TA72

Young, John, NMENV

From: Mark Everett [meverett@lanl.gov]
Sent: Tuesday, May 29, 2007 6:18 PM
To: Young, John, NMENV
Cc: Shen, Hai, NMENV; katzman@lanl.gov; 'David E. Broxton'
Subject: R-35b Proposed Well Design
Attachments: Fig1 R-35Bwelldesign.pdf; Fig2 R-35composite chem.pdf; Fig3 R35a_ELAN_model_results_prelim1-500scale.pdf; R-35b Well Design_052907.doc

LANL TA-72 [GW, R-35b, Sandia Canyon, TA-3]

John,

Attached is our proposed well design for R-35b. included is a discussion of our rationale for picking the proposed interval and supporting documentation. Please review, and if it looks good, respond via e-mail with your approval. If you have questions, please call Danny (699-1042) or me (231-6002) to discuss.

Thanks,

Mark Everett, PG
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TA-72 [GW, R-35b, Sandia Canyon, TA-3]

Review of R-35a and R-35b Well Objectives from Work Plan

Conceptual Model	Hexavalent chromium contamination is present in the upper part of the regional groundwater system at R-11 and R-28. Natural hydraulic gradients in the area are expected to cause the contamination to move eastward with possible local northeast gradients resulting from the pumping of municipal water at PM-3. Thick Miocene basalt probably provides a lower confining bed for the vertical movement of chromium contamination, restricting the movement of chromium to the portion of the aquifer adjacent to the upper part of the well screen at PM-3. Two conceptual models of groundwater flow were presented in the "Interim Measures Work Plan for Chromium Contamination in Groundwater." According to the first conceptual model, the top of the regional zone of saturation has a poor hydrologic connection with deeper zones pumped at PM-3 because of the strong vertical anisotropy of aquifer materials. In this case, groundwater flows laterally down gradient and may not be drawn into the submerged screen at PM-3. According to the second conceptual model, natural and pumping-induced vertical gradients cause groundwater to be drawn towards the PM-3 well screen, resulting in the distribution of chromium over a greater vertical depth. The two R-35 wells are designed to test elements of these conceptual models by determining the eastern extent of chromium contamination in the vicinity of PM-3 and the vertical distribution of chromium in the interval near the top of the PM-3 well screen.
Primary Purpose	The two single-screen wells at the R-35 location will result in two well screens set at different depths in the regional groundwater system for measuring water quality and pumping responses associated with pumping at production wells, especially at PM-3. • R-35a, the deeper of the two wells, will contain a well screen that is placed within the depth interval of the upper part of the well screen (louvers) at PM-3. R-35b will contain a well screen placed near the top of the regional zone of saturation. The paired-well configuration is designed to answer the following questions about water quality: (1) is chromium contamination present in regional groundwater near PM-3, and (2) if present, does chromium in groundwater vary as a function of depth, and is it likely to be drawn into the well screen at PM-3? If chromium contamination is not present, then the R-35 wells will be used as sentry wells for PM-3. • Water levels in the paired wells will be monitored using dedicated transducers to identify hydraulic responses to pumping at production wells, especially PM-3. These data will be used to evaluate hydraulic connectivity in the regional zone of saturation between the upper portions of the regional groundwater and deeper zones corresponding to the upper screen interval at PM-3.
Hydrogeologic and Geochemical Objectives	• The objective of the shallow screen at R-35b is to further define the lateral extent of chromium contamination in the regional groundwater. The proposed location is especially important for determining if LANL-derived contamination is present in regional groundwater in the vicinity of PM-3. • The deep screen at R-35a will help define the vertical extent of chromium (and other) contamination and is especially important in the context of monitoring for potential impacts to PM-3 because it will be placed within a zone that may be a potential pathway for contamination to enter PM-3. • If chromium is not present in one or both wells, the R-35 well pair may be used as sentry wells up gradient of PM-3. • Water levels at R-35a and R-35b will be continuously monitored during pumping of PM-3 to evaluate the hydraulic connectivity in the regional zone of saturation between the water table and the upper production zone at PM-3.

R-35b Recommended Well Design

We recommend that R-35b be installed as a single-screen well with a 20-ft stainless-steel, 20 slot, wire-wrapped well screen extending from 825 ft to 845 ft bgs. The primary filter pack will consist of 10/20 sand extending 5 ft above and below the screen openings. The 10/20 sand size is consistent with that used at other regional wells and has been shown to work well in combination with the slot

not considered a significant hydrologic feature and should not adversely impact the performance of the well.

