**Table 3.10 Exceedances of EPA Drinking Water Standards – North Valley**

| Parameter | Primary Standard | Secondary Standard | Total Number of Samples | Percent of Samples Exceeding Standard |
|---|---|---|---|---|
| Arsenic | 0.010 | | 212 | 25 |
| Beryllium | 0.004 | | 155 | 5 |
| Total Dissolved Solids | | 500 | 136 | 10 |
| Iron | | 0.3 | 198 | 10 |
| Manganese | | 0.5 | 203 | 12 |

The maximum reported nitrate concentration was 2.8 mg/L. The lack of elevated nitrate concentrations is a bit surprising because the North Valley septic systems are generally older than those in the East Mountains, North Albuquerque Acres, and Sandia Heights, and the valley has been populated for much longer period. The limited range of nitrates may be the result of a spatial sampling bias – that is that the majority of the samples included in the summary are from areas serviced by the ABCWUA wastewater system. Alternatively, the samples may have been collected in areas where groundwater conditions are anoxic, resulting in elevated iron and manganese concentrations, but lacking elevated nitrate concentrations. The soils present in the inner valley may be more conducive to septic disposal due to depth, texture, and biologic activity than those in other areas of the County. This benefit is offset by the shallow water table and the greater probability for older, improperly constructed wells and anoxic conditions.

## 1.8 ***South Valley Monitoring Wells***

The South Valley encompasses the area from Central Avenue to Isleta Pueblo and from Coors Rd. to I-25. The northern urbanized neighborhoods of the South Valley merge into the semi-urban and agricultural areas farther south. This area has a highly diversified land use pattern including agriculture, residential, and commercial and industrial use. Generally, as one moves from north to south through this area, the availability of ABCWUA-supplied municipal water and sewer decreases and reliance on individual wells and septic tanks increases. The existing water and sewer infrastructure are undergoing significant expansion in these areas.

Groundwater in the San Jose and Mountain View neighborhoods, as well as other areas, has been significantly impacted by industrial and agricultural land use and by petroleum products. The

ABCWUA's Atrisco and San Jose wellfields are located within the South Valley and are closely monitored due to potential for contamination with chlorinated solvents. Portions of the San Jose wellfield remain un-pumped due to the potential for contamination.

Bernalillo County actively monitors groundwater in the South Valley under four different projects. Shallow groundwater levels and groundwater quality near irrigation canals and drains were monitored as part of an Agrichemical Water-Quality Impact monitoring program. This Bernalillo County program included water level monitoring, and groundwater and surface water sampling. This shallow groundwater monitoring well network includes 20 shallow wells of 15-foot depth along two transects across the South Valley: one is south of Rio Bravo Boulevard (RBG-1 through RBG-8), and the other is along Malpais Road (MG-1 through MG-8). Since sampling started in 1996, no agrichemical by-products have been detected to date in any of the shallow wells or surface waters at the part per billion level. Only low-levels of phthalate compounds have been reported for this series of wells. An initial report on this study was completed in September 2006 (McGregor 2006) and the program is essentially complete. Additional sampling has focused on construction dewatering projects occurring in areas of significant agricultural land use and not immediately adjacent to canals and drains. The additional sampling will be completed in 2007-2008, depending on South Valley utility construction schedules. Results for the additional samples to date have indicated that absence of residual organic compounds at significant concentrations.

Under NMED-requirements, groundwater and methane generation are monitored at the South Broadway landfill in compliance with NMED landfill closure requirements. The South Broadway Landfill monitoring well was drilled in 1992 and is sampled annually to assess the any ground-water quality impact from the County's portion of the South Broadway Landfill, a potential regional ground-water threat. The City of Albuquerque has additional ground-water wells in which water quality and water level data are collected annually. The monitoring and reporting is conducted jointly by CABQ and Bernalillo County. Information on the sampling and results can be found in a series of annual monitoring reports submitted to the NMED by February of each year. As of late 2006, there has been no indication of groundwater contamination from this potential source.

In cooperation with the Bernalillo County Open Space program, wells on the Durand property were previously sampled. Only phthalate compounds were detected, and the low-level concentrations suggest laboratory contamination of the sample. A report of groundwater monitoring in the Open Space properties, including monitoring at the Durand Open Space, is slated for 2007.

The focus of this section of the report is on the regional groundwater monitoring conducted by Bernalillo County at two nested piezometer locations in the South Valley. The two nested piezometers are located at Rio Bravo Park and near the junction of the Isleta Drain and I-40, just north of the Isleta pueblo boundary. These two locations are jointly monitored in cooperation with the USGS. The location of community supply wells, USGS transects and piezometers, individual domestic wells and the two piezometer nests are shown in Figure 3.41.

### 1.8.1 *USGS South Valley Monitoring Wells*

The shallow hydrology of the South Valley 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 monitors wells in transects south of the Bridge Boulevard, Rio Bravo Boulevard, and I-25, where they cross the Rio Grande. These transects are used to evaluate interaction between the Rio Grande and the regional aquifer. These transects are monitored in conjunction with similar transects mentioned for the North Valley. The USGS transects along Rio Bravo Boulevard and I-25 overlap or are adjacent to the Bernalillo County transects for the Agrichemical Water Quality Impact study (McGregor, 2006). More information is available at Bosque Piezometers (http://nm.water.usgs.gov /bosque.html).

With respect to regional monitoring, the USGS monitors water levels in wells at one ABCWUA well location (San Jose 9), locations in the South Valley, and in two nested piezometers located on Mesa Del Sol (Montessa Park site,and Mesa Del Sol site).

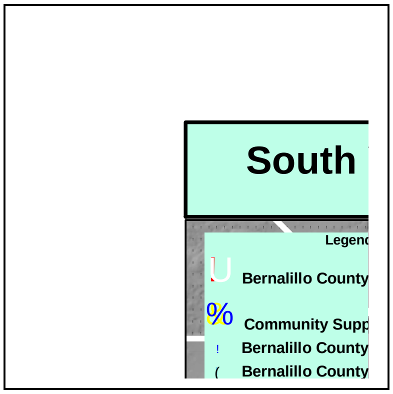


**Figure 3.41 South Valley Monitoring and Water Wells**

### 1.8.1.1 Water Levels in the South Valley

The USGS database provides water level information for one deep well location within the South Valley and two piezometer nests located on the southeast mesa. The first well is located in the San Jose wellfield (San Jose 9). Figure 3.42 provides a hydrograph for the subject well. The hydrograph does not show any significant trends in water levels aside from a general decline from 1991 to 1994 of approximately 15 feet. However, there is no indication of a significant rise or decline since that time. The seasonal fluctuations in this well are approximately 5 to 7 feet, with the peaks generally occurring during January – a time of minimal municipal pumping and water use, and lows occurring during the summer months.

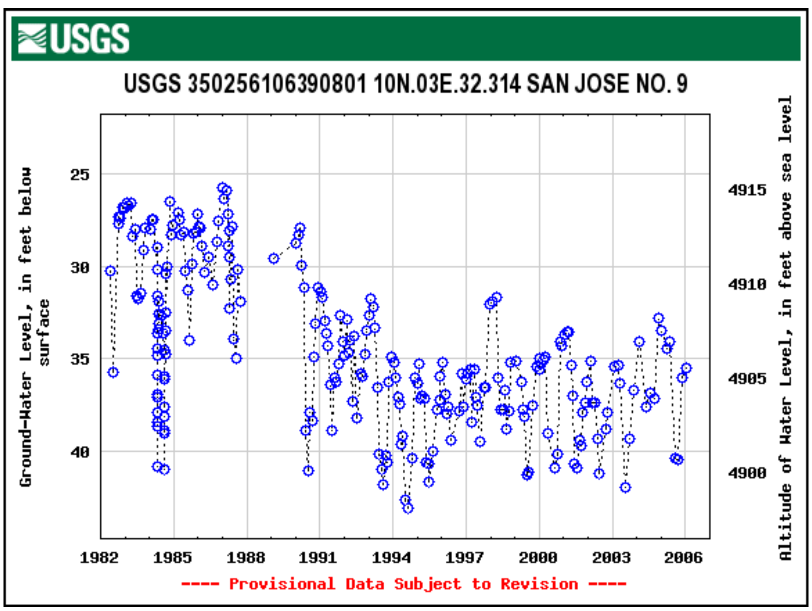


**Figure 3.42 Water Levels in the San Jose Well 9**

A better estimation of regional conditions can be garnered from hydrographs for the Montessa and Mesa Del Sol nested piezometers. These nested piezometers are located on the mesa east of I-25 and south of Kirtland AFB. Figure 3.43 and 3.44 provide hydrographs for those piezometer nests.

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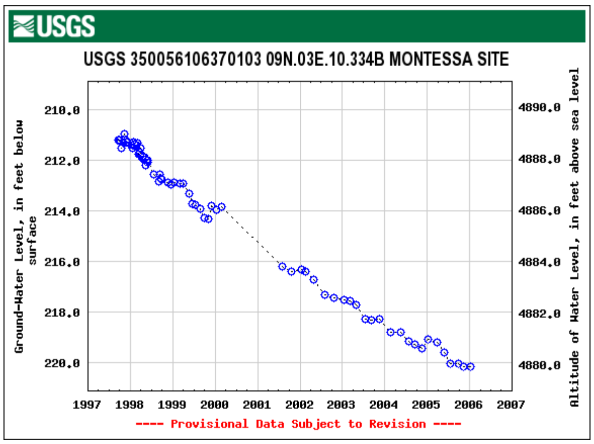

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**Well Information**

Land Surface Elevation:<br>5,100 ft amsl.

