



Red Hill Bulk Fuel Storage Facility

Informational Briefing

Stakeholder Advisory Group Meeting

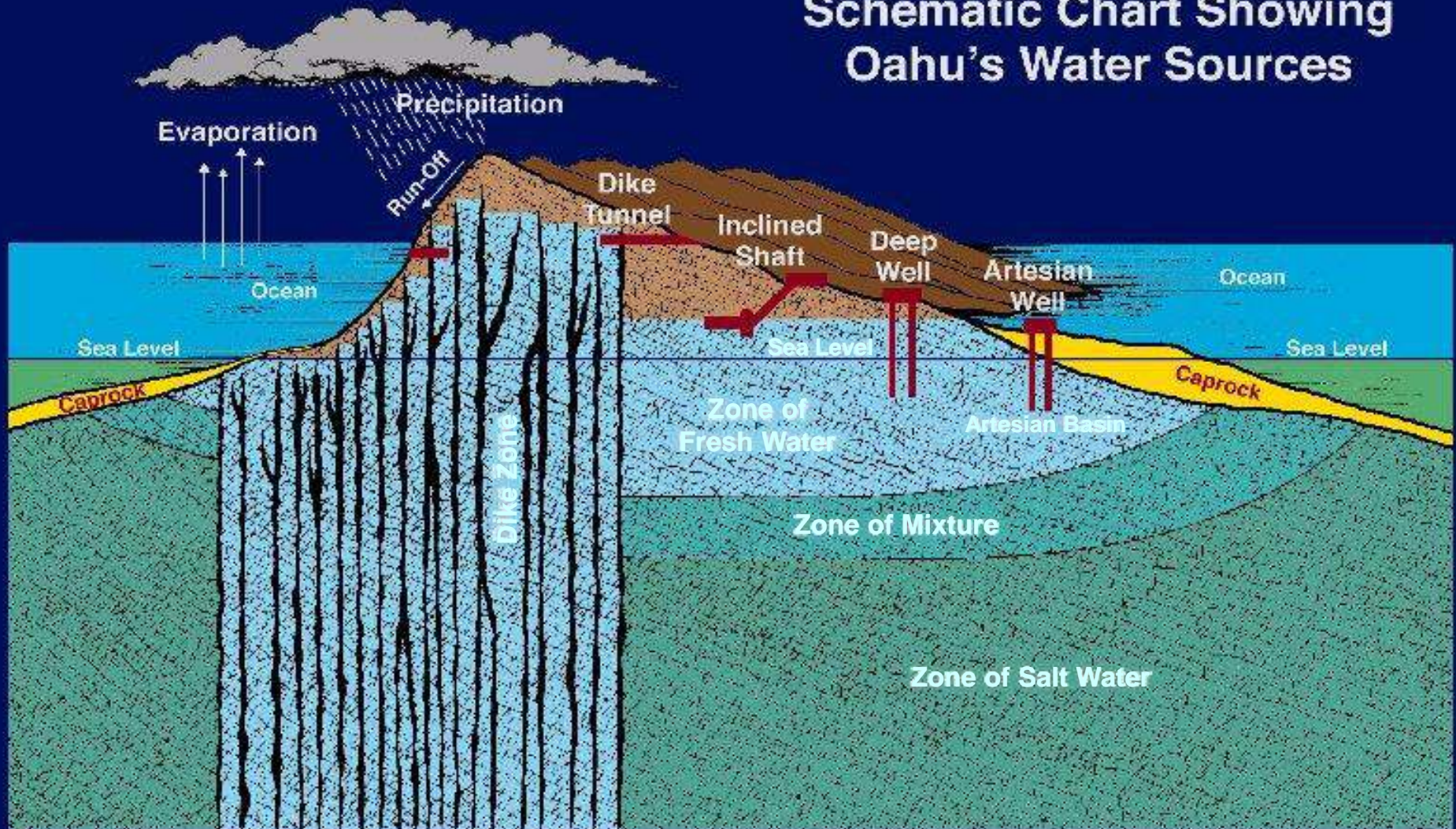
January 24, 2019



Today's Discussion

- Oahu's Groundwater Aquifer
- Review BWS understanding of data and facts to date
 - Navy proposed Tank Upgrade Alternative (TUA) Way Forward
 - Tank 14 coupons
 - Interim groundwater model report
- Summary

Schematic Chart Showing Oahu's Water Sources





Oahu's Groundwater Aquifer

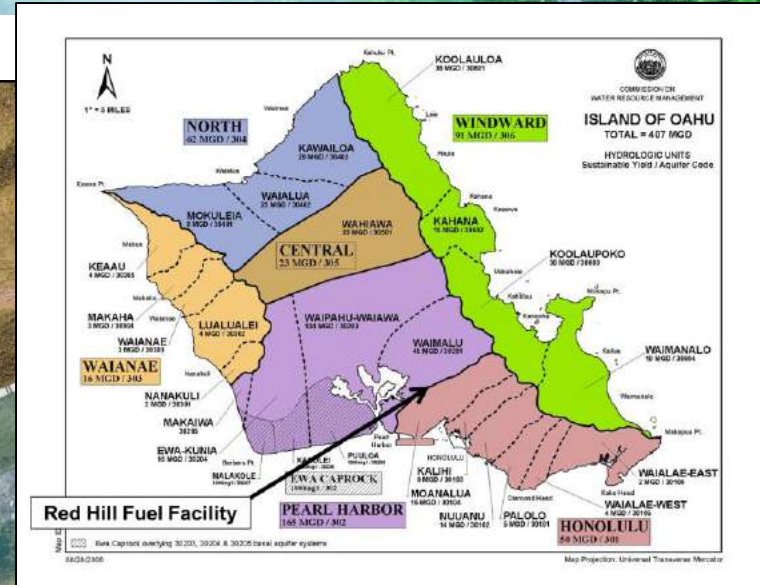
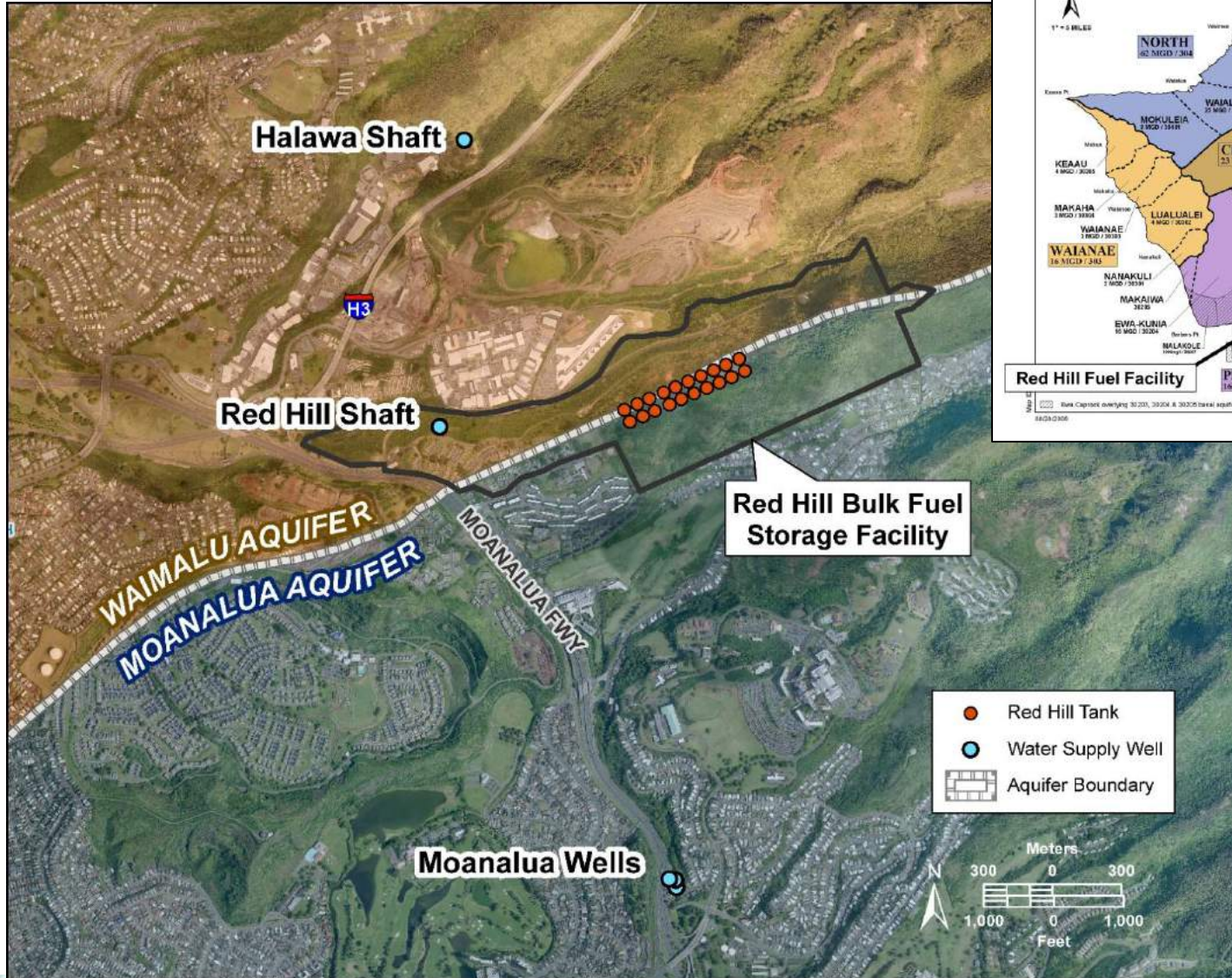
- Is one large continuous geological formation.
- Smaller aquifers (called sub-aquifers) can exist within the larger formation.
- All parts of the aquifer are hydraulically connected with each other.
- The aquifer can contain geologic subsurface features called valley fills that can exist between one part of the aquifer and another.
- Not much is known about valley fills except water can travel through them at different speeds. More data is needed to better understand them.

