writing process, and shortly after its submission, Blue Ocean consulted with a variety of State and Federal agencies regarding the proposed action. All consultations will be listed in the Final Environmental Assessment.

Ronald Weidenbach, Hawai`i Fish Company

Mr. Weidenbach supports the project. He notes that Hawai`i imports over 50% of its seafood, with the majority of these imports being aquaculture products from Asia and, to a lesser extent, Central and South America. Allowing businesses like Blue Ocean to expand and prosper will enhance the food security of the state, provide job opportunities, and increase the diversity of Hawaii's agriculture industry.

Neil Frazer, Professor of Geophysics, University of Hawai`i at Manoa

Mr. Frazer opposes the project. He states that the production of moi and kāhala are harmful to wild fish stocks, as both species are carnivorous and require fish oil in their feed. He claims that the actual "fish to fish" conversion ratio is 3-5:1, and is a more honest metric to use than the standard feed conversion ratio (FCR). He also notes that the feed is manufactured from anchovies and horse mackerel, which are integral sources of protein in third world countries.

Mr. Frazer also claims that there is parasitic spillback from farmed kāhala at Blue Ocean to sympatric wild fish. He states that every pound of kāhala raised at the facility results in a decline of twenty pounds of wild fish stock.

He believes that the production of moi is likely to be less harmful, as wild moi live in the surf zone away from the farm site.

He does commend the use of wild brood stock at Blue Ocean, and states that they may be forgiven for their failure to understand the effects of parasitic spillback.

Applicant's Response

You will be pleased to hear that the capture fisheries used as fish oil sources for our feed are among the most protected and regulated fisheries in the world. Our feed supplier makes significant use of capture fisheries by-product, and all of our feed is certified sustainable by the Global G.A.P. and Global Aquaculture Alliance certification systems.

It would be impossible for the population in Peru (a primary source of fish oil) to consume all of their forage fish production directly, which is why they trade their surplus of forage fish for goods not produced in Peru, just as Hawaii trades its resource advantages for goods not produced here. We appreciate that you may not be familiar with the basic economic principle of comparative advantage, but the conversion of forage fish into bigger and better-tasting sources of protein such as salmon, kāhala and moi is one of the highest and best uses of this resource.

There is no evidence that farmed fish are transmitting *Neobenedenia* to wild fish. In fact, the continued very low incidence of *Neobenedenia* on wild kāhala (0.05 per fish in 2013) suggests a normal, background level. There is simply no data showing even slightly elevated levels of *Neobenedenia* on wild fish.

Anonymous

This will attract sharks, and is near a popular family surfing beach of Kohana Iki. He notes that he saw a giant pen offshore in 2011 when a shark attack occurred at Lyman's surf break. Anonymous thus strongly opposes the project for safety reasons.

Applicant's Response

We employ best management practices for aquaculture operations, including daily removal of any dead or sick animals so they will not attract sharks. If sharks were to be attracted by the farm, we would see it at the nets pens first, and we have not seen any increase in activity over the years.

United States Fish & Wildlife Service

The application does not address the State's concerns for the potential nutrient and effluent risks to shallow coral reefs and project-related impacts to certain fish and wildlife resources. The service is also concerned that the pens may be vulnerable to strong wave events or storms. They ask that the application be revised with more complete information.

OCCL's Response

The comments from the Fish and Wildlife Service arrived after the comment period on the application had closed, and were not forwarded to the applicant in time for inclusion in the Final Environmental Assessment.

However, we note that the Final EA does contain a summary of the nutrient and effluent studies done over the past eight years, and no impacts have been noticed on the near shore coral reefs or other wildlife resources. The potential nutrient dispersion field remains offshore in deeper waters.

ANALYSIS:

Following review and acceptance for processing, the applicant was notified, by letter dated June 25, 2014, that:

1. The proposal was an identified land use within the Conservation District, pursuant to Hawai`i Administrative Rules (HAR) §13-5-23 *Identified land uses in the protective subzone,* P-8 STRUCTURES AND LAND USES, EXISTING, (D-1) *Major alteration of existing structures, facilities, uses, and equipment, or topographical features which are different from the original use or permit or different from what was allowed under the original permit.*

   Per the definitions found in §13-5-2, *"Major alteration" means work done to an existing structure, facility, or use that results in more than fifty percent increase in the size of the structure, facility, or use.*

   This use requires a permit from the Board of Land and Natural Resources, who have the final authority to grant, modify, or deny any permit.

2. A public hearing will be required pursuant to HAR §13-5-40 *Hearings*, (a) *Public hearings shall be held on* (1) *All applications for a proposed use of land for commercial purposes*. OCCL held the hearing on Tuesday, August 12, 2014 at the West Hawai`i Civic Center in Kailua-Kona.

3. Pursuant to HAR §13-5-31 *Permit applications,* the permit required that an environmental assessment be carried out.

   The draft environmental assessment (DEA) was published in the Office of Environmental Quality Control's (OEQC) July 8, 2014 *Environmental Notice.*

   The applicant submitted their Final Environmental Assessment on September 9, 2014; after reviewing it OCCL issued a FONSI on September 26.

§13-5-30 CRITERIA

The following discussion evaluates the merits of the proposed land use by applying the criteria established in HAR §13-5-30.

1) *The proposed use is consistent with the purpose of the Conservation District.*

The objective of the Conservation District is to conserve, protect and preserve the important natural resources of the State through appropriate management and use to promote their long-term sustainability and the public health, safety and welfare.

Mariculture operations under an approved management plan are identified uses in the Conservation District. The original facility was approved by the Board in 2003. Staff is of the opinion that the facility operators have been diligent in following the approved management plan and its associated environmental monitoring protocols.

2) *The proposed land use is consistent with the objectives of the Subzone of the land on which the use will occur.*

Pursuant to HAR §13-5-14, the objective of the Resource Subzone *is to designate open space where specific conservation uses may not be defined, but where urban use may be premature.*

The proposal in and of itself will not affect open space. The leased area will not change.

3) *The proposed land use complies with the provisions and guidelines contained in Chapter 205A, HRS entitled "Coastal Zone Management", where applicable.*

The application is consistent with the following objectives of Chapter 205A:

Recreational resources. The proposed use marginally restricts recreational opportunities at the site by requesting no anchoring or diving at the Farm Site, for safety and security reasons. Recreational boat transit, and troll / drift fishing is not restricted, and no other recreational uses have been identified.

Historical resources. No historic resources have been identified at the site.

Scenic and open space resources. The mooring system and net pens in the proposed use are mostly submerged and are not visible from the nearest shoreline public recreation areas. The site is somewhat noticeable at a distance from the residential areas on the upper slopes of Hualalai.

Coastal ecosystems. The current facility has had no noticeable impact on coastal ecosystems. Given the depth of the water column and the strong currents no impacts are anticipated from the increase in production capacity.

Economic uses. The project will increase local employment in West Hawai`i, increase private expenditures on local services, and increase the availability of locally produced seafood.

Coastal hazards. The proposed use will not impact coastal hazards. The applicant has reported that the cages were not affected by the tsunami in 2011 or Hurricane Iselle in 2014.

Public participation. The public was invited to comment on the proposal during the environmental review process and the application process. A public hearing was held in August on the proposal.

Beach protection. The proposed use will not impact beach resources.

Marine resources. The current facility has had no noticeable impact on marine resources, and none are anticipated under the current proposal.

4) *The proposed land use will not cause substantial adverse impact to existing natural resources within the surrounding area, community or region.*

The applicant states that the extensive monitoring they have conducted over the past eight years of water quality and benthic parameters has indicated that the facility has had no significant environmental impact. Per the tests that the applicant has conducted on water quality parameters and benthic parameters, the proposed action is well within the nutrient assimilation capacities of the local water column and benthos.

The environmental monitoring requirements and limits specified in the existing NPDES permit will continue under the proposed action.

OCCL notes that the Blue Ocean has been diligent in following the required monitoring protocols of the current CDUP. These protocols will remain unchanged.

The data indicates that the current facility has not had any discernable impact on the benthos, nearby reefs, or wild fish populations over the eight years of the facilities existence. Based upon tests and the modeling that the applicant has done as part of the current environmental assessment, OCCL concurs the proposed action is well within the nutrient assimilative capacities of the local water column and benthos.