Top of Screen: 260 ft

Depth of Well: 330 ft.
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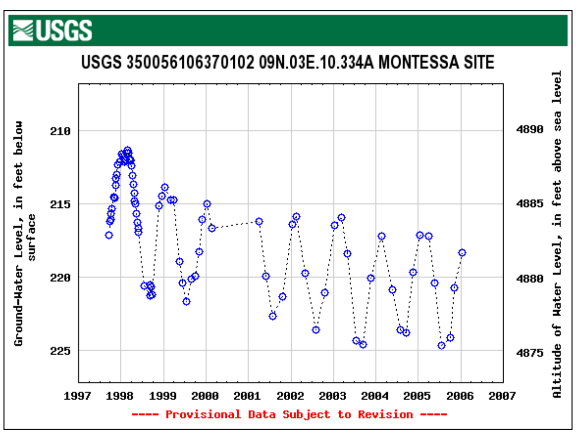

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**Well Information**

Land Surface Elevation:<br>5,100 amsl.

Top of Screen: 699 ft

Depth of Well: 708 ft.
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**Well Information**

Land Surface Elevation:<br>5,100 ft amsl.

Top of Screen: 1,618 ft

Depth of Well: 1,628 ft.
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</table>

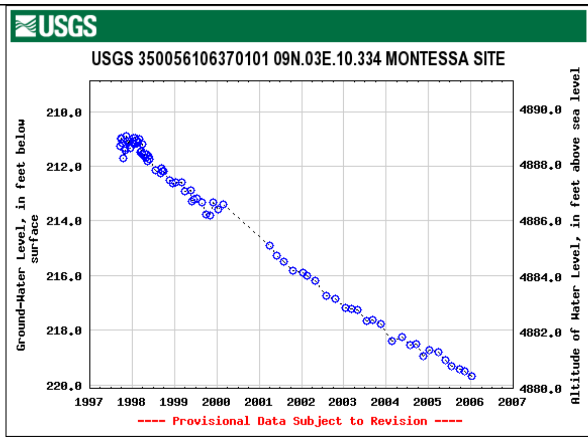
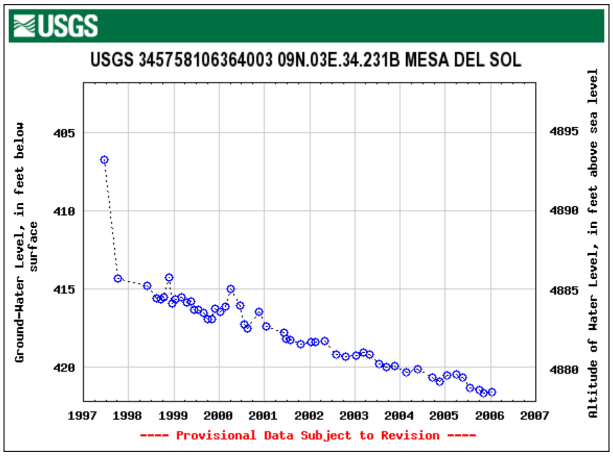


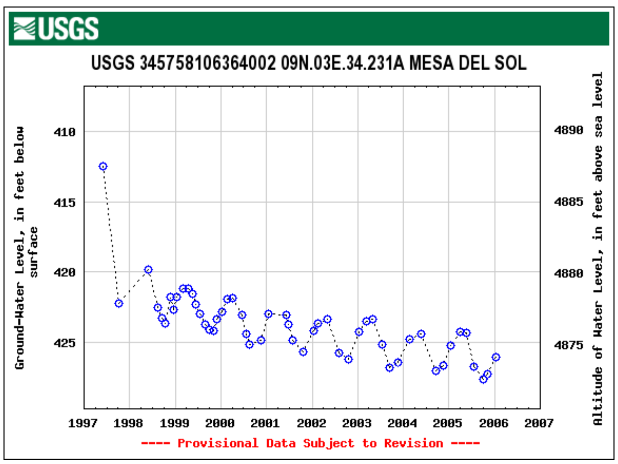

**Figure 3.43 Water Levels in the Montessa Park Nested Piezometer**




**Well Information**

Land Surface Elevation:
5,300 ft amsl.

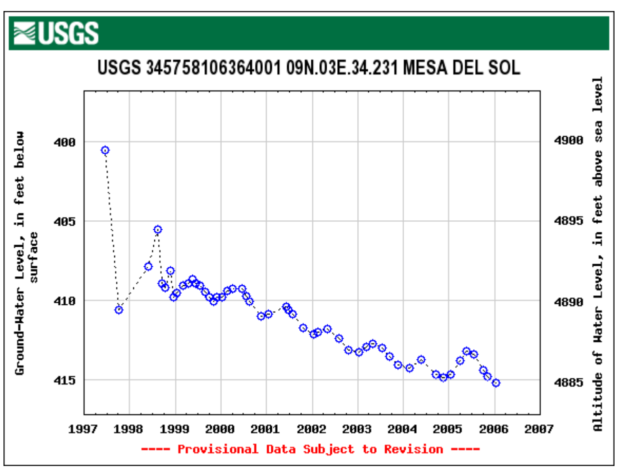
Depth of Well: 525 ft.




**Well Information**

Land Surface Elevation:
5,300 amsl.

Depth of Well: 1,015 ft.




**Well Information**

Land Surface Elevation:
5,300 ft amsl.
t

Depth of Well: 1,630 ft.

**Figure 3.44 Water Levels in the Mesa Del Sol Nested Piezometer**

The hydrographs for the Montessa Park site all indicate a continual and significant decline in water levels near Tijeras Arroyo south of Kirtland AFB. Since 1997, the water level in the shallowest portion of the aquifer (330 ft.) has declined approximately 9 feet, or at a rate of 1 foot per year. In the intermediate portion of the aquifer (708 ft.), the decline is approximately 5 feet and the rate of decline is about one-half of that in the upper portions of the aquifer. The intermediate well hydrograph shows a strong seasonal fluctuation of approximately 7 feet. This fluctuation is likely caused by nearby pumping of large volume production wells at the UNM Championship Golf Course (1 ½ miles northwest) and at Kirtland AFB (1 mile north). Other domestic and livestock wells to the northeast may also be affecting the water level. The deepest of the wells (1,628 ft) is similar to that of the shallowest. With respect to vertical gradients, during the pumping periods, the potentiometric surface (water table surface) in the intermediate zone is lower than in the overlying or deeper zone, suggesting movement of water from the overlying and underlying zones to the pumped zone. However, once pumping decreases during the winter months, the potentiometric conditions are reversed.

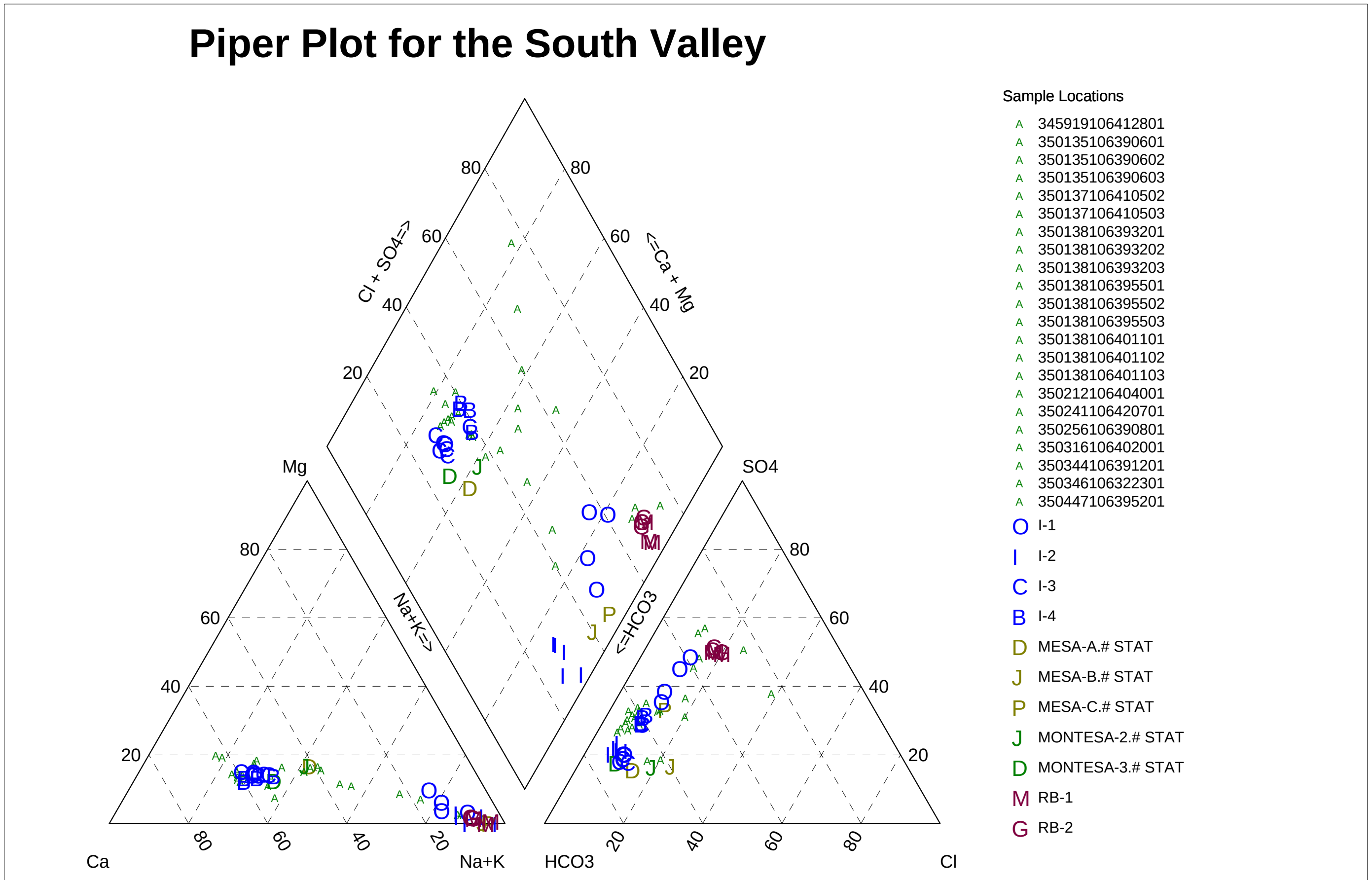
Declining trends are also evidenced in the piezometer nest located at Mesa del Sol, although the amount of decline is about one-half of that seen in the Montessa Park wells. Each of the piezometers shows approximately 5 feet of decline since 1997, with the middle (1,015 ft.) and lower wells (1,630 ft) evidencing seasonal pumping fluctuations of one to two feet. The peaks in the deepest of the wells appear to occur in early spring rather than at the first of each year. This likely reflects time delays as recharge moves from the mountain front areas toward the river. Unlike the Montessa site, the potentiometric surface in the intermediate zone (1,015 ft.) continually remains less than that in the overlying and underlying zones, suggesting movement towards the locus of pumping.