Borehole Geophysics – Data from borehole geophysical logs collected at R-35a, located about 30 ft to the west, were used to assess the placement of the well screen at R-35b. The interval from the water table (786 ft depth) to 940 ft depth was logged through 10-in and 12-in drill-casing strings; below 940 ft logs were collected through the 10-in drill casing. Schlumberger performed an integrated log analysis using as many of the processed logs as possible (using ELAN – Elemental Log Analysis program) to model the near-wellbore lithology, mineralogy, and pore fluids. Results of this analysis, presented in Figure 3, indicate most of the rocks below the water table to a depth of 910 ft are quite porous and should be productive of groundwater. ELAN porosity estimates across the proposed screen interval of 825 ft to 845 ft range between 35% and 45%. Schlumberger's evaluation suggests there is not much clay in these rocks, although clay content is difficult to characterize with the limited logs available in the interval where there are two drill-casing strings.

Borehole Groundwater Screening Results – Groundwater screening samples were collected from the R-35b borehole at 10 ft intervals from 820 to 890 ft as the drill casing was advanced, and the samples were analyzed at EES-6 geochemistry for metals and anions. Selected analyses for the borehole samples are shown as a function of depth in Figure 2. Significant features of the borehole analyses include:

1. Detectable total dissolved concentrations of chromium range between 1 to 2 μg/L in all borehole samples; these concentrations are below background (upper tolerance limit [UTL] = 6.62 μg/L) values for regional groundwater.

2. Molybdenum, a contaminant released to Sandia Canyon, occurs at concentrations significantly above background (UTL = 3.82 μg/L) in all samples. The greatest concentrations are two orders of magnitude above background in samples from 820 to 850 ft. Dissolved molybdenum concentrations in this interval range from 77 to 160 ppb or μg/L and generally decrease down hole.

3. Sulfate is elevated in a sample at 830 ft depth (9.53 mg/L), coinciding with a sample containing the highest molybdenum..

Because total dissolved chromium concentrations are below background values in all groundwater screening samples, the widespread distribution of elevated molybdenum concentrations is used to guide the identification of potential groundwater pathways and for selecting the depth interval for the well screen at R-35b. The proposed well screen (825 to 845 ft depth) targets the zone where the greatest concentrations of molybdenum were found in borehole samples.

Field Observations of Water Production – Qualitative observations of water production were made by the field geologist and driller at 10 to 20 ft intervals within the regional aquifer as the drill casing was advanced. These observations, summarized in Figure 2, suggest that water production increased down hole and that the proposed screen interval overlaps the zone with the highest water production. Other factors, discussed below, may influence the relative scale of the observations. However, the water production observations support the geologic interpretation that the interval from 825 to 845 ft contains strata that are relatively transmissive and likely represent groundwater pathways in the upper part of the regional aquifer in the vicinity of PM-3.

