HYDROGEOLOGY STUDY

THE RANCH AT DEL RIO SPRINGS
Town of Chino Valley, Arizona

Prepared for

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EXECUTIVE SUMMARY

This report was prepared to demonstrate the physical, continuous and legal availability of water supplies for the proposed 3,058-acre, mixed-use, master-planned community which is called The Ranch at Del Rio Springs (Ranch). It was also designed to define the specific relationships between the discharge of Del Rio Springs (Springs) and pumping which occurs on the Ranch. The hydrogeologic study has shown that pumping from the groundwater system—specifically from the artesian aquifer—has a direct, immediate and perceptible impact on the measured discharge which comes from the Springs. Therefore, based on the Southwest Cotton decision, recent legal decisions by the State of Arizona Supreme Court in the Gila River Adjudication, and the results of this study, pumping from this artesian aquifer fits the criteria specifically established by the Supreme Court to define the Ranch's pumped water as a surface water extraction. The Ranch's water right was recorded in the Yavapai County Mill Sites and Water Rights Book #2 in 1893 and carries a priority date of 1864. Surface water has been continuously and beneficially used on the Ranch since that date, either by direct diversion from the Springs or by pumping from the artesian aquifer.

The proposed development lies almost entirely within the Little Chino Sub-Basin of the Prescott Active Management Area (PRAMA) at elevations between 4,400 and 4,958 feet. The general geology of the area is characterized by volcanic deposits and flows which are often interbedded with thick deposits of gravel, sand and finer sediments. The geologic deposits in this area have been grouped into three hydrogeologic units by the Arizona Department of Water Resources (ADWR), based on similar hydrologic properties. For this study, Allen, Stephenson & Associates (ASA) only used the two upper units which are described as the confined and unconfined aquifers.

Available data were compiled from many sources, which included ADWR, United States Geological Survey (USGS), Arizona Department of Environmental Quality (ADEQ), and personal communications with persons knowledgeable about the area. Field investigations, which were conducted, included geophysical exploration, drawdown and recovery tests, surface and subsurface water level monitoring, as well as water quality sampling. These data were collated, analyzed, and eventually incorporated into the design of the numerical model.

Using the PRAMA Third Management Plan (TMP) guidelines, the existing water use demand for the Ranch was calculated to be approximately 3,596.1 AFY. For the existing demand, the agricultural component is 94 percent, and the residential and non-residential components comprise the remainder. During projected development, the agricultural demand will be gradually reduced to that amount which will be required to preserve 96.6 acres of permanent pasture. Over a 15-year build-out period, the population is anticipated to increase rapidly with the growth of the development. At build-out, water use demand is projected to be approximately 4,200 AFY, when one also considers the subflow irrigation of the native pasture, wetlands, and riparian habitat in the floodplain of Little Chino Wash. Surface, subsurface and reclaimed water will be used to meet the demand of the development. Reuse of reclaimed effluent will gradually replace most, if not all, of the surface water required to initially irrigate the two golf courses.

Extensive hydrogeologic investigations indicate that the confined aquifer beneath the study area is highly productive, and that changes in the hydrostatic head of this artesian aquifer exhibit a direct and appreciable impact on the discharge from the Springs. This has been established in the following ways: (1) over the 61± years of record which has been collected on the discharge of the Springs, there has been a gradual decline in flow which has been attributed to pumping from the confined aquifer; (2) on an annual basis, discharge rates from the Springs are high in the winter when limited pumping is occurring and low during the summer when intensive irrigation is taking place; (3) by analysis of statistical data accumulated during the course of ASA's studies, it has been shown that a direct and positive relationship exists between static water level changes (hydrostatic head) in the artesian aquifer and discharge from the Springs; (4) over a short period of days or weeks, pumping on the property has been shown to cause a direct and almost immediate decline in spring flow; and (5) on a routine daily basis, both positive and negative pressure changes (sinusoidal oscillations) in the artesian aquifer are reflected approximately 1 hour and 26 minutes later by a corresponding change in spring flow.

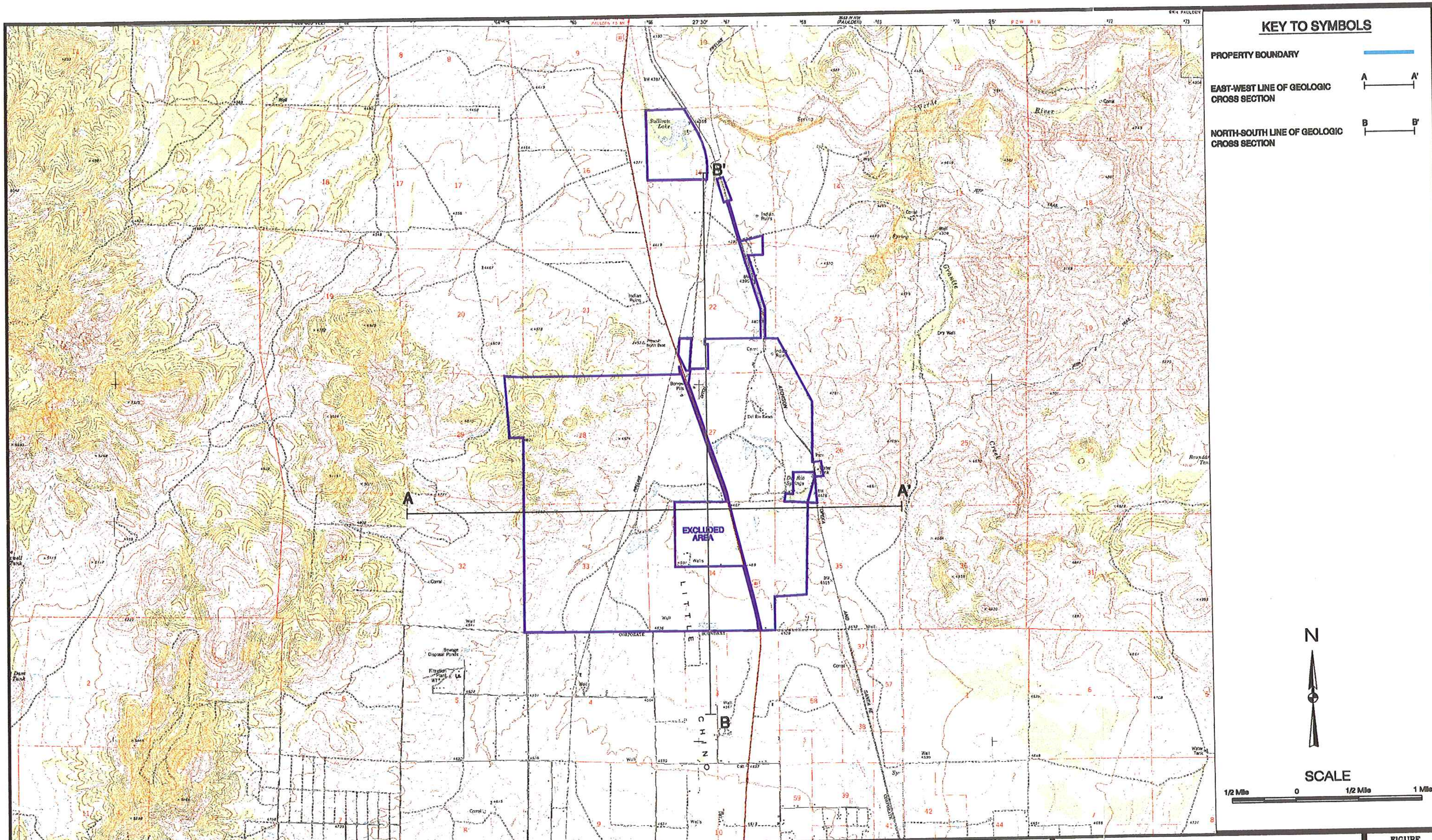
Finally, a numerical analysis was conducted to determine the 100-year impact, on the hydrologic system, imposed by the water demand of the proposed development. Water level simulations were conducted on the confined aquifer, unconfined aquifer, and the Springs discharge using the USGS analytical model MODFLOW. Results of this analysis indicate that there is adequte water in the Del Rio Ranch subsurface and surface flow systems to meet the proposed demands of the subject property for a minimum of 100 years without adversely impacting the aquifer. Water levels at the two main production wells which are located on the north side of Road 5 North show declines of 15 and 14 feet over the next 100 years.

1.0 INTRODUCTION

On behalf of the Bond Ranch at Del Rio Springs, L.L.C. and the James Bond Ranch (Ranch), Allen, Stephenson & Associates (ASA) has prepared this report for submittal to ADWR to demonstrate the physical, continuous and legal availability of water supplies for the proposed development of the Ranch. The proposed development will be a mixed-use, master-planned community, located on land that currently covers approximately 3,058 acres of undeveloped irrigated and sub-irrigated native pasture, rangeland, and irrigated cropland in northern Little Chino Valley, Yavapai County, Arizona. Ninety-four (94) percent of the property is in the PRAMA.

The Ranch property is located in the northern part of the Town of Chino Valley, Arizona, within Township 17 North, Range 2 West, Sections 33, 34, 28, 27 and portions of Sections 15, 21, 22, 26 and 35 of the Gila & Salt River Baseline and Meridian (see Figure 1). The property is recorded by the Yavapai County Assessor's Office as Parcel Nos. 306-40-027Z, 028N, 028Q, 038, 038A, 057,058A, 061B, 062, 064A, 064C, 065A & 118 and 306-46-005. The current title to the property is vested in Barbara Bond and Richard D. Bond, trustees for the James and Renata Bond Trust.

The study was designed to assess the potential impact of the proposed development on the subsurface water and subsurface water system by collecting and analyzing geologic and hydrologic data, as well as developing performing a numerical analysis. The USGS analytical flow model MODFLOW was used to develop the conceptual and numerical subsurface and surface water simulations utilizing the interface software Groundwater Vistas (GV).



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STUDY AREA MAP

FIGURE
1

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2.0 DESCRIPTION OF THE STUDY AREA

2.1 Physiography

The study area is primarily within the Little Chino Sub-Basin of the PRAMA in Townships 16 and 17 North, Range 2 West, as shown in Figure 1. Land surface elevations within the Little Chino sub-basin vary from 4,400 to 7,453 feet. Within the study area, the elevation ranges between 4,400 and 4,958 feet above sea level. The groundwater modeling area extends south of the proposed development area to incorporate existing pumpage and to provide a realistic assessment of the impact of the proposed development.

The Little Chino Sub-basin portion of the AMA is bounded on the east and northeast by the Black Hills, on the south by the Granite Mountains Range, and on the west by Sullivan Buttes. Several ephemeral streams exist in the study area. Little Chino Creek flows from south to north, capturing Del Rio Springs. Subsurface water is discharged at the Springs in a one-half mile reach of the wash. Little Chino Wash returns to its ephemeral character north of the Ranch where it flows northward for approximately three miles to Sullivan Lake near Paulden. Sullivan Lake is a small, man-made lake constructed in 1938 by the Work Projects Administration (WPA) to control head cutting of the Verde River into the lower portion of the Big Chino Valley (Corkhill and Mason, 1995). Big Draw, another ephemeral stream, flows from south to northeast in the Little Chino Sub-Basin where it joins Little Chino Creek one mile north of Del Rio Springs. There are seven stock ponds/holding reservoirs in the study area. Two are located west of Highway 89, one of which is filled with surface water and well water, and the other is filled solely with surface water. Both are used only for livestock (not for irrigation). The other five, located east of Highway 89, are filled with a combination of pump and surface water, and are used primarily for gravity irrigation of adjacent fields.

2.2 Geology

The United States Geological Survey (USGS) mapped the geology in and around the Ranch during the summers of 1953-1955 (Krieger, 1965). The geologic materials of this area consist of igneous (derived from molten rocks) intrusive and extrusive rocks of Tertiary age (± 21-27 million years), as well as gravel and alluvial stream and river deposits reportedly of Quaternary Age (≤ 2 million years).

ASA staff conducted reconnaissance mapping of the geologic units and structural features of the subject area in July and August 2000, at a scale of 1 inch = 250 feet. The results of that study are detailed in the technical report Local and Regional Geology Report (ASA, 2001a). The dominant geologic features of the subject area are found in the northwestern and eastern parts of the project area where among the higher hills, both latite domes, and flows have been identified.

Latite - Latite outcrops exposed on the property are typically covered by less than a foot of alluvium (stream, river deposits) and/or colluvium (loose, slope-derived, debris). Surface exposures of latite, even where obviously weathered, are still very hard and competent. The latite exposures in the northwest are generally massive in nature, with some jointing and some shear zones developed along faults in certain areas. The latite exposures to the east of the former Santa Fe Railway right-of-way appear to be more fractured than those in the northwestern part of the Ranch. Due to the intermediate composition of the latite, and its viscous nature, the margins of the dome or flow events are usually abruptly terminated with a fairly steep face. In some areas, the slope of the latite hills approach and may exceed 25 percent.

Basalt - Basalt is exposed at the surface in Section 15 in the vicinity of the dam at the headwaters of the Verde River, and the old Highway 89 and Santa Fe Railway bridges at the Sullivan Lake area. The basalt exposure in this area is evident along a portion of the shore of the southeast corner of the lake and dam areas, along the west side of old Highway 89, and also appears to have formed the prominent hill to the north-northeast of the Sullivan Lake area.

Gravel Deposits - Large areas of the subject property, particularly to the south in sections 33, 34, and 35, are covered with what are reported to be Quaternary age gravel deposits. In some areas near the outcrops of latite to the northwest, a significant percentage of the gravel appears to be latite-derived. At some time in the recent past, a gravel quarry was operated in the northwest corner of Section 27, west of Highway 89 and north of an engineered drainage ditch.

<u>Alluvial Deposits</u> - The remainder of the area within or along the main drainage features (Granite Creek, Little Chino Wash and its tributaries, and the engineered drainage features to the east) are all mapped as Quaternary age gravel and finer alluvial sediments.

2.3 Hydrogeology of the Study Area

Based on similarity in hydrologic properties, geologic deposits were grouped into three units in ADWR's Prescott Model (Corkhill and Mason, 1995). From the oldest to youngest, the units are the Basement Unit (BU), the Lower Volcanic Unit (LVU), and the Upper Alluvial Unit (UAU). The BU represents a wide range of crystalline or foliated igneous and metamorphic rocks that are generally dense, nonporous, and nearly impermeable (Wilson, 1988). This unit forms the impermeable floor and sides of the groundwater basin. The LVU, overlying the BU, is composed of a thick sequence of basaltic and andesitic lava flows interbedded with layers of pyroclastic and alluvial material. Groundwater flow occurs through both fractures and cavities in the volcanic deposits, and coarse-grained alluvial materials, such as sands and conglomerates. The LVU is a highly productive confined aquifer, as many wells drilled into this unit have been reported to be artesian in nature and have a discharge rate of 1,000 to 3,000 gallons per minute (gpm). The actual thickness of LVU is not well known, however the productive thickness might be only a few hundred feet based on the average depth-of-penetration of water wells which tap the unit, and from the depth-to-bedrock map prepared by Corkhill and Mason (1995). The distribution of fractures and cavities in LVU exhibits substantial spatial variability. Transmissivities, ranging from 5,000 to 110,000 ft^2/day, have been reported from previous studies.

The UAU contains a mixture of sedimentary, volcanic, and younger alluvial rocks, including clays, volcanic ash, and conglomerate. This unit is primarily an unconfined aquifer. Locally, confined aquifer conditions may be found in a few areas of theUAU where fine-grained sediments or lava flows restrict the vertical groundwater flow, but these areas have limited areal extent. Reportedly, the estimated hydraulic conductivities ranged from 1 to 200 ft/day, and the specific yield from 0.03 to 0.18.

Water within the Little Chino Valley occurs under all of the following conditions: artesian (confined), water table (unconfined), and perched. Confined aquifers, as the name suggests, contain water, held under pressure between relatively impermeable or significantly less permeable confining layers that will rise above the confining surface at locations where it is allowed to flow through fractures, wells or other breaches. A well drilled into such a confined aquifer is an artesian well if the water rises above the land surface. It may also be referred to as a flowing well.

The LVU aquifer consists of basalt flows interbedded with clay, sand and gravel, capped by an impermeable pyroclastic layer of volcanic breccia. The upper portion of the LVU consists primarily of mixed sediment layers. Though part of the confined aquifer, the sediments do not usually produce asrtesian flow. The artesian flows originate mainly from the basalt formation.

The basalt has been described by Schwalen (1967) as vesicular. Well drillers' reports also indicate that there are zones in some wells from which no cuttings were recovered, circulation losses occurred, and even some instances where drill bits dropped several feet in the hole during drilling. These data, as well as videos of two Del Rio Ranch wells show that open cavities exist in the basalt, a condition that is consistent with the deposition of volcanic flows. Additionally, fractures and joint systems, occurring as the volcanic flows cooled, and flow contact zones, are the likely pathways for groundwater flow. In most places, basalts are overlain by a clay layer that, together with additional layers of massive, nonporous basalt, form a confining layer for the artesian zone. The total thickness of the LVU aquifer is unknown, but wells have penetrated as much as 200 feet or more of basalt and alluvium after encountering artesian water.

Del Rio Springs, located at the north end of the Little Chino/Big Wash Sub-Basin near a reported groundwater flow barrier, is considered to be a zone of discharge from the artesian aquifer. Fairly complete records of discharge exist for the Springs for the period 1939-1946, indicating the average discharge was about 1,800 gpm (Corkhill, Mason, 1995). Del Rio Springs discharge is currently estimated to be about 1,590 AFY. Wirt and Hjalmarson (2000) provided additional discharge data for the periods from 1965 through 1972 and from 1984 through 1989 which showed the average annual discharge to be 2,300 and 2,400 acre feet (AF), respectively. The low flows that have been recorded over the past six years (1995-2000) appear to be directly related to low annual precipitation which has occurred in the Sub-Basin over this six-year period.

The unconfined aquifer in Little Chino Valley is composed primarily of alluvial clay, sand, gravel, conglomerate, and locally interbedded basalt. Outside of the study area, in the area south and west of Granite Dells, wells drilled through the basalt (latite?) into the saturated alluvium have encountered water at depths between 10 to 220 feet below land surface (bls). In the western and southern part of Township 16 North, Range 2 West, depth to water ranges from about 60 to about 350 feet bls. In Lonesome Valley, depth to water ranges from about 160 feet bls near the northern end of the valley, to more than 580 feet bls northeast of Granite Dells. The depth to water in the area northwest of Granite Dells ranges from about 100 feet to about 460 feet bls. In the project area, water in the unconfined aquifer is found at a depth of 0 to 25 feet bls.

Most wells completed in the water-table aquifer are used for domestic and stock purposes and are equipped to yield only a few tens of gallons per minute. These wells are classified as *exempt* and, as such, there is no requirement for reporting withdrawal. Therefore, the maximum potential yields of wells in the water-table zone are unknown.

2.4 Climate

Precipitation in the Prescott AMA ranges from about 12 inches per year in the valley areas, to more than 18 inches per year in the City of Prescott. The difference can be attributed to the orographic nature of summer thunderstorms in the area and Prescott's proximity to the mountains. Precipitation probably is significantly greater at higher elevations in the mountains surrounding the basin. Average daily maximum temperatures for the AMA are 89° F in July to 50° F in January. Average daily minimum temperatures range from 57° F in July and 22° F in January. Temperature extremes of 103° F in July to -21° F in January have been recorded.

3.0 DEMAND CALCULATION

Historically, the subject land was operated as a dairy farm for the Fred Harvey hotels between 1913 and 1956. Mules from the Grand Canyon were also pastured there and water was transported from the Del Rio springs to Fred Harvey facilities at Ash Fork, Williams, Winslow, and the Grand Canyon. The current use of the land is primarily for cattle ranching and cultivation of permanent pasture. Alfalfa, sudan and winter wheat have also been grown recently. Water usage on the subject property is primarily agriculture-related. Approximately 3,400 AF of spring and pump water per year are currently being used for irrigation, live stock and domestic purposes. This does not include that amount used by the vegetation in the cienega, the wetlands, and the riparian habitat along Little Chino Wash that thrives as a result of being subirrigated. The production of cattle food from these fields is an extremely important part of the ranching operation.

The proposed development for the Ranch at Del Rio Springs is a mixed-use, master-planned community (Figure 2), including single and multifamily units, an assisted-living housing complex, two golf courses, a number of lakes, three parks, and several gardens, blended with a fully preserved grazing pasture and a riparian corridor. Service and commercial development includes apartments, a hotel, motels, a clubhouse, a shopping center complex and possibly a medical facility.

3.1 Third Management Plan Requirements

The TMP of the PRAMA (ADWR, 1999) sets forth guidelines in the municipal, agricultural and industrial conservation programs for efficient use of water in proposed new developments during the years of 2000-2010. TMP guidelines utilized for the build-out demand calculations are summarized below:

I. Municipal Conservation Requirement (for new larger municipal provider)

Residential Water Use	
Interior single and multi-family :	57 gpcd (gallons per capita per day)
Exterior single family:	75 gphud (gallons per housing unit per day)
Exterior multifamily:	58 gphud
Non-Residential Water Use	20 gpcd

The Ranch at Del Rio Springs

Chino Valley, Arizona
Bond Ranch of Del Rio L.L.C
(Owner)

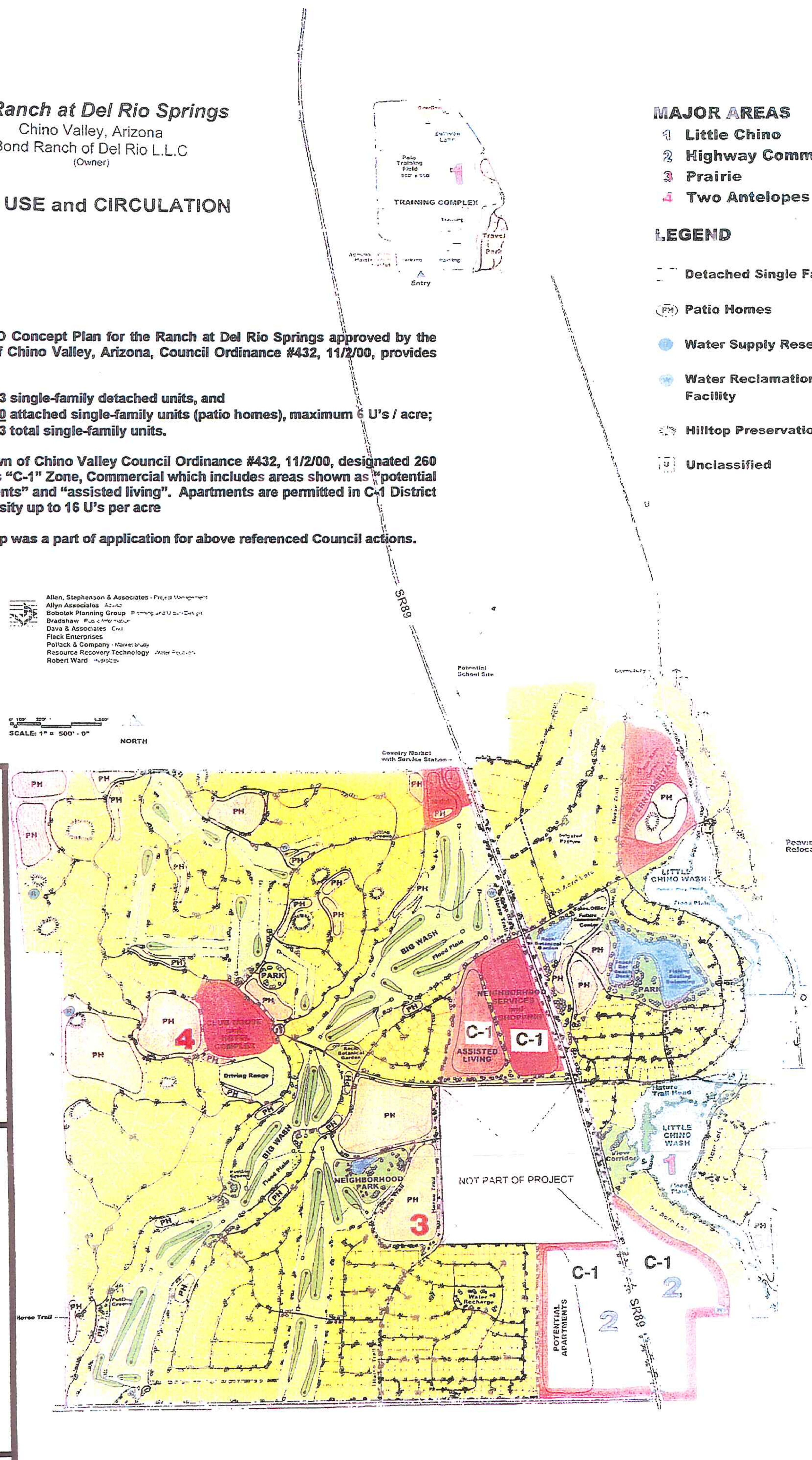
LAND USE and CIRCULATION

The PAD Concept Plan for the Ranch at Del Rio Springs approved by the Town of Chino Valley, Arizona, Council Ordinance #432, 11/2/00, provides for:

- **1,223 single-family detached units, and**
- **<u>2,640</u> attached single-family units (patio homes), maximum 6 U's / acre;**
- **3,863 total single-family units.**

The Town of Chino Valley Council Ordinance #432, 11/2/00, designated 260 acres as "C-1" Zone, Commercial which includes areas shown as "potential apartments" and "assisted living". Apartments are permitted in C-1 District at a density up to 16 U's per acre

This map was a part of application for above referenced Council actions.