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Board of Water Supply
City and County of Honolulu

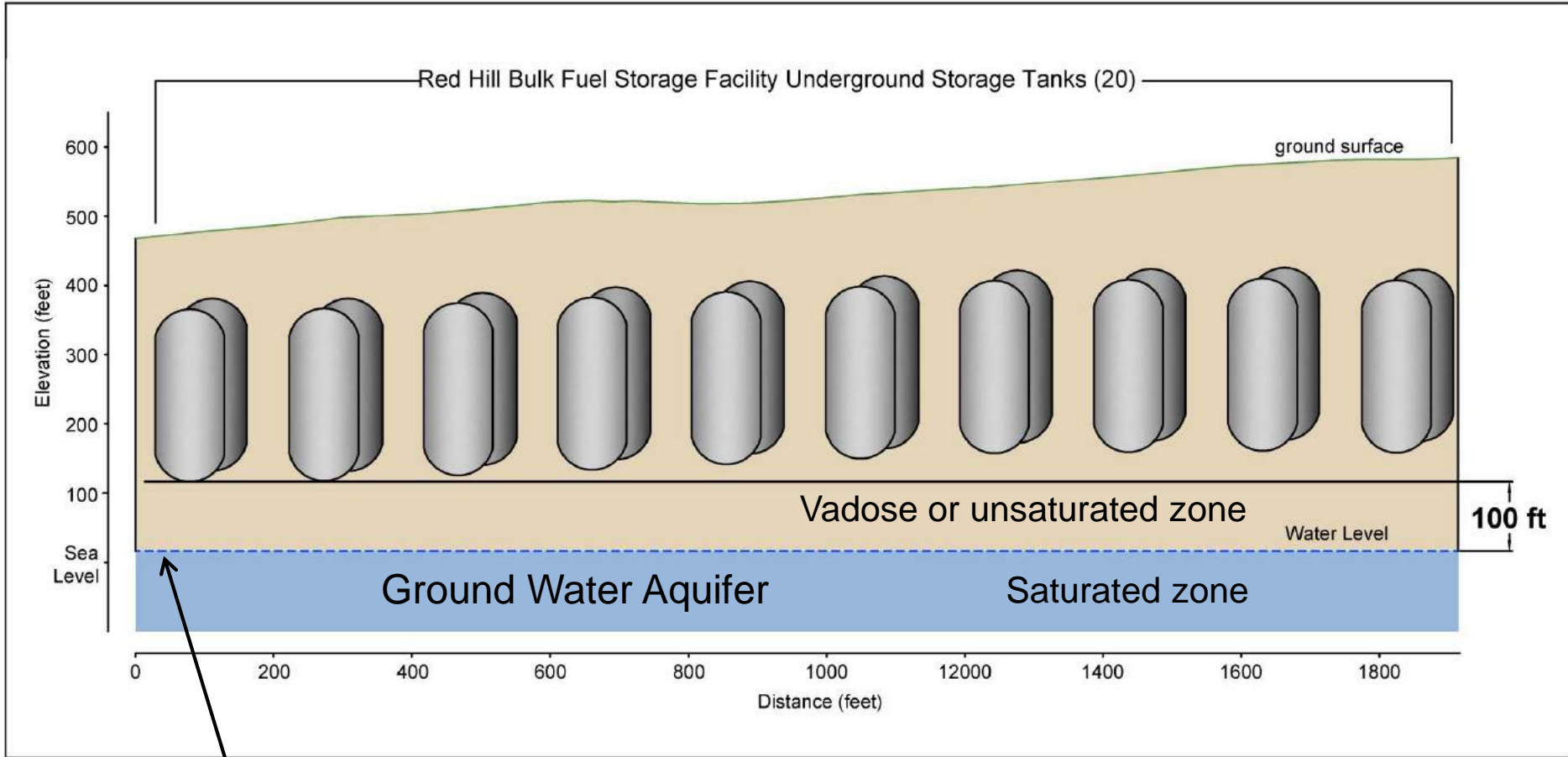


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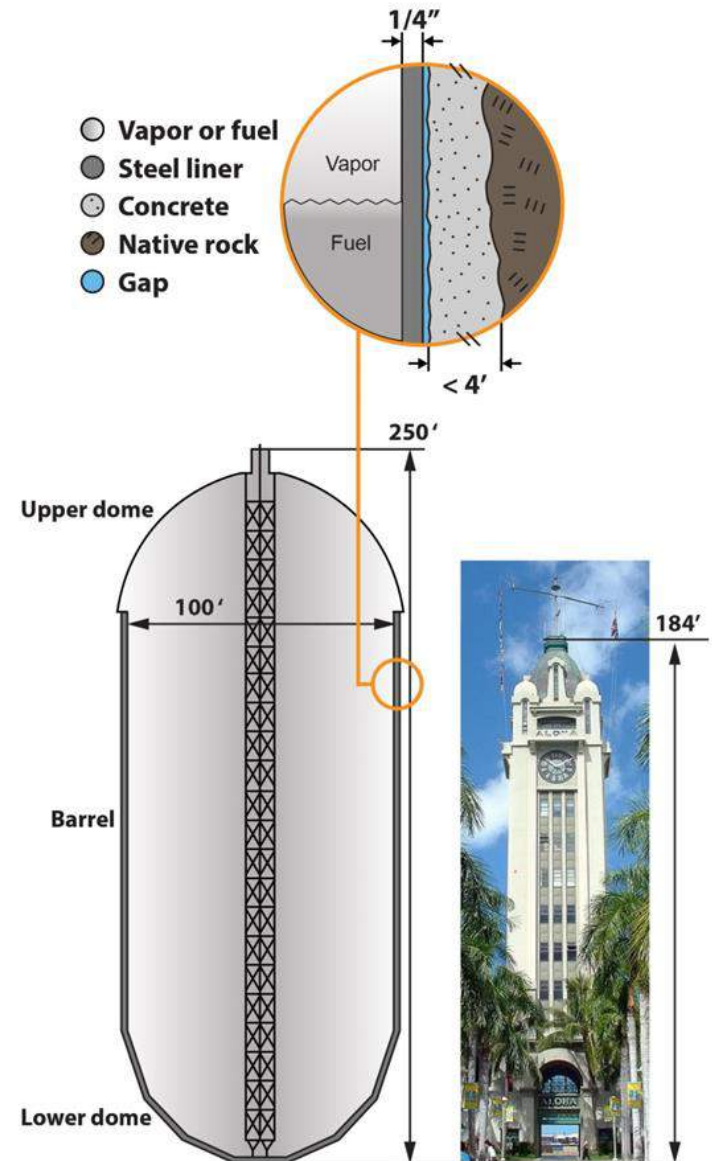
Board of Water Supply
City and County of Honolulu



Top of groundwater table (approx. + 20 ft. MSL)

Red Hill Tanks

- Concrete with $\frac{1}{4}$ inch steel liner.
(Lower dome base is $\frac{1}{2}$ inch)
- Red Hill Tank large enough to hold Aloha Tower.
- Fuel storage
 - Currently JP-5, JP-8 and F-76 (marine diesel).
- 15 active tanks together store 187 million gallons of fuel.
- Rainwater seeping between $\frac{1}{4}$ inch steel liner and concrete and corroding steel liner.