5) *The proposed land use, including buildings, structures and facilities, shall be compatible with the locality and surrounding areas, appropriate to the physical conditions and capabilities of the specific parcel or parcels.*

The proposal will be contained within the existing leased area. The maximum number of pens will increase from five to eight; their size and style are consistent with the existing facility.

6) *The existing physical and environmental aspects of the land, such as natural beauty and open space characteristics, will be preserved or improved upon, whichever is applicable.*

   The project will have little impact on open space. The site is not visible from the nearest recreation areas.

7) *Subdivision of land will not be utilized to increase the intensity of land uses in the Conservation District.*

   The proposed project does not involve subdivision of Conservation District land.

8) *The proposed land use will not be materially detrimental to the public health, safety and welfare.*

   Staff is of the opinion that the proposed addition will not be materially detrimental to the public health, safety and welfare. The modifications will make the facility more economically viable and thus sustainable in the long run.

DISCUSSION:

Mariculture facilities are an identified land use within the Conservation District, pursuant to Hawai`i Administrative Rules (HAR) §13-5-23 *Identified land uses in the resource subzone,* R-1 AQUACULTURE, (D-1) *Aquaculture under a management plan, approved simultaneously with the permit.*

In 2011 OCCL worked with the permittee, the Department of Agriculture's Aquaculture Development Program, DLNR's Division of Aquatic Resources, and the Department of Transportation's Harbors Division to develop a stronger set of monitoring protocols as part of our review of their management plan.

The applicant has consistently followed these protocols, and meets with OCCL staff quarterly to review conditions at the facility. They have collected a significant amount of data on the local water quality, the benthos, and marine mammals. The results of these studies have been included in **Exhibit 3**, which was taken from the applicant's Environmental Assessment. Blue Ocean also publishes their yearly water quality reports and benthic reports online at www.bofish.com. The data have not shown any detrimental impact to the State's natural resources.

OCCL believes that Blue Ocean operates under a strong management plan, and has recommended that other applicants for open-ocean facilities use their plan as a template.

Nutrient loads to the water column and benthos from the proposed increase in production were assessed and determined not to result in a significant environmental impact on natural resources. The proposed expansion appears to be within the carrying capacity of the site.

The proposal appears to be consistent with the Conservation District criteria contained in HAR §13-5-30, as discussed in the previous section.

There are a number of conditions of the existing permit, such as compliance with the existing monitoring and reporting requirements, a ban on the use of feeds containing supplemental hormones, and decommissioning of the site at the end of the lease, that OCCL will recommend also be made conditions of this permit. Conditions 15 to 25 are the "non-standard" conditions that are part of the current permit.

Therefore:

RECOMMENDATION:

Based on the preceding analysis, Staff recommends that the Board of Land and Natural Resources APPROVE this application for an increase in capacity at the Blue Ocean mariculture facility located offshore of Unualoha Point, North Kona, Hawai`i, subject to the following conditions:

1. The permittee shall comply with all applicable statutes, ordinances, rules, and regulations of the federal, state, and county governments, and applicable parts of this chapter;
2. The permittee, its successors and assigns, shall indemnify and hold the State of Hawaii harmless from and against any loss, liability, claim, or demand for property damage, personal injury, and death arising out of any act or omission of the applicant, its successors, assigns, officers, employees, contractors, and agents under this permit or relating to or connected with the granting of this permit;
3. The permittee shall obtain appropriate authorization from the department for the occupancy of state lands, if applicable;
4. The permittee shall comply with all applicable department of health administrative rules;
5. The permittee shall provide documentation (e.g., book and page or document number) that the permit approval has been placed in recordable form as a part of the deed instrument, prior to submission for approval of subsequent construction plans;
6. Before proceeding with any work authorized by the department or the board, the permittee shall submit four copies of the construction plans and specifications to the chairperson or an authorized representative for approval for consistency with the conditions of the permit and the declarations set forth in the permit application. Three of the copies will be returned to the permittee. Plan approval by the chairperson does not constitute approval required from other agencies;
7. Unless otherwise authorized, any work or construction to be done on the land shall be initiated within one year of the approval of such use, in accordance with construction plans that have been signed by the chairperson, and shall be completed within three years of the approval of such use. The permittee shall

notify the department in writing when construction activity is initiated and when it is completed;

8. All representations relative to mitigation set forth in the accepted environmental assessment or impact statement for the proposed use are incorporated as conditions of the permit;

9. The permittee understands and agrees that the permit does not convey any vested right(s) or exclusive privilege;

10. In issuing the permit, the department and board have relied on the information and data that the permittee has provided in connection with the permit application. If, subsequent to the issuance of the permit such information and data prove to be false, incomplete, or inaccurate, this permit may be modified, suspended, or revoked, in whole or in part, and the department may, in addition, institute appropriate legal proceedings;

11. Where any interference, nuisance, or harm may be caused, or hazard established by the use, the permittee shall be required to take measures to minimize or eliminate the interference, nuisance, harm, or hazard;

12. Artificial light from exterior lighting fixtures, including but not limited to floodlights, uplights, or spotlights used for decorative or aesthetic purposes, shall be prohibited if the light directly illuminates or is directed to project across property boundaries toward the shoreline and ocean waters, except as may be permitted pursuant to section 205A-71, HRS. All exterior lighting shall be shielded to protect the night sky;

13. Where applicable, provisions for protection of beaches and the primary coastal dune shall be established by the permittee, to the satisfaction of the department, including but not limited to avoidance, relocation, or other best management practices;

14. The permittee acknowledges that the approved work shall not hamper, impede, or otherwise limit the exercise of traditional, customary, or religious practices of native Hawaiians in the immediate area, to the extent the practices are provided for by the Constitution of the State of Hawaii, and by Hawaii statutory and case law;

15. The maximum growing volume of the facility will not surpass 72,000 m^3, the maximum number of pens will be ten, and the maximum individual net size will be 8000 m^3.

16. The use of feeds containing supplemental hormones shall not be allowed;

17. Approved species for the open-ocean facility are kāhala (almaco jack, *Seriola rivoliana* and amberjack, *S. dumerili*), mahi mahi (*Coryphaena hippurus*), ulua (giant trevally, *Caranx ignobilis*) and moi (Pacific threadfin, *Polydactylus sexifilis*). No other species is approved. Any further culture of fish species must be approved by the Chairperson of the Department of Land and Natural Resources;

18. Signs or other markings of the site shall be regulated by site plan approval. The applicant shall immediately report any ocean use conflicts, such as entanglement of fishing nets on the farm facility, to both the boating and land divisions. Buoys, signs or other markings shall be provided on the ocean surface when required by the Chairperson;

19. The permittee shall forward details of all monitoring efforts to the DLNR and water quality results to the Department of Health in accordance with the existing NPDES permit. The department shall be immediately notified of the failure of the mooring system, a disease outbreak, theft or vandalism;

20. The permittee shall monitor the condition of the submerged fish farm on a daily basis. When weather and surf conditions do not permit physical monitoring, visual monitoring shall be conducted;

21. The lease shall be in compliance with Chapter 190D, HRS. The permittee shall implement mitigative measures approved by the Chairperson to alleviate environmental or use concerns, when the need is apparent or when required by the Chairperson. Such mitigative measures may include the partial or complete removal of the fish farm facility;

22. Cages, anchors, lines and other fish farm facilities shall be removed at the conclusion of the use;

23. Any nets or other debris that foul on the cages or other part of the farm facility shall be disposed of as required by federal, state and city and county regulations and shall not be set free in the marine environment;

24. Dead fish shall not be disposed of in the surrounding waters but shall be removed from the site and disposed of at a County approved site;

25. The permittee will comply with the Reporting Requirements of the Management Plan, as amended in 2011, for the duration of the lease or until amended;

