As shown on Figure 3.22, however, samples from the Sierra Vista well have consistently plotted to the sodium bicarbonate endpoint of the Piper diagram. There are singular examples of wells in the East Mountains completed in the Madera limestone and in the Chinle exhibiting similar Piper plots. However, the geologic setting for Sierra Vista Well 1 is not conducive to migration of waters from those units. In short, the water chemistry data from Sierra Vista Well 1 is not representative of the East Mountain area as a whole.

1.6 ***Far Northeast Heights Monitoring Wells***

The Far Northeast Heights encompasses two major residential portions of the County: Sandia Heights and North Albuquerque Acres. Sandia Heights obtains its water supply from supply wells located to the southwest of the Sandia Heights community, while residents in North Albuquerque Acres depend on individual or shared domestic wells. In both cases, the water is pumped from the alluvial aquifer system that extends from the mountain front to the Rio Grande. This aquifer is prominent in the Albuquerque/Middle Rio Grande region and provides substantial amounts of groundwater as compared with the fractured aquifers in the East Mountain Area. The aquifer materials consist of gravel, sand, and silt deposited as floodplain deposits of the Rio Grande and the outwash from the breakdown of the Sandia Mountains and the associated granites. The ABCWUA also pumps from this aquifer, with wells located along the southern and eastern edge of the North Albuquerque Acres area, as do wells belonging to Sandia Utilities, Ventura Estates and the Oakland Heights Homeowners Association. The location of Bernalillo County monitoring wells, the nearest USGS piezometer, and nearby community supply wells are shown in Figure 3.23.

Both these areas utilize septic system disposal and have been the subject of studies sponsored in part by the Bernalillo County Environmental Health Department. Sandia Heights was the primary area of focus in *Evaluation of Onsite Wastewater Treatment and Disposal: Determination of Groundwater Contamination and Demonstration of Alternative Technologies* (Thomson et al. 2000). That study incorporated results of water levels and water sample analysis from four monitoring wells.

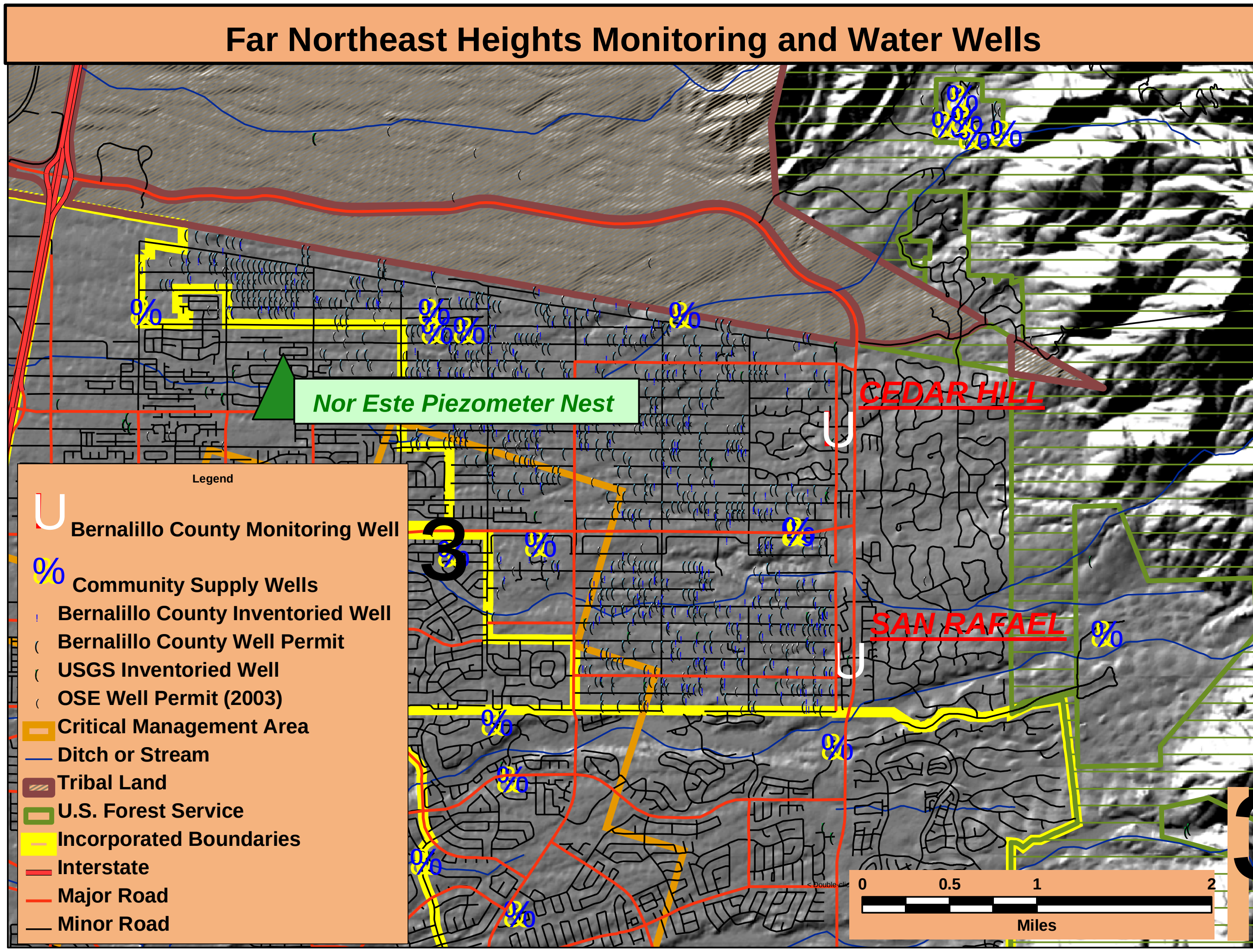


Figure 3.23 Far Northeast Heights Monitoring and Water Wells

Two of the wells were pre-existing at the time of the study (the Mhoon Well and the Elena Gallegos Well). Neither the USGS nor Bernalillo County actively monitor the wells. The City of Albuquerque monitors the Elena Gallegos well annually as a public water supply and analyzes for a minimal list of constituents (coliform, nitrate+nitrite). Nitrate levels are typically about 0.1 to 0.2 mg/L. Neither of the wells is monitored for water level. Two monitoring wells were installed as part of the study. The two wells, Cedar Hill and San Rafael, are actively monitored as part of the Bernalillo County monitoring program and are further discussed. Locations of the two wells are shown in Figure 3.23.

The Sandia Heights study resulted in the detection of nitrate concentrations of up to 3.5 mg/L in groundwater, while vadose zone sampling indicated decreasing nitrate and COD concentrations with depth and suggesting possible occurrence of denitrification in the soil column. Groundwater modeling for the study predicted a peak nitrate concentration of about 6 mg/L after 50 years of wastewater disposal through the on-site systems. The modeling results are dependent on the assumed septic tank density (7 systems / 246,330 $ft^2 \approx$ 1.2 systems / acre) and on the nitrate source concentrations (34.1 grams per day per system) (Thomson et al. 2000 p. 119 and Figures 5-9 and 5-10). A doubling of either term results in a doubling of the modeled nitrate concentration in groundwater. McQuillan et al. (2004) cite to the report and calculate and groundwater impact of 2.5 mg/L (Table 1).

Results of a separate study based on samples from 23 individual domestic wells in North Albuquerque Acres are discussed in *North Albuquerque Acres Ground Water Quality and Septic System Impact Assessment* (CDM 2002). Based on the 25 samples, CDM concluded that none of the collected samples exceeded groundwater quality standards for any of the analytes and that most of the nitrate (from septic tanks) is being denitrified in the thick vadose zone or that the solute front had not reached the groundwater in most places. Of the 23 samples, only four samples were reported as not detected and only six samples exhibited nitrate concentrations greater than 1 mg/L. The maximum reported concentration was 2.3 mg/L. Four of the samples exceeded the now implemented EPA standard for arsenic of 10 mg/L.

A review of the USGS database indicates that 31 wells have been monitored by the USGS in the Far Northeast Heights. Most of these wells were monitored only prior to 1990 and active monitoring has been discontinued.