Red Hill Facts

- Oahu's sole-source groundwater aquifer provides critical drinking water supplies and cannot be replaced.
- Enormous amount of fuel stored 100 feet over a major drinking water resource.
- Petroleum chemicals detected in groundwater and rocks underneath the tanks.

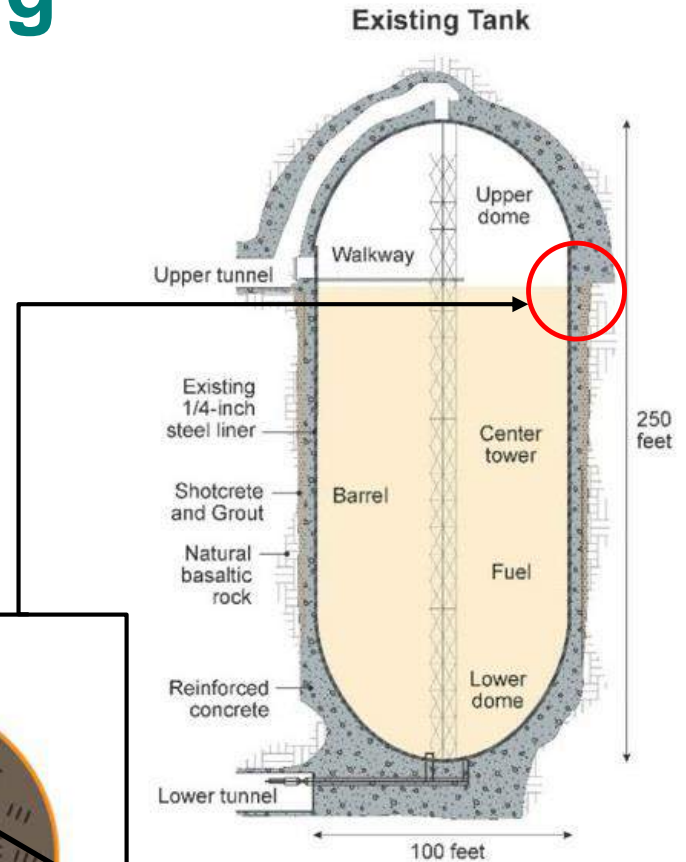


Red Hill Administrative Order on Consent (AOC)

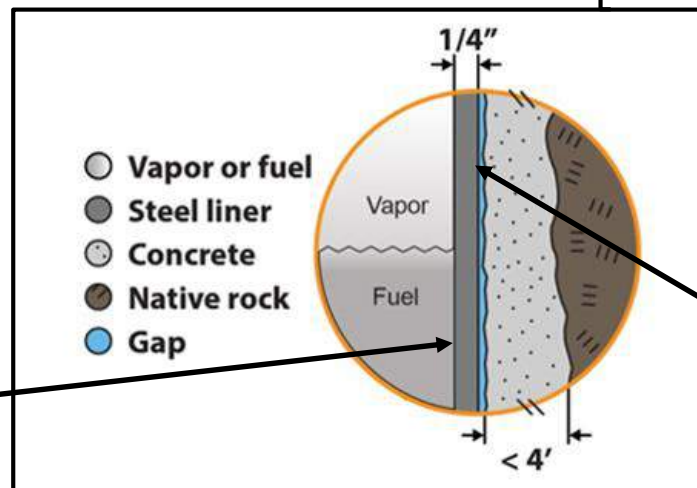
- Sec 2 – Tank inspection, repair & maintenance
- Sec 3 – Tank upgrade alternatives
- Sec 4 – Release (leak) detection and tightness
- Sec 5 – Corrosion and metal fatigue
- Sec 6 – Investigation & Remediation
- Sec 7 – Groundwater Protection and Evaluation
- Sec 8 – Risk / vulnerability assessment

Study Condition of Existing Tank

- Examine fuel side and back side of tanks.
- How well is non-destructive evaluation (NDE) techniques able to identify need for tank repairs

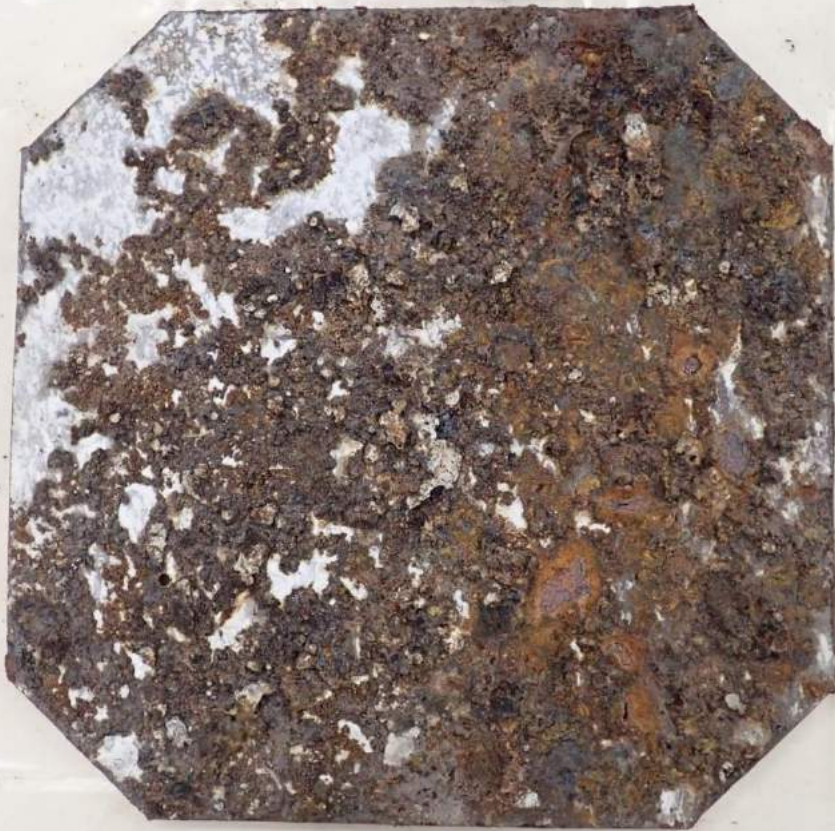


Fuel side
of liner



Back side
of liner

(Coupon #7) Barrel – back side

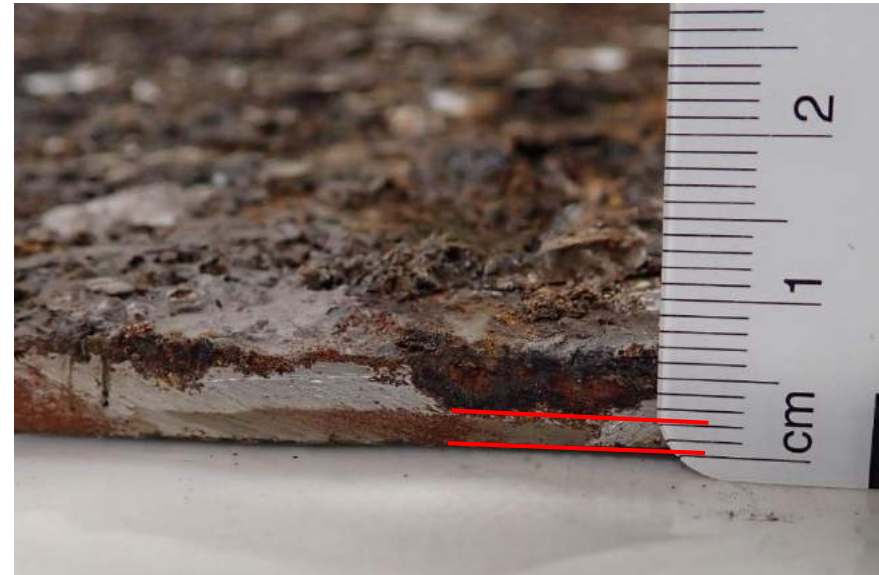


NDE Predictions:

- Minimum remaining thickness:
0.135" to 0.187"

June 25th Observations:

- Apparent remaining thickness:
2mm = 0.079"