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PROPOSED CONCEPT PLAN FOR RANCH AT DEL RIO SPRINGS

FIGURE
2

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plan map

II. Industrial Conservation Requirement

Turf-related Facilities Water Applicable Rate (10 or more acres water-intensive landscape area)

- Base allotment

Turf:	4.9 AF per acre turf per year
Water surface areas:	5.5 AF per acre water surface per year
Low water use landscaping:	1.5 AF per acre landscaping per year

- New model golf course (18 holes)

Turf area:	90 acres/golf course
Water surface area:	2.52 acres/golf course
Low water use landscaping area:	9 acres/golf course

- Allotment additions

Establishment of newly turfed area:	1.0 AF of water per acre of newly turfed area or 5.0 AF of water per hole per golf course
Allotment addition for filling bodies of water:	equal to the volume used for initial filling

New Large Landscape Users (landscape area >10, 000 sq-ft for non-hotel/motel or landscape area > 20, 000 sq-ft for hotel/ motel)

- Motel & hotel

Landscapable area limitation:	20,000 sq-ft + 20% of the facility's landscapable area
Swimming pool surface area limitation:	43,560 sq-ft

- Non -Motel & hotel

Landscapable area limitation:	10,000 sq-ft + 20% of the facility's landscapable area

III. Agricultural Conservation Requirement

Irrigation Requirement

- Native Pasture	
Consumptive use:	18.0 ac-inches or 1.5 AF
Effective precipitation:	7.2 inches/acre
- Sudan	
Consumptive use:	18.0 ac-inches or 1.5 AF
Effective precipitation:	6.6 inches/acre
- Winter Wheat	
Consumptive use:	23.0 ac-inches or 1.92 AF
Effective precipitation:	6.6 inches/acre
- Alfalfa	
Consumptive use:	41.0 ac-inches or 3.42 AF
Effective precipitation:	7.2 inches/acre
- Permanent Pasture	
Consumptive use:	51.0 ac-inches or 4.25 AF
Effective precipitation:	7.2 inches/acre

3.2 Existing Demand

I. Existing Residential

Units for single family: 5 hu
Population: 17 pop

Interior Component (SF) = (17 pop x 57 gpcd x 365 d)/325851 = 1.08 AFY
Exterior Component (SF) = (5 hu x 75 gphud x 365 d)/325851 = 0.42 AFY

Total Existing Residential Allotment **= 1.5 AFY**

II. Existing Non-residential - Approximate

Little Chino Wash Lake, Stream Side Lake, Bond Lake, Ruby's Pond, Spring Lake, Cougar Pond, Goose Pond, Property Line Pond, and Flat Worm Pond

Total water surface	= 58 acres	
Base allotment	= 58 acres x 5.5 AF/acre/yr	= 319 AFY
Subtotal water allotment for four lakes		= 319 AFY

Riparian Corridor --habitat

Area of corridor	= 8 acres	
Type of crop	= riparian habitat (cottonwood, willow)	
Water consumption rate	= 4 AF/ac/yr x 8 acres	= 32 AFY
Subtotal water allotment for riparian corridor		= 32 AFY

Riparian Corridor --native pasture

Area of	= 145 acres	
Type of crop	= native pasture	
Water consumption rate	= 1.5 AF/ac/yr	
Subtotal water allotment for riparian corridor		= 217.5 AFY

Wetland

Area of wetland	= 19.39 acre	
Type of vegetation	= reeds	
Water consumption rate	= 6.5 AF/ac/yr	= 126.6 AFY
Subtotal water allotment for wetland		

Total Existing Non-residential Allotment **= 595.5 AFY**

III. Existing Agriculture-related Demand - Approximate

Irrigation Use

Irrigation Area	=673.8 acre	
Type of vegetation	= permanent pasture	
Water application rate	= 4.25 AF/acre/yr	
Base allotment	= 673.8 acre x 3.65 AF/acre/yr	=2,863.7 AFY
Subtotal water allotment for irrigation		=2,863.7 AFY

Livestock Use

Number of Cattle and horse	= 1000 + 12 = 1012	
Daily water use	= 12 gallon	
Demand for livestock	= 1012 x 12 gallon/d x 365d/325851	=13.6 AFY
Subtotal water allotment for livestock		=13.6 AFY

Total Agricultural Allotment = 2,962.7 AFY + 13.6 AFY **= 2,976.3 AFY**

<u>Total Existing Demand for the Ranch at Del Rio Springs - Approximate</u> **= 3,976.3 AFY**

3.3 Projected Demand

For the existing demand, the residential and non-residential components are small and constant. The agricultural component, as much as 94 percent of total existing demand, will be reduced gradually to the amount only required by the 96.6 acres of preserved pasture. Meanwhile, the population is anticipated to grow rapidly with the urbanization of the proposed Del Rio Springs Ranch development. Both residential and non-residential components for the new demand will increase year by year until the proposed development is completed and all of the units are occupied.

3.3.1 New Residential Demand

The proposed master-planned community will boast a total of 1,223 single-family homes, 2,640 multi-family units designated as patio homes, and 1,184 multi-family units designated as apartments. The following parameters/assumptions were applied:

New Residential (units for assisted/living are not included)

Single Family Unit = 1223
Multi-family Unit (patio homes) = 2640
Multi-family Unit (apartment) = 1184
Estimated average number of persons per SF/MF (patio) unit = 3.32 pphu
Estimated average number of persons per MF (apt) unit = 3.36 pphu

Interior component (SFU/MFUpatio/MFUapt)		= 57 gpcd
Exterior component	SFU	= 75 gphud
	MFU patio	= 58 gphud
	MFU apt	= 45 gphud

3.3.2 New Non-residential Demand

New non-residential uses will include commercial (clubhouse, business/retail center), turf-related facilities (golf courses, parks), large landscape uses (hotel/motel, garden), and preserved pasture. Lakes and riparian areas will be preserved. Turf-related facilities such as the golf course, lakes, and parks, as well as much of the landscaping associated with the motels, hotels and commercial developments, will be irrigated with surface water from Del Rio Springs and with reclaimed effluent. Irrigation for these facilities will rely increasingly upon the use of reclaimed effluent as it becomes available.

The demand will vary from year to year during the first 15 years due to the ever-changing process of build out. Among the components calculated, some are only applicable to the specific year of construction, such as the establishment of new turfed areas and filling bodies of water. Others are primarily population dependent, and will change with the expansion of the population base and the retirement of agricultural land in the area. When summarizing the total demand for each calendar year, these components are adjusted and distributed into a timeframe based on the build out plan and effluent reuse.

3.3.3 Effluent Reuse

The Town of Chino Valley has agreed to provide wastewater reclamation service for the Del Rio development under their #208 area wide plan. The Town is also in the process of developing plans for a reclaimed wastewater recharge facility. ADWR is providing technical support for this effort. The recharge facility will be constructed at the same time that the water reclamation plant is built.

The wastewater reclamation and recharge facilities have been tentatively located on Town property identified as "Old Home Manor". However, studies are being conducted to determine if another site is more fiscally desirable for the reclamation facility.

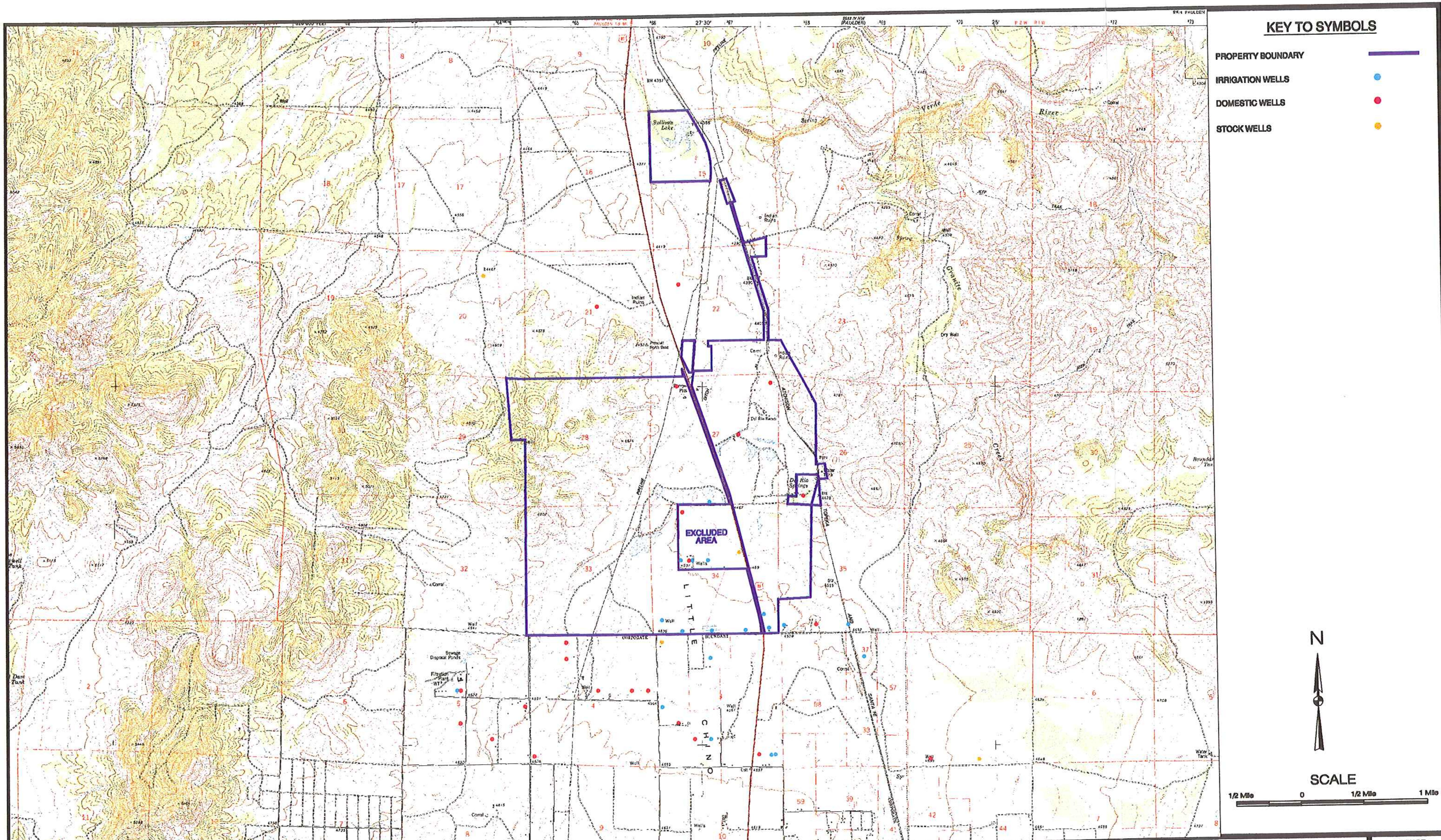
In addition to serving the Del Rio Springs development, the new reclamation facility will also serve the Town of Chino Valley, beginning with the Chino Meadow Subdivision. By the time Del Rio Springs Ranch is completed, in approximately 15 years, the Town expects that approximately 7,000 Chino Valley residents will also be connected to the wastewater reclamation system.

3.3.4 Projected Water Demand

The Assured Water Supply Rules require a demonstration of sufficient water to meet the existing and new demands of the subject property for at least 100 years. The total annual demand for each planning year is based on the build out plan for the Ranch at Del Rio Springs. This plan covers 15 years starting from 2002. After the first 15 years, the total annual demand and the demands for each component stabilize and remain the same value as the demand projected for 2015, i.e., for the remaining 85 years. Table 1 give estimates for all anticipated domestic and commercial demands from existing conditions (2001) through build out in 2015. Table 2 shows the anticipated water demand for irrigation (includes riparian), golf course and landscape usage from existing conditions (2001) through build out in 2015.

3.4 Other Groundwater Demand

To evaluate the impact of regional water demand on future surface water levels in the area of Del Rio Springs, pumpage data were analyzed for all parties located in the immediate vicinity (within one mile) of the subject property and who also pump water from the same source as the Ranch at Del Rio Springs. In this area, wells pumped at a rate larger than 10 AFY are primarily designated for irrigation use. Irrigation pumpage usually accounts for the majority of water withdrawals in a sparsely-populated, agriculture-dominated area such as the subject property and its vicinity. Locations for ADWR registered wells within the study area are shown on Figure 3.



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WELL INVENTORY MAP

FIGURE
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Table 1
Estimated Residential and Commercial Demand through Build-Out

YEAR	DEMAND SUMMARY (AF)				
	SINGLE FAMILY UNITS (@ 3.32 persons/DU) (AF	SINGLE FAMILY (PATIO) (@ 3.32 persons/DU) (AF)	MULTI-FAMILY UNITS (@ 3.36 persons/DU) (AF)	ESTIMATED COMMERCIAL DEMAND (AF)	TOTAL (AF)
2001	1.5	0.0	0.0	0.0	1.5
2002	18.4	4.4	0.0	14.4[1]	22.8
2003	42.3	10.0	78.4	16.6	147.3
2004	108.6	88.6	78.4	41.3[2]	275.6
2005	151.2	164.2	78.4	62.8	456.6
2006	169.6	218.8	78.4	95.1	561.9
2007	188.0	255.9	156.8	136.8[3]	600.7
2008	206.0	293.0	156.8	169.2	825.0
2009	235.0	317.9	156.8	201.2	910.9
2010	255.7	353.1	235.3	233.4	1077.5
2011	282.4	393.5	235.3	310.6[4]	911.2
2012	306.1	460.8	235.3	342.8	1345.0
2013	330.6	522.0	313.7	375.2	1541.5
2014	338.6	626.7	313.7	407.4	1686.4
2015	362.0	731.1	313.7	439.6	1846.4

Notes:

DU – dwelling units

(1) 70-room motel, sales office, and general store

(2) 200-room motel

(3) 70-room motel

(4) 200-bed hospital constructed (EDU equivalent of 270 homes)

Table 2
Projected Non-Residential Water Demand (2001- 2015)

Year	Irrigation (AFY)	Golf courses (AFY)	Landscape (AFY))	Total
2001	3289	0	5.3	3294.3
2002	3139	236	236.3	3711.3
2003	2563	471	236.6	3270.6
2004	1987	471	378.1	2836.1
2005	1987	471	492.8	2950.8
2006	1987	471	607.6	3065.6
2007	1520	707	759.3	2986.3
2008	1054	942	874.0	2870.0
2009	1054	942	988.8	2984.8
2010	1054	942	1103.6	3099.6
2111	798	942	1219	2959.0
2012	543	942	1219	2704.0
2013	543	942	1219	2704.0
2014	543	942	1219	2704.0
2015	543	942	1219	2704.0

Table 3 lists the pumpage for the reported years 1995 through 2000 for wells in the study area with an annual pumping rate greater than 10 AF. As indicated in Table 3, the total average pumpage for all of other parties in the immediate vicinity of the subject property is approximately 2,138.56 AFY. The average pumpage of the current property owner (J & R LTD) is 1,577.92 AF, which is approximately 42 percent of the total reported irrigation pumpage for the study area for the period of 1995 through 1999.

Based on A.R.S. §45-454, wells with less than 10 AFY withdrawal are exempt from regulation. These wells are usually for domestic/stock use, only taking limited amounts of groundwater from the upper UVA. To employ a more conservative analysis, and because of the large number of such wells within the study area, annual pumpage from these wells was also estimated and included in the total demand. Detailed information regarding data sources and the assumptions

Table 3

Annual Reported Pumpage in the Study Area (AF)

Owner	Cadastral	1995	1996	1997	1998	1999	2000	95-99 Average
J & R LTD								
609765	B-17-02 34DDD	0		0	0	0	0.0	
609766	B-17-02 34DDC	244.92	63.0	251	272	100	100.0	
609767	B-17-02 34CCC	145.56	34.6	119.48	0.55	64.97	67.8	
609768	B-17-02 27DCC	5.55	3.3	88.12	66.5	0	38.4	
609764	B-17-02 34CDD	1119.96	1604.	1192.89	1208.67	1304.2	1478.9	
subtotal		1515.99	1705.2	1651.49	1547.72	1469.17	1685.2	1577.92
DUNBAR THREE BROTHERS								
619375	B-17-02 34BDD	315.96	339.9	247.29	168.33	144.67	304.1	
619376	B-17-02 34BCD	152.3	223.3	114.29	71.37	55.27	74.3	
619377	B-17-02 34BDC			65.66	31.75	117.42	237.7	
subtotal		468.26	563.3	427.24	271.45	317.36	616.2	409.52
BETTY WELLS								
623515	B-16-02 02ABD	403.92	457.0	375.2	87.6	240	240.0	
623516	B-17-02 35CCC	367.6	191.	516.74	367.21	363.01	478.0	
623517	B-17-02 35DCC	479.42	675.	552.48	301.91	314.2	467.0	
subtotal		1250.94	1323.7	1444.42	756.72	917.21	1185.0	1138.62
A & K RAILROAD								
627269	B-17-02 26CCD	3.57	3.6	2.71	0.15	0.58	0.6	2.14
A BAR CATTLE & COMMERCE								
617596	B-16-02 03CDA	200.97	272.0	179.90	226.00	248.80	264.8	225.54
JOANNE J ROUND								
800606	B-16-02 03 CBB	37.44	36.6	33.52	31.75	34.23	27.0	34.73
BRADFORD & BARRIE SMITH								
800605	B-16-02 03 CBD	113.02	113.0	101.43	0.00	0.00	0.0	65.49
COLLIER JESS ANN								
802261	B-16-02 03 BAD	0.00	0.0	361.00	241.80	470.00	341.9	214.56
ROBERT & MARY CAMPBELL								
512905	B-16-02 03 DDD	0.00	84.6	94.94	23.16	1.82	1.0	40.92
BARBON L.L.C.								
619449	B-16-02-05BDD	6.54	5.8	14.32	0.00	8.49	1.0	7.04
Average Other								**2138.56**
Average total (2000)							**4122.9**	
Average Total (95-99)								**3716.48**

used for calculations can be found in Section 4. Field investigations revealed that four domestic wells and seven stock ponds, of which six ponds could and do receive pump water from wells, are currently in use on the subject property. The estimated annual groundwater pumpage for domestic/stock use is 9.75 AF. In addition, 27 domestic wells and 5 stock ponds are found in use in the immediate vicinity of the subject property. The estimated annual pumpage for these wells and ponds is 42.5 AF.

The estimated year 2000 existing demand by all parties located in the study area is 4,165.4 AF (combination of 4,122.90 AF and 42.5 AF). This value, together with the projected surface water demand of Del Rio Springs Ranch, was used in the 100-year hydrologic impact analysis as described in Section 5, but it does not include any water which has historically been provided from Del Rio Springs for irrigation use.

3.5 Means of Providing Water (Del Rio Springs Water Company)

All water requirements of the development will be provided by the Del Rio Water Company, a private water company that has been formed under the jurisdiction of the Arizona Corporation Commission. The source of supply for the water company is the 4,022 acre-foot surface water right which is currently in the name of the Arizona Title and Trust Company, Registry Number 36-45971. The water right was first filed by John Campbell on April 18, 1892 and is found in the Yavapai County Recorder's Office in the Water Rights & Mill Sites Book #2. It has a priority date of 1864.

4.0 SOURCE OF SUPPLY

Surface water and pumped water, both of which are legally surface water, will be used to meet the demand of the proposed development at Del Rio Springs. In addition, effluent will gradually replace some of the natural sources once the Town of Chino Valley's wastewater reclamation facility becomes operational. In this section, we will analyze the physical as well as legal availability of sources of water to meet the total demand of The Ranch at Del Rio Springs. In addition, the quality of both pump and spring water was examined by comparing State drinking water standards with the measured concentration of a selected suite of chemical constituents.

4.1 Physical Availability

4.1.1 Geologic Investigations

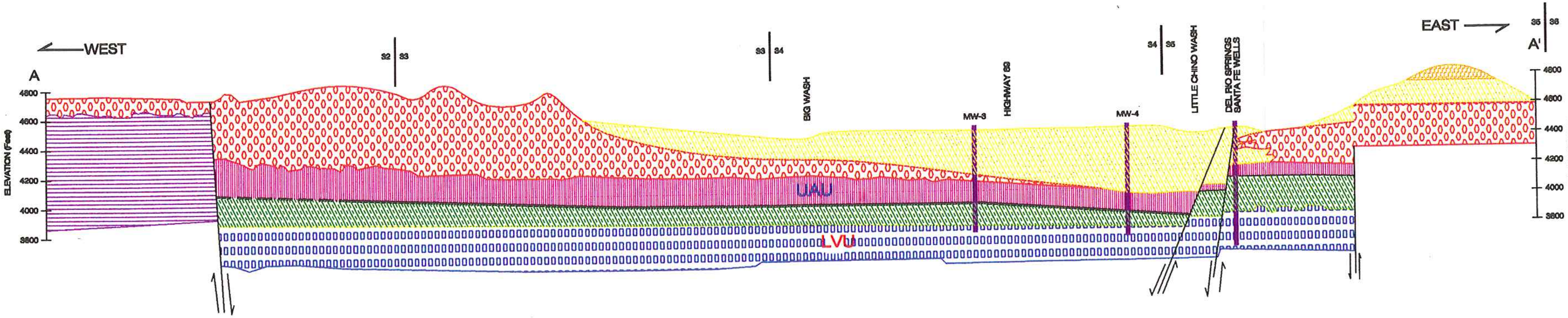
Previous subsurface geologic investigations in the Chino Valley consisted mainly of regional studies associated with the mining industry. Very little detailed information was available for the Ranch property. Krieger (1965) gives the most detailed, available description of the regional structures and stratigraphic relationships in the Prescott and Paulden Quadrangles. Schwalen (1967) reported the artesian aquifer in the Little Chino Valley, giving a detailed description of the subsurface water system. Several other studies have reported on the Del Rio Springs and its relation to the subsurface water flow system. Many wells have been drilled south of the Ranch, but only a few wells are located on the Ranch property (Figure 3). Most of the drillers' logs for these wells are inconsistent in describing the lithologies, making it difficult to accurately correlate geologic units for the area.

ASA initially reviewed ADWR well log files in an attempt to better understand the subsurface geologic framework for the Ranch property and to correlate this information with Krieger's geologic mapping. Nearly all of the irrigation production wells in the area of the Ranch are completed in the artesian aquifer at depths of less than 600 feet, giving very little knowledge of the deeper geologic strata in the area. Because of the few wells and unfavorable distribution for geologic correlations, ASA initiated additional investigations to develop a better understanding of the geologic framework underlying the Ranch property and its effect on subsurface water flow. ASA conducted downhole video scans on two key existing wells, geophysical logging on four wells, and drilled three new wells (ASA, 2001b; ASA, 2001c). In addition to well data, ASA conducted surface geophysical investigations including gravity, magnetic and seismic surveys (ASA, 2001d). ASA personnel have also had personal communication and shared data with USGS and ADWR geologists and hydrologists working in the area.

In general, the geologic materials on the Ranch property consist primarily of Quaternary sediments (terrace sands and gravels, and alluvium throughout the central lower elevations) with Tertiary volcanic formations along the west, northwest and east boundaries. Surface drainage is to the north, with Little Chino Wash and Big Wash as the primary drainages, both flowing into Sullivan Lake at the head of the Verde River.

Using the compiled data, ASA constructed two geologic cross sections to illustrate an interpretation of the geologic framework for the Ranch (ASA, 2001a). Figure 4 is a composite west-to-east cross section near the center of the Ranch, and Figure 5 is a composite south-to-north cross section through the lower elevations east of the central part of the Ranch.

Structurally, the Ranch property appears to lie within a depression, with normal faults along the west and east boundaries. Whether this is the result of a graben structure or monocline folds along the west and east is difficult to interpret. The deepest wells drilled by ASA were just over 600 feet and bottomed in the older basalt formation. This older basalt appears to be continuous at least throughout the southern half of the Ranch. The dense upper portion of this basalt formation caps the major production zone of the artesian aquifer. No Paleozoic rocks were encountered during drilling of the three wells, even though Paleozoic formations are identified outside of the boundaries of the Ranch.



SCALE

2000 0 2000 4000

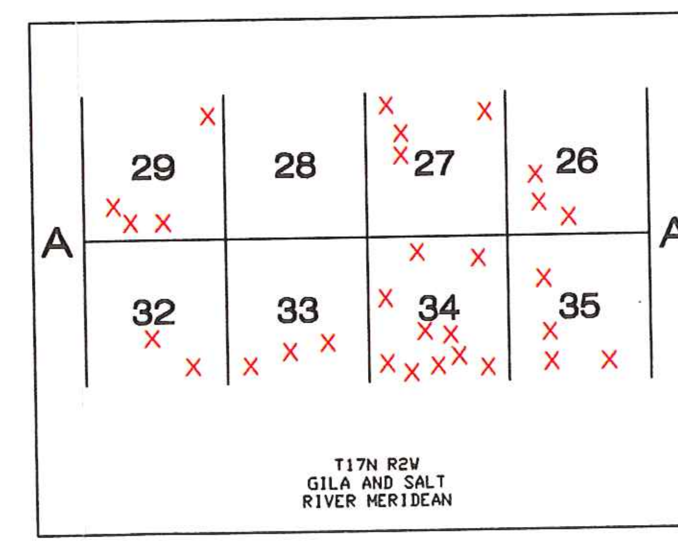
N

Vertical Exageration
4:1

LEGEND

- x Well Locations
- Landmarks
- Unit Boundary
- UAU-Upper Alluvial Unit
- LVU-Lower Volcanic Unit
- Section Lines
- Younger Basalt
- Alluvial Sediments (Older\Younger)
- Latite
- Pyroclastic
- Older Basalt
- Paleozoic Formations

LOCATION



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COMPOSITE E/W CROSS SECTION OF CHINO VALLEY

FIGURE 4

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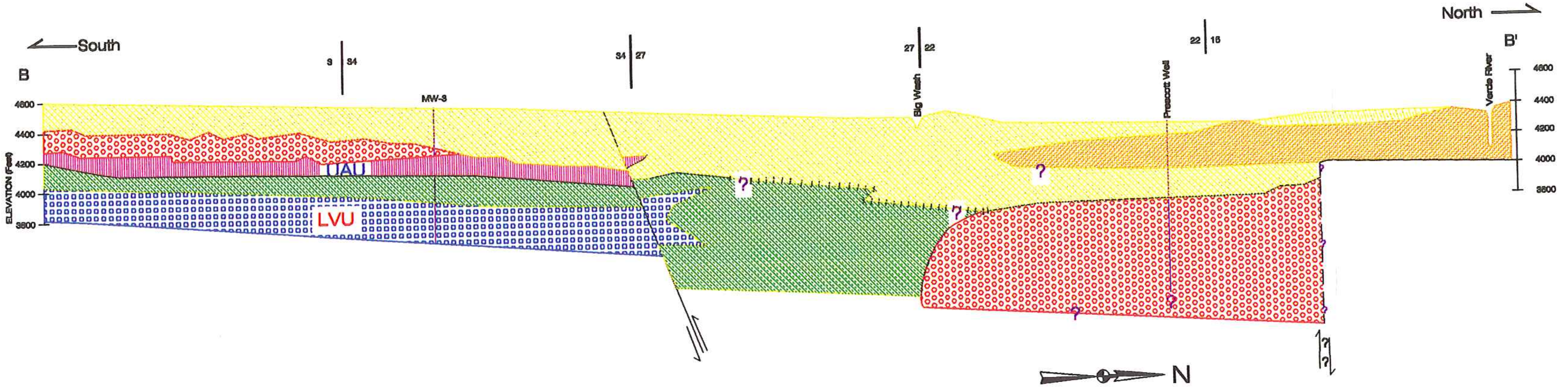


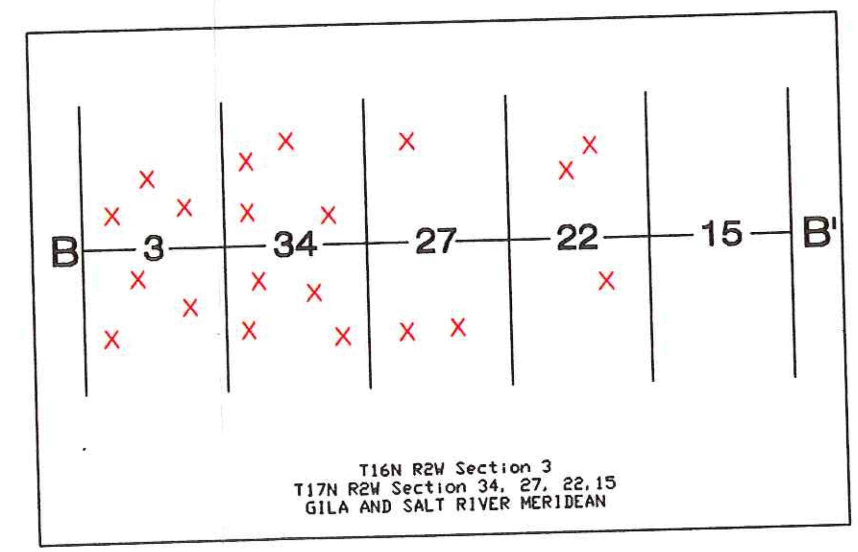
SCALE

Vertical Exageration
6:1

LEGEND

- x Well Locations
- UAU Upper Alluvial Unit
- LVU Lower Volcanic Unit
- Section Lines
- Younger Basalt
- Alluvial Sediments (Older\Younger)
- Latite
- Pyroclastic
- Older Basalt
- Texas Gulch Schist

LOCATION



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COMPOSITE N/S CROSS-SECTION OF CHINO VALLEY

FIGURE 5

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As shown on Figures 4 and 5, the lower portion of the stratigraphic sequence for the Ranch area consists of an older basalt formation overlain by an alluvial sequence composed of fine to coarse sediments. This sequence is interpreted by ASA to be the confined aquifer system referred to as the LVU by ADWR. This designation was confirmed during pump tests with a monitor well network. The upper stratigraphic sequence, referred to as the UAU, consists of a uniform thickness of pyroclastics at its base in the southern portion of the Ranch, and forms the confining layer on top of the LVU. The remainder of the sequence consists of intermittent formations of volcanic flows and a thick deposit of sands, gravels and fine sediments. The latter material consists of terrace deposits and alluvium. The volcanic flows are mainly latite and are thickest along the west and northeast part of the Ranch property.

