Environmental Defense Sciences

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EXPERT REPORT

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Hawai'i Wildlife Fund, *et al*., v. County of Maui, CIV. No. 12-00198

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1. Introduction

This expert report has two purposes: (a) to present the rationale for a National Pollutant Discharge Elimination System (NPDES) permit for the discharge of tertiary treated wastewater from the County of Maui (County) Lahaina Wastewater Treatment Facility (LWRF) through underground injection control (UIC) wells to groundwater that flows to the Pacific Ocean and provide an exemplary NPDES Draft Permit (Draft Permit) and Fact Sheet with which the LWRF can demonstrate compliance, and (b) analyze, review, comment upon and rebut Declarations and Expert Reports prepared by Adina Paytan, Ph.D., Jennifer Smith, Ph.D., and Lauren Roth Venu.

The opinions expressed in this report rely upon and reference analyses presented in a prior Expert Report dated October 30, 2014 (ER 2014) and a Declaration dated December 19, 2014 to which my *c.v.* is attached as Exhibit 2. These materials are attached and incorporated herein by reference. In addition, this report will use coastal sampling data from the Hawai'i Department of Health (HDOH) and published data from six coastal studies on the islands of Maui and Hawaii that are referenced below.

Section 2 of this report provides a statement of opinions I will express and the basis and reasons for these opinions. Section 3 details the facts and data I used in developing a Draft Permit and Fact Sheet for the LWRF injection wells, which are included herewith as **Exhibits 1 and 2**.

Section 4 of this report presents my professional opinions regarding the Paytan, Smith and Venu Expert Reports and earlier Declarations. Section 5 presents the exhibits I use to support my opinions regarding these documents. My professional qualifications to opine on these subjects are included by reference to my prior Expert Report dated October 30, 2014. In addition, I have consulted on over 200 NPDES permits for industry and municipalities, more than 30 of which have involved discharges to coastal waters or ocean. A number of these have involved working with clients to create permit language for initial draft permits. Some of these have concerned industrial cooling water discharges (power plants and refineries), others have related to Publicly Owned Treatment Works (POTWs), *i.e*., treated wastewater discharges. My firm has recently spent several years working with others to develop exemplary stormwater discharge regulations. A list of all other cases I have testified at trial or by deposition for the last four years and a statement of the compensation to be paid to me for the study and testimony in this case are also included by reference to the October 30, 2014 report authored by me.

2. Complete statement of all opinions the witness will express and the basis and reasons for these opinions

2.1 Groundwater generally is much lower in pH and salinity than seawater and is usually relatively constant in temperature. Dissolved oxgyen (DO) and nutrient concentrations in groundwater can vary considerably from seawater, depending on sources contributing to groundwater and its flow path in the aquifer.

- Groundwater exiting the seeps at Kahekili is little different in pH from other groundwaters in that the pH is lower than seawater but typical of other groundwaters. The pH of the seep water is compliant with the HDOH Water Quality Standard (WQS) for this coastal water. See Section 4 below.
- The salinity in the seeps, although much lower than sea water, is elevated by 4-6 parts per thousand (ppt) from other groundwaters, indicating mixing with saline water occurs within the aquifer, which I conclude is likely driven by geothermal activity. The salinity directly above the seeps, however, is the same as ambient ocean water. See Section 4 below.
- The temperature of the seeps at Kahekili is 3-5 degrees Celsius higher than seawater and is unique in that the temperature fluctuates rapidly (*i.e.*, within a few hours) and reaches temperatures never seen in aquifers outside of a geothermal zone. The maximum water temperatures in the seeps are much higher than any recorded effluent temperature. The temperature at the seeps is clearly related to geothermal activity. See Section 4 below.
- The DO levels in groundwater are generally lower than in the ocean. The levels in seeps at Kahekili are 3-4 mg/L lower than in the seawater but rapid mixing of seep water with the ocean waters immediately above the seeps increases the DO levels such that the impact on the ocean receiving water cannot be identified. The DO levels in the seeps are compliant with HDOH standards in that the DO saturation levels defined by ambient temperature and salinity do not drop below 75%. See Section 4 below.
- The seeps at Kahekili have nitrate and nitrite (nutrient) concentrations that are lower than in other groundwaters in Hawaii. The phosphate concentration of the seeps is higher than in other ground waters in Hawaii. The ultimate source of this phosphate is likely the basaltic lava either leaching into the groundwater or possibly from the geothermal flows that add to the salinity of the seeps. Geothermal flows are high in phosphates. Nutrients in the seeps are also rapidly mixed with the seawater in the water column directly above the seeps. See Section 4 below.

2.2 Halting injection of LWRF effluent will not change the water quality at Kahekili.

- Nutrient concentrations (nitrates) in the nearshore coastal waters at Kahekili are similar to, and in many cases less than, nearshore coastal waters at many other locations in Maui and the Island of Hawaii where there is no effluent injection (see Section 4 and **Exhibits 5-9** below). Upland well nutrient concentrations and nutrient concentrations in Black Rock Lagoon indicate that removing the effluent from the groundwater will likely raise the concentration of nitrates and nitrites at Kahekili and significantly raise the flux of these nutrients. See ER 2014, Section 3.2.

- The temperature of the seeps is geothermally controlled and this geothermal activity will continue in the absence of any effluent injection. See ER 2014 Section 3.3(d) and Section 4.4 below.
- The groundwater data in Table 6.5 of the *Interim Report* make it clear that the salinity, pH and nutrients of the seeps will remain much the same if natural groundwater replaces the effluent present in the seeps. The DO levels may rise but they are already compliant with HDOH standards.
- If temperature, salinity, pH and nutrients are truly responsible for alleged reef damage, as claimed by Dr. Smith, then removal of the injected effluent is not going to make any difference.

2.3 An NPDES permit is not appropriate for discharges from UIC wells into groundwater that flows to the ocean. If a permit is required, the exemplary Draft Permit attached as Exhibit 1 is feasible.

a. HDOH has applied zones of mixing (ZOM) for areas where groundwater entering the ocean in Hawaii does not satisfy WQS.

- Six coastal water sampling programs show that at many locations in Hawaii, including Kahekili, groundwater <u>at the point of entry</u> into the ocean does not and cannot satisfy Hawaii ocean WQS. See Section 4 and **Exhibits 5 -9** below.
- However, rapid dilution (*ca*. 20:1-40:1) of the infiltrating groundwater (*i.e*., seeps) within the immediate water column above the seeps, which is generated by buoyancy-induced mixing, waves, and wind-driven and tidal currents, gives nearshore water quality that meets Hawaii WQS. This dilution leads to rapid attainment of WQS in the coastal waters outside of a ZOM near the shoreline. See ER 2014 Section 3.3(e) and Section 4 below.
- In recognition of this rapid dilution of groundwater infiltrating the ocean HDOH has created a unique set of water quality standards for the West Coast of the Island of Hawaii that defines a ZOM between groundwater and oceanic waters (Hawaii Administrative Rules (HAR) 11-54-06(d).
- Sanctioning of a similar ZOM for groundwaters discharging into Kahekili coastal waters is therefore precedented.

b. **Any flow from the LWRF wells to the ocean disperses broadly and diffusely through an unconfined aquifer and is rapidly diluted at the shoreline in a primary zone of mixing approximately 1900 ft long and 200 ft wide.**

- Water sampling data from Kahekili show that WQS for Class A Wet coastal waters are satisfied in the region outside of a ZOM that can be permitted in such waters. See Section 4 below.

c. **The Fact Sheet supports the Draft Permit for the LWRF UIC wells.**

- The Fact Sheet is provided in **Exhibit 2.**
- The Fact Sheet provides the rationale that shows the Draft Permit is feasible.
- The basis for the Draft Permit and the Fact Sheet and the necessary monitoring schedules are discussed in the following Section 3.0.

2.4 The LWRF discharge will comply with the Draft Permit.

- See discussion in Section 3.4 below.

3.0 NPDES Program

The Federal Water Pollution Control Act (FWPCA) Amendments of 1972 created the system for permitting wastewater discharges, known as the NPDES. The U.S. Environmental Protection Agency (EPA) was required to develop and implement regulations for the NPDES permit program. The regulations are primarily in Title 40 of the Code of Federal Regulations (CFR) Part 122. States, territories, or tribes can be authorized by EPA to administer all or parts of the NPDES program. The State of Hawaii has been approved by the EPA to administer a State NPDES program, and HDOH is the agency implementing the State's NPDES program.

Under the NPDES program, all facilities that discharge pollutants from any point source into waters of the United States are required to obtain a permit. Note that "waters of the United States" is generally interpreted as surface waters of the United States. Groundwater is not a water of the United States. I do not believe discharges from UIC wells to groundwater that flows to the ocean are appropriately regulated by an NPDES permit. However, it is my understanding that the Judge in this case has concluded that the groundwater into which the LWRF injection wells discharge acts as a conduit as well as a point source carrying injected materials to the ocean, which is a water of the United States. The Judge ruled recently that an NPDES permit is required for such a discharge.[1]

If an NPDES permit is required, it would look like the exemplary Draft Permit prepared under my supervision **(Exhibit 1)**

NPDES permits generally consist of a cover page with the name and location of the discharge, effluent limitations, monitoring and reporting requirements, standard conditions that apply to all NPDES permits, and special conditions such as best management practices (BMPs), additional monitoring activities, and toxicity reduction evaluations (TREs). An NPDES fact sheet is a document that provides the principal facts and the significant factual, legal, methodological, and policy questions considered in preparing the draft permit. An NPDES fact sheet is required to document general information of the facility, rationale for the permit conditions such as applicable statutory or regulatory provisions and the decision-making process for deriving effluent limitations.

The contents of the Draft Permit and Fact Sheet developed by my firm for the LWRF wells are summarized in the following sections.

[1] In their First Amended Complaint, the Plaintiffs request that the Judge issue appropriate injunctive relief requiring the County to apply for and comply with the terms of an NPDES permit for the UIC wells at the LWRF.

3.1 Contents of the Draft Permit

3.1.1 Cover Page

The cover page of the Draft Permit (see **Exhibit 1**) contains the name and location of the facility, a statement authorizing the discharge, a listing of the coordinates of the four LWRF UIC wells and location of the shoreline section covering the effluent outflow.

Information in this section is required for all NPDES permits. We reviewed relevant documents provided by LWRF and communicated with staff of the LWRF to compile the required information.

3.1.2 Effluent Limitations and Monitoring Requirements

This section presents effluent limitations based on both technology and water quality standards. The effluent monitoring location and methods were also described in this section. Technology-based effluent limitations (TBELs) require dischargers to achieve effluent quality that is attainable using demonstrated technologies for reducing discharges of pollutants into the waters of the United States. TBELs represent the minimum level of control that must be imposed in an NPDES permit. Water quality-based effluent limitations (WQBELs) are designed to protect water quality by ensuring that water quality standards are met in the receiving water.

To determine the effluent limitations, we reviewed the operations of the LWRF, applicable regulations, water quality standards, and performed Reasonable Potential Analysis (RPA). The process of deriving the effluent limitations presented in this section is documented in the Fact Sheet.

Note that the current treated effluent turbidity exceeds the numeric limitation required by water quality standards. However, since the effluent will be filtered through almost 1000 meters of aquifer it is extremely unlikely that the turbidity of any effluent actually entering the ocean will not be in conformity with the WQS. The issue of effluent turbidity in relation to the Draft Permit is discussed in more detail in Section 3.4 below.

3.1.3 Whole-Effluent Toxicity Requirements

Whole Effluent Toxicity (WET) tests measure the degree of response of exposed aquatic test organisms to an effluent or receiving water. WET testing is used as a second approach, in addition to the chemical-specific approach, to implementing water quality standards in NPDES permits. The WET approach is required by the narrative criterion specified in HAR, Chapter 11-54-4(b)(2).

This section of the Draft Permit lays out requirements and steps for WET tests including WET permit limit, monitoring frequency, test species and methods, initial investigation Toxicity Reduction Evaluation (TRE) and Toxicity Identification Evalauation (TIE) work plan, accelerated toxicity testing and TRE/TIE process, quality assuance and results reporting.

3.1.4 Zone of Mixing

Many state WQS allow some consideration of mixing of effluent and receiving water when determining the need for and calculating WQBELs. A ZOM is usually present in the immediate vicinity of a discharge, within which the effluent mixes rapidly with the receiving water. A regulatory ZOM generally is expressed as a limited area or volume of water in any type of waterbody where initial dilution of a discharge takes place and within which the water quality standards allow certain water quality criteria to be exceeded. HAR, Chapter 11-54 allows for a mixing zone if the ZOM is in compliance with requirements in HAR, Section 11-54-9(c).

We reviewed the tracer dye study of the LWRF effluent completed by the University of Hawaii (*Interim Report* and *Report)* to determine the location and extent of the ZOM for the LWRF discharge. Water quality standards may be exceeded within the ZOM, but should be met at the edge of the ZOM. ZOM monitoring locations and programs are provided in this section to ensure compliance with WQS at the edge of the ZOM.

3.1.5 Reporting Requirements

Both 40 CFR 122.48 and HAR Chapter 11-55-28 require that all NPDES permits should specify requirements for recording and reporting monitoring results. Requirements for reporting monitoring results, noncompliance incidents and planned changes are provided in this section.

3.1.6 Other Requirements

This section lists other NPDES permit requirements including submission schedules for effluent and receiving water monitoring programs, a receiving water bottom biological communities monitoring program, an initial investigation TRE work plan and schedule of maintenance. It is also stated in this section that this Draft Permit does not authorize or approve the construction of any onshore or offshore physical structures or facilities, and it does not waive any remedy or penalty applicable under Hawaii Revised Statutes, Chapter 342D.

3.2 Main Contents of the Fact Sheet of the Draft Permit

The Fact Sheet of an NPDES permit documents the principal facts and significant factual, legal, methodological, and policy questions considered in preparing the Draft Permit. One of the most important functions of the Fact Sheet is to explain the rationale and assumptions used in deriving the effluent limitations to the discharger, the public, and other interested parties. A Fact Sheet is required by 40 CFR 124.8 for every EPA and state-issued NPDES permit to a major facility.

The Fact Sheet of the Draft Permit (see **Exhibit 2**) for the LWRF mainly contains information about the LWRF operations, effluent monitoring data, applicable regulations, the process for deriving effluent limitations and the rationale for ZOM requirements.

3.2.1 Facility Setting

This section provides a relatively detailed description of the LWRF, including the history of the facility, wastewater treatment units and methods, discharge locations, receiving water category as defined in HAR 11-54-06, and available effluent monitoring data.

The LWRF is currently regulated by state and federal UIC permits, and is required to collect and analyze four types of effluent samples. In addition, the LWRF effluent is sampled and analyzed regularly for the most commonly monitored water quality parameters by the Central Lab at the facility. We reviewed relevant monitoring reports and summarized the monitoring data in this section.

3.2.2 Applicable Regulations

NPDES permit regulations in the State of Hawaii are mainly documented in HAR 11-54 and 11-55. These two chapters of the HAR establish beneficial uses and classifications of state waters, the state anti-degradation policy, ZOM standards, water quality criteria, permit conditions and requirements for NPDES permits. HAR 11-62 describes additional requirements for wastewater treatment works. The State Toxic Control Program (STCP) also provides some guidance for the development of water quality-based toxicity control. We reviewed these documents and followed the guidance provided in these regulations to prepare the Draft Permit and Fact Sheet.

3.2.3 Rationale for Effluent Limitations

The CWA requires point source dischargers to control the amount of conventional, non-conventional, and toxic pollutants that are discharged into the waters of the United States. In 40 CFR 122.44, NPDES permits are required to include applicable technology-based effluent limitations and WQBELs to attain and maintain applicable numeric and narrative water quality criteria to protect the beneficial uses of the receiving water.

Technology-based effluent limitations for conventional pollutants are established according to the required secondary treatment standards for treatment works. Requirements for R-1 reuse water specified in HAR 11-62-26 are also included in this section. To set WQBELs, a RPA was conducted for every pollutant listed in HAR 11-54-4 and 11-54-6. Detailed steps of the RPA are documented in this section. Results of the RPAs show that turbidity of the LWRF effluent at the plant exceeds WQS, but as noted it is believed that the turbidity of the seep discharges will satisfy WQS at the point of entry to the ocean. There are insufficient data to properly conducting RPAs for total phosphate, nitrate plus nitrite, light extinction, turbidity and chlorine and chloroethers- methyl(bis)[1]. However, limited data from the *Interim Report* Maui shore monitoring stations and from the recent study by Marine Research Consultants (2014b) (see **Exhibits 9a-9d**) support the contention that WQS for these parameters are met at the edge of the ZOM. More monitoring data should be collected for these pollutants as part of the monitoring program. WET test data are also not available for the LWRF effluent. A monitoring program is included in the Draft Permit to collect WET test data.

3.2.4 Rationale for ZOM

HAR 11-54 allows for a mixing zone if the ZOM is in compliance with requirements in HAR 11-54-9(c). The tracer dye study completed by the University of Hawaii (*Report*) found that the LWRF effluent plume reached the shoreline about 0.5 miles southwest of the LWRF. The width of the detected effluent plume was approximately 3,500 feet, and effluent was detected in coastal water within 200 feet from the shoreline. However, recent shoreline monitoring (see Section 3.4 and **Exhibits 9a through 9d)** has determined that a ZOM approximately 1900 ft along the shoreline and extending 200 ft offshore will allow WQS to be met.

[1] A note in the monthly 308 effluent data stated "*Chloroethers - methyl (bis) was delisted in 1981 because its half life in water is less than 38 s at 20 degrees Celsius. Consequently no one does this analysis for water and we could not test for this constituent*."

HAR 11-54-9(c) requires that a ZOM application should show that the continuation of the operation involved in the discharge by the granting of the zone of mixing is in the public interest; the discharge does not substantially endanger human health or safety; compliance with the existing WQS without the ZOM would produce serious hardships without equal or greater benefits to the public; and the discharge does not violate the basic standards applicable to all waters, will not unreasonably interfere with any actual or probable use of the water areas for which it is classified, and has received the best degree of treatment or control. We addressed all the points listed in HAR 11-54-9(c).

3.3 New Monitoring Actions Required by Draft Permit

3.3.1 Effluent Monitoring (INT-001)

Table 1 – Effluent Monitoring

Effluent Characteristics	Minimum Monitoring Requirements	
	Measurement Frequency	Sample Type
Flow	Continuous/ Recorder	N/A
Ph	1/Month	Grab
Biochemical Oxygen Demand (5-day @ 20^oC) (BOD_5)	1/Week	Composite[2]
Total Suspended Solids (TSS)	1/Week	Composite[2]
Total Organic Carbon (TOC)	1/Month	Composite[2]
Temperature	1/Month	Grab
Oil and Grease	1/Week	Grab
Ammonia Nitrogen	1/Month	Composite[2]
Total Nitrogen	1/Month	Composite[2]
Nitrate + Nitrite	1/Month	Composite[2]
Total Phosphorus	1/Month	Composite[2]
Whole-Effluent Toxicity	2/Year	Composite[2]

[2] To allow the Permittee sufficient time to install the internal monitoring location, the Permittee may use grab samples instead of composite samples for up to 120 days from the effective date of this Draft Permit, but no longer than necessary to establish the internal monitoring station.

3.3.2 Interim Effluent Monitoring (INT-001)

Table 2 – Interim Effluent Monitoring

Parameter	Unit	Monitoring Requirements	
		Measurement Frequency	Sample Type
Turbidity	NTU	1/Month	Grab

3.3.4 Whole Effluent Toxicity Monitoring (INT-001)

The Draft Permit specifies a number of actions that are mandated for satisfaction of WET requirements:

The Permittee shall conduct semi-annual chronic toxicity tests on flow weighted 24-hour composite effluent samples at INT-001, in accordance with the procedures outlined below. Monitoring events shall be conducted at least five (5) months apart, unless otherwise specified by the Director.

Upon exceedance of the applicable toxicity effluent limitation at INT-001, the Permittee shall conduct accelerated monitoring as specified in Part B.6 of the Draft Permit. If the source of toxicity is known and the additional toxicity test required in Part B.6.a does not exceed the chronic WET permit limitation, the Permittee may return to semi-annual monitoring. If the source of toxicity is not known and additional accelerated monitoring is required as specified in Part B.6.b, the Permittee must conduct monthly chronic toxicity monitoring until 12-months of consecutive "passes" have occurred.

The Permittee shall conduct chronic toxicity testing on *T. gratilla* using Hawaiian Collector Urchin, *Tripneustes gratilla* (Hawa'e) Fertilization Test Method (Adapted by Amy Wagner, EPA Region 9 Laboratory, Richmond, CA from a method developed by George Morrison, EPA, ORD Narragansett, RI and Diane Nacci, Science Applications International Corporation, ORD Narragansett, RI) (EPA/600/R-12/022) and follow Quality Assurance procedures as described in the test methods manual Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms (EPA/600/R-95/136, 1995).

3.3.5 Receiving Water Monitoring

The Permittee shall monitor at a total of ten (10) receiving water stations along the eastern and western edges of the ZOM—i.e., at the mid-ZOM, at the edge of the ZOM, and then outside of the ZOM, at two (2) control stations, as described in **Table** 3 and shown graphically in **Exhibit 3.** The water quality parameters to monitor and type of samples are summarized in Table **4**.

Table 3 – Receiving Water Monitoring Stations

STATION	LOCATION
R1	MID-ZOM NORTH BOUNDARY
R2	EDGE ZOM NORTH BOUNDARY
R3	MID-ZOM NORTH CENTER
R4	EDGE ZOM NORTH CENTER
R5	MID-ZOM SOUTH CENTER
R6	EDGE ZOM SOUTH CENTER
R7	MID-ZOM SOUTH BOUNDARY
R8	EDGE ZOM SOUTH BOUNDARY
C1	NORTH CONTROL
C2	SOUTH CONTROL

[1] At monitoring stations with water depths greater than 10 meters, top, middle and bottom samples shall be taken. At monitoring stations equal to or less than 10 meters, only top and bottom samples shall be taken. Top is within one (1) meter

below the ocean surface, middle is mid-depth, and bottom is one (1) meter above the ocean bottom.

Table 4 – Receiving Water Monitoring

Parameter	Units	Monitoring Frequency	Type of Sample
Total nitrogen	μg/L as N	1/Quarter	Grab
Ammonia nitrogen	μg/L as N	1/Quarter	Grab
Nitrate + nitrite nitrogen	μg/L as N	1/Quarter	Grab
Total phosphorus	μg/L as P	1/Quarter	Grab
Light extinction coefficient	K units	1/Quarter	In-situ
Chlorophyll a	μg/L	1/Quarter	Grab
Turbidity	NTU	1/Quarter	Grab
pH	Std. units	1/Quarter	Grab
Dissolved oxygen	mg/L	1/Quarter	Grab
Temperature	^oC	1/Quarter	In-situ
Salinity	ppm	1/Quarter	Grab

3.3.6 Biological Communities Monitoring

Beginning on the effective date of the Draft Permit, the receiving water bottom biological communities shall be monitored at least once per year. The monitoring performed shall include the diversity and distribution of the bottom biological communities.

3.4 The LWRF Discharge Will Comply With TheDraft Permit

The LWRF discharge is somewhat unique in that some monitoring data relating to the performance of the discharge to the relevant WQS already exist. In most cases where a new permit is being issued the permit applicant and permitting agency must rely upon some kind of predictive model to ascertain whether a discharge will meet the conditions of the permit. However, in this case there are already a enough monitoring data that no predictive modeling is necessary. Monitoring at the point of discharge, namely the seeps where effluent enters the ocean, has been performed at a limited number of seeps by HDOH and by the University of Hawaii. These data may be equivalent to “end-of-pipe” data if an ocean outfall were under consideration. Data also exist from sampling on a number transects perpendicular to the beach (see **Exhibits 9a, 9b, 9c and 9d**) and are representative of compliance monitoring data.

As stated in HAR 11-54: “It is the objective of class A waters that their use for recreational purposes and aesthetic enjoyment be protected. Any other use shall be permitted as long as it is compatible with the protection and propagation of fish, shellfish and wildlife, and with recreation in and on these waters. These waters shall not act as receiving waters for any discharge which has not received the best degree of treatment or control that is compatible with the criteria established for this class.”
The purpose of the WQS is ensure that the objectives for this class of waters are maintained and, as will become apparent in the following, the WQS for class A waters are in fact being met in a way that is protective of the objective uses.

As noted in the Fact Sheet, Kahekili waters are rated Class A Wet and the WQS standards are from HAR 11-54:

Table 5 – Excerpt from HAR 11-54 Class A Wet Regulations

Parameter	Geometric mean not to exceed the given value	Not to exceed the given value more than ten per cent of the time	Not to exceed the given value more than two per cent of the time
Total Nitrogen (ug N/L)	150.00* 110.00**	250.00* 180.00**	350.00* 250.00**
Ammonia Nitrogen (ug NH_4-N/L)	3.50* 2.00**	8.50* 5.00**	15.00* 9.00**
Nitrate + Nitrite Nitrogen (ug $[NO_3+NO_2]$-N/L)	5.00* 3.50**	14.00* 10.00**	25.00* 20.00**
Total Phosphorus (ug P/L)	20.00* 16.00**	40.00* 30.00**	60.00* 45.00**
Light Extinction Coefficient (k units)	0.20* 0.10**	0.50* 0.30**	0.85* 0.55**
Chlorophyll a ug/L)	0.30* 0.15**	0.90* 0.50**	1.75* 1.00**
Turbidity (N.T.U.)	0.50* 0.20**	1.25* 0.50**	2.00* 1.00**

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

Kahekili waters are classified as unimpaired for nutrients but impaired for turbidity, thus a ZOM can be permitted for nutrients but not for turbidity. This means that the effluent turbidity is subject to a Water Quality Based Effluent Limit (WQBEL) and must meet the WQS at the "end-of-pipe", that is, at the point of discharge. The basic difficulty is that the locations for which HDOH seep turbidity data are available are the North Seep Group (NSG) located 5 meters from the shoreline, and at the South Seep Group (SSG) located 25 m from the shoreline, which are both well within the wave breaking zone. Consequently no control of the turbidity is possible during such events and it is unlikely that the WQS standards for turbidity can be met. It is clear that the turbidity measured at the seeps during such periods is likely the result of wave action and not the inherent turbidity of the seep water and its associated effluent. HDOH data show high concentrations of total suspended solids in samples taken over sandy substrates, suggesting a significant contamination of seep water samples by local wav-induced turbidity. It is not known if the samples taken for the HDOH turbidity measurements used a piezometer to collect pure seep water or whether the samples include adjacent bottom water, or if piezometers that were used were flushed for a sufficient time to assure seep water was unaffected by ambient sediment.