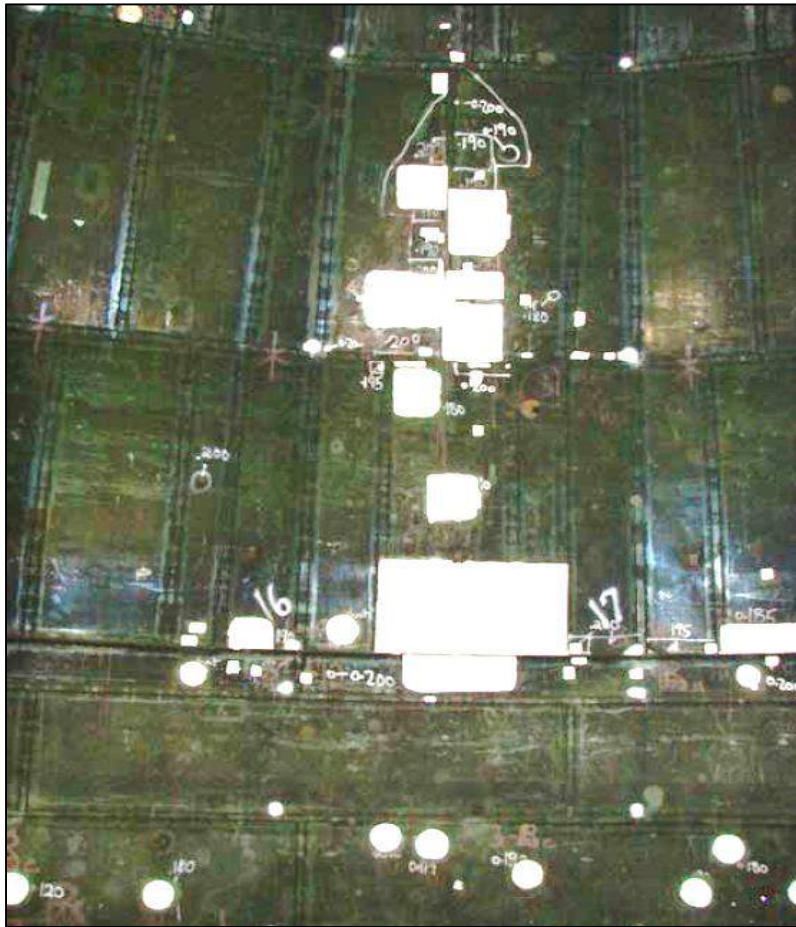




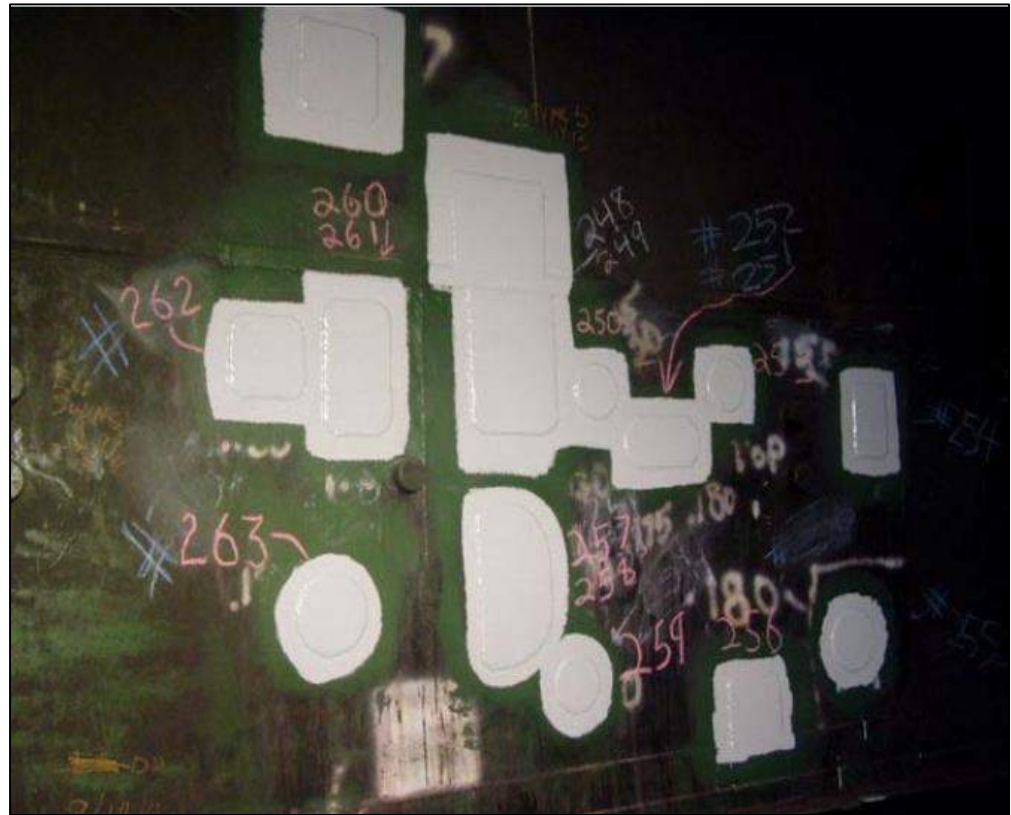
Coupon Review

- Presence of backside corrosion
 - Half of the coupons exhibited considerably more corrosion.
 - Potential for through-wall pitting, and associated fuel leaks, is a concern.
- Staining on Backside of Steel
 - Deposits on the backside of some coupons suggest hydrocarbon-staining. Chemical analysis pending.
- Current NDE Technique Appears to Underestimate Remaining Wall Thickness
 - Corrosion pit depths measured on the cut specimen edges suggest that NDE techniques were not able to locate and measure the thinnest wall of the coupon.

Existing methods cannot possibly find and fix every thinned area in need of repair in the tank due to Tank's enormous size.



Typical Patch Plate Repairs on Tank 6, Dunkin & Bush, Inc. Report on Tank 6 As Built Repairs, Contract Number N62742-03-C-1402. June 2007 (Navy, 2016).



Typical patch plate repairs in Tank 15 Dunkin & Bush Inc., Report on Tank 15 Phase 2 As Built Repairs, Contract number N62742-03-C1402, Clean and Repair Tanks 1, 6, 15, and 16, at Red Hill Fleet and Industrial Supply Center, Pearl Harbor, Hawaii, Dunkin & Bush, Inc., March, 2006 (Navy, 2016).



Tank 14 Coupon Inspection

- Concrete Tank Cannot Contain Fuels
 - Concrete was never was meant to contain fuel that why it was designed with ¼-inch steel liner
 - Concrete is porous, shrinks and cracks over time – not effective fuel barrier
 - Porous nature of concrete is demonstrated by 2014 leak and staining underneath most tanks
- Fuel Release Depends on Integrity of ¼-inch 75-year old steel liner
 - Liner outside surface cannot be protected from corrosion – it cannot be maintained, repaired, or painted
 - BWS concerned that thinnest areas of liner (from rust or other defects) will lead to a through wall hole
 - Navy has **not** demonstrated that that they can find **all** areas that need repairing (are thinner than 0.160-inches)



2014 Release is NOT the Only Release

- A release from Tank 6 was reported by the Navy in 2002 (Navy, 2002).
- Tanks 15 and 16 also had fuel releases after 1988 (Navy, 2014).
- Navy TIRM report indicate that Tank 5, Tank 10, Tank 17, Tank 19, Tank 20 underwent inspections after 1988 that identified through-wall corrosion and therefore possibly leaks below the detection limit (Navy, 2016).
- The groundwater data from 2005 to present show petroleum chemical contaminants in groundwater samples.
- Petroleum staining found in cores taken before 2014 beneath 19 of 20 tanks (AMEC, 2002).
- Navy's Red Hill Facility Groundwater Protection Plan (GWPP) report documents leaks from various tanks from 1940s – 1980s (Navy, 2008).