26. Other terms and conditions as prescribed by the Chairperson; and

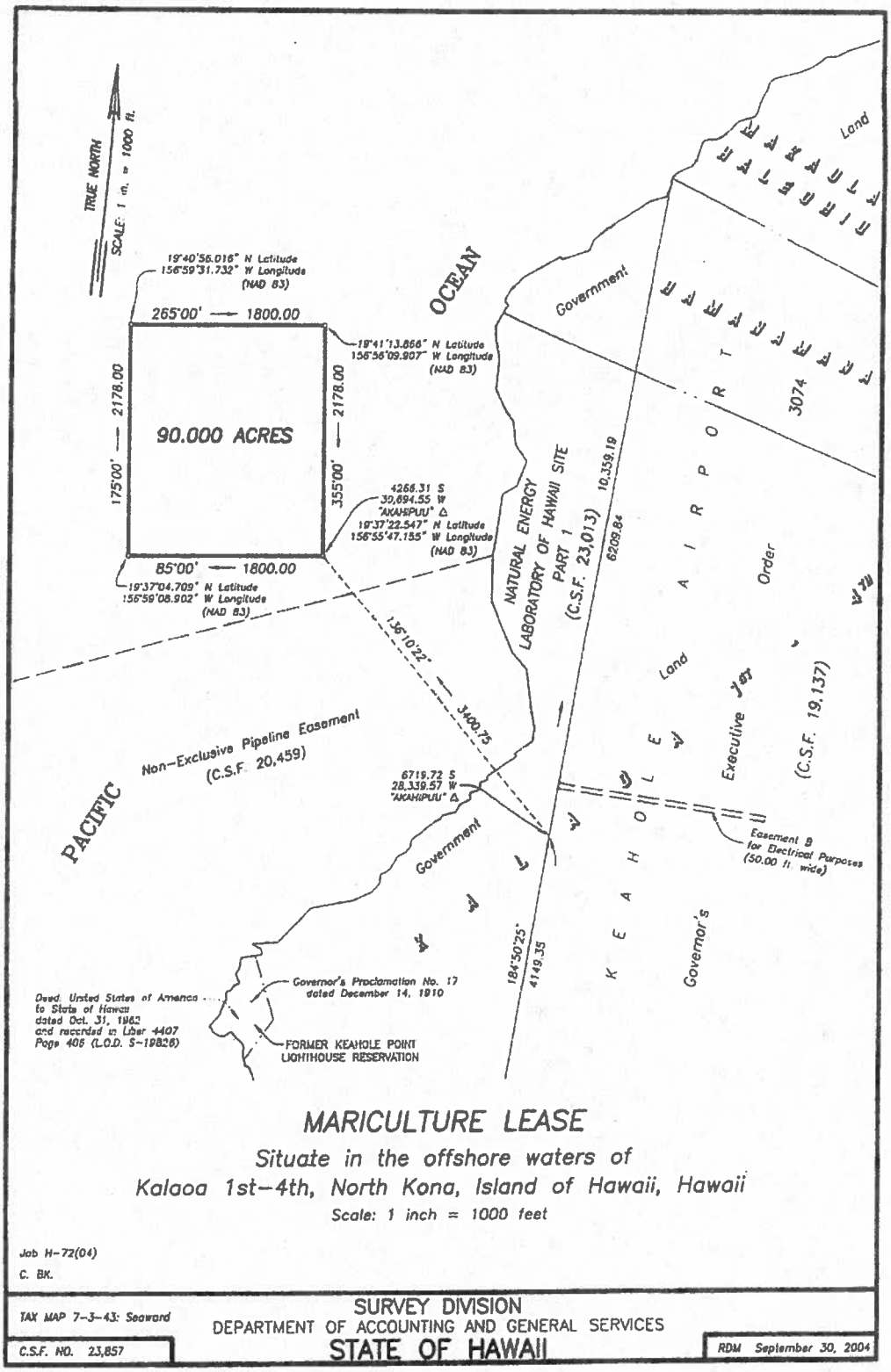
27. Failure to comply with any of these conditions shall render the permit void;

Respectfully submitted,

Michael Cain, Staff Planner
Office of Conservation and Coastal Lands

Approved for submittal:

William J. Aila, Chairperson
Board of Land and Natural Resources



MARICULTURE LEASE

Situate in the offshore waters of
Kalaoa 1st–4th, North Kona, Island of Hawaii, Hawaii

Scale: 1 inch = 1000 feet

Job H-72(04)
C. BK.

TAX MAP 7-3-43: Seaward

C.S.F. NO. 23,857

SURVEY DIVISION
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
STATE OF HAWAII

RDM September 30, 2004

Exhibit 1

Figure 1: Farm Site Location

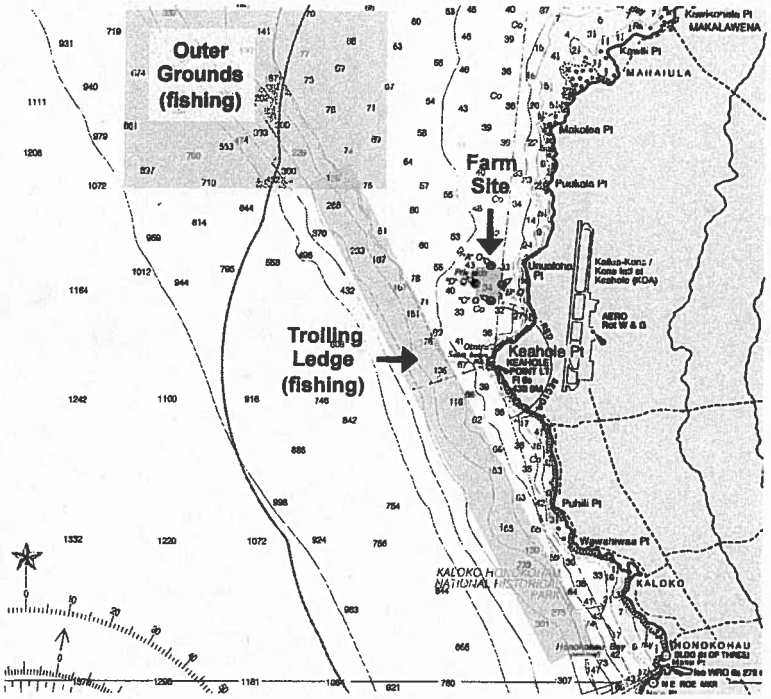


Figure 2: Modified Mooring Array (8 Cells)

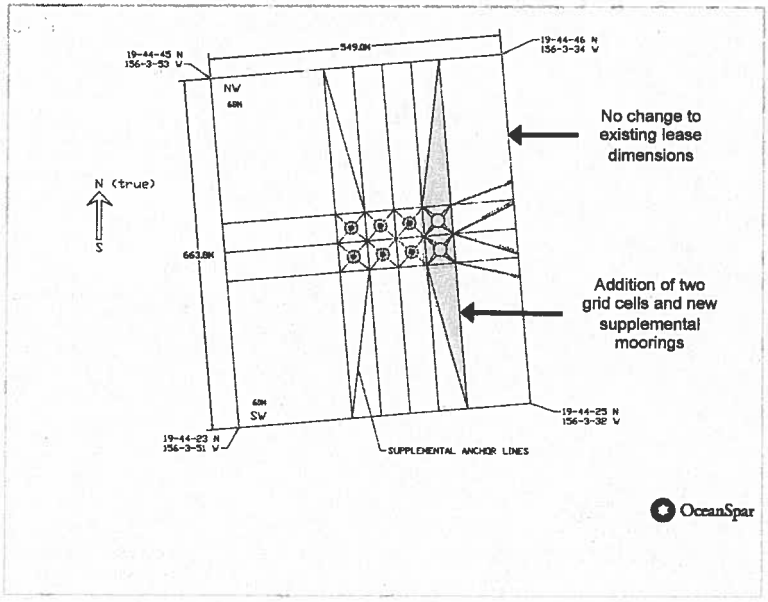


Exhibit 2

5 POTENTIAL IMPACTS AND MITIGATION

5.1 Potential Short-Term Impacts

Implementation of the Proposed Action will take place over approximately 18 months as higher capacity net pens are installed and stocked. Installation takes 2-4 days per net pen and no environmental impacts are expected. There are no discharges associated with net pen installation and the net pens do not contact the seabed at any time. Modifications to the mooring system are minor and would take place approximately one year after approval. Repositioning of existing anchors or deployment of new anchors will result in minor and temporary re-suspension of soft sediments, which will not have a significant impact on the benthos. There are no significant short-term environmental impacts associated with the increase in biomass as the nutrients discharged under the Proposed Action will increase over several years, proportionally with increased utilization of the Farm Site.

