Task #5: Update the Existing Groundwater Model

- **Overall Modeling Objectives:**
  - **Leverage considerable effort expended by local experts to develop flow (and fate and transport [F&T]) models**
  - **Refine existing flow model to improve understanding of flow in the vicinity of the facility**
  - **Improve models for use as planning tools:**
    - Re-evaluate SSRBLs
    - Support alternatives analysis
    - Inform the contingency planning

Task #5: Update the Existing Groundwater Model

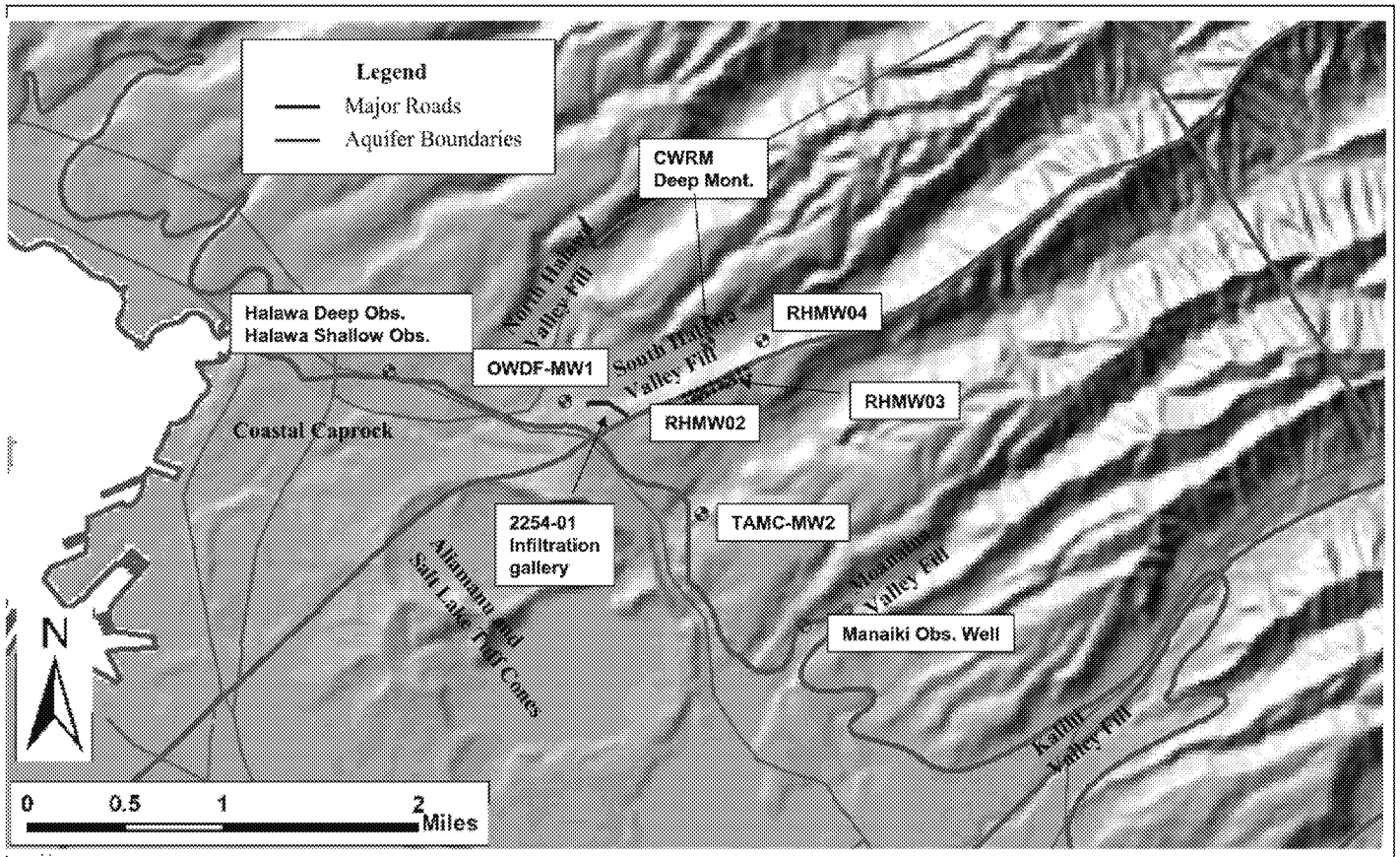

Figure 10
Locations of Monitoring and Observations Wells, and the Locations of Potential Barriers to Groundwater Flow
Groundwater Gradient Study Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Hawaii

Task #5: Update the Existing Groundwater Model

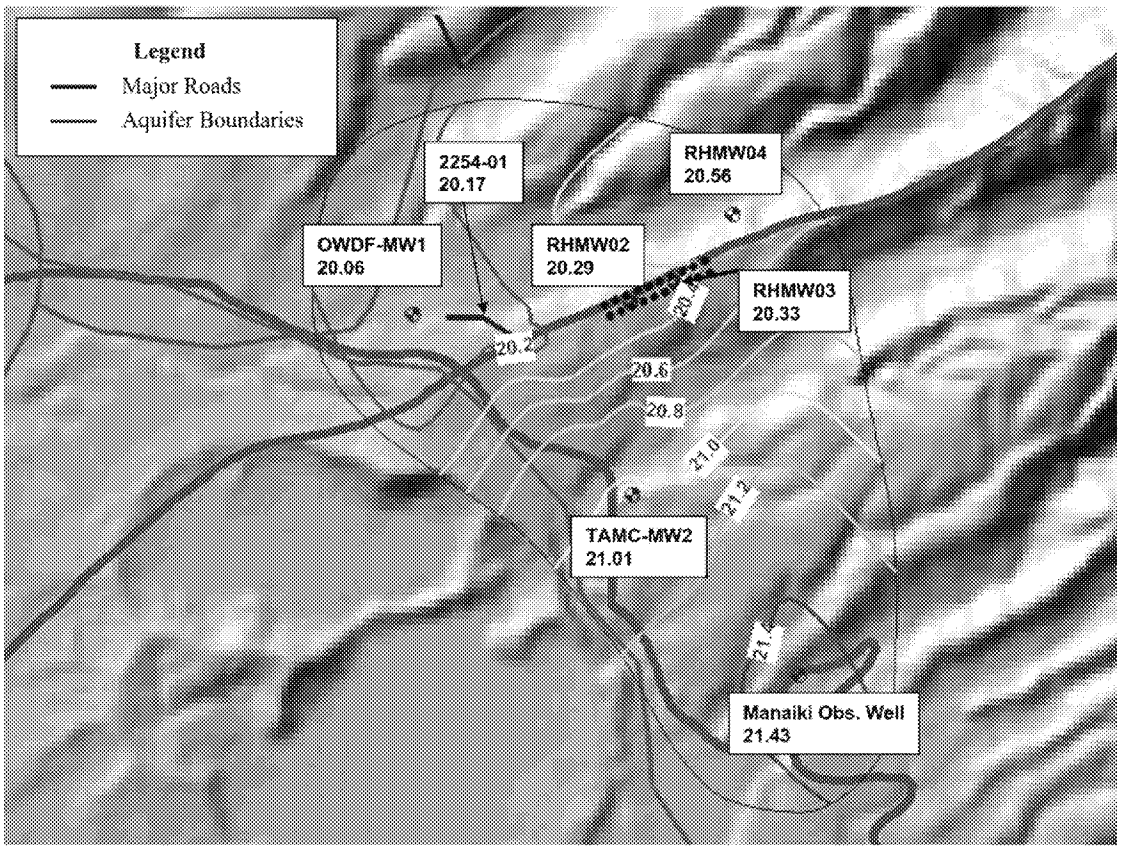

Figure 6.
Groundwater Elevation Contours Based on Water Levels Measured On May 18, 2006 (contour labels and groundwater elevations at each well shown in ft above mean tidal datum)
Groundwater Gradient Study Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Hawaii