A thick sequence of Recent alluvial deposits and Quaternary sediment and terrace gravels overlie the latite in places. Gravity data indicate an abnormally thick sequence of low-density material, interpreted as sediments, in Section 27 on Figure 5. No drilling information was available for that area, although seismic data indicate adjacent faulting.

The Prescott well in Section 22 (Figure 5), penetrates a younger basalt that crops out along the Verde Canyon to the north. The well log describes lithologies from 415 to 880 feet as "shale and schist." This may be the Precambrian Texas Gulch Formation that occurs outside the Ranch area and does contain schist and phyllite.

In summary, results of this investigation indicate that the geologic framework for the Ranch consists of a structural basin filled with intermittent deposits of volcanic material with long periods of erosion and deposition. A series of normal faults, several visible at the surface and others identified only by interpretation or seismic investigations, appear to have interrupted the subsurface water flow in the confined aquifer, discharging the water in the Del Rio Springs area in the east-central part of the Ranch property.

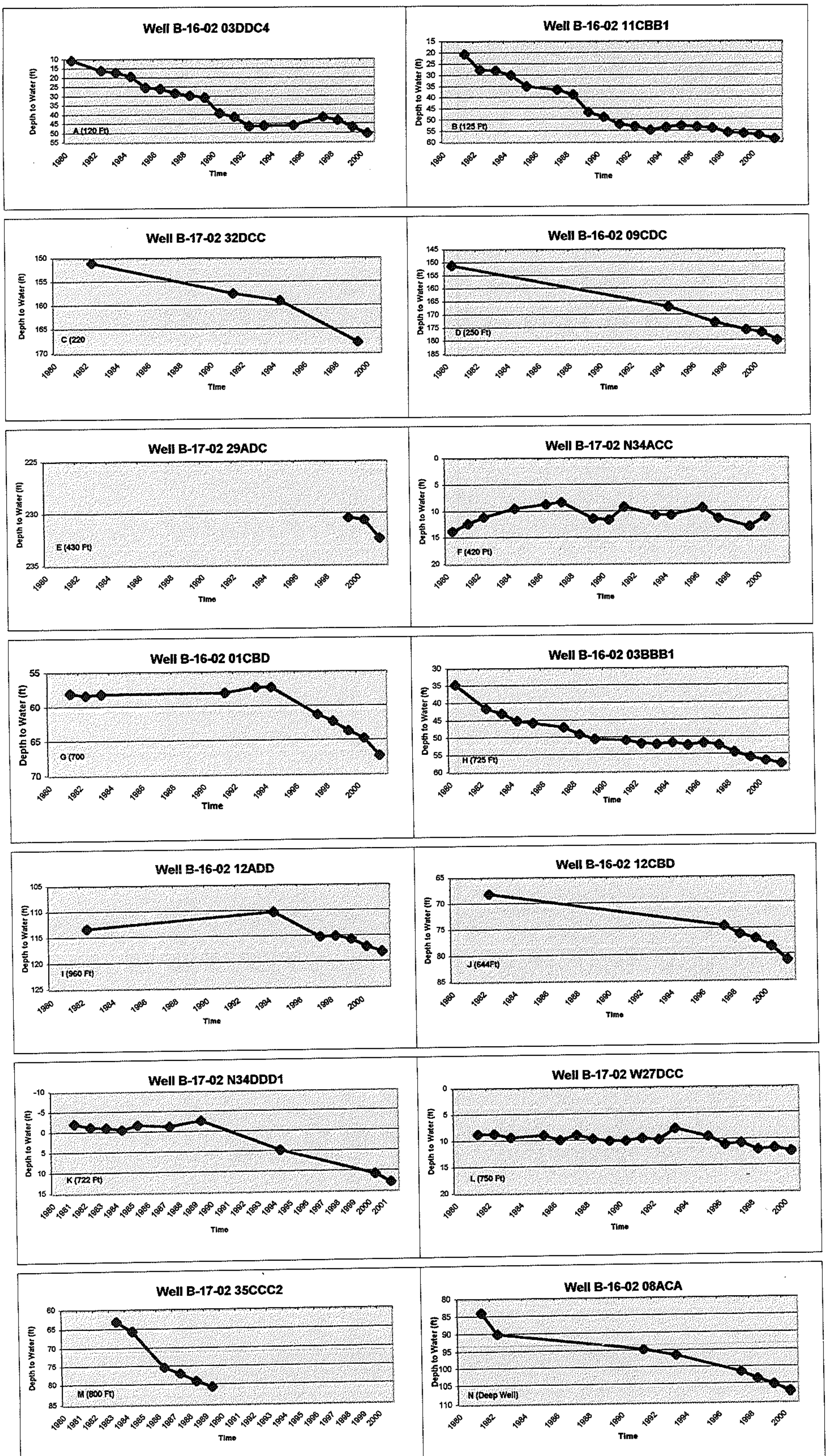
4.1.2 Subsurface Water Investigations

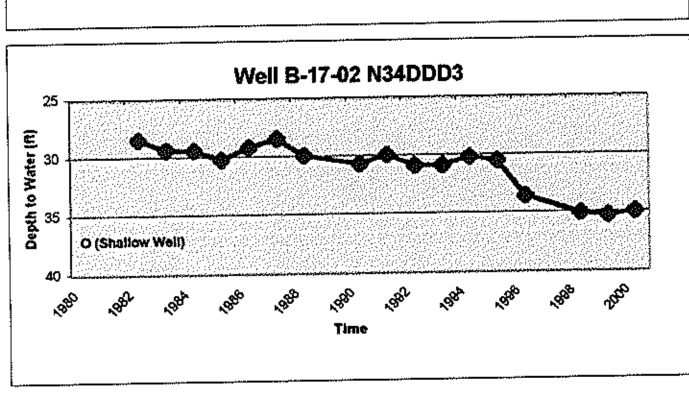
ASA used available drillers' logs and production data for wells on and adjacent to the Ranch property to assist in evaluating the subsurface water system and its relation to the discharges at the Del Rio Springs. Static winter water levels (obtained from ADWR) are illustrated for many existing wells in the study area in Figure 6. These data indicate a variety of water level fluctuations over the past twenty years, with several indications of gradual water level declines which have been most pronounced in the last seven or eight years.

To obtain additional information, ASA installed three monitor wells, two of which were screened in the confined aquifer (ASA, 2001c). Pump tests were conducted using eight wells for observation and two wells for pumping. The monitor wells, including two managed by ADWR, were equipped with pressure transducers and data recorders. The two irrigation production wells were equipped with meters that recorded both the rate and total flow at a given point in time. See Figure 7 for the location of these production and monitor wells.

Short-term (24-hour) and long-term (72-hour) pump tests were conducted during periods of time when local irrigation wells were not in use and after the piezometric surface had reached equilibrium (ASA, 2001e). Pump test data were analyzed using the *Aquifer Test* version 3.01, software package developed by Waterloo Hydrogeologic, Inc. The data were analyzed by standard interpretation methods for confined aquifers, including Theis drawdown and recovery, Cooper & Jacob methods, and the Hantush-Jacob analysis. In addition to pump tests, ASA monitored the water levels in the USU and the LVU aquifers continuously throughout the irrigation season to evaluate long-term trends in drawdown and recovery and to statistically compare water levels in the artesian aquifer with streamflow at the Del Rio Springs USGS streamflow gage.

Calculated storage coefficient in the LVU ranged from 0.00005 to 0.00014. Calculated transmissivity values from the pump test data varied widely, depending upon the type of analytical





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WINTER STATIC HYDROGRAPHS	FIGURE 6

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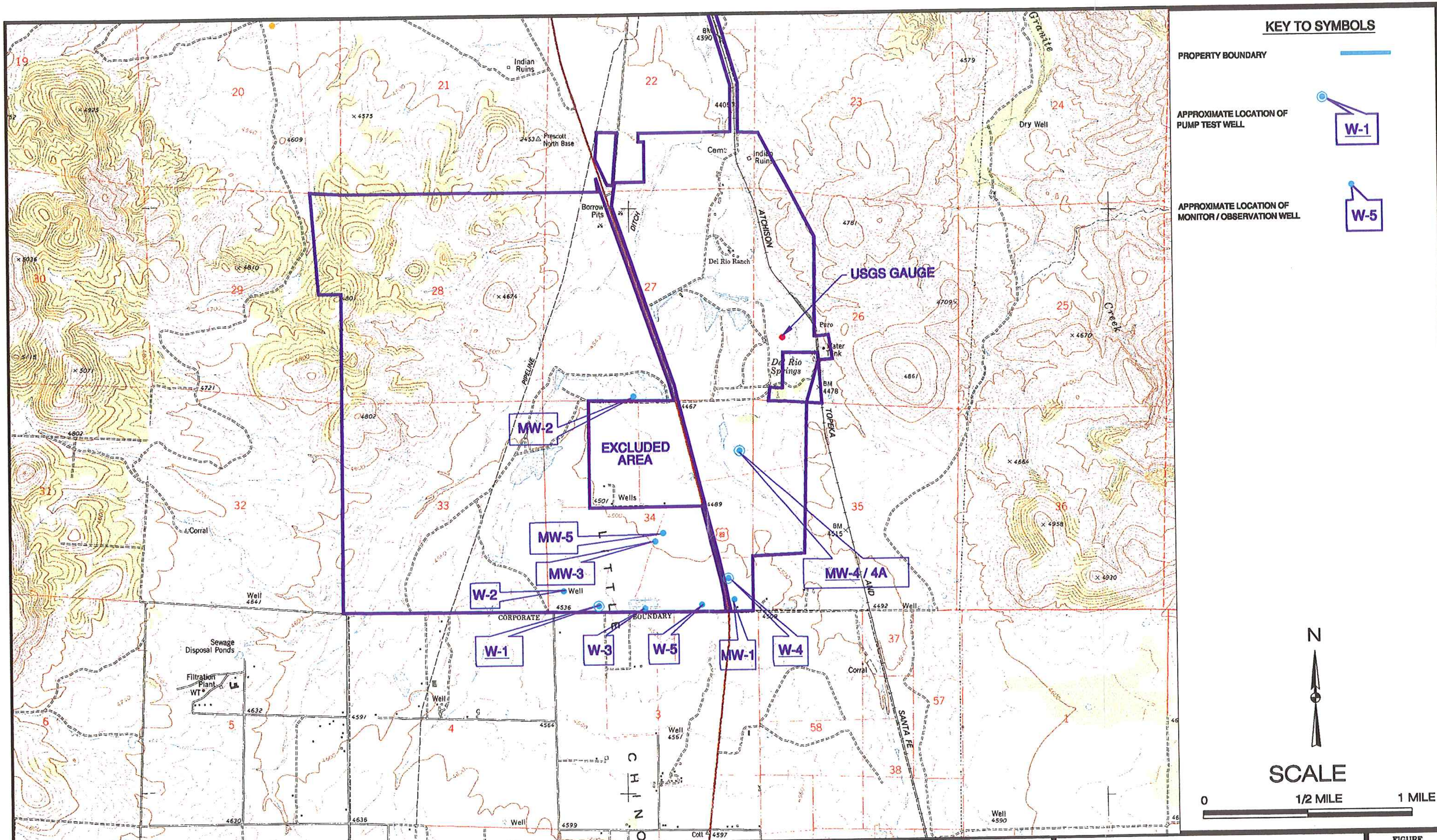

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PUMPING WELL AND MONITOR WELL LOCATION MAP

FIGURE 7

p:\delrio\cad\dwgs\PUMPTEST.dwg 10/12/01 method used, ranging between 7,778 and 97,184 ft^2/day. This information was incorporated into the numerical analysis of the LVU, where the applied transmissivity averaged approximately 70,000 ft^2/day (Section 5).

ASA estimates the thickness of the LVU to range between 180 and 400 feet within the Ranch property. Kriging, a geostatistical estimator, was used to contour the top and bottom elevations of the LVU. The average transmissivity value obtained from the tested wells was then divided by the thickness distribution to obtain conductivity values for the model.

4.1.3 Surface Water Investigations

The surface water system of the subject property and vicinity is composed of several ephemeral streams and perennial springs, which are closely interconnected with the subsurface water system. Typically, streams carry snow melt and rainfall runoff from the mountains to the basin, and much of that flow infiltrates into the subsurface before exiting the basin. Most of streams are dry year round except for the Little Chino Creek, which cuts through the shallow, unconfined aquifer in the Del Rio Springs area, and forms a series of springs along the stream channel (Figure 1).

The four largest springs, located in the southwest corner of Section 26, Township 17 north, Range 2 west, are known to be a permanent and plentiful source of excellent quality water. It is believed that the Springs are supplied largely by leakage from the artesian aquifer in Little Chino Valley and some seepage from the shallow watertable aquifer (Schwalen, 1967). Interpretation from recent drilling and geophysical surveys subcontracted by ASA indicate that three faults cut through the confined aquifer in the area of the Springs and provide direct pathways for the artesian water to flow directly to the surface. Among these faults, the east-west aligned fault also serves as a hydraulic barrier that blocks the flow in the LVU coming from the south (Figure 5) and forces it to the surface at the Springs.

A weir structure was constructed in 1939 downstream of the Del Rio Springs to measure outflow from the Del Rio Springs system. The average annual discharge was approximately 2,828 AF in

1940-1945 before significant withdrawals were made from the artesian aquifer (USGS, 2000). By 1996, the mean annual discharge had decreased to about 1,590 AF due to the decline in water levels in the Little Chino Valley. Table 4 summarizes the annual mean discharge from July 2001 at the USGS new gage located downstream of the Springs. The estimated 5-year mean annual discharge is about 1,427 AF.

Table 4
Average Annual Discharge at Del Rio Springs (USGS) 1996-2000

Water Year	Discharge (feet^3)	Discharge (AF)
1996-97	65,608,591	1,519
1997-98	64,946,880	1,419
1998-99	63,668,160	1,413
1999-00	62,726,400	1,456
2000-01	57,378,240	1,326*
Average	**62,865,654**	**1,427**

*Water Year 2000-01 includes data through May 2001.

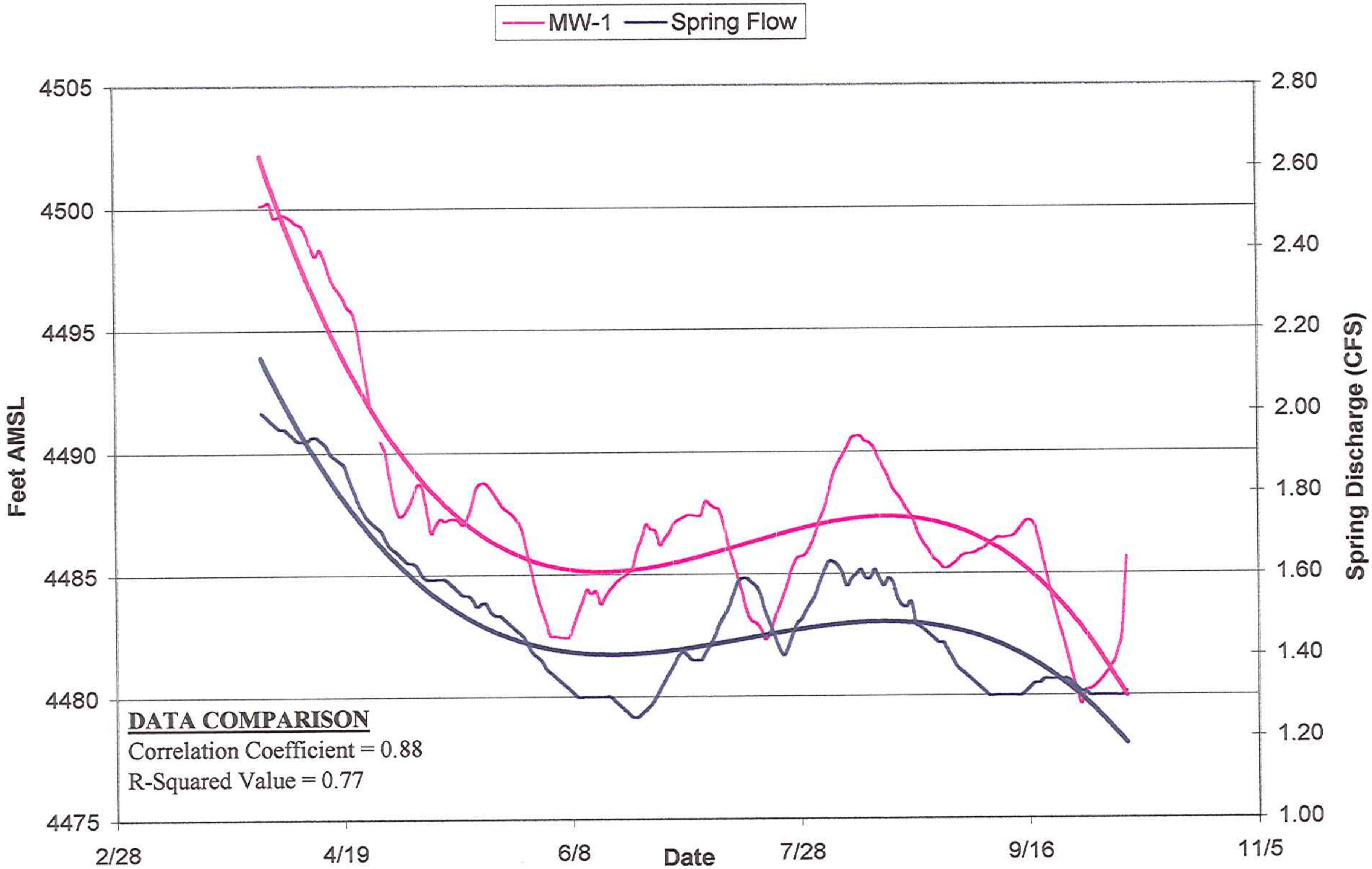
In addition, there are approximately 150 AF of spring water being diverted annually to the east irrigation pond of Del Rio Ranch before it reaches the USGS gage. The volume was estimated based on an average constant flow rate (100 gpm) out of a water pipe, which deliveries the spring water to the east pond. The estimated flow to the irrigation pond plus the measured flow at the USGS gage combine to give an estimated total spring discharge of 1,577 AFY. This does not include any of the spring discharge that flows just below the surface and sustains the wetlands, cienega, and riparian habitat in Little Chino Wash that is so important to the ranching operation.

4.1.4 Artesian Aquifer (LVU)/Surface Water Interaction

Ranchers extracting water from the confined artesian aquifer through the years since deep wells were drilled in the area have noted a direct relationship between irrigation well pumping and reductions in flow of Del Rio Springs. Schwalen (1967) reported a lag time of 6 hours between pumping of the Santa Fe wells and a reduction in flow of 0.75 cubic feet per second (cfs) at the Del Rio Springs gaging station he constructed. He also noted that, in 1943, Santa Fe pumped 855 AF and shipped it via rail to northern Arizona. From his discharge measurements of the Springs that year, he recorded a 600 to 800 acre-foot reduction in flow, therefore almost a one-to-one reduction in flow resulted from pumping that year. According to Schwalen's analysis, water extracted from the artesian aquifer would have been considered surface water according to the most recent Supreme Court rulings in the Adjudication Proceedings of the Gila River.

ASA developed a series of tests and recorded observations to assess whether water pumped from the confined aquifer on other parts of the Ranch had a direct relationship to flow at Del Rio Springs. Data were recorded from pumping wells and drawdown measurements were recorded from monitor wells on the Ranch. Discharge data at the stream gage below Del Rio Springs were also obtained from the USGS. ASA personnel worked closely with ranchers during the 2001 irrigation season so as to accurately record pumping intervals. Accurate flow/totalizing meters were installed on the two producing irrigation wells. Pressure transducers were installed in the monitor wells. Three new wells were drilled in key areas to complete the evaluation.

A statistical analysis was performed to determine the relation between water level elevations in MW-1 (the ADWR monitor well in SE, SE, SE 34-T17N-R2W) and the flow at Del Rio Springs between April 18, 2001 and October 6, 2001 (Figure 8a). Readings from the permanent transducer and data recorder installed in MW-1 by ADWR in 1996 were downloaded periodically and e-mailed to ASA. Groundwater elevations in MW-1 (in feet above mean sea level) and flow from the spring in cfs were first graphed on the primary and secondary axes and trendlines added for initial comparison. The correlation coefficient (0.88) and R-squared coefficient of determination (0.77) were calculated to test the relationships between MW-1 and



*Spring data during major storm events not included in analysis to better emulate general, everyday conditions and relationship of groundwater and spring flow.

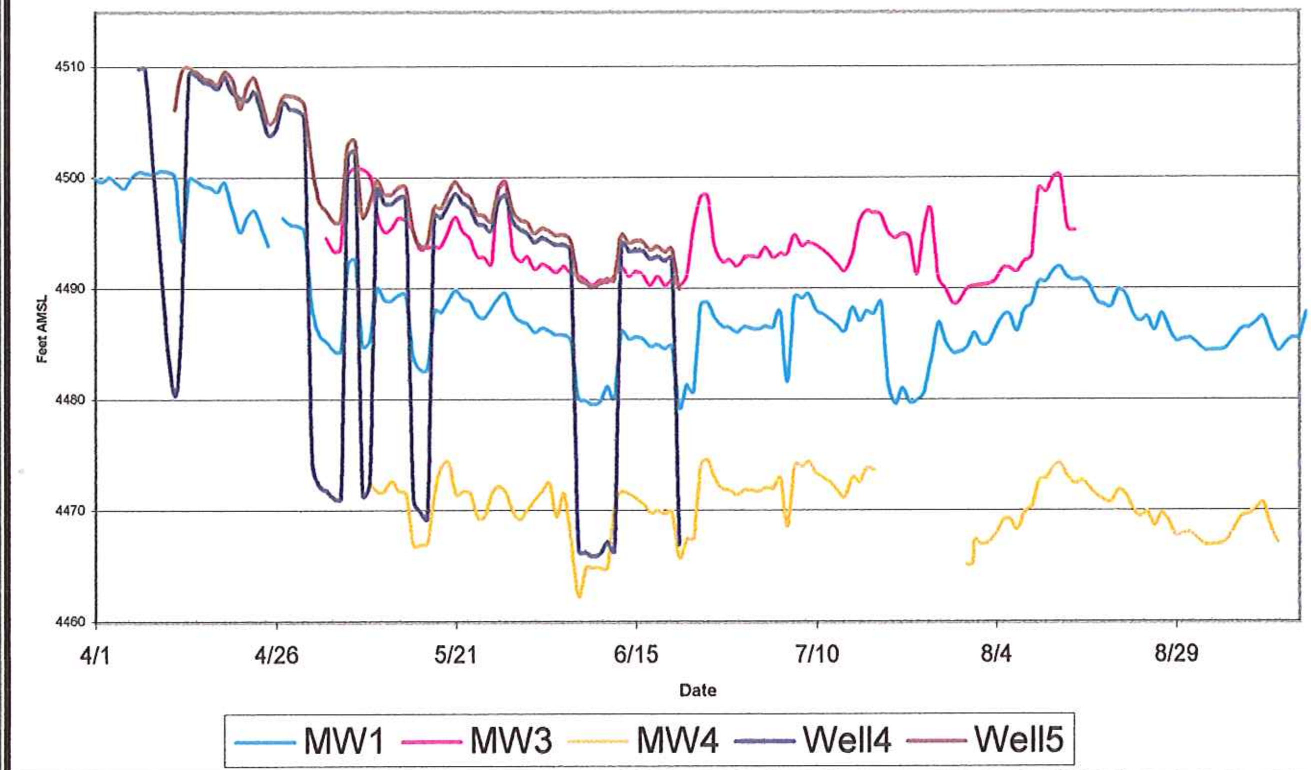
ALLEN, STEPHENSON & ASSOCIATES Hydrologic & Environmental Consultants	**Statistical Comparison of 10-Day Rolling Averages of Groundwater Elevations in MW-1 vs. Del Rio Spring Flow**	FIGURE **8A**

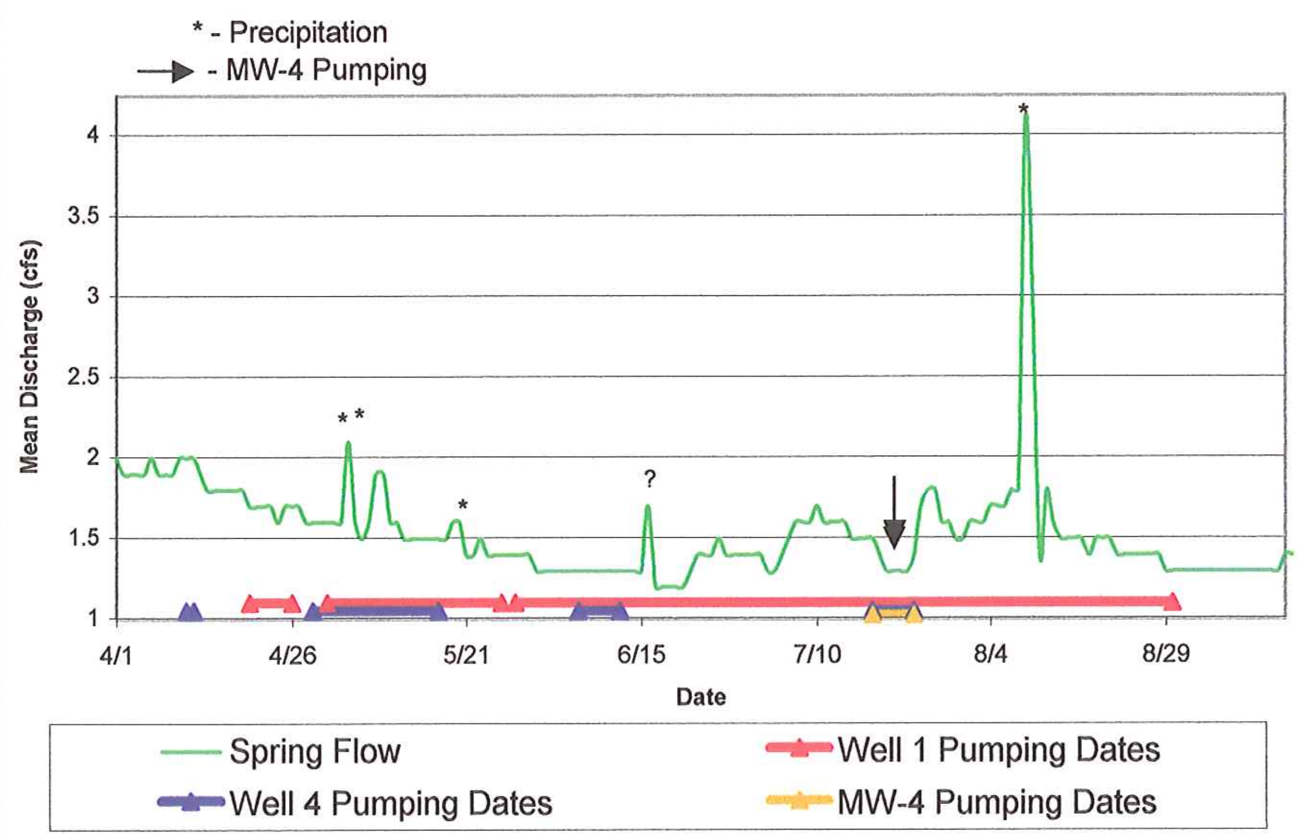
the Springs discharge. Third-order polynomial curves were also fit to each data set to show the general relationship which existed between the head in the artesian aquifer and the spring flow. This relationship is also illustrated on Figure 8a.