5.2 Water Quality

The effluent (uneaten feed, ammonia excretions, fish feces) from increased biomass related to the Proposed Action has the potential to impact water quality. Specifically, the increased amount of organic material has the potential to alter nitrogen (N) composition, turbidity, and/or phosphorus (P) levels in the surrounding waters. The concentration of N (compounds such as total nitrogen, ammonia, nitrate, nitrite) and P (as total phosphorus or orthophosphate) are indicators of nutrient enrichment and are commonly used to assess the impact of aquaculture, or any other anthropogenic activity, on water quality. High N and P inputs may serve to fertilize marine food webs, boosting overall productivity with increases in phytoplankton and macroalgal production (Cloern 2001).

The Proposed Action is not expected to generate a significant increase in primary productivity due to the farm's relatively small amount of biomass and the dynamic hydrology at the Farm Site. To avoid the potential negative impacts of increased N and P, it is important that farm production levels remain within the nutrient assimilation capacity of the surrounding environment (Price 2013). The NOAA National Ocean Service reviewed global siting data to identify farm site characteristics best suited to water quality protection, concluding that, "Protection of water quality will be best achieved by siting farms in well-flushed waters." (Price 2013). The Farm Site has many of the attributes cited in this study, including strong, mixing ocean currents, deep waters and a coarse sand bottom type. To help assess the potential impact of the Proposed Action on water quality, this DEA includes an analysis of historical water quality data at the Farm Site, a nutrient (N and P) loading projection, and a benchmark comparison to other farm operations.

Potential Water Quality Impacts (Review of Historical Data)

The Farm Site has an eight-year history of detailed monitoring and reporting on water quality under the Blue Ocean WQMP. The results from all water quality testing are provided to regulatory agencies including DLNR, DOH and EPA. The Blue Ocean WQMP monitors the level of several compounds associated with the breakdown of fish feed and fish metabolism (feces and ammonia excretions). It also monitors the acute toxicity of any discharge associated with the use of therapeutants or antibiotics.

To identify water quality impacts from the farm, the Blue Ocean WQMP defines a Zone of Mixing (ZOM) around the Farm Site (Figure 13) and requires measurement of several water quality parameters at the ZOM border to confirm that seawater leaving the Farm Site is similar in composition and quality to the surrounding waters. The water quality limitations for the Farm Site's NPDES permit are based on the State of Hawaii definition of Class AA Marine Waters, HAR 11-54-06 (Table 8). The Proposed Action does not request a modification to the NPDES permit limitations.

Table 8: NPDES Permit ZOM Limitations

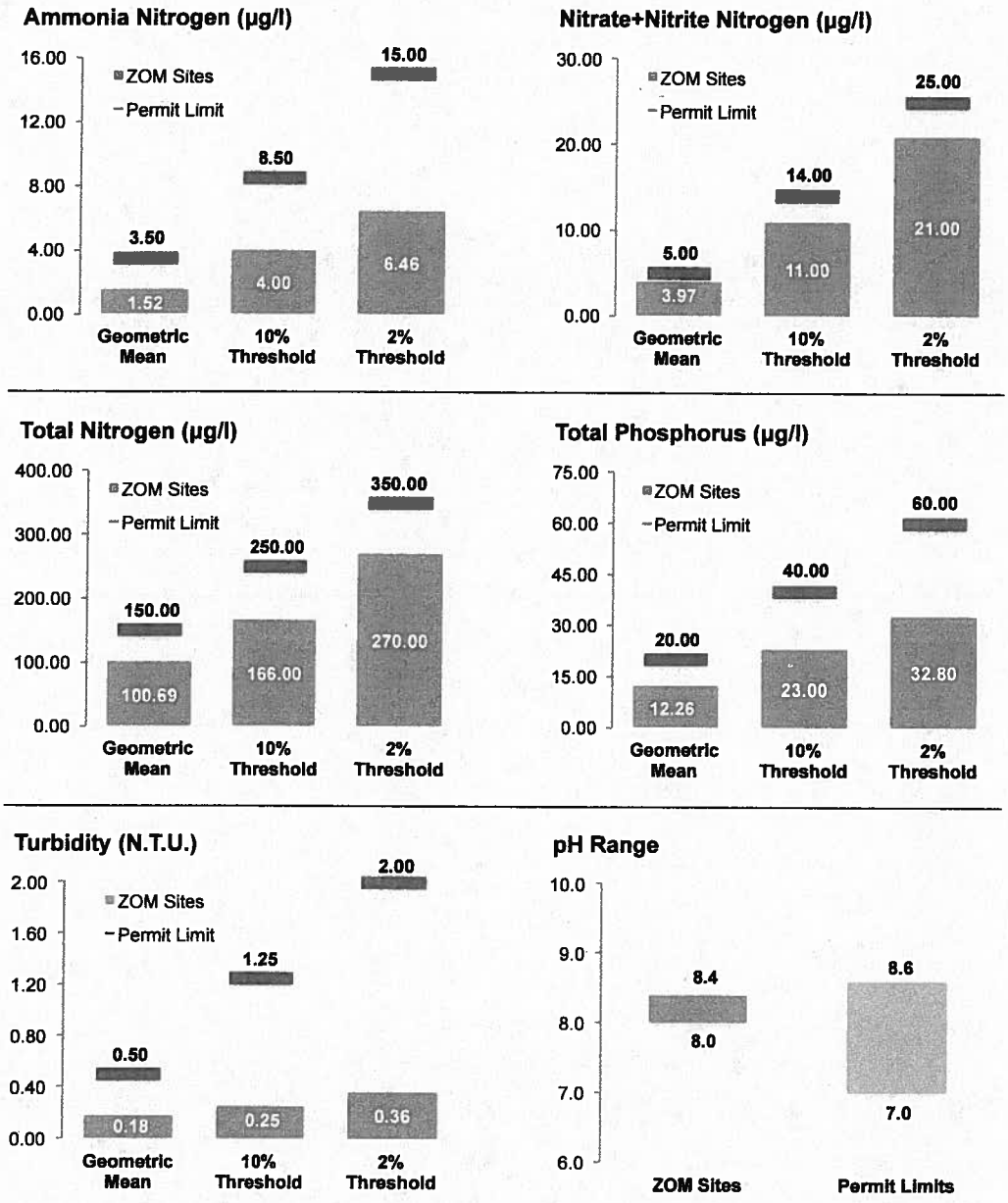
Parameter	Geometric Mean Not to Exceed the Given Value	Not to Exceed the Given Value More than 10% of the Time	Not to Exceed the Given Value More than 2% of the Time	Unit	Type of Sample
Total Nitrogen	150.00	250.00	350.00	µg/l	Grab
Ammonia Nitrogen	3.50	8.50	15.00	µg/l	Grab
Nitrate+Nitrite Nitrogen	5.00	14.00	25.00	µg/l	Grab
Total Phosphorus	20.00	40.00	60.00	µg/l	Grab
Turbidity	0.50	1.25	2.00	N.T.U.	Grab
pH Range	7.0 – 8.6			Std.	Grab[1]

[1] pH shall be tested within 15 minutes from the time the sample was collected.

Under the Blue Ocean WQMP, water samples are collected and analyzed by independent laboratories. Since the farm's inception, the levels of these compounds in the ZOM readings have been well below the specified permit limits (Figure 15). These results from ZOM testing under the Blue Ocean WQMP confirm there has been no significant impact from mariculture operations at the Farm Site on any of the six primary water quality parameters.

Exhibit 3

Figure 15: Blue Ocean WQMP Results



There are inherent difficulties testing marine waters for these compounds at the low sensitivity levels required under the NPDES permit. In 2010 the laboratory contracted by Blue Ocean reported invalid results for Total Nitrogen (TN), where TN was reported to be less than the sum of Ammonia and Nitrite + Nitrate. These results are not included in Figure 15.