1.6.1 *USGS Far Northeast Heights Monitoring Wells*

The USGS previously monitored two municipal wells located along the southern boundary of the Far Northeast Heights area (Walker 1 and Walker 2), which are approximately 2 to 2.5 miles west of the Bernalillo County monitoring wells. The USGS currently maintains a piezometer nest for water level monitoring in Nor Este Park. The piezometer nest is 3 miles west of the monitoring wells. Sandia Peak Utilities pumps from two wells located mid-way between the two Bernalillo County monitoring wells. Pumping data and water level data for the two wells is not readily available. The respective well locations are shown in Figure 3.23.

1.6.1.1 Far Northeast Heights Water Levels

Water level data for the Walker 1 and Walker 2 wells are available only during the 1980's. The available data indicates a decline in water levels of approximately 6 feet in Walker 1, and approximately 20 feet in Walker 2 from 1982 to about 1987. This indicates a decline rate of 1 to 4 feet per year. This significant decline rate was partially responsible for the establishment of the OSE's critical management area outlined in Figure 3.23.

Figure 3.24 provides a hydrograph for water levels in the Nor Este piezometer nest. Water levels have been measured by the USGS since 1997, and readily available data extends through 2005 – a time period equivalent to the period of record for the Bernalillo County monitoring wells and a period of increasing population growth in the Far Northeast Heights. The data shown below was downloaded from the USGS website (USGS Ground Water for New Mexico: Water Levels and reformatted for this report.

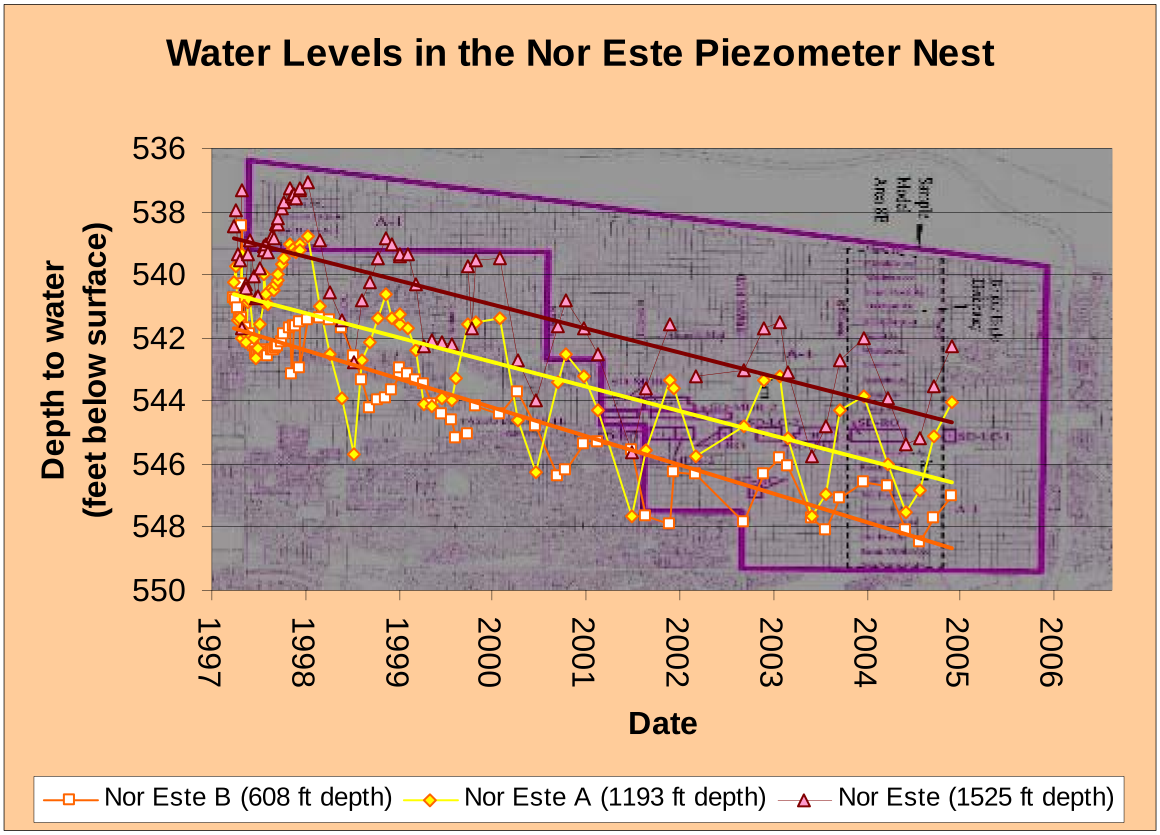


Figure 3.24 Water Levels in the Nor Este Nested Piezometer

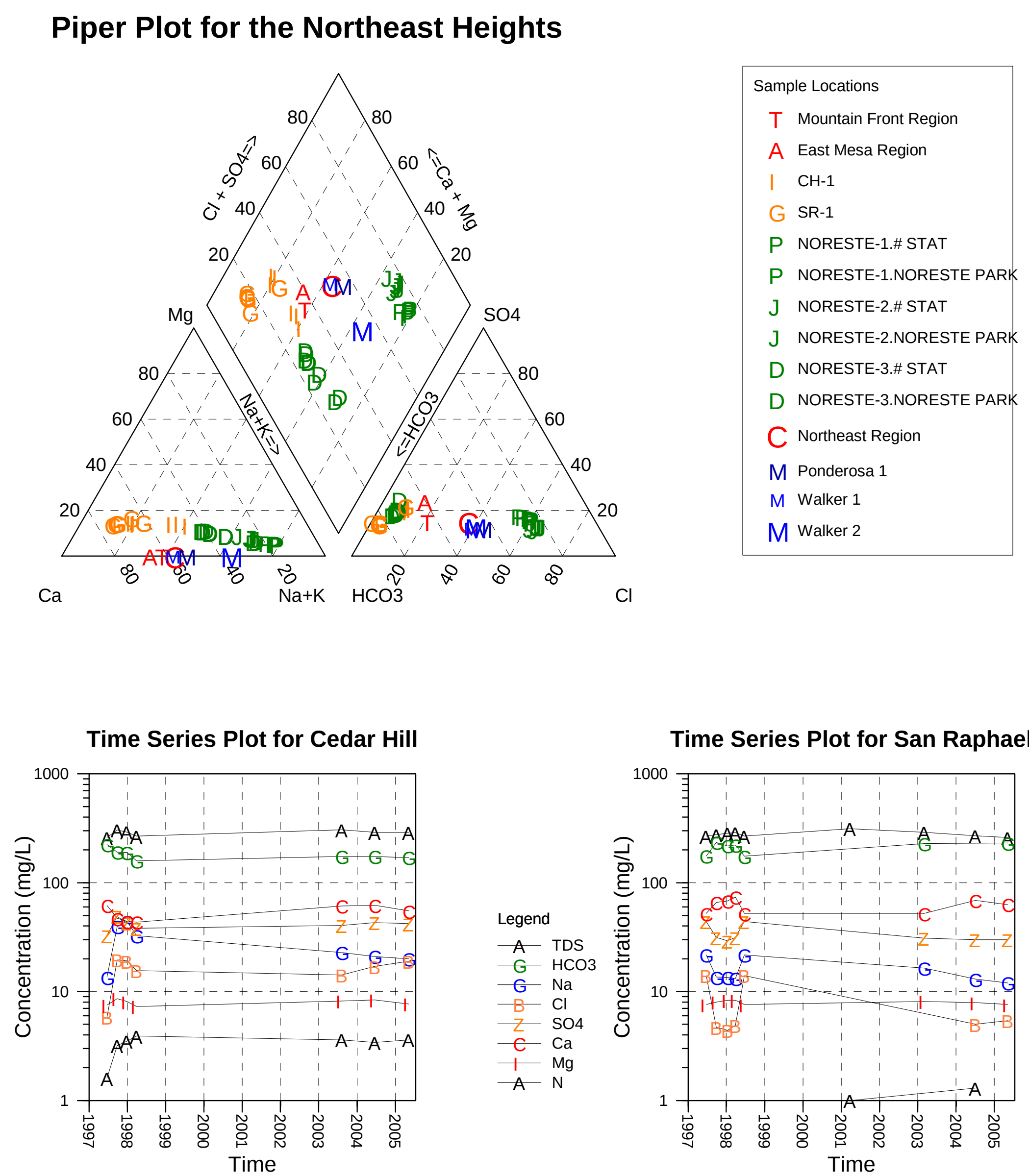
Figure 3.24 indicates three pertinent trends in the water level data from the piezometer nest. First, the general trend in water levels is a decline of approximately 4 to 9 feet (depending on the zone monitored) from 1997 through 2005. This trend is shown by the linear trend fit (as shown above) or by visually inspecting the trend in the peak highs or peak lows. This indicates a decline in water levels of 0.5 to 1.1 feet per year regardless of the depth of the piezometer or seasonal fluctuation. The decline in water levels in the piezometer nest is likely reflective of the decline in water levels in individual domestic wells throughout the area. Secondly, the hydrographs clearly show a seasonal fluctuation. Peak water levels occur during the winter months when pumping from municipal and individual wells is at its minimum. This seasonal fluctuation can be as great as four feet in the shallow part of the aquifer. Lastly, the shallowest well (608 ft deep) shows the deepest water levels (i.e. the bottom graph in Figure 3.24) and the deepest well (1525 ft deep) shows the shallowest water levels (i.e. the top graph of Figure 3.24). This indicates a generally upward flow regime in the immediate vicinity of the piezometer. This is consistent with flow moving from recharge in the mountain to discharge at the Rio Grande. Pumping of intermediate or deep wells, however, can locally change the water flow dynamics, with all flow in the immediate area of the well being toward the screened portion of the well. Wells located greater distances from high volume domestic or community wells may show a decreased effect. Pumping effects are shown in Figure 3.24 when the middle graph crosses over the bottom graph, which occurs during the summer months of each year. This crossover indicates that pumping from the intermediate zone (i.e., the middle graph) is sufficient to lower water levels such that downward flow is induced from the upper zone (i.e. the lowest graph).

