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CITY AND COUNTY OF HONOLULU
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April 30, 2018

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Mr. Omer Shalev
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and

Ms. Roxanne Kwan
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Department of Health
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Dear Mr. Shalev and Ms. Kwan:

Subject: Honolulu Board of Water Supply (BWS) Comments on the Red Hill
Administrative Order on Consent (AOC) Statement of Work (SOW)
Sections 6 and 7 Groundwater Modeling Working Group Meeting
(GMMWG) No. 10 held April 13, 2018

The BWS offers the following comments on the above referenced meeting. Enclosed for reference, as Attachment A, is a copy of the Navy slide presentation from the April 13, 2018 meeting.

In summary, the BWS has no confidence that the interim groundwater flow model justifiably represents groundwater flow in Halawa and Moanalua Valleys or any capture zone created by pumping at Red Hill Shaft. The latest presentation and discussion confirmed our concerns that the model's predictions are contradicted by observed groundwater levels, whether in the Red Hill focus area or in the adjacent valleys, and that modeling assumptions of steady-state flow conditions and saprolite groundwater barriers cannot be supported by the available data. It is particularly worrisome that the Navy and its contractors have had the data necessary to correct their modeling assumptions for many months but, appear to ignore them and not change the model to accommodate these data. The result, in our opinion as a subject matter expert (SME), is an interim groundwater flow model that cannot match any of the groundwater levels

observed during 2017 to a reasonable degree while also continuing to employ non-conservative assumptions about hydrogeologic units, hydraulic properties, and groundwater flow directions. Therefore, in our opinion this interim model is not technically viable, whether to predict groundwater flow in the area of concern or provide defensible inputs to the tank upgrade alternative (TUA) selection process.

General Comments:

Objective of Developing a Technically Defensible Groundwater Flow Model

Slide 4 states that the intent of the working group includes “developing timely and technically defensible groundwater flow and contaminant fate and transport (F&T) models. BWS is concerned that the groundwater meetings have not been properly organized and focused to achieve this objective. Rather than working with SMEs to help build and vet technically sound models, the Navy have focused the last several groundwater meetings on presenting results from models. The BWS find the current interim model is not technically defensible and our rationale for this position include:

1. The lack of a credible and comprehensive conceptual site model (CSM) for groundwater flow and aquifer properties;
2. Inadequate explanation for using averages of available measured water levels to represent steady-state conditions for average pumping rates over selected time periods in 2006, 2015, and 2017;
3. The inability of the interim groundwater model to simulate hydraulic heads and hydraulic gradients to those measured in the vicinity of Red Hill Bulk Fuel Storage Facility (RHBFSF).

Disparities between Observed and Predicted Red Hill Groundwater Levels

In our comment letter for the ninth groundwater modeling working group meeting (Lau, 2018), the BWS showed how the interim groundwater flow model's (GWFM) predicted 2017 steady-state groundwater levels did not match any measured levels made during six different months in 2017 at the monitoring wells at the RHBFSF. Nor did the interim groundwater model's predictions match the Navy's 2017 steady-state observed levels for these same monitoring wells. Based on the presentations and discussion during the April 13, 2018 meeting, our concern about the interim groundwater model's unsuitability to match observed groundwater levels is only further strengthened. Navy's slide 29 for the April 2018 meeting confirmed that the base case interim groundwater model cannot adequately predict groundwater levels and flow direction at the RHBFSF.

Data presented by the Hawaii Department of Health (DOH) and the United States Geological Survey (USGS) during the April 13, 2018 groundwater modeling working

group meeting further demonstrated the interim groundwater model's inability to provide a reasonable match to observed groundwater levels in the areas of interest. The maps of observed groundwater levels presented by the DOH during the meeting appear to show that groundwater flows from the RHBFSF to the northwest across Halawa Valley, whereas the Navy's interim groundwater model predicted groundwater flow direction is to the southwest, a difference of roughly 90 degrees. USGS plots of groundwater levels observed at Moanalua and Halawa Valley wells during the December 2017 through February 2018 time period appear to support the DOH maps. The BWS downloaded the groundwater level data from the USGS website and created the plots in Figures 1 and 2 below. Examination of the Figures reveals that groundwater levels in Moanalua Valley (represented by the Moanalua, DH43, and TAMC MW02 wells) are higher than levels at Red Hill Ridge (represented by OWDFMW01), which are in turn higher than groundwater levels in Halawa Valley (represented by Halawa Shaft, Halawa TZ, and Ka'amilo wells). This observed general pattern is contradicted by the Navy's interim groundwater model's predicted base case groundwater levels for model layer 2 on Slide 29.