Exhibit 3

In addition to a comparison against Permit Limits, ZOM readings are also compared to their corresponding Control Site readings to identify any differences between water quality in the ZOM and water quality at the Control Sites. The Control Site readings are taken up current of the discharge location, at the opposite end of the Zone of Mixing (Figure 13). Comparison of the geometric mean of ZOM and Control Site readings for the period Q3 2005 to Q4 2013 indicates no statistically significant difference between readings downstream of the discharge location and upstream of the discharge location (Table 9).

Table 9: Water Quality (ZOM v. Control)

Parameter	ZOM Readings	Control Site Readings
Total Nitrogen	100.69	100.42
Ammonia Nitrogen	1.52	1.47
Nitrate+Nitrite Nitrogen	3.97	4.07
Total Phosphorus	12.26	12.29
Turbidity	0.18	0.18
pH	8.2	8.2

A second source of historical data on primary productivity in the Farm Site area is the NELHA WQMP. Its history of chlorophyll-a readings at stations near the Farm Site show average levels of 0.10 – 0.15 µg/l, almost three times lower than the DOH standard of 0.3 ug/l (NELHA 2013). This result indicates that the level of nutrient enrichment and microalgae production in the area near the Farm Site is not elevated.

In addition to the water quality parameters, the Blue Ocean WQMP also monitors the acute toxicity of discharges of FDA-approved therapeutants (hydrogen peroxide) and in-feed antibiotics. These discharge events are defined and managed under the USFWS INAD program (INAD 11-669, INAD 9332). The Blue Ocean WQMP requires Whole Effluent Toxicity (WET) testing for each discharge event involving antibiotics and one discharge event per quarter for hydrogen peroxide (in the past, WET tests were conducted for all hydrogen peroxide events). For each WET test, a water sample is taken just outside the net pen immediately after release of the tarps (for hydrogen peroxide events) and during feeding (for antibiotic events). Samples are sent to a third-party laboratory for acute toxicity testing in accordance with Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms (EPA-821-R-02-012, Fifth Edition, October 2002). The test provides in a Pass/Fail score for each discharge event (Table 10).

Table 10: WET Test Results (2009-2013)

Chemical Discharge	Passed Tests (Rate)	Failed Tests	Total Tests[2]
Antibiotic	8 (100%)	0	8
Hydrogen Peroxide	54 (96%)	2[1]	56

[1] Two failed tests due to sample collection errors.

[2] Includes all antibiotic treatments and quarterly tests for hydrogen peroxide treatments.

The high Pass rates of historical WET tests indicate no significant impact from whole effluent discharge events. The Proposed Action does not call for any changes in the amount of therapeutants or antibiotics used per discharge event, or any changes in the protocol for such events. Since the WET test procedure is related to each independent discharge event, the historical WET test results are demonstrative of the expected WET test results and water quality under the Proposed Action.

Potential Water Quality Impacts (Mitigating the Impacts of Hydrogen Peroxide)

Concentrated hydrogen peroxide is used extensively at the Farm Site to treat fish for the removal of ectoparasites. Its use in aquaculture is approved by the FDA and is managed by U.S. Fish & Wildlife Service under the INAD program. Hydrogen peroxide is an oxidizing disinfectant that breaks down into water and oxygen when added to seawater. The formation of these by-products is one of the reasons it is considered to be relatively safe for the environment (Yanong 2008). Hydrogen peroxide degrades more rapidly in the presence of organic material, aeration and sunlight. As discussed in Section 2.1, Blue Ocean uses hydrogen peroxide to bathe fish crowded within a volume enclosed by non-permeable tarps for 30 minutes, based on a protocol set by USFWS. To mitigate the risks of environmental impact, Blue Ocean continues the tarping treatment for an extra 15 minutes to reduce the amount of unreacted hydrogen peroxide released into the environment when the tarps are removed. Treatments are typically conducted mid to late morning to maximize the breakdown of hydrogen peroxide in the hours of strongest sunlight. Increased amounts of organic material in the net pen, including fish and biofouling also help accelerate reaction. Finally, once the tarps are removed the prevailing ocean currents quickly dilute any remaining unreacted peroxide. The WET testing conducted for hydrogen peroxide at the edge of net pens indicates that little, if any, unreacted hydrogen peroxide is released into the environment.

Potential Water Quality Impacts (Nutrient Loading Model)

A Nutrient Loading Model (NLM), based on work by Fernandes and Tanner (2008) and Islam (2005), was created to estimate the amount of nutrients (N and P) added

to the surrounding waters under the Proposed Action. The incremental nutrient load is then compared to background nutrient levels to assess potential impacts on water quality.

The end point of the NLM's mass balance equation is the net amount of N and P added to the environment over the course of a production cycle. The input amount of N and P is based on the Farm Site's economic FCR and the amount of N and P contained in the feed (manufactured by EWOS, British Columbia). The amount of N and P retained by the harvested biomass is then subtracted from the input. The amounts of N and P retained in harvest fish are 3.2% and 0.6% respectively, based on whole body analysis of *Seriola quinqueradiata* (Satoh 2004). These factors are then combined to create a Farm Load Factor for N and P per metric ton of harvest production (Table 11).

Table 11: Nitrogen and Phosphorus Load Factors

Measure	Nitrogen (N)	Phosphorus (P)
Farm FCR[1]	2.3	2.3
% in Feed Input[2]	6.9%	1.2%
% Retained in Harvest[3]	3.2%	0.6%
Farm Load Factor[4] (% Production)	**12.7%**	**2.2%**

[1] Historical FCR on Farm Site.

[2] Actual levels in Blue Ocean feed supplied by EWOS.

[3] Satoh 2004, Fernandes & Tanner 2008, FAO 2003.

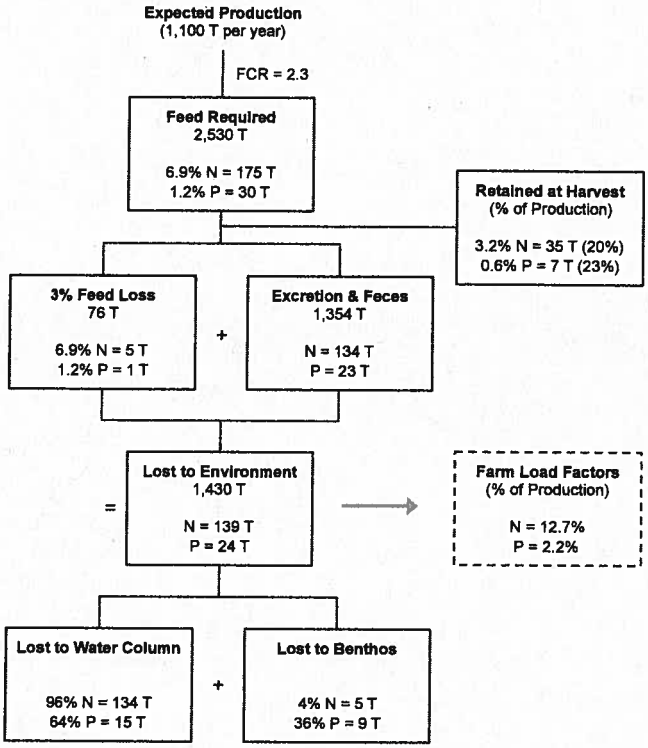
[4] = (% in Feed * Farm FCR) - % in Harvest

The Farm Load Factors for N and P represent the amount of N and P added to the environment per unit of harvest fish production. For instance, 1 metric ton of harvest fish production is projected to add 139 kg of N and 24 kg of P to the environment over the course of the production cycle. The Farm Load Factors for the Blue Ocean Farm Site are consistent with research conducted by Islam (2005) (Farm Load Factor for Nitrogen = 13.3%), and the survey conducted by Price (2013) (Farm Load Factor for Nitrogen rage = 2% to 46%).

Ninety-six percent of the N and 64% of the P added to the environment are in the form of metabolic waste that dissolves or is suspended in the water column (Fernandes 2008) (Islam 2005). Based on estimated production of 1,100 T, the NLM estimates that approximately 134 T N and 15 T P will be added to the water column per year under the Proposed Action (Figure 16).