Since any effluent in this seep water has been filtered through almost 1000 meters of aquifer it is very unlikely to retain any suspended material that could contribute to the turbidity. However, if extremely fine suspended particles were held in suspension in the groundwater then mixing of the effluent with salt water would result in these extremely small particles coagulating and creating a more turbid water. See ER 2014 List *c.v.* publications [18]-[23]. In any case, as discussed below, and in ER 2014 Section 3.3(e), there is an immediate dilution of the seeps of the order of 20:1 to 40:1, which would make this turbidity of no consequence.

A statistical analysis of the HDOH monthly sample turbidity data reveals that the turbidity in the water column above the seeps (average of mid-depth and surface turbidity) is correlated at the 90 % level with the average turbidity at the control stations. However, the turbidity measured at the seeps by HDOH is correlated at only a 1% level with the turbidity in the water column above the seeps. In other words, the turbidity measured by HDOH at the seeps is totally uncorrelated with the turbidity in the water column above the seeps, which is a very surprising result. Since the radon data and silicon data in the *Report* show that the seeps rise through the water column, and are diluted as they do so, it would be expected that there would be a high correlation between the turbidity in the water column above the seeps and the seep turbidity. There is no ready explanation for this very significant discrepancy between what is observed in the turbidity and silicon and radon concentration data. If the turbidity measured by HDOH in the seeps involved larger particles that subsequently fell out of suspension this could explain what is happening. However, without further information as to the actual source of the turbidity, *i.e.*, suspended particle sizes and concentrations this can only be a matter of conjecture.

Some further insight into the turbidity of groundwaters can be obtained from a review of the data in the research paper by Johnson and Wiegner (2014), who measured turbidity in groundwaters that floated to the surface in Kiholo Bay on Hawaii. Johnson and Wiegner went to great pains to take samples when the ocean was calm with no waves and no wind-induced mixing. Under these conditions they determined a surface water turbidity of 0.36-0.37 NTU and since the associated salinity data indicate that this floating surface water had been diluted with seawater with a turbidity of 0.24 by at least 2:1, the actual groundwater turbidity must have been less than 0.5 NTU. There is no reason to believe that that the groundwater on Maui would have a significantly different turbidity and, if so, this would explain the high correlation between the control station turbidity and the water column turbidity above the seeps—the latter would be controlled by the ambient water turbidity and not the seep turbidity.

In summary, there is every indication that despite the elevated turbidity measured by HDOH at the seeps the effluent discharged at the shoreline will in fact meet WQS for turbidity. A carefully designed sampling program that samples the seep water before it enters the ocean will likely confirm this finding.

As discussed previously, the ambient WQS are met at Kahekili and the waters are not impaired for nutrients so that a ZOM is permitted. The nearshore dilutions implied by the silicon data in **Exhibits 5-9** and the measured concentrations of nutrients in the Kahekili shore sampling conducted by Marine Research Consultants (2014b) (**Exhibits 9a-9d**) indicate that the conditions of the Draft Permit will be met at the boundary of the ZOM.

4.0 Analyses and conclusions by Dr. Smith and Dr. Paytan regarding certain water quality parameters in the nearshore off of Kahekili and their relationship to effluent from the injection wells are faulty.

The Smith and Paytan Expert Reports and prior Declarations make claims that ascribe specific attributes to the seeps and then impute an impact on nearshore ocean waters that are not supported by the available data. For example, Dr. Smith in her Expert Report of 2/9/2015 §1B1, p. 6, states (emphasis added):

"Further, the study [Tracer Study] confirmed that wastewater effluent seeping out of the reef at these locations is characterized by extremely high nitrogen and phosphorus values (levels above those known to cause algal blooms on coral reefs), extremely low dissolved oxygen (which can suffocate animals living in the surrounding areas), extremely low pH (values lower than what is projected to occur over the next 100 years with global ocean acidification), low salinity, and warm water".

Dr. Paytan in her Expert Report of 1/23/2015 §I.A., p. 1, states (emphasis added):

"Samples of water discharging from the seeps measured higher in temperature and nutrient concentrations, and lower in pH, oxygen, and salinity than samples taken at background control sites along the West Maui coast. In my opinion, the large influx of LWRF effluent mixed with natural groundwater discharging from the submarine seeps has a substantial effect on the receiving ocean water, substantially altering both its physical character (temperature) and its chemistry (nutrient concentration, pH, dissolved oxygen and salinity.)"

A careful examination of these claims and the water quality data from the area shows the claims to be inaccurate.

4.1 pH

In her Declaration of 3/17/14, Dr. Smith made the claim (p.13) that "there is substantial local acidification occurring on Kahekili's reefs due to effluent coming from the LWRF". Dr. Smith now focuses her attention (Expert Report, pgs. 10-11 Section 1B3b) on the pH of water within the seeps and claims that damage is ensuing as a result of the pH of the seeps. However, a statistical analysis of pH data (*Report*, Table ES-1) shows that the mean pH of water within the springs has an average of between 7.35 and 7.69 and that HDOH data within the seeps show a minimum pH of 7.47 with a mean of 7.7, and what Dr. Smith omits from her Report and Declarations is that HAR 11-54-6 (pg. 54-46) states that for Class A coastal waters:

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Applicable to both "wet" and "dry" conditions:
pH Units - shall not deviate more than 0.5 units from
a value of 8.1, except at coastal locations where and
when freshwater from stream, stormdrain or groundwater
discharge may depress the pH to a minimum level of
7.0.
```

The point is that pH measurements within the seeps are measurements within groundwater and that a pH less than 7.6 but greater than 7.0 is permitted. The average pH of about 7.5 in the seeps (Smith Report, p.10) is therefore well within the HAR 11-54-6 sanctioned pH level.

Furthermore, the pH in the water column above the seeps, with a mean of about 8.2, is statistically indistinguishable from the pH at the control sites and certainly does not deviate more than 0.5 from 8.1.

Dr. Smith also cites field studies by Johnson and Wiegner (2014) at Kiholo on the Island of Hawaii to support her claim that the pH at Kahekili is extremely low. In that Kiholo study, groundwater diluted with salt water and floating on the sea surface near the shore was determined to have a pH of about 8.13. Table 6-6 of the *Interim Report* shows that groundwater floating on the ocean surface above the seeps also had a pH of 8.14 and thus is no different than the Kiholo water pH. No actual groundwater samples were collected in the Kiholo study so Dr. Smith does not know what the pH of groundwater was at Kiholo. The salinity of the floating water suggests that it was diluted with seawater by at least 2:1 before the pH was measured. Dr. Smith's comparison of the results of the Kiholo study with the pH of the seeps at Kahekili is inappropriate.

In summary, the pH of the groundwater seeps at Kahekili is in compliance with WQS for pH. Thus, the groundwater meets the objectives for class A waters and cannot be legitimately classified as having extremely low pH.

Dr. Paytan admits that researchers studying submarine groundwater discharge typically measure pH because groundwater is normally characterized by lower pH than seawater (*e.g.*, see Table 6-7, *Interim Report*). Dr. Paytan concludes that the data show that the trend at the seeps is toward more acidic conditions, and that groundwater including the contribution from the effluent is responsible for this trend. As stated above, the HDOH has taken this into account in setting WQS for areas where groundwater discharge can depress pH. As I point out above, the pH at the seeps is compliant with WQS. Furthermore, as made clear in my prior report (ER 2014 Section 3.3(e)) the seeps are subject to an immediate dilution of at least 20:1, which means that the pH in the receiving ocean waters above the seeps attains the ambient pH. The Kiholo study also suggests significant dilution occurs as the groundwater enters the ocean. Dr. Paytan's claim that the seeps substantially alter the receiving ocean water pH cannot be supported by any available data from the *Interim Report, the Report* or HDOH.

4.2 Salinity

Both Dr. Smith and Dr. Paytan make claims regarding the volume of fresh water within the groundwater seeps at Kahekili that have no basis in fact or theory. For example, in her Expert Report (Section 1B3c, pg .12), Dr. Smith states: (emphasis added):

"Because the effluent increases the volume of low salinity freshwater moving through the reef, it increases the rate of coral mortality."

"Further, given the volume of fresh water that is continuously emerging from the seeps in the reef it is likely that the influence is much larger than would exist from natural groundwater sources."

As is known by all groundwater hydrologists, all rainwater that falls on an island and infiltrates either flows off the land as surface streams or emerges at the shoreline as groundwater submarine springs and diffuse flow. If LWRF effluent were not discharging at the shoreline in the spring seeps it would simply be replaced by natural groundwater.

Groundwater flows to the ocean under a hydraulic gradient that is evident as the slope of the groundwater level is recorded by land-based monitoring wells. When injection wells are established in an existing groundwater flow they push the existing natural groundwater flow to each side so that it has a slightly higher velocity over a broad area and discharges elsewhere. The gap between these parted natural flows is filled with the injected flow that moves downstream away from the injection site, on average, at a velocity very close to the velocity that existed prior to the injection. See discussion in List Declaration 12/19/14 at §27. If the injected flow is removed, the system reverts to what it was prior to the injection. In other words, the injection wells will not and cannot increase the volume of low salinity freshwater discharging at the seeps.

Moreover, the County is not creating and adding any additional groundwater to the aquifer. Groundwater above the LWRF is pumped from production wells, treated and provided as drinking water to West Maui businesses and residences. Some of this drinking water ultimately becomes wastewater that ends up at the LWRF and may be disposed of in the UIC wells. If the production wells were not operating, the groundwater otherwise not removed would flow naturally to the ocean. Either way, the sum total volume of groundwater moving through the aquifer system is not altered because of the County's operation of the UIC wells.

As noted and documented in ER 2014, Section 3.3(b): the existence of submarine springs at Lahaina has been known for a very long time and they will persist as long as rain continues to fall on the island. As noted elsewhere in this document, there is very strong evidence that the Kahekili springs are in fact geothermally driven. See Section 4.4.

In her report, Dr. Paytan claims that the LWRF effluent in the seeps has a substantial effect on the receiving ocean water salinity. However, the data in the *Interim Report* (Table 6-6) and the HDOH sampling data show that the receiving water salinity immediately above the seeps and in the surrounding nearshore ocean waters has salinity in excess of 34 ppt, which is the ambient ocean salinity. Dr. Paytan's claim of a substantial effect of the seeps on the receiving ocean waters has no basis in fact.

For the same reason, Dr. Smith's claim regarding salinity in the nearshore waters has no basis in fact.

4.3 DO

Dr. Smith provides an analysis of the HDOH sampling data for DO from within and above a few groundwater seeps at Kahekili. Given that there are 289 documented seeps (see ER 2014, pgs 11 and

12), and that the seeps at which DO was measured occupy less than one third of a square meter (m^2) compared to the identified seep area of 2300 m^2, it is difficult to accept on a statistical basis that the samples are truly representative of all the groundwater discharge.

As previously noted in my Declaration of 12/19/14, it is a natural phenomenon that as groundwaters travel through the subsurface, bacteria consume the oxygen and DO content decreases. As the HDOH data show, the difference in DO content between LWRF effluent (6.9 $\pm$ 0.3 mg/l) and minimum spring seep water DO concentration (*ca*. 4.5 mg/l) is not significant. The minimum DO content of the seeps is far from anoxic, which is defined by the United States Geological Survey (USGS) as a DO concentration less than 0.5 mg/l. In any case, the DO in the waters immediately above the springs is statistically indistinguishable from other coastal waters at control locations.

The HDOH standards for DO are that the level should not drop below 75% of saturation (HAR 11-54-6 pg. 54-48) based on ambient temperature and salinity. Since the ambient water temperature and salinity vary seasonally, the determination of the degree of saturation must be related to the ambient temperature and salinity at the time of sampling.

The problems associated with this measurement are illustrated by the data in Table 5 of ER 2014, which are a sample of the data available from HDOH sampling. Data Sample RA02241405 and RA02241406 are samples taken within seeps in the NSG. They show DO concentrations of 4.53 and 4.56 respectively. However, the degree of DO saturation given is 57.3% for the former and 80.6% for the latter. Since both seeps are discharging to the same ambient water it is difficult to reconcile these two saturation numbers with the actual DO concentrations.

The relationship between temperature and salinity and DO saturation levels is given in a recent USGS publication (USGS Office of Water Quality Technical Memorandum 2011.03, dated July 13, 2011). **Exhibit 4** reproduces Figure 6 of that document.

This exhibit shows that the solubility of oxygen for seawater with a salinity of about 34-35 ppt and temperature 23-27 °C is in the range 6.5-7.0 mg/l, so that a 75% saturation level is in the range 4.9-5.3 mg/l. The average concentration of DO <u>within</u> (emphasis added) the seeps according to Dr. Smith is 4.9 mg/l, or at the low end of the 75% saturation range. It has to be noted that these data are recorded in a few seeps as they enter the ocean and they may not be representative of the entire seepage area.

As is well known in the hydrodynamics literature, buoyant plumes and jets undergo an almost immediate dilution of at least two (2) (see Fischer *et al*, Chapter 9) A dilution of two of a discharge with a DO concentration of 4.9 by ambient water with a DO of 6.5 would give a DO concentration of 6.0. In other words, the DO concentration of a seep would almost immediately be raised well above the 75% saturation limit. Dr. Smith's claim that the reef would be exposed to water with extremely low DO content has no basis in fact.

Dr. Paytan claims that the LWRF effluent in the seeps has a substantial effect on the receiving ocean water DO concentration. The HDOH sampling data show that the average DO concentration in the water column immediately above the seeps is 6.39 (see Table 6, ER 2014) and that the control station DO concentrations are 6.87 and 6.09. There is no basis for the claim that the effluent in the seeps has a substantial effect on the receiving water DO concentration.

4.4 Water temperature

Perhaps the most egregious claim in the Paytan and Smith Expert Reports concerns the issue of water temperature.

Dr. Paytan, p. 1:
"In my opinion, the large influx of LWRF effluent mixed with natural groundwater discharging from the submarine seeps has a substantial effect on the receiving ocean water, substantially altering both its physical character (temperature) and its chemistry (nutrient concentration, pH, dissolved oxygen and salinity)."

Dr. Paytan, p. 3:
"Accordingly, where significant quantities of groundwater discharge into the ocean, the groundwater can have a substantial effect on the chemistry and temperature of the receiving waters, as is the case with the LWRF effluent and the nearshore waters at Kahekili.

Dr Paytan, p. 4:
"This thermal anomaly spans a vast 167 acres, and the LWRF water detected by the fluorescein dye, as documented by the survey discussed above, is within this area. This demonstrates the magnitude of the area affected by the warm seep discharge in the coastal zone."

Dr. Smith, p. 14:
"Both the Tracer Study and the DOH monitoring have generated substantial data showing that the groundwater mixed with LWRF effluent that is coming out of the seeps at Kahekili is highly elevated in temperature in comparison to surrounding seawater of the control sites. According to the DOH's data, over a two-year period, temperatures at the Kahekili seeps have averaged about four (4) degrees Celsius higher than temperatures at the control sites."

Dr. Paytan therefore ascribes, by implication, the thermal anomaly at Kahekili to the LWRF effluent. However, Dr. Smith in discussing the impact of warm water emerging from the seeps is more circumspect and does not explicitly mention the LWRF effluent.

The fact is that there are very strong reasons to believe that higher water temperature of the seeps and the resultant thermal anomaly have nothing to do with the LWRF effluent, but are the result of natural geothermal activity. As discussed in Section 3.3(d) of ER 2014, there is overwhelming evidence that the springs are likely geothermally driven.

Plaintiffs' experts did not address or reference this discussion of geothermal activity, nor did they rebut facts put forward to support the opinion that geothermal activity is present. However, Dr. Paytan in her Declaration of December 22, 2014, in an oblique reference to part of the geothermal argument, asserted that I did not understand the scientific concepts behind the existence of radioactive elements in groundwater. To the contrary, it is known that the concentration of short-lived isotopes that occur in groundwater as it moves through the aquifer is determined by the ratio of the rate of supply from the aquifer (fixed by the concentration of the mother isotope in the aquifer and its rate of decay) and the rate of decay of the isotope borne by the groundwater, and is pretty much independent of the flow velocity. If the concentration of an isotope in the groundwater suddenly rises, as it does near Kahekili, then the rate of supply has to increase, which is indicative of a local source of that isotope. There are clearly significant local sources of radon and radium near Kahekili, since upstream groundwaters have much lower concentrations of these isotopes: *Interim Report*, p. 124: "In general, submarine springs had higher radium concentrations than the groundwater wells (Table 5-6)".

To briefly reiterate the facts and discussion in ER 2014 Section 3.3(d), it is clear that (a) the LWRF cannot be responsible for the short term frequency with which seep water temperatures change (*i.e*., large temperature changes (5°C, [9°F]) in a matter of hours), (b) the maximum water temperatures measured in the seeps (35.9°C [96.6°F]) are much higher than any recorded effluent temperature (max. 30.9°C [87.6°F]), (c) there is insufficient potential biochemical energy in the effluent to effect anything but an insignificant temperature change in the groundwater, (d) the seeps contain much higher levels of radium and radon than exist in either natural upland groundwaters or effluent, (e) high levels of radon and radium are frequently documented in geothermal springs, (f) the chlorine/magnesium ratio in the springs is typical of geothermal flows, (g) geothermal springs often contain bubbles of nitrogen and argon as observed at Kahekili, (h) the nitrogen in the springs does not have any elevated fraction of the isotope ^{15}N, or gaseous nitrous oxide, as it would if it resulted from denitrification (Smith *et al*, 2004), (i) the Honokowai rift zone area is recognized by geothermal experts as a potential geothermal activity area (Thomas, 1985; Kitamura, 1980), and (j) geothermal springs in basaltic lavas are usually low in pH, *i.e*., pH less than 5 (Kroopnick *et al*, 1978) and high in phosphate concentration (Pringle, 1991).

In summary, the overwhelming preponderance of the evidence is that the thermal anomaly, and likely even the spring seeps, are driven naturally by a local geothermal source and have nothing to do with the effluent in the groundwater. In fact, there is no known evidence contradicting the hypothesis that there is significant geothermal activity at Kahekili.

4.5 Inorganic nutrients

The Paytan and Smith Expert Reports claim that the LWRF effluent substantially increases the flow of nutrients that change the chemical makeup of the nearshore waters at Kahekili. Dr. Smith goes so far as to say that the nutrient concentrations emerging from the seeps are exceptionally high.

Dr. Smith, p. 12 (emphasis added):
"Based upon the extensive data set that DOH collected over the last three years, which I have analyzed and compiled into graphs attached to this report as Exhibits 13 and 14, in my opinion, the nutrient concentrations in the water emerging from the seeps are <u>exceptionally</u> high, and detrimental to the reef, as the reef benthos/matrix on which all of the reef building organisms are growing is directly exposed to these high nutrient concentrations."

Dr. Paytan, p. 5-6:
"In summary, because the injected effluent from the LWRF substantially increases the flux of low-pH, low-salinity, low-dissolved oxygen, nutrient-rich and warm waters into the ocean, discharges from the LWRF injection wells are exacerbating the change to the physical and chemical make-up of the nearshore waters at Kahekili as compared to the effect of the groundwater flow without the addition of LWRF effluent."

Neither expert offers any evidence to substantiate the claims of exceptionalism, nor do they offer any other data to describe groundwater quality and flux of nutrients in the absence of the LWRF effluent. To address this point, data from five coastal investigations on Maui and the Island of Hawaii are presented in **Exhibits 5 through 9** (Marine Research Consultants 2006-2014). Each of these exhibits presents data obtained in water sampling surveys on the islands of Hawaii and Maui carried out on transects perpendicular to shore and starting in the shallowest water, where usually the effect of groundwater seepage is most evident. The exhibits make it very clear that there is a rapid decrease in nutrient and silicon concentration with distance from the shoreline, indicative of rapid dilution of the groundwater by convective motions induced by groundwater buoyancy, and mixing by wind, waves and currents. Groundwater in West Maui is naturally high in silicon concentration at 1700-2500 µg/L (*Report*, Table 6-8).

The shoreline data from the five exhibits have been summarized in **Table 6**, which gives the shoreline concentrations of nitrate and orthophosphate, ammonium ion and silicon together with data from Kahekili and upland wells. (Concentration units are in microMolar).

Table 6 - Nutrient concentration data from coastal surveys and *Interim Report.*

Location	Nitrate+Nitrite-N	Ortho-Phosphate	Ammonium-N	Silicon
Makena (Maui)	150	1.5	0.75	270
Pulelehua (Maui)(2007)	65	0.9	1.4	140
Pulelehua (Maui)(2004)	88	1.3	0.4	175
Keauhou (Hawaii)	70	0.6	2.7	280
S. Kohala (Hawaii)	100	2.5	7.5	1100
Kiholo (Hawaii)[@]	10-25	0.25-0.48	NA	NA
Kahekili (survey)	11	1.1	0.44	68
Kahekili (seeps)[#]	7.5-28	9-13.4	0.5	426-753
Upland wells[*]	37-226	5.1-8.2	0.4-1.7	785-902

[@] Johnson and Wiegner (2014); # Tables 6-7 and 6-9 Interim Report; * Kaanapali 1-2 and Hahakea 2

A review of the data in **Table 6** indicates that the claim of exceptional high levels of nutrients affecting the water quality at Kahekili has no basis in fact. Nitrate+nitrite concentrations in the Kahekili seeps are much lower than very nearshore coastal waters at any of the other five coastal surveys and much lower than in the groundwater in upland wells, water which must ultimately find its way to the ocean. To be sure, the concentration of orthophosphate in the seeps sampled is relatively high, but so is the concentration in the natural groundwaters in the upland wells. Furthermore, as discussed in ER 2014 (p. 23) basaltic lavas in other places in the world where there is no effluent injection have elevated phosphate concentrations. In addition, the geothermally-driven springs may be the source of the high phosphate concentrations in the seeps. Studies in Costa Rica (Pringle, 1991) have shown that geothermal springs in basaltic lavas can have very high concentrations of phosphate and the low pH of geothermal waters in Hawaii (Kroopnick *et al*, 1978) will generate higher phosphate concentrations in the geothermal springs.

However, it is still possible that denitrification of the nitrate in the groundwater is responsible for the release of some the phosphate from the basaltic lava as the nitrate concentrations in the seeps are significantly lower than in the upland well water or effluent. Although the orthophosphate concentration within the five seeps measured is relatively high, as compared to oceanic water, the coastal survey sampling at Kahekili indicates that this concentration is very rapidly lowered by the immediate dilution that occurs when the seep water enters the ocean.

To counter this argument, Dr. Smith (p. 2) claims that the impact to the environment occurs right at the point of seep discharge. However, according to the *Interim Report* (p. iv):

"The Seep 4 piezometer was relocated in the North Seep Group (NSG) on April 24, 2012 to replace piezometers in that area that were covered by migrating sand. The NSG is located approximately 3 to 5 m offshore with three initial monitoring points (Seep 1, 2, and 6). This location has proven extremely problematic to maintain throughout the duration of the project. The NSG's close proximity to the shoreline subjects these piezometers to the persistent littoral migration of sand from the beach onto the seep group as a result of large north swells. As each piezometer was buried, however, it was replaced with a new one. All replacement piezometers were and are currently located within 2 m of the original deployments."

And in the *Report*, p. ES-11:

"Using Seep 4 measurements to upscale to seep fluxes within SSG and NSG resulted in 21-86 m^3/d (0.0056-0.023 mgd) and 83-336 m^3/d (0.022-0.089 mgd) for SSG and SSG+NSG, respectively. When compared to total SGD determined in June and September 2011, the seep discharge as measured by the HR Aquadopp Profiler only represented <8% of total SGD determined by Rn methodologies at these two seep clusters, indicating that >90% of the discharge within the two seep groups is technically occurring as diffuse flow. Based on these findings we can conclude that the two seep groups consist of porous geology that allows groundwater to be discharged through discrete vents and other openings that may or may not be covered by sand or rock. We called the latter "diffuse seepage" because vents could not be identified. We also note, however, that the vents themselves are transient in nature and may disappear and reappear due to sand migration. The major discharge areas are confined to two clusters of only several meters width with very little discharge in between and around them."

When (a) the volume of seep discharge relative to diffusive discharge is so small and (b) the location of the seeps appears to be so transient because of sand migration, it is difficult to reconcile this statement from the *Report* with that by Dr. Smith (p. 14):

"Wastewater and associated groundwater emerges through cracks and fissures in the reef itself. As a result, before this water has a chance to undergo mixing, it first percolates through the reef matrix, directly exposing everything that is living on the reef floor (and within the reef matrix), including corals, to the chemical characteristics and physical properties (*i.e.*, temperature) of the groundwater discharged from the seeps. The corals and reef-building organisms living on the bottom of the ocean are literally enveloped by the groundwater, and cannot escape it."

Finally, the claim that the seeps form a significant fraction of the nutrient flux to the ocean is simply not borne out by the data in the Glenn study. From the *Report* p. ES-11:

"We found that groundwater discharge is responsible for significant nutrient fluxes to the coastal ocean. Fluxes of dissolved inorganic and organic nitrogen (DIN and DON) are the largest at Hanakao'o Beach (DIN: 2.9 kmol/d or 41,440 g/d of N and DON: 1.7 kmol/d or 23,700 g/d of N. Second largest DIN flux along this coastline is from Honokowai (1.9 kmol/d or 27,500 g/d of N) and DON flux at SSG (up to 650 mol/d or 9,500 g/d of N). At Hanakao'o and Honokowai groundwater discharges along 1,200 m and 300 m length, while at the seep clusters the discharge locations are only 50-100 m long. "

As stated in ER 2014, to put the issue of nitrogen nutrient sources into perspective **Table 7** has been excerpted from Table 3-6d of the *Interim Report* and it provides the estimated fluxes of DIN nutrients to the coastline. Note that the Black Rock Lagoon estimate is based on an estimated groundwater flow and does not include the tidal pumping flux of water and nutrients from the Lagoon. It is therefore likely that the flux of nutrients from the Lagoon in **Table 7** is grossly underestimated, as it is based on the estimated freshwater flow from the lagoon and not the tidal flushing (see Fischer *et al*., 1979, p. 266, for a discussion of tidal flushing).

Table 7 -Estimated flux of dissolved inorganic nitrogen (DIN) to the ocean

Site	**Est. GW Discharge (mgd)**	**DIN Flux (g/d N)**
Black Rock	0.59	7381
SSG	1.66	1,126-2,524
NSG	0.66	282-528
S. Honokowai	1.88	13,070
N. Honokowai	2.09	14,543
Hanakao'o Beach	7.40	41,437
SSG+NSG %	16.00	1.8-3.8

In summary, according to the Glenn *Reports* the NSG and SSG provide a very minor fraction of the DIN to the West Maui coastal ocean.

4.6 Dr. Paytan's Opinion That the Tracer Dye Study Was "Robust"

Dr. Paytan in her Expert Report of 1/23/15, p. 3 and referring to the Glenn *Report* states:

"Ultimately, based on these diverse complementary methods, the researchers concluded that about 64% of wastewater injected into Wells 3 and 4 is discharged at the submarine seeps, and that effluent from Wells 3 and 4 accounts for approximately 68% of the total submarine groundwater discharging at the submarine seeps and surrounding areas. I am familiar with the methods used and I find these percentages consistent with the data.

In my professional opinion, based on my experience conducting numerous studies examining the effects of submarine groundwater on marine chemistry, and in Hawaiian waters in particular, the tracer dye study was a well-designed, robust study, and its resulting data and conclusions are reliable."

I do not contest the quality of the Tracer Study data, but as discussed in my Expert Report of 10/30/14 and my Declaration of 12/19/14 there are enough issues associated with the assumptions made and used to interpret the data that the conclusions drawn from the data analysis are put into serious doubt. Dr. Paytan has neither addressed nor rebutted these arguments put forward in my Report and Declaration and simply states on faith that she finds the "percentages (of effluent in the submarine seeps) consistent with the data" and that the "conclusions are reliable".

As noted by Dr. Paytan in her report the fraction of LWRF effluent in the total submarine groundwater discharge (SGD) within the NSG and SSG areas was estimated in the *Report* using two methods: a tracer dye break through curve (BTC) analysis (64% of injected effluent discharges as springs and diffuse flow and 68% of total groundwater discharged in SGD is treated effluent) and a geochemical/stable isotope analysis (62% effluent in SGD).

The fact of the matter is that there are significant uncertainties in both analyses, and many assumptions used in the two methods of analysis are either flawed or difficult to justify. The authors of the *Report*, admit that there are significant uncertainties:

> "The estimated percent of dye mass recovered can also be used to make estimates of the fraction of treated wastewater in the submarine spring discharge, although it must be stressed that there are significant uncertainties associated with these calculations" (*Report*, p. 4-20).
>
> "There is significant uncertainty associated with the effluent percentage estimated by this method due to the assumption of a uniform FLT concentration over the entire area that the radon SGD estimates were based upon, the variability of SGD flux with time, and variability of the fraction of FLT plume water over the area used in these computations" (*Report*, p. 4-21).

The issues I identified in ER 2014 are briefly reiterated below.

1. The FLT (fluorescein) dye concentration was measured at a very limited number of springs, which covered less than 1% of the area of the NSG and SSG. It is likely that the measured dye concentrations cannot represent dye concentrations of all springs, especially springs in the NSG where dye concentrations measured during a survey were distributed over a relatively large range.

2. The FLT dye concentration of the diffuse discharge was significantly lower (<15%) than that of the spring discharges. Thus, the BTCs derived from spring discharge dye concentration data should not be applied to the diffuse discharge.

3. The dye recovery rate calculations in the *Report* used the spring discharge BTCs and the total SGD (*i.e*., spring discharge and diffuse discharge combined). Thus, the calculations very likely overestimated the dye recovery rate and the derived LWRF effluent fraction in the SGD is not meaningful.

4. Constant (*i.e.*, average) fresh groundwater discharge rates were used in the *Report* to calculate dye recovery rate. However, data clearly show large (>70%) temporal variations in fresh groundwater discharge rates. The product of the averages (discharge rate and concentration) is not the same as the average of the products – an assumption known statistically as the "Fallacy of the Averages".

5. Inconsistent salinity values were used for the FLT fraction in Equations 4-1 and 4-3, which are the bases for the evaluation of the FLT in the springs and SGD in the *Report*.

6. The significant uncertainties in the dye recovery rate calculations warrant further analyses to quantify the uncertainty, which the *Report* failed to provide.

7. Results from calculations with significant uncertainties are usually provided as a range of values rather than a single number. To serve as an example, alternative but plausible assumptions were used and it was found the calculated dye recovery rate was 11%, and the LWRF contributed 12% of the total SGD at the NSG and SSG areas.

8. In the geochemical/stable isotope mixing analysis, half of the calculated data sets failed to provide any meaningful results, demonstrating that the geochemical/stable isotope analysis method is not reliable. In addition, only six samples were collected from four submarine springs, a data set that is far too sparse to cover the spatial and temporal variations of the total SGD.

In summary, although the data collected by the analysis used to derive the 64% and 68% numbers may be "robust" that analysis itself and the conclusions drawn from the analysis are seriously wanting.

Similarly, the modeling of the movement of the injected tracers attempted in the *Report* is equally deficient. The measured breakthrough curve shows that the arrival times of the injected dye particles at the seeps are log-normally distributed and are therefore not a solution of the advective-diffusion equation, which is what the Tracer Study used to try and model the injected tracer. In the technical jargon, dispersion in porous media is represented by non-Fickian diffusion (see Berkowitz *et al*, 2006). It is therefore not surprising that all modeling attempts to reproduce the tracer breakthrough curve were unsuccessful.

4.7 Venu Expert Report

The Expert Report by Lauren Roth Venu presents a proposal for treating the effluent to reduce the concentration of nutrients carried by it before it is returned to the ground via an infiltration process. She estimates 5 MGD going into a lined wetland basin, and then the wastewater would flow into infiltration basins, and then to soil and to groundwater. As is true for all water that infiltrates the soil on an island, if is not pumped out and evaporated, it must ultimately end up in the ocean. Since the nitrate concentrations in the spring seeps are already much lower than the natural groundwater (see **Table 6** above) it is not clear to what purpose the treatment process will serve in reducing nitrate levels. As noted in **Table 6** the orthophosphate concentrations within the measured seeps are elevated to approximately twice the natural groundwater concentrations, but are immediately diluted by at least 20:1 and more like 40:1 in the water column above the seeps. Since the source of the orthophosphate appears to be the basaltic lava (see ER 2014 pg. 19) and probably the geothermal flow into the springs, and there already high concentrations of orthophosphate in the natural groundwater (see Table 6 above), it is not clear that removing phosphate from the effluent before returning it to the groundwater will necessarily accomplish anything useful. In other words, the net result of effluent treatment at significant cost will be no different from the effluent being injected at the UIC wells.

3.5 References

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5. Exhibits used to support the opinions expressed.

(Note that the following will be used as exhibits, as will excerpts from the documents referenced in this report, data relied on in this report, and data and documents relied on by Dr. Smith and Dr. Paytan and Ms. Venu)

EXHIBIT 1 DRAFT PERMIT

AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Clean Water Act, as amended, (33 U.S.C. §1251 et seq.; the "Act"); Hawaii Revised Statutes (HRS), Chapter 342D; and Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55, Department of Health (DOH), State of Hawaii,

COUNTY OF MAUI – WASTEWATER RECLAMATION DIVISION

(hereinafter PERMITTEE),

is authorized to discharge indirectly via groundwater injection tertiary treated domestic wastewater effluent to the receiving waters named the Pacific Ocean through groundwater outflow at the shoreline between coordinates:

Shoreline Point	Latitude	Longitude
Honokowai Point, Lahaina, Hawaii	20°56'53.00"N	156°41'31.22"W
Black Rock, Lahaina, Hawaii	20°55'56.80"N	156°41'35.06"W

from its Lahaina Wastewater Reclamation Facility located at 3300 Honoapiilani Highway Lahaina, Hawaii, in accordance with the effluent limitations, monitoring requirements and other conditions set forth herein, and in the DOH "Standard NPDES Permit Conditions,"that is available on the DOH, Clean Water Branch (CWB) website at http://health.hawaii.gov/cwb/site-map/home/standard-npdes-permit-conditions/.

Permittee's on-site injection wells are located approximately 1,900 feet from the shoreline between Black Rock and Honokowai Point, Lahaina, Hawaii as follows:

Injection Well No.	Latitude	Longitude
1	20° 56'46.1"N	156° 41'12.2"W
2	20° 56'45.0"N	156° 41'12.5"W
3	20° 56'42.3"N	156° 41'15.0"W
4	20° 56'41.6"N	156° 41'15.6"W

All references to Title 40 of the Code of Federal Regulations (CFR) are to regulations that are in effect on _______________, except as otherwise specified. Unless otherwise specified herein, all terms are defined as provided in the applicable regulations in Title 40 of the CFR.

This permit, including the Zone of Mixing (ZOM), will become effective on __________________.

FINAL PERMIT
(DATE TO BE DETERMINED)

This permit, including the ZOM, and the authorization to discharge will expire at midnight, (5 years after effective date).

Signed this ___ day of _______________, 2015.

____
(For) Director of Health

TABLE OF CONTENTS

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning with the effective date of this permit and lasting through (5 years from effective date), the Permittee is authorized to discharge indirectly from the shoreline between Black Rock and Honokowai Point, Lahaina, Hawaii, via injection to groundwater wells as specified below. The Permittee's on-site injection wells are located approximately 1,900 feet from the shoreline between Black Rock and Honokowai Point, Lahaina, Hawaii, at the coordinates described above.

Effluent monitoring shall be conducted as specified in Parts A.1 through A.4, and Part B of this Permit, at the monitoring locations specified in Table 1.

Table 1 – Effluent monitoring locations

Monitoring Location	Coordinates	Description
INT-001	20°56'46.101"N, 156°41'10.618"W	A location that provides a representative sample of treated domestic wastewater, after UV treatment and prior to groundwater injection.
INT-002	20°56'46.236"N, 156°41'10.878"W	A location that provides a representative sample of treated domestic wastewater, after UV treatment and prior to groundwater injection.

1. Effluent Limitations and Monitoring Requirements for INT-001 and INT-002

   The Permittee is authorized to discharge tertiary treated domestic wastewater effluent via groundwater discharge at the shoreline between Black Rock and Honokowai Point.

   a. Tertiary treated domestic wastewater shall be limited and monitored as specified in Table 2. These effluent limitations are based on a monthly average wastewater effluent discharge rate of 9 mgd. Compliance with effluent limitations in Table 2 shall be determined by monitoring the effluent wastewater after treatment and prior to groundwater injection, at Monitoring Locations INT-001 and INT-002.

Table 2 – Effluent limitations and monitoring requirements for INT-001 and INT-002

Effluent Characteristics	Discharge Limitations			Minimum Monitoring Requirements	
	Monthly Average	Weekly Average	Units	Measurement Frequency	Sample Type
Flow	[3]	[3]	mgd	Continuous/	N/A

				Recorder	
pH	Not less than 6.0 std. units nor greater than 9.0 std. units		Std. pH units	1/Day	Grab
Biochemical Oxygen Demand (5-day @ 20°C) (BOD_5)	30	45	mg/L	1/Week	Composite[2]
	2,252	3,378	lbs/day[1]		
Total Suspended Solids (TSS)	30	45	mg/L	1/Week	Composite[2]
	2,252	3,378	lbs/day[1]		
BOD5 and TSS removal (concentration)	Not less than 85%	--			
Total Organic Carbon (TOC)	[3]	[3]	mg/L	1/Month	Composite[2]
Temperature	[3]	[3]	°F	1/Day	Grab
Oil and Grease	[3]	[3]	mg/L	1/Week	Grab
Ammonia Nitrogen	[3]	[3]	µg/L	1/Month	Composite[2]
Total Nitrogen	10	[3]	mg/L	1/Month	Composite[2]
Nitrate + Nitrite	[3]	[3]	µg/L	1/Month	Composite[2]
Total Phosphorus	[3]	[3]	µg/L	1/Month	Composite[2]
Turbidity	[3]	[3]	NTU	1/Month	Composite[2]
Chlorine	[3]	[3]	µg/L	1/Month	Composite[2]
Whole-Effluent Toxicity	Pass[4]			2/Year	Composite[2]

[1] Compliance with mass-based effluent limitations shall be determined using the following formula:

lbs/day = 8.34*concentration (mg/L) * flow (MGD).

[2] To allow the Permittee sufficient time to install the internal monitoring location, the Permittee may use grab samples instead of composite samples for up to 120 days from the effective date of this permit, but no longer than necessary to establish the internal monitoring station.

[3] The Permittee shall monitor and report the parameter analytical test results.

[4] As described in Part B of this permit.

b. Monitoring Methods

The Permittee shall conduct monitoring in accordance with test procedures approved under 40 CFR Part 136, or unless otherwise specified, with detection limits low enough to measure compliance with the discharge limitations specified in Part A.1.a. For cases where the discharge limitation is below the lowest detection limit of the appropriate test procedure, the Permittee shall use the test method with the lowest detection limit.

B. WHOLE-EFFLUENT TOXICITY REQUIREMENTS

1. Monitoring Frequency

   The Permittee shall conduct semi-annual chronic toxicity tests on flow weighted 24-hour composite effluent samples at INT-001 and INT-002, in accordance with the procedures outlined below. Monitoring events shall be conducted at least five (5) months apart, unless otherwise specified by the Director.

   Upon exceedance of the applicable toxicity effluent limitation at INT-001 and INT-002, the Permittee shall conduct accelerated monitoring as specified in Part B.6 of this Permit.

   For whole effluent toxicity tests using *Tripneustes gratilla*, if the Permittee experiences difficulty in obtaining gametes or has unacceptable control performance while conducting the sea urchin sperm/fertilization bioassay during a monitoring period, the Permittee shall document its efforts, communicate all attempts to the Director, and report all attempts on the DMR for that monitoring period.

   It shall not be considered a non-compliance of the whole effluent toxicity requirements if it can be proven to the Director's satisfaction that the inability in obtaining gametes for testing was due to circumstances beyond the Permittee's control.

2. Test Species and Methods

   a. For INT-001 and INT-002

      The Permittee shall conduct chronic toxicity testing on *T. gratilla* using Hawaiian Collector Urchin, *Tripneustes gratilla* (Hawa'e) Fertilization Test Method (Adapted by Amy Wagner, EPA Region 9 Laboratory, Richmond, CA from a method developed by George Morrison, EPA, ORD Narragansett, RI and Diane Nacci, Science Applications International Corporation, ORD Narragansett, RI) (EPA/600/R-12/022) and follow Quality Assurance procedures as described in the test methods manual *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms* (EPA/600/R-95/136, 1995).

   Upon written request by the Permittee and written approval by the Director, or upon request by the Director, the Permittee shall use updated versions of the methods referenced in the section above as they become available from the EPA.

3. Chronic WET Permit Limit

All state waters shall be free from chronic toxicity as measured using the toxicity tests listed in HAR, Section 11-54-10, or other methods specified by the Director. For this discharge, the determination of "Pass" or "Fail" from a single-effluent concentration chronic toxicity test at the applicable instream waste concentration (IWC) shall be made using the Test of Significant Toxicity (TST) approach described in *National Pollutant Discharge Elimination System Test of Significant Toxicity Implementation Document* (EPA 833-R-10-003, 2010). For any one (1) chronic toxicity test, the chronic WET permit limit that must be met is rejection of the null hypothesis (Ho):

IWC (% effluent) mean response = 0.75 × Control mean response.

a. For INT-001 and INT-002, an IWC of 2.5% shall be used.

A test result that rejects this null hypothesis is reported as "Pass" on the DMR form. A test result that does not reject this null hypothesis is reported as "Fail" on the DMR form. To calculate either "Pass" or "Fail", the Permittee shall follow the instructions in *National Pollutant Discharge Elimination System Test of Significant Toxicity Implementation Document*, Appendix A. If a test result is reported as "Fail", then the Permittee shall follow Part B.6 (Accelerated Toxicity Testing and TRE/TIE Process) of this permit.

4. Quality Assurance

a. Quality assurance measures, instructions, and other recommendations and requirements are found in the chronic test methods manual previously referenced. Additional requirements are specified below.

b. This discharge is subject to a determination of "Pass" or "Fail" from a single-effluent concentration chronic toxicity test at the IWC (for statistical flowchart and procedures, see *National Pollutant Discharge Elimination System Test of Significant Toxicity Implementation Document*, Appendix A, Figure A-1). During Step 6 of Appendix A, the Permittee shall use an alpha value of 0.05 for *T. gratilla*. The chronic IWC for INT-001 and INT-002 is 2.5 percent effluent.

c. Effluent dilution water and control water shall be lab water, as described in the test methods manual *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms* (EPA/600/R-95/136, 1995). If the dilution water is different from test organism culture water, then a second control using culture water shall also be used. To maintain acceptable salinity when conducting effluent tests with *T. gratilla*, effluent dilutions shall be adjusted by adding hypersaline brine/GP2 salts and a third control using brine shall also be tested.

d. If organisms are not cultured in-house, then concurrent testing with a reference toxicant shall be conducted. If organisms are cultured in-house, then semi-annual reference toxicant testing is sufficient. Reference toxicant tests and effluent toxicity tests shall be conducted using the same test conditions (e.g., same test duration, etc.).

e. All multi-concentration reference toxicant test results must be reviewed and reported according to EPA guidance on the evaluation of concentration-response relationships found in *Method Guidance and Recommendations for Whole Effluent Toxicity (WET) Testing* (40 CFR 136) (EPA/821/B-00/004, 2000).

f. If either the reference toxicant or effluent toxicity tests do not meet all test acceptability criteria in the test methods manual, then the Permittee shall re-sample and re-test within 14 calendar days.

g. If the discharged effluent is chlorinated, then chlorine shall not be removed from the effluent sample prior to toxicity testing without written approval by the Director.

h. pH drift during a toxicity test may contribute to artifactual toxicity when pH-dependent toxicants (e.g., ammonia nitrogen, metals) are present in the effluent. To determine whether or not pH drift is contributing to artifactual toxicity, the Permittee shall conduct three (3) sets of side-by-side toxicity tests in which the pH of one (1) treatment is controlled at the pH of the effluent while the pH of the other treatment is not controlled, as described in Section 11.3.6.1 of *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms* (EPA/821/R-02/013, 2002). Toxicity is confirmed to be artifactual and due to pH drift when no toxicity above the chronic WET permit limit is observed in the treatments controlled at the pH of the effluent. Upon this confirmation and following written approval by the Director, the Permittee may use the procedures outlined in Section 11.3.6.2 of the chronic freshwater test methods manual to control effluent sample pH during the toxicity test.

5. Initial Investigation TRE Work Plan

   Within 60 calendar days of the permit effective date, the Permittee shall prepare and submit to the Director a copy of its Initial Investigation Toxicity Reduction Evaluation (TRE) Work Plan (1-2 pages) for review. This plan shall include steps the Permittee intends to follow if toxicity is measured above the chronic WET permit limit and shall include the following, at minimum:

   a. A description of the investigation and evaluation techniques that would be used to identify potential causes and sources of toxicity, effluent variability, and treatment system efficiency.

   b. A description of methods for maximizing in-house treatment system efficiency, good housekeeping practices, and a list of all chemicals used in operations at the facility.

   c. An indication of who would conduct the Toxicity Identification Evaluation (TIE) if one is necessary (i.e., an in-house expert or outside contractor).

   d. A flow chart of the workplan steps.

6. Accelerated Toxicity Testing and TRE/TIE Process