1.6.1.2 Far Northeast Heights Water Quality

Groundwater quality in the ABCWUA service area has been previously summarized by the USGS in *Spatial Patterns and Temporal Variability in Water Quality from City of Albuquerque Drinking-Water Supply Wells and Piezometer Nests, with Implications for the Ground-water Flow System* (USGS WRIR 01-4244, 2001). The Far Northeast Heights overlays portions of two of the five groundwater-quality regions identified in the report (i.e., the Northeast Region and Mountain Front Regions).

Representative samples for each of those groundwater-quality regions are plotted in Figure 3.25. The figure also includes the Piper plots for the Nor Este nested piezometer and for nearby municipal production wells. Collectively, the plots represent water quality in the Far Northeast Heights. Plots for the two monitoring wells, Cedar Hill Well 1 (CH-1) and San Rafael Well 1 (SR-1), are shown for comparison.

The Piper Plot clearly demonstrates the significant difference in groundwater quality characteristics in the Rio Grande valley area compared to the East Mountain area. The plots of the relative percentage of anions and cations for the valley area plot to the center portion of the diagram, while the samples for the East Mountain area plotted to the extreme upper left of the center diagram.



DESCRIPTION: **Water Quality in the Northeast Heights**	
PROJECT: *Water Data Report - 2005*	DATE: 5/16/06
BERNALILLO COUNTY PUBLIC WORKS / WATER RESOURCES	

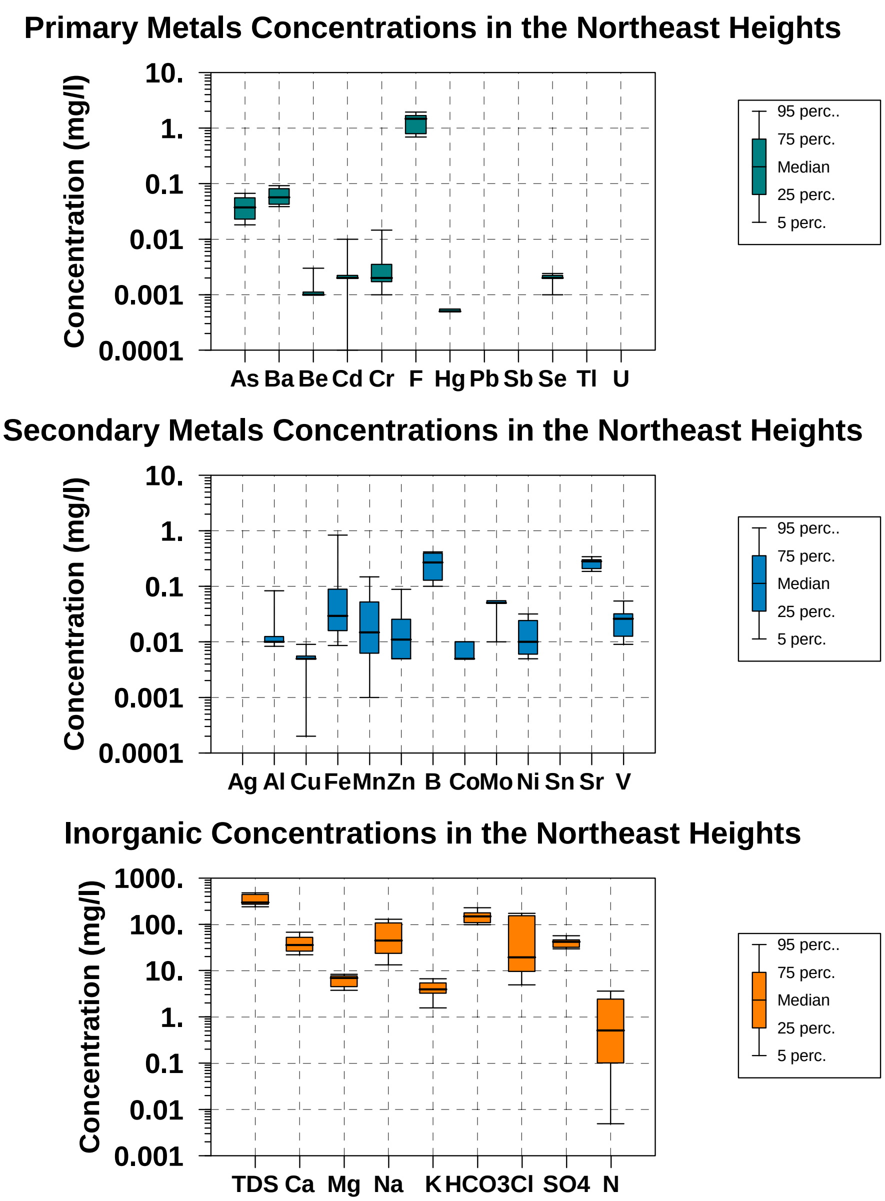
Figure 3.25 Water Quality in the Far Northeast Heights

This is due to the predominance of calcium bicarbonate in the East Mountain area and stems from the geologic setting. To a lesser degree, this is also reflected in the plots for Cedar Hill Well 1 and San Rafael Well 1. A progression to increased sodium composition with depth, is noted in samples from the Nor Este piezometer. The increase is due to interaction with the alluvial fill sediment during groundwater flow.

The diagram clearly illustrates that the water chemistry for the two monitoring wells differs from that of the production wells and the Nor Este Piezometer nest. The water chemistry in the two wells more closely resembles the representative chemistry of the Mountain Front Region, also shown on the plot. This is expected as the two shallow monitoring wells are located on the far eastern edge of the Northeast Region and reflect influence of mountain front recharge via the arroyos draining from the Sandia foothills. Of the samples shown, the chemistry of the two monitoring wells is more closely aligned to the water quality in the shallowest of the Nor Este piezometer nest. This is reasonable given the shallow depth of the wells and the minimal cation exchange that has occurred during groundwater flow.

The samples from the intermediate and deep Nor Este piezometers plot to the right mid-portion of the diagram and reflect a predominance of sodium over calcium and chloride over bicarbonate. This is reflective of the geochemical processes and effect of groundwater flow through the alluvial fill aquifer. Municipal wells demonstrate an intermediate chemistry and reflect the combined mixing of chemistry from shallow and deep zones and capture of water from both east and west, and match the "representative" chemistry for the Northeast groundwater quality region (as they should because they are part of the statistical basis of the "representative" sample.)

Figure 3.26 provides a statistical summary of the concentration distribution for trace metal and inorganics for the Far Northeast Heights as a whole. In some cases, particularly for the various metals, the sample set is small (less than 10 samples), so reliability of the distribution may be questionable. Absence of a distribution indicates that the sample size was insufficient to allow calculation of the various percentiles.