#### 1.8.1.2 Water Quality in the South Valley

The USGS has collected and analyzed water quality samples throughout the South Valley under a cooperative agreement with the CABQ and in cooperation with Bernalillo County. Water quality data for the USGS piezometer nests at Montessa Park and at Mesa Del Sol were provided by CABQ; data for individual well locations was taken from the USGS database. The South Valley contains multiple industrial contamination sites, which are routinely monitored under NMED oversight – the results of those monitoring activities are not addressed within this report.

Figure 3.45 presents a Piper Plot for water samples taken from the South Valley. This plot only reflects the results of on-going groundwater monitoring of fresh water supply from the aquifer. The Piper plot for the South Valley shows a much broader composition than those previously demonstrated for the East Mountain area and in the Far Northeast Heights, and is remarkably similar in distribution to that of the North Valley. This is expected as the wells in the South Valley screen the same portions of the aquifer as those used to represent the North Valley (see Figure 3.39 for comparison). The samples shown are either mean values based on the period of record (i.e., designated as “stat”) or are the most currently available sample. All samples for the Rio Bravo Park and the Isleta piezometer nests are shown. As with the North Valley plot, the lower right diagram shows an almost continuous and linear range in calcium to sodium contribution. This distribution demonstrates that magnesium is seldom a significant component, and that the importance of sodium increases with depth (i.e. the plots at the Na+K vertices are all for deep piezometers.).

The lower right diagram indicates that, typically, chloride contributes to less than 20 percent of the anion loading, and that bicarbonate is still the predominant anion but with increased distribution of sulfate compared to other areas of the County, excluding the North Valley. The plot also shows that results from each of the monitoring wells except Isleta 1 (I-1) are tightly clustered, while the results for I-1 indicate a wider distribution in composition. The plots for the two Rio Bravo Park piezometers plot similar to the West Bluff piezometers shown in the North Valley plot. Again, this is not surprising given the same relative position of the piezometers with respect to the Rio Grande. A comparison of the Montessa Park and Mesa del Sol plots, located on the mesa east of the inner valley, indicate that water composition is comparable to that of the inner valley and shows similar changes in composition with increasing depth.




| | |
|---|---|
| DESCRIPTION: | **Piper Plot for South Valley Piezometer Nests** |
| PROJECT: *Water Report* | DATE: 6/6/06 |
| ***BERNALILLO COUNTY PUBLIC WORKS / WATER RESOURCES*** | |

**Figure 3.45 Piper Plot for the South Valley**

All samples are from routinely monitored wells or transects. The exceedances with respect to drinking water standards are show in Table 3.11.

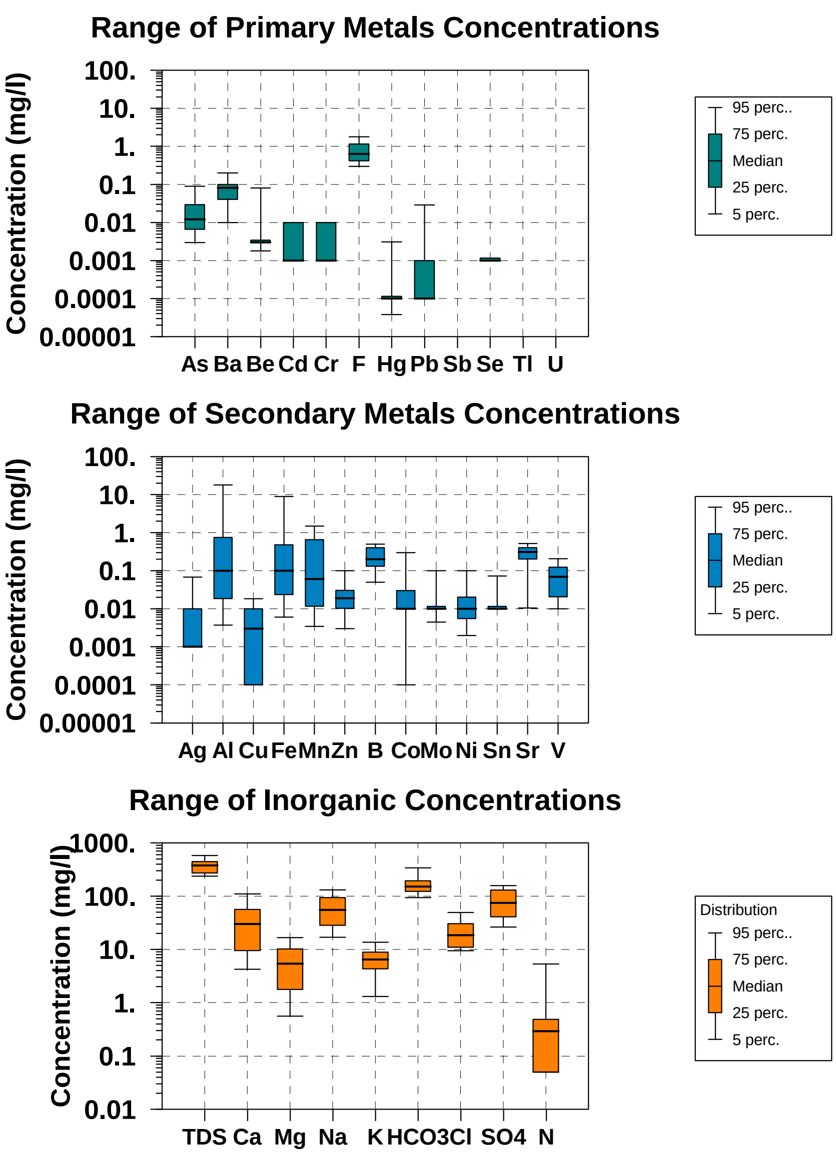
**Table 3.11 Exceedances of EPA Drinking Water Standards – South Valley**

| Parameter | Primary Standard | Secondary Standard | Total Number of Samples | Percent of Samples Exceeding Standard |
|---|---|---|---|---|
| Arsenic | 0.010 | | 87 | 50 |
| Total Dissolved Solids | | 500 | 64 | 13 |
| Aluminum | | 0.05 | 75 | 19 |
| Iron | | 0.3 | 85 | 11 |
| Manganese | | 0.5 | 86 | 26 |

A statistical summary for the metals and inorganic concentrations is provided in Figure 3.46. A summary plot of metals and inorganics for the South Valley is also provided and includes all readily available data from the USGS monitoring programs, inclusive of the Rio Bravo Park and Isleta piezometers, which are monitored by the USGS. The plot is biased in that no individual domestic wells are represented.

Figure 3.46 suggests that trace metal concentrations may at times exceed the respective drinking water standards for beryllium, cadmium, chromium, mercury, and lead. Detection limits are used for statistical summation in the event that non-detect concentrations are reported, suggesting that some exceedances have occurred. A review of the data set indicates that all concentrations for these compounds were reported as "not detected" and that no measured exceedances have occurred. Of particular note is the elevated range in aluminum concentrations (secondary standard of 0.05 mg/L). The range is caused solely by wide fluctuations in aluminum concentrations in samples from the deep well of the Isleta nested piezometer. The cause for the aluminum fluctuations is discussed below in the Isleta well discussions.

Of interest are concentrations of arsenic (maximum recorded concentration is 0.9 mg/L), total dissolved solids (maximum recorded concentration is 1,360 mg/L), iron (maximum reported concentration is 16 mg/L), and manganese (maximum recorded concentration is 2.4 mg/L). The presence of elevated concentrations of both iron and manganese generally infers a reducing (anaerobic or anoxic) environment possibly related to microbial interaction with septic wastes.




DESCRIPTION:
**Metals and Inorganic Concentrations in the South Valley**

PROJECT: *Water Report*
DATE: 6/06/06

*BERNALILLO COUNTY PUBLIC WORKS / WATER RESOURCES*

**Figure 3.46 Metals and Inorganic Concentrations in the South Valley**

Although none of the samples had total nitrate + nitrite concentrations in excess of the primary drinking water standard of 10 mg/L, the distribution indicates a 95$^{th}$ percentile value on the order of 7 mg/L. The values greater than the 75 percentile are from transect wells sampled by the USGS, suggesting localized septic waste contamination of the wells. There is a known bias in the sample set in that no individual domestic wells are represented. In the South Valley, nitrate is a known groundwater contaminant in some local communities and is being monitored under NMED programs. Large portions of the South Valley do rely on septic systems, though installation of sanitary sewers and ABCWUA drinking water supply throughout the South Valley is an on-going capital improvement project.

