

Investigation & Remediation of Releases, and Groundwater Protection and Evaluation

Poster Station #3

5 Posters

March 14, 2018

The Navy/DLA are performing various environmental actions at Red Hill to ensure the drinking water remains safe.

➤ Key Elements

- ✓ Testing and data evaluation
- ✓ Understand groundwater flow
- ✓ Understand potential movement of chemicals
- ✓ Contingency planning

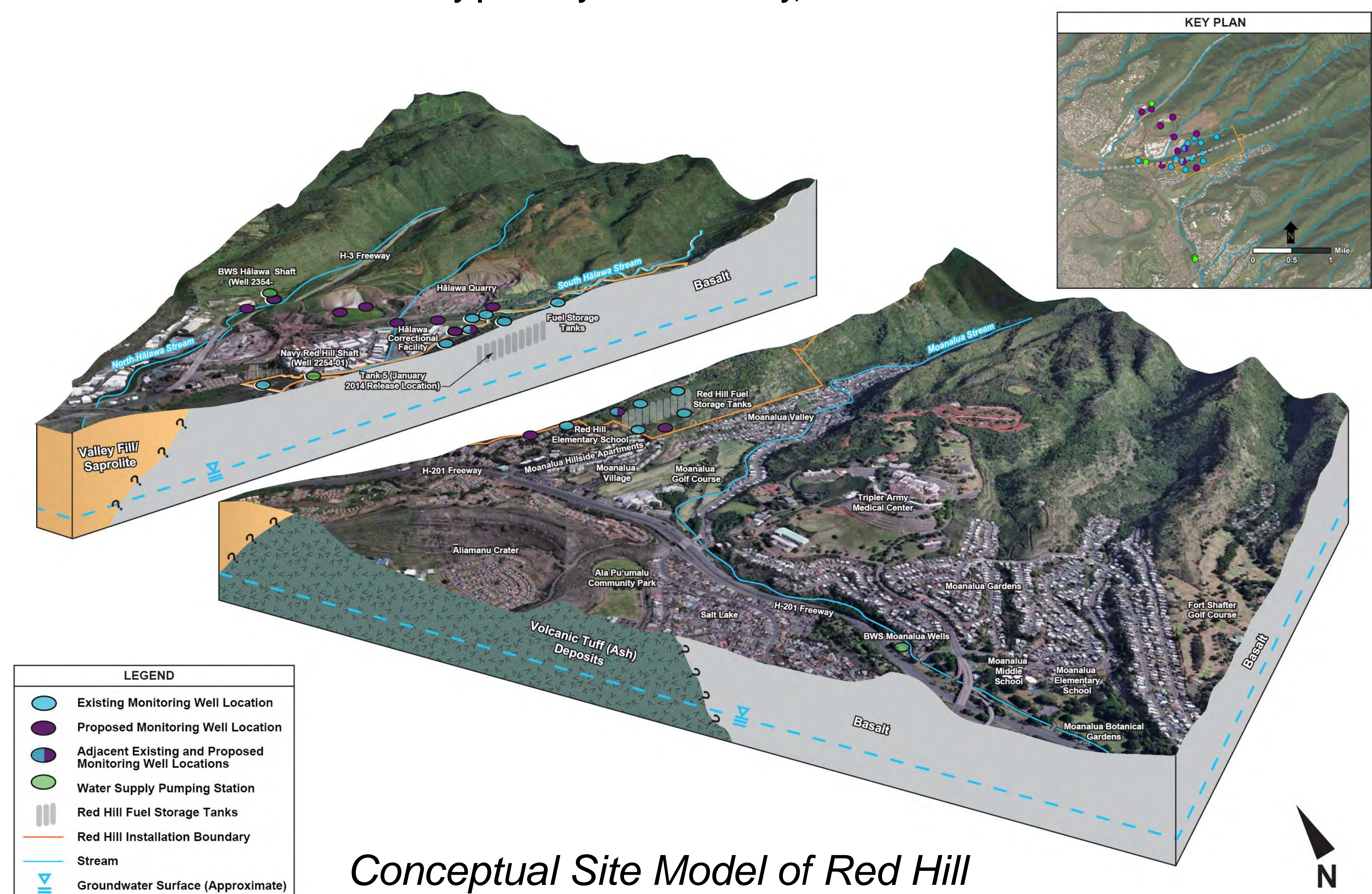
1. Evaluate and Identify Additional Actions to Protect Drinking Water

2. Update the Current *Groundwater Protection Plan*

- Ensure groundwater monitoring network is effective
- Use most up to date regulatory criteria
- Update existing contingency plans, which will include appropriate actions to address hypothetical future leak scenarios



Photo of testing at one of the newly installed monitoring wells, RHMW09. U.S. Navy photo by Denise Emsley, Public Affairs.