Task #5: Update the Existing Groundwater Model

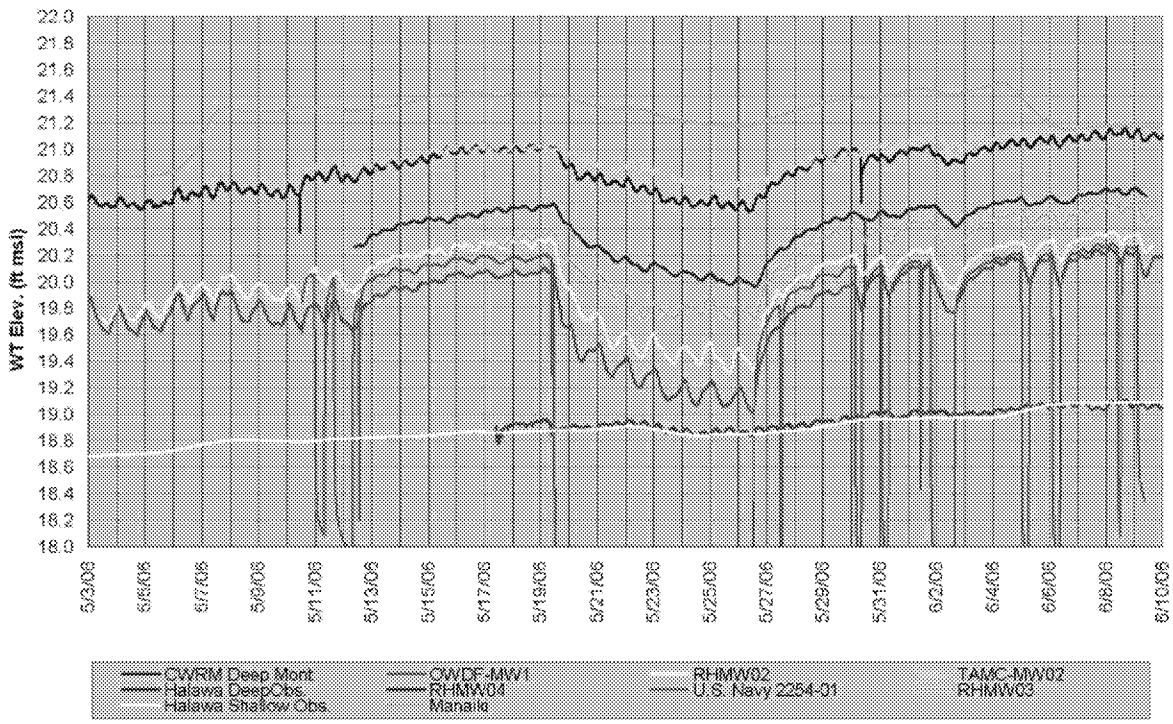

Figure 9.
Recorded Water Levels in Wells Monitored During the May 2006 Aquifer Test at Red Hill Updated Using New TOC Elevations
Groundwater Gradient Study Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Hawaii

Task #5: Update the Existing Groundwater Model

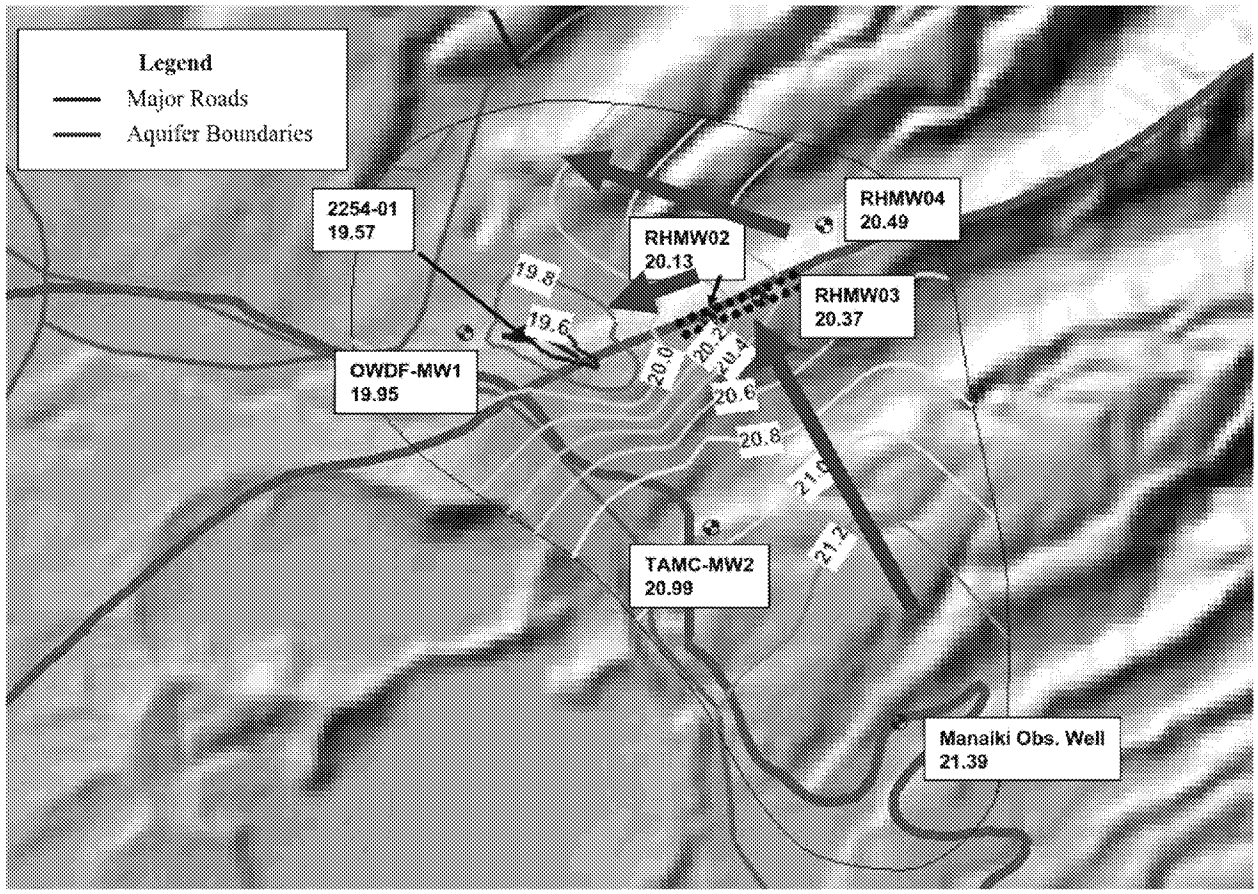

Figure 8.
Groundwater Elevation Contours Based on Water Levels Measured On May 30, 2006 (contour labels and groundwater elevations at each well shown in ft above mean tidal datum) (Blue arrows show interpreted groundwater flow directions)
Groundwater Gradient Study Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Hawaii

