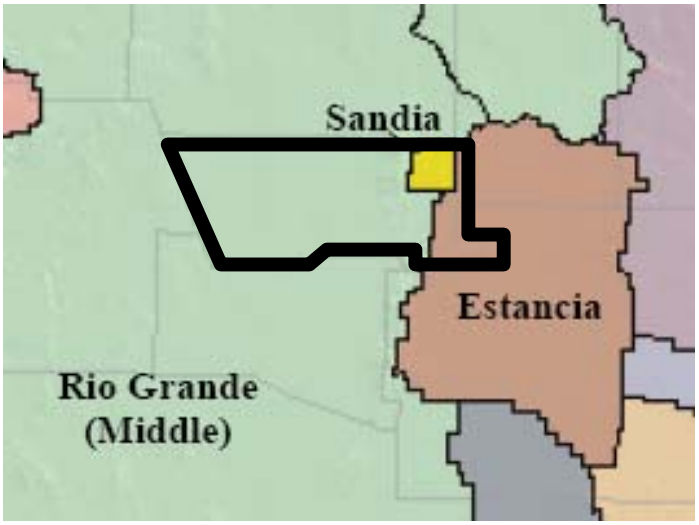
BACKGROUND INFORMATION AND PREVIOUS STUDIES

The Bernalillo County monitoring well locations (Figure EX.1) were strategically selected based upon existing land use and well use patterns, density of septic systems, access for drilling and long-term monitoring, presence of nearby existing monitoring wells, proximity to disposal facilities, and the anticipated development of future water supplies.

1.1 *Administrative and Geographic Subdivisions*

At the State level, the use and administration of water resources and water rights within the State of New Mexico are under the purview of the Office of the State Engineer (OSE). Bernalillo County includes portions of three OSE Declared Groundwater Basins. The Sandia Basin overlies the northeastern corner of the County, the Estancia Basin overlaps along the eastern boundaries with Sante Fe and Torrance County, and the area west of the Sandia Mountains is within the Middle Rio Grande Administrative Area of the Rio Grande Basin (Figure 2.1). Each of these basins is subject to differing administrative rules used by the OSE to administer water rights.



Taken from: http://www.ose.state.nm.us/PDF/Maps/underground_water.pdf

Figure 2.1 OSE Declared Groundwater Basins in Bernalillo County

Other state agencies also regulate specific types or uses of water resources germane to their regulatory function. Most notable of these is the New Mexico Environment Department (NMED). The NMED provides regulation of groundwater contamination investigations and site remediation and provides oversight of community water systems and drinking water quality.

Bernalillo County reviews the use and regulates the protection of the water resources within the context of the State level regulation through subdivision, individual well, and water conservation ordinances and provides various monitoring, permitting, and inspection programs. However, Bernalillo County does not administer the ownership, allocation, transfer or adjudication of water rights nor does it oversee drinking water systems or groundwater contamination investigations and clean-ups.

Land use patterns, geography, and geology vary greatly within Bernalillo County and serve to define distinct geographic areas with particular water resource characteristics and concerns. The locations and focus of the regional groundwater monitoring well network reflect the geographic diversity present throughout the County, which can be divided into five groundwater zones. The recently adopted Bernalillo County Water Conservation Plan (Weston, 2006) subdivides the County into seven study areas (rather than five zones) due to the additional consideration of demographics and water use patterns affecting water conservation. The five hydrogeologic-based zones and the corresponding Water Conservation Plan study areas include:

Hydrogeologic Zone	Corresponding Water Conservation Plan Study Area
East Mountain Area	East Mountains North, East Mountains South
Far Northeast Heights	North Albuquerque Acres, Sandia Heights
North Valley / Paradise Hills	North Valley
South Valley	South Valley
West Mesa	Paradise Hills, South West Mesa

1.1.1 *East Mountain Area*

The East Mountain Area encompasses the eastern third of Bernalillo County and extends from the Sandia and Manzano Mountains eastward to the county line (see Figure 2.2). This area is subdivided, as was done in the Water Conservation Plan, into North and South sections. The North Section has a southern boundary just south of I-40. It includes the communities of San Antonio,

Sandia Park, Sedillo, Carnuel, and the Village of Tijeras. The South Section extends south to the county line and includes small communities such as Chilili, Juan Tomas, Escobosa, Ponderosa Pine, and Cedro.

Most of the area north of I-40 is encompassed by the boundaries of the Sandia Groundwater Basin, while the far-east central area is encompassed by the western edge of the Estancia Groundwater Basin. The Estancia Groundwater Basin also encompasses the southeastern portions of the County. To facilitate regional groundwater planning, a Bernalillo County representative participates as a member of the Estancia Basin Water Planning Committee. The remainder of the East Mountain area falls within the boundaries of the Rio Grande Basin. (See Figure 2.1)

In general, the area is characterized by rural to semi-urban residential development generally with lots greater than 2-acres in size. Developable lands currently are zoned for no less than 2-acre lot sizes. However, older subdivisions exist which were based on 1-acre zoning. Most businesses are located along NM Hwy 14, NM Hwy 337, or along old U.S. 66. These businesses are generally small-scale restaurants, convenience stores, small retail, small offices, or other "home-based" businesses.

Approximately 57 percent of the population in the North Section is served by a water utility. The central and northern portion of the North Section has water available through a large community water system (Entranosa Water and Wastewater Association), which imports groundwater from the Estancia Groundwater Basin. The remainder is supplied by eleven (11) other subdivision-specific community systems drawing from in-basin groundwater resources. However, individual wells are common north of the I-40 corridor.

In the South Section, greater than 70 percent of the population is dependent on individual well systems with the remainder served by one of five small, subdivision-specific utilities. There are numerous community and non-community water supply wells located along the NM 14 / NM 337 corridor.

