REQUEST FOR LEGAL SERVICES

Date: **June 25, 2020**

From: **Michael J. Molina, Chair**
Governance, Ethics, and Transparency Committee

TRANSMITTAL
Memo to: **DEPARTMENT OF THE CORPORATION COUNSEL**
Attention: Richelle Thomson, Esq.

Subject: HAWAII WILDLIFE FUND, ET AL. V. COUNTY OF MAUI, CIVIL 12-00198 SOM BMK, U.S. SUPREME COURT DOCKET 18-260 (GET-26)

Background Data: ______

Work Requested: [ ] FOR APPROVAL AS TO FORM AND LEGALITY

[**X**] OTHER: Please provide the Committee a summary of the United States Supreme Court decision on April 23, 2020; a status report of proceedings in United States District Court; settlement offers; and, if appropriate, resolutions authorizing settlement or approving additional compensation for special counsel.

Requestor's signature	Contact Person
(signature) Michael J. Molina	James Forrest (Telephone Extension: 7137)

[ ] ROUTINE (WITHIN 15 WORKING DAYS)
[ ] PRIORITY (WITHIN 10 WORKING DAYS)
[ ] RUSH (WITHIN 5 WORKING DAYS)
[ ] URGENT (WITHIN 3 WORKING DAYS)

[**X**] SPECIFY DUE DATE (IF IMPOSED BY SPECIFIC CIRCUMSTANCES): June 30, 2020.
REASON: For posting on July 7, 2020, committee meeting agenda.

FOR CORPORATION COUNSEL'S RESPONSE

ASSIGNED TO:	ASSIGNMENT NO.	BY:

TO REQUESTOR: [ ] APPROVED [ ] DISAPPROVED [X] OTHER (SEE COMMENTS BELOW)
[ ] RETURNING--PLEASE EXPAND AND PROVIDE DETAILS REGARDING ITEMS AS NOTED

COMMENTS (NOTE - THIS SECTION NOT TO BE USED FOR LEGAL ADVICE):

please see attached memorandum.

DEPARTMENT OF THE CORPORATION COUNSEL

Date 6/30/2020 *By* (signature)

(Rev. 7/03)

get:ltr:026acc02:jbf

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June 30, 2020

TO: Michael J. Molina, Chair
Governance, Ethics, and Transparency Committee
Maui County Council

FROM: Richelle M. Thomson, First Deputy Corporation Counsel

RE: Hawaii Wildlife, et al., v. County of Maui,
Civil No. 12-00198 SOM-KJM (GET-26)

Chair Molina and Members of the GET Committee:

Attached is a copy of a memo transmitted to the Councilmembers on April 24, 2020, describing the decision of the U.S. Supreme Court, which reversed and remanded the above-identified case to the Ninth Circuit Court of Appeals, with instructions to apply the new multifactor test set forth in the Supreme Court's order. The Ninth Circuit confirmed that the ruling was received and effective June 3, 2020.

Thereafter, the Ninth Circuit, in turn, remanded the case to the Hawaii District Court. On June 8, 2020, the parties held a status conference before the magistrate judge, who ordered briefing on whether additional discovery, including fact discovery and expert review, is warranted. The County's brief is attached, which details the factual information not yet in the record; the specific areas of expertise needed; and where more investigation, empirical observation, and scientific analysis and conclusions are required.

On June 29, the magistrate judge agreed with the County that further fact finding and discovery is warranted in light of the new test set forth by the Supreme Court. The magistrate set discovery deadlines over the next 4-6 months, and trial is presently set for July 2021. The magistrate judge has also ordered the parties to hold a settlement conference with former Magistrate Judge Barry Kurren, who was involved in the initial Hawaii District Court proceedings.

Regarding settlement: On May 30, 2020, Mayor Victorino proposed a settlement offer to the plaintiffs. On June 9, the Plaintiffs rejected this proposal and made a counterproposal. If the committee desires, these matters can be discussed in executive session.

At this time, the Department has not submitted a resolution requesting additional compensation for special counsel.

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April 24, 2020

TO: Alice L. Lee, Chair
Keani Rawlins-Fernandez, Vice Chair
Tasha Kama, Chair Pro Tem
Riki Hokama, Councilmember
Kelly King, Councilmember
Michael Molina, Councilmember
Tamara Paltin, Councilmember
Yuki Lei Sugimura, Councilmember
Shane Sinenci, Councilmember

FROM: Richelle M. Thomson, Deputy Corporation Counsel

RE: County of Maui, Hawaii v. Hawaii Wildlife Fund, et al., Docket No. 18-260, Supreme Court of the United States (LIT4996)

On April 23, 2020, the U.S. Supreme Court published its opinion and order in the above-identified case, which is attached for your reference. Every member of the Supreme Court agreed with the County and rejected the Ninth Circuit Court's previous decision in the Hawaii Wildlife case as being too expansive, beyond what Congress intended and into areas that are left to the states to regulate.

The Court ultimately took a middle road in its approach, resolving what had been inconsistencies not only for the application of the law in the Ninth Circuit, but across the United States. In its order, the Supreme Court set out a new test for determining whether the Clean Water Act applies to indirect discharges. The Court also confirmed that groundwater is not a point source, and regulation of groundwater is a state matter.

Although there has been a wide range of press opinions, the fact is that the Court did not issue a "win" or "lose" order. The Court also did not rule against the County or order that the County requires a Clean Water Act NPDES permit.

What the Court did is send the case back to the Ninth Circuit, with instructions to apply the Supreme Court's new "functional equivalent of a direct discharge" test. In doing so, the Supreme Court laid out some of the factors that the lower court must consider in determining whether or not the disposal of recycled water into wells at the Lahaina Wastewater Reclamation Facility requires an NPDES permit. Here are the factors that must be considered:

1. Transit time
2. Distance traveled
3. The nature of the material through which the pollutant travels
4. The extent to which the pollutant is diluted or chemically changed as it travels
5. The amount of pollutant entering the navigable waters relative to the amount of the pollutant that leaves the point source
6. The manner by or area in which the pollutant enters the navigable waters
7. The degree to which the pollution (at the point it enters the water body) has maintained its specific identity (Pg. 16)

At this point, it remains to be seen how the Ninth Circuit will reanalyze the case under the Supreme Court's more moderate and comprehensive test.

To recap, in Lahaina, the same highly disinfected, UV-treated recycled water that is unused on land for irrigation flows into the UIC wells. The water then mixes with groundwater and spreads out in a diffuse manner underground, where it undergoes certain chemical processes, such as denitrification (reduction of nitrogen). The "transit time" (when the recycled water/groundwater seeps into the ocean a half-mile away and over a 2-mile stretch) begins at 3 months from the time it is disposed into the wells and concludes approximately 4 years later.

The Court's clear direction under the Clean Water Act is precisely what the County sought in its petition to the U.S. Supreme Court. From a regulated entity standpoint, it would be preferable to have a more bright-line test, rather than one which is open to interpretation. However, the new test above offers important parameters and guidelines for the County and for the State Department of Health moving forward.

Please let me know if you would like to discuss this matter further.

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IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF HAWAII

HAWAI´I WILDLIFE FUND, SIERRA CLUB – MAUI GROUP, SURFRIDER FOUNDATION, AND WEST MAUI PRESERVATION ASSOCIATION, Plaintiffs, vs. COUNTY OF MAUI, Defendant.	CIVIL NO. 12-cv-00198 SOM-KJM DEFENDANT'S MEMORANDUM REGARDING FURTHER INVESTIGATION AND DISCOVERY; DECLARATION OF ERICSON JOHN LIST w/ Figures 1 and 2; DECLARATION OF CRAIG LEKVEN; DECLARATION OF SCOTT ROLLINS; **EXHIBITS A, B, C, D and E**; CERTIFICATE OF SERVICE The Honorable Susan Oki Mollway No Trial Date

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DEFENDANTS' MEMORANDUM REGARDING FURTHER INVESTIGATION AND DISCOVERY

I. INTRODUCTION

Following the United States Supreme Court's analysis and decision in County of Maui v. Hawai´i Wildlife Fund, et al., 140 S.Ct. 1462 (April 23, 2020), the District Court Magistrate directed the parties to submit briefing on the additional discovery that may be needed in this case.

In its decision the U.S. Supreme Court did not accept the over inclusive formulation that *all* pathways of groundwater discovered to carry "pollutants" into navigable waters from a point source confer liability under the Clean Water Act. The court noted that as distinguished from direct discharge liability, groundwater pathways from a point source would require a showing of being the "functional equivalent of a direct discharge." This determination is to be made by a multi-faceted analysis, taking into account *any number of factors*, several very clear illustrations of which were provided by the court.

For purposes of this memorandum, the *non-exclusive* factors articulated by the U.S. Supreme Court clearly indicate the inquiry involves consideration and analysis of an expanded range of factual, empirical, and scientific data and observation that are not adequately addressed, *or even contained* in the Tracer Dye Study largely relied on for this court's "conduit theory" of liability determination.

As discussed in detail below, and as evidenced in the attached exhibits and declarations of Ericson John List, Craig Lekven, and Scott Rollins, Defendant observes that the record below otherwise clearly indicated(s) **1)** where factual information was lacking, **2)** what specific areas of expertise require attention, and **3)** where more investigation, data, empirical observation, and scientific analysis and conclusions are needed.

The rulings in this case will be forward looking, and setting requirements for future NPDES permits across the country. It is therefore critically important that they be made on the fullest record possible.

II. BACKGROUND

On May 30, 2014, this court granted summary judgment to Plaintiffs as to the County's liability under the Clean Water Act, for discharges of recycled water from two of four injection wells (wells 3 and 4), alleged to cause pollutants to make their way to the Pacific Ocean.

ECF No. 113. On January 23, 2015, this court ruled that the County was similarly violating the Clean Water Act with respect to discharges from the remaining two injection wells, wells 1 and 2. ECF No. 162.

As to wells 3 and 4, this court articulated its "conduit theory" of liability:

> Under this court's reading of the Clean Water Act and the court's extrapolation from appellate law, Plaintiffs may also prevail if they show that the discharge into the groundwater below the LWRF is ***functionally equivalent to a discharge into the ocean itself***. That is, liability arises even if the groundwater under the LWRF is not itself protected by the Clean Water Act, ***as long as the groundwater is a conduit*** through which pollutants are reaching navigable-in-fact water.). (emphasis added).

See Order Denying Defendant's Motion for Stay and Granting Plaintiffs' Motion for Partial Summary Judgment ("Order Regarding Wells 3 and 4") ECF No. 113, PageID 3643-44,[1] filed May 30, 2014.

The pathways of groundwater, therefore, are the medium through which a "pollutant" from a point source may travel. In formulating its

---

[1] As to wells 1 and 2 the court found there was no dispute that the recycled water injected into these wells "enters ground water and eventually flows to the ocean." ECF No. 162, PageID # 5879. The court then ruled that Plaintiffs met the "point source requirement" because not all conduits must be "confined and discrete conveyances" under this this court's "conduit theory" of liability. Id.

"conduit theory" of liability, this court narrowly held "it is the migration of the pollutant into navigable-in-fact water that brings groundwater under the Clean Water Act." Id., PageID # 3647. On review, the Ninth Circuit Court of Appeals articulated an even more inclusive formulation. *See* Hawai´i Wildlife Fund, et al. v. County of Maui, 886 F.3d 737, 749 (9th Cir. 2018) ("We hold the County of Maui liable under the [Clean Water Act] because (1) the County discharged pollutants from a point source, (2) the pollutants are *fairly traceable* from the point source to a navigable water such that the discharge is the functional equivalent of a discharge into the navigable water, and (3) the pollutant levels are more than de minimus.") (emphasis added).

Reviewing the Ninth Circuit Court of Appeals' decision, the U.S. Supreme Court found both of these formulations insufficient. Rejecting the Ninth Circuit Court of Appeals' overly inclusive analysis, the U.S. Supreme Court requires consideration and analysis of an expanded range of factual, empirical, and scientific data and observation, beyond the point source formulation as the singular consideration to making a liability determination:

> We hold that the statute requires a permit when there is a direct discharge from a point source into navigable waters ***or***

> when there is the ***functional equivalent of a direct discharge***.
>
> * * * * *
>
> The difficulty with this approach, we recognize, is that it does not, on its own, clearly explain how to deal with middle instances. But ***there are too many potentially relevant factors applicable to factually different cases*** for this Court now to use more specific language. Consider, for example, just some of the factors that may prove relevant (depending upon the circumstances of a particular case): **(1)** transit time, **(2)** distance traveled, **(3)** the nature of the material through which the pollutant travels, **(4)** the extent to which the pollutant is diluted or chemically changed as it travels, **(5)** the amount of pollutant entering the navigable waters relative to the amount of the pollutant that leaves the point source, **(6)** the manner by or area in which the pollutant enters the navigable waters, **(7)** the degree to which the pollution (at that point) has maintained its specific identity. Time and distance will be the most important factors in most cases, but not necessarily every case.

See County of Maui, 140 S.Ct. at 1476 and 1477.

By setting out the above requirement for a "functional equivalent of a discharge" *as disjunctive* with point source liability, the U.S. Supreme Court clearly rejected the over inclusive formulation that all pathways of groundwater discovered to carry "pollutants" into navigable waters from a point source require an NPDES permit.

Moreover, rejecting the Ninth Circuit's "fairly traceable" analysis, the Supreme Court specifically observed:

> Given the power of modern science, the Ninth Circuit's limitation, 'fairly traceable,' may well allow EPA to assert permitting authority over the release of pollutants that reach navigable waters many years after their release (say, from a well or pipe or compost heap) and in highly diluted forms.
>
> * * * * *
>
> Our view is that Congress did not intend the point source-permitting requirement to provide EPA with such broad authority as the Ninth Circuit's narrow focus on traceability would allow.

See County of Maui, 140 S.Ct. at 1470.

Likewise, the U.S. Supreme Court confirmed that Congress did not intend direct discharge liability under the Clean Water Act, that would include *all* pathways of groundwater that may be discovered to carry "pollutants" into navigable waters:

> Congress left general groundwater regulatory authority to the States; its failure to include groundwater in the general EPA permitting provision was deliberate.
>
> * * * * *
>
> Whether pollutants that arrive at navigable waters after traveling through groundwater are 'from' a point source depends upon how similar to (or different from) the particular discharge is to a direct discharge.

See County of Maui, 140 S.Ct. at 1472 and 1476.

III. ARGUMENT

In determining Clean Water Act liability, this court, and the Ninth Circuit Court of Appeals after it, relied almost solely on the seepage of dye detected along coastal waters of West Maui after it was introduced into West Lahaina wells. The Tracer Dye Study Final Report [ECF No. 73-10] is the primary evidence in the record upon which these courts' rulings were based. The Tracer Dye Study, however, is only relevant to Wells 3 and 4. Moreover, as further demonstrated below, the study is demonstrably lacking investigation, data, empirical observation, and scientific analysis and conclusions otherwise *capable of being obtained*, and that is needed for the expanded inquiry mandated by the U.S. Supreme Court.

Specifically, as relied and ruled on previously, the record below is absent sufficient investigation, data collection, empirical observation, and scientific analysis and conclusions quantifying and/or even qualifying levels of diffusion, chemical change, and the comparative identity of the groundwater seeps with the recycled water injected at the well sites. Moreover, there is virtually no meaningful investigation, study, and analysis of the material make-up, identifiable environmental forces, and influences acting on the recycled water as it travels with groundwater along pathways from injection site to coastal areas.

A. THE TRACER DYE STUDY ALONE IS NOT SUFFICIENT FOR DETERMINING THE "FUNCTIONAL EQUIVALENT OF A DISCHARGE"

The elements of (1) transit time, (2) distance traveled, and (6) manner or area *of entry* (*factors 1, 2 and 6*) - appear to be the primary areas of inquiry of the 2012 Tracer Dye Study, as well as the factors this court found dispositive in its Order Regarding Wells 3 and 4. ECF No. 113, PageID ## 3640-3658. It is apparent that under the "conduit theory" articulated in the Order Regarding Wells 3 and 4, and the "fairly traceable" standard articulated by the Ninth Circuit Court of Appeals, the cornerstone of determining point source liability here was simply the detection of discharged recycled water that made it from point A (injection site) to point B (seeps at ocean).

While this observation is relevant to the consideration of wells 3 and 4 of the U.S. Supreme Court's expanded standard, as a preliminary matter it has to be recognized that these empirical findings have no bearing on the analysis of wells 1 and 2 under the standard. This is because the study failed to find any seepage from well 2, and did not include injection of dye into well 1. Therefore, no time or distance analyses are possible.

Moreover, even if pollutants from wells 1 and 2 eventually reach that ocean, the current state of the record precludes any analysis of any transit time, distance,[2] manner, and/or area by which the recycled water might speculatively enter the ocean from wells 1 and 2. As this court also noted elsewhere in its Order Regarding Wells 3 and 4, "*diffusion may sometimes be so great that it is no longer reasonable to conclude that any pollutant is reaching the ocean*." ECF No. 113, PageID # 3656. Unless and until there is actual detection of seepage from wells 1 or 2, there is simply no factual or evidentiary basis sufficient to conclude the disposal of recycled water into these wells meets the Supreme Court's standard for functional equivalency.

It is also notable that in rejecting the County's argument that groundwater cannot be a conduit because it is not "confined and discrete," the Order Regarding Wells 3 and 4 held that:

> There is ***no support, therefore, for creating a categorical exclusion*** for 'deep' groundwater. The core inquiry ***must be a case-by-case determination*** of whether pollutants are reaching navigable-in-fact water."

---

[2] While the linear distance of wells 1 and 2 from the ocean can be determined, there is no manner by which the time and distance of any actual seepage from these well sites can be determined, where no seepage can be shown to have occurred, and where the location of any anticipated discharge would be purely speculative.

See Order Regarding Wells 3 and 4, ECF No. 113, PageID # 3656. (emphasis added).

Likewise, there can be no categorical *inclusion* of each individual well as requiring an NPDES permit simply because it injects recycled water into the ground, that may eventually reach the ocean someday. The Supreme Court's additional factors for the "functionally equivalent" analysis requires that each well be subject to individual factual findings and independent analysis under the test. The Order Regarding Wells 3 and 4 also noted:

> The presence of the citizen suit provision demonstrates that Congress believed courts were competent to make ***fact-sensitive determinations*** over whether ***a particular discharge*** requires a permit."

ECF No. 113, PageID # 3632-33. (emphasis added).

This court acknowledged that no study confirms the "point of entry into the ocean of flow from [W]ells 1 and 2." *See* Hawai´i Wildlife Fund v. County of Maui, Civil No. 12-00198 SOM/BMK, 2015 WL 328227 at *2 (D. Haw. Jan 23, 2015). The Hawaii District Court based its finding of liability for Wells 1 and 2 on the general acknowledgment that all groundwater on an island eventually moves seaward, and groundwater-as-conduit.

As to wells 3 and 4, under the U.S. Supreme Court's standard the dye studies offer little more than data on *the manner* by which the discharge allegedly enters the ocean – i.e., in a diffuse manner along coastal distances over substantial variations in time. The Tracer Dye Study is largely inclusive as to the time and distance of the seepage from well 3 and 4 sites. As to the time of discharge, the Tracer Dye Study shows the transit time for the seeps vary very substantially. *See* attached Declaration of Ericson John List, ¶ 4, and **Exhibits B** (*Figure 1*) and **C** (*Figure 2*). As Dr. List has also observed, and as discussed further below in **SubSection D**, "since the known seeps represent only a small fraction of the injected wastewater, the transit time for most of the wastewater injected at wells #3 and #4 are also unknown." *See also* Declaration of Craig Lekven, P.E. ¶ 4 (noting that changes in dye concentration at the seeps documented in the Tracer Dye Study demonstrate that the transit time is not a discrete thing like "plug flow" [see note 1, supra.], but extremely variable and may be a statistical function of some kind.