Task #5: Update the Existing Groundwater Model

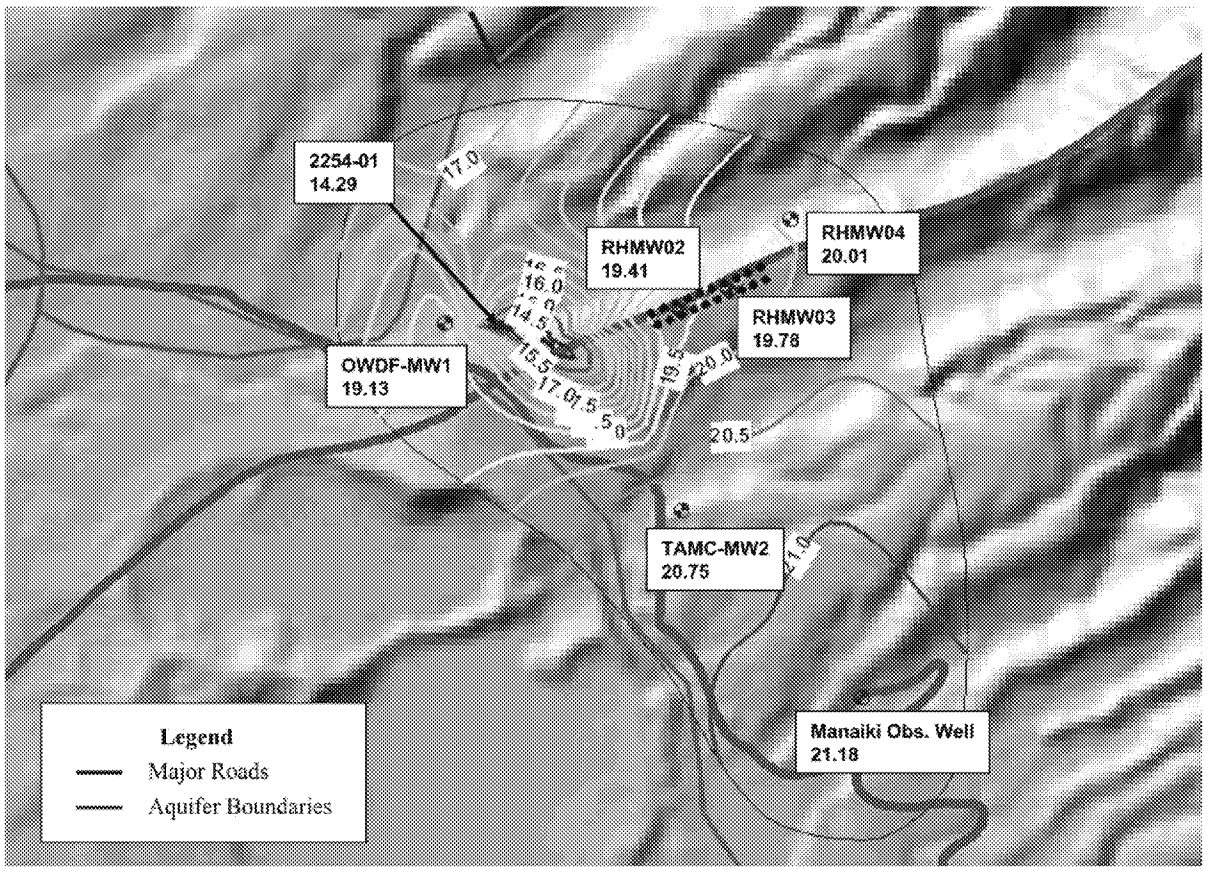

Figure 7.
Groundwater Elevation Contours Based on Water Levels Measured On May 25, 2006 (contour labels and groundwater elevations at each well shown in ft above mean tidal datum)
Groundwater Gradient Study Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Hawaii

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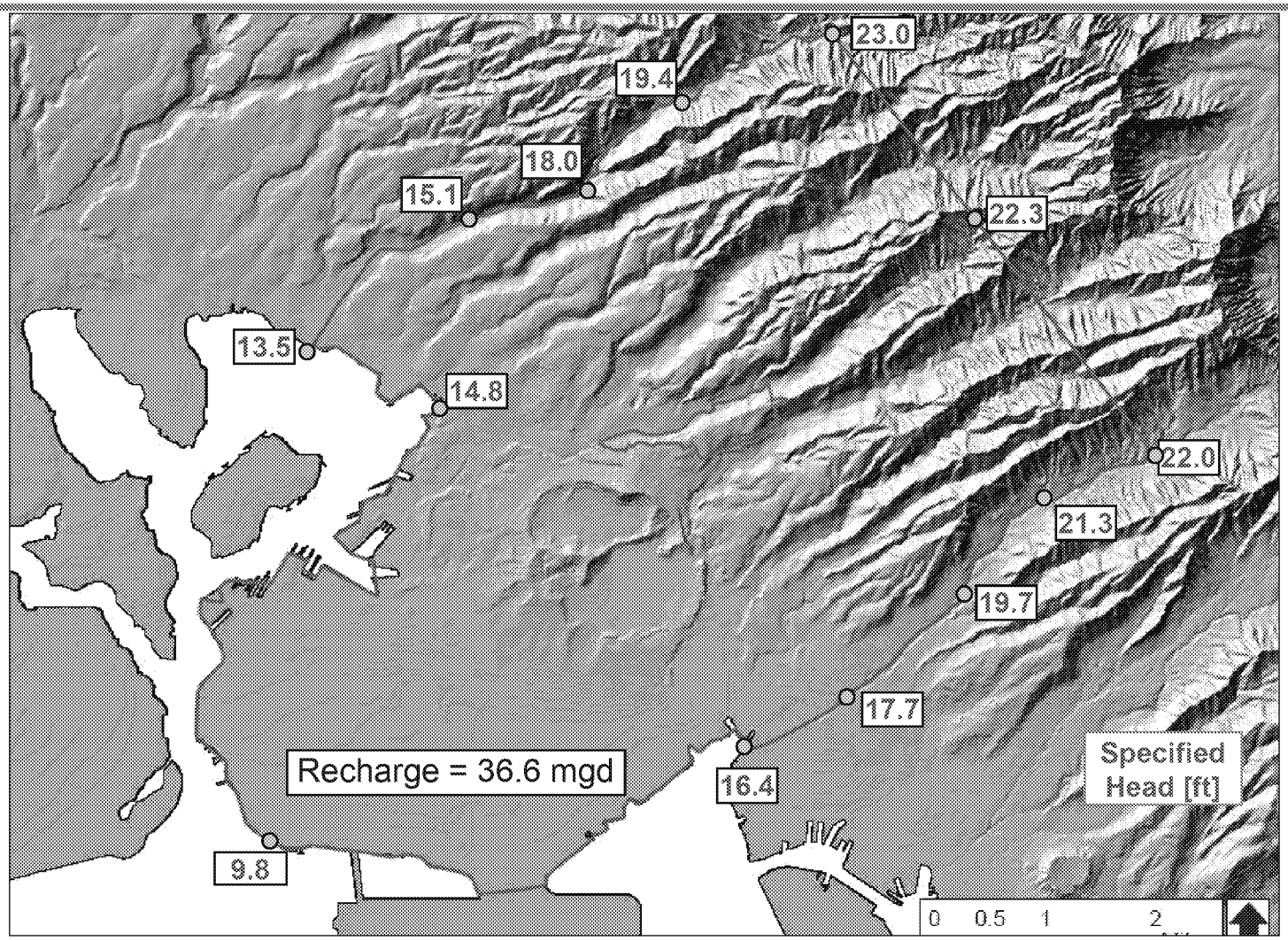
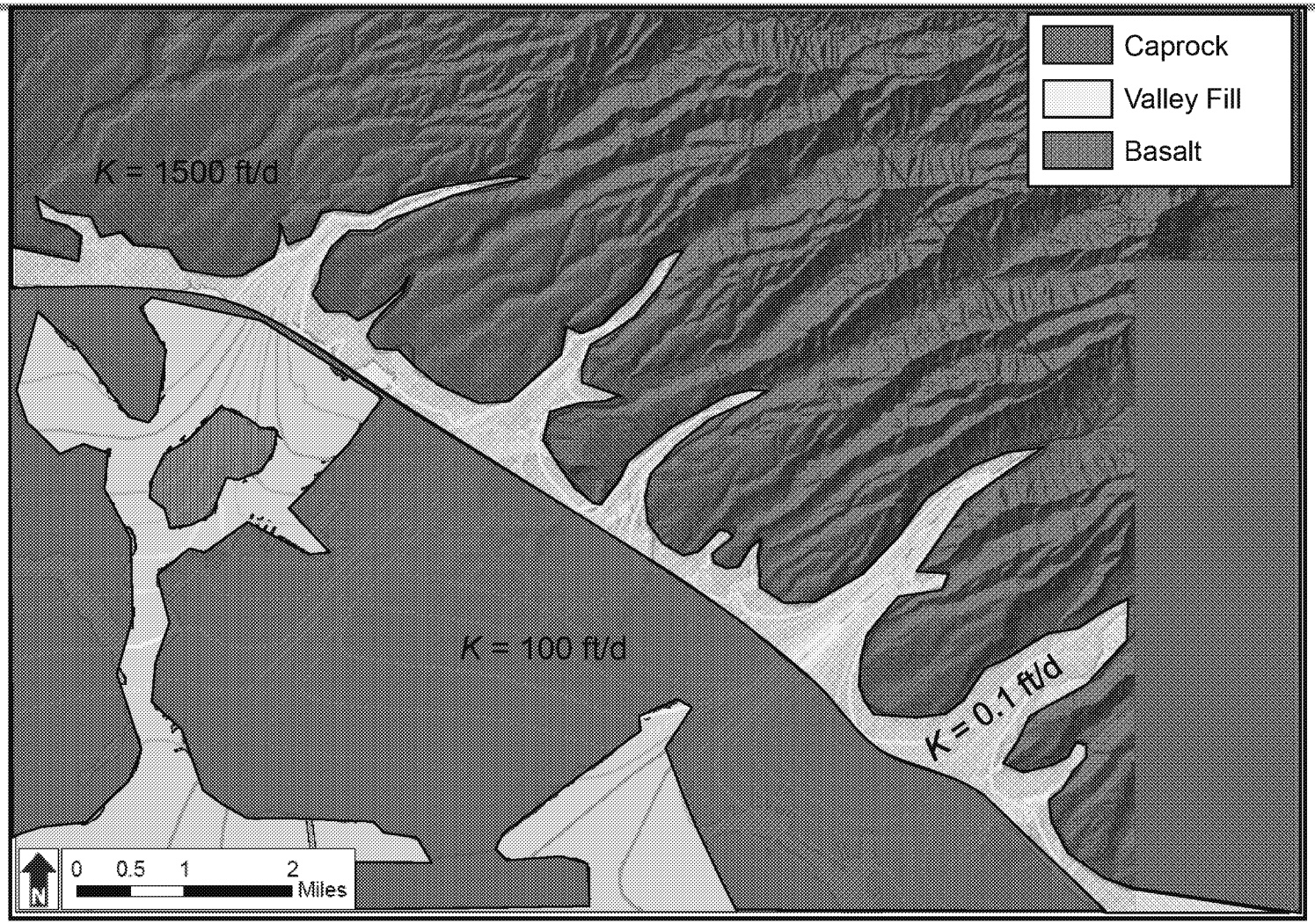
Task #5: Update the Existing Groundwater Model