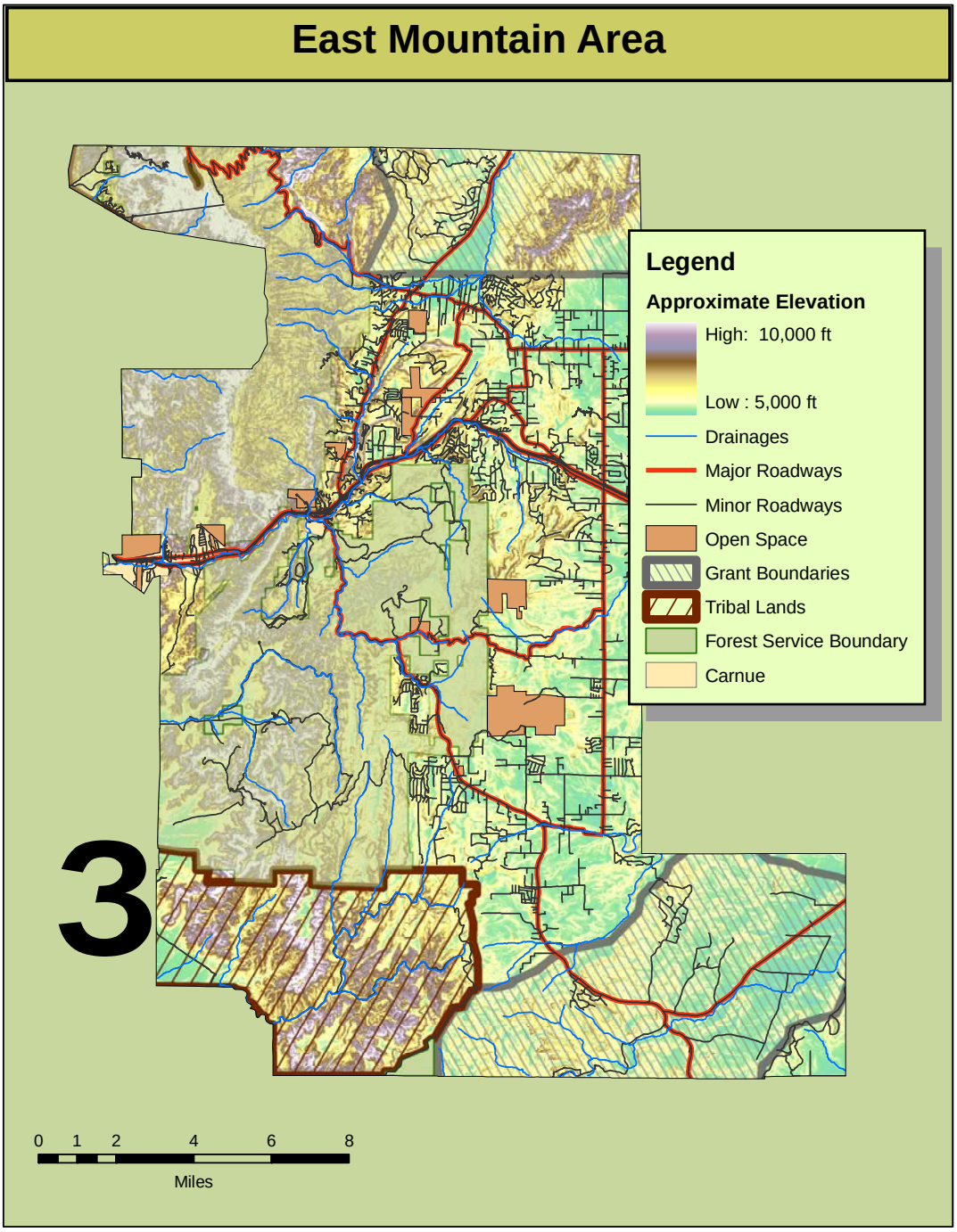


Figure 2.2 East Mountain Area

A thorough geohydrologic description of the area and related well use is available in Appendix D of the East Mountain Area Plan (Bernalillo County, 2006). Numerous springs are found on the east slope of the Sandia Mountains, and in the various canyons and arroyos dissecting the Madera Limestone of the Manzano and Manzanita Mountains. North of the I-40 corridor, the complex geology of the area results in a wide range of hydrogeologic properties, water quality, water levels, and groundwater availability. South of I-40, individual wells generally are completed within the Madera Group aquifer, a fractured limestone aquifer. The occurrence of "dry holes" occurs frequently South of I-40.

Previous County-funded studies have focused on the areas north of I-40, which is the area of greatest population density and current growth. Figure 2.3 shows the existing County monitoring well locations. Thomson et al (2000) installed these wells as part of a study to evaluate the effects of onsite wastewater systems on groundwater quality. The current monitoring program for the East Mountain monitoring wells is a continuation of the monitoring recommended in that previous study. With the exception of the Whispering Pines Senior Center, Fire Station 11 and Fire District 11 substation, there are no County-owned or monitored wells south of I-40.

The USGS conducts County-funded studies in the East Mountain area based on the program plans outlined in *Plan of Study to Define Hydrogeologic Characteristics of the Madera Limestone in the East Mountain Are of Central New* Mexico (USGS OFR 99-201, 1999). The most recent summaries of water quality data and water levels are provided in a USGS report, SIR 2004-5189, which presents data for 31 wells located throughout the East Mountain area. Figure EX-1 indicates the USGS monitoring well locations. The 31 wells are an assemblage of private, public, and dedicated monitoring wells. The USGS has not monitored water quality in any of the 31 wells since 2002, but has continued to monitor water levels in 18 of the wells through a cooperative agreement with Bernalillo County. Eight of the 31 wells monitored for water level by USGS are south of I-40 and the Village of Tijeras. The USGS also conducts water level monitoring in cooperation with the OSE.