TUA	Description	ROM cost per Tank (\$M)	Number of Tanks (% capacity)	Project End Date	Years to Complete	Cost per Year (\$M)
1A	Restoration of Existing Tank	10 – 25	18 (100%)	2031	12	15 – 38
1B	Restoration of Existing Tank + Coating	25 – 100	18 (100%)	2037	18	38 – 100
1D	Remove existing liner, Install New Steel Liner	100 – 250	18 (100%)	2038	19	95 – 237
2A	Composite Tank (Double wall) Carbon Steel	25 – 100	20 (88%)	2040	21	24 – 95
2B	Composite Tank (Double wall) Stainless Steel	100 – 250	20 (88%)	2037	18	111 – 278
3A	Tank within a tank (Carbon Steel)	100 – 250	20 (80%)	2038	19	105 – 263
Alt	New Tanks	100 - 250	40 (100%)	2051	32	125 – 312

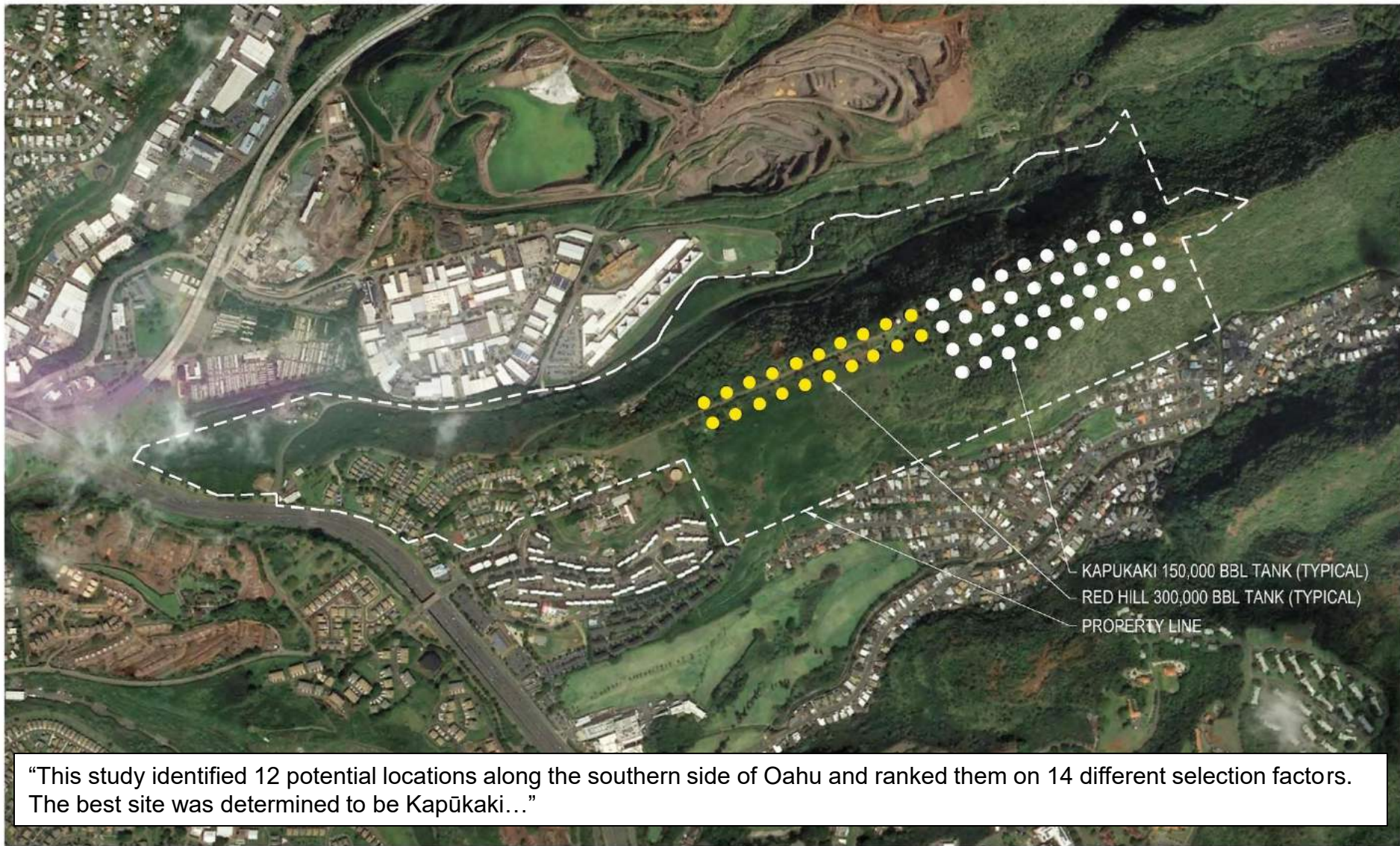


Figure 7.1-1 Kapūkaki Tank Layout

Ref: Red Hill Alternative Locations Study, Revision 3, Austin Brockenbrough Engineering and Consulting, February 5, 2018.



Navy Identifies Existing Single-Wall Tank (TUA 1A) as Proposed TUA Way Forward

“The Proposed TUA Way Forward. At this time, the Navy and DLA will:

- Continue with sustainment / maintenance of the existing tanks in accordance with current procedures as the Navy's initial best available practicable technology (BAPT) decision submittal.”

Ref: <https://www.cnrc.navy.mil/regions/cnrh/om/environmental/red-hill-tank.html>

other stakeholders such as the U.S. Geological Service and the Board of Water Supply. This series of meetings could take up to several months, but once complete, the Navy and DLA will have 60 days to submit a formal TUA recommendation report for regulatory agency approval.

The Proposed TUA Way Forward. At this time, the Navy and DLA will:

- Continue with sustainment/maintenance of the existing tanks in accordance with current procedures as the Navy's initial best available practicable technology (BAPT) decision submittal.
- Propose a pilot for regulatory approval of application of an interior epoxy coating to one tank to determine feasibility of this unproven coating method.
- Fund an upgrade to the leak detection system.

As part of this way forward, there are proactive actions being taken by Indo-Pacific Command, the Joint Chiefs of Staff, and the Institute for Defense Analyses to revalidate the fuel in the Indo-Pacific Command Area of Responsibility. The fuel requirement validation and logistics laydown 6-term plan for Red Hill. Moving forward, these studies BAPT decisions by stakeholders, recognizing that changes of other alternatives and should feed into the first

TUA Way Forward. The Red Hill fuel tanks were near long-service life. A Tank Tightness Test for each tank with federal and state regulations utilizing the Massology Precision Mass Measurement System. Since we tanks have never failed. Further, in 2016 the EPA used a baseline evaluation of the systems, management endures, at Red Hill with respect to IG industry and American Petroleum Institute, the American Society for Society of Civil Engineers, the American Society of Society for Testing and Materials, and the National Fire team found that the systems, inspection technologies/ ment practices in place at Red Hill meet or exceed best tank fuel storage facilities. Moreover, new equipment and ton fidelity.

tion plan additionally provides a multi-pronged approach sinking water. Specifically, gles are collected monthly beneath all tanks and volatile organic compound concentrations using a photo-Sampling. Samples are drawn from monitoring wells le the Red Hill lower access tunnel. Oil/water interface measurements are taken monthly at he water level at each well is gauged and measured for the ueous phase liquids using an interface meter.

part of our critical infrastructure, both in the event of conflict and humanitarian missions.

Very Respectfully,

B. P. FORT
Rear Admiral, U.S. Navy



DEPARTMENT OF THE NAVY
COMMANDER
NAVY REGION HAWAII
556 WICHAMONGUA ST STE 110
JUPITER FL 33458-0101

August 15, 2018

Aloha, Stakeholder,

This is the Navy's tenth and my third stakeholder letter to the community to share news from Navy Region Hawaii. This letter also coincides with completion of my first year of service as the Regional Commander. As I have shared with everyone I have met over the last year, my number one priority remains the warfighting readiness of our infrastructure and the force protection of that infrastructure. That most certainly includes the Red Hill Bulk Fuel Storage Facility.

Navy Leadership and Red Hill. I assure you Red Hill has the attention of our leaders both in Hawaii and in Washington, D.C. Commander, U.S. Pacific Fleet, Admiral Chris Aquilino, toured Red Hill shortly after his change of command in May, and then he personally led our Secretary of the Navy, the Honorable Richard Spencer, on a tour of the facility just last month. This is all in advance of Secretary Spencer providing testimony to the House Armed Services Committee in 2019 on the future funding of Red Hill upgrades. Leadership, on and off island, understands the national strategic importance of Red Hill and the absolute necessity of protecting public health by keeping our drinking water safe.

Red Hill Engagement. In addition to meeting with many neighborhood boards this year, we also hosted an open forum in March where we publicly presented the possible Red Hill upgrades for the first time. Both regulators, the Environmental Protection Agency (EPA) and Hawaii Department of Health (DOH), were in attendance as were other members of the public to include many from the Sierra Club. Open and professional dialogue is an important aspect of my command and this particularly applies to Red Hill. In March, I also toured several Hawaii State Legislators through Red Hill and provided testimony to two House Committees. I was very pleased that the Governor's office championed an additional engagement meeting on Red Hill to include both the Board of Water Supply and the Sierra Club. At all of these engagements, I took the opportunity to talk about not only the strategic importance of Red Hill but our commitment to ensure we never spill another drop of fuel. Most importantly, these engagements, like the one at the Governor's office, allow stakeholders the opportunity to speak with each other, not just to each other. That's the spirit of Aloha.