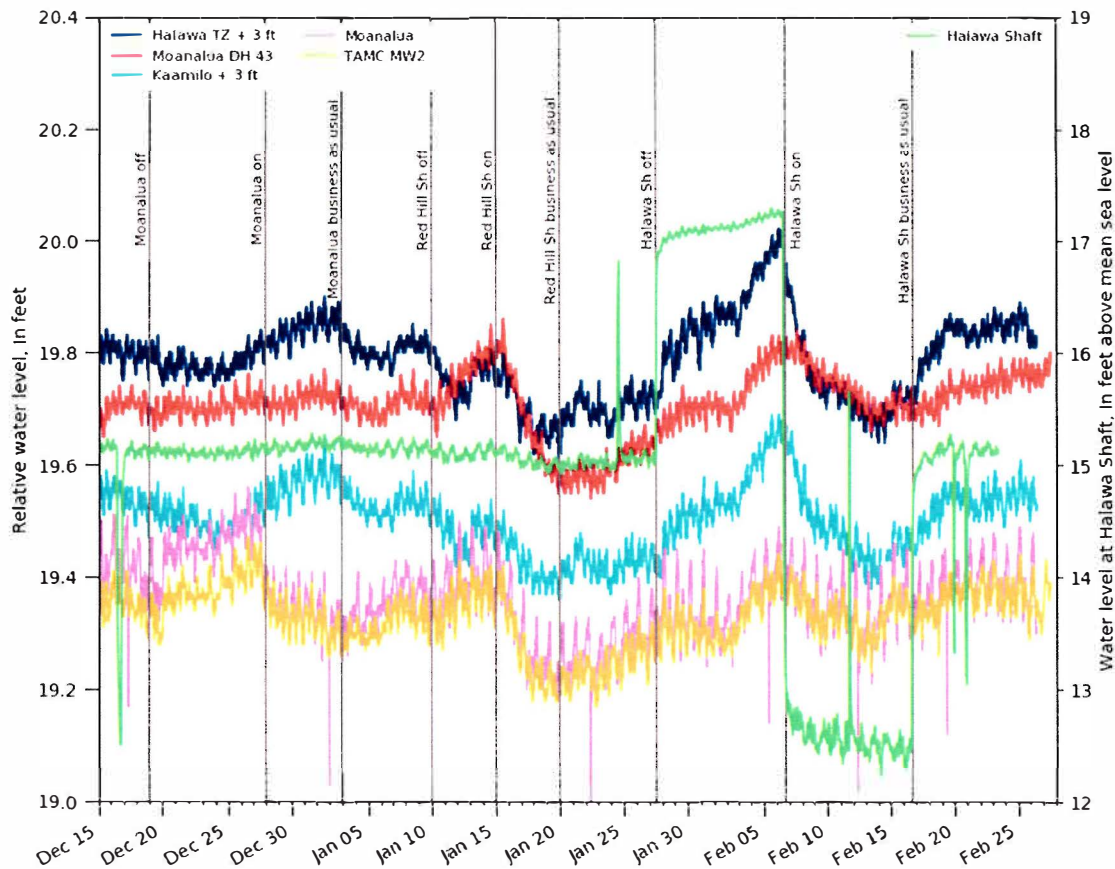


Figure 1. Observed Groundwater Levels from 2017-2018 Synoptic Water Level Survey

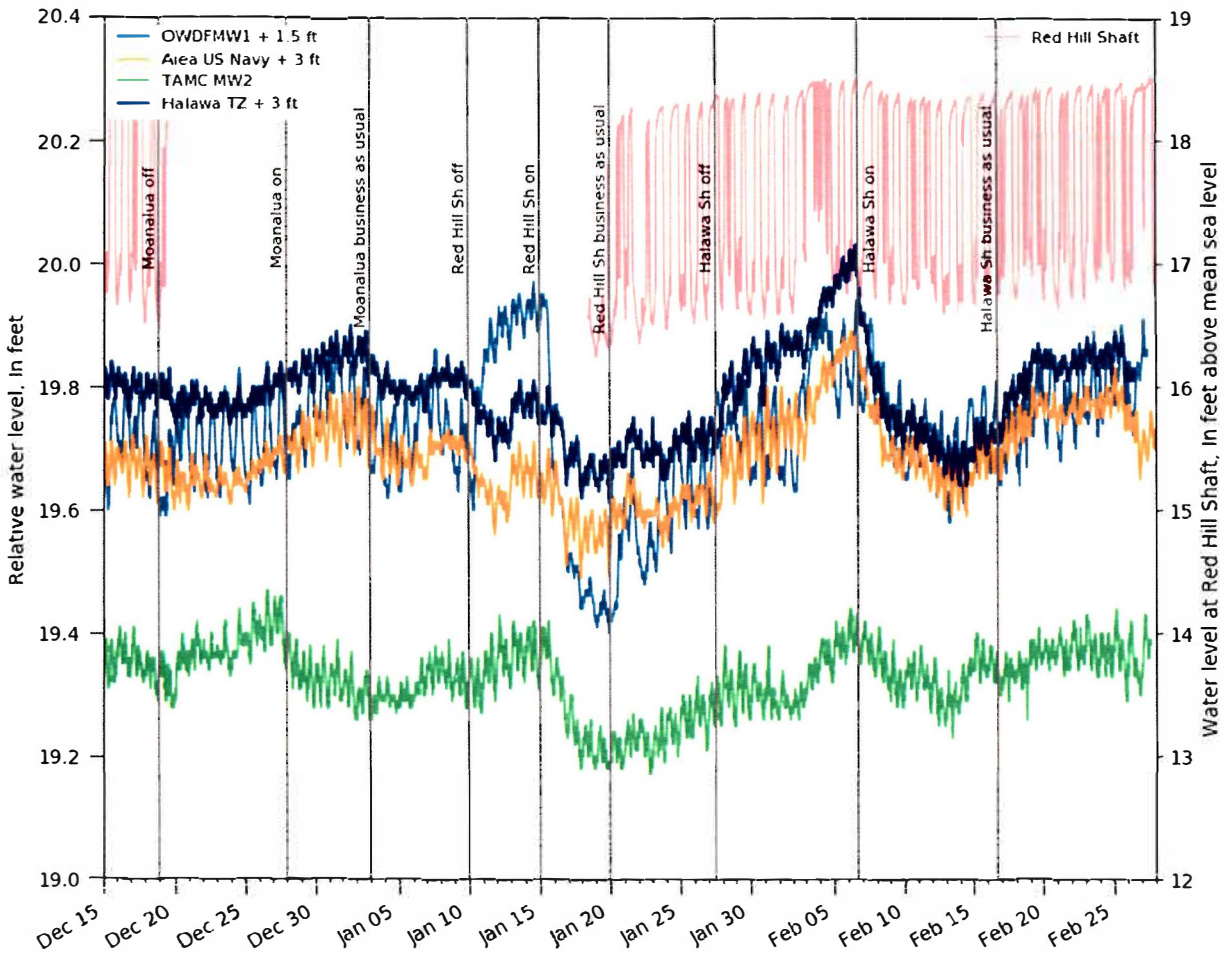


Figure 2. Observed Groundwater Levels from 2017-2018 Synoptic Water Level Survey

The increasing evidence of the Navy's interim groundwater model's inability to better simulate observed groundwater levels leads the BWS to conclude that we have no confidence in the Navy's interim groundwater flow model. There is abundance of data showing groundwater more likely flows to the north or northwest from the RHBFSF (across Halawa Valley), some of which is described above. Yet, despite the available evidence to the contrary, the interim groundwater model predicts that groundwater flows from northeast to southwest along Red Hill Ridge. The wide gulf between site-specific data and the interim model's predictions is difficult to understand, especially for non-specialists, and could be interpreted as intentional. The BWS cautions the Regulatory Agencies on accepting that the Navy's interim groundwater model can defensibly inform the TUA selection process when so much evidence contradicts both the interim groundwater model's predicted 2017 groundwater levels and its predicted large capture zone across the RHBFSF from pumping at Red Hill Shaft.

Validity of Assumption of Steady-State Conditions

During the last three groundwater meetings, BWS has expressed concerns that the Navy has not adequately vetted the rationale and data associated with developing steady-state models for 2006, 2015, and 2017. A concern we have expressed is whether the aquifer water levels can be properly modeled under the assumption of steady-state conditions. Important requirements associated with steady-state conditions include that the input and output fluxes to the groundwater flow system are perfectly balanced such that there are no changes in water levels over time. An important property of a steady-state condition is groundwater outflows such as pumping rates equal groundwater inflows such as recharge, so that water levels do not change over time. Among our concerns for using the assumption of steady-state conditions at the RHBFSF is that the Red Hill Shaft typically pumps a few hours every day and the rate is several million gallons a day. The pulsing of the water levels associated with the cyclic pumping may not allow the water levels to reach equilibrium with an average pumping rate. Another concern is that the water levels and pumping rates that were used by the Navy to model steady-state conditions were selected because they were the “best available” and not because they occurred at the best time for representing a steady-state flow. Based on limited information that BWS has reviewed regarding the water level and pumping data, it appears that the water level measurements that were used for the steady-state models were measured when Red Hill was not pumping. If this is the case, then the Navy interim steady-state models are not technically defensible.