DESCRIPTION:	**Metals and Inorganic Concentrations in the Northeast Heights**
PROJECT: *Water Data Report - 2005*	DATE: 5/16/06
BERNALILLO COUNTY PUBLIC WORKS / WATER RESOURCES	

Figure 3.26 Trace Metal and Inorganic Concentrations in the Far Northeast Heights

Groundwater samples from wells in the Far Northeast Heights generally exceed the primary drinking water standard for arsenic and may at times exceed the standard for cadmium, but concentrations are consistent with natural occurrence of these elements. The secondary standards for iron and manganese are occasionally exceeded as noted by the 95^{th} percentile exceeding the respective standards. This may be due to analysis of unfiltered vs. filtered samples, with inherent increases in concentrations due to oxides present on sediments and colloids present in unfiltered samples. The respective standards and the percentage of samples exceeding the standards are shown in Table 3.8 below.

Table 3.8 Exceedances of EPA Drinking Water Standards – Far Northeast Heights

Parameter	Primary Standard	Secondary Standard	Total Number of Samples	Percent of Samples Exceeding Standard
Arsenic	0.010		36	87
Cadmium	0.005		25	13
Iron		0.3	41	16
Manganese		0.5	40	24

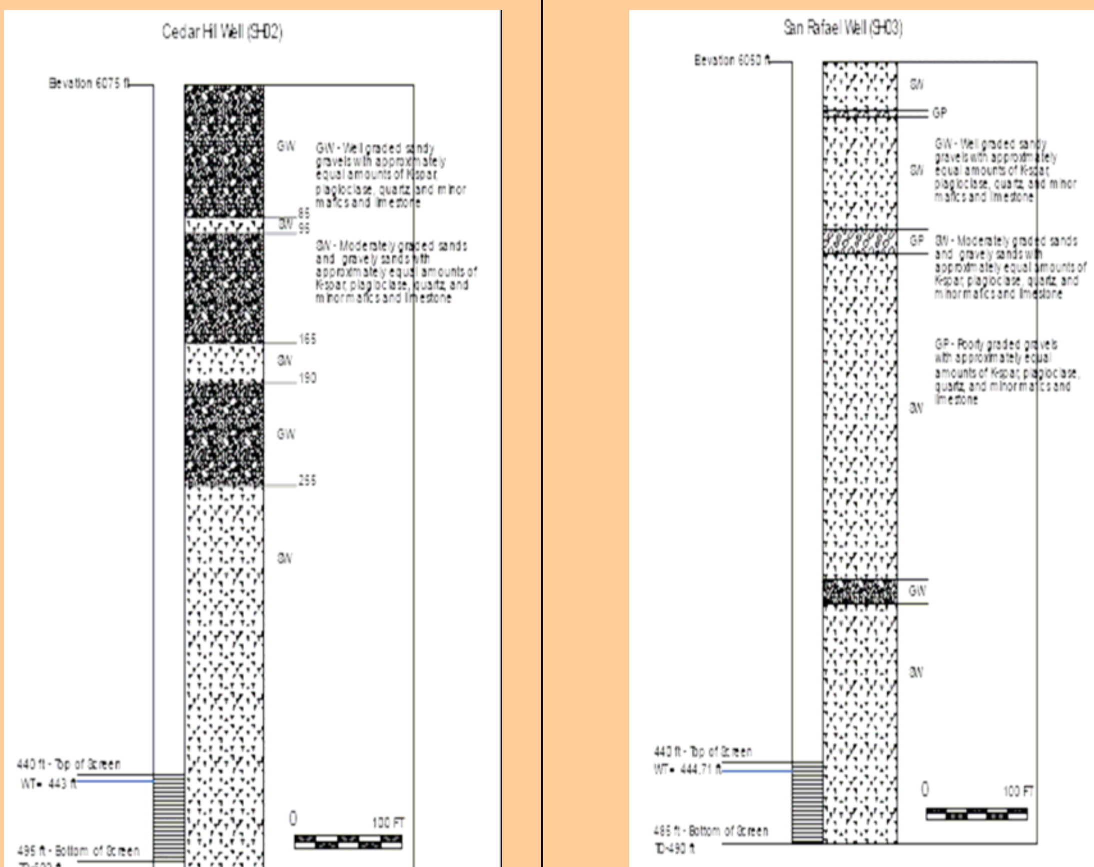
1.6.2 *Cedar Hill and San Rafael Wells*

Cedar Hill Well 1 and San Rafael Well 1 are located near Tramway Boulevard between North Albuquerque Acres and Sandia Heights (Figure 3.23). Similar to the East Mountain Area wells, these locations were originally selected to evaluate impacts of on-site wastewater treatment and disposal. The locations were selected based on a combination of factors including residential septic system density, depth to groundwater, proximity of USGS-monitored domestic wells, and availability of County-owned properties (Thomson et al. 2000, p. 36-38).

Both of the wells were completed in the Santa Fe Group alluvial aquifer, similar to most all wells in this area. The monitoring wells are completed in the shallowest portion of the aquifer at depths of 495 and 485 feet respectively as shown in Table 3.9 and Figure 3.27.

Table 3.9 Bernalillo County Regional Monitoring Well Network – Far Northeast Heights

Well	Well Type	Well / Hole Depth (ft)	Screen Settings (ft)
Cedar Hill (CH1)	Single	500	440-495
San Rafael (SR1)	Single	490	440-485



(Diagram from Thomson et al, 2000)

(Diagram from Thomson et al, 2000)

Figure 3.27 Cedar Hill and San Rafael Well Completion

The bottom 45 to 50 feet of the wells are screened and samples from these wells represent the uppermost conditions in the aquifer along the eastern side of the Far Northeast Heights. Well completion diagrams are provided in Figure 3.27. In general, domestic wells located near the monitoring wells are completed at depths in excess of 550 feet. Completion depths deepen to 600 to 800 feet or greater as once moves westward across the Embudo fault strands and to the northwest.

As shown in the geologic map and cross-section (Figure 3.28 and Figure 3.29), the monitoring wells are located east of the Sandia Fault – Tramway strand. The well locations are bounded to the west by the East and West Embudo strands. Based on geologic mapping, at least six fault strands transect the Far Northeast Heights area, with block movement consistently downward to the west. Available water level data suggests a marked increase in groundwater gradient moving westward between the East and West Embudo strands. This is highlighted in Figure 3.29. This structural control on gradient strongly suggests that the Embudo fault strands act as a partial hydraulic barrier.

1.6.2.1 Water Levels in Cedar Hill and San Rafael Wells

Water levels have been measured in the Cedar Hill and San Rafael wells since their installation in 1997. Figures 3.30 and 3.31 provide the hydrographs for the period of record. Water levels have been measured at least annually. A review of electronic data, however, indicates that identical depths to water were entered for all common dates for the two wells between 2000 and 2005, so accuracy and reliability of the data is suspect. Independent documentation is available for dates prior to 1999 and the author has taken the measurements since 2005. Based on comparison of the measurements from September1998 and February 2006, there has been an 11.4 feet decline in water levels in the Cedar Hill well, and 10.0 foot decline in the San Rafael well. The linearity of the trend between those dates is suspect due to the data irregularity mentioned. Regardless, the net decline between the two dates represents respective declines of 1.5 feet/year and 1.4 feet/year compared to 0.5 to 1.1 feet/year for the Nor Este piezometers.