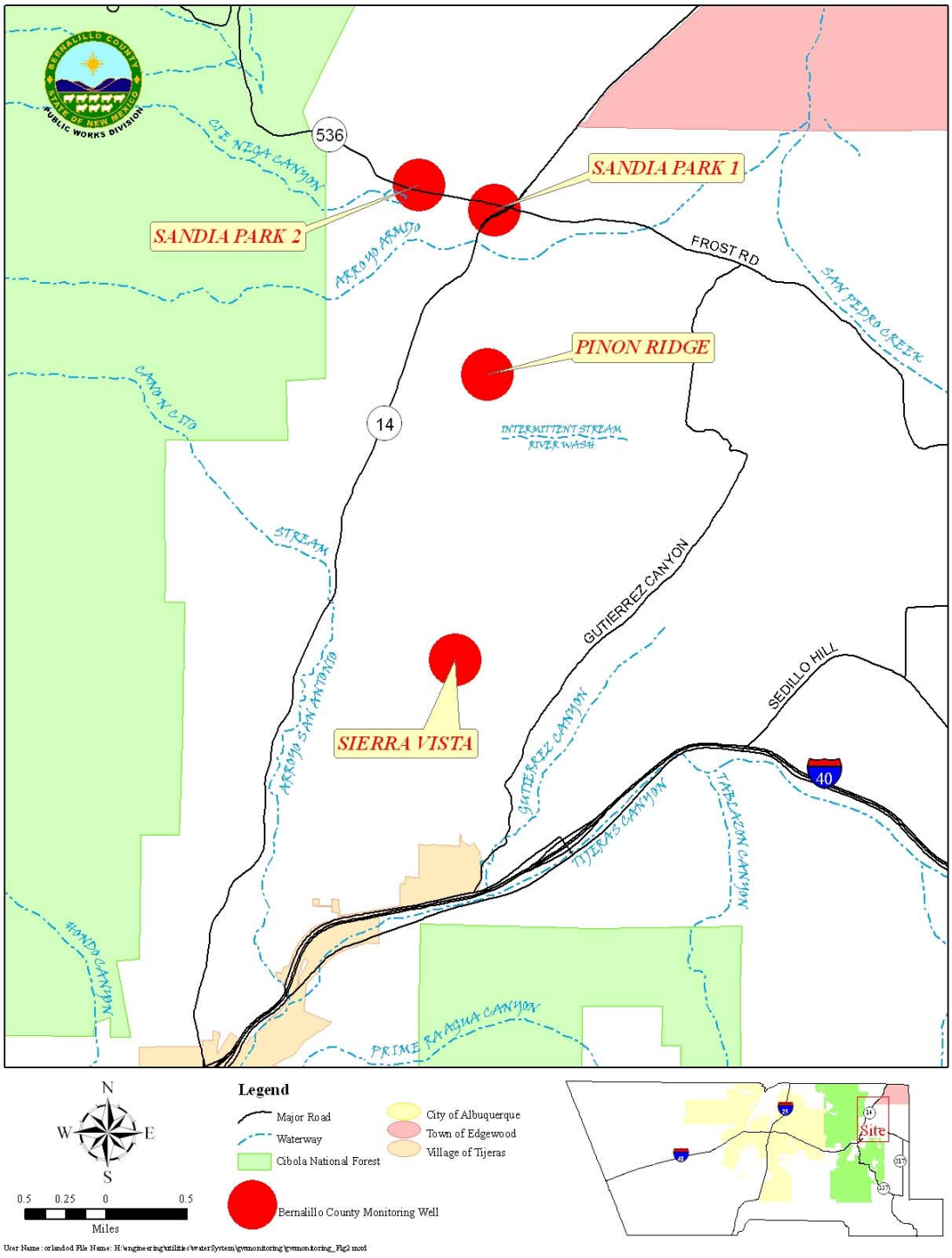


Figure 2.3 East Mountain Area Regional Monitoring Well Locations

Elevated nitrate levels have been noted throughout the area, particularly in areas with older, denser developments such as the Carnuel and Tijeras Canyon areas, Sandia Park, and the Sedillo Hill area. Elevated concentrations of fluoride may also be present in wells located along the eastern county boundary and north of I-40. Additionally, groundwater quality may be poor in some areas due to completion of wells in or through zones with naturally occurring poor quality water (e.g., the Mancos Shale).

The most significant contaminant threat to the individual wells systems in the East Mountain area stems from septic-tank use, although some limited areas along the Route 66 corridor and along NM Hwy 14 are affected by leaking underground storage tanks. The East Mountain area is particularly vulnerable to water level declines due to drought conditions and competitive pumping from individual well systems within a given subdivision. Water imported into the East Mountains is taken from the Estancia Groundwater Basin, which is a hydrogeologically closed basin. The Estancia Groundwater Basin is experiencing significant groundwater declines (at a minimum of 1 to 2 feet per year and in some areas as much as 5 feet per year) in the uppermost Valley Fill Aquifer.

1.1.2 *Far Northeast Heights*

The unincorporated portions of the Far Northeast Heights comprise two areas: North Albuquerque Acres and Sandia Heights (see Figure 2.4). These areas are characterized by residences on lots generally of 0.75 to less than 2.0 acres in size, use of individual wells, and a high density of individual septic-tank use. There is also limited commercial development in the area, though the land use is predominately residential.

This area is unique, hydrologically speaking, because it is adjacent to a recharge area for the Albuquerque Basin. The recharge occurs within the mountain front recharge zones located east of Sandia Heights (in the foothills of the Sandia Mountains and termed the Sandia Mountain Subarea by Anderholm, 2001). Infiltration likely occurs beneath the unlined arroyos encountered throughout Sandia Heights and North Albuquerque Acres (based on result of Thomas, 1995).

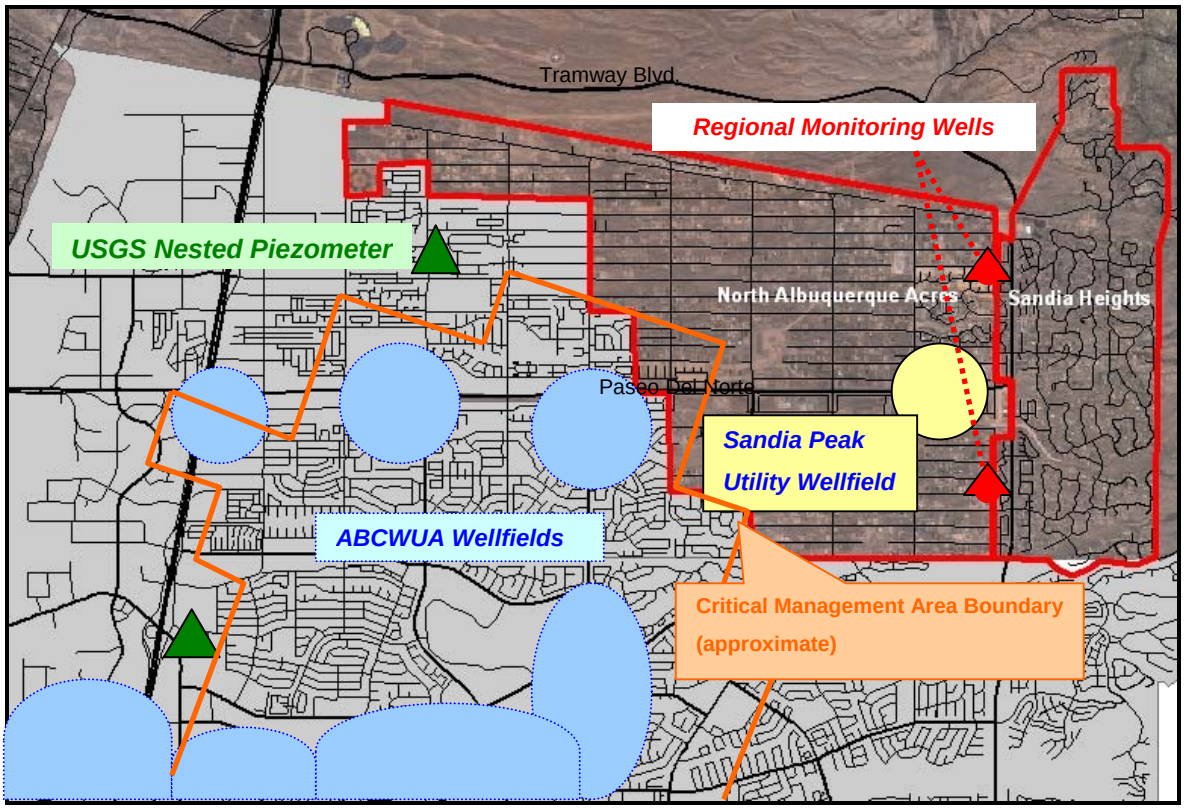


Figure 2.4 Far Northeast Heights

These features, coupled with multiple significant north-south trending faults, result in an average groundwater gradient of approximately 0.1 ft/ft to the west and southwest. However, there is a noticeable drop in water levels when transversing the easternmost faults as one moves towards the Rio Grande from the foothills area.

The entire area falls within the OSE's Middle Rio Grande Groundwater Basin administrative area. The southeast quarter of the Far Northeast Heights lies within the Critical Management Area wherein special administrative rules apply for permitting new and replacement wells. The Far Northeast Heights area also falls within the north portion of the Northeast Region as defined by Bexfield and Anderholm (USGS, WRIR-01-4244) based on water quality mapping.

The Water Conservation Plan (Weston 2006) indicates that 34 percent of the residents of the Far Northeast Heights use wells and notes the use of ornamental water features such as small pond and fountains within North Albuquerque Acres. Four small community systems service an additional 3

percent of the residents in the Far Northeast Heights. The Sandia Peak Utility services most homes (94 percent) within Sandia Heights,. The ABCWUA extends service partway along Tramway Blvd and services approximately 1 percent of the Sandia Heights residents. Water supply from ABCWUA exists to the south of the area and along portions of Tramway, but does not extend into North Albuquerque Acres. Almost all North Albuquerque Acres residents use domestic wells as their water source.

