

Detailed Responses to EPA/DOH Feedback of June 26, 2023
Sentinel and Monitoring Well Installation Work Plan Addendum

- 1) **EPA/DOH: Update the Draft WPA to include a map of current well locations and proposed future well locations. In early 2022, the EPA, DOH, and other stakeholders worked with the Navy to identify multiple well locations that would meet specific data collection objectives. Since the meeting, several of the proposed well locations have shifted or been dropped from the Navy's weekly monitoring well expansion updates. Please refer to the enclosed table documenting the original well objectives, the location changes, and whether updated locations meet original well objectives. All proposed well locations (regardless of access status) should be depicted on a WPA figure, along with completed well locations.**

Navy Response: The work plan addendum is limited to changes with the dual borehole approach. A new work plan, with future locations and data quality objectives, will be developed after the October 2023 subject matter expert meeting. This new work plan for the next phase of monitoring well installations will be provided to the Regulatory Agencies upon its completion after the subject matter expert meeting.

- 2) **EPA/DOH: The Draft WPA does not include any changes to previously approved well locations. In 2022, subject matter experts (SMEs) from the EPA, DOH, Honolulu Board of Water Supply, United States Geological Survey, CWRM, and the Navy worked together to proposed and prioritize new well locations that would meet specific objectives (e.g., assess groundwater flow patterns and geology/lithology). Understanding that field conditions and right of entry issues could potentially hinder the installation of wells in specific locations, the SMEs created a figure with well installation zones that would allow the Navy the flexibility to alter a proposed well location, so long as it was still installed within the associated zone to ensure that the specific objectives were still met. Over the past year, the Navy has changed the locations of wells so that they are far from the originally proposed location(s), omitted important proposed wells from recent figures, and added new wells with unclear objectives. The Draft WPA should include a description of these changes, the rationale behind each change, and the identification of any potential data gaps or missed objectives that may result from each change. Prior to the installation of a well in a location other than those previously approved, the Navy should seek input and approval from the SMEs and Regulatory Agencies. Should the installation of a well at an alternate location occur prior to receiving input and approval from the SMEs and Regulatory Agencies, this may result in the necessity to install an additional well(s) if the Regulatory Agencies determine that the alternate well location does not meets the specific objectives.**

Navy Response: The work plan addendum is limited to changes with the dual borehole approach and not a revision of any other component of the Sentinel and Monitoring Well Installation Work Plan. A new work plan, with future locations and data quality objectives, will be developed after the October 2023 subject matter expert meeting. This new work plan for the next phase of monitoring well installations will be provided to the Regulatory Agencies upon its completion after the subject matter expert meeting.

- 3) **EPA/DOH: Add a section to the Draft WPA to discuss changes since the *Sentinel and Monitoring Well Installation Work Plan* (SMWIWP) was conditionally approved in 2022. For instance, the Navy has proposed alternative well locations MW-1 through MW-5 and presented these wells at public meetings. These wells were not included in the SMWIWP, and it is unclear which data quality objectives (DQOs) will be met with each well. Update the Draft WPA to describe how wells MW-1 through MW-5 will be constructed and which DQOs they will meet. Update the Draft WPA with any additional changes.**

Navy Response: The work plan addendum is limited to changes with the dual borehole approach and not a revision of any other component of the Sentinel and Monitoring Well Installation Work Plan. Accordingly, the work plan addendum does not propose any changes to previously provided monitoring well locations.

The alternative well locations (MW-1 through MW-5) were presented at public meetings as evidence that the Navy is continuing its commitment to review and response to any potential permitting or site approval issues to meet its commitment of providing an expanded monitoring well network.

A new work plan, with future locations and data quality objectives, will be developed after the October 2023 subject matter expert meeting. This new work plan for the next phase of monitoring well installations will be provided to the Regulatory Agencies upon its completion after the subject matter expert meeting.

- 4) **EPA/DOH: Add a section to the Draft WPA describing barriers that prevent the placement of proposed wells and solutions that the Navy is pursuing. For instance, the Regulatory Agencies continue to encourage the Navy to pursue the placement of six wells on Queen Emma Land Company (QEL) property. The Navy has had difficulty obtaining right of entry to install the proposed wells in the six locations. The EPA, DOH, Navy, and QEL have been meeting to resolve the access issues. The Navy has reported barriers to placing other wells in housing areas, along roads, etc.**

Navy Response: The work plan addendum is limited to changes with the dual borehole approach and not a revision of any other component of the Sentinel and Monitoring Well Installation Work Plan. Accordingly the work plan addendum does not propose any changes to previously provided monitoring well locations and, therefore, does not address these barriers.