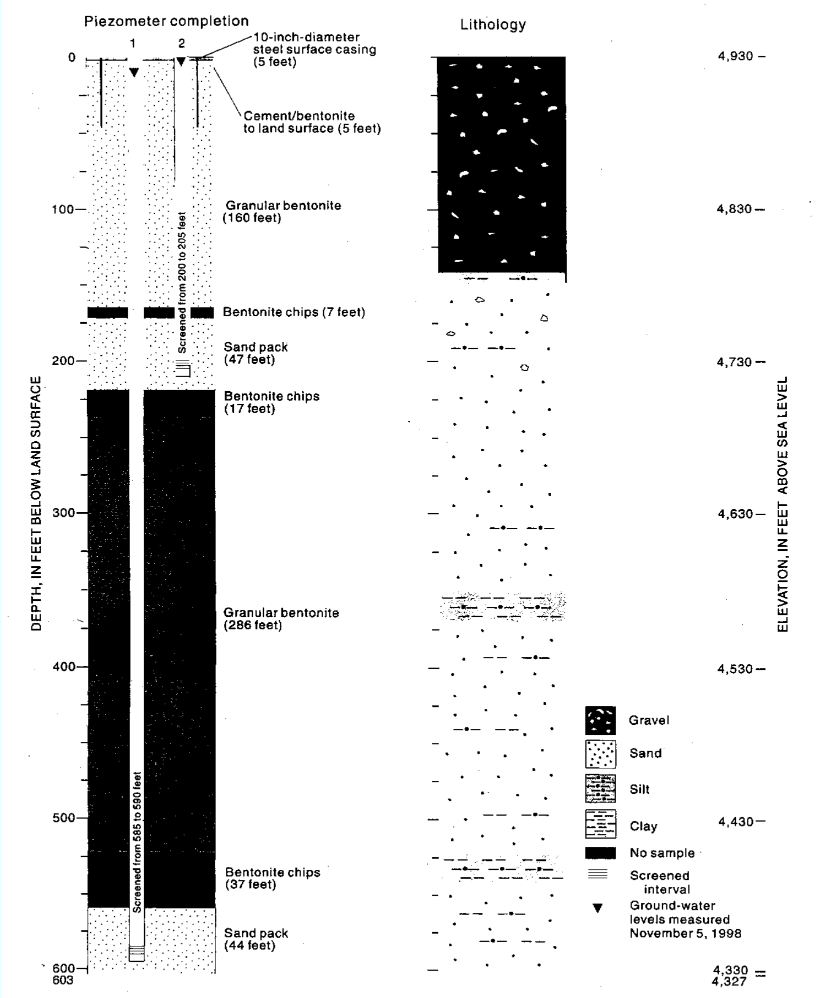
### 1.8.2 *Rio Bravo Park and Isleta Nested Piezometers*

The Rio Bravo Park and Isleta nested piezometers were drilled to access deep aquifer conditions in the middle and southern section of the inner portions of the South Valley. They monitor water pumped from the alluvial aquifer system, which extends from the mountain front to the Rio Grande. Well construction details are provided in Table 3.12 and Figure 3.47.

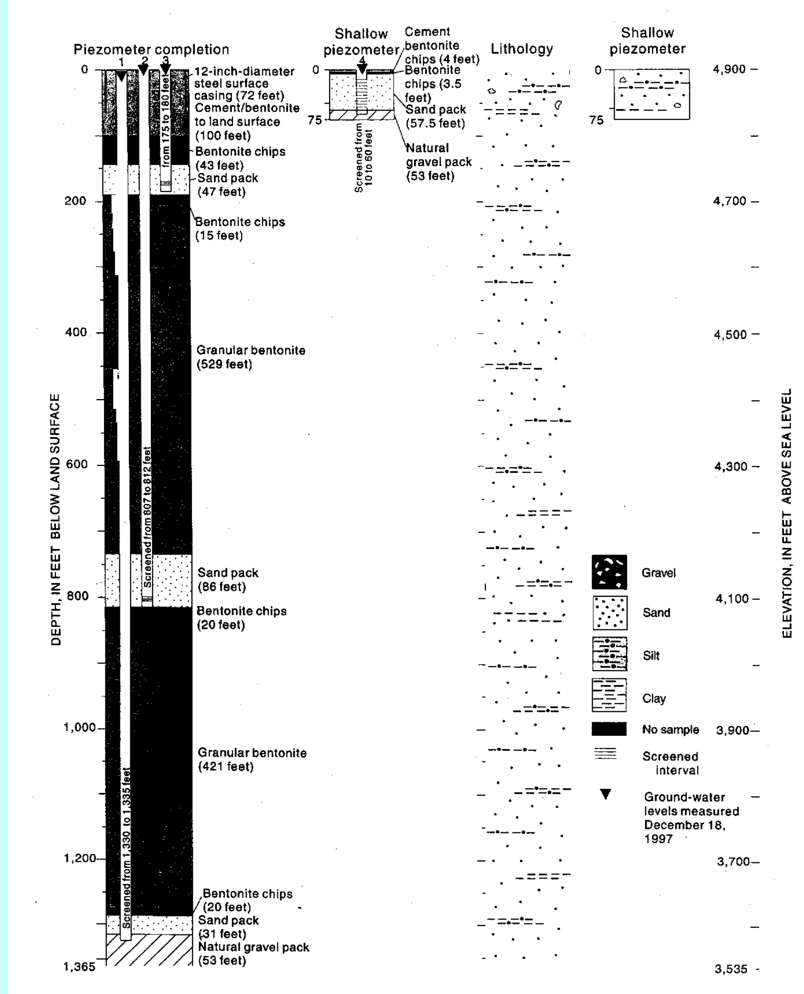
This aquifer is prominent in the Albuquerque/Middle Rio Grande region and consists of gravel, sand and silt as reflected in the geologic map and cross-sections provided on Figures 3.47 and 3.48. The alluvial material was deposited as floodplain deposits of the Rio Grande and the outwash from the breakdown of the Sandia Mountains and the associated granites and overlying formations. The ABCWUA pumps from this aquifer.

**Table 3.12 Bernalillo County Regional Monitoring Well Network – South Valley Wells**

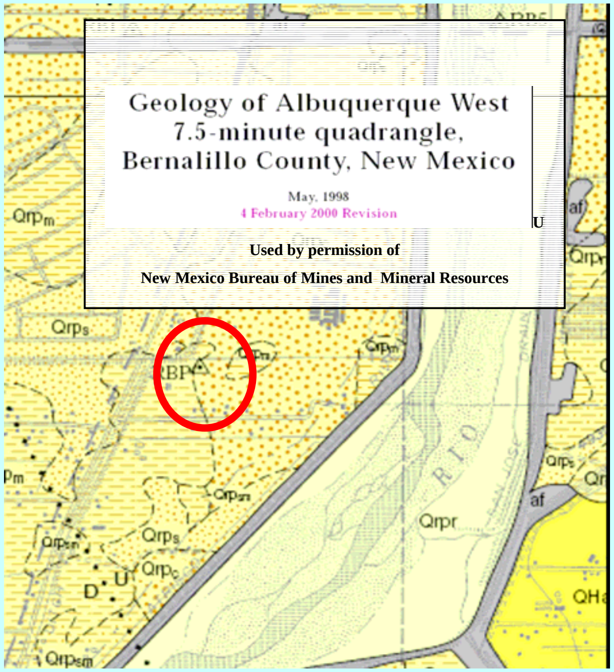
| Well | Well Type | Well / Hole Depth (ft) | Screen Settings (ft) |
|---|---|---|---|
| Isleta | Nested | 1,365 | |
| (I1) | Deep | 1,365 | 1,315-1,320 |
| (I2) | Middle | 1,365 | 805-810; |
| (I3) | Middle | 1,365 | 175-180 |
| (I4) | Shallow | 1,365 | 10-50 |
| Rio Bravo Park | Nested | 603 | |
| (RB1) | Deep | 603 | 585-590 |
| (RB2) | Middle | 603 | 200 -205 |




Rio Bravo Park Piezometer Construction
(Taken from USGS OFR 03-290 Figure 23L)




Isleta Piezometer Construction
(Taken from USGS OFR 03-290, Figure 23J)




Rio Bravo Park Nested Piezometer


Isleta Nested Piezometer

| | |
|---|---|
| Qrpr | **Modern channel deposits (Historic)** — Unconsolidated sand and gravel within the active channel of the Rio Grande. Delineated using aerial photography. |
| Qrpc | **Gravelly to sandy stream and floodplain deposits (Historic)** — Unconsolidated coarse-grained sand and pebbly sand. Interpreted to represent channel deposits. Includes Brazito series of Hacker (1977). |
| Qrps | **Sandy stream and floodplain deposits (Historic)** — Unconsolidated medium-grained sand and loamy sand. Interpreted to represent channel and floodplain deposits. Includes Vinton series of Hacker (1977). |
| Qrpsm | **Silty to sandy stream and floodplain deposits (Historic)** — Unconsolidated fine-grained sand, silt and clay. Interpreted to represent fine-grained sloughs or oxbows. Includes Glendale and Gila series of Hacker (1977). |
| Qrpm | **Silty to clayey stream and floodplain deposits (Historic)** — Unconsoldiated fine-to medium-grained sand, silt and slay. Interpreted to represent fine-grained floodplain deposits. Includes Anapra, Armijo, Agua, and Gila series of Hacker (1977). |

| | |
|---|---|
| Qa | Alluvium (Holocene to upper Pleistocene) |
| Qe | Eolian deposits (Holocene to middle Pleistocene) |
| QTs | Upper Santa Fe Group (middle Pleistocene to uppermost Miocene)—Includes Camp Rice, Fort Hancock, Palomas, Sierra Ladrones, Arroyo Ojito, Ancha, Puye, and Alamosa Formations |
| Tpb | Basaltic to andesitic lava flows (Pliocene)—Includes minor vent deposits and small shield volcanoes. Flows are commonly interbedded in the Santa Fe and Gila Groups |

