An Open Letter to the Infrastructure and Environmental Management Committee

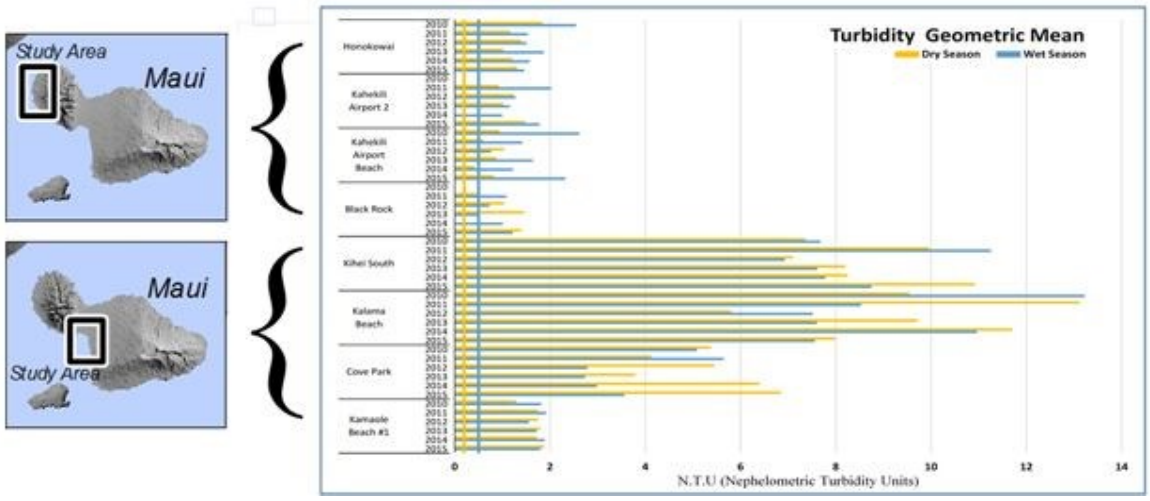
From Neil Rhoads and Dr. Mailea Miller-Pierce

Aloha and thank you for allowing us the opportunity to provide input to the committee regarding how Maui's current wastewater infrastructure impacts the coastal marine environment. We are the authors of two scientific papers which examine the topic in some depth.

Our first paper, "The influence of wastewater discharge on water quality in Hawai'i: A comparative study for Lahaina and Kihei, Maui" is based on thousands of water samples collected and analyzed by the Hawaii Department of Health, Clean Water Branch. In one portion of our study, we focused on four sampling sites near the Lahaina Wastewater Reclamation Facility and four sites near the Kihei Facility. In particular, we looked at Total Nitrogen, Total Phosphorus, Nitrate + Nitrite, Ammonia, Turbidity, and Chlorophyll a.

In general, sites near the Kihei facility exceeded state Water Quality Standards more frequently and at much greater magnitudes than sites near the Lahaina facility. To keep this letter brief, we'll simply point out a few of the most notable results and refer you to the paper itself for further detail. Cove Park was noticeably higher in all Nitrogen concentrations and appeared to be the site of most concern in terms of exceeding water quality standards. It was as much as 6.3 times the standard for Total Nitrogen, and as much as 109 times the standard in Nitrates plus Nitrites. Phosphorus concentrations were up to 5x higher than the standard near Kihei sites.

The results for Turbidity are similarly dramatic with the three sites nearest to the Kihei facility having values from 11.3 to 65.6 times higher than the water quality standards.



In discussions with longtime residents knowledgeable about local tides, currents, and weather patterns, it has been suggested that sites near the Kihei facility experience much reduced mixing with the open ocean compared to sites near the Lahaina facility. The results of our study are consistent with this interpretation. The injectate at these facilities are fairly similar in their pollutant concentrations, and the much larger differences in pollutant concentrations at the sampling sites are most likely due to the degree to which they are diluted in the nearshore waters.

In the course of conducting our study we toured the Kihei WWRF in December 2016. We were impressed with the superintendent and how the facility operates as efficiently as possible given its' outdated design. We commend the use of ultraviolet light sterilization. However, we were rather shocked that there is no mandate for Nitrogen or Phosphorus removal at the Kihei and Kahului facilities.

This is shocking because these nutrients are directly linked to negative effects on coral reef ecosystems. In addition, we are concerned about the use of large quantities of chlorine for disinfection of injectate at the Kahului facility and the negative impact this has on the nearshore environment.

We are aware that Maui County's OEM Committee will be considering a wide variety of wastewater infrastructure options. In general, we would state that we are in favor of options which would use modern biological processes to reduce Nitrogen and Phosphorus levels in wastewater throughout the County to the lowest possible concentrations. We would prioritize the Kihei facility since due to the reduced seawater mixing at nearby sites such as Cove Park would see the most immediate and dramatic benefits. Additionally, Kahului's use of chlorine for disinfection is also of concern.

In our second paper, currently in the final stages of preparation for publication, we examine the microbial content of water samples collected by the DOH Clean Water Branch. The dataset we used consisted of more than 29,000 samples collected over a 27 year period at more than 80 sites around Maui.

Without going into detail, we can generalize our results by saying that we observed increases in microbial contamination of nearshore water correlated with increased incidence of On Site Disposal Systems (OSDS) in areas of the island not served by a WWRF. It is possible that bacteria, spores, and viruses are carried in groundwater from their point of origin to discharge in coastal waters with little or no attenuation.

Launiupoko is a particularly poignant case study. In 1999, the land above Launiupoko was used exclusively for growing sugar cane. When the Pioneer Sugar Mill ceased operations, the land was sold and began to be developed into home sites. By 2010 there were 246 OSDSs installed upslope from Launiupoko, discharging an estimated 392,000 gallons of effluent per day. Between the earlier and later time periods there were statistically significant increases in the concentrations of the two microbes we studied. The increases were 132% and 352%. Furthermore, these increases were gradual over time, suggesting a possible correlation with the increased installation of OSDS over the same period. In the figures at the bottom of this document all you need to know is that green is good, non-polluted water, and yellow, orange, and red indicate increasing levels of microbial contamination. The left figures are 1994 to 1998, and the right are 2004 to 2016

Nitrogen and Phosphorus concentrations at Launiupoko also increased significantly since 1999. Given the measured increases in microbes associated with human waste, the most likely source for these elevated nutrient concentrations is OSDS effluent.

Existing scientific literature shows that in many cases the Nitrogen and Phosphorus concentrations found in OSDS effluent is substantially reduced by chemical and biological processes normally found in the soil. One exception would be when the OSDS is close to the coast and there is insufficient transit time through soil before the effluent mixes with nearshore water. Another exception would be when the sheer volume of effluent overwhelms the soil's capacity to attenuate it, such as with an injection well.

In conclusion, based on our studies we would offer the following recommendations. For injection wells we emphasize the importance of reducing Nitrogen and Phosphorus as much as possible in the injectate, as well as sterilization with UV or ozone. We advise against treating injectate with chlorine or any other substance that would impair the soil's innate ability to attenuate nutrients found in the effluent. For OSDS we recommend the same thing. Reduce Nitrogen and Phosphorus in the effluent as much as

possible combined with UV or ozone sterilization. In locations far from shore, reduction of nutrients is less of a factor, especially in soils with a large capacity for attenuation.

A copy of our paper can be downloaded from http://wq.ecooak.org/.

Sincerely,

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