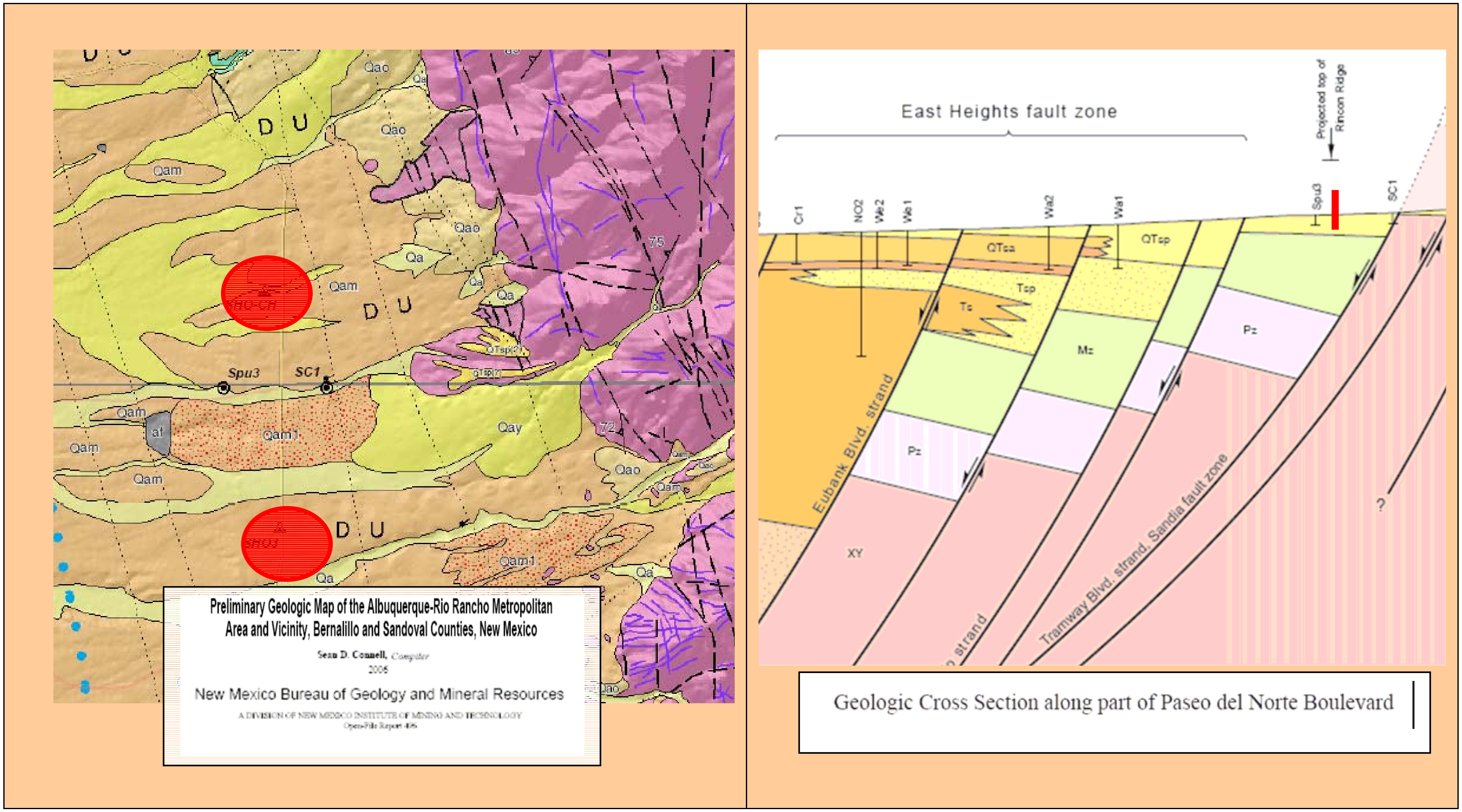
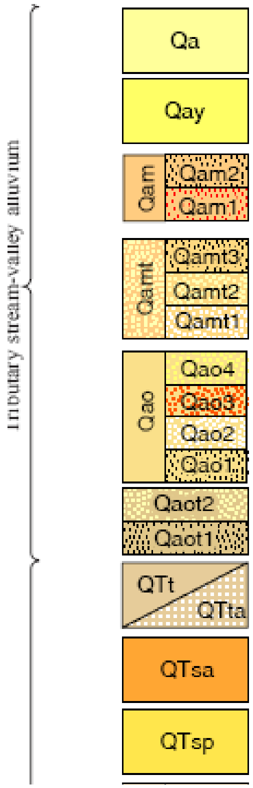


Figure 3.28a Geologic Setting of the Cedar Hill and San Rafael Wells



Active stream-valley alluvium (Qa, historic-Holocene)— light grayish- to yellowish-brown (10YR hues) sand, silty to clayey sand, and gravel; boulders are commor along western flank of the Sandia Mts; associated with modern incised stream valleys; very weakly developed (stage I) to nonexistent soils; 1-12 m thick.

Younger stream-valley alluvium (Qay, upper Pleistocene-Holocene)— pale-to light-brown (10YR hues) sand, muddy sand, and pebble to cobble gravel; boulders locally present along front of the Sandia Mountains; weakly developed soils (Stage I and II); commonly contains active stream-valley alluvium; up to 24 m thick.

Intermediate stream-valley alluvium (Qam, upper-middle Pleistocene)— yellowish-brown to reddish-yellow (7.5-10YR hues) sand, silty clay, and gravel; granite and limestone clasts dominant east of Rio Grande; variable lithology, dominated by chert and volcanic clasts west of the Rio Grande; surface is commonly mantled by eolian sand; variable soil development; divided into two subunits: Younger subunit (Qam2) contains moderately developed soils (stage II and III); Older subunit (Qam1) contains weakly developed soils (stage II); 5-43 m thick.

Intermediate stream-valley alluvium of Tijeras Canyon (middle Pleistocene)— sand and gravel associated with drainage courses of ancestral Tijeras Canyon; gravel composition more diverse than in Intermediate stream-valley alluvium with greenstone and sandstone; divided into three subunits: Younger subunit (Qam3t), Intermediate subunit (Qam2t), Older subunit (Qam1); 5-43 m thick.

Older stream-valley alluvium (Qao, middle Pleistocene)— light reddish-brown (7.5-10YR hues) sand and gravel; soil development is variable and exhibits stage I to III carbonate morphology with few or no clay films; divided into four subunits based on surface morphology and inset relationships: subunit 4 (Qao4), subunit 3 (Qao3), subunit 2 (Qao2), subunit 1 (Qao1); 2-14 m thick.

Older stream-valley alluvium of Tijeras Canyon (middle Pleistocene)— sand and gravel derived from former drainage courses of Tijeras Canyon; divided into younger subunit (Qaot2) and older subunit (Qao1t); 0-15 m thick.

Tuerto Formation (QTt, QTta, Pliocene-lower Pleistocene)— Tuerto gravels of Stearns (1953); pale-brown (10YR hues) pebbly to cobbly sandstone; unconformat overlies Sierra Ladrones Fm; locally capped by petrocalcic soils with stage III+ to IV+ carbonate morphology; gravels are predominantly limestone; subdivided into the gravel of Lomos Altos of Connell and Wells (1996) (QTta) west of the San Francisco fault, where the basal contact is 80-100 m above local base level; 4-18 m thick.

Sierra Ladrones Formation, axial-fluvial member (QTsa, Miocene(?)-lower Pleistocene)— light-gray to yellowish-brown (10YR hues), pebbly to cobbly sand, sand, and sparse mud; clasts dominated by rounded othoquartzite and volcanic rocks; interpreted as ancestral Rio Grand depostits; base not exposed; estimated thickness more than 300-800 m.

Sierra Ladrones Formation, upper piedmont member (QTsp, Pliocene-lower Pleistocene)— reddish- to yellowish-brown (7.5-10YR hues), conglomerate, sandstone, and minor mudstone; contains weakly developed paleosols and upward fining sequences of gravel, sand, and mud; generally poorly consolidated; 0-600(?) m thick.