Likewise, notwithstanding any determination of the actual distance of the seeps from wells 3 and 4, because the amount of recycled water actually reaching the ocean is uncertain, the distance of any seepage of a majority of the recycled water is uncertain. As discussed further below in **SubSection D**, the Tracer Dye Study's own admissions of uncertainties in its calculations of the amount of recycled water actually reaching the ocean, make calculations of time and distance from injection site to ocean entry highly questionable. *See* **SubSection D**, infra.; *see also* List Declaration, ¶¶ 4 & 5. In light of these limitations, the remaining considerations identified by the U.S. Supreme Court require additional focus in this case.

B. INVESTIGATION, DATA, OBSERVATION, ANALYSIS AND CONCLUSIONS ARE NEEDED REGARDING DILUTION LEVELS AND CHEMICAL CHANGES TO THE GROUNDWATER SEEPS AS COMPARED TO THE INJECTED RECYCLED WATER

The relevance of these considerations identified by the U.S. Supreme Court (*factors 4 & 7*), and more importantly, the indications of a need for more data and analysis, are demonstrated by the Tracer Dye Study itself and this court's Order Regarding Wells 3 and 4.

i. <u>DILUTION/DIFFUSION</u>

First, as noted in the attached Declaration of Craig Lekven, P.E., the dye injected into the wells 3 and 4 emerged months later - initially at minimal concentration, slowly increasing to a peak concentration, and then over the course of approximately four years, a gradual decrease in concentration until reaching zero. *See* Declaration of Lekven, ¶ 4 Moreover, the dye concentrations in the seeps was down near the detection limits. <u>Id.</u>, ¶ 5. This tracer behavior *evidences mixing and substantial dilution occurring during the groundwater journey within the aquifer*. <u>Id.</u>

The Order Regarding Wells 3 and 4 acknowledges the absence of scientific data in the record on the action of dilution identified by the U.S. Supreme Court:

> [W]ith regard to Plaintiffs' experts, the County objects that Smith's algal bloom study – Smith Decl. ¶ 9 – is prejudicial because it analyzes the impact of the water taken directly from the LWRF, without taking into account the diffusion and mixing that the effluent undergoes as it travels through groundwater and ocean water. ***The court recognizes that Smith's study does not account for these diffusion and mixing effects***, but nevertheless finds the study's analysis probative as to the potential effect that effluent has on marine life.

ECF No. 113, PageID # 3627.

The Order Regarding Wells 3 and 4 does acknowledge that "[o]f course, releasing water deeper underground ***may correlate to diffusion*** of a pollutant before it reaches the ocean. That ***diffusion may sometimes be so great that it is no longer reasonable to conclude that any pollutant is reaching the ocean***." ECF No. 113, PageID # 3656.[3]

A hydrologist with ground water modeling expertise would be able to model the dilution/diffusion that occurs in the aquifer, as well as assess the pathway of the diffuse flow of the recycled water/groundwater mix as it enters the ocean in locations other than the seep groups. Subsurface borings might assist with modeling. *See* Lekven Declaration, ¶ 6. A geotechnical firm would typically drill the borings, and supply a geologist to log the drillings in the field. Both counsel for the County and Mr. Lekven 's civil engineering firm have

[3] Under the Supreme Court's "functional equivalent of a discharge" standard, however, it obviously cannot be maintained that the County must show diffusion to completely eliminate seepage. On the other hand, the complete elimination of seepage *would* preclude liability under Clean Water Act entirely.

worked with Yogi Kwong Engineers and Hirata and Associates, two reputable geotechnical engineering firms in Honolulu. Id., ¶ 6.

ii. CHEMICAL CHANGE

Additionally, there appears to be substantial chemical change to the recycled water at the injection locations into the aquifer, and the material that is discharged at the seeps. The known sample measurements in the offshore seepage areas show substantially different water quality than the recycled water. *See* Declaration of Ericson John List, Ph.D., P.E., ¶ 7. Several factors could influence the altered chemistry of the recycled water as it enters the ocean. Id. One key factor is that the recycle water is injected deep enough in the aquifer that it is released within the salt water layer (the Ghyben-Herzberg lens) that is beneath every island. Id. This results in the increased salinity already observed by this court, and increased magnesium and sulfate in the recycled water that actually enters the ocean. Id. In addition, there are increased phosphate levels measured at the seeps, which may come from leaching of the aquifer rock, or from residual fertilizers from prior agricultural activity. Id. Wells inland from the injection wells show high levels of phosphate and nitrates and these groundwaters must commingle with the recycled water. Id.

The Order Regarding Wells 3 and 4 also does not reflect that chemical changes to the recycled water were considered in any way. Rather, on pages 5 through 7 the Order refers to alleged changes in "the chemical, physical, and biological integrity *of the nearshore waters*." *See* ECF No 113, PageID ## 3618-19 (citing generally Declaration of Adina Paytan, ECF No. 73-1, ¶¶ 5, 23-26, Declaration of Jennifer E. Smith, ECF No. 72-2, ¶¶ 13-4 and noting "Plaintiffs' experts conclude that the water near the seeps has elevated levels of inorganic nitrogen and phosphorus, low salinity, low pH, and high temperatures."). (emphasis added). The Order refers to alleged impacts of "additional nitrogen and phosphorus" in the nearshore water. Id., # 3519. (citing Smith Decl. ¶13). The Order refers to alleged impacts of "lower pH levels and oxygen concentration" of the discharge flowing into the ocean. Id., pp. 6-7 (citing Smith Decl. ¶¶ 29, 35, and Paytan Decl. ¶¶ 31, 34). The Order refers to the impacts of the discharge as allegedly having a "lower salinity and higher temperature than the receiving water[.]" Id., # 3620 (citing Paytan Decl. ¶¶ 25-29 and Smith Decl. ¶¶ 31-33, 37-38).

None of these observations about the alleged *changes to the nearshore water*, or the alleged impacts as caused to the nearshore water by the discharge at the seeps, speak directly (or even indirectly) to the dilution/diffusion, changes, and alterations to the chemical make-up occurring to the recycled water as it travels from the injection site. The Order Regarding Wells 3 and 4 does recognize "[t]he County's expert, Paulsen, maintains that, 'as groundwater moves through the subsurface, various chemicals and biological reactions can occur that alter the characteristics of the groundwater." ECF No. 113 PageID # 3653 (citing Paulsen Decl. ¶ 17, ECF No. 79-3). No other findings or observations were made.[4]

An isotopic geochemist should be retained to investigate, gather data, and analyze the substantial chemical changes occurring to the recycled water between the point of injection and the seeps. Dr. List has identified John Lambie, PEG as a candidate. *See* List Declaration, ¶ 7. The investigation would likely involve analysis of the source of the

[4] While the Order Regarding Wells 3 and 4 notes that this observation does not indicate transformation of the recycled water into something other than a "pollutant" [ECF No. 113, PageID # 3653], under the U.S. Supreme Court's expanded analysis no such showing is required.

phosphate levels measured at the seeps, that Dr. List observes may come from leaching of the aquifer rock or from residual fertilizers from prior agricultural activity. Id. As also observed by Dr. List, groundwaters from wells inland from the injection well sites showing high levels of phosphate and nitrates may be commingling with the recycled water. Id.

Finally, as at odds with the assertions by Plaintiffs, and certain of the findings in the Order Regarding Wells 3 and 4, ocean quality testing by the State Department of Health around the seeps consistently showed very similar values as compared to other DOH testing sites around the island that are not influenced by the seeps. *See* Rollins Declaration, ¶ 7. This discrepancy seems to have fallen from discussion, giving way to lengthy, questionable allegations of impacts to the reefs in the nearshore waters at the seep locations.

Evidence of alleged effects otherwise does not answer questions of quantitative dilution/diffusion, and the comparative chemical make-up of the discharge at the area of seepage as compared to the site of injection where the wells are located.

C. INVESTIGATION, DATA, OBSERVATION, ANALYSIS AND CONCLUSIONS ARE NEEDED REGARDING THE MATERIAL MAKE-UP, IDENTIFIABLE ENVIRONMENTAL FORCES, AND INFLUENCES ACTING ON THE RECYCLED WATER

Given the Supreme Court's attribution of significance to "the nature of the material through which the pollutant travels," the conclusion in the Order Regarding Wells 3 and 4 that "[n]othing in the Act supports relying on the manner in which the pollutants *travel* to determine liability" needs to be revisited. ECF. No. PageID # 3657. More in line with the U.S. Supreme Court's thinking, this court in in its Order Regarding Wells 1 and 2 had already expressly observed that "in determining whether pollutants are reaching the navigable-in-fact water. . . "[o]ther factors, *such as the permeability of the rock*, may be equally important[,]" ECF No. 3656. (emphasis added).

In this regard, the 1½-page summary in the Tracer Dye Study about the general geological make-up of the island is insufficient. It does not appear that either the Plaintiffs or Defendant have done any meaningful investigation on the make-up of the substrate and rock material through which the groundwater travels before seeping into ocean.

While it has been assumed that the rock material between the point of injection and the area of discharge is similar to that observed during the drilling of the injection wells, this is not really known. *See* Declaration of Scott Rollins, ¶ 2; *see also* attached Declaration of Ericson John List, ¶ 6. A geotechnical engineer and geologist would also assist in gathering necessary core samples and data to analyze what is known about the underlying substrate, and the lithological make-up through which the ground water travels from injection site to the ocean. This would include mineral composition of the subterranean pathways groundwater travels as it makes its way makai. This data would also inform a determination of chemical changes occurring to the recycled water (*factor 4*) as well as the specific identity of the discharge at the seeps (*factor 7*).

As Dr. List has also noted, the Tracer Dye Study fails to account for *geothermal activity* in reporting measurements within the submarine springs. *See* **SubSection E**, infra. In addition to the lithological and mineralogical make-up of the substrate, a geologist and geotechnical engineer can investigate and analyze the geothermal properties of the material through which the treated discharge travels.

None of the experts retained in this case to date have expertise in the apparently critical disciplines of geology or lithology.

Generalizations and/or assumptions about the make-up about the material substrate would seem inadequate in light of this express factor of the Supreme Court's expanded analysis. Additionally, in light of **1)** the significant area(s) of land mass between the well sites and the ocean, **2)** what are undoubtedly potential significant variations in substrate material from point of discharge to areas of seepage, *and* **3)** how different areas and variations in the material make-up of the earth along any path of ground water travel may cause differing levels of diffusion, chemical change, and alteration of the specific identity of the treated discharge from injection site to areas of seepage, a geologist assisted by a geotechnical engineer appear required for this case.

A geotechnical firm could also retain a geophysicist as useful to this area of investigation. The current science of geophysics includes the ability to conduct non-invasive subsurface surveys, using electrical resistivity. *See* Lekven Declaration, ¶ 7.

D. AN ANALYSIS OF THE AMOUNT OF SEEP INTO THE OCEAN AS RELATIVE TO THE AMOUNT OF RECYCLED WATER INJECTED AT THE WELL IS NEEDED

Extrapolation of the amount of pollutant entering into the ocean relative to the amount of pollutant that leaves the injection site appears as another inquiry insufficiently addressed by the Tracer Dye Study.

The Order Regarding Wells 3 and 4 relies exclusively on the Tracer Dye Study for a determination as to the amount of seep into the ocean from the injection site:

> The central finding of the Tracer Dye Study – and the centerpiece of Plaintiffs' case – is that '64% of the treated wastewater injected into wells [3 and 4] currently discharges from the submarine spring areas' and into the ocean. Tracer Dye Study at ES-2, 3; Paytan Decl. ¶ 18. Because wells 3 and 4 'receive more than 80 percent of the treated wastewater,' see Tracer Dye Study ES-21, it appears over 50% of the wastewater discharged at the LWRF emerges into the ocean.

ECF No. 113, PageID ## 3652-53 (citing Tracer Dye Study at ES-2)("We have estimated that once the tracer dye break through curve has reached completion, that 64 percent of the dye injected into Wells 3 and 4 will have been fully discharged at the submarine spring areas. Thus, as viewed at steady state, it is also our conclusion based on these calculations that 64 percent of the recycled water injected into these wells currently discharges from the submarine spring areas."); and Paytan Decl. ¶ 18).

The Order Regarding Wells 3 and 4 also acknowledges that "[t]his court recognizes that, in the absence of a tracer dye study, *depth, diffusion, and distance might serve as proxies to help determine <u>how much</u>*, if any, *pollutant is reaching navigable-in-fact water*. But such approximations are unnecessary when pollutants have been precisely traced from the point of discharge to the ocean." ECF No. 113, PageID # 3658. (emphasis added).

As noted by defense expert Dr. List, **1)** the Tracer Dye study recognizes "significant uncertainties" with its own estimates," of volume/amount, and **2)** there is "very substantial variability not accounted for in the calculations of the 64%:"

> In my professional opinion, and as acknowledged by the Tracer Study authors, there are "significant uncertainties" with the Tracer Study estimates of the amount of effluent from Wells 3 and 4 that enters the ocean through the Diffuse Flow Area. As the Tracer Study explains, while the percent of recovered dye mass can be used to estimate the fraction of effluent entering the ocean through the Diffuse Flow Area, "it must be stressed that there are significant uncertainties associated with these calculations." Ex. 3, at 4-20. Likewise, "[t]here is significant uncertainty associated with the effluent percentage estimated . . . ." due to the multiple

> assumptions made in performing the calculations Ex. 3, at 4-21.
>
> * * * * *
>
> In summary, the freshwater flows used to calculate the tracer dye recovery, which forms the basis for the 64% effluent fraction in the Diffuse Flow Area are subject to ***very substantial variability that was not accounted for*** in the calculation of the 64%.

ECF No. 137-1, PageID ## 4563- **Exhibit A** (2015- List Decl., ¶¶ 45 and 46 through 57) (providing an extended and detailed mathematical analysis of the calculations presented by the Tracer Dye Study).

As otherwise observe by Dr. List:

> The springs, which have been identified as ocean points of release from wells #3 and #4 have ***estimated discharged of 400 cubic meters per day while the injected waste water flow rate is of the order of 10,000 cubic meters per day***. In other words, the location of discharge of only a very small fraction of the injected waste water has actually been identified and the rest must be a diffuse discharge over a significant area.

See attached List Declaration, ¶ 8 (emphasis added); *see also* Rollins Decl., ¶ 3 (noting competing contentions among University of Hawai´i researchers as to the methods of calculation and percentage(s) of recycled water discharged at the seeps), and **Exhibit D**.

In light of the above, and in light of the Tracer Dye Studies' own admissions, not exclusively, there are clearly substantial uncertainties in the Tracer Dye Study's estimate of discharged recycled water at 64%.

It appears that further investigation and analysis should occur that may account for the appreciable variability, and differing contentions as to the amount of recycled water allegedly discharged at the seeps. These studies would take into account "*depth, diffusion, and distance,"* which this court observed *"might serve as proxies to help determine* <u>*how much*</u>, if any, *pollutant is reaching navigable-in-fact water*." ECF No. 113.PageID # 3658.

In light of Dr. List's extremely detailed calculations and analysis, the Order Regarding Well 3 and 4's observations that the County only at the hearing "disputed the specific quantities stated in the Tracer Dye Study," and observation that "[w]hat the County failed to do was explain why it believed the quantities cited in the Study were incorrect," should fairly be revisited. ECF No. 113, PageID # 3653. While List's complex analysis may or may not have been presented at the oral argument, or a matter of record at the time, they are a matter of record now and should be given some weight.

E. INVESTIGATION, DATA, OBSERVATION, ANALYSIS AND CONCLUSIONS ARE NEEDED REGARDING THE SPECIFIC IDENTITY OF THE WATER EXITING THE GROUNDWATER SEEPS AS COMPARED TO THE RECYCLED WATER

The declaration testimony of Dr. List reveals another fundamental limitation of the Tracer Dye Study, in the context of this particular factor and analysis under the U.S. Supreme Court's ruling for determining Clean Water Act liability. While a necessary means for discovering pathways, the usefulness of the Tracer Dye Study did not go much further beyond that:

> The point of using a tracer to try and identify the ocean discharge of the waste water was because it is extremely difficult to readily identify the waste water by any other means. There is no obvious unique and readily accessible waste water identifier that does not require intensive laboratory analysis. However, once the seep discharge could be associated with the injected waste water by means of an injected tracer, ***other measurements within the spring seeps showed parameters that could not be associated with the waste water***. In particular, ***temperature measurements within the seeps disclosed transient high temperature anomalies*** (*see* ECF No. 137-2, PageID # 4599 - Table 7, List Expert Report) ***that could not possibly be sourced to the injection wells***. A second parameter measured in the seeps that cannot be associated with the injection wells, and also appears unique to the seeps, is ***the high level of the radium isotope 224 in the seep discharge*** (see Table 9.2 , Expert Report) [ECF No. 137-2, PageID # 4604]. In the absence of any other explanation ***these temperature and radium anomalies in the seeps are strongly suggestive of a geothermal***

> ***source for the springs and make it clear that the "pollutant" has not maintained its specific identity.***

See attached List Declaration, ¶ 9.

Of course, geothermal sources for elevated temperatures in groundwater should come as no surprise to any inhabitant on a volcanic island. In fact, Dr. List found records of geothermal activities in the Lahaina and larger West Maui area dating back to as early as the 1930s. ECF No. 137-2, PageID # 4600. As compared to the recycled water at the injection site, the water at the seeps now is as much as 1° Celsius [33° Fahrenheit] warmer. *See* Rollins Declaration, ¶ 5.

It should be apparent even to a lay person, that these environmental forces will also potentially cause chemical changes to recycled water traveling groundwater pathways. The effects of this geothermal activity on groundwater, and on the recycled water that travels along its pathways from the Lahaina wells, is also another area of inquiry for a geochemist, assisted by a geotechnical engineering firm and a geologist.

IV. CONCLUSION

In light of the U.S. Supreme Court's holding in County of Maui v. Hawai´i Wildlife Fund, et al., 140 S.Ct. 1462 (April 23, 2020), and the expanded and multi-faceted inquiry that court has imposed for the determination of liability under the Clean Water Act, it is incumbent on the parties and the District Court to more thoroughly investigate whether the injected recycled water is functionally equivalent to any seepage into the ocean.

Defendant anticipates Plaintiffs will be opposing any further investigation, opposing further discovery, and asking for summary judgment. In light of the U.S. Supreme Court's decision, this would clearly be inappropriate. The rulings in this case will be forward looking, and setting requirements for future NPDES permits across the country. It is therefore critically important that they be made on fullest record possible.

DATED: Wailuku, Maui, Hawaii, June 22, 2020.

MOANA M. LUTEY
Corporation Counsel
Attorney for Defendant/Appellee
COUNTY OF MAUI

By /s/ Brian A. Bilberry
BRIAN A. BILBERRY
Deputy Corporation Counsel

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF HAWAII

HAWAI´I WILDLIFE FUND, SIERRA CLUB – MAUI GROUP, SURFRIDER FOUNDATION, AND WEST MAUI PRESERVATION ASSOCIATION, Plaintiffs, vs. COUNTY OF MAUI, Defendant.	CIVIL NO. 12-cv-00198 SOM-KJM DECLARATION OF ERICSON JOHN LIST; **EXHIBITS A, B, and C**

DECLARATION OF ERICSON JOHN LIST

I, Ericson John List, declare as follows:

1. I am a Registered Civil Engineer (State of California) and an *Emeritus* Professor of Environmental Engineering Science at the California Institute of Technology. I hold Bachelor's degrees in Mathematics and Engineering and a Masters degree in Civil Engineering from the University of Auckland. I was awarded a Ph.D. degree in Applied Mechanics and Mathematics by the California Institute of Technology. I have more than 50 years of research, teaching and consulting experience in the determination of

the fate and transport of pollutants in the environment, in particular in rivers, lakes, groundwaters and the coastal ocean. On these topics I have co-authored more than 50 peer reviewed articles in scientific and engineering journals. My consulting experience has involved the analysis of polluted ground waters involving sewage, DDT, perchlorate, arsenic, chromium, volatile organic compounds and other metals, and the development of NPDES permits for ocean outfalls in Hawaii and elsewhere. My education, research and practical experience with ocean outfalls and contaminated groundwater flows have provided me with the scientific basis and expertise to assist with the court's evaluation and determination of whether the LWRF injection wells are the "functional equivalent of a direct discharge." My qualifications as a witness and *curriculum vitae* are already a matter of record in this case. ECF No. 137-2, PageID ## 4639-47.