Our Approach to the Tank Upgrade Alternative (TUA) Decision. On May 21 of this year, the EPA and DOH approved our TUA report. In accordance with the Administrative Order on Consent, that required I brief both regulators within 60 days on our TUA selection and proposed way forward. On July 20, I had phone calls with both the EPA and DOH to discuss our proposal. As you would expect, our preferred TUA option and proposed way forward was coordinated with numerous senior military staffs to include U.S. Pacific Fleet, U.S. Indo-Pacific Command, Defense Logistics Agency (DLA), Navy Installations Command and the Navy Staff, and both the Secretary of the Navy and the Secretary of Defense staffs. As I opened with in this letter, Red Hill has the attention of our leaders both in Hawaii and Washington D.C.

My phone calls to the EPA and DOH were just the first step, though. This week actually began a series of face-to-face meetings in Hawaii amongst the Navy, the regulators, and many



Existing Single Wall Tank (TUA 1A) as the Navy's TUA Way Forward

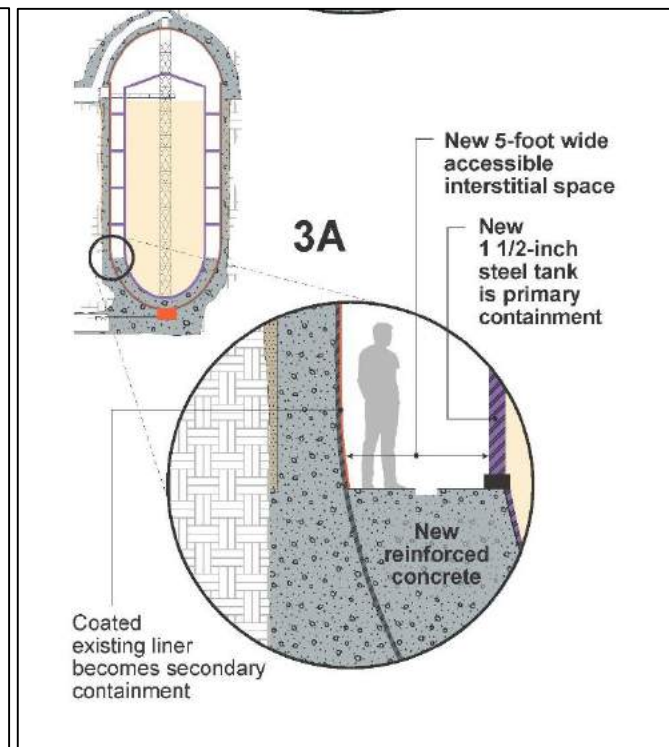
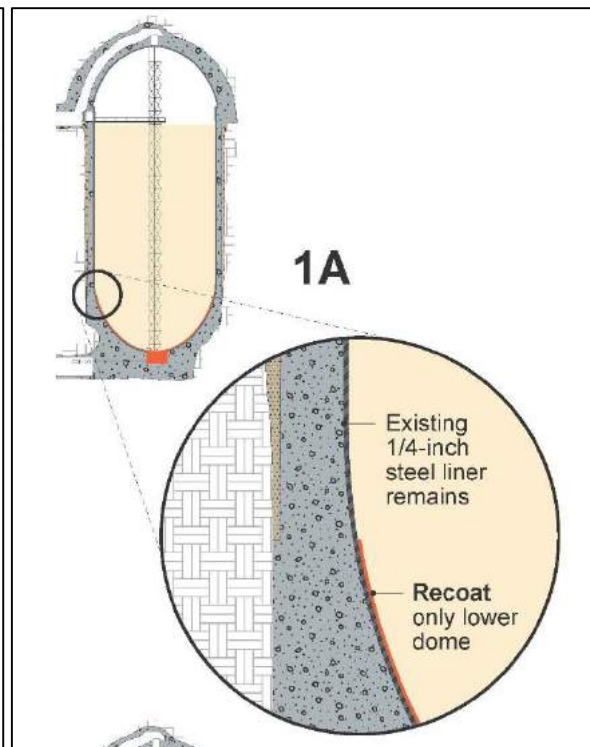
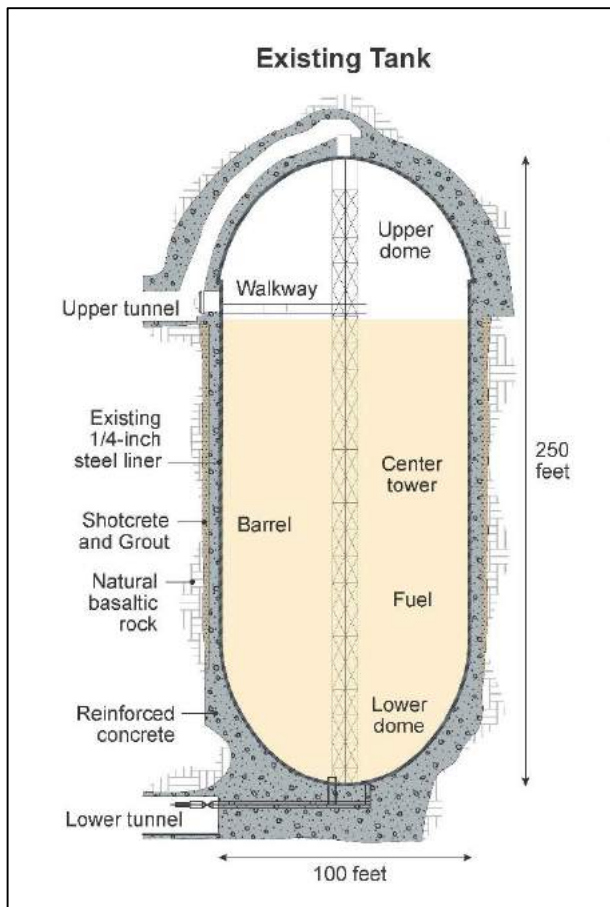
- Proposed TUA Way Forward is relying on interim and preliminary studies.
 - Laboratory analysis of Tank 14 coupons not yet available to SMEs for review and comment.
 - Interim groundwater flow model report.
 - Risk and vulnerability study not yet complete.



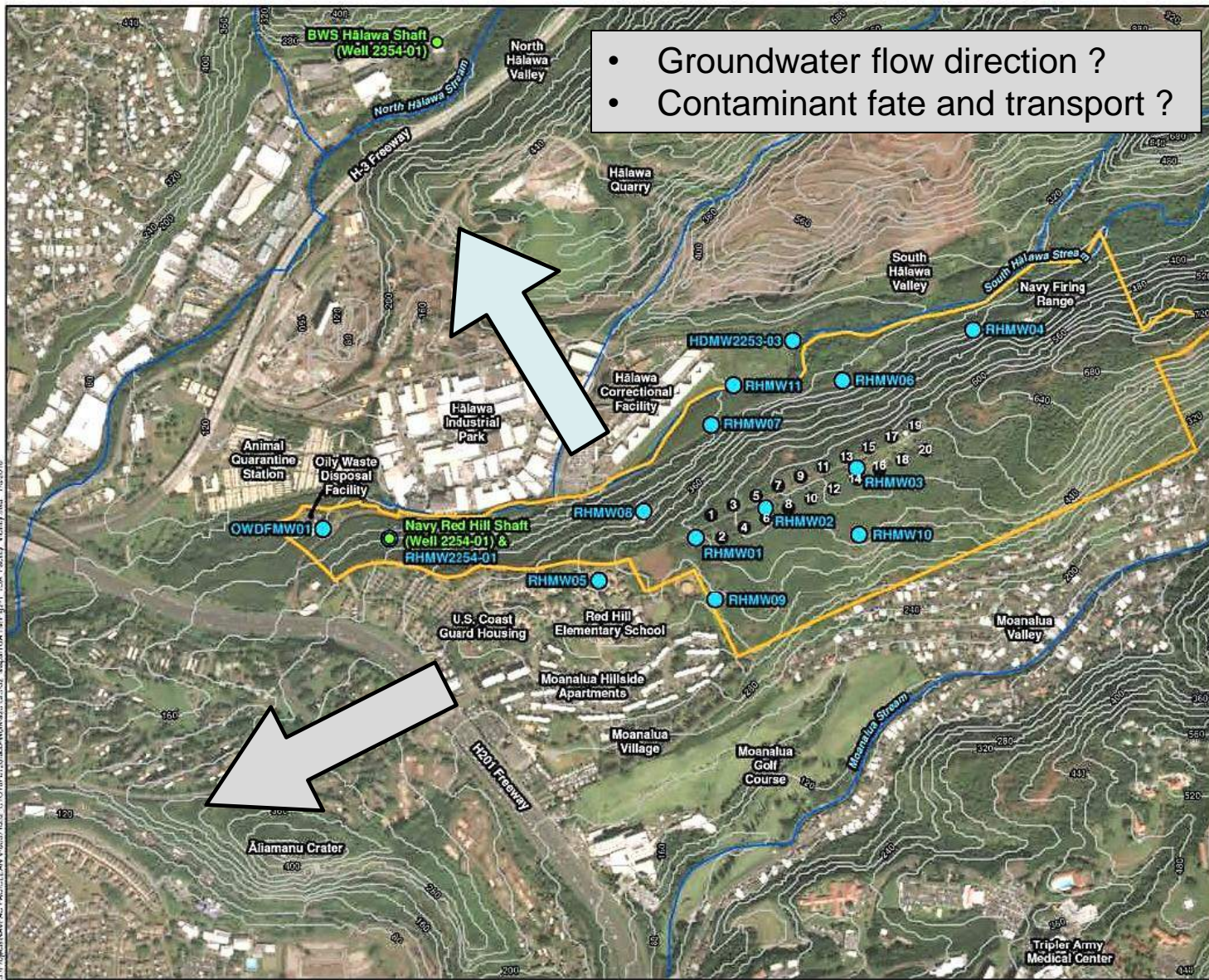
Existing Single Wall Tank (TUA 1A) as the Navy's TUA Way Forward – cont.