- Previous Modeling Methodology (TEC 2007)
  - Multi-layer MODFLOW model (industry standard)
  - Calibrated steady-state flow model based on the island-wide SWAP model
  - Boundary conditions (specified head on sides, saline water interface at bottom boundary)
  - Calibrated transient flow model with a 18-day aquifer test of RHS
  - Delineated Capture Zones of Municipal Groundwater Sources
- Following slides are taken from presentation by Kolja Rotzoll

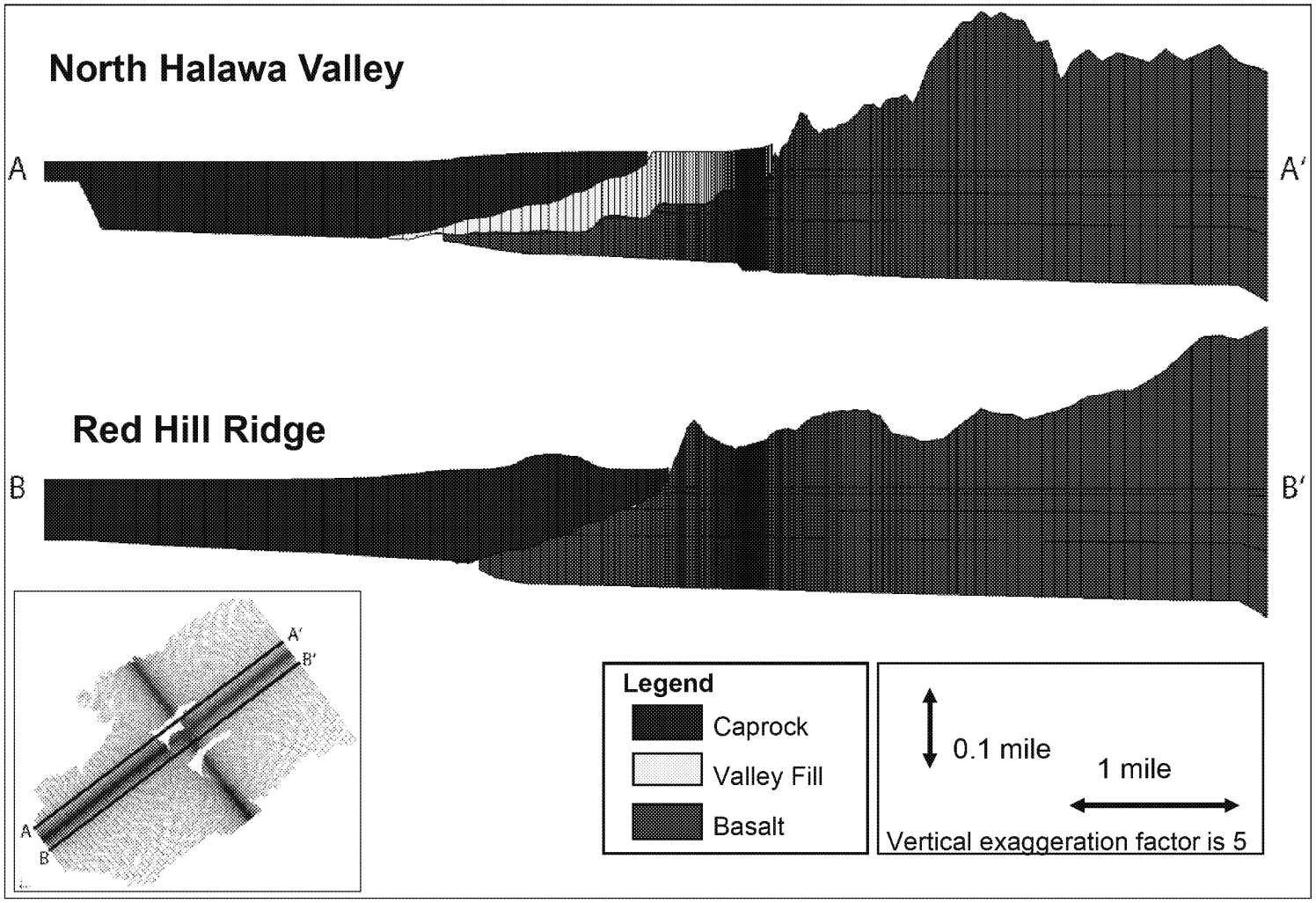
Task #5: Update the Existing Groundwater Model Boundary Conditions