**Figure 3.48 Geologic Setting of the Rio Bravo Park and Isleta Nested Piezometer**

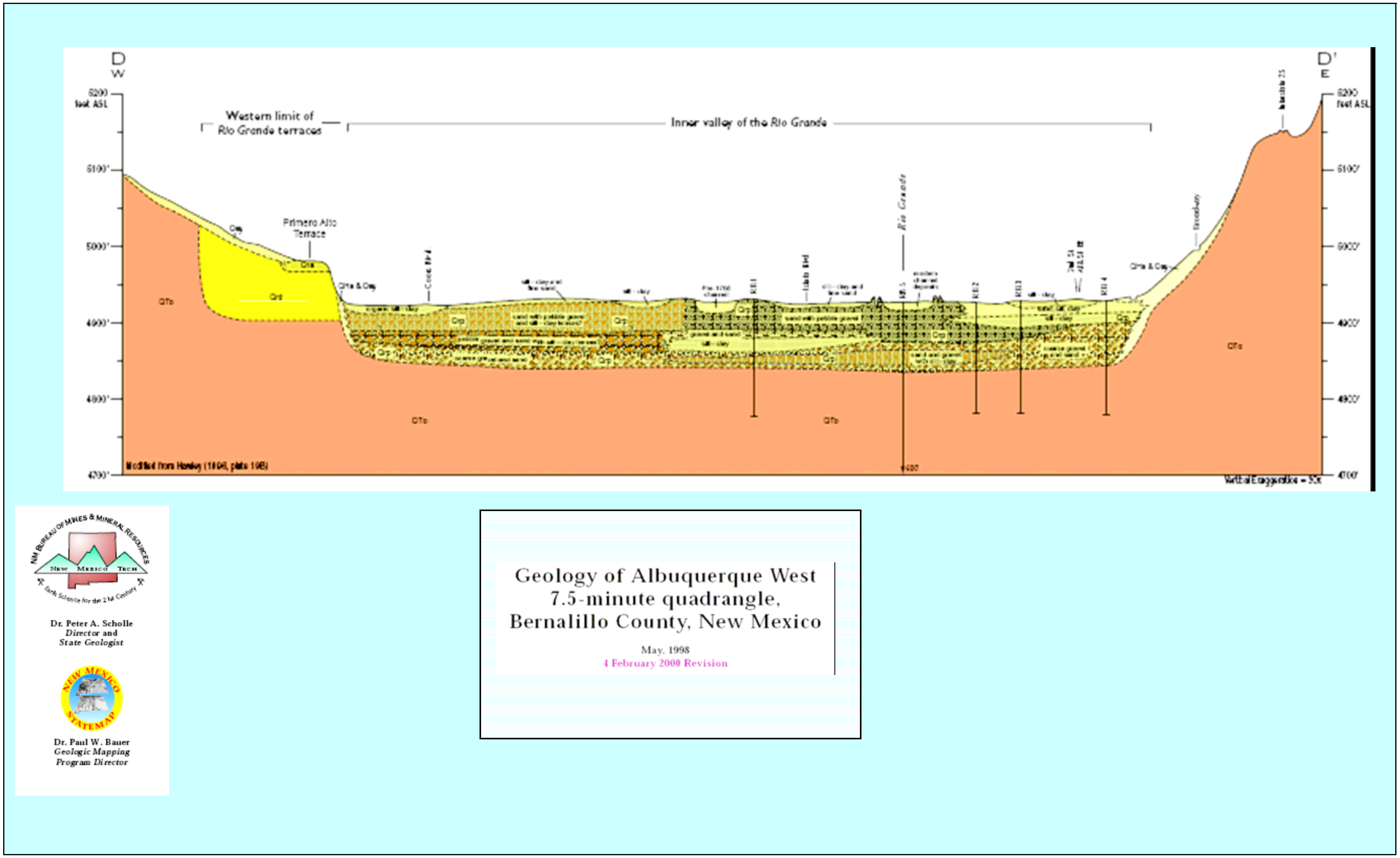



**Figure 3.49 Geologic Cross Section through the South Valley along Rio Bravo Boulevard**

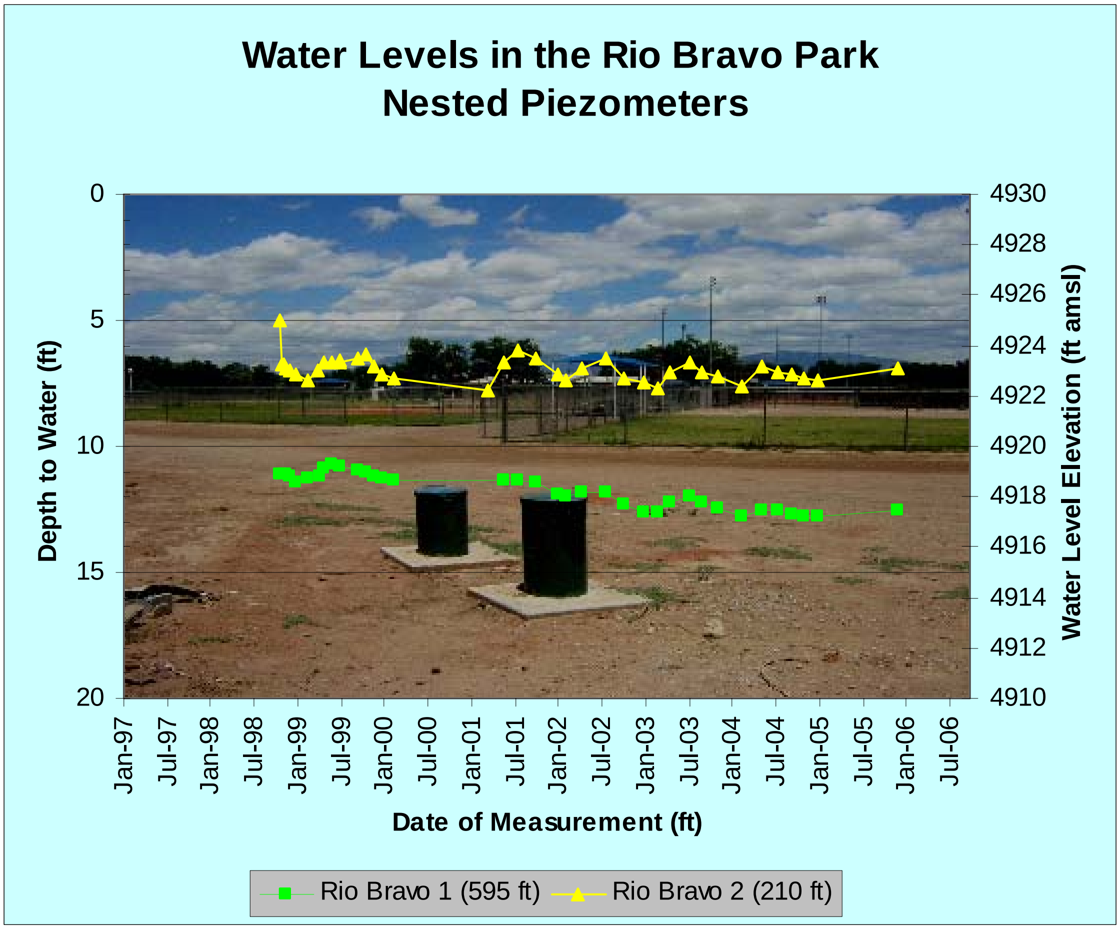
#### 1.8.2.1 Water Levels in the South Valley Piezometers

The USGS provides continuous water level measurements for the Rio Bravo Park and Isleta piezometers using pressure transducers and dataloggers. Graphs of the USGS data are provided in Figure 3.50 along with plots of the hand measurements collected annually by Bernalillo County.

The Rio Bravo Park piezometers (RB-1 and RB-2) are located south of Rio Bravo Boulevard and due west across the river from the ABCWUA Waste Water Treatment facility. For the Rio Bravo Park piezometers, the measurements indicate that water levels in the shallow piezometer, Rio Bravo Park 2 (RB-2, 210 ft.) exceed those in the deep piezometer, Rio Bravo Park 1 (RB-1, 595 ft.), suggestive of a downward vertical gradient in this reach of the Rio Grande. The gradient does not invert during the year, indicating that the Rio Grande is recharging the aquifer in this reach.

Records for the shallow piezometer indicate that the lowest water levels occur during the spring of the year, followed with rapid rise to peak levels during the spring to early summer and with subsequent decline. This fluctuation is likely indicative of seasonal recharge from the Rio Grande during spring melt, and possibly due to seasonal irrigation, with subsequent delays for the peaking events to extend into the subsurface. There are no nearby municipal supply wells and more distant wells screen lower portions of the formation, so the fluctuations seen in Rio Bravo Park 2 are not likely the result of pumping effects. The low points of the hydrograph indicate an overall rise in water levels since 2001, suggesting no significant decline or perhaps a slight rise in water levels in the upper portion of the aquifer at this location. This is due largely to the effects of annual recharge or is possibly related to discharge from the ABCWUA Wastewater Treatment facility located immediately east across the river.

The deeper piezometer, Rio Bravo Park 1 (RB-1, 595 ft) shows a continual decline since measurement started in late 1998. Total declines are approximately 1.8 feet over the eight-year period, or a decline rate of 0.2 ft/year. This decline is likely due to the long-term effects of municipal pumping, but is less than rates noted for the North Valley due to greater distance from the municipal wells. The deep well also shows some indication of the effects of annual recharge events (an annual increase of no more than 0.2 to 0.5 feet), but the subsequent declines tend to be slightly greater, leading to a net decline through time.