- Installing new leak detection technology does not prevent releases to aquifer.
- Citing human error with Tank 5 repairs does not stop tank deterioration that required the repair in the first place.
- Secondary containment or tank relocation away from the aquifer affords the best protection of the aquifer.

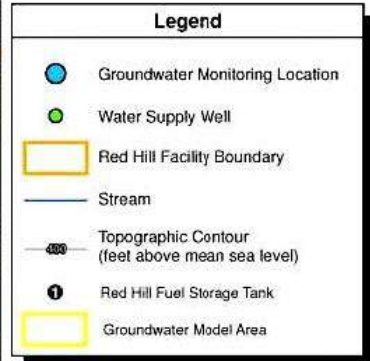
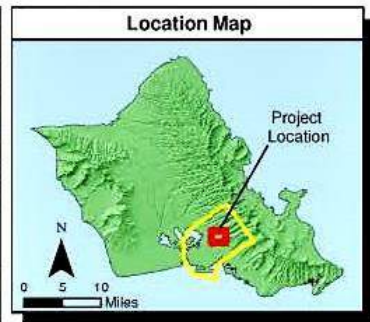
Single wall v. Secondary containment



Secondary containment affords the best protection from leaks both large and small.



• Groundwater flow direction ?
 • Contaminant fate and transport ?



Notes

1. Map projection: NAD 1983 UTM Zone 4N
2. Base Map: DigitalGlobe, Inc. (DG) and NRCS. Publication Date: 2015

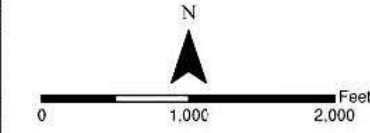


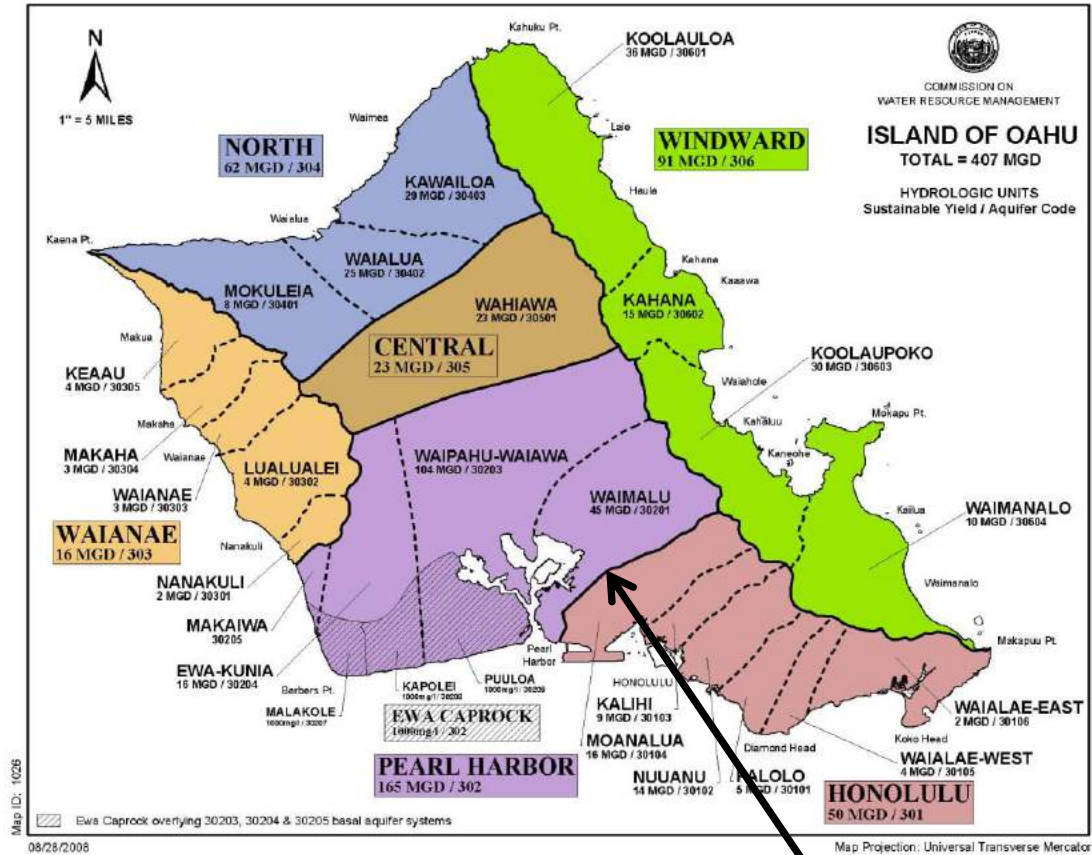
Figure 2-1
 Red Hill Bulk Fuel Storage Facility and Vicinity
 Groundwater Protection and Evaluation
 Considerations for Input
 to the TUA Decision Process
 Red Hill Bulk Fuel Storage Facility
 JBPHH, O'ahu, HI

Figure 2-1: Red Hill Bulk Fuel Storage Facility and Vicinity



Groundwater Model

- A reliable groundwater model which is calibrated using data collected in the field should help us understand where groundwater is flowing in the Red Hill area and what happens to petroleum releases in it.
- The lines on the map are drawn for managing water use and not aquifer boundaries.