I offer this Declaration as a discussion on the need for further investigation and studies in this case, as follows:

2. In preparing this declaration I have reviewed the Expert Report, dated October 30, 2014, that I previously prepared for the County of Maui in the matter of Hawai'i Wildlife Fund, *et al.*, v. County of Maui, CIV. No. 12-00198. ECF No 137-2. The material in

that Expert Report forms the basis for the opinions that are set forth in this declaration. Additionally, my Declaration attached here as **Exhibit A**, and dated December 19, 2014 has been previously filed in this case. ECF No. 137-1.

3. I have also reviewed the US Supreme Court ruling in the case County of Maui v. Hawaii Wildlife Fund, No. 18-260, an important section of which is quoted herewith:

' Whether pollutants that arrive at navigable waters after traveling (sic) through groundwater are "from" a point source depends upon how similar to (or different from) the particular discharge is to a direct discharge.

The difficulty with this approach, we recognize, is that it does not, on its own, clearly explain how to deal with middle instances. But there are too many potentially relevant factors applicable to factually different cases for this Court now to use more specific language. Consider, for example, just some of the factors that may prove relevant (depending upon the circumstances of a particular case): (1) transit time, (2) distance traveled, (3) the nature of the material through which the pollutant travels, (4) the extent to which the pollutant is diluted or chemically changed as it travels, (5) the amount of pollutant entering the navigable waters relative to the amount of the *pollutant that leaves the point source, (6) the manner by or area in which the pollutant enters the navigable waters, (7) the degree to which the pollution (at that point) has maintained its specific identity. Time and distance will be the most important factors in most cases, but not necessarily every case.'*

In what follows, I address certain of these factors:

4. **Transit time** – There are four injection wells and the time taken for a specific molecule injected into the aquifer to reach the ocean, which is the point of discharge where an NPDES permit analysis would be performed, varies substantially. This a consequence of the tortuous paths injected molecules can take through the aquifer. For injection wells #1 and #2 the area of discharge into the ocean has never been determined, so this transit time is completely unknown. For wells #3 and #4 there are two known seep areas that have been identified and tracer studies show that the transit time to these seeps varies very substantially. **Exhibit B** (*Figure 1*), attached to this Declaration shows the measured concentration of tracer at the Southern Spring Group (a seep area) as a function of time from tracer release at the injection wells. The peak concentration occurred approximately 250 days after tracer release, but, as is evident significant tracer was still arriving

after 500 days. The average travel time was about 336 days (obtained by fitting an empirical distribution curve to the data). Similarly, **Exhibit C** (*Figure 2*) attached shows for the Northern Spring Group the peak tracer concentration arrived 250 days or thereabout after the tracer release, while a concentration tail dragged on after 500 days. The computed average travel time was about 417 days. As noted below, since the known seeps represent a small fraction of the discharge of injected waste water the transit time for most of the waste water injected at wells #3 and #4 are also unknown. By comparison, for an ocean outfall, where the point of discharge is precisely known and must be specified in an NPDES permit, the transit time from the treatment plant to the ocean is, for example, at the East Honolulu Wastewater Treatment Plant (EHWWTP) about 5 *minutes*.

5. **Distance travelled** – For injection wells #1 and #2 the distance pollutant travels is unknown because the point of entry of the injected waste water from these wells has never been identified, despite two tracer studies performed for well #2. For wells #3 and #4 the distance from the point of injection to the recognized seeps is about 1000 meters, but as will be discussed below these seeps are but a small fraction of the waste water discharged to the ocean and the

actual distance travelled for most of the waste water is unknown. For a typical ocean outfall, *e.g.,* EHWWTP, this distance is about 425 meters, although some outfalls are much longer.

6. **Nature of material through which the pollutant travels** – it is assumed that the material between the point of injection and the area of discharge is similar to that observed during the drilling of the injection wells, but this is not really known. The services of an expert local geologist should be retained to offer an expert opinion.

7. **The extent to which the pollutant is diluted or chemically changed as it travels** – Again for injection wells #1 and #2 this is not known because there are no ocean-based samples of the waste water injected at these wells at the point of its release to the ocean. For wells #3and #4 there are samples taken from the waste water and from the seeps that offer some insight into the chemical changes that occur in the passage from the injection wells to the seeps. There are several factors that influence the altered chemistry of the waste water as it enters the ocean. One key factor is that the waste water is injected deep enough in the aquifer that it is released within the salt water layer (the Ghyben-Herzberg lens) that is beneath every island. This results in increased salinity, and

increased magnesium and sulfate in the injected water that actually enters the ocean. In addition there are increased phosphate levels measured at the seeps, which may come from leaching of the aquifer rock or from residual fertilizers from prior agricultural activity. Wells inland from the injection wells show high levels of phosphate and nitrates and these ground waters must commingle with the injected waste water. The dilution and chemical changes of the injected waste water between the point of injection and the seeps could possibly be determined by an expert isotopic geochemist, such as John Lambie, PEG. To summarize, the known sample measurements in the offshore springs show substantially different water quality than the injected waste water.

8. **The manner by or area in which the pollutant enters the navigable waters** – The ocean release location for waste water from wells #1 an#2 is not known and, based upon the inability of the dye studies to locate the discharge from well #2, it must presumably be very diffuse. The springs, which have been identified as ocean points of release from wells #3 and #4 have an estimated discharge of 400 cubic meters per day while the injected waste water flow rate is of the order of 10,000 cubic meters per day. In other words, the location of discharge of only a very small fraction

of the injected waste water has actually been identified and the rest must be a diffuse discharge over a significant area.

9. **The degree to which the pollution (at that point) has maintained its specific identity-** The point of using a tracer to try an identify the ocean discharge of the waste water was because it is extremely difficult to readily identify the waste water by any other means. There is no obvious unique and readily accessible waste water identifier that does not require intensive laboratory analysis. However, once the seep discharge could be associated with the injected waste water by means of an injected tracer other measurements within the spring seeps showed parameters that could not be associated with the waste water. In particular, temperature measurements within the seeps disclosed transient high temperature anomalies (*see* ECF No. 137-2, PageID # 4599 - Table 7, List Expert Report) that could not possibly be sourced to the injection wells. As second parameter measured in the seeps that cannot be associated with the injection wells, and also appears unique to the seeps, is the high level of the radium isotope 224 in the seep discharge (see Table 9.2 , Expert Report). In the absence of any other explanation these temperature and radium anomalies in the seeps are strongly

suggestive of a geothermal source for the springs and make it clear that the "pollutant" has not maintained its specific identity.

10. **Uncertainty**- There are a number of uncertainties in the data that have been collected to describe the injection well discharges, in particular using the chemistry and isotopic composition of the waste water and ocean waters to arrive at better descriptions of the waste water dispersion in the ocean. Much of this could possibly be resolved by a careful analysis of the data by a recognized isotopic water chemistry expert such as John Lambie, PEG.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and ability.

DATED: June 23, 2020, Papamoa Beach, New Zealand.

ERICSON JOHN LIST, Ph.D., P.E. (CA)

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IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF HAWAII

HAWAIʻI WILDLIFE FUND, SIERRA CLUB – MAUI GROUP, SURFRIDER FOUNDATION, AND WEST MAUI PRESERVATION ASSOCIATION, Plaintiffs, vs. COUNTY OF MAUI, Defendant.	CIVIL NO. 12-cv-00198 SOM-KJM DECLARATION OF CRAIG LEKVEN

DECLARATION OF CRAIG LEKVEN

I, Craig Lekven, declare as follows:

1. I am a registered engineer in the State of Hawai´i and California, and have 31 years of extensive experience planning and designing wastewater treatment and recycling infrastructure projects and systems. I have experience with facultative ponds, aerated lagoons, constructed wetlands, as well as planning and design of natural wastewater treatment systems, including constructed wetlands and all three types of land application systems described in the USEPA Process Design Manual. My experience includes tenure as the Biosolids Program Manager and Recycled Water Program Manager for the Sacramento Regional County Sanitation District, which included the development of award-winning public outreach programs.

Currently, I am the Director in Brown and Caldwell's Maui office, and have managed projects for the County of Maui throughout my 12-year tenure on the island.

2. I was asked by the County of Maui to review and provide opinions on the Expert Disclosure Report by Ms. Lauren Roth Venu, dated February 9, 2015, earlier in this litigation.

3. I understand the United States Supreme Court has reviewed this matter, and issued an opinion providing guidance as to how a

determination is to be made about what constitutes a "functional equivalent of a discharge" requiring an NPDES permit. I offer this Declaration as observations on the need for further investigation and studies of the discharges into groundwater at issue in this case, as follows:

4. Unlike a traditional or direct discharge,[1] when the University of Hawai´i added dye to the injection wells at Lahaina, the dye emerged months later, first at minimal concentration, then slowly increasing to a peak concentration, and then a gradual decrease in concentration until reaching zero. This tracer behavior is the result of mixing and dilution occurring as the groundwater travels within the aquifer. This also shows that the transit time is not a discrete thing like plug flow [*see* note 1, supra.], but extremely variable and may be a statistical function of some kind.

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[1] Working with a discharge in the traditional sense (through a pipe), a discrete slug of a tracer into the flow for, say 1 hour for example, would result in the tracer emerging at the point source discharge and flow out for approximately 1 hour. This is what is called "plug flow." At the end of the discharging pipe, one would expect the tracer concentration to start at zero, rapidly increase to the tracer concentration for 1 hour, and then decrease rapidly to zero again.

5. Additionally, the tracer concentrations at the seeps were down near detection limits, also indicating substantial dilution during the groundwater journey.

6. A hydrologist with ground water modeling experience expertise would be able to model the dilution that occurs in the aquifer, as well assess where all of the injected waste water goes that is not appearing at the seeps. Subsurface borings might assist with this modeling. A geotechnical firm would typically drill the borings, and supply a geologist to log the drillings in the field. My firm has worked with Yogi Kwong Engineers and Hirata and Associates, Inc., both reputable geotechnical firms in Honolulu.

7. A geophysicist might also be useful for this case. The current state of the science and technology of geophysics includes the performance of non-invasive subsurface surveys using electrical resistivity.

8. A geochemist would also be able to assist with the investigation of chemical transformations that have been shown to occur in the groundwater at the seeps.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and ability.

DATED: June 22, 2020, Wailuku Maui, Hawai´i.

CRAIG LEKVEN, P.E. (HI, CA)

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IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF HAWAII

HAWAI´I WILDLIFE FUND, SIERRA CLUB – MAUI GROUP, SURFRIDER FOUNDATION, AND WEST MAUI PRESERVATION ASSOCIATION, Plaintiffs, vs. COUNTY OF MAUI, Defendant.	CIVIL NO. 12-cv-00198 SOM-KJM DECLARATION OF SCOTT ROLLINS, P.E.; **EXHIBIT D**

DECLARATION OF SCOTT ROLLINS, P.E.

I, Scott Rollins, declare as follows:

1. I am a civil engineer in the State of Hawai´i and California, have been employed by the County of Maui for over 21 years, and am currently Wastewater Reclamation Division (WWRD) Chief with the County of Maui's Department of Environmental Management. As a Senior Engineer in the Wastewater Division, I oversee wastewater planning, Capital Improvement Planning (CIP), permitting review, Recycled Water Program, Pretreatment Program, GIS program, Design and Construction Section and the Operations Section.

I am well acquainted with the Lahaina Wastewater Reclamation Facility, its injection well system at the center of this litigation, and familiar with the studies done by the University of Hawai´i to trace the injected wastewater from the well sites.

2. I am aware that the County's boring logs for the injection wells provide some information about the material substrate at the injection well site, and were available to the university research team. I am also aware that there have been some USGS reports on groundwater and soil types in the Lahaina area, but I am not aware that any geologic or soil studies and reports have been conducted and prepared of the area(s) between the wells and the ocean.

3. There has always been some debate among the scientists working on the study, as well as the WWRD, surrounding the percentage of recovered wastewater as seepage, and how it was derived. In particular, was Bob Whittier, who worked for UH at the time as the dye test and groundwater modeler for the study (and is now with the State Hawai´i Department of Health). He felt the method of estimation used in the study produced an overstated percentage and should be more toward 42%. Some methods of calculation put it even lower.

4. Attached here as **Exhibit D** is a true and correct version of Bob Whittier's e-mail to me, dated August 24, 2015.

5. There have also always been questions as to why and how the average temperature at the seeps was about 1° Celsius higher (and some samples 3 to 5° C higher) than the water discharged at the well sites. It was/is unclear how the disposed R-1 quality effluent would take 3-months to 4-years to reach the ocean through groundwater pathways yet would not tend toward the temperature of the groundwater and surrounding material while it traveled and if it did, why was it warmer?

6. There was a conductivity/temperature profile of an exploratory well drilled at what was in 2015 the Starwood Vacation

Ownership resort, the existence of which was not available during the university study. Further sampling at this site could be beneficial to understand the movement of groundwater, its composition and fate.

7. Finally, another matter that warrants further investigation and discussion is how the ocean quality testing by the State Department of Health at the seeps shows very similar values as compared to other DOH testing sites around the island that are not influenced by the Lahaina seep discharges.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and ability.

DATED: June 22, 2020, Wailuku Maui, Hawai´i.

SCOTT ROLLINS

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UNITED STATES DISTRICT COURT

DISTRICT OF HAWAII

HAWAI'I WILDLIFE FUND, SIERRA CLUB – MAUI GROUP, SURFRIDER FOUNDATION, AND WEST MAUI PRESERVATION ASSOCIATION,

Plaintiffs,

vs.

COUNTY OF MAUI,

Defendant.

Civil Case No. 12-00198 SOM BMK

DECLARATION OF E. JOHN LIST, PH.D., P.E. IN SUPPORT OF DEFENDANT COUNTY OF MAUI'S OPPOSITION TO PLAINTIFFS' MOTION FOR SUMMARY JUDGMENT RE: DEFENDANT'S LIABILITY FOR UNPERMITTED DISCHARGES INTO WELLS 1 AND 2

Hearing: January 12, 2015, 9:45 a.m.
Judge: Susan Oki Mollway
Trial Date: April 7, 2015

Related to: Dkt No. 129, Plaintiffs' 56.1 Concise Statement

EXHIBIT A

DECLARATION OF E. JOHN LIST, PH.D., P.E.

I, E. John List, Ph.D., P.E., declare as follows:

1. I am submitting this Declaration on behalf of Defendant County of Maui ("County") in support of the County's Opposition to Plaintiffs' Motion for Summary Judgment Re: Defendant's Liability for Unpermitted Discharges into Wells 1 and 2 ("Plaintiffs' Motion") in the above-referenced matter. I am over 21 years of age, and if called to testify, I could competently testify to the information provided below.

2. I previously provided an expert report dated October 30, 2014 in support of the County for this case. A true and correct copy of my report is attached as Exhibit 1. This declaration incorporates by reference all information provided in my report. Both my report and this declaration respond to statements made in the Declaration of Jean E. Moran, Ph.D. ("Moran Declaration") filed in support of Plaintiffs' Motion and Dr. Moran's Supplemental Expert Disclosure Report dated December 5, 2014 ("Moran Supplemental Report").

QUALIFICATIONS

3. I have 52 years of academic and professional experience analyzing the fate and transport of contaminants and tracers in the water environment, including rivers, lakes, groundwater and the coastal ocean.

4. I have a Bachelor of Engineering degree with First Class Honors from the University of Auckland (1961), a Bachelor of Science degree in Mathematics from the University of Auckland (1962), a Master of Engineering degree in Civil Engineering from the University of Auckland (1962), and a Ph.D. in Applied Mechanics and Mathematics from the California Institute of Technology ("Caltech") (1965).

5. Prior to joining the faculty at Caltech as an Assistant Professor in 1969, I spent three years as a lecturer and senior lecturer at the University of Auckland. From 1978 until 1997, I was a Professor of Environmental Engineering Science at Caltech. From 1980 until 1985, I was the Executive Officer for the Environmental Engineering Science Graduate Program at Caltech.

6. I am the co-author of the texts *Mixing in Inland and Coastal Waters* (Academic Press, 1979), *Turbulent Buoyant Jets and Plumes* (Pergamon Press, 1983), and the award-winning *Handbook of Groundwater Development* (Wiley, 1990). Additionally, I have authored or co-authored nearly 60 peer reviewed publications, most of which relate to contaminant fate and transport in the environment.

7. For six years (1984-1989) I was the chief editor of the American Society of Civil Engineers' *Journal of Hydraulic Engineering*, the Society's

principal publication for matters relating to fate and transport of tracers and contaminants.

8. I founded the consulting engineering company Flow Science Incorporated in 1983 and have been its Principal Consultant since 1997.

9. I have consulted on over 200 NPDES permits for industry and municipalities, more than 30 of which have involved discharges to coastal waters or the ocean.

10. A true and correct copy of my resume is attached as Exhibit 2.

11. As a result of 52 years of experience, I have the background needed to address the fate and transport of contaminants and tracers in the groundwater and coastal waters in the vicinity of the Lahaina Wastewater Reclamation Facility ("LWRF").

REFERENCES

12. In preparing this Declaration, I primarily relied on the following:

a. November 2012 University of Hawaii – *Lahaina Groundwater Tracer Study – Lahaina, Maui, Hawaii: Final Interim Report*;

b. June 2013 University of Hawaii – *Lahaina Groundwater Tracer Study – Lahaina, Maui, Hawaii: Final Report* ("Final Tracer Study") (collectively, 12.a and12.b are referred to as the

"Tracer Study"). A true and correct copy of excerpts of the Final Tracer Study is attached as Exhibit 3;

c. 2009 U.S. Geological Survey Scientific Investigations Report – *A Multitracer Approach to Detecting Wastewater Plumes from Municipal Injection Wells in Nearshore Marine Waters at Kihei and Lahaina, Maui, Hawaii* ("2009 USGS Report"). A true and correct copy of excerpts of the 2009 USGS Report is attached as Exhibit 4; and

d. Hawaii Department of Health ("HDOH") data collected at the submarine springs in the near-shore waters of Kahekili Beach between January 2012 and July 2014 ("HDOH Data").

MEASUREMENTS

13. The Final Tracer Study modeled flow from Wells 2, 3 and 4 to the ocean. The model results are depicted in Figures 4-39(a) and 4-39(b) of the Final Tracer Study. See Ex. 3, at 4-90. Figure 4-39(a) illustrates simulated particle tracking using the volumes of effluent injected into LWRF Well Nos. 2 – 4 during the term of the Tracer Study (Well 2 flow shown in green; Wells 3 and 4 flow in red). Figure 4-39(b) illustrates simulated particle tracking assuming effluent was injected only into Well 2 (flow shown in green), *i.e.*, no effluent was injected into Wells 3 or 4. This has never occurred. Plaintiffs' MSJ Ex. 14-21, 27-28; Ex. 5-6.

14. The following estimated measurements were determined by measuring areas identified in Figures 4-39 for modeled flow from Wells 2 (green) and 3 and 4 (red):

(i) effluent injected into Wells 2, 3 and 4 at the LWRF enters the ocean over approximately 3,300 meters, or more than two miles, of coastline (*i.e.*, the length from the furthest south red line to the furthest north green line of Figure 4-39(a));

(ii) regardless of whether Well 2 is operating, effluent injected into Wells 3 and 4 enters the ocean over approximately 800 meters or 0.5 miles of coastline in the vicinity of the submarine springs (*i.e.*, the entire length of spread of the red lines in Figure 4-39(a));

(iii) when Wells 3 and 4 are operating, effluent injected into Well 2 enters the ocean over approximately 1100 meters or roughly 0.7 miles (*i.e.*, the entire length of spread of the green lines in Figure 4-39(a)) roughly 1,200 meters or 0.75 miles north of the area where flow from Wells 3 and 4 enters (*i.e.*, the length between the furthest north red line and the furthest south green line in Figure 4-39(a)), so no effluent from Well 2 enters the ocean in the vicinity of the submarine springs; and

(iv) when Wells 3 and 4 are not operating, effluent injected into Well 2 enters the ocean over approximately 3,300 meters, or more than two miles of coastline, that spans both north and south of the submarine springs (*i.e.*, the entire length from the furthest south to the furthest north green line in Figure 4-39(b)).