   a. If the chronic WET permit limitation is exceeded and the source of toxicity is known (e.g., a temporary plant upset), then the Permittee shall conduct one (1) additional toxicity test using the same species and test method. This toxicity test shall begin within 14 calendar days from the receipt of the test result exceeding the chronic WET permit limit. If the additional toxicity test does not exceed the chronic WET permit limitation, then the Permittee may return to the regular testing frequency.

   b. If the chronic WET permit limit is exceeded and the source of toxicity is not known, then the Permittee shall conduct six (6) additional toxicity tests within 14 calendar days from the date the results were received. The Permittee shall use the same species and test method, approximately every two (2) weeks, over a 12 week period. If none of the additional toxicity tests exceed the chronic WET permit limit, then the Permittee may return to the regular testing frequency.

   c. If one (1) of the additional toxicity tests (in paragraphs Part B.6.a or B.6.b) exceeds the chronic WET permit limitation, then, within 14 calendar days of receipt of this test result, the Permittee shall initiate a TRE using EPA manual *Toxicity Reduction Evaluation Guidance for Municipal Wastewater Treatment Plants* (EPA/833/B-

99/002, 1999). In conjunction, the Permittee shall develop and implement a Detailed TRE Work Plan which shall include the following: further actions undertaken by the Permittee to investigate, identify, and correct the causes of toxicity; actions the Permittee will take to mitigate the effects of the discharge and prevent the recurrence of toxicity; and a schedule for these actions.

d. The Permittee may initiate a TIE as part of a TRE to identify the causes of toxicity using the same species and test method and, as guidance, EPA manuals: *Methods for Aquatic Toxicity Identification Evaluations: Phase I Toxicity Characterization Procedures* (EPA/600/6-91/003, 1991); *Methods for Aquatic Toxicity Identification Evaluations, Phase II Toxicity Identification Procedures for Samples Exhibiting Acute and Chronic Toxicity* (EPA/600/R-92/080, 1993); *Methods for Aquatic Toxicity Identification Evaluations, Phase III Toxicity Confirmation Procedures for Samples Exhibiting Acute and Chronic Toxicity* (EPA/600/R-92/081, 1993); and *Marine Toxicity Identification Evaluation (TIE): Phase I Guidance Document* (EPA/600/R-96-054, 1996). Further, the Permittee may be required by the Director to initiate a TIE as part of a TRE.

e. Prior to conducting a TIE, the Permittee shall submit a TIE plan to the Director. The TIE plan, at a minimum shall:

(1) Discuss previous TIE efforts and other available data useful in developing TIE procedures.

(2) Evaluate available operations and effluent data.

(3) Identify and discuss site-specific considerations for the TIE effort.

(4) Include a comprehensive quality control program.

(5) Establish a monitoring program.

(6) Identify test methods and statistical methods to be used for the TIE effort.

(7) Identify the TIE procedures for the baseline toxicity tests and TIE manipulations.

(8) Discuss additional potential analysis that might be helpful in evaluating the causative toxicant(s) or appropriate treatability, such as pollutant scans for toxic effluent.

(9) Discuss the personnel and their qualifications for the team conducting the TIE results interpretation.

(10) Include follow-up procedures for use if the TIE is inconclusive.

The Permittee shall incorporate all comments received from the Director within 14 calendar days of the TIE plan submittal. Within 14 calendar days of the TIE plan submittal, the Permittee shall commence with the TIE.

7. Reporting of Chronic Toxicity Monitoring Results

a. The Permittee shall report on the DMR for the month in which the toxicity test was conducted: “Pass”or “Fail”(based on the Welch’s t-test result), the calculated “percent mean response at IWC”, where:

percent mean response at IWC = ((Control mean response – IWC mean response) ÷ Control mean response)) × 100,

and to assist in evaluation of the test result, the standard deviations for the IWC mean response and the Control mean response.

b. The Permittee shall submit a full laboratory report for all toxicity testing as an attachment to the DMR for the month in which the toxicity test was conducted. The laboratory report shall contain: the toxicity test results; the dates of sample collection and initiation of each toxicity test; all results for effluent parameters monitored concurrently with the toxicity test(s); and progress reports on TRE/TIE investigations.

c. The Permittee shall notify the Director in writing within five (5) calendar days of exceedance of the chronic WET permit limitation. This notification shall describe actions the Permittee has taken or will take to investigate, identify, and correct the causes of toxicity; the status of actions required by this permit; and schedule for actions not yet completed; or reason(s) that no action has been taken.

8. Permit Reopener for Chronic Toxicity

In accordance with 40 CFR Parts 122 and 124, this permit may be modified to include new effluent limitations or permit conditions to address chronic toxicity in the effluent or receiving waterbody, as a result of the discharge; or to implement new, revised, or newly interpreted water quality standards applicable to chronic toxicity.

C. ZONE OF MIXING (ZM-###)

The establishment of this ZOM (ZM-###) is subject to the following conditions:

1. The ZOM granted will be a water area of the Pacific Ocean, with the coordinates of the four corners of the ZOM given in Table 3. The ZOM is bounded on the east by the shoreline between P1 and P2, on the west by the line connecting P3 and P4, on the north by the line connecting P1 and P4, and on the south by the line connecting P2 and P3. The ZOM is approximately 1,900 ft along the shoreline and 200 ft wide in the offshore direction. A map of the ZOM is provided in Figure 2.

Table 3 – Coordinates of northeast and southeast corners of ZOM

ZOM Corners	Latitude	Longitude
P1, Northeast corner (at shoreline)	20°56'31.16"N	156°41'33.17"W
P2, Southeast corner (at shoreline)	20°56'12.55"N	156°41'34.87"W
P3, Southwest corner (200 ft offshore)	20°56'12.65"N	156°41'36.98"W
P4, Northwest corner (200 ft offshore)	20°56'31.35"N	156°41'35.27"W

2. The ZOM granted is for the assimilation of tertiary treated domestic wastewater.

3. The discharge at the shoreline between Black Rock and Honokowai Point shall not cause any water quality standards set forth in HAR, Chapter 11-54, to be exceeded, including basic water quality criteria, except that the specific water quality criteria set forth in Table 4 may be exceeded within the ZOM. Compliance with receiving water quality standards shall be determined based on a calendar year at the individual receiving water monitoring locations at the edge of the ZOM.

Table 4 – Water Quality Criteria for "Class A Wet Open Coastal Waters"

Parameter	Units	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/L as N	150	250	350
Ammonia nitrogen	µg/L as N	3.5	8.5	15
Nitrate + nitrite nitrogen	µg/L as N	5	14	25
Total phosphorus	µg/L as P	20	40	60
Light extinction coefficient	K units	0.2	0.5	0.85
Chlorophyll a	µg/L	0.3	0.9	1.75
Turbidity	NTU	0.5	1.25	2
pH	Std. units	Must be between 7.0 and 8.6		
Dissolved oxygen	mg/L	Not less than 75% saturation at ambient temperature and		

		salinity
Temperature	^oC	Within 1^oC relative to ambient
Salinity	ppm	Within 90% and 110% of natural ambient

4. Receiving Water Monitoring Requirements

   a. Receiving Water Monitoring Locations

   The Permittee shall monitor at a total of eight (8) receiving water stations, distributed at four (4) transects with two (2) stations along every transect. The Permittee shall monitor at two (2) receiving water control stations. Locations of the monitoring stations are described in Table 5 and shown in Figure 2. An acceptable method to locate the positions of the monitoring stations shall be utilized.

Table 5 – Receiving Water Monitoring Stations

Transect	Station Name	Station Location[1]	Station Coordinates	
			Latitude	Longitude
1	R-1	Mid-ZOM North Boundary	20°56' 31.26"N	156°41' 34.22"W
	R-2	Edge ZOM North Boundary	20°56' 31.35"N	156°41' 35.27"W
2	R-3	Mid-ZOM North Center	20°56' 24.74"N	156°41' 34.86"W
	R-4	Edge ZOM North Center	20°56' 24.82"N	156°41' 35.87"W
3	R-5	Mid-ZOM South Center	20°56' 19.55"N	156°41' 35.47"W
	R-6	Edge ZOM South Center	20°56' 19.60"N	156°41' 36.35"W
4	R-7	Mid-ZOM South Boundary	20°56' 12.60"N	156°41' 35.93"W
	R-8	Edge ZOM South Boundary	20°56' 12.65"N	156°41' 36.98"W
Control	C-1	North Control	20°56' 38.31"N	156°41' 35.04"W
Control	C-2	South Control	20°56' 6.28"N	156°41' 36.93"W

[1] At monitoring stations with water depths greater than 10 meters, top and middle samples shall be taken. At monitoring stations equal to or less than 10 meters, only top and bottom samples shall be taken. Top is one (1) meter below the ocean surface, middle is mid-depth, and bottom is one (1) meter above the ocean bottom.

   b. Receiving Water Monitoring Program

   The receiving water shall be monitored, at a minimum, as specified in Table 6 at all receiving water and control stations:

Table 6 – Receiving Water Monitoring Stations

Parameter	Units	Monitoring Frequency	Type of Sample
Total nitrogen	µg/L as N	1/Quarter	Grab
Ammonia nitrogen	µg/L as N	1/Quarter	Grab
Nitrate + nitrite nitrogen	µg/L as N	1/Quarter	Grab
Total phosphorus	µg/L as P	1/Quarter	Grab
Light extinction coefficient	K units	1/Quarter	In-situ
Chlorophyll a	µg/L	1/Quarter	Grab
Turbidity	NTU	1/Quarter	Grab
pH	Std. units	1/Quarter	Grab
Dissolved oxygen	mg/L	1/Quarter	Grab
Temperature	^{o}C	1/Quarter	In-situ
Salinity	ppm	1/Quarter	Grab

It shall be a violation of this permit if the monitoring results exceed the specific criteria for Class A Wet Open Coastal Waters in Part C.3 at the boundary of the ZOM during a calendar year.

c. The DOH shall be notified immediately of any change that may have any adverse effects on the receiving waters from the normal conditions for which this ZOM is granted.

d. Biological Communities Monitoring

Beginning on the effective date of this permit, the receiving water bottom biological communities shall be monitored at least once per year. The monitoring performed shall include the diversity and distribution of the bottom biological communities. On January 28th of each year, a report summarizing the bottom biological communities monitoring performed during the past 12 months shall be submitted to the DOH. For the first calendar year of permit issuance, the associated report shall summarize the biological communities monitoring performed during the remaining months in the year, upon obtaining program approval. A program of research to develop reasonable alternatives to the methods of treatment or control in use may be required if research is deemed prudent by the Director. This monitoring requirement may be waived upon demonstrating to the Director that the discharge does not impact the existing bottom biological communities; or, no bottom biological communities exist in the receiving water.

5. In accordance with 40 CFR Parts 122 and 124, this permit may be modified to include new effluent limitations or permit conditions based on monitoring results; or to

implement new, revised, or newly interpreted water quality standards applicable to HAR Chapter 11-54-6 water quality standards.

D. REPORTING REQUIREMENTS

1. Transmittal and Monitoring Results Reporting Requirements

   a. Certification of Transmittals

      Submit all information in accordance with HAR, Section 11-55-07(b), with the following certification statement by an appropriate signatory:

      "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine or imprisonment for knowing violations."

   b. Include "NPDES Permit No. HI 0000___"on each transmittal.

      Failure to provide the assigned permit number for this facility on future correspondence or transmittals may be a basis for delay of the processing of the document(s).

   c. Reporting of Discharge and Monitoring Results

      (1) Monitoring and all other reports required by this permit, except those described in Part D.1.e of this permit, shall be submitted through the CWB Compliance Submittal Form for Individual NPDES Permits and NGPCs. This form is accessible through the e-Permitting Portal website at: https://eha-cloud.doh.hawaii.gov/epermit/View/home.aspx.

      You will be asked to do a one-time registration to obtain your login and password. After you register, click on the Application Finder tool to locate the form. Follow the instruction to complete and submit this form. All submissions shall include a CD or DVD containing the downloaded e-Permitting submission and a completed Transmittal Requirements and Certification Statement for e-Permitting NPDES/NGPC Compliance Submissions Form, with original signature and date.

(2) Monitoring reports shall be submitted no later than the 28th day of the month following the completed reporting period, or as otherwise allowed under Part D.1.e of this permit.

(3) Should there be no discharges during the monitoring period, the DMR form shall so state.

d. Additional Monitoring by the Permittee

If the Permittee monitors any pollutant at location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified in 40 CFR Part 136, the results of such monitoring shall be included in the calculation and reporting of the values required in the DMR form. The increased frequency shall also be indicated.

e. Submittal of Monitoring Results Using NetDMR

The Permittee shall submit DMRs required under this permit electronically using NetDMR. NetDMR is accessed from: http://www.epa.gov/netdmr.

DMRs shall be submitted electronically no later than the 28th day of the month following the completed reporting period. Once the Permittee begins submitting DMRs using NetDMR, the submission of hard copies of DMRs to the Director will no longer be required, unless otherwise requested by the Director.

2. Reporting of Noncompliance, Unanticipated Bypass, or Upset

In case of conflict between the conditions stated here and those in the **"Standard NPDES Permit Conditions"** the more stringent conditions shall apply.

a. Immediate Reporting

(1) The Permittee or its duly authorized representative (40 CFR 122.22) shall immediately report orally the following:

(a) Any noncompliance or discharge which may endanger health or the environment;

(b) Any discharge at a location not authorized in the permit;

(c) Any discharge of any wastewater not identified in the application filed for the NPDES permit;

(d) Any unanticipated bypass.

(e) Any upset; and

(f) Violation of any discharge limitation specified in Part A of this permit.

(2) Oral Reporting

The Permittee or its duly authorized representative shall provide oral reports by telephone to the Clean Water Branch at (808) 586-4309 during regular office hours (7:45 a.m. to 4:30 p.m). Outside of regular office hours, the Permittee or its duly authorized representative shall report orally to the Hawaii State Hospital Operator at (808) 247-2191.

(3) Written Reporting

A written submission shall also be provided within five (5) days of the time the Permittee becomes aware of the circumstances. The written submission shall contain:

(a) A description of the noncompliance and its cause;

(b) The period of noncompliance, including exact dates and times;

(c) If the noncompliance has not been corrected, the anticipated period over which it is expected to continue; and

(d) Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

The Director may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

b. 24-Hour Reporting

The Permittee or its duly authorized representative shall orally report any other noncompliance as described in Part D.2.a.(2) within 24-hours of the time the

Permittee or its duly authorized representative becomes aware of the circumstances. Written submission shall be described as above in Part D.2.a.(3). The Director may waive the written report on a case-by-case basis.

3. Planned Changes

   Any planned physical alterations or additions to the permitted facility, not covered by Standard Condition 16.a.(1), (2) or (3) shall be reported to the Director on a quarterly basis.

4. Types of Sample

   a. "Grab sample" means an individual sample collected at a randomly-selected time over a period not exceeding 15 minutes.

   b. "Composite sample" means a combination of at least eight (8) sample aliquots, collected at periodic intervals during the operating hours of the facility over a 24-hour period. The composite must be flow proportional; either the time interval between each aliquot or the volume of each aliquot must be proportional to either the stream flow at the time of sampling or the total stream flow since the collection of the previous aliquot. Aliquots may be collected manually or automatically.

E. OTHER REQUIREMENTS

1. Schedule of Submission

   a. Effluent and Receiving Water Monitoring Programs

      (1) Effluent Monitoring Program

      Within 30 calendar days after the effective date of this permit, the Permittee shall submit an Effluent Monitoring Program which complies with Part A of this permit to the Director for approval.

      (2) Receiving Water Monitoring Program

      Within 60 calendar days after the effective date of this permit, the Permittee shall submit a Receiving Water Monitoring Program which complies with Part C.5 of this permit to the Director for approval.

      (3) The Programs(s) shall include at a minimum, but not be limited to the following:

         (a) Sampling location map;
         (b) Sample holding time;
         (c) Preservation techniques;
         (d) Test method and method detection level; and
         (e) Quality control measures.

      The DOH reserves the right to require the Permittee to revise the approved program, as appropriate, pursuant toward compliance with the terms and conditions of this permit.

      Monitoring shall be conducted according to test procedures approved under 40 CFR 136 with detection limits low enough to measure the compliance with Parts A and C of this permit. For cases where the discharge limitation is below the lowest detection limit of the appropriate test procedure, the compliance shall be based upon the lowest detection limit of the method.

      If a test method has not been promulgated for a particular constituent, the Permittee may use any suitable method for measuring the level of the constituent in the discharge provided the Permittee submit a description of the method or a reference to a published method.

b. By January 31st of each year, the Permittee shall submit to the Director a report of the previous year's monthly average discharge of tertiary treated effluent in million gallons/day (mgd).

c. Within 60 calendar days after the effective date of the permit, the Permittee shall submit a receiving water bottom biological communities monitoring program detailing the requirements in accordance with Part C.5.d to the Director for approval.

d. Within 60 calendar days after the effective date of the permit, the Permittee shall submit an initial investigation TRE workplan in accordance with Part B.5 to the Director.

2. Schedule of Maintenance

   The Permittee shall submit a schedule for approval by the Director at least fourteen (14) days prior to any maintenance of facilities, which might result in exceedance of effluent limitations. The schedule shall contain a description of the maintenance and its reason; the period of maintenance, including exact dates and times; and steps taken or planned to reduce, eliminate, and prevent occurrence of noncompliance.

3. Onshore or Offshore Construction

   This permit does not authorize or approve the construction of any onshore or offshore physical structures or facilities or the undertaking of any work in any waters of the United States.

4. Remedy or Penalty

   Nothing in this permit waives any remedy or penalty applicable under Hawaii Revised Statutes, Chapter 342D.

F. LOCATION AND ZOM (ZM-XXX) MAPS

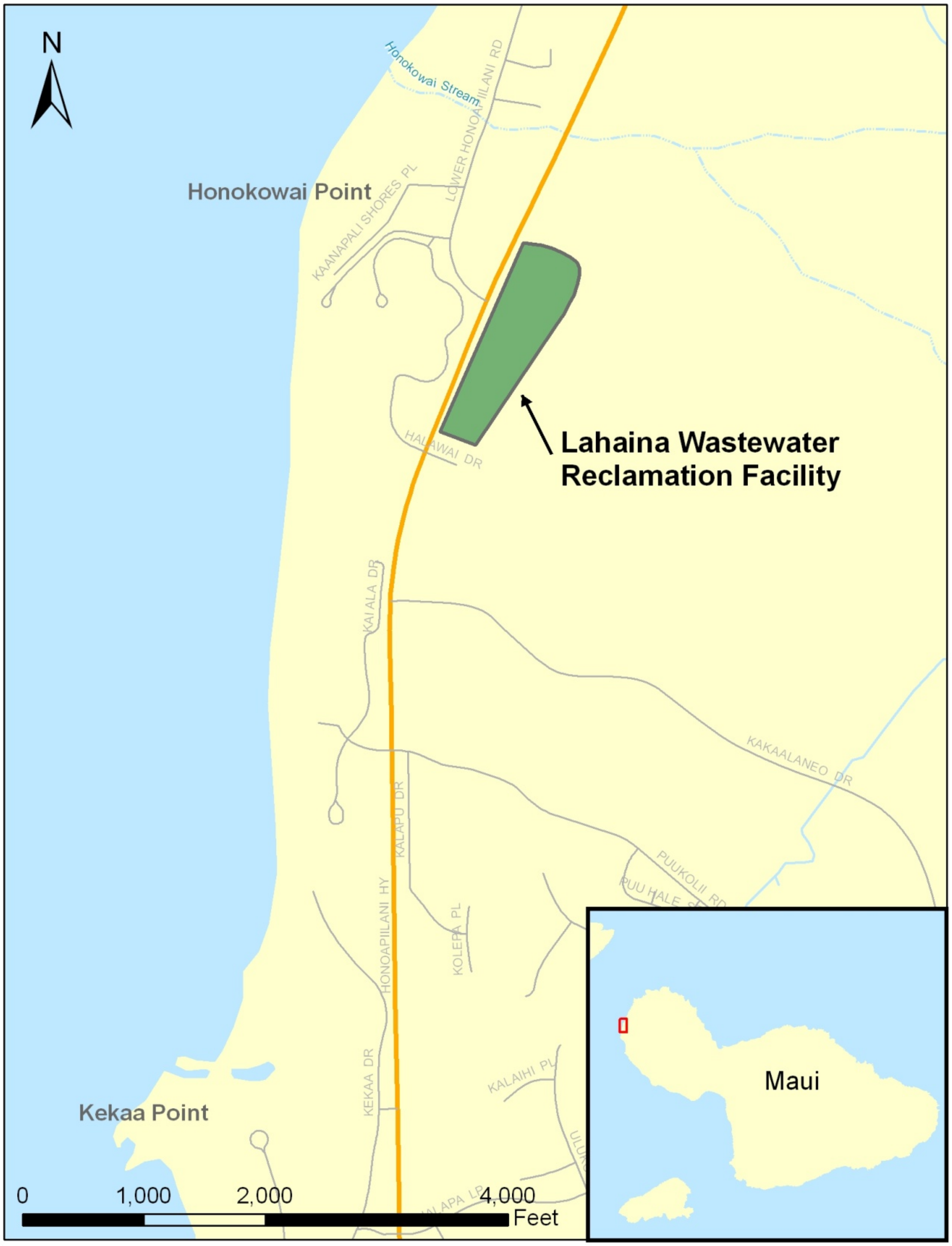


Figure 1 – Location Map

Figure 2 – Zone of Mixing (ZM-XXX)

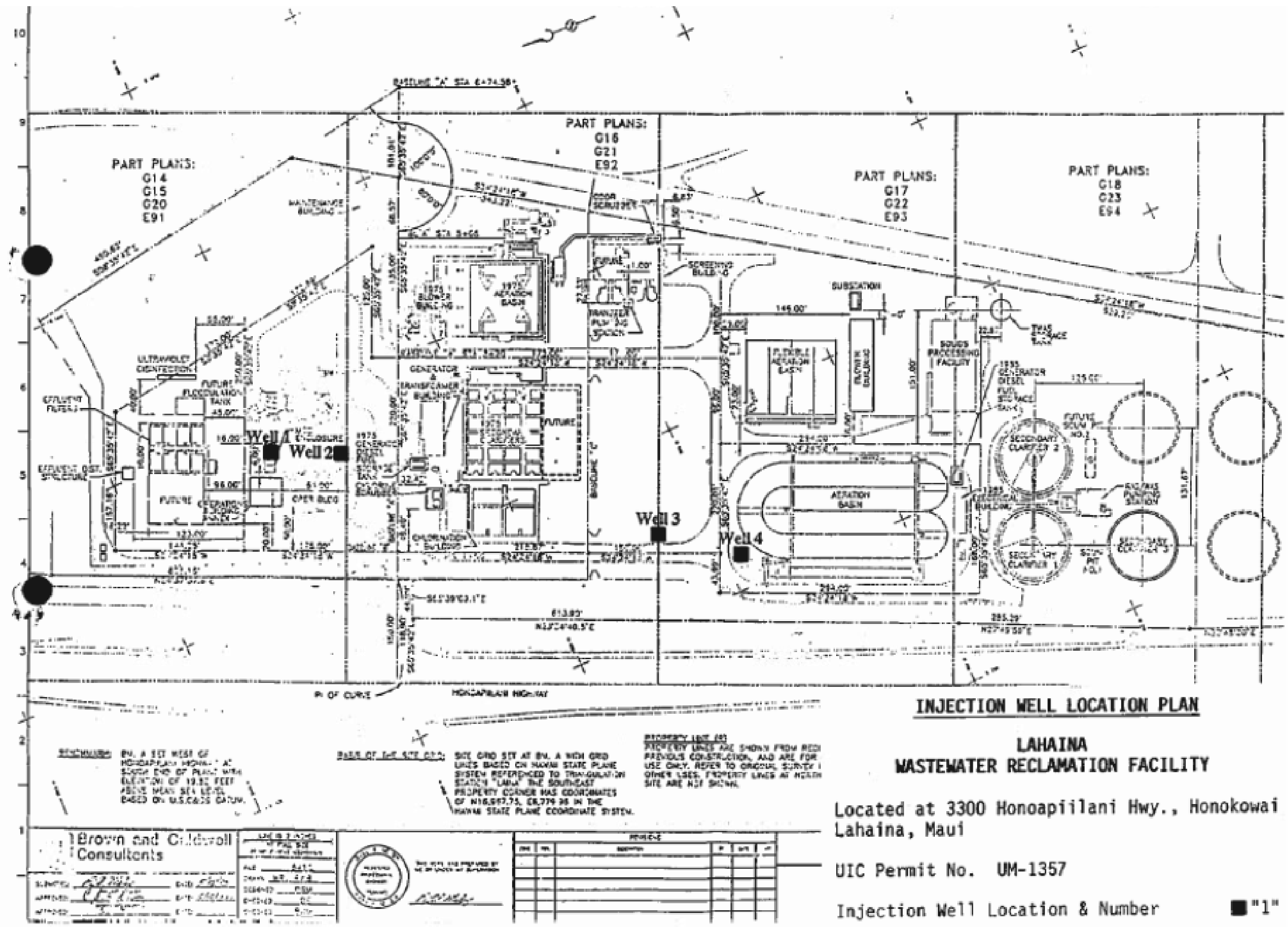

INJECTION WELL LOCATION PLAN
LAHAINA
WASTEWATER RECLAMATION FACILITY
Located at 3300 Honoapiilani Hwy., Honokowai
Lahaina, Maui
UIC Permit No. UM-1357
Injection Well Location & Number "1"
Well 1
Well 2
Well 3
Well 4
PART PLANS: G14 G15 G20 E91
PART PLANS: G16 G21 E92
PART PLANS: G17 G22 E93
PART PLANS: G18 G23 E94
AERATION BASIN
SECONDARY CLARIFIER 2
SECONDARY CLARIFIER 1
SOLIDS PROCESSING FACILITY
HONOAPIILANI HIGHWAY
Brown and Caldwell Consultants

Figure 3 – Facility Site Drawing

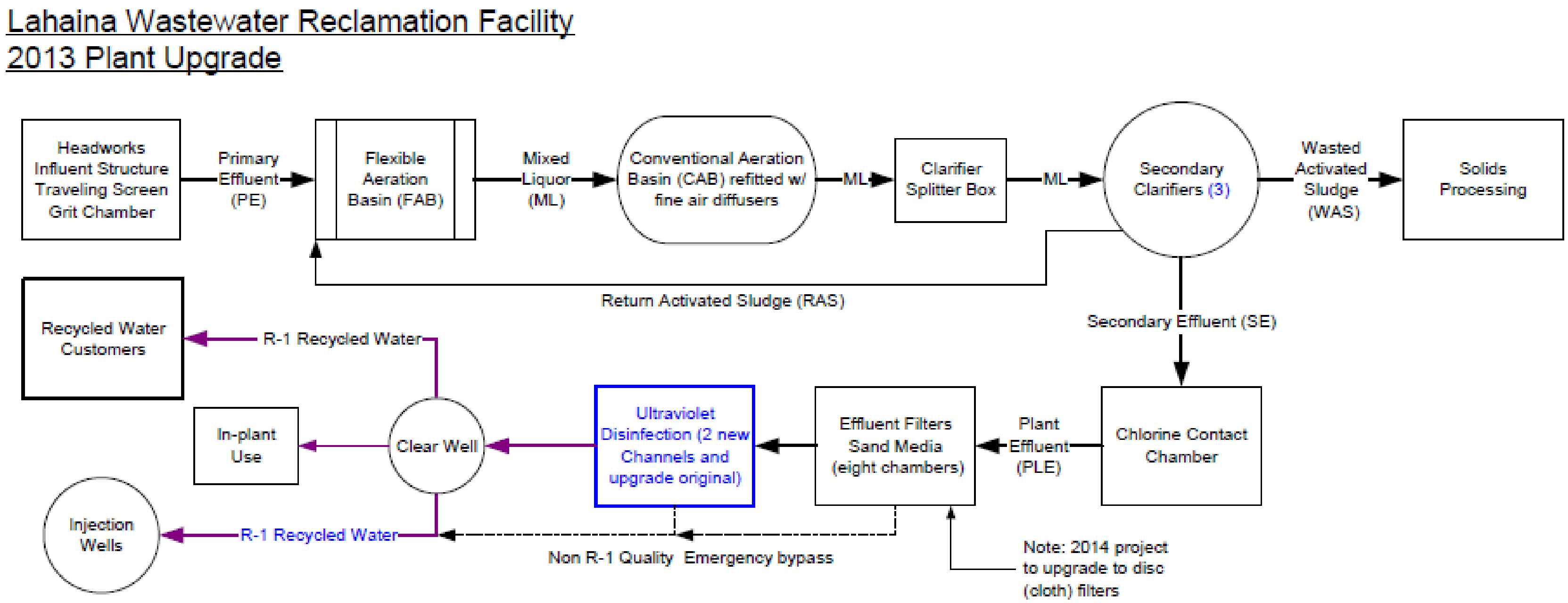


Figure 4 – Facility Process Flow Diagram

Figure 5 – Facility Water Flow Schematic

[TO BE ADDED]

EXHIBIT 2

FACT SHEET

APPLICATION FOR NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT AND ZONE OF MIXING (ZOM) TO DISCHARGE TO THE PACIFIC OCEAN WATERS OF THE UNITED STATES

Table of Contents

This Fact Sheet includes the legal requirements and technical rationale that serve as the basis for the requirements of the draft permit.

A. Permit Information

The following table summarizes administrative information related to the Lahaina Wastewater Reclamation Facility (LWRF) operated by the County of Maui.

Table 1 – Facility information

Permittee	County of Maui – Wastewater Reclamation Division
Name of Facility	Lahaina Wastewater Reclamation Facility
Facility Address	3300 Honoapiilani Highway Lahaina, Hawaii 96761-9413
Facility Contact, Title, and Phone	TBD, Plant Supervisor, (808) 661-8460
Authorized Person to Sign and Submit Reports	TBD
Mailing Address	3300 Honoapiilani Highway Lahaina, Hawaii 96761-9413
Billing Address	Same as above
Type of Facility	Publicly owned treatment works (POTW)
Pretreatment Program	NA
Reclamation Requirements	Producer
Facility Permitted Flow	9 mgd Average Dry Weather Flow (ADWF)
Facility Design Flow	9 mgd ADWF
Receiving Waters	Pacific Ocean
Receiving Water Type	Marine
Receiving Water Classification	Class A Wet Open Coastal Waters (HAR, Section 11-54-06(b)(2)(B))

Up until this point, the facility has been operated under underground injection control (UIC) permit No. 1357, issued by the State of Hawaii, Department of Health (DOH) and the United States Environmental Protection Agency (EPA), current permit No. HI596001. This draft NPDES permit is prepared for the County of Maui for the Lahaina Wastewater Reclamation Facility (LWRF), and represents the first NPDES permit for the LWRF.

For the purposes of this Fact Sheet, references to the "discharger" or "Permittee" in applicable federal and state laws, regulations, plans, or policy are held to be equivalent to references to the LWRF herein.

B. Facility Setting

B.1 Facility Operation and Location

The LWRF, owned and operated by the County of Maui, is a publicly owned municipal wastewater treatment facility located about three (3) miles north of the town of Lahaina, Hawaii. The LWRF consists of two parallel plants: one plant was constructed in 1975 with an average flow capacity of 3.2 mgd, and the other plant was constructed in 1985 and upgraded in 1995 and 2013 with an average flow capacity of 6.7 mgd. The 1975 plant is currently not in operation. The LWRF currently receives approximately four (4) million gallons per day (mgd) of wastewater from the town of Lahaina and the Napili community.