During the irrigation season, pumping from well W-1 at 2,100 gpm at various intervals between April 20 and August 30 is reflected by drawdown in wells MW-3, W-3, W-5, MW-1, and W-4 (see Figure 5 for well locations). Pumping from W-4 at 800 gpm at various intervals between April 11 and June 22 is reflected by drawdown at wells MW-4, MW-1, W-5, W-3, and MW-3 *and at the USGS gage below Del Rio Springs*. Pumping from MW-4 at 285 gpm between July 18 and July 24, during which time W-4 was also pumping, is reflected by drawdown at W-3, MW-1, *and at the USGS gage below Del Rio Springs*. Using a small step of logic, if pumping from W-1 affects W-4, and pumping from W-4 affects MW-4, and pumping from MW-4 and W-4 affects flow at Del Rio Springs, as represented on Figure 8b, the confined aquifer throughout the Ranch area exhibits a direct relationship to the Del Rio Springs discharge.

To further demonstrate the impact of pumping on spring flow in greater detail, ASA installed a 285 gpm submersible pump in MW-4 and combined this with the rancher's 800 gpm pumping at W-4 to test the confined aquifer/spring flow relationships. This test, with a combined pumping of 1,085 gpm, ran for six days to monitor any changes in the Del Rio Springs flow. MW-3 was utilized to evaluate the pumping impact on the artesian system. A pressure transducer was installed in the throat of the USGS Parshall flume to measure gage height changes related to the pumping regime. Results of this test, presented in Figure 8b, show a direct relationship between the pumping of these two wells, the discharge at the USGS gage, and the drawdown which occurred in MW-3.

An additional illustration of the close relationship between the artesian system and the flow of the Springs is the low-level sinusoidal oscillations which were noted in both systems during this period of this test. Figure 5 illustrates the locations of the pumped wells, the monitor wells, Del Rio Springs, and the USGS gaging station. In early spring, when data acquisition began, daily oscillations of a minor nature were recognized in the USGS gage height readings. Within these



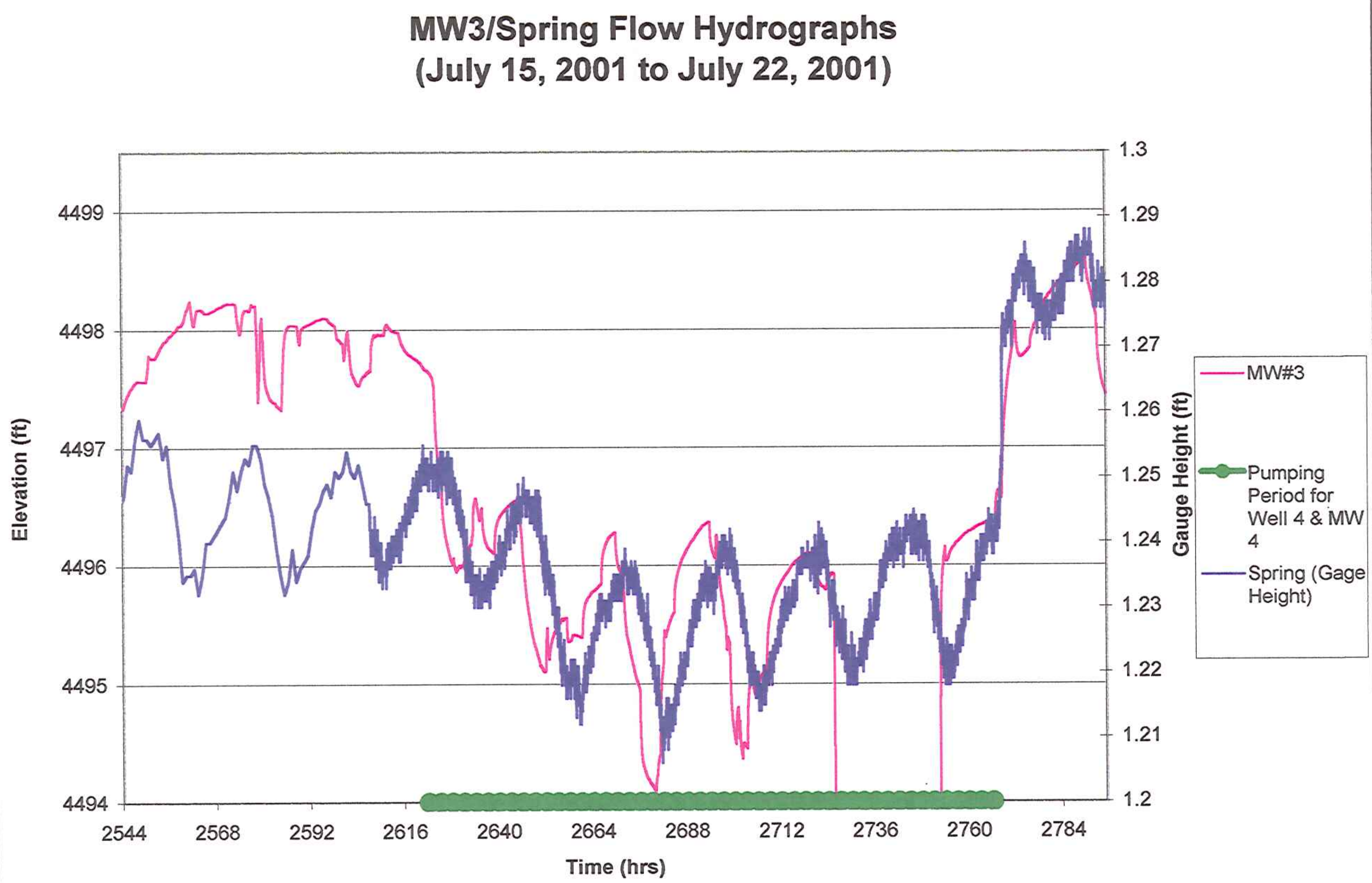


ALLEN, STEPHENSON & ASSOCIATES Hydrologic & Environmental Consultants	Groundwater/Surface Water Interaction	FIGURE 8B

oscillations, the maximum height (reflecting a higher discharge) occurred between 5:30 a.m. and 8:00 a.m.; whereas, the low flows were generally between 5:30 p.m. and 6:30 p.m. During the period of the impact analysis, the data recorder at the gaging station was set to read every minute, and the one in MW-3 was set to be read every 20 minutes (Figure 9). Both sites recorded the same oscillations; however, the average time of the high and low levels of the artesian aquifer occurred 1 hour and 50 minutes earlier than the comparable high and low flow readings recorded at the USGS gaging station. Based on the measured flow velocity at the gaging station, it is estimated that it takes 24 minutes for water discharged from the Springs to reach the gaging station; therefore, the high and low levels of spring flow occur approximately 1 hour and 26 minutes after the same modulations were noted in the artesian aquifer at MW-3. *These observations indicate a direct tie between the discharge of the spring and the changing pressure head in the artesian aquifer.*

Discharge data reported by the USGS (Wirt and Hjalmarson, 2000) on the spring flow for 1994-2001, also show that rainfall was below normal from 1993 to 2000. In fact, the data show that one year during the latter part of this period, rainfall accumulations were only three inches. This was the lowest annual precipitation level that has occurred in the past 60 years. This leads to the conclusion that the recent recorded decline in the Del Rio Springs discharge is more likely related to a paucity of rainfall than it is to sustained pumping from the artesian system. Therefore, these two data sets indicate that the annual discharge as well as the daily and hourly discharge of the Springs is directly related to changes in the hydrostatic pressure which occurs in the artesian aquifer.

Based on the discussion above, it is apparent that the artesian aquifer has a direct and appreciable impact on spring flow. ASA's model analysis appears to bear out the relationship between pumping the confined aquifer and spring flow. The period which has been used (1993-1999) to calibrate the model is representative of the most conservative data ASA could have utilized to determine the impact of long-term pumping on the spring flow and its source, the artesian aquifer.



ALLEN, STEPHENSON & ASSOCIATES Hydrologic & Environmental Consultants	**MW-3 and Spring Flow Hydrographs**	**FIGURE** **9**

4.1.5 Determination of System Components

The aquifer system beneath the subject property consists of an upper alluvial aquifer and a lower volcanic aquifer as conceptualized by ADWR's Prescott model (Corkhill and Mason, 1995). The areal extent of the Del Rio Springs Ranch subsurface system, by ASA's definition, covers the subject property and the area extending one mile beyond the property boundary. Water inflow into the Del Rio LVU and UAU originates from natural mountain front and ephemeral stream

recharge, infiltration from excess irrigation water, and southern boundary inflow from up-gradient subsurface flow in the Little Chino Basin. Recharge from precipitation in the model analysis is considered to be negligible in the immediate area covered by the model, since this water is initially absorbed by the soil and is subsequently lost through evaporation and transpiration. The outflow from the Del Rio subsurface system primarily consists of four components: natural discharge at Del Rio Springs, groundwater seepage in the cienega both north and south of the spring, northern boundary outflow through the narrow gap between the bedrock hills, and water withdrawal for a variety of uses by wells.

In the following paragraphs, the methods used to estimate each component of inflow and outflow are described. A summary of the subsurface water budget for the Del Rio system is also presented.

4.1.5.1 Natural Recharge

The subject property is located at the north end of Little Chino Valley, surrounding by low hills in front of North Sullivan Butte on the west and western extension of the Black Hills on the east. Fairly large areas of bedrock (latite, quartzite, basalt and limestone) are exposed in the hills at the margins of the valley. Fractures in these rocks may lead to the infiltration of water directly from the mountains. In addition, several washes on the subject property and in the immediate vicinity may also be sources of recharge to the subsurface. Therefore, natural recharge may not be excluded even though the watershed on which the Del Rio Ranch development resides is in the outflow area of Little Chino Sub-Basin. The volume of natural recharge from mountain front and ephemeral streams was estimated based on the watershed area associated with or adjacent to the subject property and a base annual recharge rate calculated using the area of Granite Creek and Willow Creek Watersheds, as well as annual median stream flow on those creeks during 1933-1947 (Corkhill and Mason, 1995).

Table 5 was constructed to illustrate the recharge rate for the Granite Creek watershed (48 AFY per square mile [AF/mi^2]), and the estimated recharge rate for the Willow Creek watershed at about 39 AF/mi^2. Rates for watersheds adjacent to the subject property (north Granite Creek and north Sullivan Buttes) were calculated by first normalizing the individual watershed precipitation rates to the average Granite and Willow Creek rate of about 19.5 inches/year, and then multiplying the normalized precipitation rate by the average Granite Creek and Willow Creek recharge rate of about 44 AF/mi^2.

Table 5

Estimated Natural Recharge for Watersheds within the Study Area

Watershed	Area (miles^2)	Average Precipitation (in/yr)	Median Recharge Rate (AF/mi^2)	Median Annual Recharge (AFY)
Willow Creek	23.3	19	39	900
Granite Creek	49.1	20	48	2350
Average	*36.2*	*19.5*	*44*	*1590*
North Granite Creek (subject property)	7.0	12	27	190
North Sullivan Buttes	4.4	12	27	120
Total for Study Area				310

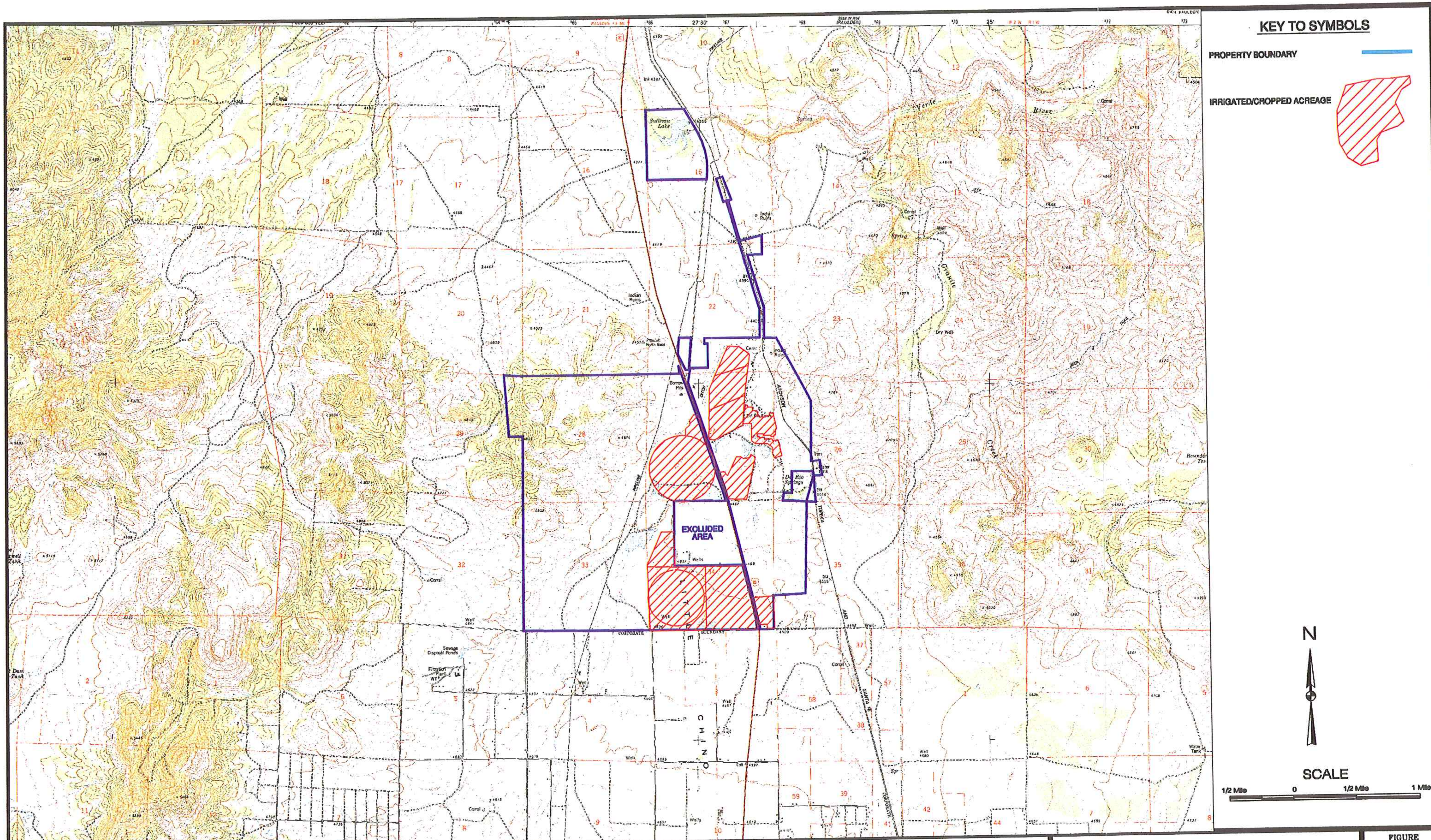
Modified from Corkhill and Mason, 1995

Table 5 shows that approximately 310 AF of mountain front and stream water might recharge the Del Rio subsurface system each year. It should be pointed out that this value is meant to be the upper limit of natural recharge in the immediate area, which will be adjusted later during subsurface water balance analyses and the calibration of the Del Rio MODFLOW model.

4.1.5.2 Agricultural Recharge

The volume of irrigation water was calculated by combining recorded agriculture-related groundwater pumpage with estimated spring water diversion within the subject property and its vicinity. As listed in Table 3, an average 3,714 AF of water were pumped (exclusive of A & K Railroad wells) for agricultural purposes between 1995 and 1999. In addition, approximately 1,577 AF of spring discharge was diverted and stored in holding ponds or used directly for irrigation. Considering evaporation loss of spring water during the storage and delivery process, a volume of 319 AF was deducted based on an estimation of 58 acres of irrigation-associated free water surface and an evaporation rate of 5.5 AF/acre of free water per year. Therefore, the total volume of irrigation water that finally went into the field averaged 4,985 AFY over the past five years (1995-1999).

The volume of recharge from excess irrigation water was also estimated by the method used by Corkhill and Mason (1995). It was assumed that the entire volume of water associated with irrigation inefficiency could potentially be recharged. For the PRAMA, the average annual irrigation efficiency for farms in that area is 50 percent based on the figure provided by former local AMA Director Phil Foster for the ADWR Prescott model. However, the efficiency, estimated by ASA for Del Rio Ranch solely, is much higher (75 percent). The latter was calculated based on the type of crops grown on the Ranch, annual water consumption by the crop, and the volume of irrigation water delivered annually. In this study, 60 percent irrigation efficiency is used given the fact that Del Rio Ranch covers most of the study area. This value will be examined during the model calibration. Initially, we consider that 1,994 AF (4,985 x (1-0.6)) of irrigation water seeps into the upper alluvial aquifer. The areal distribution of the annual agricultural recharge volumes was determined based on the distribution of Irrigation Grandfathered Rights (IGFR) cropped acreage on the subject property (Figure 10). The temporal



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IGFR CROPPED/ACREAGE MAP

FIGURE
10

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distribution of the annual agricultural recharge volumes was proportional to the average distribution of agricultural pumpage reported by ADWR for that period (Table 3).

4.1.5.3 Lateral Inflow

Flux entering the study area from the southern boundary of the subject property was determined using the ADWR's updated version of the Prescott model (Nelson, 2001). The Prescott model covers the entire AMA, including the Little Chino Valley basin, and provides an estimate of flux across any interior cross-section of the valley with relatively high accuracy. Nelson, ADWR modeler, conducted a simulation using the Prescott model for the purpose of our investigation. His estimate of the flux, moving from south to north across the southern model boundary one half mile from the division line between T16N and T17N, was approximately 4,500 AF in 1999. This value represents the surplus of groundwater from storage in upper Little Chino Basin after withdrawals of all up-gradient wells, including the wells for the City of Prescott and the Town of Chino Valley.

4.1.5.4 Natural Discharge

Natural discharge of subsurface water occurs at Del Rio Springs, which is located at the mid-eastern side of the subject property. Monitoring of outflow from the Springs was initiated as early as 1939. Information regarding the historical and current measurements of spring flow is summarized in Section 4.1.3 in terms of annual discharge rate. As listed in Table 4, the average annual discharge captured by the USGS gage from the Del Rio springs is approximately 1,427 AF for the past 5 years. In addition, it is estimated that approximately 150 AF of spring water are routinely diverted (to the east irrigation pond of Del Rio Ranch) before it reaches the downstream gage. Therefore, the total measured annual discharge from the Springs is estimated to be 1,577 AFY. This does not include any of the spring water that is used by native pasture in the floodplain of the Little Chino Wash.

4.1.5.5 Subsurface Water Seepage

A cienega of approximately 145 acres is located both south and north of Del Rio Springs, where permanent pasture is found year-round. The lush cienega area has benefited from the seepage of water from the shallow unconfined aquifer, as well as the artesian aquifer in this area. The amount of seepage was estimated using water consumption of vegetations growing on the cienega. As listed in the PRAMA TMP, the consumptive rate of native pasture is 1.5 AF/ac/yr. Therefore, approximately 217.5 AF of Little Chino subflow is consumed by cienega vegetation each year and used for ranching purposes. This water, plus the water that flows into Bond Lake, serve as a conservative measurement of outflow occurring in this area. The actual volume of seepage may vary substantially from time to time depending on the elevation of the groundwater table on site.

4.1.5.6 Water Pumpage

Water pumpage in the study area is primarily from irrigation wells. Most of these wells, able to produce more than 100 AF of water annually, were drilled into the artisan aquifer and have a well depth of over 500 feet. The Arizona Groundwater Code has reporting requirements for all wells that pump more than 10 AFY. ADWR's ROGR database provided all reported pumping information for the study area (Table 3).

In addition to the reported ROGR pumpage, there is a substantial volume of "exempt" pumpage from domestic and livestock wells that is unreported. Exempt wells are permitted to pump at a rate no greater than 35 gallons per minute, or in excess of 10 AFY. Domestic wells may withdraw water either from the artisan or upper unconfined aquifer and have an average pumping rate of 0.5 AF per well per year per household (Foster, 2001). Stock wells are mostly shallow and windmill-operated, having a pumping rate of approximately 7.25 AF per well per year. The latter value assumes a pumping rate of 6 gpm and75 percent of operational time for windmills in that area.

To illustrate the location of groundwater pumping wells on the subject property and in its vicinity, a Well Inventory Map was plotted (Figure 3). There are a total of 17 active irrigation wells concentrated in Sections 34 and 35 of T17 N and in Sections 3, 4 and 5 of T16N. Additionally, 44 domestic wells were found, 27 of which are in the study area. The domestic wells are scattered throughout the study area, with a relatively dense distribution immediately south of the subject property. Only four stock wells and one industrial well are identified in the study area. Pumpage from the industrial well (Santa Fe or A & K Railroad) only occupies a small percentage of total pumpage in the area of interest, and, as such, was combined with irrigation pumpage in Table 6. Table 6 summarizes the average annual pumpage for each type of well and the total pumpage for all wells in the study area.

Table 6

Average Annual Pumpage for Agricultural, Domestic and Stock Pond Uses (1995-1999)

Well Type	Number of Wells	Annual Pumpage (AF)
Irrigation Well	17	3716.48
Domestic Well	27	13.5
Stock Well	4	29
Total	66	3758.98

4.1.5.7 Lateral Outflow

The groundwater underflow discharged into the Big Chino Basin at the northern boundary of the subject property is about 1,500 to 2,000 AFY for the predevelopment period (circa 1940), as estimated by the ADWR Prescott Model (Corkhill and Mason, 1995). The flow was increased to 1,800 AF in 1999 based on the simulation conducted by Neilson using the updated Prescott model. In the following Del Rio water system budget calculation, 1,500 AF of lateral outflow is used. This value was evaluated as part of the model calibration.

4.1.5.8 Water Budget and Change of Storage

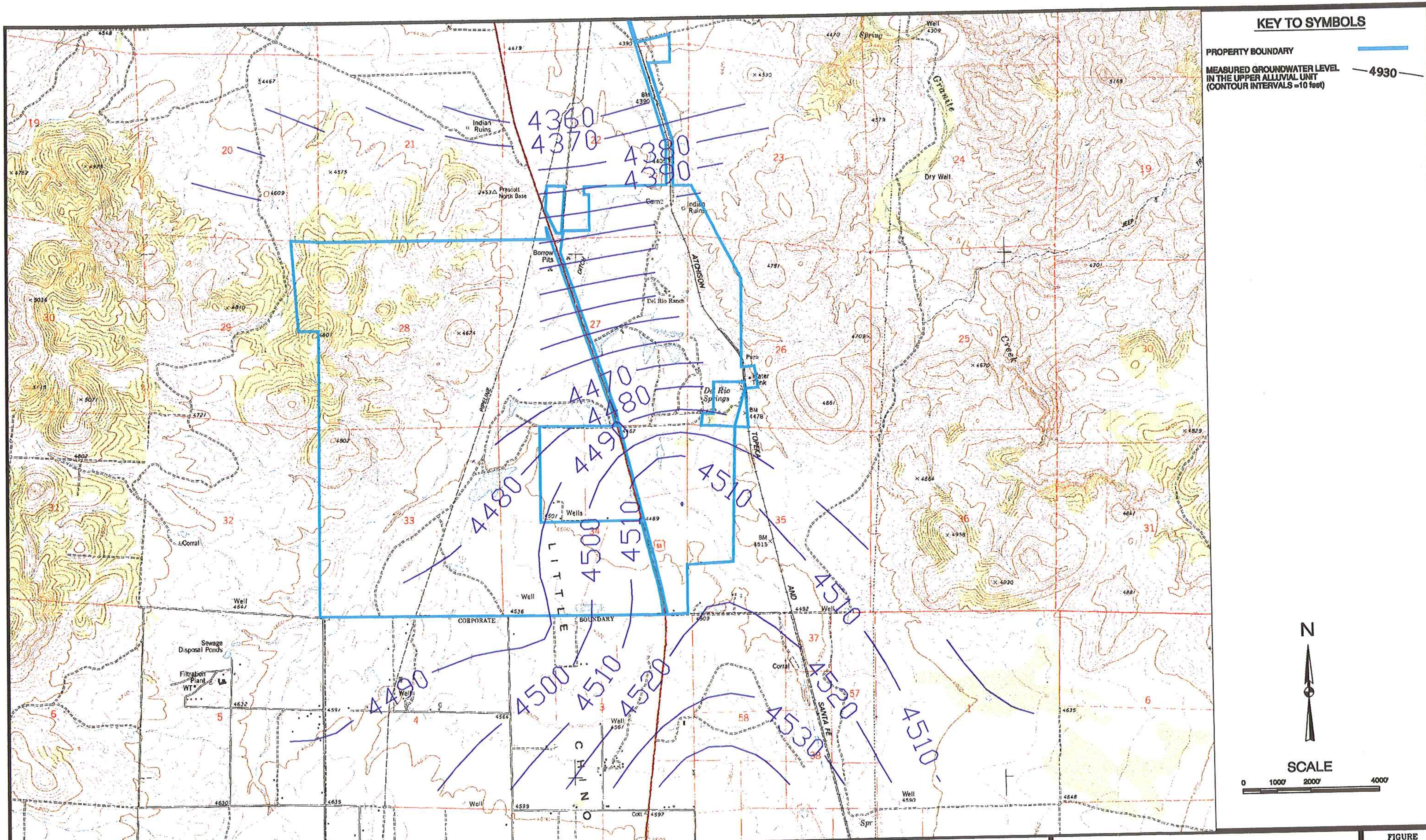
The water budget for the Del Rio subsurface system is summarized and presented in Table 7. The budget includes all major inflow and outflow components as discussed above, and serves as a conservative measurement of the existing water conditions. The total annual inflow and outflow of the Del Rio subsurface system is 6,892 AF and 7,053.5 AF, respectively. The net difference indicates 1,615 AF of deficit in subsurface water storage. If that were the case, then a general head reduction would have been observed during the past several years and, in reality, that has occurred.