Red Hill Fuel Facility



Interim Groundwater Flow Model Report

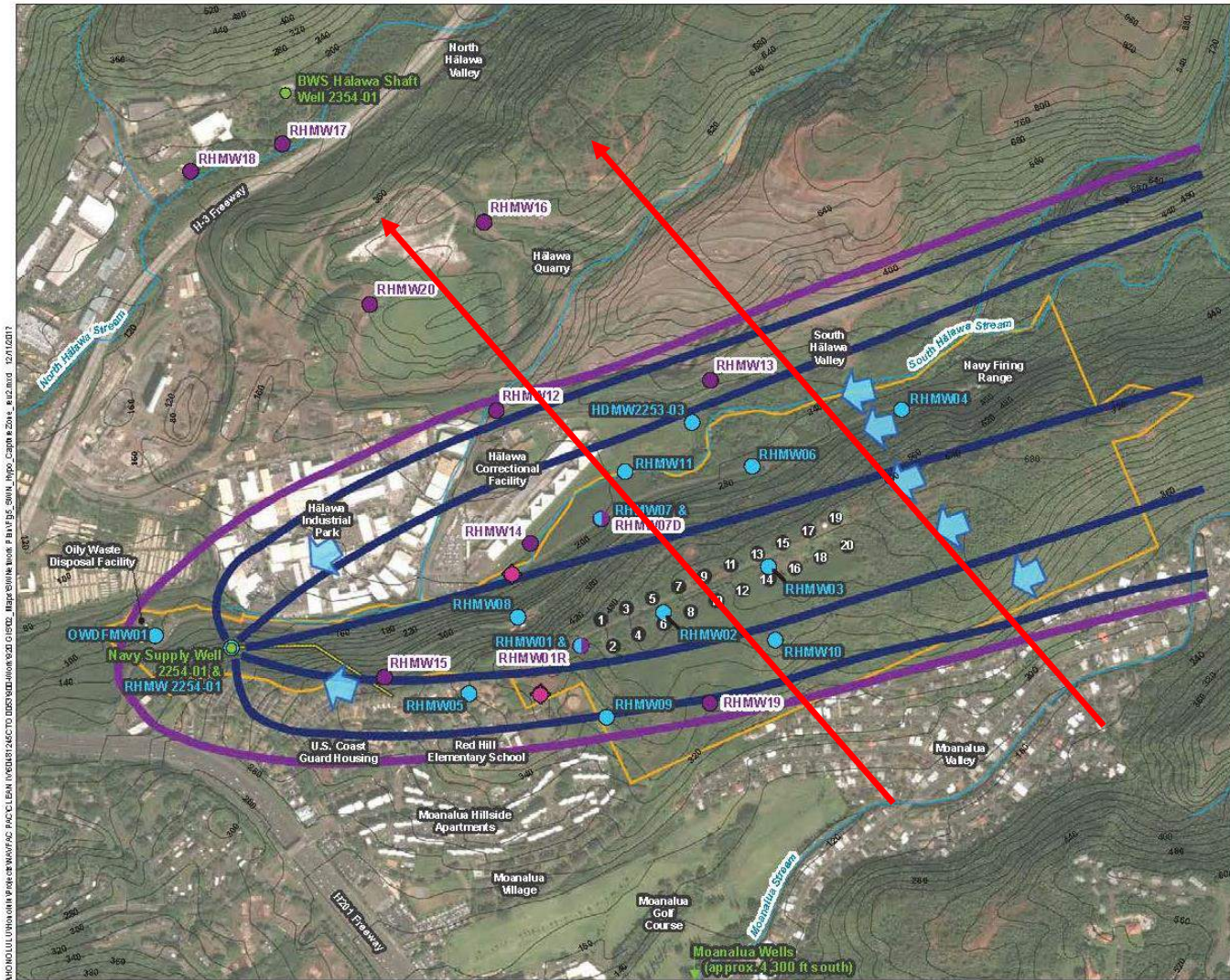
- Provide input into the TUA decision process.
- Report conclusions
 - Undetected chronic release of 2,300 gallons per year per tank biodegrades before reaching groundwater.
 - Sudden release of approx. 120,000 gallons stays underground and/or at the water table.
 - Document implies that a release as large as 700,000 gallons would not cause concern for contamination of groundwater.



BWS Review – GW Flow

Navy presents that there is no GW flow from Red Hill to any BWS wells and that Red Hill Shaft captures all groundwater flow from beneath the tanks.

BWS: Pumping test data from 2017-18 show water level changes across the valleys. EPA and DOH have asked the Navy to look at this stating some of the field data contradict Navy interim groundwater model flow paths.





BWS Review – GW Flow – cont.

Navy Interim GW model calculation of groundwater levels at Navy monitoring wells (blue line) does not match with measurements collected in the field (yellow line)

BWS: Lack of correlation between observed and model simulation means the model is not calibrated. This is a fundamental requirement of a good model and it's ability to produce reliable results. DOH and EPA share this same concern.

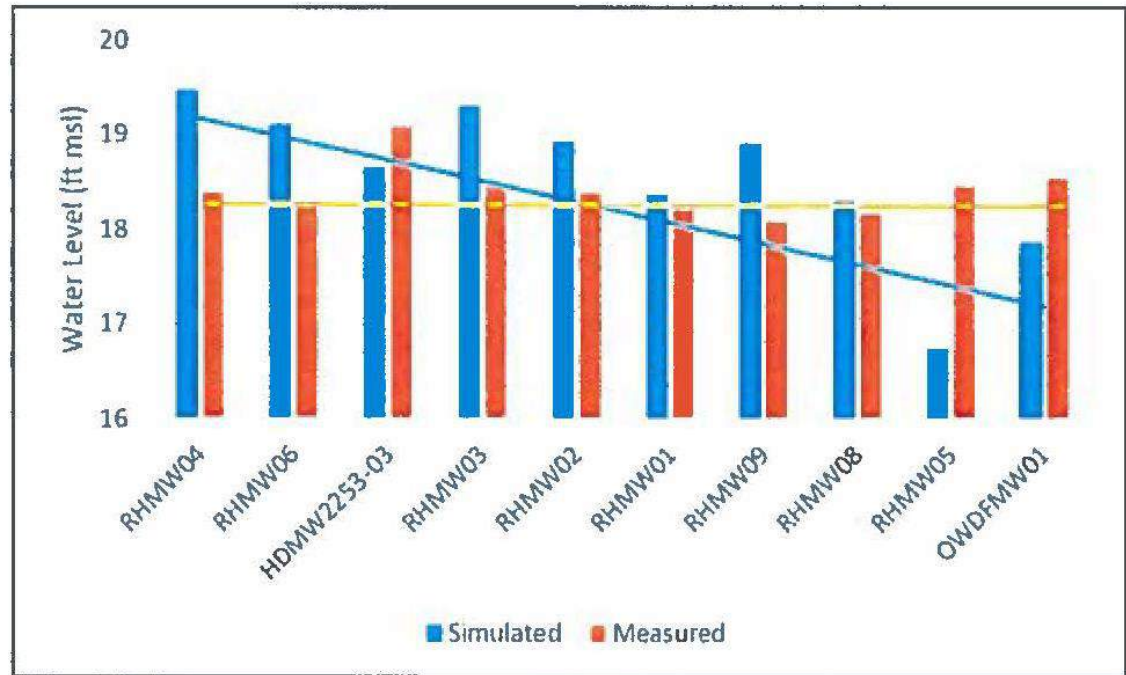


Figure 1. A comparison of the simulated and measured groundwater elevations in the RHMNW. RHMW07 is excluded from this graph since the water level in this well is very anomalous. The Red Hill Shaft (2254-01) is also excluded due to questions about the top of casing reference. Ref. Hawaii Department of Health memorandum to G. Fenix Grange from Robert Whittier re: Comments on the Progress of the Red Hill Groundwater Flow Model, February 20, 2018.

∴ Model not calibrated.



Interim Groundwater Model Report – cont.

- Navy's TUA Way Forward (TUA 1A) is relying on interim groundwater flow report that contains conclusions that have been considered to be faulty and incorrect by EPA, DOH, and BWS.
- Tank relocation away from the aquifer is the safest option.
- If the Navy wants to store millions of gallons of fuel 100 feet above the aquifer, secondary containment affords the best protection of the aquifer.

EPA and DOH Comments Presented at GW Model Working Group Meeting No. 13

EPA and DOH comments to Navy's Interim Groundwater Model and Conceptual Site Model.

1. *Basalt strike-and-dip – direction and magnitude in question*
2. *Saprolite extents – modeled vs. measured depths*
3. *Cap rocks, tuffs, sediments – not in interim model*
4. *Preferential pathways – not incorporated fully in interim model*
5. *Tunnel inflows – inflows do vary but modeled as consistent*
6. *Calibration – heads, gradients – directions/magnitude do not match field data*
7. *LNAPL Fate and Transport – vapor data – more rapid transport than modeled*
8. *LNAPL Fate and Transport – temperature – extent deeper than modeled*
9. *Groundwater data – concentration data contradict modeled flow path*
10. *Coastal marine discharge – boundary conditions modeled reduces model sensitivity*

Ref: Comments on tank upgrade alternative (TUA) Deliverables, Red Hill Bulk Fuel Storage Area, Oahu, Hawaii, prepared for GWMG Meeting by: Gary Beckett, Donald Thomas, Matthew Tonkin, & Robert Whittier, dated August 14, 2018 presented at the Red Hill Groundwater Model Working Group Meeting No. 13 held August 16, 2018.

The EPA and DOH comments are consistent with many letters BWS wrote to the Navy, EPA, and DOH for the past several months. Unclear if/how Navy will address EPA and DOH comments.



Summary

- If secondary containment (i.e. tank within a tank) is not selected then relocation should be strongly considered.
- Adequate supply of safe drinking water is critical to our economy.
- Question: Is the Navy listening and adopting our recommendations?
- BWS providing AOC input to inform the parties on what we believe they need to know – not what they want to hear.



Summary – cont.

- Facility is over 75 years old and continues to age.
- ¼-inch steel plates keeping fuel in the tanks continues to rust.
- Fuel contamination already present in groundwater and rocks underneath facility.
- Large volume of fuel stored 100 ft. above aquifer poses unacceptable risk to drinking water.

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Questions/Discussion