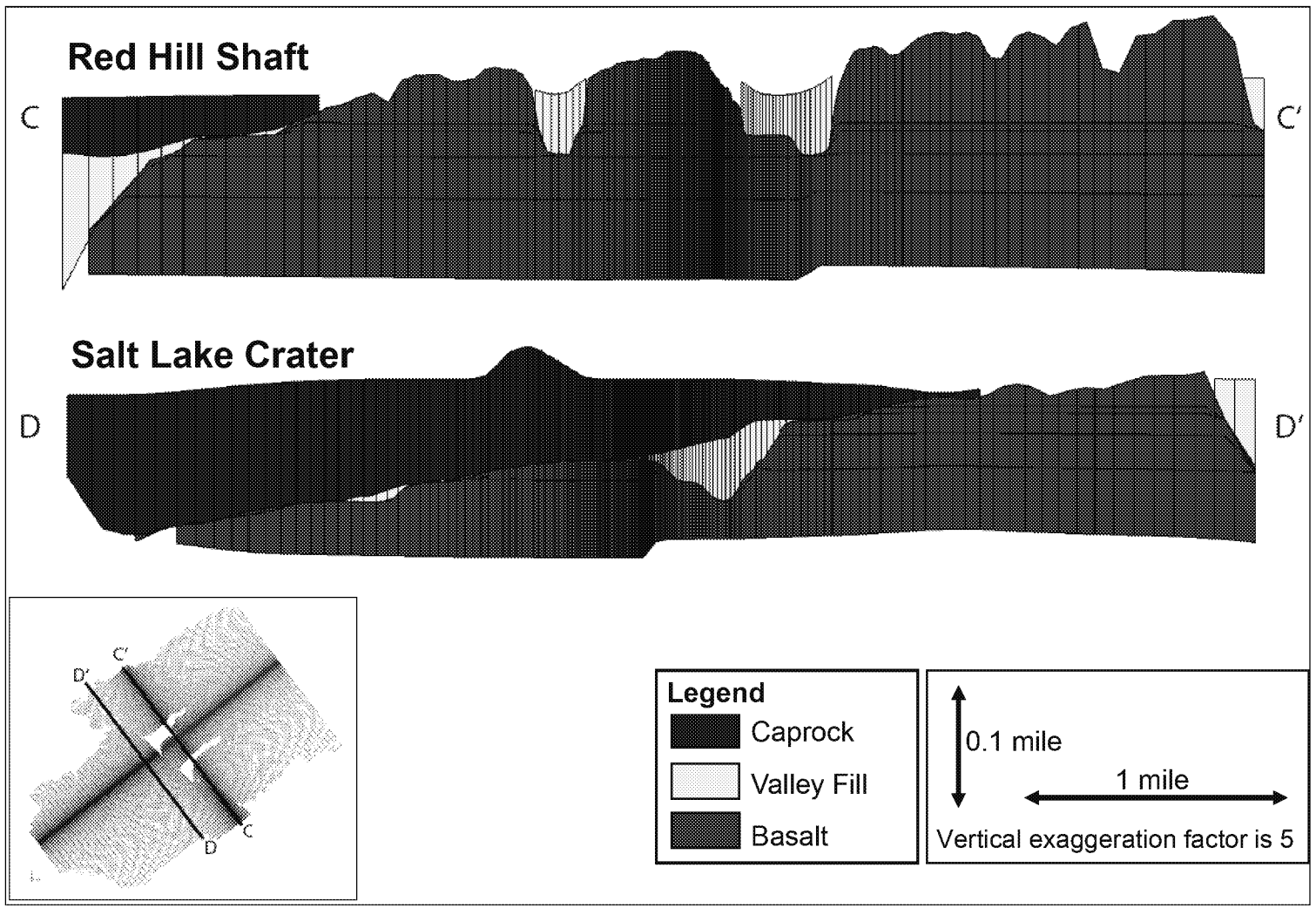
Task #5: Update the Existing Groundwater Model
Simplified Surface Geology



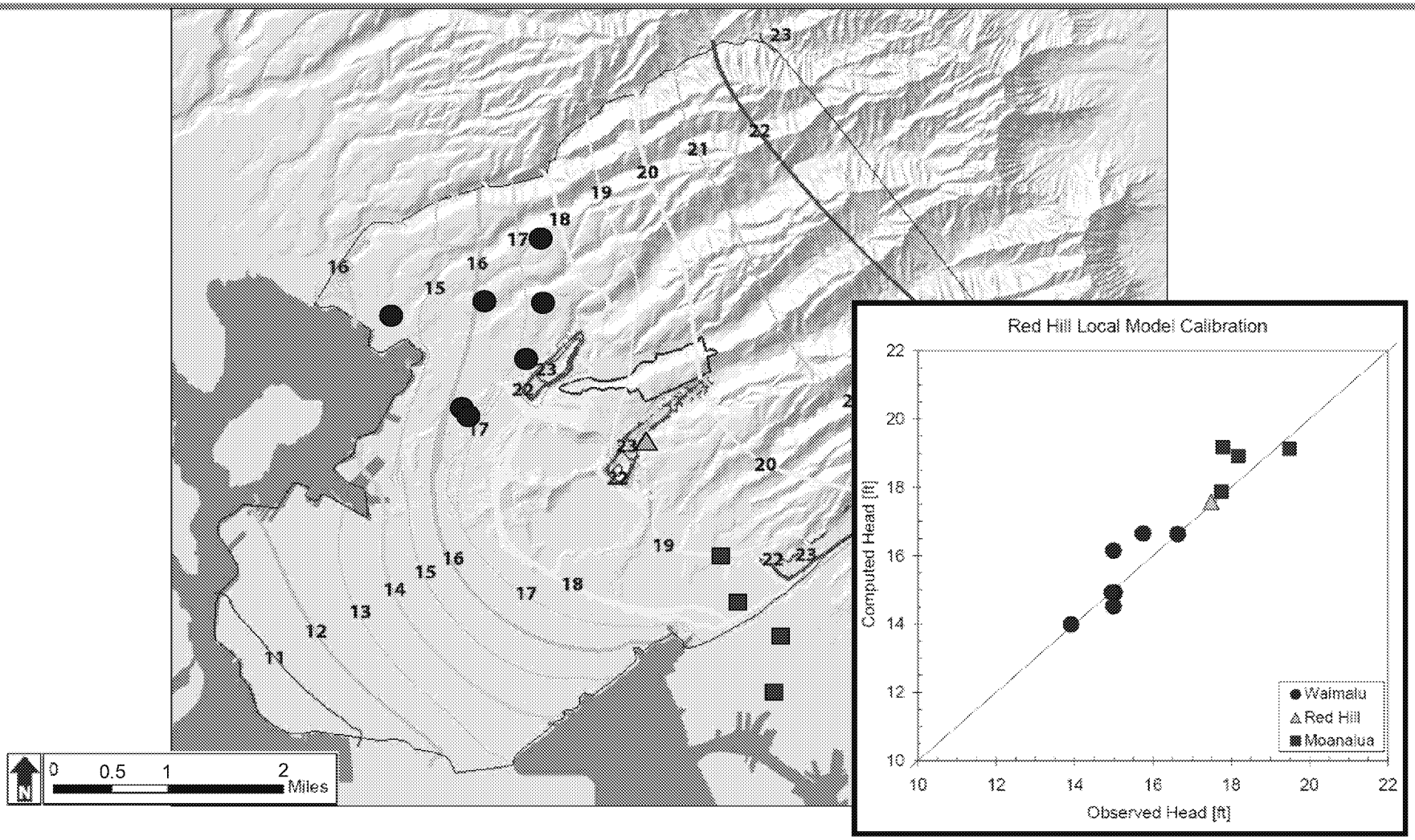
Task #5: Update the Existing Groundwater Model
7-Layer Modflow Model Grid