Table 7

Annual Water Budget for Existing Del Rio Subsurface Flow System

Inflow	AFY
Natural recharge at MT Front and Stream	310
Agricultural Recharge	2,082
Lateral Inflow from Little Chino Basin	4,500
TOTAL INFLOW	6,892
OUTFLOW	
Natural Discharge at Del Rio Springs	1,577
Subsurface Water Pumpage	3,759
Subsurface Seepage into Cienega	217.5
Lateral Outflow to Big Chino Basin	1,500
TOTAL OUTFLOW	7,053.5
CHANGE OF STORAGE	161.5

It should be noted that the above analysis is only from the point of a standard water balance, regardless of the structure of the subsurface aquifer system. To further evaluate the change of water storage regarding the specific aquifer system, contour maps were plotted for both the upper alluvium aquifer (unconfined) and the lower volcanic aquifer (confined) systems using 1994 water level measurements from ADWR's GWSI database (Figures 11 and 12). In order to capture regional groundwater level characteristics, the water elevation data were incorporated from an area much greater than the study area (covering both T17N and T16N, R2W). As indicated in Table 8, measurements from wells less than 300 feet deep were classified as



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CONTOUR MAP OF MEASURED GROUNDWATER LEVELS IN THE UPPER ALLUVIAL UNIT (1994)

FIGURE 11

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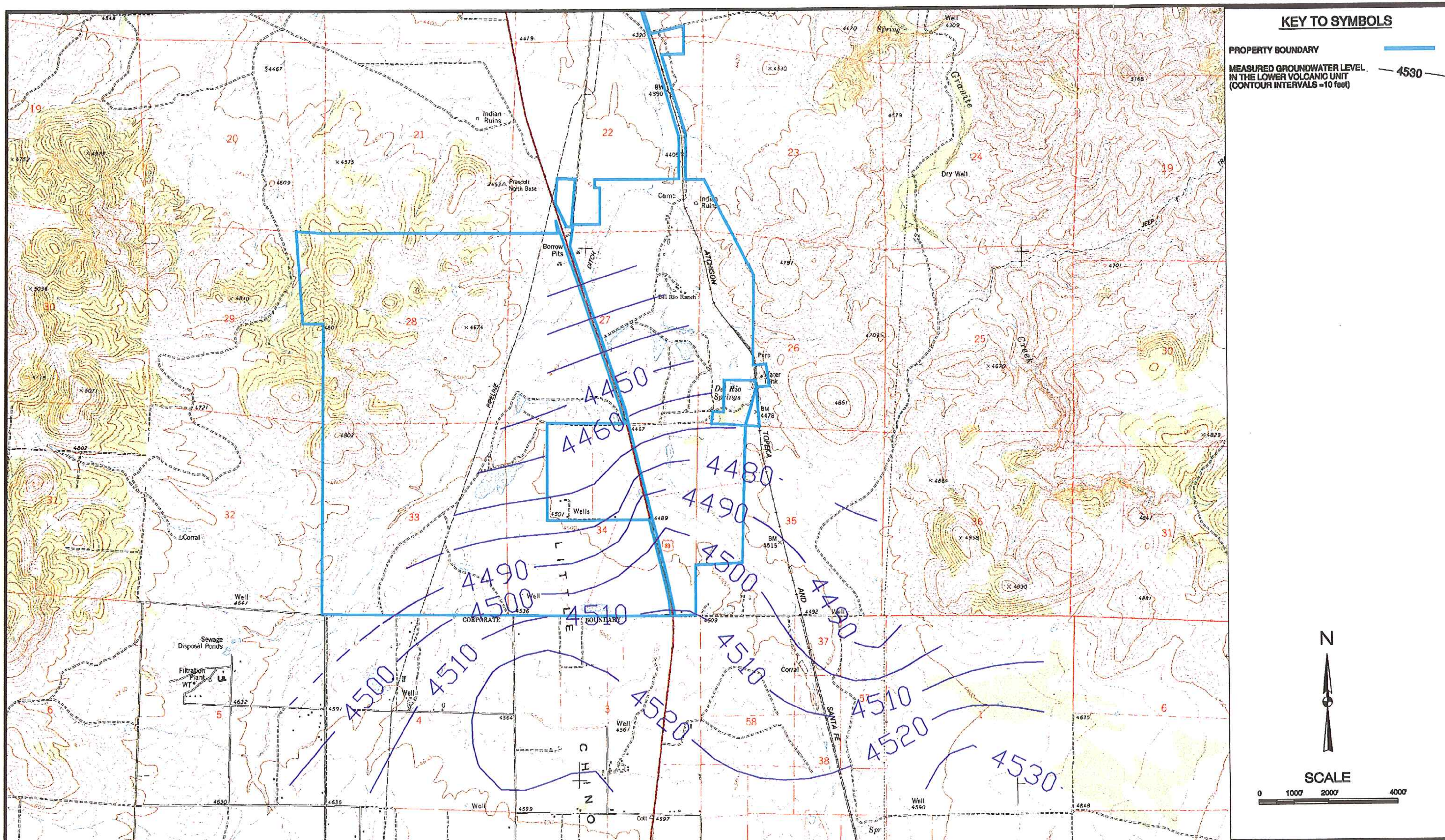

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CONTOUR MAP OF MEASURED GROUNDWATER LEVELS IN THE LOWER VOLCANIC UNIT (1994)

FIGURE 12

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Table 8

Monitor Well Elevations Inventory

Cadastral	Reg No.	Well Altitude	Date	Depth to Water	Water Surface Altitude
B-16-02 01CBD	611903	4590	20-Apr-38	-15.55	4606
			03-Mar-94	57.2	4533
			05-Feb-97	61.2	4529
			01-Mar-98	62.2	4528
			23-Feb-99	63.6	4526
			25-Feb-00	64.7	4525
			14-Mar-01	67.2	4523
B-16-02 01CCD	611902	4592	01-Apr-38	-13.2	4605
			03-Mar-94	85.7	4506
			23-Feb-99	90.6	4501
B-16-02 01CDA	611901	4625	30-Mar-52	67.31	4558
			03-Mar-94	95	4530
B-16-02 02ABD1	623514	4510	11-Apr-39	-67	4577
			24-Feb-99	8.2	4502
B-16-02 02ABD2	803169	4505	22-Mar-50	-62.8	4568
			28-Feb-94	18.76	4486
			24-Feb-99	23.55	4481
B-16-02 03BBB1		4539	23-Oct-80	34.5	4505
			01-Mar-94	51.5	4488
			10-Mar-95	52.2	4487
			18-Mar-96	51.6	4487
			06-Feb-97	52.2	4487
			12-Mar-98	54.3	4485
			24-Feb-99	55.7	4483
			28-Feb-00	56.7	4482
			13-Mar-01	57.6	4481
B-16-02 03BBB3	508299	4538	27-May-86	25.3	4513
			28-Feb-94	23.23	4515
B-16-02 03CDC1	626032	4595	20-Apr-38	-3.7	4599
			01-Mar-94	81.6	4513
B-16-02 03CDC2		4593	23-Mar-40	-6.37	4599
			01-Mar-94	71.5	4522
			23-Feb-99	75.7	4517
B-16-02 03DDC4	603665	4590	24-Oct-80	10.4	4580
			01-Mar-94	37.6	4552
			09-Mar-95	45.7	4544
			18-Mar-96	48.2	4542
			06-Feb-97	41.3	4549
			12-Mar-98	43	4547

Table 8 (cont.)

Cadastral	Reg No.	Well Altitude	Date	Depth to Water	Water Surface Altitude
B-16-02 03DDC4 (cont.)	603665	4590	23-Feb-99	46.7	4543
			28-Feb-00	50	4540
			13-Mar-01	52.4	4538
B-16-02 04ADC		4570	08-Apr-43	-32.35	4602
			01-Mar-94	43.1	4527
			24-Feb-99	47.2	4523
B-16-02 04BAB	611754	4570	23-Oct-80	70	4500
			01-Mar-94	82.6	4487
			24-Feb-99	93	4477
B-16-02 04CCC	806218	4625	06-Feb-81	110.7	4514
			01-Mar-94	131.6	4493
			11-May-99	139.9	4485
B-16-02 05DAA	602545	4587	19-Nov-80	84.2	4503
			01-Mar-94	97.3	4490
			11-May-99	106.2	4481
B-16-02 07DCA	635120	4722	07-Feb-81	185.1	4537
			24-Feb-99	204.5	4518
B-16-02 08ACA		4615	16-Apr-41	44.95	4570
			01-Mar-94	106.35	4509
			06-Feb-97	101.4	4514
			03-Mar-98	103.4	4512
			24-Feb-99	105	4510
			29-Feb-00	107	4508
			13-Mar-01	109.4	4506
B-16-02 09AAA		4602	17-Oct-80	48.2	4554
			24-Feb-99	103.8	4498
B-16-02 09ADC	607273	4638	14-Jun-45	69.6	4568
			01-Mar-94	119.6	4518
			23-Feb-99	126.8	4511
B-16-02 09CDC	634748	4688	15-Oct-80	150.9	4537
			04-Mar-94	166.8	4521
			20-Feb-97	172.9	4515
			11-May-99	175.8	4512
			29-Feb-00	176.7	4511
			13-Mar-01	179.7	4508
B-16-02 10BCD1	605843	4622	01-Apr-35	25.5	4597
			01-Mar-94	105.8	4516
			23-Feb-99	110.2	4512

Table 8 (cont.)

Cadastral	Reg No.	Well Altitude	Date	Depth to Water	Water Surface Altitude
B-16-02 10BDC	605844	4635	01-Mar-48	39.9	4595
			23-Feb-99	116.9	4518
B-16-02 11CBB1	602559	4610	21-Apr-38	51.77	4558
			15-Feb-94	53.2	4557
			19-May-94	55.15	4555
			18-Aug-94	51.3	4559
			16-Nov-94	50.35	4560
			16-Feb-95	52.5	4558
			18-May-95	53.6	4556
			17-Aug-95	46.7	4563
			14-Nov-95	50.35	4560
			12-Feb-96	53	4557
			15-May-96	52.4	4558
			13-Aug-96	49.2	4561
			19-Nov-96	51	4559
			13-Feb-97	53.6	4556
			19-May-97	54.3	4556
			11-Aug-97	52.7	4557
			14-Nov-97	55	4555
			09-Feb-98	55.51	4554
			11-May-98	54.95	4555
			10-Aug-98	54.14	4556
			16-Nov-98	53.32	4557
			10-Feb-99	55.91	4554
			23-Feb-99	55.9	4554
			11-May-99	56.1	4554
			11-Aug-99	52.05	4558
			08-Nov-99	54.85	4555
			11-Feb-00	56.64	4553
			15-Mar-00	57.16	4553
			02-Jun-00	57.3	4553
			08-Aug-00	56.49	4554
			21-Nov-00	58.07	4552
			13-Mar-01	58.45	4552
B-16-02 12ACD	606298	4628	03-Mar-94	100.3	4528
B-16-02 12ADD	606295	4648	28-Mar-48	55.6	4592
			03-Mar-94	110.2	4538
			16-May-97	115.1	4533
			01-Mar-98	115	4533

Table 8 (cont.)

Cadastral	Reg No.	Well Altitude	Date	Depth to Water	Water Surface Altitude
B-16-02 12ADD (cont.)	606295	4648	22-Feb-99	115.6	4532
			25-Feb-00	117.1	4531
			12-Mar-01	118.1	4530
B-16-02 12CBD	606300	4600	18-Apr-41	-4.96	4605
			21-Feb-97	74.4	4526
			01-Mar-98	76	4524
			22-Feb-99	76.9	4523
			25-Feb-00	78.41	4522
			14-Mar-00	78.48	4522
			02-Jun-00	87.41	4513
			07-Aug-00	87.56	4512
			21-Nov-00	83.25	4517
			12-Mar-01	81.01	4519
B-16-02 12DDD	606294	4657	06-Apr-47	58.1	4599
			03-Mar-94	134.6	4522
			22-Feb-99	122.9	4534
B-16-02 13BCB	625113	4622	06-Feb-81	114.3	4508
			28-Feb-94	97.3	4525
			22-Feb-99	104.4	4518
B-16-02 14BBB	802111	4655	06-Apr-44	57.26	4598
			02-Mar-94	129.8	4525
			22-Feb-99	134.8	4520
B-16-02 14BCC	606022	4659	02-Jul-62	135.2	4524
			03-Mar-94	154.9	4504
			23-Feb-99	136.9	4522
			28-Feb-00	145.8	4513
			13-Mar-01	151	4508
B-16-02 14CCC	606023	4680	01-Apr-38	77.4	4603
			23-Feb-99	173.1	4507
			14-Mar-01	179.3	4501
B-16-02 14CDA	606021	4674	10-Apr-49	89.11	4585
			28-Feb-94	163.7	4510
			04-Feb-97	172.2	4502
			23-Feb-99	152.5	4522
			28-Feb-00	163.4	4511
			04-Apr-01	171.1	4503
B-16-02 15AAA		4644	29-Oct-80	51.8	4592
			02-Mar-94	93.46	4551
			09-Mar-95	98.8	4545
			18-Mar-96	105.2	4539

Table 8 (cont.)

Cadastral	Reg No.	Well Altitude	Date	Depth to Water	Water Surface Altitude
B-16-02 15AAA (cont.)		4644	06-Feb-97	99	4545
			12-Mar-98	102.2	4542
			23-Feb-99	103.9	4540
			28-Feb-00	106.2	4538
			13-Mar-01	110.8	4533
B-16-02 16AAD	504619	4675	16-Mar-95	149.2	4526
			06-Feb-97	154	4521
			03-Mar-98	154.8	4520
			22-Feb-99	155.3	4520
			28-Feb-00	157.8	4517
			12-Mar-01	160.4	4515
B-16-02 17BDC	629377	4700	10-Feb-81	165	4535
			01-Mar-94	166.2	4534
			09-Mar-95	167.2	4533
			18-Mar-96	168.5	4532
			06-Feb-97	171.8	4528
			03-Mar-98	172.5	4528
			23-Feb-99	175.5	4525
			29-Feb-00	176	4524
			13-Mar-01	178.4	4522
B-16-02 19BDA	503896	4792	26-Apr-83	186.72	4605
			04-Mar-94	180.1	4612
			08-Mar-97	180.5	4612
			25-Feb-99	187.8	4604
B-16-02 19BDB	503898	4845	04-Mar-94	196.1	4649
			25-Feb-99	214	4631
B-16-02 19BDC	503899	4808	26-Apr-83	200.26	4608
			25-Feb-99	228	4580
B-16-02 20BBC2	614804	4731	23-Feb-82	53.9	4677
			02-Mar-94	50	4681
			23-Feb-99	49.9	4681
B-16-02 21BAA1	604724	4738	01-Mar-48	152.29	4586
			02-Mar-94	216.8	4521
			09-Mar-95	217.6	4520
			18-Mar-96	219.4	4519
			06-Feb-97	221.8	4516
			02-Apr-98	222.5	4516
			23-Feb-99	223.9	4514
			29-Feb-00	226.4	4512
			12-Mar-01	228.7	4509

Table 8 (cont.)

Cadastral	Reg No.	Well Altitude	Date	Depth to Water	Water Surface Altitude
B-16-02 21BAA2	604725	4741	23-Jun-81	233.44	4508
			02-Mar-94	218.6	4522
			23-Feb-99	225.6	4515
			24-Feb-00	228.16	4513
			14-Mar-00	227.63	4513
			29-Mar-00	228.32	4513
			25-May-00	240.25	4501
			02-Jun-00	242.3	4499
			08-Aug-00	243.22	4498
			21-Nov-00	236.11	4505
			12-Mar-01	230.42	4511
B-16-02 21CCC	536853	4825	02-Mar-94	301.3	4524
B-16-02 22DBA	606024	4726	29-Mar-48	125.86	4600
			28-Feb-94	192.4	4534
			23-Feb-99	201.8	4524
			28-Feb-00	201	4525
			13-Mar-01	207.6	4518
B-16-02 22DBD	606025	4733	29-Mar-48	140.58	4592
			23-Feb-99	212.2	4521
			28-Feb-00	214.6	4518
			13-Mar-01	217.5	4516
B-16-02 23CBA	800688	4680	29-Mar-48	97.26	4583
			20-Feb-97	164.7	4515
			27-Feb-98	166	4514
			22-Feb-99	167.6	4512
			24-Feb-00	169.2	4511
			14-Mar-00	168.99	4511
			04-Apr-00	168.69	4511
			02-Jun-00	180.37	4500
			08-Aug-00	181.43	4499
			21-Nov-00	176.26	4504
			12-Mar-01	171.95	4508
B-16-02 27ABA1	635722	4758	14-Oct-26	151	4607
			02-Mar-94	232.8	4525
B-16-02 27ABA3		4750	23-Feb-99	239.9	4510
B-16-02 27BCC	606428	4792	20-Nov-80	269	4523
			02-Mar-94	192.6	4599
			23-Feb-99	270.8	4521

Table 8 (cont.)

Cadastral	Reg No.	Well Altitude	Date	Depth to Water	Water Surface Altitude
B-16-02 28BDD	802035	4820	06-Sep-48	255.11	4565
			02-Mar-94	287	4533
			21-Feb-97	300	4520
			03-Mar-98	300.7	4519
			24-Feb-99	301.9	4518
			24-Feb-00	304.5	4516
			13-Mar-01	309	4511
B-16-02 28DDC	628072	4830	13-Nov-58	257.01	4573
			02-Mar-94	288.1	4542
			09-Mar-95	289.2	4541
			06-Feb-97	295	4535
			01-Mar-98	295.2	4535
			23-Feb-99	295.7	4534
			24-Feb-00	296.4	4534
			28-Jul-00	308.48	4522
			08-Aug-00	309.18	4521
			21-Nov-00	306.56	4523
			16-Mar-01	301.02	4529
B-16-02 29ABB	640269	4790	10-Feb-81	228.8	4561
			02-Mar-94	247.7	4542
			23-Feb-99	254.7	4535
B-16-02 29BCC2		4818	24-Feb-99	300.2	4518
B-16-02 31AAA	86939	4879	02-Mar-82	349.51	4529
			01-Mar-94	354	4525
			24-Feb-99	344.7	4534
B-16-02 31BBB1	632216	4902	23-Jun-81	119.7	4782
			05-Feb-91	109.6	4792
			24-Feb-99	111.5	4791
B-16-02 31DCC	87133	4970	23-Feb-82	91.46	4879
			24-Feb-99	89.3	4881
B-16-02 33CDB	500265	4890	23-Feb-82	357.8	4532
			02-Mar-94	339.3	4531
B-16-02 34ABA2	502645	4800	28-Mar-83	264.6	4535
			02-Mar-94	265.1	4535
			09-Mar-95	266.6	4533
			18-Mar-96	267.3	4533
			06-Feb-97	270.3	4530
			03-Mar-98	271	4529
			24-Feb-99	272.4	4528

Table 8 (cont.)

Cadastral	Reg No.	Well Altitude	Date	Depth to Water	Water Surface Altitude
B-16-02 34ABA2 (cont.)	502645	4800	24-Feb-00	274.2	4526
			14-Mar-01	276.6	4523
B-16-02 35DDD	639826	4835	19-Mar-57	269.8	4565
			02-Mar-94	297	4538
			22-Feb-99	302.5	4533
			16-Mar-01	306.5	4529
B-17-02 05CBA	609278	4398	01-Sep-72	156.5	4242
			22-Feb-99	140.7	4257
B-17-02 06BBB	603912	4390	09-Oct-52	129.68	4260
			01-Nov-94	128.2	4262
			31-Oct-95	128	4262
			29-Oct-96	129.4	4261
			14-Oct-97	133.8	4256
			20-Oct-98	131.2	4259
			22-Feb-99	131.1	4259
B-17-02 07CDC	86613	4530	06-Feb-92	269.8	4260
B-17-02 08ADD	803386	4402	25-Feb-99	137.3	4265
B-17-02 09CAB		4378	20-Jul-92	107.1	4271
B-17-02 10CBA	504566	4410	20-Jul-92	164.3	4246
B-17-02 15CAD2	515865	4377	20-Jul-92	60	4317
B-17-02 15CBB	503995	4388	20-Jul-92	135	4253
B-17-02 20ABD	801489	4467	13-Mar-01	177.2	4290
B-17-02 21ACC	541012	4480	17-Apr-01	112.2	4368
B-17-02 22ABB	606020	4375	21-Mar-01	23.7	4351
B-17-02 29ADC	574763	4605	28-May-99	230.4	4375
			03-Mar-00	230.6	4374
			13-Mar-01	232.4	4373
B-17-02 29CAC	518331	4750	27-May-99	456	4294
			13-Mar-01	457.6	4292
B-17-02 31DDD	84735	4740	19-Nov-80	376.8	4363
			03-Mar-94	377	4363
B-17-02 32DCC	614818	4641	22-Feb-82	150.9	4490
			01-Mar-94	158.9	4482
			11-May-99	167.68	4473
B-17-02N31ABD	554035	4850	24-May-99	549.5	4301
B-17-02N34ACA	639220	4522	01-Mar-62	1.5	4521
			28-Feb-94	-0.31	4522

Table 8 (cont.)

Cadastral	Reg No.	Well Altitude	Date	Depth to Water	Water Surface Altitude
B-17-02N34ACC	639281	4510	22-Oct-40	9.42	4501
			28-Feb-94	10.7	4499
			09-Mar-95	2.3	4508
			19-Mar-96	9.3	4501
			20-Feb-97	11.3	4499
			12-Mar-98	14.72	4495
			24-Feb-99	12.9	4497
			28-Feb-00	11.1	4499
			13-Mar-01	12.7	4497
B-17-02N34BDD2		4495	21-Mar-50	2.85	4492
			28-Feb-94	19.8	4475
B-17-02N34BDD3		4502	01-Sep-52	1	4501
			28-Feb-94	12.9	4489
B-17-02N34CCC	609767	4548	21-Mar-62	31.02	4517
			28-Feb-94	49.97	4498
B-17-02N34DDD1	608242	4513	15-Oct-43	-49.53	4563
			28-Feb-94	4.6	4508
			25-Feb-00	10.68	4502
			26-May-00	31.13	4482
			08-Aug-00	22.24	4491
			21-Nov-00	15.39	4498
			12-Mar-01	12.7	4500
B-17-02N34DDD3	633990	4515	02-Mar-82	28.4	4487
			28-Feb-94	30.1	4485
			09-Mar-95	30.4	4485
			18-Mar-96	33.5	4482
			06-Feb-97	30.9	4484
			12-Mar-98	35	4480
			24-Feb-99	35.2	4480
			25-Feb-00	34.9	4480
			12-Mar-01	35.9	4479
B-17-02S03CBB2		4405	27-Sep-72	144.65	4260
			24-Feb-99	141.7	4263
B-17-02S03CCD		4430	01-Sep-72	160	4270
			06-Feb-92	159.9	4270
			23-Feb-99	159.7	4270
B-17-02S04DBC1		4362	15-Feb-83	97	4265
			01-Nov-94	99.9	4262
			30-Oct-95	99.8	4262

Table 8 (cont.)

Cadastral	Reg No.	Well Altitude	Date	Depth to Water	Water Surface Altitude
B-17-02S04DBC1 (cont.)		4362	29-Oct-96	100.9	4261
			13-Oct-97	105	4257
			20-Oct-98	101.8	4260
			24-Feb-99	102.4	4260
			01-Feb-00	104.6	4257
B-17-02S04DBC3 PZ1	524078	4362	06-Feb-92	101.3	4261
			24-Feb-99	101.3	4261
B-17-02S04DBC3 PZ2	524078	4362	06-Feb-92	101.3	4261
			24-Feb-99	101.5	4261
B-17-02S04DBC3 PZ3	524078	4362	06-Feb-92	101.3	4261
			24-Feb-99	101.2	4261
B-17-02S16ACA	86612	4385	20-Jul-92	52.2	4333
B-17-02S31ABA	802799	4870	21-May-99	498.8	4371
			13-Mar-01	501	4369
B-17-02S34ABB	609766	4516	20-Aug-44	-60.03	4576
			12-Mar-01	1.5	4515
B-17-02W27DCC	609768	4470	21-Mar-62	5.88	4464
			03-Mar-94	9.2	4461
			09-Mar-95	9.4	4461
			19-Mar-96	10.9	4459
			06-Feb-97	10.6	4459
			12-Mar-98	11.86	4458
			25-Feb-99	11.6	4458
			29-Oct-99	13.77	4456
			05-Nov-99	13.13	4457
			20-Jan-00	12.2	4458
			25-Feb-00	12.23	4458
			02-Jun-00	16.29	4454
			08-Aug-00	14.04	4456
			21-Nov-00	11.92	4458
			12-Mar-01	12.4	4458

unconfined water levels. Alternatively, measurements from wells of depth greater than 300 feet were classified as confined water levels. At least two-thirds of the well data are from the confined aquifer, with the majority of the wells being located in the Town of Chino Valley. Only a few of the measurements were identified in the northern portion of T17N, which is outside of the PRAMA. These measurements likely represent groundwater levels in a different sub-basin (Big Chino), and hence are an indication of a general head boundary condition.

To evaluate the accessible storage of each aquifer in the Del Rio Springs area, 20-year winter static hydrographs were plotted for a selected group of wells using historical and current depth-to-water information provided by ADWR (Figure 6). As shown in Figure 6, the groundwater level in the shallow, unconfined aquifer has decreased more than 20 feet during the past 20 years. The current maximum depth to water of the unconfined aquifer is around 180 feet in the subject property and vicinity. The maximum depth to water has been shown to exceed 230 feet for the confined aquifer. Both of these low points occur in the vicinity of the southern boundary of the study area, which is close to the Town of Chino Valley.

4.2 Adequacy of Water Quality

In general, groundwater and surface water in the PRAMA are of acceptable quality for most uses. The majority of the groundwater supplies in the PRAMA meet federal and state drinking water standards, and no specific contamination areas are currently identified on the Water Quality Assurance Revolving Fund (WQARF) Priority List or the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) National Priority List.

To evaluate water quality in the study area in general, and on the subject property specifically, both historical and current water quality data were collected and/or compiled for a variety of chemical constituents. Current water quality data were collected from the Del Rio Springs, several wells, and surface water sources. While available historical information includes data collected as early as the 1930's, the USGS water quality database was the primary source of the data compiled within this report, with records dating back to 1988. Tables 9a, 9b and 9c contain analytical results for samples collected from area wells, and Table 9d contains analytical results for samples collected from the Del Rio Springs. As shown in the tables referenced above, no organics were detected in samples for which they were analyzed, and concentrations for anions/cations like Nitrate, Sulfate, Chloride and Fluoride, and for contaminant metals, including Arsenic, were all below the Arizona Water Quality Standard (AWQS) and the Environmental Protection Agency's MCLs (Maximum Contaminate Levels). Values for pH and total dissolved solids (TDS) also indicate the excellent quality of Del Rio spring and groundwater.