As measured from the Bernalillo County monitoring wells and shown in Figure 2.4, the nearest ABCWUA production wells include Walker 1 and 2, located approximately 2.5 miles to the west, and the Ponderosa 1 well located approximately 2 miles to the southwest. The Sandia Peak Utility wells are located approximately halfway between the two regional monitoring wells. The County does not have any monitoring wells located west of Tennyson St. (i.e., the far eastern edge of the North Albuquerque Acres) and the USGS maintains the Nor Este nested piezometer located approximately 3.5 miles to the northeast. County facilities in the area are supplied through individual wells, but are not currently monitored for water levels.

North Albuquerque Acres

North Albuquerque Acres is located on the eastern margin of the Albuquerque Basin and on the piedmont slopes west of the Sandia Mountains. The original plat in the 1930's encompassed 3,804 acres. Lot size in this area is typically between 0.75 and 1.0 acres. The neighborhood designs support equestrian use along the area's trails and an area equestrian facility. Each residence uses onsite wastewater disposal, and water in this area is supplied by individual domestic wells or well share arrangements. Residential wells are completed in the upper Santa Fe Group. This portion of the aquifer is composed of poorly sorted sands, gravels, and other alluvium deposits. The Sandia and West Sandia Faults transect the eastern margin of North Albuquerque Acres and have discernible impacts on the hydrogeologic conditions, most notably depth to groundwater. The ABCWUA has several municipal production wells (Webster wells and Walker wells) located to southwest of the area as shown in Figure 2.4.

Groundwater quality in North Albuquerque Acres was evaluated in a focused study (CDM 2002). The results indicated that 19 of the 23 wells sampled exhibited only slightly elevated nitrate concentrations (i.e., the maximum reported concentration was 2.3 mg/L compared to an EPA primary drinking water standard of 10 mg/L), and there was no clear indication of bacteriological contamination problems. Additionally, arsenic concentrations in excess of 10 ug/L (the EPA primary drinking water standard) were found in four of the 23 wells sampled and were located in the northwest corner of the study area.

The primary threat to groundwater in this area includes water level declines due to both municipal and residential pumping, and possible bacteriological and nitrate contamination from the high density of septic systems.

Sandia Heights

Sandia Heights is located on the far northeastern corner of the Albuquerque metropolitan area, between Tramway Bouldevard and the Sandia Mountains. The residences are, in some cases, located in the mountain-front-recharge area of the Sandia Mountains. Water levels in the area are influenced by large-scale rift-related faulting and the effects of mountain-front recharge. Water is provided by a community-system (Sandia Peak Utility) supplied by wells located between the County monitoring wells, and water quality is subject to NMED compliance requirements. This area is distinct from North Albuquerque Acres in that water is supplied by a public system while wastewater is addressed through on-site septic systems.

A study of the effect of septic tanks in this area was completed in 2002 (Thomson et al. 2002). Monitoring wells installed for that study serve as the current regional monitoring wells. The monitoring well locations are shown in Figure 2.5

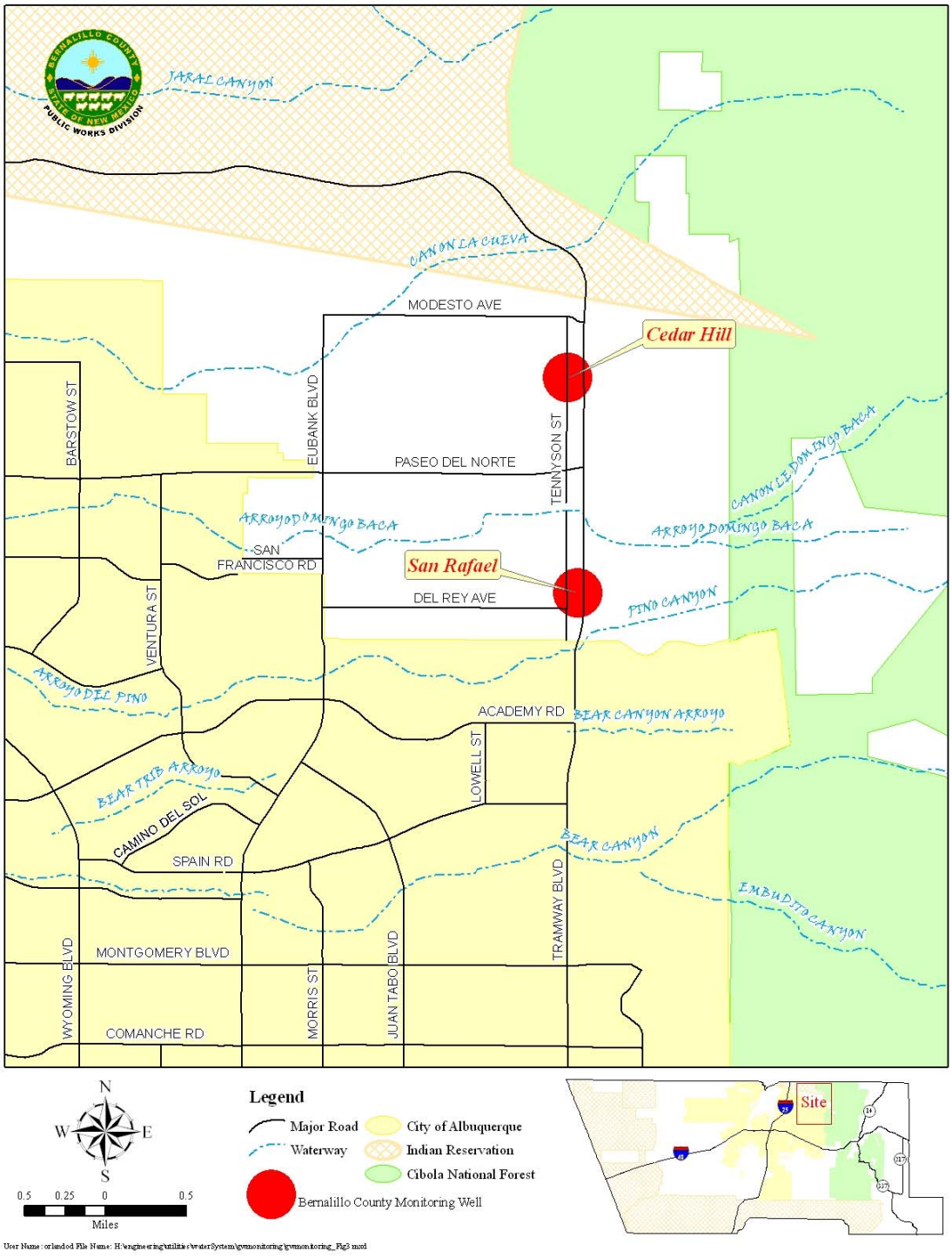


Figure 2.5 Far Northeast Heights Regional Monitoring Well Locations

1.1.3 *North Valley*

The North Valley encompasses approximately one hundred square miles in the central and northwest quadrants of metropolitan Albuquerque. Generally speaking, the North Valley area is bounded by Edith Boulevard to the east, the Rio Grande Bosque to the west, and lies north of I-40. For convenience of description, the Paradise Hills area has been included within the North Valley subdivision though it differs in cultural environment, and geologic setting. (See Figure 2.6)