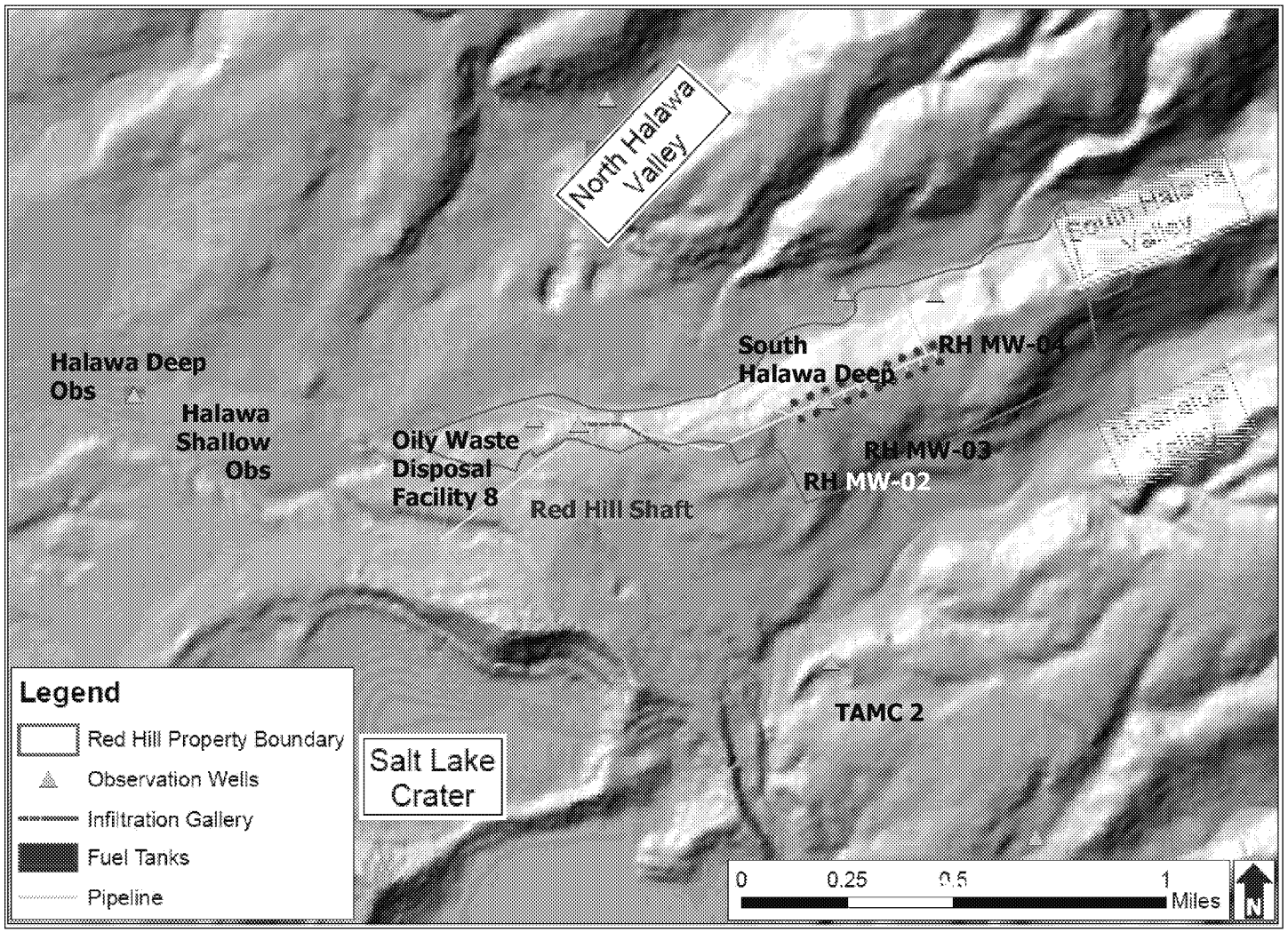
Task #5: Update the Existing Groundwater Model
7-Layer Modflow Model Grid



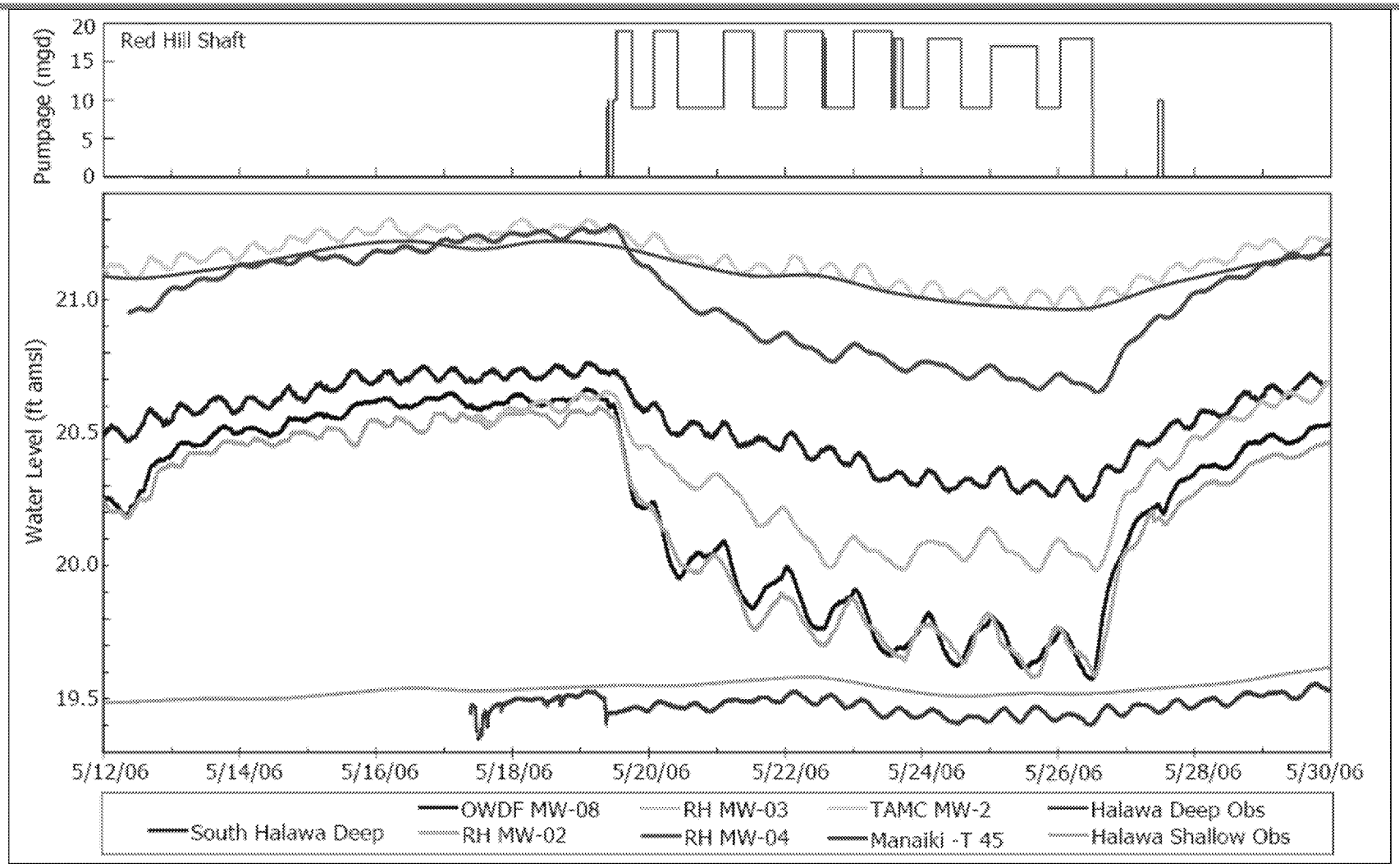
Task #5: Update the Existing Groundwater Model Modeled Water Levels