Table 9a

Historical Groundwater Quality Analysis Data for Wells in the Del Rio Springs Area - General

Cadastral	ADWR #	Date	Temperature	pH	Conductivity	TDS	NH3-N	NO2-N	NO2+NO3-N	TKN	Orthophosphate	Total Alkalinity	Total Hardness
			(oC)		(mS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L as CaCO3)	(mg/L as CaCO3)
(B-17-2) 15ACC		08/28/1997	16.77	7.58	560	300	ND	ND	1.6	ND	ND	200	210
(B-17-2) 34ABB		03/15/1989	20	8	310	NA	NA	NA	NA	NA	NA	NA	NA
(B-17-2) 34DCC	609766	06/17/1992	23.33	7.77	312	200	ND	ND	1.95	ND	0.1	108	122
(B-17-2) 34DDC	609764	08/28/1997	20.32	8	337	190	ND	ND	2.2	ND	ND	94	130
(B-16-2) 11B--	616750	06/17/1992	22.55	7.96	275	183	ND	ND	0.8	ND	ND	118	106
(B-16-2) 11B--	616750	09/19/1993	NA	8.27	292	179	ND	ND	1.12	0.12	ND	122	110
(B-16-2) 11B--	616750	06/18/1997	22.5	7.92	277	180	ND	ND	0.83	ND	ND	120	120
(B-16-2) 12DDD		08/13/1997	18.48	7.93	314	180	ND	ND	1.7	0.21	ND	100	110
(B-16-2) 14ABC	606022	03/21/1988	NA	8.17	NA	150	NA	NA	NA	NA	NA	111	73
(B-16-2) 14ABC	606022	06/15/1988	NA	8.12	NA	150	NA	NA	NA	NA	NA	110	74
(B-16-2) 14ADC	606022	03/21/1988	NA	8.16	NA	150	NA	NA	NA	NA	NA	106	84
(B-16-2) 14CCC	606023	06/15/1988	NA	8.1	NA	160	NA	NA	4.7	NA	NA	110	104
(B-16-2) 14CCC	60602?	03/21/1988	NA	8.11	NA	170	NA	NA	1.5	NA	NA	107	106
(B-16-2) 14CCC	60602?	05/03/1988	16	7.29	530	NA	NA	NA	NA	NA	NA	NA	NA
(B-16-2) 14CCC	60602?	05/31/1988	NA	NA	NA	303	<0.1	NA	4.08	1.79	NA	169	213
(B-16-2) 16AAA	504619	06/16/1992	20.17	7.79	294	180	ND	ND	2.1	ND	ND	106	117
(B-16-2) 16AAA	504619	08/13/1997	20.08	7.78	365	200	ND	ND	2.1	ND	ND	110	120
(B-16-2) 16DDD	501609	06/16/1992	NA	8.15	308	197	ND	ND	2.14	ND	ND	107	123
(B-16-2) 16DDD	501609	06/18/1997	19.23	7.93	338	190	ND	ND	2.2	ND	ND	110	130
(B-16-2) 3AAA		08/22/1995	16.91	7.24	774	NA	NA	NA	NA	NA	NA	NA	NA
(B-16-2) 3CDA	617596	08/13/1997	21.35	7.7	313	190	ND	ND	1.7	ND	ND	110	120
(B-16-2) 3CDA	521549	08/13/1997	20.16	7.55	506	290	ND	ND	3.4	ND	ND	190	190
(B-16-2) 3DBB		08/22/1995	14.75	7.28	507	NA	NA	NA	NA	NA	NA	NA	NA
(B-16-2) 3DDC		03/16/1989	15.5	7.6	660	NA	NA	NA	NA	NA	NA	NA	NA
(B-16-2) 5BBB	638369	08/13/1997	20.67	7.69	369	250	ND	ND	1.2	ND	ND	140	140
(B-16-2) 8CCC	519030	08/22/1995	19.9	7.64	314	NA	NA	NA	NA	NA	NA	NA	NA

Table 9b

Historical Groundwater Quality Analysis Data for Wells in the Del Rio Springs Area – Major Anion/Cation

Cadastral	ADWR #	Date	Ca	Mg	Na	K	Cl	SO4	F	Turbidity
			(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(NTU)
(B-17-2) 15ACC		08/28/1997	56	22	20	3.2	23	19	0.34	0.05
(B-17-2) 34ABB		03/15/1989	NA	NA	NA	NA	NA	NA	NA	NA
(B-17-2) 34DCC	609766	06/17/1992	34.7	9.1	11.6	1.43	23.3	ND	0.32	NA
(B-17-2) 34DDC	609764	08/28/1997	42	10	14	2.1	22	10	0.31	0.03
(B-16-2) 11B--	616750	06/17/1992	24.4	11.3	11.6	1.84	8.6	ND	0.32	NA
(B-16-2) 11B--	616750	09/19/1993	25.5	12.7	15	2.4	7.3	ND	0.34	NA
(B-16-2) 11B--	616750	06/18/1997	29	13	14	2	6.8	ND	0.32	NA
(B-16-2) 12DDD		08/13/1997	24	14	15	1.5	19	NA	0.35	NA
(B-16-2) 14ABC	606022	03/21/1988	12	10.4	13.6	1.9	0.3	4	1.6	NA
(B-16-2) 14ABC	606022	06/15/1988	12.1	10.2	12.8	2.1	0.3	10	1.6	NA
(B-16-2) 14ADC	606022	03/21/1988	17.9	9.5	13.9	2.2	0.4	3	1.6	NA
(B-16-2) 14CCC	606023	06/15/1988	23.1	11	13.2	1.8	0.3	10	1.4	NA
(B-16-2) 14CCC	60602?	03/21/1988	23.7	11.4	13.5	1.7	0.4	5	1.8	NA
(B-16-2) 14CCC	60602?	05/03/1988	NA	NA	NA	NA	NA	NA	NA	NA
(B-16-2) 14CCC	60602?	05/31/1988	NA	NA	NA	NA	25.9	22.1	NA	NA
(B-16-2) 16AAA	504619	06/16/1992	29.8	10.5	12.4	1.47	18	ND	0.31	NA
(B-16-2) 16AAA	504619	08/13/1997	32	12	14	1.8	21	NA	0.3	NA
(B-16-2) 16DDD	501609	06/16/1992	31.1	11.2	10.7	1.58	22.6	ND	0.3	NA
(B-16-2) 16DDD	501609	06/18/1997	36	13	14	1.7	19	10	0.36	NA
(B-16-2) 3AAA		08/22/1995	NA	NA	NA	NA	NA	NA	NA	NA
(B-16-2) 3CDA	617596	08/13/1997	31	11	14	1.8	17	ND	0.32	NA
(B-16-2) 3CDA	521549	08/13/1997	47	23	19	2.3	25	17	0.26	NA
(B-16-2) 3DBB		08/22/1995	NA	NA	NA	NA	NA	NA	NA	NA
(B-16-2) 3DDC		03/16/1989	NA	NA	NA	NA	NA	NA	NA	NA
(B-16-2) 5BBB	638369	08/13/1997	37	14	14	4.6	20	ND	0.37	NA
(B-16-2) 8CCC	519030	08/22/1995	NA	NA	NA	NA	NA	NA	NA	NA

Table 9c
Historical Groundwater Quality Analysis Data for Wells in the Del Rio Springs Area - Metals

Cadastral	ADWR #	Date	As	Ag	Ba	Be	B	Cd	Cr	Cu	Fe	Hg	Pb	Mn	Se	Sb	Zn
			(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
(B-17-2) 15ACC		08/28/1997	0.012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
(B-17-2) 34ABB		03/15/1989	0.017	<0.001	<0.1	NA	NA	<0.001	<0.01	<0.1	<0.1	<0.0005	<0.01	<0.05	<0.005	NA	<0.05
(B-17-2) 34DCC	609766	06/17/1992	ND	ND	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	NA	ND
(B-17-2) 34DDC	609764	08/28/1997	0.014	ND	ND	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	NA	ND
(B-16-2) 11B--	616750	06/17/1992	0.013	ND	ND	NA	NA	ND	0.01	ND	0.15	ND	ND	ND	ND	NA	ND
(B-16-2) 11B--	616750	09/19/1993	0.014	ND	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	NA	ND
(B-16-2) 11B--	616750	06/18/1997	0.016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	ND
(B-16-2) 12DDD		08/13/1997	ND	ND	ND	ND	ND	ND	0.013	ND	ND	ND	0.009	ND	ND	NA	0.085
(B-16-2) 14ABC	606022	03/21/1988	<0.01	<0.001	<0.1	NA	NA	<0.001	<0.01	<0.01	0.14	<0.0005	<0.01	<0.01	<0.005	NA	<0.01
(B-16-2) 14ABC	606022	06/15/1988	<0.01	<0.001	<0.1	NA	NA	<0.001	<0.01	<0.01	0.11	<0.0005	<0.01	<0.01	<0.005	NA	<0.01
(B-16-2) 14ADC	606022	03/21/1988	<0.01	<0.001	<0.1	NA	NA	0.001	0.01	0.01	0.39	<0.0005	<0.01	<0.01	<0.005	NA	0.11
(B-16-2) 14CCC	606023	06/15/1988	<0.01	<0.001	<0.1	NA	NA	<0.001	<0.01	0.01	0.4	<0.0005	<0.01	<0.01	<0.005	NA	0.04
(B-16-2) 14CCC	60602?	03/21/1988	<0.01	<0.001	<0.1	NA	NA	0.002	0.01	0.01	0.49	<0.0005	<0.01	<0.01	<0.005	NA	0.05
(B-16-2) 16AAA	504619	06/16/1992	ND	ND	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	NA	ND
(B-16-2) 16AAA	504619	08/13/1997	0.012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
(B-16-2) 16DDD	501609	06/16/1992	ND	ND	ND	NA	NA	ND	ND	ND	0.11	ND	ND	ND	ND	NA	ND
(B-16-2) 16DDD	501609	06/18/1997	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
(B-16-2) 3CDA	617596	08/13/1997	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
(B-16-2) 3CDA	521549	08/13/1997	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1
(B-16-2) 3DDC		03/16/1989	<0.01	<0.001	<0.1	NA	NA	<0.001	<0.01	<0.1	<0.1	<0.0005	<0.01	<0.05	<0.005	NA	0.05
(B-16-2) 5BBB	638369	08/13/1997	0.014	ND	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND	ND	0.2

Table 9d
Historical Water Quality Analysis Data for Del Rio Springs

Local Well Number	Date	Temperature	Conductivity	pH	TDS	D. O.	NH3-N	NO2-N
		(oC)	(mS/cm)		(mg/L)	(mg/L)	(mg/L)	(mg/L)
B-17-02 26CCC2	02/04/1981	19	290					
B-17-02 26CCC2	04/29/1981	21	350	7.6	198		0.11	
B-17-02 26CCC2	08/26/1991	20	330	8.3	215	6.3	0.02	<0.010
B-17-02 26CCC3	06/15/2000	19.8	376	7.6	210			
Local Well Number	**Date**	**NO2+NO3-N**	**Orthophosphate**	**Total Hardness**	**Ca**	**Mg**	**Na**	**K**
		(mg/L)	(mg/L)	(mg/L as CaCO3)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
B-17-02 26CCC2	02/04/1981							
B-17-02 26CCC2	04/29/1981	0.71	0.06	120	26	13	15	2.7
B-17-02 26CCC2	08/26/1991	0.92		140	30	15	17	2.6
B-17-02 26CCC3	06/15/2000			140	29	16	17	2.5
Local Well Number	**Date**	**Cl**	**SO4**	**Fl**	**Silica**	**As**	**Ba**	**Be**
		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
B-17-02 26CCC2	02/04/1981			0.7				
B-17-02 26CCC2	04/29/1981	11	12	0.3	37			
B-17-02 26CCC2	08/26/1991	19	12	0.3	33	17	10	0.7
B-17-02 26CCC3	06/15/2000	22	14	0.3	33			
Local Well Number	**Date**	**B**	**Cd**	**Cr**	**Co**	**Cu**	**Fe**	**Pb**
		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
B-17-02 26CCC2	02/04/1981							
B-17-02 26CCC2	04/29/1981	40					<10	
B-17-02 26CCC2	08/26/1991	40	<1	5	<1	<1	4	<1
B-17-02 26CCC3	06/15/2000							
Local Well Number	**Date**	**Mn**	**Mb**	**Sr**	**Vd**	**Zn**	**Li**	**Bromide**
		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
B-17-02 26CCC2	02/04/1981							
B-17-02 26CCC2	04/29/1981	1						
B-17-02 26CCC2	08/26/1991	<1	<1	480	15	<3	10	0.14
B-17-02 26CCC3	06/15/2000							
Local Well Number	**Date**	**C-13/C-12**	**H-2/H-1**	**O-18/O-16**				
		Ratio/mil	Ratio/mil	Ratio/mil				
B-17-02 26CCC2	02/04/1981							
B-17-02 26CCC2	04/29/1981							
B-17-02 26CCC2	08/26/1991	-11.5	-71	-9.85				
B-17-02 26CCC3	06/15/2000		-71	-9.97				

ASA also sampled and analyzed water from several wells, Del Rio Springs, and several surface water sources (ASA, 2001f). Table 10 presents the analytical results of samples collected in May 2001. Figure 13 provides a map of the sampling locations. Of the constituents analyzed, many were below laboratory method reporting limits, and all were well below AWQS and MCL reporting requirements. Constituents classified as Secondary Standards, such as TDS, were well within acceptable limits. Table 11 provides a narrative description of the sampling locations and/or stratigraphic positions for data represented in Table 10. Laboratory analytical results for samples collected on the subject property in 2001 can be found in Appendix C. No organic contaminants were found in any of the samples taken in May.

4.3 Legal Availability

The Del Rio Springs water was first used for military and domestic purposes as part of a permanent settlement when Fort Whipple was established in 1863 (SWCA, 2000). The use very quickly changed to agricultural purposes in 1864 when Postle, Brown and Company began farming 200 acres of the property, irrigating with water conveyed from the Springs. In 1866, the Prescott newspaper reported that Postle was cultivating approximately 300 acres. Rancher C. Rogers purchased 160 acres near Del Rio Springs in 1870, subsequently partnering with Banghart and J. Baker to purchase an additional 360 acres in Sections 15 and 22.

Shortly thereafter, Rogers relocated and founded the town of Williams, and Baker entered into a partnership with J. Campbell. This new partnership first purchased the patented land on which Del Rio Springs lay and, in 1886, purchased the Postle/Rees Ranch. In 1892, J. Campbell officially filed on the surface water rights to 4,022 AF of Del Rio Springs' water, with a priority data of 1864, to serve the Campbell-Baker Ranch, one of the largest cattle ranches in Yavapai County at the time. Baker acquired Campbell's interests in the Ranch in 1898.

Table 10
Current Subsurface/Groundwater and Surface Water Quality Data for the Ranch at Del Rio Springs

		Deep Artesian Wells				Intermediate Depth Artesian Well	Del Rio Springs		Surface Water Samples		
	Sample Site:	Big Well	MW #3	W #4	MW #4A	MW #5	Del Rio Spr.	COP Spr.	USGS Gage	E. Bond Lake	Cienega
	Sample Location:	Sec. 34, cdc	Sec. 34, dad	Sec. 34, ddd	Sec. 34, aaa	Sec. 34, dad	Sec. 26, ccd	Sec. 26, ccd	Sec. 26, cca	Sec. 27, dad	Sec. 34, dad
	Sample Date:	05/31/2001	05/31/2001	05/31/2001	05/31/2001	05/31/2001	05/31/2001	05/31/2001	05/31/2001	05/31/2001	05/31/2001
Analyte	Units	Laboratory Test Results									
Organics	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Spec. Conductance	mmhos/cm	310	270	300	280	580	340	380	360	410	550
pH	S.U.	8.2	8.4	7.9	8.2	8.2	8.1	8.1	7.7	8.1	7.8
TDS	mg/L	190	140	190	170	360	210	230	220	260	350
TSS	mg/L	<10	69	<10	360	<10	<10	<10	<10	<10	14
Residue	mg/L	210	210	190	540	380	220	240	230	280	380
Turbidity	NTU	0.08	33	0.13	74	1.2	0.27	0.39	0.37	3.1	18
Chloride	mg/L	19	21	15	18	42	16	23	20	16	16
Fluoride	mg/L	0.38	0.32	0.30	0.34	0.36	0.32	0.34	0.32	0.50	0.58
Nitrate	mg/L	<.020	0.04	<.020	<.020	0.03	<.020	<.020	<.020	<.020	<.020
Phosphate (Ortho)	mg/L	<.050	<.050	<.050	<.050	<.050	<.050	<.050	<.050	<.050	<.050
Sulfate	mg/L	12	11	12	10	18	11	18	12	17	13
Total Alkalinity	mg/L	120	92	120	120	230	140	140	140	200	20
Arsenic	mg/L	0.015	<.010	0.017	<.010	<.010	0.018	0.014	0.015	0.013	0.016
Barium	mg/L	<.010	<.010	<.010	0.11	0.037	<.010	<.010	<.010	0.033	0.079
Cadmium	mg/L	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003
Chromium	mg/L	<.010	<.010	<.010	<.010	<.010	<.010	<.010	<.010	<.010	<.010
Silver	mg/L	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Mercury	mg/L	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
Nitrate (as N)	mg/L	2.3	1.6	1.9	2	<.5	1.2	<.50	0.99	<.50	<.50
Nitrogen (kjeldahl)	mg/L	<.50	1	<.50	<.50	<.50	<.50	0.8	<.50	0.59	0.8
Phosphorus (Total)	mg/L	<.050	<.050	<.050	<.050	<.050	<.050	<.050	<.050	<.050	0.13
Lead	mg/L	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
Selenium	mg/L	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005

Notes: All sample locations are located within Township 17 North, Range 2 West of the Gila and Salt River Principal Meridian

ND Analyte not detected at a concentration equal to or exceeding its laboratory method reporting limit

TDS Total Dissolved Solids

TSS Total Suspended Solids

µg/L micrograms per liter

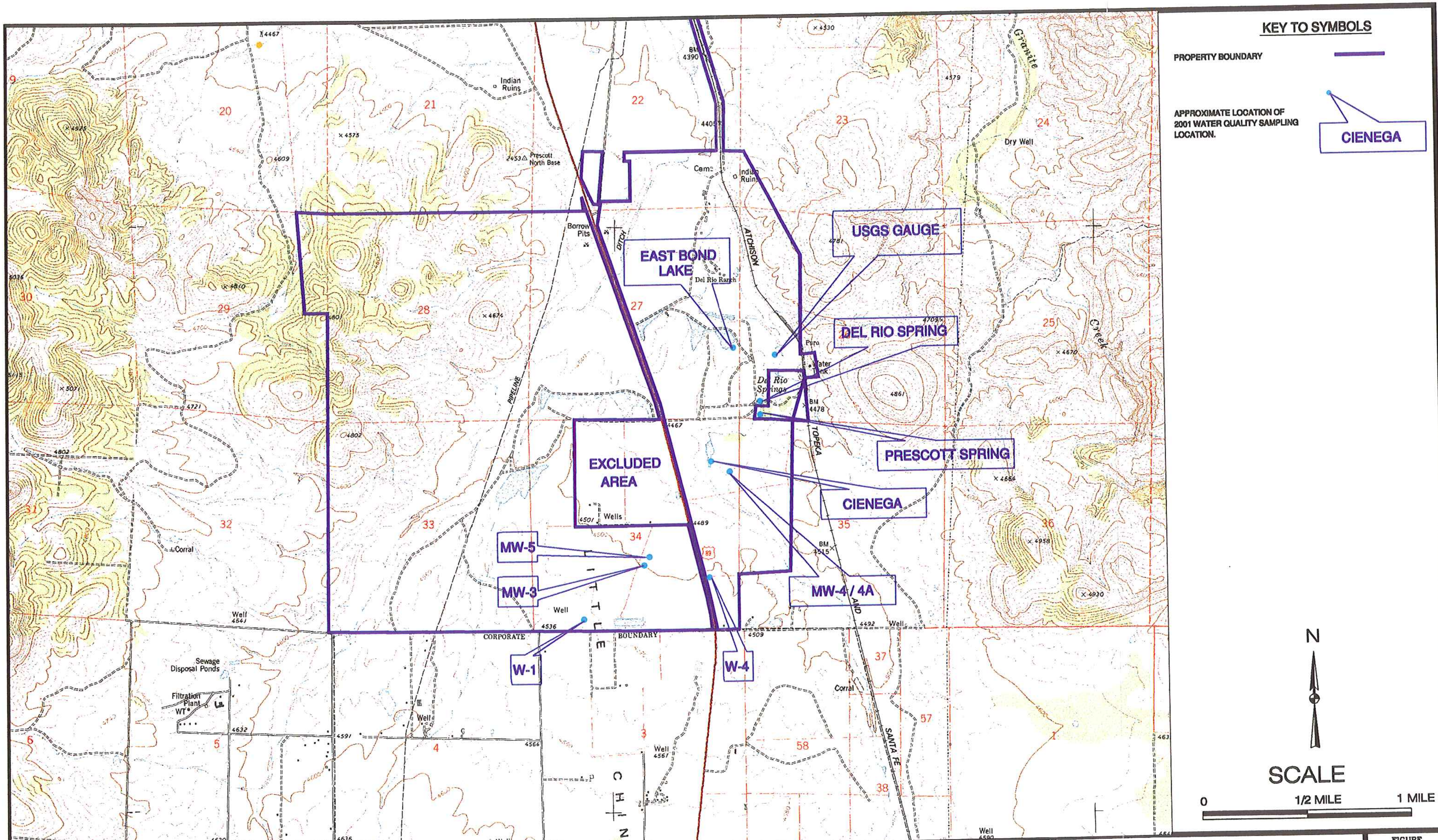
µmhos/cm micromhos per centimeter

S.U. Standard Units

mg/L milligrams per kilogram

NTU Nephalometric Turbidity Unites

* Monitor Well #4B was not properly evacuated prior to sampling; therefore, water quality represents mixture of water from the deep artesian and the intermediate depth artesian wells.



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2001 WATER QUALITY SAMPLING LOCATIONS

FIGURE
13

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Table 11
Water Quality Sample Location and Stratigraphic Position

Lab Sample Number	Location	Description
W9301	Big Well	Along Road 5 North approx. one (1) mile west of Hwy 89; supposedly from Artesian Aquifer although the casing is only set 100 feet.
W9302	Monitor Well #5	Located ¼ mile north of R5N and approximately ¼ mile west of Hwy 89; stratigraphically, this well is developed in the upper alluvial unit which has a slight artesian head at this location.
W9303	Monitor Well #3	Located 100 feet south of MW#5, this well is developed into the lower artesian aquifer, with the upper alluvial aquifer being cased out.
W9304	East Bond Lake	Surface water flows into Bond Lake from springs and tail water runoff. Sample was taken at pipe outlet.
W9305	U.S.G.S. Gage	Surface water sample taken at USGS Gage on Little Chino Creek; primary source of supply is from the Del Rio Springs approximately 600 to 700 yards south of the gaging site.
W9306	Del Rio Spring	There are four spring sites for Del Rio Springs; this one is on the Ranch property immediately North of the City of Prescott's Ranch House. The spring produces approximately 125 gpm and is cased in a concrete culvert type of structure.
W307	COP Spring	This sample was taken from the City of Prescott's cistern. It had to be pumped prior to taking the sample, but it was not evacuated three times before the sample was taken.
W9308	Cienega	This sample was taken in the wetland area above the Springs. It reflects flow from springs up valley, as well as possibly return flow from irrigation ¾ miles up stream.
W9309	Well #4	This water comes from the lower aquifer. The well is 700 feet deep and is cased less than 600 feet Therefore, the upper alluvial aquifer has been cased out.
W9310	Monitor Well #4a	This well is developed into the lower artesian zone. All water above 490 feet has been cased out. Water flows at a rate of 225 gpm when not closed off and has a pressure head of 12+ psi..

By 1893, the Santa Fe, Prescott & Phoenix Railway (SFP&P) was operating a successful route through the area. In 1894, the railroad constructed a pump house, stockyard and water tank in the immediate area, and in 1894 entered into a long-term lease with Baker that included water rights (the equivalent) of 100 gpm. By 1901, the railroad, under new ownership, began to supply water from its Del Rio siding to towns as far away as Winslow. A new partnership developed between Santa Fe and the Fred Harvey organization in 1913 to purchase/lease additional acreage and to expand the operation into a dairy ranch. The dairy business thrived until the 1920's, when the ranch ceased dairy operations and concentrated on silage production. Between 1945 and 1948, an artesian well was drilled and cultivation was expanded to about 550 acres. The Fred Harvey

Ranch was sold in 1956. All owners since, including the current owner, James Bond, have continued to utilize the property for agricultural purposes.

In 1900, the City of Prescott acquired from Baker's a 2.07-acre parcel on which one of the Springs lies, as well as an additional 231 acres to the north of the Del Rio Ranch. The City of Prescott filed for a surface water right in the amount of 2,762 AFY, with a priority right of 1875. The senior water right, with a priority date of 1864, is held by Del Rio Springs Ranch, under the name of Arizona Title Insurance and Trust Company, for 4,022 AFY. A copy of this document is contained in Appendix A. Stock pond rights also exist for the ponds on the west side of U.S. Highway 89; one just east of Big Wash, and one on an unnamed wash in the NE1/4 of Section 28. A detailed summary of the history of water use on the Del Rio Ranch is included in Appendix B.

5.0 IMPACT ANALYSIS

This section describes the results of the numerical analysis used to evaluate the impact of cumulative demands proposed to be placed on the source of the water supply that currently serves the subject property and its vicinity. The numerical data required and the modeling parameters are contained in Appendix D. To accomplish this goal, a 3-D numerical model was developed to simulate the Del Rio subsurface flow system. The model incorporates the structure of the local aquifer system as well as the inflow and outflow discussed above. It was first calibrated using water level and spring discharge measurements, and then applied to predict system dynamics, such as future static water levels in the UAU and the LVU water demands for The Ranch at Del Rio Springs. Simulations conducted in this study covered a period of 107 years. The pumping stresses used in the simulations were summarized from both projected demands of the subject property and existing demands from other local entities. To address regulatory compliance for proposed water demands, the predicted static water level elevations and the water budget demands after 100 years of development will be compared with safe yield criteria for the PRAMA. Results are considered to be indicative of whether the long-term withdrawal of water from the Del Rio Ranch hydrologic system is balanced with the amount of water naturally or artificially recharged to the system.

5.1 Setup of Numerical Groundwater Flow Model

The numerical code selected for the study is the Modular Three-Dimensional Finite-Difference Groundwater Flow Model, commonly known as MODFLOW (McDonald and Harbaugh, 1988). This code has been embedded into a graphic design environment, Groundwater Vistas (GV) (Rumbaugh, 1999). Using GV, a numerical model was developed for the subsurface flow system of the Ranch at Del Rio Springs. The following paragraphs describe the model setup as well as sources of data and assumptions used in the parameter specifications.