The LWRF uses primary, secondary, and tertiary effluent treatment methods to remove contaminants contained in the incoming wastewater. The plant consists of headworks with screens and a grit chamber, flexible aeration basins (FAB), conventional aeration basins (CAB), secondary circular clarifiers, chlorination contact chambers, sand filter chambers and Ultraviolet (UV) disinfection channels. Influent enters the 1985 Plant from headworks and mixes with mixed liquor at the FAB and subsequently at the CAB. Effluent from the CAB flows to the circular clarifiers to separate the solids and the clear effluent. The majority of the settled sludge at the clarifiers is returned to the aeration basins. Some of the settled sludge is removed from the process as waste activated sludge (WAS) to maintain an approximate number of microorganisms within the treatment process. The clarifier effluent flows to the chlorination contact chambers for disinfection. The disinfected effluent from the chlorine contact chambers then flows to the sand filters, and subsequently to UV disinfection channels. Part of the effluent from the UV channels is reused as R-1 irrigation water, and the remainder effluent is disposed of through the injection wells.

The LWRF on-site injection wells are located approximately 1,900 feet from the shoreline between Black Rock and Honokowai Point, Lahaina, Hawaii. Locations of the four (4) on-site injection wells are summarized in Table 2 below. Figure 1 of the draft permit provides a map showing the location of the facility.

Table 2 – Injection well locations

Injection Well No.	Effluent Description	Well Latitude	Well Longitude
1	Tertiary treated domestic wastewater effluent from the LWRF	20° 56' 46.1 N	156° 41' 12.2" W
2	Tertiary treated domestic wastewater effluent from the LWRF	20° 56' 45.0" N	156° 41' 12.5" W
3	Tertiary treated domestic wastewater effluent from the LWRF	20° 56' 42.3" N	156° 41' 15.0" W
4	Tertiary treated domestic wastewater effluent from the LWRF	20° 56' 41.6" N	156° 41' 15.6" W

B.2 Receiving Waters

Effluent from the LWRF is discharged to groundwater through four on-site injection wells. All four injection wells are located seaward of the “UIC line”, which is defined in Section 11-23-03 of Hawaii Administrative Rules (HAR) and published in maps by Hawaii DOH. Thus, the groundwater receiving the LWRF effluent is not a source of drinking water and is within an “exempted aquifer” (Section 11-23-03, HAR).

The injected effluent mixes with groundwater and undergoes various physical, chemical and biological processes. Eventually, the diluted LWRF effluent flows into the ocean. A report of a tracer dye study of the LWRF effluent (Glenn et. al., 2013) indicated that diluted LWRF effluent was detected at two submarine seep groups off Kahekili. However, less than 10% of the LWRF effluent was found discharging to the ocean through these two seep groups; more than 90% of the LWRF effluent reached the ocean as diffuse discharges. The dye study data also showed that the diffuse-discharged LWRF effluent was more diluted than the seep-discharged LWRF effluent.

The Pacific Ocean water along the coast near the LWRF is designated as “Class A Wet Open Coastal Waters” under Section 11-54-06(b)(2)(B), HAR. Protected beneficial uses of Class A waters include recreation, aesthetic enjoyment, and the protection and propagation of fish, shellfish, and wildlife.

B.3 Ocean Discharge Criteria

The Director has considered the Ocean Discharge Criteria, established pursuant to Section 403(c) of the Clean Water Act (CWA) for the discharge of pollutants into the territorial sea, the waters of the contiguous zone, or the oceans. The EPA has promulgated regulations for Ocean Discharge Criteria in 40 Code of Federal Regulations (CFR) Part 125, Subpart M. The Director has determined that the discharge will not cause unreasonable degradation of the marine environment. Based on current information, the Director proposes to issue a permit.

B.4 Impaired Water Bodies on CWA 303(d) List

CWA section 303(d) requires states to identify specific water bodies where water quality standards (WQS) are not expected to be met after implementation of technology-based effluent limitations on point sources. The 2014 State of Hawaii Water Quality Monitoring and Assessment Report, which includes the 303(d) List of Impaired Water Bodies in the State of Hawaii, has been approved by EPA on October 22, 2014. In this report (dated September 2, 2014), Kahekili, near the LWRF, is listed as an impaired water body on the 2014 303(d) list because of water turbidity exceeding water quality standards, and given a medium priority level for developing a Total Maximum Daily Load (TMDL) plan. However, no water pollution reduction plans or TMDLs have been established for this water body yet.

B.5 Summary of Existing Requirements and Self-Monitoring Report Data

The LWRF effluent injection is currently regulated by a UIC permit issued by the Hawaii DOH (UIC permit NO. UM-1357) and a UIC permit issued by the EPA (UIC Permit No. HI596001). This permit sets limitations on the injection flow rate and requires four types of effluent samples be collected and analyzed at various sampling frequencies for a large number of parameters. The sampling requirements and effluent monitoring data are summarized in the sections below. In addition to the monitoring data required by the UIC permit, the central lab of the LWRF also conducts routine monitoring of the effluent for a number of most commonly analyzed water quality parameters. These data are also presented below.

B.5.a Effluent Monitoring Required by the UIC Permits

(1) Effluent Flow Rate

Both the DOH and the EPA UIC permits require that the weekly average effluent injection rate shall not exceed 9.0 mgd and the maximum daily effluent injection rate shall not exceed 19.8 mgd. Effluent flow rate data for the period of July 2011 – June 2014 are summarized in Table 3 below.

Table 3 – Effluent flow rate requirements and monitoring data

Parameter	Units	Regulatory Level		Monitoring Data *	
		Weekly Average	Daily Maximum	Highest Weekly Average	Daily Maximum
Effluent Injection Rate	MGD	≤ 9.0	≤ 19.8	4.7	5.784

*Source: LWRF daily injection well flow data, July 2011-June 2014;

(2) Type I Sample

The requirements for Type I Samples are:

1) Type I samples, involving both composite and grab, shall be collected and analyzed at least once every six (6) months.
2) Type I samples shall be analyzed for the test parameters listed in Table 4.
3) Type I grab samples shall be collected within the time period of composite sample collection and between the hours of 9 a.m. and 3 p.m.
4) Type I composite sample procedures shall be established by the Permittee and approved by the Director.
5) The analytical results (Type I) shall be submitted to the Hawaii DOH and a copy shall be kept on file at the facility. Analytical results are due within 60 days from the sampling date. If applicable, for a reporting schedule that indicates a group-of-months submittal of analytical results, the analytical results from the indicated group of months are due within 60 days from the last sampling date of the group.

Requirements and effluent monitoring data for Type I samples are summarized in Table 4.

Table 4 – Test parameters for Type I samples

Parameter	Units	Regulatory Level		Monitoring Data *	
		Monthly Average	Daily Maximum	Highest Monthly Average	Daily Maximum
Biochemical Oxygen Demand (BOD_5)	mg/L	30	60	8.0	18
Field pH	SU			7.0	7.65
Total Suspended Solids	mg/L	30	60	3.8	5
Turbidity	NTU			3.4	5.8

*Source: monitoring data for type I parameters are from LWRF reuse and lab data, July 2011-December 2013.

(3) Type II Sample

The requirements for Type II Samples are:

1) Type II samples, involving both composite and grab, shall be collected and analyzed at least once every six (6) months in conjunction with Type I samples.
2) Type II samples shall be analyzed for the test parameters listed in Table 5.
3) Type II grab samples shall be collected with Type I samples between the hours of 9 a.m. and 3 p.m.
4) Type II composite sample procedures shall be established by the Permittee and approved by the Director.
5) The analytical results (Type II) shall be submitted to the Hawaii DOH and a copy shall be kept on file at the facility. Analytical results are due within 60 days from the sampling date.

Requirements and effluent monitoring data for Type II samples are summarized in Table 5.

Table 5 - Test parameters for Type II samples

Parameter	Units	Action Level (6-month maximum)	Monitoring Data (2011-2012)* (1-month maximum)
Ammonia (as N)	mg/L		3.70
Dissolved Oxygen	mg/L		4.96 (minimum)
Fecal Coliform	MPN/10		4.00
Field Temperature	^{o}C		28.8
Nitrate-Nitrite (as N)	mg/L		5.20

Oil and Grease	mg/L		ND (<5)
Orthophosphate (as P)	mg/L		1.26
Total Dissolved Solids	mg/L		1,200
Total Kjeldahl Nitrogen (as N)	mg/L		7.40
Total Phosphorous	mg/L		1.61
Total Nitrogen (as N)**	mg/L	10	7.98

* Source: Monthly 308 effluent sampling data, July 2011-June 2012.

** Total Nitrogen equals Total Kjeldahl Nitrogen plus Nitrate-Nitrite Nitrogen.

(4) Type III Sample

The requirements for Type III Samples are:

1) Type III samples, grab, shall be collected and analyzed at least once every 12 months in conjunction with Type I and Type II samples.
2) Type III samples shall be analyzed for Ignitability, Corrosivity, Reactivity, and Method 1311: Toxicity Characteristic Leaching Procedure (TCLP) as described in 40 CFR, Part 261, Appendix II. Reference is hereby made to Table 6 which lists the test parameters for which the analysis shall be conducted under Method 1311. Regulatory levels of the chemical parameters are listed for reference.
3) Type III samples shall be collected between the hours of 9 a.m. and 3 p.m.
4) The analytical results (Type III) shall be submitted to the Hawaii DOH and a copy shall be kept on file at the facility. Analytical results are due within 60 days from the sampling date.

Requirements and effluent monitoring data for Type II samples are summarized in Table 6.

Table 6 - Test parameters for Type III samples

Parameter	Units	Regulatory Level (12-month maximum)	Monitoring Data (2011-2012)* (1-month maximum)
Inorganics:			
arsenic	mg/L	5	ND
barium	mg/L	100	0.005
cadmium	mg/L	1	ND
chromium	mg/L	5	ND
lead	mg/L	5	0.018
mercury	mg/L	0.2	ND
selenium·	mg/L	1	0.029

silver	mg/L	5	ND
Organics:			
Benzene	mg/L	0.5	ND
carbon tetrachloride	mg/L	0.5	ND
chlordane	mg/L	0.03	ND
chlorobenzene	mg/L	100	ND
chloroform	mg/L	6	0.0027
o-cresol	mg/L	200	
m-cresol	mg/L	200	
p-cresol	mg/L	200	
1,4-dichlorobenzene	mg/L	7.5	ND
1,2-dichloroethane	mg/L	0.5	ND
1,1-dichloroethylene	mg/L	0.7	ND
2,4-dinitrotoluene	mg/L	0.13	ND
heptachlor	mg/L	0.008	ND
hexachlorobenzene	mg/L	0.13	ND
hexachloro-1,3-butadiene	mg/L	0.5	ND
hexachloroethane	mg/L	3	ND
methyl ethyl ketone	mg/L	200	
nitrobenzene	mg/L	2	ND
pentachlorophenol	mg/L	100	ND
pyridine	mg/L	5	
tetrachloroethylene	mg/L	0.7	ND
trichloroethylene	mg/L	0.5	ND
2,4,5-trichlorophenol	mg/L	400	
2,4,6-trichlorophenol	mg/L	2	ND
vinyl chloride	mg/L	0.2	ND
endrin	mg/L	0.02	ND
lindane	mg/L	0.4	ND
methoxychlor	mg/L	10	ND
toxaphene	mg/L	0.5	ND
2,4-D	mg/L	10	
2,4,S-TP (silvex)	mg/L	1	

* Source: Monthly 308 effluent sampling data, July 2011-June 2012.

(5) Type IV Sample

Requirements for Type IV samples are:

1) Type IV samples, grab, shall be collected and analyzed at least once every 12 months in conjunction with Type I, II and III samples. A monitoring and reporting schedule is attached that outlines the schedule of analyses and reportings.

2) Type IV samples shall be analyzed for volatile organic compounds as described in 40 CFR, Part 136, Appendix A, Method 624. Reference is hereby made to Table 7 which lists the test parameters and the analytical methods.
3) Type IV samples shall be collected between the hours of 9 a.m. and 3 p.m.
4) The analytical results (Type IV) shall be submitted to the Hawaii DOH and a copy shall be kept on file at the facility. Analytical results are due within 60 days from the sampling date.

Requirements and effluent monitoring data for Type II samples are summarized in Table 7.

Table 7 - Test parameters for Type IV samples

Parameter	Units	Action Level (12-month maximum)	Monitoring Data (2011-2012)* (1-month maximum)
Acetone	mg/L		
Benzene	mg/L		ND
Bromodichloromethane	mg/L		0.0106
Bromoform	mg/L		0.0354
Bromomethane	mg/L		ND
Carbon Tetrachloride	mg/L		ND
Chlorobenzene	mg/L		ND
Chloroethane	mg/L		ND
2-Chloroethylvinyl ether	mg/L		ND
Chloroform	mg/L		0.0027
Chloromethane	mg/L		ND
Dibromochloromethane	mg/L		0.0295
1,2-Dichlorobenzene	mg/L		ND
1,3-Dichlorobenzene	mg/L		ND
1,4-Dichlorobenzene	mg/L		ND
1,1-Dichloroethane	mg/L		ND
1,2-Dichloroethane	mg/L		ND
1,1-Dichloroethylene	mg/L		ND
trans-1,2-Dichloroethene	mg/L		ND
1,2-Dichloropropane	mg/L		ND
cis-1,3-Dichloropropene	mg/L		ND
trans-1,3-Dichloropropene	mg/L		ND
Ethyl benzene	mg/L	0.14	ND
Methylene chloride	mg/L	0.0043	ND
1,1,2,2-Tetrachloroethane	mg/L		ND
Tetrachloroethene	mg/L	0.145	ND
Toluene	mg/L	2.1	ND

1,1,1-Trichloroethane	mg/L	6	ND
1,1,2-Trichloroethane	mg/L		ND
Trichloroethene	mg/L	0.7	ND
Trichlorofluoromethane	mg/L		
Vinyl Chloride	mg/L	0.002	ND
Xylene	mg/L	10	

* Source: Monthly 308 effluent sampling data, July 2011-June 2012.

B.5.b LWRF Effluent Monitoring Data

The LWRF effluent is sampled and analyzed regularly for the most commonly monitored water quality parameters by the Central Lab at the facility. These monitoring data are presented in Table 8 below. In addition, monitoring data for effluent flow rate and a few other parameters required by the NPDES permit are compiled from relevant data sources and also summarized in Table 8.

Table 8 – LWRF effluent monitoring data

Parameter	Units	Maximum Daily Value	Average Daily Value	
			Value	NO. of Samples
pH (minimum)[1]	s.u.	5.53	--	--
pH (maximum)[1]	s.u.	7.65	--	--
Flow Rate[2]	mgd	5.784	3.08	1096
Temperature[3] (winter)	°C	28.2	27.8	3
Temperature[3] (summer)	°C	28.6	28.2	3
BOD-5[1]	mg/L	18	3	146
Fecal Coliform[1]	MPN/100ml	>1600	158	336
Total Suspended Solids (TSS)[1]	mg/L	5	1.9	152
Ammonia (As N)[1]	mg/L	12.3	1.6	116
Chlorine (total residual, TRC)[1]	mg/L	43.8	2.2	335
Dissolved Oxygen[3]	mg/L	7.69	6.76	12
Total Kjeldahl Nitrogen (TKN)[1]	mg/L	14.2	2.8	131
Nitrate Plus Nitrite Nitrogen[1]	mg/L	13.5	3.5	125
OIL and GREASE[3]	mg/L	ND (<5)	ND (<5)	8
Phosphorus (Total as PO_4)[1]	mg/L	10.4	2.4	95

Total Dissolved Solids (TDS)[3]	mg/L	1200	1127	12

[1] Data from LWRF reuse and lab data, July 2011-December 2013.
[2] Data from LWRF daily injection well flows, July 2011- June 2014.
[3] Data from monthly 308 effluent sampling data, July 2011-June 2012.

C. Applicable Plans, Policies, and Regulations

C.1 Hawaii Administrative Rules, Chapter 11-54

On November 12, 1982, the Hawaii Administrative Rules, Title 11, Department of Health, Chapter 54 became effective (HAR, Chapter 11-54). HAR, Chapter 11-54 was amended and compiled on October 6, 1984; April 14, 1988; January 18, 1990; October 29, 1992; April 17, 2000; October 2, 2004; June 15, 2009; October 21, 2012; December 6, 2013; and the most recent amendment was on November 15, 2014. HAR, Chapter 11-54 establishes beneficial uses and classifications of state waters, the state anti-degradation policy, zones of mixing standards, and water quality criteria that are applicable to the Pacific Ocean.

On March 18, 2013, the DOH received approval from EPA, in accordance with CWA Section 303(c) and implementing federal regulations at 40 CFR 131, to implement schedules of compliance for State-adopted water quality standards in NPDES permits. The following sections of Chapter 11-55 contains Hawaii's provisions to implement schedules of compliance: 11-55-01, 11-55-08(a)(2)(B), 11-55-15(d), 11-55-19(a)(4)(A), 11-55-21, and 11-55-22. These compliance schedule implementation provisions adopted by the State in Chapter 11-55 on October 21, 2012, were found by EPA to be consistent with the requirements of the CWA and EPA's regulations at 40 CFR 131.5 and 131.6. Accordingly, the DOH is authorized to incorporate schedules of compliance for water quality based effluent limits into NPDES permits.

Requirements of the draft permit implement HAR, Chapter 11-54.

C.2 Hawaii Administrative Rules, Chapter 11-55

On November 27, 1981 HAR, Title 11, Department of Health, Chapter 55 became effective (HAR, Chapter 11-55). HAR Chapter 11-55 was amended and compiled on October 29, 1992; September 22, 1997; January 6, 2001; November 7, 2002; August 1, 2005; October 22, 2007; June 15, 2009; October 21, 2012; December 6, 2013 and November 15, 2014. HAR Chapter 11-55 establishes standard permit conditions and requirements for NPDES permits issued in Hawaii.

Requirements of the draft permit implement HAR, Chapter 11-55.

C.3 Hawaii Administrative Rules, Chapter 11-62

On December 10, 1988 HAR, Title 11, Department of Health, Chapter 62 became effective (HAR, Chapter 11-62). HAR Chapter 11-62 was amended and compiled on December 9, 2004.

HAR Chapter 11-62 establishes requirements for wastewater treatment works, individual wastewater systems, wastewater sludge use and disposal, wastewater management permits and registration, and wastewater and wastewater sludge pumpers and haulers.

Requirements of the draft permit implement HAR, Chapter 11-62.

C.4 State Toxics Control Program

NPDES Regulations in 40 CFR 122.44(d) require permits to include water quality-based effluent limitations (WQBELs) for pollutants, including toxicity, that are or may be discharged at levels that cause, have reasonable potential to cause, or contribute to an exceedance of a WQS. The *State Toxics Control Program: Derivation of Water Quality-Based Discharge Toxicity Limits for Biomonitoring and Specific Pollutants* (STCP) was finalized in April, 1989, and provides guidance for the development of water quality-based toxicity control in NPDES permits by developing the procedures for translating WQS in HAR, Chapter 11-54 into enforceable NPDES permit limits. The STCP identifies procedures for calculating permit limits for specific toxic pollutants for the protection of aquatic life and human health.

Guidance contained in the HAR 11-54 and the STCP was used to determine effluent limitations in the draft permit.

D. Rationale for Effluent Limitations and Discharge Specifications

The Federal CWA mandates the implementation of effluent limitations that are as stringent as necessary to meet water quality standards established pursuant to state or federal law [33 U.S.C., § 1311(b)(1)(C); 40 CFR, § 122.44(d)(1)]. NPDES permits must incorporate discharge limits necessary to ensure that water quality standards are met. This requirement applies to narrative criteria as well as to criteria specifying maximum amounts of particular pollutants. Pursuant to Federal Regulations, 40 CFR Section 122.44(d)(1)(i), NPDES permits must contain limits that control all pollutants that "*are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any state water quality standard, including state narrative criteria for water quality*." Federal Regulations, 40 CFR, §122.44(d)(1)(vi), further provide that "*[w]here a state has not established a water quality criterion for a specific chemical pollutant that is present in an effluent at a concentration that causes, has the reasonable potential to cause, or contributes to an excursion above a narrative criterion within an applicable State water quality standard, the permitting authority must establish effluent limits.*"

The CWA requires point source dischargers to control the amount of conventional, non-conventional, and toxic pollutants that are discharged into the waters of the United States. The control of pollutants discharged is established through effluent limitations and other requirements in NPDES permits. NPDES regulations establish two principal bases for effluent limitations. In 40 CFR 122.44(a), permits are required to include applicable technology-based limitations and standards; and in 40 CFR 122.44(d), permits are required to include WQBELs to attain and maintain applicable numeric and narrative water quality criteria to protect the beneficial uses of the receiving water. When numeric water quality objectives have not been established, but a discharge has the reasonable potential to cause or contribute to an excursion above a narrative criterion, WQBELs may be established using one or more of three methods described in 40 CFR 122.44(d): 1) WQBELs may be established using a calculated water quality criterion derived from a proposed state criterion or an explicit state policy or regulation interpreting its narrative criterion; 2) WQBELs may be established on a case-by-case basis using EPA criteria guidance published under CWA Section 304 (a); or 3) WQBELs may be established using an indicator parameter for the pollutant of concern.

D.1 Technology-Based Effluent Limitations

D.1.a Scope and Authority

The State of Hawaii has been authorized by the EPA to administer the NPDES program in Hawaii. Chapter 11-55 of the HAR documents the regulations of the NPDES program in Hawaii. HAR 11-55-19 (a)(1) requires compliance with effluent limitations under Sections 301 and 302 of the CWA, 33 USC 1311 and 1312. CWA Section 301(b) and 40 CFR 122.44(a) require that NPDES permits include applicable technology-based limitations and standards.

Section 301(b)(1)(B) of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500), 33 U.S.C. 1311(b)(1)(B) and 1314(d)(1) require that publicly owned treatment works must, as a minimum, meet effluent limitations based on secondary treatment as defined by the EPA Administrator. Based on these statutory requirements, EPA developed secondary treatment regulations, which are specified in Part 133 of 40 CFR. These technology-based regulations apply to all municipal wastewater treatment plants and identify the minimum level of effluent quality attainable by secondary treatment in terms of biochemical oxygen demand (BOD_5), total suspended solids (TSS), and pH.

Section 11-62-26 of the HAR requires that the effluent of treatment works meet concentration limitations for BOD_5 and TSS. In addition, HAR 11-62-26 specifies requirements for disinfection, fecal coliform density and turbidity for R-1 and R-2 recycled water.

D.1.b Applicable Technology-Based Effluent Limitations

(1) BOD5 and TSS

Federal Regulations, 40 CFR, Part 133, establish the minimum weekly and monthly average level of effluent quality attainable by secondary treatment for BOD_5 and TSS. HAR 11-62-26 also specifies BOD_5 and TSS levels for monthly composite samples and a single grab sample. BOD_5 is a measure of the amount of oxygen used in the biochemical oxidation of organic matter. The secondary treatment standards for BOD_5 and TSS are indicators of the effectiveness of the treatment processes. The principal design parameter for wastewater treatment plants is the daily BOD_5 and TSS loading rates and the corresponding removal rate of the system. In addition to the average weekly and average monthly effluent limitations, a daily maximum effluent limitation for BOD_5 and TSS is included in the draft permit to ensure that the treatment works are not organically overloaded and operate in accordance with design capabilities. The mass limitations are based on the design flow of 9 mgd. See Table 9 for final technology-based effluent limitations required by this draft permit. In addition, 40 CFR 133.102, in describing the minimum level of effluent quality attainable by secondary treatment, states that the 30-day average percent removal shall not be less than 85 percent. This draft permit contains a limitation requiring an average of 85 percent removal of BOD_5 and TSS over each calendar month.