Figure 3.28b Geologic Setting of the Cedar Hill and San Rafael Wells

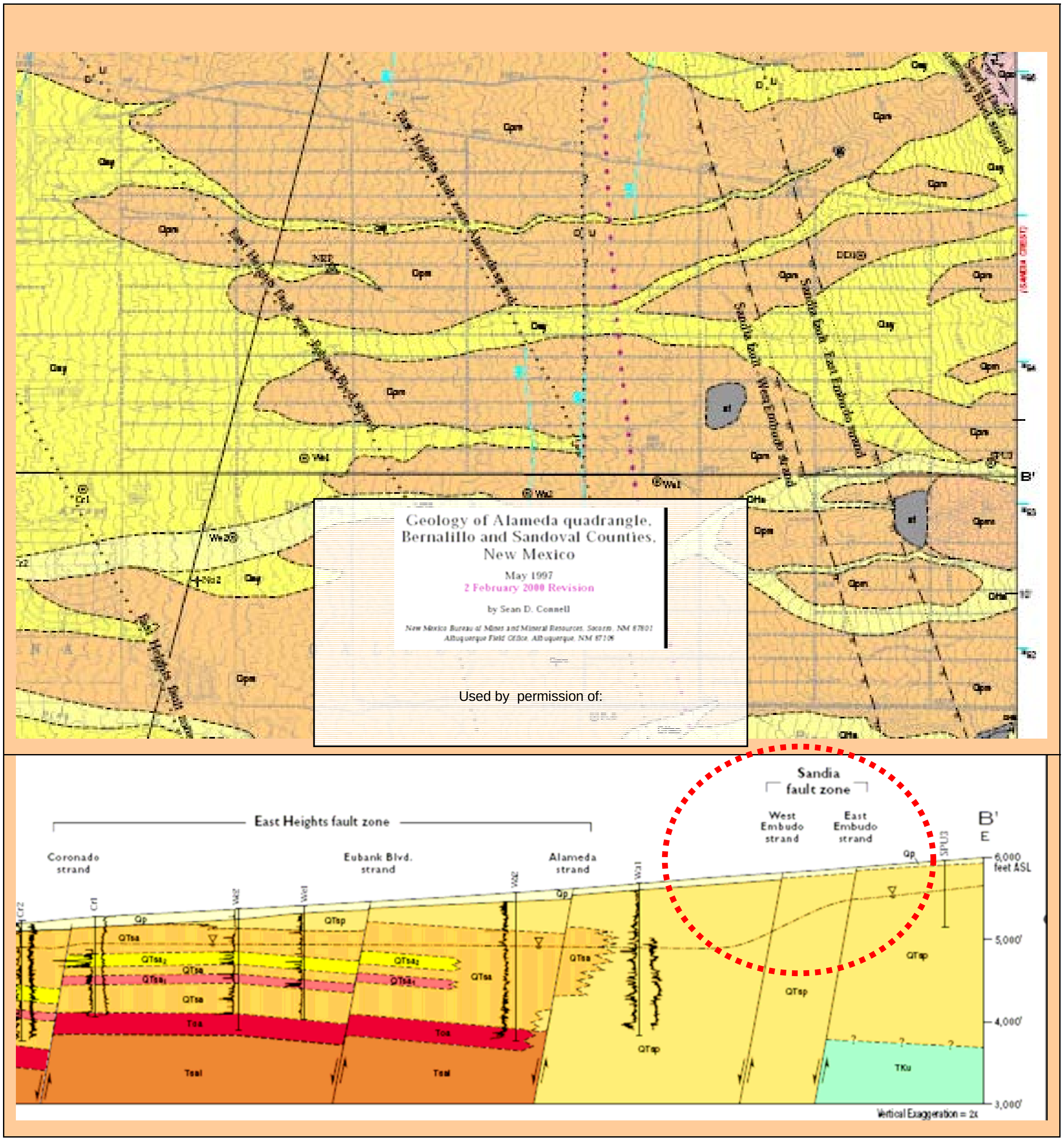
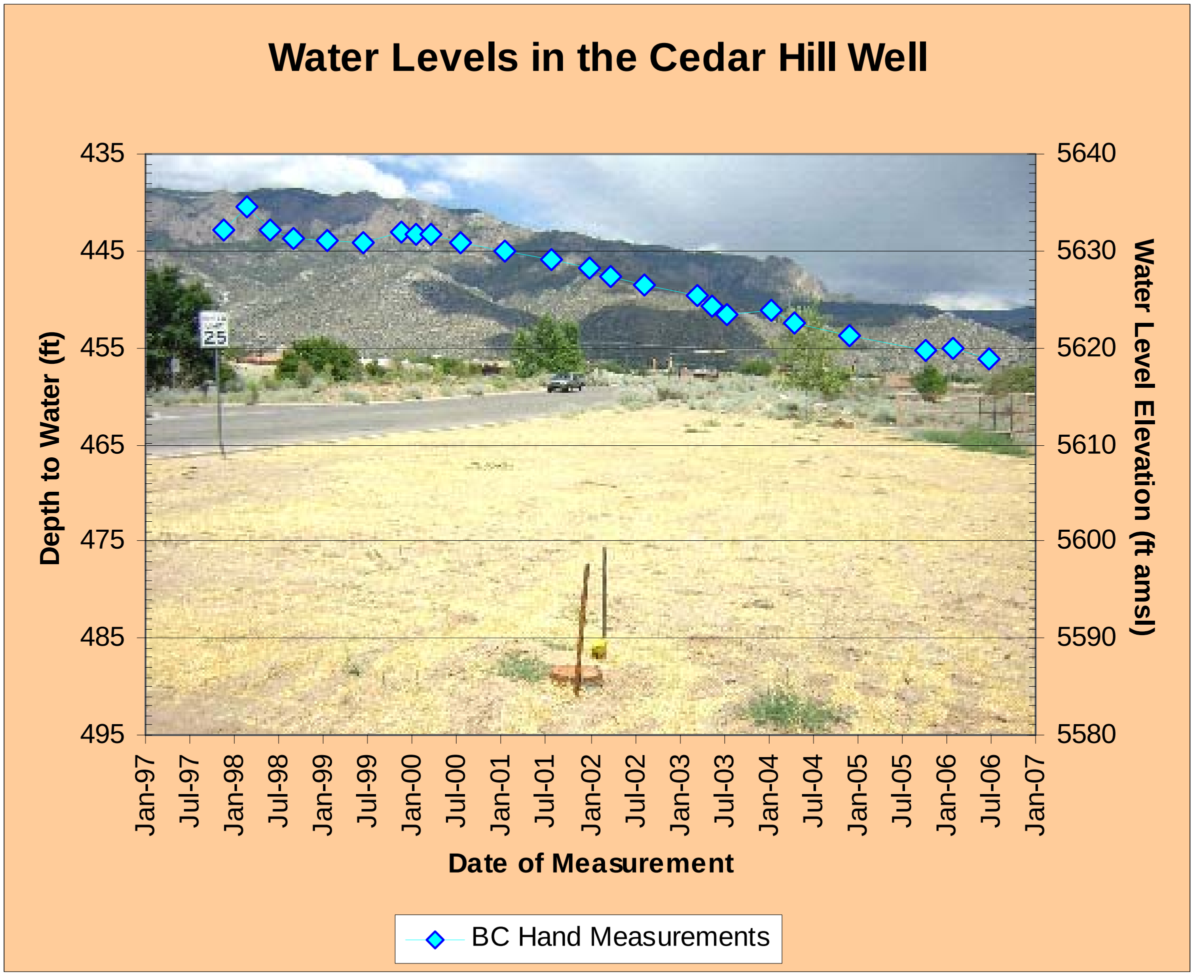