Inadequate Hydraulic Characterization of Basalt in Vicinity of Red Hill Fuel Storage Area

A prerequisite for the development of credible groundwater transport models is a proper understanding and characterization of the hydraulic properties of the aquifer. Among the major deficiencies associated with the Navy’s interim groundwater model is the incorporation of the hydrogeological data available to the Navy to justify the simplified representation of the basalt hydraulic properties in the interim groundwater model. As described by BWS in November 2017, the Navy’s Groundwater Model Evaluation Plan (GMEP) incorrectly attributed the hydraulic properties from basalts in Maui to the basalts at the RHBFSF (Lau, 2017). Instead of trying to work with SME’s to determine how best to fill this data gap, the Navy has ignored this data gap and has made assumptions regarding the basalt that the BWS believes are not technically defensible based on the information provided in the groundwater modeling working group meetings. Among the major omissions of the basalt characterization is a transient analysis of the cyclic pumping at Red Hill Shaft on water levels that could provide estimates of the basalt storativity and transmissive properties. Another major omission is an analysis of the spatial heterogeneity and geological features observed in existing cores and driller reports from the installation of Red Hill Shaft and the Red Hill monitoring wells. This information should be used to investigate an alternative

explanation for the inability of the interim groundwater model to accurately simulate observed hydraulic gradients and measured water levels.

Intent of the Red Hill Groundwater Modeling Working Group

Slide 4 states “the intent of the GWFM Working Group is to support the Navy’s objectives relative to development timely and technically defensible groundwater flow and contaminant fate & transport (F&T) models for Red Hill.” This statement appears to suggest the purpose of the GWFM Working Group is to not only support the Navy’s effort to develop the groundwater model but also approve the model developed to date as being “technically defensible”. The BWS attends the GWFM Working Group meetings to offer our advice and recommendations in support of developing technically defensible groundwater models. Our attendance represents our commitment to the process but not tacit endorsement of Navy models that we find are not technically defensible. To date the BWS has contributed input to interim groundwater model development through our questions and comments made in person and through our numerous comment letters that explain our most important concerns with development of the interim groundwater model. Unfortunately, we find our recommendations are not accepted based on the lack of change between one version of the model and the next. For this reason, BWS participation in the GWMWG meetings is not an endorsement of the proceedings and the resulting interim groundwater model. Based on the available data and Navy’s statements and presentations, the BWS has concluded the Navy’s interim groundwater model developed to date is not technically defensible.

Specific Comments to Navy Slide Presentation

Slide 4: As discussed previously, Slide 4 states that the intent of the working group includes “developing timely and technically defensible groundwater flow and contaminant fate and transport (F&T) models for Red Hill.” BWS participates in the GWFM Working Group as an SME offering technical input intended to improve the technical defensibility of the conceptual and numerical modeling for the Red Hill area. Our presence and participation in the working group represents our commitment to the process but not endorsement of work products we find are not technically defensible. Based on our previous comment letters and our comments made above, the BWS’s position is that the current interim model is not technically defensible.

Slides 9 and 10: Where are the entries for the RHBFSF’s monitoring wells? Why were they left off when these monitoring wells are located in the middle of the focus area? Please correct the table as soon as possible and provide to all SMEs.

Slide 27: The calibration statistics without the presence of saporlite do not differ significantly from those when saporlite in present, indicating that the flow

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calibration is not sensitive to the presence or absence of saprolite. This means that the Navy has constructed and continues to use a non-conservative interim groundwater model, which contradicts their contractors' statements that they will be conservative.

Slide 29: Predicted groundwater levels show the same incorrect pattern whether saprolite is included as a lower permeability material or not. This demonstrates that the Navy's choices of the interim groundwater model boundary conditions create the incorrect pattern, not the presence or absence of saprolite.

We continue to ask that the Navy distribute meeting handouts and other information documents two weeks prior to the start of each meeting to ensure SMEs and other stakeholders are afforded the opportunity to thoroughly review the materials ahead of time. We also request that the Navy and its contractors provide copies of all materials disclosed at the previous groundwater modeling working group meetings that they committed to share with SMEs.

Thank you for the opportunity to comment. If you have any questions, please feel free to call Erwin Kawata, Program Administrator of the Water Quality Division, at 808-748-5080.

Very truly yours,



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Enclosure: Attachment A, Navy Slide Presentation Dated April 13, 2018

References

- Lau, E. 2017. Board of Water Supply Comments on the Groundwater Model Evaluation Plan (GMEP), Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility Administrative Order on Consent (AOC) in the Matter of Red Hill Bulk Fuel Storage Facility, EPA Docket Number RCRA 7003-R9-2015-01 and OOH Docket Number 15-UST-EA-01, Attachment A, Statement of Work (SOW) Section 6.2, Section 7_1-2, Section 7.2.2, and Section 7.3.2 dated September 8, 2017. November 13.
- Lau, E. 2018. Honolulu Board of Water Supply (BWS) Comments on the Red Hill Administrative Order on Consent (AOC) Statement of Work (SOW) Sections 6 and 7 Groundwater Modeling Working Group Meeting No. 9 held March 16, 2018. April 26.