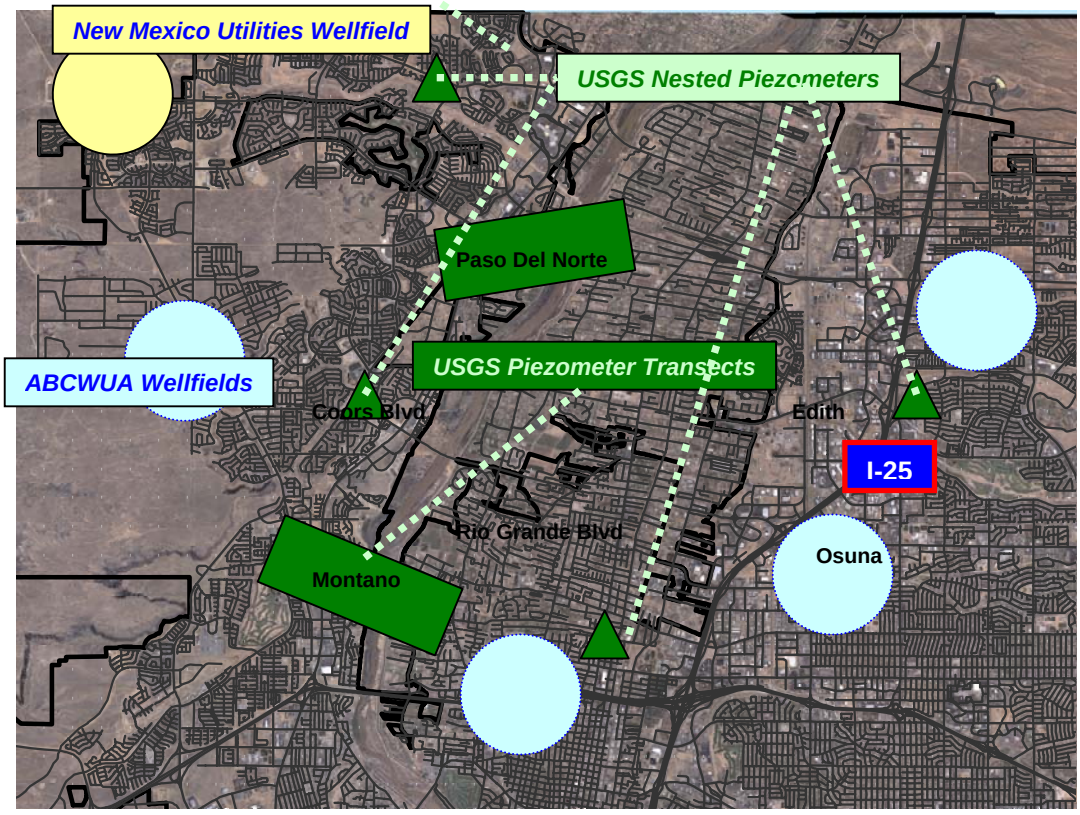


Figure 2.6 North Valley Area

The environmental character of the North Valley is strongly influenced by the Rio Grande and the associated bosque. The North Valley is unique for the abundant evidence of early settlement and agriculture including acequias, winding streets, long narrow parcels, and older homes. The North Valley retains its semi-rural, light agricultural character and some agricultural activity continues despite subdivision and development. In addition to gardens producing crops primarily for home use, there are numerous horse farms, pastures, and small-scale animal operations (Rosner and Rosner, 1996). Accordingly, land use is quite varied and parcel size ranges from lot size developments to

multi-acre sites. There is minimal heavy industrial development in the area, though commercial use is common.

Similar to the South Valley, 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. Much of the North Valley has access to ABCWUA water and sewer systems, though some localized areas remain dependent on individual septic systems. Though domestic well use may be limited, private wells are used for irrigation and livestock watering. The deeper aquifer is heavily affected by municipal groundwater pumping from the Santa Fe Group aquifer in surrounding wellfields.

The Paradise Hills area is more typically suburban with large-scale subdivision and tract housing. The geology of the setting is more typical of the West Mesa and associated arroyo drainage than the valley floor. A major drainage, the Arroyo de Las Calabacillas, lies north of the unincorporated area and extends several miles westward and is a key hydrogeologic feature for the area. Water in the Paradise Hills area is supplied by New Mexico Utilities and there is minimal, if any, domestic well use. There are no records of permitted domestic wells in the area. Sewage is collected by New Mexico Utilities and then piped to ABCWUA facilities for treatment.

Bernalillo County does not maintain regional monitoring wells in these areas due to the general availability of water and sewer to area residents and general lack of domestic well use. Also, the ABCWUA and USGS monitor wells in the immediate areas to the west and east and the USGS maintains water level transects in the bosque along Montano Rd and Paseo Del Norte.

The primary threat to groundwater stems from the density of on-site wastewater systems, many of which pre-date wastewater system regulation, and the high percentage of individual wells. Anoxic groundwater conditions exist within the valley floor area, possible caused by septic tank waste loading of the shallow aquifer system. Urban issues also affect the shallow groundwater quality. The existing sewer infrastructure is undergoing significant expansion throughout this area and will eventually provide service to the entire area.

1.1.4 *South Valley*

The South Valley (Figure 2.7) encompasses the area from Central Avenue to the Isleta Pueblo and from Coors Road to I-25 and comprises approximately 39 square miles. This area has a highly diversified land use pattern including agriculture, residential, commercial, and industrial use. The northern urbanized neighborhoods merge into the more semi-urban, and agricultural areas farther south. 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.