15. According to the 2009 USGS Report, LWRF effluent moves toward and enters the coast in a "horseshoe-shaped" plume. Figure E3 of the 2009 USGS Report illustrates the horseshoe-shaped plume as illustrated by the red line in the figure. See Ex. 4, at v. Based on a measurement of the length of the intersection of the horseshoe-shaped plume with the coastline, groundwater containing effluent from the LWRF enters the ocean over more than 800 meters of coastline that extends both north and south of the submarine springs.

OPINIONS AND SUPPORT

16. My report provides background and more detail on most of the opinions expressed below. See Ex. 1.

17. In my professional opinion, effluent from the LWRF enters groundwater and travels through the subsurface toward the ocean in a broad and diffuse manner.

18. As illustrated in Figure 1-4 of the Final Tracer Study, effluent injected into Wells 1 and 2 enters the aquifer through an approximately 100 foot opening in each well. See Ex. 3, at 1-21. Upon entry into the groundwater, the effluent rises up to the fresh water/salt water interface and spreads both laterally and vertically.

19. As depicted in Figure 5 from the 2009 USGS Report, the effluent and groundwater mixture moves through the subsurface continuing to spread laterally and disperse. See Ex. 4, at 7.

20. In my professional opinion, which is based upon the close similarity between Kihei and Lahaina injection wells in aquifer properties, distance from shore of the injection wells, depth of effluent injection and the effluent flow rates, Figure 5 from the 2009 USGS Report is an accurate depiction of what subsurface flow would look like following injection of effluent into the LWRF wells. See Ex. 1, at 54.

21. Pollutants from other sources (including nutrient sources) migrate to groundwater. These pollutant sources mix with the groundwater/effluent mixture from LWRF wells as the groundwater moves toward the ocean. See, e.g., Ex. 4, at 3 for references to other sources of nutrient pollutants. The Final Tracer Study recognized but did not quantify other sources of nutrient pollutants. See Ex. 3, at 3-8.

22. In my professional opinion, (i) flow from Wells 3 and 4 influences where flow from Wells 1 and 2 enters the ocean; and (ii) flow from Wells 1 and 2 enters the ocean in a broad and diffuse manner. See Ex. 3, Fig. 4-39, at 4-90; Ex. 4, Fig. E3, at v; Ex. 8.

23. Based on modeling assuming a total injection rate of 12,100 m^3/day (3.2 million gallons/day, *i.e.*, mgd), the Tracer Study estimates that with Wells 3 and 4 operating, Well 2 flow enters the ocean over approximately 1100 meters or 0.7 miles of coastline in an area roughly 1200 meters or 0.75 miles north of the area where Wells 3 and 4 enter (*i.e.*, flow from Well 2 enters the ocean outside of the submarine springs when Wells 3 and 4 operate). Because Well 2 is upgradient from Wells 3 and 4, flow from Wells 3 and 4 displaces flow from Well 2 causing it to initially divert east and then travel in a northwesterly direction to the ocean. Ex. 3, at ES-21, 4-37. "The displacement significantly lengthens the travel path this [Well 2] dye takes and increases the dispersion." Ex. 3, at ES-21. Without Wells 3 and 4 operating, the Tracer Study modeling estimates Well 2 flow enters the ocean over 3,300 meters, or more than two miles, of coastline.

24. Both the Tracer Study and the 2009 USGS Report acknowledge that groundwater containing LWRF effluent may emerge in the ocean at locations other than those discussed in the respective reports. <u>See</u> Ex. 3, at 4-38−4-39. ("no conclusions can be made regarding the hydraulic connection between Well 2 and the nearshore waters at Kaanapali" and "a discharge point deeper and further from shore needs to be considered."; Ex. 4, at iii, 65 ("results do not preclude effluent discharging farther offshore.").

25. In my professional opinion, flow from the LWRF wells will likely enter the ocean over a larger area than estimated by the Tracer Study modeling as the Tracer Study modeling depicted in Figures 4-39(a) and 4-39(b) does not account for dispersion or diffusion. See Ex. 3, at 4-37.

26. In my professional opinion there is no unique "fast path" transporting effluent from the LWRF to the ocean. Moran Dec., at ¶¶ 19, 25-26. The heterogeneous nature of the subsurface environment leads to a broad distribution of particle flow velocities. This broad distribution of flow velocities creates dispersion that accounts for the initial, peak and trailing concentrations of dye illustrated in the breakthrough curve (BTC) for tracer injected at Wells 3 and 4 and measured at the submarine springs as identified and presented in the Tracer Study.

27. The comparison of the average (*i.e.*, mean) particle flow velocity of 1.7 to 2.1 meters/day measured in the Tracer Study (Ex. 3, at 4-52) to the average background groundwater flow velocity of 2.0 meters/day, computed using Darcy's Law from the aquifer data (hydraulic conductivity, porosity and hydraulic gradient) available in the Gingrich and Engott 2012 report (see Table 4 and p. 17) relied upon by Dr. Moran in her expert report, refute Dr. Moran's fast path argument. Essentially, the Tracer Study data show that the majority of the injected effluent travels in a manner that is little different from the natural groundwaters and at approximately the same average velocity (*i.e.*, 1.7-2.1 meters/day v. 2.0

meters/day). If there were such a "fast path" or a preferential flow path taken by the tracer dye particles, as claimed by Dr. Moran, then the average (*i.e.*, mean) velocity of particles on this path would exceed the natural groundwater flow velocity, but it does not. The fact that some tracer particles arrive before and after others is a reflection of the natural distribution of flow velocities that occur in any aquifer. This distribution of particle velocities is not accounted for in Darcy's Law of fluid flow, which is the basis for the MODFLOW aquifer modeling, which deals only in average velocity, which is why MODFLOW modeling cannot reproduce breakthrough curves.

28. There was no tracer study on Well 1 and, as Dr. Moran acknowledges, the Tracer Study did not unequivocally detect dye injected into Well 2 in August 2011 in the ocean. Moran Dec., ¶ 10 ("The SRB dye from Well 2 was not conclusively detected during the tracer dye study . . . ."). The 1994 Tetra-Tech tracer study conducted on behalf of EPA also did not detect dye from Well 2. The Moran Declaration does not reference the 1994 Tetra Tech study.

29. Other than in references to a "fast path", the Moran Declaration does not address the dispersion that occurs as LWRF effluent enters or flows through the subsurface. Likewise, the Moran Declaration does not discuss the 0.5 mile or the greater than 2 mile expanse of coastline where effluent could enter the ocean as estimated by the 2009 USGS Report and Tracer Study, respectively.

30. In my professional opinion, Table 1 of the Moran Declaration cannot be used to support conclusions pertaining to the similarity between the flow paths, travel times and dye dilution between Well 2 and Wells 3 and 4 in paragraphs 32-34 of the Moran Declaration. Dr. Moran uses dye concentrations and travel times measured at the submarine springs for dye injected into Wells 3 and 4 to predict the behavior and concentration of effluent injected at Well 2. However, these predictions are useless for inferring how effluent injected into Well 2 will behave with Wells 3 and 4 in operation. Since injection flow data show that Well 2 almost never operates without Wells 3 and 4 in operation, the conclusions about the concentration and travel times offered in paragraphs 32-34 of the Moran Declaration are inappropriate and irrelevant.

31. Relying on the Tracer Study, Dr. Moran maintains the mean travel time for effluent from the LWRF to reach the ocean is about 10 months. Moran Dec., ¶ 38.

32. In my professional opinion, because the LWRF operates 7 days a week, 24 hours a day, and the effluent takes on average 10 months to reach the ocean, a rolling monthly average of the relative well injection rates should be used in estimating the percentage of effluent from Wells 1 and 2 that actually enters the ocean at any given time. Static calculations, focusing on effluent injection rates in any discrete time period will not provide an accurate estimate of the fraction of

effluent from Wells 1 and 2 entering the ocean in that time period. See Moran Dec., ¶ 37 and Declaration of David L. Henkin, ¶¶ 30-31 for examples of Plaintiffs' usage of static time frames to allege percentage of effluent from Wells 1 and 2 that reached the ocean.

33. The maximum fraction of effluent from Wells 1 and 2 entering the ocean at any time between January 1, 2006 (the start date used by Dr. Moran) and November 15, 2014 can be "book ended" using the results of the Tracer Study and the injection flow rates. Relying on Dr. Moran's estimated effluent mean travel time, a ten month rolling average of injected flow rates is appropriate to use in calculating the lowest maximum fraction of effluent from Wells 1 and 2 that will appear at the coastline. Relying on the Tracer Study's conclusion that dye first appears at the submarine springs approximately three months after dye injection, a three month rolling average is appropriate to use in calculating the largest maximum fraction of effluent from Wells 1 and 2 that will appear at the coastline.

34. Tracer dye was added to Wells 3 and 4 in July 2011 and to Well 2 in August 2011. The ten month rolling average of effluent injected into Wells 1 and 2 between August 2010 and August 2011 (*i.e.*, 12 months before the Tracer Study) was 45%. The highest three month rolling average of effluent injected into Wells 1 and 2 during this same timeframe was 63%.

35. Plaintiffs' MSJ Exhibits 14-21 and 27-28 do not contain injection well data for (i) Well 3 between July 11, 2012 and August 31, 2012 and October 1, 2012 and February 28, 2013; or (ii) Well 4 between July 11, 2012 and February 28, 2013. A true and correct copy of the County's daily injection of effluent into Wells 1-4 between January 2011 and July 31, 2014 is attached as Exhibit 5.[1] A true and correct copy of the County's daily injection of effluent into Wells 1-4 between August 1, 2014 and November 15, 2014 is attached as Exhibit 6.

36. Based on monthly injection data between January 1, 2006 (the start date used by Dr. Moran) and November 15, 2014, the highest ten month rolling average for injection into Wells 1 and 2 was 54% in December 2006 and the highest three month rolling average was 72% in September 2014.

37. Exhibit 7 of this declaration provides true and correct copies of graphs prepared by me for the timeframe from January 1, 2006 through November 15, 2014 that illustrate (i) the monthly average percentage of total effluent injection for Wells 1 and 2; (ii) 10 month and 3 month rolling averages of the effluent percentage in Wells 1 and 2; and (iii) the monthly average of the daily total effluent injection rate for all four wells. The average daily rate of effluent injection

[1] Given the missing date ranges for effluent injected into Wells 3 and 4, it is unknown what data Dr. Moran relied upon in creating the Monthly Flow into LWRF Injection Wells from January 2006 through July 2014 contained in the Jean E. Moran, Ph.D. – Expert Disclosure Report, dated October 6, 2014.

during the period January 1, 2006 through November 15, 2014 was 13,300 cubic meters per day.[2]

38. Using a simplified mathematical model (also referred to as conservative because it does not take into account effluent mounding, dispersion, diffusion or the thinning of the aquifer near the coastline), I modeled Wells 1 and 2 operating as a pair and Wells 3 and 4 operating as a pair. I assumed an effluent injection rate of 13,300 m^3/day (*i.e.*, the daily average rate between January 1, 2006 and November 15, 2014) with Wells 1 and 2 receiving either 54% or 72% of the injected effluent.

39. Exhibit 8 of this declaration provides true and correct copies of illustrations of the modeling results conducted under my direction when either 54% or 72% of effluent is injected into Wells 1 and 2 (using a total injection rate of 13,300 m^3/day). This modeling shows groundwater containing effluent enters the ocean over approximately 1300 meters or 0.8 mile of coastline, in a similar horseshoe-shaped plume to that identified in the 2009 USGS Report. Because Wells 1 and 2 are upgradient of Wells 3 and 4, flow from Wells 1 and 2 is deflected around the flow of Wells 3 and 4, and enters the ocean along an area outside of and wider than flow from Wells 3 and 4. Flow from Wells 1 and 2

[2] Data contained in Plaintiffs' MSJ Exhibits 14-21 and 27-28 as well as Exhibits 5 and 6 of this declaration were used to perform the calculations referenced in this paragraph.

would enter the ocean outside of the Diffuse Flow Area containing the submarine springs as defined in paragraph 43 below. The boundary of flow from Wells 1 and 2 is shown in blue and that from Wells 3 and 4 is shown in green.

40. In my professional opinion, during the January 1, 2006 through November 15, 2014 timeframe, assuming a daily effluent injection rate of 13,300 m^3/day and a rolling monthly average for the percentage of effluent injected, regardless of the amount injected into Wells 1 and 2 during any discrete time period, flow from Wells 1 and 2 entered or will enter the ocean at an area outside of the Diffuse Flow Area containing the submarine springs as defined in paragraph 43 below.

41. The injection rate at the LWRF is not constant. Between August 1, 2014 and November 15, 2014, the average daily injection rate was 14,000 m^3/day. Accounting for a larger average daily injection rate, the overall plume would widen, meaning LWRF flow from all wells would reach the ocean over a broader area than the 1300 meters estimated by my modeling assuming the overall average effluent injection rate of 13,300 m^3/day. As the plume widens, the flow from Wells 1 and 2 still needs to pass around flow from Wells 3 and 4. As a result, flow from Wells 1 and 2 enters the ocean at coastline locations even further away from the Diffuse Flow Area containing the submarine springs as defined in paragraph 43 below.

42. The timeframe between February 1, 2007 through November 15, 2014 includes a total of 94 months and 2,845 days. In 13 out of 2,845 days, or approximately 0.46% of the relevant time period, both Wells 3 and 4 were not operating. In 80 out of 94 months, or in more than 85% of the relevant time frame, Wells 3 and 4 received more than 50% of the effluent injected from LWRF. Attached as Exhibit 9 is a true and correct copy of a graph I prepared summarizing the monthly percentage of flow injected into Wells 1 and 2 between January 2007 and November 15, 2014.

43. The Tracer Study refers to three separate measurements in the submarine spring area: (i) the diffuse flow area of 10,180 m^2 around the springs defined by the radon mass-balance derived groundwater fluxes ("Diffuse Flow Area"); (ii) the 2,300 m^2 area encompassing all submarine springs ("Submarine Spring Area"); and (iii) the 0.327 m^2 total flow area of the individual submarine springs ("Individual Spring Area"). The Diffuse Flow Area includes the Submarine Spring Area and Individual Spring Area. The Submarine Spring Area includes the Individual Spring Area. Attached as Exhibit 10 is a true and correct copy of Exhibit 14[3] from my October 30, 2014 Expert Report that illustrates the three areas with the Diffuse Flow Area in the black rectangles, the Submarine

[3] Note that Exhibit 14 incorrectly ascribes the total spring flow to the NSG. The spring flow in the NSG is estimated (Ex. 3, at 3-10) to be 62-220 m^3/d, not 83-296 m^3/d, which is the estimated total spring flow.

Spring Area in the pink boundaries, and the Individual Spring Area appearing as the colored dots. Using different methods, the Tracer Study estimates that 62%, 64% or 68% of effluent injected into Wells 3 and 4 enters the ocean in the Diffuse Flow Area. See Ex. 3, at ES-2–ES-3, ES-16.

44. There is no reference in the Tracer Study to 65% of effluent from Wells 3 and 4 entering the ocean through the submarine springs as cited in paragraph 9 of the Moran Declaration. The Tracer Study estimates that the average injection rate of LWRF effluent into Wells 3 and 4 was 9,340 m^3/d . Ex. 3, at 4-53. Since the estimated flow from the 2,300 m^2 Submarine Spring Area was 83- 296 m^3/d (Ex. 3, at 3-10) the submarine spring vents within this area must discharge at most between 0.8% and 3.2 % of all effluent injected into Wells 3 and 4 that enters the ocean and the more than 96.8% remaining enters the ocean as diffuse flow.

45. In my professional opinion, and as acknowledged by the Tracer Study authors, there are "significant uncertainties" with the Tracer Study estimates of the amount of effluent from Wells 3 and 4 that enters the ocean through the Diffuse Flow Area. As the Tracer Study explains, while the percent of recovered dye mass can be used to estimate the fraction of effluent entering the ocean through the Diffuse Flow Area, "it must be stressed that there are significant uncertainties associated with these calculations." Ex. 3, at 4-20. Likewise, "[t]here is

significant uncertainty associated with the effluent percentage estimated . . . . " due to the multiple assumptions made in performing the calculations. Ex. 3, at 4-21.

46. In estimating the fraction of effluent entering the ocean through the Diffuse Flow Area, the Tracer Study dye "recovery" calculations used a constant total rate of flow of 7,162 m^3/day for groundwater containing tracer dye entering the ocean within the 10,180 m^2 Diffuse Flow Area.[4] This was made up of 1,752 m^3/day at the NSG and 5,439 m^3/day at the SSG, as used in Table 4-14 (Ex. 3, at 4-53). These freshwater flow rates were derived from estimates of total submarine groundwater discharge (SGD) at the NSG of 2,500 m^3/day and 6,300 m^3/day at the SSG (Ex 3, Table 4-14, at 4-53), for a total SGD (saline plus fresh) flow of 8,800 m^3/day, that were corrected for the saline water content. These numbers are also repeated in Table 3-5(a) (Ex. 3, at 3-11). However, Table 3-4 (Ex. 3, at 3-10) gives SGD flow estimates of 2,500-3,400 m^3/day at the NSG and 5,900-9,200 m^3/day at the SSG, or a range of 8,400-12,600 m^3/day, so that the total SGD flow used to calculate the dye recovery in Table 4-14 (Ex. 3, at 4-53) is at the very low end of the estimated total SGD. Moreover, Table 3-5(a) (Ex. 3, at 3-11) gives freshwater SGD estimates for the NSG of 1,600 m^3/day and 4,950 m^3/day, which

[4] The Expert Disclosure Report of Adina Paytan, Ph.D., dated December 5, 2014 ("Paytan Report") takes issue with my use of the term "constant" flow rate saying the Tracer Study used and reported "an average" flow rate. Paytan Report, at ¶ 6. My use of the term "constant" is synonymous with Dr. Paytan's use of the term "average" as both refer to the Tracer Study's use of a single flow rate value of 7,162 m^3/day for effluent entering the ocean within the Diffuse Flow Area.

are significantly less than the SGD tracer dye fraction flows in Table 4-14 (Ex. 3, at 4-53) used to calculate the fraction of "recovered" tracer dye. In summary, the freshwater flows used to calculate the tracer dye recovery, which forms the basis for the 64% effluent fraction in the Diffuse Flow Area are subject to very substantial variability that was not accounted for in the calculation of the 64%.

47. Given the average effluent flow during the 10 month period prior to the dye injection was about 13,000 m^3/day, by presuming that the 7,162 m^3/day flow emanating from the 10,180 m^2 Diffuse Flow Area is all effluent affected, the analysis presupposes that 55% of the effluent is discharged in the Diffuse Flow Area, (7162/13000 = 0.55, or 55%).

48. The Tracer Study maintains that greater than 90% of the SGD in the Diffuse Flow Area enters the ocean as diffuse flow. See Ex. 3, at 3-4. Because the minimum estimated SGD in the Diffuse Flow Area is 8,400 m^3/day and the maximum estimated SGD in the Spring Flow Area is 296 m^3/day (Ex. 3, at 3-10) then more than 96% of the SGD enters the ocean as diffuse flow. The Tracer Study used dye concentrations measured at less than 1% of the total freshwater flows within the Diffuse Flow Area to calculate total dye recovery. The calculations did not account for the dye concentration in the Diffuse Flow Area outside of the Individual Spring Area, which accounts for more than 96% of the total flow. These diffuse flow dye concentrations were six-fold to ten-fold lower

than dye concentrations measured at the Individual Spring Area. See Ex. 3, Table A-6, at A-49–A-74.

49. As part of the Tracer Study, estimates of the percentages of upland waters, marine waters and LWRF effluent emanating from six (6) individual submarine spring vents were calculated using end member pair analysis based on the concentration of stable isotopes of oxygen, hydrogen and chlorine in the three waters. A total of eighteen (18) analyses were performed, but half the results were excluded because they yielded marine, effluent, or upland water fractions that were either negative or greater than 100 percent. See Ex. 1, at 38 for a true and correct copy of the Interim Tracer Study Table 6-14 (reproduced as Table 12 in my expert report). The remaining nine data sets estimated the percentage of effluent from Wells 3 and 4 that enters the ocean through the Individual Spring Area as ranging between 12% and 96%.