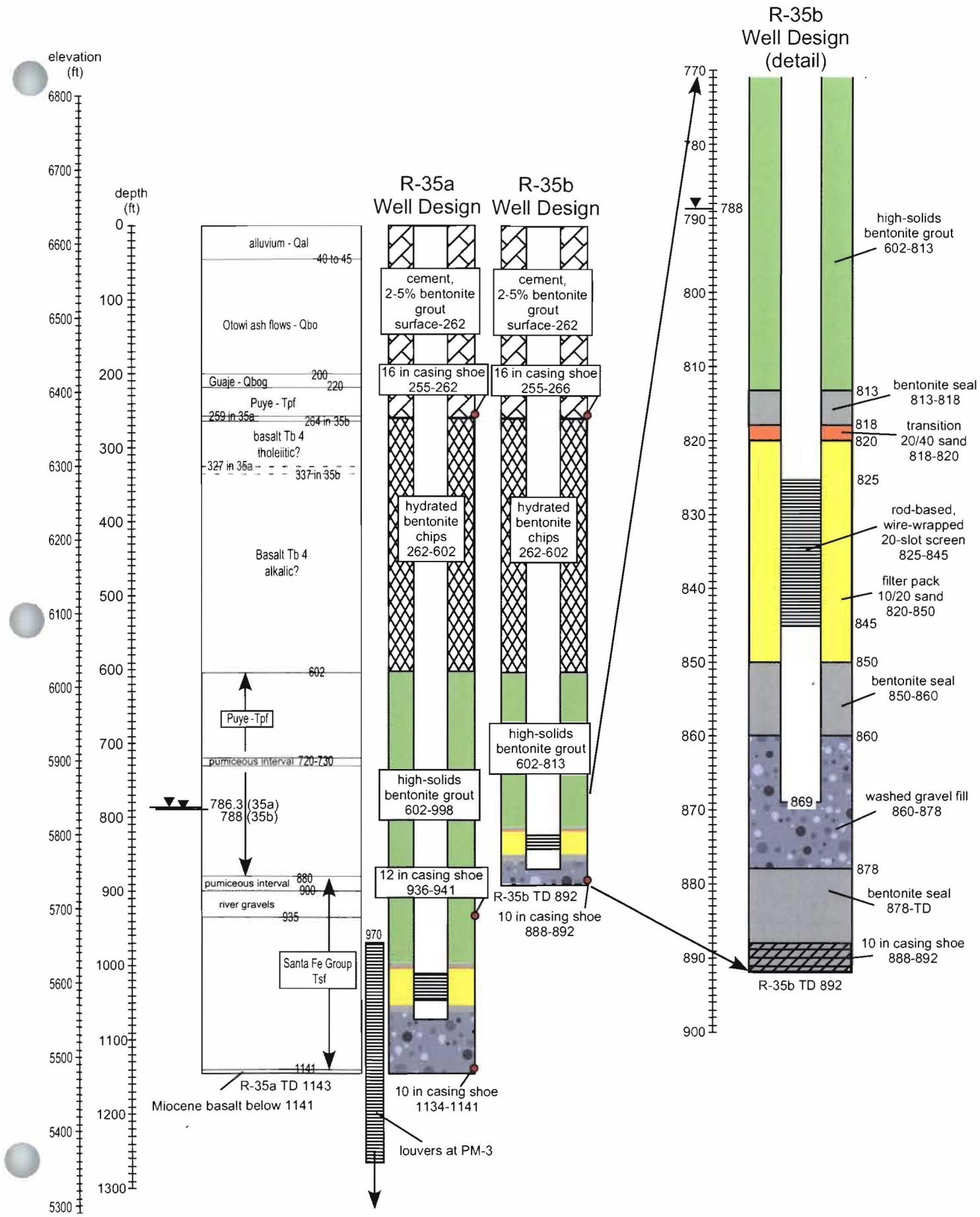


Figure 1. R-34b proposed well design shown relative to the well screen at R-35a and the top of louvers at PM-3.

Figure 3.

Schlumberger

ELAN* Geophysical Log Integrated Analysis

Optimized Mineral + Pore Volume Model (Prelim)

COMPANY: LANL

WE[illegible] R-35 A

FI[illegible] LANL

State: New Mexico

COUNTRY:

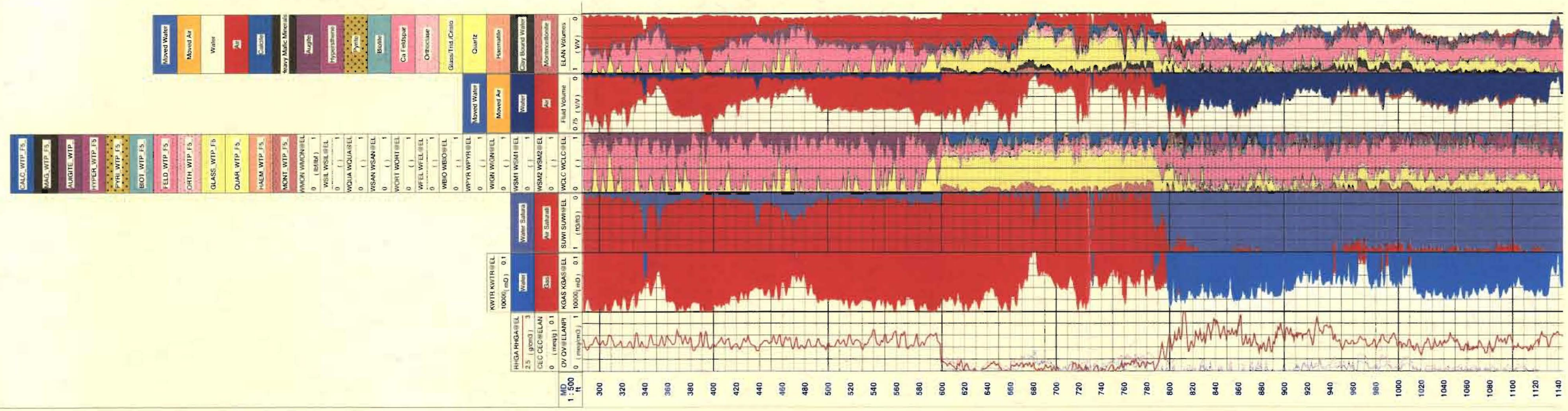
*Elemental Log ANalysis, Mark of Schlumberger

Date Processed:	18-May-2007	Date Logged:	11-May-2007
Job Number:		Processed at:	
Well Location:			
Latitude:		Longitude:	
Elevations:	KB:	DF:	GL:

Depth ref. is ground surface. Results are affected by cased hole conditions.