Exhibit 3

Figure 16: NLM for Proposed Action



The next step is to determine if this impact is significant by comparing the increased levels of N and P to background levels and NPDES permit limits for these nutrients. Using the baseline nutrient levels defined in Table 4 and the seawater replenishment rate defined in Figure 11, the background amounts of N and P through the Farm Site each year from normal ocean processes are over 38,000 T and 4,600 T, respectively (Table 12).

Table 12: Background Nutrient Load (Water Column)

Measure	Unit	Nitrogen (N)	Phosphorus (P)
Dynamic Seawater Volume[1]	T / yr	379 billion	379 billion
Baseline Nutrient Levels in the Water Column[2]	µg/l	100.42	12.29
Background Nutrient Load in the Water Column	T / yr	38,032	4,655

[1] See Section 4.2.

[2] See Section 4.1.

Exhibit 3

A comparison of the nutrient levels under the Proposed Action to background levels indicates that the impact of the Proposed Action is not significant. The projected increase in the level of N in the water column is 0.35% per year and the projected increase in P is 0.33%. In addition, these estimates show the projected levels of N and P in the surrounding waters will remain well below the N and P limits specified in the Farm Site's NPDES permit (Table 13).

Table 13: Impact of Farm Nutrient Levels (Water Column)

Measure	Unit	Nitrogen (N)	Phosphorus (P)
Farm Load (Impact)	T / yr	134	15
Background Nutrient Load in the Water Column	T / yr	38,032	4,655
Farm Load as % of Background Load	µg/l	0.35%	0.33%
Projected New Readings at Discharge Stations[1]	µg/l	100.78	12.33
NPDES Permit Limits	µg/l	150.00	20.00

[1] Baseline nutrient levels + new Farm Load.

The NLM provides a robust estimate of the incremental nutrient (N and P) loads expected under the Proposed Action. The deep waters and strong ocean currents replenish the Farm Site deliver with large amounts of nutrients under normal ocean processes. These same dynamic hydrological factors will reduce residence time and accumulation of the incremental nutrients added by the farm. These factors and associated analysis suggest no significant impact on water quality under the Proposed Action.

Potential Water Quality Impacts (Benchmark Comparisons)

Most developed aquaculture industries manage environmental impacts by limiting producers to a Maximum Allowed Biomass (MAB) per farm site, which represents the total biomass (T) in the water at any given time. Under the Proposed Action, the production level of the Farm Site is expected to increase from 450 T whole fish in 2013 to approximately 1,100 T whole fish by 2017. This level of production represents a maximum standing biomass of no more than 600 T. This Farm Site MAB is significantly below the MAB limits set by countries with developed aquaculture industries (Table 14). The results do not account for variations in site hydrology, water depths or bottom composition, but they indicate that the Farm Site will remain well below the size and subsequent impacts of most commercial aquaculture operations.

Exhibit 3

Table 14: Benchmark Comparison (Farm Size)

Location	Individual Farm Site Limit (Standing Biomass)	Species
Norway[1]	3,120 T	Atlantic Salmon (*Salmo salar*)
Canada[1]	4,500 T	Atlantic Salmon (*Salmo salar*)
Scotland[1]	2,500 T	Atlantic Salmon (*Salmo salar*)
United States[2]	3,000 T	Atlantic Salmon (*Salmo salar*)
Australia[3]	1,600 T	Yellowtail (*Seriola lalandi*)
Tasmania[4]	3,240 T	Atlantic Salmon (*Salmo salar*)
Blue Ocean	**600 T**	**Yellowtail (*Seriola rivoliana*)**

[1] Marine Harvest, Salmon Farming Industry Handbook 2013

[2] American Gold, Puget Sound, Washington State

[3] Clean Seas, Port Lincoln, South Australia

[4] Tassal Group, Macquarie Harbour, Tasmania

Water Quality Impact Mitigation

Blue Ocean works to mitigate Farm Site impacts on water quality in several ways. The Company participates in ongoing research with its feed supplier to improve the digestibility of its aqua feeds. Higher digestibility helps reduce the amount of metabolic waste (reduced amounts of feces) and leads to a lower FCR (reduced overall amounts of feed input). The move to larger net pens and increased use of HDPE surface pens will help improve the effectiveness of fish crowding, which will help reduce the amount of therapeutants (particularly hydrogen peroxide) required per T of biomass. Blue Ocean will continue to employ best animal husbandry practices to avoid use of antibiotics.

5.3 Benthic Environment

Farm Site effluent (particulate organic matter) in the form of feed loss and fish feces has the potential to impact the benthic environment. Particulate organic matter is the basis for the benthic food chain, which begins with bacteria, followed by colonization of ciliates and flagellates, followed by larger detritovores (Bybee 2003). The level of organic carbon (C) in the sediment is a direct indicator of the amount of particulate organic matter on the seafloor (e.g., uneaten feed, macroalgae or bacteria). High levels of

Exhibit 3

C in the seabed can lead to new algal and bacteria growth, which in turn can impact existing benthic species diversity (Cromey 2002). In cases of extreme accumulation of organic matter, bacteria may overgrow, and microbial breakdown of organic matter will consume more oxygen than is available in the substrate or nearby water, creating anoxic conditions in the benthos (Hargrave 2008). However, the amount of C added to the benthos under the Proposed Action is not expected to create significant benthic impacts for several reasons:

- Blue Ocean's feed management strategies effectively minimize the amount of feed loss, the major driver of C accumulation in the sediment.
- The small dispersion area for lost feed tends to limit effects to the immediate area under the net pens, typically within 30 meters (Nash 2005) (Rensel 2013).
- The coarse sand bottom and strong currents at the Farm Site allow greater oxygen mixing and carbon assimilation than other sediment types (Price 2013).
- The predominant long shore (N-S) current direction tends to keep nutrient loads away from coral reef areas.
- The proposed production level remains small relative to the water depth and replenishment rate at the Farm Site.
- Regular net pen cleaning will reduce long-term buildup of biofouling and inhibit the establishment of aquatic invasive species.

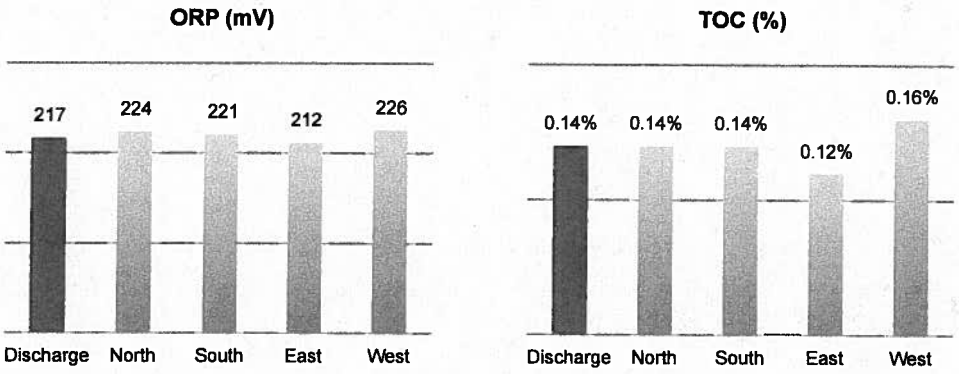
As part of this DEA, an analysis of historical benthic monitoring data at the Farm Site was conducted and a model of sediment carbon loading was created to evaluate the potential impacts on the benthos from the Proposed Action.

Potential Benthic Impacts (Review of Historical Data)

The Blue Ocean BMP provides information indicating that, to-date, the Farm Site has not had a significant impact on the benthic environment. ORP and TOC analysis at the discharge and control sites over the past three years shows that for both measures, the discharge site readings are consistent with control site baseline readings, indicating no significant impact (Table 15). In addition, the ORP levels at the discharge site are well above hypoxic (0 mV) and anoxic (-100 mV) risk levels (Wildish 2005) (Hargrave 2008). TOC levels are consistently low (< 0.16%) within and around the Farm Site indicating little organic enrichment. This level is markedly lower than many other aquaculture sites around the world, which range from 0.2% to 26.1% (Price 2013), and they are within the range of values (0.17% to 0.33%) seen in non-impacted sites around other Hawaiian Islands (Russo 2011).