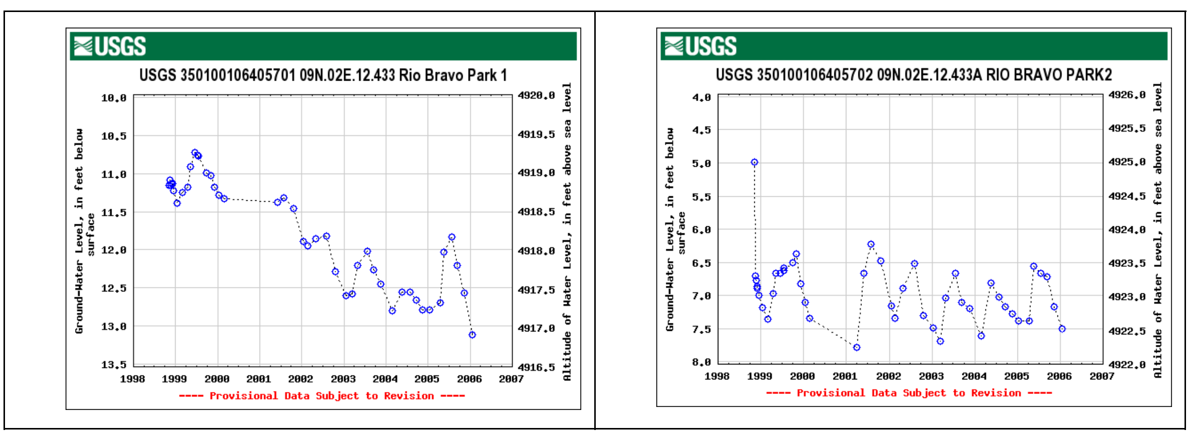
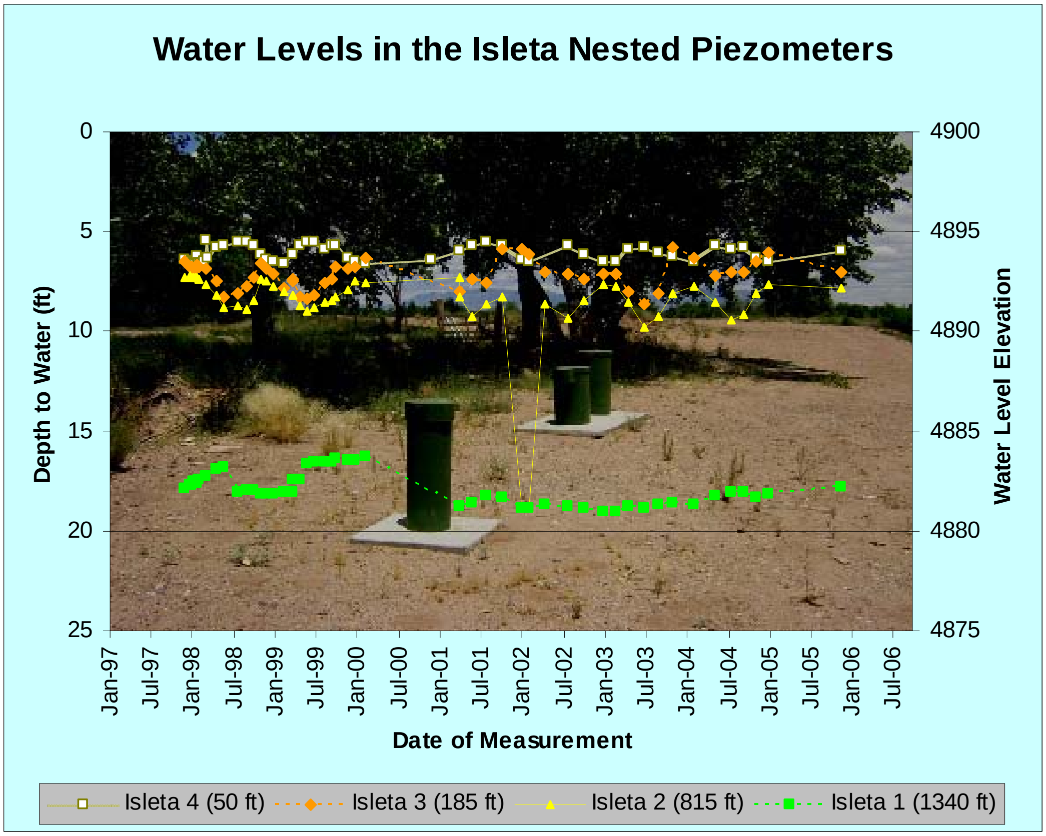




**Figure 3.50 Water Levels in the Rio Bravo Park Nested Piezometer**

The Isleta nested piezometer is located near the confluence of the Isleta Drain, the Los Padillas Drain, and the Arenal Main Canal just north of the Isleta Pueblo boundary. Geologically, the location is unique due to the presence of the Rio Grande floodplain and associated alluvial material juxtaposed against the basalts on Black Mesa which lie immediately southwest of the piezometer locations. The piezometer nests consist of four piezometers, with total depths ranging from very shallow (50 ft) to extremely deep (1,340 ft).

Generally, the water levels indicate an overall downward vertical gradient. However, as can be seen in Figure 3.51 the water levels in the two shallow piezometers (I-4, 50 ft; and I-3, 185 ft.) on occasion invert during the winter months, and vertical flow may be upward during the early portions of each calendar year. Given the location near two of the primary drains and a primary source canal, this annual pattern is attributable to the annual irrigation cycle. Shallow recharge occurs from the irrigation canals and field irrigation during the late spring and summer months, and fields drain during the fall and winter months. The recharge to the aquifer occurs during the irrigation season. The recharge is reflected as water level peaks occurring progressively later in the year and at greater depths as recharging water moves downward through the aquifer system. Together, the irrigation cycle and vertical movement of water result in the "pinch and swell" nature of the hydrographs seen in Figure 3.51 when comparing the shallowest and mid-level hydrographs. This cyclical rise and fall in water levels is minimized by the time the deepest of the piezometers is reached.

The influence of the surface irrigation on water levels is supported by a comparison of shallow and deep groundwater quality relative to the water quality evidenced in the irrigation canals and drains, as is discussed below. The hydrographs indicate that seasonal recharge can be traced at least to the intermediate level of the aquifer as evidenced by the response in Isleta Well 2 (I-2, 815 ft). The USGS hydrographs for the deepest of the piezometers, Isleta 1 (I-1, 1,340 ft.) indicates minor seasonal fluctuations on the order of 0.1 feet or less. The minor changes in water level are insufficient to conclude that seasonal recharge is reaching the deepest portions of the aquifer. The hydrograph also shows a gradual rise in the deep aquifer levels since 2001.



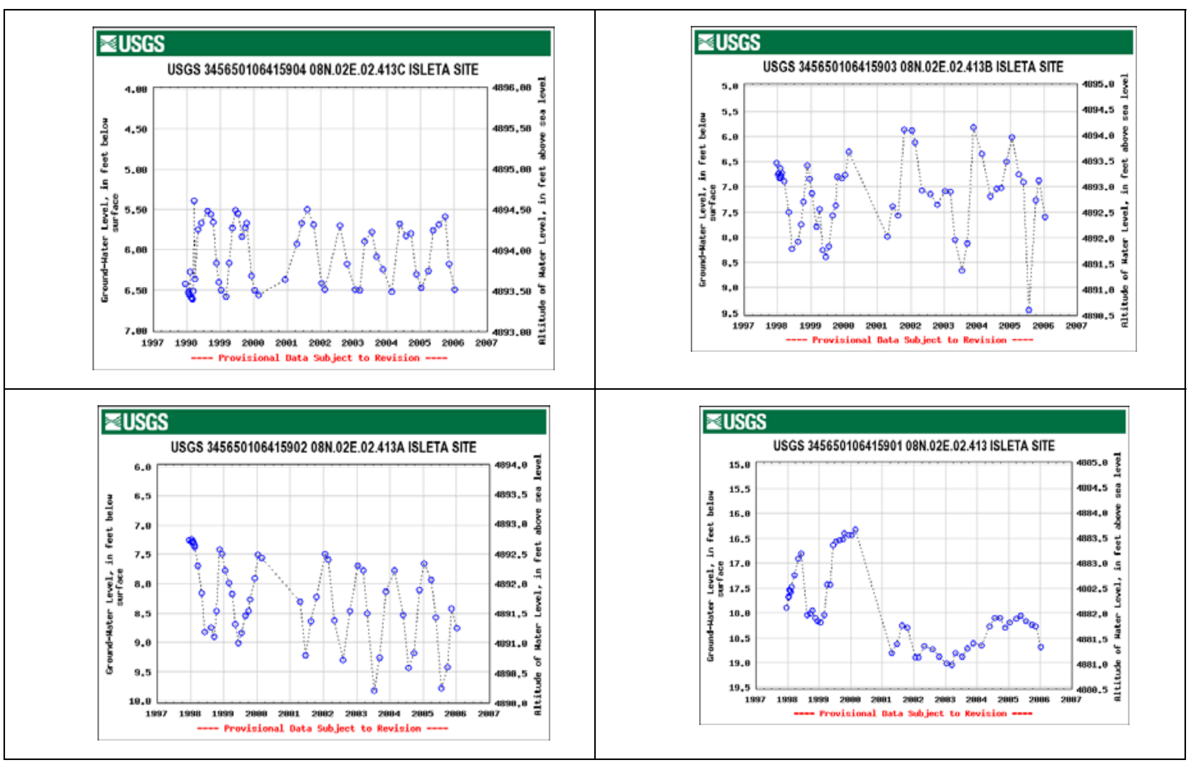




**Figure 3.51. Water Levels in the Isleta Nested Piezometer**

The hydrographs presented in the upper portion of Figure 3.51 are hand measurements taken by Bernalillo County. There are some discrepancies in these hydrographs compared to the electronically measured values available from the USGS website (USGS Ground water for New Mexico: Water Levels) and shown in the lower half of the figure. With two notable exceptions, these differences appear to be a result of measurement frequency rather than measurement errors. The first exception is the extreme low data point occurring in the Isleta 2 (815 ft) in 2002. This measurement appears to duplicate the measurements for the deepest piezometer, but no field records are available to verify the measurement. This measurement is presumed to be a data entry error because the sudden drop in water levels is not reflected in the electronic data presented by the USGS. Similarly, the USGS data indicate a low measurement point occurring in the Isleta 3 (150 ft.) in the summer of 2005, which is not reflected in the series of available hand measurements. However, the measurement is reasonable and there is no evidence to suggest an error. It is presumed correct.