Figure 3.29 Locations of Faults in the Far Northeast Height



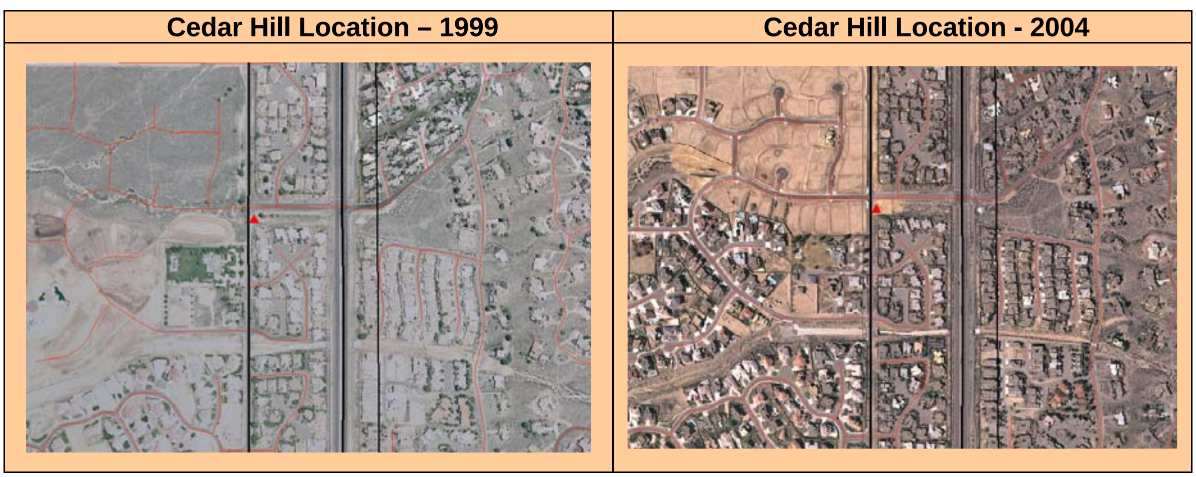
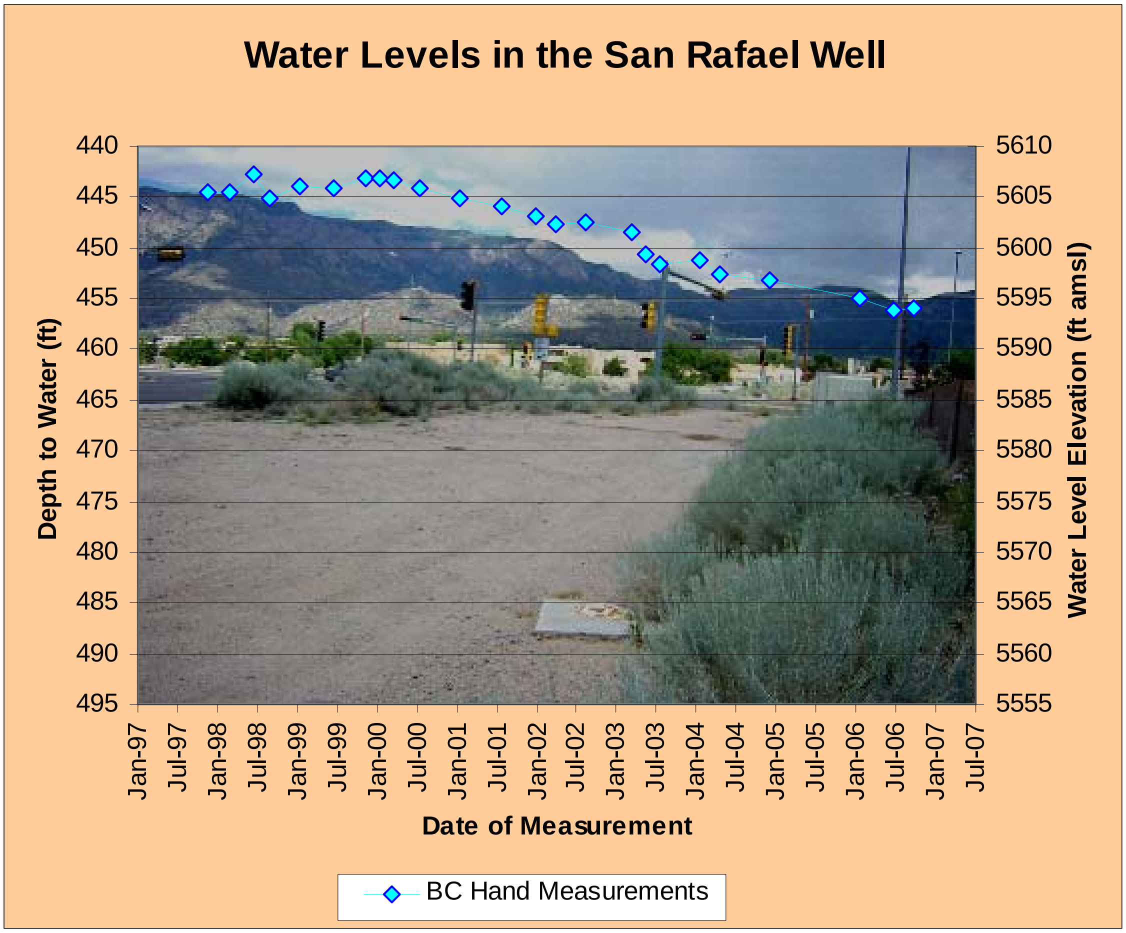


Figure 3.30 Water Levels and Comparative Aerial Photos for the Cedar Hill Location



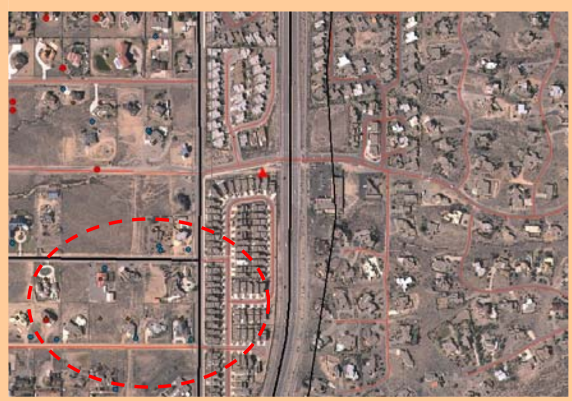
San Rafael – 1999	San Rafael - 2004
	

Figure 3.31 Water Levels and Comparative Aerial Photos for the San Rafael Location

At least four factors may account for this difference in decline rates between the County monitoring wells and the USGS nested piezometer. First, declines are expected because New Mexico has been in drought conditions since 1996 so water level declines should be anticipated. Some minor variations in decline rates are to be expected due to change in locales – however, the Nor Este and the monitoring wells are in relatively close proximity and screen the same aquifer and the same depths. Therefore, the normal variation should not be significant. A second factor may be localized effects of geology. As mentioned, there are a series of faults that separate the Nor Este location from the monitoring wells. These faults likely affect groundwater flow and are reflected in differing responses to various stressors. The third factor may be the effects of municipal pumping. The Nor Este piezometer nest has three municipal wells located within 1.5 miles (4,000, 7,000 and 9000 feet). There is a similar distribution of municipal pumping for the monitoring well locations (2 wells at 3,000 ft, and wells at 9000, and 12,000 feet). Differences in pumping rates, distances between wells, and specifics of the geologic setting likely account for noticeable differences in the decline rate. However, pumping data from the respective wells is not readily available for review to verify this assumption. The fourth factor is likely differences and/or increases in the density of nearby individual domestic wells.

The Nor Este piezometer nest is located in a residential area served by ABCWUA, and based on available County and OSE records, the nearest domestic wells are located at a distance of approximately 2,000 feet from the Nor Este piezometer location. The nearest municipal wells are the Webster 1 and 2 wells located approximately 1 mile to the south, and the Walker 1 and 2 and Coronado Wells 1 and 2 located approximately 1½ miles to the southeast and southwest respectively. Due to the distances involved, declines in the piezometer water levels are not predominately due to increases in domestic well pumping. Municipal pumping is the primary cause of drawdown in the Nor Este piezometer nest.

For Cedar Hill Well 1, the distribution of domestic wells is similar to that for the Nor Este piezometer nest, but most of the wells have been constructed since 2000 (although the records are not definitive in that regard). By contrast, the San Rafael well has at least 25 domestic wells within a one-mile radius. Figures 3.30 and 3.31 provide aerial photos for the area surrounding the two locations and provide a visual comparison of 1999 to 2004 growth in the number of residences, most of which are supplied by individual domestic wells. The red, blue, and brown dots represent plotted well locations taken from OSE and BCOEH databases with varying spatial accuracy. Rather than representing individual wells, adjacent dots of differing color likely indicate a single well location. A comparison of the aerial photographs for the San Rafael location indicate that within 2000 feet of the San Rafael location, no less than 10 new residences supplied by domestic wells were constructed between 1999 and 2004. This agrees with the number of building permits issued within a 2,000-foot radius. At least one of these residences includes a swimming pool. Although more building permits have been issued for a comparable radius around the Cedar Hill well, these residences are on the ABCWUA supply, not individual wells. There is no significant increase in individual wells near the Cedar Hill well. Coupled with relative distance to fault strands, the domestic well pumping and municipal well pumping likely result in the increased rate of drawdown in the monitoring wells. This also accounts for the increased rate of decline compared to the Nor Este piezometer.

Figure 3.32 provides a simulation plot for the effect of pumping from a 2 gpm domestic well at 1,000 feet from a monitoring well and for pumping from a 500 gpm well at 3,000 feet from a monitoring well. The 2 gpm rate is an average value for domestic well use, and the 500 gpm is based on reported annual volume produced by Sandia Peak Utilities. Although only an approximation, the figure indicates that for a domestic well pumping at 2 gpm, the rate of decline is approximately 0.006 feet/year at a point 1,000 feet distant ((0.23 ff-0.17 ft) / 10 years). The figure also indicates that after thirty years of pumping, the rate of decline from the 500 gpm well at a distance of 3,000 feet from the pumping well is about 0.1 ft/yr (35 ft – 34 ft / 10 year).