FOLD HERE

The well name, location and borehole reference data were furnished by the customer.



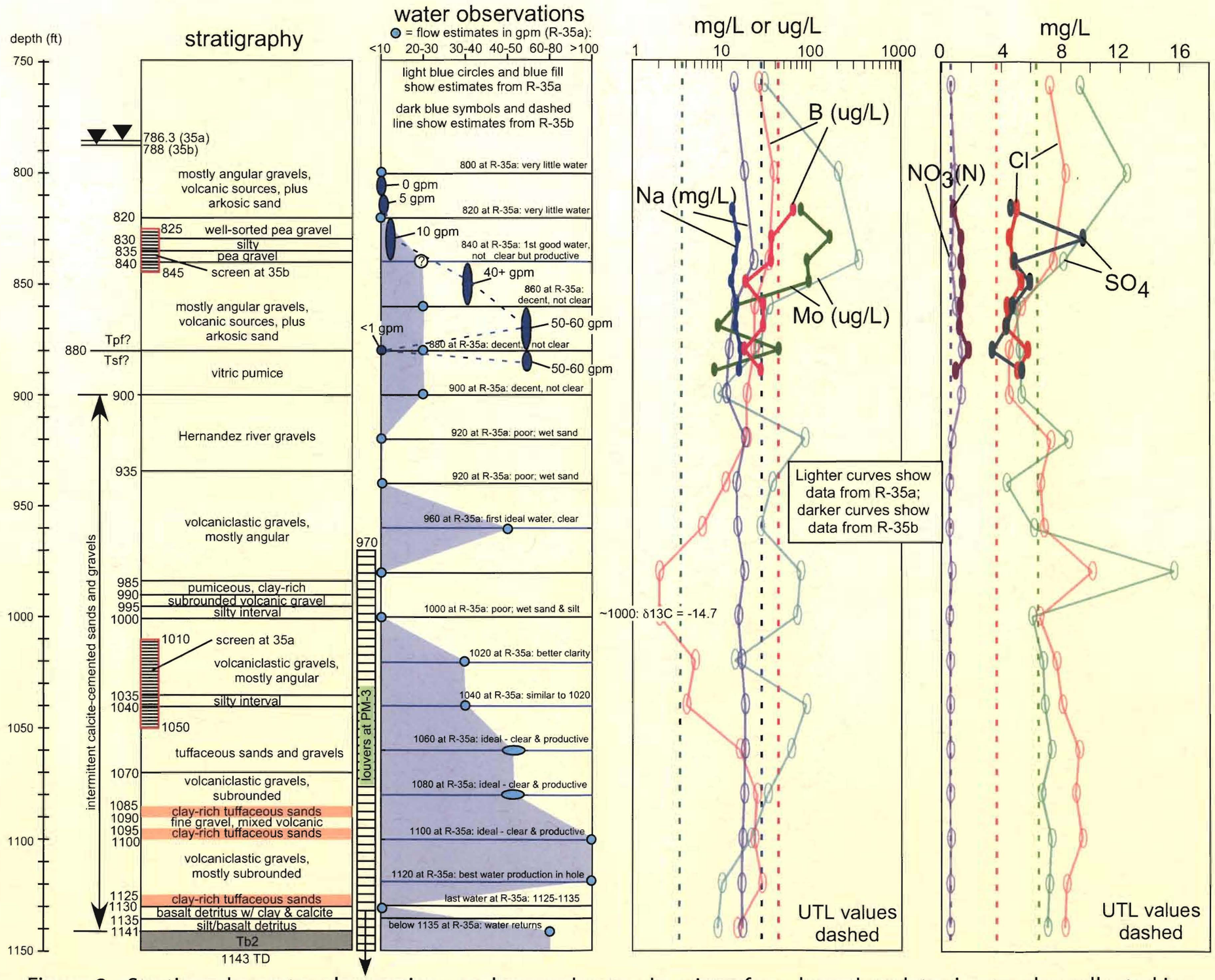


Figure 2. Stratigraphy, water observations, and groundwater chemistry for selected analytes in samples collected in boreholes R-35a and R-35b.