50. Section 5 of the Final Tracer Study explains the Tracer Test Design Model (TTDM). The TTDM was developed to estimate "the tracer dye dilution that would occur as it traveled from the injection wells to the submarine springs." Ex. 3, at 5-1. As the results of the initial TTDM were different than the actual measured dye concentrations from Wells 3 and 4, the TTDM was modified in an attempt to match the data. Id. at 5-7–5-8.

51. In my professional opinion this attempt to match the tracer dye breakthrough curve with the TTDM was a futile exercise. The basic problem is that the TTDM uses Darcy's Law to calculate the average velocity of fluid flow at points within the aquifer, which is perfectly reasonable and forms the basis of the MODFLOW model used in the TTDM. However, the transport and distribution of the injected tracer dye was modeled using an advection-dispersion model MT3DMS that utilizes the average velocity output of the MODFLOW code to describe how the tracer is carried (*i.e.*, advected) through the aquifer. The advection-dispersion model attempts to replicate impact of the natural distribution of particle velocities within the aquifer by using a dispersion coefficient. The fundamental problem is that the dispersion coefficient is symmetric and disperses, *i.e.*, spreads out, particles equally both forwards and backwards as they move through the aquifer. In other words, the dispersion replicates a particle velocity distribution that is symmetric, which it is definitely not, as shown by the very strong asymmetry of the tracer dye breakthrough curves. See Ex. 3, at ES-39. (The tracer breakthrough curves are actually a representation of the distribution of particle velocities.) In summary, the TTDM was attempting to model a physical process that was not represented in the modeling equations.

52. In an attempt to force this inappropriate model to deliver results that could in some way match the physical data represented by the BTCs, the modelers

tried a number of stratagems including by: (i) adjusting the way in which the hydraulic conductivity was allocated, *i.e.*, different hydraulic conductivities east-west, north-south and *vice versa*, (ii) trying various aquifer porosities, (iii) looking at the possibility of adsorption of the tracer dye to the aquifer medium, (iv) introducing a "fast path" or preferential pathway from the injection wells to the SSG, (v) adjusting the geometry of the downstream flow boundary, (vi) inserting and adjusting drains in the model at the location of the NSG and SSG, (vii) introducing a horizontal flow barrier (HFB) at the northern boundary of the model domain−but none of these ploys worked. The model simply failed to reproduce the physical data.

53. Despite this complete failure of the model, Figure 5-19 of the Tracer Study (Ex. 3, at 5-46) claims to show the estimated concentration of SRB dye from Well 2 when Wells 3 and 4 are operating (5-19(a)) and when only Well 2 is operating (5-19(b)) 620 days after dye injection. Ex. 3, at 5-18. According to Figure 5-19(a) (Ex. 3, at 5-46), SRB dye should have been detected over approximately 0.5 miles of coastline that spans north and south of the submarine springs at concentrations ranging from 0.05-4.0 parts per billion ("ppb") when Wells 3 and 4 were operating. The Tracer Study calculated the method detection limit for SRB dye as 0.013 or 0.005 ppb. Ex 3, at 4-32. Given the method detection limit is less than the concentration range of estimated SRB dye (0.05-4.0

ppb), Figure 5-19(a) (Ex. 3, at 5-46) indicates that dye from Well 2 should have been detected as part of the Tracer Study. However, no SRB dye from Well 2 was detected in the ocean as part of the Tracer Study. Ex. 3, at 5-19. Given the models failure to reproduce the physical data it is therefore highly likely that Figure 5-19 (Ex. 3, at 5-46) does not accurately represent either of the tracer dye injections.

54. Figure 5-16 (Ex. 3, at 5-43) illustrates other concerns with the TTDM results. This figure illustrates the estimated concentration of FLT dye injected into Wells 3 and 4. According to this figure, FLT should have appeared at concentrations over the method detection limit over more than 1.0 mile of coastline, including north of the HFB. The Tracer Study maintains that no effluent should be located north of the HFB because the results of the thermal images and the δ^{15}N data show that this section of coast is not impacted by the treated wastewater plume (Ex. 3, at 5-13).

55. For the reasons outlined in paragraphs 50 to 54 above, it is my professional opinion that the results of the TTDM cannot be relied upon to make any predictions about the fate of the effluent injected into Wells 2, 3 and 4. Given that the problems with the TTDM are not reflected in the average flows predicted by MODFLOW, and that the BTCs show average particle velocities closely related to the natural ground water velocity, the flow paths illustrated in Figures 4-39(a) and 4-39(b) (Ex. 3, at 4-90) are more likely to be a correct representation of the

fate of the injected effluent than that represented in Figures 5-19(a) and 5-19(b) (Ex. 3, at 5-46).

56. In my professional opinion, geothermal activity in West Maui accounts for an approximately 11% geothermally-driven water fraction in the material entering the ocean through the Individual Spring Area. The Tracer Study does not address the implications of geothermal activity in reporting measurements within the submarine springs.

57. In my professional opinion, LWRF effluent cannot adversely affect ocean water quality based on the five parameters identified in Plaintiffs' Motion for Summary Judgment on Wells 1 and 2, *i.e.*, nutrients, pH, salinity, dissolved oxygen ("DO") and temperature.

58. Nutrients: In October 2014, the United States Environmental Protection Agency approved the 2014 State of Hawaii Water Quality Monitoring and Assessment Report. This report shows that Kahekili Beach meets HDOH mandated nutrient water quality criteria. In addition to the reasons outlined in my expert report, this EPA-approved report supports my opinion that nutrients are not a concern at Kahekili Beach.

59. pH: The Tracer Study reports 603 pH measurements within the submarine springs. All but two of these had pH levels between 7.0 and 7.9, with the average pH being 7.5. The two other reported levels were 6.75 and 6.9 and

considering the large number of measurements above pH 7, would normally be considered as “outliers”. Hawaii water quality criteria for marine waters require a value within 0.5 units of 8.1 (*i.e.*, 7.6 to 8.6) “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.” H.A.R. § 11-54-6(a)(3). As groundwater enters the ocean at the submarine springs, the pH levels measured within the springs are consistent with Hawaii water quality criteria. pH is also not a concern for the other reasons identified in my report.

60. Salinity: The salinity of groundwater is consistently lower than seawater. The lower salinity measured within the springs is a natural phenomenon that is not specifically or uniquely related to the effluent from the LWRF. Lower salinity water enters the ocean along all sections of the Maui coastline. See Ex. 3, at 1-28

61. Dissolved oxygen: DO concentration in water is a function of temperature and exposure to the air. 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 and spring water is not significant. The DO content of injected effluent is on the order of 6.9 ± 0.3 mg/l. HDOH measured DO content within the submarine springs ranges from 6.07-6.87 ± 0.35. DO in the waters

immediately above the springs is indistinguishable from other coastal waters at control locations.

62. Table 6-17 of the Interim Tracer Study references a Swarzenski *et al.* USGS Open File Report 2012 as the source of DO data referred to in the Tracer Study. However, the Swarzenski *et al*. report does not contain DO data and states that although DO content was measured, the data were not included in the report. As the source of the DO data referenced in the Tracer Study is unknown, I did not consider it. The HDOH Data provide the only known source of DO data for the springs and nearby waters.

63. <u>Temperature</u>: The temperature of material within the submarine springs is controlled by the geothermal activity, not by effluent from the LWRF or by biological activity within the aquifer. LWRF effluent temperature generally ranges between 25.5-28.6°C (with a maximum recorded temperature of 30.9°C). Temperature measured within the springs was as high as 35.9°C, *i.e.*, 5 degrees higher than the maximum LWRF effluent temperature. The temperature within the springs rapidly fluctuates (as much as 5°C in a day) and varies over more than ten degrees (23.8°C to 35.9°C). There is insufficient biochemical material energy available to provide such heating. Geothermal activity explains the rapid temperature fluctuations and variability and the high concentrations of radium and radon in the spring water.

MORAN SUPPLEMENTAL REPORT RESPONSE

Below I respond to some of the concerns raised in the Moran Supplemental Report.

64. At footnote 4 of her supplemental report, Dr. Moran takes issue with my use of the term "submarine springs" or "springs" to refer to the individual submarine springs identified in the Tracer Study. Dr. Moran maintains that these should instead be referred to as "seep vents." As the Tracer Study uses the terms "springs" and "seeps" interchangeably, this does not appear to be a legitimate concern. Moreover, as explained in paragraph 43 above, the Tracer Study focused on three discrete areas related to the submarine springs: the Diffuse Discharge Area (10,180 m^2 around the springs within both seep groups as defined by radon mass-balance derived groundwater fluxes (this equates to Dr. Moran's "seep area")); (ii) the Submarine Spring Area (2,700 m^2 area encompassing all submarine springs or "all seep vents"); and (iii) the Individual Spring Area (0.327 m^2 total flow area of the individually monitored submarine springs or "individual seep vents").

65. To the extent Dr. Moran suggests that the flow entering the ocean at the individual submarine springs contains 100% effluent, she is incorrect. As Table 6-14 of the Interim Tracer Study illustrates, flow entering the ocean at the springs contained three different components or "fractions": effluent, natural

groundwater (referred to as the "well fraction"), and salt water (referred to as the "marine fraction"). A true and correct copy of Table 6-14 is reproduced as Table 12 at page 38 of my October 30, 2014 expert report attached as Exhibit 1 to this declaration. As illustrated in Table 6-14, natural groundwater (or the well fraction) was calculated to be as high as 80% of the flow exiting at a spring (or seep vent).

66. Dr. Moran refers to "fast flow, limited dispersion along subsurface flowpaths, and focused discharge . . . in the seep areas" to support her position that flow from Wells 1 and 2 would enter the ocean in the Diffuse Flow Area documented in the Tracer Study for Wells 3 and 4. Moran Supplemental Report, at 2. The "focused discharge" refers to flow entering the ocean at the individual submarine springs or seep vents. According to the Tracer Study, the highest amount of flow exiting through the springs was 296 m^3/day (*i.e.*, 220 m^3/day + 76 m^3/day as illustrated on Exhibit 10 of this declaration). The average flow into LWRF wells during the Tracer Study was approximately 13,000 m^3/day. Based on Tracer Study measurements, less than 2.5% of all effluent from Wells 3 and 4 was measured as exiting from the Individual Spring Area (*i.e.*, 296/13,000 = 0.0223 or less than 2.5%), which can hardly be classified as a "focused discharge."

67. As part of my expert report, I provided a conservative flow model (also referred to as a "simple" flow model) to illustrate the deflection of flow from Wells 1 and 2 around Wells 3 and 4. Contrary to any suggestion by Dr. Moran,

this model was not intended to replicate the Tracer Study Model. Moran Supplemental Report, at 3. Likewise, neither this model nor my opinion assumed a "uniform" rate at which flow would enter the ocean as suggested at pages 2 and 3 of the Moran Supplemental Report. Moreover, because of the complexity of doing so my model did not take into account any mounding that occurs as a result of the flow injection. If mounding had been taken into account, the model would have shown that flow from Wells 1 and 2 enters the ocean at a distance even further away from the Diffuse Flow Area.

68. Dr. Moran indicates that based on my modeling exercise, I concluded that effluent from the LWRF enters the ocean over approximately 800 meters of coastline. Moran Supplemental Report, at 2. I did not reach any such conclusion. The parameters used in the modeling in my expert report (10,000 m^3/day of effluent injected 50:50 into two well pairs ((Wells 1 and 2) and (Wells 3 and 4)), resulted in a horseshoe-shaped plume similar to that predicated by the 2009 USGS Report, with flow entering the ocean over approximately 800 meters of coastline. Furthermore, the effluent flow at the coastline, as defined by my model equation (see Ex. 1, at 11), is definitely not uniform, and as shown in paragraph 39 above and Exhibit 8, if the model parameters change, the area over which flow enters the ocean also changes.

69. Dr. Moran disagrees with my opinion that there were problems with the Tracer Study break through curve (BTC) calculations used to conclude that 64% of effluent from Wells 3 and 4 discharges at the Diffuse Flow Area. Dr. Moran's disagreement is based on her opinion that the Tracer Study used "an unusually robust data set." Moran Supplemental Report, at 5. Dr. Moran's reference to a "robust data set" refers to the Tracer Study's use of dye concentrations measured at four (4) individual springs or "seep vents" accounting for a 0.084 m^2 area. These measurements were then ascribed to a 7000 m^2 area (*i.e.*, the Diffuse Flow Area for the south seep group as illustrated in Ex 10 of this declaration). According to the data in Table A-6 (Ex. 3, at A-49−A-74), these dye concentration measurements at the four springs are far from a "robust" estimate of the dye concentrations in the Diffuse Area to which they were applied.

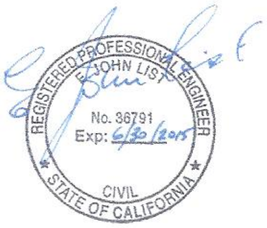
70. Dr. Moran disagrees with my opinion that effluent injected into Wells 1 and 2 diffusely enters groundwater over roughly 100 feet of aquifer through openings in each well. Moran Supplemental Report, at 5. Dr. Moran bases her disagreement on clogging she claims is documented for Wells 1, 3 and 4. Any clogging of Wells 3 and 4 is irrelevant with respect to the distribution of flow within Wells 1 and 2. Moreover, clogging refers to the rate at which effluent can be injected into the wells, it does not equate to the distribution of flow into the aquifer within the well.

71. According to Dr. Moran's calculation, at most 16% of all flow entering the ocean in the vicinity of Kahekili Beach is composed of effluent from the LWRF. Moran Supplemental Report, at 3. In other words, 84% of the flow entering the ocean comes from other sources.

72. After acknowledging that the deflection of flow from Well 2 around Wells 3 and 4, and the related dispersion caused by this deflection is the likely reason no dye from Well 2 was detected in the ocean as part of the Tracer Study, Dr. Moran goes on to list a host of other potential reasons dye was not detected from Well 2 in the ocean. Moran Supplemental Report, at 6-7. In my professional opinion, dispersion, dilution and displacement caused by the deflection of Wells 1 and 2 flows by Wells 3 and 4 is the most plausible explanation for the lack of detection of any dye from Well 2 in the ocean, as was also concluded by the Tracer Study. See Ex. 3, at 5-25.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and ability.

Executed this 19th day of December, 2014 at Whitford, New Zealand



E. John List, Ph.D, P.E. (CA)

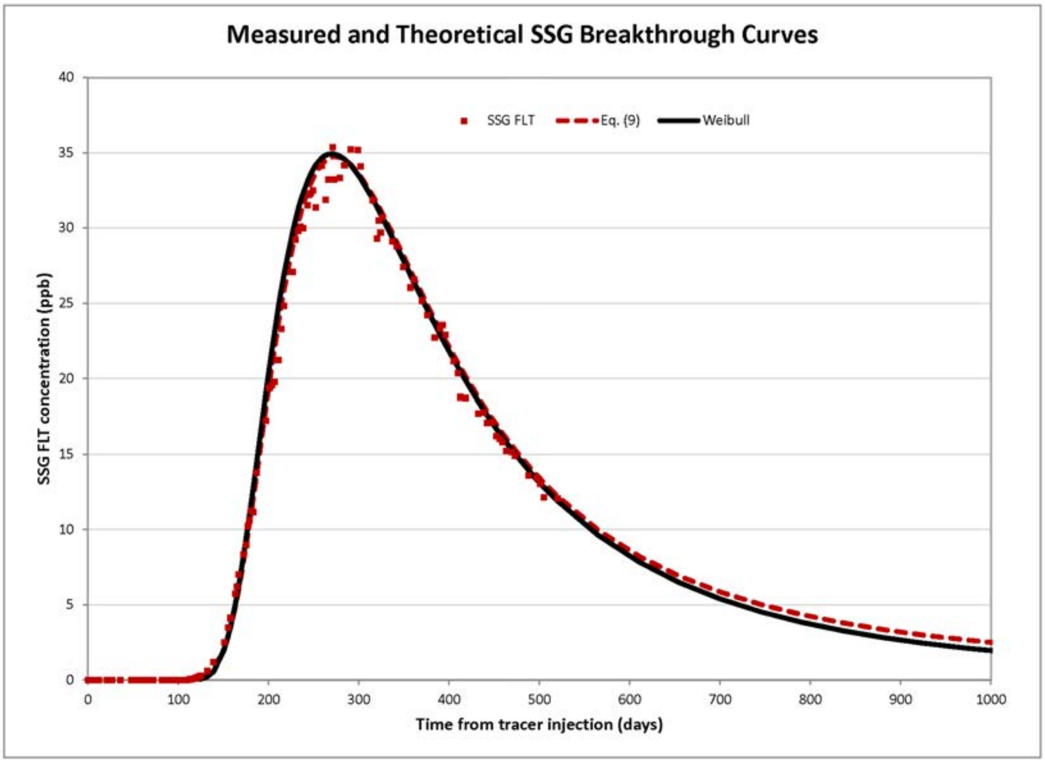


Figure 1 – Measured tracer concentration at SSG as a function of time from release. Implied average particle velocity 2.97 meters/day.

EXHIBIT B (Figure 1)

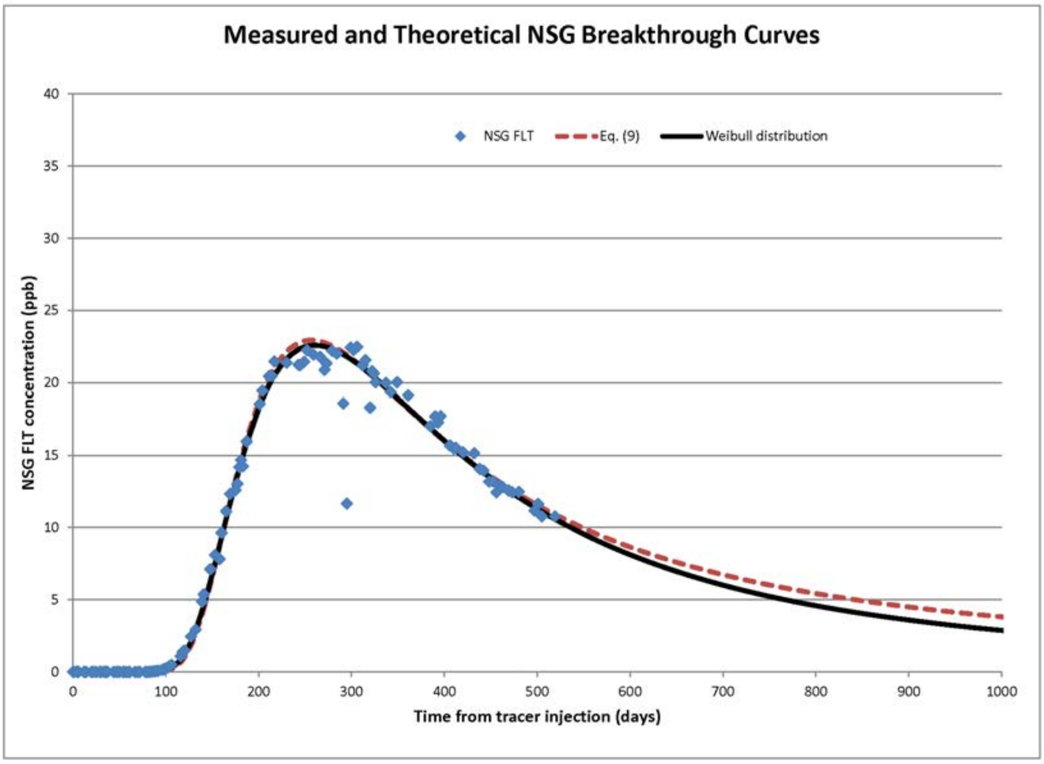


Figure 2– Measured tracer concentration at NSG as a function of time from release. Implied average particle velocity 2.45 meters/day.