The Navy has continued with the pursuit of placement of wells on Queen Emma Land property and has kept those wells on the list, pending resolution of legal issues. The last version of the SMWIWP, provided on November 22, 2022, included many of the requested descriptions.

The Navy intends to review and discuss the barriers to the installation of the originally planned wells with the well installation stakeholders in the October 2023 subject matter expert meeting. A new work plan, with future locations and data quality objectives, will be developed after the October 2023 subject matter expert meeting. This new work plan

Enclosure (1)

for the next phase of monitoring well installations will be provided to the Regulatory Agencies upon its completion after the subject matter expert meeting.

- 5) **EPA/DOH: Upload the associated boring log(s), geophysical log(s) and monitoring well installation construction diagram(s) into the Environmental Data Management System within thirty (30) calendar days following the completed installation of each monitoring well.**

Navy Response: Per the conditional approval letter of September 29, 2022, the Navy continues to provide the geophysical logging reports, boring logs, and finalized drilling data files to the Regulatory Agencies approximately 90 days after each well is completed. An earlier turnaround time remains infeasible due to the time required to prepare and finalize the logs, including completing appropriate review, verification, data entry, and validation.

- 6) **EPA/DOH: Item #1 – Dual Borehole Approach. The Regulatory Agencies will consider this change if:**
- **The boreholes are placed close enough that coring logs represent the geology and hydrogeology of the well borehole;**
 - **The depth of the borehole used for geophysical logging and water level testing is the same depth as the borehole used for well placement;**
 - **The geophysical/water level data are used to inform well design; and**
 - **Installation of more than one monitoring well screens can be accommodated dependent on downhole data and location.**

Also provide documentation that CWRM reviewed and approved the changes proposed in Draft WPA Item #1.

Navy Response: While specific lithology may vary over short distances (e.g., few feet) given the heterogeneity of the site geology, the data obtained during coring is not needed to identify target zones for well completion. A distance of 10-15 feet was proposed to provide adequate separation to avoid the remote possibility of the core hole intersecting the completed well. In clinker intervals, the cement is harder than the formation and causes the potential for hole deviation.

The observational data needed to design the well screen are independent of the core details. Cores are being collected for other purposes of lithologic characterization. Coring data provides key information such as the presence of confining units, the data for further understanding overall site geology, and provides informative data to support the geologic conceptual site model (CSM). Core hole fluids complicate water level interpretations and potentially reduce formation permeability. Reaming an open core hole creates the possibility of vertical conduits if the plumbness and alignment of the reamed hole deviates from the original core hole and for that reason, the core hole is filled with cement and over drilled in the vadose zone. Over drilling the grouted core hole can be problematic.

Enclosure (1)

Observations can be made during air drilling on the presence/absence of perched groundwater, water level elevations, and productivity at various depths in the borehole which is key information for determining well completion depths. The ability to evacuate the borehole with air provides better observational data faster, more accurately, and more efficiently than water level evaluation during core drilling where large volumes of fluids are injected and the hole cannot be easily evacuated. Additionally, downhole video logging and preliminary geophysical logging data can be used to evaluate the borehole characteristics.

According to the CWRM and the Hawaii Well Construction & Pump Installation Standards, test borings do not require well construction permits. This has been confirmed through emails (2018) and phone calls (2022/2023) with the Commission on Water Resource Management. As defined in the standards, a “test boring means any excavation or drilled hole whose purpose is the immediate determination of subsurface geologic, hydrologic, or contaminated conditions usually, but not always, in the unsaturated zone above the ground-water level. This definition includes borings for foundation, underground storage tanks, environmental monitoring under the purview of other government agencies and hazardous water remediation. A test boring is not intended for the purpose of conversion to a production well.”

The dual borehole approach could be used to install additional co-located wells with deeper screen interval at sites where analytical data suggest the potential for more than one preferential pathway at locations distant from Red Hill and near potential receptors (e.g., water supply wells). However, the Navy believes that co-locating or installing nested wells are not viable without impacting the CY2023 well installation program.