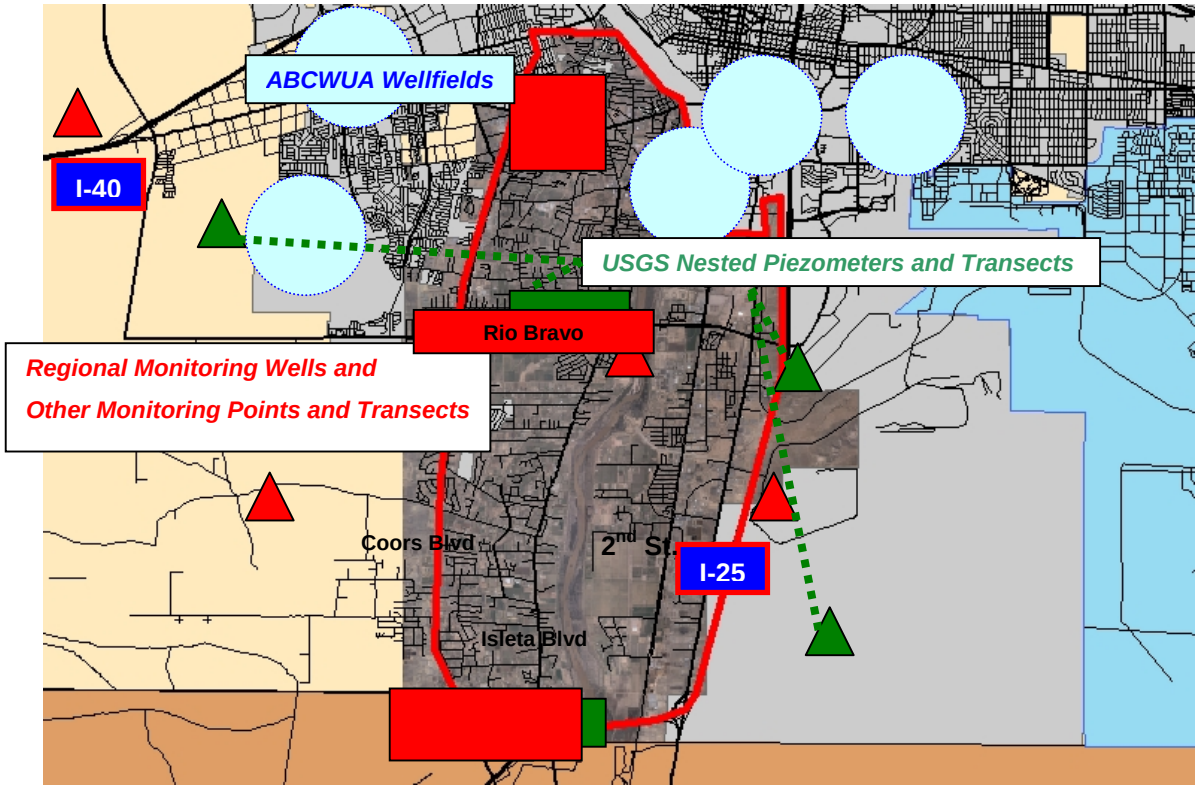


Figure 2.7 South Valley Area

Municipal groundwater pumping from the Santa Fe Group aquifer significantly affects water levels in the deeper portions of the aquifer. Municipal pumping is concentrated north of Rio Bravo Boulevard. There are no ABCWUA wells located within the inner portions of the South Valley. 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.

The nearest ABCWU wells are the Leavitt Wells located approximately 3.5 miles to the northwest of the Rio Bravo Park piezometers. The ABCWUA's Atrisco wellfield is located slightly less than four (4) miles to the north of the piezometers, and the San Jose wellfield is located across the Rio Grande and 3.5 miles to the northeast of the piezometers. The USGS monitors the Westgate Heights nested piezometer located approximately 4 miles to the northwest of the piezometers and beyond the western border of the South Valley. The USGS also monitors two piezometer nests on the eastern mesa along Tijeras Arroya and further south in Mesa del Sol. Approximate locations are shown in Figure 2.7.

Two targeted water quality assessments are focused within the South Valley: the South Broadway Landfill monitoring and the Agrichemical Water Quality Impact Study (McGregor 2006). The South Broadway Landfill is located south of Tijeras Arroyo and east of I-40 (see Figure 2.7 for the approximate well locations). It is immediately southwest of the Journal Pavilion site. The City of Albuquerque and the County jointly monitor the South Broadway Landfill. The monitoring is conducted in accordance with a closure plan approved and monitored by the NMED. The monitoring activities and sample results are reported annually to the NMED. Details can be found in the annual report to the NMED; the 2005 landfill report was submitted in February 2006. The area north and east of the closed landfill site is slated for intensive development (Mesa del Sol), which involves multiple entities.

The monitoring network for the agrichemical study consists of a total of forty-five surface water and shallow groundwater sampling locations located in the South Valley. The sampling locations are located in three transects, with sampling locations in or adjacent to irrigation canals and drains on MRGCD property. These three transects include surface water sites at the inlets to canals and drains near the Rio Grande in the north part of the South Valley, water and monitoring well locations along Rio Bravo Boulevard, and along Malpais Rd. The Rio Bravo transect is located just north of the Rio Bravo Park nested piezometer, and the Malpais Rd. transect incorporates the Isleta regional monitoring well nest. The sampling locations were selected to capture background concentrations of

Rio Grande water supplied for irrigation and for determining contaminant concentrations in waters draining from agricultural fields and in groundwater. These transects also overlap with previous and on-going USGS studies sites used to quantify water level interaction between the shallow groundwater and the Rio Grande. General locations of the various transects are indicated in Figure 2.7 as are well locations for the Doss Open Space and the West Mesa regional monitoring well locations.

Bernalillo County regional monitoring well locations for the South Valley are shown in Figure 2.8. Water levels in the Rio Bravo Park and the Isleta nested piezometers are monitored continuously by the USGS and annual sampling is conducted by Bernalillo County. Also shown on Figure 2.8 are the South Broadway Landfill monitoring well locations, though these are not considered part of the regional monitoring program.

The primary threat to groundwater stems from the density of onsite wastewater systems, many of which are dated and the high percentage of individual wells. The existing sewer infrastructure is undergoing significant expansion throughout this area. Urban issues also affect the shallow groundwater quality.

Portions of the South Valley, particularly the Mountain View community, are affected by groundwater contaminant plumes. These plumes stem from past agricultural practices, septic tank discharges, and industrial discharges. There also are numerous petroleum storage tanks sites located along Isleta Blvd between Bridge Boulevard to the north and Gun Club Road to the south. Monitoring at the discharging facilities is under the regulatory authority of the various agencies of the NMED.