EXHIBIT C (Figure 2)

Lahaina Data

From: Robert Whittier <whittier@hawaii.edu>
To: Scott.Rollins@co.maui.hi.us
Date: Monday - August 24, 2015 11:28 AM
Subject: Lahaina Data
Attachments: TEXT.htm; Lahaina figures and graphs.pdf; seep_nutrients_data.xlsx; Mime.822

Scott,

Thanks for having lunch with us. Attached are some various figures and graphs that we talked about on Thursday including:

- A conductivity/temperature profile of an exploratory well drilled at the SVO resort. We did not know about the existence of this well during the tracer study. It was submitted as part of a UIC application to DOH. It could be obtained via a request to Norris
- A graph of dN15, TIR data, and relative Fluorescein concentrations (unpublished)
- a map of the relative Fluorescein concentrations along the Kahakili shoreline (part of the HWEA and Annual Conference presentations)
- a graph I did some time ago of the total N at the seeps,
- the last three slides are taken from a presentation I gave at the HWEA/AWWA conference on 5/11/14. Part of the purpose of that talk was that I felt the point radon measurements were incorrectly upscaled to rectangles representing the north and south seep groups. I re-did the calculations using the coastal and point measurements and came out with lower percent recoveries (Scenario 3 is my best estimate based on the available data).
- And lastly my tracking of the total N&P at the seeps.

If you want any of the presentations, that should be requested from Norris and reference Lahaina presentations given 5/11/14 at the HWEA/AWWA conference or the Lahaina presentation given at the 2nd Annual Intergovernmental Conference on Maui on 8/13/15.

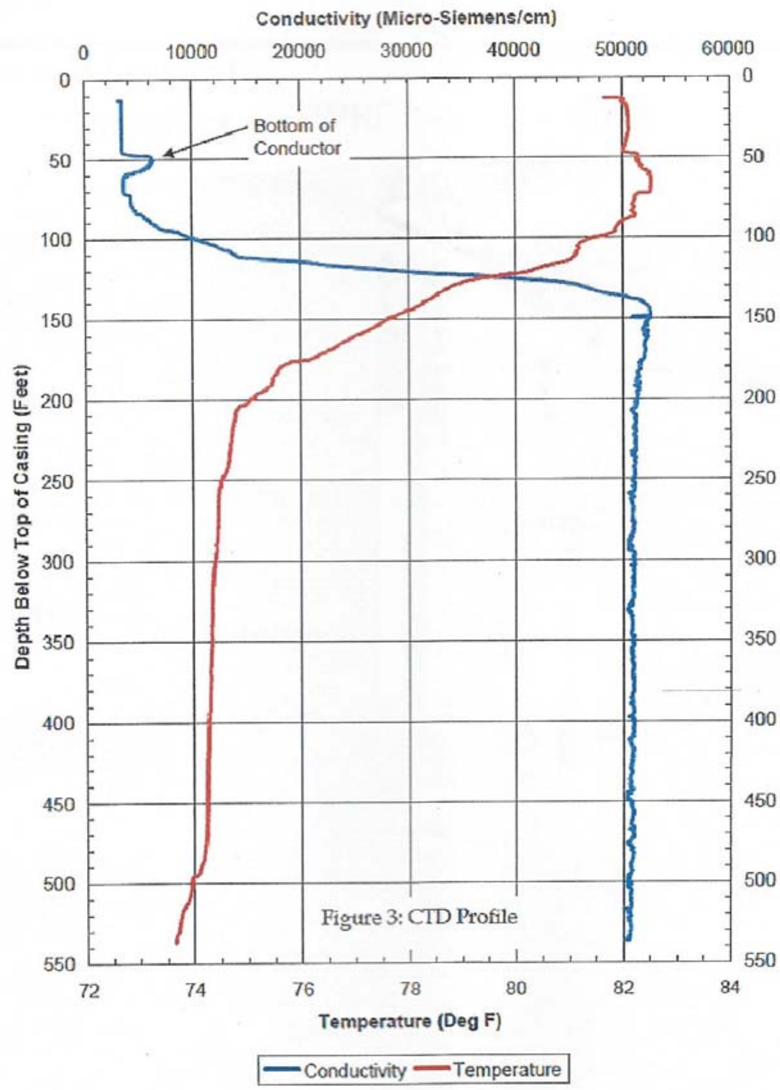
Hope this does more than just confuse things,

Bob W.
--

Robert B. Whittier, PG

Cell: (808)387-4869

EXHIBIT D



Conductivity and Temperature Profile of RO Injection Well

Figure 1. A specific conductivity and temperature profile for the SVO exploratory well. This well was located in the middle of injectate plume area. It shows the least saline water has the highest temperature, about 84 °F (29 °C).

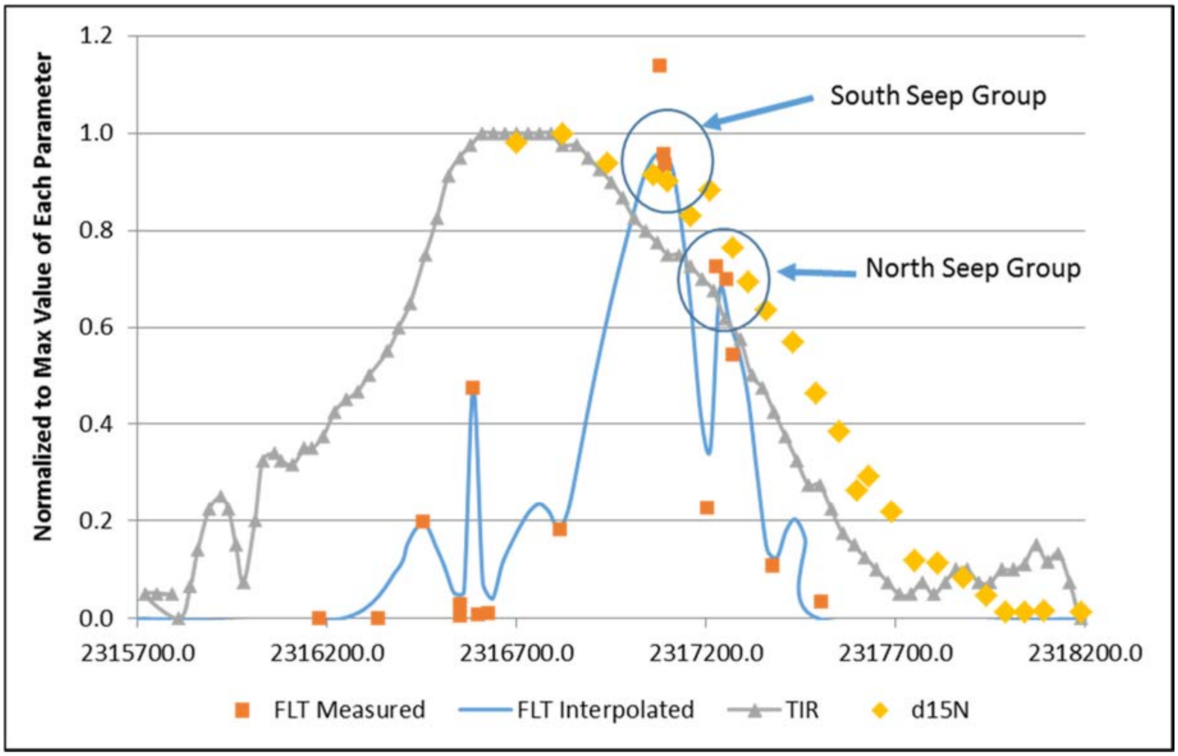


Figure 2. A normalize plot of the Fluorescein (FLT) concentration, sea surface temperature measured by the Thermal Infared (TIR) survey, and the algal $\delta^{15}N$ (d15N). The TIR and d15N data are normalized to their maximum values, the FLT concentration is normalized to at Seep 3, the major spring in the South Seep Group. This graph shows excellent correlation between sea surface temperature and algal $\delta^{15}N$. There is also reasonable correlation with the FLT concentrations showing an injected wastewater influence.

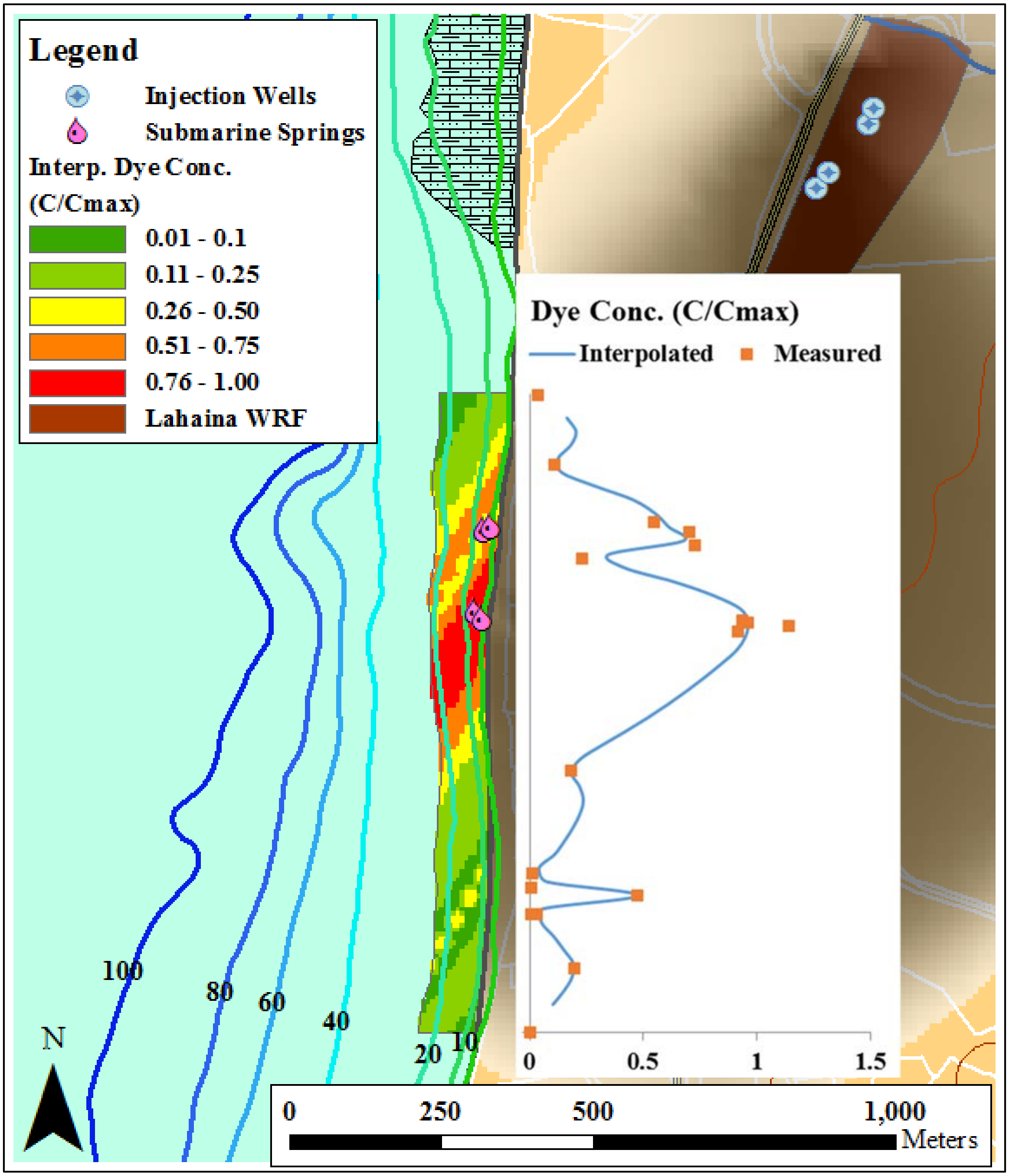


Figure 3. The profile of the normalized tracer dye concentration aligned to the plume front at the shoreline.

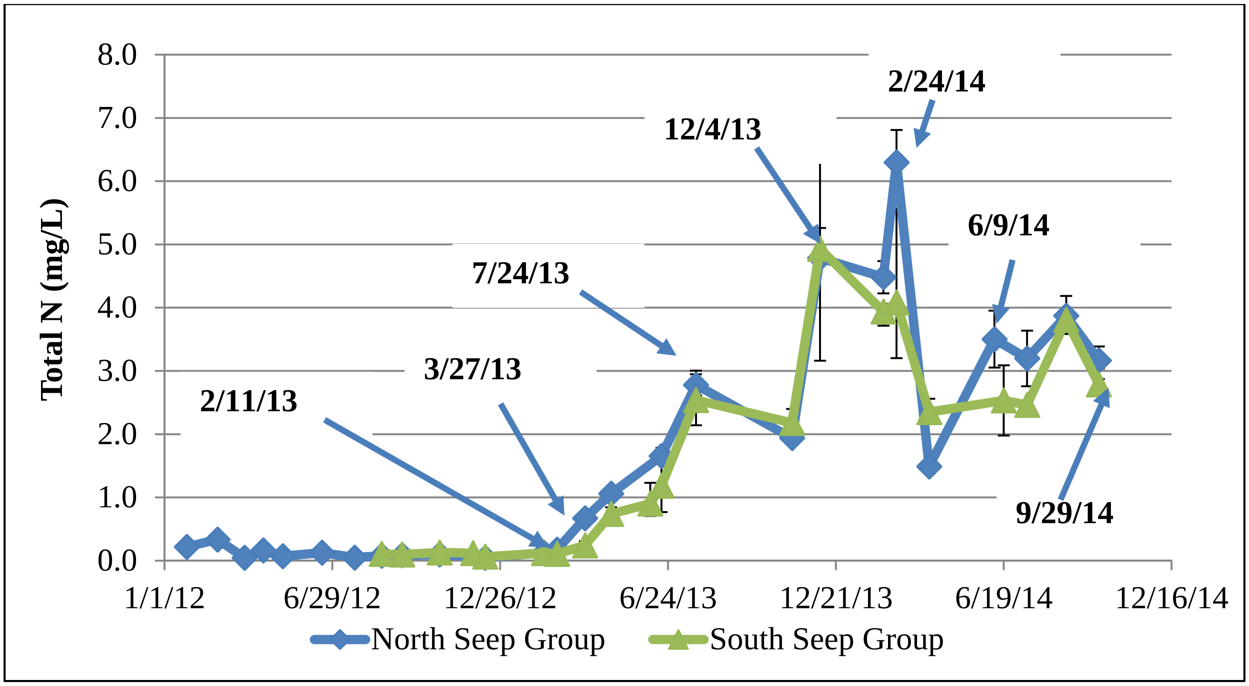
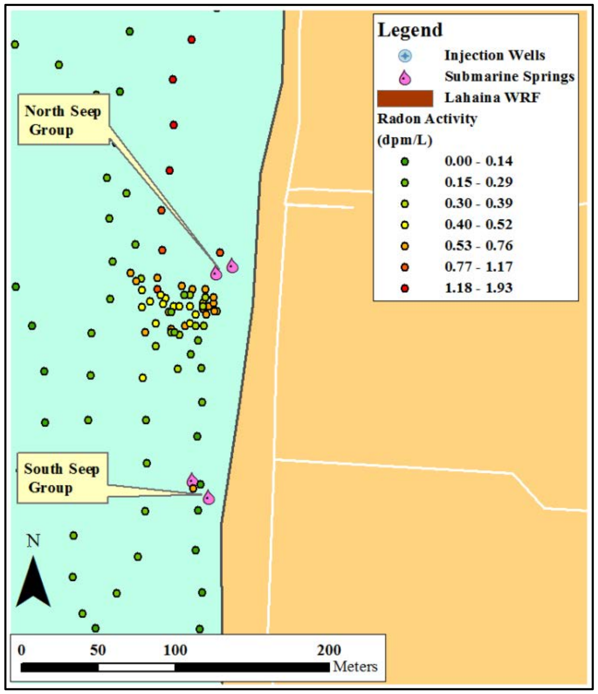
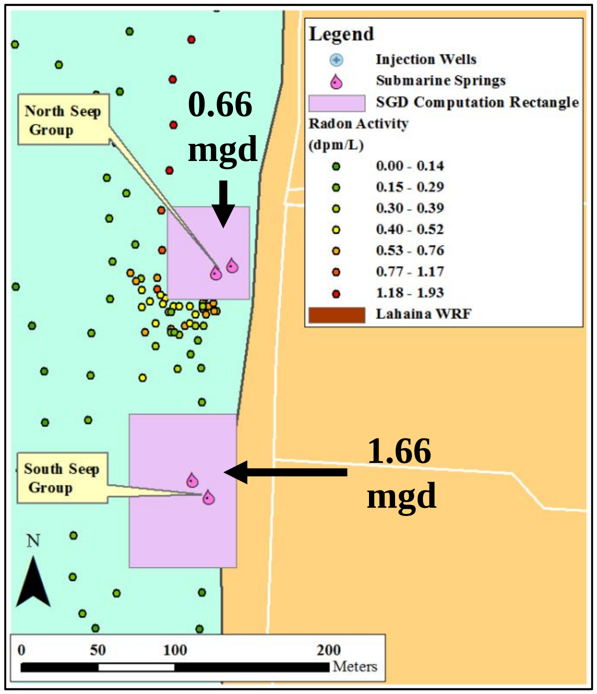
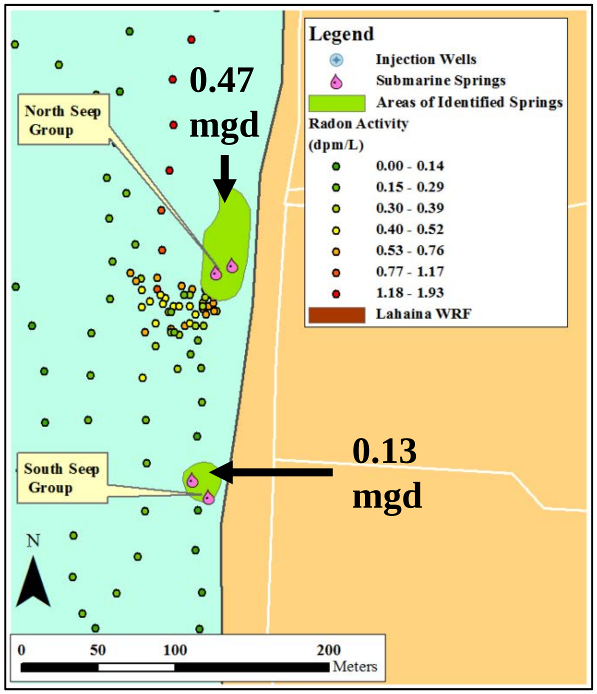


Figure 4. The average total nitrogen concentration in the discharge from the NSG and SSG. Error bars show the maximum and minimum concentrations measured at each sampling event.

Flux Calculation Scenarios







Scenario 1, the SGD was calculated using only the coastal radon survey data.

Scenario 2, the SGD was calculated using the coastal radon survey data outside of the rectangles
Inside of the rectangles the discharge rate calculated from the time-series measurements were used

Scenario 3, similar to Scenario 2 except the time-series computed discharge rate was applied to the polygons that enveloped the active vents identified in a sea-bottom survey.

Estimated Nutrient Loads

Parameter	Scenario 1	Scenario 2	Scenario 3	Average of 2&3	Honokawai Aquifer*
Total SGD (mgd):	1.96	4.09	2.72	3.40	23.5
Length of Shoreline (mi):	0.66	0.66	0.66	0.66	7.34
SGD per mi of shoreline (mgd/mi)	3.0	6.2	4.1	5.13	3.20
FLT Recovery:	24%	88%	42%	65%	
Injectate Discharge (mgd):	0.69	2.51	1.21	1.86	
Nitrogen Flux (kg/d):	0.39	1.42	0.69	1.05	
Phosphorus Flux (kg/d):	1.05	3.80	1.83	2.81	

* Recharge from Engott and Vana (2007) minus pumpage

Nutrient Loading Results Compared With Other Studies

Study	Total N Conc. mg/L	Total P Conc. mg/L	N Flux lbs/yr	P Flux lbs/yr	Comments
TetraTech, 1993	12.0	10.2	150,000	130,000	Plant upgrades have since improved injectate chemistry
Swarzenski et al., 2012	**0.66**	**0.37**	**1,535**	**834**	**Seep discharge extrapolated to an assumed plume width of 50 m**
Craig et al., 2013	1.1	0.44	7,577	3,074	Total N & P flux in delineated seep rectangles
This Analysis	**0.15**	**0.40**	**949**	**2,530**	**Includes contribution of Wells 1 & 2**
Current Conditions	**7.0**	**0.40**	**39,100**	**2,530**	**N Conc. as of Feb, 2014**

Somewhat like comparing apples and oranges!