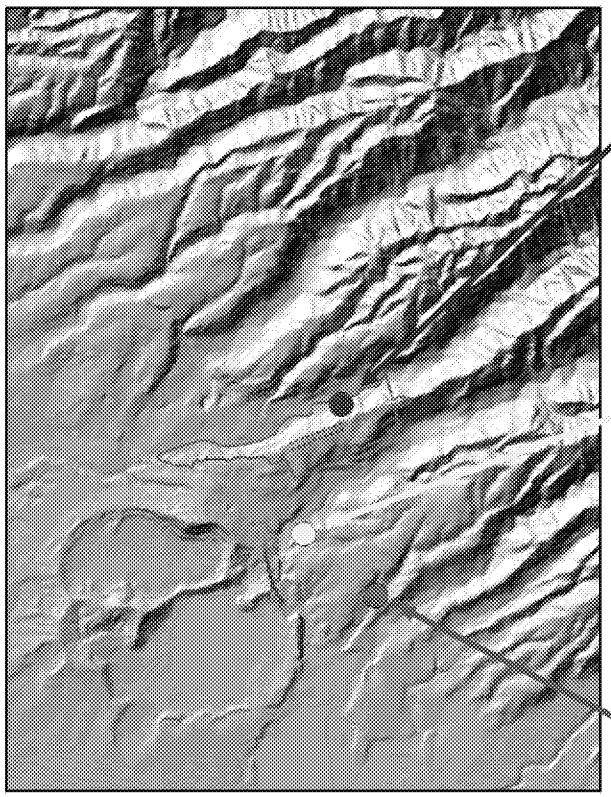
Task #5: Update the Existing Groundwater Model Observation Wells