#### 1.8.2.2 Water Quality in the South Valley Piezometers

Groundwater samples from the Rio Bravo Park piezometers have not exceeded the primary drinking water standards with the exception of arsenic. Arsenic concentrations in RB-1 have ranged from non-detect to 0.050 mg/L, while the standard is 0.01 mg/L. Of the five samples collected, arsenic was not analyzed in one sample, was below the standard in one sample, and exceeded the standard in three others. Arsenic concentrations in samples from RB-2 were above the standard at 0.011 mg/L in the initial sample, but have since been reported as below the detection limit. Neither well suggests any problems with nitrate concentrations.

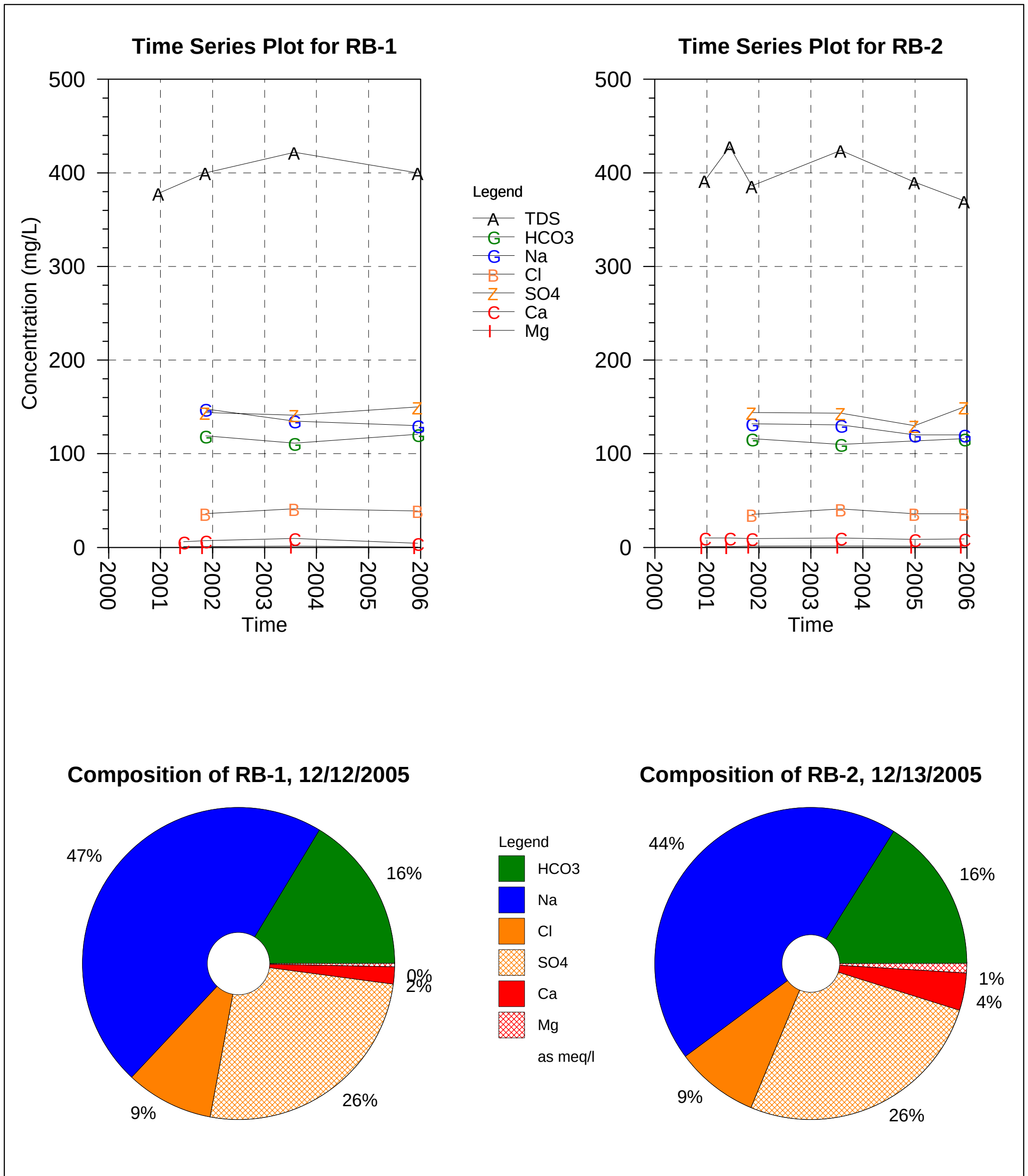
With respect to organic compounds, detected compounds in the Rio Bravo Park and Isleta piezometers have been limited to low concentrations of phthalate compounds and one instance of methyl ethyl ketone. Since changing analytical laboratories in 2003, there have been no reports of these compounds in either of the Rio Bravo Park or the Isleta piezometers. Consequently, it is suspected that the compounds were laboratory contaminants. Phthalates are a common plasticizers used in sample bottles, labware, and tubing, and methyl ethyl ketone is common laboratory solvent and surrogated compound. Both compounds are commonly recognized as laboratory contaminants.

There has been one instance of detection of 1,4-Dioxane (140 ug/L) in the 2004 sample from the deepest of the Isleta piezometers (I-1). The reported concentration was 130 ug/L. The source of this compound is not known. This is an isolated instance and is puzzling because there are no similar detections in the shallower wells or in the quality control blanks. The compound 1,4-dioxane is not a common laboratory contaminant.

Figure 3.52 provides a time series plot for the inorganic constituents in the Rio Bravo Park piezometers. There are no significant trends in concentrations with time. The composition and concentration of the water in the two wells is quite similar. Both wells indicate that the waters are largely of a sodium sulfate composition, consistent with other deep wells located within the inner portions of the South Valley.

Figure 3.53 provides a time series plot for the inorganic constituents in the Isleta piezometers. Groundwater samples taken from the four Isleta piezometers have not exceeded the primary drinking water standards with the exception of arsenic. The arsenic standard (0.01 mg/L) has not been exceeded in the two shallowest wells. In the two deeper wells, the arsenic standard has been exceeded in three out of five sampling rounds in Isleta 1. Reported concentrations were 0.090 mg/L in I-1 in all instances. In Isleta 2, there have been two exceedances in five samples, at concentrations of 0.045 and 0.050 mg/L. These concentrations are consistent with naturally occurring arsenic in groundwater throughout the area.

Secondary drinking water standards have also been exceeded in the Isleta piezometers. The total dissolved solids concentrations have consistently exceeded 500 mg/L in the shallowest piezometer (Isleta 4), as have the secondary standards for iron (0.30 mg/L) and manganese (0.05 mg/L); the maximum report concentrations were 0.50 mg/L and 1.4 mg/L respectively. Samples from the shallow well (Isleta 3) on two occasions have exceeded the limit for manganese, but not for iron. No secondary standards have been exceeded in the intermediate depth well (Isleta 2).




DESCRIPTION:

**Inorganic Time Series Plots for the Rio Bravo Park Piezometers**

PROJECT: *Water Report*

DATE: 6/20/06

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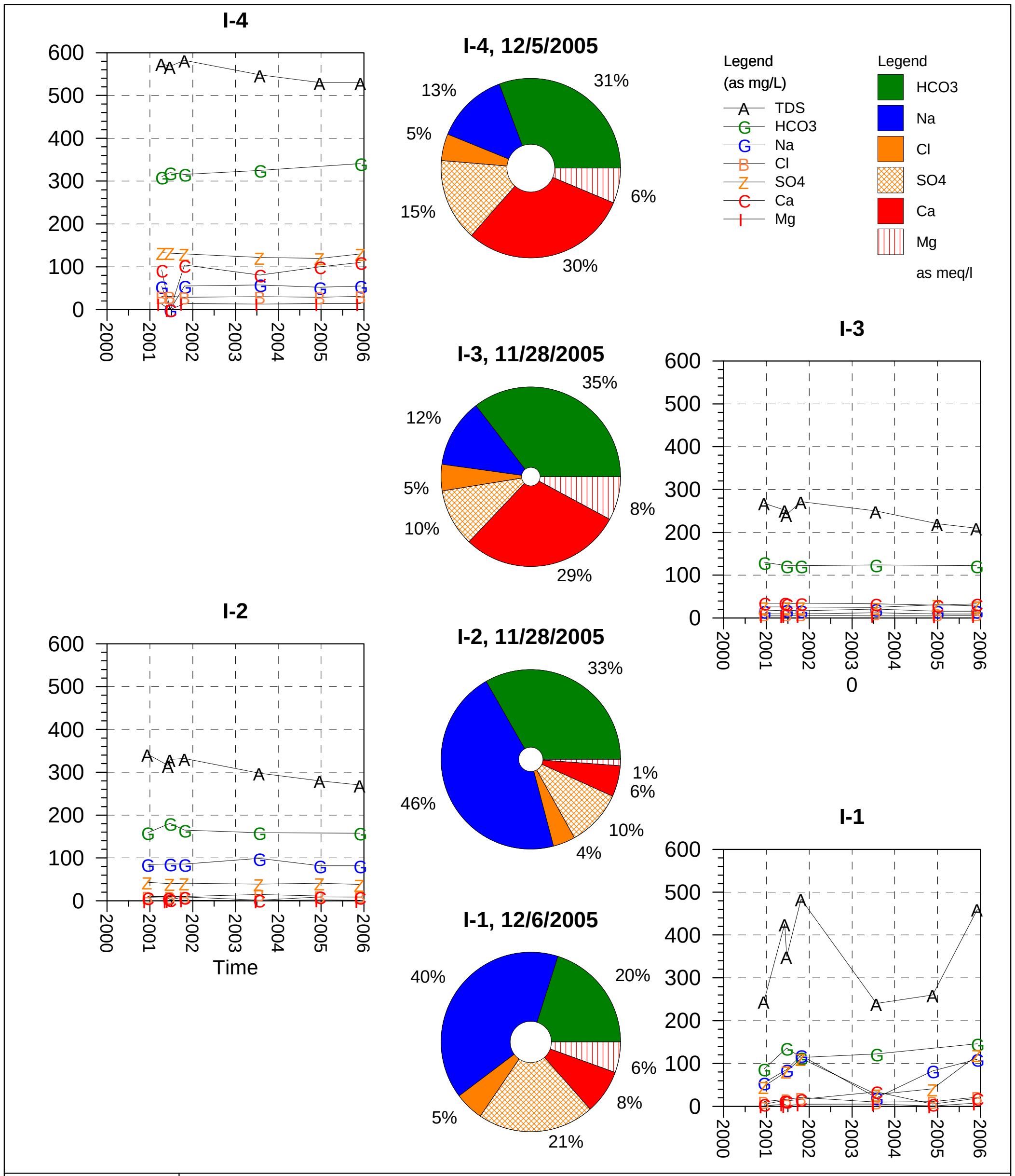
**Figure 3.52 Time Series Plots for the Rio Bravo Park Nested Piezometer**