West Maui Water Quality Monitoring Report

State of Hawaii, Clean Water Branch

September 23, 2016

EXHIBIT E

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Executive Summary

The Lahaina Tracer Study[1] identified a hydraulic connection between the Lahaina Wastewater Reclamation Facility and the nearshore coastal waters of West Maui. As a follow-up, the Department of Health, Clean Water Branch sampled the submarine groundwater discharge and the nearshore coastal waters of West Maui from 2011-2015, in an effort to characterize the submarine groundwater discharge and determine the potential impacts of injection well effluent on coastal waters. Bacteria and nutrient samples were collected directly from submarine groundwater seeps and from the nearshore coastal waters of West Maui. There are no current groundwater standards to compare the submarine groundwater seep results to, so the data were compared to the Open Coastal Water Quality Standards (WQS) found in Hawaii Administrative Rule 11-54[5].

Bacteria results showed consistently low concentrations of *Enterococcus* and *Clostridium perfringens* in both seep and nearshore water samples. No bacteria

samples exceeded the current *Enterococcus* Beach Action Value (BAV) of 130 cfu/100 ml.

Ammonia and chlorophyll a concentrations found in the submarine groundwater discharge did not appear to have an effect on nearshore water quality throughout the study period.

Nitrate + Nitrite and Total Nitrogen concentrations in the submarine groundwater discharge were initially low in 2012. Both nitrate + nitrite and Total Nitrogen concentrations spiked and exceeded WQS starting in 2013, and nitrate + nitrite concentrations in the nearshore water were affected. The elevated nitrate + nitrite concentrations (10 to as much as 300+ times the Water Quality Standard) of submarine groundwater caused exceedances of the nitrate + nitrite Water Quality Standard of 5.00 µg/L in nearshore coastal waters from 2013-2015.

Total Phosphorus concentrations in the submarine groundwater discharge exceeded WQS by more than 20 times the standard of 20 µg/L from 2012-2015. However, nearshore water quality remained low throughout the study period, indicating that Total Phosphorus concentrations in the submarine groundwater discharge did not have an effect on nearshore water quality.

The Lahaina WWRF discharged chlorinated effluent into the injection wells from October 2011 through April 2013. It is believed that this chlorinated effluent may have killed off a sub-surface population of denitrifying bacteria causing nitrate + nitrite and Total Nitrogen concentrations in the submarine groundwater discharge to spike starting in 2013.

Acknowledgements

The Department of Health, Clean Water Branch, would like to thank the many people who made this study possible. We thank Meghan Dailer for her technical knowledge of the study area, the maintenance of the submarine groundwater equipment, and for the assistance she provided in collecting the submarine groundwater samples. Thank you to the staff of the DOH, State Laboratories Division, Water Pollution and the Maui District Health Laboratory who processed the nutrient and bacteria samples. We also thank Dr. Robert Whittier of the

Department of Health, Safe Drinking Water Branch, for providing the technical support regarding groundwater flows in the study area.

Introduction

Numerous documented seasonal algal blooms have plagued the coastal areas of West Maui since the mid 1980's. As studies evolved over years, nutrient loading into the coastal waters of West Maui from different sources have been investigated. Studies have shown the possible connection between the treated wastewater injection at the Lahaina Wastewater Reclamation Facility (WWRF) and the nearshore coastal waters of West Maui [1,2,3].

The Lahaina WWRF is located approximately 3 miles north of Lahaina, Maui. It receives approximately 4 million gallons per day (mgd) of sewage. The wastewater undergoes tertiary treatment and is disinfected with UV radiation to produce R-1 reuse water. Approximately 0.7-1.5 mgd of the facility's R-1 water is sold to customers for landscape and golf course irrigation. The remaining tertiary treated effluent is discharged into four on-site injection wells.

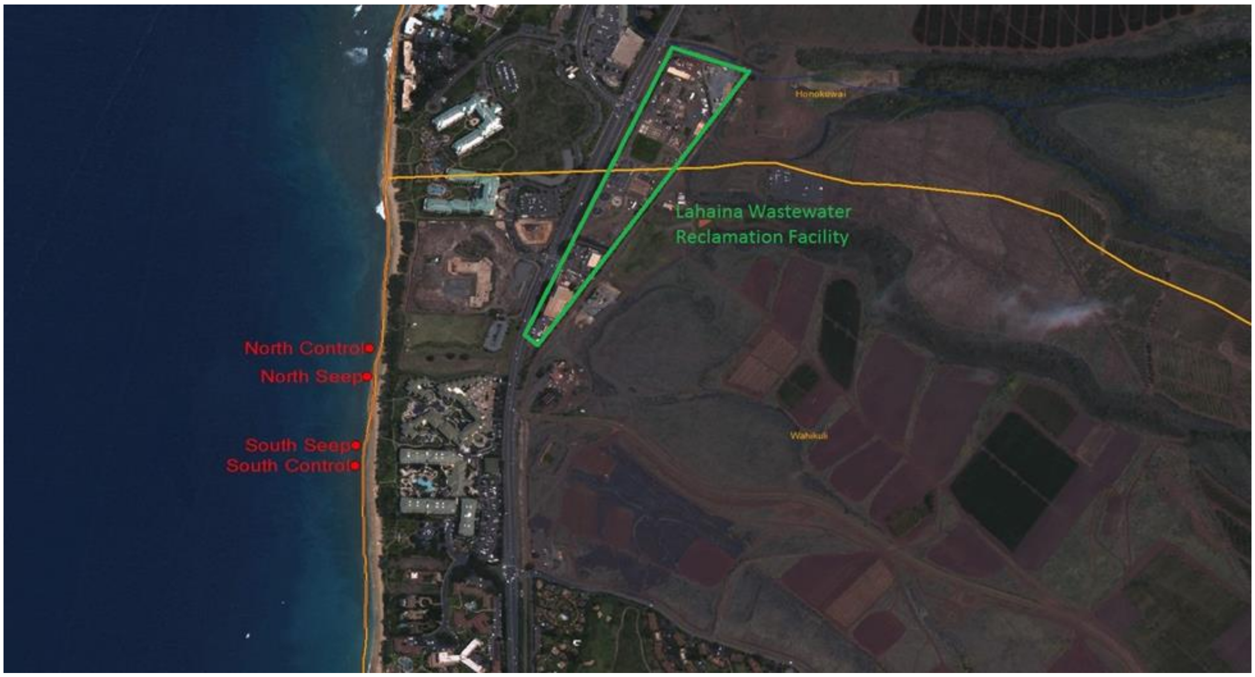
The Lahaina Groundwater Tracer Study[1] identified a hydraulic connection between the injection wells at the Lahaina WWRF and the nearshore coastal waters off of West Maui, in the North Ka'anapali Beach area. In response to concerns raised by the results of the Tracer Study, the Hawaii State Department of Health, Clean Water Branch (DOH-CWB) initiated this study beginning in September 2011 to determine the potential impacts of injection well effluent on coastal waters.

One objective of the study was to characterize water quality in the nearshore coastal area of North Ka'anapali Beach and the submarine groundwater entering the nearshore coastal waters. The second objective was to compare the results from the study to applicable Water Quality Standards. There are no current groundwater standards to compare the submarine groundwater seep results to, so the DOH-CWB assessed whether the nearshore coastal and submarine groundwater are in exceedance of Open Coastal Water Quality Standards (WQS) found in Hawaii Administrative Rule 11-54[5].

Study Location

North Ka'anapali Beach is a stretch of beach between Black Rock and Honokowai Point located on the western side of the Island of Maui, towards the northern end of the Wahikuli Watershed (Figure 1). The Lahaina WWRF sits approximately 0.80 kilometers north east of the study location.

Figure 1: Aerial view of the study location.



The Lahaina Tracer Study found two large clusters of seeps near the North Ka'anapali Beach area and were termed the North Seep Group (NSG) and the South Seep Group (SSG)[3]. For each sampling event, 3 seep samples were collected from each seep group (NSG and SSG). In addition, nearshore water samples were collected at four sampling locations, above the NSG, above the SSG, the North Control, located approximately 50 meters north of the NSG and the South Control, located approximately 50 meters south of the SSG (Table 1). Samples were collected at two depths, surface and mid-depth, for each sampling location.

Table 1: Location information on the sampling locations.

Station Name	Latitude (Deg Min Sec)	Longitude (Deg Min Sec)
North Seep	N 20 56 26.8	W 156 41 34.2
South Seep	N 20 56 24.6	W 156 41 34.4
South Control	N 20 56 17.6	W 156 41 35.4
North Control	N 20 56 19.2	W 156 41 35.3

Sampling Methods

Bacteria sampling started in September and November, 2011. Nutrient sampling was added starting in January, 2012. Bacteria and Nutrient sampling occurred monthly from January 2012-December 2014. The sampling frequency decreased to once every other month in 2015. Sampling events were cancelled during periods of high surf or inclement weather due to unsafe sampling conditions. Efforts to make up the missed sampling event were made when it was possible. When it was not possible to make up the missed sample event, the sampling schedule was resumed at the next scheduled sampling event. Sampling concluded at the end of 2015.

Each water sample collected consisted of one 500 mililiter (ml) Nalgene bottle for the fecal indicator bacteria (FIB) testing of *Enterococcus* (EPA approved FIB) and *Clostridium perfringens* (Hawaii's secondary tracer organism), and two (2) 1-liter brown bottles for the testing of nutrients (ammonia, nitrate + nitrite, Total Nitrogen, Total Phosphorus, silica, and Chlorophyll a). Water quality parameters (temperature, pH, dissolved oxygen, salinity, and turbidity) were analyzed for each water sample. Free and Total Chlorine levels in each water sample were measured starting in April, 2012.

Submarine groundwater (seep) samples were collected directly from the NSG and SSG through a piezometer inserted into coral substrate or the sandy bottom. Polyethylene tubing was connected to the piezometer and a peristaltic pump was used to draw the seep water up to the beach for collection[3].

Water samples were collected from the water column at two depths (surface and mid-depth) directly above the two seep groups and at two control stations located outside of the direct influence of both seeps groups[6,7].

Water quality parameters were measured in-situ using a Hydrolab Quanta [6,7] and the Hach 2100 Turbidimeter[8].

Residual chlorine samples were measured in-situ using a Hach Pocket Calorimeter[9].

Results

The West Maui Water Quality Monitoring data was collected from 2011-2015. The study area receives almost 3.2 mgd of submarine groundwater discharge[4]. Due to the amount of submarine groundwater discharge in the study area, the results were compared to the "Wet" criteria WQS listed in Hawaii Administrative Rule 11-54[5]. Only the bacteria and nutrient data which have WQS in accordance to Hawaii Administrative Rule 11-54 are summarized below.

There were a total of 36 sampling events during the study period. Table 2 summarizes the number of samples for each parameter that were included in the analysis. The entire data set is available upon request.

Table 2: West Maui Water Quality data summary table.

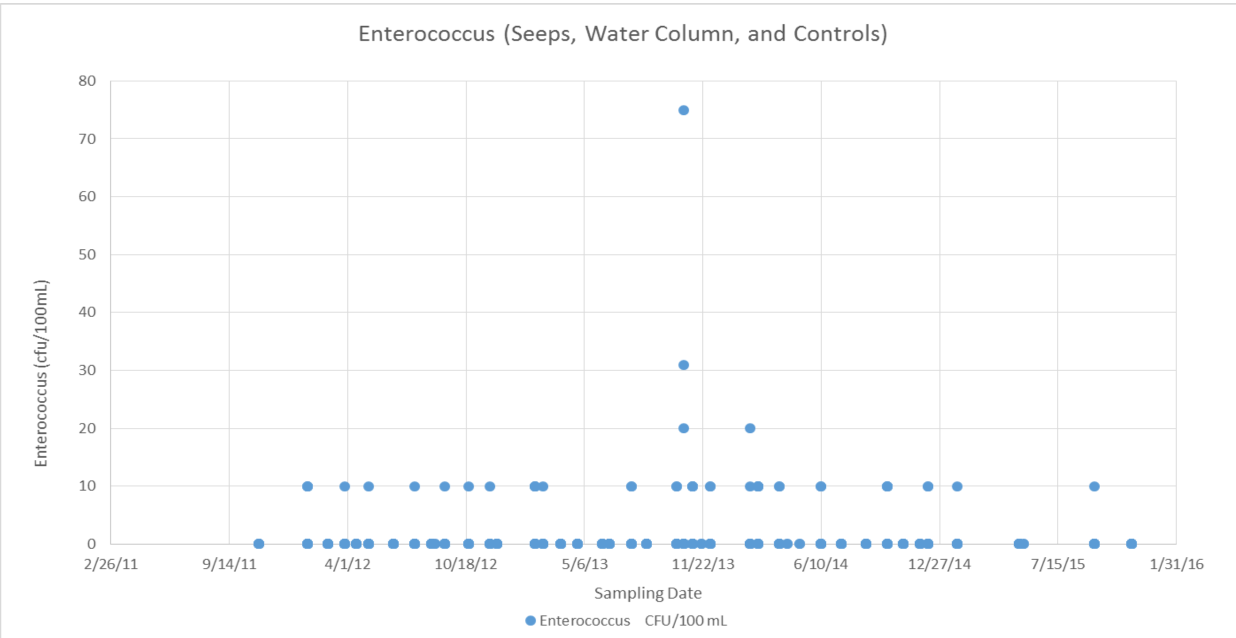
Parameter	**n**
Enterococcus	539
Ammonia	440
Nitrate + Nitrite	436
Total N	397
Total P	381
Chlorophyll a	449

Bacteria:

Nearshore and seep discharge water samples showed consistently low concentrations of FIB. A majority (91%) of *Enterococcus* samples analyzed resulted in a non-detect. 90% of *Clostridium perfringens* samples analyzed resulted in a non-detect.

Nearshore and seep discharge water samples in the North Ka'anapali Beach area were not in exceedance of Recreational WQS for *Enterococcus* (geometric mean of 35 cfu/100 ml) and none of the samples exceeded the current Beach Action Value (BAV) of 130 cfu/ 100 ml for Enterococcus[5] (Figure 2).

Figure 2: Enterococcus data shows no exceedance of the BAV



Chemistry:

To assess the chemistry of the seep discharge and the nearshore water, the data was combined into 3 groups and a yearly geometric mean was calculated for each nutrient (Tables 3-5):

1. The North and South Seeps: All groundwater samples collected from the NSG and the SSG.
2. The North and South Seep Water Column: Surface and mid-depth water samples collected from the water column directly above the NSG and the SSG.
3. The North and South Controls: Surface and mid-depth water samples collected from the water column at the North and South Control locations.

Seeps

Table 3: North and South Seep geomean data: WQS exceedances are indicated by the highlighted values.

Year	Ammonia: NH3 (ug/L)	Nitrate-Nitrite: NO3 + NO2 (ug/L)	Total N (ug N/L)	Total P (ug/L)	Chlorophyll 'a' (ug/L)
2012	2.96	3.81	93.09	374.96	0.05
2013	2.64	312.08	585.52	457.29	0.14
2014	4.01	1940.43	2799.17	310.07	0.09
2015	3.24	1686.64	2582.84	350.57	0.07

Water Column

Table 4: North and South water column geomean data: WQS exceedances are indicated by the highlighted values.

Year	Ammonia: NH3 (ug/L)	Nitrate-Nitrite: NO3 + NO2 (ug/L)	Total N (ug N/L)	Total P (ug/L)	Chlorophyll 'a' (ug/L)
2012	3.63	3.15	51.46	16.09	0.09
2013	3.33	10.40	66.72	22.76	0.13
2014	2.42	23.29	85.51	18.31	0.16
2015	15.31	29.57	73.77	16.36	0.14

Control

Table 5: North and South Control geomean data: WQS exceedances are indicated by the highlighted values.

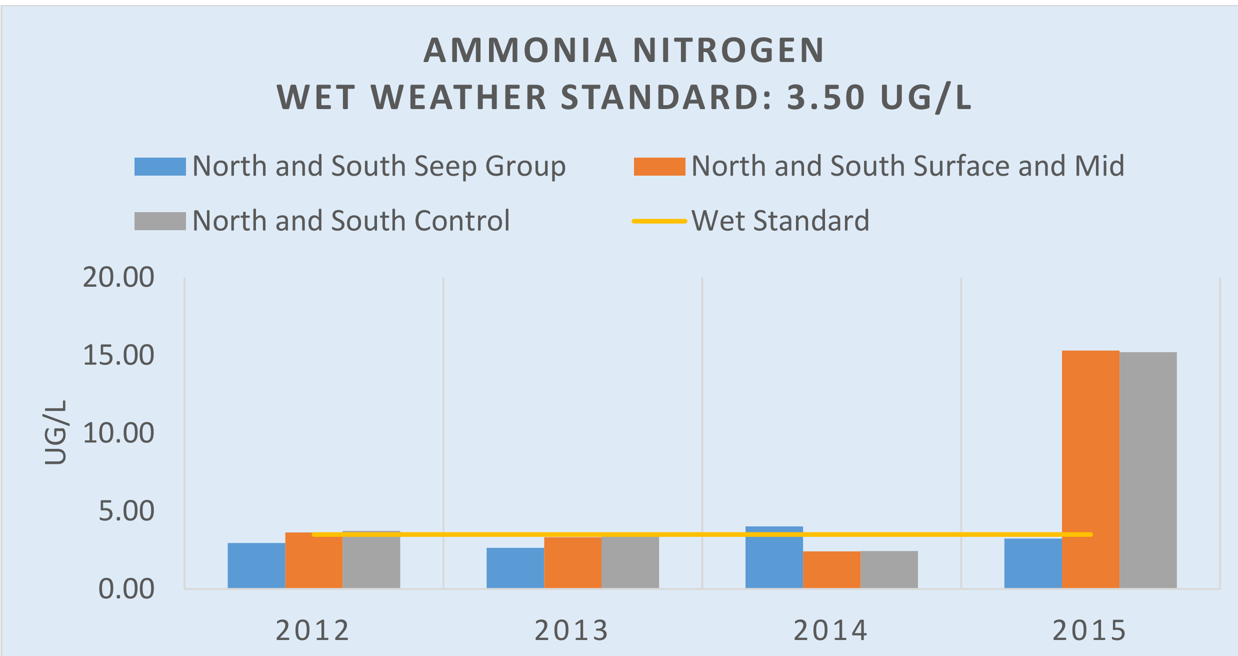
Year	Ammonia: NH3 (ug/L)	Nitrate-Nitrite: NO3 + NO2 (ug/L)	Total N (ug N/L)	Total P (ug/L)	Chlorophyll 'a' (ug/L)
2012	3.73	3.09	45.57	12.50	0.08
2013	3.37	5.29	59.76	16.81	0.12
2014	2.43	5.73	67.44	13.42	0.15
2015	15.20	7.24	63.29	11.93	0.12

Ammonia (NH^3):

The data collected showed that there were similar concentrations of ammonia detected in all 3 groups from 2012-2014. In 2015, ammonia concentrations in the Water Column, and the Control increased 5 fold. (Figure 3).

In 2012, ammonia concentrations in the Water Column and the Control exceeded the WQS of 3.50 µg/L (micrograms/Liter) slightly. In 2014, ammonia concentrations in the Seeps exceeded the WQS slightly. In 2015, ammonia concentrations in the Water Column and the Control were 4 times the ammonia WQS.