5.1.1 Model Domain and Grid

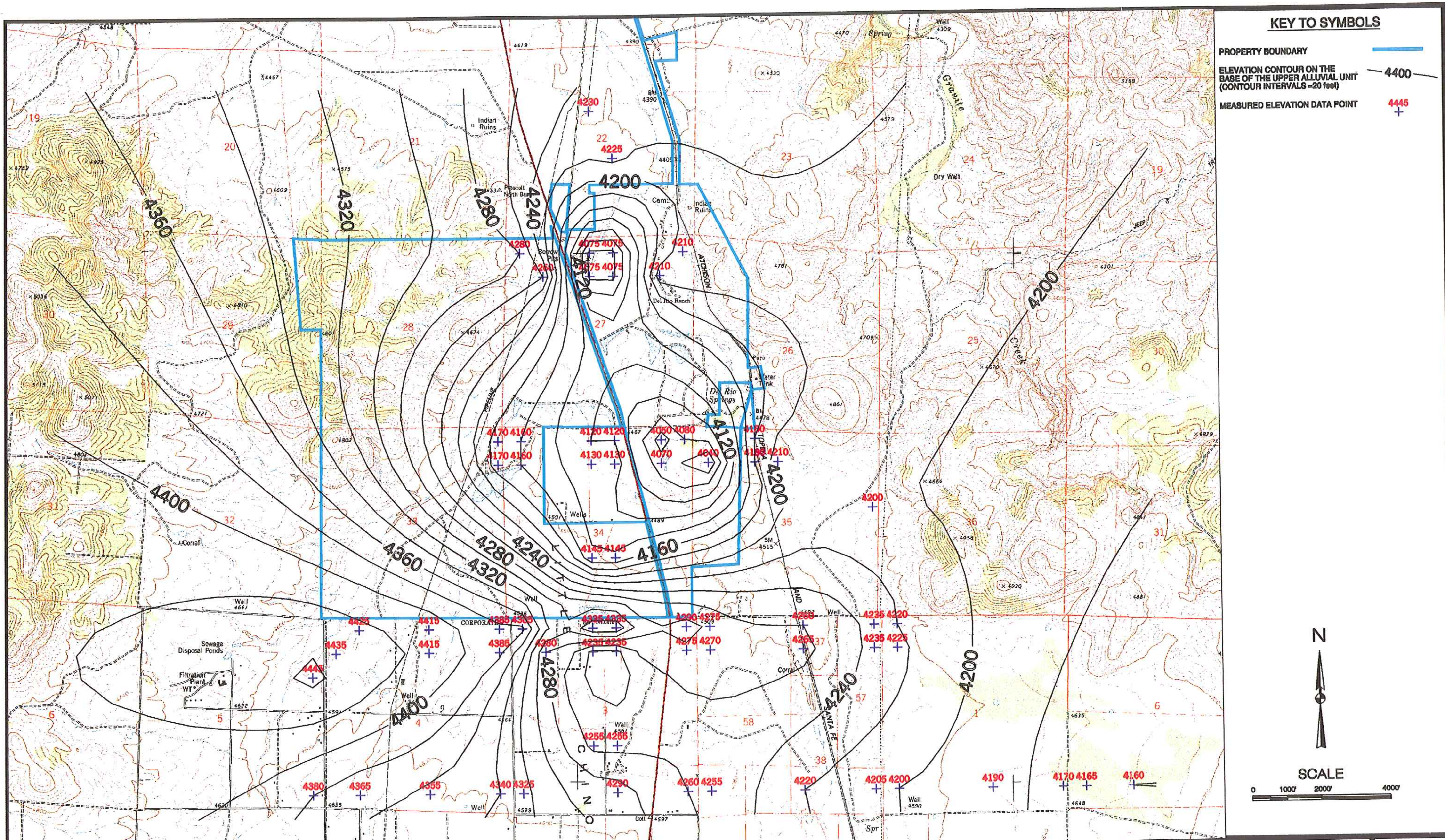
The model domain covers the subject property and the area beyond the property boundaries extending one mile beyond the north and south boundaries, and one and one-half miles beyond the east and west boundaries. The modeling area is discretized into two modeling layers, each with 32 rows and 48 columns. The cell size of the grid is one-eighth mile in length and width, representing a ten-acre area. The active model domain corresponds to the bottleneck portion of Little Chino Groundwater Basin and the southern edge of the Big Chino Basin. It is only in the Little Chino portion of the model domain that subsurface water flow is simulated to occur, and not within the Big Chino Basin.

5.1.2 Model Layers and Aquifer Parameters

Two model layers were used to represent the aquifer system beneath the Ranch at Del Rio Springs. The upper layer, layer 1, refers to the UAU aquifer. Layer 1 is modeled as an unconfined, watertable aquifer. The lower layer, Layer 2, corresponding to the LVU aquifer, is modeled as a fully convertible confined/unconfined aquifer, depending on the saturation condition of Layer 1. The bottom elevations of each layer were determined primarily from drilling and geophysical information. Point elevation values across the study area were retrieved from two cross-sections (Figure 4 and 5) and interpolated into spatial distribution maps for each layer using a Geostatistical Estimator–Kriging. Figures 14 and 15 are contour maps of the bottom elevations for the UAU and the LVU aquifers. As shown on Figure 16, the thickness of the LVU aquifer ranges across the study area from 180 feet to 400 feet.

Most of the aquifer parameters for layers 1 and 2 were adopted from ADWR's updated Prescott model (Nelson). These include:

hydraulic conductivity	1 to 25 feet per day (ft/day) for Layer 1, and 0.1 to 125 ft/day for Layer 2;
specific yield	0.1 to 0.12;
storage coefficient	0.0001;
vertical conductance	0.000001 to 0.0002 per day.



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CONTOUR MAP OF BOTTOM ELEVATIONS OF THE UPPER ALLUVIAL UNIT

FIGURE **14**

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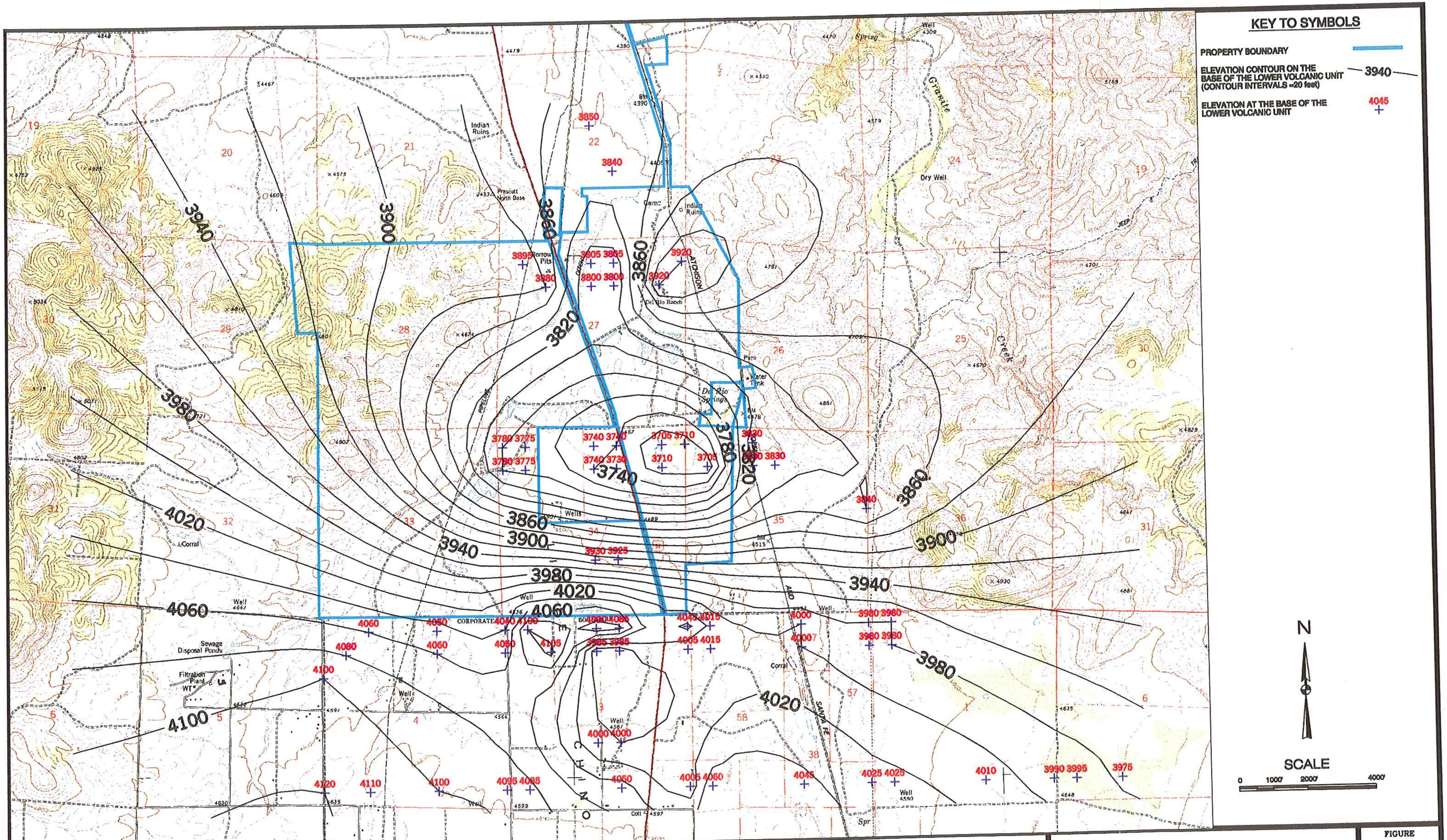

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CONTOUR MAP OF BOTTOM ELEVATIONS OF THE LOWER VOLCANIC UNIT

FIGURE

15

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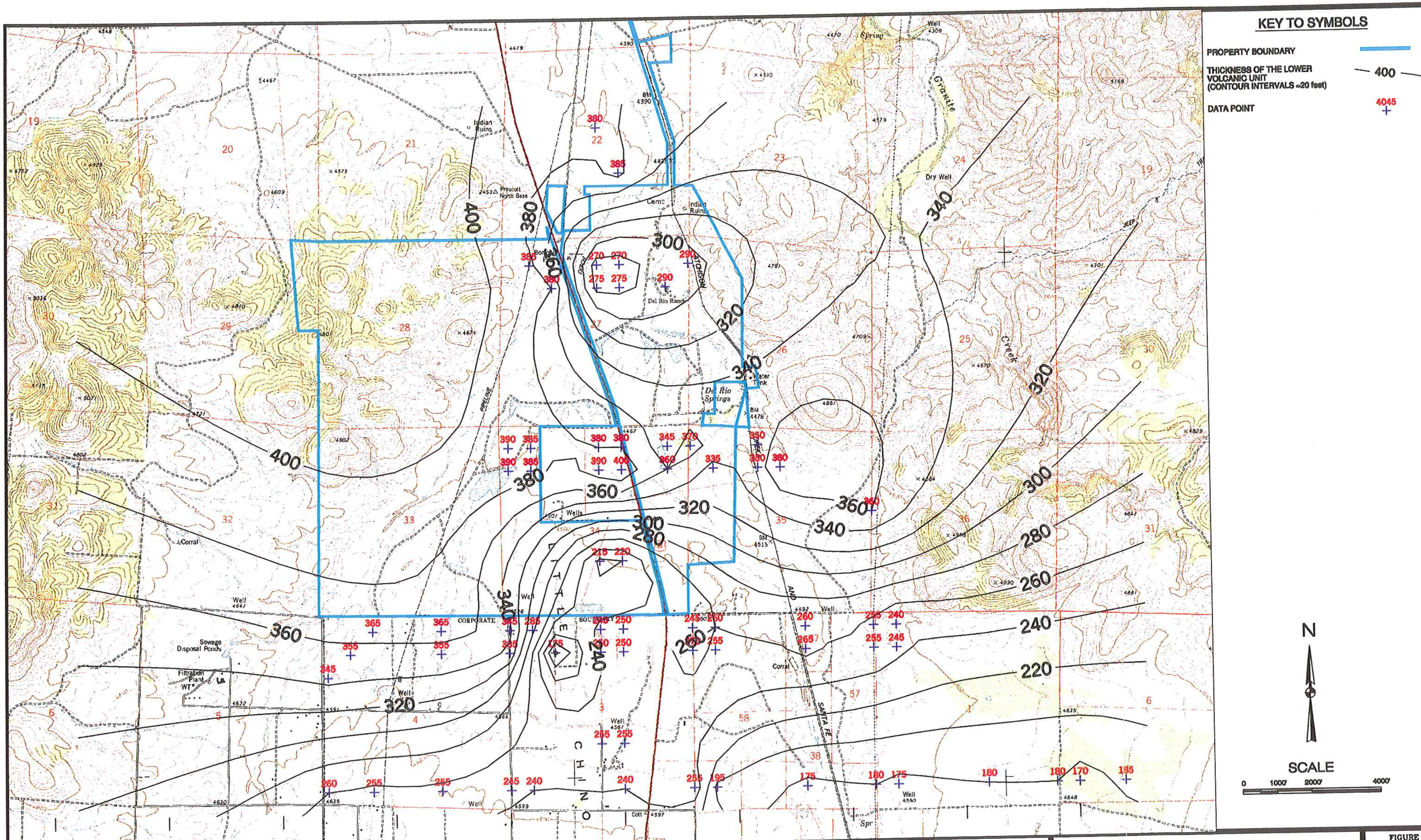

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CONTOUR MAP OF THE THICKNESS OF THE LOWER VOLCANIC UNIT

FIGURE 16

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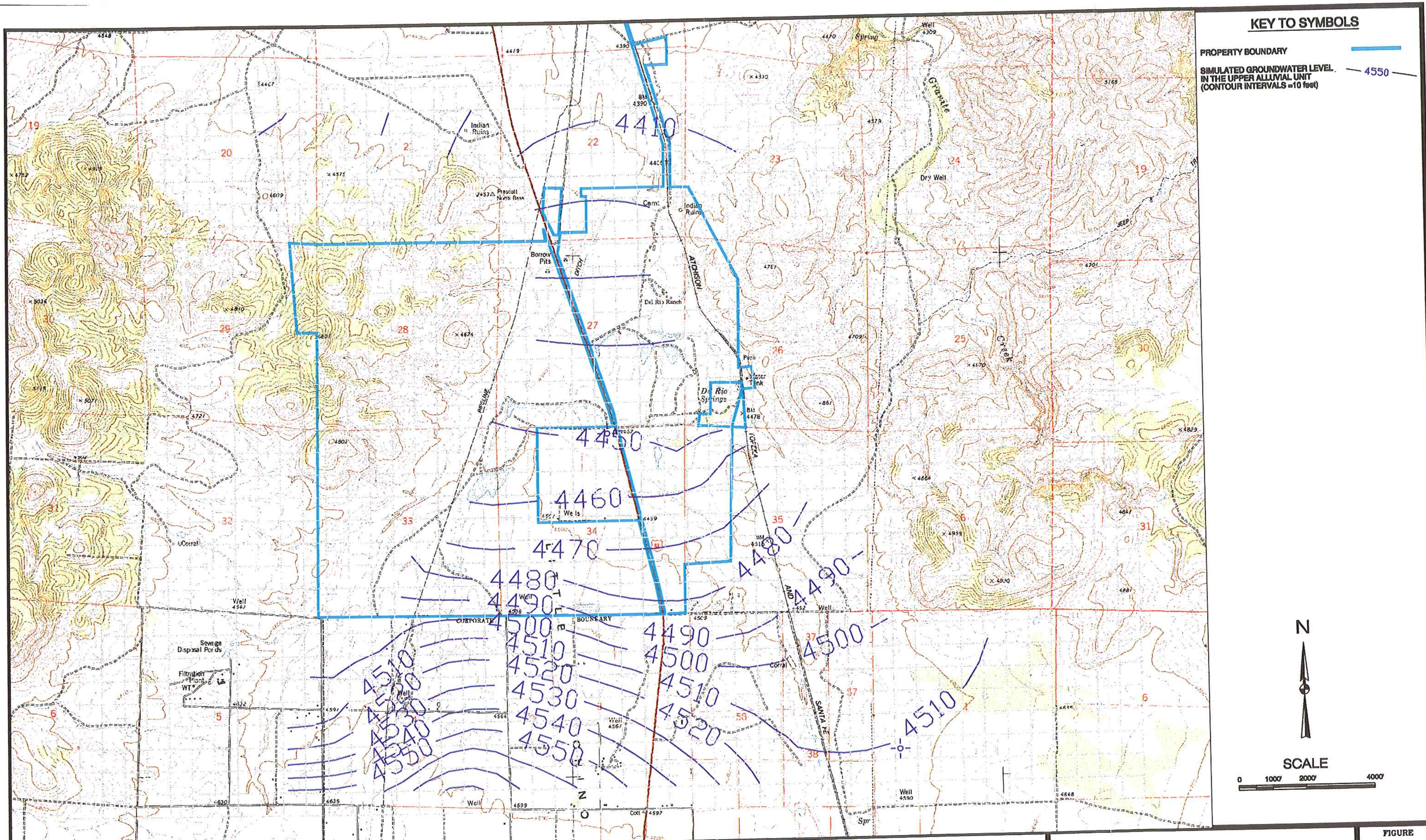

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CONTOUR MAP OF SIMULATED GROUNDWATER LEVELS IN THE UPPER ALLUVIAL UNIT (1999)

FIGURE
17

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To incorporate knowledge gained from ASA's recent pumping tests and data analyses (ASA, 2001e), the hydraulic conductivity and storage coefficient for the LVU aquifer around Section 34, T17N, R2W were modified. The new data indicate that the permeability of this region is much higher than originally recognized. ASA estimated the hydraulic conductivity to be approximately 200 ft/day, significantly larger than ADWR's specification (7-25 ft/day, for a barrier). The estimated storage coefficient is lower (0.00005), only half of ADWR's value. These parameters indicate that Layer 2 (the LVU) is a highly productive aquifer.

The impact of the three faults on flow at Del Rio Springs was modeled by specifying three zones of high vertical conductance following the trace line of faulting on the surface. This methodology provides a mechanism for the confined water in Layer 2 to rise vertically through Layer 1 and discharge at the Springs. At the same time, one zone of low permeability was also specified next to the zone of high vertical conductance to simulate the barrier effect of the faulting.

5.1.3 Boundary Condition

The "active" portion of the model domain is bounded on the northwest and the northeast mostly by impermeable Base Units. These units form the "inactive" portion of the model and also serve as no-flow boundaries. Along the southern boundary of the model domain, constant flux cells were used to represent influx from up gradient in Little Chino Basin. The 4,500 AFY of influx was initially segregated into two portions, with 40 percent of the total implemented uniformly in Layer 1, and 60 percent in Layer 2. This artificial boundary was tested during model calibration. Groundwater outflow to Big Chino Basin was modeled using a general head condition at the northern end of Layer 1. The specified boundary head is determined from mean groundwater levels measured at two shallow wells near the vicinity.

5.1.4 Surface and Inner Fluxes

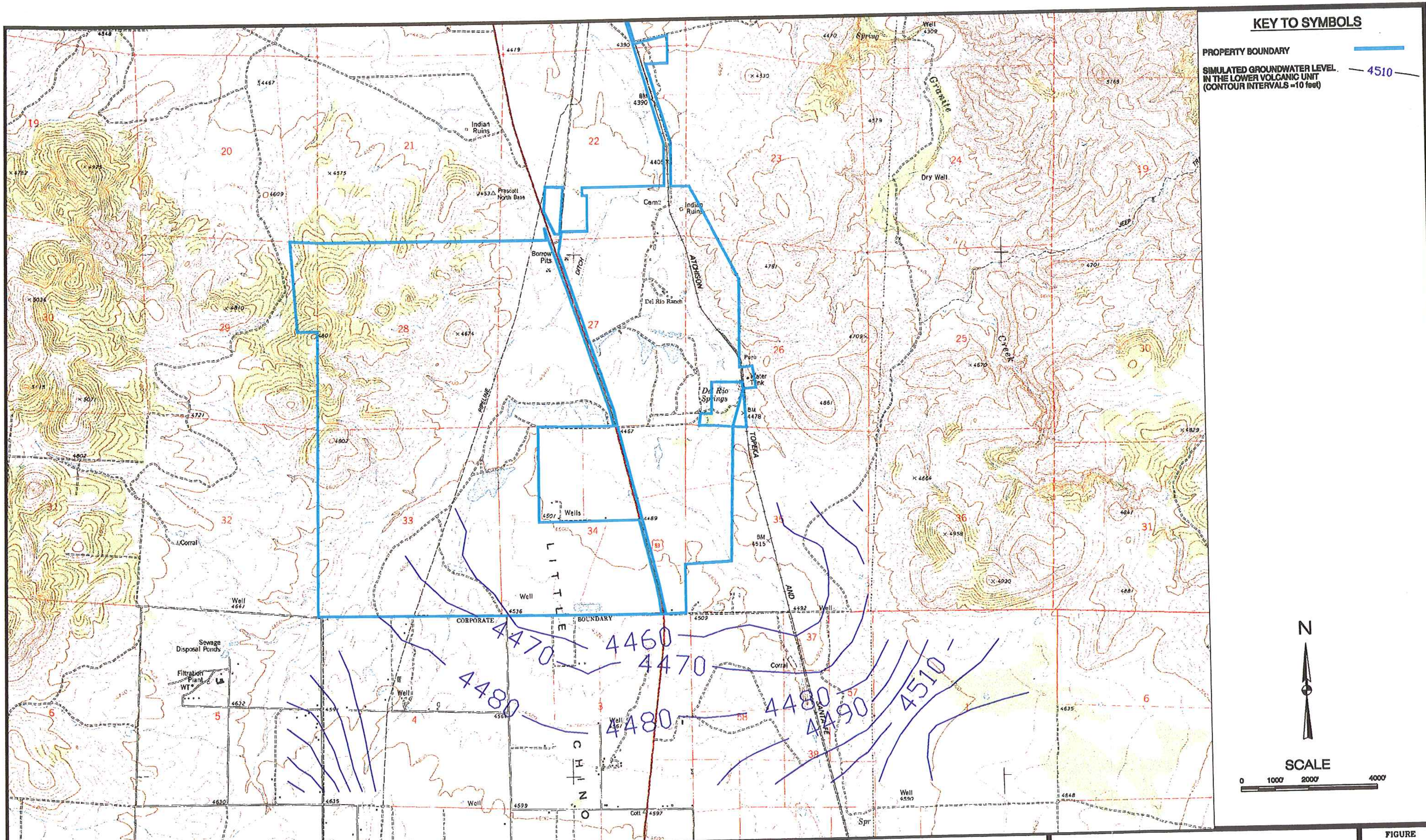
Other fluxes, such as mountain front recharge and ephemeral stream channel infiltration, were simulated using constant flux conditions. Mountain front recharge was incorporated by applying recharge to the cells located along the eastern and western borders of the active domain. Head-dependent, naturally occurring discharge from Del Rio Springs and Little Chino Wash above the

Springs were simulated using the Drain Package. The stage height, width, and length of each drain cell were determined using a 2-foot contour aerial map that clearly shows the variation of vegetation around the spring and in the central section of the Wash. In addition, Recharge and Well Packages were used to simulate agriculture recharge and pumping from both aquifers in the Del Rio Springs area, respectively. The spatial and temporal distributions of these two fluxes were determined based on information listed in Table 3 and Figure 10. The volumes of recharge were uniformly distributed at each recharge cell, but varied year to year, as a function of annual irrigation pumpage.

The vertical groundwater flux between the UAU aquifer and the LVU aquifer is controlled by the vertical hydraulic gradient and vertical conductance. The latter, as defined in MODFLOW, should be calculated externally by dividing the harmonic mean vertical hydraulic conductivity of two vertically adjacent model cells by the vertical flow path length between the midpoints of the cells. In this model, the vertical conductance matrix provided by the ADWR Prescott Model was adopted. Values range from 0.000001 per day in the southern portion of the modeling area, to 0.0002 per day for the Del Rio Springs region.

5.1.5 Simulation Period and Initial Condition

The model covered a total time frame of 107 years. The time interval used in the model was one year, because most of data were collected on a yearly basis for such items as annual pumpage or annual winter static water levels. The first five years of modeling time is designated as a calibration period. Starting from 1994, transit simulation was initiated with an initial head distribution derived from measured elevation contour maps for Layers 1 and 2 (Figures 11 and 12). Simulated head distributions at the end of the calibration period (1999) are shown on (Figures 17 and 18). As part of the analysis, simulated hydrographs in monitoring wells and discharges from Del Rio Springs were compared to measured well head and spring discharge measurements for the calibration period. The aquifer and flow parameters of the Del Rio model were adjusted until the differences between the model simulated heads and those measured at



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CONTOUR MAP OF SIMULATED GROUNDWATER LEVELS IN THE LOWER VOLCANIC UNIT (1999)

FIGURE **18**

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corresponding targets were acceptable. The prediction period was designed for 102 years, beginning right after the calibration period and ending at year 2101. During this period, calibrated head distributions for 1999 served as the starting heads for both Layer 1 and Layer 2.

5.2 Model Calibration

The model was calibrated to the transient flow conditions for the LVU and UAU water development period between 1994 and 1999. During the calibration process, the aquifer and flow parameters of the model were adjusted for a reasonable fit between simulated heads and observed ones on the three selected target wells (two deep wells located in Section 1, T16N, R2W and Section 27, T17N, R2W, and a shallow well which is found in Section 3, T16N, R2W).

5.2.1. Calibration Parameters

Details concerning the estimation of aquifer parameters including hydraulic conductivity, vertical conductance, storage coefficient, and specific yield were discussed in Section 5.1. These aquifer properties were adjusted on a cell-by-cell basis, within the range described, until an acceptable calibration result was achieved. In addition, the natural recharge, lateral inflow, agricultural recharge, pumpage, natural discharge, and lateral outflow discussed in Section 4.1.5 were used for the initial estimate. During the calibration process, the natural recharge, pumpage and agricultural recharge were kept the same; other flow components were adjusted. Lateral inflow that entered the modeling domain through the south boundary, representing influx from up gradient in the Little Chino Basin, was determined to be 4,500 AFY using ADWR's 2001 updated version of the Prescott model. Initially, 40 percent of this influx was distributed uniformly to Layer 1 and the remaining 60 percent was distributed uniformly to Layer 2. However, according to ASA's geological survey, the thickness of Layer 2 (LVU), while variable, is significantly more than 200 feet, which was used as a uniform thickness for the LVU aquifer in ADWR's model. To maintain the same groundwater level, more influx was needed to fill the bigger "water tank". Consequently, the estimated influx of 4,500 AFY per annum was increased to 4,600 AFY, and the distribution ratio between the two layers was also revised from 4:6 to 3:7. The lateral outflow and natural discharge were also adjusted to achieve an acceptable calibration.

5.2.2. Calibration Error Analysis

Due to limited information on measured groundwater elevations during the period between 1995 and 1999, calibration error analyses were carried out using three selected monitoring wells, one in Layer 1 and two in Layer 2, by comparing the difference between observed and simulated heads. Results are shown on Table 12 and Tables 13a, 13b, and 13c. According to Table 13a, the combined (UAU and LVU) residual error analysis, the absolute mean and standard deviation, were 7.67 feet and 7.29 feet, respectively. These error analysis results are within the calibration goal, indicating that the model was generally successful in simulating the hydrologic system.

5.2.3. Water Budgets

The accuracy of the calibration was also evaluated by comparing the degree of correspondence between components of the conceptual and simulated water budgets. As shown in Table 14, simulated flow components were observed to match the conceptual components quite well, indicating a slight net loss of storage in the hydrologic system. The simulated net loss is also corroborated by the gradual decline of water levels observed during the five years from 1995 to 1999.

5.3 Model Predication

To evaluate the 100-year impact of projected demand on the existing flow system, ASA's prediction scenario runs from 1999 to 2101.