(2) pH

Federal Regulations, 40 CFR Part 133, also establish technology-based effluent limitations for pH. The secondary treatment standards require the pH of the effluent to be no lower than 6.0 and no greater than 9.0 standard units.

(3) Flow

The total capacity of the LWRF is up to an average dry weather flow of 9 mgd.

(4) Total Nitrogen

The current treatment processes at the LWRF are capable of achieving a monthly average total nitrogen concentration below 10 mg/L in the effluent.

Table 9 – Summary of technology-based limitations for LWRF effluent

Parameter	Units	Effluent Limitations				
		Average Monthly	Average Weekly	Maximum Daily	Instantaneous Minimum	Instantaneous Maximum
Flow	mgd	9				
BOD	mg/L	30	45	60		
	lbs/day	2252	3378	4504		
TSS	mg/L	30	45	60		
	lbs/day	2252	3378	4504		
pH	s.u.				6.0	9.0
Total Nitrogen	mg/L	10				

(5) R-1 Water Disinfection

Ultraviolet disinfection is employed at the LWRF to produce R-1 recycled water. HAR 11-62-26(c)(1)(B) requires that non-chlorine disinfection process shall achieve inactivation and removal of 99.999% of the plaque forming units of F-specific bacteriophage MS2 or polio virus in the wastewater.

(6) R-1 Water Fecal Coliform

HAR 11-62-26 (d)(1) requires that grab samples shall be taken at a point following disinfection to monitor fecal coliform density. Bacteriological results of the last seven (7) days for which analyses have been completed shall show a median density of fecal coliform less than 2.2/100 milliliters; and the density shall not exceed 23/100 milliliters in more than one sample in any thirty (30) day period; and the density in any one sample shall not exceed 200/100 milliliters.

(7) R-1 Water Turbidity

HAR 11-62-26 (e) requires continuous turbidity monitoring and recording prior to the filtration process and at a point after the filters and before application of the disinfectant. Turbidity of the effluent from granular media filters shall not exceed 2.0 nephelometric turbidity units (NTUs).

D.2 Water Quality-Based Effluent Limitations (WQBELs)

D.2.a Scope and Authority

NPDES Regulations at 40 CFR 122.44(d) require permits to include WQBELs for pollutants, including toxicity, that are or may be discharged at levels that cause, have reasonable potential to cause, or contribute to an exceedance of a water quality standard, including numeric and narrative objectives within a standard (reasonable potential). As specified in 40 CFR 122.44(d)(1)(i), permits are required to include WQBELs for all pollutants "*which the Director determines are or may be discharged at a level that will cause, have reasonable potential to cause, or contribute to an excursion above any state water quality standard*". HAR 11-55-19 also requires that effluents have limitations to ensure compliance with water quality standards.

The process for determining reasonable potential and calculating WQBELs, when necessary, is intended to protect the receiving waters as specified in HAR, Chapter 11-54. When WQBELs are necessary to protect the receiving waters, the requirements of HAR, Chapter 11-54, the STCP, and other applicable state and federal guidance policies have been followed to determine WQBELs in the draft permit.

Where reasonable potential has been established for a pollutant, but there is no numeric criterion or objective for the pollutant, WQBELS must be established in accordance with the requirements of 40 CFR 122.44(d)(1)(vi), using (1) EPA criteria guidance under CWA Section 304(a), supplemented where necessary by other relevant information; (2) an indicator parameter for the pollutant of concern; or (3) a calculated numeric water quality criterion, such as a proposed state criterion or policy interpreting the state's narrative criterion, supplemented with other relevant information.

D.2.b Applicable Water Quality Standards

The beneficial uses and WQS that apply to the receiving waters for this discharge are from HAR, Chapter 11-54.

(1) HAR, Chapter 11-54

HAR, Chapter 11-54 specifies numeric aquatic life standards for 72 toxic pollutants and fish consumption standards for 60 toxic pollutants, as well as narrative standards for toxicity. Effluent limitations and provisions in the draft permit are based on available information to implement these standards.

(2) Water Quality Standards

The facility discharges to the Pacific Ocean, which is classified as Class A Wet Open Coastal Waters in HAR, Chapter 11-54. As specified in HAR, Chapter 11-54, saltwater standards apply when the dissolved inorganic ion concentration is above 0.5 parts per thousand. As such, a reasonable potential analysis was conducted using saltwater standards. Additionally, fish consumption WQS were also used in the RPA to protect human health. Where both saltwater standards and fish consumption standards are available for a particular pollutant, the more stringent of the two was used in the RPA.

40 CFR 122.45(c) requires effluent limitations for metals to be expressed as total recoverable metal. Since WQS for metals are expressed in the dissolved form in HAR, Chapter 11-54, factors or translators must be used to convert metal concentrations from dissolved to total recoverable. Default EPA conversion factors were used to convert the applicable dissolved criteria to total recoverable.

(3) Receiving Water Hardness

HAR, Chapter 11-54 contains water quality criteria for six metals that vary as a function of hardness in freshwater. A lower hardness results in a lower freshwater water quality standard. The metals with hardness dependent standards include cadmium, copper, lead, nickel, silver, and zinc. Ambient hardness values are used to calculate freshwater WQS that are hardness dependent. Since saltwater standards are used for the RPA, the receiving water hardness was not taken into consideration when determining reasonable potential.

D.2.c Determining the Need for WQBELs

NPDES regulations at 40 CFR 122.44(d) require effluent limitations to control all pollutants which are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any state water quality standard. Assessing whether a pollutant has reasonable potential is the fundamental step in determining whether or not a WQBEL is required. Using the methods prescribed in EPA's *Technical Support Document for Water Quality-Based Toxics Control* (the TSD, EPA/505/2-90-001, 1991), the effluent data from the LWRF were analyzed to determine if the discharge demonstrates reasonable potential. The Reasonable Potential Analysis (RPA) compared the effluent data with numeric and narrative

WQS in HAR, Chapter 11-54-4. To determine reasonable potential for parameters contained in HAR, Chapter 11-54-6, projected maximum concentrations of these parameters in the receiving water were directly compared to the most stringent WQS.

(1) Reasonable Potential Analysis (RPA)

The RPA for pollutants with WQS specified in HAR, Chapter 11-54-4, based on the TSD, combines knowledge of effluent variability as estimated by a coefficient of variation with the uncertainty due to a limited number of data to project an estimated maximum receiving water concentration as a result of the effluent. The estimated receiving water concentration is calculated as the upper bound of the expected lognormal distribution of effluent concentrations at a high confidence level. The projected maximum receiving water concentration, after consideration of dilution, is then compared to the WQS in HAR, Chapter 11-54-4, to determine if the pollutant has reasonable potential. The projected maximum receiving water concentration has reasonable potential if it cannot be demonstrated with a high confidence level that the upper bound of the lognormal distribution of effluent concentrations is below the receiving water standards.

Because the most stringent WQS for pollutants specified in HAR, Chapter 11-54-6, are provided as geometric means and exceedances of these WQS are less sensitive to effluent variability, the RPA was conducted by doing a direct comparison of the receiving water concentration to the most stringent applicable WQS.

(2) Data

The RPA was based on effluent monitoring data from July 2011 through June 2012 provided by the LWRF and receiving water monitoring data collected by Hawaii DOH from January 2012 through July 2014.

(3) Dilution

The STCP defines dilution as the reduction in the concentration of a pollutant or discharge which results from mixing with the receiving waters, and discusses dilution for submerged and high-rate outfalls. The STCP states that minimum dilution should be used for establishing effluent limitations based on chronic criteria and human health standards for non-carcinogens, and average conditions be used for establishing effluent limits based on human health standards for carcinogens.

Buoyancy of the LWRF effluent produces mixing with receiving seawater as the effluent rises to the sea surface. Based on data from the UH tracer study, the LWRF effluent dilution ratio is in the range of 20-50 as the effluent rises to the sea surface. A minimum effluent dilution ratio of 20:1 (total volume: effluent volume) is used in this RPA analysis. This dilution ratio is applied to the WQS for pollutants listed in HAR 11-54-4(c)(3) to calculate an effluent limitation that can be applied end-of-pipe. Note that this 20:1 minimum dilution ratio only accounts for the mixing of the effluent and coastal water in the immediate vicinity of the discharge locations. Additional mixing and dilution will occur as the diluted effluent spreads out. Therefore, the dilution ratio at the edge of the zone of mixing (ZOM) will be significantly higher. This is confirmed by the results of a recent coastal study at Kahekili by Marine Research Consultants and by the data at the offshore sampling locations (Maui stations) in the *Interim Report*.

For parameters listed in HAR 11-54-6(b)(3), a zone of mixing (ZOM) is allowed for the effluent to meet WQS. Concentrations of these parameters can exceed WQS within the ZOM but should comply with WQS at the edge of the ZOM. However, due to other potential sources of pollutants discharging into the receiving water, such as storm water runoff or unidentified discharges, it is often difficult to determine the cause of WQS exceedances in the receiving water at the edge of a ZOM. It is more practical to determine the available dilution provided in the ZOM and apply that dilution to the WQS to calculate an effluent limitation that can be applied end-of-pipe. Thus, for these parameters, the reasonable potential to contribute to an exceedance of WQS can be alternatively assessed by comparing monitoring data at the edge of the ZOM to the applicable WQS. If the geometric mean of a parameter at the edge of the ZOM exceeds the applicable WQS, the Permittee is determined to have reasonable potential for the pollutant. If an exceedance of WQS is not observed at the water surface, it is assumed that sufficient dilution and assimilative capacity exists to meet WQS.

Where reasonable potential has been determined for HAR, Section 11-54-6(b)(3) pollutants, limitations must be established that are protective of water quality. Because presently the dilution at the edge of the ZOM can only be estimated, where assimilative capacity exists this permit establishes limitations for Section 11-54-6(b)(3) pollutants as performance-based effluent limitations and receiving water limitations and requires the Permittee to conduct a dilution analysis at the edge of the ZOM so that end-of-pipe effluent limitations may be established during future permitting efforts. Where assimilative capacity does not exist, it is not appropriate to grant a ZOM and/or dilution, and an end-of-pipe criteria-based effluent limitation must be established that is protective of the relevant WQS.

(4) Summary of RPA Results

Table 10 below presents the maximum effluent concentrations from effluent monitoring data for July 2011 through June 2012, Hawaii DOH receiving water monitoring data from January 2012 through July 2014, maximum projected receiving water concentrations after dilution calculated using methods from the TSD, the applicable HAR (Section 11-54-4(b)(3) or 11-54-6) water quality standards, and the results of the RPA for pollutants discharged from the LWRF. Only pollutants with sufficient monitoring data for the RPA are presented in Table 10; pollutants with insufficient data for the RPA or those not detected in the effluent are not listed.

Note that data for Total Nitrogen, Ammonia Nitrogen and Chlorophyll in Table 10 are from DOH receiving water monitoring data sampled at the sea surface over the north and south submarine seeps where the LWRF effluent discharges into the ocean. These data are within the ZOM because only one study provides data at the edge of the ZOM (Marine Research Consultants, 2014b). Concentrations of these pollutants at the edge of the ZOM will be lower than the values presented in Table 10, because data at control locations indicate that the receiving water has assimilative capacity for these pollutants. Thus, these pollutants have no reasonable potential to contribute to exceedance of WQS.

Although concentrations of nitrate+nitrite nitrogen and total phosphorus at water surface above the seeps exceeded the WQS, these concentrations are within ZOM and the receiving water has assimilative capacity for these two pollutants. Therefore the Permittee is required to conduct a dilution analysis or to collect concentration data for these two parameters at the edge of the ZOM to determine whether reasonable potential exists for these two parameters.

Measured turbidity at water surface above the submarine seeps exceeded WQS. Although the turbidity data were within the ZOM, turbidity values at control locations were also higher than the WQS. A USGS investigation of the nearshore water at Lahaina (Hunt and Rosa, 2009) found that chlorophyll and turbidity values tended to be highest along the most inshore transect of the surveys. "*This may reflect more phytoplankton inshore taking up groundwater-borne nutrients, or it could be a general artifact of wave-stirred sediment in shallowest waters. Chlorophyll and turbidity were both high in the lagoon at Black Rock and can be linked confidently there to the visible, bright-green phytoplankton bloom that appears to be a persistent feature of that water body (it is visible on several sets of air photos as well as being observed firsthand during our surveys)*" (Hunt and Rosa, 2009). Therefore, the high turbidity in nearshore water is possibly a result of natural processes in the shallow coastal water rather than the discharge of high turbidity water to the ocean. In addition, the aquifer between the injection wells and the shoreline provides an effective clarification of the injected LWRF effluent. Thus the measured turbidity values at the LWRF injection wells are not representative of turbidity of the effluent entering the ocean. To perform an RPA for turbidity, turbidity data for the diluted LWRF effluent discharging near the shoreline (through submarine springs and as diffuse discharge) need to be collected. Indications from data obtained at other groundwater seeps (Johnson and Wiegner, 2014) is that groundwater turbidity is less than 0.5 NTU, which is the Class A Wet turbidity criterion.

Chlorine concentrations of LWRF treated wastewater are measured at a location right before the injection wells. Data showed that these measured chlorine concentrations exceeded WQS. However, the injected LWRF effluent becomes diluted after mixing with groundwater and the assimilative capacity of the aquifer further reduces chlorine concentrations as the diluted LWRF effluent travels through the aquifer. Data of chlorine concentrations at the locations where the diluted LWRF effluent discharges to the ocean is not available. Therefore, an RPA for chlorine cannot be conducted. The plant has switched from the use of chlorine to ultraviolet (UV) disinfection so this is no longer an issue.

Table 10 – Summary of RPA results for LWRF effluent

Parameter	Units	Max. Effluent Conc.	Max. Projected Conc.	Applicable WQS	RPA Results
Aluminum, total recoverable	µg/L	11	1.5	NA	No

Chloroform	µg/L	2.7	0.1	5.1	No
Copper, total recoverable	µg/L	15	1.1	3.5	No
Lead, total recoverable	µg/L	18	2.1	5.9	No
Selenium, total recoverable	µg/L	29	2.9	71	No
Thallium	µg/L	28	2.8	16	No
Zinc, total recoverable	µg/L	34	2.6	91	No
Total nitrogen	µg/L	57[1]	NA	150	No
Ammonia nitrogen	µg/L	3.1[1]	NA	3.5	No
Chlorophyll a	µg/L	0.11[1]	NA	0.3	No
pH	s.u.	8.13 (minimum) [2] 8.37(maximum) [2]	NA	7.0 – 8.6	No
Temperature	°C	23.31 (minimum) [2] 27.56 (maximum) [2]	NA	within 1 °C relative to ambient	No
Salinity	ppt	33.80 (minimum) [2] 35.71 (maximum) [2]	NA	within 90% and 110% of natural ambient	No
Dissolved Oxygen	% saturation	80.3 (minimum) [2]	NA	Not less than 75% saturation	No

[1] Highest geometric mean at receiving water surface over the seeps, calculated from DOH data 1/2012 – 7/2014.
[2] Values were at receiving water surface over the seeps, DOH data 1/2012 – 7/2014.

Reasonable potential cannot be determined for some pollutants because of limited data. The draft permit requires the Permittee to continue to monitor for these constituents in the effluent and at the edge of the ZOM using analytical methods that provide the lowest available detection limits. When additional data become available, further RPAs will be conducted to determine whether to add numeric effluent limitations to this draft permit or to continue monitoring.

Data for the following parameters were either not available or there were insufficient data for RPAs:

i. concentration in the effluent
- chloroethers- methyl(bis)[1]

ii. concentration at the edge of the ZOM
- nitrate + nitrite nitrogen
- total phosphorus
- light extinction coefficient

iii. parameters at near shore discharge locations
- turbidity
- chlorine

[1] A note in the monthly 308 effluent data stated "*Chloroethers - methyl (bis) was delisted in 1981 because its half life in water is less than 38 s at 20 degrees Celsius. Consequently no one does this analysis for water and we could not test for this constituent.*"

D.2.d WQBEL Calculations

Specific pollutant limits may be calculated for both the protection of aquatic life and human health.

(1) WQBELs Based on Aquatic Toxicity and Human Health Standards

HAR 11-54-4 (b)(4)(A) requires that continuous discharges through submerged outfalls shall not contain: (i) pollutants in 24-hour average concentrations greater than chronic toxicity standards multiplied by the minimum dilution; (ii) non-carcinogenic pollutants in 30-day average concentrations greater than fish consumption standards multiplied by the minimum dilution; (iii) carcinogenic pollutants in 12-month average concentrations greater than fish consumption standards multiplied by the minimum dilution.

Effluent from the LWRF is discharged into groundwater through underground injection wells, and the discharged effluent, after mixing with groundwater, discharges to the ocean through submerged springs and diffuse discharges. Therefore, the LWRF discharge is a continuous submerged discharge without a constructed outfall structure. The impact of the LWRF discharge on water quality and aquatic life is similar to that of a continuous discharge through a submerged outfall equipped with diffusers. Thus, for pollutants with reasonable potential, the draft permit establishes, on a pollutant by pollutant basis, daily maximum effluent limitations based on the saltwater chronic aquatic life standard and average monthly effluent limitations for non-carcinogens or annual average effluent limitations for carcinogens based on the human health standard.

WQBELs established in the draft permit are discussed in detail below.

(2) Calculation of Pollutant-Specific WQBEL

The following equations were used to calculate reasonable potential for the HAR 11-54-4(b)(3) pollutants listed in Table 10.

$$\text{Projected Maximum RWC} = \text{MEC} \times 95\%\text{ratio} \times \text{De}$$

Where:
RWC = Receiving water concentration;
MEC = Maximum effluent concentration reported;
95%ratio = The 95% ratio from Table 3-2 in the TSD;
De = Dilution of the effluent.

If the projected maximum receiving water concentration is greater than the applicable water quality standard from HAR, Chapter 11-54, the reasonable potential exists for the pollutant and effluent limitations are established. No reasonable potential has been identified for the HAR 11-54-4(b)(3) parameters. The calculations for the projected maximum RWC for Copper are presented below as an example.

(a) Copper

i. Copper Water Quality Standards

The most stringent applicable water quality standard for Copper is 2.9 µg/L, as specified in HAR, Chapter 11-54. An EPA specified conversion factor of 0.83 was used to convert this soluble Copper standard to total recoverable Copper standard, which was calculated to be 3.5 µg/L.

ii. RPA Results

LWRF effluent monitoring data showed that twelve (12) effluent samples were analyzed for Copper from 7/2011 to 6/2012 and the maximum concentration was 15 µg/L. According to the TSD, the value for CV is calculated to be 0.5 and the 95% multiplier from Table 3.2 of the TSD is 1.5. As discussed in Part D.2.c.(3) of this fact sheet, the estimated minimum dilution is 20:1. Therefore, De = 5%.

Projected Maximum RWC = MEC x 95%ratio x De
= (15 µg/L) × 1.5 × 0.05
= 1.1 µg/L

Water Quality Standard = 3.5 µg/L

The projected maximum receiving water concentration (1.1 µg/L) does not exceed the most stringent applicable water quality standard for this pollutant (3.5 µg/L), demonstrating no reasonable potential.

D.2.e Whole Effluent Toxicity (WET)

WET limitations protect receiving water quality from the aggregated toxic effect of a mixture of pollutants in an effluent. WET tests measure the degree of response of exposed aquatic test organisms to an effluent mixed in some proportion with control water (e.g., laboratory water or a non-toxic receiving water sample). The WET approach allows for protection of the narrative criterion specified in HAR, Chapter 11-54-4(b)(2) while implementing Hawaii's numeric WQS for toxicity. WET tests include both acute and chronic toxicity tests. An acute toxicity test is conducted over a short period of time and measures mortality; while a chronic toxicity test is generally conducted over a longer period of time and may measure mortality, reproduction, or growth. HAR, Chapter 11-54-10(b) specifies that toxicity tests should be performed following the guidelines provided by EPA/600/4-91/002, or EPA/600/4-90-027F, or EPA/600/4-91/003.

Based on HAR, Chapter 11-54-4(b)(4), the Director may apply more stringent requirements to ensure compliance with the toxicity standards in HAR, Chapter 11-54-4(b)(2). Acute toxicity effluent limitations may not account for non-fatal toxic impacts that may occur in the receiving water. DOH has begun implementing EPA's Test of Significant Toxicity Method (TST) for WET effluent limitations within the State. As such, the chronic WET effluent limitation needs to be established consistent with the TST method. In addition, a WET effluent monitoring program is necessary to ensure compliance with applicable WQS in HAR, Chapter 11-54-4(b)(2).