For the San Raphael well, there are at least 10 domestic wells within a 2,000 foot radius (suggesting a resulting rate of decline of perhaps 0.05 to 0.1 feet /year). Two of the Sandia Peak Utility production wells are located approximately 3,000 feet from the Cedar Hill and San Rafael monitoring wells, suggesting an additional rate of decline of 0.2 feet/year due to nearby community system pumping. This represents at least 0.3 feet/year decline (and likely greater) of the difference between the Nor Este piezometer and the County well locations.

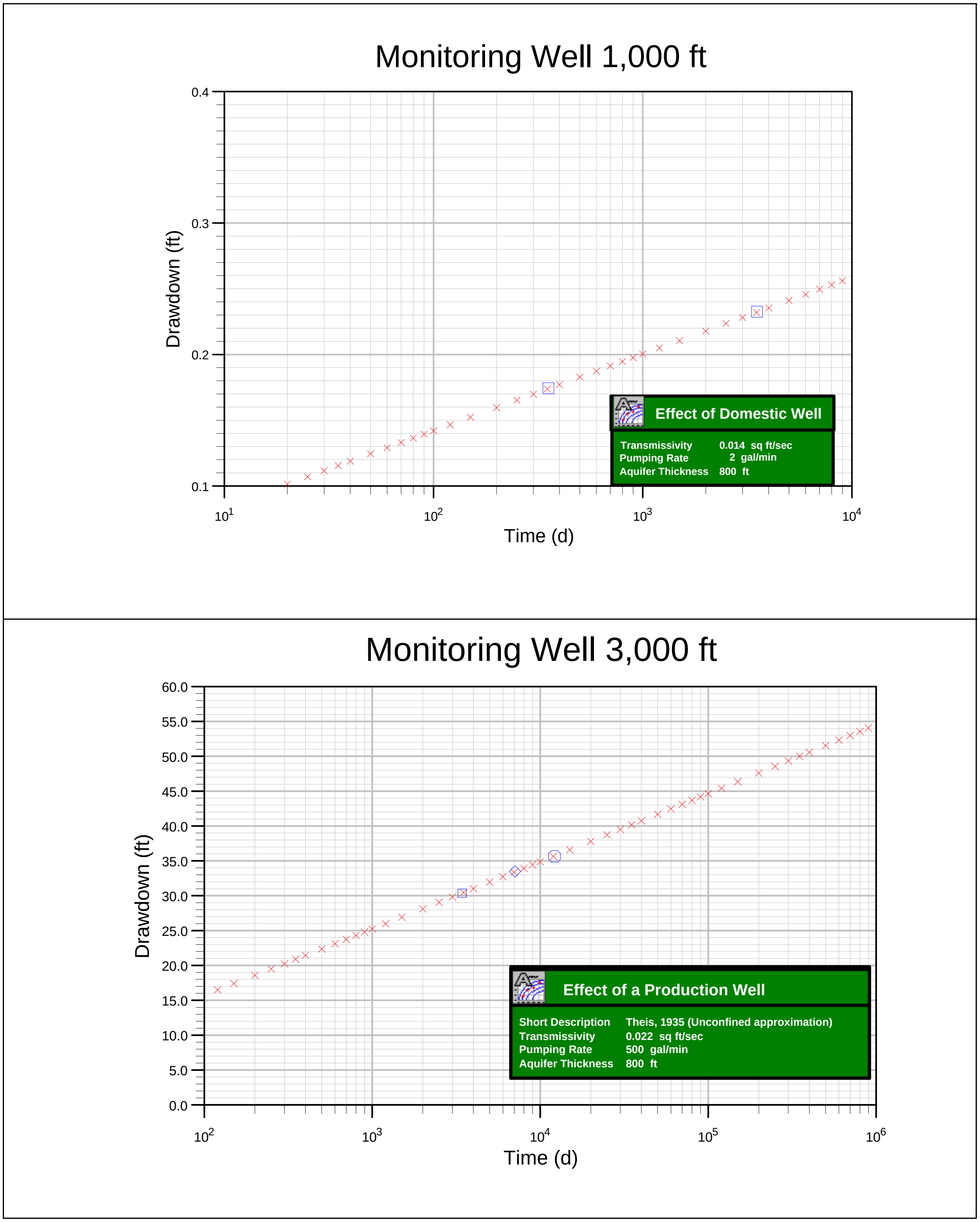


Figure 3.32 Simulated Effects of Pumping

Existing water level data are inadequate to define gradient directions for the eastern portion of the aquifer. Locally, gradients are affected by the presence of low-transmissivity fault structures and the production from high-volume community supply wells. Based on 2002 USGS data (USGS WRIR 02-4233), the lower portion of the alluvial aquifer demonstrates a gradient to the south - southeast. However, the water level contours were inferred and are bounded by an "apparent hydraulic discontinuity not near a known fault". The USGS models, however, do not incorporate measurements from production wells located within the Far Northeast Heights. Based on the available hydrogeology and location of production wells (see Figure 3.23), it is suspected that the general gradient is southerly and in some locations may be to the southwest. Using the three known shallow water levels (the two monitoring wells and the Nor Este piezometer), simple triangulation suggests a gradient to the west – southwest in the shallow portion of the aquifer and likely shifting more southerly as one moves westward and downward in the aquifer, due to the effect of increased municipal pumping.

1.6.2.2 Water Quality in Cedar Hill and San Rafael Wells

General trends in water quality in the Far Northeast Heights were previously discussed. Water quality data for the two wells for late 1997 through 1998 is available in Thomson et al. (2000). After 1998, data were collected by Bernalillo County.

Groundwater samples from wells in the Far Northeast Heights have not exceeded the Primary Drinking Water Standards. Secondary standards for iron and manganese have been exceeded in the Cedar Hill well, and on one occasion for aluminum in the San Rafael well. Again, this may be due to issues of analysis of unfiltered vs. filtered samples.

Figure 3.25 provides Piper plots and time-series plots for the Cedar Hill and San Rafael wells. Neither of the wells has ever exceeded the drinking water standard for nitrate. However, elevated concentrations of nitrate (nitrate + nitrite as total N and greater than 2 mg/L), have been reported consistently for the Cedar Hill well. A maximum concentration of 3.9 mg/L was reported in September 1998; subsequent analyses indicate concentrations ranging from 3.4 to 3.6 mg/L. Statistical trend determinations were inconclusive and showed neither increasing nor decreasing trends in concentration. Regardless, the reported concentrations do appear elevated compared to concentrations from the Elena Gallegos well, which is located east and hydraulically upgradient of Sandia Heights. Concentrations in that well in 1997 – 1998 were all less than 0.25 mg/L. The initial nitrate concentrations in the San Rafael well were reported at 3.2 mg/L. Subsequent measurements since 2001 have yielded concentrations of less than 1.5 mg/L. Modeling results presented in Thomson et al. (2000, Figures 5-6 and 5-7) suggest that nitrate concentrations would likely reach a maximum concentration of 6 mg/L based on current septic tank densities and practices, and recharge and water use conditions.

The San Rafael well was sampled and analyzed for the 66 compounds USGS considered indicative of anthropogenic effects on water quality (i.e., emerging contaminants). None of the compounds were detected in the sample from the San Rafael location. The lack of detection is reasonable given the minimal nitrate concentrations in the San Rafael well. Samples from the Cedar Hill well were not analyzed for these compounds.

The two wells have been sampled for volatile and semi-volatile organic compounds. There have been only two reported low-level detections of organic compounds: methyl ethyl ketone and phthalate compounds. Both of these compounds are common laboratory contaminants, and the detections are anomalous events, suggesting they were laboratory-related contaminants.

1.7 ***North Valley Monitoring Wells***

Bernalillo County does not currently conduct groundwater monitoring in the North Valley / Paradise Hills area. The North Valley encompasses the ABCWUA's Griegos, Duranes, Gonzales and Atrisco wellfields. These wells are actively monitored by the ABCWUA and by the USGS. The shallow hydrology of this area is complicated by the interaction of surface and groundwater along numerous irrigation and drainage channels and the Rio Grande. As a result, the USGS also monitors well transects at the Paseo del Norte, Montano, Central Ave., and I-25 bridges where they cross the Rio Grande. Information is available at Bosque Piezometers (http://nm.water.usgs.gov/bosque.html). In addition, the USGS monitors multiple shallow and deep wells on the perimeter of the North Valley.