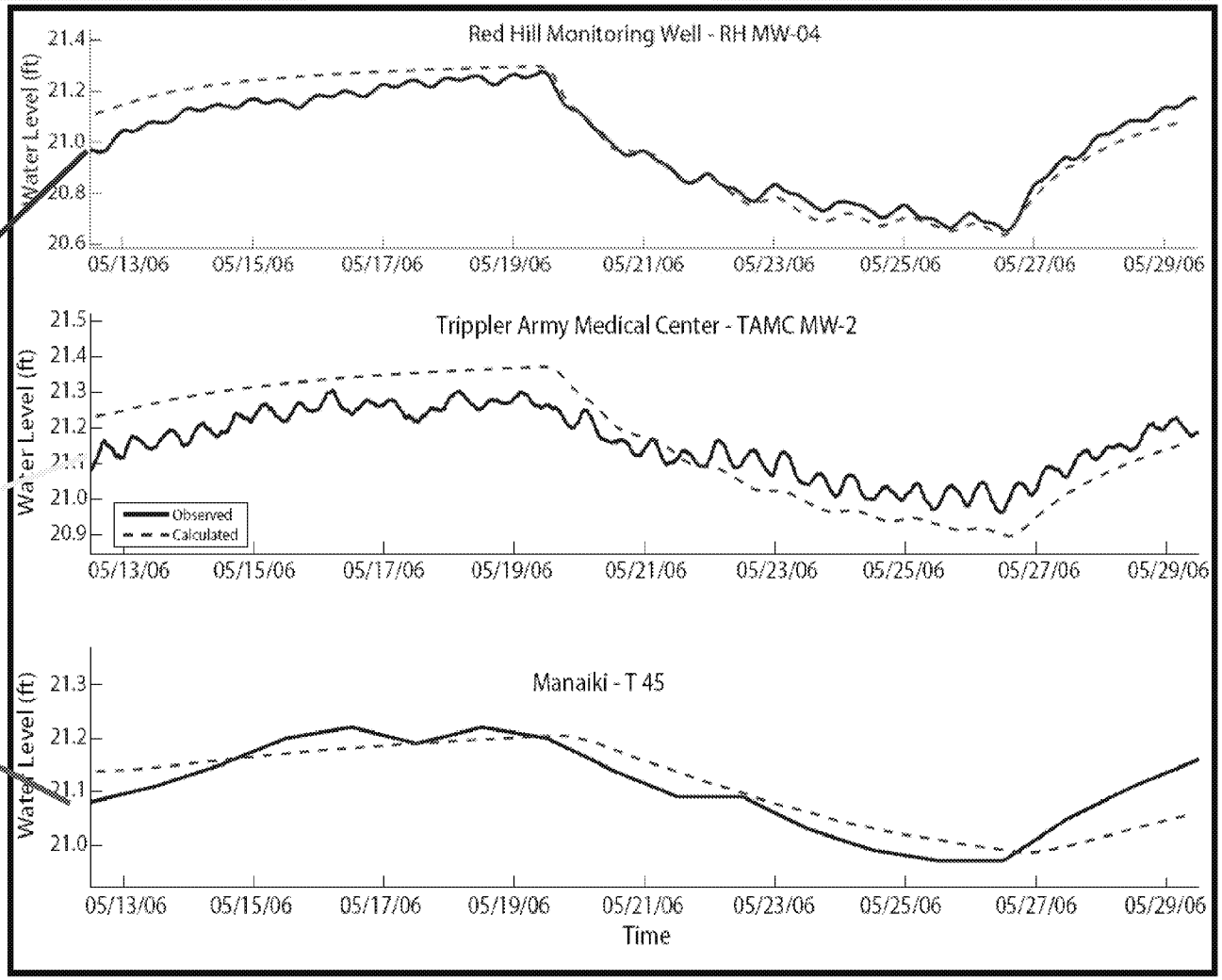


Task #5: Update the Existing Groundwater Model
Red Hill Shaft Pump Test



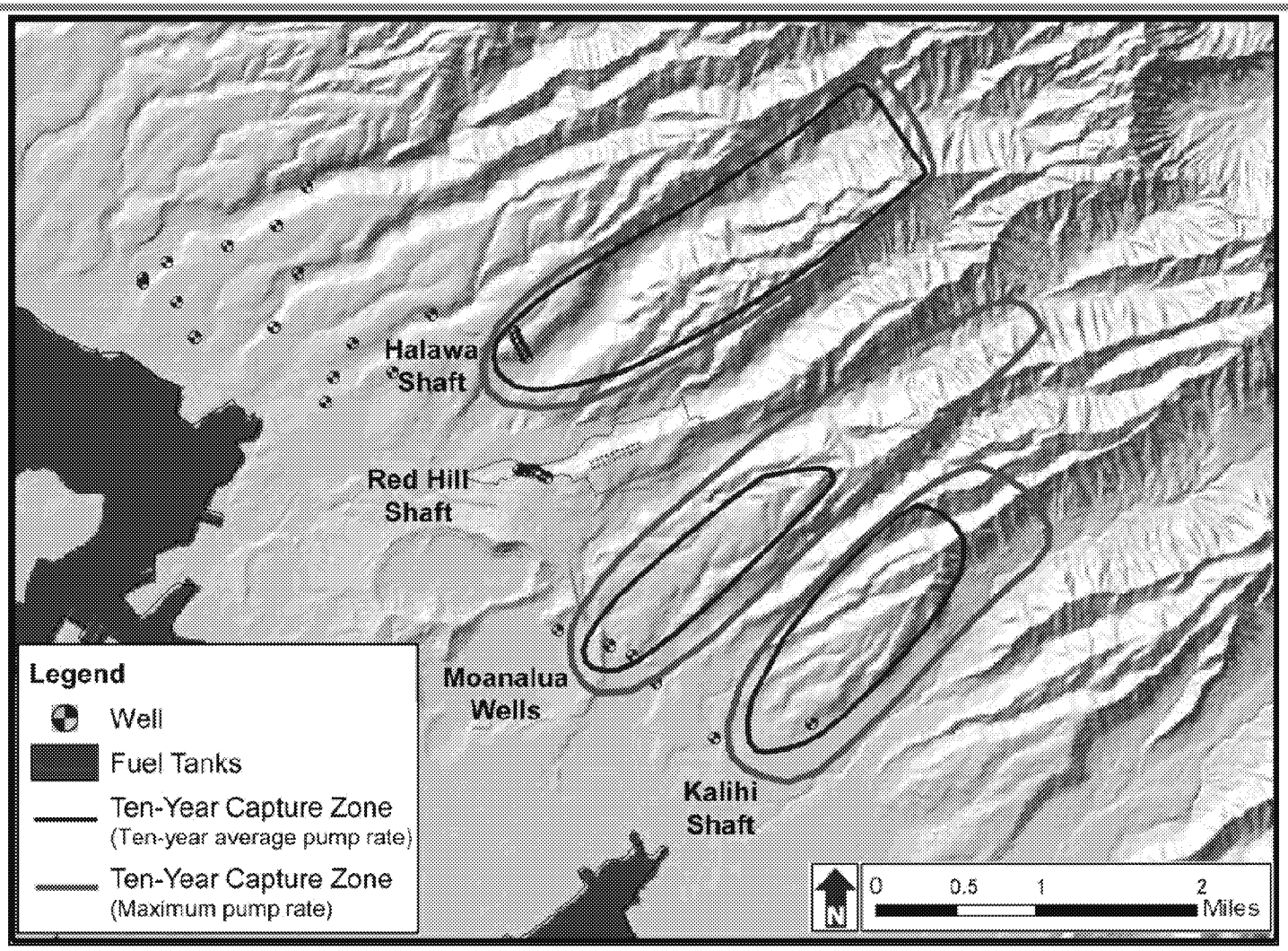
Task #5: Update the Existing Groundwater Model
Red Hill Shaft Pump Test



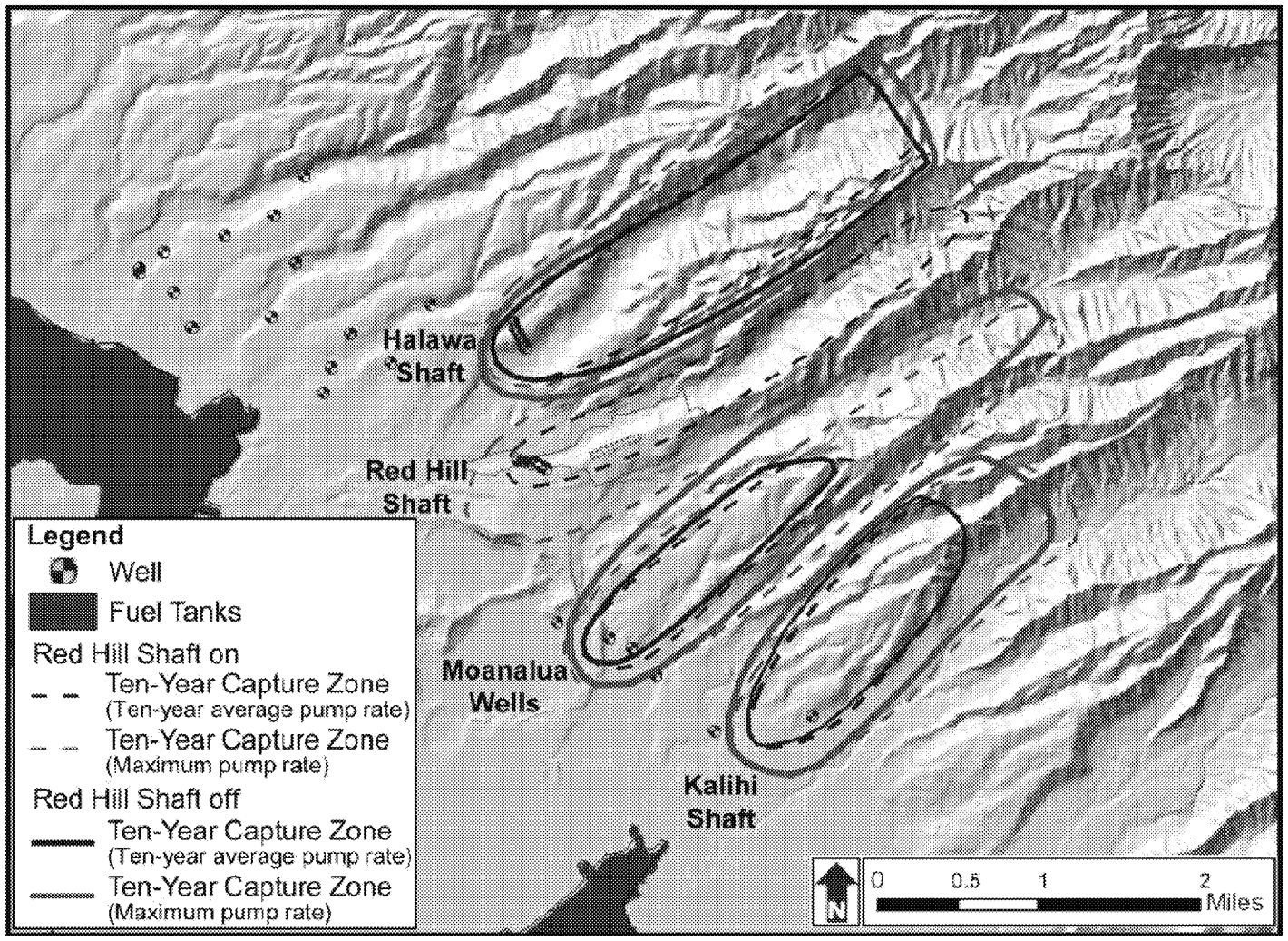


Specific Yield = 0.03

Task #5: Update the Existing Groundwater Model Capture Zone Delineation, Red Hill Shaft Off



Task #5: Update the Existing Groundwater Model Capture Zone Delineation, Both



Task #5: Update the Existing Groundwater Model Flow Model Strengths, Data Gaps

- Existing Flow Model Strengths
  - MODFLOW is the industry-standard flow model, tried and tested at countless sites
  - Significant effort expended by local experts to develop site model and calibrated with site data and pump test
  - Reasonably simulates transient drawdown from Red Hill Shaft
  - Supports concept of aquifer as porous medium
- Recommendations for Flow Model Improvement
  - Gather more site geologic, hydrogeologic, and hydraulic data
  - Gather more widespread hydraulic head data
  - Better define stratigraphy and properties of relatively low-permeability valley-fill barrier
  - Add saprolite layer beneath valley fill