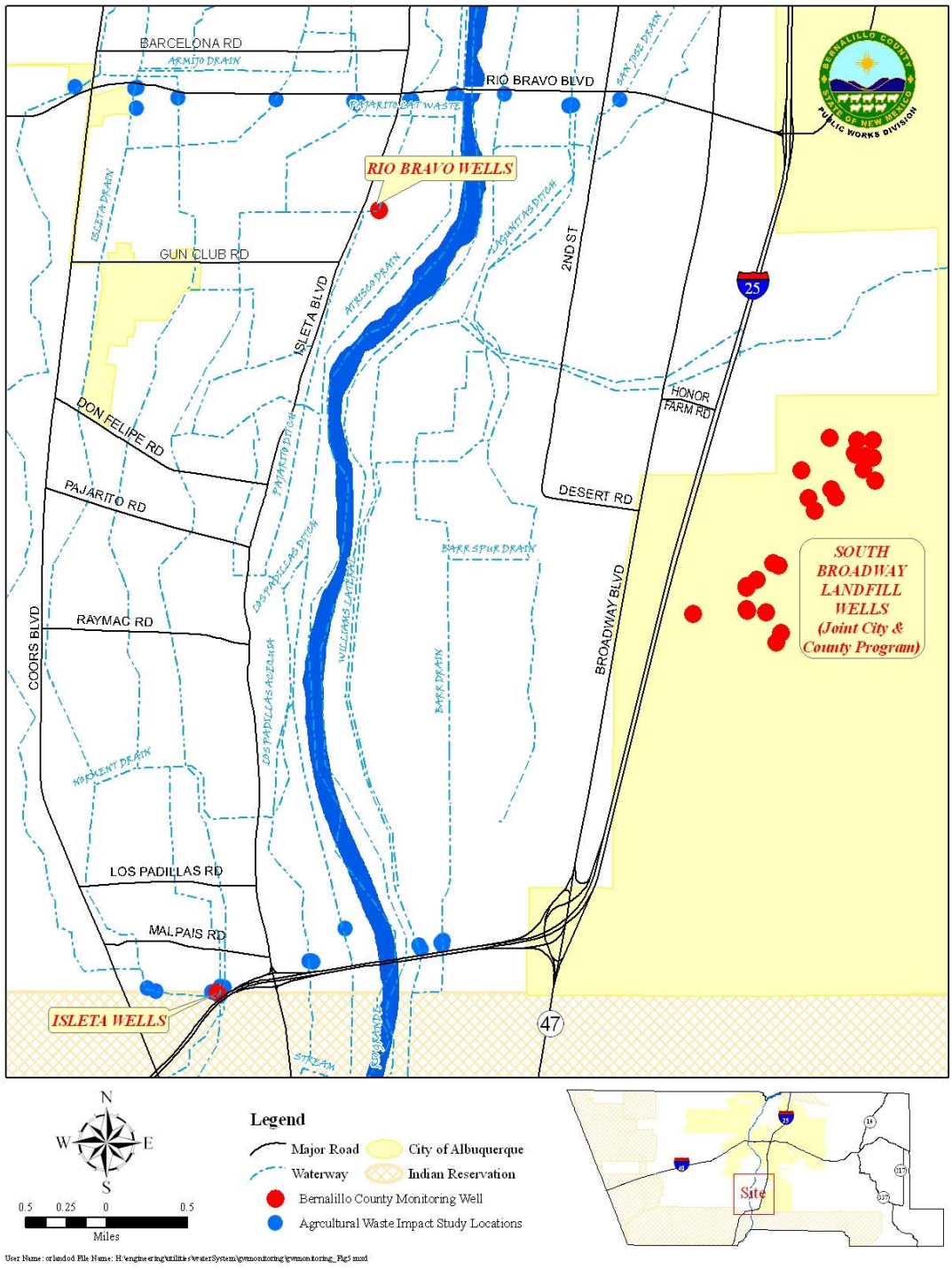


Figure 2.8 South Valley Regional Monitoring Well Locations

1.1.5 *West Mesa*

The West Mesa (Figure 2.9) generally include all areas of the County west of Coors and Unser Boulevards and extending to the tribal lands boundaries to the northwest, west, and southwest. The Northwest Mesa, West Mesa, and Southwest Mesa (Pajarito Mesa) above the ceja (ridge) are largely undeveloped. Master planned developments are in process for the West Mesa immediately north and south of I-40. These areas could see a combination of commercial, industrial and residential development in the near future.

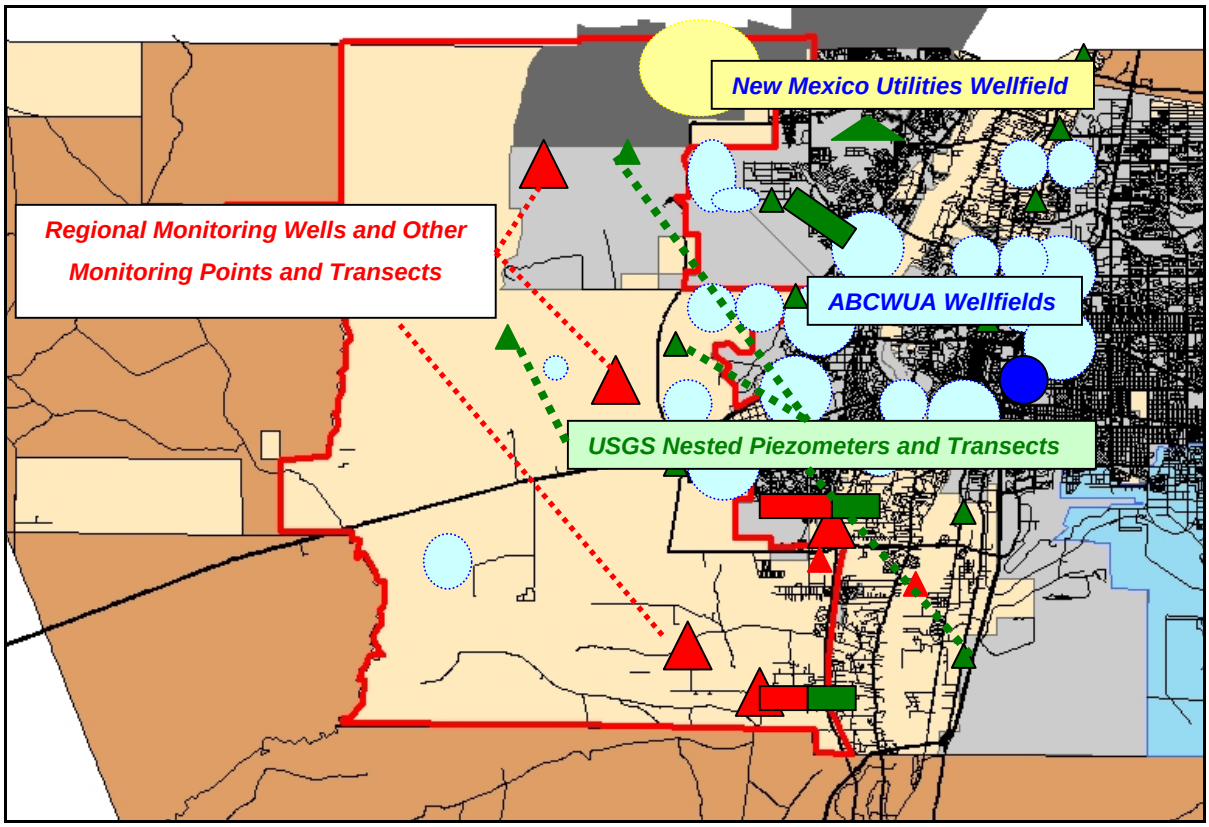


Figure 2.9 West Mesa Area

Development in these areas is currently constrained by lack of access, lack of existing infrastructure, limited groundwater availability, depth to water, and concerns with water quality. Although foreseeable, existing plans for expansion of municipal water and sewerage do not currently extend to the West Mesas. Of particular concern is development on the Southwest Mesa (Pajarito Mesa) that does not meet the County's development standards. The nearest ABCWUA wellfields include, from north to south, the Volcano Cliffs, College, West Mesa, and Leavitt wellfields. Stand-alone

ABCWUA systems exist at the Tempur-Pedic / Campos de Suenos and the Metropolitan Detention Center. The USGS installed piezometers in the remote reaches of the West Mesa in the early to mid 1990's but no longer actively monitors the sites and takes only annual water level measurements in these wells.

Bernalillo County monitoring well locations on the West Mesa are shown in Figures 2.10 and 2.11. The Paradise Rd. well is located in the northwestern portion of the county near the jurisdictional boundary with Rio Rancho and north of Double Eagle Airport. It is located on the eastern edge of the ABCWUA Soil Amendment Facility. The USGS previously monitored this well but now performs only annual water level measurements. The nearest ABCWUA wellfield, Volcano Cliffs, is located approximately 4.5 miles southeast. That is also the general location of the USGS Sierra Vista nested piezometer.

The 9-Mile Hill monitoring well is located at a former County-owned landfill site, near the intersection of Paseo Del Volcan and I-40. The nearest ABCWUA wells are Don 1, located a little over one mile to the east, and the West Mesa wellfield located approximately 2 miles to the east. The USGS previously maintained the 98th Street nested piezometer located approximately 2.5 miles to the northeast, but the site was lost due to development.

The Niese Rd. monitoring well is located on the Southwest Mesa east of the Southwest Landfill. The USGS continuously monitors water levels in this nested piezometer. There are no nearby ABCWU facilities.