The Navy intends to review and discuss co-located or nested locations with the well installation stakeholders in the October 2023 subject matter expert meeting. A new work plan, with future locations and data quality objectives, will be developed after the October 2023 subject matter expert meeting. This new work plan for the next phase of monitoring well installations will be provided to the Regulatory Agencies upon its completion after the subject matter expert meeting.

- 7) **EPA/DOH: Item #2 – Requirements for Conductor Casing. Draft WPA Item #2 recommends no conductor casing when no evidence of contamination is present. The addendum references past challenges with installing casings and difficulties retrieving core pipes (that could have led to the abandonment of the well itself). The EPA has the following concerns:**
- **Future contamination may potentially reach the basal aquifer if no conductor casings are installed.**
 - **Current contamination may not be identified with the proposed screening techniques, so wells may inadvertently be constructed without conductor casings within dissolved-phase plumes. Note that not all contamination can be identified in the field. There may be no smell or visual evidence of dissolved-phase fuel additives, other fuel components, or per and**

Enclosure (1)

polyfluorinated substances. Some of these contaminants will not trigger photoionization detectors readings.

Navy Response: All monitoring wells are installed with vertical seals from a minimum of approximately 10 feet above the basal aquifer to land surface that will protect from future migration in the vadose zone. Per the approved SMWIWP, conductor casings are only required where evidence of a perched water body is encountered or contamination is observed during drilling.

Approving Item #2 would allow intervals of suspected perched water with significant inflow identified during drilling to be grouted and re-drilled or isolated using conductor casing to reduce or eliminate inflow to the borehole. Additionally, item #2's conductor casing design aligns with the Honolulu Board of Water Supply's proposed well schematics for their Halawa Valley Groundwater Study. Conductor casing does not provide a better seal, it provides a seal during drilling into the basal aquifer and well construction that becomes redundant after the well is fully constructed.

A color-coded figure of well design that better illustrates the well casing design will be included in the new work plan following the October 2023 subject matter expert meeting.

- 8) **EPA/DOH: Item #3 – Change in Well Design Conductor Casing Diameter. If conductor casings are installed, Draft WPA Item #3 recommends using smaller conductor casings while still allowing for a 4-inch casing to be installed. The addendum states this may expand the list of drillers available that offer this service.**

The Regulatory Agencies agree with Draft WPA Item #3, assuming CWRM reviewed and approved this proposed change.

Navy Response: All changes are within regulation of the monitoring well's construction permit.

A copy of the WPA was sent to CWRM on June 8th, 2023. To date, no comments have been received. Direct emails to CWRM were sent in December of 2022 regarding casing dimension changes. CWRM had no issues, provided the well was constructed within standards. All monitoring wells comply with state regulations.

- 9) **EPA/DOH: Item #4 – Tunnel Well Drilling. Draft WPA Item #4 recommends changes to drilling equipment to allow for drilling within the lower access tunnel. It also sets criteria to determine whether a conductor casing is installed. The Regulatory Agencies reiterate our concerns that not installing conductor casings, especially within the lower access tunnel, increases the risk of contamination reaching the basal aquifer from future contamination migration.**

Enclosure (1)

The Regulatory Agencies do not approve the Draft WPA Item #4 recommendation. Refer to the approved protocols in the SMWIWP when determining whether to install conductor casing in Red Hill groundwater monitoring wells.

Navy Response: Only an electric Hagby drill rig is available for well installation in the lower access tunnel. As stated in the Work Plan Addendum, drilling an 8-inch-diameter borehole in basalt to install a 5-inch Schedule 40 low-carbon steel conductor casing is not possible in the lower access tunnel due to the drill rig's limitations. The maximum borehole diameter (6 inches) that the Hagby drill rig can drill does not allow for installation of conductor casing. If perched water or evidence of contamination is not observed, coring would be conducted until the target depth is reached and a 2-inch-diameter well will be constructed.

The only well currently planned in the tunnel is RHMW21. That well has been delayed until the next phase of monitoring well installations to avoid conflicting with defueling operations. Specific details about the way this in-tunnel well will be constructed will be discussed at the October 2023 well installation meeting, with any required deviations from a typical well construction included in the new work plan for the next phase of monitoring well installations.

Enclosure (1)