14 March 2018

Understanding the Subsurface and How Groundwater Moves

Newly collected data will support improved understanding of groundwater flow, which will be used to make more informed decisions to protect drinking water.

1. New Groundwater Monitoring Wells

- ✓ Six (6) new wells installed since the January 2014 Tank 5 leak
- ✓ Plan to install additional new wells at Red Hill, North Hālawā Valley, South Hālawā Valley, and Moanalua Valley
- ✓ Monitoring wells will improve understanding of groundwater and potential chemical movement

2. Groundwater Level Study

- ✓ Started in July 2017 and conducted with the United States Geological Survey
- ✓ First pump test completed in February 2018 at Navy's Halawa Shaft and Red Hill Shaft, and at Board of Water Supply's Moanalua wells and Halawa Shaft
- ✓ Study will improve understanding of groundwater flow

3. Seismic Survey

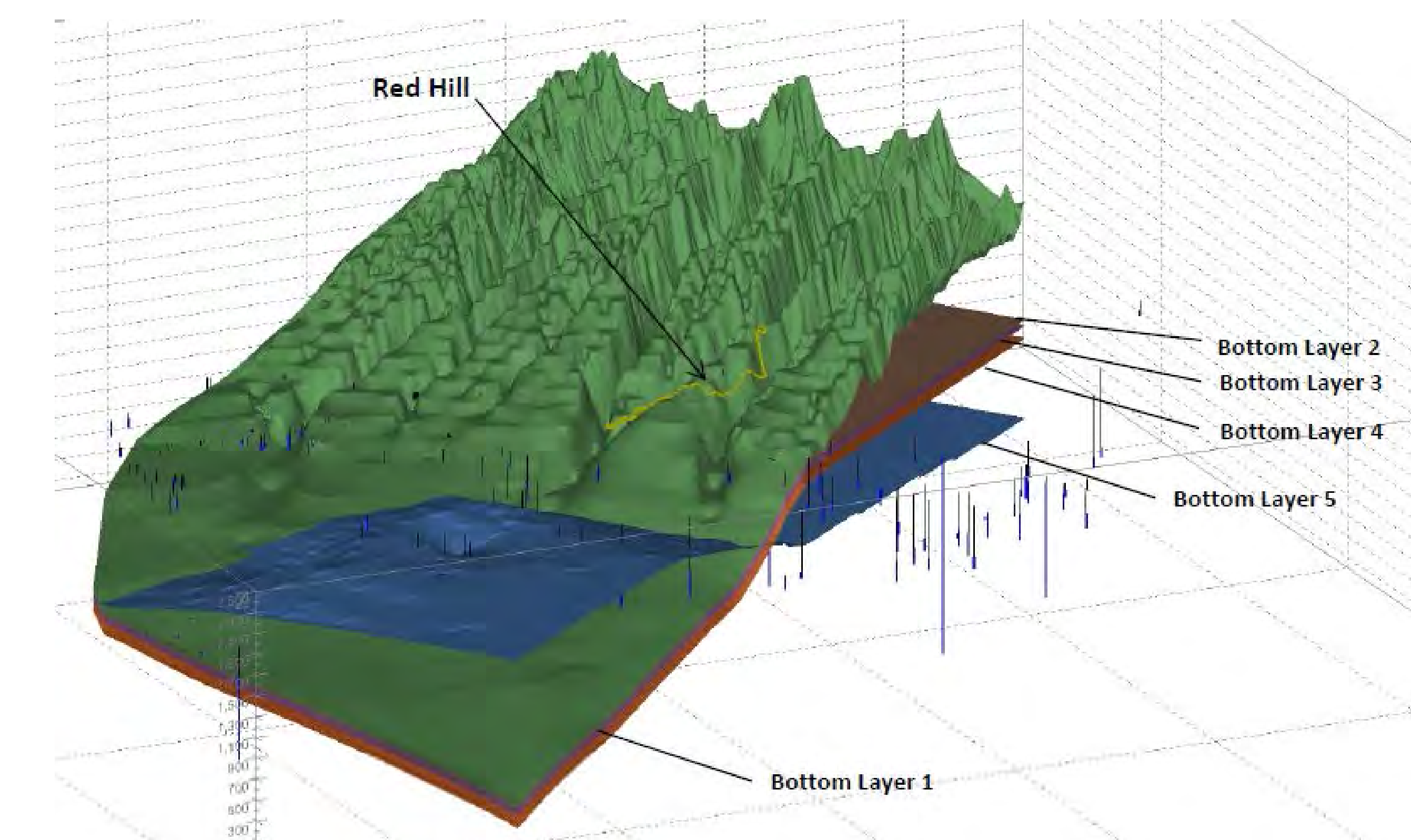
- ✓ Completed in December 2017 in North Hālawā Valley, South Hālawā Valley, and Moanalua Valley
- ✓ Used hammer to create vibrations, and measured vibration distance and time traveled through subsurface materials (i.e. geology)
- ✓ Seismic survey will improve understanding of subsurface geology