WET data is not available for the LWRF. A monitoring program is included in the draft permit to collect WET test data. If the discharge demonstrates a pattern of toxicity exceeding the numeric toxicity monitoring trigger, the Discharger is required to initiate a Toxicity Reduction Evaluation (TRE), in accordance with an approved TRE work plan. The numeric toxicity monitoring trigger is not an effluent limitation; it is the toxicity threshold at which the Discharger is required to perform accelerated chronic toxicity monitoring, and is the threshold to initiate a TRE if a pattern of effluent toxicity has been demonstrated.

E. Rationale for Receiving Water and Zone of Mixing Requirements

E.1 Summary of Receiving Water Monitoring Data

Data from a tracer dye study completed by the University of Hawaii (Glenn, *et al.*, June 2013) showed that the effluent from the LWRF discharges to shallow coastal water off Kahekili, approximately 1,800 ft to the southwest of the LWRF. Coastal water quality in this area has been monitored by the DOH. The DOH monitoring data over the period of 1/2012 – 7/2014 and applicable WQS are summarized in Table 11 and Table 12 below.

Table 11 – Receiving Water Monitoring Data (Part I)

Location		pH (s.u.)		Temperature (°C)		Salinity (ppt)		Dissolved Oxygen (% saturation)
		minimum	maximum	minimum	maximum	minimum	maximum	minimum
Within ZOM	north seep A	7.33	8.17	24.16	30.20	3.94	25.39	38.5
	north seep B	7.36	8.03	26.26	30.73	4.06	13.34	45.2
	north seep C	7.42	7.76	28.45	32.24	4.20	20.25	38.3
	north seep mid-depth	8.16	8.40	23.28	27.06	33.88	35.49	74.8
	south seep A	7.11	7.90	25.45	32.24	2.83	22.76	36.1
	south seep B	7.44	7.84	25.52	33.16	3.57	22.73	40.8
	south seep C	7.44	7.66	25.99	34.39	3.22	28.43	38.4
	south seep mid-depth	8.17	8.34	23.87	27.57	33.23	35.71	85.7
	north seep surface	8.16	8.37	23.31	27.06	33.80	35.39	80.3
	south seep surface	8.13	8.35	23.85	27.56	34.20	35.71	86.3
Control	control north mid-depth	8.14	8.32	23.07	27.00	34.55	35.73	84.4
	control north	8.12	8.34	23.14	26.98	34.63	35.73	82.1

	surface							
	control south mid-depth	8.19	8.34	23.85	27.59	34.58	35.52	96.8
	control south surface	8.17	8.36	23.90	27.60	34.50	35.45	95.5
	Applicable Water Quality Standards	7.0	8.6	within 1 °C relative to ambient		within 90% and 110% of natural ambient		Not less than 75% saturation

Table 12 – Receiving Water Monitoring Data (Part II)

Location		**Geometric Mean**					
		Total Nitrogen	**Ammonia Nitrogen**	**Nitrate + Nitrite**	**Total Phosphorus**	**Chlorophyll a**	**Turbidity**
		µg/L	µg/L	µg/L	µg/L	µg/L	NTU
Within ZOM	north seep A	492	3.3	108	345	0.07	1.4
	north seep B	809	2.5	209	431	0.04	1.4
	north seep C	261	2.5	117	366	0.04	4.7
	north seep mid-depth	53	2.9	8.7	23	0.13	0.76
	south seep A	478	3.4	59	440	0.11	2.5
	south seep B	390	3.3	57	439	0.12	2.5
	south seep C	433	3.2	68	382	0.13	2.7
	south seep mid-depth	61	3.1	7.3	19	0.10	0.66
	north seep surface	57	3.1	8.6	24	0.10	0.80
	south seep surface	57	3.0	7.1	22	0.11	0.80
Control	control north mid-depth	52	2.9	2.9	16	0.11	0.73
	control north surface	51	2.7	3.7	17	0.11	0.95
	control south mid-depth	47	3.1	4.9	15	0.10	0.54
	control south surface	53	3.8	4.4	16	0.10	0.64
	Applicable Water Quality Standards	150	3.5	5.0	20	0.3	0.5

E.2 Proposed Receiving Water Limitations

E.2.a Basic Water Quality Criteria Applicable to All Waters

The DOH adopted WQS specific for open coastal waters in HAR, Chapter 11-54, and the discharge shall not cause a violation of any applicable water quality standard for receiving waters specified in HAR 11-54. The draft permit incorporates receiving water limitations and requirements to ensure the facility does not exceed applicable WQS.

The receiving water of the LWRF effluent is classified as "Class A Wet Open Coastal Waters." Thus, the discharge from the facility shall not interfere with the attainment or maintenance of that water quality which assures protection of public water supplies and the protection and propagation of a balanced indigenous population of shellfish, fish, and wildlife and allows recreational activities in and on the water. The draft permit incorporates receiving water limitations for the protection of the beneficial uses the Pacific Ocean.

E.2.b Specific Criteria for "Class A Wet Open Coastal Waters"

The receiving water quality shall not exceed the water quality criteria specified in HAR 11-54-6(b)(3) for "Class A, Wet Open Coastal Waters", as summarized in Table 13, except within the ZOM.

Table 13 – Water Quality Criteria for "Class A Wet Open Coastal Waters"

Parameter	Geometric mean not to exceed the given value	Not to exceed the given value more than ten percent of the time	Not to exceed the given value more than two percent of the time
Total nitrogen (µg/L as N)	150	250	350
Ammonia nitrogen (µg/L as N)	3.5	8.5	15
Nitrate + nitrite nitrogen (µg/L as N)	5	14	25
Total phosphorus (µg/L as P)	20	40	60
Light extinction coefficient (k units)	0.2	0.5	0.85
Chlorophyll a (µg/L)	0.3	0.9	1.75
Turbidity (NTU)	0.5	1.25	2
pH	Must be between 7.0 and 8.6		
DO	Not less than 75% saturation		
Temperature	Within 1^{o}C relative to ambient		
Salinity	Within 90% and 110% of natural ambient		

E.3 Zone of Mixing

HAR, Chapter 11-54 allows for a mixing zone (ZOM) if the ZOM is in compliance with requirements in HAR, Section 11-54-9(c). A tracer dye study completed by the University of Hawaii (Glenn, *et al.*, June 2013) found that the LWRF effluent plume reached Kahekili shoreline, about 1,800 ft southwest of the LWRF. Nutrients and other water quality parameters were analyzed for water samples collected by Steve Dollar on August 23, 2014 along nine transects that spanned the area off Kahekili reef, and extended from the highest wash of waves on the beach to the open coastal ocean approximately 350 meters from shore. Based on this water quality data set, the Permittee applied for a ZOM with locations of the four corners of the ZOM summarized in Table 14. The ZOM is bounded on the east by the shoreline between P1 and P2, on the west by the line connecting P3 and P4, on the north by the line connecting P1 and P4, and on the south by the line connecting P2 and P3. The ZOM is approximately 1,900 ft along the shoreline and 200 ft wide in the offshore direction. Steve Dollar's data indicated that WQS can be met outside of this ZOM. A map of the ZOM and monitoring stations of the ZOM is provided in Figure 2 of the draft permit.

Table 14 – Location of ZOM

ZOM Corners	Latitude	Longitude
P1, Northeast corner (at shoreline)	20°56'31.16" N	156°41'33.17" W
P2, Southeast corner (at shoreline)	20°56'12.55" N	156°41'34.87" W
P3, Southwest corner (200 ft offshore)	20°56'12.65" N	156°41'36.98" W
P4, Northwest corner (200 ft offshore)	20°56'31.35" N	156°41'35.27" W

HAR 11-54-9(c)(5) requires that a ZOM application and supporting information should clearly show that: the continuation of the operation involved in the discharge by the granting of the ZOM is in the public interest; the discharge does not substantially endanger human health or safety; compliance with the existing WQS without the ZOM would produce serious hardships without equal or greater benefits to the public; and the discharge does not violate the basic standards applicable to all waters, will not unreasonably interfere with any actual or probable use of the water areas for which it is classified, and has received the best degree of treatment or control.

The following findings were made in consideration of HAR 11-54-9(c)(5):

> The LWRF is the only publicly owned wastewater treatment plant serving about 12,000 residences and businesses in the Lahaina-Kannapali area, and it presently processes approximately four (4) million gallons of municipal wastewater every day. The LWRF plays a key role in reducing pollutants discharged to coastal waters in the Lahaina-Kannapali area. In addition, the LWRF provides approximately two (2) million gallons of R-1 reuse water every day, which is a significant contribution to water conservation in its service area. It is clear that the operation of the LWRF is in the public interest.
>
> No known information indicates that the LWRF discharge is causing or contributing to conditions that substantially endanger human health or safety. Further, the Draft Permit

requires the Permittee to conduct water quality monitoring regularly to verify the presence or absence of assimilative capacity for nutrients with reasonable potential.

The feasibility and costs to install additional treatment necessary to meet applicable WQS end-of-pipe were not provided by the Permittee to demonstrate potential hardships. However, based on effluent data, significant facility enhancements and capital costs would likely be necessary to comply with applicable WQS for which the ZOM was applied. The LWRF provides wastewater treatment services to the public, which clearly benefits the public. It is unknown whether greater benefits to the public can be achieved by requiring the LWRF to comply with WQS without the ZOM, though it seems unlikely that any such benefits would equal or exceed the cost of enhancing the facility.

As discussed in Part D.2.c of this draft Fact Sheet, monitoring data and RPA have not identified reasonable potential for the LWRF effluent to contribute to exceedance of applicable WQS. The Draft Permit requires compliance with the effluent limitations and conditions that are protective of the actual and probable uses of the receiving water and implement applicable technology-based effluent limitations.

The Department has determined that the ZOM satisfies the requirements in HAR, Section 11-54-09(c)(5).

The establishment of this ZOM is subject to the conditions specified in Part C of the draft permit. The draft permit also incorporates receiving water monitoring requirements.

F. Rationale for Monitoring and Reporting Requirements

40 CFR 122.41(j) specifies monitoring requirements applicable to all NPDES permits. HAR Chapter 11-55-28 establishes monitoring requirements applicable to NPDES permits within the State of Hawaii. 40 CFR 122.48 and HAR Chapter 11-55-28 require that all NPDES permits specify requirements for recording and reporting monitoring results. The principal purposes of a monitoring program are to:

- Document compliance with waste discharge requirements and prohibitions established by the DOH;
- Facilitate self-policing by the Permittee in the prevention and abatement of pollution arising from waste discharge;
- Develop or assist in the development of limitations, discharge prohibitions, national standards of performance, pretreatment and toxicity standards, and other standards; and,
- Prepare water and wastewater quality inventories.

The draft permit establishes monitoring and reporting requirements to implement federal and State requirements. The following provides the rationale for the monitoring and reporting requirements contained in the draft permit.

F.1 Effluent Monitoring

F.1.a Tertiary Treated Domestic Wastewater, Monitoring Location INT-001 and INT-002

Monitoring requirements for flow, pH, BOD_5, and TSS have been established in the draft permit in order to determine compliance with technology-based effluent limitations. Monitoring shall be conducted at Monitoring Locations INT-001 and INT-002, two locations after treatment and prior to groundwater injection. These monitoring locations have been established to determine compliance with technology-based effluent limitations.

Monitoring requirements for turbidity and chlorine have been established in the draft permit in order to determine compliance with water quality standards. Monitoring shall be conducted at locations where the diluted LWRF effluent discharges to the ocean. Samples can be collected at the submarine seeps documented in the tracer dye study (Glenn, *et al.*, June 2013). Data collected can be used for future RPAs.

Effluent monitoring requirements for total nitrogen, ammonia nitrogen, nitrate+nitrite, total phosphorus, and temperature are established to enable comparison with receiving water monitoring results.

Effluent monitoring requirements for TOC and oil and grease are established to collect data for future RPAs.

F.2 Whole Effluent Toxicity Monitoring

Semi-annual whole effluent toxicity testing is required in order to determine compliance with whole-effluent toxicity effluent limitations as specified in Parts A.1 and B of the draft permit.

F.3 Receiving Water Quality Monitoring Requirements

For the establishment of baseline receiving water quality data, the Permittee shall monitor water quality at the following 10 stations (at a minimum): four stations at the halfway distance between the shoreline and the offshore edge of the ZOM (Stations R1, R3, R5, and R7), four stations along the offshore edge of the ZOM (Stations R2, R4, R6, and R8), and two control stations (C1 and C2) outside the ZOM, as specified in Part C.4.a of the draft permit. These monitoring requirements are necessary to determine compliance with WQS for open coastal waters listed in HAR, Section 11-54-6(b)(3).

F.4 Other Monitoring Requirements

F.4.a Effluent and Receiving Water Monitoring Programs

The draft permit requires the Permittee to submit Effluent and Receiving Water Monitoring Programs within 30 calendar days after the effective date of the draft permit, as described in Part E of the draft permit. The Permittee is required to submit these plans so that the DOH can verify that the proposed effluent and receiving water monitoring will be in compliance with monitoring requirements at 40 CFR 122.41(j), HAR Section 11-55-28, and HAR Section 11-55-29.

F.4.b Bottom Biological Communities Monitoring Program

In accordance with HAR, Section 11-54-09(c)(6)(C), the draft permit requires the Permittee to submit a receiving water bottom biological communities monitoring program detailing the requirement within 60 days after the effective date of the draft permit, in accordance with Part C.4.d of the draft permit. This monitoring requirement may be waived upon demonstrating to the Director that either the discharge does not impact the existing bottom biological communities, or no bottom biological communities exist in the receiving water.

G. Rationale for Provisions

G.1 Standard Provisions

The Permittee is required to comply with DOH Standard NPDES Permit Conditions (Version 14), which are included as part of the draft permit.

G.2 Monitoring and Reporting Requirements

The Permittee shall comply with all monitoring and reporting requirements included in the draft permit and in the DOH Standard NPDES Permit Conditions.

G.3 Special Provisions

G.3.a Reopener Provisions

(1) New or revised WQS and/or new information

The draft permit may be modified in accordance with the requirements set forth at 40 CFR 122 and 124, to include appropriate conditions or limits based on newly available information or to implement any new state WQS or criteria that are approved by the EPA in accordance with 40 CFR 122.62.

(2) TMDLs

A TMDL may be established for turbidity for the receiving water body. Should TMDLs with waste allocations be established for any parameters, the permit may be reopened to include final numerical limits.

G.3.b Special Studies and Additional Monitoring Requirements

(1) Toxicity Reduction Requirement

The draft permit requires the Permittee to submit an initial investigation Toxicity Reduction Evaluation (TRE) workplan to the Director which shall describe steps which the Permittee intends to follow in the event that toxicity is detected. This requirement is discussed in detail in Part B.5 of the draft permit.

H. Public Participation

The public will be afforded two 30-day comment periods during the processing of this permit.

References

Johnson, E.E. and Wiegner, T.N. (2014) Surface Water Metabolism Potential in Groundwater-Fed Coastal Waters of Hawaii Island, USA. *Estuaries and Coasts* (2014) 37:712–723.

Glenn, Craig R. *et al*., (2013) Lahaina Groundwater Tracer Study – Lahaina, Maui, Hawaii: Final Report. University of Hawaii at Manoa, June 2013.

Hunt, C.D., Jr., and Rosa, S.N. (2009) A multitracer approach to detecting wastewater plumes from municipal injection wells in near shore marine waters at Kihei and Lahaina, Maui, Hawaii, U.S. Geological Survey Scientific Investigations Report 2009-5253.

Johnson, E.E. and Wiegner, T.N. (2014) Surface Water Metabolism Potential in Groundwater-Fed Coastal Waters of Hawaii Island, USA. *Estuaries and Coasts* (2014) 37:712–723.

Marine Research Consultants (2014b) Marine Water Quality Monitoring Kahekili, Maui. Water Chemistry. Report prepared for County of Maui.

Exhibit 3 Proposed Zone of Mixing and Monitoring Locations

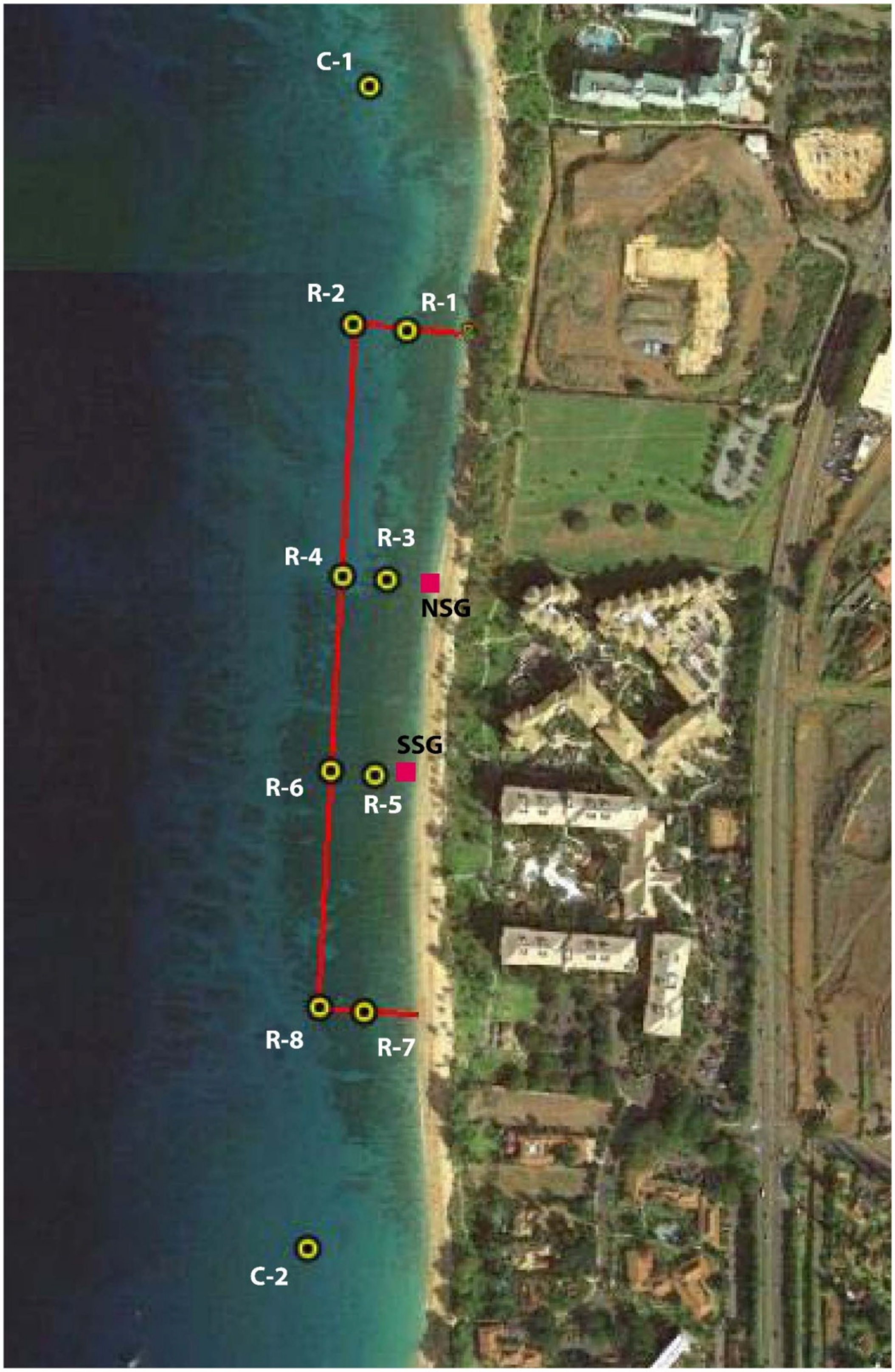


Exhibit 4—Oxygen Solubility as a Function of Temperature and Salinity

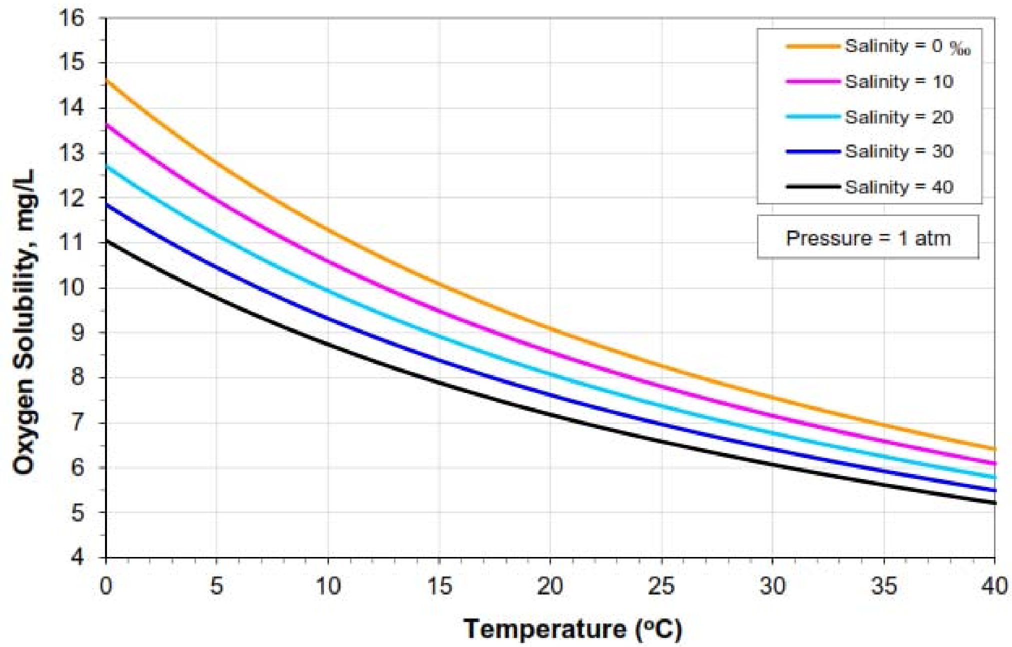


Figure 6. Graph showing the predicted solubility of oxygen in water at 1 atmosphere (760 mm Hg) as a function of water temperature and salinity using the Benson and Krause (1980, 1984) formulas embodied in equations 1 and 7-11 of this Technical Memorandum.

Source: USGS Office of Water Quality Technical Memorandum 2011.03, July 13, 2011.

Exhibit 5a – Sampling locations nearshore Pulelehua, Maui

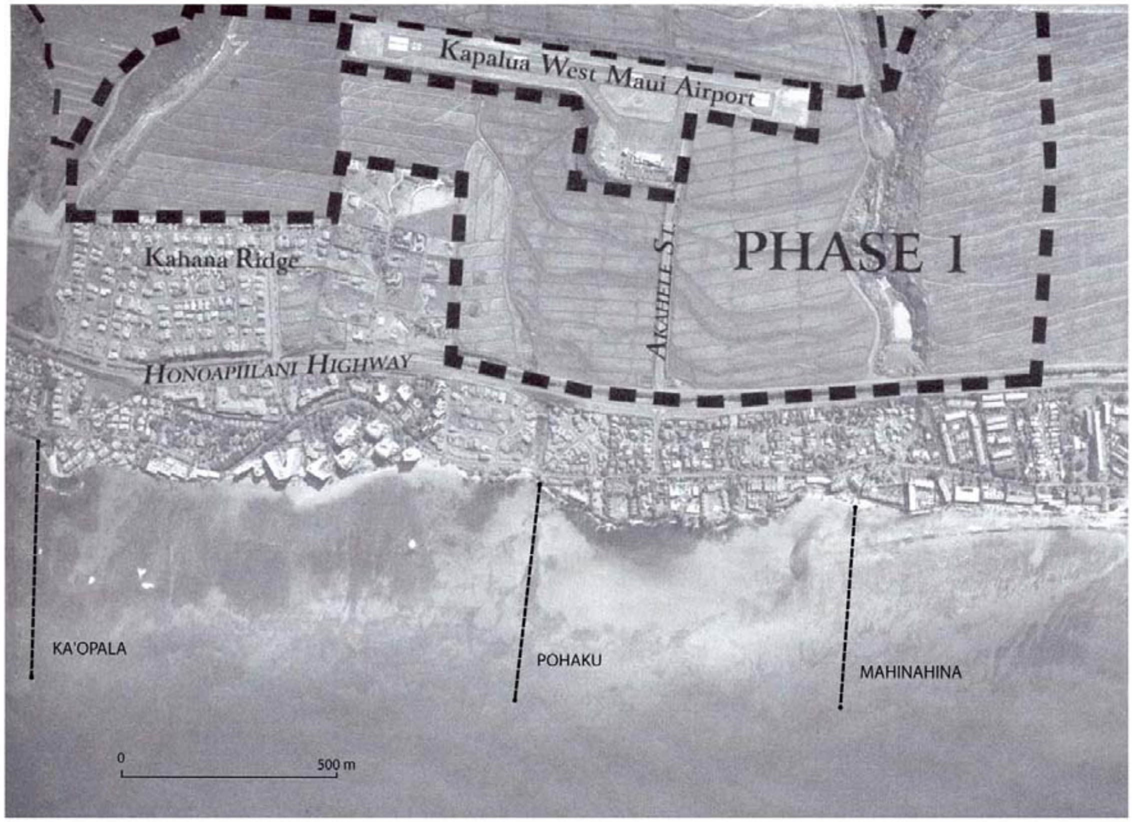


FIGURE 1. Aerial photograph of Mahinahina area of west Maui showing locations of three water quality sampling transects (dashed lines) in Ka'opala Bay, Pohaku Bay and off the Mahinahina drainage culvert. Also shown is the Kapalua West Maui Airport, Honoapiilani Highway and the property boundaries for Phase I of the Pulelehua project.

Source: Marine Research Consultants (2007)

Exhibit 5b – Nearshore distribution of nutrients Pulelehua, April 2004

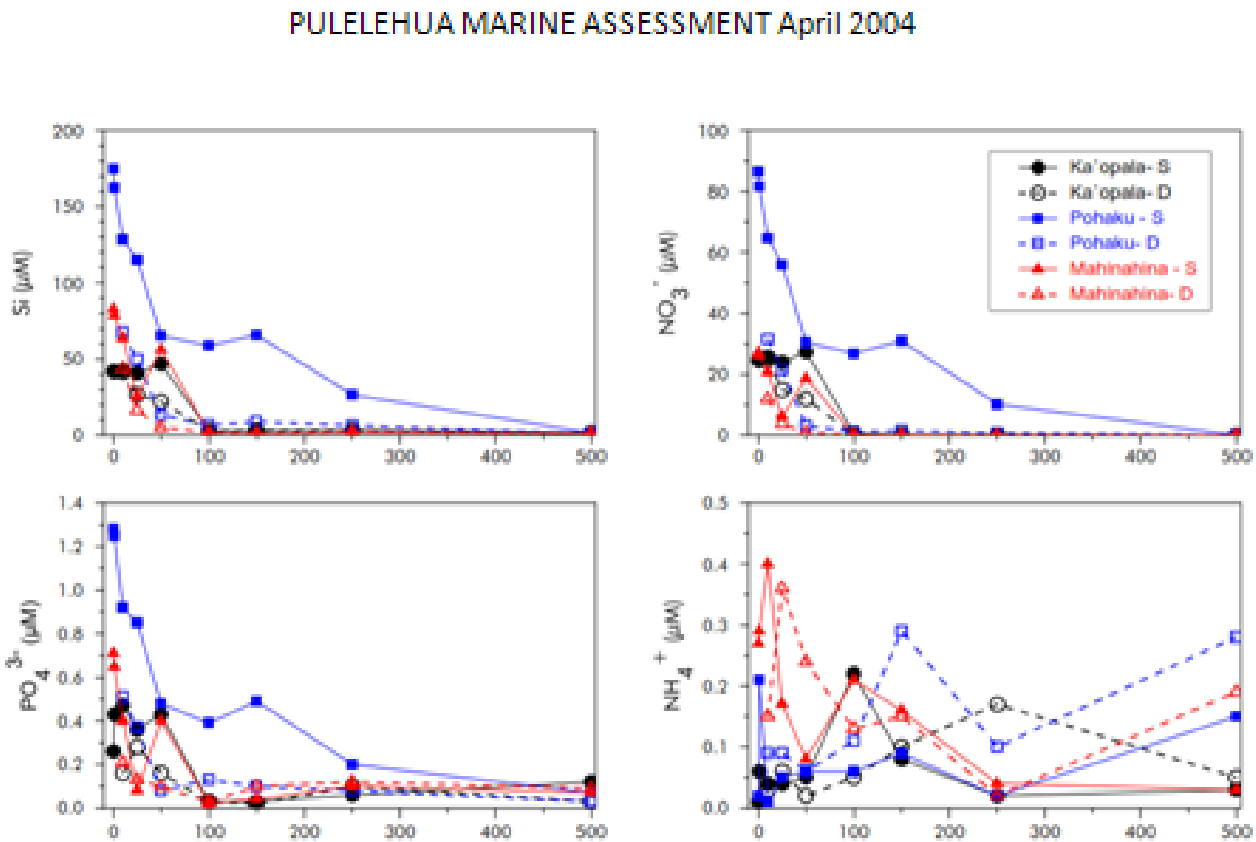


FIGURE 4. Plots of dissolved nutrients in surface (S) and deep (D) samples collected along three transects offshore of the proposed Pulelehua project site in April 2004 as a function of distance from the shoreline. See Figure 2 for similar plots of data collected in May 2007. For transect locations, see Figure 1.

Source: Marine Research Consultants (2007)

Exhibit 5c – Nearshore distribution of nutrients Pulelehua, May 2007

PULELEHUA MARINE ASSESSMENT May 2007

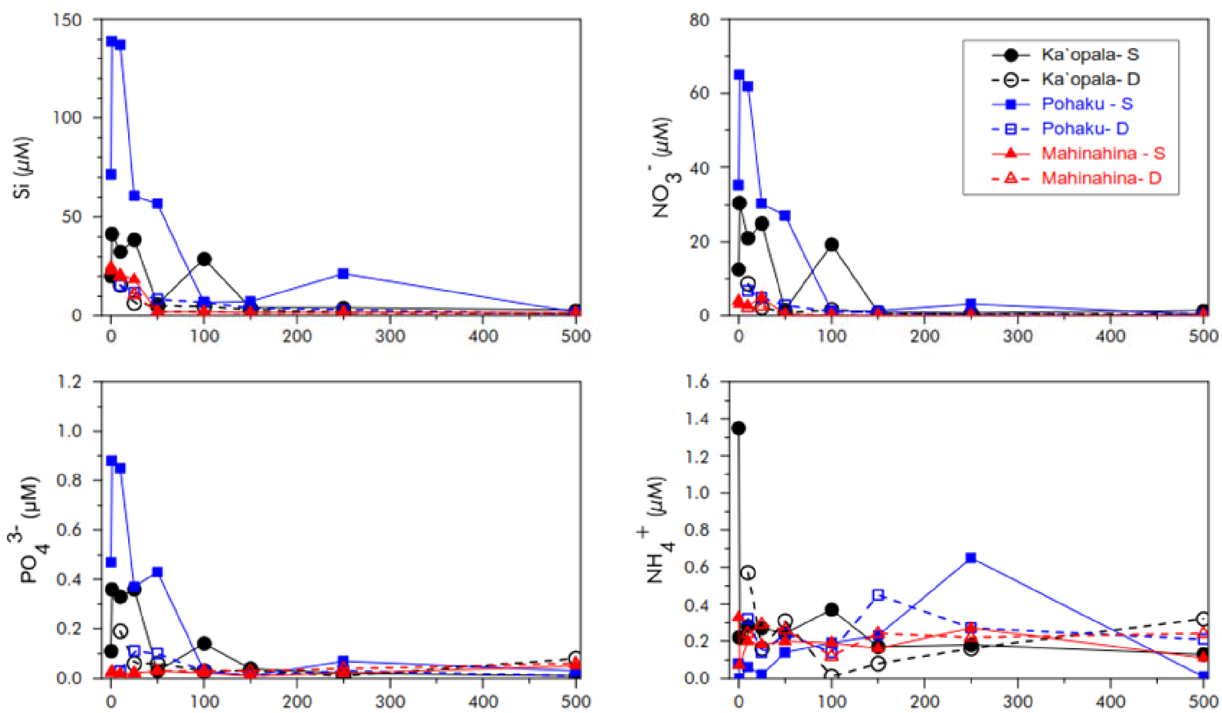


FIGURE 2. Plots of dissolved nutrients in surface (S) and deep (D) samples collected along three transects offshore of the proposed Pulelehua project site on May 5, 2007 as a function of distance from the shoreline. See Figure 4 for similar plots of data collected in April 2004. For transect locations, see Figure 1.

Source: Marine Research Consultants (2007)

Exhibit 6a – Sampling locations nearshore Keauhou, Hawaii

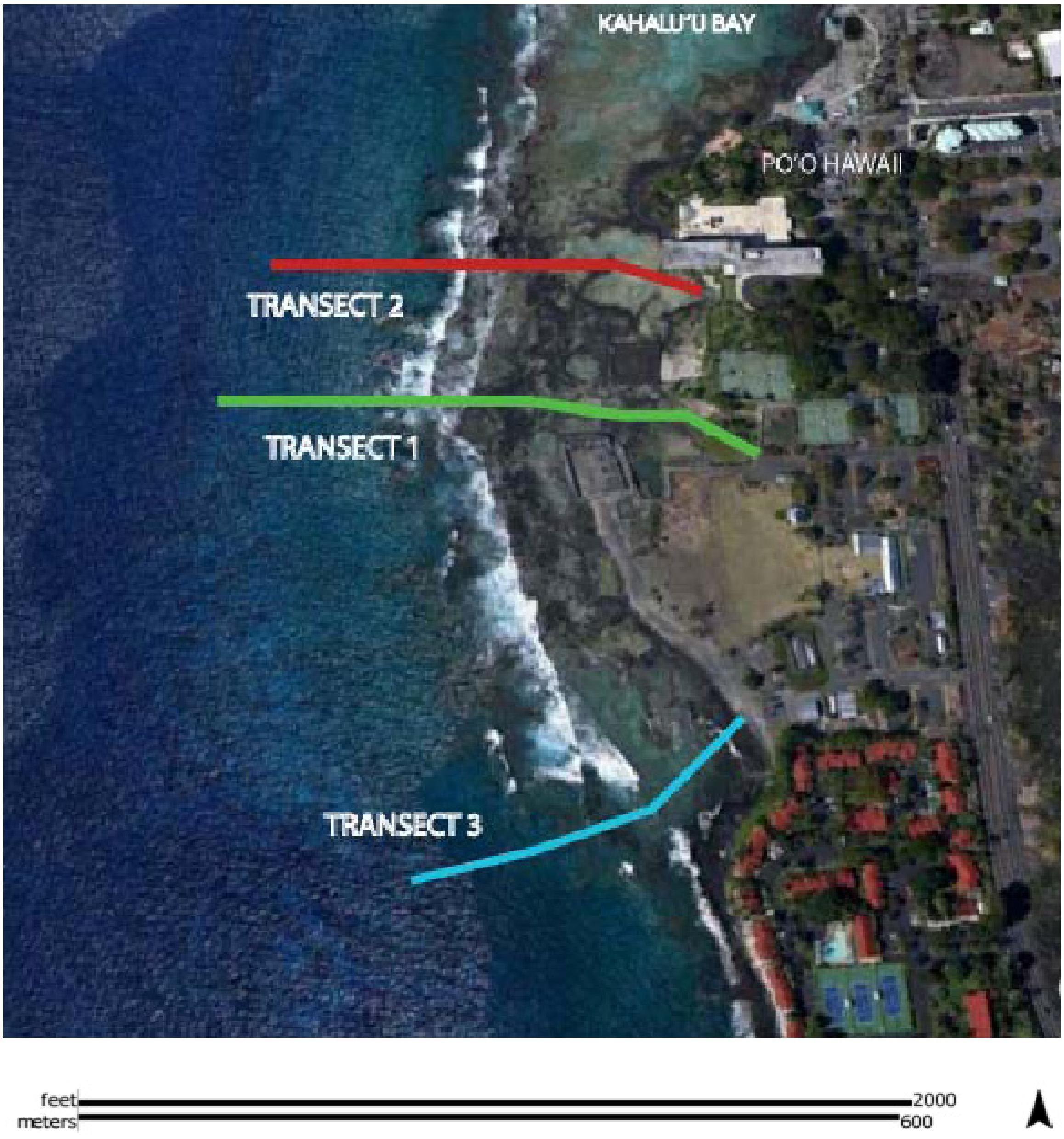


FIGURE 2. Aerial photograph showing three transect lines along which samples were collected for evaluation of water chemistry off the Kamehameha Schools Kahalu'u Ma Kai Project site in Keauhou, Island of Hawaii. Transects 1 and 2 extend from the most inland reach of tide pools to the open coastal ocean. Also shown is location of

Source: Marine Research Consultants (2013)

Exhibit 6b – Nearshore distribution of nutrients Keauhou, 2013

Kahaluu Ma Kai Project, Keauhou, North Kona Hawaii

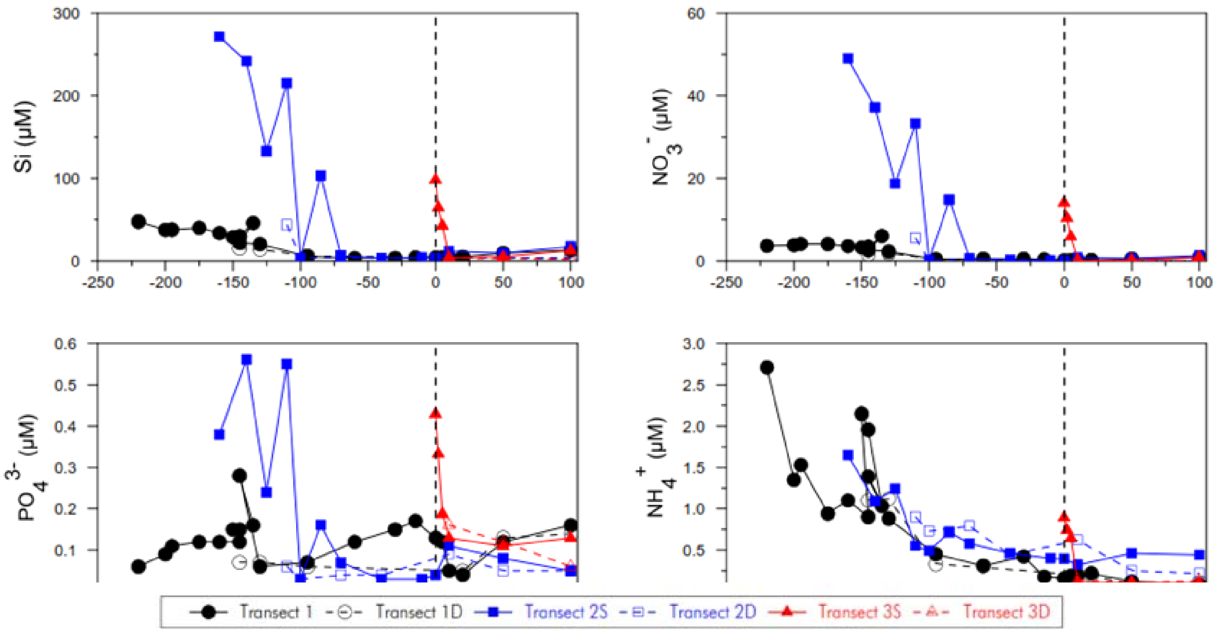
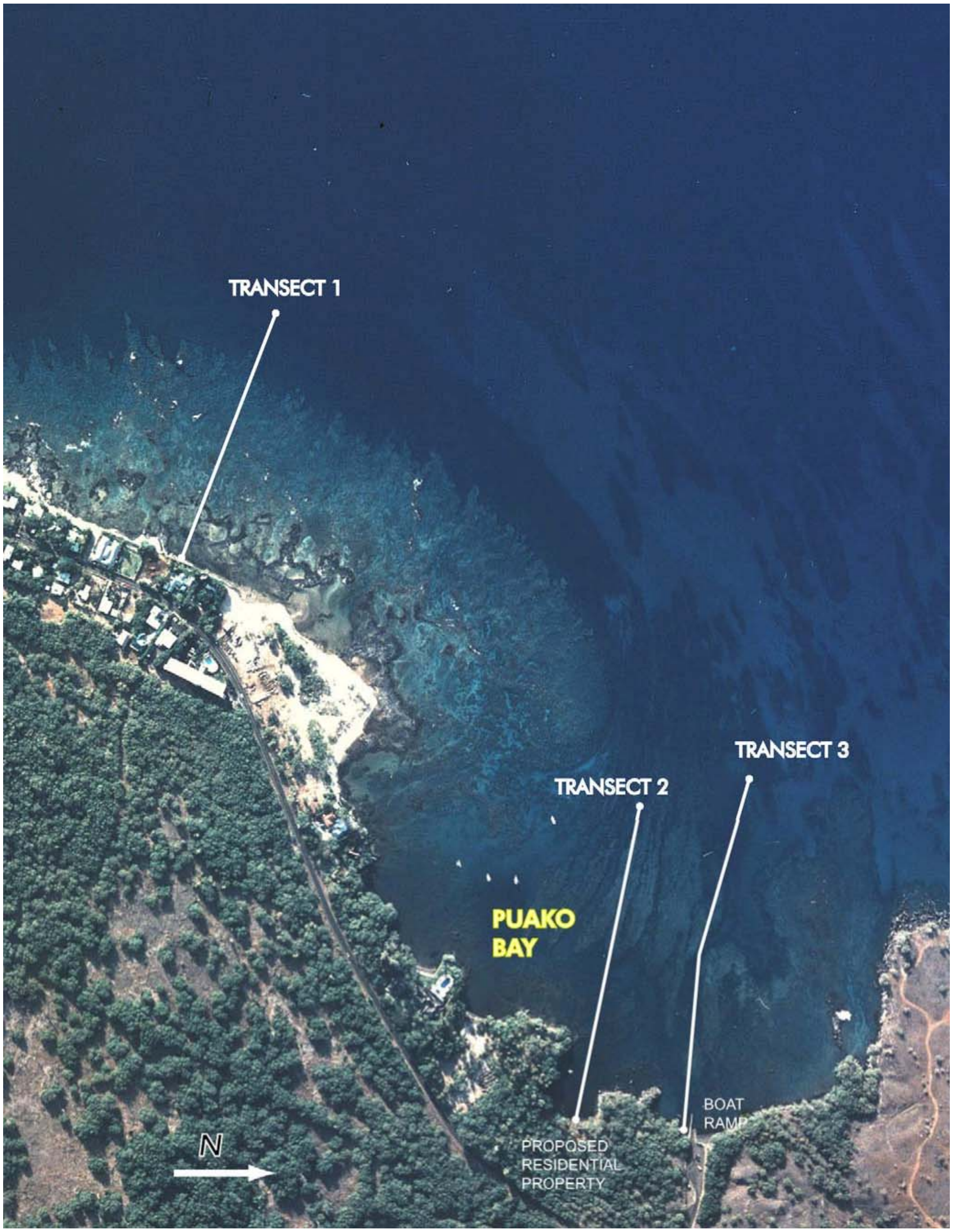


FIGURE 3. Plots of dissolved nutrients in surface (S) and deep (D) samples collected along three transects off the Kahaluu Ma Kai Project site in Keauhou, North Kona, Hawaii as a function of distance from the shoreline. Negative distances are inland from the shoreline in a series of tidepools. Positive distances extend from the shoreline seaward. For transect locations, see Figure 1.

Source: Marine Research Consultants (2013)

Exhibit 7a – Sampling locations nearshore South Kohala, Hawaii



Source: Marine Research Consultants (2006)

Exhibit 7b – Nearshore distribution of nutrients South Kohala, July 2006

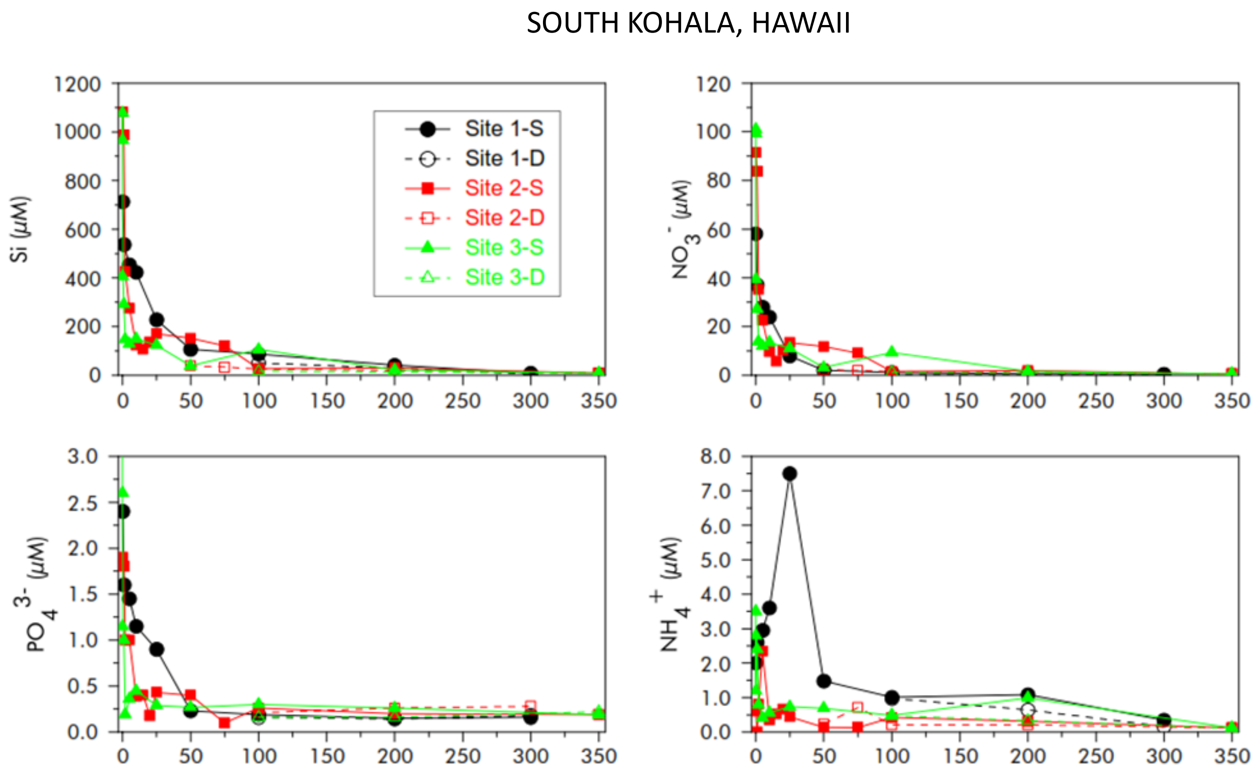


FIGURE 2. Plots of dissolved nutrients in surface (S) and deep (D) samples collected on July 12, 2006 as a function of distance from the shoreline in the vicinity of the proposed Puako residentital project in South Kohala, Hawaii. For site locations, see Figure 1.

Source: Marine Research Consultants (2006)

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Exhibit 8a– Sampling locations nearshore Makena, Maui

FIGURE 1. Aerial photograph of Makena Resort on southwest coastline of Maui. Also shown are locations of five water sampling transects that extend from the shoreline to 150-200 m from shore. The southern end of the Wailea golf course is visible at right.

Source: Marine Research Consultants (2014a)

Exhibit 8b– Nearshore distribution of nutrients Makena, (13 Surveys).

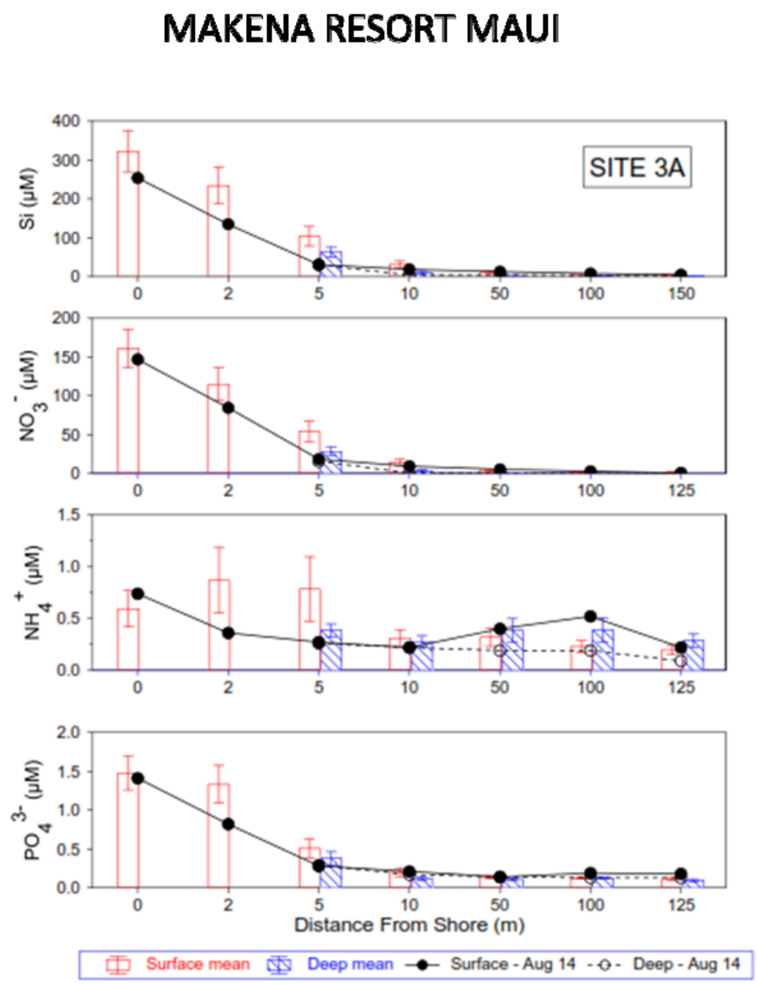
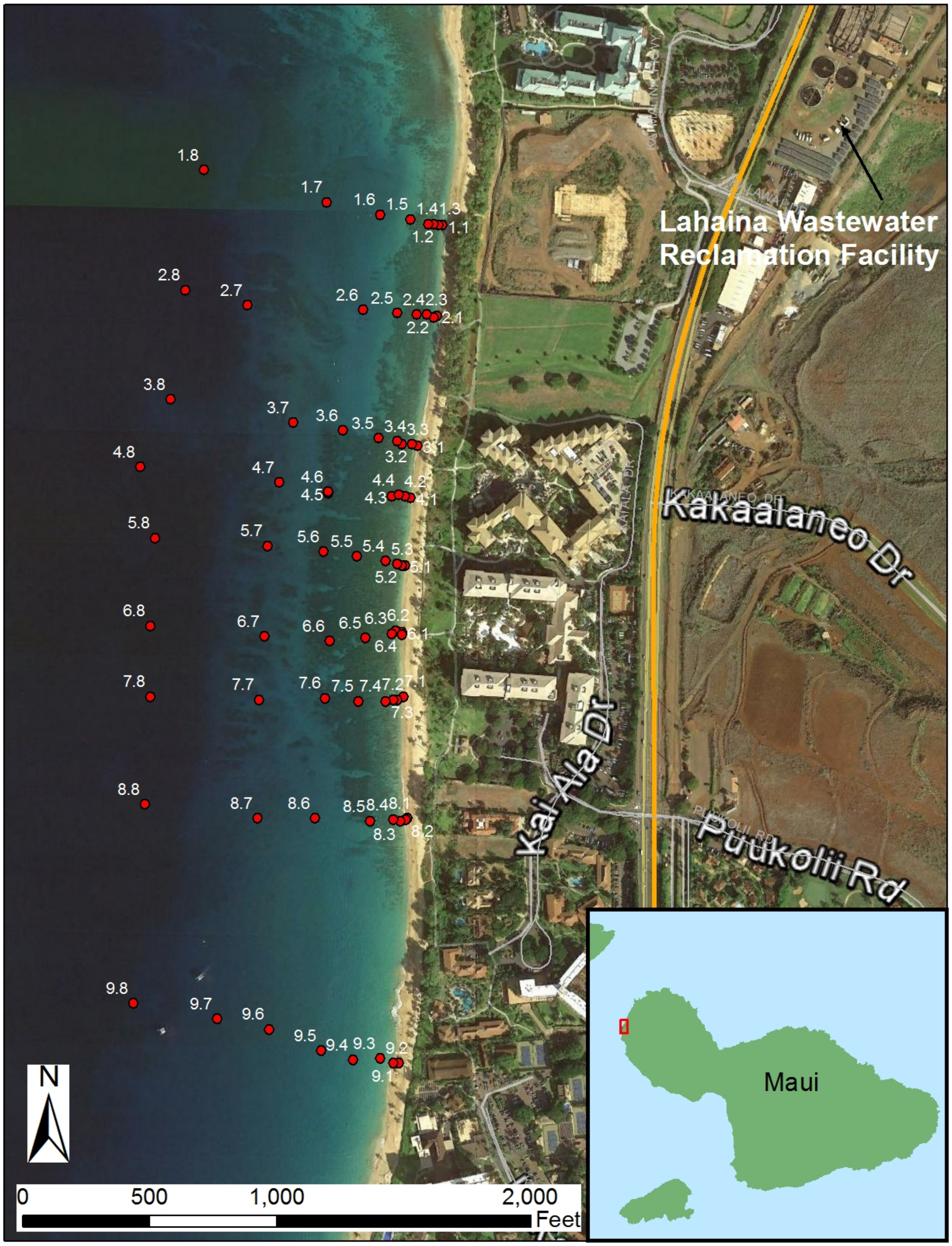


FIGURE 16. Plots of dissolved nutrient constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 3A, offshore of the Makena Resort. Data points and connected lines from samples collected during the most recent survey, bar graphs represent mean values at each sampling station for surveys conducted since June 2007 (N=13). Error bars represent standard error of the mean. For site location, see Figure 1.

Source: Marine Research Consultants (2014a)

Exhibit 9a – Sampling locations nearshore Kahekili, Maui



Source: Marine Research Consultants (2014b)

Exhibit 9b – Nearshore distribution of silicon Kahekili, August 2014

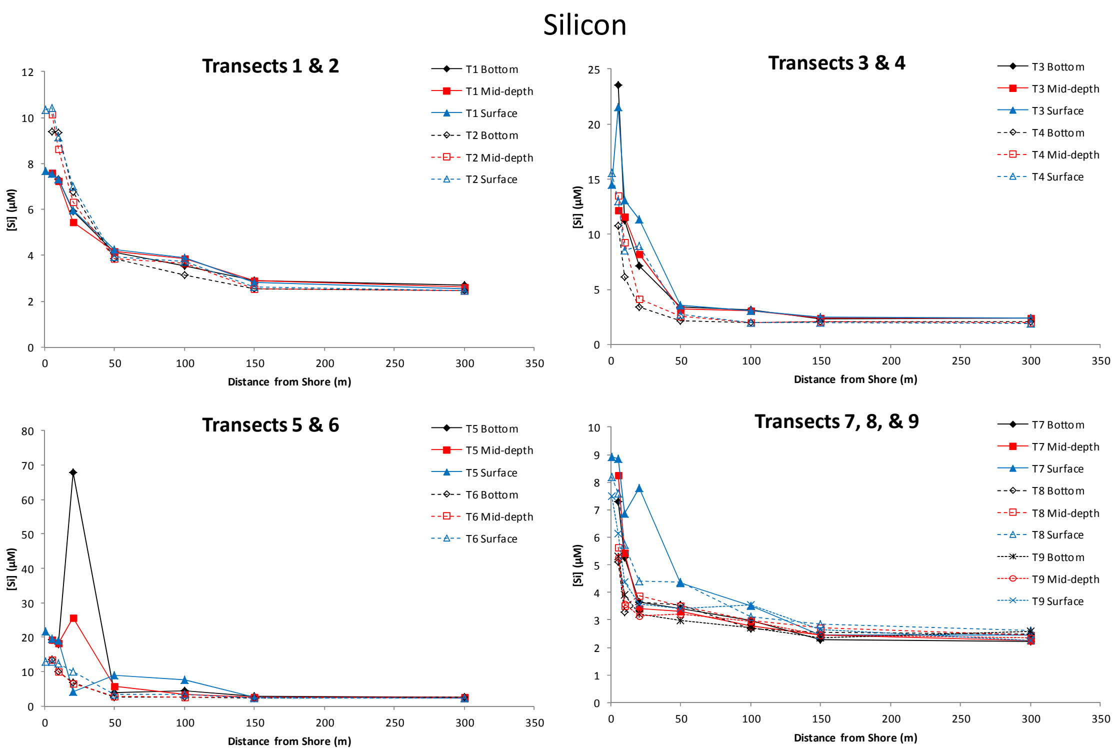


Figure 1a. Results of water chemistry sampling off Kahekili Beach conducted on August 23, 2014. Samples were collected along nine transects that spanned the area off Kahekili reef, and extended from the highest wash of waves on the beach to the open coastal ocean approximately 350 meters from shore. Samples were collected at 8 sites on each transect from just below the ocean surface, midway in the water column, and just above the ocean floor

Source: Marine Research Consultants (2014b)

Exhibit 9c – Nearshore distribution of phosphate Kahekili, August 2014

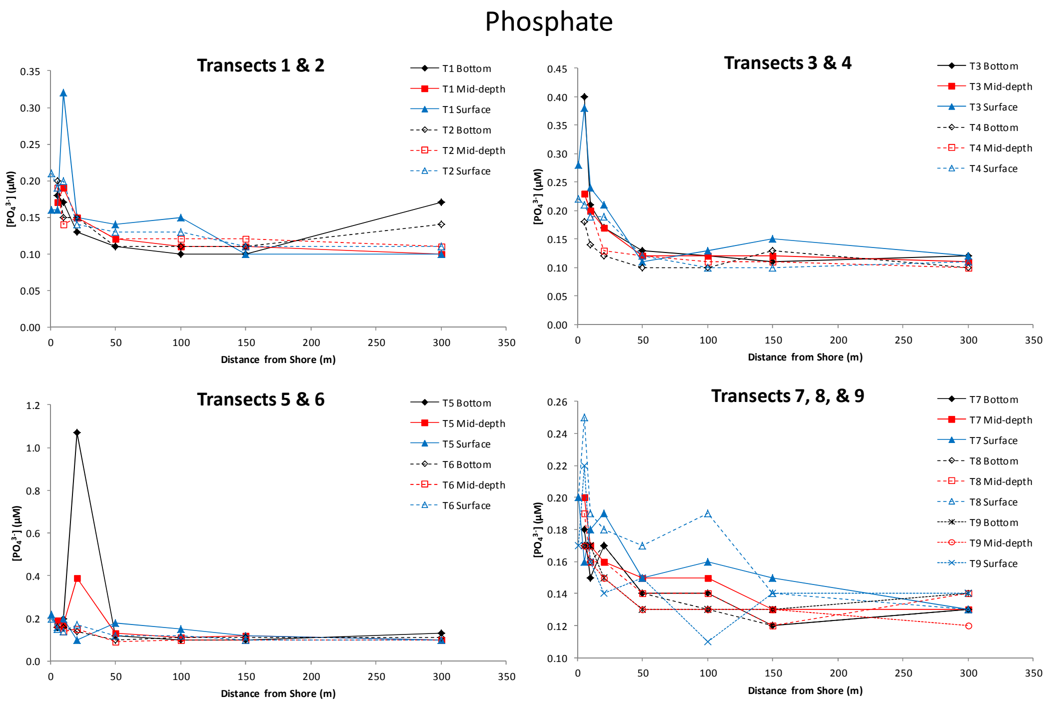


Figure 1c. Results of water chemistry sampling off Kahekili Beach conducted on August 23, 2014. Samples were collected along nine transects that spanned the area off Kahekili reef, and extended from the highest wash of waves on the beach to the open coastal ocean approximately 350 meters from shore. Samples were collected at 8 sites on each transect from just below the ocean surface, midway in the water column, and just above the ocean floor

Source: Marine Research Consultants (2014b)

Exhibit 9d– Nearshore distribution of nitrate+nitrite Kahekili, August 2014

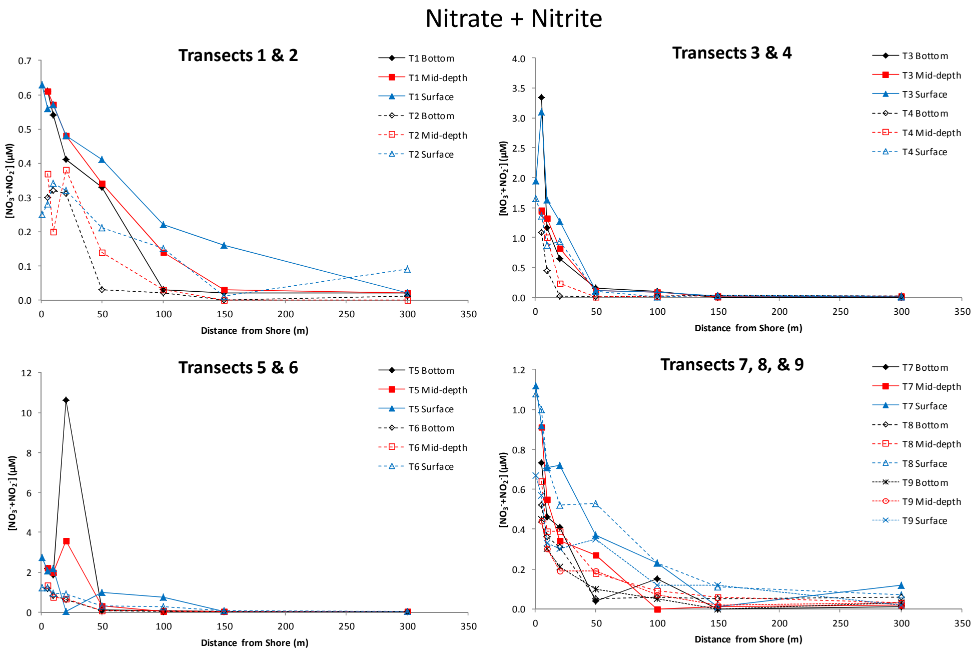


Figure 1b. Results of water chemistry sampling off Kahekili Beach conducted on August 23, 2014. Samples were collected along nine transects that spanned the area off Kahekili reef, and extended from the highest wash of waves on the beach to the open coastal ocean approximately 350 meters from shore. Samples were collected at 8 sites on each transect from just below the ocean surface, midway in the water column, and just above the ocean floor

Source: Marine Research Consultants (2014b)