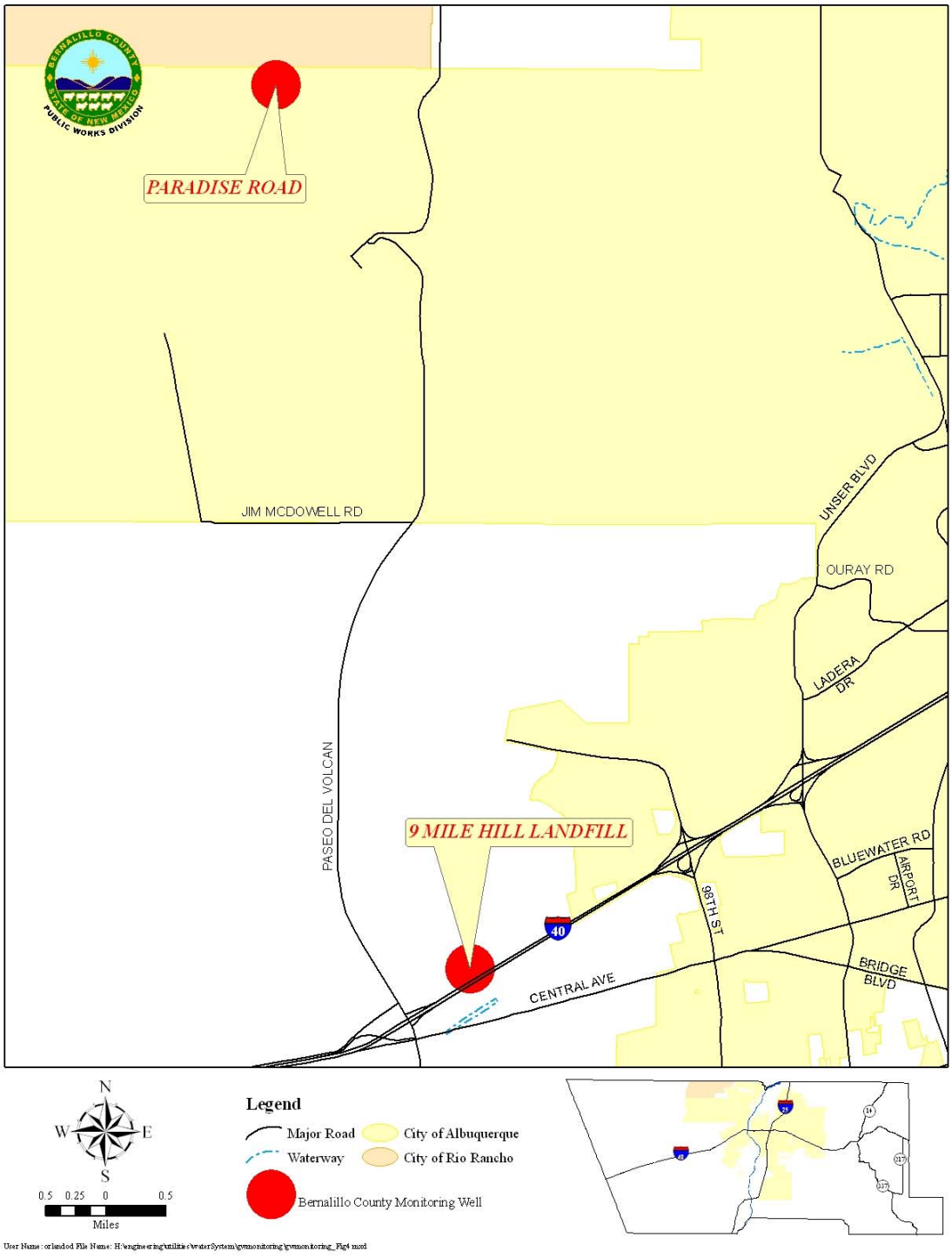


Figure 2.10 Northwest Mesa and West Mesa Regional Monitoring Well Locations

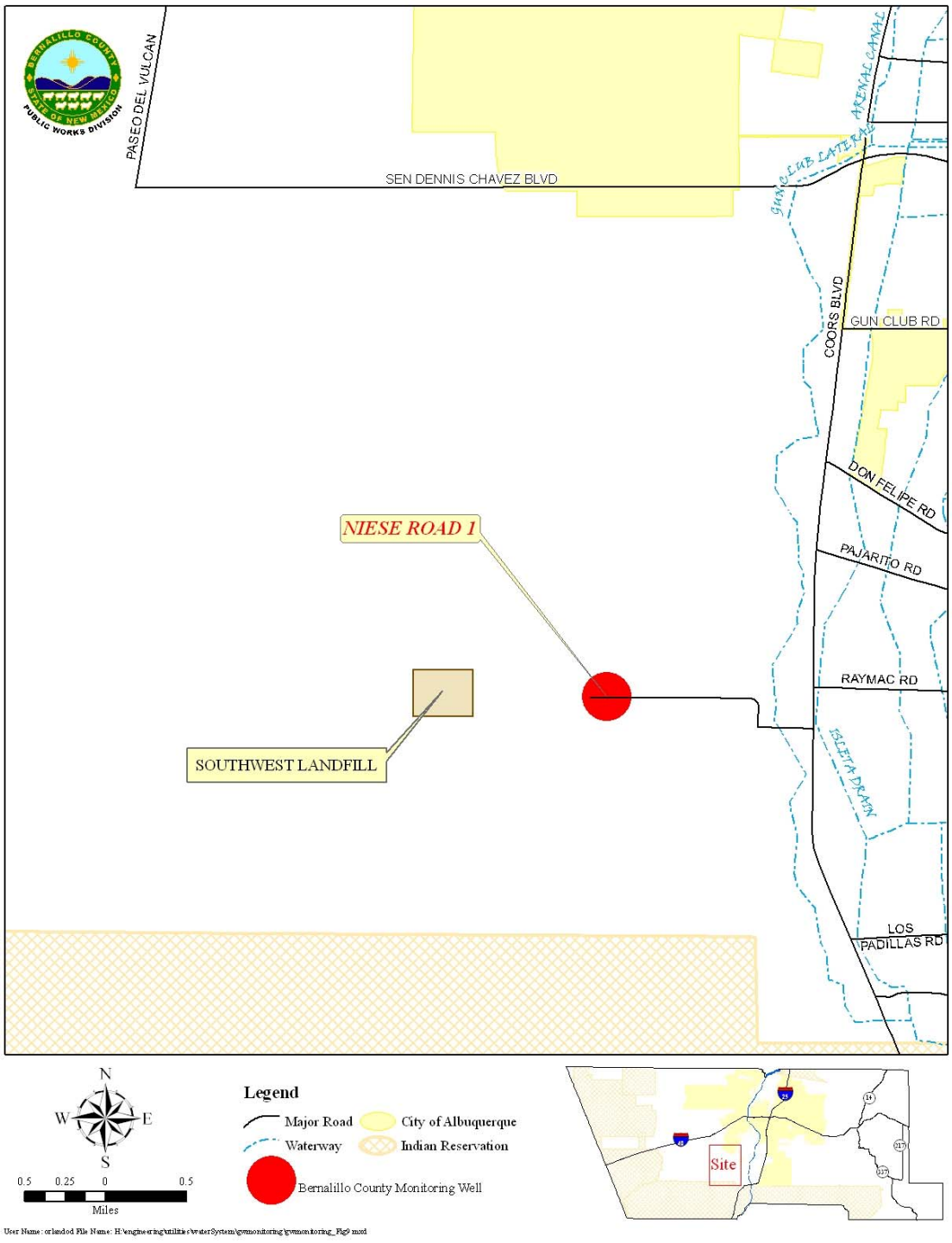


Figure 2.11 Southwest Mesa Regional Monitoring Well Location