5.3.1. Planning Scenario

The simulated heads at the end of the calibration period (1999) were used as the initial head distribution for the prediction scenario. Figures 17 and 18 show the contour maps of the simulated head distribution for 1999 in Layer 1 and Layer 2, respectively. The stresses imposed on the system in the MODFLOW model simulation during this prediction scenario are described as follows:

Table 12

Simulated and Measured Water Levels in Monitor Wells

Layer Type	Cadastral	Well Altitude/Depth	End of Year	Observed Head (ft)	Simulated Head (ft)	Error (ft)
Layer 2	B-16-02 01CBD	4590/700	1995		4526.61	
			1996	4529	4510.5	18.5
			1997	4528	4505.72	22.28
			1998	4526	4534.65	-8.65
			1999	4525	4524.38	0.62
Layer 2	B-17-02W27DCC	4470/750	1995	4459	4456.96	2.04
			1996	4459	4446.02	12.98
			1997	4458	4441.05	16.95
			1998	4458	4457.03	0.97
			1999	4458	4452.71	5.29
Layer 1	B-16-02 03DDC4	4590/80	1995	4542	4540.28	1.72
			1996	4549	4540.59	8.41
			1997	4547	4541.32	5.68
			1998	4543	4541.26	1.74
			1999	4540	4541.58	-1.58

Table 13a

Combined Statistical Summary of Error Analysis for USU (Layer 1) and LVU (Layer 2)

Raw: Measured Minus Simulated (feet)			Absolute: Measured Minus Simulated (feet)		
Mean	Standard deviation	Median	Mean	Standard deviation	Median
6.21	8.66	3.665	7.67	7.29	5.485

Table 13b

Statistical Summary of Error Analysis for the UAU (Layer 1)

Raw: Measured Minus Simulated (feet)			Absolute: Measured Minus Simulated (feet)		
Mean	Standard deviation	Median	Mean	Standard deviation	Median
3.194	3.89	1.74	3.83	3.09	1.74

Table 13c

Statistical Summary of Error Analysis for the LVU (Layer 2)

Raw: Measured Minus Simulated (feet)			Absolute: Measured Minus Simulated (feet)		
Mean	Standard deviation	Median	Mean	Standard deviation	Median
7.89	10.26	5.29	9.81	8.19	8.65

Table 14

Conceptual and Simulated Annual Water Budget (1995-1999)

	Conceptual (AF)	Simulated (AF)
Inflow		
Natural Recharge + Lateral Inflow from Up Gradient of Little Chino Basin	4810	4910
Agricultural Recharge	2082	2083
Total Inflow	**6892**	**6993**
Outflow		
Pumpage	3759	3759
Natural Discharge & Seepage at Springs	1808	1679
Lateral Outflow to Big Chino Basin	1500	1621
Total Outflow	**7067**	**7059**
Change in Storage	**-175**	**-66**

Natural Recharge

Natural recharge from mountain front and ephemeral streams was applied to our prediction scenario at a rate of 310 AFY using the same magnitude and distribution as those in the calibration period.

Lateral Inflow

The flux enters the modeling domain through the south boundary representing the surplus of groundwater from up gradient in Little Chino Basin. For the prediction scenario, the rate of 4,910 AFY was applied.

Agricultural Recharge

Assuming the average annual irrigation efficiency in the study area to be 60 percent, the agricultural recharge was projected to equal 40 percent of the combined irrigation-related pumpage in the study area and the projected spring water diversion within the study area. Table 2 lists annual irrigation-related water usage from year 2001 to 2015. It was assumed that there would be no change in irrigation-related water usage following year 2015, but would remain the same for all subsequent years to 2101.

Projected Water Pumpage

It is assumed that the 13 irrigation wells already operating in the vicinity of the subject property will continue to serve the same irrigation purpose during the prediction scenario. The projected annual pumpage for the 13 wells is estimated based on the five-year average between years 1995 and 1999. It should be noted that, due to predicted reduction in agricultural irrigation, wells B170234BDD (ADWR Reg. No. 619375) and B170235CCC (ADWR Reg. No. 623516) are shut off after year 2005, and that well B170235DCC (ADWR Reg. No. 623517) and B160202ABD (ADWR Reg. No. 623515) are projected to be shut off after year 2010. Table 15 displays the projected annual pumpage for irrigation wells in the study area including the property and its vicinity from year 2001 to 2015. It is anticipated that a new domestic well will be installed on the property in year 2005, so the projected annual pumpage for the property is distributed among the four existing wells and the anticipated new well on the property. It is also assumed that, from year 2016 to 2101, the annual pumpage for irrigation wells both on the subject property and in the vicinity will continue at the same rate as that of year 2015. In addition, the annual pumpage for domestic wells and stock wells, estimated to be about 42.5 AFY, are projected to remain at the same rate as that in 1999 throughout the prediction scenario.

5.3.2. Model Results for the Prediction Scenario

Table 16 shows the model-simulated water budget for the year 2101. The contour maps of predicted groundwater levels at year 2101 for the UAU aquifer and the groundwater for the LVU

Table 15

Groundwater Pumping Demands for Numerical Analysis (2001-2015)

Year	Pumpage in Property and Vicinity (Layer 1) (AFY)	Pumpage in Vicinity (Layer 2) (AFY)	Pumpage in Property (Layer 2) (AFY)
2001	42.5	2139	1711
2002	42.5	2139	2247
2003	42.5	2139	1964
2004	42.5	2139	1674
2005	42.5	2139	1916
2006	42.5	1533	2138
2007	42.5	1533	2138
2008	42.5	1533	2073
2009	42.5	1533	2231
2010	42.5	1533	2425
2111	42.5	755	2465
2012	42.5	755	2272
2013	42.5	755	2373
2014	42.5	755	2447
2015	42.5	755	2529

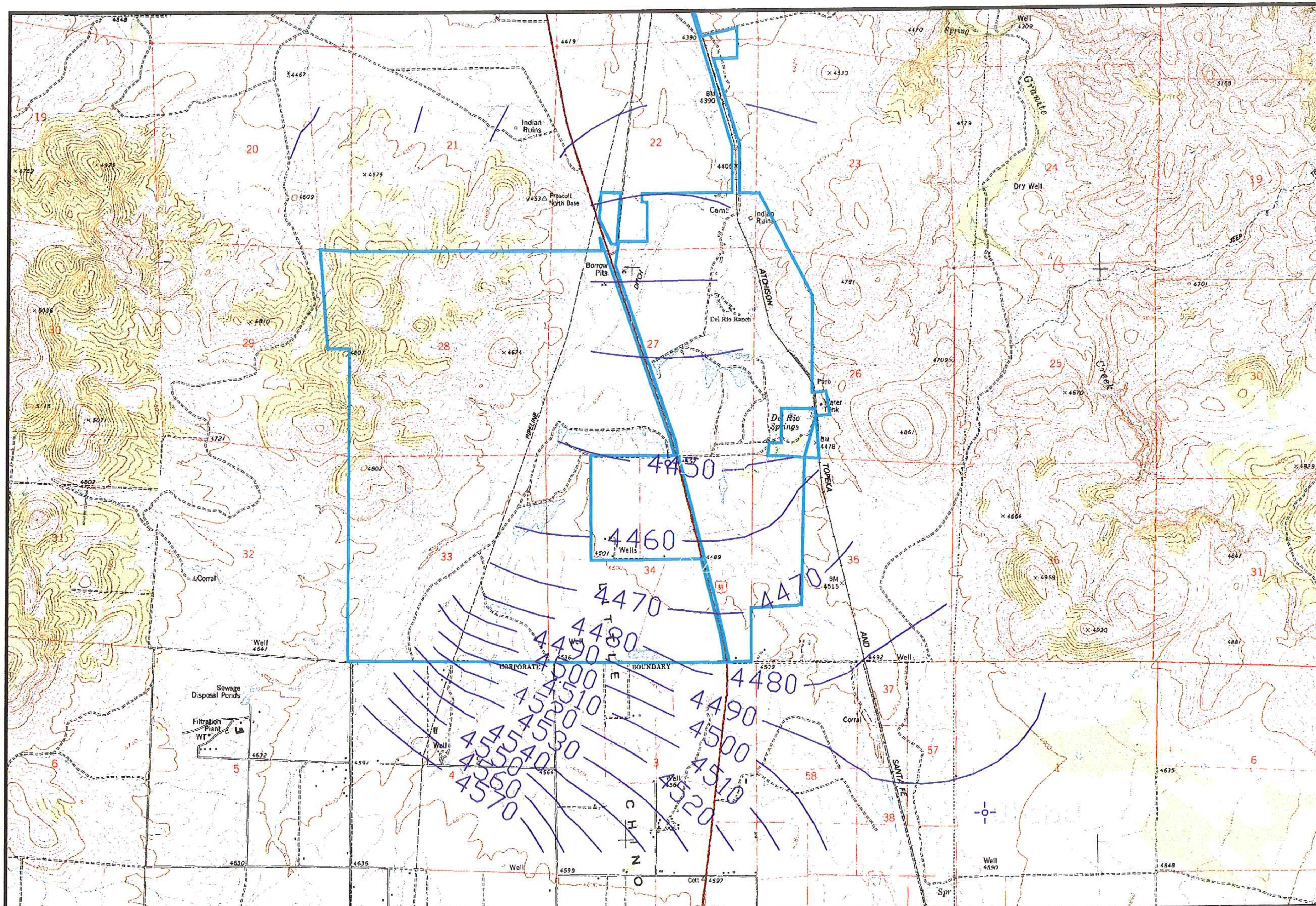
Table 16

Simulated Water Budget for Year 2101

	Simulated (AF)
Inflow	
Natural Recharge + Lateral Inflow from Up Gradient of Little Chino Basin	4923
Agricultural Recharge	1382
Total Inflow	**6305**
Outflow	
Pumpage	3328
Natural Discharge & Seepage at Springs	1246
Lateral Outflow to Big Chino Basin	1729
Total Outflow	**6303**
Change in Storage	**2**

aquifer are shown on Figures 19 and 20. According to the simulated water budget, the Del Rio subsurface flow system is projected to experience a very slight net gain of storage, i.e. 2 AF, at the end of year 2101. Compared to the simulated net loss of storage (i.e., 161.5 AF) in 1999, the start time of our prediction simulation, the slight gain of storage in year 2101 indicates that, during our prediction scenario, the static water levels in Layers 1 and 2 gradually increase subject to changes in the projected water demands. This conclusion is confirmed by the water level contour maps for both the UAU and LVU aquifers in 2101. The spring discharge at Del Rio Springs is projected to be approximately 1,246 AF in 2101.

It must be pointed out that this flow model is calibrated and simulated given the assumption that the future hydrostatic head conditions in Layers 1 and 2 will be similar to those conditions prevailing between 1993 and 1999. Results of the prediction scenario indicate that there is sufficient water in the lower artesian aquifer to meet the existing and the development demands of the subject property for a minimum of 100 years, even under the very low recharge conditions which prevailed during the period of calibration (1993-1999).



KEY TO SYMBOLS

PROPERTY BOUNDARY

PREDICTED GROUNDWATER LEVEL IN THE UPPER ALLUVIAL UNIT (CONTOUR INTERVALS =10 feet) —4570—

N

SCALE

0 1000' 2000' 4000'

ALLEN, STEPHENSON & ASSOCIATES

HYDROLOGIC & ENVIRONMENTAL CONSULTANTS

1130 EAST MISSOURI AVENUE, SUITE 110, PHOENIX, ARIZONA 85014

CONTOUR MAP OF PREDICTED GROUNDWATER LEVELS IN THE UPPER ALLUVIAL UNIT (2101)

FIGURE 19

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6.0 SUMMARY AND CONCLUSIONS

The hydrogeology study was designed to assess the potential impact by the proposed development on the surface water and subsurface systems by analyzing existing geologic and hydrologic data and performing a numerical analysis. Available data were compiled from many sources, including ADWR, USGS, ADEQ and personal communications with persons knowledgeable about the area. Additional field studies were conducted, including geophysical investigations, pump tests, surface and groundwater monitoring and water quality sampling. These data were collated and analyzed, and eventually incorporated into the design of the numerical model.

Projected water demand for the proposed development was calculated using the parameters provided by the PRAMA TMP. At build-out, the demand is anticipated to be slightly greater than 4,000 AFY.

Extensive hydrogeologic investigations indicate that the confined aquifer beneath the study area is highly productive, and that this aquifer exhibits a direct impact on the Del Rio Springs discharge. The senior surface water right on the Del Rio Springs is held by Del Rio Springs Ranch, under the name of Arizona Title Insurance and Trust Company, for 4,022 AFY with a priority date of 1864. *Based on the Southwest Cotton decision, recent legal judgments in the Gila River Adjudication and the subsurface water/spring flow relationships established during the course of this study, it has been demonstrated that water pumped from the confined aquifer beneath the subject property is legally surface water because of the direct and perceptible impact of pumping on spring flow.*

A numerical analysis was conducted to determine the long-term impact on the hydrologic system by the proposed development's 100 years' water demands. The conceptual and numerical simulations were accomplished using the USGS analytical flow model MODFLOW. Results of the analysis indicate that there is sufficient water in the artesian aquifer to meet the existing and new demands of subject property for a minimum of 100 years.

7.0 REFERENCES

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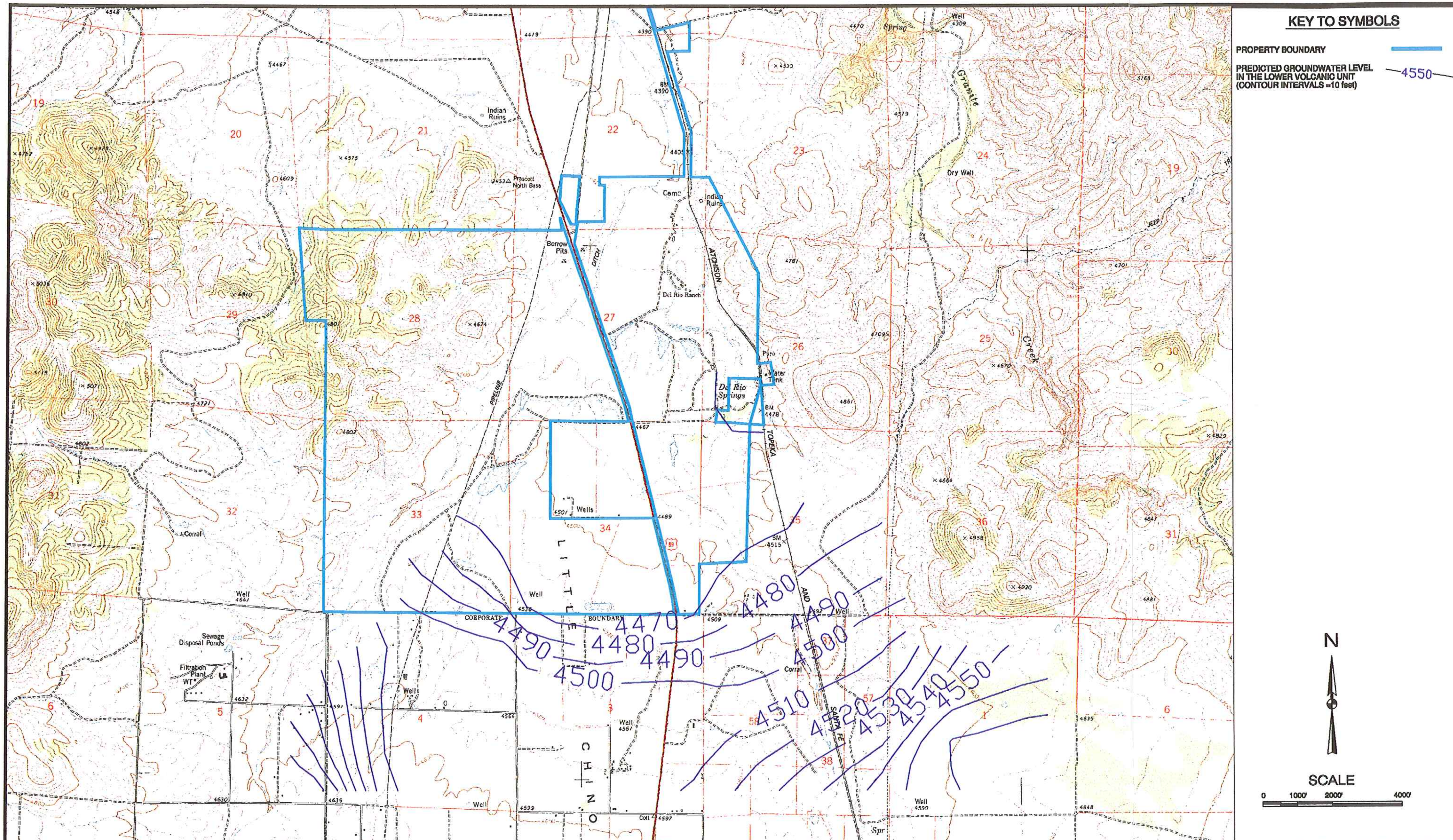

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CONTOUR MAP OF PREDICTED GROUNDWATER LEVELS IN THE LOWER VOLCANIC UNIT (2101)

FIGURE 20

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APPENDIX A

Statement of Claim of Right to Use Public Waters of the State

ARIZONA STATE LAND DEPARTMENT
1624 West Adams
Phoenix, Arizona 85007

STATEMENT OF CLAIM OF RIGHT TO USE
PUBLIC WATERS OF THE STATE

Filing Fee $5.00

(LEAVE BLANK)
Registry No. 36-45971
Filed 6-8-77 (DATE) at 2:23 PM. (TIME)

INSTRUCTIONS:

1. Submit Statement of Claim in duplicate.
2. Answer all questions fully.
3. File separate claim for each claimed right to appropriate and for each source of water.

1. Name of Claimant ARIZONA TITLE INSURANCE AND TRUST CO., as (Print Last Name or Name of Co.) (First Name) (Middle Initial)
Trustee for Tech-Sym Corporation,
111 West Monroe, Phoenix, Arizona 85003 (Address, City, State, Zip) 252-5941 (Phone No.)

2. The purpose(s) and extent of use(s) Irrigation, stockwater & Recreation (Examples: Irrigation, Stockwater, Domestic)

3. The quantities of water used annually 4022 (~~Gallons~~ or Acre feet) from 1 (Day) January (Month)
to 31st (Day) December (Month) each year

4. The date(s) the water was first used beneficially (Month) (Day) 1864 (Year)

5. The Name(s) of the water course(s) or Water Source(s) being claimed Del Rio Springs (Source Name)
Tributary to Chino Creek on the Verde River (Leave Blank) Watershed

6. The point of diversion is within the See Attached... ¼ Section.. Schedule,
of Township 17N (N/S), Range 2W (E/W), G&SRB&M, in the County of Yavapai.

7. The Place(s) of use is in the See Attached. ¼; Section ..Schedule, of
Township 17N (N/S), Range 2W (E/W), G&SRB&M, in the County of Yavapai.

8. The legal basis for the claim prior appropriation by beneficial application

(Attach copies of any documents being filed in support of Claim)

STATE OF ARIZONA)
) SS
County of Maricopa)

BARBARA CLAYTON being first duly sworn on oath, deposes and states that the foregoing Statement of Claim is true and correct of her own knowledge except as to any matters stated therein to be on information and belief and as to all such matters so stated she believes the same to be true and correct.

ARIZONA TITLE INSURANCE AND TRUST COMPANY,
an Arizona corporation, as Trustee
Barbara Clayton
(CLAIMANT(S) Trust Officer

Subscribed and sworn to before me this 7th day of June, 19 77.

My Commission Expires:

December 9, 19 80.
(SEAL)

Linda S. McPherson
(NOTARY PUBLIC)

Filed in Water Rights Claim Registry No. 36-45971 of the State Land Department of
June 8, 1977 at 2:23 p. M.

F. C. Ryan
F. C. Ryan, Director
Water Rights Division

ARS 45-184 "FILING OF CLAIM WITH THE DEPARTMENT NOT DEEMED ADJUDICATION OF RIGHT"

TECH-SYM CORPORATION

401 UNITED BANK BLDG. / PHOENIX, ARIZONA 85012 / TELEPHONE 277-2671

STATEMENT OF CLAIM OF RIGHT TO USE PUBLIC WATER OF THE STATE

Item 6.

Description	Section
NE¼ NE¼	34
NW¼ SW¼	26

Item 7.

Description	Section
S½ SE¼	22
SE¼ SW¼	22
SW¼ NW¼	26
NW¼ SW¼	26
E½ NW¼	27
NE¼	27
N½ SE¼	27
NE¼	34
W½ NW¼	35

3/ 45971

TECH-SYM CORPORATION

401 UNITED BANK BLDG. / PHOENIX, ARIZONA 85012 / TELEPHONE 277-2671

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Description	Section
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NW¼ SW¼.	26
E½ NW¼.	27
NE¼.	27
N½ SE¼.	27
NE¼.	34
W½ NW¼.	35

EDP

ARIZONA STATE LAND DEPARTMENT
1624 West Adams
Phoenix, Arizona 85007

ST' 'EMENT OF CLAIM OF RIGHT TO USE
PU .C WATERS - STATE OF ARIZONA

Ex mination Fee $5.00
Map (see instructions)
CLAIM MUST BE SUBMITTED IN DUPLICATE

To be filled in by
State Land Department

Registry No. 36-45971
Filed ________ at ________ M
(Date) (Time)

. Name of Claimant AZ TITLE INSURANCE CO
(Print Last Name or Name of Co.) (First Initial) (Middle Initial)

(Address, City, State, Zip) (Phone No.)

. The waters claimed are used for DAGD

. The amount of water used annually is ________ from ________
(Gallons or Acre Feet) (Day) (Month)
o ________ each year.
(Day) (Month)

. The date the water was first used beneficially was 00 00 864
(Month) (Day) (Year)

The direct source of supply is DEL RIO SP
(Source Name) (Type of Watercourse)

'ributary to ________ on the 05 Watershed.
Leave Blank

'he Point of Diversion (locate on map) is within the NE ¼ NE ¼, Section 34,
of Township 17ON, Range 02W, G&SRB&M, in the County of ________

umber of Points of Diversion 2

The Place(s) of Use (locate on map) is in the ____ ¼ ____ ¼, Section ____, of
ownship ________, Range ________, G&SRB&M, in the County of ________
(N/S) (E/W)

:cres irrigated ________ Number and Kind of Stock ________ ____
(Number) (Kind)

Number of Families ________ Other uses explain on line 14.

he water is diverted by ________

________ the maximum flow is ________

: water is stored, give capacity and name of Reservoir in Acre Feet ________
(Capacity)

____
(Name)

I ight of Dam ________ ft., Area inundated in Acres ________

The Claimed Right to Water was created by the following facts: ________

(Attach copies of any documents supporting Claim)

The land on which the water is used is owned by X

m

APPENDIX B

History of Water Use on Del Rio Ranch

HISTORY OF WATER USE ON DEL RIO RANCH

1. 1829 – Ewing Young Expedition – 20 troopers camped at Del Rio Springs over the winter prior to traveling west to Colorado River.
2. 1854 – Lieutenant Amiel Weeks Whipple led party of U.S. Topographical Corps of Engineers which set up field camp at Del Rio Springs on a survey of the 35th Parallel.
3. 1863 – Surveyor General of New Mexico Territory, John A. Clark, and a company of California volunteers led by Captain Nathanel J. Pishon selected Del Rio Springs area as a military post for the 1st Territorial Capital of Arizona.
4. January 22, 1864 – Fort Whipple was established and Territorial Capital was established. Governor John Goodwin, Secretary Richard McCormic, and Justice Joseph Allyn, along with 30 cavalrymen, two companies of soldiers, and interested citizens were first permanent residents. By March of 1864, the fort included a hospital, commissary, quartermaster buildings, corral, and sleeping quarters for the troops.
5. May 18, 1864 – Fort Whipple and Territorial Capital moved to Prescott and, in August, 1864, Postle, Brown and Company settled on the former site of Fort Whipple and started farming the property. By September the Miner reported 200 tons of hay had been cut from the property and sold in Prescott.
6. November 1866 – Miner reported that 300 acres were under cultivation to corn, wheat, barley, potatoes, and a variety of vegetables. Postle also constructed a grist mill (run by hydropower) and five new families moved into Del Rio Springs area.
7. 1872 – Government Land Office plat indicates that land was under cultivation in Sections 27 and 22, T17N, R2W, with a "ditch" shown emanating from Del Rio Springs to supply the irrigated land.
8. 1885 – Prescott and Arizona Central Railroad built through Del Rio Ranch; George Banghart operated railroad station in immediate area.
9. 1892 – John Campbell officially filed on 4,022 AF of Surface Water Rights of Del Rio Springs (Yavapai County Recorder's Office – Mill Sites and Water Rights Book 2) with a priority date of 1864.

10. 1893 – Santa Fe, Prescott and Phoenix Railway (SFP&P) established second rail line through Del Rio.
11. 1894 – SFP&P Railway built a pump house, stockyard, and water tank on the Del Rio Ranch.
12. 1898 – SFP&P Railroad entered into a long-term lease with one of the Del Rio Ranch partners (Baker) to remove 161 AF annually from the Ranch for domestic use in Northern Arizona.
13. 1901 – SFP&P Railroad began supplying water to Grand Canyon, Williams, Winslow, Ash Fork, and Seligman from its siding at Puro, which is immediately north-northeast of Del Rio Spring. Ash Fork was totally dependent on Del Rio water through 1956.
14. 1910 – SFP&P Railway purchased property at Del Rio to set up a dairy. In 1913, the Fred Harvey Company entered into a partnership with SFP&P on the dairy. Immediately, a bunkhouse, cow barn, horse barn, mess house, milking barn, milk processing facility, chicken and turkey houses, feeding shed, milk plant, pump house, power plant, and adobe house were constructed. Approximately 200 acres were in cultivation through the 1930's.
15. October 12, 1940 [U.S.D.A., Natural Resource Conservation Division photos #COU 8-30 and COU 8-32] – 436.03 acres under cultivation using surface water. Irrigation practices included use of tail water from fields to the south, surface application of spring water, and subirrigation of native pasture along Little Chino Wash both north and south of Del Rio Springs.
16. Between 1938 and 1946, the average annual flow of Del Rio Springs was approximately 2,849 AFY. During that time, the flow was as low as 2,256 AFY and as high as 3,429 AFY. Most of the water was being used on the Ranch. During this same period, Schwalen (1967) noted a .75 cfs (336.65 gpm) reduction in spring flow when the Santa Fe wells were pumped. The decline in spring discharge occurred within six hours after pumping was initiated.
17. An additional point of surface diversion (identified as W-3 in this report) was drilled sometime between 1945 and 1948 and a total of about 550 acres were put into cultivation.

18. November 19, 1953 [U.S.D.A. Natural Resources Conservation Division photo #VV HUM 1 AMS 134 32] – This photo was taken shortly after major artesian wells were drilled on the Ranch just north of Road 5 North. It shows the area on the Ranch under irrigation (from both surface irrigation and subflow irrigation).

19. April 16, 1972 – Photo of Chino Valley designated as #116246 1-1 H-12000 GS-VCZZ. Photo shows southern part of Del Rio Ranch but not northern part. It is assumed that the agricultural fields to the north did not change significantly. The agricultural acreage in the area north of Road 5 North increased again, resulting in 589.91 acres in cultivation (both surface and subflow being included). Additionally, a large 22.64-acre stock pond had been recently constructed which received water from a well near Road 5 North.

20. 1980 – On October 17, 1989, the Arizona Department of Water Resources issued a Grandfathered Irrigation (IGFR) Certificate #58-106092.0001 partially overlapping the Ranch's surface water filing for the irrigation of 673.5 acres. A 7.6-acre parcel that was historically cultivated north of Bond Lake was not included. Although the IGRF was a dual filed certificate, no record was made of the amount of land that had been subirrigated/and used by spring water for centuries along Little Chino Wash. The land that fits this category (145.35 acres) was identified on the 1940 aerial photo and has changed little, if at all, over the past 61 years. Therefore, historical use is consistent with the Ranch's surface water filings and reflect a total use of 826.45 agricultural acres.