Photo of monitoring well installation activities. U.S. Navy photo by Denise Emsley, Public Affairs.

➤ What We Have Learned So Far

- ✓ Different geologic layers exist in the subsurface
- ✓ Groundwater will not flow the same way through these different layers because of the different physical properties of each geologic layer



Example of a computer model showing different geologic layers for evaluation of groundwater flow.



Photo of seismic survey activities in South Halawa Valley. U.S. Navy photo by Jack Kronen, AECOM.

14 March 2018

Understanding What Happens to Fuel-Related Chemicals in the Subsurface

Newly collected data will support improved understanding of what happens to fuel-related chemicals in the subsurface, which will be used to evaluate and identify appropriate additional actions to protect drinking water.

➤ What Have We Learned So Far?

- ✓ Fuel-related chemicals in the subsurface are degrading by naturally occurring microorganisms
- ✓ More evaluations are needed to understand how fast and complete the breakdown is occurring
- ✓ Based on testing results thus far, the drinking water remains safe for consumption

1. Biodegradation Studies

Several studies are underway to evaluate if and how fuel-related chemicals break down naturally. The studies are evaluating:

- ✓ Physical conditions (e.g., temperature, carbon traps, etc.)
- ✓ Naturally occurring chemicals that indicate breakdown
- ✓ Naturally occurring microorganisms that can break down fuel
- ✓ How chemicals are being degraded over time and distance

2. Ongoing Groundwater Sampling

- ✓ Quarterly sampling events
- ✓ Analysis of fuel-related chemicals and biodegradation parameters