Exhibit 3

Table 15: Blue Ocean BMP Results



In addition to TOC and ORP analysis, the Blue Ocean BMP calls for a periodic assessment of the micromollusc environment in the benthos under the Farm Site. A review of these assessments dating back to 2005 indicates a consistently low incidence of macrofauna (consistent with the local hydrological environment and coarse sand) and a consistent set of observed macroalgae species and locations. In addition, a review of the micromollusc environment descriptions shows a strong consistency in the characteristics of the micromollusc environment, indicating only minor changes in species diversity over time. Historical reports are consistent with an analysis from the Farm Site's 2013 micromollusc survey conducted by the University of Hawaii at Hilo, which concluded, "Overall, the data indicate a diverse and abundant molluscan fauna, with predominantly epifaunal gastropods displaying a variety of trophic levels. Microherbivores and detritivores were most abundant, with an array of carnivores and symbionts, indicating a diverse ecosystem with no apparent ill effect from the offshore aquaculture systems." (Blue Ocean BMP).

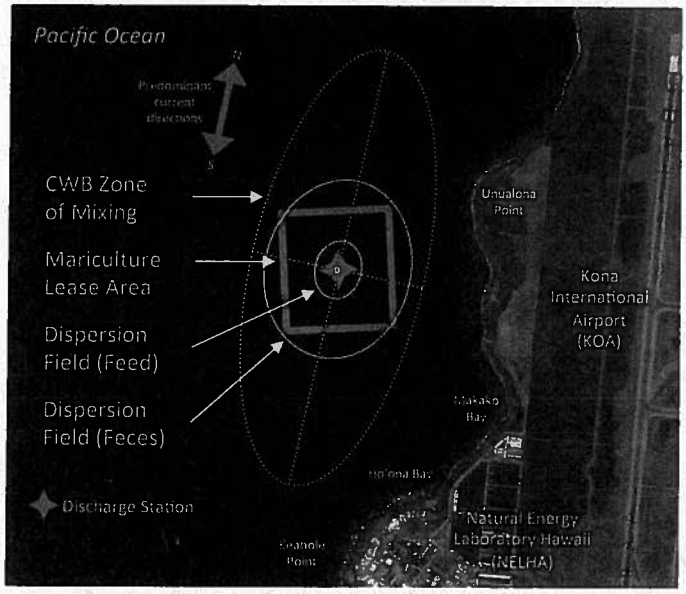
Potential Benthic Impacts (Sediment Carbon Loading Model)

Changes in organic carbon levels in the benthos can be correlated with nutrient loading from fish farms (Giles 2008) (Hargrave 2008) (Hall 1990). However, estimating the benthic impacts of C loading is complex and models are sensitive to site-specific parameters, particularly local hydrology (Chamberlain 2007). Organic carbon accumulation in the sediment (measured as grams of C per square meter per day) is one of the end points of analysis and several estimation models such as DEPOMOD have been developed (Cromey 2002). Research continues in this area to refine the models based on site-specific parameters.

A simplified Sediment Carbon Loading Model (SCLM) was created for this DEA to estimate the amount and dispersion of C sediment accumulation based on expected production under the Proposed Action. The two primary vectors for C accumulation are uneaten feed (feed loss) and biomass effluent (feces) settling to the bottom. A third

vector, periodic removal of biofouling from the net pens, is discussed separately. Impacts from feed loss and feces are modeled independently to account for the large difference in dispersion areas due to different settling velocities. Settling rates for feed loss and feces are estimated at 0.088 m/s (Vassallo 2006) and 0.025 m/s (Cromey 2002) (Rensel 2013), respectively. Ocean current speeds and direction frequency are used to define elliptical dispersion areas for C accumulation (Figure 17). The dispersion fields for feed and feces are both well within the ZOM defined by the NPDES permit.

Figure 17: Estimated Carbon Dispersion Fields



The SCLM model calculates the estimated C accumulation rates for feed loss and feces (g C m^2 day) by estimating the base C sedimentation rates, subtracting the amount of C resuspended into the water column (benthic flux) and dispersing the remaining amount of C across the respective dispersion fields for feed loss and feces (Table 16). The total amount of C input to the system is estimated as 50% of the total amount of feed input (EWOS personal communication). The amount of feed loss is 3% based on Farm Site experience. The amount of C reaching the seabed through feed loss is estimated at 95% as only minor changes to the feed take place during the drop (Hall 1990). Estimates for the amount of C reaching the seabed through feces discharge range from 8.8 (Nash, 2001) to 23% (Wu 1995). The high flushing rate and coarse sand bottom put the Farm Site at the low end of this range and a value of 9% is used. The estimate for benthic flux, primarily resuspension of particles off the bottom, is 20% (Hall 1990). The SCLM estimates that approximately 29 T C and 86 T C accumulate in the sediment per year from feed loss and feces, respectively. These amounts are dispersed across their respective dispersion areas for estimated C accumulation rates of 1.7 g C m^2 day for feed loss and 0.4 g C m^2 day for feces.

Exhibit 3

Table 16: Sediment Carbon Loading Model (SCLM)

Estimated Carbon Input
based on 1,100 T Production at 2.3 FCR
= 2,530 T Feed at 50% C
= 1,265 T C in Feed Input

Factor	Feed Loss	Feces
Feed Loss	3% = 38 T	N/A
Sedimentation Rate	95% = 36 T	9% = 108 T
Benthic Flux	20% = 7 T	20% = 22 T
Sediment Accumulation	29 T C yr	86 T C yr
Dispersion Field	45,274 m^2	560,962 m^2
Sediment Accumulation Rate	**1.7 g C m^2 day**	**0.4 g C m^2 day**

Impacts from sediment accumulation vary widely depending on the nature of the background environment and local hydrology (Price 2013). However, broad surveys of aquaculture sites indicate that moderate oxygen stress does not begin to develop until sediment accumulation rates are 2.0 to 5.0 g C m^2 day, and anoxic conditions typically require more than 10.0 g C m^2 day (Hargrave 2008) (Chamberlain 2007). The sediment accumulation values under the Proposed action are associated with normal, oxic conditions in which the benthos has an ongoing capacity to assimilate additional nutrients.

Although not included in the SCLM, the removal of net pen biofouling also contributes to the sediment carbon load, but in smaller amounts than contributed by feed loss and feces. As discussed in Section 2.1, the amount of biofouling produced annually under the Proposed Action is approximately 500 to 1,500 kg (dry weight). Blue Ocean typically removes fouling buildup about once per quarter. Assuming the biofouling contains 50% C, an additional 250 to 750 kg C will be added to the sediment load per year, or about 0.4% of the C load added by feed input under the SCLM (0.5 T C from biofouling ÷ 115 T C from feed input). The dispersion area for this sediment load is likely similar to the dispersion area for feces given the high water content of biofouling (although coralline-type fouling will fall more quickly and stay closer to the net pens).

The results of the SCLM and biofouling estimates, along with the consistency of discharge and control site readings for ORP and TOC, indicate that the increased benthic

nutrients expected under the Proposed Action will not have a significant impact on the environment. The relatively small size of the Farm Site and its discharge, combined with strong ocean currents and a coarse sand benthos, indicate minimal impact. In addition, the impact area appears to be limited to the benthos immediately under the net pens, well within the Farm Site lease area and NPDES permit Zone of Mixing boundaries.

Benthic Impact Mitigation

Blue Ocean continues to work on benthic impact mitigation strategies, including development of new technologies to reduce feed loss (e.g., video monitoring of feed events, greater precision in feed delivery equipment), improvements in feed digestibility to reduce the amount of nutrients lost to the environment (Rust 2011).

5.4 Wildlife

Fish Populations

Concerns about the environmental impacts of the Proposed Action on local fish populations are primarily focused on the potential for:

- Transmission of disease from farmed fish to wild fish.
- Transmission of ectoparasites (*Neobenedenia*) from farmed fish to wild Kahala.
- Escaped fish to reduce the genetic fitness of wild populations or become invasive.