DESCRIPTION:

**Time Series and Composition Plots for the Isleta Piezometers**

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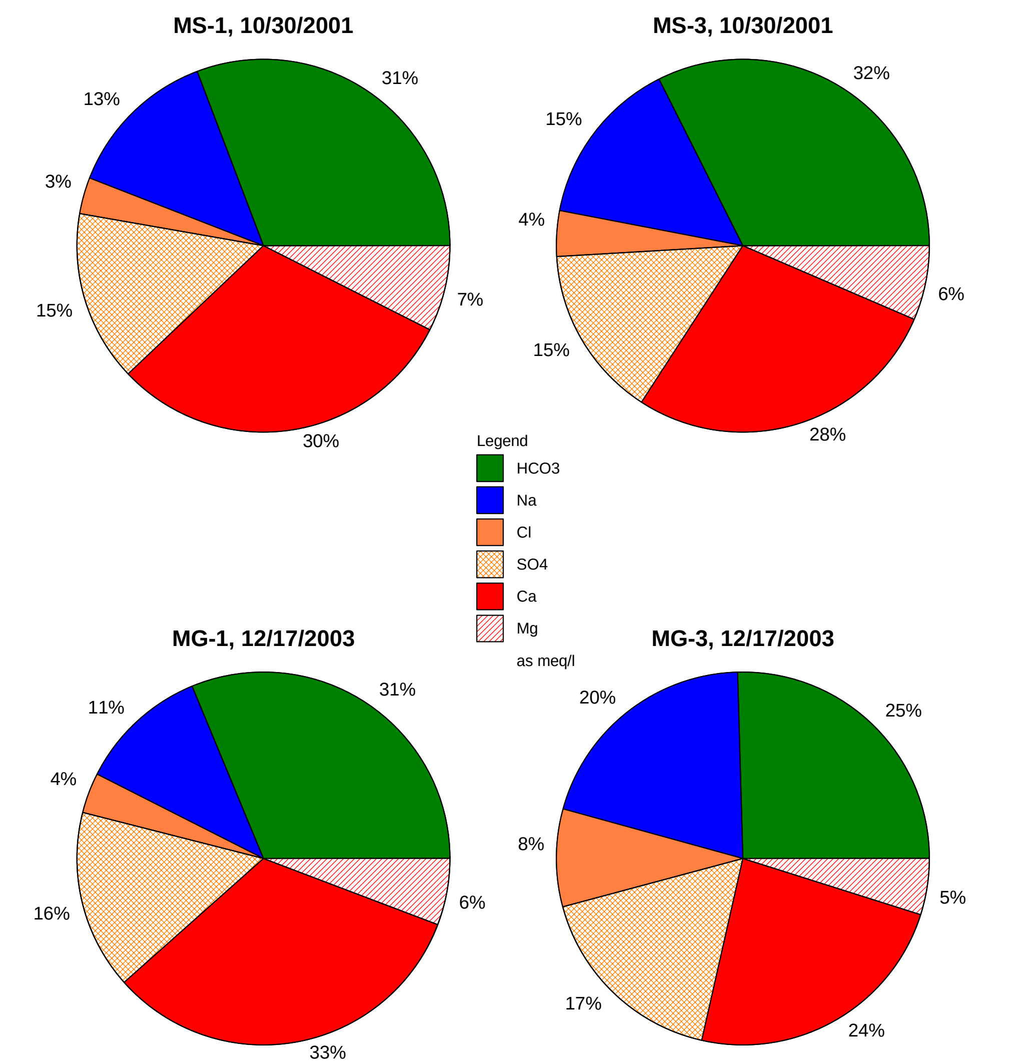
**Figure 3.53 Time Series Plots for the Isleta Nested Piezometer**

The deepest of the piezometers (Isleta-1), has shown multiple exceedances of the secondary standard for iron and manganese. Concentrations of iron are uniquely high, with a maximum reported concentration of 16 mg/L. Exceedances of manganese included a maximum reported concentration of 0.26 mg/L. Samples from Isleta 1 also yield significantly elevated concentrations of aluminum, but with significant fluctuation through time. The reported aluminum concentrations range from 0.7 mg/L to as great as 24 mg/L. Available analyses suggest that detectable concentrations of strontium and vanadium may occur from time to time. These metals concentrations are either naturally occurring or may be attributable to differences in acidified and unacidified samples.

There are two significant observations to be made regarding trends in the Isleta piezometers. First is the change in composition of the groundwater with increasing depth. As shown in Figure 3.53, there is a significant increase in the relative contribution of sodium, at the expense of calcium and magnesium, and a slight decrease in the relative contribution of bicarbonate. In the deepest well (I-1), there is a significant decrease in bicarbonate, with an increase in contribution of sulfate. A visual comparison of the composition charts for the Rio Bravo Park piezometers indicates that those two relatively deep wells are similar to the composition for the deeper two of the Isleta wells. This is shown in Figure 3.45, the Piper Plot for the South Valley, by the plotting of the respective compositions along the lower right portion of the central diamond. One noticeable difference is the predominance of sulfate in the Rio Bravo piezometers, compared to the deep Isleta piezometers.

This change in chemistry with depth is thought to be due to the influence of the annual flux of surface water from the Rio Grande via the irrigation canals and drains into the shallow aquifer system. Noticeable in the Piper Plot (Figure 3.45) is that the two shallow Isleta Piezometers plot toward the upper-left center of the diamond, along with many of the USGS sampled wells. The USGS wells are primarily shallow wells within the USGS Rio Bravo transect and located immediately adjacent to the Rio Grande. Further evidence of this source stems from results of the Agrichemical Water-Quality Impact Study (McGregor, 2006). As part of that study, water samples were taken from the canals and drains, and shallow wells associated with the irrigation ditch system. The composition of the analysis for the locations near the Isleta piezometer nest from the last round of samples is plotted as Figure 3.54.




DESCRIPTION:

**Irrigation and Groundwater Composition in Vicinity of the Isleta Piezometers**

| PROJECT: *Water Report* | DATE: 6/21/06 |
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*BERNALILLO COUNTY PUBLIC WORKS / WATER RESOURCES*

**Figure 3.54 Composition of Surface Water and Shallow Groundwater in the South Valley**

The MS locations indicate surface water samples, and the MG locations indicate groundwater locations. A visual comparison of the plots for the irrigation supply samples, the nearby shallow ground levels, and the two shallowest Isleta piezometers (Isleta 4, Isleta 3), indicate similarity in composition and strongly suggests influence of irrigation supplies.

The second observation regards the change in composition in the deepest Isleta piezometer (Isleta 1), through time. As shown in Figure 3.53, total dissolved solids and inorganic concentrations fluctuate over a narrow range in the three, uppermost piezometers (Isleta 4, Isleta 3, and Isleta 2). Isleta 1, however, exhibits a marked decrease in TDS in 2003 and 2004. Fluctuations are also seen in total dissolved solids, sodium, chloride, and aluminum, and concentrations of iron and aluminum are distinctively elevated compared to the shallower Isleta piezometers.

The geologic setting may be the key to answering "why". The shallower wells are influenced by the flux of irrigation water through the canals and ditches. This annual replenishment of shallow groundwater tends to moderate any subordinate changes in groundwater quality that might otherwise occur. This annual flux, however, does not reach the deeper portions of the formation, or at least not at rates that significantly affect the deep water levels.

Thus, in the deeper zone, arsenic concentrations may be elevated and sodium concentrations increase and other fluctuations may be seen. The source and fluctuations of the fluctuating concentrations of iron, aluminum, and other trace metals in Isleta 1 is hypothesized to be the near-surface basalt formations of Black Mesa, immediately southwest of the piezometer site. Difference in geochemistry with depth in the alluvial aquifer would explain stable differences in geochemistry with depth, but would not account for the fluctuations. A second plausible explanation for the fluctuation may be a difference in field methodology. Existing records are inadequate to determine if samples collected in 2003 and 2004 were field filtered to remove suspended materials. If so, then trace metal concentrations could expect to be lower than in samples that were left unfiltered and then acidified for preservation. However, this would not explain the variation in sodium and chloride concentrations that also occur.