Photo of an installed E-Flux carbon trap sampler.
<http://soilgasflux.com>

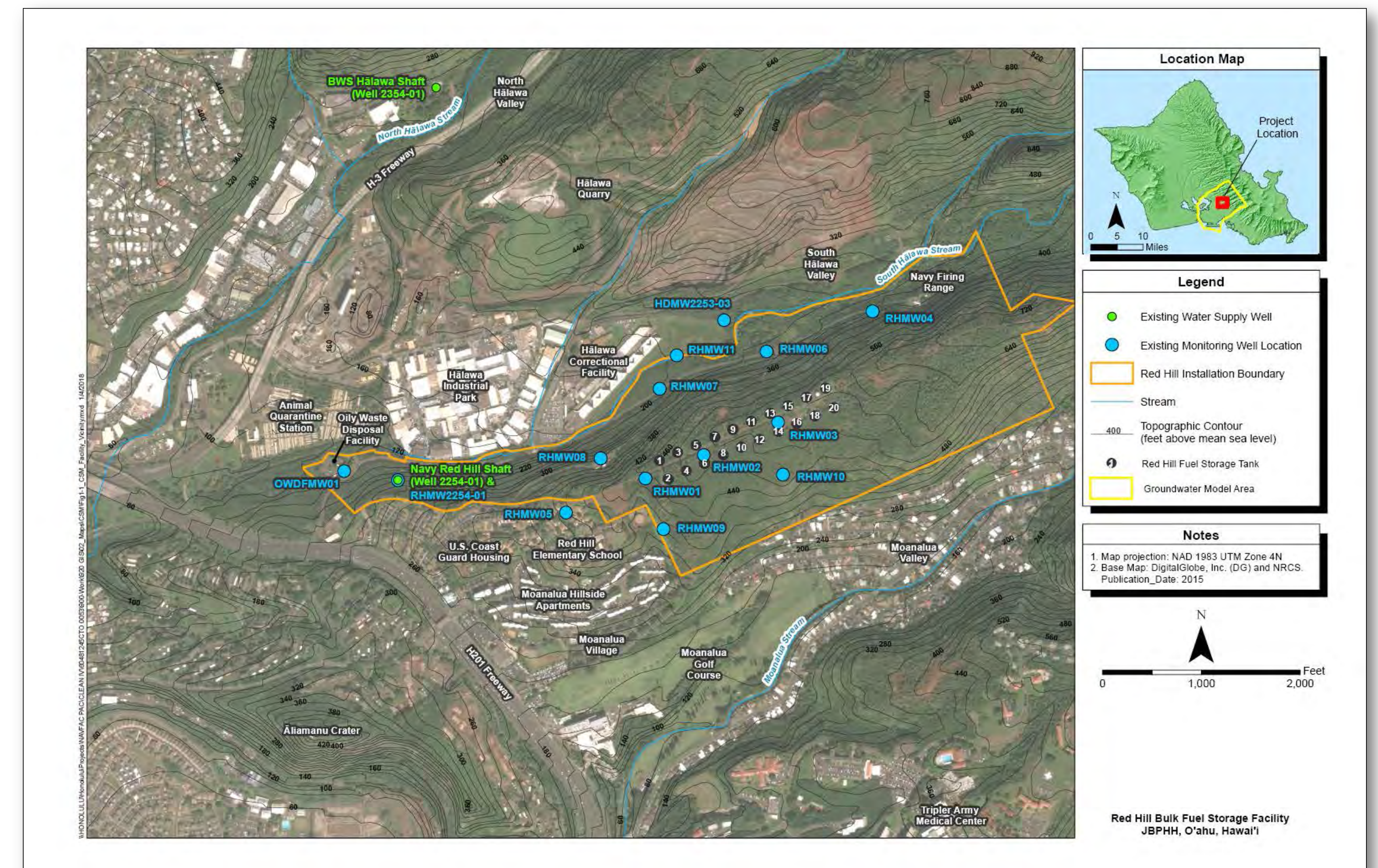


Environmental testing at one of the newly installed monitoring wells, RHMW09. U.S. Navy photo by Denise Emsley, Public Affairs.