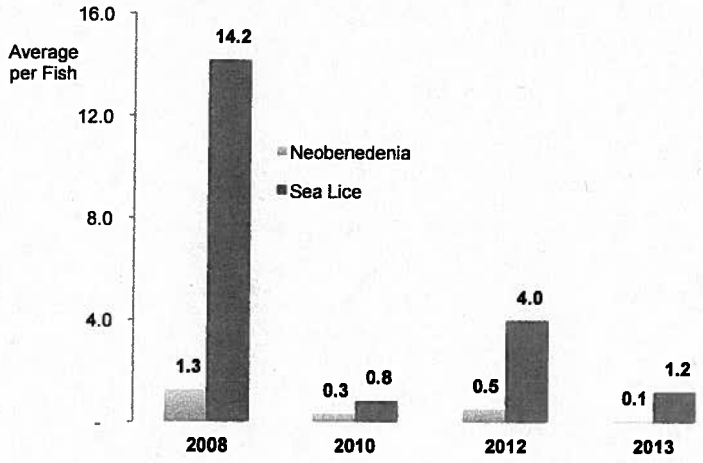
Disease Transmission. Intensive culture (large numbers of animals in an enclosed containment system) creates the potential for disease development in any farming system. Containment allows the reinfection cycle to iterate through the enclosed population and a subsequent buildup of disease intensity can follow. However, this reinfection cycle is typically broken in wild populations where fish are able to swim away at various points in the cycle, or the population is not of sufficient density to allow the disease to reach critical mass (Nash 2005). In addition, studies have shown that, within a few meters of net pens experiencing an outbreak of disease, the level of pathogens is insufficient to cause disease in nearby healthy wild or farmed fish (Nash 2005).

Disease outbreaks at the Farm Site are extremely rare. The only disease incident over the past five years was a series of bacterial infections in 2010, from strains of *Vibriosis sp.*, which are commonly found in marine environments. The infections were the direct result of a specific nutritional deficiency in the feed. Once the deficiency was identified, Blue Ocean switched to a new feed supplier and the health of the farm population recovered immediately. No evidence of disease transmission to wild populations was observed. To mitigate this risk in the future, Blue Ocean delivers basic vaccinations prior to stocking fish offshore, maintains low stocking densities in farm populations, and closely monitors the nutritional composition of its feed supply.

Exhibit 3

Ectoparasite Transmission. Ectoparasites of pelagic fish occur naturally in all marine environments, with particular species of fish being susceptible to particular species of ectoparasites. The primary ectoparasite for *Seriola sp.* is *Neobenedenia sp.*, a monogenean (Dr. Teresa Lewis, Hawaii Institute of Marine Biology, 2007 personal communications). *Neobenedenia* is common to wild *Seriola sp.* throughout the world and can build-up in intensity on cultured fish at the Farm Site. Blue Ocean monitors the potential for *Neobenedenia* transmission from Farm Site fish to local wild Kahala by sampling the ectoparasite levels on wild Kahala along the Kona Coast (CDUP HA-3497, Ectoparasite Monitoring Plan). Results from the Ectoparasite Monitoring Plan indicate no buildup of *Neobenedenia* on wild fish (Figure 18). *Neobenedenia* levels are consistently low on wild Kahala and the predominant ectoparasite observed is Sea Lice (Family Caligidae), a copepod. Sea Lice have never been observed on Farm Site fish.

Figure 18: Ectoparasite Prevalence on Wild Kahala



Blue Ocean mitigates the buildup of *Neobenedenia* on its farmed fish through reduced stocking densities and the use of hydrogen peroxide baths, which remove ectoparasites without harming the fish. The ectoparasite monitoring analysis and mitigation strategies indicate that the Proposed Action is unlikely to result in transmission of ectoparasites from farmed fish to wild fish populations. The use of copper alloy netting would significantly reduce the buildup of *Neobenedenia* by eliminating much of the biofouling habitat used for *Neobenedenia* reproduction.

Impact of Escapes. In the past, concerns have been raised that escaped farmed fish may reduce the genetic fitness of wild populations or become invasive (e.g., out-compete wild populations for food). Specifically, if a large number of cultured fish with traits developed under a selective breeding program escape and breed with wild conspecific fish, the characteristics may be passed down to offspring, making the wild fish less fit or less competitive. The risk of escapes will also be reduced by the use of copper alloy netting materials.

Exhibit 3

The potential environmental impact from escaped fish is not significant. Blue Ocean does not conduct selective breeding, which is prohibited under its operating permits. All brood fish are wild caught in the Kona Coast area as adults and thus come from the ecosystem along the Kona coast. They spawn naturally (without hormones), usually in groups, in brood tanks at the hatchery.

In addition, fish cultured at the Farm Site are harvested before they become sexually mature, and are unlikely to survive to become sexually mature in the wild. Observations of escaped fish at the Farm Site indicate that most remain in the general area of the farm and quickly become prey for predators. Farmed fish are adapted to eating delivered dry pellets and do not adapt to hunting or even accepting wild feed sources (Brown 2001). Trials conducted by KBWF in 2006 showed that farmed fish weaned on dry pellet feed would not accept offered squid or sardines. Similarly, the wild caught Kahala in Blue Ocean's brood program cannot be converted to dry pellet feed.

Dolphins

The Proposed Action is not expected to have a significant impact on the local dolphin population. Human-dolphin interactions are not permitted at the Farm Site and all Blue Ocean employees are required to acknowledge this policy in writing. Blue Ocean will continue to monitor and report dolphin activity around the Farm Site per the Marine Mammal Monitoring Plan.

Sharks

The Proposed Action is not expected to have a significant impact on the local shark population. Staffing levels will increase to ensure continuation of good animal husbandry practices such as daily mortality removal to eliminate new forage opportunities for sharks. Blue Ocean will continue to monitor and report shark activity around the Farm Site per its Shark Management Plan.

In October 2008, seven Tiger sharks were tagged along the Kona Coast and their movements were tracked in an attempt to quantify their fidelity to the Farm Site and to identify other areas visited by the sharks (Papastamatiou 2010). The sharks spent only a short period of time associated with the net pens at the Farm Site although several returned sporadically to the net pens over a 236 day period. These findings are consistent with the transient nature of Tiger sharks generally, and with Farm Site crew observations of Tiger shark behavior over the past seven years.

Seabirds

The Proposed Action is not expected to have a significant impact on seabirds. Seabirds are very rarely seen around the Farm Site and no new attractants are proposed. Blue Ocean will continue to monitor and report seabird activity around the Farm Site per its Seabird Monitoring Plan.

Exhibit 3

Aquatic Invasive Species

The Proposed Action is not expected to significantly increase the risk of Aquatic Invasive Species (AIS) being introduced to Hawaii through the Farm Site. The Proposed Action does not create a new vector for AIS introduction to local waters beyond the existing vector of workboat activity at Honokohau Harbor. Regular net pen cleaning removes a long-term habitat development opportunity for potentially invasive algae and coral species. It is also unlikely that invasive species would be able to displace more abundant native species of algae and coral during the short periods between cleanings.

5.5 Rare, Threatened and Endangered Species

Four species of threatened or endangered species were identified in Section 4.5. The potential risk to these species under the Proposed Action is not significant. The potential risk usually noted for these species is risk of entanglement with anchor lines, net pens or other mooring equipment. There have been no incidents of entanglement with threatened or endangered species in the history of the Farm Site. Blue Ocean mitigates the risk entanglement by keeping all anchor lines and mooring system lines are taut, with no opportunity for wrapping or entanglement, and by keeping all netting taut or rigid, eliminating animal entanglement issues with loose netting. The Farm Site will continue to record and report all marine mammal observations under its Dolphin Management Plan and Marine Mammal Observation Plan.

5.6 Scenic & Recreational Resources

The Proposed Action is not expected to have a significant impact on scenic and recreational resources. The scenic impact of the increase in the number of net pens from 5 to 8 is very low, particularly for submersible net pens. All mooring system changes will occur below the ocean's surface and in the same location as the existing Farm Site. No changes are proposed to recreational access to the Farm Site for tour or charter boats.

5.7 Historical & Cultural Resources

The Proposed Action is not expected to have a significant impact on historical and cultural resources. No changes in the Farm Site location or mariculture lease area are proposed. As discussed in Section 4.7, no historical or cultural resources have been identified at the existing Farm Site location. Blue Ocean will continue to monitor the Farm Site location for historical resources according to its Historic Resources Management Plan (CDUP HA-3497).

Exhibit 3