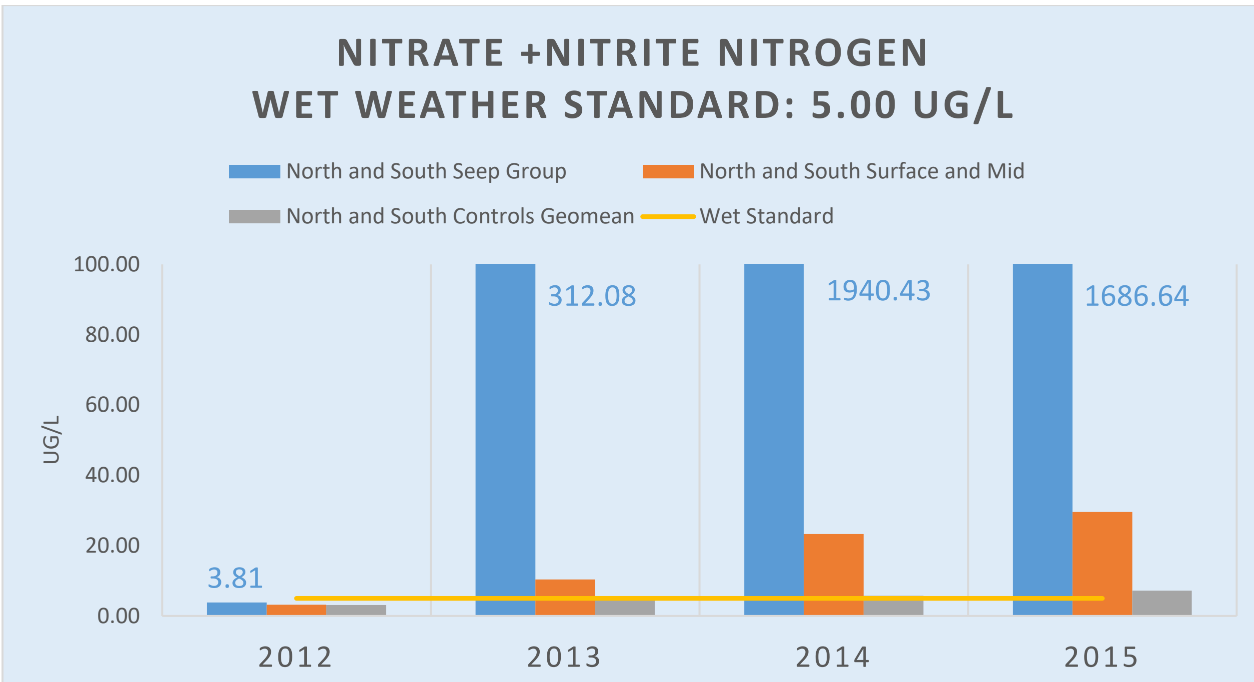
Figure 3: Ammonia concentrations – all groups.



Nitrate + Nitrite (NO^3 + NO^2):

The data collected showed that there were similar nitrate + nitrite concentrations in all 3 groups in 2012. Concentrations of nitrate + nitrite in the Seeps increased exponentially from 2013-2015 and exceeded the WQS of 5 µg/L for nitrate + nitrite by as much as 300+ times. The increase of nitrate + nitrite concentrations in the Seeps correlated with WQS exceedances of nitrate + nitrite in the nearshore water from 2013-2015 (Figure 4).

Figure 4: Nitrate + Nitrate concentrations – all groups.



Total Nitrogen (TN):

The data collected showed that there were similar TN concentrations in all 3 groups in 2012. Starting in 2013, there was an upward trend for concentrations of TN in the Seeps. From 2013-2015, concentrations of TN increased exponentially and exceeded the WQS for TN of 150 µg/L by almost 20 times. TN concentrations in nearshore water increased slightly, but did not exceed the WQS from 2012-2015 (Figures 5 and 6).

Figure 5: TN concentrations – all groups.

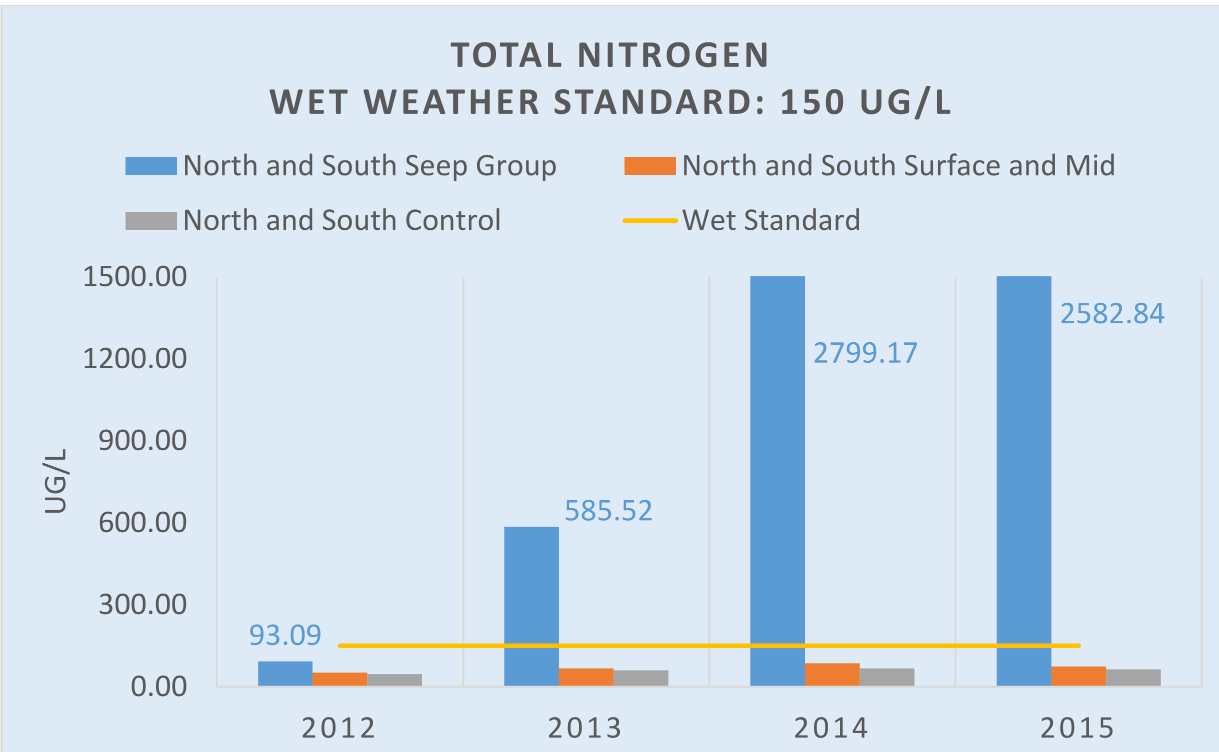
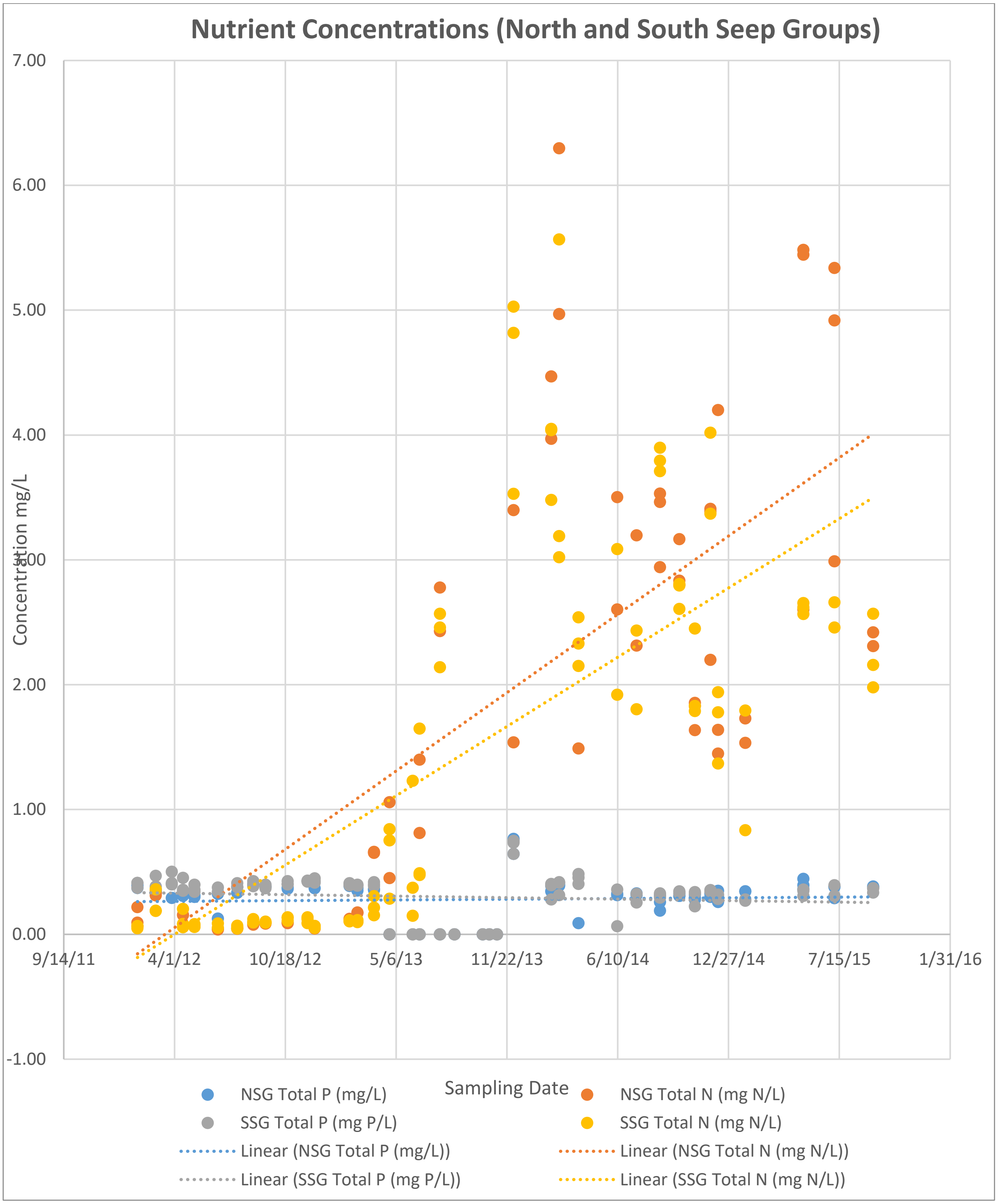


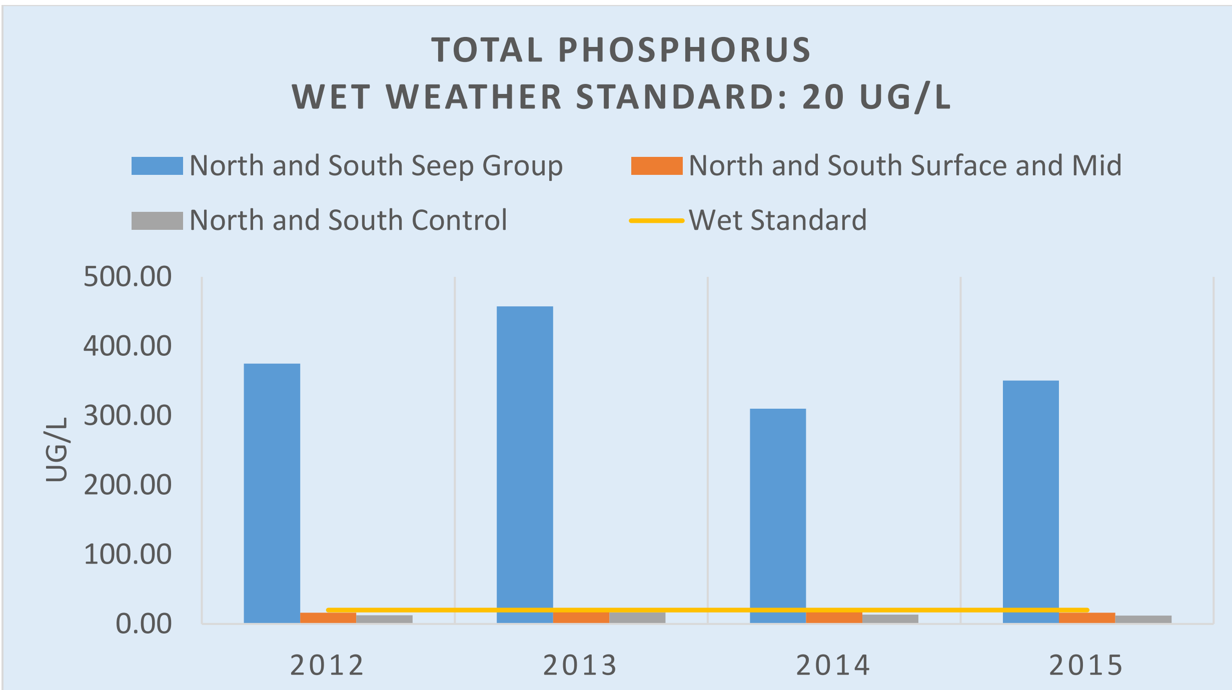
Figure 6: TN and TP concentrations in the seeps showing an upward trend of TN



Total Phosphorus (TP):

The data collected showed TP concentrations in the Seeps were over 20 times higher than the State Wet Weather WQS of 20 µg/L during the study period. TP concentrations in the Seeps exceeded WQS every year from 2012-2015. Interestingly, TP concentrations in the Seeps did not appear to affect TP concentrations in the Water Column or the Control. TP concentrations exceeded WQS in the Water Column only once, in 2013 (Figure 7).

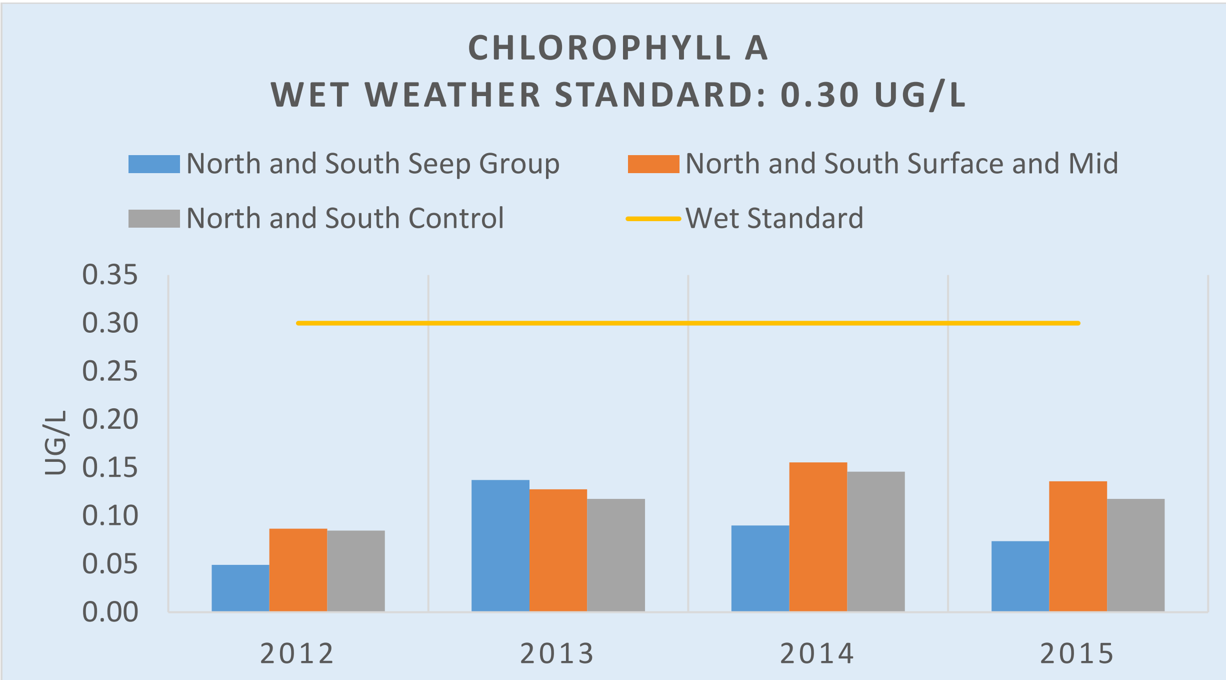
Figure 7: TP concentrations – all groups



Chlorophyll a:

The data collected showed Chlorophyll a concentrations in all 3 groups to be well below the WQS of 0.30 µg/L (Figure 8).

Figure 8: Chlorophyll a concentrations – all groups



Residual Chlorine:

Residual chlorine was detected in all 3 groups during the study period. The Free Chlorine and Total Chlorine data for each group were averaged. Free Chlorine concentrations where consistent across all 3 groups at 0.05 milligrams/L (mg/L). Total Chlorine concentrations were highest in the Seeps at 0.08 mg/L. Total Chlorine concentrations of 0.06 mg/L and 0.05 mg/L were observed in the Water Column and the Control respectively (Table 6).

Table 6: Residual Chlorine Data

Location	**Free Cl Average (mg/L)**	**Total Cl Average (mg/L)**
Seeps	0.05	0.08
Water Column	0.05	0.06
Control	0.05	0.05

Summary and Conclusions

The bacteria and nutrient concentrations of the seep discharge in the North Ka'anapali Beach area and its effects on nearshore water quality were unknown prior to the West Maui Water Quality Monitoring study.

The results from the West Maui Water Quality Monitoring Report helped to characterize the seep discharge in the North Ka'anapali Beach area. The seep discharge was consistently low in concentration of Enterococcus, Clostridium perfringens, ammonia, and chlorophyll a from 2012-2015. The seep discharge was consistently high in TP concentration from 2012-2015. The data initially showed low concentrations of nitrate + nitrite and TN in the seep discharge in 2012, then showed a sharp increase of nitrate + nitrite and TN concentrations in the seep discharge starting in 2013.

Chlorine was used to disinfect the effluent at the Lahaina WWRF for a period of time from October 2011 through April 2013. The chlorinated effluent was discharged into the injection wells during that timeframe. The DOH-CWB believe that the chlorine added to the effluent eliminated a sub-surface population of denitrifying bacteria. The approximate travel time between the injection wells and the seeps is 14-16 months[3]. From this, the DOH-CWB believes that concentrations of nitrate + nitrite and TN increased exponentially in the seep discharge starting in 2013 without the benefit of the sub-surface denitrifying bacteria population. At this time, it is unknown if the population of sub-surface denitrifying bacteria will recover to pre-2013 levels.

The results from the West Maui Water Quality Monitoring Report show that the nearshore coastal water quality in the Ka'anapali Beach area of West Maui can be influenced by the seep discharge, but its effects are not consistent across all the parameters measured.

The data showed that the elevated concentrations of nitrate + nitrite in the seep discharge had a direct effect on nitrate + nitrite concentrations in nearshore waters causing the exceedance of WQS in the surrounding nearshore waters. However, elevated concentrations of the other nutrients in the seep discharge did not always correlate to exceedances of WQS in the surrounding nearshore waters.

TN and TP concentrations in the seep discharge were exponentially higher than the WQS, yet did not directly influence the surrounding nearshore waters and cause exceedances of the WQS. It is unknown at this time why elevated nitrate + nitrite concentrations in the seep discharge directly affect the surrounding nearshore waters while elevated TN and TP concentrations had little to no effect on surrounding nearshore waters.

There were detectable levels of residual chlorine in both the seep discharge and the surrounding nearshore waters. The source of the residual chlorine is unknown. The resort area adjacent to the study area has beach showers that use water that has a chlorine odor and could potentially be another source of chlorine.

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IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF HAWAII

HAWAI´I WILDLIFE FUND, SIERRA CLUB – MAUI GROUP, SURFRIDER FOUNDATION, AND WEST MAUI PRESERVATION ASSOCIATION, Plaintiffs, vs. COUNTY OF MAUI, Defendant.	CIVIL NO. 12-cv-00198 SOM-KJM CERTIFICATE OF SERVICE

CERTIFICATE OF SERVICE

The undersigned hereby certifies that the foregoing was electronically filed with the Clerk of the Court for the United States District Court for the District of Hawai´i by using the appellate CM/ECF system on June 22, 2020.

Participants in the case who are registered CMF/ECF users will be served by the appellate CM/ECF system.

DATED: Wailuku, Maui, Hawaii, June 22, 2020.

MOANA M. LUTEY
Corporation Counsel
Attorney for Defendant/Appellee
COUNTY OF MAUI

By /s/ Brian A. Bilberry
BRIAN A. BILBERRY
Deputy Corporation Counsel