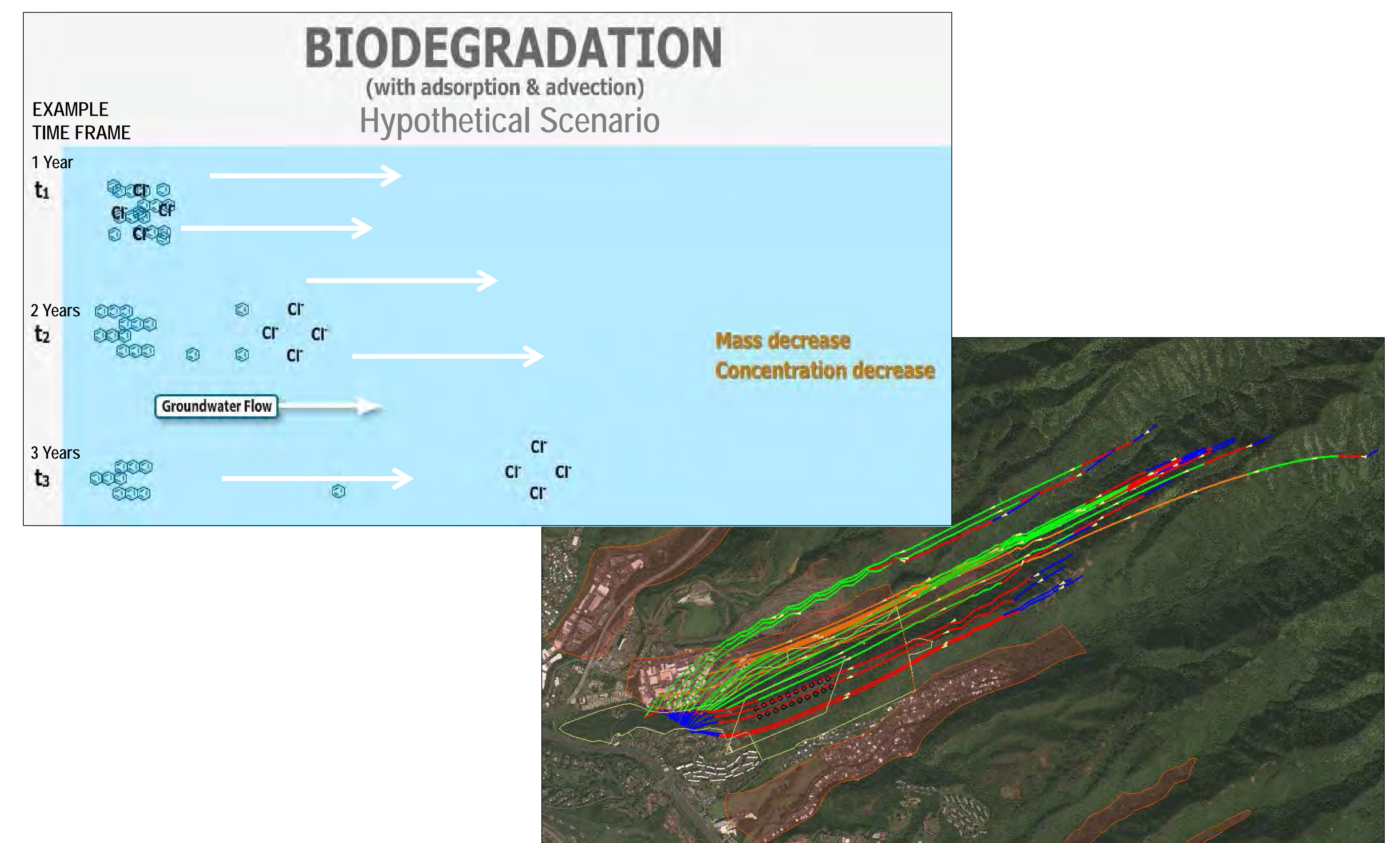
Updating the Red Hill *Groundwater Protection Plan*

The Navy/DLA's current Groundwater Protection Plan has a process to protect drinking water. The Groundwater Protection Plan will be updated using collected data and current regulatory criteria, and will include appropriate actions to ensure continued protection of drinking water.

- **Current Groundwater Protection Plan**
 - ✓ **Continue Monitoring Groundwater**
 - ✓ **Follow Current Contingency Plans**
- **Update the Groundwater Protection Plan**
 - ✓ **Integrate Newly Collected Data and Studies**
 - Environmental data currently being collected
 - Evaluation of groundwater flow
 - Evaluation of potential movement of fuel-related chemicals
 - ✓ **Refine Groundwater Monitoring Network**
 - Monitor groundwater conditions more effectively
 - ✓ **Update Contingency Plans for Hypothetical Future Leaks**
 - Response procedures and trigger points
 - Additional actions to protect drinking water
- **Groundwater Protection Plan to be Updated Every 5 Years**



The current Red Hill groundwater monitoring well network of 14 wells. Additional wells are planned for installation.



Examples of additional actions currently being evaluated for contingency planning through computer modeling: biodegradation and particle tracking in groundwater.

Red Hill's Groundwater Monitoring Network

Navy's Investigation Tasks:

- Evaluate geology
- Investigate subsurface petroleum
- Identify chemicals
- Update groundwater flow & contaminant transport models
- Identify appropriate remedies

